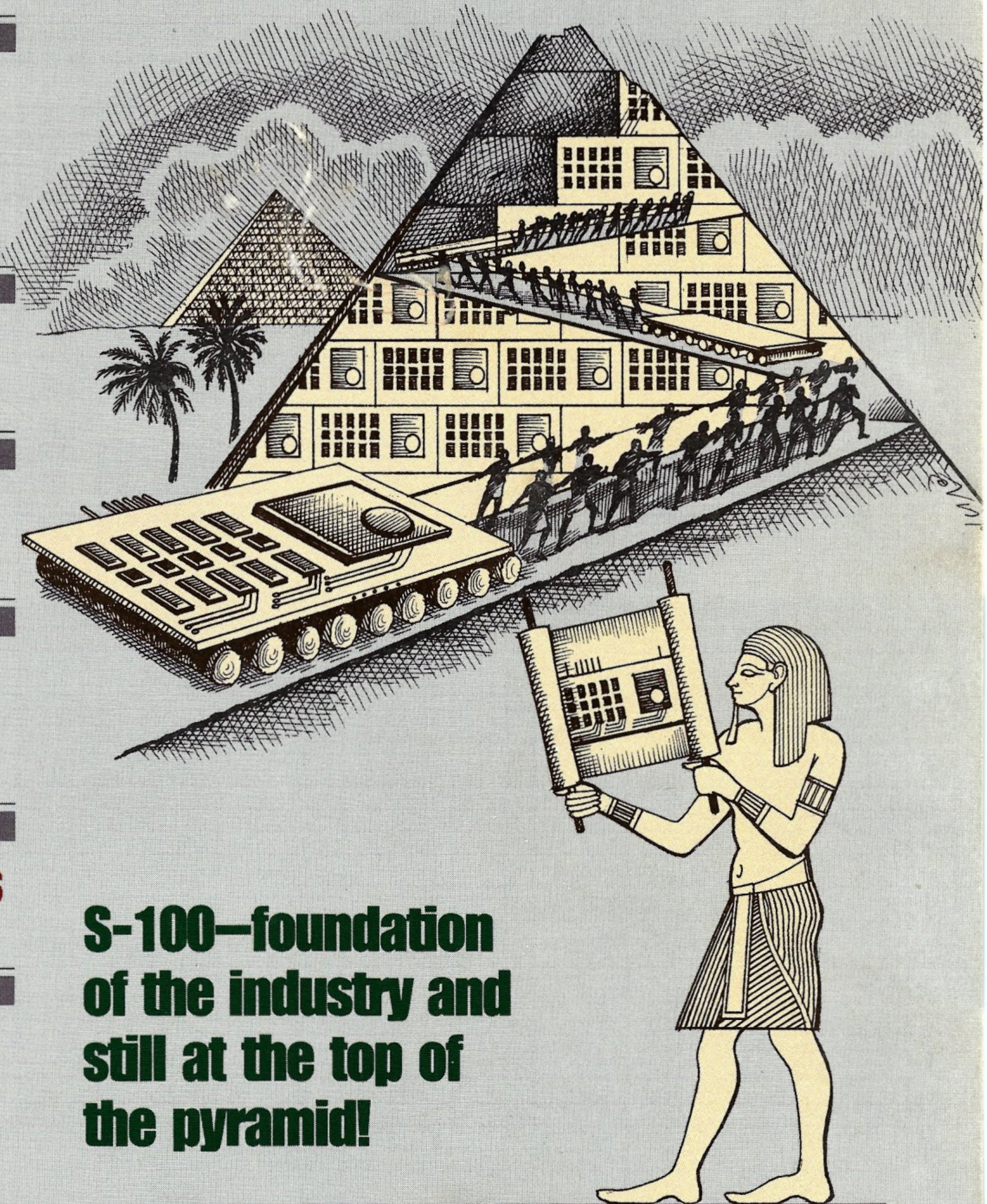
THE JOURNAL FOR ADVANCED MICROCOMPUTING

$2.95

Microsystems

Volume 5/Number 5

May 1984



S-100
Product Directory
Digitized Sound Storage
Stepper Motor Control

Networking
*WATSTAR Network

UNIX & CP/M
C/NIX: a UNIX Front End

System Utilities
A Preprocessor in C for Basic

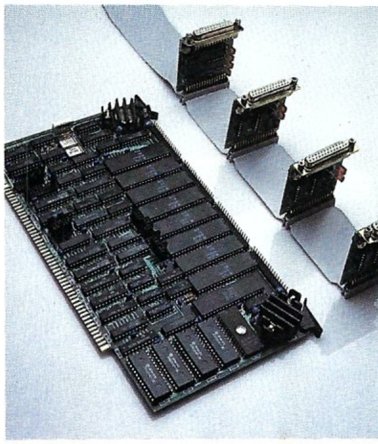
Software Reviews
SYNONYM

New Products
SuperCord II
Magic/L

S-100—foundation of the industry and still at the top of the pyramid!

0 05

CONTROL 16 S-100 USERS WITH 1 ADIT BOARD



ADIT. There's nothing else like it on the market. It's an intelligent I/O board with its own operating system that lets you control up to 16 different terminals, modems or printers. Or link your local network up to four other systems simply and inexpensively. And all this from a single slot in your S-100 bus. Now that's efficient!

ADIT gives you many extras. It allows you to upgrade to a multi-user system and expand as your needs grow—without performance degradation. The on-board 6MHZ Z80B supports DMA operations to off-load the host CPU. Multi-tasking firmware supports UNIX, MP/M and AMOS operating systems. It complies fully with IEEE 696.

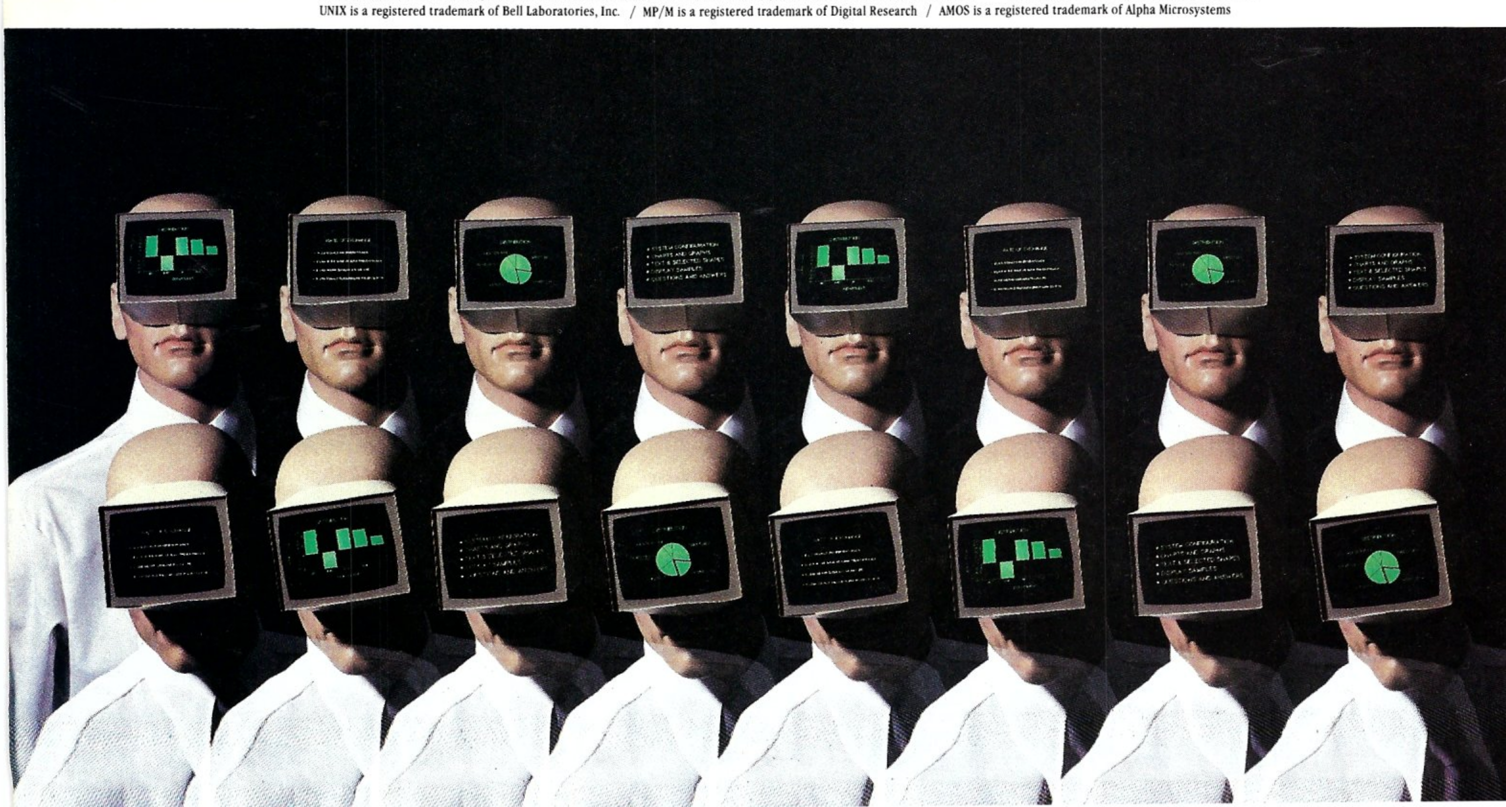
There's much more to tell you about ADIT than space allows. And it is only one of Macrotech's products designed to maximize the performance of your S-100 system. The MAX Dynamic Memory, for instance, gives you up to 1 Mbyte of memory for all your system memory and virtual disk applications—again from a single slot. And our newly developed dual-processor, CPU board. It uses a 16-bit 80286 and an 8-bit Z80B to provide unprecedented speed and power from a single slot. That's efficiency, too.

Call or write us today, and ask about these products.

CIRCLE 75 ON READER SERVICE CARD

Macrotech International Corp.
9551 Irondale Avenue
Chatsworth, CA 91311
Phone: (818) 700-1501

Dealer/Distributors: Priority One Electronics, (800) 423-5922. (213) 709-5111 / John D. Owens Assoc., (212) 448-6298 In England: Fulcrum (Europe) (0621) 828-763



68000-based systems. Just tell us what you need.

68000-based systems to fit your application.

Right from the pages of our catalog, we can deliver 68000-based supermicro systems to match virtually any application.

Including yours.

Here's how.

Built on the IEEE-696 (S-100) bus, Cromemco systems offer up to 21 board slots. And a family of 35 boards — CPU, memory and specialized I/O — to fill the slots any way you choose.

At the heart of each system is our 68000/Z-80 dual processor. Backed by as much as 16 Mb of error-correcting RAM. Full multi-tasking capability. I/O to handle up to 16 terminals.

And that's just the beginning.

You can select single or dual floppies, 5¼" or 8." A 21 Mb 5¼" Winchester hard disk. And a nine-track tape drive.

We can accommodate your taste for the exotic, too. With boards like our SMD interface that supports up to 1200 Mb of disk storage. An NTSC standard color graphics interface. A TV camera digitizer. A/D and D/A converters. An IEEE-488 bus interface. Communications. And more.

Intelligent workstations.

Then, if you're designing a distributed processing system, you'll want to take a look at our C-10 personal computer. The Z-80-based C-10 can serve our 68000-based systems as a powerful intelligent workstation in a distributed processing mode. Or as an independent personal computer with its own floppy storage.

High-level languages and applications software.

That brings us to software. It starts with CROMIX,® our UNIX™-like operating system that you're free to tailor to your application.

CROMIX can execute both 68000- and Z-80-based programs. So right along with your 68000-based packages, your system will accommodate a wide selection of CP/M® software written for the Z-80.

And our high-level language support is second to none. From a 68000 Macro Assembler. To 68000 FORTRAN 77, PASCAL, GSA-certified high-level COBOL, C and BASIC.

Cromemco means business. Your business.

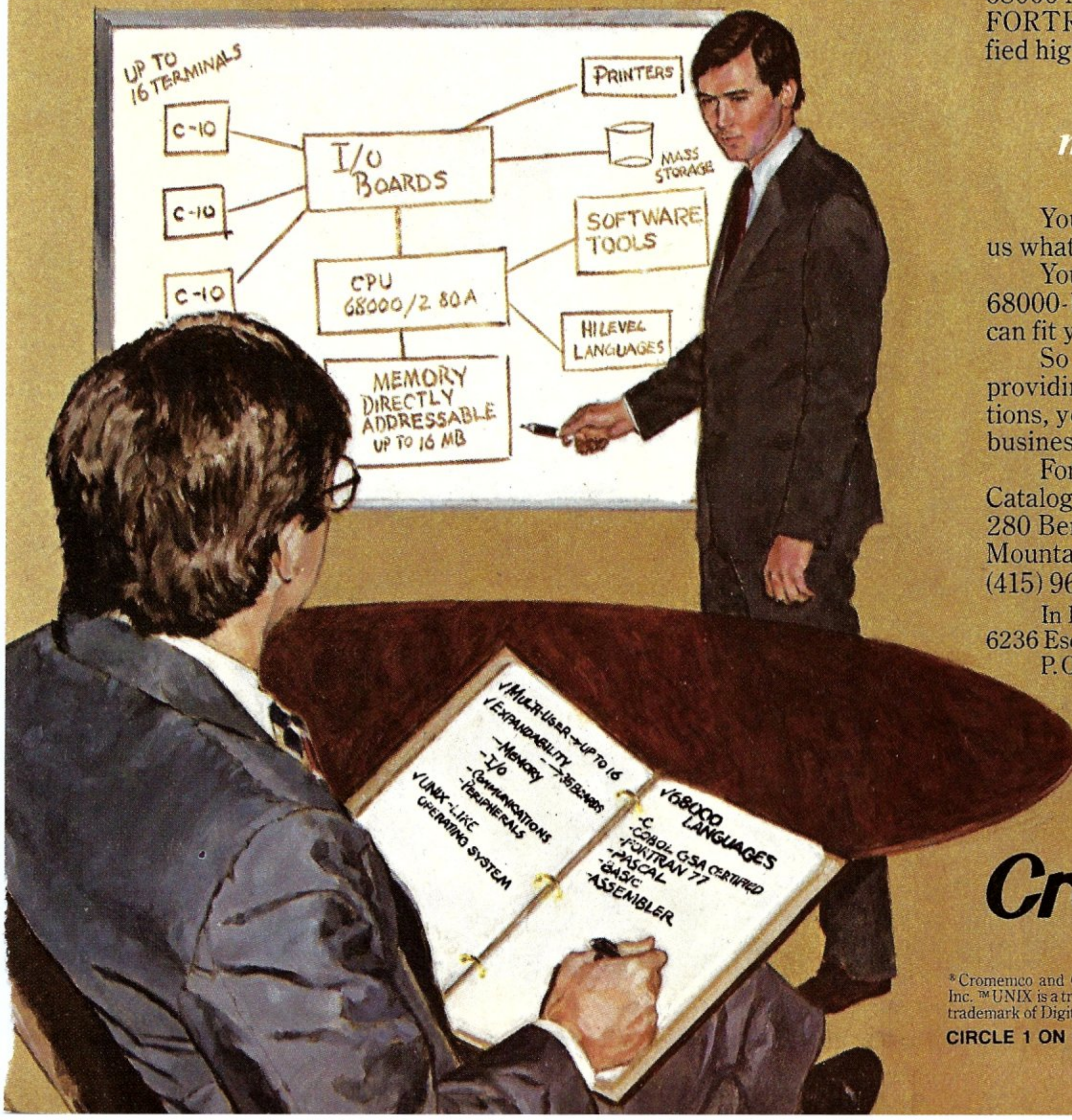
You see, when we say, "Just tell us what you need," we're not kidding.

You won't find another family of 68000-based microcomputers that can fit your needs as exactly as ours.

So if you're in the business of providing specialized computing solutions, you really should be doing business with Cromemco.

For a copy of our Systems Catalog, contact: Cromemco, Inc., 280 Bernardo Avenue, P.O. Box 7400, Mountain View, CA 94039. (415) 964-7400.

In Europe: Cromemco/GmbH, 6236 Eschborne 1, Frankfurter Str. 33-35, P.O. 5267, Frankfurt Main, Germany or Cromemco Ltd., The Cambridge House, 178-182 Upper Richmond Rd., Putney, London SW15 England.



Cromemco®

®Cromemco and CROMIX are registered trademarks of Cromemco, Inc. ™UNIX is a trademark of Bell Laboratories. ®CP/M is a registered trademark of Digital Research. ©1983, Cromemco, Inc.

CIRCLE 1 ON READER SERVICE CARD

MULTIUSER SYSTEMS MADE POWERFUL...

MultiMicro Computer raises expectations for multiuser systems.

In fact, our new system is so good we call it the MicroMainframe.

And we can prove it.

Each user gets their own processor. Each processor has 64 K of RAM. The MicroMainframe has over 1 megabyte of system memory and up to 450 megabytes of hard disk memory.

That's right, 450 megabytes.

There's more.

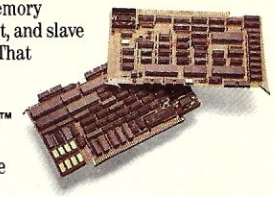
An 8" double sided, double density floppy drive, RS-232, RS-422 or Centronics™ parallel interfaces, 20 slot chassis, real time clock, true record locking and quiet operation are standard. Streaming tape backup and 6 MHz operation are available.

It's also simple.

Up to 16 users can be accommodated easily. The power supply and cooling system have been designed for straight-forward, plug-in expansion.

...AND FAST...

Best of all, TurboDOS™ takes full advantage of the MicroMainframe's direct memory access, memory management, and slave level memory architecture. That makes our system fast. Very fast.



It can also run any CP/M™ program.

The best MicroMainframe around?

The only MicroMainframe around.

...AND INEXPENSIVE.

Our Base, 4 user system with 320 K of system memory, 16 megabytes of hard disk storage and a 1.2 megabyte floppy disk drive retails for only $9950.00.

That's a fully expandable, 20 slot system. Additional users can be added for under $750.00.

CALL.

Call today. We'd like to help you solve your multiuser problems.

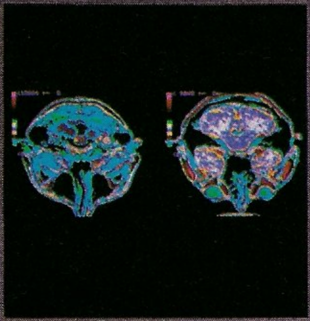
Multi Micro Computer MMC

Dealer inquiries invited.
MultiMicro Computer,
9631 Netherway, Huntington
Beach, CA 92646, 714/963-8954

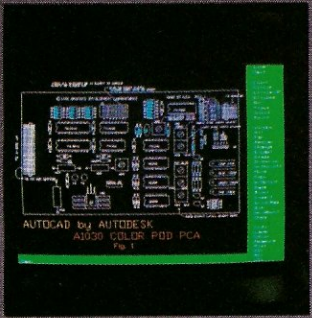
CP/M™ Digital Research. • TurboDOS™ Software 2000 Inc. • Centronics™ Centronics, Inc.

CIRCLE 79 ON READER SERVICE CARD

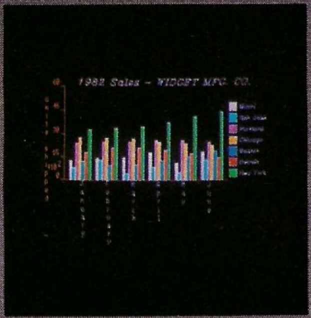
GDL's A-1000™
Why Pay More For Less?



N.M.R. Brain Scan
J. Libove, Dual Systems

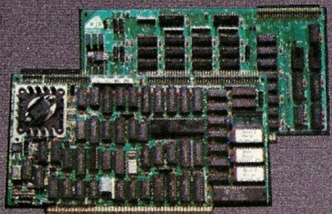


Autocad by Autodesk
R. H. Hymes, GDL



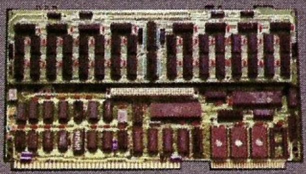
Supercalc Data Graph
Pacific Basin Graphics

Octehedron With Hidden Surfaces Removed
Dr. C.L. Morgan, Calif. S.U. Hayward



S100/696 A1000

- On-board 16 Bit Processor
- High-level Commands
- S100/696 or Multibus
- High Resolution
- Multiple Display Formats
- Simple Interface
- Extensive Software Support
- Download Capability
- Up to 16 out of 4096 Colors
- On-Board Self-Test



Multibus A1000

Graphics Development Laboratories has finally made high performance color graphics affordable. These S100/696 and Multibus compatible boards are currently at work in such diverse areas as Medicine, CAD, Education, Science, and Stock Market Analysis. And it's easy to see why, with their on-board 16-bit 8088 processor and extensive firmware, they act as intelligent graphics sub-systems, relieving the host of time intensive graphics processing, thus maximizing system throughput. Display memory is completely isolated from the host's bus and all communications occur through I/O ports. This simple interface and the high level commands allow for quick intergration into any S100 or Multibus system.

Software Support

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

The A-1000 is supported by extensive third party software including:

AUTOCAD by AUTODESK	A 2D drafting package FOR USE BY Architects, Engineers or anyone requiring high quality diagrams.
PBG100	Business software that graphs data from **Supercalc** and **DBASE II** files and keyboard input.
GRAFTALK	Business graphics package.
UGRAF	Business graphics software that interfaces to various spreadsheets, **DBASE II** and **Condor**.

OEM's, Dealers and Systems Integrators

GDL offers generous discounts to OEM's starting in small quantities. So whether you are a small systems integrator or large OEM, you will find our pricing attractive.

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

A-1000 is the trademark of Graphics Development Laboratories, Analyst is the trademark of Kales Komputers. PBG100 is the trademark of Pacific Basin Graphics. Graftalk is the trademark of The Redding Group. UGRAF is the trademark of Transparent Data Systems. Supercalc is the trademark of Sorcim Inc. DBASE II is the trademark of Ashton Tate Inc. GSX is a trademark of Digital Research Inc. Autocad is a trademark of Autodesk Inc.

DEALERS

CUSTOM COMP. TECH.
1 Craftsman Ct. Box 4160
Sedona, Ar. 86340
(602) 282-6299

MICROSET
9 Dearham Wood
West Hill, Ont. M1E 1R7
Canada
(416) 284-8602

FRONTENAC DESIGN
RD1 Box 147
Trumansburg, N.Y. 14886
(607) 387-5303

MENTZER COMP. SYSTEMS
1441 Rollins Rd.
Burlingame, Ca. 94010
(415) 340-9363

MOJAVE MICRO
17956-D Sierra Hwy.
Canyon Country, Ca. 91351
(805) 252-0155

GENESYS SYSTEMS
6 N. Goethe Box 277
Ellinwood, Kan. 67526
(316) 564-3636

EDWARDS ENGINEERING
1288 E. Mission Blvd.
Pomona, Ca. 91766
(714) 629-4349

MARTIAN TECHNOLOGIES

MOMS COMPUTING

W. W. COMPONENT SUPPLY
1771 Junction Ave.
San Jose, Ca 95112
(408) 295-7171

TOTAL ACCESS
2054 University Ave.
Berkeley, Ca. 94709
(415) 540-8066

TRACK COMPUTER CENTER
1514 University Ave.
Berkeley, Ca. 94703
(415) 845-6366

JR SYSTEMS INC.
8227 Woodmont Ave.
Bethesda, Md. 20814
(301) 657-3598

REPRESENTATIVES

MARTIAN TECHNOLOGIES
8348 Center Dr. Suite F
La Mesa, Ca. 92041
(619) 464-2924

MOMS COMPUTING
Bldg. 1055 Fort Cronkite
Sausalito, Ca. 94965
(415) 331-2043

GRAPHICS DEVELOPMENT LABORATORIES
2832 Ninth St., Berkeley Ca. 94710
(415) 644-3551 Telex: 821-676
CIRCLE 24 ON READER SERVICE CARD

Slide in. And take it for a drive test.

Diagnosing disc drive problems has just become a great deal easier.

Interrogator,™ Dysan's economical new drive diagnostics package, can run a drive through its paces in minutes. To tell you exactly what's wrong. Or right.

Just like that.

Test results come right up on the screen of the machine you're testing. Or you can print out hard copy records.

The Interrogator package includes a Digital Diagnostic Diskette,™ complete test instructions and software programmed to perform a whole battery of sophisticated tests.

Things like head radial alignment. Head positioner linearity. Head azimuth alignment. Spindle speed. Read/write verification. And over a dozen others.

Interrogator is here now for the IBM® PC and XT. Versions for other computer models are on the way.

Whether you're going for one drive or need to assure the compatibility of a company full of drives, Interrogator is the perfect tool.

And it's just the kind of thing you'd expect from Dysan. The leader in quality, innovative media and diagnostic tools.

Interrogator. What could be easier?

Just this. A toll free phone call to get more information. Or place an order. (800) 551-9000.

Dysan Corporation, 5201 Patrick Henry Drive, Santa Clara, CA 95050, (408) 988-3472.

Dysan.®

CIRCLE 7 ON READER SERVICE CARD

Microsystems

STAFF

Sol Libes	founder & editorial director
Mark Rollins	editor
Chris Terry	technical editor
Ian Darwin/Dave Fiedler/Dave Hardy/Bill Machrone/ Ernest E. Mau/Bruce Ratoff/Anthony Skjellum	contributing editors
Andrew Bender/David Gewirtz/Fred Gohlke/ Steve Leibson/Don Libes/Randy Reitz	assisting editors
Ann Ovodow	editorial coordinator
Tom Leander	editorial assistant
Will Kefauver	art director
Ilisa Goodheart/Tammi Colichio	art assistants
Jim Beloff	advertising director

ADVERTISING SALES OFFICES

New England, Midatlantic
Jeff Tompkins, *Microsystems*
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-7670

Advertising Coordinator
Michele Fischetti, *Microsystems*
Ziff-Davis Publishing Company
One Park Avenue
New York, NY 10016
(212) 725-5386

Southeast
Mark Browning, *Browning Publications*
P.O. Box 81306
Atlanta, GA 30366
(404) 455-3430

Midwest
William Biff Fairclough/
Jeff Edman, *The Pattis Group*
4761 W. Touhy Avenue
Lincolnwood, IL 60646
(312) 679-1100

Southern California, Southwest
Steve Taneman
Ziff-Davis Publishing
3460 Wilshire Blvd.
Los Angeles, CA 90010
(213) 387-2100

Northern California, Northwest
Jeff Cohen,
Ziff-Davis Publishing
11 Davis Dr.
Belmont, CA 94002
(415) 594-2290

Canada
Frank Lederer, *The Pattis Group*
501 Eglinton Ave., E. #202
Toronto, Ontario
M4P 1N4
(416) 482-6288

Direct Retail Sales
Lynn Kujawa,
Ziff-Davis Publishing
One Park Avenue
New York, NY 10016
(212) 725-7679

CONSUMER COMPUTER & ELECTRONICS DIVISION

President	Larry Sporn
Vice President Marketing	Jeff Hammond
Vice President Circulation	Carole Mandel
Vice President General Manager	Eileen G. Markowitz
Vice President Licensing and Special Projects	Jerry Schneider
Vice President Creative	Herb Stern
Editorial Director	Jonathan D. Lazarus
Creative Director	Peter J. Blank
Promotion Manager	Ronni Sonnenberg

ZIFF-DAVIS PUBLISHING

Richard P. Friese, *President* Albert S. Traina, *President, Consumer Magazine Division* Paul H. Chook, *Executive Vice President, Marketing and Circulation* Phillip T. Heffernan, *Senior Vice President* Sidney Holtz, *Senior Vice President* Edward D. Muhlfeld, *Senior Vice President* Philip Sine, *Senior Vice President* Baird Davis, *Vice President* George Morrissey, *Vice President* Rory Parisi, *Vice President* William L. Phillips, *Vice President* Selwyn Taubman, *Treasurer* Bertram A. Abrams, *Secretary*

MICROSYSTEMS (ISSN #0199-7955) is published monthly by Ziff-Davis Publishing Company, One Park Avenue, New York, N.Y. 10016.

Second Class postage paid at New York, N.Y. 10016 and at additional mailing offices. POSTMASTER: Send address changes to MICROSYSTEMS, PO Box 2937, Boulder, CO 80322. Subscriptions are $26.97 for 12 issues. Canadian prices are $5.00 per year additional; other foreign $8.00 per year additional (U.S. currency only). For information or questions about subscriptions phone: (800) 631-8112.

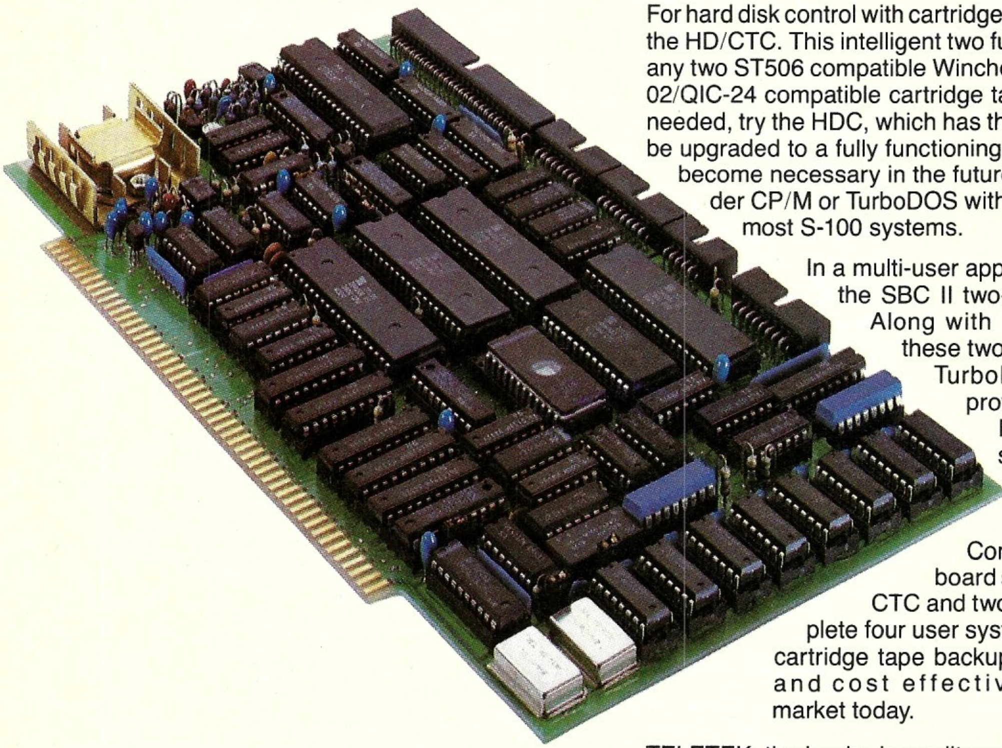
Editorial correspondence is welcomed and should be sent to: MICROSYSTEMS, One Park Avenue, New York, NY 10016. Phone (212) 725-6856.

For information on commercial advertising, write to: MICROSYSTEMS Advertising Dept., One Park Avenue, New York, NY 10016 or call Jim Beloff at (212) 725-3452.

TELETEK provides the system integrator, the OEM or the end-user, the most complete line of fast and efficient S-100 board products offered by any manufacturer dedicated to board level production.

TELETEK S-100 BUS

The Systemaster leads our line with a Z80A CPU, 64K of RAM, *simultaneous* control of 8″ and 5.25″ floppy disk drives and memory management capabilities. With onboard RS232 SIO drivers, *no paddle boards* are required. Thus, packaging is efficient and inexpensive. For enhanced system performance, add RAM Drive to your Systemaster. This high-speed, low-cost disk emulator will dramatically increase the speed of disk-intensive application programs.



For hard disk control with cartridge tape backup, TELETEK offers the HD/CTC. This intelligent two function controller will interface any two ST506 compatible Winchester disk drives and any QIC-02/QIC-24 compatible cartridge tape drive. If tape backup is not needed, try the HDC, which has the added advantage that it can be upgraded to a fully functioning HD/CTC should tape backup become necessary in the future. Both controllers will run under CP/M or TurboDOS without hardware modifications in most S-100 systems.

In a multi-user application, TELETEK has added the SBC II two-user slave board to the line. Along with its predecessor, the SBC I, these two boards can be combined in a TurboDOS 1.3 based system and provide 128K of bank switched RAM, 4MHz or 6MHz clock speed and 2K FIFO buffering for quick block data transfers.

Consider the possibilities! A four board set with a Systemaster, an HD/CTC and two SBC II's would create a complete four user system with hard disk control and cartridge tape backup. This is the most innovative and cost effective board configuration on the market today.

TELETEK, the leader in quality and innovation, is proud to offer a 36-month warranty on our entire S-100 board line.

INNOVATION AND QUALITY

In fact, we are so confident that you will find the TELETEK board family to be exactly what you have been looking for, we are willing to offer a 30-day evaluation program with a money-back guarantee. This offer provides you with a unique opportunity to evaluate the TELETEK line at *NO FINANCIAL RISK!*

Call our Sales Department for the details and see what TELETEK can do for you.

TELETEK
4600 Pell Drive
Sacramento, CA 95838
916-920-4600

CIRCLE 124 ON READER SERVICE CARD

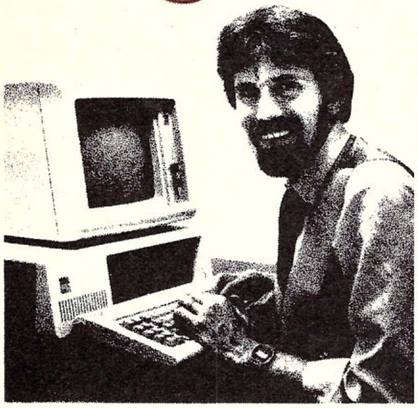
Microsystems May

Volume 5/Number 5
May 1984

S-100—
foundation of the industry and still at the top of the pyramid!

DEPARTMENTS

Editor's Page



The microcomputer market: where it's going and where we fit in

by Mark Rollins

From its inception in 1980, *Microsystems* has truly been *the* Journal of Advanced Microcomputing. Sol Libes, the founder, Chris Terry, the technical editor, and all the staff and writers have continually maintained the highest standards in presenting you, the readership, with the most current information on leading edge state-of-the-art microcomputer hardware and software.

Sol has retired as the active editor of *Microsystems* to pursue other career interests. He will, however, maintain his association with *Microsystems* in his new position as editorial director, and will continue to write the monthly News & Views column. It has been a rewarding experience for all to have benefited from Sol's knowledge, talents, and friendliness. We wish Sol the best in his other pursuits, and are happy that we will not lose his presence at *Microsystems.* With my recent appointment as editor, we intend to continue the same high standards to keep the magazine, and you, at the forefront of the rapidly advancing microcomputer technology.

Our feeling is that the 8-bit, CP/M-based technology is now relatively mature; hence, we can expect little change in this area in the future. The industry is moving toward 16-bit machines, a market dominated by the IBM PC and its look-alikes. This area is still changing and and will probably not reach maturity for another two or three years; hence we are devoting more attention to these machines and their software.

On the other hand, S-100 systems using both 8-bit and 16-bit technology still provide powerful applications for the systems integrator. We are not abandoning S-100 and CP/M-users; we are simply enlarging our scope.

The most rapid changes in the microcomputing industry are occurring in networking, multiuser, multitasking, and graphics systems. Costs are dropping so fast in these areas that such systems are becoming commonplace.

The urgent need to have multiple systems communicate with each other is putting great pressure on systems integrators to learn networking technology. To complicate the issue, the technology itself is relatively immature and is being developed with some urgency by systems designers.

We expect the multitasking and multiuser fields to be dominated by the UNIX operating system. The built-in power of UNIX primitives and the relative portability of both applications and utility programs running under UNIX make it an especially attractive operating system. In anticipation of its growing importance and use, we have already greatly increased our coverage of UNIX, and will devote even more attention to it in the future.

We also see an explosion in the use of visual communications in various disciplines and in many segments of society. For the computer industry on the whole, that means graphics. For the micro industry in particular, it means even more powerful microprocessors, increased memory storage, faster transfer rates, and technological advances in display and output devices. This will allow more sophisticated high resolution and real-time interactive graphics, and we will begin to devote more attention to that area in future issues.

In addition, there's a term being bandied about that aptly describes the *Microsystems* readership: the systems developer. That individual is indeed the advanced microcomputer user: the systems designer, systems analyst, systems programmer, systems integrator. And, more and more, it includes another group: the individual who authorizes the purchase of the hardware and software resources for the systems developer. That person must increasingly understand the systems environment in greater depth.

The task for *Microsystems* can thus be stated simply: to provide the information the systems developer needs to get the job done. That means remaining on the forefront of the industry in order to both preview what is up and coming and provide greater understanding of existing systems.

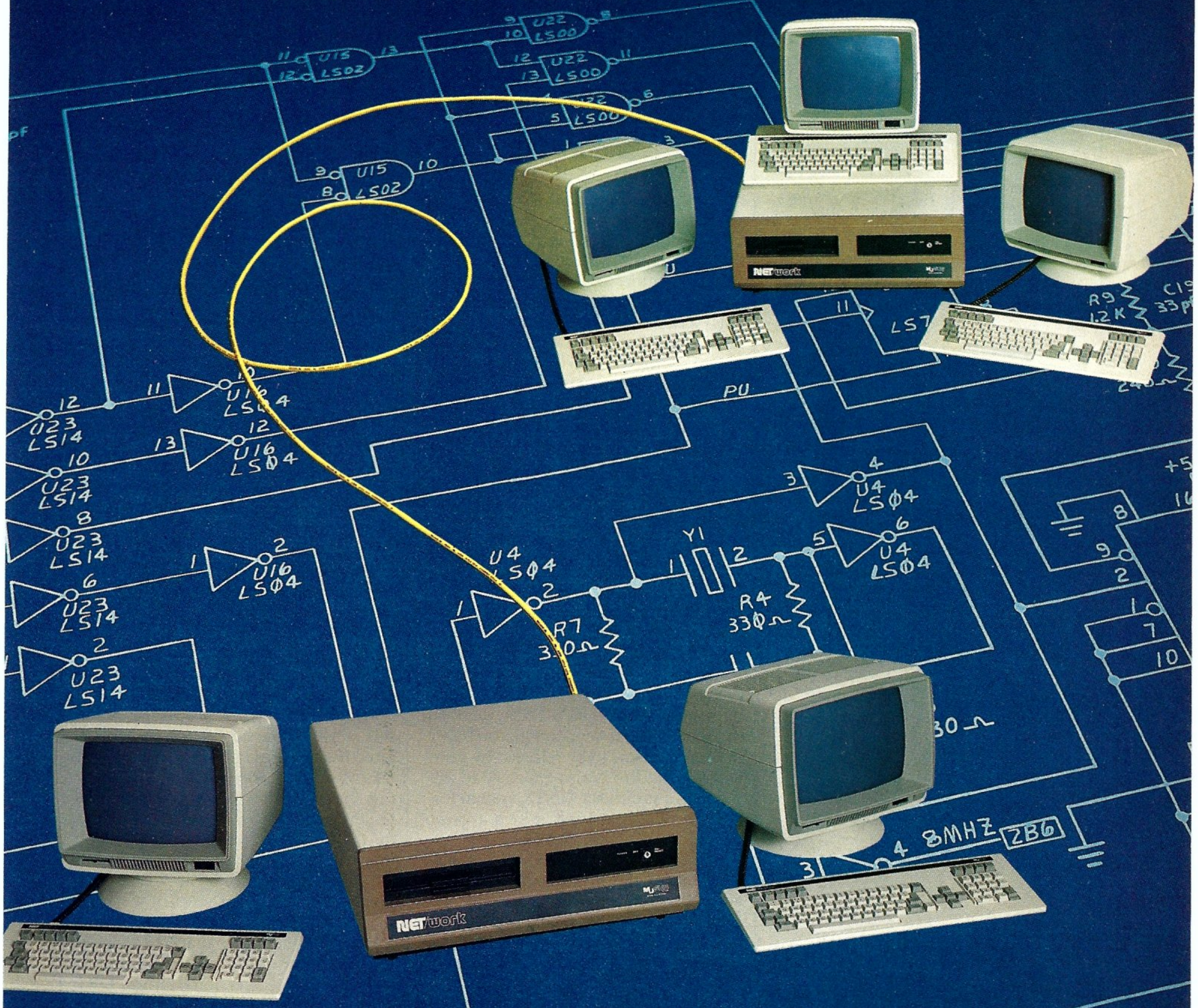
A final note on upcoming issues of *Microsystems.* The theme topics for the remainder of the calendar year are:

June	Communications
July	Graphics
August	Networking & TurboDOS
September	Word processing
October	UNIX on micros
November	32-bit microprocessors
December	Software Directory

If you have an article or an idea for one, please feel free to send it to me or Chris Terry, or to call us. (The subject does not have to be one of the theme topics above.) We especially need articles having anything to do with MS-DOS and UNIX, and on graphics, networking, and nonstandard operating systems. Send the article or an outline to:

Mark Rollins, Editor
Microsystems
One Park Avenue
New York, NY 10016
or call (212) 725-5384 or 725-6856.

THE SMALL BUSINESS MAINFRAME
MuSYS NET/work 8816



Large Multi-user Capability

The NET/work 8816 is an 8/16 bit Multi-user, Multi-processor small business computer system that affords **"Mainframe Power at a Micro Price".** The major features of the system are:

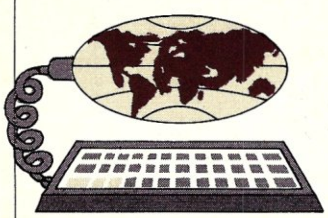
- Expandable from 2 to 8 users, with **18 to 242 formatted Megabytes** of reliable high speed storage. Each user has their own computer with a minimum of 128K RAM and access to a common database of information.
- **Runs over 3,000 CP/M and MP/M software packages.** The NET/work 8816 operates under an enhanced version of the TurboDOS operating system, providing each user with **one of the industry's largest TPAs** (minimum 63 KB).
- You won't outgrow this system! **Room for growth** without costly changes. Networking via ETHERNET links up to 16 systems to accommodate 256 users with 3.8 GIGABYTES of high-speed online disk storage.
- **Easy to install,** boots from the hard disk with a Menu-driven System Configuration Program, **and even easier to use.**
- Plus, Cartridge or 9 Track Tape Back Up Subsystems are available.

Call toll free 1-800-852-5362 for literature (sent in 24 hours), inside California (714) 662-7387. Or write MuSYS Corporation, 1752-B Langley, Irvine, California 92714. TWX 910-595-1967. Cable MUSYSIRIN.

DEALER and OEM INQUIRIES WELCOME

MUSYS CORP.
specialists in multi-user business systems

CIRCLE 83 ON READER SERVICE CARD



News & Views

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

by Sol Libes

Zilog is not expected to sample their new Z800 and Z80000 microprocessor chips until late this year. The Z800 is a greatly enhanced version of the popular Z80 8-bit microprocessor, and the Z80000 is their new 32-bit microprocessor. The Z800 will have features such as memory management, hardware multiply/divide, etc. Details on both chips have appeared previously in this column. . . Digital Research is expected to augment their recent contract to port UNIX System V to the Intel iAPX family, with an agreement to add such productivity tools as graphics, additional languages, and a library of applications packages. . . Digital Research is also expected, this month, to announce between 10 and 16 consumer-oriented applications packages to run under their new Personal CP/M system. It is expected that these packages will be sold via mass merchandisers. . . Ashton-Tate has released a multiuser version of dBASE II to run under MP/M. Further, a new enhanced 16-bit version of dBASE II is expected shortly that will run under PC/MS-DOS, CP/M-86 and UNIX. . . CompuPro is rumored to have contracted for an implementation of multiuser UNIX to run on its new IEEE-696/S-100 system, using the National Semiconductor 16032 microprocessor, to be released by year-end. CompuPro is also expected to implement a multiuser UNIX system for the new System 8-16/F, which uses a 6 MHz Intel 80286 S-100/IEEE-696 CPU. The system is currently available with CP/M and MP/M and features a 40 MB hard disk, a 1.2 MB floppy, 1.5 MB M-Drive, 512K of 16-bit-wide memory, 12 serial ports, one parallel port and one Centronics port for under $15,000. . . IBM is rumored to be donating several National Semiconductor 16032-based microcomputers to the University of California at Berkeley for a UNIX development project.

ISSCC features papers on new IC devices

The International Solid State Circuits Conference, held in San Francisco in February, saw papers presented on many new IC devices currently in development. Fujitsu, Hitachi and NEC presented papers describing their new 1-megabit dynamic RAM chips. The NEC chip is organized as 128K × 8.

Stanford University, the University of California at Berkeley, and Digital Equipment Corporation presented papers on new 32-bit microprocessors. The SU device is a pipelined NMOS device. The Berkeley device featured a reduced instruction set. DEC described a CMOS 5-chip set that implemented the complete VAX instruction set.

Papers were also presented on new image sensors, GaAs circuits, data acquisition circuits, high-speed analog circuits, data processing circuits, dedicated signal processors, nonvolatile memories, and many other devices.

IBM announces UNIX for PC

As previously rumored in this column, IBM has introduced a UNIX operating system for the PC-XT. But the big surprise is that IBM did not go with Microsoft's XENIX. Rather, IBM has chosen to have Interactive Systems Corp., Santa Monica CA, transport their implementation of UNIX for VAX machines to the PC. The operating system will be called "Personal Computer Interactive Executive" or "PC/IX." PC/IX, which costs $900, is a single-user implementation of UNIX System III, and most industry pundits are looking on it as a precursor of a multiuser version to be introduced for IBM's new 80286-based PC, mini and large mainframe computers.

DRI drops CP/M-86 Plus

CP/M-86 Plus, a greatly enhanced version of CP/M-86, which Digital Research Inc. has had in beta testing for several months, will not be released for sale. The new version would have offered the features currently available in CP/M-80 Plus. Reports from the beta test sites were that this would have been the fastest single-testing DOS available for 8088/8086 systems, incorporating many system enhancements.

In dropping CP/M-86 Plus, after investing several man-years of work in it, DRI is conceding that CP/M-86 has achieved too limited a market to justify the expense of introducing and supporting the enhanced version. Rather, DRI will concentrate their efforts on the new windowing version of Concurrent CP/M-86 (CCP/M-86), which they demonstrated at the Comdex show last November and which should be released by the time you read this column. The new CCP/M-86 will also be capable of running all PC-DOS software that follows proper interfacing rules. It is expected that IBM will market this new version.

CP/M-80 Plus, for 8-bit machines, was released almost a year and a half ago by DRI and has met with very limited acceptance despite the extended features and speed enhancements it offers. Only a handfull of OEMs have adopted it, most users being content to run the

Gifford has a lock on multiuser CP/M® 8-16.

It's 11:00 P.M. Do you know where your files are?

It's great when multiple local and off site users can run any 8- or 16-bit CP/M or MP/M™ program. It's even better when they can share expensive resources like printers, hard disks, and tape drives. Best of all is when they can share your most precious resource—data. Gifford has been delivering systems with all these features for over two years.

But sometimes data is sensitive. How do you keep people from taking more than their fair share?

Gifford adds a new dimension to CP/M security.

With our new security features, you can control what resources and data are shared.

Gifford's proprietary security enhancements include user login with encrypted passwords, control over access rights of modem users, secure electronic mail, and the ability to restrict users to specified terminals, programs, and directory areas. Plus, an audit log utility that keeps a permanent record of system activity. And you also get all the standard security features of Digital Research's MP/M-86.™

You select the level of security needed to get the best balance between file sharing and file safety.

Unleash productivity with Gifford's Virtual Terminals.

With our Virtual Terminals, each terminal on your system can monitor up to four different programs running concurrently. And at the touch of a key you can switch screens instantly from one program to another.

You could look up an address in dBASE II,™ jump over to SuperCalc™ to make some projections, then switch instantly to WordStar® to use this information to update a letter. If you forget what's on a screen, just touch a key to refresh your memory. You won't need to go through the distracting process of loading and unloading programs.

And since your Virtual Terminal can run any 8- or 16-bit CP/M or MP/M program, you can choose the best programs for your job from the biggest software library in the world. It's easier than 1, 2, 3!

The Gifford Security Blanket: Total Solutions.

Gifford delivers solutions. This means professional pre-sale consultation, expert system integration with 200 hour system burn-in, complete training, and full after sale support.

For example, our three user CompuPro® based system with a 21-megabyte hard disk costs just $9,990, and can be easily expanded for $500 per user. This includes MP/M 8-16, SuperCalc, and dBASE II.

Other Gifford solutions include systems with hard disks that range from 5 to 300 megabytes, 4 and 9 track tape backup, printers, plotters, and modems. Single- and multiuser 8086, 68000, and Z-80 based systems are available for immediate delivery, with 80286 and 16032 systems on the way.

Two year warranty protection.

In the unlikely event that you encounter a hardware related problem, we'll replace any defective S-100 part within 24 hours FREE for two full years. But chances are, it can be solved on the Gifford service hotline or diagnosed via modem. All at no cost to you.

Lock in on Gifford Security today.

If total support, training, on site service, obsolescence-proof upgradeable S-100 bus architecture, and complete system security sound appealing, cut the coupon or give us a call. We'll send you a free brochure that tells the whole story. Once you get it you'll see why Gifford has a lock on multiuser CP/M 8-16.

Gifford Computer Systems is a Full Service CompuPro® Systems Center.

The powerful Gifford System 321 shown with optional GCS-80 Virtual Terminals.

GIFFORD COMPUTER SYSTEMS
2446 Verna Court, San Leandro, CA 94577
(415) 895-0798 A division of G&G Engineering
I'D LIKE THE WHOLE STORY.
Please send me your brochure.

Name ________ Title ________
Organization ________ M/S ________
Address ________
City ________ State ________ Zip ________
Phone ________
☐ Please have a representative call me. M-S

GIFFORD COMPUTER SYSTEMS ☐ San Leandro, CA (415) 895-0798 ☐ Los Angeles, CA (213) 477-3921 ☐ Houston, TX (713) 680-1944
Amherst, NY (716) 833-4758 ☐ Telex: 704521

CIRCLE 181 ON READER SERVICE CARD

NEWS & VIEWS

Continued from page 10

old version 2.2 of CP/M-80, of which well over 2 million copies have been sold. DRI is also releasing a new version of CP/M-80, to be called "Personal CP/M," intended for very low-cost home computers using Z80 microprocessors. It is also expected that Zilog will soon release a new version of the Z80 microprocessor with most of the CP/M code ROMed in the microprocessor chip itself. CP/M-80 is expected to continue as a very popular microcomputer disk operating system for many years to come; it is likely to dominate the 8-bit micro world.

IBM sues two rivals on PC ROM copyright

IBM filed copyright infringement suits against Corona Data Systems and Handwell Corp., charging that they copied the software contained in the BIOS ROM of the IBM PC and used it in "look-alike" machines. The companies quickly reacted by agreeing to cease marketing machines using the chip. Handwell is a California importer of Taiwanese machines.

Apple Computer has set an industry precedent by filing suits against over 50 companies (most outside the U.S.), charging similar copyright infringement. One case against the U.S. micro manufacturer, Franklin Computer, dragged on through the courts for over two years. Apple finally won the suit and Franklin agreed to cease producing the chips and pay Apple damages. However, there has been a flood of Apple II computer copies arriving from Taiwan, Korea, and Europe. The U.S. Customs Service has confiscated many of these machines, but many have gotten through. Thus it is very common to see Apple II clone computer kits being sold at computer hobbyist flea markets for about one third the list price of Apple's machine. It is likely that the same will happen with the IBM PC.

Predictions

Industry prognosticators are predicting that IBM will make between 1.5 and 2 million IBM PCs this year. If they can do it, this will mean that by the end of this year there will be between 2.3 to 2.8 million IBM PCs in operation. Thus the number of IBM PCs will have exceeded the number of Apple II machines sold and will be approaching the number of Commodore C64 machines sold. Of course, in dollar terms IBM PC sales are almost equal to the combined sales of both the Apple II and C64.

Public domain software news

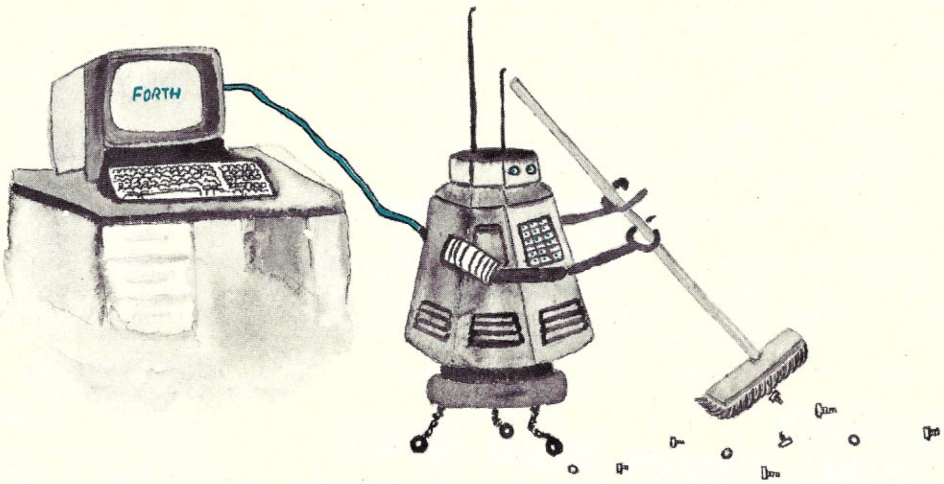
P.J.'s Company, *1062 Taylor St., Vista, CA 92083* is now selling and renting the entire CPMUG and SIG/M public domain software libraries, as well as an MS-DOS library. The CPMUG and SIG/M libraries are furnished on "flippy" disks so that two volumes are placed on one disk ($6/disk). The entire CPMUG library (92 volumes) may be rented for $45, and the SIG/M library (148 volumes) rental is $75. The MS-DOS library (100 volumes) rents for $99.50. Add $7.50 for shipping, handling and insurance). They also offer an automatic subscription service. Telephone is (619) 941-0925.

UNIX news

Motorola has announced that it has completed its port of AT&T UNIX System V to the 68000 microprocessor and has submitted the product to Bell Labs for final acceptance testing; Motorola is the first semiconductor manufacturer to do so. Intel, National Semiconductor and Zilog have also signed agreements with AT&T to port UNIX System V, but have not as yet completed their ports. Intel has entered into an agreement with Digital Research for DRI to do the port to the 80286.

Thus, it is as though Motorola would have the whole microcomputer UNIX System V market to itself for this

FORTH GIVES YOU
TOTAL CONTROL



GRAPHICS • GAMES • COMMUNICATIONS
ROBOTICS • DATA ACQUISITION • PROCESS CONTROL

FORTH: for Z-80®, 8080, 8086, 68000, and IBM® PC
(Complies with the New 83-Standard)

- ***FORTH* programs are instantly portable across the four most popular microprocessors.**
- ***FORTH* is interactive and 20 times faster than BASIC.**
- ***FORTH* programs are highly structured and easy to maintain.**
- ***FORTH* provides direct control over all interrupts, memory locations, and i/o ports.**
- ***FORTH* allows full access to DOS files and functions.**
- ***FORTH* application programs can be distributed as turnkey COM files with no license fee.**
- ***FORTH* Cross Compilers are available for ROM'ed or disk based applications on most microprocessors.**
- **Custom programming, consulting, and educational services available.**

FORTH Application Development Systems include interpreter/compiler with virtual memory management and multitasking, assembler, full screen editor, decompiler, utilities, and detailed technical manual. Standard random access files used for screen storage, extensions provided for access to all operating system functions.
Z-80 FORTH for CP/M® 2.2 or MP/M II, $100.00; **8080 FORTH** for CP/M 2.2 or MP/M II, $100.00 **8086 FORTH** for CP/M-86 or MS-DOS, $100.00; **PC/FORTH™** for PC-DOS, CP/M-86, or CCPM, $100.00; **68000 FORTH** for CP/M-68K, $250.00

FORTH + Systems are 32 bit implementations that allow creation of programs as large as 1 megabyte. The entire memory address space of the 68000 or 8086/88 is supported directly for programs and data.
PC FORTH + ... $250.00
8086 FORTH + for CP/M-86 . . . . . . $250.00
68000 FORTH + for CP/M-68K . . . $400.00

FORTH Cross Compiler allows you to customize the FORTH nucleus, recompile on a host computer for a different target computer, generate headerless and ROM-able code. Supports forward referencing. Produces executable image in RAM or disk file. No license fee for applications, $300.00.

FORTH Native Code Compilers
For Z80 FORTH and CP/M $100.00
For 8086 FORTH and CP/M-86 . . . . . $200.00
For IBM PC and PC-DOS $200.00

Extension Packages
Software floating point (Z-80, 8086, PC only), $100.00; AMD 9511 support (Z-80, 8086, 68000 only), $100.00; Intel 8087 support (8086, PC only), $100.00; Advanced color graphics (PC only), $100.00; Symbolic interactive debugger (PC only), $100.00; PC/TERM Communications/file transfer for Smartmodem, $60.00; Cross reference utility, $25.00; PC/GEN (custom character sets, PC only), $50.00; Curry FORTH Programming Aids, $150.00; B-Tree index manager, $125.00; B-Tree index and file manager, $200.00; QTF + Screen editor for IBM PC, $100.00; Quad Integer Math Pack, $25.00.

AUGUSTA, Ada subset compiler from Computer Linguistics for Z-80 CP/M 2.2 systems, $90.00

"Starting FORTH" tutorial by Brodie, softcover, $16.00.

INTEL 8087-3 Numeric Coprocessor, $250.00

Z-80 and 8080 *FORTH* require 48 Kbytes RAM. 8086 and 68000 *FORTH* require 64 Kbytes RAM. Disk formats available include: 8" standard CP/M SSSD, Northstar 5¼" QD, Kaypro 5¼", Apple 5¼", Micro-Mate 5¼", MS-DOS 5¼", Osborne 5¼", DD, and Sage. Most other formats can be special ordered. Dealer inquiries invited.

Z-80 is a registered trademark of Zilog, Inc.; CP/M is a registered trademark of Digital Research, Inc.; IBM is a registered trademark of International Business Machines Corp.; Augusta is a trademark of Computer Linguistics; PC/FORTH and PC/GEN are trademarks of Laboratory Microsystems Inc.

Laboratory Microsystems Incorporated
Post Office Box 10430, Marina del Rey, CA 90295
Phone credit card orders to ***(213) 306-7412***

VISA® MasterCard

CIRCLE 31 ON READER SERVICE CARD

NEWS & VIEWS

Continued from page 12

entire year. Microsoft is continuing to push its XENIX implementation, containing many enhancements. Reportedly there are already more computer systems running XENIX than any other UNIX implementation. Also, Microsoft and National Semiconductor have announced that the XENIX operating system will soon be available for the National Semiconductor 16032 and 32032 microprocessors.

Microsoft is expected to release version 3.0 of XENIX this fall. The new version is expected to include a visual shell with a multiplan-like user interface. Also, Microsoft is rumored to be actively working on an 80286 version of XENIX.

Readers in Australia may be interested in a new publication for Australian users of UNIX and C. Entitled *UNIX User,* it is published by *Structured Language Resources, Box 73, Mentone 3194, Victoria Australia; tel. 03-5838321 or 03-7638935.*

Motorola and DRI announce software agreement

Motorola has announced that it has commissioned Digital Research to implement Concurrent CP/M, with windows, on the 68000 and to implement its family of languages to run under Concurrent CP/M-68K and Motorola's new version of UNIX Version V. This arrangement is designed to allow software developers to easily port source code applications programs, developed using DRI's C, Pascal MT+, CBasic, Fortran 77, and PL/I languages, between the IBM PC running either PC-DOS or CP/M-86, and 68000-based systems running either CP/M-68K or UNIX Version V.

It is expected that the project will be complete by the end of the year and that the software packages will be sold by both Motorola and DRI.

User group news

The *Morrow Owners Digest* is being published by the Morrow subgroup of the Valley Computer Club (Burbank, CA). For more information send a

Zilog's new Z80 chip will incorporate CP/M in its ROM.

stamped self-addressed business-size envelope to: *Emma Paqui, 104 W. Wisteria, Arcadia CA 91006.*

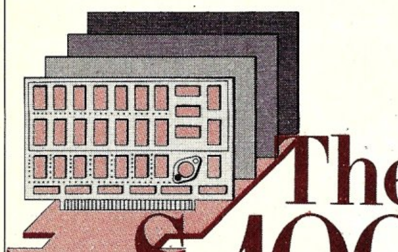
Owners of the Epson HX-20 portable computer may be interested in a user group for the machine in England. They publish a newsletter. Write: *HX-20 Users Group, 25 Sawyers Lawn, Drayton Bridge Rd., Ealing, London W13.*

Carousel Microtools, Inc., is now publishing a newsletter (6 times a year) for owners of Carousel's Software Tools. The newsletter is furnished free for one year, after which there is a $15/year fee. For information write: *Carousel Microtools, Inc., 609 Kearney St., El Cerrito, CA 94530.*

Random News

DRI and Coleco have announced an agreement for Coleco to implement Personal CP/M, in ROM, for the Coleco Adam home computer.

Readers may contact me directly at Box 1192, Mountainside, NJ 07092. If a response is desired, enclose a stamped self-addressed envelope.—Sol Libes



The S-100 Bus

"Mix and match" problems in upgrading your system

by Dave Hardy

Many of the letters I have received (in fact, more than half) are from S-100 users who are having trouble integrating "foreign" boards into their systems. Most of the problems are caused by trying to install non-IEEE-696 compatible boards into a previously IEEE-696 system, or by trying to use new IEEE-696 compatible boards in an older frame. This month, I'd like to discuss some of these "gotchas" and cover some ways that you can avoid or correct them.

Over the last several years, I have had the misfortune of personally encountering every one of the problems about to be mentioned. Although the solutions seem obvious now (problems are always easy to understand after you've solved them), many of them were the result of a great deal of hair-pulling and many long hours of hard work (usually looking in the *wrong* place). Most of the "mix and match" problems fall into four categories: Heat and Power, Speed, Motherboard, and Bus Signals.

Heat and power

Power supply problems are the easiest to find, although sometimes not the most obvious. The usual symptoms are blowing fuses, erratic operation, and excessive heat. For example, many frames are just not designed to deliver 10 amps of 8 volt power to a peripheral controller. So if you plug an old, power-hungry, cartridge disk drive and controller into your S-100 machine, the voltages will drop or the fuses will blow. In addition, something will probably get hotter than normal (usually the power supply), which will also cause trouble. The obvious solution is to avoid plugging devices that draw too much power into the S-100 frame. The manufacturer almost always provides information about how much power is required to run its particular device, so you can check the specs for exact power requirements. If your mainframe can't handle the load, then it should be replaced or modified, or an outboard power supply should be used to power the new peripheral device. A less ideal solution might be to provide more cooling to the frame and its power supply, but this usually works only if you are adding a very small load, or have access to a lot of liquid nitrogen.

Speed

Speed problems arise from differences in the cycle speed of each of the boards plugged into the S-100 bus. Obviously, you can't reliably run a 6 MHz 8085 board in a machine that uses 450 nS RAM boards, because the RAMs are just *too slow* to operate at 6 MHz. This incredibly obvious problem is often overlooked, however, because of "hidden" RAM and ROM in a machine. An almost classic case of this sort of problem is when a user upgrades his system from 2 MHz to 4 MHz by changing the CPU and RAM cards, but fails to consider the effect of the higher clock speed on the EPROMs that cold boot his machine. Also frequently overlooked in these cases is the effect that increased clock speed will have on any software timing loops used in the operating system and its application programs. Typical symptoms in these cases might be erratic disk read/write operations, slow response to system or peripheral interrupts, frequent "unaccountable" system crashes, and peripherals like printers and card readers that don't operate the way that they used to.

Motherboard

The third source of trouble often found in improperly upgraded systems is the S-100 motherboard. Actually just a backplane, S-100 motherboards come in two basic flavors: unterminated and terminated (see last month's "S-100 Bus"). Unterminated motherboards were used in all early S-100 machines like the Altair and IMSAI, and most early "homebrews," or "do it yourself" kits. Terminated motherboards are used in virtually all new IEEE-696 compatible S-100 frames.

Unterminated motherboards usually work OK at 2 MHz, but erratically at higher speeds. Any system that is intended to run at all should have active bus line terminators of the type specified in the IEEE-696 standard. If you are planning to upgrade your system, a terminated motherboard is the best first step, if you don't already have one.

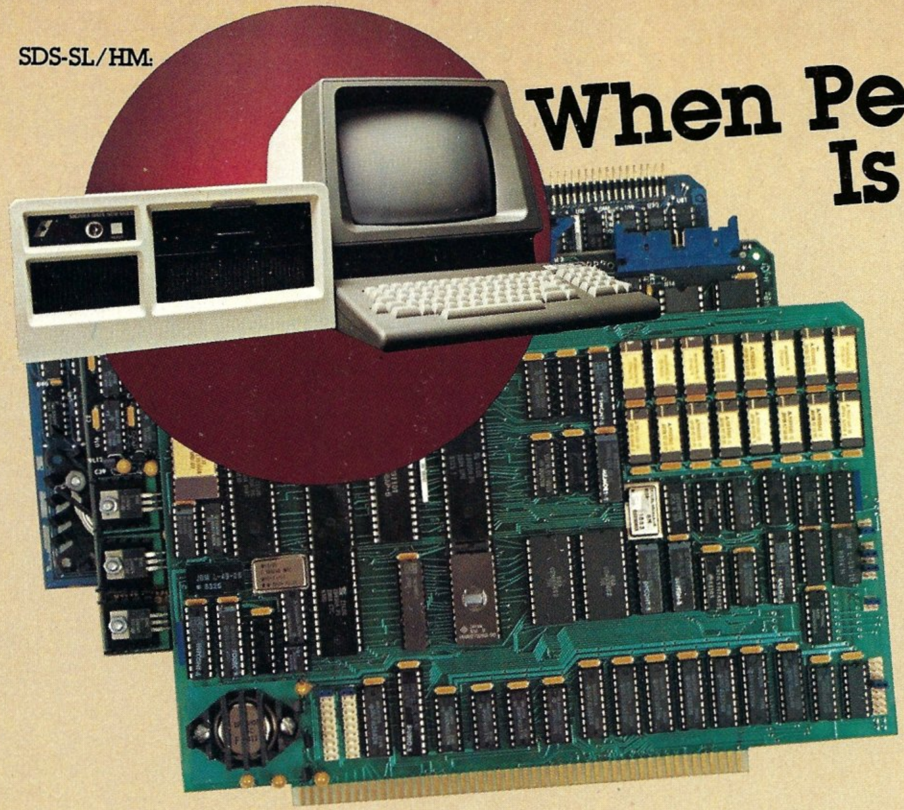
The symptoms of an improperly terminated motherboard are frequently vague, but generally are: erratic operation of certain boards in a system depending on location (i.e., which slot they are plugged into), and system "hang-ups" while performing operations in certain boards on the S-100 bus. A good oscilloscope will help you isolate this sort of problem, but if you don't have one, this sort of problem can be difficult to find.

Bus problems

Bus problems are among the most difficult to track down and solve. Some arise from nicks or solder bridges between traces. The open or short circuits that result can cause some weird symp-

SDS-SL/HM:

When Performance Is A Factor...



Winchester/SMD Hard Disk Controller

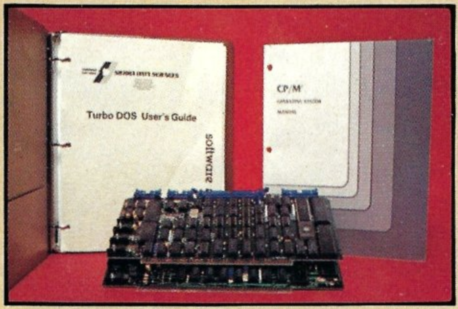
(Shown with Sierra's new 8MHZ Boards)

This is an amazing high-speed companion for your single-or multiuser system. Features NEC's new hard disk controller chip, on-board Z80 processor, buffered sector heads, full ECC supported, SASI or SMD versions available, and optional high-speed DMA pass-thru port for use on Sierra Data's new 8MHZ Master/Slave.

8MHZ-SBC Master and Slave Boards

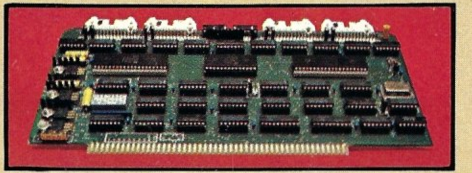
Now, from a Z80 processor, the most incredible throughput available today in the S-100 industry! As the powerful nucleus of a Sierra Data-supported CP/M 2.2* or 3.0* system, our master makes any system look good. With networking TurboDOS* and our new slave, the results are absolutely unbelievable. Check these features (M-master, S-slave):

- Z80H (M & S) Z80A (M optional)
- Dart, 2 serial ports (M & S)
- PIO, 2 parallel ports (M & S)
- CTC, 4 counter timers (M & S)
- From 64 to 512K on-board RAM (M & S)
- 8232 Math Processor (M & S)
- 4K/8K/16K EPROM (M & S)
- Meets IEEE-696/S-100 Standards (M & S)
- NEC 765 Floppy Disk Controller-controls 8 in. and 5¼ in. floppy drives simultaneously (M)
- Multiple Master Buss Arbitration (M)
- DMA Controller (M)
- High-speed Winchester DMA port (M)
- 4K static RAM 8/16 bit independent bus transfer circuit (S)
- Either one or two users per slave under TurboDOS* (S)



SBC-100 and SBC-100S Boards

The workhorses of the single-board computer industry. At 4MHZ these totally IEEE-696 compatible champs out-perform even the 6MHZ imitators. In standalone or slave-satellite configurations you get dedicated Z80A processing with 64K RAM, 4K EPROM, 2 serial RS-232 channels, 2 parallel channels, 4 counter timers and a host of floppy and hard disk interfacing options. Teamed up with Sierra-supported CP/M 2.2* or networking TurboDOS* you get the most computer power and upgradability for the money.



ZSIO-4

A powerful four-port RS-232 serial I/O and real time clock board. Zilog SIO-chips provide ideal links to CP/M-MPM-and AlphaMicro-based systems for multiuser processing with high speed data communications.

Out-perform your competition with a company that stays a step ahead. Ask for our free "Performance Building Kit" today.

216-892-1800

HARDWARE
SOFTWARE

SIERRA DATA SCIENCES

Fresno, CA
Product Support Division • 25700 First Street • Westlake, OH 44145
(216) 892-1800 • TELEX: 980131 WDMR

*TurboDOS is a Registered Trademark of Software 2000 Inc.
*CPM is a Registered Trademark of Digital Research

CIRCLE 23 ON READER SERVICE CARD


You Don't Have To Be A Magician
To Select The Right System
Advanced Digital makes system selection easy. No tricks, No Illusions . . . just an expanding line of Single and Multi-user, Multi-processing S-100 based computer systems that exceed the most demanding customer requirements.
For 1 To 8 Users, It's Super Star. . .
Tired of fighting the limitations of floppies and streamer tapes? SUPER STAR is the FIRST S-100 based system to use the 5 MByte Fixed/5MByte Removable cartridge Winchester disk drive as standard. SUPER STAR offers such outstanding features as a six-slot motherboard, low power consumption, and S-100 Bus, IEEE 696 compatibility. Easily expandable to eight users with TurboDOS* and Advanced Digital's Master/Slave boards, SUPER STAR is the best Cost/Performance Act on the stage today.
New 8/16- Bit Super System II Gives You Up to 20 Users. . .
For those large installations, its Advanced Digital's new SUPER SYSTEM II. Its many features appear right before your eyes like magic. Features such as a 12-slot motherboard, a choice of 20 MByte Winchester disk drive (standard) to 140 MByte of on-line capacity, high-speed, high-reliability 5 MByte Removable Cartridge for back-up at speeds approaching 1.5 MBytes/min., and a one year, 100 % parts/labor warranty. SUPER SYSTEM II – A hard act to follow.
All Advanced Digital Systems are compatible with CP/M* 2.2, CP/M 3.0, Concurrent CP/M and TurboDOS. When equipped with Advanced Digital's new SUPER 186 16-Bit Single Board Computer, you magically change from 8-Bits to 16-Bits. You can even perform simultaneous multi-tasking operations of both 8-Bit and 16-Bit programs.
Advanced Digital computers may perform like magic, but there's no rabbit in the hat . . . only high-quality, extremely reliable components designed and manufactured to assure user satisfaction. Don't be dazzled by cheap tricks and illusions, see your Advanced Digital dealer and take the mystery out of system selection.
See us at Booth 7010, Comdex Atlanta, Ga.
Super Star +
ADVANCED DIGITAL CORPORATION
Leading The Microcomputer Technology
*CP/M is a trademark of Digital Research
*TurboDOS is a trademark of Software 2000
CIRCLE 148 ON READER SERVICE CARD
Advanced Digital
5432 Production Drive, Huntington Beach, CA 92649
Tel. (714) 891-4004 • Telex 183210 ADVANCED HTBH
In Europe:
Advanced Digital U.K. Ltd.
27 Princess St., Hanover Square
London WIR8NQ • United Kingdom
409-0077 • 409-3351 Telex 265840 FINEST

We've Earned The Right To Be #1

By Being First So Often

When it comes to being FIRST with technology-leading products, ***Advanced Digital*** wears its #1 button with pride. We were ***FIRST*** to introduce an 8-Bit, single board S-100 computer... We were ***FIRST*** to introduce a 6 MHz, 128 KByte single board computer... We were ***FIRST*** to introduce a 6MHz, 128 KByte Slave Processor board. And our record for being FIRST continues with...

- The introduction of SUPER EIGHT – an 8 MHz master with Winchester and Floppy disk controller on one board.
- The introduction of SUPER SLAVE II – A dual slave processor that will support two users under TurboDOS.
- The introduction of our new SUPER 186 – the ***FIRST*** 16-Bit, single board S-100 computer that performs at twice the speed of older technologies. Loaded with features such as on-board floppy disk controller and up to 1 MByte of RAM, the SUPER 186 is designed to function as a bus Slave or Master. Advanced Digital's SUPER 186 permits you to take advantage of vast libraries of sophisticated applications software.

Advanced Digital boards are IEEE 696 compatible, run under a variety of operating systems such as CP/M 2.2,* CP/M 3.0, Concurrent CP/M, MP/M,* OASIS,* and TurboDOS* and are available with CPU speeds of 4, 6, or 8 MHz. On-board memory capacities range from 64 KBytes to 1 MByte.

When it comes to selecting your S-100 boards, go with Advanced Digital – The Company that earned the right to be #1.

See your local computer dealer or contact Advanced Digital today... We'll help you become #1.

ADVANCED DIGITAL CORPORATION

Leading the Microcomputer Technology

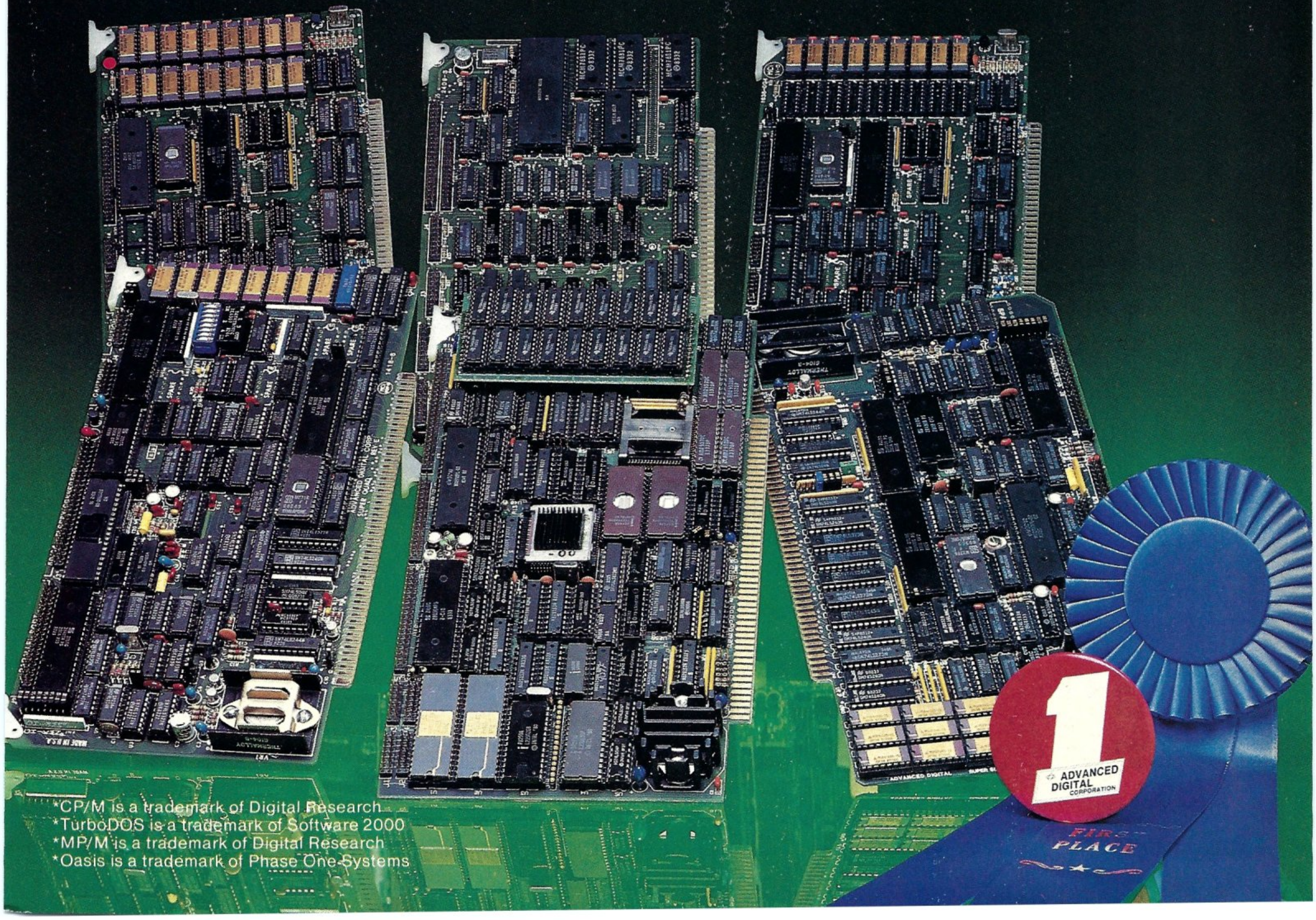
Advanced Digital
5432 Production Drive, Huntington Beach, CA 92649
Tel. (714) 891-4004 • Telex 183210 ADVANCED HTBH

In Europe:
Advanced Digital U.K. Ltd.
27 Princess St., Hanover Square
London WIR8NQ • United Kingdom
409-0077 • 409-3351 Telex 265840 FINEST

CIRCLE 18 ON READER SERVICE CARD

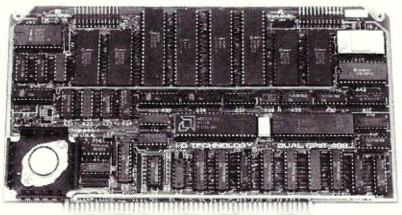
(Top row L to R: Super Slave 128, HDC-1001, Super Slave 64, Bottom row L to R: Super Quad, Super 186, Super Six)

See us at Booth 7010, Comdex Atlanta, Ga.



*CP/M is a trademark of Digital Research
*TurboDOS is a trademark of Software 2000
*MP/M is a trademark of Digital Research
*Oasis is a trademark of Phase One Systems

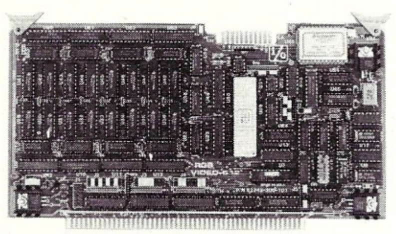
Uncompromising Additions to your S-100/IEEE-696 BUS



DUAL GPIB-488 INTERFACE BOARD

A Stand-Alone, Independently Controlled Dual Channel IEEE-488 I/O Processor. Interface Activity Modes for Controller-in-Charge, Controller Assigned or Terminal Bus Slave, and all Interface Functions are handled transparent to Host System CPU through an on-board CPU and DMA controller. User Friendly operation.

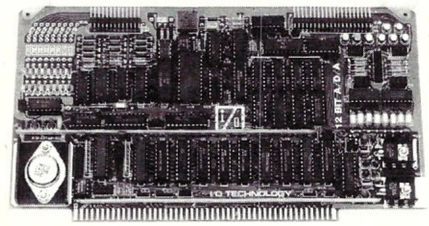
A&T, P/N 52748-800-102 $795.00



RGB VIDEO-512 COLOR GRAPHICS BOARD

Programmable resolution up to 512 x 512 pixels with 4 local video planes and on-board graphics processor. Color mapper allows 16 colors from a palette of 4096. Light pen input. Plus more ...

A&T, P/N 52748-300-101 $985.00



12-BIT A-D-A CONVERTER BOARD

8 Channel A-D: 12 microsec. Conversion, 50KHz Sample Rate, Programmable Gains, Offset and Diff./Single Modes.
8 Channel D-A: 2 microsec. Settling, Bipolar V or Unipolar I Output. Programmable Reference levels, Dual-Ported Channel Refresh RAM. **16/8-Bit Data Transfers** via I/O or Memory Mapped

A&T, P/N 52748-900-101 $455.00

MULTI-FUNCTION I/O BOARD

A&T, P/N 52748-100-101 $325.00

SMART PROTOTYPING KIT

P/N 52748-400 $60.00

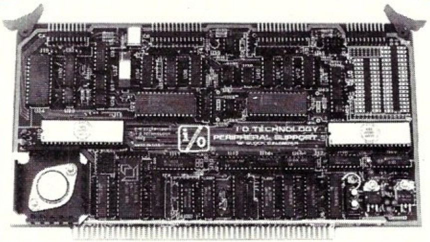
128K x 8/64K x 16 CMOS STATIC RAM MODULE

A&T, P/N 52748-650-128 $825.00

California residents add 6½% sales tax.
U.S. Domestic Price, FOB Factory.
Prices and Specifications subject to change without notice.

I/O TECHNOLOGY
POST OFFICE BOX 2119
CANYON COUNTRY
CA 91351
[805] 257-1000

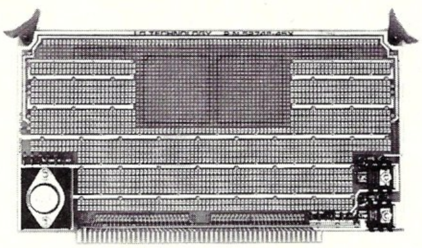
CIRCLE 11 ON READER SERVICE CARD



PERIPHERAL SUPPORT BOARD

Two Serial SYNC/ASYNC Ports with RS-232, TTL or Current Loop Outputs, three 8-Bit Parallel Ports, three Timers, Real Time Clock/Calendar and Response Programmable Interrupt Controller. Small Proto Area with +5 and ±12v.

A&T, P/N 52748-150-101 $395.00



MULTI-PURPOSE PROTOTYPING KIT

Industrial Quality with Plated-Thru holes for Wire-Wrap or Solder projects. Complete with +5, ±12v Regulators, Bus Bar, Filter Capacitors, and Manual.

A&T, P/N 52748-450 $72.00

S-100 BUS

Continued from page 16

toms, not necessarily directly concerned with the defective board. Others, which are often worse, arise from incompatible signals on the S-100 bus. These are the kinds of trouble that professional systems integrators have nightmares about. There are so many that it would take several pages just to list them all. However, one of the most common offenders against IEEE-696 bus rules is the front panel. Four of the most frequent problems that arise from mixing front panels and IEEE-696 boards are described here.

Multiple MWRT signals. MWRT is the S-100 Memory Write strobe (pin 68). Without it, most system memory boards can't be written to, which means that the system will appear unable to boot, unless its OS is entirely in ROM. MWRT is generated from the sOUT and pWR* signals of the S-100 bus, and so can be produced anywhere within the system. Most front panels produce MWRT. Unfortunately, most new CPU boards also produce MWRT, so you must be sure that MRWT is produced by only one board. The usual procedure is to generate MWRT on the CPU, unless the system has a front panel.

Bus pins 20 and 70. These pins were originally the Memory Unprotect and Memory Protect lines, before the IEEE-696 standard was adopted. Some manufacturers also used these lines to control other system functions like memory select and stall. In the IEEE-696 standard, both of these lines are connected to ground, which could cause some real problems if your system is expecting to see an active high signal on them to enable memory. Since many old front panels (most notably Altair) used pins 20 and 70 for memory protection, a ground signal (low) on either could cause the front panel to malfunction. Even the IMSAI front panel, which does not have any memory protection circuitry can be affected by these lines, depending on what previous modifications may have been performed on it.

The sM1 signal. sM1 (status Machine cycle 1) is the signal that the IEEE-696 bus uses to indicate when the master processor is fetching an instruction from the data bus. Commonly, it is used to simply indicate the start of each machine cycle. Many front panels were designed for use with an 8080 processor that outputs its status information on the data bus. Some of these front panels read sM1 from the data bus, and some read sM1 from bus pin 44 (the correct way). Erratic or missing front panel operations can sometimes be traced to this problem.

Speed problems arise from differences in the cycle speed of each of the boards plugged into the S-100 bus.

Data bus reflection. Some old front panels (at least the IMSAI) expect that the S-100 Data Out bus exactly duplicate the data carried on the Data In bus during a DEPOSIT operation. If you want to be able to use the front panel's DEPOSIT function, you may need to modify the CPU board so that it does not disable the Data Out bus during a read operation. This modification is required on all CompuPro CPU boards, as far as I know. CompuPro mentions this procedure but warns that it may increase the noise on the data bus and affect high-speed operation.

Miscellaneous

I/O port addressing. When the 8080 processor does an IN or OUT operation, the I/O port address is placed on address lines A0-A7 and *duplicated* on address lines A8-A15. When the Z80 processor does an IN or OUT operation, it places the I/O port address out on A0-A7 and the contents of the A register on address lines A8-A15. Naturally, some ingenious designers of early S-100 equipment used the *upper* eight address lines (A8-A15) to obtain the I/O port address. This flaw is great fun to track down on many old S-100 boards which, when used with a Z80 for the first time, will try to perform I/O to whatever device is addressed by the contents of the accumulator! Other processors will produce equally strange results with this sort of I/O illness. Some Z80 CPU boards, like the Cromemco ZPU, were actually designed to mirror the lower eight address lines to the upper eight address lines during I/O operations to avoid this problem, but most were not. Needless to say, none of the 16-bit CPUs performs this feat. The IEEE-696 standard does not require address mirroring during I/O. This problem also exists in the IMSAI front panel, and some others. The only solution to this problem is to hack up any boards that expect to see I/O addresses on the upper eight address bits and make them look at the lower eight bits instead.

DMA problems

Early S-100 machines that use DMA allow for only one DMA device per system, so new IEEE-696 DMA devices that require bus arbitration probably won't work. The solution is either to add bus arbitration (i.e., remove the old DMA boards) or not to add IEEE-696 compatible DMA devices. Or, you may try to kludge a DMA arbitration circuit onto the old DMA device, which is usually impossible....

In addition, IEEE-696 DMA devices use bus pins 14, 55, 56, and 57 as their DMA control bus lines. In older S-100 machines, these lines have been defined as everything from bank-select to status-strobe to battery backup, so they should be investigated before adding any new DMA devices.

pSTVAL* problems

One other common "mix and match" headache that bears mentioning is a pSTVAL* bus problem. pSTVAL* (processor STatus VALid, pin 25) is the IEEE-696 signal that replaced the old S-100 phase 1 clock signal. pSTVAL* is an active low signal that, when gated with pSYNC, signifies that data on the address and status buses is valid. Although the old phase 1 clock signal is still valid as a pSTVAL* signal, the following problem may arise when using pSTVAL* to generate wait states: Many old S-100 boards used pin 25 as a simple inverted clock signal to start and stop a wait state generator. Unfortunately, with the new definition of pin 25, there may not be two negative edges during pSYNC to start and then stop a wait state generator. Instead, there might be only one. If this happens, the board will remain in a wait state forever. The symptoms of this problem, then, would be that the board would "go out to lunch" with the system whenever it executed a wait state. You can usually confirm this sort of problem by turning off all wait states on the suspected board (although this might not always work unless you lower the clock speed, too). The solution to this problem is to hack up the offending board and make it use an inverted clock signal (invert pin 24).

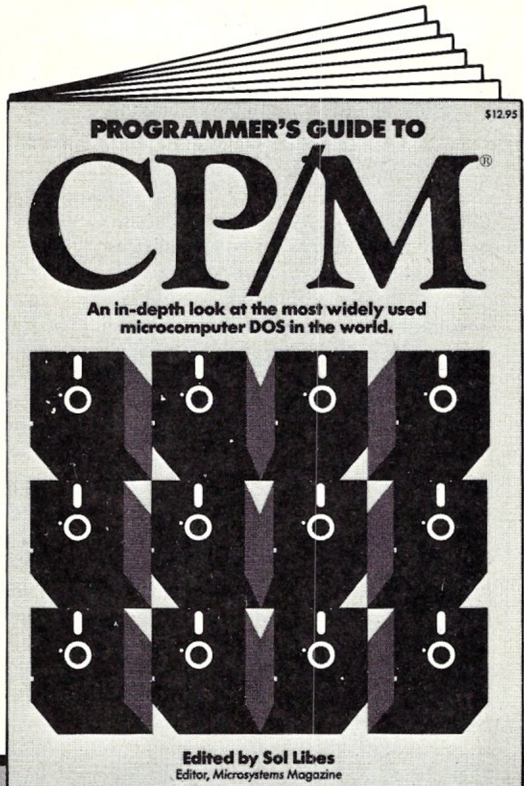
This column is intended as a forum on S-100 bus topics. Readers are encouraged to send in questions on the S-100 bus, which I will attempt to answer. Please write to: Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48203.

PROGRAMMER'S GUIDE TO CP/M®

Edited by Sol Libes

Here's an important collection of CP/M insights that you'll never find in any CP/M manual. CP/M is the most popular microcomputer DOS in use today, and this widespread use has generated many innovative techniques and enhancements of CP/M. *Programmer's Guide to CP/M* tells you what these enhancements are and how to put them to use, how to get around apparent limitations of a CP/M system and why CP/M is far more versatile than you might have imagined. Every article in *Programmer's Guide to CP/M* originally appeared in MICROSYSTEMS between January 1980 and February 1982. Except for this collection, these articles are now unavailable! *Programmer's Guide to CP/M* gives you an in-depth look at CP/M from the viewpoint of the programmer—the individual who creates the software that interfaces directly with CP/M, or who is installing CP/M on systems for which configurations do not already exist.

Contents include "An Introduction to CP/M," "The CP/M Connection," "CP/M Software Reviews," "CP/M Utilities & Enhancement," "CP/M 86" and "CP/M Software Directories." 200 pages, $12.95.



CP/M is a registered trademark of Digital Research, Inc.

Microsystems

MICROSYSTEMS PRESS
Dept. NT1F •39 East Hanover Avenue•Morris Plains, NJ 07950

Send me _____ copies of *Programmer's Guide to CP/M* at $12.95 each, plus $2 for postage and handling. **#14C**

Foreign orders (except Canada and Mexico) add $3 for postage and handling. Shipped airmail only.

☐ **PAYMENT ENCLOSED** $_______ (NJ residents add 5% sales tax.)

☐ **CHARGE MY:**
☐ American Express ☐ MasterCard ☐ Visa

Card No.______________ Exp. Date________

Signature______________________

Print Name______________________

Address______________________ Apt.______

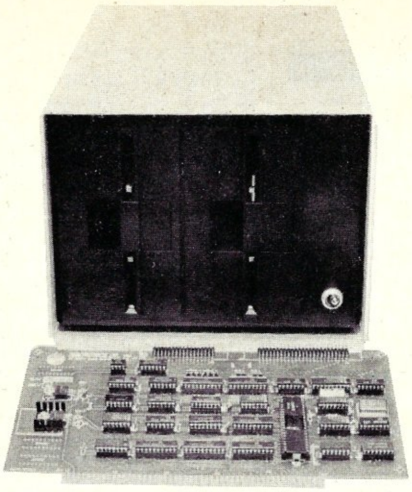
City______________________

State______________ Zip______________

For faster service,
CALL TOLL FREE: 800-631-8112
(In NJ only, call 201-540-0445)
Please refer to Dept. NM2F when ordering.

☐ Check here for FREE catalog.

Institutions only—purchase orders under $50 not accepted.



DISK MAKER™ MAKES *FIFTY* DIFFERENT DISKS

Solving the 5¼" Disk Hassle

Frustrated with the multitude of 5¼" Disk Formats?
Missing sales because you don't have the right format?
Wasting time downloading software?

Solution: **Disk Maker I**

YOUR BENEFITS

- **No more time consuming downloading.** — Finding two computers, connecting them, getting a modem program running in each computer, and then waiting becomes a thing of the past.
- **From yours to theirs** — Your customer needs software on his XYZ but you have it on ABC. Disk Maker does the conversion — at disk speed.
- **One to Many** — Disk Maker can provide disks in any of over FIFTY formats. And the number of formats is increasing monthly.

DISK MAKER II™

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

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

What is included?
- **An S-100 Floppy Disk Controller Board** — supports 4 drives, any combination of 5¼" or 8" — double-sided, double-density, 48 tpi or 96 tpi. And extendable to the new 3" drives in the near future!
- **48 tpi to 5¼" Disk Drive** — double-sided, double-density in a dual drive cabinet and power supply. A second 96 tpi DSDD drive is optional. Drive cables included.
- **Powerful Disk Maker Software.** DMFORM formats diskettes in any of over FIFTY formats. DMSET automatically links Disk Maker with your CP/M system to create up to four additional disk drives on your system. You can then just copy any programs from your system's disk drives to Disk Maker's — using standard CP/M® utilities or our enhanced Multiple Copy (MC) program.

What disk formats can I make?
Any of over FIFTY formats. Osborne, Cromemco, DEC Rainbow and VT180, Epson, Sanyo, TI, Xerox, Eagle, Archives, KayPro, NEC, IBM PC (CP/M 86), SuperBrain, Otrona Attache, Zenith Z-100, Heath (Soft Sector) and TeleVideo to name just a few. And new formats as they are added.

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

Options:
96 tpi DSDD 5¼" drive: $385.00
8" DSDD drive, power supply & cabinet: $840.00.

TM - CP/M, CP/M 86 - Digital Research, Disk Maker — New Generation Systems

NEW GENERATION SYSTEMS, inc.

1800 Michael Faraday Drive — Suite 206 — Reston, VA 22090

(703) 471-5598 • **(800) 368-3359**

CIRCLE 123 ON READER SERVICE CARD

From the Sidelines

The PCjr finally arrives

by Hank Kee

By the time this column goes to print, PC*jrs* will be available on dealer shelves for public sale. IBM's production goal is to deliver in excess of 900,000 units for 1984. The press has wondered if there would be sufficient corporate and home purchases to justify IBM's marketing projections. Only time will tell. Even with numbers like this, the preliminary industry forecast is still predicting a shortage of PC*jrs* for the year. Wouldn't all PC manufacturers like to have that kind of problem?

The relatively long incubation period from the time of announcement to general release has resulted in many erroneous conjectures about the capability of the PC*jr*. With each PC publication racing to outscoop its competition, the press relied on IBM's promotional literature and internal product briefs rather than actual product tests. Getting access to PC*jr* review units has been like adopting one of the Cabbage Patch Kids. I've had a PC*jr* since late January, and I have been putting it through its paces.

PC*jr* and PC-DOS 1.10

Originally it was noted that PC-DOS 2.1 was required for diskette operation of the PC*jr*. This is not absolutely true. The PC*jr* can run PC-DOS 1.10, which requires a smaller resident monitor. This is important, since RAM on the PC*jr* is presently limited to 128K. The only drawback is that 1.10 does not support some of the peripherals newly announced for the PC*jr*.

In addition to a gain in memory space, another major advantage of PC-DOS 1.10 is its ability to run LOTUS 1-2-3 version 1. This is an earlier release that is still available. The updated version, 1A, was implemented so that it would be usable on the IBM PC-XT, which requires PC-DOS 2.1. As a result, memory requirements went up to 192K. I had to dust off the archived files to find this particular version. I was not, however, able to properly load the LOTUS GRAPH option without modification. Otherwise the size of the available spreadsheet space was fairly decent at over 14K. Let's hope there will be a revised reintroduction of LOTUS version 1 for PC-DOS 1.10 on the PC*jr*. That's one step forward and two steps backwards.

A somewhat illogical thing about the PC*jr* is that it will not execute Basic or Basic A residing on the PC-DOS 2.1 diskette, even when the Basic cartridge for the PC*jr* has been inserted. Basic A or Basic only invokes the cartridge. The Basic cartridge costs $75. This ROM cartridge actually extends your memory to about 192K. Basic does not penalize the user by occupying RAM space. If you try to call Basic A from the PC-DOS 2.1 diskette without the cartridge, the system will dutifully inform you that it is not permitted. It is, however, possible to use Basic A from the PC-DOS 1.10 version. This does not rely on the Basic cartridge.

Gee whiz extensions

The Basic cartridge on the PC*jr* is an extended version of the diskette implementation. New functions and options have been added to the regular Basic. The major additions have been commands to access the hierarchical directories of PC-DOS 2.1. This makes it possible to access files across the various subdirectories within Basic. Terminal emulation has also been included on this cartridge. Not bad, considering the $75 price. These extended Basic features will be reviewed more fully at a later time. The trend will be to offer valuable software on cartridges to decrease the chances of software piracy.

PC*jr* and CP/M-86

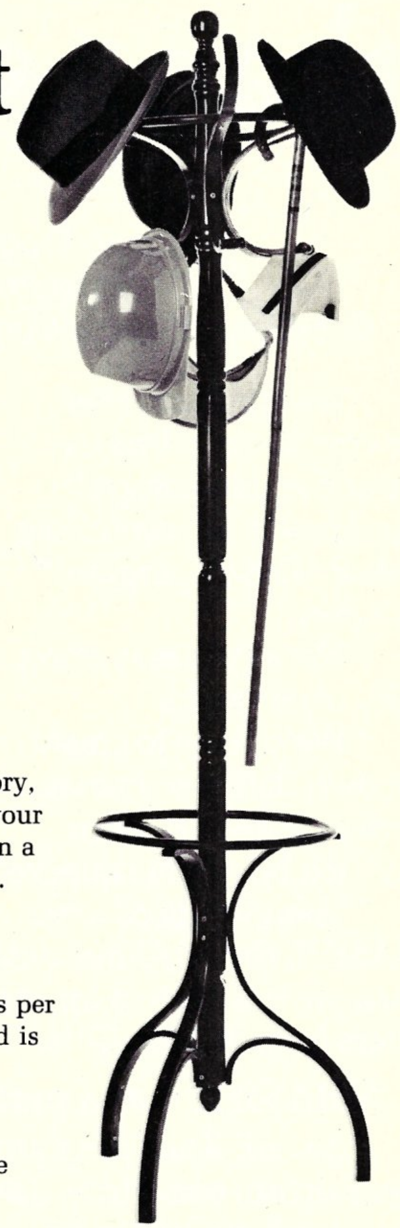
The PC*jr* can also run CP/M-86 version 1.0 as sold by the IBM Product Center for $250. CP/M-86 version 1.1 with GSX, as sold by Digital Research for $60, will not load properly. It does not properly sense the correct number of diskette drives in the system. With CP/M-86 1.0, the only problem seems to be the screen, which only displays 40 columns at system boot. There is no internal switch readily accessible as in the PC, to indicate a choice between 80 x 25 or 40 x 25 color. This is not an insurmountable problem. Use ED and DDT86 to create an escape sequence, and you then have yourself one fine little CP/M machine:

```
ED WIDTH80   invoke ED naming new
             file WIDTH80
I            ED command to insert
ABC          any three letters
[ESC]        [escape] to exit
             insert mode
E            exit ED and save file
             WIDTH80
DDT86        invoke DDT86
RWIDTH80     read file WIDTH80
SO           initial location to
             modify
1B           hex value of ''ESC''
61           hex value of ''a''
33           hex value of ''3''
WWIDTH80     rewrite file WIDTH80
^C           control-C to exit
             DDT86
```

Use the command TYPE WIDTH80 to

At last,

software that doesn't tell you how to run your business. No matter what hat you wear!



Isn't it time you started using *it's my* **Business**™

With *it's my* **Business**™ you can create video templates to manage inventory, accounting, mailing lists, filing, and other problems which are special to your business or profession. You will be amazed when you can make software in a couple of hours that would normally take a professional developer months.

it's my **Business**™ features 3-key/mouse driven video templates, pop-up menus, a 32-megabyte virtual memory capability, and Simplex™, the first networked/relational database, which supports up to 64K files, 64K records per file, 64K bytes per record, 255 keys with up to 16K replication per key, and is capable of sorting up to 500,000 zip codes.

it's my **Business**™ supports LOGICAL, BYTE, WORD, INTEGER, SINGLE, DOUBLE, REAL, ARRAY, STRING, and TEXT types in an English-language format, both with and without 8087 coprocessor support.

it's my **Business**™ may be used on a network and has login, privilege, and database protection.

Dealerships still available in certain areas. *it's my* **Business**™, *it's my* **Word**™, *it's my* **Graphics**™, Simplex™, and the Quest logo are trademarks of Quest Research, Inc., 303 Williams Avenue, Huntsville, AL. 35801, 205-533-9405 or 800-558-8088.

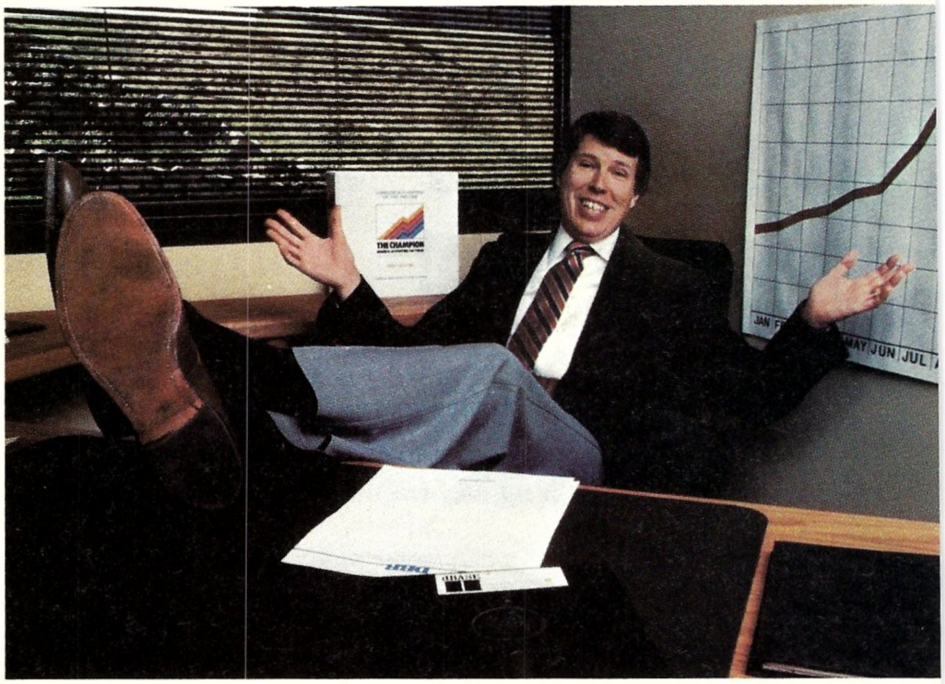
Quest™

Quest Research, Inc.

CIRCLE 21 ON READER SERVICE CARD

"dBASE II® is far, far better than a shoehorn."

Rusty Fraser
President
Data Base Research Corp.



"We laughed when our customers asked us to put our minicomputer-based real-time accounting system, The Champion,™ on a micro.

"No way was it going to fit, we thought.

"We'd have to create our own database management system and, even then, it'd be a tight squeeze.

"Then we discovered dBASE II, the relational database management system for microcomputers from Ashton-Tate."

"dBASE II was a perfect fit."

"dBASE II is a program developer's dream come true. The dBASE II RunTime™ module quickly provided us with the powerful text editing, data entry speed and other 'building block' capabilities we needed to develop and deliver a new Champion to our customers—the leading real-time on-line accounting system available for a micro."

The short cut to success.

The dBASE II RunTime module has helped a lot of program developers like Data Base Research become successful software publishers.

For more about dBASE II and RunTime, contact Ashton-Tate 10150 West Jefferson Boulevard, Culver City, CA 90230, (800) 437-4329, ext. 217. In the U.K., call (0908) 568866.

For more about The Champion, call Data Base Research at (303) 987-2588.

ASHTON·TATE

CIRCLE 15 ON READER SERVICE CARD

SIDELINES

Continued from page 22

switch to 80 x 25 screen. When the escape sequence "ESC a 7" is typed out, it switches the screen to 40 x 25. This programming tip was provided by Dennis Tillman, Technical Support Specialist at Digital Research.

The advantage of using CP/M-86 is that practically all related application programs were written with calls to the BIOS. Thus standard calls were used rather than direct mapping onto memory. If the program had its genesis in CP/M-80, use of overlays to keep within 64K will most certainly fit within the 128K limitation of the PC*jr*. Most commodity CP/M software running on the IBM PC will run on the PC*jr*. Very few commercial CP/M programs are hardware specific.

PC*jr* and PC-DOS 2.1

Using the MODE 80 system command, you can easily put the PC*jr* system into 80-column mode. Once this has been accomplished, you will find that WordStar, Condor, Crosstalk and many other programs will have no difficulty running on the PC*jr*. Experiment with some of your favorites.

PC-DOS 2.1

In a prior column, I presented an overview comparing PC-DOS 1.10 and CP/M 2.2. They are, as I stated, similar and yet different. In PC-DOS 2.1, however, there is a vast departure from CP/M architecture.

Getting a PC*jr* review unit was like trying to adopt a Cabbage Patch Kid.

PC-DOS 1.10 functions are a virtual subset of PC-DOS 2.1. The extended functions on an IBM PC*jr* make it a very powerful personal computing system. The Batch processing commands have been extended. The additional internal subcommands are:

ECHO	inhibits screen display
FOR	interactive execution of commands
GOTO	transfers control to line following the label
IF	conditional execution of commands
SHIFT	allows command lines to make use of more than 10 replaceable parameters

The external command structure has been extended to include:

ASSIGN	uses a different drive from the one specified
BREAK	checks for a control break whenever a program requests a DOS operation
CHDIR	changes the current DOS directory
CLS	clears screen
MKDIR	creates a subdirectory
PATH	causes specified directories to be searched for commands
PRINT	prints a queue of data files on the printer

SIDELINES

Continued from page 27

RECOVER	recovers a specific file that cannot be copied or otherwise used because of a defective spot on disk
RMDIR	removes a subdirectory
TREE	displays all the directory paths
VER	displays the DOS version number
VERIFY	performs read after write on disk
VOL	displays the volume label

If you wish to add or change the configuration, you can. Each time the DOS is started, it searches the root directory of the drive for a special configuration file called CONFIG.SYS. It reads this file (if found) and interprets the text commands to alter default values. The text control commands are:

BREAK	sets ctrl-break (initially OFF)
BUFFERS	allocates number of disk buffer from 1 to 99; the default value is 2
DEVICE	specifies the name of a file containing a device driver
FILES	allocates number of files that can be opened at one time; the default value is 8
SHELL	specifies name of top-level command processor that DOS initialization will load in place of COMMAND.COM

PC-DOS 2.1 has input/output directional control. The standard input and output device redirection feature allows a program to receive its data from a source other than the keyboard or direct its output to a device other than the display. PC-DOS 2.1 also features piping, which allows the screen output of one program to be used as the keyboard input to another program.

Here is an example of piping and redirection:

```
DIR A: 123.*

 Volume in drive A has no label
 Directory of A:\

123   EXE    87269   1-18-83   3:13p
123   CNF      128  12-24-82   8:33a
123   HLP   176858   1-18-83   2:31p
   3 File(s)        0 bytes free
```

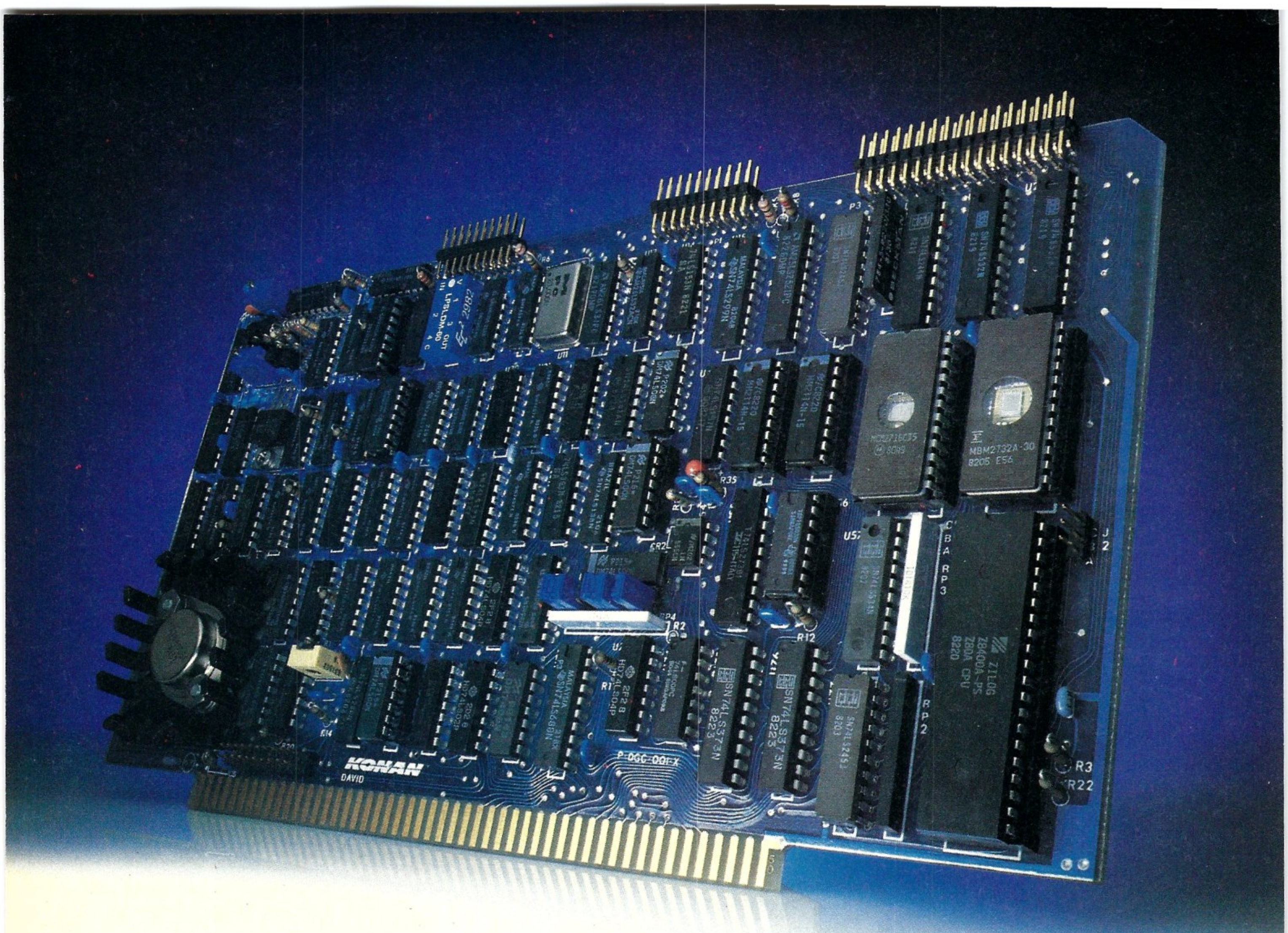
We would use the following command to sort the directory on file size and direct it to an external file:

```
DIR A: 123.*|SORT/+14>FILES
TYPE FILES

123   CNF      128  12-24-82   8:33a
123   EXE    87296   1-18-83   3:13p
123   HLP   176858   1-18-83   2:31p
Directory of A:\
   3 File(s)       0 bytes free
Volume in drive A has no label
```

These advanced commands have been added to the DOS:

CTTY	changes to an auxiliary console (internal command)
FIND	searches files for string of text
MORE	displays a screenfull of data
PROMPT	sets a new prompt (internal command)
SET	inserts strings into the command processors environment (internal command)
SORT	sorts text data

When PC-DOS 2.1 was announced and released, many assumed there would be a fixed disk capability for the



ANOTHER S-100 HARD DISK SOLUTION THAT PUTS YOU IN CONTROL.

5¼'' Winchester control at a price that can't be beat!

$259 *large OEM quantities*

From the spectrum of Konan S-100 solutions comes the DGC-100. Offering full sector buffering, error correction, automatic flaw mapping...all standard. The DGC-100 supports the known spectrum of ST-506 compatible drives. And features what is possibly the best data clock separator on the market today.

Konan's DGC-100. Reliability. High performance. On-time deliveries. And...a low, low price.

For more information or to place an order, write or call:

KONAN™ *in control*

1448 North 27th Avenue, Phoenix, Arizona 85009
(602) 257-1355, TWX/TELEX 9109511552

CIRCLE 242 ON READER SERVICE CARD

SIDELINES

Continued from page 29

PC*jr*, since these utilities are included on the distribution diskette. But so are Basic A and Basic. As previously stated, PC-DOS 2.1 is a replacement for PC-DOS 2.0. The following fixed disk commands, available under PC-DOS 2.1, are not used on the PC*jr*:

BACKUP	backs up files from a fixed disk to diskettes
FDISK	initializes and configures a fixed disk
RESTORE	restores one or more files from diskettes to a fixed file

The user may also alter file attributes in the directory. But the mechanism to do this is not a part of the normal functions of the operating commands. From an overall point of view, PC-DOS 2.1 is pretty nifty, especially for a PC*jr*.

Integrated systems

Lotus 1-2-3 and Context MBA have made substantial headway in offering multifunction software. Others are now making available added functions to their original product offering. Microsoft has released Microsoft WORD, which is compatible with MultiPlan. SuperCalc 3 offers extended graphics to their spreadsheet system. And while all this is going on, OS suppliers are offering windows.

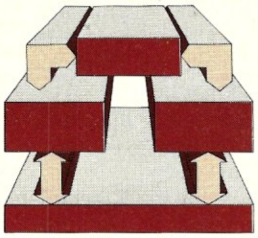
It would be better if vendors could standardize on an OS data format.

According to Microsoft's file definitions, data integration can be achieved by windowing, or subdividing the screen into smaller windows. Each window can be "painted" with its own color and can process a different task or program; also, data can be transferred between windows. Thus it is hoped that systems integration can be achieved via the OS—and outcome preferable to having a single package developer offer all functions to all people, with each function being state of the art. This is not a practical expectation from a package vendor.

Digital Research has carried windowing a step further in their offering of Concurrent CP/M for the IBM. They are also offering MS-DOS emulation as a process available in one of the windows. All this development by DRI and Microsoft is very nice, but it is very difficult for the user to interchange data between operating systems.

It would be better if vendors could "standardize" on an operating system data format. Each offers unique functions and discrete formats that are incompatible with each other. An OS, by definition, demands that all software subsystems be able to have common formats for data files that can be accessed and/or shared. Perhaps Concurrent DOS, offered by DRI, is the answer.

Hank Kee, 42-24 Colden St., Flushing, NY 11355



The UNIX File

Using the USENET network for information exchange; the shell as a programming language

by Ian F. Darwin

By popular request, we start this month with some information on public domain software for the UNIX system. Then there's some information on "shell programming" again, and a new feature—the first of a series of efficiency tips for small UNIX systems. Plus a few UNIX product vendors who missed the deadline for listing in last month's software survey.

In the public domain

In my column in the March 1983 issue of *Microsystems,* I wrote:

"Some people have claimed that there is more software available for CP/M than for UNIX. However, a lot of the public domain software for CP/M is just there to fill gaps in the system! The public domain software for UNIX consists of useful items such as a spreadsheet package, electronic mail interfaces, bibliography packages and so on.

"Most of the UNIX public domain software is written in higher-level languages such as C and is therefore movable from machine to machine, while a lot of the CP/M public domain programs are written for the 8080/Z80 machine and cannot readily be moved to the 16-bit machines."

A number of readers wrote in asking how they could get access from their small UNIX systems to this software. So here's looking at public domain software and UNIX.

The major source of public domain software for UNIX is UNIX itself. Last month I discussed the UNIX **uucp** and USENET networks. There are about 1500 machines (not counting single-user workstations) forming the USENET network for information exchange. One "newsgroup" (or classification of messages sent out on USENET) is called **net.sources**, and consists of the source code for new programs. It is here that a large amount of public domain software appears. Therefore, to get access to this software, you need only to get access to **net.sources**.

Simple, he says. What you must do, in fact, is to arrange locally with a larger computing center using UNIX to get access through them. Your access may be either as a **uucp** node or as a dumb terminal (no offense to your terminal). Your mode of access depends upon what software you have available on your system and on what arrangements you can make locally. In either case, you should be able to send and receive **mail** at once, and receive **news** if you run UNIX or XENIX or a similar system that is generously endowed with disk storage. You shouldn't consider trying to run **news** unless you have about 10 megabytes of free disk storage to devote to it.

You'll have to keep the source around while you're setting it up, and you'll probably want to keep it around for bug fixes and updates. Basically, **news** is for sites with large reserves of hard disk storage.

The **news** software is itself in the public domain, and you normally get the source for it from either your **news** connection or from your system vendor. To install it yourself usually requires some knowledge of C programming.

I keep the source for a few public domain programs on my system. Presently these include **nro, tmodem** and **sc**. **nro** is Stephen Browning's version of the Software Tools text formatter. Written in C, it's a subset of the UNIX **nroff** program. It was written for CP/M, but I have it running under UNIX at present. **tmodem** is a UNIX version of the CP/M Christensen MODEM protocol. It runs on UNIX, and a CP/M system can dial in to upload or download files. In this sense, it is comparable to **xmodem**.

A simple spreadsheet program, **sc**, was written by James Gosling (of EMACS fame). If you want copies of any of these, send the request via electronic mail to my address, below. Sorry, no tapes or floppies; if you don't have UNIX, then you would not be able to use most of these programs anyway, since they depend upon the UNIX programming environment.

Another major source of public domain software is found in technical organisations such as the Software Tools User Group (see last month's column) and USENIX. The USENIX Association puts together several tapes of software each year; this often contains licensed source code, so it's available only to institutional members of the Association. Some of it, however, is not licensed and can be redistributed by the institutions that get it. In fact, there is a "no-license" version of the tape for institutional members without a UNIX license; this contains only publicly distributable material.

Last month's listing of UNIX software included several packages—Gary Perlman's statistics package and the Icon programming language—with the addresses you can contact to obtain them. More in future columns.

More on the shell

In an earlier column I said I'd return to the use of the UNIX shell as a

THE UNIX FILE

Continued from page 32

programming language. Here are just a few tips, since a full treatise would never fit in this column. Bear in mind that my discussion is primarily for the standard "Bourne shell"; the Berkeley "C-shell" does many of the same things but in different ways.

Why do we even talk of the shell as a programming language? Most people think of the shell as the program that reads and interprets commands, like CP/M's CCP. CP/M has a fixed set of commands in CCP, and you can add various "command programming" languages such as SUBMIT or SUPERSUB for looping and argument substitution.

A sophisticated shell feature is command substitution.

With UNIX, the single "command language" or shell provides all these functions in a unified fashion. So unified, in fact, that you can type commands to perform a repetitive series of commands interactively, without having to edit a submit file and then submit it. CP/M and most other operating systems require these two separate steps. It's worth noting that with UNIX the command syntax is *exactly* the same whether commands are coming from the terminal or from a file of commands. To run a series of commands with filenames can, of course, be tedious. Let the shell expand some abbreviations, and make it do the repetitive typing.

```
for i in [a-k]*.c
do cc $i
done
```

This will run the C compiler (**cc**) for each file whose name begins with a letter from a through k and whose name ends in **.c**. The words **for**, **in**, **do** and **done** are shell keywords. Note that once you type the **for** statement during an interactive session, the shell recognizes that you are composing a multiline command and prompts with your continuation prompt (called PS2, normally ">") for the remaining lines. The sequence is not actually executed until after you type **done**.

Another feature is command substitution. This allows you to use the output from one command as the operands to another. (Note that this is more sophisticated than sending the output from one command as the input to another command, for which the **pipe** mechanism is used.) Any command that can output a list of filenames is useful here. The normal

```
Grep mumble *
```

will look for the word "mumble" in all files in the current directory, and print all the lines of text that contain "mumble" with the name of the file in which each line occurred. However,

```
grep -l mumble *
```

will do the same looking, but will print only the names of the files (and only once per filename), not the actual lines containing "mumble." And

```
pr 'grep -l mumble *' | lpr
```

will paginate all the files containing "mumble" and send them to the printer (lpr), all with one command. This is useful for listing all the programs that refer to a particular variable, or printing all the letters that talk about a particular deal or client.

A final example:

```
For i in 'grep -l mumble *'
do
     echo $i
     ed   $i
done
```

This is very useful. See if you can figure out what it does (answer below)†. Just as we were going to press, I got to use the command substitution feature in a rather bizarre way. The asterisk key ("*") on my terminal broke. Rather than type all the filenames when I'd normally have used a "*", I used something like

```
pr 'ls| grep "\.c"'
```

where I would have wanted to say

```
pr *.c
```

†The shell example given as an exercise above looks for "mumble" in all the files in your current directory, and puts you into the editor for each file found. This is often necessary when you need to make changes to all files containing a particular name or phrase, but when you can't guess what the changes are all going to be without looking into each file. And if the change is the same on all files? Watch for a later column to see how this can be automated.

THE UNIX FILE

Continued from page 34

This is baroque (some would say bizarre), but I know of no other system that would have let me bypass such a glaring hardware failure so readily.

That's all the shell tips for now. If readers report that they're useful, I'll have more in future columns.

Efficiency tip: use case instead of if/test

On many versions of UNIX, you can save some overhead by using the Bourne (standard) shell's **case** statement instead of the corresponding **if** statement. For example, the following are logically equivalent:

```
if test $# -eq 0
then
     echo usage: $0 file
     exit 1
fi
```

and

```
case $# in
     0) echo usage: $0 file
        exit 1
        ;;
     *) ;;
esac
```

Both of these fragments of a shell file check to see that at least one argument (presumably the name of a file) has been given when the command file was invoked. But the former will run faster, especially on a system with slow disks. Most UNIX versions implement the **test** command as a binary program, while **case** is handled inside the shell itself. (Look to see if you have a file called /bin/test on your system). The result? If you use **case** (where applicable) instead of **if**, your shell programs can run a lot faster. Another reason is that the latter is a much better programming language than the former.

Note that this particular efficiency tip applies only to the Bourne shell. The C-shell implements testing and many other functions inside the shell. But then again, C-shell is a much bigger program to load in from disk when you log in. On my system, the sizes are 29,804 bytes for /bin/sh and 61,460 for /bin/csh. This is one reason that many people who use **csh** for interactive programming still use **sh** for writing command files.

Note also that I don't want you to think that you need to spend a lot of time concentrating on "micro-efficiency" to use UNIX well. (Micro-efficiency is an undue concern for optimising small pieces of code without concern for the overall performance or economics of the system.) Quite the contrary, UNIX lets you be productive by letting you escape from many small details. But there are a few ways to make substantial improvements in speed by minor changes in style, and this is what I'm describing under the heading of "efficiency tips."

More vendors

I hope you recall that last month we ran a big listing of UNIX software. Naturally, information from a few vendors arrived just after the publication deadline. Here are some of them.

Cadmus Computer Systems, *600 Suffolk St., Lowell, MA 01854;* phone (617) 453-2899; offers the "Cadmus 9000 computer system with UNIX System V and UNISON distributed environment." Contact David Schell at Cadmus for information.

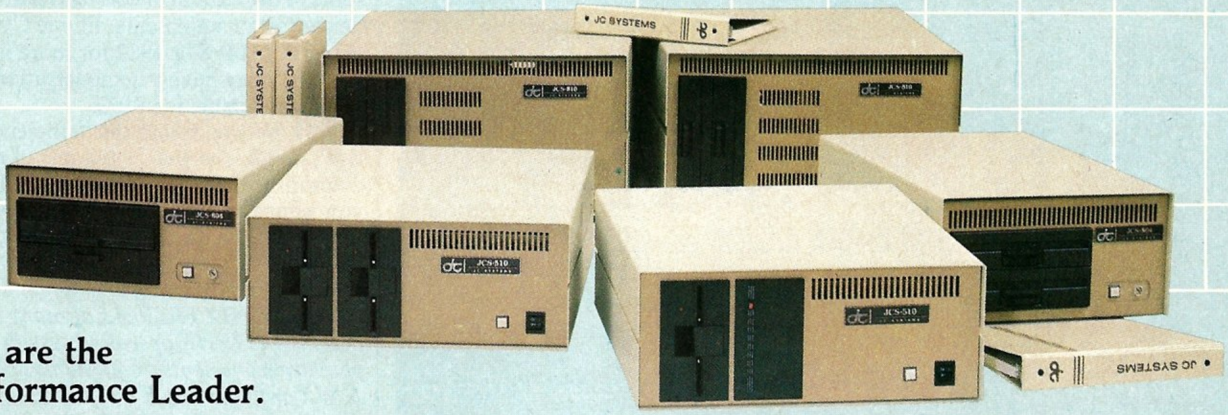
Precision Software, Ltd., *4 Park Terrace, Worchester Park, Surrey, England KT4 7JZ;* phone John Green at 01-330-7166. They offer the "UNIGEN Electronic Manager," an office automation product. Their U.S. address is *820 2nd Avenue, Suite 1100, New York NY 10017; phone (212) 490-1825.*

Productivity Products International, *37 High Rock Rd., Sandy Hook, CT 06482.* Contact Andrew J. Iorio at (203) 426-1875 for information on the Objective-C compiler.

Cybernetics, Inc., *8041 Newman Avenue, Suite 208, Huntington Beach, CA 92647* offers the RealWorld Busi-

THE MOST OUTSTANDING MULTIPROCESSOR, MULTIUSER ORCHESTRA.

PERFORMING ARTS of COMPUTER SCIENCE

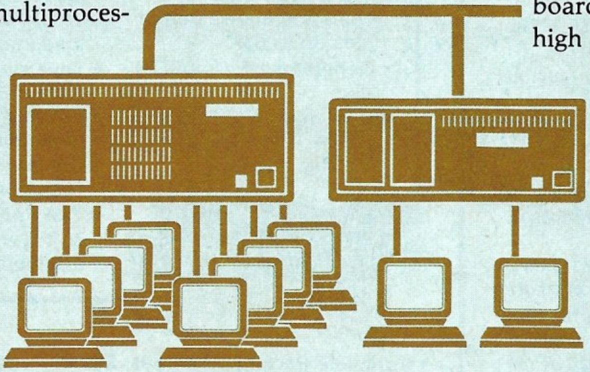


We are the Performance Leader.

Our Duet Product (**MCM*80 and DCM*80**), installed in thousands of multi-processor multi-user systems as well as in single user systems worldwide, certifies our field-proven performance. Our state-of-the-art products, first and best, have been soundly accepted by the various institutes, from the government to the universities, and utilized by the various applications, from office automation to control automation. Our product superiority is recognized for the following reasons.

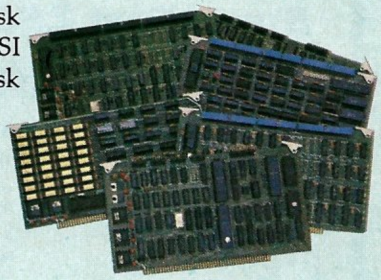
Identical Master/Slave SBC (Single Board Computer) architecture results in a prime advantage, never letting the entire system down. Not only that, the master/slave status is programmable, so it is truly possible to build redundancy in a multiprocessor system.

Unlimited Expandability differentiates our products from other multiprocessor based systems which are bound to the networking limitation. Our TURBODOS implementation on multiple networks, which connect multiple multiprocessor systems, matches the capacity of a mainframe, thus surpassing the mini computers.



Low Cost Local Area Networking has always been a subject but never a solution. Our approach to the LAN of SBCs, with integrated LAN control thru the high speed and reliable IPC (Inter-Processor Channel), provides an ultimate low cost solution for each computing station in a network.

Superior S-100 board Products are the key to superior system products. We now provide two prominent single board computers: **MCM*80**, based on Z80 (4 MHz, 6 MHz, or 8 MHz) processor family, and **MCM*186** based on 80186 (8 MHz) processor. There are two disk controller products, **DCM*80** and **DCM*80 II. DCM*80** is the first disk controller to integrate the floppy disk controller and the SASI (ANSI SCSI) hard disk host adapter in one board. **DCM*80 II** is **DCM*80** plus 8K Track Buffer with on-board DMA for high performance.



Our **RAM*80** is the first memory board which has quad-mode capability. It works not only as an 8-bit and 16-bit memory board, but also as a memory disk board.

LINK*80 is an intelligent I/O board designed for high performance foreground processing capability with on board processor (Z80 A) and memory buffer.

JC SYSTEM
469 Valley Way
Milpitas, CA 95035
408/945-0318 TWX 910-381-7041

JC Systems products are available worldwide thru 60 dealer bases which are growing continually. All of our products are serviced factory-direct or by our dealers. We maintain highly confident technical support, both in the hardware and software products, CP/M and TURBODOS.

CP/M is a trademark of Digital Research, Inc.
TURBODOS is a trademark of Software 2000, Inc.

CIRCLE 238 ON READER SERVICE CARD

THE UNIX FILE

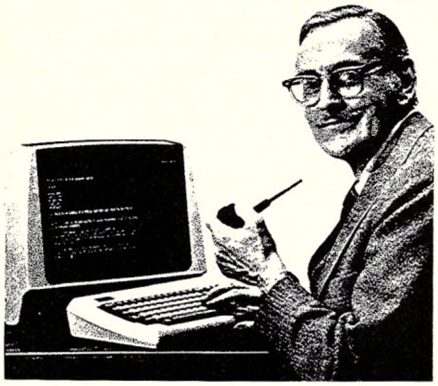
Continued from page 36

ness Software as well as something called "CRT!", a Cobol Reprogramming Tool. This product is described as "A Program Generator for RM/COBOL." I've never been fond of Cobol; if you had to use Cobol, I guess a program generator would free you from some of the tedium of coding those wonderful Cobol statements. Phone Cybernetics at (714) 848-1922 for more information. They have a demonstration kit version available for $100.

I hope you found the "efficiency tips" helpful, as well as the rest of the column. If there are particular topics you want covered, please let me know. Until next month, keep those disks spinning!

The UNIX File looks at many aspects of the UNIX operating system. If you have comments or questions about UNIX or this column, feel free to write to Ian Darwin at Box 603, Station F, Toronto, Ontario, Canada M4Y 2L8. If you have UNIX mail access to the UUCP network, you can contact Mr. Darwin at **"decvax!utcsstat!darwin!ian"** *or at* **"ihnp4!darwin!ian".**

In the Public Domain



Public domain software written in C

by Chris Terry

This month I shall mainly be discussing public domain software written in C. The appearance of UNIX and its derivatives on a number of micros has stimulated the publication of many books both on UNIX itself and on the C language, and an increasing number of micro users are trying out C and finding it to their liking. Thus, more and more programs in C are appearing in the public domain. The most prominent sources for these are the BDS C Users Group, the Software Tools Users Group, and some UNIX users reachable on USENET (refer to Ian Darwin's UNIX Software Directory, *Microsystems,* April 1984).

The BDS C Users Group has been in existence for some years now, and has issued a considerable number of volumes of public domain software. Some of these (such as TELNET, the telecommunications package) have appeared on the release disks of the BDS C compiler at various times. In the days when I was running a Processor Tech VDM-1 memory-mapped video board, I played for hours at a time with a program called LINES, which generated continuously changing patterns of lines and solid blocks much more interesting than anything in monochrome that the Cromemco Dazzler could produce—though of course the Dazzler could do far better in color.

The BDSCUG library

As one might expect, the catalog of the BDSCUG library abounds in utilities specifically related to the CP/M-80 environment: directory displays, disk viewers, print utilities, and C functions for various purposes to supplement the standard library. Among the print utilities are two that I have found very useful: The first is LPR (in Volume CG5), which prints as many files as you can get on the command line and, when these have all been printed, prompts the user for additional files (one at a time). This program assumes 60 print lines on an 11″ form, but is not difficult to modify for elite type. The second, PNUM (in the same volume), displays a file on the console with line numbers up to 999, but does no paging. It's useful for locating compiler or assembly error messages in the source.

Of much more importance are the editors, formatters, and text utilities. Among these are EDIT and ROFF (Volume CUG—"Just Like Mom's") source code for a flexible and powerful editor and text formatter, with associated on-line help facilities and good documentation. For people who do a lot of writing, the Utilities I disk contains a series of programs that can be of great help. CONCORD, for example, scans on input file and produces an intermediate file that can be used for a number of other processors such as a word totaler, a word frequency counter, a line sorter, and, above all, a KWIC (Key Word In Context) index generator. Another word processor (WP) is to be found on the Utilities II disk; other than the fact that it is patterned after ROFF, I know nothing about it.

Utilities IV is another intersting disk, since it has the C source code for the SQUEEZE and UNSQUEEZE programs that I mentioned in my December column. While I'm on the subject of these programs, a problem has appeared. SQ15 and USQ15 cleared up some bugs that had occasionally plagued users of earlier versions, but the algorithm was not changed, and the files squeezed by that version could be unsqueezed by an earlier version.

Now, however, there appears to have been a major change in SQ/USQ19: I am still using SQ/USQ15 and have received (from different sources) two files compressed by SQ19 that could not be handled by USQ15. In each case processing aborted with the message "Write Error." This puzzled me since I knew my disks were OK, so I checked back with the senders. Both had used SQ19. This difficulty will no doubt be dealt with by the originators and RCPM sysops, but in the meantime you should be careful about what version of SQ/USQ you use when transmitting files to other people.

What I have discussed here is only a brief sample of the many programs available from the BDS C Users Group, and does not take into account volumes issued during the last six months, about which I don't have any information. If you are doing any programming in C, look into the 30 or more disks available from this Users Group; there are many programs that can be valuable to you even if you are using a compiler other than BDS.

Next month I shall discuss public domain software available for the IBM PC and MS-DOS. Addresses of the users groups mentioned here are:

Sheila Henson
C Users Group
Box 287, 112 N. Main
Yates Center, KS 66783

Software Tools Users Group
1259 El Camino Real, #242
Menlo Park, CA 94025

The CP/M Bus

More on Forth in the CP/M environment

by Randy Reitz

Continuing last month's discussion of Forth and CP/M, I now come to some of the problems raised by CP/M Plus.

The CP/M Plus data structure is shown in Figure 1.

The DPB in CP/M Plus has been extended with two items over CP/M 2.x. These items can be used to determine the physical sector size. With all this information in the DPB, a gigantic Forth word can be written to decode the DPB data into four useful items. The **DECODE** word is shown in Listing 1.

This is a listing of one of the screens in the DIRECT.BLK file after modification for use with CP/M Plus. Line 0 is a comment. Line 1 starts the definition of **DECODE** using the **:** defining word. The stack comment indicates that one argument is expected—the address of the DPH. Line 2 picks up the contents of the first word of the DPH and saves it in the XLT variable. Line 3 adds 12 to the DPH and gets the contents of this address. This is the DPB address. The address is saved in the variable DPB. The DPH address has been replaced by the @ word in line 3, and now the DPB address is on the stack. Line 4 uses the Forth **LENGTH** word to get the contents of the address on the stack and then bump the address by 2. This has the same immediate effect as the @ word does, with the side effect of leaving the incremented address on the stack below the value just retrieved. The value in the first word of the DPB is the number of logical sectors (the 128-byte variety) per track (called SPT in CP/M documentation).

At this point you will begin to need a pencil and paper in order to keep track of the stack. The **SWAP** word at the end of line 4 flips the top two items on the stack; this brings the address of the DPB+2 to the top of the stack. Line 5 moves one more byte and then uses **COUNT** to get the byte contents of the address on the stack and increment the address. (You can see that **LENGTH** and **COUNT** are similar.) The value now on the stack is the block length mask item of the DPB. Adding one to the BLM will give the number of logical records per disk group. This value is the number of logical records that CP/M stuffs into each "unit" of disk space that it manages. CP/M simply numbers these units (groups) sequentially until the maximum available number is reached. This brings us to the next important item in the DPB. The **SWAP** at the end of line 5 brings the DPB+4 address to the top.

Line 6 bumps the address to DPB+5 and uses **LENGTH** to get the value of the DSM. This is one less than the total number of groups allowed on the drive. Line 6 ends by adding 1 so the stack value will be the maximum number of groups. Line 7 rotates **(ROT)** the top three items of the stack by bringing the third item to the top. This puts the BLM+1 value on top and the DSM+1 value just below it. Next the * word muliplies the top two items, replacing them with the product, which is the total capacity of the data area of the disk in terms of 128-byte records. Next, 2 **PICK** brings a copy of the SPT item to the top and **/MOD** divides the top two items, leaving the quotient on top and the remainder below. Line 8 **SWAP**s these two items, checks if the remainder is not zero with the **IF**, and, if there is a remainder, adds one to the quotient (doing, in effect, a ceiling operation). This quotient is the number of tracks in the data area of the disk. The formula is:

```
Tracks in data area = ceiling [
    ((DSM+1) * (BLM+1)) / SPT ]
```

Line 9 **SWAP**s the top two items; this brings the DPB+7 address to the top. Six is added to get to DPB+13, where the number of system tracks is obtained with another **LENGTH** word. Another **SWAP** brings the DPB+15 address to the top. Adding 1 brings the address to DPB+16, where a **C@** replaces the address on the top of the stack with its byte value. This is the physical record mask (PHM), one of the new items added to the DPB in CP/M Plus. The PHM is one less than the number of 128-byte logical records per physical disk sector. Therefore 1 is added; this value is copied, multiplied by 128, and the product copied and saved in **B/SEC**—the number of bytes per physical sector.

In line 11, **B/BUF** is a Forth constant for the number of bytes per Forth screen. This value is 1024. The number of 128-byte records per physical sector is brought to the top with **SWAP** and divided into **B/BUF.** The quotient is the number of physical sectors per Forth screen and is saved in **SEC/BUF.**

Line 12 does a reverse rotation **(-ROT)** of the top three stack items. This puts the top item third on the stack, with items 3 and 2 moving up to 2 and 1. The top item moved down to third is the copy of PHM+1 made by the first **DUP** in line 10. The items now on the top are the number of system tracks and the calculated number of tracks in the data area. These are added and saved in **TRK/DRV,** the total number of tracks on the disk. The DPB ad-

At Last!

Your Final Assembly Is Final.

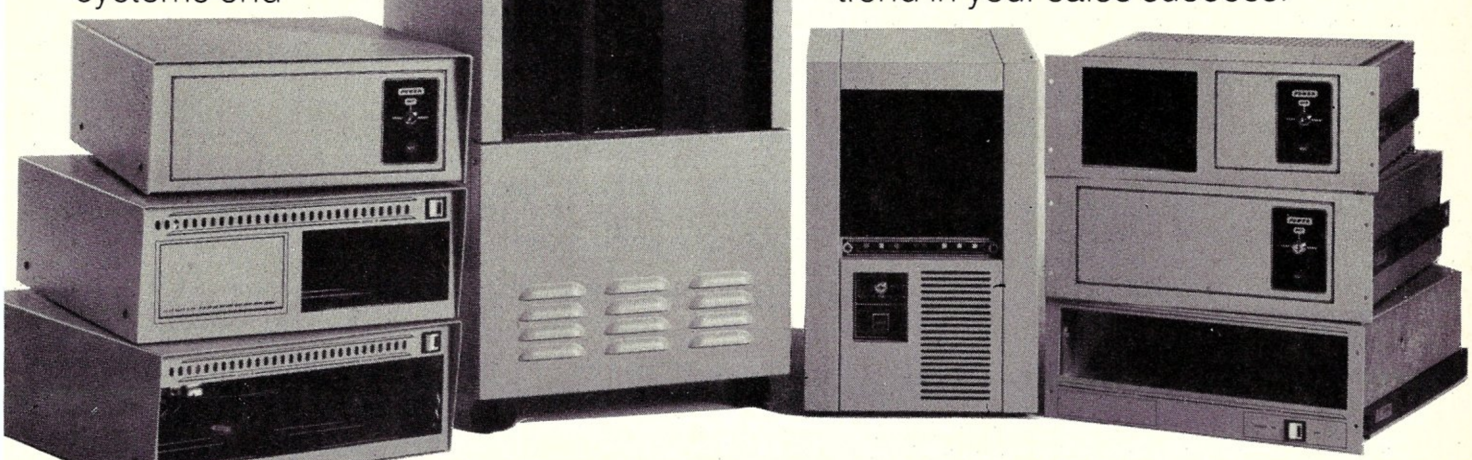
If you are like most computer designers and manufacturers, you build products from the inside out, drawing board or CAD, to bread-board, to assembly line, and finally, into a "can."

That last thing that you do is the first thing your customer sees. In today's competition, functional packaging is paramount. Your competitive edge is PARA DYNAMICS. And, they provide more than an attractive package.

Whether a rack mount, desk top, or stand alone model, well engineered housing can eliminate in-service failures. Para Dynamics patent-ed, super-efficient heat dissapation systems end heat related failures, the cause of two-thirds of board-level failures. Para Dynamics constant voltage power supplies, up to 680 WDC, and spike suppression circuitry end the other common in-service problem – irregular line voltages.

Para Dynamics builds a variety of modern, efficient, trouble-free, expandable housing systems for most S-100 BUS configurations, from a single 5¼ drive enclosure to the world famous PRONTO, which accomodates three drives, floppies, hard discs, or tape back-ups.

Best of all, Para Dynamics enclosures are beautiful. Please call, today, for full details on the enclosure that will assure your final assembly is final, and start a new trend in your sales success.



PARA DYNAMICS CORPORATION
7895 East Acoma Drive, Scottsdale, AZ 85260
(602) 991-1600
Telex: 140238 PDC UT

See us at
COMDEX™/Spring '84
BOOTH 6200

CIRCLE 165 ON READER SERVICE CARD

THE CP/M BUS

Continued from page 40

dress is no longer on the stack—it was used by the **C@** word in line 10 to get the PHM.

In line 13, the PHM+1 is on the top of the stack and the SPT from line 4 is below it. The division of SPT by PHM+1 yields the number of physical sectors per track and is saved in **SEC/TRK.** The word **DECODE** thus computes the four parameters needed for Forth to do direct access. The access is accomplished by defining the following words, as shown in Listing 2.

Listing 2 defines words needed to select a drive **(SET-DRV)**, select a sector **(SET-SECTOR)**, select a track **(SET-TRACK)** and set up for the access of a desired Forth screen (sometimes called a buffer). The **SET-IO** word expects a "buffer header" address as its argument. The buffer header is a data structure used in the Forth 83 Model to hold relevant informaion about the current disk buffer. The contents of the first word of the buffer header is the desired Forth screen number. **SET-IO** simply converts the Forth screen number to a physical sector number by multiplying by **SEC/BUF,** the number of physical sectors per Forth screen. This value is then converted to physical track by dividing by **SEC/TRK.** The quotient is the track number; the remainder is the sector number within this track. The track number is checked against the maximum track for this drive. **SET-TRACK** and **SET-SECTOR** are then called to send these values to the BIOS. Notice that **SET-SECTOR** first translates the sector number to skew the sectors using the XLT table saved from the **DPH.** The **TRANSLATE** word is defined as:

```
: TRANSLATE BIOSPB 4 + !    16
  DBIOS ;
```

if sector skewing is desired, or as

```
: TRANSLATE BIOSPB 4 + !    0 16
  DBIOS + ;
```

if it is not desired. The sleight-of-hand shown above uses the sector translate table to determine if the sectors are numbered, starting with 0 or 1. The XLT table is used to skew sector number 0. If a 0 is returned, the disk has sector origin 0; if a 1 is returned, the disk has sector origin 1. The value returned is added to the sector desired to adjust for the origin. No skewing takes place. Other useful words are shown in Listing 3.

Listing 4 defines the words used to do the actual read and write. **BLOCK-READ** receives a buffer-header, uses **SET-IO** to start a loop that runs for **SEC/BUF** times. Each time through the loop, the DMA address is set and a sector is read. The DMA address is bumped by **B/SEC,** and the next track/sector is set with **+SECTOR.** The final **DROP** throws away the last DMA address. **BLOCK-WRITE** is similar to **BLOCK-READ.**

Listing 1

```
 0 \ DPB decoding                                          05Feb84rcr
 1 : DECODE   ( DPH -- )
 2   DUP @ XLT !
 3   12 + @     ( DPB ) DUP DPB !
 4   LENGTH     ( SPT ) SWAP
 5   1+ COUNT   ( BLM ) 1+   ( records/group  )  SWAP
 6   1+ LENGTH ( DSM ) 1+   ( groups/drive )
 7   ROT * ( rec/drv in file area ) 2 PICK ( copy of SPT ) /MOD
 8   SWAP IF 1+ THEN ( round up )
 9   SWAP 6 + LENGTH ( OFF ) SWAP
10   1+ C@ ( PHM ) 1+ DUP 128 * DUP B/SEC !
11   B/BUF SWAP / SEC/BUF !
12   -ROT + TRK/DRV !
13   / SEC/TRK ! ;
14
15
```

Listing 2

```
\ set drive, track and sector                            05Feb84rcr
: SET-DRV     (S drive -- )
  DUP DRIVE ! DPB @ 0= NOT BIOSPB 4 + ! 9 DBIOS
  DUP 0= ABORT" Bad Drive" DECODE ;

: SET-SECTOR  (S sector -- )
  DUP SECTOR ! XLT @ TRANSLATE SETSEC ;

: SET-TRACK   (S track -- )
  DUP TRACK ! SETTRK ;

: SET-IO      (S buffer-header -- buf_adr rec/blk 0 )
  DUP @ SEC/BUF @ * SEC/TRK @ /MOD
  DUP TRK/DRV @ >= ABORT" Block out of range"
  SET-TRACK SET-SECTOR
  4 + @ ( buf_adr ) SEC/BUF @ 0 ;
```

Listing 3

```
: SETTRK   (S track -- )     10 DBIOS DROP   ;
: SETSEC   (S sector -- )    11 DBIOS DROP   ;
: SETDMA   (S address -- )   12 DBIOS DROP   ;
: READ     (S -- error )   0 13 DBIOS DISK-ERROR !  ;
: WRITE    (S -- error )   0 14 DBIOS DISK-ERROR !  ;
```

Listing 4

```
\ read write                                             03Feb84rcr
: +SECTOR       (S -- )
  SECTOR @ 1+ DUP SEC/TRK @ =
   IF DROP 0 TRACK @ 1+ DUP TRK/DRV @ =
    IF DROP 0 DRIVE @ 1+ SET-DRV THEN
   SET-TRACK THEN
  SET-SECTOR ;

: BLOCK-READ    (S buffer-header -- )
  SET-IO
  DO  DUP SETDMA B/SEC @ +  READ  +SECTOR  LOOP DROP ;

: BLOCK-WRITE   (S buffer-header -- )
  SET-IO
  DO  DUP SETDMA B/SEC @ +  WRITE +SECTOR  LOOP DROP ;
```

Summary

I have shown some important differences between CP/M 2.x and CP/M Plus. These differences are due to the banked storage required to make effective use of CP/M Plus features, and the

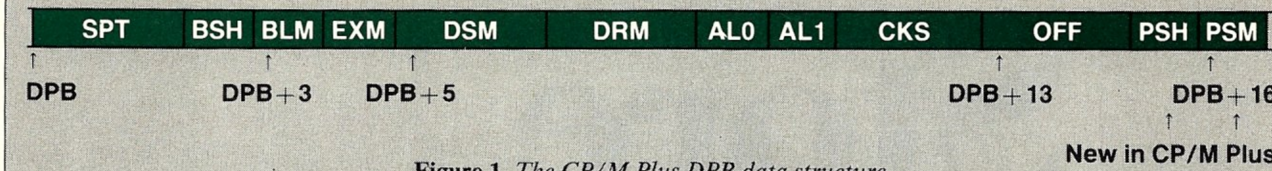


Figure 1. *The CP/M Plus DPB data structure.*

way CP/M Plus handles physical disk sectors. The Forth-83 implementation available in SIG/M Volume 154 is a good example of how these differences affect an application.

CP/M Plus provides BDOS function 50 for applicatons that require direct BIOS calls. Although the CP/M Plus documentation does not describe the action of BDOS function 50 when a data structure in bank 0 is returned, my empirical evidence shows that the BDOS makes a copy of the data structure and returns the address of this copy. This is the effect observed in requesting BIOS function 9 (select disk). The DPH address returned by BIOS function 9 is not the address returned by BDOS function 50 to the application. This is a key point for applications that need to examine the DPH for a drive.

The other key point concerning direct BIOS calls under CP/M Plus is that disk I/O will be handled in units of physical sectors rather than the "usual" 128-byte logical sectors. The DPB in CP/M Plus has been augmented with two additional items at the end of the normal CP/M 2.x DPB. The first item is called the PSH, and specifies the physical record shift factor. In the Forth-83 application, I used the second item, called the PSM, which is the physical record mask. The PSM is one less than the number of 128-byte records per physical sector.

One final note, for anyone interested in Forth: whether you are just starting or are an experienced user, I recommend the Forth-83 Model available on SIG/M Volume 154. This model comes from Henry Laxen and Mike Perry, who deserve a big thanks for putting it in the public domain.

Vol. 154 can be ordered by addressing a request to:

SIG/M Users Group, *P.O. Box 97, Iselin, NJ 08830-0097.*

The cost for an 8" SSSD disk is $5 (U.S.) per volume plus shipping; check or money order payable to SIG/M Users Group. Include $1 for the first disk and 50¢ for each additional disk for shipping. Other disk formats are available. Current SIG/M information and selected volumes are available on these two RCPMs:

(201) 272-1874:
Hayes 212A/PPMI, Cranford, NJ;
(215) 398-1634:
Vadic 212A/PPMI, Allentown, PA.

(Note: Forth words are boldfaced in this article.)

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

Store Speech and Music on Your System

The CompuFone turns your system into an answering machine—or adds sound to your program

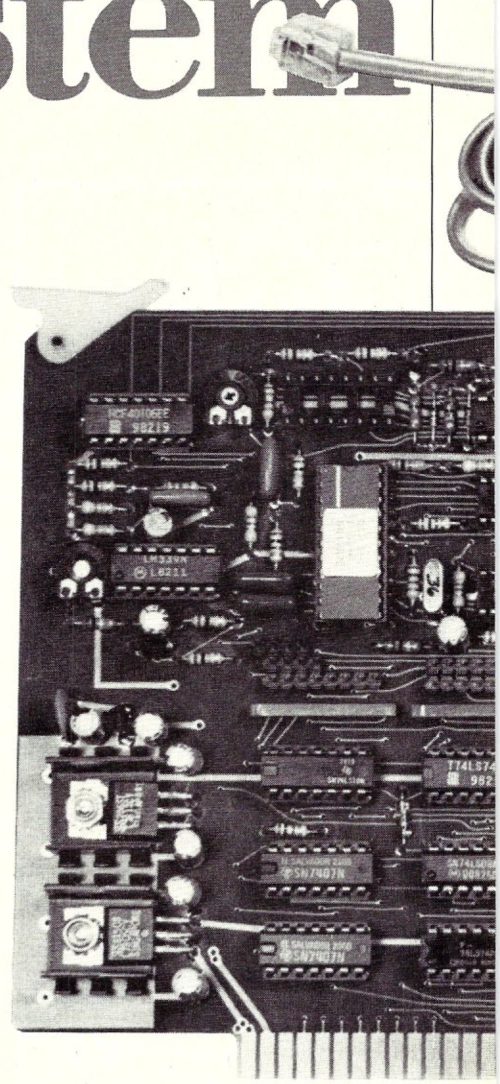
by Randy Reitz

CompuFone, made by the Computalker products division of Compuvoice, Inc., is a new product combining several features that result in many possible voice technology applications. CompuFone is an S-100/IEEE-696 board that contains the following subsystems:

- An FCC-approved direct-connector telephone interface.
- A Touch-Tone generator and decoder.
- A speech digitizer.
- An analog multiplexer that can select any of eight sources for connection to the speech digitizer/telephone line interface.

The direct-connect telephone interface is capable of recognizing tones on the telephone network such as dial tone, ringing and busy. The interface can pulse or Touch-Tone dial, allowing CompuFone to originate calls as well as answer them.

Touch-Tones can be generated at any time and can be sent to the telephone interface for transmission. Touch-Tones can also be received and



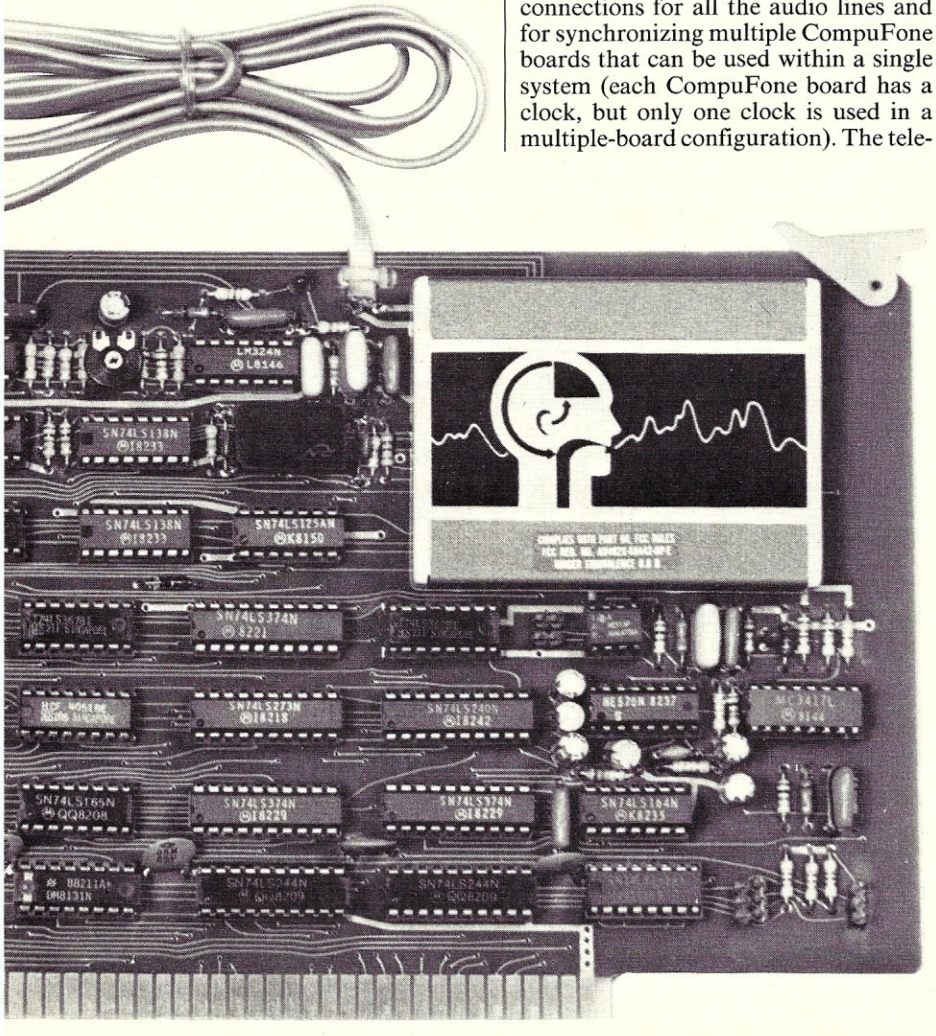
decoded to allow control of the program running the CompuFone.

The speech digitizer subsystem functions as a "solid state tape recorder" by allowing speech or other sound to be saved in either RAM or mass storage and reproduced on playback. The speech digitizer uses a hardware data compression technique to reduce the memory and mass storage space needed to record messages. This data compression technique achieves a 5-to-1 compression over an A/D converter. This allows acceptable quality speech to be recorded and played back at a rate as low as 1.25K per second. This kind of compression makes the storage of messages on floppy disk feasible. A total of five sampling rates are available, from 1.25 to 4K bytes per second.

Finally, the analog multiplexer allows any one of eight sources to be connected to the internal audio bus. The internal audio bus, which feeds both the telephone line and the speech digitizer, is buffered and is available at a connector (line-out pin) for attachment to an external amplifier and speaker. Seven of the lines connected to the multiplexer are microphone, line-in, three aux lines, the Touch-Tone generator, and speech digitizer output. The analog multiplexer uses three bits of the base port to control the selection of input. The eighth choice is zero, which the documentation says is the telephone line. However, the telephone line is always connected to the internal audio bus. I believe this "selection" allows the telephone line to be connected to the audio bus without attenuation and without being mixed with any other source. I will say more about why I have to guess in the documentation section below. The aux lines are bidirectional paths to the internal audio bus. They allow multiple CompuFone boards to be connected together for call rerouting as well as other special applications.

Hardware

The CompuFone is a high-quality board, fully socketed, solder masked, and has a gold-plated S-100 edge connector with all 100 pins. Options are selected with push-on jumpers. There is one user-adjustable potentiometer that controls the microphone gain. A 16-pin socket at the top of the board provides connections for all the audio lines and for synchronizing multiple CompuFone boards that can be used within a single system (each CompuFone board has a clock, but only one clock is used in a multiple-board configuration). The telephone interface is mounted on the board and has a telephone wire with modular plug permanently attached to the board.



The CompuFone board occupies four consecutive I/O port addresses. Jumpers are provided that set the base address at any modulo 4 address in the I/O space. The first (base) port output is used for analog multiplexer control, telephone interface on-hook/off-hook control and interrupt mask. The base port input provides status information that can be used to determine which of the three possible interrupts is active and provides status useful for detecting tones on the telephone network. The second port (base+1) is used to output a character to the Touch-Tone generator and read a Touch-Tone character when one is detected. The third port (base+2) is used to read and write a byte from/to the speech digitizer. The fourth port (base+3) is used in input mode only to reset the interrupt latches.

CompuFone boards can be connected to reroute calls.

Installation is simple, since all the options are factory set to agree with the software provided. Assuming that four I/O addresses from 30 to 33 Hex are available in your system, the board can be simply plugged in and connected to the phone line. By far the hardest part of the installation is devising a way to connect audio cables to the header plug provided. A minimum of two audio cables are required, one for the mike and one for the external amplifier. A header with a ribbon cable attached is provided, but this just puts off the connection problem to the end of the ribbon cable. I chose to use the blank header plug and soldered three small shielded cables to the header (the third cable was used for the high-level line input). Once I had the cables connected to my amplifier and microphone, the demonstration software ran without a hitch.

The speech digitizer sampling rate is selected by plugging in one of the five headers supplied. In addition to setting the sampling rate, the header also optimizes the low-pass filters for the given rate. Consequently, the headers sup-

COMPUFONE

Continued from page 45

plied have the CompuFone's serial number stamped on them and shouldn't be used on other CompuFone boards.

Headers are provided for rates of 1.25K, 2K, 2.5K, 3K and 4K bytes per second. The board comes with the 2.5K header installed, and I found this rate to be adequate for the experiments I performed. The higher sampling rate produces better speech quality, but at a cost of using up more disk storage space.

The jumper options provide the flexibility for system integration.

When the speech digitizer is running, it produces a byte of data (or requires a byte of data if it is reproducing speech) at a rate determined by the particular sampling header installed on the board. This requires that the speech digitizer port be serviced periodically—a requirement can easily be met by polling the port—but interrupts are a more efficient way to handle the data. The board provides full interrupt support; it can produce an interrupt using either the INT* (S-100 pin 73) or one of the vectored lines VI0* through VI7* (pins 4 through 11). The board can handle the interrupt acknowledge (INTA—pin 96) request resulting from any one of these interrupt choices by generating a (jumper) selected RST instruction. Even if your system doesn't have an interrupt controller, you can use the interrupt features of the CompuFone.

Even though the speed demands of the speech digitizer can be handled by polling, interrupts are important in a practical system using the CompuFone. This is because eventually something must be done with all the data that the speech digitizer either produces or consumes. That is, a mass storage device of some type is needed for a practical message storage/playback system. Otherwise, message length is limited by the amount of available RAM. The CompuFone interrupts are necessary to be sure that no data servicing needs of the digitizer are missed while I/O with the mass storage device is in progress. This means that whatever controller is being used for communicating with mass storage, the controller must coexist with interrupts.

Unfortunately, neither my North Star nor Versafloppy floppy disk controllers will tolerate interrupts. I was still able to use the CompuFone, however, since I have a "bubble disk" that will work fine with interrupts. The software I will describe later builds a simple telephone answering machine using the bubble disk for temporary message storage. Since the bubble disk is small (127K available for data storage), the software moves messages between the bubble disk and the other disks in my system. This is an important point, however. To make full use of the CompuFone, the host system must have a mass storage controller that can allow interrupts. RAM disks and DMA-type disk controllers (whether ported or memory mapped with sector buffering) should have no problem with interrupts.

The other interrupts the CompuFone can generate are for local ring detect and Touch-Tone detect. All the interrupts can be masked under software control, and the jumper options provide all the flexibility required to integrate into any system.

Software

The CompuFone is supplied with an 8″ SSSD disk of software (other formats are available).

The CFDEMO program quickly introduces all the features of the board and is used for CompuFone checkout. This program is menu driven, and provides selections for taking the telephone line off-hook and on-hook, recording speech from the telephone, microphone or line-in, and for playback of recorded speech. No interrupts or mass storage are used, and messages are saved in available RAM. With a 60K TPA, about 20 seconds of speech can be saved using the 2.5K per second header. Telephone numbers can be entered into CFDEMO so that the dial-out feature of the CompuFone can be demonstrated. While dialing and waiting for an answer, tones on the telephone line are displayed on the console (such as dial tone, ringing, busy). Finally, Touch-Tones are generated whenever a number key on the console is typed. If a telephone connection is active, an indication of any Touch-Tone on the telephone line appears on the terminal. The CFDEMO program is a good checkout for the board and effectively demonstrates its capabilities.

A CFDMOI program is the same functionally as CFDEMO with the addition of interrupts. This provides a stepping-stone approach to system integration.

The next steps are disk recording and playback. CFRECORD and CFSPEAK test this feature without interrupts. These programs use available RAM to record and then write the data on disk. For playback, the disk file is first read to RAM and then transferred to the CompuFone. As with CFDEMO, the length of messages is limited to available RAM. But these programs are valuable in providing one more step in system integration.

The RECDISK and SPKDISK programs use interrupts to record or play back messages to or from disk files. Messages are limited by the size of the disk space available. These programs are likely to require some modification before they will run. They quickly demonstrated several points about my system. First, since I am running CP/M Plus, the interrupt vectors must be present in *all* memory banks. After placing the interrupt vectors in all banks, I found that the interrupt service routines must be located in memory common to all banks. After fixing this, I found that disk controllers that don't allow interrupts really do cause problems with the CompuFone. However, I was able to successfully record and play back to my bubble disk.

All of the demonstration programs worked as advertised and were a big help in understanding system integration. Several prerecorded speech files are also provided that demonstrate the quality available with the various sampling rate headers supplied.

Touch-Tones are generated whenever a number key on the console is typed.

Applications

But what about "useful" software? The uses for the CompuFone board are truly many. An automatic dialer with information solicitor and a sophisticated telephone message center are just two possibilities. An application note is provided in the documentation that discusses implications of automatic call placement. A program for either one would be a significant undertaking. It isn't feasible for Computalker to supply such an application, since it would likely require extensive customizing for each particular installation.

A compromise provided by Computalker is a module of subroutines that provide the basic functions the above applications need. The final piece of software provided on the disk is called the CompuFone Interface Module.

The CompuFone Interface Module provides 14 functions. The module is written in 8080 assembler and is intended to be included in whatever application software is developed. The module uses a jump table to access the functions and an argument block for exchanging data with the application. This arrangement is sufficient for using in an application developed in assembler or a high-level language. I know of an interface for C, and I used Forth to develop a simple telephone answering machine. The interface module is best described in the context of an application.

A simple telephone answering machine

I invariably use Forth in my hardware projects because it provides the development speed of an interpretor and the execution speed of machine code. I use the Mountain View Press MVP-Forth that implements a successor to FIG-Forth that conforms to the Forth-79 standard. This Forth is in the public domain and is available from Mountain View Press. The Telephone Answering Machine application is contained in 15 "screens" that are provided in Listing 1. I will refer to the screen numbers contained in the listing as I describe the application.

Screen 120, the load screen for the application, initializes the CF-MODULE code and runs the application. *Screens 121 and 122* are CP/M interface words and contain utilities I need to copy message files between disk drives. I mentioned earlier that the bubble disk is the only suitable mass storage I have for recording and playing back messages. Since the bubble disk is only 127K, I used another disk for permanent storage of messages. This complicates the application only slightly.

Screen 123 defines the location of the CFMODULE code and argument block. The CFMODULE begins with 13 jump vectors. I have made free RAM available above my system at F000 Hex. I assembled the CFMODULE code with this origin and loaded the Hex output of the assembler into a CF-MODULE.IMG file using SID. This is a straightforward application of ASM and either DDT or SID. The documentation contains a section that describes what changes you may want to make in CFMODULE before using it in an application. The only changes I made to the CFMODULE code was to be sure that interrupt vectors were set in each RAM bank. This is required since I am using banked CP/M Plus; for CP/M 2.x no changes other than the interrupt option described in the installation documentation are required.

A mass storage device of some type is needed for a practical message/playback system.

The argument block follows the CFMODULE code at FA00 Hex. The CFMODULE code is ROMable, and all of the RAM usage is confined to the argument block.

In order to handle the data requirements of the speech digitizer and do mass storage I/O as well, a double buffering scheme is used in CFMODULE. The size of the buffers is determined by the speed of transfer between the mass storage and RAM. Screen 123 defines the start of the buffer area as C000 Hex, and the size of each buffer is 16 128-byte sectors (2K). I found that the speed of the bubble disk was high enough that a smaller buffer could be used. The CFMODULE defaults to 4K buffers. The CompuFone documentation discusses a procedure that can be used to determine the minimum buffer size. Again, banked CP/M Plus requires that the buffer be located in RAM common to all banks, hence the high address. With CP/M 2.x, both the CF-MODULE code and disk buffers could be located anywhere in RAM.

Screen 124 defines the locations in the argument block. A defining word ARGUSER creates a word that will leave the address of the particular argument on the Forth stack. The ARG-USER word is similar to the Forth USER word. The offset from the base (in the case of the argument block, the base is in the variable ARGBLK) is saved in the definition of each argument block variable and used to compute the argument address when the word is executed.

Most of the argument locations will be described below. TPSW is not used; it contains a switch to indicate whether pulse or Touch-Tone dialing is desired. MAXRING is not used; it contains the maximum number of rings to count before aborting an outgoing call. The MUX argument contains the desired selection of the analog multiplexer. The two values used are defined in the TELE and MIKE words.

Screen 125 defines the CF-MODULE jump vector locations. In order to use the CFMODULE code, an 8080/Z80 call instruction to the appropriate location in the jump vector is all that is required. The CFMODULE code saves all registers and uses its own local processor stack. The defining word FUNCALL takes the jump vector offset as an argument and compiles a word that will perform the necessary call instruction. The ARGUSER and FUNCALL words are all that is required to define the CFMODULE interface. This little bit of Forth demonstrates the defining word that is a key "power" of Forth.

Screen 126 continues the Forth "defining word power" by using PHONE# to compile telephone words in the Forth dictionary. The FILENM defining word is defined in screen 121 and is used to save CP/M filename strings in the Forth dictionary. TESTFIL and DELFIL are words that expect a CP/M filename string on the Forth stack and use the CFMODULE code to test if the file exists or to delete the file respectively.

Screen 127 contains words that are used for demonstrating the dialing and calling capabilities of CFMODULE. CALLNUM needs a telephone number string on the Forth stack; the string is put in the start of the first disk buffer in the argument block and then the CALLOUT function of CFMODULE is used. TESTFIL and DELFIL also use the first disk buffer to pass the CP/M filename string to CF-MODULE. INITBUF is the word that takes a string from the Forth stack and loads it into the BUF1BEG disk buffer (INITBUF is defined in screen 126). String arguments are passed to the CF-MODULE by using the BUF1BEG disk buffer. All the strings must be null terminated. RECORD and PLAY are words used in the telephone answering machine application. These words expect a CP/M filename string; they use the CFMODULE LISTEN for record-

COMPUFONE

Continued from page 47

ing to the file and SPEAK for playback from the file. If no filename string is found on the Forth stack, the DEFAULT word puts the default name C:TEST on the stack. CFMODULE functions that refer to CP/M files append the extension .SPH if no extension is supplied in the filename.

The RECORD word sets the FLAG argument to 10 in order to produce a one-second tone prior to recording. The FLAG argument is multipurpose; it is used to specify tone length (in 100 msec units) and also contains return status information. In the CFMODULE LISTEN function, FLAG contains the code explaining why the recording terminated. The possible values are: -1 for data transfer timing error (this means that the disk buffers are too small), 2 for a Touch-Tone detect during recording, 3 for a key strike on the local console, 4 for a disk I/O problem (DONECODE contains additional information), 5 for DEADTIME time-out, and 6 for MAXTIME time-out. FLAG contains similar codes for return from the CFMODULE SPEAK function. DONECODE is another argument that is used to return information to the application program. The Forth word VALUES is used to print the contents of these two arguments after a CFMODULE call. VALUES is used for debugging.

Screen 128 loads the CFMODULE code into RAM and calls CFINIT to initialize the code. The INIT_COMPUFONE word performs these tasks. It is called from screen 120 after all the screens have been loaded. The contents of the arguments BUF1BEG, BUF2BEG and BUFSIZE are initialized after CFINIT returns to override the default values provided by CFINIT.

Screen 129 defines a local telephone ring counter. Two words are needed to count three rings. The first, LONG_WAITRNG, will loop until a local ring is detected or until a key is struck on the console. The CHKRING function of CFMODULE is used to see if the telephone is ringing. The second word, WAITRNG, used after the first ring is detected, will wait only 15 seconds. If it gets a ring indication during that time, it will return the local ring flag on the Forth stack. Two successful WAITRNG returns are determined by the AND word that will terminate the BEGIN-UNTIL loop. The last line of WAIT3RNG will return to the Forth interpretor if a console key has been struck. This is how the ANSWER_MACHINE word is killed.

Screen 130 handles the CP/M files for messages. The MESSAGE word contains the CP/M filename used for recording and playback on the bubble disk. The SAVMSG word contains the CP/M filename used for permanent message storage. The SET_MESSAGE word will modify the SAVMSG filename by changing the last character of the filename. FREEMSG changes the filename in SAVMSG until an *unused* filename is found. The FEXIST function in CFMODULE is used by TESTFIL to determine if the file exists. NEXTMSG changes the filename in SAVMSG until a *used* filename is found.

Screen 131 defines the use of DO_MESSAGE. This word is used to wait for the telephone to ring three times, answer, play the HELLO message, record a message and hang up. The comments in the screen explain the function of each line. OFFHOOK is the CFMODULE routine that switches the telephone line to the active or off-hook condition; this is similar to lifting the handset off the cradle. The OFFHOOK function returns immediately, but there is a 2.7 second delay before the phone line connection is established. I suspect this delay is used to meet an FCC requirement that insures the answered call is billed.

The CFMODULE WAIT function is used to wait for the connection to be made. WAIT expects the FLAG argument to contain the length of the wait in 100 msec units. The TELE word is used before PLAY to set the value of the MUX argument so the analog multiplexer will connect the full-level telephone line to the speech digitizer. The HELLO word contains the CP/M filename for the previously recorded hello message. PLAY uses the CFMODULE SPEAK function to play back this message to the telephone line after the call is answered. The RECORD word is used to record a message into the CP/M filename contained in MESSAGE; but first two timers are initialized.

The LISTEN function of CFMODULE uses two timers. Both are programmable in 100 msec units. MAXTIME is used to set the maximum length of the recording. This essentially sets an upper boundary on the size of the resulting disk file. I picked 30 seconds for MAXTIME, which will produce a

```
SCR #120
( Load Screen for COMPUFONE words                       27JAN84RCR)

121 134 THRU

254 SET_ERROR_MODE         \ CP/M+ Display error and RETURN mode

INIT_COMPUFONE             \ Load and Initialize the CFMODULE code

ANSWER_MACHINE             \ Word to run the Telephone Answering app

PLAY_MESSAGES              \ Word to playback recorded messages


SCR #121
( CP/M Interface, Make FCB, Open, Close, Read, Write 17JAN84RCR)
: CHKSTK DEPTH - 0< NOT ABORT" NEED ARG(S)" ;
: NULLTERM DUP COUNT + 0 SWAP C! DUP C@ 1+ SWAP C! ;
\ Create a FILE NaMe string
: FILENM CREATE BL WORD DUP NULLTERM C@ 2+ ALLOT DOES> ;
VARIABLE PFCB 2 ALLOT
\ Initialize an FCB variable with a FILENM string
: INITFCB 2 CHKSTK ( FCB_addr FILENM --- ) 1+ PFCB ! PFCB 2+ !
  152 PFCB SYSCALL 255 = ABORT" BAD FILE NAME" ;
: SET_ERROR_MODE 1 CHKSTK 45 SWAP SYSCALL ;
: FSIZE 35 OVER SYSCALL ABORT" FILE NOT FOUND" 33 + @ ;
: OPEN 1 CHKSTK 15 SWAP SYSCALL ABORT" FILE NOT FOUND" ;
: MAKE 1 CHKSTK 22 SWAP SYSCALL ABORT" FILE EXISTS" ;
: CLOSE          16 SWAP SYSCALL ABORT" FILE NOT FOUND" ;
: SEQ_READ       20 SWAP SYSCALL ABORT" READ ERORR" ;
: SEQ_WRITE      21 SWAP SYSCALL ABORT" WRITE ERROR" ;


SCR #122
( CP/M Utilities, load a file, copy a file               27JAN84RCR)

\ Load the file in FCBaddr into RAM starting at load_addr
: LOAD_FILE 2 CHKSTK      ( FCBaddr load_addr --- )
  OVER OPEN OVER FSIZE 0 DO DUP 26 SWAP SYSCALL DROP
```

COMPUFONE

Continued from page 48

75K file at the 2.5K per second sample rate. DEADTIME is used to set the maximum interval of silence. This timer, reset by the LISTEN function whenever sound is detected during the recording, allows LISTEN to end before MAXTIME times out. Most recorded messages in this application end with the DEADTIME timer time-out due to the caller's hanging up after leaving a message. These two timers provide flexibility in using LISTEN. The DEADTIME timer is also used in the CFMODULE GETTONE function. GETTONE will wait for a Touch-Tone from the receiver. This function can be used to enter codes that play back messages over the telephone or to record data solicited by a prerecorded message. Each timer can be disabled by setting its argument value to zero.

An application note in the documentation discusses experimentation needed to find an acceptable value for these timers. For example, if the DEADTIME timer is too long, the local telephone exchange may return a busy signal after the called party hangs up and the calling party is still off hook. This situation would produce a "sound" that would reset the DEADTIME timer, and recording would continue. The DEADTIME timer provides an acceptable solution to the problem of there not being a way to electrically detect whether the called party has hung up.

DO_MESSAGE ends by checking the LISTEN return code in FLAG. If LISTEN terminated due to MAXTIME time-out or due to a disk full condition, the SORRY message is PLAYed.

Screen 132 defines the words used to move messages between the bubble disk and a conventional floppy disk. SAVE_MESSAGE moves a message off the bubble for permanent storage after recording. The RESTORE_MESSAGE word returns a message for playback.

Screen 133 defines the use of the ANSWER_MACHINE word. The telephone answering application requires a HELLO and SORRY file, so it begins by checking that these files exist. The first FREEMSG filename is found and an endless loop is entered. DO_MESSAGE is used to record a message, SAVE_MESSAGE moves the message off the bubble disk, and FREEMSG gets the next filename.

Screen 134 defines the PLAY_MESSAGES word used to listen to the recorded messages. Its structure is similar to ANSWER_MACHINE. Saved messages are deleted if the response to QUERY is a "Y".

```
  OVER SEQ_READ 128 + LOOP DROP CLOSE ;

\ Copy contents of file fromFCB to file toFCB
: COPYFILE 2 CHKSTK     ( fromFCB toFCB --- )
  DUP MAKE OVER OPEN 26 128 SYSCALL DROP
  OVER FSIZE DUP 0= IF DROP EXIT THEN 0 DO
    OVER SEQ_READ DUP SEQ_WRITE
  LOOP  CLOSE CLOSE ;


SCR #123
( Define CFMODULE area and DISK storage area          27JAN84RCR)

HEX
\ Define RAM for CFMODULE code
VARIABLE ENTRY       F000 ENTRY !

\ Define RAM for CFMODULE argument block
VARIABLE ARGBLK      FA00 ARGBLK !

\ Define size of buffers (NRECS in units of 128-byte records)
VARIABLE NRECS       10 NRECS !

\ Define location of disk buffers
VARIABLE DBUFF       C000 DBUFF !
DECIMAL


SCR #124
( Define ARGUMENT BLOCK locations                     27JAN84RCR)
\ ARGUSER is a defining word similar to the FORTH USER word
: ARGUSER CONSTANT ;CODE
  D INX XCHG M E MOV 0 D MVI ARGBLK LHLD
  D DAD HPUSH JMP END-CODE

\ Here are the arguments available in ARGBLK
0 ARGUSER FLAG            1 ARGUSER DONECODE
2 ARGUSER DEADTIME        3 ARGUSER MAXTIME
5 ARGUSER MUX             6 ARGUSER TPSW
7 ARGUSER MAXRING         8 ARGUSER BUFSIZE
9 ARGUSER BUF1BEG        11 ARGUSER BUF2BEG

\ Here are the values used for the MUX argument
: TELE 0 MUX C! ;         \ Select telephone line
: MIKE 7 MUX C! ;         \ Select microphone input


SCR #125
( Define CFMODULE calls                               27JAN84RCR)

\ FUNCALL will define a word that will call a CFMODULE function
: FUNCALL CONSTANT ;CODE
  D INX XCHG M E MOV 0 D MVI ENTRY LHLD
  D DAD NEXT D LXI D PUSH PCHL END-CODE

\ Here are the 13 functions available in CFMODULE
 0 FUNCALL CFINIT                3 FUNCALL ONHOOK
 6 FUNCALL OFFHOOK               9 FUNCALL GETTONE
12 FUNCALL DIALER               15 FUNCALL GENBEEP
18 FUNCALL CHKRING              21 FUNCALL CALLOUT
24 FUNCALL LISTEN               27 FUNCALL SPEAK
30 FUNCALL FEXIST               33 FUNCALL FDELETE
36 FUNCALL WAIT


SCR #126
( define PHONE#s and FILE NaMes                       27JAN84RCR)
\ PHONE# will define a word that will leave a string address
\ on the FORTH stack, FILENM is the same idea
: PHONE# CREATE BL WORD DUP NULLTERM C@ 2+ ALLOT DOES> ;

PHONE# TIME 9761616      \ TIME OF DAY NUMBER
PHONE# DUM  1111111

FILENM TEST  C:TEST      \ DEFAULT FILE NAME
```

INDUSTRIAL GRADE IEEE-696/S-100 BOARDS

Dual Systems designs and manufactures a variety of IEEE-696/S-100 boards for 16-bit microprocessor systems running under UNIX and other operating systems. These boards bring high performance and three years of field-proven experience to your computing environment.

Each board is rigorously tested and burned-in for 168 grueling hours. If it can't bear the heat, it won't bear our name.

High Performance System Boards

Model WDC-SMD The WDC-SMD Hard Disk Controller* is specially designed for high throughput in large, heavily-loaded multi-user UNIX systems. All sectors on a track are transferred essentially within a single disk rotation regardless of where the head first settles or the order in which sectors are encountered.

The controller offers 16-bit throttled DMA data transfers and disk transfers up to 10 Mb/sec. Also features dual-ported, full-track, look ahead cache, and on-board microprocessor. Interfaces with one or two SMD drives. $2195.

Model SIO4-DMA The most advanced, intelligent, 4-port serial I/O board available for the IEEE-696/S-100 bus, this module features 256 bytes of FIFO buffer for input characters and provides DMA transfers for output. A built-in 8085A processor greatly reduces system overhead. $695.

*Patent Pending

Model DMEM Features 256K bytes of memory and either 8 or 16-bit data paths. 24-bit addressing, and parity checking on each byte. DMEM has no S-100 wait states. $1395.

Model EPROM Capable of either 8 or 16-bit data transfers, this 32/64K EPROM offers the versatility of running with 68000, Z-8000, 8086, 16000, and other 16-bit processors. It accepts industry-standard 2732 and 2716 EPROMs. 64K RAMS may be mixed with 2716 EPROMs for use as a RAM/EPROM board. $345.

Model CPU-68000M High-performance CPU board with 16-bit data path, 10 MHz CPU operation, and MC68451 MMU for multi-tasking applications. $1195.

Model CPU-68000 Similar to 68000M, but features 8K bytes of on-board ROM with Motorola's MacsBug monitor instead of the Memory Management Unit. $895.

Models M/BD-15 & 20 Back Planes These premium quality motherboards feature four-layer construction with two internal ground planes, and Schottky-diode termination. They provide high-speed operation with true transmission line characteristics and minimum noise. M/BD-15: $495, M/BD-20: $545.

Model CMEM This non-volatile CMOS memory board provides easy-to-use 8 or 16-bit data paths and 32K bytes of memory with dynamically movable write/protect window. On-board lithium battery holds data for 3-10 years with power off. $725.

Data Acquisition and Control Boards

Model CLK-24C Clock-calendar features a LSI CMOS chip and on-board, long-life lithium battery. $325.

Model AIM-12 A highly reliable A-to-D converter with 35msec. maximum conversion time, 12-bit resolution and accuracy, and 32 channels single-ended/16 channels differential. $725.

Model AOM-12 This D-to-A converter offers I/O-mapped port address, 12-bit ±½ L.S.B. accuracy (0-70°C), and voltage outputs of 0 to 10 volts, ±5 volts, and ±10 volts. $675.

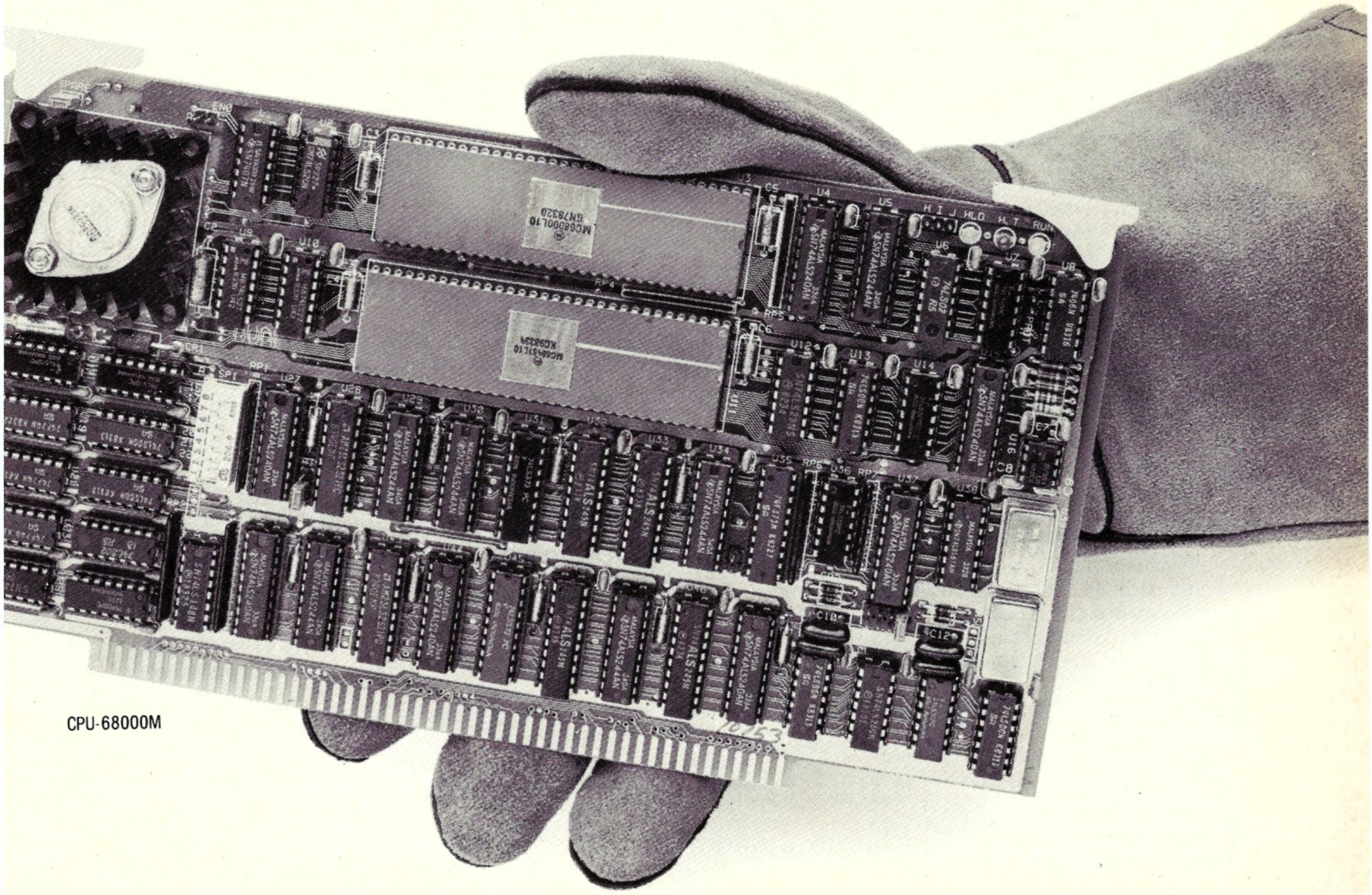
Model VIC 4-20 Converts voltage outputs from AOM-12 into four separate 4-20MA current outputs. Module also provides overvoltage protection on all current output, plus transient protection per ISA standards. $600.

For more information, call (415) 549-3854. Dual Systems Corp., 2530 San Pablo Avenue, Berkeley, CA 94702

THERE'S ONLY ONE

DUAL

CIRCLE 127 ON READER SERVICE CARD



CPU-68000M

COMPUFONE

Continued from page 50

I have used this telephone answering machine for a few days and it works fine. There are more features I would like to add, and the CFMODULE software has the functions I would need to add an automatic playback of messages controlled by a telephone connection. GETTONE is a function that inquires about the status of the Touch-Tone receiver. Using GETTONE to detect Touch-Tones is the primary way to control application software from the telephone line. Both recording (the LISTEN function) and playback (the SPEAK function) are interrupted by a Touch-Tone signal. All sorts of control possibilities are available with this function.

The only CFMODULE function I haven't mentioned is GENBEEP. This function generates a tone (the FLAG argument is used to specify the duration) that can be sent to the telephone line and line-out connector.

The telephone number string accepted by the CFMODULE functions DIALER and CALLOUT can contain two special characters. The : character in a string will wait for another dial tone. This is useful in dialing from a PBX that requires an access code such as 9 to get an outside line. The + character in a string to CALLOUT will cause CALLOUT to complete the call progression in progress and then start over with the rest of the string. This is useful in accessing long-distance services that first require a call to a local number, which then supplies a dial tone for placing a long-distance call. Call progression refers to the CALLOUT sequence of dial tone, dialing, ring and answer. CALLOUT uses DONECODE to return a value that indicates how far the call progression has gone. I used CALLOUT for a simple call to a local number for the time check, and it performed as advertised.

Documentation

The CompuFone comes with a large manual. Over half of the manual is devoted to assembler listings of all the supplied software. The listings are well commented, so that a person familiar with assembler can glean some information about hardware aspects of the board that are not documented. Including the listings in the documentation prevents you from having to list the programs yourself.

Chapter 1 covers installation; Chapter 2 deals with checkout using the CFDEMO software. Chapter 3 describes the hardware, with some notable exceptions mentioned below. Chapter 4

```
FILENM HELLO C:HELLO     \ HELLO MESSAGE
FILENM SORRY C:SORRY     \ MAX TIME MESSAGE

: INITBUF 1 CHKSTK DUP C@ SWAP 1+ BUF1BEG @ ROT CMOVE ;
: DEFAULT DEPTH 0= IF TEST THEN INITBUF ;
: TESTFIL INITBUF FEXIST  DONECODE C@ ;
: DELFIL  INITBUF FDELETE DONECODE C@ ;

SCR #127
( Calling Words, Record/Playback Words                    27JAN84RCR)
\ Print the values of the arguments FLAG and DONECODE
: VALUES ." FLAG=" FLAG C@ . 9 EMIT
  ." DONECODE=" DONECODE C@ . ;

\ "PHONE#" must be on stack
: DIALNUM INITBUF DIALER  CR ." DIALER  RETURNS:" VALUES ;
: CALLNUM INITBUF CALLOUT CR ." CALLOUT RETURNS:" VALUES ;

\ If no "FILENM" is on stack, default name is used
\ set FLAG, MUX, MAXTIME and DEADTIME before call
: RECORD DEFAULT 10 FLAG C! LISTEN
  CR ." LISTEN  RETURNS:" VALUES ;
: PLAY    DEFAULT SPEAK
  CR ." SPEAK   RETURNS:" VALUES ;

SCR #128
( Load CFMODULE code and Initialize COMPUFONE             17JAN84RCR)

  VARIABLE FCB_CFMODULE 34 ALLOT          \ FCB for CFMODULE code
  FILENM CFMODNM F:CFMODULE.IMG           \ FILE NaMe of CFMODULE

: INIT_COMPUFONE
  FCB_CFMODULE CFMODNM INITFCB            \ set up FCB_CFMODULE
  FCB_CFMODULE ENTRY @ LOAD_FILE          \ load the code

  CFINIT         \ let the CFMODULE code initialize itself

  DBUFF @ BUF1BEG !      \ set up the two buffers
  DBUFF @ NRECS @ 128 * + BUF2BEG !
  NRECS @ BUFSIZE C! ;

SCR #129
( Telephone Ring counter                                  17JAN84RCR)
: TESTRNG DONECODE C@ ?TERMINAL OR ;
: WAIT1SEC 10 FLAG C! WAIT ;
\ Wait for a ring or terminal interrupt
: LONG_WAITRNG BEGIN CHKRING TESTRNG UNTIL ;

: WAITRNG        \ Wait up to 15-seconds for a ring
  15 0 DO WAIT1SEC CHKRING TESTRNG IF LEAVE THEN LOOP
  TESTRNG ;
: WAIT3RNG       \ Wait for 3 consecutive rings
  BEGIN
    LONG_WAITRNG           \ Returns on first ring
    WAITRNG WAITRNG AND    \ Two more rings within 30-sec
  UNTIL                    \ Until 3 rings total
  ?TERMINAL ABORT" INTERRUPT!" ;     \ This is way to stop it

SCR #130
( Message handler                                         17JAN84RCR)
FILENM MESSAGE C:MESSAGE.SPH    FILENM SAVMSG B:MESSAGE1.SPH

\ Get address of last character of filename
: ADDR_CHAR SAVMSG DUP C@ + 5 - ;
\ Set SAVMSG filenm to n          ( n --- )
: SET_MESSAGE 1 CHKSTK 48 + ADDR_CHAR C! ;
: FREEMSG         \ Find next available save message file name
  10 1 DO SAVMSG TESTFIL
    IF I SET_MESSAGE ELSE LEAVE THEN LOOP
  SAVMSG TESTFIL ABORT" ALL MESSAGE FILES IN USE" ;
```

COMPUFONE

Continued from page 52

covers disk recording and playback, and Chapter 5 describes the CFMODULE software. Chapter 5 ends with some applications notes that deal with special characters in dial strings, buffer allocation, timers and automatic call placement. The appendices contain the program listings and a one-page schematic. There is no index.

A board schematic is supplied for the S-100 bus interface only (page one of a three-page schematic). I requested a complete schematic and was told that the circuit was proprietary. I guess an OEM with a large order could get a complete schematic.

Lacking a complete schematic, I had to rely on the documentation to supply the details. The documentation is complete as far as setting the options, describing the sample programs, and describing each function available in CFMODULE; but no technical description is provided.

The three "trunk status" bits that appear on the base input port are not documented. The only reference in the documentation is that "the trunk status lines are used by the call progression software to detect dial tone, busy, remote ring, connection established and dead line." This means that you have to depend on the assembler listings if you want to know how to detect dial tone or busy or any other status information. If you can't figure out the meaning of these trunk status bits from the assembly listing, you are left with the functions provided in CFMODULE.

Details of the hardware data compression technique used by the speech digitizer subsystem are not provided. I inquired about the possibilities for signal processing of the digitized speech and was told that essential information for speech recognition was removed by the digitizing process; therefore, speech recognition after digitization is not possible. A special buffered output is provided on the audio socket with this inscription: "special connection for experimental speech recognizer—contact factory for details." One piece of information supplied was that silence is digitized to a string of AA or 55 Hex bytes. This could be useful if it was desired to further compress silent stretches out of recorded files.

I am not accustomed to the technical details of a board being proprietary. The only other experience I had with this was when I inquired into the telephone interface used by my PMMI modem board. I guess getting a two- to four-wire duplexer with a high degree of transmit/receive isolation working on

```
: NEXTMSG        \ Find next occupied message file
  58 ADDR_CHAR C@ 1+ DO
    I ADDR_CHAR C! SAVMSG TESTFIL IF LEAVE THEN LOOP
  SAVMSG TESTFIL NOT ABORT" ALL MESSAGE FILES SCANNED" ;

SCR #131
( Take a message                                        27JAN84RCR)
: DO_MESSAGE     \ Answer phone and take a message from caller
  WAIT3RNG                 \ wait for 3 rings, then
  OFFHOOK                  \ answer call
  27 FLAG C! WAIT          \ answer delay
  TELE HELLO PLAY          \ play "hello" message
  50 DEADTIME C!           \ a 5-second pause will stop recording
  300 MAXTIME !            \ a 30-second message maximum
  MESSAGE RECORD CR        \ record the message
  \ 1-second beep tone set-up in RECORD
  \ check record result and play sorry message if MAXTIME
  \ exceeded or disk is full
  FLAG C@ DUP 4 = SWAP 6 = OR IF SORRY PLAY THEN
  ONHOOK ;                 \ finally, hangup

SCR #132
( Copy message to another disk                          23JAN84RCR)
VARIABLE MSG_FCB 34 ALLOT                  \ FCB for message
VARIABLE SAV_FCB 34 ALLOT                  \ FCB for copy
: SAVE_MESSAGE
  MSG_FCB MESSAGE INITFCB
  SAV_FCB SAVMSG  INITFCB
  SAVMSG  DELFIL  DROP
  MSG_FCB SAV_FCB COPYFILE ;
: RESTORE_MESSAGE
  MSG_FCB MESSAGE INITFCB
  SAV_FCB SAVMSG  INITFCB
  MESSAGE DELFIL  DROP
  SAV_FCB MSG_FCB COPYFILE ;

SCR #133
( A simple Telephone Answering Machine                  27JAN84RCR)
: ANSWER_MACHINE
  HELLO TESTFIL NOT ABORT" HELLO FILE NOT FOUND"
  SORRY TESTFIL NOT ABORT" SORRY FILE NOT FOUND"
  1 SET_MESSAGE            \ prepare to receive first message
  FREEMSG                  \ get name of next free message file
  BEGIN
    DO_MESSAGE             \ get a message
    SAVE_MESSAGE           \ save message on another disk to free
                           \ space on BUBBLE disk
    FREEMSG                \ prepare to receive another message
    1 WHILE                \ do for all 9 messages files
  REPEAT ;

SCR #134
( Play-back recorded messages                           17JAN84RCR)
: PLAY_MESSAGES
  0 SET_MESSAGE            \ start with first one
  BEGIN
    NEXTMSG                \ get next message filename
    RESTORE_MESSAGE        \ copy message back to BUBBLE disk
    CR SAVMSG COUNT TYPE   \ print message name
    MESSAGE PLAY           \ play it back
    ." Delete? "           \ answer "Y" or "YES" to delete message
    QUERY BL WORD COUNT 0= NOT SWAP C@ 89 = AND
      IF SAVMSG DELFIL THEN
    1 WHILE                \ do for all 9 message files
  REPEAT ;
```

SYSTEMS OR BOARDS, YOU CHOOSE!

The S100-PC by LOMAS DATA PRODUCTS: Offering high performance at a "low" price . . . and it's IBM-PC compatible.

The system offers the following standard features:

- 8 MHz 8086 CPU (8087 optional)
- 128K byte RAM (expandable to 1 megabyte)
- 2 RS232 serial ports and 2 parallel ports
- Battery protected clock calendar
- CONCURRENT CP/M-86* version 3.1, PERSONAL BASIC, CP/M 2.2 emulator and communications program.
- 2 double sided 5 1/4″ floppy drives (720K bytes)
- Attractive 15 slot desktop enclosure

The S100-PC is a cost effective high performance floppy based system ideally suited to business and scientific applications.

In addition to the above standard features many options are available: Winchester disk drives 10 to 40 Mbyte, 80286 microprocessor, and IBM-PC compatible graphics support (JUN84). If you're using an IBM-PC or other compatible and you want to improve the performance of your software, LOMAS DATA PRODUCTS is the solution.

S100 BUS boards products & support for the system integrator

■ LIGHTNING ONE * 8086/8088 CPU**
8086 or 8088, with 8087 and 8089 coprocessors. Up to 10 MHZ operation . . . . **PRICES start at $425.00**

■ HAZITALL SYSTEM SUPPORT BOARD
2 serial, 2 parallel ports, battery protected clock calendar, Hard disk controller host interface . . . . **PRICE $325.00**

■ LDP 128/256K DYNAMIC RAM
Advanced dynamic RAM with LSI controller for failsafe operation, parity . . . . **PRICE** 128K—**$495.00,** 256K—**$795.00**

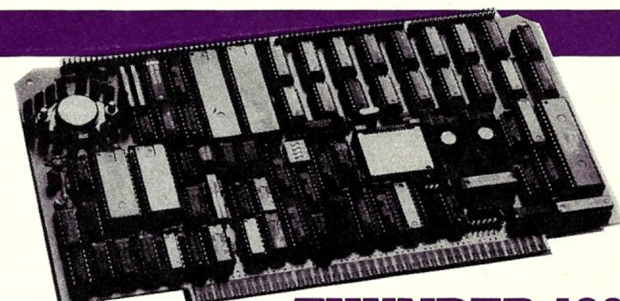
■ RAM67 HIGH PERFORMANCE STATIC RAM
High speed (100ns) low power CMOS static RAM. 128K bytes, extended addressing . . . . **PRICE $995.00**

■ LDP72 FLOPPY DISK CONTROLLER
Single/double density, single/double sided disks, both 8″ and 5 1/4″ inch drives simultaneously . . . . **PRICE $275.00**

■ LDP88 8088 SINGLE BOARD COMPUTER
8088 CPU, 1K RAM, 8 K EPROM, Monitor RS232 serial port, 8 vectored interrupts . . . . **PRICE $349.00**

■ LIGHTNING 286—80286 CPU BOARD
Offers 4 times the performance of a 5MHZ 8086 CPU while maintaining software compatibility. . . . . **PRICE $1395.00**

■ OCTAPORT 8 PORT SERIAL BOARD
8 serial ports 0 to 19200 baud operation real time clock interrupt. Ideal for multi-user systems such as MP/M-86.* . . .
PRICE $395.00



THUNDER 186

THUNDER 186 is the only complete S100 BUS, 16 bit single board computer available today. This board comes complete and ready to plug into an enclosure and run. It comes with the most advanced microprocessor operating system CONCURRENT CP/M-86, which in addition to running CP/M-86 programs also runs MS-DOS programs. This board offers the perfect combination of performance and cost. Price with 256K bytes of RAM only **$1595.00**

All of LDP boards are fully tested to exacting standards and carry a one year warranty. We specialize in 16-bit products & support the four major operating systems for 16-bit processors: CP/M-86*, MP/M-86, CONCURRENT CP/M-86*, and MS-DOS (PC-DOS).

Dealer inquiries invited.

LDP

LOMAS DATA PRODUCTS, INC. □ 66 Hopkinton Road, Westboro, MA 01581 □ (617) 366-6434 □ Telex: 4996272

**CP/M-86, MP/M-86 and CONCURRENT CP/M-86 are trademarks of Digital Research.*
***MS-DOS is trademark of Microsoft*
****Lightning One is trademark of Lomas Data Products, Inc.*

CIRCLE 248 ON READER SERVICE CARD

COMPUFONE

Continued from page 54

any telephone connection with its varying impedance requires a clever design, and the design would be kept proprietary. Every telephone interface I have seen has been sealed up tight so that it can't be reverse engineered. But I don't agree with the practice of keeping the major portion of a board's theory of operation proprietary—especially such useful information as what three trunk status bits mean.

In order to understand the analog multiplexer, I used a block diagram given in the hardware chapter. This diagram shows seven connections, but the description talks about eight. I found the chip on the board and consulted the data sheet. Sure enough, there are eight connections in/out and one common out/in.

A phone call to Computalker clarified what the eighth connection to the analog multiplexer is used for. My curiosity was piqued because I thought that a telephone amplifier was available by using the microphone and external speaker. This does work, but the level of the signal from the telephone line is attenuated and therefore hard to hear in the speaker. The eighth connection to the analog multiplexer is the unattenuated telephone line. Since only one "switch" can be closed at any one time, a practical telephone amplifier is not feasible. Too bad, it would have been a nice extra feature.

OEMs will see an opportunity to develop software and package it with CompuFone.

The description of the jumper-selectable options in the hardware chapter is good. I had no problem understanding them because I had the S-100 interface schematic to augment the text, but generally, I found the hardware description incomplete.

Conclusion

The CompuFone board adds significant flexibility for S-100 machines. The voice digitizer, telephone interface and Touch-Tone generator/decoder provide the capability for many interesting and useful applications such as voice store and forward systems, computer-aided instruction, remote data entry, remote control of computer applications, Ham radio repeaters and phone patches. Since software for these applications would have to be user developed, I wouldn't recommend this board for the novice user. OEMs will be likely to see the possibilities here, and will develop software to package with the board. I have a brochure from Applied Voice Technology that offers CompuFone software for a full-featured voice message system (PhoneXpress), a voice-oriented data retrieval system (PhoneForms), and Pascal routines to control the CompuFone (VoicePak).

The single unit price of $995 will prevent competition with simple telephone answering machines like the application I described. However, the more sophisticated uses of the board will support its price.

A brochure is available from **Computalker,** *1730 21st Street, Santa Monica, CA 90404.* **Applied Voice Technology** is located at *2103 W. Harrison Ave., Suite 5A, Olympia, WA, 98502.*

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

S-100 Product Directory

by Sol Libes

This is the second annual S-100/IEEE-696 Product Directory to appear in *Microsystems*. It contains a concise listing of over 500 S-100/IEEE-696 products available from over 150 companies. The number of companies listed here has risen slightly from last year, and the number of products has increased by about 15%. Thus the S-100 market, although nowhere as dynamic as that for the integrated personal computer, is healthy and growing. However, there is no doubt that the S-100 market can now be considered a mature industry with only moderate growth potential, compared to the IBM PC-compatible market.

Markets for other bus-oriented computer systems, such as Multibus and Standard Bus, are also thriving and expanding. Whereas the early growth of the S-100 marketplace relied mainly on hobbyists and early personal computer users, the industry is now concentrating on OEM multiuser systems, and applications requiring more computer power. Thus, as one looks through this directory, one sees many listings for the more powerful 16-bit systems, based on the Motorola 68000, Intel 80286 and National Semiconductor 16032 microprocessors, as well as high-density color graphics systems.

S-100 systems therefore continue to make progress in the multiuser, multiprocessing marketplace running MP/M, TurboDOS, UNIX, and UNIX-like operating systems. Hence there is no doubt that the adoption of the IEEE-696 Standard for S-100 systems has stimulated industry growth, as virtually all manufactures are now making a concerted effort to make their equipment conform to the Standard.

Using the directory

Of necessity, it was not possible to include detailed specifications on the many products listed. In some cases, however, I was able to list some of the specifications. For example, I was able to indicate the microprocessors used in the complete systems, single board computers and CPU cards. In these cases the following abbreviations were used:

80	=	Intel 8080
85	=	Intel 8085
86	=	Intel 8086
88	=	Intel 8088
186	=	Intel 80186
188	=	Intel 80188
286	=	Intel 80286
032	=	National Semiconductor 16032
68K	=	Motorola 68000
Z80	=	Zilog Z80
Z8K	=	Zilog Z8000

In the columns under RAM and ROM cards, I have indicated the maximum memory each could contain. Under RAM cards, S or D following the memory size indicates either Static or Dynamic memory.

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

For the video and graphic controller cards, I have indicated either the number of lines and columns (e.g., 24 x 80) or the pixel resolution, and whether the board has color capability. On the local area networking cards (where the manufacturer included the information), I was able to indicate the type of LAN system used. In the address section, where a company has supplied the name of a person to contact, that name is given last.

I recognize that this directory is not complete, since many companies did not respond to our questionnaire (we mailed to almost 250 companies). Therefore, companies that produce S-100/IEEE-696 products and wish to be listed in future directories should send me information on their products.

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

S-100 PRODUCT DIRECTORY

Company	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 Network	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
ABACUS Technology Systems			T11																						1
Ackerman Digital Systems		6809	6809 6800		32S 128S	2-512								●			●		●	●	●			S-100/PDP-11 peripheral card incl. RT-11 V5 software with CP/M emulation	2
Action Computer Enterprise, Inc.		86 Z80	Z80	86		4K	8S/8P				●	●	●	●	●			●			●	●	●	Interrupt Controller	3
Adaptive Data & Energy Systems														●	●										4
Advanced Computer Products					32/64S															●					5
Advanced Computer Technology, Inc.	Z80	Z80																			●	●	●		6
Advanced Digital Corp.	Z80	Z80												●											7
Alloy Computer Products															●										8
Applied Innovations				88,86		256											●								9
Artec Electronics		85			8/16/32S	32							●												10
Automated Control Systems							7P									●									11
BG Computer Applications					64/256S	64/256																			12
Brown Dog Engineering																	●							DPM interface board/industrial controller boards	13
California Computer Systems		Z80			64D 16/32S		4,6S 4P 2S + 2P						●	●						●	●	●			14
California Data Corp.														●		●									15
California Digital, Inc.					256D/64S																				16
Caimbridge Development Lab.								28x80																	17
Casheab																								Music synthesizer	18
CER-TEK, Inc.																	●								19
Chrislin Industries, Inc.					64D																				20
Communications Research, Inc.	186	186																							21
Components Express, Inc.					64S																				22
CompuPro Systems	Z80 85/88 86/ 68K Z86		Z80 85	88/86 286/ 68K 16032	64/128S 256/512D		2S, 8S 3P + 1S 1P + 3S		●	●			●	●										I/O processor, multifunction RAM disk, interrupt controller & disk emulator cards	23
Computalker																								Speech synthesizer & telephone interface	24
Computer Dynamics, Inc.														●										Hard disk system	24
Computer Systems	86/88/68K	86/88 68K		86/88 68K	256S	128	8S/6P	25×80	512×480 color	●	●	●	●	●	●	●	●	●	●	●	●	●			25
Compu/Time					256D								●					●							27

S-100 PRODUCT DIRECTORY

	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 Network	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
Corvus Systems, Inc.														•											28
Cromemco, Inc.	Z80 68K	Z80	Z80	68K	4S,16/ 64/ 256/ 512D	32	3S + 2P 4P,8P 2S+ 2P	80×25	754× 482 color	C NET	•	•	•	•	•	•	•			•	•	•	•	TV camera digitizer & floating point processor boards	29
CSD, Inc.									512× 512 color																30
Cybertext Corp.																								S-100-to-Compugraphic typesetter interface card	31
Cygnus Systems																			•						32
D & W Digital											•														33
Data Technology Corp.													•	•	•										34
Debu Tech									256× 192 color																35
Destek Group										Des-net															36
Digi-Data Corp.															•									Tape system	37
Digiac Corp.	Z80		Z80		64D		2P+ 4S						•												38
Digicomp Research Corp.	Z80 64K		Z80	68K	64/ 128 256D		3P+ 4S																	Pascal card	39
Digital Graphic Systems, Inc.	Z80/ 85 86/88 68K								512× 512 color															B/W & color frame grabbers	40
Digital Media	68705				64D		1S+1 P										•							PAL/FPLA programmer	41
Digital Multi-Media Control							1S+ 3P																		42
Digital Research Computers					16/32 64S	32																			43
Digtex	Z80				128K		2-14S 1P																	System runs Datapoint software	44
Disc Tech One, Inc.																								Hard disk system	45
Dual Systems Control Corp.	68K			68K	256D 32S	64	4S+1 P		512× 512 color	Ethernet			•	•	•	•	•	•			•			Floating point processor card	46
Dylon Corp.											•				•										48
Educational Microcomputer Systems		68K						24×80	160× 96																49
Electralogics, Inc.					64S/ 256D	64/ 256	8S+ 2P											•		•				Disk emulator board	50
Electronic Control Technology, Inc.	80 Z80		80		16/48/ 64S	64	3S+ 1P +ROM				•									•	•	•	•		51
Empirical Research Group, Inc.	68K			68K	128S 1MBD		8S+ 3P						•												52
Extended Processing			Z80		64S		3S+ 1P										•								53
Fischer Computer Systems																								Shaft encoder-counter card	54
Fulcrum Computer Products					64S		2S	25×80		•												•			55

S-100 PRODUCT DIRECTORY

	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 Network	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
Futronics								24 x 80																	56
Genesis Computer Corp.	Z80												●	●	●						●	●	●		58
GMR, Inc.	Z80																								59
Graphics Development Labs									512 x 480 color															RGB-to-NTSC encoder cards	60
GSR Computers					256D								●					●							61
Hayes Microcomputer Products												●													62
Illuminated Technologies, Inc.								1Kx1K color																	64
IMS International	Z80		Z80		64D		1P+ 2S	24X 80		●			●	●							●				163
Independent Business Systems	Z80 186	Z80 186	Z80	186	64-256		2S+ 1P			●		●	●		●										65
Inner Access Corp.	68K			68K	256S	256	8S+ ROM							●			●	●		●	●	●		PROM/EPROM simulator card	66
InnerVision Computers			Z80	16032																					67
Integrand																						●	●		68
Intercontinental Micro Systems Corp.		Z80 86	Z80	86	256D		2S+ 2P			Arc-net				●				●						Master & slave processors	69
Interlogic Industries		Z80			256D		4S+ 1P						●				●			●	●			Diagnostic bus analyzer card	70
I/O Technology					128S		3P+ 2S	512x 512 color																	63
Ithaca Intersystems	Z80 Z8K		Z80	Z8K	64D 256D		6S 2S+2 P						●	●	●						●			Memory management cards	71
Jade Computer Products, Inc.	Z80		Z80		64S 256D								●								●			Plug-in front panel type cards	72
JC Systems	Z80 186 68K	●	Z80	186 68K	256D		4S+ 2P						●	●						●	●				73
J.E.S. Graphics									144x 192 288x 192 color							●									74
Jones Futurex, Inc.																								Encryption/decryption	75
JVB Electronics																								Printer buffer card	76
Konan Corp.							1P+ 8S						●	●											77
Kramer Systems International																								S-100 interface for Superbrain, CompuStar, TeleVideo, etc.	78
Lexicomp Data Systems		68K			64S							●	●			●									79

S-100 PRODUCT DIRECTORY

	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 Network	IEEE 488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/ Calendar	Speech Snythesizer	Prototyping Extender	Card Cage/ Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Lomas Data Products				86, 88 186, 286	128 256D 64/ 128S			25x80	620x 200 color				●		●			●							80
Macrotech International					1MBD 256D		16S																	Intelligent I/O card	81
Matco																		●						EPROM emulator	82
Matrox Electronic Systems, Ltd.								80 x 24	512 x 256																83
MCP Computer Products	Z80 188	188	Z80	188	64S			80 x 24					●												84
Measurement Systems & Controls	Z80		Z80	128D	64S		8S		●			●	●	●	●						●	●	●		85
Memory Merchant			Z80	8088	64S																				86
Methode Electronics, Inc.																				●					87
Micro Designs																								Floating point processor card	88
MicroDynamics Corp.									256 x 192 color								●								89
Micro Mike's, Inc.	Z80																								90
Micromint, Inc.									256 x 192																91
Mimic, Inc.							1P									●			●						92
MOM'S Computing, Inc.	●																							CAD/CAM & Data acquisition systems	93
Monitor Dynamics, Inc.														●	●										94
Morrow Designs	Z80		Z80		64S		1P+ 3S 4P+ 2S						●	●						●					95
Mullen Computer Products																				●					96
MUSYS Corp.	Z80	Z80	Z80	86																					97
National Instruments											●														98
Netronics R & D, Ltd.	85	85			16/32/ 48/ 64D	8							●						●						99
New Generation Systems																								Disk formatter and drive tester	100
New World Computer Co., Inc.														●										Hard disk system, 10 MB	101
North Star Computers	Z80		Z80		32 64D		4S						●	●	●				●					Floating point processor card	102
Octagon			NSC-800	88	256D																				103
Optronics Technology			–		256S 512D 1MBD												●	●							104

S-100 PRODUCT DIRECTORY

	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 Network	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
Para Dynamics Corp.																						●	●		105
paraGraphics								24 x 80 40 x 80	512 x 576																106
PCE Systems					64/ 128 256D									●											107
Perex, Inc.										ether- net															108
Performics, Inc.				86/ 286	256- 1MBD/ 128S								●												109
Pickles & Trout											●														110
Piiceon				86/88	64/ 256D								●												111
Pixeltronics	Z80/ 186		Z80						640 x 408 color																112
PolyMorphic Systems	186			186	320/ 1MBD	16	2S+ 1PE	80 x 25 132 x 26	960 x 480 color	●	●	●	●	●				●				●			113
North Atlantic/Qantex															●										114
Quality Computer Services (QCS, Inc.)														●											115
QDP Computer Systems (Quasar Data Products, Inc.)	Z80																								116
QT Computer Systems	Z80	Z80																●			●	●			117
Random Factors Ltd.							●									●									118
Ronsan Electronics																		●							119
S-100/696 Corp.						16														●	●			Cassette I/O card	120
S.C. Digital			Z80		64/ 128 256D 16/ 32S	32	1P+ 3S						●												121
Scion Corp.					64K	12K		40 x 85	512 x 480 color																122
Scitronics, Inc.																		●						Power monitor & power controller cards	123
SDSystems	Z80		Z80		64K 256 1024D		4S, 8S	24 x 80					●	●			●								124
Seattle Computer Products, Inc.	86			86	64S		2S+4 P						●												125
SemiDisk Systems					512D 1024D																			Disk emulator board	126
Sierra Computer Products						16/32											●			●					127
Sierra Data Sciences	Z80	Z80	Z80				4S						●	●							●	●		MUX/Display board	128

S-100 PRODUCT DIRECTORY

Company	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 Network	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
Sigen Corp.		Z80											●	●											129
Signum Systems																								In-circuit 8048 emulator card	130
Simpliway Products Co.		Z80					2S+ 2P	24x80 25x80																	131
Ski Electronics				80																					132
Sky Computers Inc.																								Floating point processor cards	133
Snow Micro Systems, Inc.																								Stepper motor controller	134
SPC Technologies, Inc.																								Math processor card	135
SSM			80 Z80		64S	128	8S 2P+ 3S	16x64 24x80 50x80									●			●					136
Standard Microsystems Corp.							4S	●		●			●												137
Stanford Applied Engineering, Inc.																				●	●			Backplane	138
Sunny International																						●	●		139
Sunol Systems														●	●										140
Suntronics Co.		Z80	Z80		64S	64							●					●		●	●				141
Systems Group			Z80		64/128D		8S						●												142
Tarbell Electronics	Z80		Z80		64S		1P+ 2S						●												143
Tecmar, Inc.	86 Z80		Z80	86	64D 16S	4	1P+ 2S						●	●		●		●						Video digitizer & monitor interface cards	144
Teleram Communications Corp.																								Bubble memory card	145
Teletek		Z80	Z80		64/256D	8	2P 2P+ 4S						●	●	●									Intelligent I/O cards	146
Theta Labs, Inc.							4S 2P+ 2S																		147
Thoughtworks														●											148
Transend Corp.			80/Z80		64S	128	2S+ 2P 8S	16x64 24x80 50x80												●					149
Two Bits Computer Products					256D 256S																				150
U.S. Micro Sales	Z80		Z80		64S								●	●	●						●	●	●		151
U.S. Robotics Inc.																									152
Vector Electronics Co.					64S		2S/3P+ 1S													●	●	●			153
VLSI Networks, Inc.										●															154
Wameco, Inc.			Z80		16S																				155

S-100 PRODUCT DIRECTORY

	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 Network	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
Xitex								16x24																	156
Yang Electronic Systems, Inc.					32S																				157
Zenith Data Systems	85/88				256D		4S+ 1P			Arc-net			●	●											158
Zobex	Z80		Z80		64D		4S																		159
X COMP														●											160
Bytewrite																								Barcode reader/ printer	161
Commercial Dynamics, Inc.		Z80 256K				8K	2S																		165
Peak Electronics		68008			128K											●									164
PSCE Inc.		68000																							162
HDL Research Lab Inc.																					●	●	●		166
Mesa Power Systems																					●	●	●		167

Super assemblers plus the world's largest selection of cross assemblers!

Z-80 Macroassembler $49.50

Power for larger programs! This 2500AD macro-assembler includes:
- Zilog Z-80 Macroassembler (with the same powerful features as all our assemblers)
- powerful linker that will link up to 400 files
- Intel 8080 to Zilog Z-80 Source Code Converter (to convert all your Intel source to Zilog Syntax in one simple step)
- COM to Hex Converter (to convert your object files to Hex for PROM creation, etc.)
- 52 page User Manual

8086/88 Assembler with Translator $99.50

Available for MSDOS, PCDOS, or CPM/86! This fully relocatable macroassembler will assemble and link code for MSDOS (PCDOS) AND CPM/86 on either a CPM/86 or MSDOS machine. This package also includes:
- An 8080 to 8086 source code translator (no limit on program size to translate)
- A Z-80 to 8086 translator
- 64 page user manual
- 4 linkers included:
  - –MSDOS produces .EXE file
  - –CPM/86 produces .CMD file
  - –Pure object code generation
  - –Object code and address information only

  Linker features:
  - Links up to 128 files
  - Submit mode invocation
  - Code, Data Stack and extra segments
  - Handles complex overlays
- Written in assembly language for fast assemblies.

Z-8000 Cross Development Package $179.50

Instant Z-8000 Software! This package allows development and conversion of software for the Z8001, 8002, 8003 and 8004 based machines on a Z-80, Z-8000 or 8086 machine. This powerful package includes:
- a Z-80 to Z-8000 Assembly Language Source Code Translator
- an 8080 to Z-8000 Source Code Translator
- Z-8000 Macro Cross Assembler
- Linker and Loader
- COM to Hex File Converter
- a 100 page User Manual
- a Zilog Z-8000 Technical Reference Manual

The Translators provide Z-8000 source code from Intel 8080 or Zilog Z-80 source code. This source code expansion is from 2% to 11%. The Translator outputs a worksheet and a Z-8000 source file. The worksheets show each line of 8080 Z-80 code, with notes to help the programmer to optimize performance, and further lower code expansion. It even comments lines it adds! The Z-8000 source code used by these packages are the unique 2500AD syntax using Zilog mnemonics, designed to make the transition from Z-80 code writing to Z-8000 easy.

All 2500 AD Assemblers and Cross Assemblers support the following features:

Relocatable Code—the packages include a versatile Linker that will link up to 128 files together, or just be used for external reference resolution. The Linker allows Submit Mode or Command Invocation.
Large File Handling Capacity—the Assembler will process files as large as the disk storage device. All buffers including the symbol table buffer overflow to disk.
Powerful Macro Section—handles string comparisons during parameter substitutions. Recursion and nesting limited only by the amount of disk storage available.
Conditional Assembly—allows up to 248 levels of nesting.
Assembly Time Calculator—will perform calculations with up to 16 pending operands, using 16 or 32 Bit arithmetic (32 Bit only for 16 Bit products). The algebraic hierarchy may be changed through the use of parentheses.

S-100 Vendor Directory

1 **ABACUS Technology Systems, Inc.**
8343 Carvel
Houston, TX 77036
(713) 777-0401
Patricia Allison

2 **Ackerman Digital Systems**
216 W. Stone Ct.
Villa Park, IL 60181
(312) 530-8992
Lawrie Ackerman

3 **Action Computer Enterprise, Inc.**
430 N. Halstead St.
Pasadena, CA 91107
(213) 351-5451
Kwok Ong

4 **Adaptive Data & Energy Systems**
2627 Pomona Blvd.
Pomona, CA 91768
(714) 594-5858
Richard Oldmixon

5 **Advanced Computer Products**
1310 E. Edinger, #B
Santa Ana, CA 92705
(714) 588-8822
Luanne Delnero

6 **Advanced Computer Technology, Inc.**
5575 Magnatron Blvd., #D
San Diego, CA 92111
(619) 571-2746
Aram Pashaian

7 **Advanced Digital Corp.**
5432 Production Dr.
Huntington Beach, CA 92649
(714) 891-4004
Matt Stein

8 **Alloy Computer Products, Inc.**
100 Pennsylvania Ave.
Framingham, MA 01701
(617) 875-6100
Rosemary A. Swift

9 **Applied Innovations**
3000 Scott Blvd., #106
Santa Clara, CA 95050
Robert Taber

10 **Artec Electronics, Inc.**
605 Old Country Rd.
San Carlos, CA 94070
(415) 592-2740

11 **Automated Control Systems**
1105 Broadway
Somerville, MA 02144
(617) 628-5373
Pamela Warren

12 **BG Computer Applications**
P.O. Box 4723
Bryan, TX 77805
(409) 775-5009
Philip Green

13 **Brown Dog Engineering**
24521 Walnut St.
Lomita, CA 90717
(213) 326-8482
Orv Balcom

14 **California Computer System**
250 Caribbean Dr.
Sunnyvale, CA 94089
(408) 734-5811
Suzanne M. Kelley

15 **California Data Corp.**
3475 Old Conejo Rd. C10
Newbury Park, CA 91320
(805) 498-3651
Don Cohee

16 **California Digital, Inc.**
17700 Figueroa Ave.
Carson, CA 90248
(213) 643-9001
Terry Reiter

17 **Cambridge Development Lab.**
50 Milk St. 15th Steadman Cole
Boston, MA 02109
Jean L. Graef

18 Casheab
5737 Avenida Sanchez
San Diego, CA 92124
(619) 277-2547
Ceasar Castro

19 CER-TEK, Inc.
6020 Doniphan Dr.
El Paso, TX 79932
(915) 581-6697
L.J. Floyd

20 Chrislin Industries, Inc.
31352 Via Colinas, #102
Westlake Village, CA 91362
(213) 991-2254
Edward M. Ross

21 Communications Research, Inc.
1720 130th Ave. NE,
Bellevue, WA 98005
(800) 426-8075

22 Components Express, Inc.
1380 E. Edinger
Santa Ana, CA 92705
(714) 558-3972

23 CompuPro Systems
3506 Breakwater Ct.
Hayward, CA 94545
(415) 786-0909
Mark Pleis

24 Computalker
1730 21 St.
Santa Monica, CA 90404
(213) 828-6546
John Anderson

25 Computer Dynamics, Inc.
105 S. Main St.
Greer, SC 29561
(803) 877-7471
Kurt Priester

26 Computer Systems
26401 Harper Ave.
St. Clair Shores, MI 48081
(313) 779-8700
R. Martin

27 Compu/Time
8614 Hamilton Ave.
Huntington Beach, CA 92646
(714) 536-5000

28 Corvus Systems, Inc.
2100 Corvus Dr.
San Jose, CA 95124
(408) 559-7000
J. Peter Nelson

29 Cromemco, Inc.
280 Bernardo Ave.
Mt. View, CA 94039
(415) 964-7400
Gary Breeding

30 CSD, Inc.
Box 253
Sudbury, MA 01776
(617) 443-2750

31 Cybertext Corp.
P.O. Box 860
Arcata, CA 95521
(707) 822-7079
Gerald Kaminski

32 Cygnus Systems
1245 Columbine, #402
Denver, CO 80206
(303) 393-6526

33 D & W Digital
1524 Redwood Dr.
Los Altos, CA 94022
(415) 887-5711
Walt Wood

34 Data Technology Corp.
2775 Northwestern Pkwy.
Santa Clara, CA 95051
(408) 496-0434
Frank Krule

35 Debu Tech
1548 Monterey St.
San Luis Obispo, CA 93401
(805) 541-6398
Omer L. Smith

36 Destek Group
830 E. Evelyn Ave.
Sunnyvale, CA 94086
(408) 737-7211
Dennis Rieger

37 Digi-Data Corp.
8580 Dorsey Run Rd.
Jessup, MD 20794
(301) 498-0200
Gordon Carpenter

38 Digiac Corp.
19 Power Dr.
Hauppauge, NY 11788
(516) 234-2100
Jim Gobetz

39 Digicomp Research Corp.
Terrace Hill
Ithaca, NY 14850
(607) 273-5900
Jeff Cox

40 Digital Graphic Systems, Inc.
935 Industrial Ave.
Palo Alto, CA 94303
(415) 856-2500
Robert Pickthorn

41 Digital Media
3178 Gibraltar Ave.
Costa Mesa, CA 92627
(714) 751-1373
David Scott

42 Digital Multi-Media Control
355 California Dr., #122
Burlingame, CA 94011
(415) 342-5904
Debra Yantis

43 Digital Research Computers
P.O. Box 401565
Garland, TX 75040
(214) 271-3538
Jim Tanner

44 Digitex
2044 Armacost Ave.
Los Angeles, CA 90025
(213) 826-4500
David R. Fournier

45 Disc Tech One, Inc.
849 Ward Dr.
Santa Barbara, CA 93111
(805) 964-3535
Linda Marie Smith

46 Dual Systems Control Corp.
2530 San Pablo Ave.
Berkeley, CA 94702
(415) 549-3854
Joan R. Stivers

48 Dylon Data Corp.
9561 Ridgehaven Ct.
San Diego, CA 92123
(619) 292-5584
R.A. Comstock

49 Educational Microcomputer Systems
1 Clear Spring
Irvine, CA 92715
(714) 553-0133
André Bonderman

50 Electralogics, Inc.
39 Durward Pl.
Waterloo, Ontario, Canada
N2L 4E5
(519) 884-8200
Shirley Harnell

51 **Electronic Control Technology, Inc.**
763 Ramsey Ave.
Hillside, NJ 07205
(201) 686-8080
M. Dupré

52 **Empirical Research Group, Inc.**
P.O. Box 1176
Milton, WA 98354
(206) 872-7655
Lee Sorensen

53 **Extended Processing**
3861 Woodcreek Lane
San Jose, CA 95117
(408) 249-8248
Judy Nelson

54 **Fischer Computer Systems**
445 Bay St.
Angwin, CA 94508
(707) 965-2414
Randy Fischer

55 **Fulcrum Computer Products**
1771 Junction Ave.
San Jose, CA 95112
(408) 295-7171
Robert Snider

56 **Futronics**
P.O. Box AE
Sparks, NV 89432
(702) 356-0801
Jan Baker

58 **Genesis Computer Corp.**
Ben Franklin Technology
Center, Lehigh University
Bethlehem, PA 18015
(215) 861-0850
Marc P. Giguere

59 **GMR, Inc.**
1048 E. Burgrove St.
Carson, CA 90746
(213) 639-4663
Harvey Mushman

60 **Graphics Development Laboratories**
2832 9*th* St.
Berkeley, CA 94710
(415) 644-3551
Robert Hymes

61 **GSR Computers**
60-10 69*th* St.
Maspeth, NY 11378
(212) 476-2091

62 **Hayes Microcomputer Products**
5923 Peachtree Industrial Blvd.
Norcross, GA 30092
(404) 449-8791
Judy Boyd

63 **I/O Technology**
P.O. Box 2119
Canyon Country, CA 91351
(805) 252-7666
Marilyn Joy

64 **Illuminated Technologies, Inc.**
P.O. Box 83348
Oklahoma City, OK 73148
(405) 943-8086
J. Masterman

65 **Independent Business Systems**
5915 Graham Ct.
Livermore, CA 94550
(415) 443-3131
Dick A. Glass

66 **Inner Access Corp.**
517-K Marine View
Belmont, CA 94002
(415) 591-8295
Gavy Feierbach

67 **InnerVision Computers**
1634 Roll St.
Santa Clara, CA 95050
(408) 244-8474
Jim Avera

68 **Integrand**
8620 Roosevelt Ave.
Visalia, CA 93277
(209) 651-1203
Bob Frank

69 **Intercontinental Micro Systems Corp.**
4015 Leaverton Ct.
Anaheim, CA 92807
(714) 630-0964
Sam Calvillo

70 **Interlogic Industries**
85 Marcus Dr.
Melville, NY 11747
(516) 420-8111
John F. Jermusyk

71 **Ithaca Intersystems, Inc.**
1650 Hanshaw Rd.
Ithaca, NY 14850
(607) 273-2500
Peter Collins

72 **Jade Computer Products, Inc.**
4901 W Rosecrans Ave.
Hawthorne, CA 90250
(213) 973-7707
Scott Anderson

73 **JC Systems**
469 Valley Way
Milpitas, CA 95035
(408) 945-0318
Rita Koenigs

74 **J.E.S. Graphics**
P.O. Box 2752
Tulsa, OK 74101
(918) 742-7104
Steve Sawyer

75 **Jones Futurex, Inc.**
9700 Fair Oaks Blvd., #G
Fair Oaks, CA 95623
(916) 966-6836
Dan L. Morris

76 **JVB Electronics**
1601 Fulton Ave., #10-A
Sacramento, CA 95825
(916) 483-0709
Joe Breen

77 **Konan Corp.**
1425 N 27th Lane
Phoenix, AZ 85009
(602) 257-1355
Dan Vasquez

78 **Kramer Systems International**
11510 Georgia Ave.
Silver Spring, MD 20902
(301) 933-8300
Harvey Kramer

79 **Lexicomp Data Systems**
Box 222, 67 Valley Rd.
Lexington, MA 02173
(617) 862-3088
Donald L. Charlantini

80 **Lomas Data Products**
66 Hopkinton Rd.
Westboro, MA 01581
(617) 366-6434
Bev Lomas

81 **Macrotech International Corp.**
9551 Irondale Ave.
Chatsworth, CA 91311
(818) 700-1501
Bruce Kimmel

82 **Matco**
427 Perrymont
San Jose, CA 95125
(408) 998-1655

83 **Matrox Electronic System, Ltd.**
5800 Andover Ave.,
Montreal, Canada H4T 1H4
(514) 735-1182
Gerry Sullivan

84 **MCP Computer Products**
6992 El Camino Real, #104-444
Carlsbad, CA 92008
(619) 438-3270
Jim Yates

INFINITE SOLUTIONS

Like the molecules in a snowflake, the elements of a computer database can be structured and related in an infinite variety of combinations. Being able to present these combinations quickly and efficiently, with maximum flexibility and minimum programming knowledge, is the mark of excellence which sets the sophisticated database management system apart from the ordinary.

Thousands of satisfied users, from amateur and professional programmers to government agencies, major corporations and industries, have found that DataFlex has no equal in applications development software.

Write or phone for our latest literature and a list of existing applications.

Compatible with CP/M, CP/M-86, MP/M-86, MSDOS, PCDOS, TurboDOS, Novell Sharenet, PC-Net, Molecular N-Star, Televideo MmmOST, Action DPC/OS, Omninet, IBM PC w/Corvus and OSM Muse.

DATAFLEX™

APPLICATIONS DEVELOPMENT SOFTWARE

DATA ACCESS CORPORATION

8525 S.W. 129th Terrace, Miami, Florida 33156 (305) 238-0012 TELEX 469021 Data Access CI

CIRCLE 215 ON READER SERVICE CARD

85 Measurements Systems and Controls
1601 W. Orangewood Ave.
Orange, CA 92668
(714) 633-4460
Joyce Siegrist

86 Memory Merchant
14666 Doolittle Dr.
San Leandro, CA 94577
(415) 483-1008
Gregory J. Besse

87 Methode Electronics, Inc.
7444 W Wilson Ave.
Chicago, IL 60656
(312) 867-9600, x229
Karen Callies

88 Micro Designs
Box 497, Tour de la Bourse
Montreal, Canada H4Z 1J7
(514) 284-3348

89 MicroDynamics Corp.
6363 Poplar Ave., #105
Memphis TN 38119
(901) 682-4054
Alan Wilson

90 Micro Mike's, Inc.
3015 Plans
Amarillo, TX 79102
(806) 372-3633
Hal Marsh

91 Micromint
561 Willow Ave.
Cedarhurst, NY 11516
(516) 374-6793

92 Mimic, Inc.
Box 921
Acton, MA 01720
(617) 263-2101
Steve Thurston

93 MOMS Computing
The Golden Gate Energy Center
Bldg. 1064 Fort Cronkhite
Sausalito, CA 94965
(415) 331-2043
Jamal Munshi

94 Monitor Dynamics, Inc.
1121 W. 9*th* St.
Upland, CA 91786
(714) 985-7214
Richard Turner

95 Morrow Designs
600 McCormick St.
San Leandro, CA 94577
(415) 430-1970

96 Mullen Computer Products
Box 6214
Hayward, CA 94545
Richard Jennings

97 MUSYS Corp.
1752 B Langley Ave.
Irvine, CA 92714
(714) 770-8521
Chuck McComb

98 National Instruments
12109 Technology Blvd.
Austin, TX 78727
(512) 250-9119
Deborah DeCoux

99 Netronics R & D, Ltd.
333 Litchfield Rd.
New Milford, CT 06776
(800) 243-7428
George Meyerle

100 New Generation Systems, Inc.
1800 Michael Faraday Dr., #206
Reston, VA 22090
(800) 368-3359
Rick Rump

101 New World Computer Co., Inc.
6624 Owens Dr.
Pleasanton, CA 94566
(415) 463-0330
William Bowman

102 North Star Computers
14440 Catalina St.
San Leandro, CA 94577
(415) 357-8500
Chris Sokoloski

103 Octagon
2960 N. 1*st* St.
San Jose, CA 95134
(408) 262-7777

104 Optronics Technology
2990 Atlantic Ave.
Penfield, NY 14526
(716) 377-0369
Edna Monroe

105 Para Dynamics Corp.
7895 E. Acoma Dr.
Scottsdale, AZ 85260
(602) 991-1600
Gary Deakins

106 paraGraphics
58 Needham St.
Norfolk, MA 02056
(617) 620-9513
Susan Kearney

107 PCE Systems
4219 S Market Ct.
Sacramento, CA 95839
(916) 921-5454

108 Perex, Inc.
1798 Technology Dr.
San Jose, CA 95110
(408) 280-7566
Tom Dalzell

109 Performics, Inc.
P.O. Box 3207
Nashua, NH 03061
(603) 881-8334
P. Lapointe

110 Pickles & Trout
P.O. Box 1206
Goleta, CA 93116
(805) 685-4641
Christine Pickles

111 Piiceon
2114 Ringwood Ave.
San Jose, CA 95131
(408) 946-8030

112 Pixeltronics
1050 Tulip Way
Palatine, IL 60074
(312) 359-1442
U.M. Ebert

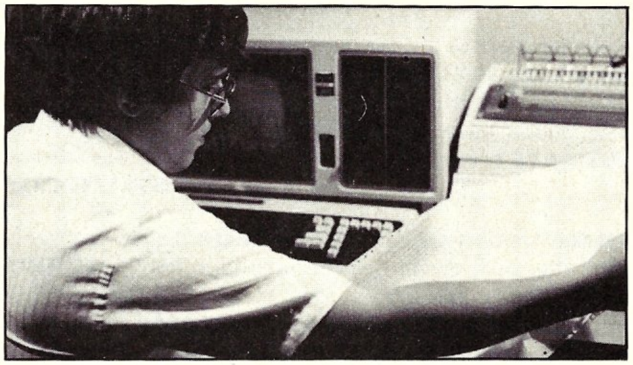
113 PolyMorphic Systems
5330 Debbie Rd.
Santa Barbara, CA 93111
(805) 967-0468
Ken Gudis

114 North Atlantic/Qantex
60 Plant Ave.
Hauppauge, NY 11788
(516) 582-6060
S. Richard Rausch

115 Quality Computer Services
3 Quces Dr.
Metuchen, NJ 08840
(201) 548-2135
Michael Chait

The Micro-world's Most Powerful Editor is also the Easiest to Use.

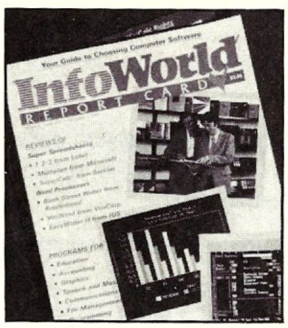
Easy to Use



VEDIT is an exceptionally easy to use, flexible and powerful full-screen editor. Now you can perform word processing quickly and easily, yet have command of editing tools created for the most sophisticated programmer.

VEDIT helps you concentrate on creativity instead of devoting your attention to operating the program. VEDIT is also forgiving - it allows you to make mistakes or experiment. If you don't like what you've just typed, 'undo' it with a single keystroke.

Need Help? Just press the help key, a summary of commands and your keyboard layout will be displayed. Even include your own help messages.



Other helpful features include a directory display, single key search and selective replace, line and column display, word wrap, adjustable margins, paragraph formatting & print functions, plus the unique ability to completely determine your own keyboard layout.

Acclaimed

VEDIT is highly acclaimed in every major computing journal. Reviewers say VEDIT is 'nothing short of outstanding', and 'the most flexible programming editor I've ever seen'. In InfoWorlds 1983 Report Card of word processing software, VEDIT scored highest of all CP/M-MSDOS word processors/editors reviewed.

- True Full Screen Editing
- Automatic Disk Buffering
- Compact (Only 16K) & Fast
- 'Undo' Key to Restore Line
- Automatic Indent/Undent
- Repeat Function Key
- Text Move and Copy
- Load, Save Buffers on Disk
- Powerful Command Macros
- Directory Display

- Insert Another Disk File
- Unlimited File Handling
- Recovery from Full Disk
- Change Disks While Editing
- Word Wrap
- Format Paragraph
- Printing
- 200 Page Indexed Manual
- Startup Command File
- Customizable Keyboard Layout

Powerful

VEDIT - the micro industry's most respected full screen editor - has evolved into a powerful programming language, with the flexibility, performance & features of SPF, TECO and other mainframe editors. The power of its command macro language is virtually limitless. Sophisticated search/replace with pattern matching of multiple strings in multiple files may be executed automatically. You can create a custom macro program to do virtually anything. Translate source code. Format printed output. Convert WordStar files to VEDIT. With a one line command you can selectively strip comments from programs. And macros may be loaded, saved and reused at a later time.

VEDIT is a 'virtual editor' with unlimited and automatic file handling capability - there is no limit to the size of files you can edit. Plus you can change disks at any time.

VEDIT's Newest Features

- Horizontal Scrolling (Edit Spread Sheets)
- Single Key Search & Selective Replace
- Pattern Matching
- On-Line Help
- Numerical Capability

Expect a lot from VEDIT. While easy to use, VEDIT is specifically designed for complex text manipulations. VEDIT has 10 text registers for extensive 'cut & paste' on multiple files, plus special features for programming in Pascal, PL/1, C, Assembler and other languages.

VEDIT runs on practically every computer, CRT terminal, and memory mapped display made. To order, please specify your computer make, operating system (CP/M, CP/M-86, Concurrent CP/M-86, MSDOS, etc.), and disk format.

VEDIT
CUSTOMIZABLE FULL SCREEN EDITOR

VEDIT - Disk and Manual
8080, Z80 or IBM PC. $150
CP/M-86 or MSDOS $195
Manual Only. $18

CP/M is a registered trademark of Digital Research Inc. MSDOS is a trademark of Microsoft. IBM is a trademark of International Business Machines. WordStar is a trademark of MicroPro.

CIRCLE 22 ON READER SERVICE CARD

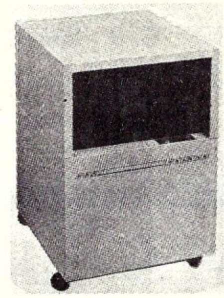
CompuView PRODUCTS, INC.

1955 Pauline Blvd., Ann Arbor, Michigan 48103 (313) 996-1299 Telex - 701821
Orders: P.O. Box 1349, Ann Arbor, Michigan 48106

TURN-KEY, MULTI-USER BUSINESS SYSTEM
Running the Turbo-Dos Operating System

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

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



- 5 USERS
- 2 PRINTERS
- 5 CONSOLES
- 1 Z80A CPU
- 6 Z80B CPU'S
- 2 8" DRIVES
- 15 MEGABYTE FORMATTED H.D.
- 832k BYTES OF MEMORY
- ATTRACTIVE ENCLOSURE
- TURBO-DOS 1.30
- TURBO-PLUS 1.04
- CCD CONFIG 1.05
- ALL CABLES
- MANUALS
- PREPAID SHIPPING

SAVE OVER $3000.00

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

Users can be assigned their own work areas, thus one user can not affect another. All user printing is **"SPOOLED"** and will not tie up the users console. In addition, time consuming printing and other processes may be **"QUEUED"** or **"BATCHED"** to be run later.

Included is a free membership to **"TUG"** (Turbo Users Group) which provides a forum for **TURBO-DOS** users.

The complete **SYSTEM-1** will be shipped prepaid to your location ready to operate, with the exception of your application software.

ORDER #CCD-09001-00..$16,499.95

STD HEIGHT 5.25" FLOPPY DISK DRIVES
CCD08207-02 MPI B51 40 trk, 1 side............$199.95
CCD08201-02 MPI B52 40 trk, 2 side............$264.95
CCD08206-02 MPI B91 80 trk, 1 side............$269.95
CCD08202-02 MPI B92 80 trk, 2 side............$369.95

HALF HEIGHT 5.25" FLOPPY DISK DRIVES
CCD08204-05 SA-465, 80 trk, 2 side............$379.95

STD HEIGHT 8" FLOPPY DISK DRIVES
CCD08205-02 Qume 842, 77 trk, 2 side.......$579.95

HARD DISK DRIVES, 5.25"
CCD08501-02 ST-419, 19 meg..........................$999.95

HARD DISK SYBSYSTEMS, 5.25"
CCD09201-08 11 Megabyte, CP/M.............$1699.95
CCD09202-08 22 Megabyte, CP/M.............$2199.95
CCD09203-08 44 Megabyte, CP/M.............$3099.95

PRINTERS, RS-232 SERIAL
CCD08701-02 MPI Printmate 150G w/softkey, & 4k buffer..................$1199.95
CCD08703-04 Prowriter 2, 1550.................$ 739.95
CCD08705-04 Prowriter 8510.......................$ 569.95

CCD08204-05 SA-465

HARD DISK SUBSYSTEMS

CCD08601-02 LSI, ADM-11

CRT TERMINALS, RS-232
CCD08601-02 LSI, ADM-11.................................$559.95
CCD08602-09 QUME, QVT 102.........................$559.95

TELETEK IEEE-696 S-100 CARDS
CCD-08101-01 Systemaster CPU......................$589.95
CCD-08102-01 SBC-1 4mhz, 64k, Slave........$579.95
CCD-08103-01 RAM-64k, Expand to 256k...$359.95
CCD-08104-01 RAM-256k.................................$659.95
CCD-08105-01 PSIO, Quad RD232..................$219.95
CCD-08106-01 HDTC, Disk/Tape Control.....$524.95

NOVATION MODEMS
CCD-08801-06 Novation 212 auto cat............$589.95
CCD-08802-06 Novation D-cat modem...........$164.95
CCD-08803-06 Novation J-cat modem............$119.95

8" CP/M SOFTWARE
CCD-07001-01 CP/M 2.2, Teletek....................$150.00
CCD-07002-06 M.S. BASCOM-80.....................$249.95
CCD-07003-06 M.S. Cobol-80...........................$469.95
CCD-07004-06 M.S. Fortran-80......... ....$314.95
CCD-07005-06 M.S. MBASIC-80.......................$219.95
CCD-07006-06 M.S. Multiplan............................$179.95
CCD-07007-06 Perfect Calc/Filer.....................$ 349.95
CCD-07008-06 Perfect Writer/Speller...........$ 299.95
CCD-07009-06 Supercalc..................................$124.95
CCD-07010-06 Supercalc II...............................$195.95

(713) 488-9754

Circle Reader Service number 90 for System 1 Information
Circle Reader Service number 121 for Computer Component Information

COMPUTER COMPONENT DISTRIBUTION
100 East Nasa Road 1, Suite 209
Orders outside the U.S. are subject to a surcharge

VISA & M.C. welcome, Sorry No C.O.D.
Checks take 4 weeks.
Prices subject to change.
ADD 5% shipping, plus 4% tax (Texas).
Terms to rated Firms only

116 QDP Computer Systems (Quasar Data Products, Inc.)
10330 Breckville Rd.
Cleveland, OH 44141
(216) 526-0838
Ken Perich

117 QT Computer Systems
15335 S. Inglewood
Lawndale, CA 90260

118 Random Factors, Ltd.
P.O. Box 2875
Durango, CO 81301
(303) 247-9306
Dick Burke

119 Ronsan Electronics
1491 Stubbins Way
San Jose, CA 95132
(408) 251-9279
Ron Tisinger

120 S-100/696 Corp.
14425 N. 79*th* St., #B
Scottsdale, AZ 85260
(602) 991-7870
John McCarren

121 S.C. Digital
Box 906
Aurora, IL 60507
(312) 897-7749
Jimmy Song

122 SCION Corp.
12310 Pinecrest Rd.
Reston, VA 22091
(403) 476-6100
Teri Shuck

123 Scitronics, Inc.
523 S. Clewell St.
Bethlehem, PA 18015
(215) 868-7220
W. R. Haller

124 SDSystems
Box 28810
Dallas, TX 75080
(214) 340-0303
P.V. Pennisi

125 Seattle Computer Products, Inc.
1114 Industry Dr.
Seattle, WA 98188
(206) 575-1830
Jeri Nickerson

126 SemiDisk Systems
P.O. Box GG
Beaverton, OR 97075
(503) 642-3100
Jim Bell

127 Sierra Computer Products
6305 Steelhead Ct.
Pollock Pines, CA 95726
(916) 644-5932
T.M. Sickles

128 Sierra Data Sciences
25700 1*st* St.
Westlake, OH 44145
(216) 892-1800
John Costanzo

129 Sigen Corp.
1800 Wyatt Dr., #6
Santa Clara, CA 95054
(408) 988-2527
Mike Janak

130 Signum Systems
726 Santa Monica Blvd.
Santa Monica, CA 90401
(213) 451-5382
Jerry Lewendowski

131 Simpliway Products Co.
P.O. Box 601
Hoffman Estates, IL 60195
(312) 359-7337
Dan Lurey

132 Ski Electronics
3134 Woods Way
San Jose, CA 95148
(408) 270-1680

133 Sky Computers, Inc.
Foot of John St.
Lowell, MA 01852
(617) 454-6200
John Dunn

134 Snow Micro Systems, Inc.
P.O. Box 2201
Fairfax, VA 22031
(703) 830-3494
Ted Rabenko

135 SPC Technologies
1425 N. Quincy St.
Arlington, VA 22207
(703) 841-2980
Andrew Ralston

136 SSM
2190 Paragon Dr.
San Jose, CA 95131
(408) 946-7400
Barbara Sauer

137 Standard Microsystems Corp.
35 Marcus Blvd.
Happauge, NY 11788
(516) 273-3100
Chris Schmitt

138 Stanford Applied Enineering, Inc.
3520 De La Cruz Blvd.
Santa Clara, CA 95050
(408) 988-0700
Sam Camperi

139 Sunny International
Box 4296
Torrance, CA 90510
(213) 328-2425

140 Sunol Systems
1072 Serpentine Lane
Pleasanton, CA 94566
(415) 484-3322
Robert C. Lindgren

141 Suntronics Co., Inc.
12621 Crenshaw Blvd.
Hawthorne, CA 90250
(213) 644-1140
Wayne Smith

142 Systems Group
1601 Orangewood Ave.
Orange, CA 92668
(714) 633-4460

143 Tarbell Electronics
950 Dovlen Place, #B
Carson, CA 90746
(213) 538-4251
Don Tarbell

144 Tecmar, Inc.
6225 Cochran Rd.
Solon, OH 44139
(216) 349-0600
John Brandon

145 Teleram Communications Corp.
2 Corporate Park Dr.
White Plains, NY 10604
(914) 694-9270

146 Teletek
4600 Pell Dr.
Sacramento, CA 95838
(916) 920-4600
Tim Noxon

147 Theta Labs, Inc.
10911 Dennis, #405
Dallas, TX 75229
Monroe MacDonald

148 Thoughtworks
3582 W. Thomas Rd.
Phonenix, AZ 85019
(602) 269-6841

149 Transend Corp.
2190 Paragon Dr.
San Jose, CA 95131
(408) 946-7400
P.J. Moeller

150 Two Bits Computer Products
235 Tally Ho Rd.
Arroyo Grande, CA 93420
(805) 489-6733
D.L. Jones

151 U.S. Micro Sales
11 Edison Dr.
New Lenox, IL 60451
(815) 485-4002
Michael R. Sefcik

152 U.S. Robotics, Inc.
1123 W. Washington
Chicago, IL 60607
(312) 733-0497
Wesley Cowell

153 Vector Electronics Co.
12460 Gladstone
Sylmar, CA 91342
(213) 365-9661
Jack Martz

154 VLSI Networks, Inc.
2631 Manhattan Beach Blvd.
Redondo Beach, CA 90278
(213) 536-0781
John Cahill

155 Wameco, Inc.
111 Glenn Way, #8
Belmont, CA 94002

156 Xitek
Box 2952
Garland, TX 75041
(214) 840-2072

157 Yang Electronic Systems, Inc.
307 Compton Ave.
Laurel, MD 20707
(301) 776-0076

158 Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-8860
A. Lambert

159 Zobex
10845-A Wheatlands Ave.
Santee, CA 92071
(619) 562-9306
Eva G. Zoboki

160 X COMP Corp.
3554 Ruffin Rd. S
San Diego, CA 92123
(619) 537-0077
J. Casey Ferguson

161 Bytewrite
5715 Klump Ave.
North Hollywood, CA 91601
(818) 985-5715
Laddie Chapman

162 PSCE, Inc.
P.O. Box 8
Port Jefferson, NY 11777
(516) 473-7500
Paul Siegel

163 IMS International
2800 Lockheed Way
Carson City, NV 89701
(702) 883-7611
Tom Lindley

164 Peak Electronics
P.O. Box 3449
Santa Clara, CA 95055
Don Pannell

165 Commercial Dynamics, Inc.
168 Bowen St.
Providence, RH 02906
(401) 274-4038
William Poole

166 HDL Research Lab, Inc.
11320B FM 529
Houston, TX 77041

167 Mesa Power Systems
2240 Micro Pl.
Escondido, CA 92025
(619) 489-8162
Ed Bohorquez

Microsystems

S-100 DIRECTORY

INSTRUCTIONS:

This Product Directory will help you locate manufacturers and suppliers of S-100 products. If you would like further information, please fill in the coupon completely and circle the number corresponding to the vendor(s) from whom you would like more information.

SEND TO

MICROSYSTEMS MY1283
P.O. Box 8580, Philadelphia, PA 19101

Name____________________

Ttile____________________ Phone No. (______)__________

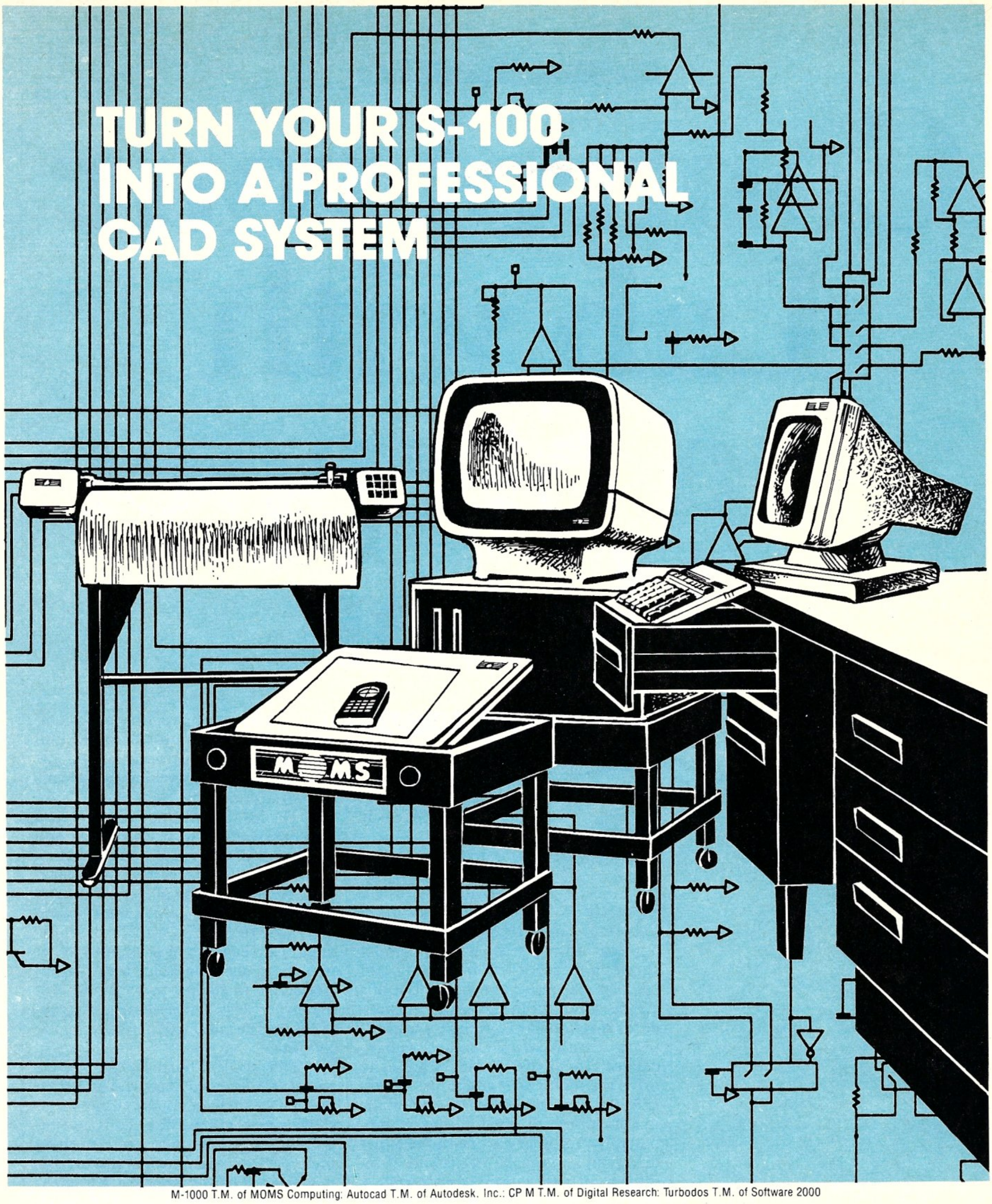
Company Name____________________

Address____________________

City______________ State__________ Zip__________

I would like more information on the following companies:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
45	46	47	48	49	50	51		53	54	55	56	57	58	59	60	61	62	63	64	65	66
67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154
155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176
177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198
199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242
243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264
265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286
287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308
309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330
331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352
353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374



M-1000 T.M. of MOMS Computing; Autocad T.M. of Autodesk, Inc.; CP M T.M. of Digital Research; Turbodos T.M. of Software 2000

The **M-1000**™ **AUTOCAD**™ subsystem for S-100 and MULTI-BUS. Compatible with CP M 2.2; CP M 3.0; CP M 86; Turbodos 1.22

APPLICATIONS:

- P & ID
- Process flow diagrams
- Vessel drawings
- Architectural drawings
- Facilities planning
- Plot plan and layout
- Schematics
- PC board layout

MOMS Computing Inc.

MOMS COMPUTERS THAT WORK FAST

1055 Fort Cronkhite, Sausalito CA 94965
(415) 331-2043

CIRCLE 42 ON READER SERVICE CARD

Control your Lab with a Stepper Motor

The Snow S-100 stepper motor control

by Joseph Long

Stepper motors are found everywhere these days, as they are a simple, easily controlled way of producing mechanical motion. Most printers use stepper motors, as do many robotic devices. Laboratory chart recorders are another application. In years past, variable-speed chart recorders invariably had complex, expensive gear trains. Use of a stepper motor in this application eliminates mechanical complexity and replaces it with a simple variable-rate oscillator circuit that produces pulses to drive the motor. An additional advantage of stepper motors here is that if the motor pulses are generated by a computer, the recorder may be run in either direction, at variable speeds and, if required, in very complex patterns. A chart recorder of this sort is just one step from being a digital plotter, another device that derives its power and utility from the linkage of computers with stepper motors.

The MC100 hardware/software package is designed to be used as an inexpensive development system for projects that use stepper motors. It is targeted to developers who use systems that are very expensive, from such companies as Compumotor Corporation. The MC100 will perform most of the functions of larger development systems and do so at a much lower cost.

The MC100 will also be of interest to people working with automation, and in other fields where mechanical motion is of concern. My interest in such hardware stems from use of stepper motors to drive small peristaltic pumps which are used to automatically transfer chemical reagents in a laboratory. It was this application which led to my introduction to stepper motors, and ultimately to Chris Terry asking me whether I would be interested in reviewing the MC100.

The MC100 hardware/software package is designed to control up to two four-phase stepper motors. (Four-phase stepper motors have four coils and require a four-phase pulse train to drive them.) The set-up on which this evaluation is based consisted of the MC100 S-100 stepper motor controller board, an optional manual control panel and optional software package, and two manuals, one for the MC100 board and the other for the software.

The MC100 board will function without the software package, but most users would probably want it because the software is powerful, easy to use, and very inexpensive. The control panel, used to operate the stepper motors independently of the computer, is also a very worthwhile unit.

Four-phase stepper motors can be driven directly from a parallel output port, using four output port bits to turn four power transistors on or off; the four coils in the stepper motor being connected in series with the power transistors. A four-phase pulse train output through the port will then turn the stepper motor. A simple improvement to this circuit consists of a couple of flipflops connected between the output port and the driver transistors that will produce the four-phase signal from a pulse series using only one bit of the output port. Figure 1 shows such an interface, driving the peristaltic pump I mentioned earlier. This interface is very simple, and using it to drive a stepper motor requires only a few lines of code.

There are several problems with this approach. The motor speed is limited by the speed of the language used. Use of Basic can result in quite low maximum motor speeds. In addition, while the motor is being run, the CPU is busy; it cannot do anything but drive the stepper. If you wish to have a stepper motor follow a complex pattern, the software can quickly get out of hand.

The MC100 board (represented by the block diagram in Figure 2) solves both of these problems. The board contains Intel 8253 counter/timer chips (one for each stepper motor) which are programmed to function as frequency dividers. The S-100 clock signal is divided by these chips to produce the pulses which drive the stepper motors. Motor speeds are changed by sending different values to the 8253s. Once a motor has been started, it can run for a long period (32,000 steps) without attention from the CPU.

8253s contain three 16-bit counters. Two are used in cascade as the dividers and the third is used to count the pulses sent to the steppers, in order to keep track of the total number sent to a motor. This count can be taken internally by counting the pulses going to the motor from the MC100, or externally by counting pulses produced by the stepper, using an optical shaft encoder or another device.

The board also contains an 8255 parallel I/O chip, two sections of which function as motor control and status ports. The third section of the 8255 is available to the user for use as an 8-bit I/O port.

Each motor has two limit switches associated with it. These switches would typically be set up so as to limit mechanical travel produced by the stepper motors. The limit switches are connected to gates that disable pulses to the motors

The MC100 will perform most of the functions of larger development systems.

when the switches are opened.

The software package makes it possible to write very complex stepper motor control routines that are compact and use little CPU time. The software takes full advantage of the capabilities of the MC100 board. All of the MC100 board's features are accessible to and usable by the programmer from Microsoft M80 assembler or Basic 80. Source code is included for all of the software.

Hardware

The MC100 is a high-quality board that conforms to the IEEE 696/S-100 specification. It is made of green fiberglass/epoxy, solder-masked, and has silk-screened part numbers. All S-100 pins are present, and the parts all appear to be of excellent quality. I have experienced no electrical or mechanical problems with the board despite running it 24 hours a day for several months in a very hot, completely filled North Star Horizon computer. All the cable connectors terminate at the top of the board, so it doesn't have to be removed to make changes unless jumpers or the board's address are to be changed. The board has a set of four tiny LEDs in a block at the top of the board that monitors the position of the limit switches. This can be handy in detecting damaged or mis-set switches, especially if the external control box is not used.

The control panel is also well built. Its operation is self-evident from the markings on its front panel. The manual includes schematics of the control box, but the theory of its operation is not given. Basically, it contains a 555 chip, configured as an oscillator, which is used to generate pulses to drive the stepper motors. Either motor can be selected, the directions selected (CW or CCW), and the motor speed varied.

Although it's not absolutely necessary to use the control box, most users would want it because it can be very helpful when bringing up the controller for the first time, as well as in development work and in case of any problems with the software, computer, MC100 board, stepper motors, or limit switches. The control box can make it much quicker to isolate a problem. Using the control box, the steppers can be operat-

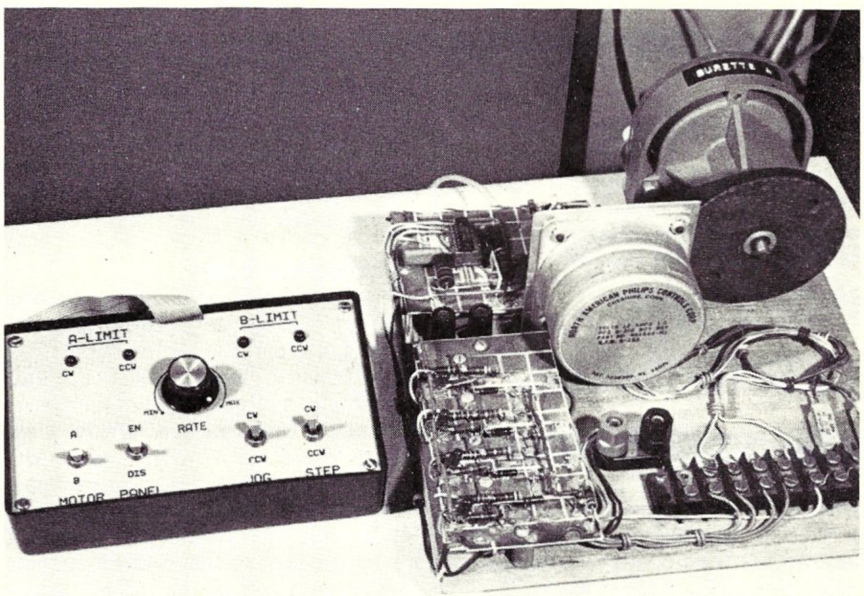


Figure 1. *Stepper motor connected to peristaltic pump. The electronics on the board consist of driver transistors connected to the motor windings and flipflops that are connected to a parallel output port. Use of the MC100 eliminates the necessity for these electronics. The device on the left is the MC100 control panel.*

Snow MC100

Continued from page 81

ed independently of software and even independently of the S-100 bus as long as the bus power supply voltages are present.

Set-up of the board

The board contains only a few jumpers; they configure the board for 8 V, 16 V, or external voltage to operate the stepper motors, internal or external counting of motor pulses, and for interrupt operation of the board. Most of the options are clearly explained (if not self-evident) and should cause no problems. Each motor may be configured independently.

Two items that gave me trouble in the set-up were the board address switches and the interrupt jumpers. When I set the DIP switches per the manual, the board was at the wrong address block. (The board uses a block of 12 addresses and can be set on any multiple of 10H.) The problem turned out to be the switch numbering. The switch itself contains numbers, and there are numbers silk-screened on the board. Naturally, they are different. I have seen many variations on this problem and it should no longer catch me, but it does. There ought to be a warning about this in the manual.

The jumpers for interrupt operation are explained in the manual, but exactly how to set them to work with the MC100 software package was not clearly set forth. I got them by studying the manual very carefully, then doing a bit of trial and error while running a demonstration program included with the software. (I tried several combinations until I found the one that worked.)

It is easy to do fancy and sophisticated things with stepper motors.

The MC100 can be operated in an interrupt-driven or polled mode. The interrupt-driven mode allows somewhat more versatile operation of the board. The only reason for using polled software would probably be that your hardware does not support interrupt operation.

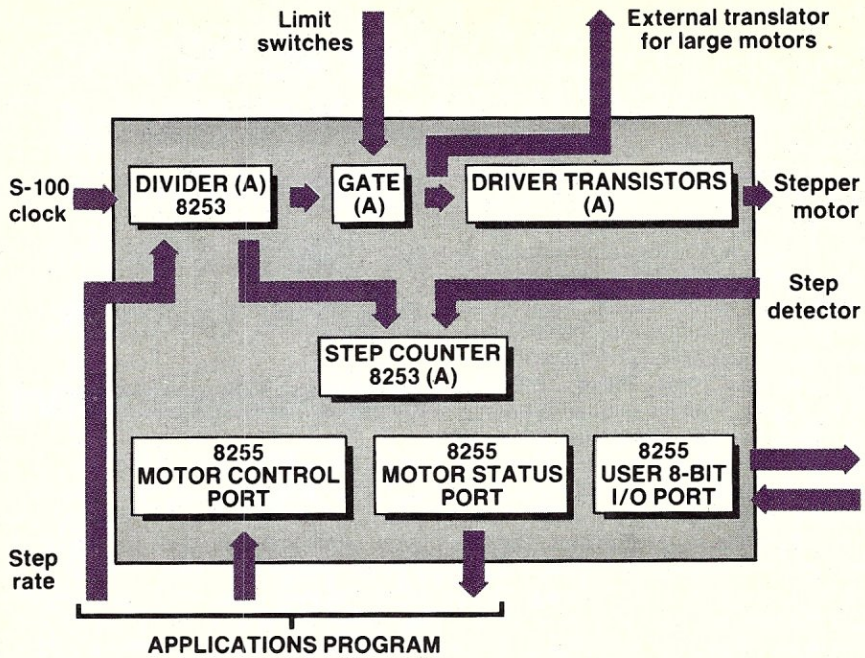


Figure 2. *Simplified block diagram of the MC100. The sections marked (A) are duplicated for a second motor.*

The MC100 has provision for driving stepper motors that exceed the power limits imposed by the board. This is done with a 26-pin connector which can be run to an external translator that contains large power transistors and supplies sufficient power to operate large motors. The signals to the external translator presumably are standard and usable with all such devices; I have done no work with high power stepper motors, so external translators are outside my experience.

Initializing the board

Because at first I could not use the software package (more about why not later), I attempted to write a simple Basic program to initialize the board and operate the motors. I did not quite succeed until I called Snow Micro Systems, where I received assistance from Mr. Ted Rabenko, who wrote a simple Basic program for me that initializes the board and runs the stepper motors. I have since learned that Snow is supplying this program in the MC100 documentation, which means that it should be much easier to bring up the board and test it without making any use of the main MC100 software package. Listing 1 is the program I wrote and fixed with the help of Snow. Their version is a little more complex and illustrates the use of more MC100 features.

This example program is useful as a way of familiarizing yourself with the board. The relation between values loaded into the counters and motor stepping speeds can be seen by trying different values. The use of the motor control port to enable or disable the motors, change their directions, etc., can be studied. The use of the motor status port can likewise be explored. This is the way I learn best, and a few minutes of playing around with the program was more illuminating than the hours I had spent studying the MC100 hardware manual.

Manual

The manual furnished with the MC100 is well written. It includes a section on the theory of operation of the board that is quite detailed and easy to follow. It contains extensive sections on programming the 8253s and 8255 for use with the MC100. There are additional sections on configuring the board jumpers, several installation examples and a parts layout drawing, and a set of nicely drawn schematics. Some of the printing on the schematics is very small and a bit hard to read. There is also a list of which S-100 signals are used, which is something all manufacturers really should supply in their documentation.

Table 1. Parameters passed to driver software from Microsoft Basic.

1. Total No. of steps (less than 32,768)
2. Starting (minimum) motor step rate
3. Ending (maximum) motor step rate
4. Change in step rate during ramp up/down
5. No. of steps taken at each rate during ramp up/down
6. Motor select
7. Motor direction (cw/ccw)
8. Motor final state (cw/ccw/stop)
9. Enable/disable ramp up
10. Enable/disable ramp down

There is a 1-to-1 correspondence between these values and those in Listing 2 in the call statement.

Table 2. Hardware-dependent configuration switch settings

Switch	Default value(s)
Board base address	E0
User I/O port	Bits 0-3 in, bits 4-7 out
Interrupt operation	True for interrupt version (BMOTOR) False for polled version (PMOTOR)
External control of interrupts	False: driver enables and disables interrupts as required
Vector interrupt location	V17

The manual is not written with the beginner in mind. I had never actually had to program chips like the 8255 and 8253 used by the MC100, but I was familiar with the basic idea. Still, several hours of studying the manual along with an Intel Data manual and a call to Snow Micro Systems were required to clarify things.

The newly supplied Basic program amounts to a great improvement in the documentation for the first-time user, but still, someone with no assembly language experience would find the manual a challenge. The manual, 32 pages long and printed on good quality paper, includes a table of contents but no index.

Software package

The purpose of the software package is to provide control of the MC100 from applications programs written using Microsoft Basic 80 or M80 assembler.

The fundamental idea is that in an application you will have a sequence of operations for a stepper motor to perform, such as to start up, run for a while at a particular speed, ramp up to a higher speed, reverse direction if a limit switch opens, etc. The software allows you to carry out such operations in a straightforward, easy way. The applications program passes information to the stepper motor driver software, which translates the data into values that are loaded into the hardware on the MC100 board. Table 1 shows the parameters passed to the driver.

Once the driver software is installed and working properly, it is easy to do all sorts of fancy, sophisticated things with stepper motors. My previous work with stepper motors involved using them to drive small chemical pumps at various speeds. Just making a motor run at a high speed using the parallel port interface I described previously is impossible in Basic, so the ability to control two motors, making them accelerate, decelerate, reverse direction, etc., all while using very little CPU time is most impressive.

The heart of the software package is a program named CORE. For use with Basic programs, CORE is linked with several other files to produce a program (BMOTOR.COM) which is located at the top of memory, just below CP/M. Parameters are passed through this driver from the Basic program to the MC100 board. BMOTOR.COM is supplied and ready to use unless your hardware conflicts with it. BMOTOR is for interrupt operation. PMOTOR is a polled version of the driver.

For programs written in M80, CORE is used by linking it to the application program using the Microsoft Linker.

Installing the software

Table 2 gives the configuration settings supplied by Snow, which may have to be changed before you can use the software. If these settings cause no conflicts, then no installation is required and the software may be used immediately. The command sequence

```
A > BMOTOR          (or PMOTOR)
B > MBASICDEMO      (or PDEMO)
```

will install the driver and then run the demonstration program which, if all goes well, will result in a pair of running stepper motors. If only the location of BMOTOR (or PMOTOR) needs to be changed, as was my situation, then a submit file, supplied with the software, can be used to make the new version. You simply run the submit file, specifying the address where BMOTOR is to be placed. The submit file uses ZSID and L8O.

This was a point where I got stuck, since I didn't have ZSID. Snow Micro Systems was kind enough to do the relocation of BMOTOR for me. (Snow will supply users of the software with a relocated version of BMOTOR/PMOTOR for a nominal charge.) I have since acquired ZSID and done the relocation myself with no problems.

If other changes in the configuration switch settings are required, then CORE.MAC and BDISPTCH.MAC and possibly HARDWARE.VAR must be modified and reassembled. The source files are well documented, and a user with a modest amount of experience with assembly language programming should be able to change the configuration switches with no problem. BDISPTCH translates data from the Basic program into a form that can be read by CORE, and HARDWARE.VAR sets the base address for the board.

The heart of the software is a program called CORE.

Documentation

I was unable to get the software running until I had made several calls to Snow Micro Systems. The problem was

Snow MC100

Continued from page 83

that the documentation did not make it very obvious how to get started.

I tried carefully studying the manual, which was not of much help. I tried looking through the listings of all the source files on the disk. I was more confused. A few minutes on the phone with Snow on a couple of occasions got me going.

Partly, I believe, as a result of my phone calls and questions, Snow is now shipping a three-page addendum to the manual that should allow the first-time user to get things going with less trouble than I had. The addendum consists of a list of the files on the disk, with an explanation of what each is for. Information includes how to proceed from the simplest test program I referred to earlier through how to configure and use the Basic driver package.

The manual consists in large part of an explanation on the theory of CORE and how it is used. This is where I got bogged down initially: you don't need to know how CORE works to run the software package and try the demonstration programs.

The last sections of the manual

Listing 1

```
1000 REM                    SIMPLE PROGRAM USED TO ATTEMPT TO RUN MOTORS
1010 REM                    USING SNOW MICROSYSTEMS INC. MC100 STEPPER
1020 REM                    MOTOR CONTROLLER
1030 REM
1040 REM                    AUGUST  1983
1050 REM                    J.W. LONG
1060 REM                    CHEMISTRY DEPARTMENT
1070 REM                    BROOME COMMUNITY COLLEGE
1080 REM                    BINGHAMTON, NY 13902
1090 REM
1100 REM
1110 REM----------------SETUP BASE ADDRESS OF BOARD-------------------
1120   BASE=&HE0 : REM SEE MC100 USER'S MANUAL PAGE 5 TABLE 3.1
1130               REM SEE TABLE 3.2 FOR THE OFFSETS TO THE BASE ADDRESS
1140               REM FOR ALL FOR THE PORTS AND REGISTERS USED BY THE MC10
1150               REM SOME OF  WHICH ARE USED IN THIS EXAMPLE PROGRAM.
1160 REM----------------END ADDRESS SETUP-----------------------------
1170 REM
1180 REM
1190 REM---------------8255 INITIALIZE--------------------------------
1200   OUT BASE+&HB,&H82  : REM SEE MC100 USER'S MANUAL PAGE 14, TABLE 4.4
1210 REM                    REM OTHER POSSIBLE VALUES ARE 83H, 8AH AND 8BH.
1220 REM---------------END 8255 INITIALIZE----------------------------
1230 REM
1240 REM
1250 REM--------------MOTOR CONTROL REGISTER (8255) INITIAL VALUE--------
1260   OUT BASE+8,&HFF   : REM SEE MC100 USER'S MANUAL SECTION 4.2.1
1270                       REM CHANGING VALUES HERE WILL ENABLE/DISABLE
1280                       REM MOTORS, CHANGE DIRECTIONS, ETC.
1290                       REM THE &HFF ENSURES THAT BOTH MOTORS ARE
1300                       REM OFF UNTIL APPROPRIATE VALUES ARE LOADED
1310                       REM INTO THE COUNTERS.
1320 REM--------------END MOTOR CONTROL REGISTER INITIAL VALUE
1330 REM
1340 REM
1350 REM---------------8253 INITIALIZE--------------------------------
1360 REM--INITIALIZE 8253 FOR MOTOR A--
1370   OUT BASE+3,52  : REM  SEE MC100 USER'S MANUAL 4.1.1 PAGE 13
1380   OUT BASE+3,116 : REM  DECIMAL VALUES USED HERE
```

SUBVERSIVE SOFTWARE

So cheap and useful it's...dangerous!

A RADICAL IDEA IN SOFTWARE DEVELOPMENT

USEFUL PASCAL PROGRAMS, WITH:

- Complete annotated *source listings;*
- Disk(s) with *source code and compiled code;*
- User manual;
- Complete programmer documentation describing data structures and algorithms; and giving suggestions for modification.

Modify them, include them in your own systems, or simply use them.

A growing library of software tools you'll find hard to resist.

PDMS

The Pascal Data Management System. A user-oriented data management system in which numeric and alphanumeric data are stored in tables with named columns and numbered rows. Currently being used for dozens of different kinds of business and scientific applications, from inventory management to laboratory data analysis. Includes over 20 Pascal programs; more than 10,000 lines of code. Main features include:

- Maximum of 32,767 rows per file;
- Maximum of 400 characters per row, and 40 columns per table;
- Full-screen editing of rows and columns, with scrolling, windowing, global search/replace, and other editing features;
- Sorting, copying, merging, and reducing routines;
- Mailing label program;
- Reporting program generates reports with control breaks, totals and subtotals, and selects rows by field value; many other reporting features;
- Cross-tabulation, correlations, and multiple regression;
- Video-display-handling module;
- Disk-file-handling module.

Many other features. UCSD formats only.

$250

MINT

A terminal emulation program for communication between computers of any size.

- User-configurable uploading and downloading of files;
- X-ON/X-OFF and EOB/ACK protocols;
- Interrupt-driven serial input (for Prometheus Versacard in Apple II);
- Printer-logging.

$50

TPL

The Text Processing Language. A text-file runoff program consisting of a set of text-processing primitive commands from which more complex commands (macros) can be built (as in Logo). Features include:

- Complete customization of text processing through macro definition and expansion, looping structures, and conditional statements;
- Adapts to any printer;
- Pagination;
- Text justification and centering;
- Indexing and tables of contents;
- Superscripts and subscripts;
- Bolding and underlining;
- Multiple headers and footers;
- End notes and footnotes;
- Widow and orphan suppression;
- Floating tables and 'keeps.'

$50

ZED

Full-screen text editor; designed to be used either with TPL or by itself.

- Full cursor control;
- Insert mode with word wrap;
- 'Paint' mode;
- Single-keystroke or dual-keystroke commands;
- Command synonyms;
- Global search and replace;
- Block move, block copy, and block delete.

$50

PLANE

Planimetry program:

- Bit-pad entry of cross sections;
- Real-time turtlegraphics display;
- Calculation of areas;
- Saves calculations to text file.

$100

SCINTILLA

A log logit curve fitting program for radioimmunologic data; must be used with PDMS (described above).

- Multiple protocol files;
- Quality control files;
- Four-parameter non-linear curve fit.

UCSD formats only.

$250

DBX

Blocked Keyed Data Access Module. Maintains disk files of keyed data. Can be used for bibliographies, glossaries, multi-key data base construction, and many other applications.

- Variable-length keys;
- Variable-length data;
- Sequential access and rapid keyed access;
- Single disk access per operation (store, find, delete) in most cases;
- Multiple files;
- Dynamic memory allocation for RAM-resident index and current "page" of entries;
- Includes demonstration program and testbed program.

$50

CHROME

Chromatography data analysis program:

- Graphic display of analog data;
- Panning and zooming;
- Automatic peak-finding and baseline calculation;
- Full interactive peak editing;
- Computation of peak areas;
- Strip charts on C. Itoh and EPSON printers.

$100

For more information, call 919-942-1411.
To order, use form below or call our toll-free number: 1-800-PASCAL-1.

Check appropriate boxes:

FORMAT	PRODUCT	PRICE
☐ 8" UCSD SSSD	☐ DBX	$ 50
☐ 5¼" Apple Pascal	☐ PDMS	$250
☐ 5¼" UCSD IBM PC 320k	☐ TPL	$ 50
	☐ ZED	$ 50
☐ 8" CP/M SSSD	☐ MINT	$ 50
☐ 5¼" IBM MS-DOS	☐ SCINTILLA	$250
☐ 5¼" CP/M Osborne	☐ CHROME	$100
	☐ PLANE	$100

☐ MasterCard ☐ VISA ☐ Check ☐ C.O.D.

(Please include card # and expiration date)

Name ______

Address ______

City ______ State ______ Zip ______

SUBVERSIVE SOFTWARE
A Division of
PASCAL AND ASSOCIATES
135 East Rosemary Street
Chapel Hill, NC 27514

Apple and Apple Pascal are trademarks of the APPLE Computer Corp. IBM and IBM PC are trademarks of International Business Machines. UCSD Pascal is a trademark of the Regents of the University of California. Osborne is a trademark of Osborne Computer. EPSON is a trademark of EPSON America, Inc. C. Itoh is a trademark of C. Itoh Electronics.

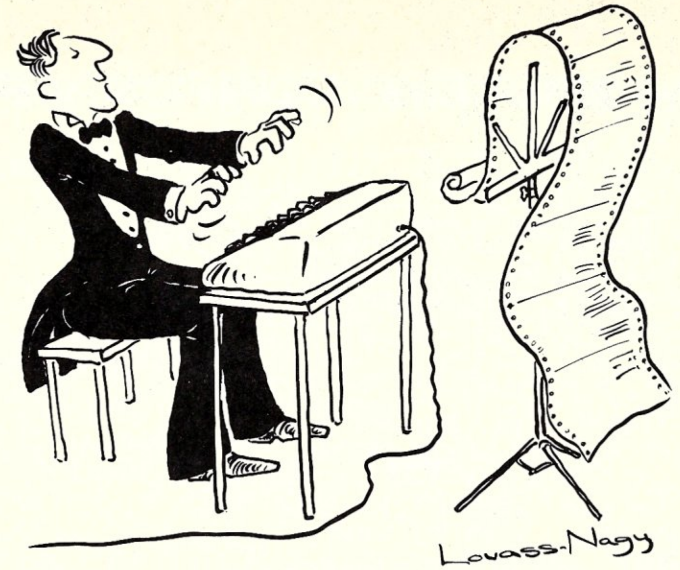
Snow MC100

Continued from page 84

contain an explanation of the configuration switch settings and two appendices that explain how to use the package with assembly language and Basic. These sections are very brief. The assembly language section explains that to write a new program the sample program (TEST.MAC) and/or the driver (CORE.MAC) may be modified, then reassembled with M80 and linked with L80, which is straightforward. There is no specific advice on writing assembly language programs for the MC100 except for the example program TEST.-MAC. I had trouble understanding TEST.MAC, but the problem is perhaps with me: my version of M80 is earlier than the one used by Snow and lacks some features of the newer release. Several of these features are used in TEST.

The Basic section of the manual is chiefly concerned with generating the driver for use with Basic. I found this section of the manual confusing until I made another telephone call to Snow Micro Systems and received an explanation of the fundamental idea behind the installation of the driver. The manual contains no specific information on us-

```
1390   OUT BASE+3,176
1400 REM--END 8253/A INITIALIZE--
1410 REM
1420 REM
1430 REM--INITIALIZE 8253 FOR MOTOR B--
1440   OUT BASE+7,&H34  : REM SEE MC100 USER'S MANUAL 4.1.1 PAGE 13
1450   OUT BASE+7,&H74  : REM HEXADECIMAL VALUES USED HERE
1460   OUT BASE+7,&HB0
1470 REM--END 8253/B INITIALIZE--
1480 REM----------------END 8253 INITIALIZE---------------------------------
1490 REM
1500 REM
1510 REM----------------LOAD 8253 COUNTERS FOR EACH MOTOR------------------
1520 REM--FIRST MOTOR A--
1530   OUT BASE+0,64  : REM RATE GEN 0 MOTOR A, LOW BYTE * 2000000/64=31250 HZ
1540   OUT BASE+0,0   : REM RATE GEN 0 MOTOR A, HI BYTE  *
1550   OUT BASE+1,156 : REM RATE GEN 1 MOTOR A, LOW BYTE * 31250/156=200 HZ
1560   OUT BASE+1,0   : REM RATE GEN 1 MOTOR A, HI BYTE  * SEE SECTION 4.1.2
1570   OUT BASE+2,10  : REM STEP COUNTER MOTOR A, LOW BYTE
1580   OUT BASE+2,20  : REM STEP COUNTER MOTOR A, HI BYTE
1590 REM--MOTOR A COUNTERS LOADED--
1600 REM
1610 REM
1620 REM--NOW MOTOR B--
1630   OUT BASE+4,64  : REM RATE GEN 0 MOTOR B, LOW BYTE 2000000/64=31250 HZ
1640   OUT BASE+4,0   : REM RATE GEN 0 MOTOR B, HI BYTE
1650   OUT BASE+5,56  : REM RATE GEN 1 MOTOR B, LOW BYTE  56 & 1 BELOW ADD TO
1660   OUT BASE+5,1   : REM RATE GEN 1 MOTOR B, HI BYTE 312. 31250/312 IS 100 HZ
1670   OUT BASE+6,254 : REM STEP COUNTER MOTOR B, LOW BYTE
1680   OUT BASE+6,10  : REM STEP COUNTER MOTOR B, HI BYTE
1690 REM--MOTOR B COUNTERS LOADED--
1700 REM
1710 REM
1720 REM---------------TURN ON MOTORS USING MOTOR CONTROL PORT---------------
1730   OUT BASE+8,&HC0 : REM TURNS ON BOTH MOTORS, BOTH CCW ROTATION. BOTH
1740                     REM CONTINUE RUNNING EVEN AFTER REACHING TERMINAL
1750                     REM COUNT. SEE MC100 USER'S MANUAL SECTION 4.2.1.
1760                     REM TO CHANGE MOTOR DIRECTIONS, ETC CHANGE THE
1770                     REM VALUE OUTPUT HERE.
1780 REM---------------END MOTOR TURN ON-------------------------- -----------
1790 REM
```



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.

The Well-Tempered Cross-Assembler

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.

5¼" disk formats available at no extra cost include Osborne, Xerox, H-P, IBM PC, Kaypro, North Star, Zenith, Televideo, Otrona, DEC.

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)

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.

Avocet Cross-assembler	Target Microprocessor	CP/M-80 Version	CP/M-86 IBM PC, MSDOS** Versions
XASMZ80	Z-80		
XASM85	8085		
XASM05	6805		
XASM09	6809		
XASM18	1802		$250.00 each
XASM48	8048/8041		
XASM51	8051	$200.00 each	
XASM65	6502		
XASM68	6800/01		
XASMZ8	Z8		
XASMF8	F8/3870		$300.00 each
XASM400	COP400		
XASM75	NEC 7500	$500.00	
Coming soon: XASM68K...68000			

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

Programmer $429
Options include:
Software Driver Package -- enhanced features, no installation required.
CP/M-80 Version .... $ 75
IBM PC Version .... $ 95
RS 232 Cable .... $ 30
8748 family socket adaptor ... $ 98
8751 family socket adaptor ... $174
8755 family socket adaptor ... $135

G7228 Programmer by GTek -- baud to 2400 ... superfast, adaptive programming algorithms ... programs 2764 in one minute.

Programmer $549

Ask us about Gang and PAL programmers.

HEXTRAN Universal HEX File Converter -- Converts to and from Intel, Motorola, MOS Technology, Mostek, RCA, Fairchild, Tektronix, Texas Instruments and Binary formats.

Converter, each version $250

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.

CALL TOLL FREE 1-800-448-8500
(In the U.S. except Alaska and Hawaii)

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 **Trademark of Microsoft

AVOCET SYSTEMS INC.™
DEPT. 484-M
804 SOUTH STATE STREET
DOVER, DELAWARE 19901
302-734-0151 TELEX 467210

CIRCLE 201 ON READER SERVICE CARD

Snow MC100

Continued from page 86

ing the Basic/driver software. The example program (BDEMO or PDEMO) can be used as a reference, along with the manual. I found BDEMO to be somewhat difficult to follow, as it contains numerous GOTOs and its documentation is a bit sparse. I probably spent two hours going back and forth between BDEMO.BAS and the MC100 manual until I had it figured out, which probably is not an unreasonable amount of time, considering the scope of the program.

The manual is 15 pages long. It has a table of contents but no index.

Other languages

Snow supports only Microsoft Basic 80 and M80 for use with their software. Microsoft Fortran is mentioned in their ads, but no mention is made of it in the documentation. It would seem that both Microsoft Fortran and compiled Basic should work with the MC100, but I have not tried them. It is possible that other Basics would work with the MC100 if they can pass integer (2 byte, ordered low byte, high byte) data to the Basic driver, but it is up to the user to

```
1800 REM
1810 REM---------------COMMENTS--------------------------------------
1820 REM        AT THIS POINT BOTH MOTORS SHOULD BE RUNNING, MOTOR A AT
1830 REM        TWICE THE SPEED OF MOTOR B. THE MOTORS WILL CONTINUE
1840 REM        RUNNING EVEN WHEN THE PROGRAM STOPS. BECAUSE OF THE
1850 REM        MOTOR CONTROL BYTE VALUE (&HCO) WHICH DOES NOT STOP THE
1860 REM        MOTORS EVEN WHEN THE TERMINAL COUNT IS REACHED.
1870 REM
1880 REM        THE MOTOR STATUS CAN BE MONITORED BY READING THE
1890 REM        MOTOR STATUS PORT (BASE+8). SEE MC100 USER'S MANUAL
1900 REM        TABLE 4.6, PAGE 15.
1910 REM
1920 REM
```

Listing 2

```
1000 REM                 ALL VARIABLES BELOW TYPE INTEGER
1010 REM .
1020 REM .
1030 REM .
1035   CALL SYSINIT : REM INITIALIZE MC100 HARDWARE
1040 REM .
1050 REM .
1060 REM .
1070   CALL BUFF (ATOTSTEP,AMINFREQ,AMAXFREQ,ADELTAFREQ,ADELTASTEP,
            AMOTORSELECT,AMOTORDIR,AFINAL,ARAMPUPDIS,ARAMPDNDIS)
1080 REM    THIS CALL SENDS VALUES FOR MOTOR A TO BUFFER IN DRIVER.
1090 REM    A SIMILAR CALL CAN BE USED FOR MOTOR B
2000 REM .
2010 REM .
2030 REM .
2040   AMOTORSTATE=USR(AMOTORSEL) : REM CHECK STATUS OF MOTOR A
2050 REM .
2060 REM .
2070 REM .
```

EE/EPROM PROGRAMMERS & UV ERASERS

NOW AVAILABLE PAL PROGRAMMERS

See us at COMDEX SPRING, ATLANTA

UV ERASERS
QUV-T8/1
$49.95
*HOBBY

QUV-T8/2N
$68.95
*INDUSTRIAL

QUV-T8/2T
$97.50
*WITH TIMER & SAFETY SWITCH

GANGPRO-8™
$995.00
(GANG PROGRAMMER)
Add Shipping

Money Back Guarantee

RS-232 serial, STAND ALONE, INTELLIGENT

***EASY DUPLICATION *USER FRIENDLY *128K BUFFER**

SUPPORTS: MOST 8K, 16K, 32K, 64K, 128K, 256K EPROMS
PROMPRO-8: KEY PAD OPTION, EPROM SIMULATION MODE
Microcomputer Chips: 8748 (H), 8749H, 8750, 8751, 8741, 8742, 8755A
SOFTWARE DRIVERS: MDS ISIS, TEKTRONICS 8002, IBM PC, ATARI, APPLE II, CPM, FLEX, TRS-80
DIRECT HOOK UP TO ANY DUMB TERMINAL OR COMPUTER.

AFFORDABLE ★ RELIABLE ★ AVAILABLE

DISTRIBUTOR INQUIRY WELCOME. TO ORDER **1-800-EE1-PROM**

LOGICAL DEVICES INC.

1321 N.W. 65 Place, Ft. Lauderdale, FL 33309 For Info: (305) 974-0967

CIRCLE 191 ON READER SERVICE CARD

YOU DON'T NEED EUREKA!™ ??

CONGRATULATIONS!!

We admire your talents. After all, few people can remember where to find that six month old letter to Wonder Waffle Works, or which of the twenty versions of IMPORTNT.BAS is the one you need yesterday.

Or maybe we should envy your spare time. Ah, to be able to haul out a stack of disks, slip each one into a drive, browse through the directory, and TYPE the various prospects to find that one file or program.

Or perhaps you're the adventurous type who thrills to the challenge of groping through scantily labeled disks, cheering that magical moment when hidden treasures are uncovered.

On the other hand, it occurs to us that you just may not know the advantages of **EUREKA!**, the fast, menu driven disk cataloger for CP/M 2.2. **EUREKA!** puts your entire disk library at your fingertips. Files may be found quickly and easily - by name or by comments you can put in the file itself. Of course the manual includes a tutorial to help you get started.

Still only $50. Ask your dealer, or contact:

MENDOCINO SOFTWARE COMPANY, INC.

Dept M-2,
P.O. Box 1564
Willits, CA 95490
Phone: (707) 459-9130

Add $2.50 Shipping;
Calif. residents add $3.00 sales tax.

We accept VISA
& Mastercharge

CP/M is a registered trademark of Digital Research Corp.
EUREKA! is a trademark of Mendocino Software Co., Inc.

CIRCLE 77 ON READER SERVICE CARD

We Give You More

Than a Board, a Cable and a Smile.

The P&T Interface (S-100 computer to IEEE-488 instrumentation bus) offers comprehensive software, documentation and close to 100% reliability!

Most manufacturers of similar equipment sell you a board, a cable and their best wishes. At Pickles & Trout, we go several steps farther . . . supporting five languages: BASIC (Microsoft, CBasic®, Cromemco and North Star), Pascal/M™ and MT™, FORTRAN (Microsoft), C (Quality Systems) and Assembler. And we support 8 operating systems, 3 of which are multi-user (CROMIX™, MP/M II™, Turbo DOS™)!

The P&T-488 Comes Complete

For only $450.00 (domestic, FOB Goleta), here's what you get: The basic interface with driver software for your system and language, sample programs, an operating manual, 18" cable and connector mounting, useful utilities that include BUSMON, an interactive 488 bus monitor which helps you to debug your 488 system.

Reliability? In five years, fewer than 1/4 of 1% of all P&T-488 have required service of any kind.

Please call or write today for detailed information and specifications.

PICKLES & TROUT®

PICKLES & TROUT®
Box 1206 • Goleta, California 93116
(805) 685-4641

*CBasic 2 is a registered trademark, MP/M II and Pascal/MT+ are trademarks of Digital Research, Inc., CROMIX is a trademark of Cromemco, Inc.; Pascal/M is a trademark of Sorcim; Turbo DOS is a trademark of Software 2000.

CIRCLE 89 ON READER SERVICE CARD

Snow MC100

Continued from page 88

determine whether it is possible and just how it would be done.

Summary

The MC100 package is very high quality and does exactly what is claimed for it; it is a powerful, sophisticated stepper motor control/development system. The documentation for the product is adequate for programmers with some assembly language experience, but could be improved to make the system easier to install and use for less experienced persons.

Snow Micro Systems has a new revision of the software in preparation that will enhance the utility of the MC100 package. It will be ROMable, usable with both Z80 and 8080 processors, and allow higher step rates and contain numerous enhancements and improvements, as well as improved documentation. The new revision will probably be available by the time this is published.

References

Bober, R.E.: "Taking the First Step," *Byte (*February 1978), pp. 35-112.

Guilder, J.: "Focus on Stepping Motors," *Electronic Design* (October 25, 1977), p. 48.

Joseph W. Long, Department of Chemistry and Chemical Engineering Technology, Broome Community College, Binghamton, NY 13902

VENDOR INFORMATION

Products:

MC100 Dual Stepper Controller	$350
Manual Control Panel	$135
Software (8″ CP/M)	$ 35

Hardware requirements

IEEE 696/S-100 system
Block of 12 I/O ports

Software requirements

32K CP/M
Z80 processor
ZSID (possibly required for installation)
Microsoft Basic 80 and/or M80 assembler, version 3.0

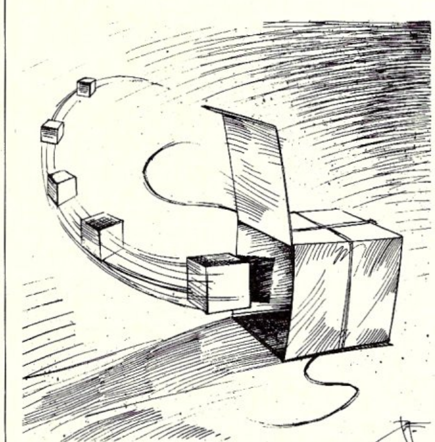
Manufacturer

Snow Micro Systems, Inc.
P.O. Box 2201
Fairfax, VA 22031
(703) 830-3494

CIRCLE 301 ON READER SERVICE CARD

Simplify your Command Lines

Create CP/M files on the fly with SYNONYM



by Joseph Katz

Among the handiest programs to have on a CP/M system is SYNONYM, a public domain program written by Bill Allen and modified by him and Roy Lipscomb to version 3.0.

SYNONYM builds CP/M commands. It does not create new programs, but it does allow you to use existing programs more efficiently by creating new commands that may be executed on the command line from the CP/M prompt (A>, B>, etc.).

That may sound silly, but if you think about it for a few moments, it should suggest itself as a downright useful capability.

Say you want to run a program written in Microsoft Basic, and it needs to reservc two files and the first 36K of memory. Issuing the command to do all that requires entering the command

```
MBASIC FILENAME/F:2/M:&H9000
```

and if you think that is a simple matter, especially if you have to do it over and over again, you should have little interest in SYNONYM. What SYNONYM can do is let you create a new CP/M command that will save you from having to type that nonsense time after time. Just typing a single letter and ENTER can supply the entire command line, once it is installed with SYNONYM.

Or suppose you are, like I am, a mite casual about labeling disks as you work with them. You know, you tell yourself you'll remember that the one with the thumbprint on the upper right-hand corner has your spreadsheet template for I.R.S. Form 1040. Sure you will. So tax time comes around and you have to hunt among several disks, all with thumbprints on them. The old way to do it is to put one disk after another into Drive B and type DIR B: until the right one unveils itself. The new way, with SYNONYM, is to create a command like B.COM that merely requires you to type B and press ENTER to process those unlabeled disks on a mass-production basis.

Or perhaps you use business software that requires complicated commands and is finicky about how they are entered. I use dBASE II from Ashton-Tate, and DataStar and SuperSort from MicroPro International. The most efficient way to invoke these programs is to follow them on the CP/M command line with instructions about the routine they should follow. For instance, you

SYNONYM

Continued from page 92

know that in dBASE II the easiest way to get to work with the date demonstration file is to issue the command as DBASE DATER, and the best way to work on the demonstration invoicing file with DataStar is the enter DATASTAR ORDERS. SYNONYM allows you to write each command line into a separate file. Type DATE, for example, and you get dBASE II doing its stuff automatically; type ORDERS and DataStar goes into action.

SYNONYM is at its best in really complicated situations such as those offered by a program like SuperSort. SuperSort will sort almost any file in almost any way, but remembering how to use its commands is difficult for anyone who does not use the program frequently. Here is one set of commands needed to sort a file called SAMPLE.DAT:

```
A> SORT
INPUT = 62, CR-DEL
SORT-FILE = SAMPLE.DAT
OUTPUT-FILE = OUTPUT.DAT
KEY = #4,6,DESCEND
GO
```

That is not as easy to remember as DOIT.

Fortunately, SuperSort allows you to use your word processor (in nondocument mode, of course) to write that sequence into a command file with the extension .CMD. Then all you have to do is issue something like the following command:

```
A> SORT CFILE=DOIT.CMD
```

If you cannot remember that, you can look up the command sequence in the manual. Or use SYNONYM to create DOIT.COM, then type DOIT and press ENTER. That way is simpler, because you can use SYNONYM to build a command "on the fly." To use SYNONYM, follow this model and type

```
SYNONYM NEWNAME OLDNAME PARAMETER
```

What results is the new command.

Let us take that step by step. SYNONYM invokes the program, of course. But you cannot simply do that and wait for prompts about what to do next: the new command name and everything you want it to do must be entered when you invoke SYNONYM.

So NEWNAME is the name of your new command, the one you are creating to save you work. In my example it would be DOIT (you do not type DOIT.COM because SYNONYM adds the extension).

Next comes OLDNAME (again without the extension .COM because SYNONYM knows that whatever follows NEWNAME is a command file).

Then come the parameters to be passed to OLDNAME—whatever you want it to do. The SuperSoft example has all parameters included in the file DOIT.CMD, so no parameters are included in DOIT.COM. Now take the command to read the directory of Drive B, for example. If that is all you want—to read the entire directory—there would be no parameters and you would simply use SYNONYM to create B.COM containing the command DIRB:. But if you wanted to find a particular file, you would need the filename as a parameter. You can install it as part of B.COM or can issue it as a runtime parameter by entering the command B FILENAME and pressing enter.

Suppose you wanted to search a stack of unlabeled disks inserted one after another into Drive B for a spreadsheet template called 1040.CAL. That filename would be the parameter, and the command you would need would be DIRB:1040.CAL.

Now all you need to find it, with SYNONYM and some elbow grease, is to create that command by issuing the following command:

```
SYNONYM B DIR B:1040.CAL
```

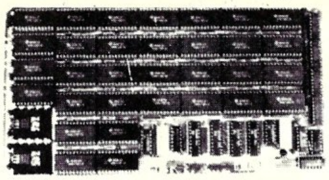
64K S100 STATIC RAM

$199.00 KIT

NEW!

LOW POWER!

RAM OR EPROM!



BLANK PC BOARD WITH DOCUMENTATION $55

SUPPORT ICs + CAPS $17.50

FULL SOCKET SET $14.50

FULLY SUPPORTS THE NEW IEEE 696 S100 STANDARD (AS PROPOSED)

FOR 56K KIT $185

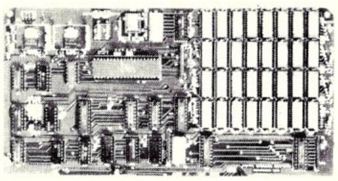
ASSEMBLED AND TESTED ADD $50

FEATURES:
* Uses new 2K x 8 (TMM 2016 or HM 6116) RAMs.
* Fully supports IEEE 696 24 BIT Extended Addressing.
* 64K draws only approximately 500 MA.
* 200 NS RAMs are standard. (TOSHIBA makes TMM 2016s as fast as 100 NS. FOR YOUR HIGH SPEED APPLICATIONS.)
* SUPPORTS PHANTOM (BOTH LOWER 32K AND ENTIRE BOARD).
* 2716 EPROMs may be installed in any of top 48K.
* Any of the top 8K (E000 H AND ABOVE) may be disabled to provide windows to eliminate any possible conflicts with your system monitor, disk controller, etc.
* Perfect for small systems since BOTH RAM and EPROM may co-exist on the same board.
* BOARD may be partially populated as 56K.

ALL SALES SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. FREE COPY UPON REQUEST.

256K S-100 SOLID STATE DISK SIMULATOR!

WE CALL THIS BOARD THE "LIGHT-SPEED-100" BECAUSE IT OFFERS AN ASTOUNDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.



FEATURES:
* 256K on board, using + 5V 64K DRAMS.
* Uses new Intel 8203-1 LSI Memory Controller.
* Requires only 4 Dip Switch Selectable I/O Ports.
* Runs on 8080 or Z80 S100 machines.
* Up to 8 LS-100 boards can be run together for 2 Meg. of On Line Solid State Disk Storage.
* Provisions for Battery back-up.
* Software to mate the LS-100 to your CP/M* 2.2 DOS is supplied.
* The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.
* Compare our price! You could pay up to 3 times as much for similar boards.

BLANK PCB (WITH CP/M* 2.2 PATCHES AND INSTALL PROGRAM ON DISKETTE) $69.95

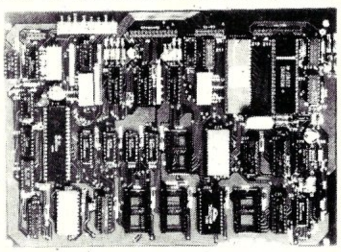
$399.00 #LS-100 (FULL 256K KIT)

THE NEW ZRT-80

CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY, AND VIDEO MONITOR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM FOR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

FEATURES:
* Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
* RS232 at 16 BAUD Rates from 75 to 19,200.
* 24 x 80 standard format (60 Hz).
* Optional formats from 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
* Higher density formats require up to 3 additional 2K x 8 6116 RAMS.
* Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
* 3 Terminal Emulation Modes which are Dip Switch selectable. These include the LSI-ADM3A, the Heath H-19, and the Beehive.
* Composite or Split Video.
* Any polarity of video or sync.
* Inverse Video Capability.
* Small Size: 6.5 x 9 inches.
* Upper & lower case with descenders.
* 7 x 9 Character Matrix.
* Requires Par. ASCII keyboard.



BLANK PCB WITH 2716 CHAR. ROM, 2732 MON. ROM $59.95
SOURCE DISKETTE - ADD $10
SET OF 2 CRYSTALS - ADD $7.50

WITH 8 IN. SOURCE DISK! (CP/M COMPATIBLE)

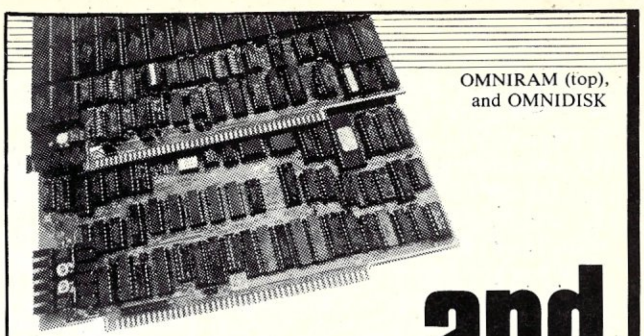
$129.95 # ZRT-80 (COMPLETE KIT, 2K VIDEO RAM)

Digital Research Computers

P. O. BOX 461565 • GARLAND, TEXAS 75046 • (214) 271-3538

TERMS: Add $3.00 postage. We pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa and Master-Card. Texas Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. Orders over $50 add 85¢ for insurance.

CIRCLE 64 ON READER SERVICE CARD



OMNIRAM (top), and OMNIDISK

...and Collect IMMEDIATE Interest

All FULCRUM products incorporate features that every S-100 system will boast of...someday.

For example, the OMNIDISK is re-defining performance standards for S-100 disk controllers by offering:
- *Simultaneous support of 5¼" and 8" floppy disks.*
- *Ability to address memory beyond 64K.*
- *24-bit DMA for CPU by-pass.*
- *Power-on boot PROM for quicker access.*
- *On-board de-blocking to save RAM space over BIOS.*
- *Interface with WD-1000® hard disk controller.*
- *Full-track buffer to recall entire track, not just sectors.*
- *RAMDISK capability using extended addressing beyond 64K with DMA.*

*And the OMNIDISK is priced at only **$399.*** So before you buy another S-100 component, call or write for our *FREE* catalog. Because your S-100 system should draw interest. But not from your bank account!

Also in FULCRUM'S Family: 8MHz Z80 CPU, Serial I/O 2-2 & Video I/O Interface boards, Relay board, I-8080, 8015 and 8035 main frames with 21 slot mother boards.

FULCRUM COMPUTER PRODUCTS

707/433-0202 451 Allan Court, Healdsburg, CA 95448,

*CP/M *2.2 configured for OMNIDISK $60. *Trade mark of Digital Research. FREE U.P.S. ground shipping on prepaid orders. Shipping is added to VISA, M/C, and C.O.D. orders. CA residents, please add sales tax.

CIRCLE 63 ON READER SERVICE CARD

SYNONYM

Continued from page 94

After a second there is a new file on your disk: B.COM. Type B and press ENTER and the search begins on Drive B for the file 1040.CAL.

When you find it, you are in business. You can begin getting information together for your tax return or, depending on the command you had SYNONYM create to you, anything else.

What do you do with the command SYNONYM has created when you are through with it? Erase it if you like. For a trivial operation like the directory scan, that probably is what you ought to do to avoid cluttering the disk and its directory with needless files. But if the new command has a continuing use, keep it. Do not worry about forgetting what B.COM does: if ever you want to see its contents, use the CP/M resident command TYPE and TYPE B.COM.

Bill Allen and Roy Lipscomb deserve a great deal of credit for creating SYNONYM, version 3.0, and giving it free to the community of CP/M users. I am additionally grateful to Bill Allen for reading the manuscript of this article and for his permission to include the source code here. The object code,

SYNONYM lets you use existing programs more efficiently by creating new commands that are executable from the CP/M prompt.

SYNONYM3.COM, is available on many remote CP/M systems for the price of some time and a telephone call. (A similar program is included with Fox & Geller's Quickcode, a dBASE II utility program.) But the source code is a little more difficult to come by. Because it can be customized to make SYNONYM even more useful than it already is—for example, by making SYNONYM set the NEWNAME .COM to $ SYS so that it is invisible to the directory—it is well worth having.

I have tidied the source code a little and tested SYNONYM thoroughly on Pickles & Trout CP/M 2.2 and Radio Shack's Model II microcomputer. It should work as is on any standard CP/M. Owners of Radio Shack's Model I and of early Heath equipment, and anyone else with a nonstandard CP/M, will have to change the ORG equate to reflect the beginning of the TPA (Transient Program Area) and may have to change the equates at the following labels: CURDRIV, CPMEP, DISPLC. The equate at DISPLC is used in computing the address of the CCP (Console Command Processor) and assumes that it starts 0800H bytes below FBASE. I have used "+ + +" to mark the beginnings of the areas that may have to be changed. SYNONYM.ASM can be assembled using the Digital Research, Inc., assembler ASM.COM.

Joseph Katz, 103 South Edisto Ave., Columbia, SC 29205

TURBO FORCE™

- ★ MULTI-USER HARD DISC SYSTEM
- ★ TURBO-DOS OPERATING SYSTEM
- ★ UP TO 4 INDEPENDENT USERS
- ★ S-100 BUS ARCHITECTURE – 6 SLOTS
- ★ 8-BIT AND/OR 16 BIT PROCESSOR BOARDS

The "Turbo-Micro" is a revolutionary new business system designed for single or multi-user, multi-processor networking capabilities for fast response time. The "Turbo-Micro" is an attractive desktop computer with modular designs for fast and easy maintenance, yet it is rugged and well packaged for safe shipping and handling. It represents a state-of-the-art advancement with reliable components and disk drives. It is a powerful, yet compact system, 16" W x 7½" H x 22¼" D.

PACKAGED DEALER PRICE $4995.

PRICE INCLUDES:

- Complete desktop system with 110/220V power
- Master processor board — Z80B 6MHz, 64K. Byte memory, 2 serial/2 parallel ports, DMA
- Two slave processor boards, Z80B 6MHz, 64K. Byte memory, 4 serial/2 parallel ports, per board
- 25M. Byte winchester hard disk, 5¼" drive
- Floppy disk drive DS/DD, 1.6M. Byte, 8" drive
- Turbo-Dos* multi-user operating system with print spooling capabilities
- 100% CP/M* compatibility
- Complete manuals with schematics and diagnostics

SYSTEM OPTIONS:

- 16-bit processor, Intel 186 CPU with 128K. Byte or 256K. Byte memory
- Master/Slave CPU upgrade to 128K. Byte memory
- Battery back-up for up to 10 minutes of operation
- System upgradable to the powerful stand-alone cabinet for future expansion
- CP/M 2.2* or CP/M 3.0* operating system
- Complete library of application programs, general business accounting, CPA, medical, dental, pharmacy, construction, manufacturing, POS, PTY management and many others
- Terminals and printers are optional

CIRCLE 8 ON READER SERVICE CARD

Please call today or visit us, to reserve one for you, and
MAY THE TURBO FORCE BE WITH YOU!

OVERSEAS INQUIRIES ARE INVITED.

ADVANCED COMPUTER TECHNOLOGY, INC.
5575 MAGNATRON BLVD., SUITE D
SAN DIEGO, CA 92111 (619) 571-2746

* Turbo-Micro is a trademark of Advanced Computer Technology, Inc.
* CP/M is a trademark of Digital Research Corporation
* Turbo-Dos is a trademark of Software 2000, Inc.

UNIX Front-End Power for CP/M

Add UNIX directory structure and command-line processing with C/NIX

by Robert A. Langevin

Scanning the contents pages of some of the current microcomputer journals gives the impression that UNIX is taking over the world. If, like me, you have an 8-bit system with CP/M-80, you have probably been envious of 16-bit owners for whom hierarchical directories, pipes, and I/O redirection are everyday words. Fortunately, inexpensive help is at hand in the form of C/NIX-80, a new product from C/Craft.

C/NIX, written in C, runs in conjunction with CP/M and provides an impressive array of features. These include:

- Hierarchical directories
- Input/output redirection
- Pipes
- Nestable shell files
- UNIX-like commands and programs
- On-line help files

Together, this collection of features provides a real taste of UNIX and, in my opinion, is superior in some respects to the earlier efforts represented by Microshell and Unica.

Program summary

As supplied, C/NIX-80 consists of three basic programs: **cnix.com**, a 25K program that implements most of the C/NIX features; **cnixhigh.sys**, a 1.4K program that is loaded immediately below the CCP when C/NIX is first started and remains resident until C/NIX exits; and **cnixutil.pre**, an 11K program that loads above C/NIX when needed and implements the commands **chmod, mkdir,** and **rmdir.**

Numerous additional programs are included in the package, including **grep.pre**, a 10.4K program that implements a UNIX-style generalized regular expression parser; **mkrel.com**, a 9.5K program that permits you to create relocatable versions of machine language programs that will load immediately above C/NIX; 84K of help files that provide on-line access to the entire C/NIX manual; and 56K of C source code for a variety of useful functions. All in all, at its current $65 price, C/NIX-80 provides more capability that you would believe possible.

C/NIX features

Hierarchical directories. Hierarchical directories are implemented in C/NIX by using the user feature of CP/M to provide subdirectories. User numbers 6 through 31 are used for this purpose, so that 26 subdirectories can be defined on a single physical or logical disk drive. The C/NIX implementation permits subdirectories to be nested four deep, enough for most practical purposes. The root directory on an individual disk is identified by **/x**, where **x** is a drive letter. The path name to specify a particular file is then of the form

```
/x/dir1/dir2/.../name.ext
```

where dir1, dir2, etc., are subdirectories along the path to **name.ext**.

C/NIX maintains a record of the current (last used) directory for each disk, and these current directories can be referenced by the short form **x:**, where (as before) **x** is a drive letter. This is of considerable importance, since normal CP/M programs are unable to parse a path name—a limitation that can be partially obviated by incorporating the programs in shell files. It is noteworthy, by the way, that neither of the competing products, Microshell nor Unica, implement hierarchical directories—one of the most appealing features of UNIX.

Unfortunately, except for shell files, as discussed below, C/NIX does not offer a path search capability. As a result, a file not in the current directory of a logged disk must be accessed by using its full path name. In practice, this is not a serious deficiency.

Input/output redirection. Input/output redirection is implemented in C/NIX in a fairly extensive way, going somewhat beyond the capability afforded by UNIX. Four operators are available for redirecting console output: >, > >, > +, and > &. These are used with the syntax "command operator outfile". The first operator, >, is used if the outfile does not exist. An outfile is created, and the output of command is written to it. If the outfile exists, the use of > will abort the operation (with no error message). The second operator, > >, will append the output of command to the end of outfile. The third operator, > +, displays the output of command on the console as it is written to outfile. The last form of the operator, > &, writes both normal console output and error output to outfile. Error output is defined in C/NIX as output produced using the BDOS direct console output function.

C/NIX supports console input redirection with three operators, <, < +, and < (text). The syntax of the first two operators is "command operator infile". Of these, the first uses infile instead of the keyboard as the source of input to command. The second causes infile to be echoed to the console as it is read. The last form, < (text), is used primarily in shell files and supplies text to command when console input is requested. Text can contain control characters.

Finally, a number of combined forms is also supported: > > +, > > &, > + &, and > > + &, where, as before, + means input display, & means error redirection, and > > means appending. Together, the C/NIX redirection operators provide more flexibility than you are ever likely to use.

Pipes. Since CP/M doesn't support concurrent processing, C/NIX implements pipes by using temporary files that hold the interprocess results. These are created on the disk from which C/NIX is loaded, although a patching procedure (using DDT) is provided in the manual for designating a different disk for these temporary files. As you would expect, they are deleted after use. The pipe operator is the familiar UNIX | and is used with the same syntax as in UNIX, command1 | command2 | command3 |. . . . Thus the output of command1 is supplied as input to command2; its output, in turn, is supplied as input to command3, and so forth.

While this implementation of pipes is relatively slow as a consequence of creating, writing, reading, and deleting the temporary files that implement the pipe operator, there is no real alternative in the absence of a concurrent processing capability. However, if you need to use pipes frequently and have implemented a RAM disk on your machine, you can significantly improve the speed of pipe operations by patching C/NIX, using the instructions provided in the manual, so that pipes are created on the RAM disk instead of on a floppy.

C/NIX, with an impressive array of features, provides a real taste of UNIX.

Shell files. Shell files, which are called command files in the C/NIX manual, provide all of the capability of CP/M's **submit** and **xsub** constructions and more. A shell file always has a name of the form **name.sub** and may reside in any directory in your system. The contents of the file consist of a list of one or more CP/M or C/NIX commands. The list is terminated by control-Z. Unlike CP/M **submit**, shell files can contain control characters and can be nested.

A shell file is invoked simply by supplying its name without the sub extension. Thus, for example, if **cs.sub** is a shell file to clear the screen on the console, typing "cs RETURN" will invoke a subshell of C/NIX, execute the shell file **cs.sub**, and return to the directory from which the subshell was invoked.

As C/NIX is presently implemented (version 1.01), shell files are the only files for which a simple path search capability is implemented. This works as follows: If a shell file is invoked, C/NIX first looks for the file in the current directory. If the file is not found there, C/NIX looks for the file in the top-level directory of the disk from which C/NIX was loaded. If the file is still not found, C/NIX finally looks for it in the top-level directory of the disk in drive A. If the file is not found there, C/NIX aborts the operation with a message that the file was not found.

Wildcards. C/NIX supports the use of wildcards in filenames, and these are fully expanded by the command interpreter. As with CP/M, the character ? will match any character in a filename. Likewise, the character * will match any character string in a filename, but unlike its use in CP/M, if * is used at the end of the name or extension part of a filename, it is equivalent to a string of ?s.

C/NIX commands

The available C/NIX commands are shown in Table 1. In the command statements, optional flags are shown in square brackets, alternatives are separated by vertical bars, and ellipses (. . .) are used to represent lists of files or parameters.

While the function of most of these commands is either self-evident or is the same as that of the corresponding UNIX command, there are a few differences from UNIX usage that are worthy of note.

The **cat** command, when used alone, asks for user input from the console. The input is terminated by entering control-Z. When used to concatenate files, the hyphen, -, stands for console input. Thus the following construction is possible:

```
cat file1 - file2 > outfile.
```

This command string will create outfile and write file1 to it. Then the command processor will append whatever is input from the console to outfile until a control-Z is encountered, after which it will append file2 to outfile and terminate.

The **chmod** command is used to set

C/NIX-80

Continued from page 99

a file or files to read-only status, **-w**, or read/write status, **+w**. In addition it permits you to mark a file as system, **+s**, or nonsystem, **-s**. Files marked as system files are not displayed when the short form, **ls**, of the directory command is used. They are displayed, however, when the long form, **ls -l**, is used.

The **-v** flag in the subshell command, **csh**, causes each command from the invoked command file to be echoed to the console before it is executed.

When using the **era** command to erase files, the **-f** flag generates a query on the console before each file is erased.

Finally, the **mkrel** command is unique to C/NIX. Its syntax is

```
mkrel file100 file200 file.pre.
```

The parameters, file100 and file200, are identical machine language files except for the fact that the first is origined at 100H and the second at 200H.

The result of executing the **mkrel** command string shown above is to produce a relocatable version, **file.pre**, of the program in file100 that will load and execute immediately above **cnix.com**. As a result, when **file.pre** has finished executing, **cnix.com** does not have to be reloaded.

Additional features

In addition to the basic C/NIX as decribed above, the distribution disk contains the source code, written in C, for a number of library functions that will be useful to C programmers. These include the following:

bdos	— a C interface to BDOS
getc	— buffered character input
fopen	— buffered file open and close
main	— hidden main to interface to C/NIX
malloc	— dynamic memory allocate and release
putc	— buffered character output
strutils	— standard string utilities

All of these functions use the calling conventions of the Software Toolworks C/80 C compiler. In part, they replace the library functions already supplied with it by alternative versions that interface more readily with C/NIX.

Documentation

The documentation supplied with C/NIX-80 consists of a 41-page, 8½ by 11″ offset manual best decribed as terse but adequate. The manual is organized (without an index) in the same format as UNIX manual pages, so that for each C/NIX command you find the usual name, synopsis, description, notes, see-also, and bugs sections.

Actually, all the information that you need to know about C/NIX is in the manual, but it can be devilishly difficult to dig out. Worse, some knowledge of the UNIX command language and structure is almost essential to make effective use of the manual. For those without such background, an introductory UNIX reference text such as *A User Guide to the UNIX System* by Thomas and Yates (Osborne/McGraw-Hill), is essential.

C/NIX supports the use of wildcards in filenames.

Problems

C/NIX-80 operates precisely as decribed in the manual, and support and nominally priced updates are promised by C/Craft for six months after the package is purchased. The bugs sections of the manual pages are quite honest about limitations of the present version of C/NIX.

Most of the limitations are not very serious, but a few are inconvenient. One of the most bothersome is the fact that the copy and move commands, **cp** and **mv**, fail if a file of the same name exists in the target directory. It would be very helpful if you had the option to overwrite existing files if desired.

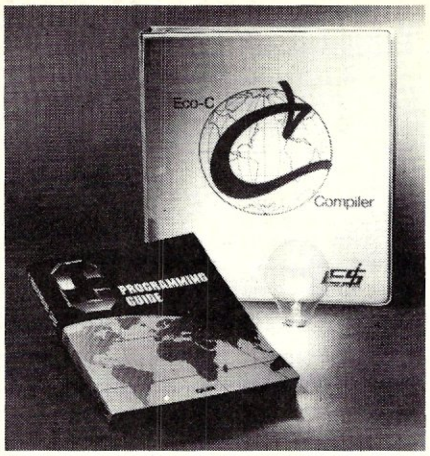
The UNIX link command, **ln**, is not implemented in C/NIX and is sorely missed, since it affords the capability to maintain a single copy of a file and reference it from several directories, thereby conserving disk space.

It would also be helpful if a user-defined path search capability was available for all applicable C/NIX commands, rather than the present inflexible path search provided only with shell files.

Strangely, and unlike most UNIX implementations, the line printer is not

Table 1. Summary of C/NIX commands

Command syntax		Command function
bye	—	leave the C/NIX shell (exit)
cat file1 file2. . . > outfile	—	Concatenate text files
cat < (. . .)	—	Output text in parens
chdir	—	Change to top-level directory
chdir dir	—	Change to a new directory
chmod [+w|−w|+s|−s] file1. . .	—	Change "mode" of files
cd	—	Change to top-level directory
cd dir	—	Change to a new directory
cp filefrom fileto	—	Copy a file
cp file1 file2. . .dir	—	Copy files to new directory
csh [−v] cmndfile param'. . .	—	Invoke subshell on command file
dir [−l] pattern1 pattern2. . .	—	List directories
dir [−l]	—	List current directory
echo param1 param2. . .	—	Echo parameters to console
era [−f] file1 file2. . .	—	Erase files
exit	—	Exit the C/NIX shell
grep "pattern" file1	—	Search files for a pattern
grep "pattern"	—	Search console input for a pattern
help topic1 topic2. . .	—	Display help information
help	—	Display list of help topics
ls [−l] pattern1 pattern	—	List directories
ls [−l]	—	List current directory
man topic1 topic2	—	Display pages from manual
man	—	Display list of manual pages
mkdir dir1 dir2. . .	—	Make directories
mkrel file100 file200 file.pre	—	Make page-relocatable program
mv oldname newname	—	Move/rename file
mv file1 file2. . .dir	—	Move files to new directory
pwd	—	Print pathname of working directory
ren oldname newname	—	Rename a file
rm [−f] file1 file2. . .	—	Remove files
rmdir dir1 dir2. . .	—	Remove directories
type file file2. . .	—	Type text files



C/NIX-80

Continued from page 101

known to C/NIX so that, for example, you can't use a command like **cat file > lst**, where **lst** is the line printer. However, control-P works as in CP/M to echo the console screen to the printer so that you can work around the absence of a **lst** device.

Summary

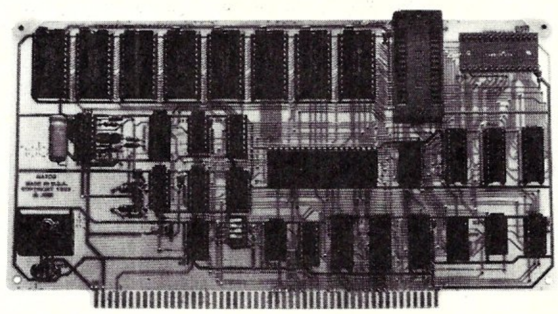
C/NIX-80 provides many UNIX-like capabilities for 8-bit systems with CP/M-80. It works as represented, takes up little space in RAM, and contributes new capabilities to the CP/M environment. In addition, C/NIX has an educational value in providing a useful introduction to many of the more common features of UNIX. At its present price, it is an outstanding value.

Prices: C/NIX-80, $65; manual only, $20.

Available from:
C/Craft
22 Downing Rd.
Lexington, MA 02173

CIRCLE 303 ON READER SERVICE CARD

Robert A. Langevin, 7621 Fontaine St., Potomac, MD 20854



ANNOUNCING *CREATIVE COMPUTING's* 1984

BUYER'S GUIDE

TO PERSONAL COMPUTERS & PERIPHERALS

ADVICE YOU CAN TRUST ON SELECTING PERSONAL COMPUTERS, PERIPHERALS AND ELECTRONIC GAMES

Unless you have the memory of a computer there's no way you can keep track of all the games, programs and peripherals available for your computer. And even if you could, you'd still have a problem figuring out what's best for your needs and how to get the most for your money.

That's why you need the *1984 Buyer's Guide to Personal Computers & Peripherals.* It's a comprehensive collection of product reviews and consumer-oriented shopping advice put together by the experts at *Creative Computing* magazine.

You'll get a rundown of what's new on the market. Analysis of new product performance, reliability, operation, applications, cost—even what kind of repair service you can expect. Easy-to-understand comparisons between different models. Tips on bugs and design problems. Plus "inside" information you won't get from manuals or sales people.

Plug into the *1984 Buyer's Guide to Personal Computers & Peripherals* and find out what's hot in...

- ☐ Personal computers
- ☐ Pocket-sized computers
- ☐ Telecomputers
- ☐ Disk drives
- ☐ Memory expanders
- ☐ Word processors
- ☐ Dot matrix printers
- ☐ Electronic games
- ☐ Video game cartridges
- ☐ Joysticks and paddles
- ☐ Game port extenders
- ☐ Color graphics boards
- ☐ Speech synthesizers
- ☐ Do-it-yourself kits
- ☐ And more

You may even discover that you need *less* equipment than you think. The *1984 Buyer's Guide to Personal Computers & Peripherals* helps you avoid overbuying by showing you how to customize your current system.

What else does the *1984 Buyer's Guide to Personal Computers & Peripherals* give you? Book reviews, glossaries of new terms, evaluations of batteries for electronic games and calculators, and lots of other useful information.

Don't buy until you've consulted the *1984 Buyer's Guide to Personal Computers & Peripherals!* Order your copy today.

Send to: **Creative Computing Buyer's Guide** NS1F
CN 1914, Morristown, NJ 07960

Yes! Please rush me Creative Computing's *1984 Buyer's Guide to Personal Computers & Peripherals.* Enclosed is my check or money order for $3.95 plus $1 for postage and handling.

Mr./Mrs./Ms.____________________
(please print)

Address____________________

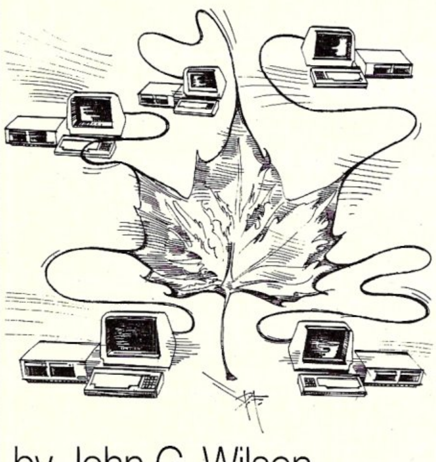
City____________________

State__________ Zip__________

Please make check payable to Creative Computing Buyer's Guide. CA, NJ and NY State residents please add applicable sales tax. Price outside U.S.A. is $6.

The *WATSTAR Network

Network or file server? One implementation provides an answer



by John G. Wilson

*WATSTAR? Low technology? Aren't there enough networks around already? Yes, all those questions and more can well be raised. "Network" has now become the umbrella buzzword under which systems companies can sell substantial amounts of hardware, and the suggestion that networking is close to motherhood and apple pie is undoubtedly part of the selling pressure. However, for the end user, the real question is, "What facilities does the network give me?" As always, the design of the system is the critical item. The hardware—that profitable hardware—is only the vehicle; the basic design decides what user facilities are available, and the software, which implements the design, makes it fly.

What, then, makes *WATSTAR different? *WATSTAR is a system designed at a university and is not currently on the marketplace, although that may come to pass. It's a network that provides suitable facilities for teaching support in a way that is not available anywhere on the microcomputer market. A low-technology system that keeps its costs down by using off-the-shelf 8-bit hardware, *WATSTAR has gone out of its way to keep its design straightforward. It concentrates on the prime directive of providing a shared disk system, and has no superfluous "gold plating." Finally, *WATSTAR continues to astound our visitors with its performance: it has been running 24 hours a day, seven days a week for more than six consecutive academic terms.

So let's open up the package and see what we have. *WATSTAR's name and logo are derived from its place of origin, the University of Waterloo, Canada, and the fact that it is a star network. The need that led to its conception was a shortage of adequate computing resources for first-year classes. This may be hard to believe on a campus where the central facility consists of four IBM 4341s. However, in every new class, some 1800 freshmen enter programming courses that require the completion of 10 computing assignments in 12 weeks. This amounts to a time allocation of 108,000 student terminal hours—without even considering the needs of upper classmen and the graduate and research community. The central facility is overworked, and the available resources have never kept up with the demand. This has created an environment receptive to the development of any alternate system that can pick up some of the load imposed by computing assignments.

*WATSTAR was designed and developed by the Faculty of Engineering, whose earliest microcomputer experience was acquired on SOL20s. The *WATSTAR objective was to use network technology to create a shared disk system. The software resources were to be off-the-shelf CP/M packages. Two years later the results, and the experience of six consecutive academic terms, have exceeded all our expectations. The original *WATSTAR installation now contains 30 stations available to users—25 of which have XCEL graphics boards—and is currently supporting over 200 user accounts. During the term all stations are normally in use for hours on end with a typical work pattern of edit, compile and link. The worst-case performance with all stations working still seems to be at least three times better than a floppy disk.

Why did we have to design our own system when networks were available on the market? Quite simply because none of them, then or now, provides facilities for each of many users to have private space on the central disk. This is not an unusual requirement for a system in which many people need access through a limited number of gateways. All the big mainframe systems and many of the minicomputers have this capability in at least one of their available operating systems. However, nowhere in the world of micros does it appear to exist! And yet without it, educational networks are awkward and tend to assume that the user carries a private floppy disk around. When multiple users have private space on disk, a network suddenly becomes a versatile general-purpose public facility—one whose usefulness is not restricted to the educational environment.

The remaining parameters are capacity and performance. The first is provided by the current central host, a Memorex 214 (Fujitsu 2312) 84 MB SMD disk. The original development work was done on a CDC 9448. The Memorex unit is an 8″ Winchester hard disk with a 20 msec access time, and represents the leading edge of current off-the-shelf technology. The second parameter is provided by the use of COMPUSTAR network protocol and stations. This permits a 200 K/sec packet transfer rate on the network bus. Finally, the central operating system, or file server, manages a neat and compact cache system that reduces the disk accesses by a factor of four.

What makes our network achieve such a satisfactory performance using normal components from the low-technology 8-bit world? It is a straightforward, clean design that works well all the time. It proves that a 4 MHz Z80 is no slouch; far from being superseded by 16-bit CPUs, the Z80 and CP/M seem destined to become the PDP-8 of this technological generation.

With *WATSTAR any station may generate a request to become temporary bus master for one round of packet communications.

The physical *WATSTAR system consists of the packaged disk subsystem, usually a 5″ x 19″ rack-mounted box, and five boards in an S-100 mainframe. These boards are uncomplicated. They comprise an AMD SuperQuad single-board computer, a KONAN SMC100 disk controller, a clock/calendar board, and our own S-100 network controller board, which supplies the network bus protocol and RS422 drivers. These are all hosted in a CCS2200 mainframe, one of the nicest examples of bent metal engineering around.

The network protocol is unchanged from COMPUSTAR, which is a token-passing polling system. However, the token is an implicit one, being passed either by timeout or by release on task completion. The system should not be thought of as having a full network capability, since it is not possible for the central system to initiate communication to any station. It is best thought of as a shared disk system where any station may generate a request to become temporary bus master for one round of packet communications. The advantage of a token-passing system compared to a collision detection or avoidance system (CSMA/CD) is that network response time depends only on the average disk access load. In any CSMA/CD environment, especially where an indefinite number of retries is permitted, this process adds an indeterminate amount of time to the delay due to disk access.

The central network controller board is a neat and effective design which provides for IEEE-696 signals on one side and for the data and control lines and the drivers required in a COMPUSTAR network on the other. COMPUSTAR is a multiconductor, full duplex, byte parallel, RS422 network. The controller has a 1K on-board buffer, whose address is jumper selectable, and a control port. The board generates PHANTOM whenever the buffer is addressed, which enables it to be treated as a normal part of the host memory from the S-100 side.

The stations are standard Intertec VPUs and the station interface is the standard chaining adapter board which comes with a VPU. These make the network look like two parallel ports to the station network drivers. Each station is encoded on the board and no two stations may have the same code. The central polling loop goes to each station in sequence, putting an encoded query on the bus. If the station does not acknowledge, the query times out and the polling moves on to the next station. If a station does have a software request pending, this bit completes the technical protocol which then makes the station temporary bus master.

The station now makes a block transfer of one packet to the output port. Because the station is bus master, this transfer moves the byte stream directly into the central controller's buffer from the network side. When this is complete, the central software examines the packet header, which is now in its own address space, and dispatches whatever task is called for. The results are sent back to the station by the same procedures in reverse. The station then releases the bus, and the polling loop picks up again.

The software design is best reviewed from the station end first. The key to any user being able to access the appropriate logical disk area is to get the correct disk parameter blocks into the station BIOS. This is all done by the sign-on utility, which the user talks to after power up or reset. Once the user ID and password have been validated, the DPBs are obtained from the system record area and linked in, at which point CP/M initialization is completed and the user sees a normal prompt. A standard CP/M system with four disks is then available to the user, with these four logical disks being partitions on the central host.

All disk space is allocated to groups of users who may number one or more in size. A major system utility permits group, user, or station space to be allocated, modified or withdrawn dynamically at any time. Each user has access to four primary logical disks: A, which is private; B, which is group common

*WATSTAR

Continued from page 105

and is read only to all except the master account of the group; C, which is scratch space for the duration of the logon period only; and D, which is the public common space and is read only to all except the system master account. A and C are the only disks with write permission. D normally contains the system library of resource software. Any group may have up to 99 users, and this is the normal basis for allocating space to a section of an academic course or to any smaller group of users.

Part of the disk is set aside as the system record area, and the overall system configuration and structure is contained in this hierarchy of records, which do not, themselves, occupy more than 400K. The current system configuration at any time can thus be saved on a floppy disk and contained in a few files. Record blocks are kept for each user, each group, and each station.

Other records contain system parameters, space allocation records, and a group directory. The remaining system space contains the central operating system, the various station operating systems for different types of machine, and the boot, sign-on and copy programs. All disk operations are controlled through access codes. This helps to prevent casual reads or writes in the system record area, which is normally only accessed at sign-on or logoff time. Once the required parameters have been obtained, the station operating system has all the information it needs to access the user's disk space directly using the normal CP/M functions.

The central operating system can be described as a file server, but a more accurate description is that of a function dispatch mechanism. It is a stand-alone system and does not need the presence of any general-purpose system such as CP/M. The primitive nucleus resides in EPROM. As soon as a central reset or power up takes place, the EPROM program relocates itself to RAM and reconfigures the board to all RAM. This nucleus contains the disk drivers, the network drivers and the station polling mechanism. In this configuration, any write operation, such as formatting, can take place; however, whenever the first read demand is made from the network, the full central operating system is booted off the disk and commences execution in the central CPU. The system now contains the print spool mechanism and the caching system, and permits the full range of function operations.

***WATSTAR is a straightforward, clean design: it works well and proves the 4 MHz Z80 is no slouch.**

A special disk area is set aside as the print spool space. Whenever any material is sent to the CP/M list device from any station, it is stored in this print spool space. When the user is ready for actual hard copy, a system utility called PRINT is run. This causes all the material stored for the station to be sent to the printer. The output buffer is serviced by interrupts but not on a character-by-character basis, which would be an excessive overhead. The printer is a parallel device run from a Zilog PIO. Each time the handler is entered, the next buffer is literally stuffed down the line until a control character is encountered which will cause mechanical action in the printer. At this point, the control character is sent, interrupts are re-enabled, and the handler exited.

DEC afficionados will recognize the mechanism, but it is not as simple as it sounds in the Zilog world, since the PIO does not seem to have been de-

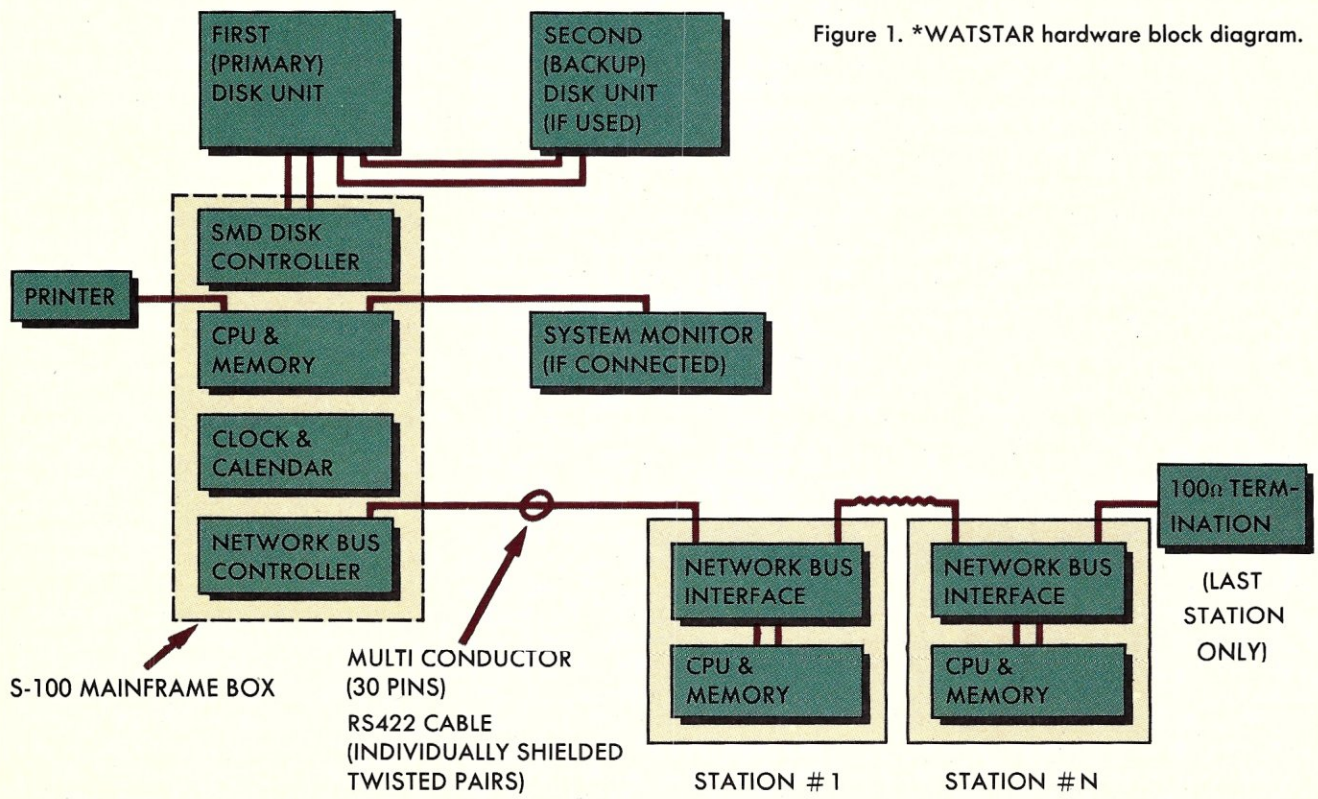


Figure 1. *WATSTAR hardware block diagram.

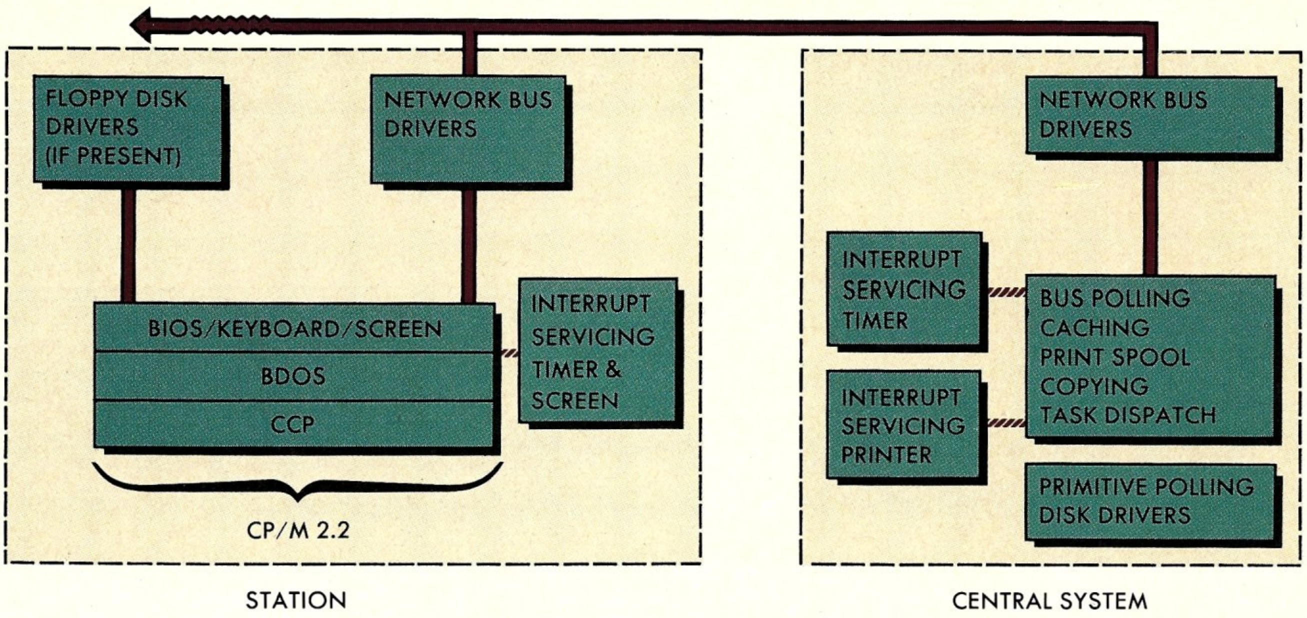


Figure 2. *WATSTAR system block diagram.

signed with this in mind! However, it does work and is the key to permitting disk operations to interleave efficiently with print output in the central system. The alternative would be the additional cost of a dedicated print output station. The printer in the current system is a Printronix 300; a machine of this quality is necessary for such heavy-duty usage (close to 3000 pages per day). Our only regret is that it is not a model 600.

The cache system has proved to be the most significant contribution to system throughput. Network descriptions often give great emphasis to the packet transfer rates in a given system. Our experience is that it is meaningless to compare these numbers if the packet transfer time is small compared with the key limiting factor—the disk access time. *WATSTAR, for example, has a 200 K/sec transfer rate on the network and a 20 msec disk access time, almost a 1:10 ratio. In simple terms, if the network drivers are sitting around waiting most of the time, there is no point in the network going any faster, and it will not degrade the performance if it goes slower.

Caching, on the other hand, positively reduces the number of disk accesses. The principle is quite straightforward: whenever a demand is made for disk access, the cached records are searched first. If the sector is in cache, which is an organized set of buffers in memory, then the demand is met from memory without any disk access. If not, then once the required sector has been accessed, as many contiguous sectors as possible are read in at the same time.

This number depends on the amount of memory available and the number of stations. It makes sense to try to bring in a complete allocating block, since CP/M space organization makes sectors contiguous within allocation blocks. However, the fundamental purpose is to read as much as possible without a fresh seek. When this is done, the additional sectors are stored in the cache area in anticipation and the requested sector is sent out.

Available networks did not provide private space for many users on the central disk.

Once again, this is not as simple as it sounds, but the basic principle is clear and achievable. The benefit is that any reduction in the number of accesses is a corresponding improvement in throughput. This, to the user, is the system's perceived performance. In *WATSTAR, using only 64K memory in the central system and no clever bank-switching games, it was possible to realise a four-time improvement in throughput. This made it possible to support 25 stations in heavy usage with a satisfactory response time.

To summarize, *WATSTAR is a network system that can be used as a plug-in replacement for the central component of a COMPUSTAR system, or as a fresh system where the network stations and cabling are standard COMPUSTAR. Its central operating system provides a multiple-account, multiuser, password-protected environment where each station sees a single-user CP/M 2.2 system. The disk and directory sizes for all accounts are selected dynamically at set-up time and are only subject to the limitations of CP/M. The central system permits additional disk units to be added to extend the primary capacity and/or to provide low-cost on-line archiving. Many more stations can be added, theoretically up to 255; performance does not depend upon this factor and is only degraded by the concurrent network I/O demand. This is probably true of most networks.

Installation is a friendly and proven procedure using stand-alone, automatic utilities to take the supervisor of the new system up to the stage of having one account and one station on line. At this point, the normal space management utility is used to set up whatever further accounts and stations are planned. The system permits any CP/M packages to be loaded through a floppy disk gateway. Any package configured for a SuperBrain will run in a VPU, and installation changes are only needed to reflect the logical disks available.

ANNOUNCING

A LIBRARY OF SOFTWARE PROGRAMS FOR **APPLE II & IIe** COMPUTERS

A+DISK MAGAZINE

Now you can build a library of programs for your Apple™ at a fraction of the usual cost

Each issue of A+ Disk Magazine provides you with up to 10 programs for as little as $2.00 each.

A+ DISK MAGAZINE is making it easier than ever before to build a library of computer software for your Apple II series microcomputer. Because now you can save 34% on the programs you need to expand the use of your personal computer. Issue after issue, **A+ DISK MAGAZINE** gives you business and finance aids, utilities, subroutines, games, home and personal applications... all for as little as $2 per program.

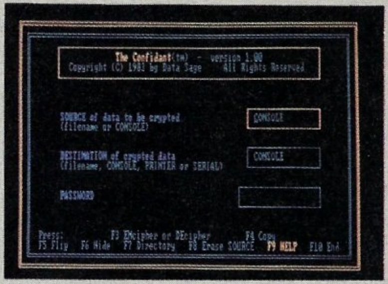
And when you consider that many of today's most popular programs sell for $50, $60, $80 and more, your savings can be *enormous*... much more than the cost of your subscription to **A+ DISK MAGAZINE.**

Along with your subscription to **A+ DISK MAGAZINE**, you'll receive

up to 10 thoroughly-tested, ready-to-run programs and files on a floppy disk. Complete with comprehensive, illustrated User Manual, **A+ DISK MAGAZINE** is easy, efficient, and very economical.

Here's just a sampling of what you can expect in every issue:

Programming tools: Create cross-reference listings for your

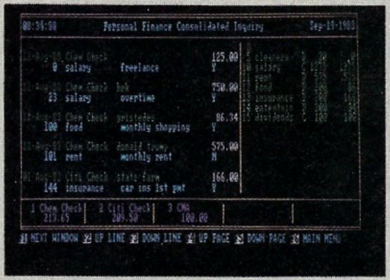


BASIC programs. Use your text editor on your BASIC programs. Convert data between BASIC and VISICALC® formats.

Business and finance aids: Compute loan payment tables. Calculate the Present Value and Internal Rate of Return for your investments. VISICALC templates for Real Estate, Lease/Purchase and Tax Shelter analysis. Create advanced pie, bar and line chart graphics.

Home/personal applications: Whether you need your own income tax return helper… a personal cash flow analyzer… a speed reading trainer… proven ways to maintain a mailing list… or SAT test preparation aids, **A+ DISK MAGAZINE** has it all.

Utilities and diagnostics: **A+ DISK MAGAZINE** shows you



how to use your Apple to simulate a conversational terminal with control of disk or printer logging… print graphics, screen images on your printer… backup, copy, delete, un-delete or type files with simple menu commands… plus more.

Data files: From tax tables, to population statistics, from dictionaries to economic times series, **A+ DISK MAGAZINE** involves you as never before.

Games: Adventures! Strategies! Test your skill, intelligence and luck.

The latest software developments at your fingertips for a fraction of the cost.

There's no need to type listings into your computer. With **A+ DISK MAGAZINE**, all you do is boot the disk and go! The accompanying User Manual explains everything in clear, easy-to-understand terms. So you'll be able to run the programs as soon as you receive your first issue of **A+ DISK MAGAZINE**.

Program Submissions

If you wish to submit a program for inclusion in future issues, please write to: **A+ DISK MAGAZINE**, Author Submissions, One Park Avenue, New York, N.Y. 10016.

Guarantee

- All programs are fully tested and guaranteed to run. Damaged or faulty disks will be replaced at no charge.
- If you wish to cancel a subscription, simply return the most recent disk in its sealed package and you will receive a full refund for this copy and all unmailed issues.

Product Specifications

Programs will run on Apple II series computers using Apple DOS 3.3 and require a minimum of 48K. Most programs will be written in Applesoft Basic—however some machine language code may be used.

Programs and documentation are copyrighted by Ziff-Davis Publishing Company. All rights of reproduction in all forms and media strictly reserved.

Subscribe to A+Disk Magazine and save up to 34%—$60 off with this Introductory Offer!

A+DISK MAGAZINE

P.O. Box 2469
Boulder, Colorado 80322

YES Please accept my subscription to **A+ DISK MAGAZINE** for:
☐ 1 issue for $29.95
☐ 3 issues for $69. I SAVE $20.00!
☐ 6 issues for $119. I SAVE $60.00!

Name________________

Address________________ 8H179

City__________ State__________ Zip__________

Check one: ☐ Payment enclosed* ☐ Bill me

Charge my*: ☐ American Express ☐ Visa ☐ MasterCard

Credit Card No.__________ Exp. Date__________

*10% discount for cash or credit card orders—U.S. only.

MAIL NO-RISK COUPON TODAY—AND SAVE UP TO 34%!

Canadian and foreign orders shipped via Air Printed Matter only; add $5 per issue and include payment with order in U.S. funds.

*WATSTAR

Continued from page 107

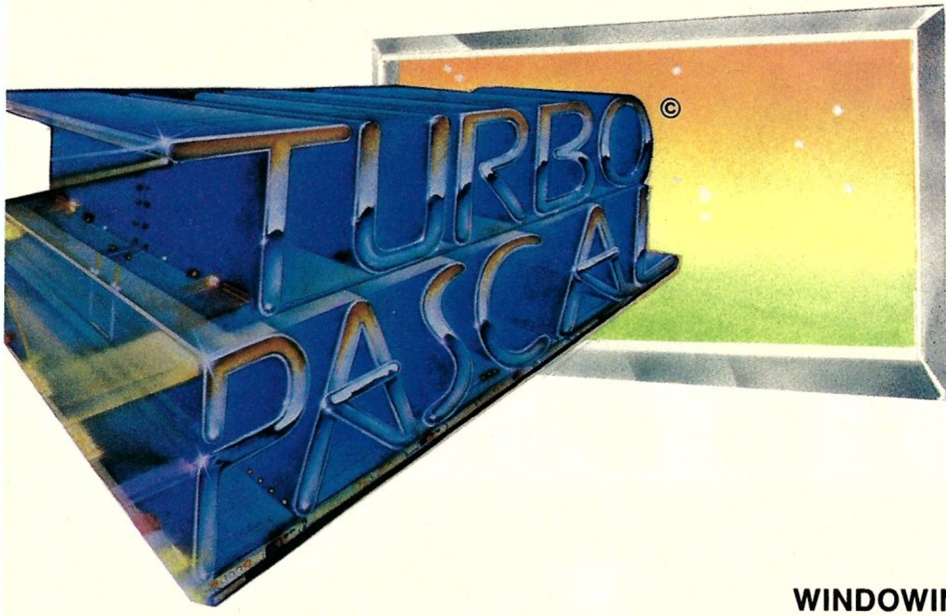
Since this is a university, the work goes on, and we have plans for exploring several new avenues. Some of these are:

- Integrating alien (non-CP/M) stations into the network, starting with the IBM PC.
- Setting up a network that serves only PCs or PC look-likes, but that offers the alternate operating systems as a user-switchable facility.
- Reworking the central operating system to use extended memory through the extended addressing capability of the AMD board. This would permit more extensive caching and greater throughput and allow us to add more stations without unacceptable degradation.
- Reworking the central operating system around one of the 16-bit CPU chips, probably the 10 MHz 80186.
- Discontinuing the use of the expensive RS422 cable and employing 75 ohm coax, which will demand the redesign of the bottom layer of the network and the interface.

John G. Wilson, Faculty of Engineering, University of Waterloo, Waterloo, Ontario, Canada N2L 3GI

ANNOUNCING . . .
VERSION 2.0

EXTENDED PASCAL FOR YOUR IBM PC, PC jr., APPLE CP/M, MSDOS, CP/M 86, CCP/M, OR CP/M 80



NOW . . .
WITH
WINDOWING
$49.95

NEW FEATURES

WINDOWING!

. . . This is a real shocker. On the IBM PC or PC jr. you'll now have a procedure to program windows. . . . Any part of the screen can be selected as a window and all output will automatically go to this part of the screen only. As many windows as you please can be used from the same program.

AUTOMATIC OVERLAYS!

. . . No addresses or memory space to calculate, you simply specify OVERLAY and TURBO PASCAL will do the rest.

GRAPHICS, SOUND AND COLOR SUPPORT

. . . For your IBM PC or JR!

FULL HEAP MANAGEMENT!

. . . via dispose procedure.

OPTIONAL 8087 SUPPORT!

. . . Available for an additional charge.
If you have a 16 bit computer with the 8087 math chip—your number crunching programs will execute up to 10X faster!

"What I think the computer industry is headed for: well documented, standard, plenty of good features, and a reasonable price."
Jerry Pournelle,
Byte, February 1984

"The Perfect Pascal"
Alan R. Miller,
Interface Age, January 1984

If you already own Turbo Pascal version 1.0, you can upgrade to 2.0 for $29.95. Just send in your old master with your check. (Manual update included of course).

ORDER YOUR COPY OF TURBO PASCAL VERSION 2.0 TODAY

For VISA and MasterCard orders call toll free: **1-800-227-2400 x968**
In CA: **1-800-772-2666 x968**

(lines open 24 hrs, 7 days a week)
Dealer & Distributor Inquiries welcome
408-438-8400

CHOOSE ONE (please add $5.00 for shipping and handling for U.S. orders)

_____ Turbo Pascal 2.0 $49.95
_____ Turbo Pascal 2.0 with 8087 support $89.95
_____ Update (1.0 to 2.0) Must be accompanied by the original master $29.95
_____ Update (1.0 to 8087) Must be accompanied by the original master $69.95

Check _____ Money Order _____
VISA _____ MasterCard _____
Card #: _____________________
Exp. date: __________ Shipped UPS

BORLAND
INTERNATIONAL

Borland International
4113 Scotts Valley Drive
Scotts Valley, California 95066
TELEX: 172373

My system is: 8 bit ________ 16 bit ________
Operating System: CP/M 80 ____________
CP/M 86 _____ MS DOS _____ PC DOS _____
Computer: ________ Disk Format: ________
Please be sure model number & format are correct.
NAME: ______________________________
ADDRESS: ______________________________
CITY/STATE/ZIP: ______________________________
TELEPHONE: ______________________________

California residents add 6% sales tax. Outside U.S.A. add $15.00. (If outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars.) Sorry, no C.O.D. or Purchase Orders. A9

Down with Line Numbers

A C preprocessor for Basic

by James L. Shearer

In their well-known benchmark article, "Eratosthenes Revisited," (*Byte*, January 1983, page 283), Jim and Gary Gilbreath observed that programming in C is like driving a small car: "It gets the job done quickly, briefly; it feels zippy and maneuverable." After getting a copy of C/80 (my candidate for the best software buy in America) from The Software Toolworks a few months ago, I've come to appreciate and endorse that opinion. This article presents a C program which illustrates how useful the C language is.

Many of us still program in Basic; probably more than will admit it. But Basic programs are hard to maintain because of the inherently poor structure, the GOTOs and GOSUBs, and the remarks and white space that slow performance and use up memory. Moreover, the incessant line numbers clutter up the code and are a pain to type.

The preprocessor shown in Listing 3 overcomes most of these shortcomings. The Basic source program can be written without line numbers, using your favorite text editor. Alphanumeric labels are used for GOTO, GOSUB, and other branching statements. Listing 1 shows a simple program written in this fashion. The preprocessor strips away REM statements and unnecessary white space, then inserts the line numbers, substituting the appropriate ones for labels, and produces compact, interpreter-readable code (see Listing 2).

The syntactical requirements for this preprocessor are few. The Basic code (MBasic in this case) must have correct syntax according to the requirements of the language; the preprocessor in the simplified form presented here does no syntax checking. Line numbers may *not* be used. Where GOTO, GOSUB and other branching statements indicate the need for a line number, replace it with a label named in a manner to help clarify your code. The labels are eight-character strings whose first character must be the at-sign, @, and whose subsequent characters may be letters, numerals, or periods. Examples:

Acceptable	Unacceptable
@PRINT.1	@WRITE#4 (# is illegal char)
@EXIT	EXIT.6 (no leading @)
@age.sr	@POSITION.35 (too long)

Actually, labels longer than eight characters are allowed; but only the first eight characters are recognized. If that imposes any serious hardship, the dimensions of the label array and the other eight-character limitations can easily be changed.

Looking at the main program in Listing 3, you will see that the preprocessor passes the source program file twice. On the first pass, it counts lines (by 10), skipping any REM or blank lines, searches for labels at the start of the line storing those labels in the array **label[ ]**, and stores the associated line numbers in array **lineno[ ]**.

On the second pass, the lines are read, REM lines and blank lines are skipped, line numbers are written to the output file, labels are replaced by the appropriate line numbers, and the text of the line is then written to the output file. The workhorse of this pass is the function **writeln.**

The functions **isalpha**, **isdigit**, **strcpy**, etc., are standard library functions contained in the file **stdlib.c** that comes with C/80 (version 3). Those functions are probably included with most C compilers. In any event, they are simple functions that can be written as part of the preprocessor program.

So how is the preprocessor used? Write the MBasic "source" program as described above, being sure *not* to use

The Basic source program can be written without line numbers.

line numbers. Use plenty of white space and remarks. They won't slow your program. Save your program using an extension such as .SRC or .PRE (anything but .BAS). Suppose your program is named SAMPLE.PRE. Run the preprocessor by typing

```
MBPRE SAMPLE.PRE SAMPLE.BAS
```

when the > prompt appears. Your source file SAMPLE.PRE will be read, the labels will be converted, REM and spaces eliminated, and the resulting MBasic program will be written to SAMPLE.BAS. The program file SAMPLE.BAS can now be run like any other MBasic program.

Listing 1

```
REM    Test for MBASIC preprocessor
REM    110383

        A=2:B=3.14159
@START  PRINT:PRINT:PRINT
        PRINT "MBASIC arithmetic with A = 2,  B = pi."
        PRINT
        PRINT "Enter 1 for A*B"
        PRINT "      2 for A/B"
        PRINT "      3 for A+B"
        PRINT "      0 to quit"
        INPUT "Your choice";C
          IF C=0 THEN @EOJ

        ON C GOSUB @MULT, @DIV.2, @ADD
        GOTO @START

@MULT   PRINT A*B
          RETURN

@DIV.2  PRINT A/B
          RETURN

@ADD    PRINT A+B
          RETURN


@EOJ    END
```

Listing 2

```
10 A=2:B=3.14159
20 PRINT:PRINT:PRINT
30 PRINT "MBASIC arithmetic with A = 2,  B = pi."
40 PRINT
50 PRINT "Enter 1 for A*B"
60 PRINT "      2 for A/B"
70 PRINT "      3 for A+B"
80 PRINT "      0 to quit"
90 INPUT "Your choice";C
100 IF C=0 THEN 190
110 ON C GOSUB 130 , 150 , 170
120 GOTO 20
130 PRINT A*B
140 RETURN
150 PRINT A/B
160 RETURN
170 PRINT A+B
180 RETURN
190 END
```

Listing 3

```
/* mbpre.c
** MBASIC pre-processor
**    James L. Shearer
**    210 West Maumee St. - Suite 2
**    Angola, IN  46703
**    (219) 665-7673
*/

#include "printf.c"
#define NULL 0
#define EOF -1
#define MAXLEN 255                          /* Max line len   */
#define MAXLBL 500                          /* Room for 500 labels */

char label[9*MAXLBL];                       /* arrays for labels */
int labelno[MAXLBL];                        /* and their line nmbrs */
static int lblcnt = 0;

main (argc, argv)
int argc;
char *argv[];
{
        int len;
```

LINE NUMBERS

Continued from page 113

The preprocessor shown in Listing 3 is a stripped-down model. You can add to it to your heart's content. If you are using a Basic other than MBasic, you may need to modify this program. My preference is baZic, a North Star look-alike from Micro Mike's, Inc., of Amarillo, Texas. Numbers are coded in BCD so that round-off errors are eliminated, multiline functions are implemented, and the interpreter is coded in Z80 rather than 8080. However, baZic suffers from the shortcomings of North Star Basic—notably, the inability to use long variable names. To overcome that, I have modified the preprocessor shown here to convert long variable names into the letter-digit format required by that interpreter.

Price: C/80, $49.95; add $2 shipping for $5^1/_4$" format, $3 for 8". C/80 Mathpack extension package, $29.95.

The Software Toolworks, *15233 Ventura Blvd., Suite 1118, Sherman Oaks, CA 91403; (818) 986-4885.*

James L. Shearer, 210 W. Maumee St., Suite #2, Angola, IN 46703

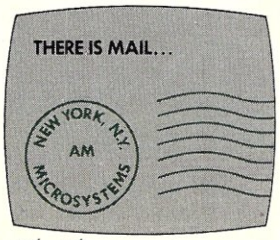
```
    static int f1, f2;
    char line[MAXLEN];
    char word[MAXLEN];
    static int lineno = 0;

    if (argc != 3)
    {
        printf("Usage:  mbpre d:srcfile.ext d:outfile.ext \n");
        exit();
    }
    f1 = file(argv[1]);

/******************************************************************
* First pass. Assign line nos, build label table, drop REM lines *
******************************************************************/

    while((len = getln(line, MAXLEN, f1)) > 0)
    {
        getwrd(word,line);
        if (len > 1 && strcmp(word,"REM"))
        {
            lineno = lineno + 10;
            if (*line == '@')
                bldlabel(line,lineno);
        }
    }

    fclose(f1);
    f1 = file(argv[1]);
    if ((f2 = fopen(argv[2],"w")) == 0)
        printf("Can't open: %s\n",argv[2]);

    lineno = 0;

/******************************************************************
* Second pass. Replace labels with line nos, squeeze out unnec- *
```

LINE NUMBERS

Continued from page 114

```
* essary white space, write statement lines with nos to outfile *
*****************************************************************/

    while((len = getln(line, MAXLEN, f1)) > 0)
    {
        getwrd(word,line);
        if (len > 1 && strcmp(word,"REM"))
        {
            lineno = lineno + 10;
            writeln(line,lineno,f2);
        }
    }
    eoj(f2);
}

file(fname)     /* Open file fname for binary read.  Return file */
char *fname;    /* number. Print error message if no file        */
{
    int i;
    i = fopen(fname,"r");
    if (i > 0)
        return i;
    else
    {
        printf("Can't open: %s\n",fname);
        exit();
    }
}

getln(s, lim, f1)               /* Reads line from file f1 to s */
int lim, f1;                    /* Returns line len (0 if EOF)  */
char s[];
{
    int c, i;

    i = 0;
    do (c=getc(f1));            /* pass white space */
        while(isspace(c));
    if (c != EOF && c != '\n')
    {
        s[i++] = c;
        while(--lim > 0 && (c=getc(f1)) != EOF && c != '\n')
            s[i++] = c;
    }
    if (c == '\n')
        s[i++] = c;
    s[i] = '\0';
    return(i);
}

bldlabel(s,n)                   /* Put label from line s and line */
char *s;                        /* number n into arrays.          */
int n;
{
    if (lblcnt <= MAXLBL);
    {
        wrdcpy(label+9*lblcnt,s);
          label[9*lblcnt+8] = '\0';     /* limit label to 8 char */
        labelno[lblcnt] = n;
        lblcnt = lblcnt + 1;

    }
}

writeln(s,n,f2)    /* Write line s to outfile f2 inserting line */
int f2, n;         /* number n.  Also replace internal labels   */
char s[];          /* with appropriate line numbers.            */
{
    int i, j;
    char t[MAXLEN];

    i = 0;
    if (s[i] == '@')                        /* label if 1st char @ */
    {
        while(s[i++] != ' ')            /* pass it */
```

```
			;
		while(isspace(s[i]))		/* and white space */
			++i;
	}
	fprintf(f2,"%d ",n);			/* write line number */
	while(s[i] != '\n')
	{
		if (s[i] == '"')			/* check for quotes */
		{
			putc(s[i],f2);		/* write first " */
			while(s[++i] != '"')	/* and all in between */
				putc(s[i],f2);
			putc(s[i++],f2);	/* then ending " */
		}
		else if (s[i] == '@')		/* check for label */
		{
			getwrd(t,&s[i]);	/* get label into t */
			i = i + strlen(t);	/* move ptr past label */
			t[8] = '\0';		/* only 8 char signif */
			for (j = 0; j <= lblcnt; j++)
				if (strcmp(t,label+9*j) == 0)
				{		/* write line # if match */
					fprintf(f2,"%d ",labelno[j]);
					break;
				}
			if (j > lblcnt     )	/* no match */
			{
				printf("\n##### No match for label ");
				printf("%s on line %d\n",t,n);
				fprintf(f2,"?%s?",t);
			}
		}
		else
			putc(s[i++],f2);		/* 'regular' character */
	}
	putc(s[i],f2);				/* end-of-line char(s) */
}

getwrd(t,s)		/* Get next word from s, put it in t.	*/
char s[],t[];		/* For our purposes, words start with @	*/
{			/* or alpha and then alpha, digits, embed */
	int i, j;	/* '.' and optional final type char.	*/

	i = 0;
	if (s[i] == '@' || isalpha(s[i]))
	{
		++i;
		while(isalpha(s[i]) || isdigit(s[i]) || s[i] == '.')
			i++;
		if (s[i]=='%' || s[i]=='!' || s[i]=='#' || s[i]=='$')
			i++;
	}
	for (j = 0; j <= i; j++)
		t[j] = s[j];
	t[i] = '\0';
}

wrdcpy(s,t)	/* copy next word (see getwrd) from t to s */
char *s, *t;
{
	while (isalpha(*t) || isdigit(*t) || *t == '@' || *t == '.')
	{
		*s = *t;
		s++;
		t++;
	}
}

eoj(f2)
int f2;
{
	int j;
	fclose(f2);
	for (j = 0; j <= lblcnt; ++j)
		printf("\n%4d %10s",labelno[j],label+9*j);
	printf("\n");
	exit();
}

#include "stdlib.c"
```



Letters to the Editor

This month... A SAL/80 rebuttal, more on file transfer systems, and a note from paraGraphics

Dear Mr. Terry,

I'd like a chance to respond to Mike Barker's review of our SAL/80 package (March 1984). First, I should say that we *have* changed the license contract to state *explicitly* that no royalties are required on programs written with the SAL/80 compiler package. We had assumed that such a statement would be redundant, *since there is no runtime package to charge royalties on!* But the fact that the question has arisen shows that assumption to have been in error.

I really do not want to write one of those endless line-by-line rebuttals of all those points upon which I take issue with the reviewer. On the other hand, since more than 800 readers of *Microsystems* have requested information about SAL/80 either by letter, phone or bingo card, here is some more information about the package.

"SAL/80 is a package of macros that claims to be a compiler implementing a new language of the same name." A more accurate description would be that it converts the DRI macro assemblers into *structured* macro assemblers. It is sometimes convenient to refer to this combination as a compiler.

What distinguishes SAL/80 from other structured assemblers is the size and scope of the package. Where other structured assemblers are content to provide an IF-ELSE and one or two LOOP constructs, SAL/80 also provides a SELECT/CASE, five flavors of LOOP, a fairly complete set of console I/O primitives, and OPTIMIZES the test/branch code emitted by the control-statements. This optimization means a saving of two (Z80) or three (8085) bytes in about a third of the branches generated.

The manual is large (235 pages), and considerable effort has been expended to make the contents accessible as a reference. In addition to the 3-page table of contents there is a $5\frac{1}{2}$-page subject index. The compiler source (which is given in Appendix A) has its own table of contents and index.

Chapter 1 (45 pages) covers the syntax and semantics of the various constructs of the "language," with flowcharts and hints on how to use each directive. There are cross-references to other sections of the manual and to the DRI MAC/RMAC manual.

Chapter 2 (31 pages) is a tutorial on SAL/80 in the design and coding of well-structured modular programs. A "worked" example is given in the form of an elaborate memory-test program, with "snapshots" of portions of the code at various stages of completion.

Chapter 3 (50 pages) consists of the complete listing of the "worked" example in its final form. There are about 1,150 lines of SAL/80 code set off by enough white space and comments to expand it to about 2,000 lines in all. The code is very readable, and anyone undertaking to learn SAL/80 would be well advised to spend some time with this chapter.

Chapter 4 is seven pages of tips on how not to get mugged by the various snares and pitfalls of the SAL/80 package and/or the DRI macro assemblers.

Appendix A is the compiler source (70 pages), and, quite aside from the actual utility value of the program it represents, is an interesting example of what can be done with the macro facility of MAC and RMAC.

Appendix B covers the error messages (generated by SAL/80) by showing what will actually appear on the screen and explaining its significance.

Appendix C is a summary of the SAL/80 commands, with the formal sytnax and cross-references to both the pertinent text in Chapter 1 as well as to the implementing source code in Appendix A.

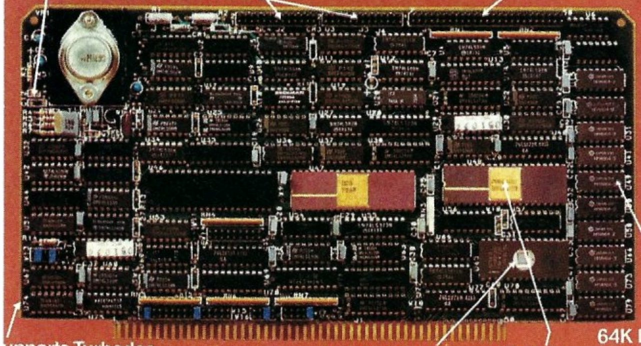
Programs in SAL/80 are written by starting with a template that outlines the "generic" shape of the program and may be altered to suit the taste of the individual. This consists largely of commented-out predeclarations and MACLIB statements. Almost all data structuring and manipulation is done as one is accustomed to do in ordinary assembly-level programming, but all of the CONTROL structuring (test/branch code) is accomplished by using the SAL/80 control statements.

These control statements work almost precisely as do the corresponding statements in Pascal or C, with IF-ENDIF, IF-ELSE-ENDELSE and SELECT-CASE-ENDSELECT providing most of the forward branching and the several loop statements generating the backward branches. The loop structures include the NON-indexed loops WHILE-ENDWHILE (test/exit at the top), REPEAT-ENDREPEAT (test/exit at the bottom) and LOOP-UNTIL-ENDLOOP (test/exit in the middle) as well as the INDEXED loops FOR-UNTIL-STEP-ENDFOR (test/exit anywhere) and DO-ENDDO (test/exit at the bottom).

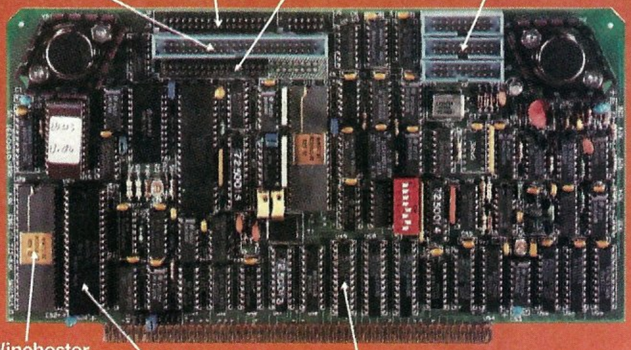
The "utility" macros are primarily concerned with console I/O although there are some string operations (search and compare) and some 8- by 16-bit multiply and divide routines. The console I/O primitives reduce by an order of magnitude the number of keystrokes required as compared with that of "naked" assembler.

THE ULTIMATE MULTI-PROCESSOR BUILDING BLOCKS

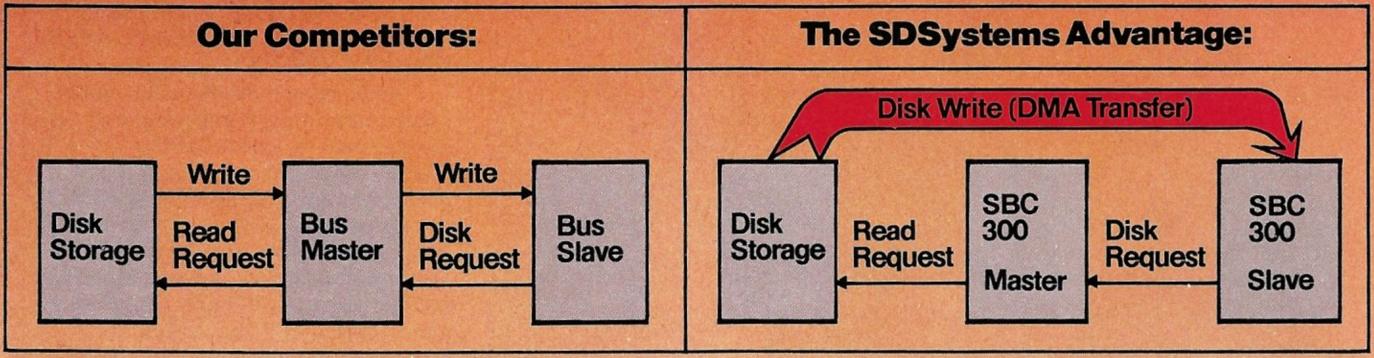
SBC 300
single board computer



VFW-III
floppy/Winchester disk controller



AND HERE'S WHY!



The SBC 300 offers you 64K bytes of dual ported parity RAM. Dual porting allows DMA transfers from disk storage *directly* to an individual slave processor. This maximizes multi-processor system performance.

Performing the DMA transfers is the VFW-III peripheral controller. It is quite possibly the only S-100 disk controller you'll ever want to buy. With the VFW-III you'll have simultaneous control of up to three 5¼″ Winchester drives and up to four 5¼″ and 8″ floppy drives.

Together they are the ultimate multi-processor building blocks. Systems integrators appreciate our strict adherence to the IEEE-696 specification and our complete line of high quality S-100 bus products. Evaluation hardware is available for qualified OEM's. Call, write, or circle the number below to receive technical information on these and other fine SDSystems products.

P.O. Box 28810 Dallas, Texas 75228 214-340-0303 Telex 682 9016

SDSYSTEMS

CIRCLE 9 ON READER SERVICE CARD

LETTERS

Continued from page 119

A program of 100 lines (exclusive of comments or white space) will compile in about one minute on a 6 MHz machine using 8″ disks. Although this is rather slow, programmers experienced in the use of the package have found that the overall reduction in development time is great enough to make this acceptable.

We at PROTOOLS expect that the next version (3.0) will be a separate, native code preprocessor compatible with other assemblers, will support Zilog as well as Intel mnemonics, and should

SAL/80 structures your code with macros.

run two to four times faster. In the meantime, the price of $59 (which includes a free update to version 3.0 when available, later this year) is intended to compensate for the slowness of compilation. A SAL/86 for the IBM PC will be offered for $99 at the same time.

As to ease of use, the point can be argued either way: If you program in assembler only on rare occasions, say, one 80-line device driver a year, then it's probably not worth the effort to learn to use the package. If you program in assembler on a continuing basis or write large programs, then any structured assembler you use will repay the effort many times over. For a review of SAL/80 written by a user, see the February issue of *Dr. Dobb's Journal.*

Steve Newberry
PROTOOLS
24225 Summerhill Avenue
Los Altos, CA 94022

Dear Mr. Libes,

Re: Moving from one OS to another

You asked for readers to let you know of file transfer systems other than those listed by you. Here are two more, both of which require soft-sectored IBM 3740 compatible disks.

1) FILESTAR, a CP/M based system that reads and writes TEXT files, and that displays and initializes directories on disks intended for, or received from, any of the following four operating systems: a) IBM Basic Exchange; b) DEC RT/11; c) Motorola MDOS and

d) Intel ISIS. I've only used it so far with DEC RT/11. It costs about £130 retail (about $195 in March 1984; send foreign money order) and is by:

> **MicroSec**
> *49b Market Parade, Havant*
> *Hampshire P09 1PY England*
> *phone: international*
> *+ 44 705 450055*
> *(speak to Mr. Hindmarsh or to Mr. Russell)*

I gather they developed this particular program as a tool to help them in their main occupation of writing custom software for solving engineering problems.

2) A small French office equipment consultant is working on transfers from WordStar texts to XEROX 860/850 texts. I watched his Xerox 860 (just the kind of word processor that my larger customers buy for their typing pools) make a fairly successful attempt at transferring a SpellBinder file to Xerox 850 format. The only real problem lies in SpellBinder's not using the type of control codes the consultant expects from WordStar, which simply means I should have filtered them out.

Again, this system relies on "standard" 8" diskettes, and again it is an in-house tool. At the moment this system is still experimental and isn't on sale. I'm still hawking the one file he has done for me round my customers' typing pools to see if their typists can cope.

> **Monsieur Jean-Pierre Cros**
> *Association Française de Bureautique*
> *33 bis, Avenue Edouard Vaillant*
> *92100 Boulogne, France*
> *phone: international*
> *+ 33 1 620 1477*

My main interest in file transfer arises because I earn my living as a translater, often by typing directly into SpellBinder using various CP/M format disks. I also dictate work, which is then typed by various free-lance typists who have their own word processors (all different brands).

I would like to be able to use my machine to make corrections to their work. Likewise, my customers would like to make corrections (or changes) on their own machines, or, alternatively, their correspondants in the USA, UK, Australia, South Africa, etc., want to change things.

Computer people always bleat "modems" as the solution—but up to

LETTERS

Continued from page 121

now, and at least in France, typists just don't have modems, and I can't afford to buy one for each of them, let alone pay the telephone bills to Australia for 20 pages at 300 baud. So I'm interested in any hard information you might be able to let me have on the subject of passing files between unrelated machines and by means of disks.

The most informative book I've read on the subject is *Machine Language Disk I/O & Other Mysteries* by Michael J. Wagner, published by IJG, Inc., ostensibly for the TRS-80, but in practice applicable to any Z80 plus Western 1771 or 179x controller chip.

An extremely lightweight article, "Out on a 5″ Limb," by Roger L. Modeen appeared in the Nov/Dec 1983 *CP/M Review*, but at least it does include DPBs and skew tables for some 16 different 5″ CP/M formats. One of the "details" overlooked is the business of how many 128-byte CP/M sectors there may be per sector on the disk. This information can be deduced from skew tables which are actually skewed, but otherwise it isn't there. Perhaps other BIOSes recognize the sector length on the disk and act accordingly—mine does not; it needs telling explicitly (twice over, and in two different ways, but that is another story!).

Most typists—at least in France—don't have modems, and I can't afford to buy one for each of them.

Other annoyances include hard-sector systems, and at least Apple, CBM/PET, & Sirius/Victor doing their own soft-sector things. I'd like to ignore them all, but the three word processing systems used by my typists and customers are hard sectored: Philips P5000, Addrex-plus (=Lannier), and Wang.

Right now, the upshot is that I can probably communicate with someone interested in computers even without using a modem, but disk communication with typists is still very limited—in spite of the fact that IBM invented the floppy disk as a means of communication between separate machines.

Andrew S. Marland
35 Avenue Chevreul
92270 Bois Colombes
France

Dear Mr. Libes,

We wish to thank Mr. Beser for his comments and suggestions on our product, "The Game Board," as reviewed in the January 1984 issue of *Microsystems*. There are a few inaccuracies in his article which we would like to comment on. First, "The Game Board" partially emulates the Heath H19/Z19 and the DEC VT100/VT52. The ANSI mode of "The Game Board" is compatible with the VT100, not the VT52, as stated in Mr. Beser's article. Second, we also offer "The Game Board" fully assembled and tested for $595.

In reference to his "wish list," all of his suggestions have been implemented except the grey scale. We have adopted Digital Research's GSX graphics extension as our design specification for a new version of firmware. It includes commands to draw points, lines, arcs, pie slices, circles, filled areas, cell arrays, graphics text, etc. Grey tones may be simulated by the use of area fill with a user-supplied pattern to provide texture. This firmware is available now with our regular products and as an update to previous purchasers.

John Murphy
Technical Director
paraGraphics
58 Needham St.
Norfolk, MA 02056

New Products

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

Vector S-100 interface

A multipurpose interface for IEEE-696/S-100 bus systems provides three full-duplex parallel I/O channels, an RS232C serial port, and a selectable-rate interrupt timer on a single board. Designated the 8800GF2 by Vector Electronic Company, the board is ideal for data-acquisition systems, machine-tool interfaces, process control, printers, or other I/O-oriented systems.

Each of the three parallel data channels incorporates eight TTL latched input lines and eight tri-state output lines with 24 mA drivers. Additional lines provide strobe, enable, or attention signals with selectable polarity. Data transfer rates up to 10 MHz are supported.

A switch-selectable interrupt timer gives fixed interrupt rates from 50 interrupts/sec to 19,200 interrupts/sec. The basic rates may be reduced further by factors of 2, 4, or 8 with appropriate jumper placement. Each parallel connector provides power for peripheral devices. The total power available for all three connectors is +5 volts @ 200 mA and ±12 volts @ 50 mA.

The model 8800GF2 serial port provides RS232C ±12V signals or optically-isolated 20 mA signals with an internal or external current source. In RS232C, the board functions either in the data terminal equipment (DTE) mode or data communication equipment (DCE) mode.

Character frames can be 7 bits or 8 bits long with odd, even, or no parity and one- or two-stop bits. The data transmission rate is switch selectable from 50 bits per second to 19,200 bps, including a 134.5 bps rate for Selectric typewriters.

Fabricated of epoxy-glass material, the 10" by 5.3" circuit board is solder masked on both sides and has gold-plated card-edge connectors for superior contact and long wear.

Power requirements for the 8800GF2 interface are +8V at 400 mA typical, 800 mA maximum; +16V at 50 mA typical, 200 mA maximum; and -16V at 50 mA typical, 200 mA maximum.

Available in two versions, the 8800GF2CB is qualified as a Certified System Component (CSC) with a 200-hour burn-in, two-year limited warranty and direct exchange in case of malfunction. The 8800GF2B is an assembled and tested (A&T) version with a 20-hour burn-in and has a one-year limited warranty.

Prices: CSC, $399 each; A&T, $325 each.

Vector Electronic Co., *12460 Gladstone Ave., Sylmar, Ca 91342; (213) 365-9661.*

CIRCLE 326 ON READER SERVICE CARD

SuperCord II interface transforms typewriter into printer

A new interface accessory that enables an ordinary electronic typewriter to become a printer for computers has been announced by Cord Ltd.

The SuperCord II is an update of the original SuperCord, which received the first U.S. patent for its ability to link electronic typewriters and computers.

The SuperCord II contains a 4K memory buffer. This enables the electronic typewriter to print out data from the computer at the typewriter's rate of speed, usually 110 baud, even if data arrives at a much faster baud. The SuperCord 4096 memory buffer stores information until the typewriter is ready to accept and print it.

Use of SuperCord II enables every popular brand of computer to have letter-quality printout at the low cost of an electronic typewriter. Of course, when the SuperCord II computer interface is turned off, the electronic typewriter functions as an ordinary typewriter.

Nearly every popular brand of computer can be used with the SuperCord II for connection to a typewriter. This includes the IBM PC, Apple, Atari 800, Commodore 8032 Pet, TRS-80, Eagle PC, and others. The list of electronic typewriters able to use the SuperCord includes Adler, Brother, Royal, Smith-Corona, Silver-Reed, etc.

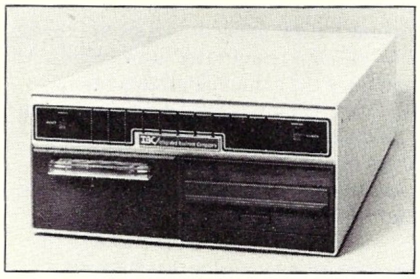
Prices: Model 1, $295; Model 2, $365.

Cord Ltd., *2815 Junipero Ave., Bldg. 102, Signal Hill, CA 90806; (213) 595-4446.*

CIRCLE 327 ON READER SERVICE CARD

Super Cadet business computer

IBC has announced its largest 8-bit



business computer, the Super Cadet. IBC's other models include the Middi Cadet in both high-performance and low-cost versions, and the 16-bit Ensign.

The Super Cadet allows up to 16 users per system; it has up to 640K of RAM, a high-speed 8 MHz Z80H CPU, and fast memory management capabili-

NEW PRODUCTS

Continued from page 124

ty. The system is compatible with the OASIS and MP/M II operating systems, thus providing the user with an abundant supply of sophisticated application packages.

Price: The Super Cadet, with 8 MHz operation, 256K 120 ns memory, single 1 MB floppy disk drive, 85 MB 8" hard disk, 8 serial I/O ports, Centronics port, and 30" desktop cabinet: $15,095.

The Middi Cadet is a low-cost, physically smaller version of the Super Cadet. Housed in a 12" x 16" x 17" cabinet, it includes a 6 MHz Z80B CPU, with 256K of RAM, a 20 MB $5\frac{1}{4}$" hard disk drive, a 1 MB $5\frac{1}{4}$" floppy disk drive, 10 serial ports and a Centronics port. The Middi Cadet can switch-select between operating systems such as MP/M and OASIS. Optionally available are a 512K memory, a cartridge tape, and a bisynchronous port for communications.

Price: $7,495.

The high-performance Middi Cadet includes all of the standard Middi Cadet features, plus 10-user support, 40 MB hard disk storage, 512K of RAM, and a high-speed 8 MHz Z80H CPU. The HP Middi offers performance beyond any of the 8-bit systems on the market and exceeds that of some 16-bit systems

Price: $10,995.

IBC predicts that 8-bit computer sales will remain high because these machines provide an alternative to operating systems requiring large, high-performance hardware capability not currently available in low-priced systems. However, they have also developed the 16-bit Ensign for the UNIX-based business systems market.

The Ensign is a 16-bit, multiprocessing/multiuser business microcomputer based on a MC68000 and four slave CPUs capable of running the UNIX operating system. The system operates at 8 MHz with no wait states, using proprietary memory management and ECC circuitry. The Ensign is designed to handle I/O for up to 32 concurrent users. The system is available in either a desktop or rack-mounted cabinet, and supports up to 8 MB of main memory (up to 512K per user), a capacity of over 1000 MB of SMD disk memory, and cartridge or 9-track reel-to-reel magnetic tape units.

Price: $25,000; includes a 16-port system with 512K of memory, 85 MB disk storage, 1 MB of floppy disk storage, and a centronics port.

IBC/Integrated Business Computers, *21592 Marilla St., Chatsworth, CA 91311; (213) 882-9007.*

CIRCLE 328 ON READER SERVICE CARD

Floppy disk storage file

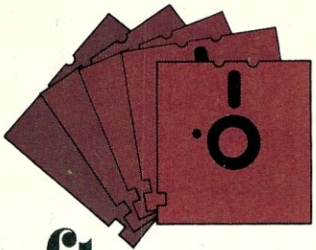
The new $5\frac{1}{4}$" Flexible Disk File holds floppy disks and protects them from becoming warped, scratched, touched or damaged in any way. It is made of tough plastic that has a built-in antistatic material which helps prevent damaging static electricity from reaching flexible disks.

Forty-eight labels and 168 tabs are supplied with each filing case, which come as 12 labels and 42 perforated tabs in each of four colors: red, yellow, green and blue. Permanent pressure-sensitive disk labels measure $1\frac{1}{4}$" by 3" and are printed four up in typewriter format. Each file is $\frac{1}{4}$" high, $8\frac{1}{8}$" wide and 8" deep.

Price: less than $40 each.

Eddie Goodwin Co., *P.O. Box 470331, Miami, FL 33147.*

CIRCLE 340 ON READER SERVICE CARD



Software Directory

New programming aids that shorten development time and increase productivity

Program name: APPGEN (Applications Systems Generator)
Requirements: Any microcomputer running PICK, UNIX or having a standard C Compiler
Miniumum memory: 128K
Language: C or Databasic
Description: APPGEN provides all the tools necessary for the development of complete, fully documented commercial applications in a fraction of the time and cost required by traditional programming methods. The APPGEN development and runtime environments are easily portable among all the machines and operating systems supported by The Software Express, Inc. In addition to the applications generator, numerous fully integrated accounting packages are available for use as standalone applications as well as for modification or enhancement under the generator. These packages can also be included as parts of comprehensive vertical packages developed under APPGEN.
Price: $12,000
Included with price: documentation, video demonstration, training
Available from:
The Software Express, Inc.
10103 Fondren, #220
Houston, TX 77096
(713) 270-5218
CIRCLE 320 ON READER SERVICE CARD

Program name: FileDriver
Requirements: any microcomputer running CP/M, MP/M, or TurboDOS
Minimum memory: 51K
Language: C
Description: FileDriver is a comprehensive, integrated collection of utilities that allows the creation of hundreds of application-specific, customized utilities. FileDriver's unique CUSTOM feature lets you create your own, user-named .COM files specifying all the functions and options you wish, as well as an entire command line consisting of one or more file IDs. Directions to read file IDs from a text file previously created by the user are included. Thus complex, but powerful utilities can be invoked with a minimum of keystrokes. FileDriver utilities may be accessed in one of three ways: from individual .COM files, from an all-in-one .COM file, or from a menu interface. FileDriver does not modify the operating system (is not a CCP replacement) and will run in conjunction with other utilities and other menu interfaces leaving sufficient TPA. Other features include multiple wild cards on a command line, wildcard user areas and disk drives, exclude list of files from a wild-card designation, write to/read from text files, act across user-area boundaries, copy/archive to sequential floppy drives, support attribute flags and group numbers.
Price: $85 (8″); $90 (5¼″)
Included with price: disk (8″ or 5¼″) and documentation
Available from:
Dunbar-Ridge Group
102 Sterling Court
Syosset, NY 11791
(516) 4964431
CIRCLE 321 ON READER SERVICE CARD

Program name: MAGIC/MPS
Requirements: A Z80 microcomputer running any version of CP/M or MS-DOS
Minimum memory: 64K
Description: MAGIC/MPS is a medium level, portable language that maintains traditional language philosophies to create application programs without the need of a runtime package. The instruction set, through the MAGIC compiler, permits the creation and maintenance of machine-executable programs. It is multiuser and has file I/O capabilities with random, sequential and ISAM file types. Other features include: internal data areas that are completely variable with buffers that are dynamically allocated for both hardware and software efficiency; fast BCD arithmetic with up to 35 digits; simplified screen formatting and data editing; handwritten assembly language can be mixed anywhere in the source code; total string manipulation capability; convenient control over peripherals and conditional compilation of source code.
Price: MPS/80: $795 (for CP/M-80)
MPS/86: $995 (for CP/M-86 and MS-DOS)
Included with price: disk containing assembler, linker and compiler, plus full documentation
Available from:
Data Management Associates, Inc.
P.O. Box 4340
Wilmington, DE 19807
(302) 655-8986
CIRCLE 322 ON READER SERVICE CARD

Program name: Lattice 8086 C Compiler (with 8087 support) Version 2.1
Requirements: PC-DOS or MS-DOS
Minimum memory: 128K
Description: This updated version enables C programs to access the complete 1 MB program and data space that can be addressed by 8086 and 8088 microprocessors. Four distinct memory models are supported, allowing the C programmer to choose the best combination of efficiency and addressability. The S and P models produce compact

PORTABLE 68000 ASSEMBLER

MOTOROLA SYNTAX
MACROS
LINKER
CONDITIONALS
OBJECT LIBRARIAN
CROSS REFERENCE
STRUCTURED PROGRAMMING FEATURES

OBJECT CODE OPTIMIZED FOR CP/M-80, CP/M-86 CP/M-68K OR IBM PC-DOS	$300
PORTABLE C SOURCE	$750

Quelo
843 NW 54th
Seattle, WA 98107

(206) 784-8018
mornings
Dick Curtiss

CP/M is a trademark of Digital Research
IBM-PC is a trademark of IBM

CIRCLE 60 ON READER SERVICE CARD

C Programmers: Program three times faster with Instant-C™

Instant-C™ makes programming three or more times faster by eliminating the time wasted by traditional compilers. Many repetitive programming tasks are automated to make programming less frustrating and tedious.

- Two seconds elapsed time from completion of editing to execution.
- Full-screen editor integrated with compiler; compile errors set cursor to trouble spot.
- Editor available any time during session.
- Symbolic debugging; single step by statement.
- Automatic recompilation when needed. Never a mismatch between source and object code.
- Directly generates .COM, .EXE, or .CMD files.
- Follows K & R—works with existing source.
- Single, integrated package.
- Works under PC-DOS*, MS-DOS*, CP/M-86*.

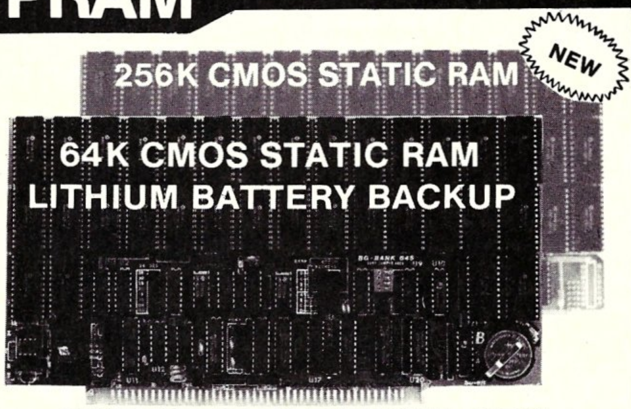
More productivity, less frustration, better programs. **Instant-C™** is $500. Call or write for more information.

Rational Systems, Inc.
(617) 653-6194
P.O. Box 480
Natick, Mass. 01760

*[Trademarks: PC-DOS (IBM), MS-DOS (Microsoft), CP/M-86 (Digital Research, Inc.) Instant-C (Rational/Systems, Inc.)]

CIRCLE 39 ON READER SERVICE CARD

PRAM PERMANENT RAM



GUARANTEED TO RUN WITH: MPM CDOS • CROMIX • OASIS • AMOS

✓ **PLUS:** 8/16 BIT TRANSFERS • 24-BIT EX. ADDRESSING
8-12 MHZ • 2K DESELECTS • RAM-EPROM MIX
IEEE 696/S-100 • LOW POWER • FULLY STATIC

LITHIUM BATTERY BACKUP OPTION: Unique POWER-FAIL-SENSE circuit tell processor when bus power is failing, then disables WRITE. Lithium Battery retains memory contents for up to a year. Avoids POWER FAILURE MEMORY CRASHES intelligently.

BG BANK 256S	$1,499	Battery Backup	$99
BG BANK 64S	$499	Battery Backup	$59

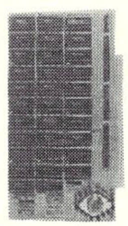
BG COMPUTER APPLICATIONS, 206 Brookside, Bryan, Texas 77801. Foreign orders add 20%. **(409) 775-5009**

CIRCLE 10 ON READER SERVICE CARD

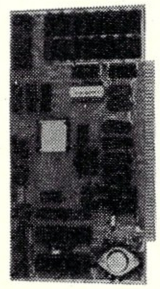
MCP MAKES HIGH PERFORMANCE S-100 AFFORDABLE

MCP/SCC-6 Z80B 6MHz S-100 CPU. Operates at 2,4 or 6MHz. Includes two serial ports using 8251 usarts with selectable baud rates from 50 to 19.2k, three programmable 8 bit parallel ports, 1k onboard static ram, and 2716 Eprom with monitor. Onboard ram and eprom can be disabled on system boot. ASSEMBLED AND TESTED PRICE — $225.00

MCP/FDC FLOPPY DISK CONTROLLER. Utilizes the WD1793 double density F/D controller chip and the WD1691 floppy support logic chip. The MCP/FDC offers superb performance and reliability due to enhanced data recovery and write precomp support. The MCP/FDC will support up to four 8" single or double sided Shugart, Qume, Siemens or compatible drives. CP/M 2.2 Bios supplied on standard density 8" diskette. ASSEMBLED AND TESTED PRICE — $200.00



MCP 64KS S-100 MEMORY. Sixty-four k bytes (64K x 8) of low power high performance (2k x 8) 150 ns static ram for systems requiring the ultimate in reliable performance. Extended address capability to one megabyte is provided. ASSEMBLED AND TESTED PRICE — $258.00



MCP 80188 S100 SBC, PERFORMANCE PLUS PACKAGE. Features high integration Intel APX 80188 processor with two DMA channels, three programmable 16-bit timers and programmable interrupt controller. Onboard features include DMA floppy disk controller, supports both 5.25 and 8" disk drives, two RS232 serial ports and 128k ram.

MCP COMPUTER PRODUCTS
MasterCard
Suite 104-444 • 6992 El Camino Real • Carlsbad, CA 92008 • (619) 438-3270
VISA
CP/M IS A REGISTERED TRADEMARK OF DIGITAL RESEARCH

CIRCLE 172 ON READER SERVICE CARD

SOFTWARE

Continued from page 128

code that can address up to 64K of data, while the D and L models allow access to as much as 1 MB of data. Program size is limited to 64K in the S and D models, but can be as large as 1 MB in the P and L models. The Lattice C function library has been extensively improved to handle the new MS-DOS multilevel file directories and to be more compatible with the latest versions of UNIX. Users of the current Lattice compiler may obtain the updated version by contacting the dealer from whom they purchased it.

Price: C compiler: $500
Library source code: $500 (reduced from $1,500)

Available from:
Lattice, Inc.
P.O. Box 3072
Glen Ellyn, IL 60138
(910) 858-7950

CIRCLE 323 ON READER SERVICE CARD

Program name: JETIII
Requirements: CP/M, CCP/M, MP/M, PC-DOS, or MS-DOS
Minimum memory: 3 MB
Language: CBasic
Description: JETIII is an integrated, computer-aided applications software development system and multiuser database. A menu-driven program generator enables programmers to write remarked and structured software code in a fraction of the time it normally takes to develop applications software, automatically generating code for many standard functions, such as file maintenance, transaction processing, and reporting. JETIII can also accommodate relational, hierarchical, and network database structures, as well as integrate applications software with the company's BizWiz modules (general ledger, payroll, accounts payable and accounts receivable). All Jetsoft programs and packages developed with JETIII are operating system-independent and transportable to most microcomputers. A menu-driven report-writer program is also included which is designed to generate a variety of reports and delimited files from the database. Other functions provided by JETIII include menu/forms creation capabilities and system security.
Price: $40,000
Included with price: manuals and "hotline" telephone support
Available from:
Jetsoft, Inc.
170 Main Street
East Falmouth, MA 02536
(617) 548-6670

CIRCLE 324 ON READER SERVICE CARD

SOFTWARE

Continued from page 130

Program name: ANSI Standard MUMPS
Requirements: CP/M and North Star Horizon or comparable hardware
Minimum memory: 56K
Language: machine language
Description: ANSI Standard MUMPS is a high level applications development language with a built-in DBMS. All software created with ANSI MUMPS is transportable to any hardware environment adhering to the ANSI Standard. It has statements similar to those of Basic, i.e.: subscript by alphanumeric string, collating sequence function, examine variable contents, restart after break point, GOTO named alphabetic or numeric entry points, pattern matching, etc.
Price: $40
Included with price: User's Guide
Available from:

HSC Computer Services, Ltd.
P.O. Box 43
Brooklyn, NY 11236
(212) 642-6912

CIRCLE 329 ON READER SERVICE CARD

Program name: DESIGNER SCREENS
Requirements: Z80, 8080 or 8085 running CP/M 2.2 with ASCII terminal, 80 x 24 or larger
Minimum memory: 48K
Language: 8080 assembler and C
Description: DESIGNER SCREENS is a full-screen editor and runtime support package for terminal screen designs intended for use by serious programmers. Using DESIGN, a programmer can type displays directly onto the terminal screen. Elements of the design, called "objects," can be rearranged on the screen with simple cursor commands. Five visual attributes and line drawing are supported. Designs are transportable between installed terminals.

A linking program, LINK, is provided to link up to six screen designs to a user program. During the linking process, a customized, self-relocating, 8080 machine language program is generated to support the linked designs at runtime. The package makes it easy to implement on-screen forms, menus, help screens, boilerplate notices, and even simple animation. Runtime support for input includes: data-type control, decimal alignment, a type-ahead buffer, end-user edit commands, and everybody's favorite, "Fred's Magic Window," which can display field-by-field input instructions automatically, as needed.
Price: $195
Included with price: Design program, LINK program, Install program, typeset manual and demo programs.
Available from:

Austin E. Bryant Consulting
P.O. Box 1382
Lafayette, CA 94549
(415) 945-7911

CIRCLE 330 ON READER SERVICE CARD

Program name: BASXREF
Requirements: any 8080, 8085 or Z80 microcomputer
Minimum memory: 32K
Description: BASXREF is a program that facilitates the understanding, debugging and maintenance of Basic programs by generating an alphabetized cross-reference of the variables used in a program, along with their corresponding line numbers. This list can be written to console, disk or printer output. BASXREF can also suppress certain parameters, as well as adapt itself to various dialects of Basic.
Price: $39
Included with price: detailed documentation
Available from:

COMPU-DRAW
1227 Goler House
Rochester, NY 14620
(716) 454-3188

CIRCLE 331 ON READER SERVICE CARD

★MICROCOMPUTER★ BUSINESS SOFTWARE

MEDICAL MGMT...
DENTAL MGMT...
INSURANCE AGENT
LEGAL BILLING.....
PROPERTY MGMT..
AND MUCH MORE !

UNIVAIR INTERNATIONAL
9024 St. Charles Rock Road
ST. LOUIS, MISSOURI 63114
(314) 426-1099

CIRCLE 224 ON READER SERVICE CARD

MOTOROLA 68000 STRUCTURED MACRO CROSS ASSEMBLER

for CP/M-80*
EXORmacs† Compatible
$200

Linker & Library Utilities included

Manual $20

Source Available

farbware
1329 Gregory
Wilmette, Ill. 60091
(312) 251-5310
after 5 p.m.

*Trademark of Digital Research †Trademark of Motorola, Inc

CIRCLE 277 ON READER SERVICE CARD

STATISTICS

IFDAS
Statistical Package

• Large problem size • High accuracy • Fully integrated system • Data manipulation capabilities • P-value computations • Missing data features • Many analyses, including: Multiple regression, Curvilinear regression, Summary statistics, Scatter plots, ANOVA, Correlation, and more.

For a complete description of **IFDAS**™, see the Statistical Computing section of the November, 1983 issue of the American Statistican.

IFDAS will be available soon to CP/M™-based Z80™, 8080, and 8085 microcomputer owners. An IBM/PC version is planned for late in the second quarter of 1984. Currently **IFDAS** operates only on Cromemco systems.

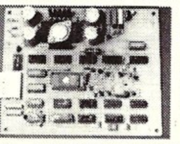
The Software Hill
Dept. MS1
1857 Apple Tree Lane
Mountain View, CA 94040
(415) 969-4233

Trademarks: Digital Research (CP/M), Zilog (Z80), The Software Hill (IFDAS).

CIRCLE 276 ON READER SERVICE CARD

CP/M EPROM PROGRAMMING SYSTEM

2708, 2758, 2716, 2732, 2764, 2732A, 27128, 27C16, 27C32, 27C64



- STAND ALONE BOARD - ELECTRONIC SWITCHING OF EPROM TYPES
- USES 24 VOLT XFMR FOR POWER - ALL SUPPLIES/TIMING ON BOARD
- DESIGNED WITH EASY TO GET PARTS - COMPREHENSIVE 28 PG MANUAL
- WORKS WITH ANY CP/M SYSTEM - INDEPENDENT OF SYSTEM SPEED

* * INTERFACE TWO WAYS * *

1 - ONE 8 BIT INPUT PORT AND ONE 8 BIT OUTPUT PORT - 16 WIRES AND A GROUND - NO HANDSHAKE LINES REQUIRED
2 - CENTRONICS PRINTER PORT - 8 OUTPUT DATA BITS AND ONE INPUT DATA BIT (BUSY LINE) - 9 WIRES AND A GROUND

* * CONTROL PROGRAM COMMANDS * *

- PROGRAM EPROM(S) FROM DISK
- READ DISK FILE INTO RAM
- READ EPROM(S) INTO RAM
- VERIFY EPROM IS ERASED
- SAVE EPROM(S) TO DISK
- PROGRAM EPROM(S) FROM RAM
- COMPARE EPROM WITH RAM
- COPY EPROM
- DISPLAY/MODIFY RAM - (MONITOR MODE) WITH 11 SUB COMMANDS FILL-DUMP-XFER-EXAMINE-MODIFY-BIAS-PROGRAM-VERIFY, ETC)

BARE P.C. BOARD WITH COMPLETE DOCUMENTATION AND SOFTWARE ON 8" SINGLE DENSITY DISKETTE $69
(ABOVE WITH COMPLETE PARTS KIT - $169)(A&T - $189)
SOFTWARE AVAILABLE FOR OSBORNE, KAYPRO OR ON 2764 EPROM

TO ORDER SEND CHECK, MONEY ORDER, WRITE OR CALL
ANDRATECH
P.O. BOX 222
MILFORD, OHIO 45150
(513) 752-7218

CALL OR WRITE FOR MORE INFORMATION -- ADD $3.00 FOR SHIPPING
OHIO RES ADD 5.5% TAX -- VISA/MC ACCEPTED -- $3.00 FOR COD

CIRCLE 251 ON READER SERVICE CARD

NORTHSTAR AND MBSI REALWORLD USERS

New Products and Enhancements

THE FINANCIAL ANALYST:
a concise financial analysis program fully interfaced with general ledger.

MULTI-CO:
an enhancement to enable recording of multiple companies on a single disk.

FINSEC:
church contribution management and mailing program.

FUTURE ENHANCEMENTS FORTHCOMING . . .

Contact Victor Moffitt or circle reader service number.

DATA-CO.
978 TIOGUE AVENUE
COVENTRY, RI
(401) 828-7385
Dealer Inquiries Invited

CIRCLE 229 ON READER SERVICE CARD

TECHTYPE

You need to write по-русски? ?עברית ¿En español?
Or worse yet --

$$P_{nm}(\cos\theta) = \frac{\sin^m\theta}{2^n\, n!}\,\frac{d^{n+m}\,(n^2-1)^n}{dn^{n+m}} \quad ?$$

Your present word processing system isn't exactly a polyglot and flunks algebra? What's the solution?

TECHTYPE™ is a text-formatting system designed especially for *scientific, engineering, mathematical,* and *multi-lingual* document preparation. **TECHTYPE** runs under CP/M® and is adaptable to most hardware. By using your present editor and its three programs

- DISPLAY - Preview on CRT screen
- DRAFT - High-speed dot-matrix printout
- PRINT - High-quality daisywheel printout

you can spend more of your time *solving* equations instead of typing them.

TECHTYPE's capabilities include:

- Multiple type fonts
- Multipass printing
- Unlimited sub/superscript levels
- Control of format, font, pitch, and emphasis.

Multipass printing allows the use of up to *ten* different fonts with only *one* printwheel change per page per font. Price $300.

GREEN MOUNTAIN RADIO RESEARCH COMPANY
240 Staniford Road
Burlington, Vermont 05401 U.S.A.
802-862-0997

SATISFY YOUR DRIVES

Z-80A with
256-K bytes RAM as:
FAST **RAM DISK A:** 192K bytes
64K **USER RAM**
ROM DISK B: CP/M, COPY, DIR, LOG pgms.
DISK C: 192K byte 5¼" floppy drive
DISK D: optional external expansion
DISK E: optional external expansion

- Bundled with software included on 5¼" floppy disk.
- R/W IBM, KAYPRO, MORROW and OSBORNE disks.
- Transportable-7"hx4"wx14"d,8lbs., 120 VAC 40 W
- (2) RS-232C serial ports (110-19,200 baud)
- (1) Bi-directional parallel port (incl. Centronics)
- (1) Expansion buss (up to 256K addl. RAM or ROM)

EXPAND YOUR (computer's) MIND ... INSTANTLY!
The **COMPANION** can add 256K byte storage, printer spooling, port expansion and CP/M programs to your portable computer or terminal.

PRICE $1095 Terms Min. 25% Dep. Bal. COD MasterCard or VISA OK

COMPANION COMPUTERS
192 Deerfield Rd. Apex, NC 27502 (919)362-6655

Full Screen Text Editor with Full Source Code in C for CP/M 68K or CP/M 80

edward k. ream

RED
$95

Call today for valuable information:
(608) 231-2952
To order send a check to:
Edward K. Ream
1850 Summit Avenue
Madison, Wisconsin 53705

CIRCLE 278 ON READER SERVICE CARD

NORTH STAR USERS UNITE!

★ Get the information you need from the user's point of view
★ Over 150 pages of members newsletter articles last year
★ Dos and cp/m disk library for members
★ Solve problems
★ Get assistance
Membership dues $20

International North Star Users Association
P.O. Box 2789 M, Fairfield, CA 94533

CIRCLE 279 ON READER SERVICE CARD

classified ads

CLASSIFIED RATES: Per Word, 15 Word Minimum. REGULAR: $2.00. EXPAND-AD: $3.00 GENERAL INFORMATION: Prepayment discounts available. Payment must accompany order except credit card — Am. Ex., Diners, MC, VISA (include exp. date) — or accredited ad agency insertions. Copy subject to publisher's approval; must be typewritten or printed. First word set in caps. Advertisers using P.O. Boxes MUST supply permanent address and telephone number. Orders not acknowledged. They will appear in next available issue after receipt. Send order & remittance to: Classified Advertising, MICROSYSTEMS Magazine, 1 Park Avenue, New York, NY 10016. Direct inquiries to (212) 725-3927.

SOFTWARE

REL/MAC converts M80 REL files to MAC source files. $99.95 on 8" SSSD, CP/M-80. Free information. Microsmith Computer Technology, P.O. Box 1473, Elkhart, IN 46515.

RENT PUBLIC DOMAIN SOFTWARE. It's not copyrighted, no fees to pay. Copy hundreds of useful CP/M business, utility and game programs from our UG rental libraries onto your own computer at home! Catalog Disk $5.00 pp. (Specify format). National Public Domain Library, 1062 Taylor, Vista, California 92083. (619) 941-0925.

PROGRAMMERS WE WILL HELP YOU FIND A SOFTWARE PUBLISHER FREE. We represent publishers looking for programs of all types. (Please send program profiles) SOFTSEARCH, Inc., Box 281, Budd lake, New Jersey 07828. (201) 627-1790.

STRUCTURED ASSEMBLY LANGUAGES SAL/80 and SAL/86 do for assembler what RATFOR does for FORTRAN. Improves productivity by factor of two, maintainability by order of magnitude. Extensively documented, available all CP/M formats. $59.00, requires MAC/RMAC and 64K RAM. California residents add 6%. PROTOOLS® "Software Tools for the Professional," 24225 Summerhill Avenue, Los Altos, CA 94022. (415) 948-8007.

COMPUTER EQUIPMENT/SUPPLIES

COMPUTER PAPER—Save $$$; Top quality. Low single carton prices. Free samples. Shipping via UPS. Call A-1, (800) 628-8736 or (213) 804-1270.

PROJECTS

CP/M-68K (trademark of Digital Research, Inc.) users wanted to conduct beta test with multiple user O.S. Contact: Benjamin Kaufman at C.D.S., (212) 241-8019.

ADD ANOTHER DIMENSION to your REGULAR CLASSIFIED ad—all BOLD type like this! Call (212) 725-3927 for more information!

ADVERTISERS INDEX

THREE NEW PRODUCTS. With the addition of a new 6 MHz Master/SBC, a 128K RAM slave processor board and ARCNET capability through our ARC-100 ARCNET controller board you can build sophisticated S100 bus systems for one to 4000 users.

Intercontinental Micro continues to make State of the Art simple to use.

SYSTEM FLEXIBILITY. With 4 MHz or 6 MHz 8-bit SBC/masters, 4 or 6 MHz 8-bit slave processors with 64K or 128K RAM, TurboDOS™ and PC-DOS™ operating systems, ARCNET links between systems and a complete line of interface and controller boards, Intercontinental Micro System's give you and your customers flexibility—to grow and change.

Imagine, with the introduction of our 16 bit slave in the second quarter, you'll be able to use both 8 and 16 bit processors on the same network—allowing you to keep your 8 bit software library as you grow into the 16 bit world. Soon even IBM PCs will be able to act as slaves in an Intercontinental S-100 bus system.

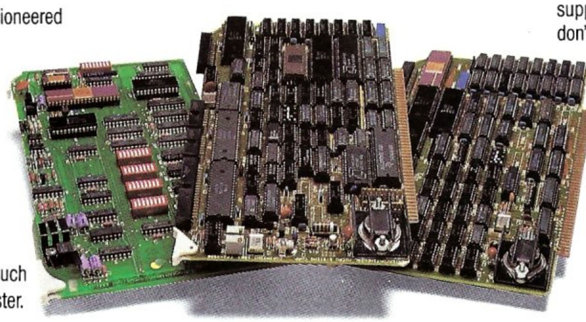
TurboDOS allows you to construct true multiuser systems with CP/M,™ MP/M,™ CP/M 86 and soon PC-DOS capability. And ARCNET makes local area networks with up to 4000 users possible—and very cost effective. From a simple single user station to large scale ARCNET business system groups, Intercontinental provides flexibility. In fact, our products have been used for a host of functions—from process control and robotics to satellite communications, special movie effects and building demolition.

SPEED AND POWER. Intercontinental Micro pioneered the use of 4 channels of Direct Memory Access (DMA), in the micro world—making our master slave combinations up to 300% faster than the competition. Other state of the art features found in Intercontinental products include: 16 MegaByte Memory Management Unit (MMU) on all SBC/Masters, bank selectable slave memory, vectored priority interrupts, and multiple parallel/serial ports.

Features are great–but they don't mean much unless they help you do your job better and faster.

ANNOUNCING THE FASTEST, MOST POWERFUL, COMPREHENSIVE LINE OF S-100 PRODUCTS EVER AVAILABLE.

Ask for confidential benchmark studies on our product's speed. We think you'll agree we can save you and your customers time.



A COMPLETE PRODUCT LINE. CPZ-4800X—Single Board Computer, 4 or 6 MHz processor (Z80A/B), onboard floppy disk controller, 64K RAM, 4 channel DMA controller, 18 vectored priority interrupts, two parallel I/O channels, two synchronous or asynchronous serial I/O channels, real time clock. 16 bit version available 3rd quarter 1984.

CPS-MBX—slave processor, 4 or 6 MHz processors, 64K or 128 RAM basic selectable memory mapped, two serial ports synchronous or asynchronous, two parallel ports, software selectable baud rates. 16 bit version available 2nd quarter 1984.

256KMB-Memory Board, linear addressable to two megabytes, 220 nano second access time—maximum, bank selectable in 16K increments, I/O port address bank selection, in 16K increments, I/O port address bank selection, configures for phanton deselection, parity error detection, Cromix ZPU compatible.

ARC-100—ARCNET controller meets 696.2/D1 S-100 spec, coax cable interface, 255 nodes per network segment, 2.5 megabit data rate.

MD-1013—Hardisk controller, user selectable sector sizes of 256, 512 or 1024 bytes, implied seek and error recovery, user selectable controller address. Handles up to two drives, 5MB to 140MB.

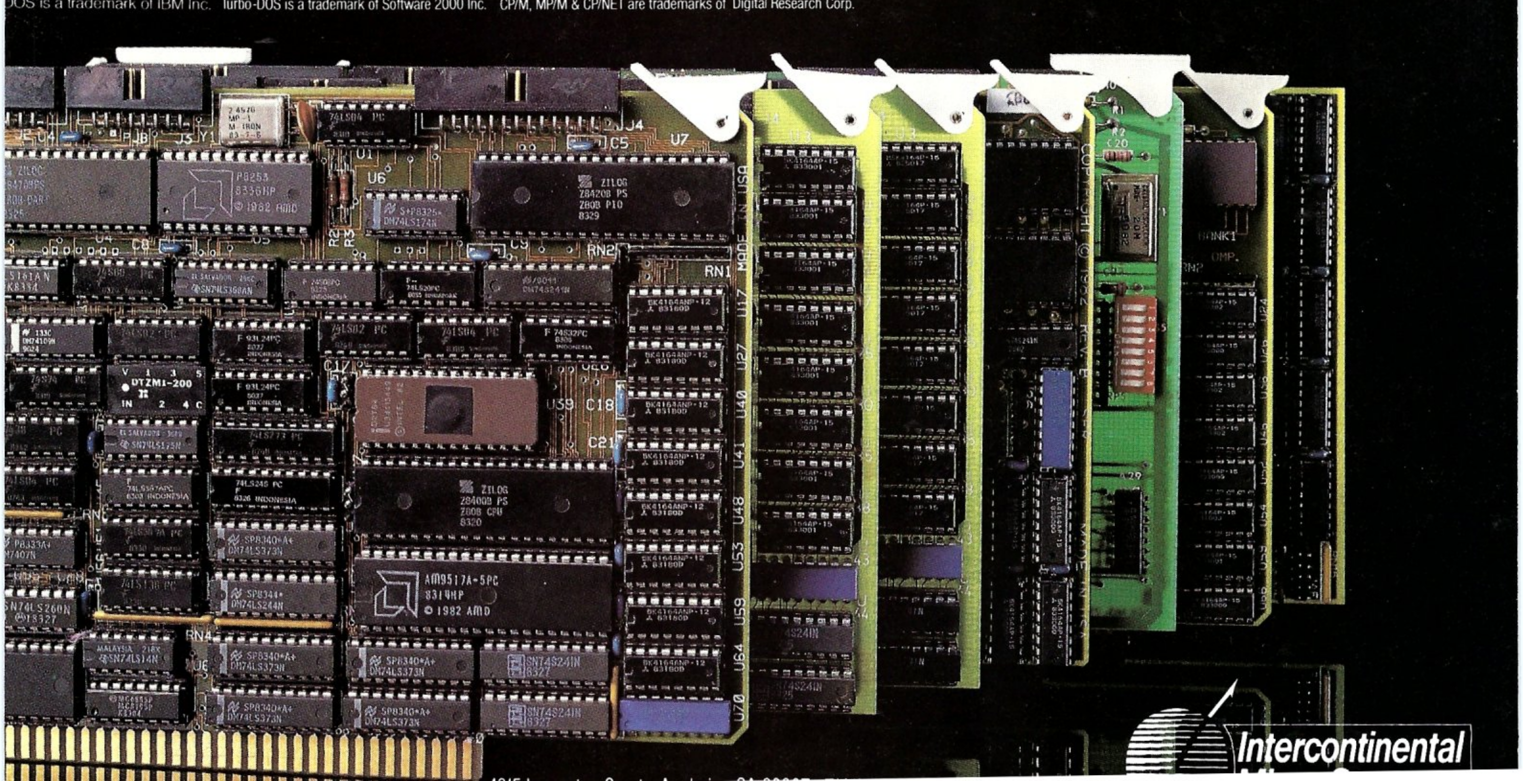
Personality Boards—SASI, Centronix, PRIAM, Clock/Calendar, RS232, Modem, RS422, long distance serial communications (up to 4000 ft).

SUPPORT, SUPPORT, SUPPORT. Everyone talks about support. Intercontinental Micro Systems does more. We don't build systems, so you are our most important customer. Ask us for references or call our dedicated support team. You'll find out that support is more than just a word at Intercontinental Micro Systems. It's what we're here for.

SO GET IT ALL. A comprehensive product line loaded with benefits for you and your customers. Flexibility to grow. And support that sets industry standards. Call Intercontinental Micro Systems today—we can help you with your S-100 bus system needs.

CIRCLE 185 ON READER SERVICE CARD

DOS is a trademark of IBM Inc. Turbo-DOS is a trademark of Software 2000 Inc. CP/M, MP/M & CP/NET are trademarks of Digital Research Corp.



HERE TODAY
HERE TOMORROW

When buying a computer, you can't limit yourself to just satisfying today's needs. **The best value in a system comes from its productivity . . . both for today and tomorrow.** CompuPro's System 816™ computer has that value. With all the power and capacity to handle your needs now and down the road.

System 816's longevity stems from top quality components . . . high storage capacity . . . the flexibility to handle a large variety of applications . . . and the speed to get the job done fast. Upgrading is easy, and when it's time to expand from single to multi-user operation, it's as simple as plugging in boards and adding terminals. Your system grows as you grow.

CompuPro also provides a library of the most popular software programs with your system and because it's CP/M® based, you have more than 3,000 other programs to choose from.

Even our warranty is for today and tomorrow. It spans 365 days — and includes the additional security of Xerox Americare™ on-site service nationwide for designated systems.

What's more, CompuPro is one company you can count on to be around tomorrow. For more than ten years we've been setting industry standards, increasing productivity and solving problems.

For a free copy of our business computer buyer's primer, and the location of the Full Service CompuPro System Center nearest you, call **(415) 786-0909 ext. 206.**

CompuPro's System 816. The computer that's just as essential tomorrow as it is today.

CIRCLE 12 ON READER SERVICE CARD

CompuPro®

A *GODBOUT* COMPANY

3506 Breakwater Court, Hayward, CA 94545

System 816 and The Essential Computer are trademarks of CompuPro. CP/M is a registered trademark of Digital Research Inc. Americare is a trademark of Xerox Corporation.
System 816 front panel design shown is available from Full Service CompuPro System Centers only.

The Essential Computer™