

MAY 1980

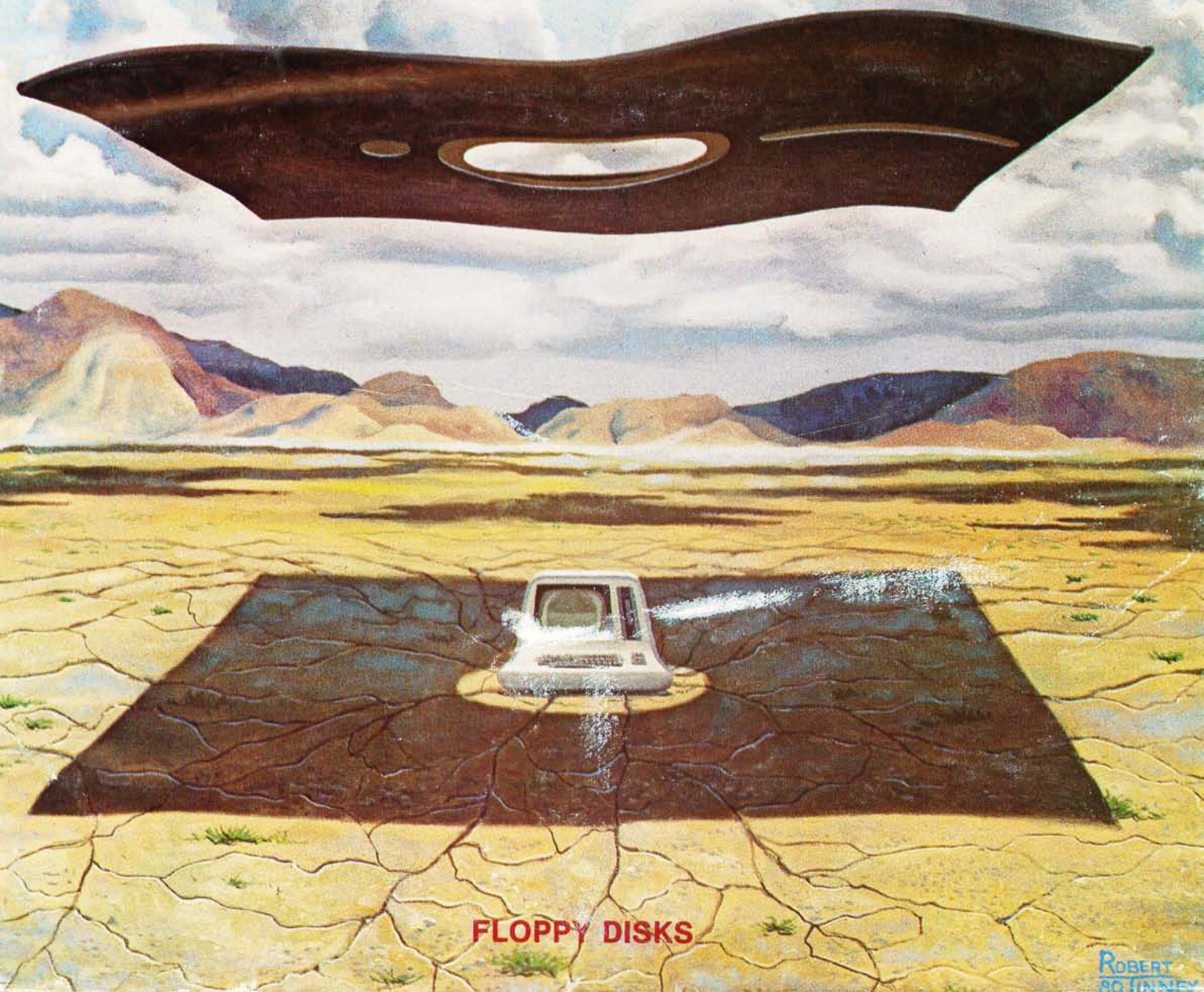
Volume 5, Number 5

\$2.50 in USA/\$2.95 in Canada

BYTE[®]

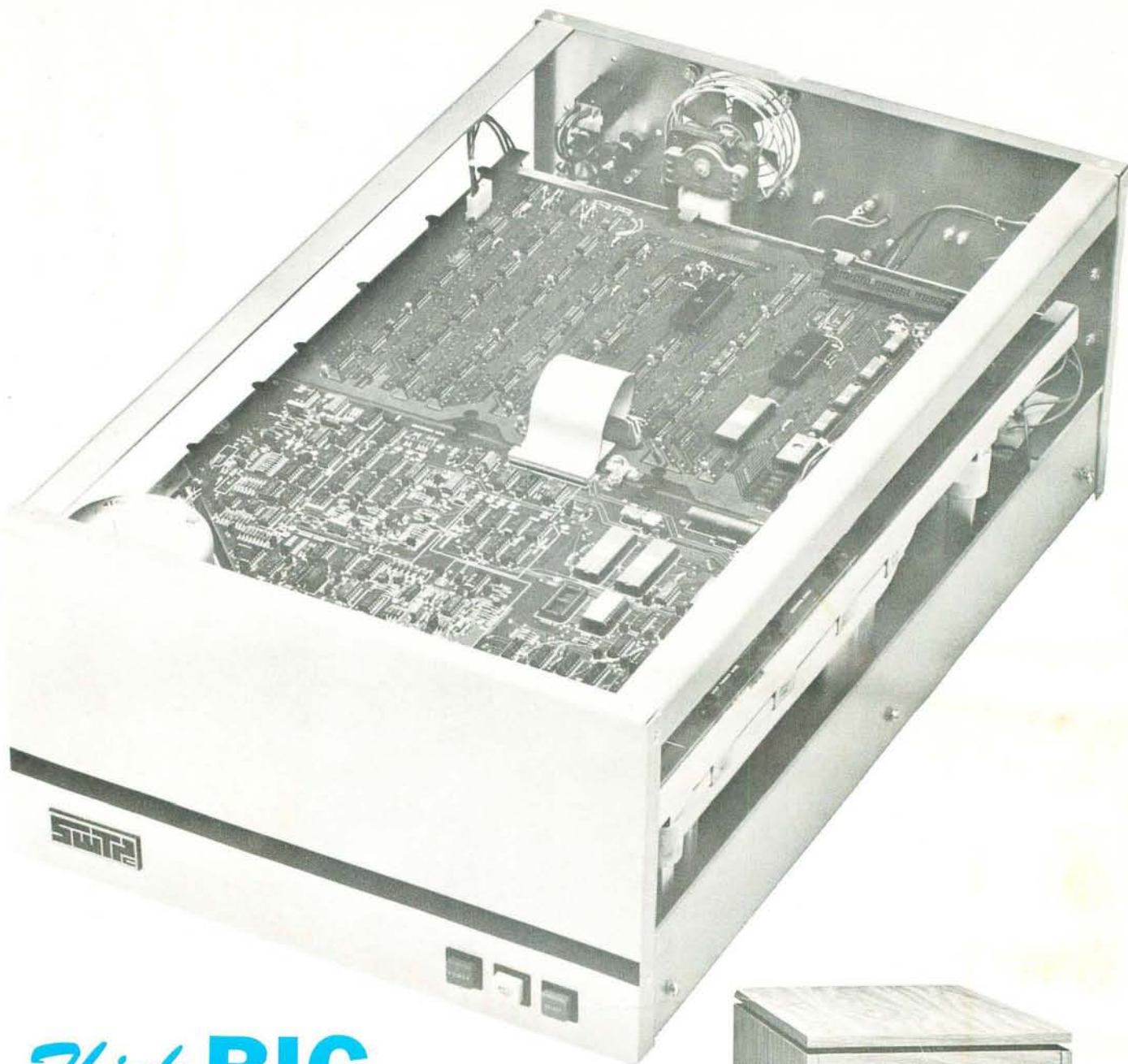
the small systems journal

A MCGRAW-HILL PUBLICATION



FLOPPY DISKS

ROBERT
80 JINNEY



Think **BIG**

State of the art "Winchester" type hard disk with a data storage capacity of nearly 16 Megabytes, makes the SWTPC 6809 system the most flexible as well as the most powerful eight-bit microcomputer system in the world. The intelligent controller, using DMA data transfer, makes maximum use of the "Winchester" capability. It is completely compatible with the FLEX9 operating system used on the SWTPC 6809 floppy disk system.

CDS-1 "Winchester" disk drive with controller . . \$3,995.00
Cabinet—matching our 6809 computer desk . . . \$150.00



SOUTHWEST TECHNICAL PRODUCTS CORPORATION
219 W. RHAPSODY
SAN ANTONIO, TEXAS 78216

(512) 344-0241

Circle 325 on inquiry card.



Low-cost hard disk computers are here and field proven

11 megabytes of hard disk and 64 kilobytes of fast RAM in a Z80A computer for under \$10K. Two floppy drives, too. Naturally, it's from Cromemco.

It's a reality. In Cromemco's new Model Z-2H you get all of the above and even more. With Cromemco you get it all.

In this new Model Z-2H you get not only a large-storage Winchester hard disk drive but also two floppy disk drives. In the hard disk drive you get unprecedented storage capacity at this price—11 megabytes unfur-

matted. You get speed—both in the 4 MHz Z80A microprocessor and in the fast 64K RAM which has a chip access time of only 150 nanoseconds. You get speed in the computer minimum instruction execution time of 1 microsecond. You get speed in the hard disk transfer rate of 5.6 megabits/sec.

EXPANDABILITY

You get expandability, too. The high-speed RAM can be expanded to 512 kilobytes if you wish.

And the computer has a full 12-slot card cage you can use for additional RAM and interface cards.

BROADEST SOFTWARE SUPPORT

With the Z-2H you also get the broadest software support in the

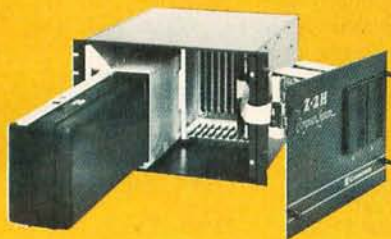
microcomputer field. Software Cromemco is known for. Software like this:

- Extended BASIC
- FORTRAN IV
- RATFOR (RATional FORtran)
- COBOL
- Z80 Macro Assembler
- Word Processing System
- Data Base Management

with more coming all the time.

SMALL, RUGGED, RELIABLE

With all its features the new Z-2H, including its hard disk drive, is still housed in just one compact cabinet.



Hard disk drive at lower left can be interchanged just by sliding out and disconnecting plug. Seven free card slots are available. Z-2H includes printer interface card.

Included in that cabinet, too, is Cromemco ruggedness and reliability. Cromemco is time-proved. Our equipment is a survey winner for reliability. Of course, there's Cromemco's all-metal cabinet. Rugged, solid. And, there's the heavy-duty power supply (30A @ 8V, 15A @ +18 V, and 15A @ -18V) for circuitry you'll sooner or later want to plug into those free card slots.

SEE IT NOW

Last summer we told you this new Z-2H would be a smash. And it is. So see it at your dealer's now. Have him put you in touch with a user—there are lots of them because Cromemco has been delivering for months. See for yourself how pleased our users are.

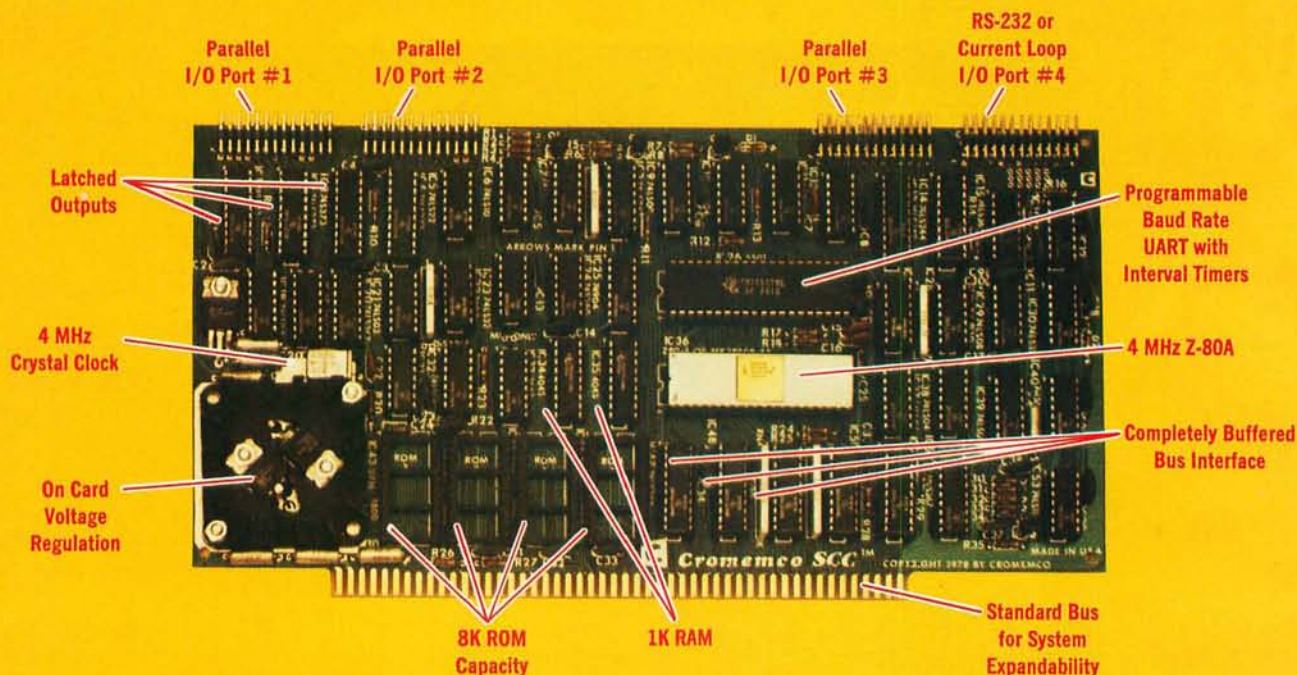
PRESENT CROMEMCO USERS

We've kept you in mind, too. Ask about the new Model HDD Disk Drive which can combine with your present Cromemco computer to give you up to 22 megabytes of disk storage.



Cromemco
I n c o r p o r a t e d

280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400
Tomorrow's computers today



The single card computer with the features that help you in real life

COMPLETE COMPUTER

In this advanced card you get a professional quality computer that meets today's engineering needs. And it's one that's complete. It lets you be up and running fast. All you need is a power supply and your ROM software.

The computer itself is super. Fast 4 MHz operation. Capacity for 8K bytes of ROM (uses 2716 PROMs which **can be programmed by our new 32K BYTESAVER®** PROM card). There's also 1K of on-board static RAM. Further, you get straightforward interfacing through an RS-232 serial interface with ultra-fast speed of up to 76,800 baud — software programmable.

Other features include 24 bits of bi-directional parallel I/O and five on-board programmable timers.

Add to that vectored interrupts.

ENORMOUS EXPANDABILITY

Besides all these features the Cromemco single card computer gives you enormous expandability if you ever need it. And it's easy to expand. First, you can expand with the new Cromemco 32K BYTESAVER PROM card mentioned above. Then there's Cromemco's broad line of S100-bus-compatible memory and I/O interface cards. Cards with features such as relay interface, analog interface, graphics interface, optoisolator input, and A/D and D/A conversion. RAM and ROM cards, too.



Card Cage



32K BYTESAVER PROM card

EASY TO USE

Another convenience that makes the Model SCC computer easy to use is our Z-80 monitor and 3K Control BASIC (in two ROMs). With this optional software you're ready to go. The monitor gives you 12 commands. The BASIC, with 36 commands/functions, will directly access I/O ports and memory locations — and call machine language subroutines.

Finally, to simplify things to the ultimate, we even have convenient card cages. Rugged card cages. They hold cards firmly. No jiggling out of sockets.

AVAILABLE NOW/LOW PRICE

The Model SCC is available now at a low price of only \$450 burned-in and tested (32K BYTESAVER only \$295).

So act today. Get this high-capability computer working for you right away.



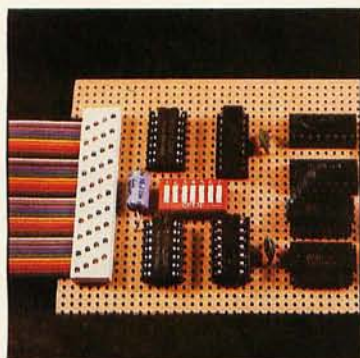
Cromemco
i n c o r p o r a t e d

Specialists in computers and peripherals

280 BERNARDO AVE., MOUNTAIN VIEW, CA 94040 • (415) 964-7400



page 6



page 22



ON LAST MONTH'S COVER

The April cover, which has received so many compliments, was a creation of the photographic artistry of Ed Crabtree. Ed is a professional commercial photographer in Peterborough, N H and has been BYTE's photographer from day one. This was Ed's first BYTE cover. We're sure it won't be his last.

Foreground

20 A DC-TO-DC CONVERTER *by Michael Picco*

Here's a simple converter that uses a standard integrated circuit for producing a 25 mA bipolar source from a single-ended power supply.

22 I/O EXPANSION FOR THE RADIO SHACK TRS-80, Part 1: Principles of Parallel Ports *by Steve Ciarcia*

This month Steve explains the operation of parallel input/output as a prelude to next month's design for an economical RS-232C interface.

44 KIMDOS, Using Your KIM-1 with a Percom Floppy-Disk Drive *by Joel Swank*

Using the LFD-400 disk-controller board, the KIM-1 can access up to 87.5 K data bytes on several 5-inch hard-sectored floppy-disk drives.

72 INTERFACE A FLOPPY-DISK DRIVE TO AN 8080A-BASED COMPUTER

by John Hoeppner

Building a disk-controller board for a Shugart SA400 disk drive can be done easily and with commonly available parts.

196 GIVE YOUR COMPUTER AN EAR FOR NAMES *by Tom Munnecke*

With the Soundex code, you can locate people's names in your data base by similar, but not exact, spellings.

214 THE COSMAC DOODLER *by Jeff Duntemann*

An electronic sketchpad? Even a small system like the COSMAC ELF can draw designs using a video display.

250 ERROR CHECKING AND CORRECTING FOR YOUR COMPUTER

by Gregory J Walker

Storage devices can introduce data errors. The system presented here can increase reliability and speed of these peripherals.

Background

12 THE CASSETTE LIVES ON, An Alternative to Floppy-Disk Mass Storage

by Emory Cook

Floppy disks may be the glamorous way to store programs and data, but the cassette is far from obsolete.

104 A GRAPHICS TEXT EDITOR FOR MUSIC, Part 2: Algorithms

by Randolph Nelson

The conclusion of this article sets forth the routines to create and use the various arrays described in part 1.

120 USING THE COMPUTER AS A MUSICIAN'S AMANUENSIS, Part 2: Going from Keyboard to Printed Score *by Jef Raskin*

Part 2 continues the examination of the subtle problems encountered when translating information from performance to written score.

130 COMPARING FLOPPY-DISK DRIVES BY SOFTWARE SIMULATION

by Dennis Nendza

Now you can get some idea of the relative performance of different units by simulating their mechanical functions in a BASIC program.

202 THE CLUB COMPUTER NETWORK *by Joe Kasser*

If your club is considering to form a program- and data-exchange network, the telephone and amateur radio links described here will be a valuable source of ideas.

Nucleus

- | | | | |
|-----|--|-----|--------------------------------|
| 6 | Editorial: Computer-Controlled Viewing of the 1980 Eclipse | 226 | put for the KIM-1 |
| 8 | Letters | 230 | Book Reviews |
| 144 | BYTELINES (formerly BYTE News) | 234 | Clubs and Newsletters |
| 152 | Technical Forum: Simplifying the Curve-Plotting Calculation by Geometric Means; Alpha Locking in Software; Maintaining a Single Exit Point | 236 | BYTE's Bits |
| | | 238 | BYTE's Bugs |
| | | 280 | Event Queue |
| | | 286 | NCC Information |
| | | 335 | What's New? |
| 190 | Programming Quickies: Decisions, Decisions; Formatted Program Out- | 336 | Unclassified Ads, BOMB Results |
| | | | Reader Service, BOMB |

Publishers

Virginia Londoner, Gordon R Williamson

Associate Publisher

John E Hayes

Assistant

Cheryl A Hurd

Editorial Director

Carl T Helmers Jr

Editor-in-Chief

Christopher P Morgan

Book Editor

Bruce A Roberts

Editors

Richard S Shuford, Gregg Williams,

Curtis P Feigel

Chief Copy Editor

David William Hayward

Copy Editors

Faith Hanson, Warren Williamson,

Robin M Moss, Anthony J Lockwood

Assistant to the Editors

Faith Ferry

Assistant

Debe Wheeler

New Products Editor

Clubs, Newsletters

Charles Freiberg

Drafting

Jon Swanson

Production Director

Nancy Estle

Production Art

Wai Chiu Li, Christine Dixon,

Holly Carmen LaBossiere, Deborah Porter

Typographers

Sherry McCarthy, Debi Fredericks,

Donna Sweeney

Advertising Director

Thomas Harvey

Assistants

Ruth M Walsh, Ms. Marion Gagnon

Special Projects Coordinator

Jill E Callihan

Assistant

Karen A Cilley

Marketing Coordinator

Laura A Hanson

Circulation Manager

Gregory Spitzfaden

Assistants

Pamela R H Spitzfaden, Agnes E Perry,

Melanie Bertoni, Barbara Varnum,

Louise Menegus

Dealer Sales

Thomas Yanni

Receptionist

Jacqueline Earnshaw

Traffic Department

Mark Sandagata, Rob Hannings

Controller

Daniel Rodrigues

Assistant

Mary E Fluhr

Accounts Receivable Specialist

Karen Burgess

Accounts Receivable Assistant

Jeanne Cilley

National Advertising Sales Representatives:

Hajar Associates Inc

East

280 Hillside Av, Needham Heights MA 02194

(617) 444-3946

521 Fifth Av, New York NY 10017

(212) 682-5844

Midwest

2405 Lawndale

Evanston IL 60201 (312) 864-3467

West, Southwest

1000 Elwell Ct, Suite 227, Palo Alto CA 94303

(415) 964-0706/(714) 540-3554



ON THE COVER

On May's cover, Robert Tinney has formed an abstraction of the most important medium of mass storage in today's era of small computers, the floppy disk. Heightening its shimmering mystery, we find a disk wavering in the heat above some desert landscape. To enlighten you, this issue features several articles that present valuable information about floppy-disk technology. This technology is no mirage — it will even work well in a similar, hot environment of East Africa, as the editorial on page 6 describes.

Officers of McGraw-Hill Publications Company: Paul F. McPherson, President; Executive Vice Presidents: James E. Boddorf, Gene W. Simpson; Group Vice President: Daniel A. McMillan; Senior Vice President-Editorial: Ralph R. Schulz; Vice Presidents: Kemp Anderson, Business Systems Development; Stephen C. Croft, Manufacturing; Robert B. Doll, Circulation; James E. Hackett, Controller; William H. Hammond, Communications; Eric B. Herr, Planning and Development; John W. Patten, Sales; Edward E. Schirmer, International.

Officers of the Corporation: Harold W. McGraw Jr, President, Chief Executive Officer and Chairman of the Board; Robert F. Landes, Senior Vice President and Secretary; Ralph J. Webb, Treasurer.

BYTE is published monthly by BYTE Publications Inc, 70 Main St, Peterborough NH 03458, a wholly-owned subsidiary of McGraw-Hill, Inc. Address all mail except subscriptions to above address: phone (603) 924-9281. Address subscriptions, change of address, USPS Form 3579, and fulfillment questions to BYTE Subscriptions, PO Box 590, Martinsville NJ 08836. Controlled circulation postage paid at Waseca, Minnesota 56093 - USPS Publication No. 528890 (ISSN 0360-5280). Canadian second class registration number 9321. Subscriptions are \$18 for one year, \$32 for two years, and \$46 for three years in the USA and its possessions. In Canada and Mexico, \$20 for one year, \$36 for two years, \$52 for three years. \$32 for one year air delivery to Europe. \$32 surface delivery elsewhere. Air delivery to selected areas at additional rates upon request. Single copy price is \$2.50 in the USA and its possessions, \$2.95 in Canada and Mexico, \$4.00 in Europe, and \$4.50 elsewhere. Foreign subscriptions and sales should be remitted in United States funds drawn on a US bank. Printed in United States of America.

Address all editorial correspondence to the editor at the above address. Unacceptable manuscripts will be returned if accompanied by sufficient first class postage. Not responsible for lost manuscripts or photos. Opinions expressed by the authors are not necessarily those of BYTE. Entire contents copyright © 1980 by BYTE Publications Inc. All rights reserved.

BYTE® is available in microform from University Microfilms International, 300 N Zeeb Rd, Dept PR, Ann Arbor MI 48106 USA or 18 Bedford Row, Dept PR, London WC1R 4EJ ENGLAND.



Subscription WATS Line: (800) 258-5485

Office hours: Mon-Thur 8:30 AM - 4:30 PM, Friday 8:30 AM - Noon, Eastern Time

- 512 x 484 resolution display supervised by its own Z80 microprocessor
- 32K bytes of dual port memory give a completely undisturbed screen image
- Resident software emulates an ASCII terminal and provides graphics routines for point, line, region, and light pen usage, and more
- Compatible with any S-100 system, yet easily interfaced to other computers
- 72 key keyboard with graphics function keys
- 15" high performance monitor

MICROANGELOTM HIGH RESOLUTION GRAPHICS SUBSYSTEM

\$1995.00

Light Pen Optional



SUBSYSTEMS

By
SCION CORP.

WORDSMITHTM VIDEO SUBSYSTEM \$1595.00



- Wordsmith Word Processor software
- 40-line page display
- Selectric layout keyboard plus 20 Wordsmith function keys
- 15" high performance monitor
- Compatible with S-100 systems
- Complete documentation

Call or write:
SCION CORP.
8455-D Tyco Road
Vienna, Virginia 22180
(703) 827-0888

**Look for
Shugart drives
in personal
computer systems
made by these
companies.**

Altos Computer Systems
2360 Bering Drive
San Jose, CA 95131

Apple Computer
10260 Bandy Drive
Cupertino, CA 95014

Commodore Business Machines, Inc.
3330 Scott Boulevard
Santa Clara, CA 95051

Digital Microsystems Inc.
4448 Piedmont Avenue
Oakland, CA 94611

Industrial Micro Systems
628 N. Eckhoff
Orange, CA 92668

Micromation Inc.
1620 Montgomery Street
San Francisco, CA 94111

Morrow Designs Inc.
Thinker Toys
5221 Central Avenue
Richmond, CA 94804

North Star Computers Inc.
1440 Fourth Street
Berkeley, CA 94710

Polymorphic Systems
460 Ward Drive
Santa Barbara, CA 93111

Tano Corporation
4301 Poche Court West
New Orleans, LA 70129

Technico Inc.
9051 Red Branch Road
Columbia, MD 21045

Texas Electronic Instruments
5075 S. Loop East
Houston, TX 77033

Vista Computer Company
1401 E. Borchard
Santa Ana, CA 92705

 **Shugart**

Editorial

Computer-Controlled Viewing of the 1980 Eclipse

by Carl Helmers

As noted in the March 1980 editorial, I traveled to Kenya in East Africa to observe the 1980 total solar eclipse with an Apple II Pascal system controlling the photographing of the event. This month's editorial is a commentary about the experience. This commentary was written upon my return to New Hampshire a week after the eclipse.

The final preparations for the Kenya eclipse of 1980 were made in an intensive session of 24-hour workdays, February 2, 3, 4, and 5. One physiological consequence of no sleep for 3 or 4 days is that when traveling through 8 time zones there is no possibility for jet lag! One's body is so tired that all memory of the previous time zone is erased completely. Norm Whyte and Laurel Allen, who coordinated many of the details of the trip to Kenya, arrived in Boston from California on the second of February and spent the weekend at my home. During this final weekend's activity, we each had several chores to finish. One detail, for example, was making sure that both computers would operate simultaneously off Norm's portable Honda AC generator. Another was adding a hardwood extension to Norm's telescope mount so that my camera could be attached along with his.

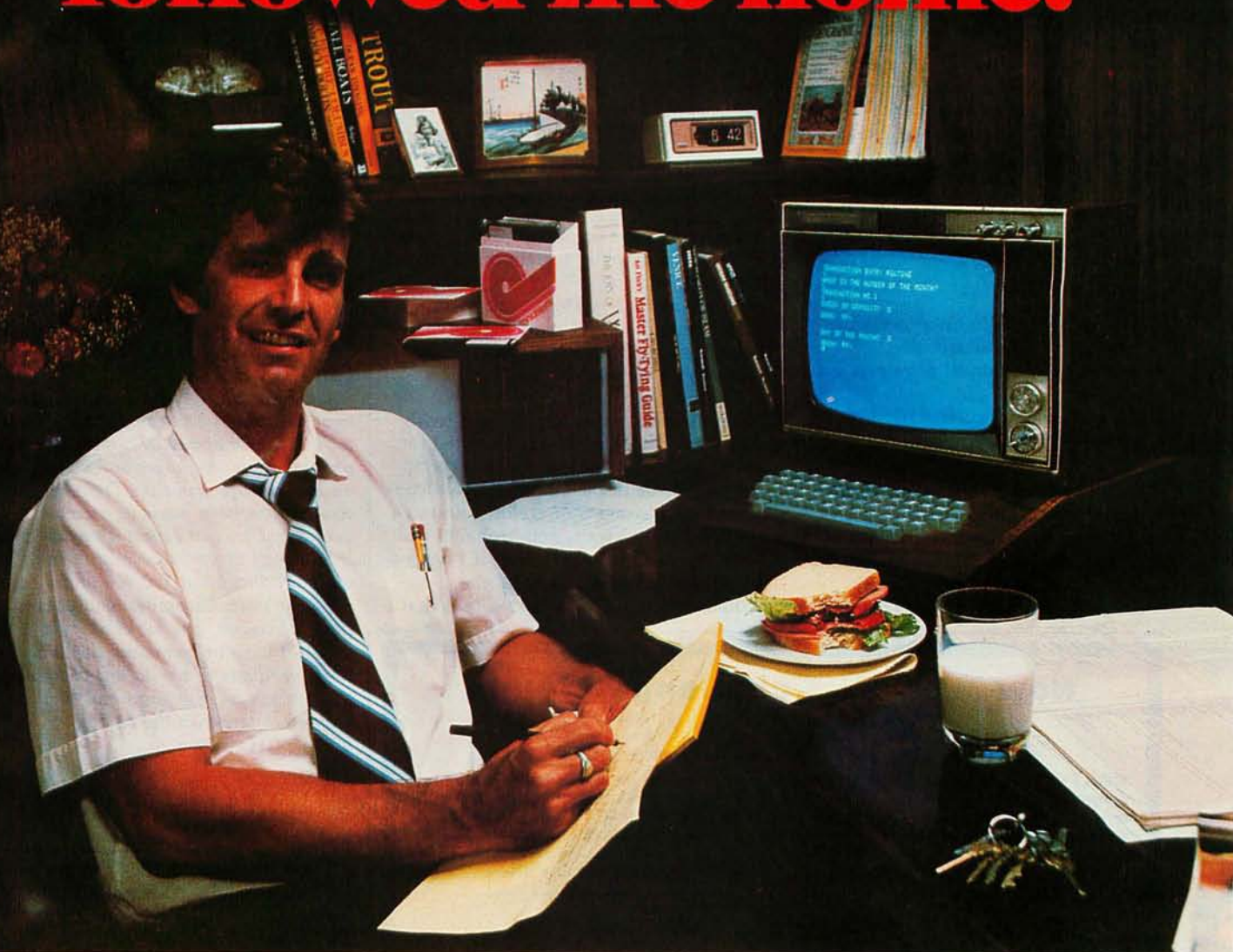
In connection with the program design of my experiment, a number of crucial points had to be verified. With the time allocation procedures completed as described in the March 1980 editorial, writing the real-time procedures to execute the time line proved trivial. These were the procedures left in dummy form in the listing 1 published with the March 1980 editorial. In listing 1 accompanying this editorial, readers will find the final form of the program I used. In approaching this final form I implemented the execution routines using a module named "milli" to carry out time delays of an integer number of milliseconds. The program itself was verified by driving the camera interface using a first approximation to "milli" in the form of Pascal dummy loops used to count time.

Originally I hoped that (by fortuitous circumstance) I could use some combination of Pascal statements in a loop to provide time delays in units of milliseconds. But, after perhaps an hour of fooling with various combinations, I came to the conclusion that this would not be possible. I was either 6% too slow or 6% too fast depending on whether or not I put a unary negation in a timing loop's dummy assignment statement.

Since program development time was limited by a departure schedule, it soon became apparent that the lesser of two evils (imprecision or assembly language) was to write an assembly-language routine called "milli" that links to Pascal with a single integer parameter specifying a loop delay time in milliseconds. I finished this necessary step sometime in the wee hours of February 4. I checked the accuracy with various simple test programs written in Pascal. Of course, my timing assumption was that zero time would be spent outside of "milli" executing the Pascal code of the actual program. This assumption was verified with test runs of the whole eclipse photography sequence, which showed about 1% error. By adjusting the constants in the delay routine slightly, this error was compensated at the gross level of the entire eclipse sequence's 241-second execution time.

Text continued on page 52

"My Shugart followed me home."



"After working all day with the computer at work, it's a kick to get down to Basic at home. And one thing that makes it more fun is my Shugart minifloppy™. We use Shugart drives at work, so when I bought my own system I made sure it had a minifloppy drive.

"Why? Shugart invented the minifloppy. The guys who designed our system at work tell me that Shugart is the leader in floppy design and has more drives in use than any other manufacturer. If Shugart drives are reliable enough for hard-working business computers, they've got to be a good value for my home system.

"When I'm working on my programs late at night, I can't wait for cassette storage. My minifloppy gives me fast random access and data

transfer. The little minidiskettes™ store plenty of data and file easily too.

"I made the right decision when I bought a system with the minifloppy. When you lay out your own hard-earned cash, you want reliability and performance. Do what I did. Get a system with the minifloppy."

If it isn't Shugart, it isn't minifloppy.

 **Shugart**

435 Oakmead Parkway, Sunnyvale, California 94086

See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

™ minifloppy is a registered trademark of Shugart Associates

Letters

Information on Potter Printer Needed

Can a reader of BYTE help me? I recently purchased a printer from salvage, and I hoped to obtain documentation and a schematic diagram from the manufacturer.

The printer is a Potter Model LP-3000, manufactured by the Potter Instrument Company, formerly of Plainville, New York. I called the firm, and I was told:

- 1) The company is in the process of moving to New Hampshire.
- 2) This particular model of printer is obsolete.
- 3) They have no documentation or schematic for this model.

From my examination of the circuits and machinery, I believe the Potter LP-3000 is a daisy-wheel type with a serial data input. However, whether it uses ASCII or not, I can't tell.

Can someone tell me how I can inter-

face this printer to my Radio Shack TRS-80 Model I Level II computer with expansion interface?

Nick Tountas
838 Juniper Rd
Glenview IL 60025

Questioning "Affordable"!

When you are on Social Security, an affordable computer system that costs \$6000 is like "# @ *"! When your monthly income is \$360, to have an editor smugly talk of plunking down \$6000 cash as if it were a minor outlay tends to be very irritating.

On top of that, the system Mr Helmers described is just the sort (with minor modifications) I have wanted for ages. Another thing that hurts is the industry-wide disinclination to even consider time payments or credit. I know that I'll have to wait, and probably wait over 5 years, but maybe not. If I were just disgusted with your editorial, I wouldn't have bothered to write. What I

would like to know is if any BYTE reader knows of a way I can obtain such a system as Mr Helmers described — perhaps secondhand — without paying thousands of dollars cash? By squeezing, I can afford \$100 a month now, and by July I should be able to afford \$150 a month, perhaps more.

In a way, I have to thank Mr Helmers for that editorial. It made me mad enough to write, and perhaps there is a solution to my problem.

Fred J Remus Jr
POB 2453
San Diego CA 92112

Carl Helmers Replies

Give the industry time. Five years ago, the same system might have been well in excess of \$30,000, with inferior programming languages and comparable on-line storage capacity. Tremendous strides have been made in the past 5 years, and we can expect a certain leveling-off of prices in the future as mass production at 100,000 unit levels per year starts becoming reality. And then, of course, one looks at it from the point of view of increasing demand for these products. If we do not write about the conception of a good machine, we have no interest on the part of users....CH

Gomoku

I was interested in the "Programming Quickie" by John Allwork ("BASIC Game: GOBANG," November 1979 BYTE, page 56) for Gobang is also called "Gomoku." There has been a competition running for Gomoku programs since 1975; I am the current champion. People interested in the contest should contact:

Shem Wang
Dept of Computer and Information
Science
University of Guelph
Guelph, Ontario, CANADA

So far my different programs have run on large mainframe computers, but I hope to have one working on my North Star microcomputer for the next round of competition.

Mike Compton
196 Metcalfe St, Apt 810
Ottawa, Ontario
K2P 1P8 CANADA

Now MONTY™ challenges you to SCRABBLE*

MONTY™'s no ordinary Scrabble® player! He spices up his game with music and colorful graphics. And he can challenge you at any skill level—beginner to expert with tens of thousands of words. Available on disk only for Apple II, TRS-80 LEVEL II and CP/M based systems (16K required) for use with your Scrabble game. Send \$29.95 check or money order or CALL NOW Toll Free (see below) for VISA or MASTERCARD purchase. Iowans add sales tax. "MONTY™ plays Monopoly" also available.

Another Incredible Computer Opponent Program



Ritam Corporation
P.O. Box 921
Fairfield, Iowa 52556

*Scrabble is a trademark of Selchow & Righter Co.
Monopoly is a trademark of Parker Bros., Inc.
Apple is a trademark of Apple Computer, Inc.
TRS-80 is a trademark of Tandy Corp.
CP/M is a trademark of Digital Research Inc.
MONTY™ is not sponsored or endorsed by
Selchow & Righter Co. or Parker Bros., Inc.
©Ritam Corp. 1980

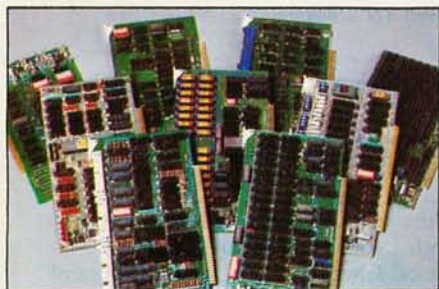
"MONTY™ plays Scrabble"		"MONTY™ plays Monopoly"	
<input type="checkbox"/> Apple II disk	\$29.95	<input type="checkbox"/> Apple II cassette	\$24.95
<input type="checkbox"/> TRS-80 Level II disk	29.95	<input type="checkbox"/> Apple II disk	27.95
<input type="checkbox"/> CP/M 5" disk	29.95	<input type="checkbox"/> TRS-80 cassette	24.95
<input type="checkbox"/> CP/M 8" disk	29.95	<input type="checkbox"/> TRS-80 disk	27.95

Charge my ☐ VISA ☐ MASTERCARD Exp. Date. _____
Credit Card # _____ MC Bank # _____
Signature _____
Name _____
Address _____
City _____ State _____ Zip _____

ORDER NOW TOLL FREE • 800-624-7888 • 800-852-7777 (Calif.) • 800-824-7919 (HI & AL) Ask for Operator 975.

At Intersystems, "dump" is an instruction. Not a way of life.

(Or, when you're ready for IEEE S-100, will your computer be ready for you?)



We're about to be gadflies again.

While everyone's been busy trying to convince you that large buses housed in strong metal boxes will guarantee versatility and ward off obsolescence, we've been busy with something better. Solving the *real* problem with the first line of computer products *built from the ground up to conform to the new IEEE S-100 Bus Standard*. Offering you extra versatility in 8-bit applications today. And a full 16 bits tomorrow.

We call our new line Series II™. And even if you don't need the full 24-bit address for up to 16 megabytes (!) of memory right now, they're something to think about. Because of all the perform-

ance, flexibility and economy they offer. Whether you're looking at a new mainframe, expanding your present one or upgrading your system with an eye to the future. (Series II boards are compatible with most existing S-100 systems and *all* IEEE S-100 Standard cards as other manufacturers get around to building them.)

Consider some of the features: Reliable operation to 4MHz and beyond. Full compatibility with 8- and 16-bit CPUs, peripherals and other devices. *Eight* levels of prioritized interrupts. Up to 16 individually-addressable DMA devices, with IEEE Standard overlapped operation. User-selectable functions addressed by DIP-switch or jumpers, eliminating soldering. And that's just for openers.

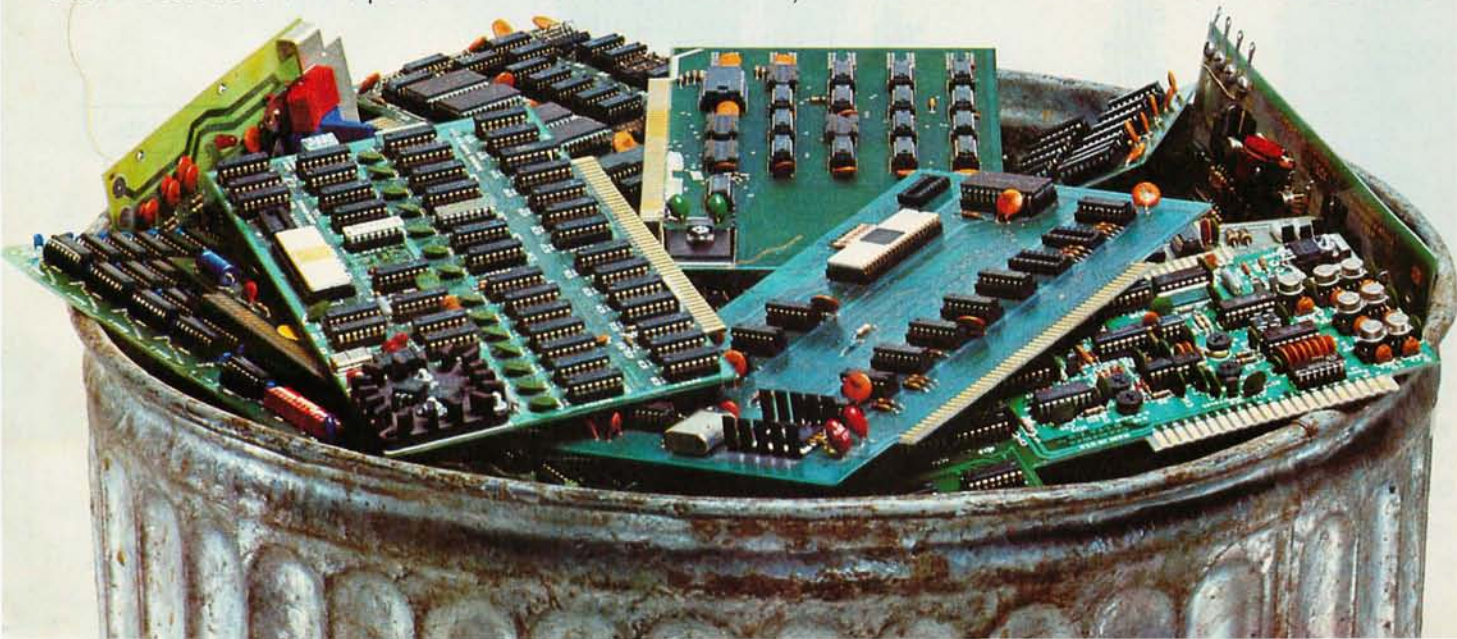
The best part is that all this heady stuff is available now! In our advanced processor—a full IEEE Bus Master featuring Memory Map™ addressing to a full megabyte. Our fast, flexible 16K Static RAM and 64K Dynamic RAM boards. An incredibly versatile and

economical 2-serial, 4-parallel Multiple I/O board. 8-bit A/D-D/A converter. Our Double-Density High-Speed Disk Controller. And what is undoubtedly the most flexible front panel in the business. Everything you need for a complete IEEE S-100 system. Available separately, or all together in our new DPS-1 Mainframe!

Whatever your needs, why dump your money into obsolete products labelled "IEEE timing compatible" or other words people use to make up for a lack of product. See the future now, at your Intersystems dealer or call/write for our new catalog. We'll tell you all about Series II and the new IEEE S-100 Bus we helped pioneer. Because it doesn't make sense to buy yesterday's products when tomorrow's are already here.

InterSystems™

Ithaca Intersystems Inc.,
1650 Hanshaw Road/P.O. Box 91,
Ithaca, NY 14850
607-257-0190/TWX: 510 255 4346



Searching for FORTRAN Compiler

I am an avid reader of BYTE and I believe that one of my fellow readers may be able to help me with a problem.

My school is thinking about expanding the courses that are offered in the area of computer science. It is hoped that an extensive course in FORTRAN programming may be offered.

Our computer is a CIP/2200 manufactured by the Cincinnati Milacron Corporation. It has a small disk-operating system and a card reader. The word size is 32 bits, and, at this point in time, the memory size is 32 K bytes. There are plans, however, to expand the memory to 64 K bytes by the time the FORTRAN course is offered.

My problem is that the Cincinnati Milacron Corporation does not make a FORTRAN compiler for our machine. I would like to know if any reader of BYTE could suggest any companies that might sell a compiler that is compatible with our machine.

Daniell B McCormick
Box 675
Presbyterian College
Clinton SC 29325

Seeking Computers for the Blind

Does any reader of BYTE know of a source for a computer system that uses audible output instead of characters displayed on a terminal for its customary interaction with the user, such as that produced by the Votrax speech interface? Such a computer system would be used by blind people. It would be desirable if a BASIC interpreter that used audible output were included.

If anyone has or knows of such a system, please contact me.

Walter F Keleher
56 Robin St
Rochester NY 14613

Altair BASIC Patch Needed

I wonder if any BYTE readers could assist me in locating the patch to Altair 8 K 4.0 Version and Altair Extended 4.0 Version BASICs which will allow these BASICs to run on a Z80.

I recently purchased a TDL ZPU which uses the Z80. The manual notes

this incompatibility stating that Altair BASIC "has as part of its routines several occasions where the parity flag is checked as part of the function. In the Z80 the parity flag indicates OVERFLOW during math routines, not parity." The manual states that it contains a patch in Appendix C, but no Appendix C is included.

If any reader of BYTE knows where this patch may be obtained, please let me know.

Hugh Morgan
7725 Berkshire Blvd
Powell TN 37849

Pascal Examples Needed

Just a short note to tell you how very much I appreciated Carl Helmers' "Pascal Checkbook Balancing Program" which appeared in the January 1980 BYTE.

As a beginner, I don't think he "profaned" Pascal by writing a simple little ... etc. The program was *most informative*, and I studied it in detail. I have adapted it to the formulation of a metrics conversion program. It was certainly clearer than most of the program examples in the few, but confusing, texts on Pascal.

I realize that in general BYTE magazine caters to the experienced programmer, but what we need are more examples like yours—the we being those of us relatively new to the art.

So thank you once again—and *please* some more tutorials and programs!

Max Nareff
5235 Diamond Heights Blvd
San Francisco CA 94131

A Satisfied Reader Comments

I couldn't believe it! Ted Carter's article "Implementing Dynamic Data Structures with BASIC Files" (February 1980 BYTE, page 92) was exactly what I needed for a program I am writing to computerize billing on a newspaper route.

I had tentatively planned my file routines, but I scrapped my ideas after reading the article.

James E Nichol
1416 Oak Knoll Dr
Cincinnati OH 45224 ■



It took the creator of SWITCHED-ON BACH 12 painstaking years to realize every synthesized note of Bach's most popular works, the complete Brandenburg Concertos. Hear a truly electrifying performance from the best-selling artist in electronic music.

Wendy Carlos' SWITCHED-ON BRANDENBURGS.
A specially-priced double album.
On CBS Masterworks Records and Tapes.



M2X 35895

"CBS," "Masterworks," and the CBS logo are trademarks of CBS Inc. © 1980 CBS Inc.

New from SSM.



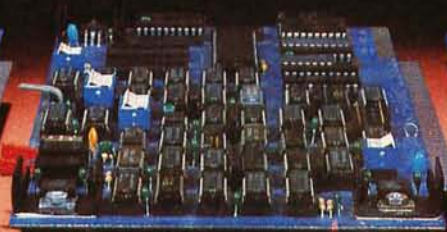
80 Character Video

With 80 characters per line our VB3 is the perfect video interface for word processing. It produces a standard 80x24 display of upper and lower case characters or as much as 80x51 for a full page of text. The matrix for graphic display goes up to 160x204. And with optional EPROM, as many as 256 user programmed characters or symbols can be produced.

VB3 is memory mapped for rapid screen updating. But it occupies memory only when activated. So one or more VB3s can be located at the same address with a full 65K of memory still available to the user.

It generates both U.S. and European TV rates and meets the new IEEE S-100 standard. Other features include keyboard input, black on white or white on black, one level of grey, underline, strike thru, blinking char., blank-out char., and programmable cursor. Software includes a CP/M compatible driver and a powerful terminal simulator.

VB3 is available in several configurations. Retail prices start at \$375 kit, \$440 assembled.



Z-80 CPU

We spent over a year designing the CB2 to assure that it will be the most fully S-100 compatible Z-80 CPU on the market.

It operates at 2MHZ or 4MHZ by DIP switch selection and includes two sockets for 2716/2732 EPROMs or TMS 4016 2K RAMs. Memory sockets can be disabled. Separate run/stop and single step switches allow system evaluation without the benefit of a front panel.

CB2 also features an MWRITE signal, firmware vector jump, and an output port to control 8 extended address lines (allowing use of more than 65K of memory). Jumper options generate the new IEEE S-100 signals to insure future S-100 compatibility.

Retail price—\$210 kit, \$275, assembled.



8080 CPU

Our new CB1A is identical to our popular CB1 with the exception that the on-board RAM has been increased from 256 bytes to a full 1K.

It also features an optional 2K of 2708 EPROMs, power-on/reset vector jump, MWRITE, parallel input port with status and DIP switch addressing.

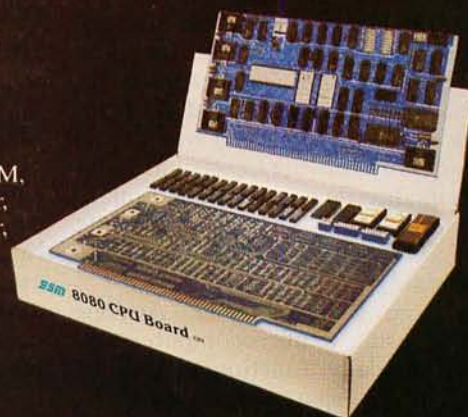
Retail price—\$159 kit, \$219 assembled.



SSM Microcomputer Products
2190 Paragon Drive
San Jose, CA 95131 (408) 946-7400

Send for our free brochure and find out why SSM has become the favorite of discerning Hobbyists and OEMs.

Our line, CPU, Video, I/O, RAM, EPROM, EPROM Programmer, Music, Prototyping, Terminator, Extender, and Mother boards. Available assembled or as kits.



The Cassette Lives On

An Alternative to Floppy-Disk Mass Storage

Emory Cook
Cook Laboratories Inc
375 Ely Ave
Norwalk CT 06854

In a world where floppy and hard disks are becoming more affordable for the average small-business user and hobbyist, sequential mass storage in the form of cassette tape is gaining disfavor. Still, many disk users get into trouble when something happens to a floppy disk and they have *not* made backup copies. Although any backup system requires the time and inconvenience of regularly carrying out the file-copying procedure, one problem with using floppy disks for file backup is the cumulative cost of the number of disks needed to maintain backup copies of all records.

The Cassette Solution

What is needed is a low-cost filing medium. Cassette storage is the answer, provided we take the necessary precautions to make it reliable. Old files, such as files of records for last quarter, last year, and the years before, *belong* on cassette. The disk-to-cassette transfer for backup purposes becomes sensible in terms of both expense and security. With adequate tape recorders and high-quality cassette tapes (which use both quality tape material and quality mechanical housings) cassette storage can and does become highly dependable.

Let's go a step further. Anyone who is using a microcomputer and needs its daily functioning will be acquiring a spare microprocessor. With a three-head, audio-cassette

machine, which has a separate playback head following the record head (a common piece of high-fidelity equipment), the spare microprocessor can readily be set up with a machine-language program. This program verifies a backup tape by reading the information immediately as the tape is written. [*The same result can be accomplished (a bit slower, however) for those of us who cannot afford a spare microprocessor board or an expensive cassette recorder. This can be attained by using a verification program running on the same microprocessor to reread the newly created tape and compare its information with the contents of computer memory....GW*]

Floppy disks may be a glamorous way to store programs and data, but the cassette is far from dead.

When records are backed up at the end of some reasonable period (ie: day, week, month, etc), the extra time needed to dump the records to cassette at a low transfer rate is not an overwhelming disadvantage. A second backup tape simultaneously made with a second recorder is always a good idea. In other cases, one cassette copy can simply serve as

a backup for printed records, thus saving time, printer wear, ribbons, and paper.

For even the most inexpensive cassette deck, a small amount of money and attention can result in the following:

- excellent performance and reliability (no more trial-and-error adjustment of the volume control)
- a very low error rate (statistically as good as that of a 5-inch floppy disk)
- the lowest possible cost per bit stored

Problems with Cassette Storage

The main problems with currently used cassette-storage methods are dirt, variation in tape speed, problems with azimuth alignment, and inferior tape quality.

Dirt collects on the tape recorder head from several sources, from the room, from dust left on poorly manufactured tapes, and sometimes from sweaty fingers attempting to wipe the head clean. The tape head and the pressure roller can be cleaned using pure alcohol and a cotton-tipped swab.

Periodic cleaning is imperative when using poorly manufactured tapes. Cassette tapes are manufactured by slitting a 30.5 cm (12-inch) wide sheet of magnetic material called a *web*. Slitting is accomplished with knives, which often get dull from cut-

**The best supported
personal computer
you can buy.**

 **apple[®] computer**
Call 800-538-9696, 800-662-9238 in California
or write: Apple Computer, 10260 Bandley Drive,
Cupertino, California 95014.

ting the inherently abrasive magnetic coating. If the knives are not periodically sharpened (which is the case in making some inexpensive cassettes), the dull knives cause a fine powder of magnetic coating to collect on the edges of the tape. As a result, abrasive magnetic powders come in contact with the tape head when the cassette is later played. The poorer the quality of the tape, the greater the chance that this is occurring.

Variation in tape speed can be caused by belts slipping within the cassette recorder, but it is more often caused by flaws in the pressure roller, which with the capstan is meant to push the tape through the machine at a constant speed. Leaving the tape recorder set in play mode with the motor disengaged (as is done in several current personal computer systems that let the computer control the tape motor) may eventually cause indentations on the pressure roller, with some inevitable variation in tape speed. This variation impairs the reliability and the data-transfer rate of the cassette interface, so it is important to keep the pressure roller clean at all times and disengaged when not in use.

Azimuth of the tape head refers to the angle between an imaginary line drawn in the direction of tape movement and the vertical, magnetic gap on the record/playback head of the cassette recorder. This angle should be 90°—that is, the tape should run

straight across the tape head, perpendicular to the magnetic gap. If the tape head is somehow knocked out of alignment (which happens frequently, although nobody knows how), it must be restored if the tape recorder is to faithfully play back a recorded tape.

There is an adjustment mechanism, usually a small Phillips screw, on the left-hand side of most tape heads. However, some tape recorders do not allow you to reach the mechanism when the recorder is in the play mode. Because of this, it is important to do one of two things: either buy a cassette recorder that has an azimuth access hole, or have a good craftsman carefully drill a hole over the screw so that it can be reached with a tiny screwdriver when the recorder is in the play mode.

Recording with a Peak-Signal-Strength Meter

It is the peak output, *not* the average or the root-mean-square value of the cassette signal, that most tape interfaces are sensitive to. In order to repeatedly load cassette tapes on the first try, you must be able to send a signal of known strength to the cassette interface. However, most computer systems give us no feedback on cassette signal strength—in other words, we are operating “blindly.” Let us use the TRS-80 Level II tape format as an example. The cassette input port terminates within

the TRS-80 with a resistance of 100 ohms. A signal from the cassette with a peak level of about 2 V is needed to insure a correct load. If the cassette record/playback head is correctly aligned with the tape, and the signal is adjusted (via the volume control and our peak-signal-strength meter) to a peak level of 2 V, then the TRS-80 (or whatever computer you have) should load correctly every time.

Figure 1 presents the circuit for a peak-signal-strength meter. The signal from the cassette recorder comes in jack 1 and goes out jack 2 to the computer. Two halves of an LM358N dual operational-amplifier device are used to create a circuit that is highly sensitive to voltage changes in the 2 V region.

Although component layout is not critical, a full-size, printed-circuit-board pattern for this circuit is given in figure 2. A 9 V transistor radio battery will have a life of around 2000 hours of continuous use. The unit can be calibrated by marking the milliammeter dial while applying a known voltage from a DC 1.5 V flashlight battery cell; the reading should not change significantly when the polarity of the input voltage is reversed. The circuit is reasonably accurate in measuring peak voltages of signals with a frequency of up to 20 kHz, and it will then give good accurate readings as long as the 9 V battery supplies 5 V or greater.

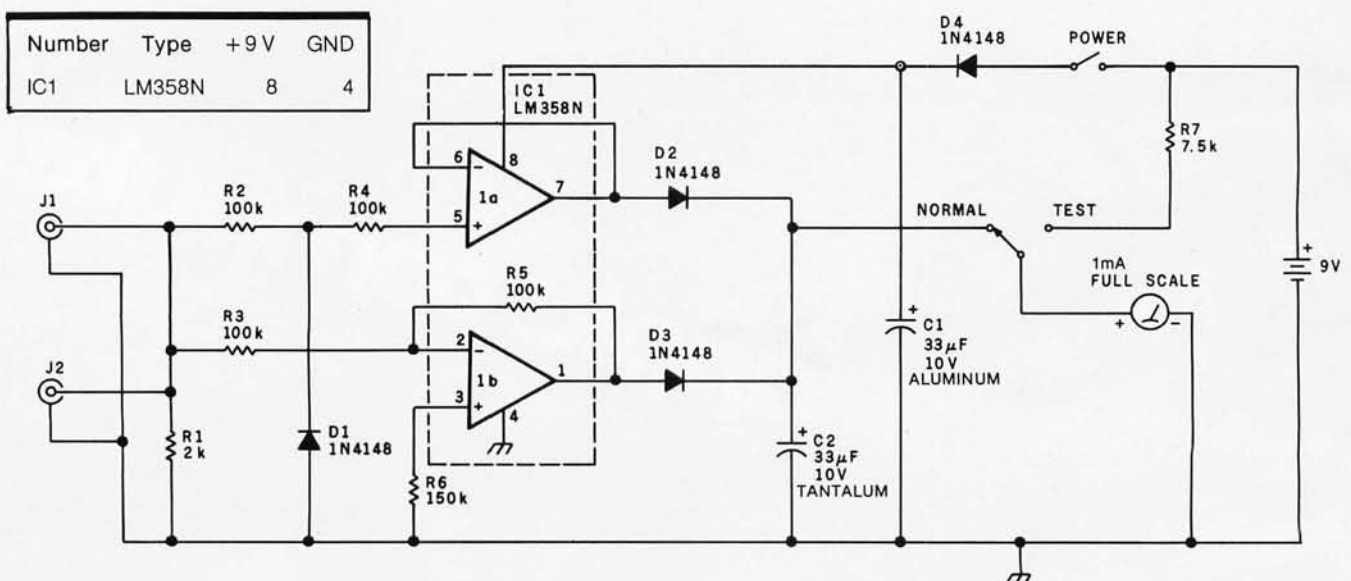


Figure 1: Schematic diagram of peak-signal-strength meter. This meter enables the user to present the cassette interface with a signal of known peak intensity—usually, about 2 V. The circuit is designed to be sensitive to voltage changes around the 2 V area.

From Percom . . .

Low Cost Mini-Disk Data Storage for EXORciser Bus Computers

- Compatible with EXORciser* and other 6800/6809 computers based on EXORciser* bus concept.
- 40- or 77-track drives in one-, two- and three-drive configurations add 102K bytes to 591K bytes of random access data on-line.
- 40-track LFD-400EX* drives store data on both surfaces of mini-diskettes — almost 205K bytes per disk.
- EXORciser* bus compatible controller includes 1K of RAM, provision for 3K of PROM. Mature design features explicit clock-data separator, drive motor inactivity time-out function, and more.
- Support software includes disk operating systems, a file manager, text editor, assembly language program development/debugging aids, an extended BASIC interpreter, an SPL/M compiler and business programs. Numerous programs available from other suppliers may be used with LFD-400/800EX mini-disk systems with little or no modification. Watch for FORTRAN & Pascal announcements.

Low cost Percom LFD-400/800EX mini-disk data storage systems are a fast, dependable alternative to tape storage for 6800/6809 EXORciser* bus computers. A single 40-track LFD-400EX* drive adds 102K bytes of formatted on-line storage; a single 77-track LFD-800EX* drive adds almost 200K bytes. And data may be stored and read from either surface of LFD-400EX* minidiskettes.

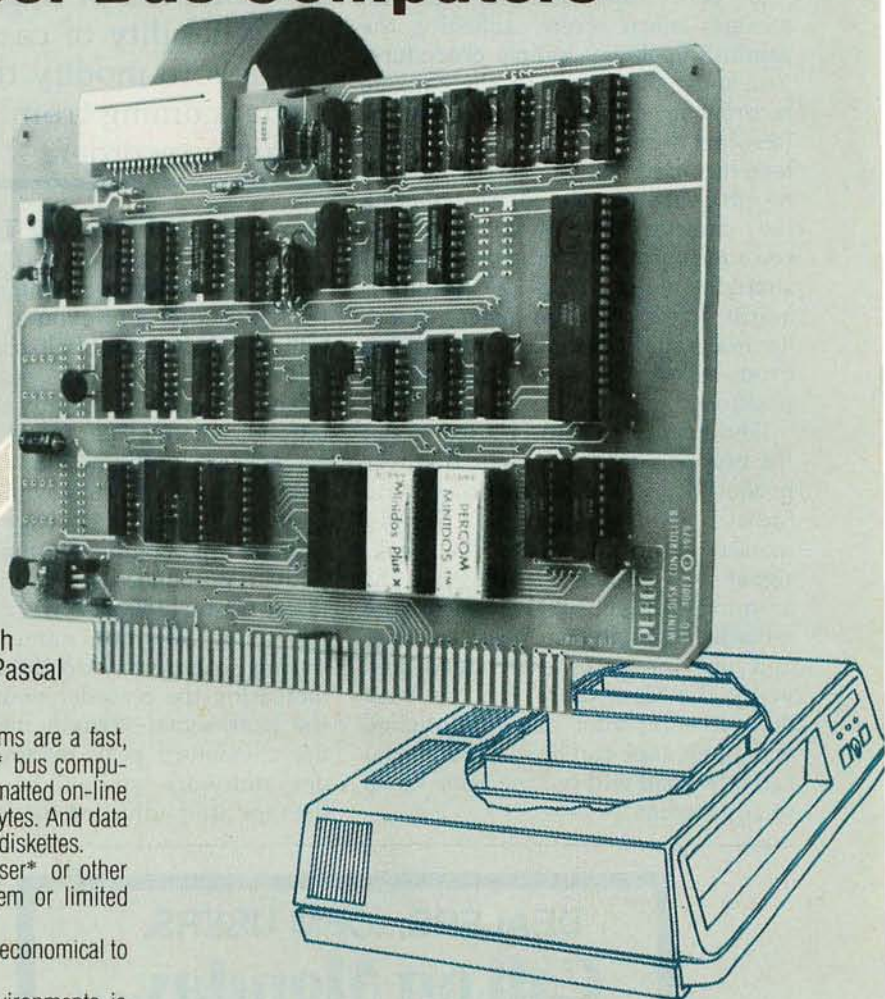
Fast mini-disk data storage makes your Motorola EXORciser* or other EXORciser* bus computer more than just a development system or limited evaluation system.

For example, at the low LFD-400/800EX prices it becomes economical to use your development system as the final working system.

Data capture/retrieval in research, test and production environments is another application where versatile, random-access LFD-400/800EX storage can provide efficient operation.

Equipment control is yet another area where the speed and facility of mini-disk storage greatly expands application possibilities. Even if you use a mini-disk only to load and control programs you'll save simply by taking a lot less time than with slow, inconvenient tape storage. Moreover, by storing programs on fast-loading, low cost minidiskettes you eliminate the overhead of burning PROMs — an expense that quickly adds up to far more than the price of an inexpensive Percom mini-disk system.

The bottom line? An EXORciser* or Micromodule*, with percom LFD-400/800EX mini-disk data storage, is a remarkably adaptable microcomputer — a system that meets the quality and dependability demands of industry yet is competitively priced with personal computing systems.



PRICES

Model	1-drive system	2-drive system	3-drive system
LFD-400EX™	\$649.95	\$1049.95	\$1449.95
LFD-800EX™	\$945.95	\$1599.95	\$2245.95

MPX Disk Operating System (2-chip ROM set)

Standard versions for most popular monitors \$69.95

LFD-400/800EX Users Instruction Manual:

Includes driver utility listings, controller schematic \$15.00

The system prices are single-quantity prices. A system includes (1) the drives, power supplies and enclosure, (2) the EXORciser* bus compatible controller PC card with 1K RAM and provision for three 2708 EPROMs, (3) an interconnecting cable, (4) an 80-page users instruction manual, and (5) a system minidiskette. The Percom Software Services Group will customize the MPX DOS for a nominal charge if one of the standard versions is not suitable for your monitor. LFD-400EX* systems use 40-track drives; store 102K bytes of formatted data per minidiskette side. LFD-800EX* systems use 77-track drives; store almost 200K bytes on one side of minidiskette.

Orders may be placed by dialing 1-800-527-1592 (outside of Texas) or (214) 272-3421 (in Texas). For additional technical information dial (214) 272-3421.

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

PERCOM



Checking the Recorder Azimuth

If your tape recorder has an azimuth-adjust screw, adjusting the azimuth angle is a simple procedure. You must first place in the cassette recorder an azimuth-calibration tape (see text box) or a similar cassette tape recorded on a machine *known* to be properly aligned. Then, playing the cassette and monitoring the recorder output with the peak-signal-strength meter, turn the azimuth-adjust screw until the meter reaches its maximum reading. The reading drops off on both sides of the optimal position.

The meter can also be used to get the best reading from a tape that was produced on a tape recorder with faulty head alignment. Simply monitor that tape with the peak-signal-strength meter, adjusting the azimuth-adjust screw until the recorder gives the strongest reading, and use the recorder to load and verify the tape. Once this has been done, the recorder can be realigned and a new tape can be made that you can later load without the same kinds of adjustment.

One method of improving the reliability of cassette tapes is to modify the signal coming from the cassette recorder.

Problems with Reading Tapes

With most computers, you will need to load a tape using an input peak-signal level of about 2 V (which will appear as about half-scale on the milliammeter of the peak-signal-strength meter). With only slight variations due to a particular computer/recorder combination, the same reading from the peak-signal-strength meter will result in effective loads. A cassette tape coming from a recorder with a misaligned head will give a lower reading than a correctly recorded tape for the same volume setting. First try to load the tape after increasing the recorder volume until the peak-signal-strength meter gives the customary peak reading. If this does not work, you will have to load the tape after adjusting the azimuth in

the manner previously described.

Whenever the tape head is misaligned with respect to the tape path, the peak-signal intensity will flutter, even if the tape being played was recorded correctly. This effect is called *skew*. If the signal variation is severe enough, you will be unable to load the tape properly due to data dropout. Signal flutter due to skew is a subtle problem; it will not show on a meter because no meter needle can move fast enough to follow the flutter.

Flutter can also be caused by *tape weave*, which has a variety of causes. If the pressure pad opposite the record/playback head is not positioned properly, it will tend to push the tape away from the center of the head. This is aggravated by the fact that most cassette recorders do not maintain tension on the supply reel, allowing the pressure pad to pull out tape freely and push the tape away from the center line of the head. Also, a tape with a thin backing is more susceptible to tape weave.

Altering Tape Waveforms

Another method of improving the reliability of cassette tapes is to modify (and sometimes rerecord) the signal coming from the cassette recorder. For example, several waveform-changing interfaces that improve the loading reliability of the cassette are available for the Radio

DEALERS...OEM USERS.

Call on Monday...
your North Star
computer
will be
delivered by
Thursday.



WHOLESALE PRICES AVAILABLE.
GBC maintains ready stock on the following products and software:

- North Star
- Centronics
- Perkin-Elmer
- Epson
- Zenith
- NEC Spinwriter
- Turnkey North Star Business Software

(609) 424-0465

GBC inc.
General Business Computers
2020 Fairfax Avenue
Cherry Hill, New Jersey 08003

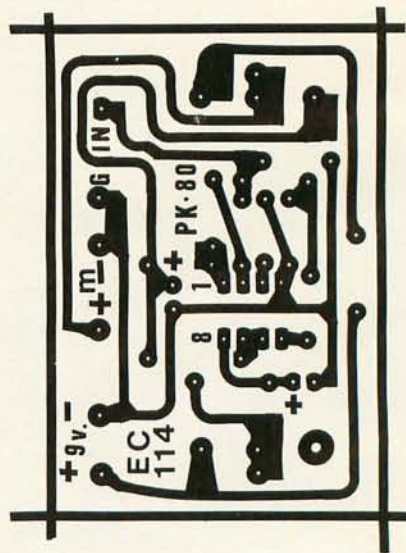
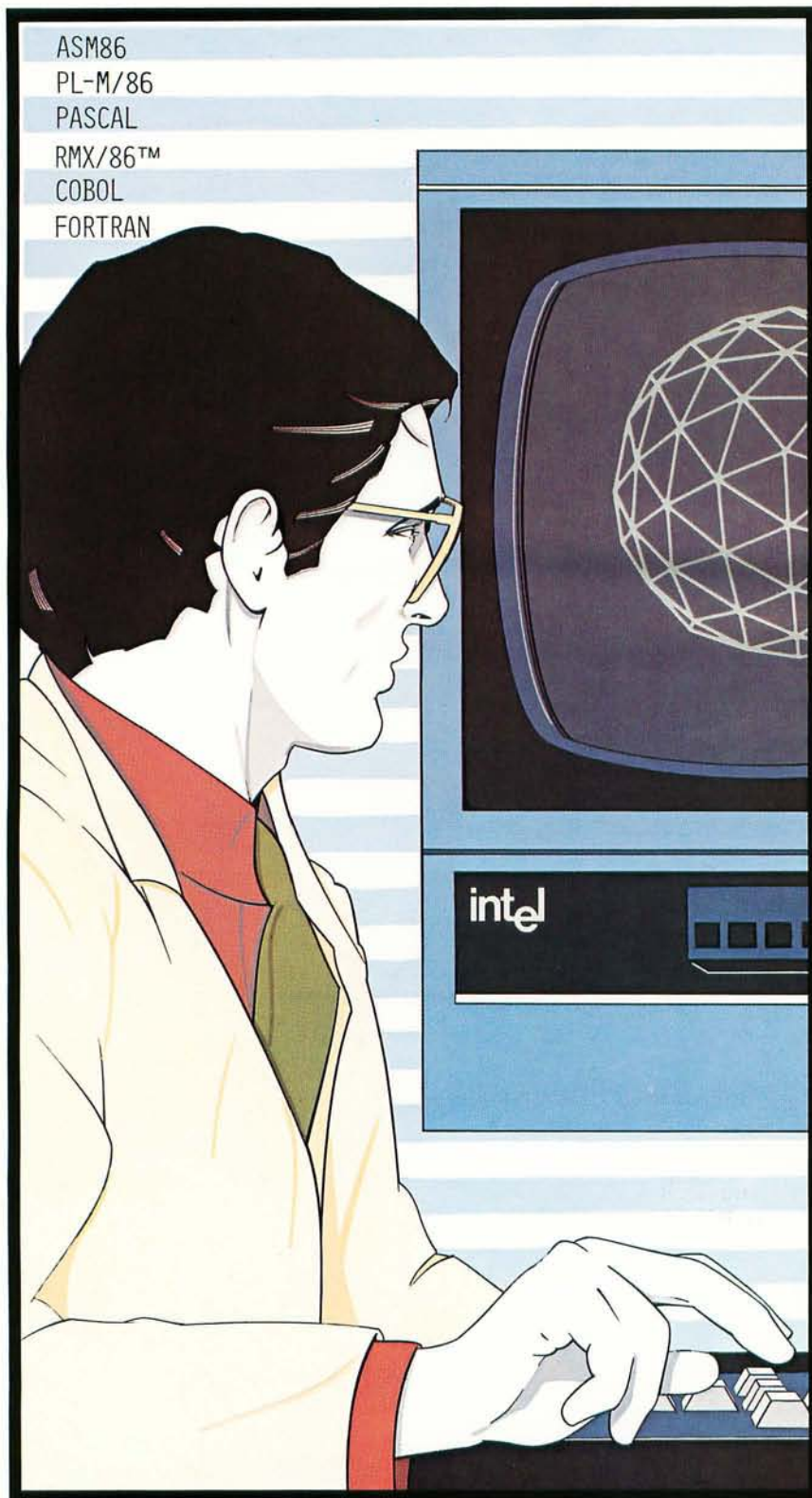


Figure 2: Full-sized, printed-circuit-board pattern for the peak-signal-strength meter circuit of figure 1.

**There is only one
high performance
VLSI computer
solution.**

Intel delivers it.

Tools to solve the



How Intel delivers the key to productivity in the '80s.

As we move into the '80s, the increasing demand for complex computer programs, the critical shortage of programmers, and the seemingly unstoppable rise in software development costs will reach crisis proportions. To understand how to bring this situation under control, we have to understand its cause.

In the 1970s, the microcomputer was used successfully to lower the cost of hardware engineering. Each new microcomputer generation integrated more and more of the system, lowering the cost of design and making it easier to put electronic intelligence anywhere and everywhere. As hardware cost dropped, rising software costs became increasingly visible.

So, today, as costs climb, management puts everyone under increasing pressure to deliver projects on time and on budget. Yet, the cost of programming is still outpacing productivity. Software development and integration still lag the system hardware. The software crisis of the '80s rages on.

Tools for structured solutions

Once a problem grows beyond a certain point, the most efficient way to solve it is with a top down approach. You break the problem into units, program and debug each one, and combine the units into a unified solution.

That's the concept. But you can't stop there. In the '80s, bridging the gap between a conceptual solution and a working one will require tools as efficient as the top down method. New tools, like a CPU with a dramatically different architecture. An architecture uniquely suited to a world of higher level languages and structured programming. Tools like a modular operating system, of a kind never before available on a 16-bit microprocessor. Tools like the

software crisis.

only complete family of programming languages, because no one language is right all the time.

Different languages have different strengths and weaknesses, and using the right language for the right job can make your programming easier. So, Intel delivers ASM86 Macro Assembly Language for space and speed sensitive modules. Our PL-M/86 systems programming language and PASCAL support structured programming at the systems and applications levels. FORTRAN and COBOL will also be available.

With Intel's relocation and link-age tools, modules written in the different languages are combined, with library utilities and operating system routines, into one, complete solution, automatically. Using this modular approach, and the right language for the right job, your finished product is clean, reliable, maintainable, and understandable.

The critical module

Since complex software requires sophisticated operating systems support, the operating system is the most critical module in your solution. It is the foundation upon which your application is built. It is also available, off the shelf, from Intel.

Today, Intel delivers the RMX/86™ operating system. RMX/86 is new, and it's the first modular, real-time, multitasking operating system for 16-bit microcomputers. File manipulation, task scheduling, and interrupt control are configured by you, according to the needs of your application. There's no unnecessary burden.

Intel's investment in the development of RMX/86 is substantial. Depending

upon the features you select, you save from two to forty man years of programming effort. That's an additional two to forty man years you can devote to your application.

Tools for realizing your solution

Of course, having the foundation and the concept of your solution doesn't help if you can't write the programs to implement it. So, Intel delivers development tools to support you through the entire development cycle. Support from source entry, with CREDIT, a CRT based text editor, through compiling and debugging, with an Intellec® development system

and ICE™ hardware/software debugging system. Intel's tools work with you. They shorten development time and support the structured approach you've taken.

But debugging software on a development system is not the same as testing it on the actual hardware. The ICE modules help here, too. During development, these tools let you trace through your software and debug it, symbolically, at the source language level. Now, these In-Circuit Emulators replace your prototype hardware's CPU to speed hardware/software integration.

If your hardware is built from components, ICE Modules will help you separate the hardware and software bugs, so you don't spend your time fixing engineering problems. If your hardware is built around an Intel iSBC 86/12A™ Single Board Computer, you'll already have a known, working hardware environment for program testing. You can use ICE Modules to concentrate your efforts on debugging your software.

Either way, the same software, operating system support and debugging tools are available to help you bring your application to life.

Synergy for high performance

In the '60s and '70s, programs were used to instruct computers. Applications of the '80s require programs to be the solutions to problems. High performance solutions will be the result of synergy between the hardware and the software.

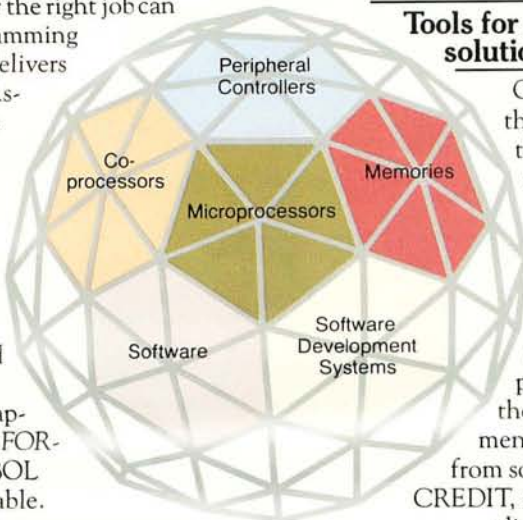
To create this synergy today, Intel delivers the 8086 processor. The 8086 processor is unique. Instead of a linear, or flat architecture, the 8086 is the only microprocessor optimized to work with high level languages and the structured solutions they implement.

For the specialized needs of the '80s, the 8086/87 and 8086/89 co-processing systems will set the standard of performance for mathematical processing and I/O bound applications.

And Intel peripheral controllers contribute to your system throughput by freeing processors for more computation.

Your software design may be revolutionary. And with help from an architecture designed to support your structured solution, its performance can be revolutionary, too.

Intel's software tools let you concentrate your planning on the payoff—getting to market today with a superior product. To take your first step to higher productivity, fill out and mail the coupon on the other side of this page. It's a productive use of your time.



Intel Structured System

intel® delivers solutions.

Europe: Intel International, Brussels, Belgium.
Japan: Intel Japan, Tokyo. United States and Canadian distributors: Alliance, Almac/Stroum, Arrow Electronics, Avnet Electronics, Component Specialties, Hamilton/Avnet, Hamilton/Electro Sales, Harvey, Industrial Components, Pioneer, L.A. Varah, Wyle Distribution Group, Zentronics.

Your first step toward productivity

How to get more information on solving the software crisis of the '80s.

To find out more about our solutions, fill out the informa-

tion requested below and send it to Intel Corporation, Literature Department, 3065 Bowers Avenue, Santa Clara, CA 95051. Indicate what your particular interests are, including workshops, and we'll make sure you get the appropriate material. If you don't have a pair of

scissors handy, give us a call at 408/734-8102 (Literature Department) and we'll rush the material out to you. Or call your local Intel distributor.

Intel wants to help you solve the software crisis of the '80s. It all starts right here.

Name _____

Title _____

Company _____

Division _____

Address _____

City, State, ZIP _____

☐ I have an immediate requirement, please telephone me at (_____) _____

☐ I need additional information.

Please put the letter corresponding to your yearly requirements in the line to the left of those products of interest.

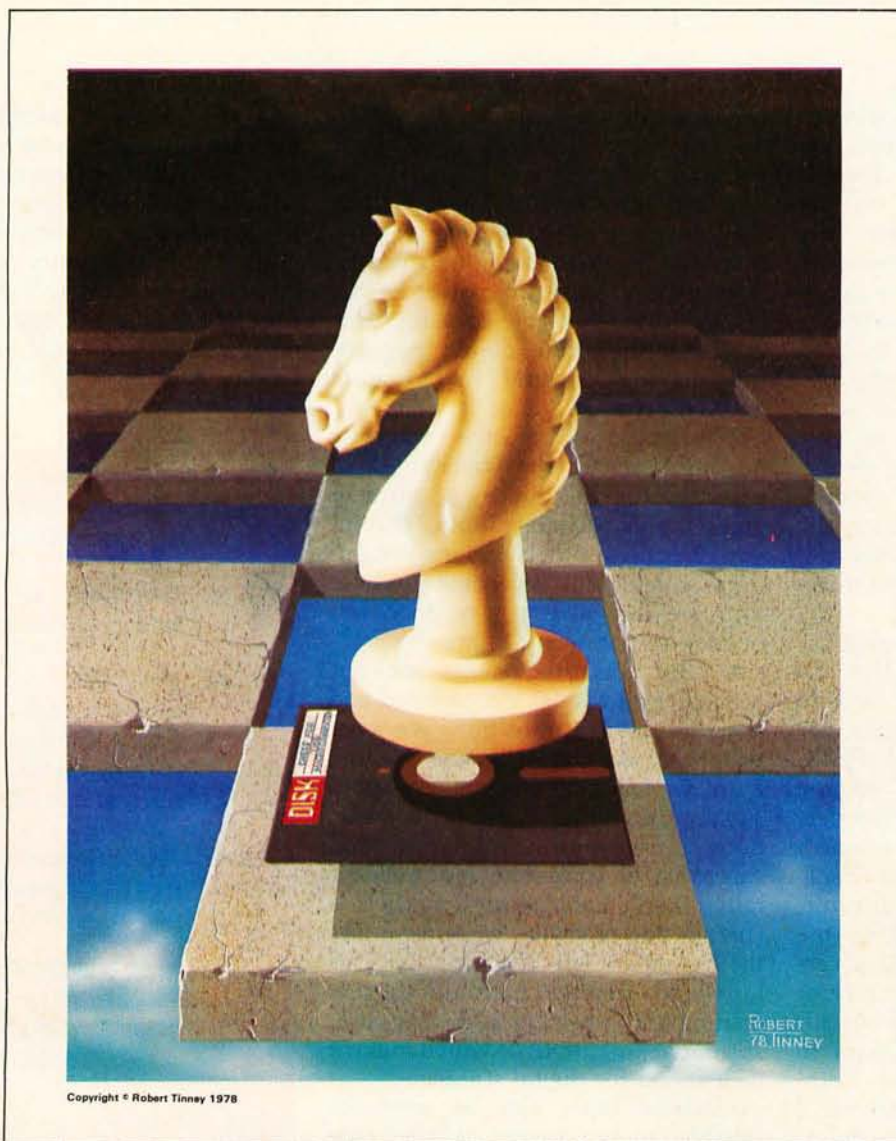
W for 1-10 per year
X for 11-99 per year
Y for 99-999 per year
Z for over 1,000 per year

☐ A 16-bit Microprocessors
☐ B 8-bit Microprocessors
☐ C Single-Chip Microcontrollers
☐ D Peripheral Controllers
☐ E RAMS

☐ F EPROMS
☐ G Bubbles
☐ H Single Board Computers
☐ I Development Systems
☐ J Debug Tools
☐ K High-Level Languages

(_____)
Indicate languages

☐ L Macroassembler
☐ M Operating Systems (RMX/86™)
☐ N Telecom Products
☐ O Military Products
☐ P Workshops



Beautiful "Computer Chess" Reproduction—only \$4.95!

This dramatic reproduction of the October '78 Byte cover art has been produced with the same care and quality as limited edition prints—yet it is available for the price of a poster.

The overall size is 18" x 22", which includes a 1½" border. It is printed on heavy, 80 lb., matte finish, coated stock, excellent for the finest framing if desired.

The price of this quality reproduction is \$4.95, plus \$1.00 for mailing tube, handling, and postage. In addition, the artist, Robert Tinney, will select the 100 finest prints from this first edition for his personal signature and number. These 100 signed and numbered prints will be sold on a strictly first-come basis for \$24.00 plus \$1.00 postage and handling.

See coupon below for ordering.


Send me _____ of the \$4.95 posters, and _____ of the \$24.00 signed prints. I have included \$1.00 for postage and handling.

Please charge this to my _____
 Visa/Master Charge: _____

Name: _____ Visa card number: _____
 Address: _____ Master Charge no.: _____
 City: _____ State: _____ Zip: _____

Card expires: _____

Make check payable to:
robert tinney graphics
 P.O. Box 45047
 Baton Rouge, LA 70895



Shack TRS-80. About two winters ago here at Cook Laboratories, we developed a modified tape format that records more reliably on the TRS-80. Without going into the details of the TRS-80 tape format, I can say that the unaltered tape signal crowds too much information into a given space and thus opens itself to reliability as well as saturation problems. The latter problem is what makes the TRS-80 normally so volume sensitive. The waveform we use at Cook Laboratories, when recording tapes for the TRS-80, reorders the waveform shape and narrows the pulse width so that the cassette interface does not get confused.

The various waveform modifications could certainly be used to improve the reliability of the cassette storage on other microcomputers. For example, on the old-model PETs, there is no way to alter the volume level of the built-in cassette recorder. However, Commodore can provide a documented program called S-21. This program, when running, monitors tape being played in the PET cassette deck and displays certain information about the quality of the tape signal on the PET screen. This is a very effective program to have if you know how to use it; Commodore is the only manufacturer I know that supplies a program like it.

Tape Is Also a Factor

Several factors having to do with

the cassette tape itself can also affect the reliability of tape loading. As I mentioned before, a tape that is too thin will likely give in to tape weave. Tape stiffness is a property of the thickness of the backing and is proportional to the third power of the gauge thickness of the backing. This indicates that you should not use long-playing cassettes for program and data storage.

The thickness of the magnetic coating affects the reliability of cassette storage, but in a different way. Standard audio tapes, chromium dioxide or otherwise, are not optimal for digital recording because they are designed to give good frequency response in the low frequencies. But low frequencies are not needed here; rather, well-defined and sharp waveform transitions are what count. A thinner magnetic coating than what is used in standard audio cassettes results in nice improvements both in waveform resolution and sharpness of transition. Not incidentally, Cook Laboratories markets a custom line of digital cassettes under the trademark MICROFUSION. This tape has a thinner chromium dioxide coating and a heavier and, therefore, stiffer backing, both of which make it well suited for digital storage.

Cassette tapes can be used for reliable mass storage if the tape recorder is kept clean and properly aligned, if quality tape (especially tape made for digital storage) is used,

and if the signal going from the cassette to the computer is monitored and kept constant (from tape to tape) with a peak-signal-strength meter. Although disks are readily available and bubble memories are not far away, no medium will ever become obsolete as long as it provides a needed function. Cassettes, too, are here to stay. ■

The following items are available from Cook Laboratories, 375 Ely Ave, Norwalk CT 06854:

AZ-80	Precision azimuth cassette, chromium dioxide.	\$14.95
PK-80	Kit for peak-signal-strength meter, including board, litho panel, screw-driver, meter, case, and instructions, less battery	\$25.90
AZ-B1	Printed-circuit board for peak-signal-strength meter, etched and drilled	\$2.50
	MICROFUSION digital cassette, C-10	\$3.26
	C-20	\$3.68
	C-30	\$4.09

Add \$2.00 for each order for handling and shipping within the continental United States. Connecticut residents add 7% tax.

DO YOU SEE EYE TO EYE WITH YOUR APPLE?

The DS-65 Digisector® opens up a whole new world for your Apple II. Your computer can now be a part of the action, taking pictures to amuse your friends, watching your house while you're away, taking computer portraits... the applications abound! The DS-65 is a random access video digitizer. It converts a TV camera's output into digital information that your computer can process. The DS-65 features:

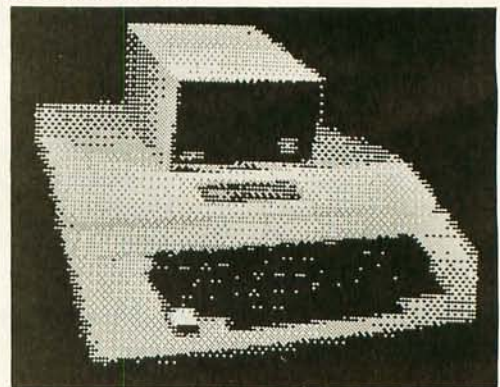
- **High resolution:** 256 X 256 picture element scan
- **Precision:** 64 levels of grey scale
- **Versatility:** Accepts either interlaced (NTSC) or industrial video input
- **Economy:** A professional tool priced for the hobbyist

The DS-65 is an intelligent peripheral card with on-board software in 2708 EPROM. Check these software features:

- Full screen scans directly to Apple Hi-Res screen
- Easy random access digitizing by Basic programs
- Line-scan digitizing for reading charts or tracking objects
- Utility functions for clearing and copying the Hi-Res screen

Let your Apple see the world!

DS-65 Price: \$349.95
Advanced Video FSII Camera Price \$299.00
SPECIAL COMBINATION PRICE: \$599.00



APPLE SELF-PORTRAIT

THE
**MICRO
WORKS**

P.O. BOX 1110 DEL MAR, CA 92014 714-942-2400

PROGRAM EPROMS WITH YOUR APPLE

NEW FROM MOUNTAIN HARDWARE ROMWRITER™

FASTER THAN A SPEEDING DISK!

Firmware in ROM is as fast as your software in RAM, but in ROM it frees up RAM memory space for companion programs. And, there never needs to be a LOAD from disk! Create firmware for your Apple* by programming EPROMs with RomWriter.

FIRMWARE NOT SOFTWARE.

Many frequently used programs really ought to be installed as firmware. ROM-based firmware permits a "power up and go" configuration. Use RomWriter to create firmware for peripherals such as printers or create program cards. By installing EPROMs that you have programmed on Mountain Hardware's ROM-PLUS+™ board, program cards of up to 12K in length may be created.

FEATURES.

Programs 2716 EPROMs (5V). All 2K or part of the EPROM can be programmed. Installs in a peripheral slot. EPROMs mount in a zero insertion force socket. A switch turns power off to the socket so EPROMs can be inserted or removed without powering-down your computer. A Write Protect switch is provided for programmed EPROMs while running. A \$CFFF OFF switch to suppress this command during programming or RUNNING. EPROMs can be RUN on RomWriter, or ROMPLUS+™ when creating firmware systems.

SOFTWARE

Virtually foolproof programming. Specify a Start and End address in the EPROM and either a Disk File name or a starting address in memory. Desired code will be BURNED followed by a VERIFY. Additionally, existing EPROM code can be merged with desired changes to facilitate EPROM debugging. Easy data entry and high reliability are designed into RomWriter. Programmed EPROMs can be RUN while residing on RomWriter or can be transferred to Mountain Hardware's ROMPLUS+ board, requires Applesoft firmware.

THE RIGHT PRICE.

See for yourself how firmware can enhance the power of your Apple system. Drop by your local computer store for a demonstration. RomWriter and Mountain Hardware's full line of computer products are available at dealers worldwide.

*Apple is a trademark of Apple Computer, Inc.



Available through dealers worldwide



Mountain Hardware, Inc.

LEADERSHIP IN COMPUTER PERIPHERALS
300 Harvey West Blvd., Santa Cruz, CA 95060
(408) 429-8600

- Fast Firmware? Send me all the details on RomWriter.

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

A growing line of tools to expand the Apple.

A DC-to-DC Converter

Michael Picco
POB 516
Corte Madera CA 94925

Have you ever had the need for a bipolar power source, but had only a positive voltage available? With the help of a timer and a few external components, this problem can be overcome. The circuit in figure 1 is sufficient for powering op amps or similar devices requiring a supply current of 25 mA or less at -12 V.

The heart of this circuit is a 555 timer that provides a drive signal of approximately 20 kHz to a voltage doubler. This signal is removed if the

magnitude of the output voltage exceeds that of the supply voltage. In this sense, the converter operates as a switching-mode regulator.

The output voltage is set by controlling the timer via the reset input (ie: pin 4). When the output voltage reaches a negative potential with the same magnitude as the supply voltage, a low logic state is placed on the reset input, causing the timer output to go low and the increase in voltage magnitude to cease. ■

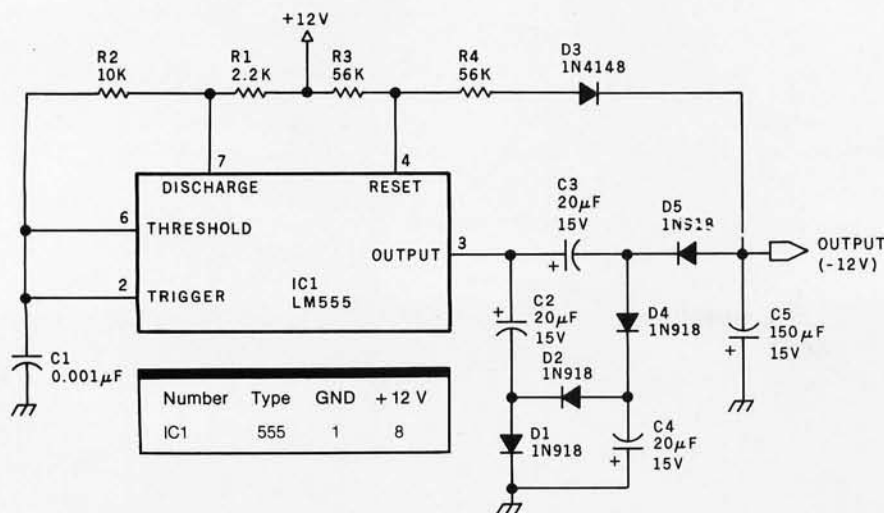


Figure 1: Schematic for the DC-to-DC converter. The 555 timer produces a rectangular wave at about 20 kHz, which is inverted by the diode-capacitor voltage-doubler arrangement. A feedback signal reaching the reset pin of the 555 regulates the magnitude of the output, which is -12 V at 25 mA.

7440A Programmable Interrupt Timer Module.

Time events in four operating modes—continuous, single shot, frequency comparison, and pulse width comparison. Includes three 16-bit interval timers, plus flexible patch area for external interface. Programmable interrupts, on-board ROM, and much more.

7720A Parallel Interface.

Two bi-directional 8-bit I/O ports will connect your Apple to a variety of parallel devices, including printers, paper tape equipment, current relays, external on/off devices. Full featured, programmable interrupts, supports DMA daisy chaining.

7811B Arithmetic Processor.

Interfaces with Applesoft, so you just plug in and run. Based on the AM 9511 device, provides full 16/32-bit arithmetic, floating point, trigonometric, logarithmic, exponential functions. Programmed I/O data transfer, much, much more.

7710A Asynchronous Serial Interface.

Conforming to RS-232-C A thru E 1978 standard, this card will drive a variety of serial devices such as CRT terminals, printers, paper tape devices, or communicate with any standard RS-232 device, including other computers. Full hand-shaking, and fully compatible with Apple PASCAL!

7470A 3½ BCD A/D Converter.

Converts a DC voltage to a BCD number for computerized monitoring and analysis. Typical inputs include DC inputs from temperature or pressure transducers. Single channel A/D, 400 ms per conversion.

7490A GPIB IEEE 488 Interface.

A true implementation of the IEEE 488 standard—the standard protocol for instrumentation and test devices. Control and monitor test instruments such as digital voltmeters, plotters, function generators, or any other device using the IEEE 488.

7114A PROM Module.

Permits the addition to or replacement of Apple II firmware without removing the Apple II ROMs. Available with on-board enable/disable toggle switch.

7500 A Wire Wrap Board.

For prototyping your own designs.

7510A Solder Board.

7590A Extender Board.

7016A 16K Dynamic Memory Add-On.

Watch this space for new CCS products for the Apple. We've got some real surprises in the works. To find out more about the CCS product line, visit your local computer retailer. The CCS product line is available at over 250 locations nationally, including most that carry the Apple. Or circle the reader service number on this ad.

Apple II, Apple II Plus, and Applesoft are trademarks of the Apple Corporation.

CCS makes the difference.

We see the Apple a little differently.



We see it as a good way to get things done.

Apple has built a great computer. We at CCS have built a great line of peripherals and components to expand the Apple. To do almost anything you want to get done with a computer.

If you want to do business with an Apple, we've got tools to connect the Apple to standard business printers and terminals. Or to modems, for communications over telephone lines, with other computers, even with other Apples.

If you want to apply your Apple to engineering, scientific, or graphic projects, we've got tools for high-powered,

high-speed math functions, and fast, high resolution graphics. And tools to connect the Apple to lab test equipment like function generators or plotters.

And we have tools to connect the Apple to the outside world, including A/D converters and interval timers with external interface.

We make components for the S-100 bus, the PET, and the TRS-80, too. We built our products to deliver hard-nosed value to the OEM, and to the inventor who knows the best, at prices that are unbeaten.

To find out how much computer your Apple II can be, see things our way. Because for serious users with serious uses for the Apple, we've got the tools.



California Computer Systems

250 Caribbean Sunnyvale, CA 94086 (408) 734-5811

I/O Expansion for the Radio Shack TRS-80

Part 1: Principles of Parallel Ports

Steve Ciarcia
POB 582
Glastonbury CT 06033

I receive a lot of mail: enough that I'm beginning to feel like the "Dear Abby" of the personal computer ranks. The sources of the letters range from high school students asking for advice on science fair projects to major corporations seeking consultant services. Even though it takes considerable time to answer this mail, I regard it as a significant opportunity to gauge reader interest. Every letter in some way contributes to my choice of article topics, either through suggestions or by continued occurrence of similar questions.

Recently, my mail has been dominated by owners of the Radio Shack TRS-80 Model I thirsting for hardware expansion by means other than Tandy Corporation equipment. The majority of questions concern connection of my interfaces to the TRS-80 expansion connector.

In general, I have tried to present projects that are computer independent. That is, the interfaces described are driven through parallel input/output (I/O) ports rather than directly from a computer bus. This had not been a problem in the past, because virtually all of the early personal computers incorporated some parallel I/O capability. For those experimenters interested in enhanced I/O capabilities, I presented the article

"Memory-Mapped I/O" in the November 1977 BYTE on page 10 (reprinted in *Ciarcia's Circuit Cellar* Volume I, BYTE Books), which detailed parallel-port construction.

In the 2½ years since that article was first published, a number of

A port is a hardware channel for the computer to transmit and to receive data via an external peripheral device.

significant changes have occurred in personal computing. Most importantly, the Radio Shack TRS-80, the Apple II and the Commodore PET were introduced. The difficulty in maintaining and operating a computer is no longer a serious consideration for most computer enthusiasts. Much of my mail indicates that a new explanation of parallel and serial I/O is in order, and that it is time for hardware-expansion circuits to be detailed.

This month's *Ciarcia's Circuit Cellar* is the first of a two-part article on serial and parallel I/O port expansion of the TRS-80. The first part em-

phasizes parallel I/O, and the second part is concerned with serial interfacing. The result will be a complete Radio Shack software-compatible communications interface capable of supporting a variety of serial- and parallel-interfaced peripheral devices. The hardware was designed and the components were selected to be economical to build and easy to check out. First, here is a brief review of the basics.

What Is an I/O Port?

Just as some people are initially confused with the terms *hardware* and *software*, some find the concept of input and output ports difficult to understand without substantial explanation. The classical definition: a *port* is a hardware channel for the computer to transmit and receive data via an external peripheral device. The key words in this definition are *external* and *data* which imply externally collected information; the channel through which this data is obtained is called a *port*. A printer is a typical external peripheral device. The characters to be printed are sent from the computer to the printer. In some of the more sophisticated units, status signals such as *busy* and *out of paper* are returned to the computer from the printer.

Ports can be either parallel or serial. In *parallel* mode, data is transferred in increments equivalent to the word size of the computer. On the Z80, for instance, an 8-bit microprocessor, an output instruction through a parallel port transfers 8 bits at a time. A 16-bit processor such as the Intel 8086 transfers data in 16-bit increments. The number of bits transmitted simultaneously by a parallel port is dependent upon the size of the microprocessor data bus and how many bits the processor can transfer simultaneously.

However, serial data is always transmitted a single bit at a time, according to a fixed schedule defined by the data rate (usually expressed in bits per second, or *bps*) and a few specific options. The microprocessor has no single instruction that transmits serial data. It must rely on another device called a universal asynchronous receiver/transmitter (UART) to put the data word into serial form and transmit it. Any communication between the processor and the UART is in parallel form and is done through the processor's memory reference or I/O data-transfer instructions. A more in-depth discussion of serial ports will be presented next month in Part 2.

Address, Data, and Control Buses

Consider a computer system that includes a printer, video terminal with keyboard, and an audio cassette recorder as peripherals. Data would have to be relayed to the printer, to and from the video terminal, and to and from the cassette recorder. How can the computer tell the difference between data destined for the terminal and the data destined for the printer?

Most microprocessors incorporate a bidirectional *data bus* and an *address bus*: this is shown in figure 1. To keep track of the data transfer between the processor and its peripherals, the system uses a quantity of control signals which together can be called the *control bus*. The usual 8-bit processor has an 8-bit data bus, a 16-bit address bus, and a dozen or so control signals.

When the microprocessor is reading a data byte from memory, the address of the memory location being referenced is placed on the address bus. Memory information stored at

that location goes on the data bus and flows from memory to the processor. When data is being written into memory, the operation is reversed. A 16-bit address bus allows the processor to directly address 65,532 (ie: 64 K) memory locations.

In an 8080 or Z80 processor there is a specific set of instructions that perform input/output functions. The operation of these I/O instructions is similar to that of memory-reference instructions, except that only 8 bits of the address bus are used. These 8 bits

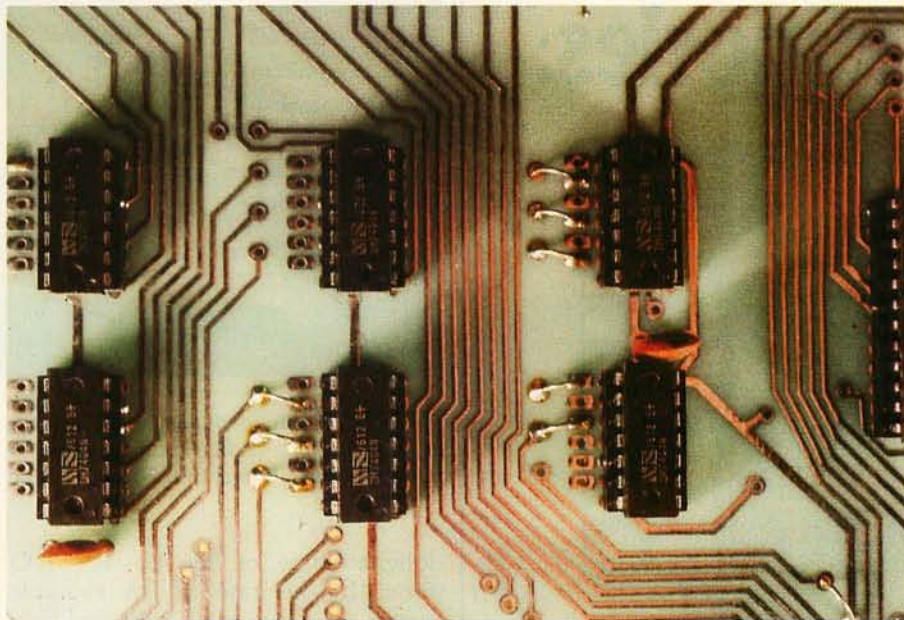


Photo 1: There are a variety of ways to decode the address for a particular input/output (I/O) port from the signals present on the address bus. The least expensive method uses inverters and printed-circuit-board jumpers to select the correct logic polarities. Three address lines are connected through each 7404 hex inverter with two possible connections for each address line. A connection to the upper trace on the circuit board decodes a logic 1; a connection to the lower trace decodes a logic 0.

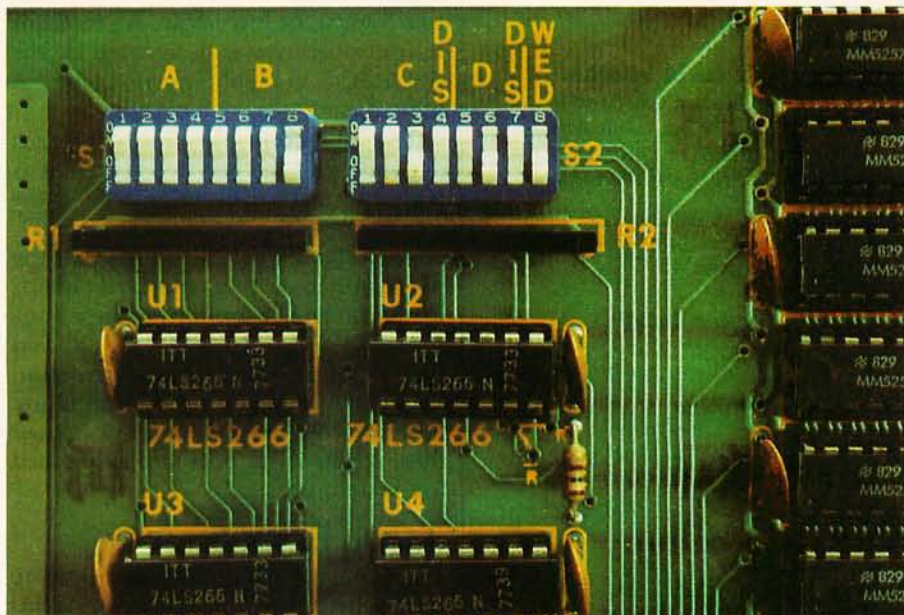
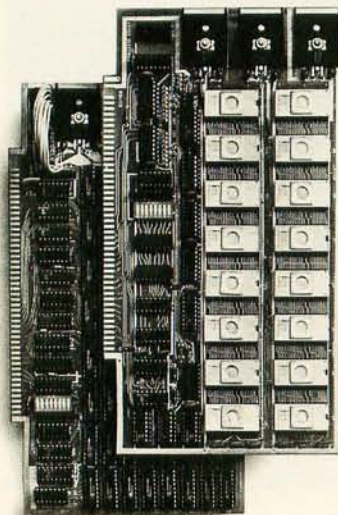


Photo 2: A more expensive and more easily changed addressing scheme employs dual in-line-pin (DIP) switches and exclusive-NOR gates. The schematic diagram for this is shown in figure 3b.

Have some great memories.



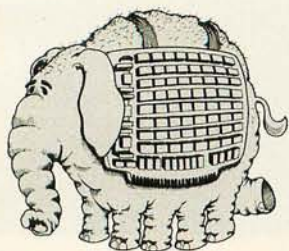
16K PROM boards.

- PROM card has 2708-type memory
 - Quality board construction
 - 0-4 wait states
 - Address any 4K group to any 4K boundary
 - Control up to 8 banks of memory
 - Fully assembled and tested
 - PRICE—\$300
- (California residents add 6% sales tax)

Expandable 5 MHz RAM boards.

- 8—32K expandable RAM board uses TI 4044 memory
 - Runs at 5MHz
 - Fast 250ns access time
 - Bank select
 - Address any 4K block to any 4K boundary
 - Quality board construction
- PRICE—8K—\$210; 16K—\$378; 24K—\$570; 32K—\$744; 8K add-on kits—\$162
- (California residents add 6% sales tax)

Call or write Artec for details



ARTEC ELECTRONICS, INC.

605 Old County Rd., San Carlos, CA 94070
Telephone (415) 592-2740

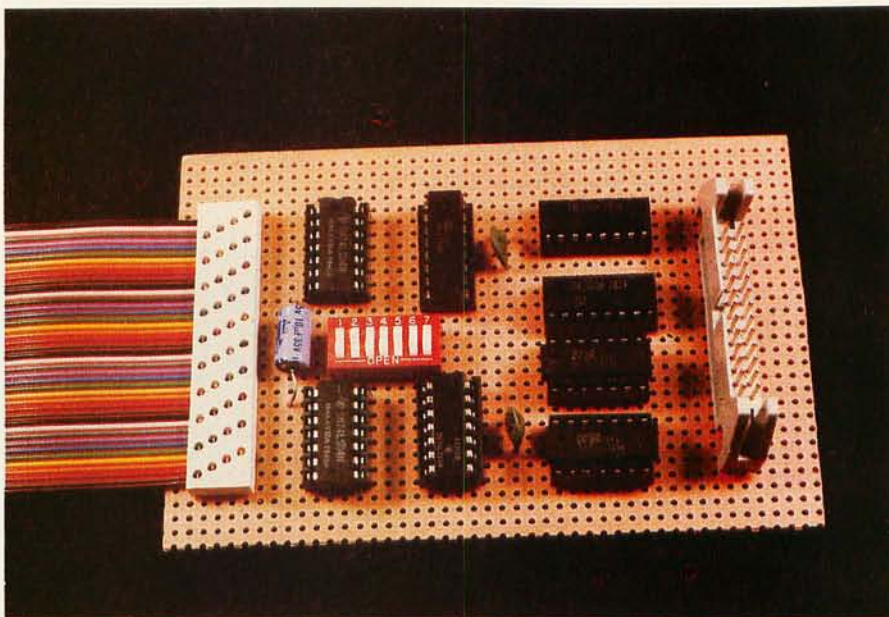


Photo 3: Prototype of an 8-bit I/O port for the Radio Shack TRS-80. The ribbon cable at left connects to the expansion port on the keyboard/processor unit. The two I/O ports are brought out to the ribbon-cable connector on the right edge of the board.

designate one of 256 possible I/O ports. In the case of the example system, a separate port address would be used for each peripheral.

Keeping track of bus direction and information flow is a matter of properly decoding the control signals during program execution. In a Z80 for instance, any memory-reference operation is signified by the control signal \overline{MREQ} in the processor going to a logic 0, or low, state. An input or output operation is designated by the $\overline{I/OREQ}$ control signal being at logic 0.

The direction of the data bus depends on whether the processor is trying to read or to write data. If the processor is in a read mode, the \overline{RD} control signal becomes a logic 0; if the processor is writing, the \overline{WR} line is in the 0 state. Monitoring these four lines, \overline{MREQ} , $\overline{I/OREQ}$, \overline{RD} , and \overline{WR} , gives us all the information necessary to support I/O decoding functions. Figure 2 demonstrates how these control outputs are combined for system use.

Address Decoding

So far we have discussed how to determine when the processor wants to send a character to an output device. In such an operation the $\overline{I/OREQ}$ and \overline{WR} lines are both low. To tell the difference between

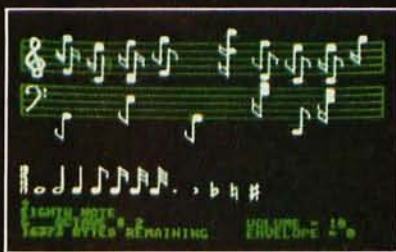
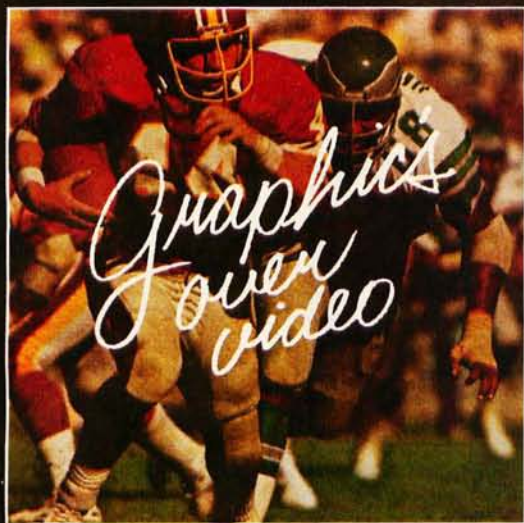
data for the printer and data for the terminal, we must decode the 8-bit port address.

The port address is determined by the logic voltages present on the low-order eight lines (that is, the 8 least significant bits) of the address bus during I/O operations. Various techniques can be employed to decode these lines. Figure 3 outlines a few simple methods. The objective, whatever the logic employed, is to produce a single pulse (ie: a strobe) whenever the logic states representing a particular address appear on the address bus. To eliminate false outputs when the processor is executing instructions not dealing with I/O, it is best to combine control and address signals as demonstrated in figure 4.

If you own a 6800- or 6502-based system, you have probably noticed that the processor has no special I/O instructions. This does not mean that these processors have no external communications capability, only that these processors communicate with peripheral devices differently. How can we discover this different method? Let us begin by looking closely at the I/O functions of the 8080 and Z80 that we have just discussed.

A close inspection of the I/O functions of an 8080 or Z80 should point

Text continued on page 30



APPLE POWER

VIDEO DATA PROCESSOR

Called the VDP, comes complete with 16K memory, its own color text and graphics generator and is designed to superimpose its graphics and text over incoming video signals from video tape, video disk, TV camera, Apple Video or Broadcast • Color text and graphics on an independent screen • Video titling or video interactive training uses. It's like your own TV station, works with OUR Light Pen too! Available directly from Symtec at \$1500.00.

SPECIAL PROBLEMS

We can help. Symtec does custom engineering, fabrication, hardware and software design for microprocessor. Beginning at \$1500, these services can solve your custom application needs for industrial, scientific, medical, engineering or personal uses.

SUPER SOUND GENERATOR

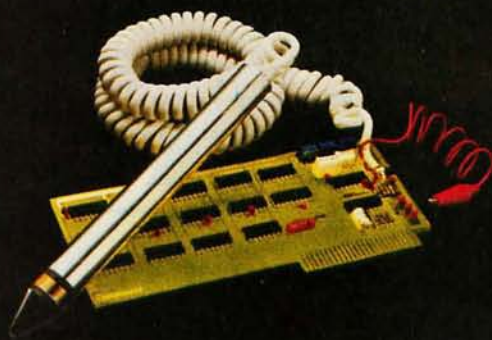
Apple Music Power with a plus • 3 voices, 6 in stereo version • Noise generator • Independent control of volume, envelope and shape by channel • Full power, easy to use software to compose, edit, play in hi-res graphics, PLUS, input and output ports allow extra uses: • Printer interface • Remote ASCII or music keyboard interface • and, optional BSR X-10 Adapter is available. Suggested retail \$159.95 mono, \$259.95 stereo.

SYMTEC X-10 CONTROL

Now for the Apple II, a low cost control to link your computer to the BSR X-10 Home Control System. Control your home or office lighting and appliances • Energy management • Display lighting Security and more. Suggested retail \$49.95.

LIGHT PEN

A professional quality, full feature light pen for the Apple II Computer • Hi-resolution — draw on the screen • X, Y and sensitivity adjustments — fits any standard TV • Sync adjustment for remote video source • Touch switch sets interface flag • Rugged metal case • Recommended by Apple. Complete, ready to go, the Symtec Light Pen is provided with software and documentation in Basic, Applesoft and machine code. Muse's Pilot II Language using the Symtec Light Pen is also available. The Light Pen is useable for graphics, games, education, exhibits, freedom from the keyboard. Suggested retail \$249.95.



See your Apple Dealer for a demonstration of the Symtec Light Pen, Supersound Generator or Symtec Apple X-10 Control. Other products and services are available directly from Symtec. Apple is a trade mark of Apple Computer Inc. BSR System X-10 is a trade mark of BSR Ltd. Muse is the trade mark of Micro Users Software Exchange, Inc.



New CRT SENSATION!

You have been reading about our astounding high performance microcomputer products. Our X-9000 Pascal MICROENGINE™ CPU that executes **Pascal 13x faster than an LSI-11 and 3x faster than a PDP11-34.** Our X-920 CRT matches the features of the SOROC IQ140. Our X-8000 16-bit CPU **addresses 8M bytes** of memory directly and is coming soon!

*Trademark Western Digital Corporation

DISPLAY/EDIT TERMINAL Model X-920

\$920

\$820 (Without 18 function keys)



STANDARD FEATURES (partial list)

- Microprocessor controlled
- Serial RS232C and 20 ma current loop
- 10 baud rates—75 to 19,200
- 24 lines x 80 characters
- 96 ASCII displayable characters
- Upper and lower case
- 12 x 10 character resolution
- Dual intensity display
- Clear full intensity data only
- Programmable reverse video
- Programmable underline
- 105 keys with alpha lock
- 14 key numeric pad with decimal
- 16 special function keys
- 8 edit function keys
- 2 block transmission keys
- Self test mode
- Protect mode
- Block mode
- 80 storable tabbing
- Insert/delete character and line
- Scrolling
- Addressable cursor
- A host of other features, including cursor controls and remote commands such as clear to nulls, spaces, end of line, end of screen; set hi,lo,zero intensity; set blink; etc.
- **Optional** screen print & 2nd page memory

For our system or for yours, in commercial, technical, educational or personal applications, the Computex X-920 is **unmatched** in its class.

All features of the Hazeltine 1400 and ADM-3A
Plus: 128 ASCII characters...
7 x 10 matrix... Reverse
video... Print key...
Shiftlock... Transparent
mode... Backspace...
Tabbing... Integrated
numeric pad.



\$799

List price \$956

PERKIN-ELMER (Model 550)

Off the shelf delivery now on the Model X-920 and P-E Model 550. Add 40 lb. shipping.

Customer satisfaction is guaranteed.

Full refund with the return of any product within 10 days. X-9000 CPU \$2995. Pascal MICROENGINE™ owners manual \$19.95; X-920 operators manual \$10, postpaid. **Cash prices.** 10% down guarantees priority. IL residents add 5% sales tax. **Master Charge and Visa** accepted.

Computex stands for competence. We **service what we sell.** Written hardware warranty. Nationwide service contracts. Custom software. We provide **expert technical support.**

(312) 684-3183
COMPUTEX
Microcomputer Systems
"The Computer Experts"
5710 Drexel Avenue
Chicago, IL 60637

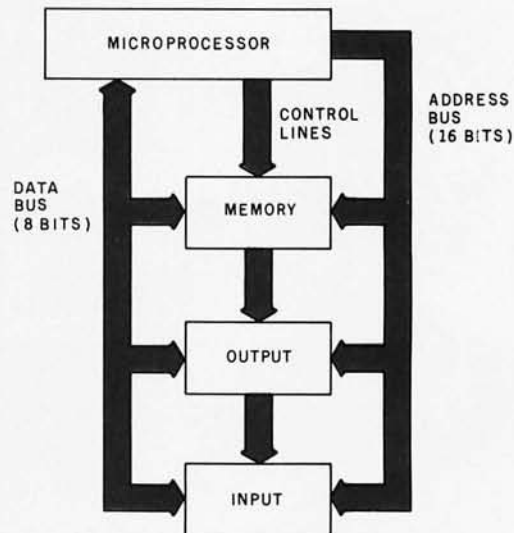


Figure 1: Block diagram of a microcomputer system that uses an 8-bit microprocessor such as the Z80. This system uses bussing techniques that are both multiplexed and bidirectional.

Z80 SIGNALS

CONTROL STROBES

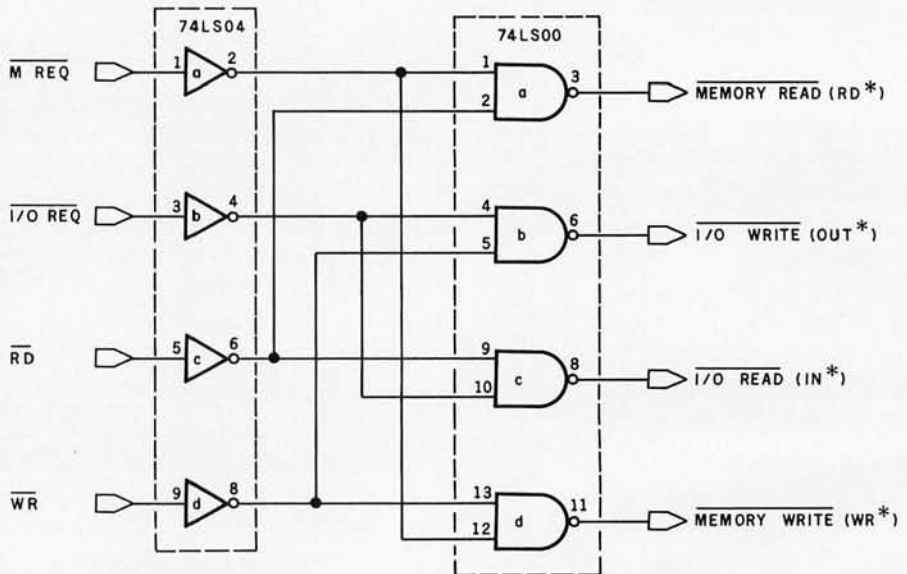
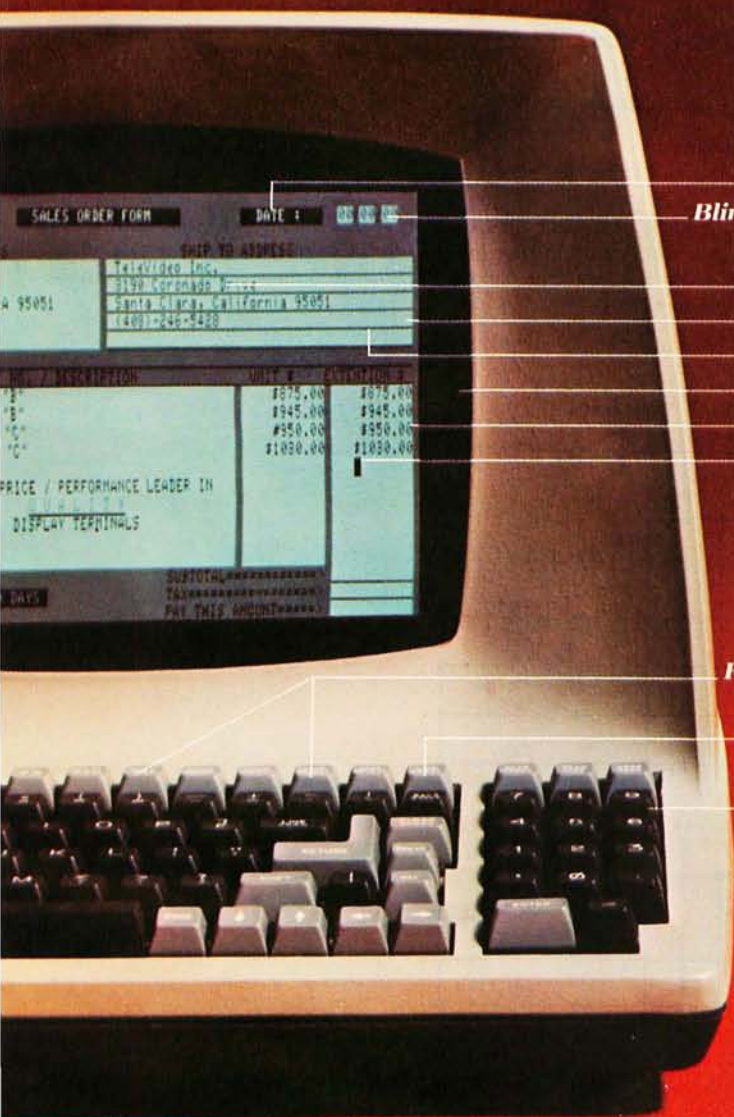


Figure 2: Control signals on the Z80 microprocessor. The Z80 uses a variety of control signals to keep data flowing at the right time and in the right direction. Four control signals are as follows: the \overline{MREQ} line goes to a low state (ie: a logic 0) when a memory-reference operation is in progress; the $\overline{I/OREQ}$ line goes to a low state when an input/output (I/O) operation is in progress; the \overline{RD} line goes low when the processor is reading data from memory or from a peripheral device; the \overline{WR} line goes low when the processor is writing data to memory or to a peripheral device. The \overline{RD} and \overline{WR} signals control the direction that data flows along the bidirectional data bus. Monitoring these four lines gives us all the information necessary to support I/O decoding functions.

Signals from the four processor control lines are logically combined to form control-strobe signals that perform specific functions. The characters in parentheses give the names by which the control-strobe signals are known in the documentation for the Radio Shack TRS-80.

COMPARE SMARTS.



Reverse video
Blinking/blank fields

Upper/lower
case char.

Protected fields

Underlining

Non-glare screen

12 x 10 char. res.

Blinking cursor

• **9 Baud rates**
(75-9600 Baud)

• **Self test**

• **Auxiliary port**

Function/edit keys
Typewriter/TTY
keyboards

Numeric pad

Model 920C shown.

Feature-for-feature our smart CRT terminals cost less than *their* dumb ones. Much less. Compare smarts. Then compare price. You'll pick TeleVideo.

Four different models to choose from. Each with features you'd expect to pay extra for. But with TeleVideo, they're standard.

We put a lot of engineering savvy into our CRTs. Their modular design means high reliability. It also lets us build in high volume. And sell to you at low prices.

Find out how you can make your next CRT buy a smart one. Contact TeleVideo today for information.

Nationwide Field Service is available from General Electric Co., Instrumentation and Communication Equipment Service shops.



TeleVideo™

TeleVideo, Inc., 3190 Coronado Dr.
Santa Clara, California 95051
Phone (408) 727-5428

COMPARE PRICE.

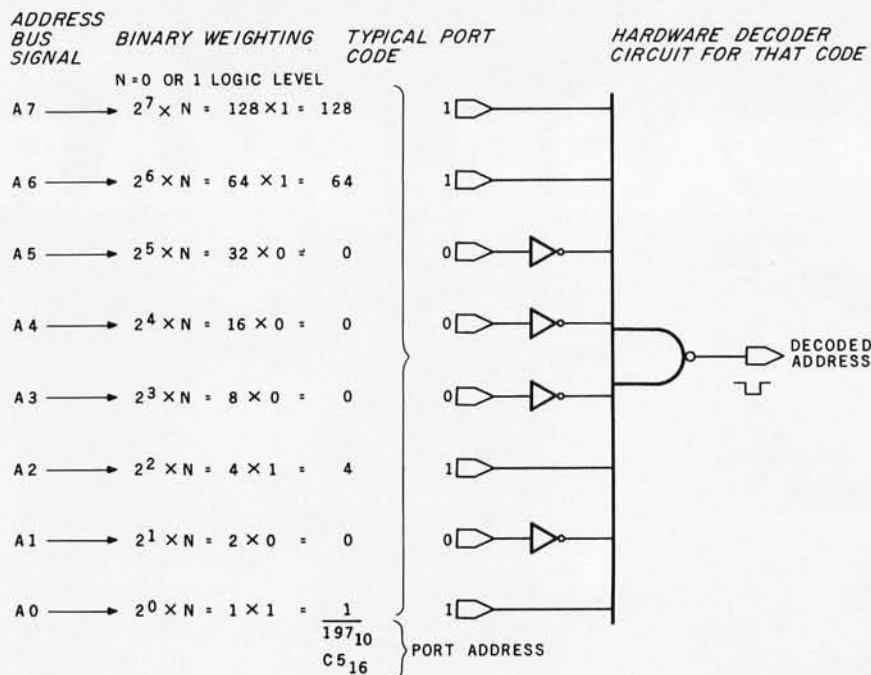


Figure 3a: Various methods can be employed to decode the address signals that appear on the address bus during I/O operations. Here, various inverters and an eight-input NAND gate are hardwired in a configuration that will produce a logic 0 output for one of 256 possible I/O port addresses. The logic 0 output can be used to activate the interface for the peripheral device. Here the circuit decodes the address hexadecimal C5, or decimal 197.

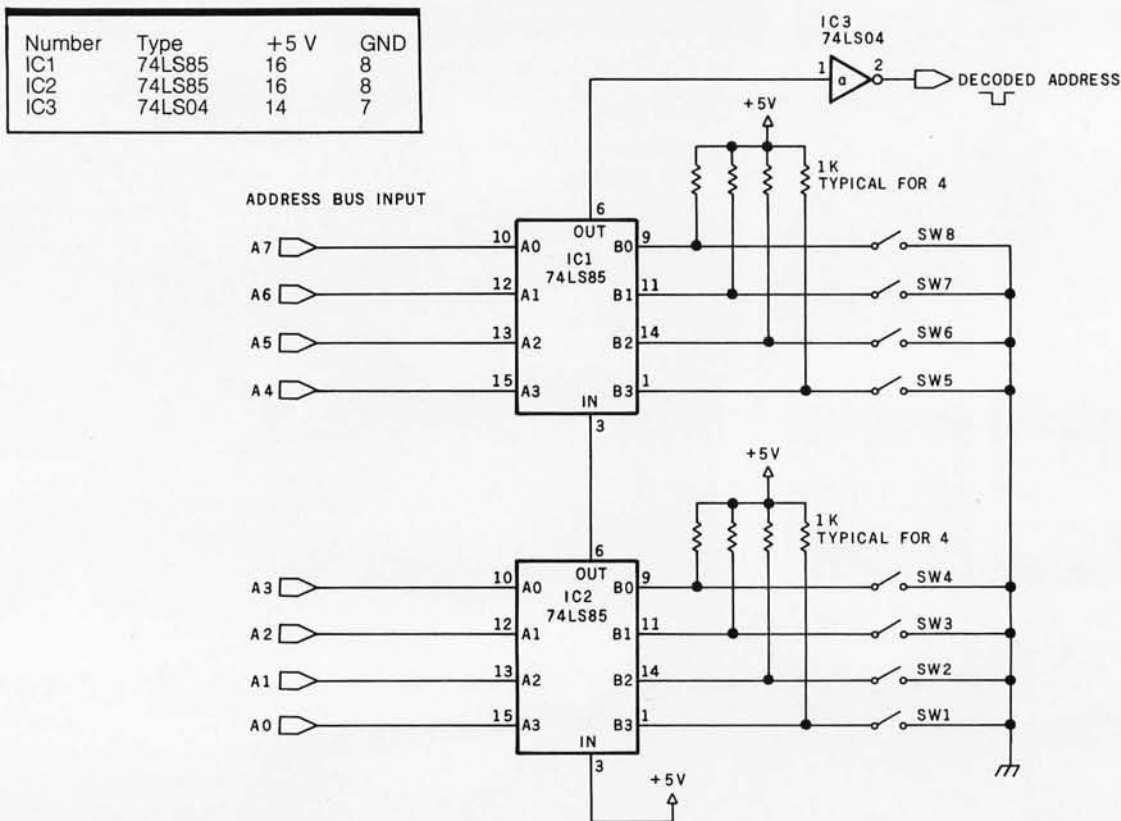


Figure 3b: Another method of decoding an address signal. Two 4-bit comparators can be cascaded together to decode an 8-bit address. The desired 8-bit port address is set up on switches SW8 thru SW1. When the combination of high and low logic states that corresponds to the desired address appears on the address bus, the output signal produced at pin 2 of IC3 (the 74LS04 inverter) will go low to a logic 0 state. This decoding method allows the port addresses to be easily changed, but the method here is considerably more expensive than the decoding method shown in figure 3a. The switches are single-pole, single-throw (SPST) types; an open switch shows logic 1, and a closed switch shows logic 0.

Now! North Star Application Software!

North Star now offers application software for use on the HORIZON! Now you have one reliable source for both hardware and software needs! The first packages available are:

NorthWord—

NorthWord is a simple-to-operate word processing system designed for use with the popular North Star HORIZON. NorthWord enables you to increase office efficiency and cut document typing time and cost. NorthWord incorporates the most sought-after word processing features: easy editing, on-screen text formatting, simultaneous document printing, and much more. NorthWord can be integrated with other North Star software packages to produce customized letters, labels and reports quickly and efficiently.

MailManager—

MailManager enables you to compile and maintain complete organized mailing lists. Lists are easily accessible and can be compiled with a great deal of flexibility. Entries, corrections and deletions are easily made. The North Star MailManager can print your list on individual envelopes, on mailing labels, or in compact summary form.

InfoManager—

InfoManager is a powerful list-oriented, data management system. It will accept up to 50 categories of information for each record and has the ability to select and sort before printing. The North Star InfoManager has power and flexibility for many applications: product inquiry, inventory, customer/client records, calendar reminders, and as an easy way to fill in often-used forms.

GeneralLedger—

General Ledger and Financial Reporting, two programs in one, maintains general ledger accounts based on such input as checks, bank deposits and journal entries, and uses the information in the general ledger to produce customized financial statements and financial reports.

NorthWord is the central building block for all the North Star application software to follow. Packages now being tested include other accounting and professional application packages. For more information or a demonstration, contact your local North Star dealer.

NorthStar 
North Star Computers, Inc.
1440 Fourth Street
Berkeley, CA 94710
(415) 527-6950
TWX/Telex 910-366-7001



Text continued from page 24:

out that the I/O instructions bear a surprising resemblance to memory-reference instructions. The 6800 and 6502 microprocessors actually allocate a certain portion of their memory address space to be decoded and to function as I/O ports.

This technique, which can be used on the Z80 and 8080 just as easily, has certain advantages in speed and ease

of use over direct I/O instructions. This technique is referred to as *memory-mapped I/O*. An illustration of the logic associated with this method is in figure 5. For a more rigorous analysis of memory-mapped I/O, I refer you to the November 1977 "Ciarcia's Circuit Cellar" article previously mentioned.

The final area for consideration is the actual transfer of data to and

from the bidirectional data bus. The circuits of figure 4 and figure 5 tell only *when* the I/O operation occurs. Additional logic has to be provided to place data on the bus during an input instruction or to latch and hold the contents of the data bus during output instructions.

When the 8080 or Z80 assembly language instruction OUT (N),D is executed, the contents of the accumulator, D, are placed on the data bus and written into device N. The same is true for the BASIC-language instruction OUT N,D. The data is actually valid during only a few clock cycles, perhaps 500 ns. Making this data available for longer periods of time requires the addition of an 8-bit latch: the latch is made from a set of clocked flip-flops.

The output lines are attached to the data bus. When the proper output instruction is executed, signified by a strobe signal from our address and I/O WRITE decoder circuit as shown in figure 6, the contents of the data bus are transferred into the 8-bit register in synchronization with the processor clock signal. This combination of circuitry is commonly called an *8-bit latched parallel output port*.

External devices cannot be directly connected to the data bus for input, because of the possibility that interference and bus-loading problems will result. A three-state buffer is used as a *gate* to allow signals from the peripheral device to be placed onto the bus at the appropriate time.

During an input operation the process used for output is reversed. When the proper input sequence is executed, signified by the appropriate output from the address decoder and I/O READ decoder, the 8-bit three-state buffer is strobed into operation during the few clock cycles it takes for the processor to execute the input instruction. Logic levels present on the buffer input lines during that instant become impressed onto the data bus and are transferred into the accumulator. Figure 6 shows the logic elements that perform these functions.

Add Parallel I/O to Your TRS-80

I have been told that the TRS-80 Model I is currently the largest-selling personal computer. Unfortunately it

Text continued on page 38

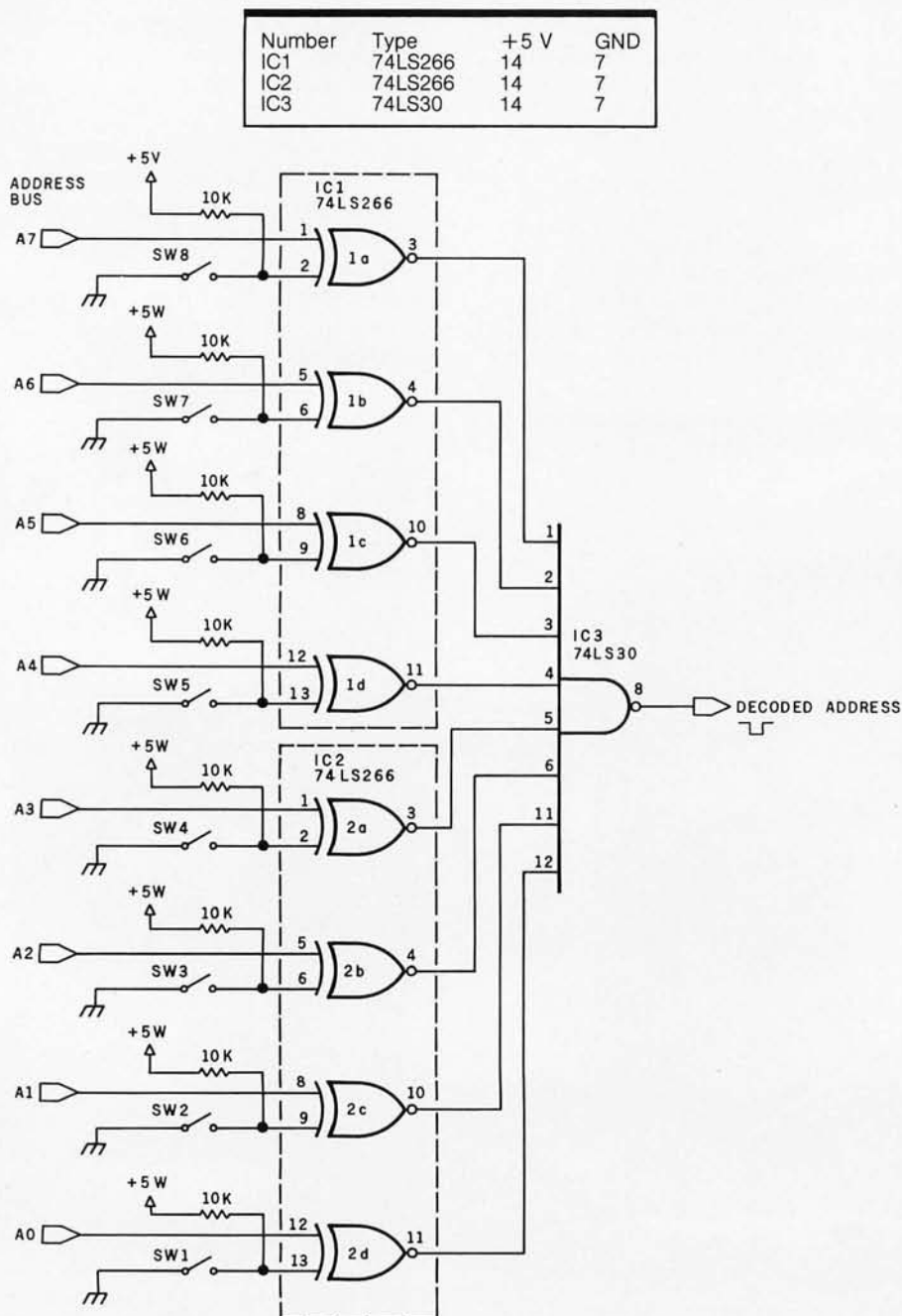


Figure 3c: Another method of decoding an 8-bit address, using exclusive-NOR gates and an eight-input NAND gate. As in figure 3b, the desired port address is set up on switches SW8 thru SW1.

Grrraphics.

The Paper Tiger[™] puts more bite into everything you do.

The Paper Tiger strikes again. With a DotPlot[™] graphics option that lets you make the most of your Apple II[†], TRS 80[‡], or other personal computer.

With DotPlot and available software drivers, you can print screen graphics, draw illustrations, write block letters, plot charts. And DotPlot includes an expanded, 2K-byte buffer.

That's not all. Every Paper Tiger gives you 8 software-selectable character sizes. 80 and 132 column formats. Multi-part business forms handling. Forms control. Reliable stepper-motor paper drive. Adjustable width tractor feed. Continuous duty cycle operation. Plus lots more.

[†]Apple II is a trademark of Apple Computer Inc.

[‡]TRS-80 is a trademark of Radio Shack, a division of Tandy Corp.

The Paper Tiger costs only \$995. The DotPlot option only \$99 more. But don't let these low prices fool you. Because the Paper Tiger is rugged enough to stand up to the most demanding printer-plotter requirements.

For the name of the Paper Tiger dealer nearest you, call toll-free 1-800-343-6412 (except Massachusetts, Alaska, and Hawaii).

Integral Data Systems, 14 Tech Circle, Natick, MA 01760. (617) 237-7610.

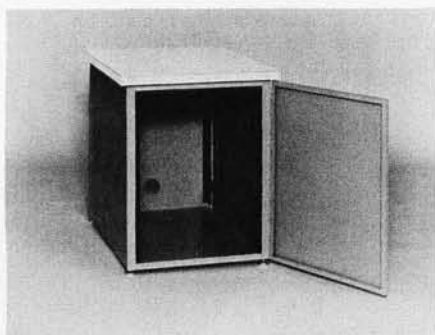


Circle 15 on inquiry card.

Integral Data Systems, Inc.



GET IT OFF THE FLOOR



Now that you have a shiny new computer terminal, what are you going to put it on? Computer Furniture and Accessories makes a variety of furniture for a wide range of computer applications. In combinations of six widths, three depths, and three heights. With "L" shaped returns, Micro shelves, data shelves, RETMA mounting, and printer stands. With optional drawers, doors, CRT turntables, and casters. Sizes, shapes and colors designed to fit your office or computer room environment. Reasonably priced and shipped from stock.

Call CF&A. We'll get your system up where you can really put it to use.

CF&A

**Computer Furniture and
Accessories, Inc.**
1441 West 132nd Street
Gardena, CA 90249
(213) 327-7710

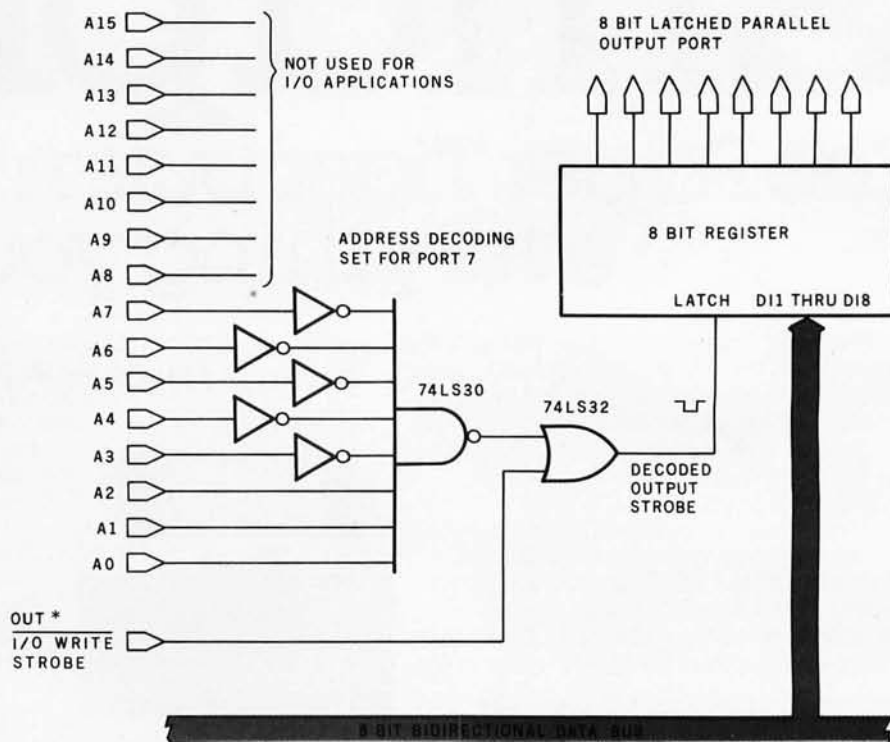


Figure 4a: Block diagram of a typical parallel output port. The logic that decodes the 8-bit port address was shown in three forms in figure 3. The signal from the address-decoding circuit is logically combined with one of the control signals from figure 2 (I/O WRITE) to produce an output strobe signal that activates the 8-bit output latch register.

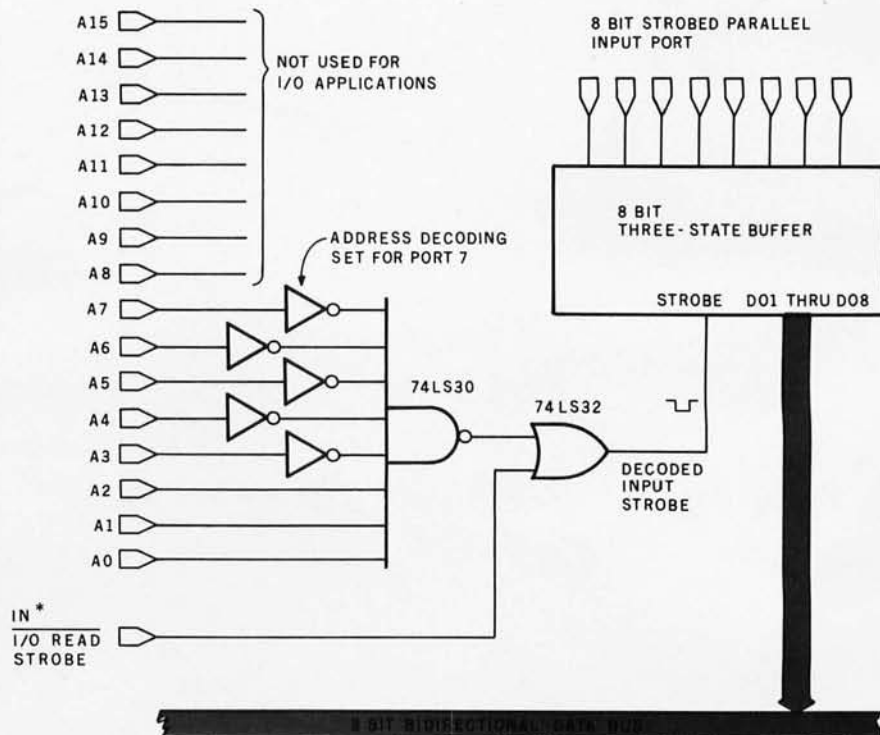
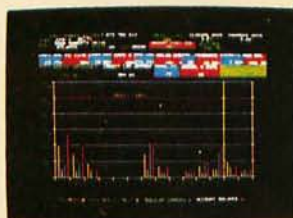
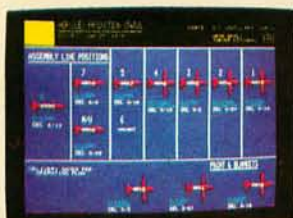
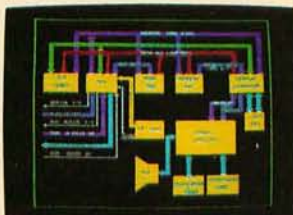


Figure 4b: Block diagram of a typical parallel input port. Note the resemblance to the output port of figure 4a.

Booth 4231 at NCC



Color communicates better. That's the *obvious* benefit of ISC's new CP/M® compatible desktop computer.



What isn't as obvious is how easy it is to operate the Intecolor® 8963. Because the CP/M operating system lets you choose from an abundance of prepared CP/M business software, you don't have to write programs unless you want to. And with ISC's color-coded word processing program, you can take advantage of the 8-color graphics display immediately! Color-enhanced programs are also available from Peachtree Software* to handle your General Ledger, Accounts Receivable and Payable, Payroll, Mailing List and Inventory Management System.

The Intecolor 8963 is complete with 19" CRT display, 32K of user RAM (now expandable to 64K), 591K dual 8" floppy disk drive and a color version of Microsoft® Business BASIC. At just \$6395†, it's perfect for the small business.

If you'd rather get down to business than write programs, ask for a demonstration of the Intecolor 8963. Available at selected computer dealers, or contact your nearest ISC sales representative.

†U.S. domestic price.

Unretouched photo of screen.

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

*TM Retail Sciences, Inc.

ISC SALES REPRESENTATIVES: AL: 205/883-8660, AZ: 602/994-5400, AR: (TX) 214/661-9633, CA: Alhambra 213/281-2280, Goleta 805/964-8751, Irvine 714/557-4460, Los Angeles 213/476-1241, Los Altos 415/948-4563, San Diego 714/292-8525, CO: 303/355-2363, CT: 203/624-7800, DE: (PA) 215/542-9876, DC: (VA) 703/569-1502, FL: Ft. Lauderdale 305/776-4800, Melbourne 305/723-0766, Orlando 305/425-5505, Tallahassee 904/878-6642, GA: Atlanta 404/455-1035, HI: 808/524-8633, ID: (UT) 801/292-8145, IL: (No.) 312/564-5440, (So. MO) 816/765-3337, IN: (IL) 312/564-5440, IA: (Scott County Only) 312/564-5440, (MO) 816/765-3337, KS: (MO) 816/765-3337, KY: 606/273-3771, LA: 504/626-9701, ME: (MA) 617/729-5770, MD: (VA) 703/569-1502, MA: 617/729-5770, MI: Brighton 313/227-7067, Grand Rapids 616/333-9839, MN: 612/645-5816, MS: (AL) 205/883-8660, MO: 816/765-3337, MT: (CO) 303/355-2363, NB: (MO) 816/765-3337, NH: (MA) 617/729-5770, NJ: (No.) 201/224-5911, (So.) 215/542-9876, NV: (AZ) 602/994-5400, NM: 505/292-1212, NY: Metro LI (NJ) 201/224-5911, N. Syracuse 315/699-2651, Fairport 716/223-4490, Utica 315/732-1801, NC: 919/682-2383, ND: (MN) 612/645-5816, OH: Cleveland 216/398-0506, Dayton 513/435-7684, OK: (TX) 214/661-9633, OR: 503/644-5900, PA: (E) 215/542-9876, (W) 412/922-5110, RI: (MA) 617/729-5770, SC: 803/798-8070, SD: (MN) 612/645-5816, TN: 615/482-5761, TX: Austin 512/454-3579, Dallas 214/661-9633, El Paso Area (Las Cruces, NM) 505/524-9693, Houston Only 713/681-0200, UT: 801/292-8145, VT: (MA) 617/729-5770, VA: 703/569-1502, WA: 206/455-9180, WV: (PA) 412/922-5110, WI: (IL) 312/564-5440, WY: (CO) 303/355-2363.

EUROPEAN EXPORT SALES: EUROPE: (MA) 617/661-9424, BELGIUM: Brussels 02-242-36-04, DENMARK: 02-913255, FRANCE: Rueil Malmaison 749-47-65, Paris 33-1-306-4606, GREECE: Athens 642-1368, ITALY: Milano 02/600733, THE NETHERLANDS: Poeldijk 01749-47640, Amsterdam 020-360904, SPAIN: Barcelona 204-17-43, SWEDEN: Vallingby 08-380-370, SWITZERLAND: Mutschellen 057-546-55, UNITED KINGDOM: Bournemouth 0201671181, WEST GERMANY: Koblenz 01149-31025/6, AUSTRALIA & NEW ZEALAND: Auckland 876-570, Canberra 58-1811, Chermside 59-6436, Christchurch 796-210, Melbourne 03-543-2077, Sydney 02-808-1444, Wellington 644-585, CANADA: Dorval 514/636-9774, Ottawa 613/224-1391, Toronto 416/787-1208, Vancouver 604/684-8625, CENTRAL AND SOUTH AMERICA & CARIBBEAN: (GA) 404/394-9603, MEXICO: Monterrey 564-876, FAR EAST: (CA) 213/382-1107, HONG KONG: 5-742211, JAPAN: (Tokyo) (03) 463-9921, TAIWAN: (Taipei) 02-7026284, MIDDLE EAST: (GA) 404/581-0243, EGYPT: 809933, ISRAEL: Ramat Gan 03725749, KUWAIT: Kuwait 438-180/1/2, LEBANON: Beirut 221731/260110, SAUDI ARABIA: Jeddah 27790, Riyadh 25083-39732.

For sales and service in other countries contact ISC headquarters in Norcross, GA., U.S.A.



Intelligent Systems Corp.

Intecolor Drive • 225 Technology Park/Atlanta • Norcross, GA 30092 • Telephone 404/449-5961 • TWX 810-766-1581

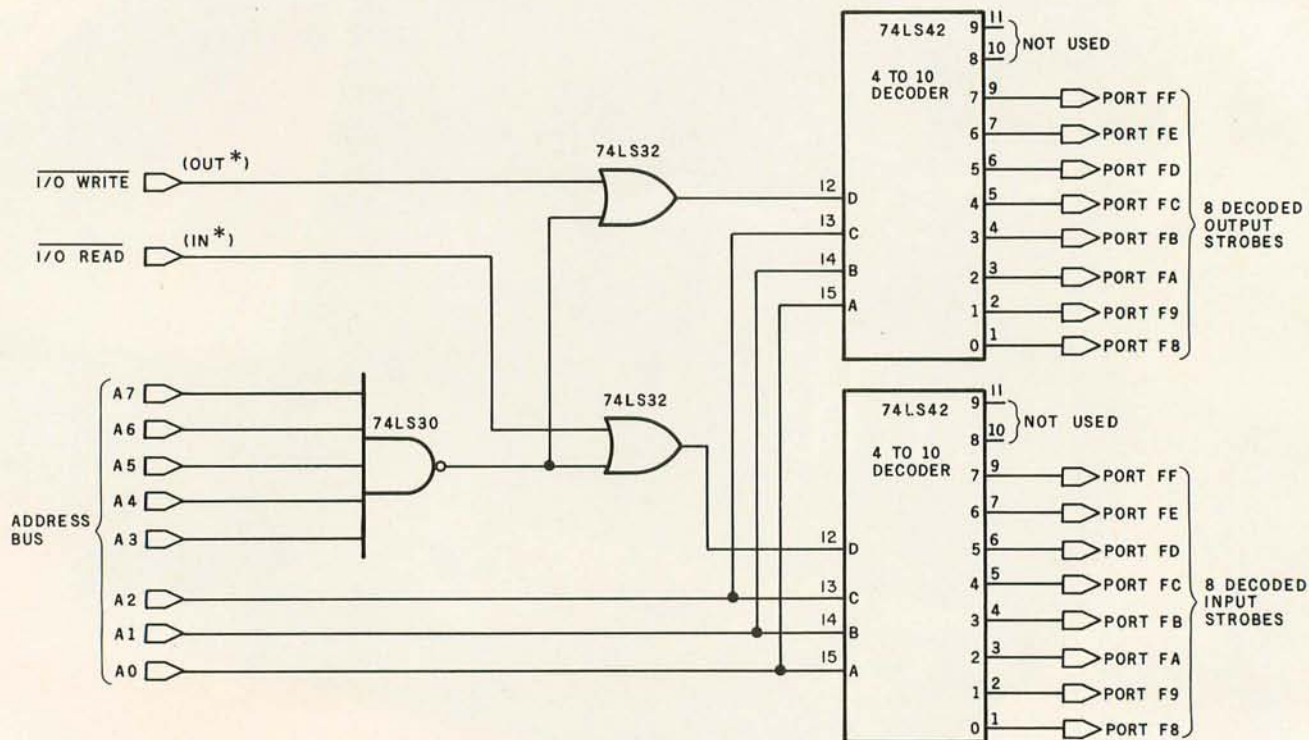


Figure 4c: Schematic diagram of a circuit that produces eight decoded input-strobe signals and eight decoded output-strobe signals. The port addresses produced are hexadecimal F8 thru FF.

Circle 18 on inquiry card.

**"A pencil, a card, and this low-cost reader...
it's the new, fast way to enter data into your
microcomputer."**

Interfaces to TRS-80, Apple II, PET, and others.

Good news! Now, all you need is a standard #2 pencil, a card, and our new MR-500 mark sense card reader to quickly and easily enter data into your favorite microcomputer.

As Easy as One, Two, Three...

Here's all you have to do. *One* — program the card by marking with the pencil. *Two* — feed the card into the reader slot. *Three* — the reader automatically turns on, the card is fed through, and data is instantly entered into memory. It's the simple low-cost alternative to keyboard data entry.

For Educators, Small Businessmen, and...

The applications for our low-cost MR-500 are endless. For small businesses, it's ideal for inventory, time cards, labor distribution (just to name a few). Educators will find that the MR-500 streamlines test scoring, attendance records, and grade reporting. Bet you can find a use already.

The Small Reader for the Small Computer

The MR-500 is lightweight — 4 lbs. Compact — a 4½-inch cube. And at \$750, it's the only mark sense card reader that makes sense for the small computer.



**CHATSWORTH DATA
CORPORATION**

20710 Lassen Street • Chatsworth, California 91311
(213) 341-9200

**Combine the POWER of PASCAL
with the MUSCLE of your MICRO!
Get the tool to do your job right:**

PASCAL/MT[®] 3.0

Compile in 32K CP/M[®]! SYMBOLIC DEBUGGER INCLUDED

Industrial features:

Bit, byte & string
manipulation.

Floating Point math.

Interrupt procedures.

8085 Support.

Inline assembly code.

Multiple HEAPs.

AMD 9511 support.

Note: Both compilers are
exactly the same except
for REAL implementation.

Complete System for \$250

Includes all these items:

- 95 Page User's Guide
- Industrial/Scientific Compiler
[Floating Point]
- Commercial Compiler
[18 digit BCD]
- Source code for run-time library
- Pascal/MT Library in
Pascal source
- Interactive Symbolic
Debugging Package

ROMABLE 8080/Z80 CODE! MINIMUM OVERHEAD 1280 Bytes!

Commercial features:

18 digit BCD REALs.

Program chaining.

CP/M[®] sequential and
RANDOM File I/O.

User formatting
routines.

Dynamic Strings.

Multiple HEAPs.

Printer Support.

Note: BCD Reals are 18
digits with 4 fixed decimal
places.

Manual available separately for \$30, refundable with system order



MT MicroSYSTEMS

1562 Kings Cross Drive
Cardiff, CA 92007 [714] 753-4856

We ship on 8" single density disks

OTHER DISK FORMATS: LIFEBOAT ASSOC (212) 580-0082, FMG (TRS-80) (817) 294-2510

® CP/M tradename of DIGITAL RESEARCH

PASCAL/MT trademark of MT MicroSYSTEMS

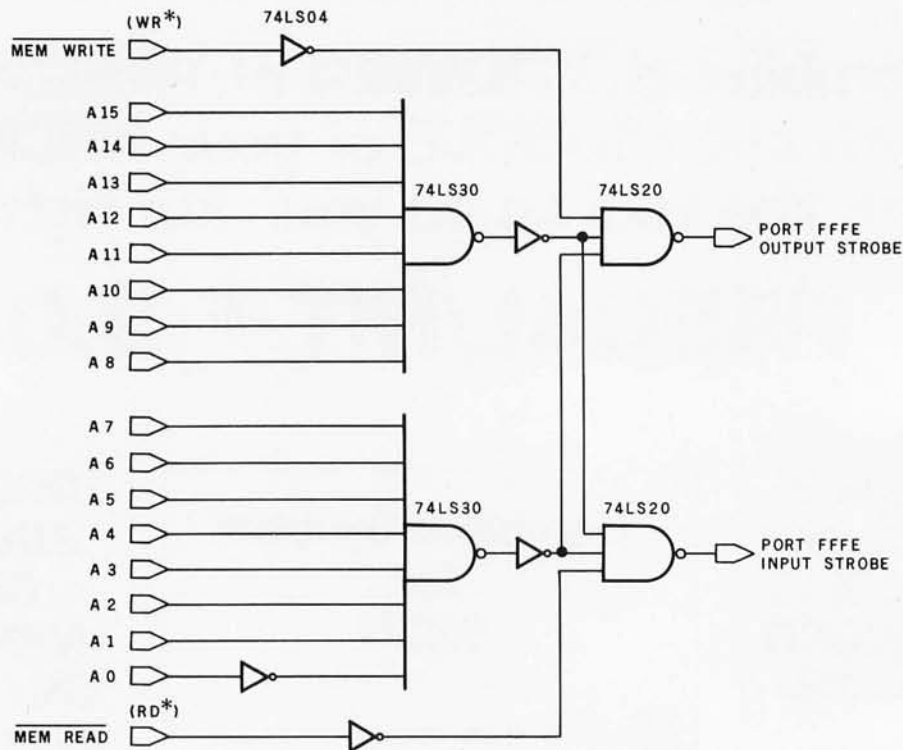


Figure 5: Memory-mapped input and output. Some microprocessors do not have specific input and output instructions. In systems that use such microprocessors, the I/O port hardware is wired as a memory location; I/O operations take place using the memory-reference instructions (eg: load-into-accumulator and store-in-memory instructions) of the microprocessor. This type of addressing is called memory-mapped I/O, and all sixteen lines on the address bus must be decoded to perform an I/O operation.

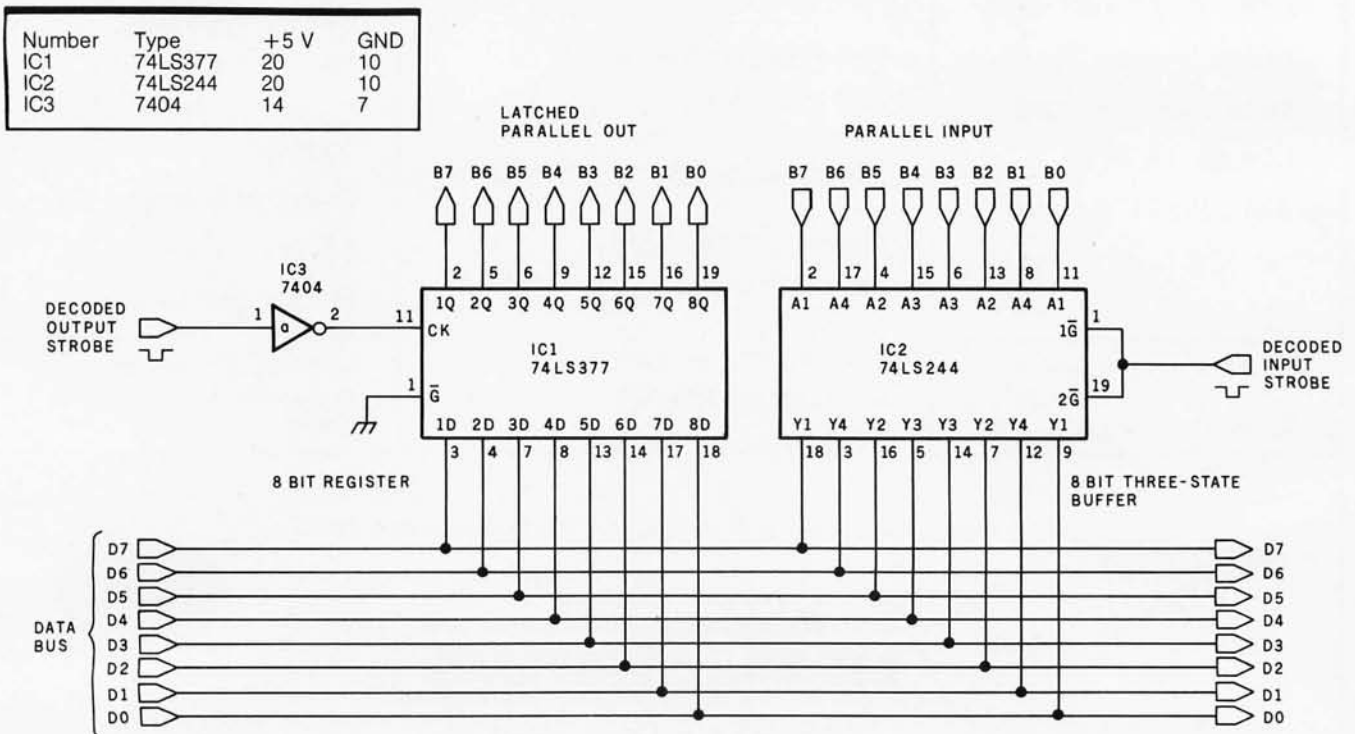


Figure 6: Data connections in input and output ports. Once the proper port address has been decoded and combined with the read- or write-control signal to form an I/O strobe signal, the actual process of accessing the data bus for data transfer is relatively easy. For input to the accumulator (the most common pathway for I/O), a three-state buffer is used in conjunction with the decoded input-strobe signal that controls the enable line of the buffer. For output from the accumulator, an 8-bit latch is connected to the data bus. During the execution of the output instruction, the contents of the data bus are clocked into the latch register and are latched there by the output-strobe signal.

people who play the computer specify Verbatim®

Virtuoso performers at computer keyboards deserve the ultimate in recording quality. That's why you should specify Verbatim brand diskettes, minidisks, cartridges and data cassettes for your computer or word processing system.

At Verbatim, the whole message is quality. We specialize in digital data recording media and have become the world leader by setting the standards for flawless, dropout-free magnetic media. Every size, every format, and available everywhere. Order them from

your computer supplies dealer.
Simply specify Verbatim.

For the name of your nearest Verbatim distributor, call:

800-538-1793

In California call:

(408) 737-7771 collect

Verbatim Corporation
323 Soquel Way
Sunnyvale, CA 94086

In Europe:

Verbatim S.A.

Case Postale 296

1215 Genève 15

Switzerland

Telephone: 41(22) 34-90-55

Telex: 22647 ITGE CH.

See us at NCC, booth 1228-1234



Number	Type	+5 V	GND
IC1	74LS125	14	7
IC2	74LS125	14	7
IC3	74LS75	5	12
IC4	74LS75	5	12
IC5	74LS155	16	8
IC6	74LS04	14	7
IC7	74LS04	14	7
IC8	74LS30	14	7

Text continued from page 30:

is not configured to be easily interfaced to the projects I present each month. The widely sold Level II BASIC, 16 K-byte memory version has no parallel I/O capability, aside from the single-bit cassette-motor control. With the addition of the expansion interface, the user gets one

parallel output port and one half (ie: 4 bits) of an input port. If these ports are used, as Radio Shack intends, to drive a printer, then the only way to provide usable parallel I/O capability is to add a separate I/O interface.

Considering the pertinent elements of the previous discussions, it is easy to construct both parallel input and

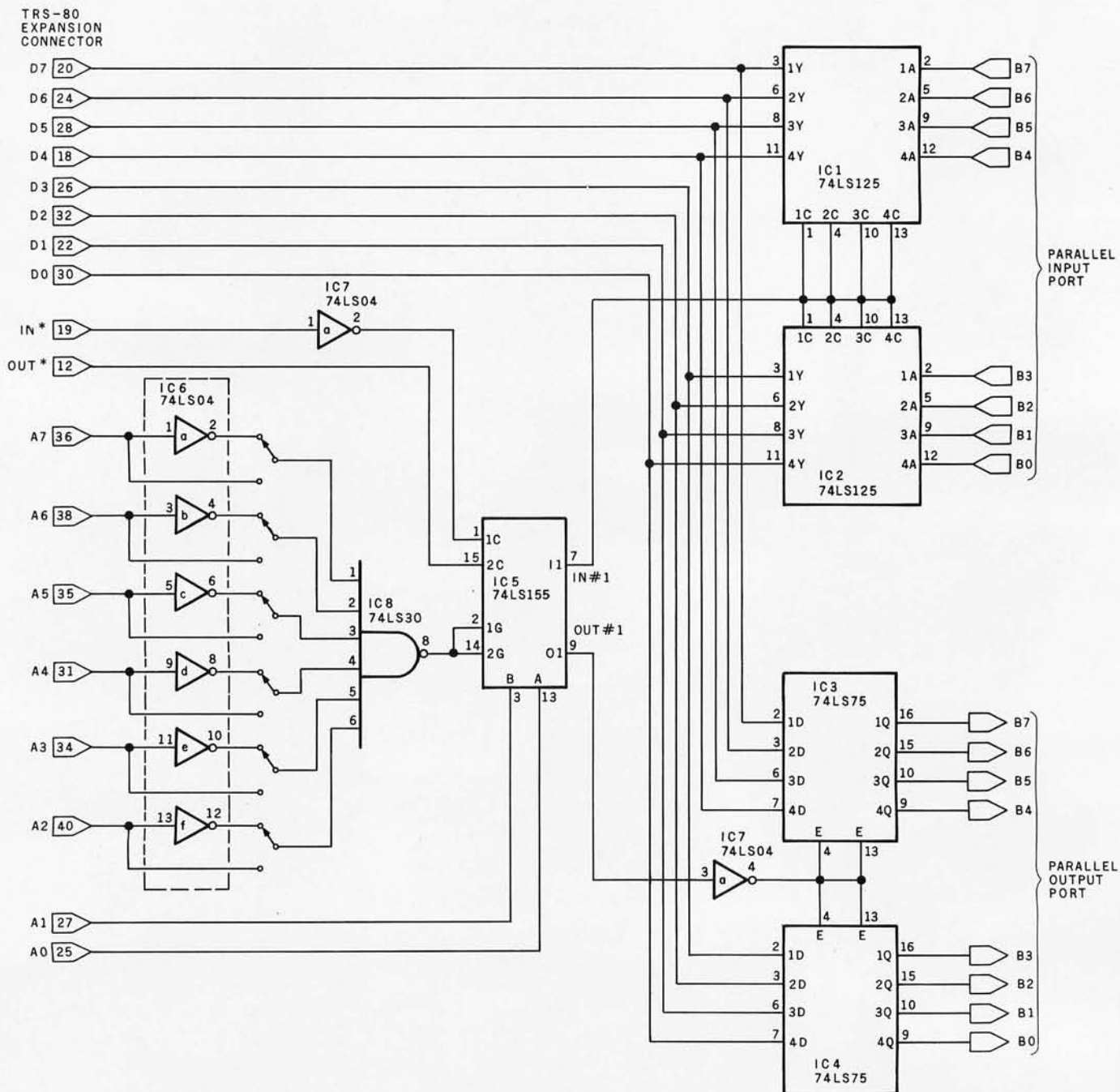


Figure 7: A complete, economical, parallel I/O interface circuit for use with the Radio Shack TRS-80 computer, or with other computers that use a similar bidirectional data bus. This interface can be connected directly to the expansion connector at the rear of the TRS-80 keyboard/processor unit, or it can be connected through the expansion-interface unit. As the circuit is shown here, there are six presently undefined additional strobes available on IC5. These six strobes can be used to support three additional ports. Refer to figure 3 and figure 4 to determine the proper selection of the I/O port address for this interface.

Look to



for the ...

BIG +

IEEE S-100

There's a BIG + in every interface that QT manufactures. That's because every one of our products is an improvement over any other on the market. And every one is an S-100-based unit that meets the exacting IEEE standards.

COMPATIBLE

Most items in our BIG + line are available as bare boards, a kit or a completely assembled and tested unit. What's more, we have the S-100 mainframe available for all our boards.

EXPANDABLE + DYNAMIC MEMORY (16K to 64K)

- + Works With Cromenco Systems
- + Bank Selectable Write Protect
- + Uses 3242 Refresh Chip
- + Phantom Output Disable
- + 4 Layers Mean A Quiet Board
- + Switch Selectable Output Disable

Bare Board	\$ 49.95	32K Kit	\$369.95	48K A&T	\$494.95
16K Kit	\$295.95	32K A&T	\$419.95	64K Kit	\$519.95
16K A&T	\$345.95	48K Kit	\$444.95	64K A&T	\$569.95

Z + 80 CPU

- + 1K Ram On Board + 2 Programmable Timers
- + Programmable Baud Rate Selection (110 to 9600)
- + Switch Selectable 2 or 4 MHZ
- + On-Board EPROM May be Used in Shadow Mode, Allowing Full 64K RAM to be Used
- + Power On Jump to On-Board 1K or 2K EPROM (2708-2716-2732) Can be Addressed on any 1K, 2K or 4K Boundary
- + On-Board USART for Synchronous or Asynchronous RS-232 Operation (On-Board Baud Rate Generator)

Bare Board	\$ 45.00	A&T	\$229.95
Kit	\$169.95	1K Memory Kit	\$ 12.00

CLOCK CALENDAR +

- + Time of Day in Hours, Minutes and Seconds
- + Simple Read Instructions Allow Simple Interface to Basic, CPM, Etc.
- + 24 Hour Time Format
- + Will Run With 4 MHZ Processors
- + Month and Day Date Function
- + Can be Located at any Group of 4 I/O Port Addressed

Bare Board	\$45.00	Kit	\$99.95	A&T	\$149.95
------------	---------	-----	---------	-----	----------

SILENCE + MOTHER BOARDS

- + No Need for Termination
- + Fits in Most Mainframes
- + Very High Crosstalk Rejection
- + 6, 12 and 18 Slots Available
- + LED Power Indicator

	6-SLOT		12-SLOT		18-SLOT
Bare Board	\$24.95	Bare Board	\$39.95	Bare Board	\$ 59.95
Kit	\$49.95	Kit	\$89.95	Kit	\$129.95
A&T	\$59.95	A&T	\$99.95	A&T	\$149.95

ASK FOR THE FOLLOWING NEW INTERFACES:

- I/O +
- Disk Controller +
- Video +
- Modem +
- EPROM Programmer +
- Mainframe +

Three of our newest dealers are:

DAL-COMP
2560 Electronic Lane
Suite 108
Dallas, TX 75220
214/350-6895

PRIORITY ONE (L.A. Area)
16723 Roscoe Blvd.
Sepulveda, CA 91343
213/894-8171
800/423-5633

SANTA ROSA COMPUTER CENTER
604 7th Street
Santa Rosa, CA 95404
707/528-6480

Dealer Inquiries Invited



COMPUTER SYSTEMS INC.

15335 South Hawthorne Boulevard
Lawndale, California 90260
(213) 970-0952
800/421-5150 (Continental U.S. Only)



"QUICK & TIMELY"

parallel output ports for the TRS-80. The interface shown in figure 7 provides one input and one output port. The signals necessary to drive this interface are available on the forty-pin

expansion connector of the keyboard/processor unit or on connector J2 on the expansion interface. In either case, a separate +5 V supply is necessary to power the circuit. The

signals on the expansion connector are listed in table 1, and the pinouts are shown in figure 8.

The schematic diagram of figure 7 shows a port address FF. To set another port address simply refer to figure 3 and 4 and place the switches for the proper code.

There are many other methods for implementing I/O capability. An 8255 programmable peripheral interface, a parallel I/O device, could have been used. The circuit I have

I hope to enable many TRS-80 owners to build this I/O circuit and to use it to attach other "Circuit Cellar" projects to their computer systems.

chosen to present is intended to be inexpensive and easy to operate. By minimizing potential parts-acquisition problems and keeping down the software handshaking necessary when using large-scale circuits like the 8255, I hope to enable many TRS-80 owners to build the circuit and use it to attach other "Circuit Cellar" projects to their computer system.

Those experimenters who hesitate to build hardware might want to purchase the entire communications interface. An assembled and tested unit, with power supply and containing a parallel port (for the Centronics printer) and a serial RS-232C-compatible interface, is available. The complete communications unit, called the COMM-80, will be presented in part 2 of this article and is available for \$179.95 from:

MicroMint Inc
917 Midway
Woodmere NY 11598
Telephone (513) 374-6793

(New York residents please add applicable sales tax.)

Next Month

I shall complete the COMM-80 presentation by discussing the construction of a software-compatible RS-232C interface for the TRS-80 that has selectable data rates from 50 to 19200 bps. ■

Pin Number	Signal Name	Description
1	RAS*	row-address strobe output for 16-pin dynamic memories
2	SYSRES*	system-reset output, low during power-up initialization or when the reset switch is depressed
3	CAS*	column-address strobe output for 16-pin dynamic memories
4	A10	address output
5	A12	address output
6	A13	address output
7	A15	address output
8	GND	signal ground
9	A11	address output
10	A14	address output
11	A8	address output
12	OUT*	peripheral-write strobe output
13	WR*	memory-write strobe output
14	INTAK*	interrupt-acknowledge output
15	RD*	memory-read strobe output
16	MUX	multiplexer control output for 16-pin dynamic memories
17	A9	address output
18	D4	bidirectional data bus
19	IN*	peripheral-read strobe output
20	D7	bidirectional data bus
21	INT*	interrupt input (maskable)
22	D1	bidirectional data bus
23	TEST*	placing a logic 0 on this line causes a high-impedance condition on address lines A0 thru A15, data lines D0 thru D7, WR*, RD*, IN*, OUT*, RAS*, CAS*, and MUX
24	D6	bidirectional data bus
25	A0	address output
26	D3	bidirectional data bus
27	A1	address output
28	D5	bidirectional data bus
29	GND	signal ground
30	D0	bidirectional data bus
31	A4	address bus
32	D2	bidirectional data bus
33	WAIT*	processor-wait input, to allow for slow memory
34	A3	address output
35	A5	address output
36	A7	address output
37	GND	signal ground
38	A6	address output
39	—	on Level I machines: low-current +5 V output on Level II machines: no connection
40	A2	address output

Table 1: Description of function for the pins on the expansion port at the rear of the TRS-80 keyboard/processor unit. This pin assignment is also used in expansion slots in the expansion-interface unit. This information is provided through the courtesy of Radio Shack, a division of Tandy Corporation.

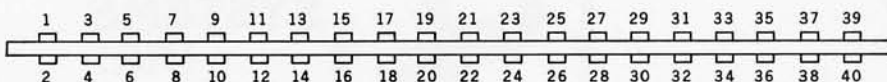


Figure 8: The configuration of output pins on the expansion port on the rear of the TRS-80 keyboard/processor unit. See table 1 for an explanation of the function of each pin.

APPLE •

ALTOS •

LSI-11 •

*Are your needs beyond the
reach of your computer?*

*With the Corvus Constellation,
the sky's the limit.*

S-100 BUS •

TRS-80
MODEL 1 •
MODEL 2 •

Now you can transform your personal computer into a multi-user system for business or educational applications. From two to sixty-four computers can be linked together sharing up to 40 million bytes of Corvus hard disk capacity.

A true multi-processing system, the CONSTELLATION™ provides open or secured access to all data files on the Corvus disk drive. Additional benefits include the ability to share peripherals and communicate with other computers in the CONSTELLATION network. Providing performance usually found in much more expensive systems, the price of the CONSTELLATION multiplexer is only \$750. Interfaces for additional computers are as low as \$235.

The CONSTELLATION is another innovative new product in the growing family of intelligent peripherals from Corvus. Our 10 million byte disk drives, MIRROR™ back-up/archival storage system, and now the CONSTELLATION, are all fully compatible with the most popular microcomputers available today: APPLE* (DOS and Pascal), TRS-80** (Model I & II), S-100 BUS, LSI-11, and ALTOS. Our Z-80 based intelligent controller handles up to four 10 million byte Winchester disks of proven performance and reliability—the IMI-7710.

Corvus—recognized leader in intelligent peripherals for microcomputers—provides solutions, not just hardware.

For complete information call or write Corvus today.

*Trademark of Apple Computers, Inc.

**Trademark of Radio Shack, a Tandy Co.

Corvus CONSTELLATION photo courtesy Science Graphics, Tucson, Ariz.

CORVUS SYSTEMS, Inc.

2029 O'Toole Avenue
San Jose, California 95131
408/246-0461 TWX: 910-338-0226

NOW CLEANING YOUR COULD SAVE YOU A AND A LO

The recording heads on your diskette drives may be filthy—and that can cause you a lot of grief. There's the serviceman you have to call when the machine doesn't perform. (You know how much service calls cost these days!) There's machine down-time. Idle data entry clerks. All the other delays a cranky machine can cause.

And that service call might not even be necessary.

3M SOLVES THE PROBLEM IN SECONDS— AND LEAVES YOUR HEADS "COMPUTER ROOM CLEAN".

The new Scotch® 7400 head-cleaning diskette kit lets you clean the read-write heads on your 8" or 5¼" diskette drives. In just 30 seconds, without any disassembly, mess or bother, the heads can be completely



cleansed of dirt, dust, magnetic oxides—all the things that can get into your machines every day. And foul them up. Just saturate the special white cleaning pad in its jacket with the cleaning solution. Then insert the jacket into the diskette drive and turn it on. Your machine does the rest. The heads are microscopically cleaned without wear or abrasion.

This new 3M head-cleaning diskette kit has been evaluated and approved by major diskette drive manufacturers. It's the best possible way to clean your heads without service calls or machine teardowns.

AT ONLY \$1 PER CLEANING IT'S THE BEST INSURANCE YOU CAN GET.

This fast-cleaning new Scotch kit comes with everything you need (including special fluid, applicator tip, cleaning diskettes) to handle up to 30 cleanings. That's only about a dollar a

cleaning. Frankly, it's outstanding insurance.

Use the Scotch cleaning diskette



DOWN DISKETTE HEADS \$40 SERVICE CALL. T MORE.



A Scotch cleaning diskette shown before and after 15 cleanings of recording heads.

frequently, to make sure your diskette heads are kept clean. And to help them perform at the level specified by the manufacturer.

You could save yourself a lot more than just a service call. So we want you to try this remarkable new kit now. Order before June 30 and get \$6.00 off... a full 20% discount. Order from your local Scotch Brand Information Processing Products distributor, or send it right to us. Coupon must accompany order. One kit per coupon.



Circle 23 on inquiry card.

\$6.00 OFF!

We'll take \$6 off the list price when you order the 7400 Kit with this coupon and your check or money order. So send for this special offer today. (Send to: 3M, Dept. P, P.O. Box 33984, St. Paul, MN 55133.)

My Name _____ (PLEASE PRINT)

My Company _____

Address _____

City _____

State _____ Zip _____

Please send my new kit for \$24. I enclose
☐ Check ☐ Money Order. Add state sales tax where applicable. Make check payable to 3M.

Diskette size: ☐ 5¼" ☐ 8" (Not yet available for Burroughs Mini-Disk II or Vydec drives.)

(Offer good in U.S. and Canada only. Void where prohibited by law. Expires June 30, 1980.) Offer valid only if coupon is completed.

B5

3M

KIMDOS

Using Your KIM-1 with a Percom Floppy-Disk Drive

Joel Swank
4655 SW 142nd Apt 186
Beaverton OR 97005

Any owner of the MOS Technology KIM-1 knows the utility of the KIM's built-in audio-cassette interface. But, any KIM-1 owner who has expanded his system knows just as well how inappropriate the cassette is for storing long files. The standard KIM cassette format is intolerably slow, and even using the Hypertape method (a faster cassette-storage format for the KIM), a 4 K-byte file takes a minute and a half to load, not counting the time needed to position the tape.

The natural storage alternative is, of course, the floppy disk. However, there are some difficulties. A floppy-disk system requires a considerable amount of software to make it useful. In addition, many floppy-disk systems available today come with proprietary software for the 8080/Z80 or 6800 processors. Interfacing such systems to a KIM-1 requires the hobbyist to write his or her own 6502 software, working from the machine code for the other processor. While it is possible to do this, few hobbyists are willing to translate machine code to get their disk system up and running.

I decided to interface a Percom LFD-400 disk system to my KIM-1. The LFD-400 system contains a disk controller capable of controlling up to three 5-inch floppy-disk drives. It comes with complete, annotated source code for the 1 K-byte MINIDOS disk-operating system, written for the 6800 processor. MINIDOS allows the reading and writing of contiguous memory files, and is the nucleus of MINIDOS-

PLUSX, a 6800-based disk-operating system sold by Percom.

KIMDOS is a KIM-1-compatible version of the Percom MINIDOS. It allows a KIM-1 to read and write files that are compatible with the Percom format. This article will concentrate on explaining the workings of the KIMDOS software. The LFD-400 system easily interfaces to the bus lines of any KIM-1 system (see table 1); because of this, hardware interfacing will not be discussed here.

The LFD-400 uses hard-sectored

disks with ten 256-byte sectors per track and thirty-five tracks per disk. This gives 87.5 K bytes of usable data per disk. The controller board has sockets for up to 3 K bytes of 2708-type erasable programmable read-only memory (EPROM). KIMDOS has been written to fit in one 2708 device.

The controller board requires unregulated power supplies of +14 V, -14 V, and +8 V; or regulated power supplies of +12 V, -5 V, and +5 V. The controller is



Photo 1: The author's personal computer system. It contains the following commercially built equipment: a MOS Technology KIM-1 microcomputer, three 8 K-byte Digital Group static memory boards, a Percom LFD-400 floppy-disk controller and two Shugart 5-inch floppy-disk drives, a Southwest Technical Products Corporation GT-6144 graphics board, an ACT-1A terminal with Leedex monitor, an Olivetti TE-300 hard-copy terminal, and several Lambda power supplies. Homebrew equipment in the system includes a programmer for erasable programmable read-only memories (EPROMs), a programmable integrated-circuit tester, a calculator interface, the motherboard, and the input/output (I/O) interface board.

Photograph taken by John M Hannam.

Chief Relief

For years many small business system buyers thought that in order to get "real" performance and enough storage to be a "real" business system they would have to sacrifice the family jewels.

But with the introduction of the Smoke Signal Chieftain series office computers a lot of people's minds have been changed.

Because we designed the highly reliable Chieftain small business system with the most innovative combination of performance and efficiency around.

At your fingertips there are 64,000 characters of random access memory and you can address anywhere from 740,000 characters to 2 million characters with Smoke Signal's new double density controller. For larger concerns, there's a 20M byte hard disk available.

At a time when other small computer manufacturers tell you "you're on your own", Smoke Signal offers an abundance of easy-to-use software programs such as order entry, inventory control,

accounts receivable, invoice entry, payroll, word processing and much, much more. There's BASIC, COBOL and FORTRAN — even a multi-user BOS (Business Operating System) that allows for numerous users simultaneously.

Chieftain systems starting at under \$200.00 per month display performance on par with systems costing twice to three times as much.

So call (213) 889-9340 for your nearest authorized Smoke Signal dealer — he'll be glad to demonstrate the Chieftain's high reliability and ease of operation.



For dealers only, circle 25
All other inquiries, circle 24

SMOKE SIGNAL



BROADCASTING

31336 Via Colinas, Westlake Village, California 91361. (213) 889-9340



composed of twenty-seven transistor-transistor logic (TTL) integrated circuits and the Z5023 universal synchronous receiver/transmitter (USRT) on a 15.24 by 25.4 cm (6 by 10 inch) two-sided printed-circuit board. Low-power Schottky (LS) components are used to reduce power consumption and minimize bus loading.

Floppy-Disk Drive

The Shugart 5-inch floppy-disk drive comes assembled and tested from Percom. A copy of the Shugart instruction manual is included in the system documentation; it is thirty-three pages long, and contains schematic diagrams and complete specifications for the drive and its operating principles. Troubleshooting procedures are also detailed.

Each disk drive must be set up to respond to a specific drive number. This programming is accomplished by plugging a shunt block into a fourteen-pin dual-in-line pin (DIP) socket. A seven-pole DIP switch can replace the shunt block; the drive numbers may be easily changed using the switch.

Because the Shugart floppy-disk drive allows only three drive-select lines, the controller board in the Percom LFD-400 system uses only the drive-select lines that are numbered 01 thru 03. A drive-select line for device 00 exists, and can be selected by the KIMDOS software; however, this line is not usually connected to anything. With the addition of the proper jumpers to the controller and disk-drive boards, a four-drive disk system can be configured using device numbers 00 thru 03. The Micropolis disk drive could be used for this purpose, since it has a fourth drive-select line on pin 34 of the thirty-four-pin ribbon cable.

Functions of the Controller

The LFD-400 uses a crystal oscillator to time the data and clock bits from the drive. The data is separated from the clock bits and is shifted into the universal synchronous receiver/transmitter. The USRT latches each 8-bit byte and sets a flag to notify the processor to read the byte. For a write operation, the USRT sets a flag when it is ready to receive data from the processor. After the processor has stored the data in the USRT, the data is shifted out,

LFD-400	KIM Connector	Function	Comments
9	E-7	RST	
10	E-V	R/W	
11	E-22	VMA	VMA always true on KIM-1
12	E-U	ϕ_2	
19		+14 V	or use regulated +12 V
20		-14 V	or use regulated -5 V
21		+8 V	or use regulated +5 V
22		+8 V	
23		+8 V	
24	E-22	ground	
25		ground	
26		ground	
27	E-A	A0	
28	E-B	A1	
29	E-C	A2	
30	E-D	A3	
31	E-E	A4	
32	E-F	A5	
33	E-H	A6	
34	E-J	A7	
35	E-K	A8	
36	E-L	A9	
37	E-M	A10	
38	E-N	A11	
39	E-P	A12	
40	E-R	A13	
41	E-S	A14	
42	E-T	A15	
43	E-8	D7	
44	E-9	D6	
45	E-10	D5	
46	E-11	D4	
47	E-12	D3	
48	E-13	D2	
49	E-14	D1	
50	E-15	D0	

Table 1: Hardware connections from the KIM-1 single-board computer to the Percom LFD-400 disk-drive controller. Also given is the function of each line used.

merged with the clock bits, and is sent to the drive.

The controller also takes care of maintaining the current sector count. The motor-control circuit contains a monostable multivibrator (commonly called a one-shot) that turns the motor off after about 3 seconds of nonuse. The drive select is a 2-bit number that is latched and decoded to select one of three drive-select lines, as discussed previously. The drive-select line for device 00 is not used. The step and direction bits are also latched. The track-0 and the write-protect lines are buffered for the microprocessor. Address decoding is provided for all controller addresses and for the 2708s. The data bus is buffered with 8835 three-state buffer devices.

Hardware Modifications

The only incompatibility between the KIM-1 and the LFD-400 lies with the use of a "low-true" logic conven-

tion on the SS-50 data bus. In the low-true convention, a voltage potential of 0.4 V or less is regarded as a true or binary 1 logic signal. This convention is used because the 8835 devices are *inverting* buffers.

The KIM-1 uses a high-true convention on its data bus; potentials of 3.5 V or greater are regarded as a true or binary 1 logic condition. To remedy this problem, I replaced the 8835 buffers with their noninverting counterparts, 8833 buffers. Since the disk-controller board does not have sockets, the 8835s had to be unsoldered. An alternative method would have been to write software that accepts and translates the inverted data coming from the controller, but the software method seemed more difficult and error-prone than the hardware method of replacing the three-state buffers.

My KIM-1 system has regulated voltage sources of +5 V, -12 V, and +12 V. I chose to bypass the

**Z8000 IEEE S-100
Board \$495**

**Z80 Emulator \$250
(with purchase of Board)**

Z-8000 QDP-8100

Prices good until next Magazine issue
Domestic & International Dealer Inquiries Invited

**16 Bit Z8000 / S100 bus
Complete Computer,
Programs, Emulator to
run Z80 programs on
Z 8000**

PAPER TIGER PRINTER

Includes Graphics (New low price) **\$ 949**
Best quality cables for TRS-80 & Apple, In stock **\$ 39**

INTERTEC INTERTUBE TERMINAL

Checked and tested by us **\$ 797**

SINGLE BOARD COMPUTER

4MZ Z-80, DBL sided, DBL density disk controller, 2716 prom burner, 2 parallel & 2 Ser. ports, real time clock, Bios for CPM 2.2, monitor in prom. This is absolutely the best board we have ever seen. It plus the Con. Data 64K memory board gives you a complete system. One year parts & labor guarantee. (The best) **\$ 995**

SUPERBRAIN COMPUTER

32K System **\$2735**
64K System (CP/M & Basic included) **Add \$ 160**

TI 820 SERIAL PRINTER

Full package **\$1995**

ATARI-VIDEO COMPUTER SYSTEM 800

8K RAM, Basic, cassette recorder **\$ 895**
Software & disk drives available

QDP-100 \$4995

8 Bit Z-80 4 MHZ CPU



g-r-r-r-eat!

QDP-8100

16 Bit Z-8000 4 MHZ CPU

\$6395
IEEE -100

- ★ 64K Memory
- ★ Monitor in Prom
- ★ Four ports
2 Serial 2 Parallel
- ★ Two 8" double-sided,
double density floppies



- ★ CP/M 2.2 included
- ★ Full editing, smart CRT terminal
- ★ Disk Controller—up to 4 M.B.
- ★ Basic language included
- ★ S-100 Motherboard

QDP-100

includes PromBurner and
real time clock

Quasar Computer System

QDP-8100

includes Z-80 Emulator
runs 16 or 8 bit programs

CENTRAL DATA 4MZ 64K

Dynamic Ram Bd. assembled & tested

16K — **\$250** 32K — **\$350** 48K — **\$450** 64K — **\$549**

TELETEK DBL. DENSITY, DBL. SIDED

Disk Controller Board **\$ 395**
(The best) includes cable & source bios

MFE DBL. SIDED, DBL. DENSITY

Floppy disk drives (the best) **\$ 650**
Using the Teletek Controller under CP/M, this drive will give
you almost one megabyte per disk drive
Power supply for above **\$ 110**

SOFTWARE

Integrated Accounting System G/L, A/P, A/R, P/R, INV. **\$1500**
Selector III Data Base Management System **\$ 295**
Wordstar by Micro Pro Word Processing System **\$ 445**
C Basic **\$ 109**

QUASAR FLOPPY SYSTEM

★ Two MFE DBL sided drives ★ Cable ★ Case & Power Supply
assembled and tested **Special \$1695**

QUASAR 2 MEG FLOPPY

Special - \$2095

- ★ 2 MFE double sided drives
- ★ Wood cabinet
- ★ Teletek disk controller board
- ★ CP/M version 2.2 & bios
- ★ Power supply & cable
- ★ Assembled & tested



Checks, money orders accepted
Add \$2.50 freight charges on orders under 10 lbs. Over 10 lbs. F.O.B. Cleveland

QUASAR DATA PRODUCTS

25151 Mitchell Dr., No. Olmsted, Ohio 44070 (216)779-9387





New easy-to-use educational module. Your best ticket to the microprocessor world. Ideal for teaching. Yourself. Or others.

TI's new TM990/189 University Module is a stand-alone learning lab. Fully assembled and designed for maximum hands-on experience. To ease and simplify learning and teaching.

Outstanding features include powerful 16-bit microprocessor with easy-to-learn, easy-to-use minicomputer instruction set; 45-key alphanumeric keyboard and ten-digit seven-segment display for easy **assembly-language** programming; ROM-resident software including system monitor for program debug and symbolic assembler; audio cassette interface; easy-to-add EIA and TTY interface; 1K-byte RAM expandable to 2K; 4K-byte ROM and 2K-byte expansion EPROM socket; 16-bit programmable I/O controller;

user addressable LEDs, and sound indicator.

A 570-page tutorial text accompanies the module. It is a detailed guide for self-paced learning. Or the basis for a

three-hour university course. Chapters include an overview of microprocessors; programming exercises; assembly language; memory systems; I/O concepts and designs; software engineering; product development; a variety of lab experiments, and much more. Also with the module: a 300-page user's guide.

The University Module complete with tutorial text and user's guide is only \$299.00.*

To order your University Module contact your nearest authorized TI distributor. For more information, write Texas Instruments Incorporated, P.O. Box 1443, M/S 6404, Houston, Texas 77001.

OPTIONAL ACCESSORIES

TM990/189 Kit K1 **\$72.00***

An I/O expansion kit that provides the following options to TM990/189:

1. Asynchronous Communication port
2. On-board relay for audio cassette interface
3. Off-board CRU expansion

TM990/189 Kit K2 **\$34.00***

A RAM expansion kit that will double on-board RAM from 1K bytes to 2K bytes.

*U.S. prices, subject to change without notice.

Circle 26 on inquiry card.

© 1980 Texas Instruments Incorporated

TEXAS INSTRUMENTS
INCORPORATED



85577A

LFD-400 regulators for +5 V and +12 V and drive the circuits that require these voltages directly from the system power supply. I fed the -12 V source into the -5 V regulator on the LFD-400 to obtain that regulated voltage.

The only other modification required was due to a problem with the oscillator circuit, which did not always start when the system was powered up. To correct this, I short-

circuited the 0.001 μ F capacitor near the crystal, effectively removing it from the circuit. According to the engineers at Percom Data Corporation, no one else has reported this problem.

There are five ten-pin Molex connectors on the controller board. Mates for these are available from Percom; however, it may be more convenient to simply remove the Molex connectors and replace them with

another type. The pin numbers on the controller board and the KIM-1 equivalents are given in table 1.

Software and Hardware Interaction

All communication between the microprocessor and the disk controller takes place through hexadecimal memory addresses CC00 thru CC06. Because address lines A4 thru A9 are not decoded, addresses as low as hexadecimal CC10 to CC16 and as high as hexadecimal CFF0 to CFF6 also respond identically; but these addresses are not used. A complete list of controller addresses and functions is found in table 2.

The data on each floppy disk is arranged in thirty-five tracks or concentric circles. The motor rotates the disk at 300 rpm — one rotation takes 200 ms. Each track is divided into ten sectors in this hard-sectored scheme.

In *hard sectoring*, the sector boundaries are detected by means of physical holes punched through the recording surface of the disk. As the disk rotates, these holes pass between a light-emitting diode (LED) and a photoelectric detector. Percom floppy disks have ten sector holes evenly spaced around the hub hole of the disk, with a single additional index hole placed halfway between two of the sector holes. This index hole is used to identify one sector on the disk as sector 0. Timing circuits in the controller detect the shorter distance between holes when the index hole passes the photodetector. When the index hole is detected by this method, the sector counter is reset.

Each sector occupies one tenth of the circumference of a track on the disk and passes across the disk data-transfer head in 20 ms. Data is written to the disk at a rate of 1 byte every 64 μ s, theoretically giving room for up to 312 bytes per sector. It is not possible to fully use these 312 bytes. The Percom format uses a maximum of 287 bytes for leader, header, useful data, and trailer, with the data length variable from 1 to 256 bytes. Table 3 details the format of data stored in each sector.

Each track on the disk has ten sectors. The sectors are numbered in decimal from 000 to 349. In this three-digit numeral, the two high-order digits denote the track number in

2a

Hexadecimal Address	Function When Used as Input
CC00	Read USRT status: bit 0 = 1 means disk unit ready to send byte to computer at address CC01 during read operation bit 7 = 1 means disk unit ready to receive byte from computer at address CC01 during write operation
CC01	Address used to transmit data from disk drive to computer during read operation
CC02	During read operation, bits 0 thru 3 contain current sector number in binary
CC03	Drive status byte: see table 2b.
CC04	Accessing this location with a load instruction (LDA) causes a read operation to take place

2b

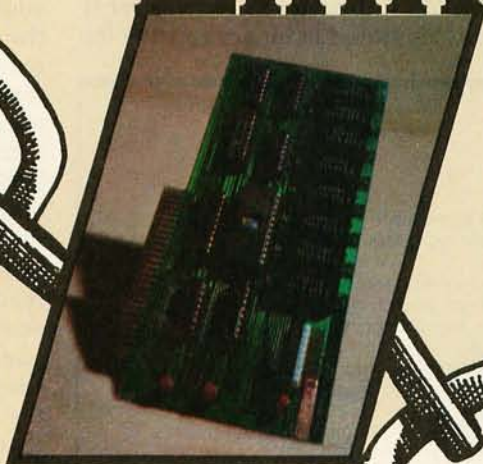
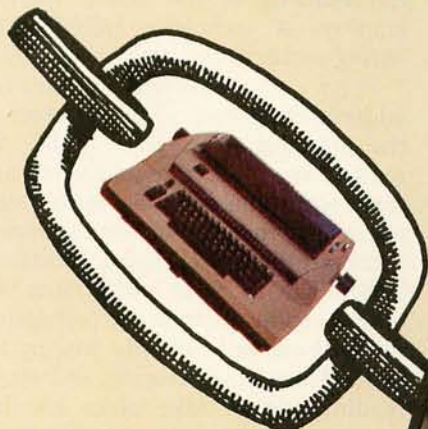
Bit	Value	Meaning
0	1	Write-protect notch in disk covered; disk is protected
1	1	Head is at track 0
2	0	Drive motor is on
3	0	Drive circuit is ready to write to disk
4	1	Sector pulse; drive detects sector hole
5	1	Index pulse; drive detects special index hole
6,7		Binary number of drive selected (01 thru 03)

Table 2: Memory addresses used by the LFD-400 disk-controller board. Communication takes place between the disk and the computer via memory-mapped bytes as listed. Table 2a gives the function of 5 bytes used for input from disk to computer. Table 2b defines the permissible values of bits in the drive-status byte (hexadecimal location CC03). Table 2c gives the function of 7 bytes used to control output from the computer to the disk.

2c

Hexadecimal Address	Function When Used as Output
CC00	Defines value that controller will recognize as the SYNC byte at the beginning of a read operation; hexadecimal FB used in Percom format
CC01	Address used to transmit data from computer to disk unit during write operation
CC02	Defines value that controller will recognize as the filler byte (written after trailer until disk motor turns off); hexadecimal FF used in this software
CC03	Data to select drive and head-movement direction: bit 4 = direction of head movement: 1 = in, 0 = out bit 5 = step pulse bit; causes data-transfer head to jump to next track in direction given by bit 4 bits 6, 7 = binary number of drive to be selected
CC04	Accessing this location with a store instruction (STA) causes a write operation to take place
CC05	Accessing this location with either a load (LDA) or store instruction causes a motor-on pulse to be sent to the disk drive
CC06	Accessing this location with either a load or store instruction causes a motor-off pulse to be sent to the disk drive

The Missing Link



WORD PROCESSING QUALITY OUTPUT

for the Apple II is now affordable with IBM's Electronic Typewriters - Models ET50 (proportionally spaced), 60, and 75. Our "Missing Link" plugs directly into Apple's I/O BUS and to the IBM electronics. It's fully isolated; uses no solenoids, linkages, baseplates, etc; does not affect normal typewriter operation; does not void IBM's warranty or the availability of an IBM maintenance contract. The intelligence on the card handles everything totally "transparent" to the user.

(No peeks, pokes, etc.) IBM's attractive purchase plans on these sophisticated typewriters further reduce the barrier to Apple II Word Processing.

The ET50 and 60 are currently priced at \$1,590, leasing at \$85 per month, and several time pay plans are available. Check with your local IBM sales representative for exact prices.

WORD PROCESSING QUALITY INPUT

for Wycliffe Bible Translators (a 3500 member missionary organization which has already translated the New testament into over 100 languages) was the major design criteria in the development of the PTP (Programmable Text Processor) language and Manuscripter word processing program. Since their conception in 1976, PTP and MANUSCRIPTER have evolved within Wycliffe and are now working on 8080, Z80, and PDP11 computers. The newest 6502 version for the Apple II incorporates all of the sophistication and ease of use gained by this experience. (All the normal features as well as "virtual" disk storage, merging of names and addresses, assembling new text automatically from a paragraph library, conditional hyphenation, global search and replace, and much much more). The 130 page manual offered below describes all the features.



To locate your nearest dealer or to place your order:

CALL TOLL FREE 1-800-854-2003 ext. 895

IN CALIF. CALL 1-800-522-1500 ext. 895

☐ MISSING LINK @ \$225.00

☐ Missing Link Technical Manual @ \$2.50*

☐ Manuscripter Word Processing Program @ \$195.00

☐ Manuscripter Manual @ \$9.95*

*Fully credited toward purchase

Enclosed is my check for _____ Bill VISA ☐ Bill Master Charge ☐

Card # _____ Exp. Date _____

Signature _____ Name _____

Street Address _____

City _____ State _____ Zip _____ Phone _____

WE DON'T PLAY BINGO:

Our industry is blessed with fantastic interest but plagued by many who circle "Bingo" numbers purely for their entertainment value. Obviously the cost of all this **free** literature is ultimately paid by those who **actually buy** the products. If you're genuinely interested in our products we feel you'll appreciate paying only for the literature and manuals **you** receive.

CompuSystems



P.O. BOX 5144 • 2301 DEVINE ST. • COLUMBIA, S.C. 29205 • (803) 254-0804

which the sector is located. The low-order digit specifies the sector within the track. When we prefix this three-digit numeral with the number of the disk drive, we obtain the *external* drive/track/sector (DTS) number, a four-digit quantity which is stored in binary-coded-decimal (BCD) form in 2 bytes.

For use in actual disk-addressing operations, the external DTS number

is reformatted into a binary, *internal* drive/track/sector number. The internal DTS number has the following properties. The number of the disk drive (1 thru 3) is stored in binary form in the 2 high-order bits of the first byte of the internal DTS number. The track number (1 thru 34) is stored in the 6 low-order bits of the first byte. The individual sector number (1 thru 9) is stored in binary form in the

second byte.

While the reformatting of the drive and track numbers from external to internal format involves only a simple decimal-to-binary conversion, the reformatting of the sector number employs a technique called *alternating-sector addressing*.

Why is alternating-sector addressing necessary? The sectors of the spinning disk pass under the read/write head consecutively, and there is no time between sectors during which the disk-operating system can perform housekeeping functions. While KIMDOS is performing the housekeeping routines for one sector, the next sector is already passing the head. Since housekeeping and sector reading cannot take place simultaneously, reading the sectors in sequential order would require the computer to wait for a full rotation of the disk to occur to read the sector that passed the head during housekeeping. Since every sector must be treated this way, only one sector could be read during each rotation of the disk if sectors were to be read sequentially. To remedy this problem, the sequential sector numbers are converted into alternating sector numbers.

KIMDOS reads or writes alternate sectors on the disk; the disk must rotate twice for all sectors on the track to be read or written. The order of physical sectors is therefore not the order of logical sectors. In the two complete rotations of the disk, the physical sectors are read in the following order: 0, 2, 4, 6, 8 (first rotation); 1, 3, 5, 7, 9 (second rotation). Sectors are accessed alternately to allow time in between data-transfer operations for executing housekeeping routines.

Each sector contains a *sector header* that holds information about the sector and the file of which it is a part. The first two bytes of the sector header contain the DTS number of the current sector; this is used to assure proper head position when reading. Each sector is linked via a forward pointer to the next sector and via a backward pointer to the previous sector. A forward pointer equal to 0 indicates the last sector in a file; a backward pointer equal to 0 indicates the first sector in a file.

The header also contains a data-length byte, a file-type byte, and the

Text continued on page 158

Field Name	Length in Bytes	Contents
Leader	16	Binary zeros
Sync	1	Hexadecimal FB to indicate start of data
Current DTS number	2	Drive/Track/Sector numbers of this sector
Backward link	2	DTS number of previous sector in file
Forward link	2	DTS number of next sector in file
Byte count	1	Length of data in this sector, in hexadecimal (00 means hexadecimal 100)
Target address	2	Address of memory from which data was written
File type	1	Indicator of the nature of the data
Data	1 to 256	Data being stored
Check sum	2	2-byte cyclic redundancy check sum of all bytes after sync byte
Trailer	2	DTS number of first sector of this file, or execution address if this is last sector in this file

Table 3: Table of sector fields and format. The drive/track/sector (DTS) number, stored here in internal binary format, points to a given sector.

TRS-80 MOD II WORD PROCESSING



The best is now even better...

**New Features
New Commands
New Capabilities
New Manual**

SPECIAL PACKAGE INCLUDES:

- Wp Daisy™ word processor
- Mail Merge™ mailing list package
- I/OS operating system
full CP/M™ & CDOS
compatibility

Includes

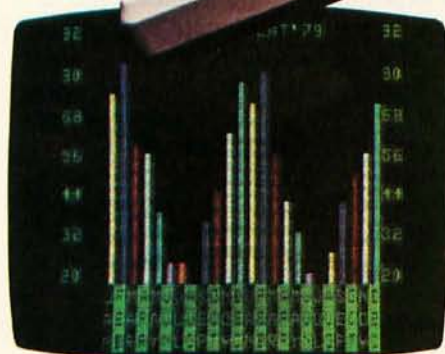
- Diablo, Spinwriter and Qume support
- Printer spooling
- 30 programs

CP/M™
TM of Digital Research

Contact your dealer or ...

InfoSoft
SYSTEMS INCORPORATED
28 SYVAL ROAD, SOUTH
WESTPORT, CONN 06890
(203) 266-8937

The Imagination Machine™



The Imagination Machine offers more at its price than any other personal computer on the market today.

Consider these features: 9K RAM, with 14K BASIC in ROM, 53-key typewriter keyboard. A fine resolution picture, generated on your television set or monitor in 8 colors!

The only computer with color, sound, user programmability and expandability at \$599.

A built-in, dual-track cassette tape deck with 1500 baud rate, for APF's digitally recorded, "saturated," tape programs. A built-in sound synthesizer. And two, built-in, game style controllers, with joysticks and numeric keypads.

When you want to go beyond APF's library of educational, home-and-personal management or entertainment programs... when you want to create your own programs... you can. The Imagination Machine is programmable in BASIC and 6800 machine language. The Imagination Machine

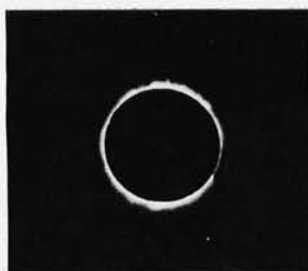
is also expandable. Just add our "Building Block", an optional, four-port expansion device, and you can hook up a printer, telephone modem, and additional memory cartridge or mini-floppy disk drive. For the name of your nearest Imagination Machine dealer call, TOLL FREE: 1-800-223-1264. (New York residents call: (212) 758-7550) or write: APF Electronics, Inc. 444 Madison Avenue, N.Y., N.Y. 10022.

\$599. Manufacturer's suggested retail price.

APF electronics inc.

"YOUR LIFE WILL NEVER BE THE SAME!"

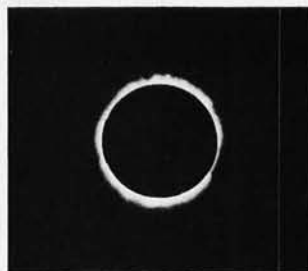
See us at NCC, Booth 85



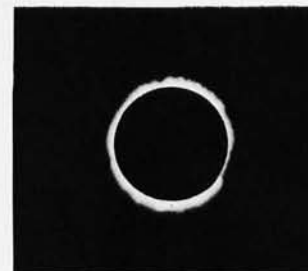
(3a) 1 millisecond



(3b) 2 milliseconds



(3c) 5 milliseconds



(3d) 10 milliseconds



Photo 1: A 5-second exposure with ASA 64 Ektachrome brings out significant coronal detail twice per 25-exposure cycle.



Photo 2: A minimal length exposure shows the beginnings of some prominence detail and the inner corona. This exposure corresponds to the shortest nominal exposure time, 1 ms plus the minimum trigger-pulse width of 20 ms. The electromechanical system which is the Nikon MD-2 Motor Drive unfortunately has a minimum shutter-open time on the order of 20 ms. Thus the exposures nominally programmed at 1, 2, 5, and 10 ms were actually on the order of 21, 22, 25, and 30 ms.

Text continued from page 6:

With this crucial timing step completed, I turned my attention to refining the Pascal program shown as listing 1 in the March 1980 BYTE editorial. These refinements included one conceptual change and some trivial changes in the experiment's design.

The conceptual change was that of adding a single long exposure made during the "slack time" interval at the end of the eclipse sequence during totality. As noted earlier, the model for the eclipse photography sequence used two manual inputs: one to start a sequence of diamond-ring exposures followed by automatic totality photography, and a second manual input to start the final diamond-ring sequence after a "slack time" for synchronization. My conceptual change was to open the shutter of the camera during this slack time, thus allowing one extremely long exposure to take place while waiting for the second manual input. Thus by specifying a smaller number of exposures during totality and a longer slack time, I would obtain this one long exposure.

The relatively trivial changes began with the alteration of the table of exposure times to provide a total of twenty-five different times instead of ten. In making this change I used the UCSD text editor to change the name of the table in every occurrence throughout the program. I also changed the initialization to provide a 1, 2, 5 sequence of exposure times in each decimal order of magnitude. (See photo 3's captions for the values resulting.)

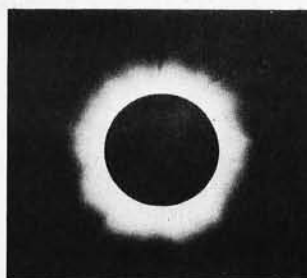
Another relatively minor change was to allow multiple tries at allocation of the exposures, rather than falling inexorably into a run of the photography sequence. This change proved quite useful in the field where it provided a means of verifying that



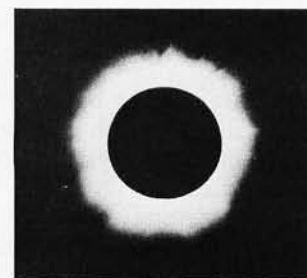
(3e) 20 milliseconds



(3f) 50 milliseconds



(3g) 0.1 second



(3h) 0.2 second

the computer had not died in the last minutes prior to totality. The program also had to be modified to talk to a 40-character-wide field on the Apple II video display instead of the 80-character width available on the terminal I normally use. This change amounted to condensation of the texts displayed during the allocation procedures. The final form of the program as used by the shores of Lake Jipe on February 16, 1980 is shown in listing 1.

The final equipment check prior to leaving was the verification that the display on a 2-inch diagonal Sanyo television screen was adequate. A jumper cord once used to interface between a tape recorder and my old homebrew computer provided the means for routing the output of the Apple's auxiliary RF modulator to the Sanyo television. The display wavered a bit when running on the portable generator. It was a tiny display but adequately readable for my purposes.

After this crucial experiment, the final detail was to make redundant copies of my eclipse application program's disk, as well as the UCSD Apple Pascal system's disks Apple1, Apple2, and Apple3. Redundancy was important. If I were to have a directory crash due to dust or dirt while on the other side of the equator 11,000 miles from home, a second chance would have been well worth it.

On Tuesday morning February 5, we hastened to Boston where the air travel to Kenya began with a trip to New York's Kennedy Airport. The party at this time consisted of myself, Tully Londoner, Norm Whyte, and Laurel Allen. Rick Lutman, the fifth member of our party, would join us in Nairobi. In due course we boarded Pan American's flight 190, an 18-hour international puddle jumper with stops at Roberts Field, Liberia, and Lagos, Nigeria. The computer equip-

ment and telescope mount in addition to trunks and pack frames full of clothes, sleeping bags, and tools constituted our luggage.

On reaching Nairobi at about 8 PM that Wednesday, we met our guide, Iain Allan, and his associate Vince Fayad. Iain does business as Tropical Ice (Mountain Guides) Ltd, Post Office Box 57341, Nairobi, Kenya. Making the connection with Iain was the only redeeming virtue of an otherwise hopelessly botched set of travel arrangements made by our US travel agents (who shall remain anonymous). Iain was our guide to the wilds of Kenyan culture for the next two weeks. His good humor and knowledge of local flora, fauna, and climate are highly recommended to anyone traveling in East Africa for purposes of game trekking or technical mountain climbing. Iain wrote the guidebook on Mt Kenya and other climbs in Kenya. He also frequently guides technical climbing trips on Tanzania's Kilimanjaro, when not tackling various other challenging rock climbs in places as diverse as Nepal and Yosemite.

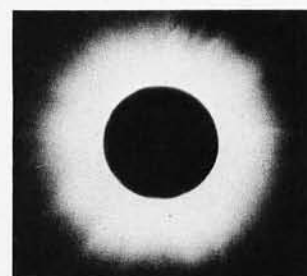
As in any trip of this kind, there were some difficulties. The most significant (and in retrospect, completely avoidable) difficulty was the need to post a 30,000 shilling bond on our equipment with Kenyan customs on entry. We later had to recover our customs bond on departure (minus an exorbitant 10% fee exacted by the local branch of a major US multinational bank). The fact that we had to post a bond at all was due to an un-



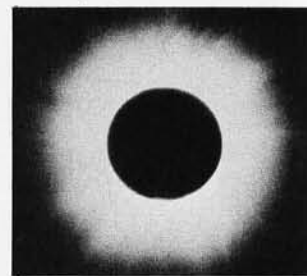
(3i) 0.5 second



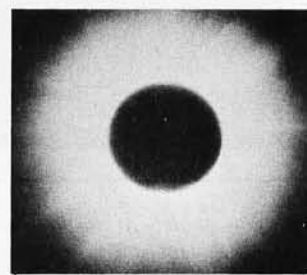
(3j) 1.0 second



(3k) 2.0 seconds



(3l) 5.0 seconds



(3m) 10.0 seconds

Photo 3: Black and white reproductions of the entire series of different exposures taken with the aid of the final version of the Pascal control program for the camera. Times are nominal shutter-open intervals stored in a table in the program. Actual times reflect a fixed lower-limit overhead of approximately 20 ms.

fortunate mistake by one of our party, a slipup which can possibly be avoided by readers in similar circumstances.

When listing personal computer equipment being carried for such an expedition, never ever list its monetary value or speak of its value. To satisfy US customs, all you need is a list of serial numbers of your personal equipment carried abroad. This list can be used to advantage when entering another country. But if you give the customs officer at another country the list of items and values you prepared for your insurance agent, it is like waving a red flag in front of a bull.

We had to post a customs bond on Norm's equipment using credit cards to obtain nearly \$4000 in cash, then retrieve the cash bond at the end of the trip by pleading lack of time to Kenyan customs officials in order to

get all the paperwork completed by our departure. We wasted two out of sixteen days figuring out all the "catch-22"-style sophistries of this problem.

Kenya is a very British relic of a former era, where dual languages of Swahili and English dominate. Iain pointed out that it would have been much more complicated in several countries in which he has traveled for purposes of mountain climbing. In one Asian country he has visited for climbing, Iain points out, there is not even a recognizable set of paperwork to be filled out. It was quite a relief to get back to a (relatively) sane United States at the end of the trip.

So much for the bureaucratic problems of taking computers abroad to equatorial Africa. What about the engineering problems? We did as thorough a job of preparation as we could, yet would the computers and

generator still play together when we reached our final encampment on the shores of Lake Jipe in Kenya's Tsavo West National Park?

We answered this question by an ancient technique: crossing fingers and applying power. We arrived at Lake Jipe 2 days before the eclipse, after a 6-hour trek over some incredible roads in Iain's Volkswagen bus with trailer in tow. The computers were inside the bus with seven human bodies and food packed with solid CO₂ in the famous Tropical Ice Box. All the rest of our gear was carried in the trailer. The roads we traveled from Amboseli to Lake Jipe included one 5-mile stretch of a semi-improved lava flow, an unmarked dead end which looked like the main road of two alternatives, and other miscellaneous "hazards" like herds of elephants and troops of baboons.

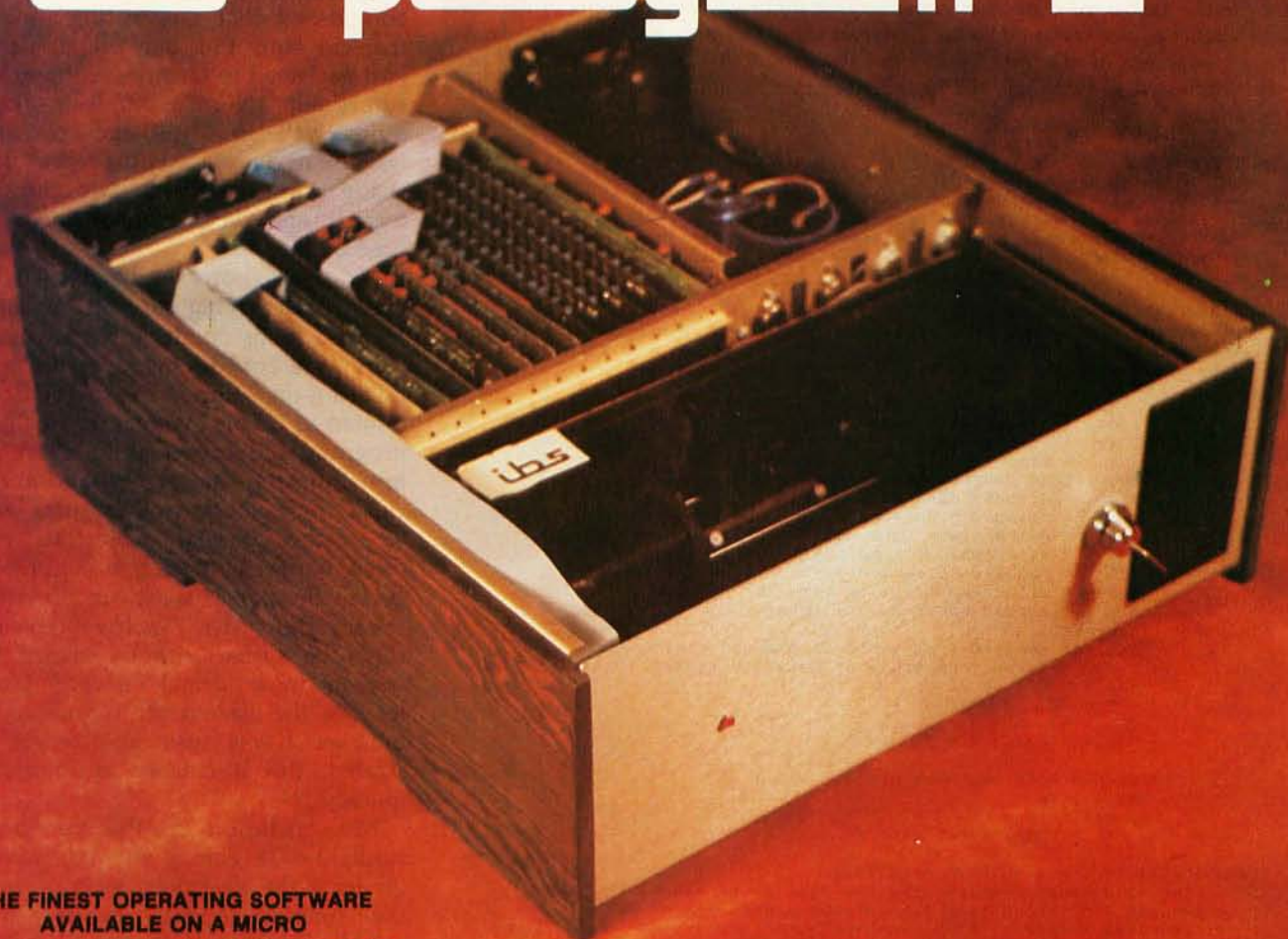
The day before the eclipse, Norm



Photo 4: A view of the equipment set up at the Tsavo West National Park campsite on the shores of Lake Jipe. Norm was using a 500 mm reflex lens with his camera; I was using my 1000 mm reflex lens. The two Nikon cameras were mounted on the equatorial telescope mount carted to Africa along with the 110 VAC generator in Norm's homebrew plywood shipping trunk. The Apple Pascal system is shown sitting in the bottom of its carrying case on top of a trunk.

MULTI-USER MULTI-TASKING MULTI-PROCESSOR

ibs betasystem II



THE FINEST OPERATING SOFTWARE AVAILABLE ON A MICRO

- The enormously popular UCSD PASCAL™ extended by IBS to allow up to 8 simultaneous and independent timeshared users, including
 - powerful screen oriented text editor
 - PASCAL and BASIC compilers
 - file handling system with interlocks for multiple access files
 - segmentation and precompiled "units" facilities
 - easily reconfigurable I/O unit assignment
- CP/M™ and MP/M™ available
- Multiple independent Z-80 processors for up to 10 users. Each processor card has 64K RAM, Z-80 processor, 2 serial, 2 parallel ports, optional hardware floating point (available July, 1980)
- Wide variety of applications software including medical office, retail point-of-sale, and general accounting and taxes

WIDE RANGE OF CONFIGURATION OPTIONS

- 2 to 4 Micropolis™ 5.25" floppy drives for 1.2 Mbyte storage
- 11 to 40 Mbyte 8" winchester drives
- 17 Mbyte cartridge or 110 Mbyte video tape backup
- Up to 400kbyte RAM, 336k configurable as super-fast "RAM DISK"
- I/O cards (each with 4 bidirectional fully buffered parallel ports with hardware strobe generation and 4 software-selectable baud rate serial ports) to drive virtually ANY combination of peripherals
- Low price — floppy systems from \$4,695.00

THE SINGLE HANDSOME DESKTOP ENCLOSURE WITH ALL THE FEATURES YOU'VE DREAMED OF

- 12 slot S-100 fully terminated bus, giving the versatility of components from many different manufacturers
- 4 Mhz Z-80 processor for high throughput and extended software compatibility
- Dual Whisperfan cooling and optimal heat-sinking for maximum reliability and long life.
- High capacity power supply adequate for all system configurations and upgrades
- Chassis designed for easy interchange of mass storage media
- On-off-reset switch protects against inadvertent reset or unauthorized access
- Furniture quality cabinet

ibs INDEPENDENT BUSINESS SYSTEMS INC. 5476 Cleo Ct., Livermore, CA 94550 (415) 443-3131
TYPE III, 3021 Germantown Pike, Fairview Village, PA (215) 539-0122
Distributors: ELIF, 725 DeCarie, Suite 304, Saint-Laurent, Canada; H4L3L4 (514) 747-4751
EEI, P.O. Box 5088, Sharjah, U.A.E. Tel: 354688, Telex: 68188 EEI SH

DEALER INQUIRIES INVITED

UCSD PASCAL is a trademark of the Regents of the University of California.
CP/M and MP/M are trademarks of Digital Research, Inc.

Listing 1: This is the final version of my Pascal Eclipse Control Program as used in Kenya, February 16, 1980. Major changes from the previously published version include filling in the details of real-time execution and modifying the exposure table to provide twenty-five shots instead of ten. Also added was an interactive option to reenter the exposures allocation phase so that different combinations of diamond ring and totality exposures could be tried. Initialization now puts in a symmetrical rising and falling sequence of exposure times from 1 ms to 10,000 ms. All interactive texts have been adjusted so that they will fit the 40-character width of the Apple's built-in video display.

```
( NOTES ABOUT THE DESIGN PROCESS )
(
Step 1: High Level Description - begun November 22, 1979 )
( This is a first cut at a program to simulate the eclipse )
( photography process, and define some of the necessary global )
( data of the problem. )
( COMPLETED 11/24/79 )
(
Step 2: Fill in allocation details - )
( Achieve a complete allocation of the eclipse camera con- )
( trol function as evidenced by calculation of a detailed time )
( line for the eclipse event given various conditions: )
( Given: )
( n = number of totality exposures )
( m = number of diamond ring exposures )
( t = totality time )
( s = slack in allocated totality time )
( Then let us seek the followings... )
( * d2 = diamond ring time at 2nd contact )
( * d3 = diamond ring time at 3rd contact )
( * z = extra slack (one half of diamond ring total) )
( * P = anticipation time (half first diamond ring) )
( * A = required time for exposures during totality )
( * a = allocated totality time for exposures )
( * x = margin per frame in totality )
( Theorems: )
( d2,d3 derived from table of diamond ring frames )
( A derived from table of totality frames )
( z = (d2 + d3)/2 )
( P = d2 / 2 )
( a = t - s - z )
( x = (a - A) / n )
(
PROCEDURES Detailed Here Are... )
( initialize )
( normalize )
( COMPLETED 12/16/79 )
(
Step 3: Fill in the simulated details... )
( Create a program which uses the results of step 3 to )
( go through a detailed time line of the experiment on paper )
( (or terminal screen). Each event (shutter transition )
( open-->close or close-->open will be marked by a report of )
( its nature and time of execution relative to <start> signal )
(
PROCEDURES Detailed Here Are... )
( await_cue )
( diamond_rings_burst )
( totality )
(
Step 4: Adapt to real time control - )
( Put in augmentations of the software to actually demon- )
( strate operation with the Nikon F2A camera via a relay )
( plugged into the Apple II Game Paddle Socket )
( THIS IS THE FINAL FORM OF THE PROGRAM TO BE USED IN THE )
( FIELD CONTROLLING THE EXPERIMENT... )
( Necessary step: determining a method of measuring time )
( intervals from the CPU clock which is consistent with UCSD )
( Pascal. Possibly use assembly language subroutine. )
( )
```

PROGRAM eclipse_monitor_simulation;

```
CONST
minimum_pulse_width = 20 (milliseconds);
overhead_duration = 210 (milliseconds);
open_shutter_address = -16295 (sets AN0 output to "1");
close_shutter_address = -16296 (resets AN0 output to "0");
post_rings_delay = 500 (milliseconds);

TYPE
seconds = INTEGER;
milliseconds = INTEGER;
absolute_time =
RECORD
```

Listing 1 continued on page 58

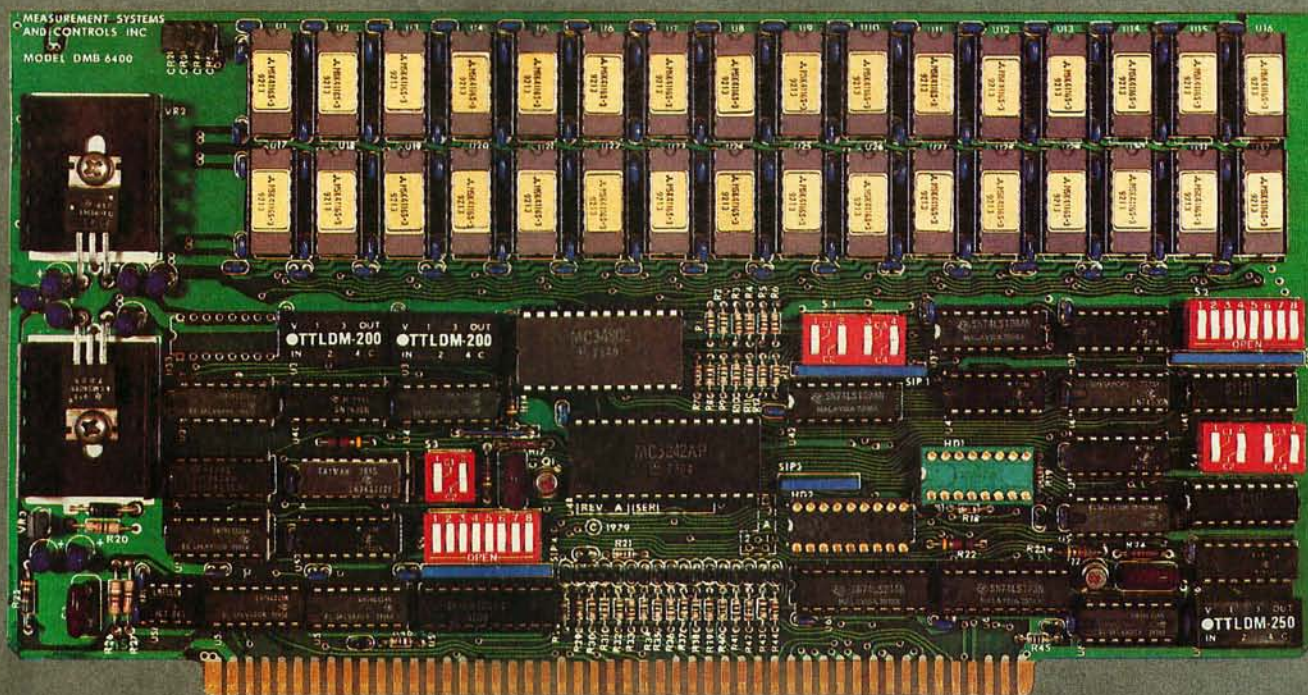
fired up the generator to supply power. We then set up our respective Apples. We naively thought that final programming details could be accomplished that day sitting in the tropical sun. But our preparations had neglected to include a canopy or sun shade. Norm's Apple worked quite well in the heat, perhaps because he had rigged up a sort of sun shade using his towel, two camera tripods, and a large piece of gaily colored cloth.

My Apple, however, had been baking in its carrying case all morning before I set it up. Its integrated circuits were hot to touch even before I turned it on. I turned it on and Pascal booted as usual. I entered my eclipse program and proceeded to check it out. But after one or two allocation runs, the operation of the program was rather unusual and erratic. As often happens in such situations, I cycled the power switch in order to reboot the system's software. With this, the system simply refused to operate in a normal fashion! After leaving the system off for about 2 minutes, I was again able to get it started. But it crashed again more quickly.

My conclusion was that the direct sunlight was baking my computer, giving it the electronic equivalent of the sunburn I was so carefully avoiding for myself. It seems that Apples do not work too well when temperatures are elevated to the point where components are too hot to touch. I estimate that the surface temperature of the main board at this time was in the range of 150° to 180°Fahrenheit (66° to 82° Celsius). Noting the excessive heat, I just turned off the system and thought about strategies for keeping it cool and out of sunlight until the eclipse happened. That evening after sunset and before the nightly parade of hippos began, I verified that the computer was still functional.

As it turns out, heat was not a problem the next day, February 16, 1980. The day of the eclipse broke with a solid overcast, not an auspicious beginning. If first contact were to have occurred at 8:30 in the

Text continued on page 66



BANK SELECT — 64K BYTE EXPANDABLE MEMORY BOARD

MODEL DMB6400 SERIES
FULLY COMPATIBLE WITH:

**ALPHA MICRO
 CROMEMCO
 NORTH STAR
 MP/M**

and most other
 S-100 systems

- Four independent, 16K software selectable banks.
- Switch selectable bank sizes — from 16K to 64K in 16K increments.
- Eight banks (512K) per I/O port for each of the 256 ports.
- Z-80 4MHz operation with no wait states.
- Low power — 8 watts maximum.
- Reliable, tested and burned-in memory.
- **ONE YEAR GUARANTEE**
- IEEE S-100 compatible timing.
- Attractive Dealer & OEM Prices

MEASUREMENT
 systems & controls
 incorporated

867 North Main Street • Orange, CA 92668
 Telephone: 714/633-4460



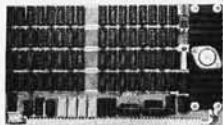
WANT TO BE KING OF THE HILL?

Treat Yourself Royally with GIMIX
Unique and Incomparable Boards
and Systems... DIP-switch Versatility
for use with both SS50 (6800) and
SS50C (6809) Systems (SWTP, etc.)

32K STATIC RAM BOARD

- SS50C Extended Addressing (can be disabled)
- 4 separate 8K blocks
- Low Power 2114L RAMS (2 AMP TYP. for 32K)
- Write Protect
- Fully Socketed for 32K
- Gold Bus Connectors

NEW!



16K...\$328.12
24K...\$438.14
32K...\$548.15

16 & 24K Versions are socketed for 32K and require only additional 2114S for expansion.

All GIMIX Memory Boards are assembled, burned-in, and tested at 2MHz.

FACTORY PRIME STATIC RAMS

2114L 450 ns...\$5.90 200 ns....\$6.90
4044 450 ns...\$5.90 250 ns....\$6.90
Add \$5.00 Handling on Orders Under \$200.00

THE UNIQUE GIMIX 80 x 24 VIDEO BOARD

- ★ Upper and Lower Case with Descenders
- ★ Contiguous 8x10 Character Cells
- ★ Hardware Scrolling
- ★ X-Y Addressable Hardware Cursor

It is the **ONLY Video Board** that gives you **Software Control** of:

- A programmable RAM Character Generator plus 2 EPROM Character Generators (128 char. ea.).
- Selecting 256 Displayable Characters from 384 available.
- Normal or inverse video, full or reduced intensity, or combinations of these by **both** ASCII Code and Bit 8.
- GHOSTability — multiple boards at the same address.

Fully decoded, occupies only 2K of address space
Fully socketed — Gold bus connectors.
Assembled, Burned-in, and Tested at 2MHz.

Deluxe Version.....\$458.76
Without RAM Character Generator...\$398.24
Other Video Boards from.....\$198.71



THE CLASSY CHASSIS

- Ferro-resonant Power Supply
- Heavyweight Aluminum Cabinet with fan and provisions for two 5" disk drives.
- 6800/6809 Mother Board, fifteen 50 pin and 8 DIP-switch addressable 30 pin slots — Gold Plated Pins. Fully decoded.....\$798.19

With Baud Rate Generator on Mother Board...\$828.19

32K SYSTEM Incomparable Features, at a Comparable Price!.....\$1,594.59

Includes: Chassis, 6800 CPU, 32K RAM Board, Choice of I/O Card.

16K Version of above.....\$1,374.49

Phone, write, or see your dealer for details and prices on our broad range of Boards and Systems for the SS50/SS50C bus and our AC Power Control Products for all computers.

GIMIX INC.

1337 W. 37th Place • Chicago, IL 60609
(312) 927-5510 • TWX 910-221-4055

The Company that delivers.

Quality Electronic products since 1975.

GIMIX® and GHOST® are Registered Trademarks of GIMIX Inc.

Listing 1 continued:

```
units : seconds;
thousandths : milliseconds;
END;
exposures = INTEGER;
an_exposure_detail =
  RECORD
    duration : milliseconds;
    wait_after : milliseconds;
  END;
string_pointer = ↑STRING;
```

```
VAR
  s : STRING[128];
  crash_ahead : BOOLEAN;

  an_integer : INTEGER;

  x,n : INTEGER;
  sigma : INTEGER;
  which_rins : (second,third);

  a,b,c : absolute_time;
  rins_time : absolute_time;
  second_contact_rins : absolute_time;
  third_contact_rins : absolute_time;
  tot_time : absolute_time;
  time_totality : absolute_time;
  margin_time : absolute_time;
  current_time : absolute_time;
  half_time : absolute_time;
  quarter_time : absolute_time;
  slack_in_totality : absolute_time;
  dummy : absolute_time;
  total_elapsed_time : absolute_time;
  total_duration : absolute_time;

  maximum : exposures;
  total_eclipse : exposures;
  rins_frames : exposures;
  current_shot : exposures;
```

```
twenty_five_shots : PACKED ARRAY[0..24] OF an_exposure_detail;
transient_shots : PACKED ARRAY[0..1] OF an_exposure_detail;
```

<<<< opening "EUTILS.TEXT">>>>

```
( Miscellaneous routines used throughout the program )
( ---> new_page )
( ---> set_parameter )
( ---> error_abort )
( ---> subtract_time )
( ---> divide_time )
( ---> add_time )
( ---> print_time )
( ---> )
( ---> )
( ---> )
( ---> )
( ---> )
```

PROCEDURE new_page;

```
VAR
  stuff : STRING[24];
  clear_screen : CHAR;
BEGIN
  stuff := ' ';
  clear_screen := CHR(24);
  WRITELN(clear_screen,stuff);
  WRITELN(' ');
  WRITELN(' ');
  WRITELN(s);
END (new_page);
```

PROCEDURE set_parameter(VAR time : absolute_time);

```
VAR
  a_string : STRING[128];
  i : INTEGER;
  period : BOOLEAN;
  decimal_count : INTEGER;
  factor, result : INTEGER;
```

PROCEDURE add_a_digit(position : INTEGER);

```
VAR
  digit : INTEGER;
BEGIN
  digit := (ORD(a_string[position])-ORD('0'));
  IF period THEN
    BEGIN
```

Listing 1 continued on page 60

MICROTEK

SO RELIABLE WE GIVE YOU

365 DAYS WARRANTY

360	361	362	363	364
355	356	357	358	359
350	351	352	353	354
345	346	347	348	349
340	341	342	343	344
335	336	337	338	339
330	331	332	333	334
325	326	327	328	329
320	321	322	323	324
315	316	317	318	319
310	311	312	313	314
305	306	307	308	309
300	301	302	303	304
295	296	297	298	299
290	291	292	293	294
285	286	287	288	289
280	281	282	283	284
275	276	277	278	279
270	271	272	273	274
265	266	267	268	269
260	261	262	263	264
255	256	257	258	259
250	251	252	253	254
245	246	247	248	249
240	241	242	243	244
235	236	237	238	239
230	231	232	233	234
225	226	227	228	229

TOTAL PEACE OF MIND.

We are business people, just like you. We wouldn't stick our neck out unless we were certain we could back our claims and promises to the last letter. We wouldn't offer a legally binding long-term warranty on our Microtek MT-80, unless we were positive of its solid reliability.

We are sure that our versatile, alphanumeric line printer will provide you consistent, dependable performance. This is why we give you, not the usual 90-days in fine print, but an incredible 365-days warranty. We stand behind every product we make.

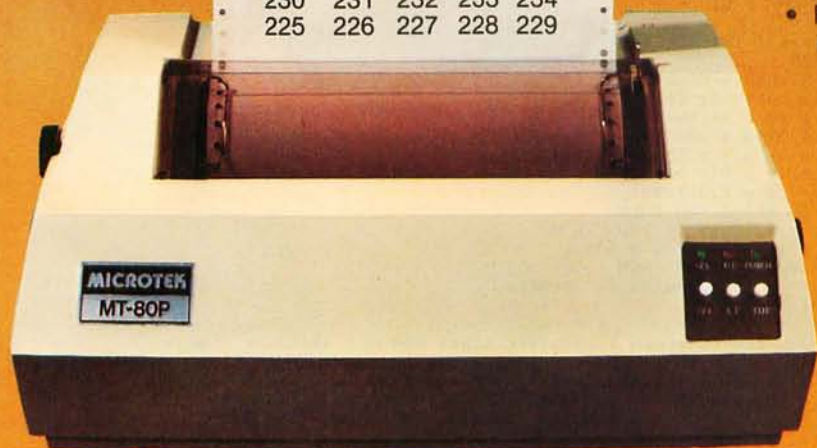
LOADED WITH INNOVATIONS

- 40, 80 or 120 columns (software selectable)
- Non-thermal paper, pin feed
- 125 CPS, 70 lines per minute
- 9 x 7 dot matrix
- Vertical format unit
- 96-character ASCII (upper and lower case)
- Adjustable forms width to 9½"
- Parallel and serial (RS-232C) interfaces available

OUR UNIT PRICE

\$795 Parallel

\$895 Serial (RS-232C)

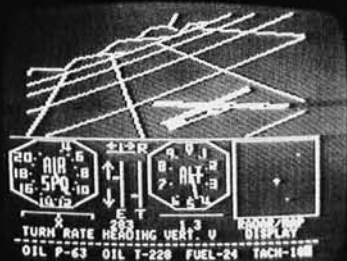


RELIABILITY

For more information contact:

MICROTEK, Inc.
9514 Chesapeake Dr.
San Diego, CA 92123
Tel. (714) 278-0633
TWX 910-335-1269

The subLOGIC FS1 Flight Simulator*



is just one
application of
our fine
graphic
software.

Other
applications
can be yours!

Choose from a coordinated software
and hardware collection to fit your
graphic needs...

SOFTWARE

A23D1 animation package for the
Apple II (\$45 on cassette, \$55 for disk).

8080/Z80 3D package for most S100
systems (\$41 on tarbell cassette or
paper tape, \$51 on 5" North Star disk,
or \$52 on 8" CPM disk).

HARDWARE (S100)

Biotech CGS 808	\$399
Matrox ALT-256	\$395
Matrox ALT-512	\$595

Write or call for an informative catalog
describing these and other graphic
products and their easy use in your
applications.

Most subLOGIC software is at your
dealer's. If he doesn't stock it, order
direct from subLOGIC. Add \$1.25 for
UPS or \$1.75 for first class mail. Visa
and Mastercharge accepted.

*The FS1 Flight Simulator is available
for Apple II and TRS-80 Level I & II
for \$25 on cassette.

(217) 359-8482

subLOGIC

Box V, Savoy, IL 61874

The engineering and graphics experts.

Listing 1 continued:

```

decimal_count := decimal_count + 1;
IF decimal_count < 4 THEN
  BEGIN
    time.thousandths := time.thousandths
      + ((1000 * disit) DIV factor);
    factor := 10 * factor
  END
END
ELSE (before period)
  time.units := (time.units * factor) + disit
END;

BEGIN (set_parameter)

PAGE(OUTPUT);
time.units := 0;
time.thousandths := 0;
WHILE ((time.units=0) AND (time.thousandths=0)) DO
  BEGIN
    factor := 10;
    decimal_count := 0;
    period := FALSE;
    WRITELN(s);
    READLN(a_string);
    FOR i := 1 TO LENGTH(a_string) DO
      BEGIN
        CASE a_string[i] OF
          '0','1','2','3','4','5','6','7','8','9':
            add_a_disit(i);
          '.':
            period := TRUE
        END
      END
    END (WHILE);
  END (set_parameter);

PROCEDURE error_abort;
BEGIN
  maximum := 250;
  total_eclipse := 200;
  rind_frames := 25;
  WRITELN('Unrecoverable error in data');
  crash_ahead := FALSE
END;

PROCEDURE subtract_time(a,b : absolute_time; VAR c : absolute_time);
BEGIN
  c.thousandths := a.thousandths - b.thousandths;
  sigma := 0;
  IF c.thousandths < 0 THEN
    BEGIN
      c.thousandths := c.thousandths + 1000;
      sigma := -1
    END;
  c.units := a.units - b.units + sigma
END;

PROCEDURE divide_time(
  VAR a : absolute_time;
  b : absolute_time;
  n : INTEGER
);
( a <-- b DIV n )
VAR
  p,q : INTEGER[16];
BEGIN
  a.thousandths := 0;
  a.units := 0;
  q := b.units;
  q := q * 1000;
  q := q + b.thousandths;
  q := q DIV n;
  p := q DIV 1000;
  IF p < 32768 THEN
    a.units := TRUNC(p);
    p := q - (1000 * p);
    IF p < 32768 THEN
      a.thousandths := TRUNC(p)
    END;
  END;

PROCEDURE add_time(a,b : absolute_time; VAR c : absolute_time);
BEGIN
  sigma := a.thousandths + b.thousandths;
  c.thousandths := sigma MOD 1000;
  c.units := a.units + b.units + (sigma DIV 1000)
END;

PROCEDURE Print_time(a : absolute_time);
VAR
  z1000,z100 : STRING[11];
BEGIN
  IF a.thousandths < 100 THEN z1000 := '0' ELSE z1000 := '';
  IF a.thousandths < 10 THEN z100 := '0' ELSE z100 := '';
  IF LENGTH(s) > 25 THEN s := COPY(s,1,25);
  WRITELN(s,a.units,'.',z1000,z100,a.thousandths)

```

Listing 1 continued on page 62

The Solution Store



Your Computer Store for the 80's.

MicroAge Computer Stores were designed for the 80's . . . and beyond. Designed to provide solutions, not just to sell hardware. From systems integration to easy-to-use application software. From research and development to warranty service and repair.

From systems consulting to training and installation. In all these, we are the acknowledged leaders, the industry pioneers. The model for all

computer stores of the future. Don't just take our word for it. Visit the MicroAge Computer Store nearest you. You'll leave with a whole new idea about what a computer store is all about . . . and will be for years to come.

MicroAge[®]
COMPUTER STORES

Circle 32 on inquiry card.

Paradise Valley Mall
(Cactus Rd. & Tatum Blvd.)
Phoenix, Arizona

1220 Melbourne Dr.
Hurst, Texas

2525 N. Scottsdale Rd.
Scottsdale, Arizona

Spring Valley Rd. & Coit St.
Richardson, Texas

2612 East Broadway
Tucson, Arizona

24 West Camelback Rd.
Phoenix, Arizona

For franchise opportunities, contact the director of franchising, (602) 967-1421.

RAYGAMCO**JOIN
NOW!****BIG SAVINGS
ON EVERY
ITEM!**

Become a member of
RAYGAMCO
Computer Discount Club.

By being a RAYGAMCO Member you receive substantial discounts on every item you purchase, including all hardware, software, accessories, even books and paper! You will also receive a monthly newsletter with all the latest available for your particular computer system, and much more — exclusive to RAYGAMCO Members only!

Here's how to join. Fill out the information and mail. That's all there is to it. I want to be a RAYGAMCO Computer Discount Club Member. Please send my RAYGAMCO Membership card to:

Name _____ Zip _____
 Address _____ State _____
 City _____
 Computer (Brand Name) _____
 I would like information on (please specify system, part, accessory, book, program, etc.) _____

TOLL FREE, EXCEPT CA

Store Hours: 800-854-6455
 Sat 10-6, Sun 12-4, Tu-Fri 11-8

RAYGAM, INC.
 6791 WESTMINSTER AVENUE
 WESTMINSTER, CA 92683
 TELEX 182274 (714) 891-2587

Listing 1 continued:

```

END;
<<<< opening "ENORMAL.TEXT">>>>

PROCEDURE normalize_timings;
VAR
  i          : INTEGER;

PROCEDURE sum_up_rings(ring: INTEGER; VAR ring_total : absolute_time);
VAR
  index,i : INTEGER;
  this_ring : absolute_time;

BEGIN
  ring_total.units := 0;
  ring_total.thousandths := Post_rings_delay;
  FOR i := 1 TO ring_frames DO
    BEGIN
      this_ring.units := 0;
      this_ring.thousandths := transient_shots[rings].wait_after;
      add_time(this_ring,ring_total,ring_total);
      this_ring.thousandths := transient_shots[rings].duration;
      add_time(this_ring,ring_total,ring_total)
    END
  END;

END;

PROCEDURE sum_up_eclipse(VAR eclipse_total : absolute_time);
VAR
  this_shot : absolute_time;
  index,i,j : INTEGER;
BEGIN
  eclipse_total.units := 0;
  eclipse_total.thousandths := overhead_duration;
  ( this compensates for the minimum wait after one )
  ( frame started and ended during the slack time period )
  FOR i := 1 TO total_eclipse DO
    BEGIN
      this_shot.units := 0;
      index := (i-1) MOD 25;
      this_shot.thousandths := twenty_five_shots[index].wait_after;
      add_time(this_shot,eclipse_total,eclipse_total);
      this_shot.thousandths := twenty_five_shots[index].duration;
      add_time(this_shot,eclipse_total,eclipse_total)
    END
  END;

END;

PROCEDURE Preliminary_allocation;
BEGIN
  s := 'Allocation of Eclipse Times...';
  new_page;
  s := 'Total time of eclipse = ';
  Print_time(time_totality);

  WRITELN('-----');
  which_rings := second;
  sum_up_rings(ORD(which_rings),second_contact_rings);

  s := 'Second contact time = ';
  Print_time(second_contact_rings);

  which_rings := third;
  sum_up_rings(ORD(which_rings),third_contact_rings);

  s := 'Third contact time = ';
  Print_time(third_contact_rings);

  add_time(second_contact_rings,third_contact_rings,rings_time);
  s := 'Tot. diamond rings time = ';
  Print_time(rings_time);
  divide_time(quarter_time,second_contact_rings,2);
  s := 'Anticipation time = ';
  Print_time(quarter_time);

  WRITELN('-----');
  sum_up_eclipse(tot_time);
  s := 'Totality time = ';
  Print_time(tot_time);
  s := 'Margin at end totality = ';
  Print_time(slack_in_totality);

  divide_time(half_time,rings_time,2);
  s := 'Diamond rings slack = ';
  Print_time(half_time);

  add_time(tot_time,slack_in_totality,total_duration);
  add_time(total_duration,half_time,total_duration);
  s := 'Total time initially = ';
  Print_time(total_duration);

  WRITELN('-----');
  subtract_time(time_totality,total_duration,margin_time);
  s := 'Margin for allocation = ';
  Print_time(margin_time)
END Preliminary_allocation;

```

Listing 1 continued on page 64



More than meets the eye.

The new Series 5000 is mighty for its size. In more than several thousand ways!

In fact, it's the first small system offering over a megabyte of integrated mini-floppy capacity. And with its super memory management, you can have better than 300k of RAM in desk or desktop versions. But hardware is just the beginning of the story.

It's the wide selection of software that really makes this system mighty.

Operating systems? Choose CP/M* with CBASIC†—the most widely accepted small computer operating system ever. Or MVT-FAMOS,** a multi-user, multi-tasking operating system with file management like the big guys, Or MICROCOBOL,††

also for multiple users, but implemented in COBOL, familiar to commercial users the world over.

And applications programs for these operating systems number in the thousands. From real estate to accounting, taxes to inventory control, they're all available at low cost—ready to run.

When you add these software and hardware features to Industrial Micro Systems' reputation for rugged, reliable quality products you'll begin to see it all. A lot more systems than your first glance reveals.

See even more at your dealer. Call us to find out the name of your nearest dealer. He'll tell you everything you need to know. And really open your eyes!

* Trademark of Digital Research Inc.

** Trademark of MVT Microcomputer Systems Inc.

† Trademark of Software Systems

†† Product of CAP-CP

INDUSTRIAL MICRO SYSTEMS

628 N. Eckhoff St., Orange, CA 92668, (714) 978-6966
2800 Lockheed Way, Carson City, NV 89701

CP/M® SOFTWARE

8080 Emulator

RAID is a software-based system rivaling hardware emulators costing thousands of dollars. RAID is absolutely the most advanced and sophisticated debugging system ever developed for a computer. Fully symbolic, including labels, operands and op-code mnemonics, RAID combines real-time and emulation modes in a single package. Tracing by *prime path*, *individual instructions*, *subroutines* and *breakpoints* is supported. Special feature allows emulation and real-time modes to function together for high speed emulations. Other features include memory search facilities, disk access by track and sector, single-step, multi-step, block move, user-selectable radix, etc. Over 70 commands in all. Requires 24K min. CP/M®² system.

Raid\$150
Manual only\$ 25

ISIS¹ Conversion

ISIS¹ to CP/M® conversion utilities permit CP/M® users to read or write files to or from an ISIS¹ diskette. The package consists of three utility programs that *read*, *write* and display the ISIS¹ *directory*.

ISIS¹ - CP/M® Utilities\$125
Manual only\$ 5

Floating Point Package

'FPP' is a set of 8080 assembly language subroutines that provide 12 digit BCD arithmetic functions for *add*, *subtract*, *multiply*, and *divide*. BCD arithmetic means no conversion errors and minimal conversion time. Source code is supplied on standard 8" diskette.

FPP on CP/M® diskette\$125
FPP on ISIS¹ diskette\$175
Manual only\$ 10

¹ISIS is a trademark of Intel Corporation.
²CP/M® is a registered trademark of Digital Research.



586 Shades Crest Road
Birmingham, Al.

Send check or money order to:
P.O. Box 3373 A
Birmingham, Al. 35205
Phone: 205 933-1659

Listing 1 continued:

```

PROCEDURE marsin_dispersal;
VAR
  marsin_per_frame : absolute_time;
  i : INTEGER;
BEGIN
  divide_time(marsin_per_frame, marsin_time, total_eclipse);
  FOR i := 0 TO 24 DO
    twenty_five_shots[i].wait_after :=
      twenty_five_shots[i].wait_after +
      (1000 * marsin_per_frame.units) +
      marsin_per_frame.thousandths;
    s := 'Marsin per tot. frame = ';
    print_time(marsin_per_frame)
  END (marsin_dispersal);

PROCEDURE final_allocation;
BEGIN
  sum_up_eclipse(tot_time);
  s := 'Adjusted total phase = ';
  print_time(tot_time);

  add_time(tot_time, slack_in_totality, total_duration);
  add_time(total_duration, half_time, total_duration);
  s := 'Adjusted commitments = ';
  print_time(total_duration);

  add_time(tot_time, slack_in_totality, total_elapsed_time);
  add_time(total_elapsed_time, rind_time, total_elapsed_time);
  s := 'Total elapsed time = ';
  print_time(total_elapsed_time);

  WRITELN('-----');
  subtract_time(time_totality, total_duration, marsin_time);
  s := 'Marsin after allocation = ';
  print_time(marsin_time)
END (final_allocation);

PROCEDURE alloc_exposures;
BEGIN
  rind_frames :=
    (maximum - total_eclipse) DIV 2;
  IF rind_frames < 2 THEN error_abort;
  sisma := maximum - (total_eclipse + (2 * rind_frames));
  total_eclipse := total_eclipse + sisma;
  WRITELN('');
  WRITELN('      Exposures map:');
  WRITELN('First diamond rind = ', rind_frames);
  WRITELN('Totality = ', total_eclipse);
  WRITELN('Second diamond rind = ', rind_frames);
  WRITELN('-----');
  WRITELN('      TOTAL = ', maximum);
  WRITELN('');
  WRITELN('');
  WRITELN('Press return to continue');
  READLN(s)
END (alloc_exposures);

BEGIN (normalize_timing)

  alloc_exposures;

  preliminary_allocation;

  marsin_dispersal;

  final_allocation

END (normalize_timing);

PROCEDURE milli(time : INTEGER);
EXTERNAL;

PROCEDURE ref_memory(address : INTEGER);
( This procedure uses the variant record technique to
  reference an address passed to it as a 16 bit signed
  INTEGER. The Apple-II hardware will set or reset the
  annunciator outputs of the Game I/O connector if the
  appropriate addresses are simply referenced by a program.
)

TYPE
  ptr = ^CHAR;

  memory_access = (pointer, number)
( this is a dummy statement required by the syntax of
  Pascal variant records such as "memory" below. The
  variant record "trick" is not the most elegant way
  to reference an absolute hardware address, since it
  requires an implementation-dependent assumption about
  variant records, ie: that a 16 bit signed two's complement
  INTEGER type maps bit for bit into the 16 bit positive
  integer value of an address stored in a Pascal pointer
  data type.
);

```

Listing 1 continued on page 66



Break out with our breakthrough!

**Give your small computer
a UDS 103-LP modem
for less than \$200**

End your isolation. Talk to the rest of the world. Add a UDS 103-LP modem to your personal or small business computer system and you'll have access to the whole dial-up telephone network.

You can communicate with time-sharing services, fellow computer buffs or the larger systems of your customers and suppliers. And, thanks to our breakthrough, the investment is less than \$200.

You get a fully Bell-compatible, originate only, Model 103 modem. It offers full duplex communications capability at any speed from 0 to 300 bps. It fits right under your phone, is FCC certified for direct connection to the telephone network and requires no AC power source. All required operating power comes directly from the phone line itself.

Break out now by getting full details.
Contact Universal Data Systems,
5000 Bradford Drive, Huntsville, AL 35805.
Telephone 205/837-8100.
TWX 810-726-2100.

Patent Applied For

Member IDCMA

"Confidence in Communications"

Universal Data Systems



Text continued from page 56:

morning as was the case in Montana last year, we would have missed the eclipse. But by the time of first contact, about 10 AM, the clouds had dissipated somewhat in the hot sun, to the point where maybe 50% of the time the sun was obscured. What this early cloudiness did, however, was keep my Apple from getting too hot too soon.

As the eclipse progressed, the air cooled off. Whether this lack of insolation due to the early phases of the eclipse affected the weather or not, it certainly helped guarantee the performance of my Apple during the total phase of the eclipse. At 11 AM when I turned on the power to my computer, it was delightfully cool in comparison with the previous afternoon. The weather had also improved considerably. We seemed by this time to be in a beautiful bowl of clear blue sky with the nearest clouds perhaps 5 to 10 miles away. This perfect eclipse-viewing weather lasted until well after the end of the event.

The Pascal system booted properly, and I proceeded to set up the final allocation I would use. Because I wanted to take a few partial phase shots manually, I had decided earlier that morning to limit the shots of totality to 200 exposures, with 120 taken during actual totality and the balance of 80 split equally between the two diamond-ring events. A slack time of 40 seconds was chosen to allow for the extra long exposure toward the end of the eclipse. Just to keep verifying the operation of the computer, I kept reentering the allocation phase of the program every few minutes.

Finally, at 11:21 AM, totality was heralded by a beautiful set of "shadow bands." After watching these last glimmers of direct sun, I removed the filter from my camera and gave the first manual cue to my eclipse program. I then had four enjoyable minutes of direct viewing of the eclipse, its effects on the local animal life, a glimpse of sunlight still illuminating the upper part of Kilimanjaro, and the incredible colorations of the distant clouds on the

Listing 1 continued:

```
memory =
RECORD
CASE memory_access OF
pointer : (a_pointer : ptr);
number : (a_number : INTEGER)
END;

VAR
anybyte : memory;
anychar : CHAR;

BEGIN
anybyte.a_number := address;
anychar := anybyte.a_pointer;
END (ref_memory);

PROCEDURE take_picture(photograph : an_exposure_detail);
BEGIN
ref_memory(open_shutter_address);
milli(photograph.duration);
ref_memory(close_shutter_address);
milli(photograph.wait_after)
END (take_picture);

PROCEDURE initialize;
VAR
running_index : INTEGER;
BEGIN (initialize)
s := '';
ref_memory(close_shutter_address);
current_time.units := 0;
current_time.thousandths := 0;
current_shot := 0;
twenty_five_shots[0].duration := 1 + minimum_pulse_width;
twenty_five_shots[1].duration := 2 + minimum_pulse_width;
twenty_five_shots[2].duration := 5 + minimum_pulse_width;
twenty_five_shots[3].duration := 10 + minimum_pulse_width;
twenty_five_shots[4].duration := 20 + minimum_pulse_width;
twenty_five_shots[5].duration := 50 + minimum_pulse_width;
twenty_five_shots[6].duration := 100 + minimum_pulse_width;
twenty_five_shots[7].duration := 200 + minimum_pulse_width;
twenty_five_shots[8].duration := 500 + minimum_pulse_width;
twenty_five_shots[9].duration := 1000 + minimum_pulse_width;
twenty_five_shots[10].duration := 2000 + minimum_pulse_width;
twenty_five_shots[11].duration := 5000 + minimum_pulse_width;
twenty_five_shots[12].duration := 10000 + minimum_pulse_width;
twenty_five_shots[13].duration := 5000 + minimum_pulse_width;
twenty_five_shots[14].duration := 2000 + minimum_pulse_width;
twenty_five_shots[15].duration := 1000 + minimum_pulse_width;
twenty_five_shots[16].duration := 500 + minimum_pulse_width;
twenty_five_shots[17].duration := 200 + minimum_pulse_width;
twenty_five_shots[18].duration := 100 + minimum_pulse_width;
twenty_five_shots[19].duration := 50 + minimum_pulse_width;
twenty_five_shots[20].duration := 20 + minimum_pulse_width;
twenty_five_shots[21].duration := 10 + minimum_pulse_width;
twenty_five_shots[22].duration := 5 + minimum_pulse_width;
twenty_five_shots[23].duration := 2 + minimum_pulse_width;
twenty_five_shots[24].duration := 1 + minimum_pulse_width;
FOR running_index := 0 TO 24 DO
twenty_five_shots[running_index].wait_after := overhead_duration;

transient_shots[0].duration := 5 + minimum_pulse_width;
transient_shots[1].duration := 50 + minimum_pulse_width;
FOR running_index := 0 TO 1 DO
transient_shots[running_index].wait_after := overhead_duration;

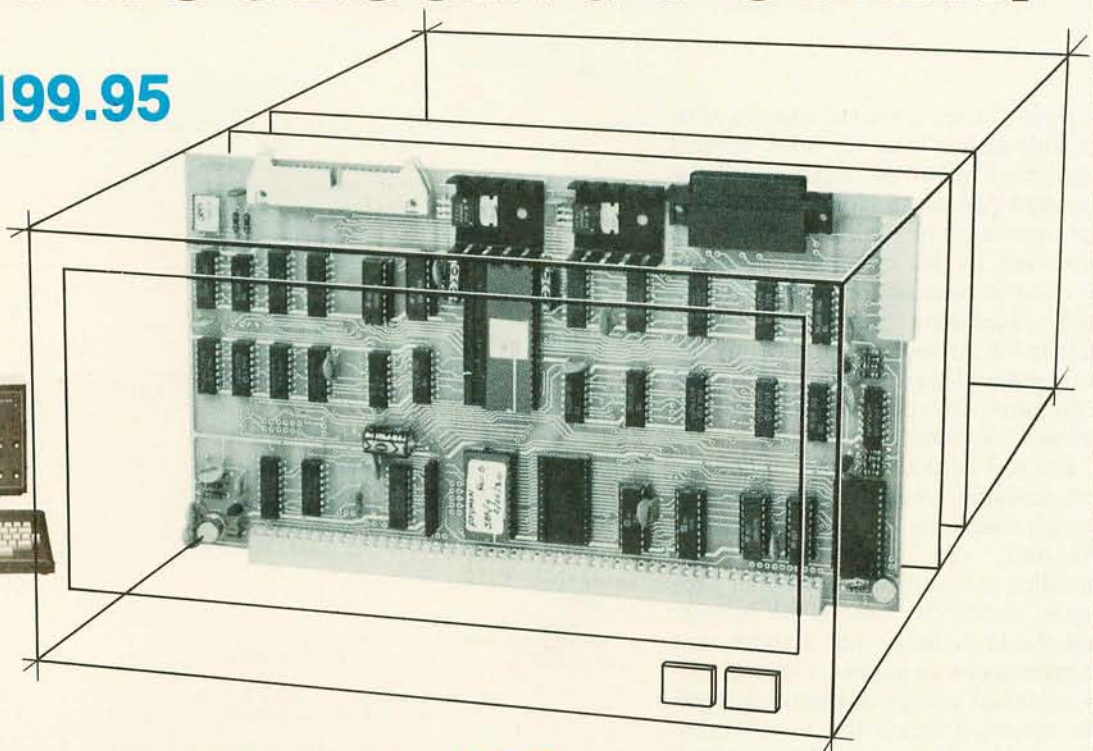
s := 'Restarting the program';
new_page;
WRITELN('Enter 0 to end, 1 to continue');
WRITELN(' ' then <return> ' ');
READLN(an_integer);

IF an_integer > 0 THEN
BEGIN
s := 'Preliminary data initialization';
new_page;
s := 'Enter number of exposures';
set_parameter(dummy);
maximum := dummy.units;
s := 'Enter exposures in totality';
REPEAT
BEGIN
set_parameter(dummy);
total_eclipse := dummy.units
END
```

Listing 1 continued on page 68

6809 PROCESSING POWER!

only \$199.95



The Percom SBC/9™: A "10" By Any Measure.

Available with either the new, powerful 6809 μ P or an optional 6800-software-compatible 6802, here are 10 beautiful reasons why the Percom SBC/9™ is not just another runner-up MPU/Single-Board-Computer card.

- 1 SS-50 bus direct, plug-in-compatible upgrade MPU. Requires **no** modification of the system bus, I/O or memory.
- 2 Full-capability stand-alone single-board computer. Accommodates a 6809 microprocessor or optional 6802 microprocessor **without modification**.
- 3 On-card 1 K ROM monitor "auto-links" to optional second 1 K PROM — if installed. Second PROM may be used to easily extend or modify the primary monitor command set.
- 4 Eight-bit parallel port is multi-address extension of system bus. Accommodates an exceptional variety of peripheral devices ranging from game paddles and keyboards to memory management modules. Connector is optional.
- 5 Serial port includes a full-range selectable bit rate generator. Optional subminiature 'D' connector provides RS-232 compatibility.
- 6 Extendable addressing via SS-50 bus baud lines to 1 Mbyte. Extendable addressing to 16 Mbytes or more through the parallel "super port."
- 7 Includes 1 Kbyte of static RAM.
- 8 All on-card I/O is fully decoded so that adjacent memory space may be used.
- 9 ROM circuit may be jumper-wired for single- or triple-voltage 2716 EPROM.
- 10 On-card power regulators simplify power supply design by minimizing regulation demands.

Plug the SBC/9™ into your SS-50 system bus, and just that easily you've upgraded to the new super-fast super-powerful 6809 MPU with such programming amenities as 10 addressing modes, 16-bit instructions, auto-increment/auto-decrement and position-independent code. Plus, you now have extended addressing capability, and operation under control of PSYMON™, the most powerful and flexible 1K ROM 6809 operating system yet written.

Percom SYstem MONitor
PSYMON™ provides the usual ROM monitor functions in 1 Kbyte. It is easily extended and customized because its unique "look-ahead" program structure first searches an alternate command table. The table, if present, may be used to redefine or extend PSYMON's™ command set.

And with PSYMON™, I/O is easily directed to any peripheral device — even a disk system — through a Device Control Block table located

in memory. This allows you to leave the details of I/O software to the separate I/O device drivers.

A PSYMON™ ROM is included free with the purchase of an SBC/9™. The Users Manual includes a source listing.

The 1 Kbyte ROM monitor for the SBC/9™ 6802 option includes a primary set of typical 6800-compatible monitor commands. As for PSYMON™, the commands are easily extended or modified.

Products are available at Percom dealers nationwide. **Call toll-free, 1-800-527-1592, for the address of your nearest dealer, or to order direct.** Prices and specifications subject to change without notice.

™ trademark of Percom Data Company, Inc.

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

PERCOM

Listing 1 continued:

horizon. I used a second camera with a wide-angle lens to take several hand-held pictures. Eventually the moment passed as Norm announced the coming of third contact as predicted by his computer program running in conjunction with a Mountain Hardware real-time clock. Perhaps a bit too late, I gave my second manual cue to my program, and I prepared to apply the lens cap to protect the camera and optics.

The rest of the trip was, of course, anticlimactic. I had the satisfaction of having had my program work as planned, the good fortune of avoiding a repeat of the thermal problems of the day before the eclipse, and the knowledge that a significant improvement in eclipse viewing can be achieved using a computer system. We returned home the next Thursday, and by Friday noon I was able to view the images photographed by my system during those 4 minutes in Tsavo the Saturday before. I don't know when I will next see a solar eclipse, but I am sure that whatever the state of the art of microcomputers at the time, I will be using one to improve my automation of photography of the 1980 eclipse.

Articles Policy

BYTE is continually seeking quality manuscripts written by individuals who are applying personal computer systems, designing such systems, or who have knowledge which will prove useful to our readers. For a more formal description of procedures and requirements, potential authors should send a large (9 by 12 inch, 30.5 by 22.8 cm), self-addressed envelope, with 28 cents US postage affixed, to BYTE Author's Guide, 70 Main St, Peterborough NH 03458.

Articles which are accepted are purchased with a rate of up to \$50 per magazine page, based on technical quality and suitability for BYTE's readership. Each month, the authors of the two leading articles in the reader poll (BYTE's Ongoing Monitor Box or "BOMB") are presented with bonus checks of \$100 and \$50. Unsolicited materials should be accompanied by full name and address, as well as return postage.

```

UNTIL
    (total_eclipse > 0)
    AND
    (total_eclipse < maximum);
s := 'Enter totality duration (sec)';
set_parameter(time_totality);
s := 'Enter slack time (sec)';
set_parameter(slack_in_totality);
END;
crash_ahead := TRUE;
END (initialize);

PROCEDURE await_cue;
VAR
    anychar : PACKED ARRAY[0..0] OF CHAR;
BEGIN (await_cue)
    WRITELN('');
    WRITELN('');
    WRITELN('');
    WRITELN('*****');
    WRITELN('Awaiting manual cue');
    WRITELN('*****');
    UNITREAD(2, anychar, 1, 0, 0);
END (await_cue);

PROCEDURE diamond_rings_burst;
VAR
    i : INTEGER;
BEGIN (diamond_rings_burst)
    FOR i := 1 TO rings_frames DO
        BEGIN
            IF which_rings = second THEN
                take_picture(transient_shots[0]);
            ELSE
                take_picture(transient_shots[1]);
            END;
            milli(post_rings_delay);
        END (diamond_rings_burst);

PROCEDURE totality;
VAR
    exposure_count : INTEGER;
    cyclic_choice : INTEGER;
BEGIN (totality)
    WRITELN('Begin totality sequence');
    cyclic_choice := 0;
    FOR exposure_count := 1 TO total_eclipse DO
        BEGIN
            take_picture(twenty_five_shots[cyclic_choice]);
            cyclic_choice := (cyclic_choice + 1) MOD 25;
        END;
    WRITELN('End totality sequence');
END (totality);

PROCEDURE summarize;
BEGIN (summarize)
    WRITELN('Press return to end program');
    READLN(s);
END (summarize);

PROCEDURE perform_eclipse_dance;
BEGIN
    await_cue;
    diamond_rings_burst;
    totality;
    ref_memory(open_shutter_address); (sneak in one more exposure)
    await_cue;
    ref_memory(close_shutter_address);
    milli(overhead_duration);
    diamond_rings_burst;
END;

BEGIN (eclipse_monitor_simulation)
    an_integer := 100;
    WHILE an_integer > 0 DO
        BEGIN
            initialize;
            IF an_integer > 0 THEN
                BEGIN
                    normalize_times;
                    WRITELN('Is this an eclipse run? (Y = yes)');
                    READLN(s);
                    IF LENGTH(s) < 1 THEN s := ' ';
                    IF ((s[1] = 'y') OR (s[1] = 'Y')) THEN
                        perform_eclipse_dance;
                    END
                END;
            END;
            summarize;
        END (eclipse_monitor_simulation);

```


Your micro-computer deserves the best in data base management

Get the most out of your micro-computer. Use an advanced and progressive data management system...one with many large-computer features...one designed to meet your present and future needs.

HDBS is an extended hierarchical data base system offering

1. fixed length records
2. file-level read/write protection
3. one-to-many set relationships

MDBS is a full network data base system offered as an upgrade from HDBS...or it may be ideal as your initial system. **Unique and versatile**, it adds these features:

4. full network CODASYL-oriented data structures
5. variable length records
6. multiple levels of read/write protection
7. one-to-one, many-to-one, and many-to-many sets
8. non-redundancy of data, easy updating
9. occurrences of a record type may own other occurrences of the same type
10. a single set may have multiple owner and member record types

MDBS-DRS. As an add-on to MDBS, the DRS system offers extraordinary flexibility in data base restructuring to meet new needs.

11. Item, record, and set types can be added, deleted, or renamed in an existing data base as well as other data base characteristics. You can redesign the data base after it is already on-line!

HDBS and MDBS Packages include:

- DDL data definition language analyzer/editor
- 260-page users manual
- DMS data management routines callable from host language
- Sample application program and DDL files
- Relocator to re-org all routines
- System specific manual for bringing up our software



Write or call for free copy of 54-page "primer" on data base systems for micro-computers.

Both HDBS and MDBS Systems...

- a. Run under CP/M (and similar derivatives) with Microsoft BASICs, FORTRAN or COBOL; under North Star DOS with North Star BASIC; under TRSDOS or NEWDOS with TRS Disk BASIC and with Apple DOS and Applesoft BASIC. Machine language callable forms also available.
- b. Up to 254 record-types definable in the data base; each record-type may contain up to 255 item-types; each item-type may be up to 9,999 bytes in length.
- c. Names of data items, records, sets, and files are wholly user definable.
- d. Command to add, delete, update, search, and traverse the data base.
- e. Straightforward use of ISAM-like structures.
- f. Records can be maintained in several sorted orders.
- g. Written in machine language for maximum execution efficiency and minimal memory usage.
- h. Independent of types and sizes of disk drives. Support data base spread over several disk drives (max. 8); disks may be mini- or full-sized floppies or hard disks.
- i. Available in versions Z80 (requires approx. 18K), 6502 (approx. 26K), and 8080 (approx. 22K).

Ordering and pricing information:

HDBS - Z80	\$250.00	MDBS - Z80	\$750.00
HDBS - 6502	325.00	MDBS - 6502	825.00
HDBS - 8080	325.00	MDBS - 8080	825.00
HDBS/MDBS Manual	35.00	MDBS/HDBS Manual	35.00
HDBS - Upgrade to MDBS	550.00	MDBS - DRS add-on	100.00
System Specific Manual (each)	5.00	MDBS - DRS Manual	5.00

For machine language callable forms, add \$75.00

We accept Visa and Master Charge.

Add \$2.50 handling fee for non-cash order (\$5.00 outside U.S.). Indiana residents add 4%.

When ordering, specify intended use with...

1. North Star DOS and BASIC
2. CP/M - Microsoft BASIC 4.XX
3. CP/M - Microsoft BASIC 5.XX
4. CP/M - Microsoft BASIC Compiler or FORTRAN-80
5. CP/M - Microsoft COBOL-80
6. TRSDOS and TRS Disk BASIC
7. NEWDOS and TRS Disk BASIC
8. CP/M - machine language callable form
9. Apple DOS and Applesoft BASIC
10. (Other versions coming)

Name (please print)	Phone	
Company	Address	
City	State	Zip
Master Charge #	Bank #	
Visa #	Expr. date (either card)	

Finally, our software may cost a little more... but it's worth a lot more in quality and versatility.

Micro Data Base Systems, inc.

Box 248, Lafayette, Indiana 47902 / 317-742-7388



Critique of Technique

This use of computer automation in photographing a solar eclipse provided a valuable improvement over manual methods. Computer automation allowed me to plan an exposure sequence which would be executed without relatively error-prone manual operations. This goal was achieved in the experiment described here. But by building on experience, one can always improve the techniques.

A relatively simple improvement would be to devote some automation to the partial phases of the eclipse. This would be accomplished by adding a loop to take photographs, for example, every five minutes, listening for the manual cue of imminent totality between partial phase shots. This would also assume cool enough temperatures for reliable operation over a 90-minute time span. I left this feature out because I had no idea of the proper exposure time to use and was too busy getting the main goal accomplished.

The problem of determining the mechanical overhead of the Nikon Motor Drive in the "bulb" position needs further attention. The shortest exposures in the 1980 eclipse were dictated by a fixed overhead time needed to ensure reliable triggering of the motor drive. If this time is too long, given the film used, then two options remain: using a slower film, or applying a filter to the lens during totality. The diamond-ring exposure times were much too long for a good photographic result. This problem would go away if a slower film or filters were applied. Since an equatorial telescope mount was tracking the sun during the eclipse, use of slower film would give a shorter effective minimum exposure time without sacrificing resolution with the long shots.

Two problems with my procedures during the 1980 eclipse will not go away given improvements

in computer systems techniques. The first problem is that of inadequate timing cues. While it would be possible to use a real-time clock to coordinate with universal time, such an open-loop operation would not necessarily guarantee better timing of the start of the sequences of totality photographs due to imprecision in our knowledge of latitude and longitude at a remote site.

The second difficult problem is forgetting to verify focusing of the camera during the automatic sequence. In this eclipse, I was lucky, because I did not jar the camera while removing the filter. But, quite frankly, I forgot to even look through the viewfinder while the automatic programming sequence was in operation. Had I twisted the barrel of the lens while removing the filter I could have had a real disaster of unfocused results.

And of course, the next time I go to the tropics with a computer, a sun shade of some sort will accompany me.

High-Level Conference

A key part of the success of this application of a personal computer to eclipse photography was the use of a high-level language system for nearly all of the programming. Listing 1 shows the final version of the eclipse camera-control program with an additional month's development from the state shown in listing 1 of the March 1980 editorial. This very successful use of Pascal in a relatively sophisticated engineering application helps emphasize the importance of the high-level-language design approach.

The importance of high-level languages in design extends far beyond any particular application. To help provide our professionally oriented readers with an intensive exposure to the design philosophy of modern software tools for small computers, we have created a

seminar on the subject. The seminar is organized in conjunction with the McGraw-Hill Conferences and Seminars group. It will be held at the McGraw-Hill building in New York City, June 16 and 17, 1980. The sessions of "The BYTE Conference on Languages and Tools for Microcomputing" will include six important talks on several essential high-level-language systems concepts for small computers.

Dr Fred Martin of Intermetrics Incorporated will talk about the high-level language-oriented software tools developed for the real-time systems programming of the NASA Space Shuttle flight computers. Dr Peter Grogono, author of *Programming in Pascal*, will present the philosophy of Pascal, the predominant block-structured, strongly typed language of contemporary microcomputer usage. Dr Ken Bowles, the driving force behind UCSD Pascal, will provide a fascinating talk entitled "After Pascal, What?" which concerns proposed microcomputer implementations of the US Defense Department's Ada language. John Morse of Digital Equipment Corporation will set Bell Laboratories' C language into a microcomputer context, describing its value as a systems and applications program implementation language. Dr Charles Moore of Forth Incorporated will describe the characteristics of Forth as a programming tool appropriate for small computers. Dr Henry Baker of the University of Rochester will complete this suite of language-oriented tools for microcomputers by presenting information on LISP and its applications. This 2-day intensive conference will end with a panel session in which all the speakers will participate.

For further information, contact The McGraw-Hill Conference and Exposition Center, 1221 Avenue of the Americas, Rm 3677, New York NY 10020, or see the advertisement in this issue. ■

Now... You, the small systems user can enjoy the advantages of HI-performance *low cost* computer graphics

HIPLLOT™ Digital Plotters



The perfect small system output device

- Displays data in easy to read graphical format
- Both serial and parallel inputs built-in.
- Uses standard 8½" x 11" paper (DIN A4)
- Plotting speed up to 2.4 ips (60 mm per sec)
- Resolution of both 0.01 and 0.005 in. (0.2 mm and 0.1 mm)
- Baud rate and step size easily changed
- Completely assembled and ready to use
- Priced at \$1085*

HIPAD™ Digitizers



The perfect small system input device

- Resolution and repeatability of 0.005 in. (0.1 mm)
- Origin is completely relocatable
- RS232C and 8 bit parallel interface selectable at the connector
- Accuracies of ± 0.015 in. (0.4 mm)
- Optional LC display shows actual values being inputted
- Digitizing surface 11" x 11" (28 cm x 28 cm)
- Priced at \$795*

For complete information contact Houston Instrument, One Houston Square, Austin, Texas 78753. (512)837-2820. For rush literature requests persons outside Texas call toll free 1-800-531-5205. In Europe contact Houston Instrument, Rochesterlaan 6, 8240 Gistel Belgium. Phone 059/27 74 45.

**houston
instrument**

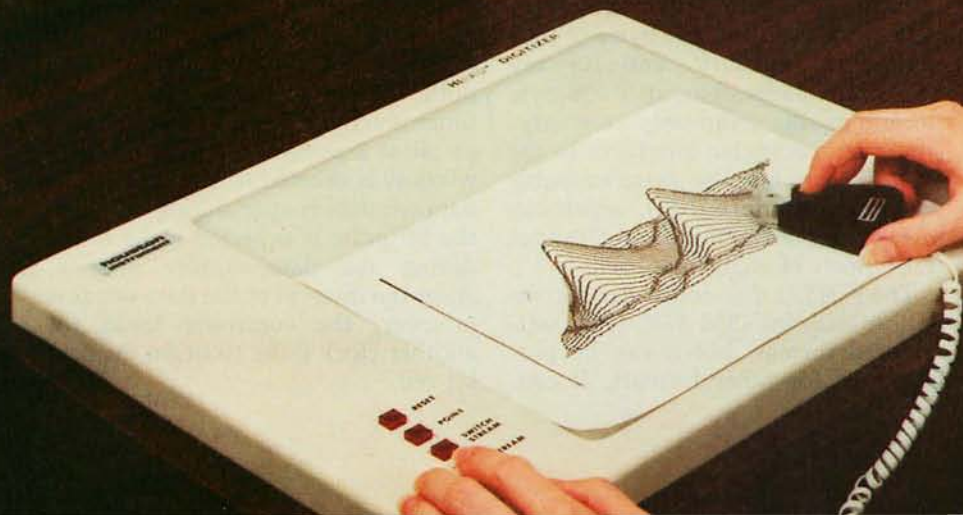
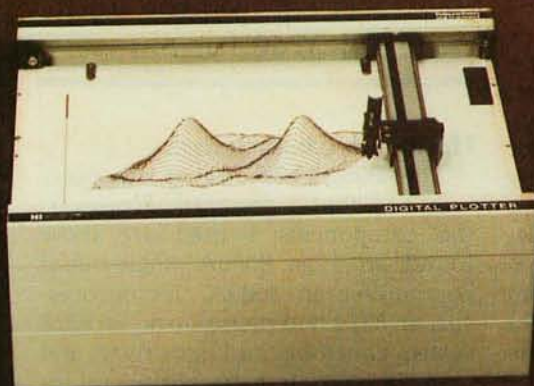
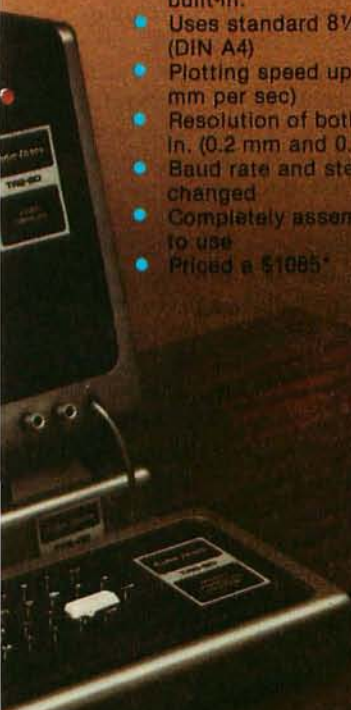
DIVISION OF BAUSCH & LOMB

"the graphics - recorder company"

HIPLLOT-Circle inquiry #39

HIPAD-Circle inquiry #40

TM Trademark of Houston Instrument
*U.S. Domestic Price Only



Interface a Floppy-Disk Drive to an 8080A-Based Computer

John Hoepfner
Shugart Associates
415 Oakmead Pky
Sunnyvale CA 94086

The audio cassette has been used by most of us for off-line storage of programs and data. It has two advantages: it is inexpensive, and it is easy to implement because of the wide variety of cassette interfaces available.

However, I grew tired of waiting for the BASIC interpreter and all my data to be loaded every time I powered up my system. Even then, I sometimes had to load and reload the data until the interpreter and my programs were transferred correctly. I decided to try an alternative.

On one hand, the Shugart minifloppy 5-inch disk drive, which costs about \$350, was a little more expensive than my cassette recorder; but, on the other hand, the 5-inch floppy disk it uses costs about the same as a quality cassette tape — around \$4. And, despite a higher initial investment, the floppy disk is more reliable, and it can transfer programs and data as much as thirty times faster than the audio cassette. It seemed the more programs that were developed, the more worthwhile the additional investment would be. Also, with a recently introduced integrated circuit from Western Digital, the FD1771 floppy-disk formatter/controller, I could design a controller myself that could be interfaced to my

8080A-based microcomputer system.

This article describes the hardware developed to connect a Shugart floppy-disk drive to an 8080A-based system using the Western Digital FD1771 chip, as well as the software routine necessary to drive the FD1771.

The FD1771 disk formatter/controller device is compatible with the IBM 3740 format.

Hardware Characteristics

The 8080A-based microcomputer was one that I designed. However, the components I used are those found on most 8080A single-board computers: an 8080A microprocessor, an 8224 two-phase clock, an 8228 system controller and bus driver, and an 8255 programmable peripheral interface. (See figure 1.) For temporary data storage, I used 2 K bytes of programmable memory, and for my bootstrap loader, I used a 256-byte programmable read-only memory. The microcomputer interfaces to the FD1771 through the programmable peripheral interface (PPI), which can be programmed as three input/output (I/O) ports of eight lines each.

The FD1771 disk controller is compatible with the IBM 3740-type, soft-sectored format, but it can be programmed for other formats. It con-

tains five registers: data, command, sector, track, and status. These registers hold the data and commands transferred from the 8080A processor. The FD1771 has a cyclic redundancy check (CRC) generator for performing a validity check on data transfers. It is also equipped with an internal data separator for separating clock and data bits from the disk into two separate streams. I chose not to use the internal data separator for the following reason.

Each bit of data on the disk is stored during a time interval called a *bit cell*. The bit cell is the space between two of the clock pulses that are recorded on the disk; the beginning of the bit cell is defined by the clock pulse. If the bit is to be recorded as a 1, a pulse is written in the center of the bit cell. If the bit is to be recorded as a 0, no pulse is written in the cell.

The bit pulse must be written on the disk inside certain boundaries. When the pulse is read by the disk drive, the pulse is presented to the controller within a certain time frame called the *data window*. The length of the bit cell is 8 μ s. When the clock pulse is detected by the controller, a timer is activated. This timer counts 2 μ s; after 2 μ s have elapsed, the data window is deemed to be "open." The data window is open during 4 μ s, and the bit pulse is expected to be found during the data-window interval. After the interval of the data window is over, the controller looks for another clock pulse to begin the next bit cell.

Minifloppy is a registered trademark of Shugart Associates used to describe their 5-inch floppy-disk drives.

SuperBrain™



The Honor Graduate

There's been a lot of talk lately about intelligent terminals with small systems capability. And, it's always the same. The systems which make the grade in performance usually flunk the test in price. At least that was the case until the SuperBrain graduated with the highest PPR (Price/Performance Ratio) in the history of the industry.

For less than \$3,000*, SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard features include: two dual-density mini-floppies with 320K bytes of disk storage, up to 64K of RAM to handle even the most sophisticated programs, a CP/M Disk Operating System with a high-powered text editor, as-

sembler and debugger. And, with SuperBrain's S-100 bus adapter, you can even add a 10 megabyte disk!

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing . . . the SuperBrain handles all of them with ease.

Your operators will praise the SuperBrain's good looks. A full ASCII keyboard with a numeric keypad and function keys. A non-glare, dynamically focused, twelve inch screen. All in an attractive desktop unit weighing less than a standard

office typewriter. Sophisticated users will acclaim SuperBrain's twin Z-80 processors which transfer data to the screen at 38 kilobaud! Interfacing a printer or modem is no problem using SuperBrain's RS-232C communications port. But best of all, you won't need a PhD in computer repair to maintain the SuperBrain. Its single board design makes servicing a snap!

So don't be fooled by all the freshman students in the small systems business. Insist on this year's honor graduate . . . the SuperBrain.



2300 Broad River Road, Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

*Quantity one. Dealer inquiries invited.

See us at NCC booth 2240



Quiet Designs forecasts a new and brighter future for your flexible disks... ...introducing Flip Sort™

- **Library Concept**
Easy filing, easy retrieval.
- **Index Dividers**
Adjustable tabs can be set to desired positions.
- **Durability**
Each unit is molded from a highly-durable, transparent, smoke-colored acrylic.
- **Storage Capacity**
Each unit has a storage capacity of 50-60 disks. The unique lid design provides for easy access and also doubles as a carrying handle.
- **Sizes**
Both Mini Disk (5¼") and Large Disk (8") sizes available.



Quiet Designs

Quiet Designs Bay Area
473 Macara #706
Sunnyvale, Ca. 94086
(408) 739-5215
Contact Debbie Sherrick

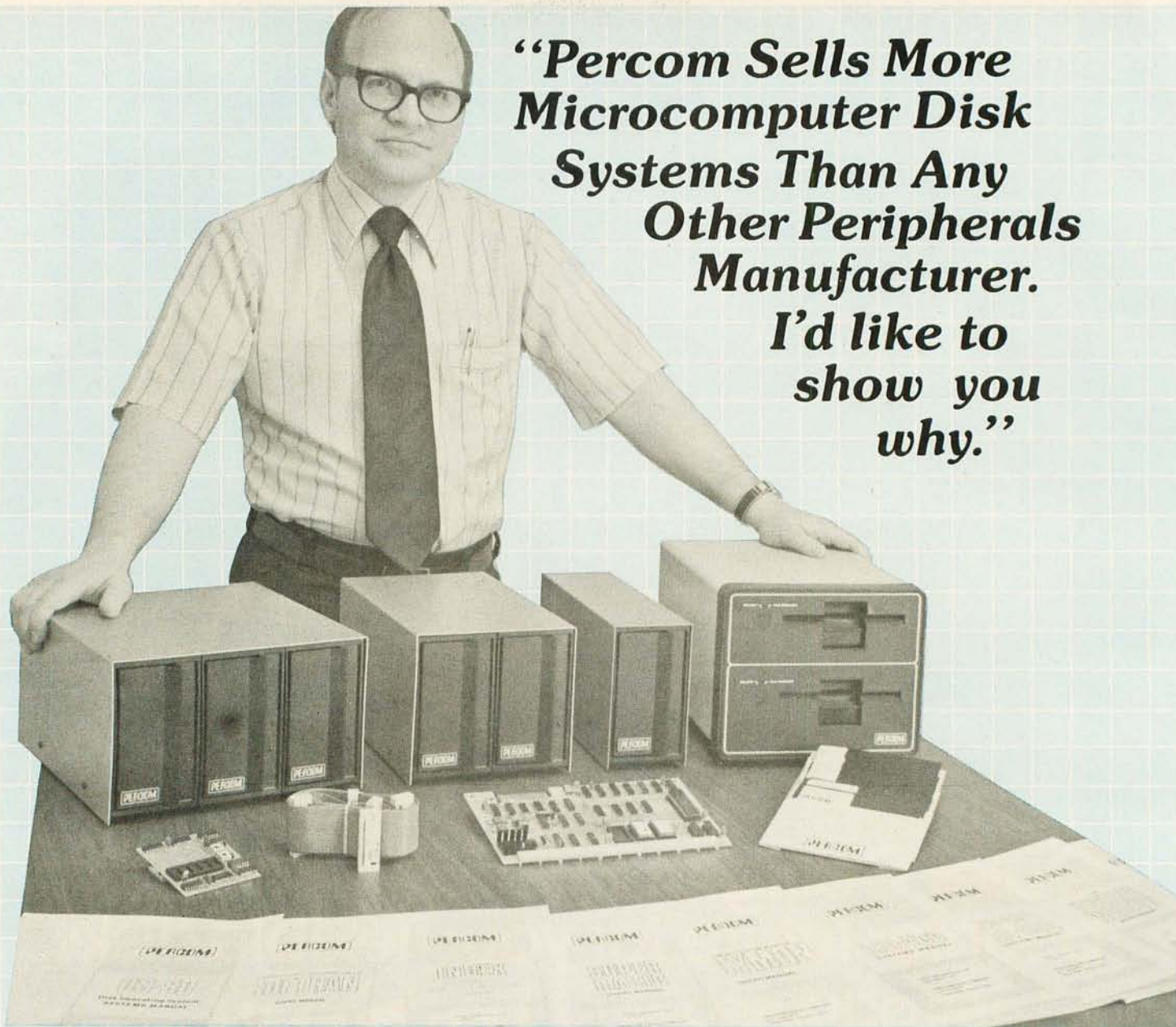
Quiet Designs Inc.
1330 W. Robinhood Dr., Suite F
Stockton, Ca. 95207
(209) 957-8631
Contact Garry Potten

See us at NCC booth 26.

Quiet Designs Ltd.
2nd floor, 1198 W. Pender
Vancouver, B.C. V6E 2R9
(604) 681-7532
Contact Ken Magoski

Quiet Designs Calgary Ltd.
101 Tenth Ave. South east
Calgary, Alberta T2G 0V8
(403) 237-6187
Contact Roy Moore

**“Percom Sells More
Microcomputer Disk
Systems Than Any
Other Peripherals
Manufacturer.
I’d like to
show you
why.”**



“Percom has been manufacturing mini-disk storage systems for microcomputers since 1977 when we introduced the 35-track, single-drive LFD-400™. Now we produce 1-, 2- and 3-drive systems in 40- and 77-track versions, a multi-density MEGABASE™ system and a host of accessories and software.

“Volume not only means experience in critical production and testing operations, it also means we can offer superior design features, extra testing and qualified backup support at very competitive prices.

“I know of no other microcomputer disk system manufacturer who even begins to offer the broad spectrum of disk equipment and programs available from Percom.”

“So before you buy a mini-disk system for your 6800, 6809 or TRS-80* computer, take a good look at what the people at Percom have to offer.”

Harold Mauch
President, Percom Data Company

Percom disk systems start at only \$399.00. Disk systems and other quality Percom products are available at computer dealers nationwide. **Call toll-free, 1-800-527-1592, for the locations of dealers in your area, or to order direct.**

PERCOM

PERCOM DATA COMPANY, INC.
211 N. KIRBY GARLAND, TEXAS 75042
(214) 272-3421

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

™ trademark of Percom Data Company, Inc.

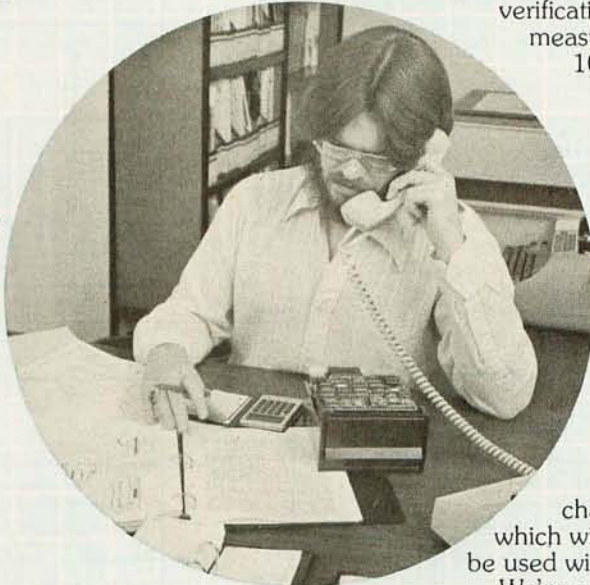
*trademark of Tandy Radio Shack Corporation which has no relationship to Percom Data Company.

"From an efficient 1K-byte control system DOS to high level languages such as FORTRAN and Pascal, no other microcomputer disk systems manufacturer provides the range and quality of development and application programs available from Percom."



"Connie is running a 'cats eye' test on a mini-disk drive to check radial track alignment. Drive motor-speed timing and sensor alignment tests have already been performed. Disk formatting and format verification tests are next. These measurements are part of the 100% testing every single unit receives."

"Whether you call about a shipping date or ask a tough technical question, you get a competent courteous answer. Outstanding customer service is a hallmark of Percom."



"Richard's making final changes to a disk controller which will allow Percom drives to be used with yet another computer. We're constantly developing and introducing new products that extend and enhance the value of Percom systems."

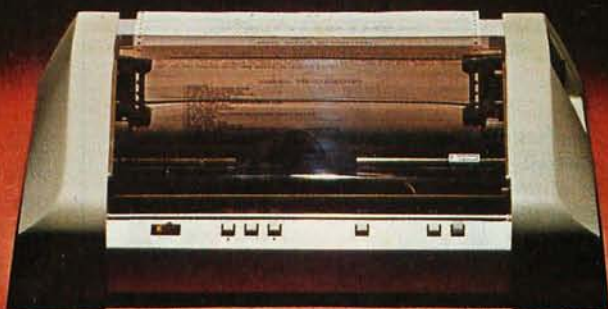


"Slipping a circuit board through the eye of a needle would be easier than slipping a cold solder joint past Beverly. These are four-drive LFD-400/800 disk system controllers she's inspecting."



Meet two new Printers from Anadex:

Resolutionary!



Introducing two totally new line printers from Anadex - Models DP-9500 and DP-9501 - offering 132/158/176 and 132/165/198/220 columns, respectively, and featuring true high-density graphics under direct control of the data source.

Both models employ a rugged, Anadex-built 9-wire print head life-tested to 650 million characters. Combining long life with high resolution, this new head provides dot resolutions of 72 dots/inch vertical and up to 75 dots/inch horizontal.

The full standard ASCII 96 character set, including descenders and underlining of all upper and lower case letters, is printed bi-directionally on the original and up to 5 crisp copies at speeds up to 200 CPS. Print densities are switch- or data-source selectable from 10 up to 16.7 characters/inch, and all can be printed double-width by communications command.

The three ASCII compatible interfaces (parallel, RS-232-C, and Current Loop) are standard in both models; so interfacing is usually a matter of "plug it in and print." Also standard is a sophisticated communications interface providing control of Vertical Spacing (6 or 8 lines/inch), Form Length and Width, Skip-Over Perforation, Auto Line Feed, and full point-to-point communications capability.

Other standard features are: forms width adjustment from 1.75 to 15.6 inches, shortest-distance sensing logic, self-test, quick-change ribbon cartridge with 6 million character life, and a 600 character FIFO buffer. (An additional 2048 character plug-in buffer is optional).

For complete details, quantity discounts and a demonstration, contact Anadex today.



Text continued from page 74:

Therefore, it was necessary during the design process to shorten the time for checking the status of the drive. To allow fast status checking, bit 7, the most significant bit, of port C is tied to the FD1771's data-request line (DRQ). The value of the DRQ is brought into the accumulator by performing a memory-access instruction. It is then possible to perform an inclusive-OR of the accumulator with itself (ORA A), which results in the

sign bit being set to 1 if there is a data request (ie: if DRQ is high). Based on the status of the sign bit, control can branch to the appropriate routine. This arrangement eliminates the need to perform a separate check on the status bits using one of the logical instructions, thereby saving a significant amount of time.

Interfacing to the SA400

The SA400 drive has connections for twelve transistor-transistor logic

(TTL) compatible signal lines. Seven of them connect directly to the FD1771 lines through type-7414 Schmitt-trigger inverters used as line drivers and 7438 open-collector NAND buffers used as line receivers.

The WRITE-DATA line transmits digitized serial data to be written on the floppy disk. The WRITE-GATE signal, when activated, causes the data to be written on the disk. The WRITE-PROTECT line, when active in a low state, indicates that a write-protected disk has been inserted in the drive. The STEP line, when pulsed, causes the read/write head to move radially a distance of one track. The DIRECTION-SELECT line defines the direction that the read/write head moves when the STEP line is pulsed. The TRACK-00 line, when low, indicates when the read/write head is positioned over the outermost track, track 0. The INDEX line transmits the pulse that occurs once for every revolution of the floppy disk to indicate the beginning of a track. (The pulse comes when the index hole passes the photodetector.)

Three drive-select lines, which assign the logical drive address, are connected to port A of the 8255 through 7414 and 7438 circuits used as line drivers and receivers. A MOTOR-ON line, also tied to the 8255, controls the spindle-drive motor. The READ-DATA line is tied to the monostable multivibrator (commonly known as a one-shot) that shortens the pulse width from the drive to 300 ns before sending it to the data separator.

The FD1771 has nine other control lines, which control head positioning and data transfers, but which do not interface directly to the disk drive. Four of the lines to the FD1771 are not used. Lines TEST, DINT, WF and 3PM are therefore tied to +5 V through a 10 k-ohm resistor.

Of the remaining five control lines for the FD1771, the SEPARATED-CLOCK and SEPARATED-DATA lines transmit the clock and data bits from the data separator. (Clock pulses are used in frequency modulated (FM) encoding to signal the beginning of a bit cell.)

The READY line, which signals that the drive is ready for a read or write operation, must be active for the FD1771 to perform any function.

Text continued on page 84

A1	A0	Register Affected During Read (RE = 0, WE = 1)	Register Affected During Write (RE = 1, WE = 0)
0	0	Status Register	Command Register
0	1	Track Register	Track Register
1	0	Sector Register	Sector Register
1	1	Data Register	Data Register

Table 1: Access to registers within the Western Digital FD1771 disk formatter/controller device. The FD1771 has five internal registers: command, data, sector, status, and track. A given register is read or written by placing the appropriate values on lines A1 and A0 and pulling down either the READ-ENABLE (RE) line for a read operation, or the WRITE-ENABLE (WE) line for a write operation. The sector and track registers specify the sector and track when these parameters are needed by a given command byte. The command register, when filled, causes one of eleven high-level instructions to be executed (see table 2). Data passes between the computer and the disk drive through the data register. After a command has been executed by the FD1771, the status register must be read before another command can be executed.

COMPUTER CENTER

5 Complete Stores In One!

- BUSINESS • PERSONAL • HOBBY SHOP
- COMPUTER LIBRARY • REPAIR SHOP



Presenting the remarkable...



TEXAS INSTRUMENTS

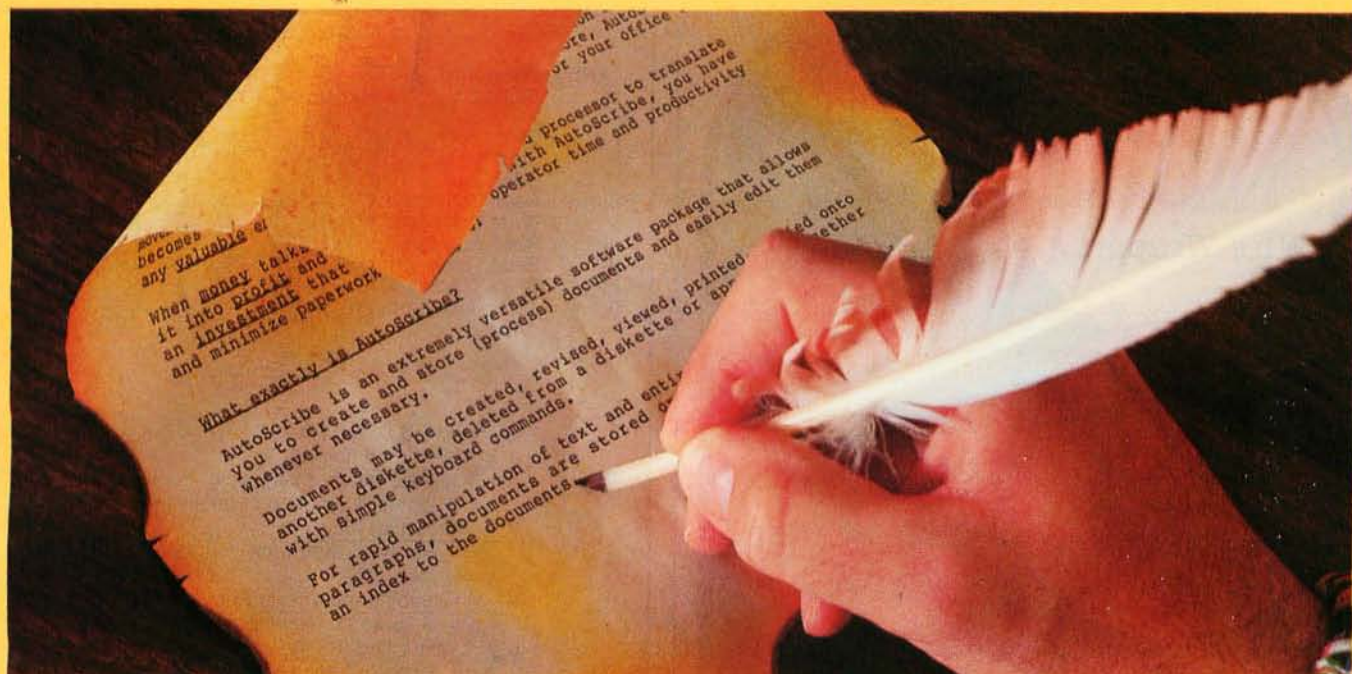
TI-99/4 HOME COMPUTER

includes CONSOLE and COLOR VIDEO MONITOR Complete... **\$899**

Call to order by Credit Card or send Certified Check to avoid shipping costs.
Open Monday thru Saturday 9:30 AM to 6:30 PM

DigiByte
SYSTEMS CORP.

31 EAST 31ST STREET
NEW YORK, N.Y. 10016
(212) 889-8130



The Masterpiece Machine

AutoScribe™ and Your MicroComputer

Word Processing Anyone Can Operate. Immediately.

If you've seen other word processing systems, you probably find it hard to imagine. You know other systems require special codes and initials, secret words and annoying pauses, before you can even *think* about creating copy.

AutoScribe is ready to perform at the touch of a key.

With just a handful of simple, logical keyboard commands, the AutoScribe user rapidly learns to create, revise, generate, duplicate, edit, store and retrieve... effortlessly and conveniently.

Word Processing That Gets Results

With AutoScribe, every document is a masterpiece... justified columns, letter-perfect correspondence, reports that impart the impact of a discerning professional.

Performance? Global search and replace, block move and copy, infinite reverse scroll, page numbering, mailing list merge for customized letters, complete format

flexibility... the traits of the most advanced state-of-the-art in word processing are standard features of AutoScribe.

AutoScribe puts word processing in Proper Perspective

Word processing should be an efficient, cost-effective business tool... not a mysterious and cumbersome operation requiring weeks of training and highly specialized, expensive hardware.

Supported by lucid, self-teaching documentation, AutoScribe makes your general-purpose microcomputer into an easy-to-use but sophisticated word processor to efficiently complement your other business applications.

Make Your Micro Into a Masterpiece Machine

Put AutoScribe to work in your business operations. Now available for CP/M

operating systems and Zenith-Heath systems, as well as double-density NorthStar systems. AutoScribe is also available as a complete turnkey system, including: fast Z80 processor with dual ports and two disk drives for double-density and quad-density



floppy disk storage, letter-quality printer, and professional text-editing videoterminal.

AutoScribe™

MicroSource™

See your MicroSource™ dealer for other powerful, user-oriented applications software: *LedgerPlus™*—the company bookkeeper, *Bookkeeper™*—the office accountant, *MoneyBell™*—the money manager, *TimeKeeper™*—the time accountant. For the MicroSource dealer nearest you, call (602) 894-9247, and ask for Customer Service. Or write us at 1425 W. 12th Pl., Tempe, AZ 85281.

©1979 THE PHOENIX GROUP, INC.

Traditional

NEW



Wire-Wrapping

JUST WRAP



Wire-Wrapping

**WHY CUT?
WHY STRIP?
WHY NOT ...**

JUST WRAP™

WIRE
WRAPPING
TOOL

- AWG 30 Wire
- .025" Square Posts
- Daisy Chain or Point To Point
- No Stripping or Slitting Required

- JUST WRAP™
- Built In Cut Off
- Easy Loading of Wire
- Available Wire Colors:
- Blue, White, Red & Yellow

PATENTED U.S.A.
FOREIGN PATENTS PENDING

JUST WRAP TOOL WITH ONE 50 FT. ROLL OF WIRE		
COLOR	PART NO.	U.S. LIST PRICE
BLUE	JW 1 B	\$14.95
WHITE	JW 1 W	14.95
YELLOW	JW 1 Y	14.95
RED	JW 1 R	14.95
REPLACEMENT ROLL OF WIRE 50 FT.		
BLUE	R JW B	\$ 2.98
WHITE	R JW W	2.98
YELLOW	R JW Y	2.98
RED	R JW R	2.98
JUST WRAP-UNWRAPPING TOOL		
	JUW 1	\$ 3.49

*Minimum billings \$25.00, add shipping charge
\$2.00/New York State residents add applicable tax



**OK Machine & Tool
Corporation**

3455 Conner St., Bronx, N.Y. 10475 U.S.A.
Tel. (212) 994-6600 Telex 125091

TYPE	COMMAND	BITS							
		7	6	5	4	3	2	1	0
I	Restore	0	0	0	0	h	V	r ₁	r ₀
I	Seek	0	0	0	1	h	V	r ₁	r ₀
I	Step	0	0	1	u	h	V	r ₁	r ₀
I	Step In	0	1	0	u	h	V	r ₁	r ₀
I	Step Out	0	1	1	u	h	V	r ₁	r ₀
II	Read Command	1	0	0	m	b	E	0	0
II	Write Command	1	0	1	m	b	E	a ₁	a ₀
III	Read Address	1	1	0	0	0	1	0	0
III	Read Track	1	1	1	0	0	1	0	0
III	Write Track	1	1	1	1	0	1	0	0
IV	Force Interrupt	1	1	0	1	l ₃	l ₂	l ₁	l ₀

(a)

BIT VALUES FOR TYPE 1

h = Head Load flag (Bit 3)

h = 1, Load head at beginning

h = 0, Do not load head at beginning

V = Verify flag (Bit 2)

V = 1, Verify on last track

V = 0, No verify

r₁, r₀ = Stepping motor rate (Bits 1 thru 0)

r₁, r₀ = 11 gives 40 ms step time

u = Update flag (Bit 4)

u = 1, Update Track register

u = 0, No update

(b)

BIT VALUES FOR TYPE II

m = Multiple Record flag (Bit 4)

m = 0, Single record

m = 1, Multiple records

b = Block length flag (Bit 3)

b = 1, IBM format (128 to 1024 bytes)

b = 0, Non-IBM format (16 to 4096 bytes)

a₁, a₀ = Data Address Mark (Bits 1 thru 0)

a₁, a₀ = 00, FB (Data Mark)

a₁, a₀ = 01, FA (User defined)

a₁, a₀ = 10, F9 (User defined)

a₁, a₀ = 11, F8 (Deleted Data Mark)

(c)

BIT VALUES FOR TYPE III

s = Synchronize flag (Bit 0)

s = 0, Synchronize to Address Mark

s = 1, Do not synchronize to Address Mark

(d)

BIT VALUES FOR TYPE IV

l₀ thru l₃ = Interrupt Condition flags (Bits 3 thru 0)

l₀ = 1, Not Ready to Ready transition

l₁ = 1, Ready to Not Ready transition

l₂ = 1, Index pulse

l₃ = 1, Immediate interrupt

E = Enable HLD and 10 ms Delay

E = 1, Enable HLD, HLT and 10 ms delay

E = 0, Head is assumed engaged and there is no 10 ms delay.

(e)

Table 2: The high-level instructions of the FD 1771 disk formatter/controller device. When one of the instructions as defined by table 2a is loaded into the command register of the FD1771, the FD1771 executes one or a series of actions. Bits represented by a letter within a command are defined in the bit value tables for that type instruction, tables 2b thru 2e.

Text continued from page 80:

Since the Shugart SA400 floppy-disk drive has no "ready" signal, the drive's index signal is used to determine a ready condition.

The disk drive transmits the index pulse only when the drive door is closed, the disk is inserted, and the spindle motor is turning. Because the index pulse is transmitted once for each rotation of the disk, the speed of rotation may be determined by measuring the interval between pulses. When the drive spindle has reached final speed, the index pulse is transmitted at intervals of 200 ms.

I used the index pulse to trigger a monostable multivibrator, which generates a one-shot pulse with a length slightly greater than 200 ms. When the drive is up to speed, the one-shot is continuously activated, since the index pulse retriggers it at 200 ms intervals. This one-shot pulse is connected to the ready line on the FD1771, and the derived "ready" signal remains true as long as the drive is ready.

The HEAD-LOAD and HEAD-LOAD-TIME lines are related in func-

tion. When the FD1771 issues a command to the drive, the drive may have to first load the head. The head-load time for a Shugart SA400 drive is 75 ms. Since the FD1771 is designed for use with drives having a shorter head-load time, a time-out signal to indicate that the head is loaded must be generated externally. To insure that the head is loaded, the HEAD-LOAD signal from the FD1771 is tied to a monostable multivibrator having a pulse duration of 75 ms. The output is fed back to the FD1771 as its HEAD-LOAD-TIME input to force the FD1771 to wait for 75 ms before sending a read or write command to the drive.

The FD1771 controls the floppy-disk drive with one of several 8-bit command words; these command words are high-level in the sense that each initiates a series of operations that define the function requested. Generally, each command requires some type of parameter. So, before the 8080A microprocessor sends a command, it must first load the necessary parameter in the form of an 8-bit byte into the appropriate

register of the FD1771, whether the destination is the data, sector, or track register.

To place the necessary data in a register, address lines A0 and A1 are set according to the data in table 1, the READ-ENABLE (RE) line is held high and the WRITE-ENABLE (WE) line is pulled low. To implement a command, lines A0 and A1 must address the command register. An 8-bit byte representing the appropriate command is placed on the data lines of the FD1771 (via the B port of the 8255) and is sent to the command register as the WRITE-ENABLE line is toggled from high to low.

FD1771 Commands

The FD1771 recognizes eleven high-level commands; these are illustrated in table 2 with their binary representations. They can be divided into four types. Type I commands are used to move the drive's read/write head. Type II commands are read- and write-sector commands. Type III commands are read-address, read-track and write-track or formatting

INSTEAD of a catalog, have you ever seen those dreaded words: I/O ERROR?

Track & Sector List™

Is all lost? NO! Now you may be able to save your disk. With this interactive assembly language utility program, which enables the disk to be directly accessed, you can "undelete" a deleted file, protect a bad sector from access, remove invisible control characters embedded in file names, and much more. Because the data

00	0123	4567	89AB	COEF
10	FOA	----	----	LBRE
20	LLO	----	----	----
30	RCOP	Y	----	B-OL
40	----	Y	----	----
50	JLB	FINA	NCE	I O
60	----	KLDU	FOAT	E 3
70	2 /	----	----	----
80	ARCA	DE	JRPE	NNY
90	ONAD	E	2+TL	BLEM
CO	----	----	----	----
DO	CHAI	N	----	+LO
EO	----	----	----	----
FO	----	----	----	C-

on an entire sector is displayed on one screen-page, it is possible to identify an I/O ERROR and recover from it. The 32-page tutorial manual begins with basic concepts of disk operation and progresses to detail the directory, the VTOC, track bit maps, etc. If you use Track & Sector List only once to recover a lost program, it is worth it! Disk only (32K) 29.95

AppleAids™

Form-It-Out™

A series of routines in Integer Basic and Applesoft containing detailed explanation and examples of programming techniques necessary to format your screen output. Included are cursor positioning and location, right and center justification, text windowing and error subroutines.

Disk (48K) 19.95

Scroll Control™

Have you ever wondered why you cannot list an Integer Basic or Applesoft program one screen-page at a time? So have we, and we did something about it! Our machine language Scroll Control, hidden in RAM so as not to "bump" into your program, can be engaged or disengaged at a flick of the keyboard. Why be frustrated when instead you can control the scroll?

Cassette 9.95 Disk 14.95

Little Tricks™

A series of carefully explained subroutines containing a potpourri of useful programming techniques in Integer Basic and Applesoft, such as specific key stroke identification, timing loops, simple sort, iterative solution, no return key entry, and many more.

Disk (32K) 19.95

Hex and Decimal Learning Tree™ Series

My ABC's and **Now I Can Rhyme** are both early learning Integer Basic programs requiring 48K, incorporating high resolution graphic letters and pictures in a drill-and-practice format. **My ABC's** is designed to develop identification of capital letters with pictures. **Now I Can Rhyme** is designed to develop rhyming skills. Score-keeping capabilities allow adult monitoring of progress. Child tested and teacher recognized. Each program: Cassette... 14.95 Disk 19.95

N.J. res. add 5% sales tax
Add \$1.50/item, shipping and handling
Apple II, Apple II plus and Applesoft are
registered trademarks of
Apple Computer, Inc.

SOFTAGON™

INCORPORATED

software for the Apple II and Apple II plus

P.O. Box 774M
Morristown, NJ 07960
(201) 539-3770



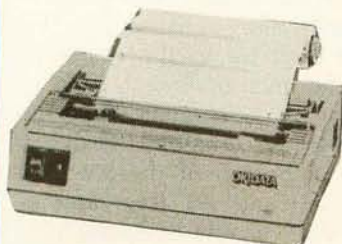


**free
freight!**



MICROWORLD®

New Products



Okidata MicroLine 80

Compact, lightweight 80 cps line printer; 9X7 matrix . . . friction, pin or tractor feed! 132 column w/compressed print, graphics, and more!

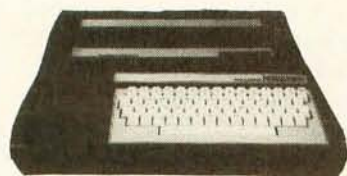
Call for Price!



Atari 800

The "timeless" home computer system: expandable memory, advanced components, comprehensive software library.

Call for Price!



Mattel Intellivision

Transforms your home TV into a family center for games, entertainment, education and household management. Separate master and keyboard components.

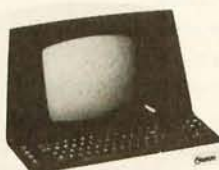
Call for Price!

MicroWorld® Attacks Inflation With Free Freight, Low Pricing . . .

MicroWorld introduces the most attractive mail-order offer in the computer industry. *The nation's largest inventory*, plus our own automated order processing, allows us to pass along unrivaled cost savings. And now, as an additional measure to counter inflation, we offer *free freight* on any product featured on this page. We'll pay the surface freight on all pre-paid products in this ad, to any of 18,000 U.S. tariffed locations. *No handling charges*, add-on costs, insurance fees or credit card fees! Most items are *in stock* for fast delivery at exceptional discounts!

Call us before you buy anywhere else. Find out *their* total cost. Then compare with our low, freight-free price. Our industry-trained staff stands behind every order. *We're the source you can trust.* We grew up with the microelectronics revolution. We helped pioneer its growth. Our Free Freight program, our attractive pricing, and off the-shelf delivery are our "thanks" to the thousands of satisfied computer users who made MicroWorld the *world's leading mail-order source* for microcomputers and peripherals!

Soroc IQ 120



High quality, text editing terminal, 73-key board, built-in 2KRAM, RS232 interface.

\$789

Comprint GP



Low priced electrostatic matrix printer, 225 cps; ideal for personal computers, or professional applications requiring second printer.

Call for Price!

TeleVideo 920B



Low-cost terminal loaded with features: full-function keyboard, 24X80 display, blink, reverse, self-test!

Call for Price!

Novation Cat

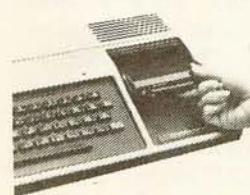


Call for price!

Acoustic modem with originate or answer modes over phone lines; compatible with any Bell 103 modem.

Call for Price!

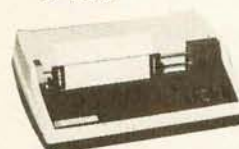
Texas Instruments 99/4 Home Computer



Superior sound, 16 colors, graphics; low price includes 13" color monitor, 16 bit CPU, TI BASIC and more!

Call for Price!

TI 810



150 cps, RS 232C tractors, 3" to 15" form width; bi-directional printing. An industry standard.

\$1589

Zenith-Heath Data Systems Z-89 All-in-One Computer



Two Z80 processors, mini-floppy drives, 25X80 display, 16K expandable to 48K!

Call for Price!

North Star Horizon



Quad- or double-density, while they last! Plus, hard disk drives for expansive storage requirements.

Call for Price!

Prices subject to change without notice; products subject to availability.

TOLL-FREE 1-800-528-1418

commands. Type IV includes a class of command that raises the FD1771 interrupt line on a given condition.

The *restore* command causes the addressed drive to move the head to (or *seek*) track 0. When the *seek* command is executed, the addressed disk drive positions the read/write head over the track specified by the 8080A. The *step* command causes the drive to step the head one track in the direction previously selected. The *step-in* command causes the head to step one track toward track 35, the innermost track. With the *step-out* command, the head steps one track toward track 0.

A *read* command transfers a full sector of data, 1 byte at a time, from the disk to the 8080A. A *write* command transfers data for one sector from the microprocessor to the drive. A *read-track* command transfers all bytes of data on a track to the microprocessor. A *read-address* command transfers the next-encountered identification (ID) field to the microprocessor, places the sector address into the sector register, and checks the 2-byte cyclic-redundancy-check (CRC) field. During a *write-track* (format) command, the microprocessor must supply all gap, ID-field, and data bytes except for address marks and CRC bytes.

Data transfers between the 8080A and the floppy-disk drive can be performed using either direct memory access (DMA) or programmed I/O, both of which are supported by the FD1771. I chose programmed I/O, because it is the simpler method of the two, and because it is fast enough for single-density disk drives. With single-density recording, 1 byte is transferred every 64 μ s. An average 8080A instruction takes 5 to 6 μ s to execute, so that about ten instructions can be executed during the transfer time. This is enough time to gather the data and perform the required housekeeping functions.

Initializing the FD1771

Before the FD1771 can execute commands, it must be initialized. The program shown in listing 1 sets up the control ports of the 8255 PPI so that port A controls certain aspects of disk selection (as well as the *MASTER-RESET* (MR) pin of the FD1771); port B transmits the command, data, and status words for communication

between the 8255 and the FD1771; and port C controls data exchanges between the two devices. All commands and parameters come from the computer to the FD1771 through port B of the 8255. All data and status information from the disk to the computer uses the same path.

Data transfers can be performed with either direct memory access (DMA) or programmed input/output.

The initialization routine of listing 1 also checks the status of the FD1771 and initializes all the registers. The stack pointer is set to memory location hexadecimal 0BEF. For large applications, code for a disk-file library could be established in this routine as well.

Formatting the Disk

Formatting the disk is a matter of loading the track-address register with the point at which formatting is to begin, issuing the seek command which moves the head to that location, loading the data register with the format values, and issuing the write-track command to place that format on the disk.

Assuming that the formatting is to begin at track 0 on the disk, for example, a seek routine (such as the one given in listing 2) is executed. First, the seek routine places the track address (which is 0) on port B of the 8255. Then, holding line A0 high and A1 low (see table 1), the routine causes a write operation to the FD1771 to take place by holding the *READ-ENABLE* line (RE) high and pulling the *WRITE-ENABLE* line (WE) low. (See line 2 of table 1.) Similarly, the command code for a seek operation (hexadecimal 10) is placed on port B of the 8255 and is deposited into the command register of the FD1771 by holding both A0 and A1 low and causing a write operation to take place. When the FD1771 receives the command byte, it executes the seek command, ending with the read/write head in position over the appropriate track (here, track 0).

At the end of the operation, the FD1771 automatically raises the logic state on the interrupt line. At the same time, a byte of status information that indicates whether the command operation was successful is made available to the 8080A. Although the byte of status information does not *have* to be interpreted, the status register *must* be read before another operation can be performed. This is the purpose of the code marked "status handshake" in listing 2.

To format each track, the write-track command must be issued. This is done by placing the command byte for the write-track command (hexadecimal F4) on port B of the 8255, setting lines A0 and A1 low, and strobing the write-enable line with a high-to-low transition. Once this command is received, the FD1771 waits for an index pulse from the disk. The data register must then be filled with the contents of the entire track, 1 byte at a time. At the end of the track the disk drive sends the next index pulse, which causes an interrupt. To write the next track, a seek-to-track-1 operation is performed and another write-track command is issued.

Floppy Disk Format

Although the FD1771 permits non-IBM data-storage formats, I chose to use a modified version of the standard IBM format illustrated in figure 3. This is a 16-sector-per-track, 128-byte-per-sector format. In other words, each of the thirty-five tracks of the floppy disk contains sixteen records (see figure 3).

Each track starts with a gap, called G1, of 16 bytes, each containing the value hexadecimal FF. Next come sixteen records, each of which contains an identification (ID) field, a second gap (G2), a data field of 128 bytes, and an inter-record gap, G3, of 26 bytes. The track is finished with approximately 101 bytes of a final G4A gap field.

A 6-byte synchronization, or sync, section begins the identification field and is included to insure that the data separator is in phase with the data. The single-byte address mark (abbreviated as AM) field contains a unique character that defines the beginning of the ID2 section; here, it has a value of hexadecimal FE. The ID2 section

Text continued on page 100

"INTRODUCING THE HOTTEST THING OFF THE DRAWING BOARDS: A COMPUTER TRIO THAT TAKES YOU FROM SMALL TO BIG."

Geof Karlin
Director of Systems Development



If you're considering your first computing system, you need to know more than what it will do for you today. You need to know what it will do tomorrow.

Many businesses outgrow their first computer within a year or two. And when they do, they find their system is difficult if not impossible to add onto—because adding on requires a different manufacturer's equipment, different operating system, different programming languages.

At ADDS, we've just solved this problem with Multivision, a compact trio of stacking computers with ADDS' CP/M®-compatible, multi-user operating system. You can begin with one and expand as needed.

MULTIVISION 1 (top module) is a get-started computer with 5 MHz processor, 64K bytes of RAM (Random Access Memory) and floppy-disk storage capacity of 700K bytes. It's available with a wide range of business application software. We even offer our own word processing package. A fully loaded Multivision 1 is list-priced at \$3,785 without terminal.

MULTIVISION 2 (top and bottom modules) uses the new Winchester technology to provide 5M or 10M additional bytes of hard-disk storage. List-priced at \$7,995 for 5M bytes of disk, it is thousands less than other hard-disk systems.

MULTIVISION 3 (entire stack) turns your computer into a multi-user system with up to 256K bytes of RAM that supports up to four display terminals. It allows four different parts of your business—i.e., accounting, marketing, purchasing, and shipping—to share data and simultaneously use the system. No other microsystem offers so much for so little.

Before you decide upon any small computer, look into ADDS Multivision. For years we've been the largest supplier of display terminals to computer giants.

Now we're making a system for you.

For information, write: Systems Division, Applied Digital Data Systems Inc., 100 Marcus Boulevard, Hauppauge, N.Y. 11787. Dealer inquiries invited.

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

ADDS
Applied Digital Data Systems Inc.

**SOMETHING EXTRA IN
EVERYTHING WE DO**

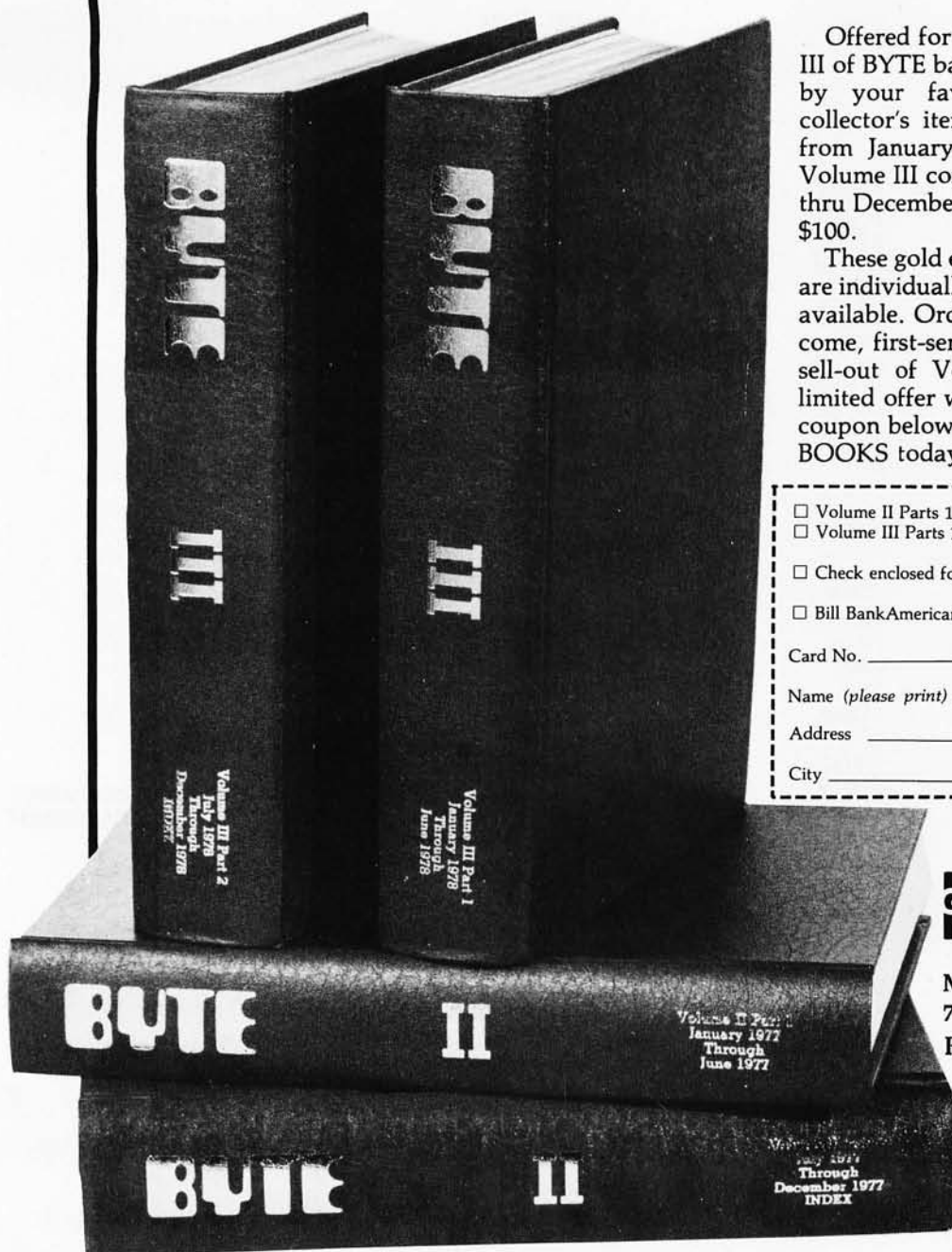
ADDS MULTIVISION

Listing 1: Program header and initialization routines. This routine initializes the 8255 programmable peripheral interface and sets the read/write head in the floppy-disk drive to track 0.

Hexadecimal Address	Hexadecimal Code	Label	Instruction Mnemonic and Operand	Commentary
		; INIT		
				; THIS PROGRAM IS DESIGNED TO PERFORM SEEKS,
				; READS, WRITES AND FORMATS USING THE
				; WESTERN DIGITAL FD1771 FLOPPY CONTROLLER
				; CHIP INTERFACED TO AN SA400 AND A 8080 MPU
0091		CTRL EQU 91H		
				; CONTROL WORD FORMAT:
				; MODE=0
				; PORTA=DATA PORT (INPUTS)
				; PORTB=STATUS AND COMMAND LINES (OUTPUTS)
				; PORTC=INPUTS, 0-3
				; PORTC=OUTPUTS, 4-7
8000		PORTA EQU 8000H		; PORT A ADDRESS
8001		PORTB EQU 8001H		; PORT B ADDRESS
8002		PORTC EQU 8002H		; PORT C ADDRESS
8003		CWR EQU 8003H		; CONTROL WORD ADDRESS
0520		CHARS EQU 520H		; COMMAND CHARACTERS
				ENTERED VIA CONSOLE
07D0		SEEK EQU 7D0H		; SEEK TRACK ROUTINE
0B10		READ EQU 0B10H		; READ SECTOR ROUTINE
0B80		WRITE EQU 0B80H		; WRITE SECTOR ROUTINE
0798		PIN EQU 798H		; PORT B SET AS INPUTS
				ROUTINE
		ORG 600H		
0600				; INITIALIZE THE PPI (POWER UP)
				; MR ALWAYS=1 AFTER INITIALIZATION
0600	31FF0B	INIT	LXI SP,0BFFH	; SET THE STACK
0603	CD9807		CALL PIN	; PORTB INPUTS
0606	210080		LXI H,PORTA	; PORTA ADRS
0609	3E01		MVI A,01H	; MR=0,DR SEL,MOT ON
060B	77		MOV M,A	; WRITE PORTA
060C	110280		LXI D,PORTC	; LOAD PORTC ADRS
060F	3E00		MVI A,0	; RE,WE=1
0611	12		STAX D	; WRITE PORTC
				; PPI INITIALIZATION DONE
				; RESTORE TO TRACK 0 IS AUTOMATIC
		TRK0		
0612	3E00		MVI A,00H	; MR=1
0614	77		MOV M,A	; WRITE PORTA
0615	3E08		MVI A,08H	; READ ENAB-STAT REG
0617	12		STAX D	; (RE=0) WRITE PORTC
0618	3A0180		LDA PORTB	; READ PORTB—GET
				STATUS
061B	4F		MOV C,A	; SAVE STAT REG
061C	3E00		MVI A,00H	; RE=1 (MR,WE=1)
061E	12		STAX D	; WRITE PORTC
061F	79		MOV A,C	; MOV STATUS TO A
0620	E604		ANI 4H	; GET TRAK 0 STATUS
0622	FE04		CPI 4H	; TRAK 0?
0624	CA1206		JZ TRKO	; NO
				; DRIVE NOW AT TRACK 0 — TEST READY
0627	79		MOV A,C	; RESTOR STATUS IN A
0628	E680		ANI 80H	; GET READY STATUS
062A	FE80		CPI 80H	; READY?
062C	CA3506		JZ INTERP	; YES GO TO IDLE LOOP
062F	010000		LXI B,0H	; ERROR CODE
0632	CD0007		CALL ERROR	

} PPI
INITIALIZE

LIMITED EDITION



Offered for the first time, Volumes II and III of BYTE back issues, packed with articles by your favorite authors, are a real collector's item. Volume II contains issues from January '77 thru December '77 and Volume III contains issues from January '78 thru December '78. Each volume is priced at \$100.

These gold embossed, hard-cover volumes are individually numbered with only 100 sets available. Orders will be handled on a first-come, first-served basis. Based on our quick sell-out of Volume I, we know that this limited offer will sell rapidly. So fill out the coupon below and rush your order to BYTE BOOKS today.

- ☐ Volume II Parts 1 and 2 (Jan '77 thru Dec '77) \$100.00
☐ Volume III Parts 1 and 2 (Jan '78) \$100.00

**BYTE
BOOKS**

☐ Check enclosed for _____

☐ Bill BankAmericard/Visa ☐ Bill Master Charge

Card No. _____ Exp. Date _____

Name (please print) _____

Address _____

City _____ State _____ Zip _____



Mail to: BYTE Books, Inc.
 70 Main Street
 Peterborough N.H. 03458

Listing 2: Seek routine. This routine causes the read/write head to go to (or seek) the track specified by a 2-digit number entered from the system console.

Hexadecimal Address	Hexadecimal Code	Label	Instruction Mnemonic and Operand	Commentary
			;THIS ROUTINE IS DESIGNED TO SEEK THE ;DRIVE TO A TRACK SPECIFIED BY THE 3RD & 4TH ;CHARACTERS ENTERED BY AN OPERATOR.	
	8000	PORTA	EQU 8000H	;PORT A ADDRESS
	8001	PORTB	EQU 8001H	;PORT B ADDRESS
	8002	PORTC	EQU 8002H	;PORT C ADDRESS
	0793	POUT	EQU 793H	;PORT B SET AS OUTPUTS ROUTINE
	0798	PIN	EQU 798H	;PORT B SET AS INPUTS ROUTINE
	0769	STATUS	EQU 769H	;ROUTINE, CONVERTS STATUS TO ASCII PRINTABLE DATA
	0520	CHARS	EQU 0520H	;COMMAND CHARACTERS ENTERED VIA CONSOLE.
			;	
	07D0		ORG 7D0H	;
			;	
			;FORM THE TRACK ADDRESS FROM THE 3RD & 4TH ;CHARACTERS. 4TH CHARACTER MIGHT BE NEGATIVE ;IF ONLY ONE CHAR WAS ENTERED.	
			;	
07D0	2A2205	SEEK	LHLD CHARS+2	;GET BOTH CHARS
07D3	7C		MOV A,H	;XFR LS CHAR
07D4	B7		ORA A	;TERM ?
07D5	F2DC07		JP TWO	;NO
07D8	7D		MOV A,L	;LOAD SINGLE CHAR
07D9	C3E207		JMP NEWTRK	;YES
07DC	7D	TWO	MOV A,L	;XFR MS CHAR
07DD	07		RLC	;SHIFT TO MS POSITION
07DE	07		RLC	
07DF	07		RLC	
07E0	07		RLC	
07E1	84		ADD H	;MERGE CHARS
			;NOW PUT NEW TRACK ADDRESS IN FDC DATA REGISTER	
			;	
07E2	322008	NEWTRK	STA TRACK	;SAVE TRACK ADDRESS
07E5	CD9307		CALL POUT	;PORTB=OUTPUTS
07E8	210280		LXI H,PORTC	;GET PORT C ADRS
07EB	0603		MVI B,03H	;A0,A1=1
07ED	70		MOV M,B	;WRITE PORTC
07EE	3A2008		LDA TRACK	;TRAK ADRS
07F1	2F		CMA	;INVERT FOR WD BUS
07F2	320180		STA PORTB	;WRITE PORTB
07F5	0607		MVI B,07H	;WRITE TO DATA REG
07F7	70		MOV M,B	;WRITE PORTC
07F8	0600		B,00H	
07FA	70		MOV M,B	;WRITE PORTC
			;	
			;INITIATE SEEK COMMAND	
			;	
07FB	3E1F		MVI A,1FH	;SEEK 40 MS STEP
07FD	2F		CMA	
07FE	320180		STA PORTB	;WRITE PORTB
0801	0604		MVI B,04H	;WRITE TO CMD REG
0803	70		MOV M,B	;WRITE PORTC
0804	0600		MVI B,00H	;RE,WE = 1
0806	70		MOV M,B	;WRITE PORTC
			;	
			;WAIT FOR END OF SEEK — THEN REPORT STATUS	
			;	

**COMMAND
HANDSHAKE**

Listing 2 continued on page 92

MICROSOFT. NOBODY DOES IT BETTER.

In 1975, Microsoft wrote the first BASIC interpreter for the 8080. Today, hundreds of thousands of microcomputers run with Microsoft software. And tomorrow—a full line of system software for the 8086 and Z8000. With microcomputer software, nobody does it better.

BASIC Compiler Microsoft's BASIC compiler is the ideal software tool for the development of BASIC applications programs for resale. Compiled object code for any application may be distributed to your customers on diskette or ROM, thus safeguarding the source program. And execution speeds with our compiled BASIC code are faster than with any other BASIC. Highly optimized, compact object code means maximum efficiency in any application. The BASIC Compiler supports all the language features of our BASIC-80 Interpreter. Comes with macro assembler and loader. Runs with CP/M, ISIS-II, TRSDOS. \$395.

BASIC Interpreters for 8080, Z80, 8086, 6800, 6809 Language features above and beyond any other BASIC have made Microsoft's BASIC the world's most popular interpreter. And now three new versions are available for the 8086, 6800, and 6809. The latest releases of BASIC-80 and BASIC-86 support the new WHILE conditional, plus CHAINing of programs with COMMON variables, dynamic string space allocation and variable length records in random files. All versions have double precision arithmetic, full PRINT USING, tracing, renumbering, edit mode, and many other features. BASIC-80 for CP/M, ISIS-II, TEKDOS: \$350. BASIC-86 standalone on SBC 86/12: \$600. BASIC-68 for FLEX: \$200. BASIC-69 for FLEX: \$250.

COBOL-80 Compiler The best implementation of the world's most widely used programming language is COBOL-80 from Microsoft. As small business applications become not-so-small, COBOL-80 is ready with powerful use of disk files, data manipulation facilities, CHAIN, segmentation and interactive ACCEPT/DISPLAY. Plus three-dimensional arrays, full COPY facility, indexed and relative files and an optional packed decimal format that saves on mass storage by as much as 40%. Comes with macro assembler and loader. Runs on CP/M, ISIS-II, and TRSDOS. \$750.

NEW! muSIMP/muMATH-79

At last, a sophisticated math package for microcomputers. muMATH performs mathematical operations efficiently and accurately. Use it to solve equations and simplify formulas; or perform exact arithmetic, symbolic integration and differentiation, infinite precision integer arithmetic and symbolic matrix inversion. muMATH is an invaluable tool for engineering and scientific applications involving lengthy, analytical computations. It is also an ingenious teaching method for all levels of math from arithmetic to calculus. muMATH is implemented in muSIMP, a highly structured language for complex symbolic manipulations. muSIMP/muMATH Package, CP/M versions: \$250.

NEW! muLISP-79

LISP—the lingua franca of the artificial intelligence world—is now available in this efficient, low-cost version for microcomputers. Features include dynamic allocation of storage resources; program control structures such as an extended COND and a multiple exit LOOP; user functions defined as CALL by Value or CALL by Name; and 83 LISP functions. muLISP-79, CP/M version: \$200.

NEW! XMACRO-86 For the development of 8086 programs, our new XMACRO-86 cross assembler has just been released. It supports the same features as our MACRO-80 assembler. Develop 8086 programs now on your current CP/M, ISIS-II, or TEKDOS system. \$300.

NEW! Micro-SEED DBMS If you are developing applications software in-house or bundling hardware and software for resale, a database manager could be the software tool you've been looking for. Micro-SEED is the first CODASYL compatible database management system to run with CP/M; and Microsoft's FORTRAN-80 has been implemented as the host language. When an application becomes limited by traditional floppy disk file handling, but remains overpowered by the cost and maintenance of a minicomputer, the solution is Micro-SEED. \$900.

FORTRAN-80 Compiler Microsoft FORTRAN-80 is the most complete microcomputer FORTRAN available. It has all of ANSI-66 FORTRAN (except COMPLEX data), plus unique enhancements for use in the microcomputer environment. An extensive library of single and double

precision scientific functions, too. Comes with macro assembler and loader. Versions for CP/M, ISIS-II, TEKDOS. \$500.

MACRO-80 Assembler The most powerful microcomputer assembler on the market today is Microsoft's MACRO-80. It is fast, and it supports Intel-standard macros, relocation pseudo-ops, conditionals and listing controls. MACRO-80 comes with a relocatable linking loader and runs with CP/M, ISIS-II, and TEKDOS. \$200.

EDIT-80 Text Editor Random access to floppy disk files makes EDIT-80 the fastest microcomputer text editor. It's the essential tool for creating and maintaining all files. EDIT-80 includes FILCOM, a file compare utility. EDIT-80, CP/M version: \$120. Prices quoted are USA domestic only. OEMs should contact Microsoft for prices.

MICROSOFT OS	CP/M	ISIS-II	TRSDOS	TRSDOS Md II	TEKDOS
BASIC-80 INTERPRETER	●	●	■	■	●
BASIC COMPILER	●	●	□	●	
FORTRAN-80 COMPILER	●	●	□	■	●
COBOL-80 COMPILER	●	●		●	
muMATH/muSIMP muLISP	●		□		
MICROSEED DBMS	●				
EDIT-80 TEXT EDITOR	●		□	■	
MACRO-80 ASSEMBLER	●	●	□	■	●

● contact Microsoft ■ contact Manufacturer
□ contact Microsoft Consumer Products

MICROSOFT

10800 NE 8th, Suite 819
Bellevue, WA 98004
206-455-8080 Telex 328945



We set the standard.

FOR THE VERY BEST IN NORTHSTAR® COMPATIBLE SOFTWARE

DATA BASE MANAGERS SPECIAL!! \$10.00 OFF of Selector-III C2

SELECTOR-III C2: SuperSoft is proud to offer the Selector-III C2 at a special \$10.00 discount. Selector III allows instant recall of any record using any information item in the record. This makes Selector-III the most powerful Data Base Management System in micro-computers today! You can define a data format and begin entering your data in minutes. Helps bring applications on line in hours instead of months. (Note: Selector-III C2 requires CP/M and C BASIC-2, not supplied - also 48K Ram required for some applications) Selector-III C2 is: \$335.00 (\$10.00 off list!). (Manual alone: \$20.00)

INSURANCE AGENTS

CRS - Client Record System. A complete program package for the Insurance agent. CRS will provide you with very fast online access to your client records, print reports and mail labels, and give you all the information you will need to increase your sales through the use of CRS as a MARKETING TOOL.

CRS stores a complete record for each client that includes the name, address, telephone #, as well as provisions for customer #, salesman # and up to six policies (expandable, if needed). Write for details.

CRS comes with two(2) user's manuals, one for the owner, and one for office personnel (minimal system: one drive, 40K RAM starting 2000H) \$250.00 (Manual: \$40.00)

TEXT PROCESSORS

TFS - Text Formatting System. At last a full featured text processor for NorthStar that you can rely on! TFS has left & right margin justification, page numbering, chaptering, page headings, centering, paged output & MORE. Supports powerful text manipulation including: global & local 'search and change,' file merges and block moves. This means that you can restructure your text file at any time to look the way you want it to, you can even 'chain' files together from disk for documents larger than your current memory.

TFS is completely 'load and go' therefore you can start using it at once. You get two(2) user's manual: one is a Quick Start manual to get you going in minutes, the other is an in depth study of TFS. (TFS requires RAM from 0000H to 2000H) \$75.00 (Manual only: \$20.00)

SPEECH SYNTHESIZER SOFTWARE

'ANGLOPHONE' - Lets any 8080/280 computer convert ordinary English into phonetic codes to drive Votrax, computalker, and TRS-80 Voice synthesizers. This is a hardworking, tested program suitable for use in the most demanding situations. (Details below). Inquire for specific prices and media.

SPECIFY SINGLE OR DOUBLE DENSITY

TRS-80 COMPATIBLE SOFTWARE

'Tiny' Pascal FOR TRS-80

Now you too can have Pascal! The famous Chung/Yuen 'tiny' Pascal has been specially designed for the TRS-80! The full power and elegance of 'tiny' Pascal is at your command. Programs written in 'tiny' Pascal run at least 4 times faster than the same program in BASIC! 'tiny' Pascal is also a great way to learn Pascal programming, & fun too.

Best of all, you only need a 16K Level II TRS-80! No disk is required. The 'tiny' Pascal operating system is self-contained and very easy to use.

'Tiny' Pascal is a subset of standard Pascal & includes: RECURSIVE PROCEDURE/FUNCTION, IF THEN ELSE REPEAT/UNTIL, 'PEEK' & 'POKE', WHILE DO, CASE, MORE! (Plus full graphics for your TRS-80).

You can save and load programs to and from tape in both source or compiler form. You get all this and more, plus a user's manual for \$40.00

SPEECH SYNTHESIZER SOFTWARE

'ANGLOPHONE': At last you can take complete advantage of your TRS-80 voice synthesizer. Forget about cumbersome phonetic codes. With 'Anglophone' you can simply use ordinary English. Completely interfaces with BASIC, or just about any other programming language. 'Anglophone' applies sophisticated pronunciation rules to transform normal English spelling into speech using the TRS-80 Voice Synthesizer. Minimum hardware: Level II, 16K, Voice Synthesizer. Comes complete with user's manual and test program.\$45.00



ALL ORDERS PREPAID OR C.O.D.
ILLINOIS RESIDENTS ADD 5% SALES TAX
(217) 344-7596

COMPUTER AIDED INSTRUCTION

M I S S - Microcomputer Instructional Support System. A complete, self-contained CAI package applicable to home, school or business education. Includes everything needed to create a sophisticated computer learning environment. MISS allows one to create any type lesson complete with wrong answer branching, re-test, and complete record keeping. The student is prompted 100% of the way and need have no special knowledge. A special feature is the optional use of a unique algorithm which separates spelling errors from incorrect responses. Absolutely no programming knowledge is required. MISS is completely interactive and maintains complete records on any number of students and lessons (limited only by disk space). MISS is a completely flexible system that will allow you to either create lessons or to purchase pre-programmed lessons which run under MISS. Complete with user's manual....\$40.00 (Manual alone: \$10.00)

ASSEMBLERS

ARIAN - A complete 8080 assembler that interfaces directly to your DOS. ARIAN is completely 'load and go'. Features include: dynamic file and RAM allocation, custom disk and RAM command capability, several library routines directly accessible by the user. Also, a complete text editor, and system executive. ARIAN is both powerful and easy to learn and use; it is an assembler that you can grow with. Comes complete with a 51 page user's manual (ARIAN requires RAM from 0000H to 2000H) \$50.00 (Manual alone: \$10.00)

ARIAN Utility Package - Several disk based utilities. Includes a complete DEBUG Package: \$50.00

PROGRAMMING LANGUAGES

'Tiny' Pascal - This is famous Chung/Yuen 'tiny' Pascal. FAST - ELEGANT - STRUCTURED. Local and global variables plus procedure and function independence make 'tiny' Pascal great for high speed applications. Compiles to 8080 code that executes up to 25 times faster than BASIC. You also receive SOURCE to 'tiny' Pascal written in Pascal. This means that you can compile the compiler! Add features, relocate, etc. (you will need 36K to do this) \$40.00

UTILITIES

D E B E - (Does Everything But Eat!) This is a must for NorthStar user's. You can: COMPACT & EXPAND BASIC programs. Compacting removes unnecessary spaces and remarks. This saves money and makes programs run faster. Expanding puts them back again.

Cross-reference BASIC programs by variables and transfer statements.

Global substitutions of variables and transfer statements.

Formatted print outs of BASIC programs as well. \$40.00

Energy-Miser

Energy-Miser is a complete heating/cooling analysis program for your home, office or business! With Energy-Miser you can calculate heat loss because of poor insulation, leaky doors and windows, poor planning and more. With Energy-Miser you can predict the annual savings on your utility bills for various improvements or modifications, including: use of solar power, better insulation, opening and closing drapery, etc.

But there is even more: Energy-Miser can also calculate your Return on Investment. That is, you can find your break point for converting to solar, for insulating better, etc. Energy-Miser even takes into consideration the Energy Tax Credit! Energy-Miser is a program designed to save you money!

Energy-Miser is a proven program written by a professional and includes a complete user's manual for \$22.50. (Minimum System 16K Level II, No Disk Required)

'TALKING TERMINAL': The 'Talking Terminal' program turns a TRS-80 into a talking computer terminal. The 'Talking Terminal' program receives input from a remote computer and converts it to spoken words. Its many user options include: Instant Replay, spelled speech, silent or pronounced punctuation, and more. Minimum hardware: Level II, 16K, Voice Synthesizer, RS-232C board and expansion interface.\$145.00

SUPERSOFT

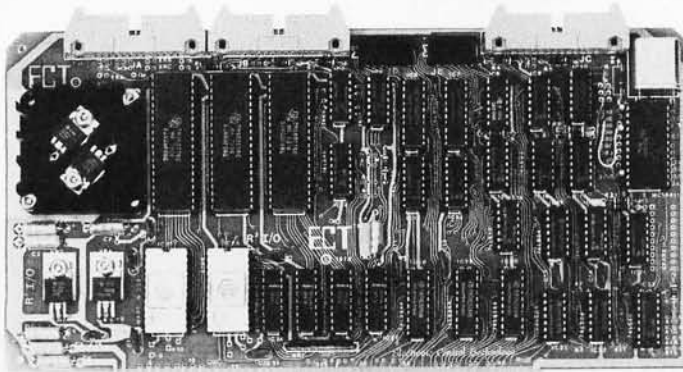
P.O. Box 1628
Champaign, IL 61820

Listing 2 continued:

0807	CD9807		CALL PIN	
080A	7E	WAIT	MOV A,M	;WAIT FOR END OF SEEK
080B	E640		ANI 40H	
080D	CA0A08		JZ WAIT	
0810	3E08		MVI A,08H	;STAT REG READ
0812	77		MOV M,A	;WRITE PORTC
0813	3A0180		LDA PORTB	;BRING STATUS
0816	0600		MVI B,00H	;RE,WE=1
0818	70		MOV M,B	;WRITE PORT B
0819	2F		CMA	;INVERT
081A	E618		ANI 18H	;SEEK AND CRC BITS
081C	CD6907		CALL	;REPORT TO CONSOLE
			STATUS	
081F	C9		RET	
0820	00	TRACK	BYTE 0	
	07D0		END SEEK	

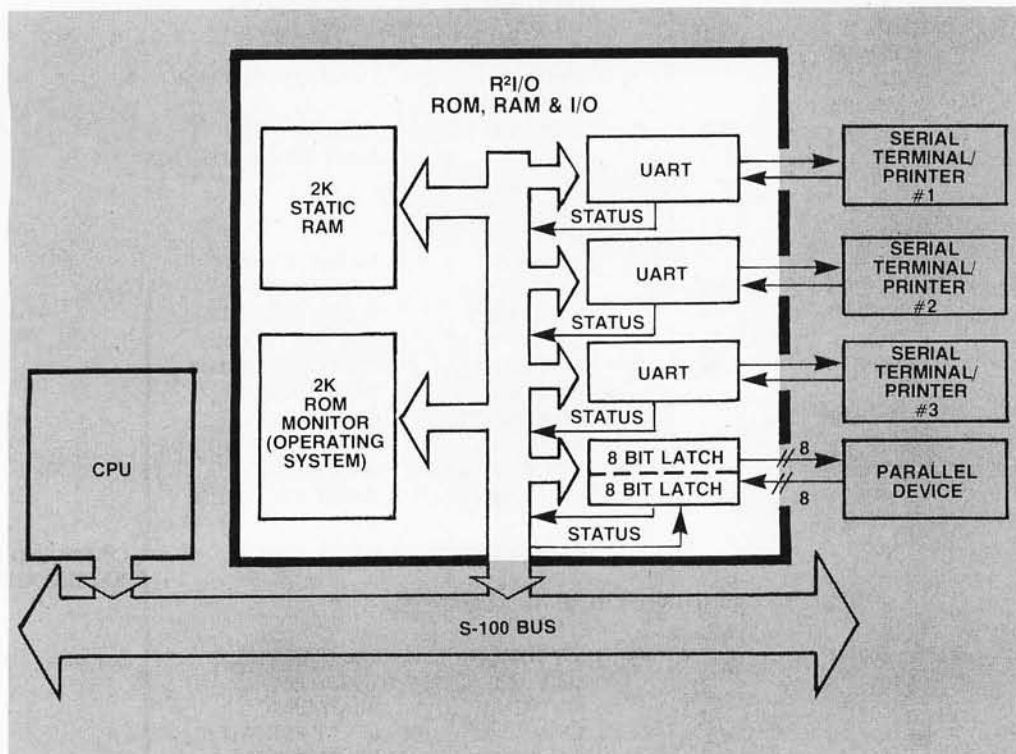
**STATUS
HANDSHAKE**

ECT R²I/O... The S-100 ROM, RAM & I/O Board



- S-100 BUS
- 2K ROM
- 2K RAM
- ROM Monitor (Operating System)
- 3 Serial I/O Ports
- 1 Parallel I/O Port
- 4 Status Ports

ELECTRONIC CONTROL TECHNOLOGY's R²I/O is an S-100 Bus I/O Board with 3 Serial I/O Ports (UART's), 1 Parallel I/O Port, 4 Status Ports, 2K of ROM with Monitor Program and 2K of Static RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as - CRT terminals, line printers, modems or other devices, to an S-100 Bus Microcomputer or dedicated controller. It also provides for convenient Microcomputer system control from a terminal keyboard with the 8080 Apple ROM monitor containing 26 Executive Commands and I/O routines. It can be used in dedicated control applications to produce a system with as few as two boards, since the R²I/O contains ROM, RAM and I/O. The standard configuration has the Monitor ROM located at F000 Hex with the RAM at F800 Hex and the I/O occupies the first block of 8 ports. Jumper areas provide flexibility to change these locations, within reason, as well as allow the use of ROM's other than the 2708 (e.g. 2716 or similar 24 pin devices). Baud rates are individually selectable from 75 to 9600. Voltage levels of the Serial I/O Ports are RS-232.



8080 APPLE MONITOR COMMANDS

- A - Assign I/O
- B - Branch to user routine A-Z
- C - Undefined
- D - Display memory on console in Hex
- E - End of file tag for Hex dumps
- F - Fill memory with a constant
- G - GOTO an address with breakpoints
- H - Hex math sum & difference
- I - User defined
- J - Non-destructive memory test
- K - User defined
- L - Load a binary format file
- M - Move memory block to another address
- N - Nulls leader/trailer
- O - User defined
- P - Put ASCII into memory
- Q - Query I/O ports: QI (N)-read I/O; QO(N,V)-send I/O
- R - Read a Hex file with checksum
- S - Substitute/examine memory in Hex
- T - Types the contents of memory in ASCII equivalent
- U - Unload memory in Binary format
- V - Verify memory block against another memory block
- W - Write a checksummed Hex file
- X - Examine/modify CPU registers
- Y - 'Yes there' search for 'N' Bytes in memory
- Z - 'Z END' address of last R/W memory location

ECTTM

*Specializing in Quality Microcomputer Hardware
Building Blocks for Microcomputer Systems, Control and Test Equipment
Card Cages, Power Supplies, Mainframes, CPU's, Memory, I/O*

ELECTRONIC CONTROL TECHNOLOGY

763 Ramsey Ave., Hillside, N.J. 07205

(201) 686-8080

Listing 3: Read-sector routine. This routine causes the contents of a given sector of the current track (specified by a 2-digit number entered from the system console) to be transferred from the disk drive to an area of memory starting at the location given by the value of DATBUF, using decreasing memory addresses.

Hexadecimal Address	Hexadecimal Code	Label	Instruction Mnemonic and Operand	Commentary
			;READ READ SECTOR ROUTINE	
			;	
			;READ SECTOR ROUTINE INITIATES THE READ	
			;COMMAND AND TRANSFERS ALL THE DATA FOR A	
			;SELECTED SECTOR TO THE BOTTOM OF MEMORY	
			;BEGINNING AT LOCATION 5FF	
			;R,XX READ SECTOR, SECTOR ADRS	
	8000	PORTA	EQU 8000H	;PORT A ADDRESS
	8001	PORTB	EQU 8001H	;PORT B ADDRESS
	8002	PORTC	EQU 8002H	;PORT C ADDRESS
	0793	POUT	EQU 793H	;PORT B SET AS OUTPUTS ROUTINE
	0798	PIN	EQU 798H	;PORT B SET AS INPUTS ROUTINE
	0769	STATUS	EQU 769H	;ROUTINE CONVERTS STATUS TO
				ASCII PRINTABLE DATA
	05FF	DATBUF	EQU 5FFH	;BEGINNING ADRS OF "READ"
				DATA BUFFER
	0520	CHARS	EQU 520H	;COMMAND CHARACTERS ENTERED
				VIA CONSOLE
			;	
	0B10		ORG 0B10H	
			;	
0B10	2A2205	READ	LHLD CHARS+2	;GET BOTH CHARS
0B13	7C		MOV A,H	;XFER LS CHAR
0B14	B7		ORA A	;TERM?
0B15	F21C0B		JP TWO	;NO
0B18	7D		MOV A,L	;LOAD SINGLE CHAR
0B19	C3220B		JMP SECTOR	
0B1C	7D	TWO	MOV A,L	;XFER MS CHAR
0B1D	07		RLC	;SHIFT TO MS POSITION
0B1E	07		RLC	
0B1F	07		RLC	
0B20	07		RLC	
0B21	84		ADD H	;MERGE CHARS
0B22	327C0B	SECTOR	STA SECSTR	;STOR SECTOR
0B25	CD9307		CALL POUT	;PORTB OUTPUTS
0B28	210280		LXI H,PORTC	;GET PORTC ADRS
0B2B	0602		MVI B,02H	;SECTOR REGISTER
0B2D	70		MOV M,B	;WRITE PORTC
0B2E	3A7C0B		LDA SECSTR	;SECTOR ADRS
0B31	2F		CMA	;INVERT FOR WD BUS
0B32	320180		STA PORT B	;WRITE PORTB
0B35	0606		MVI B,06H	;WRITE TO SECTOR
			REG	
0B37	70		MOV M,B	;WRITE PORTC
			;	
			;INITIATE THE READ COMMAND	
			;	
0B38	0600		MV B,0	;SEL CMD REG
0B3A	70		MOV M,B	;WRITE PORTC
0B3B	3E88		MVI A,88H	;READ CMD
0B3D	2F		CMA	;INVRT FOR WD BUS
0B3E	320180		STA PORTB	;WRITE PORTB
0B41	0604		MVI B,04H	;ISSUE READ TO
				CMD REG
0B43	70		MOV M,B	;WRITE PORTC
			;	
			;WAIT FOR END OF READ — THEN REPORT	
			;	

**COMMAND
HANDSHAKE**






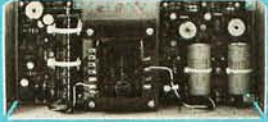

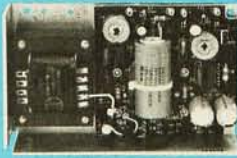
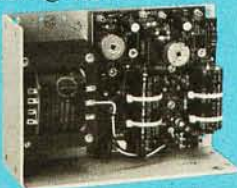
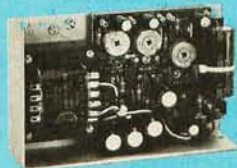


Listing 3 continued on page 96

POWER-ONE D.C. POWER SUPPLIES

Now available for small systems applications

Power-One, the leader in quality open-frame power supplies, now offers a complete line of single, dual, and triple output models for small computer systems. Also available are special purpose models for Floppy Disk and Microcomputer applications.

Below are just a few popular examples of the over 90 "off the shelf" models now available from stock.

SINGLE OUTPUT & LOGIC POWER SUPPLIES <ul style="list-style-type: none"> • 56 "off the shelf" models • 2V to 250V, 0.1A to 40A • $\pm .05\%$ regulation • 115/230 VAC input 	5V @ 3A, w/OVP  HB5-3/OVP \$24.95 single qty.	5V @ 12A, w/OVP  HD5-12/OVP \$79.95 single qty.	5V @ 40A, w/OVP NEW  SK5-40/OVP Switching Model \$250.00 single qty.
FLOPPY-DISK SERIES <ul style="list-style-type: none"> • 8 "off the shelf" models • Powers most popular drives • Single/dual drive applications • 2-year warranty 	5V @ 0.7A, w/OVP NEW 12V @ 1.1A/1.7A PK  CP340 For one 5.25" Media Drive \$44.95 single qty.	5V @ 1A, w/OVP -5V @ 0.5A, w/OVP 24V @ 1.5A/1.7A PK  CP205 For one 8.0" Media Drive \$69.95 single qty.	5V @ 2.5A, w/OVP -5V @ 0.5A, w/OVP 24V @ 3A/3.4A PK  CP206 For two 8.0" Media Drives \$91.95 single qty.
DUAL OUTPUT MODELS <ul style="list-style-type: none"> • 15 "off the shelf" models • $\pm 5V$ to $\pm 24V$, 0.25A to 6A • I.C. regulated • Full rated to $+50^{\circ}C$ 	12V/15V @ 0.25A NEW  HAD12-.25/HAD15-.25 \$32.95 single qty.	5V @ 2A, w/OVP 9 - 15V @ 0.5A  HAA512 \$44.95 single qty.	$\pm 12V$ @ 1.7A or $\pm 15V$ @ 1.5A  HBB15-1.5 \$49.95 single qty.
TRIPLE OUTPUT MODELS <ul style="list-style-type: none"> • 10 "off the shelf" models • 5V plus $\pm 9V$ to $\pm 15V$ outputs • Models from 16W to 150W • Industry standard size 	5V @ 2A, w/OVP $\pm 9V$ to $\pm 15V$ @ 0.4A  HTAA-16W \$49.95 single qty.	5V @ 3A, w/OVP $\pm 12V$ @ 1A or $\pm 15V$ @ 0.8A  HBAA-40W \$69.95 single qty.	5V @ 6A, w/OVP $\pm 12V$ @ 1.7A or $\pm 15V$ @ 1.5A  HCBB-75W \$91.95 single qty.



NEW 80' CATALOG!

Get Your FREE Copy Now!

Phone us direct or circle the reader service number below.

1 **Power-one** INC.
D.C. POWER SUPPLIES



Power One Drive • Camarillo, CA 93010 • (805) 484-2806 • TWX 910-336-1297

Listing 3 continued:

0B44	0603		MVI B,03H	;SEL DATA REG	} DATA TRANSFER SEQUENCE
0B46	70		MOV M,B	;WRITE PORTC	
0B47	CD9807		CALL PIN	;PORTB = INPUTS	
0B4A	11FF05		LXI D,DATBUF	;FWA OF DATA	
0B4D	0603		MVI B,03H	;RE,WE=1	
0B4F	C35C0B		JMP DLOOP		
0B52	3E0B	GD	MVI A,0BH	;RE=0	
0B54	77		MOV M,A	;WRITE PORTC	
0B55	3A0180		LDA PORTB	;GET DATA	
0B58	2F		CMA	;INVERT DATA	
0B59	12		STAX D	;SAVE IT	
0B5A	1B		DCX D	;BUMP INDEX	
0B5B	70		MOV M,B	;RE=1,PORTC	
0B5C	7E	DLOOP	MOV A,M	;GET STATUS PORTC	
0B5D	B7		ORA A	;DRQ=1?	
0B5E	FA520B		JM GD	;YES	
0B61	E640		ANI 40H	;INTRQ SET?	
0B63	CA5C0B		JX DLOOP	;NO	
;READ DONE — GET STATUS					
0B66	3E00		MVI A,0	;ADRS STAT REG	} STATUS HANDSHAKE
0B68	77		MOV M,A	;WRITE PORTC	
0B69	3E08		MVI A,08H	;STROBE RE=0	
0B6B	77		MOV M,A	;WRITE PORTC	
0B6C	EB		XCHG		
0B6D	227E0B		SHLD ISAVE	;SAVE INDEX TO DATA	
0B70	EB		XCHG	;RESTOR PORTC ADRS	
0B71	3A0180		LDA PORTB	;GET STAT BYTE	
0B74	0600		MVI B,0	;STAT HANDSHAKE	
0B76	70		MOV M,B	;WRITE PORTC	
0B77	2F		CMA	;INVERT STAT BYTE	
0B78	CD6907		CALL STATUS	;REPORT STATUS	
0B7B	C9		RET		
0B7C	0000	SECSTR	WORD 0	;SECTOR ADRS	
0B7E	0000	ISAVE	WORD 0	;DATA INDEX STORAGE AREA	
	0B10		END READ		

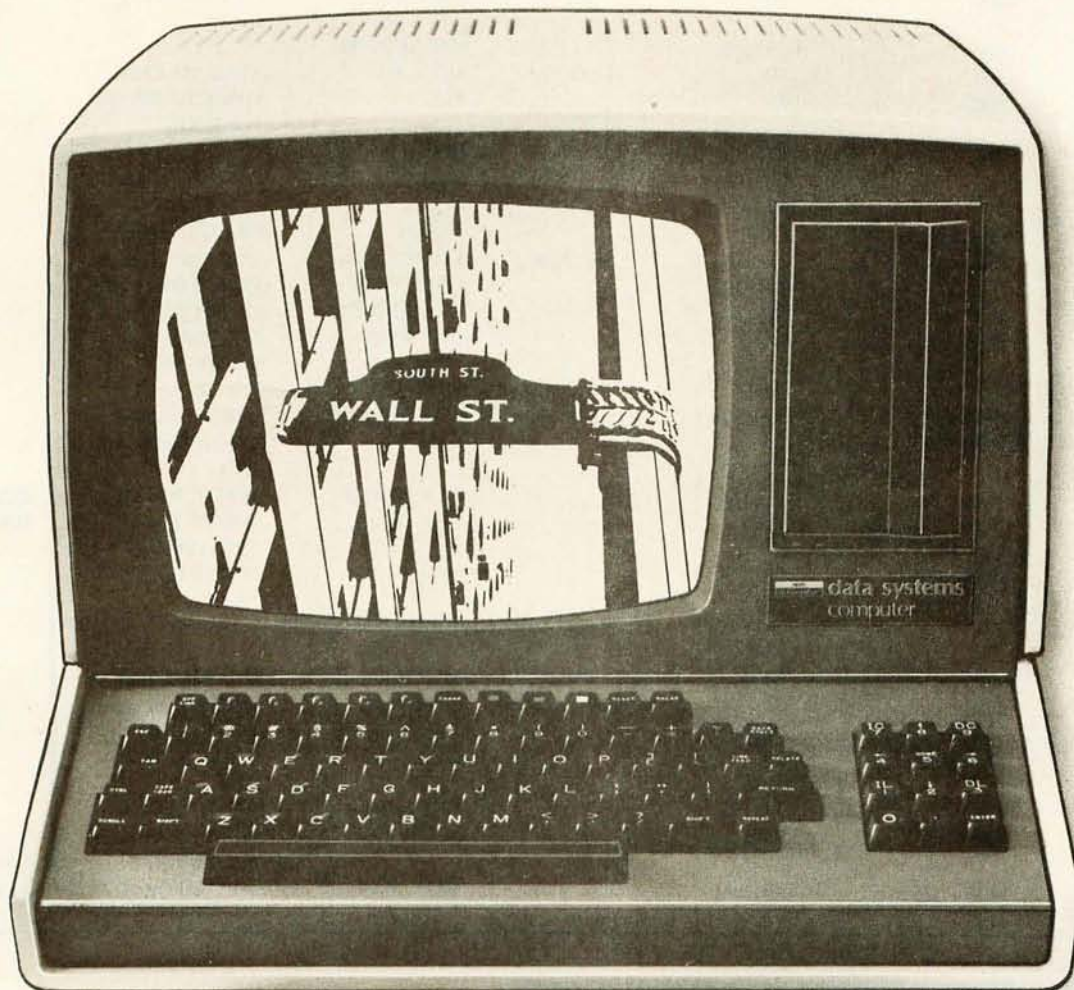
Listing 4: Write-sector routine. This routine causes a section of memory to be written to a given sector on the disk. The sector number is specified by a 2-digit number entered from the system console.

Hexadecimal Address	Hexadecimal Code	Label	Instruction Mnemonic and Operand	Commentary
			;WRITE WRITE SECTOR ROUTINE	
			;WRITE SECTOR ROUTINE INITIATES THE WRITE ;COMMAND AND TRANSFERS ALL THE DATA FOR A ;SELECTED SECTOR	
			;W,XX = WRITE SECTOR,SECTOR ADRS	
8000	PORTA		EQU 8000H	;PORT A ADRS
8001	PORTB		EQU 8001H	;PORT B ADRS
8002	PORTC		EQU 8002H	;PORT C ADRS
0793	POUT		EQU 793H	;PORT B SET AS OUTPUTS ROUTINE
0798	PIN		EQU 798H	;PORT B SET AS INPUTS ROUTINE
0769	STATUS		EQU 769H	;ROUTINE CONVERTS STATUS TO ASCII PRINTABLE DATA
0520	CHARS		EQU 520H	;COMMAND CHAR-

Listing 4 continued
on page 98

MicroQuote

Your personal computer becomes
a window on Wall Street.



MicroNET, the personal computer service of CompuServe, now offers MicroQuote, a comprehensive securities information system.

With MicroQuote you can gain information from a data bank of over 32,000 stocks, bonds and options from the New York, American, OTC and major regional markets plus Chicago options. MicroQuote contains price and volume data from January, 1974 with cumulative adjustment factors and dividend information from January, 1968.

You can determine indicated annual dividends, earnings per share, shares outstanding, BETA factors, open interest on options and amount outstanding on debt issues. MicroQuote can provide issue histories on a daily, weekly or monthly basis and even performs certain statistical analyses on the data. It's a vital tool for any investor.

It's just part of the MicroNET service

MicroNET also allows error-free downloading of software via the new software exchange and executive programs (now available for the TRS-80,* Apple II* and CP/M* systems). It also provides electronic

mail service and can be accessed with a 300 baud modem via local phone calls in more than 175 U.S. cities. Write for full details on how your microcomputer can control one of the nation's largest and most sophisticated time-sharing computer centers for about 8 cents a minute!

TRS-80 is a registered trademark of Tandy Corporation
Apple II is a registered trademark of Apple Computer, Inc.
CP/M is a registered trademark of Digital Research

Regional distributors and local dealers wanted.
Inquire to Dept. R

Software authors: MicroNET seeks to license quality programs for software exchange. Write to Dept. S

MicroNET

Mail to:
CompuServe

Dept: B
Personal Computing Division
5000 Arlington Centre Blvd.
Columbus, Ohio 43220

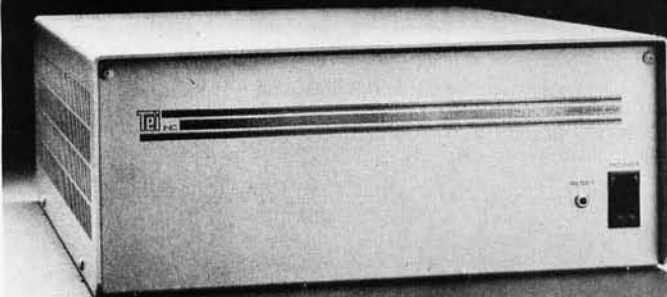
	0B80	:	ORG 0B80H	
0B80	2A2205	READ	LHLD CHARS +2	;GET BOTH CHARS
0B83	7C		MOV A,H	;XFER LS CHAR
0B84	B7		ORA A	;TERM?
0B85	F28C0B		JP TWO	;NO
0B88	7D		MOV A,L	;LOAD SINGLE CHAR
0B89	C3920B		JMP SECTOR	
0B8C	7D	TWO	MOV A,L	;XFER MS CHAR
0B8D	07		RLC	;SHIFT TO MS POSITION
0B8E	07		RLC	
0B8F	07		RLC	
0B90	07		RLC	
0B91	84		ADD H	;MERGE CHARS
0B92	32E50B	SECTOR	STA SECSTR	;STOR SECTOR
0B95	CD9307		CALL POUT	;PORTB OUTPUTS
0B98	210280		LXI H,PORTC	;GET PORTC ADRS
0B9B	0602		MVI B,02H	;SECTOR REGISTER
0B9D	70		MOV M,B	;WRITE PORTC
0B9E	3AE50B		LDA SECSTR	;SECTOR ADRS
0BA1	2F		CMA	;INVERT FOR WD BUS
0BA2	320180		STA PORTB	;WRITE PORTB
0BA5	0606		MVI B,06H	;WRITE TO SECTOR REG
0BA7	70		MOV M,B	;WRITE PORTC
		:		
		;INITIATE THE READ COMMAND		
		:		
0BA8	0600		MVI B,O	;SEL CMD REG
0BAA	70		MOV M,B	;WRITE PORTC
0BAB	3EA8		MVI A,0A8H	;WRITE CMD
0BAD	2F		CMA	;INVRT FOR WD BUS
0BAE	320180		STA PORTB	;WRITE PORTB
0BB1	0604		MVI B,04H	;ISSUE READ TO CMD REG
0BB3	70		MOV M,B	;WRITE PORTC

COMMAND HANDSHAKE

Listing 4 continued
on page 100

The Mainframe.

(or how to get a good night's sleep)



There is no other mainframe that compares with the performance and reliability of a TEI mainframe. Its unique design enhances substantially the reliability of any S-100 computer system by providing high efficiency power, brown out protection, line noise rejection and a sophisticated high-speed bus packaged in a durable enclosure.

TEI manufactures the broadest selection of S-100 mainframes . . . 8, 12 and 22 slot, desk top and rackmount models. Whether your requirements are standard or custom, TEI's extensive manufacturing capacity and know-how can solve your mainframe problems today!

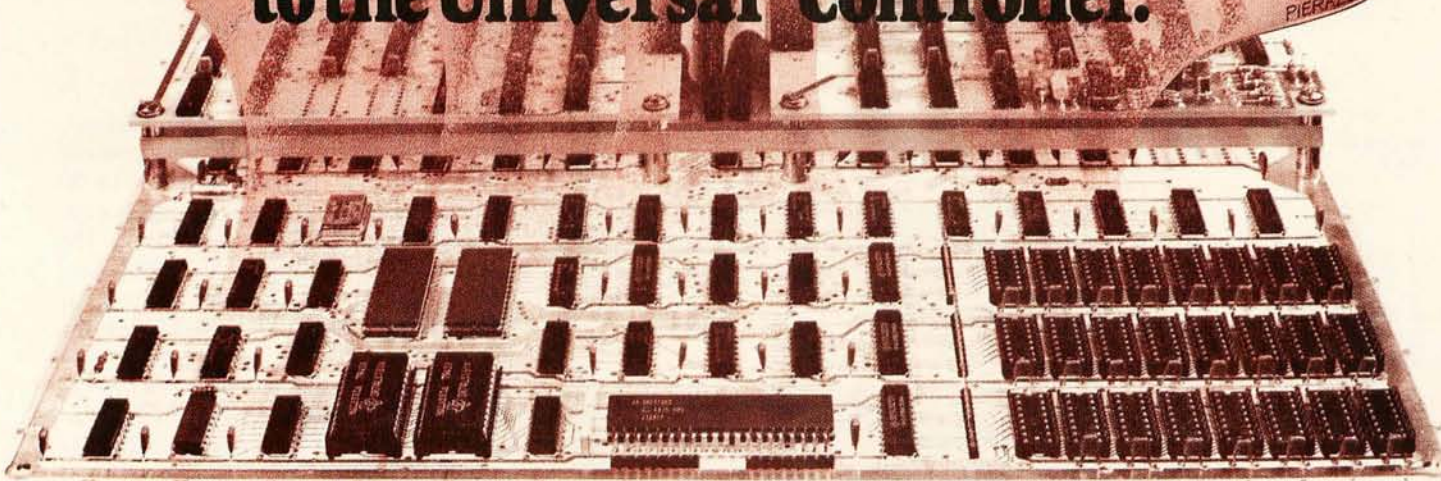
Successful OEM's, system integrators and computer dealers worldwide rely on TEI mainframes and enjoy a good night's sleep knowing that their systems are still running. Call TEI today... you too can enjoy a good night's sleep!

TEI More than a decade
of reliability.

5075 S. LOOP E., HOUSTON, TX. 77033
(713) 783-2300 TWX. 1 910-881-3639

The UniversalTM Intelligent Controller and the 5 Little Plugs

**This little pluggy
went to the S-100,
This little pluggy
stayed with fixed disks,
This little pluggy
had floppies,
This little pluggy
supported tape,
And this little pluggy
went all the way home,
to the UniversalTM Controller.**



Five plug sets is all it takes for simultaneous, multi-device storage control. DML's UniversalTM Intelligent Controller makes it possible.

- S-100 Bus, with CP/M* support
- Plug adaptable device support
- Control of up to 8 storage devices: 4 fixed disks, 4 floppy or tape cartridge drives
- IEEE DMA or port transfer

Call or write for full information. Data Management Labs, 2148 Bering Drive, San Jose, CA 95131 (408) 248-2104.

*CP/M is a trademark of Digital Research



DATA MANAGEMENT LABS

Listing 4 continued:

WAIT FOR END OF READ — THEN REPORT				
0BB4	0603		MVI B,03H	;SEL DATA REG
0BB6	70		MOV M,B	;WRITE PORTC
0BB7	110180		LXI D,PORTB	;PORTB ADRS
0BBA	0603		MVI B,03H	;RE,WE=1
0BBC	C3C70B		JMP DLOOP	
0BBF	3E8D	GD	MVI A,8DH	;LOAD DATA
0BC1	2F		CMA	;INVRT DATA
0BC2	12		STAX D	;WRITE PORT B
0BC3	3E07		MVI A,07H	;WE=0
0BC5	77		MOV M,A	;WRITE PORTC
0BC6	70		MOV M,B	;RE=1,PORTC
0BC7	7E	DLOOP	MOV A,M	;GET STATUS
				PORTC
0BC8	B7		ORA A	;DRQ=1
0BC9	FABF0B		JM GD	;YES
0BCC	E640		ANI 40H	;INTERQ SET
0BCE	CAC70B		JZ DLOOP	;NO
READ DONE — GET STATUS				
0BD1	CD9807		CALL PIN	;PORTB INPUTS
0BD4	3E00		MVI A,0	;ADRS STAT REG
0BD6	77		MOV M,A	;WRITE PORTC
0BD7	3E08		MVI A,08H	;STROBE RE=0
0BD9	77		MOV M,A	;WRITE PORTC
0BDA	3A0180		LDA PORTB	;GET STAT BYTE
0BDD	0600		MVI B,0	;STAT HANDSHAKE
0BDF	70		MOV M,B	;WRITE PORTC
0BEO	2F		CMA	;INVERT STAT
				BYTE
0BE1	CD6907		CALL STATUS	;REPORT STATUS
0BE4	C9		RET	
0BE5	0000	SECSTR	WORD 0	;SECTOR ADRS
	0B80		END READ	

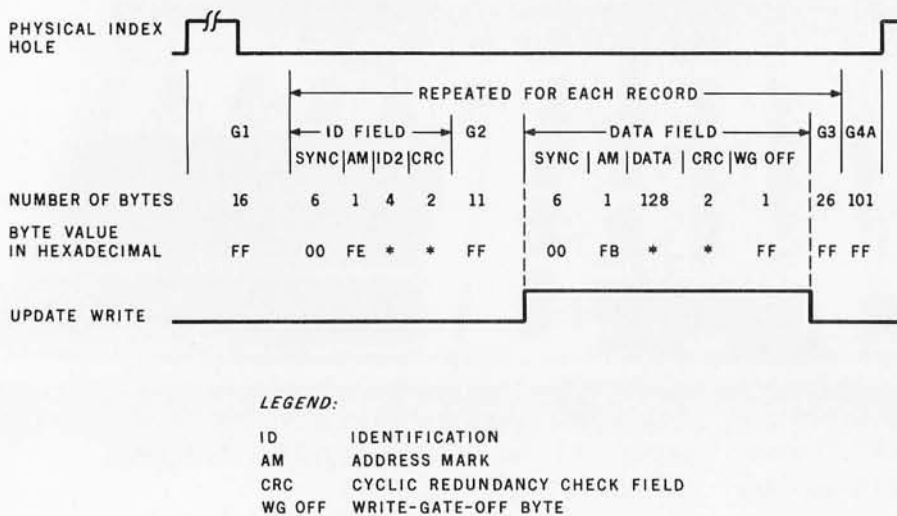


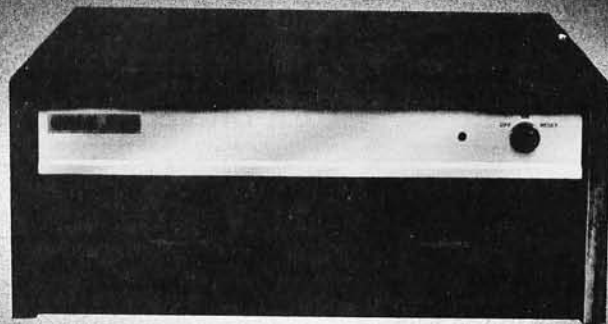
Figure 3: Format of data as recorded on one track of the disk drive. Each track contains sixteen records, each of which contains 128 bytes. Each record consists of an identification (ID) field followed by a data field. The columns marked with an asterisk represent fields with contents that vary from record to record.

Text continued from page 86:

contains the following: track address, side-select byte (set to 00 here), sector address, and sector length (set to 00 here because the sector length is constant); each field is 1 byte long. The cyclic-redundancy-check (CRC) section contains a 2-byte value that serves to check the accuracy of the previous bytes as written onto the disk. A command byte of hexadecimal F7 sent to the FD1771 controller causes it to generate and write the CRC bytes.

The data field also begins with a sync section. The address mark for this section, hexadecimal FD, is a different value than for the sync section in the identification field. A data section of 128 bytes follows and can be filled with any desired data. The last section within the data field is the write-gate-off (WG-off) byte, which allows the head an area in which to be

25MB



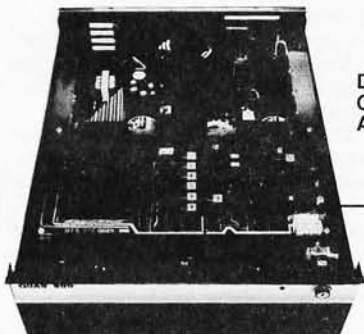
standard on our 900 SERIES microcomputer system . . . under \$4,000.00*

Having so much disk capacity as standard in a low cost microcomputer system is reason enough to make the 900 Series your logical choice — but the fact is, it's only one of the reasons why this system offers the best price/performance value of any now on the market. There's also a simple modular design, a reliable single board computer, dual flexible disk drives, a versatile disk operating system, plenty of room for expansion, and attractive quantity discounts — plus a lot more.

Just check out these standard features and expansion capabilities.

STANDARD ON THE 900 SERIES:

- ☐ Single board microcomputer: Z80 based; 4 MHz. operation; DMA controlled disk access.
- ☐ Dual eight inch flexible disk drives: on-line formatted capacity of 2.5 megabytes expandable to 5 Mb; access time of 3 milliseconds track-to-track; 8000 hour MTBF reliability rating.
- ☐ IBM 3740 format compatible
- ☐ 48 kilobytes of dynamic RAM, expandable to 65 Kb.
- ☐ CP/M® Disk Operating System with assembler, editor and debug subsystems.
- ☐ RS232 or TTY serial port for system console.
- ☐ Parallel line printer port (Centronics-compatible).



DESIGNED FOR OPTIMUM RELIABILITY AND EASY SERVICING

Single board design
Quad-density flexible disk drives
Turn-key operation and security
Expansion capabilities
Industrial quality construction

OPTIONS FOR THE 900 SERIES:

- ☐ Disk expansion: up to 5 Mb formatted capacity.
- ☐ Serial I/O expansion: two additional RS232 ports (serial printer, modem, etc.)
- ☐ S100 bus adaptor for system expansion.
- ☐ Multi-user operation
- ☐ Hard disk subsystem

AVAILABLE SOFTWARE FOR THE 900 SERIES:

- ☐ High level languages include: BASIC, FORTRAN, COBOL and PASCAL.
- ☐ Application packages include: Inventory, Word Processing, GL, AR, AP and Payroll.

the Quay 900 Microcomputer System offers the most complete package for the money



QUAY CORPORATION

P.O. Box 386, Freehold, New Jersey 07728 ■ (201) 681-8700
Factory: Route 34, Wall Township, New Jersey 07719

DISTRIBUTOR AND REPRESENTATIVE INQUIRIES WELCOME
Circle 59 on inquiry card.

*Unit price (\$3,996.) in small quantities; please contact factory for complete discount schedule
CP/M® is a registered trademark of Digital Research

\$\$\$ SAVE \$\$\$ **TRS-80*/ZENITH/APPLE/MATTEL** **ATARI COMPATIBLE HARDWARE**



DISK DRIVES

More capacity than Radio Shack 35 Track (80 K Bytes) drives. Fully assembled and tested. Ready to plug-in and run the moment you receive it. Can be intermixed with each other and Radio Shack drive on same cable. TRS-80* compatible silver enclosure.

90 DAY WARRANTY. ONE YEAR ON POWER SUPPLY.

FOR TRS-80*

CCI-100	5 1/4", 40 Track (102K Bytes) for Model I	\$314
CCI-200	5 1/4", 77 Track (197K Bytes) for Model I	\$549
CCI-800	8" Drive for Model II (1/2 Meg Bytes)	\$795

For Zenith Z89

CCI-189	5 1/4", 40 Track (102K Bytes) add-on drive	\$394
Z-87	Dual 5 1/4" add-on drive system	\$1095

DISKETTES — Box of 10 (5 1/4") — with plastic library case \$24.95

16K MEMORY UPGRADE KITS \$59.95

for TRS-80*, Apple II, Sorcerer (specify)

PRINTERS

NEC Spinwriter



Letter Quality High Speed Printer

Includes TRS-80* interface software, quick change print fonts, 55 cps, bidirectional, high resolution plotting, graphing, proportional spacing

\$2479

With Tractor Feed **\$2679**

779 CENTRONICS TRACTOR FEED PRINTER \$995

Same as Radio Shack line printer

737 CENTRONICS FRICTION & PIN FEED PRINTER \$849

Text quality matrix, proportional spacing

730 CENTRONICS FRICTION & PIN FEED PRINTER \$640

7 x 7 matrix

P1 CENTRONICS PRINTER \$349

Same as Radio Shack quick printer

PAPER TIGER (IP440) \$995

Includes 2K buffer and graphics option

TI-810 \$1599

Upper and lower case, parallel and serial, paper tray and TRS-80* interface software

OKIDATA Microline 80 Friction and pin feed \$645

Tractor Feed, friction, and pin feed

EATON LRC 7000 + 64 columns, plain paper \$349

COMPLETE SYSTEMS

TRS-80* LEVEL II-16K with keypad \$722

TRS-80* Expansion Interface \$274

ZENITH Z89 all-in-one computer \$2295

ZENITH Z19 \$740

ATARI 400 \$549 ATARI 800 \$999

MATTEL INTELLIVISION \$299

DISK OPERATING SYSTEMS

PATCHPAK #4 by Percom Data \$ 8.95

CP/M for Model I, Zenith \$145.00

CP/M for Model II, Altos \$245.00

NEWDOS Plus — with over 200 modifications 35 Track \$ 89.00
 and corrections to TRS-DOS 40 Track **\$ 99.00**

CAT MODEM Originate and answer same as \$157.50

Radio Shack Telephone Interface II

The CPU SHOP

TO ORDER CALL TOLL FREE 1-800-343-6522

Massachusetts residents call (617) 242-3361

5 Dexter Row, Dept. B-5, Charlestown, MA 02129

Hours: 10AM-6PM (EST) M-F (Sat. till 5)

Massachusetts residents add 5% sales tax

Freight collect, F.O.B. Charlestown

*TRS-80 is a trademark of Tandy Corporation

Prices subject to change without notice.



turned off from the write mode without destroying any valid data. Although a hexadecimal FF is written to this field, we do not care what value resides in the WG-off field on the floppy disk.

Once the disk is formatted, reading or writing can begin. The read and write commands are similar in several respects to other commands such as the seek command. Each must be part of a software routine in which a command parameter is loaded into the data, sector, or track register, and the command itself is loaded into the command register. All commands also generate an interrupt signal at their completion. This interrupt must be reset through a status handshake routine that reads the status register.

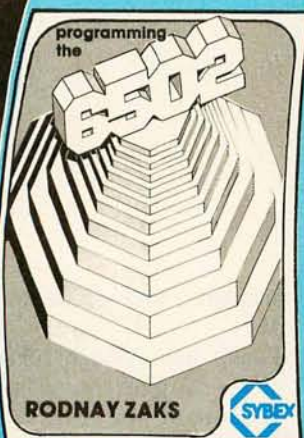
However, the read and write commands differ from commands like the seek command in the following one respect: data must be transferred. For example, a write command, in a data-transfer routine like that presented in hexadecimal locations 0BB4 thru 0BCE of listing 4, places a byte of data in port B and points the address pointers (lines A0 and A1) to the data register. When the FD1771 raises the DRQ line, the WRITE-ENABLE line is brought low. The byte of data, which is placed in the FD1771 data register, is transferred from the FD1771 to the disk. The 8080A places another byte in the port and pulls the WRITE-ENABLE line low again when the FD1771 signals that it is ready to accept another byte of data. A similar procedure is followed for a read command (see listing 3), except that this command uses the READ-ENABLE line.

This concludes our discussion of the hardware and software necessary to interface a Shugart SA400 disk drive to an 8080A-based microcomputer system. Additional application information is given in the application notes available from the companies listed in the references. ■

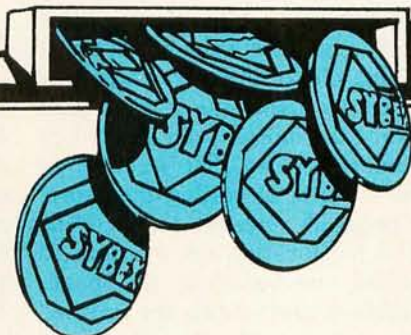
References

1. SA400/450 Minifloppy Diskette Storage Drives with an 8080A/FD1771 Single Density System Application Bulletin, Shugart Associates, 415 Oakmead Parkway, Sunnyvale CA 94086
2. FD1771 Floppy Disk Formatter/Controller Data Sheet, Western Digital Corporation, 3128 Red Hill Ave, POB 2180, Newport Beach CA 92663
3. Intel 8080 Microcomputer Systems User's Manual, Intel Corporation, 3065 Bowers Ave, Santa Clara CA 95051

YOU WIN!



with SYBEX



PROGRAMMING THE 6502

This book is designed as a progressive, step-by-step approach to assembly language programming—with exercises developed to test the reader at every step. Learn to write complete applications programs. Features: Programming and addressing techniques, input/output techniques and devices, application examples, data structures, program development and more.

Ref. C202

\$12.95

6502 APPLICATIONS BOOK

This title presents real life application techniques for any 6502 based micro-computer board. Programs presented cover building a complete home alarm system, electronic piano, motor speed regulator... and more. Learn techniques ranging from simulated traffic control to analog-digital conversion. The KIM-1, SYM-1 and AIM 65 are thoroughly covered.

Ref. D 302

\$12.95

6502 GAMES

Designed as an educational text on advanced programming techniques, this book presents a comprehensive set of algorithms and programming techniques for common computer games. All of the programs were developed for the 6502 at the assembly language level. Learn how to devise strategies suitable for the solution of complex problems commonly found in games.

Ref. G402

\$12.95

Please send me _____ Charge my _____ Visa _____ Mastercharge _____
 Name _____ American Express _____
 Company _____ Card # _____ Exp. Date _____
 Address _____ Signature _____
 City _____ State _____ Zip _____ ☐ Please send me your detailed catalog.

TO ORDER:

By Phone: (415) 848-8233, Visa, MC, AmEx

By Mail: Indicate quantity desired. Pre-payment required

Shipping: Add \$1.50 per book (UPS) or 75¢ (4th Class - allow 4 weeks delivery)

Tax: In California please add tax



AVAILABLE AT BOOK AND COMPUTER STORES EVERYWHERE

A Graphics Text Editor for Music

Part 2: Algorithms

Randolph Nelson
2039 West Artesia Blvd
Apt 121
Torrance CA 90504

The Commands

With what commands should the editor provide the user in order to make the program easy to use, and how does the nature of these commands affect the structure of the program?

Mode Commands

We begin to answer this question by distinguishing three major ways in which the user will use the program. The first is when the user creates a score of music. Here the editor must establish a file for the score and allow the user to overwrite the default values for the music, such as the key and time signatures. The second major use consists of editing the score. The program needs to provide facilities for locating the measure to be edited, reformatting the pages after editing, and writing the finished version out to a file. The third and hardest facility the editor must provide is the ability to display the score on the screen.

A multitude of problems must be handled automatically by the editor in adjusting the format of the score as

it will appear on the screen. The above discussion leads to a definition of three separate modes of operation for the editor called the CREATE, EDIT, and DISPLAY modes. Switching between modes is done by issuing a command through the graphics tablet as discussed in part 1. The editor also switches modes automatically to display the contents of a measure while the user creates or edits the score.

Location Commands

Commands must be provided to allow sequential passage through the score. In order to do this, the user must first set a symbolic-operation mode which determines the units to be used as increments in moving through the score. These units are pages, lines, measures, or characters, and are set via commands on the template. For example, suppose you are located on page two, line one, measure three, and character twenty-one of the score, and you wish to edit page five, line four, measure one, and character three. The following sequence of commands will accomplish this:

1. Touch page. This sets the increments to pages, and sets the line, measure, and character values to one.
2. Touch forward three times. This positions you on the first line,

measure, and character of page five.

3. Touch line. Touch forward three times. You are now at the first measure of line four.
4. Touch character and touch forward two times.

If you are editing the end of a unit, it is often faster to back up. If you were editing the last character, number thirty-seven, of measure one above, you could go to measure two and then back up one character rather than going forward from measure one, thirty-seven times. If the program is to provide this flexible location scheme to the user, it should be easy to determine the location of the page, line, measure, and character at any place in the score. A look back at the data structures indicates that this was accomplished using doubly-linked pointers between the score area arrays.

Edit Commands

The program must support all editing features that allow easy text manipulation. Commands to insert, delete, replace, or move pages, measures, lines, or characters must be provided, as well as methods of searching the text for patterns of music. These facilities require a set of routines that will automatically adjust the paging of the music after editing.

Note

The figure numbering sequence is continued from part 1 which appeared in the April 1980 BYTE.

SYNCHRO-SOUND

The ORIGINAL Computer People
who KNOW Computers
and offer EVERYTHING you need
in Small Computer Systems

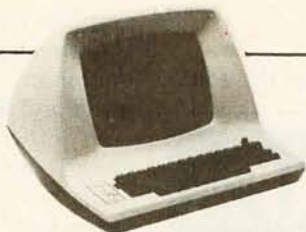


TERMINALS

ADDS Regent 25

LEAR SIEGLER

ADM 3A
ADM 31
ADM 42



HAZELTINE

1400	1500	Mod 1
1410	1510	Edit
1420	1520	



PRINTERS

QUME Sprint

5/45 KSR
5/55



DECwriter IV
LA 34



TELETYPE
43



CENTRONICS

779-2 | 703-0
700-2 | 730



A PERFECT SUPER SPECIAL MATCHED PAIR!



Texas Instrument
810 Multi Copy
Impact Printer
150 characters per sec.
bi-directional printing



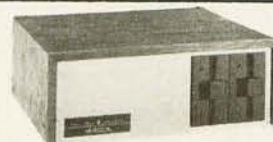
Intertec
Super Brain
Computer Terminal
Dble. Density Dual Mini-
Floppies, CPM based
Development or Business System

ONLY \$3995.

COMPUTERS

DIGITAL SYSTEMS

DSC 2
Dble. Density
Dual Drive Disk



NORTHSTAR
HORIZON II
HORIZON II Quad

CROMEMCO
System 3



ATARI
400
800

MORE SPECIALS

Okidata SL125	\$2595.00	Livermore Acoustic Coupler	\$195.00
Okidata SL300	2995.00	Centronics Micro Printer	349.00
Persci 277	1395.00	5" Scotch Diskette Box	34.95
Integral Data Systems Paper Tiger Printer	895.00	8" Scotch Diskette Box	39.95
Imsai PCS 80/15	499.00		
Televideo 912, 920	CALL		

MANY OF OUR PRICES ARE TOO LOW
TO ADVERTISE. PLEASE CALL OR WRITE

We carry a full line of Alpha-Micro Products.
We have a full staff of Programmers and Computer
Consultants to design, configure and deliver a Turnkey
Computer System to meet your specific requirements.



SYNCHRO-SOUND

ENTERPRISES, INC.

THE COMPUTER PEOPLE

193-25 Jamaica Ave., Jamaica, New York 11423 • TWX 710-582-5886

PHONE ORDERS, CALL
New York 212/468-7067
Los Angeles 213/628-1808
Chicago 312/641-3010
Dallas 214/742-6090

Exit Commands

After editing a measure, the user either wants the version to become a permanent part of the score, or wishes to inform the program to ignore any changes made. This is the function of the EXIT and NULL-EXIT commands on the template. Note that the exit command must transfer the contents of the work area to the score area and make the necessary format changes while the NULL-EXIT simply does nothing.

Symbols

Music abounds with symbols. The

template shown in part 1 indicates only a few. The actual design allows for one hundred different symbols. In order to avoid cluttering the template you would have to cull the necessary symbols for the type of music that is being scored. To transfer from one notational style to another is not a difficult task, since only the template and interface program would have to be changed. The main portion of the editor is protected from such alterations.

Output

The hardest problems of the editor

are related to displaying the musical score on the screen in a pleasing and useful format. I will touch on three classes of problems, and outline their solutions in this section.

Dimension Problems

This set of problems is caused by the physical dimensions of the screen output. The actual physical dimensions of the height and length of the screen are fixed, and you must work around their limitations. Since most graphics screens represent points in a coordinate system, the maximum and minimum absolute coordinates for the X and Y axis are set.

In order to achieve a flexible design, no commitment should be made to any of these machine-dependent characteristics. Instead, you should work in a virtual coordinate space controlled by the editor, and write another interface program to handle the conversion of coordinates in the virtual space to the actual screen coordinates. Every dimension that is given will then represent a dimension of the virtual space in the editor. Since the option of determining the size of a score of music should be left to the user, you must understand that all dimensions are subject to scaling factors that will be set by the user on entrance to the program. With these considerations in mind, I will now discuss three problems and their solutions.

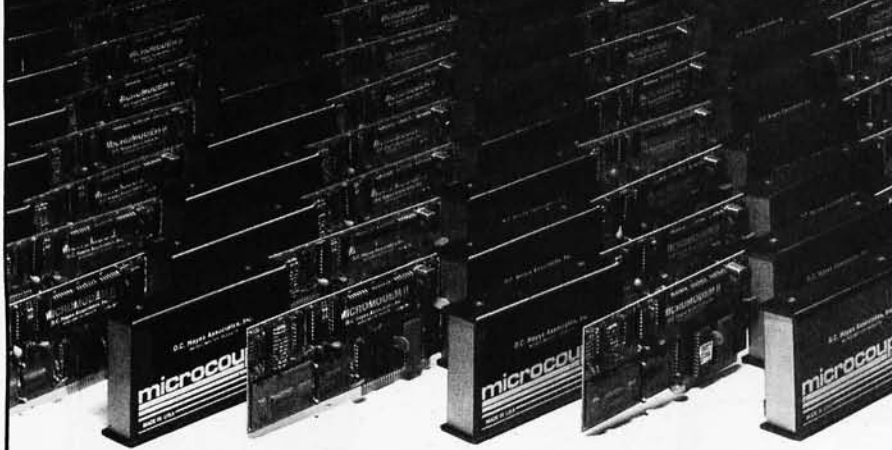
1. The Spacing Problem for the Staff

How are the dimensions for the staff, notes, and symbols determined? The solution was found by taking measurements from scores of music and determining the standard sizes. Figure 5 shows the dimensions of the staff and lists the dimensions for other symbols. Note that all dimensions are given in terms of LSPACE, which is the distance between the lines of the staff.

2. The Length of the Measure Problem

How do you assign a virtual length to a measure? Although each measure has the same number of beats, their lengths can differ radically. Observe in figure 7 that the length between notes of the same value is not always equal. This eliminates a simple method in which you would assign virtual lengths to specific note values

Production is up 400%



Demand is up even more for micromodem II™

Congratulations! A lot of you have found out how much our micromodem II adds to your Apple II.* We knew it was good when we developed it, but we couldn't tell how many of you would realize that too. Since the Apple II has become so popular and very low cost time sharing networks have evolved, demand for micromodems has been increasing.

We've expanded production capacity, moved to new facilities and added personnel in order to meet the demand. But, like most of the industry, availability of parts has limited our ability to expand production as fast as we would like.

We at D.C. Hayes Associates are committed to supporting the microcomputer industry through providing your local dealer with superior quality products, as rapidly as supplies and our high quality production techniques allow. Thanks for waiting for our micromodems, we know you'll be glad that you did.

D.C. Hayes Associates, Inc.
MICROCOMPUTER PRODUCTS

10 Perimeter Park Drive, Atlanta, Georgia 30341 (404) 455-7663

*Registered trademark of Apple Computer, Inc. Micromodem II is a registered trademark of D.C. Hayes Associates, Inc.

TRS-80 OWNERS

MAKE PROGRAMMING EASY WITH THE BALCODE SYSTEM

- OP codes based on IBM 370 BAL.
- Non-primitive BALCODE instructions do the work of six to eight Z-80 instructions.
- Dual macro expanders for flexibility and higher order coding structures.
- Super editor includes copy, move, find and change commands with stop at CRT fill-up.
- Editor, assembler, source code and object code all reside in memory at the same time. Edit, assemble and run without dumps or loads.
- Fortran equations are permitted.
- Special OP codes for printer and CRT displays.

WHEN ORDERING PLEASE SPECIFY DOS OR CASSETTE SYSTEM.

BALCODE 80—Available now, Super editor, dual macro expanders, BALCODE assembler, user's manual **\$69.00**

BALCODE 80A—Available now, same as BALCODE 80, includes 32/56 bit floating point assembler **\$79.00**

BALCODE 80B—Available in July 1980. Same as 80A. Allows inclusion of Fortran statements. (\$10 to purchasers of 80A). ... **\$89.00**

BALCODE 11—Available in July 1980. Transcendentals and complex variable operations **\$15.00**

BALCODE 21—Available in July 1980. Matrix operations, Kalman digital filter, polynomial curve fitting **\$75.00**

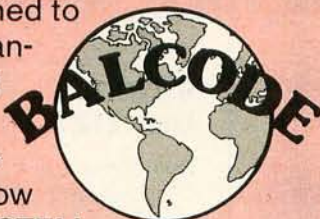
BALCODE 31—Numerical integration. Gravity and atmospheric models **\$49.00**

Additional BALCODE manuals ... **\$15.00**

**ALL FUTURE UPGRADES \$10.00 TO ORIGINAL PURCHASERS
CHECK, MONEY ORDER, VISA & MASTER CHARGE**



The BALCODE SYSTEM is designed to provide a universal assembly language, standard subroutine and macro libraries, and a compiler to permit Fortran equations. The full capability of the Z-80 can now be achieved with the BALCODE SYSTEM.



BALCODE SOFTWARE INC.

P.O. BOX 3750
WOODLAND HILLS, CA 91365
(213) 889-4394



Figure 5: Dimensions of the musical staff, notes, and symbols. All dimensions are given in terms of LSPACE, the distance between the lines of the staff.

and determine the total length of the measure by summing their values. A modified approach to this simple scheme can be adopted, however. You must first determine the minimum distance between notes that allows sharps and flats to be inserted, while still preserving readability. This distance can be fine-tuned to the eye of the user, but it is approximately nine-fourths the distance between the lines of the staff, or $(9/4) \times \text{LSPACE}$. This dimension will be called the *internote distance*, denoted by INTER. Second, a *beaming group* is defined as a set of notes that are connected by beams. Later I will discuss a routine that determines beaming groups in the measure. Assume here that the job has been done. Next, a code for

each possible note value is determined (this code was actually developed much earlier and is used throughout the program in most of the data structures). This information is shown in table 5. Notice that all the values are integer quotients of 20160. There are several reasons for this particular encoding scheme. First, the editor allows for twenty-six different note values. In order that the subgroupings of these notes add up to correct total values, each note must have the same common denominator. The value 20160 fulfills the requirement. The code for one beat is 5040. Other reasons for this encoding concern the eventual placement of the notes in their proper screen locations. The total length of the measure is

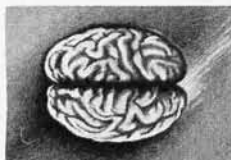


Figure 6: An example of a rarely occurring musical symbol. Of the many thousands of symbols which are used to communicate different forms of expression, some are used only infrequently. This particular symbol is found in piano music. It directs the performer to reach inside the instrument and strike the string corresponding to the indicated note with a mallet.

now the sum of the lengths of all of the beaming groups of that measure plus the lengths of the rests. The algorithm for determining the length for the beaming groups can now be stated:

1. Determine the total number of beats for the beaming group. This can be done by summing the codes for all the notes in the group and dividing by 5040, the value for one beat. Let this value be NUM.
2. Find the minimum value for the beaming group. Call this MIN.
3. Determine the number of notes required if the total number of beats were to be taken up by the minimum note. This is simply NUM / MIN .
4. Multiply this number by the internote distance. Thus you finally get the length, which is equal to $(\text{NUM} / \text{MIN}) \times \text{INTER}$.

You can now perform the above routine for all of the beaming groups of the measure and sum up the lengths, with rests included. The total value represents the virtual length of

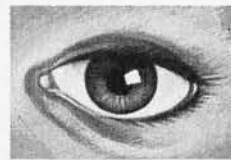


8086 Boards

CPU with Vektored Interrupts \$650.
PROM-I/O \$495.
RAM \$395.
8K x 16/16K x 8

ANALOG Boards

A/D 16 Channel, \$495.
12 Bit, High Speed
D/A 4 Channel, \$395.
12 Bit, High Speed



VIDEO DIGITIZATION

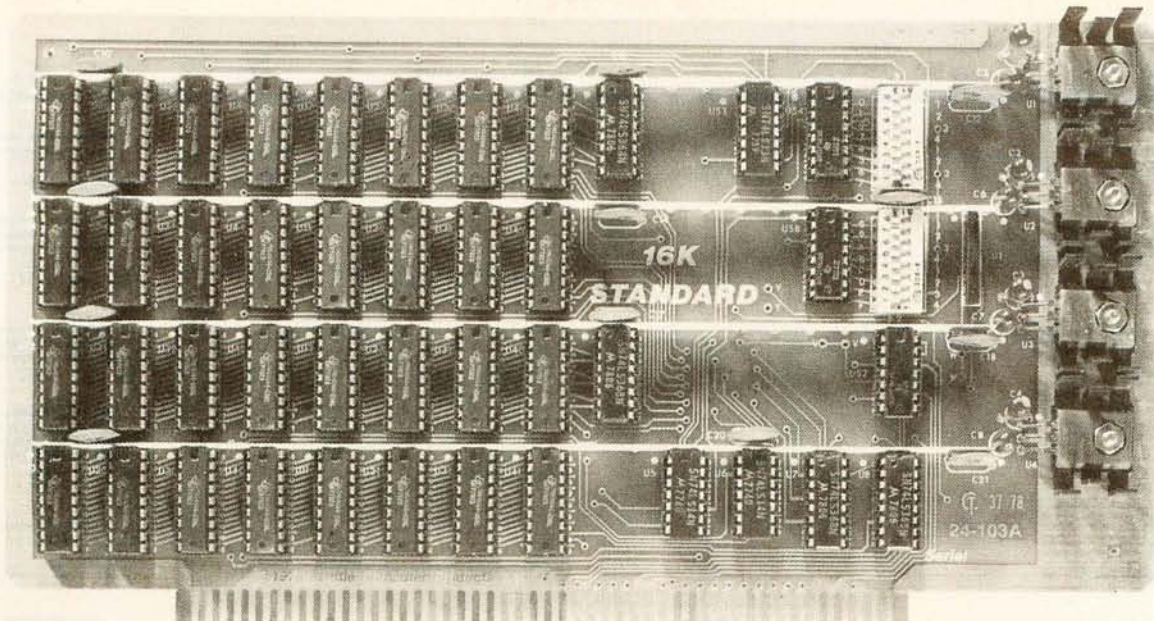
Real Time Video \$850.
Digitizer and Display
Computer Portrait System \$4950.

S-100 Boards

Video and/or Analog
Data Acquisition
Microcomputer Systems



The High Performance S-100 People
TECMAR, INC.
23414 Greenlawn • Cleveland, OH 44122
(216) 382-7599



16K RAM *Fully Static* \$265

300 nsec. for 4 Mhz. Z-80

The Model 24-103 "STANDARD RAM" was designed for the smaller system which does not require bank select. It has been in production since late 1978 and has earned an enviable record for reliability. Although it does not have some of the options of the commercial cards listed below, its manufacturing quality has not been cut in any way. The card has DIP switch addressing — any

continuous 16K on 4K boundaries. All inputs are buffered and it comes fully assembled, tested and guaranteed for one year. Prices for the card with 300 nsec. chips start at \$265 and drop to \$225 for quantities 5-9. Add \$30 per board for 250 nsec. chips for faster CPU clock speeds.

OTHER S-100 BUS STATIC RAMS

16K PLUS

This board has been sold primarily to dealers/system integrators during the past 20 months. It has become the reliability standard against which other boards are compared. It is fully static, 16K by 8 bits, and a premium quality product featuring Schmitt triggers for all signal inputs. The board has been optimized for the Cromemco systems using output port 40H for its bank select. It also has start-up options which allow the board to come up in either the enabled or disabled condition. It is addressable by DIP switches in any continuous 16K on 4K boundaries. Prices with 300 nsec. chips (for 4 Mhz. Z-80 systems): 1-4, \$365; 5-9, \$295. Add \$30 per board for 250 nsec. chips for faster CPU clock speeds.

16K APEX

This board is very similar to the PLUS card. It differs in that its bank select can use any of 256 output port addresses and it can be addressed on 16K boundaries only. Pricing is the same as for the PLUS.

8/16 RAM

This board was designed for the 1980s. It is configured as 16K by 8 bits when accessed by an 8-bit processor and configured 8K by 16 bits when used with a 16-bit processor. The configuration switching is automatic and is done by the card sampling the "Sixteen Request" signal sent out by all 16-bit CPU boards. The card has all the high noise immunity features of the PLUS and APEX as well as "extended addressing". Extended addressing is a replacement for bank select which makes use of a total of 24 address lines to give a directly addressable range of over 16 megabytes. (For older systems, a switch will cause the card to ignore the highest 8 address lines) This card ensures that your memory board purchase will not soon be obsolete. It comes with 200 nsec. memory chips only and is guaranteed to run without wait states with our 8086 CPU using an 8 Mhz. clock. Prices: 1-4, \$445; 5-9, \$345.

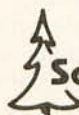
MEMORY CHIPS

We have 4044 type 4K by 1 fully static memory chips available. See our ad in March BYTE for prices.

ALL SCP BOARDS ARE FULLY ASSEMBLED, TESTED AND GUARANTEED ONE YEAR

HOW TO ORDER

There are two ways to go. You can check with your local dealer or order directly from the factory. Bank cards, personal checks, CODs okay. There is a 10-day return privilege on factory orders. All boards are guaranteed for one year — both parts and labor. Shipped prepaid by air from stock in US and Canada. Foreign purchases — must be prepaid in US funds. Also add \$10 per board for overseas air shipment.



Seattle Computer Products, Inc.

1114 Industry Drive, Seattle, WA. 98188
(206) 575-1830

Whole	20160		Sixteenth	1260	
Dotted Half	15120		Dotted Thirty-second	945	
Half	10080		Thirty-second	630	
Quarter	5040		Sixty-fourth	315	
Dotted Quarter	7560		Triplet with dotted eighth	2520	
Dotted Eighth	3780		Triplet	1680	
Eighth	2520		Sextuplet with dotted sixteenth	1260	
Dotted Sixteenth	1890		Sextuplet	840	

Others: Fifth 1008, Seventh 720, Ninth 560, Tenth 504, Eleventh 458, Twelfth 420, Thirteenth 387, Fourteenth 360, Fifteenth 336.

Table 5: Additional musical symbols.

the measure. This is stored in the character array of the score area.

3. The Line Length Problem

With different sized measures, how do you determine the number of measures that will fit on each line, thus assuring that the bar lines at the end of each line are aligned? The difficulty of this problem is increased by the fact that not all of the space in a line is used. Each line of music starts with a clef, key signature, and time signature. Every bar line of every measure is bounded by empty space. (Refer to figure 5.) All of these spaces must be accounted for in determining the number of measures that can fit on each line.

Assume that the total length of the line in virtual space is LLINE. The first part of that space must be allocated to the clef and signatures; this will be called LWASTE. The total usable virtual space, LUSABLE, is then equal to LLINE - LWASTE. The wasted space around each measure will be called LMSRWST. If N

measures are on the line, then $N \times LMSRWST$ space has been wasted in these measures. Now suppose that you are positioned at the first measure that will go on the line. You know the virtual lengths of this measure and all that follow. Denote the sum of the lengths of these first N measures as SUMN. The problem is then to find the largest N such that:

$$LUSABLE \geq SUMN + N \times LMSRWST$$

This says that you want to find the greatest number of measures that can be put on the line before going past the end of the line. In general, the measures will not fit perfectly on the line; therefore there will be excess space at the end. This excess must be distributed equally among the measures, and to do this you must find a scaling factor to transform each X coordinate of the measure into a new coordinate. This scaling factor can be easily determined. Let EXCESS be the excess space at the end of the line. It is equal to $LUSABLE -$

$SUMN - N \times LMSRWST$. The scaling factor then is simply $LUSABLE / (LUSABLE - EXCESS)$. The solution to the line length problem is shown in algorithmic form in listing 1.

Beaming

Before this problem can be formulated I will review some of the questions that must be answered when writing music on the page. These are various conventions used for writing music. The following lists a few of these problems.

Stems Up or Down?

You must first decide if a group of eighth or sixteenth notes will be underbeamed or overbeamed (ie: whether the ligature is placed at the top or bottom of the note stems which point up or down, respectively). The easiest solution to this problem consists in finding the maximum note displacement from the center line of the staff and then drawing the note stems in that direction. There are

several exceptional cases for this simple algorithm. For example, if the previous group of notes was underbeamed and the maximum displacement of the next group is above the middle line of the staff (but not by much), the score will read easier if the group is underbeamed rather than overbeamed.

Determining Beam Inclination

Note in figure 7 that the ligature inclination of beaming groups is not always the same. To determine the angle of the beam, you must find the height difference between the stems of the maximum note and the minimum note. For each octave of this difference, increase the height of the tilt by one unit. Notice that the tilt can be

either up or down. In the following discussion I will talk about one of the four cases: underbeamed and tilting upward. The other three cases are easy modifications to the algorithms.

Determining the Stem Lengths

The length of the stems from the notes depends on several factors. Suppose you have an underbeamed, upward-inclined beaming group. The shortest note stem must be at least a certain minimum length for readability. Once this distance is set, determine the lengths of the stems for the other notes of the beaming group. These distances depend on the location of the note and the angle of the beam. Although the algorithms are quite involved, they basically consist

of solving equations to find the intersection point for the lines of the stems and the beam. A complete description of an example with all the equations is given in figure 8.

The algorithms for each of these problems are not difficult, and for the most part they consist of only a few instructions. However, the exceptional cases which make the music more readable are complex and tedious. Given the ad hoc nature of musical notation there seems to be no mechanical way to eliminate these exceptional cases. Let me briefly outline the basic algorithms. Once again, you assume that you have a routine that provides the beaming groups and that you are dealing only with an underbeamed upward-inclined group.

The beam-characteristic algorithm is shown in listing 2.

Next I will discuss how to determine the beaming groups. The basic strategy is to collect notes with flags until one either goes past a beat or encounters a rest. Then output a beaming group, and if a rest is encountered, continue within the beat to collect the remaining notes of the beat. Only in cases of syncopated rhythms will beaming groups cross over a beat. I might add that this is the reason for the strange initialization:

```
BEATCOUNT =  
BEATCOUNT + 5040
```

in step 2 of the algorithm, for if BEATCOUNT comes back negative from step 4, a beat has been crossed over. The algorithm is shown in listing 3.

Symbol Problems

Several ways are presented for routines that draw the notes and symbols on the screen. You must keep in mind that the eventual size of the symbols is left to the discretion of the user, and the program must therefore allow for scaling. Scaling sometimes distorts characters, so the editor must have procedures to keep this distortion within a readable limit. I found that for symbols consisting mostly of straight lines, simply storing a set of relative points and drawing lines between them is sufficient. For symbols that are curves, such as the G clef, a better approach is to use a spline-fitting routine to draw the symbol.

Listing 1: *Solution to the line-length problem in algorithmic form.*

1. LUSABLE = LLINE - LWASTE
2. N = 1 SUMN = Virtual length of first measure
3. VALUE = SUMN + N × LMSRWST
IF LUSABLE < VALUE THEN GO TO 4
N = N + 1
SUMN = SUMN + VALUE of virtual length of Nth measure
GO TO 3
4. EXCESS = LUSABLE - VALUE
LSALE = LUSABLE / (LUSABLE - EXCESS)
5. Store scale into the scale portion of the line array for future use when displaying the measure.

Listing 2: *Algorithm used to determine whether a group of notes should be under or overbeamed.*

1. Find the minimum note in the beaming group. MINX, MINY
Find the maximum note in the beaming group. MAXX, MAXY
Let OCTAVE be the height of an octave.
Let MID be the height of the middle note of the staff.
Let STEM be the minimum length of a stem.
Let LENGTH be the virtual length of the beaming group.
2. IF (MAX - MID) ≥ (MID - MIN) then overbeam, ELSE underbeam.
Assume underbeam.
3. TILT = (MAX - MIN) / OCTAVE (integer division)
4. For each note in beaming group:
Get coordinates into NOTEX, NOTEY
M = TILT / LENGTH
B = (MINY - STEM) - MINX × M
The height of the stem for this note is then equal to NOTEY - M × NOTEX - B.

Listing 3: *Algorithm to determine the beaming groups.*

1. BEATCOUNT = 0
MEASURECOUNT = Number of beats to a measure times 5040.
2. BEATCOUNT = BEATCOUNT + 5040
IF MEASURE ≤ 0 GO TO 5
3. Get value of next note into NOTEVAL
BEATCOUNT = BEATCOUNT - NOTEVAL
MEASURECOUNT = MEASURECOUNT - NOTEVAL
4. IF BEATCOUNT ≤ 0 THEN output group and GO TO 2.
IF encountered a rest THEN output group and go to 3
5. Finished with measure, either continue or stop.



Figure 7: Sample of a musical score, in this case part of a bourrée by J S Bach. Note the difference in note spacing and in angles of beams.

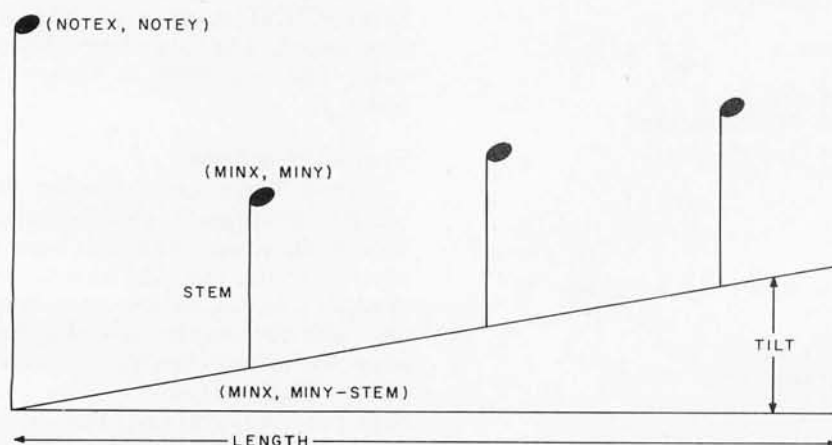


Figure 8: Calculating the equation of the line segment forming a beam. The standard slope intercept equation $Y = mX + b$ is used. We know that the slope is $M = \text{TILT} / \text{LENGTH}$, and that the value of one point on the line is $(\text{MINX}, \text{MINY} - \text{STEM})$. Fitting this to the equation of the line, we can find $b = (\text{MINY} - \text{STEM}) - M \times \text{MINX}$. The heights for all the other stems can then be calculated. For each note, put the X and Y coordinates in NOTEX and NOTEY. The height for this stem is then $\text{HEIGHT} = \text{NOTEY} - M \times \text{NOTEX} - b$.

Although this requires much more computation time on the computer, it does produce an aesthetically pleasing symbol and allows the user to fine-tune the form of the symbol by simply moving a few of the interpolation points.

Other Points

Now that the basic design of the editor has been presented, I will discuss some of the finer points of the design.

Patterns and Sequences

Although the input format is satisfactory for most music, the use of the current template becomes taxing, if not impossible, when creating a score of complex music. There is no facility that allows the user to input complex rhythms. In order to provide this ability, the concept of a pattern

TODAY MAY BE THE BEST TIME TO MAKE YOUR CAREER MOVE

But first make sure your new employer measures up.

With all of those prospective employers trying to attract your engineering skills, now is the best time to look beyond "just a job" and consider your career. Your real objective is to find the perfect combination—challenge, satisfaction, security, and reward. To assist you, we've prepared a checklist of points to consider when you're evaluating a new employment possibility. It's a good way to compare the companies seeking your expertise.

Career Opportunity Checklist for Engineers

INDUSTRY GROWTH AND STABILITY

No one wants to be "phased out," so check for security: YES ? NO

- Is the company part of an industry that's vital, growing, dynamic? ☐ ☐ ☐
- Will the growth continue throughout the 1980s and beyond? ☐ ☐ ☐

COMPANY HISTORY AND REPUTATION

You can tell a lot about a firm by its track record:

- Is the company recognized and respected in the industry? ☐ ☐ ☐
- Have sales and profits increased at a steady rate? ☐ ☐ ☐
- Is it known for its technological innovations? ☐ ☐ ☐
- Are its employees motivated and well rewarded? ☐ ☐ ☐
- Does the company seek technological employees on a permanent, ongoing basis? ☐ ☐ ☐

WORKING CONDITIONS AND ENVIRONMENT

Look for good people, team spirit, and top-notch facilities:

- Is the atmosphere one of loyalty, pride, and achievement? ☐ ☐ ☐
- Do employees welcome the challenge of difficult assignments? ☐ ☐ ☐
- Are creativity and independent thinking encouraged? ☐ ☐ ☐
- Are the company's engineering goals clear-cut and attainable? ☐ ☐ ☐

THE COMPANY LOCATION

Relocation is a big professional and personal commitment.

- Is the company located in an existing or emerging electronics center? ☐ ☐ ☐
- Are there major universities and other technological resources nearby? ☐ ☐ ☐
- Will the company assist me in relocating? ☐ ☐ ☐
- Can I provide my family a comfortable lifestyle in this area? ☐ ☐ ☐
- Are there cultural and entertainment opportunities? ☐ ☐ ☐
- Is there a variety of recreational and leisuretime activities? ☐ ☐ ☐
- Are the climate and surroundings pleasant? ☐ ☐ ☐

PERSONAL AND PROFESSIONAL GROWTH

Job satisfaction means more than just a paycheck:

- Does the company give full recognition to the engineering role? ☐ ☐ ☐
- Will I be working and interacting with other talented professionals in my field? ☐ ☐ ☐
- Will my accomplishments be acknowledged, appreciated, rewarded? ☐ ☐ ☐
- Will I be encouraged to seek more challenge and responsibility? ☐ ☐ ☐
- Will the company pay for advanced training in technology and management? ☐ ☐ ☐
- Can I pursue my own career goals within the company framework? ☐ ☐ ☐

THE LONG RANGE PICTURE

Where will you be professionally in 5 years? ... in 10 years?

- Are there plenty of opportunities for rapid advancement within the company? ☐ ☐ ☐
- Does the company encourage engineers to assume positions of authority? ☐ ☐ ☐
- Will I be allowed to move into those engineering areas that interest me most? ☐ ☐ ☐
- Can I choose my own career path—into technological leadership or executive management? ☐ ☐ ☐

One Company to Evaluate

At Racal-Milgo, we're looking for capable communications hardware and software people to join our engineering team. Our success has created needs at every level, from entry to top management. We have a lot to offer you.

The mainstream of our business is data communications—where today's action is. We're a pioneer, and a recognized leader in the field. Our state-of-the-art product lines include modems, multiplexers, data encryption, and systems for sophisticated network control and performance assessment.

We're proud of our growth—\$64 million in sales two years ago, \$80 million last year, and over \$100 million this year—and we're still growing. Applied research and technology keep us on the leading edge in data communications; our engineers face some of the industry's most challenging (and rewarding) responsibilities.

Racal-Milgo is a great place to work. We encourage our technical people to think creatively, to turn their innovative ideas into successful products—in an atmosphere of friendly, professional teamwork. We provide them with one of the nation's most advanced engineering facilities. Our salaries and benefit programs are among the best in the business.

We're located in suburban South Florida, one of the growing new electronics centers in the sunbelt. It's an international area, gateway to Latin America, blessed with a pleasant climate year-round. There are excellent cultural and entertainment opportunities, plus swimming, diving, boating, sport fishing, golf, tennis, and all the other benefits of a cosmopolitan resort. There's a wide choice of employee clubs to introduce you and your family to new activities. And if you're interested in furthering your professional or business related education, we'll pay for your coursework at any of the major universities nearby.

At Racal-Milgo, we're experiencing dynamic growth, and we need good people at all levels. The working conditions are excellent...advancement and rewards come fast...and our new two-track career program lets you decide whether to rise to the top on the technical side or to move into management. (Our president and board chairman are both EE's.)

We're looking for the best. If you are too, let's get together. I hope to personally welcome you aboard. Send me your resume today; no letter required. You'll receive a prompt reply.

Ed Hilpert

Ed Hilpert
Vice-President, Engineering



Racal-Milgo™ Racal-Milgo, Inc.
8600 N.W. 41st Street Miami, FL 33166

















HALF 	QUARTER 	EIGHTH 	SIXTEENTH 	THIRTY-SECOND 	TRIPLET 	SEXTUPLET 
DOTTED HALF 	DOTTED QUARTER 	DOTTED EIGHTH 	DOTTED SIXTEENTH 	DOTTED THIRTY-SECOND 	DOTTED TRIPLET 	DOTTED SEXTUPLET 
WHOLE 	SIXTY-FOURTH 	5TH	7TH	9TH	10TH	11TH
SET	END	DISPLAY	12TH	13TH	14TH	15TH
PAT	1	2	3	4	5	6
SEQ	1	2	3	4	5	6

Figure 9: Extensions to the musical template for more advanced editing.

of rhythm is created. Here the user can establish any rhythmic pattern with a code number. When this code number is touched on the template, the interface program organizes the notes which are entered after it according to that rhythm. The template must now have more fields on it to accommodate this ability, and the interface program must be expanded to perform these computations. The extensions to the template are shown in figure 9. In order to create a rhythmic pattern the user must issue the following commands:

1. Push SET and PAT. This informs the interface program that a pattern is to be created.
2. Push a number on the PAT row. This will be the number of the pattern, and any existing pattern with this number is overwritten.
3. Push the series of note values which determines the pattern.
4. Push END. This signifies the end of the pattern.

To use the pattern the user issues the following commands:

1. Push the number of the pattern.
2. Push the pen onto the correct pitch positions on the staff, preceding them with any attached symbols such as sharps, dots, slurs, etc. Note that the order of the notes and symbols is now important, but the X locations on the staff are immaterial.

The end of the pattern occurs when the number of notes of the pattern is pushed onto the screen. If more notes are entered before another pattern number is pushed, the interface program issues a warning to the user signifying that the pattern is ended. If an insufficient number of notes is entered before another command is issued, the user is warned and the incomplete input is discarded.

A sequence, as used here, is simply a series of patterns. Suppose that sequence 1 consists of the patterns 2, 5, 1. The use of sequence 1 will cause the notes pressed to follow the rhythm of pattern 2. When all of its notes are used up, it will follow the rhythm of pattern 5, and when that is finished, it will follow pattern 1. Setting a sequence is similar to the setting of a

pattern. The steps are:

1. Push SET and SEQ.
2. Push a number in the SEQ row. This is the sequence number.
3. Push a series of numbers in the PAT or SEQ row.
4. Push END.

Sequences can cross over measures and can consist of other sequences. To clarify these concepts, input the music in figure 7, using patterns and sequences. There are many ways to input that section of score. Break up the rhythms into their smallest components and then form sequences from them. Thus, three patterns are defined first: one consisting of a quarter note only, the other of two eighth notes, and the last of four sixteenth notes. The following commands do this:

1. Push SET, PAT, and 1.
2. Push QUARTER.
3. Push END.
4. Push SET, PAT, and 2.
5. Push EIGHTH twice.
6. Push END.

\$10000.00 + PLUS \$

SPONSORED BY THE MAKERS OF THE

BASIC SOFTWARE LIBRARY

NOW ★ 10 ★ Volumes and Growing

And unlike others we are giving a portion in CASH that you Don't have to spend with us.

In addition to the \$10,000 Give Away we are going to celebrate July 4th by giving a Special Bonus to purchasers of an entire set of the Basic Software Library on a single order.

★ SPECIAL BONUS ★ 15% discounts on single purchase of full set by July 4th, 1980

We have over 100,000 in circulation since 1975 and we are still around and That's more than Anyone else can say. We used to sell hundreds of programs individually, the programs in Volume X were sold for several years at over \$10,000, in Volume III for over \$6,000 but a few years ago we decided to promote software to the mass public and it was an instant success. We are still several years ahead of our time in our marketing concepts as well as our products and we are going to be making another major change in the market. We are going to offer our programs in cassette form. NOT just one of two programs like everybody else. But a book full of programs for just \$9.95.

For Homeowners, Businessmen, Engineers, Hobbyists, Doctors, Lawyers, Men and Women

Vol. I \$24.95	Vol. II \$24.95	Vol. III \$39.95	Vol. IV \$9.95	Vol. V \$9.95	Vol. VIII \$19.95	Vol. IX \$19.95	Vol. X \$69.95
Business & Personal Bookkeeping Programs	Animals Four Astronaut Bagel Bio Cycle Cannons Checkers Craps Dogflight Golf Judy Line Up Pony Roulette Sky Diver Tank Teach Me	Binomial Chi-Sq. Coeff. Confidence 1 Confidence 2 Correlations Curve Differences Dual Plot Exp-Distri Least Squares Paired Plot Plotpts Polynomial Fit Regression Stat 1 Stat 2 T-Distribution Unpaired Variance 1 Variance 2 XY.	Beam Conv. Filter Fit Integration 1 Integration 2 Intensity Lola Macro Max. Min. Navaid Optical Planet PSD Rand 1 Rand 2 Solve Sphere Triang Stars Track Triangle Variable Vector	Billing Inventory Payroll Risk Sched. 2 Shipping Stocks Switch	Andy Cap Baseball Compare Confid 10 Descrip Differ Engine Fourier Horse Integers Logic Playboy Primes Probab Quadrac Red Baron Regression 2 Road Runner Roulette Santa Stat 10 Stat 11 Steel Top Vary Xmas	Auto Cypher Hurrtrac ID Lorana Map Navigate Omega Patterns Radar RDF	Intro. A/R A/P Mer Inv Check Assets Payroll Bal Sh P/L Year End Data Base Tax Up Basic St.
Bond Building Compound Cyclic Decision 1 Decision 2 Depreciation Efficient Flow Installment Interest Investments Mortgage Optimize Order Pert Tree Rate Return 1 Return 2 Schedule 1 Games & Pictures	A. Newman J.F.K. Linus Ms. Santa Nixon Noel Noel Nude Peace Policeman Santa's Sleigh Snoopy Virgin	APPENDIX A	Vol. VI \$49.95 Mini-Ledger Payroll A/R Inventory Peprec. Ledger	APPENDIX B	Balance Checkbook Instal 78 Deprec 2 APPENDIX C Favorites		
					Volume III—Part 1—Billing Inv. Pyrl. Volume VII—Part 1—Chess —available on TRS-80 level II compatible cassette \$9.95 Add \$1.00 per tape Post./Handling		
					Volume VI — Disk programs are compatible with TRS-80 disk basic The disk programs in Volumes VI, VII and X are written in (CP/M) M Basic and Disk Extended Microsoft Basic. Other programs written in 8K Basic.		

Volume III—Part 1—Billing Inv. Pyrl.
Volume VII—Part 1—Chess
—available on TRS-80 level II
compatible cassette \$9.95
Add \$1.00 per tape Post./Handling

Volume VI — Disk programs are
compatible with TRS-80 disk basic
The disk programs in Volumes VI, VII and X are
written in (CP/M) M Basic and Disk Extended
Microsoft Basic. Other programs written in 8K
Basic.

SELECTED PROGRAMS AVAILABLE ON CASSETTE



OVER 116,000 IN USE TODAY

Add \$1.50 per volume handling, all domestic shipments sent U.P.S. except APO and P.O. Box which go parcel post. Foreign orders add \$6.00/volume for air shipment and make payable in U.S. dollars only.

AVAILABLE AT MOST COMPUTER STORES
Master Charge and Bank Americard accepted.
Our Software is copyrighted and may not be reproduced or sold.

Unlike others we have NOT raised our prices in five years

No Purchase Necessary, to enter send name & address on a 3 x 5 card.
You are automatically entered everytime you make a purchase from us.
Void where prohibited by law.

KEMCO, LTD.

P.O. Drawer 2208L Petersburg, VA 23803

24 Hour HOT LINE 800-528-6050 ext. 1184
In Arizona call 800-352-0458

No.12:

Current Products

Software for most popular 8080/Z80* computer disk systems including NORTH STAR, iCOM, MICROPOLIS, DYNABYTE DB8/2 & DB8/4, EXIDY SORCERER, SD SYSTEMS, ALTAIR, VECTOR MZ, MECA, 8" IBM, HEATH H17 & H89, HELIOS, IMSAI VDP42 & 44, REX, NYLAC, INTERTEC SUPER-BRAIN, VISTA V80 and V200, TRS-80* MODEL I and MODEL II, ALTOS, OHIO SCIENTIFIC, DIGI-LOG, KONTRON PS180, IMS 5000 DISKETTE formats and CSSN BACKUP cartridge tapes.

Genuine CP/M for Apple II coming soon! Call for details.

Prices reflect distribution on 8" single density diskettes. If a format is requested which requires additional diskettes, a surcharge of \$5. per additional diskette will be added. A surcharge of \$25. will be added for software on CSSN format DC 300XL cartridges.

CP/M* VERSION 2 FOR TRS-80 MODEL II NOW AVAILABLE

All Lifeboat programs require CP/M, unless otherwise stated.

CP/M* FLOPPY DISK OPERATING SYSTEM - Digital Research's operating system configured for many popular micro-computers and disk systems:

System	Version	Price
North Star Single Density	1.4	145/25 v
North Star Double Density	1.4	145/25
North Star Micro-Disk 2411	2.x	170/25
iCOM 3712	1.4	145/25 v
iCOM 3812	2.x	170/25
Mits 3202/Altair 8800	1.4	145/25
Heath H8 + H17	1.4	145/25
Heath H89	1.4	145/25
TRS-80 Model I	2.x	170/25
TRS-80 Model II	2.x	170/25
Processor Technology Helios II	1.4	145/25
Gromecmo System 3	1.4	145/25
Intel MDS Single Density	1.4	145/25
Intel MDS Single Density	2.x	200/25
Intel MDS 800 Double Density	2.x	200/25
Intel MDS 230 Double Density	2.x	200/25
Micropolis Mod I	1.4	145/25 v
Micropolis Mod II	1.4	145/25 v

The following configurations are scheduled for release during the first half of 1980:

North Star Double/Quad + Corvus 2.x	250/25
North Star Horizon HD-1	2.x 250/25
Ohio Scientific C3	2.x 200/25
Ohio Scientific C3-B	2.x 250/25
Ohio Scientific C3-C	2.x 250/25
Micropolis Mod II	2.x 200/25
Mostek MDX STD Bus System	2.x 350/25 **
iCOM 3812	2.x 225/25
iCOM 4511/Pertec D3000	2.x 375/25 +
TRS-80 Model II + Corvus	2.x 250/25

Software consists of the operating system, text editor, assembler, debugger and other utilities for file management and system maintenance. Complete set of Digital Research's documentation and additional implementation notes included. Systems marked * include firmware on 2708 and 2716. Systems marked + include \$440 media charge. Systems marked v require the special v versions of software in this catalog. Systems marked v have minor variants available to suit console interface of system. Call or write for full list of options.

MP/M* - Intel MDS single density only (Documentation includes CP/M 2.0 manuals) \$300/\$50

Z80 DEVELOPMENT PACKAGE - Consists of: (1) disk file line editor, with global search and replace facilities; (2) Z80 relocating assembler, Zilog/Mostek mnemonics, conditional assembly and cross reference table capabilities; (3) linking loader producing absolute Intel hex disk file \$65/\$10

ZOT - Z80 Monitor Debugger to break and examine assembly displays. \$35 when ordered with Z80 Development Package \$50/\$10

XASM-68 - Non-macro cross-assembler with nested conditionals and full range of pseudo operations. Assembles from standard Motorola MC6800 mnemonics to Intel hex \$200/\$25

XASM-65 - As XASM-68 for MOS Technology MCS-6500 series mnemonics \$200/\$25

DISTEL - Disk based disassembler to Intel 8080 or TDL/Xitan Z80 source code, listing and cross reference files. Intel or TDL/Xitan pseudo ops optional. Runs on 8080 \$65/\$10

DISILOG - As DISTEL to Zilog/Mostek mnemonic files. Runs on Z80 only \$65/\$10

SMAL/80 Structured Macro Assembler Language - Package of powerful general purpose text macro processor and SMAL structured language compiler. SMAL is an assembler language with IF-THEN-ELSE, LOOP-REPEAT-WHILE, DO-END, BEGIN-END constructs \$75/\$15

tiny C - Interactive interpretive system for teaching structured programming techniques. Manual includes full source listings \$105/\$40

BDS C COMPILER - Supports most features of language, including Structures, Arrays, Pointers, recursive function evaluation, overlays. Includes linking loader, library manager, library containing general purpose, file I/O, and floating point functions. Lacks initializers, statics, floats and longs. Documentation includes THE C PROGRAMMING LANGUAGE by Kernighan and Ritchie \$125/\$20

WHITESMITHS C COMPILER - The ultimate in systems software tools. Produces faster code than a pseudo-code Pascal with more extensive facilities. Conforms to the full UNIX* Version 7 C language, described by Kernighan and Ritchie, and makes available over 75 functions for performing I/O, string manipulation and storage allocation. Linkable to Microsoft REL files. Requires 60K CP/M \$630/\$30

MICROSOFT

BASIC-80 - Disk Extended BASIC, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records \$325/\$25

BASIC COMPILER - Language compatible with BASIC-80 3-10 times faster executor. Produces standard Microsoft relocatable binary output. Includes MACRO-80. Also linkable to FORTRAN-80 or COBOL-80 code modules \$350/\$25

FORTRAN-80 - ANSI 66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) \$425/\$25

COBOL-80 - Level 1 ANSI '74 standard COBOL plus most of Level 2. Full sequential, relative, and indexed file support with variable file names. STRING, UNSTRING, COMPUTE, VARYING/UNTIL, EXTEND, CALL, COPY, SEARCH, 3-dimensional arrays, compound and abbreviated conditions, nested IF. Powerful interactive screen-handling extensions. Includes compatible assembler, linking loader, and relocatable library manager as described under MACRO-80 \$700/\$25

MACRO-80 - 8080/Z80 Macro Assembler, Intel and Zilog mnemonics supported. Relocatable linkable output. Loader, Library Manager and Cross Reference List utilities included \$149/\$15

XMACRO-86 - 8086 cross assembler. All Macro and utility features of MACRO-80 package. Mnemonics slightly modified from Intel ASM86. Compatibility data sheet available \$275/\$25

EDIT-80 - Very fast random access text editor for text with or without line numbers. Global and intra-line commands supported. File compare utility included. \$89/\$15

PASCAL/M* - Compiler generates P code from extended language, implementation of standard PASCAL. Supports overlay structure through additional procedure calls and the SEGMENT procedure type. Provides convenient string handling capability with the added variable type STRING. Typed files allow memory image I/O. Requires 56K CP/M \$199/\$20

PASCAL/Z - Z80 native code PASCAL compiler. Produces optimized, ROMable re-entrant code. All interfacing to CP/M is through the support library. The package includes compiler, Microsoft Compatible relocating assembler and linker, and source for all library modules. Variant record strings and direct I/O are supported. Requires 56K CP/M and Z80 CPU \$395/\$25

PASCAL/MT - Subset of standard PASCAL. Generates ROMable 8080 machine code. Symbolic debugger included. Supports interrupt procedures, CPU file I/O and assembly language interface. Real variables can be BCD, software floating point, or AMD 9511 hardware floating point. Version 3 includes Enumeration and Record data types. Manual explains BASIC to PASCAL conversion. Source for the runtime package requires Digital Research's MAC. Requires 32K \$250/\$30

ALGOL-60 - Powerful block-structured language compiler featuring economical run-time dynamic allocation of memory. Very compact (24K total RAM) system implementing almost all Algol 60 report features plus many powerful extensions including string handling direct disk address I/O etc. Requires Z80 CPU \$119/\$20

CBASIC-2 Disk Extended BASIC - Non-interactive BASIC with pseudo-code compiler and run-time interpreter. Supports full file control, chaining, integer and extended precision variables, etc. \$120/\$15

MICRO FOCUS

STANDARD CIS COBOL - ANSI '74 COBOL standard compiler fully validated by U.S. Navy tests to ANSI level 1. Supports many features to level 2 including dynamic loading of COBOL modules and a full ISAM file facility. Also, program segmentation, interactive debug and powerful interactive extensions to support protected and unprotected CRT screen formatting from COBOL programs used with any dumb terminal \$850/\$50

FORMS 2 - CRT screen editor. Output is COBOL data descriptions for copying into CIS COBOL programs. Automatically creates a query and update program of indexed files using CRT protected and unprotected screen formats. No programming experience needed. Output program directly compiled by CIS COBOL (standard) \$200/\$20

Tasty low prices!

EIDOS SYSTEMS

KISS - Keyed Index Sequential Search. Offers complete Multi-Keyed Index Sequential and Direct Access file management. Includes built-in utility functions for 16 or 32 bit arithmetic, string/integer conversion and string compare. Delivered as a relocatable linkable module in Microsoft format for use with FORTRAN-80 or COBOL-80, etc. \$335/\$25

KBASIC - Microsoft Disk Extended BASIC with all KISS facilities, integrated by implementation of nine additional commands in language. Package includes KISS REL as described above, and a sample mail list program \$585/\$45
To licensed users of Microsoft BASIC-80 (MBASIC) \$435/\$45

XYBASIC Interactive Process Control BASIC - Full disk BASIC features plus unique commands to handle bytes, rotate and shift, and to test and set bits. Available in Integer, Extended and ROMable versions. Integer Disk or Integer ROMable \$295/\$25
Extended Disk or Extended ROMable \$395/\$25

BASIC UTILITY DISK - Consists of: (1) CRUNCH-14 - Compacting utility to reduce the size and increase the speed of programs in Microsoft BASIC and TRS-80 BASIC. (2) DPFFUN - Double precision subroutines for computing nineteen transcendental functions including square root, natural log, log base 10, sin, arc sin, hyperbolic sin, hyperbolic cos, etc. Furnished in source on diskette and documentation \$50/\$35

STRING-80 - Character string handling plus routines for direct CP/M BDD calls from FORTRAN and other compatible Microsoft languages. The utility library contains routines that enable programs to chain to a COM file, retrieve command line parameters, and search file directories with full wild card facilities. Supplied as linkable modules in Microsoft format. \$95/\$20

STRING/80 source code available separately \$295/n.a.

THE STRING BIT - FORTRAN character string handling. Routines to find, fill, pack, move, separate, concatenate and compare character strings. This package completely eliminates the problems associated with character string handling in FORTRAN. Supplied with source \$65/\$15

VSORT - Versatile sort/merge system for fixed length records with fixed or variable length fields. VSORT can be used as a stand-alone package or loaded and called as a subroutine from CBASIC-2. When used as a subroutine, VSORT maximizes the use of buffer space by saving the TPA on disk and restoring it on completion of sorting. Records may be up to 255 bytes long with a maximum of 5 fields. Upper/lower case translation and numeric fields supported. \$175/\$20

CPM/374X - Has full range of functions to create or re-name an IBM 3741 volume, display directory information and edit the data contents. Provides full file transfer facilities between 3741 volume data sets and CP/M files \$195/\$10

BSTAM - Utility to link one computer to another also equipped with BSTAM. Allows file transfers at full data speed (no conversion to hex), with CRC block control check for very reliable error detection and automatic retry. Use it! It's great! Full wildcard expansion to send *.COM, etc. 9600 baud with wire. 300 baud with phone connection. Both ends need one. Standard and Q versions can talk to one another \$150/\$55

WHATSI?* Interactive data-base system using associative tags to retrieve information by subject, hashing and random access used for fast response. Requires CBASIC-2 \$175/\$25

SELECTOR III-C2 - Data Base Processor to create and maintain multi key data bases. Prints formatted sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source \$295/\$20

LECTOR - General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system \$250/\$25

CBS - Configurable Business System is a comprehensive set of programs for defining custom data files and application systems without using programming languages such as BASIC or FORTRAN. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. No support language required \$295/\$25

MICRO DATA BASE SYSTEMS

HBDS - Hierarchical Data Base System. CODASYL oriented with FILES, SETS, RECORDS and ITEMS which are all user defined. ADD, DELETE, UPDATE, SEARCH, and TRAVERSE commands supported. Set ordering is sorted, FIFO, LIFO, next or prior. One to many set relationship supported. Read/Write protection at the FILE level. Supports FILES which extend over multiple floppy or hard disk devices.

MDBS - Micro Data Base System. Full network data base with all features of HBDS plus multi-level Read/Write protection for FILE, SET, RECORD and ITEM. Explicit representation of one to one, one to many, many to many, and many to one SET relationships. Supports multiple owner and multiple record types within SETs. HBDS files are fully compatible.

MDBS-DRS - MDBS with Dynamic Restructuring System option which allows altering MDBS data bases when new ITEMS, RECORDS, or SETs are needed without changing existing data.

HBDS-Z80 version \$250/\$40

MDBS-Z80 version \$750/\$40

MDBS-DRS-Z80 version \$850/\$50

8080 Version available at \$75. extra

When ordering, specify one of the languages listed below.

all micropro prices are discounted!

SUPER-SORT I - Sort, merge, extract utility as absolute executable program or linkable module in Micro-Soft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating & fixed point, exponential, field justified, etc. Even variable number of fields per record! \$225/\$25

SUPER-SORT II - Above available as absolute program only \$175/\$25

SUPER-SORT III - As II without SELECT/EXCLUDE \$125/\$25

WORD-STAR - Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text pagination, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block mode etc. Requires CRT terminal with addressable cursor positioning \$445/\$40

WORD-STAR Customization Notes - For sophisticated users who do not have one of the many standard terminal or printer configurations in the distribution version of WORD-STAR NA/\$95

WORD-MASTER Text Editor - In one mode has super-set of CP/M's ED commands including global searching and replacing, forwards and backwards in file in video mode, provides full screen editor for users with serial addressable-cursor terminal \$125/\$25

SELECTOR III-C2 - Data Base Processor to create and maintain multi key data bases. Prints formatted sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source \$295/\$20

LECTOR - General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system \$250/\$25

CBS - Configurable Business System is a comprehensive set of programs for defining custom data files and application systems without using programming languages such as BASIC or FORTRAN. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. No support language required \$295/\$25

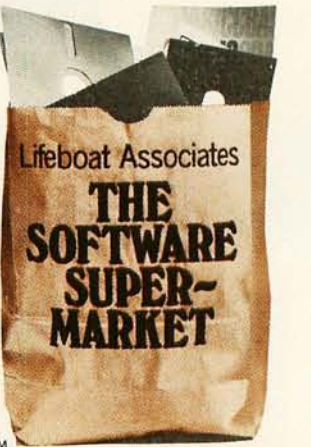
WHATSI?* Interactive data-base system using associative tags to retrieve information by subject, hashing and random access used for fast response. Requires CBASIC-2 \$175/\$25

SELECTOR III-C2 - Data Base Processor to create and maintain multi key data bases. Prints formatted sorted reports with numerical summaries or mailing labels. Comes with sample applications, including Sales Activity, Inventory, Payables, Receivables, Check Register, and Client/Patient Appointments, etc. Requires CBASIC-2. Supplied in source \$295/\$20

LECTOR - General Ledger option to SELECTOR III-C2. Interactive system provides for customized COA. Unique chart of transaction types insure proper double entry bookkeeping. Generates balance sheets, P&L statements and journals. Two year record allows for statement of changes in financial position report. Supplied in source. Requires SELECTOR III-C2, CBASIC-2 and 52K system \$250/\$25

CBS - Configurable Business System is a comprehensive set of programs for defining custom data files and application systems without using programming languages such as BASIC or FORTRAN. Multiple key fields for each data file are supported. Set-up program customizes system to user's CRT and printer. Provides fast and easy interactive data entry and retrieval with transaction processing. Report generator program does complex calculations with stored and derived data, record selection with multiple criteria, and custom formats. Sample inventory and mailing list systems included. No support language required \$295/\$25

Prices and specifications subject to change without notice.



Everything on #12 runs on 64K TRS-80 Model II

POLYVIEW/80 - Full screen editor for any CRT with XY cursor positioning. Includes vertical and horizontal scrolling, interactive search and replace, automatic text wrap around for word processing, operations for manipulating blocks of text, and comprehensive 70 page manual. . . . \$135/\$15

POLYTEXT/80 - Text formatter for word processing applications. Justifies and paginates source text files. Will generate form letters with custom fields and conditional processing. Support for Daisy Wheel printers includes variable pitch justification and motion optimization. . . . \$85/\$15

TEXTWRITER III - Text formatter to justify and paginate letters and other documents. Special features include insertion of text during execution from other disk files or console, permitting recipe documents to be created from linked fragments on other files. Has facilities for sorted index, table of contents and footnote insertions. Ideal for contracts, manuals, etc. Now compatible with Electric Pencil! . . . \$125/\$20

Now-applications Software for Microsofts BASIC interpreter!

PEACHTREE SOFTWARE

GENERAL LEDGER - Records details of all financial transactions. Generates a balance sheet and an income statement. Flexible and adaptable design for both small businesses and firms performing client writeup services. Produces reports as follows: Trial Balance, Transaction Register, Balance Sheet, Prior Year Comparative Balance Sheet, Income Statement, Prior Year Comparative Income Statement and Department Income Statements. Interactive with other PEACHTREE accounting packages. Supplied in source code for Microsoft BASIC. . . . \$990/\$30

ACCOUNTS PAYABLE - Tracks current and aged payables and incorporates a check writing feature. Maintains a complete vendor file with information on purchase orders and discount terms as well as active account status. Produces reports as follows: Open Voucher Report, Accounts Payable Aging Report and Cash Requirements. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC. . . . \$990/\$30

ACCOUNTS RECEIVABLE - Generates invoice register and complete monthly statements. Tracks current and aged receivables. Maintains customer file including credit information and account status. The current status of any customer account is instantly available. Produces reports as follows: Aged Accounts Receivable, Invoice Register, Payment and Adjustment Register and Customer Account Status Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC. . . . \$990/\$30

PAYROLL - Prepares payroll for hourly, salaried and commissioned employees. Generates monthly, quarterly and annual returns. Prepares employee W-2's. Includes tables for federal withholding and FICA as well as withholding for all 50 states plus up to 20 cities from pre-computed or user generated tables. Will print checks, Payroll Register, Monthly Summary and Unemployment Tax Report. Provides input to PEACHTREE General Ledger. Supplied in source code for Microsoft BASIC. . . . \$990/\$30

INVENTORY - Maintains detailed information on each inventory item including part number, description, unit of measure, vendor and reorder data, item activity and complete information on current item costs, pricing and sales. Produces reports as follows: Physical Inventory Worksheet, Inventory Price List, Departmental Summary Report, Inventory Status Report, The Reorder Report and the Period-to-Date and Year-to-Date reports. Supplied in source code for Microsoft BASIC. . . . \$1,190/\$30

MAILING ADDRESS - Keeps track of name and address information and allows the selective printing of this information in the form of mailing lists or address labels. Allows the user to tailor the system to his own particular requirements. User-defined format and print-out system uses a special format file which tells programs how to print the mailing list or address labels. Standard format files are included with system. Automatic sorting of data used and file management routines which allow the name and address information to be sequentially retrieved and printed without file sorting. Supplied in source code for Microsoft BASIC. . . . \$790/\$30

GRAHAM-DORIAN SOFTWARE SYSTEMS

GENERAL LEDGER - An on-line system; no batching is required. Entries to GRAHAM-DORIAN accounting packages are automatically posted. User establishes customized C.O.A. Provides transaction register, record of journal entries, trial balances and monthly closings. Keeps 14 month history and provides comparison of current year with previous year. Requires CBASIC-2. Supplied in source . . . \$995/\$35

ACCOUNTS PAYABLE - Maintains vendor list and check register. Performs cash flow analysis. Flexible - writes checks to specific vendor for certain invoices or can make partial payments. Automatically posts to GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source . . . \$995/\$35

ACCOUNTS RECEIVABLE - Creates trial balance reports, prepares statements, ages accounts and records invoices. Provides complete information describing customer payment activity. Receipts can be posted to different ledger accounts. Entries automatically update GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source . . . \$995/\$35

PAYROLL SYSTEM - Maintains employee master file. Computes payroll withholding for FICA, Federal and State taxes. Prints payroll register, checks, quarterly reports and W-2 forms. Can generate ad hoc reports and employee form letters with mail labels. Requires CBASIC-2. Supplied in source . . . \$590/\$35

INVENTORY SYSTEM - Captures stock levels, costs, sources, sales, ages, turnover, markup, etc. Transaction information may be entered for reporting by salesman, type of sale, date of sale, etc. Reports available both for accounting and decision making. Requires CBASIC-2. Supplied in source . . . \$590/\$35

JOB COSTING - Designed for general contractors. To be used interactively with other GRAHAM-DORIAN accounting packages for tracking and analyzing expenses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN General Ledger or runs as stand alone system. Requires CBASIC-2. Supplied in source . . . \$995/\$35

Orders must specify disk systems and formats: e.g. North Star single, double or quad density, IBM single or 2D-256, Altair, Helios II, Micropolis Mod I or II, 5 1/4" soft sector (Micro CCM-SD Systems) Dynabyte, etc.

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

Manual cost applicable against price of subsequent software purchase.

The sale of each proprietary software package carries a non-exclusive license for use on one system only.

Prices F.O.B. New York. Shipping, handling and C.O.D. charges extra.

APARTMENT MANAGEMENT SYSTEM - Financial management system for receipts and security deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source . . . \$590/\$35

CASH REGISTER - Maintains files on daily sales. Files data by sales person and item. Tracks sales, over-rings, refunds, payouts and total net deposits. Requires CBASIC-2. Supplied in source . . . \$590/\$35

POSTMASTER - A comprehensive package for mail maintenance that is completely menu driven. Features include keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2. . . . \$150/\$15

STRUCTURED SYSTEMS GROUP

GENERAL LEDGER - Interactive and flexible system providing proof and report outputs. Customization of COA created interactively. Multiple branch accounting centers. Extensive checking performed at data entry for proof, COA correctness, etc. Journal entries may be batched prior to posting. Closing procedure automatically backs up input files. Now includes Statement of Changes in Financial Position. Requires CBASIC-2. . . . \$1250/\$25

ACCOUNTS RECEIVABLE - Open item system with output for internal aged reports and customer-oriented statement and billing purposes. On-Line Enquiry permits information for Customer Service and Credit departments. Interface to General Ledger provided if both systems used. Requires CBASIC-2. . . . \$1250/\$25

ACCOUNTS PAYABLE - Provides aged statements of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or with NAD. Requires CBASIC-2. . . . \$1250/\$25

PAYROLL - Flexible payroll system handles weekly, bi-weekly, semi-monthly and monthly payroll periods. Tips, bonuses, re-imbursements, advances, sick pay, vacation pay, and compensation time are all part of the payroll records. Prints government required periodic reports and will post to multiple SSG General Ledger accounts. Requires CBASIC-2 and 54K of memory. . . . \$1250/\$25

INVENTORY CONTROL SYSTEM - Performs control functions of adding and deleting stock items, adding new items and deleting old items. Tracks quantity of items on hand, on order and back-ordered. Optional hard copy audit trail is available. Reports include Master Item List, Stock Activity, Stock Valuation and Re-order List. Requires CBASIC-2 \$1250/\$25

ANALYST - Customized data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level break-points for summarization. Requires CBASIC-2. . . . \$250/\$15

LETTERRIGHT - Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailing. Requires CBASIC-2. . . . \$100/\$20

NAD Name and Address selection system - Interactive mail list creation and maintenance program with output as full reports with reference data or interactive information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2. . . . \$100/\$20

OSORT - Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created. . . . \$100/\$20

CONDIMENTS

HEAD CLEANING DISKETTE - Cleans the drive Read/Write head in 30 seconds. Diskette absorbs loose oxide particles, fingerprints, and other foreign particles that might hinder the performance of the drive head. Lasts at least 3 months with daily use. Specify 5" or 8".

Single sided . . . \$20 each/\$55 for 3

Double sided . . . \$25 each/\$65 for 3

FLIPPY DISK KIT - Template and instructions to modify single sided 5 1/4" diskettes for use of second side in single sided drives. . . . \$12.50

FLOPPY SAVER - Protection for center holes of 5" and 8" floppy disks. Only 1 needed per diskette. Kit contains centering post, pressure tool and tough 7 mil mylar reinforcing rings for 25 diskettes.

5" Kit . . . \$14.95

5" Rings only . . . \$7.95

8" Kit . . . \$16.95

8" Rings only . . . \$8.95

PASCAL USER MANUAL AND REPORT - By Jensen and Wirth. The standard textbook on the language. Recommended for use by Pascal/Z, Pascal/M and Pascal/MT users. . . . \$10

THE C PROGRAMMING LANGUAGE - By Kernighan and Ritchie. The standard textbook on the language. Recommended for use by BDS C, tiny C, and Whitesmiths C users. . . . \$12

STRUCTURED MICROPROCESSOR PROGRAMMING - By the authors of SMAL/80. Covers structured programming, the 8080/8085 instruction set and the SMAL/80 language. . . . \$20.00

ACCOUNTS PAYABLE - ACCOUNTS RECEIVABLE - CBASIC - By Osborne/McGraw-Hill. . . . \$20

GENERAL LEDGER - CBASIC - By Osborne/McGraw-Hill. . . . \$20

Hearty Appetite.

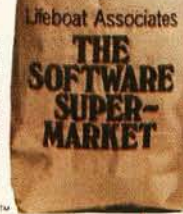
*CP/M and MP/M are trademarks of Digital Research. *80 is a trademark of Zilog, Inc. *UNIX is a trademark of Bell Laboratories. *WHATSIT? is a trademark of Computer Headware. *Electric Pencil is a trademark of Michael Shrayor Software. *TRS-80 is a trademark of Tandy Corp. *Pascal/M is a trademark of Sorcim.

Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

User license agreement for this product must be signed and returned to Lieboat Associates before shipment may be made.

This product Includes/Excludes the language manual recommended in Condiments.



7. Push SET, PAT, and 3.
8. Push SIXTEENTH four times.
9. Push END.

Note that there are now four sequences that can be defined. They are labelled on the score. I will create the commands for the first one only, since the others are similar:

1. Push SET, SEQ, and 1.
2. Push 3,1,2,1,2,1,1,1 on the PAT row.
3. Push END.

The other sequences consist of:

- #2 - 3,1,3,1,1,2,2,1
- #3 - 3,1,3,1
- #4 - 2,2,2,2,2,1,1,1

The different ways of ordering sequences and patterns are numerous. The above score in particular could have been entered in several ways.

Using a scheme like this, any score of music can be entered into the editor. Other schemes could be devised to tailor the input form to the type of music being edited. The only changes to the program, however, would occur in the input-interface program; the main part of the editor would remain unchanged.

Symbols That Cross Over Measures

I have not yet approached the problem of symbols that cross over measures and, thus, over lines and pages. Nor have I discussed the placement of nested slurs or ties and how to draw them on the screen. These problems are complex; their solutions lie in keeping pointers in the character array to the locations where the symbol begins and ends. Any changes to these measures, such as deletion, must also change these pointers - for example, we do not have a beginning of a crescendo with no end. Thus these pointers must again be doubly-linked. Drawing the correct arcs for slurs and ties presents a problem because they can be separated by long distances. A routine must be called when the screen locations are known to fit a curve through these points.

Reformatting

After editing a page, the format of the pages from then on is usually different. If you simply added a

character in a measure, the paging will probably remain the same; however, if you add thirty notes to the measure, it is much longer, and might change the number of measures on the line and hence the format of the page. How far this change will carry depends upon the size of the change and the scaling factors of the measures. (If the scaling factors were all 1.0, then any change to a measure would cause a complete repaging of the score.)

Whenever the user wants to display or edit the score, a formatting program must be called to repage the score. This routine must execute the algorithms given previously, which determine the beaming groups of the measures and the measure lengths of all changed measures. It must then determine which measures will go on the lines. It needs to alter the existing paging only as far as the change propagates, but there is no way to predict this in advance. Thus a simple change could cause considerable computation.

Conclusion

I hope that the reader has begun to

appreciate the problems involved in creating a text editor for music. What is the utility of such a program? To anyone who has ever tried printing a score of music with india ink, the virtues of an editor with hard-copy facilities are obvious. A number of uses for the program present themselves. For example, very often music written in one key needs to be changed into one of the other keys. This is called *transposition*. A program can easily be written which takes the contents of the character array and performs the transformation.

You might wish to create computer music and display it on the screen. You could write a music-generation program and feed its output to a conversion routine that would convert its output into the format of the editor. If actual sounds were converted into pitches and durations with an electronic device, this could be placed in the editor, and you could see the music that was being played. If several scores by a composer are entered into the program and statistical analysis is performed on them to determine the probabilities of

certain patterns of music, the results could, in theory, be used to drive a music-generation program that would simulate the composer's style. This same approach could be applied to music from different historical periods, thus enabling the computer to create a classical symphony or a twelve-tone quartet. ■

Editor's note: The data-entry system for musical scores described in this article has a bias toward transcription of scores containing a single melodic line. Other types of musical scores contain elements which are not dealt with here. For instance, music for keyboard instruments, such as the piano, usually contain chords consisting of several notes to be sounded simultaneously. These chords are often written as several note heads sharing a single stem. It would be difficult at best to work with such music using this system. Enhancing the system to handle these elements would be a good project for the ambitious reader. . . . RSS

IMMEDIATE DELIVERY — FROM ORANGE MICRO



TELEVIDEO 912B
\$769⁰⁰

STANDARD FEATURES (partial list)

- Reverse video, Underline, Blinking, Reduced
- Protected fields, Security Blank fields.
- Block or Conversational modes.
- Editing: Line or Character; Insert/Delete.
- Tab, Backtab; Columnar tab.
- 14 key numeric pad with return key.
- RS232 Printer Port

OPTIONAL:

- Deluxe Selectric® Keyboard: \$75⁰⁰
- 2nd Page Memory: \$80⁰⁰
- 11 Special function keys and 8 edit keys: \$70⁰⁰



Phone orders WELCOME. Same day shipment for VISA and MASTER CHARGE. Personal checks require 2 weeks to clear. Add 3% for shipping and handling. CA residents add 6%. Manufacturer's warranty included. Prices subject to revision.

BASE 2 PRINTER
\$599⁰⁰



FEATURES:

- 72, 80, 96, 120 or 132 Columns per line.
- Bi-directional, 7 dot matrix, impact.
- Graphics Capability.
- RS232, Centronics®, IEEE-488, 20 ma.
- 60 LPM / Fast feed.
- User Programmable Character Fonts.
- 16 Baud Rates — to 19,200.
- Expanded Characters.
- Tractor Mechanism

OPTIONAL:

- 2K Memory Buffer: \$50⁰⁰
- Paper Rack: \$20⁰⁰



Digicom Coupler
ORIGINATE
\$179⁰⁰



* with initial order of CRT or Printer

COMPARE QUALITY,
FEATURES & DISCOUNT

Products also available:
**Gume, MPI, Lear Siegler, Cables,
System Furniture**
CALL OR WRITE FOR CATALOG

CALL (714) 630-3322

**Orange
Micro**



POST OFFICE BOX 2076
YORBA LINDA, CALIFORNIA 92686

The **FLEX™** Disk Operating System

FLEX™ is a powerful, easy-to-use disk operating system which has become the standard for 6800 and 6809 micro-processor systems. Two new versions are now available and both include a disk editor and assembler:

FLEX for the EXORciser™ \$150.00

Runs on a Motorola EXORciser with EXORDisk™ II or III. Requires no hardware modifications with the possible exception of memory re-addressing. Uses the same boot as MDOS™.

FLEX for General Use \$150.00

Fully documented to allow a user to write his own terminal and disk I/O routines to adapt to most any hardware. Three system requirements are: (1) at least 12K of RAM at \$0000; (2) 8K of RAM at \$A000 for 6800 or \$C000 for 6809; (3) floppy disk drive capable of 256-byte, soft sectors. This package is not for beginners!

FLEX Support Software

New!

Extended BASIC	\$100.00
Standard BASIC	65.00
6809 Diagnostics Package	75.00
Text Processing System	60.00
Sort/Merge	75.00
68000 Cross Assembler	250.00
6809 Cross Assembler	100.00
6809 FLEX Utilities	60.00
6800 FLEX Utilities	100.00
6809 Debug Package	75.00
6800 Debug Package	55.00
FLEX for SWTPc	90.00

Be sure to specify disk size and 6800 or 6809. All orders should include 3% postage and handling (10% on foreign orders). Mastercharge and Visa are welcomed.

FLEX is a trademark of Technical Systems Consultants, Inc.
EXORciser, EXORDisk, and MDOS are trademarks of Motorola, Inc.



**technical systems
consultants, inc.**

Box 2570, West Lafayette, IN 47906
(317) 463-2502



Using the Computer as a Musician's Amanuensis

Part 2: Going from Keyboard to Printed Score

Jef Raskin
Apple Computer Co
10260 Bandle Dr
Cupertino CA 95014

More Problems with Rhythm and Tempo

The would-be Composer's Aid designer plummets into another pile of programming problems when tempo change. The beat, *sometimes* constant within a piece, may abruptly slow down, as may happen in a reflective refrain in a blues number, or gradually accelerate, as in a Greek folk dance. Changes of tempo present problems that are worse than the problems in transcribing rhythms that we have already seen.

It is not difficult to see that an abrupt change in tempo cannot be detected the instant that it happens, but only after a few notes have been played at the new speed, establishing, as musicians say, the new tempo. This brings up the concept that rhythm does not exist only in relation to the length of individual notes, but exists also in a much larger musical context.

About the Author

Jef Raskin's credentials in music include his years as a professional musician and a music teacher. He is presently the manager of Advanced Systems at Apple Computer Co. His personal music and computer equipment includes a piano, a harpsichord, an organ, a PDP-11, and three Apple II computers.

Therefore, a computer (or a human being) cannot notate rhythm in real time (ie: as it happens). The notator must wait and accumulate a significant sample (ie: listen for a while) before making any decision how to write down what has been heard. A computer program that must deter-

A computer (or a human being) cannot notate rhythm in real time.

mine rhythms will most probably have to backtrack through the data, perhaps a number of times, before deciding how to notate the music.

Much of the fun in listening to music comes from anticipation of the rhythm; the composer or performer can use rhythmic expectations as a background against which to introduce rhythmic novelties. This is similar to the use of harmonic and melodic "surprises" that cannot be assessed until some time after they have been heard. The fact that we hear music in a context of expectations built on previous experience stands as a sentinel, guarding against the possibility that there is an easy algorithm that might "understand" music on a note-by-note basis.

Further Consequences of Changes of Tempo

A gradual change of tempo is either *accelerando* (getting faster) or *ritardando* (getting slower). In *ritardando* (very common at the ends of pieces or sections of pieces), how is the computer to tell the difference between a gradual lengthening of the written note values on one hand, and the use of the word "ritardando" along with an actual constant note length, on the other? This is very easy for a human to do, but it is very difficult to tell a computer how we do it.

In many pieces that require this slowing down, there is no notation for a *ritardando* at all. In these cases, the *ritardando* is inherent in the nature of the music. The conventional notation is to write the score as if nothing at all happens to the tempo.

This last problem afflicts score-to-performance transforming programs more than it afflicts programs that transform performances to scores. It is one of the symptoms of "soulless" computer performances. The computer too often is programmed with only the notes, but not with the *style*—that part of the music which is indigenous to a culture or time. Without the proper style, music tends to sound "wooden" or "dead."

Ten reasons why your floppy disk should be a BASF FlexyDisk®.



More than four decades of experience in magnetic media – BASF invented magnetic recording tape, the forerunner of today's wide range of magnetic media, back in 1934, and was the first independent manufacturer of IBM-compatible floppy disks.

Tough Tyvek sleeve – no paper dust, no static electricity.

Special self-cleaning jacket and liner help eliminate data errors and media wear and tear.

Packaging to suit your requirements – standard flip-top box, Kassetette 10® storage case, or bulk pack.

Center hole diameter punched to more accurate standards than industry specifications, for top performance.

100% certification – every single disk is tested at thresholds 2-3 times higher than system requirements, to be 100% error-free.

Bi-axially oriented polyester substrate – for uniform and reliable performance year after year.

For the name of your nearest supplier, write BASF Systems, Crosby Drive, Bedford, MA 01730, or call 617-271-4030. See us at the NCC, Booth 1121

Cross-linked oxide coating – for low head wear and long trouble-free media life.

Total capability – one of two manufacturers in the world that makes both 8" and 5.25" models, has tape and disk experience, and manufactures floppy disk drives.

Double lubrication – lubricants both in the formula and on the disk surface, to minimize media wear due to head friction.



BASF

Floppy Disks Mag Cards Cassettes Computer Tapes Disk Packs Computer Peripherals

Someone Tries to Sell the Author a "Notating Machine"

An entrepreneur tried to interest me in funding a device he was in the process of patenting. According to him, it would do the "simple" task of transcribing any rhythm tapped out on its surface into standard musical notation. It was to be the size of a hand-held calculator.

I asked him the questions that I have brought up in this discussion, and it soon became clear that he had not given the matter even as much thought as I have been giv-

ing the problem in this article. As an answer to the question of *accelerando* and *ritardando*, he suggested that the instructions would specify that the user must not slow down or speed up.

As happens too often in the world of computing, he was forced to lean toward a device that would—perhaps—write down the easy rhythms, leaving the difficult ones for the user to figure out. Most users, I suspect, would rather have a device to write down the difficult rhythms. The users can figure out the easy ones without

mechanical aid.

Incidentally, one of the most difficult problems for a beginner to solve is determining on which beat of a measure a piece begins. Pieces very often begin in the middle of a measure. This is also a vexing problem for anyone who would program a computer to notate rhythms.

Placing any restrictions not found in the music itself on the user seems inherently wrong to me. The system must accommodate the person, not the other way around.

There are many other problems with rhythm—for example, *rubato*, where one part momentarily goes faster or slower than accompanying parts. Another class of problems are rhythmic complexities such as triplets, grace notes (so short that their time value is not notated), and other groups of notes that break the simpler rhythmic patterns.

A *triplet* is a melodic phrase consisting of three notes of equal length,

three quarter notes, for instance. These three quarter notes are played in the same time interval that two quarter notes occupy in the normal rhythm of the piece. It is difficult to tell what has happened when a few triplets are introduced in a piece. When they first occur in a piece, you may ask yourself (if you are a trained musician), "Has the tempo suddenly changed, or have triplets been introduced?" The program will be hard

put to guess at the difference.

Another problem occurs when very long notes occur in a piece which previously consisted only of relatively short notes. You must decide, for instance, whether to write them as tied shorter notes or as longer note forms. Of course, they might be written as the *same* note-length notations as the earlier, shorter notes, but with a tempo change!

All of this judgment of tempo must be done in the face of the first problem, that the note lengths and inception times are not coming in precisely, but with considerable variation. Often, the amount of this variation may mask tempo or rhythmic changes. Consider, too, that the people who need the Composer's Aid most are those who may be least proficient at performing upon conventional instruments. The designer probably has a more difficult task to make the Composer's Aid accurately portray the muddled attempts at rhythmic regularity of a beginner, than to make it follow the (probably) more precise playing of a master.

Before leaving the subject of rhythm, I shall take the liberty to give the following advice to all would-be designers of automatic music-transcribing systems. First, build one that has but one key or button, and get it to determine rhythms correctly. By "correctly" I mean without unreasonable limitations. It should be able to handle any rhythm found in a Mozart or a Beatles' melodic line. If you cannot master that, then you certainly cannot transcribe more complex music, which might have a solo melody as a part of a piece.

The problems of rhythm are not

SUPERPASCAL

5-10 times faster...
and more!

Meet Pascal/Z™ the fast, flexible compiler with higher speed, greater efficiency and improved debugging:

- **True Z-80 native code Pascal compiler**—5-10X faster than competing P-code implementations—no interpreter required.

- **The only multi-tasking Pascal**—produces ROMable re-entrant code.

- **Optimized** for fastest execution—recognizes and exploits special cases.

- **Easily transportable**—all hooks to your system made through support library.

- **Includes standard** floating point package. Single copy on CP/M-compatible disk includes compiler, companion macro-assembler & source of the library, \$395. OEM licenses available. Write or call for more information.

InterSystems™

Ithaca Intersystems Inc., 1650 Hanshaw Road/P.O. Box 91,
Ithaca, NY 14850/607-257-0190/TWX: 510255 4346

© 1979 Ithaca Intersystems Inc.



How COMPUMAX stacks up to the competition

COMPARISON SHOPPING? STOP HERE!

IMPORTANT QUESTIONS ABOUT BUSINESS SOFTWARE	COMPUMAX	OSBORNE/McGRAW HILL	PEACHTREE SOFTWARE	STRUCTURED SYSTEMS
What programs are available? <i>Are they INTERACTIVE?</i>	INTERACTIVE: GENERAL LEDGER ACC'TS PAYABLE ACC'TS REC'BLE INVENTORY PAYROLL/PERSONNEL	INTERACTIVE: GENERAL LEDGER ACC'TS PAYABLE ACC'TS REC'BLE PAYROLL	INTERACTIVE: GENERAL LEDGER ACC'TS PAYABLE ACC'TS REC'BLE PAYROLL NON-INTERACTIVE: INVENTORY	INTERACTIVE: GENERAL LEDGER ACC'TS PAYABLE ACC'TS REC'BLE NON-INTERACTIVE: STOCK CONTROL INVENTORY
What versions are available?	TRS-80, APPLE II COMMODORE PET MICROSOFT, CBASIC2 CP/M _R MICROPOLIS: EXIDY SORCERER, VECTOR MZ, DYNABYTE CROMEMCO III	WANG CBASIC2 CP/M _R	MICROSOFT CP/M _R	CBASIC2 CP/M _R
What is the price?	MICROLEDGER, A/P, A/R, INV, PERS: \$140.-each. MAXILEDGER, ORDER ENTRY \$350.-each.	One-time dealer cost: \$250 each. Suggested book price: \$20 each, without machine- readable code.	GL, A/P, A/R, PAYROLL, INVENTORY \$1000 each.	GL \$995.- A/P \$750.- A/R \$750.- INV. \$500.-
Hardware options	40 column CRT 64 column CRT 80 col. terminal 80 col. printer included	64 col. CRT or terminal minimum. 132 col. printer.	80 col. CRT only 132 column printer only	cursor addressable terminal only 132 column printer only.
Is source code included?	YES, INCLUDING PROGRAM FLOWCHARTS.	YES	YES	NO
What type of after-purchase support is offered?	1 YR WARRANTY & CORRECTION OF DEFECTS THROUGH DEALER. INDIVIDUAL PROGRAM AUTHORS AVAILABLE FOR QUESTIONS.	DEALER IS RESPONSIBLE FOR SUPPORT.	1 YR WARRANTY & CORRECTION OF DEFECTS THROUGH DEALER.	TECHNICIANS AVAILABLE FOR QUESTIONS. UPDATES MADE AVAILABLE FOR A FEE.

Prices and specifications available Feb. 1980. CP/M is the registered trademark of Digital Research.

COMPUMAX is your one-stop shop for all your business bookkeeping software.

You've been led down the path before, but not this time. No more promises of turnkey computers without the key. It's YOUR turn to tell the computer how to run the business, not vice versa.

With COMPUMAX software you have a beginning. With 5 years of experience and over 3,000 systems installed, they are professionals, when it comes to solutions for the businessman.

COMPUMAX software is designed with CHANGE in mind, since everybody really wants his own touch added. The programs are SIMPLE, YET ELOQUENT.

COMPUMAX supplies ready, working programs. You can, then, easily customize them, as your additional requirements develop.

Or do as many have done—keep it simple by running the programs in their ready form. Join the microcomputer revolution the simple way.

For a demo, visit your local computer store. If your local retailer does not carry COMPUMAX software, have him give us a call at (415) 321-2881.

COMPUMAX

467 HAMILTON AVENUE PALO ALTO, CA 94301



Figure 1: The same passage as written (1a) and as performed (1b). Both examples here are from the “St Louis Blues.”

unexplored. Some of the algorithms that adaptively follow varying-rate Morse code may be useful. A number of moderately successful programs, all quite large and complex (using many techniques from artificial intelligence work, and *not* operating in real time), have been created. [*The October 1976 issue of BYTE contained several discussions of Morse-code decoding problems.* . . .RSS]

If you first succeed with rhythm, *then* you might have a chance at the rest of the problem. At least a good portion of the problem of transcribing a musical performance into a standard score will have been solved.

More and Less

It is clear that a performance of a piece often contains *more* information than is given in the score: things happen in the performance that are not specified in the written music. Jazz, usually played from sketchy "charts," is an especially good example. The lilting "dotted" rhythms of jazz are notated as equal notes on the page. But everyone "knows" how it should sound. Look at the example from W C Handy's "St Louis Blues" in figure 1.

It is clear that the performance in figure 1b is quite different from the written notation in figure 1a, as it must be in order to sound right. The figure shows just one possible way of singing the opening measure of the chorus to the "St Louis Blues" (and it is not an especially extreme example).

It is rare, if not unheard of, that two live performances are the same. Some of the changes are minor, such as changing two eighths to a dotted eighth and a sixteenth. More surprising is the modification of the opening two eighth notes into half notes (with a ritard, no less). But that is the way

it is done.

Strangely enough, the same convention about playing eighth notes with a certain uneven lilt occurs in much baroque music, in spite of the fact that the notes were written down as being of equal length. Many performances of Bach's music, for example, are marred by a "wooden" playing of such passages.

Many conductors and performers play baroque music exactly as it is notated. It sounds as if you tried playing jazz or rock exactly as written in songbooks and sheet music: the result is dull music. This may help to account for some of the comments about baroque music sounding like a melodic sewing machine—some performers play it as though their in-

INPUTS				
Musical Idea	Score	Keypresses	Sound	
Inspiration	Plagiarization	Stimulation	Synthesized Music	Musical Idea
Composition	Arranging, Copying	Transcription	Taking Dictation	Score
Improvisation	Performance	Coupling	Playing By Ear	Keypresses
"Science Fiction"	Automation	"Sonification"	Transmission	Perceived Sound

O
U
T
P
U
T
S

Table 1: Musical transformations, representing the various ways of obtaining musical results. The table is read by starting at the top at a given input and proceeding downward and to the right to read the output. The shaded example illustrates that the term performance describes the connection between a printed score and the production of keypresses. (For simplicity's sake, the table deals only with keyboard instruments.) Similarly, to go from a musical idea (ie: input) to a score (ie: output) requires "composition." The term coupling refers to the mechanical addition of extra voices to an organ keyboard so that the organist can play more than one pipe with a single keystroke. Automation refers to the procedure by which mechanical musical instruments (such as music boxes and player pianos) take a score in machine-readable form and generate perceived sound. For want of a better word, sonification is used to describe the production of perceived sound from pressing a key on a keyboard. The terms in the row called "musical idea" are meant to be taken tongue-in-cheek.

No typing skills required

It's easier and more accurate to enter alphanumeric data with a BIT PAD than a keyboard. Now anyone can. . .

- Enter whole lines of characters with a single stroke.
- Enter data directly to business forms by simply checking a box.
- Enter variable alphanumeric data from a menu keyboard.

Take a printed form—price list, order entry, loan or insurance application, laboratory request—lay it on the

BIT PAD tablet and touch the pertinent items with the pen. The information is entered directly into your data processing system.

Plus, the BIT PAD does even more.

Try to describe a fluctuating business trend to your computer through a keyboard. With BIT PAD you simply trace the trend with the pen. Special keyboard menus can be created by the user to enter high level languages, foreign languages or special symbols.

Before you order any kind of data entry equipment, ask Summagraphics to give you the full story on the BIT PAD ONE.

Summagraphics Corporation, 35 Brentwood Avenue, Fairfield, Connecticut 06430; or call Marketing Department, Peripheral Products (203) 384-1344.



Summagraphics
corporation

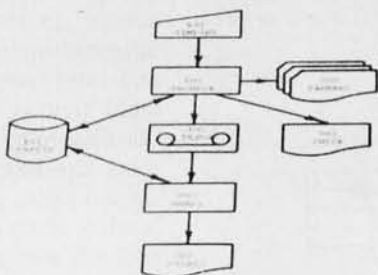
See us at NCC booth 1345.

The BIT PADTM alternative to keyboard data entry



Summagraphics

BIT PAD ONETM



ORDER FORM

MODEL	MODEL NUMBER	GAUGE	CHAMBER	BARREL LENGTH	CHOKE	DEALER	PRICE
412	412001	12	2-3-4	28	IC MOD	191.75	255.00
412	412002	12	2-3-4	28	IC MOD	191.75	255.00
412	412003	12	2-3-4	28	IC MOD	191.75	255.00
412	412004	12	2-3-4	28	IC MOD	191.75	255.00
412	412005	12	2-3-4	28	IC MOD	191.75	255.00

MODEL	MODEL NUMBER	GAUGE	CHAMBER	BARREL LENGTH	CHOKE	DEALER	PRICE
412	412001	12	2-3-4	28	IC MOD	191.75	255.00
412	412002	12	2-3-4	28	IC MOD	191.75	255.00
412	412003	12	2-3-4	28	IC MOD	191.75	255.00
412	412004	12	2-3-4	28	IC MOD	191.75	255.00
412	412005	12	2-3-4	28	IC MOD	191.75	255.00

MODEL	MODEL NUMBER	GAUGE	CHAMBER	BARREL LENGTH	CHOKE	DEALER	PRICE
412	412001	12	2-3-4	28	IC MOD	191.75	255.00
412	412002	12	2-3-4	28	IC MOD	191.75	255.00
412	412003	12	2-3-4	28	IC MOD	191.75	255.00
412	412004	12	2-3-4	28	IC MOD	191.75	255.00
412	412005	12	2-3-4	28	IC MOD	191.75	255.00





Please send your free software catalog.

(Check which software is of particular interest)

☐ C COMPILER. Optimized native code for VAX 11/780, PDP-11, LSI-11, Z80, 8085, 8080. Full C language as defined in Kernighan and Ritchie, with comprehensive portable library. Cross compilers available. Runs under VMS, IAS, RSX-11D, RSX-11M, RSTS/E, RT-11, UNIX, Idris, CDOS, CP/M. From \$500.

☐ IDRIS OPERATING SYSTEM. System calls and file system identical to UNIX V6, including pipelines. Utilities include shell, editor, assembler, loader, archiver, compare, copy, grep, etc., plus system utilities for file system maintenance. Runs on LSI-11, PDP-11. From \$1000.

☐ PASCAL COMPILER. Optimized native code for VAX 11/780, PDP-11, LSI-11, Z80, 8085, 8080. Full Pascal language as defined in Jensen and Wirth, with standard library. Includes C compiler and portable library, permitting intermixed C and Pascal. Cross compilers available. Runs under VMS, IAS, RSX-11D, RSX-11M, RSTS/E, RT-11, UNIX, Idris, CDOS, CP/M. From \$750.

Idris is a trademark of Whitesmiths Ltd.
UNIX is a trademark of Bell Laboratories.
CP/M is a trademark of Digital Research Co.

VMS, RSX-11, RT-11, RSTS/E, VAX,
PDP-11, LSI-11 are trademarks of Digital
Equipment Corporation.

Name _____

Company _____

Street _____

City _____ State _____ Zip _____

Whitesmiths, Ltd.
Software for grownups.
(212) 799-1200
P.O.B. 1132 Ansonia Station, New York, N.Y. 10023

simultaneous voices bring another host of difficulties to the attempt for accurate transcription.

It is nearly impossible for even an expert musician to determine unambiguously, from listening alone, which note should be allocated to which voice. I realize that this portion of the discussion is delving heavily into the terminology of music, but the intricate details of music are what make this problem so fascinating. The two segments of music in figures 4a and 4b sound the same, and are both notated correctly. Nevertheless, the differences are significant and useful to the musician performing the music.

This is not the place to go further into the musical significance of these notational differences. Enough examples of problems have been amassed to give you a starting place at which to begin to think about having a computer "listen" to and "understand" music.

Problems in Determining Pitch With a Computer

If things were not difficult enough given direct input from a keyboard,

many people (eg: ethnomusicologists) would love to be able to play a recording into a computer and produce a written score. So would I. However, two new problems are introduced. Finding what pitch is being played is not easy. To be sure, a simple sine wave could be digitized by a frequency counter. Unfortunately, real musical sounds are far more complex, often having harmonics and overtones that make almost any frequency-determining method unsure. And what do you do when a note slides from one frequency to another (*portamento* in musical jargon)? Or when a chorus finishes singing a chorale a semitone lower then when they started—will the computer notate it as a sudden modulation in the middle?

Even determining how long a note lasts is difficult. Try playing a piano note; strike a key and hold it down. How long does it last? Just when does its gradual dying away cease? In a quiet room, with a good piano, it may take several minutes. You might as well ask where the rainbow changes colors. Musical sounds often do not have well-defined edges with

respect to time or pitch.

Summary

The point has been made, and it is possible to show many more examples than have been shown here that you cannot go from a performance to a score, or vice versa, in any easy fashion while preserving the qualities that make the notation of music readable to most musicians and the properties of a performance that make it worthwhile listening material.

A score is a highly idiomatic rendering of a piece of music, and a piece of music is a unique instance of the composition that the composer had in mind when the score was written.

These facts assure that the building of a perfect music transcriber is literally impossible. Whether it is possible to make the Composer's Aid good enough for most practical purposes remains to be seen. If we put low enough limits on the idea of "good enough," I am sure that it can be done quite easily. If it is to satisfy me (and musicians of like mind), it will probably not be easy at all.

A final suggestion: if you want to tackle any project of this sort, make sure that you know music well. Also make sure that you know your computing well or forge a partnership that can provide the needed experience. I have met many people who do not know the first thing about music trying to achieve difficult goals combining computers and music. I have also met musicians who imagined that they could get the computer to do some task that they found very easy—only to discover that they did not understand the difficulty of what they themselves could easily do.

The greatest benefit the computer confers upon mankind is that it forces us to truly understand what we are doing, for it is only through such understanding that we can instruct a computer. ■

Acknowledgments

I would like to thank the many people who have made useful suggestions about this article, and I would like to specially mention Doug Wyatt of the Xerox Palo Alto Research Center for many useful discussions about the nature of music, Brian Howard of Apple Computer Co for his excellent editing and criticisms, and both of them for the many hours of rehearsal, performance, and programming that they have shared with me.

The Pascal Software Tool

OMSI PASCAL V1.2™

The value of Pascal in computer software design is becoming widely recognized. And our new V1.2 version contains significant enhancements in ease of operation and reliability. Consider the V1.2 Symbolic Debugger.

Pascal debugging should be performed in Pascal, not with assembler listings and memory maps. Our Debugger knows your data names and structures. Values are accepted and displayed in Pascal notation, including scalars, sets, arrays, records, and pointers.

Complete interactive control displays your original source lines, including embedded comments. Breakpoints give statement numbers and procedure names, rather than octal addresses. The Debugger can show the program execution history, including all stacked procedure calls. Should fatal errors occur, they are intercepted by the Debugger instead of ending your testing.

For more information on our approach, ask for the complete OMSI Pascal V1.2 Product Description.

Oregon Software

2340 S.W. Canyon Road • Portland, Oregon 97201 • (503) 226-7760 • TWX 910-464-4779

INTERNATIONAL DISTRIBUTORS

Australia: Sydney;
Network Computer Services
390-3677

Canada: Vancouver;
Valley Software
(604) 291-0651

England: Stafford;
Hours Computing Ltd.
0785-44221

Japan: Tokyo;
Rikei Corporation
03-345-1411



Let this New Series from BYTE BOOKS™ answer your programming questions

Programming Techniques is a series of collected articles concerned with the art and science of computer programming. The first volume in the Programming Techniques series is entitled **Program Design**. The purpose of the book is to provide the personal computer user with the techniques needed to design efficient, effective, maintainable programs.

ISBN 0-07-037825-8 Pages: 96

Price: \$6

Editor: Blaise W. Liffick

Simulation is the second volume in the Programming Techniques series. Both theoretical and practical applications are included. Particularly stressed is simulation of motion, including wave motion and flying objects, and the use of simulation for experimentation.

ISBN 0-07-037826-6 Pages: 126

Price: \$6

Editor: Blaise W. Liffick

Numbers in Theory and Practice is the third book in the series. It includes information of value to both the novice and the experienced personal computer user. The mechanics of the binary system are discussed, including software division and multiplication, as well as floating point

numbers, numerical methods, random numbers, and the mathematics of computer graphics.

ISBN 0-07-037827-4 Pages: 192

Price: \$8.95

Editor: Blaise W. Liffick

The 4th volume of the Programming Techniques series, **Bits and Pieces**, covers various topics of interest to programmers. It

is a collection of the best articles from past issues of BYTE magazine plus new material collected specifically for the series, on subjects such as multiprogramming, stacks, interrupts optimization, and real time processing.

ISBN 0-07-037828-2 Pages: 160

Price \$8.95

Editor: Blaise W. Liffick



Please send

- ☐ _____ copies of **Program Design**
- ☐ _____ copies of **Simulation**
- ☐ _____ copies of **Numbers in Theory and Practice**
- ☐ _____ copies of **Bits and Pieces**

B6

Name _____ Title _____ Company _____

Street _____ City _____ State/Province _____ Code _____

☐ Check enclosed in the amount of \$ _____

☐ Bill Visa ☐ Bill Master Charge

Card No. _____ Exp. Date _____

Add 60¢ per book to cover postage and handling.



70 Main St, Peterborough, NH 03458

Comparing Floppy-Disk Drives by Software Simulation

Dennis Nendza
1622 W Ave de Maximillian
Tucson AZ 85704

Large companies learned long ago that preliminary performance specifications of systems can be predicted reasonably well by computer simulation. The National Aeronautics and Space Administration (NASA) saved much money and effort by simulating numerous systems that have been developed for the space program. In a somewhat smaller way, microcomputers can be used to simulate a variety of operational systems. Complex equations and analysis are not always required.

Here I shall present a practical simulation. I have chosen a topic of interest to myself and many small-computer enthusiasts: a comparison of the operating speeds of floppy-disk drives. This article will explain basic mechanical drive movements and illustrate the transformation of these physical events into the algorithmic steps of a computer program. Estimating one drive's performance in relation to others is the goal.

To do such a comparison, we need some knowledge of the operational parameters of floppy-disk drives. These parameters are the lengths of time required for a drive to perform a given function. All drives have at least these four parameters:

- head load
- seek
- rotational latency
- data-transfer rate

I shall look at each function in detail.

Head-Loading Motion

Before any data can be located or

transferred on some drives, the data-transfer head must be *loaded*; firm contact between the head and the disk surface must be assured. To accomplish this, a pressure pad is placed against the disk on the side opposite the head. This pressure pad movement is referred to as *loading the head*. The length of time required to move the pad into place and insure that all mechanical bouncing has stopped is termed *head-load time*. Look at figure 1 to see a diagram of the head-load mechanism.

Track-Seeking Motion

Once the head is loaded, it may be necessary to move the head to a position over another data track on the disk. In most drives, the track-to-track movement, or *seeking*, is accomplished by a *stepper motor*. This motor rotates in steps of fixed, discrete increments; a specific interval of time is required for each incremental movement. Thus, to move the head across X tracks takes an amount

of time equal to X intervals. Once we know the time interval required to perform a movement and the number of tracks to move across, we can predict how much time it will take the head to reach the desired track.

All stepper motors exhibit some vibration at the end of the last step in a given movement. There may be a settling time required before a read or write operation can begin.

Another type of motor is used in floppy-disk drives such as the PerSci Model 277. It is called a *linear motor* since it produces linear motion directly. The method is also called "voice-coil" positioning, due to the similarity to the action of a loudspeaker mechanism. Figure 2 depicts the stepper- and linear-motor positioning systems in simplified form.

The amount of time required per track for the linear motor to perform a seek operation varies according to the total number of tracks to be skipped. Unless the manufacturer supplies data describing the seek-time

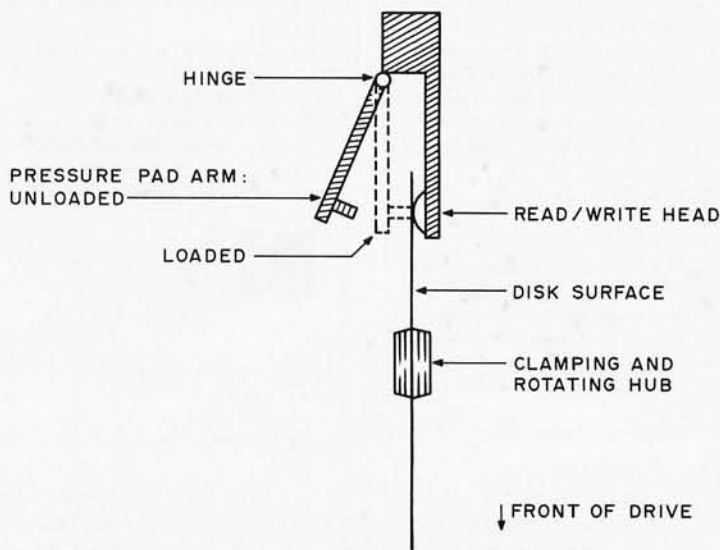


Figure 1: Diagram showing a side view of the floppy disk loaded in the drive. When loaded, the read/write head is pressed against the surface of the disk by the pressure pad.

About the Author

Dennis Nendza is 32 years old and is currently working as a computer systems consultant, after previous experience as a systems programmer, analyst, and data processing manager. He wrote his first computer program while in high school, using the ALGOL language.

YOU'RE A GENIUS FOR BUYING DATASTAR.TM

But you don't have to be one to use it.

Now, from those wonderful folks that brought you WordStar,TM comes DataStar.TM A general purpose key to disc data entry software package you don't have to be a graduate from M.I.T. to operate.

DataStar makes life a breeze because DataStar makes data entry and verification a breeze.

It has two distinct phases. One allows you to actually design on the CRT the exact form you need. Just name the job. If it can be done on a CP/M* based micro-computer, then DataStar can do it. From handling inventory and billing to entering names in the office football pool.

How's *that* for flexibility!

The other phase allows you to store and retrieve data. All kinds of data. Quickly and accurately. Which also allows you a chance for that second coffee break, you genius you.

And don't worry, DataStar makes sure that what you put into the system is right; because even a genius like you can sometimes make a mistake.

So go ahead. Let DataStar bring out the genius in you.

Simply call us at (415) 457-8990. After all, with over 300 dealers around the world, we've made *buying* DataStar as easy as *using* DataStar.



The world leader in microcomputer word processing.

MicroPro International Corporation 1299 4th Street, San Rafael, California 94901 Telex 340388
Dealer/Distributor/O.E.M. inquiries invited.

*Trademark of Digital Research Corporation

Prices and specifications subject to change without notice.

"Stop by booth 16 at the NCC & Personal Computing Festival in Anaheim so we can brag, brag, brag."

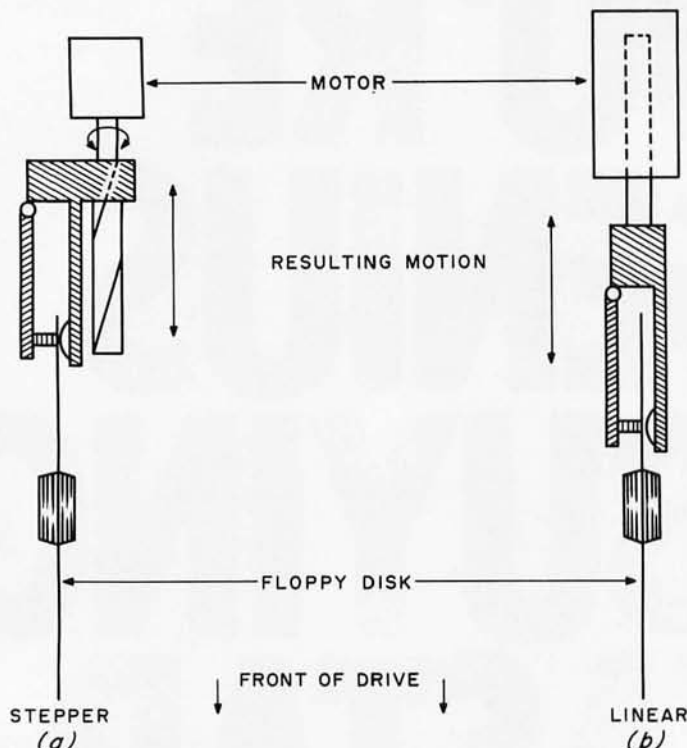


Figure 2: Two methods of moving the read/write head from track to track across the disk. A stepper motor is shown as (a); a linear or "voice-coil" motor is shown as (b). The rotary motion of the stepper motor must be converted into linear motion by a gear arrangement.

function, it must be derived from empirical measurements. This derivation, however, is not within the scope of this article.

Rotational Latency

Reading and writing operations are equivalent functions with respect to the actual time required for completion. With that in mind, the discussion will proceed as if a read operation is being executed. Assuming that the head is now loaded and positioned over the proper track, it remains for us to examine how long a delay may be expected in waiting for the desired record to spin past the head.

A look at figure 3 shows how most soft-sectored disk formats appear. Actually, the soft-sectored format contains 128 bytes of user data; the other data locations are used as address marks and gaps between certain fields. To determine the extent of the delay that must be endured before the desired sector is available, I will consider two cases.

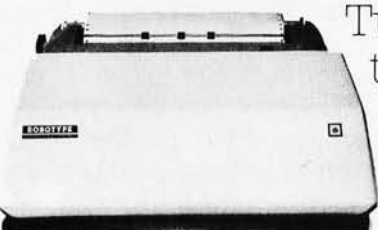
The first case occurs when we begin a read operation and find the correct sector just about to pass by the head. In this event, there is no wait or *latency*, as it is called, before starting the transfer of data. The second case shows that the beginning of the desired sector just went by an instant before the read operation was started. We must now wait for one full rotation of the disk, or the *maximum rotational latency*, for the record to appear at the head again. These two extreme cases show that there are well-defined minimum and maximum rotational latencies. Of course, most delays will be at some random point within this range for actual read operations. The absolute delay for a single read operation is not predictable, but the average for a group of read operations is predictable within limits.

Data-Transfer Time

Finally, there is the most obvious function of the disk drive, data transfer. Data-transfer time is dependent on three basic parameters: disk rotational speed, data density, and format. The faster the disk surface spins past the head, the faster the

New Robotype™


Turns your typewriter into a quality output printer!



- easily connects to any computer
- serial and parallel interface
- all electronics included—ready to use from package
- connects to IBM Selectric II typewriter in just one minute
- adapts to a variety of typewriters—no modifications
- compatible with Radio Shack TRS-80, Apple II, Pet, etc.
- Centronics interface compatible
- available from stock in 30 days


Put a Robotype to work on your typewriter for under \$1,000. Call (614) 436-3163 today!

Dealer, distributors, and word processor OEM inquiries welcome.



Robotype™
(A trademark of Compu-Matics, Inc.)

Applied
Computer
Systems, Inc.



77 East Wilson Bridge Road • Worthington, Ohio 43085

The COMPUTER FACTORY

TO ORDER CALL (212) 687-5000

SUPERBRAIN™

INTERTEC
DATA
SYSTEMS
64K
ONLY
\$2995



32K \$2795

More than an intelligent terminal, the SuperBrain outperforms many other systems costing three to five times as much. Endowed with a hefty amount of available software (BASIC, FORTRAN, COBOL), the SuperBrain is ready to take on your toughest assignment. You name it! General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing... the SuperBrain handles all of them with ease.

FEATURES INCLUDE:

- 2 dual-density minifloppies with 285K bytes of disk storage
- 64K of RAM to handle even the most sophisticated programs
- a CP/M Disk Operating System with a high-powered text editor, assembler and debugger.

NEW Model QD \$3895
With Dual Density/Double Sided Drives with 720K bytes disk storage and 64K RAM



**11 Megabyte
Hard Disk
For Apple
\$ 4995**



APPLE II PLUS ONLY \$1195

A complete self-contained computer system with APPLESOFT floating point BASIC in ROM, full ASCII keyboard in a light weight molded carrying case.

Features Include:

- auto-start ROM • Hi-Res graphics and 15 color video output.
- Expandable to 48K.

Supertalker	\$279	Micromodem	\$379
Disk	595	Superterm (24 x 80)	395
Add-on Disk	495	Speechlab	229
Pascal Card	495	Communication Card	225
Business Software	625	Modem	200
Monitor	159	Graphics Printer	595
Printer Card	180	Graphics Tablet	795

ATARI Computers & Disks



ATARI 800 Now In Stock! ATARI 400 Personal Computer



**TEXAS INSTRUMENTS
TI-99/4
HOME COMPUTER**

Only \$1095 Includes 13" Color Monitor!

Over 1000 software tapes, books, disks, on display. Come in and browse.

**apple
BREAKTHROUGH!**
New KRAM 2.0
Software for Apple
ONLY
\$99.95

Keyed Random Access Method - The new, ultra-fast access method for Apple or Corvus disks, provides keyed retrieval/storage of data, in either direct or sequential mode, by either full or partial key values. Written in 6502 machine code allowing full optimization of your system. Eliminates the need for "Sort" routines! KRAM 2.0 is modeled after a very powerful access method used on large-scale IBM virtual storage mainframes.

- KRAM 2.0** • Create/Open Dataset
Functions: • Get record by Full or Partial Key
• Add or delete record by Key
• Put record by Key
• Read next or previous record
• Dynamic space reclamation
• Requires 32K or 48K Integer Apple or Integer Card

CENTRONICS 704



- 180 cps Bi-Directional • Up to 15" Paper Width • 9 x 9 Matrix
- Upper/Lower Case
- Tractor Feed
- RS-232 Serial Interface

\$1895
List \$2500

CENTRONICS 700-9

- 60 cps • Up to 15" paper width
- Tractor Feed • Parallel Interface for Apple & TRS-80 • 2 channel vertical forms! • Top of Form!

**CENTRONICS (Letter
737 Serial \$995 quality)
737 PARALLEL \$965**

**CENTRONICS
730 Serial \$845
730 Parallel \$795**



**NEW XMEC
1000 with QUADRA-PITCH \$1295**
10, 12, 15 Pitch & Proportional Spacing

The XMEC HY-Q 1000 is "Tomorrow's Printer" - with virtually every advancement built in as standard. No other options are required. Its versatility matches your output format - and - it can be used as an off-line typewriter.

**RADIO SHACK • PET • SORCERER •
APPLE • COMPUCOLOR • ETC.
PRINTERS • PRINTERS • PRINTERS**

The COMPUTER FACTORY'S extensive inventory and wide selection of computer printers assures you of finding the printer best suited for your needs and specifications. The following printers work well with all known personal computers.	Centronics 779 ...	\$1095
	Centronics 730 ...	795
	Trendcom 100 ...	375
	Paper Tiger 440 ...	1095
	Xerox 1740 ...	2895

Commodore Computer

These low cost Commodore PET Business Computers have virtually unlimited business capabilities. Accounts Receivable, Inventory Records, Payroll, and other accounting functions.

PET 16N & 32N COMPUTERS

- Full Size keyboard
- 16 or 32,000 Bytes Memory
- Level III Operating System
- Full Screen Editor
- Upper/lower case & 64 graphic characters



\$995



\$1295



\$695

PET DUAL FLOPPY DISK

- Stores 360,000 Bytes on-line
- Microprocessor controlled
- Uses single or dual sided floppies

HI-SPEED PRINTER

- 150 characters per second • Up to 4 copies 8" wide
- Microprocessor controlled • Prints All Graphics
- Full Formatting Capability

PERIPHERALS FOR PET

• 24K Memory Expansion	\$499
• 16K Memory Expansion	399
• PET to RS232 Serial	179
• 2 Way Serial/Communication	229
• Modem Board for PET	375
• Analog to Digital Board for 16 Devices	275
• Second Cassette Drive	95

Great PET Software

DATABASE MANAGEMENT SYSTEM - Six modules comprising 48K of programming allows you to: create, edit, delete, display, print, sort, merge, etc. - databases of up to 10,000 records. Printer routines included. 60 Pages of documentation for 16-32K PET and 2040 Dual Disk... **Cost \$125**

KRAM - Keyed Random Access Method - The new, ultra-fast access method for the PET Disk, provides keyed retrieval/storage of data, in either direct or sequential mode, by either full or partial key values. 6502 coding **KRAM 1.0 (logical delete) \$79.95 for PET**
KRAM 2.0 (physical delete) \$99.95

ANDERSON JACOBSON

841 I/O Terminal Ideal for word processing and small businesses.



**Parallel \$1130
Serial \$1230**

- ASCII Code
- 15 CPS Printout
- High Quality Selectric Printing
- Reliable heavy duty mechanism
- Completely Refurbished by A.J.

• Delivered FREE to nearest service center

★ FREE
\$35 of Software with purchase of any computer on this page.



**Min Credit Card
Order \$75**



**Open
Mon.-Fri.
10-6
Sat. 10-4**

N.Y. residents add 8% sales tax
• Same day shipment on prepaid and credit card orders • Add \$5 shipping for computers, \$3 for boards, \$1 each cassette tape.

TO ORDER CALL (212) 687-5000

(46th St.)

The COMPUTER FACTORY

485 Lexington Avenue 750 Third Avenue New York, N.Y. 10017
Foreign order desk • Telex 640055

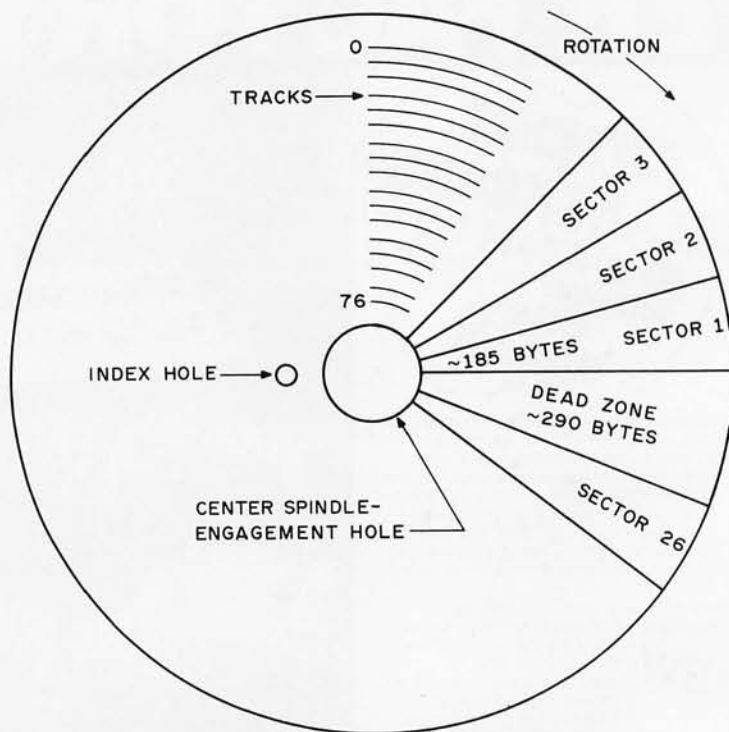


Figure 3: Format of data storage on a soft-sectored, 8-inch floppy disk, viewed from the side that faces the pressure pad.

ASCII keyboards: parallel or serial output, as low as \$69.*



RCA VP-600 series ASCII keyboards are available in two formats. You can choose either a 58-key typewriter format. Or a 74-key version which includes an additional 16-key calculator-type keypad. Both can be ordered with parallel or serial output.

These keyboards feature modern flexible membrane key switches with contact life rated at greater than 5 million operations. Plus two key rollover circuitry. A finger positioning overlay combined with light positive activation key pressure gives good operator "feel," and an on-board tone generator gives aural key press feedback.

The unitized keyboard surface is spillproof and dustproof. This plus high noise immunity CMOS circuitry makes these boards particularly suited for use in hostile environments.

Parallel output keyboards have 7-bit buffered, TTL compatible output. Serial output keyboards have RS 232C compatible, 20 mA current loop and TTL compatible asynchronous outputs with 6 selectable baud rates. All operate from 5 V DC, excluding implementation of RS 232C.

For more information contact RCA Customer Service, New Holland Avenue, Lancaster, PA 17604.

Or call our toll-free number: 800-233-0094.

*Optional user price for VP-601. Dealer and OEM pricing available.

RCA

head can read the data. (Large 8-inch disks spin faster than the smaller 5-inch disks.) The higher the density, the more data can be transferred in a given interval of time. Format differences can account for different effective transfer rates on large records, but will not be dealt with in this simulation. I will deal primarily with the standard IBM 3740 soft-sectored, 8-inch floppy-disk format.

Building the Simulation

We now have an understanding of what happens when a function of the floppy-disk drive is requested. We can now construct a program framework that will use this information. To read or write a record, we must pass through four distinct states: head-loading, track-seeking, rotational-latency waiting, and data-transferring. To compute the actual time required to pass through these states, we must get some information from the manufacturer's specifications for a given drive. Typically, the manufacturer will list the time for head load, track step, average latency, and sector transfer in milliseconds.

Head-load time calculation is easy. Each time that the head is loaded, a value corresponding to the head-load time is added to a total-time accumulator. As a matter of practice, most drives and control software leave the head loaded for a fixed-time interval following a disk operation. This reduces head-loading delays and acoustic noise, but it also increases disk surface wear slightly. For most programs (such as assemblers) that engage in almost continuous disk activity, the head will probably go through the load cycle only once during an execution of the program.

Computation of track-step time is not difficult in most cases. We merely figure the number of steps we must make from the current track to the desired track, and multiply that value by the specified track-step time. Do not forget to add the *settling* time, if the manufacturer gives it. (Remember that the settling time indicates the time taken by the head to stop vibrating from its track seeking and to start reading.)

Thus, for disk drives using stepper

Diagnostics I for CP/M* & TRSDOS

Someday your computer is going to break; even the most reliable computer systems "go down". Often, finding exactly what is wrong can account for the most time consuming part of repairing the system, and the longer the system is down, the more money you lose.

DIAGNOSTICS I is a complete program package designed to check every major area of your computer, detect errors, and find the cause of most common computer malfunctions, often before they become serious. For years, large installations have run daily or weekly diagnostic routines as a part of normal system maintenance and check-out procedures.

DIAGNOSTICS I is designed to provide that kind of performance testing for 8080/Z80 micro computers.

DIAGNOSTICS I will really put your system through its paces. Each test is exhaustive and thorough. The tests include:

- Memory Test
- CPU Test (8080/8085/Z80)
- Disk Test
- CRT Test
- Printer Test

To our knowledge, this is the first CPU test available for 8080/Z80 CPU's. Many times transient problems, usually blamed on bad memory, are really CPU errors.

A good set of diagnostics is an indispensable addition to your program library even if your system is working fine. Hours have been wasted trying to track down a "program bug" when actually hardware was to blame!

DIAGNOSTICS I also allows you to be confident of your system. This can be critical when file merges or sorts and backups are involved. You want to be as sure of your computer as possible during these critical times. Running DIAGNOSTICS I prior to these and other important functions helps to insure that your system is operating at peak performance.

DIAGNOSTICS I is supplied on discette with a complete users manual.

DIAGNOSTICS I: \$50.00

Manual: \$15.00

Requires: 24K CP/M; 16K disc for TRS-80

formats: CP/M 8" SOFT SECTORED, NORTHSTAR CP/M AND TRS-80 DOS

All Orders and General Information:

SUPERSOFT ASSOCIATES

P.O. BOX 1628

CHAMPAIGN, IL 61820

(217) 344-7596

Technical Hot Line: (217) 384-0847

(answered only when technician is available)

Give your computer a "physical" today!



SuperSoft

First in Software Technology

*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH
#TRSDOS, TRS-80 TRADEMARKS TANDY CORP

motors, the seek time is the absolute value of the distance from the current track to the desired track multiplied by the track-step time, all added to the settling time, or:

$$T_{seek} = \frac{ABS(P_{current} - P_{desired})}{\times T_{step} + T_{settling}}$$

where T is used for values of time, and P shows the position of the head in relation to data tracks on the disk.

But what should be done when the disk drive uses the linear-type motors to move the head from track to track? The specification sheets for the PerSci unit give only a single-track seek time of 10 ms. Is that the same as the stepper-motor drive timing? No—this timing is for a single-track step, and there is no settling time to be added. In fact, if the two-track seek time is measured, it is one and one-half times the single-track seek time. If a ten-track seek is measured, we find that it takes only three times as long as moving the head a distance of one track.

Well then, what can be done about this device? For this simulation, my plan of attack was direct. I merely

measured the time that it took for all possible seek distances (seventy-six values) and then computed an approximating function by using a least-squares polynomial curve-fit calculation. The concepts behind this computation are not simple. Fortunately, the routine is adaptable from a book that addresses such problems, *Data Reduction and Error Analysis for the Physical Sciences* by Philip R Bevington (McGraw-Hill Book Company Inc, 1969).

When the seek time for the PerSci drive is needed in my simulation, the number of tracks the head crosses is evaluated and is given as an argument to the empirically derived seek-time function. The result of the function evaluation is the number of milliseconds required to complete the seek. Thus, the PerSci drive becomes a special case in the simulation, but handling it is not so awkward.

To compute the rotational latency, one of two possible techniques is employed. For any large number of discrete read operations, the actual, average rotational latency experienced will approach one-half of the

maximum latency. This value can be used for each read operation as a typical latency. I prefer to calculate a random latency for each read operation. Approximately the same results will appear as in the first method for a large sampling of read operations. You will notice that the results from using random latency values are not likely to be the same each time the program is executed. This is due to the accumulation of random variability, which is an effect you would see if the simulation were carried out on real hardware as well as in a program. The function for randomly determining a latency time is simply: the value of the maximum latency multiplied by a random number between 0 and 1.

The final item which must be dealt with is the actual time it takes the drive to transfer the data to (or from) the disk. The time to transfer 128 bytes of data has been chosen for this simulation. The time values for each drive in this simulation were calculated based on the rotational speed and data density. Record overhead bytes and interrecord gaps were not considered. In the simulation program, the computed values are reflected in the appropriate field in DATA statements that describe the characteristics of each drive. Transfer time for n bytes is calculated by multiplying n by 8, and then dividing by the transfer rate, in bits per second.

About the Simulation Program

Now that we understand the basic drive mechanics, there should be no difficulty in comprehending how the simulation works. The program performs two simulations for each disk drive under consideration.

The first simulation is a set of 500 sequential-read operations, as you would find in a sequential file-copy operation. The second simulation involves a random reading of 500 records, as you might encounter in a program that reorganizes an indexed file according to an unordered secondary key field.

These two modes of access will exhibit the characteristics of general interest concerning floppy-disk drive performance. Briefly, the program steps through the DATA statements that supply the drive name and parameters for that drive. Both simulations are run for a given drive,

NOW, FROM MOUNTAIN HARDWARE. THE 100,000 DAY CLOCK.™

Put your S-100 Computer on the clock.

A real time clock could double the utility of your computer. Time events in 100 μ S increments for up to 100,000 days (over 273 years). Program events for the same period with real time interrupts that permit pre-programmed activities to take place...without derailing on-going programs. Maintain a log of computer usage. Call up lists or appointments. Time and date printouts. Time events. An on-board battery keeps the clock running in the event of power outage.

Mountain Hardware also offers a complete line of peripheral products for many fine computers.



Available at your dealer's. Now.

Mountain Hardware, Inc.

300 Harvey West Blvd.
Santa Cruz, CA 95060 (408) 429-8600



Large System Performance / Small System Price



North Star Horizon Hard Disk COMPLETE Timesharing Computer Systems by Micro Mikes, Inc.

Another minor miracle in advanced microcomputer technology is sending shock waves reverberating throughout the micro-computer and minicomputer industry. Micro Mike's interrupt-driven, bank-switching North Star Horizon timesharing coupled with Shugart 26 megabyte (29 megabyte, unformatted) hard disk unit(s) has sent the nearest competitors scrambling back to the drawing board.

Now as many as seven users, each with 32K to 56K RAM, can simultaneously use the same North Star Horizon computer. As many as four 26 megabyte (29 megabyte, unformatted) Shugart Winchester-type, sealed-media hard disk units can be used in conjunction with the Horizon's 5 1/4" minifloppy drives, providing users access to more than 105 million characters (formatted) of stored information in a flash.

Virtually any North Star BASIC program, in any precision of BASIC, will run with TIMESHAYER™, Micro Mike's time-sharing/hard disk operating system. Each user is allotted a specific bank of memory for that user's individual use. With each memory bank operating independently, each user may simultaneously run a different program.

The standard real time clock and vectored-interrupt header features of the North Star Horizon computer's motherboard make Micro Mike's interrupt-driven, bank-switching timesharing scheme a natural evolutionary progression of the Horizon's foresightful engineering.

The Shugart SA4008 double-platter, winchester-type, sealed-media hard disk drive is interfaced to the Horizon via a single S-100 buss controller card. The hard disk drive employs eight read/write heads while the controller communicates with the buss through three I/O ports (command, status and data) for lightning-quick data transfer.

Through JOEDOS™ Micro Mike's hard disk operating system, each drive may be considered to be one drive or divided into many different "segments" (for convenient backup and separation of different user's files). As many as four of these 26 megabyte units can be operated with the same controller card.

Four-User North Star Horizon / Hard Disk COMPLETE Timesharing Computer System

One North Star Horizon computer, including: 48K RAM per user (as much as 56 K RAM, optional). Fully populated motherboard. Two 360K quad capacity 5 1/4" disk drives (as many as four, optional) Four Zenith Z19 intelligent (Z80-based) CRTs.
Two Printers: One Texas Instruments TI 810 dot matrix, 150-character per second, bi-directional tractor pin feed printer with all available options.

One NEC Spinwriter document-quality, 55 character per second, full character printer with friction feed and tractor pin feed.
One Shugart 26 megabyte (formatted) Winchester-type, sealed-media hard disk unit with S-100 buss controller, power supply, cabinet, all cables, ports and connectors, interfaced to BASIC through Micro Mike's interrupt-driven, bank switching timesharing/hard disk operating system, TIMESHAYER™ (as many as four 26 megabyte hard disk units, seven users, optional).

All cables, ports and connectors required for operation.
Ten 5 1/4" diskettes, — and

†Micro Mike's Program Library membership.

Total System (including Program

Library Membership).....\$21,497

Micro Mike's will, for a fee, deliver and set up a system anywhere in the USA. Personal user training and/or custom programming is also available.

Shugart SA 4008 26 megabyte (formatted) Winchester-type, sealed media hard disk units completely interfaced through JOEDOS™ Micro Mike's hard disk operating system, to BASIC, ready to go, complete with S-100 buss controller, cabinet, power supply, all cables, ports and connectors. As many as four 26 megabyte drives can be operated with the same controller card\$5,495

Additional 26 megabyte drive, cabinet and power supply\$4,495

Micro Mikes offers a complete selection of top-notch business application software written in North Star BASIC around a "skeleton" program, CSUB (Common SUBroutines). Among comprehensive CSUB-based business application program packages offered:

Programs included in Micro Mike's Program Library are indicated by (†) They are also available separately. These are:†General Ledger †Accounts Receivable †Accounts Payable †Inventory †CSUB (Common SUBroutines) †Payroll †Mail List/Directory Sort †Word Processing/Text Editing †Project Cattle Profits †Timesharing (for the Horizon) †Double density/quad capacity 8" drive interface to DOS and BASIC (DOSCHG) and † Commodities Charts. †Many more as they are developed, plus hundreds of outstanding utilities programs, games and public domain programs.

Programs indicated by (•) shown below are not included in Micro Mike's Program Library, and are available separately. They are: • Time and Expense Package for Accountants, Attorneys and other professionals • Patient Daily Record Program (Doctor/Patient Ledger) for Physicians • Land Subdivision Package • Pharmacy • Hotel/Motel Reservation with Night Audit • Banker's Trust • Feedlot Package • Oil and Gas Producer's Package and • Builders Job Cost Package.

IN STOCK:

North Star Horizon computers

Zenith Z19 intelligent CRTs (Z80 based)

Shugart SA 4008 26 megabyte (formatted) hard disk units with S-100 controller card, interfaced to BASIC

DISCUS™ double density and quad capacity eight inch disk drives complete with S-100 buss controller, interfaced to DOS, BASIC and CP/M™ (optional) 512K to more than one megabyte each, formatted)

Printers: NEC Spinwriter, IDS-440 Paper Tiger, Texas Instruments TI 810 and TI 820.

Used Intertec Intertube CRTs,

Closeout\$495

†††Using 56K RAM per user may involve "wasting" or turning off as much as 8K RAM per user. The present maximum number of 56K RAM users is four. As many as seven 48K users can presently be supported.

Prices are subject to change without notice
Complete North Star Horizon Service Center
Call or write for descriptive literature

Mike's

Micro Mike's, Inc.

905 South Buchanan
Amarillo, Texas 79101 — USA
Telephone: (806) 372-3633

Making technology uncomplicated...for People
DISCUS™ is a registered trademark of Morrow Designs, Inc. JOEDOS™ and TIMESHAYER™ are registered trademarks of Micro Mike's, Incorporated. CP/M is a registered trademark of Digital Research.
Copyright 1980 Micro Mike's, Incorporated
All Rights Reserved Worldwide

and the results are printed. Look at the program shown in listing 1 to see the simple logic and computations.

Results and Notes

If this simulation were run using a true random-number generator, you would find that the resulting timings will vary on each run. As noted earlier, this is random variation that is to be expected. Do not expect to see exactly the same results as printed here; the values *will* be within a few percent on all runs.

Referring to the simulation output shown in listing 2, observe that, on sequential-read operations, the

transfer times for the 5-inch floppy-disk drives are about 25% slower than the times for the standard size (ie: 8-inch) drives. Allowing for random variation, this is very close to the 20% speed difference that might be predicted based on the different rotational rates of the two sizes of floppy disks. The 8-inch disk drives also outperform the 5-inch drives during random-access operations. Most, but not all, of the smaller drives are slower in seeking from track to track, and this really shows during random access.

The fastest-seeking drive of the group, the PerSci Model 277, does

not get a chance to show off while reading sequentially, but its capability becomes apparent during random-access operation. This device really moves the head fast! The second and third places go to the Memorex Models 552 and 550 respectively; these use fast stepper-motor drives.

Now that you have read this far, I can reveal some bad news concerning this simulation. The timings obtained are not likely to be a true indication of how long it would take to actually perform these operations on a running computer system. Accomplishing so realistic a simulation involves additional simulation of the interface

Listing 1: Program to simulate mechanical characteristics of various 8-inch and 5-inch floppy-disk drives, written in BASIC-E and running under the CP/M operating system. One step is the simulation of 500 sequential-read operations; the other is the simulation of 500 random-access read operations. Due to the use of random numbers, some variation of results is expected between different executions of this program.

```

REM PROGRAM TO COMPARE ACCESS TIMES OF VARIOUS FLOPPY-DISK DRIVES FOR
REM SIMULATED SEQUENTIAL AND RANDOM READING.
REM
REM THE FIRST TEST IS FOR 500 SEQUENTIAL READS, 128 BYTES PER READ.
REM STARTING TRACK IS 0. THE HEAD IS LOADED AND REMAINS LOADED.
REM WHERE A DRIVE HAS SECTORS GREATER THAN 128 BYTES, THE SECTOR TRANSFER
REM RATE HAS BEEN ADJUSTED IN THE DATA FOR THAT DRIVE.
REM
REM ALL TIMES ARE IN MILLISECONDS.
REM
READ DRIVES                                REM GET NUMBER OF DRIVES TO SIMULATE
INPUT "ENTER ANYTHING TO SEED THE RANDOM-NUMBER GENERATOR";A$
PRINT : PRINT                               REM UPSPACE A FEW LINES
PRINT TAB(30); "FOR 500 READ OPERATIONS"
PRINT TAB(25); "DRIVE SPEED COMPARISON SIMULATION"
PRINT TAB(30); "ALL TIMES IN MILLISECONDS"
PRINT
PRINT "DRIVE NAME"; TAB(25); "SEQUENTIAL"; TAB(40); "RANDOM"
PRINT TAB(25); "-----+-----"
PRINT
RANDOMIZE                                    REM SHAKE UP RANDOM-NUMBER GENERATOR
FOR D=1 TO DRIVES
  READ DNAME$, TTRK, TSETL, HLOAD, LATENCY, SECREAD, NSECS, NTRKS
  CURTRACK = 0                                REM STARTING TRACK
  TOTALTIME = 0                                REM SET TIME ACCUMULATOR TO 0
  REM LOAD THE HEAD ONCE FOR THIS SEQUENTIAL TEST
  GOSUB 1000                                REM GO ACCUMULATE HEAD-LOAD TIME
  FOR I=1 TO 500
    GOSUB 2000                                REM 500 SEQUENTIAL READS LOOP
    GOSUB 3000                                REM STEP TO NEXT TRACK IF NEEDED. ACCUMULATE TIME
    REM READ NEXT RECORD. ACCUMULATE TIME
  NEXT I
  REM PRINT RESULTS FOR TEST 1
  PRINT DNAME$; TAB(28); INT(TOTALTIME*10)/10; TAB(40);
  REM NOW FOR 500 RANDOM READS IN A FILE 35 TRACKS LONG
  TOTALTIME = 0                                REM SET TIME ACCUMULATOR TO 0
  LOWTRACK = 0                                REM LOWER FILE TRACK LIMIT
  HIGHTRACK = 34                                REM UPPER FILE TRACK LIMIT
  CURTRK = 0                                REM START AT TRACK 0
  FOR I=1 TO 500
    NEXTRK = LOWTRACK + INT(RND*35)            REM NEXT RANDOM TRACK
    TRACKSTOMOVE = ABS(CURTRK-NEXTRK)          REM NUMBER OF TRACKS TO TRAVERSE
    GOSUB 2500                                REM COMPUTE TIME TO DO SEEK. ACCUMULATE IT
    GOSUB 3000                                REM COMPUTE RECORD READ TIME. ACCUMULATE IT
    CURTRK = NEXTRK                            REM NEXT TRACK HAS BECOME THE CURRENT TRACK
  NEXT I
  PRINT INT(TOTALTIME*10)/10                    REM PRINT RANDOM READ RESULTS
NEXT D
STOP
REM SUBROUTINES FOLLOW
1000 REM ACCUMULATE HEAD-LOAD TIME

```

Listing 1 continued on page 140

Listing 1 continued:

```

TOTALTIME = TOTALTIME + HLOAD
RETURN
2000 REM COMPUTE SEQUENTIAL TRACK READ-SEEK TIME
IF I/NSECS NE INT(I/NSECS) THEN RETURN      REM NO TRACK ADVANCE
2500 IF TTRK = 0 THEN 2800                    REM USE SPECIAL PERSCI FUNCTION
SEEKTIME = TRACKSTOMOVE * TTRK + TSETL      REM COMPUTED SEEK TIME
2600 TOTALTIME = TOTALTIME + SEEKTIME
RETURN
2800 REM PERSCI-277 DERIVED SEEK TIME FUNCTION
IF TRACKSTOMOVE = 0 THEN :                   REM NO MOVEMENT REQUIRED
SEEKTIME = 0:                               REM THEREFORE SEEKTIME IS ZERO
RETURN
X = TRACKSTOMOVE
SEEKTIME = 10.89605 + 2.178647 * X - 4.846975E - 2 * X * X + 7.936448E - 4 * X * X * X - 4.406022E - 6 * X * X * X * X
GOTO 2600
3000 REM COMPUTE RECORD READTIME INCLUDING ROTATIONAL LATENCY
RNDLATENCY = INT(RND * LATENCY)              REM RANDOM ROTATIONAL LATENCY
TOTALTIME = TOTALTIME + RNDLATENCY + SECREAD REM ACCUMULATE READ TIME
RETURN
REM FIELD ORDER IN DATA STATEMENTS
REM DRIVE NAME, TRACK-TO-TRACK TIME, SETTLING TIME, HEAD-LOAD TIME,
REM MAX LATENCY, TRANSFER TIME, SECTORS PER TRACK, TRACKS PER DISK
DATA 12                                     REM NUMBER OF DRIVES TO SIMULATE
DATA "PERSCI 277",0,0,40,166.7,4.096,26,77
DATA "REMEX RFD 1000A/B",6,24,50,166.7,4.096,26,77
DATA "SHUGART SA800",8,8,35,166.7,4.096,26,77
DATA "SHUGART SA400 MINI",40,10,75,200,8.192,18,35
DATA "SHUGART SA450 MINI",25,15,50,200,4.096,18,35
DATA "PERTEC FD200 MINI",25,10,35,200,8.192,16,35
DATA "ICOM FD3800 DUAL-DENSITY",10,0,40,166.7,2.048,26,77
DATA "ICOM MICROFLOPPY",40,10,75,200,8.192,16,35
DATA "MEMOREX 550",6,10,35,166.7,26,77
DATA "MEMOREX 552",3,15,35,166.7,26,77
DATA "MICRO PERIPHERALS B51 MICROFLOPPY",5,15,35,200,8.192,16,40
DATA "ALTAIR 88-DCDD",10,10,45,166.7,4.096,32,77
END

```

and software delay characteristics. However, the relative standing of the drives is unlikely to change if these factors are included.

The important elements to consider for additional simulation are: the record formats on the disk, the interface and controller characteristics, processor speed, and the algorithm of the program performing the access.

As an example of the discrepancy

between the simulation and the speed of the total system, I offer the following. My system uses a Z80 microprocessor running at a 2 MHz clock rate, and contains 24 K bytes of zero-wait-state memory. The drive controller, designed by George Morrow, connects to a PerSci Model 277 with the fast-seek option. The operating system is CP/M. The time to read 500 records sequentially using BASIC-E is

109 seconds; to read 500 records randomly takes 525 seconds. Compare these times with those in the results of the simulation for the PerSci drive. Beware of making system estimates based only on a part of the total operation. Does anyone want to write an article that describes operating-system timing simulation?

Two for One

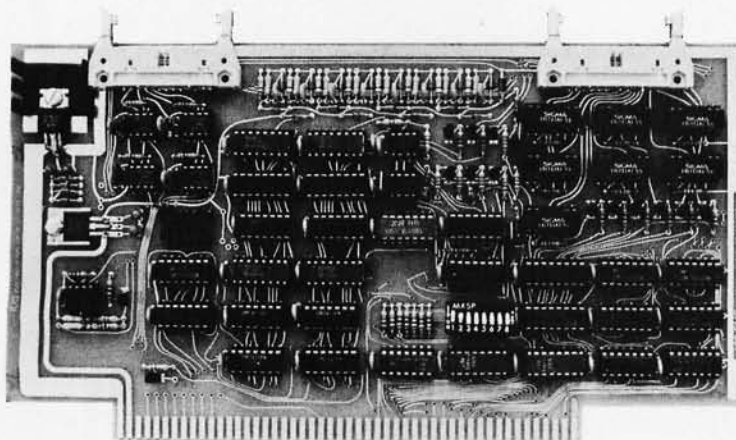
There are two basic lessons to be learned from this exercise. The first one concerns an elementary introduction to the motions that occur in floppy-disk drives and affect their speed of operation. The second lesson concerns derivation of mathematical functions that describe these mechanical motions; it also concerns putting the functions into a program for the purpose of obtaining an estimate of performance. Performance, for the purpose of this article, considers only the relative speed of operation of the various drives. In making a decision to select a particular floppy-disk drive, you must understand that overall performance, not just speed of operation, should be examined. ■

Listing 2: Output of simulation results produced by the program of listing 1.

FOR 500 READ OPERATIONS DRIVE SPEED COMPARISON SIMULATION ALL TIMES IN MILLISECONDS		
DRIVE NAME	SEQUENTIAL -----+-----	RANDOM
PERSCI 277	43107.6	57912.2
REMEX RFD1000A/B	43650.1	92281.9
SHUGART SA800	44163.1	94881.9
SHUGART SA400 MINI	53547.8	288397.1
SHUGART SA450 MINI	55153.2	198631.3
PERTEC FD200 MINI	52804.8	201703.6
ICOM FD3800 DUAL-DENSITY	43110.0	101456.6
ICOM MICROFLOPPY	55698.8	293376.0
MEMOREX 550	44821.1	77892.1
MEMOREX 552	44000.1	66670.3
MICRO PERIPHERALS B51 MICROFLOPPY	55287.8	89390.2
ALTAIR 88-DCDD	42634.1	108670.8

IDS Announces S-100 Energy Management Module

The 100-EMM Energy Management Module provides temperature measurement at four separate locations indoors or out; monitors eight (8) doors, windows, or fire sensors; controls six external devices via relay or optoisolator; and provides an intrusion alarm with battery backup (alarm operates even during primary power outages). Put the 100-EMM to use in your home or business and claim a 30% tax credit for the cost of your S-100 computer system including the 100-EMM. (Purchasing the 100-EMM can actually save you several times its cost in tax credits. Full instructions for filing are included in the 100-EMM manual.)



**BUY THIS S-100 BOARD
AND GET UP TO A 30%
TAX CREDIT BASED ON
THE COST OF YOUR
COMPUTER SYSTEM!**

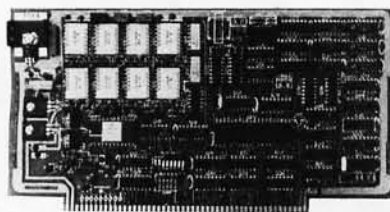
100-EMM Energy Management Module
Assembled and Tested **\$395.00**
Kit **\$345.00**

Options for 100-EMM:

CP-52 Cable Panel - Terminates two 26-conductor flat cables in 26 screwlocks. Use it for convenient interconnection of the 100-EMM to the "outside world". **\$45.00**

CABL-26-STD 26-Conductor Flat Ribbon Cable - Four feet in length with connectors for 100-EMM and CP-52 above. **\$35.00** Other lengths available on special order. Add **\$1.00** per foot.

OTHER PRODUCTS FROM IDS. The most complete source of S-100 compatible modules for process control, data acquisition, energy management, and data communications.



88-MODEM S-100 ORIGINATE/ANSWER MODEM WITH AUTO-DIALER. Software selectable baudrate provides any baudrate from 66-600 baud. Provides 1.5 stop bits when operated in 5-bit code mode. Auto-answer programs available for CROMEMCO CDOS, CP/M, North Star Horizon and MDS, and Alpha Micro.

Assembled and Tested **\$395.00** Kit **\$245.00**

88-UFC UNIVERSAL FREQUENCY COUNTER

Four software selected inputs. Measure frequency from 0-650 MHz and period from .1µs to 1 Second. Extensive software included.

Assembled and Tested **\$299.00** Kit **\$199.00** Temperature-Compensated Crystal Oscillator option **\$145.00**

88-SAI SYNCHRONOUS/ASYNCHRONOUS INTERFACE

The most versatile serial interface on the market. Computer access/control of all data and handshake lines and provision for masked interrupts, inversion of any input or output signal, and onboard baudrate generation for 110, 134.5, 150, 300, 600, 1200, 2400, 4800, 9600, and many other baud rates. Many more features.

Assembled and Tested **\$299.00** Kit **\$199.00**

88-SPM TIME OF DAY CLOCK with battery backup. Set the clock with three out instructions: no delays! Programs included in North Star BASIC, CBASIC, and 8080 assembly language.

Assembled and Tested with crystal option **\$199.00** Kit less crystal option **\$99.00** Crystal Option Kit **\$25.00**

88-RCB RELAY CONTROL BOARD

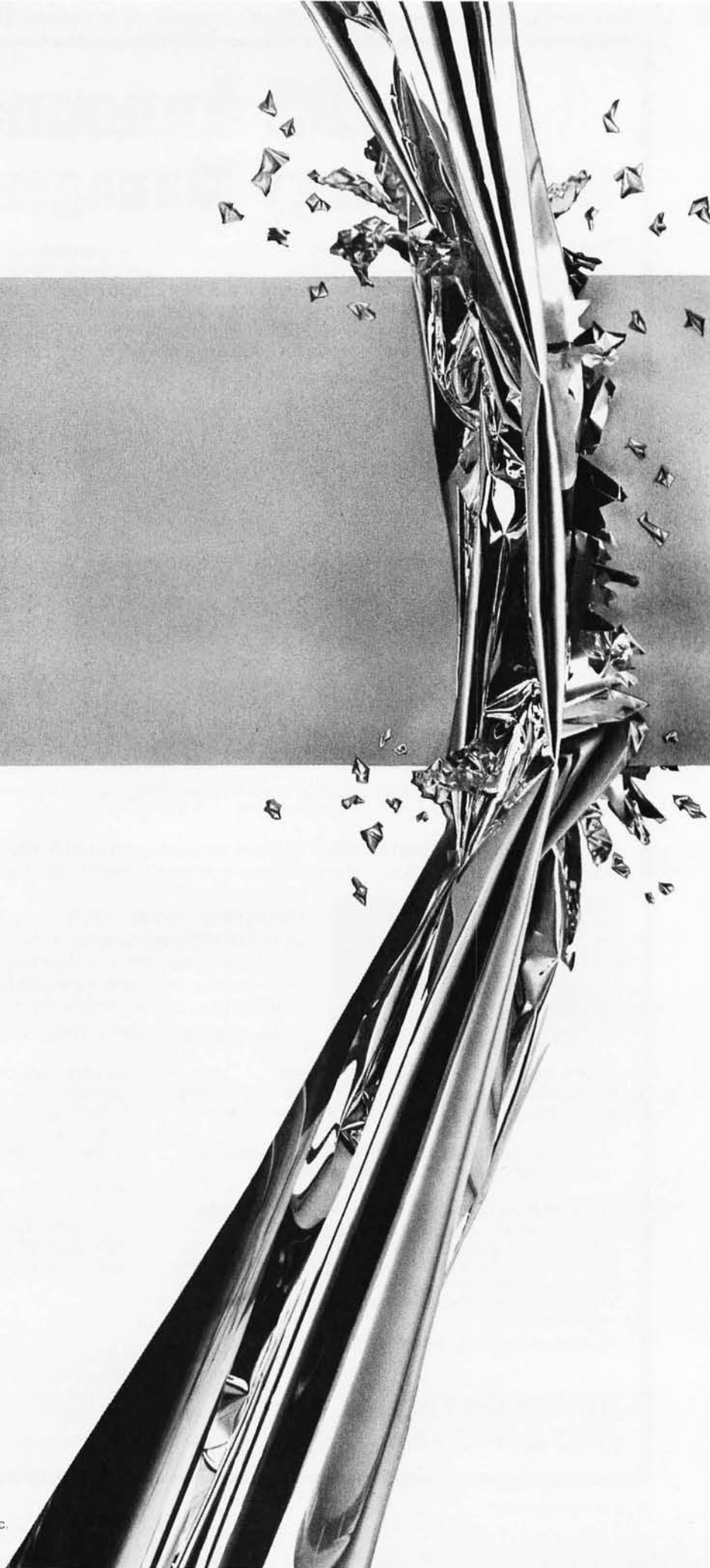
16 Relays on one board. Control appliances, production equipment, or even musical instruments (See BYTE Magazine Sept 1977 page 12)

Assembled and Tested **\$299.00** Kit **\$199.00**

**INTERNATIONAL
DATA SYSTEMS, INC.**

Mailing Address:
Post Office Box 17269
Dulles International Airport
Washington, DC 20041
Telephone (703)661-8442

Shipping Address:
400 West Service Road, Suite 130
Dulles International Airport
Washington, DC 20041 USA
TELEX 901112 IDS CTLY



*Z80 is a registered trademark of Zilog, Inc.

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

ALTOS BREAKS THE MICRO BARRIER.

Yesterday, microcomputer meant micro performance. Once you outgrew it, you had to step up to a mini. Which meant a big step up in price.

Today, there's the new Altos ACS8000-6 single-board microcomputer system.

It's the first system for the OEM, small businessman and personal user, that offers minicomputer performance and minicomputer storage capacities—at a microcomputer price.

MULTI-USER, WINCHESTER STORAGE, FLOPPY BACK UP: \$14,260.

The new Altos ACS8000-6 is a highly advanced Z80* based microcomputer system with high-speed RAM, floppy disk and Winchester hard-disk controllers, DMA, six serial and two parallel I/O ports and the AMD 9511 floating point processor all on a single board. A typical four-user system configuration with two megabytes of Shugart floppy and 29.0 megabytes of Shugart Winchester storage, including CPU and 208K bytes of RAM, costs only \$14,260—compared to \$30,000 or more for a similar minicomputer system. And that adds up to mini performance at less than half the cost!

MULTI-USER EXECUTIVE SUPPORTS FOUR INDEPENDENT USERS RUNNING CP/M COMPATIBLE PROGRAMS.**

This revolutionary new microcomputer system features the MP/M** Multi-User Executive software program that's unique in two ways. It includes a multi-user CP/M capability and the ability to handle Winchester-type hard disks. The advanced Z80 operating program supports four independent CP/M

compatible programs in any of six popular languages: BASIC, FORTRAN, COBOL, PASCAL, APL, C, and a large assortment of additional business application packages. MP/M is compatible with both the 1.4 and 2.0 versions of Digital Research's CP/M, which means programs based on either version can run under MP/M without modification.

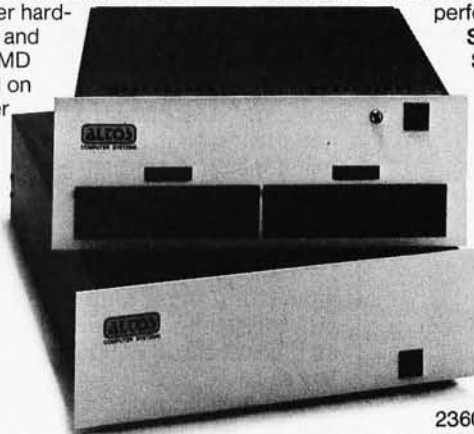
With MP/M at the helm, your Altos ACS8000-6 system can support up to four simultaneous users with 48K bytes of RAM each plus 58 megabytes of Winchester storage and 4 megabytes of floppy back up. And that adds up to the first microcomputer to give you the power and performance of a minicomputer.

SINGLE-USER, HARD-DISK SYSTEMS START AT \$9450.

The Altos ACS8000-6 series. It's a barrier breaker in every sense. Our entry-level, single-user, hard-disc system with floppy back up is priced under \$10,000 and even our 4-user CP/M model is available for under \$12,000. And all configurations are easily upgraded. For specific details about pricing or performance, call or write: Altos Computer Systems, 2360 Bering Drive, San Jose, CA

(408) 946-6700. TELEX 171562 ALTOS SNA.

Circle 83 on inquiry card.



ALTOS
COMPUTER SYSTEMS

BYTE LINES

NEWS AND SPECULATION ABOUT PERSONAL COMPUTING

Conducted by Sol Libes

What To Look For At NCC: The computer show of the year is the National Computer Conference (NCC), which will be held this month (May 19 thru 22) at the Anaheim Convention Center in Anaheim, California. In 1979, 60,000 people attended the NCC. Many new products are introduced each year at NCC. The 1980 show will see many more Japanese manufacturers displaying, among other things, 8-inch Winchester disk drives and microcomputer systems. Furthermore, look for several manufacturers from the United States to show complete microcomputer systems that use the Zilog Z8000 and Motorola 68000 16-bit microprocessors. Last year's show saw the introduction of 8086-based microcomputers. Also, look for disk-operating-system-based languages and applications packages for these new 16-bit microcomputer systems. Several multiprocessing and multiuser microcomputer systems will also be shown.

John Mauchly, Computer Pioneer, Dies: Dr John W Mauchly, co-inventor of the digital computer, died on January 8, 1980 at the age of 72. Together with his colleague Dr J Presper Eckert, Dr Mauchly conceived, designed, and built ENIAC, the first electronic digital computer.

It was built at the University of Pennsylvania and became operational in 1944. ENIAC contained thousands of vacuum tubes, filled 150,000 square feet of space, and weighed 30 tons. It was used for ten years.

Mauchly and Eckert later formed the Electronic Control Company (later called the Eckert-Mauchly Computer Corporation) to manufacture BINAC (Binary Automatic Computer), which became the prototype for the UNIVAC I (Universal Automatic Computer). The UNIVAC I was the first commercial computer; it was installed at the United States Census Bureau in 1951.

When the company was purchased by Remington-Rand in 1950, Dr Mauchly continued with the Univac Division as Director of Applications and worked on weather-forecasting projects. In 1959 he left to form Mauchly Associates, a consulting firm that developed the critical-path method for construction.

In 1967 he founded Dynatrend, a computer consulting firm, and since 1973 he had served as a consultant to Sperry Univac.

Mauchly and Eckert met in 1941 at the University of Pennsylvania's Moore School of Electrical Engineering, where both were instructors. They first proposed the building of the digital computer to the US Army in 1942 for calculating

trajectory tables. ENIAC contained ten accumulators, had internal memory, used subroutines, and was all-electronic, while prior machines were electromechanical and very limited in power. Some parts of ENIAC can be seen at the Smithsonian Institution in Washington, DC.

At the time of his death Dr Mauchly was believed to be working on a word-processor project using a Radio Shack computer. He was an active proponent of personal computing, and he will be missed by many.

News Bits: Friends Amis has developed an interface for the Craig M-100 hand-held language translator that allows the user to add read-only memories containing data bases such as wine lists, Olympic scores, history, or metric conversion.... Panasonic will introduce a hand-held computer to sell for about \$180 in late 1980. The RLT500 Electronic Data Center can be connected to a television set for display, to an acoustic modem for communication, to a printer for hard copy, or to a speech synthesizer for audible output. Quasar will bring out the HC2000RA Information Processor for \$150, which should work with the accessories for the Panasonic machine.... Amateur robot builders have a new source for parts: Vedos Ltd, Suite

1113, 19 W 34th St, New York NY 10001.

Random News Bits: In last month's column I mentioned a rumor about a new printer to compete with the Sanders Technology word-processing dot-matrix printer. The unit has now been formally announced by Florida Data Corporation of West Melbourne, Florida. It offers up to 900 characters per second (cps) speed with correspondence-quality type and high-resolution graphics (at a slower speed). It is said to use a magnetic stored-energy print head, and to offer an almost unlimited choice of type fonts, full graphics, and extended-character format. The machine will be available in the fourth quarter of 1980, and it should be priced under \$2000.... Micro Peripherals Incorporated of Salt Lake City, Utah, plans an under-\$1000 word-processing printer using a seventeen-wire matrix head and printing at 60 to 75 cps.... In the meantime Diablo, Qume, and Nippon Electric Company (NEC) are rumored to be developing under-\$1000 daisy-wheel printers.... Dataproducts will soon introduce a daisy-wheel printer; some observers speculate that it will sell for 20 to 30% less than current daisy-wheel units.... Next year, General Motors (GM) will make much use of on-board microcomputer systems in its vehicles to

Put your applications to work on the Mostek STD-Z80 BUS.



You're ready. You've gone beyond the learning stage and are using your personal computer to implement real time control applications.

We can take you one big step further. By showing you how to take the programs you have developed using your TRS-80 (or other Z80 based computer) and place them in PROM on a low-cost stand-alone micro card system. This will not only free up your main computer for new applications, but will also permit your current application to be "on-line" continuously, or even "cloned" - for multiple installations or sales to other users.

Mostek's MD SeriesTM of STD-Z80 BUS compatible microcomput-

er cards makes all this possible. There are more than twenty different boards in this off-the-shelf family available now, including data processing boards; memory boards (Static and Dynamic RAM, ROM/PROM); I/O cards; A/D; D/A; high speed floating point math; and floppy disk controller cards.

QC Micro Systems offers all of these products directly, including a full range of support products such as prototyping hardware,

support software and, of course, extensive documentation. And much more. Contact us for details so they can be put to work for you, by sending in the coupon below. Today. QC MicroSystems, P. O. Box 401326, Garland, TX 75040, (214) 343-1282.



Yes! I'm ready for more information on the STD-Z80 BUS products from QC MicroSystems. My application is

- ☐ Personal ☐ Resale
☐ Industrial Control ☐ Other
☐ Yes, I would like to use my TRS-80 as my STD BUS development station.

Name _____

Company _____

Address _____

City _____

State _____

Zip _____

meet the stringent requirements for emissions control and fuel economy. GM's need for electronic parts will be so great that the company will use 56% of the world's supply of 8 K-byte read-only memories and 40% of the analog-to-digital converters, according to a GM estimate. In all, GM will buy 13 to 15 million electronic parts each day, more than 3 billion parts per year.... Chase Manhattan Bank is developing the Personal Computer Bank Communications System. Any bank customer who has a home terminal or computer system will be able to access (via telephone) his or her account, get an up-to-the-second status report, and cause funds to be transferred. The user with a computer will also be able to do batch-mode transfers and off-line processing of bank account data.... The precursor of flat solid-state data displays may have appeared. Crockroft International of Sunnyvale, California, has introduced a liquid-crystal display (LCD) panel with 32-by-32-dot display. It operates about four times faster than current LCD displays. The company also expects to have a variable-color display in the near future.... For the first time, a microcomputer-software package has been placed on the prestigious Datamation magazine Honor Roll of Software Packages. Naturally, the software package was the CP/M operating system, a product of Digital Research. Microsoft BASIC and UCSD Pascal received honorable mention.... A report from International Resource Development, a management consulting firm, predicts that four billion dollars will have been spent on electronic-mail services and equipment by 1990. The field will be dominated by IBM,

AT&T, and GT&E, with the US Postal Service getting about one quarter of the business.... A new supercomputer project has been started. Denelcor of Denver, Colorado, is planning to manufacture a computer that uses 50 processors, capable of performing 500 million instructions per second in parallel.... Texas Instruments and Hitachi are developing 64 K-bit programmable memories, which should become available next year....

Court Upholds FCC Ruling On TI Modulator:

The District of Columbia Court of Appeals has rejected an appeal by Atari Corporation (see last month's column). Atari challenged the ruling of the Federal Communication Commission (FCC) that allows Texas Instruments (TI) to sell its stand-alone radio-frequency (RF) modulator while the FCC reexamines its own guidelines for electronic television accessories. Atari argued that the FCC should have forced Texas Instruments to abide by the present rules until changes became final. The present regulations prohibit the marketing of stand-alone modulators. Texas Instruments uses these modulators with its Model 99/4 personal computer system.

Radio Shack And Apple Ask FCC For Deadline

Extensions: Tandy Corporation (parent company of Radio Shack) and Apple Computer Company have filed separate petitions with the FCC, asking that the FCC's July 1, 1980 deadline for compliance with new radiation standards be extended. They feel that there could be an adverse effect on products still in dealer stocks, which could take 6 to 9 months to sell. All units

manufactured after July 1 will have to comply with the standards. General Electric, General Telephone and Electronic (GT&E) Services Corporation, Honeywell, Control Data Corporation, Atari, American Telephone and Telegraph (AT&T), the Computer and Business Equipment Manufacturers Association (CBEMA), and Electronic Industries Association (EIA) have also filed petitions. Most of these petitioners asked for a 2-year extension, while some asked for as many as 7 years.

Word-Processing Standard In Development: An American National Standards Institute (ANSI) Group (number 4 of X4A12) has completed a working draft of the page-image format of a word-processor standard. The purpose is to facilitate communications between word processors from different vendors in a common language. The present draft is considered only a first step; the first part of the standard is expected to be adopted by midyear.

Microprocessor Technology Seen Affecting Employment: A report presented at a recent conference of the Organization for Economic Cooperation and Development (OECD) in Paris, France, cited an impact on employment in Japan by microcomputers. The report was prepared by a special committee organized by the Japan Information Processing Development Center and sponsored by the Ministry of International Trade and Industry.

The report forecasts substantial job layoffs due to labor-saving microcomputer-controlled equipment. The biggest effect will be felt in assembly manufac-

turing where automation will substantially reduce the number of unskilled workers on the assembly line. On the other hand, the report predicted an increased need for systems and software personnel.

Microcomputer Lip-Reader For Deaf: The Research Triangle Institute in North Carolina, working with funds from the National Aeronautics and Space Administration (NASA) and the Veterans Administration, is developing a microprocessor-based system to help the deaf read lips. The device, called Autocuer, can increase a trained lip-reader's comprehension from the typical 25% to about 90%. A light-emitting diode (LED) display projects representations of sounds as nine simple patterns corresponding to the sound.

Commodore Introduces New 4-bit Microprocessor:

While other semiconductor makers are going to larger microprocessors (typically 16-bit or enhanced 8-bit devices) Commodore has decided to go in the other direction. Chuck Peddle, the wizard who created the 6502 microprocessor (used in the PET, Apple, Ohio Scientific, Atari, and other computers) and who also created the KIM-1 and PET computers, has now turned his efforts to designing a "super" 4-bit microprocessor called the MCS4500. Using complementary metal-oxide semiconductor (CMOS) technology, it has thirty-four instructions, on-board memory (including 2 K bytes of read-only memory and 176 nybbles of scratch-pad memory), and can directly drive up to four multiplexed liquid-crystal displays (LCDs). Memory can be expanded, and many of

ITEM NO.
WK-7

CMOS SAFE

IC INSERTION/EXTRACTION KIT

KIT INCLUDES

- MOS-1416 14-16 CMOS SAFE INSERTER
- MOS-2428 24-28 CMOS SAFE INSERTER
- MOS-40 36-40 CMOS SAFE INSERTER
- EX-1 14-16 EXTRACTOR
- EX-2 24-40 CMOS SAFE EXTRACTOR

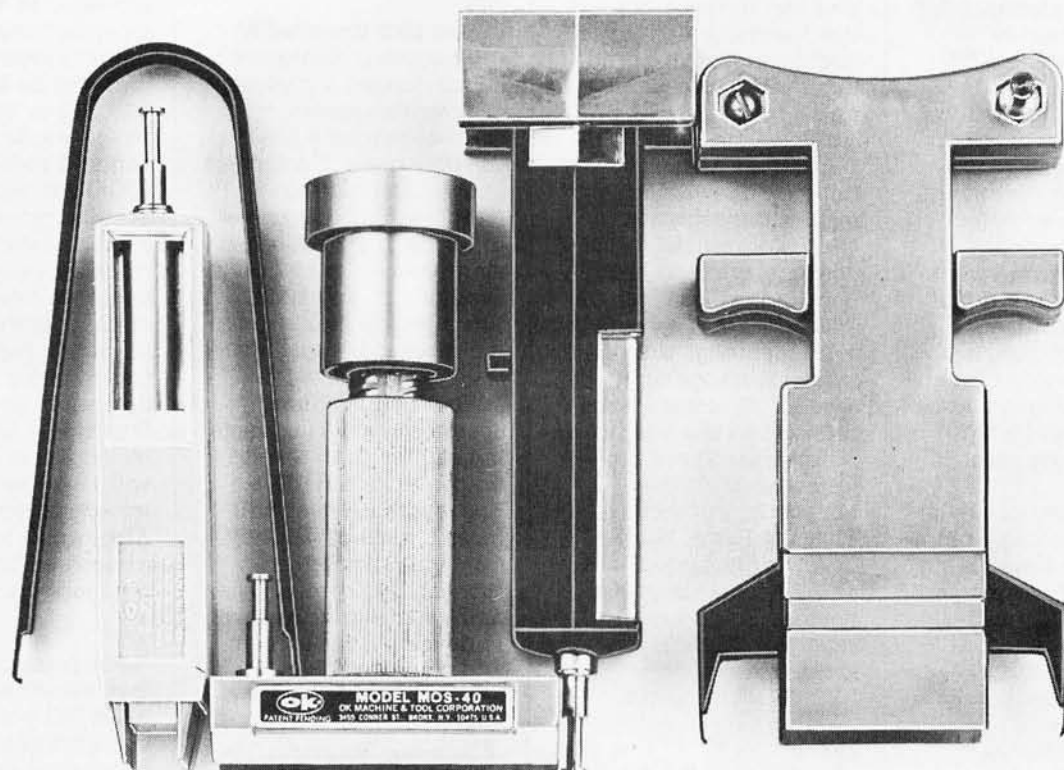


OK MACHINE & TOOL CORPORATION
3455 CONNER ST., BRONX, N.Y. 10475 U.S.A.
PHONE (212) 994-6600 TELEX NO 125091



PRINTED IN U.S.A.

PATENT PENDING



INS-1416	14-16 PIN DIP IC INSERTER	\$ 3.49
MOS-1416	14-16 PIN MOS CMOS SAFE INSERTER	\$ 7.95
MOS-2428	24-28 PIN MOS CMOS SAFE INSERTER	\$ 7.95
MOS-40	36-40 PIN MOS CMOS SAFE INSERTER	\$ 7.95
EX-1	14-16 PIN EXTRACTOR TOOL	\$ 1.49
EX-2	24-40 PIN CMOS SAFE EXTRACTOR TOOL	\$ 7.95
WK-7	COMPLETE IC INSERTER/EXTRACTOR KIT	\$29.95

MINIMUM BILLING \$25.00. ADD SHIPPING CHARGE \$2.00. NEW YORK RESIDENTS ADD APPLICABLE TAX.

OK MACHINE & TOOL CORPORATION 3455 CONNER ST., BRONX, N.Y. 10475 (212) 994-6600/TELEX 125091

the features found on 8-bit processors are included. Commodore will offer an assembler and emulator for the device that runs on a PET microcomputer.

IEEE Developing Assembly-Language Standard For Microcomputers:

The Institute of Electrical and Electronics Engineers (IEEE) is developing a standard for assembly language on microprocessors (IEEE Task P694/D11). It is long overdue and will be of enormous value to all assembly-language programmers who are struggling to write code for different microprocessors. The group working on the standard has done some genuinely worthwhile things, such as demonstrating that all the current major microprocessors can be handled by a single standard.

The problems of present inconsistency are incredible. For example, in assembly code for some processors, MOV A,B means "move the contents of register B to A," while for others it means just the opposite.

The new IEEE standard should cure problems such as those that occurred when Zilog did not use the Intel mnemonics for the Z80's instructions, which are a superset of the 8080's instructions (probably because Intel copyrighted the mnemonics).

The standard also covers instruction names, address modes, operand sequences, expression evaluation, constants, labels, comments, and assembler directives. The standard does not specify the syntax necessary to support macroinstructions or conditional assembly.

The IEEE Computer Society is to be congratulated for its activities in developing computer standards,

which are overcoming problems created by companies that all too often intentionally create incompatibilities to protect their competitive position.

I predict that this assembly-language standard will meet with the wide adoption that the other IEEE standards (such as the IEEE-488 interface and IEEE S-100 bus standards) have met. You can obtain a copy of the Assembly Language Standard draft by sending a self-addressed 10 by 13 inch (25.4 by 33 cm) envelope with \$0.54 US postage affixed to Dr Robert G Stewart, Chairman of Computer Standards Committee, IEEE Computer Society, 1658 Belvoir Dr, Los Altos CA 94022.

Incidentally, the IEEE is also working on several other standards relevant to the microcomputer area. These projects are: Multibus, Microbus, Futurebus, Floating Point, High-Level Languages, Pascal and Relocatable Object Format. I will try to report on IEEE's progress in a future BYTELINES column.

Telecomputing Companies Off To A Good Start:

The Source, a telecomputing service provided by Telecomputing Corporation of America (or TCA, headquartered in McLean, Virginia), is just six months old. The Source has 3000 subscribers and is adding 500 more per week. The company, which provides information retrieval and software services via a telephone network, has grown to thirty-five employees and a monthly revenue of \$100,000. TCA is aiming to have 100,000 customers by the end of 1980.

A competing service called MicroNet, provided by CompuServe Incorporated of Columbus,

Ohio, is aimed more at the hobbyist. They claim to have 1200 customers already. However, there is a dark cloud on the horizon, in the form of the Teletext and Viewdata systems now being tested by GT&E, Texas Instruments, and others. This may provide much lower cost but less flexible data access to the home television screen.

Flat CRT Unveiled At CES: Sinclair Radionics demonstrated a prototype of their flat-screen cathode-ray tube (CRT) at the Consumer Electronics Show (CES) held in January. Sinclair hopes to use it in a \$125 television receiver to be available in late 1981. The electron gun is mounted sideways, with the beam deflected to strike the phosphor-coated screen. The image is brighter than images on conventional CRTs. The entire receiver will measure 2.5 by 10.2 by 12.7 cm (1 by 4 by 5 inches). The company is doing additional research to develop large-screen and color flat CRTs.

Random Rumors: Centronics, the largest supplier of printers today, will soon cut prices 20 to 30% on existing low-cost printers and will unveil new products directed specifically at the personal computer market, including both impact and nonimpact serial matrix units....

Dataproducts, Okidata, and a number of Japanese manufacturers including NEC are rumored working on multipass, high-density, dot-matrix printers to compete with the RC Sanders Technology Systems Media 12/7 printer. However, at present Sanders Technology has about a 2-year lead time on this technology.... Radio Shack might introduce

more than one new personal computer system in the late fall (see the February 1980 column for previous rumors).... Reports have been circulating that Data General is developing a desk-top computer, code-named Wing. It will use a microprocessor, have two floppy-disk drives, and will be made in Taiwan.... It is rumored that Toshiba Electric Company is working on an experimental voice-input typewriter. The unit will be able to type 100,000 to 200,000 different words in Japanese and will recognize words with 90% accuracy. Toshiba recently demonstrated prototype voice-activated television and high-fidelity equipment.... More rumors are surfacing regarding the future plans of Apple Computer Company. Reportedly the new model Apple computer will be a Pascal machine for educational users. Also, Apple will place increased emphasis on the business market....

Congress Considering Two Personal Computer Bills: Did you know that two bills about personal computers have been introduced in Congress? One is H.R.3822, which would set up a national endowment for personal computers. The other is H.R.4326, which would create a presidential commission to make recommendations about the personal computer field.

MAIL: I receive a large number of letters each month as a result of this column. If you wish a response, please include a stamped, self-addressed envelope.

Sol Libes
Amateur Computer
Group of New Jersey
(ACG-NJ)
1776 Raritan Rd
Scotch Plains NJ
07076

EXCITING MAIL ORDER DISCOUNTS



apple computer II

16K

\$959

CASH PRICE
APPLE II 32K \$1050
APPLE II 48K \$1100

•COLOR •GRAPHICS •SOUND

APPLE II ACCESSORIES

CORVUS 10 MEGABYTE DISK DRIVE	\$465.00	DC HAYES MICROMODEM II	\$335.00
PASCAL LANGUAGE SYSTEM	445.00	ALF MUSIC SYNTHESIZER	245.00
GRAPHICS INPUT TABLET	875.00	SSM A10 CARD (KIT)	125.00
DISK II with CONTROLLER CARD	495.00	SSM A10 CARD (A&T)	190.00
DISK II without CONTROLLER	440.00	NOVATION CAT MODE M	189.00
APPLESOFT FIRMWARE CARD	155.00	SUP-R-MOD RF TV MODULATOR	25.00
INTEGER FIRMWARE CARD	155.00	SUP-R-TERM 80 col. CARD	349.00
SERIAL INTERFACE CARD	180.00	DAN PAYMAR lower case kit	45.00
COMMUNICATIONS CARD	190.00	SVA 8" DISK CONTROLLER CARD	349.00
CLOCK/CALENDAR CARD	230.00	CCS ARITHMETIC PROCESSOR CARD	349.00
INTROL X-10 SYSTEM	325.00	CCS GPIB INTERFACE CARD	289.00
SUPERTALKER SPEECH SYNTHESIZER	325.00	CONTROLLER Gen. Bus. software	529.00
ROMPLUS CARD	199.00	CASHIER Retail Mangmt. & Inven. soft.	209.00
HEURISTICS SPEECHLINK 2000	225.00	APPLE POST Mailing List software	45.00
		APPLEWRITER Word Processing software	69.00

WE SELL APPLE SOFTWARE ALSO.



Texas Instruments

TI-99 4 \$979



- 16K of user RAM
- Extended BASIC language in ROM
- 16 COLOR GRAPHICS
- Supported with Solid State Software

INCLUDES a 13 inch COLOR VIDEO MONITOR

We sell TI-99/4 Accessories & Software Too.

MICROPOLIS™

MetaFloppy. DRIVES

1021 MOD II (Single w/o pwr supply or controller)	\$529.00
1041 MOD II (Single w/o pwr supply, w/controller)	899.00
1043 MOD II (Single with pwr supply & controller)	999.00
1053 MOD II (Dual drive w/pwr supply & controller)	1649.00



- 315K Bytes storage per drive
- QUAD DENSITY DESIGN
- COST EFFECTIVE STORAGE
- 4 TIMES STANDARD CAPACITY!

SOROC IQ 120

- SERIAL RS232C
- FULL ASCII UPPER/LOWER CASE
- NUMERIC KEYPAD CURSER KEYS
- SCREEN CONTROL & PROTECTED FIELDS

\$739



•ALSO AVAILABLE•
SOROC IQ 140 \$1195.00

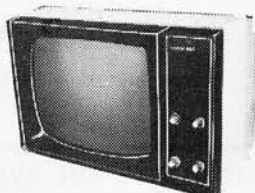
These terminals are shipped freight collect only.

MONITORS

LEEDEX VIDEO 100

- 12" BLACK & WHITE MONITOR
- VIDEO BANDWIDTH 12 MHz ±3db
- COMPOSITE VIDEO INPUT

\$135.00



SANYO 9" Black & White Monitor . \$169

SANYO 15" Black & White Monitor . 259

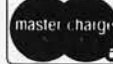
ZENITH 13" Color Monitor 399

PRINTERS

PAPER TIGER ITS 440	875
With Graphics Option	1,075
CENTRONICS 730-1	850
CENTRONICS 779-1	1,049
ANADEx DP-8000	850
AXIOM EX-801	495
AXIOM EX-820	795
COMPRINT 912S	599
COMPRINT 912P	559
TRENDCom T-100	349

• TO ORDER •

Phone orders invited, using credit cards. Or send cashiers check or money order that draws on a U.S. bank. Please add 3% (\$5.00 Minimum) for handling, shipping (air service) and insurance, or equipment will be shipped freight collect. California residents add 6% sales tax. All equipment is in factory cartons with the manufacturers warranty. Equipment is subject to price change and availability without notice.



ATARI 800™

PERSONAL COMPUTER SYSTEM

\$899

ATARI 400 COMPUTER	\$499.00
ATARI 820 PRINTER	\$499.00
ATARI 810 DISK DRIVE	\$599.00
ATARI 410 PROGRAM RECORDER	\$69.00
ATARI 16K RAM MODULE	\$149.00

- High resolution COLOR Graphics
- 10K Basic in ROM
- 8K user RAM expandable to 48K
- 57 key full stroke keyboard

- Built-in RF TV modulator
- High speed serial I/O port
- Includes ATARI 410 program recorder

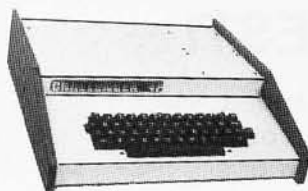
WE SELL ATARI SOFTWARE ALSO.

THE AMAZING **SORCERER™** BY \$995.00

The SORCERER is a Z80 CPU based micro computer internally expandable to 48K. 4K ROM resident monitor. I/O connector for S-100 expansion. Parallel and serial interface. Dual cassette I/O. Graphic resolution of 240 x 512. 30 lines of 64 characters. 8 x 8 dot matrix. Full ASCII set (upper and lower case), plus standard graphic symbols. User may define up to 126 characters. Keyboard is 63 key data processing type, plus a 16 key numeric input pad.



32K 1,145.00 48K 1,295.00



OHIO SCIENTIFIC CHALLENGER 4P \$649

Featuring.

- 8K BASIC in ROM
- 8K Ram expandable to 32K
- 16 COLOR GRAPHICS
- 32 x 64 Upper & Lower case characters
- 256 x 512 High resolution graphic points
- Programmable tone generator 20hz - 20KHz
- Plus more!

CHALLENGER C4P MF \$1589

All the features of the C4P plus...

- A SINGLE MINI FLOPPY DISK DRIVE
- A REAL TIME CLOCK
- SECURITY SYSTEM, MODEM & PRINTER INTERFACE
- 24K RAM expandable to 48K (of reliable static RAM)

WE SELL OSI ACCESSORIES & SOFTWARE ALSO.



COMPUTER SPECIALTIES

6363 EL CAJON BLVD., SUITE 205,
SAN DIEGO, CA. 92115 • (714) 579-0330



NEECO

Microcomputer Systems Division

**PROUDLY ANNOUNCES THE NEWEST
HARDWARE AND SOFTWARE FOR YOUR PET!**

The PET is now a truly sophisticated
Business System with the announcement
of these peripherals and software packages.

**FREE
SOFTWARE
& PET DUST
COVER!**
(Offer ends
2/28/80)



NEW
NEW
NEW

PRODUCT	DESCRIPTION	PRICE	AVAILABILITY
PET 2001—8KN (Large Keys)	8K RAM	\$ 795	IMMEDIATE
PET 2001—8K	8K RAM	\$ 795	IMMEDIATE
PET 2001—16KN (Large Keys)	16K RAM*	\$ 995	IMMEDIATE
PET 2001—32KN (Large Keys)	32K RAM	\$1295	IMMEDIATE
PET 2023 PRINTER	ROLL FEED	\$ 695	IMMEDIATE
PET 2022 PRINTER	TRACTOR/ROLL	\$ 795	IMMEDIATE
ROMRETRO KIT	UPDATED O/S	\$ 90	IMMEDIATE
PET 2040	DUAL FLOPPY*	\$1295	IMMEDIATE
PET C2N	2nd Cassette	\$ 95	IMMEDIATE

*The 16K/32K (large keyboard) units do not include a cassette drive. Order C2N Cassette.
2040 Floppy Drive requires a 16K or 32K unit. 8K RAM Retrofit available July.

ALL PETS ARE FULLY TESTED BY NEECO BEFORE SHIPMENT. NEECO IS A FULL
CUSTOMER-ORIENTED COMPANY. CALL FOR OUR FREE CATALOG. ALL ORDERS
OVER \$795 WILL RECEIVE A FREE NEECO PET DUST COVER AND \$100 OF SOFT-
WARE FROM OUR CATALOG IF YOU MENTION YOU SAW THIS AD.

EDUCATORS TAKE NOTICE !

2 Commodore Computers **NOW = 3** Commodore Computers (At least until Aug. 15th, 1980)

Neeco is pleased to announce a Special Educational Program from Commodore Business Machines. Any bona fide school or educational institution will receive one CBM/PET Computer absolutely ★Free★ (direct from Commodore) for every two CBM/PET Computers Purchased at retail!

Contact NEECO for details and ordering information

EDUCATORS TAKE NOTICE !

PRODUCTS ARE AVAILABLE TO DEALERS VIA MICROAMERICA DISTRIBUTING (617-449-4310)



FOR WORD PROCESSING NEC IS BEST!

- * 55 characters per second output speed
- * Changeable thimble for different typesizes
- * Less than 1% warranty malfunction rate
- * IBM quality letter output
- * Dealer inquiries invited

**THE NEC SPINWRITER
MODEL 5530-P** (Centronics I/O
modified for PET)

\$2995

*Price includes IEEE interface
to PET. IEEE Port is available
for use with 2040 Dual Disk.

*The NEC 5530-P is the output printer recommended by Commodore for their Word Processing System.



NEECO

679 Highland Ave.
Needham, MA
02194

Mon-Fri 9:30-5:30
MasterCharge &
Visa Accepted

(617) 449-1760
Telex: 951021

MICROAMERICA DISTRIBUTING

"Nationwide distributors of Computer Equipment"

21 Putnam Street
Needham, MA
02194

(617) 449-4310



NEECO
PROUDLY
INTRODUCES

MULTI-CLUSTER

*"Multi User Management System for
Commodore CBM/PET* Computers"*

UP TO 8 CBM/PETS MAY NOW SIMULTANEOUSLY ACCESS ONE 2040!



Channel Module
CM-100

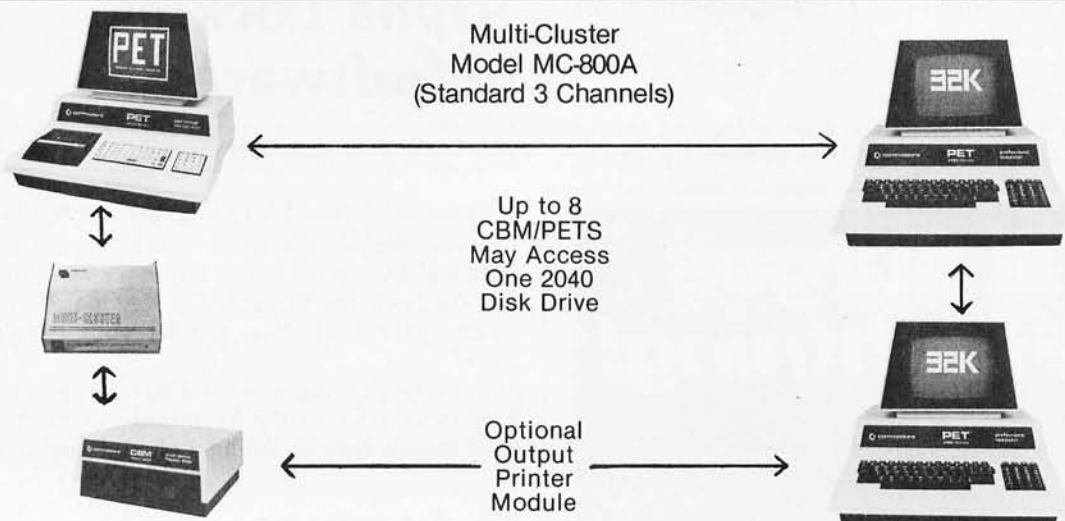


Multi-Cluster
Model MC-800A
Standard 3 Channels)

\$995

- Up to 8 Channel (3 Standard) for CBM/PET Computers.
- Up to 8 CBM/PETS can multi-use one Commodore 2040 dual disk drive simultaneously with equal access.
- Multi-Cluster supports all 2040 disk O/S commands including sequential, random access, and user files.
- Multi-Cluster does not utilize any RAM or ROM from the 2040 or host CBM/PET units.
- Multi-Cluster is compatible with all known software that utilize the IEEE port.
- Multi-Cluster can be fully implemented on 8 PETS, completely ready to use, in less than 15 minutes.
- Simply plug the Multi-Cluster unit into the IEEE port of the 2040 Disk Drive, then attach a Channel Module, #CM100, (3 Channel Modules are standard with unit), to the IEEE port of each PET.

THE MULTI-CLUSTER SYSTEM HAS BEEN USED AND FULLY-TESTED BY NEECO



Multi-Cluster is ideal for industrial, OEM, Vertical Markets, and Educational Institutions. Multi-Cluster allows you to make full use of the Commodore 3 units for the price of 2 educational programs.

Output Printer Module allows
1 CBM/PET to scan 2040 Disk
and print flagged files.

Standard Components:

- | | |
|--------------------------|---------|
| 1 Multi-Cluster | #MC800A |
| 3 Channel Modules | #CM-100 |
| 3 6' Ribbon Cables | #RC6 |

Optional Component Prices:

- | | |
|-------------------------------------|-------|
| Each additional CM-100 | \$250 |
| Each 12' Ribbon Cable (RC12) | \$ 40 |
| Each 18' Ribbon Cable (RC18) | \$ 60 |
| Output Printer Module (PM200) | \$200 |
| (For Centronics Protocol Printers) | |

*PET is a registered trademark of Commodore Business Machines. Small Keyboard PETS require a ROM Retrofit Kit for Multi-Cluster system operation.

Multi-Cluster is available in Canada from BMB Compu Science, Milton, Ontario, (416) 878-7277



NEECO

679 Highland Ave.
Needham, MA
02194

Dealer Sales:

Microamerica Distributing

21 Putnum St., Needham, MA 02194
(617) 449-4310 Telex: 951021

Customer Sales:

NEECO

679 Highland Ave., Needham, MA 02194
(617) 449-1760

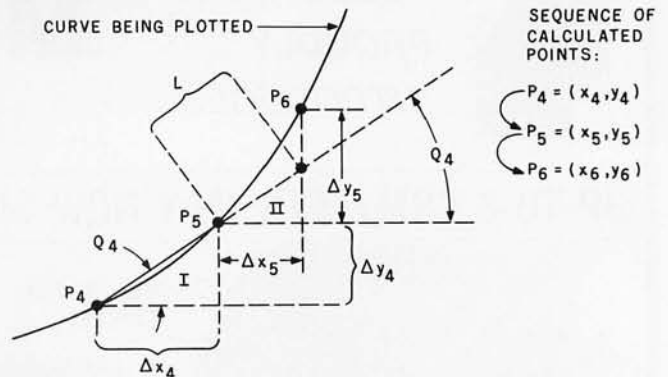
Technical Forum

Simplifying the Curve-Plotting Calculation by Geometric Means

A David Nawrocki, 1101 Wiltshire, San Antonio TX 78209

I enjoyed reading Timothy G Bowker's interesting article "Minimizing Curve-Plotting Calculation" (December 1979 BYTE, page 134). Perhaps it is worth pointing out that his equation (1) on page 138, which involves arc-tangent and cosine functions, can be reduced to a more efficient form for computational purposes. Although the improvement is slight, the use of a single square-root term will allow more rapid calculation than the trigonometric functions originally used. If a very large number of points must be plotted, the accumulated savings in time can be significant.

First, let us note from the illustration in figure 1 that his Δx_5 (the quantity to be found) is related by similar



triangles (I and II) to Δx_4 , Δy_4 , and L (quantities known from previous steps) as follows:

$$\frac{\Delta x_5}{\sqrt{\Delta x_4^2 + \Delta y_4^2}} = \frac{L \Delta x_4}{\Delta y_4}$$

The possible scale factors M and N cancel out, and it is not necessary to compute Q_4 to obtain Δx_5 . ■

Alpha Locking in Software

W S Lewis, POB 1555, East Canton OH 44730

Those readers of BYTE who are not hardware fanatics can accomplish the same results in software as was obtained by use of hardware in Terry Conboy's article "Alpha Lock for Your ASCII Keyboard" (January 1980 BYTE, page 156). You can let your computer do the work!

In particular, users of the Z80 microprocessor can add 8 bytes of code to the keyboard-input subroutine. The code shown here as listing 1 should appear in the input

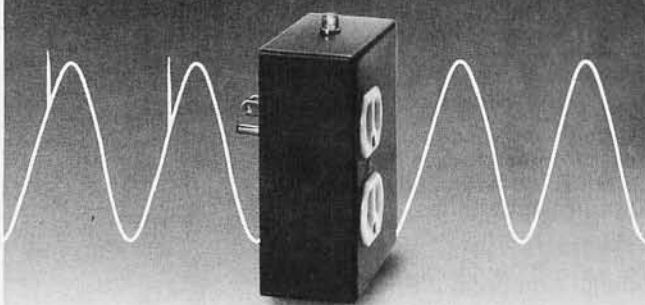
Listing 1: Portion of Z80 code for uppercase to lowercase conversion, input section.

Hexadecimal Object Code	Instruction Mnemonics	Comments
DB 30	XIN IN A,(30H)	;STATUS PORT
CB 4F	BIT 1,A	
28 FA	JR Z,XIN	
DB 31	IN A,(31H)	;KEYBOARD
CB BF	RES 7,A	;MASK PARITY

Listing 2: Final portion of Z80 code for uppercase to lowercase conversion.

Hexadecimal Object Code	Instruction Mnemonics
FE 61	CP 61H
F8	RET M
FE 7B	CP 7BH
F0	RET P
D6 20	SUB 20H
C9	RET

Kill Surges Like Lightning!



Surge Sentry 120 works in parallel with the power line to shunt destructive power surges in less than 1 nanosecond! Triggers at 10% above the nominal peak voltage. Plugs into any standard 120-volt outlet for immediate protection.

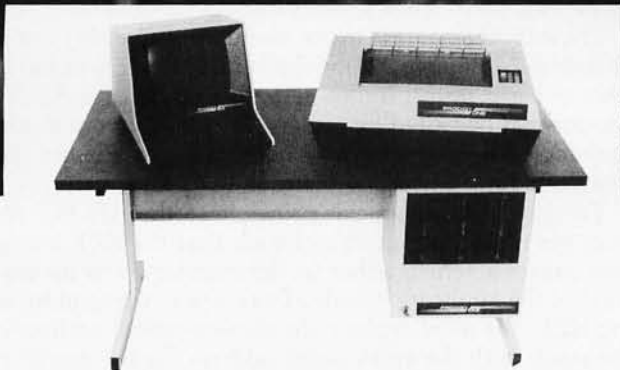
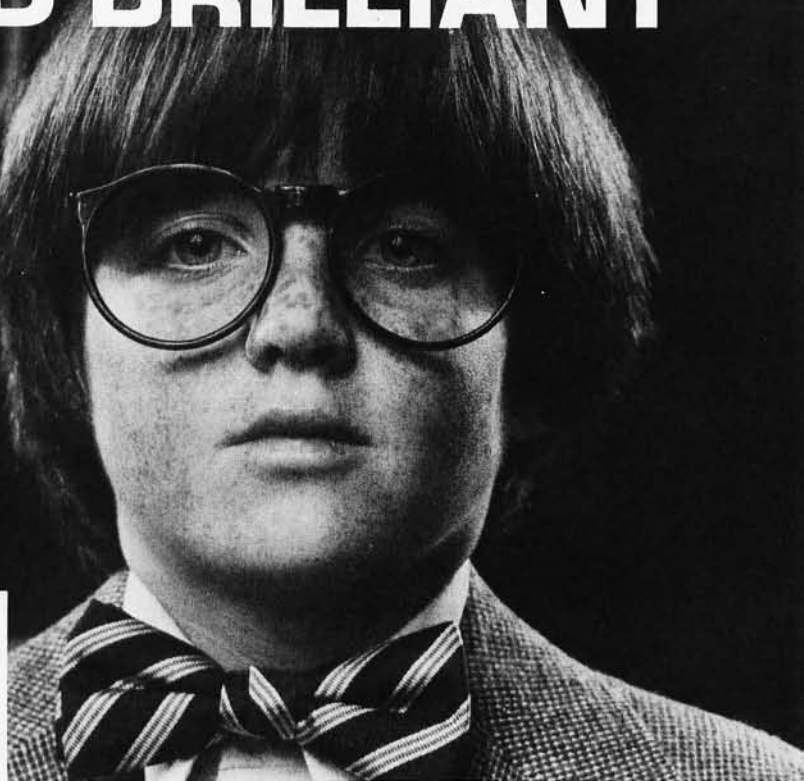
Ideal for small computers, communications, medical, and other sensitive electronic equipment. Suggested retail price \$89.50. OEM model also available. Call or write:

R&K Enterprises

643 South 6th Street, San Jose, CA 95112
(408) 288-5565.

Dealer inquiries invited.

PRODIGY: YOUNG AND BRILLIANT



Every so often an individual is born exhibiting extraordinary talent at a very early age. Often, they rise above the multitude establishing themselves as masters in their fields. These individuals are called prodigies.

The Prodigy computer is so advanced, it clearly establishes itself as a master in the field of small business computing.

Modular design and single board construction mean reliability, expandability, and ease of service.

But it is SOFTWARE which truly sets Prodigy apart. Unlike other computers, software was a major design consideration rather than an afterthought. Prodigy utilizes a highly advanced operating system and PROTEGE* to provide some very impressive features:

- | | |
|------------------------|-----------------|
| ■ DATA BASE MANAGEMENT | ■ INDEXED FILES |
| ■ VIRTUAL CODE | ■ SPOOLING |
| ■ DATA COMPRESSION | ■ MULTI-TASKING |

The result? Incredible speed and storage capacity, and economical systems development and maintenance.

... "Though it may look like many other microcomputer systems ... Prodigy One literally speeds away from them ..." — Max Schindler, Software Editor-ELECTRONIC DESIGN.

Your local Prodigy dealer maintains an extensive library of field proven application software. Available applications include General Ledger, Accounts Receivable, Accounts Payable, Payroll, Medical Billing, and a remarkable system for the Personnel Placement Industry. All are easy to use yet provide a level of sophistication unheard of in its price class. And Prodigy also does word processing!

Prodigy systems are supported by a nationwide organization of thoroughly trained, experienced professionals. Your Prodigy dealer is a SINGLE source for hardware, software and a level of service that continually insures effective, trouble free operation.

Speed, sophistication, and low cost; an incredible combination for a small business computer. Would you expect less from a PRODIGY?

PRODIGY
SYSTEMS, INC.

497 LINCOLN HIGHWAY • ISELIN, N.J. 08830 • (201) 283-2000

*Prodigy's easy to use compiler-based small business applications development language. Prodigy also supports other popular languages such as FORTRAN, COBOL, BASIC, and PASCAL.

The Working Analyst.



If you would like to put a computer to work collecting, organizing, and summarizing the information you need to make better decisions, take a look at Analyst.

Analyst is a software package designed to let you store and analyze virtually any information involving numbers, dollars, dates, and descriptions. Simply tell Analyst what kind of information

you want to store. Analyst creates a computerized file for that information. And Analyst creates an information entry program for your file that asks you for each entry, and checks your data for errors. (You can create any number of different files.)

Then tell Analyst what reports you want from your data file. There are all sorts of record selection and report formatting options, so you can design an unlimited variety of reports to focus on different aspects of the same data file.

Analyst is so flexible, you'll find a million ways to use it. It is easy to use, so you don't need to be a programmer to make your computer really work for you. If this bit of information intrigues you, find out the rest. You'll like what you see.



Analyst is a part of a full line of working software solutions from Structured Systems Group, all ready to run on any CP/M* microcomputer system. For more information, see your computer retailer, or call us.

*CP/M is a trademark of Digital Research.

Structured Systems

5204 Claremont Oakland, Ca. 94618 (415) 547-1567

154 May 1980 © BYTE Publications Inc

Circle 93 on inquiry card.

subroutine. The code in listing 2 goes at the end of the input subroutine, just before it returns to its calling routine.

Note that the uppercase option is completely under software control. The first compare-immediate (the CP 61H) instruction in listing 2 can be changed to a return (RET) instruction when lowercase is desired, and restored to CP when uppercase is desired. ■

Maintaining a Single Exit Point

Armond Inselberg, 234 Central Ave, Mountain View CA 94040

I agree with James Lewis, author of "Some Notes on Modular Assembly Programming" (December 1979 BYTE, page 222), in his emphasis on modular programming. However, another important tenet of structured programming is the use of a single entry point and a single exit point for a given program module.

The ABORT routine in the modular 8080 code example of listing 2 (on page 224) violates this principle of having only one exit point. In this case we find that the ABORT routine can be exited by either the JNZ (ie: jump if accumulator is not equal to 0) instruction or by the RET (return from subroutine) instruction.

To apply the single-exit principle to the ABORT routine, we must arrange things such that the RET instruction causes a return either to the monitor or to the main level of the application code. To return to the monitor using RET, we must replace the current return address on the stack with the entry-point address for the monitor.

The top of the stack can be changed with the XTHL instruction, which exchanges the contents of the H and L registers with the top of the stack. The ABORT routine would then be coded:

```
ABORT    LDA SHKEY
          ORA A
          JZ RETURN      ;no shift key request
          LXI H,MONITOR  ;shift key hit
          XTHL            ;exchange stack and HL
RETURN   RET
```

However, my preference is that the return to the monitor never be made at all from the ABORT routine, since ABORT is nested below the main level of code. I would rather proceed as follows.

First, in ABORT, test for the conditions requiring a monitor return, and set up the stack (if necessary) for the return to the monitor. Then, ABORT should set a signal requesting a return to the monitor, and then just return to the main level of the application code. At the main level, either a return to the monitor or a jump to the starting point of the application would be made.

The main level would then be coded:

```
START    CALL RANDOM
          CALL NOTE
          CALL ABORT
          JZ START      ; no monitor request
          RET            ; monitor return requested. ■
```


SuperSoft announces a complete line of CP/M* compatible software

ACCOUNTING

SuperSoft offers a complete, interactive accounting system at an affordable price. We started with the Osborne accounting system, the standard of the industry, and made it even better. Since either the General Ledger and the Accounts Payable/Receivable can stand alone, you do not need to purchase the entire system at once. This means that you can start with what you need and up-grade later. Look for a compatible Payroll package in the future.

ACCOUNTS PAYABLE/RECEIVABLE: A complete, user oriented package which features:

- automatic postings to general ledger (optional)
- accounts payable: • check printing with invoice • invoice aging
- accounts receivable: • progress billing • customer statements
- partial invoice payments • invoice aging

The entire package is menu driven and easy to learn and use. It incorporates error checking and excellent user displays. This package can be used stand alone or with the General Ledger below. Requires: 48K CP/M, terminal with cursor positioning and clear screen, one 8" disk or Two 5" disks. CBASIC2 required.

Supplied with extensive user manual: \$200.00. Manual alone: \$20.00.

GENERAL LEDGER: A complete, user oriented package which features:

- Accepts postings from external programs (i.e. AP/AR above)
 - Accepts directly entered postings
 - Maintains account balances for current month, quarter, and year and previous three quarters
 - Financial reports: trial balance, income statement balance sheet, and more.
- Completely menu driven and easy to learn and use. Excellent displays and error checking for trouble free operation. Can be used stand alone or with Accounts Payable/Receivable above. Minimal requirements: 48K CP/M, terminal with cursor positioning, home and clear screen, one 8" disk or Two 5" disks. CBASIC2 required.

Supplied with extensive user manual: \$200.00. Manual alone: \$20.00.

TEXT PROCESSING

TFS—Text Formatting System: An extremely powerful formatter. More than 50 commands. Features include:

- left & right margin justification
- headers and footers
- page numbering
- chaptering
- dynamic insertion from disk file
- extended & indented paragraphs
- works with any printer or CRT
- tabbing
- auto paragraphing
- auto list numbering
- centering
- user defined macros
- underlining and backspace
- much, much more

TFS lets you make multiple copies of any text. For example: Personalized form letters complete with name & address & other insertions from a disk file. Text is not limited to the size of RAM making TFS perfect for reports, manuals or any big job.

Text is entered using CP/M standard editor or most any CP/M compatible editor. TFS will link completely with Super-M-List making personalized form letters easy.

Requires: 24K CP/M.

Supplied with extensive user manual: \$85.00. Manual alone: \$20.00.

Source to TFS in 8080 assembler (can be assembled using standard CP/M assembler) plus user manual: \$250.00.

MAILING LIST

SUPER-M-LIST: A complete, easy to use mailing list program package. Allows for two names, two address, city, state, zip and a three digit code field for added flexibility. Super-M-List can sort on any field and produce mailing labels direct to printer or disk file for later printing or use by other programs. Super-M-List is the perfect companion to TFS. Handles 1981 Zip Codes!

Requires: 24K CP/M.

Supplied with complete user manual: \$75.00. Manual alone: \$10.00.

UTILITIES

Utility pack #1: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!). Includes:

- CMP: Compare two files for equality.
- ARCHIVER: Compacts many files into one, useful when you run out of directory entries.
- SORT: In core sort of variable length records.
- XDIR: Extended, alphabetical directory listing with groupings by common extension.
- PRINT: Formatted listings to printer.
- PG: Lists files to CRT a page at a time.
- ... plus more ...

Requires: 24K CP/M.

Supplied with instructions on discette: \$50.00.

SYSTEM MAINTENANCE

DIAGNOSTICS I: Easily the most comprehensive set of CP/M compatible system check-out programs ever assembled. Finds hardware errors in your system, confirms suspicions, or just gives your system a clean bill of health. Tests:

- Memory
- CPU (8080/8085/Z80)
- Terminal
- Disk
- Printer

To our knowledge the CPU test is the first of its kind anywhere. Diagnostics I can help you find problems before they become serious. A good set of diagnostic routines are a must in any program library.

Minimal requirements: 24K CP/M. Supplied with complete user manual: \$50.00. Manual alone: \$15.00.

SOFTWARE SECURITY

ENCODE/DECODE: A complete software security system for CP/M. Encode/Decode is a sophisticated coding program package which transforms data stored on disk into coded text which is completely unrecognizable. Encode/Decode supports multiple security levels and passwords. A user defined combination (One billion possible) is used to code and decode a file. Uses are unlimited. Below are a few examples:

- data bases
- general ledger
- inventory
- payroll files
- correspondence
- accounts pay/rec
- programs
- tax records
- mailing lists

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use. Encode/Decode II provides enhanced security for the most demanding needs. Both versions come supplied on discette and with a complete user manual.

Encode/Decode I: \$50.00

Encode/Decode II: \$100.00. Manual alone: \$15.00.

PROGRAMMING LANGUAGES

ENHANCED 'TINY' PASCAL: We still call it 'Tiny' but it's bigger and better than ever! This is the Famous Chung/Yuen 'Tiny' Pascal with more features added. Features include:

- recursive procedures/functions
- integer arithmetic
- CASE
- FOR (loop)
- sequential disk I/O
- one dimensional arrays
- IF ... THEN ... ELSE
- WHILE
- 'PEAK' & 'POKE'
- READ & WRITE
- REPEAT ... UNTIL
- more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs.

SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.

'Tiny' Pascal is perfect for writing text processors, real time control systems, virtually any application which requires high speed. Requires: 36K CP/M. Supplied with complete user manual and source on discette: \$85.00.

Manual alone: \$10.00.

INTERCOMPUTER COMMUNICATIONS

TERM: a complete intercommunications package for linking your computer to other computers. Link either to other CP/M computers or to large timesharing systems. TERM is comparable to other systems but costs less, delivers more and source is provided on discette!

With TERM you can send and receive ASCII and Hex files (COM too, with included conversion program) with any other CP/M computer which has TERM or compatible package. Allows real time communication between users on separate systems as well as acting as timesharing terminal.

- Engage/disengage printer
- error checking and auto retry
- terminal mode for timesharing between systems
- conversational mode
- send files
- receive files

Requires: 32K CP/M.

Supplied with user manual and 8080 source code: \$100.00

Manual alone: \$15.00.

formats: CP/M 8" SOFT SECTORED, NORTHSTAR CP/M

All Orders and General Information:
SUPERSOFT ASSOCIATES
P.O. BOX 1628
CHAMPAIGN, IL 61820
(217) 344-7596

Technical Hot Line: (217) 384-0847
(answered only when technician is available)

*CP/M REGISTERED TRADEMARK DIGITAL RESEARCH

SuperSoft

First in Software Technology



H & E COMPUTRONICS INC.

...EVERYTHING FOR YOUR TRS-80...

TRS-80 is a trademark of the Radio Shack Division of Tandy Corporation

★ All Orders processed within 24-Hours

★ Free Shipping within U.P.S. areas (add \$3 for orders outside of the U.S.A. or U.P.S. areas).

★ 30-Day Money Back Guarantee on all Software (less a \$3 penalty for handling).

★ 10-Day Money Back Guarantee on Disk Drives and Printers PLUS 120-Days Free Service.

• **LEARNING LEVEL II** by David Lien
The Original Author Of The Level Manual
A Step By Step approach to Learning Level II
especially geared to new TRS-80* Owners
\$15.95

• **TRS-80 DISK AND OTHER MYSTERIES**
\$19.95 (\$22.95 after 2/1/80). Over 100 pages
of indispensable information for disk owners
Learn to recover information from bad disks,
how to make Basic programs unlistable and 12
more chapters of never published tips and information.
Written by H.C. Pennington (For all
Disk Owners)

NEW SBSG BUSINESS SYSTEM FOR MODEL I OR MODEL II - IN STOCK

- General Ledger
- Accounts Receivable
- Accounts Payable
- Payroll
- Inventory Control With Invoicing
- Each module can be operated individually
or as a coordinated **SYSTEM**. Turn-Key error
catching operation for beginners
- Complete manual and documentation
accompany each program
- Minimum System requirements 2-Disk
Drives for Model I...1-Disk Drive for Model II
- Each module can be formatted to span data
on Up to 4-Disk Drives
- Free 30-Day telephone consultation
- Call for complete specifications
- Model I Version \$125 per module
- Model II Version \$225 per module
- \$995 per System

DATA MANAGEMENT SYSTEMS

- DMS replace index cards or any data
requiring long lists of information.
- **TBS In-Memory Information System**
(for cassette systems) \$24.50
- **TBS Disk Data Manager** (requires 1 or more
disk drives)...Set up fast random access
files in minutes. Stores up to 320K of
information on 4 Drives. Up to 10 fields
and 255 characters per record. Supports
upper and lower case RS-232 or TRS-232...
Features complete editing \$49.50
- **Personal Software CCA Data Management**
System...Completely user oriented, menu
drive, 130 page Step by Step Manual...
capable of inventory control, sorting data,
reporting data in nearly any form (for reports
and mailing labels). Sorts data by up to 10
fields for zip code, balance due, geographic
location or whatever. Prints reports with
subtotals and totals automatically calculated.
Fast random access \$75.00

FROM RACET COMPUTES

- **REMODEL-PROLOAD** - Renumbers program
lines, combines programs. The only re-
number program that will renumber the middle
of a program. Specify 16K, 32K or 48K. Works
with Cassette or Disk... \$34.95
- **GSF** - Use in your Basic Programs for Instant
Sorting (will sort 1000 items in 9 seconds). Other
commands include Compress and Uncompress
Data, Duplicate Memory, Display Screen
Controls and Fast Graphic Controls... \$24.95
(For Cassette or Disk, specify 16K, 32K or 48K)
- **DOSORT** - All G S F commands plus special
Multiple Disk Sorting Routines... \$34.95
(Specify 32K or 48K)
- **INFINITE BASIC** - Adds 70 commands to
your TRS-80 including Instant Sort, Matrix
Commands, String Commands, Left and Right
Justification, String Centering, Simultaneous
Equations, Upper and Lower Case Reverse and
more... \$49.95 (For Cassette or Disk)
- **INFINITE BUSINESS** (Requires Infinite Basic) -
Eliminate Round-off error, 127-Digit Calculation
Accuracy, Insert New Elements in Sorted
Arrays, Automatic Page Headings, Footings,
and Pagination, Multiple Precision Arithmetic
and more... \$29.95 (For Cassette or Disk)
- **COPSYS** - Copy Machine Language
Programs... \$14.95 (For Cassette only)

FROM SMALL SYSTEM SOFTWARE

- **RSM-2** Machine Language Monitor... \$26.95
- **RSM-2D** Disk Version of RSM-2... \$29.95
- **DCV-1** Converts Machine Language Programs
from tape to disk... \$9.95
- **AIR RAID** - The ultimate TRS-80 game converts
your TRS-80 into a real time shooting
gallery... \$14.95
- **BARRICADE** - A fast pong style game... \$14.95
- **CPM** - \$150 (for Disk only)
- **TRS-232 INTERFACE** - Interface with Soft-
ware driver RS-232 printers to your
TRS-80... \$49.95
- **TRS-232 FORMATTER** - Additional
(optional) Software for TRS-232 owners. Adds
many printer commands to your
TRS-80... \$14.95 (\$9.95 with purchase of
TRS-232)

- **MAIL PAC** - For Model I or Model II Disk
Systems only... \$99.95. Quick-sorting full user
control over mailing list from Galactic Software

FROM ADVENTURELAND INTERNATIONAL

- **ADVENTURE #1 - #8** by Scott Adams
\$14.95 each available on Cassette or Disk

SARGON II
THE CHESS CHAMP
\$29.95

FROM APPARAT
NEW DOS - \$99.95

35, 40 and 77 Track Versions available

FROM THE BOTTOM SHELF

- **CHECKBOOK II** (for Cassette or Disk)... \$18.50
- **INFORMATION SYSTEM** (for Cassette or
Disk)... \$24.50
- **SYSTEM DOCTOR** (a complete diagnosis of
your TRS-80... checks memory, video, cassette,
disk, ROM and all other parts of your system) -
for Cassette or Disk... \$28.50
- **CHECKBOOK REGISTER ACCOUNT-**
ING SYSTEM (requires 2 disk drives)... \$49.50
- **LIBRARY 100** - 100 established business,
game and educational programs plus **FREE** Tiny
Pilot all for... \$49.50
- **BASIC TOOL KIT** - lists all variables, GOTO's
and GOSUB's in your program... \$19.80
- **SOUNDWARE** - Adds sound to your TRS-80.
Just plug it in... \$29.95. Sample programs
included.
- **TING TONG** - Can be used with Soundware
for a Sound version of pong... \$9.95.
- **VIC-The Carta Visual Instructional \$19.95**
Computer Program
The Level II 16K Cassette is designed to teach
beginners the Basics of Machine Language and
Assembly Language Programming. See every
Machine Language Instruction Display on
your Video
VIC includes a Step By Step 55 page manual

VISTA V80 DISK DRIVE
110 K OF STORAGE
\$395

Add \$29.95 for Cable
(Free with Purchase of Two Disk Drives)
— 10 Day Money Back Guarantee —

FROM HOWE SOFTWARE

- **MON-3** - Machine Language Programming for
Beginners. **MON-3** is a Complete
System Monitor with Users
Manual... \$39.95
- **MON-4** - Disk Version of **MON-3**... \$49.95

LEVEL III BASIC... \$49.95 FROM
MICROSOFT - Now Cassette owners can add
Disk Commands to their TRS-80 without owning
a Disk Drive.

- **BRAND NEW OLIVETTI PRINTER**... \$2495
Business Letter quality print, Automatic Line
Justification (on request), Quick Printing, can
be used as a Memory Typewriter, plugs right
into your TRS-80 without any modification or
software

THE ELECTRIC PENCIL
Cassette... \$99.95
Disk... \$150.00

- **HORSE SELECTOR II** by Dr. Hal Davis...
\$50. The TRS-80 version updated for the TRS-80
and originally reviewed in Systems and
Methods

COMPUTRONICS
MATHEMATICAL APPLICATIONS SERVICE

Box 149 New City, New York 10956

48-Page Catalog \$2 FREE With Any Order

Order by Phone or Mail

No Shipping Charge

Add \$3 for C.O.D.

Add \$3 for all Foreign and non-UPS shipments

Add \$3 for UPS Blue Label



24
HOUR ORDER LINE
(914) 425-1535



THE ORIGINAL MAGAZINE FOR OWNERS OF THE TRS-80™* MICROCOMPUTER

SOFTWARE
FOR TRS-80™
OWNERS

COMPUTRONICS INC.

MONTHLY
NEWSMAGAZINE
FOR TRS-80™
OWNERS

MONTHLY NEWSMAGAZINE Practical Support For Model I & II

- PRACTICAL APPLICATIONS
- BUSINESS
- GAMBLING • GAMES
- EDUCATION
- PERSONAL FINANCE
- BEGINNER'S CORNER
- NEW PRODUCTS
- SOFTWARE EXCHANGE
- MARKET PLACE
- QUESTIONS AND ANSWERS
- PROGRAM PRINTOUTS
- AND MORE

PROGRAMS AND ARTICLES PUBLISHED IN OUR FIRST 12 ISSUES INCLUDE THE FOLLOWING:

- A COMPLETE INCOME TAX PROGRAM (LONG AND SHORT FORM)
- INVENTORY CONTROL
- STOCK MARKET ANALYSIS
- WORD PROCESSING PROGRAM (FOR DISK OR CASSETTE)
- LOWER CASE MODIFICATION FOR YOUR VIDEO MONITOR OR PRINTER
- PAYROLL (FEDERAL TAX WITHHOLDING PROGRAM)
- EXTEND 16-DIGIT ACCURACY TO TRS-80™ FUNCTIONS (SUCH AS SQUARE ROOTS AND TRIGONOMETRIC FUNCTIONS)
- NEW DISK DRIVES FOR YOUR TRS-80™
- PRINTER OPTIONS AVAILABLE FOR YOUR TRS-80™
- A HORSE SELECTION SYSTEM***ARITHMETIC TEACHER
- COMPLETE MAILING LIST PROGRAMS (BOTH FOR DISK OR CASSETTE SEQUENTIAL AND RANDOM ACCESS)
- RANDOM SAMPLING***BAR GRAPH
- CHECKBOOK MAINTENANCE PROGRAM
- LEVEL II UPDATES***LEVEL II INDEX
- CREDIT CARD INFORMATION STORAGE FILE
- BEGINNER'S GUIDE TO MACHINE LANGUAGE AND ASSEMBLY LANGUAGE
- LINE RENUMBERING
- AND CASSETTE TIPS, PROGRAM HINTS, LATEST PRODUCTS COMING SOON (GENERAL LEDGER, ACCOUNTS PAYABLE AND RECEIVABLE, FORTRAN-80, FINANCIAL APPLICATIONS PACKAGE, PROGRAMS FOR HOMEOWNERS, MERGE TWO PROGRAMS, STATISTICAL AND MATHEMATICAL PROGRAMS (BOTH ELEMENTARY AND ADVANCED) ... AND

WORD PROCESSING PROGRAM (Cassette or Disk)

For writing letters, text, mailing lists, etc., with each new subscriptions or renewal.

LEVEL II RAM TEST (Cassette or Disk)

Checks random access memory to ensure that all memory locations are working properly.

DATA MANAGEMENT SYSTEM (Cassette or Disk)

Complete file management for your TRS-80™

CLEANUP

(Cassette or Disk)

Fast action Maze Game.

* TRS-80™ IS A TRADEMARK OF TANDY CORP

SEND FOR OUR NEW 48 PAGE SOFTWARE CATALOG (INCLUDING LISTINGS OF HUNDREDS OF TRS-80™ PROGRAMS AVAILABLE ON CASSETTE AND DISKETTE). \$2.00 OR FREE WITH EACH SUBSCRIPTIONS OR SAMPLE ISSUE.

COMPUTRONICS
MATHEMATICAL APPLICATIONS SERVICE™

Box 149

New City, New York 10956

ONE YEAR SUBSCRIPTION \$24

TWO YEAR SUBSCRIPTION \$48

SAMPLE OF LATEST ISSUE \$ 4

START MY SUBSCRIPTION WITH ISSUE

(#1 - July 1978 • #7 - January 1979 • #12 - June 1979 • #18 - January 1980)

NEW SUBSCRIPTION RENEWAL

CREDIT CARD NUMBER EXP. DATE

SIGNATURE

NAME

ADDRESS STATE ZIP

*** ADD \$6/YEAR (CANADA, MEXICO) - ADD \$12/YEAR AIR MAIL - OUTSIDE OF U.S.A., CANADA & MEXICO ***



24 HOUR
ORDER
LINE
(914) 425-1535



Text continued from page 50:

address in the computer's memory from which the data was written onto the disk. All DTS numbers written on the disk have the bits that indicate the disk-drive number masked to 0 so that the file can be read from any disk drive, regardless of the drive in which it was loaded when it was written.

The *sector trailer* is 4 bytes long. The first 2 bytes contain the check sum. The last 2 bytes, except in the last sector in a file, contain the DTS number of the first sector of the file. In the last sector of the file, the last 2 bytes of the sector trailer contain the address at which execution of the contents of the file begins.

Software: The Basic Disk Routines

The basic disk routines handle head positioning, drive selection, sector selection, motor control, and computation of the check sum. Head positioning is performed by the use of the step and direction bits of the drive-select/status word (hexadecimal location CC03). Since the only indication of the position of the head is the track-0 bit in the drive-select/status

KIMDOS is a KIM-1 compatible version of the Percom MINIDOS disk operating system.

word, the position of the head must be kept by software as a value in memory.

In a multiple-drive disk system, it is desirable to keep track of the head positions of all drives in the system. The drive-selection routine (subroutine DRIV in listing 1) takes care of this. It saves the current track number of the current drive, restores the current track of the desired drive, and latches the desired drive into the controller. KIMDOS reinitializes the track registers (hexadecimal locations 000F thru 0013) with each operation so that preservation of these bytes is not necessary. However, if the system should be expanded with additional software, the track registers become very important. Inadvertant altera-

tion of these locations would cause reading or writing of the wrong track.

In a multiple-drive system, drive motors are either all running or all stopped. The motors cannot be controlled individually since the drive-selection circuitry does not affect the motor-on signal. This necessitates some special handling of drive selection.

The drive-selection routine must insure that the write head is disabled before switching drives, or the area currently under the head of the newly selected drive will be overwritten. The drive-selection routine must also insure that the sector counter on the controller board is synchronized with the newly selected drive. This can be done only after at least one index pulse has been received from the new drive to reset the sector counter.

The sector-selection routine reads the sector number from the controller. It must catch the leading edge of the desired sector so that the read or write operation does not begin in the middle of the sector; it does this by looking for the change from the previous sector to the desired sector. The sector-selection routine detects the disk-missing condition by setting a KIM hardware timer located on one of the 6530 devices for a quarter of a second. If the timer times out before the desired sector is found, the routine assumes that the disk is not properly inserted in the drive.

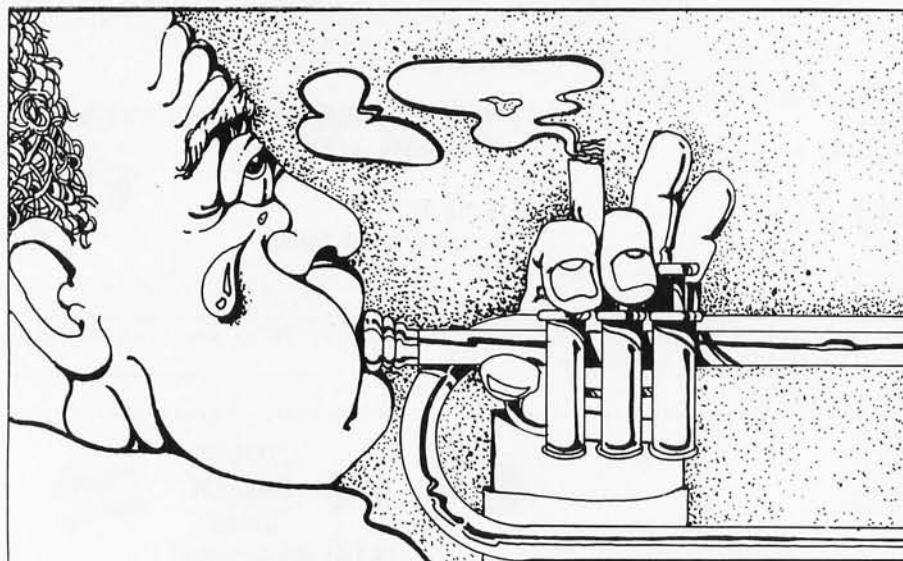
Read and Write Routines

The read and write routines are a fundamental part of KIMDOS, which is given in listing 1. Listing 2 is a cross-reference table for the symbols used in listing 1.

The read routines are designed to automatically try again to read incorrectly read sectors. They will try to read a sector up to six times before reporting a read error. Intermittent errors (such as those caused by random electrical noise, airborne contaminants, slight fluctuations in motor speed, small defects in the written data or track surface, or any combination of the above) can be recovered by rereading the sector.

After a read error, the read routine acts as follows: first, the routine rereads twice. If that fails, the routine moves the head to track 0 and back in an attempt to clear any interfering

Text continued on page 178



THE TRS-80* BLUES.

Do your TRS 80'S limitations hit a sour note? Our full line of business-oriented software can change that tune.

They're easy to use, modularly designed, and superiorly documented, giving you versatility and sophistication of a higher scale, at a price you'll sing about.

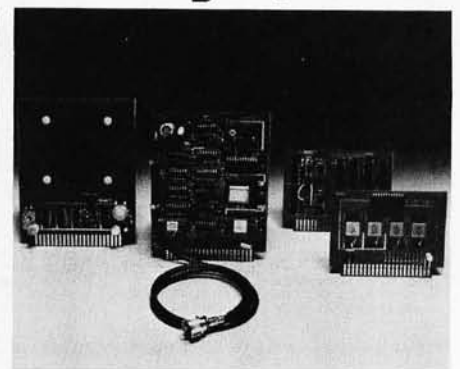
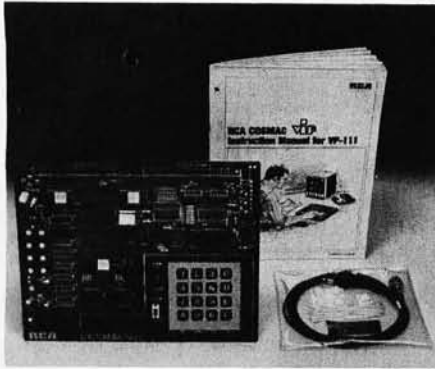
So write us, and we'll send you the score.

SMALL BUSINESS SYSTEMS GROUP

GROTON STREET, DUNSTABLE, MA. 01827 (617) 649-9595

*TRS-80 is a registered trade mark of Radio Shack, a division of Tandy Corp.

The VIP hobby computer: Start programming for only \$99.



New! VP 111 Microcomputer \$99. Assembled* and tested.

Features:

- RCA 1802 Microprocessor.
- 1K Bytes static RAM.
- Expandable on-board to 4K.
- Expandable to 32K Bytes total.
- 512 Byte ROM operating system.
- CHIP-8 interpretive language or machine language programmable.
- Hexidecimal keypad.
- Audio tone generator.
- Single 5-volt operation.
- Video output to monitor or modulator.
- Cassette interface—100 Bytes/sec.
- Instruction Manual with 5 video game listings, schematics, CHIP-8, much more!

Ideal for low-cost control applications.

Expandable to full VIP capability with VP-114 Kit.

*User need only connect cables (included), a 5-volt power supply, and speaker.

New low price! \$199. The original VIP .. \$199. Completely assembled and tested.

All the features of the VP-111 plus:

- A total of 2K Bytes static RAM.
- Power supply.
- 8 Bit input port.
- 8 Bit output port.
- I/O port connector.
- System expansion connector.
- Built-in speaker.
- Plastic cover.
- Three comprehensive manuals:
- VIP Instruction Manual—20 video game listings, schematics, much more.
- VIP User's Guide—operating instructions and CHIP-8 for the beginner.
- RCA 1802 User's Manual (MPM-201B) - complete 1802 reference guide.

RCA

COSMAC VIP lets you add computer power a board at a time.

With easy-to-buy options, the versatile RCA COSMAC VIP means even more excitement. More challenges in graphics, games and control functions. For everyone, from youngster to serious hobbyist.

Built around an RCA COSMAC microprocessor, the VIP is easy to program and operate. Powerful CHIP-8 interpretive language gets you into programming the first evening. Complete documentation provided.

Send the coupon now ...

Complete the coupon below and mail to: RCA VIP Customer Service, New Holland Avenue, Lancaster, PA 17604.

Or call toll free (800) 233-0094 to place your Master Charge or VISA credit card order. In Pennsylvania, call (717) 397-7661, extension 3179.

Please send me the RCA COSMAC VIP items indicated.

Type	Description	Price
<input type="checkbox"/> VP-111	New low cost Microcomputer (See description above)	\$99
<input type="checkbox"/> VP-114	Expansion Kit for VP-111—Includes 3K RAM, I/O Port and connectors... ..	\$ 76
<input type="checkbox"/> VP-711	VIP—The original VIP Microcomputer (See description above)	\$199
<input type="checkbox"/> VP-44	RAM On-Board Expansion Kit—Four 2114 RAM IC's. Expands VP 711 memory to 4K bytes	\$ 36
<input type="checkbox"/> VP-590	VIP Color Board—Converts VIP to color. Four background and eight foreground colors	\$ 69
<input type="checkbox"/> VP-595	VIP Simple Sound Board—Provides 256 programmable frequencies. For simple music or sound effects. Includes speaker	\$ 30
<input type="checkbox"/> VP-550	VIP Super Sound Board—Turns your VIP into a music synthesizer! Two independent sound channels. On- board tempo control. Outputs to audio system.....	\$ 49
<input type="checkbox"/> VP-570	VIP Memory Expansion Board— Plug-in 4K RAM memory	\$ 95
<input type="checkbox"/> VP-580	VIP Auxiliary Keypad—Adds two- player interactive capability. 16-key keypad with cable. Connects to sockets on VP-590 or VP-585	\$ 20
<input type="checkbox"/> VP-585	VIP Keypad Interface Board—Inter- faces two VP-580 Auxiliary Keypads to VIP	\$ 15

<input type="checkbox"/> VP-560	VIP EPROM Board—Interfaces two 2716 EPROMs to VIP	\$ 34
<input type="checkbox"/> VP-565	VIP EPROM Programmer Board—Programs 2716 EPROMs. With software	\$ 99
<input type="checkbox"/> VP-575	VIP Expansion Board—Provides 4 buffered and one unbuffered expansion sockets	\$ 59
<input type="checkbox"/> VP-576	VIP Two-Board Expander—Allows use of 2 Accessory Boards in either I/O or Expansion Socket	\$ 20
<input type="checkbox"/> VP-601	ASCII Keyboard—128-character ASCII Encoded alphanumeric keyboard	\$ 69

<input type="checkbox"/> VP-611	ASCII/Numeric Keyboard—Same as VP-601 plus 16 key numeric keypad	\$ 89
<input type="checkbox"/> VP-620	Cable: Connects ASCII keyboards to VIP	\$ 20
<input type="checkbox"/> VP-700	VIP Tiny BASIC ROM Board—BASIC code stored in 4K of ROM	\$ 39
<input type="checkbox"/> VP-710	VIP Game Manual—Listing for 16 exciting games	\$ 10
<input type="checkbox"/> VP-720	VIP Game Manual—II—More exciting games (Available 2nd qtr. '80)	\$ 10
<input type="checkbox"/> MPM-201B	CDP1802 User Manual—(Included with VP-711)	\$ 5
<input type="checkbox"/>	Please send more information	—

Enclosed is \$_____ for items checked plus shipping & handling charge of \$3.00.

Add your state and local taxes \$_____ Total enclosed \$_____

I enclose ☐ check or ☐ money order or, charge my ☐ VISA/Bank Americard

☐ Master Charge.

Credit card account No. _____

Master Charge Interbank No. _____ Expiration date: _____

Signature (required for credit card orders): _____

Name (please type or print): _____

Street address: _____ City: _____

State & Zip: _____ Telephone: () _____

Make checks payable to RCA Corp. Prices and specifications are subject to change without notice.

Listing 1: KIMDOS, a small disk-operating system for the KIM-1 microcomputer. KIMDOS is a set of disk read and write routines used with a KIM-1 connected to a Percom LFD-400 floppy-disk system. KIMDOS occupies under 1 K bytes of memory (from hexadecimal addresses C000 thru C3FE) and can be stored in one 2708 erasable programmable read-only memory (EPROM). Observe that this listing does not use standard 6502 mnemonics.

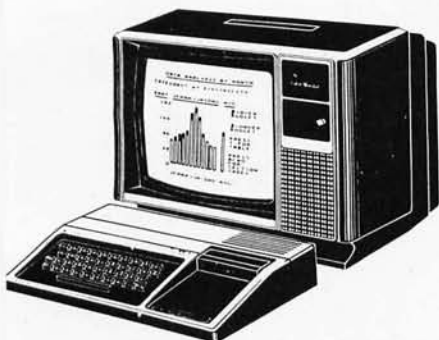
Line Number	Hexadecimal Address	Object Code	Label	Instruction Mnemonic	Operand	Commentary
0001:						
0002:						
0003:						
0004:						
0005:						
0006:						
0007:						
0008:						
0009:						
0010:	C000		KIMDOS ORG	\$C000		
0011:						
0012:	C000		DSOR *	\$0000	DESIRED DRIVE	
0013:	C000		DSRK *	\$0001	AND DESIRED TRACK	
0014:	C000		DSEC *	\$0002	DESIRED SECTOR	
0015:	C000		BLTK *	\$0003	BACK LINK TRACK #	
0016:	C000		RLSC *	\$0004	BACK LINK SECTOR #	
0017:	C000		FLTK *	\$0005	FORWARD LINK TRACK #	
0018:	C000		FLSC *	\$0006	FORWARD LINK SECTOR #	
0019:	C000		LEN *	\$0007	BYTE COUNT (RECORD LENGTH)	
0020:	C000		TGTP *	\$0008	TARGET ADDRESS	
0021:	C000		TCTL *	\$0008		
0022:	C000		TCTH *	\$0009		
0023:	C000		FTYP *	\$000A	FILE TYPE	
0024:						
0025:						
0026:						
0027:	C000		CKSL *	\$000B	THE CHECKSUM	
0028:	C000		CKSH *	\$000C		
0029:	C000		PSHL *	\$000D	POSTAMBLE/EXECUTION ADDRESS	
0030:	C000		PSHL *	\$000E		
0031:	C000		CHTK *	\$000F	CURRENT TRACK	
0032:						
0033:	C000		CTKP *	\$0010	CURRENT TRACK SAVEAREA	
0034:	C000		CTKQ *	\$0011	DRIVE 0	
0035:	C000		CTKH *	\$0012	DRIVE 1	
0036:	C000		CTKS *	\$0013	DRIVE 2	
0037:						
0038:	C000		DPTR *	\$0014	DRIVE 3	
0039:	C000		DPTL *	\$0014	DATA POINTER	
0040:	C000		OPTR *	\$0015		
0041:	C000		ALTP *	\$0016		
0042:	C000		ALTL *	\$0017	ALTERNATE LOAD POINTER	
0043:	C000		ALTH *	\$0017		
0044:	C000		TPXH *	\$0018		
0045:	C000		EXCL *	\$0019	CKSUM TEMP STORAGE	
0046:	C000		EXCH *	\$001A	PROGRAM EXECUTION ADDRESS	
0047:	C000		SAVEP *	\$001B		
0048:	C000		CRDR *	\$001D	CURRENT DRIVE TEMPORARY	
0049:	C000		HIOR *	\$001B	TEMPORARY STORAGE FOR COTS	

0050:	C000	RCNT *	\$001B	HEAD COUNT TEMPORARY
0051:	C000	CKPT *	\$001C	CKSUM POINTER
0052:	C000	CKPL *	\$001C	
0053:	C000	CKPH *	\$001D	
0054:	C000	DTSA *	\$001C	DRIVE TRACK SAVE
0055:	C000	TSSA *	\$001D	TRACK SECTOR SAVE
0056:	C000	ENDL *	\$001E	END OF DATA
0057:	C000	ENDH *	\$001F	
0058:				
0059:	C000	PCL *	\$00EF	PROGRAM COUNTER SAVE
0060:	C000	PCH *	\$00F0	
0061:	C000	PHTL *	\$00FA	DISPLAY WINDOW
0062:	C000	PPTH *	\$00FB	
0063:				
0064:				
0065:				
0066:				
0067:	C000	INPUT		CONTROLLER COMMUNICATION ADDRESSES
0068:	C000	RST *	\$CC00	USRT STATUS
0069:	C000	ROTA *	\$CC01	RECEIVE DATA
0070:	C000	SECT *	\$CC02	SECTOR COUNTER
0071:	C000	DVST *	\$CC03	DRIVE STATUS
0072:	C000	HVST *	\$CC04	RECEIVER RESTART PULSE
0073:	C000	MON *	\$CC05	MOTOR ON PULSE (SEND)
0074:	C000	MOFF *	\$CC06	MOTOR OFF PULSE (SEND)
0075:				
0076:	C000	OUTPUT		SYNC WORD
0077:	C000	SYNC *	\$CC00	SEND DATA
0078:	C000	WOTA *	\$CC01	FILL WORD
0079:	C000	NTSL *	\$CC03	DRIVE SELECT
0080:	C000	WPLS *	\$CC04	WRITE PULSE
0081:				
0082:				
0083:	C000	OTHER LABELS		
0084:	C000	TJX *	\$1705	TIMER START
0085:	C000	TOUT *	\$1707	TIME OUT CHECK
0086:	C000	STAT *	\$1C4F	
0087:				
0088:				
0089:				
0090:				
0091:	C000	EQUATES		
0092:	C000	WRTBIT *	\$000B	
0093:	C000	WTRBIT *	\$0004	
0094:	C000	MILSEC *	\$007D	
0095:	C000	ZERO *	\$0000	
0096:	C000	DRVMSK *	\$00CF	
0097:	C000	STEPIN *	\$0010	
0098:	C000	SCMSK *	\$000F	
0099:	C000	HEDLEN *	\$000A	
0100:	C000	THKMSK *	\$003F	
0101:	C000	THKMT *	\$0023	
0102:	C000	STRTIT *	\$0010	
0103:	C000	STPDIT *	\$0020	
0104:				
0105:				
0106:				
0107:	C000	ERROR CODES		
0108:	C000	DISKMS *	\$0000	DISK MISSING
0109:	C000	WPHOT *	\$0001	WRITE PROTECT
		INVSEC *	\$0002	INVALID SECTOR #

Fantastic Introductory Savings!

TEXAS INSTRUMENTS
INCORPORATED

TI-99/4 home computer



You can begin using the TI Home Computer in minutes — Without any previous computer experience. You simply snap in one of TI's Solid State Software™ Command Modules. Step-by-step instructions are displayed right on the screen.

Solid State Software Command Modules come in a wide range of application areas — from education to entertainment to personal finance and home management.

FEATURES:

- Powerful TI-BASIC
- Up to 72K total memory capacity
- Outstanding graphic, music and sound capabilities
- 13" color monitor included
- Revolutionary Solid State Speech™ Synthesizer is optional

List \$1150

OUR PRICE \$995

Immediate delivery on most items. Prices do not include shipping by UPS. Prices and offers subject to change without notice.

 **apple computer**



Apple II personal computer.

16K
List \$1195

**ONLY
\$989**

32K, List \$1395 **\$1169**

48K, List **\$1259**



16K RAM, expandable to 48K.
List \$1295.

OUR PRICE ONLY \$999

32K Model, List \$1395 **\$1099**

48K Model, List \$1495 **\$1199**

Video Display, List \$499 **\$439**

Display Disk, List \$2995 **\$2599**

Floppy Disk Subsystem, List \$1150 **\$999**

S-100 Expansion Unit, List \$419 **ONLY \$369**

Software

Development PACT™, List \$99 **\$ 89**

Word Processing PACT™, List \$199 **\$179**

EPROM PACT™, List \$49 **\$ 45**

Microsoft Disk-Extended BASIC, \$300 **\$259**

**commodore
pet**

CALL
OR
WRITE
FOR
PRICES!




ATARI®

A Warner Communications Company 

ATARI® 400™ PERSONAL COMPUTER SYSTEM

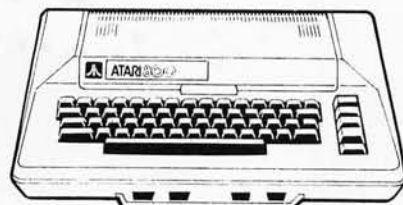


List \$630 **ONLY \$499**

ATARI® 800™ PERSONAL COMPUTER SYSTEM.

List \$1080

ONLY \$849



ATARI® 820™ Printer, List \$599.95 **\$499**

CX852 8K RAM Memory Module
List \$124.95 **\$105**

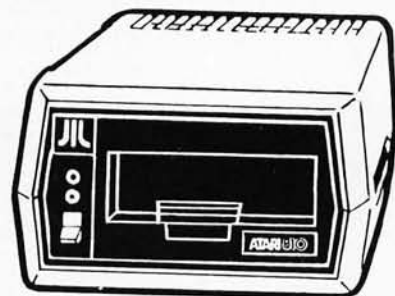
CX853 16K RAM Memory Module
List \$199.95 **\$169**

CX30-04 Paddle Controller **Pair \$19.95**

CX40-04 Joystick Controller **Pair \$19.95**

ATARI® 810 DISC DRIVE

List \$699.95 **OUR PRICE \$589**



609 Butternut St.,
Syracuse, NY 13208
(315) 478-6800

Personal Computer Systems

Circle 97 on inquiry card.

Listing 1 continued:

```

0110: C000          BLANK SECTOR
0111: C000          DISK OVERHUN
0112: C000          PERMINENT HEAD ERROR
0113: C000
0114: C000
0115: C000
0116: C000
0117: C000
0118: C000 4C AA C1
0119: C003 4C CF C2
0120: C006 4C 7E C2
0121: C009 4C 89 C1
0122: C00C 4C 9A C0
0123: C00F 4C 0A C0
0124: C012 4C 90 C3
0125: C015 4C 4C C3
0126: C018 4C 4C C3
0127: C01B 4C 4C C3
0128: C01E 4C 4C C3
0129: C021 4C 4C C3
0130: C024 4C 4C C3
0131: C027 4C 4C C3
0132: C02A 4C 4C C3
0133: C02D 4C 4C C3
0134: C030 4C 4C C3
0135: C033 4C 4C C3
0136: C036 4C 4C C3
0137: C039 4C 4C C3
0138: C03C 4C 4C C3
0139: C03F 4C 4C C3
0140: C042 4C 4C C3
0141: C045 4C 4C C3
0142: C048 4C 4C C3
0143: C04B 4C 4C C3
0144: C04E 4C 4C C3
0145: C051 4C 4C C3
0146: C054 4C 4C C3
0147: C057 4C 4C C3
0148: C05A 4C 4C C3
0149: C05D 4C 4C C3
0150: C060 4C 4C C3
0151: C063 4C 4C C3
0152: C066 4C 4C C3
0153: C069 4C 4C C3
0154: C06C 4C 4C C3
0155: C06F 4C 4C C3
0156: C072 4C 4C C3
0157: C075 4C 4C C3
0158: C078 4C 4C C3
0159: C07B 4C 4C C3
0160: C07E 4C 4C C3
0161: C081 4C 4C C3
0162: C084 4C 4C C3
0163: C087 4C 4C C3
0164: C08A 4C 4C C3
0165: C08D 4C 4C C3
0166: C090 4C 4C C3
0167: C093 4C 4C C3
0168: C096 4C 4C C3
0169: C099 4C 4C C3

```

```

SEEX : MOVE HEAD TO DESIRED TRACK
SEEX LDAZ DSTK GET DESIRED THACK#
ANDIM THKMSK IGNORE DRIVE#
TAY CRK THERE ALREADY?
CPYZ SOUT YES
BCC STPO LESS THAN CURRENT
JSR TKIN STEP IN
INCH CRK
CPYZ STPI THERE YET?
BNE STPI NO
BEQ SETL STEP OUT
DECZ CRK
CPYZ CRK THERE YET?
BNE STPO NO
LDXIM $1E 30 MS HEAD SETTLING
DNE DELA
DELAY 20 MS
DEL LDXIM $14
DELA : DELAY 1 MILLISEC FOR EACH INC OF X
DELA PHA
LOOP LDXIM $1E
TAX STA START TIMER
LDA TOUT TIME UP?
BEQ LOOP NO
DNE LOOP 1 MS PER LOOP
PLA
RTS
SOUT
DRVTST : SYNC SECTOR COUNTER TO CURRENT DRIVE
DRVTST JSR START MOTOR
LOVIM $19 25 CHANGES
JSR FTIME SET TIMER
DVLUP LDXIM $1E
AND DVST GET SECTOR BIT
LDA TOUT TIME UP?
DNE ERHJ YEP
TAX CHANGE IN SECTOR BIT?
EORZ SAVEP NO, WAIT
BEQ DVLUP YES SAVE AND COUNT
DEY
DNE DVLUP
RETRIG LDA MON RETRIGGER MOTOR
CLC
RTS
ERRJ LDXIM $1E DISK MISSING
SEC
RTS
PHEP : SELECT AND PREPARE DRIVE FOR OPERATION
PREP LDA DSEC GET SECTOR

```



```

0231: C0BC 00 0A 0A CMP $0A LESS THAN 10?
0232: C0FC 00 0C 0C PCS PADPHM NO, ERROR
0233: C0C1 A5 01 LDA PSTK RET, FRACK
0234: C0C3 29 3F LDA TRKMSK CLEAR DRIVE
0235: C0C5 C9 23 CMPIM TRKLMT OVERFLOW?
0236: C0C7 90 07 BCC DRV NO, GO CHECK DRIVE
0237: C0C9 A9 04 LDALM CVRUN YES, ERROR 4
0238: C0CB 30 SEC
0239: C0CD 60 RTS
0240: C0CD A9 02 PADPHM LDALM INVSEC INVALID SECTOR
0241: C0CF 60 RTS
0242:
0243: C0D0 AD 03 0C DRV IDA DVST GET CURRENT DRIVE
0244: C0D3 29 C0 ANDIM SC0 SAVE
0245: C0D5 85 10 STAZ CRDR
0246: C0D7 A5 00 LDAXZ DSDR GET DESIRED DRIVE
0247: C0D9 29 C0 ANDIM SC0
0248: C0DB C5 10 CMPZ CRDR SAME?
0249: C0DD C0 08 PNE SWIT NO, SWITCH DRIVES
0250: C0DF A5 0F LDA CRTR GET CURRENT TRK
0251: C0E1 C9 FF CMPIM $FF DRIVE INITIALIZED?
0252: C0E3 F0 24 BEQ DI NO
0253: C0E5 D0 30 BNE DS YES
0254:
0255: C0E7 48 SWIT PHA
0256: C0E8 A5 10 LDAXZ CRDR
0257: C0FA 10 CLC
0258: C0EB 2A ROLA
0259: C0FC 2A ROLA
0260: C0ED 2A ROLA
0261: C0EE AA TAX
0262: C0EF A5 0F LDAXZ CRTR SAVE CURRENT TRACK
0263: C0F1 95 10 STAZX CRTP IN SAVEAREA
0264: C0F3 60 PLA
0265: C0F4 48 PHA
0266: C0F5 18 CLC
0267: C0F6 2A ROLA
0268: C0F7 2A ROLA
0269: C0F8 2A ROLA
0270: C0F9 AA TAX
0271: C0FA B5 10 LDAXZ CRTP GET CURRENT TRACK
0272: C0FC B5 0F STAZ CRTR FROM SAVEAREA
0273: C0FE A9 08 DA LDALM WRTRBIT
0274: C100 2C 03 0C DB DIT DVST IS WRITE GATE OFF?
0275: C103 F0 FB BEQ DB NO, THEN WAIT
0276: C105 60 PLA
0277:
0278: C106 80 03 0C STA DTSL NOW SELECT DRIVE
0279: C109 20 95 C0 DI JSR DRVTSI SYNC TO DRIVE
0280: C10C B0 10 BCS DP ERROR EXIT
0281: C10E A5 0F LDA CRTR
0282: C110 C9 FF CMPIM $FF DRIVE ONLINE?
0283: C112 D0 03 BNE DS YES
0284: C114 20 22 C0 JSR CTXK NO, ZERO TRACK
0285: C117 20 31 C1 DS JSR START CHECK MOTOR
0286: C11A 20 60 C0 JSR SEEX FIND DESIRED TRACK
0287: C11D 18 CLC
0288: C11E 60 DP RTS
0289:
0290:
0291:

```

CKSEC : PART OF CTSC

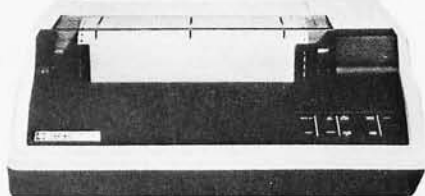
```

0292: C11F AD 07 17 C11F AD 07 17 CKSEC LDA TOUT TIME UP?
0293: C122 D0 08 DNE MISS YEP
0294: C124 AD 02 CC LDA SECT GET CURRENT SECTOR
0295: C127 29 0F ANDIM SCTMSK
0296: C129 C5 02 CMP CSEC = DESIRED?
0297: C12D 60 RTS
0298: C12C 68 MISS RESTORE STACK
0299: C12D 68 PLA
0300: C12E 4C B6 C0 JMP ERHJ
0301:
0302: START : START MOTOR
0303:
0304: C131 A9 04 START LDALM MTRBIT
0305: C133 2C 03 CC PIT DVST IS MOTOR ON?
0306: C136 F0 0C BEQ STAHR YES
0307: C138 AB TAY
0308: C139 AD 05 CC LDA MON START IT
0309: C13C A2 00 LDAXIM ZERO THEN WAIT ASEC
0310: C13E 20 85 C0 DELSS JSR DELA
0311: C141 88 DEY
0312: C142 D0 FA PNE DELSS
0313: C144 4C B1 C0 STARR JMP RETRIG
0314:
0315: CTSC : WAIT FOR DESIRED SECTOR TO COME AROUND
0316:
0317: C147 78 CTSC SEI DISABLE INTERRUPTS
0318: C148 20 80 C1 FTIME START TIMER
0319: C14B 20 1F C1 CTLUPA JSR CKSEC IF DESIRED IS CURRENT
0320: C14E F0 FB BEQ CTLUPA THEN WAIT TILL NXT REV
0321: C150 20 1F C1 CTLUPB JSR CKSEC THEN WAIT FOR
0322: C153 D0 FB BNE CTLUPB DESIRED
0323: C155 18 CLC
0324: C156 60 RTS
0325:
0326:
0327:
0328:
0329: C157 A5 14 CHC LDA DPTL MOVE DATA PTR
0330: C159 B5 1C STA CKPL TO CKSUM PTR
0331: C15B A5 15 LDA DPTH
0332: C15D B5 1D STA CKPH
0333: C15F A6 07 LDAXZ LEN GET LENGTH
0334: C161 A9 00 LDALM ZERO CLEAR SUM
0335: C163 AB TAY
0336: C164 B5 18 STAZ TPXH CLEAR TEMP STORAGE
0337: C166 20 72 C1 JSR CX COMPUTE DATA SUM
0338: C169 B6 1D STXZ CKPH POINT TO HEADER
0339: C16B E8 INX
0340: C16C B6 1C STXZ CKPL
0341: C16E A2 0A LDAXIM HDLEN !HEADER LENGTH
0342: C170 A0 00 LDAXIM ZERO
0343: C172 51 1C FORTY CKPT COMPUTE CKSUM
0344: C174 0A ASLA
0345: C175 26 18 ROLZ TPXH
0346: C177 90 02 BCC CQ
0347: C179 69 00 ADDIM ZERO
0348: C17B C8 INY
0349: C17C CA DEX
0350: C17D D0 F3 BNE CX
0351: C17F 60 RTS

```

Listing 1 continued on page 166

T.I. 810 Printer



Bi-directional; 150 cps; logic seeking; adjustable tractor. Available with lower case compressed print; Forms Length Control or Vertical Forms Control option.

TI-810 Basic Unit, List \$1895 **ONLY \$1695**

TI-810 w/full ASCII (lower case), vertical forms control, and compressed print . \$1895

TI-825 75 cps, w/lower case, List \$1565 **\$1395**

NEC Spinwriter™



5510 or 5530 Centronics parallel interface w/Tractor, List \$3285 **ONLY \$2889**

5510 or 5530 w/o Tractor, List \$3265 **\$2689**

Call us for Centronics, Integral Data, Paper Tiger, Anadex, Okidata, et.al.

Televideo TVI-912



OUR PRICE ONLY \$789

Upper case and lower case; 15 baud rates: 75 to 19,000 baud; dual intensity; 24 x 80-char. display, 12 x 10 resolution. Numeric pad. Programmable reversible video; aux. port; self-test mode; protect mode; block mode; tabbing; addressable cursor. Microprocessor controlled; programmable underline; line and character insert/delete.

Bantam 550



PERKIN ELMER

NOW FROM

US AT

\$799

with anti-glare

CRT only

\$829

\$10,000 Value!

Complete Business System

only \$5995

(Price includes air freight shipping)



VECTOR SYSTEM B, complete with Vector Mindless Terminal, 64K of RAM, Dual Floppy Disks (630 kilobytes of storage), and printer . . . so complete, you'll get all cables, box of 10 Floppy Disks, and EVEN a box of 3500 sheets of Fanfold Paper.

OVER \$3500 OF SOFTWARE INCLUDED!!!

Digital Research's 2.0 CP/M™ Disk Operating System, Interpreter, Microsoft 80 BASIC



AND one of the finest Business Packages — from Retail Science's PEACHTREE SOFTWARE:

- GENERAL LEDGER
- ACCOUNTS RECEIVABLE
- ACCOUNTS PAYABLE
- INVENTORY
- PAYROLL

The System B doubles as an **EXCELLENT Word Processing System** (Software at slight additional cost).

System may be expanded for multi-user time-sharing data and word processing! Up to 5 terminals at nominal cost.

Unless otherwise specified, shipping charges are additional. All prices subject to change and all offers subject to withdrawal without notice. Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.

— WRITE FOR FREE CATALOG —

MiniMicroMart

1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

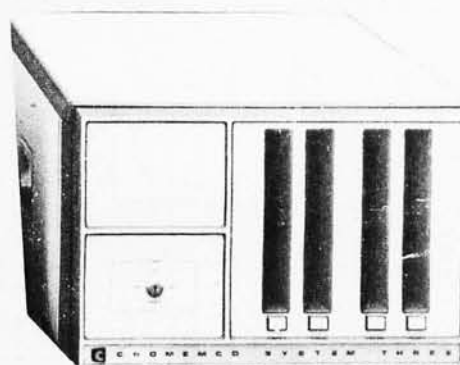


MiniMicroMart:

Your No. 1 Supplier of Systems for Business Applications and Word Processing . . .



HARD DISKS
MiniMicroMart is your best source
for Hard Disk Systems!
Cromemco, North Star, Vector,
Dynabyte, Morrow Thinker Toys®
Corvis, Lobo, et. al.



North Star Horizon® 2

32K 4 MHz, dual-drive, with double density controller board, two RS232C serial ports, a parallel port. Included is DOS and North Star Extended Disk BASIC.

Horizon 2, 32K, DD, List \$3095 ONLY \$2619

32K, Quad Density, List \$3595 \$3049

64K, Double Density (\$3830) \$3239

64K Quad System also available.

Cromemco System 3

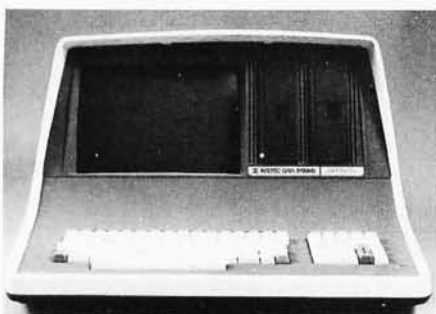
Features 4 MHz CPU, 64K of RAM, dual-sided Per-Sci 299B Floppy Disk Drive, RS232C interface, and printer interface.

Cromemco System 3, List \$6990 ONLY \$5890

System 2, List \$3990

OUR PRICE \$3390

Z-2H Hard Disk Computer System, List \$9995 \$8489



SUPERBRAIN™

32K or 64K totally self-contained computer, uses two Z-80 CPU's. Commercial-type terminal with 12" monitor (like the Intertube). Dual double density minifloppies (quad density available). Comes with CP/M™ operating system; BASIC included.

32K, List \$2995 ONLY \$2685

SuperBrain, 64K OUR PRICE \$2883

Circle 98 on inquiry card.

Complete your system with a Terminal, Printer, Business Software:

INCLUDES:

- Your choice of Terminal
 - P-E Bantam 500
 - Intertube II
 - Televideo 912
 - SOROC 120
- Software with Manuals
 - General Ledger
 - Accounts Receivable
 - Accounts Payable
 - Payroll
- 10 Floppy Disks
- Two RS232 Cables
- 3500 Sheets of Paper
- Anadex DP-8000 Printer

Over \$2500 Value . . . Limited Time Special \$1795

With T.I. 810 Printer — Retail Value over \$3400 . . **ONLY \$2595**

When purchased with SuperBrain (Terminal not required or furnished)

With Anadex DP-8000 Printer **\$1049**

With T.I. 810 Printer **\$1695**

— THIS OFFER EXPIRES JULY 10, 1980 —

Listing 1 continued:

```

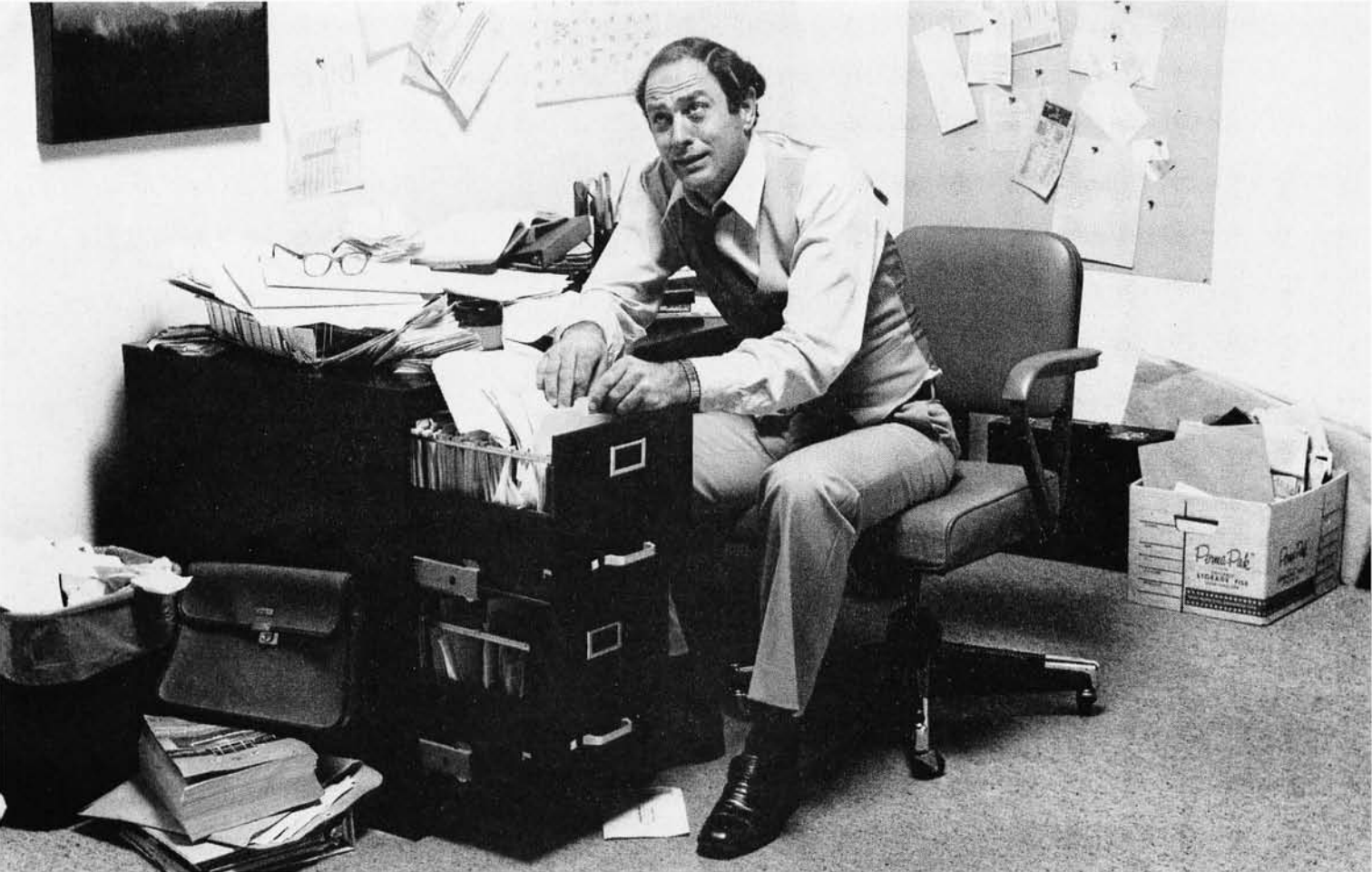
0352:          FFFTIME : START TIMER FOR 1/4 SECOND.
0353:          STORE TWICE FOR 65300 BUG.
0354:
0355:          FFFTIME LD AIM $FF
0356:          STIMER STA TOUT
0357:          STA TOUT
0358:          STA TOUT
0359:          HTS
0360:
0361:          SECTION 2 READ ROUTINES
0362:
0363:          LOOKX : READ A MEMORY FILE FROM DISK
0364:
0365:          LOOKX : READ A MEMORY FILE FROM DISK
0366:
0367:          LOOKX : READ A MEMORY FILE FROM DISK
0368:
0369:          LOOKX : READ A MEMORY FILE FROM DISK
0370:          LOOKX : READ A MEMORY FILE FROM DISK
0371:          LOOKX : READ A MEMORY FILE FROM DISK
0372:          LOOKX : READ A MEMORY FILE FROM DISK
0373:          LOOKX : READ A MEMORY FILE FROM DISK
0374:          LOOKX : READ A MEMORY FILE FROM DISK
0375:          LOOKX : READ A MEMORY FILE FROM DISK
0376:          LOOKX : READ A MEMORY FILE FROM DISK
0377:          LOOKX : READ A MEMORY FILE FROM DISK
0378:          LOOKX : READ A MEMORY FILE FROM DISK
0379:          LOOKX : READ A MEMORY FILE FROM DISK
0380:          LOOKX : READ A MEMORY FILE FROM DISK
0381:          LOOKX : READ A MEMORY FILE FROM DISK
0382:          LOOKX : READ A MEMORY FILE FROM DISK
0383:          LOOKX : READ A MEMORY FILE FROM DISK
0384:          LOOKX : READ A MEMORY FILE FROM DISK
0385:
0386:          RSEX : READ A SECTOR WITH ERROR RETRY
0387:
0388:          RSEX : READ A SECTOR WITH ERROR RETRY
0389:          RSEX : READ A SECTOR WITH ERROR RETRY
0390:          RSEX : READ A SECTOR WITH ERROR RETRY
0391:          RSEX : READ A SECTOR WITH ERROR RETRY
0392:          RSEX : READ A SECTOR WITH ERROR RETRY
0393:          RSEX : READ A SECTOR WITH ERROR RETRY
0394:          RSEX : READ A SECTOR WITH ERROR RETRY
0395:          RSEX : READ A SECTOR WITH ERROR RETRY
0396:          RSEX : READ A SECTOR WITH ERROR RETRY
0397:          RSEX : READ A SECTOR WITH ERROR RETRY
0398:          RSEX : READ A SECTOR WITH ERROR RETRY
0399:          RSEX : READ A SECTOR WITH ERROR RETRY
0400:          RSEX : READ A SECTOR WITH ERROR RETRY
0401:          RSEX : READ A SECTOR WITH ERROR RETRY
0402:          RSEX : READ A SECTOR WITH ERROR RETRY
0403:          RSEX : READ A SECTOR WITH ERROR RETRY
0404:          RSEX : READ A SECTOR WITH ERROR RETRY
0405:          RSEX : READ A SECTOR WITH ERROR RETRY
0406:          RSEX : READ A SECTOR WITH ERROR RETRY
0407:          RSEX : READ A SECTOR WITH ERROR RETRY
0408:          RSEX : READ A SECTOR WITH ERROR RETRY
0409:          RSEX : READ A SECTOR WITH ERROR RETRY
0410:          RSEX : READ A SECTOR WITH ERROR RETRY
0411:          RSEX : READ A SECTOR WITH ERROR RETRY

```

```

0412: C108 CA FD
0413: C109 D0 FD
0414: C10A D0 CC
0415: C10B 20 66 C2
0416: C10C 90 03
0417: C10D 28
0418: C10E 30
0419: C10F 60
0420: C110 20 66 C2
0421: C111 A8
0422: C112 45 01
0423: C113 29 3F
0424: C114 D0 56
0425: C115 90
0426: C116 85 01
0427: C117 20 66 C2
0428: C118 C5 02
0429: C119 D0 4C
0430: C11A A2 00
0431: C11B 20 66 C2
0432: C11C 95 03
0433: C11D E8
0434: C11E E0 08
0435: C11F 0E F6
0436:
0437: C206 A5 17
0438: C207 F0 09
0439: C208 85 15
0440: C209 A5 16
0441: C20A 85 14
0442: C20B 85 14
0443: C20C 40 10 C2
0444: C20D A5 08
0445: C20E 85 14
0446: C20F A5 09
0447: C210 85 15
0448: C211 A0 00
0449: C212 A0 00 CC
0450: C213 4A
0451: C214 90 FA
0452: C215 A0 01 CC
0453: C216 91 14
0454: C217 C8
0455: C218 C4 07
0456: C219 D0 F0
0457: C220 A2 00
0458: C221 20 66 C2
0459: C222 95 00
0460: C223 E8
0461: C224 E0 04
0462: C225 D0 F6
0463: C226 20 57 C1
0464: C227 C5 00
0465: C228 D0 06
0466: C229 A5 18
0467: C230 C5 0C
0468: C231 F0 0A
0469: C232 20
0470: C233 C6 10
0471: C234 F0 03
0472: C235 4C C8 C1

```

Record keeping problems? Our CCA Data Management System solves them easily.

Having information at your fingertips can make your job a whole lot easier. And that's what the CCA Data Management System is all about.

With this Personal Software™ package and an Apple II™ or TRS-80™ disk system, it will be far easier to keep inventories, customer lists, accounts receivable and payable records, patient histories and many more items.

In fact, you can use the CCA DMS for all of your data management needs, rather than buying (expensive) or writing (time consuming) separate programs for each application. That's because DMS lets you create your own filing systems, adapting itself to the types of records you keep. You specify the number and names of each data field—without any programming.

With DMS keeping all of your records, you only have to learn how to use one system. That's easier, too. It's menu driven, with plenty of prompts to help you create files and add, update, scan, inspect, delete, sort, condense and print data. Our comprehensive 130-page step-by-step instruction manual even provides complete "how to" inventory and mailing list applications so you can start processing immediately.

DMS is a very powerful system, with more file and record storage capacity than other data base programs on the market.

*Apple is a trademark of Apple Computer, Inc.; TRS-80 is a trademark of the Radio Shack Div. of Tandy Corp.

Circle 99 on inquiry card.

And it also gives you greater data handling flexibility. To customize DMS, write add-on BASIC programs that read or write DMS files and perform any kind of processing you want.

You can sort and print your data in nearly any form of report and mailing label you want. Sort data by up to 10 fields for zip code, balance due, geographic location or whatever. And print reports with subtotals and totals automatically calculated.

The CCA Data Management System, written by Creative Computer Applications, has two years of field testing on other microcomputers. Now Personal Software makes DMS available on the TRS-80 Level II and Apple II and II Plus 48k disk systems. And at under \$100, DMS is also easy to afford.

One demonstration will convince you how easy computerized record keeping is. Ask your Personal Software dealer to show you. To locate your nearest dealer, contact Personal Software, Inc., (408) 745-7841, 592 Weddell Dr., Sunnyvale, CA 94086.

See us at NCC booth 48 and 49.



**PERSONAL
SOFTWARE**

Listing 1 continued:

```

0473: C24F 10 SERH CLC
0474: C24F 10 RTB
0475: C250 28 SUCC PLP
0476: C251 A5 17 LDAZ ALTH
0477: C253 F0 00 DEQ NOCQ
0478: C255 A5 07 LDAZ LEN
0479: C257 10 CLC
0480: C258 F0 06 DEQ INCA
0481: C25A F5 16 ADC2 ALTL
0482: C25C 85 16 STAZ ALTL
0483: C25E 90 02 DCC NOCQ
0484: C260 E6 17 INCZ ALTH
0485: C262 10 CLC
0486: C263 A9 FF LDAIM $FF
0487: C265 60 RTS
0488:
0489:
0490:
0491: C266 AD 00 CC IN IN : READ A BYTE AND CHECK FOR OUT OF SECTOR
0492: C269 4A LSHA
0493: C26A 00 00 INQ INQ YFS READ IT
0494: C26C AD 02 CC LDA SECT SET SECTOR FROM CONTROLLER
0495: C26F 29 0F ANDIM $0F
0496: C271 C5 02 CMPZ DSEC
0497: C273 F0 F1 DEQ IN YES
0498: C275 A9 03 LDAIM FLNKSC EMPTY SECTOR
0499: C277 38 SEC ERROR FLAG
0500: C278 60 RTS
0501: C279 AD 01 CC INQ LDA HDTA GET A BYTE
0502: C27C 18 CLC
0503: C27D 60 RTS
0504:
0505:
0506:
0507:
0508:
0509:
0510:
0511:
0512:
0513: C27E A9 00 SAVX LDAIM ZERO
0514: C280 85 03 STAZ FLTK
0515: C282 85 04 STAZ RLSC
0516: C284 A2 01 LDAIM $01
0517: C286 F5 01 LDAZX DSTK
0518: C288 95 0D STAZ PSTL
0519: C28A 95 05 STAZ FLTK
0520: C28C CA DEX
0521: C28D 10 F7 DPL KLUP
0522: C28F 20 4C C3 SXS JSR FWDC
0523: C292 20 20 C3 JSR LNTH
0524: C295 A5 14 LDA DPTL
0525: C297 85 08 STA TCTL
0526: C299 A5 15 LDA DPTH
0527: C29B 85 09 STA TGTB
0528: C29D 20 CF C2 JSR WSEX
0529: C2A0 80 39 BCS ERRO
0530: C2A2 A5 07 LDAZ LEN
0531: C2A4 F0 07 DEQ INCT
0532: C2A6 10 CLC

```

```

0533: C2A7 65 14 ADCZ DPTL
0534: C2A9 85 14 STAZ DPTL
0535: C2AB 90 02 BCC NOCW
0536: C2AD E6 15 INCZ DPTH
0537: C2AF A5 1F LDAZ ENDH
0538: C2B1 C5 15 CMPZ DPTH
0539: C2B3 F0 03 DEQ CONT
0540: C2B5 80 09 BCS SETU
0541: C2B7 60 RTS THEN RETURN
0542: C2B8 A5 1E LDAZ ENDL
0543: C2BA C5 14 CMPZ DPTL
0544: C2BC F0 02 DEQ SETU
0545: C2BE 90 F7 FCC SRET
0546: C2C0 A2 01 LDAIM $01
0547: C2C2 95 01 LDAZX DSTK
0548: C2C4 95 03 STAZ BLTK
0549: C2C6 85 05 LDAZX FLTK
0550: C2C8 95 01 STAZ DSTK TO TRACK/SECTOR
0551: C2CA CA DEX
0552: C2CB 10 F5 RPL SLUP
0553: C2CD 30 C0 DMI SXS UNCONDITIONAL
0554:
0555:

```

WSEX : WHITE A SECTOR

```

0557: C2CF 20 DA C0 WSEX JSR PREP PREPARE DRIVE
0558: C2D2 80 08 BCS WSQ ERROR EXIT
0559: C2D4 A9 01 LDAIM $01
0560: C2D6 2C 03 CC BIT DVST WRITE PROTECT ON?
0561: C2D9 D0 02 BNE WSR NO
0562: C2DB 38 SEC
0563: C2DC 60 RTS
0564: C2DD 20 57 C1 WSR JSR CRC COMPUTE CHECKSUM
0565: C2E0 85 08 STAZ CKSL SAVE IT
0566: C2E2 A5 18 LDAZ TPXH
0567: C2E4 85 0C STAZ CKSH
0568: C2E6 A9 FF LDAIM $FF
0569: C2E8 8D 02 CC STA FILL
0570:
0571: C2EB 08 PHP
0572: C2EC 20 47 C1 JSR CTSC SAVE INTERRUPT STATUS
0573: C2EF 80 37 BCS WERR FIND SECTOR
0574: C2F1 8D 04 CC STA WPLS START TRANSMITTER
0575: C2F4 A2 10 LDAIM $10
0576: C2F6 A9 00 LDAIM $00
0577: C2F8 20 63 C3 WSS JSR OUT WRITE LEADER 16 X 00
0578: C2FB CA DEX
0579: C2FC D0 FA BNE WSS
0580: C2FE A9 FB LDAIM $FB
0581: C300 20 63 C3 WST JSR OUT SEND SYNC
0582: C303 B5 01 LDAZX DSTK WRITE 10 BYTE HEADER
0583: C305 20 63 C3 JSR OUT
0584: C308 E8 INX
0585: C309 E0 0A CPXIM $0A
0586: C30B D0 F6 BNE WST
0587: C30D A6 07 LDAZ LEN
0588: C30F A0 00 LDYIM $00
0589: C311 B1 14 WST LDYIM DPTH
0590: C313 20 63 C3 JSR OUT
0591: C316 C8 INY
0592: C317 CA DEX

```

Listing 1 continued on page 170

Settle for More from Your TRS-80

BASIC Compiler. With TRS-80 BASIC Compiler, your Level II BASIC programs will run at record speeds! Compiled programs execute an average of 3-10 times faster than programs run under Level II. Make extensive use of integer operations, and get speeds 20-30 times faster than the interpreter.

Best of all, BASIC Compiler does it with BASIC, the language you already know. By compiling the same source code that your current BASIC interprets, BASIC Compiler adds speed with a minimum of effort.

And you get more BASIC features to program with, since features of Microsoft's Version 5.0 BASIC Interpreter are included in the package. Features like the WHILE . . . WEND statement, long variable names, variable length records, and the CALL statement make programming easier. An exclusive BASIC Compiler feature lets you call FORTRAN and machine language subroutines much more easily than in Level II.

Simply type in and debug your program as usual, using the BASIC interpreter. Then enter a command line telling the computer what to compile and what options to use.

Voila! Highly optimized, Z-80 machine code that your computer executes in a flash! Run it now or save it for later. Your compiled program can be saved on disk for direct execution every time.

Want to market your programs? Compiled versions are ideal for distribution.* You distribute only the object code, not the source, so your genius stays fully protected.

BASIC Compiler runs on your TRS-80 Model I with 48K and disk drive. The package includes BASIC Compiler, linking loader and BASIC library with complete documentation. \$195.00.

*Microsoft royalty information for the sale of programs compiled with BASIC Compiler is available from Microsoft.

muMATH Symbolic Math System

expands your TRS-80 beyond the limits of numerical evaluation to a much higher level of math sophistication.

Symbolic mathematics is muMATH's power. For the first time, algebra, trigonometry, calculus, integration, differentiation and more can be performed on a system smaller than an IBM 370. And in a fraction of the time you could do them manually.

Yet for all its power, muMATH is simple to use.

To perform a differentiation you could enter:
?DIF (A*X[↑]3 + SIN(X[↑]2),X);

In almost no time, the computer would reply with: @2*X*COS(X[↑]2) + 3*A*X[↑]2.

Or to add fractions: ?1/3 + 5/6 + 2/5 + 3/7;

The instantaneous answer: 419/210.

Or to perform a more difficult trigonometric expansion you enter: SIN(2*Y)*(4*COS(X)[↑]3 - COS(3*X) + SIN(Y)*(COS(X+Y+PI) - COS(X-Y));

Just a few seconds later, the computer replies: @4*SIN(Y)*COS(X)*COS(Y).

muMATH has virtually infinite precision with full accuracy up to 611 digits.

If you use math, you'll find countless ways to save time and effort with muMATH. It's a professional tool for engineers and scientists. A learning tool for students at any level from algebra to calculus.

And if you want to expand your capabilities even beyond the standard muMATH, the option is open. muSIMP, the programming language in which muMATH is written, is included in the muMATH package. A superset of the language LISP, muSIMP is designed especially for interactive symbolic mathematics and other artificial intelligence applications.

muMATH and muSIMP were written by The Soft Warehouse, Honolulu, Hawaii. Priced at \$74.95, the package includes muMATH, muSIMP and a complete manual. It requires a Model I TRS-80 with 32K and single disk. muMATH for the Apple II Computer will be available later this year.



You can buy muMATH and BASIC Compiler at computer stores across the country that carry Microsoft products. If your local store doesn't have them, call us. 206-454-1315. Or write Microsoft Consumer Products, 10800 Northeast Eighth, Suite 507, Bellevue, WA 98004.

MICROSOFT
CONSUMER PRODUCTS

Listing 1 continued:

```

0593: C318 D0 F7
0594: C31A A0 04
0595: C31C 05 00
0596: C31C 20 63 C3
0597: C321 E8
0598: C322 88
0599: C323 D0 F7
0600: C325 28
0601: C326 18
0602: C327 60
0603: C327 60
0604: C328 28
0605: C329 38
0606: C32A 60
0607:
0608:
0609:
0610: C32B A5 1E
0611: C32D 38
0612: C32E E5 14
0613: C330 05 07
0614: C332 A5 1F
0615: C334 E5 15
0616: C336 F0 05
0617: C338 A9 00
0618: C33A 05 07
0619: C33C 60
0620: C33D E6 07
0621: C33F 05 05
0622: C341 05 06
0623: C343 A5 19
0624: C345 05 00
0625: C347 A5 1A
0626: C349 05 0E
0627: C34D 60
0628:
0629:
0630:
0631:
0632: C34C A5 06
0633: C34E C9 08
0634: C350 F0 0C
0635: C352 00 04
0636: C354 69 02
0637: C356 D0 08
0638: C358 E6 05
0639: C35A A9 00
0640: C35C F0 02
0641: C35F A9 01
0642: C360 05 06
0643: C362 60
0644:
0645:
0646:
0647: C363 4B
0648: C364 AD 00 CC
0649: C367 10 FB
0650: C369 6B
0651: C36A 8D 01 CC
0652: C36D 60
0653:

BNE WSV
LDXIM $04
LDZX CKSL
JSR OUT
INX
DEY
ONE WSV
PLP
CLC
RTS
WERR
SEC
RTS

LNTH : COMPUTE LENGTH AND FIND LAST BLOCK

LNTH LDZX ENDL
SEC
SBCZ DPTL
STAZ LEN
LDZX ENDL
SBCZ DPTH
BEQ LQ
LDXIM $00
STAZ LEN
RTS
INCL LEN
STAZ FLTK
FLTK =CURRENT TRACK
STAZ FLSC
LDZX EXCL
STAZ PYTL
LDZX EXCH
STAZ PYTH
RTS

FWDC : CALCULATE FORWARD LINK. ASSUMES
FLTK =CURRENT TRACK

FWDC LDZX FLSC
CMPIM $08
BEQ FR
DCC FQ
INCZ $02
DNE FS
INCZ FLTK
LDXIM $00
BEQ FS
LDXIM $01
STAZ FLSC
RTS

OUT : SEND A BYTE WHEN USRT IS READY

OUT PHA
LDA RDST
OUTQ
RPL OUTQ
PLA
STA WDIA
RTS

```

SECTION 4 KEYBOARD CONTROL ROUTINES

```

0654:
0655:
0656:
0657:
0658:
0659:
0660:
0661:
0662:
0663:
0664:
0665:
0666:
0667:
0668:
0669:
0670:
0671:
0672:
0673:
0674:
0675:
0676:
0677:
0678:
0679:
0680:
0681:
0682:
0683:
0684:
0685:
0686:
0687:
0688:
0689:
0690:
0691:
0692:
0693:
0694:
0695:
0696:
0697:
0698:
0699:
0700:
0701:
0702:
0703:
0704:
0705:
0706:
0707:
0708:
0709:
0710:
0711:
0712:
0713:
0714:

SAVK : ENTRY TO WRITE FILE
ENTER THE FOLLOWING VIA KIM:
BEGINNING ADDRESS 14,15
ENDING ADDRESS 1E,1F
EXECUTION ADDRESS 19,1A
DRIVE/TRACK/SECTOR 1C,1D
FILE TYPE 0A

JSR INTCVT INIT AND CONVERT
DCC KERR ERROR
JSR SAVX WHITE FILE
DCC KERR
JSR CVTDEC CONVERT D/T/S
JMP STRT RETURN TO KIM

LOOK : READ A MEMORY FILE
ENTER THE FOLLOWING
DRIVE/TRACK/SECTOR 1C,1D
ALTERNATE TARGET OR 0 16,17

JSR INTCVT INIT AND CONVERT
RCS KERR
JSR LODX READ FILE
DCC LAST SHOW LAST TRK/SECTOR
STAZ PNTL ERROR CODE TO DISPLAY
LDXIM $FF ERROR FLAG
STAZ PNTL
BNE KIMQ

CVTDEC : CONVERT TRACK/SECTOR FOR DISPLAY

CVTDEC LDXIM $FF ZERO COUNT?
STAZ PNTL
LDZX DSTK GET TRACK #
ANDIM TRKMSK IGNORE DRIVE#
SEC
INCZ PNTL
SBCIM $0A DIVIDE BY 10 LOOP
RCS LSQ FRANCH NO BORROW
ADDCIM $0A REMAINDER IN A
PHA
LDZX DSEC CONVERT ALTERNATE TO
LSHA
RCC KSS TO SEQUENTIAL SECTOR
ADDCIM $04 ADD 4 + CARRY
STAZ PNTL
PLA SAVE
ASLA
ASLA
ASLA
ASLA
ASLA
STAZ PNTL MERGE TRACK 1SB
STAZ PNTL WITH SECTOR
RTS

```

Listing 1 continued on page 172

**NEECO
PROUDLY**

INTRODUCES **COMMODORE'S NEW 8000 SERIES (80 column) COMPUTERS**



\$1695 (available May/June '80)

CBM™ 8050 DUAL DRIVE FLOPPY DISK

The CBM 8050 Dual Drive Floppy Disk in an enhanced version of the intelligent CBM 2040 Disk Drive. The CBM 8050 has all of the features of the CBM 2040, and provides more powerful software capabilities, as well as nearly one megabyte of online storage capacity. The CBM 8050 supplies relative record files and automatic diskette initialization. It can copy all the files from one diskette to another without copying unused space. The CBM 8050 also offers improved error recovery and the ability to append to sequential files.

HARDWARE SPECIFICATIONS

Dual Drives
Two microprocessors
974K Bytes storage on two 5.25" diskettes (ss)
Tracks 70
Sectors 17-21
Soft sector format
IEEE-488 interface
Combination power (green) and error (red) indicator lights
Drive Activity indicator lights
Disk Operating System Firmware (12K ROM)
Disk Buffer (4K RAM)

FIRMWARE

DOS version 2.0
Sequential file manipulation
Sequential user files
Relative record files
Append to sequential files
Improved error recovery
Automatic diskette initialization
Automatic directory search
Command parser for syntax validation
Program load and save

CBM™ 8000 SERIES BUSINESS COMPUTERS

The new Commodore 8000 series computers offer a wide screen display to show you up to 80-character lines of information. Text editing and report formatting are faster and easier with the new wide-screen display. The 8000 series also provides a resident Operating System with expanded functional capabilities. You can use BASIC on the 8000 computers in both interactive and program modes, with expanded commands and functions for arithmetic, editing, and disk file management. The CBM 8000 series computers are ideally suited for the computing needs of the business marketplace.

SCREEN

2000 character display, organized into twenty-five 80-column lines
64 ASCII, 64 graphic characters
3 x 8 dot matrix characters
Green phosphor screen
Brightness control
Line spacing: 1½ in Text Mode
1 in Graphics Mode

KEYBOARD

73-key typewriter style keyboard with graphic capabilities
Repeat key functional with all keys

MEMORY

CBM 8016: 16K (15359 net)
random access memory (RAM)
CBM 8032: 32K (31743 net)
random access memory (RAM)

POWER REQUIREMENTS

Volts: 110V
Cycles: 60 Hz
Watts: 100

SCREEN EDITING

CAPABILITIES
Full cursor control (up, down, right, left)
Character insert and delete
Reverse character fields
Overstriking
Return key sends entire line to CPU regardless of cursor position

INPUT/OUTPUT

Parallel port
IEEE-488 bus
2 cassette ports
Memory and I/O expansion connectors

FIRMWARE

24K or ROM contains:
BASIC (version 4.0) with direct (interactive) and indirect (program) modes
9-digit floating binary arithmetic
Tape and disk file handling software

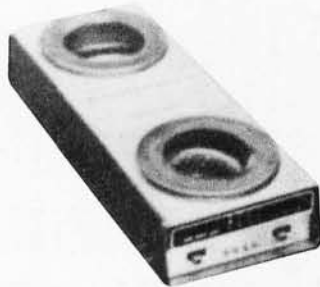
The 8000 Series will be available May/June '80

Model 8016 Model 8032 2040 Dual Floppy

\$1495

\$1795

\$1295



Available June/July

\$395

CBM™ IEEE MODEM

SPECIFICATIONS

*Full or half duplex operation
*300 bits per second
*Standard IEEE 488 interface
*Switch selectable originate, off, answer-full duplex, test, half duplex
*Visible indicators are transmit data, receive data, carrier ready, test
*Frequency shifted modulation
*Bell 103/113 compatible

"Exceptional performance - even on noisy phone lines"

*CBM is a registered trademark of Commodore. All prices and specifications are subject to change without notice.

NEECO

679 Highland Ave.
Needham, MA
02194

Mon-Fri 9:30-5:30
MasterCharge &
Visa Accepted

(617) 449-1760
Telex: 951021

MICROAMERICA DISTRIBUTING

"Nationwide distributors of Computer Equipment"

21 Putnam Street
Needham, MA
02194

(617) 449-4310

Listing 1 continued:

[illegible]

CHDR	001E	CHTK	000F	CTKP	0010	CTKQ	0011
CTKR	0012	CTKS	0013	CTBIN	0018	CTVDEC	0019
DA	C172	DA	C0FE	CALP	C210	DB	C100
DELA	C085	DELS9	C13E	DEL	C083	DI	C109
DELSKMS	0000	DP	C11E	DPH	0015	DPIL	C094
DPTR	0014	DRV	C0C0	DRVSK	00CF	DVST	0015
DS	C117	DSDR	0000	DSEK	0002	DSK	0001
DPDASH	001C	DTSL	C003	DVLUP	C09D	DVST	CC03
ENDSH	001F	ENDL	001E	ERRJ	C0F6	ERRO	C2D8
EXCH	001A	EXCL	0019	FFTIME	C180	FILL	CC02
FLSC	0006	FLTE	0005	FQ	C358	FR	C35E
FFS	C360	FTYP	000A	FWOC	C34C	CDAT	C21E
GETP	C028	CTKX	C022	CTLUPA	C14C	CTLUPB	C150
GTSC	C147	HEDLEN	000A	HIOR	0014	HLUP	C1FC
IN	C266	INCA	C260	INCT	C2AD	INITDV	C018
INQ	C279	INTCVT	C305	INTLUP	C01C	INVS	C3FC
INVSQC	0002	KEHR	C388	KIMDOS	C000	KIMQ	C37B
KLUP	C286	KSS	C3A9	LAST	C378	LEN	0007
LNTH	C328	LOOK	C37F	LODX	C189	LOOP	C088
LIQ	C330	LSQ	C399	LUUP	C086	MILSEC	007D
LISS	C12C	MOFF	C066	MON	CC05	MTRBIT	000A
LNTHV	C047	NEND	C198	NOAL	C213	NOCQ	C262
NOVCW	C2AF	NOSEC	C1E3	CUTQ	C364	OUT	C363
OVFL	C0C9	CVRUN	0004	PCH	0000	PCL	00EF
PNTH	00FB	PNTL	00FA	PREP	C0BA	PSTH	000E
PNSTL	000D	RCNT	0014	RDRT	C1C6	RDST	CC00
PRDS	C1C7	RDTA	CC01	HEAD	C1C8	HEADER	0005
RETRIG	C001	ROK	C1E6	HQ	C1D8	HRST	CC04
RSEX	C1AA	SAVEP	0010	SAVK	C36E	SAVX	C27E
SCBTBIT	0010	SCTMASK	000F	SECT	CC02	SEEX	C060
SEHR	C24E	SETL	C07F	SETU	C2C0	SKER	C246
SLUP	C2C2	SOUT	C094	SRET	C207	START	C131
STARTR	C144	STEPIIN	0010	STIMER	C182	STPBIT	0020
STPI	C06C	STPO	C076	STRT	1C4F	SUCC	C250
SWIT	C0E7	SXS	C20F	SXT	C29D	SYNC	CC00
TGTH	0009	TGTL	0008	TGTP	0008	THEEND	CC0E
TJX	1705	TKIN	C040	TKOT	C038	TOUT	1707
TPXH	0018	TRKLMT	0023	TRKMSK	003F	TSSA	001D
WDTA	CC01	WERR	C028	WPLS	CC04	WPHOT	0011
WHBTBIT	0008	WSEX	C2CF	WSQ	C2DC	WSR	C2D0
WSS	C2FB	WST	C303	WSU	C311	WSV	C31C
WERC	0000						

Listing 2: Cross-reference table for the symbols in listing 1.

SYMBOL	DEFINED	REFERENCES	DVLUP	210	216	219	142	152	155	211	243	274	305
ALTH	43	438 476 484	DVST	70	560	537 614							
ALTL	42	441 481 482	ENDH	57	542 610								
ALTP	41		ERRJ	223	213 300								
PADPHM	240	232	EXCH	562	625								
PLNKSC	110	490	EXCL	46	623								
RLSC	16	515	FFTIME	45	209 318								
RLTK	15	432 514 548	FILL	78	569								
CDQ	733	727	FLSC	18	371 375 622 632 642								
CDR	734	732	FLTK	17	373 377 519 549 621 638								
CRPH	53	332 338	FQ	638	635								
CKPL	52	330 340	FR	641	634								
CKPT	51	343	FS	642	637 640								
CKSEC	292		FTYP	23									
CKSH	28	467 567	FWDC	632	126 522								
CKSL	27	459 464	GDAT	448	443								
CLUP	458	462	GETP	141	145								
CONT	542	539	GTKX	139	393								
COPPL	380	374	CTLUPA	319	284								
CQ	348	346	CTLUPB	321	320								
CRC	329	463 564	GTSC	317	322 572								
CRDR	48	245 248	HEDLEN	98	409 572								
CRTK	31	147 175 179 180 184 185 250	HIOR	49	341 746 750								
		262 272 281	HLUP	431	435								
		263 271	IN	491	415 420 427 431 458 497								
CTKP	33		INCA	484	480								
CTKQ	34		INCT	536	531								
CTKR	35		INITDV	130									
CTKS	36		INQ	501	493								
CVTBIN	721	124	INTCVT	719	668 680								
CVTDEC	692	125 672	INTLUP	132	134								
CX	343	337 350	INVS	765	724 741 754 759								
DA	273		INVSEC	189									
DALP	449	451 456	KERR	685	669 671 681								
DB	274	275	KINDOS	10									
DEL	191	159 168	KING	673	688								
DELA	195	188 310	KLUP	517	521								
DELSG	310	312	KSS	706	704								
DI	279	252	LAST	672	683								
DISKMS	107	223	LEN	19	333 455 478 530 587 613 618								
DP	288	280			620								
DPTH	40	331 440	LNTH	610	523								
DPTL	39	329 442 445 524 533 534 543	LOOK	680									
DPTR	38	453 589	LOOX	369	379 682								
DRIV	243	236	LOOP	198									
DRVMSK	95	153 156	LQ	620	616								
DRVTS	207	279	LSQ	697	699								
DS	285	253 283	LUUP	196	201								
DSOR	12	246 762	MILSEC	93	196								
DSOC	14	230 296	MIS	298	293								
DSK	13	172 233	MOFF	73									
		550 582 694 742 752 755	MON	72									
DTSA	54	744 756	MTROIT	92	167 308								
DTSL	79	158 161 166 278			304								

Listing 2 continued on page 176

DO IT

University Software gives you



Canned Programs are Only a Beginning. Pre-programmed disks and cassettes are a terrific way to get started in micros. But they're just a start. The best thing about owning a computer is programming it. Yourself.

University Software makes it easy. Using compact, easy-to-understand Microsoft BASIC, *University Software* has selected the best work of scores of different authors to create this spiral-bound, five-volume set of the programs you most want to have. All you have to do is sit down at the keyboard and enter them.

Software for People. The problem with BASIC as a language is that it was developed on timeshare and other large capacity computers. But Microsoft BASIC was specifically designed to run on micros; it's fast, it's simple, and memory requirements are minimal.

All the programs in the *University Software* set were written on micros, for micros. If you own a TRS-80, Apple, Texas Instruments, Atari, Commodore PET, Sorcerer, or Ohio Scientific micro,



A University Software Sampler

Here is a small sample of the programs you'll get in each of the five University Software volumes.

HOME & ECONOMICS—\$24.95

Text Editor: Compose and correct your notes, letters, invoices.
Utilities: Electric, water, phone, gas and trash bills control.
Temperature Conversion: Lets you convert different temperature units.
Eternal Calendar: Returns the day of the week for a given date.
Recipes Book: Sets up recipes on cassette tape.
Checking Account: Checkbook analysis.
... Plus 9 more!

FUN & GAMES Volume I—\$14.95

Space Race: You command Federation Trading Ships in the Asteroid Belt.
Mastermind: Players attempt to figure out one another's combinations.
Combat: Battle game employing numbered board on screen.
Biorhythm: Physical, emotional and intellectual patterns.
Merchant of Venus: Make money in outer space.
... Plus 10 more!

FUN & GAMES Volume II—\$14.95

Blackjack: The famous card game.
World War III: War game.
Bridge: Deals four hands on screen.

Battlestar Galactica: You have to reach Earth passing many Cylon stations.
... Plus 17 more!

EDUCATION & SCIENTIFIC—\$34.95

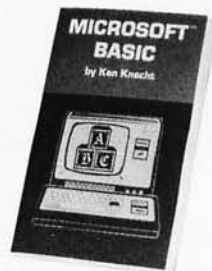
Astronomical Computations: Compute the positions of the planets; draw orbits.
Pythagorean Theorem: Review geometry theorems.
Word Search: Spelling puzzle.
Quantum Chemistry: Compute quantum numbers of an atom.
Program Manager: Load and run multiple programs.
... Plus 21 more!

SMALL BUSINESS—\$49.95

Mortgage Analysis: Outputs loan tables.
Distributions Mapping: Maintains library of distribution functions.
Billing System: Creates and manages data base containing bills.
Investment Management: Analysis of stocks, funds, debentures, real estate.
Small Business Accounting: Posts income and expenses, prints trial balance; chart of accounts.
Tax: Federal Income and F.I.C.A. taxes.
... Plus 22 more!

Act now for your FREE BOOK

You can order each of these volumes separately NOW through Folio Books. But if you call today and order the entire set, we'll include *Microsoft BASIC*, a standard introductory guide to the use of the language by Ken Knecht absolutely FREE.



Offer expires June 30, 1980

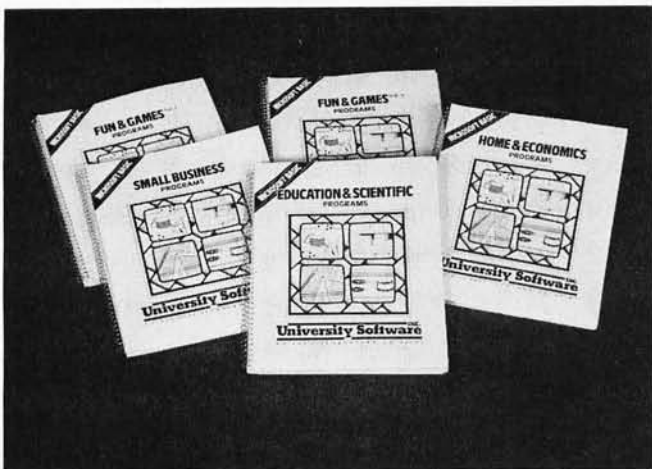
YOURSELF.

105 Microsoft programs. For less than a buck and a half apiece.

umes of Fun & Games programs offer a total of 35 games and graphics to challenge every level of skill. Finally, the Home & Economics text contains the programs you need to help you manage your life more efficiently—an appointments calendar, metric conversions, and programs to help you balance your checking account and budget the family income.

Do Your Pocketbook a Favor. It's this simple: if you input your own programs, you save money. Lots of money. Preprogrammed cassettes and disks nowadays cost anywhere from \$10 to upwards of \$50. And if the program you want is not available in a format for your computer, you're just flat out of luck.

If you buy the entire set of *University Software* programs, on the other hand, you get 105 programs for \$139.75—about \$1.33 each. Plus, there's a conversion appendix in the back of *each* volume to help you convert any Microsoft BASIC program written on one computer to run on yours.



Do Yourself a Favor. To really master and understand your computer, you can't be content to sit back and let it do all the work. You've got to roll up your sleeves and accept the challenge to your own creativity. *University Software* programs will help you run your life. And they'll help you grow.

You can order any of the *University Software* volumes separately, but if you *act now* and order the entire set, we'll include Ken Knecht's *Microsoft BASIC*, a complete introduction and tutorial book on programming in Microsoft BASIC, **FREE!** It's yours—a \$10 value—just for ordering the whole *University Software* set at one time.



We'll jump right on your order. There's only one place you can get the entire *University Software* set shipped directly to you almost as soon as you call: Folio Books. We are specialists in computer books for micro and mini computers, and honestly believe that *University Software* is the finest set of application Microsoft programs available to the general public.

Call us today. Do it for yourself.

ORDERING INFORMATION: Call toll-free (800) 423-4864, M-F 9-5 p.m. Pacific Time. Mail order: include name, address and telephone. M/C and Visa customers include: your name as it appears on your card, card number, expiration date. All orders add \$1.00 per volume for shipping and handling. California residents add 6% sales tax. We ship UPS or Parcel Post. Introductory offer: order 3 or more volumes and receive a 10% discount; order all 5 and we also pay shipping anywhere in U.S.A.

(800) 423-4864

In California call collect: (213) 795-5224

University Software is available from

Folio Books

P.O. Box 4100-H, Los Angeles, California 90041

University Software Also Available at Leading Computer Stores Everywhere.

Listing 2 continued:

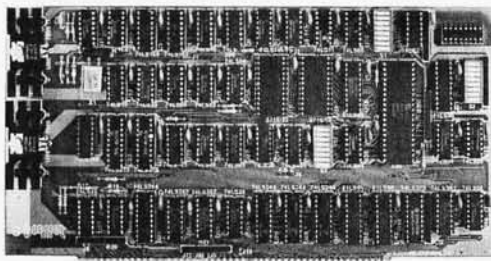
158	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH	WTVH

the FIRST of the New Generation

Our innovative **Z-80A CPU board** is truly the first of a new generation of S-100 bus equipment... a generation that's designed to accommodate multi-user setups and other high level industrial, scientific, and commercial applications.

This CPU card contains all the good Z-80 features of other boards, but also features full compliance with the proposed IEEE S-100 bus standards, provision for adding two EROMs for 4K to 8K of on-board ROM (2716 or 2732 - not included with board), power on jump to any of 256 boundaries, on-board fully maskable interrupts at port FE (hex) for interrupt driven systems, 2 or 4 MHz operation, power on clear that generates preset and slave clear according to IEEE specs, selectable automatic wait state insertion for servicing M1* instructions - MRQ* - I/O RQ* - or the on-board ROM (individually or severally selectable), non-maskable interrupt on bus pin 12 as per IEEE specs, and we've also included on-board IEEE compatible extended addressing at port FD (hex).

These advanced features give you the power you need for future expansion, as well as the system flexibility that comes from superior design... but perhaps best of all, the price is competitive with boards that do a whole lot less. **The Z-80A CPU board is available for \$225 unkit, \$295 assembled, and \$395 for units qualified under our Certified System Component program.**



Next month: The second new generation CPU board, featuring our 8085/8088 dual processing technique, as well as the Spectrum color graphics board. Please do **not** call for information on these products; send an SASE and we'll send the information to you.

HIGH PERFORMANCE S-100 MOTHERBOARDS

6 slot: \$89 unkit, \$129 assm

12 slot: \$129 unkit, \$169 assm 19 slot: \$174 unkit, \$214 assm

Ideal for use with the above enclosure. **Unkits** have edge connectors and termination resistors pre-soldered in place for easy assembly. Meets or exceeds IEEE S-100 specs; includes true active termination, grounded Faraday shield between all bus signal lines, and edge connectors for all slots.

LOOKING FOR MEMORY?

Our boards are static, run up to 5 MHz, meet the IEEE S-100 standards, low in power, and include a 1 year warranty. Choose from **unkit** (sockets, bypass caps pre-soldered in place), **assembled**, and boards qualified under our high-reliability **Certified System Component (CSC)** program.

Memory Name	Bus & Notes	Unkit	Assm	CSC
8K Econoram* IIA	S-100	\$169	\$189	\$239
16K Econoram XIV	S-100 (1)	\$299	\$349	\$429
16K Econoram X-16	S-100	\$329	\$379	\$479
16K Econoram XIII-A-16	S-100 (2)	\$349	\$419	\$519
16K Econoram XV-16	H8 (3)	\$339	\$399	n/a
16K Econoram IX-16	Dig Grp	\$319	\$379	n/a
24K Econoram VIIA-24	S-100	\$449	\$499	\$599
24K Econoram XIII-A-24	S-100 (2)	\$479	\$539	\$649
32K Econoram X-32	S-100	\$599	\$689	\$789
32K Econoram XIII-A-32	S-100 (2)	\$649	\$729	\$849
32K Econoram XV-32	H8 (3)	\$649	\$749	n/a
32K Econoram IX-32	Dig Grp	\$599	\$679	n/a
32K Econoram XI	SBC/BLC	n/a	n/a	\$1050

Econoram is a trademark of Godbout Electronics.

(1) Extended addressing (24 address lines). Addressable on 4K boundaries.

(2) Compatible with all bank select systems (Cromemco, Alpha Micro, Etc.); addressable on 4K boundaries.

(3) Bank select option for implementing memory systems greater than 64K.

THE GODBOUT COMPUTER BOX

\$289 desktop, \$329 rack mount

Quiet fan, dual AC outlets and fusehold, heavy-duty line filter, black anodized front panel, and card guide. Ask about our matching power supply.

S-100 2708 EROM BOARD \$85 unkit

4 independently addressable 4K blocks. Includes all support chips and manual, but does not include 2708 EROMs.

S-100 ACTIVE TERMINATOR BOARD \$34.50 kit

Plugs into older, unterminated motherboards to improve performance.

S-100 MEMORY MANAGER BOARD

\$59 unkit, \$85 assm, \$100 CSC

Adds bank select and extended addressing to older S-100 machines to dramatically increase the available memory space.

2S "Interfacer I" S-100 I/O BOARD

\$199 unkit, \$249 assm, \$324 CSC

Dual RS-232 ports with full handshake. On-board crystal timebase, hardware UARTS, much more.

3P PLUS S "INTERFACER II" I/O BOARD

\$199 unkit, \$249 assm, \$324 CSC

Includes 1 channel of serial I/O (RS-232 with full handshake), along with 3 full duplex parallel ports plus a separate status port.

PASCAL/M™ + MEMORY SPECIAL

PASCAL can give a microcomputer with CP/M more power than many minis. You can buy our totally standard **Wirth PASCAL/M™ 8" diskette**, with manual and Wirth's definitive book on PASCAL, for **\$150 with the purchase of any memory board**. Specify Z-80 or 8080/8085 version. PASCAL/M™ available separately for \$350.

SEE COMPUPRO PRODUCTS IN PERSON: Many of these products are stocked by finer computer stores world-wide, or write us if there's no dealer in your area.

TERMS: Cal res add tax. Allow 5% for shipping, excess refunded. VISA®/Mastercharge® call our 24 hour order desk at (415) 562-0636. COD OK with street address for UPS. Sale prices good through cover month of magazine; other prices are subject to change without notice.

CompuPro™ from **GODBOUT ELECTRONICS**

Bldg. 725, Oakland Airport, CA 94614

(415) 562-0636

Text continued from page 158:

particles from the head surface. In addition, this operation insures that the head is on the proper track. Another three reads are attempted; if this fails, the data is assumed to be unrecoverable.

The memory locations that must be initialized before a read operation are given in table 4.

The write routines write a contiguous block of memory to the disk on the required number of sequential sectors. They are also responsible for calculating the forward and backward links and the check sum for each sector. Each sector except the last contains 256 bytes of data; if the number of bytes to be saved is not an integer multiple of 256, the last sector may be shorter. Each sector is preceded by 16 bytes of 0s before the sync character. This is followed by the sector header, the data, and the trailer. No read operation is done after writing to verify the data, because the infrequency of write errors does not warrant the extra overhead.

The memory locations that must be initialized before an area of memory can be saved on disk are given in table 5.

Control Routines

The routines SAVK and LODK provide the interface between the user and the disk routines. These routines expect the appropriate information to

be preset in memory by use of the KIM keyboard. The only incompatibility with the Percom MINIDOS routines here is in the indication of an omitted value. The Percom routines use the value hexadecimal FFFF to indicate a field not in use, and KIMDOS uses a high-order byte of 0. This is not important since the 6800 and 6502 microprocessors store their high- and low-order address bytes in the opposite order and are not compatible anyway.

The control routines SAVK and LODK convert their parameters into the proper format where necessary and call the disk subroutines. Upon return, these two routines display the results of the requested operation on the KIM display and return control to the KIM monitor. The information displayed is either the DTS number of the last sector read or written in decimal, or FFnn, where nn is an error code. The error codes are given in table 6.

Interrupts

In any system, it is often desirable to use interrupts for various processes. Because KIMDOS is involved in time-critical functions when doing disk input/output (I/O), an interrupt at the wrong time could cause catastrophic errors. Therefore, the non-maskable interrupt (NMI) line cannot be used during disk I/O.

However, KIMDOS does allow for

the use of the maskable interrupt request (IRQ) line. This is done by saving the status register and disabling the IRQ line before starting any time-critical functions. The status register is then restored after the critical function is completed. This causes the servicing of the IRQ interrupt to be delayed for as much as 20 ms at a time. Any interrupt-driven system that can tolerate this limitation can function properly with KIMDOS.

Testing

Since the drive and controller both come assembled and tested, the checkout procedure is relatively simple. The only equipment I used was a logic probe and a multimeter.

The first step is to connect the drive and controller to the KIM bus and verify all power-supply voltages. When they are correct, basic communication with the controller can be verified by entering the hexadecimal address CC05 via the KIM-1 keypad. This should start the motor and keep it on until the address is changed. If the motor does not start, then there is probably a bad connection to KIM.

Next, the motor-off pulse can be checked by pressing the + key on the KIM keypad to increment the address on the display to hexadecimal CC06. This should turn off the motor immediately. The motor time-out circuit can be checked by entering hexadecimal CC05 on the KIM display,

Hexadecimal Address	Contents
0016, 0017	Beginning memory address (optional; substitute 0 to use address stored in the disk file)
001C, 001D	Drive/Track/Sector (DTS) number of first sector in the file being read

Table 4: Information required to read a file into memory from disk. The file being read into memory will begin at the address pointed to by hexadecimal memory locations 0016 and 0017. However, if the contents of these two bytes are 0, the file will be loaded into memory beginning at the address stored with the file. The DTS number is stored here in binary-coded decimal format, with the high-order byte stored first.

Hexadecimal Address	Contents
0008, 0009	Beginning address of memory to be saved
000A	File type
0019, 001A	Execution address (optional; use 0 to omit)
001C, 001D	Drive/Track/Sector number of first sector to be written
001E, 001F	Ending address of memory to be saved

Table 5: Information required to save a file. These are the hexadecimal memory locations that must be set before the SAVK (save a file) routine from listing 1 is called. The DTS number is stored here in binary-coded decimal format, with the high-order byte stored first.

Error Code	Message
0	Disk missing (given after read or write operation)
1	Disk protected (given after write operation only)
2	Invalid sector number (given after read or write operation)
3	Blank sector (given after read operation only)
4	Disk overrun; attempted to write more than 349 sectors
5	Permanent read error

Table 6: List of disk-related error codes. If a read or write operation ends in failure, the left four digits of the KIM display will read FFnn, where nn is one of the error codes listed in this table.

The 1980's: Hard Disks

for your Microcomputer! Cromemco, North Star and other S-100; TRS-80®; SuperBrain®; Apple, Alpha Micro, et. al. . . .



Cromemco Z-2H

Full 11-megabyte Hard Disk System

- Fast Z80A 4 MHz processor
- 11-megabyte Hard Disk Drive
- Two Floppy Disk Drives
- 64K RAM Memory
- RS232 Special Interface
- Printer Interface
- Extensive software available

List \$9995

MiniMicroMart price: **\$8489**

CROMEMCO HDD

11/22 megabyte Hard Disk System, for use with existing systems. DMA controller, transfer rate of 5.6 megabytes per second.

HDD-11, single drive, List \$6995

OUR PRICE \$5,939

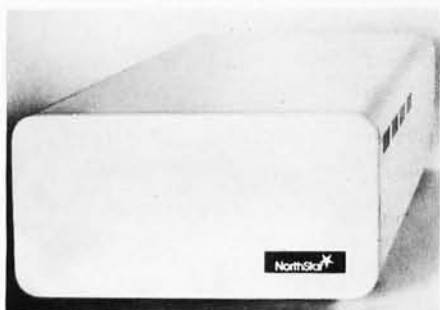
HDD-22, dual drive, List \$11,995

OUR PRICE \$10,189

NORTH STAR HD-18

18 megabytes (expandable to a 4-drive system). North Star uses a tried-and-proved 14" Century Data Marksman. The interface is through the North Star parallel port and runs with existing software. List \$4,999

OUR PRICE \$4,199



CORVUS for TRS-80/Apple/S-100

The Corvus and Lobo interfaces use the new IMI 7710 8" Winchester with 10 megabytes of formatted storage. Either system is available from MiniMicroMart. The Corvus is \$5,300 list

OUR PRICE \$4,795

MICROAGE

MicroAge has for some time been marketing hard disk interfaces to the North Star Horizon and to the Alpha Micro System. They have utilized the Konan controller with two popular drives: The Control Data 9448 (PHOENIX) with 32 megabytes of capacity and the Fujitsu M-2201 with 50 megabytes.

EITHER MODEL, List \$9,995 . . . **\$7,495**

Call us for
Dynabyte and Vector Graphic

MICROMATION

Comes another array of hard disks, utilizing 14" Shugarts. Their model MD-I utilizes the Shugart 4001, which provides for over 10 megabytes of formatted storage. The Model MD-II utilizes a Shugart 4008, and provides for over 20 megabytes of formatted storage.

MD-I, List \$5,995 . **our price \$5,095**

MD-II, List \$6,995 **\$5,945**

XCOMP KB10

One of the early firms to bring a hard disk to the S-100 bus, it interfaces to the popular, removable cartridge types of disk drive, which have become an industry standard for mini-computers over the past few years. They supply a system utilizing the top-loading 5440-type of cartridge. These drives have been traditionally available with one fixed drive on the bottom with a removable cartridge on top. Some operate at 100 tracks per inch, with a high-density one operating at 200 tracks per inch. The high-density unit allows storage of 5 megabytes per cartridge, or 10 megabytes per drive. The XCOMP controller provides for handling four drives, for a total capability of 40 megabytes. Since the top cartridge is removable, back-up is simple, fast, and practical.

CALL US FOR PRICE!

MORROW THINKER TOYS* DISCUS M26™

26 megabytes of formatted storage (expandable to 104 megabytes). The system is complete with Shugart SA-4008 14" Winchester, cabinet, power supply, controller board, and CP/M 2.0. It features a 512-byte sector buffer on board; each sector can be individually write-protected for data base security. The S-100 controller incorporates intelligence to supervise all data transfers and communicates with a CP/U via 3 I/O ports (command, status, data). The controller has the ability to generate interrupts at the completion of each command to increase system throughput. List \$4,995

ONLY \$4,199



SHIPPING AND INSURANCE: Most Hard Disk Systems are shipped freight collect.

All prices subject to change and all offers subject to withdrawal without notice.

Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.

— WRITE FOR FREE CATALOG —

VISA

MiniMicroMart, Inc.



1618 James Street, Syracuse, NY 13203 (315) 422-4467

TWX 710-541-0431

Hard sectoring means that sector boundaries are detected by means of holes punched in the floppy disk.

followed by another address. The motor should run about 3 seconds and stop.

Now the sector-counting circuitry can be checked. With a disk inserted in the drive, enter hexadecimal CC05 and then hexadecimal CC02. The rightmost digit of the KIM display (which shows the low nybble of the contents of hexadecimal location CC02) should be rapidly changing as long as the motor is running. When the motor stops, this digit should contain a decimal digit (0 thru 9) indicating the last sector passed.

After all of the previously mentioned tests have been completed, the software can be used to do further testing. The TEST routine, given in listing 3, is included for this purpose. TEST does a static test of most of the controller functions and their interaction with various subroutines within KIMDOS. It uses the number of the key pressed on the keypad as an index into a table of subroutine addresses. From there, it does a subroutine jump to the routine thus addressed.

Upon return, the TEST routine displays the value of the accumulator in the rightmost two digits of the KIM display. It also displays the value of the carry flag in the left four digits — FFFF for carry set and 0000 for carry clear. (This is done for those routines that return the carry flag set as an error indicator and use the value in the accumulator as an error code.)

Execution of the TEST routine begins at hexadecimal 0200. The appropriate data must be set in the 0 page for the subroutines to be tested. Some subroutines must be used together. For example, the motor must be started and the drive must be selected before the head-movement routines will work. To add more subroutines, increase the value in the compare instruction at hexadecimal location 020C and add the appropriate addresses to the end of the table.

The final test that I had to do was

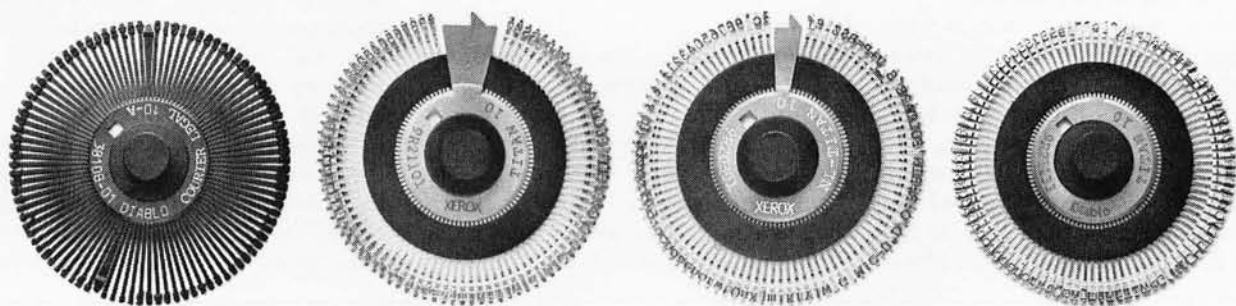
Listing 3: Listing for program TEST. This program executes a given KIMDOS routine (see documentation at the beginning of the listing) depending on which key on the KIM keypad is pressed.

Hexadecimal Address	Object Code	Label	Instruction Mnemonic	Operand	Commentary		
0001:							
0002:					TEST : ROUTINE TO TEST THE BASIC DISK		
0003:					DRIVER SUBROUTINES		
0004:							
0005:					SUBROUTINES UNDER TEST		
0006:							
0007:		SUB	ADDRESS	KEY#			
0008: 2000	GTKX *		\$C022	0	GO TO TRACK 0		
0009: 2000	PREP *		\$C00C	1	PREPARE DRIVE FOR I/O		
0010: 2000	STAHT *		\$C131	2	START MOTOR		
0011: 2000	TKOT *		\$C038	3	MOVE HEAD OUT 1		
0012: 2000	TKIN *		\$C040	4	MOVE HEAD IN 1		
0013: 2000	SEEX *		\$C060	5	FIND TRACK IN 01		
0014: 2000	GTSC *		\$C147	6	FIND SECTOR IN 02		
0015:				7	RETURN TO KIM		
0016:							
0017:					KIM ADDRESSES		
0018:							
0019: 2000	SCND *		\$1F1F				
0020: 2000	GETK *		\$1F6A				
0021: 2000	KIM *		\$1C4F				
0022:							
0023:					ZERO PAGE STORAGE		
0024:							
0025: 2000	TOAD *		\$0020				
0026: 2000	TODQ *		\$0021				
0027: 2000	SAKE *		\$0022				
0028: 2000	PNTH *		\$00FB				
0029: 2000	PNTL *		\$00FA				
0030: 2000	INH *		\$00F9				
0031:							
0032: 2000		ORG	\$2000				
0033:							
0034: 2000 20 1F 1F	STAR	JSR	SCND		LITE DISPLAY		
0035: 2003 20 6A 1F		JSR	GETK		GET KEY		
0036: 2006 C5 22		CMPZ	SAKE		DEBOUNCE		
0037: 2008 F0 F6		REQ	STAHT				
0038: 200A B5 22		STAZ	SAKE				
0039: 200C C9 08		CMPIM	\$00		VALID?		
0040: 200E C0 F0		BCS	STAHT		NO		
0041: 2010 0A		ASLA			YES, MULTIPLY BY 2		
0042: 2011 AA		TAX			TO GET INDEX		
0043: 2012 0D 32 20		LDAAX	TABL		MOVE OBJECT ADDRESS		
0044: 2015 B5 20		STAZ	TOAD		TO JUMP VECTOR		
0045: 2017 E8		INX					
0046: 2018 0D 32 20		LDAAX	TABL				
0047: 201D B5 21		STAZ	TODQ				
0048: 201D 20 2F 20		JSR	JMPP		CALL SUBROUTINE		
0049: 2020 B5 F9		STAZ	INH				
0050: 2022 A9 FF		LDAIM	\$FF		ERROR FLAG		
0051: 2024 00 02		BCS	STOR		BRANCH ON ERROR		
0052: 2026 A9 00		LDAIM	\$00		GOOD FLAG		
0053: 2028 B5 FA	STOR	STAZ	PNTL				
0054: 202A B5 FB		STAZ	PNTH				
0055: 202C 4C 00 20		JMP	STAR				
0056: 202F 6C 20 00	JMPP	JMI	TOAD				
0057:							
0058: 2032 22	TABL	=	GTKX				
0059: 2033 C0		=	GTKX	/			
0060: 2034 0C		=	PREP				
0061: 2035 C0		=	PREP	/			
0062: 2036 31		=	STAHT				
0063: 2037 C1		=	STAHT	/			
0064: 2038 38		=	TKOT				
0065: 2039 C0		=	TKOT	/			
0066: 203A 40		=	TKIN				
0067: 203B C0		=	TKIN	/			
0068: 203C 60		=	SEEX				
0069: 203D C0		=	SEEX	/			
0070: 203E 47		=	GTSC				
0071: 203F C1		=	GTSC	/			
0072: 2040 4F		=	KIM				
0073: 2041 1C		=	KIM	/			
0074:							
0075:							
0076:							
GETK	1F6A	GTKX	C022	GTSC	C147	INH	00F9
JMPP	202F	KIM	1C4F	PNTH	00FB	PNTL	00FA
PREP	C00C	SAKE	0022	SCND	1F1F	SEEX	C060
STAR	2000	START	C131	STOR	2028	TABL	2032
TKIN	C040	TKOT	C038	TOAD	0020	TODQ	0021

Diablo introduces the first printer that runs on four wheels.

The Diablo 630 printer is the most versatile printer you can get.

It's the only one that gives you a choice of 4 different interchangeable print wheels and over 100 different type styles.



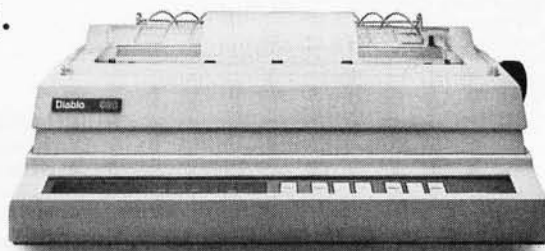
Every 630 works just as well with a 96-character plastic daisy print wheel as it does with an 88, 92, or 96-character metal daisy print wheel.

The 630 also has fewer moving parts than competitive printers, which makes it exceptionally reliable.

This new addition to our line offers unsurpassed print quality. Compatibility with existing Diablo supplies. And automatic bi-directional printing.

The Diablo 630 printer.

Probably the best thing to happen to printing since we re-invented the wheel.



Diablo Systems

to read and write data using a floppy disk previously recorded in the Percom format. I did this to confirm that the KIMDOS software produces results using the controller board and disk that are identical to the results produced by the Percom 6800 code. Since I found this to be the case, no one using KIMDOS needs to repeat that test.

Error Recovery

As in all systems, there will occasionally be unrecoverable errors. The Percom format allows for recovery of broken files. Since each sector contains the DTS number of the first sector of the file, each sector can be associated with its file. Reading does not have to start with the first sector; it can start on any sector and will continue to the end of the file.

When a read error occurs, try rereading the sector several times. Also try to read a sector on another track of the disk (to move the head around some) before rereading the original sector in error. Reinserting the disk may also help. If all of the above measures fail, then execute the routine LAST at hexadecimal address

Alternating-sector addressing allows time for the housekeeping routines that must be executed between reading and writing sectors.

C378. This will display the number of the sector containing the error. To try a partial recovery, start the read operation at one sector past the displayed address. If that fails, try the next sector, and so on. Any valid sector can be read in this way. A file may have only one bad sector, with the rest readable.

Expansion

To fully utilize the features of the LFD-400 disk system, a more extensive disk-operating system is necessary. This software is designed to be the basis of such a system. These subroutines can be used to perform the basic functions needed by a larger disk-operating system that provides

for named files, automatic space management, and buffered I/O.

To facilitate expansion, KIMDOS has a jump table located at the beginning of the executable code that contains JMP instructions to all subroutines in KIMDOS needed by external software. This allows KIMDOS to be updated (in case of bugs or enhancements) without reassembling the calling routines. With the nine routines in the jump table, any disk I/O can be performed under external program control.

RSEX and WSEX are used to read and write individual sectors. To use them, the data at hexadecimal locations 0000 thru 000A must be supplied. (See the beginning of listing 1.) To read an individual sector, the alternate address pointer, hexadecimal locations 0016 and 0017, must point to the starting location of the file when it is loaded into memory. If the value of the alternate address pointer is 0, the sector will load beginning at an address stored in the sector header. Similarly, to write an individual sector, the data pointer, hexadecimal locations 0014 and 0015, must point to the beginning byte of

New Produced and widely used in England and U.S.A. COMPLETE BUSINESS PACKAGE

**INCLUDES EVERYTHING FROM INVENTORY TO SALES SUMMARY
PROMPTS USER, VALIDATES EACH ENTRY, MENU DRIVEN**

Approximately 60-100 entries/inputs require only 2-4 hours weekly and your entire business is under control.

PROGRAMS ARE INTEGRATED-

- 01 = ENTER NAMES/ADDRESS, ETC
- 02 = ENTER/PRINT INVOICES
- 03 = ENTER PURCHASES
- 04 = ENTER A/C RECEIVABLES
- 05 = ENTER A/C PAYABLES
- 06 = ENTER/UPDATE INVENTORY
- 07 = ENTER/UPDATE ORDERS
- 08 = ENTER/UPDATE BANKS
- 09 = EXAMINE/MONITOR SALES LEDGER
- 10 = EXAMINE/MONITOR PURCHASE LEDGER
- 11 = EXAMINE/MONITOR (INCOMPLETE RECORDS)
- 12 = EXAMINE PRODUCT SALES

SELECT FUNCTION BY NUMBER-

- 13 = PRINT CUSTOMER STATEMENTS
- 14 = PRINT SUPPLIER STATEMENTS
- 15 = PRINT AGENT STATEMENTS
- 16 = PRINT TAX STATEMENTS
- 17 = PRINT WEEK/MONTH SALES
- 18 = PRINT WEEK/MONTH PURCHASES
- 19 = PRINT YEAR AUDIT
- 20 = PRINT PROFIT/LOSS ACCOUNT
- 21 = UPDATE END MONTH FILES MAINTENANCE
- 22 = PRINT CASH FLOW FORECAST
- 23 = ENTER/UPDATE PAYROLL (NOT YET AVAILABLE)
- 24 = RETURN TO BASIC

WHICH ONE? (ENTER 1-24)

**01 SUB. MENU EXAMPLE: 01 = EXAMINE: 02 = INSERT: 03 = AMEND: 04 = DELETE
05 = PRINT (1,2,3): 06 = NUMERIC COMBINATIONS: 07 = SORT
VERY FLEXIBLE. ADD YOUR OWN FUNCTIONS. EASY TO INTEGRATE.**

All programs in BASIC for CP/M. PET. 6800

G. W. COMPUTERS LTD, the producers of this beautiful package in U.K.

**WE EXPORT TO ALL COUNTRIES:
BARCLAYCARD ACCEPTED
CBM APPROVED**

CP/M Ver. 9.00 is one 16 K core program using random access releasing both drives for data storage, and 250 word vocabulary is translatable in any foreign language.

PRICES: Programs 1-23 EXC (19,20,22,23) £475

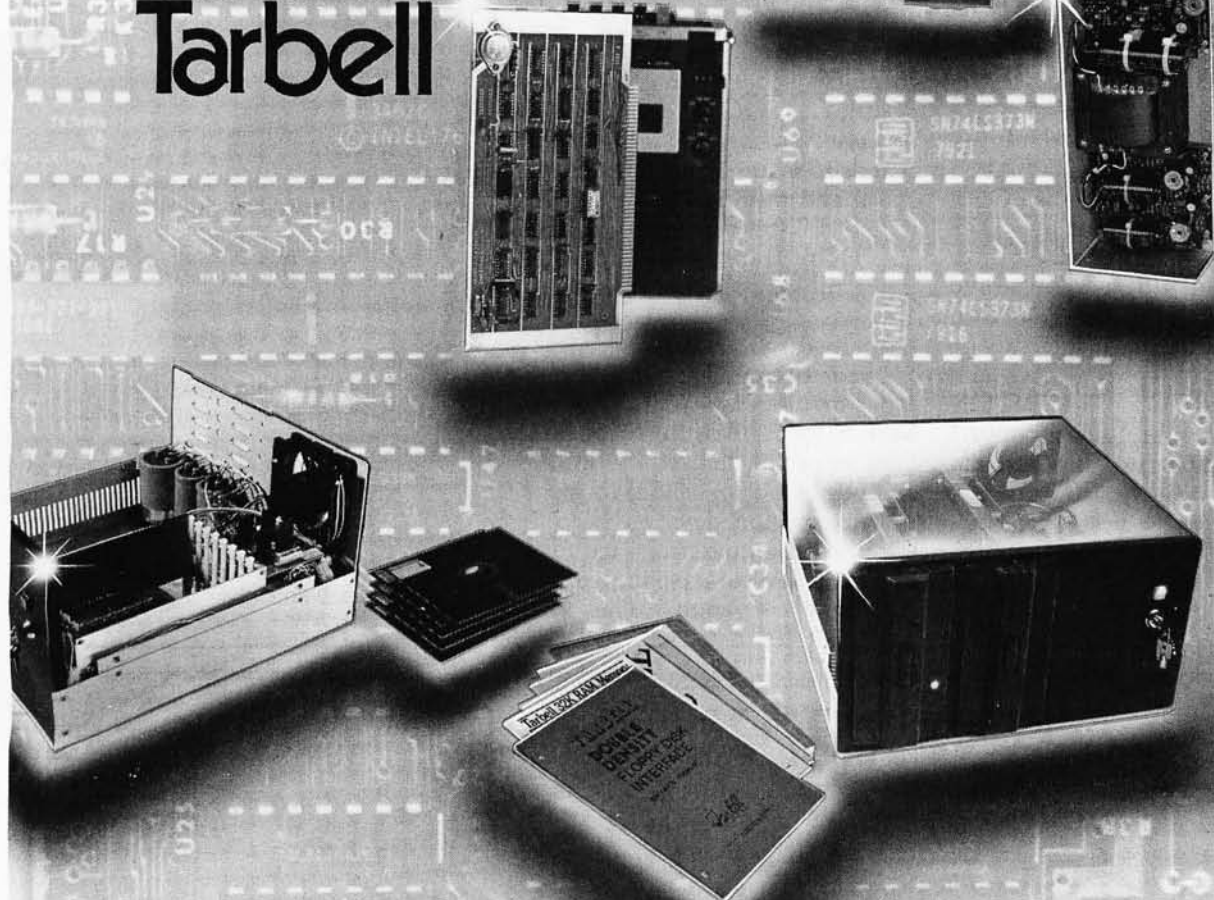
**CALLERS BY APPOINTMENT ONLY
89 Bedford Court Mansions
Bedford Avenue
London WC1, U.K.**

**CONTACT TONY WINTER 01-636-8210
BARCLAYCARD ACCEPTED
CBM APPROVED**

CP/M Ver. 9.00 is one 16 K core program using random access releasing both drives for data storage, and 250 word vocabulary is translatable in any foreign language.

£575 Stock Integrated Option + £100 Bank Integrated Option + £100

You Know Tarbell



But, do you know all the components Don Tarbell has ready for you?

When someone says "Tarbell" there's no doubt what's meant . . . the cassette interface whose reliability and solid engineering made it an industry standard.

Since that first breakthrough-product, Don Tarbell has expanded his list of useful, dependable components . . . components to meet your needs of today, and keep you prepared for tomorrow.

Check this partial list of quality components Don Tarbell has ready for you. You're probably ready for them, right now.

- When it comes to RAM memory, Tarbell means reliability. 16K and 32K static memory that offers you easier trouble shooting, and far easier maintenance. Remember that.

- Tarbell BASIC brings simplicity and sophistication to your programs. Our BASIC is easier to program, and offers unique commands and statements not found in regular BASICS under any name.

- CP/M® disk operating system is, of course, the standard for software exchange. At Tarbell we provide our own approved CP/M system modified for all Tarbell floppy disk interfaces. Note. We also have MP/M® for those interested in multi user systems.

- The Tarbell VDS line comes as a complete package . . . or, as separate units. For example, the Tarbell mainframe can be ordered with 1 or 2 Shugart or Siemens drives, or no drives. Whichever way you go, you get the reliability of Tarbell tested components.

- With the Tarbell Double Density floppy disk interface, storage capacity, speed and versatility are greatly increased. Under our DD CP/M, single and double density disks may be intermixed with no penalty. The system automatically determines which is in place.

We also still have our Single Density floppy disk interface. It's specifically designed to operate with many different and unusual drives. Naturally, they're Tarbell tested.

Tarbell
Electronics

950 Dovlen Place, Suite B
Carson, California 90746
(213) 538-4251 / 538-2254

*CP/M & MP/M are products of Digital Research Corp.

Since the drive and controller both come assembled and tested, the checkout procedure is relatively simple.

the area to be stored on the disk file. All head positioning and drive preparation is taken care of.

LODX and SAVX are the subroutine versions of LODK and SAVK. They require the same data as LODK and SAVK, except that the DTS number must be converted to three single-byte quantities and stored in hexadecimal locations 0000 thru 0002. The subroutine PREP can be used to select the desired drive and seek the desired track. The CVTBIN and CVTDEC subroutines convert the DTS number to binary and decimal, respectively. Subroutine FWDC calculates the next sector in a file. The INITDV subroutine sets the track registers to hexadecimal FF. If any errors are encountered, control is

returned to the calling routine with the carry bit set and the error code in the accumulator. This allows complete external control of the disk system.

Since developing KIMDOS, I have developed ZAPDOS. ZAPDOS is modeled after Percom's MINIDOS-PLUSX disk-operating system. It allows loading and saving of up to thirty-one named files per disk. It occupies the upper two read-only-memory sockets in the LFD-400 board. ZAPDOS contains thirteen read-only-memory resident commands to manipulate and display disk space and memory. When used with its ten disk-resident utility programs, ZAPDOS transforms KIM into a powerful microcomputer system.

Conclusion

I have been independent of cassette tape for over two years now. It has been a great pleasure to be able to load even the largest file in 1 or 2 seconds. I no longer leave my KIM system on for days to keep from spending the time necessary to write all of memory to tape and verify that the tape is good. The Percom

LFD-400 is a viable and cost-effective answer to the mass-storage problem.

KIMDOS should be easily converted for use on other 6502 systems. An interface for the Apple II should be straightforward. KIMDOS is available in a 2708 read-only memory from Percom. (See below.) I would like to express thanks to Bob Haas for his valuable consultation on this project. ■

Percom Data Company (211 North Kirby, Garland TX 75042) is making available the current version of KIMDOS on a 2708 erasable programmable read-only memory (EPROM) part to be used on the disk-controller board of the Percom LFD-400 5-inch floppy-disk drive. This can be obtained along with a Percom LFD-400 disk drive for \$15 above the current price of the disk-drive unit. A floppy disk containing KIMDOS-related software (including the ZAPDOS disk-operating system mentioned at the end of this article) is also available from Percom.

**A REFURBISHED "SELECTRIC" ASCII TERMINAL
FOR THE SMALL BUSINESSMAN OR SERIOUS HOBBYIST.**

The AJ 841 I/O terminal. Now available from dealers nationwide.

Demand for our AJ 841 I/O computer terminal has been great. And now it's getting even greater. So call your local computer shop dealer right away. Supply is limited! You may never have another opportunity like this one to buy your own professional terminal.



The AJ 841 features:

- Choice of serial RS 232 or parallel interface
- ASCII code
- 14.9 cps printout
- High quality Selectric printing
- Heavy-duty Selectric mechanism
- Off-line use as typewriter
- Documentation included
- 30-day warranty on parts and labor (details available on request)

Call toll-free now

For location of your nearest AJ dealer, call toll-free:

800/538-9721

California residents call 408/263-8520.



**ANDERSON
JACOBSON**

BYTE·BYTE·BYTE

**LANGUAGES
AND
TOOLS
FOR
MICROCOMPUTING:
A BYTE
CONFERENCE**

BYTE·BYTE·BYTE

**June 16-17, 1980
McGraw-Hill World Headquarters
New York City**

The microcomputer revolution in system design, engineering, and technology is here!

Sophisticated 32 bit computer architectures are appearing in single packages that may be used in a personal computer, a word processor, or even automobile or microwave oven controls. A typical microcomputer-oriented, finished-product design can incorporate total memory, with an address-space utilization of 16K to 64K bytes. With high-volume manufacturing, the total package may cost as little as \$100 to \$500.

Over the past 25 years there has been a tremendous evolution in the functional capabilities of language systems. These systems need no longer be confined to "big" machines. Much of the improvement in function is becoming available in language systems for microcomputers.

Yet, major manufacturers are still promoting their "super" micro assemblers/debuggers as the best software tool for applications software of computer systems. Consequently, many programmers and designers continue to work with primitive language tools.

This first BYTE-sponsored conference on languages and tools for microcomputing will introduce designers, systems analysts, implementers, and managers to various high level languages and associated systems tools that are becoming commercially available. Knowledge of these recent developments is absolutely essential to productive use of microcomputer technology when that scarce resource, programmer/designer time, is being spread more and more thinly among a myriad of potential applications.

The conference will zero in on five specific high level languages because they are—or shortly will become—readily available for implementations with small computers. Speakers will explore these languages and tools for programming in terms of their usefulness for practical microcomputer applications.

Three of the featured languages are members of a family of languages evolved from FORTRAN by way of Algol: Pascal, C, and Ada. These are most appropriate for uses in which documentation is as much a part of the design philosophy as the achievement of a functional design itself. HAL/S, also in this family, will be discussed at the conference in terms of the history of software tools used in the NASA space-shuttle project's flight-control system design. These languages share purposes with some of the more common commercial languages available on large computers, such as PL/I and COBOL.

Differing in philosophy and point of view—but also commercially available—are two other languages and corresponding language concepts: LISP and FORTH. Each is characterized by a concept of language extensibility, which is implemented in a highly interactive approach. The central and dominant theme of LISP is one of list structures, which may be either data or program material. The concept of tree structures and relationships underlies LISP's usefulness in the artificial-intelligence milieu. FORTH has a central theme of a stack-oriented processor, emulated as a threaded code interpreter, and an extensible library of operations that may be defined beyond a basis set of standard primitives.

THE PROGRAM

Introduction

Carl T. Helmers, Jr.
Editor-in-Chief
BYTE Magazine

Writing in high level languages has numerous well-publicized advantages: programs are more portable; they have superior structures; they are easier to write and debug. At this first session of the conference, Carl Helmers will survey and define language systems, analyze language systems as complete tools, discuss the evolution of all high level languages, and establish reasons why specific high level languages are appropriate for microcomputers.

The Importance of Tools

Dr. Fred H. Martin
Executive Officer
Intermetrics, Inc.

The use of software tools in the development of systems involving computers is crucially important. Fred Martin, one of the designers of the HAL/S language, will review the advantages of high level language techniques and automated aids to programming from the point of view of his NASA experience with HAL/S, developed specifically to replace the machine-dependent, low-level programming that plagued the Apollo project. The crucial importance of high level languages in reliable software design will be reviewed in the context of this system—in which a software crash can literally lead to a pile of broken parts on the ground.

Peter Grogono
Analyst/Programmer
Concordia University

After Pascal, What?

While Pascal is an immensely useful language, it is not necessarily a panacea. Limitations of the language in areas of real time control and handling of multiple concurrent processes, in particular, argue for a new look at the design of the language. Ken Bowles will introduce one evolutionary variant that will become very important over the next decade—the Ada language, originally designed for the Department of Defense. Microcomputer implementations of this language, using machine-independent techniques, will make it a strong alternative for programming microcomputer applications systems.

Dr. Henry G. Baker, Jr.
Assistant Professor
University of Rochester

The LISP language offers the block-structured control of Pascal, together with the friendly interactive nature of BASIC. In addition, it offers lists and trees as data structuring primitives and a tireless "garbage collector" to keep memory neat and clean.

Henry Baker will discuss the LISP language and the kinds of automated tools required to use it.

John A. Morse
Principal Engineer,
Corporate Research
Digital Equipment Corporation

The language C was originally developed at Western Electric for use as a tool for development of the UNIX operating system at Bell Laboratories. Now that C compilers are starting to become available for microcomputer sys-

The Forth Alternatives

One viable and unconventional approach to programming is the highly interactive language FORTH, a language in which the feature of extensibility is emphasized. The typical implementation of FORTH is a highly integrated combination of software development tools and programming aids oriented toward a conceptual stack machine with integers as the primitive data type. In any given application, unique extensions that fit into the matrix basic core of the language are created by the designer. Charles Moore, the inventor of FORTH, will demonstrate some of the more dynamic uses of the language in real-time applications.

BYTE BYTE BYTE

**LANGUAGES
AND
TOOLS
FOR
MICROCOMPUTING:
A BYTE
CONFERENCE**

BYTE BYTE BYTE

Who Should Attend

Designers, systems analysts, implementers, and managers with an interest in holding down costs on their software projects. Fields with special applicability include electronics and electronics design, automated manufacturing, scientific instrumentation design, and aerospace control systems.

Tentative Schedule

June 16, 1980

8:00- 9:00 A.M.
9:00-10:00 A.M.
10:00-10:30 A.M.
10:30-12:00 P.M.
12:00- 1:30 P.M.
1:30- 3:00 P.M.
3:00- 3:15 P.M.
3:15- 4:45 P.M.
4:45- 5:15 P.M.

June 17, 1980

8:30-10:00 A.M.
10:00-10:30 A.M.
10:30-12:00 P.M.
12:00- 1:30 P.M.
1:30- 3:00 P.M.
3:00- 4:00 P.M.

REGISTRATION

INTRODUCTION: Carl Helmers

COFFEE INTERMISSION

THE IMPORTANCE OF TOOLS: Fred Martin
LUNCHEON

THE PASCAL PERSPECTIVE: Peter Grogono

COFFEE INTERMISSION

AFTER PASCAL, WHAT?: Ken Bowles
OPEN DISCUSSION

TREES AND LISTS AS TOOLS: Henry Baker

COFFEE INTERMISSION

THE FORTH ALTERNATIVE: Charles Moore
LUNCHEON

WHAT IS C?: John Morse

PANEL DISCUSSION: All speakers

Circle 110 on inquiry card.

To attend the Languages and Tools for Microcomputing Conference, June 16-17, 1980, McGraw-Hill World Headquarters in New York City, fill in the coupon, or write on your company letterhead to:

McGraw-Hill Conference & Exposition Center

1221 Avenue of the Americas
Room 3677
New York, New York 10020
Or call: 212/997-4930

Please Print or Type

NAME _____
Last Name First Name
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____
TELEPHONE () _____
REGISTRANT'S SIGNATURE _____

Registration Fee: \$485

- ☐ Payment enclosed (Make check payable to McGraw-Hill Conference & Exposition Center)
- ☐ Please bill me directly
- ☐ Please bill company (Payment due prior to Conference)
- ☐ This confirms my phone reservation

Hotel Reservations: The New York Hilton (212-586-7000) is holding a block of rooms up to three weeks prior to the Conference. For reservations, contact the hotel directly. Please be sure to identify the title and dates of the Conference for preferential treatment.

Cancellation Liability: In the event of cancellation of the Conference for any reason, McGraw-Hill's liability is limited to the return of the registration fee.

Cancellation Policy: Confirmed registrants who cancel within FOURTEEN BUSINESS DAYS of the Conference are subject to a \$100 service charge. Cancellation must be received in writing. Confirmed registrants who fail to attend and do not cancel prior to the Conference are liable for the entire registration fee. You may, if you wish, send a substitute.

"WHAT WOULD YOU SAY TO BIG COMPUTER PERFORMANCE FROM YOUR MICROCOMPUTER?"

"YOU'RE TALKING OUR LANGUAGE: PL/I-80.TM"

New PL/I-80 from Digital Research Brings Big Computer Programming Power to Microcomputer Systems.

PL/I-80 is the biggest news for small system users and OEMs since we introduced CP/M[®] and MP/M. PL/I-80 is ANSI's General Purpose Subset of full PL/I, tailored into a language for 8080, 8085 and Z80 users who expect the software revolution they've seen in hardware—better results at lower cost. PL/I-80 works harder than any other general-purpose language for business, science, research and education.

The PL/I-80 software package includes a native code compiler, comprehensive subroutine library, linkage editor and relocating macro assembler. And it's backed by our CP/M and MP/M operating systems.

Best of all, **the complete PL/I-80 system diskette and documentation costs just \$500.**

PL/I-80: There's no better way to get big-machine results from your 8-bit processor.

Single and Multi-User Operating Systems That Set Industry Standards.

CP/M is the industry standard operating system for small machines. With thousands of users throughout the world, it's the most popular and widely used. It's the original, hardware-independent 'bus' for users working with a broad array of languages, word-processing and applications software available from scores of suppliers at affordable prices.

Now we've made a great CP/M even better. CP/M 2.2 is the latest release of the efficient, reliable system that's truly universal, able to manage virtually any 8080, 8085 or Z80 micro and its floppy or hard-disk subsystems. Named to the 1979 Datapro Software Honor Roll, CP/M comes on a diskette with its own operating manual, for **just \$150 in unit quantity.**



MP/M provides big-computer power at small-computer cost. It provides multi-terminal access with multi-programming at each terminal. And it's CP/M compatible, so you can run many programming languages, applications packages and development software on your system.

Check these advanced capabilities. Run editors, translators, word processors and background print spoolers simultaneously. Use MP/M's real-time facilities to monitor an assembly line and schedule programs automatically, or control a network of micros. Even write your own system processes for operation under MP/M. The possibilities are endless, **yet MP/M costs just \$300 (unit price for diskette and manual).**

Utilities That Work For You.

Use our utilities. Thousands do. They're designed to make your small system work extra hard, yet they cost surprisingly little.:

- MAC[™] (Macro Assembler)—\$90.
- SID[™] (Symbolic Instruction Debugger)—\$75.
- ZSID[™] (Z80 Symbolic Instruction Debugger)—\$100.
- TEX (Text Formatter)—\$75.
- DESPOOL[™] (Background Print Utility)—\$50.

All are supplied on a diskette, with operating manual.

Order the professional's choice.

UCSD Pascal.™

The Pascal everyone is talking about is UCSD Pascal...with over 10,000 users and growing. The fully developed Pascal is available with support from a professional software company. Implemented on most major microprocessors.

Not just another compiler, but complete development software — from operating system to screen-oriented editor. Language extensions for systems development and commercial applications programming.

Program portability that allows programs written on one microcomputer to run without recompilation on different microcomputers. This protects your software investment...without restricting your hardware options.

If you have CP/M®, visit your local computer store or order below. System supplied on single-density, soft-sectored, 8" floppy disks and requires 48K of contiguous RAM. For other systems call us or write for more information. Telephone orders accepted with Master Charge or VISA.

SOFTech
MICROSYSTEMS
A SUBSIDIARY OF SOFTECH

9494 Black Mountain Road • San Diego • CA • 92126
TEL: (714) 578-6105 • TWX: 910-335-1594

CP/M is a registered trademark of Digital Research Corporation. LSI-11 is a trademark of Digital Equipment Corporation. UCSD Pascal is a trademark of the Regents of the University of California.

- ☐ Yes! Rush me a complete UCSD Pascal system for my CP/M® based microcomputer. A check or money order for \$300.00 is enclosed. I have a _____ computer.
- ☐ Send me more information about UCSD Pascal. Versions are available for systems using the following microprocessors: LSI-11™ 6502, 6800, 6809, 9900, Z80 and 8080/8085.
- ☐ Send me only the complete set of documentation for UCSD Pascal. A check or money order for \$37.00 is enclosed.
- ☐ Send distributor information.

Name _____

Company _____

Address _____

City _____

State/Zip _____

M/C or VISA # _____ Exp. Date _____

Mass. and Calif. residents enclose applicable sales tax.

B-5

Programming Quickies

Decisions, Decisions

Geoffrey Gass, 5240 SW Dosch Rd, Portland OR 97201

Frequently, a program has to select one of two positive actions as the result of a test (eg: print a "+" or a "-" after checking the sign of a number).

Conventionally, it might be done in a skip chain like this 6800 code:

SGN	TST NUMB	Make the test.
	BMI NEG	One course if negative.
	LDA A #' +	The other course if positive.
	BRA PRINT	Watch out — don't run into NEG.
NEG	LDA A #' -	Minus sign for negative number.
PRINT	JSR OUTPUT	Back together again; print the sign.

It's awkward, running into yourself like that. Here is how to avoid the awkwardness and save a couple of bytes:

SGN	LDA A #' +	Set up for one course in advance.
	TST NUMB	Then make the test.
	BPL PRINT	Confirming advance choice.
	LDA A #' -	Change course if advance choice wrong.
PRINT	JSR OUTPUT	Print the proper sign.

The bytes saved (if not otherwise needed) can be used after the TST NUMB to BEQ (branch on accumulator equal to 0) past the PRINT routine if the number is zero, so 0 will be output without a sign, assuming we are dealing with a 1-byte number.■

Formatted Program Output for the KIM-1

Lawrence A Ezard, PhD, Associate Professor of Engineering, Pennsylvania State University, Capitol Campus, Middletown PA 17057

Here is a short program that might be useful for owners of the MOS Technology KIM-1 system. It can be used to find bugs, and to print out and document programs.

The flowchart in figure 1 illustrates the algorithm utilized. This program will examine the contents of programmable memory and print the program instructions found there. The output is in a format of address, operation code, and operand. The user specifies the starting and stopping addresses to be examined by storing values in the appropriate locations. At the end of its execution, the program returns control to the KIM monitor.

In writing the program, I made use of the fact that, with three exceptions, the least significant digit (in hexa-

MORE COLOR. MORE SOUND. MORE PERSONAL/BUSINESS POWER.



Compare the built-in features of leading microcomputers with the Atari personal computers. And go ahead, compare apples and oranges. Their most expensive against our least expensive: the ATARI® 400™.

Start with graphics capabilities. The ATARI 400 offers 128 color variations. 16 colors in 8 luminance levels. Plus 29 keystroke graphics symbols and 8 graphics modes. All controlled from a full 57 key ASCII keyboard. With upper and lower case. And the system is FCC approved with a built-in RF modulator. That's just for openers.

Now, compare sound capabilities. Four separate sound channels and a built-in speaker. With the optional audio/digital recorder, you can add Atari's unique Talk & Teach™ Educational System cassettes.

Here's the clincher: Solid state (ROM) software. For home management, business and entertainment. Or just plug in an Atari 10K BASIC or Assembler language cartridge and the full power of the computer is in your hands.

Memory? 8K expandable to 16K. And that's just for the ATARI 400 at a suggested retail of only \$599.99.

The ATARI® 800™ gives you all that and much more.

User-installable memory to 48K. A full-stroke keyboard.

With a high-speed serial I/O port that allows you to add a whole family of smart peripherals. Including up to four individually accessible disk drives. And a high speed dot-matrix impact printer. And, the Atari Program Recorder is included with the 800 system. Suggested retail price for the ATARI 800 (including recorder) is \$999.99.

Make your own comparison wherever personal computers are sold.

Or, send for a free chart that compares the built-in features of the ATARI 400 and 800 to other leading personal computers.

Atari promises to be the most popular Personal Computer System of the 1980's! Feel free to contact us for Atari literature.



NEECO

679 Highland Ave.
Needham, MA
02194

Customer Sales:
NEECO

679 Highland Ave., Needham, MA 02194
(617) 449-1760

Circle 114 for NEECO

Dealer Sales:
Microamerica Distributing
21 Putnum St., Needham, MA 02194
(617) 449-4310

Circle 113 for microamerica

decimal) of 1-byte op codes is always 8 or A. Also, with nine exceptions, the least significant digit of 3-byte op codes is always C, D, or E.

Listing 1 was produced by the program. The labels,

source code mnemonics, and comments were added later. The program uses several subroutines from the KIM-1 monitor: CRLF, PRTPNT, OUTSP, PRTBYT, and INCPT.■

Listing 1: Program in 6502 code to print out hexadecimal instruction codes from KIM-1 memory. Before running the program, do the following. Load the starting address for examination in locations 17F5 (SAL, low-order) and 17F6 (SAH, high-order). Load the ending address plus 1 in locations 17F7 (EAL, low-order) and 17F8 (EAH, high-order). Clear the decimal mode by entering 00 in location 00F1. The starting address for execution is hexadecimal 0301. The memory used is 0300 to 03D0.

Hexadecimal Address	Hexadecimal Code			Label	Op Code	Operand	Comments
0300				TEMP1			
0301	AD	F5	17		LDA	SAL	Load starting address in POINTL
0304	85	FA			STA	FA	and POINTH
0306	AD	F6	17		LDA	SAH	
0309	85	FB			STA	FB	
030B	20	2F	1E	START1	JSR	CRLF	Do carriage return and line feed
030E	20	1E	1E		JSR	PRTPNT	Print starting address
0311	20	9E	1E		JSR	OUTSP	Print 2 spaces
0314	20	9E	1E		JSR	OUTSP	
0317	A2	00			LDX	#\$00	
0319	A1	FA			LDA	(FA,X)	Load Contents of address at FB, FA
031B	8D	00	03		STA	TEMP1	
031E	C9	00			CMP	#\$00	Decide if Op Code is 1 byte
0320	F0	15			BEQ	PRNT1	
0322	C9	40			CMP	#\$40	
0324	F0	11			BEQ	PRNT1	
0326	C9	60			CMP	#\$60	
0328	F0	0D			BEQ	PRNT1	
032A	29	0F			AND	#\$0F	
032C	C9	08			CMP	#\$08	
032E	F0	07			BEQ	PRNT1	
0330	C9	0A			CMP	0A	
0332	F0	03			BEQ	PRNT1	If not 1 byte
0334	4C	40	03		JMP	B3	Jump to test for 3-byte Op Code
0337	AD	00	03	PRNT1	LDA	TEMP1	Print 1-byte Op Code
033A	20	3B	1E		JSR	PRTBYT	
033D	4C	B7	03		JMP	INCAD	Jump to increment address
0340	AD	00	03	B3	LDA	TEMP1	Test for a 3-byte Op Code
0343	C9	19			CMP	#\$19	
0345	F0	31			BEQ	PRNT3	
0347	C9	39			CMP	#\$39	
0349	F0	2D			BEQ	PRNT3	
034B	C9	59			CMP	#\$59	
034D	F0	29			BEQ	PRNT3	
034F	C9	79			CMP	#\$79	
0351	F0	25			BEQ	PRNT3	
0353	C9	99			CMP	#\$99	
0355	F0	21			BEQ	PRNT3	
0357	C9	B9			CMP	#\$B9	
0359	F0	1D			BEQ	PRNT3	
035B	C9	D9			CMP	#\$D9	
035D	F0	19			BEQ	PRNT3	
035F	C9	F9			CMP	#\$F9	
0361	F0	15			BEQ	PRNT3	
0363	C9	20			CMP	#\$20	
0365	F0	11			BEQ	PRNT3	
0367	29	0F			AND	#\$0F	
0369	C9	0C			CMP	0C	
036B	F0	0B			BEQ	PRNT3	
036D	C9	0D			CMP	#\$0D	
036F	F0	07			BEQ	PRNT3	
0371	C9	0E			CMP	#\$0E	
0373	F0	03			BEQ	PRNT3	
0375	4C	A1	03		JMP	PRNT2	GOTO print 2 bytes
0378	AD	00	03	PRNT3	LDA	TEMP1	Print 3 bytes
037B	20	3B	1E		JSR	PRTBYT	Print Op Code
037E	20	9E	1E		JSR	OUTSP	Space
0381	20	9E	1E		JSR	OUTSP	
0384	20	63	1F		JSR	INCPT	Increment address
0387	A2	00			LDX	#\$00	Load contents of address
0389	A1	FA			LDA	(FA,X)	at FBFA
038B	20	3B	1E		JSR	PRTBYT	Print Operand
038E	20	9E	1E		JSR	OUTSP	
0391	20	9E	1E		JSR	OUTSP	
0394	20	63	1F		JSR	INCPT	Increment address
0397	A2	00			LDX	#\$00	Load contents of address
0399	A1	FA			LDA	(FA,X)	at FBFA
039B	20	3B	1E		JSR	PRTBYT	Print Operand
039E	4C	B7	03		JMP	INCAD	
03A1	AD	00	03	PRNT2	LDA	TEMP1	Print 2 bytes

Listing 1 continued on page 194

By Netronics

ASCII/BAUDOT,
STAND ALONE

Computer Terminal

COMPLETE
FOR ONLY
\$149⁹⁵

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requiring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: 1.5 P/P into 75 ohm (EIA RS-170) • **Baud Rate:** 110 and 300 ASCII • **Outputs:** RS232-C or 20 ma. current loop • **ASCII Character Set:** 128 printable characters—

0123456789:;<=>?@ABCDEFGHIJKLMN O PQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
! " # \$ % & ' () * + , - . / : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~

BAUDOT Character Set: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z . : * 3 5 H () , 9 0 1 4 / 5 7 ; 2 / 6 8
Cursor Modes: Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing • **Cursor Control:** Erase, End of Line, Erase of Screen, Form Feed, Delete • **Monitor Operation:** 50 or 60Hz (jumper selectable).

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

Netronics R&D Ltd., Dept. PE-9
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- ☐ Netronics Stand Alone ASCII Keyboard/Computer Terminal Kit, \$149.95 plus \$3.00 postage & handling.
- ☐ Deluxe Steel Cabinet for Netronics Keyboard/Terminal In Blue/Black Finish, \$19.95 plus \$2.50 postage and handling.
- ☐ Video Display Board Kit alone (less keyboard), \$89.95 plus \$3 postage & handling.
- ☐ 12" Video Monitor (10 MHz bandwidth) fully assembled and tested, \$139.95 plus \$5 postage and handling.
- ☐ RF Modulator Kit (to use your TV set for a monitor), \$8.95 postpaid.
- ☐ 5 amp Power Supply Kit In Deluxe Steel Cabinet (±8VDC @ 5 amps, plus 6-8 VAC), \$39.95 plus \$2 postage & handling.

Total Enclosed (Conn. res. add sales tax) \$ _____

By—
☐ Personal Check ☐ Cashiers Check/Money Order
☐ Visa ☐ Master Charge (Bank # _____)

Acct. # _____ Exp. Date _____

Signature _____ Print Name _____

Address _____

City _____

State _____ Zip _____

☐ Send Me More Information

Start Computing For Just \$129.95 With An
8085-Based Professional Computer Kit—

Explorer/85

100% compatible with all 8080A and
8085 software & development tools!

No matter what your future computing plans may be, Level "A"—at \$129.95—is your starting point.

Starting at just \$129.95 for a Level "A" operating system, you can now build the exact computer you want. Explorer/85 can be your beginner's system, OEM controller, or IBM-formatted 8" disk small business system...yet you're never forced to spend a penny for a component or feature you don't want and you can expand in small, affordable steps!

Now, for just \$129.95, you can own the first of a fully expandable computer with professional capabilities—a computer which features the advanced Intel 8085 cpu, thereby giving you immediate access to all software and development tools that exist for both the 8085 and its 8080A predecessor (they are 100% software compatible)—a computer which features onboard S-100 bus expansion—plus instant conversion to mass storage disk memory with either 5-1/4" diskettes or standard IBM-formatted 8" disks.

For just \$129.95 (plus the cost of a power supply, keyboard/terminal and RF modulator, if you don't have them already), Explorer/85 lets you begin computing on a significant level...applying the principles discussed in leading computer magazines...developing "state of the art" computer solutions for both the industrial and leisure environment.

Level "A" Specifications

Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an 8155 ROM-I/O—all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, plus generous prototyping space.

(Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.)

PC Board: glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader...provision for 24-pin DIP socket for hex keypad/display...cassette tape recorder input...cassette tape recorder output...LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit bus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Control Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F800, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at F800 leaving 0000 free for user RAM/ROM. Features include tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

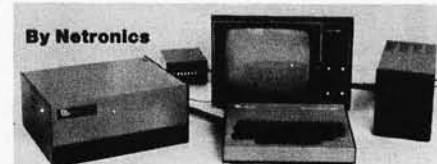
System Monitor (Hex Version): Tape load with labeling...tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address...move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer...serial console in and console out channel so that monitor can communicate with I/O ports.

Netronics R&D Ltd., Dept. RE 10
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below—

- ☐ Explorer/85 Level "A" Kit (ASCII Version), \$129.95 plus \$3 p&h.
- ☐ Explorer/85 Level "A" Kit (Hex Version), \$129.95 plus \$3 p&h.
- ☐ 8k Microsoft BASIC on cassette tape, \$64.95 postpaid.
- ☐ 8k Microsoft BASIC in ROM Kit (requires Levels "B," "D," and "E"), \$99.95 plus \$2 p&h.
- ☐ Level "B" (S-100) Kit, \$49.95 plus \$2 p&h.
- ☐ Level "C" (S-100 6-card expander) Kit, \$39.95 plus \$2 p&h.
- ☐ Level "D" (4k RAM) Kit, \$69.95 plus \$2 p&h.
- ☐ Level "E" (EPROM/ROM) Kit, \$5.95 plus \$0.6 p&h.
- ☐ Deluxe Steel Cabinet for Explorer/85, \$49.95 plus \$3 p&h.
- ☐ ASCII Keyboard/Computer Terminal Kit (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator), \$149.95 plus \$2.50 p&h.
- ☐ Hex Keypad/Display Kit, \$69.95 plus \$2 p&h.
- ☐ Deluxe Steel Cabinet for ASCII Keyboard/Terminal, \$19.95 plus \$2.50 p&h.
- ☐ Power Supply Kit (±8V @ 5 amps) in deluxe steel cabinet, \$39.95 plus \$2 p&h.
- ☐ Gold Plated S-100 Bus Connectors, \$4.85 each, postpaid.
- ☐ RF Modulator Kit (allows you to use your TV set as a monitor), \$8.95 postpaid.
- ☐ 16k RAM Kit (S-100 Board expands to 64k), \$199.95 plus \$2 p&h.
- ☐ 32k RAM Kit, \$329.95 plus \$2 p&h.
- ☐ 48k RAM Kit, \$459.95 plus \$2 p&h.
- ☐ 64k RAM Kit, \$589.95 plus \$2 p&h.
- ☐ 16k RAM Expansion Kit (to expand any of the above up to 64k), \$139.95 plus \$2 p&h each.
- ☐ Intel 8085 cpu User's Manual, \$7.50 postpaid.
- ☐ Special Computer Grade Cassette Tapes, \$1.90 each or 3 for \$5, postpaid.
- ☐ 12" Video Monitor (10 MHz bandwidth), \$139.95 plus \$5 p&h.
- ☐ North Star Double Density Floppy Disk Kit (One Drive) for Explorer/85 (includes 3 drive S-100 controller, DOS, and extended BASIC with per-

By Netronics



registers...single step with register display at each break point...go to execution address. Level "A" in the Hex Version makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.



Hex Keypad/Display Specifications

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

Hex Keypad/Display.

Level "B" Specifications

Level "B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion select-able in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.



Explorer/85 with Level "C" card cage.

Level "C" Specifications

Level "C" expands Explorer's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and cards are neatly contained inside Explorer's deluxe steel cabinet.

Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from 0000 to 0FFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

Order A Coordinated Explorer/85 Applications Pak!

Experimenter's Pak (SAVE \$12.50)—Buy Level "A" and Hex Keypad/Display for \$199.90 and get FREE Intel 8085 user's manual plus FREE postage & handling!

Student Pak (SAVE \$24.45)—Buy Level "A," ASCII Keyboard/Computer Terminal, and Power Supply for \$319.85 and get FREE RF Modulator plus FREE Intel 8085 user's manual plus FREE postage & handling!

Engineering Pak (SAVE \$41.00)—Buy Levels "A," "B," "C," "D," and "E" with Power Supply, ASCII Keyboard/Computer Terminal, and six S-100 Bus Connectors for \$514.75 and get 10 FREE computer grade cassette tapes plus FREE 8085 user's manual plus FREE postage & handling!

Business Pak (SAVE \$89.95)—Buy Explorer/85 Levels "A," "B," and "C" (with cabinet), Power Supply, ASCII Keyboard/Computer Terminal (with cabinet), 16k RAM, 12" Video Monitor, North Star 5-1/4" Disk Drive (includes North Star BASIC) with power supply and cabinet, all for just \$1599.40 and get 10 FREE 5-1/4" minidisettes (\$49.95 value) plus FREE 8085 user's manual plus FREE postage & handling!

Continental U.S.A. Credit Card Buyers Outside Connecticut

CALL TOLL FREE 800-243-7428

To Order From Connecticut Or For Technical Assistance, Etc. Call (203) 354-9375

sonalized disk operating system—just plug it in and you're up and running! \$699.95 plus \$5 p&h.

☐ Power Supply Kit for North Star Disk Drive, \$39.95 plus \$2 p&h.

☐ Deluxe Case for North Star Disk Drive, \$39.95 plus \$2 p&h.

☐ Experimenter's Pak (see above), \$199.90 postpaid.

☐ Student Pak (see above), \$319.85 postpaid.

☐ Engineering Pak (see above), \$514.75 postpaid.

☐ Business Pak (see above), \$1599.40 postpaid.

Total Enclosed \$ _____ (Conn. res. add sales tax) By—

☐ Personal Check ☐ M.O./Cashier's Check ☐ Visa ☐ Master Charge (Bank # _____)

Acct. # _____ Exp. Date _____

Signature _____ Print Name _____

Address _____

City _____

State _____ Zip _____

☐ Send Me Information

Listing 1 continued:

03A4	20	3B	1E		JSR	PRTBYT	Print Op Code
03A7	20	9E	1E		JSR	OUTSP	Space
03AA	20	9E	1E		JSR	OUTSP	
03AD	20	63	1F		JSR	INCPT	Increment address
03B0	A2	00			LDX	#\$00	Load contents of
03B2	A1	FA			LDA	(FA,X)	address at FBFA
03B4	20	3B	1E		JSR	PRTBYT	Print Operand
03B7	20	63	1F	INCAD	JSR	INCPT	Increment to next Op Code
03BA	A5	FB			LDA	FB	Address
03BC	CD	F8	17		CMP	EAH	
03BF	F0	03			BEQ	NEXT	
03C1	4C	0B	03		JMP	START1	If this address is
03C4	A5	FA		NEXT	LDA	FA	equal to the ending
03C6	CD	F7	17		CMP	EAL	address then stop
03C9	F0	03			BEQ	STOP	Otherwise go to START1
03CB	4C	0B	03		JMP	START1	and print the Op Code
03CE	4C	4F	1C	STOP	JMP	START	

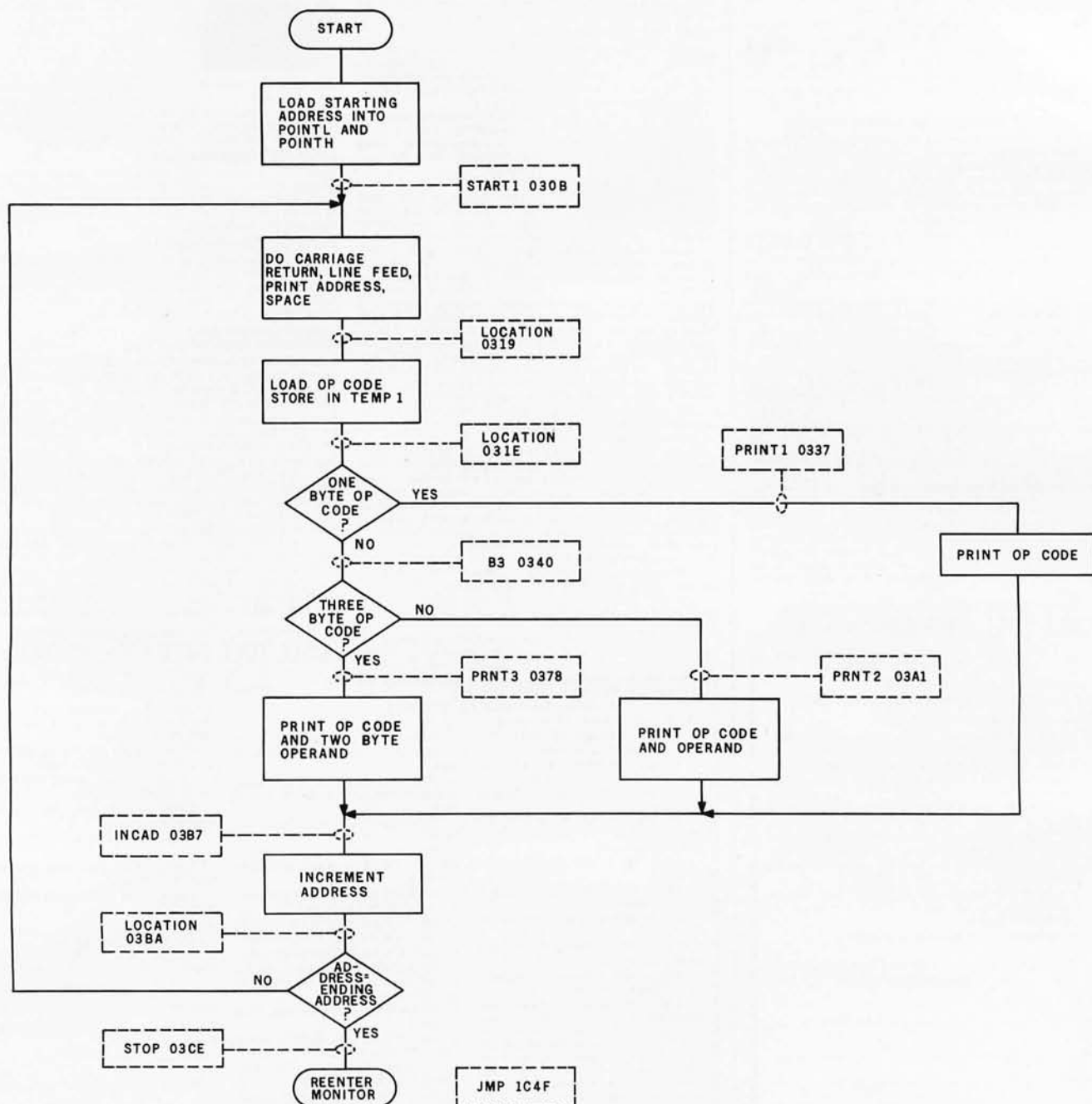


Figure 1: Flowchart of procedure used to print hexadecimal instruction codes from KIM-1 memory.

Until now, computer graphics suffered from terminal high cost.

If you've ever considered displaying Tektronix* graphics data from a host computer, you know all about terminal high cost. A hunk of hardware like a Tektronix 4010 graphics terminal can set you back quite a few kilobucks. It's enough to drive a person of modest means to the drafting table.

The Affordable Alternative

ABW Corporation has just made graphics display as practical as the personal computer. With TEKSIM, The Apple II/Tektronix 4010 Simulator. TEKSIM is a read-only memory (ROM) that plugs directly into an inexpensive Apple II* computer. Combining an advanced programming technique known as *distributed processing* with Apple's high resolution plotting capabilities enables TEKSIM to emulate Tektronix 4010-series terminals at a fraction of the cost. (A symbolic representation of TEKSIM in operation is provided below for the technically minded.)

Outstanding Features

The TEKSIM-Apple combination functions in the same way as a Tektronix terminal, displaying graphical output from a host computer *without any modification to the host-resident program*. You can also input data to the host using game paddles or a joystick. And a TEKSIM-Apple terminal even has features not available in the 4010-series. Six-color "palette" for multicolored displays. Selective erase. Video output to allow any size television to serve as the screen. Plus the added benefits of a powerful Apple II computer to use both in and out of graphics mode. Any compromise? Just one. Apple's resolution is about a fourth that of a Tektronix terminal. Still more than adequate for most applications.

Best Buy for Business; Education

TEKSIM is the logical choice for corporations and educators. A Tektronix terminal can be too much for a limited

budget. And investing in TEKSIM-Apple terminals will make any budget—big or small—go a lot further.

Exceptional performance. Affordable price. That's TEKSIM, from ABW. At \$795†, TEKSIM marks the end of terminal high cost.

For more TEKSIM information, mail this coupon to:

ABW Corporation
P.O. Box M 1047
Ann Arbor, MI 48106

Or call (313) 971-9364.

Name _____

Position _____

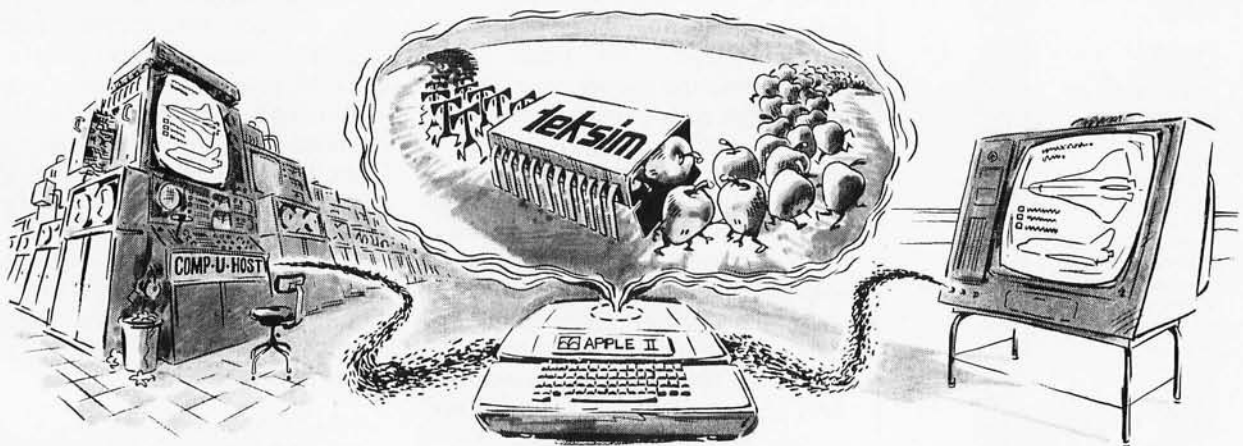
Company _____

Address _____

City _____ State _____ Zip _____

Please contact me. Phone _____

Dealer inquiries invited. 10050



Here's how TEKSIM works: First, Tektronix data comes out of the host computer.

Then TEKSIM transforms it into Apple data...

...so it can be displayed on the Apple's TV screen.

teksim®

APPLE II/TEKTRONIX 4010 SIMULATOR

©1979 by ABW Corp.
*Tektronix is a registered trademark of Tektronix, Inc.
Apple II is a registered trademark of Apple Computer Inc.
†MSRP, suggested retail price. Quantity discounts available.
ABW Corp. is not affiliated with, and TEKSIM is not endorsed by, Tektronix, Inc.

ABW CORPORATION

Give Your Computer an Ear for Names

Tom Munnecke
c/o Metasystems
6199 Shaker Dr
Riverside CA 92506

One of the major criticisms of the computer is that it is too literal (ie: unable to accept minor errors from fallible human operators). When the computer asks a question, if an answer is not *exactly* right the computer rejects it, even if the answer was *nearly* correct. The computer does not apply a human's reasoning ability

to determine the intent of the operator. Instead, it works only with the exact response.

There is a technique which has been used since the turn of the twentieth century to retrieve names based on pronunciation, rather than their spelling. It is called the Soundex code, and was originally developed to search for names in the 1890 census files. The technique is to give each name a four-character code, consisting of the first letter of the last name followed by three digits representing the sounds found in the rest of the name. This code is then used to group together all names which "sound like" each other.

The Soundex code allows the user to enter a name in a form believed to be the proper spelling. The computer responds with a menu listing all sound-alike names, allowing the user to make a selection. If only one name is found, the computer could confirm the name identity and proceed.

For example the user could

misspell "Gonzales" as "Gonzalez"; "Smythe" as "Smith"; or "Andersen" as "Anderson." I am particularly sensitive to this problem because my name (loosely pronounced "money-key") is regularly misspelled. Table 1 shows a sample of the misspellings, as collected from actual mail I have received during the last two years.

The exact use of the Soundex code varies greatly with the computer's file-management system. Some database management systems support Soundex codes directly; others require the programmer to structure the search logic. The program is easily modified to arrange sounds in groups other than as shown. Therefore, there are many modified versions of this technique in use around the country to account for local variations in names and programmer's whims.

The user might see the Soundex routine working as follows (user input is italicized):

WHAT NAME: *SMITH*

SELECT ONE:

1. Smith, Jack 123 Main St
2. Smith, John 456 Central St
3. Smythe, Zachary 789 First Ave

Enter Choice: _____

If there is only one name with the sound, the computer might respond:

WHAT NAME: *SMITH*

John Smith, 123 Main St

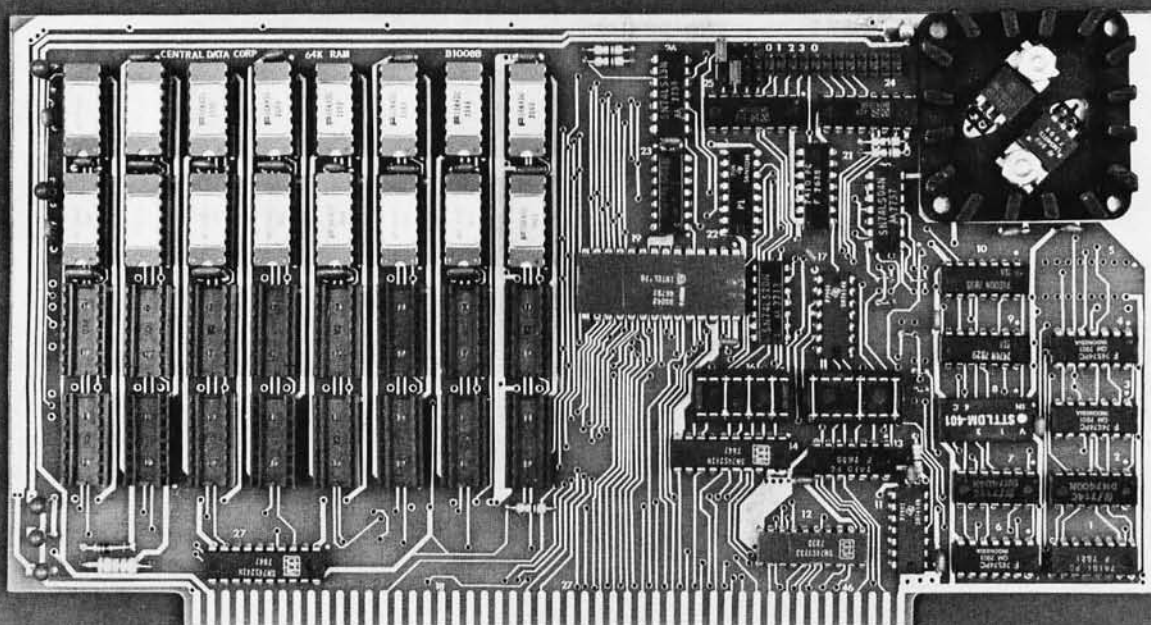
This approach is only the most simple technique. It can be enhanced by adding the first initial of the first name, sex, birthdate, or other characteristic

Name	Code
Munnecke	M520
Minnecke	M520
Munnuke	M520
Munneake	M520
Munneeke	M520
Municky	M520
Muneeck	M520
Monkey	M520
Muneick	M520
Munnick	M520
Monnecks	M521
Muuncake	M522
Munnedie	M530
Lunnecke	L520
Munnecl	M524
Euler	E460
Gauss	G200
Hilbert	H416
Knuth	K530
Lloyd	L300
Lukasiewicz	L222
Smith	S530
Smyth	S530
Smythe	S530
Smitty	S530
Gonzales	G524
Gonzalez	G524

Table 1: Sample Soundex code for several names. The first fourteen names following the author's are misspellings of his name, actually found on mail, along with their respective Soundex codes. Notice that most of the misspellings reduce to the same Soundex code and could identify the correct name.

Letters	Code Digit
b,f,p,v	1
c,g,j,k,s,x,z	2
d,t	3
l	4
m,n	5
r	6

Table 2: Numeric single-digit codes that are assigned to letters from the corresponding groups as they occur in a name being encoded in the Soundex system.



32K Board Pictured Above

Why Not the Best?

From The Dynamic RAM Company.

2MHz	4MHz
16K—\$249	\$259
32K—\$375	\$395
48K—\$500	\$530
64K—\$625	\$665

We have now been shipping our 2MHz dynamic RAM boards for over two years. Hundreds of 4MHz boards have been going out every month since early 1979. Our reliability is proven in the thousands of systems which contain our board. Many quality-minded systems houses across the country and overseas are using our boards for their equipment.

Our prices still beat all.

Despite rising 16K memory chip prices (at least from reputable suppliers), Central Data continues to give you the best buy in memory today. Nobody offers a board with a capacity of 64K, assembled, tested, and guaranteed for a full year at the price we do.

Deselect around PROMs. Our boards have the important deselect feature which lets you overlap any fixed memory in your system with no interference.

Our features make the board easily used and expanded. You address our boards on 16K boundaries with mini-jumps (small shorting plugs that slide over wire-wrap pins) near the top of the board for easy access. If you want to expand your board after you have purchased it, all that you need to do is add memory. We can supply you with expansion packages (\$150-2MHz, \$160-4MHz) which include eight RAMs that you can depend on as well as two mini-jumps for addressing. And of course, our board **never** generates wait states.

Low power consumption keeps your computer running cool and reliable. The total power consumption of our 16K board is typically less than 4 watts (+8V @ 300ma, +16V @ 150ma and

—16V @ 20ma). Boards with additional memory typically increase power consumption only 1 watt per 16K!

Standard S-100 Interface. Our board is designed to interface with any standard S-100 CPU. All of the timing of the board is independent of the processor chip, and the board is set up for different processors by changing two plugs on the board.

Call or write us today. That will guarantee a fast response with more information on the board. Or make an order — you'll probably have the board in two weeks! **If you're interested, also ask for a catalog on our Z8000 16-bit processor board designed for the MULTIBUS.** All of these products are available to your local dealer, also.

Central Data Corporation, 713 Edgebrook Drive, PO Box 2530, Station A, Champaign, IL 61820. (217) 359-8010

Central Data

Listing 1: Soundex program written in Microsoft BASIC for the Commodore PET. Table 3 describes variables used in the program.

```

100 REM TEST DRIVER FOR SOUNDEX
110 INPUT "LAST NAME":N$
120 GOSUB 2000:REM EXECUTE SUBROUTINE
130 PRINT "SOUNDEX CODE =" ;S$
140 GOTO 100
2000 REM SOUNDEX ROUTINE TOM MUNNECKE 2/22/79
2010 REM RETURNS SOUNDEX CODE S$ FROM LAST NAME N$
2020 REM SEE KNUTH, "ART OF COMPUTER PROGRAMMING", VOL #3, P 391
2030 REM L$=" ": REM LAST SOUND
2040 S$=MID$(N$,1,1):REM START WITH FIRST LETTER OF NAME
2050 IF LEN(N$) < 2 THEN 2200:REM SKIP SHORT NAMES
2060 FOR I = 2 TO LEN(N$):REM FOR EACH REMAINING LETTER
2070 E$=MID$(N$,I,1):REM SELECT I-TH LETTER
2080 E=ASC(E$)-64:REM CONVERT A THRU Z TO NUMBER 1 THRU 26
2090 IF E > 26 OR E < 1 THEN 2160:REM USE ONLY LETTERS
2095 REM SELECT SOUNDEX CODE
2100 K$=MID$("0 1 2 3 0 1 2 0 0 2 2 4 5 5 0 1 2 6 2 3 0 1 0 2 0 2",E,1)
2110 REM ABCDEFGHIJKLMNOPQRSTUVWXYZ
2120 IF K$=L$ OR K$="0" THEN 2160:REM SKIP TWO CONTIGUOUS SOUND-ALIKES
2140 S$=S$+K$:REM BUILD UP SOUNDEX RESULT
2150 IF LEN(S$)> 3 THEN 2200:REM ONLY FIRST 4 SOUNDS
2160 L$=K$:REM SAVE LAST SOUND
2170 NEXT:REM DO NEXT CHARACTER IN NAME
2200 S$=LEFT$(S$+"000",4):REM PAD TO RIGHT WITH ZEROS AND SHORTEN TO 4 CHARS
2210 RETURN
2999 END

```

to identify the person with greater accuracy.

Constructing the Soundex Code

The technique for constructing the Soundex code is found on page 391 of *The Art of Computer Programming, Volume 3: Sorting and Searching* by

Donald Knuth (published by Addison-Wesley, Reading MA). The four steps in generating a Soundex code are:

1. Retain the first letter of the name, and drop all occurrences of a,e,i,o,u,w,y,h and q in

other positions.

2. Assign group numbers to the remaining letters after the first according to the scheme given in table 2.
3. If two or more letters with the same code are adjacent in the original form of the name

<p>HAZELTINE 1500,1510, 1520 Outstanding reliability. Clearest video image in this price range. Excellent single & quantity pricing. Also available with 50Hz. and French, German, Swedish characters.</p> <p>IBM CRT 3101 .....\$1,295 9 x 16 dot matrix. Selectric-like keyboard. Works on 50Hz., 220V.</p> <p>TELEVIDEO Smart CRTs. Many edit features and remote commands. B models have TTY-like keyboard; C models have Selectric-like keyboards. 912B.....\$745 912C.....\$780 920B.....\$795 920C.....\$850</p> <p>SOROC IQ 120.....\$865</p> <p>4116 RAM CHIPS .....\$10 For Superbrain and TRS-80</p> <p>IMS 16K Memory, 250 ns .....\$340</p> <p>CALIFORNIA COMPUTER SYSTEMS.....\$270 16 K memory, Runs in 4MHZ systems without wait states. Excellent value.</p> <p>Call on us for product sheets. Dealer inquiry invited. (Prices subject to change without notice.)</p>	<p>IMS 5000 SYSTEM .....\$2,765 Z-80 CPU, S-100. Runs CP/M.[®] Dual, double density 5 1/4 drives, 32K RAM.</p> <p>IMS 8000 .....\$4,185 Like 500 system but with 8 inch drives. Double sided drives also available. Expansion to 64K, four drives.</p> <p>MARINCHIP 9900 16 BIT CPU .....\$700 Extensive software package included in price. Text editor and word processor worth over \$500 by itself! Manuals skillfully written. CPU Kit.....\$550</p> <p>DRIVES SIEMENS .....\$450 SHUGART ..\$525 MPI 851 .....\$275 PER SCI 277\$1,210 and the beautiful INNOTRONICS ..\$525 (John favors the INNOTRONICS for their construction and performance.)</p> <p>TEI MAINFRAMES 12 slots .....\$500 22 slots .....\$670</p> <p>TEXAS INSTRUMENTS PRINTERS 810 .....\$1,695 820 .....\$1,795 745 .....\$1,075</p> <p>PAPER TIGER .....\$945 with graphics .....\$100</p>	<p>TELETYPE MODEL 43 .....\$985 with RS232.....\$1,085 220 v. transformer, installed .....\$100 tractor feeder mechanism.....\$100</p> <p>DEC LA 34.....\$1,159 Plug compatible alternative to the hard-to-get TTY 43</p> <p>DEC LA 35/36 UPGRADE ....\$750 Increases baud rate to 1200. Micro-processor controlled. Many features including TOF, tabs and margins control. Quantity pricing.</p> <p>NEC SPINWRITER 5510....\$3,000 DIABLO 1640 KSR.....\$3,195 These prices include tractor</p> <p>QUME SPRINT 5/55 .....\$3,380</p> <p>CONTROLLERS KONAN Hard disk, S-100 .....\$1,550 TELETEK Double density .....\$415 for 5 1/4 and 8 inch and single density TARBELL Double density .....\$385</p> <p>MODEM: The CAT from Novation \$179 Originate/answer</p> <p>CODs accepted at no extra charge. Shipping: \$13 for light printers and CRTs. Credit cards add 4%. NY residents add tax.</p>
--	--	---

WE EXPORT

Overseas Callers:

Phone 212 448-6298

or TWX 710 588 2844

or Cable: OWENSASSOC

**JOHN D. OWENS
Associates, Inc.**

12 Schubert Street

Staten Island, New York 10305

212 448-6283 • 212 448-6298

**We Are Known for Our
Prompt and Courteous Service!**

**We have no reader
inquiry number.
Please call or write.**

Basic In A Nutshell

Name: Step-By-Step

Vendor: Program Design, Inc., 11 Idar Court, Greenwich CT 06830

Price: \$49.95

Purpose: Teaches how to program a TRS-80 using BASIC

Documentation: Outstanding

Loading: OK—Level 6, not critical

Implementation: This is a case of a BASIC program that teaches BASIC programming. It starts out with the assumption that the student only knows how to turn the TRS-80 on. Three cassette tapes are mounted in the cover of a loose-leaf notebook that also contains supplementary information frames. The course is divided into ten two-part lessons. From a simple PRINT "Hi" through arrays and graphics to complex programs, all of the Level II commands and statements are exercised.

The instruction method consists of explanation, example, trial and testing. Commands and statements are presented and explained, examples are shown both on the screen and in the notebook, and then the student is presented with some problems to solve using the BASIC elements under discussion. If an incorrect answer is given,

two more tries are allowed, and then the correct answer is displayed. Each lesson ends with a test that is administered and scored by the computer. The results are then entered into the student's progress chart. More comprehensive examinations are given at the end of Lesson 5 and at the end of the course.

Suitability: This is the kind of educational programming that personal computing needs more of. The student (my teenage son) learned much more quickly than I could have taught him, and at his own pace. However, this course isn't just for youngsters but for anyone who wants to be able to program effectively using the BASIC language. In a household where there isn't anyone to do the teaching, this course would be especially useful. I'd like to see a similar course for assembly-language programming.

Other software available from the same vendor: IQ Builders (four different kinds), Memory Builder and Story Builder.

Reprinted with permission:
80 Microcomputing, February 1980

Step by Step also available for Apple II and Pet • Apple II version also available on disks for \$59.95.

Available at Computerland and other fine computer dealers. Or, use the coupon below.



Program Design, Inc. 11 Idar Court Greenwich, Conn. 06830 203-661-8799

ORDER FORM

Quantity _____

Title _____

Computer _____

Price _____

STEP BY STEP

Please send me a list of dealers in my area ☐

Check or m.o. enclosed ☐

Shipping 5% _____

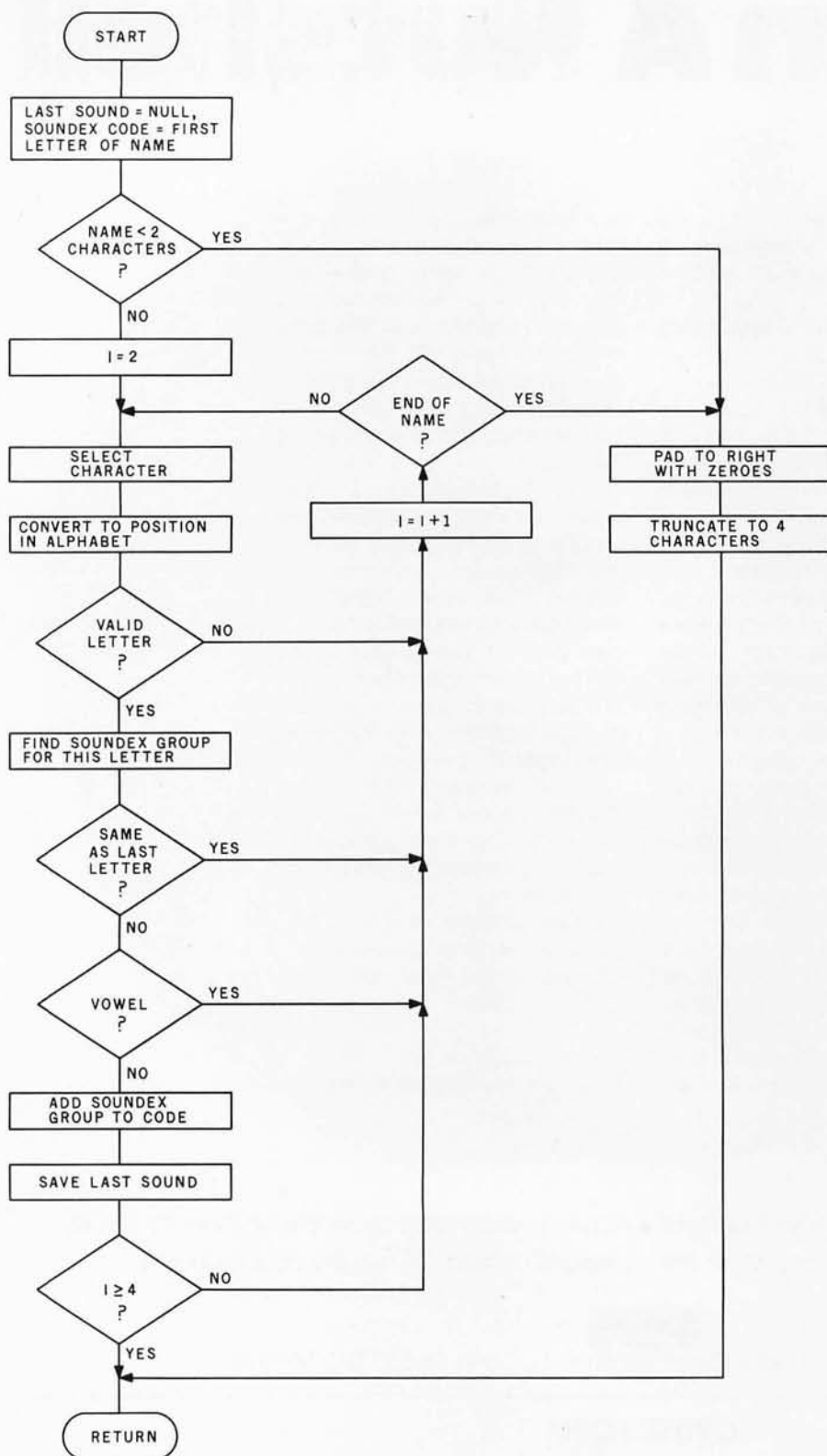
CT resident add 7% _____

BankAmericard/VISA # _____ Name: _____ TOTAL _____

Mastercharge # _____ Address: _____

MC 4 digits over name _____ City: _____ * Foreign orders: U.S. funds

EX date _____ Phone _____ State & Zip: _____ Add \$10.



Input	
N\$	— Name to be coded
Output	
S\$	— Soundex code of N\$ (form: letter,digit,digit,digit)
Temporary	
I	— Character position in N\$ under consideration
E\$	— Ith Character in N\$
E	— Alphabetic sequence of E\$
L\$	— Last sound during evaluation
Table 3: Variables used in the Soundex program.	

structs the encoded form from a last name. It was written and tested on a Commodore PET 2001 computer, but it should work on any computer using Microsoft BASIC. It should work on other BASICs which have LEFT\$, RIGHT\$, and MID\$ functions, and use "+" for string concatenation.

Figure 1 shows the flowchart describing the program's operation. Line numbers on the flowchart correspond to the BASIC line numbers in listing 1. The program is separated into two parts: the Soundex routine, starting at line 2000, and a test driver starting at line 100. The driver is used to ask for a name, invoke the Soundex generator, then print the results. It will be replaced by your program logic for filing and retrieving. The Soundex generator in line 2000 accepts as input the variable N\$, representing the last name to be converted. It returns S\$, the Soundex code for N\$.

The only tricky part of the program is contained between lines 2080 and 2110. Instead of testing each letter individually, as shown in the original technique above, the program converts the letter to a number from 1 to 26, representing its position in the alphabet. It then uses this number to index a character string, containing the group codes for each letter. The comment below the index line at line 2110 documents this technique, and provides a reference in case the codes need to be changed.

The Soundex subroutine may be incorporated into programs that require the computer to understand user input. The addition of a Soundex routine can increase the usefulness of a computer. ■

Figure 1: Flowchart of the Soundex algorithm subroutine.

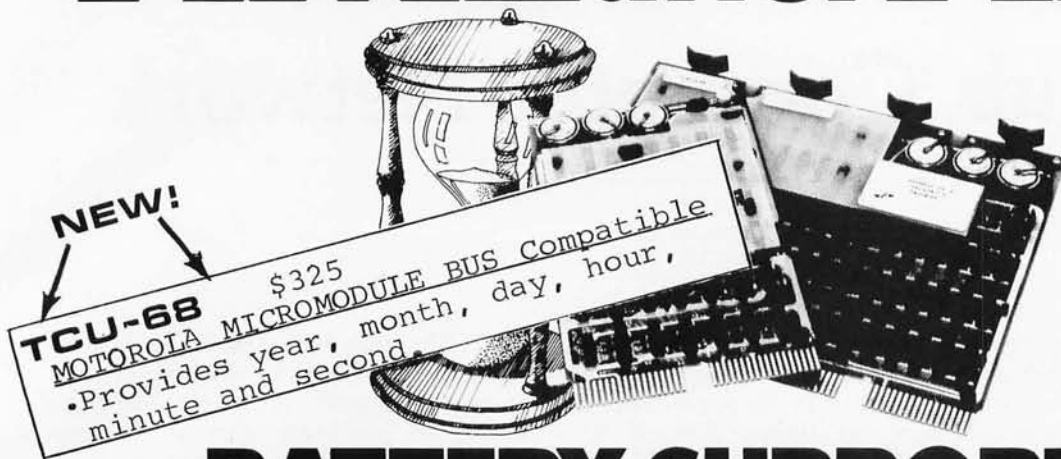
- (before step 1), omit all but the first.
- Convert the name to the form letter, digit, digit, digit by adding trailing zeroes (if there are less than three digits), or by

dropping rightmost digits, if there are more than three.

BASIC Program

Listing 1 shows the Soundex code generating subprogram that con-

TIME_{after}TIME



BATTERY SUPPORTED CALENDAR CLOCKS

PDP-11*

TCU-100 • \$495

- Provides month, day, hour, minute and second.
- Can interrupt on date/time, or periodic intervals.

TCU-150 • \$460

- Provides year, month, day, hour, minute and second.
- Automatic leap year.
- Patches for RSX-11M, RT-11 FB/SJ VO2, VO3 and UNIX.

LSI-11/2*

TCU-50D • \$325

- Provides month, day, hour, minute and second.
- Dual size board.
- Patches for RT-11 SJ/FB VO2, VO3B.

Lockheed SUE

TCU-200 • \$550

- Provides year, month, day, hour, minute, second and milli-second.
- Interval interrupts between 1/1024 seconds and 64 seconds.

Computer Automation (Naked Mini)

TCU-310 • \$385

- Provides year, month, day, hour, minute and second.

*Trademark of Digital Equipment Corporation

Multi-Bus**

TCU-410 • \$325

- Provides year, month, day, hour, minute and second.
- SBC/BLC compatible.

HP 2100

TCU-2100 • \$395

- Correct time restored after power failure.
- Compatible with the HP TBG card.

Serial Clock (RS 232 or 20 mA)

SLC-1 • \$640

- Connects between any terminal and host computer.
- Provides date, time and more!

All Digital Pathways TCUs have on board NICAD batteries to maintain time and date during power down. Timing is provided by a crystal controlled oscillator. Prices are U.S. domestic single piece. Quantity discounts available.

For more information on these products, contact:
Digital Pathways Inc.
4151 Middlefield Road
Palo Alto, CA 94306
Phone: (415) 493-5544



**Trademark of Intel Corporation

***Trademark of Computer Automation Incorporated

DIGITAL PATHWAYS

The Club Computer Network

Joe Kasser
11532 Stewart Ln
Silver Spring MD 20904

Does a club need a computer network? What are its uses? What are the advantages of having such a network?

This article attempts to answer these questions and provide ideas on the techniques used in implementing the network.

Basic Communications Needs

An important aspect of any hobby is communication. The sharing of information and experiences can add a great deal of enjoyment and save much time. If the techniques used to solve some problem are made available by the solvers to others, the recipients of the solution can advance the state of the art. This is done by building upon the foundations developed by the original solvers, rather than by rebuilding the same foundations.

In the computer field, communications fall into two similar but distinct categories: the exchange of personal messages and the exchange of computer data (programs or data bases).

Personal messages may contain any plain language text. Computer data may contain programs, data bases, and instructions for processing files.

About the Author

Joe Kasser is vice-president of the Chesapeake Microcomputer Club, director of information and publicity of the Radio Amateur Satellite Corp (AMSAT), and editor of ORBIT. He has worked with microcomputers professionally since 1975, and has built an 8080-based, S-100 computer system which served as the prototype for the club's construction project. He has contributed other articles to BYTE, including "AMSAT 8080 Standard Debug Monitor" (September 1976, page 108, with Richard C Allen), "The Sky's the Limit" (November 1978, page 48) and "The AMSAT-GOLEM-80" (September 1979, page 182).

Computer data comes in many forms. In the personal computer area, data may be on paper tape, cassette tape, or floppy disk. If it is on cassette, it may be in a digital saturation format or some modulated audio format. It may also be recorded at one of several data rates.

If data is on a floppy disk, the disk may be soft-sectored or hard-sectored. Data may be on 5- or 8-inch disks, which may be single or double density, single or double sided. The disk format may be compatible to a disk operating system such as CP/M or North Star, or it may not.

Most computer users do not have the means for reading or writing all of the different types of off-line storage media. Thus, two users who wish to share software may have what is known as a "media incompatibility problem."

A typical example occurs in the Chesapeake Microcomputer Club (CMC). Two members own 8080 or Z80-based systems, each running the Digital Research CP/M disk operating system. One member, however, uses 8-inch soft-sectored disks, while the other uses a North Star system (5-inch hard-sectored disks). They have no compatible medium such as tape. How then are they to share computer files?

The club is spread out over a wide geographic area. Several of the officers require access to the club roster or membership list. Currently the list is kept by one officer who has to update it, see that labels are printed for mailings, and send physical copies of the list to the other officers. Since officers may live 30 to 50 miles apart, the telephone and postal services are the only practical method for information exchange. There must be a better way.

The club has a need for disseminating information. Reports concerning main meetings, chapter meetings, group purchases, surplus information, and special interest groups have to be made available to the membership. Currently the information is passed out at meetings and through the mails by a monthly newsletter. Is there a better way?

Many of the members possess their own computer systems. The degree of sophistication ranges from a simple KIM-1 to a system with dual disk drive, large amounts of memory, and line printers. A number of members have become involved with the club computer project and the group-purchase plan for equipment. Each one of these systems is in a different stage of development. Many people are finding that their system cannot perform the tasks that they wish it to perform, because several system components (such as extra memory or disk storage capability) are lacking for one reason or another. Perhaps the capital outlay involved is not available, or they are waiting for deliveries to take place.

When contemplating the purchase of additional hardware and software, decisions involving hundreds of dollars must be made, sometimes with little factual information. At club meetings members can discuss their requirements and experiences, but that just results in acquisition of information about how a particular item of computerware works in someone else's environment and how it meets his requirements.

It would be nice to be able to get together with a friend and gain hands-on experience of the way that a computer system component performs in one's own environment before purchasing it. Visiting friends

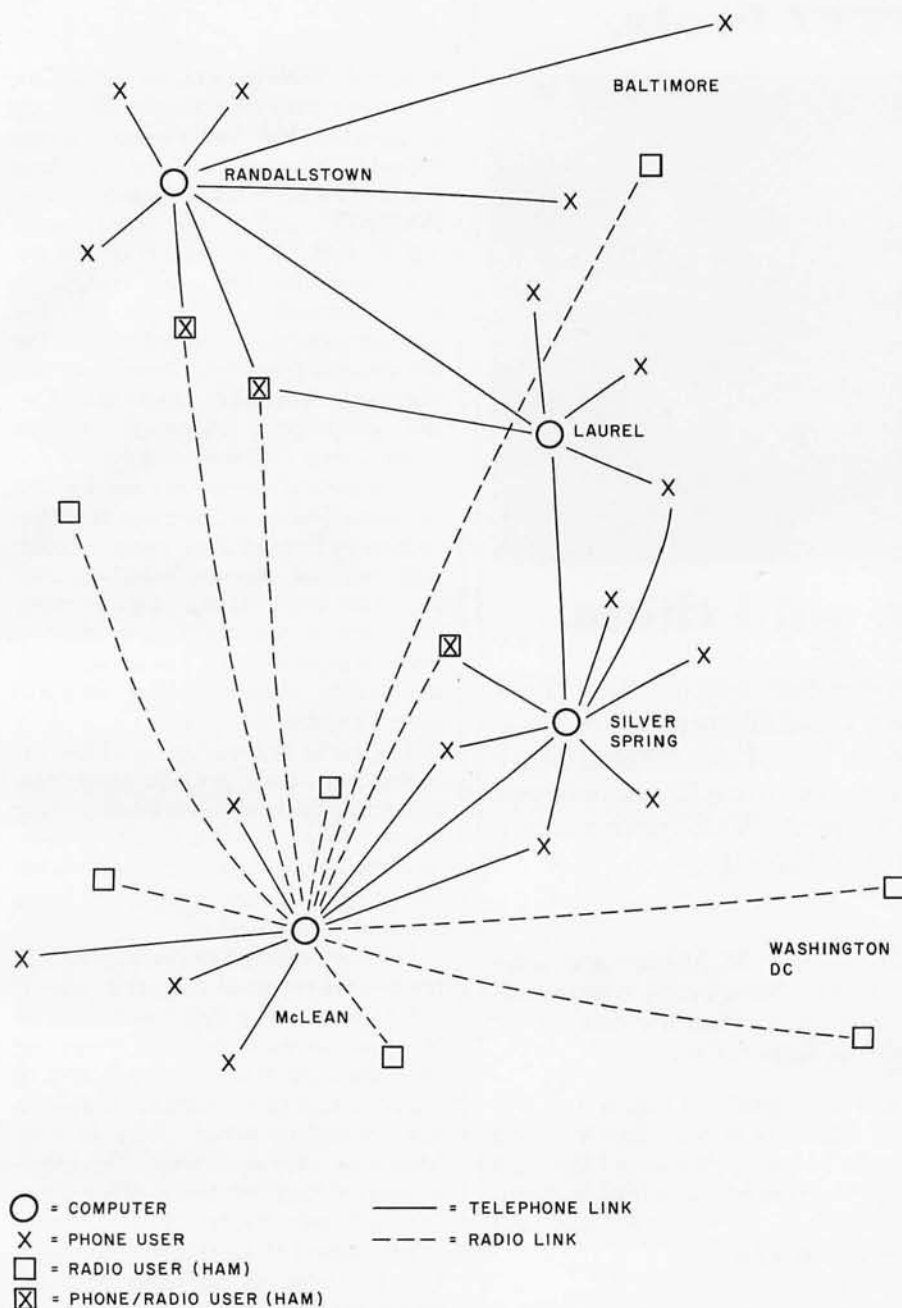


Figure 1: Diagram of sample telephone and radio-data transmission links in a typical club computer network. Several computers form nodes in the network. Solid lines indicate telephone links; dotted lines indicate links through a 2-meter band amateur radio repeater system (at the same location as one of the computers). Communities identified are located in northern Virginia and in Maryland (except for Washington DC).

and using their systems can provide this facility, but it is inconvenient, especially when a long session is planned or the traveling distance is great. There must be a better way.

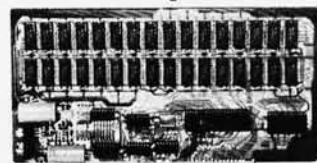
Basic Network

There is a better way. It is called a *club computer network*. All club members can have access to it. It may be centralized or distributed, but it

will provide a service to the club members. Access may be via the telephone line or via amateur radio-teletypewriter (RTTY) circuits. Each access method has its own advantages and disadvantages.

An example of such a network is shown in figure 1. It incorporates both radio and telephone links. It also allows for a number of computers in the system. It is spread out over a

The days of complicated, unreliable, dynamic RAM are gone:



INTRODUCING JAWS

the ultrabyte memory board

\$199.95 (complete kit with 16K memory)

Netronics consistently offers innovative products at unbeatable prices. And here we go again — with JAWS, the ultrabyte 64K S100 memory board.

ONE CHIP DOES IT ALL

JAWS solves the problems of dynamic RAM with a state-of-the-art chip from Intel that does it *all*. Intel's single chip 64K dynamic RAM controller eliminates high-current logic parts . . . delay lines . . . massive heat sinks . . . unreliable trick circuits.

REMARKABLE FEATURES OF JAWS

Look what JAWS offers you: Hidden refresh . . . fast performance . . . low power consumption . . . latched data outputs . . . 200 NS 4116 RAMs . . . on-board crystal . . . 8K bank selectable . . . fully socketed . . . solder mask on both sides of board . . . designed for 8080, 8085, and Z80 bus signals . . . works in Explorer, Sol, Horizon, as well as all other well-designed S100 computers.

GIVE YOUR COMPUTER A BIG BYTE OF MEMORY POWER WITH JAWS — SAVE UP TO \$90 ON INTRODUCTORY LIMITED-OFFER SPECIAL PRICES!

UNDECIDED? TRY A WIRE 16K JAWS IN YOUR COMPUTER ON OUR 10-DAY MONEY-BACK OFFER (SPECIFY YOUR COMPUTER).

CONTINENTAL U.S.A. CREDIT CARD BUYERS: OUTSIDE CONNECTICUT CALL
CALL TOLL FREE 800-243-7428

From Connecticut Or For Assistance, (203) 354-9375 Dept. B

NETRONICS RESEARCH & DEVELOPMENT LTD.
333 Litchfield Road, New Milford, CT 06776

Please send the items checked below:

- ☐ JAWS 16K RAM kit, No. 6416, \$199.95.*
- ☐ JAWS 16K RAM fully assembled, tested, burned in, No. 6416W, \$229.95.*
- ☐ JAWS 32K RAM kit, No. 6432, (reg. price \$329.95), SPECIAL PRICE \$299.95.*
- ☐ JAWS 32K RAM fully assembled, tested, burned in, No. 6432W, (reg. price \$369.95), SPECIAL PRICE \$339.95.*
- ☐ JAWS 48K RAM kit, No. 6448, (reg. price \$459.95), SPECIAL PRICE \$399.95.*
- ☐ JAWS 48K fully assembled, tested, burned in, No. 6448W, (reg. price \$509.95), SPECIAL PRICE \$449.95.*
- ☐ JAWS 64K RAM kit, No. 6464, (reg. price \$589.95), SPECIAL PRICE \$499.95.*
- ☐ JAWS 64K RAM fully assembled, tested, burned in, No. 6464W, (reg. price \$649.95), SPECIAL PRICE \$559.95.*
- ☐ Expansion kit, JAWS 16K RAM module, to expand any of the above in 16K blocks up to 64K, No. 16EXP, \$129.95.*

*All prices plus \$2 postage and handling. Connecticut residents add sales tax.

Total enclosed: \$

☐ Personal Check ☐ Money order or Cashiers Check
☐ VISA ☐ MASTER CHARGE (Bank No.)

Acct. No. _____ Exp. Date _____

Signature _____

Print Name _____

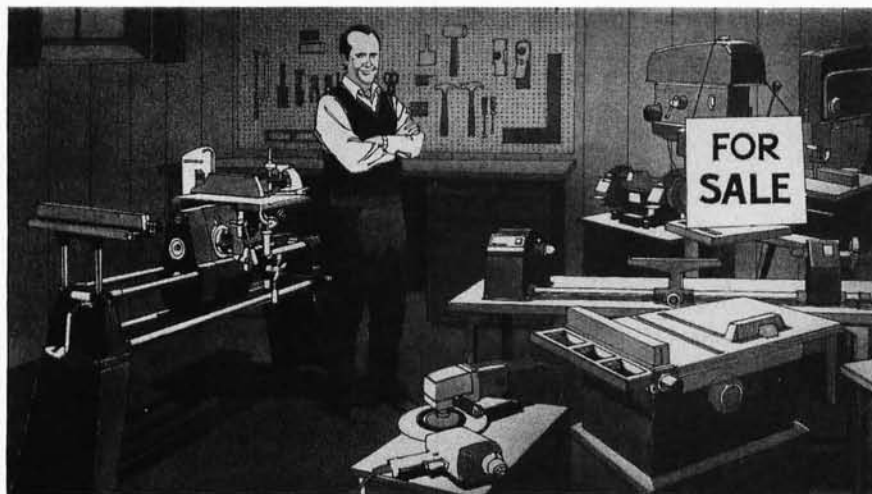
Address _____

City _____

State _____ Zip _____

☐ Send me more information

Jack McAlister had \$12,000 worth of power tools.



Here's why he sold them.

"My shop was equipped with commercial tools in which I had an investment of \$12,000 or more. I sold all my machines at a nice profit, and purchased one Mark V . . . I can do anything I was doing on all the machines, this gives me a lot more room and I have several thousand in the bank. What more could I ask for?" — Jack McAlister, Tucker, Georgia

Jack McAlister found something out that a lot of woodworkers at all levels already know. You don't need a shop full of expensive power equipment to do just about any job you could imagine. All you need is a Shopsmith Mark V.

The 5-in-1 tool that does it all.

The Shopsmith Mark V is actually a complete workshop in a single, compact unit no bigger than a bicycle. It includes the five basic power tools no home shop should be without.

It's powered by a rugged precision-built motor that any power tool owner would be proud to own. And it can do more than your standard power tools because it actually lets you borrow features and set-ups from one tool to enhance the capabilities of the others. So you can tackle jobs you now wouldn't dream of doing yourself. And, thanks to the Mark V's built-in precision and control, you'll do them successfully.

Maybe it's time for you to find out

what Jack McAlister and over 350,000 Shopsmith owners already know. Mail the coupon for all the facts today.

Don't you owe it to yourself to find out more about the Mark V — the single piece of equipment that can actually replace \$12,000 or more in power tools — yet costs less than 1/10 that figure?

The Shopsmith Mark V —
the tool to start with . . .
the system you grow with.



Shopsmith Inc.

Dept. 2458
750 Center Drive
Vandalia, Ohio 45377

Yes! Please mail me your FREE Information Kit on the Shopsmith Mark V. I understand there is no obligation.

Name _____
Address _____
City _____
State _____ Zip _____

relatively wide geographic area. One computer may be accessed either via a 2-meter FM radio-teletypewriter repeater (operated by the Amateur Radio Development Association, AMRAD, using the frequencies 147.81 and 147.21 MHz), or via the telephone line. The other computers are operated on behalf of the Chesapeake Microcomputer Club Inc by various members. Note that this area-wide operation is necessitated by the geographic dispersal of the membership of the two clubs.

The central computers are located so that at least one computer is within local telephone-dialing range of each club member. Several members may be within local dialing range of more than one. If one machine in the network is down, or in use at any particular time, these members can try to access another computer.

The radio link can be used by virtually any amateur radio teleprinter station in the area that is equipped for 2-meter FM operation. Of course, any member of the club can access any computer by making a long-distance telephone call.

Data is collected in each computer for remote retrieval at a later time. If the data in one machine is addressed to a user outside the local telephone area, the data is automatically sent to the computer in the distant area in the late evening, when long-distance telephone rates are lowest. This inter-computer transfer takes place once per night per machine in a predetermined sequence to transfer the maximum number of messages with the minimum number of calls.

Link Types

Consider first the characteristics of the radio links. Many amateur radio operators already use noncomputerized automatic-starting radio-teletypewriter equipment for receiving message traffic. A computer network for message handling is a logical successor to these existing autostart networks.

The existing noncomputerized network works as follows. All stations monitor the same frequency. Messages are sent blind; when a message is originated into the network, the sender does not know for certain if the destination station is

DECIDE FOR YOURSELF...



WISE 1 TERMINAL

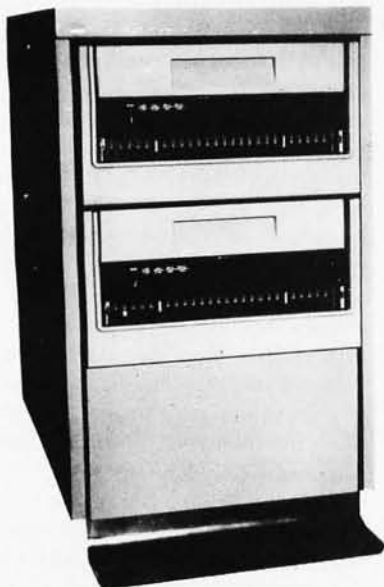
Totally intelligent terminal which can be used for single or multi-user capabilities. Expandable into a complete system. Suggested List Price \$ 1695



IPS-100 MICROCOMPUTER MAIN FRAME

Functions with the Wise 1 as a complete system or with most other dumb terminals.

Suggested List Price \$ 3495



HARD DISK MODULE

32 Megabytes of on-line storage...16 fixed / 16 removable

Suggested List Price \$11,995

shown w/ opt. rack & 2nd drive

...WHICH CDS SYSTEM BEST SUITS YOUR NEEDS

AUTHORIZED DISTRIBUTORS

In Florida

Datatron
11041 N.W. 44th Street
Coral Springs, FL 33065
(305) 753-7514

In Canada

House of Computers, Inc.
368 Eglinton Ave., West
Toronto, Ontario,
Canada M5N 1A2
(416) 482-4336

In Italy

Computer Data Systems, SRI
Scali D'Azeglio, 52
Livorno, Italy 57100
0586-376461/7

In Spain

Polytronica
Cavanilles, 30
Madrid, 7, Spain
252 55 89-433 27 34

DEALER INQUIRIES INVITED



Bldg. #3, Drummond Plaza
Newark, DE 19711
(302) 738-0933

DEALERS

Computer Data Systems, Inc. - 25 West Woodbine - Youngstown, OH 44505 - (216) 747 5539
All Type Business Systems - 57 Verdi Street - Farmingdale, NY 11735 - (516) 249-4650
Microprocessor Applications - Maskell Hill Road - Selby, Victoria, Australia 3159 - (03) 7545108
Realistic Computing of Georgia - 101 Mc Cartan Street - Augusta, Ga 30902 - (404) 722 0831
Computerease - 403 Milltown Road - Wilmington, DE 19808 - (302) 995 6546
Dotson & Wilson Consulting - P. O. Box 12152 - Lexington, Ky 40581 - (606) 233-9958
Forbes & Associates - P. O. Box 455 - Marlton, nj 08053 - (609) 435-0404
Freeman Electronics - 708 North 7th Street - West Monroe, La 71291 - (318) 388-2312
Diversified Data Systems - 9811 Mallard Drive - Laurel, MD 20811 - (301) 776 1200
Great Neck Computer Co. - 89 31 161st Street - Jamaica, NY 11432 - (212) 291 8880
Nova Group, Inc. - 2864 Hartland - Falls Church, VA 22043 - (703) 698 5116
Computer Center - 125 Pillow Street - Butler, PA 16001 - (412) 287 0754
Computer Center - 31 East 31st Street - New York, NY 10016 - (212) 889-8130
Texas Microcomputers - 120 North 10th Street - Mc Allen, TX 78501 - (512) 687 8744
Computer Sales Co. - 63 Gentry Court - Box 3351 - Annapolis, MD 21403 - (301) 267 6600
Integrated Business Systems - 7009 Prospect - NE - Albuquerque, NM 87110 - (505) 884 9705
Business Computer Systems, Inc. - 1401 Walnut River - Canton, MI 48187 - (313) 981 3180
Custom Business Computers - 4565 W. 77th Street - Suite 136 - Minneapolis, MN 55435 - (612) 831 1580
DeWalt Computer Sales - POB 253 - Lightstreet, PA 17839 - (717) 784-4496
Modulo-2 - 709 Supreme House, Penang Road, Singapore 0923 - Phone: 39843, 30539

monitoring the frequency, unless 2-way contact is first established. In the evening, or during weekends, this may not pose much of a problem, because the probability of someone being at home is great. However, during the working day, that probability decreases. Thus, if contact cannot be established directly, the message can still be sent, but there is a probability that the destination receiver will not be on line, and the message will be lost.

If, however, the message can be stored in a central computer by the sender, and retrieved later by the

receiver, the probability of successful transmission of the message from sender to receiver is almost certain. The addition of a computer therefore becomes an asset to the network.

If several stations in the network have computers capable of answering back to the sender, the utilization of the computer may be reduced. A sender can put out a direct call. If an answer is not received (indicating that the destination is not on line or monitoring at the time), the message can either be transmitted to the computer for storage, or held and transmission attempted again at a

later time. It is also possible for the assignment of which network computer will perform the store and forward operation to be rotated among the various member-station computers on basis of availability, as long as the network computer has a distinctive identification.

With a radio network set up in this way, anyone equipped either with simple radio-teleprinter equipment or with sophisticated computer equipment may make use of the full network message storage and forwarding capabilities. This concept of allowing minimally equipped stations to access the network requires that simple techniques be used for data transfer. These include 5-level ("Baudot") or ASCII plain language text, a control language that is readable by both man and machine, with minimal error checking. The advantages of more sophisticated techniques mean that many people will want to use them. That leads to a hierarchical concept of the network utilization. This will be discussed later.

The disadvantage of the radio network is that since everyone is on line, the privacy level is zero. Therefore, data that is not intended for public knowledge cannot be passed over the network. For this reason, mailing lists and other confidential club data should not be passed over the radio link. [Also, FCC regulations require that no message traffic pertaining to any business or commercial activity may be transmitted by an amateur radio station...RSS]

Use of the telephone line for gaining access to the computer limits the number of users that can be on line at the same time. One great advantage of the telephone line is security. The connection between the user and the computer is private. Mailing lists can be accessed and changed remotely without compromising the security of the data, provided that only authorized users are allowed access to these data files.

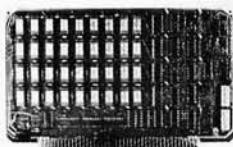
System Implementation

Bringing up the network for the first time can be simple or complex. One method is to install a computer equipped with dual floppy-disk drives, 32 K bytes of memory, and the phone line, and make it available 24 hours per day. It is an expensive method, especially when the demand

64KB RAM MEMORIES

LSI-11 - \$750.00 ● SBC 80/10 - \$750.00

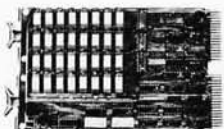
S-100 - \$750.00 ● 6800 - \$750.00 ● 6800-2 - \$995.00



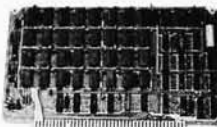
CI-6800-2 64K x 9



CI-S100 64K x 8



CI-1103 32K x 16



CI-6800 64K x 8



CI-8080 64K x 8

CI-6800-2 — 16KB to 64KB. Plugs directly into Motorola's EXORciser I or II. Hidden refresh up to 1.5 Mhz. Cycle stealing at 2 Mhz. Addressable in 4K increments with respect to VXA or VUA. Optional on Board Parity. 64K x 9 \$995.00.

CI-S100 — 16KB to 64KB. Transparent hidden refresh. No wait states at 4 Mhz. Compatible with Alpha Micro and all Major 8080, 8085 and Z80 Based S100 Systems. Expandable to 512 K bytes thru Bank Selecting. 64K x 8 \$750.00.

CI-1103 — 16KB to 64KB on a single dual height board. On board hidden refresh. Plugs directly into LSI 11/2, H11 or LSI 11/23. Addressable in 2K word increments up to 256 K Bytes. 8K x 16 \$390.00. 32K x 16 \$750.00.

CI-6800 — 16KB to 64KB on a single board. On board hidden refresh. Plugs directly into EXORciser I and compatible with Rockwell's System 65. Addressable in 4K increments up to 64K. 16K x 8 \$390.00. 64K x 8 \$750.00.

CI-8080 — 16KB to 64KB on a single board. Plugs directly into MDS 800 and SBC 80/10. Addressable in 4K increments up to 64K. 16 KB \$390.00. 64K \$750.00.

Test and burned-in. Full year warranty.



Chrislin Industries, Inc.

Computer Products Division

31352 Via Colinas • Westlake Village, CA 91361 • 213-991-2254

BACK AGAIN, BIGGER AND BROADER THAN EVER!

The 1980 Business & Home Computer Shows.

Last year's spectacular success in Boston broadens its reach this year into the prosperous Chicago and Washington/Baltimore markets as well. The Business & Home Computer Shows are coming up again. But space is going fast. So call now if you want to be a part of the hottest thing ever in regional end-user computer expositions.

A SMASH LAST YEAR; EVEN BETTER THIS YEAR.

A record-breaking 31,000 people attended the first of these shows in 1979, a three-day affair in Boston. This year's events are broadened to four days, and will have even bigger promotional budgets than ever. *In fact, the Business & Home Computer Shows have the largest national and regional advertising budget of any computer exhibits except NCC.*

SELLING SHOWS WHERE PEOPLE REALLY BUY.

The Business & Home Computer Shows produce solid results. These are eager audiences — about

70% businessmen and the rest hobbyists — primed with purchasing power in mini- and microcomputers, word processors, peripherals, and software. They come to buy. And cash sales are permitted throughout the show.

CALL NOW! SPACE IS RUNNING LOW.

Four hundred booths and 100,000 square feet of floor space for each of the three shows may sound big, and it is. But over half that space has already been sold, mostly to last year's participants. (Several companies tried single booths last year and are back again with reservations for 12 to 16 booths!) So hurry. Call Bill Mahan or Joan Donahue at (617) 524-4547 to get more facts and assure your reservation.

WASHINGTON/BALTIMORE: D.C.

Armory/Starplex, Thu., Sept. 18 thru Sun., Sept. 21.

CHICAGO: McCormick Place, Thu., Oct. 16 thru Sun., Oct. 19.

BOSTON: Hynes Auditorium/Prudential Center,

Thu., Nov. 20 thru Sun., Nov. 23.

THE
BUSINESS & HOME
COMPUTER
SHOWS™

P.O. Box 678, Brookline, MA 02147

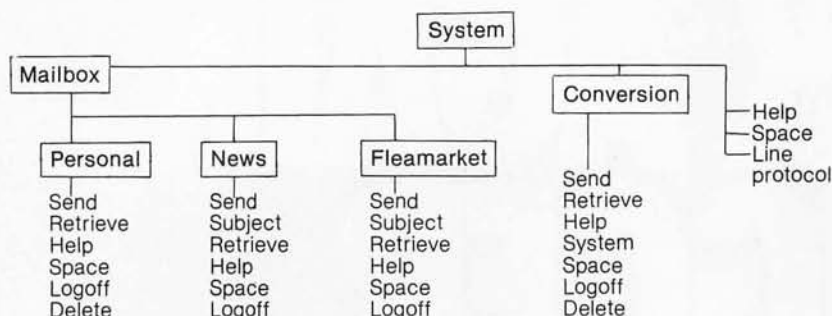


Figure 2: Hierarchy of software modes in the club computer network software. Names of program routines are enclosed in boxes. Commands available with each program are listed below.

A Message to our Subscribers

From time to time we make the BYTE subscriber list available to other companies who wish to send our subscribers promotional material about their products. We take great care to screen these companies, choosing only those who are reputable, and whose products, services, or information we feel would be of interest to you. Direct mail is an efficient medium for presenting the latest personal computer goods and services to our subscribers.

Many BYTE subscribers appreciate this controlled use of our mailing list, and look forward to finding information of

interest to them in the mail. Used are our subscribers' names and addresses only (no other information we may have is ever given).

While we believe the distribution of this information is of benefit to our subscribers, we firmly respect the wishes of any subscriber who does not want to receive such promotional literature. Should you wish to restrict the use of your name, simply send your request to BYTE Publications Inc, Attn: Circulation Department, 70 Main St, Peterborough NH 03458. Thank you.

A Message from North Star Computers Inc.

Due to a miscommunication between our advertising agency and BYTE Magazine, an advertisement for North Star Computer new Applications Software ran in April instead of May. This ad was not intended to appear until all North Star dealers had been informed of our new software products and were prepared to handle customer inquiries.

We regret any inconveniences and embarrassment this has caused North Star dealers and customers, and we are grateful to BYTE for allowing us to clarify this situation. The new Application Software packages will be available through North Star dealers in early May.

Sincerely
Charles A. Grant
President
North Star Computers Inc.

for such a service has not yet been demonstrated in the club.

A second method is to bring the service on line gradually, using equipment belonging to club members, and then put together a club system as club finances allow. This method has the advantage that the cost can be spread out over a period of time, but does have a disadvantage because there will be many intervals during the early stages of the network implementation when the system is not available.

The network can be started by one or more club members making their personal systems available. On the radio link, there will be no noticeable difference with the different computers, since they should all answer to the same call sign, and the user need not know which machine is storing his traffic. In practice each computer will also transmit its own station call sign as required by law.

Telephone access is a little more difficult, because a list of numbers must be made available to the network members, and a rule must be established for dialing the computer. An example of such a rule is that if the computer does not answer by the second ring, dial another number.

When the system is first put into use, it will be lightly loaded. It can thus be used for secondary purposes apart from the message storage or media transfer applications. Club members will have a chance to use the sophisticated system and to play with it. The availability of any single computer during the early stages may be intermittent: since it is the personal system of a club member, it will be available for club use only when the owner is not using it. This unreliable accessibility will encourage members to upgrade their systems as fast as possible for their noncommunication uses. However, the system as a whole will have a greater reliability, since there is a good probability that at least one computer will be available when one is required.

Using the Telephone Link

The typical telephone communication system operates at a data rate of either 110 or 300 bits per second (bps), allowing the use of simple Bell 103-compatible modems. In order to set the data rate for a transmission, each user must transmit a carriage

An Extraordinary Offer to introduce you to the benefits of Membership in

ELECTRONICS BOOK CLUB

invites you to take
this 1,442-page
Computer Library
for only

\$ **1.99**

You
Get **ALL**
FIVE Of These
Huge Books
For Only
\$1.99

Microprocessor Cookbook

A chip-by-chip comparison of the most popular modern microprocessors—including programming, architecture, addressing, instruction sets, and applications! You get complete data on what makes up the structure of a microprocessor chip and a microcomputer, how to give instructions, the overall organization of a computer system, and more. Then you get a chip-by-chip profile of modern microprocessors—with thorough discussions of applications, architecture, functions, etc. Included are the Intel 8080, Motorola 6800, Fairchild's F8 family, Zilog Z80, TI's TMS 9900, National Semi SC/MP, Intel's 8021, and many more. 266 pgs., 124 illus. List \$9.95

The BASIC Cookbook

A complete dictionary of all BASIC statements, commands, and functions—with programming examples and flowcharts. Thoroughly defines the BASIC vocabulary in alphabetical order, illustrates the definitions with sample programs, and further clarifies the programs with matching flowcharts... plus explaining BASIC system commands. You'll learn how to professionally manipulate and use each BASIC term in a workable program. Also defines programming terms that apply to APL, ALGOL, COBOL, FORTRAN, RPG, PL1, etc. 140 pgs., 49 illus. List \$7.95

57 Practical Programs & Games in BASIC

57 of the hardest working, most enjoyable BASIC programs you've ever seen... everything from space war games to blackjack, from craps to I Ching, from arithmetic progression to statistical permutations to one-arm bandits! It's an easy-to-use manual that gives you 57 different simplified BASIC programs... all ready to run! You can program your minibrain for all kinds of fun and games, or for solving many different types of problems. 210 pgs., 64 illus. List \$10.95

Complete Microcomputer Systems Hdbk.

A complete guide to microcomputers—how they operate, how to use them, how to program them, and how to troubleshoot, test, and repair them... plus the very latest on modern applications like magnetic bubble memories, computers in networks, computer decision making, simulation and forecasting, teaching machines to learn, robot control, speech synthesizers, digital music, mobile computers, etc. There's extensive coverage of computer problems and how to diagnose and repair them, plus lots of hard debugging data. You'll learn how to find and fix all types of mechanical and electronic troubles—plus how to use test signals and closed loop signals, how to replace chips, how to align disc drives, etc. 322 pgs., 147 illus. List \$15.95

The Giant Handbook of Computer Projects

This MAMMOTH 504-page step-by-step guide to building modern computers and accessories—CPUs, memories, I/O hardware, etc.—is a HUGE collection of ready-to-use construction info. It's a builder's dream, with projects, complete schematics, parts lists, and step-by-step construction instructions that let you build your own systems. Also contains a thorough discussion of microprocessors, with comparisons of several units, including the Kim-1, the Z-80, and the 8080, etc... plus data on memory boards, RAM checkout, PROM programmers, memory chips, inexpensive input/output devices, paper tape systems, interfacing with clock chips, and more. 504 pgs., 217 illus. List \$15.95

57 PRACTICAL PROGRAMS & GAMES IN BASIC

Programs for everything from space war games to blackjack... from craps to I Ching!

THE COMPLETE MICROCOMPUTER SYSTEMS HANDBOOK

A complete guide to microcomputers—how they operate, how to use them, how to troubleshoot and the latest on modern applications

The GIANT Handbook of Computer Projects

by the Editors of 73 Magazine

Let us send you this 5-volume, 1,442 page Computer Library as part of an unusual offer of a Trial Membership in Electronics Book Club.

Here are quality hardbound volumes, each especially designed to help you increase your know-how, earning power, and enjoyment of electronics and computers. Whatever your interest in electronics/computers, you'll find Electronics Book Club offers practical, quality books that you can put to immediate use and benefit.

This extraordinary offer is intended to prove to you, through your own experience, that these very real advantages can be yours... that it is possible to keep up with the literature published in your areas of interest, and to save substantially while so doing. As part of your Trial Membership, you need purchase as few as four books during

Facts About Club Membership

- The 5 introductory books carry a publisher's retail price of \$60.75. They are yours for only \$1.99 for all 5 (plus postage/handling) with your Trial Membership.
- You will receive the Club News, describing the current Selection, Alternates, and other books, every 4 weeks (13x a year).
- If you want the Selection, do nothing: it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
- To complete your Trial Membership, you need buy only four additional monthly Selections or Alternates during the next 12 months. You may cancel your Membership any time after you purchase these four books.
- All books—including the Introductory Offer—are fully returnable after 10 days if you're not completely satisfied.
- All books are offered at low Member prices, plus a small postage and handling charge.
- Continuing Bonus: If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates plus payment of the nominal sum of \$1.99 will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

- ✓ Only \$1.99 for ALL FIVE!
- ✓ Regular List Price \$60.75
- ✓ Top-Quality Hardbinding
- ✓ Contains the very latest info on computers!
- ✓ Over 600 illustrations
- ✓ Contains over 500,000 words
- ✓ 1,442 data-packed pages

the coming 12 months. You would probably buy at least this many anyway, without the substantial savings offered through Club Membership.

To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive the 5-volume Computer Library for 10-day inspection. YOU NEED SEND NO MONEY. If you're not delighted, return the books within 10 days and your Trial Membership will be cancelled without cost or obligation.

ELECTRONICS BOOK CLUB, Blue Ridge Summit, Pa. 17214

ELECTRONICS BOOK CLUB

Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in ELECTRONICS BOOK CLUB and send my 5-volume Computer Library, invoicing me for only \$1.99 plus shipping. If not delighted, I may return the books within 10 days and owe nothing, and have my Trial Membership cancelled. I agree to purchase at least four additional books during the next 12 months after which I may cancel my membership at any time.

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(Valid for new Members only. Foreign and Canada add 15%.) BY-580

CMC NETWORK. ENTER LOGON: - **G3ZCZ**
 G3ZCZ LOGON IN PROGRESS AT 1115 ON 6 NOV 1978
 4 MESSAGES
 READY **MAILBOX**
 MAILBOX READY **HELP**
 CHOOSE BETWEEN 'SEND, RETRIEVE, HELP, SPACE, LOGOFF'
 MAILBOX READY **SPACE**
 DISC SPACE = 25K
 MAILBOX READY **SEND**
 DESTINATION? **WB4APR**
 INPUT: — **BOB, WE HAVE TO DISCUSS THE RADIO PROTOCOL. CALL ME WHEN YOU HAVE A MOMENT, BETWEEN 9 AND 11 PM ANY NIGHT EXCEPT FRIDAY.** [control-Z]
 MESSAGE ACCEPTED
 MAILBOX READY **RETRIEVE**
 RETRIEVE IS NOT VALID
 MAILBOX READY **RETRIEVE**

MESSAGE	SOURCE	DATED
1	WB4APR	1 NOV 1978
2	CMC 105	3 NOV 1978
3	TERRY FOX	5 NOV 1978
4	G8BTB	5 NOV 1978

MAILBOX READY **RETRIEVE 2**
 MESSAGE READS: BRING THE DOCUMENTATION ON THE GLOOP BOX TO THE MEETING. FRED.
 MAILBOX READY

Figure 3: Sample interaction between the author (G3ZCZ) and the Chesapeake Microcomputer Club-Amateur Radio Development Association (CMC-AMRAD) computer system. Characters sent by the system are shown in regular type; those typed by the user are shown in boldface type. Note that when the "RETRIEVE" command (a misspelling) is entered, an error message is generated by the system.

return character so that the computer can set up the correct data rate. Once the data rate is established, the computer sends out a sign-on message and asks the user to log in with an identification code. This identification can be a membership number, an amateur radio call sign, or some arbitrary name. It is limited to a length of eight characters. The computer will then indicate the presence or absence of any personal messages addressed to the user that has just logged in.

The software in each computer is identical in behavior and is organized in a structured top-down approach as shown in figure 2. The user has a choice of programs as shown that

perform the various functions. Various commands are associated with each program as listed. Consider each program and mode in turn.

The mailbox program is designed to enable club members to send short messages (up to 256 characters) to each other. The messages are in plain language. The response to a SEND command is to prompt the user with DESTINATION? Upon entering the identification code of the destination, the user is prompted to send the message and terminate it with a control-Z character. Should more than 256 characters be entered, the entire message will be rejected. This discourages long messages.

The response to the RETRIEVE

command is to list the sender identification of each message in the system awaiting the user.

A sample user session is shown in figure 3. The computer output is shown in regular type, the user input in boldface type.

The other messages may be retrieved in turn. The RETRIEVE command has the following characteristics: If followed by a carriage return, it lists all messages. If followed by a 0, it lists all messages. If followed by a number, it lists the corresponding message.

Identification numbers are assigned to the messages only to allow the user to retrieve them. The numbers are reassigned as messages are deleted.

UCSD Pascal* for TRS-80† Model II

The Standard Package: Operating System □ Compiler □ Screen Editor □ Filer □ Library □ Z-80 Assembler □ Patch Utility Program □ 280 page User Manual □ Jensen & Wirth Pascal Reference Manual □ Bowles' Beginners Guide To UCSD Pascal □ tutorial disk.

Plus:

- Single or double density diskettes in one or more standard formats.
- Disk Formatting program.
- Configuration program for serial I/O.

\$350

Complete

Optional Utility Programs:

- File conversion—
 CP/M† to Pascal \$50.00
 TRSDOS to Pascal \$50.00
- Z-80 Disassembler/Dump Program \$50.00

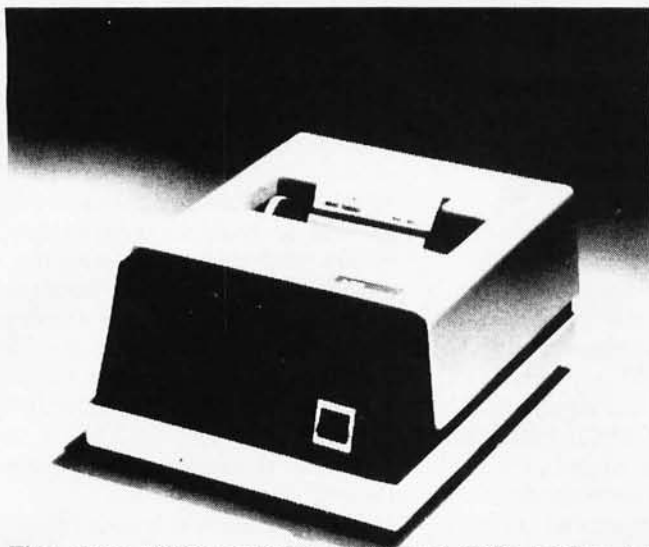
PCD SYSTEMS

323 Keuka St. • Penn Yan • New York 14527 • 315-536-3734

*Trademark of the Regents of the University of California

†Trademark of Tandy Corp.

‡Trademark of Digital Research Corp.



No matter what type of personal computer you have, or are thinking of buying, Eaton LRC's new 7000+ dot-matrix impact printer can be interfaced with plug-in simplicity and be printing in just a matter of seconds.

The 7000+ features uni-directional printing with a line speed of 1.25 lines per second. It accepts any single or two-ply paper roll from 3/4-inch to 3-7/8 inches wide and prints a 3-1/3 inch line. Capacity is adjustable and can be 40 columns at 12 characters to the inch using the single width font; or 20 columns at 6 characters to the inch using the double-width font. The 7000+ accepts the full ASCII character set (upper and lower case). An available option allows the unit to print 64 columns at the single width setting, and 32 columns using a double width font, selectable under software control.

The new 7000+ comes equipped with Eaton LRC's newest printhead with a minimum life of 100-million characters. This new, long-life head has been carefully designed to print continuously without overheating.

7000+ (40 & 20 columns) List \$389 \$369
APPLE* cable \$20

7000+ (64, 32, 40 & 20 col.) List \$405 \$389
TRS-80* cable \$20

DEALER INQUIRIES INVITED

TRS-80* COMPUTERS:

Level II, 4K (list \$619) \$559
Level II, 16K, no keypad \$669
Level II, 16K, w/keypad (list \$849) \$749

EXPANSION INTERFACES:

Exp. Int., no RAM (list \$299) \$269
Exp. Int., 16K RAM, (NEC) (list \$448) \$369
Exp. Int., 32K RAM, (NEC) (list \$597) \$459

DISK DRIVES:

Percom, TFD-100, 40-track (list \$399) \$389
Percom, Dual TFD-100's (list \$795) \$775
Percom, TFD-200, 77-track (list \$675) \$650
Percom, Dual TFD-200's (list \$1350) \$1300
RS Mini-Disk #0 (list \$499) \$449
RS Mini-Disk #1-2-3 (list \$499) \$439

DISK DRIVE ACCESSORIES:

2-drive cable for TRS-80 (list \$29.95) \$29
4-drive cable for TRS-80 (list \$39.95) \$39
Percom Data Separator \$29.95
Extender Card (list \$15.95) \$15

PRINTERS:

Centronics 730 (list \$795) \$719

Centronics 737 (list \$995) \$895
Centronics 753-2 (list \$3196) \$2695
Centronics 779-2 (list \$1559) \$ 995
RS Quick Printer II (\$219) \$197
RS Line Printer III (list \$1960) \$1813
NEC 5530 Spinwriter (list \$2995) \$2595
LRC 7000+ (list \$389) \$369
LRD 7000+ (list \$405) \$389

PRINTER CABLES:

QP11 to Exp. Int. cable (\$19.95) \$19
LRC to TRS-80 cable (list \$20)
730 to TRS-80 cable \$29
779 or 753 to TRS-80 cable \$35
NEC 5530 to TRS-80 cable \$35

PERIPHERALS:

Novation CAT Modem (\$189.95) \$179
UDS 103-LP \$195
RS-232-C Interface Board (list \$99) \$89
TRS-232 Printer Interface \$49.95
Data Dubber \$49.95
16K Memory Kit, Keyboard \$99
16K Memory Upgrade Kit, E.I. \$95
Percom Electric Crayon, w/cable \$279.95
Busy Box \$109.95
BSR X-10, Starter Kit \$124.95
Comm-80 Interface \$179.95

TO ORDER
TOLL-FREE
1-800-258-1790

(In N.H. call 673-5144)

6 SOUTH ST.,
MILFORD, NH 03055

HARDSIDE™

We buy & sell
used TRS-80s. Call
(603) 673-5144
for details!

*TRS-80 is a trademark of Radio Shack and Tandy Corp. *Apple is a trademark of the Apple Computer Co.

Deletion of messages is allowed by the system under restricted conditions. Only the system manager, the sender, or the retriever can delete messages. Each user is assigned a password that must be entered prior to a DELETE command. This allows some degree of security. Messages will be deleted by the system manager periodically, depending on the storage requirements of the system.

In the *news* and *fleamarket* modes, updates are handled by a single club member designated for that duty. All messages for input to the system are routed to this person for scanning before being placed on the system. This is to keep the system from being cluttered up with undesirable messages. Updates of these messages take place as time permits, with a maximum delay time of one week.

The *conversion* program is designed for exchange of data between different media. One club member desiring to receive a data file from another will arrange for the second member to put the file into the system for retrieval within hours. The expected life of a file in the conversion mode is about 24 hours. Conversion uses a different protocol than the mailbox mode. Since long files are being exchanged, the data flow has to be stopped from time to time to allow disk read and write operations. A full-duplex mode is used.

The maximum message length of 256 characters applies in all modes except conversion. Messages with more than 256 characters are rejected in their entirety. This encourages brevity. A rejection message is printed by the computer to the sender in the case of a message rejection. A user who has to retype messages will soon get the idea.

Several existing network systems carry a large number of undesirable messages. We hope to minimize them in the CMC-AMRAD network. Any user trying to enter unwanted messages may have them rejected by the system manager.

Data Complexity Levels

Data may be transmitted over a link at one of several levels of complexity of internal organization. The basic level (level 0) is plain ASCII-encoded text in half-duplex mode. Level 1 is a simple ASCII-based, full-duplex mode developed by Tim Pugh. Level 2 is an emulation of the PCNET (personal computer network) protocol. Level 0 is used by anyone in talking to the computer during execution of any user program. Level 1 may be used in the conversion mode, while Level 2 is used for intercomputer data exchange. Any properly equipped user can request any level when he logs onto the system.

Any club member having an *answer-mode modem* can run the basic network system software on his or her machine. An extension can be made to the system to allow access to the disk operating system so that other club members can play with the other software available on the machine.

Radio Restrictions

Mailbox and news are the only categories of data exchange available via radio links. Conversion-mode data may contain binary or other unusually coded files, and fleamarket may contain advertisements; radio transmission of both of these classes of messages is forbidden by law.

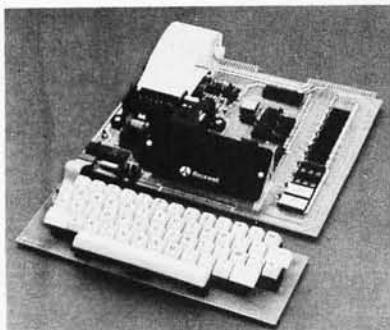
The procedure for logging onto the system is different from the one used

over the telephone. Half-duplex mode is employed when using a single-band repeater, such as the 147.81/147.21 MHz AMRAD machine. If the inputs and outputs were on different amateur frequency bands, full-duplex operation would be easily achievable. In order to avoid the requirements for duplex exchanges and to reduce the amount of information exchanged, the modified *Q code* is employed. See my article "The Sky's the Limit: Use Ham Radio Bands for Intercomputer Communication" (November 1978 BYTE, page 48), for a more complete discussion of the use of these Q codes.

[The Q code is a system of 3-letter abbreviations that all begin with the letter Q. Various Q codes are used during Morse-code radio transmissions to speed up message exchange. An adapted set of Q codes is used for computer network communication... RSS]

Any amateur can log into the network and receive a reply from any on-line computer that has a message for him or her. Thus, users without computers can store their messages in the network computer; those with computers can leave messages on their own machine for later remote retrieval. Possible contention interference (from more than one machine simultaneously trying to communicate over the network) can be overcome initially by employing a different time-delay response characteristic for each computer in the network (both user and system computers).

The radio link can also be used for long-distance links between the club network and other club networks. Again, see "The Sky's the Limit" for a more complete discussion. ■



AIM 65

AIM 65 is fully assembled, tested and warranted. With the addition of a low cost, readily available power supply, it's ready to start working for you. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM.

- Thermal Printer
- Full-Size Alphanumeric Keyboard
- True Alphanumeric Display
- Proven R6500 Microcomputer System Devices

- Built-In Expansion Capability
- TTY and Audio Cassette Interfaces
- ROM Resident Advanced Interactive Monitor
- Advanced Interactive Monitor Commands

PRICE: \$375.00 (1K RAM) \$369.00

Plus \$4.00 UPS (shipped in U.S. must give **street** address), \$10 parcel post to APO's, FPO's, Alaska, Hawaii, Canada, \$25 air mail to all other countries

We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send \$1.00 (International send \$3.00 U.S.) for airmail delivery of our complete catalog.

Circle 193 on inquiry card.

RNB ENTERPRISES
INCORPORATED

2967 W. Fairmount Avenue • Phoenix, AZ 85017 • (602) 265-7564

INTRODUCING A GREAT WARGAME FOR TWO GREAT HOME COMPUTERS.



COMPUTER BISMARCK™ FOR YOUR APPLE II OR TRS-80.

Historical wargaming may be the only intellectual hobby which creates more intensely devoted fanatics than home computing. When two wargamers spend an evening refighting a famous battle, they'll spend several hours happily setting up the gameboard, firepower charts, unit strength tables and so forth... all before the first shot can be fired! There are such paper & pencil simulations of every famous battle from Shiloh to El Alamein. If you've ever tried one, you already know the excitement and challenge of trying to be a better general than Rommel.

Home Computer

Now there's a true historical wargame for your home computer. Computer Bismarck accurately simulates the epic battle between the awesome German battleship and the British Home Fleet. Best of all, the computer program eliminates the drudgery of paper & pencil wargames — remembering all the rules and details while keeping track of the battle on a North Atlantic map on your video display.

Play the Computer

It maneuvers the Bismarck and Prinz Eugen so well that you'll have to command the British ships brilliantly to avoid losing your vital merchant convoys.

Play a Human

The two of you plot your strategies in grease pencil on an off-screen mapboard while the battle is fought on the video screen (monochrome or multi-color depending on your display capabilities). You deploy battleships, cruisers, carriers — each with unique and realistic operating parameters. You must deal with all the variables which challenge an actual battle commander: firepower and damage; shadowing ability (better in radar-equipped vessels); and visibility — which depends on weather, which varies with geography and time. If the game is interrupted, the computer saves it on a minidisc for resumption later.

More like Chess than Pong

Computer Bismarck is a test of intellect and courage rather than hand-eye coordination. If you can imagine playing chess with pieces like a knight who must return to the stables periodically for a fresh horse or a queen whose radius of action can be affected by battle damage... all on a 360 square chessboard partially obscured by fog... that's Computer Bismarck!

Cassette for Your TRS-80

We've just described the cassette version of Computer Bismarck which is played on a 16K Level II TRS-80 system. For \$49.95 you get a programmed cassette, a 12-page rule book, 2 mapboard charts (for plotting secret strategies in grease pencil between moves), 2 ship data charts, and a set-up instructions sheet.

Disc for your Apple

The disc version includes all of the cassette features plus actual submarine, destroyer, convoy, and aircraft units that are moved by the players. Players must also deal with fuel restrictions on both ships and planes and with the ever-changing weather of the North Atlantic.

If you've got an Apple II Plus (or an Apple II with Applesoft ROM Card) with 48K memory and a 5¼" mini floppy disc drive, you can be playing Computer Bismarck in a few days. For \$59.95 you get the game program disc, 2 mapboard charts, 2 ship data charts, 2 system command cards, a loading instruction sheet, and a rulebook — everything you need to play one of the most exciting wargames ever designed!

Credit card holders call **800-648-5600** (toll free) and ask Operator 180 to charge your order to your VISA or MASTERCARD (Nevada only call 800-992-5710). Or send a check to Strategic Simulations, Incorporated, P.O. Box 5161, Stanford, CA 94305 (California residents add 6.5% sales tax).

For complete details and an inside look at Computer Bismarck, we'll mail you its rulebook. Just send us a check for \$5 along with your name and address. Please indicate cassette or disc version rulebook. The \$5 will be credited to your purchase of Computer Bismarck.

COMPUTER BISMARCK™. There's never been anything like it.



IT'S HERE... anti-magnetic protection for cassette-stored data



TAPE*SAFE METAL CASSETTE SHIELDS

Don't risk the erasure of valuable cassette-stored data through accidental magnetic-field exposure. Such irretrievable loss can occur during storage or transit if unprotected tapes are exposed to the magnetic fields produced by motors, transformers, generators, electronic equipment—even the intense transient fields induced by electrical storms. TAPE*SAFE Cassette Shields are constructed of the same special magnetic alloy used to shield cathode ray tubes and other magnetic-sensitive components. Helium-welded seams and hydrogen annealing assure optimum shielding properties. Each attractively-finished TAPE*SAFE Shield accommodates one cassette in its original plastic box. The handsome FILE DECK, in contrasting color, stores six TAPE*SAFE Shields (One FILE DECK sent FREE with each six Cassette Shields). Order direct from this ad. Visa and MasterCard telephone orders accepted.

TAPE*SAFE Cassette Shields—\$14.95 ea., postpd.

Six or more at one time—\$12.95 ea., postpd.

Inquire about quantity discounts

Data-Safe Products, Inc.

1926 Margaret St., Phila., PA 19124 • 215/535-3004
Dealer Inquiries Invited



FILE DECK

Stores six
TAPE*SAFEs
for quick,
easy access

\$10.95
ea., ppd.

FREE with six TAPE*SAFEs

SPECIAL INTRODUCTORY OFFER

Ship _____ TAPE*SAFE Shields at \$ _____ ea.

Ship _____ FILE DECK Racks at \$ _____ ea.

Total Enclosed \$ _____ (check or money order)

Pa. Residents add 6% Sales Tax.

Name _____

Address _____

City _____ State _____ Zip _____

The COSMAC Doodler

Jeff Duntemann
301 Susquehanna Rd
Rochester NY 14618

When the COSMAC ELF micro-computer first appeared several years ago, its designer called it a microcomputer trainer. That meant that you had a few hexadecimal displays and a light-emitting diode (LED) to play with in your programs, and nothing else. Clever people managed to make the ELF play music or even generate Morse code without much additional hardware.

As far as I know, the ELF is the only microcomputer that has often been built from scratch by hobbyists without using a predesigned printed-circuit board. There is no better way to learn microprocessor hardware than to buy a handful of parts and wire-wrap all of the connections. In ironing out your mistakes, you will become familiar with every processor timing signal, every kink in every system timing diagram, and every little architectural quirk that can grow up to be a big bug in later programs. It is a rigorous education, I promise you, but an excellent one.

Then RCA released the CDP1861 video-display-controller integrated circuit for sale, and suddenly the ELF could do something no comparable computer could do for triple the price. With the CDP1861, the ELF displays a bit-map of 1024 bytes of memory on a video screen (in black and white), with no hardware needed except the CDP1861 and several resistors, and with software consisting of a 30-byte interrupt routine.

This development was not purely a gift to hobbyists, of course. The

CDP1861 formed the heart of RCA's Studio One home video game. In such games cost is probably the most important factor. Video-game-type graphic displays are now easily done on the ELF. The fourth article in the ELF series ("Build the PIXIE Graphics Display," Joseph A. Weisbecker, *Popular Electronics*, July 1977, page 41) outlined the hardware required and included a simple test program, but it was up to hobbyists to come up with video software to make the ELF earn its keep.

The Video Doodler program presents a winking cursor in the upper left-hand corner of the screen. By actuating toggle switches, the cursor can be made to move horizontally, vertically, or diagonally. As it moves, it either leaves behind a trail of white dots against the black background, or it "eats" previously written white dots and lines back to blackness. Once you fill the screen, one push of the INPUT switch wipes it clean again.

Memory Requirements

The only problem is the program's size. Within the limits of a typical ELF one-page memory system, there is no room left in memory after you toggle in the program to do any drawing on the screen. The only way out of this problem is to expand memory to at least two 256-byte pages. If you shop wisely, you can do this for less than \$9.00. Adding another page of memory requires only two additional 2101 static memory chips and a CD4042 complementary metal-oxide semiconductor (CMOS) latch. Figure 1 details an ELF two-page memory system.

If you do not intend to add much more memory beyond two or three pages, you might consider replacing

Text continued on page 218

About the Author

Jeff Duntemann works for Xerox Corp. He has built a small robot (named Cosmo) that he controls with his computer, and enjoys amateur radio operation (as KB2JN). His writing is not confined to technical articles; he has had a science fiction story published in Isaac Asimov's Science Fiction Magazine.

OSBORNE/McGraw-Hill presents . . .

An Introduction to Microcomputers

The World's
Best Selling
Microcomputer Text
REVISED!



An Introduction to Microcomputers: Volume 1 — Basic Concepts
2nd Edition, by Dr. Adam Osborne

This new edition of Volume 1, published in April 1980, incorporates all of the newest technology. Basic microprocessor concepts are discussed in terms of modern hardware configurations, and examples of common microcomputer applications are drawn from today's most popular devices. For example, the logic instructions and programming concepts of the new 16-bit microprocessors are discussed in detail, and current logic distribution configurations are used throughout the text, illustrations and examples. Programming mnemonics conform to the newly proposed IEEE standard. This book is the first in print to use them, a feature which will be appreciated by beginners and professionals alike.

Basic Concepts presents the fundamental logic framework upon which microcomputer systems are built, so that the reader can evaluate the applicability of microcomputers to any practical problem. Using concepts that are common to all microprocessor systems, **Volume 1** develops a detailed picture of what a microcomputer can do, how it does what it does, and how its particular capabilities can best be applied.

Over 200,000 copies sold since December 1975. Now completely revised! The most current and topical book on the market!

#34-9, \$12.50

Also in the Introduction to Microcomputers series:

Volume 0 — The Beginner's Book
by Adam Osborne



This book introduces computer logic and terminology to the complete beginner in the field of microcomputers. Numerous illustrations and photographs combine with clear, easy-to-follow text to provide an elementary but broad-based background.

#26-8 \$7.95

Volume 2 — Some Real Microprocessors
by Adam Osborne et al.

This unique reference provides objective descriptions of virtually every microprocessor on the market today. Lets you know what's available, how they work (or don't work), and how to use them. Loose-leaf. Binders and yearly updates (six issues) sold separately.

Vol. 2 book, 1978 ed.	#15-2	\$25.00
Vol. 2 binder	#16-0	\$ 5.00
Vol. 2 1978/79 updates	#97	\$25.00

Volume 3 — Some Real Support Devices
by Jerry Kane et al.

Same objective, in-depth coverage as Volume 2, but applied to support devices: memory, data converters, data communication devices, direct memory access controllers, busses, and much more. Loose-leaf. Binders and yearly updates (six issues) sold separately.

Vol. 3 book, 1978 ed.	#18-7	\$15.00
Vol. 3 binder	#19-5	\$ 5.00
Vol. 3 1978/79 updates	#98	\$25.00

Combined update subscriptions can be purchased for both Volume 2 and 3, a total of twelve update issues.

#99 \$40.00

Book	Price	Quantity	Amount
#			
#			
#			
#			
Subtotal			
California residents tax			
Shipping			
TOTAL			

Calif. residents add 6% sales tax.

S.F. BART residents add 6 1/2% sales tax.

No tax on update subscriptions.

SHIPPING (Shipping for large orders to be arranged)

☐ All foreign orders \$4.00 per item for air mail

☐ No charge in the U.S. on update subscriptions

☐ \$0.75 per item 4th class in the U.S. (allow 3-4 weeks)

☐ \$1.25 per item UPS in the U.S. (allow 10 days)

☐ \$2.50 per item special rush shipment by air in the U.S.

For faster shipment or credit card, phone (415) 548-2805

NAME: _____
ADDRESS: _____
CITY: _____ STATE: _____
ZIP: _____ PHONE: _____

OSBORNE/McGraw-Hill

630 Bancroft Way, Dept. B4

Berkeley, CA 94710

(415) 548-2805

TWX 910-366-7277



Number	Type	+5 V	GND
IC1	4042	16	8
IC2	2101	22	8
IC3	2101	22	8
IC4	2101	22	8
IC5	2101	22	8

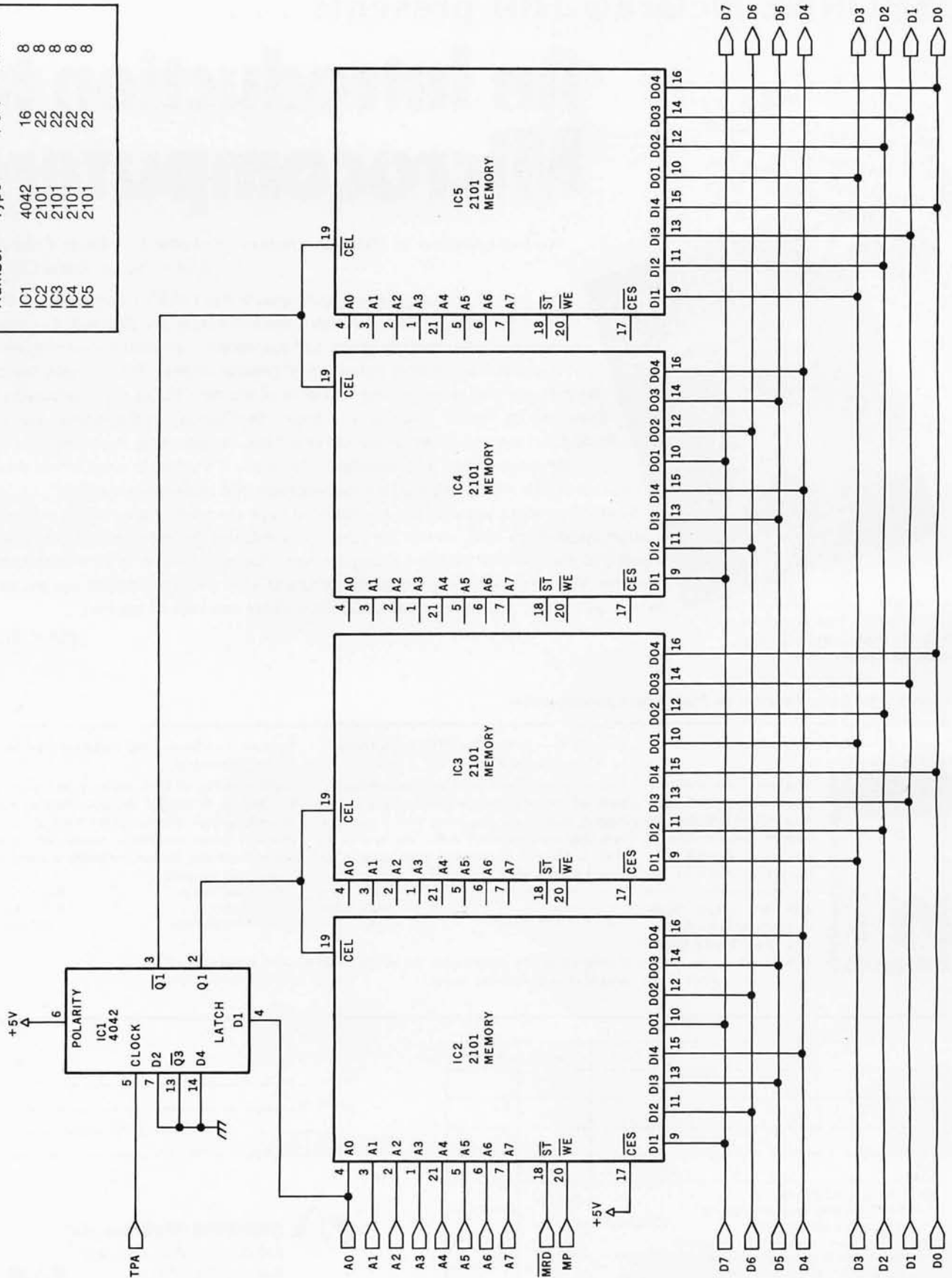


Figure 1: Schematic diagram of a two-page programmable-memory system that can easily be added to a COSMAC ELF microcomputer. Pins 17 and 22 of the memory parts should not be connected together. Instead of 2101 memory devices, it is possible to substitute CMOS 5101, 74C920, or CDP1822CD parts. Use of complementary metal-oxide semiconductor memories enables the use of batteries to retain data in memory even when the main power supply is shut off.

Telecommunications Software Professionals:

OUR COMPUTERS WANT TO TALK WITH YOU

Some of the best computer systems in the business are looking for new ways to express themselves. Maybe you're the one to make this happen.

Wang is one of the top manufacturers of computers and word processing systems of all sizes. We're #1 in CRT-based word processing, #2 in small business computers. Now we're seeking to establish and maintain a leading posture in telecommunications, involving state-of-the-art networking and protocols.

Wang is committed to providing the resources you need to get results. We're moving into a brand new facility—a 12 story tower with fully modern equipment. The right kind of environment for you to achieve your best. We're determined to make Wang the best in telecommunications, so join us and together we'll start new telecommunications projects.

Last year this group grew 400%. We expect our telecommunications development and support staff to double in the next 12 months, and you can shape your career as you grow with us.

If you're talented in telecommunications...then let our computers know what you have to say.

Telecommunications Systems Programmers Associate to Senior Level Project Leaders

If you're a design oriented software development specialist who is not only comfortable with on-going telecommunications standards such as 3270, HASP, x.25 and SDLC/SNA but also capable of addressing the long range projects of the future in protocol and networking development, then we may have a position for you. Systems Programmers are needed to design, develop and maintain telecommunications systems for our total product line. Positions exist in our Development, Systems Engineering, and Product Support areas and offer a challenge unparalleled in other organizations. These positions are new and represent ground floor opportunities for total systems responsibilities.

Telecommunications Software Technical Writers

Positions exist for qualified writers who are interested in researching, organizing, and writing telecommunications related documents. Projects include Operators' Manuals, Network/Operations/Communications Managers' Manuals, Technical Staff Programmers' Guides and data sheets. Two or more years technical experience and a Bachelor's Degree are required.

If you are interested in the above positions please send your resume, including salary history to Susan Morse, Professional Recruiter, Wang Laboratories, Inc., Dept. B-1, One Industrial Avenue, Lowell, MA 01851

Telecommunications Systems Support Analysts

Software verification is this group's specialty. We make crucial decisions regarding the effectiveness of new developments in a hands-on environment, from minis to mainframes.

Working with all Wang's product lines you will be responsible for the support activities of all Wang's TC products and write telecommunication application software in higher level languages. Frequent interaction with marketing and development will be required.

The Telecommunication Support Analyst will support the pre and post development and pre-installation activities as well as participate in the definition, specification and evaluation of Wang's telecommunication products.

To qualify, you should have a strong data communications background including experience with protocols, modems, networks, and telecommunication hardware and software. Prior experience with large IBM systems 3270 networks or RJE terminals is desirable.

Telecommunications Remote Diagnostic Engineers

Individuals with strong hardware background (BSEE or MSEE) are needed to locate potential problem areas in the entire Wang line of telecommunication products.

You will design fault isolation diagnostics and power-up diagnostic software and real-time, remote, micro-code, environment utilizing micros through mainframe. You must be able to effectively interface with both hardware and software development teams.

If you are interested in the above positions please send resume including salary history, to Thomas Bahio, Professional Recruiter, Wang Laboratories, Inc., Dept. B-1, One Industrial Avenue, Lowell MA 01851.

Wang offers excellent salary and benefits including profit sharing, stock purchase plan, stock bonus plan, medical and dental insurance.

We are an affirmative action employer



WANG

Making the world more productive.

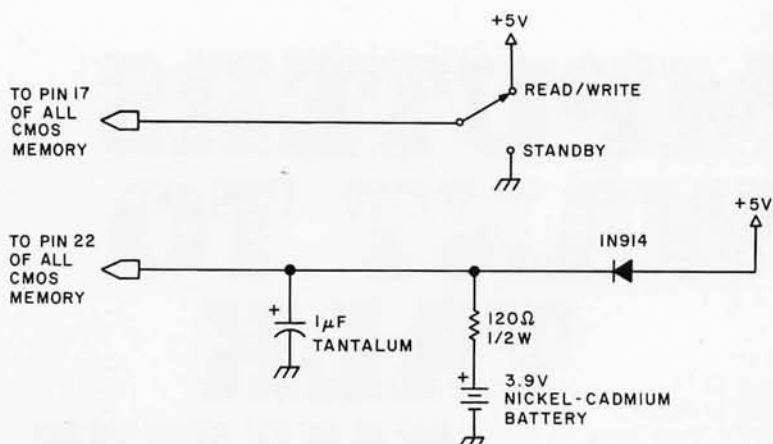


Figure 2: Memory data-retention circuit for CMOS memories. Do not use this circuit with a 2101-type memory. The nickel-cadmium battery cells charge during normal operation, and thereafter maintain data in the memory when main power has been turned off.

Text continued from page 214:

your 2101 devices with CMOS 5101 or CDP1822 memory. A small 3.9 V battery can allow data to be retained in CMOS memory even when the main power is off, thus keeping you from facing the exasperating job of toggle-loading 195 bytes every time you want to show off the Doodler.

If you can locate a 3.9 V nickel-cadmium battery, the circuit in figure 2 can be built and then forgotten about. The ni-cad will charge while the power is on, and keep memory alive when power is off. If you

operate your ELF at least a few hours per month, the battery will never fully discharge.

Register Use

The Doodler program makes heavy use of the COSMAC general-purpose registers. A register-use summary is given in table 1 to keep everything straight while you are trying to understand the program's operation.

Where Is the Cursor?

It takes two pointers to specify a

cursor position on the screen. The *byte pointer* is the memory address of a single byte somewhere among the 256 bytes displayed on the screen.

The *bit pointer* is a byte stored in half of a general-purpose register. Only one bit of this byte ever contains a binary 1. This bit represents the position of the cursor within the byte indicated by the byte pointer.

The Doodler actually has two sets of pointers for its cursor. The permanent pointers contain the actual position of the cursor at any given time. The temporary pointers are modified during each scan of the toggle switches.

The toggle switches are read and separately tested by shifting bits out of the D register (COSMAC's accumulator). Each of the first five switches controls a program function. If the first toggle switch is actuated, the temporary bit pointer is shifted one bit to the right. If during this shift the bit crosses over into the next byte, the temporary byte pointer is incremented by one.

Actuating the second toggle switch shifts the bit pointer to the left, and decrements the byte pointer if the bit crosses the border into the next byte leftward. The third toggle switch adds the hexadecimal value 08 to the byte pointer. This does not affect the

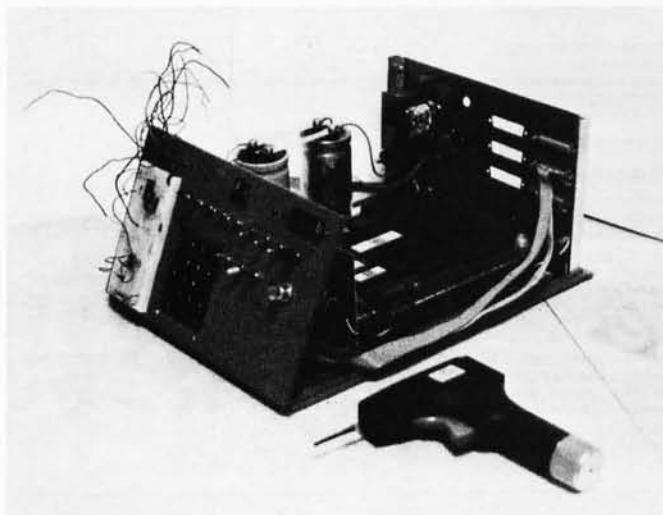


Photo 1: The author's homebrew COSMAC computer system. It contains 2560 bytes of memory and uses a full 16-bit address display. Important processor and input/output signals are brought out through the front panel for ease in breadboarding.

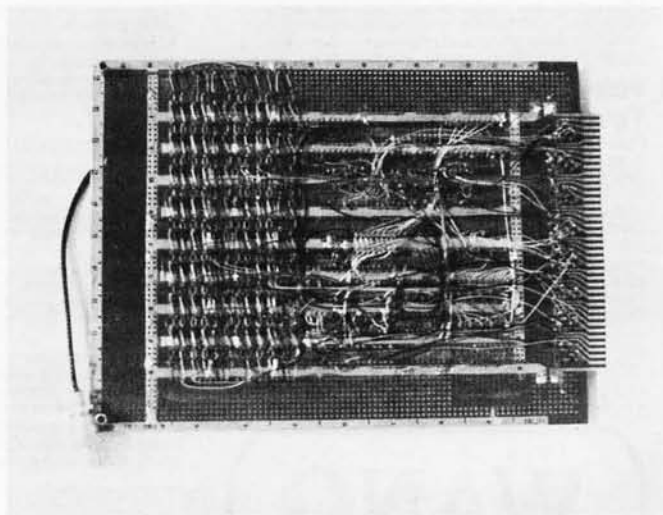
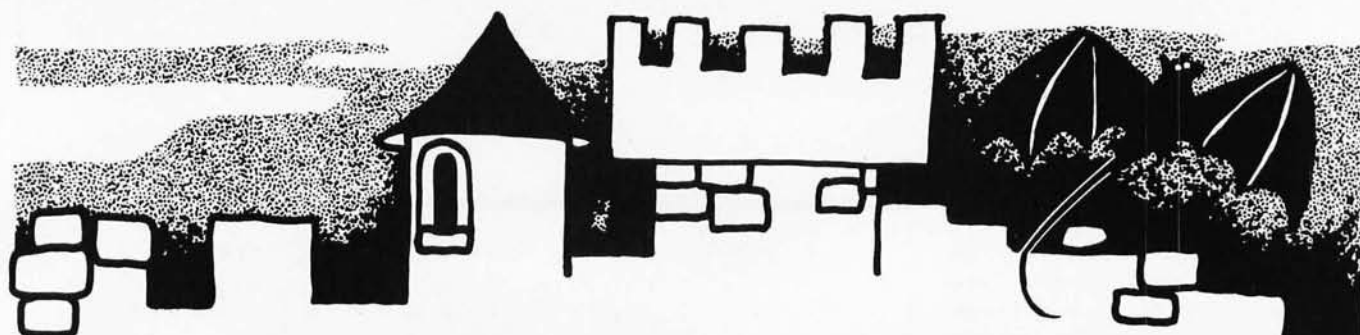


Photo 2: Bottom side of the processor board. Six weeks of even-ing work with an OK Tool Hobby Wrap wire-wrap gun and 150 feet of wire were needed to complete the connections.



Did you read about the Dungeonmaster who became so enchanted playing a real life version of Dungeons and Dragons that he disappeared for a month?

You'll be able to hold on to reality just a little better when you play the **Dunjonquest™** computer version, the greatest of all the role-playing fantasies.

But don't bet on it.

Sit at your computer. You're the hero. Enter the Dunjonquest "Temple of Apschai" and into the greatest fantasy adventure you've ever experienced. The Temple has over 200 rooms and catacombs in which lurk more than 30 kinds of monsters and beasts ready to do you in—in real time—before you can reach any of the 70 or so treasures waiting for the hero. You may spend days, weeks, months... the rest of your life... striking at the forces of evil, or running from them, or calling on powers you can never completely understand. Always, always demonstrating in varying degrees your strength, constitution, dexterity, intelligence, intuition, the force of your ego.



Unlike chess or bridge or monopoly, this role-playing game—like other good role-playing games—is an **experience** rather than a game: it is not played so much as it's lived or experienced. Your alter ego goes forth into the world of demons and darkness, dragons and dwarves. Your character will do whatever you want him (or her or it) to do.



Actual photo of screen during a Dunjonquest game. In Room 3 in the Temple of Apschai, our hero observes two treasures unattended by dragons, monsters or demons... for the moment. He is completely free of wounds; he is not at all fatigued. He carries 44 pounds of armor and 19 arrows in his quiver. He has already slain five demons. Will he capture the treasures before moving on... or before the forces of darkness intercept him?

"The Temple..." comes complete with a superbly illustrated 56-page rule book and cassette program, designed to operate with the Level II 16K TRS 80, the PET 32K or the Apple II 48K (Applesoft) computer. Only \$24.95 complete, **including** shipping and handling on orders placed within the next 30 days. (Apple or TRS 80 disk available for \$29.95).

Dunjonquest's "The Temple of Apschai" is **guaranteed** to be the best version of Dungeons and Dragons/ Dragons and Dungeons. It's a product of the two guys who **are** Automated Simulations: Jim Connelley and Jon Freeman. Jim is a Dungeon Master, running continuous D & D campaigns. He's been a data processing professional with Westinghouse, GTE, Sylvania, Logisticon... an expert in computer-based math-modeling and in simulation of complex phenomena. Jon is a game player, designer and author. He's a frequent contributor to *Games* magazine; his book, "The Playboy Winner's Guide to Board Games" is a paperback best-seller.

As we said, **guaranteed**: Guaranteed to be the best version; guaranteed that you'll be happy with it. Order now, use it for two weeks. If you don't enjoy completely this fantasy adventure experience that goes beyond all others, send it back to us. We'll refund your money in full; no questions asked.

Master Charge or Visa card holders: charge "The Temple of Apschai" to your credit card. Just call our toll free number: (800) 824-7888, operator 861 (In California, call operator 861 (800) 852-7777. In Hawaii and Alaska, operator 861 (800) 824-7919) and you can begin enjoying your Dunjonquest game in days. Or send your check for \$24.95* (or \$29.95)* to



Automated Simulations

Dept. 3
P.O. Box 4232
Mountain View,
CA 94040



*California residents, please add 6.5% tax.

cursor's horizontal position (the bit pointer remains the same), but the cursor is moved down one row. Similarly, the fourth toggle switch subtracts hexadecimal 08 from the byte pointer. This makes the cursor move one row upward.

Only after the toggle switches have been completely scanned are the values in the temporary pointers transferred to the permanent pointers, and the cursor moved to its new position. This makes motion on the diagonal possible without visible up-and-across motion on the way to the new position. If all four toggles are actuated, the cursor does not move. The four motions cancel one another before any information is transferred to the permanent pointers.

The fifth toggle switch determines whether the bit written into the cursor position will be a white dot or a blank space.

Operation of Subroutines

Two subroutines accomplish the transfer of information from temporary to permanent pointers and the final writing of the cursor bit onto the screen. If the fifth toggle is actuated, subroutine BNKWRT does the job and writes a 0 (blank) into memory at the cursor position. If the fifth toggle

is not actuated, the job is done by DOTWRT, and the cursor leaves a white dot behind in memory and on the screen.

A third subroutine, DELAY, slows the process down so that you can direct the cursor intelligently on the

screen. The execution time for DELAY (and thus the speed at which things happen) is determined completely by the constant that begins at memory location 0046. You increase or decrease this constant to slow the program or speed it up.

Text continued on page 224

Register	High Byte	Low Byte
0	Direct-memory-access pointer	Direct-memory-access pointer
1	Interrupt program counter	Interrupt program counter
2	Stack pointer	Stack pointer
3	Main program counter	Main program counter
4		
5	BNKWRT program counter	BNKWRT program counter
6	DOTWRT program counter	DOTWRT program counter
7		
8	DELAY program counter	DELAY program counter
9	Temporary byte pointer	Temporary byte pointer
A	Inter-shift	Inter-shift
B	D storage	D storage
C	Permanent byte pointer	Permanent byte pointer
D		
E	Blanking pointer	Blanking pointer
F	Delay-timing constant	Delay-timing constant

Table 1: Use of COSMAC 1802 16-bit registers by Video Doodler program.

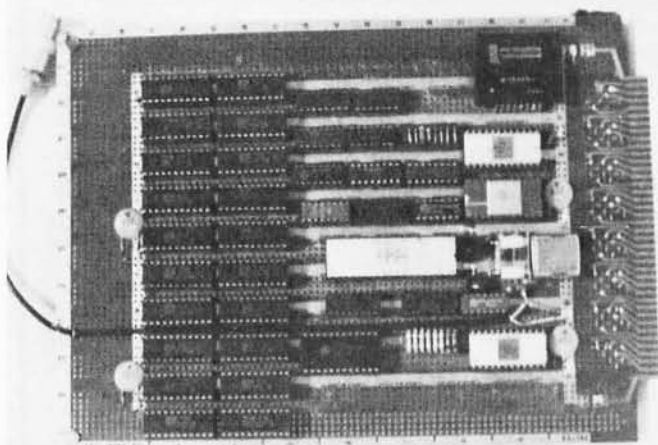


Photo 3: Component side of the processor board. The video signal is brought off the board by the miniature 75-ohm coaxial cable.



Photo 4: Display produced using the Video Doodler. The isolated dot at the center right is the blinking cursor.

ALMOST PERFECT.

The **MAGIC WAND**TM is the most powerful, most flexible, most reliable, *most usable* word processing software available for a CP/M[®]-based computer.

That's not bragging. That's just telling it like it is.

The MAGIC WAND is the best word processing software ever written for a microcomputer. It can do more work in less time with higher quality than any other product you can buy.

The MAGIC WAND is a rock solid piece of software. The command structure is simple and logical and complete. We have not tossed in features without thought to the overall design of the package. Nor have we included any feature that is not thoroughly implemented. The programs are crash-proof and completely reliable.

And the system is supported by what we are told is the best user's manual ever produced for microcomputer software. It contains a step-by-step instructional program designed for the novice. The trainee uses sample files from the system disk and compares his work to simulated screens and printouts in the manual.

Support doesn't stop when you buy the package. As a registered user, you receive our bi-monthly newsletter which answers questions, reports upgrades and teaches new applications of the MAGIC WAND.

It's through a lot of hard work that we are able to offer you a product that is "almost perfect," but we aren't about to stop working until we can say that the MAGIC WAND is perfect.

Full screen text editing

The MAGIC WAND has probably the most responsive and easy-to-use editor available for either a serial or DMA terminal. It uses only single stroke control keys to give command and takes advantage of the special function keys on your terminal whenever possible. In addition, you can set up library files with coded sections that you can merge by section name.

Full text formatting commands

The MAGIC WAND allows you to set the left, right, top and bottom margins, page length, indentation, paragraph indentation, (including "hanging" paragraphs), text left flush, right flush, justified (two ways), literal or centered, variable line and pitch settings, variable spacing (including half lines), bold face, underlining (solid or broken), conditional hyphenation, sub- and superscripting. You may change any of these commands at run-time *without reformatting the file*.

Merging with external data files

You may access any external data file, with either fixed length or sequential records. The MAGIC WAND converts the record into variables that you define and can use like any other variable. Of course, you may use the data for automatic form letter generation. But you can also use it for report generation.

Variables

You may define up to 128 variables with names of up to seven characters. The current value of a variable may be up to 55 characters, and you may print it at any point in the text without affecting the current format. Although the MAGIC WAND stores the variables as strings, you may also treat them as integer numbers or format them with commas and a decimal point. You may increment or decrement numeric variables or use them in formatting commands.

Conditional commands

You may give any print command based on a run-time test of a pre-defined condition. The conditional test uses a straight-forward IF statement, which allows you to test any logical condition of a variable. You may skip over unneeded portions of the file, select specific records to print, store more than one document in a single file, etc.

True proportional printing

The MAGIC WAND supports proportional print elements on NEC, Diablo and Qume printers. Other formatting commands, including justified columns, boldface, underline, etc., are fully functional while using proportional logic.

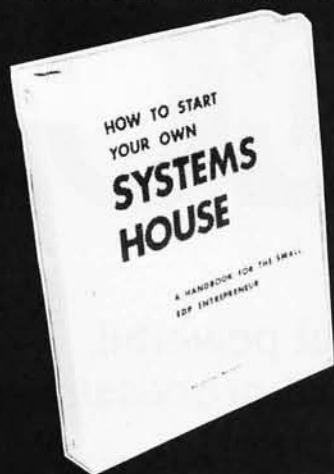
Available on 8" soft-sectored and 5 1/4" Northstar or Micropolis (hard or soft sectored) diskettes, as well as ONYX hard disk. Terminals supported include—ADDS, Beehive, Cromemco, Dynabyte, Hazeltine, Heath, Imsai, Intertec, Lear Siegler, Microterm Act V, Perkin Elmer, Sol VDM1, Soroc, TEC, TEI, Televideo, TRS80 Mod II, Vector Graphics, plus a variety of video boards.

small business applications, inc.

3220 Louisiana • Suite 205 • Houston, Texas 77006 • 713-528-5158

CP/M is a registered trademark of Digital Research Corp

YOU TOO can become a successful computer ENTREPRENEUR!



HOW TO START YOUR OWN SYSTEMS HOUSE is a practical step-by-step guide for the EDP professional or small businessman who wants to enter the micro-computer systems business.

Written by the founder of a successful systems house, this fact-filled 220-page manual covers virtually all aspects of starting and operating a small systems company. It is abundant with useful, real-life samples: contracts, proposals, agreements and a complete business plan are included in full, and may be used immediately by the reader.

Proven, field-tested solutions to the many problems facing the small systems house are presented.

From the contents:

- New Generation of Systems Houses • The SBC Marketplace • Marketing Strategies • Vertical Markets & IAPs • Competitive Position/Plans of Major Vendors • Market Segment Selection & Evaluation • Selection of Equipment & Manufacturer • Make or Buy Decision • Becoming a Distributor • Getting Your Advertising Dollar's Worth • Your Salesmen: Where to Find Them • Product Pricing • The Selling Cycle • Handling the 12 Most Frequent Objections Raised by Prospects • Financing for the Customer • Leasing • Questions You Will Have to Answer Before the Prospect Buys • Producing the System • Installation, Acceptance, Collection • Documentation • Solutions to the Service Problem • Protecting Your Product • Should You Start Now? • How to Write a Good Business Plan • Raising Capital

6th edition, March 1980 220 pages

Essex Publishing Co. DEPT. 3
285 Bloomfield Avenue Caldwell, N.J. 07006

I would like to order **HOW TO START YOUR OWN SYSTEMS HOUSE** at \$36.00 (New Jersey residents add 5% sales tax)

☐ Check Enclosed ☐ VISA ☐ Mastercharge

Name _____

Address _____

City _____

State _____ Zip _____

Card # _____ exp. _____

For immediate shipment on credit card orders call (201) 783-6940

Listing 1: Video Doodler program in machine code for the COSMAC ELF.

Address	Hexadecimal Code	Comments
00	F8 00 B1 B2 B3 B5	Initialize high-order registers and byte pointers
06	B6 B8 A9 AB	
0A	F8 01 B9 BB BD	
0F	F8 80 AC AA	Initialize bit pointers
13	F8 28 A1	Initialize interrupt PC
16	F8 FF A2	Initialize stack pointer
19	F8 66 A3	Initialize MAIN PC
1C	F8 5A A5	Initialize BNKWRT PC
1F	F8 4F A6	Initialize DOTWRT PC
22	F8 45 A8	Initialize DELAY PC
25	D3	Begin executing MAIN PC
INTERRUPT		
26	72 70	Restore D, X, & P
28	22 78 22 52	Push P, X, & D onto stack
2C	C4 C4 C4	NOP s for sync delay
2F	F8 01 B0 F8 00 A0	Re-point R0 to display page
35	80 E2	Prepare for first DMA cycle
37	E2 20 A0	DMA reset
3A	E2 20 A0	DMA reset
3D	E2 20 A0	DMA reset
40	3C 35	Test for refresh done
42	30 26	Go to return
DELAY		
44	D3	Return to MAIN
45	F8 07 BE	Load timing constant into RE
48	2E	Decrement RE
49	9E	Load RE.1 into accumulator
4A	3A 48	Loop again if not done
4C	30 44	Go to return
DOTWRT		
4E	D3	Return to MAIN
4F	89 AB	Update byte pointer
51	8A AC	Update bit pointer
53	EB	X = B
54	F1	Combine bit pointer & screen via OR
55	5B E2	Write dot to screen
57	30 4E	Go to return
BNKWRT		
59	D3	Return to MAIN
5A	89 AB	Update byte pointer
5C	8A AC	Update bit pointer
5E	FB FF	Inverts D via XOR IMMEDIATE
60	EB	X = B
61	F2	Combine bit pointer & screen via AND
62	5B E2	Write blank to screen
64	30 59	Go to return
MAIN		
66	E2 69	Turn CDP1861 on
68	3F 75	Skip clearing routine unless INPUT pressed
6A	F8 FF AD	Point RD to top of display page
6D	ED	X = D
6E	F8 00 73	Store 00 on screen & decrement pointer
71	8D	Load pointer into D
72	3A 6E	Loop again if not done
74	5D	Store 00 in last byte of display page
75	E2 6C	Input toggles
77	F6 33 89	Tests "move right" bit & branches
7A	F6 33 98	Tests "move left" bit & branches
7D	F6 33 A7	Tests "move down" bit & branches
80	F6 33 AF	Tests "move up" bit & branches
83	F6 3B B7	Tests dot/blank bit
86	7B	Turn Q on
87	30 B7	Go to EXECUTE
89	BA	Store D in RA.1
8A	8A	Fetch temporary bit pointer
8B	F6 33 92	Shift right and test for border cross

Listing 1 continued on page 224

Data Terminals From MICROMAIL? YES,

Because We Offer....

...A 'Personal Approach'

Towards the Quick and Efficient Handling of Your Individual Order.

...Inventory.

The Equipment You Select is Readily Available from Our Stock.

...Terminals Only.

We Specialize in Data Terminal Equipment.



DIABLO 1650

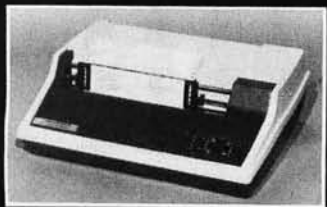
- Prints at 40 cps, using 88, 92, or 96 char. metalized printwheels.
- Vertical resolution 1/48"; Horizontal 1/120". Capable of proportional spacing, bidirectional printing, and graphics under software control.
- Bidirectional normal and direct tabs. Left, right, top and bottom margins.

R.O. \$2890.00
KSR \$3285.00

DIABLO 1640

- Uses plastic printwheel and prints at 45 cps. Otherwise, shares identical features with 1650 including:
 - Friction or tractor feed, up to 15" wide.
 - Cartridge ribbon, fabric or carbon.

R.O. \$2745.00
KSR \$3140.00



T.I. 810

- Includes upper/lower case option.
- Bidirectional printing at 150 cps.
- Tractor-feed forms, 3" to 15" wide.

\$1599.00

Options:

- Forms length control — \$100.00
- Vertical Format Control with Compressed Print — \$125.00



DEC LA 34

(Shown with optional forms tractor and numeric keypad).

- Prints 10, 12, 13.2, or 16.5 characters per inch, upper/lower case.
- 2, 3, 4, 6, 8, or 12 lines per inch.
- Friction feed, paper width to 15 inches.

\$999.00

Options:

- Numeric keypad — \$80.00
- Adjustable forms tractor — \$130.00



ANADEX DP-9500/9501

- High Density Graphics
- Parallel, RS-232C, and Current Loop interfaces standard.
- Double width printing
- 132/175 or 132/220 columns.
- 50 to 200+ lines/min., 150/200 CPS 9 x 7/7 x 9 font or 120/200 CPS with 11 x 9/7 x 9 font.
- 9-wire print head, 650 million character life.
- Bi-Directional printing with shortest distance sensing logic.
- Adjustable width tractor paper feed.
- Complete forms control.

\$1399.00



SOROC IQ 120

- Displays 80 x 24, upper/lower case.
- Separate numeric keypad and cursor keys.
- Protected fields displayed at reduced intensity.

\$740.00



SOROC IQ 140

- 117-key detachable keyboard with numeric cluster and cursor control.
- Insert/delete line, insert/delete character.
- Underline, blink, reverse, 1/2 intensity, protected and blank fields.
- Printer port with independent baud rate — prints line, partial or full screen.

\$1130.00



TEC 510

- Reverse video, blinking, underline, 1/2 intensity, protected fields, blank security field.
- Transmit character, line, partial page, page, or unprotected data.
- Cursor up, down, left, right, return, home, plus load and read.

\$699.00



TELETYPE 43

- Prints 132 columns, upper/lower case with true descenders.
- 30 character/second print speed. 110-300 baud.
- Uses 12" wide by 8.5" pinfeed paper.
- Print position scale, paper guide and supply rack.

\$999.00

Write or Call In for Our Free Catalogue!

MICROMAIL

MICROMAIL • BOX 3297 • SANTA ANA, CA 92703

(714) 731-4338

Visit MICROMAIL at the NCC-Personal Computing Festival, Booths 65-66!

TO ORDER: Send check or money order to: MICROMAIL, P.O. Box 3297, Santa Ana, CA 92703. Personal or company checks require two weeks to clear. Terminals in stock are shipped the business day after receipt of certified funds. All equipment includes factory warranty.

SHIPPING: We ship freight collect by UPS when possible. Larger terminals are shipped by motor freight. Air and express delivery is available on all products.

HANDLING: All orders are subject to MICROMAIL's handling charges. Less than \$750.00, add 3%. \$750.00 to \$2,000.00, add 2%. Over \$2,000.00, add 1%.

Listing 1 continued:

8E	AA				Update bit pointer
8F	9A	30	7A		Put old D back in D & return to shift & test
92	19				Increment temporary byte pointer
93	76				Shift bit back into other end of bit pointer
94	AA				Update bit pointer
95	9A	30	7A		Put old D back in D & return to shift & test
98	BA				Store D in RA.1
99	8A				Fetch temporary bit pointer
9A	FE	33	A1		Shift left and test for border cross
9D	AA				Update bit pointer
9E	9A	30	7D		Put old D back in D & return to shift & test
A1	29				Decrement temporary byte pointer
A2	7E				Shift bit back into other end of bit pointer
A3	AA				Update bit pointer
A4	9A	30	7D		Put old D back in D & return to shift & test
A7	BA				Store D in RA.1
A8	89				Fetch temporary byte pointer
A9	FC	08			Add 08 to D & put sum in D
AB	A9				Update byte pointer
AC	9A	30	80		Put old D back in D & return to shift & test
AF	BA				Store D in RA.1
B0	89				Fetch temporary byte pointer
B1	FF	08			Subtract 08 from D & put difference in D
B3	A9				Update byte pointer
B4	9A	30	83		Put old D back in D & return to shift & test
EXECUTE					
B7	D5	D8	D6	D8	Generate one "wink" of cursor
BB	31	C0			Go to M(C0) if Q is on
BD	D6				Call DOTWRT & write on screen
BE	30	68			Go to test for clear
C0	D5				Call BNKWRT & write on screen
C1	7A				Turn Q off
C2	30	68			Go to test for clear

Text continued from page 220:

One novel effect may be produced by changing the sequence of bytes beginning at location 0046 to 01, AE, 2E, 8E. This permits the program to run at maximum speed. The cursor will streak across the screen almost too quickly for the eye to follow. As you flip the toggle switches up and down, it will paint a crazy-quilt pattern across the screen.

To clear the screen, simply hold INPUT depressed while flipping RUN up. This branches to a simple routine that writes zeroes consecutively in memory from the top of the displayed page on down.

Design Storage

Saving a design produced with the Doodler for later display involves dumping the contents of the display page of memory into some mass-storage medium. Lacking a cassette tape interface or some other storage, you will have to step through memory and write the hexadecimal contents of each byte in the page.

Doodle away!■



When no one has your floppy disks in stock... here's a new four letter word to use:

The word is KYBE. Because KYBE can ship any model floppy disk, data cassette or mag card in only two days. You'll get the same high performance products we've built for OEM's for years. Consistent quality media that meets the most demanding specifications. The full line is competitively priced, backed by an unconditional 90 day warranty and inventoried for fast delivery.

Call toll free (800) 225-8715.

Dealer inquiries invited



KYBE

Dennison KYBE Corporation
132 Calvary Street, Waltham, Mass. 02154
Tel. (617) 899-0012; Telex 94-0179
Outside Mass. call toll free (800) 225-8715
Offices & representatives worldwide

Great Games!
Bargain
Price!

Unbeatable
documentation!
Magazine,
cassette or disk!

We want to buy your S-80,
APPLE, and ATARI
programs!

SoftSide TM **Now**  **Too!**
ATARI [®] A Warner Communications Company 

SoftSide: S-80* Edition 12 issues, \$18., Bulk Rate: ● \$25., 12 issues, First Class; \$39.50., 6 issues with cassette; ● \$69., 6 issues with diskette.

SoftSide: Apple* Edition \$15., 12 issues, Bulk Rate; ● \$22., 12 issues, First Class; ● \$69. 6 issues with diskettes.

SoftSide: Atari Edition \$15., 12 issues, Bulk Rate; ● \$22., 12 issues First Class

PROG/80 . . Programming Methods, Utility Programs, Timesharing Section, Reviews, Hardware Projects, \$15. 6 issues, Bulk Rate, ● \$21. 6 issues, First Class.

USE YOUR MASTERCHARGE OR VISA AND CALL TOLL-FREE 1-800-258-1790

(In NH call 673-5144) SoftSide Publications, P.O. Box 68, Milford, NH 03055

Buy SoftSide at these dealers:

Datel Systems
1211 Ave. of Americas
New York, N.Y. 10036
Personal Computer
South 104 Freya Suite 104
Spokane, WA 99202
Computerland
1500 S 336 St.
#12 Parkway Center
Federal Way, WA 98003
Byte Shop
6019 W. Layton
Greenfield WI 53220
Computerland
10111 W. Capitol Dr.
Milwaukee, WI 53222
Team Elect.
2321 E. Claire
Eau Claire, WI 54701
Ye Old Computer Shop
1301 George Washington Way
Richland, WA 99352
Camera & Computer Emporium
921 Southwest Morrison
Portland, OR 97205
Neighborhood Computer Store
13045 W. Alameda
Lakewood, CO 80215
Camera & Computer Emporium
16144 SE McLoughlin
Milwaukee, OR 97222

Byte Shop Computer Store
6041 Greenback Ln.
Citrus Hgts, CA 95610
Santa Rosa Computer Center
604 7th Street
Santa Rosa, CA 95454
Computerland
611 5th St.
Santa Rosa, CA 95404
Computerland
1077 Saratoga Sunnyvale Rd
San Jose, CA 95129
Micro Sun Computer Center
2989 N. Main
Walnut Creek, CA 94596
Computerland
6743 Dublin Blvd
Dublin, CA 94566
Byte Shop
1122 B St.
Hayward, CA 94541
Computerland
11074 San Pablo Ave.
El Cerrito, CA 94530
Computerland
4546 El Camino Real
Los Altos, CA 94022
Byte Shop
123 Yorba Linda Blvd.
Placentia, CA 92670

Computerland
289 E. Highland Ave.
San Bernardino, CA 92404
Computerland
4233 Convoy
San Diego CA 92111
Byte Shop
8038 Clairemont Mesa Blvd.
San Diego, CA 92111
Computerland
171 E. Thousand Oaks Blvd #1
Thousand Oaks, CA 91360
Computers Are Fun
2268 Westwood Blvd.
Los Angeles, CA 90064
Computerland
3152 E. Camelback Rd.
Phoenix, AZ 85016
Computer Room
1515 S. 150E
Salt Lake City, UT 84105
Byte Shop
6019 W. Layton
Greenfield, WI 53220
Byte Shop
3464 S. Acoma
Eaglewood, CO 80110
Computerland
1537 Howe Ave. #106
Sacramento, CA 95825

Computerworks
Liberty Plaza
1439 Post Rd E
Westport, CT 06880
Computers Plus
6120 6120 Franconia Rd.
Alexandria, VA 22310
Computerland
1520 E. Fowler Ave.
Tampa, FL 33612
Compu Shop Dallas
N. Central Espy
Dallas, TX 75234
Computerland of South Bay
16720 Hawthorne Blvd.
Lawndale, CA 90260
Computer Store
820 Broadway
Santa Monica, CA 90401
Computer Metrics Inc
1251 Broadway
El Cajon, CA 92021
Computerland
4546 El Camino Real
Los Altos, CA 94022
Capitol Computer Systems
3396 El Camino Ave.
Sacramento, CA 95821
Computer Haven
6 South St.
Milford, NH 03055

*TRS-80 is a trademark of Radio Shack and Tandy Corp. *Apple is a registered trademark of Apple Computer Co.

Book Reviews

TRS-80 Assembly Language Programming

William Barden Jr
Radio Shack, 1979
224 pages, softcover
\$3.95

"The goal of this book is to take a TRS-80 user

familiar with some of the concepts of programming in BASIC and introduce him to TRS-80 assembly language." With that statement in the preface, Mr Barden proceeds to do exactly that. He introduces the user of the Radio Shack TRS-80 computer to that mysterious element of programming called assembly language.

For you old-timers, *TRS-80 Assembly Language Programming* is a refreshing review of how we used to program way back in the good old days. For you novices, perhaps discouraged after trying to debug a BASIC program, this book is the change of pace you need. Throw away, or at least put aside, that BASIC

user's manual, type in "SYSTEM" when the prompt character appears, and load that Editor/Assembler or TBUG tape you just bought. Now you are going to see what computer programming is all about!

Although the author states that the Radio Shack Editor/Assembler package or its equivalent is not a requirement, you will miss half the fun of reading this book if you do not have it. Also, TBUG is recommended by the author in order to fully appreciate some material.

Barden has developed a unique presentation to introduce and explain the general concepts of the TRS-80 assembly language, the mnemonic system for the Z80 microprocessor. I say a unique presentation because this is the first assembly-language book which I have enjoyed reading. Barden is not averse to injecting a little humor into his writing. After all, who says that programming books should be all bits, bytes, and syntax restrictions?

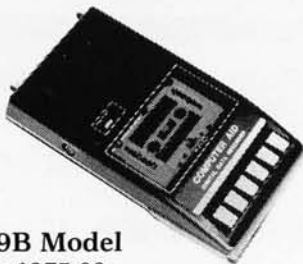
Barden begins with the architecture of the Z80, its instruction set, and its addressing modes. He then proceeds through the Editor/Assembler and the TBUG commands and formats in the first section of the book.

There is quite a bit of information packed within these first eighty-four pages, and it pays to read through Section 1 with a highlighting marker in hand. In fact, I skimmed through these pages for my first reading and then reread them more carefully the second time. This method tends to fix certain important details in your mind and will act as a referencing tool.

After you feel confident with the introductory material, move on to Sec-

DIGITAL DATA RECORDER MODEL CC-9B

For five years now, the CC series recorders have been the industry NRZ Asynchronous recorder standard. Now the B model sets a new standard in stability and reliability with its tachometer feedback LC stabilized motor circuit.



CC-9B Model
Price \$275.00

CC-9 Model \$225.00

4800 or 9600 Baud
(3" or 6" per second)

10⁻⁸ Error Rate
RS232 or TTL

In and Out
RTS motor start,
CTS Data start

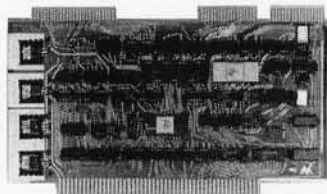
DB 25 or special
connector optional

110/220 - 50/60 Hz
Wow & Flutter $\pm .3\%$

Speed Stability (long term) $\pm .1\%$

DOUBLE DENSITY DISK CONTROLLER

The D4S Disk Controller for Z80 based S-100 systems. Gives you megabytes on line. Controls up to 8 each 5" or 8" drives (even mixed sets) single or double sided when used with CP/M 2.2. This second generation double density controller utilizes the WD 1797 chip to read all single and double density formats. Fits North Star and we have a CP/M 2.2 for NorthStar or any other Z80 based S100 machine. Has on board serial I/O Port for optional terminal or list device.



SPECIAL COMBINATION

Two Double Sided Double Density MFE Drives in simulated walnut case with Power Supply, cable, fan, D4S CONTROLLER and CP/M 2.2. Puts 2.3 Megabytes on line. \$2,250.00
Need 8" Double Sided Drives? - Call for quote.

NATIONAL MULTIPLEX CORPORATION

260 Lackland Drive East Middlesex, New Jersey 08846
Tel. (201) 356-9200 TWX 710-997-9530

MULTI-USER OASIS HAS THE FEATURES PROS DEMAND. READ WHY.

(THEN COMPARE.)

Computer experts (the pros) usually have big computer experience. That's why when they shop system software for Z80 micros, they look for the big system features they're used to. And that's why they like Multi-User OASIS. You will too.

DATA INTEGRITY: FILE & AUTOMATIC RECORD LOCKING

The biggest challenge for any multi-user system is co-ordinating requests from several users to change the same record at the same time.

Without proper co-ordination, the confusion and problems of inaccurate or even destroyed data can be staggering.

Our File and Automatic Record Locking features solve these problems.

For example: normally all users can view a particular record at the same time. But, if that record is being updated by one user, automatic record locking will deny all other users access to the record until the up-date is completed. So records are always accurate, up-to-date and integrity is assured.

Pros demand file & automatic record locking. OASIS has it.

SYSTEM SECURITY: LOGON, PASSWORD & USER ACCOUNTING

Controlling who gets on your system and what they do once they're on it is the essence of system security.

Without this control, unauthorized users could access your programs and data and do what they like. A frightening prospect isn't it?

And multi-users can multiply the problem.

But with the Logon, Password and Privilege Level features of Multi-User OASIS, a system manager can specify for each user which programs and files may be accessed — and for what purpose.

Security is further enhanced by User Accounting — a feature that lets you keep a history of which user has been logged on, when and for how long.

Pros insist on these security features. OASIS has them.

EFFICIENCY: RE-ENTRANT BASIC

A multi-user system is often not even practical on computers limited to 64K memory.

OASIS Re-entrant BASIC makes it practical. How?

Because all users use a single run-time BASIC module, to execute their compiled programs, less

memory is needed. Even if you have more than 64K, your pay-off is cost saving and more efficient use of all the memory you have available — because it services more users.

Sound like a pro feature? It is. And OASIS has it.

AND LOTS MORE...

Multi-User OASIS supports as many as 16 terminals and can run in as little as 56K memory. Or, with bank switching, as much as 784K.

OASIS IS AVAILABLE FOR: Altos; Bell Controls; Billings; Compucorp; Cromemco; Corvus; Delta Products; Digital Group; Digital Microsystems; Dynabyte; Godbout; IBC; Industrial Microsystems; Konan; Micromart; Micropolis; North Star; Onyx; SD Systems; Tarbell; Thinktoys; TRS 80 Mod. II; Vector Graphic; Vorimex; X Comp; and others.

Multi-Tasking lets each user run more than one job at the same time.

And there's our BASIC — a compiler, interpreter and debugger all in one. An OASIS exclusive.

Still more: Editor; Hard & Floppy Disk Support; Keyed (ISAM), Direct & Sequential Files; Mail-Box; Scheduler; Spooler; all from OASIS.

Our documentation is recognized as some of the

best, most extensive, in the industry. And, of course, there's plenty of application software.

Put it all together and it's easy to see why the real pros like OASIS. Join them. Send your order today.

CIRCLE WHAT YOU WANT

Product	Price with Manual	Manual Only
OPERATING SYSTEM (Includes: EXEC Language; File Management; User Accounting; Device Drivers; Print Spooler; General Text Editor; etc.) SINGLE-USER MULTI-USER	\$150 350	\$17.50 17.50
BASIC COMPILER/INTERPRETER/DEBUGGER	100	15.00
RE-ENTRANT BASIC COMPILER/INTERPRETER/DEBUGGER	150	15.00
DEVELOPMENT PACKAGE (Macro Assembler; Linkage Editor; Debugger)	150	25.00
TEXT EDITOR & SCRIPT PROCESSOR	150	15.00
DIAGNOSTIC & CONVERSION UTILITIES (Memory Test; Assembly Language; Converters; File Recovery; Disk Test; File Copy from other OS; etc.)	100	15.00
COMMUNICATIONS PACKAGE (Terminal Emulator; File Send & Receive)	100	15.00
PACKAGE PRICE (All of Above) SINGLE-USER MULTI-USER	500 850	60.00 60.00
FILE SORT	100	15.00
COBOL-ANSI '74	750	35.00

Order OASIS from:
Phase One Systems, Inc.
7700 Edgewater Drive, Suite 830
Oakland, CA 94621
Telephone (415) 562-8085
TWX 910-366-7139

NAME _____
STREET (NO BOX #) _____
CITY _____
STATE _____ ZIP _____
AMOUNT \$ _____
(Attach system description; add \$3 for shipping; California res dents add sales tax)
☐ Check enclosed ☐ VISA
☐ UPS C.O.D. ☐ Mastercharge
Card Number _____
Expiration Date _____
Signature _____

MAKES MICROS RUN LIKE MINIS.

OASIS

tion 2. Barden not only explains the how and the why of assembly language, but does so with useful examples of assembly-language coding. When he explains how to move data, he does it by coding the instructions and discussing the pertinent background. Arithmetic and comparison operations, logical and bit operations, shifting, strings, and tables are explained and presented with appropriate coding. If you have TBUG

or Editor/Assembler, you can code along with the text and actually see the operations being executed. This interactive approach works well.

In *TRS-80 Assembly Language Programming*, Barden handles the discussion of input/output (I/O) operations in an easily readable, yet informative fashion. After you complete this phase of your education, the mystery of assembly language magically

evaporates, and you are ready to tackle some sophisticated assembly-language programming.

But that's not all. Barden ties together most of the loose threads by including some interesting and useful subroutines. If you want a quick routine to fill a block of memory with any given 8-bit value or move the contents of a block of memory from one area to another, you need only assemble the subroutines already coded

for you and presented in the book.

Some arithmetic subroutines are also given: adding or subtracting operands containing up to 256 bytes, and multiplying or dividing 16-bit numbers. The compare subroutine is useful since it compares two 8-bit operands in true algebraic fashion. A routine for converting an 8-bit value into two American Standard Code for Information Interchange (ASCII) characters is included, as is a search subroutine. Finally, three subroutines that operate in a manner similar to the SET, RESET, and POINT statements in BASIC are given in the book.

Barden offers four complete assembly-language programs to start your program library off on the right foot. These perform the functions of writing data to the screen (good for looking at the contents of memory locations), moving patterns at high speed (great for animated graphics), a graphic bubble sort (good for demonstrations), and a program to play music via the cassette output port.

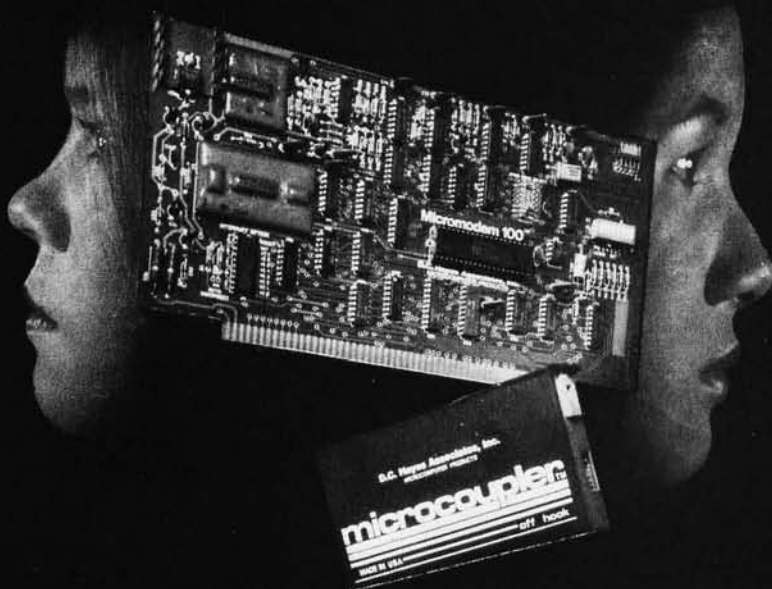
The appendices include a listing of the Z80 instruction set and a listing of the Z80 op codes. (For quick reference to Z80 mnemonics, Zilog offers the *Z80-CPU Programming Reference Card*, which I have found more convenient to use than flipping through the pages of a book.)

One further note: William Barden is also the author of *The Z80 Microcomputer Handbook* (Howard W Sams Co Inc, 1978), which takes the Z80 software a few steps deeper into the assembly-language forest.

So, what can you get for \$3.95 in addition to Barden's excellent introductory text dealing with Z80 assembly-language programming? Quite possibly you will get a hard-to-shake bite from the assembly-language bug. ■

Len Gorney
Box 91 RR 5
Salisbury Rd
Clarks Summit PA 18411

Future World-Today



Instant Nationwide Communications

A Micromodem 100 in your S-100 bus adds: Automatic Time Sharing, Nationwide Communications, Remote Data Base Access, TWX Simulation, Branch Office Communications, and much, much more. The D.C. Hayes Associates Micromodem 100 is compatible with 300 baud modems and the proposed IEEE S-100 bus standard. It is built to the highest quality standards and tested with automated equipment to assure reliability. Whether built-in to original equipment, or added on from your local computer store, the Micromodem 100 adds new communications capabilities to every S-100 bus computer.

D.C. Hayes Associates, Inc.

MICROCOMPUTER PRODUCTS

10 Perimeter Park Drive, Atlanta, Georgia 30341 (404) 455-7663

*Registered trademark of Apple Computer, Inc. Micromodem II is a registered trademark of D.C. Hayes Associates, Inc.

Your Discount Software Source!

STRUCTURED SYSTEMS

Cash Price/Manual

GENERAL LEDGER — Interactive and flexible system providing proof and report outputs. Customization of COA created interactively. Multiple branch accounting centers. Extensive checking performed at data entry for proof, COA correctness, etc. Journal entries may be batched prior to posting. Closing procedure automatically backs up input files. Now includes Statement of Changes in Financial Position. Requires CBASIC-2 **\$749/\$25**

ACCOUNTS RECEIVABLE — Open item system with output for internal aged reports and customer-oriented statement and billing purposes. On-Line Enquiry permits information for Customer Service and Credit departments. Interface to General Ledger provided if both systems used. Requires CBASIC-2 **\$749/\$25**

ACCOUNTS PAYABLE — Provides aged statements of accounts by vendor with check writing for selected invoices. Can be used alone or with General Ledger and/or NAD. Requires CBASIC-2 **\$749/\$25**

PAYROLL — Flexible payroll system handles weekly, bi-weekly, semi-monthly and monthly payroll periods. Tips, bonuses, re-imbursements, advances, sick pay, vacation pay, and compensation time are all part of the payroll records. Prints government required periodic reports and will post to multiple SSG general ledger accounts. Requires CBASIC-2 **\$749/\$25**

INVENTORY CONTROL SYSTEM — Performs control functions of adding and depleting stock items, adding new items and deleting old items. Tracks quantity of items on hand, on order and back-ordered. Optional hard copy audit trail is available. Reports include Master Item List, Stock Activity, Stock Valuation and Re-order List. Requires CBASIC-2 **\$449/\$25**

ANALYST — Customized data entry and reporting system. User specifies up to 75 data items per record. Interactive data entry, retrieval, and update facility makes information management easy. Sophisticated report generator provides customized reports using selected records with multiple level breakpoints for summarization. Requires CBASIC-2 **\$199/\$15**

LETTERRIGHT — Program to create, edit and type letters or other documents. Has facilities to enter, display, delete and move text, with good video screen presentation. Designed to integrate with NAD for form letter mailings. Requires CBASIC-2 **\$169/\$25**

NAD Name and Address selection system — interactive mail list creation and maintenance program with output as full reports with reference data or restricted information for mail labels. Transfer system for extraction and transfer of selected records to create new files. Requires CBASIC-2 **\$89/\$20**

QSORT — Fast sort/merge program for files with fixed record length, variable field length information. Up to five ascending or descending keys. Full back-up of input files created **\$89/\$20**

PEACHTREE

GENERAL LEDGER, \$1000 **\$749/30**
ACCTS. PAYABLE, \$1000 **\$749/30**
ACCTS. REC., List \$1000 **\$749/\$30**
INVENTORY, List \$1200 **\$749/\$30**
MAILING ADDRESS, \$800 **\$599/\$30**

Business Packages in Microsoft BASIC

- General Ledger
- Accounts Receivable
- Accounts Payable
- Payroll

Extremely well documented with source code. **BEST VALUE ON THE MARKET.** Support Limited.

ONLY \$99 per pkg.
All four for only \$339

GRAHAM-DORIAN

GENERAL LEDGER.... **\$849/\$35**
ACCOUNTS PAYABLE... **\$849/\$35**
ACCOUNT RECEIVABLE **\$849/\$35**
PAYROLL SYSTEM.... **\$499/\$35**
INVENTORY SYSTEM... **\$499/\$35**

JOB COSTING — Designed for general contractors. To be used interactively with other GRAHAM-DORIAN accounting packages for tracking and analysing expenses. User establishes customized cost categories and job phases. Permits comparison of actual versus estimated costs. Automatically updates GRAHAM-DORIAN general ledger or runs as stand alone systems. Requires CBASIC-2. Supplied in source. **\$849/\$35**

APARTMENT MANAGEMENT SYSTEM — Financial management system for receipts/security deposits of apartment projects. Captures data on vacancies, revenues, etc. for annual trend analysis. Daily report shows late rents, vacancy notices, vacancies, income lost through vacancies, etc. Requires CBASIC-2. Supplied in source. **\$499/\$35**

All packages available in 8" CP/M™ and 5 1/4" CP/M™ FOR North Star, Micropolis, Vector Graphic, SuperBrain, and others.

SHIPPING AND INSURANCE: Add \$2.50 per order. All prices subject to change and all offers subject to withdrawal without notice. Prices in this ad are for prepaid orders. Slightly higher prices prevail for other than prepaid orders, i.e., C.O.D., credit card, etc.

— WRITE FOR FREE CATALOG —

MICROSOFT

BASIC-80 — Disk Extended BASIC, ANSI compatible with long variable names, WHILE/WEND, chaining, variable length file records **\$269/\$25**

BASIC COMPILER — Language compatible with BASIC-80 and 3-10 times faster execution. Produces standard Microsoft relocatable binary output. Includes Macro-80. Also linkable to FORTRAN-80 or COBOL-80 code modules **\$325/\$25**

FORTRAN-80 — ANSI 66 (except for COMPLEX) plus many extensions. Includes relocatable object compiler, linking loader, library with manager. Also includes MACRO-80 (see below) **\$389/\$25**

CBASIC-2 Disk Extended BASIC — Non-interactive BASIC with pseudo-code compiler and runtime interpreter. Supports full file control, chaining, integer and extended precision variables, etc. **\$89.95/\$15**

MICROPRO

SUPER-SORT I — Sort, merge, extract utility as absolute executable program or linkable module in Microsoft format. Sorts fixed or variable records with data in binary, BCD, Packed Decimal, EBCDIC, ASCII, floating, fixed point, exponential, field justified, etc. Even variable number of fields per record! **\$219/\$25**

WORD-STAR — Menu driven visual word processing system for use with standard terminals. Text formatting performed on screen. Facilities for text paginate, page number, justify, center and underscore. User can print one document while simultaneously editing a second. Edit facilities include global search and replace, Read/Write to other text files, block move, etc. Requires CRT terminal with addressable cursor positioning **\$395/\$40**

WORD-STAR/MAIL-MERGE — As above with option for production mailing of personalized documents with mail list from Datastar or NAD .. **\$525/\$25**

OSBORNE

Business Software

Only \$89 per Package
All 4 for only \$289

General Ledger, Accounts Receivable, Accounts Payable, and Payroll (with Cost Accounting). Available in the following BASICs: CBASIC2, Cromemco 16K, North Star, Microsoft, and TRS-80

MiniMicroMart, Inc.

1618 James St., Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431

Clubs and Newsletters

Newsletter for Ohio Scientific Users

The OSI Users' Independent Newsletter is edited, published, and written by Charles Curley, 6061 Lime Ave, Number 2, Long Beach CA 90805. A year's subscription is \$10 for six issues. The newsletter includes

articles on software, hardware, bugs and fixes, and reviews of items of interest to OSI users. Articles are welcome from enthusiastic owners and users.

Salem, Oregon Area Computer Club

Club membership is open to all those that are in-

terested in using microcomputers for fun and business. Membership dues are \$5 per year. The club meets the first Monday of each odd-numbered month at McKinley Community School, 461 McGilchrist St, Salem, Oregon. On even-numbered months, they meet at Computer Pathways Unltd Retail Store, 831 Lan-

caster Dr, Salem, Oregon. A monthly newsletter is published. Each meeting features a presentation by a club member or invited guest. For information, contact Salem Area Computer Club, c/o Doug Walker, 4554 Jan Ree Dr NE, Salem OR 97303.

North London Hobby Computer Club (NLHCC)

The NLHCC has scheduled their meetings for the next 3 months. The theme for the May meeting is "Computer-Aided Instruction." The meeting will be held May 7 at 7 PM in the Students Common Room in the Polytechnic of North London. On June 4, the meeting is entitled "The House Computer." July third's meeting is on "The Personal Computer and Restel/Teletext." Contact NLHCC, Holloway, London N7 8DB, ENGLAND.

TRS-80 Users Group of Sacramento

The TRS-80 users group of Sacramento meets at the Sacramento Country Branch Library, 2443 Marconi Blvd (Marconi and Fulton), Sacramento, California, from 7 to 10 PM as called. For more information, contact the TRS-80 Users Group of Sacramento, POB 255704, Sacramento CA 95825.

University of New Hampshire Computer Services Newsletter

On Line is a well-produced newsletter covering software programs, schedules of events and other activities of interest to students in the computer programs. For more information, contact Computer Services, University of New Hampshire, Kingsbury Hall, Durham NH 03824.



WE'VE TURNED MORE THAN 40,000 PEOPLE ON TO SMALL COMPUTERS—YOU'RE NEXT! NATIONAL SMALL COMPUTER SHOW October 30 - November 1, 1980 New York Coliseum

See more than 100 manufacturers of systems, peripherals, and software, and attend more than thirty hours of free lectures. Don't wait on line in October, register now!

REGISTRATION FOR AMERICA'S BIGGEST SMALL COMPUTER SHOW

Please register me for the 4th Annual National Small Computer Show, Oct. 30 - Nov. 1, 1980 New York Coliseum.

NAME _____

BUSINESS TITLE (if Any) _____

COMPANY (if Any) _____

TELEPHONE _____

ADDRESS _____

ZIP _____

(Check main interest)

- ☐ Banking/Insurance
- ☐ Business office
- ☐ Communications
- ☐ Educational
- ☐ Government
- ☐ Hobby
- ☐ Industrial/Manufacturing
- ☐ Military
- ☐ Professional
- ☐ Stock Brokerage
- ☐ Transportation
- ☐ Utility
- ☐ Wholesale/Retail
- ☐ Other _____

(Check main job function)

- ☐ Accountant
- ☐ Administrator (Business)
- ☐ Architect/Builder
- ☐ Art Director
- ☐ Banker
- ☐ Computer technician
- ☐ Consultant
- ☐ Controller
- ☐ Engineer
- ☐ Industrial Designer
- ☐ Lawyer/law office mgr.
- ☐ Marketing manager
- ☐ Medical doctor

☐ ONE DAY \$10

☐ TWO DAYS \$20

☐ THREE DAYS \$30

Mail with payment of \$10 for each day you wish to attend. Use one form per person. Registration badge will be sent by mail in early October. Check or money order only.

Mail prior to October 1, 1980.
National Small Computer Show,
110 Charlotte Place,
Englewood Cliffs, N.J. 07632
201-569-8542





BUY ONE of these great professional books and GET ONE FREE

(values up to \$60.00)
when you join the
**COMPUTER
PROFESSIONALS'
BOOK CLUB**



Choose any one of these books at the special club discount, and select any other as your gift Free of Charge when you enroll:

AUTOMATIC DATA PROCESSING HANDBOOK
Edited by The Diebold Group, Inc.
168/075 Pub. Pr., \$38.95 Club Pr., \$25.75

PROGRAMMING LANGUAGES By A. B. Tucker, Jr.
654/158 Pub. Pr., \$22.00 Club Pr., \$16.50

MINICOMPUTER SYSTEMS, 2nd Ed. By R. H. Eckhouse
787/026 Pub. Pr., \$21.95 Club Pr., \$16.50

MICROCOMPUTERS/MICROPROCESSORS: Hardware, Software & Applications By J. L. Hilburn & P. N. Julich
771/499 Pub. Pr., \$22.50 Club Pr., \$16.50

MICROPROCESSOR APPLICATIONS MANUAL
By Motorola, Inc.
435/278 Pub. Pr., \$38.00 Club Pr., \$26.50

THE 8080A BUGBOOK: MICROCOMPUTER INTERFACING AND PROGRAMMING By P. R. Rony, D. G. Larsen & J. A. Titus
783/845 Pub. Pr., \$9.95 Club Pr., \$8.45

MICROCOMPUTER-BASED DESIGN By J. Peatman
491/380 Pub. Pr., \$26.50 Club Pr., \$18.95

DATA BASE DESIGN By G. Wiederhold
701/30X Pub. Pr., \$24.50 Club Pr., \$18.25

PRINCIPLES OF INTERACTIVE COMPUTER GRAPHICS, 2nd Ed. By W. M. Newman & R. F. Sproull
463/387 Pub. Pr., \$24.95 Club Pr., \$19.95

PROGRAMMING FOR MINICOMPUTERS By J. C. Cluley
785/49X Pub. Pr., \$17.50 Club Pr., \$13.50

REAL-TIME PROGRAMMING WITH MICROCOMPUTERS By R. C. Turner
786/372 Pub. Pr., \$16.95 Club Pr., \$13.95

MEMORY DESIGN: Microcomputers and Mainframes By Electronics Magazine
191/549 Pub. Pr., \$18.50 Club Pr., \$15.50

HOW TO DESIGN AND BUILD YOUR OWN CUSTOM TV GAMES By D. L. Heiserman
786/585 Pub. Pr., \$14.95 Club Pr., \$11.95

HANDBOOK OF OPERATIONAL AMPLIFIER CIRCUIT DESIGN By D. F. Stout, edited by M. Kaufman
617/97X Pub. Pr., \$29.95 Club Pr., \$17.50

ANALOG SYSTEMS FOR MICROPROCESSORS AND MINICOMPUTERS By P. H. Garrett
786/496 Pub. Pr., \$18.95 Club Pr., \$14.95

ENCYCLOPEDIA OF COMPUTER SCIENCE Edited by A. Ralston & C. L. Meek
769/01X Pub. Pr., \$60.00 Club Pr., \$39.95

MICROPROCESSOR AND MICROCOMPUTER SYSTEMS By G. V. Rao
783/659 Pub. Pr., \$24.50 Club Pr., \$19.50

THE Z-80 MICROCOMPUTER HANDBOOK By W. Barden, Jr.
784/914 Pub. Pr., \$8.95 Club Pr., \$7.60

Why YOU should join now!

- **BEST BOOKS IN YOUR FIELD**—Books are selected from a wide range of publishers by expert editors and consultants to give you continuing access to the latest books in your field.
- **BIG SAVINGS**—Build your library and save money too! We guarantee savings of at least 15% off publishers' list prices on every book. Usually 20%, 25% or even higher!

• **BONUS BOOKS**—You will immediately begin to participate in our Bonus Book Plan that allows you savings between 70-80% off the publisher's price of many books.

• **CONVENIENCE**—14 times a year you receive the Club Bulletin FREE, fully describing the Main Selection and alternate selections, together with a dated reply card. If you want the Main Selection, you simply do nothing—it will be shipped automatically. If you want an alternate selection—or no book at all—you simply indicate it on the regular reply card and return it by the date specified. You will have at least 10 days to decide. If, because of late mail delivery of the Bulletin you should receive a book you do not want, just return it at the Club's expense.

As a Club member, you agree only to the purchase of four books (including your first selection) over a two-year period.

See us at NCC, booth 1215

Computer Professionals' Book Club

P.O. Box 582, Hightstown, New Jersey 08520

Please enroll me as a member and send me the two books indicated, billing me for my first selection only at the discounted member's price, plus local tax, postage and handling. If not satisfied, I may return the books within 10 days and my membership will be canceled. I agree to purchase a minimum of 3 additional books during the next 2 years as outlined under the club plan described in this ad. Membership in the club is continuous but cancellable by me any time after the four book purchase requirement has been fulfilled.

Write Code # of
FREE selection here

Write Code # of
FIRST selection here

Orders from outside the U.S. must be prepaid with international money orders in U.S. dollars.

Charge my ☐ VISA ☐ MASTER CHARGE* Exp. Date _____

Credit Card # _____ *MC Bank # _____

Signature _____

Name _____

Address _____

City, State, Zip _____

Corporate Affiliation _____

This order subject to acceptance by McGraw-Hill. All prices subject to change without notice. Offer good only to new members. A postage and handling charge is added to all shipments.

P39458

Central Oklahoma Amateur Computing Association (CENOACA)

CENOACA meets the second Saturday of each month at the OSU Technical Institute, 900 N Portland, Oklahoma City, Oklahoma, at 10 AM. Their purpose is to acquaint beginners with personal computing and increase their knowledge of special interest areas, including SwTPC and 6800 systems. Their newsletter, *CENOACA Newsbits*, is published on an irregular basis. Contact CENOACA, POB 2213, Norman OK 73070.

Another Group in Florida

The Space Coast Microcomputer Club meets on the fourth Thursday of each month at 7:30 PM in the Merritt Island Public Library Auditorium. They are affiliated with the JF Kennedy Space Center at

Cape Canaveral. The group publishes *Enterprise*, a monthly newsletter. The primary interests are Z80, 8080, and S-100 systems. Dues are \$5 per year, and inquiries should be sent to Ray O Lockwood, 315 Inlet Ave, Merritt Island FL 32952.

APL Newsletter

A quarterly newsletter describing tools, techniques, services, and containing general news of interest to APL users, is being published by Southwater Corp, 2348 Whitney Ave, Mt Carmel CT 06518. Subscriptions are \$6 annually and requests should be sent to *APL Market Newsletter*, at the above address.

Newsletters on the UCSD Pascal System

The Institute for Information Systems is publishing

newsletters describing the UCSD Pascal System developed by the University of California, San Diego. For more information, contact the Institute for Information Systems, mail code C-021, University of California, San Diego, La Jolla CA 92093.

Apple Users Group

The Goldcoast Computer Apple II Users Club desires additional members. The group publishes a monthly newsletter with programming tips, and they have a library selection of over 1000 programs. Send for details: Florida's Goldcoast Computer Apple II Users Club, 133 Brenda St, Milton FL 32570.

Feedback From Fujitsu

Feedback From Fujitsu is a

newsletter from Fujitsu Limited, Japan's largest computer manufacturer. It contains items concerning discoveries and general business news of Japan's strides in the computer industry. For more information, contact *Feedback From Fujitsu*, Ruder and Finn Inc, 110 E 59th St, New York NY 10022.

Association for Computers and the Humanities

This international organization is devoted to the study of computer applications in language and literary studies, history, musicology, the visual arts, cultural anthropology, and other related social sciences. Members of the association are entitled to discount at the International Conference on Computers and the Humanities and the meetings of the Association for Literary and Linguistic Computing. The annual dues are \$15, and a quarterly newsletter is available for \$15 per year. For details, write Association for Computers and the Humanities, Queens College, Flushing NY 11367.

Computers and Gambling Magazine

This quarterly magazine is oriented toward computer hobbyists interested in using computers for all types of handicapping systems, card counting systems, and techniques for stock and future markets investments. Articles describe products and techniques for the computerized gambler, and advertising of products and personal computers is included. Sample issues are available for \$1. Subscriptions are \$5 per year and may be obtained by writing to Joe Computer, 22713 Ventura Blvd, Suite F, Woodland Hills CA 91364. ■

TRS-80, PET, APPLE, SORCERER Ham Interface Systems



- ☐ Send & Receive RTTY / CW.
- ☐ Complete Hardware & Software Package.
- ☐ Extensive User Manuals.
- ☐ From \$129.

Write or call for complete catalog



MACROTRONICS, inc.®

1125 N. Golden State Blvd. / Suite G
Turlock, CA 95380 (A)
(209) 667-2888 / 634-8888

*We are experiencing telephone difficulties,
please keep trying.*



California residents add 6% tax

EVERY TRS-80^{*} MODEL II NEEDS

DataBank

Data Management & Reporting System

"Deposit" data, or make almost instantaneous "withdrawals" with DataBank!

A complete modular software system, DataBank provides the new Model II user and professional alike with the ability to quickly and easily generate custom information systems in minimum time. Using Hash Access to records, DataBank gives superfast response time, minimum system overhead, and the facility to deal with very large numbers of records. Fast assembler sorting optimizes Model II's performance. DataBank includes:

Configuration Utilities: interactive programs which guide you step by step through creating definitions for your file system, formatted entry and display screens and reports. These utilities automatically create the information tables which control the rest of DataBank's operation.

User Subroutines: a comprehensive library of software "black boxes" that you can use to extend DataBank where needed to produce custom applications programs. A simple GOSUB can call records from disk by key, fielded and ready for evaluation, inquiry or update. Or, display a prompted input of defined length and data type anywhere on the screen. More...

Run Time Routines: the programs you will use in day to day operation to initialize the system, display a master menu of options, and load DataBank's file maintenance and report programs and other programs which you may create to work with your data. As soon as you specify your file contents, data entry can begin immediately!

Report Generator: an easy to use, fast, flexible reporting system. You create the report headings and formats using the Configuration Utilities. Then, Report Generator reads the specifications, and draws information from your records to produce the finished printouts. Has range and select capabilities, and assembler sorting on any field in your file definition.

The uses of DataBank are unlimited... inventory, personnel, mailing lists, customer/client files, medical/dental records, membership or subscriber lists, and with your own programming added the possibilities go on and on.

DataBank \$189.00

DataBank Inventory, Order Entry, Accounts Receivable/Payable
Point of Sale, General Ledger and Payroll available soon!

Index Sequential Data Management System w/Report....\$179.

An ISAM based system for the TRS-80 Model I

We have Accts. Receivable, Inventory, Gen. Leg. & Payroll for Mod I



DEALER AND SYSTEMS HOUSE INQUIRIES INVITED



Call or Write for Information:

DATA ACCESS CORPORATION
4221 Ponce De Leon Blvd., Coral Gables, Florida 33146 / (305) 446-0669

*TRS-80 is a registered trademark of Tandy Corporation

Observations from BYTE's Ongoing Monitor Box, The BOMB

As the card says, BYTE's BOMB is your direct line to the editor's desk. Ever since the third issue of BYTE (November 1975), BYTE's editors have used the BOMB as an important source of information on how readers react to our magazine. Therefore we thank the readers who have mailed the BOMB card to us and included their comments.

Occasionally we like to share with you some of the more interesting responses received on these cards. The most pictorial BOMB card in recent memory came from a reader in Hackensack, New Jersey, shown front and back in photos 1 and 2. It seems our friend in New Jersey was generally pleased with our January 1980 issue.

Regretfully not all of our readers have been as well pleased. On one February 1980 BYTE BOMB card

most of the articles were rated as being of poor quality, and a single word appeared in the "Comments" section: "PHOOEY." Yet another BOMB card for February said: "Your best issue in my 3 years!!" Clearly, a split decision.

If you have wondered when we stop accepting BOMB cards for a given issue, we cut off tabulation during the second week of the month after the cover date of an issue.

If you have never sent in a BOMB card, but intend to do so, please observe the following points. The card should be sent to our offices in Peterborough, New Hampshire. The card is presently not postpaid, but \$0.10 US postage will suffice for most readers. The card is intended to record your subjective opinion, so just write your reaction, and put any specific comments on the bottom of the card. You are free to remain anonymous, but you may put your name

and address on the card if you wish. In any case, letting us know your responses to our work helps us to work better. . . .RSS

The Largest Computer Store in America?

What is the largest personal computer store in America? The answer to that question is debatable, but on the East Coast, it's probably NEECO's (New England Electronics Company Incorporated) new facility in Needham, Massachusetts. The 9000-square-foot showroom was filled with a variety of hardware and software on our recent visit. President Robert Crowell told us about their new nationwide distribution subsidiary, called Microamerica, which was announced last fall and carries most of the major computer product lines.

We have noticed a marked increase in the

number of large computer stores like Bob Crowell's with diverse product lines. This supermarket-like approach can be beneficial to the industry when combined with personal service to customers—a vital ingredient to any store's success.

In the West, things are also humming in the personal computer store field. Micro-Age in Tempe, Arizona, is a good example. Run by Jeff McKeever and Alan Hald, Micro-Age has been expanding. We were favorably impressed by their facility and by their approach to the market during a recent visit. . . .CM

Texas Instruments Has an Award Winning Bubble Memory

Texas Instruments has been awarded the 1979 Information Product of the Year Award for its Model 763 Bubble-Memory Data Terminal and Model 765 Portable Bubble-Memory Data Terminal. Both terminals have a full, 128-character, alphanumeric keyboard. Up to 80,000 characters can be collected and stored in the nonvolatile bubble memory, then transmitted at rates from 110 to 9600 bits per second (bps) to a host computer system. Both units have a quiet 30-character-per-second (cps) print speed and built-in acoustic coupler modem.

A bubble memory is a small electromagnetic circuit that stores digital information by changing the magnetic polarity of a thin, crystalline film. The bubbles are cylindrical magnetic islands polarized in a direction opposite from that of the film. Bubble memory has no moving parts, and, because it works magnetically, retains information when the power is turned off. It offers higher access



Photo 1

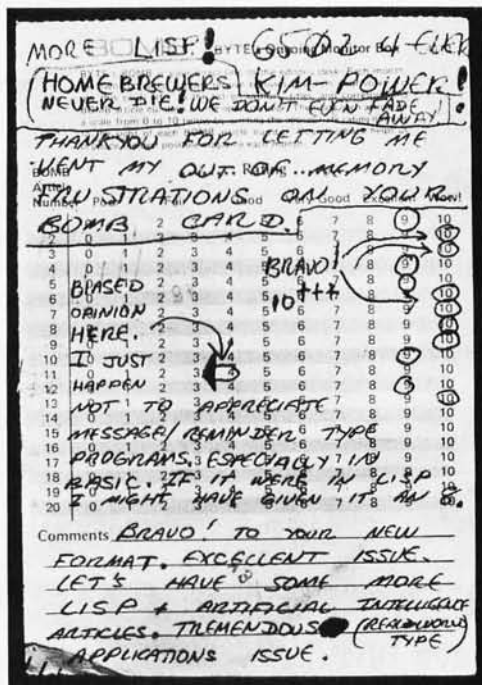


Photo 2

"THE CREATOR®"

By Complete Business Systems, Inc. Software Division

High level language program generator develops complete programs in "Basic".

Enables ANYONE to write complete, running, debugged BASIC LANGUAGE Programs in 35 to 40 minutes with NO PRIOR PROGRAMMING KNOWLEDGE OR ABILITY.

Now available for TRS-80®, TRS-80 Model II®, Apple II®, Tandy 10®, Adds System 70 or 75®.

IF you are one of the many who bought a micro-computer in the belief that with just a little studying you could write your own programs, you now know that you can't.

IF you, as a businessman, thought you could have stock software modified at a reasonable cost with reasonable results, you know that's not possible either.

IF you are a hobbyist getting tired of the untold hours it takes to write a program, only to find it takes more hours to debug than to write...

IF you are a skilled programmer you don't have to be reminded of the repetitious time spent on each new application.

IF you have left your micro-computer sitting somewhere gathering dust... meet "THE CREATOR®".

"THE CREATOR®" is not just another data base generator!

"THE CREATOR®", at your direction, makes complete running programs that are thoroughly documented, easy to modify at any time by YOU!

"THE CREATOR®" cuts programming time up to 90% for a skilled programmer.

"THE CREATOR®" will make anyone a skilled programmer in 30 to 35 minutes!

"THE CREATOR®" does the work! You answer the simple direct questions and "THE CREATOR®" CREATES... AND ALL IN BASIC LANGUAGE.

Q. After "THE CREATOR®" has produced a program, can it be modified?

A. Yes, the resulting program is modular, fully documented and readily accessible for alterations or deletions.

Q. Does the program created use so much disc space that there is very little space left for record storage?

A. No, the code produced is extremely compact despite complete documentation. If requested "THE CREATOR®" will even "pack" or compress information. You may even delete the "remarks" making it even more space efficient.

Q. Must I be expert or even conversant with Basic Language?

A. No, all questions to and answers from the operator require no computer language knowledge, simple every day English will do.

Q. What about math ability?

A. If you can count your fingers and toes, you'll have no problems.

Q. Will the programs which I produce with "THE CREATOR®" be bulky, slow or amateurish?

A. No, the resulting programs will be sophisticated and extremely fast operating. For example, should you create a mailing list or inventory program, the time for any record to be retrieved and displayed from a full disc would take a maximum of 1 second.

Q. Must the programs produced conform to a pre-determined format and file length?

A. No, you determine format and file size to fit your requirements. You may have as many as 22 fields or as few as 1.

Q. Can I develop my own business programs?

A. For the most part, yes.

Q. What are the limitations? What programs can I produce with "THE CREATOR®"?

A. Your own ingenuity and hardware limitations.

Q. Will future versions of "THE CREATOR®" make my present copy obsolete?

A. The purchase price includes your original diskette and user instructions. Your program is registered in your name. For a period of one year from the date of purchase you will be entitled to receive FREE any improvements or modifications. The only expense to you will be a new diskette charge (if applicable), packaging and mailing.

TECHNICAL ASPECTS

- Record access by a hashing algorithm guaranteeing fast record retrieval.
- Duplicate keys permitted.
- Record deletion automatically supported.
- Record access and file maintenance is user transparent.
- Minimal disc overhead since there is no special assembly language routine called. No "Basic" overhead.
- Programs produced can be transported between 6800, 6502, 8080, Z80, 8085, 8086 and Z8000 based systems.
- Can be used with Micro-Soft Basic and CP/M systems.
- On TRS-80 has automatic blocking for maximum number of records per disc.
- Complete file maintenance including up-date of any record in any field, delete and add new records even with duplicate key.

We are seeking qualified dealers and distributors to handle our growing software lines. Address inquiries, on your company letterhead, to: Complete Business Systems, Inc., Software Division, 9420 W. Foster Ave., Chicago, Illinois 60656.

Enclosed is my check (or money order) in the amount of \$250.00. Please send me my serial numbered, registered copy of "THE CREATOR®" as soon as my check clears. (No wait for Certified checks, bank checks or money orders.) Sorry, no credit cards accepted.

(Please print) _____
 Full name _____
 Address _____ Apt. # _____
 City _____ State _____ Zip _____
 Computer make _____ Model _____

speeds, smaller size, and less weight and power consumption over paper-tape, cassette and floppy-disk systems. Bubble memory terminals can access any indexed record in memory in less than 15 ms (ie: 10 times faster than a floppy disk). If the data location is unknown, the character-string-search speed is 1000 cps, about 4 times the speed of a cassette search.

For more information, contact Texas Instruments, POB 1444, M/S 7784, Houston TX 77001.

The Fifth Annual California Computer Swap Meet

The Fifth Annual California Computer Swap Meet will be held on June 1, 1980, from 10 to 6 PM at the Santa Clara County Fairgrounds (344 Tully Rd, San Jose CA). Last year's event, held in September at the San

Mateo County Fairgrounds, was attended by over 3000 buyers.

Personal computing hardware and software will be sold by individuals, computer manufacturers, and computer stores. New software and hardware, as well as used, will be offered by vendors and individuals who have cleaned out their back rooms and garages for the event. Admission is free to buyers. Contact the Fifth California Computer Swap Meet, POB 52, Palo Alto CA 94302, or call 415-324-2404.

Inexpensive Communications Via Meteor Trails

The hundreds of millions of meteors that enter the earth's atmosphere every day leave in their wake a very inexpensive communications medium—the meteor trail. This band of ionized

particles is an effective alternative to satellites for communication. Meteor trails can be used to relay data concerning icebergs, pollution, earthquakes, and oil reserves, and can link remote villages with distant sources of supplies and emergency assistance.

Meteor burst transmission has proven reliable and cost-effective for the snow telemetry program operated by the US Department of Agriculture's Soil Conservation Service. By transmitting snowfall data from remote locations, the program has eliminated costly manual measurements.

Meteor burst transmission systems work in several stages. Remote sensors gather data while a microprocessor-controlled station emits a continuous radio signal, which bounces off a meteor trail whenever one occurs within range. When this signal reaches a transceiver at a remote site,

data is transmitted via the meteor trail to the central station.

For more information, contact SRI International, 333 Ravenswood Ave, Menlo Park CA 94025. ■

BYTE's Bugs

Escher's Nationality

I was interested in the February 1980 BYTE cover and in Carl Helmers' editorial concerning the Euler Problem of Königsberg. I immediately noticed when I received the issue the similarity of the cover painting to Escher's work. However, I must take argument concerning the statement that Escher was a Swiss artist.

Maurits C Escher was born on June 17, 1898 in Leeuwarden, Netherlands, and died March 27, 1972 in Laren, also in the Netherlands. He was in fact a *Dutchman* whose works are almost revered today in the Netherlands. I certainly commend artist Robert Tinney for combining two of Escher's more famous prints *Drawing Hands*, from January 1948, and *Reptiles*, from March 1943. However, the sequence of reptiles in Escher's original work came around and completed the cycle, by returning to the flat paper, whereas these "dragons" seem to disappear around the corner.

Naturally, the Towers of Hanoi did not go unnoticed either.

My commendation to Mr Tinney, but I think that the history of Escher, who may have been the world's greatest graphic artist, should be given correctly.

Neal Koss
3440 Lomita Blvd
Suite 452
Torrance CA 90505



MULTI TERMINAL SMALL BUSINESS COMPUTERS

IBC System 40 with 64 K byte memory, 2M byte disk storage, cabinet, and multi-user operating system with BASIC	*4700
Additional 64K byte memory (128 total)	700
Additional 2M byte disk storage	1950
Additional 20M byte disk storage (Winchester)	4000
CRT Terminal	895
Matrix Printer (150 cps)	1895
Character Printer (55 cps)	2695

*Dealer Prices

- Up to 6 CRTs/printers can operate independently and simultaneously. System 40 has dynamic memory allocation, reentrant code, and vectored interrupt. Operating system runs foreground, background, interactive, and batch. BASIC has multiple key ISAM.

- Multi-user wordprocessing concurrent with data processing.

IBC Integrated Business Computers

22010 Wilmington Ave., Suite 306, Carson, CA 90745 (213) 518-4245

For the Best and Latest in Computer Technology... Look to Howard W. Sams & Co., Inc.

There's something for everyone—from those who want to discover what computers are all about to those who are already utilizing computers and programming. The fundamentals . . . programming . . . interfacing . . . logic—we are the complete knowledge source for home, business, educational and professional users.

The "Starters"

new



☐ **The Howard W. Sams Crash Course in Microcomputers**
by Frenzel.
Introducing . . . the fastest and most effective way for everyone from the average consumer to the doctor of science to learn about today's microcomputers. Focuses on all aspects of microcomputers from fundamentals and operating systems to programming and modern peripheral equipment such as floppy disks. 264 pages, No. 21634, \$17.50

☐ **How To Buy & Use Minicomputers and Microcomputers**
by Barden.

A single source to buying and using a computer in your home or business to handle recreational or practical tasks from playing games to setting up a burglar alarm. 240 pages, No. 21351, \$9.95

☐ **Getting Acquainted With Microcomputers**
by Frenzel.

Gives you a complete working knowledge of the microcomputer—organization, operation, and programming. 288 pages, No. 21486, \$8.95

☐ **Fundamentals of Digital Computers (2nd Ed.)**
by Spencer.

Unravels the mysteries of computers and programming. 320 pages, No. 21534, \$9.95

☐ **Introduction to Microcomputers for the Ham Shack**
by Helms.

Gives the radio amateur an opportunity to be in the forefront of utilizing and developing techniques in "computerations." 96 pages, No. 21681, \$4.95

new

Prepub Offer—Save 10% (expires 8/30/80)

☐ **Microcomputer Primer, (2nd Ed.)**
by Waite and Pardee.

new

Completely revised and broadened to reflect the latest advances in microprocessor technology from the new 8-bit microprocessors to solderless breadboards. An excellent starting point for all those interested in computers. Approximately 368 pages, No. 21653. Prepub price—\$10.76. Regular Price—\$11.95

The "Programmers"

☐ **How to Program Microcomputers**
by Barden.



A popular, complete guide to assembly language programming of the Intel 8080, Motorola MC6800, and MOS Technology MCS 6502 Microprocessors. 256 pages, No. 21459, \$8.95

☐ **BASIC Programming Primer**
by Waite and Pardee.

Covers everything from getting organized to writing a game program. 240 pages, No. 21586, \$8.95

☐ **DEBUG: An 8080 Interpretive Debugger**
by Titus and Titus.

Covers program operation and how it's applied to program development and testing. 112 pages, No. 21536, \$4.95

☐ **6502 Software Design**
by Scanlon.

new

Tells how to program for the 6502 assembly language. Approximately 288 pages, No. 21656, \$9.95*

☐ **8080/8085 Software Design, 2 volumes**
by Titus, Larsen, & Titus

Volume 1 gives you an introduction to assembly language programming. 336 pages, No. 21541, \$9.50—Volume 2 is a unique, one-of-a-kind, computer science book for the design engineer. Written in Intel machine code. 352 pages, No. 21615, \$9.95
Two-volume set No. 21659, \$17.50

☐ **TEA: An 8080/8085 Co-Resident Editor-Assembler**
by Titus.

256 pages, No. 21628, \$8.95

new

The "Computer Technology" Leaders



☐ **The Z-80 Microcomputer Handbook**
by Barden.

Gives current and prospective users a one-stop source to Z-80 technology—hardware and software aspects and instrumentation problems. 304 pages, No. 21500, \$8.95

☐ **Using the 6800 Microprocessor**
by Poe.

Acquaints you with the hardware and software of the "6800" fun machine. 176 pages, No. 21512, \$6.95

☐ **Computer Graphics Primer**
by Waite.

Shows how to create your own graphic affects—from detailed drawings to moving figure animation. 184 pages, No. 21650, \$12.95

new

☐ **Microcomputers for Business Applications**
by Barden.

Explains the various types of microcomputers available, points out pitfalls to avoid, and defines computer-related terms, or "buzzwords" in easy-to-understand language. 256 pages, No. 21583, \$8.95.

"Interfacing" Bookshelf



☐ **Microcomputer-Analog Converter Software & Hardware Interfacing**

by Titus, Titus, Rony, and Larsen.
Concepts and techniques of interfacing digital computers to analog devices. 288 pages, No. 21540, \$9.50

☐ **TRS-80 Interfacing**
by Titus.

192 pages, No. 21633, \$8.95

☐ **Interfacing & Scientific Data Communications Experiments**
by Rony, Larsen, Titus, & Titus.

160 pages, No. 21546, \$5.95

☐ **Microcomputer Interfacing With the 8255 PPI Chip**
by Goldsbrough.

224 pages, No. 21614, \$8.95

☐ **Z-80 Microprocessor Programming & Interfacing, 2 Volumes**
by Nichols, Nichols, & Rony.

800 pages, No. 21611, \$21.95.

☐ **Introductory Experiments in Digital Electronics and 8080A Microcomputer Programming and Interfacing, 2 Volumes**
by Rony, Larsen, and Titus.

912 pages, No. 21552, \$20.95



"Reference" Library

☐ **Computer Dictionary & Handbook (3rd Ed.)**
by Sippl and Sippl. **new**

The best and latest resource for anyone involved in computers or computer applications. over 900 pages; No. 21632 \$25.95

☐ **Computer Dictionary (3rd Edition)**
by Sippl and Sippl.

Over 12,000 entries, 640 pages, No. 21652, \$11.95*

"Logic" Cookbooks

☐ **Lancaster's Cookbook Library**

A famous resource for all electronic buffs who want to know what makes TTLs, CMOS, and active filters cook—what they are, how they work, and how to use them.

by Don Lancaster, one of the most popular authors in the electronics industry.

TTL Cookbook 21035 \$ 9.50

CMOS Cookbook 21398 10.50

Active-Filter Cookbook 21168 14.95

TOTAL LIST PRICE \$34.95

Less 15% Discount 5.24

You Pay Only \$29.71

Order Special Library Package No. 21707 and SAVE!

☐ **The Cheap Video Cookbook**
by Lancaster.

256 pages, No. 21524, \$5.95

☐ **IC Op-Amp Cookbook**
by Jung.

592 pages, No. 20969, \$12.95

☐ **IC Converter Cookbook**
by Jung.

576 pages, No. 21527, \$13.95

* Tentative price

Look to Sams . . . In the world of computers

ORDER FORM

HOWARD W. SAMS & CO., INC.
4300 WEST 62ND STREET, P.O. BOX 7092
INDIANAPOLIS, INDIANA 46206
(317) 298-5400

Indicate quantity in boxes above and complete ordering information below:

Sub Total _____

Add local sales tax where applicable _____

GRAND TOTAL _____

☐ Bill Me (Shipping and Handling Charge will be added)

☐ Payment Enclosed (No Shipping Handling Charge)

☐ Check ☐ Money Order

☐ Master Charge

☐ Bank Americard/Visa

Exp. Date _____

Account No. _____

Interbank No. _____

(Master Charge Only)

Minimum Credit Card Purchase \$10.00

☐ Please send free 1980 Computer Book Catalog, No. 21719

AD003

Signature _____

Name _____

Address _____

City _____ State _____ Zip _____

Prices subject to change without notice. All books available from Sams

Distributors, Bookstores, and Computer Stores. Offer good in U.S. only.

Note: Distributor, computer store and dealer inquiries are welcome.

Event Queue

MAY 1980

May and June

Microprocessor Training Courses, Cudham Hall, Cudham, Sevenoaks, Kent, ENGLAND. Microprocessor familiarization, microprocessor applications for the equipment user and for the manufacturer, and microprocessor-based equip-

ment design and development are the courses being offered by the Sira Institute Limited. Write to Conference and Courses Unit, Sira Institute Ltd, South Hill, Chislehurst, Kent BR7 5EH ENGLAND.

May 1-2

Programming Language Technology and Ada, San Francisco CA. Conducted by Anthony Wasserman, the

conference will discuss concepts of programming languages including those which support Ada language definition and development activity. The course costs \$450. Registration information is available from Software Research Associates, POB 2432, San Francisco CA 94126.

May 5-7

Software Principles for Management, San Francisco CA. The course is intended for managers who need to understand what software is and how to utilize it properly. Registration is \$675, and

additional information is available from Technology Transfer Institute, POB 49765, Los Angeles CA 90049.

May 5-7

Data Communications, George Washington University Library, 2130 H St. NW, Washington DC. This course is intended to highlight major data communication services available, the basic choices in designing a data communications network, and essential engineering aspects of data communications. It is intended for systems analysts, engineers and managers. Contact the Director, Continuing Engineering Education, George Washington University, Washington DC 20052. The course fee is \$510.

May 6-10

The Eighth Annual Canadian Association for Information Science, Toronto, CANADA. Technology, commodity, and rights are the themes of this conference. Topics will cover information in the marketplace, information transfer and policy issues, right to access, new information technologies and applications, and other subjects. For more information, contact the Program Chairman, Eighth Annual CAIS Conference, Technical Information Centre, Bell Northern Software Research, 12th Floor, 522 University Ave, Toronto, Ontario M5G 1W7 CANADA.

In order to gain optimal coverage of your organization's computer conferences, seminars, workshops, courses, etc, notice should reach our office at least three months in advance of the date of the event. Entries should be sent to: Event Queue, BYTE Publications, 70 Main St, Peterborough NH 03458. Each month we publish the current contents of the queue for the month of the cover date and the two following calendar months. Thus a given event may appear as many as three times in this section if it is sent to us far enough in advance.

INTELLIGENT MODEM



Eliminate The Data Comm Hassles of Outmoded "DUMB" Modems

BIZCOMP's Intelligent Modem is new. Brand new. It teams a Bell 103-type "dumb" modem with a custom BIZ-080 microcomputer in an attractive desk-top enclosure. RESULT: Incredibly simple data comm for professional users. No more mad dash to get a handset into coupler muffs before being disconnected by the remote. No more exclusion-key telephone needed to do the dialing. No more outboard coupler boxes. And for computer sites, communications software written in high level language like BASIC or COBOL. How's that for simplicity!

The 1030 gives you automatic dial, automatic answer and, unique to the industry, automatic REPEAT dial. The top-of-the-line 1031 adds command-selectable tone or dial pulse dialing for TWX net applications and self-test for ensuring full functionality. Both models are FCC registered for direct connection and feature comm rates from 110, 134.5, 150, 200 to 300 baud. BIZCOMP's innovative Code-Multiplexed Design enables complete control using a simple 3-wire RS-232 interface. Don't burden your customers with data comm hassles. Install a BIZCOMP Intelligent Modem today.

BIZCOMP Communications...
Why not start with the best?

BIZCOMP

P.O. Box 7498 • Menlo Park CA 94025 • 415/854-5434

Suggested prices from \$395.00

Patent Pending

we have the largest selection of TRS-80*, APPLE* and ATARI* software, anywhere!

For more
details, send \$1.
(refundable
toward your first
purchase) for
our complete
software
catalog!

TRS-80*

Accts Rec II Disk 32K	69.95
Adv Pers Fin Disk	24.95
Adventure Sample = 0	5.95
2 Adventures on Disk	24.95
<input type="checkbox"/> Land & Pirate	
<input type="checkbox"/> Mission & Voodoo	
<input type="checkbox"/> Count & Odyssey	
<input type="checkbox"/> Fun House & Pyramid	
3 Adventures on Disk	39.95
<input type="checkbox"/> Land Pirate Mission	
<input type="checkbox"/> Count Voodoo Odyssey	
Adventures on tape	14.95
<input type="checkbox"/> Count	
<input type="checkbox"/> Fun House	
<input type="checkbox"/> Land	
<input type="checkbox"/> Mission Impossible	
<input type="checkbox"/> Pirate's Cove	
<input type="checkbox"/> Pyramid of Doom	
<input type="checkbox"/> Strange Odyssey	
<input type="checkbox"/> Voodoo	
Adventure (Microsoft)	29.95
Air Raid	9.95
Alien Invasion (sound)	cas. 9.95
Alien Invasion (sound)	disk 14.95
Amateur Radio Disk	24.95
Amazin' Mazes	7.95
Android Nim (sound)	14.95
APL	disk 34.95
APL	w/book 49.95 + \$3
APL	tape 14.95
APL	book only 15.50 + \$3
Appointment Log	9.95
Automated Disk Directory	14.95
Barricade	9.95
Basic Handbook	14.95 + \$1
Basic Statistics	9.95
Basic Styles Handbook	5.95 + \$1
Bee Wary (sound)	14.95
Blinders	4.95 + \$1
Biorhythms	4.95
Bridge Challenger	14.95
Cassettes	
<input type="checkbox"/> C-10	10 for 6.50 + \$1
<input type="checkbox"/> C-20	10 for 7.50 + \$1
Casino Anthology	7.95
Challenge (sound)	9.95
Chess Companion	7.95
COMPROC Command Processor	tape for disk only \$19.95
Cribbage	7.95
Data Management System (CCA)	79.95 + \$2
Diskettes	
BAS	<input type="checkbox"/> 5 for 24.95 + \$1
	<input type="checkbox"/> 10 for 39.95 + \$1
	<input type="checkbox"/> 20 for 69.95 + \$2
	<input type="checkbox"/> 100 for 299.00 + \$3
Dysan	box of 5 29.95 + \$1
Dynamic Data Base	39.95
Diskette Storage Box	5.00 + \$1
Dosort 32K or 48	tape 34.95
DSM Sort Utility for disk	75.00
Editor/Assembler Plus 16K	tape 29.95
Electric Pencil	tape 100.00
Electric Pencil	disk 150.00

Educator Assistant	9.95
8080-280 Conversion	14.95
Electronics Assistant	9.95
End Zone II	9.95
Fastgammon	19.95
File Manager 80	49.95
Floppy Armour	box of 5 4.95 + \$1
Floppy Disk Diagnostic	24.95
Fortran/Assembler	150.00 + \$5
Fortran	80.00 + \$2.50
Assembler	80.00 + \$2.50
Galactic Empire	14.95
Galactic Trader	14.95
Galactic Empire/Trader	disk 29.95
GSF 16K, 32K, 48K	24.95
Ham Radio	9.95
Ham Radio	Advanced Version 32K disk 24.95
Histogram/Scattergram	9.95
Home Financial Management	9.95
I Ching Level II 16K	7.95
Infinite BASIC by Racer	49.95
Business add-on	29.95
Intro TRS-80 Graphics	7.95 + \$1
Inventory II.3 Disk	79.95
Inventory S	tape 24.95
Inventory S disk	w/invoicing 59.95
	w/o/invoicing 39.95
Journey Center Earth	7.95
Kamikaze	7.95
Keyboard	9.95
Kriegspiel	7.95
KVP	24.95
KVP on Disk	29.95
KVP 232	24.95
Learning Level II	15.95 + \$1
Level I in Level II	14.95
Level III BASIC	49.95
Life Two (sound)	14.95
Loan Amortization	19.95
Lost Dutchman's Gold	9.95
Machine Lang. Mon. (RSV 2)	26.95
Machine Lang. Mon. (RSV 2D)	29.95
Magic Paper Calculator	14.95
Mail List II disk	99.95
Mastermind	7.95
Mastermind II	14.95
Mean Checkers Machine	tape 19.95
Mean Checkers Machine	disk 24.95
Microchess 1.5	19.95
Microsoft Editor/Assembler Plus	29.95
Micro Tax I	tape 25.00 + \$2
Micro Tax II	tape 35.00 + \$2
Micro Tax III	tape 50.00 + \$2
Microtext Editor	9.95
Mortgage Calculator	3.95
Moving Signboard	9.95
NEWDOS	49.95
NEWDOS +	99.95
NEWDOS 80	149.95
9 Games/Preschool Child	9.95
Numerology 32K	disk 14.95
On-Line Invoicing	disk 39.95
Pathways Through the ROM	29.95
Payroll Disk 32K	39.95
Pencil Pal	35.00
Pentominoes (sound)	7.95
Periodical Cross Reference	tape 14.95
Periodical Cross Reference	disk 19.95
Personal Finance	9.95
Pigskin	9.95
Pork Barrel	9.95
PR Doughtlight	7.95
Preflight	20.00
Print Spooler	disk 24.95
Remodel & Preload 16K, 32K, 48K	34.95
Renumber	7.95
Renumx	24.95
Roots	disk 19.95
RPN Calculator	9.95
RSM-2	26.95
RSM-20	29.95
RX (disk)	24.95
Sargon Chess	19.95
Sargon II	29.95
Sargon Handbook	15.95 + \$1
Secrets of the Tarot	9.95
Small Business Bookkeeping	tape 24.95
Small Business Bookkeeping	disk 29.95
Small Business Bookkeeping	journal 7.00
Snake Eggs (sound)	14.95
Space Battles	tape 14.95
Space Battles	disk 19.95
STAD	24.95
Star Trek III.4	14.95

ST80 Smart Terminal	49.95
ST800 Smarter Disk	79.95
ST80 III	150.00
ST80UC	24.95
Super Simon	99.95
System Copy	9.95
T Short	9.95
Talpan	9.95
Tape Recorder Alignment Kit	9.95
Text 80 Disk	59.95
Time Series Analysis	14.95
Time Trek	14.95
Ting Tong Level II 16K	9.95
Tiny Comp	tape 19.95
Tiny Comp	disk 24.95
Troll's Gold	4.95
TRS-80 Assy. Lan. Pro.	3.95 + \$1
TRS-80 Disk & Other Mysteries	22.95 + \$1
TRS-80 Interfacing	8.95 + \$1
TRS-80 Opera Theatre (sound)	9.95
with challenge on disk	19.95
Tycoon	7.95
Typing Tutor	19.95
VTOS 3.1	49.95
VTOS 3.1	manual 29.95 + \$3
VTOS 3.1	w/manual 74.95 + \$3
VTOS 3.1	w/BASIC 99.95 + \$3
Warfare	7.95
Words	14.95
X-Wing Fighter II	9.95
XREF	19.95
Y-Y Bar by Racer	14.95
Z-80 Chip Poster	3.99 + \$1
Z-80 Gourmet Cookbook	14.95 + \$1
Z-80 Handbook	4.95 + \$1
Z-80 and 8080 Assembly	7.95 + \$1

APPLE*

Adventure Sampler	cas. 5.95
Alien Invasion	cas. 9.95
Android Nim	disk 17.95
Appen I Text Editor	cas. 17.95
Appilot Edu-Disk	disk 49.95
Apple 21	cas. 9.95
Apple Invader	cas. 15.95
Apple IIstner	cas. 15.95
AppleTalker	cas. 15.95
Baseball	cas. 14.95
BASIC Handbook	14.95 + \$1
Blitzkrieg	cas. 15.95
Breakthru	cas. 9.95
Bridge Challenger	cas. 14.95
CCA Data Base Manager	disk 99.50
(Works in conjunction with Visicalc)	
Count Adventure	cas. 14.95
Dan's Disk Utilities	disk 39.95
Dr. Memory	disk 49.95
Dungeon Campaign	cas. 12.50
	disk 14.95
Electric Crayon	cas. 17.95
Engineering Math Tape I	cas. 14.95
Escape	cas. 12.95
Fastgammon	cas. 19.95
Form Letter	disk 24.95
Forté	cas. 19.95
Fun House Adventure	cas. 14.95
Game Playing Tape 1	cas. 9.95
Game Playing Tape 2	cas. 9.95
Game Playing Tape 3	cas. 9.95
General Math Tape I	cas. 14.95
Global War	disk 24.95
Hi-Res Boxing	cas. 15.95
Higher Graphics	disk 24.95

Land Adventure	cas. 14.95
Little Book of BASIC Style	5.95 + \$1
Mailing List	disk 39.95
Mailing List Database	disk 34.58
Master Catalog	disk 29.95
Maze Game	cas. 12.95
Memo Calendar	disk 29.95
Micro Information System	disk 99.95
Mission Impossible Adventure	cas. 14.95
Music Box	cas. 12.95
Pirates Cove Adventure	cas. 14.95
Pyramid of Doom Adventure	cas. 14.95
Sargon	cas. 19.95
Sargon II	cas. 29.95
Slide Shows	cas. 12.95
Strange Odyssey Adventure	cas. 14.95
Stunt Cycle	cas. 15.95
Super-Text	disk 99.95
Tank War	cas. 12.95
Text Editor	disk 64.95
Three Mile Island	disk 39.95
U-Draw I	cas. 17.95
U-Draw II	disk 39.95
Uncle Sam's Jigsaw	cas. 12.95
Visicalc	disk 150.00
Voodoo Castle Adventure	cas. 14.95
Wilderness Campaign	cas. 14.95
Wilderness & Dungeon Campaigns	disk 17.50
	disk 29.95



A Warner Communications Company

ROM CARTRIDGES

Assembler/Editor	59.95
Basketball	39.95
Video Essel	39.95
Super Breakout	39.95
Music Composer	59.95
Computer Chess	39.95
3D Tic-Tac-Toe	39.95
Star Raiders	59.95
Personal Finance	59.95

EDUCATION SYSTEM CASSETTE PROGRAMS

U.S. History	29.95
U.S. Government	29.95
Supervisory Skills	29.95
World History (Western)	29.95
Basic Sociology	29.95
Counseling Procedures	29.95
Principles of Accounting	29.95
Physics	29.95
Great Classics	29.95
Business Communications	29.95
Basic Psychology	29.95
Effective Writing	29.95
Principles of Economics	29.95
Spelling	29.95
Basic Electricity	29.95
Basic Algebra	29.95

BASIC PROGRAM CASSETTES

Introduction to Programming	19.95
Kingdom	14.95
Lemonade	14.95
Baseball	14.95
Blackjack	14.95
Mugwump	14.95
Biorhythm	14.95
Hangman	14.95

The Software Exchange

6 South Street, Box 68, Milford, NH 03055 603-673-5144

TO ORDER CALL TOLL-FREE
1-800-258-1790

(In NH call 673-5144)

*TRS-80 is a trademark of Tandy Corporation

*Apple is a registered trademark of Apple Computer Co.

*Atari is a registered trademark of Warner Communications.

May 12-13

Data Communications, Worcester Polytechnic Institute, Worcester MA. This seminar is designed to help professionals develop an effective data communications system. Network design, requirements, software, diagnostics, and controls are some of the issues to be covered. The fee is \$375 which covers everything except hotels. For information, contact Office of Continuing Education, Worcester Polytechnic Institute, Worcester MA 01609.

May 13-15

Microprocessors: New

Directions for Mankind, Albuquerque NM. This symposium will deal with a variety of microprocessor applications. It is part of the Ideas in Science and Electronics Show. Contact J Arlin Cooper, Div 2331, Sandia Laboratories, Albuquerque NM 87185.

May 13-15

Electro/80 Show and Convention, Hynes Auditorium and Boston Sheraton, Boston MA. This show consists of presentations and exhibitions by computer industry manufacturers. Contact Electronic Conventions

Inc, 99 N Sepulveda Blvd, El Segundo CA 90245.

May 13-16

The Ninth Annual Conference of MUMPS Users Group, Islandia Hyatt House, San Diego CA. This meeting will bring together scientific, medical, and business professionals to discuss current research and application development. Areas of participation are paper presentations, workshops and tutorials, and vendor exhibits. Contact Dr Jack Bowie, MUG 80 Program Chairman, The Mitre Corp, Mail Stop 641,

1820 Dolley Madison Blvd, McLean VA 22102.

May 21-22

The Second Clemson Small Computer Conference, Clemson University, Clemson SC. This program will consist of presentations, discussions and an exhibition. Emphasis will be placed on business, industry, engineering, science, and education. For registration information, contact J K Johnson, Continuing Engineering Education, Clemson University, Clemson SC 29631. For general information, contact W J Barnett, Electrical and Computer Engineering Dept, Clemson University, Clemson SC 29631.

May 21-23

Business and Personal Computer Sales-Expo 80, Philadelphia Civic Center, Philadelphia PA. This show is aimed at a wide range of interests in business and any other area that has a need for computers and computer-related products. Exhibitors will be giving demonstrations of equipment. Contact Produx 2000 Inc, Roosevelt Blvd and Mascher St, Philadelphia PA 19120.

May 23

The Digital Computer Association, Annual Meeting, Pacifica Hotel, 6161 Centinela Blvd, Culver City CA. A slide show, followed by dinner and an evening program, are the main events of the meeting. The price is \$15 prepaid. Send reservations to Mary Rich, 731 Bayonne St, El Segundo CA 90245.

May 24-25

Amateur Radio and Computer Hobbyists Second Annual Convention, Cervantes Convention Center, St Louis MO. Speakers, presentations, equipment displays, and a flea market will be featured. For more information, contact the Gateway Amateur Radio Association Inc, POB 68, Marissa IL 62257.

D
E
S
K

T
O
P



C
O
M
P
U
T
E
R

Chrislin is First !!!

with deliveries of DEC's Desk Top Computers. Available with LSI 11/2 or LSI 11/23 CPU. Complete system totally enclosed within VT100 Video Terminal. Price **\$4,500** with LSI 11/2 and 64K bytes or **\$8,995** with LSI 11/23 and 256K bytes.

NOW Available — PDP 11/23 with 256 KB Memory \$8,900.

SPECIAL — LSI 11/2 and 32K x 16 Memory \$1,095.

10 MEGA BYTE Cartridge Disk System with Controller, RT11 compatible **\$6,100.**

1 MEGA BYTE RX02 Floppy Disc System **\$3045.**



Chrislin Industries, Inc.

Computer Products Division

31352 Via Colinas • Westlake Village, CA 91361 • 213-991-2254

DYNACOMP

Quality software for: Apple II Plus
TRS-80 (Level II)
North Star

All software is supplied with complete documentation which includes clear explanations and examples. Each program will run with standard terminals (32 characters or wider) and within 16K program memory space. Except where noted, all software is available on North Star diskette (North Star BASIC), TRS-80 cassette (Level II) and Apple cassette (*Applesoft* BASIC). These programs are also available on PAPER TAPE (Microsoft BASIC).

FLIGHT SIMULATOR

(as described in SIMULATION, Volume II)

Price: \$17.95 postpaid

A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers.

SIMULATION, Volume II (BYTE Publications): \$6.00

VALDEZ

Price: \$14.95 postpaid

A simulation of supertanker navigation in the Prince William Sound and Valdez Narrows. The program uses an extensive 256X256 element radar map and employs physical models of ship response and tidal patterns. Chart your own course through ship and iceberg traffic. Any standard terminal may be used for display.

BRIDGE 2.0

Price: \$17.95 postpaid

An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice.

HEARTS 1.5

Price: \$14.95 postpaid

An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies.

DATA SMOOTHER

Price: \$14.95 postpaid

This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER

Price: \$14.95 postpaid

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

MAIL LIST I

Price: \$18.95 postpaid (available for North Star only)

A many-featured mailing list program which searches through your customer list by user-defined product code, customer name or Zip Code. Entries to the list can be conveniently added or deleted and the printout format allows the use of standard size address labels. Each diskette can store more than 1000 entries.

MAIL LIST SERVICE

DYNACOMP can provide you with a customized mail list service. Your customer/patient records are placed in a master computer file and you are provided with address-able, self-adhesive labels for your mailings. These labels may be sorted by name, Zip Code, date, or other identifiers. Write for further details and a price schedule.

TEXT EDITOR I (Letter Writer)

Price: \$14.95 postpaid

An easy to use, line-oriented text editor which provides variable line widths and simple paragraph indexing. This text editor is ideally suited for composing letters and is quite capable of handling much larger jobs.

GAMES PACK I

Price: \$10.95 postpaid

Seven entertaining games for less than a dollar a kilobyte! Play CATAPULT, CRAPS, SWITCH, HORSE RACE, SLOT MACHINE, BLACKJACK and LUNAR LANDER. This is an excellent and economical way to start your games library.

All orders are processed within 48 hours. Please enclose payment with order. If paying by MASTER CHARGE or VISA, include all numbers on card. Foreign orders add 10% for shipping and handling.

Write for detailed descriptions of these and other programs available from DYNACOMP.



DYNACOMP
P.O. Box 162

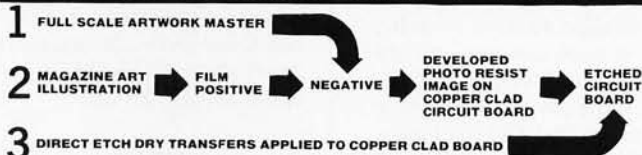


Webster, New York, 14580

New York State residents please add 7% NYS sales tax.

PHOTO ETCHTM PRINTED CIRCUIT KIT

Makes circuits THREE WAYS



Copy circuits right from a magazine using special photo film. No camera or darkroom used. Page is not destroyed in process.

Do your own master art, make negatives, sensitize boards and etch one or a hundred circuits; all identical, all perfect.

For one-of-a-kind PC's, use special dry transfer patterns as a direct etch resist right on the blank copper board.

Do it all with the ER-4. In stock at parts distributors or order direct. Add 7% shipping. Minimum factory order: \$30.00.

ER-4 Complete Photo Etch Set	\$29.95
ER-2 Assorted Etch Resist Patterns & Tapes	4.25
ER-3 1/4 lb. Dry Ferric Chloride (makes one pint)	1.95
ER-5 Six sheets Pos-Neg Copy Film, 5"x6"	5.15
ER-6 Film Process Chemicals	2.50
ER-71 Photo Resist Liquid (negative) does 1700 in ²	6.50
ER-8 Photo Resist Developer, 16 oz.	3.30
ER-12 Power Etch bubble pump unit*	7.25

*not included in ER-4 set

the **DATAK** corp.
65 71st St. • Guttenberg, N. J. 07093

TWICE THE BYTE!



8" DISK CONTROLLER NOW—DOUBLE SIDED OPTION!

- DOUBLES APPLE II STORAGE
- APPLE DOS COMPATIBLE
- SHUGART 800 OR 850 COMPATIBLE
- IBM 3740 DATA ENTRY CAPABILITY
- CP/M, UCSD PASCAL CAPABILITY

Available at your local APPLE Dealer: \$400.



SORRENTO VALLEY ASSOCIATES
11722 SORRENTO VALLEY RD.
SAN DIEGO, CA 92121

May 31

Amateur Radio Fair, Minnesota State Fairgrounds, St Paul MN. The North Area Repeater Association is sponsoring this swapfest and exposition for personal computer enthusiasts and radio amateurs. There will be free overnight parking for self-contained campers on May 30. The admission is \$3. For information, write Amateur Radio Fair, POB 30054, St Paul MN 55175.

May 31-June 1

Microcomputers and the Physician's Office, Hyatt Regency Hotel, San Francisco CA. This seminar will provide a realistic look at microcomputer applications in the private practice. Contact Medical Data Systems, POB 193, Ojai CA 93023.

JUNE 1980

June 2-4

Improving Productivity and Distributed Data Entry,

Sheraton Center, New York NY. The conference and seminar schedule includes discussions on word processing, data processing, future directions of data entry, improving data entry productivity, automated offices, installing a data-entry incentive system, and more. Contact Data Entry Management Association, POB 3231, Stamford CT 06905.

June 4-5

Microprocessors: Hardware, Software, and Application, Holiday Inn, Boston MA. This course is recommended for technical professionals who need an understanding of microprocessors in relation to their corporate and business careers. Contact Office of Continuing Education, Worcester Polytechnic Institute, Worcester MA 01609.

June 4-6

Salon de l'Ordinateur Computer Show, Place Bonaventure, Montreal, CANADA. This exhibition will feature

over eighty manufacturers' hardware and software.

For more information, contact Industrial Trade Shows of Canada, 36 Buttrick St, Toronto, Ontario M8W 3Z8 CANADA.

June 9-13

Microcomputer Workshop, Carnegie-Mellon University, Pittsburgh PA. Engineers, research scientists, educators, and managers will benefit from this course. It covers all aspects of microcomputers and software. Hands-on-training will be provided. The tuition is \$585 and housing can be arranged. Contact the Post College Professional Education, Carnegie-Mellon University, Pittsburgh PA 15213.

June 14

Microcomputers in Business and The Professions: Systems Selection, Butler University, 4600 N Sunset Ave, Indianapolis IN. This seminar will cover various types of hardware and soft-

ware, how to evaluate the kinds and performances of computers, and their applications in business and home use. The registration fee is \$75. For information, contact College of Business Administration, Butler University, 4600 N Sunset Ave, Indianapolis IN 46208.

June 15-18

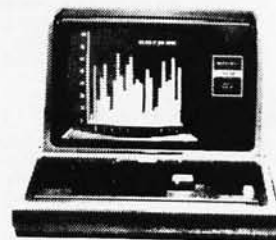
International Summer Consumer Electronics Show, McCormick Place, McCormick Inn, Pick-Congress Hotel, Chicago IL. The Consumer Electronics Show (CES) will feature exhibits from many companies; seminars and discussions; and items ranging from televisions, tape recorders, telephones, and translators, to computers, component systems, auto sound systems, and electronic games will be displayed. Attendance is limited to dealers and the press. Contact Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 N Michigan Ave, Chicago IL 60601.



AUTHORIZED

Radio Shack® DEALER A301

COMPUTER SPECIALISTS



**10%
DISCOUNT
Off
List**

**64K 1 Drive
\$3499.00**

Popular 16K Level II System	\$ 722.00
26-1145 RS-232 Board	84.00
26-1140 "O" K Interface	254.00
26-1160 Mini Disk	424.00
26-1171 Telephone Modem	169.00
Fast 100 CPS Centronics 730 Printer	750.00
Highly Reliable Lobo 5 1/4" Drives	375.00
Versatile Lobo Interface, 8" Drives and IMI Hard Drives.....	Call For Prices

**15%
DISCOUNT
Off
List**

**4K Level II
\$527.00**

No Taxes on Out Of
State Shipments

Immediate Shipment
From Stock.

MICRO MANAGEMENT SYSTEMS, INC.
DOWNTOWN PLAZA SHOPPING CENTER
115 C SECOND AVE. S.W.
CAIRO, GEORGIA 31728
912-377-7120

Full Factory Warranty
on All Items Sold.

VISA, Master Charge
and COD's, Add 3 %

3-G LIGHT PEN

PET
APPLE
TRS-80
(Level II)

- Bypass the keyboard and interact directly with the screen. Makes your computer more versatile for the novice as well as the more sophisticated user.
- The use of the 3-G Light Pen is limited only by your imagination! Use it to experiment with graphics, display a menu for quick data retrieval, as a teaching tool with your child, to proportion recipes instantly, or to play unique games.
- At a major medical center an anesthesiologist uses our pen to select proper dosages. In Holland they use it to create graphics. A man in New York uses it to teach his pre-school age daughter how to match capital with lower case letters. Teachers are using it in science and foreign language classes.
- NO ASSEMBLY NECESSARY. READY TO PLUG IN. Detailed sample programs included. Complete documentation so you can write your own programs in BASIC. No machine language coding necessary. All Professional models plug into machine ports and don't require batteries. Economy model plugs into tape recorder and batteries are included.
- YOU GET: 1) 3-G Light Pen
2) Demo-Game Cassette (with Professional TRS-80, PET and Apple)
3) Sample Program
4) Complete documentation and instructions.

MANY GAMES AND OTHER LIGHT PEN SOFTWARE AVAILABLE.

MAIL COUPON OR CALL TODAY FOR IMMEDIATE DELIVERY

3G COMPANY, INC. DEPT. BT (503) 662-4492
RT. 3, BOX 28A, GASTON, OR 97119

TRS-80 Economy \$19.95 TRS-80 Professional \$34.95 PET Professional \$31.95 Apple Professional \$32.95

Yes, I want to make my computer more versatile. Rush me 3-G Light Pens. (Add \$1.50 for mailing and handling - \$6.00 foreign)

Enclosed is: ☐ check or money order ☐ Master Charge ☐ Visa

Card No. Exp. date
NAME
ADDRESS
CITY STATE ZIP

REMEMBER, 3G OFFERS A 30 DAY UNCONDITIONAL MONEY BACK GUARANTEE!

LRC EATON MODEL 7000+ IMPACT PRINTER

NEW



- Simple Design
- Simple Maintenance
- Simple Interfacing to:
 - Apple
 - Pet
 - TRS-80
 - Exidy
 - OSI
 and many other personal computers

The 7000+ was designed to provide the personal computer user with an inexpensive, yet reliable printer. Take a look - you won't regret it!

SPECIFICATIONS

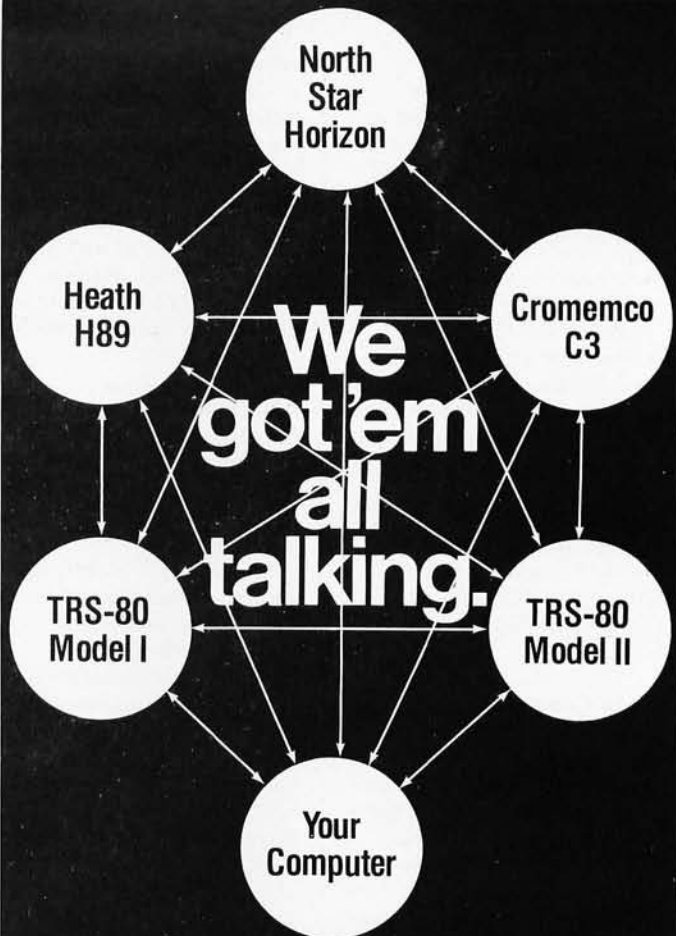
- Impact Unidirectional
- 125 LPS; 50 CPS
- 40 or 64 Column
- 5 x 7 Dot Matrix
- Standard Paper Rolls
- 100 Million Character Printhead Life (minimum)
- 6 LPI Line Spacing

Substantial Dealer Discounts are Available.

OEM inquiries are invited. Please contact:

SIGMA INTERNATIONAL, INC.

P.O. Box 1118 SCOTTSDALE, AZ 85252 USA
Tel. (602) 994-3435 Tlx. 165-745 Sigma Cable: SIGMAS



"BSTAM"

Byrom Software Telecommunications Access Method

The missing link between any CP/M or TRSDOS computers!

A commercially oriented telecommunications facility for transmitting and receiving CP/M* and TRSDOS** files, BSTAM has BIG computer features for your micro:

- links computers directly at 9600 baud with UARTS, or via phone lines using modems
- full speed data transfer without hex conversion overhead
- full wildcard expansions to send *.COM, etc.
- reliable error detection and automatic retry with console messages for status and errors

It's Terrific!

We use it ourselves!

\$150 PER COMPUTER \$5 MANUAL ALONE

Prices reflect distribution on 8" single density diskettes. If a format is requested which requires additional diskettes, a surcharge of \$.80 per additional diskette will be added.

*CP/M is a trademark of Digital Research

**TRSDOS is a trademark of Tandy Corporation

Lifeboat Associates

2248 Broadway New York, N.Y. 10024 (212) 580-0082 Telex: 220501

Lifeboat Associates

THE SOFTWARE SUPER-MARKET

June 16-20

Data Flow Concepts in Computer Language and Architecture, Massachusetts Institute of Technology (MIT), Cambridge MA. MIT's program will cover principles of data flow computer organization and programming language design and applications. Certain architectures will be covered and techniques will be discussed. Familiarity with languages and architecture is a prerequisite. The tuition is \$750. Living arrangements can be made through the school. Contact the Office of the Summer Session, Room E19-356, MIT, Cambridge MA 02139.

June 17-19

Data Comm, Palais des Expositions, Geneva, SWITZERLAND. Data communications and distributed-data processing are the main themes of this conference and exhibition. Software development and tools, computer languages, managing data-communications systems, and definitions,

concepts, and applications of data communications and distributed-data processing are some of the topics that will be covered in the conference.

For more information, contact Industrial and Scientific Conference Management Inc, 222 W Adams St, Suite 999, Chicago IL 60606.

June 18-21

Association for Computational Linguistics, University of Pennsylvania, Philadelphia PA. The meeting will cover theoretical and methodological problems of computational linguistics, speech acts, analysis of multisentence texts, dialogue, machine translation, and computational semantics. For further information contact Don Walker, Artificial Intelligence Center, SRI International, 333 Ravenswood Ave, Menlo Park CA 94025.

June 20-22

The Fifth Annual Computerfest, Franklin Universi-

ty, Columbus OH. Sponsored by the Midwest Affiliation of Computer Clubs, this is a gathering of interested hobbyists, professionals, and business-oriented computer users. Workshops and discussions are the main features of the conference. Contact James Crowley, 4008 Rickenbacker Ave, Columbus OH 43213.

JULY 1980

July 7-11

Computers and Related Products, Hyatt Regency Hotel, Seoul, KOREA. This show is limited to approximately forty firms for exhibition. For details, contact Robert Wallace, Rm 6015A, US Dept of Commerce, Industry and Trade Commission, Washington DC 20230.

July 14-16

Diagnostic Software: Planning and Design, Sheraton-Lexington Motor Inn, Lexington MA. The seminar is for design, test, and

diagnostic engineers. Design examples, lectures, informal sessions, and programming are part of the course. The fee is \$450. Contact Professor Donald French, Institute for Advanced Professional Studies, One Gateway Center, Newton MA 02158.

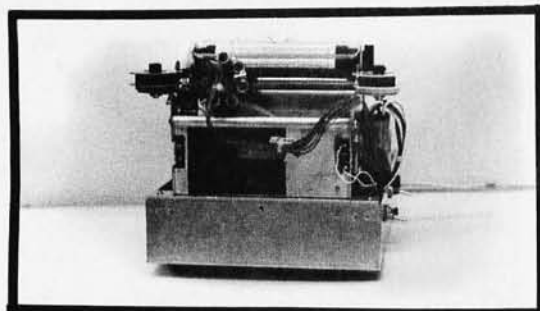
July 14-18

SIGGRAPH '80, Seattle Center, Seattle WA. Panel discussions and readings will be included in this conference. The topics will include graphic displays, animation/dynamics, cartography, input techniques, video and color hardware, and more. For general information, write to SIGGRAPH '80, POB 88203, Seattle WA 98188.

July 22-24

Microcomputer Show, Wembley Center, London, ENGLAND. New products will be exhibited, along with presentations of papers. For information contact TMAC, 680 Beach St, Suite 428, San Francisco CA 94109. ■

LOW COST 40 & 80 COLUMN IMPACT PRINTERS

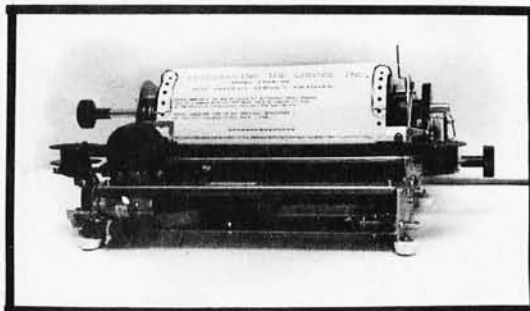


MODEL 101A-40

\$ 295 KIT

\$325 ASSEMBLED & TESTED

- MICROPROCESSOR CONTROLLED IMPACT PRINTER
- 5 or 10 X 7 DOT MATRIX
- 96 ASCII UPPER/LOWER CASE CHARACTERS



MODEL 101B-80

\$ 455 KIT

\$485 ASSEMBLED & TESTED

- PARALLEL & SERIAL INTERFACE
- 110 to 9600 BAUDRATE
- 110 CPS—ONE LINE PRINT RATE
- GRAPHICS MODE

CoosoL, Inc.

P.O. Box 743A Anaheim, Ca. 92805

PHONE 7 DAYS
A WEEK

(714) 545-2216

DISCOUNT SOFTWARE

CP/M®

OSBORNE AND ASSOC.
business software in CBASIC-2

* General Ledger	} \$59/\$19 each
* Acct. Rec./Acct. Pay.	
* Payroll w/Cost Acct.	
Buy 2 get 1 free.	\$118/\$57
All 3 plus CBASIC-2	\$199/\$71

CBASIC-2® \$89/\$14

DIGITAL RESEARCH
CP/M® 2.2 for TRS-80® Model II \$149/\$24
CP/M® 2.2 for Northstar \$149/\$24

WORDSTAR by MicroPro \$399/\$24

WHITESMITHS
C Compiler \$600/\$29
*Pascal (includes **C**) \$750/\$44

* SELECTOR III-C2 \$269/\$19

PEACHTREE business software
in Microsoft BASIC source code.

1 General Ledger	} \$399/\$65 each
1 Acct. Rec.	
1 Acct. Pay.	
1 Payroll	
1 Inventory	
All 5 plus WORDSTAR	\$1995/\$349

TRS-80® MODEL II

CP/M® 2.2
Latest Version \$149

ELECTRIC PENCIL II
Standard Printer \$249
Diablo, Qume, NEC \$279

APPLE II®

VISICALC® by Personal Systems \$122

VISA • MASTERCHARGE

ORDERS ONLY — CALL TOLL FREE

1-800-854-2003 ext. 823 A

Calif. 1-800-522-1500 ext. 823 A

For information write or call:

THE DISCOUNT SOFTWARE GROUP
1610 Argyle Ave., Bldg. 102
Los Angeles, CA 90028
(213) 461-3127

CP/M users: specify disk systems and formats.
Most formats available.

And \$2.50 postage and handling per each item.

California residents add 6% sales tax.

Allow 2 weeks on checks. C.O.D. OK.

Prices subject to change without notice.

All items subject to availability.

* — Special Bonus with order * — Requires CBASIC-2
† — Requires Microsoft BASIC * — Mfgs. Trademark

P.S. — We want to be your software source. Give us the opportunity to beat any nationally advertised price!

ED SMITH'S SOFTWARE WORKS 6809 SOFTWARE TOOLS

RRMAC M6809 RELOCATABLE RECURSIVE MACROASSEMBLER. The one assembler that contains real macro capabilities (see our May, June BYTE ad). RRMAC is designed with the assembly language programmer in mind and contains many programmer convenience features. RRMAC contains a mini-editor, supports spooling or co-resident assembly, allows insert files, is romable, generates cross-references, execution times, lists target addresses of all relative references.

M69RR \$150.00

SGEN M6809 DISASSEMBLER/SOURCE GENERATOR will produce source code (with symbolic labels) suitable for immediate re-assembly or re-editing. The output source file can be put on tape or disk. A full assembly type output listing with labels and mnemonic instructions can be printed or displayed on your terminal. Large object programs can be segmented into small source files. M69RS \$ 50.00

ANNOUNCING TWO NEW M6809 DEVELOPMENT TOOLS

CROSSBAK — A 6809 TO 6800 CROSS MACROASSEMBLER that runs on your M6809 development system to produce relocatable M6800 object code. Has all features of M69RR (see above). Includes 6800 Linking Loader. M69CX \$200.00

CROSSGEN — A 6800 OBJECT CODE DISASSEMBLER/SOURCE GENERATOR that runs on your M6809 development system. Has all features of M69RS (see above). An invaluable tool for converting all 6800 object files over to the M6809. M69CS \$ 75.00

All programs are relocatable and come complete with Linking Loader, Programmer's Guide and extensively commented assembly listing. Available on 300 Baud cassette or mini-floppy disk. For disk, specify SSB or FLEX. Source Text input/output is TSC/SSB editor/assembler compatible.

Order directly by check or MC/Visa. California residents add 6% sales tax. Customers outside of U.S. or Canada add \$5 for air postage & handling.

Dealer inquiries welcome. FLEX is a trademark of TSC

Ed Smith's **SOFTWARE WORKS**
P.O. Box 339, Redondo Beach, CA 90277, (213) 373-3350

Exciting APPLE BREAKTHROUGH! New KRAM 2.0 Software

From United Software
by Ken Germann

KRAM

Keyed Random Access Method

KRAM is the **FASTEST** and **MOST POWERFUL** keyed access method available for the Apple Computer. Written entirely in 6502 machine code, **KRAM** is extremely fast, comprehensive in scope, very compact, and easy to use. **KRAM** function calls are invoked via a single instruction.

Using the sophisticated capabilities of **KRAM** the Apple Computer can now fully meet the requirements of information management applications, such as: Accounts Receivable/Payable, Inventory Control, General Ledger, Payroll, and Database Management.

KRAM Release 2.0 Functions:

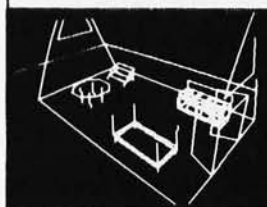
- Create/Open a dataset
- Add & delete records by key
- Get any record by Full/Partial key in 4/10ths of a second (2/10ths with Corvus Disk)
- Read next or previous record
- Dynamic space allocation
- Dynamic space reclamation
- Dynamic index compression

Introductory
Special
\$99.95

An 80 page manual fully documents **KRAM 2.0** detailing **KRAM** functions and illustrating with programming samples. **KRAM** architecture is fully explained and a sample mailing list application program is included.

KRAM is designed to work with both Apple's Disk II, or Corvus Systems 10 Megabyte Winchester Disk. **KRAM 2.0** requires an integer Apple or Apple Plus with integer card and at least one disk drive. Will not work with language system.

PET/CBM OWNERS — KRAM 2.0 for 40/80 column 16K/32K PETS and 2040/3040/8050 disk units is available for \$99.95



3-D Animated Graphics APPLE WORLD

By Paul Lutus

The Program made famous on National TV!

APPLE WORLD turns your Apple into a sophisticated graphics system capable of creating animated three-dimensional color images, projecting them in true perspective on the screen, rotate them, move them closer, further away, and many other things.

A powerful screen-oriented text editor is included to facilitate image formation. This program was recently featured on Tom Snyder's Prime Time Saturday TV Show and is now available for sale.

APPLE WORLD'S powerful editor is so easy to use that children will love it. You can now "sketch" your dream house, boat, car, or fantasy empire. Then view it as it would be seen from 10,000 feet, or you can ZOOM in until the screen is filled with a doorknob. You could then go inside and move from room to room examining furniture placement as your screen rotates within the room. Images or specific parts of images can easily be saved to disk or printer.

Does all this sound like science fiction? You won't think so after you have visited **Apple World**. **Introductory Price \$59.95**

36 page manual included

Look for USA's Red-White-Blue Software Rack at your local computer store or send in your order plus \$1.00 shipping to:

USA United Software of America
750 3rd Ave., New York, NY 10017
(212) 682-0347 Dealer Inquiries Invited

Buy By Mail and Save!

COMPUTERS

INTERTEC SuperBrain®

32K RAM \$2995 . . . \$2495
64K RAM \$3345 . . . \$2695

NORTH STAR Horizon® 1

32K Kit, List \$1999 . . \$1579
32K Assembled \$2695 . \$2149

Horizon 2

32K DD, Kit, \$2399 . . \$1885
32K DD, Asm. \$3095 . \$2439
32K QD, Kit \$2779 . . \$2359
32K QD, Asm. \$3595 . \$2859

CROMEMCO

System 3, 64K, \$6990 . \$5479
System 2, 64K, \$3990 . \$3179
Z-2, List \$995 . . . \$ 829

VECTOR MZ, \$4313

System B, List \$5463 . \$4359

HEATH WH-89 . . . \$1949

DISK SYSTEMS

THINKER TOYS®

Discus 2D, \$1149 . . . \$939
Discus 2+2, \$1549 . . \$1288

PRINTERS/TERMINALS

ANADIX DP-8000 . . \$869

PAPER TIGER IDS-440 \$849
with graphics option . . \$949

INTERTUBE II, \$995 . \$729

PERKIN-ELMER

Bantam 550 \$789

SOROC 120, List \$995 . \$745

TELEVIDEO 912 . . . \$789

CENTRONICS 730-1 . \$799

779-1, List \$1245 . . . \$939

779-2, List \$1350 . . . \$989

T.I. 810 \$1575

Most items in stock for immediate delivery, factory-sealed cartons, with full factory warranty. N.Y.S. residents add appropriate sales tax. Prices do not include shipping. VISA and Master Charge add 3%. COD orders require 25% deposit. Prices subject to change and offers subject to withdrawal without notice.

Computers Wholesale



P.O. Box 144
Camillus, NY 13031
(315) 472-2582



TRS-80 LEVEL II \$720. COMPLETE SYSTEM

The world's most popular microcomputer, with 16K of memory and Level II basic for only \$720, complete with full 90 day Radio Shack warranty. We accept check, money order or phone orders with Visa or Master Charge. (Shipping costs added to charge orders).

Disk drives, printers, peripherals, software and games . . . you name it, we've got it (Both Radio Shack & other brands). Write or call for our complete price list.



Shown is Level I. Level II includes Alphanumeric keypad.

C&S ELECTRONICS MART Ltd.

AUTHORIZED
DEALERSHIP

Radio Shack

32 E. Main Street • Milan Michigan 48160 • (313) 439-1400

MAKE YOUR BASIC BETTER FOR BUSINESS

Developing business applications without keyed file support is like producing a play without the right cast — you can expend needless time and money, and end up giving an inadequate performance.

Enter MAGSAM™

MAGSAM picks up where your BASIC leaves off by providing it with a powerful Keyed File Management System that's quick and easy to use. The result is applications that do exactly what you want them to — instead of only what BASIC allows you to.

Supporting Cast

MAGSAM's advanced features and capabilities include:

- Random, sequential, and generic access by key
- Secondary indexing with any number of keys
- Key and record deletes with automatic space reclamation
- Dynamic file allocation and extension
- Complete compatibility with BASIC files
- Interactive tutorial program
- One year update service

The versatile MAGSAM file management is now available in two major versions. MAGSAM IV, the new high performance assembler version, is ideal for business applications in which response time is critical. Complete with an interface for CBASIC, MAGSAM IV is \$295. MAGSAM III is the standard version and is in use world wide. Written in BASIC, it is available for CBASIC, Microsoft BASIC, or Micropolis BASIC for \$145. The MAGSAM manual alone is \$25.

You're the Star

MAGSAM is available immediately — off the shelf. So you can begin saving time and money now while providing your customers and clients with applications that truly meet their needs. Send for a free brochure telling the full story on MAGSAM, or see a demonstration at your computer dealer today.

Another Business Solution from:



MICRO APPLICATIONS GROUP

7300 Caldas Avenue, Van Nuys, CA 91406



The system of the 80's

Easy to use

- Fully interactive
- Top down design
- Bottom up debugging
- Structured programming supported

Powerful

- Fast, compact code generated
- Recursive and re-entrant
- Interfaces with CP/M*
- Enhanced Forth vocabulary

Versatile

- Machine independent code
- System can be configured as RAM or ROM based from a 2K controller to a 16K development system

Ordering information

- Diskette and documentation \$150*
- Documentation only \$25
- Please specify which version when ordering:
Z80 with CP/M*
- 8080 with CP/M*
- OEM and dealer pricing available upon request



*Single site, non-commercial license

The StackWorks

321 E. Kirkwood / Bloomington, Indiana 47401

(812) 336-1600

P&T CP/M® 2 unleashes the POWER of your TRS-80 MODEL II

Pickles & Trout has adapted CP/M 2, one of the world's most popular operating systems, to the TRS-80 Model II and the result is spectacular:

- 596K bytes usable storage at double density
- Runs both single and double density disks with automatic density select
- Single drive backup
- Multi-drive software can run on a 1 drive system
- Operates with 1, 2, 3, or 4 drives
- Full function CRT control
- Type-ahead buffer for keyboard input
- Full access to both serial ports and parallel printer port
- Fully software programmable serial ports
- Loads an 18K Basic in 2.5 seconds
- Full compatibility with existing CP/M software and application packages
- Full set of 7 CP/M manuals plus our own for the TRS-80 Model II

Introductory price: \$175

Prepaid, COD, Mastercharge or Visa orders accepted
Shipping extra. California residents add 6% sales tax.



PICKLES & TROUT

P.O. BOX 1206, GOLETA, CA 93017. (805) 967-9563

CP/M is a trademark of Digital Research Inc. TRS-80 is a trademark of Tandy Corp.

8088 S100 CPU

Want to upgrade your 8 bit system to a 16 bit system? Don't want to discard your 8 bit boards? The **LDP88** offers 10 to 20 times the processing power of your present CPU while retaining compatibility with your 8 bit memory and peripherals. The **LDP88** is a single board computer with complete **IEEE S100** bus compatibility. The board has the following features:

- Up to 8K bytes of ROM/EPROM
- 1K bytes static RAM
- 8 vectored interrupts
- Serial I/O port
- 16 bit instruction set
- **8086** software compatibility
- Address up to 1 Megabyte of memory

PRICE: \$399.99 (assembled and tested)

Serial monitor for CRT or TTY: \$79.99
(Mass. residents add 5% sales tax)

See your March and April BYTE for Steve Ciarcia's articles about the 8088.

To order send check or money order to:

Lomas Data Products

11 Cross Street
Westborough, MA 01581
Telephone: (617) 366-4335

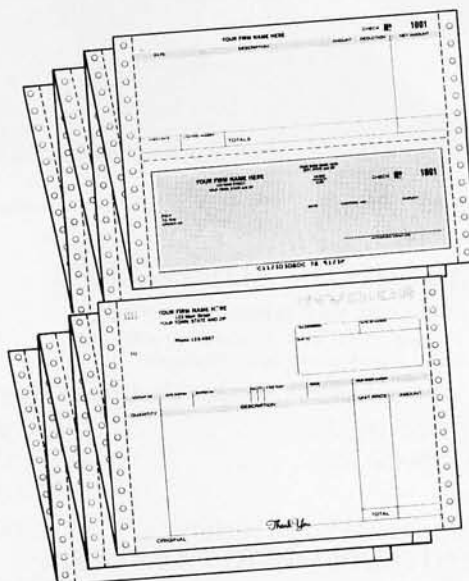


FREE COMPUTER FORMS KIT

EACH KIT CONTAINS:

Samples, Prices, Order Form,
4 Checks, 2 Statements, 2 Invoices,
Programming Guides.

We specialize in small quantities, low prices.
500 CHECKS ONLY \$29.95



**SEND COUPON, CIRCLE BINGO or
PHONE TOLL FREE
1 + 800-225-9540**

FAST SERVICE — It is our policy to ship within 6 working days following our receipt of your order. **CODE 459**

Name

Address

City

State, Zip

NEW ENGLAND BUSINESS SERVICE, INC.
GROTON, MASS. 01450

The 'Red Box'. Our dynamite duo!

Bit Error Rate Test Set - EIA Interface Breakout Panel in pocket size package.

IDS'S MODEL 65/60 lets you both analyze and test at the EIA interface between a modem and terminal. Combines our popular "Blue Box" model 60 with a new bit error rate test set. All in one light, portable, hard plastic case. Works on rechargeable batteries. Available now.



INTERNATIONAL DATA SCIENCES, INC.
7 Wellington Rd., Lincoln, R.I. 02865
Tel. 401-333-6200 TWX 710-384-1911
Export: EMEC, Box 1285,
Hallandale, Fla. 33009 Telex 51-43-32

Fully TRS-80® Compatible

MPI B/51 DISK DRIVE

Includes: Case and Power Supply

In Stock!
Limited Quantities.

\$315⁹⁵
plus \$5 per drive shipping

Guaranteed for 90 days!

- 40 tracks
- 102K per disk
- 5 ms track-to-track

Save time . . . Order by phone
Toll free: 1-800-323-4335

IN ILLINOIS CALL: 312-251-5955

FREE CATALOG

Hundreds of other computer products at major savings.

16K Memory Kits
300ns 250ns 200ns

Cables TRS-80
Diskettes Printers
Operating Systems

Midwest Computer Peripherals

P.O. Box 437 • Wilmette, Illinois 60091



TRS-80® CP/M® & CBASIC® BUSINESS SOFTWARE

LOW-COST MOD II DISK EXPANSION
... over 610,000 bytes/disk with our CP/M ... plus many other features.

Find out why ours is the **Better Business Buy!**

Model II CP/M (rel. 2.0) \$250.00
Model I CP/M (re. 1.5) 150.00
CBASIC 95.00

APH (Automated Patient History) 175.00
RESIDENTIAL PROPERTY ANALYSIS

system 300.00
MAGIC WAND® Word Processor 400.00
RM COBOL® (Z80 code) 750.00

Osborne & Assoc. CBASIC source programs—
O&A Payroll w/Cost Accounting \$250.00
O&A Accts. Rec./Accts. Payable 250.00
O&A General Ledger w/Cash Journal. 250.00
O&A CBASIC books for above (each) 20.00

Send 30¢ SASE for CP/M Users Group software list & free "CP/M Primer".

- * MAGIC WAND is a registered trademark of Small Business Applications, Inc.
- * RM COBOL is a registered trademark of Ryan McFarland Corp.
- * TRS-80 is a registered trademark of Radio Shack, a Lands company.
- * CP/M is a registered trademark of Digital Research.
- * CBASIC is a registered trademark of Software Systems.



(714) 848-1922

8041 NEWMAN AVENUE • SUITE 208 • HUNTINGTON BEACH, CALIFORNIA 92647

For Business Systems Software Programmers Only!! Machine Language ISAM

FOR
TRS-80® Models I and II
ACCESS TIME ½ SECOND!!

This machine language ISAM ROUTINE provides file access sophistication required to implement complex business software, and is completely compatible with TRS-80® BASIC.

Specifications: based on 1000 record file, key length of 6, data length of 64

Access time of ½ second
Best add/delete time of 1 second
Average add/delete time of 2 seconds
Worst case add/delete time of 5 seconds
Keys up to 25 characters
Data up to 255
Provides next highest key upon each file access.
Preset range of allowable key values, set upon file creation up to 4 files held open concurrently.
No special utilities needed to "Reclaim" used record space.
Model I Routine occupies 5 K of user space (loads at top of user memory)
Model II Routine occupies 6 K of user space (loads at top of user memory)
EOF, file full, empty, key not found, INVALID key value and all TRS DOS* error codes supported.

TRS-80 Model I (32 K + 48 K only) \$160.00
TRS-80 Model II (64 K only) \$170.00

Includes: All necessary documentation, file creation program, file inspection program, machine language ISAM routine and loader.



RELIABLE COMPUTER RESOURCES
415 MILLBURY STREET
WORCESTER, MA 01607
(617) 755-8134

*TRS-80 and TRS DOS are trademark of Tandy Corporation, which has no relationship to RCR Inc.

MICAH

OSBORNE BUSINESS SOFTWARE

in CBASIC2 or CROMEMCO 16K BASIC

* features *

- Four Complete Packages...
 - General Ledger
 - Accounts Receivable
 - Accounts Payable
 - Payroll with Cost Accounting
- Strong support from Osborne Manuals
- CBASIC2 runs under CP/M or under CDOS version 1.07 on Cromemco computers
- 16K BASIC runs on Cromemco computers
- Cursor addressing routines for Hazeltine, Lear Siegler and Cromemco (Beehive) Terminals
- Source Codes and Installation Instructions provided along with disks
- Automatic Command Start-up
- Easy to apply to all of your business and systems needs

* hardware required *

- One or more 8" or 5" Floppy Drives
- CRT with cursor addressing
- 132-Column Printer

\$95 per package

TO ORDER:
Add \$5 for shipping.
Calif. add 6-1/2% Sales Tax.
CREDIT CARDS ACCEPTED

• DEALER INQUIRIES INVITED •

MICAH'S PRODUCTS OF DISTINCTION

- | | | |
|--|--|--|
| • OSBORNE BUSINESS SOFTWARE (in CBASIC2 & 16k) | • DCP/1 (Disk Utilities for CP/M and CDOS) | • EXPAND (Run Cromemco Software on CP/M) |
| • CBIOS (CP/M for Cromemco Computers) | • DCP/2 (Disk Utilities for Cromemco) | • BLACKJACK (Tutorial Casino Action) |
| • MICROPLOT (Versatile Printer Graphics) | • DCP/3 (DCP/2 Expanded) | • DRIVE (Customized Printer Drivers) |
| | • SPOOL (Cromemco Format Utility) | • DBMS Conversion to NAD |

• Call or Write for Free Catalogue and More Information •

★ We will Customize any of our programs at our Standard Consulting Rates ★

Ah! MICAH . . . Satisfy'n' Software

That turns your system on!

MICRO Applications and Hardware

• CONSULTANTS and SOFTWARE DEVELOPERS •

MICAH Box 22212 San Francisco, California 94122 USA phone: 415/664-0778

FROM THE ORIGINATOR OF THE TRS-80 PROJECT...

**FMG Corporation — for
HIGH LEVEL LANGUAGES**

- FORTRAN
- PASCAL
- COBOL
- BASIC

Microcomputer software for business applications, engineers, consumers, hobbyists and others who have a serious interest in computers.



M: 450



SEND FOR
FREE
SOFTWARE
CATALOG

- CP/M — Industry Standard Operating System
- USCD PASCAL PACKAGE
- GENERAL LEDGER; PAYROLL; ACCOUNTS RECEIVABLE and ACCOUNTS PAYABLE
- FORTRAN-80 PACKAGE — New Capabilities for TRS-80 Users
- FMG's MICRO COBOL — For TRS-80 and TRS-80 Model II
- CP/M Z80 — Macro Assembler
- ZSID — Symbolic Debugger
- Custom Programming, Service, Installation and Training are Available at Additional Cost

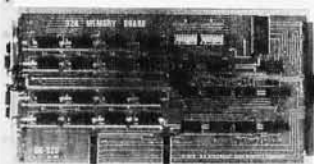
FMG Corporation is an Independent Software Company — from the ORIGINATOR OF THE TRS-80 PROJECT and THE AUTHOR OF THE FIRST CP/M FOR THE TRS-80.



5280 Trail Lake Drive
Suite 14
Ft. Worth, Texas 76133
(817) 294-2510

CP/M is a registered trademark of Digital Research Corp.
TRS-80 is a registered trademark of Radio Shack.

HEATH® COMPATIBLE



DG-32D 32K RAM FEATURES:

- ✓ Plugs into Heath® H8 Computer.
- ✓ Ready to use. Fully assembled, tested & burned in.
- ✓ Operates with existing Heath® memory.
- ✓ Protected memory Output Buffers in the event of Address error.
- ✓ Utilizes popular 4116 RAM devices.
- ✓ Memory Address DIP switch changeable.
- ✓ Arranged as 4 Independent 8K Blocks.
- ✓ Low Power Consumption: Less than 6 watts, typical.
- ✓ Transparent Refresh.
- ✓ One year guarantee.
- ✓ Compatible with all current H8 peripherals.

D•G Electronic Developments Co. brings you a totally compatible, fully assembled and tested 32K RAM for Heath® H8 computers. The DG-32D has less than 6 watts power consumption. This allows you to add a full 32K bytes of Random Access Memory without taxing or replacing your computer's power supply. Engineered to plug-in and run without any user modifications, the DG-32D can be

Heath® and H8 are registered trademarks of the Heath Corporation, Benton Harbor, Michigan.

used with or without existing H8 RAM without modification. Protection of the memory output buffers is provided in the event of assigning two blocks to the same address space. The DG-32D is the ideal answer to expansion of the Heath® H8 computer. . . Low power consumption, low price, high capacity, total engineering and exacting production methods.

BURNED IN 16K MEMORY CHIP SET
H88-H89 **\$89.00**

ORDERING INFORMATION: DG-32D RAM available only from DG Electronic Developments Co., P.O. Box 1124, 1827 South Armstrong, Denison, Texas 75020. Check, money-order, VISA or Master Charge. Phone orders accepted on charge orders. NO COD's. Foreign orders add 30%. Texas residents add 5%. For VISA or Master Charge orders call 214-465-7805. \$479.00 freight prepaid. Allow three weeks for personal checks to clear banks.

**D•G ELECTRONIC
DEVELOPMENTS CO.**

32K RAM \$479⁰⁰

Error Checking and Correcting for Your Computer

Gregory J Walker, President
Design Innovations, Inc
Birch Acres
New London NH 03257

An active error-checking and correcting system can go a long way toward solving the occasional problems that hamper the usefulness of low-cost data-storage devices (such as audio-cassette recorders). It offers a means of improving reliability in problem-plagued situations, and in cases where the error frequency is already sufficiently low, the checking and correcting system allows increased data densities and transfer rates with an overall gain in storage system performance. In a well-designed system, error detection and correction schemes can lead to marked reductions in loading times due to higher average data rates.

Figure 1 shows the connection of the active error-checking and correcting apparatus between the computer and the peripheral data-storage device.

The theoretical development of error-trapping and correcting codes is largely due to the efforts of Richard W Hamming, a mathematician who first published on the subject in the *Bell System Technical Journal* early in 1950. (See reference 1.) Now, thirty years later, *Hamming codes* still represent one of the more practical approaches to the error-correcting problem.

A particularly important aspect of

Hamming's work focused on his formulation of the concept of *code distance* (indicated by the letter D). This relates the uniqueness of (or "distance between") meaningful codes to the number of *simultaneous* errors (indicated by the Greek theta, θ) that can be detected and corrected.

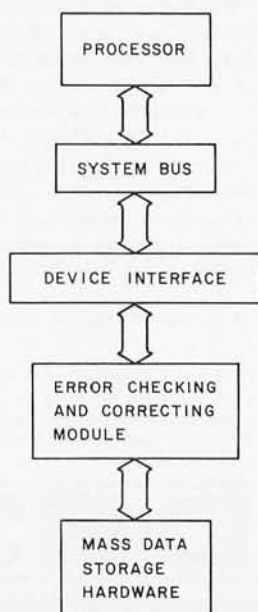


Figure 1: Block diagram showing interconnection of error-checking and correcting system with the computer.

Definition of Hamming Distance

The Hamming distance between any two words is defined as the number of bit positions in which they differ. In terms of logical processes this is merely the total number of bits set to logic 1 following an exclusive-OR operation between the two words, as shown in figure 2. Simple binary coding has a Hamming distance of 1. This unitary distance is precisely the source of the problem, because any given code value appears to be as valid as any other.

Normally, as a processor receives binary data from a peripheral device, no mechanism is present which can correct a bit inversion. If a bit is read erroneously, it will either invalidate the check sum and cause an error trap, or it will be loaded into main memory without detection, thus propagating the error. It may or may not be a critical fault.

Consider the following 4-bit code:

Symbol	Encoded Form bit 3210
0	0001
1	0010
2	0100
3	1000

This limited shifting pattern generates a code format with a Ham-

GET YOURS FREE 1980

PAIA
ELECTRONICS, INC.

ADVANCED ELECTRONICS FOR THE '80s AND BEYOND

NEW IDEAS IN PAIA's 1980 CATALOG

P-4700A COMPUTER BASED MODULAR
SYNTHESIZER SYSTEM
page 2

8700 COM

COMPUTER

VIDEO

SYNTHESIZER

PROTEUS

EKx-EXPONENTIAL MODULE CARDS
page 8

PROTEUS - PROGRAMMABLE PRESET LEAD SYNTHESIZER page 5

PLEASE RUSH

MY FREE 1980 CATALOG

name: _____

address: _____

city: _____ state: _____ zip: _____

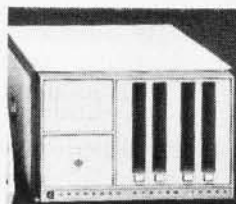
PAIA ELECTRONICS, Dept. 5-B1020 W. Wilshire, Oklahoma City, OK 73116

WE CARRY —

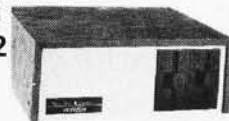
- CROMEMCO
- NORTH STAR
- VECTOR GRAPHICS
- THINKER TOYS
- NEC
- CENTRONICS
- INTERTUBE — \$750.00
- SERENDIPITY
- SOROC — \$775.00
- TEXAS INSTRUMENTS

Professional A/R, A/P, Ledger, Payroll, Medical Billing software with customization available. Send for our catalog — Send for quote.

Call for quote.



**SARA-TECH
COMPUTERS**
P.O. Box 692
Venice, FL
33595
(813) 485-3559



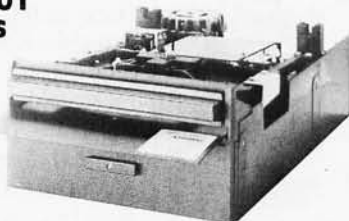
Why pay more ... and get less?

Sirius gives you lower prices and higher quality!

Remex RFD 4000/4001 8" Floppy Disc Drives Double sided ... Double density!!

\$549⁹⁵

RFD 4001, \$564.95



Offers quality and features found in drives costing much more! ■ Single or Double Density ■ Double-Sided Drive ■ Door Lock INCLUDED ■ Write-Protect INCLUDED ■ 180 Day Warranty ■ Compatible with Shugart 850/851 ■ Low Power Operation ensures LONGER LIFE!! ■ Model RFD 4001 offers Data and Sector Separator

AVAILABLE OPTIONS/ACCESSORIES

- ☐ Single Drive Power Module, \$119.95 ☐ RFD4000 Manual, \$5.95 ☐ Drive Cabinet, \$29.95
☐ Dual Drive Power Module, \$139.95 ☐ Interface Manual, \$2.95

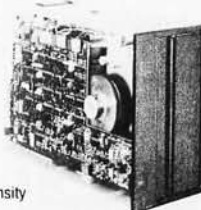
Remex 1000B ... If you've been looking for a less expensive floppy disc drive, but not wanting to sacrifice quality — this is it!

\$419⁹⁵

You get both in the Remex 1000B! For only \$419.95 look at what you get: ■ 8" Floppy Drive ■ Single or Double Density ■ Hard or Soft Sectoring ■ Media Protection Feature ■ Single Density Data Separator ■ 180 Day Factory Warranty

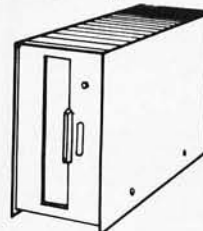
AVAILABLE OPTIONS/ACCESSORIES

- ☐ Door Lock, \$19.95 ☐ Connectors, \$9.95 ☐ Interface Manual, \$2.95
☐ Write-Protect, \$19.95 ☐ Drive Cabinet, \$29.95 ☐ 1000B Technical Manual, \$5.95
☐ Interface Adapter (Remex to Shugart), \$12.95



SIRIUS 80plus Series ... perfect add-ons for your TRS-80*!

- Comes complete ready to plug in and run!
- 5ms track to track
- SIRIUS 80+1 and 80+2 — up to 102,000 bytes
- SIRIUS 80+3 and 80+4 — 240K and 480K bytes



SIRIUS 80+1 (Single Head) **\$349⁹⁵**

SIRIUS 80+2 (Dual Head) **\$419.95**

SIRIUS 80+3 (Single Head) **\$439.95** SIRIUS 80+4 (Dual Head) **\$539.95**

MPI 51/52 ... A Great Reliable Mini-Drive!

- Fast! 5ms track to track access
- Exclusive Pulley-Band Design
- Unique Door/Ejector Mechanism
- Reliable 1½% Speed Stability



MPI-51 (Single Head) **\$259.95**

MPI-52 (Dual Head) **\$349.95**

MPI 91/92 ... More Drive For Your Money! 240K/480K!

MPI-91 (Single/240K) **\$349.95**

MPI-92 (Dual/480K) **\$449.95**

*TRS-80© Tandy Corp.

**SIRIUS
SYSTEMS**

(615) 577-1072

P.O. Box 9748, Knoxville, TN 37920

Phone Orders accepted 9AM-7PM (EST)

VOLUME DISCOUNTS AVAILABLE



01001111	}	10100110
11101001		
00000000	}	00000001
00000001		
00000000	}	11111110
11111110		
01010101	}	11111111
10101010		

Figure 2: The logical exclusive-OR function produces the output bytes shown in the right column from the input bytes shown in the left column. For each bit, the output bit is a 1 if and only if one of the input bits is a 1.

Hamming Distance (Minimum)

1
2
3
4
5

code uniqueness
single-error detection
single-error correction
single-error correction/double-error detection
double-error correction

Table 1: Minimum Hamming code distances necessary to obtain the listed properties in a particular coding scheme. Capabilities increase directly as Hamming distance increases (for small distances). Correction of an arbitrary number of errors requires a Hamming distance of at least twice the number of errors plus 1.

ming distance of 2. It is impossible to invert a single bit position and create any one of the other three valid words.

Symbol	Encoded Form
3	1000
	↓
INVALID	1100

However, if a dual error occurred, the code's error-detection capability would fail:

Symbol	Encoded Form
3	1000
	↓
2	0100

As indicated above, when the Hamming distance increases, the allowable number of simultaneous errors, θ , also rises. Errors can be trapped effectively as long as θ does not equal or exceed the Hamming distance minus 1 ($D - 1$). This should be clear, any sequence of

($D - 1$) errors will result in the generation of a meaningless code word if the distance between code words is given by D . No series of ($D - 1$) errors will produce a meaningful code.

Correcting Errors

Error-correction capability necessitates a larger Hamming distance, as shown in table 1. Any pattern of θ errors can be corrected if, and only if the Hamming distance D is greater than or equal to $(2\theta + 1)$. In this case, any received data word with θ errors differs from the transmitted, correct word in θ positions, but it also differs from all other meaningful words in at least $(2\theta + 1 - \theta)$, that is, $(\theta + 1)$ positions.

The erroneously received word therefore lies closer to the correct transmitted word than to any other possible word. Thus, it is possible to reconstruct the proper coding and recover the correct data word. To illustrate this point, the 4-bit code from the previous example does not meet the criterion of D greater than or equal to $(2\theta + 1)$, and is therefore uncorrectable. A single bit error in either of the two positions can lead to the same erroneous code:

Symbol	Encoded Form
3	1000
	↓
INVALID	1010
	↑
1	0010

Examination of the invalid code (1010) yields no information concerning what the correct pattern was initially. This meaningless value (1010)

--- Texas Instruments --- Home Computer TI-99/4

Math Speech Dict	\$ 29.95
Modem	224.95
Thermal Printer	399.95
RS 232 Interface	224.95
Disk-Controller	299.95
Disk Drive	499.95
Joystick (pair)	34.95
Dual Cassette Cable	15.95
Video Graphs	19.95
Early Learning Fun	29.95
Beginning Grammar	29.95
Early Rdg & Spch Dict	54.95
Diagnostic	29.95
Home Financial Decisions	29.95
Football	29.95
Physical Fitness	29.95
Household Budget Mgt	44.95
Tax / Invest Rec Kpg	69.95
Investment Analysis	54.95
Personal Record Keeping	49.95
Statistics	54.95
Video Chess	69.95
Number Magic	19.95
Speech Editor	44.95
Speech Synthesizer	149.95
Terminal Emulator	44.95



Send \$1.00 for 12 page Color Brochure. (Refundable with your TI-99/4 order.)

You Don't Have To Be A Genius To Own The TI Home Computer



(The genius is built in)

Superior color, music, sound and graphics--and a powerful extended BASIC--all built in. Plus a unique, new Solid State Speech Synthesizer.

fS FACTORY DIRECT SALES
Dept. 47
1317 E. Colorado St.
Glendale, CA 91205
Phone: (213) 245-1417

ORDER TODAY



California residents add 6% sales tax.

SATISFACTION GUARANTEED OR YOUR MONEY BACK!

Price subject to change without notice Refunds guaranteed

- 26K ROM
- Up to 72K total memory capacity
- 16-color graphics capability
- Built-in equation calculator

Main Console Unit
\$899

Color Video Monitor

\$399

Delivery subject to product availability by manufacturer.

SuperBrain[®] Software.

	MICROSOFT	C-BASIC	PRICE
A/R	X	X	\$250.00
A/P	X	X	\$250.00
G/L	X	X	\$250.00
P/R	X	X	\$250.00
Inventory	X	X	\$250.00
Restaurant Payroll	X		\$250.00
Mailing List	X		\$150.00
Word Processing	X		\$195.00

"Industry Standard" programs on 5 1/4" diskette include source and complete professional documentation. Ready to run on SuperBrain.[®] One time charge, non exclusive license.



116 South Mission
Wenatchee, WA 98801
(509) 663-1626 Ask for wholesale division
Also SuperBrain[®] computers check on prices.

© Trademark of Intertec Data Systems

Z_S-SYSTEMS ZOBEX INC.

Complete computer on 3 S-100 boards for
UNDER \$1000.00*
Runs M/PM, C/PM and OMNIX

64K RAM
4 MHz
No WAIT States
IEEE Std.

Low power,
DMA operation,
Bank select in 16K sections
Can be disabled in 4K increments

Z80 CPU
2-4 MHz
IEE Std.

3 serial ports, 3 parallel, one 4K
EPROM, Vectored interrupts, real time
clock, Software controlled baud rates,
Drives daisy wheel printer directly

DISK CONTROLLER
8" and 5"
DRIVES

All digital design for stable and
reliable performance. No one-
shots or analog circuitry.

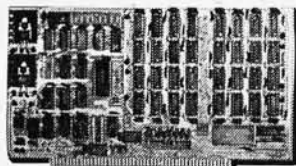
CARD CAGE
and Fan

Wide-spaced 6 slot shielded
motherboard for good cooling and low
noise.

SEND FOR FREE INFORMATIONS
6 months warranty on our boards with normal use

Z_S-SYSTEMS / ZOBEX INC.
P.O. Box 1847, San Diego, Ca. 92112
(714) 447-3997

*introductory offer for limited time only



64K BYTE EXPANDABLE RAM
DYNAMIC RAM WITH ONBOARD TRANSPARENT
REFRESH GUARANTEED TO OPERATE IN
NORTHSTAR, CROMEMCO, VECTOR GRAPHICS,
SOL, AND OTHER 8080 OR Z-80 BASED S100
SYSTEMS *4MHZ Z-80 WITH NO WAIT STATES.
* SELECTABLE AND DESELECTABLE IN 4K
INCREMENTS ON 4K ADDRESS BOUNDARIES.
* LOW POWER—8 WATTS MAXIMUM.
* 200NSEC 4116 RAMS.
* FULL DOCUMENTATION.
* ASSEMBLED AND TESTED BOARDS ARE
GUARANTEED FOR ONE YEAR AND
PURCHASE PRICE IS FULLY REFUNDABLE IF
BOARD IS RETURNED UNDAMAGED WITHIN
14 DAYS.

	ASSEMBLED / TESTED
64KRAM	\$595.00
48K RAM	\$529.00
32K RAM	\$459.00
16K RAM	\$389.00
WITHOUT RAM CHIPS	\$319.00

S100 MAINFRAME
AND CARD CAGE

- * W/ SOLID FRONT PANEL \$239.00
- * W/ CUTOUPS FOR 2 MINI-FLOPPIES \$239.00
- * 30 AMP POWER SUPPLY \$119.00



VISTA V-200 MINI-FLOPPY SYSTEM
* S100 DOUBLE DENSITY CONTROLLER
* 204 KBYTE CAPACITY FLOPPY DISK
DRIVE WITH CASE & POWER SUPPLY
* MODIFIED CPM OPERATING SYSTEM
WITH EXTENDED BASIC
\$695.00
* EXTRA DRIVE, CASE & POWER SUPPLY
\$395.00

16K X 1 DYNAMIC RAM
THE MK4116-3 IS A 16,384 BIT HIGH SPEED
NMOS. DYNAMIC RAM. THEY ARE EQUIVALENT
TO THE MOSTEK, TEXAS INSTRUMENTS, OR
MOTOROLA 4116-3.
* 200 NSEC ACCESS TIME, 375 NSEC CYCLE
TIME.
* 16 PIN TTL COMPATIBLE.
* BURNED IN AND FULLY TESTED.
* PARTS REPLACEMENT GUARANTEED FOR
ONE YEAR
\$8.50 EACH IN QUANTITIES OF 8

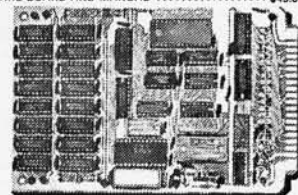
BETA
COMPUTER DEVICES

1230 W. COLLINS AVE.
ORANGE, CA 92668
(714) 633-7280

KIM/SYM/AIM-65—32K EXPANDABLE RAM
DYNAMIC RAM WITH ONBOARD TRANSPARENT
REFRESH THAT IS COMPATIBLE WITH KIM/
SYM/AIM-65 AND OTHER 6502 BASED
MICROCOMPUTERS.

- * PLUG COMPATIBLE WITH KIM/SYM/AIM-65.
MAY BE CONNECTED TO PET USING ADAPTOR
CABLE. SS44-E BUS EDGE CONNECTOR.
- * USES +5V ONLY (SUPPLIED FROM HOST
COMPUTER BUS). 4 WATTS MAXIMUM.
- * BOARD ADDRESSABLE IN 4K BYTE BLOCKS
WHICH CAN BE INDEPENDENTLY PLACED ON
4K BYTE BOUNDARIES ANYWHERE IN A 64K
BYTE ADDRESS SPACE.
- * BUS BUFFERED WITH 1 LS TTL LOAD.
- * 200NSEC 4116 RAMS.
- * FULL DOCUMENTATION
- * ASSEMBLED AND TESTED BOARDS ARE
GUARANTEED FOR ONE YEAR, AND
PURCHASE PRICE IS FULLY REFUNDABLE IF
BOARD IS RETURNED UNDAMAGED WITHIN
14 DAYS.

	ASSEMBLED / TESTED
WITH 32K RAM	\$419.00
WITH 16K RAM	\$349.00
WITHOUT RAM CHIPS	\$279.00
HARD TO GET PARTS ONLY (NO RAMS)	\$109.00
BARE BOARD AND MANUAL	\$49.00



CALIF RESIDENTS PLEASE ADD 6% SALES TAX.
MASTERCARD & VISA ACCEPTED. PLEASE
ALLOW 14 DAYS FOR CHECKS TO CLEAR BANK
PHONE ORDERS WELCOME.

could have been generated from an originally encoded 3 (pattern 1000), with an error in bit 1, or from an encoded 1 (pattern 0010) with an error in bit 3. Without any additional information, it is impossible to distinguish between these cases. Once an error occurs, although it can be trapped by searching for invalid codes, it cannot be corrected.

Now consider the correctable code:

Symbol	Encoded Form
0	00000
1	11101
2	11010
3	00111

Examination of this new code reveals a minimum Hamming distance (D) of 3 between the various states, permitting single error correction. (See table 1.) The inefficiency of

this code is obvious; however it should be clear that any single error can be detected and *located* using this scheme.

Symbol	Encoded Form
0	00000
	↓
INVALID	00001

The erroneous pattern could only be the result of encoding a 0 with an inversion in the least significant bit. Given the word 00001, the original, correct coding could be restored. This can be attributed to the fact that even the invalid, meaningless patterns display a limited uniqueness, and are directly traceable to specific *valid* codes subject to a small number of errors.

Uses of Parity

Clearly, coding efficiency is hampered as the Hamming distance is increased and as the requirements for trapping and correcting power are made more stringent. It becomes a matter of systematically generating a code that displays enough "correcting power" to handle data words of a useful length, without creating an excessive code-redundancy overhead. Here, the concept of *parity* plays an important role. Parity is established in a data word through the setting of an *additional* bit, such that the total number of bits set to logic 1 is either always odd or always even.

The operation of simple parity encoding and decoding is easy to understand. Assume, for example, that a data word 4 bits wide undergoes an odd-parity test across the entire word:

```

┌ 1010
└
1 1010

```

During encoding in this example, the fifth bit (the parity bit) is set to establish *odd* parity. Upon decoding, if the parity bit is included in an identical parity check, namely odd parity across the entire word (now 5 bits wide), the output of the parity test will be a logic 0.

If at some point between encoding and decoding, an error forces an inversion in a single bit (eg: with an error in bit 3, input to the decoder will be 10010), the odd-parity test will


Symbol	Binary Form	7-bit Encoded Form
00	0000	1110000
01	0001	1000001
02	0010	0100010
03	0011	0010011
04	0100	0000100
05	0101	0110101
06	0110	1010110
07	0111	1100111
08	1000	0011000
09	1001	0101001
10	1010	1001010
11	1011	1111011
12	1100	1101100
13	1101	1011101
14	1110	0111110
15	1111	0001111

Table 2: Sixteen different logical entities or symbols can normally be represented by a 4-bit code. Use of a unique 7-bit encoding increases the Hamming distance to 3 and allows a single-bit error correction.

The
Self-Indexing
Query System

WHAT'SIT?

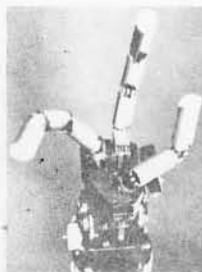
Wow! How'd All That Stuff get In There?



**COMPUTER
HEADWARE**

BOX 14694
SAN FRANCISCO 94114

GIVE YOUR COMPUTER A HAND



Have you ever wanted to do more with your micro than play computer games and balance your checkbook? **Robotics Age** gives you all the information you need to transform your home computer into a working **ROBOT!** Every aspect of robot research and experimentation—from the basic principles to the latest developments in laboratories around the world—is covered. Special emphasis is given to plans, circuits, and programs that you can use in your own microcomputer-controlled robot. Each article is designed to be understandable to the novice experimenter, but with technical detail and complete references that will satisfy even the professional researcher. Added to that are robotics-related New Products, Book Reviews, abstracts of selected recent technical papers, and reports on how you can participate in the growing number of robotics and Artificial Intelligence organizations in the US and abroad. Join the thousands of **Robotics Age** readers and learn how you can contribute to the development of the intelligent robots of the future—**Subscribe Today!**

ROBOTICS AGE P.O. Box 801, La Canada, CA 91011

- ☐ 1 yr. (4 issues)—US:\$8.50; Canada & Mexico:\$10; Foreign:\$12
☐ 2 yrs. (8 issues)—US:\$16; Canada & Mexico:\$19; Foreign:\$23
 Payment enclosed ☐ Bill me (No. America only) ☐ Bill my Mastercharge ☐ VISA ☐

Number _____

Signature (required) _____

Expiration date _____

Name _____

Address _____

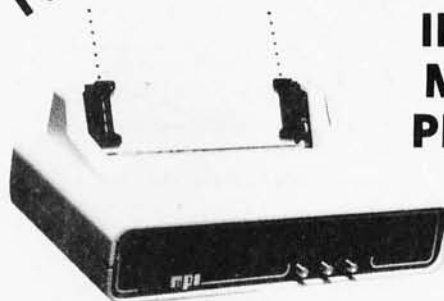
City _____

State _____

Zip _____

NEU!

MPI MODEL 88T IMPACT MATRIX PRINTER



The first of a series of new, full-capability, low cost, high performance printers designed by MPI to meet the requirements of the general use computer market – hobbyist or professional.

SPECIFICATIONS

- Impact Bidirectional
- 7x7 Dot Matrix
- 100 Characters Per Second
- 80, 96 and 132 Column
- 10 Lines Per Second
- Tractor and Friction Feed
- Normal Paper: Roll, Fan-fold or Cut Sheets
- 115/230 VAC $\pm 10\%$, 50/60 Hz.
- 96 ASCII Upper and Lower
- RS232C; 20 ma. Current Loop
- 110-1200 BAUD
- 2 Line Buffer; 1 or 2 K Optional
- Centronics Parallel
- 41x27x16 cm; 7 Kg.

Sigma International, Inc. is master international distributor for MPI and seeks dealers/distributors worldwide. Please write us on your letterhead at the following address:

SIGMA INTERNATIONAL, INC.
 P.O. Box 1118 SCOTTSDALE, AZ 85252 USA
 Tel. (602) 994-3435 Tlx. 165-745 Sigma Cable: SIGMAS

THE MM-103 DATA MODEM AND COMMUNICATIONS ADAPTER

S-100 bus compatible

FCC APPROVED

Both the modem and telephone system interface are FCC approved, accomplishing all the required protective functions with a miniaturized, proprietary protective coupler.

WARRANTY

One year limited warranty. Ten-day unconditional return privilege. Minimal cost, 24-hour exchange policy for units not in warranty.

HIGH QUALITY

-50 dBm sensitivity. Auto answer. Auto originate. Auto dialer with computer-controlled dial rate. 61 to 300 baud (anywhere over the long-distance telephone network), rate selection under computer control. Flexible, software-controlled, maskable interrupt system.

ASSEMBLED & TESTED

Not a kit! (FCC registration prohibits kits)

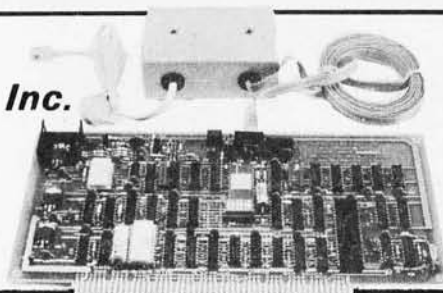
LOW PRICE—\$359.⁹⁵— For Modem AND Coupler

plus shipping
& handling



Potomac Micro-Magic, Inc.

Write for brochure:
 First Lincolnia Bldg., Suite B1
 4810 Beauregard St.
 Alexandria, Va. 22312



Call for further information:
 VOICE: (703) 750-3727
 MODEM: (703) 750-0930 (300 baud)



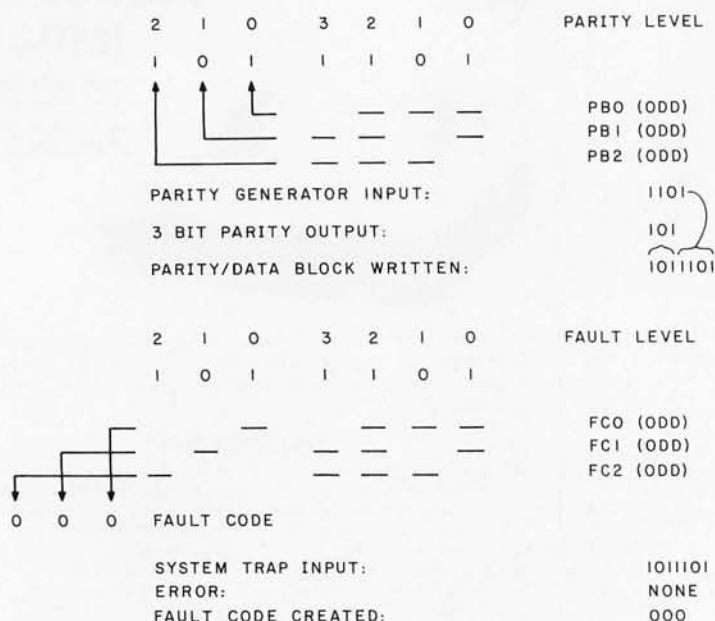


Figure 3: Sixteen different logical states may be represented in a 7-bit code with a Hamming distance of 3. Single-bit errors may be detected and corrected. Encoding in 7 bits is accomplished by performing three distinct parity checks on 4 data bits. Table 4 shows the possible fault codes. The fault code of 000 indicates that no error was detected in decoding.

Versatile

Konan's SMC-100 is available with software drivers for the most popular operating systems. It interfaces S-100 bus micro computers with all hard disk drives having the Industry Standard SMD Interface. Each SMC-100 controls up to 4 drives ranging from 8 to 600 megabytes per drive, including most "Winchester" drives -- such as Kennedy, Control Data, Fujitsu, Calcomp, Microdata, Memorex, Ampex, and others.

Fast

SMC-100 transfers data at fast 6 to 10 megahertz rates with onboard sector buffering, sector interleaving, and DMA.

Cost Efficient

SMC-100 uses very low cost per megabyte technology to keep your micro computer system micro-priced. Excellent quantity discounts are available.

Available

Off the shelf to 30 days in small quantities. (Complete subsystems are on hand for immediate delivery.)

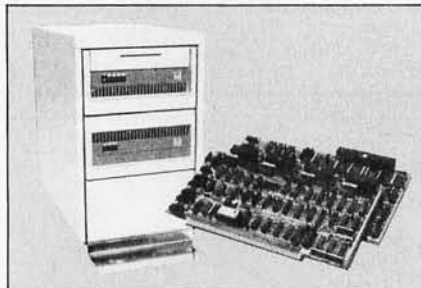
Call Konan's TOLL FREE ORDER LINE today:

800-528-4563

Or write to Konan Corporation, 1448 N. 27th Avenue, Phoenix, AZ 85009. TWX/TELEX 9109511552

KONAN

UP TO 2400 MEGABYTES OF HARD DISK CONTROL FOR THE S-100 BUS



fail and produce a logic 1 signifying an error.

Operation of Hamming Codes

Certainly this mechanism can be fooled by multiple errors, but it is possible to construct *multiple-level* parity checks which will trap a surprising number of errors. This is precisely how the Hamming codes operate. Fundamentally, Hamming's algorithm performs multiple-level parity generation on a data word at the data source. This parity code is then transmitted along with the data, and the entire code block (data plus parity code) is subsequently decoded under an analogous process. Any bit errors occurring during transmission will be detected.

Clearly, the efficiency of this error trap will approach 100% only in very simple cases. Several parameters have direct bearing on the trapping success: total word length N , number of data bits K , number of parity bits M ($M = N - K$). The ultimate goal, of course, is to realize the ideal where the quantity N/K approaches 1, and M is minimized without sacrificing trapping and correcting capability.

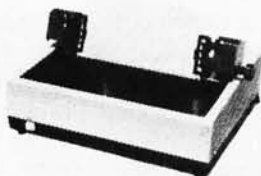
A 4-bit binary code is normally capable of representing sixteen different states with a Hamming distance equal to 1. Momentarily setting aside questions of efficiency, the same sixteen states can also be represented in a 7-bit code at triple the Hamming distance, as shown in table 2. Again, referring to table 1, a Hamming distance of 3 facilitates single-error correction. Encoding in 7 bits is accomplished by performing three distinct parity checks on the 4 data bits. Details of the three parity checks are summarized in table 3 and diagrammed in figure 3.

It should be understood that the actual encoded form of each symbol is irrelevant and need not be known. When no error is present, decoding of the 7-bit word will reset all three parity checks to logic 0, and will restore the data to its original form. The error-handling process is demonstrated in figure 4. With an error in the third data bit, the parity-decoding procedure flags a fault code of 110, which in table 4 is seen to correspond uniquely to an error in data position 3.

THE BRAND NEW EXCEL TX-80

DOT MATRIX PRINTER

PRICES
TOO LOW
TO ADVERTISE



STANDARD FEATURES:

- 80 columns on plain paper with adjustable paper width
- 150 Characters per second (70 LPM) throughput
- 7X5 dot matrix, 96 ASCII set (upper & lower case) plus 7X6 dot matrix PET's* graphic set
- Centronics compatible parallel interface plus your choice of a TRS-80*, Apple II*, IEEE 488 or RS232C IF
- Microprocessor control with 2716 EPROM character set
- Double width elongated printing for labels
- New improved sound dampening foam lined casing
- Tractor Feed & Friction Feed Version not interchangeable
- 90 days warranty for parts and labor

OPTIONAL INTERFACE BOARDS & CABLE SETS:

- PET/CMB*, 2K Buffer/RS232C, Loadable RAM full graphics interface available at extra cost
- Cable sets for each interface are at extra cost

CALL or SEND for free brochure & price list.

TERMS:

- Checks, Master Charge and Visa accepted • Allow up to 4 weeks for delivery
- Please add \$15 per printer for shipping & handling • Calif residents add 6% sales tax

EXCEL COMPANY

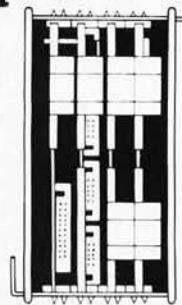
MICRO COMPUTER SYSTEMS
618 GRAND AVENUE
OAKLAND, CALIF. 94610
(415) 465-4240

We are the original PET* Keyboard Interface people

*Trade Marks of Commodore, Apple & Tandy Corp.

DEC LSI-11 Components

Dependable service
at discount prices
Domestic
and Export



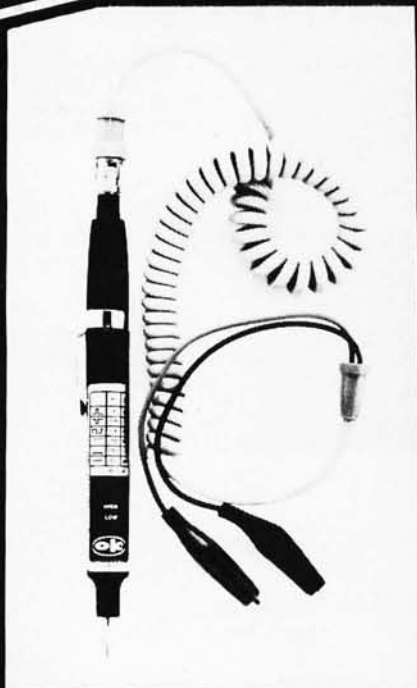
Mini Computer Suppliers, Inc.

25 Chatham Rd., Summit, N.J. 07901
Since 1973

(201) 277-6150 Telex 13-6476

©Mini Computer Suppliers, Inc.
1979

NEW!



PRB-1 DIGITAL LOGIC PROBE

Compatible with DTL, TTL, CMOS, MOS and Microprocessors using a 4 to 15V power supply. Thresholds automatically programmed. Automatic resetting memory. No adjustment required. Visual indication of logic levels, using LED's to show high, low, bad level or open circuit logic and pulses. Highly sophisticated, shirt pocket portable (protective tip cap and removable coil cord).

- DC to > 50 MHZ
- 10 Nsec. pulse response
- 120 K Ω impedance
- Automatic pulse stretching to 50 Msec.
- Automatic resetting memory
- Open circuit detection
- Automatic threshold resetting
- Compatible with all logic families 4-15 VDC
- Range extended to 15-25 VDC with optional PA-1 adapter
- Supply O.V.P. to ± 70 VDC
- No switches/no calibration

\$36⁹⁵*

* ADD \$2.00 FOR SHIPPING
(N. Y. CITY AND STATE RESIDENTS ADD TAX)

OK MACHINE & TOOL CORPORATION

3455 Conner St., Bronx, N.Y. 10475 (212) 994-6600 / Telex 125091

Admittedly, this does not constitute a true Hamming code, in the sense that the fault code does not display the binary form of the error-bit position within the word. This feature is convenient to implement for the shorter codes, but need not be attempted in the more comprehensive

correction schemes where fault-code interpretation can be readily handled in a read-only memory.

Practicality of Use

An overhead of three parity flags for every 4 data bits is undesirable. These techniques become useful only

for larger word lengths. Initially, performance increases as the data word length becomes longer, up to $N = 31$. It is possible to correct single-bit errors in words with 8 data bits and four additional parity flags, an overhead of 50%. Single-error correction of 16 bits requires five flags, an overhead of 32%.

In the case of an 8-bit system, an overhead of 50% may seem exorbitant, but it can pay off rapidly. Assuming that with correcting logic in operation, single errors are virtually nonexistent, it may well be possible to realize a decrease in loading time by a factor of 2, 5 or even 10. It is true that 1.5 times as many bits are being moved into and out of the storage medium, but if the data rate merely doubles, loading times will fall to

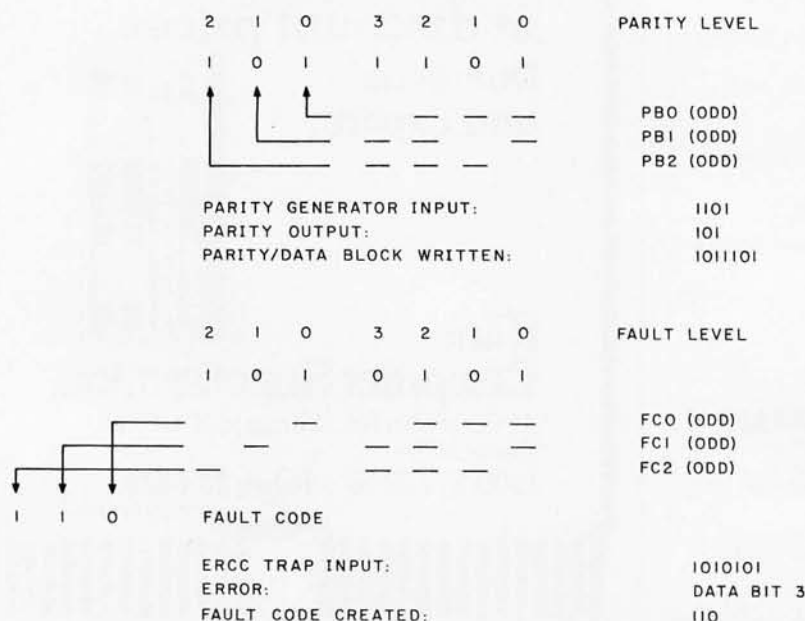


Figure 4: Another example of encoding and decoding data composed of 4 bits in a 7-bit word. In this case an error has been detected; the fault code of 110 indicates an error in data bit 3.

Check Bit	Data Positions
0	0,1,2 (odd)
1	0,2,3 (odd)
2	1,2,3 (odd)

Table 3: Encoding 4-bit data into 7 bits is done by performing 3 distinct parity checks on the 4 data bits. Each of the 3 check bits corresponds to the parity value of the data positions shown here.

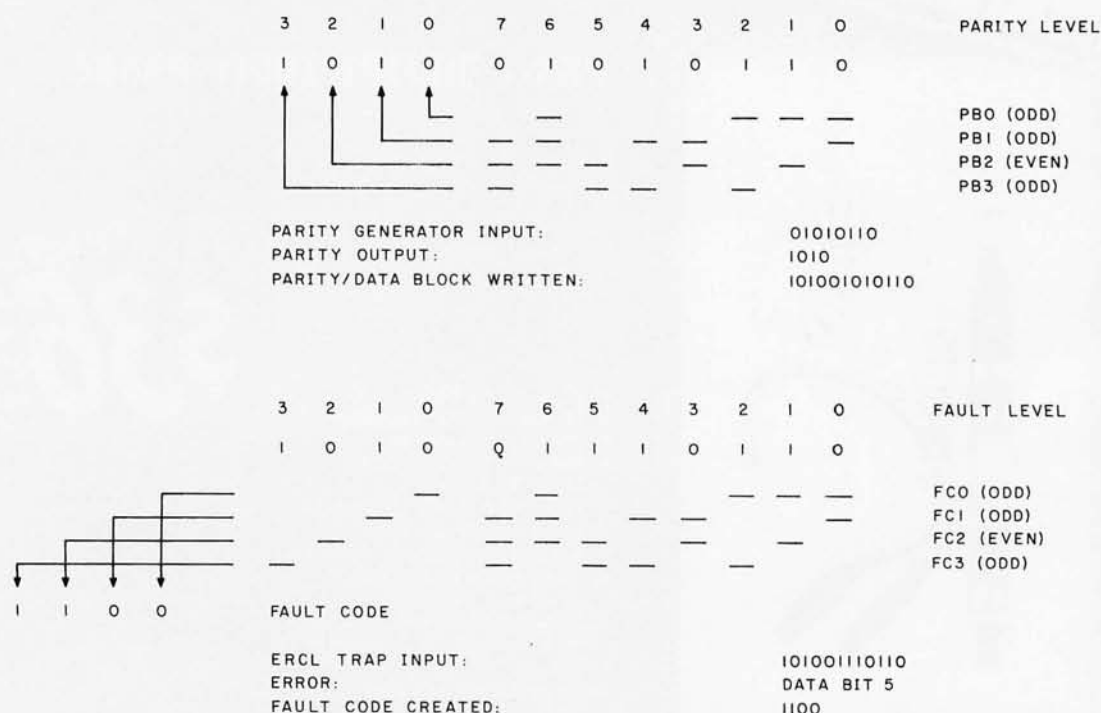


Figure 5: Encoding and decoding for data consisting of an 8-bit byte. Four bits are used for error checking; the possible fault codes are given in table 6.

FREE Catalog

New 4-way relief from problems with minicomputer supplies and accessories.

1. One-stop shopping.

Inmac (formerly known as Minicomputer Accessories Corporation) has a catalog of over 1000 products. Everything from racks and line-printer paper to connectors and cables. Each designed to help keep your minicomputer or word processing system up and running.



2. Hassle-free ordering.

Inmac lets you order by mail or phone. So keep this free catalog close. It makes those once-tough tasks like ordering your magnetic media easy, fast and foolproof.

3. Fast shipment of just the quantity you need.

Inmac ships your order within 24 hours from centers in California, New Jersey and Texas. In a bind? Call us for the many special services that can get your products to your installation even faster, with no minimum-order requirement.

4. Field-proven quality means precision performance.

Inmac guarantees every product in these 70 pages for at least 45 days. And even some for up to ten years.



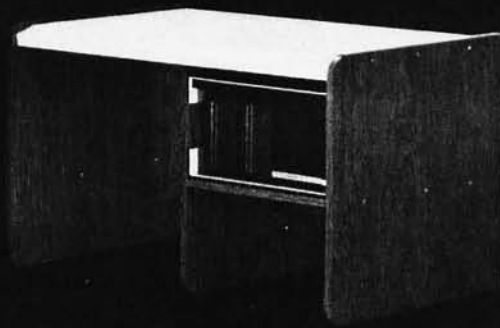
Send for your **FREE**
Inmac catalog or call
(408) 727-1970 today!

2465 Augustine Drive, P.O. Box 4780, Santa Clara, CA 95051
© 1979 International Minicomputer Accessories Corporation

Desk Main/Frame Desk Main/Frame

LOW COST & ATTRACTIVE STYLING

- MAIN/FRAME INTEGRATED INTO FURNITURE QUALITY DESK
- ELECTRONICS PACKAGE SLIDE MOUNTED FOR EASY ACCESS
- SUPPORTS TWO 8" FLOPPY DRIVES FROM SEVERAL MANUFACTURERS (DRIVES NOT INCLUDED)
- 10 SLOT MOTHERBOARD INCLUDES CONNECTORS
- POWER SUPPLY FOR DRIVES AND CARDS
- DESK AND MAIN/FRAME AVAILABLE SEPARATELY
- MATCHING PRINTER DESK AVAILABLE



WRITE OR CALL FOR OUR BROCHURE WHICH INCLUDES
OUR APPLICATION NOTE: 'BUILDING CHEAP COMPUTERS'

INTEGRAND

8474 Ave. 296 • Visalia, CA 93277 • (209) 733-9288
We accept BankAmericard/Visa and MasterCharge

NEW!

from

ads

6809 SINGLE-BOARD COMPUTER S-100 bus

- IEEE S-100 Proposed Standard
- 2K RAM
- 4K/8K/16K ROM
- PIA, ACIA Ports
- adsMON; 6809 Monitor Available

P.C. Board & Manual Presently Available

ALL PC BOARDS FROM ADS ARE SOLDER MASKED, WITH GOLD CONTACTS, & PARTS LAYOUT SILK SCREENED ON BOARD.
Add 50¢ postage & handling per item.
Ill. residents add sales tax.

Sound Effects... Sound Effects...!!!

© NOISEMAKER *

S-100 bus

© NOISEMAKER II **

Apple II bus

ADD "SPACESHIP" SOUNDS, PHASERS,
GUNSHOTS, TRAINS, MUSIC, SIRENS, ETC.!!
UNDER SOFTWARE CONTROL!!!

- Soundboards Use GI AY 3-8910 I.C.'s to Generate Programmable Sound Effects.
- On Board Audio Amp. Breadboard Area With +5 & GND.
- Noise Sources • Envelope Generators • I/O Ports

PCB & Manual: *\$39.95 (NM); **\$49.95 (NM II)

!!!!!!ATTENTION APPLE II USERS!!!!!!

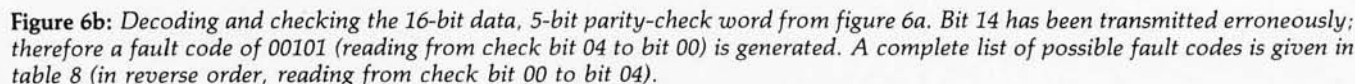
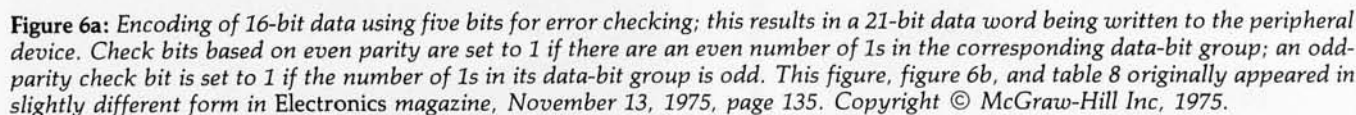
Assembled and Tested NM II Units Now Available!!!

Call or Write for Details.

ads

Ackerman Digital Systems, Inc., 110 N. York Road, Suite 208, Elmhurst, Illinois 60126

(312) 530-8992



Encoding for 8 and 16 bits is shown in figures 5 and 6. The detailed parity tests for these appear in tables 5 and 7 respectively. The fault-code look-up tables are shown as tables 6 and 8. This 16-bit system was developed by the Data General Corporation. It will correct single-bit errors throughout the entire word, and will reportedly trap an average of 97% of the multiple faults that occur. Eight-bit coding logic has been verified in macro-assembler routines on a DECsystem 10 by my associate Stephen J Gross, who is now at Stanford University.

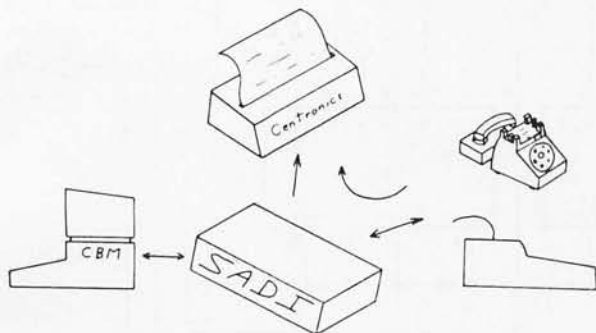
Check Bit	Data Positions
0	0,1,2,6 (odd)
1	0,3,4,6,7 (odd)
2	1,3,5,6,7 (even)
3	2,4,5,7 (odd)

Error-Reducing Hardware

Hardware implementation utilizes standard 7400 series transistor-transistor logic (TTL). Schematic diagrams are shown in figures 7 and 8. Parity encoding and decoding is accomplished with 9-bit parity trees (using a 74180 parity generator/tester).

Worst-case data path for both 8-bit and 16-bit error checking and correcting amounts to about 120 ns delay. Certainly, this interval is short enough to prevent it from imposing any constraint at even unusually high data-transfer rates. It should be clear that when handling errors, operation

PET TWO-WAY RS-232 and PARALLEL OUTPUT INTERFACE



SADI - The microprocessor based serial and parallel interface for the Commodore PET. SADI allows you to connect your PET to parallel and serial printers, CRT's, modems, acoustic couplers, hard copy terminals and other computers. The serial and parallel ports are independent allowing the PET to communicate with both peripheral devices simultaneously or one at a time. In addition, the RS-232 device can communicate with the parallel device.

Special Features for the PET interface include:
Conversion to true ASCII both in and out
Cursor controls and function characters specially printed
Selectable reversal of upper and lower case
PET IEEE connector for daisy chaining
Addressable - works with other devices

Special Features for the serial interface include:
Baud rate selectable from 75 to 9600
Half or full duplex
32 character buffer

X-ON, X-OFF automatically sent
Selectable carriage return delay

Special Features for the parallel interface include:
Data strobe - either polarity
Device ready - either polarity
Centronics compatible

Complete with power supply, PET IEEE cable, RS-232 connector, parallel port connector and case. Assembled and tested.

SAD1a (110VAC) \$295

SAD1e (230VAC) \$325

Order direct or contact your local computer store.

CONNECTICUT microCOMPUTER, Inc.
150 POCONO ROAD
BROOKFIELD, CONNECTICUT 06804
TEL: (203) 775-9659 TWX: 710-456-0052

VISA AND M/C ACCEPTED - SEND ACCOUNT NUMBER, EXPIRATION DATE AND SIGN ORDER.
ADD \$3 PER ORDER FOR SHIPPING & HANDLING - FOREIGN ORDERS ADD 10% FOR AIR POSTAGE.

ANNOUNCING:

NEW!

MICROSTAT

A complete statistics package for business, scientific, education and research work. No other package has the features of MICROSTAT. For example:

- File oriented with COMPLETE editing
- A Data Management Subsystem for editing, sorting, ranking, lagging, data file transfers PLUS 11 data transformations (e.g., linear, reciprocal, exponential, etc.)
- Frequency distributions
- Simple and multiple regression
- Time series (including exponential smoothing)
- 11 Non-parametric tests
- Crosstabs/Chi-square
- Factorials (up to 1,000,000!), permutations, combinations
- 8 Probability distributions
- Scatterplots
- Hypothesis test (Mean, proportion)
- ANOVA (one and two-way)
- Correlation
- Plus many other unique features

Users manual: \$10.00 (credited towards purchase) and includes sample data and printouts. Uses NORTH STAR BASIC 32K of memory, one or two disk drives (2 recommended). Printer optional. Price: \$200.00



ECOSOFT

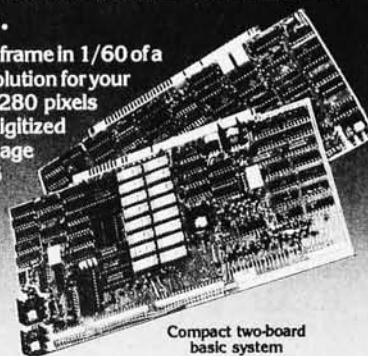
P.O. Box 68602
Indianapolis, IN 46268

Phone orders:
(317) 253-6828

CAT-100 FULL COLOR GRAPHICS

The original 256-color imaging system with high resolution video FRAME GRABBER for the S-100 bus.

Capture and digitize a video frame in 1/60 of a second. Select the best resolution for your application, from 256 to 1280 pixels per TV line. Display your digitized or computer processed image with 256 gray levels or 256 colors on standard B&W, NTSC or RGB color TV monitors.



Features:

- Highest possible quality 480x512x8 digital video image presently available on the market
- Input capability from TV camera or other sources
- Variety of synchronization choices
- 2 selectable video A/D conversion circuits
- Choice of 1, 2, 4, 8, 16 or 32 bits per pixel
- 32K-byte image memory on the basic system
- 32, 64, 128 & 256K byte system capacity
- Lightpen input
- Photographic trigger control input
- Software selectable system parameters
- Interfaces for TRS-80 and other processors
- Comprehensive line of accessories, monitors and support software

SEND FOR FREE CATALOG



DIGITAL GRAPHIC SYSTEMS
441 California Ave., Palo Alto, CA 94306 415/494-6088

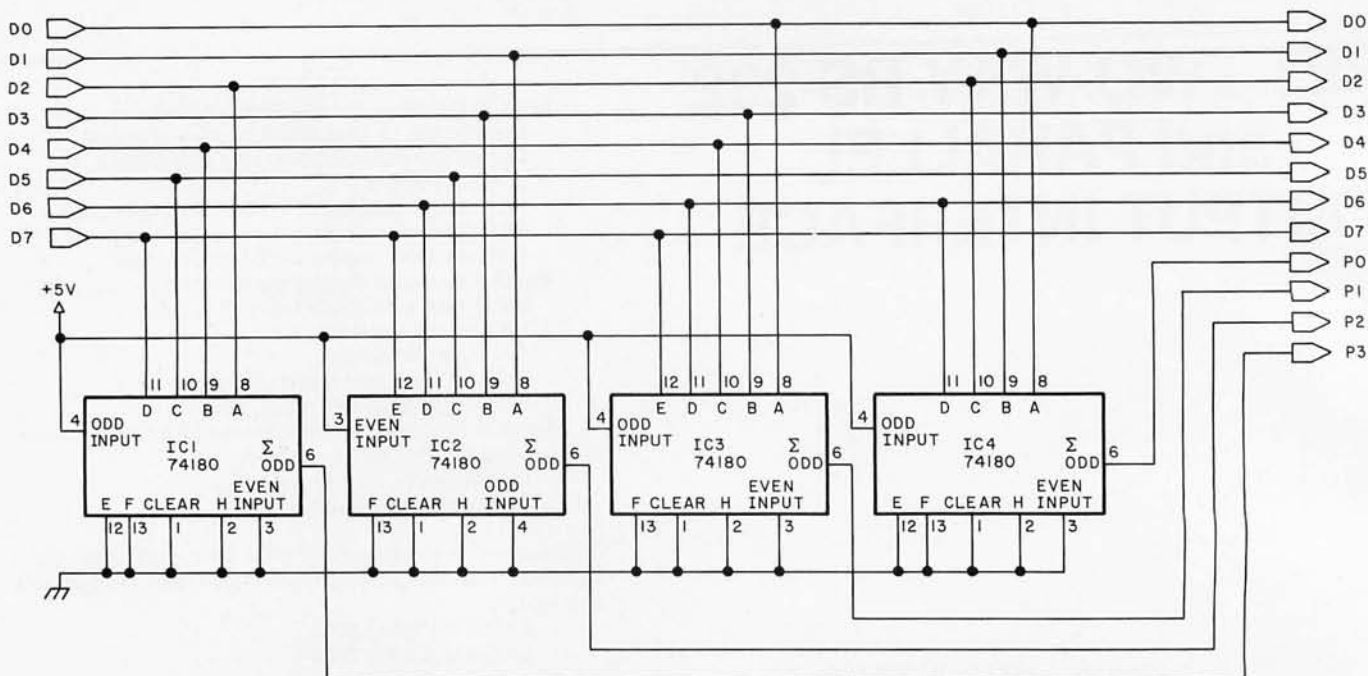


Figure 7a: Schematic diagram of electronic logic that encodes 8-bit data. Unused input pins on the 74180 parity-generator and tester devices are connected to ground.

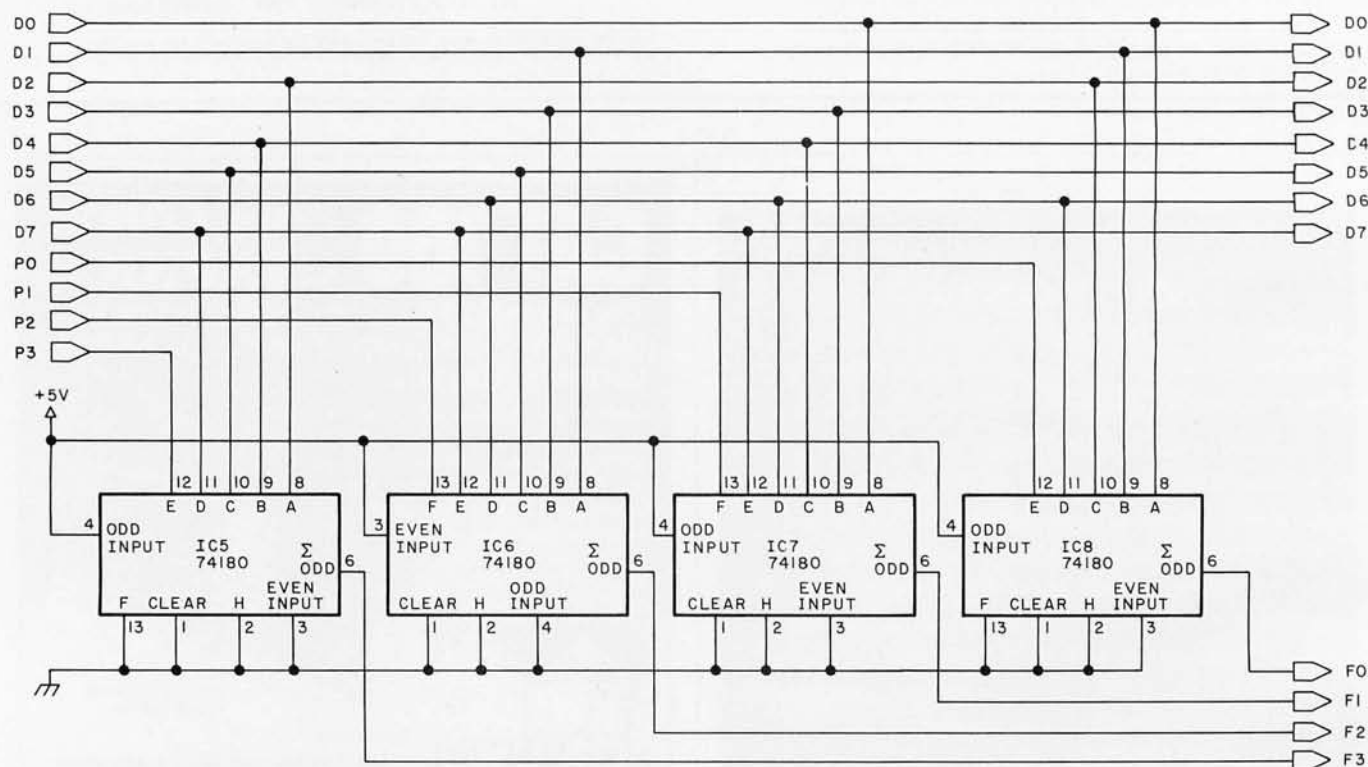


Figure 7b: Schematic diagram of circuit for trapping errors in the 8-bit data encoded by the circuit in figure 7a. The 12-bit word received from the peripheral device is separated into 8 bits of meaningful data and 4 bits of parity-checking data. Unused inputs on the 74180s are grounded.

of the error checking and correcting apparatus is rapid enough to make it entirely transparent to the processor and the system bus.

Though the underlying theory requires the writing of additional parity

bits, the generation and interpretation of these flags are contained entirely within the error-processing system. (See figure 9.) The parity bits do not appear on the bus and are not seen by the processor; therefore no

interface modification is necessary. Additional data-transfer logic is required to deal with the parity bits. The circuits in figures 7 and 8 create parallel data which must undergo a

Text continued on page 274

APPLE II PARALLEL INTERFACE CARD

John Bell Engineering is announcing an Apple II Parallel Interface Card. There are four I/O ports with handshaking logic. The board has two 6522 versatile interface adapters and a 74LS74 for addressing and timing. Each 6522 has two interval timers. This will interface your Apple II to printers, speech synthesizers, keyboards, and other John Bell Engineering products. Inputs and outputs are TTL and CMOS compatible.

Prices:

79-295 Complete kit \$69.95
79-295 Assembled \$79.95

SOLID STATE SWITCH

Now you can control the World! Switch lights on and off for home security, computer controlled disco light shows. Turn your printer on only when needed. The Switch can handle 720 watts (120 VAC 6 AMPS). Its input is TTL compatible (5V-2MA), isolation 1500VDC. The circuit board is 2" square on the one channel kit and 2"x 8" on the 4 channel unit.

Prices:

1 Channel kit \$9.95 assm. \$12.50
4 Channel kit \$34.95 assm. \$44.95

A to D D to A CONVERTER

John Bell Engineering now has available an Analog to Digital and Digital to Analog Converter Board. Features low cost medium speed (50,000 conversions per second) for applications such as speech recording and music synthesizing. Single power (+5) required. Parallel inputs and outputs include 8 data bits, strobe lines, and latches. Analog inputs and outputs are medium impedance zero to five volt range.

Prices:

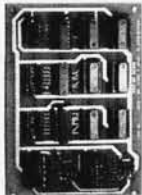
79-287 Kit \$49.95
79-287 Assembled \$69.95

PRODUCTS AVAILABLE FROM:

JOHN BELL ENGINEERING
P.O. BOX 338
DEPT. 4
REDWOOD CITY, CA 94064
(415) 367-1137

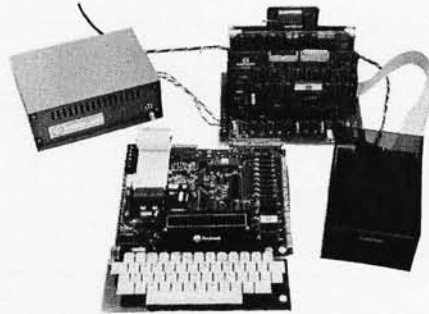
ADD 6% SALES TAX IN CALIFORNIA AND \$1.00 SHIPPING & HANDLING FOR ORDERS LESS THAN \$20. ADD 4% FOR VISA OR M.C.

J B ENGINEERING



compass
microsystems

There is nothing like a
DAIM



A complete disk system for the Rockwell Aim 65. Uses the Rockwell Expansion Motherboard. Base price of \$850 (U.S.) includes controller with software in Eprom, disk power supply and one packaged Shugart SA400 Drive.

224 SE 16th St.
P.O. BOX 687

AMES, IA 50010
(515) 232-8187

BLINK.

At first it appears to be an IBM Selectric™. It is! A standard keyboard, familiar operation that does such a good job on day-to-day typing. Look, closer. There are extra controls: CONTROL ESCAPE DELETE REPEAT ABORT TEST. The full functions of a communications terminal. It is! Connect the cable to your system's RS232C connector and quick as a blink you can communicate. Input and receive? That's right. It's a printer, too. And, what a printer! Sharp, neat, clear impressions. IBM

Selectric™ quality, whether typed by hand or by your computer. Typewriter yes, communicator yes, printer yes. All three beautifully packaged in a single machine for \$1595.

Buy one, today, and expand your present system with the flick of a switch. In the blink of an eye.

Western I/O



Western I/O 7750 E. Redfield Road Scottsdale, Arizona 85260 Area Code (602) 948-3162

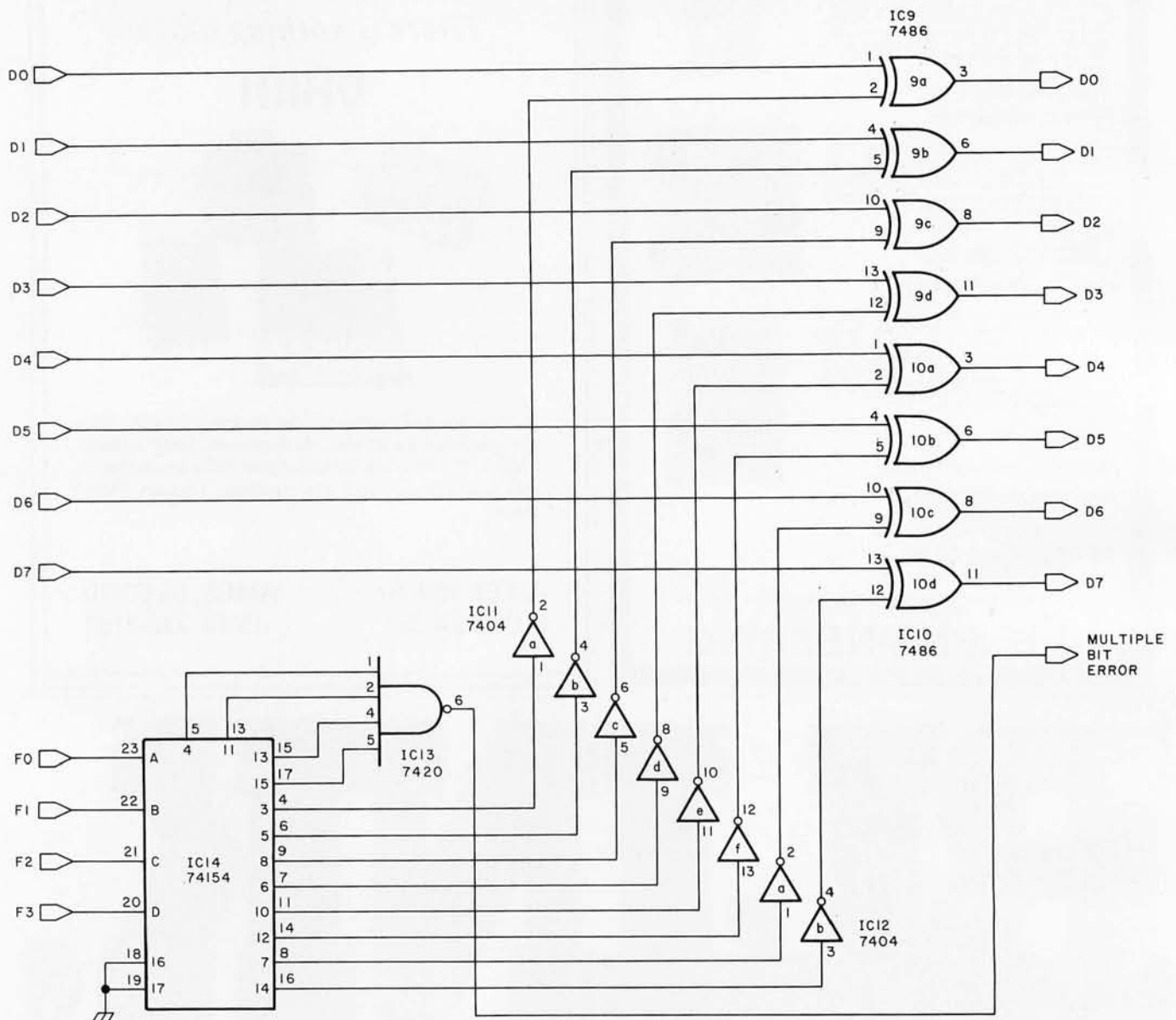


Figure 7c: Schematic diagram of the circuit which corrects single-bit errors trapped by the circuit of figure 7b. Multiple-bit errors are made known to the processor, but cannot be corrected using this scheme.

“Everything should be as simple as possible,
but no simpler” — Einstein

DR. DOBB'S JOURNAL (Software and systems for small computers)

P.O. Box E, Dept. H8, Menlo Park, CA 94025 • \$15 for 10 issues • Send us your name, address and zip. We'll bill you.

TERMINALS

FROM TRANSNET

PURCHASE FULL OWNERSHIP AND LEASE PLANS

DESCRIPTION	PURCHASE PRICE	12 MOS.	24 MOS.	36 MOS.
LA36 DECwriter II	\$1,695	\$162	\$ 90	\$ 61
LA34 DECwriter IV	1,295	124	69	47
LA120 DECwriter III KSR ...	2,495	239	140	90
LA180 DECprinter I	2,095	200	117	75
VT100 CRT DECscope	1,895	182	101	68
VT132 CRT DECscope	2,295	220	122	83
DT80/1 DATAMEDIA CRT ...	1,895	182	101	68
TI745 Portable Terminal ...	1,595	153	85	57
TI765 Bubble Memory Terminal	2,795	268	149	101
TI810 RO Printer	1,895	182	101	68
TI820 KSR Printer	2,195	210	117	79
TI825 KSR Printer	1,695	162	90	61
ADM3A CRT Terminal	875	84	47	32
QUME Letter Quality KSR ...	3,195	306	170	115
QUME Letter Quality RO ...	2,795	268	149	101
HAZELTINE 1410 CRT	875	84	47	32
HAZELTINE 1500 CRT	1,195	115	64	43
HAZELTINE 1552 CRT	1,295	124	69	47
DataProducts 2230 Printer ..	7,900	757	421	284
DATAMATE Mini Floppy	1,750	168	93	63

FULL OWNERSHIP AFTER 12 OR 24 MONTHS • 10% PURCHASE OPTION AFTER 36 MONTHS

ACCESSORIES AND PERIPHERAL EQUIPMENT

ACOUSTIC COUPLERS • MODEMS • THERMAL PAPER RIBBONS • INTERFACE MODULES • FLOPPY DISK UNITS
PROMPT DELIVERY • EFFICIENT SERVICE



TRANSNET CORPORATION

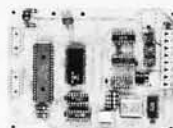
1945 ROUTE 22, UNION, N.J. 07083

201-688-7800

TWX 710-985-5485

CONTROL THE WORLD THROUGH A EIA RS-232C PORT

NEW NEW



ALI has designed a new control system that uses a standard serial port to communicate to over 1000 output points and read over 1000 input points. With this system you can now control relays, lights, motors, D/A, and sense photo eyes, voltage, switches, A/D, keyboards and a lot more. All this control over a single RS-232C link! All it takes is a standard RS-232C port and one or more ALI control modules, per your I/O requirement. Up to 225 modules can be connected to a single EIA RS-232C port.

The modules consist of an I/O CONTROL COMMANDER by itself or in conjunction with one of the specific I/O interface boards. Each I/O CONTROL COMMANDER has 8 TTL inputs and 4 TTL outputs, plus all of the circuitry necessary for proper address decoding and communications timing. Each CONTROL COMMANDER is crystal controlled for highest accuracy and reliability. Baud rate is selectable from 150 to 9600 baud.

Various peripherals can be plugged into the I/O CONTROL COMMANDER to handle specific I/O functions.

	ASSM	KIT
I/O CONTROL COMMANDER	\$149	\$129
• 8 TTL inputs		
• 4 TTL outputs		
• 150 to 9600 Baud		
• Crystal controlled		
RELAY INTERFACE	120	98
• 4 2A, 120V AC relay outputs		
• 4 5V-120V AC or DC opto-isolated inputs		
UNIVERSAL I/O, KEYBOARD DISPLAY INTERFACE	190	152
• Up to 16 character display		
• Up to 32 digits display		
• Up to 64 individual inputs		
• Sense full ASCII keyboard		
• Up to 128 individual outputs		
ALPHA NUMERIC DISPLAY	179	155
• 16 Alpha numeric displays		
• Mates with UVKD		
THUMBWHEEL SWITCH UNIT	165	145
• 8 Digits BCD inputs		
• 32 Bits TTL input		
• Mates with UVKD		

As you can see from the above description, you can mix and match modules to meet your specific requirements. All this and more over a single RS-232C link. The above is only a brief summary of the available options.

TO ORDER CALL OR WRITE:



AL INDUSTRIES
15 Algonquin Trail, Oakland, N.J. 07436
(201) 337-2030

*N.J. Residents add 5% sales tax • Dealers Inquiries Invited



INFINITE BASIC

For MOD I TRS-80™ Tape and Disk Systems

Extensions to Level II and Disk BASIC \$49.95

Full MATRIX Functions — 30 BASIC commands!!
Mathematical and common matrix functions. Change arrays in mid-program. Complete array handling. Tape array read and write, including strings. Common subroutine calls.

Over 50 more STRING Functions as BASIC commands!! String manipulation, translation, compression, copying, search, screen control, pointer manipulation and utility functions. Includes multikey multivariable machine language sorts. Load only machine language functions that you want! Where you want in memory! Relocating linking loader! More than you ever expected!!

∞ BUSINESS (Requires Infinite BASIC) \$29.95

20 Business oriented functions including:
Printer Automatic Pagination with headers and footers!
Packed Decimal Arithmetic (+, -, *, /) 127 digits!
Binary array searches and hash code generator!

COMPROC Command Processor for Disk Systems \$19.95

Auto your disk to perform any sequence of DOS commands, machine language loads, BASIC, memory size, run program, respond to input statements, etc. Single BASIC command file defines execution! Includes auto key-debounce, screen print and lower case software driver.

REMODEL + PROLOAD Specify 16, 32, or 48K Memory \$34.95

REnumber any portion or all of BASIC program. MOve any portion of program from one location to another. DElete program lines. MERGE all or any portion from tape. Save and verify portion or all of combined merged programs to tape.

GSF (Specify 16, 32, or 48K) \$24.95

18 Machine language routines. Includes RACET sorts.

CHECK, VISA, M/C, C.O.D.

Calif. Residents add 6%

Telephone Orders Accepted (714) 637-5016

TRS-80 IS A REGISTERED TRADEMARK OF TANDY CORPORATION

DEALER INQUIRIES INVITED

WHEN ORDERING PLEASE
ADVISE PUBLICATION SOURCE

DISK SORT MERGE 'DSM'

For MOD I and MOD II TRS-80™

FAST — Now you can sort an 85K diskette in less than 3 minutes* **— FAST**

Perfect for your multi-diskette RANDOM file mailing lists, inventory, etc. Ideal for specialized report generation. Sort, merge or combination. All machine language stand-alone package — Efficient and easy to use. No separate key files required! Physical records are rearranged on diskette! Supports multiple sub records per sector including optional sector spanning. Sorts on one or more fields — ascending or descending. Sort fields within records may be character, integer, and floating-point binary. Provides optional output field deletion, rearrangement, and padding.

*Sort timings shown below are nominal times. Times will vary based on sort and system configurations. Nominal times based on Mod I 48K 4-drive configuration, 64 byte records, and 5 sort keys.

TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)	TYPE	FILE SIZE (Bytes)	SORT TIME (Sec)
SORT	16K	33	SORT	340K	1081
SORT	32K	49	SORT	680K	2569
SORT	85K	173	SORT and MERGE	85K SORT + 1275K Merge	1757
SORT	170K	445			

DSM for Mod I (Minimum 32K, 2-drives) \$75 On-Disk

DSM for Mod II (Minimum 64K, 1-drive) \$150 On-Disk

Mod II Development Package \$100

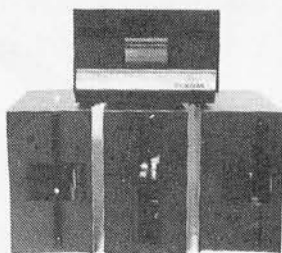
Machine Language SUPERZAP, plus Editor/Assembler and Disassembler patches.

Mod II Generalized Subroutine Facility 'GSF' \$50

RACET COMPUTES
702 Palmdale, Orange CA 92665

SAVE ON ADD-ON PRODUCTS FOR TRS-80

The largest family of disk drives from the largest supplier, drives come complete with power supply and cabinet.



TF-Perfec FD200, 40 track, use both sides	\$389
TF-3 Shugart SA400, 35 track, same as tandy	\$389
TF-5 MPI B51, 40 track	\$389
TF-70 Micropolis, 77 track with 195K of storage	\$639
TDH-1 Dual sided drive, 35 track	\$499

* MAX-DISC TWO *

Maxi Disk 1: 10 Megabyte Hard Disk with 5 fixed, 5 removable with controller	\$6299
Maxi Disk 2: 10 Megabyte (fixed) Winchester Technology	\$5349
77 tracks of Storage includes new DOS+	\$695

PRINTERS

DP800 Anadex, 80 column, 112cps	\$950
LP779 Centronics 779	\$1069
LP730 Centronics 730	\$950
LP700 Centronics 700-1	\$1495
LP701 Centronics 701-1	\$1759
LP702 Centronics 702-2	\$1995
SPW-1 Spinwriter-NEC	\$2599

NEW! LINE PRINTER BASE 2

Base 2 Printer 80, 132 col., graphics 60 LPM with tractors	\$649
--	-------

* DRIVES FOR ANY MICROCOMPUTER *

Does not include power supply & cabinet.
MOD II DISK DRIVES NOW AVAILABLE

Perfec FD200	\$282
Perfec FD250 (dual head)	\$399
Shugart SA400 (unused)	\$286
Shugart SA800	\$479
MPI B51	\$279
MPI B52	\$349

SOFTWARE

New DOS+ with over 200 modifications and corrections to TRS-DOS	\$99
New DOS+ 40 track	\$110
AJA Word Processor	\$75
AJA Business Program	\$250
Racet Infinite Basic	\$49.95
Disk Drive Alignment Program	\$109
Radix Data Base Program	\$99.95
Electric Pencil	\$150

ALL PRICES CASH DISCOUNTED. FREIGHT FOB/FACTORY



**MICROCOMPUTER
TECHNOLOGY
INCORPORATED**

Circle 329 on inquiry card.
3304 W. MacArthur
Santa Ana, CA 92704
(714) 979-9923



Apparat, Inc.

Circle 202 on inquiry card.
7310 E. Princeton Ave.
Denver, CO 80222
(303) 758-7275

"See us at NCC,
booth 69"

Fault Code Error

0000	no error detected
0001	check bit 0
0010	check bit 1
0011	data bit 0
0100	check bit 2 *
0101	data bit 1
0110	data bit 3
0111	data bit 6
1000	check bit 3
1001	data bit 2
1010	data bit 4
1011	all data and parity set to logic 0
1100	data bit 5
1101	multi bit error
1110	data bit 7
1111	multi bit error

Table 6: Look-up table of fault codes used by the 8-bit to 12-bit encoding scheme. Setting of the check-bit-2 fault code (indicated by an asterisk) shows that all data and parity bits are set to logic 1.

Check Bit Data Positions

0	2,5,10,11,12,13,14,15 (odd)
1	4,5,6,7,8,9,10,15 (even)
2	1,2,3,7,8,9,14,15 (odd)
3	0,2,3,5,6,9,12,13 (even)
4	0,1,3,4,6,8,11,13 (odd)

Table 7: The 16-bit encoding scheme uses 5 parity bits that enable single-bit error correction. Each parity-check bit performs its check operation upon the data-bit positions shown here.

Fault Code Error

00000	no error detected
00001	error in check bit 4
00010	error in check bit 3
00011	error in data bit 0
00100	error in check bit 2
00101	error in data bit 1
00110	multiple-bit error
00111	error in data bit 3
01000	error in check bit 1
01001	error in data bit 4
01010	all data and parity set to logic 1
01011	error in data bit 6
01100	error in data bit 7
01101	error in data bit 8
01110	error in data bit 9
01111	multiple-bit error
10000	error in check bit 0
10001	error in data bit 11
10010	error in data bit 12
10011	error in data bit 13
10100	error in data bit 14
10101	all data and parity set to logic 0
10110	error in data bit 2
10111	multiple-bit error
11000	error in data bit 10
11001	multiple-bit error
11010	error in data bit 5
11011	multiple-bit error
11100	error in data bit 15
11101	multiple-bit error
11110	multiple-bit error
11111	multiple-bit error

Table 8: Look-up table of fault codes used by the 16-bit to 21-bit encoding scheme. The codes are shown here in order from check bit 00 to bit 04, reversed from the representation in figure 6.

Address Input	Data Output
00000	7 6 5 4 3 2 1 0
00001	0 0 0 1 0 0 0 0
00010	0 1 0 1 0 0 0 0
00011	0 1 0 1 0 0 0 0
00100	0 0 0 0 0 0 0 0
00101	0 1 0 1 0 0 0 0
00110	0 0 0 0 0 0 0 0
00111	0 0 0 0 0 0 0 1
01000	0 1 0 1 0 0 0 0
01001	0 0 0 0 0 1 0 0
01010	1 1 0 1 0 0 0 0
01011	0 0 0 0 0 1 1 0
01100	0 0 0 0 0 1 1 1
01101	0 0 0 0 1 0 0 0
01110	0 0 0 0 1 0 0 1
01111	0 0 1 1 0 0 0 0
10000	0 1 0 1 0 0 0 0
10001	0 0 0 0 1 0 1 1
10010	0 0 0 0 1 1 0 0
10011	0 0 0 0 1 1 0 1
10100	0 0 0 0 1 1 1 0
10101	1 0 1 1 0 0 0 0
10110	0 0 0 0 0 0 1 0
10111	0 0 1 1 0 0 0 0
11000	0 0 0 0 1 0 1 0
11001	0 0 1 1 0 0 0 0
11010	0 0 0 0 0 1 0 1
11011	0 0 1 1 0 0 0 0
11100	0 0 0 0 1 1 1 1
11101	0 0 1 1 0 0 0 0
11110	0 0 1 1 0 0 0 0
11111	0 0 1 1 0 0 0 0

Table 9: Truth table which is programmed into a program-mable read-only memory for use in the electronic circuit of the 16-bit error-checking and correcting system.

Number	Type	+5 V	GND
IC1	74180	14	7
IC2	74180	14	7
IC3	74180	14	7
IC4	74180	14	7
IC5	74180	14	7
IC6	74180	14	7
IC7	74180	14	7
IC8	74180	14	7
IC9	7486	14	7
IC10	7486	14	7
IC11	7404	14	7
IC12	7404	14	7
IC13	7420	14	7
IC14	74154	24	12
IC15	74180	14	7
IC16	74180	14	7
IC17	74180	14	7
IC18	74180	14	7
IC19	74180	14	7
IC20	7404	14	7
IC21	74180	14	7
IC22	74180	14	7
IC23	74180	14	7
IC24	74180	14	7
IC25	74180	14	7
IC26	7488	16	8
IC27	74154	24	12
IC28	7404	14	7
IC29	7404	14	7
IC30	7404	14	7
IC31	7486	14	7
IC32	7486	14	7
IC33	7486	14	7
IC34	7486	14	7

Table 10: Power supply connections for integrated circuits used in electronic logic described in this article.

VEDIT CP/M Visual Editor

**Now Edit 5 to 10 Times Faster
in Word Processing, C-Basic,
Fortran, Assembler and more.**

VEDIT is a customizable screen-oriented editor which ends tedious editing of C-Basic, Word Processing, Fortran, Assembler and other text files. No longer will you have to retype long lines, and cumbersome commands and editing errors become a thing of the past. You simply move the cursor to any place in the file and make necessary changes by typing new text or hitting a function key. VEDIT provides a full array of easy to use cursor movements, including zip to the end of line. Function keys allow for character deletion, line deletion, and lines to be concatenated or split. For full flexibility, the normal set of ED commands is included, plus macros with imbedded visual mode and text move.

Special Features: Included is a setup program which

allows you to customize VEDIT to your screen characteristics and keyboard layout. You decide which key or control code to use for each cursor movement or visual function. Tab key allows insertion of tab character or spaces to settable tab positions. Lines longer than the screen are eloquently handled by writing them on multiple screen lines and indicating in the first reserved column those that are continuation lines. Continuation lines are automatically created as necessary while you type. Sophisticated disk buffering can do automatic READ and WRITE commands for files larger than the available main memory space. Good program documentation is encouraged because now all editing becomes natural and easy.

Availability: VEDIT is available immediately for CP/M Systems with any memory mapped displays, including the VDM, SSM or Matrox boards, or Piceon I/O mapped display board. Please call or write on availability for VDM 8024 (May), smart CRT terminals, Sorcerer (May) and the TRS-80 (June).

Ordering: Specify memory or I/O mapped, 8080/Z80 or Z80 code versions. All packages include 8" disk, VEDITS (all features of VEDIT except regular ED-like commands), customization program and documentation on disk.

Standard Package: Disk with VEDIT & manual \$100
Deluxe Package: All versions of VEDIT & manual \$130
Budget Package: VEDITS only, no manual \$75
Manual \$15

5% discount for money orders, certified checks. Michigan residents add 4% sales tax. Visa and Master Charge welcomed.

Dealer Inquiries Invited

*CP/M is a trademark of Digital Research Corp.
 * TRS-80 is a trademark of Tandy Corporation.

CompuView Products Inc.

1531 JONES DRIVE • ANN ARBOR, MICHIGAN 48105
 CALL ANYTIME: (313) 996-1299

Rx AVAILABLE WITHOUT PRESCRIPTION!

THE ONLY SYSTEM OF ITS KIND YOUR MICROCOMPUTER WILL EVER NEED!

GLOBAL™ DATABASE MANAGEMENT SYSTEM

for

PROGRAMMERS, ACCOUNTANTS, BOOK-KEEPERS, DOCTORS, LAWYERS, PUBLISHERS, SCIENTISTS, MANUFACTURERS, WHOLESALERS, RETAILERS, MANAGERS, LANDLORDS, REAL ESTATE AGENTS, TEACHERS, STUDENTS, ETC.

Extremely comprehensive, versatile user-oriented management system for database creation and list maintenance. Runs under CP/M* and CBASIC2 on a microcomputer system in only 40K RAM.**

Completely user-defined file structure with sequential, random and linked file maintenance; user-defined number of fields; data transfer between records; automatic high speed search algorithms with global search function; built-in ISAM; fast sort/merge utility; record selectable output can be formatted (with/without headings, column titles, totals, etc.) and printed on various forms (labels, envelopes, preprinted forms, etc.); links to CP/M commands or programs with automatic return to Global; provides status reports on diskette, data file and hardware environment; disk used as extended memory.

Supplied on standard 8" IBM disk (inquire about other formats), complete with BASIC subroutine library in source code, with comprehensive manual.

\$295

MANUAL ONLY...\$25

*Trademark of Digital Research

**Trademark of Software Systems

Add { Shipping \$2.00
C.O.D. 1.00
Sales Tax where applicable

DEALER INQUIRIES INVITED

GLOBAL PARAMETERS

1505 Ocean Ave., Brooklyn, N.Y. 11230
212/252-5002

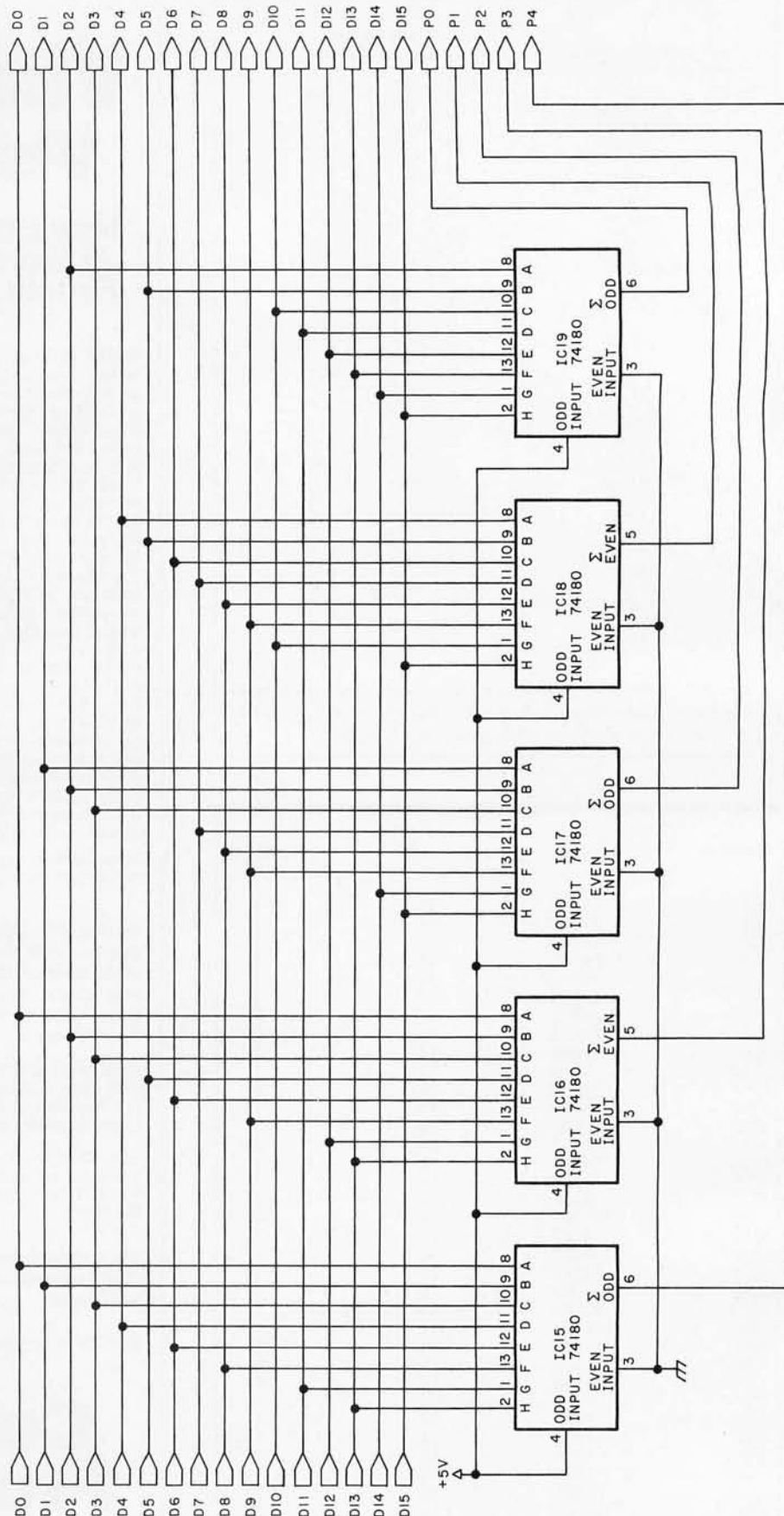


Figure 8a: Schematic diagram of the circuit to encode 16-bit data into 21-bit words containing 5 parity bits.

DECwriter® GRAPHICS



Graphics II™ converts your DECwriter® to a plotter and a whole lot more!!

- Vector graphics (automatic line generator)
- 1320 × 792 dots per page
- Bi-directional line feed
- Multiple character sets (includes APL)
- Variable character styles
- Multiple interfaces including RS232
- Prints at 40 Characters/second
- Communicate up to 1200 BAUD
- 1000 character buffer with x-on/x-off
- Easy to install & plug compatible
- No mechanical changes required
- Raster graphics option
- Software option
- Time share compatibility

Graphics II for the DECwriter II does everything your old DECwriter did . . . and a whole lot more!!

Call or write today for more information



SELNAR Corporation (408) 727-2811
2403 De La Cruz Blvd. Santa Clara, CA 95050
DECwriter is a registered trademark of Digital Equipment Corporation



SOFTWARE

FOR MECHANICAL ENGINEERS

- **PIPE FLEXIBILITY PROGRAM:** \$6000.00† with sophisticated preprocessor.
- **NEMA/API 617 REPORT PROGRAM:** \$1500.00*, † steam turbines, centrifugal compressors allowable reactions.
- **PUMP-API 610 REPORT PROGRAM:** \$1500.00*, † pump nozzle allowable reactions.
- **PIPE REINFORCEMENT PAD PROGRAM:** \$2000.00† capacity for multiple combinations of pressures and temperatures.
- **MTO CONTROL PROGRAM:** \$8000.00† material takeoff and control for pipe, valves, fittings for E and C companies.
- **THIN WALL EXPANSION JOINT PROGRAM:** \$2500.00*, †
- **WELDING RESEARCH COUNCIL, BULLETIN 107 PROGRAM:** \$1000.00*† curves not included.
- **HELICAL SPRING COIL PROGRAM:** \$1000.00*
- **QUOTATION PRICING PROGRAM:** \$5000.00* develops pricing data for company selling items containing many types and sizes, and prepares final quotation.

NOTE: All programs are in standard Fortran 4.
†For Univac 1108. All documentation \$20.00.
*For microcomputers.

SUPPORT TECHNOLOGY & PRODUCTS, INC.
P. O. Box 35797
Houston, Texas 77035
(713) 988-6622, Telex 76-2306

Call now for a quotation
(312) 733-0497

The 550 BANTAM from Perkin-Elmer



\$799

All the features of the Hazeltine 1400 & LSI ADM-3A plus

- Upper/Lower Case
- 7x10 Character Matrix
- White or Black Characters
- Transparent Mode
- Addressable Cursor
- Tab Function
- Backspace Key
- Shiftlock Key
- Print Key
- Integrated Numeric Pad
- Editing Functions
- Extremely Compact:
15" W x 19" D x 14" H
- Silent fan-free operation

**All products
in stock!**

U.S. ROBOTICS, INC.

1035 W. LAKE ST.

CHICAGO, ILL. 60607

LA34 DECwriter IV



\$1199

- Tabs
- 132 columns
- 10, 12, 13.2, 16.5 characters/inch
- 2, 3, 4, 5, 8 or 12 lines/inch
- Optional tractor feed
- 110 or 300 baud
- RS232C/ASCII
- Friction feed/up to 15" wide paper
- 9x7 dot matrix, impact printing
- Upper/lower case

Teletype Model 43 KSR \$1049

- 110 or 300 baud
- RS232C/ASCII
- Pin feed/8 1/2" H x 11" W paper is perfect for filing and copying.

PENRIL 300/1200 MODEM Originate/Auto-Answer



\$799

- 0-300 or 1200 baud
- Bell 212A & 103/113 compatible
- 1 year warranty
- Stand alone
- RS232
- Full duplex over voice grade phone lines
- FCC certified for direct connection to phone lines via RJ11C voice jack (standard extension phone jack)



- 132 columns
- Upper/lower case, true descenders
- Dot matrix, impact printing

Connect your TRS-80,
Apple or ANY other
computer to the phone
lines with the...

USR-330 Originate/ Auto-Answer Modem



\$339

FCC certified for direct connection to phone lines via standard extension phone jack

- 0-300 Baud
- Bell 103/113 compatible
- Stand Alone
- RS232
- 1 Year Warranty
- Crystal Controlled
- State of the Art LSI circuitry
- 5 stage active filters

USR-310 Originate Acoustic Coupler



\$159

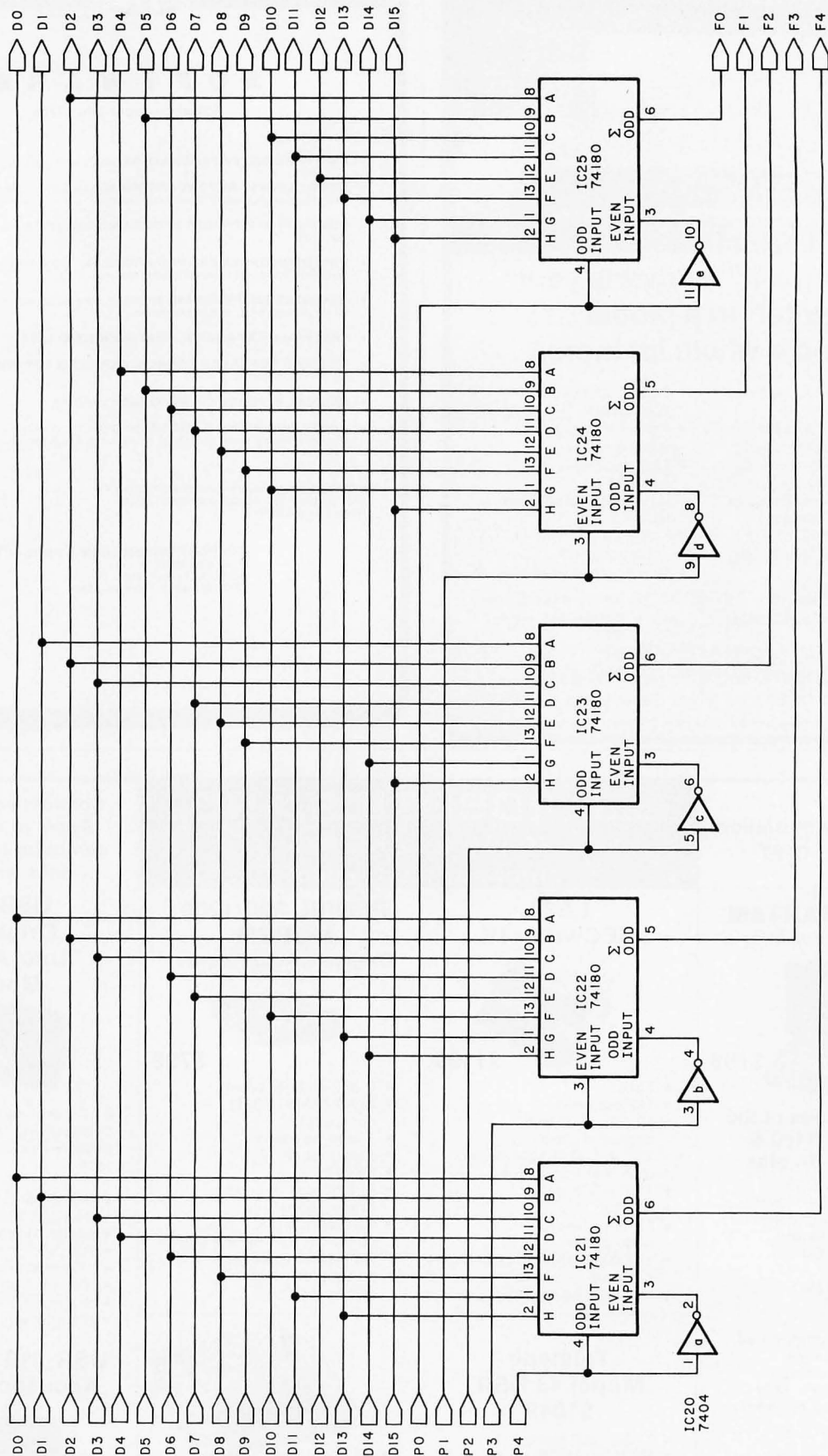
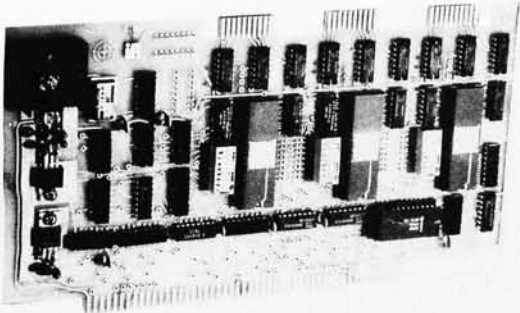


Figure 8b: Schematic diagram of the circuit which traps errors from the encoded 16-bit data. Five error-detecting bits are sent to the error-correcting circuit of figure 8c.

S-100, 6-PORT COMMUNICATIONS

- INTERFACES MULTI TERMINALS, COMPUTERS, PRINTERS, MODEMS, ETC.
- 2, 4, OR 6 CHANNELS; 2 OPTIONAL RTC'S
- SELECTABLE I/O ADDRESS
- PROGRAMMABLE SYNC. CHARACTERS
- SYNC AND ASYNC
- HARDWARE ERROR CHECKING (CRC-16, CCITT)
- COMPLIES WITH: EIA RS-232C STANDARD; IEEE PROPOSED S-100 BUS STANDARD

FULL 6-PORT CONFIGURATION (ASSEMBLED AND TESTED) \$895.00

For information, contact: Dianne Polk (703) 893-4330 x 100



Inco, Inc.

7916 Westpark Drive □ McLean, Virginia 22102

POCKET ASCII TERMINAL

MIDGET
DUPLEX UNIT
WITH MAN-SIZED
CAPABILITIES

Here's \$395 worth of convenience for anyone working with digital systems. Carry it anywhere in a pocket, valise or toolkit to enter and retrieve data, run diagnostics, change constants, test data links, etc.



Look at its facilities:

- Transmits 128 ASCII codes
- Can display last 30 characters received
- Displays full 64-character ASCII set on clear 16-segment LEDs
- 25-line RS232/c compatible interface
- Single 5V supply required at 400mA typical
- 110 or 300 baud transmission selectable
- Parity codes, stop bits settable to your standard
- Obeys bell, cursor and data format control codes

Phone or write us for more details now:

GR ELECTRONICS

1640 Fifth Street,

Santa Monica, CA 90401.

Telephone: (213) 395-4774.

Telex: 65-2337 (BT Smedley SNM).



BUSINESS & PROFESSIONAL SOFTWARE FOR APPLE II

HOME FINANCE PAK I: Complete package \$49.95

BUDGET: The heart of a comprehensive home finance system. Allow user to define up to 30 budget items. Actual expense input can be by keyboard or by automatic reading of CHECKBOOK II files. Costs are automatically sorted and compared with budget. BUDGET produces both monthly actual/budget/variance report and a year-to-date by month summary of actual costs. Color graphics display of expenses by month. \$24.95

CHECKBOOK II: This extensive program keeps complete records of each check/deposit. Unique check entry system allows user to set up common check purpose and recipient categories. Upon entry you select from this pre-defined menu to minimize keying in a lot of data. Unique names can also be stored for completeness. This system produces rapid access to check files. Check register display incorporates unique up/down scrolling system for the ultimate in flexibility. 40 column printout of check register. Up to 100 checks per month storage. Files accessible by BUDGET program. \$14.95

SAVINGS: Allows user to keep track of deposits/withdrawals for up to 10 savings accounts. Complete records shown via screen or 40 column printer. \$14.95

CREDIT CARD: Keep control of your cards with this program. Organizes, stores and displays purchases, payments and service charges. Screen or 40 column printer display. Up to 10 separate cards. \$14.95

THE UNIVERSAL COMPUTING MACHINE: \$39.95

A user programmable computing system structured around a 15 row by 30 column table. User defines row and column names and equations forming a unique computing machine. Table elements can be multiplied, divided, subtracted or added to any other element. User can define repeated functions common to a row or column, greatly simplifying table setup. Hundred of unique computing machines can be defined, used, stored and recalled, with or without old data, for later use. Excellent for sales forecasts, engineering design analysis, budgets, inventory lists, income statements, production planning, project cost estimates in short for any planning, analysis or reporting problem that can be solved with a table. Unique cursor commands allow you to move to any element, change its value and immediately see the effect on other table values. Entire table can be printed by machine pages (user defined 3.5 columns) on a 40 column printer. Transform your computer into a UNIVERSAL COMPUTING MACHINE.

COLOR CALENDAR: HI-RES color graphics display of your personal calendar. Automatic multiple entry of repetitive events. Review at a glance important dates, appointments, anniversaries, birth days, action dates, etc. over a 5 year period. Graphic calendar marks dates. Printer and screen display a summary report by month of your full text describing each day's action item or event. Ideal for anyone with a busy calendar. \$19.95

MICROACCOUNTANT: The ideal system for the small cash business. Based on classic T-accounts and double-entry bookkeeping, this efficient program records and produces reports on account balances, general ledger journals, revenue and expenses. Screen or 40 column printer reports. Handles up to 500 journal entries per period, up to 100 accounts. Program instructions include a short primer in Financial Accounting. \$49.95

THE MATHEMATICIAN: Complete package \$39.95

MATRIX: A general purpose utility program for computing the determinant or inverse of a matrix, as well as the solution to an N-dimensional set of linear equations. \$14.95

PLOTTER 2D: Two dimensional plotting of any function. \$9.95

PLOTTER 3D: Three dimensional surface plotting of any 3-variable function, using Apple II HI-RES. \$14.95

ROOTS: A general purpose program for numerically finding the solutions to any non-linear equation. Uses quadratic interpolation. \$14.95

SEND FOR FREE CATALOG - All programs run on 32K Apple II with Disc and Applesoft ROM Card, or 48K without ROM Card. Detailed instructions included with each program. California residents add 6% sales tax. Send check or money order to:

SPECTRUM SOFTWARE

P.O. BOX 2084 - SUNNYVALE, CALIFORNIA 94087

FOR SERIOUS USERS OF 8080, 8085, OR Z80 COMPUTERS

PRINTER WIZARD - Now add powerful capabilities to your printer. Free your computer for use while simultaneously printing backlogged output on a first-in-first-out basis. Transparent operation without noticeable slowing of the computer. Allows continuous computer and printer operation on programs having sporadic output. Will backlog up to 100 pages when used with a disk system. Adds optional automatic paging with numbers, adjustable margins on 4 sides, indented overflow lines. Occupies less than 2 1/2 K.

Documentation only	EX80M103	\$45.00
	EX80M103D	\$ 7.50

DISASSEMBLER - Disassemble machine code into standard source language. Modify or relocate existing programs such as DOS or BASIC using your existing assembler (not included). Disassembles any 8080, 8085, or Z80 code, including embedded data blocks and "trick" codes. Generates symbol and label tables.

Documentation only	EX80M217	\$75.00
	EX80M217D	\$12.50

ALL EXCOM products are fully supported and warranted indefinitely against original defects. Available on single or double density NORTHSTAR 5 1/4" diskettes, 300 or 1200 baud cassettes (specify). Washington residents add 5.3% tax.

EXCOM

P.O. Box 1802 Bellevue, Washington 98009 U.S.A.

Telephone (206) 641-6577

the electric pencil II™

is now available
for the TRS-80 Model II* Computer

Standard Printer Version \$275

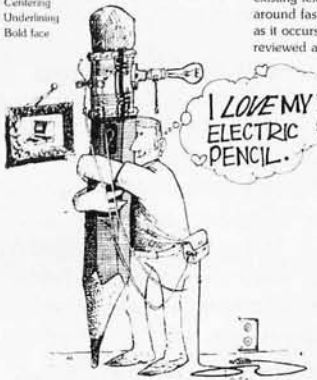
SERIAL DIABLO, QUME and NEC Printer versions \$300

Features

- CP/M COMPATIBLE ONLY
- Supports four disk drives
- Dynamic print formatting
- DIABLO and NEC printer packages
- Multi-column formatting in one pass
- Print value changing
- Page-at-a-time scrolling
- Bidirectional multispeed scrolling controls
- Subsystem with print value scoreboard
- Automatic word and record number tally
- Full margin control
- End-of-page control
- Non-printing text commenting
- Line and paragraph indentation
- Centering
- Underlining
- Bold face

The Electric Pencil II is a Character Oriented Word Processing System. This means that text is entered as a string of continuous characters and is manipulated as such. This allows the user enormous freedom and ease in the movement and handling of text. Since line endings are never delimited, any number of characters, words, lines or paragraph may be inserted or deleted anywhere in the text. The entirety of the text shifts and opens up or closes as needed in full view of the user. The typing of carriage returns or word hyphenations is not required since lines of text are formatted automatically.

As text is typed and the end of the line is reached, a partially completed word is shifted to the beginning of the following line. Whenever text is inserted or deleted, existing text is pushed down or pulled up in a wrap around fashion. Everything appears on the video display as it occurs, which eliminates guesswork. Text may be reviewed at will by variable speed scrolling both in the forward and reverse direction. By using the search or search and replace functions, any string of characters may be located and/or replaced with any other string of characters as desired.



*TRS-80 is a registered trademark of Radio Shack, a Tandy Corp.
Demand a demo from your dealer!



MICHAEL SHRAVER SOFTWARE, INC.
1198 Los Robles Dr.
Palm Springs, CA 92262
(714) 323-1400

NO FRILLS! NO GIMMICKS! JUST GREAT DISCOUNTS MAIL ORDER ONLY

HAZELTINE

1400	\$ 549.00
1410	750.00
1420	795.00
1500	875.00
1500 (Kit)	850.00
Mod 1 Edit	1295.00

CENTRONICS Special

700-2	1095.00
Micro Printer	325.00

DEC

LA34	1075.00
------	---------

NORTH STAR

Horizon I assembled kit	} 20% Off
Horizon II assembled kit	

XYMEC

HY-Q1000 Daisy Printer	2295.00
------------------------	---------

INTERTEC

Superbrain	2595.00
------------	---------

DIGITAL SYSTEMS

Computer	\$4345.00
Double Density	
Dual Drive	2433.00

TELEVIDEO

912	775.00
920	850.00

OKIDATA

SL160	2395.00
CP110	995.00

CROMEMCO

System III \$1000 off	5990.00
-----------------------	---------

TEXAS INSTRUMENTS

810 Printer	1595.00
-------------	---------

ATARI 800

795.00	
--------	--

ADDS Regent 25

CALL	
------	--

Optima Cabinets

(New)	99.95
-------	-------

5" Scotch Diskette

Box / 34.95	
-------------	--

8" Scotch Diskette

Box / 39.95	
-------------	--

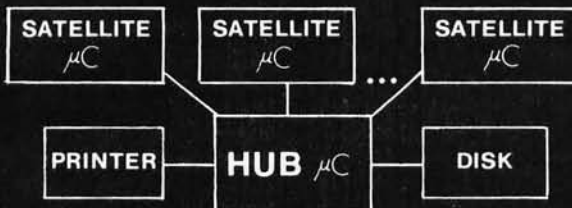
Most items in stock for immediate delivery. Factory-fresh, sealed cartons.

DATA DISCOUNT CENTER

Box 100 135-53 Northern Blvd., Flushing, New York 11354, 212/465-6609

N.Y.S. residents add appropriate Sales Tax. Shipping FOB N.Y.
BankAmericard, Master Charge add 3%. COD orders require 25% deposit.

At last—NETWORKING!



The CDL Network Operating System in your computers will give you:

SAVINGS One disk and printer can be shared among any number of satellite computers. Hard and floppy disk versions are available.

POWER All satellites have a full CPM environment. You can access the largest collection of software available for microcomputers.

FLEXIBILITY The network software can be adapted to your input/output hardware. It even adapts automatically to available RAM.

The CDL Networking Operating System is a quality software product with excellent documentation backed by extensive testing.

Write for information.



CAMBRIDGE DEVELOPMENT LAB
44 Brattle Street Cambridge, MA 02138

THE ESSENCE of output quality

- Any IBM SELECTRIC® can be converted to produce high quality output at an affordable price!
- Interfaces directly to S100, Parallel, RS-232 or IEEE-488.
- Compatible with TRS-80, Sorcerer, Pet, Apple, Horizon, etc.
- Why be printer bound? Prices from \$496 to \$675.

Call
today.



Backspace and Tab
Available NOW!



Escon Products, Inc.
171 Mayhew Way, Suite 204
Pleasant Hill, Ca., 94523
(415) 935-4590

Text continued from page 262:

parallel-to-serial conversion during a write operation, and a serial-to-parallel conversion during a read pro-

cess. Details of this hardware will depend upon the actual data-transfer logic present in existing systems.

Locating single errors is accom-

plished by interpreting the fault code generated by the error-detection logic. This interpretation is done by use of an 8-bit by 32-word programmable read-only memory (8223/7488) which produces a binary output corresponding to the error-bit position in the data word. Error correction is achieved by loading the binary pointer into a 4-to-16 line demultiplexer that flags the proper bit line and corrects the fault with an exclusive-OR inversion. (See figure 10.) With an 8-bit system, the inconvenience of programming the read-only memory may be avoided by loading the fault code directly into the demultiplexer and then "picking off" the corresponding output.

Treatment of Multiple Errors

Although single-bit errors are far more common, multiple failures within one data word can and do appear. For all intents and purposes, these are uncorrectable—particularly in longer data words. Prohibitively extensive logic would be required to locate multiple-fault bits; therefore, these errors are simply trapped to cause a processor interrupt. The

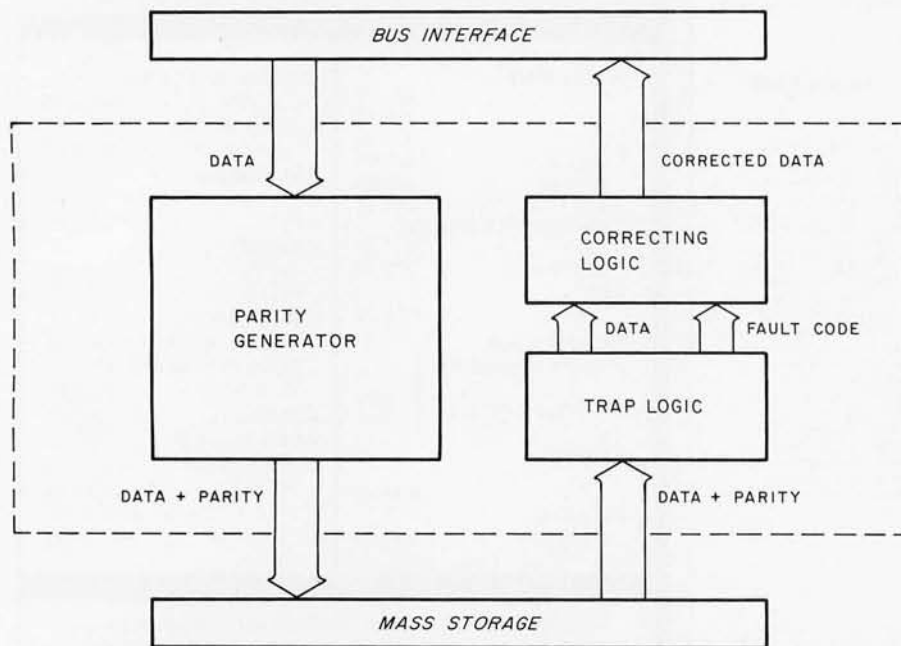


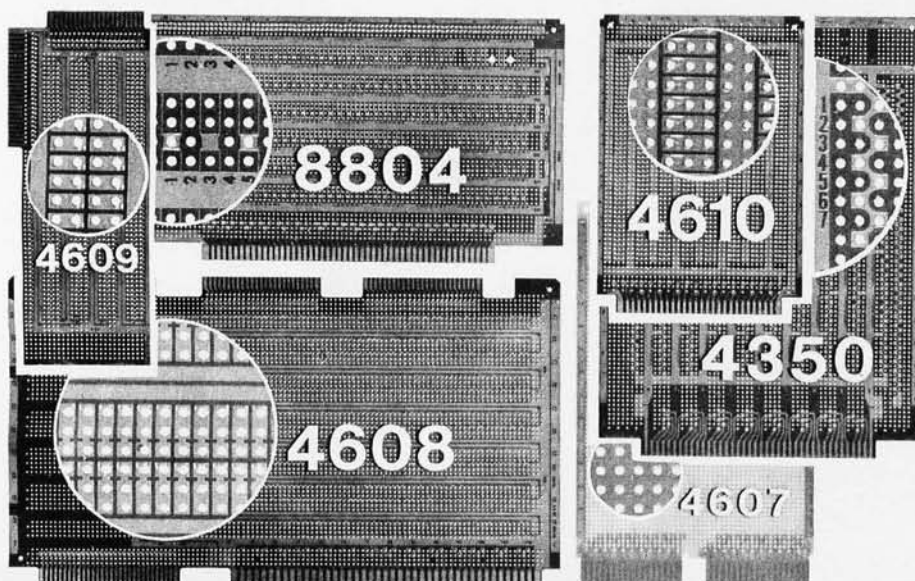
Figure 9: Block diagram of data flow through the error-checking and correcting system. The extra parity bits are never seen by the processor, and make the system transparent from the point of view of the system bus.

BUILD YOUR COMPUTER BREADBOARDS & INTERFACES FASTER AND EASIER WITH NEW VECTOR PLUGBORDS

EASY TO USE!

COST EFFECTIVE!

CLEAN HOLES!



4610 Series - For STD-BUS-WW, solderable and unpatterned models

4608 Series - For Intel/National SBC/BLC 80-WW/ solderable, or unpatterned

8804 Series - For S100 - 5 models available

4607 - For DEC LSI 11/ PDP8-11, Heath H-11

4609 - For Apple II, SuperKim, Pet Commodore with Expandamem

4350 - For TI 980 Computer



Vector Electronic Company INCORPORATED

12460 Gladstone Ave., Sylmar, CA 91342 (213) 365-9661 TWX (910) 496-1539

Available through Distributors or Factory Direct if not available locally.

74801

CP/M® SOFTWARE

Word Processing For CP/M

FMT Text Formatter\$75

Use FMT and your text editor to convert your CP/M system to a powerful word processor. FMT features include automatic page headings and footings, page numbering, centering, underscoring, external file merging, and in-line console input. FMT works with any video, CRT, or hardcopy terminal and printer combination. Added capabilities for daisy-wheel printers: superscripting, subscripting, and half-line spacing.

Run Cromemco Software Under CP/M

ADAPT Software Interface\$50

Now you can get Cromemco software to run on your CP/M system. ADAPT interfaces those powerful Cromemco packages (except for Multi-User BASIC) to any Z-80 based CP/M system without patching. ADAPT works without changes for any memory size.

Fast RATFOR

RATFOR [RAtional FORtran]\$95

RATFOR lets you write structured code that translates to Microsoft or Cromemco FORTRAN. TSW's RATFOR (RAtional FORtran) precompiler runs at more than 1000 statements per minute. Documentation includes "Software Tools" book by Kernighan and Plauger. (ADAPT and RATFOR packages combined \$125)



THE SOFTWARE WORKS
8369 Vickers
San Diego, CA 92111
(714) 569-1721

VISA and MasterCard accepted.

* CP/M is a trademark of Digital Research.

CHESS CP/M CP/M

Sargon for CP/M from your Sargon Book assembled and patched to run as a COM File. Also included, a complete ASCII source file of the original text of the book.

This modified program allows adjourning a game in progress and saving to disk for continuation at a later time. The list of moves for both sides is saved and can be listed to the console or printer for a permanent game record. Powerful new analysis feature allows setting up of board positions, changing sides or level during a game, or taking back moves. Terminal non-specific board position display routines. Sargon automatically orients the displayed board so that the player's pieces are always toward him for ease of play. The last 15 moves are constantly displayed with the board position.

This program is written in Z80 Assembler and does not require any interpreters. Runs in as little as a 20K CP/M System.

All this for only **\$24.49!**

Custom Graphics Interface, 2 x 3 cell memory mapped video, such as Vector FW II or IMSAI VID and others. Displays board and pieces in chess graphics for an eye-catching display of the game.

Only **\$39.44** Complete with all other above features.

Specify disk type and format.

Any 8" IBM, Micropolis Mod II,
Northstar SD or DD, Cromemco 8" or 5".

Send us your book and a blank disk and we pay return postage.

If you do not have a book

Add \$14.95 and we will provide one.

Add \$6.00 and we provide the diskette.
California residents add 6% sales tax on book and diskette

ALSO: Personalized InfoSoft IOS Version 2.0. 100% CP/M*, CDOS*, SDDS* Compatible Disk operating system runs with absolutely any hardware now available. Four years and thousands of hours of use by 8080/80 users all over the country.

Standard Features Include:

1. Multiple disk types running simultaneously (all formats 100% lifeboat compatible)
2. Automatic Print Spooler
3. Complete set of powerful utilities
4. Enhanced system function calls
5. Fully end-user relocatable
6. File attributes
7. Complete manuals for novice users or experienced programmers

Put an end to CP/M hardware specific limitations at last and save money at the same time with this personalized IOS configuration service.

\$95 Standard Configuration. (We have thousands of standard configurations) nominal charge for custom I/O and disk drivers.

InfoSoft IOS Version 3.0

For hard disks with improved dynamic directory processing and memory management. See InfoSoft ad in BYTE. \$150.00 configured.

The Old Association
3744 Pascadero Drive
Santa Barbara, Calif. 93105
(805) 682-8587

*TM Digital Research, Cromemco, SD Systems

TOLL FREE ORDERING



These Fine Products and More

NORTHSTAR	ASM	KIT	TERMINAL	
HRZ-1-16K-D	1600.	1275.	SOROC IQ-120	760.
HRZ-1-32K-D	1995.	1580.	HAZELTINE 1400	760.
HRZ-2-32K-D	2300.	1900.	HAZELTINE 1500	940.
HRZ-1-32K-Q	2300.	1750.	HAZELTINE 1510	1050.
HRZ-2-32K-Q	2700.	2230.	TELEVIDEO 912	700.
			TELEVIDEO 920	750.
RAM-16K	365.	325.		
RAM-32K	565.	515.		
FPB-A	285.	220.	PRINTERS	
MDS-A-D	710.	660.	BASE-2	450.
MDS-A-Q	880.	830.	TI-810	1580.
EXTRA DRIVE-D	—	350.	CENTRONICS-799	970.
EXTRA DRIVE-Q	—	525.	NEC-5510	2550.
HARD DISC SYSTEM	CALL		NEC-5520	2800.
Most NorthStar computers come standard with real wood cover, 2 serial ports, 1 parallel port, real time clock, disc operating system and NorthStar basic.				
			SOFTWARE—DISCS—MISC	
			AUTOSCRIBE	325.
			VERBATUM DISCS (10)	28.
			5 FOOT RS-232 CABLE	20.
			10 FOOT RS-232 CABLE	25.

WE WILL TRY TO BEAT ANY ADVERTISED PRICE

A. E. I.

4341 W. Commonwealth Ave Suite D
Fullerton, Calif. 92633
(714) 739-4701 (800) 854-6003

APPLE • CENTRONICS • TEXAS INSTRUMENTS
HORIZON • VECTOR GRAPHIC • CROMEMCO
• RADIO SHACK • HP • MICROPOLIS • SOROC
• OSI • SWTP • M • IBM • NEC •
PET • DIABLO • HAZELTINE
• HEATH • D • IMSAI •
DEC • PET • • SOL
• WANG • • LSI •



WE'VE GOT YOU COVERED!

Cover Craft Dust Covers protect your hardware and your investment. Save maintenance, downtime and look great. Our Dust Covers come in hundreds of sizes each custom designed to fit a particular model of terminal, CPU, Line Printer, Floppy Disk. They're a proven way to help eliminate dust and dirt accumulation, improve system reliability and save many times the cost in reduced maintenance and downtime. What's more, your **satisfaction is 100% guaranteed.**

Cover Craft Dust Covers are available from your local computer retailer or contact Cover Craft.

Can you afford to wait any longer?

COVER CRAFT
P.O. Box 555, Amherst, NH 03031
Telephone (603) 889-6811

loader program can either abort the data transfer immediately, initiate a second read attempt from the last record, or display an error message on the computer terminal prompting direct operator intervention.

Theoretical Advances

As reviewed by Peterson and Weldon, the Hamming algorithm falls in the category of *cyclic codes*. (See reference 3.) In cyclic codes, executing a one-unit right-shift

operation on any symbol in the complete code set will produce a binary bit pattern identical to that of one of the *other* members of the code set. Since Hamming's initial publication, an extensive array of cyclic codes has been derived. Perhaps the best known are the Bose-Chaudhuri-Hocquenghem (BCH) codes, which are related to the Hamming algorithm.

The BCH codes actually represent a generalized expansion that is particularly suited to coping with multiple-bit errors. None of these newer solutions offer major advantage over the basic Hamming check when correcting an 8-bit data word. Several mathematical difficulties are encountered when attempting to derive more effective encoding procedures. Not only is word length relatively short in these systems, but it can be shown that code redundancy overhead can be minimized to a tolerable level in only a small number of cases.

The alternative method, which is not unreasonable, would be to encode and decode entire data blocks, as opposed to individual data words. This would take advantage of the increased coding efficiency found for the longer codes, but would probably require a software implementation to minimize hardware design and expense. Such an approach would certainly increase system reliability, but it would defeat the purpose of increasing the speed and efficiency of data transfer to and from mass storage, since the processor would spend considerable time encoding and decoding the parity and data blocks before and after each data transfer. ■

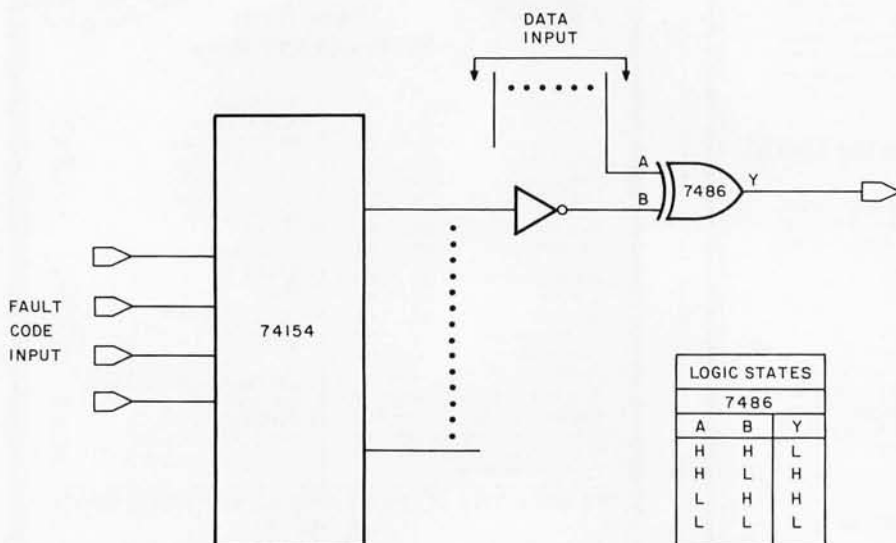


Figure 10: Detail of the error-correcting logic. Error correction is achieved by loading a binary pointer into a 4-to-16 line demultiplexer that flags the proper bit line and corrects the fault with an exclusive-OR inversion. Eight-bit systems may load the fault code directly into the demultiplexer and avoid the use of a read-only memory.

PASCAL/M™

A CP/M* COMPATIBLE PRODUCT

PASCAL/M is an implementation of the Standard Pascal programming language designed by Niklaus Wirth.

PASCAL/M does all input/output and file manipulation via calls to CP/M. The file interface intrinsic was chosen to promote Pascal program transportability and to provide a bridge between CP/M and the Standard Pascal language definition. In selecting and defining extensions to PASCAL/M, heavy weight was given to compatibility with other existing Pascal implementations. Over 45 extensions to Standard Pascal support:

- Console Cursor Controls
- Type String
- Untyped files
- Runtime debug support
- Segment procedures
- Random access files
- Otherwise clause on Case statement

PASCAL/M provides single precision floating point (Type Real). Both integer (16 bit) and long integer (32 bit, 9 digit) arithmetic are supported. An optional version will support the 9511A math chip. **COMING SOON: PASCAL/M FOR THE 8086/88.**

AVAILABLE VERSIONS		
CP/M Type	CPU Type	Disk Size
1.4	8080/85	8"
1.4	Z80	8"
Cromemco		
CDOS	Z80	8"
Northstar 2D	Z80	5¼"
Superbrain	Z80	5¼"
2.2	8080/85	8"
2.2	Z80	8"
MP/M* 1.1	8080/85	8"
MP/M 1.1	Z80	8"
TRS Mod II	Z80	8"

PASCAL/M requires 56K RAM and one floppy disk. The cost is \$350. For manual, only - \$95. Add \$10. outside the USA. VISA/MC

PASCAL/M is a trademark of Sorcim
*CP/M & MP/M are trademarks of Digital Research

Digital Marketing
2670 Cherry Lane
Walnut Creek, CA 94596
(415) 938-2880

References

1. Hamming, R W, "Error Detecting and Error Correcting Codes," *Bell System Technical Journal*, Volume 26 Number 2 pages 147 thru 160, American Telephone and Telegraph Company, 1950.
2. West, J T, "Product Development Profile: Data General Corporation," *Electronics* Volume 48 Number 23 pages 130 thru 136, November 13, 1975.
3. Peterson, W Wesley and E J Weldon Jr, *Error-Correcting Codes*, Second Edition, MIT Press, Cambridge 1972.
4. Sellers, F, Hsiao, M Bearson, L, *Error Detecting Logic for Digital Computers*, IBM Corporation Systems Development Division, McGraw-Hill.

GENERAL LEDGER PAYROLL ACCOUNTS RECEIVABLE & PAYABLE

Flexible and sophisticated business software that is among the highest quality on the market. Originally developed by OSBORNE & ASSOCIATES and rapidly becoming a standard. Our service is support. We will send you these programs with the proper I/O and CRT specific subroutines for your hardware configuration. Get back to business and leave the programming to us. Include hardware description with order.

- Accounts Receivable and Payable 145.00
- Payroll (California) 145.00
- Non California state tax calculations
(please inquire) 15-250.00
- General Ledger 145.00
- Multiple profit center option for G/L 25.00
- Manuals (each) 20.00

All programs in CBASIC under CP/M (includes source)

UTILITIES

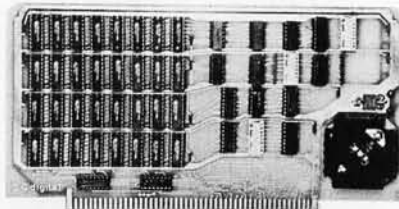
- DOS MOVER for NORTH STAR. Moves DOS and BASIC anywhere you want it. (i.e., from 2A00 to 0000) 35.00
- ALS-8 MOVER on North Star Disk 35.00

Synergetic Computer Products

508 University Ave • Palo Alto, CA 94301
(415) 328-5391

Visa • Mastercharge • COD • Certified Check
CP/M is a trademark of Digital Research

S.C. Digital Proudly Introducing "UNISELECT" Model 16KUS



16K Static Memory (Ram) with Universal Bank Select

Introductory Price: \$255
with 250 nsec memory chips
Assembled, Tested, and Guaranteed.

Featuring:

- S-100 Compatible** - Meets IEEE-S100 standard.
- Fully Static** - 4045 or 2114, No DMA restrictions.
- Addressing** - Dip switch addressing in 16K blocks.
- Bank Select** - Port and bits dip switch selectable. Compatible with Alph Micro, Cromemco, Marinchips, North Star, etc.
- Phantom** - Built in memory disable via Phantom line.
- Quality** - Fully socketed, silk legend, solder masks, gold contacts.
- Orders** - MC, Visa or COD (\$4 handling charges for COD) or Personal check. Shipping from stocks to 2 weeks. Illinois residents add 5.25% sales tax.

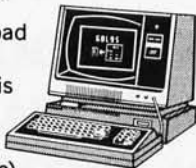
S.C. Digital

P.O. Box 906 Phone:
Aurora, IL 60507 (312) 897-7749

Unlock the ENGINEERING POWER of the Microcomputer

Engineering Software for TRS-80 Mods I & II

- Air Cond. Com. Cooling/Heating Load
- Residential Cooling/Heating Load
- Hardy Cross Water Network Analysis
- Word Processing for Spec Writing
- Lighting Design
- Air Duct Design
- Accounting
- Surveying
- Solar F-Chart
- & Econ. Analysis
- Energy Invest. Econ. Anal. (June)
- Hydraulic Pipe Design
- Electrical Fault Current (June)
- Fire Sprinkler System Design
- Life Cycle Cost Analysis



Selected programs also available for other microcomputers

Please tell me more about your engineering programs.

Name _____

Company _____ Phone _____

Address _____

City _____ State _____ Zip _____

I am interested in _____

MC12
PROGRAMS
formerly scotware

McClintock Corp.
P.O. Box 430980
Miami, FL 33143
(305) 666-1300

CATCH THE S-100 INC. BUS!



	LIST PRICE	OUR SPECIAL CASH PRICE
SSM CB-2 Z-80 CPU Kit	210.00	179.00
SSM VB-3 80x24 Video Boardkit	375.00	320.00
Dynabyte MCS 1625 16K Static RAM 250 NS A&T	555.00	349.00
Godbout Econoram VII A-24K 4MHz Memory "Unkit"	419.00	358.00
S.D. Systems Expandoram 64K Memory Board Kit w/o RAM	220.00	188.00
Shugart SA400 Double Density Bare Drive	450.00	295.00

Subject to Available Quantities • Prices Quoted Include Cash Discounts.
Shipping & Insurance Extra.

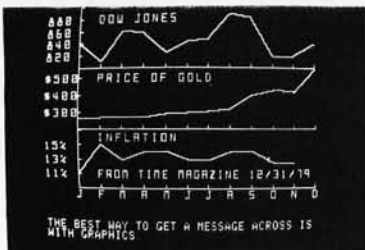
We carry all major lines such as
S.D. Systems, Cromemco, Ithaca Intersystems, North Star,
Sanyo, ECT, TEI, Godbout, Thinker Toys, Hazeltine, IMC
For a special cash price, telephone us.

Hours:
Mon.-Fri.
10 A.M.-6 P.M.

Bus **S-100, inc.**
Address **7 White Place**
Clark, N.J. 07066
Interface **201-382-1318**

Use x,y Genesis

Applesoft Subroutines for
Apple II graphs



With **x,y Genesis** you'll have:
smaller programs
shorter programming time
subroutines useful in any program
periodic news on tips & applications
a professional product

At only **\$74.95**

Contact:

FUTUREWORLD
Dept. B5
2514 University Dr.
Durham, NC 27707
(919) 489-7486

Ask about our new business statistics software.

VULCAN = DBMS

THE PROFESSIONAL and PERSONAL
DATABASE MANAGEMENT SYSTEM

For 8080/Z80 systems under CP/M® or PTDOS

- * **VULCAN** is a complete database management system that has 38 powerful, easy to learn, English-like commands to manipulate files, records, fields, and scratch-pad variables.
- * **VULCAN** has a command repertoire which includes such commands as: SORT, REPORT, APPEND, INSERT, EDIT, COPY, REPLACE, LOCATE, DISPLAY, DO, LIST, and LOOP.
- * **VULCAN JR.** is an interactive inquiry/response system while **VULCAN** can be used in interactive or program mode. The program mode uses modern structured command programs to combine powerful DBMS operations.
- * **VULCAN** is written in assembly language for efficient information processing and requires 36K bytes CP/M® system and one or more disk drives.
- * **VULCAN** can accept or store data in standard ASCII files to be compatible with BASIC, FORTRAN, word processors, etc.
- * **VULCAN** can be used for mail lists, inventory, accounting systems, parts lists, etc. It puts you in fingertip control of your data. With **VULCAN**, you don't need to write a program to do something out of the ordinary.

***VULCAN** (CP/M® or PTDOS) \$490
***VULCAN JR.** (CP/M® only) \$ 98
Manual only \$ 25

SCDP

Software Consultation Design
and Production

6542 Greeley St.

Tujunga, CA 91042 (213) 352-7701

California residents add 6% sales tax.

CP/M® is a registered trademark of Digital Research

DATADISK SYSTEMS

PROFESSIONAL SOFTWARE FOR NORTH STAR SYSTEMS

DIGITAL RESEARCH

CP/M® 2.0 — Digital Research's latest disk operating system for 8080/8085/Z80 based microcomputers, now specially tailored for the North Star disk systems. Includes ED text editor, DDT debugger, ASM assembler, additional utility programs and complete documentation. CP/M 2.0 is upward compatible with earlier releases and makes a wealth of professional software available to your system. \$150/\$25

TEX — A powerful text formatter. Produces finished copy with automatic page numbering, left and right margin justification, indentation, page headers, line centering and other quality features. Output may be vectored to printer, disk or console. \$70/\$15

MAC — 8080 Macro assembler. Allows use of library programs, greatly increasing programming efficiency. Uses Intel macro conventions. Assembly toggles allow listing, hex and symbol table outputs to be directed to disk, printer, console or combination. A tremendous development aid. \$85/\$15

SID — Symbolic Instruction Debugger for the 8080. Allows multiple break points with user set pass counter. Displays user labels during debugging when used with MAC. Greatly reduces hard-copy listing requirements. Includes back-trace and histogram utilities. A must for serious software development. \$85/\$15

ZSID — Same as SID except incorporates complete Z80 instruction set and uses Z-80 mnemonics. \$95/\$15

DESPOOL — Allows simultaneous printing of disk files and user access to other programs. No need to stop production while lengthy printouts are in progress. \$45/\$5

SOFTWARE SYSTEMS

CBASIC-2 — A commercially oriented, compiler-extended disk BASIC. Self documenting, using full length variable labels without penalizing speed. Compiler permits distribution of software without releasing source code. \$105/\$15

California residents add 6% sales tax.
Specify single, double or quad capacity.
Additional formats available soon.
Structured Systems Group programs require CP/M and CBASIC-2.

*CP/M is a registered trademark of Digital Research.
†Software and documentation/documentation only.



Datadisk Systems, P.O. Box 195, Poway, CA 92064, (714) 578-3831

BUSINESS SOFTWARE FROM STRUCTURED SYSTEMS GROUP

GENERAL LEDGER — A comprehensive applications package for business accounting or CPA multi-client write up. Produces financial reports to user defined specifications. Interactive posting, balance sheet, income statement, general and cash disbursement journals, sort, multiple profit centers, accounts distribution and much more. Outstanding package. \$895/\$25

ACCOUNTS RECEIVABLE — A complete open item or balance forward system. Operates alone, or interfaces with General Ledger. Produces customer statements, aged trial balance, on-line inquiry, sales reports, reminder notices and more. \$695/\$25

ACCOUNTS PAYABLE — A powerful cash management system. Aged account statements, writes checks, cash requirements projection, General Ledger update and more included. Stand alone operation or interfaces with General Ledger and OSORT. \$695/\$25

NAD — Name and Address System - Stores mailing lists on disk. Prints mailing labels or lists additional references information. Selective data extraction. \$75/\$10

OSORT — A generalized, full disk sort/merge package. Fast and flexible. Multiple key/sorting. \$95/\$15

LETTERRIGHT — Word processing for the business office. Produces professional correspondence, letters, envelopes, and more. High speed production with minimal training. Multiple personalized letters produced when used with list formed by NAD. \$175/\$20

ANALYST — Generalized data base management program. Stores and retrieves disk data producing user formatted reports. Interactive input. Easy to use. Tremendous versatility. \$225/\$20

INVENTORY — Complete inventory control program limited in capacity only by your disk size. On-line inquiry, average valuation, reorder and activity reports with report range option. Menu driven and fully auditable, the system uses full screen formatting and permits user defined record numbers. \$795/\$25

NOW—AN AFFORDABLE HARD DISK

Ask about our 13.2 megabyte Winchester technology hard disk business system. Uses all above listed software. Price varies with software configuration.

6809!

INTRODUCING THE NEW STATE-OF-THE-ART IN MICROCOMPUTER SOFTWARE.

Call or write today for our
free catalog.

MICROWARE

5835 Grand Ave. • P.O. Box 4865
Des Moines, IA 50304 • 515/279-8844

Take the mystery out of programming

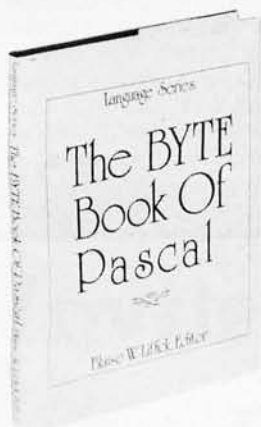
with the latest from *BYTE Books*tm

The BYTE Book of Pascal

Edited by Blaise W. Liffick

Based on the growing popularity of Pascal as a programming language, numerous articles, language forums and letters from past issues of *BYTE* magazine have been compiled to provide this general introduction to Pascal. In addition, this book contains several important pieces of software

including two versions of a Pascal compiler - one written in BASIC and the other in 8080 assembly language; a p-code interpreter written in both Pascal and 8080 assembly languages; a chess playing program; and an APL interpreter written in Pascal. **\$25.00 Hardcover pp. 342 ISBN 0-07-037823-1**



YOU JUST BOUGHT A PERSONAL WHAT?

by Thomas Dwyer and Margot Critchfield

Whether you are a novice programmer or an experienced computer user, this book is filled with practical ideas for using a personal computer at home or work. It will take you through the steps necessary to write your own computer programs, and then show you how to use structured design techniques to tackle a variety of larger projects. The book contains over 60 ready-to-use programs written in Microsoft and Level II BASIC in the areas of educational games, financial record keeping, business transactions, disk-based data file and word processing. **\$11.95 pp. 256 ISBN 0-07-018492-5**

Beginners Guide for the UCSD Pascal System

by Kenneth Bowles

Written by the originator of the UCSD Pascal System, this highly informative book is designed as an orientation guide for learning to use the UCSD Pascal System. For the novice, this book steps through the System bringing the user to a sophisticated level of expertise. Once familiar with the System, you will find the guide an invaluable reference tool for creating advanced applications. This book features tutorial examples of programming tasks in the form of self-study quiz programs. The UCSD Pascal Software Systems, available from SofTech Microsystems Inc, 9494 Black Mountain Road, San Diego CA 92126, is a complete general purpose software package for users of microcomputers and minicomputers. The package offers several interesting features including:

- Programs which may be run without alteration on the General Automation or DEC PDP-11 minicomputers, or an 8080, 8085, Z80, 6502, 6800, or 9900 based microcomputers.
 - Ease of use on a small, single-user computer with display screen and one or more floppy disk drives.
- \$11.95 ISBN 0-07-006745-7**



These and other *BYTE*/McGraw-Hill books are available from *BYTE Books* or your local computer store.

Please send

- ☐ _____ copies of The *BYTE Book of Pascal*
☐ _____ copies of *You Just Bought a Personal What?*
☐ _____ copies of *Beginner's Guide for the UCSD Pascal System*

Add 75¢ per book to cover postage and handling.

Name _____ Title _____ Company _____

Street _____ City _____ State/Province _____ Code _____

☐ Check enclosed in the amount of \$ _____
☐ Bill Visa ☐ Bill Master Charge
Card No. _____ Exp. Date. _____

BYTE BOOKS

BYTE BOOKS Division • 70 Main Street
Peterborough, NH 03458

B5

The NCC:

New Emphasis on Personal Computing

What's happening in personal computing? The American Federation of Information Processing Societies, Inc (AFIPS) is banking that you'll find out at the National Computer Conference's Personal Computing Festival, to be held on May 20-22 in Anaheim, California at the Anaheim Convention Center. In the 3 years that personal computing has had a separate exhibit area at the NCC, the number of exhibitors has increased from 76 to 154. Over 20% of those who came to the NCC last year registered specifically for the Personal Computing Festival, and over half of the 60,000 plus attendees visited the Festival.

The booming show-attendance figures reflect the fast growth of the personal-computing industry as a whole. Highlights include the Apple Computer Company's expectations to triple its

sales by the end of 1980. Commodore International computer sales may increase by a factor of 2 during the first quarter of 1980, and Radio Shack expects similar increases. According to industry estimates, the market value of personal-computer software sold in 1980 could surpass \$150 million.

Judging from the attendance at last March's West Coast Computer Faire in San Francisco (approximately 20,000), there is an ever-increasing interest in personal computing among a wide variety of people. We expect to see a trend toward more sophisticated software at the 1980 NCC Personal Computing Festival. There will be a flood of new Pascal packages, new simulation programs, the appearance of new Forth software (look for the special section on the Forth language in the August

1980 BYTE), as well as intriguing new hardware like Microsoft's new Z80 processor circuit card for the Apple computer that allows Apple owners to use programs written to run under Digital Research Corporation's CP/M operating system. Word-processing and small-business software are two other rapidly growing areas that will be well represented at the conference.

Will some major consumer electronics companies enter the personal computer market? Is there a move toward some standardization in the microcomputer industry? Will Japanese companies make any major moves into personal computing? [Nippon Electric Company (NEC) is rumored to be unveiling a new computer at the show]. We'll keep our eyes open at the show to find out! ■

Personal Computing Festival

Preliminary List of Exhibitors

ABC Computer Inc
American Word Processing Co
Apple Computer Co
Applied Digital Data Systems Inc
Artec Electronics Inc
Atari

BASF Systems
Benwill Publishing Corp
BYTE Publications Inc

California Computer Systems
Cardamion Co
Centronics
Comprint
Compucolor Corp
Compucorp
Computer City
Computer Textile
Computerworld
Computhink
Control Data Corp
Corvus Systems Inc
Creative Computing
Cromemco Inc

Diablo Systems Inc
Dilithium Press

Electronic Data Systems-Evolution I

Executive Information Systems Inc
Exidy Inc

Findex Inc

Harris Technology
Hayden Book Co Inc
H & E Computronics
Heath/Zenith
Hewlett-Packard Co

Industrial Micro Systems
International Memories Inc (IMI)

Jade Computer Products

Leedex Corp
Lobo Drives International
LRC/An Eaton Co

3M-Data Recording Products Div
MAS (Micro Application Systems Inc)
Memory Media Products
MicroAge
Microamerica Distributing Co Inc
Microcomputer Technology Inc
Micromail
MicroPro International Corp
Microsette Co
Microsoft

NEC America Inc
North Star Computers Inc

Omni Magazine
Osborne/McGraw-Hill

Personal Software
Priam
Prodigy Systems Inc

RCA MicroComputer Products
Radio Shack
Realizations Etudes Electroniques (R2E)
Rockwell Microelectronic Devices

SD Systems Inc
Sharp Electronics Corp
Smoke Signal Broadcasting
Spectra Logic Corp
Sybex Inc

TEI Inc
TSA Software

Xymec

Back, and Bigger than Ever.

NCC Personal Computing Festival May 20-22, Disneyland Hotel

So great is the interest in personal computing, so dynamic is the personal computer industry, that this year's Personal Computing Festival is again being held separate from the rest of NCC, at the Disneyland Hotel.

The 3-day festival features its own impressive roster of exhibitors plus over 50 learning sessions on every aspect of personal computers and their use.

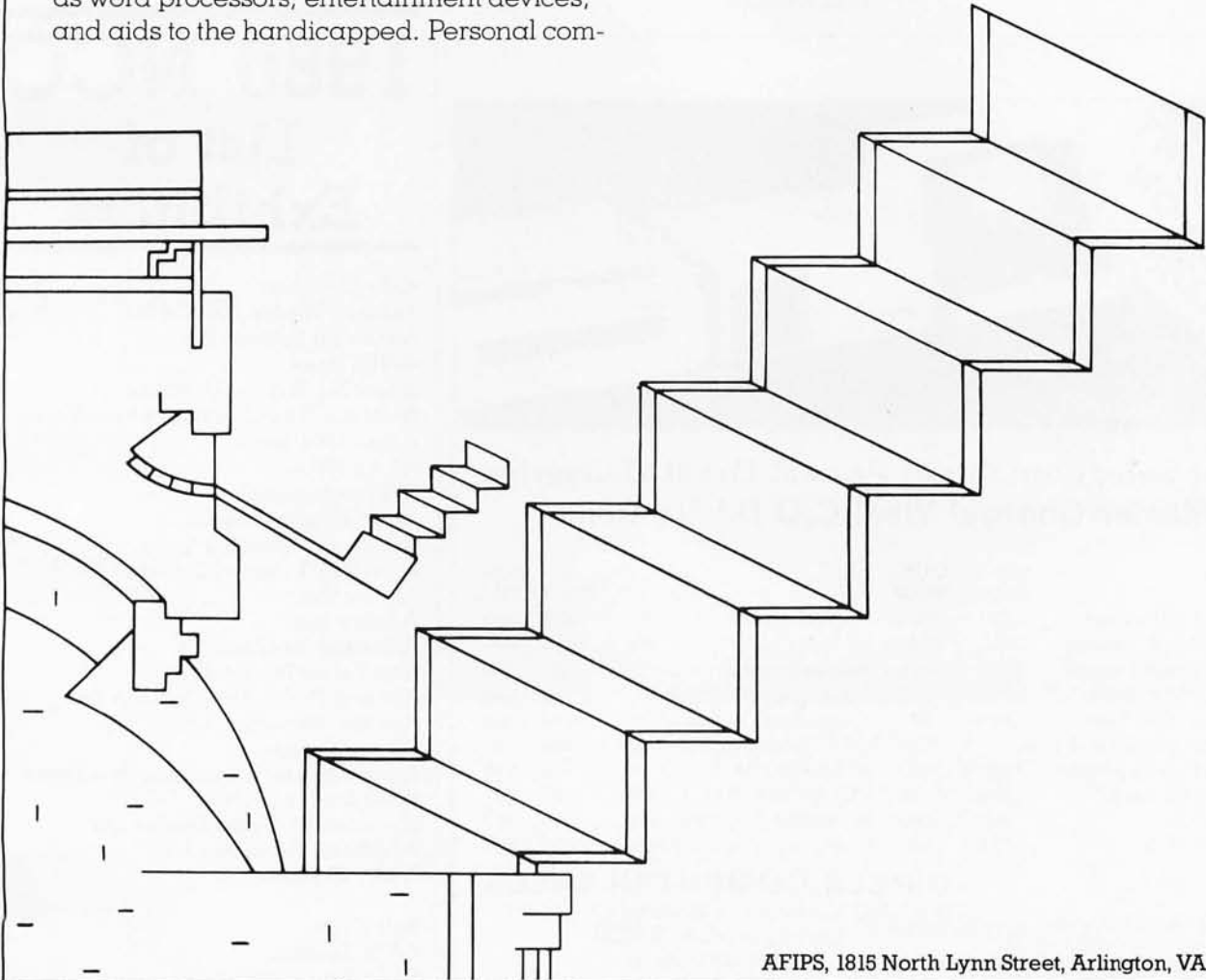
Personal computers at home, at school, and in the executive suite. Personal computers as word processors, entertainment devices, and aids to the handicapped. Personal com-

puter operating systems, programming languages, and software evaluation.

In addition, we've set aside a special area where demonstrations of personal computers will be conducted throughout the show. And we're awarding prizes for the most interesting use of personal computers.

If you're coming to NCC '80, be sure to make The Personal Computing Festival part of your visit.

Who knows—you may even win a prize.



AFIPS, 1815 North Lynn Street, Arlington, VA 22209

Personal Computing Festival

Program Schedule

May 20 - Tuesday - 10:00 AM

High-Level Languages

Pascal Part I

Jim Gagne

Word Processing

Shopping by Objectives

Bill Radding

Portable Personal Computing

Jim Flourney

1:00 PM

Higher-Level Languages

Pascal Part II

Jim Gagne

Computer Hardware Considerations & Applications

L Silvern

Forth Business Applications

Jim Flourney

2:30 PM

Networks You Can Access With Your

Personal Computer

Cliff Barney

May 21 - Wednesday - 10:00 AM

Using Computers to Overcome Dis-

ability Handicaps

Part I

Jeff Moyer

Mary Anne Glicksman

The Future of Personal Computing

Panel

Verne Kallejian

Operating Systems

Roger Vass

1:00 PM

Using Computers to Overcome Dis-

ability Handicaps

Part II

Computer Networks-Technical

Craig Vaughn

Software Evaluation

Tom Williams

2:30 PM

Computer Music

Carl Helmers

May 22 - Thursday - 10:00 AM

Medical Computing for

Microprocessors

Jim Gagne

Data Base Management

Doug Seeley

Computers In Education

Chris Morgan

1:00 PM

Use of Computers in Kindergarten

thru Ninth Grade

Flora Russ

Business Applications

Nancy Leeper

Computers In Education Panel

Chris Morgan

2:30 PM

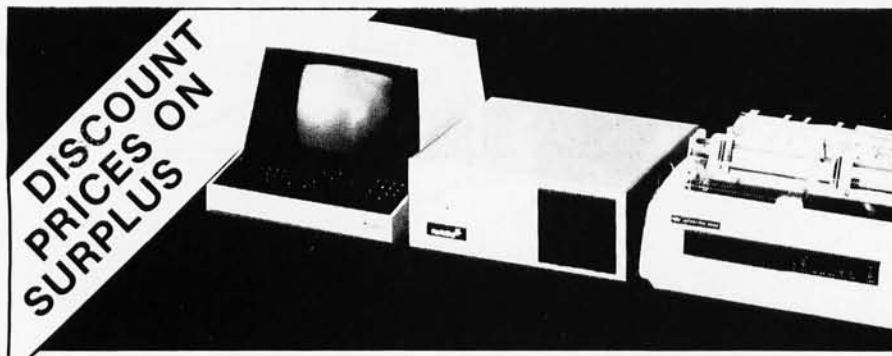
Programming Potpourri

1980 NCC

List of Exhibitors

Able Computer
Addison-Wesley Pub Co Inc
Advanced Systems Inc
AFIPS Press
Aham Inc/Rubber Urethane
Alanthus Data Communications Corp
Alpha Data Inc
Alpha Micro
AM International
Amco Engineering Co
American Magnetics Corp
American Terminal Leasing
Ampex Corp
Anadex Inc
Anderson Jacobson Inc
Ann Arbor Terminals Inc
Applied Digital Data Systems Inc
Applied Magnetics Corp
Aspen Ribbons
Association for Computing Machinery
Atlas Energy Systems
Audiotronics Video Display Div
Auerbach Publishers Inc
Aydin Controls

Ball Corp
BASF Systems
Basic Four Corp



Great Selection! Great Prices! Great Deliveries
Master Charge! Visa! C.O.D.! No Risk!

	List Price	OUR PRICE		List Price	OUR PRICE
Horizon-2-64K-Quad	4330	3695	Hazeltine 1500	1225	1089
Horizon-2-32K-Double	3095	2595	Hi-Plot Plotter	1085	929
Horizon-2-64K-Double	3830	3195	Hi-Pad Digitizer	795	669
NorthStar 32K RAM	739	599	TI810 w/CP,FLC,FUL	2195	1989
North Star 16K RAM	499	399	Thinkertoys Discus-2	1149	1099
North Star 18MB Hard Disk	...	Call	CP/M 2 for Discus	150	140
NEC 5515 Serial Printer	2850	2499	ATARI 800 8K	999	849
NEC Tractor Feed	220	199	PET 8K Graphics, Lg KB	795	695
Soroc IQ120	995	889	Word Star Word Processor	500	350
Hazeltine 1420	995	899	Magic Wand Word Processor	400	350

CIRCLE COMPUTER SALES

700 Larkspur Landing Circle

Larkspur, CA 94939

(415) 461-2616

Prices subject to change.
Delivery subject to availability.
We pay shipping on prepaid orders.

Battelle Memorial Institute
BDT Büro-und Datentechnik Gabil
Beehive International
Bell & Howell Display Devices
Bell System
Benson-Varian Int
Benwill Publishing Corp
Berger-Lahr Corp
Boschert Inc
British Trade Development Office
BTI Computer Systems
Burroughs Corp

CalComp
Characters USA Inc
Centigram Corp
Centronics
Century Data Systems—A Xerox Co
Chromatics Inc
Cii Honeywell Bull
Cipher Data Products Inc
Circuit Assembly Corp
Clinton Electronics Corp
CMP Publications
Codex Corp
Compugraphic
Computer Automation
Computer Decisions
Div of Hayden Pub Co Inc
Computer Design
Computer Devices
Computer-Link Corp
Computer Power Systems
Computer Products Magazine
Computer Roomers Inc
Computer Science Press Inc
Computer Transceiver Systems Inc
Computerworld Computer Business
News (CW Communications)
Computron Technologies Corp
Contal Corp
Conrac
Continental Resources
Control Data Corp
Cortron & Licon Div IIW
Cullinane Corp
Curtis 1000 Inc
Custom Systems Inc
Cyberex Inc

Daily Business Products
Data Access Systems Inc
Data Communications/McGraw-Hill
Publications
Data Dimensions Inc
Data Electronics Inc
Data General Corp
Datagraphic
Data-Mate/Maine Manufacturing Co
Datamation
Datamedia Corp
Data Motion
Data Printer Corp
Datapro Research Corp
Data Processing Management Assoc
Data Processing Power
Dataran Corp
Data Specialties Inc
Dataware Inc
Datum Inc

Deciteck
Delta Data Systems Corp
Deltec Corp
Diablo Systems Inc
Digi-Data Cor.
Digi-Log Systems
Digital Associates Corp
Digital Computer Controls
Digital Equipment Corp
Digitech Data Industries Inc
Digitronics Div Contec Information
Systems
Distributed Logic Corp
Diva Inc
Documation Inc
DOSC Inc (Digitron)
Dragnet Engineering Labs Inc

Eastman Kodak Inc
Edge Technology Inc
Educational Data Systems
Eichner Systems Inc
Electronic Component News
Electronic News
Elgar Corp
Emergency Power Engineering Inc
Emerson Electric Co
Emulex Corp
Epic Data
Epicon Inc
Epson America Inc
Exide Power Conversion ESE Inc

Facit Inc
Fairchild Camera & Instrument
Floating Point Systems Inc
Florida Data Corp
Four-Phase Systems
Fujitsu Ltd

General Automation Inc
General DataCom Industries Inc
General Electric Co
General Robotics Corp
General Terminal Corp
GMT Automatic Inc
Graphic Controls
GTE Sylvania

Hamilton Avnet
Harris
Haveg Industries Inc
Hazeltine Corp
HEI Inc
Hitachi America Ltd
Honeywell Information Systems Inc
Houston Instruments
Hutchinson Industrial Corp

IBM Corp
ICI American Inc
IEEE Computer Society (Computer
Magazine)
Incoters Corp
Industrial Engraving Co Inc
Information Processing Inc
Informer Inc
Infosystems Magazine/Hitchcock Pub
Co
INMAC

Innovative Electronics Inc
Input
Integral Data Systems
Integrated Software Systems Corp
(ISSCO)
Intelligent Systems Corp
Interdyne Co
Interface Mechanisms Inc (Intermec)
International Data Corp
International Mathematical & Statistical
Libraries Inc (IMSL)
International Power Machines Corp
Interstate Electronics Corp
Intertec Data Systems Corp
C Itoh Electronics Inc

Japan Market Consultants Div
Engineers International Inc

Kennedy Co
Key Tronic Corp
Knickerbocker Case
Kybe Corp

Liebert Corp
LogAbax SA—US Div

3M
Magnavox Display Systems
Mag-Tek Inc
Management Science America
Mathematics Products Group Inc
Maxell
McCormack & Dodge Corp
McGraw-Hill Book Co
MDB Systems Inc
Megatek Corp
Melco Sales Inc
Memorex Corp
MFE Corp
Micon Systems Inc
Micon Industries
Microcomputer Systems Corp
Microdata Corp
Micro Peripherals Inc
Micropolis Corp
Micro-Term Inc
MiniComputer Systems Inc
Mini-Micro Systems Cahners Pub
Monolithic Systems Corp
Mostek Corp
Motorola Inc
MBI Systems Corp

Nanodata Corp
National Computer Communications
Corp
National CSS
National Electric Cable
National Technical Information Service
NCR Corp
NEC Information Systems Inc
Network Systems Corp
Newman Computer Exchange Inc
Nicolet Zeta Corp
Nippon Peripherals Ltd
Nixdorf Computer Corp
Northern Zelecon Systems Corp
Nortronics Co Inc
Nova Electric Manufacturing Co

Ohio Scientific Inc
Okidata Corp
Ontel Corp

Panasonic Co
Paradyne Corp
Peripheral Dynamics Inc
Perkin-Elmer
PerSci Inc
Pertec Computer Corp
Philips Test & Measuring Instruments Inc
Plessey Peripheral Systems
PolyMorphic Systems
Practical Automation
Precision Handling Devices
Prentice Corp
Prentice-Hall Inc
Prime Computer Inc
Princeton Electronic Products
Printronic Inc
Pro-Log Corp

Qantel Corp
Qantex
Quantor
Qume

Rascal-Milgo Inc
Racal-Vadic
Radio Shack
Ramtel Corp
Randomex Inc

Raymond Engineering Inc
Remex Div/Ex-Cell-O
Resource Management—Div of
Cutler Williams
Ranco Electronic Systems

SAS Institute Inc
Scientific Measurement Systems Inc
SCI Systems Inc
Sheldon Industries Inc
Shugart Associates
Society for Computer Simulation
Software AC
Sola—A Unit of General Signal
Spatial Data Systems Inc
Specialized Products Co
Sperry Univac
Storage Technology
Structured Methods Inc
Summagraphics Corp
Systems Furniture Co

TAS Products Co
Tally Corp
Tandberg Data Inc
Tandem Computers Inc
T-Bar Inc
TEAC Corporation of America
Technology Transfer Institute
Techtran Industries Inc
Tektronix Inc
Tedyne Instruments

Telefile Computer Products Inc
Telenet Communications Corp
Teletype Corp
Televideo Inc
Telex Computer Products
Terak Corp
Termiflex Corp
Tesdata Systems Corp
Texas Instruments
Timeplex Inc
Tokyo Juki Industrial Co Ltd
Topax Electronics
Toshiba International Corp
Trilog Inc
Triple I Inc
Tymnet Inc

Universal Data Systems

Van Nostrand Reinhold
Van San Corp
Vector Graphic Inc
Verbatim Corp
Versatec
Victor Data Products
Vistron Corp
Vu-Data Corp

Wabash Tape Corp
Wall Street Journal
Wang Labs Inc
Warrex Computer Corp
Wavetek Data Communications
Wescorp
Western Peripherals
Westrex OEM Products
John Wiley & Sons Inc
Wintek Corp

Xerox Business Systems

Yourdon Inc

Zenith Radio Corp
Zilog Inc

Professionally written Software for ● APPLE® ● CP/M ● TRS-80™ ●

USMAIL FOR CP/M



USMAIL is by far the best mailing list program available! Written completely in machine language. Only requires 32K. Easy to use, interactive, command driven, comes with 2 demos that automatically show how to use it. Supports up to 1927 entries. There are commands to SORT, SEARCH, ADD, DELETE, CHANGE, COPY, MERGE, LIST, produce LABELS (many different ways), and more. Professionally designed and developed by an expert in data base management systems. Special introductory price: \$95 for diskette and manual, \$20 for manual only.

APPLE®



LINKER — A linkage editor/loader for APPLE DOS. Includes a library of subroutines (PRINT, OPEN, READ, etc.) A must for all assembler programmers.
32K APPLE \$49.95 DISKETTE



BABBLE — Teach your APPLE to create its own stories, poetry, music, and color displays. Includes editor, compiler, interpreter and demo programs.
16K APPLE
\$15 CASSETTE \$20 DISKETTE



BENEATH APPLE MANOR — Explore an underground labyrinth, fighting monsters and finding magical treasures. Uses color graphics for floor plans.
16K APPLE
\$15 CASSETTE \$20 DISKETTE



ASTROAPPLE — An astrological package that produces natal horoscopes, 30 day forecasts, and compatibility ratings. Includes an 18 page manual.
32K APPLE
\$15 CASSETTE \$20 DISKETTE

TRS-80™

SUPERMAZE — 10,000 cell maze generator, LEVEL II 16K \$15 CASSETTE
TTT3D - 3-dimensional tic-tac-toe LEVEL II 16K \$15 CASSETTE

Available by mail or at your local computer store. California residents add 6% sales tax. CP/M, APPLE, and TRS-80 are registered trademarks of Digital Research, Apple Computer Co., and Tandy Corp.

The
Software Factory
23849 LA SALLE CANYON DR.
NEWHALL, CA 91321

NCC Main Conference Proceedings

During each of the 4 days of the NCC, there will be discussions and papers related to the following major topics. A detailed schedule of events will be available at the conference.

Computer Architecture

Covers design of equipment and supporting technologies, and distribution through networking. Includes decisions relating to supersystems, survivability systems and data-base installation.

Applications of Computer Technologies

Explores the use of computers in entertainment, microcomputers and their impact, management of the computing tool and staff, and the role of inhouse and academic education and training.

Data Base Management & Communications

State-of-the-art, user-oriented sessions on the storage, retrieval, and transfer of data. From hardware considerations to natural-language access to a data base.

Office Automation

Every computer-related aspect of this explosive growth area, including electronic mail. How computers are used, managed, and integrated in an overall automated office.

Simulation Technologies

Where we've been, where we are, and where we're going with computer modeling. Its value to small and large businesses and its role in decision support will be discussed. Special sessions on solar energy-simulation modeling will be included.

Software Engineering Technologies

Sessions on programming standards, software quality assurance, languages, and requirements engineering. Emphasis upon the needs and responsibilities of the user.

Social Dynamics and Special Topics

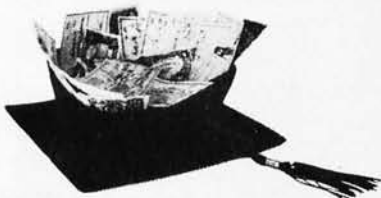
A broad spectrum of critical subjects: data security, legal issues, transborder data flow, societal impact, voice communications, venture capital and its effect upon technology.

Image Processing and Computers in Medicine

How image processing is used and will be used in industry and medicine. Trends in facsimile data coding, compression, and standards. How doctors use image-analysis display.

Professional Development Seminars

Full and half-day seminars for the professional who wants to come away with solutions and ideas he can implement now. Half-day seminars tie in with regular program sessions.



**Make America smarter.
Give to the college
of your choice.**

Beating the Races with a Computer

Steven L. Brecher

Explains the theory and application of statistical techniques which yielded a profit of 5-25% per dollar bet on a computerized sample of 1,345 thoroughbred races. "Elegant work...creative thinking...impressive"—Tom Ainslie, foremost handicapping author and former *Daily Racing Form* columnist.

— CONTENTS —

If I'm So Smart, Why Ain't I Rich? • Horse Racing is a Stochastic Process: "Darkness likely tonight, increasing chance of lightness towards morning..." • What We Need to Know to Bet: Don't Expect the Expected • Multiple Regression: Declarations of Dependence • The Database: Telling the Computer What Happened • Data Weighting and Normalization: 1 Apple + 1 Orange = 1 Fruit Salad • Generation of the Model Equations: Getting Involved in Meaningful Relationships • The Kelly Criterion for Bet Sizing: If You Lose You Can Always Go Out and Work to Get Even • Simulated Wagering Tests: "Even if I made as little as a million a day, then..." • Getting Started: For Do-It-Yourself Types • Regression Coefficients and Statistics • Annotated Bibliography

\$14.95

BITS[™] inc.

Books to erase the impossible

25 Route 101 W, P.O. Box 428, Peterborough, NH 03458 USA
Mon-Fri 9-5 TOLL FREE 800-258-5477 (in NH dial 924-3355).



SHIPPING CHARGES

We ship UPS insured unless Postal 4th class is requested.

US: \$1.75 1st book, \$.75 each additional book, to a maximum charge of \$4.00.

Foreign: \$1.50 per book to a maximum charge of \$5.00; Air Mail \$7.00 per book.

Ask for book #999-B

BYTE BACK ISSUES FOR SALE

The following issues are available:

1976: July; 1977: March, May thru December; 1978: February thru October, December; 1979: January thru December except March; 1980: January and March
Cover price for each issue thru August 1977 is \$1.75 Domestic; \$2.75 Canada and Mexico; \$3.75 Foreign. September 1977 through October 1979 issues are \$2.50 Domestic; \$3.25 Canada and Mexico; \$4.00 Foreign. November 1979 to current is \$3.00 Domestic; \$3.75 Canada and Mexico; \$4.50 Foreign.



Send requests with payment to:

BYTE Publications
70 Main Street,
Peterborough, NH 03458
Attn: Back Issues

What's New?

MISCELLANEOUS

RS-232C-Compatible Paper-Tape Reader



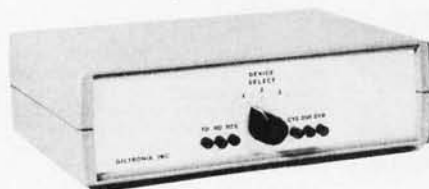
The Model 612 stand-alone paper-tape reader has the ability to read five- to eight-level tape and to transmit seven to eleven frames per character at 50 to 9600 bits per second (bps). It also features starting and stopping on character at all speeds, manual control or automatic on and off, 90 to 260 VAC, 50 to 60 Hz, and even, odd, or no parity. RS-232C, current loop, or parallel outputs are available. The price of the 612 is \$656 to \$854. Contact Add-master Corp, 416 Junipero Serra Dr, San Gabriel CA 91776.

Circle 562 on inquiry card.

Bidirectional Interface for the PET

This interface package is a combination of hardware and software that enables any model of the Commodore PET to send and receive data on printers, terminals, and other peripherals. ASCII/ISO-7 characters are sent from the PET in serial or parallel mode but are received in serial mode only. Serial speeds are selectable at rates up to 240 characters per second (cps). The interface is available for either 20 mA current loop or transistor-transistor logic (TTL) serial or parallel. The machine-language program may be stored anywhere in programmable memory; the code used to terminate a message is selectable. The price for the package is £70 (approximately \$160). Further details from Allen Computers, 16 Hainton Ave, Grimsby, South Humberside, ENGLAND.

Circle 563 on inquiry card.



Centronics-Compatible Switching and Monitoring Units

Giltonix Inc, 450 San Antonio Ave, Suite 44, Palo Alto CA 94306, has introduced a family of switching and monitoring units. The GRS 232 units are used for interfacing, configuring, and monitoring computer terminals, printers, and other peripherals that comply with the RS-232 and the IEEE-488 specifications. The new family consists of four models: the GRS 232-P24, -S24,

-2P24, and -2S24. Each unit consists of a standard three-way switching system and an optional interface monitor. All the units can be cascaded and thereby allow interfacing of more than five devices. The systems can be ordered with signal monitoring capability. The units are priced at approximately \$130.

Circle 564 on inquiry card.

Large Capacity Winchester Backup from Corvus

This backup system, the Mirror, employs a standard video cassette with a total capacity of 100 megabytes. In less than ten minutes, the 10 megabytes of data on the Corvus 8-inch hard disk can be transferred to a Mirror cassette. The video cassette should be of the VHS, Beta, or U-Matic format. If a larger data capacity is required, a reel-to-reel video-tape recorder can be used. This approach to storage embodies standard television technology and proven cassette reliability. The Mirror uses the same Z80 and Corvus interface bus as the Corvus disk. The Mirror will interface to the Apple II, TRS-80, S-100, and LSI-11 computers. Data format in the Mirror is fully compatible with the standard NTSC signal. For error detection, the Mirror contains cyclic redundancy check (CRC) detection hardware. If unattended or remote operation is desired, a low-cost option is available to interface the Mirror to the Panasonic Omnivision NV-8200 cassette recorder allowing archival storage files to be created without operator interaction. The price of the Mirror is \$790. Write Corvus Systems, 900 S Winchester Blvd, San Jose CA 95128.

Circle 565 on inquiry card.



What's New?

MISCELLANEOUS

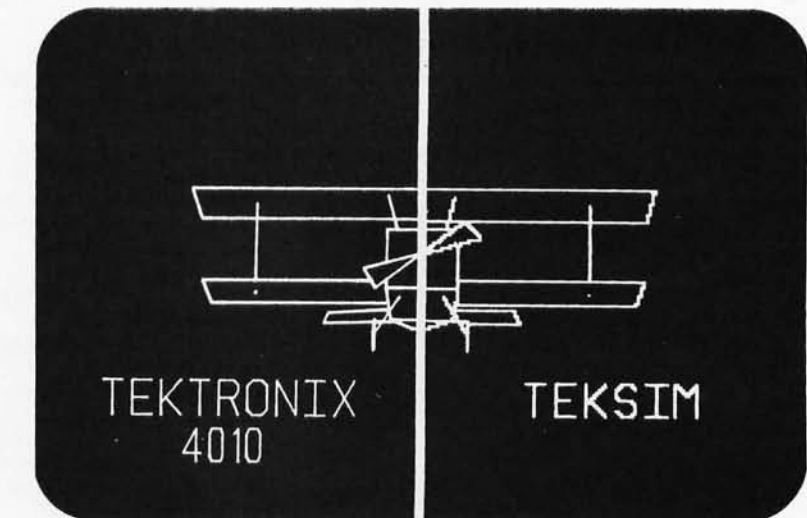
Speechlink Voice Recognition for S-100 Computers

Heuristics has announced its Model 20S-64 Speechlink 64-word voice input unit for S-100 bus computers. The 20S-64 is a speaker-programmed, isolated word-recognition device that recognizes up to 64 words at each instant. Vocabulary sets may be stored away and recalled when needed. This system will produce a usable vocabulary of several hundred words for data entry and system control applications. Word recognition is completed in 200 ms. Successive words must be separated by at least 100 ms of silence. Preprogramming of the Speechlink is necessary. The unit requires 2 K bytes of programmable memory for programs, and 64 bytes for each word in the vocabulary, up to a maximum of 4 K bytes. The price is \$299 including board, microphone, and manual. Contact Heuristics Inc, 1285 Hammerwood Ave, Sunnyvale CA 94086.

Circle 441 on inquiry card.

Hardware and Software for Homebrewers

Snow Micro Systems Inc, POB 1704, Silver Spring MD 20902, provides low-cost hardware and software to personal computer users and clubs. Their bare boards are sold with schematics, layout drawings, and component lists. They are



Graphics Terminal Emulator for Apple IIs

TEKSIM, the Tektronix Simulator, employs distributed processing in its programming approach and uses the Apple's high-resolution plotting capabilities to emulate Tektronix 4010-series graphics terminals. No modification to the program in the remote computer is required to display

or input graphic data. The TEKSIM-Apple combination features multi-colored displays, selective erase, and a standard video output that lets any television set used with an RF converter function as a monitor. The suggested price for the plug-in device is \$795, and it is available from ABW Corp, POB M 1047, Ann Arbor MI 48106.

Circle 442 on inquiry card.

unassembled and come without parts. The company offers a troubleshooting service, if necessary. Some of their products include a front panel interface card, the Golem-80 S-100 Troubleshooter, a Station Controller Card, and more. Snow Micro software

includes AMS-80 Version 5.8 debug packages, object code and source code, and other AMS-80 software related items. For prices and information, contact Snow Micro Systems at the above address.

Circle 443 on inquiry card.

CP/M Package for the STD Bus

Micro/sys has developed a CP/M system for the STD Bus microcomputer card system. The Micro/sys package consists of two STD Bus-compatible cards, the SB8500 Floppy Disk Controller, the SB8420 Dual Serial Interface, and an eight-inch floppy disk containing the CP/M system. The SB8500 can control up to four floppy disk drives from a single STD Bus slot. The SB8420 provides communication with a console device, and a second serial port that can be used for printers and other devices. The cards are compatible with 8085 and Z80 microprocessors.

CP/M provides a disk file management, a text editor, and an 8080 assembler, a dynamic debugger, and various utilities. Price of the Micro/sys CP/M package is \$695. For more information, contact Micro/sys Inc, 1353 Foothill Blvd, La Canada CA 91011.

Circle 444 on inquiry card.

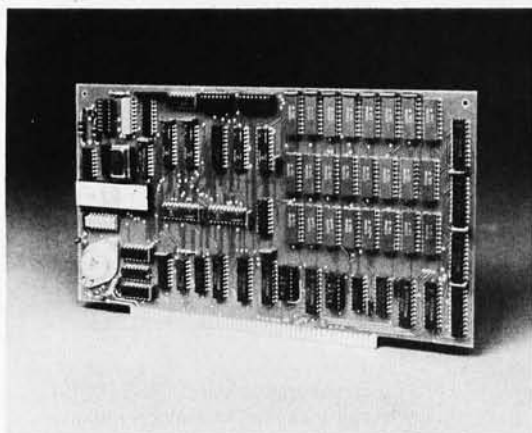


What's New?

MISCELLANEOUS

Video Graphics for S-100 Bus Systems

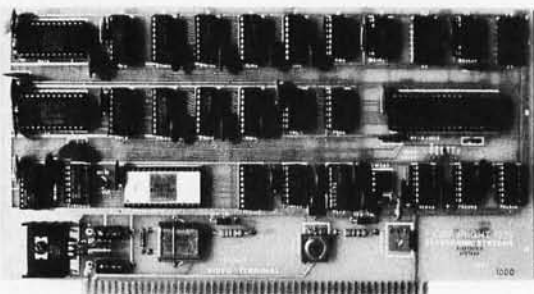
A single-card, high-density, computer-display system is being offered for the S-100 bus by International Product Development Incorporated (IPDI). The VG100 is designed for text-oriented applications. It has programmable fonts allowing any set of up to 256 characters to be defined in programmable memory with available software. The system can generate a combination of 16 gray levels or 16 colors, or combinations of both. The



character field is 9 by 16 (or 144) pixels with a raster scan of 621 pixels. The entire character field can be changed at one time for fast animation. Adjoining character fields of any shape can be combined to create large continuous characters. The VG100 is configured in 12 K bytes of programmable memory and is selectable in three 4 K-byte blocks. The price is \$645. For details, contact IPDI, 1708 Stierlin Rd, Mountain View CA 94043.

Circle 589 on inquiry card.

Video Terminal Board



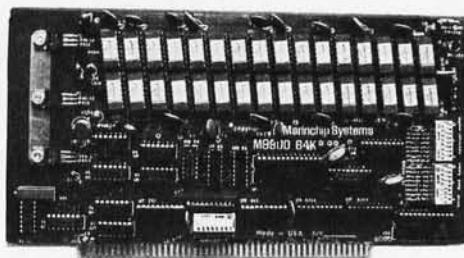
This board features full uppercase and lowercase, 5 by 7 dot matrix, 16 lines with 64 columns, and serial RS-232 input and output with parallel keyboard input. The data rate generator has a range from 75 to 1200 bits per second (bps) and is jumper-selectable. The board has 1 K byte of memory and an SF96364 processor integrated circuit. The device is S-100 compatible. It requires ± 16 VDC at 100 mA and 8 VDC at 1A. The price is \$199.95 in kit form. Contact Electronic Systems, POB 21638, San Jose CA 95151.

Circle 590 on inquiry card.

64 K Byte Memory for Heathkit/Digital H11

The CI-1103 memory module is designed for the Heathkit/Digital H11, LSI 11/2, and PDP 11/03 computers. The product uses 200 ns cycle time, type-4027, 4 K by 1-bit dynamic memory parts or 200 ns, type-4116, 16 K dynamic memory devices. The CI-1103 is available with either on-board distributed refresh or external refresh control logic. Data access time is 300 ns and cycle time is 525 ns. On-board memory-select is available in 2 K increments up to 128 K words of memory. Power consumption is under seven watts. The 8 K by 16 board is \$390 and the 32 K by 16 board is \$750. For information, contact Chrislin Industries Inc, 31352 Via Colinas #102, Westlake Village CA 91361.

Circle 591 on inquiry card.



Serial Interface Card for Apple II Computers

California Computer Systems' 7710A Asynchronous Serial Interface card enables the Apple II to communicate with all RS-232C serial devices. It is fully compatible with Apple Pascal. The card features selectable data rates from 50 to 19,200 bits per second (bps), 8- or 9-bit character transmission, and optional odd, even, or no parity. Software programmable interrupts, double buffered data input/output (I/O), and full handshaking are included. It is available in kit form or fully assembled and tested. The price for the card is \$159.95. For more information, contact California Computer Systems, 250 Caribbean, Sunnyvale CA 94086.

Circle 592 on inquiry card.

Percom Board Interfaces Speak & Spell to Computer

Percom Data Co, 211 N Kirby, Garland TX 75042, has announced production of a printed circuit board which will interface the Texas Instruments Speak & Spell learning aid to a computer. The "Speak 2 Me 2" allows communication with a Speak & Spell in BASIC, so a computer can talk using the words and phrases of a Speak & Spell unit. The board is installed in the battery compartment. Installation involves disassembly and some modification of the Speak & Spell unit. The board with instructions, TRS-80 driver software, and a TRS-80 cable sells for \$69.95. The cable connects to the printer port and may be adapted for other computers.

Circle 593 on inquiry card.

Head-Cleaning Floppy Disks from Lifeboat

Lifeboat Associates, 2248 Broadway, New York NY 10024, has an important product for floppy-disk systems: head cleaning disks. The head-cleaning floppy disks are manufactured by attaching a lint-free nylon mat to a mylar substrate. The design avoids damaging abrasion, which keeps head wear to within industry standards for normal magnetic media. The disk is used by inserting it into the drive in the same manner as a floppy disk, and loading the head for 30 seconds. It is recommended that this procedure be used once per day as prevention against oxide build-up. The disks are available in 5 1/4- and 8-inch sizes for \$20 each, or \$45 for three. Each disk is suitable for three months of daily use.

Circle 594 on inquiry card.

A MCGRAW-HILL PUBLICATION

onComputing™

GUIDE TO PERSONAL COMPUTING

GETTING STARTED
What You Need And What It Will Cost

EQUIPMENT REVIEWS
TRS-80, Apple, Sorcerer and PET

Best-Selling Author
JERRY POURNELLE
"Writing With A Microcomputer"

THE BINARY WORLD

Also...
A PERSONAL
COMPUTER DIRECTORY
COMPUTER CLUBS:
WHO NEEDS THEM?

Plus much much more
for the new computer user

When will the Personal Computer Explosion touch YOU?

Are you prepared for the explosive transformation? Right in your own home? Electronic mail. Personalized investment analysis. Foreign language tutorial. Home energy management. Robots. Computer music. Secretarial service. Diet and menu planning. And more, more, more.

onComputing™ the new McGraw-Hill quarterly, prepares you for the enormous changes coming during the



1980's (Some are already here). **onComputing™** explains in nontechnical language what personal computers are, how they work, and how you can use them at home, for fun and profit.

Don't let the personal computer explosion catch you off guard. Know what's happening and help make it happen! Prepare now for the exciting future with a subscription to **onComputing™**!

**Call Toll-Free
800-258-5485**

**Start your
subscription today.**

onComputing™ Subscription Dept. P.O. Box 307, Martinsville, NJ 08836

DOMESTIC subscription rate:

☐ U.S. 1 yr. (4 issues) @ \$8.50 ☐ Canada & Mexico, 1 yr. (4 issues) @ \$10.00

FOREIGN (to expedite service, please remit in U.S. funds drawn on a U.S. bank.)

☐ Europe (and all other countries, except above), 1 yr. @ \$12.00 — surface delivery.

☐ Bill Visa ☐ Bill Master Charge ☐ Bill me (North America only)

Card Number

Expiration

Signature

Name (please print)

Street/Apartment Number

City

State/Province/Country Code

7850

Please allow 6-8 weeks for processing.

What's New?

PUBLICATIONS

Hardside Announces Expanded New Catalog

Hardside, a mail-order hardware company in Milford, New Hampshire, has announced the release of an expanded version of the Hardside catalog. Hardside features Radio Shack computer products at a discount price and also peripherals from other manufacturers which are suited to work with the TRS-80. The company specializes in computers and related hardware. The Hardside catalog is free from Hardside, 6 South St, Milford NH 03055.

Circle 572 on inquiry card.

Monthly Newsletter Covers the Office Computing Industry

Entitled the *Office Computing Industry Report* (OCIR), this monthly newsletter focuses on small-scale data processing, word processing, and data communications systems. OCIR also covers the merging of EDP and Business Machine distribution systems and support activities and the relationship of these new office computing systems to network-based information systems and distributed data processing. News analysis, market forecasts, new product reviews, vendor profiles, and technology forecasts are included. The *Office Computing Industry Report* is available from Vantage Research Inc, 2680 E Bayshore Rd, Mountain View CA 94043, for \$195 per year in North America and \$225 in Europe and Asia.

Circle 566 on inquiry card.

Supplies Catalog from Diablo

A 25-page brochure from Diablo Systems Inc, 24500 Industrial Blvd, Hayward CA 94545, illustrates and describes the variety of print wheels and ribbon cartridges designed for use on the company's Series 1640 and 1650, HyType, HyTerm, and matrix printers and terminals. The brochure contains a sample type line from all of the plastic and metallized daisy-wheel print elements. For copies of the brochure and the name of the nearest Diablo dealer, call (800) 227-2076, except in California where the number is (415) 443-2273.

Circle 567 on inquiry card.

S-100 Magazine Being Published



S-100 Microsystems is a new publication directed towards users of S-100 microcomputer systems. It is a forum on such S-100 topics as interfacing, CP/M, Pascal, Assembler, FORTRAN, and BASIC software. The magazine will also cover 16-bit microprocessors, multiprocessors, multitasking, time-sharing, word processing, system development, data base management, scientific, and other applications and issues. It will be concerned with S-100 systems such as Cromemco, North Star, Intersystems, IMSAI, Poly Morphics, Processor Technology (Sol), Xitan, and others.

S-100 Microsystems is edited by Sol Libes. Sol has written 13 books, many magazine articles, and has edited several newsletters. He is the founder and past president of the Amateur Computer Group of New Jersey, the largest personal computer organization in the world. The first issue of *S-100 Microsystems* includes the complete proposed Institute of Electrical and Electronics Engineers (IEEE) S-100 Standard, the first part of a tutorial on CP/M, an article on modifying the SDS Video Board for Pascal editor functions, the source code for an 8080 disassembler, a directory of Computerized Bulletin Board Systems (CBBS), and more. *S-100 Microsystems* will be published six times a year. A sample copy is \$2. For subscriptions and additional information, contact *S-100 Microsystems*, POB 1192, Mountainside NJ 07092.

Circle 568 on inquiry card.

Short Form Catalog and Price List

Sara-Tech Electronics Inc, POB 692, Venice FL 33595, has published a catalog which includes systems and peripherals from Cromemco, North Star, Centronics, Heath, and many more companies. They also have a listing for computer-paper forms for all systems. Sara-Tech sells systems, peripherals, and software of most major companies.

Circle 569 on inquiry card.

A Book on Computerized Typesetting

Donald Knuth, author of *The Art of Computer Programming*, has written *TEX and METAFONT, New Directions in Typesetting*, which describes new techniques in typesetting. Dr Knuth explains how TEX, originally designed for use in setting technical and mathematical text, can be applied to all computerized typesetting. METAFONT is a system for the design of alphabets. It is suited for implementation on raster-based devices that print or display text. With it, computers can draw new fonts of characters in seconds. TEX and METAFONT represent improvements in typesetting that will benefit the scientific and technical community. The book consists of three parts. The first is a lecture on mathematical typography; the two other parts describe TEX and METAFONT. The book costs \$12 and is available from Dept TM:X, Digital Press, Educational Services, Digital Equipment Corp, 12-A Esquire Rd, N Billerica MA 01862.

Circle 570 on inquiry card.

Software Catalog for Heath Users

The Heath Users' Group has published a catalog of programs written by Heath users for all Heath computers. The programs described include games, financial applications, utilities, computer-assisted education, and amateur radio. The catalog lists the language and designated computer next to the program. Prices are given, along with services of the Users' Group. For more information, contact Heath Users' Group, Hilltop Rd, St Joseph MI 49085.

Circle 571 on inquiry card.

What's New?

SYSTEMS

Intellivision from Mattel

Mattel Electronics is introducing six cartridges for its home computer system, Intellivision Intelligent Television.

Soccer, Golf, Skiing, Boxing, Tennis, and Sea Battle join the existing fourteen cartridges, which range from sports and games to children's learning. Intellivision's Master Component contains a 16-bit microprocessor that delivers simulated sound effects, three-part harmony, and color reproduction. Two 12-button, hand-held controllers, each with four play-action keys, and a 16-directional control knob for movement of screen objects are included. The unit attaches to any television set.

The Keyboard Component uses programmed cassettes and features a keyboard and a digital cassette system with fast-forward and tape search.

Its programs include Physical Fitness, Speed Reading, Stock Analysis,

and Guitar Lessons. The Master Component will retail for approximately \$300 or less. The Keyboard Component will cost around \$550 and the cartridges will cost approximately \$30, with the cassettes priced slightly under \$30. For information, contact Mattel Electronics, 5150 Rosecrans Ave, Hawthorne CA 90250.



Circle 586 on inquiry card.

Computer System from NNC

NNC Electronics, 15631 Computer Ln, Huntington Beach CA 92649, has released the System 80 computer. The System 80 uses a 4 MHz Z80 microprocessor and features a floppy-disk controller and two dual-density, 8-inch disk drives, 32 K bytes of programmable memory, two serial ports, and the CP/M operating system. The eight-slot S-100 card cage has five slots available for expansion. The desktop unit weighs less than 29 kg (65 pounds) and retails for \$3995.

Circle 587 on inquiry card.

Altos Announces a Hard-Disk System

The Altos Systems ACS8000-6 can take advantage of as much as 58 megabytes of hard disk storage. The system can control up to four 14.5-megabyte Shugart disks using Winchester-type technology. Altos designed the ACS8000-6 series so that it handles up to four

floppy-disk drives. The floppy units could accommodate another 4.0 megabytes of on-line storage. The ACS8000-6 family comes with input/output (I/O) control to support two serial and two parallel ports in addition to the four serial ports to which the users are connected. The hard-disk controller features direct memory access (DMA) operation; firmware address checking; a high-speed first-in, first-out (FIFO) buffer; and intelligent sequencing. The controller firmware contains a routine that automatically double-checks all addresses before performing any disk writes. The FIFO enables the system to transfer data at a 7 million bits per second (bps). The system will support asynchronous, bisynchronous, and networking communications protocols and configurations. Prices range from \$9450 for a single-user system with two floppy-disk drives and one 14.5-megabyte hard disk, to \$14,260 for the four-user, 29-megabyte system with two dual-sided floppy-disk units. For details, contact Altos, 2338A Walsh Ave, Santa Clara CA 95050.

Circle 588 on inquiry card.



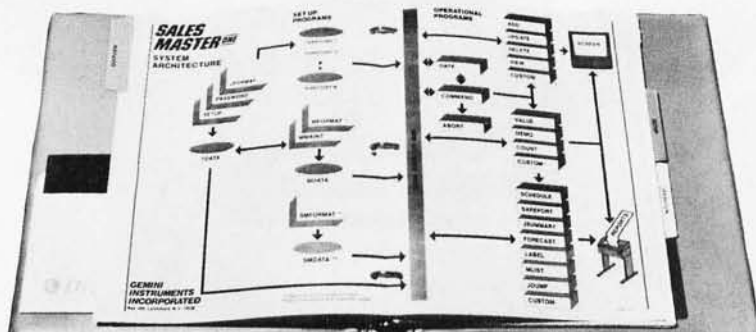
What's New?

SOFTWARE

A North Star Program for Salesmen

The Sales Master One is a collection of 22 programs designed by salespeople for salespeople. The Sales Master One is territory-oriented, allowing users to pinpoint selling activities to a particular location. The system generates reports on sales activities,

forecasts, and schedules. Various other reports assist in daily selling efforts. The system has room for 400 jobs on one 5¼-inch floppy disk. The package contains a program that allows modifications to be made without the need to refer to the operations manual. A customized disk-operating system allows the package to be run on Cromemco, Dynabyte, and Processor Technology computers. Sales Master One comes on a 5¼-inch floppy disk with a manual for \$375. Contact Gemini Instruments Inc, POB 205, Larchmont NY 10538.



Circle 573 on inquiry card.

Software from Compucolor

Compucolor Corp, POB 569, Norcross GA 30091, has released several software programs for the Compucolor II system.

The BASIC Editing package features six programs including FRED (Friendly Editor), RENUM (Renumber), MERGE, COMPAC, REMPAC (Deletes Remarks), and BASSRC (BASIC-to-Source Conversion). FRED, the most

useful of the programs, allows the user to edit any line, move existing lines, delete a range of lines, and to search for the occurrence of any string, variable, or command within a program. The package comes on a floppy disk and costs \$29.95.

Statistics is a series of three disks that is useful for engineering applications. The floppy disks are entitled *Statistics I, II, and III*. Each disk contains five programs including plot, stat, polreg (polynomial regression), index, and

more. Common to all three packages is a file manager program that generates, maintains, and displays files for use by other programs. *Statistics I* sells for \$24.95. *Statistics II* and *III* sell for \$29.95 each.

Compucolor has also released Soundware. This program includes the software and hardware necessary to create sounds on the Compucolor II. It is written in BASIC, with a range of two to three octaves. The price is \$49.95.

Circle 574 on inquiry card.

TLC-LISP for Z80 Systems

The LISP Company has announced its version of the LISP language for the Z80. TLC-LISP allows manipulation of functions as data objects; promotes object-oriented programming style; defines functions with a variable number of parameters; includes structured iteration and nonstructured escape mechanisms; contains complete string and character processing capabilities; and includes fixed- and floating-point arithmetic. The language system also contains a table-driven scanner; com-

prehensive error control, an autoloader feature that "virtualizes" infrequently used functions and constants to disk files, freeing programmable memory; and execution speeds comparable to a KA-10 running MACLISP. Over 150 utility functions are provided. TLC-LISP is available for Z80 CP/M systems and other versions will be available soon. A detailed manual is \$15, and the system on 5- or 8-inch floppy disks is \$150. Write The LISP Co, POB 487, Redwood Estates CA 95044.

Circle 575 on inquiry card.

Software Catalog for TRS-80 Level II

National Software Marketing Inc, POB 6195, Hollywood FL 33021, has announced a free catalog of software for the TRS-80 Model II. The software described includes accounts receivable and payable, general ledger, payroll, inventory, rental management, and a variety of financial and mathematical programs. These systems will operate on the 64 K-byte model with the built-in disk. The programs have list prices of \$15 to \$100.

Circle 576 on inquiry card.

A Gomoku Program

Five Stones Software, POB 1369, Station B, Ottawa, Ontario, K1P 5R4, CANADA, has released a Gomoku program for North Star Horizon disk-operating systems and CP/M-based systems. The program features a book of openings with 200 entries, the ability to take back moves, a 19 by 19 board, recent moves displayed along with the board, and the ability to customize to different screen sizes. The program requires a minimum of 32 K bytes of programmable memory and is available on 5-inch floppy disks for \$29.95.

Circle 577 on inquiry card.

PLMX — A Language That Communicates with All 8- or 16-bit Microprocessors

PLMX is a universal high-level language for microprocessors. It can be used with all 8- or 16-bit microprocessors and was designed primarily for use in microcomputer product development systems and in real-time process-control applications. PLMX syntax is identical to PL/M, so the entire library of existing PL/M programs can be compiled under PLMX. PL/M programs may be used on microprocessors other than the 8080 through

the PLMX compiler. PLMX is a true compiler, allowing fast compiling times — useful for real-time applications. It has been developed as a user-oriented language. There are no arbitrary formatting rules or line numbers. Comments may occur anywhere in the source text, except within reserved words, identifier names, and numbers. PLMX is priced at \$1000, which includes an 8-inch compiler floppy disk and instruction manuals. To obtain additional information, write Systems Consultants Inc, Product Development Group, 4015 Hancock St, San Diego CA 92110.

Circle 578 on inquiry card.

What's New?

SOFTWARE

High-Speed Sort Utility for Ohio Scientific

BPSort is a high-speed, assembly language, sort/merge utility program for Ohio Scientific floppy and hard disk systems. It is capable of sorting 20 K bytes in ten seconds. Files can be an entire hard or floppy disk in length. BPSort handles fixed length records. Five keys can be specified for ascending and/or descending sequence. Sort parameters are established using a BASIC program. BPSort is OS-DMS compatible and is supplied as part of the BPS, an interactive data management system. It is sold in single-user licensed copies for \$124. Earlier versions can be updated for \$25. Order from BPS, 322 W 57th St, New York NY 10019.

Circle 579 on inquiry card.

Microsoft Announces TRS-80 Model II Software

Microsoft is selling TRSDOS-compatible versions of its COBOL and BASIC compilers for the TRS-80 Model II. Both compilers provide complete facilities for commercial or in-house software development, including

Microsoft to Market muLISP and muMATH

Microsoft has become the distributor for muLISP-79 and muMATH-79, which were written by the Soft Warehouse of Honolulu, Hawaii. muLISP offers all of LISP's programming features, including 83 LISP functions, flexible program-control structures, and infinite precision integer arithmetic in any desired radix (2 to 36). The modular muMATH symbolic mathematics package is useful for scientific and engineering applications. The muMATH routines are written in muSIMP, which is included in the

Microsoft's macroassembler and linking loader. The COBOL-80 compiler is an ANSI-74 implementation of COBOL. The BASIC compiler produces object code that runs faster than interpreted BASIC programs. All Microsoft BASIC language features are supported. The BASIC compiler is also available in a version for the TRS-80 Model I. Microsoft is the author of Radio Shack's BASICs. The BASIC compiler is \$395, and the COBOL-80 compiler is \$750. Contact Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

Circle 580 on inquiry card.

package. Both programs run with CP/M systems. The muLISP program costs \$200 and the muMATH/muSIMP-79 program is priced at \$250. Contact Microsoft, 10800 NE Eighth, Suite 819, Bellevue WA 98004.

Circle 581 on inquiry card.

Six Programs for TRS-80 Level II and Disk-Operating System

International Data Services has developed Microsketch III, a graphics program for the Level II with 16 K bytes of programmable memory for \$7.95. Freakout is a keyboard-generated graphics and sound program for the Level II with 4 K bytes of programmable memory for \$3.95. The number-base conversion program converts any base to any other base between 2 and 16. It is priced at \$3.95. Three other programs are available for disk BASIC with 16 K bytes of programmable memory. BASIC to Electric Pencil file conversion, machine language to BASIC data statement conversion, and mail-list file up-percase to uppercase-and-lowercase conversion programs all cost \$3.95. Contact IDS, 340 W 55th St, New York NY 10019.

Circle 582 on inquiry card.

RCA's BASIC I Compiler/Interpreter for COSMAC Development System

RCA's BASIC I Compiler/Interpreter CDP18S834 is a software package that can accelerate program development on the COSMAC DOS Development System CDP18S007. The package gives the user the option of developing and running programs in BASIC I or converting the programs to object code. The output of the compiler is assembled by the COSMAC macroassembler to produce the executable object code. Some of the features of the compiler/interpreter include: 70 characters per line, variable designation by a single capital letter, and fixed-point arithmetic. BASIC I functions include MOD, AND, OR, XOR, and USR. The USR function extends BASIC I by means of machine-language subroutines. Some of the statements available to the programmer are REM, LET, GOTO, IF, INPUT, WFLN, and NEW. With a manual, the package is priced at \$300. Contact RCA Solid State Div, POB 3200, Somerville NJ 08876.

Circle 583 on inquiry card.

A Data Base System for the TRS-80

V R Data Corp, 777 Henderson Blvd, Folcroft PA 19032, has announced a Data Base system for the TRS-80 Models I and II. The Data Base system provides the capability to define and create customized records for various applications. Records may contain up to 25 user-defined variable-length fields and up to 250 characters per record. A dictionary of the fields and their characteristics is maintained by the system. Records may be added, deleted, and extended; field contents may be changed, and fields may be removed or added to the record or renamed at any time. Records may also be linked logically. The records may be sorted by any combination of fields in ascending or descending order. Reports are fully user-definable and may be routed to a printer or the video display. This four-program BASIC system requires 48 K bytes of programmable memory, a minimum of two disk drives and a line printer for the TRS-80 Model I, with 300 records per disk. Programs are available for the Model II with 950 records per disk.

Circle 584 on inquiry card.

Machine-Language Program for TRS-80 Disk Systems

The ST80-111 machine-language program is written for the TRS-80 Level II system. This package includes programs that allow users to talk to a time-sharing computer, transfer files to and from the central computer, and customize the ST80-111 system. Some of the programs included in the system are a BASIC program that creates translation tables, one that tells if a file is American Standard Code for Information Interchange (ASCII) or binary, a binary-to-ASCII conversion program, and one that changes machine-language programs to binary. The ST80-111 has been run on HP2000, IBM 370 and 360, PDP-11, Burroughs, Apple, and North Star systems. The minimum requirements for the system are the TRS-80 Level II with one disk drive and 16 K bytes of memory, an RS-232C board, and a modem. The package is produced by Small Business Systems Group, Main St and Lowell Rd, Dunstable MA 01827, and is priced at \$150.

Circle 585 on inquiry card.

GET Paid for using your Computer

FUN!

Easy

RUSH COUPON FOR

FREE FACTS

GREAT SPARE TIME

Send today to — DAR-B5
3110 Fulton Ave, Sacramento CA 95821

CASH

NAME _____

STREET _____

CITY _____

STATE _____ ZIP _____

Circle 236 on inquiry card.

TRS-80 Model I and II quality software

DATA BASE MANAGER IBM-IV \$69
You can use it to maintain a data base & produce reports without any programming. Define file parameters & report formats on-line. Features key random access, fast multi-key sort, field arith, label generator, audit log. MOD-II version with more than 50 enhancements \$199

ACCOUNTS RECEIVABLE ACCT-III \$69
One or more drives. Order entry calculates sales tax, shipping, amount for multiple items. Credit checking, aging, sales analysis, invoices, statements and reports. As opposed to most other A/R ours can be used by doctors, store managers, etc. MOD-II version \$149

WORD PROCESSOR 16K \$39 32K \$49 MOD-II \$49
First word processor specifically designed for the TRS-80 that uses disk storage for text. Written in BASIC. No special hardware and text limit. Use for letters, manuals & reports. 32K version features upper/lower case without hardware change and multiple input text files

MAILING LIST advanced MAIL-V \$59
Fast sort by any field. Multiple labels and reports. 4-digit selection code, new zip code ext., screen input, live keyboard, powerful report writer. MOD-II \$99

INVENTORY INV-V \$99
9-digit alphanumeric key for fast key random access. Reports include order info, performance summary, etc. Calculate E.O.Q. Powerful report writer. MOD-II \$149

All programs are on-line, interactive, random access, virtually bug free, documented and delivered on disks. MOD-I requires 32K, DOS. We challenge all software vendors to offer low cost manuals so you can compare and avoid those high-priced undocumented, on-memory programs. Send \$5 for a MOD-I manual and \$10 for MOD-II

MOD-II programs are extensively modified, guaranteed to run with 1 year newsletter & updates. 10% off for ordering more than 1 MOD-II programs

MICRO ARCHITECT

96 Dothan St., Arlington, MA 02174

Circle 237 on inquiry card.

C-10 SHORT CASSETTES 50 FT.



Qty. Price

1 \$1.00

10 \$0.75

50 \$0.65

Premium tape and cassettes acclaimed by thousands of repeat order microcomputer users. Price includes labels, cassette box and shipping in U.S.A. VISA and MC orders accepted. California residents add sales tax. Phone (415) 968-1604.

MICROSETTE CO.

475 Ellis Street

Mt. View, CA 94043

Circle 238 on inquiry card.

TRS-80 II TWO NEW CASSETTES

• VENTURE ANALYSIS • ANALYZE VARIOUS EFFECTS IN MINUTES

7 YR RESULTS INCLUDE:
REVENUES, COSTS
BT & AT EARNINGS
UNDEPRECIATED CAPITAL
CASH FLOW — ROIC
AND OTHERS

16 K 14.95

• DUPL. BRIDGE SCORING • 4, 5, 6 TABLES

HOWELL MOVEMENT —
ENTER SCORES, BOARD
AND PLAYER TOTALS

16K 6.95

Check or M.O. To:

RLK SOFTWARE
1310 E. Clarendon St.
Arlington Heights, IL 60004

Circle 239 on inquiry card.

Product versatility and value

IN NEW YORK CITY

**OHIO SCIENTIFIC & ARISTO/
POLKS FULL STOCK AND SER-
VICE ON CHALLENGER MICRO-
COMPUTERS.**

CHALLENGER C1P BK \$399.00
C1P 5" FLOPPY 20K \$1198.00
SUPERBOARD C1P \$279.00
CHALLENGER (COLOR) C4P 8K \$698.00
C4P FLOPPY 24K 5" \$1698.00
CHALLENGER C8P \$895.00
COLOR-DUAL 8" FLOPPY C8P \$2597.00
C-3 48K DUAL FLOPPY 8" \$3995.00
C-3 + 23 MEG HARD DISK \$9900.00
C-2-0EM 48K DUAL FLOPPY 8" \$2699.00
PLUS ALL SOFTWARE & PERIPHERALS

Mail order invited if machine can be sent back to us for service. 220V conversions available for systems-write for quote. Write for free catalog. M/C, VISA, AX CARDS ACCEPTED.

Aristo/Polks • 212-279-9034

314 5TH AVE. (32 ST) N.Y.C., N.Y. 10001

9:30/6-DAILY THURS TIL 9 SUNDAY 11-5

Look to Aristo/Polks for reliability, quality, product versatility and value

Circle 240 on inquiry card.

BUSINESS SOFTWARE CP/M AND MODEL II COMPATIBLE NEWLY ENHANCED VERSIONS

MEDICAL MGMT SYSTEMS \$495
DENTAL MGMT SYSTEM \$495
REAL ESTATE MULTI-LIST \$495
INSURANCE AGENCY MGMT \$495
LEGAL TIME ACCOUNTING \$495
GENERAL LEDGER \$495
ACCOUNTS PAYABLE \$495
ACCOUNTS RECEIVABLE \$495
PAYROLL PROCESSING \$495
INVENTORY MANAGEMENT \$495
WORD PROCESSING/NAD \$495
DATABASE MANAGEMENT \$495
HIGH-SPEED UTILITY SORT \$300

NEW! LATEST CBASIC-2 \$ 99
NEW! LATEST MBASIC 5.1 \$300
NEW! MBASIC COMPILER \$350

** CP/M 2.0 FOR MODEL II \$170
COMPLETE SOFTWARE CATALOG \$ 5
COMPLETE HARDWARE GUIDE \$ 5

UNIVAIR, INC. 314-426-1099
10327 LAMBERT INTL AIRPORT
ST. LOUIS, MISSOURI 63145 USA
MASTER CHARGE/VISA CARDS O.K.

Circle 241 on inquiry card.

SURPLUS INVENTORY

NEW
\$99



22 MHz
BANDWIDTH

***SOLID STATE MONITORS:** Sylvania 12" B&W CRT, 22 MHz video bandwidth, 800 line resolution! ASL Model C12ACB, OEM tabletop style without case. P4 phosphor. Inputs = separate video, horz. & vert. pos. sync pulses at nominal TTL/CMOS levels. Any sweep rate, 10-20 KHz. 115 VAC. Simple TRS-80 hookup, add 2 jumpers. With full maint. manual incl. timing, schematics, TRS-80 hookup etc. Used, re-checked, very clean, no burns \$77. New, checked, \$99

2102 BONANZA: Prime, brand new static 1024x1 RAM. Fairchild F-2102-FPC, 350 ns. Sold in sleeves of 25, 1-3 sleeves at \$20 ea. 4-9 sleeves at \$16 ea. 10 sleeves and up at \$10 per sleeve, that's prime, new 2102s at \$.40 ea

***\$100 CORE SALE:** Brand new, tested Ampex core. See article "IT'S TIME FOR CORE" (9/79 KiloBaud p. 34) which describes an easily built interface between this core and an S-100 machine. But ignore the prices in the article! Sale priced, including large documentation pkg. 8K boards \$99 16K boards \$230. Add \$4 for schematics of core.

***OTHER SURPLUS BARGAINS:** HARD DISKS, new w/manual \$895. SHUGART SA800-1/801 floppies w/manual, new \$425. Full ASCII KEYBOARDS \$44. TOUCHTONE DECODERS \$66.

TERMS: UPS included 48 states except disk drives. UPS COD add \$1.25. VISA & MC add 4%. NJ add sales tax. Everything guaranteed. Immediate shipment or immediate refund. Phone orders and questions are welcome.

* Write or call for full spec sheets on specific items.

ELECTRAVALUE INDUSTRIAL

P.O. BOX 157-B
MORRIS PLAINS, NJ 07950

Phone orders
are welcome.

201/267-1117

GAME DESIGN

Leading Coin-op Amusement
Game company will consider use
of YOUR pinball, video or other
game idea on a royalty, commis-
sion or other basis. WRITE FOR
DISCLOSURE FORM BEFORE
SUBMITTING GAME IDEA.

Department BMA

P.O. Box 236

Bensenville, IL 60106

Dial: 402-987-3771

HOT LINE

YOU NEED CRISP, HIGH CONTRAST
BLACK-WHITE and VIVID COLOR
ALPHA-NUMERICS/GRAPHICS
CAPABILITIES FROM YOUR VIDEO
MONITOR IF YOU WANT REALLY
SUPER-LOOKING IMAGES FROM
YOUR COMPUTER!!

AS SPECIALISTS IN VIDEO
IMAGING...we think we
have the right monitor or
modulator for your system.
Our product line includes
the popular "Micro-Verter"
(OSI and Apple Inc. approved
UIF color modulator), a variety
of color and B-W monitors, color
cameras, B-W cameras, Audio
subcarrier kits and parts. FREE
CATALOG UPON REQUEST.
Dealers welcomed. Well established
program with over 400 dealers.



GET FREE
DETAILS
VIA OUR
HOTLINE!!!

ATV Research 13-B BROADWAY DAKOTA CITY, NE. 68731

Circle 244 on inquiry card.

Apple II Or APPLE II PLUS



16K \$975.95, Extra 16K E.S. RAM installed \$74.95, extra 32K E.S. RAM installed \$148.95.

APPLE II HOBBY/ PROTOTYPING CARD

Part No. 7907 \$14.95

REAL TIME 100,000 DAY CLOCK

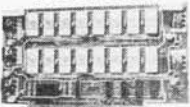
MT. HARDWARE Double the utility of your S-100 bus computer with a real-time clock that keeps time in 100µS increments for over 273 years. Program events for the entire period with real time interrupts...without derailing the system. Maintain a log of computer usage, time and date transaction printouts, call up lists...virtually any activity where time is a factor. On-board battery backup. MHPX004—\$249.95

SUPER MODEM



Originate, RS-232 and 20 mA compatible, Full duplex, and half duplex, direct connect or acoustic coupled, on board power supply, carrier detect light, DB25 plug, 300 BAUD, Type 103 compatible frequencies. Bare board Part No. 2000, \$19.95, Kit Part No. 2000A, \$99.95.

16K EPROM



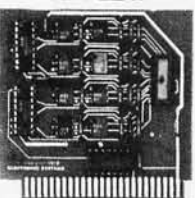
Uses 2708 EPROMs, memory speed selection provided, addressable anywhere in 65K of memory, can be shadowed in 4K increments. Board only \$24.95 part no. 7902, with parts less EPROMs \$49.95 part no. 7902A.

PET COMPUTER



With 16K & monitor - \$795. Dual Disk Drive - \$10.95

OPTO-ISOLATED PARALLEL INPUT BOARD FOR APPLE II



There are 8 inputs that can be driven from TTL logic or any 5 volt source. The circuit board can be plugged into any of the 8 sockets of your Apple II. It has a 16 pin socket for standard dip ribbon cable connection. Board only \$15.00. Part No. 120, with parts \$69.95. Part No. 120A.

VIDEO TERMINAL



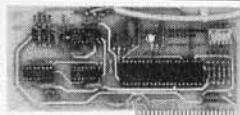
16 lines, 64 columns • Upper and lower case • 5x7 dot matrix • Serial RS-232 in and out with TTL parallel keyboard input • On board baud rate generator 75, 110, 150, 300, 600, & 1200 jumper selectable • Memory 1024 characters (7-21L02) • Video processor chip SFF96364 by Neculonic • Control characters (CR, LF, →, ←, ↑, ↓, non destructive cursor, CS, home, CL) • White characters on black background or vice-versa • With the addition of a keyboard, video monitor or TV set with TV interface (part no. 107A) and power supply this is a complete stand alone terminal • also S-100 compatible • requires +16, & -16 VDC at 100mA, and 8VDC at 1A. Part No. 1000A \$199.95 kit.

PARALLEL TRIAC OUTPUT BOARD FOR APPLE II



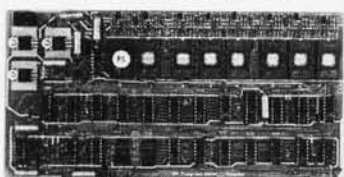
This board has 8 triacs capable of switching 110 volt 6 amp loads (660 watts per channel) or a total of 5280 watts. Board only \$15.00 Part No. 210, with parts \$119.95 Part No. 210A.

APPLE II** SERIAL I/O INTERFACE



Baud rate is continuously adjustable from 0 to 30,000 • Plugs into any peripheral connector • Low current drain. RS-232 input and output • On board switch selectable 5 to 8 data bits, 1 or 2 stop bits, and parity or no parity either odd or even • Jumper selectable address • SOFTWARE • Input and Output routine from monitor or BASIC to teletype or other serial printer • Program for using an Apple II for a video or an intelligent terminal. Also can output in correspondence code to interface with some electrics. • Also watches DTR • Board only \$15.00 Part No. 2, with parts \$42.00 Part No. 2A, assembled \$62.00 Part No. 2C

8K EPROM PIGEON



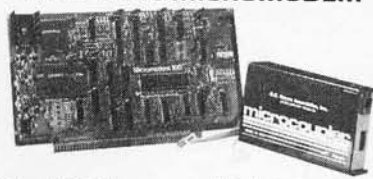
• Programs 2708's address relocation of each 4K of memory to any 4K boundary • Power on jump and reset jump option for "turnkey" systems and computers without a front panel • Program saver software in 1 2708 EPROM \$25. Bare board \$35 including custom coil, board with parts but no EPROMS \$139, with 4 EPROMS \$179, with 8 EPROMS \$219.

WAMECO PRODUCTS

With ELECTRONIC SYSTEMS parts

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, pertek, remex 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM (not included). PCBD \$42.95
FPB-1 Front Panel. (Finally) IMSAI size hex displays. Byte or instruction single step. PCBD \$42.95
MEM-1A 8Kx8 fully buffered, S-100, uses 2102 type RAMS. PCBD \$24.95, \$168 Kit
GMB-12 MOTHER BOARD, 13 slot, terminated, S-100 board only \$34.95
CPU-1 8080A Processor board S-100 with 8 level vector interrupt PCBD \$25.95
RTC-1 Realtime clock board. Two independent interrupts. Software programmable. PCBD \$25.95, \$60.95 Kit
EPM-1 1702A 4K EPROM card PCBD \$25.95
\$49.95 with parts less EPROMS
EPM-2 2708/2716 16K/32K EPROM card PCBD \$24.95
\$49.95 with parts less EPROMS
GMB-9 MOTHER BOARD. Short Version of GMB-12. 9 Slots PCBD \$30.95
\$67.95 Kit
MEM-2 16Kx8 Fully Buffered 2114 Board PCBD \$25.95, \$269.95 Kit

D.C. HAYES MICROMODEM



Fully S-100 bus compatible including 16-bit machines and 4 MHz processors. • Two software selectable Baud rates—300 Baud and a jumper selectable speed from 45 to 300 Baud. (110 standard). Supports originate and answer modes. • Direct-connect Microcoupler. This FCC-registered device provides direct access into your local telephone system, with none of the losses or distortions associated with acoustic couplers and without a telephone company supplied data access arrangement. • Auto-Answer/Auto-Call. The MICROMODEM 100 can automatically answer the phone and receive input; it can also dial a number automatically. • Automatic Reset and Disconnect. • Software compatible with the D.C. Hayes Associates 80-103A Data Communications Adapter. Micromodem-DCHA32625—\$379.95

TIDMA



Tape Interface Direct Memory Access • Record and play programs without bootstrap loader (no prom) has FSK encoder/decoder for direct connections to low cost recorder at 1200 baud rate, and direct connections for inputs and outputs to a digital recorder at any baud rate • S-100 bus compatible • Board only \$35.00 Part No. 112, with parts \$110.00 Part No. 112A.

SYSTEM MONITOR

8080, 8085, or Z-80 System monitor for use with the TIDMA board. There is no need for the front panel. Complete with documentation \$12.95.

RS-232/TTY INTERFACE



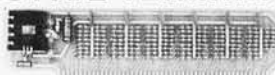
This board has two active circuits, one converts RS-232 to 20 mA, the other converts 20 mA to RS-232. Requires +12 and -12 volts. \$9.95 Part No. 600A Kit.

SERIAL I/O



Four Serial I/O RS-232 ports. S-100 Bus, Software or jumper selectable baud rate (110, 300, 600, 1200, 2400, 4800, 9600, 19.2K), on board Xtal baud rate generator, Addressing, switch selectable, Parity or no parity (odd or even) switch selectable, 1 or 2 stop bits, 5 to 8 bits/character. Board only \$29.95, Part No. 7908. With parts (kit) \$199.95, Part No. 7908A.

S-100 BUS ACTIVE TERMINATOR



Board only \$14.95 Part No. 900, with parts \$24.95 Part No. 900A

To Order: Mention part no. description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800

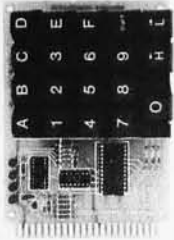


Send for FREE Catalog... a big self-addressed envelope with 41¢ postage gets it fastest!

ELECTRONIC SYSTEMS Dept. B P. O. Box 21638, San Jose, CA USA 95151

HEX ENCODED KEYBOARD

Four onboard LEDs indicate the HEX code generated for each key depression. The board requires a single +5 volt supply. Board only \$15.00 Part No. HEX-3, with parts \$49.95 Part No. HEX-3A, 44 pin edge connector \$4.00 Part No. 44P.



T.V. TYPEWRITER



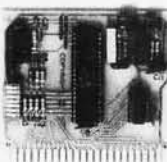
- Stand alone TVT
- 32 char./line, 16 lines, modifications for 64 char./line included
- Parallel ASCII (TTL) input • Video output
- 1K on board memory
- Output for computer controlled cursor
- Auto scroll • Non-destructive cursor
- Cursor inputs: up, down, left, right, home, EOL, EOS • Scroll up, down
- Requires +5 volts at 1.5 amps, and -12 volts at 30 mA • All 7400, TTL chips
- Char. gen. 2513
- Upper case only • Board only \$39.00 Part No. 106, with parts \$145.00 Part No. 106A

44 BUS MOTHER BOARD



Has provisions for ten 44 pin (.156) connectors, spaced 3/4 of an inch apart. Pin 20 is connected to X, and 22 is connected to Z for power and ground. All the other pins are connected in parallel. This board also has provisions for bypass capacitors. Board cost \$15.00 Part No. 102. Connectors \$3.00 each Part No. 44WP.

UART & BAUD RATE GENERATOR



- Converts serial to parallel and parallel to serial
- Low cost on board baud rate generator
- Baud rates: 110, 150, 300, 600, 1200, and 2400
- Low power drain +5 volts and -12 volts required
- TTL compatible
- All characters contain a start bit, 5 to 8 data bits, 1 or 2 stop bits, and either odd or even parity.
- All connections go to a 44 pin gold plated edge connector
- Board only \$12.00 Part No. 101, with parts \$35.00 Part No. 101A, 44 pin edge connector \$4.00 Part No. 44P

RS-232/20mA INTERFACE



This board has two passive, opto-isolated circuits. One converts RS-232 to 20mA, the other converts 20mA to RS-232. All connections go to a 10 pin edge connector. Requires +12 and -12 volts. Board only \$9.95, part no. 7901, with parts \$14.95 Part No. 7901A.

ASCII TO CORRESPONDENCE CODE CONVERTER

This bidirectional board is a direct replacement for the board inside the Trendata 1000 terminal. The on board connector provides RS-232 serial in and out. Sold only as an assembled and tested unit for \$249.95. Part No. TA 1000C

ASCII KEYBOARD

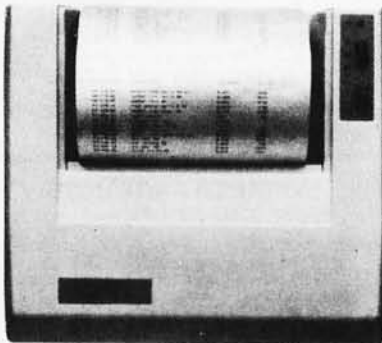
53 Keys popular ASR-33 format • Rugged G-10 P.C. Board • Tri-mode MOS encoding • Two-Key Rollover • MOS/DTL/TTL Compatible • Upper Case lockout • Data and Strobe inversion option • Three User Definable Keys • Low contact bounce • Selectable Parity • Custom Keycaps • George Risk Model 753. Requires +5, -12 volts. \$59.95 Kit.

ASCII KEYBOARD

TTL & DTL compatible • Full 67 key array • Full 128 character ASCII output • Positive logic with outputs resting low • Data Strobe • Five user-definable spare keys • Standard 22 pin dual card edge connector • Requires +5VDC, 325 mA. Assembled & Tested. Cherry Pro Part No. P70-05AB. \$119.95.



COMPRINT PRINTER



Printing Characteristics: 225 characters/second (170 lines/minute) throughput • 9 horizontal x 12 vertical matrix • 96 ASCII character set with upper and true lower case • 60 characters/line • 5.8 lines/inch

Buffer Memory: standard 256 bytes; optional: 2,048 bytes (buffer memory option designated as Model 912-2K), add \$149.95.

Paper Requirements: electrosensitive type (aluminum coated) • 8-1/2 inch width • 3.7 inch max. (300 ft.) roll diameter.

Model 912-S Interfacing: serial interface RS232 and 20 mA current loop • BAUD rates 110, 150, 300, 600, 1200, 2400 and 4800 are strap selectable.

Model 912-P Interfacing: parallel interface, IEEE-488 and 8 bit parallel (strobe/acknowledge). Model 912-S, Part No. CPIA, 32118, \$579.95. Model 912-P, Part No. CPIA, 32117, \$559.95.

T.V. INTERFACE



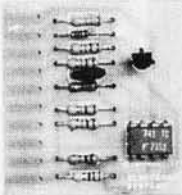
- Converts video to AM modulated RF, Channels 2 or 3. So powerful almost no tuning is required. On board regulated power supply makes this extremely stable. Rated very highly in Doctor Dobbs' Journal. Recommended by Apple
- Power required is 12 volts AC C.T., or +5 volts DC
- Board only \$7.60 part No. 107, with parts \$13.50 Part No. 107A

SOROC IQ 120



Upper/lower case display • Numeric keypad & cursor keys • Protected fields, 1/2 intensity display • RS 232 interface & aux. port. IQ120—\$799.95 • IQ140 Detachable keyboard—\$1199.95

RS-32/TTL INTERFACE



- Converts TTL to RS-232, and converts RS-232 to TTL
- Two separate circuits
- Requires -12 and +12 volts
- All connections go to a 10 pin edge connector, kit \$9.95 Part No. 232A 10P, edge connector \$3.00 part No. 10P.

DC POWER SUPPLY

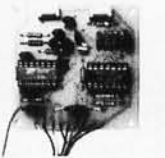
- Board supplies a regulated +5 volts at 3 amps., +12, -12, and -5 volts at 1 amp. • Power required is 8 volts AC at 3 amps., and 24 volts AC C.T. at 1.5 amps. • Board only \$12.50 Part No. 6085, with parts excluding transformers \$42.50 Part No. 6085A

TAPE INTERFACE



- Converts a low cost tape recorder to a digital recorder
- Works up to 1200 baud
- Digital in and out are TTL serial
- Output of board connects to mic. in of recorder
- Earphone of recorder connects to input on board
- No coils
- Requires +5 volts, low power drain
- Board only \$7.60 Part No. 111, with parts \$29.95 Part No. 111A

MODEM



- Type 103
- Full or half duplex
- Works up to 300 baud
- Originate or Answer
- Serial TTL input and output
- Connect 8 Ω speaker and crystal mic. directly to board
- Requires +5 volts
- Board only \$7.60 Part No. 109, with parts \$29.95 Part No. 109A.

COMPUCOLOR II



With reg. keyboard MOD3 8K \$1595.95 MOD4 16K \$1695.95 MOD5 32K \$1995.95 Now includes \$250 more, worth of software and accessories with 101 key option add \$134.95 with 117 key option add \$179.95

To Order: Mention part no. description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800

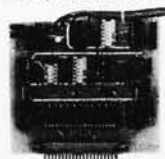


Send for FREE Catalog . . . a big self-addressed envelope with 41¢ postage gets it fastest!

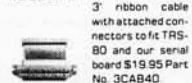
ELECTRONIC SYSTEMS Dept. B P. O. Box 21638, San Jose, CA USA 95151

TRS-80 SERIAL I/O

- Can input into basic
- Can use LLIST and LPRINT to output, or output continuously
- RS-232 compatible
- Can be used with or without the expansion bus
- On board switch selectable baud rates of 110, 150, 300, 600, 1200, 2400, parity or no parity odd or even, 5 to 8 data bits, and 1 or 2 stop bits. D.T.R. line
- Requires +5, -12 VDC
- Board only \$19.95 Part No. 8010, with parts \$59.95 Part No. 8010A, assembled \$79.95 Part No. 8010C. No connectors provided, see below.



EIA/RS-232 connector Part No. DB25P \$6.00, with 9' 6 conductor cable \$10.95 Part No. DB25P9



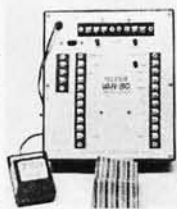
3' ribbon cable with attached connectors to fit TRS-80 and our serial board \$19.95 Part No. 3CAB40

COMPUCRUISE



\$129.95, with cruise control \$169.95

THE TELESIS VAR-80 INTERFACE UNIT



For the TRS-80 with Level II Basic • Provides 8 outputs • Provides 8 inputs • 2 ft. of interconnecting cable w/ connector • Plugs directly into TRS-80 • Power supply provided • Assembled and tested. Part No. VAR80, Introductory price \$109.95.

GAME PADDLES & SOUND



Includes: 2 game paddles, interface, software, speaker, power supply, full documentation including: schematics, theory of operation, and user guide; plus 2 games on cassette (Pong and Starship War). \$79.95 Complete Part No. 7922C

DIGICOM DATA PRODUCTS INC. Series 312 Acoustic Coupler



300 BAUD Originate, Part No. AC3122, \$219.95. 300 BAUD Answer, Part No. AC3122, \$219.95. 300 BAUD Answer/Originate, Part No. AC3123, \$229.95.

LIGHT-PEN For Your TRS-80



Your TRS-80 Light-Pen is a carefully engineered instrument and with the proper care will give satisfactory use and many years of service. Part No. TRS80LP \$24.95.

SYSTEM EXPANSION from LNW Research

- Serial RS232C/20 mA I/O
- Floppy controller
- 32K bytes memory
- Parallel printer port
- Dual cassette port
- Real-time clock
- Screen printer bus
- Onboard power supply
- Software compatible
- Solder mask, silk screen, PC board and user manual, Part No. LNW80, \$69.95.

DISKETTES



Box of 10, 5" \$29.95, 8" \$39.95. Plastic box, holds 10 diskettes, 5" - \$4.50, 8" - \$6.50.

16K RAMS

For the Apple, TRS-80 or Pet \$8 each Part No. 4116/2117.

LEEDEX MONITOR



12" Black and White • 12 MHz Bandwidth • Handsome Plastic Case • \$139.00

S-100 INTERFACE



AN S-100 bus Adapter—Motherboard for the TRS-80. Kit, Part No. HUH81DLXK, \$295.95. Assembled, Part No. HUH81DLXA, \$375.95.

NOW! A FULL SUPPORT SYSTEM FOR TRS-80



- 32K of RAM
- EPROM firmware
- Disk control
- Data acquisition
- Parallel I/O
- Serial I/O
- Plug into GPA's Motherboard. GPA's quality design includes: 6-44 pin edge connectors • +5V, -5V, +12V, -12V external power supply required
- Active termination. The Motherboard, Part No. GPA80, is only \$149.95.

TAKE ADVANTAGE OF GPA-EXPANSION CARDS FOR THE GPA80

Memory cards: Now with Fortran compilers available for your TRS-80, additional expansion memory is a must! Card with sockets only, Part No. GPA801, \$119.95. Card with 16K of 4116 Dynamic Ram, Part No. GPA802, \$224.95. Card with 32K of 4116 Dynamic Ram, Part No. GPA803, \$329.95. All cards come equipped with sockets to accommodate 32K of Ram.

EPROM firmware card. Put those valuable subroutines in firmware. Don't waste time loading and unloading tapes and disks. For 2708 or 2716 EPROMS, Part No. GPA806, \$79.95.

Serial I/O card. Here's what you've been asking for, a full serial terminal interface, with RS-232C or 20 mA. Current loop. Input/output capabilities. Part No. GPA807, \$79.95.

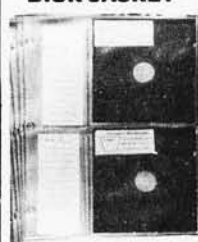
Parallel I/O Card. Control functions in the outside world, monitor and store real time events. Two parallel output ports. Dip switches select ports (0-254). Part No. GPA808, \$79.95.

FLOPPY DISK STORAGE BINDER



Three-ring binder comes with ten transparent plastic sleeves which accommodate either twenty, five-inch or ten, eight-inch floppy disks. Binder & 10 holders \$14.95 Part No. 8800; Extra holders 95¢ each, Part No. 800.

DISK JACKET™



Holds two 5-1/4 inch diskettes and will fit any standard three ring binder. \$9.95/10 Pack.

TRENDCOM PRINTER



- 40 characters per second
- 4-7/16 inch wide thermal paper
- Graphics (TRENDCOM 100): 480 seventeenth print positions per line. TRENDCOM 100, Part No. TRC0100, \$495.95. TRENDCOM 200, Part No. TRC0200, \$375.95.
- Interface for TRS-80.** Part No. TRC0A \$45.95. For Apple II, Part No. TRCAII, \$75.95. For PET, NO. TRCP2, \$79.95. For Scocorer, TRCSR1 \$45.95.

DIGITAL CASSETTE



5 min. each side. Box of 10 \$9.95. Part No. C-5.

SARGON: A Computer Chess Program

Features the complete program that won the 1978 West Coast Computer Faire Tournament. Part No. 00603 — TRS-80 Level II; Part No. 00604 — Apple II (24K). \$19.95

SOUND EFFECTS AND MUSIC FOR YOUR COMPUTER



SOUNDWARE is a complete system. It includes a speaker/amplifier unit with volume control, earphone jack, and connectors. It boasts excellent tone quality yet is small and convenient to use. Add batteries, plug it in, and play. One year warranty. **SOUNDWARE** package (includes INTRO to SOUNDWARE programs) PET (8K), Part No. 20003, \$29.95. TRS-80 Level II (16K), Part No. 20002, \$29.95. CompuColor II (8K), Part No. 20001, \$39.95. **INTRO to SOUNDWARE** programs only PET and TRS-80, Part No. 20005, \$14.95. CompuColor II Part No. 20006, \$19.95.

To Order: Mention part no. description, and price. In USA shipping paid by us for orders accompanied by check or money order. We accept C.O.D. orders in the U.S. only, or a VISA or Master Charge no., expiration date, signature, phone no., shipping charges will be added. CA residents add 6.5% for tax. Outside USA add 10% for air mail postage and handling. Payment must be in U.S. dollars. Dealer inquiries invited. 24 hour order line (408) 448-0800

Send for FREE Catalog... a big self-addressed envelope with 41¢ postage gets it fastest!

ELECTRONIC SYSTEMS Dept. B P. O. Box 21638, San Jose, CA USA 95151



CALIFORNIA COMPUTER SYSTEMS

16K RAM BOARD. Fully buffered addressable in 4K blocks. IEEE standard for bank addressing 2114's. PCBD\$ 26.95 Kit 450 NSEC\$249.95

PT-1 PROTO BOARD. Over 2,600 holes 4" regulators. All S-100 buss functions labeled, gold fingers. PCBD\$25.95

PT-2 PROTO BOARD. Similar to PT-1 except set-up to handle solder tail sockets. PCBD\$25.95

CCS MAIN FRAME. Kit (S-100)\$349.95

APPLE EXTENDER. Kit\$22.95

APPLE IEEE INSTRUMENTATION INTERFACE
KIT 7490. Kit\$275.00

ARITHMETIC PROCESSOR FOR APPLE 7811A.
Kit\$350.00

APPLE ASYNCHRONOUS SERIAL INTERFACE
7710A. Kit\$89.95

APPLE SYNCHRONOUS SERIAL INTERFACE
7712A. Kit\$89.95

ALL OTHER CCS PRODUCTS AVAILABLE



PB-1 2708 & 2716 Programming Board with provisions for 4K or 8K EPROM. No external supplies require textool sockets. Kit\$129.95

CB-1A 8080 Processor Board. 2K of PROM 256 BYTE RAM power on/rest Vector Jump Parallel port with status. Kit\$129.95 PCBD\$27.95

VB-3 80 x 55 VIDEO BOARD.
Graphic includedTBD

IO-4 Two serial I/O ports with full handshaking 20/60 ma current loop: Two parallel I/O ports. Kit\$130.00 PCBD\$26.95

VB-1B 64 x 16 video board, upper lower case Greek composite and parallel video with software. S-100. Kit\$125.00 PCBD\$26.95

CB-2 Z80 CPU BOARD. Kit\$185.95

AIO APPLE SERIAL/PARALLEL\$159.95

ALL OTHER SSM PRODUCTS AVAILABLE



WAMECO INC.

FDC-1 FLOPPY CONTROLLER BOARD will drive shugart, pertek, remic 5" & 8" drives up to 8 drives, on board PROM with power boot up, will operate with CPM™ (not included). PCBD\$42.95

FPB-1 Front Panel. IMSAI size, hex displays. Byte, or instruction single step. PCBD\$47.50

MEM-1A 8K x 8 fully buffered, S-100, uses 2102 type rams. PCBD\$25.95

QM-12 MOTHER BOARD, 13 slot, terminated, S-100 board only\$34.95

CPU-1 8080A Processor board S-100 with 8 level vector interrupt. PCBD\$26.95

RTC-1 Realtime clock board. Two independent interrupts. Software programmable. PCBD\$23.95

EPM-1 1702A 4K Eprom card. PCBD\$25.95

EPM-2 2708/2716 16K/32K EPROM CARD.
PCBD\$25.95

QM-9 MOTHER BOARD. Short Version of QM-12. 9 Slots. PCBD\$30.95

MEM-2 16K x 8 Fully Buffered 2114 Board.
PCBD\$26.95

PTB-1 POWER SUPPLY AND TERMINATOR BOARD.
PCBD\$25.95

IOB-1 SERIAL AND PARALLEL INTERFACE.
2 parallel, one serial and cassette.
PCBD\$26.95

2708\$9.49 2114 (200 NS) low pwr.
2114 (450 NS) low pwr. 5.99\$6.99

MIKOS

NOTE:
NEW ADDRESS AND PHONE (415) 726-7593
P. O. Box 955 • El Granada, CA 94018
Please send for IC, Xistor and Computer parts list

MAY SPECIAL SALE ON PREPAID ORDERS

(Charge cards not included on this offer)

IO-4 LAYOUT REJECTS. One simple change.
PCBD\$20.00

8K x 8 RAM. Fully buffered. 450 NSEC assembled and tested.\$99.99

MIKOS PARTS ASSORTMENT

WITH WAMECO AND CYBERCOM PCBDs

MEM-2 with MIKOS =7 16K ram\$249.95
with L2114 450 NSEC\$249.95

MEM-2 with MIKOS =13 16K ram\$279.95
with L2114 250 NSEC\$279.95

MEM-1 with MIKOS =1 450 NSEC 8K RAM\$119.95

CPU-1 with MIKOS =2 8080A CPU\$ 94.95

QM-12 with MIKOS =4 13 slot mother board\$ 89.95

RTC-1 with MIKOS =5 real time clock\$ 54.95

EMP-1 with MIKOS =10 4K 1702 less EPROMS\$ 49.95

EPM-2 with MIKOS =11 16-32K EPROMS less EPROMS\$ 59.95

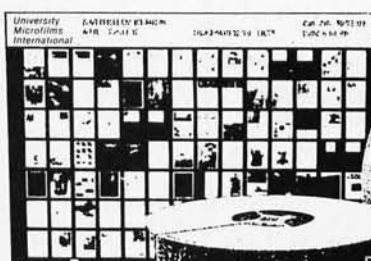
QM-9 with MIKOS =12 9 slot mother board\$ 79.95

FPB-1 with MIKOS =14 all parts for front panel\$134.95

MIKOS PARTS ASSORTMENTS ARE ALL FACTORY MARKED PARTS. KITS INCLUDE ALL PARTS LISTED AS REQUIRED FOR THE COMPLETE KIT LESS PARTS LISTED. ALL SOCKETS INCLUDED.

VISA or MASTERCHARGE. Send account number, interbank number, expiration date and sign your order. Approx. postage will be added. Check or money order will be sent post paid in U.S. If you are not a regular customer, please use charge, cashier's check or postal money order. Otherwise there will be a two-week delay for checks to clear. Calif. residents add 6% tax. Money back 30-day guarantee. We cannot accept returned IC's that have been soldered to. Prices subject to change without notice. \$10 minimum order. \$1.50 service charge on orders less than \$10.00.

this publication is available in microform



Please send me additional information.

Name _____
Institution _____
Street _____
City _____
State _____ Zip _____

University Microfilms International

300 North Zeeb Road
Dept. P.R.
Ann Arbor, MI 48106
U.S.A.

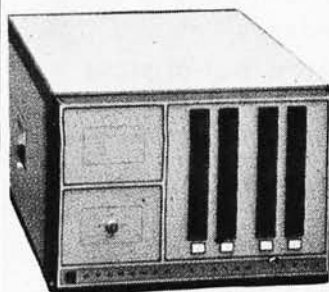
18 Bedford Row
Dept. P.R.
London, WC1R 4EJ
England



MICRO BUSINESS WORLD™

MAIL ORDER

Immediate response to your orders (verbal or written). Phone (213) **371-1660**



Cromemco System Three FEATURES . . .

- Z-80A Micro Processor • 64K RAM
- Dual 8" Double Sided Disk Drive easily expandable to 4 Drives • RS232 and Printer Interface.

CALL FOR OUR PRICE

Cromemco System Two FEATURES . . .

- Z-80A Micro Processor • 64K RAM
- Wangco Drives • RS232 and Printer Interface.

CALL FOR OUR PRICE

SANYO 9" MONITOR

A Superb Black and White TV Monitor that can be used with most Computers

OUR PRICE \$185



Apple II personal computer.

We have a complete stock of different **Software** for the **Apple II**

All Apple and Apple related products...
20-25% OFF list price



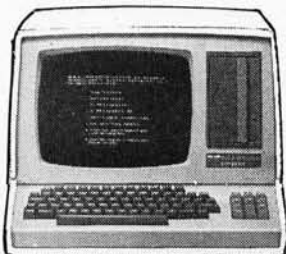
Texas Instruments TI-99/4 Home Computer

The TI-99/4 gives you an unmatched combination of features, including: • Powerful TI-BASIC—built-in 13-digit, floating point BASIC. • Up to 72K total memory capacity — 16K RAM (Random Access Memory), 26K ROM (Read Only Memory), plus up to 30K ROM in TI's Solid State Command Modules. • 13" color monitor included.

• Revolutionary Solid State Speech™ Synthesizer (optional) **Our Price \$999.**



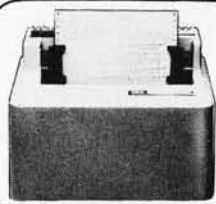
ZENITH DATA SYSTEMS: Smart Video Terminal



Z-89 Computer System:

includes: Z19 Display, a built in 5 1/4" Floppy Disk, 2 serial ports, and 16K of memory. **2295.00**
48K Memory version **2595.00**

Z-19 has a Z80 Microprocessor, Numeric Keypad and 8 function key **\$895.00**



IDS 440 Impact Printer

The Paper Tiger

This low-cost printer has the capability of printers twice its price. *Ideal for use with small computers*

w/graphics **OUR PRICE \$1050.**

DYSAN DISKETTES

THE CADILLAC OF THE FLOPPY DISKS
AT LOW LOW PRICES

- | | |
|---|-------------------|
| 8" (Box of 10) 37401/1 sgl side/sgl density | \$4.50 ea. |
| 8" (Box of 10) 37401/D sgl side/dbl density | \$6.95 ea. |
| 5" (Box of 5): | |
| 104/1 Soft Sector or 107/1 10 Sectors | |
| or 105/1 16 Sectors | \$4.50 |

Plastic Floppy Disk Holder
Plastic Floppy Disk Holder

(up to 10) 8" **\$3.95**
(up to 10) 5" **\$3.25**



ATARI 800 Personal Computer System

Packed with: Computer Console, Basic Language Card, Education System Master Cartridge, Cassette Recorder, TV Modulator, 8K Memory (expandable to 48K), Power Supply & all Books and Manuals **\$849.99**

ATARI 400 Personal Computer System for less

Packed with: Computer Console, Basic Language Cartridge, Power Supply, TV Modulator, and all Books and Manuals **\$524.99**

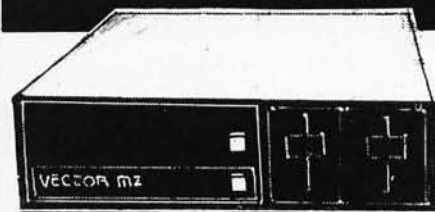
ATARI Program Recorder **69.99**

ATARI Software, Roms, Cassettes 25% off list price

ATARI Expansion Memory 8K Module **99.99**

16K Module **169.99**

The Vector MZ Microcomputer



System B is a Z-80 based microcomputer with over 630,000 characters of on-line storage and is capable of handling standard accounting or special computations of any small business or large company department — even scientific calculations in a technical environment.

Call for **Our Price**

16K RAM set of 8 4116's 250 ns or better **\$65.00**

Prices subject to change without notice.
VISA and MASTER CHARGE WELCOME. Allow 2 weeks for cashiers check to clear, 4 weeks for personal checks. Add 2% for shipping and handling. Calif. residents add 6% sales tax. (Sorry, no C.O.D.)

U.S. and International dealer inquiries invited.

Copyright 1980 • MICRO Business WORLD Circle 249 on inquiry card.



MICRO BUSINESS WORLD™

15818 Hawthorne Boulevard
Lawndale, California 90260 (213) **371-1660**



NO ONE CAN GIVE YOU A BETTER DEAL ON TRS-80 COMPUTERS!!

OUR Radio Shack® Merchandise is New and covered by Radio Shack® Warranties

WE PAY Domestic U.P.S. Shipping & Insurance on minimum orders

NO TAXES are collected on out-of-state Shipments

TOLL FREE Order Number

OPEN 8:00 a.m. to 6:00 p.m., Central Time, Monday through Friday; 9:00 a.m. to 6:00 p.m., Saturday

on computers, peripherals, software and other Radio Shack® products.

Offered Exclusively By

Pan American Electronics

INCORPORATED

A

Radio Shack®

AUTHORIZED SALES CENTER

1117 CONWAY MISSION, TEXAS 78572

TOLL FREE ORDER NUMBER 800/531-7466

TEXAS AND MAIN TELEPHONE NUMBER 512/581-2765



WAMECO

**THE COMPLETE PC BOARD HOUSE
EVERYTHING FOR THE S-100 BUSS**

INTRODUCTORY SPECIAL

IOB-1 SERIAL/PARALLEL INTERFACE BOARD

- * TWO PARALLEL DATA PORTS PROGRAMMABLE USING AN 8255 WITH SEPARATE HANDSHAKING.
 - * ONE SERIAL PORT USING AN 8251 WITH PROVISIONS FOR PARITY, STOP BIT AND CHARACTER LENGTH. BAUD RATES 110 TO 9600 BAUD. OUTPUTS RS232, TTL AND CURRENT LOOP.
 - * KANSAS CITY STANDARD CASSETTE INTERFACE, 300 BAUD FOR USE WITH THE SERIAL INTERFACE.
 - * STATUS MAY BE POLLING SOFTWARE OR VECTURED INTERRUPTS.
- PCBD\$31.95
- KIT TO BE ANNOUNCED LATER.

FUTURE PRODUCTS: 80 CHARACTER VIDEO BOARD.

Z-80 CPU BOARD WITH RAM, ROM AND PROGRAMMABLE VECTOR INTERRUPTS.

**DEALER INQUIRIES INVITED, UNIVERSITY DISCOUNTS AVAILABLE
AT YOUR LOCAL DEALER**

MOST PRODUCTS FOR IMMEDIATE SHIPMENT. NO 4-8 WEEK DELAYS REQUIRED FOR OTHERS.

NOTE:
NEW ADDRESS AND PHONE

WMC inc.

WAMECO, INC., P. O. BOX 877 • 455 PLAZA ALHAMBRA • EL GRANADA, CA 94018 • (415) 726-6378

NEW PRODUCTS!

Super Color S-100 Video Kit \$99.95
Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, 280 etc.

Gremlin Color Video Kit \$59.95
32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. Not expandable to high resolution Graphics.

Quest Super Basic

Quest, the leader in inexpensive 1802 systems announces another first. Quest is the first computer worldwide to ship a full size Basic for 1802 systems. A complete function Super Basic by Ron Cenko including floating point capability with scientific notation (number range $\pm 1.7E^{30}$), 32 bit integer ± 2 billion; Multi dim arrays; String arrays; String manipulation; Cassette I/O. Save and load, Basic, Data and machine language programs; and over 75 Statements, Functions and Operators.

Easily adaptable on most 1802 systems. Requires 12K RAM minimum for Basic and user

Elf II Adapter Kit \$24.50

Plugs into Elf II providing Super Elf 44 and 50 pin bus plus S-100 bus expansion (With Super Expansion). High and low address displays, state and mode LED's optional \$18.00.

1802 16K Dynamic RAM Kit \$149.00

1802/S-100 expandable to 32K. Hidden refresh w/clocks up to 4 MHz w/no wait states Addl. 16K RAM \$79.00.

programs. Cassette version in stock now. ROM versions coming soon with exchange privilege allowing some credit for cassette version.

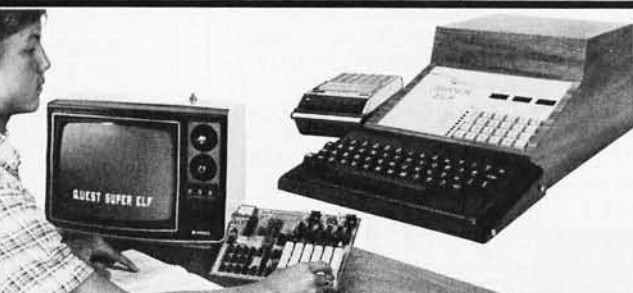
Super Basic on Cassette \$40.00

Tom Pittman's 1802 Tiny Basic Source listing now available. Find out how Tom Pittman wrote Tiny Basic and how to get the most out of it. Never offered before. \$19.00

S-100 4-Slot Expansion \$9.95

Super Monitor VI.1 Source Listing \$15.00

Coming Soon: Assembler, Editor, Disassembler, DA/AD, Super Sound/Music, EPROM programmer, Stringy Floppy Disc System.



RCA Cosmac Super Elf Computer \$106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the Super Elf for so little money. The Super Elf is a small single board computer that does many big things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily expanded with additional memory. Full Basic, ASCII Keyboards, video character generation, etc.

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The Super Elf includes a ROM monitor for program loading, editing and execution with SINGLE STEP for program debugging which is not included in others at the same price. With SINGLE STEP you can see the microprocessor chip operating with the unique Quest address and data bus displays before, during and after executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 video graphics chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a speaker system included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

Super Expansion Board with Cassette Interface \$89.95

This is truly an astounding value! This board has been designed to allow you to decide how you want it optioned. The Super Expansion Board comes with 4K of low power RAM fully addressable anywhere in 64K with built-in memory protect and a cassette interface. Provisions have been made for all other options on the same board and it fits neatly into the hardware cabinet alongside the Super Elf. The board includes slots for up to 6K of EPROM (2708, 2758, 2716 or TI 2716) and is fully socketed. EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor \$19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with

A 24 key HEX keyboard includes 16 HEX keys plus load, reset, run, wait, input, memory protect, monitor select and single step. Large, on board displays provide output and optional high and low address. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for all IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 400 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. Compare before you buy. Super Elf Kit \$106.95, High address option \$8.95, Low address option \$9.95. Custom Cabinet with drilled and labelled Plexiglas front panel \$24.95. Expansion Cabinet with room for 4 S-100 boards \$41.00. NiCad Battery Memory Saver Kit \$6.95. All kits and options also completely assembled and tested. Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for \$12.00 per year. Issues 1-12 bound \$16.50.

Tiny Basic Cassette \$10.00, on ROM \$38.00, original Elf kit board \$14.95, 1802 software; Moew's Video Graphics \$3.50. Games and Music \$3.00, Chip 8 Interpreter \$5.50.

subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the Super Expansion Board and Super Monitor the monitor is up and running at the push of a button.

Other on board options include Parallel Input and Output Ports with full handshake. They allow easy connection of an ASCII keyboard to the input port. RS 232 and 20 mA Current Loop for teletype or other device are on board and if you need more memory there are two S-100 slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. Parallel I/O Ports \$9.85, RS 232 \$4.50, TTY 20 mA I/F \$1.95, S-100 \$4.50. A 50 pin connector set with ribbon cable is available at \$15.25 for easy connection between the Super Elf and the Super Expansion Board.

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

7400TTL	LM323K-5	5.95	CD4021	1.25
7400N	LM323K-12	1.50	CD4022	1.10
7402N	LM323K-15	1.50	CD4023	2.80
7403N	LM323K-16	1.60	CD4024	2.75
7409A	LM323K-18	1.60	CD4025	2.80
7410N	LM323K-19	1.50	CD4026	2.80
7411N	LM323K-20	1.50	CD4027	2.80
7412N	LM324N	1.15	CD4028	8.5
7422N	3933N	5.50	CD4029	1.02
7423N	3934N	5.50	CD4030	1.02
7424N	LM340K-8	3.35	CD4035	8.11E
7444N	LM340K-12	3.35	CD4040	1.02
7447N	LM340K-15	3.35	CD4041	1.02
7449N	LM340K-16	3.35	CD4042	1.02
7450N	LM340K-24	3.35	CD4043	8.5
7451N	LM340K-25	3.35	CD4044	8.5
7452N	LM340K-26	3.35	CD4045	8.5
7453N	LM340K-27	3.35	CD4046	8.5
7454N	LM340K-28	3.35	CD4047	8.5
7455N	LM340K-29	3.35	CD4048	8.5
7456N	LM340K-30	3.35	CD4049	8.5
7457N	LM340K-31	3.35	CD4050	8.5
7458N	LM340K-32	3.35	CD4051	8.5
7459N	LM340K-33	3.35	CD4052	8.5
7460N	LM340K-34	3.35	CD4053	8.5
7461N	LM340K-35	3.35	CD4054	8.5
7462N	LM340K-36	3.35	CD4055	8.5
7463N	LM340K-37	3.35	CD4056	8.5
7464N	LM340K-38	3.35	CD4057	8.5
7465N	LM340K-39	3.35	CD4058	8.5
7466N	LM340K-40	3.35	CD4059	8.5
7467N	LM340K-41	3.35	CD4060	8.5
7468N	LM340K-42	3.35	CD4061	8.5
7469N	LM340K-43	3.35	CD4062	8.5
7470N	LM340K-44	3.35	CD4063	8.5
7471N	LM340K-45	3.35	CD4064	8.5
7472N	LM340K-46	3.35	CD4065	8.5
7473N	LM340K-47	3.35	CD4066	8.5
7474N	LM340K-48	3.35	CD4067	8.5
7475N	LM340K-49	3.35	CD4068	8.5
7476N	LM340K-50	3.35	CD4069	8.5
7477N	LM340K-51	3.35	CD4070	8.5
7478N	LM340K-52	3.35	CD4071	8.5
7479N	LM340K-53	3.35	CD4072	8.5
7480N	LM340K-54	3.35	CD4073	8.5
7481N	LM340K-55	3.35	CD4074	8.5
7482N	LM340K-56	3.35	CD4075	8.5
7483N	LM340K-57	3.35	CD4076	8.5
7484N	LM340K-58	3.35	CD4077	8.5
7485N	LM340K-59	3.35	CD4078	8.5
7486N	LM340K-60	3.35	CD4079	8.5
7487N	LM340K-61	3.35	CD4080	8.5
7488N	LM340K-62	3.35	CD4081	8.5
7489N	LM340K-63	3.35	CD4082	8.5
7490N	LM340K-64	3.35	CD4083	8.5
7491N	LM340K-65	3.35	CD4084	8.5
7492N	LM340K-66	3.35	CD4085	8.5
7493N	LM340K-67	3.35	CD4086	8.5
7494N	LM340K-68	3.35	CD4087	8.5
7495N	LM340K-69	3.35	CD4088	8.5
7496N	LM340K-70	3.35	CD4089	8.5
7497N	LM340K-71	3.35	CD4090	8.5
7498N	LM340K-72	3.35	CD4091	8.5
7499N	LM340K-73	3.35	CD4092	8.5
7500N	LM340K-74	3.35	CD4093	8.5
7501N	LM340K-75	3.35	CD4094	8.5
7502N	LM340K-76	3.35	CD4095	8.5
7503N	LM340K-77	3.35	CD4096	8.5
7504N	LM340K-78	3.35	CD4097	8.5
7505N	LM340K-79	3.35	CD4098	8.5
7506N	LM340K-80	3.35	CD4099	8.5
7507N	LM340K-81	3.35	CD4100	8.5
7508N	LM340K-82	3.35	CD4101	8.5
7509N	LM340K-83	3.35	CD4102	8.5
7510N	LM340K-84	3.35	CD4103	8.5
7511N	LM340K-85	3.35	CD4104	8.5
7512N	LM340K-86	3.35	CD4105	8.5
7513N	LM340K-87	3.35	CD4106	8.5
7514N	LM340K-88	3.35	CD4107	8.5
7515N	LM340K-89	3.35	CD4108	8.5
7516N	LM340K-90	3.35	CD4109	8.5
7517N	LM340K-91	3.35	CD4110	8.5
7518N	LM340K-92	3.35	CD4111	8.5
7519N	LM340K-93	3.35	CD4112	8.5
7520N	LM340K-94	3.35	CD4113	8.5
7521N	LM340K-95	3.35	CD4114	8.5
7522N	LM340K-96	3.35	CD4115	8.5
7523N	LM340K-97	3.35	CD4116	8.5
7524N	LM340K-98	3.35	CD4117	8.5
7525N	LM340K-99	3.35	CD4118	8.5
7526N	LM340K-100	3.35	CD4119	8.5
7527N	LM340K-101	3.35	CD4120	8.5
7528N	LM340K-102	3.35	CD4121	8.5
7529N	LM340K-103	3.35	CD4122	8.5
7530N	LM340K-104	3.35	CD4123	8.5
7531N	LM340K-105	3.35	CD4124	8.5
7532N	LM340K-106	3.35	CD4125	8.5
7533N	LM340K-107	3.35	CD4126	8.5
7534N	LM340K-108	3.35	CD4127	8.5
7535N	LM340K-109	3.35	CD4128	8.5
7536N	LM340K-110	3.35	CD4129	8.5
7537N	LM340K-111	3.35	CD4130	8.5
7538N	LM340K-112	3.35	CD4131	8.5
7539N	LM340K-113	3.35	CD4132	8.5
7540N	LM340K-114	3.35	CD4133	8.5
7541N	LM340K-115	3.35	CD4134	8.5
7542N	LM340K-116	3.35	CD4135	8.5
7543N	LM340K-117	3.35	CD4136	8.5
7544N	LM340K-118	3.35	CD4137	8.5
7545N	LM340K-119	3.35	CD4138	8.5
7546N	LM340K-120	3.35	CD4139	8.5
7547N	LM340K-121	3.35	CD4140	8.5
7548N	LM340K-122	3.35	CD4141	8.5
7549N	LM340K-123	3.35	CD4142	8.5
7550N	LM340K-124	3.35	CD4143	8.5
7551N	LM340K-125	3.35	CD4144	8.5
7552N	LM340K-126	3.35	CD4145	8.5
7553N	LM340K-127	3.35	CD4146	8.5
7554N	LM340K-128	3.35	CD4147	8.5
7555N	LM340K-129	3.35	CD4148	8.5
7556N	LM340K-130	3.35	CD4149	8.5
7557N	LM340K-131	3.35	CD4150	8.5
7558N	LM340K-132	3.35	CD4151	8.5
7559N	LM340K-133	3.35	CD4152	8.5
7560N	LM340K-134	3.35	CD4153	8.5
7561N	LM340K-135	3.35	CD4154	8.5
7562N	LM340K-136	3.35	CD4155	8.5
7563N	LM340K-137	3.35	CD4156	8.5
7564N	LM340K-138	3.35	CD4157	8.5
7565N	LM340K-139	3.35	CD4158	8.5
7566N	LM340K-140	3.35	CD4159	8.5
7567N	LM340K-141	3.35	CD4160	8.5
7568N	LM340K-142	3.35	CD4161	8.5
7569N	LM340K-143	3.35	CD4162	8.5
7570N	LM340K-144	3.35	CD4163	8.5
7571N	LM340K-145	3.35	CD4164	8.5
7572N	LM340K-146	3.35	CD4165	8.5
7573N	LM340K-147	3.35	CD4166	8.5
7574N	LM340K-148	3.35	CD4167	8.5
7575N	LM340K-149	3.35	CD4168	8.5
7576N	LM340K-150	3.35	CD4169	8.5
7577N	LM340K-151	3.35	CD4170	8.5
7578N	LM340K-152	3.35	CD4171	8.5
7579N	LM340K-153	3.35	CD4172	8.5
7580N	LM340K-154	3.35	CD4173	8.5
7581N	LM340K-155	3.35	CD4174	8.5
7582N	LM340K-156	3.35	CD4175	8.5
7583N	LM340K-157	3.35	CD4176	8.5
7584N	LM340K-158	3.35	CD4177	8.5
7585N	LM340K-159	3.35	CD4178	8.5
7586N	LM340K-160	3.35	CD4179	8.5
7587N	LM340K-161	3.35	CD4180	8.5
7588N	LM340K-162	3.35	CD4181	8.5
7589N	LM340K-163	3.35	CD4182	8.5
7590N	LM340K-164	3.35	CD4183	8.5
7591N	LM340K-165	3.35	CD4184	8.5
7592N	LM340K-166	3.35	CD4185	8.5
7593N	LM340K-167	3.35	CD4186	8.5
7594N	LM340K-168	3.35	CD4187	8.5
7595N	LM340K-169	3.35	CD4188	8.5
7596N	LM340K-170	3.35	CD4189	8.5
7597N	LM340K-171	3.35	CD4190	8.5
7598N	LM340K-172	3.35	CD4191	8.5
7599N	LM340K-173	3.35	CD4192	8.5
7600N	LM340K-174	3.35	CD4193	8.5
7601N	LM340K-175	3.35	CD4194	8.5
7602N	LM340K-176	3.35	CD4195	8.5
7603N	LM340K-177	3.35	CD4196	8.5
7604N	LM340K-178	3.35	CD4197	8.5
7605N	LM340K-179	3.35	CD4198	8.5
7606N	LM340K-180	3.35	CD4199	8.5
7607N	LM340K-181	3.35	CD4200	8.5
7608N	LM340K-182	3.35	CD4201	8.5
7609N	LM340K-183	3.35	CD4202	8.5
7610N	LM340K-184	3.35	CD4203	8.5
7611N	LM340K-185	3.35	CD4204	8.5
7612N	LM340K-186	3.35	CD4205	8.5
7613N	LM340K-187	3.35	CD4206	8.5
7614N	LM340K-188	3.35	CD4207	8.5
7615N	LM340K-189	3.35	CD4208	8.5
7616N	LM340K-190	3.35	CD4209	8.5
7617N	LM340K-191	3.35	CD4210	8.5
7618N	LM340K-192	3.35	CD4211	8.5
7619N	LM340K-193	3.35	CD4212	8.5
7620N	LM340K-194	3.35	CD4213	8.5
7621N	LM340K-195	3.35	CD4214	8.5
7622N	LM340K-196	3.35	CD4215	8.5
7623N	LM340K-197	3.35	CD4216	8.5
7624N	LM340K-198	3.35	CD4217	8.5
7625N	LM340K-199	3.35	CD4218	8.5
7626N	LM340K-200	3.35	CD4219	8.5
7627N	LM340K-201	3.35	CD4220	8.5
7628N	LM340K-202	3.35	CD4221	8.5
7629N	LM340K-203	3.35	CD4222	8.5
7630N	LM340K-204	3.35	CD4223	8.5
7631N	LM340K-205	3.35	CD4224	8.5
7632N	LM340K-206	3.35	CD4225	8.5
7633N	LM340K-207	3.35	CD4226	8.5
7634N	LM340K-208	3.35	CD4227	8.5
7635N	LM340K-209	3.35	CD4228	8.5
7636N	LM340K-210	3.35	CD4229	8.5
7637N	LM340K-211	3.35	CD4230	8.5
7638N	LM340K-212	3.35	CD4231	8.5
7639N	LM340K-213	3.35	CD4232	8.5
7640N	LM340K-214	3.35	CD4233	8.5
7641N	LM340K-215	3.35	CD4234	8.5
7642N	LM340K-216	3.35	CD4235	8.5
7643N	LM340K-217	3.35	CD4236	8.5
7644N	LM340K-218	3.35	CD4237	8.5
7645N	LM340K-219	3.35	CD4238	8.5
7646N	LM340K-220	3.35	CD4239	8.5
7647N	LM340K-221	3.35	CD4240	8.5
7648N	LM340K-222	3.35	CD4241	8.5
7649N	LM340K-223	3.35	CD4242	8.5
7650N	LM340K-224	3.35	CD4243	8.5
7651N	LM340K-225	3.35	CD4244	8.5
7652N	LM340K-226	3.35	CD4245	8.5
7653N	LM340K-227	3.35	CD4246	8.5
7654N	LM340K-228	3.35	CD4247	8.5
7655N	LM340K-229	3.35	CD4248	8.5
7656N	LM340K-230	3.35	CD4249	8.5
7657N	LM340K-231	3.35	CD4250	8.5
7658N	LM340K-232	3.35	CD4251	8.5
7659N	LM340K-233	3.35	CD4252	8.5
7660N	LM340K-234	3.35	CD4253	8.5
7661N	LM340K-235	3.35	CD4254	8.5
7662N	LM340K-236	3.35	CD	

asap
computer
products, inc.

11542-1 KNOTT ST.
GARDEN GROVE,
CA 92641
(800) 854-6411
(714) 891-2663

100 PIN-GOLD
IMSAI CONN.
SOLDERTAIL
\$2.75 each
10 for **\$2.60** ea.

MICROBYTE
16K STATIC
RAM BOARD

- S-100 COMPATIBLE
- 4K BANK ADDRESSABLE
- EXTENDED MEMORY MANAGEMENT
- NO DMA RESTRICTIONS
- ASSEMBLED & TESTED
- 4MHZ OPERATION

\$250.00 each

CATALOG
AVAILABLE
CALL OR WRITE

ORDERING INFO

NAME, ADDRESS, PHONE
SHIP BY: UPS OR MAIL
SHIPPING CHRG. ADD
\$2.00 UP TO (5) LBS.

TERMS

WE ACCEPT CASH,
CHECK, MONEY ORDER,
VISA & MASTER CHARGE
CREDIT CARDS.
(U.S. FUNDS ONLY)
TAX: 6% CALIF. RES.

4116's—200^{NS}

ADD-ON MEMORY FOR: TRS-80,
APPLE, HEATH, EXIDY, ETC.

8 for \$55.00

16 for \$110.00

MICROBYTE
32K STATIC
RAM BOARD

- IEEE/S-100 compatible
- 4K bank addressable to any 4K slot within a 64K boundary
- On board 8-bit output port
- No DMA restrictions
- 4 Hmz operation

LO-PRO SOCKETS

	1-99	100 Up
14 PIN	.11	.10
16 PIN	.12	.11
18 PIN	.16	.14
20 PIN	.24	.22
24 PIN	.31	.29
28 PIN	.35	.31
40 PIN	.42	.39

LOBO INT'L.

APPLE II
DISK DRIVE
(1) SHUGART 400
W/CABLE

\$395.00

*WITH OPTIONAL
INTERFACE CARD

\$495.00

2708's

450NS.

8.50 each
8/\$60.00

8251
U-ART

\$5.00 each
or
\$2 for \$9.50

CENTRONICS
PRINTERS
MODEL #703

180 CPS BI-DIRECTIONAL
LOGIC SEEKING PRINTER
WITH 132 COLUMN
CARRIAGES, ELECTRONIC
TOP OF FORM, VFU &
CENTRONICS STANDARD
PARALLEL INTERFACE

\$1995.00

TRS-80 DISK DRIVE

- UP TO 218K BYTES
 - SINGLE/DOUBLE DENSITY
 - SOFT SECTOR
 - 25 MSEC. ACCESS
 - SOFTWARE COMPATIBLE
 - ASSEMBLED & TESTED
- \$395.00** each

2716's

450NS

5-VOLT ONLY

\$35.00

REGULATORS

320T-5	.....90
320T-12	.....80
340T-5	.....75
340T-12	.....65
78405	.....5.00

LOBO INT'L

SA 800

SINGLE-SIDED/
DBL. DENSITY
SHUGART 8''
FLOPPY DISK
DRIVE, INSTALLED
W/PWR. SUPPLY
(1) DRIVE INSTALLED

\$775.00

(2) DRIVES INSTALLED

\$1250.00

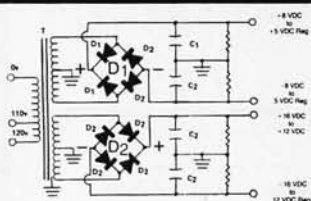
CAPACITORS

.1 @ 12 VOLTS

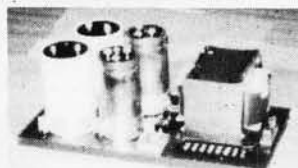
10c each

or

100/\$9.00



BUILD YOUR OWN LOW COST
MICRO-COMPUTER
POWER SUPPLIES
FOR S-100 BUS, FLOPPY DISCS, ETC.



POWER TRANSFORMERS (WITH MOUNTING BRACKETS)

ITEM NO.	USED IN KIT NO.	PRI. WINDING TAPS	SECONDARY WINDING OUTPUTS			SIZE W x D x H	UNIT PRICE
			2x8 Vac	2x14 Vac	2x24 Vac		
T ₁	1	0V, 110V, 120V	2x7.5A	2x2.5A	—	3 3/4" x 3 5/8" x 3 1/8"	21.95
T ₂	2	0V, 110V, 120V	2x12.5A	2x3.5A	—	3 3/4" x 4 3/8" x 3 1/8"	27.95
T ₃	3	0V, 110V, 120V	2x9A	2x2.5A	2x2.5A	3 3/4" x 4 3/8" x 3 1/8"	29.95
T ₄	4	0V, 110V, 120V	2x4A	—	2x3A	3 3/4" x 3 5/8" x 3 1/8"	21.95

POWER SUPPLY KITS (OPEN FRAME WITH BASE PLATE, 3 HRS. ASSY. TIME)

ITEM	USED FOR	@+8 Vdc	@-8 Vdc	@+16 Vdc	@-16 Vdc	@+28 Vdc	SIZE WxDxH	UNIT PRICE
KIT 1	15 CARDS SOURCE	15A	—	2.5A	2.5A	—	12" x 6" x 4 7/8"	51.95
KIT 2	SYSTEM SOURCE	25A	—	3A	3A	—	12" x 6" x 4 7/8"	58.95
KIT 3	DISC SYSTEM	15A	1A	2A	2A	4A	14" x 6" x 4 7/8"	66.95
KIT 4	DISC SOURCE	8A	1A	—	—	5A	10" x 6" x 4 7/8"	49.95

EACH KIT INCLUDES: TRANSFORMER, CAPACITORS, RESIS., BRIDGE RECTIFIERS, FUSE & HOLDER, TERMINAL BLOCK, BASE PLATE, MOUNTING PARTS AND INSTRUCTIONS.

DISC DRIVE POWER SUPPLY "R3" ASSY. & TESTED, OPEN FRAME, SIZE: 9" (W) x 5" (D) x 5" (H) **64.95**

SPECS: +5V @ 5A REGULATED, -5V @ 1A REG., +24V @ 5A REG., SHORTS PROTECT.

IDEAL FOR 2 SHUGART 801/851 OR SIEMANS FDD 100-8/200-8 DISK DRIVES & ROCKWELL AIM-65.

SHIPPING FOR EACH TRANSFORMER: \$4.75. FOR EACH POWER SUPPLY: \$5.00 IN CALIF. \$7.00 IN OTHER STATES. CALIF. RESIDENTS ADD 6% SALES TAX. OEM WELCOME.

SUNNY INTERNATIONAL
(TRANSFORMERS MANUFACTURER)
Telephone: (213) 633-8327

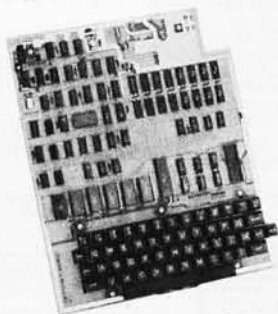
STORE:
7245 E. ALONDRA BLVD.
PARAMOUNT, CA 90723
STORE HOURS: 9 AM-6 PM



MAIL ORDER:
P.O. BOX 4296
TORRANCE, CA 90510

VISA

Now get OHIO SCIENTIFIC personal computer products with guaranteed, quick, mail order delivery.



ONLY \$299

Ohio Scientific Superboard II

The first complete computer system on a board. Includes keyboard, video interface and audio cassette interface. 8K BASIC-in-ROM; 4K RAM. Requires power supply + 5V at 3 Amp.

"We heartily recommend Superboard II for the beginner who wants to get into microcomputers with a minimum cost. A real computer with full expandability."
POPULAR ELECTRONICS, MARCH, 1979

"The Superboard II is an excellent choice for the personal computer enthusiast on a budget."
BYTE, MAY, 1979

Ohio Scientific C1P Series.



The Challenger 1P. The best bargain in personal computer anywhere! 8K BASIC-in-ROM. 4K RAM. Cassette based with 53-key keyboard. B&W video interface, 30 rows x 30 columns. Upper and lower case. 8K RAM **\$399.**

Ohio Scientific C1P MF. Mini-floppy version of the C1P. 8K BASIC-in-ROM. **\$995.** 20K RAM and OS-65D software. Fully expandable. **\$1250.**

SOFTWARE

Cassettes		MDMS Checking and Savings Account	
Add Game	\$ 6.00		
BASIC Tutor Series			\$29.00
Torpedo	\$29.00	MDMS Personal Calendar/Address Book	\$29.00
Address Book	\$ 6.00	Home Control II	\$29.00
	\$ 8.00		
Programmable Calculator	\$12.00	DAC I Music Generation	\$39.00
Savings Account		Baseball I & II, Golf, Bowling, Hockey	\$39.00
Breakout	\$ 6.00	Poker, Black Jack, Spades, Hearts, more	\$29.00
Battleship	\$ 6.00	Tiger Tank, Space Attack, Etch-A-Sketch, more	\$29.00
Bowling	\$ 6.00		
Destroyer	\$ 6.00		
Space War	\$ 6.00		
Star Trek	\$ 6.00		
Tiger Tank	\$12.00		
Disks		Star Wars, Zulu 9, High Noon, more	
When ordering, specify Challenger 1P, 4P or 8P		Monster, Kite, Three Little Pigs, Humpty Dumpty and more (2 Disk Set)	\$29.00
MDMS Education System	\$29.00		

Many, many more software systems are available to you. See our catalog for complete listings.

Accessories

AC-3P 12" B/W monitor, TV	\$ 125
AC-15P 12" Color monitor	\$ 450
AC-16P 2-8 Axis Joysticks with cable	\$ 39
AC-11P Answer/Originate 300 baud modem with cable	\$ 199
AC-17P Home Security Starter Set. 1 fire detector, 2 window alarms, 1 door unit.	\$ 249
AC-18P 8 1/2" aluminized paper printer. Upper/lower case.	\$ 695
AC-9TP Centronics 799 110cps tractor feed, business printer with interface	\$ 1250
AC-12P AC-Remote starter set. Console. 2 lamp modules, 2 appliance modules, OS 65D home control operating system	\$ 175
Disk Drives	
CD 3P Single 5" mini floppy	\$ 499
CD 2P Dual 8" Disk with interface and OS-65D DOS	\$ 1599
Power Supplies	
PS 1. 5-volt @ 3 amps regulated. For use with Superboard II	\$ 29
Boards (Assembled and tested)	
CM 9P. 24K Static.	\$ 399
610. 8K Static. Expandable to 24K and dual mini-floppy controller.	\$ 298
CA-14A. Votrax® voice synthesizer.	\$ 399
CA-15 Universal Telephone Interface, rotary or touch tone	\$ 499
CA-15V UTI with Votrax®	\$ 799
CM-6 48K Dynamic memory board.	\$ 499
4KP. 4K static RAM chip set.	\$ 69
CA12. 96 line parallel I/O	\$ 175
Books:	
How to Program Microcomputers, By William Barden	\$ 8.95
Basic and Personal Computer By Dwyer & Critchfield	\$12.95
Howard Sams C1P Service Manual	\$ 7.95
Howard Sams C4P Service Manual	\$15.95

Freight Policies

All orders of \$100 or more are shipped freight prepaid. Orders of less than \$100 please add \$4.00 to cover shipping costs. Ohio Residents add 5.5% Sales Tax.

Guaranteed Shipment Cleveland Consumer Computers & Components guarantees shipment of computer systems within 48 hours upon receipt of your order. **Our failure to ship within 48 hours entitles you to \$35 of software, FREE.**

Ohio Scientific C4P Series.



The Challenger 4P. A 4-slot computer with one open slot. Highly sophisticated 16 color video interface. 32 rows x 64 columns, upper and lower case. 8K BASIC-in-ROM, 8K RAM. 200-20KHz programmable tone generator. AC remote interface. Expandable to 32K RAM and two mini-floppy drives. **\$750.**

The Challenger 4P MF. Mini-floppy version of the 4P. Two to three times faster than competitors. More I/O built-in than any other in its class. 24K RAM. Real time clock. Modem interface. Printer interface. Foreground/Background operation and much, much more. **\$1795.**

Ohio Scientific 8P Series.



Challenger 8P. Ohio Scientific's mainframe-class. Personal computer. 8 slots with 6 open. Cassette based with 8K BASIC-in-ROM. 8K static RAM, expandable to 32K RAM, and dual 8-inch floppy disk drive. **\$950.**

Challenger 8P DF. A top of the line personal and small business computer. 32K RAM, expandable to 48K. Features dual 8" floppy disk drives. Audio output 200 20KHz. DAC for voice generation. Keypad interfaces. Joystick (2) interfaces. AC Remote. Real Time Clock. Printer & Modem interfaces. And more. **\$2895.**

To Order:

Or to get our free catalog
CALL 1-800-321-5805 TOLL FREE.
Charge your order to your **VISA** or **MASTER CHARGE ACCOUNT**
Ohio Residents Call: (216) 464-8047.
Or write, including your check or money order, to the address listed below.

Hours:
Call Monday thru Friday
8:00 AM to 5:00 PM E.S.T.



**TO ORDER: CALL
1-800-321-5805
TOLL FREE**

**CLEVELAND CONSUMER
COMPUTERS & COMPONENTS**
P.O. Box 46627
Cleveland, Ohio 44146

Z-80
*
\$1250

APPLE GAME PORT REMOTE PLUG-IN EXPANDER with SELECTOR!

Allows continuous connection of any three of the Apple game port options. **\$3995**

80-COLUMN IMPACT PRINTER

LOWEST IN PRICE—HIGHEST IN PERFORMANCE

18 Lines per minute
110/220VAC, 50 or 60 Hz
72, 80, 96, 120 or 132 Characters/Line
Self test Switch
Auxiliary User Defined Character Set
RS-232, 20ma, IEEE 488 and Centronics I/O
18 Bond Paper in 15, 300

599⁰⁰
base2, inc.



8038C
VCO Waveform Gen.
w/sine **\$265**

78H05
\$595

4116
Dynamic
RAM
MEMORY ADD-ON FOR THE
TRS-80 OR APPLE II™
to 450ns
8 for **\$4995**

video 100

12" BLACK & WHITE
LOW COST VIDEO
MONITOR **\$129⁰⁰**



8216 \$199
BUS DRIVER

**LOGIC
PROBE
KIT**

2708
1024X8 EPROM
\$745
450ns AMD, SGS

SOROC
IQ120
\$749⁰⁰

DustCover
for Apple
keyboard \$895
disk \$395

74LS240
74LS241
74LS243
74LS244
74LS373
74LS374
\$245
LIMIT 10 EACH
IN STOCK

2716 16K EPROM
\$27⁹⁵
450ns single+5V
T.I. HIT. INT. SGS

8212
I/O PORT
3.95

RESISTOR NETWORKS
values
14 Pin-7 Res.
OHMS
1.5K & 10K
16 Pin-11 Res.
.89^{EA}
100/49¢

MH0026CJ
DUAL CLOCK
DRIVER **\$100**

74S373
74S374
\$325

**S-100 16K ADD-ON
BARE BOARD**
WITH DOCUMENTATION AND
DETAILED INSTRUCTION BOOK. **\$28⁹⁵**

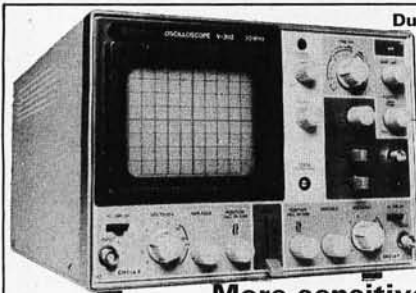
2114L
1024x4 Static RAM
450 ns **\$475**

EPROM ERASER BY SPECTOLINE
UP TO 6 EPROMS IN 19 MINUTES
6000 HOUR BULB LIFE **\$4995**

CONCORD COMPUTER COMPONENTS

1971 SOUTH STATE COLLEGE • ANAHEIM, CA. 92806
VISA-MASTERCARD (714) 937-0637 MINIMUM ORDER-\$10.00
CHECK OR M.O. ADD \$1.50 FOR FRT. CAL. RES. ADD 6%
NO C.O.D. We stock and sell over 12,000 types of semi-conductors

**16K
STATIC
RAM**
S-100 MEMORY ADD-ON
** FULLY STATIC OPERATION
** USES 2114 TYPE STATIC RAMS
** +8 VDC INPUT AT LESS THAN 2 AMPS
** BANK SELECT AVAILABLE BY BANK PORT AND
** BANK BYTE
** PHANTOM LINE CAPABILITY
** ADDRESSABLE IN 4K BLOCKS IN 4K
** INCREMENTS
** LED INDICATORS FOR BOARD/BANK
** SOLDER MASK ON BOTH SIDES OF BOARD
**ASSEMBLED
& TESTED** **\$269⁰⁰**
California Computer Systems



Dual Trace Oscilloscope
HITACHI 30 MHz
• TV sync-separator circuit
• High-sensitivity 1mV/div (5MHz)
• Sweep-time magnifier (10 times)
• Z-axis input (Intensity modulation)
• Signal delay line
• X-Y operation
• Trace Rotation **\$945.00**

More sensitive to your input

**Function
Generator** XR-2206KB
KIT **\$19⁹⁵**

LEDS

.200 in. dia.
XC556R red 5 for \$1
XC556G green 4 for \$1
XC556Y yellow 4 for \$1
.125 in. dia.
ED209R red 5 for \$1
ED209G green 4 for \$1
ED209Y yellow 4 for \$1

Light Emitting Diode
ED95 Red-Orange
and Green
Color mixing
possible due
to separate an-
ode terminals. **ONLY \$1⁶⁰**

Flasher LED
FRL-4403 ONLY
Red LED and
Flasher IC Chip **92¢ ea.**
in One Package

8080A
MICRO- **\$5⁹⁵**
PROCESSOR
EPROM
(5 Volt) **\$29⁹⁰**
2716

ok Vacuum Vise
Vacuum based light duty vise
for precision handling of small
components and assemblies.
Rugged ABS construction. 1 1/2
in. wide jaws, 1 1/2 in. travel for
maximum versatility. Also
features screw lugs for permanent
installation. **VV-1 \$3.49**

SD Systems	KITS
27001	ExpandRAM Kit - Expandable RAM Board Kit (No RAM).....\$220
27002	Versafloppy Flexible Disk Drive Controller Kit.....250
27003	SBC-100 Single Board Computer Kit.....295
27004	280 Starter Kit.....340
27007	ExpandPROM Kit.....175
27010	Add-on RAM (16K Devices) 4116 (250ns) (package of eight devices).....165
27011	VDB-8024 Video Display Board Kit.....370
27012	ExpandRAM II Expandable RAM Board Kit (16K RAM).....460
27013	Versafloppy II Flexible Disk Drive Controller Kit.....350
27014	PROM-100 PROM Programmer Board Kit.....200
27015	MPD-100 280 Central Processing Unit Board Kit.....250
27017	Add-on RAM (16K devices) 4116 (200ns).....250
27018	SBC-200 Single Board Computer Kit.....320
27024	ExpandRAM II Expandable RAM Board Kit (No RAM).....230

SD Systems	ASSEMBLED
38001	ExpandRAM (16K of on-board RAM).....\$ 480
38002	ExpandRAM (32K of on-board RAM).....620
38003	ExpandRAM (48K of on-board RAM).....760
38004	ExpandRAM (64K of on-board RAM).....900
38005	Versafloppy Flexible Disk Drive Controller.....335
38006	SBC-100 Single Board Computer.....350
38007	280 Starter System.....450
38010	ExpandPROM.....245
38011	Cable for 8" Disk Drives.....80
38013	VDB-8024 Video Display Board.....470
38016	Cable, 8ft., 26 Pin Edge Connector (one end).....50
38017	Cable for SD-100/SD-200 Interconnect Texas Instruments 810 Printer.....80
38018	Cable, same as above (Internal).....120
38019	Cable, same as above (External).....80
38020	ExpandRAM II (16K Population).....610
38021	ExpandRAM II (32K Population).....840
38022	ExpandRAM II (48K Population).....1070
38023	ExpandRAM II (64K Population).....1300
38024	Versafloppy II Double Density Flexible Disk Drive Controller.....430
38025	PROM-100 PROM Programmer.....265
38026	MPD-100 280 Microprocessor Board.....325
38028	SBC-200 Single Board Computer.....400

**NEW
HICKOK
LX 304**
**DIGITAL
MULTIMETER**
Compact
Accurate
Dependable
\$89⁹⁵

**Universal Oscilloscope
Probe**
\$36⁰⁰

SWITCHABLE X1 and X10 ATTENUATION FACTOR
KEY ADDITIONAL FEATURES: • 100 MHz bandwidth • Heavy duty tip • Break resistant center conductor • Slender, flexible cable • 6 ft. length • Wide compensation range • Fits all scopes • Ground reference can be activated at tip • Includes SPRUNG HOOK, I.C. TIP, BNC ADAPTOR, INSULATING TIP and TRIMMER TOOL accessories

**★ 15% ★
DISCOUNT
COUPON**
Bring this COUPON into one of our stores or
mail to our Mail Order address shown below and
receive a **15% DISCOUNT**
on purchases from this Ad of \$100.00 or more.
Offer EXPIRES on May 31, 1980
NAME.....
ADDRESS.....
CITY..... STATE.....
ZIP..... PHONE NO.....
Coupons accepted only with full name and address filled in.

ANCRONA			
Send check or Money Order to: P.O. Box 2208Y, Culver City CA 90230. California residents add 6% sales tax. Minimum Order: \$10.00. Add \$1.00 to cover postage and handling. Master Charge and Visa welcomed. Please include your charge card number. Interbank number and expiration date. PHONE ORDERS: (213) 641-4064			
MAIL ORDER P.O. Box 2208Y Culver City, CA 90230 (213) 641-4064	PORTLAND 1125 N.E. 82nd Ave Portland, OR 97220 (503) 254-5541	SANTA ANA 1300 E. Edinger Ave. Santa Ana, CA 92705 (714) 547-4424	CULVER CITY 11080 Jefferson Blvd. Culver City, CA 90230 (213) 390-3595
TUCSON 4518 E. Broadway Tucson, AZ 85711 (602) 881-2348	HOUSTON 2649 Richmond Houston, TX 77098 (713) 529-3489	ATLANTA 3330 Piedmont Rd. N.E. Atlanta, GA 30305 (404) 261-7100	SUNNYVALE 1054 E. El Camino Real Sunnyvale, CA 94087 (408) 243-4121

Radio Hut
201 LOCHWOOD MALL • DALLAS, TEXAS 75218
ORDER BY PHONE—214-324-5509

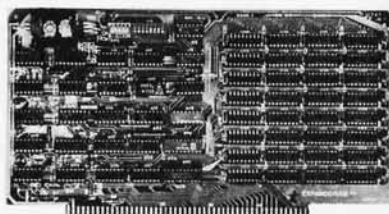
PLEASE WRITE FOR CATALOG
PRICES SUBJECT TO CHANGE
WITHOUT NOTICE

ORDERING INFORMATION & TERMS: Orders under \$15.00 add 75c handling. No C.O.D. We accept Visa, MasterCard, and American Express cards. Tex. Res. add 5% tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items. Add 5% P&H, maximum \$5.00.
ORDER BY PHONE — (214) 324-5509

The EXPANDORAM is available in versions from 16K up to 64K, so for a minimum investment you can have a memory system that will grow with your needs. This is a dynamic memory with the invisible on-board refresh, and IT WORKS!

- Bank Selectable
- Phantom
- Power 8VDC, +16VDC, 5 Watts
- Lowest Cost Per Bit
- Uses Major Brand 16K RAMS
- PC Board is doubled solder masked and has silk-screened parts layout
- Extensive documentation clearly written

SD EXPANDORAM



- Complete kit includes all Sockets for 64K
- Memory access time: 375ns, Cycle time: 500ns.
- No wait states required
- 16K boundaries and Protection, via Dip Switches
- Designed to work with Z-80, 8080, 8085 CPU's

EXPANDORAM 64K Kit (16K Ram)

16K	\$239.95
32K	309.95
48K	379.95
64K	449.95

SD'S PROM 100 PROM Programmer Board

The PROM-100 Programmer is a development tool for S-100 Bus computer systems. The Zero Insertion Force Programming Socket extends above the card cage height for easy access to PROM devices. Software verifies PROM erasure, verifies program loading and provides for reading of object file from Disk or PROM and programming into PROM/EPROM. Features include: On-board generated 25vdc Programming pulse, TTL compatible, maximum programming time for 16,389 bits is 100 seconds. Programs: 2708, Intel 2758, 2716, 2732 and TI 2516. DIP Selectable EPROM type.

PROM-100 Board Kit \$149.95

SD'S SBC-200 SINGLE BOARD COMPUTER Kit \$289.95

S-100 Bus compatible and based on the powerful Z80 microprocessor, the SBC-200 meets the needs of a Z-80 CPU board with many additional features. Ideal for Industrial and control applications. All of the same features that have made the SBC-100 famous, PLUS 4MHz OPERATION. • S-100 Bus Compatible • Z80 Central Processing Unit • 1024 Bytes of Random Access Memory • 8K Bytes of PROM using 2716 • Serial Input/Output Port (with Asynchronous and Synchronous Operation) • Parallel Input and Output Ports • Four Channel Counter/Timer (Z80-CTC) • Software Programmable Baud Rate Generator • No-Front Panel Required for Operation • 4 MHz Operation.

SD'S VERSAFLOPPY II
• IBM 3740 Compatible Soft Sectors Format for Single Density Drives • Operates with Single and Dual Sided Drives, Single or Double Density Drives and 5" & 8" Drives — in any combination of four simultaneously • Drive Select and Side Select Circuitry • S-100 Bus Compatible • Vectored Interrupt Operation Optional • Phase Locked Loop Data Recovery Circuit • Operates with Z80 CPU's • Uses FD1791-1 Controller Chip • The Versafloppy II incorporates all the possible features of a flexible disk drive controller into one board. Capable of handling four drives simultaneously, combinations of any variety are possible, such as 5" single sided, 8" dual density dual sided, 5" dual density single sided. Most popular drives are controlled directly with the Versafloppy II. The operating system for the Versafloppy II is the extremely powerful SDOOS available for SD Systems. Diagnostic and control software available to complete your disk system.
KIT \$335.95



SD'S VDB-8024 VIDEO DISPLAY BOARD

The VDB-8024 features its own on-board Z80 microprocessor. This gives the capability of using software (included in ROM) to control functions and enhancements without interference with the computer's CPU. Included in the special features: 80 characters by 24 lines display, keyboard power and interface, composite and separate video output, 2K on-board RAM, a total of 256 available characters, full cursor control, forward and reverse scrolling, underlining, field reverse, field protect enhancements, programmable characters.
KIT \$329.95 A&T \$389.95

SD'S "VERSAFLOPPY I" KIT

FEATURES: IBM 3740 soft sector compatible, S-100 BNS Compatible for Z-80 or 8080. Controls up to 4 drives (single or double sided). Directly controls the following drives: Sugart SA400/450 Mini Floppy • Shugart SA800/850 Standard Floppy • PERSCI 70 and 277 • MFE 700/750 • CDC 9404/9406

\$189.95



SD'S SBC-100 SINGLE BOARD COMPUTER

The SBC-100 provides a complete micro-computer on a single board! The Z80 microprocessor is used as the heart of the SBC-100. The SBC-100 meets all the requirements of a Z80 CPU board with the added features of I/O ports, counter/timer channels, on board RAM, provisions for PROM/ROM and a software programmable baud rate generator. S-100 Bus compatible, the SBC-100 features are: 8K bytes of available PROM, 1024 bytes on-board RAM, Serial I/O with both synchronous and asynchronous operation, Parallel I/O ports, Operational Vectored Interrupts, and Four Counter/Timer Channels. SD Monitor available for RS-232 and Video Terminals. Disk based system software also available.
SBC-100 KIT \$249.95

TARBELL FLOPPY DISK INTERFACE
Compatible with Z80 & 8080. S-100 Bus. Uses CPM operating system. Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate
KIT \$190.00 Assembled & Tested \$260.00

TARBELL CASSETTE INTERFACE
Plugs directly into your IMSAI or ALTAIR • Fastest transfer rate • Extremely reliable • Phase encoded • 4 extra status & control lines
KIT \$99.95

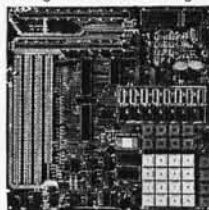
SSM CB2 Z-80 CPU Board Kit \$186.00
Operates at 2 MHz or 4 MHz by DIP switch selection and includes two sockets for 2716 or 2732 EPROMs or TMS 4016 2K RAMs. Jumper options generate the new IEEE S-100 signals.

SSM VB3 80 Character Video Board Kit \$299.95
• 80 char. per line, up to 51 lines • Graphics up to 160 x 204 matrix • Up to 256 user defined symbols (optional EPROM) • Composite video.

PB1 2708/2716 Programmer & 4K/8K EPROM Board Kit \$124.00
• S-100 bus • 2 separate programming sockets for 2708 or 2716 (5V) EPROMs • Programming voltage generated on board — no need for an external power supply • Software control of 2708/2716 programming selection • LED indicator for programming mode and an on-off switch for programming voltage • 4 sockets for 4K of 2708 or 8K of 2716 EPROMs • Unused EPROM sockets do not enable data bus drive so the board is never committed to the full 4K or 8K of memory • Jumper selectable wait states (0-4) for fast or slow EPROMS

Z80 STARTER KIT

Kit: \$279.95 Assembled & Tested \$349.95
SD System's Z80 Starter Kit enables the novice to build a complete microcomputer on a single board. Featuring the powerful Z80 microprocessor, the Z80 Starter Kit features • Keyboard and Display • Audio Interface • PROM Programmer • Expansion and Wire Wrap Area • On Board RAM • 4 Channel Counter/Timer • Z-BUG Monitor in PROM • I/O Ports.



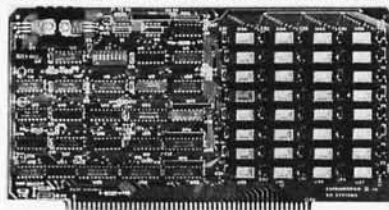
NOVATION CAT ACOUSTIC COUPLER/MODEM \$189.00
Let your computer communicate with other computers. Bell Systems 103 compatible 300 baud, answer or originate.

SYM-1
Reg. \$269.00
NOW \$219.00
• KIM-1 Compatible
• 4K ROM Monitor
• 1K Bytes 2114 RAM
• 65K Memory Expansion
• User EPROM 2716

I04 2 Parallel/2 Serial I/O Board Kit \$126.00
• S-100 bus • 2 serial I/O ports (2 in & 2 out) • Independent baud-rate selection from 55 to 9600 baud • Regulated +5V, +12V & -12V outputs provided on both serial headers • 2 latched parallel I/O ports (2 in & 2 out) • Independent DIP switches for setting address • Interrupt capability provided for on serial and parallel I/O ports • +8V @ 0.95A, +16V @ 0.6A, & -16V @ 80mA typical **SSM**

VB18 VIDEO BOARD KIT \$124.00
• S-100 bus • 64 or 32 characters per line (DIP switch selectable), 16 lines • Graphics 128x48 matrix • Upper case, lower case, Greek characters, symbols and numbers • 7x9 dot character matrix • Black-on-white or white-on-black • Timing 60Hz vertical rate, 16.2KHz horizontal rate, Crystal 12.44MHz • Parallel and composite video output (US TV signals), separate video, horizontal and vertical sync **SSM**

SD'S EXPANDORAM II The Random Access Memory



- S-100 Bus Compatible
- Up to 4Mhz Operation
- Expandable Memory from 16K to 256K
- DIP Switch Selectable Boundaries
- Uses 16K (4116) or 64K (4164) Memory Devices
- Page Mode Operation Allows up to 8 Memory Boards on Bus
- Operates with Z80 CPU's
- Phantom Output Disable
- Invisible Refresh (Synchronized with Wait States)

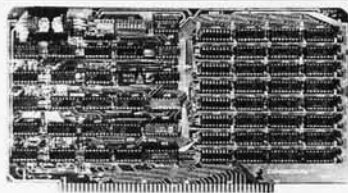
SD Systems' ExpandoRAM II is a dynamic RAM board with capacities from 16K bytes (4116) to 256K bytes (4164). It operates on the industry S-100 Bus. The design allows 8 boards to operate from the same S-100 Bus. The ExpandoRAM II is compatible with most S-100 CPU's based on the Z80 microprocessor.

EXPANDORAM II KIT

16K	\$295.95
32K	369.95
48K	444.95
64K	519.95

JADE. INFLATI FOR THE 80's.

OPENING BOUT



EXPANDORAM

Expandable to 64K Using 4116 RAMS

Interfaces with most popular S-100 boards
Bank selectable; PHANTOM provision
Draws only 5 watts fully populated
Designed to work with Z-80, 8080, and 8085 systems
No wait states required
16K boundaries & protect via dip switches
Kits come with sockets for full 64K
Invisible refresh

MEM-64133K 64 K KIT	\$399.95
MEM-64133A A&T	\$449.95
MEM-48132K 48K KIT	\$334.95
MEM-48132A A&T	\$384.95
MEM-32131K 32K KIT	\$269.95
MEM-32131A 32K A&T	\$319.95
MEM-16130K 16K KIT	\$204.95
MEM-16130A 16K A&T	\$259.95

Sale Price \$475.00

32K STATIC RAM

Expandable 8K/32K, 2/4MHz, KIT/A&T

Switchable 2 or 4 MHz

THE JADE BIG Z

Z-80A CPU with Serial I/O Port

This CPU can accommodate a 2708, 2716, or 2732 EPROM in SHADOW mode, allowing you to use a full 64K of RAM. The MWRITE signal is generated automatically if you use the board without a front panel. There's also an independent on-board USART to control the RS232 serial port at baud rates from 75 to 19,200.

We've sold thousands of these high quality S-100 CPU boards at \$159.95; but now, in a brief fit of financial insanity, we're offering them to you for only \$135.00!

Don't pass this one up!

CPU-30201K (KIT)	\$135.00
CPU-30201A (A&T)	\$199.00
CPU-30200B (BARE BOARD)	\$35.00

S D Systems

EXPANDORAM II

4 MHz RAM Board Expandable to 256K

S-100 bus compatible, up to 4 MHz operation
Expandable memory from 16K to 256K
Dip switch selectable boundaries

Page-mode allows up to 8 boards on the same bus
Invisible refresh; PHANTOM output disable
Designed to operate in Z-80 based systems

MEM-64633K 64K KIT	\$509.95
MEM-64633A 64K A&T	\$559.95
MEM-48632K 48K KIT	\$439.95
MEM-48632A 48K A&T	\$489.95
MEM-32630K 32K KIT	\$359.95
MEM-32630A 32K A&T	\$409.95
MEM-16630K 16K KIT	\$279.95
MEM-16630A 16K A&T	\$329.95

Solid State Music

PB-1

EPROM Programmer for 2708 or 2716

MEM-99510K (KIT)	\$125.00
MEM-99510A (A&T)	\$175.00

JADE DOUBLE-D

Double Density Disk Controller

Read/write single or double density, 8" or 5 1/4" drives
On board Z-80 insures reliable operation
CP/M compatible in either single or double density
Density is software selectable

Up to 4 single or double sided, single or double density drives may be mixed on the same system
EIA level serial printer interface on board-up to 9600 baud (perfect for despooling operations)

All the hard work of disk access is done by the on board Z-80A and 2K memory, leaving your host CPU free for its normal duties

Uses IBM standard formats for proven reliability

THIS BOARD REALLY WORKS!!!!!!

IOD-1200K (DOUBLE-D KIT)	\$285.00
IOD-1200A (DOUBLE-D A&T)	\$349.00
IOD-1200D (MANUAL ONLY)	\$15.00

Terminal Sale

ADDS REGENT

Our Finest Line of Terminals

REGENT 20 \$795.00

24 lines X 80 characters, EIA and 20ma current loop interfaces, 110 to 9600 baud, 96 ASCII codes plus 32 control codes, both upper and lower case, 8 X 8 dot matrix, reverse video, auxiliary EIA serial interface, and addressable cursor.

REGENT 25 \$850.00

All the features of the Regent 20 plus an 18 key numeric and cursor control pad.

REGENT 40 \$1195.00

All the features of the Regent 20 plus a 14 key numeric pad, 8 function keys, 5 cursor control keys, auxiliary port control key, reverse video, underline, blinking, plus full, half, and zero intensities, 8 X 8 dot matrix, 11 special line drawing symbols, reverse scrolling, and send/receive capability using the Regent 40's bi-directional interface.

REGENT 60 \$1495.00

All the features of the Regent 40 plus Print Local, Editing, and Transmission Mode keys, business graphics, bar charts, histograms, and graphics, ability to insert or delete characters or lines, buffered mode reduces software needs, and can transmit data at baud rates other than rate received.

Special Package Price

RS-232 SET-\$6.50

1 Male DB-25, 1 Female DB-25, 1 Cover

JADE DISKETTES

Magnificent Magnetic Media™

5 1/4" single sided, single density, box of 10

MMD-5110103 (SOFT SECTOR)	\$29.95
MMD-5111003 (10 SECTOR)	\$29.95
MMD-5111603 (16 SECTOR)	\$29.95

5 1/4" double sided, double density, box of 10

MMD-5220103 (SOFT SECTOR)	\$39.95
8" single sided, single density, box of 10	
MMD-8110103 (SOFT SECTOR)	\$34.95

8" single sided, double density, box of 10

MMD-8120103 (SOFT SECTOR)	\$55.95
8" double sided, double density, box of 10	
MMD-8220103 (SOFT SECTOR)	\$57.95

S D Systems

VERSAFLOPPY

Versatile Floppy Disk Controller

IBM 3740 soft sector format

S-100 Z-80 or 8080 compatible

Controls up to 4 single or double sided drives

Compatible with all popular disk drives

CP/M compatible

Listings for control software included

IOD-1150K (KIT)	\$239.00
IOD-1150A (A&T)	\$289.00

S D Systems

Z-80 STARTER

Complete Z-80 Microcomputer

On-board keyboard, display, EPROM programmer, cassette interface and S-100 interface

Wire-wrap area and room for 2 S-100 connectors

Two 8-bit parallel I/O ports, 4 channel CTC,

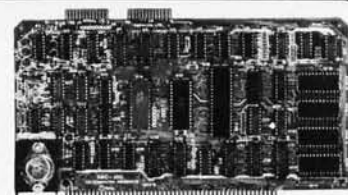
5 programmable breakpoints

Examine & change memory, I/O ports, or register

CPS-30010K (KIT) \$239.95

CPS-30010A (A&T) \$299.95

TITLE MATCH



S D Systems

SBC-100/200

2 or 4 MHz Single Board Computer

S-100 bus compatible Z-80 CPU

1K of on-board RAM

4 EPROM sockets accommodate 2708, 2716, or 2732

One parallel and one serial I/O port

4-channel counter timer chip (Z-80 CTC)

Software programmable serial baud rates

CPC-30100K (2 MHz KIT) \$239.95

CPC-30100A (2 MHz A&T) \$289.95

CPC-30200K (4 MHz KIT) \$259.95

CPC-30200A (4 MHz A&T) \$309.95

Coming Soon

NEW JADE P/S I/O

Parallel Serial Interrupt Board

Z-80 SIO, PIO, 2 CTCs, expands to 2 SIOs, 4 CTCs

4 serial ports (async, sync, bisync, SDLC/HDLC)

2 parallel ports with full handshake

Software baud rate generators, interval timers, counters,

and generates 32 vectored interrupts

Designed especially for MP/M multi-user multi-

tasking operating systems. For use with Z-80 only

IOI-1045B (BARE BOARD) \$55.00

IOI-1045K (KIT) \$169.95

IOI-1045A (A&T) \$224.95

Solid State Music

I/O-4

2 Serial & 2 Parallel I/O Ports

IOI-1010K (KIT) \$149.95

IOI-1010A (A&T) \$199.95

ON FIGHTER ROUND #2.

**KNOCKOUT
PRICES**

CP/M 2.0

Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatibility with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

A powerful operating system for only..... \$150.00

Jade's New Motherboards THE ISO-BUS

6-SLOT

BARE BOARD \$24.95
KIT \$49.95
ASSEMBLED & TESTED \$59.95

12-SLOT

BARE BOARD \$39.95
KIT \$89.95
ASSEMBLED & TESTED \$99.95

18-SLOT

BARE BOARD \$59.95
KIT \$129.95
ASSEMBLED & TESTED \$149.95

Special Price for NOVATION CAT Acoustic Coupler/Modem

\$157.50



Let your computer talk to other computers!
Bell Systems 103 compatible
300 baud, answer or originate
10M-5200A (SALE PRICED) \$157.50

PLACE ORDERS TOLL FREE

Inside California 800-262-1710
Continental U.S. 800-421-5500

Write for our FREE 1980 catalog

For customer service or technical inquiries call
213-973-7707

TERMS OF SALE: Cash, checks, money orders and credit cards accepted. Minimum order \$10.00. California residents add 6% sales tax. Minimum shipping and handling charge \$2.50. Prices are for U.S. and Canadian delivery only and are subject to change without notice. For export prices and information send for a JADE INTERNATIONAL CATALOG.



JADE
COMPUTER PRODUCTS

4901 W. Rosecrans, Hawthorne, CA 90250

COST FIGHTERS

RAMS		6800 SUPPORT	
211.02 (2 MHz)	\$1.25	6821P	\$5.95
211.02 (4 MHz)	\$1.50	6828P	\$11.95
211.4L (2 MHz)	\$5.75	6834P	\$12.95
211.4L (4 MHz)	\$5.95	6840P	\$18.75
4116 (250ns)	\$8.95	6850P	\$4.80
4116 (200ns)	\$9.50	6852P	\$5.79
4127 (70ns)	\$39.95	6875L	\$7.40
4164 (64K x 1)	\$175.00	68488P	\$25.00
5257 (2 MHz)	\$6.75	PROMS	
5257 (4 MHz)	\$7.25	2708 (450ns)	\$8.95
BAUD RATE GENERATORS		2716 (450ns)	\$34.95
MC14411	\$10.00	2716 (5v)	\$34.95
CRYSTAL	\$4.95	2732 (5v)	\$95.00
		2758 (5v)	\$34.95
SUPPORT DEVICES		MICROPROCESSORS	
8212	\$2.50	Z-80	\$10.95
8214	\$4.65	Z-80A	\$12.50
8216	\$2.95	6502	\$11.50
8224	\$3.25	6800	\$11.95
8226	\$3.85	6802	\$17.95
8228	\$4.95	6809	\$39.95
8238	\$4.95	8035	\$24.00
8243	\$8.00	8035-8	\$24.00
8250	\$14.95	8080A	\$6.59
8251	\$6.50	8085	\$15.95
8253	\$13.95	TMS9900JL	\$39.95
8255	\$6.50	UARTS	
8257	\$19.95	AY5-1013A	\$5.25
8259	\$17.95	AY3-1014A	\$8.25
8275	\$49.95	TR1602B	\$5.25
8279	\$8.95	TMS6011	\$5.95
3881	\$12.95	IM6403	\$9.00
3882	\$12.95		
3883	\$45.00		

Special Package Price ROCKWELL AIM-65 The Head-Start in Microcomputers

KIM-I compatible
On-board printer
Full ACSII keyboard
AIM-65 w/1K RAM. \$395.00
AIM-65 w/4K RAM. \$439.95
8K BASIC ROM. \$100.00
POWER SUPPLY. \$59.95
CASE for AIM-65. \$49.95
4K Assembler/Editor. \$85.00



Special Package Price \$599.00
4K AIM-65, 8K BASIC ROM, Power Supply, and Case.

JADE Memory Expansion Kits FOR

TRS-80 APPLE EXIDY

Everything you need to add 16K of memory to your computer. Your kit comes neatly packaged with easy to follow instructions. In just minutes your computer is ready to tackle more advanced software.

\$59.95

Integral Data Systems THE PAPER TIGER 132 Column Dot Matrix Printer

Up to 198 CPS
1.75 to 9.5 inch adjustable tractor.
Parallel and serial interface.
98 character ASCII set.
80 to 132 columns.
6 or 8 lines per inch.
Eight software selectable character sizes.
110, 300, 600, or 1200 baud.



PRM-33440 \$950.00
PRM-33441 (GRAPHICS & 2K BUFFER) \$1050.00

S D Systems

VERSAFLOPPY II Double Density Disk Controller

Single or double density floppy disk controller
985600 bytes on 8" double sided diskettes
259840 bytes on double sided 5 1/4" diskettes
S-100 bus (IEEE) standard compatible
IBM 3740 format in single density
8" and 5 1/4" drives controlled simultaneously
Operates with Z-80, 8080, and 8085 CPU's
Controls up to 4 drives
Vectored interrupt operation optional
100-1160K KIT \$299.95
100-1160A A&T \$349.95

TKO CHAMPS

ATARI 800

Don't Miss Out on Our Special Sale Price

At last there is a machine designed to give serious competition to Apple and Radio Shack. This computer contains many advanced technical features such as: built in RF modulator for use with a standard TV; 8K of internal RAM (expandable to 48K); 8K BASIC language included; extremely sharp high-resolution color graphics; and built-in peripheral I/O ports. Software is available in plug-in paks and cassette tapes, with many programs available in the areas of entertainment, education, and business/home management.

Available accessories include a printer, disk drives, game controller paddles, and memory expansion cartridges.

And JADE has the Atari 800 in stock at a special introductory price.

ATARI 800 \$825.00
810 DISK DRIVE \$575.00
820 PRINTER \$550.00
16K RAM EXPANSION KIT \$169.95
CX30-04 PADDLE CONTROLLER \$19.95
CX40-04 JOYSTICK CONTROLLER \$19.95
ATARI 400 \$599.95

We Think It's Superior SDOS

A New Disk Operating System

SDOS is a disk operating system which will run any program that runs under CP/M*. It is designed specifically for use with the SBC-100/Versafloppy (1 or II) board set by S.D. Systems. SDOS actually has more functions than CP/M, including file attributes, disk label, and read/write logical blocks. It provides additional protection features and is expandable to a multi-user realtime system. And if all that doesn't impress you, SDOS also contains S.D.'s ASSEMBLER/EDITOR/LINKER package and CBASIC 2!

SFX-55001002M (5 1/4" W/MAN) \$150.00
SFX-55001006F (8" W/MAN) \$150.00
SFX-55001000D (MANUAL ONLY) \$ 15.00

*CP/M is a trademark of Digital Research

Textool

ZIP* DIP II SOCKETS



16 PIN ZIP* DIP II \$5.50
24 PIN ZIP* DIP II \$7.50
40 PIN ZIP* DIP II 10.25

* ZERO INSERTION PRESSURE

COMPUTER EQUIPMENT & SOFTWARE BARGAINS



EVERY MONTH

BUY, SELL OR TRADE ALL TYPES OF COMPUTER EQUIPMENT AND SOFTWARE (pre-owned and new) among 20,000 readers nationwide in BIG (11x14") pages. Classified ads are only 10¢ per word and are indexed for easy and fast location. Subscription: \$10 a year/12 issues. Bank cards accepted. Money back guarantee.

COMPUTER SHOPPER

P.O. Box F-14
Titusville, FL 32780
(305) 269-3211

Circle 260 on inquiry card.

DISBURSEMENTS & CASH RECEIPTS JOURNALS

In stock & ready to go to work, ready to ship...no waiting

- Co-authored, debugged and used by a licensed, practicing CPA.
- A copyrighted document balance routine provides for no-fault entries.
- As many as 4 Gen. Ledger postings for each document, can all be different.
- Document types supported by programs: DJ-1001 Cash/Checks/Payroll CJ-2001 Deposits/R.O.A./Credit Memo
- Complete audit trails for analysis.
- Concise, ready-to-use printouts.
- No special training. Programs use live-cueing at every step.
- Fully Documented, with listings, & supplied on 5 1/4" diskette, written in TRS-80 Basic.
- Also available in MOD II format.
- Total support for 1-year from date-of-purchase.

DISBURSEMENTS JOURNAL DJ-1001 \$95.00
CASH RECEIPTS JOURNAL CJ-2001 \$75.00
SPECIAL...BOTH PROGRAMS ONLY \$145.00

Complete software packages, and computer supplies at competitive prices.

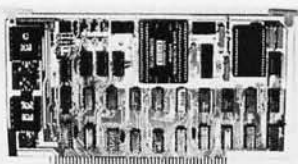
Checks O.K. S & A DATA SYSTEMS
Master Charge/Visa P.O. BOX 39
NO COD'S Craig, CO 81625

NO CHARGE 1-800-854-2003 (ext 804) TOLL
In Calif. 1-800-522-1500 (ext 804) FREE

Circle 263 on inquiry card.

NEW

S-100 A/D



- S-100 Bus Compatible A/D Converter
- 12 Bit Accuracy
- 16 Channel Analog Input
- Programmable Gain Amplifier with Sample-and-Hold
- High Quality Commercial/Industrial Construction

2 and 4 Channel, 12 Bit D/A Boards also available.



CALIFORNIA DATA
CORPORATION

3475 Old Conejo Road, Suite C10
Newbury Park, California 91320
(805) 498-3651

Circle 266 on inquiry card.

MICRO MART

16K UPGRADE KIT FOR TRS-80, APPLE, PET,
SORCERER \$70
Mostek 4215-3 200ns 16K x 1 RAMS

MICROPOLIS 8" HARD DISK DRIVE with
Power, 5-100 controller
9 Megabyte \$3995
27 Megabyte \$4495
45 Megabyte \$4995

TI 994 \$1050.00

DISCOUNTS on EXIDY SORCERER, PET, most
other systems, peripherals, and software.

MICROCOMPUTERS,
PERIPHERALS AND SOFTWARE

1015 NAVARRO SAN ANTONIO, TEXAS 78205
512/272 1427

Circle 261 on inquiry card.

MEMOREX Floppy Discs

Lowest prices. **WE WILL NOT
BE UNDERSOLD!!** Buy any
quantity 1-1000. Visa, Mastercharge
accepted. Call free (800)235-4137
for prices and information. All
orders sent postage paid.



PACIFIC
EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401 (In Cal. call
(805) 543-1037.)

Circle 262 on inquiry card.

DES-MAR ELECTRONICS

2306 Remo Court
Santa Clara, CA. 95054
(408) 496-0692

BRAND NEW (PLUG IN & RUN)
TRS-80 16K LEVEL 2
\$699.00 DELIVERED

TRS-80 TOTAL COMPATIBLE
DISK DRIVES WITH CABLE
(JUST PLUG IN & RUN)
\$399.00 DELIVERED

*CHECKS OR MONEY ORDERS
*PRESENT LEAD TIME: 2 WEEKS
*CA. RESIDENTS 6.5% TAX

T.M. OF TANDY CORP.

Circle 265 on inquiry card.

TRS-80 users

Learn FORTH

FORTH is a structured high level language that
dramatically cuts program development time. You
can expand the FORTH language by defining new
operations and data types. FORTH programs are
compiled to reduce memory space and speed execution.

tinyFORTH is a complete version of the powerful
FORTH language tailored to the TRS-80. The
tinyFORTH system includes FORTH, a text editor,
an assembler, graphics, and cassette I/O.

Learn FORTH on your own computer. The
tinyFORTH user's manual contains hundreds of
examples to teach you FORTH in a hands-on style.

tinyFORTH for 16k level II TRS-80:

Cassette and full documentation \$29.95
Documentation only \$ 9.95

All orders are fully guaranteed. And \$1.50 for
postage and handling. Order with check, money
order, Visa, or Mastercharge.

Write for a FREE booklet describing FORTH.

The Software Farm

Box 2304 Dept. A-21 Reston, VA 22090

Circle 264 on inquiry card.

Power Supplies

5 volts
@ 25 amps
SURPLUS UNITS IN
LIKE NEW CONDITION

INPUT: 115 vac 43-63 Hz
OUTPUT: 5 vac 0.25 amps
REGULATION: 0.1% - 5 mV
NL FL: 0.1% - 5 mV for 10%
input change
SUPPLY: 3mV RMS max., 20 mV
P-P max.
STABILITY: Typically 10 mV for
eight hour period

REMOTE SENSING, REMOTE VOLTAGE ADJUSTMENT
OVERLOAD PROTECTION AND OVERVOLTAGE PROTECTION
ALSO AVAILABLE IN 12 VDC - 13 AMPS \$79.00 per unit

HOUSE MARKED
DARLINGTON TRANSISTOR
SPECIFY 3 AMPS 65 WATTS
MIN. 80 VOLTS
COMPAR TO
TOP SYMBOL
PMP
75¢ each 1000

22/44 EDGEBOARD CONNECTOR
TIN SOLDER TAIL .156" x .200"
LARGE QUANTITIES AVAILABLE
\$1.35 each 10 for \$12.50

1% AMP
FULL
WAVE
BRIDGE
RECTIFIER
400 PIV
2 for \$1.00

REED RELAYS
9-15 VOLT D.C. LATCH
NORMALLY OPENED
CONTACTS:
1 amp max. switch
2 amp max. carry
BODY SIZE:
approx. 1 inch long
1/4 inch high

S.P.S.T. 1500 ohm coil
each \$1.15
D.P.S.T. 1200 ohm coil
each \$1.30
S.P.S.T. 750 ohm coil
each \$1.50

ALL ELECTRONICS CORP.

905 S. Vermont Ave., Los Angeles, Calif. 90006
DEPT. BY-1 (213) 380-8000

STORE & WAREHOUSE HOURS

Mon. - Fri. 9 AM - 5 PM
Saturday 10 AM - 3 PM

TERMS
• Quantities Limited
• Min. Order \$10.00
• Add \$1.50
Shipping USA
• Calif. Res. Add 6%
• Prompt Shipping

SEND FOR OUR FREE CATALOG

Circle 267 on inquiry card.

DISCOUNT PRICES

NORTH STAR
APPLE II
MICROTEK
ANADIX
TREND COM
CENTRONICS
SOROC
INTERTUBE
THINKER TOYS
SOLID STATE MUSIC
& OTHERS
Call for Prices
(301) 694-8884

FREDERICK COMPUTER PRODUCTS

Municipal Airport
Frederick, MD. 21701

Circle 268 on inquiry card.

UP TO 25% OFF

IMMEDIATE DELIVERY: Why wait 5 months for hardware from other suppliers—get it quicker—and at lower prices NOW.



TRS 80 MODEL II \$3899.00

- 64 K RAM ● 1/2 MEG DISK
- FIRST EXPANSION DRIVE 899.00
- SECOND OR THIRD DRIVE 600.00
- LINE PRINTER III Reg. \$1999.00 NOW \$1859.00

TRS 80 MODEL I

	LIST PRICE	OUR PRICE
4 K LEVEL I SYSTEM	\$499.00	\$464.10
4 K LEVEL II SYSTEM	\$619.00	\$575.70
16 K LEVEL II SYSTEM	\$849.00	\$789.60
EXPANSION INTERFACE (O K Memory)	\$299.00	\$278.10
TELEPHONE MODEM	\$199.00	\$185.10

	LIST PRICE	OUR PRICE
CENTRONICS 730	\$995.00	\$695.00
CENTRONICS 737		
● 100 CPS		
● LETTER QUALITY DOT MATRIX	\$950.00	
● TRUE DESCENDERS		
NEC SPINWRITER 5530 (with Tractors)	\$3195.00	\$2950.00

YOUR OWN TRS-80 SYSTEM AT TREMENDOUS SAVINGS

MAY SPECIAL

Good Until May 31, 1980

MINI DISK DRIVES NOW \$350

Over \$135 less than Radio Shack's!

WE ARE COMMITTED TO THE TRS-80 and THE TRS-80 USERS

Fully compatible with Radio Shack's operating system TRSDOS™ and drives. Just plug in and run!

- One, two, three or four drive configurations, 102k to 408k bytes.

- All systems include a patch program to upgrade your TRSDOS™ to 40 tracks.

- Cases are furnished in gray to match your system.

IMMEDIATE DELIVERY: Why wait 5 months for mini disk drives from other suppliers—get better drives—quicker—and at lower prices now!

ORDER NOW TOLL FREE 800-345-8102



ORDER NOW TOLL FREE 1 - (800) - 345-8102

NEW! FOR MODEL II

10-MEG FIXED/REMOVEABLE HARD DISK DRIVE WITH SOFTWARE AND CONTROLLER ONLY \$6495.00

NEW! THE SOURCE

A new information and communication network to add power and utility to your micro.
Call or Write for details.

BUSINESS SOFTWARE

	Model I	Model II
Payroll	\$99.00	199.00
GENERAL LEDGER	149.00	199.00
DATA BASE		
MANAGEMENT SYSTEM	149.00	249.00

VRData

corp. MORE DATA PER DOLLAR

777 Henderson Boulevard N-6 • Folcroft Industrial Park • Folcroft, PA 19032 • (215) 461-5300

FOREIGN and DOMESTIC DISTRIBUTORSHIPS AVAILABLE • TOLL FREE 1 - (800) 345-8102 Orders only!



NOW OPEN
V R DATA'S Computer
Repair Center

BECKIAN ENTERPRISES

ALL PRIME QUALITY — NEW PARTS ONLY
SATISFACTION GUARANTEED.

EDGE CARD CONNECTORS: GOLD PLATED:

Abbreviations: S/E Solder Eye . S/T Sold Tail: W/W Wire Wrap.

PART # DESCRIPTION.	Row Sp.	1-9pc.	10-24pcs.	25pcs. Up.
BRAND: TEXAS INST.				
4070 50/100 Imsai/Crom.	.250	\$3.95ea.	\$3.55ea.	\$3.15ea.
4090 50/100 Imsai W/W	.250	4.30ea.	3.85ea.	3.45ea.
BRAND: SULLINS: U.I. Reg.				
129865 50/100 Solder Eye	.140	6.80ea.	6.10ea.	5.45ea.
129870 50/100 S/T Imsai	.250	4.50ea.	4.10ea.	3.70
129875 50/100 W/W Imsai	.250	5.25	4.75	4.20
129885 50/100 S/T Altair	.140	4.95	4.45	3.95
129990 50/100 S/T Cromem.	.250	4.75	4.25	3.80

OTHER .125" CONTACT CTR CONNECTORS:				
12305 22/44 S/E No Ears	.140	4.15	3.75	3.35
12759 36/72 S/T	.140	5.40	4.85	4.35
12790 40/80 W/W	.250	6.30	5.65	5.00

.100" CONTACT CTR CONNECTORS:				
10048 13/26 S/E No Ears	.140	3.40	3.05	2.15
10280 25/50 S/E TRS 80	.140	4.50	4.05	3.60
10175 20/40 S/E TRS 80	.140	5.85	5.35	4.75
10180 20/40 W/W TRS 80	.200	3.30	3.00	2.15
10190 20/40 S/T TRS 80	.140	3.20	2.90	2.55
10485 36/72 S/E Vector	.140	5.50	4.90	4.40
10490 36/72 W/E Vector	.200	5.80	5.25	4.65
10500 36/72 S/T Vector	.140	5.70	4.20	4.80
10535 40/80 S/E PET	.140	5.85	5.35	4.75
10540 40/80 W/W PET	.200	6.00	5.40	4.80
10550 40/80 S/T PET	.140	5.80	5.25	4.65
10585 43/86 S/E COS/ELF	.140	6.95	6.25	5.55
10605 43/86 S/T COS/ELF	.140	6.60	5.95	5.30
10595 43/86 W/W COS/ELF	.200	6.90	6.20	5.95
10615 43/86 S/T COS/ELF	.200	6.80	6.10	5.40

.156" CONTACT CENTER CONNECTORS.				
PART # DESCRIPTION.	Row Sp.	1-9pc.	10-24pcs.	25pcs. Up.
15105 6/12 S/E PET/NSC	.140	\$1.80	\$1.65	\$1.45
15110 6/12 S/T PET/NSC	.140	1.85	1.65	1.50
15137 6/12 S/T PET/NSC	.200	1.80	1.54	1.45
15175 6/- S/E Sgle Row	.140	1.70	1.50	1.30
15270 10/20 S/E	.140	2.15	1.95	1.70
15275 10/20 S/T	.140	2.00	1.85	1.60
15435 12/24 S/E PET	.140	2.60	2.35	2.10
15440 12/24 S/T PET	.140	2.65	2.40	2.15
15445 12/24 S/T PET	.200	2.75	2.50	2.20
15505 15/30 S/E GRI Key	.140	2.50	2.25	2.00
15510 15/30 S/T GRI Key	.140	2.40	2.15	1.95
15515 15/30 W/W GRI Key	.200	2.60	2.35	2.10
15600 18/36 S/E	.140	3.35	3.05	2.70
15610 18/36 S/T	.140	3.00	2.70	2.40
15615 18/36 W/W	.200	3.60	3.20	2.90
15700 22/44 S/E KIM/VEC	.140	2.98	2.90	2.75
15705 22/44 S/T KIM/VEC	.140	3.98	3.30	3.00
15710 22/44 W/W KIM/VEC	.200	3.49	3.20	2.85
15875 25/50 S/E	.140	4.85	4.20	3.75
15880 25/50 S/T	.140	4.55	4.10	3.65
15885 25/50 W/W	.200	4.85	4.35	3.90
16115 36/72 S/E	.140	6.50	5.85	5.20
16120 36/72 S/T	.140	6.55	5.90	5.25
16125 36/72 W/W	.200	6.75	6.10	5.40
16145 36/72 S/T	.200	6.50	5.85	5.20
16235 43/86 S/T Mot 8800	.140	6.60	5.95	5.30
16240 43/86 W/W Mot 8800	.200	7.80	7.05	6.25
16260 43/86 S/T Mot 8800	.200	6.50	5.85	5.20
16725 43/86 S/T Mot 8800	.140	7.20	6.50	5.75
K-1 Pol-Keys		.15	.12	.10

'D' TYPE SUBMINIATURE CONNECTORS.				
PART NUMBER	DESCRIPTION.	1-9pcs.	10-24pcs.	25-99pcs.
DE 9P	Male	\$1.60ea.	\$1.40ea.	\$1.30ea.
DE 9S	Female	2.25ea.	2.00ea.	1.90ea.
DE 110963-1	2 pc. Gray Hood.	1.50ea.	1.35ea.	1.20ea.
DA 15P	Male	2.35ea.	2.15ea.	2.00ea.
DA 15S	Female	3.25ea.	3.10ea.	2.90ea.
DA 51211-1	1 pc. Gray Hood	1.40ea.	1.20ea.	1.15ea.
DA 51226-1	2 pc. Black Hood	2.50ea.	2.25ea.	2.00ea.
DA 110963-2	2 pc. Gray Hood	1.60ea.	1.35ea.	1.30ea.
DB 25P	Male	2.80ea.	2.60ea.	2.40ea.
DB 25S	Female	3.60ea.	3.40ea.	3.20ea.
DB 51212-1	1 pc. Gray Hood	1.50ea.	1.30ea.	1.10ea.
DB 51226-1	2 pc. Black Hood	1.90ea.	1.65ea.	1.45ea.
DB 110963-3	2 pc. Gray Hood	1.75ea.	1.50ea.	1.35ea.
DC 37P	Male	4.20ea.	4.00ea.	3.70ea.
DC 37S	Female	6.00ea.	5.75ea.	5.50ea.
DC 110963-4	2 pc. Gray Hood	2.25ea.	2.00ea.	1.75ea.
DD 50P	Male	5.50ea.	5.10ea.	4.75ea.
DD 50S	Female	9.40ea.	8.60ea.	8.00ea.
DD 51216-1	1 pc. Gray Hood	2.40ea.	2.20ea.	2.00ea.
DD 110963-5	2 pc. Gray Hood	2.60ea.	2.40ea.	2.10ea.
D 20418-2	Hardware Set (1 Hood Set)	.90ea.	.80ea.	.70ea.

I.C. SOCKETS GOLD. W/WRAP 3 TURN

14 pin	\$0.40 ea.
16 pin	0.44 ea.

8080A PRIME.

\$5.00 ea.

EIA 8 CONDUCTOR CABLES 8ft. Long. CLASS #1 Type Cables.

1 to 4 pcs.	\$22.00
5 to 9 pcs.	19.00

I.C. SOCKETS TIN.

14 pin	\$0.15 ea.
16 pin	0.17 ea.

CONNECTORS FOR CENTRONICS 700 SERIES. Amphenol 57-30360

1 to 4 pcs.	\$8.00 ea.
5 to 9 pcs.	6.00 ea.

COOLING FANS. Extra Quiet.

1 to 4	\$18.00 ea.
5 to 9	17.00 ea.

PHONE: 213-988-6196

MAIL ORDERS TO:

TERMS: MINIMUM ORDER: \$15.00 ADD \$1.35 For Handling & Shipping. Orders over \$30.00 in the U.S.A. We Pay the Shipping. CALIF. RESIDENTS: Please Add 6% Sales Tax.

NOTE: NO C.O.D. OR CREDIT CARD ORDERS WILL BE ACCEPTED.

BECKIAN ENTERPRISES
P.O. BOX #3089
SIMI VALLEY, CA 93063



COMPUTER
SYSTEMS
INC.

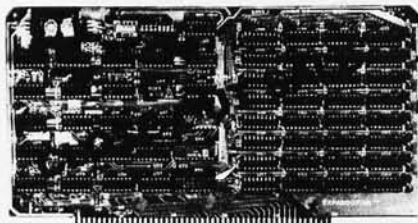
15335 South Hawthorne Boulevard
Lawndale, California 90260
(213) 970-0952

Look to QT for the BIG +

S D SYSTEMS

EXPANDORAM ST

EXPANDABLE TO 64K USING 4116 RAMS



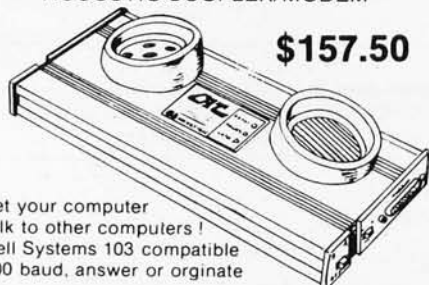
Interfaces with most popular S-100 boards
Bank selectable; PHANTOM provision
Draws only 5 watts fully populated
Designed to work with Z-80, 8080, and 8085 systems
No wait states required
16K boundaries & protect via dip switches
Kits come with sockets for full 64K
Invisible refresh

MEM-16K (16K KIT)	\$239.95
MEM-16AT (16K A&T)	\$289.95
MEM-32K (32K KIT)	\$309.95
MEM-32AT (32K A&T)	\$359.95
MEM-48K (48K KIT)	\$379.95
MEM-48AT (48K A&T)	\$429.95
MEM-64K (64K KIT)	\$449.95
MEM-64AT (64K A&T)	\$499.95

SPECIAL

NOVATION CAT

ACOUSTIC COUPLER/MODEM



\$157.50

Let your computer
talk to other computers!
Bell Systems 103 compatible
300 baud, answer or originate



QT SYSTEMS FURNITURE +

DS4830 48" w X 30" d X 26" h Pecan or white finish avail	\$149.95
DS4830-1 48" w X 30" d X 26" h with Micro-Shelf, Pecan finish	\$224.95
DS4830-2 48" w X 30" d X 26" h with Return, Pecan or white finish avail	\$249.95
DS-810 Printer Stand for TI 810	\$120.00

EPROMS

1702A	\$ 4.95
2708	\$ 6.75
2516	\$24.00
2716 (TI)	\$24.00
2716 (5 VOLT)	\$24.00
2758	\$27.00
2532	\$70.00
2732	\$70.00

NEW DISK OPERATING SYSTEM SDOS

SDOS is a CP/M compatible operating system designed for the S D Sales Versafloppy I or II. It requires the SBC-100/Versafloppy board set and functions as a superset of CP/M giving 19 additional functions including the attributes, disk label and read/write logical blocks. It provides additional protection features and is expandable to a multi-user real time system. **\$200.00**

TI PRINTERS

TI810 PARALLEL	\$1895.00
TI810 SERIAL	\$1695.00



16 PIN ZIP* DIP II	\$5.50
24 PIN ZIP* DIP II	\$7.50
40 PIN ZIP* DIP II	10.25
* ZERO INSERTION PRESSURE	

CP/M 2.0

Digital Research has done it again! This new release of their industry standard disk operating system is bound to be an even bigger hit than the original version. All of the fundamental file-size restrictions of release 1 have been eliminated, while maintaining full compatibility with the earlier versions. This new release can be field-configured by the user for a single mini-disk up through a multiple drive hard-disk system with 128 megabyte capacity. Field configuration can be accomplished easily through use of the Macro Library (DISKDEF) provided with CP/M 2.0.

A powerful operating system for only ... **\$150.00**

5 1/4" DISK DRIVES

MPI B-51	\$295.00
SHUGART SA400	\$295.00
SHUGART 8" 801R	\$495.00
REMEX RFD 4000	\$595.00

HARD DISK

LOBO 10 MEGABYTE For Apple with controller	\$4295.00
LOBO 10 MEGABYTE For S-100 with controller	\$4795.00

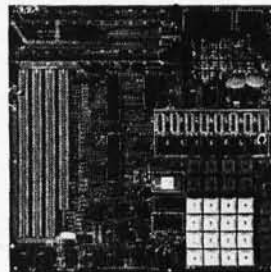
QT DISKETTES

SOFT SECTOR 5 1/4" single sided, single density box of 10	\$29.95
SOFT SECTOR 8" single sided, single density box of 10	\$34.95

S D SYSTEMS

Z-80 STARTER KIT

COMPLETE Z-80 MICROCOMPUTER



On-board keyboard, display, EPROM programmer,
and cassette interface
On-board S-100 interface
Wire-wrap area and room for 2 S-100 connectors
Two 8-bit parallel I/O ports, 4-channel CTC, 5
programmable breakpoints
Examine and change memory, I/O ports, or register
Z-80K (KIT) **\$279.95**
Z-80AT (A&T) **\$349.95**

BEST BUY RATED

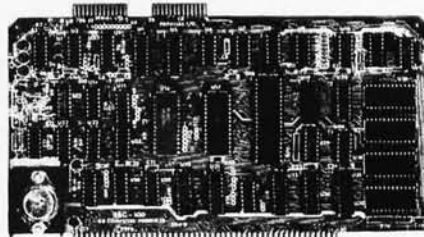
TV-1 ONLY \$7.95

OUR BEST SELLING R.F. MODULATOR

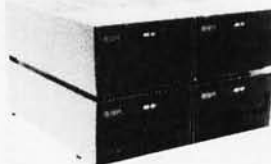
S D SYSTEMS

SBC-100/200

OR 4 MHz SINGLE BOARD COMPUTER



S-100 bus compatible Z-80 CPU
1K of on-board RAM
4 EPROM sockets accommodates 2708, 2716, or 2732
One parallel and one serial I/O port
4-channel counter timer chip (Z-80 CTC)
Software programmable serial baud rates
SBC-100K (2 MHz KIT) **\$249.95**
SBC-100AT (2 MHz A&T) **\$299.95**
SBC-200K (4 MHz KIT) **\$289.95**
SBC-200AT (4 MHz A&T) **\$339.95**



TRS-80 DISK DRIVE (CABLES INCLUDED)

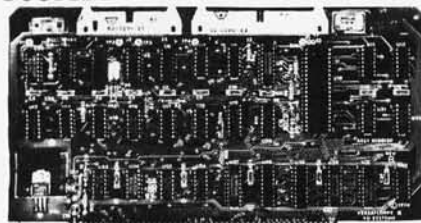
TRS-80 I (5 1/4")	\$395.00
TRS-80 II (8")	\$1095.00
APPLE II	\$1550.00

DISK DRIVE SYSTEMS S-100

MS-800-1 (Drive with cables & power supply)	\$1095.00
MS-800-2 (2 Drives with cables & power supply)	\$1595.00

SD SYSTEMS VERSAFLOPPY II

DOUBLE DENSITY DISK CONTROLLER



Single or double density floppy disk controller
985600 bytes on 8" double sided diskettes
259840 bytes on double sided 5 1/4" diskettes
S-100 bus (IEEE) standard compatible
IBM 3740 format in single density
8" and 5 1/4" drives controlled simultaneously
Operates with Z-80, 8080, and 8085 CPU's
Controls up to 4 drives
Vectored interrupt operation optional
VF-2K (KIT) \$335.95
VF-2AT (A&T) \$385.95

APPLE PRODUCTS APPLE KITS & ASSEMBLED BOARDS

AIO Apple Serial/Parallel Interface Kit	\$115.00
Assembled and Tested	\$155.00
MICRO-MODEM II	\$350.00
WIZARD CONTROLLER for 8" Disk Drive	\$360.00
SORRENTO CONTROLLER for 8" Apple Disk Drive	\$360.00
INTROL X-10 SYSTEM (turns appliances on/off)	\$275.00
MICRO-MUSIC (Software)	\$180.00
AIO/Serial-Parallel Board Kit	\$115.00
AIO/Serial-Parallel Board A&T	\$155.00
INTEGER Firmware Card	\$179.00
PARALLEL INTERFACE CARD	\$90.00
VISICALC (Business Software Package)	\$124.95
SUPER-MOD II (connects Apple to TV)	\$25.00
ROM WRITER (EPROM burner) Mountain Hardware (order)	\$175.00
PROGRAMMER AID #1	\$50.00
APPLE CLOCK	\$280.00
SANYO 15" MONITOR	\$295.00



MODEL 920 TELEVIDEO SMART (CRT) TERMINAL

- Reverse Video
 - Blinking/blank fields
 - Upper/lower case character
 - Protected fields
 - Non-glare screen
 - Underlining
 - 12x10 character res.
 - Function/editing keys
 - Blinking cursor
 - Typewriter/TTY keyboards
 - Numeric pad
 - 9 Baud rates (75-9600 Baud)
 - Self-test
 - Auxiliary port
- SALE PRICE \$895.00
Freight charge \$20.00

QT MEMORY EXPANSION KITS FOR TRS-80 APPLE EXIDY

4116-200 ns

Expansion Kit	\$60.00 ea.
100 pcs	\$5.95 ea.
1,000 pcs	\$5.25 ea.

MICROPROCESSORS

Z80 (2 MHz)	\$10.95
Z80A (4 MHz)	\$12.95
6502	\$11.25
6800	\$12.50
6802	\$19.50
8035	\$20.00
8035-8	\$20.00
8080A	\$ 3.95
8085A	\$20.00
8086-4	\$60.00
8748-8	\$70.00

8080A SUPPORT

8212	\$ 4.50
8214	\$ 4.50
8216	\$ 2.95
8224	\$ 4.00
8238	\$ 6.00
8243	\$ 5.00
8251	\$ 7.00
8253	\$19.00
8255	\$ 6.25
8257	\$17.95
8259	\$19.95
8275	\$69.95
8279	\$17.50
8295	\$16.50

STATIC RAMS

21L02 (450 ns)	64 ea./\$1.20 ea.
	100 ea./\$1.10 ea.
	1,000 ea./\$.95 ea.
2102-1	\$1.35
2114L (450 ns)	\$5.25 ea.
	100 ea./\$4.75 ea.
2114L (300 ns)	\$5.50 ea.
	100 ea./\$4.50 ea.

UARTS

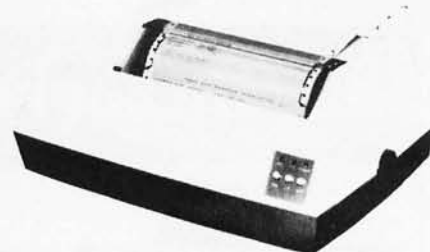
TR1602B	\$ 3.75
---------	---------

BAUD RATE GENERATOR

MC14411P	\$10.00
----------	---------

CHARACTER GENERATORS

2513 (Upper case)	\$10.95
2513 (Lower case)	\$10.95
2513 Upper (5 v)	\$ 9.75
2513 Lower (5 v)	\$10.95
2516 (Sig)	\$13.00
6571	\$13.00
6571AP	\$10.95



MATCHLESS PRINTERS

FEATURES:

- Documentation included
- 132 columns, 63 lines per minute, Bi-Directional, Nominal Thruput
- High Reliability - Heavy Duty Cycle, 100 Million Characters Print Head Life
- Sprocket Feed
- 9x7 Dot Matrix Character Front

SALE PRICE WITH CABLE

FOR TRS-80 I	\$795.00
FOR TRS-80 II	\$795.00
FOR APPLE	**\$849.00
FOR S-100	\$795.00

*Includes parallel interface with documentation.
Add freight \$20.00



PRODUCTS

S-100 BARE BOARDS

CB1A 8080 CPU	\$30.95
VB1B Memory Mapped Video Interface	\$26.95
VB2 I/O Mapped Video Interface	\$29.95
IO2 Parallel I/O Interface	\$34.00
IO4 2P + 2S I/O Interface	\$26.95
SB1 Music Synthesizer	\$39.95
OB1 Vector Jump & Prototyping Board	\$29.95
MB6B 8K Static RAM	\$25.95
MB7 Low Power 16K Static RAM	\$26.95
MB8 4K 1702 EPROM Board	\$29.95
MB8A 16K 2708 EPROM Board	\$34.95
T1 Terminator	\$26.00
MT1 15 Slot Motherboard	\$45.00
XB1 Extender Board	\$13.50



SOFTWARE, FIRMWARE, MANUALS, MISC.

SMM 8080 Monitor (on two 2708s or eight 1702s)	\$50.00
AIO Apple Parallel Interface Firmware	\$25.00
AIO Apple Pascal Patcher Disk	\$25.00
SB1 Music Synthesizer Software	
Paper Tape of MUS-X1 Interpreter	\$ 9.00
CP/M Compatible 8" Disk, containing	
• MUS-X1 Music Interpreter	
• Test Program	
• 18 Encoded Music Selections	\$25.00
SB1 Booklet (with 21 Encoded Music Selections)	\$10.00
Manuals	
SB1 Music Synthesizer Manual	\$10.00
All Other Manuals	\$ 5.00
100 Pin edge connector (short st)	\$ 3.00
100 Pin edge connector (standard ww)	\$ 4.00
Card Guides	\$.15

S-100 KITS & ASSEMBLED BOARDS

CB1A 8080 CPU	
Kit	\$129.95
Assembled & Tested	\$189.95
CB2 Z-80 CPU	
Kit	\$185.95
Assembled & Tested	\$250.00
VB1B Memory Mapped Video Interface	
Kit	\$125.00
Assembled & Tested	\$180.00

VB2 I/O Mapped Video Interface	
Kit	\$150.00
Assembled & Tested	\$195.00
VB3 80 Character Video Interface	
80x24 Display, 2 MHz	
Kit	\$299.95
Assembled & Tested	\$389.95
80x24 Display, 4 MHz	
Kit	\$324.95
Assembled & Tested	\$410.00
Upgrade Kit for 80x51 Display	
2 MHz	\$ 69.00
4 MHz	\$ 89.00
IO2 Parallel I/O Interface	
Kit	\$ 59.00
Assembled & Tested	\$ 89.00
IO4 2P + 2S I/O Interface	
Kit	\$126.00
Assembled & Tested	\$199.95
SB1 Music Synthesizer (4)	
Kit	\$199.00
Assembled & Tested	\$279.00
OB1 Vector Jump & Prototyping Board	
Kit	\$ 55.00
Assembled & Tested	\$ 85.00
MB6B 8K Static RAM	
450 ns RAM	
Kit	\$129.95
Assembled & Tested	\$149.95
250 ns RAM	
Kit	\$159.95
Assembled & Tested	\$224.95
MB7 Low Power 16K Static RAM	
Kit	\$269.96
Assembled & Tested	\$375.00
PB1 2708/2716 EPROM Programmer	
Kit with Textool sockets	\$129.95
Assembled & Tested with Textool sockets	\$175.00
MB3 4K 1702 EPROM Board	
Kit - without EPROMs	\$ 65.00
Assembled & Tested	\$125.00
MB8A 16K 2708 EPROM Board	
Kit - without EPROMs	
Assembled & Tested	
T1 Active Terminator	
Kit	\$ 34.00
Assembled & Tested	\$ 64.00
MT1 15 Slot Motherboard	
Kit (with Connectors)	\$129.95
Assembled & Tested	\$149.95
XB1 Extender Board	
Kit (with Connector)	\$ 19.95
Assembled & Tested	\$ 29.95



COMPUTER
SYSTEMS
INC.

15335 South Hawthorne Boulevard
Lawndale, California 90260
(213) 970-0952

PLACE ORDERS
TOLL FREE
1-800-421-5150
(CONTINENTAL U.S. ONLY)



Buy Direct From CompuMart

COMPUMART NOW OFFERS THE
ENTIRE DEC LSI-11 PRODUCT LINE -
CALL FOR PRICES & DELIVERY.



**Buy Direct from the Largest
Commodore Dealer in the Country
— NCE/CompuMart.**

8K-KeyBoard N	\$795
16K-KeyBoard B	\$995
16K-KeyBoard N	\$995
32K-KeyBoard B	\$1,295
32K-KeyBoard N	\$1,295
B — large keyboard (graphics not on keys)	
N — large keyboard with graphics symbols	

SUPER SAVER. Thanks to Commodore their printer prices have been drastically reduced:

Commodore Printer (tractor feed)	was \$995 NOW \$795
Commodore Printer (friction feed)	was \$849 NOW \$695

NEW FROM EXIDY THE SORCERER II 48K COMPUTER

Z-80 Microprocessor, Full-sized keyboard • ROM PAC Programs • Microsoft BASIC • Powerful Graphics • Serial and Parallel I/O • Dual Cassette I/O Memory Internally Expandable • S-100 Expansion Options.
48K Sorcerer II

\$1,395

CENTRONICS PRINTERS



The 779-2 is a tractor feed printer designed for small business systems. Uses a 5x7 dot matrix to produce all 64 upper case ASCII characters. Centronics is the biggest name in printers and this is their most popular model.
List. \$1,245 **SALE! \$1,079**

The New 730-1 parallel matrix printer is ideally suited for all personal and microcomputer systems. Standard Features include: 100 cps • 80 char./line • 3-way paper handling system • 7x7 dot matrix • 96 character ASCII • List \$995 **SALE! \$839**

To meet our Centronics' quotas we are offering these great specials on their printers!

753-9 9 x 9 Data Processing Printer. List: \$2,995 **SALE! \$2,395**

704-9 9 x 9 180 CPS. List: \$1,995 **SALE! \$1,750**

701-9 9 x 9 Matrix. List: \$1,595 **SALE! \$1,395**

730-3 Serial 730. List: \$895 **SALE! \$745**

Brand New. Centronics Model 737, the first printer in its class capable of offering print quality suitable for text processing, plus the performance & application flexibility required for data processing. Unbelievable quality of type.

737-3 Serial Word Processor Printer \$1,045
737-1 Parallel Word Processor Printer \$995

The Perfect Printer for Small Business Systems

2 Good reasons for buying your PET™ from CompuMart: (1) \$100 IN FREE ACCESSORIES WITH 16K or 32K PET.

When you buy a 16K or 32K PET, apply \$100 toward PET accessories. FREE. Choose from the accessories listed below and indicate on your order that you have reduced the cost of your accessories by \$100.

(2) FREE WITH PURCHASE OF ANY PET (Offer extended until May 15, 1980)

A Texas Instruments' Hex/Octal Calculator (\$60 Value), and a set of 6 PET Workbooks (Worth \$36).

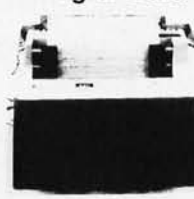
PET Accessories

Commodore Dual Floppy Disk Drive	\$1,295.00
Second Cassette—from Commodore	\$95.00
Commodore PET Service Kit	\$30.00
Beeper—Tells when tape is loaded	\$24.95
Petunia—Play music from PET	\$29.95
Video Buffer—Attach another CRT	\$29.95
Combo—Petunia and Video Buffer	\$49.95
TNW Bi-Dir.RS-232 printer S-face	\$229.00
KIM 1 (A Single Board Computer from Commodore)	\$179.00
PET TO IEEE Cable	\$39.95
IEEE TO IEEE Cable	\$49.95
KIM1 & Power Supply Package Special	\$200.00

Commodore's 3 for 2 is Back! SPECIAL OFFER TO EDUCATORS - GET A FREE PET COMPUTER

For a limited time only, when your school buys any 2 PET's at the regular list (see our PET™ prices listed above), Commodore will include another PET in the deal, absolutely FREE! Call CompuMart TOLL-FREE for complete details.

The Paper Tiger Printer From Integral Data



ROAR!

Standard features include: 4 character 8.3 to 16.5 cpi • 56 cps at 10 char. per in. • Selectable line spacing • 8 switch-selectable form sizes.

The IDS Graphics Option for the Paper Tiger allows full dot pattern control and includes an expanded 2048-byte buffer (a 256-byte buffer is standard).

IDS Paper Tiger Printer

IDS Graphics Paper Tiger Printer \$1,094

SANYO MONITORS

9-inch

reg. \$199

SALE! \$169



15-inch

reg. \$299

SALE! \$269

Perfect for Apple users...
Sanyo Cassette Recorder \$55



We have a complete inventory of Apple computers, peripherals, & software In-Stock for immediate delivery —

\$200 in FREE accessories with the purchase of a 48K Apple II reg. or Apple II plus.

16K Apple reg. or plus — \$1,195 (\$100 in free acces.)
32K Apple reg. or plus — \$1,395 (\$150 in free acces.)
48K Apple reg. or plus — \$1,495 (\$200 in free acces.)

Apple Accessories

PASCAL	\$495
Micromodem	\$379
VisiCalc	\$150
The Controller (Business Package)	SALE! \$550
The Cashier (POS System)	SALE! \$200
Integer BASIC ROM Card	\$200
Centronics Printer Interface	\$225
Disk and Controller	\$595
Parallel Printer Card	\$180
Communications Card	\$225
Hi-Speed Serial Card	\$195
Firmware Card	\$200
NEW! AppleWriter Text Editor	\$75

NOVATION CAT™ ACCOUSTIC MODEM

- Answer Originate • Bell 108
- 300 Baud • Low Profile Design

Looks good, works great! **\$179.00**



ZENITH

**EXCLUSIVE
FROM
COMPUMART!**

COLOR VIDEO MONITOR

Beautiful Display Capabilities. Excellent for use with Apple, Atari, & Sorcerer Computers. This 13-inch monitor is Zenith's first color video display designed specifically for computers. Features include color and degaussing circuits.
Zenith Color Monitor

\$499.00

HAZELTINE TERMINALS AT SPECTACULAR SAVINGS!

Hazeltine 1410-TTY-style keyboard, 8 baud rates from 110 to 9600, 12" screen, 24x80 display, 5x7 dot Matrix Upper Case ASCII character set, 12-key numeric keypad. List Price \$895 **SALE! \$779**
Hazeltine 1500 — 8 baud rates from 110 to 19,200, and ANSI Standard Keyboard. EIA RS-232, All 94 Upper/Lower Case characters in a high resolution 7x10 matrix display. Much more.
List Price \$1,145 **SALE! \$995**

Hazeltine 1520 — Take advantage of this \$310 savings while it lasts! The Hazeltine 1520 is a powerful multi-processor terminal.
List Price \$1,585 **SALE! \$1,275**



THE SINGLE BOARD DEVELOPMENT SYSTEM ROCKWELL AIM 65

6502 Microprocessor • 20-character, alpha-numeric LED display • Full-size 54-key keyboard with 3 user-defined functions • Fast, on-board 20-column thermal printer • 8K Advanced Interactive Monitor program • Dual cassette interface board • On-board timer • On-board ROM expansion to 12K • 4K on-board RAM • On-board TTY interface • 16 parallel I/O lines • One serial I/O port • KIM-compatible edge connectors for even further memory or I/O expansion.

The CompuMart AIM System combines all of our options for the AIM to give you the capabilities of development systems costing 5 to 10 times as much. This system includes a 4K AIM 65 with BASIC and Assembler, an MTU power supply, a Sanyo tape recorder and an EGI Enclosure for the AIM.

CompuMart AIM System	\$785.00
4K AIM-65	\$450.00
Paper for the AIM	\$4.75

CompuMart

**We've Had a Reputation for
Dependability Since 1971.**

DEPT. BY50, 270 THIRD ST., CAMBRIDGE,
MA. 02142

To Order: 1 (800) 343-5504
In Mass: 1 (617) 491-2700



**Member
Computer
Dealers
Assoc.**

10-DAY FREE TRIAL

SEND FOR OUR
FREE CATALOG

Lear Siegler Terminals & Printers at Tremendous Savings

ADM-3A. Industries' favorite dumb terminal for some very smart reasons. 12" diagonal screen • Full or half duplex operation at 11 selectable data rates • 1,920 easy-to-read characters in 24 rows of 80 letters • RS-232C interface extension port • Direct cursor addressing. Reg. Price. \$895

Sale! CALL



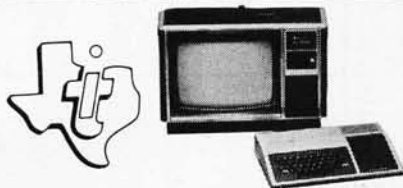
ADM-31. A terminal that's too smart to be considered dumb. Comes complete with keyboard, control logic, character generator, refresh memory & interface • Displays two pages of text instead of one • Field protect mode • Factory installed selected parameters. Reg. Price. \$1,450

Sale! CALL

ADM-42 with Keyboard. Reg. Price. \$1,795 **Sale! CALL**
ADM-42 without keyboard. Reg. Price. \$1,595

Sale! CALL

Model 310 Ballistic Printer (Serial/Parallel)
Reg. Price. \$2,045 **Sale! CALL**



The remarkable TI-99/4 Home Computer. Compare it. Dollar for dollar. Feature for feature.

Superior color, music, sound & graphics - and a powerful extended BASIC - all built in. Plus a unique new Solid State Speech™ Synthesizer and TI's special Solid State Software™.

Comes complete with the Features you want:

- Powerful TI-BASIC
 - Up to 72K total memory capability - 16K RAM, 26K ROM plus up to 30K ROM in TI's Solid State Software Command Modules.
 - 16 - color graphics capability
 - Music & sound effects
 - Built-in equation calculator
 - High quality 13" color monitor
- Call our Sales Dept. for Complete Description & Specs.
- TI-99/4 Home Computer w/Monitor \$1,050.
TI-99/4 Home Computer w/o Monitor \$8.95.
TI User Reference Manual \$9.95.

TI CALCULATORS - Three of the finest from the first.

TI Programmable 59 \$245.00
TI-58C Programmable Calculator (w/continuous memory) \$104.00
TI Programmer \$59.00

Add convenient versatile printing capabilities to your TI Programmable 58C or 59 calculator with the PC-100C thermal printer, plotter.

TI PC-100C 168.00

TI Talking Translator. The translator that actually speaks! \$300.00 Language Modules for the TI Translator \$49.95 Ea. Available in: Spanish, French, English & German.

SPEAK & SPELL™ - TI's remarkable learning aid with electronic voice & brain. \$69.95 Modules for Speak & Spell \$17.95 Ea: Super Stumpers (grades 4-6), Vowel Power (Ages 7 & up), Super Stumpers (Grades 7 & 8)

ADDITIONAL TI-99/4 ACCESSORIES

Speech Editor	\$99.95
Demonstration	\$69.95
Diagnostic	\$29.95
Joysticks	\$29.95
Speech Box	\$149.95
Dual Cassette Cable	\$19.95
Math Dictionary	\$29.95
Beginners Basic	\$9.95
SOLID STATE SOFTWARE COMMAND MODULES	
Entertainment:	
• Football	\$29.95
• Video Chess	\$69.95
• Video Graphs	\$19.95
Home Management/Personal Finance:	
• Home Financial Decisions	\$22.95
• Household Budget Mgt.	\$44.95
Education:	
• Early Learning	\$29.95
• Physical Fitness	\$29.95
• Number Magic	\$19.95
• Beginning Grammar	\$29.95

300 Series Ballistic Printers. This application-oriented matrix printer is built to last. Features include: Ballistic Printing • Positive 180 cps • Bi-directional Printing • A character buffer that is optionally expandable to 2,048 characters • 512 character buffer standard.

We Stock Lear Siegler

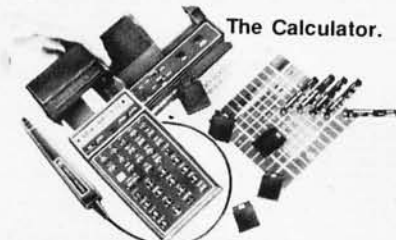
**Accessories —
Call For Details.**

ADM-42. The semi-intelligent terminal that provides you with flexibility of format, security, editing, interface, and transmission. Two-page display standard (Optionally expandable to eight) • Blank, blanking, and reverse fields • Three ways to TAB • 16 Function keys do the work of 32 • Detachable keyboard.

A Calculator, A system, A Whole New Standard.

The finest calculators available for Science, Engineering, & Business.

HEWLETT-PACKARD'S HP-41C



The Calculator.

Features over 130 functions and offers up to 400 lines of program memory or 63 data storage registers — expandable to 319 registers or up to 2,000 lines. RPN Logic. Alpha-numeric capabilities let you communicate with the calculator in English. Customization features allow you to totally reassign the keyboard functions. Continuous memory. HP-41C Calculator \$288.00

The System.

Memory Modules. For storing programs or up to 2,000 lines of program memory. \$45.00
"Extra Smart" Card Reader. Records programs and data back onto blank mag-cards. \$179.00
The Printer. Upper and Lower case. High resolution plotting. Portable. Thermal operation. \$320.00
Application Modules. \$45.00 EACH.
Standard pac, Statistics, Math, Financial, & Surveying.

HP SERIES E CALCULATORS

HP-31E — Scientific, Trigonometric, exponential & math functions. \$49.95
HP-32E — Advanced Scientific with Statistics. All HP-31E functions plus hyperbolic and comprehensive statistics. \$66.95
HP-33E — Programmable Scientific. A programmable science, math and statistical calculator. \$79.95

Also available with continuous memory. \$86.40
HP-37E — Business Management. Best choice for a business/finance calculator. \$69.95

HP-38E — Advanced Financial with Programmability. All the features of the HP-37E plus a lot more power. \$108.00
Also available with continuous memory. \$144.95
THE ALL NEW HP-34C. Advanced Continuous Memory Scientific Programmable with an impressive array of programming features. \$144.95

CompuMart STOCKS THE COMPLETE LINE OF MATROX PRODUCTS. CALL FOR SPECS.

CompuMart

Dept. BY50,
270 Third St.,
Cambridge, Mass.
02142

**TO ORDER CALL:
1-800-343-5504
IN MASS. CALL: (617) 491-2700**

Based on our policy of offering our customers only the finest in micro-computers, CompuMart is pleased to announce that we now carry the new generation of Personal Computers by Atari™.



INTRODUCTORY SPECIALS

To celebrate our commitment to Atari, we are offering the following Atari Specials:

- (1) Buy additional memory for your computer, 8K or 16K, and we will double the amount of memory FREE! (A potential savings of \$200.)
- (2) Buy the Atari 800 Computer and take \$100 off the purchase price of the Atari 810 Disk Drive or the Atari 820 printer.

ATARI® 800™

PERSONAL COMPUTER SYSTEM

- Comes with:**
- Computer Console
 - BASIC Language Cartridge
 - Education System Master Cartridge
 - BASIC Language Programming Manual
 - 800 Operator's Manual
 - ATARI 410 Program Recorder
 - Invitation to Programming™ Cassette
 - 8K RAM Memory Module
 - 10K ROM Operating System

- Power Supply
- TV Switch Box

SPECIFICATIONS:

High resolution color graphics
57 key full stroke keyboard
Built-in RF modulator for channel 2/3 operation with standard TV set
Composite video output for use with monitor
Internal Speaker
Two cartridge slots for rapid program insertion
Four internal slots for expansion up to 48K RAM
6502B Microprocessor
High speed serial I/O port

Atari 800 Computer System \$995.95

ATARI® 820™ PRINTER

High resolution dot matrix impact printer
Uses standard 3/4 inch roll paper and ribbon
40 characters per line
Speed: 40 characters per second
UL approved

Atari 820 Printer \$599.95

ATARI® 810™ PRINTER

Uses standard 5 1/4 inch diskettes
88K bytes storage per diskette
Up to four disk drive units can operate with the system
Average data access time: 236 milliseconds
Power: AC adapter: UL approved

Atari 810 Disk Drive \$699.95

Upgrade your computer with additional memory. (Note that the Atari 800 Computer comes with 8K of RAM memory and will accept up to 48K.)

Atari 8K RAM Memory Module \$124.95
Atari 16K RAM Memory Module \$199.95

IMPORTANT ORDERING INFORMATION

All orders must include 4% shipping and handling. Mass. residents add 5% sales tax. Mich. residents 4% for sales tax.

Phones open from 8:30 a.m. to 5:30 p.m. EST Mon.-Fri. • P.O. accepted from D&B rated companies — shipment contingent upon receipt of signed purchase order • All prices are subject to change without notice • Most items in stock for immediate shipment — call for delivery quotation • In the Ann Arbor area? Our retail store is open 11:00 a.m. to 7:00 p.m. Tues.-Fri. 10:00 a.m. to 5:00 p.m. Saturdays (closed Sun. and Mon.)

**"IF NOT SATISFIED RETURN PURCHASE
WITHIN 10 DAYS FOR A FULL REFUND."**



Cromemco
Incorporated

Z80-4MHz Single Card Computer



Cromemco's Single Card Computer is a complete computer which brings the power of the Z80 and the flexibility of the S-100 bus to the dedicated computer environment.

The card offers 4 Kbit memory, 8 Kbytes of on-board 2716 PROM, and 16 Kbytes of static RAM memory. This card alone can be programmed as 6522 (256K current loop) serial interface with programmable baud rates to 76.8K, 19.2K, 9.6K, 4.8K, 2.4K, 1.2K, 600, and 300 baud rates, and 8 programmable timers. Only a power supply and PROM software are required for operation. The Single Card Computer is available in either ROM (SCC-R) for \$450, The Monitor and Control BASIC are sold in two ROM's (MCC-M216) for \$90.

Processor: 4MHz Z-80
Instruction Set: 150 instructions with 38 instructions of the 8080
ROM Capacity: 8K Bytes (on-board expandable to 16K)
RAM Capacity: 16K Bytes (on-board expandable to 32K)
RAM Type: 2716 PROM on-board
ROM Type: 2716 PROM on-board
RAM Type: 4045, Static

Serial I/O Ports:
1/0 Lines: RS-232 or 250K baud rate
Serial Lines: 1150 or 250K baud rate
Parallel Ports:
Input Port: 24 bit bidirectional
Output Port: 24 bit bidirectional
Status Port: 20 bit I/O
Interrupt Times: 100ns
Number of Lines: 9

Power: 40W
Temperature: 0 to 50°C
Voltage: 5V ± 5%
Current: 1.5A
Power Requirements:
+5V @ 1.5A
+12V @ 100mA
-12V @ 75mA
Operating Environment: 0 to 50°C

SCC-W (Assembled) \$450.00

DISCRETE LEDS

XC556R .200" red 5/51	MV50 .085" red 6/51	XC118R .190" red 5/51	XC119R .190" green 4/51
XC556G .200" green 4/51	XC209R .125" red 5/51	XC119G .190" green 4/51	XC119Y .190" yellow 4/51
XC556Y .200" yellow 4/51	XC209G .125" green 4/51	XC119Y .190" yellow 4/51	XC119C .190" clear 4/51
XC556C .200" clear 4/51	XC209Y .125" yellow 4/51		
XC221R .200" red 5/51	XC209C .125" clear 4/51		
XC221G .200" green 4/51	XC209Y .125" yellow 4/51		
XC221Y .200" yellow 4/51	XC209C .125" clear 4/51		
MV10B .170" red 4/51	XC209C .125" clear 4/51		

DISPLAY LEDS

TYPE	POLARITY	HT	PRICE	TYPE	POLARITY	HT	PRICE
MAN 1	Common Anode-red	270	2.95	MAN 6730	Common Anode-red ± 1	560	.99
MAN 2	5 x 7 Dot Matrix-red	300	4.95	MAN 6740	Common Cathode-red 0-D	560	.99
MAN 3	Common Cathode-red	125	2.50	MAN 6750	Common Cathode-red ± 1	560	.99
MAN 4	Common Cathode-red	187	1.95	MAN 6760	Common Cathode-red	560	.99
MAN 7G	Common Anode-green	300	1.25	MAN 6780	Common Cathode-red	560	.99
MAN 7Y	Common Anode-yellow	300	.99	DL701	Common Anode-red ± 1	300	.99
MAN 74	Common Cathode-red	300	1.25	DL704	Common Cathode-red	300	.99
MAN 82	Common Anode-yellow	300	.49	DL707	Common Anode-red	300	.99
MAN 84	Common Cathode-yellow	300	.99	DL728	Common Cathode-red	500	1.49
MAN 3620	Common Anode-red	400	.99	DL741	Common Anode-red	600	1.25
MAN 3630	Common Anode-orange ± 1	300	.99	DL746	Common Cathode-red ± 1	630	1.49
MAN 3640	Common Cathode-orange	300	.99	DL747	Common Cathode-red ± 1	630	1.49
MAN 4510	Common Anode-orange	300	.99	DL750	Common Cathode-red	600	1.49
MAN 4640	Common Cathode-orange	400	.99	DL758	Common Cathode-red	110	.35
MAN 4710	Common Anode-red	400	.99	FN070	Common Cathode	250	.69
MAN 4730	Common Anode-red ± 1	400	.99	FN058	Common Cathode ± 1	357	.99
MAN 4740	Common Cathode-red	400	.99	FN059	Common Cathode	357	.75
MAN 4810	Common Anode-yellow	400	.99	FN053	Common Cathode (FN0500)	500	.99
MAN 6640	Common Cathode-yellow	400	.99	FN057	Common Cathode (FN0510)	500	.99
MAN 6610	Common Anode-orange-0-D	560	.99	H0527-7330	Common Anode-red	300	.99
MAN 6630	Common Anode-orange ± 1	560	.99	H0527-3403	Common Anode-red	800	1.50
MAN 6640	Common Cathode-orange-0-D	560	.99	H0527-3403	Common Cathode	800	1.50
MAN 6650	Common Cathode-orange ± 1	560	.99	H0527-3403	Common Cathode	800	1.50
MAN 6660	Common Anode-orange	560	.99	S082-7302	4 x 7 Sgl. Digit-LHD	600	19.95
MAN 6670	Common Cathode-orange	560	.99	S082-7302	4 x 7 Sgl. Digit-LHD	600	19.95
MAN 6710	Common Cathode-red-0-D	560	.99	S082-7340	4 x 7 Sgl. Digit-Hexadecimal	600	22.50

RCA LINEAR CALCULATOR CHIPS/DRIVERS

CA3013T 2.15	CA3082N 2.00	MM5725 2.25	MM5309 4.95	MC1408L7 4.95	MOTOROLA
CA2023T 3.25	CA3083N 1.60	MM5738 2.50	MM5311 4.95	MC1408L8 5.75	
CA3032T 2.40	CA3086N .85	DM8864 2.00	MM5312 4.95	MC1439L1 2.95	
CA3037T 1.35	CA3089N 3.75	DM8865 1.00	MM5314 4.95	MC3022P 2.95	
CA3046N 1.30	CA3130T 1.39	DM8867 .75	MM5316 6.95	MC3061 3.50	
CA3059N 3.25	CA3140T 1.25	DM8868 .75	MM5318 9.95	MC4016 (4465) 5.00	
CA3062N 3.25	CA3160T 1.25	DM8869 .75	MM5369 2.95	MC4024P 3.95	
CA3080T 2.00	CA3401N .59	LED driver 1.50	MM5387/1998A 4.95	MC4040P 6.95	
CA3081N 2.00	CA3600N 3.50	LED driver 1.50	CT 7001 6.95	MC4041P 4.50	

LOW PROFILE (TIN) SOCKETS

Pin	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.22	.21	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.44	.44	.43
28 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

Pin	1-24	25-49	50-100
8 pin ST	.27	.25	.24
14 pin ST	.30	.27	.25
16 pin ST	.35	.32	.30
18 pin ST	.45	.42	.40
20 pin ST	.50	.47	.45
22 pin ST	.55	.52	.50
24 pin ST	.60	.57	.55
28 pin ST	.75	.72	.70
36 pin ST	1.10	1.07	1.05
40 pin ST	1.15	1.12	1.10

WIRE WRAP SOCKETS (GOLD) LEVEL #3

Pin	1-24	25-49	50-100
8 pin WW	.59	.54	.49
14 pin WW	.69	.63	.58
16 pin WW	.73	.67	.62
18 pin WW	.85	.77	.70
20 pin WW	.99	.90	.81
22 pin WW	1.19	1.09	.99
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS - 5%

ASST.	5 ea.	10 ea.	15 ea.	20 ea.	25 ea.	30 ea.	35 ea.	40 ea.	45 ea.	50 ea.
ASST. 1	10 OHM	12 OHM	15 OHM	18 OHM	22 OHM	27 OHM	33 OHM	39 OHM	47 OHM	56 OHM
ASST. 2	68 OHM	82 OHM	100 OHM	120 OHM	150 OHM	180 OHM	220 OHM	270 OHM	330 OHM	390 OHM
ASST. 3	470 OHM	560 OHM	680 OHM	820 OHM	1K	1.2K	1.5K	1.8K	2.2K	2.7K
ASST. 4	3.3K	3.9K	4.7K	5.6K	6.8K	8.2K	10K	12K	15K	18K
ASST. 5	22K	27K	33K	39K	47K	56K	68K	82K	100K	120K
ASST. 6	150K	180K	220K	270K	330K	390K	470K	560K	680K	820K
ASST. 7	1M	1.2M	1.5M	1.8M	2.2M	2.7M	3.3M	3.9M	4.7M	5.6M

ASST. 8R Includes Resistor Assortments 1-7 (350 Pcs.) \$9.95 ea.

\$10.00 Min. Order - U.S. Funds Only Spec Sheets - 25¢

Calif. Residents Add 6% Sales Tax 1980 Catalog Available - Send 41¢ stamp

Postage - Add 5¢ plus \$1 Insurance (if desired)

FREE 1980 CATALOG

Jameco ELECTRONICS

MAIL ORDER ELECTRONICS - WORLDWIDE

1355 SHOREWAY ROAD, BELMONT, CA 94002

PRICES SUBJECT TO CHANGE



Cromemco
Incorporated

Z80-4MHz Single Card Computer



Cromemco's Single Card Computer is a complete computer which brings the power of the Z80 and the flexibility of the S-100 bus to the dedicated computer environment.

The card offers 4 Kbit memory, 8 Kbytes of on-board 2716 PROM, and 16 Kbytes of static RAM memory. This card alone can be programmed as 6522 (256K current loop) serial interface with programmable baud rates to 76.8K, 19.2K, 9.6K, 4.8K, 2.4K, 1.2K, 600, and 300 baud rates, and 8 programmable timers. Only a power supply and PROM software are required for operation. The Single Card Computer is available in either ROM (SCC-R) for \$450, The Monitor and Control BASIC are sold in two ROM's (MCC-M216) for \$90.

Processor: 4MHz Z-80
Instruction Set: 150 instructions with 38 instructions of the 8080
ROM Capacity: 8K Bytes (on-board expandable to 16K)
RAM Capacity: 16K Bytes (on-board expandable to 32K)
RAM Type: 2716 PROM on-board
ROM Type: 2716 PROM on-board
RAM Type: 4045, Static

Serial I/O Ports:
1/0 Lines: RS-232 or 250K baud rate
Serial Lines: 1150 or 250K baud rate
Parallel Ports:
Input Port: 24 bit bidirectional
Output Port: 24 bit bidirectional
Status Port: 20 bit I/O
Interrupt Times: 100ns
Number of Lines: 9

Power: 40W
Temperature: 0 to 50°C
Voltage: 5V ± 5%
Current: 1.5A
Power Requirements:
+5V @ 1.5A
+12V @ 100mA
-12V @ 75mA
Operating Environment: 0 to 50°C

SCC-W (Assembled) \$450.00

DISCRETE LEDS

XC556R .200" red 5/51	MV50 .085" red 6/51	XC118R .190" red 5/51	XC119R .190" green 4/51
XC556G .200" green 4/51	XC209R .125" red 5/51	XC119G .190" green 4/51	XC119Y .190" yellow 4/51
XC556Y .200" yellow 4/51	XC209G .125" green 4/51	XC119Y .190" yellow 4/51	XC119C .190" clear 4/51
XC556C .200" clear 4/51	XC209Y .125" yellow 4/51		
XC221R .200" red 5/51	XC209C .125" clear 4/51		
XC221G .200" green 4/51	XC209Y .125" yellow 4/51		
XC221Y .200" yellow 4/51	XC209C .125" clear 4/51		
MV10B .170" red 4/51	XC209C .125" clear 4/51		

DISPLAY LEDS

TYPE	POLARITY	HT	PRICE	TYPE	POLARITY	HT	PRICE
MAN 1	Common Anode-red	270	2.95	MAN 6730	Common Anode-red ± 1	560	.99
MAN 2	5 x 7 Dot Matrix-red	300	4.95	MAN 6740	Common Cathode-red 0-D	560	.99
MAN 3	Common Cathode-red	125	2.50	MAN 6750	Common Cathode-red ± 1	560	.99
MAN 4	Common Cathode-red	187	1.95	MAN 6760	Common Cathode-red	560	.99
MAN 7G	Common Anode-green	300	1.25	MAN 6780	Common Cathode-red	560	.99
MAN 7Y	Common Anode-yellow	300	.99	DL701	Common Anode-red ± 1	300	.99
MAN 74	Common Cathode-red	300	1.25	DL704	Common Cathode-red	300	.99
MAN 82	Common Anode-yellow	300	.49	DL707	Common Anode-red	300	.99
MAN 84	Common Cathode-yellow	300	.99	DL728	Common Cathode-red	500	1.49
MAN 3620	Common Anode-red	400	.99	DL741	Common Anode-red	600	1.25
MAN 3630	Common Anode-orange ± 1	300	.99	DL746	Common Cathode-red ± 1	630	1.49
MAN 3640	Common Cathode-orange	300	.99	DL747	Common Cathode-red ± 1	630	1.49
MAN 4510	Common Anode-orange	300	.99	DL750	Common Cathode-red	600	1.49
MAN 4640	Common Cathode-orange	400	.99	DL758	Common Cathode-red	110	.35
MAN 4710	Common Anode-red	400	.99	FN070	Common Cathode	250	.69
MAN 4730	Common Anode-red ± 1	400	.99	FN058	Common Cathode ± 1	357	.99
MAN 4740	Common Cathode-red	400	.99	FN059	Common Cathode	357	.75
MAN 4810	Common Anode-yellow	400	.99	FN053	Common Cathode (FN0500)	500	.99
MAN 6640	Common Cathode-yellow	400	.99	FN057	Common Cathode (FN0510)	500	.99
MAN 6610	Common Anode-orange-0-D	560	.99	H0527-7330	Common Anode-red	300	.99
MAN 6630	Common Anode-orange ± 1	560	.99	H0527-3403	Common Anode-red	800	1.50
MAN 6640	Common Cathode-orange-0-D	560	.99	H0527-3403	Common Cathode	800	1.50
MAN 6650	Common Cathode-orange ± 1	560	.99	H0527-3403	Common Cathode	800	1.50
MAN 6660	Common Anode-orange	560	.99	S082-7302	4 x 7 Sgl. Digit-LHD	600	19.95
MAN 6670	Common Cathode-orange	560	.99	S082-7302	4 x 7 Sgl. Digit-LHD	600	19.95
MAN 6710	Common Cathode-red-0-D	560	.99	S082-7340	4 x 7 Sgl. Digit-Hexadecimal	600	22.50

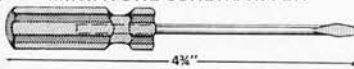
RCA LINEAR CALCULATOR CHIPS/DRIVERS

CA3013T 2.15	CA3082N 2.00	MM5725 2.25	MM5309 4.95	MC1408L7 4.95	MOTOROLA
CA2023T 3.25	CA3083N 1.60	MM5738 2.50	MM5311 4.95	MC1408L8 5.75	
CA3032T 2.40	CA3086N .85	DM8864 2.00	MM5312 4.95	MC1439L1 2.95	
CA3037T 1.35	CA3089N 3.75	DM8865 1.00	MM5314 4.95	MC3022P 2.95	
CA3046N 1.30	CA3130T 1.39	DM8867 .75	MM5316 6.95	MC3061 3.50	
CA3059N 3.25	CA3140T 1.25	DM8868 .75	MM5318 9.95	MC4016 (4465) 5.00	
CA3062N 3.25	CA3160T 1.25	DM8869 .75	MM5369 2.95	MC4024P 3.95	
CA3080T 2.00	CA3401N .59	LED driver 1.50	MM5387/1998A 4.95	MC4040P 6.95	
CA3081N 2.00	CA3600N 3.50	LED driver 1.50	CT 7001 6.95	MC4041P 4.50	

LOW PROFILE (TIN) SOCKETS

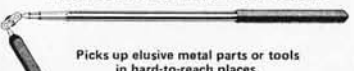
Pin	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.22	.21	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35

MINIATURE SCREWDRIVER



RUGGED CONSTRUCTION
1000% OF USES - 1/8" TIP 2/\$1.00

MAGNETIC RETRIEVER TOOL



Picks up elusive metal parts or tools
in hard-to-reach places.

EXTENDS TO 26" - ROTATES 360°

STRONG, LIFETIME MAGNET

MRT-2281 \$3.95

CSC CONTINENTAL SPECIALTIES

LOGIC PROBE KIT



SPECIFICATIONS

Input Impedance: 300,000 Ohms.

Thresholds: "Lo" 30%Vcc - "Hi" 70%Vcc

Maximum Speed: 300 nsec., 1.5MHz

Input Protection: 350VDC continuous 117VAC

for 15 sec.

Power: 30mA @ 5V - 40mA @ 15V - 25V max.

reverse voltage protected; 36" cable with color

coded clips included.

Operating Temp.: 0-50°C.

Dimensions: 5.8L x 1.0W x 0.7D in.

(147 x 25 x 18mm)

Weight: 30 oz. (85 gm)

LPK-1 \$21.95/Kit



Proto Clips

14-PIN CLIP	PC-14	\$ 4.50
16-PIN CLIP	PC-16	\$ 4.75
24-PIN CLIP	PC-24	\$10.00
40-PIN CLIP	PC-40	\$16.00

Proto Boards

PB-6	\$17.95
PB-100	19.95
PB-101	22.95
PB-102	26.95
PB-103	44.95
PB-104	55.95
PB-204	99.95
PB-203A	155.00
PB-203A-Kit	131.00

Jumbo 6-Digit Clock Kit

- Four .330"ht. and two .300"ht. common anode displays
- Uses MM5314 clock chip
- Switches for hours, minutes and hold functions
- Hours easily viewable to 30 feet
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hour operation
- Includes all components, case and wall transformer
- Size: 6 1/2" x 3 1/4" x 1 1/4"

JE747 \$29.95



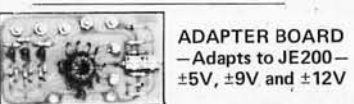
JE701

6-Digit Clock Kit \$19.95

Regulated Power Supply

Uses LM309K. Heat sink provided. PC board construction. Provides a solid 1 amp @ 5 volts. Can supply up to +5V, +9V and +12V with JE205 Adapter. Includes components, hardware and instructions. Size: 3 1/2" x 5" x 2 1/4"

JE200 \$14.95



ADAPTER BOARD
-Adapts to JE200-
±5V, ±9V and ±12V

DC/DC converter with +5V input. Toroidal hi-speed switching XMFR. Short circuit protection. PC board construction. Piggy-back to JE 200 board. Size: 3 1/2" x 2" x 9/16"

JE205 \$12.95

MICROPROCESSOR COMPONENTS

8080A/8085A SUPPORT DEVICES			MICROPROCESSOR MANUALS		
8080A	CPU	\$ 7.95	M-260	User Manual	\$7.50
8212	8-Bit Input/Output	3.25	M-COP1802	User Manual	7.50
8214	Priority Interrupt Control	5.95	M-2650	User Manual	5.00
8216	8-Directional Bus Driver	3.95			
8224	Clock Generator/Driver	3.95			
8226	Bus Driver	3.49			
8228	System Controller/Bus Driver	4.95			
8238	System Controller	5.95			
8251	Prog. Contr. 1/0 (USART)	7.95			
8253	Prog. Interval Timer	14.95			
8255	Prog. Periph. 1/0 (PPI)	9.95			
8257	Prog. DMA Control	19.95			
8259	Prog. Interrupt Control	19.95			
8080/8085 SUPPORT DEVICES			ROM'S		
MC6800	MPU	\$14.95	2513(2140)	Character Generator (upper case)	\$9.95
MC6802CP	MPU with Clock and Ram	24.95	2513(3021)	Character Generator (lower case)	9.95
MC6810APl	128K Static Ram	5.95	2515	Character Generator	10.95
MC6821	Periph. Inter. Adapt (MC6820)	7.49	MM5230N	2048-Bit Read Only Memory	1.95
MC6828	Priority Interrupt Controller	12.95			
MC6830L8	1024X8 Bit ROM (MC6830-8)	14.95			
MC6850	Asynchronous Comm. Adapter	7.95			
MC6852	Synchronous Serial Data Adapt.	9.95			
MC6860	0-600 bps Digital MODEM	12.95			
MC6862	2400 bps Modulator	14.95			
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25			
MICROPROCESSOR CHIPS - MISCELLANEOUS			RAM'S		
2801780C1	CPU	\$13.95	1101	256X1 Static	\$1.49
CDP1802	MPU	15.95	1103	1024X1 Dynamic	.99
2650	MPU	19.95	2101(8101)	256X4 Static	3.95
6502	CPU	19.95	2102	1024X1 Static	1.75
8035	8-Bit MPU w/clock, RAM, 1/0 lines	19.95	2111(8111)	256X4 Static	3.95
P8085	CPU	19.95	2112	256X4 Static MOS	4.95
TM5990JUL	16-Bit MPU w/hardware, multiply & shift	49.95	2114	1024X4 Static 450ns	7.95
			2114-1	1024X4 Static 450ns low power	10.95
			2114-3	1024X4 Static 300ns	10.95
			2114-3	1024X4 Static 300ns low power	11.95
			5101	256X4 Static	7.95
			5280-2107	4096X1 Dynamic	4.95
			7489	16X4 Static	1.75
			745200	256X1 Static Tristate	4.95
			93421	256X1 Static	2.95
			UPD414	4K Dynamic 16 pin	4.95
			UPD416	16K Dynamic 16 pin 250ns	9.95
			(MK4116)	4K Static	14.95
			TM5454-4	4K Static	14.95
			45N1	1024X4 Static	14.95
			TM54045	1024X4 Static	14.95
			2117	16,384X1 Dynamic	41.00
			MM5262	2KX1 Dynamic	39.95
SHIFT REGISTERS			PROM'S		
MM500H	Dual 25 Bit Dynamic	5.50	1702A	2048 FAMOS	\$5.95
MM503H	Dual 50 Bit Dynamic	.50	2718TETL	16K EPROM	59.95
MM504H	Dual 15 Bit Static	.50	TM5216	16K EPROM	39.95
MM506H	Dual 100 Bit Static	.50	(2715)	*Requires single +5V power supply	
MM510H	Dual 64 Bit Accumulator	.50	TM5232	4096 EPROM	89.95
MM5016H	500:512 Bit Dynamic	.89	2708	8K EPROM	10.95
2504T	1024 Dynamic	3.95	2716 T.J	16K EPROM	29.95
2518	Hex 32 Bit Static	4.95			
2522	Dual 132 Bit Static	2.95			
912	Static	.99			
2525	1024 Dynamic	2.95			
2527	Dual 256 Bit Static	2.95			
2528	Dual 250 Static	4.00			
2529	Dual 240 Bit Static	4.00			
2532	Quad 80 Bit Static	2.95			
3341	Fifo	6.95			
74LS670	4Kx4 Register File (TTL static)	2.49			
			82S123	32X8 Bipolar	3.95
			74186	512 TTL Open Collector	3.95
			74188	256 TTL Open Collector	3.95
			74S287	1024 Static	2.95
UART'S					
A-Y-5-1013	30K BAUD	5.95			

JE600 HEXADECIMAL ENCODER KIT



FEATURES:

- Full 8 bit latched output for micro-processor use
- 3 User Define keys with one being bi-stable operation
- Debounce circuit provided for all 19 keys
- LED readout to verify entries
- Easy interfacing with standard 16 pin IC connector
- Only +5VDC required for operation

FULL 8 BIT LATCHED OUTPUT - 19 KEYBOARD

The JE600 Encoder Keyboard provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8 bit microprocessor or 8 bit memory circuits. Three (3) additional keys are provided for user operations with one having a bi-stable output available. The outputs are latched and monitored with LED readouts. Also included is a key entry strobe.

JE600 \$59.95

Hexadecimal Keypad only \$14.95

DIGITAL THERMOMETER KIT



- Dual sensors-switching control for indoor/outdoor or dual monitoring
- Continuous LED, 8" ht. display
- Range: -40°F to 199°F / -40°C to 100°C
- Accuracy: ±1° nominal
- Set for Fahrenheit or Celsius reading
- Sim. walnut case, A/C wall adapter incl.
- Size: 3-1/4" H x 6-5/8" W x 1-3/8" D

JE300 \$39.95

62-Key ASCII Encoded Keyboard Kit



FEATURES:

- 60 Keys generate the full 128 characters, upper and lower case ASCII set
- Fully buffered
- 2 user-definable keys provided for custom applications
- Caps lock for upper case only alpha characters
- Utilizes a 2376 (40 pin) encoder read only memory chip
- Outputs directly compatible with TTL/DTL or MOS logic arrays
- Easy interfacing with a 16-pin dip or 18-pin edge connector

The JE610 62-Key ASCII Encoded Keyboard Kit can be interfaced into most any computer system. The JE610 kit comes complete with an industrial grade keyboard switch assembly (62 keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and -12V @ 10mA for operation.

JE610 \$79.95

62-Key Keyboard only . . \$34.95

HICKOK LX303 Portable LCD Digital Multimeter



- Big 3 1/2 inch High, 3 1/2 Digit Liquid Crystal Display
- Over 200 Hours of operation with a 9V battery
- Automatic zero, polarity and overrange indication
- 100mV DC F.S. sensitivity
- 1% basic accuracy
- 10 ranges and functions
- Rugged Cyclotron cast and removable cover, stores test lead set
- Full one year warranty

PART NO.	DESCRIPTION	PRICE
INC-3	110V AC ADAPTER	7.50
CC-3	PADDED CARRYING CASE	7.50
VP-10	X10 DC PROBE ADAPTER (Up to 10K)	14.95
VP-40	400V DC PROBE	25.00
CS-1	10 Amp DC Current Shunt	14.95

\$10.00 Min. Order - U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage - Add 5% plus \$1 Insurance (if desired)

FREE 1980 CATALOG

Jameco ELECTRONICS

MAIL ORDER ELECTRONICS - WORLDWIDE

1355 SHOREWAY ROAD, BELMONT, CA 94002

PRICES SUBJECT TO CHANGE

PHONE ORDERS WELCOME
(415) 592-8097

The Incredible "Pennywhistle 103"



\$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and is able to communicate directly with another modern and terminal for telephone "hacking" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method Frequency-Shift Keying, full-duplex (half-duplex selectable) 300 Baud.

Maximum Data Rate Asynchronous Serial (return to mark level required between each character)

Receive Channel Frequencies 2025 Hz for space; 2225 Hz for marks.

Transmit Channel Frequencies Switch selectable: Low (normal) - 1070 space, 1270 mark; High - 025 space, 225 mark.

Receive Sensitivity -46 dbm acoustically coupled.

Transmit Level 15 dbm nominal. Adjustable from -6 dbm to -20 dbm.

Digital Data Interface EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).

Power Requirements 120 VAC, single phase, 10 Watts.

Physical All components mount on a single 5" by 9" printed circuit board. All components included.

Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
• 8 each UPD416-1 (16K Dynamic Rams) 250NS
• Documentation for conversion

TRS-16K \$75.00

JUST WRAP™

- 30 AWG wire
- .025" square posts
- Built-in cut off
- Includes 50 ft. wire
- No stripping or slitting required - just wrap

Part No.	Color	Price
JW-1-B	Blue	\$14.95
JW-1-W	White	14.95
JW-1-Y	Yellow	14.95
JW-1-R	Red	14.95

JUST WRAP™ Replacement Wire

Part No.	Color	Price
R-JW-B	Blue	50 ft. roll \$2.98
R-JW-W	White	50 ft. roll 2.98
R-JW-Y	Yellow	50 ft. roll 2.98
R-JW-R	Red	50 ft. roll 2.98

JUST WRAP™ Unwrap Tool \$3.49

Vacuum Vise

Vacuum-based light-duty vise for small components and assemblies. ABS construction. 1 1/2" jaws, 1 1/2" travel. Can be permanently installed.

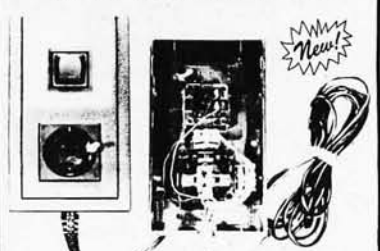
VV-1 \$3.49

ADJUSTABLE WRENCH

- Two Sizes: 6" and 10"
- Professional Quality
- Chrome Vanadium Steel

6" - AW-6 . . \$4.95 10" - AW-10 . . \$6.95

JOYSTICK VIDEO CONTROLLER



- IDEAL FOR ALL VIDEO GAMES OR REMOTE CONTROL PROJECTS
 - SMALL CASE SIZE: 1-1/2"H x 2-3/8"W x 4-5/16"L
 - 2 MINIATURE POTENTIOMETERS - 40K OHM EACH
 - SPST PUSH BUTTON CONTROL
 - 5-WIRE CONNECTION CABLE - 5 FEET LONG
 - RUGGED PLASTIC CASE
- JVC-40 \$4.95 each**

Word Processing for UCSD Pascal

PROFF formats and prints out text files. FORML interacts with PROFF to produce multiple copies of a form letter, each with a different addressee. Features include:

- multi file input
- interactive debug
- adjustable margins
- filling, centering
- underscoring

Each program is written in UCSD Pascal and is distributed on floppy disk. User manuals are included or can be purchased separately. Volume discounts are available.

(714) 452-0681

Renaissance Systems Inc.
11760 Sorrento Valley Rd.
San Diego, Ca. 92121

Circle 275 on inquiry card.

16 K RAMS & RAM CONTROLLERS

- 16 K X 1 DYNAMIC RAMS MK4110P3
- 200 NSEC ACCESS/375 NSEC CYCLE TIMES
- 16 PIN TTL COMPATIBLE
- ALL CHIPS BURNED IN AND FULLY TESTED
- PRICE WITH DATA SHEET \$68.00 IN QTY OF 8/THAT'S \$8.50 EACH

6800/6502 64K BYTE RAM & CONTROLLER SET
MAKE 64K BYTE MEMORY FOR YOUR 6800 OR 6502
THIS SET INCLUDES:
• 32 MSK 4116-3, 16K X 1, 200 NSEC RAMS
• 1 MC3480 MEMORY CONTROLLER
• 1 MC3242A MEMORY ADDRESS MULTIPLEXER AND COUNTER
• DATA & APPLICATION SHEETS. PARTS TESTED AND GUARANTEED.
\$295.00 PER SET

DYNAMIC MEMORY CONTROLLER MC3480L
• GENERATES RAS/CAS & REFRESH TIMING FOR 16K TO 64K BYTE MEMORIES
• PRICE WITH DATA SHEET: \$13.95 EACH

MEMORY ADDRESS MUX/COUNTER MC3242AP
• MUX ADDRESS & REFRESH COUNTER FOR 16K TO 64K BYTE MEMORIES
• PRICE WITH DATA SHEET: \$12.50 EACH

QUANTITY DISCOUNTS AVAILABLE
ALL ORDERS POSTPAID U.S. FUNDS OR INTERNATIONAL
ORDERS CHECK OR MONEY ORDER VISA/MC ALSO AC
CREDIT SEND ACC. NO. EXPIRATION DATE & RETURN
NO WITH SIGNED ORDER. CALIF. RESIDENTS PLEASE ADD
6% SALES TAX PHONE ORDERS (714) 633-4460

MEASUREMENT SYSTEMS & CONTROLS, INC.
MEMORY DEVICES DIVISION
867 NORTH MAIN ST. ORANGE, CA 92668

MYCHESS

- Highest scoring microcomputer chess program at the 1979 ACM North America Computer Chess Championship.
- Available for CP/M, CDOS, IMDOS, TRS-80, hard-sectored North Star with CP/M
- Program allows 9 levels of play
- Searches on the opponent's time
- Program enables you to save game for later play
- Optional formatted hard copy of game
- Allows computer to play itself

\$50.00

Contact:

COMPUTER SERVICES

2431 Lyvona Lane
Anchorage, AK 99502
(907) 243-8730

Circle 279 on inquiry card.

DISK DRIVE/CRT

★SALE★

Shugart
SA801R
for
RS MOD. II
ONLY

\$489



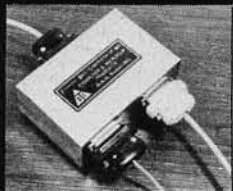
Hozeltine 1000 (unused) \$ 599
Shugart SA400 282
Pertec FD200 \$282 — FD250 399
MPI B51 \$279 — B52 399
SA801R w/PS/Cab 799
Dual Drives w/PS/Cab 1645

LIMITED QUANTITIES

MTI 3304 W. MacArthur Blvd.
Santa Ana, CA 92704
(714) 979-9923

Circle 277 on inquiry card.

TERMINAL DATA CORPORATION



MODEL 1200 RS-232 DATA SPLITTER available in kit form

Model 1200K gives the terminal or microprocessor user a second interface for a printer, plotter, cassette or tape drive. It operates at any speed & isolates the two output devices from each other, while providing 2 RS-232 interfaces from the terminal or microprocessor.

The kit consists of 3 RS-232 connectors, printed circuit board, all necessary components, enclosure, mounting hardware & assembly instructions \$64.00

write or call

TERMINAL DATA CORP.
11878 Coakley Cir.
Rockville, MD 20852
(301) 881-7655

Circle 278 on inquiry card.

Floppys & Systems Repair

DRIVES

- Per Sci - Shugart
- Pertec - Micropolis

COMPUTERS

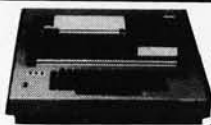
- Apple - TRS-80

Computer Service Center
1023 N. La Brea
Hollywood, CA 90038
(213) 851-2226

Circle 280 on inquiry card.

SURPLUS ELECTRONICS

ASCII



ASCII

IBM SELECTRIC BASED I/O TERMINAL WITH ASCII CONVERSION INSTALLED \$645.00

- Tape Drives • Cable
 - Cassette Drives • Wire
 - Power Supplies 12V15A, 12V25A, 5V35A Others, • Displays
 - Cabinets • XFMRs • Heat Sinks • Printers • Components
- Many other items, SEND \$1.00 FOR CATALOG
REFUNDABLE FIRST ORDER
WORLDWIDE ELECT, INC.
130 Northeastern Blvd.
Nashua, NH 03060
Phone orders accepted using
VISA or MC
Call 603-889-7661

Circle 281 on inquiry card.

MAGIC WAND™ Word Processing System

\$400

**Starbust Computer
Group, Inc.**
Route 2 Box 183
Afton Virginia 22920
(Authorized Dealer)

Magic Wand works on any CP/M® system with all major CRT's. Ask for our free point-by-point comparison of Magic Wand and two popular word processing systems.

Magic Wand is a Trademark of Small Business Applications Inc.

"CP/M is a registered Trademark of Digital Research"

(804) 361-1180

Circle 282 on inquiry card.

H9 OWNERS!

Upgrade your video terminal with one of these long overdue kits:

GRAFIX — Graphical display capabilities assembled and tested \$69.95. Kit \$59.95.

CURSOR CONTROL — A total of 8 functions assembled and tested \$34.95. Kit \$29.95.

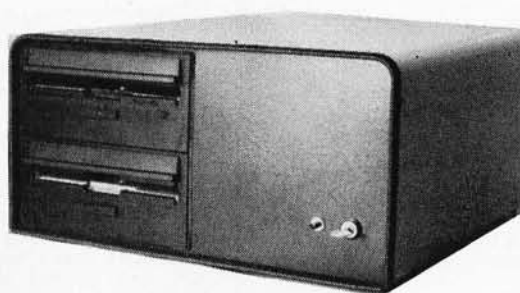
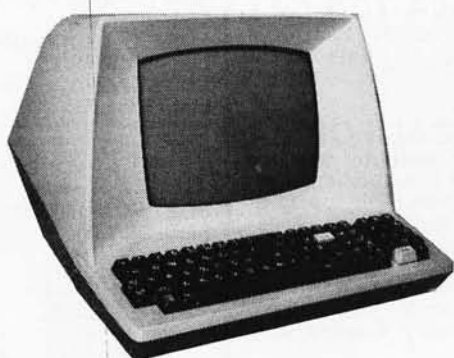
FLICKER FREE — 4800 baud operation assembled and tested \$79.95. Kit \$69.95.

All have a full 6 month warranty.

**NORTHWEST COMPUTER
SERVICES, INC.**

8503 N.E. 30th Avenue
Vancouver, WA 98665

Circle 283 on inquiry card.



(Printer not pictured)

- A complete computer package, easy to install, easy to maintain
- Practical to operate; designed for the businessman/woman (even for non-computer specialists)
- Upwards expandable (built-in flexibility & updating)
 - Desk-top (rack mount available)
 - Can use many available software packages
 - Expandable for multi-user functions

Specifications:

- Z-80 CPU (4 MHz) with 2 SIO + 3 PIO
- S-100 Compatible
- Two 8" Floppy Disk Drives
- Single/Double Density Disk Controller
- 80 x 24 Terminal with editing capabilities plus second page memory
- 132 Column DOT Matrix printer
- Compiler Business Basic [C Basic 2 — version 2.04]
- Powerful OS-1 Operating System (uses any CP/M or Cromenco program)
- All necessary cabling and documentation
- Osborne software package: general ledger, accounts payable/receivable and payroll

PRAGMATIX — 100™

Assembled and Tested

Options:

- Double sided Disk Drives
- Structured Systems Software
- 220 V/50 Hz available
- Dealer Inquiries Invited
- Quantity pricing available
- Call for exact p&d on options
- Terminal with special function and line insert/delete keys
- 8 channel SIO with real time clock and interrupt control
- Autotype — powerful word processor
- Qume S/5 45 RO Printer with Tractor Feed
- 10 & 20 MBY Removable Hard Disk, DMA Controller & Custom Cabinetry available
- CP/M is a registered trademark of Digital Research

In California: 415-321-5601
Outside Ca.: 800-227-8266

Electrolabs
POB 6721, Stanford, Ca. 94305

Circle 284 on Inquiry card.

Worldwide:
TLX: 345567 Electrolabs PLA

PRIORITY ONE ELECTRONICS

LOBO 8" DISK DRIVE CABINET



New from Lobo, a dual Cabinet with power supply, and internal data cable hook-up.

- Cabinet accepts 2 801R, 800R, FD120, or FD200 style disk drives.
- Power Supply for 2 drives.
- Assembled, tested and guaranteed by Lobo Drives.
- Shipping Weight 30 lbs.

LBO - DUAL 8 PCS.....\$329.00

BUY CABINET AND DRIVES AND SAVE

WITH 1 DRIVE WITH 2 DRIVES
LBO-801R-1PSC \$775.00 LBO-801R-2PSC \$1250.00

DISC DRIVE ONLY

SHU-801R.....\$499.00

EXTERNAL DATA CABLES

CARDEDGE TO CARDEDGE CARDEDGE TO SOCKET
PRI-50CE-CE \$19.95 PRI-50CE-SKT \$19.95

1c SALE

Box of 10 Diskettes with the Purchase of a V-80 System



The VISTA V-80 Disk Drive System

- 23% more storage capacity than TRS-80 • 120 day warranty • 40 track patch at NO CHARGE from VISTA
- Single drive system.....\$395.00
- Two drive system.....\$770.00
- Four drive system.....\$1450.00
- Two drive cable.....\$29.95
- Four drive cable.....\$39.95

Two Drive Systems comes Complete with Data Cable

NEW MS-230 DUAL TRACE MINISCOPE 30 MHz BANDWIDTH



- 1 NLS MS-230 30 MHz Scope... \$598.15
- 2 NLS 41-141 10 to 1 Combo Probe \$54.00
- 1 NLS 41-180 Deluxe Leather Case \$45.00

LIST PRICE.....\$697.15
MS 230 COMBO PRICE.....\$547.15
SAVE \$150.00

MEMORY MEMORY

- 2102LIPC Low Power 450ns in lots of 20.....\$1.10
- 2102AL-2 Low Power 250ns in lots of 20.....\$1.25
- 2114-3L 1Kx4 300ns Low Power.....8/\$50.00
- 5257-3L 4Kx1 300ns Low Power.....8/\$55.00
- 2708 8K 450ns EPROM8/\$60.00-\$8.50 ea.
- 2716 16K 5 Volt only EPROM 8/\$248.00.....\$32.00 ea.



ORDER TOLL FREE
1-800-423-5633
except CA, AK, HI, CALL
(213) 894-8171



CENTRONICS

730 - 1 Dot Matrix Printer
List - \$995.00... Sale - \$795.00
SAVE \$200.00



NOVATION CAT ACOUSTIC COUPLER/MODEM

List - \$199.00... Sale \$156.00



CALIFORNIA

- S-100 compatible • Industrial/commercial quality construction • Flip-top cover • Excellent cooling capability • 12 slot capability (uses model 2501A) • Input 105, 115, or 125 VAC • Output + 8 VDC20A, + -16 VDC 4A • Active termination of all bus lines • Fan and circuit breaker included • Rugged construction
- CCS-2200A Assembled & Tested 35 lbs.....\$399.95
- CCS-2200AK Kit 35 lbs.....\$349.95



CCS-M-XVI-M

The true 16K Static Ram module for S-100 bus systems. ASSEMBLED & TESTED -100% BURN IN - FEATURES: • Fully static • Uses popular 2114 static RAMS • +5 volt operation only • Bank Select available by bank port and bank byte • Phantom Line capability • Addressable in 4K blocks • 4K blocks can be addressed anywhere with in 64K in 4k increments. • Meets IEEE proposed S-100 signal standards • LED indicators for board selection and bank selection • FR-4 EPOXY PC boards • Solder masked on both sides • Silk screen of part number and part designator.

OUR PRICE

CCS-2016BA 450ns
100% Tested for 4MHZ
Z80 Operation
Reg. Price \$349.95.....\$279.95
CCS-2016BB 300ns
Reg. Price - \$389.95.....\$309.00
CCS-2016BY Bare Board - only...\$29.95

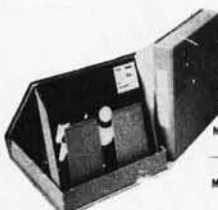


Part No.	Seating	Application	Pk. of 2	Box of 10
VRB-MD 525-01	Soft Sector	TRS-80 Apple	\$ 8.95	\$29.95
VRB-MD 525-10	Hard 10 Sector	North Star	\$ 8.95	\$29.95
VRB-FD32-1000	Hard 16 Sector	Microplus	\$11.95	\$37.00
VRB-FD34-1000	Soft Sector	Shugart 801R IBM 3740	\$11.95	\$37.00

SHIPPING WEIGHT 1 LB.

BE SURE TO ORDER YOUR KASSETTE/10 LIBRARY CASE BELOW

KASSETTE/10 LIBRARY



Part No.	GREY BLACK BLUE BEIGE	8" DISKETTE HOLDER \$4.50 or 3 1/2"
MMM-KS-10		
Part No.	GREY BLACK BLUE BEIGE	5 1/4" DISKETTE HOLDER \$4.25 or 3 1/2"
MMM-KM-10		

PRIORITY ONE ELECTRONICS

16723K Roscoe Blvd. Sepulveda, CA 91343

Terms: Visa, MC, BAC, Check, Money Order, U.S. Funds Only. CA residents add 6% sales tax, Minimum order \$10.00 Prepaid U.S. orders less than \$75.00 include 5% shipping and handling. MINIMUM \$2.50. Excess refunded. Just in case... please include your phone no. Prices subject to change without notice. We will do our best to maintain prices thru MAY 1980. *SOCKET and CONNECTOR prices based on GOLD, not exceeding \$500 per oz.

*Sale Prices are for prepaid orders only credit card orders will be charged appropriate freight



SD EXPANDORAM

EXPANDABLE TO 64K
USING 4116 RAMS

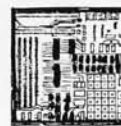
SDS-EXPANDORAM-16K KIT
List - \$385.00... Sale - \$205.00
SDS-EXPANDORAM-32K KIT
List - \$550.00... Sale - \$269.00
SDS-EXPANDORAM-48K KIT
List - \$715.00... Sale - \$330.00
SDS-EXPANDORAM-64K KIT
List - \$880.00... Sale - \$390.00



PROM-100

PROGRAMS 2708, 2716, 2732, 2758, 2516 EPROMS

SDS-PROM-100 KIT
List - \$200.00... Sale - \$175.95



Z-80

STARTER KIT

COMPLETE Z-80 MICROCOMPUTER

SDS-Z80 STARTER KIT
List - \$340.00... Sale - \$239.00

TRS-80/APPLE

MEMORY EXPANSION KITS

from Leading Manufacturers (16K x 1 200/250ns) 4116's RAMS... 8 for \$55.00 Add \$3.00 for programming jumpers for TRS 80 Keyboard.



VERSAFLOPPY

SINGLE DENSITY DISK CONTROLLER
SDS-VERSAFLOPPY KIT
List - \$250.00... Sale \$235.00



VDB-8024

80 x 24 I/O MAPPED VIDEO BOARD

SDS-VDB-8024 KIT
List - \$375.00... Sale - \$315.00



VERSAFLOPPY II

DOUBLE DENSITY DISK CONTROLLER
SDS-VERSAFLOPPY II KIT
List - \$350.00... Sale - \$299.00



EXPANDORAM II

4 MHz RAM BOARD

EXPANDABLE TO 256K
SDS-EXPANDORAM-II - 16K KIT
List - \$470.00... Sale - \$280.00
SDS-EXPANDORAM-II - 32K Kit
List 720.00... Sale - \$360.00
SDS-EXPANDORAM-II - 48K KIT
List \$970.00... Sale - \$440.00
SDS-EXPANDORAM-II - 64K KIT
List \$1220.00... Sale - \$510.00



SBC-100/200

2 OR 4 MHz SINGLE BOARD COMPUTER
SDS-SBC-100 2MHZ KIT
List-\$295.00... Sale-\$235.00
SDS-SBC-200 4MHZ KIT
List-\$320.00... Sale-\$255.00



ROCKWELL AIM-65

The Rockwell AIM 65 with 4K
RCK-AIM65 4K 8 lbs.....\$445.00
The Rockwell AIM 65 with 1K
RCK-AIM65 1K 8lbs.....\$375.00
4K Assembled-RCK-AIM65-010...\$85.00
8K Basic in ROM RCK-AIM65-020\$100.00



FOR MORE INFORMATION SEE OUR 52 PAGE AD IN JANUARY BYTE OR SEND \$1.00 FOR CATALOG

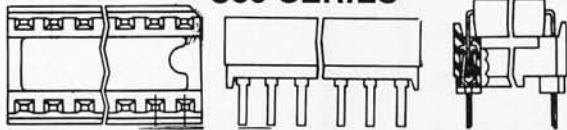
• Sale Prices are for prepaid orders only • Quantities are limited, subject to prior sale • CREDIT CARD ORDERS WILL BE CHARGED APPROPRIATE FREIGHT

ORDER TOLL FREE (800) 423-5633

SEND \$1.00 FOR 52 PAGE CATALOG



Texas Instruments FACE GRIP LOW PROFILE SOLDER TAIL DIP SOCKETS C85 SERIES



- Face grip design provides maximum retention force
- Anti-wicking feature
- Redundant contact points

PART NO.	PINS	1-9	PRICE			
			10-49	50-99	100-499	500-999
TIS-08LP	08	N/A	.15	.10	.08	.07
TIS-14LP	14	N/A	.18	.15	.14	.12
TIS-16LP	16	N/A	.20	.18	.16	.13
TIS-18LP	18	.30	.25	.22	.18	.15
TIS-20LP	20	.30	.25	.23	.20	.17
TIS-22LP	22	.35	.30	.25	.22	.19
TIS-24LP	24	.40	.35	.30	.24	.20
TIS-28LP	28	.45	.40	.35	.28	.24
TIS-40LP	40	.50	.45	.42	.40	.35

*MINIMUM ORDER \$1.00 Per Line Item

Sockets purchased in multiples of 100 per type may be combined for best price

DIP PLUGS



PART NO.	PINS	PRICE			
		1-9	10-24	25-99	100-249
KNX-08DP	8	.50	.45	.43	.40
KNX-14DP	14	.65	.60	.58	.55
KNX-16DP	16	.70	.65	.62	.58
KNX-24DP	24	1.15	1.05	.90	.95
KNX-40DP	40	1.90	1.70	1.60	1.50



Texas Instruments

Gold Plated Edgeboard Connectors

Standard But Not Ordinary

The H4 Series standard edgeboard connectors offer the best value in the edgeboard market today.

To assure reliable electrical connections, our cantilever contacts are pre-loaded for optimum normal force and bifurcated for redundancy; each contact point features from 50 (Wire Wrap) to 75 (solder tail) microinches (minimum) of wrought gold inlay over a nickel diffusion barrier. The inlay is metallurgically bonded to a copper-nickel-tin alloy (CA 725)

- FEATURES**
- RELIABLE, COST-EFFICIENT CONTACT DESIGN
 - 50 (Wire Wrap) to 75 (solder tail) microinches gold inlay over a nickel diffusion barrier (minimum thickness).
 - Copper-nickel-tin CA 725 Alloy.
 - Bifurcated contact points.
 - Preloaded, cantilever spring design.
 - Contacts are user removable.



TI EDGE CONNECTORS

.1" Contact Centers: STG - Solder Tail GOLD; WWG - Wire Wrap GOLD



.125" Contact Centers: STG - Solder Tail GOLD; WWG - Wire Wrap GOLD

PART NO.	1-9	10-24	PRICE		100-249
			25-99	100-249	
TIC-1530-I STG	1.60	1.45	1.30	1.10	
TIC-1530-I WWG	1.70	1.55	1.35	1.15	
TIC-1836-I STG	2.00	1.80	1.60	1.40	
TIC-1836-I WWG	2.10	1.90	1.65	1.45	
TIC-2244-I STG	2.25	2.00	1.75	1.50	
TIC-2244-I WWG	2.40	2.15	1.90	1.60	
TIC-2550-I STG	2.50	2.25	2.00	1.65	
TIC-2550-I WWG	2.70	2.45	2.15	1.80	
TIC-3060-I STG	2.95	2.60	2.30	1.90	
TIC-3060-I WWG	3.20	2.85	2.55	2.20	
TIC-3672-I STG	3.30	2.95	2.60	2.30	
TIC-3672-I WWG	3.90	3.50	3.10	2.60	
TIC-4080-I STG	3.60	3.25	2.85	2.40	
TIC-4080-I WWG	4.40	4.00	3.60	3.00	
TIC-4386-I STG	3.90	3.50	3.10	2.60	
TIC-4386-I WWG	4.65	4.15	3.70	3.10	
TIC-50100-I STG	4.50	4.05	3.60	3.00	
TIC-50100-I WWG	5.40	4.90	4.30	3.60	

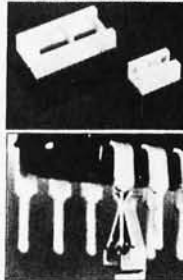
PART NO.	1-9	10-24	PRICE		100-249
			25-99	100-249	
TIC-2244-2 STG	2.30	2.10	1.85	1.50	
TIC-2244-2 WWG	2.60	2.35	2.10	1.75	
TIC-2856-2 STG	2.80	2.55	2.25	1.85	
TIC-2856-2 WWG	3.20	2.90	2.55	2.15	
TIC-3060-2 STG	2.90	2.60	2.30	1.95	
TIC-3060-2 WWG	3.40	3.05	2.70	2.25	
TIC-3162-2 STG	3.05	2.75	2.45	2.05	
TIC-3162-2 WWG	3.50	3.15	2.80	2.35	
TIC-3672-2 STG	3.45	3.10	2.75	2.30	
TIC-3672-2 WWG	4.00	3.60	3.20	2.68	
TIC-4080-2 STG	3.80	3.45	3.05	2.55	
TIC-4080-2 WWG	4.45	4.00	3.55	2.95	
TIC-4488-2 STG	4.20	3.80	3.35	2.80	
TIC-4488-2 WWG	4.85	4.35	3.90	3.20	
TI-S100STG	3.20	2.90	2.50	2.20	
S-100, VECTOR 8803, CROMENCO, IMSAI,					
.250 SPACED ROWS					
TI-S100WWG	4.00	3.75	3.50	3.25	
S-100 WIRE WRAP					

ROBINSON NUGENT, INC.

GOLD 3 LEVEL
WIRE WRAP SOCKETS

AND OTHER LEADING MANUFACTURES

IYN SERIES GOLD 3 LEVEL WIRE WRAP SOCKETS



- Deep Chamfered Closed Entry Contacts
- RN Side Wipe Contact Design
- Terminal Barbs Allow Self-lock into PC Board
- Rugged Socket Body Design

PART NO.	PINS	1-9	PRICE*			
			10-24	25-99	100-249	250-999
RNS-08WWG	8	.50	.42	.40	.37	.33
RNS-14WWG	14	.60	.49	.47	.45	.42
RNS-16WWG	16	.65	.52	.50	.47	.44
RNS-18WWG	18	.65	.52	.50	.47	.44
RNS-20WWG	20	.85	.75	.70	.65	.60
RNS-22WWG	22	1.00	.90	.80	.75	.70
RNS-24WWG	24	1.25	1.15	1.10	1.05	1.00
RNS-28WWG	28	1.25	1.15	1.10	1.05	1.00
RNS-40WWG	40	1.85	1.65	1.55	1.45	1.35

*Price based on gold not exceeding \$500 per oz.

Sockets purchased in multiples of 50 per type may be combined for best price.



ZERO INSERTION FORCE TEST SOCKETS

ZIP-16DIP	\$5.50
ZIP-24DIP	\$7.50
ZIP-40DIP	\$10.25

RS232 and "D" SUB-MINIATURE CONNECTORS



P = Plug, Male Type - S = Socket, Female Type - C = Cover, Hood

PART NO.	DESCRIPTION	PRICE		
		1-9	10-24	25-99
CND-DE9P	9 Pin Male	1.70	1.50	1.40
CND-DE9S	9 Pin Female	2.35	2.10	2.00
CND-DE9C	9 Pin Cover	1.50	1.35	1.20
CND-DA15P	15 Pin Male	2.45	2.25	2.10
CND-DA15S	15 Pin Female	3.35	3.20	3.00
CND-DA15C	15 Pin Cover	1.60	1.45	1.30
CND-DB25P	25 Pin Male	2.90	2.70	2.50
CND-DB25S	25 Pin Female	3.75	3.65	3.35
CND-DB51212-1	1 pc Grey Hood	1.50	1.30	1.10
DB-P258C	2 pc Grey Hood	1.45	1.25	1.00
DB1226-1A	2 pc Black Hood	1.90	1.65	1.45
CND-DC37P	37 Pin Male	4.40	4.20	3.90
CND-DC37S	37 Pin Female	6.20	5.95	5.70
CND-DC37C	37 Pin Cover	2.25	2.00	1.75
CND-DD50P	50 Pin Male	5.75	5.45	5.00
CND-DD50S	50 Pin Female	9.65	8.85	8.25
CND-DD50C	50 Pin Cover	2.40	2.20	2.00
D2041B-S	Hardware Set 2 pr.	1.00	.80	.70
CND-RS232-8FT	RS232, DB25P, EIA class 1 cable 8 con. 8 ft. long	18.00	16.00	14.00
CND-57-30360	Centronics 700 Series printer connector	9.00	7.50	6.00

ORDER TOLL FREE

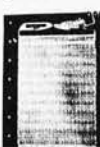
1-800-423-5633

except CA., AK., HI., CALL
(213) 894-8171

VCT-8803



- Kit includes 12 tantalum capacitors for +5, +12, -12 buses and insulated mounting spacers
- Wiring side shown. Component side bare epoxy glass with white markings for component locations.
- GTO epoxy glass board with 2 ounce copper, solder plated and .038 diameter holes for leads.
- Solder mask with solder windows on etched circuits to avoid accidental short circuits.
- Mounts 11 receptacles with 100 contacts (2 rows) on .125 centers with .250 row spacing. Vector part number P88-2, or mounts 10 receptacles plus interconnectors to smaller mother board for expansion.
- Includes etched circuits and instructions for option of active, dual in-line, or floating terminations.
- Large buses: +5V and GND (10 AMPS) ± 12V at 16V (7 AMPS). Current ratings are per MIL-STD-275 with 10PC rule.
- Fits in Vector pak enclosures.
- Fits in IMSAI 8080 microcomputer as expansion board.



Price:
\$29.50



VCT-8800V
Universal Microcomputer/processor
plugboard, use with S-100 bus.
Complete with heat sink & hardware.
5.3" x 10" x 1/16"

1-4	5-9	10-24
\$21.81	\$19.82	\$17.82

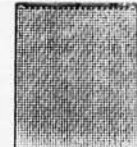
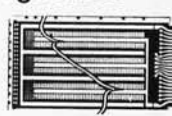
VCT-8801-1
Same as 8800V except plain, less power buses & heat sink.

1-4	5-9	10-24
\$17.08	\$15.65	\$14.04

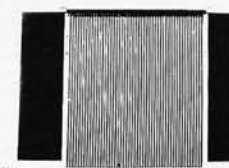


VCT-3677 9.6" x 4.5"
\$11.71
VCT-3677-2 6.5" x 4.5"
\$10.55
Hi-Density Dual-In-Line
Plugboard for Wire Wrap
with Power & Gnd. Bus
Epoxy Glass 1/16" 44
pin. con. spaced 156

Plugboards



VCT-3662 6.5" x 4.5"
\$9.88
VCT-3662-2 9.6" x 4.5"
\$12.26
P. pattern plugboards for
IC's Epoxy Glass 1/16" 44
pin. con. spaced 156



VCT-3690-12
CARD EXTENDER
Card Extender has 100 contacts 50 per side on .125 centers. Attached connector is compatible with S-100 Bus Systems.
VCT-3690 6.5" 22/44 pin... \$27.69
156 ctrs. Extenders. \$13.98

ORDER TOLL FREE (800) 423-5633

For Your TRS-80
DISK SYSTEM

ElectraSketch

Add Animation to your
TRS-80 Programs

- Animation Compiler and Graphics Editor Package
- Add smooth, fast action to basic programs
- Create ad layouts, newsletter covers, posters

\$14.95

Write or call for complete catalog

MACROTRONICS, inc.

1125 N. Golden State Blvd. / Suite G
Turlock, CA 95380 (A)
(209) 667-2888 / 634-8888

We are experiencing telephone difficulties,
please keep trying.

California residents add 6% tax

VISA or MC

Circle 286 on inquiry card.

BASEX is . . .

- More *Basic* than BASIC!
- More *Forthright* than FORTH!
- More *Tiny* than TINY C!
- Runs *Fast* like FORTRAN!
- Less *Hascal* than PASCAL!

*97 page manual (\$8) with complete source listing.

*TAPES (\$25) — Meca, SOL, Poly88, TRS80 (16K/II), Paper tape.

*DISKS — NStar (\$25); CPM (\$35) 8" SD or 5" (NStar, Meca, MicroII).

ADD \$.75 shipping (\$1.50 UPS or special handling)



INTERACTIVE MICROWARE, INC
Box 771, State College, PA, 16801

CALL (814) 238-8294

Circle 287 on inquiry card.

6800/6809 PASCAL

DYNASOFT PASCAL is a cassette based PASCAL subset designed to run on most 6800/6809 systems with 12K or more of memory.

DYNASOFT PASCAL includes most of the control structures of standard PASCAL including IF-THEN-ELSE, CASE-OF-OTHERWISE, WHILE-DO, REPEAT-UNTIL, FOR-TO/DOWNT-DO, and recursive PROCEDURE's and FUNCTION's. It supports the data types INTEGER, CHAR, BOOLEAN, scalar (user-defined), subrange, pointer and ARRAY. It is built around a one pass compiler which produces fast, compact p-code and comes complete with a line-oriented text editor, p-code interpreter, and program SAVE and LOAD routines. The whole system resides in less than 8K.

The cassette version with manual is priced at \$35 plus \$3 for postage and handling. Please specify 6800 or 6809.

**dyna
soft
systems**

P. O. BOX 51
WINDSOR JCT., N. S.
CANADA B0N 2V0

Circle 288 on inquiry card.

3M / Scotch Floppy Discs

Lowest prices. **WE WILL NOT BE UNDERSOLD!!** Buy any quantity 1-1000. Visa, Mastercharge accepted. Call free (800)235-4137 for prices and information. All orders sent postage paid.



PACIFIC EXCHANGES
100 Foothill Blvd.
San Luis Obispo, CA
93401 (In Cal call
(805) 543-1037.)

Circle 289 on inquiry card.

OHIO SCIENTIFIC USERS!

Read

PEEK (65)

The Unofficial OSI Users Journal

- User Equipment Reviews
- Hardware Mods
- Software Exchange
- Peeks & Pokes
- Bugs & Fixes

Send \$8⁰⁰ for 12 issues to:

PEEK (65)
62 Southgate Ave.
Annapolis, MD 21401

Circle 290 on inquiry card.

AURORA, IL. AREA

apple computer
Sales and Service

10% off
ALL APPLE
PRODUCTS
for a
limited time



IDS-440-G PAPER TIGER
PRINTER '995⁰⁰



**FARNSWORTH
COMPUTER CENTER**
1891 N. Farnsworth Ave.
Aurora, IL. 60505
Ph. 312-851-3888

Circle 291 on inquiry card.

COMPUCOLOR II BACKGAMMON

- * Impressive graphics
- * Player vs. Computer
- * 16K RAM required
diskette \$18.00

Blank CCII diskette
\$4.50

Same day shipping with
money order or send check
to . . .

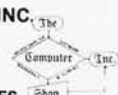
Med Ford Software
419 N. Chapelgate Ln.
Balto., Md. 21229

Dealer inquiries invited

Circle 293 on inquiry card.

THE COMPUTER SHOP, INC.

1000 Pike Road
Birmingham, AL 35218
(205)781-0711



SCOTCH 3M BRAND DISKETTES

Type	Size	Density	Package	Sector	Price/10	Apl.
744-0	5 1/4"	single	storage case	soft	36.00	(1)
744-0	5 1/4"	single	library case	soft	39.00	(1)
740-0	8"	single	storage case	soft	36.00	(2)
741-0	8"	double	storage case	soft	55.00	(3)

(1) for Apple, TRS-80, Pet, SWTP, Cromenco

(2) for IBM 3740 series and compatible drives

(3) for TRS-80 Mod II, Shugart 800/801 and compatible drives

PERSONAL COMPUTING CASSETTES w/leader 10 min
\$1.95, 30 min \$2.30 (10 minimum order)

OTHER SCOTCH BRAND PRODUCTS — Velostat Anti-static Mats, Digital Cassettes, Data Cartridges, Word processing supplies etc. Call or write for pricing.

ANADIX DP8000 PRINTER — 9 x 7; Upper & lower case; adj. width tractor feed; bidirectional; 1K buffer; expanded print; Parallel, RS232C serial, and Current loop interface. Many more features. \$949. Send \$2 P & H for a sample printout. (Call or write about the new 9500/9501).

LOBO Minidisk Drive for TRS-80 — \$395

Authorized SCOTCH Minicomputer Distributor

All merchandise is premium grade. Alabama residents add 6%. Foreign orders add 10%. Orders accompanied by payment are shipped at our expense.



Circle 294 on inquiry card.



INDUSTRIAL MICRO SYSTEMS COMPUTER
Desk Top Model With Z80 CPU at 4 MHZ • Dual Double Density 8inch Shugart Floppy with 1.2 M Bytes • 48K Memory with Bank Switching and expandable to 256 K • 2 Serial and 3 Parallel Ports • Transparent Single and Double Density Operation • CPM 1.4 Disk Operating System (Optional) • 90 Days Parts and Labor Warranty • Complete and Ready to Run at . . . \$4,250.00
Or a Complete System including CRT Terminal and Texas Instrument 820 Printer at . . . \$7,350.00

Dealer Inquiries Invited.

SOO NAM KIM

O S M COMPUTER

2364 WALSH AVE., SANTA CLARA, CA 95051
(408) 496-6910

Circle 292 on inquiry card.

DELTA IS READY . . .

Call For
DEALER
In Your Area

Z-80 CPU



Two serial ports, three parallel ports. 2/4 MHz, on board Prom Monitor Phantoms. (Less cable and Monitor).
A & T \$325.00

DOUBLE/SINGLE DISK CONTROLLER



Two stage phase lock loop circuitry for greatest reliability, data transfer at maximum rate. Transparent density selection. 8" or 5" operation 2 or 4 MHz (Some restrictions on DMA).
DMA — \$425.00
STD. — \$385.00

16K, 32K STATIC RAM



Worlds most reliable memory, responds to extended address lines A16, A17, cool running, fast.
16K-\$395.00 32K-\$650.00

32K, 48K, 64K DYNAMIC RAM



Basic dynamic board tested to run at 4MHz with our Z-80 board. 4116 chips at 200 nanosecond speed insures most reliable data storage. Double density and DMA compatible.
32K-\$580.00 48K-\$640.00
64K-\$750.00

32K, 48K, 64K ERROR DETECTING Cromenco/ Alfa Micro



State of the art development. Parity generation and error detection. Compatible with 16 bit CPU designs. 16K bank, select under software control. 4MHz Z-80, 8086, Cromenco, Alpha Micro compatible.
32K-\$650.00 48K-\$725.00
64K-\$850.00

FLOPPYS



8" Shugart. . . . \$550.00
8" Siemans. . . . \$525.00
5" Siemans. . . . \$350.00
(Double Sided)
8" CDC. . . . \$675.00
8" Remex. . . . \$645.00

TELEVIDEO 912



80 x 24—Lower case descenders. Teletype or typewriter keyboard 110/220 VAC. 50 to 19.2K Baud Hex entry pad. Similar to SOROC but better looking with NO FAN NOISE

TELEVIDEO 920



Similar to TV 912 but has programmable functions keys across top. Excellent for WORDSTAR Text Editing.

WINCHESTER/SHUGART SA 1000



5 megs now expandable to 10, works alongside floppy disk drive for expanded storage. Use with controller below.
\$1950.00

WINCHESTER/CENTURY DATA SYSTEM (Hunter Shown)



20 megs expandable to 40—Marksman series, plugs into our CPU parallel port or MP/M board drive, cabinet, power supply, 2.0 Bios.
\$4850.00

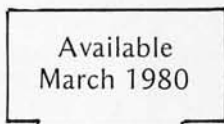
FLOPPY DISKS

D Y S A N Quality



8" SSDD \$4.25
8" SSDD \$5.50
8" DSDD \$7.60
5" SSDD \$4.10
(Boxes of 10 only)

MPM[®]/I/O TIMER



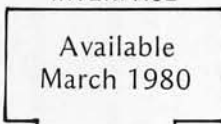
Designed for MP/M[®] software of Digital Research. 6 users serial port, three 8 bit parallel ports for hard disk. Timer and vectored interrupt.
©TM Digital Research

80 x 24 VIDEO



Keyboard input, Z-80 Processor, on board RAM makes this a non-memory mapped substitute for a terminal when mated with a keyboard.
\$430.00

WINCHESTER/FLOPPY INTERFACE

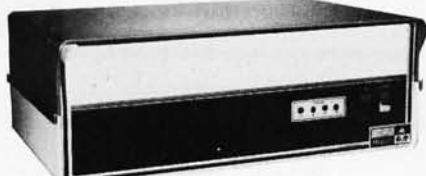


Allows mixing of Shugart Winchester and floppy drives on same cable when used with DP-DSK. Supplied with software Bios for MP/M[®] and 2.0
©TM Digital Research

SOFTWARE/ CABLES/PROMS

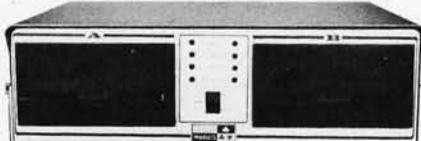
CP/M[®] 2.2. . . . \$150.00
MP/M[®]. . . . \$350.00
2708 Monitor . . . \$ 25.00
2716 Monitor . . . \$ 40.00
Disk 50 Pin . . . \$ 22.00
RS-232 \$ 15.00
CPU to Back. . . . \$ 32.00
Disk DC \$ 4.50
Disk AC \$ 2.50
Winchester. . . . \$ 28.00

DP S-100 Main Frame



- 12 slot S-100 Motherboard (6 populated)
 - +8V @ 20A ±16V @ 6A. (Nylon card guides).
 - Mates with disk system shown in center column.
 - 3 user convenience outlets at rear.
 - Status indicators for I/O wait, memory error, voltage levels.
 - Multi-user capable with circuit board selection at top.
- Kit (less fans) \$295.00 A & T \$450.00

Disk Drive Storage



- Cabinet comes with multiple power.
 - Supply to suit all popular disk drives ±5A, +24 @ 6A.
 - DP-1000K Twin double density Shugart SA-800B or Siemens FDD-100-8 (1 megabyte). \$1800.00
 - DP-2000K Double sided, double density Shugart SA-850-R or Siemens FDD-200-8 (2 megabytes). \$2450.00
 - Drive box less drives with ample power supply.
- Kit (less fans) \$295.00 A & T \$450.00

NORTH STAR Competitor



- Cost effective Z-80 dual drive micro system.
- Double density Siemans drives sport 340K single sided, 680K double sided.
- 32K RAM standard, expandable to 64K.
- CPM[®] 2.0 software included.

\$2450.00

West:

DELTA PRODUCTS

15392 Assembly Lane, Unit A
Huntington Beach, Calif. 92649
Tel: (714) 898-1492

Circle 295 on inquiry card.



Telex: 681-367 DELTMAR HTBH

East:

DELTA PRODUCTS

11 Edison Drive
New Lennox, Illinois 60451
Tel: (815) 485-9072

TEXAS INSTRUMENT 99/4 COMPUTER \$ 989.
 TI 810 PRINTER \$1590.
 CENTRONIC PRINTERS:
 730-1 PARALLEL PRINTER \$ 749.
 730-2 SERIAL PRINTER \$ 799.
 779-1 FRICTION FEED \$ 959.
 779-2 TRACTOR FEED \$ 999.
 COMPRINT 912 APPLE, TRS-80, PAR \$ 559.
 912 SERIAL \$ 599.
 ANADIX WITH PAR & SERIAL INTERFACE \$ 799.
 COMMODORE BUSINESS MACHINES:
 PET 2001-8K COMPUTER \$ 695.
 PET 2001-16K \$ 895.
 PET 2001-32K \$1090.
 PET 2022 TRAC. FEED PRINTER \$ 699.
 PET 2023 FRIC. FEED PRINTER \$ 679.
 ATARI 800 \$ 889.
 400 \$ 495.
 INTERTEC SUPERBRAIN(32K) \$2495.
 NORTH STAR COMPUTER AND ACC.
 ** SAVE \$ SAVE \$ **
 DISPLAY TERMINALS:
 INTERTEC II \$ 775.
 HAZELTIME 1400 \$ 690.
 1410 \$ 785.
 1500 \$ 990.
 IMMEDIATE DELIVERY FROM STOCK.

MULTI-BUSINESS COMPUTER SYSTEMS
 28 HARBOROUGH STREET
 PORTLAND, CONN. 06480
 (203) 342-2747

Circle 296 on inquiry card.

CROMEMCO SYSTEMS DISCOUNTED

System 2 with 64k RAM—\$3195
 System 3 with 64k RAM—\$5735

Discounts up to 20%
 on most Cromemco hardware.
 We carry the full Cromemco line.

TORREY PINES BUSINESS SYSTEMS

14260 Garden Rd., Suite 1B
 Poway, California 92064
 (714) 486-3460

Add 3% for shipping and handling
 California residents add 6% sales tax

Circle 297 on inquiry card.

SUN-FLEX OPTICAL FILTER

THE SUN-FLEX OPTICAL FILTER ENHANCES CONTRAST,
 ELIMINATES GHOST AND REFLECTIONS, WHILE ALLOWING
 FOR BRIGHTER VISION.

THE RIGHT SIDE OF THIS UNRETouched PHOTOGRAPH
 SHOWS THESE BENEFITS.

IF YOU ARE NOT ABLE TO EASILY READ THE COPY ON
 THE LEFT SIDE OF THE SCREEN, IT'S BECAUSE IT LOOKS
 LIKE THE USUAL CRT IN YOUR HOME OR OFFICE.

THE PRICE FOR PROTECTING YOUR EYES FROM POSSIBLE
 DAMAGE IS \$29.95 FOR A 9-INCH FILTER, \$22.50 FOR
 15-INCH AND \$25.00 FOR 15-INCH. ADD \$6.00 IF YOU
 WANT COLOR.

OVER 50,000 SOLD!

SUN-FLEX COMPANY, INC.
 3020 Kerner Boulevard
 San Rafael, CA 94901

(415) 456-8482

Mastercharge/VISA or Check

Circle 298 on inquiry card.

CRANIAL LABS • CRANIAL LABS

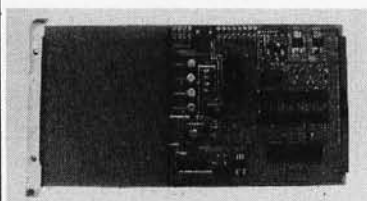
BIORHYTHMS — the Parscience of
 yourself. Your 3 body cycles till 1990.
 EGGSHELL — the ancient game of Math
 Analysis plus TIC-TAC-TOE in three
 levels, included in package \$11.00

Created for TRS-80 LEVEL 11
 16K SYSTEMS. Games played
 with friend or computer.

168 Villa Ave., Buffalo, NY 14216

Circle 299 on inquiry card.

H8 Owners



AD-8/4H ANALOG/DIGITAL SUBSYSTEM

- 8 A/D Input Channels
- Fast-Over 4500 A/D Conversions/Sec
- 4 D/A Output Channels — Each With Sample and Hold
- Full 8 Bit Resolution
- Uses Single Card Slot
- Fully Assembled And Tested
- Full Documentation Provided
- Visa, Master Charge OK

\$125.00

CCM, Inc.

P.O. Box 2308 Reston, Va. 22091

Circle 300 on inquiry card.

TRS-80 16K LEVEL II

Canadian Income Tax	\$29.95
Inventory	49.95
Accounts Receivable	49.95
Banking	19.95
Golf	16.95
Budgeting	19.95
Recipes	19.95

- Mailed on Cassette
- Replacement Guarantee

Use Our Company to Sell Your
 Programs. Send for information
 on PROGRAMMERS'
 PARTICIPATION PLAN.

Want to be on our mailing list?
 Write us today.

QUADRUS ASSOCIATES

39 Coachwood Road, Brantford,
 Ontario, Canada
 N3R 3R5

Circle 301 on inquiry card.

80X24 VIDEOTERM™ 7X9 MATRIX DISPLAY FOR

LOWER CASE W/ DESCENDERS APPLE II®



* REGISTERED TRADE MARK OF APPLE COMPUTER INC.

80 columns by 24 lines with easy to read 7x9 dot matrix,
 upper and lower case with descenders using shift lock
 feature • 1K firmware incorporates PASCAL and BASIC
 protocols so user is not required to enter machine
 language programs or change PASCALS. Misc. info. or
 Gotoxy files • Compatible with all APPLE II peripherals
 so user won't need new software patches for future
 software products • Crystal controlled dot clock for
 excellent character stability • VIDEOTERM is the same
 size as the Apple language card and power consumption
 is held to a minimum through the use of CMOS and
 lower power devices • Character set can be user de-
 finable up to a maximum of 128 symbols of 8x16 dot
 matrix font • Display control character mode and four
 standard display formats controlled by escape sequen-
 ces • Built in light pen capability • Inverse display
 mode • 50/60 HZ operation • Sockets on all IC's.

PRICE Without graphic EPROM \$345
 OPTIONS: Graphics EPROM line dwp \$25
 VIDEO SWITCH PLATE, Inserts
 in case slot to choose between
 APPLE II® and VIDEOTERM \$12
 MANUAL \$15



VIDEX 3060 N.W. Thistle Pl. Corvallis, OR 97330 Phone (503) 758-0521

Circle 302 on inquiry card.

COMPLETE S-100 MAINFRAME \$299

Sturdy aluminum enclosure
 measures 8"H x 17"W x 14"D
 and includes 6 slot S-100 mother-
 board with connectors installed,
 8 V @ 14 A and ± 16 V @ 2 A
 power supply, fan, card guides,
 circuit breaker, reset switch, line
 filter and connector cutouts.

LOGICON

P. O. Box 1343
 Pleasanton, CA 94566
 (415) 462-7361

Circle 303 on inquiry card.

We want your NEW PRODUCTS to SELL OVERSEAS

Established European Marketing
 Organization in the high technology
 instrumentation field, based in
 England and with excellent knowl-
 edge of the European Market, is
 seeking to expand its interest in the
 Consumer and Professional pro-
 ducts field by utilizing the unique
 technological development of the
 microchip revolution in the U.S.A.

We have the finance, the distribu-
 tion and the European Marketing
 expertise and are seeking products
 with sole European distribution
 rights. Principals only, please con-
 tact Brian Gould, Managing Director,
 Hampshire Design, Barksbury
 Hill, Upper Clatford, Andover,
 Hampshire SP11 7LW, England.

Circle 304 on inquiry card.

Try to beat our prices!

TELEVIDEO TVI-912



Upper case and lower case; 15 baud rates: 75 to 19,000 baud; dual intensity; 24 x 80-char. display, 12 x 10 resolution. Numeric pad. Programmable reversible video; aux. port; self-test mode; protect mode; block mode; tabbing; addressable cursor. Microprocessor controlled; programmable underline; line and character insert/delete.

OUR PRICE ONLY \$789

OTHER VIDEO TERMINALS

INTERTUBE II, List \$995	ONLY \$799
PERKIN-ELMER 550, List \$997	\$799
with anti-glare screen, \$1027	\$829
HAZELTINE 1400, List \$850	\$699
1410, List \$900	\$749
1420	\$849
1500, List \$1225	\$989
1510, List \$1395	\$1089
1520, List \$1650	\$1389
ADDS R-20, List \$995	\$945
LEAR SIEGLER ADM3A, Assembled	\$849
SOROC 120, List \$995	SPECIAL \$729
IQ140, List \$1495	\$1249

PRINTERS

ANADDEX 80-col. dot matrix,	SPECIAL \$749
INTEGRAL DATA IP-125	NOW ONLY \$689
IP-125 w/1210 option, \$838	NOW \$724
IP-225 w/1210 & 1250 op.,	List \$988 \$834
IP-225 w/tractor, 1210, 1250, 1221	
(2K Buffer), 1241 (graphics)	NOW \$899
IDS-440 Paper Tiger, List \$995	\$895
w/graphics op., incl. buffer, \$1194	\$989
CENTRONICS	
730-1 parallel interface, List \$995	\$779
779-1, Friction Feed, List \$1245	\$949
779-2 w/Tractor, List \$1350	\$1049
702-2 w/Tractor, VFU, List \$2480	\$1995
703-2 w/Tractor, VFU, List \$2975	\$2395
704-2 w/Tractor, List \$2350	\$1995
COMPRINT 912 w/parallel interf.	\$559
912 w/serial interface, List \$699	\$589
T.I. 810 Basic Unit, List \$1895	\$1695
810/serial & Centronics-style	
parallel interface, List \$1940	\$1735
810 w/full u/lc ASCII, Vertical	
Forms Control, Compressed Print	\$1895

NORTH STAR HORIZON

HORIZON 1 KITS

16K, Double Density, List \$1599	\$1474
32K, Double Density, List \$1849	\$1684
32K, Quad Density, List \$2049	\$1869

HORIZON 1 ASSEMBLED & TESTED*

32K, Double Density, List \$2695	\$2279
32K, Quad Density, List \$2995	\$2539

HORIZON 2 KITS

16K, Double Density, List \$1999	\$1824
32K, Double Density, List \$2249	\$2034
32K, Quad Density, List \$2629	\$2359

HORIZON 2 ASSEMBLED & TESTED*

32K, Double Density, List \$3095	\$2619
32K, Quad Density, List \$3595	\$3049
48K, Double Density, List \$3590	\$3039
48K, Quad Density, List \$4090	\$3469
64K, Double Density, List \$3830	\$3239
64K, Quad Density, List \$4330	\$3669

* Complete w/12 edge connectors, two SIOs, one PIO, and extra drive cable.

FLOPPY DISK SYSTEMS

MORROW THINKER TOYS® Discus 2D,	
List \$1149	OUR PRICE \$799
Discus 2D, dual-drive, List \$1948	\$1658
Discus 2+2, A&T, List \$1549	\$1319
Dual Discus 2+2, A&T, List \$2748	\$2335
MICROMATION Megabox, double-density w/	
8" drives, 1-megabyte, List \$2295	\$1949
2-megabyte, List \$3095	\$2629
MICROPOLIS 1041 MacroFloppy®	
w/enclosure (no P.S.), List \$695	\$625
1042 MacroFloppy w/case & AC P.S.	709
1053 Dual MetaFloppy®, List \$1895	\$1695

VIDEO BOARDS

I/O Mapped	
SD COMPUTER VDB-8024, kit, List \$370	\$299
Assembled, List \$470	\$399
XITEX SCT-100K, Kit	ONLY \$154.95
SCT-100A Assembled	\$174.95
SSM VB2 I/O, Kit, List \$169	\$144
Assembled & Tested, List \$234	\$199
Memory Mapped	
VECTOR GRAPHICS Flashwriter FW2	\$313
SSM VB1B, 16x64, Kit, List \$155	\$132
Assembled & Tested, List \$210	\$178
SSM VB3 80-Char., 4 MHz, Kit, List \$399	\$339
4 MHz, A&T, List \$464	\$394
INTER SYSTEMS, 16x64, A&T, List 165	\$149

CONVERT YOUR SELECTRIC TO A COMPUTER PRINTER!

Power supply & electronics, A&T. You make only a simple solenoid installation (or have the factory do it). Manufactured by ESCON.

S-100 Interface Version, List \$496 \$445

Universal Types:

Parallel — (Centronics format, for TRS-80, Sorcerer, Apple, etc.), List \$575	\$514
RS232 Standard Serial, List \$599	\$534
IEEE-488 (for PET), List \$660	\$584
TRS-80 Cable	\$25

CPU BOARDS

(assembled unless noted)

NORTH STAR Z80A (ZPB-A/A), \$299	\$254
CROMEMCO 4 MHz (ZPU-W), List \$395	\$335
4 MHz (SCC-W), List \$450	\$382
VECTOR GRAPHIC Z-80, List \$247	\$210
INTERSYSTEMS (formerly Ithaca Audio)	
NEW Series II Z-80, 4 MHz, List \$395	\$349
SSM CB1A 8080 CPU Board, List \$219	\$186
CB1A Kit, List \$159	\$135
SSM CB2 Z-80 CPU, List \$275	\$234
CB2 Kit, List \$210	\$179
DELTA Z-80, with I/O	\$239
SD SBC-100, List \$350	\$298
SBC-100 Kit, List \$295	\$250
SBC-200, List \$400	\$332
SBC-200 Kit, List \$320	\$272

MEMORY BOARDS

NORTH STAR 16K Dynamic RAM Board,	
A&T (RAM-16-A/A), List \$499	\$420
32K A&T (RAM-32/A), List \$739	\$620
CROMEMCO (16KZ-W), List \$595	\$495
64KZ-W, List \$1795	\$1485
MEASUREMENT SYSTEMS & CONTROLS	
<i>Guaranteed performance, incl. labor/parts 1 yr</i>	
DM6400 64K Board w/all 64K, \$795	\$659
DM4800 with 48K, List \$695	\$589
DM3200 with 32K, List \$595	\$509
DM1600 with 16K, List \$495	\$429
DM0000 with no RAM, \$395	\$349
THE DMB SERIES —	
DMB6400 64K Board w/all 64K	\$859
DMB4800 with 48K	\$789
DMB3200 with 32K	\$709

MORROW SuperRAM — all static, all A&T	
16K, 4 MHz or 2 MHz, List \$349	\$299
32K, 4 MHz, List \$699	\$629
16K Memory Master, List \$399	\$339
24K Memory Master, List \$549	\$465
INTERSYSTEMS (formerly Ithaca Audio)	
8K Static 2 MHz, A&T, List \$165	\$149
8K Static 4 MHz, A&T, List \$195	\$176
16K Static 2 MHz, A&T, List \$475	\$427
16K Static 4 MHz, A&T, List \$495	\$445
64K Dynamic, List \$995	\$895
CALIFORNIA COMPUTER	
16K Static, A&T, List \$349.95	\$259

FLOPPY DISK CONTROLLER BOARDS

MORROW Disk Jockey 1, A&T (\$213)	\$189
Disk Jockey 2D, A&T, List \$479	\$429
SD Versafloppy 1, Kit, List \$250	\$212
Versafloppy II, DD Kit, List \$430	\$360
Versafloppy II, DD, A&T, List \$350	\$278
DELTA double density A&T (\$385)	\$345
CONDUCTOR, double density A&T	\$269
INTERSYSTEMS (formerly Ithaca Audio)	
FDC-2, A&T, List \$495	\$439
MICROMATION Doubler, DD, A&T	\$399
TARBELL Floppy Disk Interface, Kit	\$199
double density, Kit, List \$325	\$295
double density, A&T, List \$425	\$380

SHIPPING & INSURANCE — Add \$2 for boards, \$5 for Selectric converter, \$7.50 for Floppy Disk Systems, \$15 for Horizons. Shipped freight collect: Cromemco Systems, Centronics, DEC, NEC, and T.I. printers. Contact us for shipping information on other terminals and printers. All prices subject to change and all offers subject to withdrawal without notice. Prices in this ad are for prepaid orders. Slightly higher prices prevail for other-than-prepaid orders, i.e., C.O.D., credit card, etc.

—WRITE FOR FREE CATALOG—

MiniMicroMart, Inc.

1618 James Street, Syracuse NY 13203 (315) 422-4467 TWX 710-541-0431 Circle 305 on inquiry card.

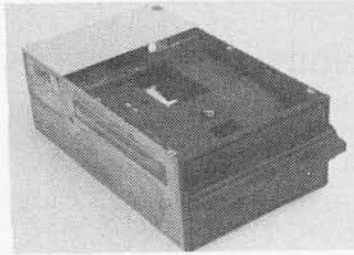


FLOPPY DISK DRIVES SYSTEMS

Qume Datatrak

Double sided floppy with NO HEADACHES. Although many think this an impossibility, seeing is believing, and this drive is really something! Shugart compatible, fully optioned, reliable, and rapidly becoming the standard in double-sided diskdom.

\$599. 2/\$549.



Siemens FDD100-8D

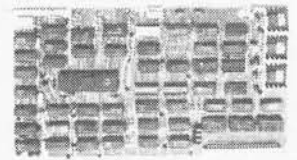
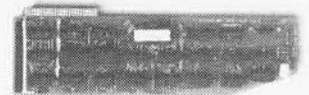
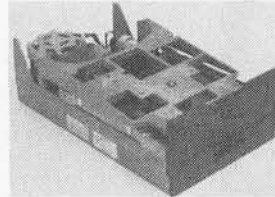
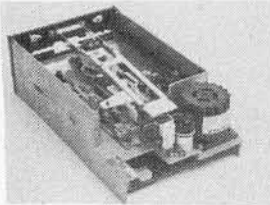
All Siemens options included in this drive, which can be configured hard/soft sector, is Shugart compatible, and not prone to some overheating problems (that other drives are). A highly reliable machine, with write protect, file busy indicator, and more.

\$499.

Cal Disk 142M 8"

Built like the proverbial tank. Single/double density, write protect, much more. With Electrolabs' special cabling, it magically becomes Shugart compatible.

Please ask about Cal Dis, enclosure \$389. 2/\$379. and power supply package bargain.



The following 5 1/4" mini-floppies share most features with their 8" cousins, so without further ado. . .

Siemens FDD 100-5D	\$279		
Cal Disk Mini	\$279		
Qume Datatrak 5		BASF Mini mini	\$279
(double sided)	\$399	SA 400	\$299

All the above mini-floppies are fully SA400 compatible.

Manuals for all drives are \$10, refundable against future purchase of drives. Also, all 8" drives can be ordered with 220 v/50 hz for worldwide use.

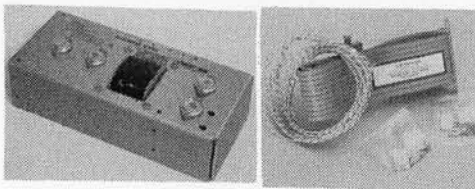
Moving on to the realm of floppy disk controllers . . . although we still feel that single density is more reliable, there are many excellent double density disk controllers available, so choose your weapons carefully.

Tarbell floppy disk controller, A & T	\$325
Tarbell floppy disk controller, A & T	\$225
Tarbell double density, DMA A & T	\$425
Tarbell double density, DMA, kit	\$325

Delta Products double density disk controller
Operate at 2 or 4MHZ, with 8 or 5" drives \$399
Micromation doubler w/programmable UART
RS-232 port \$495
Sorrento Valley single density for Apple \$399
Again, purchase price of manuals (\$5) is
applicable towards future purchase price.

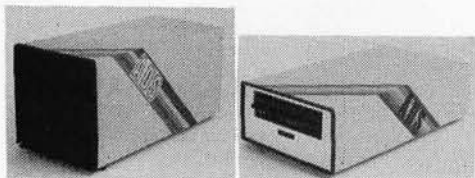
Disk Accessories

Subtract 15% OFF any Controller
with Purchase of 2 Drives.



Cable kits for 8" drives with 10'50 cond. flat cable, power cable, & all connectors. Assembled if desired. ONe drive 27.50, two 33.95, three 38.95 for mini floppies (34 cond): one 24.95, two, 29.95

CP-206 Power-one power supply. Powers two drives more than adequately, top quality. 2.8A/24V, 2.5A/5V, .5A/-5V. \$99.



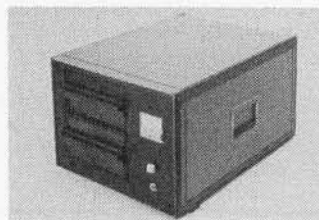
Double disk drive enclosure.
Enclosure alone \$139.
Including power supply & fan \$199.

Single disk drive enclosure. Fits all 8" disk drives, please specify make & model No. of drive to assure proper mounting hole positions. Nonmar paint available in blue, beige, silver, & off-white.
Enclosure alone \$60
Including power supply & fan \$109.

Electrolabs

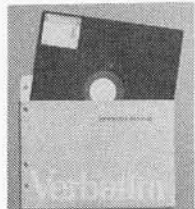
POB 6721, Stanford, CA 94305
415-321-5601 800-227-8266
Telex: 345567 (Electrolab Pla)
Visa MC Am. Exp.

ENCLOSURES, SLEEVES

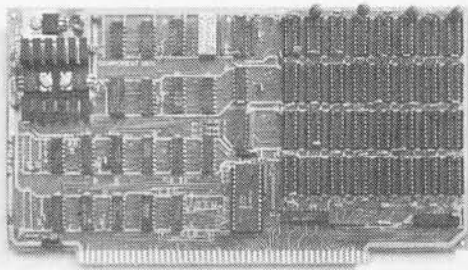


Rackmount Mainframe MT-200. This gorgeous beast is so appealing that it can easily function also as stand-alone mainframe. Very modern styling with fully actively terminated S-100 bus.
Enclosure alone \$399.
With power supply & fan \$499.
With 15 slot S-100 bus \$699.
With two 8" single-sided disk drives \$1,699.
With two 8" double sided disk drives in place of single-sided variety \$2,299.

Media



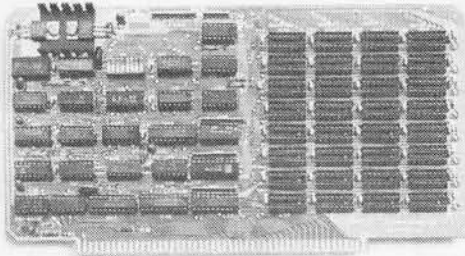
8" . . \$39.95/10 single-sided/single density
8" . . \$55.00 single sided/double density
8" . . \$55.00 double sided/single density
8" . . \$60.00 double sided
8" . . specify hard or soft
5 1/4" . . \$34.95 single sided
5 1/4" . . \$60.00 double sided
Verbatim, Memorex, Scotch, or equivalent name brand
Diskette head cleaning kid for 5 1/4" or 8" — \$28.75 includes everything for 1 drive for 1 year
Alignment Diskette \$39
For Floppy Drives



SD Systems Expandoram II Dynamic RAM

Operates at 4 Mhz, expandable memory from 16K to 256 K, allows up to 8 boards on the same bus, Z-80 based, and invisible refresh, among other things.

16K kit	\$295.
16K A & T	\$349.
32 K kit	\$369.
32 K A & T	\$419.
48K Kit	\$440.
48K A & T	\$490.
64K kit	\$510.
64K A & T	\$560.



Televideo 912c

\$760.

Upper/lower case

Adjustable baud rate — 80 X 24

Editing capabilities — Printer port

Second page memory option

This is a VERY limited extravaganza, so please act quickly

Televideo 920c

\$860.

Same specs as above, save for special function keys, ideal for text editing and word processing

New!



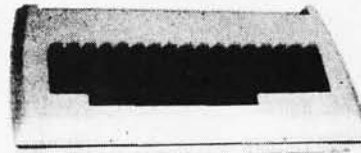
EXTRA SPECIAL !!

Imsai 65K dynamic RAM III

We made a special purchase of this now unavailable board, which were always noted for their fine performance & quality. We have a limited quantity on hand, get your orders in rapidly. These come assembled and tested, with burned-in 200 Ns RAM. Kit 299

A & T \$399.

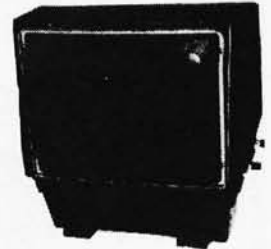
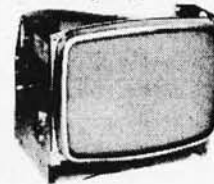
Keyboard Special



CHERRY "PRO" Keyboard \$119.00
Streamlined Custom Enclosure \$34.95
BOTH ONLY \$134.95!!!

Data Display Monitors

Used 12" Sylvania monitors. Composite Video, 15 MHz, 120VAC. Re-built with NEW P39 anti-glare tube \$89.00
New P4, \$89.00, used P4 \$69.00
U-fix model, 10/\$300.00



"OEM STYLE" as above, will fit any case, (Both versions serviced by qualified tech). Identical to above but subtract \$12.00

ELECTROLABS

POB 6721 Stanford CA 94305

(415) 321-5601 (800) 227-8266

Telex: 345567 (Electrolab Pla)

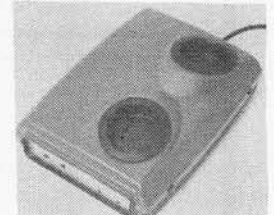
Paper Tiger

IDS MODEL 440

- 8 Software Selectable Character Sizes
- Parallel & Serial Interface
- 98 ASCII Character set, upper & Lower case
- Forms length control
- Tractor Feed \$899.
- Graphics option with 2K CRT screen buffer add \$199.00

Dynamic Devices Modem

- Acoustically coupled modem assembly set
- Asynchronous 0-300 Baud
- Switchable originate or answer modes
- Operates full or half duplex mode
- 15 minute assembly \$129.
- Novation Cat \$179.
- Digicom Coupler \$189.



Daisy Wheel Printers



Qume Sprint 3/45

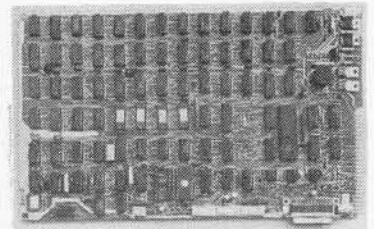
PRINTER (factory warr.)	\$1499.
POWER SUPPLY (Borschart)	349.
(Shown mounted on rear of printer)	
COMBINATION SPECIAL	1699.
Cases available	200.
S-100 interface card	149.
SPRINT 5/45 RO, RS-232	
Complete, assembled, in case, plug-in & print, hence, no muss & no fuss	\$2699.

EASTER IC EGG HUNT

(while supply lasts)

2708	\$ 8.50	2114	\$ 5.99
2716	25.00	2114-2	6.99
2732	95.00	pd411	2.50
2147	12.95	21L02	
		450 Ns	1.05
6502	\$ 6.25	UNPRECEDENTED!!!	
6809	49.00	* 16K Dynamic RAM	
6845	39.00	Set of 8 For: TRS-80,	
8085	13.00	Apple, Exidy, Heath,	
1771	26.95	etc.	
1791	37.95	* Includes all parts &	
AY5-1013A	3.95	instructions	
		* 200 NS \$59.	

Please call for dealer or quantity pricing. Minimum order \$20.00
We do custom prom programming.



ESAT 200B

BI-LINGUAL 80x24
COMMUNICATING
TERMINAL

Scrolling, full cursor, bell, 8x8 matrix, 110- 19,200 baud, Dual Front Applications. Arabic & Hebrew, Multilingual Data Entry Forms Drawing, Music, & Switchyards. \$279.

DIGITAL MULTIMETERS

Sinclair PDM35 Reg. \$69.95
Hickok LX303 Reg. \$69.50

BK PRECISION 3 1/2-Digit Portable DMM Model 2800 Reg. \$49.95

Beckman TECH310 Reg. \$130.

MURAPHONE

Cordless Telephone System Reg. \$89.95
\$74.95

GTE Flip-Phone Reg. \$37.95

Portable VOM Multitester

Model \$1995
 Reg. \$150.00

20 K Ω VDC • 10 K Ω VAC

HICKOK

Digital CB In-Line Tester Model 388 Reg. \$399.00
\$169.95

100 MHz 8-Digit Counter

20 Hz to 100 MHz range • LED display • Fully automatic
 Model MAX100 Reg. \$150.00
\$127.50

Logic Monitor

Automatically displays static and dynamic logic • Model LM-1 Works with DTL, TTL, and CMOS • 16 LED display
 Reg. \$349.95
\$59.95

6" x 9" 3-Way Speaker

20 oz. ceramic magnet
 Model BP2000-69TR
\$149.95 ea.

CODE-A-PHONE

FREE 8 pc. Tool Set (value \$14.95) with \$200.00 purchase from this ad.

Portable Oscilloscopes

15 MHz Dual Trace Triggered Miniscope Model MS-215 Reg. \$435.00
\$369.95

15 MHz Triggered Miniscope Model MS-15 Reg. \$319.00
\$269.95

30 MHz Dual Trace Triggered Miniscope Model MS-230 Reg. \$559.00
\$479.95

Function Generator

Model 2001 Reg. \$185.50
\$157.95

Sine-, square-, triangle- and separate TTL square wave output • Frequency range: 1Hz-100kHz

Attache Style Tool Case

Model TC100-ST Reg. \$471
\$279.95

Service Master Tool Kit

Model 99-SM Reg. \$69.95
\$47.50

Weller Xcelite

Model WTCN Reg. \$77.50
\$49.95

Portable Digital Capacitance Meter

Model 820 Reg. \$190.00
\$170

Measures capacitance from 0.1pF to 1 Farad • Resolves to 0.1pF • 10 ranges for accuracy and resolution • 4 digit easy-to-read LED display • 0.5% accuracy

Wahl Cordless Soldering Iron

Model 7800 Reg. \$29.95
\$29.95

Thermal-Spot Circuit Tester

Model 5800 Reg. \$29.95
\$29.95

Miniature High Fidelity 3-Way Stereo Speakers

Model HF-9 Reg. \$149.95
\$69.50 PR

In-Dash Car Stereos

8-Track Tape Player with AM/FM/MPX Radio
 Model C-777 Reg. \$52.50
\$52.50

Cassette Tape Player with AM/FM/MPX Radio
 Model CAS-888 Reg. \$57.50
\$57.50

Logic Probe

Compact circuit powered • Detects pulses as short as 50 μ sec • DTL/TTL/CMOS compatibility
 Model LP-1 Reg. \$44.95
\$44.95

RC Circuit Box

36 resistors (15 1/2 to 10 M Ω) • 18 capacitors (100 pF to 0.22 μ F)
 Reg. \$49.95
\$42.

VIZ Model WC 412A

Proto Preassembled Boards

Model PB-104 Reg. \$49.95
\$49.95

Fully assembled breadboard contains four 0T-59S sockets, seven 0T-59B bus strips and four 5-way binding posts

Proto Board with Built-in Power Supplies

Model PB-203A Reg. \$154.95
\$129.95

Regulated • Short-proof

30 MHz LEADER Dual Trace with Delay Line

Model LBO-520 Reg. \$899.95
\$899.95

DIGITAL MULTIMETER Simpson 461

Complete with nickel-cadmium batteries, AC charger/adaptor, test leads
 Reg. \$149.95
\$149.95

BSR X-10 Remote Control for Lights & Appliances

4 pc. Standard Starter Kit • One (1) Standard Command Reg. \$87.95
 Console • Two (2) Lamp Modules • One (1) Appliance Module
 Model \$79.50
\$79.50

5 pc. Ultrasonic Starter Kit • One (1) Deluxe Ultrasonic Command Console • One (1) Hand Held Remote • Two (2) Lamp Modules • One (1) Appliance Unit
 Reg. \$112.95
\$99.95

Lamp Modules: \$14.50 Standard Command Console: \$36.00
 Appliance Modules: \$14.50 Ultrasonic Command Console: \$59.95
 Wall Switch Modules: \$14.50 with Hand Held Remote

3 1/2-Digit 0.1% Digital Capacitance Meter Model 3001

9 ranges from 1999 pF to 199.9 μ F • 0.1% of reading accuracy
 Reg. \$190.00
\$170

Stereo Power Booster

Model POW-40 Reg. \$24.95
\$24.95

40W stereo

Chess Challenger 7

Reg. \$110.00
\$79.95

Model BBC

Magnifier Lamp

Precision ground and polished magnification lens
 Model MG10A Reg. \$49.95
\$49.95

Weller Controlled Output Soldering Station

Model WTCN Reg. \$77.50
\$49.95

30 MHz LEADER Dual Trace with Delay Line

Model LBO-520 Reg. \$899.95
\$899.95

BK PRECISION 30 MHz Portable Frequency Counter

Reg. \$130.00
\$65.

Model 1827

Thermal-Spot Circuit Tester

Model 5800 Reg. \$29.95
\$29.95

FREE

8 pc. Tool Set (value \$14.95) with \$200.00 purchase from this ad.

C/MOS (DIODE CLAMPED)

4001	-22	4023	-22	4066	-70	74C83	-1.30
4002	-22	4024	-75	4069	-45	74C86	-1.30
4006	-110	4025	-22	4071	-20	74C83	-3.95
4007	-22	4027	-45	4072	-25	74C151	-1.75
4008	-45	4028	-80	4081	-22	74C157	-1.75
4010	-45	4029	-80	4093	-55	74C160	-1.30
4011	-22	4030	-35	4516	-100	74C161	-1.15
4012	-22	4034	-2.25	4518	-1.20	74C163	-1.10
4013	-40	4035	-97	4520	-1.00	74C165	-1.35
4014	-1.20	4040	-1.00	74C00	-27	74C173	-1.30
4015	-1.00	4042	-85	74C02	-27	74C174	-1.30
4016	-45	4045	-45	74C08	-30	74C175	-1.30
4017	-1.05	4046	-1.95	74C10	-27	74C182	-1.30
4018	-30	4048	-75	74C14	-1.20	74C183	-1.40
4019	-45	4050	-45	74C20	-27	74C303	-1.50
4020	-1.10	4051	-1.10	74C24	-90	74C302	-1.50
4021	-1.10	4052	-1.10	74C27	-75	74C314	-1.90
4022	-1.00	4053	-1.10	74C74	-50		

PRINTED CIRCUIT BOARD

4" x 6" DOUBLE SIDED EPOXY BOARD 1/16" thick
 6.60 ea. • 5/82.60

EPOXY glass vector board
 1/16" thick with 1/10" spacing • \$1.95

74S00	-30	74S15	-40	74S151	-1.25
74S02	-30	74S32	-40	74S157	-1.25
74S08	-40	74S86	-65	74S158	-1.25
74S11	-35	74S112	-85	74S174	-1.40

7 WATT LD-65 LASER DIODE IR \$8.95

25 watt Infra Red Pulse (SG 2006 equiv.)
 Laser Diode (Spec sheet included) \$24.95

MINIATURE MULTI-TURN TRIM POTS

100K, 5K, 10K, 20K, 250K, 1 Meg, \$.75 each • 3/2.00

2N3820 P FET	45
2N5457 N FET	45
2N2646 UJT	45
ER 900 TRIGGER DIODES	4/81.00
2N 6028 PROG. UJT	65

FP 100 PHOTO TRANS.

RED, YELLOW, GREEN LARGE LED's 2" • 6/81.00

TTL-118 OPTO ISOLATOR

RED/GREEN BIPOLOAR LED's 2" • 95

MCT-6 OPTO ISOLATOR

1 WATT ZENERS: 3.3, 4.7, 5.1, 5.6, 9.1, 10, 12, 15, 18, or 22V • 6/81.00

TTL REED RELAY - SPST 5V 20ma \$1.00

TRANSISTOR SPECIALS

2N6233 NPN SWITCHING POWER	\$1.95
2N6304 C.B.F. RF Transistor NPN	\$.75
2N3772 NPN Si TO-3	\$1.00
2N4908 PNP Si TO-3	\$1.00
2N5085 PNP Si TO-3	\$1.00
2N3737 NPN Si RF	\$1.00
2N3919 NPN Si TO-3 RF	\$1.50
2N4120 NPN Si TO-3	\$1.00
2N3767 NPN Si TO-66	\$.70
2N2222 NPN Si TO-18	\$1.00
2N3005 NPN Si TO-3	\$.60
2N3004 NPN Si TO-92	\$1.00
2N3906 PNP Si TO-92	\$1.00
2N5206 NPN Si TO-220	\$.55
2N1546 PNP GERM TO-3	\$.95
2N1309 PNP 6B TO-5	\$.40

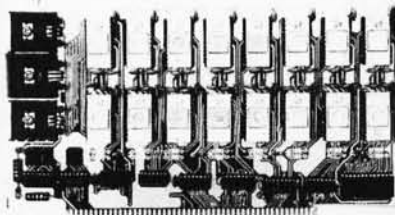
TTL IC SERIES

7400	-17	7448	-75	74155	-75
7401	-17	7450	-17	74157	-65
7402	-17	7472	-35	74163	-85
7403	-17	7473	-35	74164	-85
7404	-24	7474	-42	74165	-85
7405	-24	7475	-49	74167	-1.35
7406	-35	7476	-45	74168	-1.00
7407	-35	7480	-45	74170	-1.60
7408	-27	7483	-60	74171	-1.35
7409	-44	7485	-75	74172	-1.30
7410	-17	7486	-42	74173	-1.80
7411	-22	7489	-1.60	74174	-85
7412	-22	7490	-50	74175	-75
7413	-42	7491	-55	74176	-75
7414	-90	7492	-50	74177	-75
7415	-33	7493	-50	74178	-75
7416	-33	7494	-60	74179	-75
7417	-37	7495	-60	74180	-1.20
7418	-37	7496	-60	74181	-1.20
7419	-37	7497	-60	74182	-1.20
7420	-37	7498	-60	74183	-1.20
7421	-37	7499	-60	74184	-1.20
7422	-37	7500	-60	74185	-1.20
7423	-37	7501	-60	74186	-1.20
7424	-37	7502	-60	74187	-1.20
7425	-37	7503	-60	74188	-1.20
7426	-37	7504	-60	74189	-1.20
7427	-37	7505	-60	74190	-1.20
7428	-37	7506	-60	74191	-1.20
7429	-37	7507	-60	74192	-1.20
7430	-37	7508	-60	74193	-1.20
7431	-37	7509	-60	74194	-1.20
7432	-37	7510	-60	74195	-1.20
7433	-37	7511	-60	74196	-1.20
7434	-37	7512	-60	74197	-1.20
7435	-37	7513	-60	74198	-1.20
7436	-37	7514	-60	74199	-1.20
7437	-37	7515	-60	74200	-1.20
7438	-37	7516	-60	74201	-1.20
7439	-37	7517	-60	74202	-1.20
7440	-37	7518	-60	74203	-1.20
7441	-37	7519	-60	74204	-1.20
7442	-37	7520	-60	74205	-1.20
7443	-37	7521	-60	74206	-1.20
7444	-37	7522	-60	74207	-1.20
7445	-37	7523	-60	74208	-1.20
7446	-37	7524	-60	74209	-1.20
7447	-37	7525	-60	74210	-1.20
7448	-37	7526	-60	74211	-1.20
7449	-37	7527	-60	74212	-1.20
7450	-37	7528	-60	74213	-1.20
7451	-37	7529	-60	74214	-1.20
7452	-37	7530	-60	74215	-1.20
7453	-37	7531	-60	74216	-1.20
7454	-37	7532	-60	74217	-1.20
7455	-37	7533	-60	74218	-1.20
7456	-37	7534	-60	74219	-1.20
7457	-37	7535	-60	74220	-1.20
7458	-37	7536	-60	74221	-1.20
7459	-37	7537	-60	74222	-1.20
7460	-37	7538	-60	74223	-1.20
7461	-37	7539	-60	74224	-1.20
7462	-37	7540	-60	74225	-1.20
7463	-37	7541	-60	74226	-1.20
7464	-37	7542	-60	74227	-1.20
7465	-37	7543	-60	74228	-1.20
7466	-37	7544	-60	74229	-1.20
7467	-37	7545	-60	74230	-1.20
7468	-37	7546	-60	74231	-1.20
7469	-37	7547	-60	74232	-1.20
7470	-37	7548	-60	74233	-1.20
7471	-37	7549	-60	74234	-1.20
7472	-37	7550	-60	74235	-1.20
7473	-37	7551	-60	74236	-1.20
7474	-37	7552	-60	74237	-1.20
7475	-37	7553	-60	74238	-1.20
7476	-37	7554	-60	74239	-1.20
7477	-37	7555	-60	74240	-1.20
7478	-37	7556	-60	74241	-1.20
7479	-37	7557	-60	74242	-1.20
7480	-37	7558	-60	74243	-1.20
7481	-37	7559	-60	74244	-1.20
7482	-37	7560	-60	74245	-1.20
7483	-37	7561	-60	74246	-1.20
7484	-37	7562	-60	74247	-1.20
7485	-37	7563	-60	74248	-1.20
7486	-37	7564	-60	74249	-1.20
7487	-37	7565	-60	74250	-1.20
7488	-37	7566	-60	74251	-1.20
7489	-37	7567	-60	74252	-1.20
7490	-37	7568	-60	74253	-1.20
7491	-37	7569	-60	74254	-1.20
7492	-37	7570	-60	74255	-1.20
7493	-37	7571	-60	74256	-1.20
7494	-37	7572	-60	74257	-1.20
7495	-37	7573	-60	74258	-1.20
7496	-37	7574	-60	74259	-1.20
7497	-37	7575	-60	74260	-1.20
7498	-37	7576	-60	74261	-1.20
7499	-37	7577	-60	74262	-1.20
7500	-37	7578	-60	74263	-1.20
7501	-37	7579	-60	74264	-1.20
7502	-37	7580	-60	74265	-1.20
7503	-37	7581	-60	74266	-1.20
7504	-37	7582	-60	74267	-1.20
7505	-37	7583	-60	74268	-1.20
7506	-37	7584	-60	74269	-1.20
7507	-37	7585	-60	74270	-1.20
7508	-37	7586	-60	74271	-1.20
7509	-37	7587	-60	74272	-1.20
7510	-37	7588	-60	74273	-1.20
7511	-37	7589	-60	74274	-1.20
7512	-37	7590	-60	74275	-1.20
7513	-37	7591	-60	74276	-1.20
7514	-37	7592	-60	74277	-1.20
7515	-37	7593	-60	74278	-1.20
7516	-37	7594	-60	74279	-1.20
7517	-37	7595	-60	74280	-1.20
7518	-37	7596	-60	74281	-1.20
7519	-37	7597	-60	74282	-1.20
7520	-37	7598	-60	74283	-1.20
7521	-37	7599	-60	74284	-1.20
7522	-37	7600	-60	74285	-1.20
7523	-37	7601	-60	74286	-1.20
7524	-37	7602	-60	74287	-1.20
7525	-37	7603	-60	74288	-1.20
7526	-37	7604	-60	74289	-1.20
7527	-37	7605	-60	74290	-1.20
7528	-37	7606	-60	74291	-1.20
7529	-37	7607	-60	74292	-1.20
7530	-37	7608	-60	74293	-1.20
7531	-37	7609	-60	74294	-1.20
7532	-37	7610	-60	74295	-1.20
7533	-37	7611	-60	74296	-1.20
7534	-37	7612	-60	74297	-1.20
7535	-37	7613	-60	74298	-1.20
7536	-37	7614	-60	74299	-1.20
7537	-37	7615	-60	74300	-1.20
7538	-37	7616	-60	74301	-1.20
7539	-37	7617	-60	74302	-1.20
7540	-37	7618	-60	74303	-1.20
7541	-37	7619	-60	74304	-1.20
7542	-37	7620	-60	74305	-1.20
7543	-37	7621	-60	74306	-1.20
7544	-37	7622	-60	74307	-1.20
7545	-37	7623	-60	74308	-1.20
7546	-37	7624	-60	74309	-1.20
7547	-37	7625	-60	74310	-1.20
7548	-37	7626	-60	74311	-1.20
7549	-37	7627	-60	74312	-1.20
7550	-37	7628	-60	74313	-1.20
7551	-37	7629	-60	74314	-1.20
7552	-37	7630	-60	74315	-1.20
7553	-37	7631	-60	74316	-1.20
7554	-37	7632	-60	74317	-1.20
7555	-37	7633	-60	74318	-1.20
7556	-37	7634	-60	74319	-1.20
7557	-37	7635	-60	74320	-1.20
7558	-37	7636	-60	74321	-1.20
7559	-37	7637	-60	74322	-1.20
7560	-37	7638	-60	74323	-1.20
7561	-37	7639	-60	74324	-1.20
7562	-37	7640	-60	74325	-1.20
7563	-37	7641	-60	74326	-1.20
7564	-37	7642	-60	74327	-1.20
7565	-37	7643	-60	74328	-1.20
7566	-37	7644	-60	74329	-1.20
7567	-37	7645	-60	74330	-1.20
7568	-37	7646	-60	74331	-1.20
7569	-37	7647	-60	74332	-1.20
7570	-37	7648	-60	74333	-1.20
7571	-37	7649	-60	74334	-1.20
7572	-37	7650	-60	74335	-1.20
7573	-37	7651	-60	74336	-1.20
7574	-37	7652	-60	74337	-1.20
7575	-37	7653	-60	74338	-1.20
7576	-37	7654	-60	74339	-1.20
7577	-37	7655	-60	74340	-1.20
7578	-37	7656	-60	74341	-1.20
7579	-37	7657	-60	74342	-1.20
7580	-37	7658	-60	74343	-1.20
7581	-37	7659	-60	74344	-1.20
7582	-37	7660	-60	74345	-1.20
7583	-37	7661	-60	74346	-1.20
7584	-37	7662	-60	74347	-1.20
7585	-37	7663	-60	74348	-1.20
7586	-37	7664	-60	74349	-1.20
7587	-37	7665	-60	74350	-1.20
7588	-37	7666	-60	74351	-1.20
7589	-37	7667	-60	74352	-1.20
7590	-37	7668	-60	74353	-1.20
7591	-37	7669	-60	74354	-1.20
7592	-37	7670	-60	74355	-1.20
7593	-37	7671	-60	74356	-1.20
7594	-37	7672	-60	74357	-1.20
7595	-37	7673	-60	74358	-1.20
7596	-37	7674	-60	74359	-1.20
7597	-37	7675	-60	74360	-1.20
7598	-37	7676	-60	74361	-1.20
7599	-37	7677	-60	74362	-1.20
7600	-37	7678	-60	74363	-1.20
7601	-37	7679	-60	74364	-1.20
7602	-37	7680	-60	74365	-1.20
7603	-37	7681	-60	74366	-1.20
7604	-37	7682	-60	74367	-1.20
7605	-37	7683	-60	74368	-1.20
7606	-37	7684	-60	74369	-1.20
7607	-37	7685	-60	74370	-1.20
7608	-37	7686	-60	74371	-1.20
7609	-37	7687	-60	74372	-1.20
7610	-37	7688	-60	74373	-1.20
7611	-37	7689	-60	74374	-1.20
7612	-37	7690	-60	74375	-1.20
7613	-37	7691	-60	74376	-1.20
7614	-37	7692	-60	74377	-1.20
7615	-37	7693	-60	74378	-1.20
7616					

DIGITAL RESEARCH COMPUTERS

(214) 494-1505

16K EPROM CARD-S 100 BUSS



\$59.95
KIT

FIRST TIME OFFERED!
BLANK PC BOARD - \$28

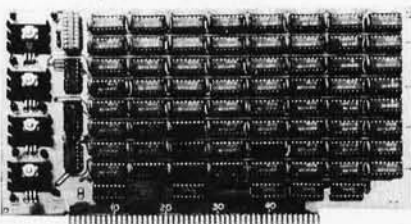
USES 2708's!

Thousands of personal and business systems around the world use this board with complete satisfaction. Puts 16K of software on line at **ALL TIMES!** Kit features a top quality soldermasked and silk-screened PC board and first run parts and sockets. Any number of EPROM locations may be disabled to avoid any memory conflicts. Fully buffered and has WAIT STATE capabilities.

OUR 450 NS 2708'S
ARE \$8.95 EA. WITH
PURCHASE OF KIT

ASSEMBLED
AND FULLY TESTED
ADD \$30

8K LOW POWER RAM KIT-S 100 BUSS SALE



PRICE
CUT!

\$119⁵⁰
KIT

21L02
(450 NS RAMS!)

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

Blank PC Board w/Documentation
\$29.95

Low Profile Socket Set...\$13.50

Support IC's (TTL & Regulators)
\$9.75

Bypass CAP's (Disc & Tantalums)
\$4.50

ASSEMBLED AND FULLY
BURNED IN ADD \$35

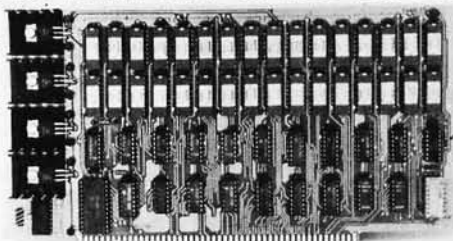
ALL ASSEMBLED BOARDS
ARE TESTED AT 4MHZ.

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

\$225 KIT

FOR 4MHZ
ADD \$10



KIT FEATURES:

1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 1.5 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA-\$33

LOW PROFILE SOCKET SET-\$12

SUPPORT IC'S & CAPS-\$19.95

ASSEMBLED & TESTED-ADD \$35

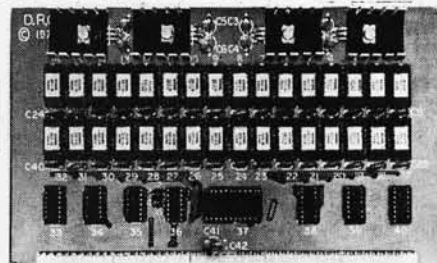
OUR #1 SELLING
RAM BOARD!

16K STATIC RAM SS-50 BUSS

PRICE CUT!

\$229 KIT

FULLY STATIC
AT DYNAMIC
PRICES



FOR SWTPC
6800 BUSS!

ASSEMBLED AND
TESTED - \$35

KIT FEATURES:

1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Runs at Full Speed
4. Double sided PC Board. Solder mask and silk screened layout. Gold fingers
5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

BLANK PC BOARD-\$26

COMPLETE SOCKET SET-\$12

SUPPORT IC'S AND CAPS-\$19.95

NEW! STEREO! S-100 SOUND COMPUTER BOARD NEW!

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

KIT FEATURES:

- * TWO GI SOUND COMPUTER IC'S.
- * FOUR PARALLEL I/O PORTS ON BOARD.
- * USES ON BOARD AUDIO AMPS OR YOUR STEREO.
- * ON BOARD PROTO TYPING AREA.
- * ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED.
- * PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
- * EASY, QUICK, AND FUN TO BUILD. WITH FULL INSTRUCTIONS.
- * USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY.

Both Basic and Assembly Language Programming examples are included.

SOFTWARE:

SCL Interpreter coming soon! Our new Sound Command Language Interpreter along with the Register Examine/Modify (REM) routines and Sound Effects Library (SEL) will be available soon in EPROM. SCL makes sound effects programming generally easier and quicker than that written in Basic or Assembly Language. An SCL users group will be formed, and the best new SCL programs submitted will be added to the Sound Effects Library in EPROM.

COMPLETE KIT!

\$84⁹⁵

(WITH DATA MANUAL)

BLANK PC
BOARD W/DATA
\$31

FOR 4MHZ **SALE!** LOW POWER - 300NS
2114 RAM SALE!

8 FOR
\$44

4K STATIC RAM'S. MAJOR BRAND, NEW PARTS.
These are the most sought after 2114's, LOW POWER and 300NS FAST.
8 FOR \$44

Digital Research Computers
(OF TEXAS)

P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 494-1505

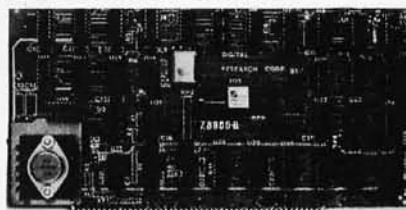
S-100 Z80 CPU CARD

Perfect for
OEM's

\$169⁹⁵

WIRED!
NOT A KIT!

4 MHZ



ASSEMBLED AND TESTED! READY TO USE! Over 3 years of design efforts were required to produce a **TRUE S-100 Z80 CPU** at a genuinely bargain price!

BRAND NEW!

FEATURES:

- * 2 or 4 MHZ Operation. * Generates MWRITE, so no front panel required.
- * Jump on reset capability. * 8080 Signals emulated for S-100 compatibility.
- * Top Quality PCB. Silk Screened. Solder Masked. Gold Plated Contact Fingers

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control. 16 Bit Envelope Period Control, 2-8 Bit Parallel I/O. 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy to interface to the S-100 or other busses.

SPECIAL OFFER: \$14.95 each Add \$3 for 60 page Data Manual.

TERMS: Add \$1.00 postage, we pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. 90 Day Money Back Guarantee on all items. Orders over \$50. add 85¢ for insurance.

NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.

SEX IS NO SUBSTITUTE

For quality software from the Software Review. This month's offerings:

SOFTWARE MUSIC SYNTHESIS SYSTEM — From California Software, this superb 4 voice synthesizer for 8080/Z-80 systems proves that software can do anything hardware can do and it can do it cheaper.
For all CP/M & N-DOS systems \$79.95
OSBORNE CBASIC BUSINESS PROGRAMS — Complete set (A/R, A/P, G/L, Payroll) in most formats (Documentation separate) . . . \$100.00
QUIK-REF — Definitive Northstar Basic Cross-Reference/Branch trace program. Machine coded for extreme speed \$21.50
DOS-POWER SYS/II — Machine code module provides additional Northstar DOS capabilities including on-line file recovery, rename, file-locking, directory reformatting, and more \$21.50
WORDSTAR — from Micropro. Super word processor Reg. \$500. Special offer \$400
KELLY CARD GAMES — Classic algorithms, STUD, DRAW, ACEY-DUCEY, BLACKJACK
Northstar only \$21.50
SUPER PILOT 4.1 — Acclaimed as the finest Pilot available. Includes tutorials on disk. For Northstar users only \$49.95

ORDER FROM

The Software Review —
704 Solano Ave., Albany, CA 94706
(415) 527-7730

Circle 310 on inquiry card.

J & B Computer Products

We:

Buy — Sell — Trade — Broker,
Mini To Mainframe Computers,
Components to Complete Systems.

We Specialize in Basic Four™

We Supply:

Disc Packs and Cartridges.
Also: Formatted B/4™ Compatible
Packs-BBII

We Supply:

Standard and Custom Cable
We Will Be Pleased To Quote
Your Specs.

Dealer Inquiries Are Invited

J & B Computer Products

P.O. Box 3089 Simi Valley, Calif. 93063
Phone Number Available After
Responsible Requests.

Circle 311 on inquiry card.

GAMES

—FOR—

MICROPOLIS MOD II

At last, software written for MICROPOLIS MOD II using MBASIC operating under MDOS. All games are delivered on a 5¼" floppy disk and include player instructions. M-VENTURE is based on Adventure found on large computer systems. The M-GAMES floppy disk contains 12 of the most popular computer games, including STARTREK. Both M-VENTURE and M-GAMES are available on a single floppy disk, M-BOTH.

- M-VENTURE \$19.95
- M-GAMES \$19.95
(Includes STARTREK)
- M-BOTH \$29.95
(Includes M-VENTURE & M-GAMES)

(California residents add 6% sales tax.)

M-SOFTWARE

21215 Merridy Street
Chatsworth, CA 91311

Circle 312 on inquiry card.



SPRINT 68 MICROCOMPUTER CONTROL COMPUTER DEVELOPMENT SYSTEM

6800 MPU, serial I/O, 48K RAM, dual 8" drives, WIZRD multitasking DOS, Editor, Assembler, 12K BASIC all for \$3995.

SOFTWARE OPTIONS

C compiler, PL/W compiler, PASCAL

HARDWARE OPTIONS

EROM Programmer, analog I/O, parallel I/O, 488 GPIB



1801 South Street
Lafayette, IN 47904
Phone: (317) 742-8428

Circle 313 on inquiry card.

JINSAM™ Data Manager

- ★ CUSTOM DATA FILES
- ★ FAST/EASY/MENU DRIVEN
- ★ HELP COMMANDS
- ★ KEYED RANDOM ACCESS
- ★ MULTIPLE SEARCH KEYS
- ★ PRIVACY ACCESS CODES
- ★ WILD CARD SEARCH

For 16K-32K PET, Dual Disk, and Printer

FREE: LABEL PRINTER MODULE

FREE: REPORT GENERATOR MODULE

Specify CBM 2040 or COMPU/THINK

Package \$150

User's Guide only \$25

Introductory

Demo Tape \$5 Disk \$ 8

Check or Money Order plus \$2 Shipping
(NY residents add 8% Sales Tax)

* - DEALER INQUIRIES WELCOMED -

JINI MICRO-SYSTEMS, Inc.

P.O. Box 274-B • Bronx, NY 10463

Circle 314 on inquiry card.

HOW CAN I GROW B TREES?

ORDER MICRO B+™

- Get fast insertion, retrieval and deletion of index entries.
- Never need to reorganize your index; no matter how often it is updated.

MICRO B+ SOURCE CODE \$195

MICRO B+ DEMO DISK \$25

SHIPPING \$2 USA. \$5 FOREIGN

Available in 8" format for CBASIC-II
and MICROSOFT Basic Version 5.

FAIR COM

2606 Johnson Drive
Columbia, Mo. 65201
314-445-3304

Check/VISA/Mastercharge

Circle 315 on inquiry card.

PROPERTY MANAGEMENT SOFTWARE

- Full General Ledger
 - user chart of accounts
 - customized statements
- Checkwriter (or manual checks)
- Budgeting
- Delinquency List
- Lost Rent Report
- Lease Expiration Report
- Real Estate Support
 - income property analysis
 - loan amortizations
 - depreciation

Compatible with CP/M, TRS-80, Apple and PET. Demonstration diskette/manual \$35.00, full system \$650, dealer inquiries welcome. COD, VISA and MasterCard welcome.

A-T Enterprises

221 N. Lois, La Habra
CA 90631 • 213-947-2762

Circle 316 on inquiry card.

CARD FAMILY



FOR EXORCISOR*/
MICROMODULE* BUS:

MIKUL 68000 CPU CARD

Motorola 8 MHz 16 bit processor
4 channel DMA . . . PTM . . . ACIA
7 vectored interrupts

MIKUL 68001 MEMORY CARD

6/12K x 16 PROM . . . 16/32/48K x 16 RAM
68000 a-syn cycle support
*Motorola TM

ALSO

6809 cards and custom design
TL Industries, Inc., 2573 Tracy Road
Northwood, OH 43619, 419-666-8144
16-BIT CARD FAMILY

Circle 317 on inquiry card.

Quick Service
Competitive Pricing

WABASH

MAXI-MYTE
DISKETTES
CONTINUOUS
LABELS

STOCK & CUSTOM
COMPUTER FORMS

COMPUTER RIBBONS
FREE CATALOG
AVAILABLE

GEM Business Systems, Ltd.

60 East 42nd Street
New York, N. Y. 10017

(212) 682-9005

Circle 318 on inquiry card.



FREE! Up to \$170 in merchandise with purchase of one of following PET-CBM items !!!

Axiom EX-801 PET Printer (with graphics)	\$ 475.00
Axiom EX-820 PET Plotter	\$ 749.00
Anderson Jacobson 841 Selectric	\$1015.00
Leedex Video 100 12" Monitor	\$ 119.00
Heath WH19 Terminal (factory asm.)	\$ 770.00
Heath WH14 Printer (factory asm.)	\$ 735.00
IEEE-RS 232 Printer Adaptor for PET	\$ 88.00

BETSI PET to S-100 Interface	\$ 119.00
PET Connectors-Parallel or IEEE	\$ 1.95
Cassette Port	\$ 1.45
Hands on Basic with a PET	\$ 10.15
Programming the 6502 (Zaks)	\$ 10.45
6502 Applications Book (Zaks)	\$ 10.45
6500 Manuals (MOS Technology)	\$ 6.50
Programming a Microcomputer: 6502	\$ 7.75
6502 Assembly Language (Osborne) NEW!	\$ 9.90

PET SPECIALS

***FREE**

PET 16N 16K full size graphics keyboard	\$ 995	\$130
PET 16B 16K full size business keyboard	\$ 995	\$130
PET 32N 32K full size graphics keyboard	\$1295	\$170
PET 32B 32K full size business keyboard	\$1295	\$170
PET 8N 8K full size graphics keyboard	\$ 795	\$100
PET 2040 DUAL DISK DRIVE-343,000 bytes	\$1295	\$170
PET 2022 Tractor Feed Printer	\$ 795	\$100
PET 2023 Pressure Feed Printer	\$ 695	\$ 70
PET C2N External Cassette Deck	\$ 95	\$ 12
Used 8K PETs (limited quantities)	\$ 495	

★ EDUCATIONAL DISCOUNTS ★

Buy 2 PET Computers, get 1 FREE

*Free Merchandise with Purchase of PET-CBM Item.

KIM-1 \$159 (add \$30 for power supply) SYM-1	\$209
BAS-1 Microsoft ROM Basic for SYM	\$ 85
Memory Plus (KIM, SYM, AIM)	\$195
SYM Assembler in ROM	\$ 85
KIM 16K Static RAM	\$284
Seawell Motherboard - 4K RAM Space	\$139
KTM-2/80 Synertek Video Board	\$349
S-100 16K Static RAM Kit	SALE \$198
TIS PET Workbooks - set of 6	\$ 21.50
Dust Cover for PET	\$ 7.45

All Book and Software Prices are Discounted
 PET Personal Computer Guide (Osborne) ... \$ 12.75
 PET and the IEEE-488 Bus (Osborne) ... \$ 12.75
 6502 Software Cookbook (Sclbi) ... \$ 9.45

Cassettes (all tapes guaranteed) AGFA PE611
 Premium quality, high out put low noise in 5 screw housing with labels:

C-10	10/5.65	50/25.00	100/48.00
C-30	10/6.90	50/30.00	100/57.00

2716 EPROM (5 volt)	\$29.00	5 @ 27.00	10 @ 25.00
4116 RAM 16K x 1	\$7.50	8 @ 7.10	
2114 L 450	\$5.35	20 @ 4.95	80 @ 4.45
2114 L 300	\$6.10	20 @ 5.65	80 @ 5.05
6502	\$8.35	10 @ 7.85	40 @ 7.35
6522	\$7.15	10 @ 6.95	40 @ 6.45
6520	\$5.15	10 @ 4.90	40 @ 4.45
6532	\$7.90	10 @ 7.40	40 @ 6.85
6502A	\$9.50		
6504	\$7.95		
21L02	\$.90		
6550 RAM (PET 8K)	\$12.70		
S-100 Wire Wrap	\$2.85	10 @ 2.65	
S-100 Solder Tail	\$2.35	10 @ 2.15	

ATARI - INTRODUCTORY SPECIAL

ATARI 400, Atari 800 and all Atari Modules 20% OFF.

Programmers Toolkit - PET ROM Utilities	\$ 44.90
Sargon II (TRS-80 or Apple) NEW!	\$ 24.90
Microchess for PET (Peter Jennings)	\$ 17.90
Visible Music Monitor (4 Voice) for PET	\$ 29.90
KL-4M 4 Voice Music Board (PET)	\$ 34.90
CmC Word Processor (8K \$25) (16K \$34)	
Adventures by Scott Adams	15% Off

SALE

(write for quantity prices)



Scotch 8" Disks	10/\$31.00
Scotch 5 1/4" Disks	10/\$31.50
Verbatim 5 1/4" Disks	10/\$26.50
Diskette Storage Pages	10/\$ 3.95
Disk Library Cases 8" - \$2.95	5" - \$2.15
BASF 5 1/4" Disks	10/\$28.00
BASF 8" Disks	10/\$29.00



MINIMAX by COMPU/THINK

MINIMAX I (8 Megabyte Disks) \$3395

MINIMAX II (2.4 Megabyte Disks) \$4495

SPECIAL - MINIMAX prices include Compu/Think PAGEMATE Database and Report Writer at no charge.

115 E. Stump Road
Montgomeryville, PA 18936

(215) 699-8386
699-5826

A B Computers

WRITE FOR COMPLETE CATALOG

Add \$1.00 per order for shipping.
We pay balance of UPS surface charges on all prepaid orders.

DAL - COMP MAIL ORDER DIV.

MODEL 550 "BANTUM" CRT



Interactive CRT terminal with high resolution 12" diagonal 24 x 80 display and a 7 x 10 character matrix. All 128 ASCII characters, highlighted numeric pad, RS-232C interface with eleven switchable baud rates (110 to 9600). Inverse video and transparent modes, switchable parity, full or half duplex and stop bits, absolute and relative cursor control from host computer. 115V, 60Hz.

\$799.00

DYNAMIC RAMS

4116-250ns	8 for \$ 59.95
------------	----------------

MICROPROCESSORS

Z80A	\$ 13.95	1702	\$ 4.95
6502	11.95	2708	7.95
8035	19.95	2716-5 Volt	21.95
8080A	4.95	2758	27.95
TMS 9900	29.95	2732	85.00

8080 SUPPORT

8212	\$ 2.50	3 Pos.	\$1.00	6 Pos.	\$1.10
8214	4.50	4 Pos.	1.00	7 Pos.	1.15
8216	2.50	5 Pos.	1.00	8 Pos.	1.20
8224	3.25				
8228	5.95				
8238	6.25				
8243	7.95				
8251	6.95				
8253	19.50				
8255	5.95				
8257	17.95				

USRT

S 2350	\$ 7.95
--------	---------

UARTS

TR 1602 B	\$ 3.95
TR 1863	5.95

DISC CONTROLLER

1771	\$ 26.95	DB25P - Male Plug	\$ 2.95
1791	37.95	DB25S - Female Socket	3.60
		DB25C - Cover	1.50

PROMS

DIP SWITCHES

ZIP DIP II SOCKETS

16 Pin	\$ 5.50
24 Pin	7.50
40 Pin	10.25

MOTHER BOARDS

6 Slot Bare Board	\$22.45
6 Slot Kit	47.45
12 Slot Bare Board	37.45
12 Slot Kit	87.45
18 Slot Bare Board	57.45
18 Slot Kit	127.45

RS-232 CONNECTORS

THE STAR MODEM From Livermore



\$179.00

0 to 300 baud data rate. Compatible with Bell 103 and 113; CCITT. Answer/Originate. Full/Half Duplex. Special self test features.

EPROM ERASER



Compact, durable, quality UV Lamp for erasing EPROM's. Features a special safety lock to prevent accidental exposure. Erases up to four devices (2708, 2716, 2732, 1702A, 5203Q, 5304Q, etc.) simultaneously.
UV-4/20 \$68.95

100% 90 DAY MONEY BACK GUARANTEE ON ALL ITEMS SOLD
SEND \$2.00 for 1980 CATALOG

DAL - COMP MAIL ORDER DIV.

TERMS OF SALE: Cash, checks, money orders, VISA, Master Charge. Minimum order \$10.00. Texas residents add 5% sales tax. Minimum shipping and handling charge \$2.50. COD orders add \$1.15 COD fee. U.S. funds only. D&B rated firms call for open account.

DAL-COMP M/O DIV. 2560 ELECTRONIC LANE, SUITE 108, DALLAS, TEX. 75220 • (214) 350-6895

DEAL #1

Hobby Wire Wrap Starter Package



BW2630 WW Tool	.....	\$19.95
BT30 #30 Bit	.....	3.95
BC1 Batteries & Charger	.....	14.95
*Kit #1 Wire Kit	.....	9.95

Regular Price \$48.80

\$39⁹⁵

*Kit #1 Contains 900 pcs. of precut wire in asst. sizes.

Choose from Red, Blue, White, Black, Green, Orange, Violet, Yellow, or assortment.

DEAL #2

Industrial Wire Wrap Starter Package



BW928BF WW Tool	.....	\$52.95
BT30I #30 Bit & Sleeve	.....	29.50
BC1 Batteries & Charger	.....	14.95
*Kit #3 Wire Kit	.....	32.95

Regular Price ... \$130.35

\$119⁹⁵

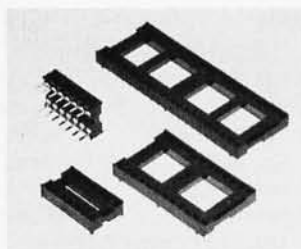
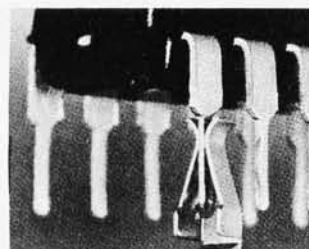
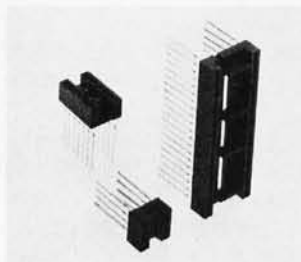
*Kit #2 Contains 4000 pcs. of precut wire in asst. sizes.

Choose from Red, Blue, White, Black, Green, Orange, Violet, Yellow or assortment.

★ ★ BIG DEAL ★ ★

RN IC Sockets by the Tube

RN HIGH RELIABILITY eliminates trouble. "Sidewipe" contacts make 100% greater surface contact with the wide, flat sides of your IC leads for positive electrical connection.



WIRE WRAP SOCKETS

	Size	Quantity/Tube	Price ea.*	Price/Tube
08 pin	52	.39		\$20.28
14	30	.46		\$13.80
3-level Gold	16	.50		\$13.00
Closed Entry	18	.68		\$15.64
Design	20	.85		\$17.85
	22	.42		\$16.56
	24	.94		\$15.95
	28	1.23		\$18.45
	40	1.60		\$16.00

*Sockets sold at these prices by the tube only.

Above prices include gold up to \$800/oz.

SOLDER TAIL

Low Profile Tin
Closed Entry
Design

**1¢/pin
(over 5 tubes)**

**3/4¢/pin
(over 100 tubes)**

*Sockets sold at these prices by the tube only.

See tube quantities above.

ORDERING INFORMATION

- Orders under \$25 include \$2 handling
- All prepaid orders shipped UPS Ppd.
- Visa, MC & COD's charged shipping
- All prices good through cover date
- Most orders shipped next day.

Limited to products Page Digital stocks. All discounts are off of list price.
Call or write for list prices.

10% off on all OK hobby products!
10% off on all Bishop Graphics products!
5% off on all Vector products!

California Digital

Post Office Box 3097 B • Torrance, California 90503

FREE Paper Tiger

With Purchase of The
INTEGRAL DATA 440

Your Choice, \$200 Value

- 1) Graphics Option Package
 - 2) Interface for APPLE II
 - 3) TRS-80 Printer Interface
- California Digital has recently researched the complete low cost printer market. It is our opinion that the IDS440 Paper Tiger is, without doubt, the most versatile and offers the best value of any printer costing under \$1,000.

This quality dot matrix printer incorporates such features as software selectable character size to allow print densities up to 132 characters per line. Full forms handling capabilities and tractor feed mechanism adjustable to 9.5". The Paper Tiger is engineered to accept either parallel or RS232 serial ASCII, 110/220V.50/60Hz.

***** \$995.00 plus shipping *****

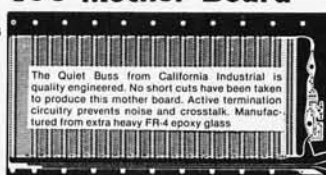


software selectable character size to allow print densities up to 132 characters per line. Full forms handling capabilities and tractor feed mechanism adjustable to 9.5". The Paper Tiger is engineered to accept either parallel or RS232 serial ASCII, 110/220V.50/60Hz.

S-100 Mother Board

Quiet
Buss

\$2995
8803-18
18 slot
IMSAI



The Quiet Buss from California Industrial is quality engineered. No short cuts have been taken to produce this mother board. Active termination circuitry prevents noise and crosstalk. Manufactured from extra heavy FR-4 epoxy glass.

\$149



MOTOROLA

New factory surplus. M3000/3211 Motorola CRT monitors.
20 MHz bandwidth
Electronics terminate into single ten pin (.156") edge connector.
Requires DC power supply

TELETYPE MODEL 43

4320 KEYBOARD

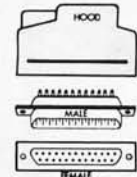
TTL AAA \$1050
RS232.... AAK 1150
Friction... AA 1100
103 Modem AAB 1575



FREE PLASTIC LIBRARY CASE with purchase of each box of Memorex mini-diskettes. \$5 value.

\$24.95
BOX OF 10
DISKETTES

CONNECTORS



RS-232

DB25P male plug & hood

\$395

DB25S female

\$395

Edge Connectors



IMSAI solder 125x.250
IMSAI w/w .125centers
Altair solder 140 row

22/44 Kim eyelet.156" \$1.95 3/\$5.00
25/50 solder tab.156" \$1.09 3/\$2.00
36/72 wide post w/w.156 \$1.95 3/\$5.00

COMPUTERS

Apple II standard 14K 898
Apple Plus 15K 988
Atari 400 450
Atari 800 850
Texas Instruments 99/4 934
Northstar Quad 32K Horizon 2995
Vector 32
CompuColor II Model 3 1395
Rockwell Altair 65 (1K) 375

CMT TERMINALS
ADES Regent 25 ten key pad 850
ADES Regent 40 1195
ADES Regent 60 1495
Hastelite 1425 850
Hastelite 1500 895

PRINTERS

IDS440G Tiger with Graphics 895
P printers P-200 (200 L.P.3X) 6500
Primatone P-600 1150
Teletype Model 43 (RS232) 1150
Teletype Model 43 (110) 1150
NEC Spinwriter 5510 R/O 2505
Texas Instruments 810 1650
Centronics 730 fraction 695
Centronics 775-2 tractor 1915
Centronics 704 395
Analex DP-6000 895
Analex DP-9300 895
Analex DP-9301 895
Disho 1540 R/O plastic wheel 2750
Disho 1540 R/O plastic wheel 3150

MODEMS
Universal Data Systems LP-300 169
Direct coupled V.F.C. Approved 169
powered from phone line, 169
Novation Cat Acoustic 169

DISK DRIVES

Shugart SA800R 8" floppy 440
Shugart SA800R 8" hard sec. 475
Lobo / Two Shugart 801's with power supply and enclosure One Shugart 801 with power supply and enclosure 795
Lobo hard drive for Apple 10 megabyte TT10 395
Lobo hard drive for TRS80 395
Lobo 4004 5 1/4" for TRS80 160
Vista V-89 for TRS80 (40K) 388
Corvus Systems hard drive

APPLE COMPATIBLE PRODUCTS
Apple disk drive with controller 405
Apple Parallel Interface 179
Ten Key Data Pad for Apple 139
Mountain Hardware Superdisk 279
Mountain Intro X-10 for IBM 229
***** Memorex Special *****
8" soft sector diskette (10) 27
8" double density for TRS80 30

S-100 PRODUCTS

Goldbox Rack Enclosure 229
Goldbox Desk Top Enclosure 229
Electronic Controls ECT 100F 230
Cal. Digital 18 size motherboards 30

S-100 BOARDS
Think/Toy Switchboard I/O 219
Goldbox Econorm Protectors 4
Shulin T8-2 Extended 4-Logic 4
Artec WS100 WireWrap Proto 25
50 54K Expander Memory 16 BIT S-100 RGA R105
Cal. Digital CAL-86 653
Ternar 8086 653
Seattle Computers 8086 653
Goldbox 8086/8085 653
Rhaia InterSystems 2-8000
S-100 D.U.S. 139
Cherry Pro ASCII Keybd. 129
Maxitech HLN Keyboard 45
LV Kraser 12-2 45
Super Mod II RF Modulator 38

Authorized Distributor

Scotch Data Products



740-0 IBM soft format. 10 Pak 50+ \$3.50
740-2 Double side soft 65.00 6.00
741-0 Double density 53.00 4.90
743-0 Double/D double 70.00 6.60
740-32 8" Hard sector 39.00 3.50
744-(0)(10)(16) 5 1/4" mini 39.00 3.50
Library case for any above; Add \$3.00
834 A Data Cassette 5.50
DC100 Mini Cartridge 16.00
DC300 Data Cartridge 20.00
920K) Disk Cartridge 89.00

Shugart Associates

SA800-R Floppy Disk Drive

The most cost effective way to store data processing information, when random recall is a prime factor. The SA800 is fully compatible with the IBM 3740 format. Write protect circuitry, low maintenance & Shugart quality.

\$449.50

XEROX 800 WORD PROCESSING KEYBOARD

ASCII ENCODED



This 77 key word processing keyboard was manufactured by Microswitch for use in the Xerox 800 word processing system. The keyboard outputs a seven bit ASCII code along with an eighth bit that allows most keys to be used in dual function as special characters. Extra large "Tab & Return" keys are designed into the layout of the keyboard to emulate the IBM Selectric. 17 illuminated keys serve for special word processing codes. The keyboard is equipped with two thumbwheel switches for defining line width.
Original Xerox acquisition over \$400.00. California Digital USED price only \$49.00. Excellent cond. Documentation included.

MEMORY

TRS-80 \$59
APPLE II 59
16k memory (8) 4116's

Installation is simple. Anyone who has ever changed a spark plug should be able to up-grade his microcomputer. How can California Digital offer these memory up-grade sets at 25% below our competition? Simple, we buy in volume, wholesale to dealers and sell the balance directly to owners of personal micro-systems. These 16K dynamic memory circuits are factory prime and unconditionally guaranteed for one full year. NOW, before you change your mind, pick up the telephone and order your up-grade memory from California Digital. Add \$3 for TRS80 jumpers.

STATIC	1-31	32-99	100-5C	-999	1K+
211L02 450ns.	1.19	.99	.95	.90	.85
211L02 250ns.	1.49	1.39	1.25	*	*
2114 1Kx4 450	5.95	5.50	5.25	4.75	4.50
2114 1Kx4 300	8.95	8.50	8.00	*	*
4044 4Kx4 450	5.95	5.50	5.25	*	*
4044 4Kx4 250	9.95	9.50	9.00	*	*
4045 1Kx4 450	8.95	8.50	8.00	*	*
4045 1Kx4 250	9.95	9.50	9.00	*	*
5257 low pow.	5.95	5.50	5.00	4.80	4.60

SPECIAL CIRCUITS

Z80A 4 MHz.	24.95	AYS-1013A UART	4.95
8080A CPU	9.95	Floppy Disc Controllers	
8085	22.50	WD 1771 single D.	39.95
8086 Intel 16bits	85.00	WD 1781 Double D	65.00
TMS9900 16bits	49.95	WD 1791 D/D 3740	*



EPROMS	1-15	16-63	64+
1702A 2K	4.95	4.50	4.00
2708 8K	9.95	9.50	9.00
2716 5V 16K	29.95	27.50	*
2716 T1	24.88	20.00	*
2532	85.00	*	*



SYSTEM X-10

It's not often that California Digital ventures into the distribution of consumer products, but we have recently come across a product that appears so unique that we just had to add it to our product line. This is the System X-10 manufactured by the X-10 turntable company. This space age system will remotely control any light or appliance in your home or office. Command signals are transmitted from the command console over your existing wiring. From your bed or easy chair you can control up to 16 different electrical devices inside and outside your home. Use the System X-10 to control your stereo, television or any light fixture on the premises.

The modular system is available in the following components:
UltraSonic Master Control Console \$34.95
Battery/Controlled Ultrasonic Controller 19.95
Appliance Module, Lamp Module or Wall Switch 13.95



ACOUSTIC MODEM

The Omnitel model 701 Modem connects the RS-232C serial port of your computer or peripheral device acoustically to your telephone line. Place the telephone handset into cradle of the modem, instantly your computer system has access to the world of digital information. Half and full duplex ability.

\$89
USED



PORTABLE DATA ENTRY SYSTEM

These used data terminals were originally designed for chain store inventory control and order entry systems. The operator enters the inventory control number, merchandise on hand and the unit price. After all pertinent data has been entered into the recorder, the main warehouse is telephoned, the handset is placed in the acoustic coupler and all the recorded information is transmitted back to the master computer. With a little imagination and one of these portable entry systems, you should be able to exchange programs and computer information with associates across the country. All units were removed from service in working condition. Original cost \$2,500. Each system comes complete with:
• Portable Cassette Drive Unit
• Removable Entry Keyboard with LED Display
• Five Gold "U" NiCads
• Acoustical Coupler
• Battery Charger
• DB25 Cable
• Shoulder strap
• Full Documentation

(213)679-9001

All merchandise sold by California Digital is premium grade. Sorry, no COD's. Orders are shipped the same day received. California residents add 6%. Foreign orders add 10%. Orders over \$25, when accompanied by payment, are shipped at our expense. Otherwise, please add \$2.



\$850

Regent 25

Through years of research the ADES Corporation has evolved a low maintenance, extremely durable CRT terminal capable of withstanding an abusive 24 hour duty cycle. The Regent 25 features Intel 8085 microprocessor controlled circuitry along with the Cherry Switch long-life capacitance keyboard. 18 key cursor and numeric pad doubles to allow for user-definable special functions. True descending lower case characters along with a fully addressable cursor makes the Regent 25 the ideal word processing terminal. High-resolution screen is capable of displaying 96 upper and lower case ASCII characters and 20 control codes. This terminal is switch selectable to display six European languages. At \$850 (plus shipping) the Regent 25 offers the best value in today's CRT terminal market. Additional data upon request.

MINIATURE SWITCHES



your choice
\$1.98 10 50 100 1k
\$8.81 .73 .66

SPDT Miniature Toggles

7101 CAK ON-NONE-ON
7107 JBT ON-OFF (MOM. ON)
7108 CK ON (MOM. ON)
7103 CK ON OFF ON
Rotary 3P-4-Pos.
Rotary 3P-6-Pos.
Push B (N.O.) \$3.96ea. 4/\$1

DIP Switch

\$1.29 10 25 100 1k
\$1.19 .109 .97 .83
specify 4 for 8 pos.



DISCOUNT Wire Wrap Center

IC SOCKETS

pin	wire wrap ea. 25	low profile ea. 25	50
8		17	16 15
14	37	36 35	18 17 16
16	38	37 36	19 18 17
24	99	93 85	36 35 34
40	169	155 139	63 60 58

50ft. \$98
KYNAR WIRE
500 1,000 11,000
\$9. \$15. \$105.

\$2995
BW 630
OK HOBBY WRAP-10 wire wrap & strip tool \$545



Circle 322 on Inquiry card.

BYTE May 1980 331

7400

SN7400N	19	SN74123N	59
SN7401N	22	SN74125N	39
SN7402N	22	SN74126N	44
SN7403N	22	SN74128N	59
SN7404N	22	SN74132N	69
SN7405N	23	SN74136N	95
SN7406N	23	SN74139N	95
SN7407N	23	SN74141N	69
SN7408N	26	SN74142N	295
SN7409N	23	SN74143N	295
SN7410N	22	SN74144N	295
SN7411N	29	SN74145N	119
SN7412N	29	SN74147N	195
SN7413N	39	SN74148N	120
SN7414N	59	SN74150N	67
SN7415N	29	SN74151N	67
SN7416N	29	SN74152N	67
SN7417N	29	SN74153N	67
SN7418N	35	SN74154N	119
SN7419N	29	SN74155N	82
SN7420N	29	SN74156N	89
SN7421N	29	SN74157N	69
SN7422N	29	SN74158N	165
SN7423N	29	SN74160N	95
SN7424N	45	SN74161N	95
SN7425N	23	SN74162N	89
SN7426N	29	SN74163N	95
SN7427N	29	SN74164N	97
SN7428N	29	SN74165N	97
SN7429N	29	SN74166N	120
SN7430N	24	SN74167N	195
SN7431N	79	SN74168N	169
SN7432N	57	SN74169N	595
SN7433N	79	SN74173N	79
SN7434N	79	SN74174N	89
SN7435N	79	SN74175N	89
SN7436N	79	SN74176N	85
SN7437N	59	SN74177N	89
SN7438N	79	SN74178N	180
SN7439N	23	SN74180N	75
SN7440N	23	SN74181N	175
SN7441N	23	SN74182N	75
SN7442N	23	SN74184N	95
SN7443N	29	SN74185N	195
SN7444N	23	SN74186N	995
SN7445N	39	SN74188N	390
SN7446N	34	SN74190N	115
SN7447N	39	SN74191N	115
SN7448N	36	SN74192N	85
SN7449N	38	SN74193N	85
SN7450N	36	SN74194N	85
SN7451N	460	SN74195N	85
SN7452N	59	SN74201N	85
SN7453N	110	SN74197N	85
SN7454N	110	SN74198N	139
SN7455N	85	SN74199N	139
SN7456N	65	SN74201N	139
SN7457N	175	SN74203N	105
SN7458N	39	SN74209N	215
SN7459N	65	SN74209N	390
SN7460N	72	SN74209N	390
SN7461N	72	SN74209N	390
SN7462N	72	SN74209N	390
SN7463N	72	SN74209N	390
SN7464N	72	SN74209N	390
SN7465N	72	SN74209N	390
SN7466N	72	SN74209N	390
SN7467N	72	SN74209N	390
SN7468N	72	SN74209N	390
SN7469N	72	SN74209N	390
SN7470N	72	SN74209N	390
SN7471N	72	SN74209N	390
SN7472N	72	SN74209N	390
SN7473N	72	SN74209N	390
SN7474N	72	SN74209N	390
SN7475N	72	SN74209N	390
SN7476N	72	SN74209N	390
SN7477N	72	SN74209N	390
SN7478N	72	SN74209N	390
SN7479N	72	SN74209N	390
SN7480N	72	SN74209N	390
SN7481N	72	SN74209N	390
SN7482N	72	SN74209N	390
SN7483N	72	SN74209N	390
SN7484N	72	SN74209N	390
SN7485N	72	SN74209N	390
SN7486N	72	SN74209N	390
SN7487N	72	SN74209N	390
SN7488N	72	SN74209N	390
SN7489N	72	SN74209N	390
SN7490N	72	SN74209N	390
SN7491N	72	SN74209N	390
SN7492N	72	SN74209N	390
SN7493N	72	SN74209N	390
SN7494N	72	SN74209N	390
SN7495N	72	SN74209N	390
SN7496N	72	SN74209N	390
SN7497N	72	SN74209N	390
SN7498N	72	SN74209N	390
SN7499N	72	SN74209N	390
SN7500N	72	SN74209N	390

74LS00

74LS00N	35	74LS164N	119
74LS01N	28	74LS165N	248
74LS02N	28	74LS166N	189
74LS03N	28	74LS168N	189
74LS04N	39	74LS169N	189
74LS05N	28	74LS170N	199
74LS06N	39	74LS173N	89
74LS07N	39	74LS174N	99
74LS08N	28	74LS175N	99
74LS09N	39	74LS181N	220
74LS10N	39	74LS190N	115
74LS11N	47	74LS191N	115
74LS12N	125	74LS192N	98
74LS13N	39	74LS193N	98
74LS14N	26	74LS194N	115
74LS15N	38	74LS195N	95
74LS16N	38	74LS196N	89
74LS17N	39	74LS197N	89
74LS18N	39	74LS221N	149
74LS19N	39	74LS240N	299
74LS20N	26	74LS241N	249
74LS21N	39	74LS242N	229
74LS22N	79	74LS243N	229
74LS23N	39	74LS244N	295
74LS24N	26	74LS245N	895
74LS25N	79	74LS247N	110
74LS26N	79	74LS248N	110
74LS27N	79	74LS249N	169
74LS28N	26	74LS251N	179
74LS29N	35	74LS253N	98
74LS30N	35	74LS257N	98
74LS31N	45	74LS258N	98
74LS32N	59	74LS259N	295
74LS33N	68	74LS260N	69
74LS34N	45	74LS261N	249
74LS35N	65	74LS266N	59
74LS36N	99	74LS273N	175
74LS37N	119	74LS274N	440
74LS38N	45	74LS279N	59
74LS39N	75	74LS283N	110
74LS40N	75	74LS290N	129
74LS41N	195	74LS293N	195
74LS42N	88	74LS295N	110
74LS43N	98	74LS296N	129
74LS44N	45	74LS324N	175
74LS45N	45	74LS347N	195
74LS46N	49	74LS348N	195
74LS47N	49	74LS352N	165
74LS48N	50	74LS353N	165
74LS49N	50	74LS363N	149
74LS50N	119	74LS365N	99
74LS51N	135	74LS366N	99
74LS52N	89	74LS367N	99
74LS53N	89	74LS368N	99
74LS54N	59	74LS373N	275
74LS55N	59	74LS374N	275
74LS56N	89	74LS375N	69
74LS57N	89	74LS377N	195
74LS58N	195	74LS386N	65
74LS59N	149	74LS386N	195
74LS60N	79	74LS390N	195
74LS61N	249	74LS393N	195
74LS62N	119	74LS396N	170
74LS63N	119	74LS399N	195
74LS64N	295	74LS424N	295
74LS65N	99	74LS424N	175
74LS66N	75	74LS467N	229
74LS67N	98	74LS468N	199
74LS68N	119	74LS468N	199
74LS69N	49	74LS468N	199
74LS70N	98	74LS468N	199
74LS71N	98	74LS468N	199
74LS72N	98	74LS468N	199
74LS73N	98	74LS468N	199
74LS74N	98	74LS468N	199
74LS75N	98	74LS468N	199
74LS76N	98	74LS468N	199
74LS77N	98	74LS468N	199
74LS78N	98	74LS468N	199
74LS79N	98	74LS468N	199
74LS80N	98	74LS468N	199
74LS81N	98	74LS468N	199
74LS82N	98	74LS468N	199
74LS83N	98	74LS468N	199
74LS84N	98	74LS468N	199
74LS85N	98	74LS468N	199
74LS86N	98	74LS468N	199
74LS87N	98	74LS468N	199
74LS88N	98	74LS468N	199
74LS89N	98	74LS468N	199
74LS90N	98	74LS468N	199
74LS91N	98	74LS468N	199
74LS92N	98	74LS468N	199
74LS93N	98	74LS468N	199
74LS94N	98	74LS468N	199
74LS95N	98	74LS468N	199
74LS96N	98	74LS468N	199
74LS97N	98	74LS468N	199
74LS98N	98	74LS468N	199
74LS99N	98	74LS468N	199
7500N	98	74LS468N	199



FLOPPY DISK DRIVES

MPI BS1-51/2, 40 tracks	279.00
Shugart SA400-51/2, 35 tracks	295.00
Shugart B00/801R 8	475.00
Siemens Shugart Compatible Model	
FDD-100-80	429.00
PERCOT Model 277 Dual	1195.00
WANG/SIEMENS 51/2" Drive	290.00
WANG/SIEMENS 282 Dual 51/2"	395.00
WANG/SIEMENS 82	290.00

HICKOK LX303 \$69.95

5% 3 1/2 digit 19 Range DVM, 1/2" LCD displays runs 200 hrs on 1 battery, 10 Meg Ohm Input, 1 yr. guarantee, made in U.S.A., test leads included.

Available Accessories	\$7.50
RC-3 115V AC Adapter	\$7.50
CD-3 Deluxe Padded Vinyl Carrying Case	\$7.50
VP-10 X10 DCM Probe Adapter	\$14.95
Probes 10 X 10 DCM Probe	\$35.00
CS-1 10 Amp Current Shunt	\$14.95

TEXAS INSTRUMENTS INCORPORATED

Calculator Discount Prices

Ti 30 SP	17.95
Ti 50	39.95
Ti 55	35.95
Ti 57	54.95
Ti 58C	97.95
Ti 59	219.95
Ti PC 100C	146.95
Ti 1035	15.95
Ti 1750	19.95
Ti 5025	69.95
Ti 5040	79.95
Ti Data Card	26.95
Ti Data Chron	37.95
Ti Business Analyst II	42.95
Ti Programmer	48.95
Ti MBA	57.95
Ti Business Card	34.95
Ti Speak & Spell	64.95
Ti Datamaster	19.95
Ti Spelling B	27.95
Ti Ltr Professor	12.95
Ti Vowel Power	12.95
Ti Super Stumpers 4, 5, 6	12.95
Ti Super Stumpers 7, 8	12.95

MONITORS

Sanyo 9"	\$169.95
Sanyo 15"	279.00
Lexicon 12" High Resolution, 22 MHz, OEM Model	219.00
Zenith 13" Color Monitor	499.00
MGA 13" Color TV	349.00
VAMP 19" Color Monitor	575.00
VAMP 15" Color Monitor	449.00

TRS-80/APPLE MEMORY EXPANSION KITS

4116's 16K (200/250 ns.) 8 pcs. for \$62.95 w/instructions & jumpers. Call For Volume Pricing

HAZELTINE TERMINALS

Model 1400	\$749.00	Model 1500	\$1085.00
Model 1410	\$825.00	Model 1510	\$1245.00
Model 1420	\$945.00	Model 1520	\$1495.00

Continental Specialties

Model 3001 Digital Capacitance Meter	275.00
Model 333 Tri-Mode Comparator	295.00
Model LM-3 40-channel Logic Monitor	585.00
Model LM-1 Logic Monitor	60.00
Model LM-2 Logic Monitor	147.00
Model 2001 Sweepable Function Generator	186.00
Model 5001 Universal Counter-Timer	360.00
Model 6001 650 MHz Frequency Counter	385.00
MAX-100 100 MHz Portable Frequency Counter	149.00
PS-500 500 MHz Decade Prescaler	70.00
MAX-50 50 MHz Handheld Frequency Counter	71.00
MAX-550 550 MHz Handheld Frequency Counter	165.00
Model 4001 Pulse Generator	835.00
Model 0P-1 Digital Probe	83.00
Logic Probe	
Model LP-1 Digital Logic Probe	50.00
Model LP-2 Economy Logic Probe	28.00
Model LP-3 High Speed Logic Probe	77.00
Logic Probe Accessories	21.95
Model LTC-1, LTC-2 Logic Analysis Kits	220-250

ADVANCED COMPUTER PRODUCTS

Apple II. 16K or Apple II. Plus \$990 16K Apple Upgrade Kit \$62.95

Hi-Speed Serial I/O	\$174.95	DS65 Digi-Sector	\$349.00	Integer ROM Card	\$175.00
Centronics Printer I/O	199.95	Apple Graphics Tablet	795.00	Proto Card	21.95
AppleSoft II Firmware	174.95	D.C. Hayes Modem II	349.95	M & R Modulator	29.95
Apple Clock	189.95	Disk II w/Controller	475.00	Sanyo Cassette	54.95
Introl X-10 System	269.95	Pascal Lang. System	575.00	16K Upgrade Kit	62.95
Introl X-10 Controller	179.95	Parallel Printer Card	165.00	Apple Radio Car	155.00
Alt Music Synthesizer	259.95	Communications Card	210.00	8" Floppy Controller	350.00
16 Ch. Analog Input	164.95	Business Software Pkg	625.00	Heuristics Speechlab	179.00
2 Ch. Analog Output	119.95	Corvus 10 Megabyte Drive	4625.00	Romplus +	169.00

ADVANCED COMPUTER PRODUCTS

GET YOUR 1980 CATALOG

FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES!

1. Proven Quality Factory tested products only.
 2. Guaranteed Satisfaction
 3. Over \$1,000,000.00 Inventory
- 1980 CATALOG NOW AVAILABLE.
Send \$2.00 for your copy of the most complete catalog of computer products.
A must for the serious computer user.

STATIC RAM BOARDS

S-100 32K (uses 2114)
ASSEMBLED Kit *Less than 1/2¢ per bit!*
450ns. 499.00 450ns. 469.00
250ns. 539.00 250ns. 499.00
Bare Board 49.95
Bare Board w/all parts less mem. 99.95

S-100 16K (S-100 Compatible)
• Low Power
• 2 MHz or 4 MHz
• 4K Bank Addressable
• Extended Memory Management
• Assembled & Tested
2 MHz \$250.00
4 MHz \$265.00

LOGOS 16K
ASSEMBLED
450 ns. 149.95 Kit 450ns. 125.95
250 ns. 169.95 250ns. 149.95
Bare PC Board w/Data \$21.95
"Special Offer" Buy 14K 450ns. Kits \$117.00

THE VISTA V-80 Disk Drive System
• 23% more storage capacity than TRS-80
• 120 day warranty
• 40 track patch w/ NO CHARGE

Single drive system \$395.00
Two drive system \$770.00
Four drive system \$1450.00
Two drive cable \$29.95
Four drive cable \$39.95

THE VISTA V-200 FOR EXIDY

Price: Starting as low as \$119.00

Item	Starting Price	Options	Price
IBM 5100	200	2 Drive	119.00
V200 E-20	400	2 Drive	154.00
V200 E-20	600	2 Drive	154.00
V200 E-20	1200	2 Drive	199.00

DC-500 HARD DISK INTERFACE

• Apple II
• TRS 80
• Cromemco (\$100)
• Others soon

DC 500 Controller - 16K 80 Model 1 \$150.00
DC 500 Controller - 16K 80 Model 2 \$150.00
DC 500 Controller - Apple II \$150.00
DC 500 Controller - Apple II \$150.00

LOW-COST ADD-ON DISK SUBSYSTEM KIT

• (2) 8" Drives
• VISTA Floppy Controller Card
• Power Supply and Interface Cable
• CP/M Disk Operating System
• Box of 10 Diskettes

Low Cost Sys. **\$1299.00**

IMS STATIC RAM BOARDS

• Memory Mapping
• Phantom
• Assembled & tested
Recommended by Alphamicrosystems

250 ns. 450 ns.
8K Static \$209.00 \$189.00
16K Static \$449.00 \$399.00
32K Static \$729.00 \$629.00

ANADEX PRINTER NEW APPLE VERSION

Model DP-8000 compact, impact, parallel or serial. Sprocket feed. 80 cpi, 84 lines/min. bi-directional. New only \$875.00
DP-8000AP (for Apple) \$875.00

SD SYSTEMS BOARDS

SDC 100 Single Board Computer (2MHz) \$295.00
SDC 200 Single Board Computer (4MHz) 299.00
Z80 Starter System 319.00
VME 8024 Video Display Board 325.00
Versa Floppy II 325.00
Expands PROM 115.00
SD100 Computer System w/4K 699.00
SD200 Computer System w/4K 799.00

6800 MICROMODULE™ PRICE LIST

MODEL NO.	DESCRIPTION	PRICE
9600A	Single Board Microcomputer	\$495.00
9600B	Advanced Single Board Comp (6800)	\$595.00
9601	16 Slot Mother Board	\$175.00
9602	Card Cage	\$75.00
9603	8 Slot Mother Board	\$100.00
9604	Power Supply	\$75.00
9605	DC Input Power Supply	\$35.00
9606	Unit Photo Board	\$35.00
9607	Anti-Protection Module	\$95.00
9608	Buffered Utility Proto Board	\$49.00
9609	32K EPROM RAM Module	\$250.00
9610	EPROM Programming Head	\$250.00
9611	16 Channel Parallel I/O Module	\$325.00
9612	Serial-Parallel I/O Module	\$325.00
9613	16K Static RAM Module 470ns	\$385.00
9614	32K Static RAM 450ns	\$695.00
9615	32K Static RAM 250ns	\$895.00
9616	Card Extender	\$85.00
9617	Multiple Programming Timer	\$395.00
9618	8 Channel Duplex Serial I/O Mod	\$520.00
9619	Intelligent Tape Controller	\$520.00
9620	32/32 I/O Module	\$275.00
9621	Contact Closure Module	\$35.00

UNPOPULATED BOARDS (Also Available)

APPLE/EXIDY/EXPANDO TRS 80 16K-UPGRADE KIT

• Special: TRS80 Schematic \$ 4.95
• Expansion Interface Schematic \$ 4.95
• Expansion Interface Connector 7.95

EXPANDOR II MEMORY KITS

• Bank Selectable
• Write Protect
• Phantom
• Power BVDC ±16VDC
• Up to 4 MHz

Expando 64 Kit (4116)
16K \$290.00 48K \$444.00
32K \$365.00 64K \$519.00

LETTER QUALITY SELECTRIC! TRENDATA 1000 COMMUNICATION STATION

Supplied with documentation. Power input 115VAC ±10%, 60Hz, 200 Watts. Printer, paper, 15" wide, Desk size: 20" x 35" wide x 23" deep. Excellent condition. Guaranteed. Shpg. Wt. 150 lbs.

CAT NO. TDP-RE232 \$1399.00
CAT NO. TDP-TTS80 \$1399.00
CAT NO. TDP-EBDCI \$1299.00

UV "Eprom" Eraser

Model UVs-1E \$69.95
Holds 4 Eprom's at a time. Backed by 45 years experience.
Model S-52T... \$265.00
Professional Industrial Model

EMAKO-20.. Reg. \$777.00 \$599.00

UNBELIEVABLE! 125 CPM, 60 PPM Vertical Format Unit - 96 Characters. Upper/Lower Case. 45° to 95° Adjustable. 80 - 400 cpi dot bubble. Width - Full 96 char. ASCII

EMAKO-22.....\$799.00

Prints a 132 col/line. Available with parallel or serial output at same price.

MIKA 20.....\$1280.00

9x7, 125 cps 136 characters/line. Full 15" width. Super for business applications requiring large IBM format paper.

NEW CENTRONICS 737 PRINTER

Uses any paper roll, fanfold, single sheets, 96 character ASCII, 7 x 7 dot matrix, 50 CPS, RS232 or parallel I/O

WOW! \$899.00

Z-80/Z-80A/8080 CPU BOARD

• On board 2708 & 2708 included (450ns)
• Power on reset completely socketed
• Z-80 Assembled and Tested \$185.00
• Z-80 Kit \$129.95
• Z-80 Bare PC Board \$ 34.95
• For 4MHz Speed Add \$15.00
8080A Kit \$ 99.95
8080A Assembled \$149.95

S-100 MOTHERBOARD SPECIAL

8 slot expandable w/9 conn. reg \$69.95..... NOW \$52.95

SIEMENS'S FLOPPY SALE

• Special buy while supply lasts.
• 8" Drive with Double-Density
• 90 Day Warranty

SIEMENS \$429.00
SHUGART \$475.00

ACOUSTIC MODEM NOVATION CAT™

O-300 Baud
Bell 103
Answer, Originate \$169.00

DATA BOOKS • COMPUTER BOOKS

1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95
1980 IC Master 5.95

SALE • MICRO BOOKS • SALE

Intro to Micros Vol. 9 7.95
Intro to Micros Vol. 10 7.95
8080A Programming 7.95
8080B Programming 7.95
Z80 Programming 7.95
Intro to Some Real Support Devices w/ Binder 18.50
Intro to Micros Vol. III 18.50

SALE • DILITHIUM COMPUTER BOOKS • SALE

Understanding Computers 11.95
8080 Microcomputer Experiments 11.95
Beginning BASIC 7.95
Beginning Assembly & Guide 7.95
Peasants Butter & Jelly Guide to Computers 6.95
8080 Machine Language Programming 6.95
Home Computers Vol. I Hardware 6.95
Home Computers Vol. II Software 6.95
Starship Computers 11.95

MICROPROCESSORS

28001 16 bit to 8080 \$189.00
28002 16 bit to 64K 149.00
28003 16 bit to 64K 10.75
28004 16 bit to 64K 14.95
28005 16 bit to 64K 14.95
28006 16 bit to 64K 14.95
28007 16 bit to 64K 14.95
28008 16 bit to 64K 14.95
28009 16 bit to 64K 14.95
28010 16 bit to 64K 14.95
28011 16 bit to 64K 14.95
28012 16 bit to 64K 14.95
28013 16 bit to 64K 14.95
28014 16 bit to 64K 14.95
28015 16 bit to 64K 14.95
28016 16 bit to 64K 14.95
28017 16 bit to 64K 14.95
28018 16 bit to 64K 14.95
28019 16 bit to 64K 14.95
28020 16 bit to 64K 14.95
28021 16 bit to 64K 14.95
28022 16 bit to 64K 14.95
28023 16 bit to 64K 14.95
28024 16 bit to 64K 14.95
28025 16 bit to 64K 14.95
28026 16 bit to 64K 14.95
28027 16 bit to 64K 14.95
28028 16 bit to 64K 14.95
28029 16 bit to 64K 14.95
28030 16 bit to 64K 14.95
28031 16 bit to 64K 14.95
28032 16 bit to 64K 14.95
28033 16 bit to 64K 14.95
28034 16 bit to 64K 14.95
28035 16 bit to 64K 14.95
28036 16 bit to 64K 14.95
28037 16 bit to 64K 14.95
28038 16 bit to 64K 14.95
28039 16 bit to 64K 14.95
28040 16 bit to 64K 14.95
28041 16 bit to 64K 14.95
28042 16 bit to 64K 14.95
28043 16 bit to 64K 14.95
28044 16 bit to 64K 14.95
28045 16 bit to 64K 14.95
28046 16 bit to 64K 14.95
28047 16 bit to 64K 14.95
28048 16 bit to 64K 14.95
28049 16 bit to 64K 14.95
28050 16 bit to 64K 14.95
28051 16 bit to 64K 14.95
28052 16 bit to 64K 14.95
28053 16 bit to 64K 14.95
28054 16 bit to 64K 14.95
28055 16 bit to 64K 14.95
28056 16 bit to 64K 14.95
28057 16 bit to 64K 14.95
28058 16 bit to 64K 14.95
28059 16 bit to 64K 14.95
28060 16 bit to 64K 14.95
28061 16 bit to 64K 14.95
28062 16 bit to 64K 14.95
28063 16 bit to 64K 14.95
28064 16 bit to 64K 14.95
28065 16 bit to 64K 14.95
28066 16 bit to 64K 14.95
28067 16 bit to 64K 14.95
28068 16 bit to 64K 14.95
28069 16 bit to 64K 14.95
28070 16 bit to 64K 14.95
28071 16 bit to 64K 14.95
28072 16 bit to 64K 14.95
28073 16 bit to 64K 14.95
28074 16 bit to 64K 14.95
28075 16 bit to 64K 14.95
28076 16 bit to 64K 14.95
28077 16 bit to 64K 14.95
28078 16 bit to 64K 14.95
28079 16 bit to 64K 14.95
28080 16 bit to 64K 14.95
28081 16 bit to 64K 14.95
28082 16 bit to 64K 14.95
28083 16 bit to 64K 14.95
28084 16 bit to 64K 14.95
28085 16 bit to 64K 14.95
28086 16 bit to 64K 14.95
28087 16 bit to 64K 14.95
28088 16 bit to 64K 14.95
28089 16 bit to 64K 14.95
28090 16 bit to 64K 14.95
28091 16 bit to 64K 14.95
28092 16 bit to 64K 14.95
28093 16 bit to 64K 14.95
28094 16 bit to 64K 14.95
28095 16 bit to 64K 14.95
28096 16 bit to 64K 14.95
28097 16 bit to 64K 14.95
28098 16 bit to 64K 14.95
28099 16 bit to 64K 14.95
28100 16 bit to 64K 14.95
28101 16 bit to 64K 14.95
28102 16 bit to 64K 14.95
28103 16 bit to 64K 14.95
28104 16 bit to 64K 14.95
28105 16 bit to 64K 14.95
28106 16 bit to 64K 14.95
28107 16 bit to 64K 14.95
28108 16 bit to 64K 14.95
28109 16 bit to 64K 14.95
28110 16 bit to 64K 14.95
28111 16 bit to 64K 14.95
28112 16 bit to 64K 14.95
28113 16 bit to 64K 14.95
28114 16 bit to 64K 14.95
28115 16 bit to 64K 14.95
28116 16 bit to 64K 14.95
28117 16 bit to 64K 14.95
28118 16 bit to 64K 14.95
28119 16 bit to 64K 14.95
28120 16 bit to 64K 14.95
28121 16 bit to 64K 14.95
28122 16 bit to 64K 14.95
28123 16 bit to 64K 14.95
28124 16 bit to 64K 14.95
28125 16 bit to 64K 14.95
28126 16 bit to 64K 14.95
28127 16 bit to 64K 14.95
28128 16 bit to 64K 14.95
28129 16 bit to 64K 14.95
28130 16 bit to 64K 14.95
28131 16 bit to 64K 14.95
28132 16 bit to 64K 14.95
28133 16 bit to 64K 14.95
28134 16 bit to 64K 14.95
28135 16 bit to 64K 14.95
28136 16 bit to 64K 14.95
28137 16 bit to 64K 14.95
28138 16 bit to 64K 14.95
28139 16 bit to 64K 14.95
28140 16 bit to 64K 14.95
28141 16 bit to 64K 14.95
28142 16 bit to 64K 14.95
28143 16 bit to 64K 14.95
28144 16 bit to 64K 14.95
28145 16 bit to 64K 14.95
28146 16 bit to 64K 14.95
28147 16 bit to 64K 14.95
28148 16 bit to 64K 14.95
28149 16 bit to 64K 14.95
28150 16 bit to 64K 14.95
28151 16 bit to 64K 14.95
28152 16 bit to 64K 14.95
28153 16 bit to 64K 14.95
28154 16 bit to 64K 14.95
28155 16 bit to 64K 14.95
28156 16 bit to 64K 14.95
28157 16 bit to 64K 14.95
28158 16 bit to 64K 14.95
28159 16 bit to 64K 14.95
28160 16 bit to 64K 14.95
28161 16 bit to 64K 14.95
28162 16 bit to 64K 14.95
28163 16 bit to 64K 14.95
28164 16 bit to 64K 14.95
28165 16 bit to 64K 14.95
28166 16 bit to 64K 14.95
28167 16 bit to 64K 14.95
28168 16 bit to 64K 14.95
28169 16 bit to 64K 14.95
28170 16 bit to 64K 14.95
28171 16 bit to 64K 14.95
28172 16 bit to 64K 14.95
28173 16 bit to 64K 14.95
28174 16 bit to 64K 14.95
28175 16 bit to 64K 14.95
28176 16 bit to 64K 14.95
28177 16 bit to 64K 14.95
28178 16 bit to 64K 14.95
28179 16 bit to 64K 14.95
28180 16 bit to 64K 14.95
28181 16 bit to 64K 14.95
28182 16 bit to 64K 14.95
28183 16 bit to 64K 14.95
28184 16 bit to 64K 14.95
28185 16 bit to 64K 14.95
28186 16 bit to 64K 14.95
28187 16 bit to 64K 14.95
28188 16 bit to 64K 14.95
28189 16 bit to 64K 14.95
28190 16 bit to 64K 14.95
28191 16 bit to 64K 14.95
28192 16 bit to 64K 14.95
28193 16 bit to 64K 14.95
28194 16 bit to 64K 14.95
28195 16 bit to 64K 14.95
28196 16 bit to 64K 14.95
28197 16 bit to 64K 14.95
28198 16 bit to 64K 14.95
28199 16 bit to 64K 14.95
28200 16 bit to 64K 14.95
28201 16 bit to 64K 14.95
28202 16 bit to 64K 14.95
28203 16 bit to 64K 14.95
28204 16 bit to 64K 14.95
28205 16 bit to 64K 14.95
28206 16 bit to 64K 14.95
28207 16 bit to 64K 14.95
28208 16 bit to 64K 14.95
28209 16 bit to 64K 14.95
28210 16 bit to 64K 14.95
28211 16 bit to 64K 14.95
28212 16 bit to 64K 14.95
28213 16 bit to 64K 14.95
28214 16 bit to 64K 14.95
28215 16 bit to 64K 14.95
28216 16 bit to 64K 14.95
28217 16 bit to 64K 14.95
28218 16 bit to 64K 14.95
28219 16 bit to 64K 14.95
28220 16 bit to 64K 14.95
28221 16 bit to 64K 14.95
28222 16 bit to 64K 14.95
28223 16 bit to 64K 14.95
28224 16 bit to 64K 14.95
28225 16 bit to 64K 14.95
28226 16 bit to 64K 14.95
28227 16 bit to 64K 14.95
28228 16 bit to 64K 14.95
28229 16 bit to 64K 14.95
28230 16 bit to 64K 14.95
28231 16 bit to 64K 14.95
28232 16 bit to 64K 14.95
28233 16 bit to 64K 14.95
28234 16 bit to 64K 14.95
28235 16 bit to 64K 14.95
28236 16 bit to 64K 14.95
28237 16 bit to 64K 14.95
28238 16 bit to 64K 14.95
28239 16 bit to 64K 14.95
28240 16 bit to 64K 14.95
28241 16 bit to 64K 14.95
28242 16 bit to 64K 14.95
28243 16 bit to 64K 14.95
28244 16 bit to 64K 14.95
28245 16 bit to 64K 14.95
28246 16 bit to 64K 14.95
28247 16 bit to 64K 14.95
28248 16 bit to 64K 14.95
28249 16 bit to 64K 14.95
28250 16 bit to 64K 14.95
28251 16 bit to 64K 14.95
28252 16 bit to 64K 14.95
28253 16 bit to 64K 14.95
28254 16 bit to 64K 14.95
28255 16 bit to 64K 14.95
28256 16 bit to 64K 14.95
28257 16 bit to 64K 14.95
28258 16 bit to 64K 14.95
28259 16 bit to 64K 14.95
28260 16 bit to 64K 14.95
28261 16 bit to 64K 14.95
28262 16 bit to 64K 14.95
28263 16 bit to 64K 14.95
28264 16 bit to 64K 14.95
28265 16 bit to 64K 14.95
28266 16 bit to 64K 14.95
28267 16 bit to 64K 14.95
28268 16 bit to 64K 14.95
28269 16 bit to 64K 14.95
28270 16 bit to 64K 14.95
28271 16 bit to 64K 14.95
28272 16 bit to 64K 14.95
28273 16 bit to 64K 14.95
28274 16 bit to 64K 14.95
28275 16 bit to 64K 14.95
28276 16 bit to 64K 14.95
28277 16 bit to 64K 14.95
28278 16 bit to 64K 14.95
28279 16 bit to 64K 14.95
28280 16 bit to 64K 14.95
28281 16 bit to 64K 14.95
28282 16 bit to 64K 14.95
28283 16 bit to 64K 14.95
28284 16 bit to 64K 14.95
28285 16 bit to 64K 14.95
28286 16 bit to 64K 14.95
28287 16 bit to 64K 14.95
28288 16 bit to 64K 14.95
28289 16 bit to 64K 14.95
28290 16 bit to 64K 14.95
28291 16 bit to 64K 14.95
28292 16 bit to 64K 14.95
28293 16 bit to 64K 14.95
28294 16 bit to 64K 14.95
28295 16 bit to 64K 14.95
28296 16 bit to 64K 14.95
28297 16 bit to 64K 14.95
28298 16 bit to 64K 14.95
28299 16 bit to 64K 14.95
28300 16 bit to 64K

The Supermarket for TRS-80* Add-on Components (and other computers, too) In stock now. Immediate delivery.

The VISTA V-80 Disk Drive System

- 23% more storage capacity than TRS-80
- 120 day warranty
- 40 track patch at NO CHARGE



Single drive system \$ 395.00
Two drive system \$ 770.00
Four drive system \$ 1450.00
Two drive cable \$ 29.95
Four drive cable \$ 39.95

The VISTA V-80 Expansion Module

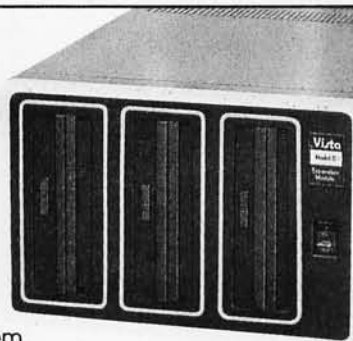
- Provides double density modification to your current Radio Shack interface (lets you format diskettes in either single or double density).
- Increases storage capacity up to 204K bytes (on single 40 track drive).
- Includes all hardware and software.

\$239.00



The VISTA Model II

- Provides one, two or three drives.
- Adds up to 1.5 million bytes of on-line storage.
- 120 day warranty
- Does everything Radio Shack's expansion system will do...for less!



\$1000.00 Single drive Expansion System
\$1550.00 Two drive Expansion System
\$2100.00 Three drive Expansion System
\$ 525.00 Additional drives alone

The TRS-80 Printers

Centronics 730... **\$945.00**
7x7 dot matrix-80 column

Anadex DP8000... **\$895.00**
9x7 dot matrix-80 column

VISTA Printer... **\$745.00**
5x7 dot matrix-80 column

Cables **\$27.50 each**



Other Products

1. VISTA Verbatim diskettes (hard or soft sector) Certified 40 track **\$ 38.95**
2. 16K RPM upgrade kits, guaranteed for 120 days.
PRIME PRODUCT **\$ 74.50**
3. NEW! DOS + **\$ 110.00**
4. LNW expansion bare board **\$ 66.95**
5. H.C. Pennington book, **TRS-80 Disk and Other Mysteries** **\$ 18.95**
6. DDT Disco-Tech disk drive timer **\$ 19.95**
7. Cryptext (An Encryption Module) **\$299.00**

Add On Drives

- | | | |
|---------|---------------------------------------|-----------------|
| MPI B51 | 40 Track, Double Density-204K | \$275.00 |
| MPI B52 | Dual Head, Double Density-408K | \$375.00 |
| Siemens | FDD100-5 40 Track Double Density 204K | \$275.00 |
| Siemens | FDD100-5 Flippy, records both sides | \$290.00 |
| Siemens | FDD100-8 8" Single Sided Drive | \$448.00 |

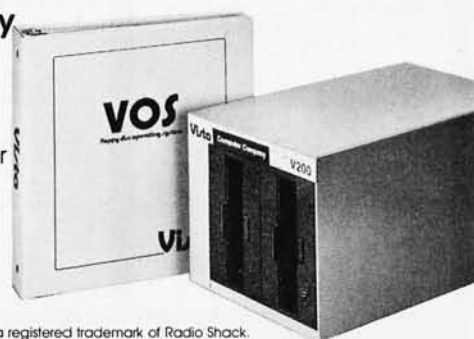
The VISTA V-200 for Exidy

- Completely packaged system, tested and ready to plug in, includes: power supply, two 40 track drives, case, controller, all cabling and total CPM documentation.
- Storage capacity from 400K to 1.2 meg.
- System software-VISTA CP/M Disk Operating System and BASIC-E Compiler recorded on 5-1/4" diskettes.

Price: Starting as low as **\$1199.00**



CALL TOLL-FREE 800-854-8017



*TRS-80 is a registered trademark of Radio Shack.

The Vista Computer Company 1401 Borchard Street • Santa Ana, California 92705 • 714/953-0523

Unclassified Ads

UNCLASSIFIED POLICY: Readers who are soliciting or giving advice, or who have equipment to buy, sell or swap should send in a clearly typed notice to that effect. To be considered for publication, an advertisement must be clearly noncommercial, typed double spaced on plain white paper, contain 75 words or less, and include complete name and address information.

These notices are free of charge and will be printed one time only on a space available basis. Notices can be accepted from individuals or bona fide computer users clubs only. We can engage in no correspondence on these and your confirmation of placement is appearance in an issue of BYTE.

Please note that it may take three or four months for an ad to appear in the magazine.

WANTED: Printer for use with Apple II. Will trade (or sell) Nikon FTN camera with f1.4 lens, Speedlight and Ring-light units, filters, closeup rings, and many other attachments. Write for complete list and send description of printer. Also, will sell Applesoft II read-only memory card for \$100 or highest bid. Gene Boggess, Star Route POB 220-6, Columbus MS 39701, (601) 327-6555.

FOR SALE: BYTE, Kilobaud, Interface Age; 1977 and 1978 plus some odd issues. Best offer. Les Palenik, 25 Allview Cres, Toronto Ontario, CANADA M2J 2R4.

FOR SALE: 16 DIP (4 K by 1-bit) dynamic programmable memories (a set of eight). Motorola 7839; 250 ns chips. Interchangeable with TMS 4027, Intel 2104A-3, MK 4096-6, and many other brands. In excellent condition, used approximately twenty hours. I upgraded my TRS-80 with 16 K chips. Will sell for \$35. Daryl Holder, Rt #2 POB 260-C, Loretto TN 38469, (615) 853-6740 after 4 PM.

FOR SALE: Complete ready-to-go SwTPC system. 6800/1 upgraded to a 6800/2, 28 K, MP-T board, CT-64 in customized cabinet, Hitachi 12-inch with direct video interface, PR-40 with parallel interface, AC-30, JPC TC-3 4800 bps tape interface with CFM/3 operating system. All documentation, assembly instructions, user guides, and source listings included. Software: three BASICs, three Assemblers, two Editors, Disassembler, Tracer, Relocator, games, and more. \$1950. Allen Porter, 493 Selfridge Dr, Colorado Springs CO 80916, (303) 574-4146.

FOR SALE: I have four Shugart SA400 disk drives for \$285 each and two Shugart SA801 disk drives for \$420 each. Need money fast; will take good offer. They work great and were bought in 1979. Four drive cables for \$20. David Sparks, 5232 Cornell Ave, Westminster CA 92683, (714) 997-7640.

FOR SALE: 6800 Microprocessor Trainer by Heathkit, Model ET-3400. Includes all manuals, built and tested trainer, programmed learning course (ET-3401), specially built peripheral interface adapter experiment board, and all parts for experiments. \$365 value, sell for \$315. Excellent condition. James Temple, 24 Spruce Ave, Bethpage NY 11714, (516) 822-6083.

FOR SALE: ESAT 200B 80/24 terminal, \$220; GRI 756 keyboard with case, \$60; Leedex Video 100 monitor, \$100; SD Z80 starter system with 4 K programmable memory, added operating system for video display on 2 K erasable-programmable read-only memory, \$260. All assembled, little used, perfect working condition. G Kish, 1621 Payne, Wichita KS 67203, (316) 262-7315.

FOR SALE: Heathkit (Motorola 6800 processor) computer and the Heath H9 video terminal. Computer has 4 K memory expandable to 64 K. Includes BASIC in read-only memory, double-function keypad on computer console, 1 K monitor also with access to memory and processor registers, 8-bit parallel and serial input/output (I/O) with EIA or 20 mA current loop. Cassette interface and cables. Complete documentation and operation manuals. Burned in for one hundred hours. Asking \$480. Osi McReynolds, Rt #1 POB 71-B, Coeburn VA 24230, (703) 395-3797.

FOR SALE: PerSci Model 277 dual-diskette drive with a Model 1070 intelligent diskette controller. Capacity 1/2 megabytes. All books and line diagrams included. Part of a purchased system that was used for six months. James Holle, 9613 W Lincoln Ave, West Allis WI 53214, (414) 541-9808.

FOR SALE: S-100: Vector Graphic 8 K static programmable memory (250 ns), \$120. Ithaca Audio Z80A processor (4 MHz), \$120. SSM IO-4 (four parallel and two serial ports), \$100. SSM PB-1 2708/2716 programmable read-only memory programmer, \$110. SSM VB-1B video interface, \$100. ECT rack-mount card cage with Thinker Toys Wunderbuss 20-slot mother board and all connectors, \$175. All boards assembled and tested, used less than twenty-five hours. Will consider best offer. Send money order to Richard Haendel, 2500 Nonesuch Rd Apt 16-G, Abilene TX 79605, (915) 692-5405.

FOR SALE: PolyMorphic video terminal interface (VTI) board for S-100 systems. Video is spotty, but also can be used as parallel input port (8212 on board) and 1 K programmable memory. Fully socketed, never used, video should be easily fixable. \$75 or best offer. Roger Buldain, 601 N Francis, Lansing MI 48912, (517) 337-2278.

FOR SALE: Heathkit ET-3400 Microprocessor Trainer with EE-3401 self-instruction program. Extra memory chips and components. Assembled and in excellent condition. Asking \$150. William Porti, Second St, Evans City PA 16033, (412) 538-5454.

WANTED: Program libraries (manuals) for obsolete but working HP-9100A and/or HP-9100B desktop calculators. Thomas H Richardson, Kansas Wesleyan, Dept of Chemistry, Salina KS 67401.

FOR SALE: E-HUH 8100 S-100 bus expansion interface for TRS-80. On-board programmable UART, serial and parallel input/output (I/O), 16 K, 250 ns programmable memory, six card slots. All enclosed in custom metal cabinet with power supply. Full hardware and software documentation. Ready to plug in and turn 16 K system into 32 K. Cables included. Must sell, \$700 value only \$500. Michael Lesser, 14623 Pine Glen Cir, Lutz FL 33549, (813) 971-8492 nights.

FOR SALE: S-100 system; IMSAI front panel with vector 18-slot mother board, in case with power supply, \$200; IMSAI MIO, \$100; 8 K WMC Static Mem-1, \$100; two 4 K static, \$50 each; Ithaca Audio Z80 processor, \$125; Cromemco Bytesaver, \$125. Above boards operating in system. Tarbell Floppy-Disk Controller, partially assembled, \$125; three IBM 8-inch FD33 floppy disks, one complete, one less interface card, and one less motor and interface card, all three for \$225. Digitronics high-speed paper tape, with 8-inch autospooler, \$100; TDL S-100 case, \$20. John Potter, 5439 Eadie Pl, West Palm Beach FL 33407, (305) 686-4666.

FOR SALE: Two Viatron 21s, one robot printer. \$500 for three units. Also, SwTPC 6800 and CT-1024, \$250. G Ludwig, POB 408, Rice Lake WI 54868, (715) 234-2680.

FOR SALE: Crossassembler for M6800 microprocessor. 4-kilo word program written in BASIC for HP-2000A. Directly usable in other HPs. With simple changes, it assembles languages of other 8-bit microprocessors. Program supports same properties as Motorola's own crossassembler. Program on paper tape, full documentation, user manual, and two-year full support; \$163 (includes postage). For manual and documentation, send \$3. If required: program in other languages or on other media. Panu Pietikainen, Rauduntie 11 H, SF-02130 Espoo 13, FINLAND.

WANTED: Copy of Z80 Assembler listing from BYTE Nybbles library. Harian Michael, 315 Valley Vista Dr, Jackson MS 39211, (601) 982-6533 days or (601) 956-5268 evenings.

FOR SALE: Three Heath 4 K by 16 memory boards. All in excellent condition with documentation. \$100 each, or all three for \$270. Dan Buckler, 6115 A 42nd Pl, Hyattsville MD 20781, (301) 927-0765.

FOR TRADE: Compucolor game programs for other homemade game programs written for the Compucolor II. Programs must be 8 K or less. Paul Weisberg, POB 2453, Melfort Saskatchewan, CANADA S0E 1A0, (306) 752-3566.

FOR SALE: Five new single-board 8080A microprocessors, completely assembled and tested. Each includes 1 K by 8 erasable-programmable read-only memory and 256 by 8 programmable memory. Complete documentation, featured in CQ magazine April, May, June 1979. \$50 each. Platteter, 1315 Q St, Bedford IN 47421, (812) 279-6265.

WANTED: Ohio Scientific Superboard IIs with all manuals and documentation, up to \$150 paid depending on year and condition. Send year and condition for my offer. For Sale: TI 99/4 microcomputer. Paid \$1150, first certified check for \$1075 gets it. Brand new and still in original carton. Or will trade TI 99/4 for \$950 plus Ohio Scientific Superboard II in good condition. Gregg Beasey, 15 Cardinal Ln, East Islip NY 11730.

FOR SALE: Control Data Corp 10 megabytes disk drive for AlphaMicro AM-500 system. Elmer G Mitchell, 1520 18th St, Huntsville TX, (713) 291-3447.

WANTED: I have a small amount of 8080 equipment (processor, a few support chips) and a large supply of other stuff (74xx, MM3501, etc) and would like to buy or trade for anything 6800ish (processor, bareboard, support, etc). Give a hand to an uprooted American. R M Bownes, 146 Warren Rd, Donaghdee County Down, NORTHERN IRELAND BT21 OPQ. PS: Please use airmail, it's a lot faster.

WANTED: Drawings and schematics for making an electrical sleep device, and other schematics for experimental hypnosis. K de Groot, P-Lastmanstr. 7, Helmond, HOLLAND.

WANTED: Heathkit Microprocessor Trainer ET-3400 and Memory I/O Accessory ETA-3400 for use with Heathkit Microprocessor Course. Will trade for Teletype printer parts, and/or cash. Please write and give details (ie: assembled/unassembled and if the unit(s) are operational). George Keim, POB 160, Yap Island GU 96943. First class mail for fastest reply, US Domestic Post Office rates.

February BOMB Results Graph Theory

Readers of BYTE expressed a burning interest in "A Computer-Controlled Wood Stove" by Steve Ciarcia (page 32). Steve won first place in the voting, his fourth first-place finish in as many months. Second place in the tally went to John A Lehman for "A Financial Analysis Program" (page 192). Judging from comments written on the BOMB cards, many readers were fascinated by an example of the balance sheet for MITS, Inc. Third place was taken by Ted Carter for "Implementing Dynamic Data Structures with BASIC Files" (page 92). Fourth place was taken by Robert A Morris for "Comparison of Some High-Level Languages" (page 128).

To get further information on the products advertising in BYTE, fill out the reader service card with your name and address. Then circle the appropriate numbers for the advertisers you select from the list. Add a 15-cent stamp to the card, then drop it in the mail. Not only do you gain information, but our advertisers are encouraged to use the marketplace provided by BYTE. This helps us bring you a bigger BYTE. *Correspond directly with company.

Index No.	Page No.	Index No.	Page No.	Index No.	Page No.	Index No.	Page No.
320	AB Computers 329	291	Farnsworth Computer 320	522	OSM Computer 320	794	Smoke Signal Broadcasting 45
117	ABW Corp 195	174	FMG Corp 249	523	Owens Associates 198	795	Smoke Signal (Dealers only) 45
191	Ackerman Digital 259	303	Folio Books 174, 175	262	Pacific Exchanges 308	25	Softagon Inc 84
50	(ADD) Applied Digital Data Sys 87	307	Fordham Radio Supply 326	289	Pacific Exchanges 320	151	Softech 190
323	Adv Computer Prod 332, 333	268	Frederick Computer Prod 308	328	Page Digital 330	138	Softside 225
200	AL Industries 265	226	Futureworld 278	176	PAIA 251	151	The Software Exchange 239
267	ALL Electronics 308	107	GW Computers Ltd 182	250	Pan American Elect 300	234	Software Factory 284
83	Altos 142, 143		Game Design (Taito America) 294	127	(A Radio Shack Auth Sales Ctr) PCD Systems Inc 210	264	The Software Farm 308
44	Anadex Ltd 79	318	GEM Business Sys 328	290	PEEK (65) 320	310	The Software Review 328
257	Ancrona 304		General Business Comp 16	5	Per Com Data 15	308	Software Works 275
109	Anderson Jacobson 184	29	Gemix 58	37	Per Com Data 67	154	Solid State Sales 326
28	APF Electronics 51	204	Global Parameters 268	43	Per Com Data 76 & 77	138	Sorrento Valley Assoc 241
202	Apparat 266	104	Godbout Electronics 177	97	Personal Computers 161	35	Southern Computer Sys Inc 64
4	Apple Computer 13	209	GR Electronics Ltd 271	99	Personal Software 167	325	Southwest Tech Prod Corp C II
76	Apple Computer Sys 132	75	H & E Computronics 156		Phase One Systems 227	210	Spectrum Software 271
240	Aristo Polks 294	95	H & E Computronics 157	168	Pickles & Trout 247	3	SSM 11
10	Artec Electronics 24	304	Hampshire Design 322	184	Potomac Micro Magic 255	166	The Stackworks 246
253	ASAP 302	128	Hardside 211	55	Power One 95	282	Starburst Computer Group Inc 316
318	AT Enterprises 328	62	D C Hayes Associates Inc 106	285	Priority One 318, 319	130	Strategic Simulations 213
144	ATV Research 294	141	D C Hayes Associates Inc 228	92	Prodigy 153	93	Structured Sys Group 154
233	Automated Simulations 219	39	Holston Instruments 71	119	Program Design Inc (PDI) 199	31	SubLOGIC 60
218	Avionic Enterprises (A.E.I.) 275	40	Houston Instruments 71	81	The Program Store 139	73	Summagraphics 125
63	Balcode Software Inc 107	148	IBC 236	84	QC Microsystems 145	254	Sunflex 322
70	BASF 121	208	Inco Inc 271	21	QT Computer Sys Inc 39	254	Sunny International 302
271	Beckian 309		Independent Business Sys 55	272	QT Computer Sys Inc 310, 311	98	Supersoft 92
195	John Bell Engineering 263	34	Industrial Micro Sys 63	301	Quadrus Associates 322	78	Supersoft 135
	Beta Computer Devices 253	330	InfoSoft Systems Inc 50	47	Quasar Data Products Inc 83	94	Supersoft 155
150	Biscomp 238	189	INMAC 259	59	Quay Corp 101	206	Support Tech & Prod Inc 269
	* The Business & Home Computer Shows 207	15	Integral Data Systems, Inc 31	42	Quiet Designs Inc 75	11	Symtec 25
51	BYTE Back Issues 285	190	Integrand 258	252	Quest 301	60	Sybox 103
230	BYTE Books 89, 129	426	Intel insert (between pp 16 & 17)	91	R & K Enterprises 152	61	Syncho Sound 105
110	BYTE Books 279	17	Intelligent Systems Corp 33	66	RACAL — Milgo 113	222	Synergetic Comp Prod 277
110	BYTE Conference 185-188	287	Interactive Microware 320	201	Racet Computes 265	108	Tarbell 183
165	C & S Electronics Mart 246	170	Int'l Data Sciences 248	258	Radio Hut 305	69	Tech Sys Consultants (TSC) 119
105	California Computer Sys 20, 21	82	Int'l Data Sys (IDS) 141	33	Raygam 62	64	Tec-Mar 108
266	California Data Corp 308	41	Intertec 73	96	RCA 159	13	TeleVideo Inc 27
322	California Digital 331		* Ithaca Intersystems 9	77	RCA Solid State 134	278	Terminal Data 316
214	Cambridge Develop Labs 273	71	Ithaca Intersystems 122	172	Reliable Comp Resources 248	57	Texas Electronics Instruments (T.E.I.) 98
	* CBS Records 10	311	J & B Computer Products 328	275	Renaissance Sys Inc 316	26	Texas Instruments 47
300	CCM Inc 322	359	Jade 306, 307	2	RITAM International 8	23	Tex Instruments 47
118	Central Data 197	274	Jameco Electronics 314, 315	239	RLK Software 294	3	3/M Company 42, 43
123	Chatsworth Data 34	314	Jini Microsystems 328	129	RNB Enterprises 212	20	Robert Tinney Graphics 17
12	Chrislin Industries 206	67	Kemco Ltd 115	182	Robotics Age 255	317	Tel Industries 328
152	Chrislin Industries 240	185	Konacorp 256	225	S-100 277	297	Torrey Pines Business Sys 322
255	Circuit Computer Sales 282		* Lifeboat 116, 117	263	S & A Data Sys 308	199	TransNet 265
196	Compas Microsystems 263	303	* Lifeboat 243	149	Howard W Sams Co Inc 237		* United Software 245
147	Complete Business Systems 235	169	Logicon 322	177	Sara-Tech 251	241	Univair Inc 294
273	CompuMart 312, 313	312	Lomas Data Products 247	223	SC Digital 277	36	Universal Data Sys 65
72	CompuMax 123	145	M-Software 328	227	SCDP 278	207	US Robotics 269
56	CompuServe (microNET) 97	286	Macrotronics 320		SCION CORP 5	216	Verbor Electronics 274
	* CompuSystems 49	224	MacIntock Corp 277	65	Seattle Computer Prod 109	20	Verbatim Corp 37
122	Computer Data Systems 205		* Meas Sys & Controls 57	205	Selanan 269	302	Videx 322
16	Computer Furniture & Access 32		* Meas Sys & Controls 316	212	Michael Shrayer Software 273	324	Vista Computer 334
	* Computer Headware 254	293	Med-Ford Software 320		* Shopsmith 204	270	VR Data 309
180	* Computer Marketing Corp 253	173	MICAH 249	158	* Shugart 6, 7	251	Wameco 300
	* Computer Prof Books Club 231	32	Micro Age Computer Stores 61	183	Sigma International 243		* Wang Labs 217
280	Computer Service Center 316	87	Micro America 150	178	Sigma International 255	197	Western I/O 263
279	Computer Services 316	89	Micro America 151	134	Sirius Systems 251		* Whitesmith's Ltd 127
294	Computer Shop Inc 320	101	Micro America 171		Small Business Applications Inc 221	313	Wintek Corp 328
260	Computer Shopper 308	113	Micro America 191		* Small Business Sys Group 158	281	Worldwide Electronics 316
86	Computer Specialties 149	164	Micro Applications Group (MAG) 246	161	Ed Smith's Software Works 245	181	Zs Systems 253
163	Computers Wholesale 246	237	Micro Architect 294				
12	Computex 26	249	Micro Business World 299				
203	CompuView 267	329	Microcomputer Tech Inc 266				
256	Concord Computer Components 304	38	MICRO DATA BASE SYSTEMS 69				
159	Coosol Inc 244	136	Micromail 223				
22	Corvus Systems 41	261	Micro Mart 308				
220	Cover Craft 275	80	Micro Mike's Inc 137				
179	CPU Shop 102	156	Micro Management Sys 242				
299	Cranial Labs 322		* Micro Pro Intl 131				
	* Cromemco 1, 2	238	Microsette 294				
196	CT MicroCOMPUTER, Inc 261	52	Microsoft 91				
	* Cybernetics Inc 248	100	Microsoft (Cons Prod Div) 169				
232	DAR Sales 294	45	Micro Source 81				
321	Dal-Comp 329	30	Microtek 59				
	* Data Access 233	229	Microware 278				
213	Data Discount Center 273	7	The Micro Worlds 18				
228	Datadisk Systems 278	49	Micro World 85				
58	Data Management Labs 99	171	Midwest Computer Periph 248				
131	Data-Safe Products Inc 214	247	Mikos 298				
153	The DataK Corp 241	187	Mini Computer Suppliers 257				
295	Delta Products 321	98	Mini Micro Mart 164, 165				
175	DG Electronics 249	105	Mini Micro Mart 179				
137	Dennison Kybe Corp 224	142	Mini Micro Mart 229				
265	Des-Mar Electronics 308	305	Mini Micro Mart 323				
106	Diablo (Div of Xerox) 181	326	Morrow/Thinker Toys CV III				
124	Digi Byte 80		* Mountain Hardware 19				
194	Digital Graphic Systems 261	79	Mountain Hardware 136				
221	Digital Marketing 276	19	MT MicroSYSTEMS 35				
120	Digital Pathways 201	296	Multi Business Comp Sys 322				
309	Digital Research: Comp 327	139	National Multiplex 226				
111	Digital Research Corp 189		* National Small Comp Show 230				
160	Discount Software Group 245	237	NCC (Personal Computing) 281				
198	Dr Dobb's Journal 264	161	NEBS (New England Business Service Inc) 247				
155	Dynacomp 241	88	NEECO 150				
288	Dynasoft Systems 320	90	NEECO 151				
193	Ecosoft 261	102	NEECO 171				
	* Electravalue Industrial 294	114	NEECO 191				
284	Electrolabs 317	115	Netronics 193				
306	Electrolabs 324, 325	116	Netronics 193				
54	Electronic Control Tech 93	121	Netronics 203				
126	Electronics Book Club 209	14	North Star 29				
245	Electronic Systems 295	283	Northwest Computer Serv 316				
246	Electronic Systems 296, 297	327	Ohio Scientific Instrument CV IV				
215	Escon 273	46	OK Machine and Tool Corp 82				
135	Essex Publishing 222	85	OK Machine & Tool Corp 147				
186	Excel 257	188	OK Machine & Tool 257				
211	EXCOM 271	219	The Old Association 275				
	* Factory Direct Sales 252		Oracomputing 289				
315	Faircom 328	68	Orange Micro 118				
		74	Oregon Software 128				
		132	Osborne/McGraw-Hill 215				

BOMB

BYTE's Ongoing Monitor Box

Article #	Page	Article	Author
1	12	The Cassette Lives On, An Alternative to Floppy-Disk Mass Storage	Cook
2	20	A DC-to-DC Converter	Picco
3	22	I/O Expansion for the Radio Shack TRS-80, Part 1: Principles of Parallel Ports	Ciarcia
4	44	KIMDOS, Using Your KIM-1 with a Percom Floppy-Disk Drive	Swank
5	72	Interface a Floppy-Disk Drive to an 8080A-Based Computer	Hoepfner
6	104	A Graphics Text Editor for Music, Part 2: Algorithms	Nelson
7	120	Using the Computer as a Musician's Amanuensis, Part 2: Going from Keyboard to Printed Score	Raskin
8	130	Comparing Floppy-Disk Drives by Software Simulation	Nendza
9	196	Give Your Computer an Ear for Names	Munnecke
10	202	The Club Computer Network	Kasser
11	214	The COSMAC Doodler	Duntmann
12	250	Error Checking and Correcting for Your Computer	Walker

Bomb results on previous page

There are two sides to our story.

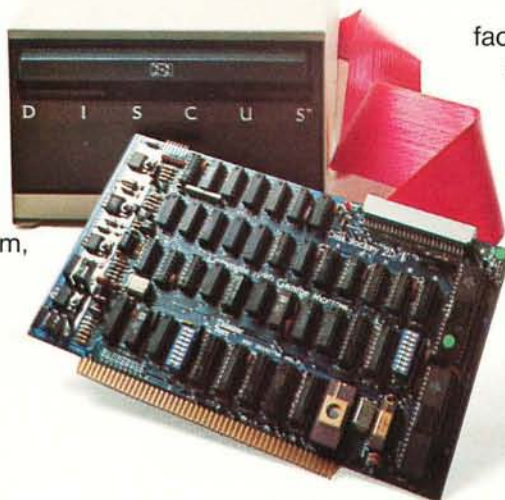
Side One

The DISCUS™ 2+2 Quad-Density Hardware

Now you can use your S-100 system to tackle big jobs. Because the DISCUS™ 2+2 Quad-Density Disk System puts 1.2 megabytes of fast-access memory on your side for just \$1545.00 complete.

With the DISCUS™ 2+2 System, complete means complete.

You get a full-size (IBM-compatible 8") double-sided/double-density disk drive,



factory mounted in a cabinet with power supply, fully-buffered S-100 single-board controller, and inter-connecting cables. All fully assembled, system-tested and fully warranted.

You get the speed and efficiency of 1.2 megabyte-per-diskette memory... and you get it for 0.13¢ per byte.

Side Two

The DISCUS™ 2+2 Quad-Density Software

1.2 megabyte quad-density hardware is only one side of the story. The DISCUS™ 2+2 System price includes all the fully-interfaced, high-performance software you need to take full advantage of your quad capacity.

The system includes our exclusive BASIC-V™ virtual disk BASIC, which allows you to address your quad-density diskettes as easily as main memory. The operating system you get is the widely accepted CP/M* 2.1. And you get our powerful DISK-ATE text editor/assembler; The most advanced software



development tool available.

Micro-Soft BASIC 5.1 and Micro-Soft FORTRAN are available as options. Both run under CP/M* 2.1.

Check out the full system price of DISCUS™ 2+2 Quad against any other floppy disk system at your local computer store. At \$1545.00, we think you'll take sides with DISCUS™ 2+2.

If your dealer doesn't carry THINKER TOYS products, write MORROW DESIGNS Inc., 5221 Central, Richmond, CA 94804. Or call (415)524-2101 9-5 weekdays (Pacific Time).

MORROW DESIGNS™ / **Thinker Toys™**

Step up to your next computer.



STEP UP TO A C4P FROM OHIO SCIENTIFIC

You know about computers. In fact, you probably own one now. One that you might be thinking of expanding. We have a better idea. Take a giant step into the personal computing future with an amazing, new C4P from Ohio Scientific.

SPEED SEPARATES THE COMPUTERS FROM THE TOYS

The C4P MF has execution speed that is twice as fast as Apple II or Commodore PET and over THREE times as fast as TRS-80. They are many times faster than the recently introduced flock of video game type computers. And, as if that weren't fast enough, the C4P nearly doubles its speed when equipped with the GT option.

Just look at the back panel of the C4P MF.



All the I/O you'll ever need!

Apple II, Commodore PET, TRS-80, and Atari 800 are registered trade names of Apple Computer Inc., Commodore Business Machines Ltd., Radio Shack, Atari, respectively.

SOUND

- 1—programmable tone generator 200 — 20KHz
- 1—8 bit companding digital to analog converter for music and voice output.

HUMAN INPUT EXPANSION

- 2—8 axis joystick interfaces
- 2—10 key pad interfaces

HOME INTERFACE

- 1—AC-12 AC remote control interface

DISPLAY

- 32 x 64 with upper and lower case 2048 Characters.
- 256 x 512 effective Graphic Points
- 16 Colors

SOFTWARE

Ohio Scientific offers a comprehensive library of both systems and applications software for the C4P.

The C4P is an outstanding premium computer — years ahead of the market. We know because there's nothing quite like it for the price, anywhere. And probably won't be for a very long time.

C4P \$750

8K BASIC-in-ROM, 8K of static RAM and audio cassette interface. Can be directly expanded to 32K static RAM and two mini-floppy disks.

C4P MF \$1795

All the features of the C4P plus real time clock, home security system interface, modem interface, printer interface, 16 parallel lines and an accessory BUS. The C4P MF starts with 24K RAM and a single mini-floppy and can be directly expanded to 48K and two mini-floppies. Over 45 diskettes now available including games, personal, business, educational and home control applications programs as well as a real time operating system, word processor and a data base management system.

Computers come with keyboards and floppies where specified. Other equipment shown is optional.

For literature and the name of your local dealer, CALL 1-800-321-6850 TOLL FREE.

OHIO SCIENTIFIC

1333 SOUTH CHILLICOTHE ROAD
AURORA, OH 44202 • (216) 831-5600

Circle 327 on inquiry card.