

The TRS-80 Model 16B with Xenix

by Steve Barry and Randy Jacobson

The Radio Shack TRS-80 Model 16B is surprising in at least two ways: first, it appeared later than the company's announcements would have indicated, and second, it has an industry-standard multiuser operating system—Microsoft's Xenix, a derivative of Bell Laboratories' Unix version 7. The Model 16B's Xenix capability is remarkable in that it represents the first use of an outside supplier's operating system in Radio Shack's history. This event is of even more interest because Xenix is to be supplied for several other popular microcomputers.

In this review we'll first present an overview of the 16B's hardware and capabilities, and, because the hardware's effectiveness depends on its ability to run Xenix, we'll also cover that operating system's major features.

The TRS-80 Model 16B is a blend of the old and the new. It is based on a dual-processor architecture (Motorola 68000 and Zilog Z80), and it runs as either a single-user or a multiuser computer. The machine is particularly significant because it has most of the hardware features available on other machines in the \$5000 to \$16,000 price bracket, and it has the support of an industry powerhouse behind it. Although not innovative in concept, the 16B is more than just a solid high-end engine for Radio Shack's software. The computer performs well for its class of machine and is likely to be a major focus of software houses trying to take advantage of Radio Shack's marketing clout and Xenix program portability. The 16B is compatible with an extensive line of Radio Shack peripheral hardware, and there is also

a strong indication that the Model 16B will be a central element in Radio Shack's announced but unmarketed local-area-network (LAN) strategy. Indeed, with its LAN-capability option, the system could become the backbone of an expandable, low-cost, office-wide, multimodel, shared-computer resource.

Background

Starting about a year ago, rumors of Radio Shack's new high-end machine piqued the curiosity of many enthusiasts. The computer was supposed to be a powerful yet inexpensive multiuser machine that employed a proprietary operating system said to be incompatible with the software available on widely distributed multiuser operating systems such as MP/M. When the machine failed to materialize, rumors said its delay was due to myriad hardware and software problems.

In spite of its uncertain beginnings, the Radio Shack TRS-80 Model 16B has hit that all important and all too narrow marketing "window," defined by public acceptance of a combination of price, performance, and features. Once such a window is filled by a few machines, other manufacturers find it difficult to penetrate the market. The target market for this machine is the small business that requires a one-source supplier of multiuser turnkey hardware, software, and service for core business applications. However, the 16B can also serve as a small Unix and Xenix development environment.



Photo 1: The TRS-80 Model 16B standard system.



Photo 2: The 86-key detachable keyboard of the 16B.

System Summary

The Model 16B (photo 1) runs a large library of single-user software. Moreover, it has multiuser capabilities, and significant multiuser software has become available early in the machine's life (see the At a Glance box).

A minimum three-user system consists of the console with 384K bytes of memory, one 1.25-megabyte 8-inch floppy-disk drive, an 11.6-megabyte hard-disk drive, two user terminals, a printer, and software. The system console has a detached 86-key keyboard (photo 2). The keytops are textured to avoid glare. The standard alphabet, number, and symbol keys and the numeric keypad keys are black with white legends. Other keys—including Shift, Tab, Break, Backspace, eight function keys, and the cursor keys—are white with black legends. A bump is placed on the numeric pad's 5 key to aid manual orientation for touch-typing. Cursor keys are arranged (awkwardly, in our opinion) in a vertical column on the left border of the numeric pad. Keytops are slightly longer vertically than horizontally and have dual-spring action so that the touch is heavier at the bottom of the key travel, but there is no other auditory or tactile feedback for key-switch closure. We felt that the keyboard touch was vague, and this prevented rapid typing during our limited use of the machine. Function keys surround the upper and right side of the numeric keypad. Control keys (such as Return, Tab, Enter, and Shift) that are either the same size or even larger at the base than the character keys have the same raised striking area as an alphanumeric key. Two important symbols for Unix users and programmers can be produced only by pressing Control and another key simultaneously. These symbols are | (for the pipe feature) and \, used primarily in C-language programming.

The system is housed in a large but attractive integrated enclosure containing a seven-slot system card cage, the floppy-disk drive, the console video display (a 12-inch-

Editor's Note: Since this article was written, Radio Shack has announced a new standard configuration for the Model 16B: a 256K-byte system with one 8-inch floppy-disk drive and a built-in 15-megabyte hard-disk drive for \$6999.

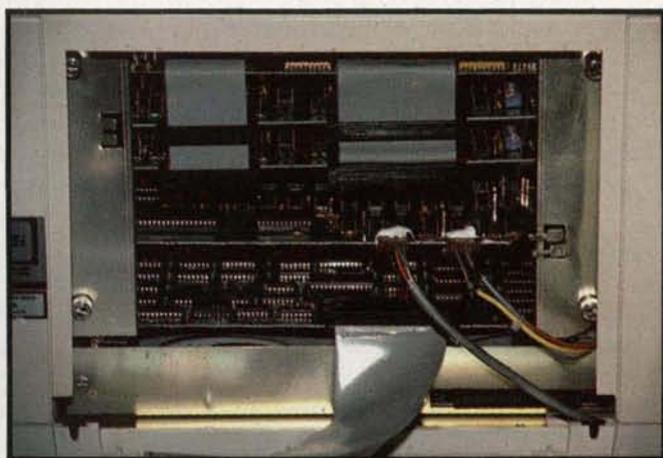


Photo 3: The Model 16B's card cage.

At a Glance

Name

TRS-80 Model 16B Computer

Manufacturer

Radio Shack Division
Tandy Corporation
1300 One Tandy Center
Fort. Worth, TX 76102

Size

14 by 21¼ by 23½ inches

Weight

Approximately 50 pounds

Components

Processors: Motorola 68000 running at 6 MHz, Z80A running at 4 MHz
Memory: Z80A with 64K bytes; M68000 with 256K bytes minimum, 768K bytes maximum (128K-byte memory-expansion board is \$699, 128K-byte add-on-chip kit is \$299)
Display: 24 lines by 80 columns, green phosphor, brightness and contrast controls, upper- and lowercase characters, 32 symbol graphics characters
Keyboard: Detached 86-key stepped keyboard with 6-foot coiled cord; keytops are textured to avoid glare
Data Storage: One 8-inch double-sided double-density 1¼-megabyte floppy-disk drive installed in the console
Expansion: Seven-slot card cage; three slots are free in a 512K-byte system with a 12-megabyte hard-disk drive

Operating Systems

TRSDOS-11/16 (single user), TRSDOS-12 (single user), TRS-Xenix (multiuser)

Documentation

TRS-80 Model 16B Operator's Manual, 100 pages; TRSDOS-11 Reference Manual, 326 pages; TRS-Xenix Operations Guide, 161 pages; TRS-80 Model 16B Owner's Manual (actually the TRSDOS-16 Operating System Manual), 256 pages; Twelve-megabyte Hard Disk Owner's Manual, 50 pages; BASIC Reference Manual (TRSDOS with BASIC interpreter), 235 pages; Assembler-16 Manual, 353 pages

Software Available

TRS-Xenix multiuser software: General Ledger (\$599); Payroll (\$699); Accounts Receivable (\$599); Accounts Payable (\$599); Order Entry/Inventory Control System (\$599); Sales Analysis (\$399); Job Costing (\$199); Multiplan spreadsheet (\$349); COBOL Development System (\$699); BASIC interpreter (\$299); and TRS-Xenix Development System with C language, electronic mail, text processing, and Xenix utilities and Assembler-16 (\$750). The Model 16B also uses Model 11 and Model 12 software in the Model 11 compatibility mode (single user)

Optional Features

Second internal 8-inch floppy-disk drive (\$799); one (\$1299) or two (\$2098) external floppy-disk drives; 11.6-megabyte primary hard-disk drive (\$3495); 12-megabyte secondary hard-disk drives (three maximum, \$2495 each); graphics video adapter board (monochrome 640- by 240-pixel resolution, \$499); DT-1 data terminals (two maximum, \$699 each)

Prices

256K bytes, one floppy-disk drive: \$4999
256K bytes, two floppy-disk drives: \$5798
384K bytes, one floppy-disk drive, one 11.6-megabyte hard-disk drive: \$9995
512K bytes, one floppy-disk drive, one 11.6-megabyte hard-disk drive (minimum recommended Xenix configuration): \$10,294

diagonal green-phosphor tube without antireflection treatment), the Motorola 68000 processor board, a memory board, and the hard-disk interface. This configuration costs in the neighborhood of \$16,000, complete with a top-of-the-line Radio Shack letter-quality printer and a complement of multiuser accounting and core business-applications programs. Moderate-resolution (640-by 240-pixel) monochrome-video-graphics hardware is an option for the console terminal but is not yet supported by Xenix software.

Software

The optional single-user software library includes all TRS-80 Model II and 12 programs (nearly 50 from Radio Shack), each targeted at a broad base of business and professional users. The optional multiuser software library is, at this writing, confined to program-development software (available at additional cost; see *At a Glance*), "big four" accounting packages (General Ledger, Accounts Payable, Accounts Receivable, Payroll), and Microsoft's Multiplan advanced spreadsheet. Other software includes an order-entry/inventory-control system, sales analysis, and small-contractor job-costing programs. COBOL and BASIC languages are sold separately, as is the TRS-Xenix development system, which includes many utilities, the C language, Unix-style communications, Unix-style text processing (*not* word processing in the usual sense), and Unix's basic electronic-mail facilities.

Hardware

The TRS-80 Model 16B has two serial RS-232C ports, a parallel printer port, and a space on the connector panel reserved for the Datapoint/Radio Shack Arcnet LAN interface. In its current configuration, then, the system can handle only three users: two working on dumb terminals, such as Radio Shack's model DT-1, and a third working on the system console. The system card cage has space for seven cards. The maximum RAM (random-access read/write memory) allowable currently is 768K bytes, which is obtained using the M68000 microprocessor's on-board memory and two 256K-byte cards. The 64K bytes of Z80 memory are on a separate card below the card cage (photo 3) in the base of the system unit. The M68000 memory cards are connected to the processor board by two card-edge ribbon cables in a bus configuration, in addition to their interface to the motherboard. One card slot is used for the hard-disk interface, and another is used for the console terminal electronics. Two slots are unused in the configuration we tested. Recent rumors suggest that Radio Shack is planning to announce a six-port terminal multiplexer board, along with a 15-megabyte hard-disk drive. The multiplexer and an Arcnet board would fill the card cage and, according to our system-performance evaluations, provide enough interfaces to cause severe response delays for a full load of users. It is possible that this machine could support only two to four users in a program-development environment, if our previous experience with similar hard-

ware applies to this machine. In fact, with only 384 bytes of memory (one advertised "complete" configuration), Xenix may even be noticeably slow with three users. However, the three-user configuration with 512 or 784K bytes of memory is clearly supported and seems to make the most sense in terms of the speed of the operating system and the memory-segmentation scheme that is implemented.

Local-Area Networking

For larger groups of users, the Arcnet board might be used to interconnect clusters of three users per Model 16B (i.e., a distributed-star network). As a user, you would have access to the 16B to which your terminal is connected and would also have read and/or write access to programs and data for which you have authorization on other 16Bs connected to the network. Typically, in other Unix systems (although there is no official indication that Radio Shack will go this way), networking means you run a program at your terminal that lets you log onto the desired remote system via the physical network facilities. You may then do work on the remote system or transport programs and data back to the system to which your terminal is directly connected. You must have a user account on each networked Unix system that you want to use. Thus, you may have several accounts on several different machines in the office, and it is possible that none of the accounts would have all of the up-to-date information you desire to use in a particular work session. This network architecture itself promotes redundant storage of data on several systems. The software for this type of network access is standard Unix fare: `uucp` is the Unix-to-Unix copy program (used for file transport and intersystem mail), and `cu` is the call-Unix program (used to establish a logical user connection over a preexisting physical connection between systems). The `cu` program lets you log onto the desired system as though your terminal were directly connected to that system. The `cu` program also allows file transport back to your actual host system. Xenix appears to have the standard Unix networking described above. This is good, but things can get much better.

In contrast, consider two alternative network architectures. The first (and by far the nicest to work on) is the virtual system. In this system, you would typically have your own powerful personal computer (e.g., a 16B) interconnected with other users' 16Bs by a local-area network (e.g., Arcnet). A program called the Network Manager would run on each active system as an invisible background task. All requests for files (i.e., programs, data, or directories) that cannot be satisfied on your system are referred to the Network Manager. The Network Manager then queries all other active systems on the network for the desired item and transports the item to your computer for execution, if that item is a program. If the item is not a program, an access link is created via the network, if you have the correct authorization. You never see all of this activity: you either get access to the file or receive an error message describing why access was

denied (file not found, file found on another file system to which access was not granted, etc.). This type of network reduces data redundancy and, more important, provides you with a transparent network-wide access interface. The Model 16B could be hooked up to this type of network if Radio Shack, Datapoint, or Microsoft creates the right network software.

In the second alternative, the 16B's Arcnet hardware could be used in a simple star network where a central network "server" consists (usually) of a central processor and disk system. Each user workstation would be a Model 16B computer having either no mass-storage system or only a floppy-disk drive. The central server is used for all fast bulk storage and may also be used to route data from one user's workstation or file system to that of another user. It is easy to make this sort of network operate like a virtual system, but such a network is usually slower and is vulnerable to faults in the server. Program execution on each of the workstations might also be slower due to the need to retrieve program or data segments from the central server's disk. The advantages of this type of local-area network are that it is low in cost, it can minimize data storage redundancy, it provides a single integrated and coordinated file system, and, finally, it has relatively good compute performance for processes that are entirely memory resident. Whatever Radio Shack decides to do with the LAN facilities it has in store for us, you can bet that it will be proprietary and will promote the sale of other Radio Shack computer products.

Xenix on the Model 16B

The Xenix implementation on the 16B is an enhancement of Unix version 7 with the addition of several extensions from the University of California, Berkeley, and from Unix System III. (For more information on the Unix operating system, see David Fiedler's three-part article, "The Unix Tutorial," appearing in the August, September, and October 1983 BYTES. See also the several theme articles in the October 1983 issue on Unix.) The system comes in two pieces. The basic multiuser Xenix operating system and a pretty good collection of utilities comes with the purchase of a Model 16B. The Xenix Development System adds numerous utilities and C, the language in which Unix is written. C is being touted in the industry as the only way to write truly portable fast-executing code. Let it be known, however, that not all versions of C are created equal. Unfortunately, despite a clear definition of what C is and what it's supposed to do by Kernighan and Ritchie in *The C Programming Language* (reference 1), several nonstandard C compilers are available on the market today. Worse, some compilers have subtle differences in their implementations that hinder true portability—code that runs well in some environments gets sick in others. The TRS-Microsoft implementation appears to be reliable and standard. The Xenix Development System adds many useful utilities and commands including the Unix electronic-mail facilities and Unix communications. Xenix is, in comparison

EXPOTEK

24 Hour Xmas Hot Line

1-800-528-8960

Guaranteed Low Prices

PRICES ARE CONTINUALLY CHANGING IN THIS FAST GROWING MARKET. WE PURCHASE IN HIGH VOLUME TO INSURE YOU OF THE LOWEST POSSIBLE PRICE. OUR ADVERTISING IS PREPARED AT LEAST ONE MONTH IN ADVANCE, SO CHECK FOR OUR CURRENT LOW PRICE.

- HIGH VOLUME SALES INSURE LOWEST POSSIBLE PRICE
- WE DO NOT "ADD ON" TO SHIPPING COSTS
- CODs ACCEPTED
- WE SHIP FROM STOCK
- WE GUARANTEE OUR PRODUCTS

PORTABLE COMPUTER CASE IBM, APPLE, FRANKLIN, TRS 80, ETC.

All metal construction designed for low RFI emissions replaces stock case. Unit folds to compact size enclosing keyboard and drives (up to three). When set on desk and opened, keyboard folds to convenient typing height.

IBM CALL SAVES

AST, Hercules, Microsoft, Maynard, Persyst, Profitsystems, Quadram, STB, Talltree

for the IBM

TANDON 100-2DD	.....	\$225
QUADRAMCARDS	.....	CALL
16K RAM CHIPS SET OF 9	.....	\$1490
64K MEM/UPGRADE	.....	\$55
SOFTWARE	.....	CALL

COMPUTERS

ALTOS

580-10	.....	\$3500
586-10	.....	\$5498
586-14	.....	\$7680
8600-12	.....	\$8399

ATARI SAVE \$ CALL NORTHSTAR

W/15MB	\$4310
--------	-------	--------

TELEVIDEO

802	.....	\$2515
802H	.....	\$4449
803	.....	\$1769
1603	.....	CALL

TERMINALS

ADDS

VIEWPOINT A1	.....	\$485
VIEWPOINT A2	.....	\$550

HAZELTINE

ESPRIT I	.....	\$498
ESPRIT II	.....	\$540

TELEVIDEO

910	.....	\$555
925	.....	\$699
950	.....	\$865
970	.....	\$975

DISKDRIVES

FOR APPLE	.....
MICOR SCI A2	.....	\$235
RANA ELITE I	.....	\$260
RANA ELITE III	.....	\$249
FOR ATARI	.....
RANA 1000	.....	\$375

PRINTERS

CITOH

F1040	.....	\$1090
F1055	.....	\$1499
1550P	.....	\$599
8510P	.....	\$345

SILVEREED SAVE \$ CALL DATASOUTH

DS120	.....	\$595
DS180	.....	\$1155

DIABLO

620	.....	\$875
630RO	.....	\$1699

NEC

3510	.....	\$1365
3550	.....	\$1705
7710	.....	\$1900
8023	.....	\$399

OKIDATA SAVE \$ CALL MONITORS

AMDEK

300 GREEN	.....	\$129
300 AMBER	.....	\$145
310 AMBER (IBM)	.....	\$199
COLOR I	.....	\$275

BMC

GREEN	.....	\$88
COLOR	.....	\$299

APPLECARDS

16K RAM	.....	\$69
Z80	.....	\$235
VIDEX 80 COLUMN	.....	\$199
VIEWMAX 80	.....	\$175
MICROSOFT PREM. PK	.....	485

DISKETTES

ELEPHANT SS/SD	.....	\$18.00 BX
SCOTCH SS/DD	.....	\$22.00 BX
DYSAN SS/SD	.....	\$33.00 BX

TWX 910-950-1194

CUSTOMER SERVICE (602) 863-0759

10439 N. CAVE CREEK RD., #111, PHOENIX, AZ 85020

How a fireman and a broken leg made software simple.



What does a fireman know about designing software? Nothing. Usually.

Meet Dennis Jarvis, a firefighter from Southern California. About five years ago he broke his leg in a fire-related accident and was confined to the house for about six months. To keep him occupied, Dennis' wife bought him a computer.

Dennis had never used a computer before. But he proved to be a natural.

Dennis was soon writing his own programs. And Basic Accounting from Firefighter was born.

It was brilliant.

And so simple, you don't have to know anything about accounting theory to use it.

But don't get the wrong idea. Just because it's simple, doesn't mean it's not smart, too.

Basic Accounting from Firefighter has so many more features and capabilities than the best selling accounting package, there's no room to list them in this ad. You'll just have to ask your dealer to show you.

Dennis? He returned to the Fire Department soon after his leg healed, but remains the spearhead of Firefighter Software.

In fact, in his never-ending efforts to make Firefighter the most personal, most supported software, Dennis has set up a telephone hotline to answer your questions and provide consultation. That's just Dennis' way of insuring Firefighter remains superior, always simpler yet smarter.

Hotline: 1-800-641-0814

California Hotline: (213) 991-8200

FIREFIGHTER.

SIMPLER, SMARTER SOFTWARE.



31245 La Baya Drive, Westlake Village, CA 91362

to other manufacturer's offerings, a fairly complete implementation of Unix (minus the languages that come standard with real Unix) at a moderate cost. However, it is possible that Unix System V will be released to end users at a low cost and so offer significant competition to Xenix.

Xenix and Unix System Calls

The most widely distributed and used version of Unix today is version 7. Microsoft Xenix is a derivative of this version with some enhancements and is available as a single or multiuser environment. Like Unix, Xenix requires a good deal of memory (at least 256K bytes for a one-user system) and a lot of hard-disk space (we think that a 10-megabyte disk with an average access time of 95 milliseconds is the minimum practical). Both systems work better with more memory and with faster, bigger disks. Xenix supports all of the version 7 standard system calls (what a program uses to talk with the operating system), plus some extensions that improve multiuser access to the system's resources. The standard system calls (similar to CP/M's BDOS, or basic disk operating system, calls) are shown with brief explanations in table 1. The most notable extensions to Unix are in the kernel; they affect file access and signaling between tasks (called processes in Unix). Unix and Xenix are structured much like an onion; at the center is the kernel, the basic code that makes it all go. Successive layers of code add utilities, features, languages, and the user interface—called the shell. The kernel has the task of making the link between the Unix standard environment and the nitty-gritty of the machine on which the operating system is running. Thus, standard system calls can be issued from programs, and their translation into action on a particular machine is handled by the kernel. This is the key to why Unix is a highly portable system. You only have to rewrite the kernel and a few device drivers to transport the whole system to another machine, using a standard C compiler and an assembler available on the target machine. One of the primary concerns in using Unix in a commercial multiuser environment is how to achieve orderly and centrally-controlled access to disk data at the individual record level. Standard Unix does not support the types of access-permission control and concurrency control (file and record locking) required by business programs. This is one of the first areas addressed by Xenix enhancements to standard Unix.

File Access Control

The Xenix extension routine `locking` locks or unlocks a specific number of bytes in a file. The process that issues the lock command has read/write access to these bytes and may allow read-only access to other processes. The parameters `mode` and `size` control these actions. If the region being locked is already locked by another process, the locking routine requesting access can wait for the entire region to be unlocked or can return with an error code. A Unix/Xenix standard specification for this routine is shown here:

Now your computer can say anything and say it well. Introducing the Votrax Personal Speech System.

Quite articulate.

The unlimited vocabulary Votrax Personal Speech System is the most sophisticated, low cost voice synthesizer available today. Its highly articulate text-to-speech translator lets your computer properly pronounce conversational words at least 95% of the time.

For all those unusual words and proper names, you can define an exception word table and store your own translations. And remember, the entirely self-contained Votrax PS System gets your computer talking without using any valuable computer memory.

Built-in versatility.

Much more than just a voice output device, the Votrax PS System lets you mix either speech and sound effects or speech and music. A programmable master clock and 255 programmable frequencies give you unmatched control of speech and sound effects.

The Votrax PS System offers user expandable ROM for custom applications, user downloadable software capability and sound effects subroutines for easy user programming. Its programmable speech rate provides more natural rhythm, while 16 programmable amplitude levels give you greater control of word emphasis.

Actual size: 12.2" x 4.5" x 2.6"

Friendly to humans.

Designed to look like a printer to your computer, the Votrax PS System is extremely easy to use. It can be used in tandem with your printer without an additional interface card. Both serial and parallel ports come standard, allowing you to connect the Votrax PS System to virtually any computer. Speech, music and sound effects are only a PRINT statement away.

“Listen here”

What to say after “Hello”.

Businesses will appreciate spoken data transmission, narration of graphic displays and unmanned, oral product demonstrations. Spoken verification of data input will make computers much easier for the blind to use. School children can receive comprehensive

Votrax®

The Votrax Personal Speech System is covered by a limited warranty.

Write Votrax for a free copy.

500 Stephenson Highway, Troy, MI 48084

computer instruction with voice textbooks as well as spoken drills and testing. And then, late at night, you can make those adventure games explode.

A quick list.

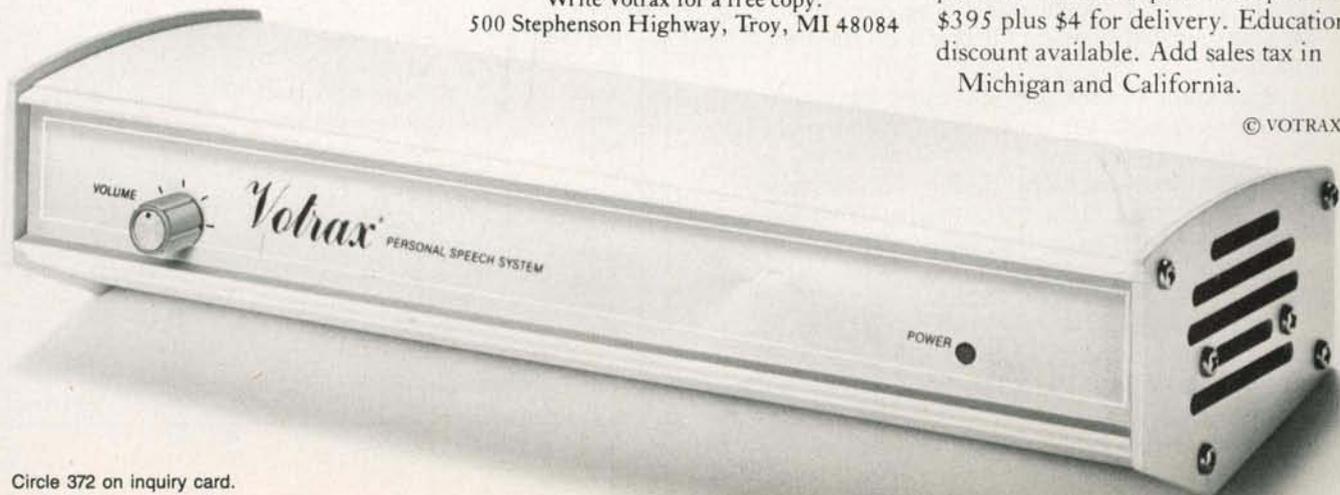
- Highly articulate Votrax text-to-speech translator.
- 255 programmable frequencies for speech/sound effects.
- 16 amplitude levels.
- Simultaneous speech and sound effects or speech and music.
- 8 octave, 3 note music synthesis.
- Serial and parallel interface standard
- User programmable master clock
 - User defined exception word table.
- User programmable speech rate, amplitude and inflection.
 - User expandable ROM for custom applications.
 - User downloadable software capability.
 - 3,500 character input buffer: subdivisible for a printer buffer.
- Internal speaker and external speaker jack.
- Real time clock and 8 user defined alarms.
- Oral power up and error prompting
- X-on/X-off and RTS-CTS handshaking
- Programmable Baud settings (75-9600)
- Interrupt driven Z-80 microprocessor.
- Parallel/Serial interconnect modes.
- Proper number string translation: the number “154” is pronounced “one hundred fifty four”.

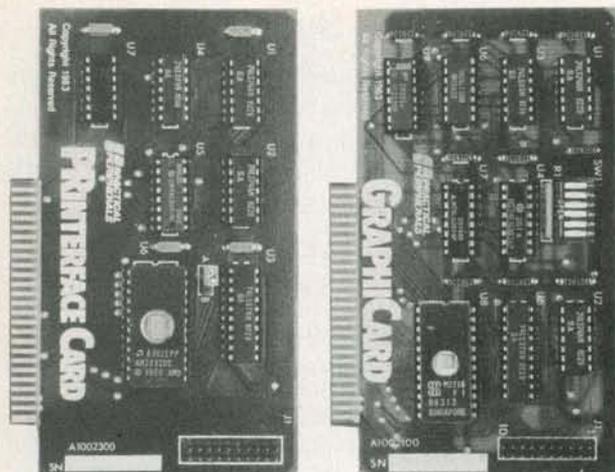
To order, see your local computer retailer or call toll-free

1-800-521-1350

Michigan residents, please call (313) 588-0341. MasterCard, VISA or personal check accepted. The price is \$395 plus \$4 for delivery. Educational discount available. Add sales tax in Michigan and California.

© VOTRAX 1988





\$75*

\$99*

RIGHT FACE. RIGHT PRICE.

At \$75 and \$99 respectively, PRINTERFACE™ and GRAPHICARD™ are the right parallel interface products for your Apple II, II+, IIe or Apple** compatible system.

But don't be fooled by those low prices. High performance features and high reliability make them the right choice for serious printing requirements.

PRINTERFACE, for example, offers 27 easy commands that let you format text, send controls to the printer. You can even dump 80-column text screen from your Apple IIe.

GRAPHICARD gives you all that, plus graphics capabilities for 37 of the most popular printers. Eight additional commands permit a variety of graphics, screen dumps, including side-by-side, top-to-bottom, double size, inverse, emphasized, rotated and mixed text and graphics. For Apple II owners, the GRAPHICARD will give 80-column screen dumps from the Videx™ 80-column board.

By the way, if you buy PRINTERFACE and decide later that graphics would be nice, there's an easy-to-install upgrade kit that'll do the trick just fine.

Both cards clearly give you more for your money. And both are warranted for five years. That's right, **five years.**

So drop into your local dealer and ask about PRINTERFACE and GRAPHICARD today. Two more practical products from Practical Peripherals.



31245 La Baya Drive, Westlake Village, CA 91362
(213) 991-8200 • TWX 910-336-5431

*Suggested retail price.

**Apple is a registered trademark of Apple Computer, Inc.

locking (files, mode, size)

int files;

int mode;

long size;

We'll describe some of the notation as we go along, but a complete specification of the C language is contained in Kernighan and Ritchie's book on C. All Unix and Xenix documentation uses headers such as this one to specify exactly what a routine's calling sequence is.

access	determine accessibility of file
acct	turn accounting on or off
alarm	schedule signal after specified time
brk	change core allocation
chdir	change working directory
chmod	change mode of file
chown	change owner and group of a file
chroot	change the root directory
close	close a file
creat	create a new file
dup	duplicate an open file descriptor
exec1	execute a file
exit	terminate process
fork	create a new process
getgid	get group identity
getpid	get process identity
getuid	get user identity
indir	indirect system call
ioctl	control device
kill	send signal to a process
link	link to a file
lock	lock a process in primary memory
lseek	move read/write pointer
mknod	make a directory or a special file
mount	mount a file system
nice	set program priority
open	open file for reading and writing
pause	stop until signal
pipe	create an interprocess channel
profil	execution time profile
ptrace	process trace
read	read from file
setuid	set user identity
setgid	set group identity
signal	catch or ignore signals
stat	get file status
stime	set time
sync	update super block
time	get date and time
times	get process times
umask	set file creation mode mask
umount	remove a file system
unlink	remove directory entry
utime	set file times
wait	wait for process to terminate
write	write on a file

Table 1: Standard Xenix system calls.



PANTHER



UNLEASH THE POWER

Having been in the microcomputing industry for 10 years, VR Data Corporation has earned its reputation for microcomputing excellence. For over a year we have been making solid deliveries of the PANTHER establishing ourselves as THE SOURCE for proven, premium quality Winchester Disk Subsystems. The PANTHER satisfies the most demanding mass storage needs with capacities of up to 30 megabytes or more.

Utilizing 5 1/4" Winchester disk drive technology, and microprocessor based error correcting controller boards, the PANTHER continues to be the #1 choice of discerning professionals. Available with one or two drives in one enclosure, the PANTHER can support many combinations of fixed and removable drives.

Now VR Data Corporation proudly introduces the newest member in the Panther family of Winchester Disk Drives, the "CUB". The CUB is a sub-mini Winchester Disk Subsystem, representing the latest in innovative technologies. With advances such as 100mm thin film plated media with embedded digital servo, and switch mode power, the CUB placed VR Data well out ahead of the pack. Available in single (master) and dual (master/slave) drive configurations, the CUB provides the user with capacities up to 10 megabytes of fixed or removable storage media.

The CUB's sleek low profile design totally eliminates that overcrowded work area problem and adds a professional appearance to your system. The CUB removable media drives are ideal for 5 megabyte on-line storage as well as 5 megabyte backup for your fixed media drives. Adapter modules are available for the most popular microcomputers. The PANTHER family of drives are available at quality Computer Stores everywhere. If your dealer does not yet carry PANTHER Drives from VR Data, tell them the future has arrived.

VRdata

777 Henderson Blvd. • Folcroft, PA 19032 • (215) 461-5300

Circle 373 on inquiry card.

Note that the notation is terse and assumes that you understand both the nuances of the C language and how C was used to implement the function.

The parameter `files` is the file description (i.e., the unique identifier) of the file to be locked. Variables are shown in C-language-type declaration statements as either integer (`int`) or long integer (`long`).

Binary semaphores are implemented in Xenix as a special file type having a length of 0. Each semaphore has a name (`sem_name`) and a mode that specifies permissions. A program creates the semaphore as follows:

```
int creatsem (sem_name, mode)
char *sem_name; /* a character pointer */
int mode;
```

Execution of the integer function `creatsem` causes the semaphore to be reset and a unique semaphore identification number to be returned. Other processes can then open the semaphore with a routine `open_sem`, but access is granted only if the calling process has been given permission by the creating process. The routine `wait_sem` suspends the calling process until that process is signalled by the routine `sigsem`. More than one process may wait for a given semaphore to be set. A first-in-first-out (FIFO) queue is maintained by the system for each semaphore. A program that reads a shared file issues `sigsem` when it is done with the file. The `sigsem` call awakens the next process on the FIFO stack that is

waiting to use the file. The routine `nbwaitsem` checks to see if the queue for a particular semaphore number is empty.

Thus, the semaphore routines provide the tools with which programmers can construct a binary signaling system between processes. The system is totally maintained by the programmer. A high degree of skill is required to use these facilities. But some such facilities are essential to the implementation of any multiuser application program on a system where one action must be completed before the initiation of the next.

Xenix also provides several convenience routines such as a "check" routine, `rdchk`, which looks to see whether there is any data to be read on an input stream. Programmers can use the routine to avoid annoying "hangs" or inactive input streams. The routine `shutdn` does all of the housekeeping necessary to shut down the Xenix system in an orderly fashion, including flushing all buffers to disk and halting the central processing unit. The consequences of a disorderly shutdown, caused by a power outage or an inadvertent flick of the power switch on the disk or the processor, are quite uncomfortable. Data and even whole files and file systems can be lost without the possibility of resurrection (unless you really know what you are doing). To reduce the impact of such incidents, Xenix also supplies a tool that allows some of the worst effects of a damaged file system to be fixed. File-system-repair programs can replace the root file system's "super block" by passing a new super block in still

GTEK INC. DEVELOPMENT HARDWARE/SOFTWARE

HIGH PERFORMANCE/ COST RATIO

(601) 467-8048

EPROM PROGRAMMER

Compatible w/all Rs 232 serial interface port * Auto select baud rate * With or without handshaking * Bidirectional Xon/Xoff and CTS/DTR supported * Read pin compatible ROMS * No personality modules * Intel, Motorola, MCS86, Hex formats * Split facility for 16 bit data paths * Read, program, formatted list commands * Interrupt driven, program and verify real time white sending data * Program single byte, block, or whole EPROM * Intelligent diagnostics discern bad and erasable EPROM * Verify erasure and compare commands * Busy light * Complete w/Textool zero insertion force socket and integral 120 VAC power (240 VAC/50Hz available)

DR Utility Package allows communication with 7128, 7228, and 7956 programmers from the CP/M command line. Source Code is provided. PGX utility package allows the same thing, but will also allow you to specify a range of addresses to send to the programmer. Verify, set the Eprom type.

MODEL 7316 PAL PROGRAMMER
Programs all series 20 PALS. Software included for compiling PAL source codes.

Software Available for CPM,¹ ISIS,² TRSDOS,³ MSDOS.⁴

1. TM of Digital Research Corp.
2. TM of Intel Corp.
3. TM of Tandy Corp.
4. TM of Microsoft.

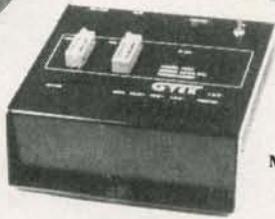
Post Office Box 289
Waveland, Mississippi 39576
[601]-467-8048

\$799 stand alone MODEL 7956

MODEL 7956 GANG PROGRAMMER
Intelligent algorithm. Stand alone, copies eight EPROMS at a time. With RS-232 option \$999.

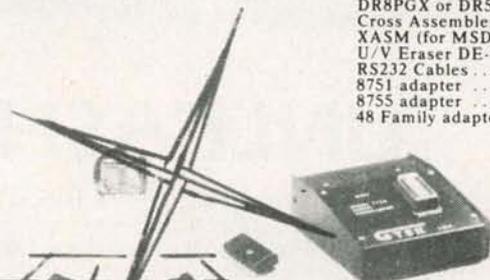


\$499 MODEL 7316



\$1195 MODEL 7324

MODEL 7324 PAL PROGRAMMER
Programs all series 20 & 24 PALS. Operates stand alone or via RS232.



\$499 MODEL 7228

MODEL 7228 EPROM PROGRAMMER
All features of Model 7128 plus Auto Select Baud, super fast adaptive programming algorithms, low profile aluminum enclosure. Programs 2764 in one minute!



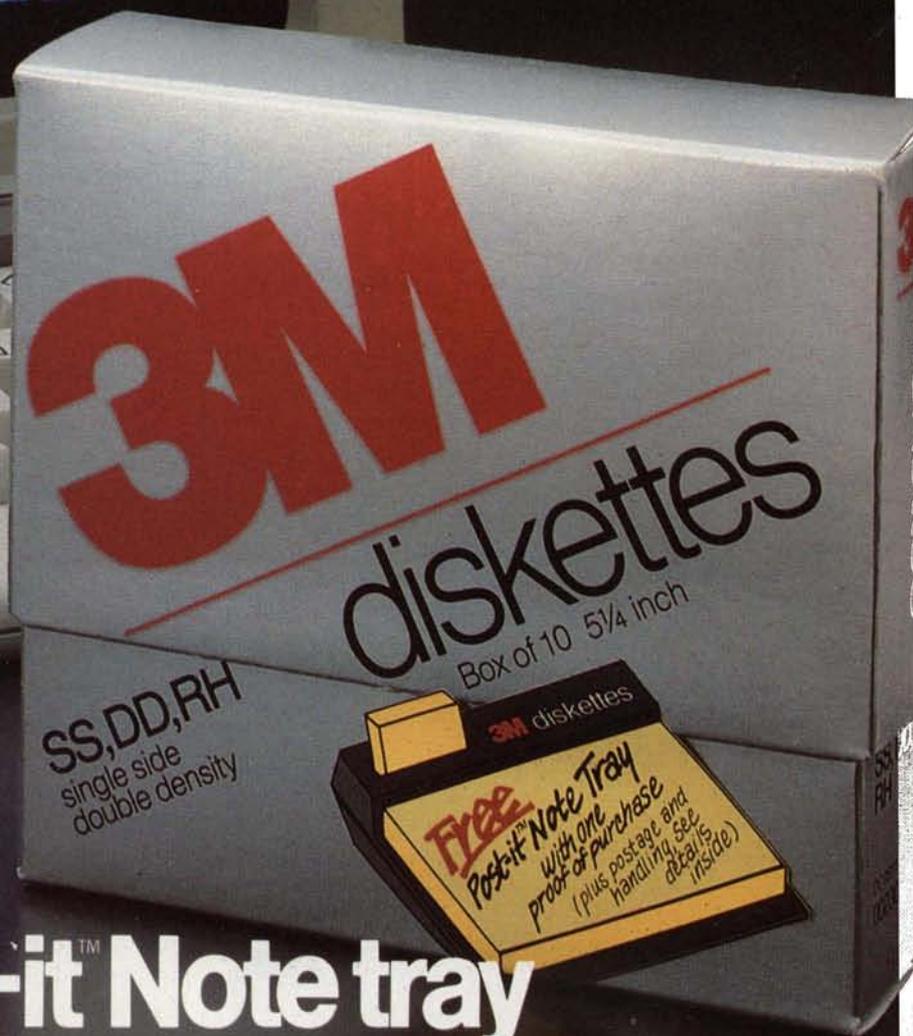
\$389 MODEL 7128

MODEL 7128 EPROM PROGRAMMER
Programs and Read:

NMOS	NMOS	CMOS	EEPROM	MPU'S
2508	2758	27C16	5213	8748
2516	2716	27C32	5213H	8748E
2632	2732	C6716	X2816	8749E
2564	2732A	27C54	48016	8741
68766	2764		12816A	8742E
68764	27128			8741E
8755	27256			8751
5133				

- Model 7128-L1,L2,L2A \$209
- Model 7128-24 \$289
- DR8 or DR5 \$ 30
- DR8PGX or DR5PGX \$ 75
- Cross Assemblers \$209
- XASM (for MSDOS) \$250
- U/V Eraser DE-4 \$ 78
- RS232 Cables \$ 30
- 8751 adapter \$174
- 8755 adapter \$135
- 48 Family adapter \$ 96

... and so respectively. Supply a two-digit
station of the hours, minutes and seconds for H, M and
seconds. When the line specified corresponds to the
line, strike a key and TDR sets the current date and
is continues.



Free Post-itTM Note tray from 3M diskettes.

We'll give you a 3M Post-itTM Note tray and a sample pack of Post-it Notes — a \$4.98 value. Absolutely free! Just buy any specially marked box of 3M diskettes and send in the proof of purchase — with 75¢ for postage and handling. Complete details inside specially marked diskette boxes.

One 3M value deserves another.
3M diskettes have long been noteworthy for their unparalleled reliability. A reputation based

on over 30 years experience in manufacturing high quality computer media. Now we're giving you one more good reason to use high quality 3M diskettes.



So buy a specially marked box of 3M diskettes. And send for your free Post-it tray and notes today! Look in the Yellow Pages under computer supplies and parts for the 3M distributor nearest you. In Canada, write 3M Canada, Inc., London, Ontario. If it's worth remembering, it's worth 3M data recording products.

3M hears you...

Circle 356 on inquiry card.





Current Specials

IN STOCK NOW

IBM-PC

\$2995

Two 320 drives, 128k RAM, color graphics/monochrome card, monochrome monitor.

Call for prices on KayPro, Superbrain, Northstar, & other brands.

PRINTERS

Tally 160L \$659
Okidata 92 \$449
IDS Prism 132 \$1209
Gorilla Banana \$229
Gemini 10X \$329

MONITORS

AMDEK 300A \$159
AMDEK Green \$149
Zenith ZVM 121 \$95
Zenith ZVM 123 \$129
BMC Green \$89

MODEMS

Hayes Smartmodem \$219
Hayes 300/1200 \$509
Hayes 1200B \$439
Anchor Mark VIII \$349
Anchor VI Internal IBM \$192

All other brands at similar savings

GEMINI 15 printer, 100 cps, 15" carriage **\$359**

KOALA PAD

APPLE \$99
IBM \$109

ZENITH 122 Amber Monitor
800 Lines

\$129

SANYO 555 Computer
w/Wordstar, Spellstar, Infostar
CALL

HERCULES GRAPHICS
Card for IBM PC

\$359

HERE'S WHAT OUR CUSTOMERS SAY ... "full service attention at mail order prices. Informed, helpful, responsive." *Wes Gilbert, DATA I/O*

PACIFIC COMPUTERS 13240 Northup Wy #4 - Bellevue, WA 98005

ORDERS ONLY
1-800-531-3133
Information
206-641-7233

Prices reflect 3% cash discount • Bankcards • Sorry no COD • FOB Bellevue
All items currently in stock



Exporting Services

We Are Buyer's Agent for Overseas Dealers and Distributors

- Lowest prices, immediate quotations, prompt delivery.
- Access to all major hardware and software manufacturers.
- All professional services provided: Licensing, Export Documentation, and Follow-through.

24-Hour Response as Close as Your Telex
TELEX 470851

American Buying and Export Services
1036 Country Club Drive, Moraga, CA 94556
(415) 376-7600

a structure that contains all of the header declarations for the super block of the file system to be repaired.

The Unix File System

The Unix file system is a hierarchical, or tree, structure. Microsoft has implemented the same general structure in a recent rewrite of its operating system for the IBM Personal Computer, PC-DOS version 2.0. The root directory, /, is where everything starts. Within / are kept data files, files that contain programs, and files that are directories of other files. It also contains a directory called /usr, which contains all of the user directories. Let's suppose that a user named Randy has, as his home directory, the file called randy. Randy writes a program called hello. To run that program it is only necessary to type the name of the program. What you type can be the whole name (/usr/randy/hello) or an abbreviation, depending on where you are—that is, what your current directory is. If you type `cd /usr/randy`, your current directory is randy and you can just type hello to execute the program. If your current directory is /usr, you must type randy/hello.

Files and file systems are held together with a glue made of pointers. Files reside in any blank space available on a disk. If the first space available is too small, the file is written partly in that space and partly in the next free space. Pointers keep track of what is where. Because directories are nothing but files, it is possible that a single bad pointer can lose hundreds or thousands of other files.

Additional problems can occur in relation to another feature of the operating system: to enhance performance writes to disk are not necessarily done when requested by the user or calling program. This is because Unix I/O is heavily buffered in memory. When some event calls for a write, the write occurs to the buffer and the system decides whether it is time to flush the buffer to the disk. Every 30 seconds or so a housekeeping process (called a daemon) comes along and flushes the buffers so that the disk doesn't get too far out of synchronization. No surprisingly, this daemon is called sync. Sometimes, due to a power fault, a bad memory location, or some other event, the disk and the memory buffers are left unsynchronized as the system crashes. Even the best-run and best-maintained Unix system will encounter an occasional crash or partial crash. The result is usually a somewhat damaged file system. It is up to the person responsible for system maintenance to repair the damage.

System Maintenance

Unix version 7 supports programs used for file-system maintenance, backup, and system accounting. Xenix has made a number of extensions to the system to make maintenance easier. File systems can be repaired using `dcheck`, `icheck`, `ncheck`, and `clri`. These utilities give the system maintainer a high degree of flexibility, but to be used effectively they also require a high degree of knowledge about the file system. Xenix includes a Unix System III utility `fsck` (file system check) to help simplify repairs to the file system.

Turn Your FLOPPIES Into FLIPPES

5 1/4" FLIP



aligned, accurate,
safe way to make
index-hole cutouts.



DOUBLES YOUR DISKETTE MEMORY IN SECONDS!

The self-aligning Write-Enable Punch has a special Deep-Grooved and "Case-Hardened" Steel Punch for making a clean write-enable cutout. Just insert into diskette and punch. Flip-it will pay for itself immediately — because every diskette you own or will buy is now like owning or buying two. Order yours today.

- a) 5 1/4" FLIP-IT: for all 5 1/4" computers incl. IBM, Osborne, Atari, Radio Shack, Commodore, Kaypro, Franklin & more only
- b) 8" FLIP-IT: for 8" computers incl. IBM, Altos, Radio Shack, DEC, DG, & more only
- c) Labels: (self-sticking, 100 ea.)
- d) Write Protect/Enable: (5 1/4" or 8") (100 ea.)
- e) Hub-Reinforcing Kit: (positioning-tool & 5 1/4" disks: \$10.99 8" disks: \$12.99)
- f) Hub-Reinforcer Rings: (50 rings ea. for opening) 5 1/4" disks: \$5.85 8" disks: \$6.95
- g) Disk Sleeves: (lint free, 10 ea.) 5 1/4" disks: \$2.55 8" disks: \$3.55

Add \$2.50 for shpg and hdg. (AK, HI, Canada=add \$5, Int'l orders add USD10) — Mass. res. add 5% tax

Tel: (617) 527-FLIP

Circle 475 on inquiry card.

Flip-It

P.O. Box 201, Newton Hlds., MA 02161

Telex: 4991009 CHTRI

copyright 1983 D/Punch Corp.

We acknowledge all trademarks

Program	Unix Version 7	Xenix	TRSDOS
log in accounting	ac	ac*	
turn on system accounting		accton*	
prompt for correct time		asktime*	
clear i-node	clri	clri*	
directory consistency	dcheck	dcheck*	
turn off terminals		disable	
incremental system dump	dump	dump	
directory of dump tape		dumpdir	
turn on terminals		enable	
file system consistency		fsck	
quickly halt system		haltsys	
storage consistency	icheck	icheck*	
test RAM			memtest
make a file system	mkfs	mkfs	format
make a special file	mknod	mknod	
add login ID to system		mkuser	
mount file system	mount	mount	
name for i-numbers	ncheck	ncheck*	
incremental system restore	restor	restor	
remove user from system		rmuser	
system accounting	sa	sa*	
print and set dump dates		sddate*	
gracefully halt system		shutdown	
become super user	su	su	
update super block	sync	sync	
back up script		sysadminn	backup
tape archiver	tar, tp	tar	
dismount file system	umount	umount	

*Available with the optional Radio Shack Development System.

Table 2: Unix version 7 maintenance programs.

Backup is a key to the integrity of Unix systems. Invariably, even with expert use of the file-maintenance utilities, files are lost due either to user error or to system error (user error is far more likely). The only effective remedy is a current backup of the file that was lost. Xenix supplies a menu-driven procedure (actually a shell script) called `sysadmin` to help users maintain an adequate backup of the system, and `sddate` is used to maintain a backup history for the system.

Normal system maintenance includes authorizing new users, deleting unneeded user accounts, establishing a logical connection between new hardware (e.g., terminals) and the system, and starting and stopping the system. Xenix has made many of these chores easier. The programs `mkuser` and `rmuser` establish (make) a user account and remove one in a far easier way than Unix, where the manager must edit the `/etc/passwd` file. In Unix version 7 the terminals were enabled and disabled by editing the `/etc/tty` file. In Xenix the programs `enable` and `disable` simplify this process. The program `shutdown` is used to warn other users that the manager intends to shut the system down. The `haltsys` program accomplishes the shutdown quickly.

Table 2 is a brief description of the maintenance programs available in Unix version 7, Xenix, and, for com-

2000 letters per hour via your personal computer



delivered in 48 hours or sooner
at 26¢ a piece.

Whether it's credit and collection applications, announcements to your customers, or sales promotions for new services, our MAIL-COM software turns your personal computer into a one-button mailing house of enormous power. All you need is a modem, a personal computer, and our MAIL-COM software.

Our software allows you to link up with the U.S. Postal Service's new ECOM System. After receiving your letters via modem, the Postal Service will then print, stuff, seal and deliver the letters usually by the next day and guaranteed within 48 hours.

MAIL-COM is a complete, interactive package supporting all ECOM formats. Available now for the IBM PC (\$195.00), CP/M (\$195.00) and the Alpha Micro (\$495.00).

To order, call or write.

Digisoft
Computers

1501 Third Avenue
New York, NY 10028
(212) 734-3875

UNIX

and MS-DOS, and VMS too!

UniPress can meet your software needs, for a range of hardware, including VAX, MC68000, and IBM-PC.

UniPress, your UNIX source.

PACKAGING: VAX/VMS and UNIX, MC68000/UNIX on Sun, Masscomp, Apollo, Tandy 16, Apple Lisa, Sritek Board for IBM PC, Dual, Plexus, Callan, and Cyb. Perq and Perkin Elmer, too. Source code, as well as binary. Maintenance available. Inquire regarding other hardware.

UniPress Software

UNIX SOFTWARE

Priced from

- Full UniPlus+ UNIX for Apple LISA \$ 495
- EMACS—Multi-window text editor (Gosling version) 395
- LEX—Powerful word processor 500
- PHACT—Isam file manager 250
- /RDB—Relational database tools 250
- MENU SYSTEM—Menu generation 495
- UniCalc—Powerful spreadsheet 350
- MIMIX—CP/M emulator 495
- C cross compiler—to 8086 and 68000 (includes assembler, linker, etc.) 8000

MS-DOS SOFTWARE

- Software tools—Unix-like facilities add power to MS-DOS: includes ed, grep, sort, diff, cat, etc. 200
- PHACT—Isam file manager 250
- C compiler—Full C language 395
- Coherent—Unix-like operating system for IBM-PC XT 500

VMS SOFTWARE

- EMACS—Multi-window text editor (Gosling version) 2500

OEM and dealer inquiries invited. Quantity terms available.

Call or write for more information.

UniPress Software, Inc.

1164 Raritan Avenue, Highland Park, NJ 08904
201-985-8000 Toll Free: 800-222-0550 (outside NJ)
Telex: 709418

Mastercard and Visa

Overseas distribution available through
Lifeboat Associates — Japan

Unix is a trademark of Bell Laboratories.
VMS is a trademark of Digital Equipment Corp.
MS-DOS is a trademark of Microsoft.
UniCalc is a trademark of Lattice, Inc.

parison, TRSDOS (an operating system that we perceive to be similar in scope—if not in structure or detail—to most of the common single-user operating systems in the microcomputer market today). Entries in tables 2 through 15 marked with an asterisk (*) in the Xenix column are available with the optional Development System from Radio Shack or Microsoft. Entries in tables 3 through 15 marked with the † symbol are from the Berkeley implementation of Unix.

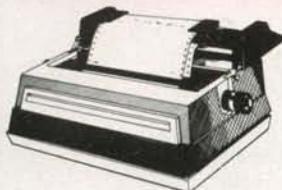
Program Development

Unix version 7 supports the program-development environment with a standard set of languages (included in the operating system package): f77 (FORTRAN 77), RATFOR (Rational FORTRAN preprocessor), a rudimentary BASIC interpreter, and, of course, C, as well as a host of useful utilities such as an assembler, a debugger, and library management. Table 3a shows the program support utilities available in several operating systems. Table 3b lists the programming languages, utilities, and related programs available in Unix and Xenix. Note that language software for Xenix is available only in the Development System or as a separate package. The arcv utility converts an archive from PDP-11 format (most of Unix was originally developed on PDP-11s) to one suitable for the Motorola M68000. Another utility, ctags, is used with vi, a full-screen (visual) editor of considerable power and complicated syntax, to edit programs using more than one source file. With ranlib you can convert an archive to a randomized library that can be used with the link editor—a program that takes the output of compilers or assemblers (i.e., object programs) and puts them together to form a single runnable program (thus, a “fix” in one program module requires only short recompilation and linkage editing to have the program running again). The Berkeley extensions mkstr, strings, and xstr minimize the storage space required for strings used in C programs.

Unix/Xenix Text Processing

The Unix community has spawned a number of editors and text processing systems. Xenix makes many of the text processors and two editors available to users. The Unix line-oriented editor ed is easier to use on a printing terminal than on a screen, but it is simple and quick and, for short texts, very effective. The vi editor has a manual nearly an inch thick and is a very powerful screen-oriented character editor. Each of these editors can be used to prepare text that can be subsequently processed by one of the formatting programs. Note that what you see is *not* what you get in the system. The text-processing formatters such as nroff, troff, and neqn provide tremendous flexibility and handle chores such as typesetting, mathematical equations, tables, and reference sections. The problem is that this is a multistep process. You place formatting commands into the text during text editing. To see the effect of these commands, you submit them to the proper formatter and print the result. You then proof the output, noting typographical errors, editorial changes, and format goofs. Back to the

\$\$ "LOWEST PRICES" \$\$



SMITH CORONA LETTER QUALITY PRINTERS

SMITH CORONA TPII	\$ 444
TPI STOCK SALE ONLY 7 LEFT	375
TELETEX TTX-1014 S & P	506
STARWRITER 40 cps S or P	1112
PRINTMASTER 55 cps S or P	1436
NEC 3510 33-cps SERIAL	1409

DOT MATRIX PRINTERS

GORILLA BANANA Graphics	221
PANASONIC KX-P1090 Fr&Tr	
Emulates FX-80	321
STAR MICRONICS GEMINI	
10X 120cps dot graphics	307
15X 120 cps like MX-100	484
OKIDATA	
82A Serial & Parallel 120cps	CALL
84 Parallel 15" Fr&Tr 200cps	CALL
92 Parallel 10"Fr&Pin 160cps	CALL
C. ITOH	
PROWRITER 8510 10"Par 120cps	404
8600 Near Letter Quality Par	1031
IDS MICROPRISM	510
EPSON FX-80	595



SUPERBRAIN

SUPERBRAIN II

DOUBLE DENSITY	\$1970
QUAD DENSITY	2376
SUPER DENSITY	2684
COMPUSTARS FOR NETWORKING	CALL
Prices too low to advertise	
SYSTEMS GROUP Multi-User	
SYSTEM 2966 w/17Mb Tape Backup	
8" Floppy+19Mb Hard Disk	\$7434
RADIO SHACK TRS-80 SAVE!	CALL

AMERICAN SQUARE COMPUTERS is organizing a World Wide Association of Computer Dealers. Open a Store or Start Work Out of Your Home! We Charge NO FRANCHISE FEE! (Our Competitors charge a FRANCHISE FEE of \$15,000.00 to \$45,000.00.) Be a Winner! Let US help YOU get started MAKING MONEY by HELPING PEOPLE to put COMPUTERS to WORK. Write or Phone Today.

Which Computers are Best FREE

Insured Shipping at Low Rates.

ADVANCED DIGITAL

ADVANCED DIGITAL 6MHz COMPUTER
SINGLE BOARD Z80B RS232 S-100 128K
with DISK CONTROLLER for 5"or8"
SUPER SIX (Includes PSNET/1) \$ 555
SUPER SLAVE=Z80B+PSNET/I+128K 491
SUPER STAR has 5Mb removableHD 4460
CPM 3 350
TURBODOS MULTI USER 518

ALTOS COMPUTERS

ALTOS S-100 COMPUTERS	
580-2 3-User 2 5 1/4"	\$2111
580-10 3-User Hard Disk	3806
580-20 3-User 20Mb	4562
8000-14 with 208K RAM	8340
586-10 16-bit 12Mb Hard Disk	5807
586-30 16-bit 30Mb Hard Disk	7176

TRAXX 5 1/4" ADD ON DRIVES

TRAXX 5 1/4" ADD ON DRIVES	
Bare drive SSDD	\$ 222
SSDD w/cabinet & power supply	322



TELEVIDEO

TERMINALS

TELEVIDEO 910 Emulates	\$ 419
TELEVIDEO 910+ Smart	538
TELEVIDEO 914 NEW Detach Kbd	506
TELEVIDEO 924 NEW Non-volatile	614
TELEVIDEO 925 Detach keybrd	674
TELEVIDEO 950 Prog funct keys	863
TELEVIDEO 970 VT-100 compat	935
ADDS Viewpoint 3A+ Emulates	442
ADDS Viewpoint G Graphics	1371
ADDS Viewpoint 60G Graphics	1511
ADDS Color Terminal NEW!	998
Zenith Z-29 Z19&VT100 compat	655
Zenith ZT-1 Terminal+modem	483
Visual 50 Ergonomic	653
Visual 55 New! Enhanced #50	734
Visual 102 80/132 columns	890
V102 Graphics option for 102	653
Visual 300 ANSI&VT100 compat.	842
Visual 330 VT52&Haz1500 comp.	842
Visual 500 Graphics 14"screen	1970
Visual 550 Graphics,Buffered	2138

MONITORS

ZENITH	
ZVM-122 Amber Phosphor	\$ 117
ZVM-123 Green Phosphor	134
ZVM-131 Composite Color	322
ZVM-RGB-135 Color Monitor	491
USI 12" Amber 20 MHz	\$ 149

NEC	
JB1205M 12" Amber Phosphor	\$ 190
JC1215 12" Color w/Audio	312

AMDEK	
AMDEK 13" COLOR I Demo,1 left	257

GRAPHICS & COLOR GRAPHICS

VECTRIX
VX 128 8 colors 322x560 Pix. \$1795
VX 384 16.8 million colors 3595
VXM Hi Res. 13" RGB Monitor 1221

MICROANGELO
MA 512 512x480 Monochrome \$ 674
MA 520 512x480 + Screen Pak2 890

COMPUTERS

COMPUPRO
Compupro computers come as main-frame, boards, and drives, and you must set the switches.

816A Computer 8085/8088 128K	\$4106
816B Computer 8085/8088 256K	5180
816C 8085/8088 512K 3 users	6613
816D 10 MHz 8086 512K	10194
816-08 CPUZ 208K Oasis	CALL
816-016 10 MHz 8086 512K	CALL
816-68K 8 MHz 68000 256K	6471

SEATTLE Pure 16 bit computer is the fastest microcomputer by actual test!

S-100, 128K Static Ram, 8 MHz
8086 18-slot Mainframe, 3 serial & 1 parallel ports.
Gazelle II Avail. Nov/Dec CALL
Hard Disk Gazelle II CALL

TARBELL with 2-8" disk drives

TARBELL REBEL S-100 64K Z80B 6MHz	
REBEL 2 2 5 1/4" Flpy=800K	\$2479
REBEL 5 1/4" Floppy + 5Mb HD	3009
REBEL 5 1/4" Floppy +10Mb HD	3139
REBEL 5 1/4" Floppy +16Mb HD	3268
TARBELL EMPIRE S-100 64K 2 8" Drvs	
EMPIRE I Single sided	\$3304
EMPIRE II Double sided	3775

MEDICAL SOFTWARE

MICROMED or MICRODENT	\$1656
STARDOC for OASIS SYSTEMS	350



NORTH STAR ADVANTAGE

NORTH STAR ADVANTAGE 8 BIT	8/16
Work Station	\$1996 \$2329
2 Floppies 360K ea.	2298 2631
5 Mb Hard + 360K Floppy	3432 3765
15 Mb Hard+ 360K Floppy	4566 4899

NORTH STAR HORIZON

	1 User	Multi
2 Floppies 360K ea	\$2775	N/A
5 Mb Hard & Floppy	3833	\$6948
15 Mb Hard +Floppy	4595	7147
18 Mb Hard +Floppy	6101	8647
CALIFORNIA COMPUTER SYSTEMS		
CALSTAR 2 8" Drvs 2.5Mb 128K	\$2295	
2210-01 ONLY 4 LEFT IN STOCK	615	



Micro Decision II

MICRO DECISION "A DEAL YOU CAN'T REFUSE"

64K RAM Z80 4MHz 2 serial ports
1 parallel port 2 5 1/4" drives.
Free Software: CPM 2.2, MicroSo
Basic, BaZic, WordStar, LogiCa
spreadsheet, Correct-it spelli
checker, Personal Pearl data ba
ON

MD2 2 Single sided drives \$ 9
MD2 + MDT50 Terminal 12
MD2 + MDT50 + MP100 Printer 17
MD3 Business Computer: Featurin
Free Software above + Free QUEST
BOOKKEEPER SYSTEM FANTASTIC BUY!
MD3 2 Double sided drives 14
MD3 + MDT50 Terminal 14
MD3 + MDT50 + MP100 Printer 19
MD11 has 10Mb HARD DISK+1DSDD (1)
and 128K RAM and CPM 3+ \$16
ABOVE PACKAGES INCLUDE ALL CABLE

DECISION I

SingleUser=FREE CPM, MicroSoft Basic
S-100, IEEE 696, 14-slot, 4 MHz Z8
Realtime clock, Interrupts, 3 Serial
& 1 parallel port, 64K RAM expandab
to 1 Megabyte

D100
D120 = D100 + DSDD 5 1/4" + 10Mb \$17
+Wordstar, Correct-It, LogiCalc
BaZic, Personal Pearl, and Quest
Bookkeeper Software 35
MultiUser = Hardware & Software at
D120 w/256K RAM & Memory Protect
+ Micronix Operating System runs
16 programs simultaneously!
D200 w/10 Mb DMA Hard Disk 38
D210 w/16 Mb DMA Hard Disk 42
D220 = D210 w/512K RAM & 6 Serial
2 Parallel ports. A 6-user system
can be upgraded for 15 users. 52

MORROW DISK DRIVES

Complete systems include S-100 con-
troller, power supply, cabinet, & fan.
CPM & Basic 80
Add Drives include power supply, cabi-
net & fan.

	System	Driv
5 1/4" Win.	10Mb	\$1572
5 1/4" Win.	15Mb	1713
8" Winchester	10Mb	2625
8" Winchester	20Mb	3187
MORROW 8" FLOPPY DISK DRIVES w/Drv		
One 1 sided	\$ 870	\$ 57
One 2 sided	1081	86
Two 1 sided	1418	101
Two 2 sided	1839	143

APPLE, IBM OR MORROW, WHICH IS BEST? FREE BROCHURE!

Call for latest prices & availability

Factory Guarantees

We Beat Prices

AMERICAN



COMPUTERS

919-889-4577

4167 Kivett Dr.

Jamestown N.C. 27282

919-883-1105

Circle 24 on inquiry card.

MRS/OS Source Code

THE Z-80 OPERATING SYSTEM

- Runs CP/M 2.2.* and CDOS* application programs
- Contains 55 OS function calls
- Direct and Standard console I/O
- Standard console I/O includes numerical formatting and I/O steering
- User defined "CNTRL C" function
- Sequential and Random disk file access
- Provides Standard file management functions plus Direct Disk Access
- 12 system utility functions include PATCH AND BATCH
- Requires 32K Z-80 computer with editor and assembler
- Directory utility provides directory error checking, statistics, and alphanumeric ordering
- "HELP" menus throughout

FULLY COMMENTED SOURCE CODE included in 250 page manual

Source code also provided on **8" SSSD disk** or **5 1/4" SSSD disk** (please specify)

ONLY \$59.95 COMPLETE

(includes shipping & handling)
Mass. orders include 5% sales tax



16 Bowman Lane
Westboro, MA 01581
(617) 366-8969
Phone orders welcome

CP/M is a registered trademark of Digital Research Corp.
CDOS is a registered trademark of Cromemco Corp.



Continuous CHECKS

for Desk-Top Computers
as low as **\$29.95**

for 250 checks printed with your name and bank information

- Statements, invoices, other forms compatible with software from over 300 sources.
- Or program to NEBS standard forms yourself.
- Quality products in small quantities shipped direct to you. Fast service, low prices, money-back guarantee.

FREE one-stop catalog of computer forms, stationery, supplies and accessories.

Write or phone for your copy Today.

TOLL FREE 1 + 800-325-1117

(Mass. residents 1 + 800-448-4688)

G5A84.3



A division of New England Business Service, Inc.

CODE 11006

A division of New England Business Service, Inc.

(3a)

Program	Unix			
	Version 7	Xenix	TRSDOS	CP/M
debugger	adb	adb*	debug	ddt, save
archive/library manager	ar	ar*		
convert archive format		arcv*		
assembler	as	as*		asm
create a tags file		ctags*†		
link editor	ld	ld*		load
ordering for library	lorder	lorder*		
maintain program group	make	make*		
message file from C		mkstr*†		
print name list	nm	nm*		
octal dump	od	od*	list	dump
display profile data	prof	prof*		
size of an object file	size	size*		stat
remove object file parts	strip	strip*		
time a command	time	time*		
randomize library		ranlib*		
extract objects strings		strings*†		
extract C strings		xstr*†		

*Available with the optional Radio Shack Development System.
†From the Berkeley implementation of Unix.

(3b)

Program	Unix	
	Version 7	Xenix
BASIC interpreter	bas	
unlimited precision	bc	bc*
C program beautifier	cb	cb*
C compiler	cc	cc*
desk calculator	dc	dc*
FORTRAN 77 compiler	f77	
lexical analyzer generator	lex	lex*
C program verifier	lint	lint*
macro processor	m4	m4*
rational FORTRAN dialect	ratfor	ratfor*
structure FORTRAN	struct	struct*
parser generator	yacc	yacc*

*Available with the optional Radio Shack Development System.

Table 3: Support utilities of four operating systems (3a) and languages and utilities available for Unix and Xenix (3b).

editor. The typos and changes are easy, but figuring out how to get the formatting just right is a matter of considerable effort for those of us who haven't had the foresight to get a Ph.D. in nroff. Table 4 shows what text utilities are available in Unix and Xenix.

File Processing

File processing was an area of considerable concern to the Unix system designers. An efficient program-development environment requires all sorts of neat ways to get at things, to see if one thing is the same as another or to sort things into some reasonable order. Xenix provides the complete Unix version 7 file-processing set and extends the set by a considerable margin. Table 5 shows the file-processing capabilities of Unix, Xenix, TRSDOS,

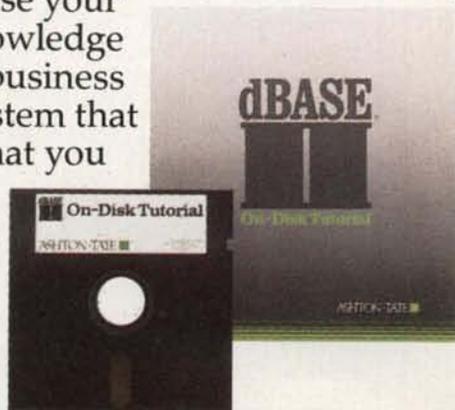
Become a dBASE II[®] expert without cracking a book.



dBASE II is, quite simply, the best-selling database management system (DBMS) made for any computer, ever. And with over 150,000 users so far, it's become the standard for managing data with a microcomputer.

Jump into dBASE II, disk-first.

The best way to learn to use dBASE II is to use dBASE II. Our on-disk tutorial is a hands-on interactive learning system that will get you up to speed on dBASE II, quickly and easily. Then you can use your new-found knowledge to create a full business information system that does exactly what you need done. A system that will handle today's problems, yet grow with you.



dBEST deal in town.

When you buy dBASE II, you'll be getting the most advanced information management tool available for your micro for only \$700 (suggested retail price). At the same time, you'll be getting the most advanced teaching tool (the dBASE II On-Disk Tutorial) for free.

For the name of your nearest dBASE II dealer, contact Ashton-Tate, 10150 West Jefferson Boulevard, Culver City, CA 90230, (800) 437-4329, ext. 212. In the U.K., call (0908) 568866.

ASHTON-TATE

dBASE II is a registered trademark of Ashton-Tate.
© Ashton-Tate 1983

Here's just a taste of our great prices.

DISKETTES

3M
S.S.D.DEN 40 TRK, 10, 16 SECTORS \$ 22.00
D.S.D.DEN 40 TRK, 10, 16 SECTORS... 34.50

VERBATIM DATALIFE
MD 525-01, 10, 16.....\$ 24.50
MD 550-01, 10, 16.....42.50

PRINTERS

C-ITOH F-10 40 CPS P/S.....\$ 1250.00
C-ITOH F-10 55 CPS P/S.....1590.00
C-ITOH PROWRITER PARALLEL.....399.00
C-ITOH PROWRITER SERIAL.....550.00
EPSON GRAFTRAX PLUS.....60.00
IDS 480 MICROPRISM.....459.00
RIBBONS FOR MX-80.....8.95
RIBBONS FOR MX-100.....24.00
SOUNDTRAP for 80 column printers.....99.00

MODEMS

HAYES MICROMODEM II/e.....\$ 256.00
HAYES SMART MODEM (300 Baud).....208.50
HAYES SMART MODEM (1200 Baud).....528.00
NOVATION APPLE-CAT (300 Baud).....310.00

MONITORS

AMDEK COLOR II INTERFACE IIe.....\$ 149.00
AMDEK RGB COLOR II.....465.00
AMDEK RGB INTERFACE.....145.00
AMDEK 300A.....159.00
AMDEK 310A IBM AMBER.....179.00
BMC GREEN MONITOR.....92.00
NEC 12" GREEN MONITOR.....158.00
TAXAN 12" AMBER.....145.00
USI AMBER 9".....155.00
USI AMBER 12".....165.00
ZENITH AMBER.....129.00

APPLE SOFTWARE

APPLE MECHANIC.....\$ 23.00
APPLESOFT WORKSHOP.....37.45
BANK STREET WRITER.....49.98
BEAGLE BAG.....23.00
DOSS BOSS.....18.50
DOUBLE TAKE.....24.95
FIREFIGHTER.....CALL
FORMAT II ENHANCED.....132.50
MICROTYPE II, Hayden.....24.35
PFS: GRAPH.....89.95
PFS: (NEW) PERSONAL FILING SYSTEM.....85.00
PFS: REPORT.....79.00
TIP DESK #1.....15.59
UTILITY CITY.....23.00

APPLE II/IIIe HARDWARE

ALS 6 MHZ CP/M w/64K/C-BASIC.....\$ 319.00
KRAFT JOYSTICK.....48.94
MICROSOFT CP/M/80 col/64K RAM.....342.50
MICROSOFT Z-80 SOFTCARD.....229.00
QUENTIN APPLEIMATE.....238.00
RANA CONTROLLER.....104.00
SUPERFAN II.....62.00
SUPERFAN II W/ZENER.....84.50
SUPER FIVE HALF HEIGHT DRIVE.....269.00
VIDEX 80x24 VIDEO CARD.....229.00
ULTRATERM.....293.00
7710A ASYNCHRON. SER.....135.00

GREAT APPLE GAMES

FLIGHT SIMULATOR (NEW).....34.50
LEGACY OF LLYLGAMYN.....32.35
LODE RUNNER.....27.25
WIZARDRY.....37.95
ZORK I, II, III.....28.00

IBM® HARDWARE

APPARAT CRANBO II w/64K.....\$ 364.00
HERCULES GRAPHICS CARD.....399.00
KEYTRONICS KEYBOARD.....215.00
KOALA PAD.....99.00
KRAFT JOYSTICK.....52.69
LATTICE C COMPILER.....369.00
MICROSOFT FLIGHT SIMULATOR.....38.95
MICROSOFT 64K.....278.00
PLANTRONICS COLOR+ w/Draftsman.....475.00
QUADBOARD 64K.....308.00
QUADLINK.....550.00
Tandon TM100-2 Double head 40 trk.....235.00
TEAC HALF HEIGHT D.S. Disk Drives.....279.00
TECHMAR GRAPHICS MASTER.....587.00
T/G JOYSTICK.....47.95
T/G TRACKBALL.....47.95
USI MULTIDISPLAY.....499.00
64K MEMORY UPGRADE.....80.00

IBM® SOFTWARE

CONCURRENT CP/M 86.....\$ 315.00
CP/M 86 DIGITAL.....54.00
d BASE II.....409.00
EASYWRITER II.....185.00
HOME ACCOUNTANT+.....105.00
JFORMAT.....29.00
LOTUS 1,2,3.....369.00
MICROSOFT FORTRAN.....257.00
MICROSOFT WORD W/MOUSE.....387.50
MONTE CARLO Multifunction Card 64K.....345.00
MULTIMATE.....324.50
PFS: FILE.....97.50
PFS: GRAPH.....97.50
PFS: REPORT.....97.50
PFS: WRITE.....107.00
PIE WRITER.....115.00
PROKEY.....58.50
VOLKSWRITER.....125.00
WORDSTAR.....279.50
WIZARDRY.....47.76

MISCELLANEOUS

FLIP & FILE DISKETTE STORAGE.....\$ 19.95
6 1/4" BIB Diskette Cleaner w/solution.....8.95

To order or for information call

In Los Angeles:

(213) 706-0333*

Alpha Byte

COMPUTER PRODUCTS

31304 VIA COLINAS
WESTLAKE VILLAGE, CA 91362

*For all your computer product needs, come visit us at our new California store.

Satisfaction Assurance — Your satisfaction is assured by our 30 day guarantee on all hardware products we sell. All manufacturers' warranties are honored by manufacturers. Dead-on-arrival software will be replaced free during the first 20 days, however, no refunds or exchanges on software. Proof of purchase required. All returns must be authorized in advance.

and CP/M. The copy utility is a handy extension that copies groups of files, whereas cp does so only with some fairly arcane manipulation. A Berkeley enhancement called more displays files a screenful at a time. Members of the grep family, including look, are used

Program	Unix Version 7	Xenix
simple text formatter	roff	
text typesetting	troff	troff*
text formatter	nroff	nroff*
typeset mathematics	eqn	eqn*
format mathematics	neqn	neqn*
format nroff/troff	tbl	tbl*
format references	refer	refer*
insert references		lookbib*
simulate typesetter	tc	tc*
greek letters print	greek	
reverse line feeds	col	col*
remove format constructs	deroff	deroff*
check eqn usage	checkeq	checkeq*
prepare for statistics		prep*
format output		sp*

*Available with the optional Radio Shack Development System.

Table 4: Unix and Xenix text utilities.

Program	Unix Version 7	Xenix	TRSDOS	CP/M
pattern processing	awk	awk		
append file to file	cat	cat	append	
catenate and print	cat	cat		type
compare two files	cmp	cmp*		
choose common lines	comm	comm*		
copy groups of files		copy	move	
copy	cp	cp	copy	pip
convert and copy a file	dd	dd		
differences in two files	diff	diff		
differences in three files		diff3*		
full expression search		egrep*		
string search		fgrep		
limited expression search	grep	grep		
print beginning of file		head†		
relational database join	join	join*		
find lines in sorted list	look	look*		
browse file		more†		
print page headings	pr	pr		
reverse lines		rev*		
stream editor	sed	sed		
sort or merge files	sort	sort		
split file	split	split*		
checksum of file	sum	sum*		
print end of file	tail	tail		
translate characters	tr	tr*		
topological sort	tsort	tsort*		
duplicate lines	uniq	uniq*		
word count	wc	wc*		

*Available with the optional Radio Shack Development System.

†From the Berkeley implementation of Unix.

Table 5: File-processing capabilities of four operating systems.

up to
384k



Thirsty for a 384k Multifunction Board? Try a SixPakPlus™

Since the introduction of DOS 2.0, the capabilities of the PC have been increased with the ability to address up to 640k of memory. With the current PC having 256k available on the computer motherboard, you need another 384k to reach 640k. Great you say, but multi-function boards only have room for 256k on them. Well look again, because now you can get the new SixPakPlus™ with up to 384k of memory, clock/calendar, asynchronous (RS232C serial) port, printer port, SuperDrive™ electronic disk emulation, and SuperSpooler™ printer spooling. There is even an optional game port. And if you already have enough memory for your present needs, you can still get on the bandwagon by buying it without any memory. When your needs for memory grow, the sockets are ready for you to install six banks of 64k parity checked memory.

With the SixPakPlus™ from AST Research you get the most advanced multifunction board available from the industry leader in IBM PC enhancements.

You get a clock/calendar powered by a clip-on battery which does not require factory service to replace. It automatically loads the correct time and date when you turn on your computer. The serial port can be configured as COM1 or COM2, and has jumpers for simplifying wiring of cables. The printer port uses all the same signals as IBM's — you can even use the IBM diagnostics on it. The optional game port uses any IBM compatible joystick.

The board is backed up with a one-year warranty on parts and labor and the Qubie® satisfaction guarantee. If for any reason you are not satisfied with the performance of your board within 30 days of purchase, you may return it for a full refund, including the postage to return it. And if your board should need warranty service we do the repairs in 48 hours or we replace your board with a new one. That's the level of service that has made us the largest dealer in the world for AST Research products.

NOW
AVAILABLE
WITH
GAMEPAK



MegaPlus II & I/O-Plus II The Ultimate Expansion for IBM PC or XT

The AST Research MegaPlus II™ has three functions standard. Parity checked and fully socketed memory up to 256k in 64k increments, clock/calendar with battery back-up for automatic loading of time and date when the computer is turned on, and asynchronous communication port (RS232C serial) which can be used as COM1 or COM2, (DTE for a printer, or DCE for a modem). Also included is SuperDrive™ "electronic disk" software. This program builds "disk drives" in memory which access your programs at the speed of RAM. You get SuperSpooler™, print spooling software. It operates your printer while you continue to work with your computer.

Options include a 100% IBM compatible parallel printer port (can be configured as LPT1, or LPT2), and a second RS232C asynchronous port (COM1 or COM2). Three MegaPak™ options can plug onto your MegaPlus II "piggyback" style to give you an additional 128k or 256k of memory, or a game port.

Circle 302 on inquiry card.

I/O-Plus II™, is the answer for those who don't need additional memory but would like all those other multi-function board features. The I/O-Plus II™ comes standard with a clip-on battery powered clock/calendar, an asynchronous communication port (RS232C serial), SuperDrive™ electronic disk, and SuperSpooler™ print spooling software.

Optional is a second asynchronous port (DTE, or DCE), a parallel printer adapter, and the best game paddle adapter on the market. It is an IBM standard game port, but it can also use Apple compatible paddles and joysticks. Options are all socketed so they may be added later should the need arise.

Both boards come with a one year factory warranty and the Qubie® satisfaction guarantee. If for any reason you are not satisfied with the performance of your board within thirty days of purchase, you may return it for a full refund, including the postage to return it.

TO ORDER BY MAIL INCLUDE:

- complete description of products requested
- daytime phone number
- California residents add 6% sales tax
- check or credit card number with expiration date. (personal checks take 18 days to clear)



TO ORDER BY PHONE:

In California (805) 987-9741
Outside California TOLL FREE (800) 821-4479

PRICES:

I/O-Plus 2™ with Clock/calendar, serial (asynchronous) port, SuperDrive™ and SuperSpooler™ - \$119

MegaPlus II™ no memory, with clock, serial, and software - \$229

SixPakPlus™ no memory, with clock, serial port, printer port, and software - \$229

Each 64k of memory installed and tested on MegaPlus, SixPakPlus or alone \$55

Parallel Printer Port \$35

Second Asynchronous Port \$35

Game Adapter (I/O or SixPakPlus) \$35

MegaPak™ with 256k of Memory \$299

128k of Memory \$199

GamePak for MegaPlusII \$40

ConnectAll Cable Bracket \$19

Cable to Parallel Printer \$35

Cable to Modem or Serial Printer \$25

Diagnostics Program \$10

SUPERWRITER by Sorcim \$179

SUPERCALC by Sorcim \$159

dBASE II by Ashton-Tate \$409

Word Processing Keyboard \$229

Keyboard/Superwriter Package \$399

SHIPMENT

Normal shipment is day after receipt of order. We pay UPS surface charges on all items except keyboards. For keyboards add \$5 for surface, \$10 for 2 day air. All COD shipments add \$3 handling.

QUANTITY PURCHASES?

If your corporation, institution, or users group has needs for quantities of boards, call us for details on our quantity purchase program.

QUBIE'

4809 Calle Alto, Camarillo, CA 93010

Tempo House
15 Falcon Road, London, SW11, UK



CRAFTSMEN OF THE NEW TECHNOLOGY.
BEST PRICES WITH QUALITY SUPPORT* ON SOFTWARE & HARDWARE.

ORYX SYSTEMS

QUALITY DISCOUNTS

APPLE/ FRANKLIN

ASHTON-TATE	
d-Base II	\$ 399
ASPEN SOFTWARE	
Grammatik	\$ 60
Proofreader	42
BEAGLE BROS.	
Apple Mechanic	\$ 22
DOS Boss	17
Utility City	22
BRODERBUND	
Bank Street Writer	\$ 49
General Ledger w/AP	305
Payroll	275
CDEX	
Visicalc Training	\$ 45
CHARLES MANN	
Class Scheduling	\$ 299
CONTINENTAL SOFTWARE	
Home Accountant	\$ 49
DOW JONES	
Market Analyzer	\$ 245
Market Manager	219
Microscope	569
HOWARD SOFTWARE	
Tax Preparer	\$ Call
LINK SYSTEMS	
Datafax	\$ Call
Datalink	79

Complete Graphics/ Apple Tablet	86
SIERRA DESIGN	
Homeward	\$ Call
SOFTTECH	
Basic Compilers' Runtime	\$ 169
Softteach	94
UCSD P-system Set	469
SOFTWARE PUBLISHING	
PFS: File	\$ 79
PFS: Graph	79
PFS: Report	79
SUPERSOFT	
Basic Tutor	\$ 79
Fortran	299
SYSTEMS PLUS (Z80 req.)	
Landlord	\$ 375
VISICORP	
Visicalc (II or IIE)	\$ 179
Visischedule	225

CP/M SOFTWARE

COMPUVIEW	
*V-Edit 8080 Z80, IBM/PC	\$ 130
*V-Edit CP/M 86, MS DOS	160
DIGITAL RESEARCH	
*Pascal MT + W/SPP	\$ 389

LOGO CORNER

Krell Logo	\$ 75
------------------	-------

MICROPRO		MAC	85
Wordstar (Special) (w/CP/M Card, 7 col. & 64K)	\$ 375	ZSID (Z80) Debugger	90
Infostar (Includes CP/M, 70 col., 64K)	375	CP/M 2.2	180
Pro Pak (WS/MM/SS/Index)	425	C Basic 2	110
MICROSOFT		PL/1-80	375
Cobol-80	\$ 499	C Basic Compiler (CB-80)	299
Fortran-80	145	Access or Display Mgr. C Language/compiler	299
TASC Compiler	125	Concurrent CP/M 2.0	260
A.L.D.S.	95	All 8" - 86 Version of Above	225
Multiplan (DOS)	169		\$ Call
OMEGA		INFOCOM	
Locksmith	\$ 69	*Deadline	\$ 49
PEACHTREE (CP/M)		*Starcross	39
Peachpak 40 G/L + A/R + A/P (Special)	\$ 237	*Suspended	39
Series 40 G/L, A/R, A/P ea.	195	*Zork, I, II, III (each)	39
Series 9	279	Planet Fall	49
Peachcalc	279	LEXISOFT	
Telecommunications	279	*Spellbinder	\$ 239
PENGUIN SOFTWARE		MARK OF THE UNICORN	
Complete Graphics	\$ 53	*Final Word	\$ 209
Graphics Magician	45	MICROPRO	
		*WordStar	\$ Call
		*InfoStar	\$ Call
		*Pro-Pack (WS/MM/SS Index)	\$ Call
		All others	\$ Call

d-BASE II CORNER

Ashton-Tate	
d-Base II	\$ Call
Bottom Line Strategist	269
FPL	475
Friday	199
Human Soft	
d-Base Plus	\$ 89
Fox & Geller	
Quick Code	\$ 199
D Util	60
Software Banc	
d-Base II User's Guide: w/ d-Base II Purchase	\$ 15
w/o d-Base Purchase	20
Anderson-Bell	
Abstat	\$ 349
Tylog Systems	
d-Base Window	\$ 199

*All above available on PC-DOS

MICROSOFT	
Basic 80	\$ 239
Basic Compiler	249
Fortran 80	330
Cobol 80	449
Macro 80	130
MuMath/MuSimp	185
MuLisp/MuStar	142
*Multiplan	175

PICKLES & TROUT	
CP/M for TRS-II	\$ 180

PRO/TEM SOFTWARE	
*Footnote	\$ 105

REVASCO	
Z80 Disassembler	\$ 85

SORCIM	
*Supercalc III	\$ Call
Superwriter (w/Speller & Mailer)	\$ 179



PEACHTREE CORNER

* PeachPak 4 (GL, AP, AR)	\$ 237
* General Ledger / Accounts Payable / Accounts Receivable / Sales Invoicing / Inventory Control / PeachPay Payroll	Each 399
* PeachText	160
* PeachText w/ Random House Thesaurus	195
* Spelling Proofreader	95
* PeachCalc	90
* Job Cost System	399
* Client Posting & Accounting	399
* Graphics Language	275
* Business Graphic System	199

MICROSTUF	
* Crosstalk	\$ 115
NORTHWEST ANALYTICAL	
* Statpak	\$ 365

OASIS	
The Word Plus	\$ 120
Punctuation and Style	99

ORGANIC SOFTWARE	
* Datebook	\$ 229
* Milestone	229

SELECT	
Select Word Processor	\$ 356

STAR SOFTWARE SYSTEMS	
* Legal Time, Billing	845
* Property Mgmt.	845
* Acc'l Partner	299

SUPERSOFT	
* Diagnostic II	\$ 89
Disk Doctor	74

Formats Available*

All prices below are for 8" standard. Other formats are available. Some formats subject to "Download" fee and require minimum 2 weeks for delivery. Please inquire.

*Fortran 4	299
Basic-8086	225
C Cross Assembler	400
*ScratchPad	199
T MAKER III	220

IBM/PC

Please see CP/M listing. All products with a * in front are also made for PC/DOS and are priced the same unless otherwise specified.

ALPHA SOFTWARE	
Data Base Mgr. II	\$ 195
Mailing List	72
Executive Pkg.	105
Type Faces	87
Question	35
Apple-IBM Connection	130

CENTRAL POINT	
Copy II PC	\$ 34

CONDOR III	
w/Training	\$ 445

CONTINENTAL	
Home Accountant	\$ 95

DIGITAL RESEARCH	
Concurrent CP/M 86	\$ 225
CP/M-86	40
Cobol 86	499
Pascal MT + 86 (MS DOS)	375
SPP 86	130
SID 86	113
C Basic 86	135
Pascal PC/DOS	385
DR Logo	109

DOW JONES	
Market Analyzer	\$ 245
Market Manager	219

ECO-SOFT	
Microstat	\$ 230

FINANCIER	
Tax Series	105
Personal	\$ 119

GRAPHIC SOFTWARE	
Super Chartman II	\$ 299
Super Chartman IV	199
Both (above)	350

LEXISOFT	
SpellBinder	\$ 259

LIFETREE	
Volkswriter	\$ 135

LOTUS 123	\$ Call
------------------------	---------

PEACHTREE	
Please see listing under CP/M.	
PeachText 5000	\$ 237

SUPERSOFT	
C Compiler - 8086	\$ 350
Star Edit	180
Disk Edit	75
Basic Compiler	225
Fortran IV PC/DOS	
or 8086	299
8087 Support	40
Diagnostics II	89
Scratch Pad	199

SYSTEMS PLUS	
Landlord (prop mgmt) \$	375
Runtime Basic	
(req'd for above)	45

... and many more!

APPLE/ FRANKLIN BOARDS

ALS CP/M Card	\$ 299
ALS Smarterm	249
ALS Z-Card II	142
ABT Keyboard	99
Axlion Ramdisk 128K	299
Bit 3 Dual Comm-plus	209
CCS 7710 Asynch Serial	119
Central Point Alaska	119
East Side Wild Card	110
Microsoft 16K Ramcard	69
Microsoft Softcard	235
Microsoft Softcard +	429
Microsoft Premium	
Softcard (IIE)	395
Microtek Printer I/F	75
Microtek Dumping-16	195
Microtek Dumping-GX	119
Mourtain A-D/D-A	279
Mountain Music	
System w/Software	299
PCP 4 MHz Appli-	
Card + 88 Card	599
PCP 88 Card 16 Bit	
+ 64K	475
Prometheus Versacard	159
Prometheus Graphitti	
Card	99
SSM ASIO Serial I/F	
w/cable	129
SSM AIO-2 Serial/	
Parallel	179
Street Echo II Speech	
Synthesizer I/F	129
Tymac Parallel I/F	
w/cable	79
Videx Display	
Enhancer	99
Videx Display	
Enhancer II	99
Videx Func. Strip	59
Videx Videoterm	
VT-600	235
Videx Ultraterm	299
Wesper 16K Ram Card	69

IBM/PC BOARDS

AST RESEARCH	
ComboPlus 64K Clock/	
Calendar, Serial &	
Parallel, I/F, Expand-	
able to 256K	\$ 279
MegaPlus 64K, Clock/	
Calendar, Serial Port,	
Expandable to 512K	
w/Megapak	269

Extra ports available	
for Megaplus and I/O	
Plus II includes Game,	
Parallel & Serial	40
Megapak 256K upgrade	
for Megaplus	\$ Call
I/O Plus II Clock/Calen-	
dar and Serial Port	115
LNW Products	\$ Call

MAYNARD ELECTRONICS	
Floppy Drive	
Controller	\$ 155
Floppy Drive Control-	
ler w/Parallel Port	209
w/Serial Port	249
Sandstar Mem. Card	
- 3 modules cap.	194
Sandstar Multifunction	
Card - 6 modules cap.	93
Sandstar Modules	\$ Call

QUADRAM	
Quadboard 64K, Clock/	
Calendar, Serial &	
Parallel Ports,	
Software	\$ 279

Microfazer Stack Printer	
Buffer (expandable to 512K)	
► Parallel/Parallel 8K	145
► Parallel/Parallel 64K	188
► Serial/Parallel 8K	170
► Serial/Serial 8K	170
Quadlink 64K Memory,	
Game Port allows	
Apple Software to	
to an IBM/PC	\$ Call

TECMAR Products		\$ Call
XEDEX/MICROLOG		
Baby Blue	\$ 475	

TALL TREE	
512K JRAM Mem.	
Board	\$ 699

DISPLAY CARD CORNER

Hercules Graphics Board	\$ 369
Orchid Monochrome Graphic Adapter	360
Plantronics Colorplus	389
USI Display Card (color/monochrome)	\$ Call
Amdex MAI Card	\$ Call
Tecmar Graphic Master	\$ Call

MONITORS

Amdex Video 300A	
Amber	\$ 159
Amdex RGB	425
NEC 12" Hi-Res Green	187
Sanjo 12" Hi-Res	
Green	199
USI Hi-Res 12" Amber	160
NEC JB-1260 Green	119
PGS RGB Color	\$ Call
NEC JC-1203 RGB	560

Panasonic	
Monitors	\$ Call
Quadram	
Quadchrome	\$ Call
Taxan 12" Amber	139
Taxan 12" Green	132
Taxan 12" Med. RGB	323
Taxan 12" High RGB	512
Taxan RGB	
Cable for PC	17
Sony Profeel	
12/19/25"	\$ Call

TELECOMMUNICATIONS CORNER

*** SPECIAL ***

Hayes Smartmodem 12000/Hayes Smartcom II Software	
AST I/O Plus II Clock Calendar and Serial Port	\$ 689
Above w/Smartmodem 300	399
Hayes Smartmodem 1200 & Smartcom II Software	575

MODEMS

Novation	
Apple-Cat II	\$ 269
Hayes Micromodem II	259
Anchor Mark I	84
Anchor Mark VII	129
Hayes	
Smartmodem 300	\$ 205
Hayes	
Smartmodem 1200	495
Hayes Chronograph	189
Novation 212	
Auto-Cat	579
US Robotics Auto-	
Dial (full auto	
answer 300/1200)	459
US Robotics Auto-	
Link (auto answer	
300/1200)	379
US Robotics Password	
300/1200	395

DISK DRIVES

Teac Half-Hgt		\$ 259
Superfive Half-Hgt		
(App)	9	
Panasonic Half-Hgt		205
Tandon TM-55-2	\$ 275	
Tandon TM-100-2	239	
Davong DSI-501 Hard	\$ Call	
Davong DSI-512 Hard	\$ Call	
Davong DSI-519 Hard	\$ Call	
Corona 5 MB Hard	1,395	
Corona 10 MB Hard	1,795	
CDC 1800	270	
Corvus	\$ Call	
Tall Grass	\$ Call	
Vista Solo 143K	\$ 259	
Vista Solo & Controller	329	

PRINTERS

C. Itoh Startwriter F10		\$ 1,149
C. Itoh Prowriter 8510		379

DISKETTES

3M 5" DS, DD, Box		\$ 4
BASF 5" DS, DD, Box		\$ 4
Maxell 5" DS, DD,		
MD2, Box		
Verbatim 5"		
DS, DD, Box		
Ultra Magnetics 5"		
DS, DD, Bonus Box		
(12 Diskettes)		\$ 4

PLOTTERS

Enter P100 Sweet P		
Apple/Franklin,		
IBM/PC	\$ 59	
Strobe M100 Plotter		
w/ I/F Apple/Franklin		\$ 49
Strobe M100 Plotter		
(RS 232)	\$ 53	
Panasonic Digital		
Plotter	\$ Ca	

MISC.

Chalk Board		\$ Ca
Kaala Technologies		
Graphic Tablet	\$ 9	
Symtec Light Pen		
IBM/PC	14	
Symtec Light Pen		
Apple/Franklin	20	
TG Joystick IBM/PC		6
TG Joystick		
Apple/Franklin	4	
Versa VersaWriter		
Tablet IBM/PC,		
Apple/Franklin	23	
Wico Analog Joystick		5
Wico Apple Adapter		1
Wico IBM/PC I/F Card		5
Keytronic Keyboard		
IBM/PC	20	
Keytronic Keyboard		
Apple/Franklin	24	
Curtis PC Products		\$ Ca
Electronic Protection		
Series	\$ Ca	

CP/M is a registered trademark of Digital Research. IBM and the IBM logo are registered trademarks of International Business Machines. Apple and the Apple logo are registered trademarks of the Apple Computer Company. Franklin and the Franklin logo are trademarks of the Franklin Computer Company.

Please:

- Wisconsin residents add 5% for sales tax.
- Add \$3.50 for shipping per software and light items. For multiple and other items, call.
- Foreign — add 15% handling & shipping for prepayment. (Int'l money order.)
- Prices are subject to change without notice.
- All items subject to availability.

Store prices are strictly retail.

ORYX SYSTEMS, INC.

425 First St. • P.O. Box 1961
Wausau, WI 54401

For technical information and
in Wisconsin: 715-848-1374

Int'l Telex: 260181
ORYX SYS WAU

We welcome:

- COD (Add \$2.00 per shipment. Cash or certified check required.)
- Visa, MasterCard & American Express. (Add 4%.)
- Checks. (Allow 1-2 weeks for clearing.)

Working Hours:

Mon. - Thurs. 8:30 - 5:30 • Fri. 8:30 - 6:30
Sat. 10:00 - 2:00 • Central Time

ORDER TOLL FREE OUTSIDE WISCONSIN 1-800-826-1589



Program	Unix Version 7	Xenix	TRSDOS	CP/M
repeat last command		!(csh)	again	
execute command at time	at	at*		
execute on log-in	.profile	.profile	auto	
create shell script	ed	ed	build	ed
schedule programs	cron	cron		
shell with C-like syntax		csh†		
echo arguments	echo	echo		
evaluate expression	expr	expr		
return false		false		
fix last command line			fc	
get string from input		gets*		
signal process	kill	kill		
run command with priority	nice	nice*		
run immune to hangups	nohup	nohup*		
return a random number		random*		
read line from terminal	read	read		
execute a shell script	sh	sh	do	submit
suspend for interval	sleep	sleep		
return true		true		
duplicate output	tee	tee*	dual	
condition command	test	test		
shell with TRSDOS syntax		tsh		
wait for completion	wait	wait		
output unit end of pipe		yes		

*Available with the optional Radio Shack Development System.

†From the Berkeley implementation of Unix.

Table 6: Program-control interface facilities available on four operating systems.

search files for patterns or words, and `cmp`, `diff`, and `diff3` are file-content comparison programs.

Xenix Shells

The program control interface for Unix systems is implemented by a shell program. This shell is the outermost skin of the operating system onion. Xenix has three shells available. You are assigned a shell when your user account is created on the system. Changing shells is a simple matter. It is possible, but not easy, to write a whole new shell and use it instead of one of the shells provided. An easier matter is to write "shell scripts" within either the standard Bourne shell or the Berkeley C-shell. Shell scripts can help make user environments that are much easier for unsophisticated users than the standard environments. Menu interfaces, for example, can be implemented without excessive difficulty. Radio Shack has also provided `tsh`, which implements an emulation of the TRSDOS environment and its commands (such as `dir`) for users familiar with that interface and unwilling to tackle the standard Unix fare. Table 6 is a comparison of the program-control interface facilities available on Unix, Xenix, TRSDOS, and CP/M.

Communication

Unix has supported intersystems communication for some time and as a standard part of the system. Xenix has expanded the complement of communications pro-

Program	Unix Version 7	Xenix	TRSDOS
reminder service	calendar	calendar*	
call up Xenix (terminal emulation)	cu	cu*	terminal
send or receive mail	mail	mail*	
permit or deny messages	mesg	mesg*	
write to user	write	write*	
Unix-to-Unix copy (file transfer)	uucp	uucp*	host
uucp log summary		uulog*	
Unix-to-Unix execution		uux*	
write to all users	wall	wall	

*Available with the optional Radio Shack Development System.

Table 7: Communication utilities. Note that Unix supports both communications among users on one system and communications among separate systems.

grams available. Of particular note is `uux`, a program that lets you specify separate systems for program input, execution, and output. Naturally, these systems must be linked by auto-dial modems or by a local-area network. Table 7 is a comparison of utilities available within Unix version 7, Xenix, and TRSDOS.

File-Access Control

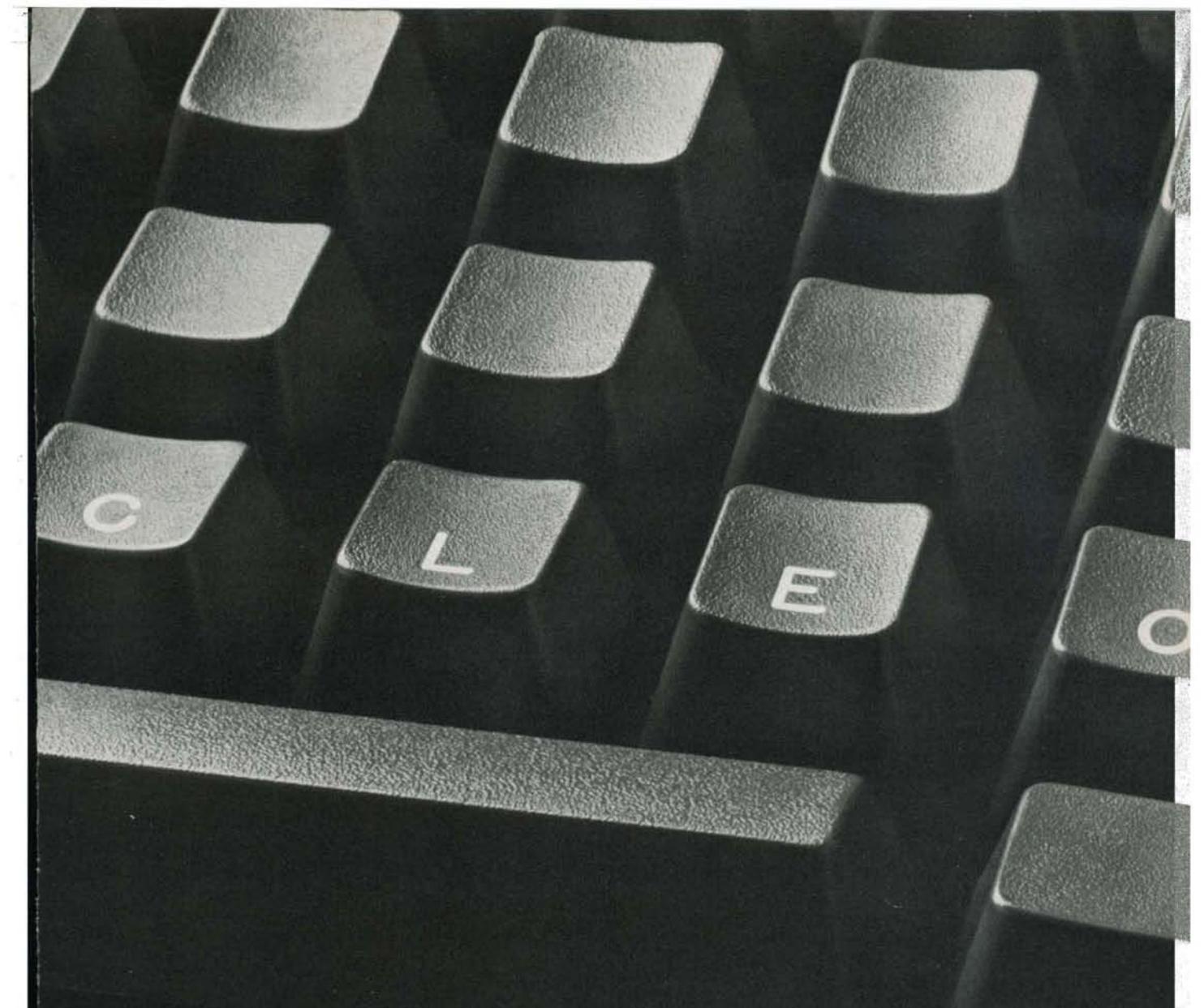
Unix files have sophisticated access controls. Each named file has an owner who, in turn, belongs to a group. The file has a set of access permissions and is marked with the date created and the date last modified.

Changing shells is a simple matter: it is possible to write a whole new shell and use it instead of one of the shells provided.

The utilities `mv` (move a file—the same as renaming it), `chown` (change owner), `chmod` (change mode—the same as changing access attributes), `chgrp` (change file group), `settime`, and `touch` are all used to change these access attributes. A directory is a special file that has special attributes and that contains references to other files. Thus, several of the listings in table 8 are directory-control functions. The utility `ln` (link) allows a file to appear in more than one directory under different names. Table 8 presents a comparison of Unix, Xenix, TRSDOS, and CP/M on file-access control.

Terminal Handling

Unix provides an easy method for handling nearly any terminal in a way that is (usually) transparent to users and their application programs. Settings include speed (data rate), parity, echo (i.e., full or half duplex), the characters to use for backspace and kill, and the end-of-file characters. The Berkeley enhancement `tset` uses the terminal-capabilities database `/etc/termcap` to set terminal modes. Note that in Xenix, it is impossible to set terminal



The best career move you can make is to the keyboard of your personal computer.

It's free. It's confidential.

Today's technical career market changes fast.

But now there's a way to keep up with it. This new key to career opportunity is your personal computer. And the cost is nothing but a phone call.

Just call CLEO. That stands for Computer Listings of Employment Opportunities.

CLEO responds to your commands. You specify what job categories, companies, or geographic locations interest you. CLEO calls up the appropriate ads right on your screen. At every step, you're guided by explicit online instructions.

Daily updates keep CLEO job listings current. You can even apply for positions right from your

own terminal. For a detailed job search, or just an idea of what's available, CLEO is waiting for your call today. With today's opportunities.

CLEO access: (415) 482-1550 • (408) 294-2000 • (213) 618-8800 • (714) 476-8800 • (619) 224-8800
300 BAUD, full duplex, standard ASCII code.
Access assistance: (213) 618-1525

CLEO

Computer Listings of Employment Opportunities

Recruitment advertisers—call (213) 618-0200 collect to find out how you can place your ad on CLEO.

An electronic publishing activity of The Copley Press, Inc.

Program	Unix			
	Version 7	Xenix	TRSDOS	CP/M
change working directory	cd	cd		
change file group	chgrp	chgrp		
change file owner	chown	chown		
change file mode	chmod	chmod	atrib	stat
find files	find	find*		
make a link	ln	ln		
make a directory	mkdir	mkdir		
move files, directories	mv	mv	rename	ren
remove files	rm	rm	kill,purge	era
remove directories	rmdir	rmdir		
change file dates		settime*		
change modified date		touch*		

*Available with the optional Radio Shack Development System.

Table 8: File-access control functions of four operating systems.

Program	Unix			TRSDOS
	Version 7	Xenix		
set key click				click
clear screen				cls
set terminal options	stty	stty		setcom
set terminal tabs	tabs	tabs*		
set terminal modes		tset†		

*Available with the optional Radio Shack Development System.

†From the Berkeley implementation of Unix.

Table 9: Terminal commands.

Program	Unix			
	Version 7	Xenix	TRSDOS	CP/M
line editor	ed	ed		ed
encode/decode	crypt	crypt*		
permuted index	ptx	ptx*		
find spelling errors	spell	spell*		
non-English spelling	typo			
screen editor		vi*†		

*Available with the optional Radio Shack Development System.

†From the Berkeley implementation of Unix.

Table 10: Text-manipulation facilities of four operating systems.

Program	Unix			CP/M
	Version 7	Xenix		
sign on	login	login		
log in to a new group	newgrp	newgrp		
change log-in password	passwd	passwd		user

Table 11: Access-protection facilities.

tab stops unless you purchase the optional Development System. See table 9 for terminal commands.

Much program development time is spent in an editor. A good editor makes program development much easier and much less error-prone. Note, however, that an editor is not a word processor. The vi editor is a very powerful screen-oriented editor that comes from the Berkeley Computer Science Labs. It relies on the termcap file to tell it how to make magic things happen, even with comparatively dumb terminals. This editor takes considerable effort to learn, but once you know it well, it allows very fast text manipulation. Table 10 compares editing text-manipulation facilities on four operating systems.

System Access

Unix was conceived as a timesharing system. Accordingly, the access-protection facilities on Unix and Xenix are far better developed than on either of the single-user operating systems shown in table 11. Users have a password that may be changed by use of the passwd command. Files are protected by user (the file owner) and by group. A user may belong to more than one group. As a safety measure, on some systems repeated unsuccessful attempts to log into a Unix system may trigger a software disable of the terminal port being accessed.

Unix has for some time had standard support for limited line and curve drawing on a number of different graphic devices. Although not very comprehensive and not nearly as user-friendly as some current commercial packages, simple graphics can be done on a basic Unix or Xenix system. Table 12 shows the three routines generally available (in the Development System for Xenix).

Unix/Xenix has a general-purpose printer spooler that works on whatever has been set up as the system's printer. In contrast, TRSDOS has several explicit and useful individual commands. These are shown in table 13.

Program	Unix	
	Version 7	Xenix
draw a graph	graph	graph*
interpolate smooth curve	spline	spline*
graphics filters	plot	plot*

*Available with the optional Radio Shack Development System.

Table 12: Unix and Xenix graphics routines.

Program	Unix			TRSDOS
	Version 7	Xenix		
line-printer spooler	lpr	lpr		print
print current screen				screen
controls spooler				spool
set to top of form				t

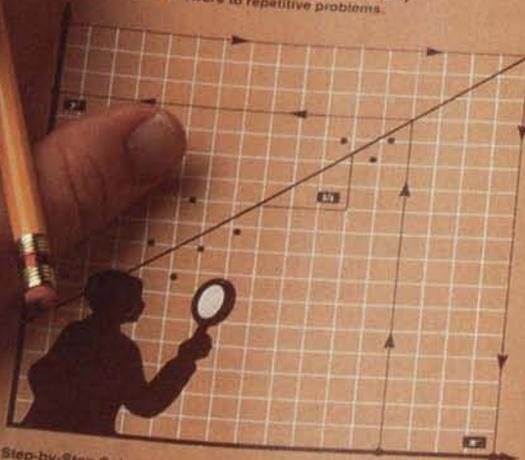
Table 13: Printer-handling commands.

Calculator Decision-Making Sourcebook

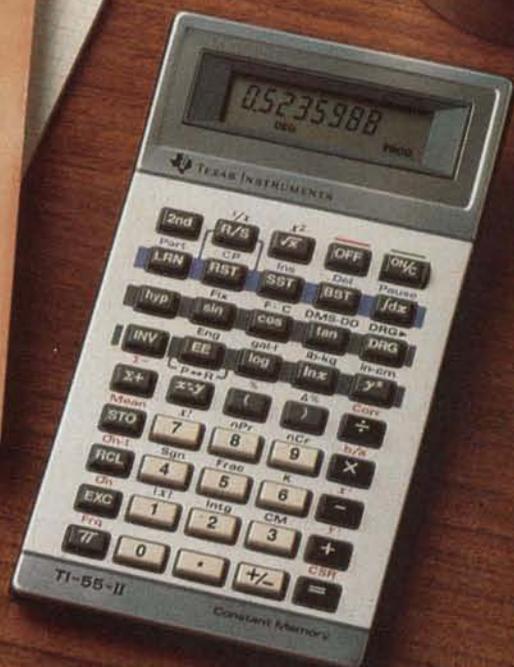
SECOND EDITION
revised and expanded

\$6.95

Whether your field or profession, your calculator can help you use the power of statistics and mathematics in making better decisions. Easy programmability gives you fast answers to repetitive problems.



- Step-by-Step Solutions:
- Unit Conversions
 - Mathematics with Integral Evaluation
 - Forecasting Trends
 - Analyzing Relationships in Data
 - Verifying Quality & Performance
 - Scientific Applications



How the TI-55-II makes short work of long problems.

Whenever you can solve complex problems quickly and accurately, you're ahead of the game. And that's exactly what the TI-55-II does for you. By giving you 112 pre-programmed functions (like definite integrals), it allows you to take short cuts without losing accuracy. You'll accomplish a lot more in less time which means increased efficiency.

With our TI-55-II you can tackle problems you thought could only be solved with higher-priced programmables. You're not only getting the standard slide rule functions but also statistical

capabilities. This way you can work out linear regressions, permutations and combinations, just to name a few.

The TI-55-II also gives you enough programmability to eliminate a lot of repetitive key punching. Our Constant Memory™ keeps programs and data on tap, even when the calculator is turned off. So once you've entered a formula, you can simply put in the variables to get your solution. The Liquid Crystal Display shows your answers in standard, scientific or engineering notations — clearly and precisely.

We also help you get the most

out of your calculator with the Calculator Decision-Making Sourcebook. It gives you step-by-step examples of the best techniques used for solving mathematical, scientific and statistical problems. And we've included a special section on how to program your TI-55-II.

So next time you're facing another time-consuming problem, cut it down to size with the TI-55-II.



**TEXAS
INSTRUMENTS**
Creating useful products
and services for you.

Program	Unix Version 7	Xenix	TRSDOS
print calendar	cal	cal*	
CAI	learn	learn*	
system manual	man	man*	help
conversion program	units	units*	

*Available with the optional Radio Shack Development System.

Table 14: Miscellaneous software features of Unix version 7, Xenix, and TRSDOS.

Program	Unix Version 7	Xenix	TRSDOS	CP/M
current date and time	date	date	date, time	
disk free space	df	df	free	stat
disk usage summary	du	du		
determine file type	file	file*		
information on user		finger*†		
input/output statistics	iostat			
directory contents		l	dir	dir, stat
directory by column		lc†	files	
directory contents	ls	ls		
file system ownership	quot	quot		
print out environment		printenv*†		
process status	ps	ps		
system statistics		pstat*	status	
working directory name	pwd	pwd		
terminal name	tty	tty		
logged-in users	who	who		

*Available with the optional Radio Shack Development System.

†From the Berkeley implementation of Unix.

Table 15: Status utilities of four operating systems.

		Real User System		
compile sieve	cc -O sieve.c -o sieve	33.0	5.4	5.9
execute sieve	sieve	10.0	9.0	0.2
simultaneous sieves	sieve&sieve&sieve&time sieve	38.0	9.0	0.2
compile terminal	cc -O terminal.c -o terminal	34.0	6.8	6.5
one terminal	terminal 1	16.0	0.4	7.5
two terminals	terminal 2	31.0	1.2	13.5
three terminals	terminal 3	46.0	1.9	19.7
compile disk	cc -O disk.c -o disk	36.0	6.4	6.4
one file	disk 1	5.0	2.0	0.5
two files	disk 2	8.0	3.7	1.2
four files	disk 4	13.0	7.5	2.1
eight files	disk 8	32.0	15.4	4.0
simultaneous sorts	sort f1>f1s&sort f2>f2s&sort f3>f3s&time sort f4>f4s	63.0	6.7	2.8
multifile sort	sort f1 f2 f3 f4 > sorted.file	97.0	37.9	12.8

Table 16: Model 16B benchmark results. Entries in the Real column represent total elapsed time; entries in the User column represent time in the user process; and entries in the System column represent kernel time. Times are given in seconds.

Miscellaneous Features

Because Unix is a fairly mature system, a lot of software has been written for it that is generally useful but hard to classify. Among the nice things available are those shown in table 14. The on-line system manual is handy for those who need access to specific manual pages fairly quickly. Note, however, that you need to know the name of the function you want to read about—you can't say, "Tell me about the utility that changes ownership of a file." The on-line computer-aided instruction (CAI) on Unix is nice, but using it tends to be a bit tedious. The conversion program for units is useful for those of us who have trouble converting from one measurement system to another in our heads.

Informal comparisons on other systems have shown the Model 16B to be about what you'd expect of a 6-MHz M68000-based machine running Unix and using the C language.

Unix and Xenix provide a number of valuable utility programs that inform you about system status and certain other data. Table 15 compares the facilities in Unix version 7, Xenix, TRSDOS, and CP/M in these areas. The finger utility from Berkeley retrieves information from your password file in a more readable format than contained in the file itself. You can list the status of processes running on the system with ps. This utility is useful in general but is especially useful to the system manager. Used in combination with the kill command, the ps utility allows the manager to free hung terminals or terminate runaway processes and unwanted processes. (Some microcomputer manufacturers don't make this feature available to their customers, claiming that their system software security scheme could be broken if it were available. However, this feature is an essential part of any Unix-style system and we applaud Microsoft and Radio Shack for making it available.) A System III utility called pstat prints out the kernel tables, which are loaded with useful information, if you know what you are doing.

TRS-80 Model 16B Performance

We subjected the Radio Shack TRS-80 Model 16B to an extensive list of performance tests. One of these tests was a compute-bound microprocessor speed test (the Sieve of Eratosthenes, used by Jim and Gary Gilbreath in "Eratosthenes Revisited: Once More through the Sieve," January 1983 BYTE, page 283), and others were designed by us for this article. We have done some informal comparisons on other systems available to us and have found the Model 16B to be about what you would expect of a 6-MHz M68000-based machine running Unix and using the C language. The Model 16B we tested had

THE BEST KEPT SECRET IS OUT.....

JUKI LETTER QUALITY, DAISY WHEEL PRINTERS ARE NOW AVAILABLE NATIONWIDE AT \$699⁰⁰



There's no mystery about it! Juki's Model 6100 bi-directional, daisy wheel printers are full featured and priced right!

Designed to perform word processing and graphic functions including bold face, subscript, superscript and shadow, the Model 6100 prints at 18 cps, has a proportional spacing control and utilizes 100 character drop-in daisy wheels. The Juki printer uses IBM Selectric Ribbons and is compatible to IBM, Apple, Osborne, Kaypro and most other personal computers. But that's no secret!

The news is that the Juki Model 6100 printers are now available through a reliable network of industry professionals strategically located throughout the country to give you the prompt, dependable sales and technical service you need. And Juki distributors are backed by a company who has been specializing in electronics for over 25 years.

So, contact the Juki distributor nearest you for the real undercover story on the best letter quality, daisy wheel printer around.



CONTACT YOUR JUKI DISTRIBUTOR FOR THE DEALER LOCATION MOST CONVENIENT FOR YOU.

ACORN DATA PRODUCTS
7304-L South Alton Way
Englewood, CO 80112
303/779-6644
Serving:
MT, WY, CO, UT, NM

BUTLER ASSOCIATES, INC.
82A Winchester Street
Newton, MA 02161
617/964-5270
Serving:
ME, NH, VT, CT, RI, MA

COMPUTER SERVICES
INTERNATIONAL CORP.
905 Boulevard East
Weehawken, NJ 07087
201/866-2880
Serving: METRO NY, E. PA, NJ

GENTRY ASSOCIATES, INC.
7665 Currency Drive
Orlando, FL 32809
305/859-7450
Serving:
TN, NC, SC, MS, LA, AL, GA, FL

INFORMATION SYSTEMS, INC.
2420 E. Dakton Street, Unit K
Arlington Heights, IL 60005
312/228-5480
Serving:
WI, IL, MN, IA, MO, NE, ND, KS, SD

INTERNATIONAL BUSINESS
SYSTEMS CENTER
7023 Little River Turnpike
Annandale, VA 22003
703/750-3882
Serving: MD, DE, DC, VA

OSSMANN COMPUTER
TECHNOLOGIES, INC.
6666 Old Collamer Road
E. Syracuse, NY 13057
315/437-6666
Serving: UPSTATE NY

SIGMA DISTRIBUTING
2110 116th Ave. N.E.
Bellevue, WA 98005
206/454-6307
Serving:
WA, OR, ID, AK

SOUTHERN MICRO
DISTRIBUTORS
8708 Royal Lane
Irving, TX 75063
214/258-6636
Serving: TX, OK, AR, LA

STAR-TRONIC
DISTRIBUTOR CO.
23976 Freeway Park Drive
Farmington Hills, MI 48024
313/477-7586
Serving: MI, IN, OH, KY, PA, W. PA, WV

TECHNOLOGY MARKETING CORP.
2300 Valley View Lane
Suite 109
Dallas, TX 75234
214/243-7994
Serving: TX, OK, AR, LA

VITEK
930 G Boardwalk Avenue
San Marcos, CA 92069
619/744-8305
Serving:
S. CA

WESTERN MICRO
TECHNOLOGY
10040 Bubb Road
Cupertino, CA 95014
408/725-1660
Serving: N. CA, NV, AZ

NATIONAL HEADQUARTERS
JUKI INDUSTRIES OF AMERICA, INC.
DA DIVISION
299 Market Street
Saddle Brook, NJ 07662
201/368-3666

WEST COAST
JUKI INDUSTRIES OF AMERICA, INC.
CALIFORNIA DIVISION
20437 South Western Avenue
Torrance, CA 90501
213/320-9001

512K bytes of memory and the 12-megabyte hard disk. Terminal I/O was, according to Radio Shack literature, done by the second processor in the system, a 4-MHz Zilog Z80. The kernel seems to be particularly slow, especially as it attends to terminal I/O. In contrast, the kernel is rather efficient on disk I/O, but the overall system is hampered by slow hardware. Note, however, that long average disk-access times are a consequence of efforts to keep the system price down—you have to pay for the speed you get. Performance times were col-

lected by executing the test using the Unix time command. This command monitors the time it takes to execute a process. Tabel 16 shows the results of the benchmarks in seconds. Total elapsed time ("Real"), time in the user process ("User"), and kernel time ("System") are reported individually. The Sieve program is shown in listing 1. The disk and terminal programs are shown in listings 2 and 3, respectively. The disk program is designed to provide a disk-intensive I/O load while the terminal program is designed to provide a serial-port I/O

Text continued on page 311

Listing 1: The Sieve of Eratosthenes program used as a compute-bound microprocessor speed test on the Model 16B.

```
#define TRUE      1
#define FALSE    0
#define SIZE     8190

char flags [SIZE + 1];

main ()
{
    int     count;
    int     i;
    int     iter;
    int     k;
    int     prime;

    printf ("10 iterations\n");
    for (iter = 1; iter <= 10; iter++)
    {
        count = 0;
        for (i = 0; i <= SIZE; i++)
            flags [i] = TRUE;
        for (i = 0; i <= SIZE; i++)
            if (flags [i])
            {
                prime = i + i + 3;
                for (k = i + prime; k <= SIZE; k += prime)
                    flags [k] = FALSE;
                count++;
            }
    }
    printf ("%d primes.\n", count);
}
```

Listing 2: The disk benchmark program.

```
#include <stdio.h>

FILE     *fp [8];
char     *file [] =
{
    "f1",
    "f2",
    "f3",
    "f4",
    "f5",

```

Listing 2 continued on page 315

SuperSoft FORTRAN

For CP/M-86®, MS DOS, IBM PC DOS®, and CP/M-80®

SuperSoft FORTRAN is the answer to the growing need for a high quality FORTRAN compiler running under CP/M-86 and IBM PC DOS. It has major advantages over other FORTRAN compilers for the 8086. For example, consider the benchmark program used to test the IBM FORTRAN in *InfoWorld*, p. 44, Oct. 25, 1982. (While the differential listed will not be the same for all benchmark programs, we feel it is a good indication of the quality of our compiler.) Results are as follows:

IBM FORTRAN:	38.0 Seconds
SuperSoft FORTRAN:	2.8 Seconds

In its first release SuperSoft FORTRAN offers the following outstanding features:

1. Full ANSI 66 standard FORTRAN with important extensions
2. Standard data types, double precision, varying string length, complex numbers
3. Free format input and free format string output
4. Compact object code and run time support
5. Special functions include string functions, dynamic allocation, time/date, and video access
6. Debug support: subscript checking, good runtime messages
7. Full IEEE floating point
8. Full 8087 support-available as option (\$50.00).

Program developers:

SuperSoft's family of FORTRAN compilers means you can write your programs once and they will run under CP/M-80, CP/M-86, and MS DOS. This lets you get your applications running fast no matter what the environment.

The current compiler allows 64K code space and 64K data space with expansion anticipated in future releases.

Circle 342 on inquiry card.



"At last, a FORTRAN compiler that works great on my 8086, 8087, and 8088 and Z-80 based systems!"

SuperSoft FORTRAN: available NOW and working great!

Requires: 128K with CP/M-86 or MS DOS,
32K with CP/M-80

Price: \$425 (in each environment)

In conjunction with SuperSoft, SuperSoft FORTRAN was developed by Small Systems Services, Urbana, IL, a leader in FORTRAN development.

CP/M-80 and CP/M-86 are registered trademarks of Digital Research. IBM PC is a registered trademark of International Business Machines Corp.

Japanese Distributor:
ASR Corporation International, TBL Building, 7th Floor,
1-19-9 Toranomon, Minato-Ku, Tokyo 105, Japan.
Tel. (03)-5025550, Telex: 222-5650 ASRTYO J.

European Distributor:
SuperSoft International Ltd., 51 The Pantiles,
Tunbridge Wells, Kent, England TN2 5TE.
Tel. 0892-45433. Telex: 95441 Micro-G.

SuperSoft®

FIRST IN SOFTWARE TECHNOLOGY

P.O. Box 1628 Champaign, IL 61820 (217) 359-2112 Telex 270365

```

        "f6",
        "f7",
        "f8"
};

main (argc, argv)
int   argc;
char  *argv [];
{
    int   num;
    int   x;
    int   y;

    num = *argv [1] - '0';
    for (x = 0; x < num; x++)
        fp [x] = fopen (file [x], "w");
    for (y = 500; y > 0; y--)
        for (x = 0; x < num; x++)
            fprintf (fp [x], "%50d\n", y);
    for (x = 0; x < num; x++)
        fclose (fp [x]);
}

```

Listing 3: The terminal benchmark program.

```

#include <stdio.h>

FILE  *fp [8];
char  *dev [] =
{
    "/dev/console",
    "/dev/tty01",
    "/dev/tty02",
    "/dev/tty03",
    "/dev/tty04",
    "/dev/tty05",
    "/dev/tty06",
    "/dev/tty07"
};

main (argc, argv)
int   argc;
char  *argv [];
{
    int   num;
    int   x;
    int   y;

    num = *argv [1] - '0';
    for (x = 0; x < num; x++)
        fp [x] = fopen (dev [x], "w");
    for (y = 0; y < 500; y++)
        for (x = 0; x < num; x++)
            fputs ("how fast are your terminals\n", fp [x]);
    for (x = 0; x < num; x++)
        fclose (fp [x]);
}

```

SuperSoft BASIC Compiler

for CP/M-86[®], MS DOS, and PC DOS

Compatible with Microsoft BASIC

The SuperSoft BASIC compiler, available under CP/M-86 and MS DOS, is compatible with Microsoft* BASIC and follows the ANSI standard. If you want to compile BASIC programs under CP/M-86, PC DOS, and MS DOS, SuperSoft's BASIC compiler is the answer.

Greater accuracy with BCD math routines

If you have used other languages without BCD math, you know how disconcerting decimal round off errors can be. For example:

**With IBM PC*
BASIC**

```
10 A=.99
20 PRINT A
30 END
Output: .9899999
```

**With SuperSoft
BASIC with
BCD math**

```
10 A=.99
20 PRINT A
30 END
Output: .99
```

As you can see, SuperSoft BASIC with BCD provides greater assurance in applications where accuracy is critical.

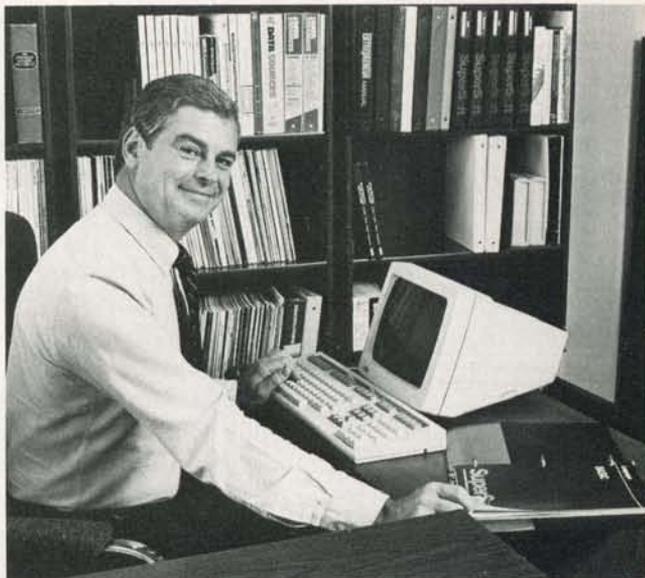
SuperSoft's BASIC is a true native code compiler, not an intermediate code interpreter. It is a superset of standard BASIC, supporting numerous extensions to the language. Important features include:

- Four variable types: Integer, String, and Single and Double Precision Floating Point (13 digit)
- Full PRINT USING for formatted output
- Long variable names
- Error trapping
- Matrices with up to 32 dimensions
- Boolean operators OR, AND, NOT, XOR, EQV, IMP
- Supports random and sequential disk files with a complete set of file manipulation statements
- IEEE floating point available soon as an option

In addition, SuperSoft BASIC has no run time license fee. SuperSoft's line of fine language compilers includes FORTRAN, BASIC, C, and Ada.

Requires: 128K memory
BASIC compiler: \$300.00

SUPERSOFT LANGUAGES: THE STANDARD OF EXCELLENCE.



SuperSoft BASIC lets me run compiled BASIC programs under either CP/M-86 or MS DOS.

*SuperSoft BASIC is compatible with Microsoft BASIC interpreter and IBM PC BASIC. Due to version differences and inherent differences in compilers and interpreters some minor variations may be found. Machine dependent commands may not be supported. The vast majority of programs will run with no changes.

Japanese Distributor:

ASR Corporation International, TBL Building, 7th Floor,
1-19-9 Toranomon, Minato-Ku, Tokyo 105, Japan.
Tel. (03)-5025550, Telex: 222-5650 ASRTYO J.

European Distributor:

SuperSoft International Ltd., 51 The Pantiles,
Tunbridge Wells, Kent, England TN2 5TE.
Tel. 0892-45433. Telex: 95441 Micro-G.

SuperSoft[®]

FIRST IN SOFTWARE TECHNOLOGY

P.O.Box 1628 Champaign, IL 61820 (217) 359-2112 Telex 270365

Microsoft is a trademark of Microsoft Corporation.
IBM PC is a trademark of International Business Machines Corporation.
CP/M is a registered trademark of Digital Research.

load. We noted the compile times for each program and for various conditions of execution of each program. These times and conditions are shown in table 16. The Sieve was executed alone and as four background tasks, the last of which was executed under time. The terminal program used the console and either one or both of the terminal ports, each set to 9600 bps (bits per second), full duplex. The disk program wrote data to one, two, four, or eight files simultaneously. The Unix sort facility was then used to sort the resultant files under two conditions: a simultaneous sort of each file to its own destination file, and a multifile sort of each file to a single destination file. We believe these benchmarks to be a fair and accurate picture of the various activities that combine to form "system performance."

Analysis

The Radio Shack TRS-80 Model 16B is a fairly well-implemented and apparently well-supported Xenix system. Business-oriented software is available from the manufacturer, and it should be possible to get third-party "Unix-compatible" software for the machine in the near future. The machine we tested was not as reliable as we would have hoped. On several occasions, the display screen seemed to roll like a TV with a maladjusted vertical-hold control. We let the display roll for 5 to 10 minutes and the problem corrected itself on every occasion. More seriously, for unknown reasons, the 12-megabyte hard

disk went down for an afternoon. After a couple of attempts to reformat the disk (23 minutes per attempt), we finally succeeded and were able to reload the operating system and development software. Everything went fine after that. This incident illustrates the three cardinal rules to be followed by all users of nonremovable hard disks: 1) back up your data and software, 2) back them up again, and 3) back them up a third time and put the media in another room.

When we opened the back of the system unit to look at the card cage, we found that one of the rivets used to attach a card-edge guide to the card cage wall had come loose, leaving the card in that slot partly unsupported. Such mechanical strain could result in premature board failure.

Despite these problems (we regard them as new-product teething pains), we thought the system was a useful and well-executed product. Radio Shack has come a long, long way from the TRS-80 Models I and III. With Radio Shack's customary attention to providing software and a wide variety of compatible peripherals, this system could become one of the more interesting offerings in its price class. It has already met and exceeded some of its competition in the area of available business software. Its only failing in addressing its target market is its use of the standard Unix shells. A turnkey business user expects a gentler user interface, such as has been provided by some of Radio Shack's competitors. We also have to



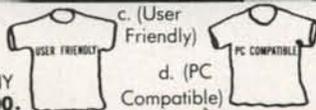
COMPUTER T SHIRTS!

Linda

SOFTWARE

HARD DISK DRIVEN

Software Fashion
P.O. Box 9861, Wethersfield,
CT 06109-0861, or call Linda
to order 1 (800) 223-1796. NY
residents call 1 (212) 371-1900.



Hey Linda, I know a good thing when I see it. Send me _____ computer shirts as indicated below. I'm enclosing \$_____ at \$9.00 plus \$2.25 postage and handling for each shirt. (CT residents add 7½% sales tax). Allow 4-6 weeks for delivery. Please print clearly.

MC Visa Check/M.O. card # _____ exp. date _____

Name _____

Address _____

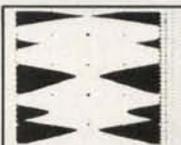
City, State, Zip _____

Qty.	Color (Black/White)	Size (S,M,L,XL)	Style (a,b,c,d)

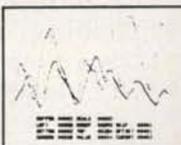
B

VERSATILE DATA REDUCTION, DISPLAY AND PLOTTING SOFTWARE FOR YOUR APPLE* II

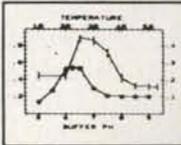
STRIPCHARTER — Turns your APPLE and Epson MX series printer into an economical 4-pen chart recorder. Prints and displays continuous 1 to 4-channel stripcharts of any length. Ideal for large data sets. Numerous user-selectable graphics options enhance output quality. Includes 5 demos on disk with 37-page manual \$100



VIDICHART — Proven tool for lab data management. Fast plots of 4 data sets with scrolling in 4 directions, zoom scaling on X and Y axes, 2 types of graphic cursors and on-screen STATUS REPORT, even plots A/D input while sampling. ADD, SUBTRACT, MULTIPLY, DIVIDE, INTEGRATE, DIFFERENTIATE, AVERAGE or NORMALIZE data sets with SIMPLE COMMANDS. Ideal for spectra, chromatograms, rate curves, etc. Includes SAMPLE DATA on disk with 28-page manual \$75

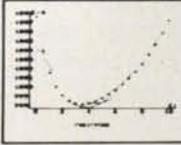


SCIENTIFIC PLOTTER — Draws professional-looking graphs of your data. You choose data format, length and position of axes, 20 symbols, error bars, labels anywhere in 4 orientations. Includes 5 demos on disk plus 30-page manual \$25



(For DIF file and Houston Instrument or H-P 7470A plotter adaptations, add \$25 for each option selected.)

CURVE FITTER — Select the best curve to fit your data. Scale, transform, average, smooth, interpolate (3 types), LEAST SQUARES fit (3 types). Evaluate unknowns from fitted curve. Includes 5 demos on disk with 33-page manual \$35



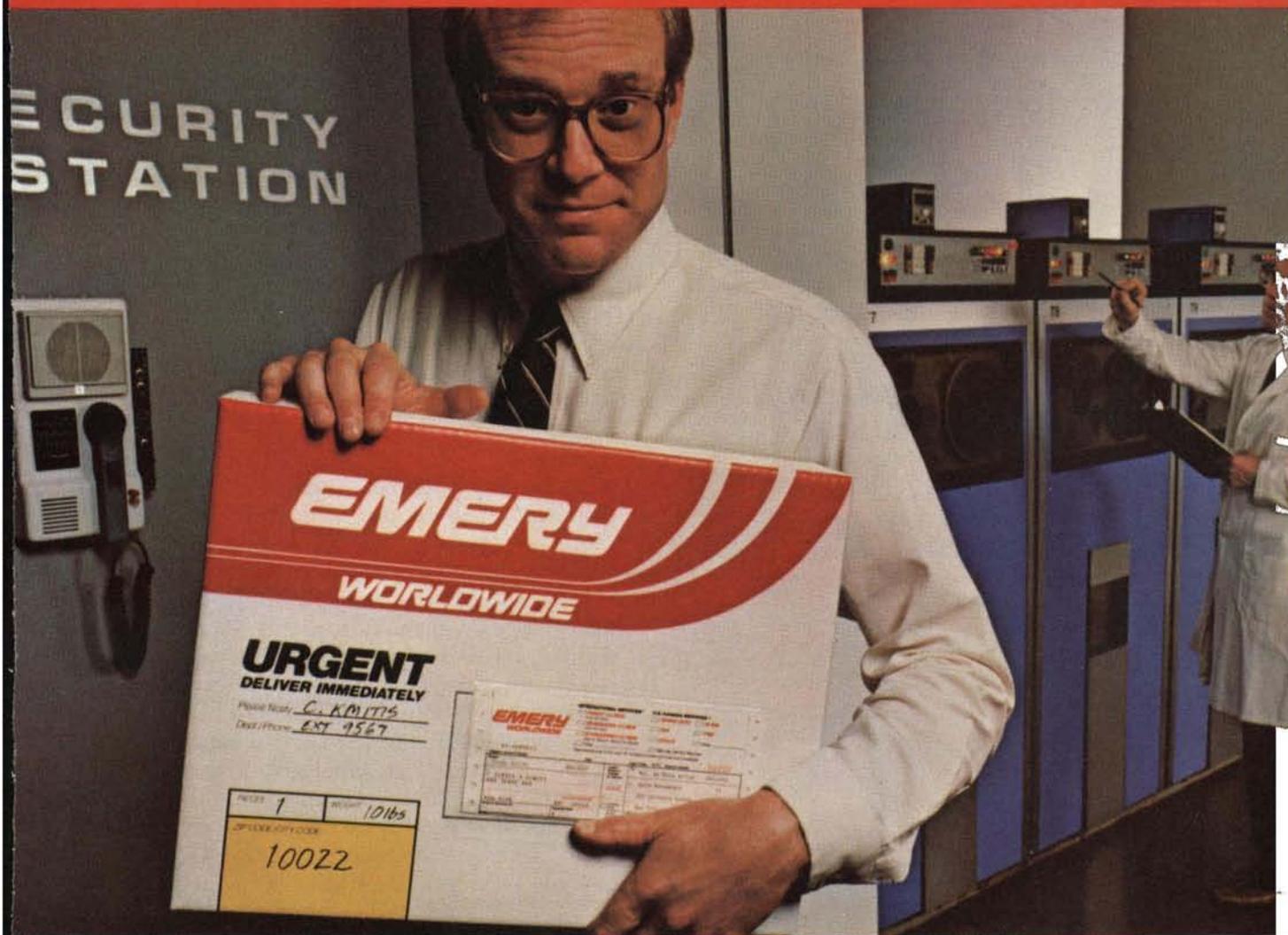
SPECIAL: VIDICHART, SCIENTIFIC PLOTTER, CURVE FITTER on 1 disk \$120

Add \$1.50 shipping on all U.S. orders. VISA or MASTERCARD orders accepted. *Trademark of Apple Computer, Inc.



INTERACTIVE MICROWARE, INC.
P.O. Box 771, Dept. 3 State College, PA 16801
CALL (814) 238-8294 for IMMEDIATE ACTION

Why The Computer Industry Trusts Emery.



We've earned the trust of companies like yours by providing on-time delivery time after time. And with Emery you can ship virtually any weight, anywhere.

People in the computer industry especially appreciate knowing that over 96,000 U.S. communities are within their reach with a single call to Emery. You can request same day and overnight services or schedule a pickup of any shipment from a time-sensitive contract, to a computer chip, to a mainframe, because our customer service representatives are skilled at handling your special needs.

You'll also appreciate the money you can save when you send more of your shipments with Emery. You qualify for Multiple Shipment Discounts from the first time you ship with us, and our Multi-piece Savings to a single destination can save you even more. So call your local Emery office today and find out how our services can be tailored to the high-pressured needs of the computer industry. © Emery Worldwide 1983

Circle 154 on inquiry card.



EMERY
WORLDWIDE

We've earned the trust of American Business.

The BROKER / Software Services

**ATTENTION
PROGRAMERS & PUBLISHERS
of
BUSINESS - INDUSTRIAL - VERTICAL MARKET
SOFTWARE**

SOMETHING NEW IS BEING ADDED:
We can expand your market exposure: Dramatically increase your sales: Help you reach virtually all software salespeople with your product: **By having your software included** in our catalog and in our service program.

SOFTWARE
SERVICES



BUSINESS
INDUSTRIAL
CATALOG

Our catalog for business, industrial & vertical market software is designed to inform & instruct software salespeople on program application & usage. Our services will include acting as consultants to salespeople and providing many other additional services for software salespeople, at **Virtually No Cost To You**. For Additional Information:
CALL OR WRITE: 1-800-421-6468

The BROKER
Software Services
314 N. Auburn - Suite 262
Farmington, NM 87401

The BROKER / Software Services

comment on the system manuals. There are eleven of them: six for Xenix and the Development System, and five for the single-user operating systems, the assembler, and hardware owner's manuals. The manuals are long, neat, well indexed, illustrated, and index-tabbed. They are, however, rather difficult to use, especially for the intended purchasers of the machine. The documentation for the hardware and single-user software is moderately informative, but tends to brush the surface of topics that require detailed treatment. There is no clear documentation path, either. One manual says to read it first (the 16B's Operator's Manual); it deals entirely with the single-user operating systems and basic use of the machine. Although it is relatively lengthy, the Xenix documentation is only a mild improvement over standard Unix manuals. There are some custom-written sections, and the organization and indexing of the manuals is much better than for standard Unix manuals. However, we feel that naive purchasers could not use this machine without a lot of careful handholding from their dealers. We hope that Radio Shack dealers are better able to handle the complexities of Unix than are most computer retail stores today.

Conclusions

The Radio Shack TRS-80 Model 16B computer is a good competitor in the race to computerize America's small businesses. Its drawbacks for an unsophisticated user relate to the traditional Unix user interface and the lack of any real help to a novice from the large stack of manuals shipped with the system. Its advantages include good initial software offerings and the support of a very large company with many dealers and service centers. While there is certainly better executed hardware and software available in the same price category, Radio Shack has a significant potential advantage in its extensive support capabilities. It's not clear whether Radio Shack can or will invest in the educational program necessary to make sure its dealers can cope with the very sophisticated Xenix environment. The Microsoft implementation of Xenix is fairly complete and has many useful extensions to the basic Unix software set. Surprisingly, to us, the Model 16B appears to be a very good choice for people who need a small Unix development environment. Radio Shack has done a good job on this machine, and it deserves serious consideration. ■

References

1. Kernighan B. W. and D. M. Ritchie. *The C Programming Language*. Englewood Cliffs, New Jersey: Prentice-Hall, 1978.
2. Weinberg, P. N. "The Multiuser UNIX Benchmark." *UNIQUE*. June 1983, pages 3-8.

Steven H. Barry is a senior scientist with Systems Research Laboratories Inc. (Eastern Division, 6231 Leesburg Pike, Suite 300, Falls Church, VA 22044). He holds a Ph.D. from the University of Rochester and an M.A. from California State University, Los Angeles.

Randall Jacobson is a software manager for Systems Research Laboratories. He was educated at the University of Maryland.

Computer Protection

**KLEEN LINE®
CONDITIONER**

Prevents:

- Computer Damage
- Brownout Interruptions
- Lightning Spike Damage
- Disruptive Line Noise
- Program Errors

Regulator • Filter • Suppressor

KLR-250A	250 Watt Load	\$291.95
KLR-250A-1S0	250 Watt Load; Patented Filter Isolated Sockets	\$346.95
KLR-500A	500 Watt Load	\$390.95
KLR-500A-1S0	500 Watt Load; Patented Filter Isolated Sockets	\$445.95

Shipping: \$12.75 Land; \$45.50 Air

Ask Your Local Dealer

ESP® Electronic Specialists, Inc.
171 South Main Street, Box 389, Natick, Massachusetts 01760

Toll Free Order Desk 1-800-225-4876
MasterCard, VISA, American Express

Dirty Power In Ultra Quiet



KLEEN LINE Power Out