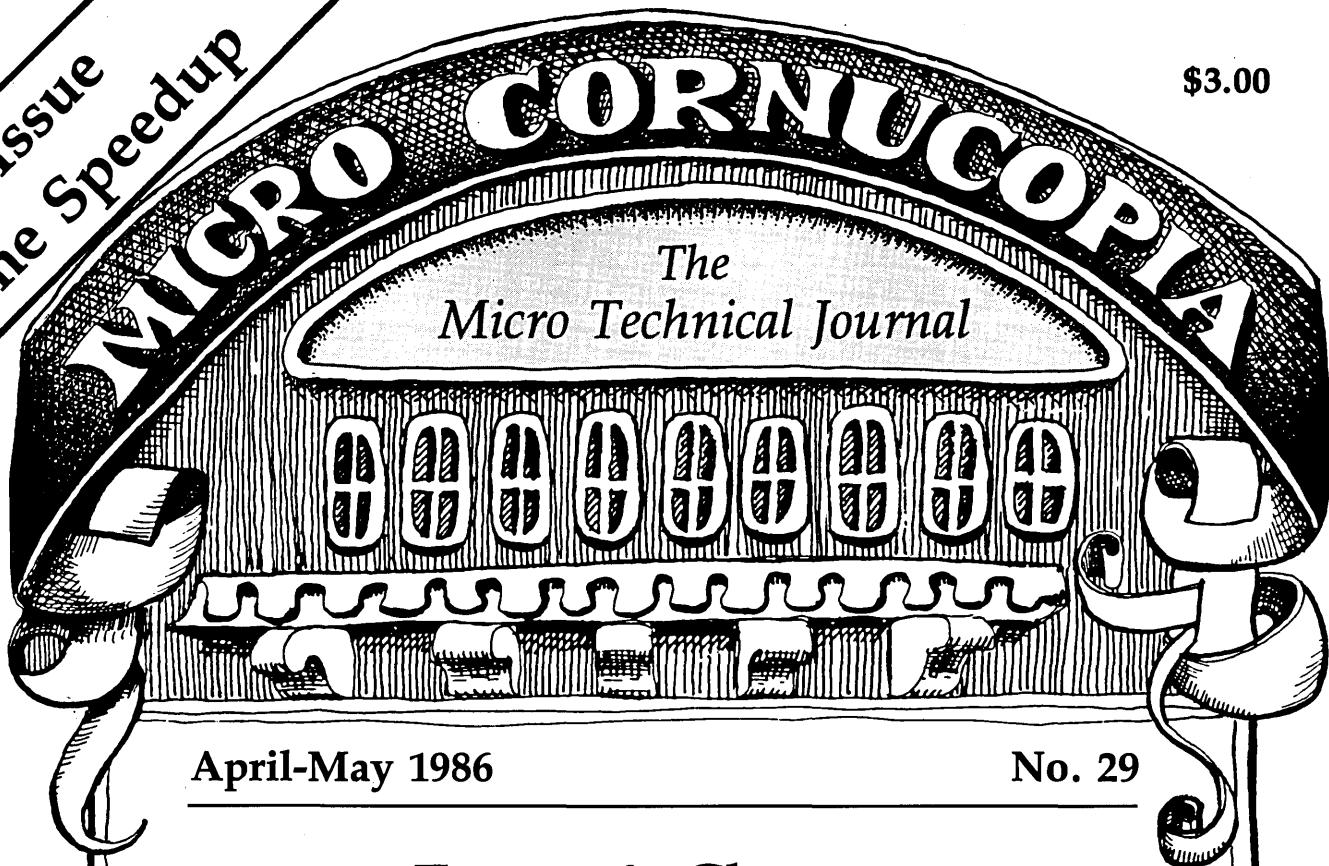


\$3.00

C Issue  
Clone Speedup



April-May 1986

No. 29

## Faster & Cheaper

- Upgrading Your XT To A Turbo For (almost) Nothing . . . . . 28**  
*If your PC or clone feels slow, here's a cheap solution.*

- Importing Systems From Taiwan. . . . . 38**  
*What are the problems you face doing your own importing? What are the benefits? Here are the answers.*

- Porting A 68000 Assembler To The Atari ST . . . . . 72**  
*Good inside look at the 68000 and the ST.*

- PC RP/M2, A Designer's View Of a CP/M Emulator. . . . . 94**  
*What are the problems faced by emulator writers and users?*

## C Extravaganza

- C Prototyping . . . . . 6**  
*Prototyping is the most exciting part of the new C standard.*

- The C Environment . . . . . 12**  
*Do the C interpreters really help?*

- Benchmarking The Speedy PCs In C . . . . . 32**  
*Benchmarking the 6.67MHz clones, Z80s, V20s & the ST with simple C routines.*

- The C Competition . . . . . 18**  
*Following on the heels of the very popular Pascal Runoff.*



# Turbo Pascal® and the Turbo Pascal family give you a perfectly integrated programming environment and unbeatable speed, power, and price

**T**urbo Pascal is faster than any other Pascal compiler, and at only \$69.95, a distinctly better deal. But it offers much more than speed, power, and price.

There's also the complete Pascal family of products that's grown from 1 to 9 products in just 3 years.

Turbo Pascal is backed by a complete range of "toolboxes" that give you most of the programming tools you'll ever need.

The Turbo Pascal family is never static, but is continuously expanding, with new products like Turbo Editor Toolbox™ and Turbo GameWorks™.

The secret of software success is not merely low price, but top quality, allied with complete documentation, like our 400-page reference manual.

All of which are some of the reasons why Turbo Pascal is clearly the leader, and the recipient of awards like PC Week's "Product of the Year" and PC Magazine's "Award for Technical Excellence." And some of the reasons why Turbo Pascal has now become a de facto worldwide standard with more than half a million users.

**Turbo Pascal has grown from a single product 3 years ago to a family of 9 today.**

Success breeds success, so the Turbo Pascal family has flourished. Your choices now include:

- Turbo Pascal 3.0 combines the fastest Pascal compiler with an integrated development environment.
- Turbo Pascal with 8087 math co-processor support for heavy duty number-crunching, and/or Binary



- Turbo Pascal 3.0
- Turbo Pascal with the 8087 support
- Turbo Pascal with Binary Coded Decimal (BCD)
- Turbo Pascal with 8087 and BCD
- Turbo Database Toolbox™
- Turbo Graphix Toolbox™
- Turbo Tutor™
- Turbo Editor Toolbox
- Turbo GameWorks

Coded Decimals to eliminate rounding-off errors for business applications.

Turbo Database Toolbox is a perfect complement to Turbo Pascal. It includes a complete library of Pascal procedures that allows you to search and sort data, and build powerful database applications.

Turbo Graphix Toolbox includes a library of graphics routines for Turbo Pascal programs. Lets even beginning programmers create high resolution graphics on the IBM® PC and true compatibles. Does complex business graphics, easy windowing, and stores screen images to memory.

Turbo Tutor teaches you step by step how to use Turbo Pascal, with commented source code for all program examples on diskette.

**Save \$109.70 when you choose the Turbo Jumbo Pack. 6 different Turbo Pascal products for only \$245.00!**

For only \$245.00, you get Turbo Pascal 3.0 and Turbo Editor Toolbox and Turbo Tutor and Turbo Graphix Toolbox and Turbo GameWorks and Turbo Database Toolbox!

All 6 for only \$245.00, which saves you \$109.70. This limited offer is good through September 1, 1986, so act now.

**NEW!** Amazing value! Turbo Editor Toolbox includes MicroStar™, a full-blown editor that also does windows! Turbo Editor Toolbox not only gives you ready-to-compile source code and a 200-page manual that tells you how to integrate the editor procedures and functions into your programs, but also

includes MicroStar, a complete editor with full windowing capabilities. (You could pay \$100.00 or more for a program like MicroStar, but you get it free as part of our Turbo Editor Toolbox.) You can also use Turbo Editor (which of course integrates with Turbo Lightning™) to build your own word processor!

**NEW!** Turbo GameWorks gives you the games you can write, rewrite, bend and amend! Turbo GameWorks reveals the secrets of game design and the strategies. You're given source code, a 200-page manual, and the insight

needed to write and customize your own irresistible games.

Turbo GameWorks also includes ready-to-play Chess, Bridge, and Go-Moku—an ancient Japanese game that can divert you from reality for hours on end.

**"Language deal of the century..."**

**Turbo Pascal**

*Jeff Duntemann, PC Magazine*

Turbo Pascal has got to be the best value in languages on the market today

*Jerry Pournelle, BYTE Magazine*

This compiler, produced by Borland International, is one of the best programming tools presently available for the PC

*Michael Covington,  
PC Tech Journal*

**YES!** I want the best.

To order by phone, or for a dealer nearest you, call (800) 255-8008; in CA call (800) 742-1133

Copies	Product	Price	Totals
—	Turbo Pascal 3.0	\$69.95	\$
—	Turbo Pascal w/8087	\$109.90	\$
—	Turbo Pascal w/BCD	\$109.90	\$
—	Turbo Pascal w/8087, BCD	\$124.95	\$
—	Turbo Database Toolbox	\$54.95	\$
—	Turbo Graphix Toolbox	\$54.95	\$
—	Turbo Tutor	\$34.95	\$
—	Turbo Editor Toolbox	\$69.95	\$
—	Turbo GameWorks	\$69.95	\$
—	Turbo Jumbo Pack	\$245.00	\$

Outside USA add \$10 per copy

CA and MA res. add sales tax

Amount enclosed

Prices include shipping to all US cities.

Carefully describe your computer system:

Mine is:  8-bit  16-bit

I use:  PC-DOS  MS-DOS

CP/M-80  CP/M-86

My computer's name and model is:

The disk size I use is:  3 1/2"  5 1/4"  8"

Payment:  VISA  MC  Bank Draft  Check

Credit card expiration date: \_\_\_\_/\_\_\_\_

Card #:

#### NOT COPY-PROTECTED

#### \*\*60-DAY MONEY-BACK GUARANTEE

Name: \_\_\_\_\_

Shipping Address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_  
CDs and purchase orders WILL NOT be accepted by Borland.  
Outside USA make payment by bank draft, payable in US dollars  
drawn on a US bank.

#### Limited Time Offer

\*\*YES, within 60 days of purchase, if this product does not  
perform in accordance with our claims, call our customer service  
department and we will gladly arrange a refund.

#### Minimum System Requirements:

Turbo GameWorks &  
Turbo Editor Toolbox—192K  
All other products, 128K  
TFS

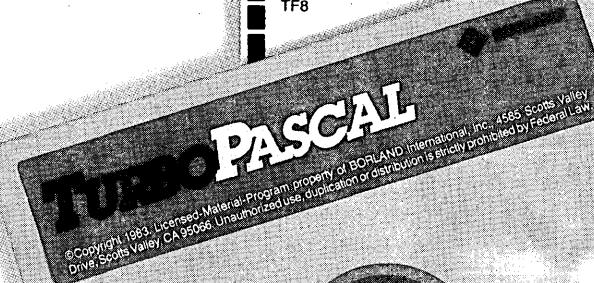


Vive la différence

4585 SCOTTS VALLEY DRIVE  
SCOTTS VALLEY, CA 95066  
(408) 438-8400 TELEX: 172373

Borland products include Turbo Pascal; Turbo Database Toolbox; Turbo Lightning; Turbo Graphix Toolbox; Turbo Tutor; Turbo GameWorks; Turbo Editor Toolbox; Reflex; The Analyst; SideKick; Sidekick; The Macintosh Office Manager; Traveling SideKick; and SuperKey—all of which are trademarks of Borland International, Inc. or Borland/Analytics, Inc.

Turbo Pascal and Turbo Tutor are registered trademarks, and Turbo GameWorks, Turbo Editor Toolbox, Turbo Database Toolbox, Turbo Graphix Toolbox, Turbo Lightning, and MicroStar are trademarks of Borland International. IBM is a registered trademark of International Business Machines Corp. Copyright 1986 Borland International. BI-1036

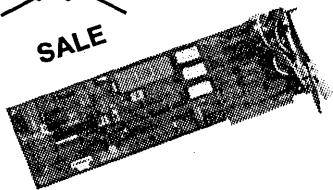


# PLUG INTO SAVINGS! FOR YOUR I.B.M.

DataMac 5.25" hard disk controller card.

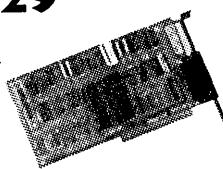
~~\$99.95~~ \$79.95

SALE



DataMac Dual Async Card (card only) comes with one active port, add the second 8250 and connector, with documentation

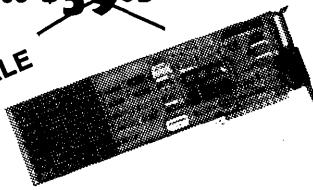
~~\$29.95~~



DataMac Dual Async card with 256K, no memory, requires 8250 plus your cable for second port.

~~\$39.95~~ \$59.95

SALE

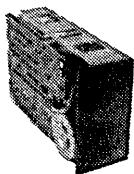


## RODIME 20 MEG 5.25" HARD DISK

These drives are brand new in factory cartons, full size with documentation

**\$299.95**

(similar to photo)



## CONTROLLER CARDS



D.T.C. 1403-D (shown with optional software and adaptor) control two 8" 851 DSDD and two 8" 1000 type

**\$249.95**

D.T.C. 520-I control four 5.25" DSDD and two ST-506 type hard disks

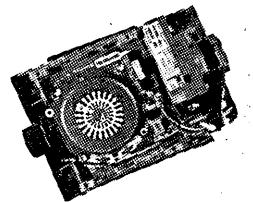
~~\$99.95~~

**\$69.95** Closeout Only 10 left

HOSTADAPTER FOR ABOVE CONTROLLERS (for most popular Z-80 computers) The Winif Adapter and software

**\$59.95**

## 3 1/2" FLOPPY DRIVES SHUGART SA300

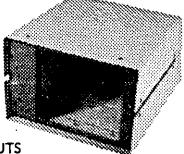


**\$99.95** EA

- BRAND NEW
- 500K
- 80 TRACK
- 135 TPI.
- THESE DRIVES GIVE YOU THE SUPER RELIABILITY OF A HARD DISK. THEY ARE COMPATIBLE WITH ANY COMPUTER WHICH USES A 1770, 1771, 1791 OR 1793 CONTROLLER CHIP
- THEY WILL FORMAT SINGLE, DOUBLE OR QUAD DENSITY, DEPENDING ON YOUR SOFTWARE.
- XEROX 820 (LITTLE AND BIG BOARD), KAPRO, AMPRO AND LOOK ALIKES AND H.P. SINGLE SIDED ARE JUST A FEW OF THE COMPUTERS THIS DRIVE CAN BE COMPATIBLE WITH

## THE SENSIBLE 5 1/4" DISK DRIVE CABINET KIT

- FUSED POWER SUPPLY 5A (115V - 12V)
- E.M.I. FILTER, 6 AMP
- SURGE PROTECTION
- POWER SWITCH
- POWER SUPPLY SHIELD
- CONNECTOR AND FAN CUTOUTS



CONSTRUCTED OF HEAVY GAUGE ALUMINUM, THIS UTILITY DISK DRIVE CASE WILL ACCOMMODATE 5 1/4" HARD DISKS, FLOPPY DRIVES, HALF HEIGHTS, FULL HEIGHTS, 2/3 HEIGHTS, CONTROLLER CARD AND SINGLE BOARD COMPUTER. OVERALL DIMENSIONS 10 1/4" X 10" X 7". COLOR IS TAN

ONLY \$119.95

LESS POWER SUPPLY **\$79.95**

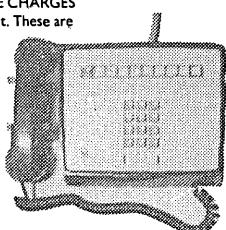
## BUSINESS TELEPHONES

STOP PAYING MONTHLY PHONE CHARGES These phones are not a cheap import. These are the same reliable I.T.T. phones that have served us both for many years.

Standard 10 button business telephones serviced by Bay Telephone Co.

ONLY **\$79.95**

limited to color selection on hand



BRAND NEW 6 BUTTON BUSINESS TELEPHONES ALL THE STANDARD FEATURES INCLUDING BUZZERS AND RINGERS. LOOKS THE SAME AS ABOVE PICTURE. COLOR, CHOC. BROWN.

ONLY **\$59.95**

(LIMITED QUANTITY)

## GO ON LINE WITH UNITED PRODUCTS

Take advantage of the many items that space does not allow us to advertise. Use your computer to down load our weekly specials and hard to find items. On line 24 hours a day, 7 days a week.

300 or 1200 baud, even parity, 8 bits with one stop bit.

The phone number is: (206) 682-5593

New items are added weekly. Don't miss out, call each week.

BUILDING A ROBOT?  
WE CAN HELP!

## I2 VDC STEPPER MOTORS

STANDARD 6 LEAD 4 PHASE

STEP ANGLE: 7.5°

RESISTANCE PER PHASE: 36 OHM

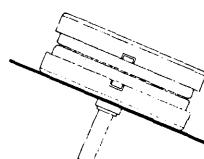
SHAFT: 1/4" X 5/8"

O.D. 1 1/4" X 2 1/4" (3/8" FLANGE)

REG PRICE \$32.00

**\$9.95** EA.

**\$6.95** EA. WITH PURCHASE OF ANY STEPPER DRIVER KIT



## UNIVERSAL STEPPER MOTOR DRIVER KITS



FOR DIRECT CONTROL FROM YOUR COMPUTER

- Control almost any stepper motor, forward/REVERSE and step sequence.
- For stepper motors rated 1.7 VDC — 12.0 VDC
- Uses a power supply with an output of between 3.0 VDC and 12.0 VDC
- Modifications included for motors rated above 12.0 VDC
- Inputs/outputs are on a standard 22 pin edge card connector (.156 spacing) 4 1/2" x 6 1/2" card, G-10 epoxy.

TECHNA-KIT  
cat# U.S.M.D.-C

**\$29.95**

SAME SPECS. AS U.S.M.D.-C  
except a stand-alone driver

• On board clock (user optional)  
• No edge connector

TECHNA-KIT  
cat# U.S.M.D.

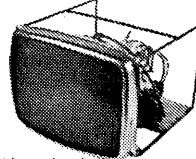
**\$19.95**

Real Power From a Famous Manufacturer delivers: 10 amps at 5V, 8 amps at 12V, measures only 8.5" by 4.5" and is only 2.25" thick

**\$39.95**

(limited supply on hand)

## MONITORS



Ball Brothers TV-120 (shown above)  
16mhz, Xerox 820 compatible, P-4 phosphor B/W, 12"

**\$59.95**

Ball Brothers TX-7

Xerox 820 compatible, 7", flat panel, antiglare for photography

**\$29.95** SOLD OUT

AudioTronics 964-02  
Xerox 820 compatible, TTL/X-Y input, 9" green screen

**\$39.95**

united products, inc.  
serving the west coast since 1968

1123 Valley Hours: 9-6  
Seattle, WA 98109 Sat. 9-5

PHONE (206) 682-5025

Terms: All orders are shipped F.O.B. Seattle, Wash.

C.O.D.'s are OK with cash or certified check

MasterCard and Visa accepted

On orders over \$50.00 in the continental U.S. we pay the freight.

All advertised items are subject to prior sale

# MICRO CORNUCOPIA

The Micro Technical Journal

Editor & Publisher  
David J. Thompson

Operations & Advertising  
David Pogue

Associate Editors  
Rebecca Ozrelic Gary Entsminger

Accounting  
Sandra Thompson

Office Manager  
Tracey Anthony

Technical Department  
Larry Fogg

Staff Assistants  
Dorcas Dsenis Cary Gatton  
Laura Logan Renee Katter

MICRO CORNUCOPIA (ISSN 0747-587X) is published bi-monthly for \$16 per year by Micro Cornucopia Inc. 155 NW Hawthorne Bend, OR 97701. Second-class postage paid at Bend, OR and additional mailing offices. POSTMASTER: Send address changes to MICRO CORNUCOPIA, PO Box 223, Bend OR 97709.

**SUBSCRIPTION RATES:**  
1 yr.(6 issues) .....\$16.00  
2 yr.(12 issues) .....\$30.00  
3 yr.(18 issues) .....\$42.00  
1 yr.(Canada & Mexico) .....\$22.00  
1 yr.(Other foreign) .....\$30.00  
Make all orders payable in U.S. funds on a U.S. bank, please.

**CHANGE OF ADDRESS:** Please send your old label and new address.

**MICRO CORNUCOPIA**  
P.O. Box 223  
Bend, Oregon 97709

**CUSTOMER SERVICE:** For orders & subscription problems call 503-382-5060, 9 am to 5 pm, Pacific time, M - F.

For technical help call 503-382-8048, 9 am to noon, Pacific time, M - F.

RBBS - 24 hrs. 300-1200-2400 baud  
503-382-7643

Copyright 1986 by Micro Cornucopia Inc.  
All rights reserved  
ISSN 0747-587X

## EDITORIAL

By David Thompson

### Round The Bend?

#### An Irish Suggestion

Pat O'Leary of Dublin, Ireland, suggested "Round The Bend" as a replacement for "Editorial." It's the best suggestion so far because it: 1) Has at least two meanings, 2) Has a certain rhythm to it (like "over the hill," or "through the woods."), 3) Doesn't sound too serious, and 4) Is the only suggestion I've received.

If you've got an idea, or if you like Pat's suggestion, let me know.

#### User's Guide?

User's Guide, "The Magazine For CP/M Computer Users" has disappeared, apparently permanently. In the last issue (Oct 85) the editors (Cheryl Rhodes and Tony Bove) wrote:

"First the good news: User's Guide is returning to an all CP/M magazine, and we are starting a magazine called PC User to handle PC-compatible users. We hope this winning combination, together with our new magazine, Desktop Publishing, will generate enough new business to allow us to continue to publish the best articles and most useful tutorials we can find."

That was the first paragraph of the editorial. The last paragraph ends thus:

"With these steps (the three magazines) we grow from a very small magazine publishing company to a "publishing empire". Step aside, CBS, McGraw-Hill, Gulf + Western!"

PC User has been shut down (before mailing the first issue). User's Guide is on hold, and on March 1, Desktop Publishing becomes the property of PC World. (Tony and Cheryl will be continuing as editors of Desktop Publishing.)

#### C Competition

Here we are announcing a C competition, and I haven't come up with an appropriately punishing name for it.

(I'm obviously suffering from an advanced case of pun rot.)

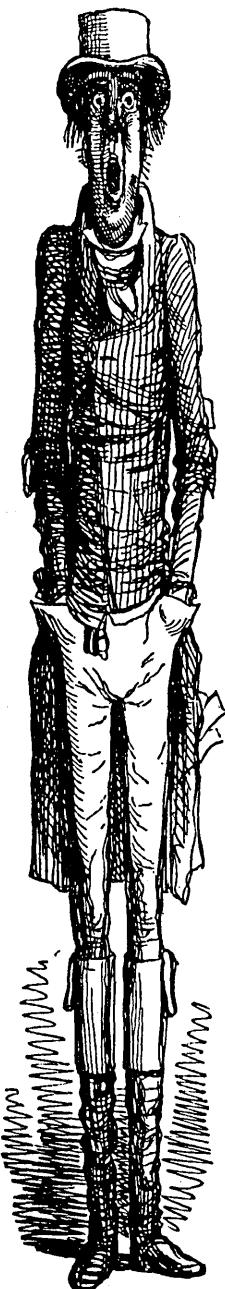
Despite this major obstacle, we are pushing forward, preparing for the greatest C competition in computer (and pre-computer) history.

See the C entry form in this issue for more details, and then start writing.

#### Where To From Here?

Things get pretty interesting around here at 5 o'clock. Some days, of course, that hour sees only heels as folks

(continued on page 76)



## C'soning

### 6 Prototyping in C

*The new C standard includes prototyping.*

### 12 The C Environment

*How do you select C interpreters? And, do you really need them?*

### 32 Benchmarking The Speedy PCs (and CP/M Emulators) In C

*What do you gain when you speed-up a PC? How much faster is the 8 MHz Atari ST?*

### 18 The C Competition *Grab your compiler and have at it.*

## Speed-up and more

### 20 Monitoring A Modem With A Bridge

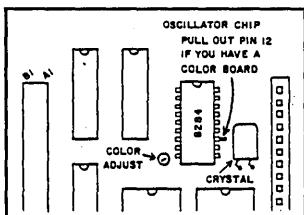
*Simple circuit monitors the phone line.*

### 24 Relief From The 300-baud Blahs

*A light review of a fast bird.*

### 28 Upgrading Your XT To A Turbo For (almost) Nothing

*Warm up the soldering iron.*



### 35 Virtual Memory

*There's nothing simple about substituting hard disk memory for RAM.*

### 47 Drive Select Reversing Switch

*Swap drives at the flick of a switch.*

### 50 Adding Directory Hashing To CP/M 2.2

*As directories get larger, linear searches take longer.*

### 62 Computing In The Netherlands

*A Dutch University instructor looks at happenings in Europe.*

### 72 Porting A 68000 Assembler To The Atari ST

*An introduction to 68000 assembly language and the ST.*

### 90 Real Time Clock Routine For The Kaypro 4

*Turbo Pascal makes time almost easy.*

### 94 PC RP/M2, A Designer's View Of A CP/M Emulator

*The problems designers face when writing a CP/M emulator for an MS-DOS System running the V20 processor.*

## Columns

### 16 C'ing Clearly Moving C to MS-DOS.

### 38 On Your Own

*Special feature on doing your own importing.*

### 43 Pascal Procedures Futuristic software.

### 48 Kaypro

*Kaypro adds four more nails to CP/M's coffin.*

### 56 In The Public Domain

*Dynamite new public domain offerings.*

### 60 S-100 Bus Turbo DOS discussion.

### 66 Xerox I/O and system speed.

### 69 86 World CCP/M Turkish style.

### 81 Culture Corner Brain teaser.

### 92 Technical Tips

## Future Tense

By Gary Entsminger

### 98 Tidbits

*Gary looks closely at CP/M emulators and much more.*

### 104 The Last Page PC upgrades, Taiwanese BIOS and The Way of Life.

# LETTERS

## Popcom Modems

I purchased a Popcom X100 modem about a year ago and soon discovered that something in my network of phone lines, power lines, EIA cables, CPU, printer, and modem was acting as a perfect antenna for a local radio station.

I filtered the power line, filtered the phone line (Micro C Technical Tips, Issue 23), shielded everything that was shieldable, and still had the problem. I then called the modem manufacturer, Prentice Corp. They had a fix; I was elated. The modem was shipped, repaired, returned — and I still had the problem.

I called Prentice again, and they agreed to call my home that evening. During the call, we went through various tests of the modem. They isolated the problem to the phone line and designed a new filter for the modem. A week later I received the modem with the new fix, and I have not had a single occurrence of the problem since.

This kind of service is outstanding. I highly recommend the Popcom X100 for its advanced functionality and the service department that supports it.

**Dave May**  
264 Maple Lane  
Roseville MN 55113

## Satisfying Software Customers

When I heard about a software package called "The Landlord" by Systems Plus, Inc., it seemed just what I needed to tame an unruly property management business. SPI referred me by name to a local software store which didn't stock the package, but readily agreed to special order it. Three weeks later they received it. \$500 lighter, I took it home.

I was extremely disappointed. When I checked the front of the training manual for a tech help number, I discovered that their information rate is \$60/hour (payable by charge card). Letters to the company went unanswered. When I called, the sales manager told me that my local software store could train me. However, my local software store had never seen the product before, and had no agreement

with SPI. As of today, still no satisfaction.

My second fiasco was with a product called Palantir. This is a word processor which was supposed to have been optimized for Turbo DOS. I bought a copy, loaded it, and watched my computer crash. The local distributor was helpful — he told me I was doing something wrong. So I shipped the whole thing back, but he refused to return my calls, or to give me a refund.

A not-so-bad story: Poor Person Software (Micro C advertiser) told me up front that their software might not run on my Turbo DOS system. They were right. I shipped it back, erased it from my system, and was promptly refunded the entire price, including shipping.

I believe a software merchant either needs to let you examine a product before purchase, or have a guaranteed refund.

**Sidney J. Balcom**  
P.O. Box 4034  
Alexandria VA 22303

## K & R "C" Clone

I made a discovery. Mix C (\$39.95) and Alcor C (\$139) are the same. At least the manuals are the same right down to the typos.

Mix C is a virtually complete K & R "C" compiler except that you can't initialize external floats, doubles, and &array\_elements. Extensions to K & R include the ability to prevent type conversion in char and float values passed to a function, and most of the Unix V extensions (not enumerated data types, however).

The object code produced needs the runtime library unless you use a linker option to produce stand-alone programs. You don't want to do that if you don't have to: the overhead is tremendous!

Compile and link speed is acceptable. Execution speed? A couple of benchmarks out of the August '83 Byte show startlingly variegated results. Fib.c calculates the 24th value in the Fibonacci series 10,000 times by means of a recursive function call. The worst speed Christopher Kern noted was

Aztec's: 237 seconds, or just under four minutes. When Mix C had passed 12 minutes with no sign it meant to finish this year, I hit the reset button.

For string.c, which calculates the length of "Now is the time for all good men to come to the aid of the parity" 25,000 times, Kern got times ranging from C/80's 357 seconds (six minutes, more or less) to Whitesmith's 138 seconds. Mix did it in 54. (The test for C/80 was slow because Kern was using version 2.0, whose string-handling was, to be polite, primitive.) (I couldn't get the Mix register version to compile.)

Mix C is a very good and economical full-C compiler affording you totally portable source code. Write: Mix Software, Inc., 2116 E Arapaho, Suite 363, Richardson TX 75081.

**R.W. Odlin**  
2127 Hoogdal Rd.  
Sedro-Wooley WA 98284

## Reader's Wish List

What new products would I like to see? I mention them every chance I get, but no one has taken me up on them, yet. They are:

1. Some little boxes the size of half-height and full-height drives (with or without a door). For someone who has encouraged so many to mutilate their Kaypros and leave them with gaping holes, I'd say you have no choice but to help them undo the damage.

2. Ever tried to find a small toggle switch (sp3t) to give your Kaypro the choice of thinking in 2.5, 4, or 5MHz? They're rare as hen's teeth. Why not make a little money for staff doughnuts by selling them?

3. While you're poring through industrial supply catalogs looking for the sp3t switch, why not look for a tiny, four-direction toggle switch. Taking off on the joystick article of a few issues ago, you could make a small keyboard joystick to zoom around on the screen and avoid using those illogically arranged cursor keys.

**Mike W. Perry**  
6035 40th NE  
Seattle WA 98115

(continued on page 86)

# Idea Processing – Pure and Simple.

Announcing the all NEW

## OUT-THINK™ outline processor.

### See your ideas like you've never seen them before!

Capture your fleeting ideas. And keep 'em organized with OUT-THINK, the incredible, new outline processor from KAMASOFT. OUT-THINK unleashes the power in your workhorse CP/M computer and turns it into an Idea Processor.

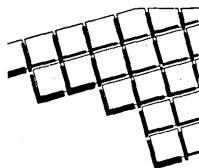
#### Get extraordinary:

- + ease of use  
Most functions are less than 3 keystrokes away!
- + ease of learning  
Completely interactive; no programming!
- + performance  
Write more and faster than you ever dreamed possible!
- + idea leverage  
OUT-THINK your competition!

OUT-THINK supports your thinking process and keeps you in touch with your ideas. That's because OUT-THINK works the way your mind works—naturally.



Begin by brainstorming. OUT-THINK lets you jot down ideas quickly, as you think of them. If you want to elaborate, you can add text with full screen editing.



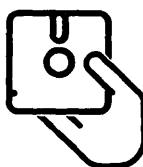
Then develop your ideas using a familiar outline format. Change the structure as easily as you change your mind. Move an idea and all attached text moves with it.

You can keep track of your main line of thought by collapsing the details from view. Then, expand portions of the outline to develop the specifics when you need to. By collapsing and expanding, you can maintain an overview and literally see how your ideas fit together.



And OUT-THINK is fast. Your ideas remain at your fingertips. OUT-THINK can locate and retrieve by keyword—even a misspelled one—in less than a second per outline file.

Once you've entered your ideas, you can get them out with a full complement of formatting, printing and file conversion options (including Wordstar compatibility). From a two-page report to the Great American Novel, OUT-THINK will rotate your headers and footers with page numbers and give you a Table of Contents to boot.



OUT-THINK is brought to you by KAMASOFT. We pioneered outline processing and brought this amazing new technology to CP/M computers. For over 2 years, our

KAMAS programmable outline processor has been widely acclaimed:

*"Outline processing might be the next wave in software, and KAMAS is a good place to start."*  
- Ezra Shapiro, BYTE

*"The outline processor is simple, easy to use, and will appeal to all users."*  
- Mark Renne, INFOWORLD

*"If you're a writer using a CP/M based system, get KAMAS. You'll love it. It's that simple."*  
- Marybeth Highton, FOGHORN

*"Considering the quality of the program itself, the documentation, and newsletter, it has to be rated an outstanding value."*  
- Thomas Tucker, PROFILES

Our new OUT-THINK is simpler and easier to use than KAMAS. Yet, it offers more printing and formatting options, better handling and control, and faster operations. And at \$49.95 your ideas have never had it so good. OUT-THINK is simply spectacular. Try it for 60 days. If you're not completely satisfied, return it for a full refund.

If you create and organize text in the course of your work, you owe it to yourself to get OUT-THINK.\*

\*But for some people, enough is never enough. Some like the challenge; others need the power. For you, we have the KAMAS Combo Pack. You get OUT-THINK's ease of use coupled with the extra horsepower of the KAMAS programming environment. And both use the same outline files.

Rush me my choices now:



OUT-THINK  
the simple and  
easy to use  
outline processor:

special  
introductory  
**\$49.95\***



KAMAS  
the programmable  
powerhouse:

**\$99.95\***



KAMAS COMBO PACK  
the power and the  
glory:  
**\$129.95\***

\*Includes S/H U.S. & Canada. Overseas add: \$10 for OUT-THINK; \$30 for KAMAS or COMBO PACK.

KAMAS owners: Send us your master disk and \$25 for OUT-THINK.

VISA  MC  AMEX  Payment Enclosed

Card No.

Exp. Date

Signature

Name

Address

City

State Zip

Telephone

Our software is available for most CP/M computers. Tell us about yours:

Computer Make/Model

Disk Size:  5 1/4" SSDD  
 5 1/4" DSDD  8" SSSD

Requirements: CP/M 2.2 or above (48K TPA). Minimum 200K of disk storage. 80 column x 24 line screen. (Note: KAMAS requires 56K TPA and Z80 processor.)

Terms: All orders prepaid. PO's accepted when accompanied by payment. Foreign checks must be drawn on US banks in US funds.

#### MAIL ORDERS TO:

**KAMASOFT™**

2525 SW 224th Ave., Dept. 111  
P.O. Box 5549  
Aloha, OR 97007

**CALL IN YOUR ORDER:**  
**503-649-3765**

Wordstar is a registered trademark of MicroPro, Inc. Z80 is a registered trademark of Zilog, Inc. CP/M is a registered trademark of Digital Research, Inc. KAMAS, KAMASOFT, and OUT-THINK are trademarks of KAMASOFT, Inc.  
© 1985 KAMASOFT, Inc.

# Prototyping In C

## Type-checking gains a foothold in this freewheeling language.

C was developed as a do-everything language — for everything from writing operating systems to creating applications. Now there's another, Modula II, which combines C's versatility with Pascal's strict data checking a definite improvement.

Now there is an ANSI standard for C and that standard includes prototyping, a process which makes it possible for C programmers to use C compilers to do data type checking. C is still alive and well and kicking.

Compared with most popular languages (say, FORTRAN), C is still a relatively young language. Brian Kernighan and Dennis Ritchie defined the C language "formally" in 1978 in "The C Programming Language," referred to throughout this article as "K&R".

### A Little C Background

K&R has remained the standard, although a maturing C has brought inevitable changes. For example, structure passing and assignment were implemented on several compilers about the same time K&R was published, but weren't permitted in K&R. Other modifications have also become common (for example, enum and void).

Figure 1 - lseek

```
long lseek(fd, offset, position)
int fd, position;
long offset;
{
    /* The details of the function */
}
```

Figure 2 - Type Mismatch

```
lseek(fd, position, offset);
```

K&R, as it is commonly used today, no longer has a one-to-one correspondence with C. That's not good, since deviations in a language can make porting programs difficult.

To prevent things from getting out of hand, the American National Standards Institute (ANSI) established the X3J11 committee to define a standard for the C language. The committee has cleared up the gray areas in K&R, standardized elements of the language, and has added several new features to the language to reduce some of C's shortcomings.

One major enhancement to C is prototyping.

### Prototyping — Problem Solver

Because C is so flexible you can call a function using the wrong data type. For example, lseek() is a function used to locate a certain area within a file. See Figure 1.

How many times have you done something like calling lseek() using an integer instead of a long data type for offset? Making such a mistake is possible because C doesn't provide type checking. That is, C doesn't check to see that the data type used for offset matches what the function expects for offset.

Another common mistake is calling a function with the arguments in the

By Jack Purdum, Ph.D.

Ecosoft, Inc.  
6413 N College Ave  
Indianapolis IN 46220

wrong order. For example, given the correct definition for lseek() in Figure 1, you can also mess up the function call to lseek(). See Figure 2.

Of course lseek() expects to see offset before position.

In other situations a programmer may even forget a function argument when using the function. In some cases, such mistakes cause obvious problems (e.g., the file can't be written to), while reversing or omitting function arguments may produce bugs that are harder to spot.

### What Is Prototyping?

Prototyping is the X3J11 committee's method for catching reversed or missing function arguments in C. In addition, prototyping spots mismatches of data types in function arguments. An example will help illustrate what prototyping is and how it works.

Given the function definition of lseek() in Figure 1, the prototype for lseek() is:

```
long lseek(int, long, int);
```

This statement tells the compiler: 1) the function returns a long data type, 2) the first argument must be an int, 3) the second argument must be a long, and 4) the last argument must be an int. Technically, the first type specifier

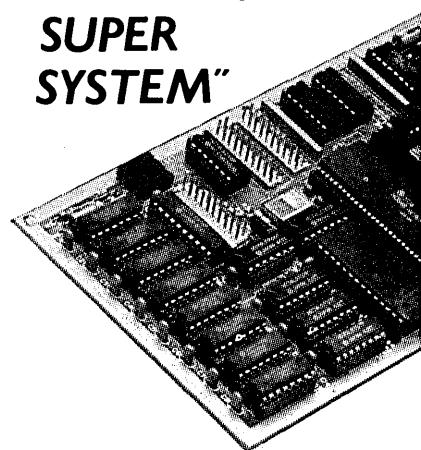
Figure 3 - Code Fragment

```
#include <stdio.h>
long lseek(int fd, long offset, int position);

main()
{
    int fd, offset, position;
    .
    .
    .
    lseek(fd, offset, position);
    /* Line xxx */
}
```

**Byte Magazine called it.**

## "CIARCA'S SUPER SYSTEM"



### The SB180 Computer/Controller

Featured on the cover of Byte, Sept. 1985, the SB180 lets CP/M users upgrade to a fast, 4" x 7½" single board system.

- 6MHz 64180 CPU (Z80 instruction superset), 256K RAM, 8K Monitor ROM with device test, disk format, read/write.
- Mini/Micro Floppy Controller (1-4 drives, Single/Double Density, 1-2 sided, 40/77/80 track 3½", 5¼", and 8" drives).
- Measures 4" x 7½" with mounting holes
- One Centronics Printer Port
- Two RS232C Serial Ports (75-19,200 baud with console port auto-baud rate select).
- Power Supply Requirements +5V +/- 5% @500 mA  
+12V +/- 20% @40mA
- ZCPR3 (CP/M 2.2/3 compatible)
- Multiple disk formats supported
- Menu-based system customization

**SB180-1**  
SB180 computer board w/256K bytes RAM and ROM monitor ..... \$369.00

**SB180-1-20**  
same as above w/ZCPR3, ZRDOS and BIOS source..... \$499.00

•Quantity discounts available-

#### NEW

**COMM180-M-S**  
optional peripheral board adds 1200 bps modem and SCSI hard disk interface.

**TO ORDER**  
**CALL TOLL FREE**  
**1-800-635-3355** **TELEX** **643331**

For technical assistance or to request a data sheet, call:  
**1-203-871-6170**



**Micromint, Inc.**  
25 Terrace Drive  
Vernon, CT 06066

isn't part of a prototype; only the information "between the parentheses" pertains to prototyping. Therefore, items 2 through 4 are prototyping information.

A compiler which supports prototyping would catch the mistake shown in Figure 2. Why? Because offset and position are of different data types, and a prototyping compiler would know this; a "straight" K&R C compiler would not.

Another variation of prototyping allows identifiers to be part of the prototype. For example, you may also say:

```
long lseek(int fd, long offset,
           int position);
```

In this example, the prototype includes identifiers to help the programmer recall what the variables are. Note that the identifiers are for documentation purposes only. The prototype doesn't define the variables fd, offset, or position. (And you can't use them until they are defined.)

Now suppose you have the code fragment shown in Figure 3 in your program.

First, notice that we define fd, offset, and position within main() even though they're present in the prototype. We do this because those variables aren't defined by the prototype; they exist only for documentation purposes. Since they don't actually exist, no storage has been allocated for them. (A way around this is discussed below.)

Now look at the rest of the program. The call to lseek() in Line xxx is incorrect because offset is declared to be an int, but the prototype expects a long. With prototyping you get tighter type checking than with pure K&R C.

#### No Argument

A prototype for a function that has no function arguments would be —

```
double drand(void);
```

which states that drand() should never be called with an argument. If you later (incorrectly) used drand() as:

```
x = drand(y);
```

the compiler will generate an error

because the prototype states that drand() cannot have an argument.

Consider the following prototype examples:

```
void func1(void, int);
/* Wrong!!! */

void func1(int1, int2);
/* OK */
```

The first is an incorrect prototype because the function says: "func1() is a function that returns nothing useful from the function and that it has no arguments followed by an int." It makes no sense to mix "void" with any other data types in the list of arguments. The second (legal) prototype expects two integer arguments and returns nothing of value.

#### Prototyping With Pointers To Functions

What if you need a pointer to a function that returns an int. For example, consider the prototype for a bubble sort function —

```
void bsort(unsigned, int (*())(),
           int (*())());
```

which states that bsort() requires three arguments: 1) an unsigned, and 2) two pointers to functions that return an int. In this example, identifiers would help make the prototype more readable. Therefore, we might use —

```
void bsort(unsigned nelem,
           int (*compare)(),
           int (*swap)());
```

This makes it a little easier to understand what bsort() is all about. Again, keep in mind that nelem, compare() and swap() are not defined in the program and cannot be used as variables or function calls. They have to be defined elsewhere in the program.

#### Prototyping With Variable Arguments

Some functions have a variable number of arguments, the data type and number of which cannot always be known at compile time. The printf() function is a common example. How can we prototype such functions?

The standards committee created a new symbol for C called an ellipsis to designate functions in which we have

(continued on page 9)

# THE CHALLENGER XT-186

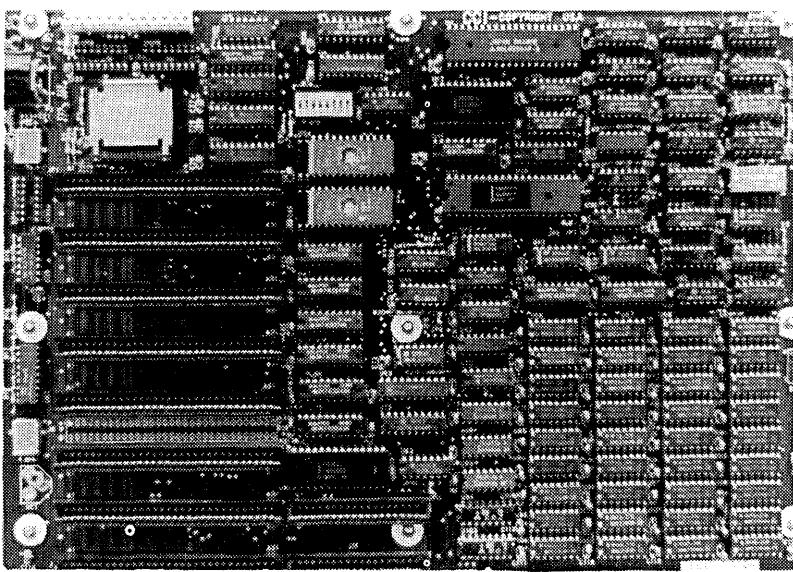
## NOT JUST ANOTHER CLONE

### FULLY IBM COMPATIBLE BUT FOUR TIMES FASTER

---

#### CHALLENGER XT-186 SINGLE BOARD COMPUTER

---



#### Standard Features:

- Intel 80186 CPU, 8MHz
- On-board 640K, parity checked RAM memory
- 8 slots for I/O Interface Board
- 4 channel 8237 DMA
- 8 channel 8259 Interrupt
- 3 channel 8253 Timer
- IBM PC-AT-like Bus with true 16 bit data path

#### Optional Features:

- 10 MHz operation
- 8087 Numerical Processor support

The Challenger XT-186 offers full IBM PC-XT compatibility. It supports industry standard operating systems: MS/DOS, PC-DOS, 1.0 through 3.1, UNIX and CP/M and runs all existing software with higher performance. The XT-186 mother board can directly replace any existing PC or PC-XT mother board, as it has the same physical dimensions and mounting holes. The Intel 80186 and 640K on-board 16 bit path RAM makes the XT-186 the fastest PC currently available.

MOTHER BOARD, 8MHz, 640K, RAM, 8 I/O slots

**\$795.00**

#### Add-On Cards:

**Color Graphic Board:** RGB and composite, 320X200 Color/B&W, 640X200 B&W only, light pen input ..... **\$120.00**

**Multifunction Card:** Real Time Calendar Clock with Battery Backup, 2 RS-232 ports built-in, 1 parallel port ..... **\$120.00**

**Floppy Diskette Controller Card:** Double-sided, double density, can support 4 floppy diskette drives ..... **\$70.00**

**Monochrome Display Card:** Supports 256 character codes on 4K ROM, 4K display buffer on static RAM with TTL monochrome video output ..... **\$110.00**

**Monochrome Graphic/Printer Card:** Two graphic pages with a resolution of 720X348, software supplied to allow the use of the basic graphic command, centronic parallel printer interface ..... **\$140.00**

Visa and Mastercard Accepted

Please Add \$3.00 Shipping

---

#### HOLLISTON COMPUTER

P.O. Box 615, Chepachet, R.I. 02814

**401-568-0522**

---

IBM PC-XT-AT PC-DOS are trademarks of International Business Machines Corp. MS DOS is a registered trademark of Micro-Soft Corp. CP M is a registered trademark of Digital Research, Inc.

## PROTOTYPING IN C

(continued from page 7)

no prior information about the number or type of arguments that might be used with the function. The ellipsis is simply three periods (...). Using the ellipsis, the prototype for printf() becomes:

```
int printf(char *, ...);
```

or

```
int printf(char *control, ...);
```

which says that printf() returns an int, and that its argument(s) will always include (at least) a pointer to char (the control string), but may have other unspecified arguments with unknown data types.

Figure 4 - Function Without Prototyping

```
char *func1(c, fp, num)
char *c; /* Argument declarations */
int num;
FILE *fp;
{
    .
    .
}
```

Figure 5 - Function With Prototyping

```
char *func1(char *c, FILE *fp, int num) /* Line 1 */
{
    .
    .
}
```

Figure 6 - System V Header File Examples

Header File	Likely Functions to be Included
stdio.h	fclose(), printf(), scanf(), etc.
math.h	sqrt(), ceil(), tan(), etc.
malloc.h	malloc(), calloc(), free(), etc.
ctype.h	isdigit(), isxdigit(), etc.
stdlib.h	(Most System V functions that do not have a header)

### **Creating Your Own Prototypes**

Use a prototype form when you write your own functions. (If your compiler doesn't support prototypes, it probably will in the near future.) This will give you the benefits of type checking that prototyping offers. If you used to define a function as in Figure 4, the new (prototype) form would be as shown in Figure 5.

Note that the prototype form does not use argument declarations; they are part of the prototype. Also notice that Line 1 of the prototype could be "block-moved" into a header file for future use as a prototype if the function definition were not in the file. (Don't forget the required semicolon at the end of the prototype if it's in a header.)

Notice in Figure 5 that a prototype

that's part of a function definition does allocate storage for the variables in the prototype, and those variables can be used in the function. This isn't true for prototypes that declare the function rather than defining it. (Think of a "declaration" as simply the function name and its prototype, while a "definition" contains the complete code, including the function body.)

### **Prototyping The Standard Library**

Given all of the above, it would seem like a lot of trouble to go through your compiler's documentation and create prototypes for all the functions in its library. Fortunately, the firm that manufactured your compiler has probably done this for you. Although deviations should be expected, you'll probably find something like Figure 6.

If a System V header file exists for a function, functions associated with that header file will most likely have their prototypes in that header file. Some examples are given in Figure 6.

Note that the last header file in Figure 6 (i.e., stdlib.h) is not etched in stone. However, several compiler manufacturers are following the pattern and file names suggested in Figure 6. Consult your compiler documentation for specifics.

### **Cast Off**

Like anything that's new, it takes a little time to get comfortable using prototypes. However, once you get used to the idea of prototyping, you'll find it reduces certain types of bugs that used to be particularly difficult to uncover. If your compiler supports prototyping, use it. It will pay off handsomely in the long run.



# ICs PROMPT DELIVERY!!!

SAME DAY SHIPPING (USUALLY)

OUTSIDE OKLAHOMA: NO SALES TAX

640 Kbyte MOTHERBOARD KITS: Zenith 150: \$75.22  
IBM PC/XT, Compaq Portable & Plus: \$70.22

V20	\$16.00	V30	\$17.50
8087-2	Math Coprocessors	150.00	
<b>DYNAMIC RAM</b>			
256K	64Kx4	150 ns	\$4.75
256K	256Kx1	120 ns	3.37
256K	256Kx1	150 ns	2.79
128K	128Kx1	150 ns	4.75
64K	16Kx4	150 ns	2.50
64K	64Kx1	150 ns	1.35
<b>EPROM</b>			
27C256	32Kx8	250 ns	\$7.35
27128	16Kx8	250 ns	3.15
27C64	8Kx8	250 ns	3.75
2764	8Kx8	250 ns	2.95
<b>STATIC RAM</b>			
6264LP-15	8Kx8	150 ns	\$3.15

QUANTITY ONE PRICES SHOWN  
100 ns 256Kx1 D-RAM @ \$5.95

OPEN 6 1/2 DAYS: WE CAN SHIP VIA FED-EXON SAT.

NO EXTRA COST  
FOR FED-EX  
SAT DELIVERY  
ON ORDERS  
RECEIVED BY  
Th: Std Air \$6/4 lbs  
Fr: P-One \$13/2 lbs

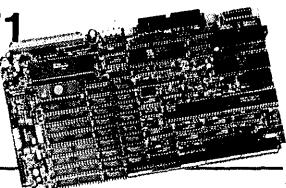
MasterCard/VISA or UPS CASH COD  
**Factory New, Prime Parts**   
MICROPROCESSORS UNLIMITED, INC.  
24,000 S. Peoria Ave., (918) 267-4961  
BEGGS, OK. 74421

Prices shown above are for Feb. 24, 1986

Please call for current prices. Prices subject to change. Please expect higher or lower prices on some parts due to supply & demand and our changing costs. Shipping & insurance extra. Cash discount prices shown. Orders received by 6 PM CST can usually be delivered to you by the next morning, via Federal Express Standard Air @ \$6.00, or Priority One @ \$13.00!

## MSC-LAT1

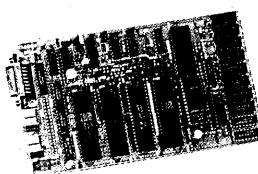
**\$649**



KAYPRO™ users can share the advantage to LAT1. Just take off your main KAYPRO board and put LAT1-K into your cabinet.

All advantage of LAT1 is yours now!

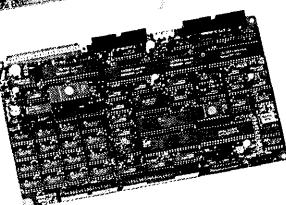
**\$674**



**MSC-MTC**

## MSC-ICO

**\$499**



CP/M plus is a registered trademark of Digital Research Inc.  
Z80 is a registered trademark of Zilog Inc.  
Turbo Dos is a registered trademark of Software2000 Inc.  
Mountain Side Computer and ZENET are trademark of Southern Pacific Limited

### Distributors

England-Quanta systems 01-253-8423  
Denmark-Danbit 03-662020  
Finland-BB Soft 90-692-6297  
India-Betamatrix PVT Ltd. 0812-71989  
Australia-LAMRON PTY. Ltd. 02-808-3666

### Manufacturer and International distributor

**SOUTHERN PACIFIC LIMITED**

Sanwa Bldg., 2-16-20 Minamisawai, Nishi, Yokohama, JAPAN 220  
Phone: 045-314-9514 Telex: 3822320 SPACIF J  
**Advanced single board computer technology company**

## Digital dynamics

- NEW - SEETIME has alarms! You can set up to 4 alarms, each containing date, time & message.
- NEW - Screen saver feature turns off the screen after a set time with no keyboard activity.
- NEW - Configuration program to set SEETIME parameters:
  - time/date location on screen
  - military or civilian display format
  - cursor blinking or steady
  - screen saver timeout
- SEETIME can input the time or date into any program, print the screen and display alarms.
- SEETIME is part of TIMEPRO:
  - APPT personal schedule manager
  - TD file time/date stamping & backup
  - LOG computer usage logging

TIMEPRO runs on '84 & later Kaypros with Kaypro, Kenmore or Advent clocks.....\$74.95  
SEETIME upgrade for TIMEPRO owners....\$14.95  
Shipping and Handling - \$2.50

(206) 772-0291 Visa, MasterCharge  
12448 83rd Ave S., Seattle WA 98178

## ZENET NETWORK through twist pair

- 6MHz HD64B180 (Z80 upward compatible) 512K byte on board (256K installed, 384K RAM DISK)
- LAN: ZENET port 800K baud CSMA CD twist pair bus type upto 500 meters HDLC
- Floppy: 3.5, 5 and 8 inch, d/s density, d/s sided and d/s track automatic desity/format checking
- Hard disk: SCSI interface on board
- Video: 80 X 24 characters (color) and 640 X 200 pixels color graphic 128K byte video RAM character set is downloaded from disk
- Timer: battery back up calendar

- Serial: RS232C X 2 and TTL X 1
  - Parallel: Centronics type, 16 bit TTL, 7.8 bit keyboard port (32 characters FIFO)
  - O.S.: Turbo Dos, MP/M (multiuser) banked CP/M plus (single user)
  - Size: 10 X 6 inch 4 layered
  - Assembled and tested
  - BIOS source code available
  - Completely faster than other Z80SBC
- MSC-PX**  
8088 expansion card for LAT1 soon available

## WORLD SMALLEST COMPUTER

- Full personal CP/M system in palm 4mhz Z80 256K RAM (128K RAM DISK)
- Serial: RS232C X 2 automatic baud rate checking
- Parallel: Centronics type printer port
- Floppy: 3.5 inch micro floppy disk drive 800K byte (option 5, 3.5 inch drive d/s sided d/s track automatic density checking)

- O.S.: CP/M plus bank version
- BIOS source code available
- Completely faster than other Z80SBC

### MSC-MTC/P

Full assembled pcb of MTC  
Under \$189 in OEM quantity

**\$299**

- ### Full featured CP/M plus system
- Z80 4mhz 128K Byte RAM Floppy: 3.5, 5 and 8 inch d/s density, d/s sided and d/s track upto 4 disk drives Automatic density/ format check
  - Serial: RS232C X 2
  - Parallel: Centronics type, 16 bits 10, 7.8 bit keyboard port
  - Timer: battery back up calendar
  - Video: 80 X 24 high speed CRT controller
  - O.S.: CP/M plus bank version included
  - Size: 10 X 6 inch 4 layered

- BIOS source code available
- DRI CP/M plus manual \$50
- New word processor program for MSC-ICO ADD \$50
- Completely faster than other Z80SBC

### MSC-HCS

Expansion card for ICO RAM disk (upto 2M byte) and SCSI hard disk interface card for ICO with installation program

**\$199**

USA distributor

**SOUTHERN PACIFIC**

COMPUTER PRODCTS U.S.A., INC.

21 Altarinda Rd. Orinda, CA 94563

Phone: 415-253-1270

**Dealer and distributor inquiries welcome**

# EPIC SALES, INC.

## — FIXED DISK DRIVE SYSTEMS

	10 MEG	20 MEG	30 MEG
TI PC (Zobex)	\$699	\$ 749	\$ 899
TI PC (Western Auto.)	999	1049	1199
TI PC (SASI)	599	649	799
TI Bus. Pro.	749	799	949
IBM PC and Compatible*	549	599	749
Sanyo 550/555	N/A	799	949
Zenith Z-100	N/A	899	N/A

For External Units Add \$200

Above include drive, controller, cables, one year warranty and 30 day return privilege. Call for pricing on larger size drives.

\*Compatibles: AT&T, Compaq, Tandy, Columbia, Corona, Zenith, Others.

## — TAPE BACKUP SYSTEMS

Irwin Internal 10 Meg .....	\$ 595
Irwin Internal 20 Meg (for AT) .....	695
Wangtek Internal 60 Meg .....	1049
For External Units Add \$100	

## — AT&T PERSONAL COMPUTER

6300, Mono, 640K, 2 Floppy, DOS, Basic .....	\$1995
6300, Mono, 640K, 1 Floppy, 20 Meg, DOS, Basic .....	2395
6300 Plus, Mono, 640K, 2 Floppy, DOS, Basic .....	4295
For High Resolution Color Add .....	459

## — OLIVETTI PERSONAL COMPUTER

(Same as AT&T 6300)

Mono, 640K, 2 Floppy, DOS, Basic .....	\$1895
Mono, 640K, 1 Floppy, 20 Meg, DOS, Basic .....	2295
For High Resolution Color Add .....	459

## — IDS PERSONAL COMPUTER

Mono, 256K, 2 Floppy, P-Port, DOS .....	\$1195
Mono, 640K, 2 Floppy, 20 Meg, P-Port, DOS .....	1795

## — FIXED DISK DRIVES FOR IBM AT AND TI BUSINESS PRO

20 Meg Seagate ST-225 (65 ms) .....	\$ 439
20 Meg Seagate ST-4026 (40 ms) .....	739
30 Meg Seagate ST-238 (65 ms) .....	589
30 Meg Seagate ST-4038 (40 ms) .....	959
33 Meg Rodime RO-203E (55 ms) .....	929
51 Meg Seagate ST-4051 (40 ms) (Bus. Pro. only) .....	1149
72 Meg CDC Wren (35 ms) .....	1949
119 Meg Maxtor 1140 (30 ms) .....	4595

## — OKIDATA PRINTERS

Model 182-IBM, 120 CPS, 9 in. Carriage .....	\$ 259
Model 192-IBM, 160 CPS, 9 in. Carriage .....	439
Model 193-IBM, 160 CPS, 15 in. Carriage .....	609

## — FLOPPY DISK DRIVES

Epson SD-521 DSDD 5.25 in. Floppy Drive .....	119
Shugart SA-465 DSQD 5.25 in. Floppy Drive .....	159
Siemens FD 200 8 in. DSDD Floppy Drive .....	185

## — EXPANSION CARDS

STB Super RIO Plus II Multifunction Card (64K) .....	\$ 259
STB Graphics II Plus Card .....	305
STB Chauffeur Mono Graphics Card .....	259
STB Super I/O Plus Card .....	195
STB Serial Card .....	95
STB Parallel Card .....	79
Zobex ZX2T Controller CARD for TIPC .....	335
Western Digital WX2S Controller Card for IBM PC .....	169
Taxan Model 555 Color Graphics Card .....	229
Central Point Copy II PC Option Board .....	89
Microsync dClock Real Time Clock .....	59
Western Automation S1 Multifunction Card (OK) .....	355
Western Automation S3 Multifunction Card (OK) .....	545
Western Automation Clock Option .....	125
512 K Ram Expansion Card for TI PC .....	259
128K Ram Expansion Card for TI Bus. Pro. ....	169
Epic 1 Meg Ram Expansion Card for TI Bus. Pro. ....	995
Epic 2 Meg Ram Expansion Card for TI Bus. Pro. ....	1595
Epic 3 Meg Ram Expansion Card for TI Bus. Pro. ....	2195

## — MODEMS

Hayes 1200B Internal (IBM or TI) .....	399
Prentice Pop Com External (IBM or TI) .....	339

## — PC REPLACEMENT POWER SUPPLY

150 Watt Side Switch .....	109
----------------------------	-----

## — INTEL MATH COPROCESSOR IC

8087-3 (5 MZ) .....	\$ 150
8087-2 (8 MZ) .....	175

## — RAM CHIPS

4164 (150ns) .....	1.30
41256 (150ns) .....	4.00

## — NEC REPLACEMENT PROCESSOR

V-20 (5 MZ 8088 REPLACEMENT) .....	\$ 20
V-30 (8 MZ 8086 REPLACEMENT) .....	35

## — TAXAN COLOR MONITORS

Taxan Model 630 High Resolution Monitor .....	539
Taxan Model 640 High Resolution Monitor .....	639

## — OTHER PRODUCTS

World Media 5.25 in. DSDD Floppy Diskette .....	\$ 10
Disk File 120, 5.25 in. Disk Storage .....	9
A-B Switch Box .....	55
Keytronic KB5151 Keyboard .....	199
Cabinet and Power Supply for (2) 5.25 in. Drives .....	72

## EPIC SALES INC.

132 WALNUT PLANO CENTER

GARLAND, TX 75042

TOLL FREE ORDER LINE: 1-800-223-EPIC

TECHNICAL INFO AND INQUIRIES: 1-214-272-5724

TERMS: CASH, CHECK, COD, MASTERCARD AND VISA ADD 3%.  
AMERICAN EXPRESS ADD 5%. TEXAS RESIDENTS ADD 6.125% SALES TAX.

# The C Environment

By Gary Entsminger  
Micro C Staff

## Interpreting and compiling under MS-DOS.

If you're gearing up for the Micro C C Contest and need a learning tool, or if you just want a stimulating C environment, one of the following systems might help you to C.

I've experimented with several C packages (a mixed bag of compilers, interpreters, and a syntax editor) trying to uncover the best learning environment, and I'm pleased to report that good inexpensive (and expensive) packages are around.

FIRSTIME FOR C (a syntax editor), INSTANT C, INTRODUCING C, and LIVING C (editor/interpreters), ECO-C (an inexpensive compiler and editor which uses the MS-DOS linker), and AZTEC C (a professional compiler/assembler/linker/editor) have been the guinea pigs. Table 1 gives some facts and figures about each.

### Testing, Testing

I went looking for a system that was easy to use, reliable, and provided —

- dependable error checking
- online or tutorial help
- good documentation
- adequate speed for small programs

Primarily, I wanted an interpreter (or compiler) that was easy to use. Learning C is hard enough without difficult-to-learn commands and procedures or undocumented bugs in compilers, interpreters, and editors.

So I learned the commands for each system (most of the editors use the cursor pad for basic movements) and tested each product with a variety of programs borrowed from introductory C books ("The C Programmer's Guide" by Jack Purdum and "The C Puzzle Book" by Alan Feuer) and benchmarks commonly used (at Micro C) for testing C compilers —

1. Dhampstone Bench (an all-around

Figure 1 - Pointer Stew

```
char *c[]={"enter",
"new",
"point",
"first"
};

char **cp[]={c+3, c+2, c+1, c};
char ***cpp=cp;

main()
{
    printf("%s", ***++cpp);
    printf("%s ", *--*++cpp+3);
    printf("%s", *cpp[-2]+3);
    printf("%s\n", cpp[-1][-1]+1);
}
```

Figure 2 - Syntax

```
main()

{
    int *k;
    int c;

    k=1;
    c= ++*++k;
    c= ++++k;
    printf("%d", k);
}
```

test based on probable use written by Jack Purdum, source available in "Computer Language," Feb. 1986).

2. Thompson Benchmarks (very simple routines by David Thompson to test arithmetic, looping, and screen I/O speed (see "Benchmarking The Speedy PCs" in this issue for C source).

3. Five problems based on the K&R standard from "The C Puzzle Book" by Alan Feuer (see Figure 1 — Pointer Stew for an example problem).

Table 2 shows the results.

### Firstime For C

I tried to create C source code, check syntax, interpret or compile, and execute object code in each environment, using the editor supplied with each package. (Firstime For C doesn't have a built-in interpreter or compiler, so I ran its okayed syntax with the Aztec compiler.)

In general, all the editors I used were adequate. Firstime (the syntax editor) was the flashiest, giving you templates for WHILEs, IF-THENs, #in-

cludes, #defines, comments, and lots more to be set up from a tasty menu of function keys.

You enter statements, definitions, etc. into the template, and Firstime checks your syntax a line at a time, flagging errors. You don't have to correct the errors, but Firstime will continue to flag them until they're corrected. It will even write a file containing the errors (if you insist).

Firstime has its own ideas about syntax (doesn't everybody?) and will occasionally reformat your freeform code, thinking it's helping you C. Usually this reformatting is no problem, but sometimes it obscures the meaning of the statement.

Twice, Firstime reformatted and okayed complex expressions which were incorrect. For example, Firstime transformed the incorrect statement —

c = + + + + k;

in Figure 2 (Syntax) to —

c = + + + + k;

Table 1 - Facts and Figures

SYSTEM (vers.testd)	COST	ON-LINE HELP	ERROR MES	MEM REQ	TUTORIAL
INSTANT C (1.44)	\$499.	NO	YES	320K	NO
INTRODUCING C(1.13)	125.	NO	YES	192K	YES
ECO-C (3.0)	59.	NO	YES	256K	YES*
LIVING C (1.0)	99.	YES	YES	192K	NO
FIRSTIME (1.2)	299.	YES	YES	256K	YES
AZTEC C (3.2d)	499.	NO	YES	256K	YES

\* ECO-C references errors to "The C Programming Language" by Dr. Purdum. Cost \$19.95.

Table 2 - Benchmarks

SYSTEM	STRING	LOGIC	PRINT	CAST	BENCH1	DHAMP	SYNTAX	FLOW	STEW
INSTANT C	0	1	1	1	1	1	1	1	0
INTRO C	0	0	0	0	0	0	0	1	0
LIVING C	1	1	1	1	0	0	0	0	0
FIRSTIME	0	1	1	1	1	1	0	1	1
ECO-C	1	*	*	1	1	1	1	1	0
AZTEC	1	1	1	1	1	1	1	1	1

#### SYMBOLS

- 1 = Program executed correctly
- 0 = Program would not execute or executed incorrectly.
- \* = ECO-C's prototyping feature prevented program execution.

No interpreter or compiler I tested would accept either of these statements (with good reason). Pointers gave Firstime (and others) the most trouble.

Yet Firstime is useful for both beginning and advanced programmers, and could improve your C programming style as well as save you a lot of typing (keywords are entered via control and function keys). But if you go this route, you'll need to buy at least one more tool (an interpreter or a compiler) and an introductory C programming guide.

Firstime comes with an online tutorial which makes learning the editor's commands a breeze.

#### Interpreting Impressions

Living C, Introducing C, and Instant C are interpreters. You enter code using their editor, and when you're finished it's evaluated a chunk (a

function or a program) at a time. If you've made an error the interpreter returns you to the editor and puts the cursor at the first error, Turbo Pascal style.

Instant C works on functions, but unlike Firstime, won't let you write a function containing syntax errors to a file, where it might get incorporated into (and corrupt) a library. If you want to exit the editor (and save your incorrect source code), you can comment out the bad code — this is a minor inconvenience.

#### Instant C

Instant C is definitely the most sophisticated of this group of interpreters and is aimed primarily at advanced programmers.

It's much faster at running your programs than Living C or Introducing C and supports most of K&R, but has little online help, and the manual is

vague about some important matters (for example, Instant C's limitations). I know it won't handle variable array size initialization (from Pointer Stew test, Figure 1) and bit fields in structures, but it successfully ran most of the test programs.

With its high price tag (\$499) and vague documentation, Instant C doesn't really beckon to the beginner, but would be a useful addition to a professional's C toolbox.

#### Living C

Living C is a delight to use, is full K&R, and provides the best on-screen debugging environment (a bouncing parser and excellent help menus). But it can be painfully slow when it's executing programs.

Sometimes, too, it behaves unpredictably. For example, it also accepted

(continued next page)

(continued from page 13)

the incorrect code in Figure 2 (producing a meaningless solution) and ran BENCH1 (a print dots to the screen program) incorrectly.

Some longer programs (100 lines or more) which compiled fine under Aztec sent Living C totally to lunch. (Error messages included: "Fatal error at FF80, contact your distributor.")

### Introducing C

Introducing C is the most limited of any of the tested environments, falling far short of K&R. For example, there can be no explicit declarations of storage class (globals are always static; locals are always dynamic). Only two subscripts are allowed for arrays. Typedef, Goto, Constant expressions, and #include are not supported. #defines can define constants but not tokens.

But Introducing C is easy to use, includes an excellent tutorial manual, and works well with its many example programs. This might be a good place to start if you're a beginning programmer. Just don't expect to write complex programs. Introducing C couldn't run most of the test programs (see Table 2).

### Compiling (Old-Fashioned & Reliable)

The classic way to C is with a standard compiler. This is the age-old edit, compile, copy down the error messages. Edit, compile, copy down the error messages... The process is relatively slow, but the finished product runs fast since it's a .EXE or .COM file.

Aztec C and ECO-C are compilers. ECO-C is definitely a bargain. At \$60, it includes both the compiler and an excellent Turbo-style editor.

Error messages are referenced to "The C Programmer's Guide," so the combination of compiler/editor/guide at \$80 makes an excellent learning environment. Gratification doesn't occur as quickly as it does with interpreters (compilers just take a little longer to deal with code), but the results are generally dependable.

ECO-C includes prototype checking (part of the new ANSI standard) and is full K&R except for bit fields. Although ECO-C supports only the small

memory model, it's still a useful compiler for advanced applications, and will serve far beyond the beginning phase.

### Aztec C

But if you don't want to start anywhere but the top, look into Aztec C, the ringer, so to speak, of this group. It's full K&R and undoubtedly a professional package (at \$499 it ought to be), but provides a good beginning as well as excellent professional environment.

The documentation is lengthy and good (although minus an index), but won't really get you started in C. If you go this route, you'll need to purchase an introductory book as well.

Like ECO-C, Aztec provides good, sensible error messages — an editor — an assembler — a linker + a debugger — a make utility — and a librarian (with glasses).

If you're committed to C for the long term, then it makes sense to go for Aztec. (Another package spoken highly of on the grapevine is Microsoft C, which we'll be testing for a future issue.)

Aztec was the only product in this group that correctly ran every test program. (In fact, we wound up testing our programs with Aztec before we tried them on the other packages — a backwards approach. We should have found it easier to verify and debug the source with an interpreter/editor combination before compiling it. But sometimes we weren't sure whether an interpreter's error message (or strange result) was caused by a problem with the source file or a problem with the interpreter.)

### Program Results

Let's look first at Figure 1. ECO-C didn't report any errors, and didn't run the program correctly. Instant C couldn't handle variable array size initialization. Introducing C ran the first part of the program correctly and then issued an error message — subscript out of range, and left me at the error to correct. Firsttime changed the syntax by adding blanks after ++ and — and eliminated the spaces after the commas. (But Aztec was able to run the revised program correctly). Living C didn't like the syntax \*—\*+ +, but

allowed me to exit gracefully. Aztec ran the program correctly.

### Logic

From attempting LOGIC.C I learned that — Introducing C limits its #defines to constants, excluding tokens. Living C handled the complex #define and ran the program correctly. Firsttime produced Aztec-able code. ECO-C wouldn't allow the int in PRINTF (a prototyping check). Instant C ran the program correctly. Aztec ran smoothly.

### BENCH1

Aztec, ECO-C, and Instant C ran it correctly. Introducing C and Living C printed one dot and went into never never land. Firsttime produced Aztec-able code.

### Print

Aztec, Instant C, and Living C ran it correctly.. ECO-C wouldn't allow int in printf (a prototyping check). Introducing C couldn't handle the complex defines. Firsttime produced Aztec-able code.

### String

Aztec, ECO-C, and Living C ran the program correctly. Introducing C didn't like the complex define. Instant C ran the program incorrectly. Firsttime didn't accept "integer."

### Dhampstone

Aztec, ECO-C, and Instant C ran the program correctly. Living C began running the program, but had not printed any results by the time I went to bed. Introducing C wouldn't compile it. Firsttime produced Aztec-able syntax.

### Syntax (Figure 2)

Aztec, ECO-C, and Instant C ran the program correctly. Living C, Introducing C, and Firsttime allowed incorrect syntax; Living C and Introducing C ran the program incorrectly.

### Wrap Up

And that's about it for this group. My tests aren't intended to be definitive, but are intended to give you a good idea about the reliability of these products. If you've had experience with these or other C tools (compilers,

interpreters, libraries, syntax editors...) let us know.

**For more info —**

Manx Software Systems (Aztec)  
P.O. Box 55  
Shrewsbury NJ 07701  
(201) 530-7997

Computer Innovations (Introducing C)  
980 Shrewsbury Ave  
Tinton Falls NJ 07724  
(201) 542-5920

Living Software (Living C)  
250 N. Orange Ave, Ste. 820  
Orlando FL 32801  
(800) 826-2612

ECOSOFT (ECO-C)  
6413 N. College Ave  
Indianapolis IN 46220  
(800) 952-0472

Spruce Technology (Firstime)  
P.O. Box 7948  
Shrewsbury NJ 07701  
(201) 741-8188

Rational Systems (Instant C)  
P.O. Box 480  
Natick MA 01760  
(617) 653-6194



## EPROM PROGRAMMER



APROTEK 1000  
ONLY

\$265.00  
COMPLETE WITH  
PERSONALITY  
MODULE

117 VOLT AC POWER-RS232  
-6 BAUD RATES - HANDSHAKE TO HOST  
ALLOWS READ, WRITE, VERIFY & COPY

Comes complete with a CPM, IBM-PC or Apple  
Driver Program on Disc.

Programs the following 5 Volt 24 or 28 pin  
devices: 2716 series through 27256, 25xx series,  
68764 plus others. Please Specify Personality  
Module desired with order. Additional Personality  
Modules only \$15.00 ea. Full 1 year warranty.

TO ORDER: CALL 1 800 962 5800 OR WRITE  
APROTEK  
1071 A AVENIDA ACASO Add  
CAMARILLO, CA 93010 \$4.00 Shipping USA  
Info: (805) 987-2454 VISA or MC Add 3%.



## Eco-C Compiler

Release 3.4

We think Rel. 3.4 of the Eco-C Compiler is the fastest full C available for the Z80 environment. Consider the evidence:

**Benchmarks\***  
(Seconds)

Benchmark	Eco-C	Aztec	Q/C
Seive	29	33	40
Fib	75	125	99
Deref	19	CNC	31
Matmult	42	115	N/A

\*Times courtesy of Dr. David Clark  
CNC - Could Not Compile  
N/A - Does not support floating point

We've expanded the library to 120 functions, improved the manual and added new compile-time switches. The price is \$149.95 and includes the SLR Systems Assembler-Linker. A savings of \$145.00 over the old price!

Call today  
1-800-952-0472 (orders only)  
1-317-255-6476 (information)



(317) 255-6476  
6413 N. College Ave. • Indianapolis, Indiana 46220



## C SOURCE CODE

### XLT MACRO PROCESSOR w/source ..... 95.00

XLT can be used as a preprocessor, text translator, or simple cross-assembler, depending on your macro definitions. Comes with manual, C source and macro files.

### Q/C 4.0 CP/M C COMPILER w/source . ONLY 95.00

Save \$70.00. Fast, full featured compiler from the Code Works includes longs, single-precision floats, excellent manual.

### QC88 C COMPILER FOR PC's w/source ONLY 125.00

Save \$70.00. As above but no floats or longs. Runs on PC clones.

### QCX C CROSS-COMPILER w/source ..... 495.00

Runs on PC, generates code fit to run on Z80 CP/M or ROM base controller system.

- Tony Ozrelic's L.A. Software is now KYSO Technology •

**TO ORDER:** Add \$5.00 to total for shipping and handling. Personal check or M.O. are OK. Sorry, no COD's, PO's, or plastic money. 30-day money-back guarantee. Most order shipped 1st class within 5 working days.

KNOCK YOUR SOCKS OFF

**KYSO**  
TECHNOLOGY

- P.O. Box 5246 • Bend, Oregon 97708 • (503) 389-3452 •

## Moving Your C And Assembly Language To MS-DOS

*Moving from CP/M to MS-DOS can be easy or not so easy. Ron found the Pascal shift easy; moving over his C and assembly language programs was not. Herein lies the tale.*

**I**t was a sad day when I received Micro C issue #27 and noticed it was abandoning its special fixation upon the single board computer and CP/M. It was a bit like hearing Teddy Kennedy voice doubts about the future of the welfare system. The announcement seemed all that much more melancholy because I find myself in the very same passage. For good or ill, PC-DOS/MS-DOS is now where most of the useful applications are and where most of the fun hacking can be had.

Perhaps some day the 68000 or even the 32000 world will take over, but for the foreseeable future the IBM and its compatibles have a stranglehold on those benefits which many of us first came to love in the Kaypro and its kin: an open machine architecture, real price competition among software and hardware producers, lots of wild and willing software in the public domain, and thousands of fellow obsessives out there to swap jargon with.

### My Initiation

After buying my Zenith 158, my first step, of course, was to buy Turbo Pascal 3.0 and a new C compiler and settle down to getting utilities and applications programs across to my new toy. Turbo performed as all of us Turbo fans knew it would — magnificently.

For example, I had written a stock market emulation game for high school students using CP/M Turbo 1.0. About 3500 lines of complex databasing and calculation in six chained-together command files. It took me about an hour to get the old code up

and running on the Zenith. All I had to do was change the pointers from 16-bit to 32-bit entities using the "seg" and "ofs" functions, erase the chain commands, get rid of duplicate declarations that had crept in in spite of my header files, and "include" it all together. And it ran — all of it, the whole darned thing, in one fat COM file. I was so happy I almost wept.

Somehow, though, my Protestant conscience kept whispering to me that DOS immigration ought to be more painful than this. It's hard for a C freak to love a language with ready-made commands called "ShowTurtle" and "HideTurtle." But I can't help it, I do. It's as if I, a motorcycle addict, had a secret affection for Buicks. And I can get my Buick for not much more than thirty bucks from those strange mail order peddlers around 47th Street.

### Cheap Compilers

Since Software Toolworks' C/80 has given me hours and hours of bug-free fun, I decided to try their MS-DOS "Toolworks C." For 50 bucks, plus 30 for the floating point routines, I couldn't lose much. As someone who learned to program on JRT Pascal, I'm partial to cheap compilers, since they (a) don't cost much money, and (b) encourage the programmer to create his own libraries, and so know what the devil is going on inside his programs. Thoreau suggests that no man really owns his house who hasn't built it up from the bare boards. Perhaps the same is true for one's working compiler.

Though I considered the DeSmet compiler, Toolworks' is even cheaper and offered me all the source code. In fact, I learned to program the 8088 by sitting down at the console and reading through Toolworks' listing. After slogging through 10K worth of assembly language modules, you get the general idea — "PROC," "SEG,"

**By Ron Miller**  
1157 Ellison Dr.  
Pensacola FL 32503

"NEAR," "FAR," "ASSUME," and all the rest. My newfound skills, of course, enticed me into getting a Microsoft Assembler to make things run faster.

After I'd converted all the string routines into assembly language and had figured out how to manipulate the memory and, more importantly, the screen directly, I began to feel at home. I quickly discovered that only wimps use interrupt 10 routines. Real men write to the CRT memory directly.

### More Gains Than Losses

All the higher level library functions from C/80 which I'd concocted over the years (bit routines and hex conversions and the like) went over without a glitch. Lots of my stuff wasn't applicable, however, because like any ambitious C hacker I'd spent a fair fraction of my Kaypro time abusing the operating system, and none of that code related to the Microsoft world. Some loss but, oh, the gains, the gains: folks who haven't tried MS-DOS can't imagine the wonderful new mysteries the interrupt system and resident-program programming hold for rainy weekends.

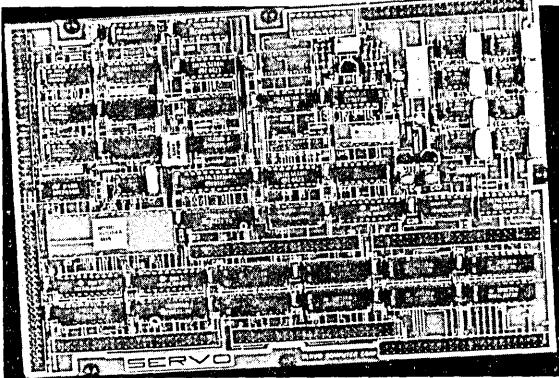
Those of you who aren't aging hotrodders and system tinkerers can certainly go a long time without dabbling in assembly language. Unfortunately, there doesn't seem to be any linkable assembler for the 8086 that can be snatched off bulletin boards, so it's cash on the barrelhead. Where's Micro C when I really need them? Did I need another set of disk utilities? No. Did I need a standin for MASM? Ye\$\$.

Anyway, when you finally indulge, you'll find that 8086 code is not too different from Z80 code, with more string routines and loop controls, and fewer jump statements. I miss juggling the Z80 alternative registers, but find the large number of accumulator registers handy for squirreling things

## SERVO INDUSTRIAL PROCESS CONTROL BOARD

### 14 Bit Lab Accuracy Industrial Durability

The Features of 5 Boards in One.



The Servo Process Control Board is a general purpose multi-channel analog and digital input/output controller which can communicate with and control most medium-scale industrial processes. Designed to work with the Servo Industrial Microcomputer, (or other computers which support the SASI interface), it offers great accuracy at prices starting as low as \$495.

■ American made ■ MILSPEC components ■ 1 year warranty

Maximum configuration includes: ■ 192 analog inputs ■ 64 analog outputs ■ 128 digital inputs ■ 512 digital outputs

■ Based on the INTERSIL 14 Bit A to D converter ■ Communicates with any micro or mainframe computer ■ Easily programmed in high level languages (Turbo Pascal, Microsoft Basic, Forth) ■ PID, FFT, Thermo-couple linearization and laboratory DAS software supplied. ■ Custom software and hardware engineering assistance available.



SERVO COMPUTER CORPORATION

360-B N. Ellensburg St.  
Box 566  
Gold Beach, OR. 97444  
(503) 247-2021

away. Folks with 32-bit machines must get bored with all those cubby holes for storage. Where's the challenge? It must be like playing tennis without the net.

#### Data And Code Limitations

Cheap compilers do have one disadvantage, and that's the limitation of the data and the code sections to 64K each. Although that's more room than we are used to with CP/M, you are still using only a small portion of that 640K blank wall that's just waiting for you to scribble all over it. (At present RAM chip prices, anyone who doesn't put 640K into his machine is short a few chips himself.)

Moreover, with this so-called "small" model, the 16-bit pointers cannot be directed toward the operating system. Most compilers have "peek" and "poke" for changing runs of memory outside the 64K boundaries, but it's not the same. Heck, BASIC (shudder) can do that. It didn't take me long to dream up a binary tree that really could use a 500K heap.

Since Turbo Pascal lets me pile up an unlimited heap, and I think I can

jury-rig my own extended pointer system using long integers and "MOVS" commands, I just haven't found it in my soul to spring for Lattice C at \$300. At the cost of fatter code and slower programs, Lattice or one its high-toned brothers would let me treat the full meg of memory as my playpen. Someday, perhaps — but by then I may own a Definicon and may be sailing boldly on a myriad-bitted pointer, out there, alone, among the terabytes.

#### Augmenting Your Cheap Compiler

What I don't miss with my cheap compiler is the huge number of specialized functions that the higher priced compilers offer you. Any programmer worth his salt can use the linker and library utility that came with the operating system to add UNIX-sounding goodies by the basketload.

My trick — I think it's ethical — is to read the manuals of compilers that friends have bought. When I run across the description of a neat function, I pop a beer and try to figure out how to do it my-y-y way. Even the entanglements these little projects in-

## HiSpeed C Library

- REFERENCE MANUAL with examples, three indexes, module maps, impatient user's guide (5.5 x 8.5, 410 pp). More than 310 functions in five libraries for Software Toolworks C/80 in Microsoft M80 format (also SLR Systems). Twenty-seven utilities. Requires Digital Research CP/M 2.2 and 8080/Z80 CPU.
- Develop portable applications using Bell Labs Unix V7 conventions. Designed from Kernighan & Ritchie, Harbison & Steele, Banahan & Rutter, Sidebottom & Wortman and Donald Knuth's three-volume set.
- Settable dynamic buffers. Full stream I/O. Transcendentals. Strings. Math. Searching & sorting. Timing. Compact code (K&R HELLO.COM is 254 bytes). Up to 255 files. Direct-disk. Directory. Memory management. High-speed seek. Fastest block reads. System access. Speed and code size optimization. Automated compile, assemble and link. Ideal incremental development.
- Useful C Utilities: Xref, Beauty, Calls, BoldList, Archive, Portable Source Generator, Jump-on-error Monitor.
- Sample Programs: Learn or teach C style using source code from textbooks, scholarly periodicals and popular magazines.
- No royalties. No copy protection. No limitations on educational use. No extra charges.
- Reference Manual with library object code on disk . . . . . \$29.95
- Source code archives and utility sources on disk . . . . . \$19.95
- Phone orders shipped immediately. Write or Call today for free brochure.

Viking C Systems  
2243 South Belaire Drive  
Salt Lake City, UT 84109  
1-801-466-6820/Grant

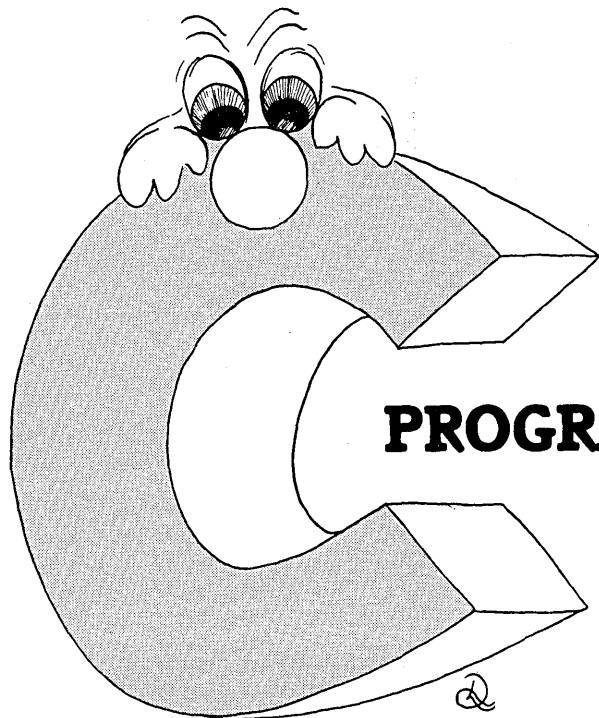


evitably get me into have been invaluable to my understanding of how things work. As long as I have the code to the run-time package and the assembly language modules, my souped-up K-Mart C can do anything that the Intel instruction set can dream of.

I'll also admit that playing with segment registers can add a whole new dimension to the game of find-the-error. When you screw up the CS register, you really have fun on your hands. The alternate-control-delete keystroke motion has by now been etched into my brain. It usually works unless you've liquidated the keyboard interrupt. I often do. Then you'd give about 576K of virgin memory for that wonderful red restart button on the back of the Kaypro. I'm clever enough to know how to pluck files back off an old RAM disk, even if I had to Alt-Ctl-Del it; but turning the machine off completely doesn't do much good at all to the information stored in the memory.

(continued on page 19)

# MICRO CORNUCOPIA'S C CONTEST



## PROGRAMMING CONTEST

### GRAND PRIZE:

- DSI-32, 1 meg, 10 Mhz 32032 computer board with assembler/linker from Definicon Systems  
21042 Vintage St., Chatsworth, CA 91311
- Optimizing C Compiler (large model)  
from Manx Software, Box 55, Shrewsbury, NJ 07701
- Essential Software's C Library  
(graphics, I/O, everything)  
from Essential Software, Inc.  
Box 1003, Maplewood, NJ 07040
- 3 year subscription to Micro C

If you've been going so hard you just can't C straight, then drop everything, dig out the old compiler, brush off the cobwebs, and C what you can C.

Any kind of C. From Small-C to large, from a hundred lines up, this is your chance to C'cure fame and glory (plus valuable prizes).

**SCORING** — The programs will be judged by the Micro C staff on the following:

- 0-15 for ALGORITHM
- 0-25 for CODE ORGANIZATION & READABILITY
- 0-40 for PROGRAM FUNCTION
- 0-20 for USER DOCUMENTATION

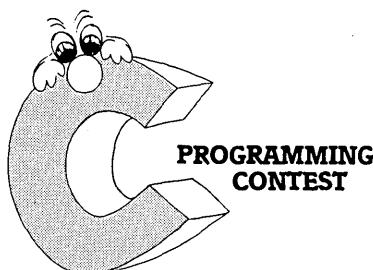
### 1st & 2nd Place

- Optimizing C Compiler (large model)
- Essential Software's C Library (graphics, I/O, everything)
- 2 year subscription to Micro C

### 3rd - 5th Place

- Aztec C Prime Package  
(interpreter & compiler)  
from Manx Software
- 1 year subscription to Micro C

----- CONTEST DEADLINE November 1, 1986 -----



## ENTRY FORM

Program Title \_\_\_\_\_

Purpose \_\_\_\_\_

Which C compiler? \_\_\_\_\_ Target system(s) \_\_\_\_\_

Please include source and object files on disk.

Signature \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

**MICRO CORNUCOPIA**

P.O. Box 223  
Bend, Oregon 97709

(continued from page 17)

*Editor's note: A non-destructive hardware reset circuit for 8088/8086 systems sounds like a good hardware project for Micro C. Any suggestions before we tackle it here? Many clones have a hardware reset circuit, so all you have to add is the momentary-contact push switch.*

### Changing The Code

Transferring actual working C code was not as effortless as I'd hoped it would be, in spite of the much-touted portability of C. Had I written that stock market game mentioned above in C, I would have had a full day's headache on my hands. Complications arise (a) because MS-DOS handles files differently than CP/M does, and (b) because the C standard (as well as function names) is evolving.

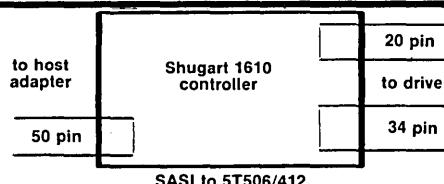
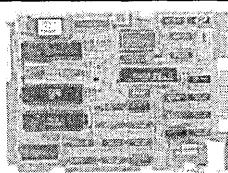
All my "setmem" calls had to be changed to "memset," for example. "Read" and "write" have become "fread" and "fwrite," with a different order of arguments. Or else "open" rather than "fopen" must be used to get things started, and that adds a twist because the MS-DOS "open" returns a different error message. File handle "minus one" is remarkably hard to work with. File pointers rather than integer handles are needed for stream input and output. Nothing ma-

jor, and changes will vary from compiler to compiler, but the first evening and a half of debugging can get VERY frustrating.

Well, if you wanted the machine to do it all for you, you'd own a Macintosh, right? Now that I know the subtleties that get lost in translation, code pops back and forth by wire from Kaypro to Zenith and Zenith to Kaypro, with compiler success coming ordinarily with a curse and a second try.

### Wrapping Up

The efforts are worth it. You can DO so much more in MS-DOS, and most applications programs, if not that clunky operating system itself, are faster. My first suggestion is that you get Peter Norton's "Programmer's Guide to the IBM PC" so you'll know the interrupt system's commands, which will open up the hardware to your amorous advances. Be patient; do it in small doses; stick to the standard library the first night; and wait a month before you start altering the segment registers. If you're very, very good, some day soon I'll tell you how to write resident programs using .EXE files from C, which I learned how to do by not following my own advice.



## 5 1/4" HARD DISK CONTROLLERS

These new factory sealed Shugart controllers come with all documentation. They will control up to two 5 1/4" hard disk drives with up to 8 heads each. These unique controllers will mount directly on the drive. By the change of an EPROM they change their instruction set to emulate other popular controllers.

- \*Shugart 1610-3 emulates Xebec S1410
- 1610-1 emulates DTC 510
- 1610-4 SCSI version similar to ADAPTEC 4000

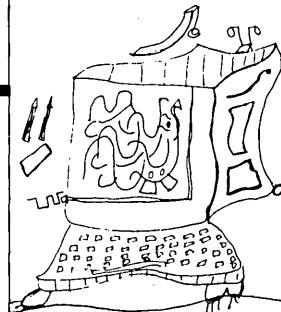
Using standard host adapters they work with:

- \* Apple II, II+, IIE
- \* MAC (see Sept. Dr. Dobbs)
- \* TRS 80 model III, IV
- \* ISI 5160 & ACS 1000 (PC clones)
- \* Wavemate Bullet
- \* All AMPRO boards (little board, etc.)
- \* And other systems with SASI Ports or host adapters

1 for \$99. ea. 2 for \$90. ea. 100 for \$75. ea.      Quantity pricing available.

• Computer Surplus Store (408) 248-0134 •

Other controllers also available for 8" and 14" drives including Shugart SA1000, 4000 SERIES and Quantum 2000 SERIES (DTC 1404, 1404D, 1403, 1403D, 1408I, 1420-1).



## C-BUNDLE \$99

VIEW: CRT Based Disk Diagnostic

EZZAP: ROM Burning Utility  
includes schematic

C-PACK: Utilities in C

C-Games: User Modifiable Maze Game

All are written in C, include Source Code, and available separately.

## ICX TOOLKIT

ICX: ISIS to CP/M or MS-DOS exchanger for MDS and iPDS      each \$89

ISE: ISIS Emulator for CP/M      \$89

CP/M™ Digital Research  
MS-DOS™ Microsoft  
ISIS™ Intel Corp

Western Wares  
303-327-4898  
Box C • Norwood, CO 81423

## CPM-80 LIVES ON YOUR PC

CP/Mulator puts a 4mhz 8 bit CPM-80 emulator in your IBM-PC for only \$99.

- Execute 8 bit CP/M programs at 4 mhz. Stop waiting around for those slow software emulators at twice the price of this speed demon!
- CP/Mulator makes a fantastic CP/M development environment and allows you to use all your CPM-80 tools, and the IBM-PC tools too!
- Why write off that expensive package that you bought for CPM-80 just because you upgrade to a IBM-PC? Apply the \$99 solution and keep it working. No retraining or conversion blues!
- CP/Mulator includes the NEC uPD70108 processor which increases the speed of your IBM-PC by at least 10%. 100% compatible with existing IBM-PC software and 8087 compatible.

### PURCHASE THE SOFTWARE ALONE FOR ONLY \$69!!

Source Information

P.O. Box 2974

Warminster, PA 18974

Phone (215) 628-4719



# Monitoring A Modem With A Bridge

Don't intrude on your own calls.

If you've ever wondered what's going on over the phone line, but your modem won't say a mumblin' word, you're in the right place. This simple project using simple parts from a simple Radio Shack should keep you informed.

**B**ack in the old days of radio broadcasting, when we wanted to see what was happening on the transmitter or remote audio (telephone) line we used a technique called bridging. Some sort of high impedance monitor was bridged across the line, enabling you to monitor the signal without disturbing it. I still have a pair of 9K ohm headphones used for the purpose.

If the audio was coming from a line with a DC control signal present, such as the switched telephone network, the bridge was capacitor isolated. The usual components of a bridge were two 2mFd 600V capacitors, two 10K ohm resistors, and a 1:1 Western Electric repeat coil transformer.

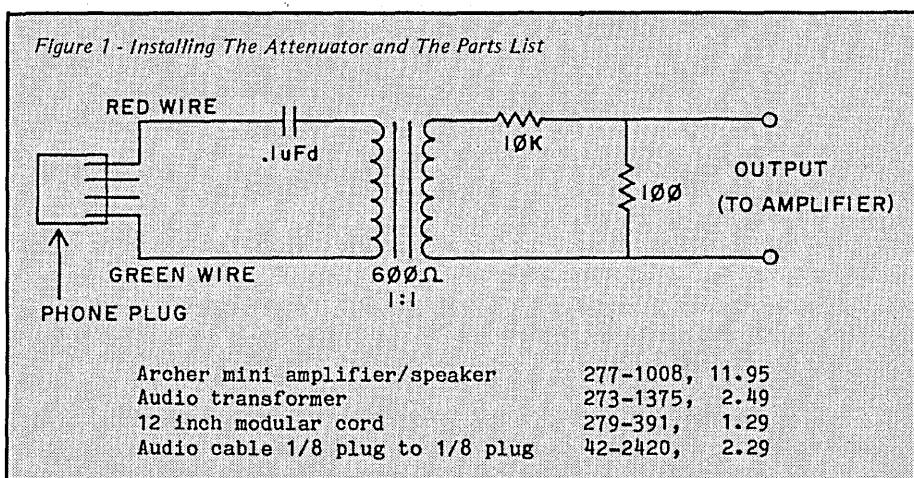
The connections to the line were through the capacitors to the resistors and then to the transformer. The resistors were omitted if audio was to be sent as well as monitored. The reason for having two of everything was to maintain the balance to ground of the line so as not to degrade common mode noise rejection.

## A More Recent Application

Once while trying to communicate with my company's Email system, I needed to know what was happening on the telephone line (connected to my Kaypro). Listening in on an extension caused noise problems and added more load to the line. In addition, when I used pulse dialing, I couldn't monitor the line with an extension until I was sure the dialing was complete.

By Philip W. Elrod

3254 Spring Dr. NW  
Doraville GA 30360



For a few dollars, I assembled a line monitor that works very well and can be assembled on a Saturday afternoon.

The monitor is a Radio Shack battery powered amplifier and speaker. The bridging transformer is another Radio Shack component, a 600 ohm to 600 ohm transformer. The DC block is two .1 50 volt ceramics in parallel for a total of .2 mFd. I didn't try to maintain strict balance since the transformer winding isn't balanced or shielded. It didn't seem to make a difference.

The level out of the secondary was way too much for this hot little amplifier, so I installed an attenuator consisting of a 10K ohm resistor in series with the transformer secondary and a 100 ohm resistor across the jack to the amplifier cable. What I did is shown in Figure 1.

The red and green wires from a modular telephone cord supply the input signal. You can plug the cord into a standard modular phone outlet once the wiring is finished.

I put the transformer and attenuator in a 2" length of 1/2" (trade size) PVC water pipe. I epoxied a fender washer to one end to hold the output jack. I also made a rubber plug from a bumper foot to retain the knotted telephone cord in the other end. If I did this again, I'd forget the jack and just use

a cord at each end.

There is nothing especially critical about any of the parts.

This modification works very well. You hear the dial tones, the ring or busy, and then the modem carriers as they do their thing.

A word of warning: While there are some other uses for this thing, some of them can get you in a lot of trouble with the law.



## FREE SOFTWARE FROM THE PUBLIC DOMAIN

User Group Software isn't copyrighted, so no fees to pay! 1000's of CP/M and IBM software programs in COM and source code to copy yourself! Games, business, utilities! All FREE!

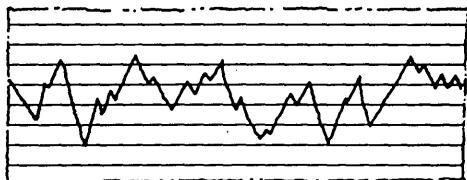
	Rent	Buy
IBMPC-SIG 1-454 Diskides .....	475.	950.
IBMPC-BLUE 1-175 Diskides .....	185.	435.
SIG/M UG 1-246 Diskides .....	160.	675.
CP/M UG 1-92 Diskides .....	45.	250.
PIC/NET 1-34 Diskides .....	25.	100.
KAYPRO UG 1-54 Diskides .....	65.	200.
EPSON UG 1-59 Diskides .....	70.	210.
COMMODORE CBM 1-28 Diskides .....	25.	65.

Public Domain User Group Catalog Disk \$5 pp.  
Send your check & specify computer format.  
Rental is for 7 days after receipt, 3 days grace to  
return. Use credit card, no disk deposit.  
Shipping, handling & insurance \$9.50 per library.  
(619) 941-0925 Orders & Technical (9 to 5)  
(619) 727-1015 24 Hr. 3 Min. Info Recording  
Have your credit card ready!

## National Public Domain Software

1533 Avohill Dr.  
Vista, CA 92084  
1-800-621-5640 wait  
for tone dial 782542  
Master Charge VISA  
AM EX.

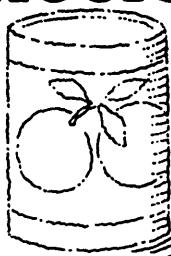
# **VEDIT® Plus Text Editor**



**The Navy charts new concepts with it... GM**

**engineers the future with**

**it...**



**National Can preserves**

**facts**



**with it... GE has bright**

**ideas with it... Here's why you**

**shouldn't be without it.**



Every day, VEDIT PLUS helps thousands of programmers, writers and engineers get down to business.

So why do people who could have ANY text editor prefer ours? For a lot of reasons, including:

- **CAPACITY**—With VEDIT PLUS, file size is never a problem. And virtual disk buffering simplifies editing of even the largest files.
- **FLEXIBILITY**—VEDIT PLUS lets you edit up to 37 files simultaneously. So you can cut and paste. Edit programs. Edit text. Even perform numerous search/replace functions in several files without user intervention.\*
- **CUSTOMIZATION**—With VEDIT PLUS, you can create your own on-line editing functions with keystroke macros. Develop your own on-line help screens. Determine and revise your own keyboard layout easily.

- **SPEED**—VEDIT PLUS not only works hard, it works fast. Faster, in fact, than any other text editor on the market.
- **EXPERIENCE**—Six years ago, CompuView revolutionized the concept of microcomputer text editing. And we've been improving our products and services ever since.

---

**Special Offer: Order a VEDIT PLUS text editor for \$225 and we'll include our V-PRINT™ document formatter—a \$120 value—absolutely free.**

---

Call CompuView today at 313/996-1299. You'll be in good company.

# **CompuView®**

CompuView® Products Inc., 1955 Pauline Boulevard—Suite 300, Ann Arbor, Michigan 48103, TELEX 701821

Available for PC DOS, MS-DOS, CP/M, CP/M-86.

\*Free sort, compare, print and main menu macros included; optional 8080-8086 translator or mailmerge, \$50 each.



# advanced technology.

## Complete MS-DOS/CPM Super Turbo

In keeping with industry trends MSO is bringing our customers high performance P.C. compatibles and accessories. MSO takes the P.C. compatible to maximum performance with its SUPER TURBO. The SUPER TURBO features the V20-8 chip which runs at three times the speed of the IBM-PC XT\* and also runs CPM 8080 software.

The SUPER TURBO comes complete with the MS-DOS operating system, Read and Run CPM, full Instructional Documentation, Utility software, **plus for our first 100 customers MSO is offering the Micropro Wordstar Professional Software package.** This package includes: Wordstar, Mailmerge, Correctstar, Starindex, Datastar and a G.L. Accounting System. The SUPER TURBO is a complete turnkey system with everything necessary to plug in and operate.

### USER SUPPORT HOT LINE

# 805/393-2247

All systems carry full 90 day warranty.

### CASH PRICE ONLY

Check in advance. Add 3% for VISA/MC. Shipping & handling charges will be added to each order.

For our catalog with complete details and prices, send \$1.00 to:

Micro Supply Organization, Inc.  
4909 Stockdale Hwy. #180  
Bakersfield, CA 93309

MON. - FRI. 7am - 5pm PST • SAT. 9am - 5pm PST

\*IBM is a registered trademark of the IBM Corporation.

Super Turbo  
Super Price:

# \$1299



The Super Turbo P.C. runs IBM software and CPM 8080 programs

- CPU - V20-8 8MHz Super Chip runs \*IBM compatible software at 3 times the speed of the IBM-XT and CP/M 8080 software.
- 8087 Math Processor optional
- 256K RAM on mother board expandable to 640K
- ROM 8K Bios
- 6 empty slots for expansion
- 2 serial port one optional with expansion kit
- 1 parallel port
- 1 game port
- Clock calendar with software
- Hi-Res monographics video board
- Floppy controller
- Dual Floppy Drives 360K ea.
- 135 watt XT Power Supply
- 5150 style compatible keyboard
- Hi-Res TTL Green or Amber 12" monitor
- MS-DOS operating system and manual.
- Instructional Documentation and Utility Software
- Assembled and tested in U.S.A.
- **Optional internal 20 meg sub system for Super Turbo add \$549**

Special printer  
pricing with  
purchase of  
above computer.



**the  
advantage.**



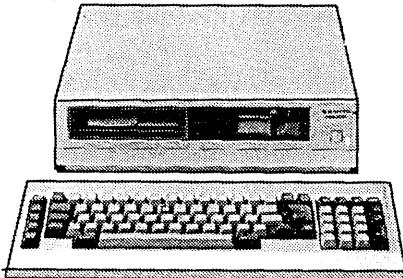
### **MBC 550 Series MS-DOS Computer**

**Complete with over \$1000 of FREE Software!**

- MS-DOS 2.11 • MS-DOS 1.25
- Wordstar • Spellstar • Mailmerge • Calcstar
- Infostar • Easywriter I • BASIC

**800K System  
with Sanyo  
monitor**

only **\$899**



ONLY \$599 (Driveless) (without monitor)

### **The OWL      \$799**

Sanyo internal 10MB Drive  
Complete with all manuals, software, and cables.

### **Accounting Software**

G/L, A/R, A/P, for small businesses with under 20 employees. Designed for the MBC 550 in color.  
Entire package only **\$149**

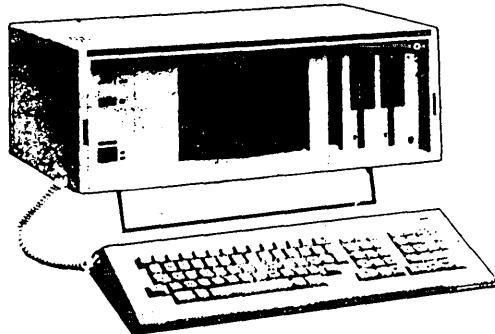
## **Accessories**

### **MODEM**

- Volks Modem 1200/300 baud modem with cable - **\$159**
- PR-5000 15 cps LQP - **\$279**
- DM-3112 12" Sanyo Monitor - **\$89**
- DMC-6113 13" Hi-Res RGB Color Sanyo monitor **\$299**
- 16K Printer Buffer - **\$84.95**
- Best prices on cables anywhere

### **Portable**

## **Philips Computer**



### **MS-DOS & CP/M COMPUTER**

**MS-DOS 2.11 & CP/M 80 Computer  
Two Fast Z80 A's & one 8088 - Processor**

### **FREE Software Included**

Wordstar (Wordprocessor) • Calcstar (Spreadsheet)

Data Plot + (Graphics Program)  
MS-DOS 2.11 CP/M 80 operating systems  
BASIC - Microsoft BASIC  
Dual 640K drives CP/M - 800K Drives MS-DOS 2.11  
256K RAM expandable to 512K for MS-DOS  
8087 Math Processor (optional)  
64K RAM under CP/M Plus 32K RAM for video  
Graphics - 512x252 pixels Alpha - 24x80 plus attributes  
SASI interface built in (works with 10 meg OWL)  
2-Serial ports bi directional ASYNC & BSYNC 60K bit/sec  
9" Green screen or optional external monitor

**\$699**

*At these prices you can enjoy the convenience of owning more than one computer!*

**CHOOSE THE SYSTEM THAT'S RIGHT FOR YOU!**

**805/393-2247**



MON. - FRI. 7am - 5pm PST • SAT. 9am - 5pm PST

All systems carry full 90 day warranty. Check in advance. Add 3% for VISA/MC. Shipping & handling charges will be added to each order.

**CASH PRICE ONLY** For our catalog with complete details and prices, send \$1.00 to: Micro Supply Organization, Inc. 4909 Stockdale Hwy. #180 Bakersfield, CA 93309

# Relief From The 300-baud Blahs

Micro C reviews a quack modem

*This flight of fancy won't do a lot to feather Dick's nest, but he would have definitely ducked his responsibilities if he hadn't sent this in.*

*The clone wars from foreign shores have expanded far beyond the PC compatibles. Here is another bargain that speaks volumes (cheap, quack, cheap, quack...)*

**O**ne of the virtues of high technology is that as its products mature they get cheaper (the government hasn't heard about this process). Remember when you paid a cool hundred (or two) for a hand-held calculator?

How about your first ball-point? I remember paying \$15 for a first run Tucker "Wonder" pen. It was a "wonder" all right, skipping like crazy and making a blue-stained mess of my hands. Today's 69-cent BIC will put any of those first ball-points to shame.

## More Wonders

The fuss today is over 2400-baud modems, and a number of bulletin boards are already using them. But the real news is that the price of 1200-baud modems is coming way, way down — to the point where 300 baud just doesn't make sense any longer.

While the Hayes Smartmodem(tm) 1200 still lists for \$595, that price has eroded significantly (I've seen them advertised as low as \$349), but a few Hayes clones have now broken the \$200 barrier.

## Modem Clone

I recently purchased a clone, advertised as a fully Hayes compatible "1200 Baud Smart Duck" (the name "Duck" came from the distributor's catalog promo: "If it walks like a duck, sounds like a duck, and looks like a duck..." What can I say?). It's manufactured in Hong Kong for a company called ADC and distributed

by DAK Industries. The price is definitely right — \$169.

## Does It Work At 300 And 1200 Baud?

You bet it does; so far it's been flawless. It comes with a 30-day money-back guarantee of satisfaction and a 1-year limited warranty. More on that later.

## Is It Really Compatible?

Comparing commands listed in their manuals and testing the Duck's response to the Hayes command set, I found only one difference: The Duck doesn't recognize ATH2, an obscure "special off-hook" command that could be important for ham RTTY use. Otherwise, they're identical, as are all of the S-register functions and their default values.

The Duck also has three commands of its own: AT\*H puts a summary of the AT command list on the screen as a help to the operator. The other two are AT\*T, which displays a static date and time from the Duck's on-board clock, and AT\*T=MM/DD/hh/mm, which sets the clock.

If this clock is accessible (for example, for the stamping of incoming files or inclusion in text), the manual gives no clue. Turning power off and then back on resets the modem's clock to 01/01, midnight.

## I Like My Duck

There are several features about the Duck I prefer over the Hayes modem. For example, rather than remove a snap-off front panel to get at the modem's configuration DIP switches, you simply turn it over on its back. (This gives you a chance to scratch its tummy as well. Try that with your Hayes.)

The Duck also has a label adjacent to the switches, which shows and defines the standard (factory) settings. It's no big deal, just that the Duck is a bit handier to configure.

---

By Dick Bollinger

Via the Micro C Bulletin Board  
17882 Wellington Ave  
Tustin CA 92680



## Redial, Redial, Redial...

Here's the one I really like. Flip the redial switch and the Duck will redial any busy number every 30 seconds until it connects. You cancel redialing by turning off the power momentarily (but there goes your clock setting! Oh well). This auto redial is handy for working busy bulletin boards and RCPMs, where it's everyone for himself.

Another feather for the Duck: It has two modular-plug receptacles, so you can plug your phone into the modem and the modem into the wall. Now, why didn't Hayes think of that?

Even when the modem is powered down (but still actively connected to the line), you can use the phone to make and answer calls normally.

The Duck has a quacker (speaker), volume control, on-off switch, and female RS-232 receptacle (it's a girl duck), exactly like the Hayes. Its power supply, though, is internal, and it must be connected to a grounded, 3-wire AC outlet.

The AC cord set on mine is heavy enough for a fair-sized waffle iron, but the modem stays quite cool. I suspect

this is a case of component engineering by availability. Anyway, I don't think the cord will ever be a problem.

But enough about the virtues of this \$169 Smartmodem(tm) clone.

The modular wall-to-modem phone cable is supplied. You'll need an 8-line (pins 1-8) or 9-line (pins 1-8,20) male-male RS-232 cable to connect your Duck to most any computer (and Xerox 820s).

Most systems should work all right in the modem's factory (default) configuration. If that doesn't work, try setting switch 8, 10, or both, to positions opposite those shown on the label. You can't hurt anything though you might ruffle a few feathers.

The Duck comes dressed in a low-boy, putty gray molded enclosure and, except for the other guy's distinctive "extruded rail" appearance, looks very much like the Hayes. (Don't worry, it doesn't say "Duck" on it anywhere, unlike some "Gorilla Banana" printers that don't look very appealing.)

The 30-day return privilege is offered by the distributor, DAK Industries, Inc., 8200 Remmet Ave., Canoga Park, CA 91304. The 1-year warranty is from the manufacturer (ADC, no address given). There is a service center address in Van Nuys, CA, listed in the back of the manual, but no customer service phone number.

#### Duck Doc

Speaking of manuals, the one supplied will get you going, but that's about all. If you plan to really work the "smarts" of your modem, borrow a Hayes manual from a friend. It contains command applications and program examples that the Hong Kong tech writer simply forgot to mention. Otherwise you'll just have to wing it.

The only things in the Hayes manual that don't apply to the Duck are the configuration DIP switch information, the block diagram, and the user support information.

#### DAK For Duck

How to order? That's the easy part. DAK has a toll-free, 24-hour, 7-day-a-week 800 number for credit card orders. It's 1-800-325-0800. In addition to the usual stuff, you'll be asked for

DAK's catalog order number, which is: No. 4334, "1200 Baud Smart Duck"

Incidentally, DAK also offers an On-Line Directory of over 1,100 data bases, with descriptions and access details, for \$14.95 (plus \$2 P&H). It's Order No. 4358. I didn't get it, but plan to, soon.

The price for the modem is \$169, plus \$6 for postage and handling. If you're a California resident, they'll add \$10.14 for the governor's cam-

aign fund. You can expect delivery in a week or less. Mine came in four days by UPS.

The package also contained a 64-page, full-color Winter '86 catalog of sundry electronic gear.

(tm) Smartmodem is a trademark of Hayes Microcomputer Products, Inc., Norcross, Georgia.



#### Advanced Concepts "Mini-Winnie"

## HARD DISK SYSTEMS

For your Z-80 Computer!

Our EXTERNAL systems install in seconds! Includes an attractive vertical cabinet with integral P/S and fan, 3 foot cables. Everything necessary to plug in and go!

Our INTERNAL systems do not displace a floppy drive, do not require a power supply upgrade, use the highest technology winchesters available. No compromises.

#### COMPLETE SUBSYSTEMS

Plug in and run! Includes software, documents, cables, brackets as req'd.

	\$665. 10mb External	\$790. 20mb External	\$790. 10mb Internal	\$845. 20mb Internal
Kaypro (1,2,4,10)	✓	✓	✓	✓
Big Board I,II	✓	✓		
Xerox 820-I,II	✓	✓		
Micro Mint SB-180	Add \$10.	Add \$10		
Gemini Zorba	✓	✓	Add \$20.	Add \$20.
Osborne I	✓	✓	✓	✓
Sanyo MBC-1150/1160	✓	✓	*	*
AVL Eagle	✓	✓	*	*
Alspa II	✓	✓		
(* Under Development)				

#### SPECIALS . . . while stock lasts . . .

5mb External \$465. TM602 or equiv. (less P/S enclosure \$395.)  
10mb External \$495. CM5616 or equiv. (less P/S enclosure \$425.)  
15mb External \$535. CM5619 or equiv. (less P/S enclosure \$465.)  
(call for current specials)

#### Drives

20mb 3.5"	\$495.	Drive cable sets 1.5' - 10.95	3' (std.) - 11.95	6' - 14.95
10mb 3.5"	\$439.	Kaypro interface cables (externals)		16.67
20mb 5.25" HH	\$439.	Host extension cable, 1 foot		18.95
10mb 5.25" HH	\$279.	"W" power cable		9.50
10mb FH SPECIAL (call)	under \$200.	Document package (incl. with system)		8.00
5mb FH SPECIAL (call)	under \$120.	Enclosure 5.25" FH, with P/S - 69.00	without P/S - 49.00	

The key to the Mini-Winnie system is the INSTALL program, which links your drive and your computer, the way YOU want it. Extensive menu options allow selection of any ST-506 compatible drive, as 1 to 4 logical drives within CP/M at any drive letter. Diagnostic and format capability provided to match the installation. Distributed in SOURCE form.

We have club, user group, OEM/Dealer programs. Call for quantity schedule. If for any reason you are not satisfied, return for full refund. Special drives warranted for 30 days. Info and manual \$8.00 credited with system purchase. Specials subject to availability.

**ORDER INFO:** Call (305) 482-7302. Terms: UPS cash COD, check or M.O. Please allow 4 weeks for delivery. Fla. add 5% tax. Shipping extra. Please specify desired floppy format.



Advanced Concepts Engineering & Consulting  
8926 S.W. 17 St., Boca Raton, FL 33433

# AFFORDABLE HARD DISKS FOR YOUR Z80

## HARD DISK SYSTEMS by Emerald Microware

Now is the time to take advantage of the low prices on hard disk drives. We have everything you need from the host board to a complete turn-key system for your computer, order only as much as you need. Runs on Xerox 820-1 or -2, Kaypro, or most ANY Z80 based system.

### HDS Host board

- Plugs into Z80 socket, no wiring required (special 50 pin host is available for Kaypro 84 series computers)
- Interfaces directly with 40 pin Western Digital 1002 series controller boards
- Comes fully assembled and tested
- Switch selectable I/O addressing

### HDS Software package by MICROCode Consulting

- Drivers locate above your existing operating system and BIOS, so it will not interfere with your other programs that install down below.
- Custom installs for your system without having to assemble any software
- Reserves system tracks and swaps so you can Warm Boot from hard drive
- Allows installation of up to two hard drives and two 5 1/4" floppies on one WD1002-05 controller board
- Runs diagnostic on system each time hard drive is installed
- Can be configured for 5 to 40 Meg hard drives, from menu or custom install
- Includes manual, FORMAT, TEST, PARK, INSTALL, and SWAP utilities

### Western Digital 1002-05 Hard Disk Controller Board

- 5 1/4" profile with standard 5 1/4" power connection (only 5 VDC required)
- Has WD2797 floppy controller and interface on board
- Can control up to three hard drives and four 5 1/4" floppies.
- 40 pin host interface
- ST506 compatible hard drive interface

### HDS TURN-KEY HARD DISK SUBSYSTEM by Emerald Microware

- External hard disk subsystem complete with all cables, controllers, hard drive, and cabinets with power supply, fully tested and burned in. Host adaptor and full installation kit supplied with software on disk format of your choice.
- Internal hard disk subsystem for '84 series Kaypro computers, complete with host, controller, cables, 3 1/2" hard drive, mounting hardware, and fan.
- Available as 10, 20, or 40 Meg, single or multi-drive systems
- External units available with both hard disk and 5 1/4" quad density floppy drives installed

10 Meg Single drive Subsystem . . . . .	\$ 795.00
20 Meg Single drive Subsystem . . . . .	\$ 995.00
Host board with software package . . . . .	\$ 89.00
WD1002-05 Hard disk controller board . . . . .	\$ 185.00
WD1002-05 controller with Host and software . . . . .	\$ 250.00
20 Meg with dual 5 1/4" floppy subsystem . . . . .	\$1295.00

## XEROX BOARDS AND ACCESSORIES

We stock a limited quantity of Xerox parts and accessories for the 820 computers.	
Xerox 820-2 Main Computer Board . . . . .	\$ 95.00
Xerox 820-2 Floppy controller board . . . . .	\$ 75.00
Xerox 820-2 Main board with floppy controller board . . . . .	\$150.00
Xerox 5 1/4" disk drive cable . . . . .	\$ 12.00
Xerox internal video harness with brightness control . . . . .	\$ 9.00
Parallel ASCII keyboard (no numeric pad) with docs . . . . .	\$ 25.00
PC mount power connector for 820 board . . . . .	\$ 2.50
Dual half height, 5 1/4" disk drives (new), DSDD - 48 TPI, in cabinet with Xerox standard cable . . . . .	\$265.00
Dual half height, 5 1/4" disk drives (new), DSQD - 96 TPI, in cabinet with Xerox standard cable . . . . .	\$295.00

We guarantee satisfaction on all of our products or your money back. Include \$4.00 shipping and handling, \$7.00 for COD, call for Blue Label charges. Phone hours: 8:30am to 5:00pm weekdays; modem hours: 10:00pm to 8:00 am seven days a week.

## WE SUPPORT OUR CUSTOMERS

### *Is single density making your Xerox 820-1 feel crowded?*

### DOUBLE DENSITY FOR THE XEROX 820-1 OR BIG BOARD I

Clearly the most versatile double density package available for the 820-1. Lets you run up to four disk drives at once, and mix 5 1/4" & 8". Runs almost all Kaypro and Xerox 820 software. Supports all standard printers and most add-ons such as the Ferguson ram board. Our ROM sets operate in banked mode to allow more space in the TPA for your programs. You get Mini-monitor functions, autoboot capability, automatic disk identification (up to 19 formats built in), IOBYTE enabled for device selections, and you can read and write 48 TPI disks on 96 TPI disk drives.

X120 Board - assembled and tested - with ROM set . . . . .	\$160.00
X120 Board - full kit - with ROM set . . . . .	\$140.00
X120 Bare board with ROM set . . . . .	\$ 72.00
X120 Bare board only . . . . .	\$ 26.00
ROM set only . . . . .	\$ 50.00
Hard to find parts set (trimmers, caps, resistors) . . . . .	\$ 12.00
WD2793 controller chip . . . . .	\$ 22.00
Other packages available . . . . .	

### *Can't find CP/M for your Xerox? Now you don't need it.*

### QP/M by MICROCode Consulting

At last, an inexpensive replacement for CP/M, and you don't need CP/M to get started! Get full CP/M compatibility with many new options. Stamp your file with the time and date - transparent to your operation, automatically re-log your disks (no more control C), change your default drive search from the keyboard, use up to 31 USER areas, select your disk drives or user areas with semicolon or colon, maintains ARCHIVING bit for efficient backups (great for hard drives), and much, much more. Runs in native Z80 code, in the same space as CP/M 2.2. Has menu oriented install for use on ANY Z80 based system. Available as a bootable disk (with BIOS) for the Xerox 820-1, 820-2, 820-XPRO, 820-PLUS2, or Kaypro. QP/M, bootable for the Xerox 820-1, 820-2, or Kaypro . . . . . \$ 80.00 QP/M, bootable for the Xerox 820-1 using XPRO or PLUS2 . . . . . \$ 65.00 QP/M, without BIOS (not bootable) . . . . . \$ 60.00

### *Tired of carrying your computer back and forth? Why not just the diskette?*

### UNIFORM and UNIDOS by Micro Solutions

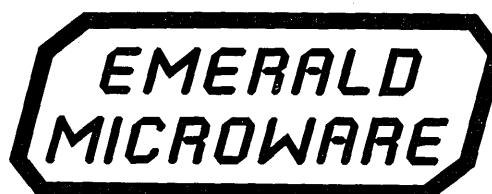
The solution to the diskette incompatibility problem. This program allows files to be transferred back and forth between close to a hundred computer formats including between CP/M and MSDOS. Lists computers by name - no special technical knowledge required. Versions available from stock for the Kaypro (XPRO), Xerox 820-2, Morrow MD2&3, and IBM 100% compatibles. Other versions available on request. Unidos allows you to run CP/M 80 programs on your IBM compatible. Requires NEC V20 chip on PC.

Uniform or Unidos . . . . .	\$ 64.95
IBM Uniform with Unidos and V20 . . . . .	\$145.00

### PANASONIC HALF HEIGHT DISK DRIVES

These are some of the finest new 5 1/4" disk drives. They are fast, reliable, and have about the lowest power consumption around.

National JA551 (Shugart 455) - DSDD, 48 TPI . . . . .	\$114.00
National JA561 (Shugart 465) - DSQD, 96 TPI . . . . .	\$129.00



P.O. BOX 6118 ALOHA, OR 97007 (503) 642-1860



# Z SETS YOU FREE!

**Free** to create computer environments right for you . . . free to automate repetitive tasks . . . free to increase your productivity. **Z-System**, the high-performance 8-bit operating system that flies! Optimized assembly language code — full software development system with linkable libraries of often needed subroutines — relocating (ROM and RAM) macro assembler, linker, librarian, cross-reference table generator, debuggers, translators, disassembler — ready to free you!

<b>TERM III</b>	New generation communications package provides levels of flexibility, functionality, performance not available until now. Replaces BYE and XMODEM . . . master/server local area network capability . . . public or private bulletin board and electronic message handling are integral features . . . auto-dial/answer, menu install . . . XMODEM (CRC/Checksum), MODEM7 Batch, Kermit, CIS, and XON/XOFF protocols . . . 100-page manual . . . . .	\$99.00
<b>Z-MSG</b>	Rolls Royce of message handling systems . . . mates with TERM III or BYE for most advanced overall electronic mail/file transfer capabilities . . . menu installed . . . extreme configurability . . . many levels of access and security . . . word, phrase editor, field search . . . complete message manipulation and database maintenance . . . . .	\$99.95
<b>DISCAT</b>	Elegant, menu and command-line driven file and disk catalog manager. Generates and controls multiple master catalogs, working catalog used for update quickness. Nine flexible modules easily altered by user for custom requirements. Works with Z shells (VMENU, VFILER, MENU), aliases, and multiple commands per line . . . . .	\$39.99
<b>ZCPR3: The Manual</b>	Bound, 350 pages, typeset book describes features of ZCPR3 command processor, how it works, how to install, and detailed command usage. Bible to understand Z-System . . . . .	\$19.95
<b>ZCPR3 and I/OPS</b>	Loose-leaf book, 50 pages, 8-1/2" by 11", describes ins-and-outs of input/output processing using Z-System. Shows how to modify your BIOS to include I/O redirection . . . complements <b>The Manual</b> . . . . .	\$9.95

**More missing links found — Z Application Programs! Fly with eagles! Our programs promote high performance through flexibility! Productivity results from dynamically changeable work environments, matching operator to tasks and machines.**

Above programs require 48K-byte memory, ZCPR3, Z-Com, or Z-System, and Z80/NSC800/HD64180-based computer. Shipping from stock. State desired disk format, plus two acceptable alternatives. As payment, we accept Visa, Mastercard, personal checks, money orders, and purchase orders from established companies. We also ship UPS COD.

Call or write to place order or to obtain literature.



**Echelon, Inc.** 101 First Street • Suite 427 • Los Altos, CA 94022 • 415/948-3820

# Upgrading Your XT To A Turbo For (Almost) Nothing

---

By David Thompson

We interrupt the diagnosing your computer series to bring you this special message. You don't need to spend \$300 or more replacing your PC or XT's processor board. If your RAM is fast enough, you can turn your tortoise into super system for under \$40. Sound familiar to you oldtimers?

**S**tories of easy speed-ups on ATs and AT clones have been around a long time. Only after IBM started using a special ROM that wouldn't let the system run 8MHz (for some unexplained reason) did the \$2.00 AT speed-ups begin to taper off.

I haven't seen any stories about speeding up the PC or the XT. That's curious, particularly since there isn't much involved and its ROM doesn't care.

Oh, going the whole route can be a little more involved than simply replacing a crystal (that's all you do on the AT), but you can get your speed in increments. The first increment is very easy.

If you do go the whole route (including changing the system clock frequency) you may not be able to run software that's been protected by some of the older anti-copy schemes. But those schemes die at the sight of an AT or any other turbo board, so you'll be in good company. (And you can add a switch to go back to 4.77 if you insist on running this kind of slugware.)

Music programs that use processor loops to generate sound become more soprano as you increase the system clock speed.

## Overview Of The Mod

The first, and simplest, thing to do is replace your 8088 processor with a V20 from NEC. Unplugging the 8088 and plugging in the V20 gives you a

significant improvement in speed. (See the benchmarks in this issue.)

Changing the system clock speed is the next step and can be a bit more involved. You'll need to make sure your RAM is fast enough, you'll need to replace the processor clock crystal, and, if you're using a color graphics board (to drive either a color monitor or a composite B&W monitor), you'll need to add another oscillator to supply 14.31818MHz to the color board.

## Background

You may be wondering why IBM chose 4.77MHz in the first place. After all, the parts they're using will run 5MHz, often 6MHz, just fine.

It turns out that the 6845 graphics controller needs a 14.31818 clock (+/- almost nothing) so it can generate horizontal sync, vertical sync, and color dot signals. IBM designers knew this when they designed the PC, and they figured that most people wanted color graphics.

So they used a 14.31818 crystal for their master clock (that way they didn't have to put another crystal on the color board). Then they added a small capacitor in series with the main crystal that they called "color adjust."

## Divide By Three

The 8088 needs a clock that spends 2/3 of its time high and 1/3 of its time low (it's asymmetrical), and the Intel 8284A clock generator IC generates this signal by dividing the main crystal frequency by 3. 14.31818 divided by 3 is 4.77 (or thereabouts).

The 8284A supplies both the 4.77MHz to the processor, and the 14.31818MHz to pin B30 on the slots. This is the signal the color board uses. The problem everyone faces when they change the system's crystal is that they screw up the color display. It's that simple. If you don't have a color board then you don't have to worry about supplying 14.31818.

## Replacing The 8088 With The V20

Remove the cover from the system, ground yourself by touching bare metal on the power supply, and then just pop out the original processor (see Figure 1). Pry up the 40-pin IC with a very small screwdriver. Pry at alternating ends until the chip is loose.

(Note: The V20 is a CMOS chip. It is extremely sensitive to static. Don't remove it from its protective container before you're ready to pop it into the system. Make sure you ground yourself before doing anything. Don't wear synthetics. And, especially, don't kiss your favorite friend (causes particularly hot sparks).)

To insert the V20, set one set of legs into their holes (don't push them in yet). Then, with your thumbs, press the chip toward the set of legs that are resting in their holes. This will flex those already positioned legs so that the second set of legs will line up with their holes.

Now apply gentle pressure straight down, rocking slightly. Take your time. Watch carefully for pins that aren't going into their holes. When you know that everything is going in properly, press down firmly to seat the chip.

You have now speeded up your system about 20%. Replace the lid, fire up your system, and watch everything run faster.

If you're a neophyte hardware hacker, untested in the surgical suite, then I'd stop right here. You've gained some speed, upgraded your system, and you're not in over your head.

Find an experienced guide before going on. You'll be a lot more comfortable, and your guide will appreciate being asked to supervise — especially if you happen to be serving his favorite beer and pizza. (Your goal is to finish the following mod before he finishes the beer.)

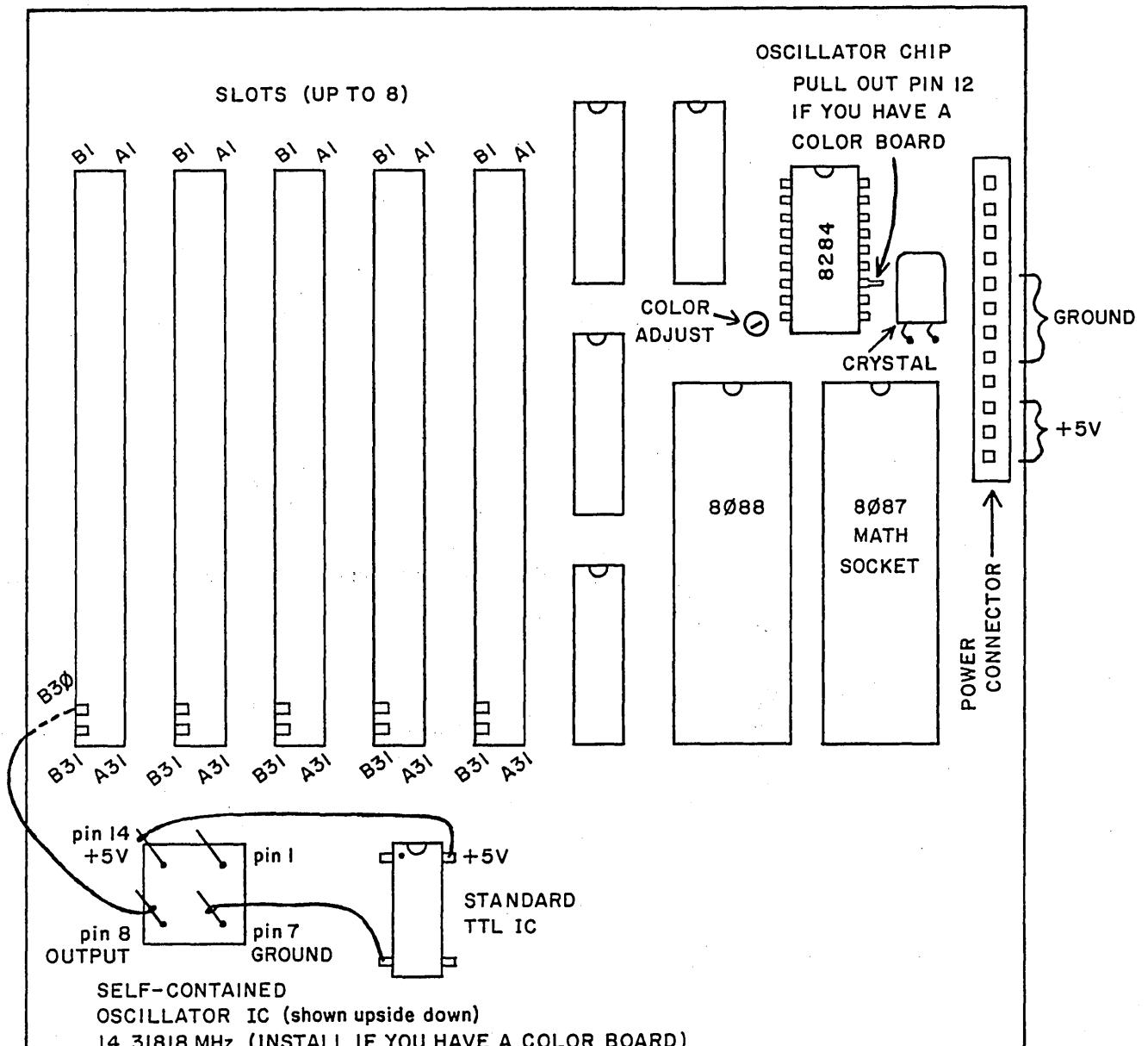


Figure 1 - XT Speed-up Component Layout

### Speeding Up The System Clock

Now that you have your courage up (or your friend's well into the food) roll up your sleeves and get ready. This is the fun part.

### Parts You'll Need:

1. 120ns or 150ns RAM chips (if yours aren't that fast).
2. 18MHz and 20MHz crystals.
3. A 14.31818MHz oscillator IC — it's a crystal and oscillator combined (if you have a color graphics board).
4. DPDT toggle switch (probably not necessary, but important if you have copy-protected software that's sensitive to system clock speed).

### Tools And Materials:

1. Small soldering iron (15 watt max) with 3-wire plug.
2. Fine-gauge electronic solder.
3. Solder sucker (the spring-loaded type with an anti-static tip). This tool is a must for any kind of PC board work.
4. Standard wire-wrap wire (30 gauge, teflon coated).
5. Small wire cutters.
6. Needle nose pliers.
7. Small screwdriver(s).

### RAM

Remove all of the plug-in boards and take a close look at the RAM on the main board (and on any RAM expansion boards).

Wrap the plug-in boards in something anti-static before you set them aside. (Aluminum foil works very well.)

On most main boards there are four banks of 9 RAM chips each (some main boards have only 2 banks). The RAM chips are marked with either a

(continued next page)

## UPGRADING YOUR XT TO A TURBO

(continued from page 29)

number ending with 64 (64K RAMs) or a number ending with 256 (256K RAMs). After the 64 or 256 there will be a “-” and another number.

If that second marking is a “-12” then the chips’ access time is 120ns (and they will work in a system running up to 8MHz). If it’s “-15” then the time is 150ns (and the RAM will run in a 7MHz, or slower, system). If this second number is “-2” or “-20” the time is 200ns and the chips will run in a 5MHz (or slower) system.

If the chips are marked “-3” or “-30” then they are 300ns and aren’t even rated for 4.77MHz systems.

Since you are changing the clock speed to 6MHz or 6.67MHz you’ll need RAM chips marked with “-12” or “-15.” If yours aren’t, then order some new ones before continuing.

64K RAM chips should cost between \$1.00 and \$1.50 each. 256K parts should cost between \$2.00 and \$4.00 each. Get 150ns or 120ns parts. Order 10 parts per bank so you’ll have a spare in case you mangle one during installation, or in case one is bad. (Japanese parts are the best.)

You remove and install RAM chips just like you removed and installed the processor. RAMs are a bit easier because there are fewer pins, but take your time. Plan on spending at least 5 minutes per bank.

Now reassemble the system enough to fire it up and verify that the new RAM is working. If there’s a problem you’ll have a good idea where to look for it.

### The Crystal

Now that your RAM is fast enough and you have the V20, it’s time to change the crystal.

The 18MHz crystal will give you a 6.00MHz system. The 20MHz crystal will give you a 6.67MHz system. You’ll probably want to try the 20 first. Replace the lid and run the system on some unimportant stuff for a day or two to see if everything seems solid. If it doesn’t boot right away, gives you parity errors, or locks up after a few hours, you’re pushing it too hard. Try the 18MHz crystal and see if that doesn’t clear up the problems.

### Replacement

The crystal resides in a small rectangular metal can very close to the main board’s power connector. It has two leads and will probably have 14.31818 stamped on its top.

First remove the main board so you can get at its underside (you might have to remove the drives to reach the screw on the front corner of the board).

Remember to touch the power supply before starting, and don’t shuffle your feet while working. Also note the color coding on the wires from the power supply. Usually the power connector comes in two parts. The black wires (grounds) are in the center of the whole assemblage.

After you remove the main board, wrap it in anti-static material (blue foam, blue bubble material, or aluminum foil).

If you are comfortable soldering and unsoldering on circuit boards and have the tools, then go for it. Otherwise, make sure you have old pizza breath peering over your shoulder (or doing it himself). This is a very simple task for the experienced, but a static spark or a solder bridge will disable your system, guaranteed.

The crystal is probably glued to the board, so take a small screwdriver and pry the top upwards away from the board so the crystal stands up on its own two legs.

Now, underneath the board, use the iron to heat one of the solder pads and then suck the solder out of the hole. (Hold the freshly tinned, hot tip against one joint. Wait three seconds after the surface becomes liquid and then jam the solder sucker down over the hot tip, yank the tip back, and hit the button.)

Remove the solder from both holes and then wiggle the crystal until it pops out. If one leg won’t come, heat it with the iron and then pull.

Stick in the new crystal (make sure the printing will be up), solder it underneath the board, and then clip off the extra wire.

### A Switch

If you need to revert back to 4.77MHz on occasion then you’ll want to install a switch. See Figure 2 for wiring instructions. Solder the original

crystal and one of your new faster crystals to the switch. Then run two (very short) wires to the board and solder them into the original holes. You may need to drill a hole in the back of the cabinet if there isn’t one there already. Do this before you replace the main board and clean up the bits of metal very carefully.

You’ll probably have to do a hardware reset (turn the system off and then on) each time you change the system speed, but you probably won’t be changing it very often.

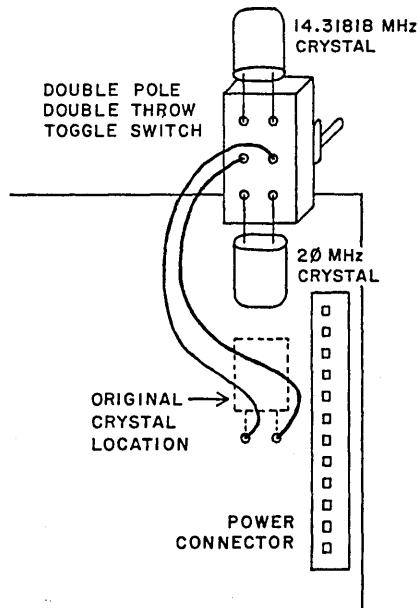
### Color Board

If you have a color board (or anything else that insists that 14.31818 be available at the slots) then you’re going to have to supply it.

First, remove the the original oscillator chip (the 8284), bend out pin 12 slightly, and then replace the chip, making sure that pin 12 doesn’t go into the socket and doesn’t touch anything (see Figure 1). This disconnects the master oscillator from pin B30 on the sockets.

Now you need a crystal oscillator and power to run it. The oscillator has four pins and is made to plug into a standard 14 pin IC socket. Pin 1 is not

Figure 2 - 2-speed Clock



(14.31818 MHz may be necessary for disk formatting)

used (there is a dot on the case above pin 1). Pin 7 is ground. Pin 8 is 14.31818MHz output. Pin 14 is +5V.

I simply soldered wire-wrap wire to the oscillator's legs and then ran the wires from pin 14 to +5V, from pin 7 to ground, and from pin 8 to B30 on the end slot (see Figure 1). I rested the oscillator upside down on top of one of the soldered-in TTL ICs and stuck it in place with hot glue.

The standard ICs (the 14, 16, 18, and 20 pin garden variety) have ground and +5V on their corner pins (see Figure 1). Use an OHM meter (and 5V and ground on the power connector) to verify which pins supply the 5V and ground.

**Parts are available from:**

V20, 18.31818MHz oscillator IC, 18MHz & 20MHz crystals, DPDT switch. (Total for all, \$37.50.) From:

MicroSphere  
PO Box 1221  
Bend OR 97709  
(503) 388-1194

RAM, (order 64K X 1 or 256K X 1, 150ns) Check for latest prices.

Microprocessors Unlimited  
24,000 S Peoria Ave  
Beggs OK 74421  
(918) 267-4961



**NEW**

FREE CATALOG

CP/M  
MSDOS

**AFFORDABLE  
ENGINEERING  
SOFTWARE**

TRSDOS  
PCDOS

- **LOCIPRO** Root Locus — **\$69.95**
- **ACTFIL** Active Filter Design/Analysis — **\$69.95**
- **STAP** Static Thermal Analysis — **\$69.95**
- **MATRIX MAGIC** Matrix Manipulation — **\$69.95**
- **RIGHTWRITER** Proofreader & Writing Style Analyzer — **\$74.95**
- **ACNAP2** AC Circuit Analysis — **\$69.95**
- **DCNAP** DC Circuit Analysis — **\$69.95**
- **SPP** Signal/System Analysis — **\$69.95**
- **PLOTPRO** Scientific Graph Printing — **\$69.95**
- **PCPLOTZ** High Resolution Graphics — **\$69.95**



**Engineering**

Professional Software



2200 Business Way, Suite 207 • Riverside, CA 92501 • (714) 781-0252

**Excellence**

In your job, it depends on having the best tools available at your disposal. With such tools, your productivity increases and your work becomes easier.

Wisely, you keep a sharp eye open for products using the latest technology...Those truly representing the state of the art.

You have now located the source of advanced debugging technology for PC-DOS and CP/M-80. More powerful debugging software is not available anywhere...at any price. Yet the cost is affordable to even the smallest budget.

DSD-80...Absolutely the most powerful and easiest to use debugger for CP/M-80. Full screen symbolic design now includes a back tracing capability. Only 125.00

DSD-86...New and innovative design combines the most sophisticated user interface with the most flexible display to create a new generation of debugging technology for the IBM PC. Only 69.95



**SoftAdvances**

P.O. Box 49473 - Austin, Texas 78765 - (512) 478-4763

Visa & Mastercard Accepted. Please include 4.00 for shipping and handling.

# Benchmarking The Speedy PCs (And CP/M Emulators) In C

By Gary Entsminger  
Micro C Staff

Gary and I (d.t.) were sitting around the office one afternoon trying to guess whether a 4MHz CP/M system was really much slower than a 4.77MHz clone, and whether 8080 code running on a V20 using CP/M emulation would be faster or slower than the same code running on a Z80 CP/M system.

What about writing to the screen? What about looping? What about integer math? None of the fancy benchmarks I'd seen addressed these questions. So I sat down and banged out three very simple programs.

We also wanted to get results from the Amiga, but we don't have the numbers yet. If they come in before we go to press they'll show up in the table. (Hey, come back here, you can't print this yet — I haven't even finished the intro...)

With all the talk about speed around the office these days, I knew it would come to a benchmarking exhibition, so here it is. Ladies and gentlemen, hang on to your seats.

## The Participants

1. Kaypro 10 — a reliable, boxy 4MHz Z80 from the world of CP/M
2. Basic Personal Clone — 4.77MHz 8088 version
3. V20 PC — 4.77MHz version (#2 with a V20 replacing the 8088)
4. Faster Personal Clone — 6.77MHz V20 version.
5. Blue Lightnin' — a 9.25MHz Z80 board plugged into a clone
6. X16 — 8MHz 80186 version
7. Kaypro 286i — (running an 80286 at 6MHz)
8. Atari ST — (running a 68000 at 8MHz)
- And three CP/M emulators —
9. RUNCPCM
10. RPM2
11. CP/Mulator

Table 1 - Benchmarks For The Speedy PCs

SYSTEM	BENCH1	BENCH2	BENCH3
<b>(8088 code)</b>			
PC (4.77MHz 8088)	54.7	28.7	73.6
PC (4.77MHz V20)	32.8	17.9	65.2
PC (6.67MHz V20)	25.7	13.9	60.3
X16 (8MHz 80186)	11.3	7.2	23.0
Kaypro 286i (6MHz 80286)	11.2	7.4	34.2
Holliston XT186 (8MHz 80186)	14.4	7.5	35.6
Slicer (8MHz 80186)	23.1	13.7	23.9
<b>(8080 code)</b>			
Blue Lightnin' (9.2MHz Z80)	203.6	104.6	38.0
RUNCPCM (6.67MHz V20)	329.0	169.2	34.3
RPM2 (6.67MHz V20)	326.8	169.0	45.0
CP/Mulator (6.67MHz V20)	331.1	170.4	63.4
Kaypro 10 (4MHz Z80)	478.2	244.6	39.0
Atari ST (8MHz 68000)	28.0	18.0	35.5

All programs were run from hard disk (load time 1 sec. or less) except on the Atari ST (load time 5 sec. for each program). Times were taken by hand stop watch.

See the speed-up article for information on speeding up your MS-DOS system from 4.77 to 6.67MHz.

All the emulators are running 8080 CP/M code on the 6.67MHz personal clone. And now, gentle folk, rev up your engines.

## The Thompson Benchmarks

Each computer will run three benchmarks written in C and compiled with the AZTEC compiler (version 3.20d for the MS-DOS programs, and version 1.06 for the CP/M emulators).

Each benchmark is processor intensive. Bench 1 does two integer additions and a division — 400,000 times. Bench 2 is identical to Bench 1 except that the math has been removed so

only the loops, tests, and screen writes remain. (That way, the difference is the processor's and compiler's speed at handling integer math.) Bench 3 writes 20K characters (dots) to the screen. (Clones are notorious for their slow video, and I was curious whether a change in processor speed would affect display update time.)

The benchmarks are very simple, but testy; see Figures 1, 2, and 3 for the C source.

## And The Winners Are

Table 1 contains the results. Surprised? We are, particularly with the



Figure 1 - Bench1.C

```
main()
{
int j, k, l, i;

j=1;
k=2;

for(l = 0; l < 20; ++l)
{
    for(i = 0; i < 20000; ++i)
    {
        k =((j+1))/j+i;
        if((i % 1000)==0)
        {
            if(l < 19) putchar('.');
            else putchar('x');
        }
    }
    printf("\n%d j %d k %d i",j,k,i);
}
}
```

hot results from the V20 sped-up PC, a last minute entry. The sped-up PC executed almost twice as fast as the basic PC and many, many times faster than the Kaypro 10.

The X16 (from PC Tech) and the 286i (from Kaypro) are the clear winners, but are just a little more than twice as fast as the sped-up PC (the \$821 entry and a hot alternative to spending a lot of money).

The emulators are good competition for the Kaypro 10 (although not with the PCs), so you CP/Mers can still have a piece of both worlds. Blue Lightnin', in particular, is a hot op-

Figure 2 - Bench2.C

```
main()
{
int i,l;

for(l = 0; l < 20; ++l)
{
    for(i = 0; i < 20000; ++i)
    {
        if((i % 1000)==0)
        {
            if(l < 19) putchar('.');
            else putchar('x');
        }
    }
    printf("\n%d i",i);
}
}
```

tion. Although spendy, it runs 8080 programs faster than the Kaypro 10 and the V20 emulators. (And unlike the emulators, Blue Lightnin' runs Z80 code so you can use the Turbo compiler and Turbo generated .COM files.)

#### Calling All Benchmarkers

If anyone has run benchmarks on other machines, please send us the results, including benchmark source. We'd especially like to see these simple programs run on the 68000 systems, the Mac, and the Commodore Amiga. (Times include loading the program from disk.)

Figure 3 - Bench3.C

```
main()
{
int i,l;

for(i = 0; i < 20000; ++i)
{
    putchar('.');
}
printf("\n%d i",i);
}
```

#### For more information —

**Decimation**  
2065 Martin Ave. Ste. 110  
Santa Clara CA 95050  
(408) 980-1678  
(for Blue Lightnin')

**PC Tech**  
P.O. Box 128  
904 North 6th St.  
Lake City MN 55041  
(612) 345-4555  
(for the X16)

**Micro Interfaces Corporation**  
6824 NW 169th St.  
Hialeah FL 33015  
(800) 637-7226  
(for RUNCPM)

**Source Information**  
P.O. Box 2974  
Warminster PA 18974  
(215) 628-4719  
(for CP/Mulator)

**Micro Methods**  
118 SW 1st, Box G  
Warrenton OR 97146  
(503) 861-1765  
(for RPM2)

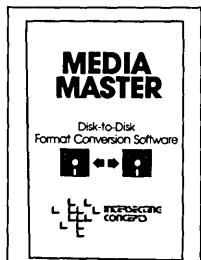


# "MAKE YOUR IBM-PC KAYPRO COMPATIBLE"

Intersecting Concepts Announces 3 Solutions To Solve Your Computer Incompatibility!

"But will it work on my computer?"

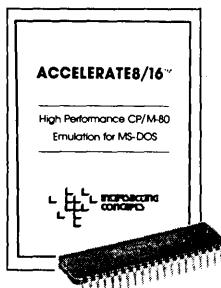
**Yes!** Finally, there are three easy ways to exchange information, transfer files, and run CP/M software on MS-DOS machines.



1. **MEDIA MASTER™** is our direct disk-to-disk format conversion program. Already an accepted industry standard, this \$39.95\* program uses simple screen prompts that lets you read, write and format up to 150 different 5 1/4" diskettes from CP/M, MS-DOS and PC-DOS operating systems. So if you work on a IBM-PC compatible at the office, but use a CP/M computer at home, now you can easily transfer files that would otherwise be "foreign" to your computer's operating system.



2. **MEDIA MASTER PLUS™** goes one step further by converting 8-bit CP/M software to run on 16-bit MS-DOS and PC-DOS machines. This newly released \$59.95 product combines our IBM-PC version of *Media Master* with ZP/EM, a powerful new emulation program. The results are amazing: CP/M programs using 8080 instructions *and* data can be transferred from popular computers like Osborne, Kaypro and Zenith to run on MS-DOS and PC-DOS machines!



3. **ACCELERATE8/16™** is also new and dramatically improves the performance of *Media Master Plus* by tailoring the CP/M emulation around a NEC V20 microchip. This user installable plug-in chip simply replaces the 8088 processor in your MS-DOS computer. Once installed, it'll run your CP/M and MS-DOS software much faster. (Speed improvements are roughly 15% faster in MS-DOS and 350% faster in CP/M!) *Accelerate8/16* includes *Media Master Plus*, V20 CP/M Emulation Software, and the NEC chip for only \$99.95!

**SEE US AT THE WEST COAST COMPUTER FAIRE — BOOTH 1833!**

## THE CHOICE IS YOURS!

So if you just need to exchange files between different computers using different operating systems, there's *Media Master* at \$39.95.

If you're upgrading to an MS-DOS or PC-DOS machine or already have one but don't want to spend money buying "new" software programs you already own, there's *Media Master Plus* for \$59.95.

And if the execution speed of your CP/M programs is important, there's *Accelerate8/16* for \$99.95, which provides a simple hardware *and* software solution to making your MS-DOS computer CP/M compatible.

## TO ORDER

To order *Media Master*, *Media Master Plus*, or *Accelerate8/16*, call **800-628-2828, ext. 629**.

All three solutions save you money by eliminating expensive modems and communications software, and none of our products are copy protected.

*For additional product and upgrade information contact:*



4573 Heatherglen Ct., Moorpark, CA 93021  
or call 805-529-5073.



Dealer inquiries invited.  
\* \$99.95 for Dec Rainbow

# Virtual Memory

By George Scolaro

Definicon Systems, Inc.  
21042 Vintage St.  
Chatsworth CA 91311

What looks like RAM, but costs like a winchester?

*There's nothing easy about being cheap. I mean, with memory prices what they are, why would someone spend months writing a virtual memory package? (And what does virtual mean anyway, except unreal?)*

*And, who would use it? Unless my memory fails me, virtual memory has only been available on those big honkers that reside in virtual rooms and cost virtual megabucks.*

*Anyway, George has been slaving away on the software to support virtual memory (a winchester or RAM disk becomes an extension of RAM memory). And as George will attest, this is a non-virtual project.*

**A**lthough memory prices continue to decrease and 1 megabyte dynamic RAMs are just around the corner, there are times when a computer still doesn't have enough memory. Many methods have been used to get around these memory limitations, such as —

1. Overlaying program and code areas.
2. Splitting the program into separate modules that chain to each other.
3. Creating virtual arrays on mass storage.
4. Demand paging (both code and data).

Of the above methods the most elegant and generally the most efficient is demand paging.

## Demand Paging

For a computer to support demand paged memory allocation, it has to meet two hardware requirements:

1. CPU capable of having any instruction aborted in midstream and later re-executed when the error condition has been removed.
2. Memory Management Unit (MMU) that can translate a logical

memory address to a physical memory address and generate an abort signal to the CPU if the page containing the logical memory address is not present in the physical memory.

The series 32000 family of microprocessors from National Semiconductor is one of the few 32-bit micros that currently (fully) supports demand paged virtual memory in hardware (and is available).

The DSI-32 co-processor board for PC/XT/AT compatibles has a socket for the NS32082 MMU. With the MMU and support software a virtual memory system can be run in a desktop unit. The current implementation of virtual memory system for the DSI-32 gives you (effectively) up to 15 megabytes of memory with a microprocessor (in this case, the 32032) that has a linear addressing architecture.

But before we go too far, let's talk a bit about virtual memory. What does it offer? What are the tradeoffs?

## Virtual Memory

Virtual memory is really a mechanism for fooling a program into believing it has more memory than it really has. This trick is performed by both the hardware (CPU and MMU) and the special support software.

The hardware detects the attempt by the CPU to access a page of memory (512 bytes on the 32000 series) which is not present in RAM.

The hardware then generates a signal which causes the CPU to abort the current instruction (in midstream) and vector to an ABORT handler. The ABORT handler then decides which page to write back to mass storage and then loads the required page from mass storage. Then the handler updates control tables for the MMU and exits back to the original program. At that point the processor re-executes the aborted instruction.

Thus, mass storage (usually a hard disk or a RAM disk) becomes an

extension to the system's main program memory.

## The Offering

This way we get more memory than we have. Contradiction? Not really.

Of course, it's much nicer to have as much physical memory as possible in a system, but even today, 15 megabytes of memory would be fairly expensive and cumbersome.

Virtual memory has the advantage over other paging schemes of being totally transparent to the programmer and the end user. It isn't necessary to create overlay maps or to keep checking whether a segment register is about to wrap around.

## The Tradeoffs

Virtual memory systems have to swap information between the mass storage and program memory. This takes time. This isn't to say the whole system will come to a halt, but performance will decrease. The bottleneck of the system now becomes the mass storage device and the paging algorithm.

## Why We Did It

Some owners of DSI-32 boards have asked for more memory than the currently available 2 megabytes.

As all programmers know, memory is like money — if you have more memory, you'll figure out a way to use it. (As far as I can recall, memory growth is exponential.)

Remember that a Z80 with 64K was, and still is, suitable for many applications. Yet, with the advent of the new 32-bit computers, the compilers alone use 250K bytes and they produce 1 megabyte object files with ease.

Of course, programmers haven't been satisfied with 1 meg programs or even 2 meg programs so we've developed virtual memory.

(continued next page)

(continued from page 35)

### The MMU And CPU

Before talking about the software portion of virtual memory, I'll quickly cover the hardware.

The 32032 CPU and 32082 MMU share a common multiplexed address and data bus. When an MMU is present in a system, the logical address that comes out of the CPU is latched by the MMU, translated in 1 T state (100 ns at 10MHz), and then output back onto the address bus along with a Physical Address Available (PAV) strobe. The PAV strobe lets the rest of the hardware know that there is an address on the bus. (Thus they never see the logical address.)

This extra T state translation delay causes around a 3% loss in CPU performance. A non-MMU system has a 4 state cycle (400 ns), while an MMU system has a 5 state cycle. Accordingly, you'd expect that the performance loss would be 25%, but this is not the case, due to the instruction pipeline in the CPU. Also, the 32032 CPU uses only around 50% of the total bus bandwidth with an average mix of instructions.

### Tables

The 32000 MMU performs translation by consulting two tables. The first table has 256 4-byte entries, each of which points to a second table which contains 128 4-byte entries. The second table level entries point to 512-byte pages that contain the user program code and data.

To minimize table lookups that are in RAM, the MMU has a fully associative cache that contains the most recently used 32 entries. These entries can thus manage 16K of memory without making the MMU do a direct lookup in RAM. To minimize the amount of memory that has to be allocated to these tables, the second level tables may themselves be virtual. Thus only the 1K bytes of the level 1 table need to be in physical memory.

The MMU automatically sets a reference bit in both the first and second level tables to enable the system software to gather usage statistics for each page. Also, the MMU sets a modified (or dirty) bit in the second level tables, thus enabling the system software to

determine not just the most recently used pages but which pages have been written to.

If the dirty bit is set, then the page must first be written to the swapping device prior to the page being freed for a more recently used page. If the dirty bit isn't set, then the old page can be written over.

### Free List

To ease the allocation of a page when an abort trap occurs, the system software maintains a free list of pages. Whenever the free list falls below a certain number, the swapper selects several pages that haven't been used recently and marks them for reuse (writing them back to disk if their dirty bits have been set).

These pages are then placed in the free list, ready for further page faults. Statistics are gathered, and then there is both a page fault and a shortage of free pages.

Normally in a multiuser system, the page usage statistics are gathered con-

tinuously, but with a single user system this isn't required. The advantage for the single user is that there is less system overhead if page use statistics are generated only after page faults.

One of the advantages of demand paged virtual memory is that it doesn't affect performance until page faults occur. As an example consider the following:

Time to assemble a program, non-virtual, 2 min. 58 sec.

Time to assemble a program, virtual, 3 min. 2 sec.

Since the assembly (9400 lines of assembler source) didn't run out of physical memory, the only difference in execution is that in the virtual mode the assembler was loaded into memory by page faults.

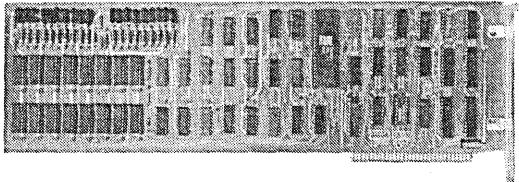
### MMU Features

The MMU offers many features that haven't been used in the DS1-32 package, such as protecting areas of memory.

The CPU and MMU keep track of

## DON'T THROW AWAY YOUR CP/M\* SOFTWARE

Emulate your Kaypro CP/M system on a Kaypro PC, IBM-PC, IBM-PC/AT or other IBM-compatible with the amazing  
**BLUE LIGHTNIN'**  
Z80\* co-processor.



Most software which runs on a Kaypro CP/M system will run without modification on your **Blue Lightnin'** equipped IBM-compatible. It typically runs the same software 2-7 times faster. The **Blue Lightnin'** comes with an incredible 9.25 megahertz clock, compared to 4 mhz on most Kaypros. Combine this increased clock speed with the faster I/O of most IBM-compatibles and you go as much as 7 times faster!

We include communication programs which allow you to exchange software with your Kaypro system. We also include a professional-quality Z80 macro-assembler and linker (SLR Systems).

At your Kaypro dealer or call today for more information.

Distributed by: **TSI**, 1897 Garden Ave. Eugene, OR 97403

1-800-874-2288

Manufactured by: **Decimation**, 2065 Martin Ave., #110, Santa Clara, CA 95050

408-980-1678

\*CP/M is a registered trademark of Digital Research, Inc. Z80 is a trademark of Zilog. DEC is a trademark of the Digital Equipment Corporation with whom Decimation is not connected.

whether an executing program is in USER or SUPERVISOR mode and whether read/write is permissible on the current memory location.

The system software can also enable the MMU either to translate only the supervisory memory or the user memory or both. In fact, the package on the DSI-32 has the virtual software running at location 8000H in the system memory, and the user program running also at location 8000H but in the user memory space. Thus the user program has no way to access or corrupt the virtual memory software.

### Loading Programs

In virtual mode, programs aren't loaded prior to execution, but rather by page faults. Once the virtual memory software has set up all the page table tables and programmed the MMU, it attempts to jump into the program. But since the program isn't loaded, an abort trap is generated.

The CPU then reads the address that failed from one of the MMU registers,

loads the page from the executable file on the mass storage device, and then re-executes the jump. Page faulting usually continues until the entire program is loaded (if possible) or until execution ends.

### Swap Files And Locked Pages

The gotcha in virtual memory occurs when the programmer wants to set a break point.

Setting a break point in the code means writing a special break character in the code. This makes that code page dirty (it's been changed). Thus, if that code page is swapped it would normally be written back into the original program (but then the program would halt at this point every time it was subsequently run).

So the code page must be written to a special swap file, and if that page has to be read back in, it must be read from the swap file (because a breakpoint hasn't been set in the original copy).

The system software maintains two

bits in each level 2 page table entry that it can check to determine whether a logical page is currently valid, to be read from the executable file, to be read from the swap file, or to be locked in memory.

The locked pages are pages such as input/output memory ports (you can't swap them) and system software memory.

### Finally

The virtual memory system provides a transparent environment for both the programmer and the user that appears to be 15 megabytes of memory.

With overlays and optimized code and virtual memory, we ought to have enough memory to keep programmers busy for 6 months, anyway.



# QUALITY SOFTWARE YOU CAN AFFORD!

**NEW**  
**Z80 Symbolic Debugger**  
Only \$49.95 plus shipping.  
• Screen oriented with a simultaneous display of instruction mnemonics, register, stack, and memory values.  
• Breakpoints may be set on any combination of fixed memory address, register values and/or memory values.  
• Uses Digital Research compatible SYM files.  
• Supports Hitachi HD64180.

**Relocatable Z80 Macro Assembler**  
• Only \$49.95 plus shipping.  
• 8080 to Z80 Source Code Converter.  
• Generates Microsoft compatible REL files or INTEL compatible hex files.  
• Compatible with Digital Research macro assemblers MAC & RMAC.  
• Generates Digital Research compatible SYM files.  
• Conditional assembly.  
• Phase/dephase.  
• Cross-reference generation.  
• Full Zilog mnemonics.  
• INCLUDE and MACLIB FILES.  
• Separate data, program, common, and absolute program spaces.  
• Supports Hitachi HD64180.  
• Z80 Linker and Library Manager for Microsoft compatible REL files available as an add-on to Assembler.

**ATTENTION Turbo Pascal Users:**  
Turbo Pascal Assembler will generate Turbo Pascal In-line machine code include files.

**TO ORDER, CALL TOLL FREE:**  
1-800-367-5134, ext. 804  
For information or technical assistance:  
(808) 623-6361

Specify desired 5 1/4" or 8" format. Personal check, cashier's check, money order, VISA, MC, or COD welcomed.

**MITEK**

Z80 is a trademark of Zilog, Inc. MAC and RMAC are trademarks of Digital Research, Inc. Turbo Pascal is a trademark of Borland International, Inc.

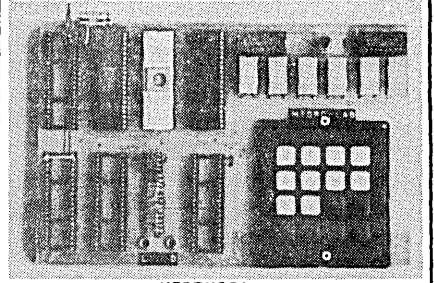
**PRICE LIST**

Z80 Macro Assembler: \$49.95  
Assembler, Linker, and Library Manager: \$95.00  
Manual Only: \$15.00

Z80 Symbolic Debugger: \$49.95  
Manual Only: \$15.00

Assembler, Linker, Library Manager, and Debugger: \$134.95  
Include \$5 for shipping and handling.

P. O. Box 2151  
Honolulu, HI 96805



\*\*\*\*\* HOBBYISTI \*\*\*\*\*

**MICRO-LAB: A SINGLE BOARD COMPUTER**

\*\*\*\*\*

- \* CPU-B085-3MHZ RAM-8156 EPROM-8755
- \* MEMORY- 4K EPROM/256 BYTES RAM/EXPAN
- \* I/O PORTS- 32 PARALLEL LINES/SID-SOD
- \* INTERRUPTS- 4 VECTORED INTERRUPTS
- \* HEX SYSTEM- KEYBOARD AND DISPLAY
- \* EPROM PROGRAMMER- PROGRAMS 8755
- \* CASSETTE LOAD AND DUMP
- \* INTERFACE-(40 PIN) BUS AND PORTS
- \* SUBROUTINES- KEYS/DISP/INT/DEBUG
- \* MANUAL WITH DRAWING

\*\*\*\*\*

**MICRO-LAB A/T-\$179 KIT-\$139**

\*\*\*\*\*

DRR CORP.  
P.O. BOX 9433, CINCINNATI, OH 45209

CHECKS, VISA/MC EXP. DATE  
ADD #3 SHIPPING, OH RES. ADD 5.5% TAX

By Dave Thompson

## Importing Systems From Taiwan

*The article in issue #27 on building a clone for \$800 was a resounding hit. Throughout the research for that article I wondered how hard it would be to buy direct, and how much I would save. So I started investigating again and this article is the result.*

**F**ive minutes spent thumbing through Byte or Computer Shopper should be enough to convince the most ardent sceptic that it's the Taiwanese, not Compaq or Japan Inc., who are winning the clone war. Dig up \$1000 and you have your choice of dozens of variations (albeit slight) on the same theme.

Such a deal! And these clones retail for less than the dealer cost of a Kaypro 2x.

But still you're paying retail, top dollar. How much would you save if you went direct — if you purchased systems directly from Taiwan? Is it possible? And more importantly, is it worth the effort?

### How It Works

Any U.S. citizen can import just about anything that's legal and that's not violating U.S. copyrights. You just figure out what you want, send the manufacturer money for the product, and wait for U.S. customs to notify you that it's arrived. After they've OK'd it, you pay customs duty (if any), and shipping, and take it home.

It's really that easy. Almost.

### The catches are:

You have to trust the manufacturer. He has your money and you aren't a regular customer. At least not yet. Even if he sends the order promptly you still don't know if everything will work. What if you have to return it? Who pays the airfreight?

Air transportation is fast, but it can cost \$125 to ship one complete computer. That's why heavy things like disk drives, cabinets, and power sup-

plies often travel by steamer. Maybe you should order just the boards direct, and buy the weighty stuff here in the U.S.

### Customs

Customs requires a bond if you're going to receive more than \$1,000 worth of equipment per shipment or if you're planning to resell the merchandise. You must get the bond and do all the paperwork required by customs before you can receive your first shipment.

Customs also has to check every incoming item to see if it violates U.S. copyrights. That means that the first time local officials see a ZNIX cabinet or processor board they're going to ask a lot of questions. If you can't give them all the right answers then customarily (of course) they'll send the whole lot off to the great customs house in the sky where they'll poke it and prod it and look it up in their books and decide whether or not Apple or IBM or Atari or Commodore or MicroSoft might hold a copyright on such an item.

Of course, if you're importing something that's already being imported, then you've got no worry. However, the process takes about two weeks.

Then there's the duty, but that's the easy part. Parts, boards, supplies, cables — all are duty free, both from Taiwan and from Japan. Duty on complete systems runs between 3.9% and 4.1% of the FOB value (depending on who you talk to). What's dutiable and what isn't changes daily. (These guys keep teletype machines in their offices just for this reason.)

### Solutions

I began researching this article by calling the customs office in Portland, Oregon. Propped up against my old Big Board was a list of questions, and under my hands was my keyboard. I was going to get down every word.

After an hour of pushing, poking, cajoling, prying, wheedling, and

pleading I felt I was getting somewhere.

I found out that I would have to fill out a special form, get bonded, get a shipping agent in Taiwan... The agent didn't seem the least bit interested in telling me which form, where to get bonded, or how to find a shipping agent.

Finally my irritation got the best of me. "I get a very strong feeling that you really don't want me to import anything."

"Oh, it's not that. You can do whatever you want, but 98% of the people who import work through a customs broker. It's easier for us, and it's much easier and faster for you."

"Is there any way to find out which ones are honest and which aren't?" (I've watched enough television to know that dock workers and shipping agents have unsavory reputations.) I wondered if brokers might be the same breed.

"Oh, I can't recommend one firm over another, but I can vouch for all the Portland brokers. Elsewhere I wouldn't know."

I thanked him for his time and got out the yellow pages.

### Customs Brokers

I called the Newman Wilson Co., a broker located near the Portland (International, of course) Airport. I talked to Don Ehrlich. It was a breath of fresh air. I had almost finished "Hello" when information began flooding through my left ear, out both hands, and onto the screen. It was like the old days on the city desk.

He knew Taiwan, computers, and customs agents. They sell the bonds (\$3.50 per thousand dollars for each shipment, with a \$30 minimum).

"We have shipping agents in Taiwan who pick up shipments from manufacturers and take them to the airfreighters.

"A good shipping agent can save you a bundle on shipping charges. A poor one won't get the best rates, and

a bad one will really jerk you around because he's getting kickbacks from the airlines and the manufacturers, and you wind up paying."

He mentioned that their agents could even track down products and set up meetings for you with the producers. You fly over, set up working relationships with the companies, and then the shipper makes sure orders get shipped.

"If there's a problem with a shipment, then we contact customs and notify them that we're returning some material, or that a shipment was short. That way you won't get double billed for duty. With Taiwan, the problem is usually not a matter of quality, it's just a shortage, and that's easy to fix."

He noted that they charge a flat \$95.00 per shipment (some brokers charge a percentage or both a percentage and a flat fee). To that you add shipping, duty, and the bond (again, \$30 minimum, and mandatory for shipments over \$1000).

#### Transferring Money

"We can negotiate letters of credit, but they don't make sense nowadays. You just send them a check or transfer funds to their bank by wire. It's not like the old days when it took months to show up on the dock.

"Now they can be manufacturing boards in some remote hilltop village, and we can have them on your doorstep within 48 hours — I mean customs and all.

"We have a really good relationship with customs. It's not an 'us-them' thing. We're working together, really know one another. They're just happier working with us. It's never taken two weeks for one of our shipments to clear customs.

"Of course, most of our shipments are hardware. Software is a very different story. It's really tricky."

It sounded almost too easy. All I had to do was decide who I wanted to purchase the product from (and they could help me locate sources), place the order, transfer the money to Taiwan (a bank could wire the money to the manufacturer's bank), and then let the broker's agent in Taiwan pick up the shipment. And within two days

BD Software, Inc., maker of the original CP/M-80 C Language Development System, knows

# Time is precious

So the compilation, linkage and execution speeds of BDS C are the fastest available, even (especially!) on floppy-based systems. Just ask any user! With 15,000 + packages sold since 1979, there are lots of users . . .

New! Ed Ream's RED text editor has been integrated into the package, making BDS C a truly complete, self-contained C development system.

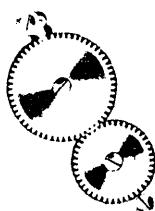
Powerful original features: CDB symbolic source-level debugger, fully customizable library and run-time package (for convenient ROM-ing of code), XMODEM-compatible telecommunications package, and other sample applications.

National C User's Group provides direct access to the wealth of public-domain software written in BDS C, including text editors and formatters, BBS's, assemblers, C compilers, games and much more.

Complete package price: \$150. All soft-sectored disk formats, plus Apple CP/M, available off-the-shelf. Shipping: free, by UPS, within USA for *prepaid* orders. Canada: \$5. Other: \$25. VISA, MC, COD, rush orders accepted.

**BDS Software, Inc.**

BD Software, Inc.  
P O Box 2368  
Cambridge MA 02238  
617 • 576 • 3828



## ON YOUR OWN

(continued from page 39)

(barring a hangup in customs) it's here. Heck, that's faster than UPS ground to San Fran.

Don Ehrlich  
Newman Wilson Co  
4974 NE 122  
Portland OR 97201

### Finally

The word I get is that everyone and his Taiwanese cousin is setting up a board manufacturing operation in the country. Quality and price are highly variable so I'd recommend that you check carefully. If you can't get to the island, you might check out the quality boards here and then try to locate the manufacturer of the best.

Most manufacturers expect to deal in 100 pieces, minimum. However, nearly all will let you place a small initial order at little or no premium over the quantity price. This is another way to check quality.

Now, just so you'll have a starting place, Figure 1 is a table showing products and prices from a few of the many Taiwanese board manufacturers. I can't vouch for any of them, and this is certainly not an exhaustive list, but these sent catalogs and current prices when I wrote to them two months ago. (Also see Andy Bakkers' European article in this issue for another source of Taiwanese information.)

The Taiwanese' command of English is excellent (outside of a few problems with syntax) and they are so polite that it might be good to write to them when you are feeling down. It would easy to develope a comfortable working relationship with such friendly people.

Figure 1 is just a sample of the products these firms manufacture. R-D has a broad selection of keyboards and plug-in boards. Ontop specializes in powersupplies and dust covers. Highlight has many monitors and complete systems.

Inswell Enterprise Co. has a number of boards and systems but they didn't include them in their price list. They did send a price list for cables and connectors (hundreds of those little connectors that cost \$2.00+ each in the U.S. and but under 25 cents from Inswell).

Figure 1 - Source and Price Information

item*	Highlight Co.	R-D Co.	Ontop Co.
FC	\$23.00	\$23.50	\$22.68
MG	47.50	52.00	51.55
CG	45.00	33.80	37.11
PB4	90.00	68.00	74.74
PB6	-	79.00	-
PBAT	-	-	-
KBD	37.00	34.30	-
IOD	53.00	53.30	59.28
135	48.00	43.50	49.50
CAB	22.00	16.50	-
SYS	550.00	440.00	-

\* Key to item abbreviations

FC = Floppy Card  
MG = Mono/Graphics Video (Hercules compatible)  
CG = Color Graphics Card  
PB4 = 4.77MHz Processor Board  
PB6 = 6.77MHz Processor Board  
PBAT = AT Processor Board  
KBD = Keyboard  
IOD = Multi I/O & Drive controller  
135 = 135W Supply  
CAB = Cabinet

HIGHLIGHT CO. - Prices shown are for 11 to 50 pieces. Many complete systems and color literature available.

R-D CO. - Prices shown are for 100 pieces.

ONTOP CO. - Prices shown are for 100 pieces.

NOTES: The main boards are 8-slot XT clones with 8M of RAM (expandable to 640K). They do not say how many layers the main board has (assume 2).

Ontop's Muscle 150W supply (about \$52) is recommended by PC Tech.

Keyboards are IBM style. Add about \$15 to listed prices for 5151 style.

Ontop Co., Ltd.  
PO Box 11718  
Taipei, Taiwan, ROC

Inswell Enterprise Co., Ltd.  
PO Box 43-248  
Taipei, Taiwan, ROC

Highlight Computer Systems, Inc  
PO Box 84-723  
Taipei, Taiwan, ROC

R-D Electronic Enterprise Co., Ltd.  
PO Box 11-02  
Shin-Tien, Taiwan, ROC

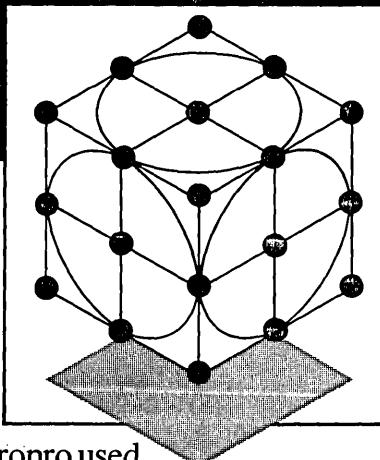


# New from Logitech.

## MODULA-2/86 VERSION 2.0

Professional  
Modula-2  
for \$89.

Now the same powerful tools Micropro used to develop its latest word processing system is available to you at a new \$89.00 price.



### Building Blocks for Tomorrow's Technology

Universities are switching to LOGITECH MODULA-2. Innovative programmers now develop applications and products with LOGITECH MODULA-2. The most productive teams at major companies depend on LOGITECH MODULA-2.

Now you can create your professional software development system using the proven technical sophistication of LOGITECH MODULA-2/86.

#### Systems to Fit Your Needs.

##### Base Language System

- Compiler and Linker
- Module Library

##### Base Language System/8087

- Inline 8087 code.

\$89

##### Base Language System/512K

- Full 8087 support.
- Uses RAM to increase speed by 40 to 50 percent.
- 80186 and 80286 support.

\$129

\$189

##### Run-Time Debugger

- Monitors the execution of a program with user-defined breakpoints or by stepping through the program.
- Symbolically displays the source code, data, procedure call chain, and raw memory.

\$69

##### MODULA-2 Editor

- Fast on-line Modula-2 syntax check.
- Can run compiler and linker from the editor.
- User definable templates for Modula-2 syntax constructs.

\$59

##### Utilities Package

- Decoders: Disassemble link and load files.
- Version: Administrate different versions of one program.
- Post-Mortem Debugger: Debugs a program after abnormal termination.
- Cross Reference: Produces a cross-reference listing of a Modula-2 program.

\$49

##### Sources

- Sources to customize your system.
- Run-Time System sources.
- Some library module sources.

\$179

Not Copy Protected

#### INTRODUCTORY OFFER

Through the end of April you get the new MODULA-2 Editor for free with any purchase of the Base Language System.

To place an order call our special toll free number:

**800-231-7717**

In California:

**800-552-8885**

**YES**, I want to create my professional software development system. Please send me the following building blocks:

BLS \$89    BLS/8087 \$129    BLS/512K \$189  
 RTD \$69\*    EDITOR \$59\*

UTILITIES \$49\*    SOURCES \$179\*

\*\$10 less with the purchase of any Base Language System.  
Please add \$5 for shipping and handling.

VISA    MASTERCARD    CHECK ENCLOSED

CARD NUMBER

EXPIRATION DATE

SIGNATURE

NAME

ADDRESS

CITY

STATE ZIP PHONE(\_\_\_\_)



**LOGITECH**

LOGITECH, Inc.

805 Veterans Blvd., Redwood City, CA 94063, USA

Telephone: (415) 365-9852

LOGITECH SA

Box 32, CH-1143 Apples, Switzerland

Telephone: 41 (21) 774545

# NOW AT THE SBC MART COMPUTING SALE-A-THON

## THE BEST OF BOTH WORLDS

Run your CP/M programs on any IBM PC or compatible. RUN/CPM transforms your PC's floppy drives into CP/M drives able to directly read, write and format over 100 CP/M disks. RUN/CPM directly executes your CP/M programs. Kaypro, Morrow, Osborne, Cromemco, Heath, many more. Because this is a hardware solution, your programs run up to 30% faster.

★ RUN/CPM only \$79 (Requires NEC V20 chip below)

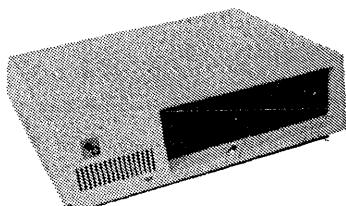
## PC SPEEDUP KITS

★ NEC's V20 chip will increase the throughput of your system up to 90%. That's almost double your present processing speed. 5MHz kit \$24. 8MHz \$29.

## ADD-ON CARDS

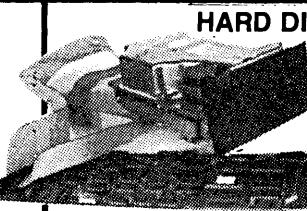
- multifunction card 384K, clk/cal w/battery, serial, parallel, and game ports, with OK save \$50 Model MFC-4 \$135
- monochrome graphics card runs 1-2-3 graphics, w/printer port, 720x348, MGC-1 now \$135 (Hercules equiv.)
- floppy controller for 1-4 48tpi or 96tpi drives, w/cable save \$25 Model FDC-2 now only \$74
- color adapter w/light pen port, RGB and composite outputs reg \$140 Model CC-1 now just \$116
- ★ better than the Super 7: floppy disk controller, clk/calendar, serial, parallel & game ports, spooler & RAMDISK s/w Sale \$145 ideal mate for 640K motherboards
- clock/calendar card reg \$58, CL-1 \$149
- ★ OMTI hard disk controller card (this card is super fast) reg \$220, Model HDC-1 now \$175, w/cables

## CASES



- high quality IBM PC look alike w/side-switch, flip-top or slide chassis
- any-combo disk drive brackets
- heavy steel, 8-cutout style
- Model CA-8 reg \$95, now \$69

Shipping and handling: drives/motherboards/cases/power supplies \$4.50 ea, cards \$2 ea, software \$2.50 ea, keyboards/modems \$4 ea, speedup kits \$2 ea, memory \$1/set, COMPUTERFACTS \$3 first set then \$1/set. CA residents add 6% sales tax.



## HARD DISKS

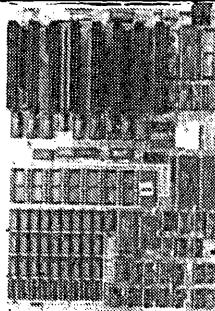
- complete 10MB Kit
- special, only \$398

- complete internal 1/2-high 10MB kit, incl. controller and cables, special \$398.
- complete 10MB kit with low power 3-1/2" half-high drive, fits 5-1/4" slots, \$469.
- 3-1/2" 10MB Winchester drive alone HD-3 just \$380.
- 20MB half-high drive HD-2 now \$395.

## SBC PLEDGE

- ★ service after sale
- ★ technical support
- ★ low prices
- ★ one year warranty

## MOTHERBOARDS



- full IBM PC/XT compatibility
- 8 I/O slots
- runs IBM's PC-DOS 3.1
- BASIC interpreter available
- great foundation for business or personal system
- 1 year warranty

★ Model MB-1 256K motherboard with OK regularly \$295, now \$199

★ Model MB-3 640K motherboard with OK regularly \$399, now \$250

★ Model MB-2 640K motherboard, 4.77 and 7+ MHz clock, w/256K Reg \$399, now \$297, this is a fast board.

## ABOUT OUR MOTHERBOARDS

- the most IBM PC compatible motherboards available
- each runs all commercially available software
- each works with all commercially available add-on cards

These FOUNDATION motherboards are the most compatible you can buy. All work with V20 chips, have parity checked memory, an 8087 socket, 8 adapter slots, four empty ROM sockets. Super manual includes complete data on how to put together a complete PC system. It even includes schematics.

## HARDWARE SPECIALS

- keyboard 5150 style regularly \$125, Model KB-3 only \$85
- keyboard 5151 style regularly \$175, Model KB-3 only \$99
- memory nine 150ns DRAMs Set ID-256 256K reg \$55, now \$34
- no better DS/DD drives anywhere, 48tpi F-4 \$99; F-9 96tpi \$129
- ★ Smarteam modem (fully Hayes equivalent) 300/1200 baud auto ans/dial, reg \$399, now just \$249

## POWER SUPPLY



- 135 Watts
- side switch
- top quality
- one year warranty
- standard cables for 4 disk drives

- Model PS-135 power supply regularly \$129, now only \$85

## LAST MINUTE SPECIALS

★ RUN/CPM only \$79--see details in upper left corner of this ad

• IBM PC-DOS 3.1 \$85 (only \$65 with motherboard); Ellis PASCAL, COBOL, FORTRAN, BASIC compilers only \$34 ea; MS mouse w/PC Paintbrush \$145

★ COMPLETE 100% IBM PC equiv syst \$987

★ 96tpi drive package: over 800K on a single floppy, complete kit with 96tpi drive, software \$149

To order or for further information: CALL (619) 375-5744

The SBC MART, P.O. Box 1296, Ridgecrest, CA 93555



AMERICAN  
EXPRESS

The SBC Mart is part of Computing Technology, 821-B Commercial Street, Ridgecrest, CA 93555

# PASCAL PROCEDURES

## The Future Of Computing (As It Ran Yesterday)

This is the most important column that John has written for Micro C. The possibilities of Chrono Pascal are so mind boggling that we've already sent off an order for the compiler. We're anticipating having a Chrono text editor written and running by the time the compiler arrives (if not before). Then for editing the magazine...

But before he finishes Chrono, John follows up with some ideas on speeding up Turbo Pascal. Great piece.

For those of you looking for a product to really increase your software efficiency, there is a new Pascal compiler available — Chrono Pascal from Berlund Extrnational. By analyzing the molecular structure of thiotimoline, the people at Berlund have developed entirely new algorithms for both their compiler and its associated runtime package.

Thiotimoline, first described by Dr. Isaac Asimov in his now classic paper "The Chronosynclastic Properties of Thiotimoline," has the curious proper-

ty of dissolving a short time BEFORE it's added to water. The routines based on the compound's structure show the same property — they finish execution before they're started.

### The Compiler/Editor

The integrated compiler/editor is a joy to use, once you get used to it. When in Edit mode, all keystrokes are acted on a short time before they are made. You'll finish typing in your programs as much as several hours before you begin an editing session. In the same fashion, the compiler will finish before it's started. Temporal gains during a compile will depend on whether you are compiling in memory mode or to a disk file.

Of course, syntax errors are detected by the compiler before they're encountered in the source, with automatic invocation of edit mode. In effect, you can't start the compiler before the source syntax is correct.

### Execution

As you'd expect, programs compiled with Chrono Pascal will always finish

sometime before execution is started. My standard benchmark program is designed to calculate the age of South American arboreal ground squirrels based on the wear patterns of the lower molars. The program is 12,326 lines of source, and with my usual test data and compiler takes 8 hr. 31 min. 22.704 sec. (+/- .003 sec) to analyze each molar. I started at 9 AM running with Chrono Pascal; the results were ready at 11:02 the previous evening. Unfortunately, I was away from the computer at the time, and the results were lost.

This underscores the fact that you must be sure any data files your program needs are present a sufficient time before the program is started, or you may get an I/O error (error #93, temporal phase error). Also, for output files, you must be sure your computer is running enough in advance of execution to receive the data.

*Editor's note: Be careful that you don't run non-temporal programs any time prior*

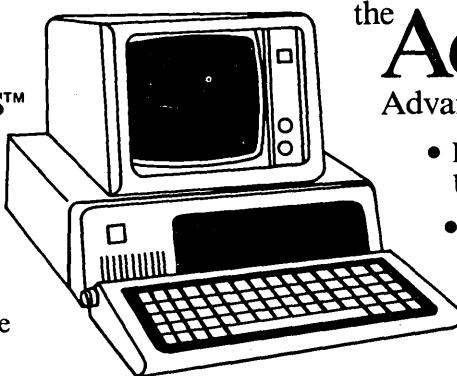
*(continued next page)*

## CP/EM™

CP/M™ 80 Emulation for MS-DOS™

- Z80 Emulation
- CP/M Version 2.2 Compatible
- Accelerator Compatible
- Serial Program Utilities Included
- FAST-Written in Assembly Language

\$79.95



## the Accelerator™

Advanced CPU for the IBM PC

- Faster Program Execution Up to 30%, 50% and more!
- Full 8088/6 Compatibility
- Extended Instruction Set
- 8 Bit and 16 Bit Bus Versions Available

\$49.95\*

\*5 MHZ for the IBM PC



Dealer inquiries welcome.

The Intelligent Computer Users Group  
P.O. Box 10118 • Rochester, NY 14610  
(716) 425-2519

IBM is a trademark of International Business Machines.  
MS-DOS is a trademark of Microsoft Corporation.  
CP/M is a trademark of Digital Research Incorporated.

## PASCAL PROCEDURES

(continued from page 43)

to running temporal programs unless you have a multitasking system.

### Extensions

In addition to the normal string and file I/O extensions, Chrono Pascal has extensions specific to its unique capabilities.

**ANTICIPATE (F, VAR);**  
[F is a file, VAR is any type ]

returns a value for VAR before it's available from file F. Similarly,

**PREDICT (FXNNNAME);**

will allow a function to return a value before its arguments are available.

The procedure SYNCHRONIZE allows you to force execution into real time mode.

### Recursion

Be extremely careful when using recursive techniques with Chrono Pascal. A friend of mine wasn't, and his computer ended up in the middle of next week!

*Editor's note: The slower the system, the farther into the future recursion takes it. Calculations show that after running a three deep recursion an Apple II-E should show up again in about a year and a half.*

### Applications

Chrono Pascal is particularly well suited for applications in fields like weather forecasting and stock market analysis.

Berlund has converted their mail order processing to run under Chrono Pascal. This allows them to ship orders as much as two days before they're received.

Many banks are converting their check processing to Chrono Pascal, since customers' accounts can be debited before the checks are written. They have shown no interest in converting deposit processing.

It's a good bet that the sale of Chrono Pascal will be prohibited in Nevada.

You won't want to use Chrono Pascal for real time data capture; the problems of temporal synchronization

between input devices and the program can be insurmountable.

### Availability

By the end of April, Berlund expects to have started shipping the product. This means that some of you have been using Chrono for some time now. Be sure to let us all know of your experiences with this exciting new compiler.

### Turbo Tips

If I can get my tongue out of my cheek for long enough, I'll talk about program efficiency in the real world.

I've spent some time working with Turbo Pascal to determine if performance can be improved by judicious choice of program structure. For instance, it could be that a FOR loop would execute more efficiently than a REPEAT or WHILE. To make a long

#### Pascal Procedures - Listing 1

```
Program copy_unbuffered;

type
  str128 = string[128];

var
  tin,tout : text;
  str : str128;

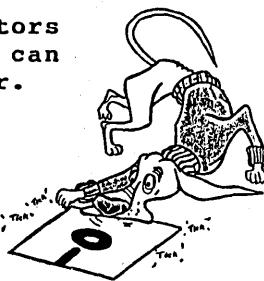
procedure process(var str:str128);
begin
  str[1] := upcase(str[1]);
end;

begin
  assign(tin,'textseek.pas');
  reset(tin);
  assign(tout,'junk.jnk');
  rewrite(tout);
  repeat
    readln(tin,str); { read one line of input }
    process(str); { massage it a bit }
    writeln(tout,str);{ to the output file }
    write('+');
  until eof(tin);
  close (tout);
end.
```

## Ever Wondered What Makes CP/M® Tick?

Source Code Generators  
by C. C. Software can  
give you the answer.

"The darndest thing  
I ever did see..."  
"... if you're at  
all interested in  
what's going on in  
your system, it's  
worth it."  
Jerry Pournelle,  
BYTE, Sept '83



The S.C.G. programs produce  
fully commented and labeled  
source code for your CP/M  
system (the CCP and BDOS.  
areas). To modify the system to your liking,  
just edit and assemble with ASM. CP/M 2.2 \$45,  
CP/M+ \$75, + \$1.50 postage (in Calif add 6.5%).

C. C. Software, 1907 Alvarado Ave.  
Walnut Creek, CA 94596 (415) 939-8153

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

story short, I found no significant differences in execution times for the following comparisons:

1. FOR - REPEAT - WHILE loops
2. Char manipulation in STRING vars or ARRAY OF CHAR.
3. Using a constant rather than a variable in a calculation.
4. Doing a calculation inline rather than in a called procedure (no parms).

I did find that `I := succ(I);` [ I is an integer ] executes about 20 percent faster than `I := I + 1;`

Where you'll improve performance (especially for CP/M 80) is in disk file intensive programs. For that operating system, Turbo uses an internal buffer of 128 bytes (one logical sector) for each file through which all data are transferred. A typical program might look like:

```
read (f1, data);
process (data);
write (f2, data);
```

Depending on various factors, the files f1 and f2 will likely reside on different areas of the disk. This means that the R/W head will have to seek between tracks for each read or write operation. Seekes are the slowest operation for any disk drive, so any technique to minimize the number of seeks will improve performance.

Listing 1 is a trivial example of this type of program. It reads a text file, modifies each line, and writes the result to another file. On my CP/M 80 machine, it takes about 34 seconds to process an 8K text file.

Performance can be improved significantly by using a linked list to buffer the data in memory. Listing 2 performs the same function as Listing 1 using this kind of buffering. The program processes the same 8K file in under 8 seconds — about a fourfold improvement.

This technique can be used for any kind of data, and can be used to provide dramatic increases in throughput.



#### Pascal Procedures - Listing 2

```
program copy_buffered;

type
  str128 = string[128];

  lineptr = ^line;

  line = record
    st : str128;
    nxt : lineptr;
  end;

var
  tin,tout : text;
  str : str128;
  root, current, next : lineptr;

procedure process(var str:str128);
begin
  str[1] := upcase(str[1]);
end;

procedure get;
begin
  new(root);           { create our anchor (list head) }
  mark(root);         { to allow recovery of memory space }
  new(current);       { working pointer }
  root^.nxt := current; { list tail }
  current^.nxt := nil; { end of list }

{ while memory and input data available }
while (memavail > sizeof(root)+100) and (not (eof(tin))) do
begin
  new(next);           { new tail var }
  current^.nxt := next; { link it to existing list }
  next^.nxt := nil;    { mark as tail of list }
  readin(tin,str);    { get the data }
  process(str);        { massage a bit }
  current^.st := str; { put data into list }
  current := next;    { update our position }
  end;
end;

procedure put;
begin
  current := root;      { start at head of list }
  while current^.nxt <> nil do { while list items available }
  begin
    str := current^.st; { recover and output the data }
    writeln(tout,str);
    write('+');
    current := current^.nxt; { point to next list item }
  end;
  release(root);        { recover memory for subsequent call to get }
end;

begin
  assign(tin,'textseek.pas');
  reset(tin);
  assign(tout,'junj.jnk');
  rewrite(tout);
  while not(eof(tin)) do
  begin
    get;
    put;
  end;
  close (tout);
end.
```

## PUT A CP/M COMPUTER IN YOUR PC!

**RUN/CPM™**



MORROW CROMENCE  
RO QUME KAYPRO OS  
RO OSBORNE HEATH  
MORROW CROMENCE  
CO QUME KAYPRO

ONLY \$99.95  
INCLUDING HARDWARE!  
Plus over 20  
CP/M80 programs!

And run 1,000's of CP/M programs  
up to 30% faster, directly from your CP/M disks!

### How does it work?

RUN/CPM virtually transforms your PC into any of the most popular CP/M systems. A simple replacement of your PC's 8088/86 microprocessor with our N.E.C. V-20/30 microprocessor gives you the ability to run both 8 bit CP/M and 16 bit MS-DOS programs. RUN/CPM will

transform your PC's floppy drives into CP/M drives able to directly read, write, and format over 100 CP/M disks! Terminal emulation supporting dozens of the most popular terminals completes the transformation of your PC into a CP/M system.

**Performance?**  
Depending on the application, many of your CP/M programs will run up to 30% faster on your PC. Other features include; ability to run CP/M programs in color, logical and physical drive assignments, run CP/M or MS-DOS programs from the same prompt. RUN/CPM is the solution to running CP/M software on PCs.

**RUN/CPM™ Plus**

### Features

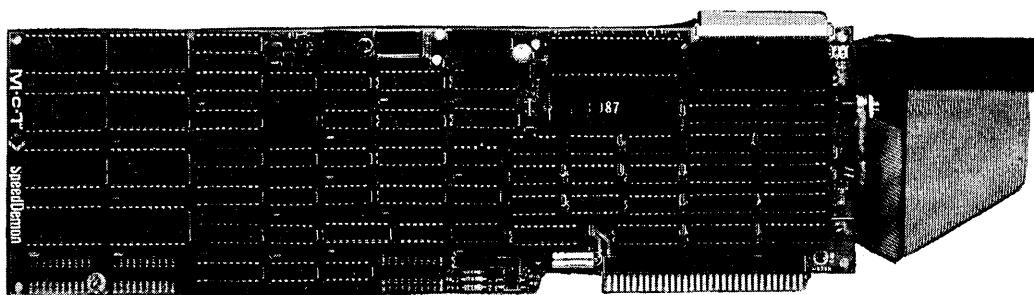
Turbocharge your CP/M Applications!

For programmers, developers,  
and advanced enthusiasts.

ONLY \$199.95  
INCLUDING HARDWARE!  
Plus over 20 CP/M80 programs!

## PC Speed Up 10 MHZ!

CALL  
FOR  
PRICE!



CALL  
FOR  
PRICE!

- Compatible with virtually all software:
- Spread sheets
- Word processors
- Data base managers
- High level languages
- Applications programs
- CAD/CAM
- Engineering
- Scientific Applications

- Compatible with virtually all accessory cards:
- Extended memory
- Printer cards
- Serial cards
- Hard disk controllers
- Floppy disk controllers
- No preboot software, virtually transparent to user.

To order  
send check or money  
order (U.S. funds)  
add \$5.00 shipping/handling.



ORDERS ONLY  
**1-800-637-7226**

Trademarks: CP/M (Digital Research Inc.), IBM (IBM Corp.), RUN/CPM (Micro Interfaces Corp.), MS-DOS (Microsoft, Inc.), INTEL (Intel Corp.)

Micro Interfaces Corporation  
6824 N.W. 169th Street, Miami, Florida 33105  
(305) 823-8088  
Telex 5106004680 MICRO INTER CO  
Ask About Our Intel Operating System Interfaces  
OEM, VAR, Dealers, Inquiries Invited

# Drive Select Reversing Switch

By Al Paarman  
368 El Gaucho Rd.  
Santa Barbara CA 93111

Ever wonder how drive select works? Curious why position on the cable makes a difference on the PC but doesn't on a CP/M system? Want to change drive A: to B: (or C: or D:) at the flip of a switch? Then this is your spot

Recently, a member of my user's group had a disk failure on drive B:. That made me wonder — what if a drive failed on my system and what if it were drive A: rather than B:?

I'd have an unusable system until I opened it up, removed the drives, and switched the drive select jumpers.

However, if I installed a switch to do the reversing, then I wouldn't have to dig into the system. Plus, if I had different types of drives in my system it would be really handy to swap A: and B: at the flick of a switch.

## The Hardware

I used a relay (Radio Shack 275-215) to actually switch the signals. Alternatively, you could run four wires to a switch and eliminate the relay. My reasons for using the relay are:

1. I like to keep the signal wires as short as possible.
2. If a wire between the switch and the main board breaks, I lose control of only the drive reversal, not of the drive itself.

## Diode

What is that diode for? The relay is an inductive load, and opening the switch causes an instantaneous reverse voltage across the coil. The diode shorts this voltage to ground.

## What's Happening

Drive A: is selected when line 10 (on the 34 pin floppy cable) goes low. Drive B: is selected when line 12 goes low.

Each drive looks for a single low signal to tell it that it is selected. When you jumper DS0 at the drive you connect the drive's select input to line 10. When you jumper DS1 the drive's select input is connected to line 12, and likewise for line 14 (drive C:) and line 6 (drive D:). The odd numbered lines are all grounds.

*Editor's note: On PCs and compatibles, drives A: and B: are both jumpered as drive B (DS1). Drives C: and D: (if they are supported by the interface card) are jumpered as drive A. The twist in the middle of the cable makes sure both drives A: and B: see their select signal on signal line 12, and C: and D: see their select signal on signal line 10 (see Figure 1).*

*The PC drive card pulls line 14 low to select drive A:, line 12 selects drive B:, line 16 (normally the motor line) selects drive C:, and line 10 selects drive D:. Most PC cards support only two drives.*

## Cutting The Traces

Basically all that's involved in this mod is swapping two signals (see Figure 2). When the computer selects the A: drive you want that signal to go to B:, and vice versa. The signals are basically DC, so wire length is not really critical.

I mounted my switch on the front panel. Drilling makes chips, so turn the cabinet upside down before starting, or build a small box out of masking tape, sticky side in, to collect the fragments.

Last, I like to put a connector on the board-to-switch wires so it can be quickly disconnected. That way you can remove the board without removing the switch.

Figure 1 - PC Cable Twist

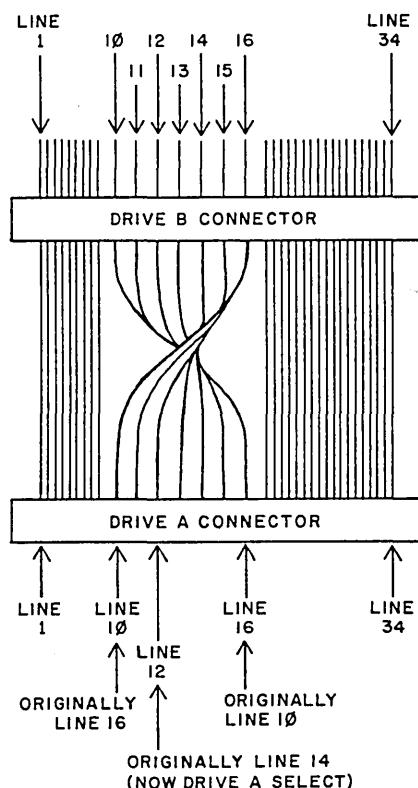
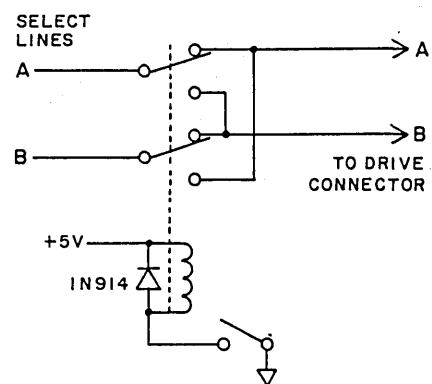


Figure 2 - Swapping Two Signals



By David Thompson

## Kaypro Bids Farewell To CP/M (Almost)

*There are beginnings and endings. Lately the news from the CP/M world has mostly been endings. Here is another.*

**I**t was around mid January when Don Thompson (from Micro-Sphere) called. "Kaypro's done it, almost." There are a lot of things that Kaypro's almost done, so I didn't hazard a guess. "What?"

"On February 1 they'll no longer be shipping any CP/M systems except the 2X. No 10, no 1, no Robie, no 4, just the 2X. All that, despite the fact that they were back-ordered on the 10, and the 1 wasn't doing badly either!"

Sales of the Kaypro PC have been so brisk that they can't turn them out fast enough. No doubt they're putting all but one of their assembly lines to work building the \$1595 clones, and so it appears that success, not failure, has spelled doom for the last bastion of CP/M. Now we're just waiting for the 2X to fall. (Remember when Osborne astounded the world with a \$1795 CP/M system that came with WordStar? The only thing smaller than the price tag was the screen.)

### Kaypro PCs And RAM

Kaypro is using some really marginal RAM chips on its PCs, and close to half the systems are having RAM related failures within hours of arriving at dealers. (They've been using cheap American made 64K dynamics.)

### \$595 Vrs. \$1595

The Kaypro PC is supposed to be available as a basic system for \$595 or as a complete system for \$1595. The temptation is to purchase the \$595 system and then just plug in your own cards. However, it doesn't work that way.

The PC's motherboard is just that, a motherboard — no memory, no pro-

cessor. So you need Kaypro's processor board for starters. Then you need Kaypro's memory board because there's no memory on the processor board. Once you've bought these two little gems you'll have spent about \$1595 anyway.

The disadvantage of having the processor on its own board is that you're locked into Kaypro for processor, motherboard, and main memory, and two of the slots are filled even before you add the video. The advantage of this type of system is that you could go to an 80286 just by changing the processor board. The latest motherboards have pads for AT-style board sockets.

### New Screen For The 2000

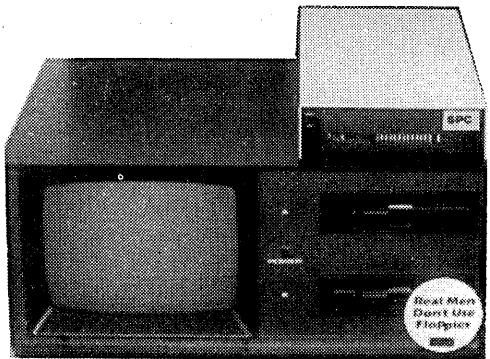
Kaypro 2000s are known for their small size, portability, and for their compatibility with the PC. Their 80 column, 25 line LCD screen even displays the same graphics as the PC color board (without the color, of course).

However, in most lighting conditions the screen is hard to read. Its contrast ratio (between the characters and the background) is only about 2 to 1; on a standard monitor the ratio is about 15 to 1.

Kaypro tech support mentioned there's a company in Salt Lake City that's upgrading Kaypro screens. I called them and talked to Dave Cox,

## FOR THE SERIOUS KAYPRO® USER

### THE NEW PRO/FILE SERIES OF WINCHESTER DISK DRIVES FROM SPC



Whether you have a KAYPRO 2, 4, 10, or even a K-16, the new low PRO/FILE hard disk drives from SPC are cost-effective and easy to install. A screwdriver is all you need. With up to 34 Megabytes available in a small 2 inch-high cabinet, you can say goodbye to floppy problems forever.

SPC provides next day delivery on all products, a one year warranty, and a friendly approach that says we appreciate your business. Customer references are provided upon request. Larger system capacities up to 120Mb. are also available, including combination fixed/removable cartridge systems.

Some of the prices above are limited to current stock on hand and are subject to change, so call SPC now and let's discuss your application. Ask about our trade-up policy and controller exchange program. Call now... ask for Shelly or Bob.

### SYSTEMS PERIPHERALS CONSULTANTS

9747 Business Park Avenue  
San Diego, CA 92131  
(619) 693-8611

vice president of marketing for Axonix Corp. Despite his title, he was intimately knowledgeable about the product (back in the early '70s he helped design the original LCD displays for watches).

#### The Lowdown

The upgrade costs \$300 and involves sending the system to Axonix. They remove the display, strip the reflective material off the back of the glass, and then mount an electro luminescent panel behind the display.

The entire package consists of the panel and a small DC to DC power supply. The panel receives 110 VAC at 300 Hz from the supply. The supply draws 350 mills (at 6V DC) when the system is running at high intensity, and 275 mills for low intensity. Because the reflective layer has been removed from the LCD display the panel must be lit for characters to be visible on the screen.

The light's power consumption reduces battery life from about four

hours to about three hours. (Since I try to leave an hour to spare, that would reduce my machine's effective working time from three hours to two.)

Dave told me that the panel puts out a white light at approximately 8 ft Lamberts on high power and 6 ft Lamberts on low. He also mentioned that the LCD adds a slight bluish cast to the light. He said that the contrast ratio rises to about 10 to 1.

They've done the installation on several hundred 2000s, Data Generals, HPs, and Radio Shack 100s, and Dave says none of the units has been returned because customers were unhappy with them.

#### My Feelings

At Comdex, I used a Kaypro 2000 whose screen glowed a sickly greenish cast. When I first heard of this mod (with its blue cast) I assumed that this was different. However, I've been told that Axonix did the mod on the Comdex Kaypro. The sickly screen was

easier to read than the original, especially in marginal light, but I didn't enjoy reading it. (And the contrast didn't seem all that great.)

Also, when I'm taking notes in a seminar or writing my editorial out on some high mountain meadow I really appreciate the four hours of operating time (for me that's three hours plus an hour margin). Losing an hour would really crimp my style.

Kaypro is supposed to be working on its own screen that's lower power and brighter, so it seems they're also not satisfied with the Axonix mod.

Finally, it depends on how you use your Kaypro. If you're in the dark a lot, and can't wait for Kaypro to come up with something better, then this might be your mod. But a great beauty, it's not.

Axonix Corp  
417 Wakara Way  
Salt Lake City UT 84108



If you own a Pro-8 monitor, this is the product you've been waiting for!

## MULTICOPY

*Save hours of time on your Kaypro with this powerful utility!*

- Format, copy and verify 96 tpi disks in under 4 minutes (exact speed depends on type of drives and year of Kaypro)
- Format, copy and verify Kaypro double and single-sided disks in approximately 1 minute and 2 minutes respectively
- Format, copy and verify any soft-sector, single or double-sided 5 1/4" disk format on your Kaypro at comparable speeds (e.g. Osborne SSDD in under a minute). Large library of formats supplied
- Use any combination of Drives A, B, C or D as source or destination drives

*(Not currently available for the Kaypro 10)*

Please send **MULTICOPY** to:

Name \_\_\_\_\_

Address \_\_\_\_\_

For further information on **MULTICOPY** and other Kaypro and CP/M software, please write or call:

Enclosed is \$39 plus \$3 shipping  
(California residents add 6% sales tax)

Check or money order  VISA  MasterCard

Number \_\_\_\_\_ Exp. \_\_\_\_\_

Signature \_\_\_\_\_  
(\$5 shipping charge for orders outside N. America)

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

**Plu\*Perfect Systems**

BOX 1494 • IDYLLWILD, CA 92349 • (714) 659-4432

# Adding Directory Hashing To CP/M 2.2

**By Clark A. Calkins**  
C.C. Software  
1907 Alvarado Ave  
Walnut Creek CA 94596

You almost never see hash any more. Even your local greasy spoon has dropped it in favor of linear searches and fries. But hash is fast, and once you're familiar with hash slinging techniques you'll wonder how you got through a project without it (and if you douse it with catsup...).

The CP/M 2.2 operating system is constructed around a simple, yet flexible, file structure. The disk area is divided into a number of small blocks, each with a fixed size. The operating system maintains a list of the blocks used for each file. Each of these blocks may reside anywhere on the disk (although not necessarily in order).

When space is required for another file, the system tries to find unused blocks that are as close together as possible. To keep track of file space, CP/M reserves a portion of the disk to be used as a directory, which is a series of blocks (in order) containing file names and associated block numbers.

CP/M locates files by starting at the beginning of the directory and searching sequentially. When the disk directory is small, this process works fairly well, but for very large directories it takes much longer than is necessary. Can you imagine looking up a name in the phone book by starting on the first page?

## Making Hash

Some operating systems go to great lengths using complicated algorithms to search a directory in the "fastest" possible way. The techniques described in this article are simple in comparison, yet result in fast access for most files. They can be installed into CP/M with little difficulty, and complete compatibility is maintained.

The small routines listed in Figure 1

will modify the normal CP/M directory search procedure and substitute a file name dependent technique. This process, called "hashing," forces the search to begin in the directory at a point calculated from the characters in the file name. This is similar to the way a phone book is alphabetized.

If the file's directory entry is written

at a location determined by this hashing technique, then future searches for this file will begin at (or very close to) the file's directory entry.

The system will still have to do some sequential searching because a directory position might already be taken. Then the system searches sequentially for the first empty directory location.

*Figure 1 - Directory Hash Index Routines*

Hash index computation routine. Enter ths routine with the directory entry number in (FILPOS), the number of entries in (DIRSIZE), and the file name in (SAVEFCB). The file entry number will vary from zero to (DIRSIZE) and it will be altered by adding the appropriate hash index based on the file name. The resulting position to search is returned in registers (HL).

The hash index is the sum of the bytes of the file name (not including the extension) and truncated to fit in the directory space.

Technique developed by C.A. Calkins, circa 1982.

```

;hash: lhld    savefcf ;Point to file name.
;      mov     a,m      ;Looking for an empty spot?
;      cpi     0e5h
;      jnz     hash0
;hash0: lhld    empty   ;Yes, use desired name to compute index.
;      mvi     b,8      ;Hash index is sum of first 8 bytes of
;      lxi     d,0      ;name. Put 16-bit sum in (DE).
;hash1: inx     h
;      mov     a,m      ;Add in next byte.
;      ani     7fh     ;Strip bit 7 always.
;      cpi     '?'     ;Ambiguous file name?
;      stc
;      jz      hash2   ...yes, can't access this way then.
;      add     e        ;Compute (DE)=(DE) + (A).
;      mov     e,a
;      mvi     a,0
;      adc     d
;      mov     d,a
;      dcr     b        ;Done entire name?
;      jnz     hash1   ;...nope, continue.
;      mov     a,e
;      ani     0fch   ;OK, force index to a sector boundary.
;      mov     e,a
;hash2: lhld    filpos  ;This is where CP/M wanted to search.
;      rc      ;(just use it on ambiguous names).
;      dad    d
;      xchg
;      lhld    dirsize ;If we went past the end, wrap around
;      inx     h       ;to the beginning. Size is 1 less than max.

```

Then, of course, when retrieving the file, the system will make the same calculation and then do the same sequential search. Thus, the speed advantage drops as the directory fills.

### Process Description

Two procedures are required to implement this hashing technique. The first generates the hash index to position a file name when it's first created. The second generates the same index when retrieving the file.

I treat the file name as a series of numbers and generate their sum. This sum is reduced (if necessary) to be within the available directory space and is used as an initial starting point.

I don't use the file's extension because CP/M creates temporary files with \$\$\$ extensions and then changes the names when the files are made permanent (see reference 4).

Also, ambiguous file names (names containing wild card characters) cannot be hashed. (So we do sequential reads from the beginning.)

The second stumbling block has to do with the way CP/M treats the index pointer. It must point to the starting file position within CP/M's directory buffer area. Since four name entries are contained in a single 128 byte buffer, the pointer must be a multiple of four. This is only a slight nuisance, however.

```

hash3: mov    a,e      ;Compute (DE)=(DE) - (HL).
       sub    1
       mov    e,a
       mov    a,d
       sbb    h
       mov    d,a
       jnc    hash3
       dad    d      ;Restore remainder and we are done.
       ret

;      Entry to save the name for the desired empty location.

;      setmt: lhld   parms   ;Move address of name for new file into
;              shld   empty   ;our own safe area.
;              ret

empty: dw     0      ;Empty address storage space.

;

;

;      Define CP/M internal addresses. Note that these addresses
;      and mnemonics were taken from the disassembly file
;      generated by SCG22. They are entered relative to the
;      beginning of CP/M.
;

mem: equ    46      ;Memory size (in k's).
cpmb: equ    (mem*4-28)*256;Base address of CP/M.
params: equ    cpmb+0b43h;Original (DE) for DBOS calls.
dirsize:equ   cpmb+15c8h;Number of directory entries -1.
savefcb:equ  cpmb+15d9H;Address of file being searched for.
filepos:equ  cpmb+15eah;Relative position index.

;

;

;      This portion actually changes the original CP/M
;      directory search procedures to utilize the above hashing
;      algorithms.

;      org    cpmb+0bc3h
;      call   hash    Generate hash index for next search.

;      org    cpmb+0d83h
;      lxi    h,dirsize;Always search entire directory space.

;      org    cpmb+1127h
;      call   setmt  ;Save name of file to be created.

;      end

```

### Implementation

To implement the hashing technique, CP/M must be altered to use our special index pointer when searching for a file. Do this by "patching" the look-up subroutine to use the programs in Figure 1.

These routines are written for the CP/M assembler ASM or MAC. The locations within CP/M to be changed are positioned with origin (ORG) statements. For these to function correctly, these routines must overlay standard CP/M.

Next, these new routines must be placed in memory at some location that will not be used by CP/M or any of the application programs. Generally the area above the BDOS portion of CP/M has to be used (see reference 2). I chose to include these extra routines as part of my BIOS. This makes it easy, but it's not mandatory, as any protected area will do.

To implement the changes, I go through the standard system generation procedure (see reference 2). Had these routines been a separate program instead of part of the BIOS, DDT (see reference 4) would be used to load them into memory on top of standard CP/M during the system generation process.

Once the new system has been created, the disks need to be modified to take full advantage of directory hashing. This is best done by creating a new system disk using SYSGEN (see reference 2 and 4) and writing PIP to this disk. Then boot up with this disk and copy all desired files over to it using PIP. For hard disk users, copy all files over to a spare partition (or user) and then copy them back. Now enjoy a speedier CP/M system!

### Renaming Procedure

When you want to change the name of a file, accessing will be more efficient if the file is transferred over with the new name (using PIP) rather than being renamed (with REN). Remember, if a file name is changed, its hashing index will change. Thus its position within the directory should also change. A revised rename procedure could be written that would actually move the directory entries and

(continued next page)

(continued from page 51)

not just change the file name. This would be an interesting project for someone.

#### Discussion

As mentioned previously, this is a simple implementation of a hash search procedure. More complex methods could be used to more precisely locate the file name.

For example, the user number and file extent bytes could be included in the hashing algorithm. For users with very large disk systems (which have very large directories), it would be worthwhile to investigate other techniques.

As with most ideas there are compromises to be made with this implementation.

When a new file is created, the hash index is used as a starting point. Then CP/M searches for the first unused location in the directory. When the directory is almost full, the first empty spot may be located a long way from the desired location (as specified by the hash index).

There's no telling where the file name is actually stored. Thus, to determine that a file is not present, it's necessary to look through the entire directory.

Previously, when CP/M logged in a disk, it saved the last used directory location so it knew when to quit looking for files. Thus it may take longer to determine that a file doesn't exist. Getting around this requires a more sophisticated procedure (another interesting project!).

One side effect of hashing is that a disk written with these procedures may be slower running when used with a standard CP/M system. This is because the file name entries may be scattered throughout the directory space.

#### Comparison With CP/M+

When Digital Research wrote CP/M+ (or CP/M version 3) they added directory hash tables (see reference 5). These were optional and supported only under banked memory conditions. And they used a similar but

more extensive procedure than the one suggested here.

For each active drive, a table was maintained that contained four bytes of hashing information and directory entry number for each file extent in the directory. This is a complete table with entries for all files, passwords, and empty locations. Looking up a file or password is a snap. Just look through this one table and you have it.

But the cost was high in terms of memory use. A typical hard disk system with four drives on the hard disk (1024 directory entries each) and two floppy disk drives (512 directory entries each) might have 20K bytes of tables, plus the search routines.

For CP/M+ the cost is worthwhile (perhaps even necessary) since it does a lot more directory work (looking for file names, passwords, time and date stamps, etc.) during each file access. However, on a standard 64K system, the space requirements are too high.

#### References

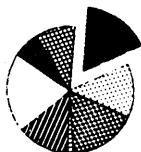
1. "SCG22, A Source Code Generator for CP/M v2.2." This will generate source code complete with labels and comments for the CP/M 2.2 operating system. Available from C.C. Software, 1907 Alvarado Ave., Walnut Creek, CA 94596 for \$45 plus \$1.50 shipping (\$2.50 foreign) and 6.5% sales tax for Californians.
2. "CP/M System Alteration Guide," Digital Research, January 1978.
3. "CP/M Interface Guide," Digital Research, 1978.
4. "An Introduction to CP/M Features and Facilities," Digital Research, January 1978.
5. "CP/M Plus (CP/M version 3) Operating System, System Guide," Digital Research, 1982.



# GRAF 3.0

the complete  
BUSINESS and SCIENTIFIC  
printer graphics program

- display floating point data directly from spreadsheets, data bases, word processors, and programming languages (or the keyboard) in a wide variety of bar, pie, line, and scatter plots
- plot and group up to 6 different variables on a single graph, distinguished by up to 14 different fill-in patterns and 8 different point-plotting symbols
- menu driven operation supports automatic graph scaling, labeling, and legend creation
- add up to 5 different-density grid lines, and choose from a wide variety of numerical labeling options

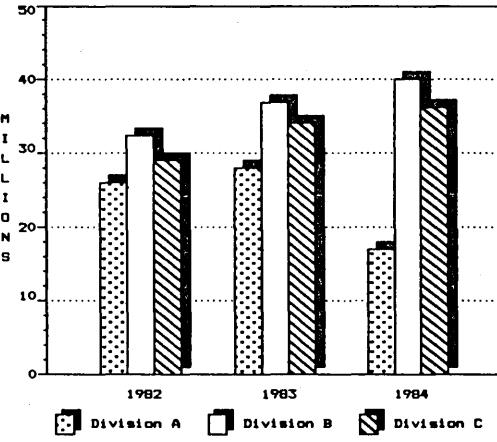


**\$49.95** **\$69.95**

CP/M-80

MS-DOS / PC-DOS

SALES BY DIVISION



**GRAF 2.0 Update Policy:** Returning your original GRAF 2.0 disk to MSC entitles you to \$20.00 off the above prices.

**TERMS:** We ship via first class mail. The above prices include domestic shipping and handling. Orders outside USA require additional \$5.00 for postage. N.Y. residents add state sales tax. When ordering you MUST state your computer and printer make and model. We support MS-DOS (PC-DOS) version 2.0 or later on computers with at least 192K RAM, and CP/M-80 version 2.2 or later on Z80 computers (other than modified Apples) supporting a TPA of at least 54k (requires 64k of RAM). Most soft-sector disk formats are acceptable. If you have a non-standard format, please send us a list. GRAF 3.0 works with any printer fully compatible with one of the following: Epson FX, RX, LX, MX (with GRAFTRAX), or IQ-1500; Ioh Prowriter; NEC 8023A; Star Micronics Gemini 10X, 15X, SG-10, SG-15; IBM Graphics Printer; Okidata 192, and earlier Okidata models equipped with the "IBM Plug 'n Play" chips. (If you have an Okidata printer, other than the 192, the "IBM Plug 'n Play" chips are required!!)

Microcomputer  
Systems  
Consultants

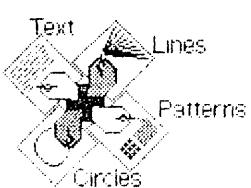
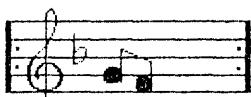
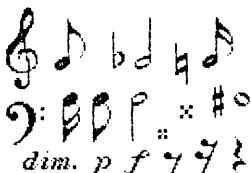
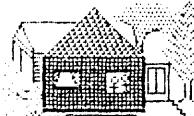
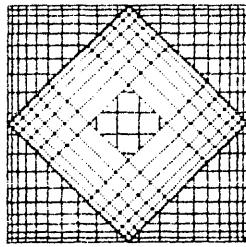
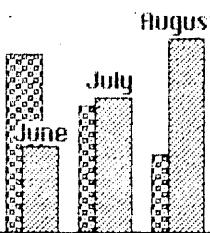
27 Forest Avenue Port Jefferson Station New York 11776-1820

DRI MS-DOS Microsoft

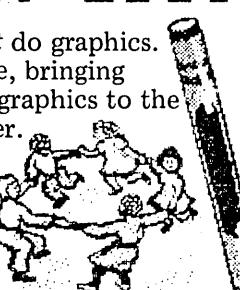


# "Kaypro makes a nice computer— too bad it doesn't do graphics"

Graphic  
Designer



Make that *didn't* do graphics. SCS-Draw is here, bringing Macintosh-style graphics to the Kaypro computer. With SCS-Draw, you can use your Kaypro to draw a picture. Of anything.



The first true drawing program for the Kaypro, SCS-Draw turns your computer screen into a sketchpad on which you can draw detailed images like those shown here. These images can be saved on disk or printed on your dot-matrix or letter-quality printer.

There are many applications of SCS-Draw. For example, you could use SCS-Draw to design and print party invitations, banners, or technical diagrams. You could also use SCS-Draw to promote your business or design your company logo.

And the best thing about SCS-Draw is that it's fun to use — when was the last time you had some *fun* with your Kaypro?

SCS-Draw gives you a variety of useful drawing tools to choose from. You can draw a detailed image dot-by-dot, or do a rough sketch with straight lines. Need a compass? SCS-Draw can draw circles of any size, wherever you need them. For subtle shading effects, use one of 23 pre-defined patterns, or create your own.



## SECOND CITY SOFTWARE

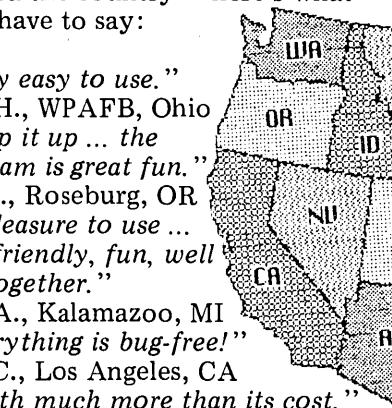
**NEW for PrintMaster Owners:** Now you can use your favorite PrintMaster images in your SCS-Draw drawings. The Image Extractor converts PrintMaster images to SCS-Draw image libraries. Price: \$24.95 SAVE when you buy SCS-Draw and the Image Extractor together: Only \$79.95

SCS-Draw, KAYPRO, Macintosh, CP/M and PrintMaster are trademarks of Second City Software, Kaypro Corporation, Apple Computer, Digital Research and Unison World, respectively.

Other features include block moves, four built-in fonts, and powerful print options like enlargement, indentation, mirror image and rotation. And with SCS-Draw's windowing feature, you can work on images much larger than your Kaypro's screen.

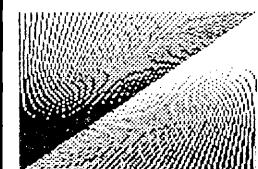
How good is SCS-Draw? Every day, we get unsolicited letters and phone calls from SCS-Draw users around the country — here's what they have to say:

- "Very easy to use."
- G.H., WPAFB, Ohio
- "Keep it up ... the program is great fun."
- J.S., Roseburg, OR
- "A pleasure to use ... user-friendly, fun, well put together."
- D.A., Kalamazoo, MI
- "Everything is bug-free!"
- D.C., Los Angeles, CA
- "Worth much more than its cost."
- B.H., Birmingham, AL

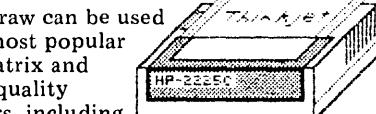
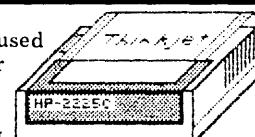


Simon & Simon  
Photography

AAAAaaa  
BBBBbbb  
CCCCccc  
DDDDddd



## Banners



SCS-Draw can be used with most popular dot-matrix and letter-quality printers, including those from Epson, Star, Okidata, C. Itoh, Panasonic, IBM, HP, Diablo and Kaypro.

Path Searching  
 Archiver  
 8Mb Print Spooler  
 Aliases  
 Disk Variables  
 Screen Paging  
 Multiple Commands  
 Pipes  
 Memory Management

# CP/M™ + ConIX™ = Perfected User Areas

I/O Redirection  
 Function Keys  
 Argument Handling  
 Virtual Disk  
 Overlay Searching  
 Memory Files  
 New SysCalls

If you've tried some of the earlier CP/M-80 add-ons such as Microshell™ and ZCPR™, then you know it's possible to add new features to CP/M. Now you can have much more without all the trade-offs when you use ConIX - **the latest and greatest upgrade for CP/M!**

"(ConIX) goes a great deal farther in flexibility than any other CP/M shells. . . this system has all of its competitors beat." *Computer Language, 6/85.*

### ConIX Operating System: List \$99.95 Special

A complete upgrade for 48K+ CP/M 2.2/3.0 and equivalent systems. Provides professional capabilities with blinding speed, as often found on more expensive MS-DOS™ and UNIX™ machines. Installs easily in 1 minute to add over 100 new commands and features. Eliminates all points of user frustration with CP/M. Uses only 1/2K TPA, 0-27K disk minimum.

ConIX is the greatest, most powerful 8-bit upgrade, with speed and capabilities that are so incredible it's bringing users back to CP/M!

### ConIX Pull-Down Menu: List \$34.95 Special

A user-friendly interface to ConIX that is fully menu-driven, with helpful prompts and easily understood explanations of all menu functions. Loads with a single keystroke at the prompt level. Source code included!

### ConIX Programming System: List \$99.95 SALE

A full programming language for ConIX extends CP/M SUBMIT capability. Features conditionals, loops, subroutines, labels, nesting, interrupt processing, error traps, and debugging facilities. Design intricate menu systems. Includes a special "compiler" that provides string and numeric variables, an integer math package, a relocatable assembly code generator, and much more. A must for CP/M power-users and developers!

### ConIX Library I - XCC Utilities : List \$49.95 SALE

Over 25 utilities written in the ConIX shell language, including hierarchical directories with overlay - adds pathname capability to existing software, interactive debugger, move/copy/link multiple files, print files with pagination, review disk files for deletion, unerase disk with stats, full-screen TYPE, and more. Source code included! Does not require Programming System.

## NEW YEAR SPECIALS - SAVE 30% TO 100% OFF!

- ConIX O.S. or Programming System: **\$49.95 each**
- ConIX O.S. and Programming System: **\$79.95 for both**
- SUPER SAVINGS WHEN YOU BUY 'EM ALL: ConIX O.S., Programming System, Menu System, Library I - Only **\$99.95!!**

Now that we've knocked the bottom out of our prices, you should have no reason to suffer along with plain-old CP/M or incompatible half-baked add-ons any more! Get started with ConIX for \$49.95, or steal us blind and get everything for only \$99.95. Either way, you get the Menu System absolutely FREE! Get on the bandwagon with a company that's committed to *you* with the ongoing development of products for CP/M and ConIX.

Prices include manual, 8" disk, and end-user support. 5½" disk conversions: 48TPI \$6, other \$10. Shipping: \$4.50 UPS, \$10 Canada, \$15 overseas. NY residents add sales tax. Discount incentives for Dealers, OEMs, User Groups - CALL!



Computer Helper Industries Inc. • P.O. Box 680 • Parkchester Station, NY 10462  
 800-628-2828 X513 24hr. order hotline - COD only • 212-652-1786 M-F:10-6 sales/technical staff

"We're helping your computer work better for you!"

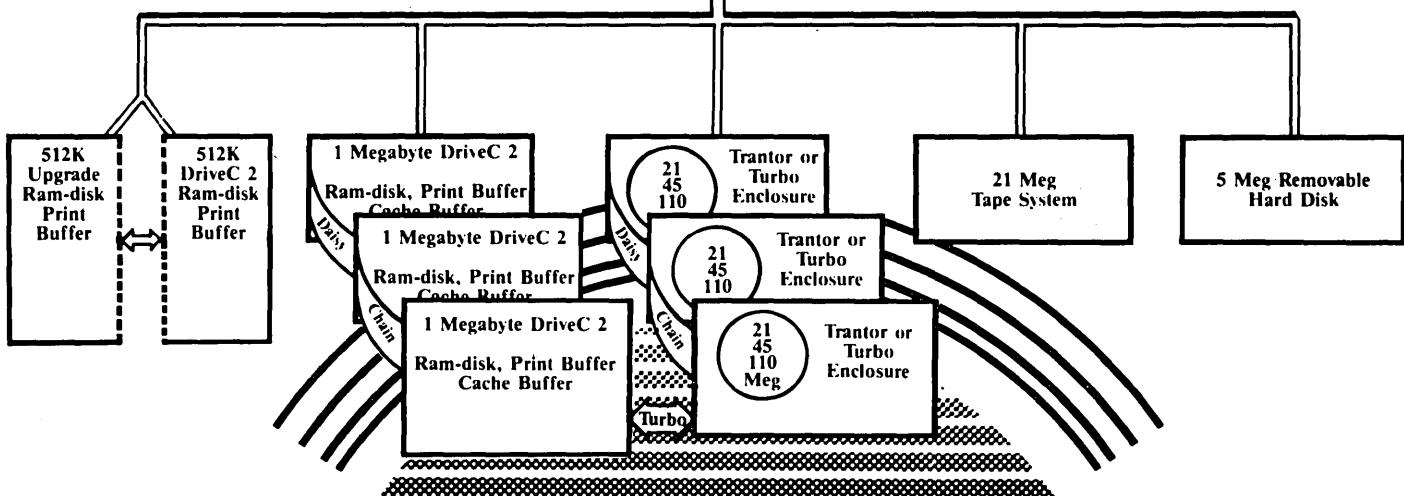
# CP/M® LIVES!

One of a Series

## The \$100 WW Interface

# WestWind

The NEXT GENERATION



# CP/M® LIVES!

## THE WestWind INTERFACE

If you're a CP/M user who's grappling with whether to keep your computer, invest in upgrades, or switch to MS-DOS, the WestWind Interface frees you to do what YOU want—right now!

The WW Interface for CP/M includes everything you need for attaching WestWind's Next Generation products to a CP/M computer, so it's easy to use our Hard Disks with your Osborne, or your KayPro, or your Morrow . . . or just about any Z80 system, by adding a WW Interface to your computer.

Best of all, our Dual Operating System feature lets you share our Trantor and Turbo (DriveC 2 Cache Buffered) Hard Disks between CP/M AND MS-DOS computers. Get a WW Interface for CP/M and a WW Interface for MS-DOS to connect our Hard Disk to either kind of computer and automatically access the right files.

And, when you're ready, use our Hard Disks completely for MS-DOS operation.

You see, we want you to get the utmost performance from your CP/M computer, to have the resources you need to make the transition to MS-DOS, and to know that an investment in a powerful enhancement for your CP/M computer *NOW* . . . will be just as valuable an investment for an MS-DOS computer *LATER*!

The WW Interface for CP/M includes—SuperSize SuperCalc2 (huge spreadsheet capacity when a DriveC 2 is added); SuperFile, the easy-to-use free-form text filing and retrieval system; our *NEW* Universal software that manages up to 3 Megabytes of DriveC 2, 3 Hard Disk subsystems, and Removable Hard Disk; MenuPac, Arkive, DiskMgr and Daisy-chaining capability to let your system grow with your needs; all necessary hardware and cables, and complete, illustrated documentation.

The WW Interface for MS-DOS includes 16-bit SuperFile, Arkive, WW Loader software, Interface Card for any IBM-like card slot, cabling and documentation.

### WW Interface

WW Interface for CP/M  
WW Interface for MS-DOS

\$ 100  
100

### WestWind IBM-compatible Systems

Complete, Hercules-compatible, Monitor, DOS 3.1, NewWord 2, SuperCalc2, SuperFile

WW XT/640K/2 Floppies/Hi-Res Mono	\$1395
WW XT/640K/1 Floppy/ 21 MEG/Mono	2095
WW XT/640K/1 Floppy/ 45 MEG/Mono	2895
WW XT/640K/1 Floppy/110 MEG/Mono	3895
WW AT/512K/1 Floppy/ 21 MEG/Mono	3895
WW AT/512K/1 Floppy/ 45 MEG/Mono	4495
WW AT/512K/1 Floppy/110 MEG/Mono	5495
Color/RGB system (replaces Mono)	400

### 16-bit Enhancements

Acceler-8/16 (with WW XT)	75
Acceler-8/16 CP/M Emulator (V20)	99
XPlus 5151 Keyboard (with WW XT)	59
XPlus 5151 Keyboard	169
8087 for WW XT	149
80287 for WW AT	199
WW 300/1200 Internal Modem	299
Multi-X I/O-2 Multifunction (XT)	199
Multi-A I/O-2 Multifunction (AT)	199
WW Hi-Res Mono Card/Parallel	199
WW Monochrome Monitor	199
WW Color Card/Parallel	169
WW Color RGB Monitor	429

### Software

Teach Yourself PC-DOS	39
SuperFile	145
UniForm and UniForm-PC	69
Media Master	39

Yes!  Send me the new, FREE WestWind Catalog.  
My computer is a \_\_\_\_\_

Yes!  I want my very own CP/M LIVES! T-Shirt!  
Size S M L XL (Circle one)

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Enclose \$9.95 plus \$2.00 Shipping and Handling for  
each T-shirt. CA residents add 6.5% Sales Tax.

Payment:  Check  Visa  MasterCard

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

WestWind Computer  
1690 65th St., Emeryville, CA 94608

**WestWind**  
COMPUTER

1690 65th Street, Emeryville, CA 94608, (415) 652-3222  
Telex: 756329 (DRIVE C UD), WU EASYLINK 62533500

Send for our FREE Catalog and get  
your own CP/M LIVES! T-Shirt,  
just \$9.95 (FREE with any \$100  
purchase!)

For Information or To Order:  
**CALL TOLL-FREE**  
**US 800-526-6500, CA 800-831-3144**

# IN THE PUBLIC DOMAIN

By Stephen M. Leon

200 Winston Drive  
Cliffside Park NJ 07010

## Hot New CP/M & MS-DOS Releases

*Steve covers new software submissions from around the world both for CP/M and MSDOS — really interesting new gifts to the computing community.*

**E**very time I am positive CP/M is dead, something turns up to convince me not only that it never died, but that it is far from having even one foot in the grave.

Claude Kagan was the featured speaker at a recent club meeting and demonstrated an MSX computer he bought in Japan. He also had some European magazines and components for MSX. Unfortunately, MSX is not yet available in this country. It will be here, but whether or not it will meet with the acceptance it has in the rest of the world is open to question. For a hobbyist, this is an inexpensive, powerful machine well worth its modest price.

*Editor's note: Yamaha MSX computers are currently available in many music stores. They have midi interfaces and software for driving Yamaha synthesizers. These Yamahas remind me more of TRS80 model 1s (cassette data storage) than real CP/M systems.*

For those of you who don't recognize Claude, his SAM76 (SIG/M Vol 53) is still popular with exotic language enthusiasts and, in fact, was a recent "language of the month" in Computer Language magazine.

### Commodore 128 SIG/M Sampler

I managed to get my hands on a Commodore 128 for a few hours. The MSX machine ran rings around the 128, and unless all of the analysts are wrong, 128 sales will never reach the level of overseas MSX sales. However, the 128 is here, and we used it to prepare a sample disk of SIG/M programs that will run on the 128. We also made arrangements with Charlie Strum, the CompuServe CP/M SIG

SYSOP, to download the Commodore material (including modem programs). These will be on a second sample disk.

The Commodore disks are being distributed in Kaypro 4 format, which means that you have some 300K on each disk. If you have a 128 and would like a copy of UNERA, SD, SQ, USQ, MODEM, etc. send \$14 for the set of two sample disks to Dutsch Computer Service, 405 East 6th Avenue, Roselle, NJ 07203.

*Editor's note: A local 128 user came in and purchased a couple of our Kaypro users disks. The next day he was back to get more. All the standard CP/M programs worked — only the modem, system diagnostics, bulletin board, and other machine specific programs didn't.*

### Gifts From Japan

I also received a package from Yoshio Monma, secretary and disk editor of the CP/M SIG of the Japan User Group (JUG). JUG has been added as a second distribution point in Japan, and they donated the twelve volumes in their CP/M library for inclusion in ours. We won't be able to release all of them, but the first of the twelve is already out.

SIG/M Volume 255 is JUG Volume 4. It has a scan program for bad sectors, a disk patcher, a printer utility, a screen editor, etc. Code is in both CP/M 80 and 86. If you think the Japanese build fine computers but don't know how to write code, take a look at the JUG releases. More of these volumes will be released in coming months, and you'll see things you never saw before in CP/M.

If you're interested in joining JUG, contact Yoshio Monma at Manyou Bldg. 4F, 3-53-3 Minami-Otsuka, Toshima-Ku, Tokyo 153, Japan. Perhaps he can arrange for you to get an MSX computer.

### CP/M In The U.S.

I would hesitate to say that CP/M is

thriving in this country, but it is far from dead. Admittedly, there is very little in the way of new commercial CP/M software, but almost everything people need is already available. In the non-commercial area, we receive more donations at SIG/M than we can possibly release. Right now we have at least 20 volumes of unreleased material including a new SYSLIB from Rich Conn (to be covered next issue).

However, if CP/M is not dead, MS-DOS is thriving. One can buy an IBM XT clone with a 20 meg hard disk and all the trimmings for \$1,200. I paid more than that for a 256K memory board for my CompuPro. dBASEII is a fine program, and we use it every day, but dBASEIII and the new Plus version run rings around it. We now write our databases in dBASEIII, compile them with Clipper, and run faster than the programs we run on the mainframe.

### New SIG/M Releases

Rick Surwilo of Stamford, CT has come up with a full screen Z80 debugger that everyone has acclaimed (SIG/M Volume 239). It features a full screen animated display of the program under test, a complete inline Z80 assembler, interactive disassembly, full trace, 16 breakpoints, etc. Every hacker type working with a Z80 has to have a copy of this program. It's that good!

A full implementation of the CCITT X.25 packet standard in all three levels is on SIG/M Volume 236. Ed Elizondo wrote it using a Digital Research Computers Big Board (BBI), but it can easily be configured for other equipment. On the disk is a full user manual for the program.

Volume 240 came to SIG/M via the United Kingdom CPMUG. It contains a 6502 cross assembler, a Z80 hard disk backup program, a line editor, and a BBS system in BASIC.

Volume 236 has a CP/M 3 BIOS for

# PROGRAMMER/4+

the Disk Jockey controller and an update to Lisp in Pascal/Z. Pilot in Pascal/Z is on 237. Volume 235 is one of those disks we thought twice about releasing and then decided to go ahead anyway. It helps if you understand Dutch, since very little of the disk documentation is in English. It's a system called BASICODE, a form of software transmission by radio, that is being tested in Holland.

The Orlando Concurrent RCP/M system donated a volume of Concurrent CP/M patches and utilities (SIG/M Volume 247), and an old favorite, Dan's Information Management System, was updated on Volume 248.

A two volume update of RBBS is on Volume 249 and 250. Volume 251 contains the ROS Turbo Pascal BBS System. For those of you who would like to see the game of Life played out over a five day period (you can stop and resume), take a look at Toru on Volume 246. For anyone interested in random number generation, Mark Weiss will show you tricks you never thought of (SIG/M Volume 243).

## The Joy Of Giving

A while back SIG/M got a letter from Friar Maurey Smith at the St. Francis of Assisi Friary in Franklin, Indiana. They had bought a bundled Kaypro and were trying to do a dBAS-EII program for their reference books. Maurey asked a lot of questions and yours truly decided the easiest way to answer them was to write a program. BOOKS on Volume 230 was the result.

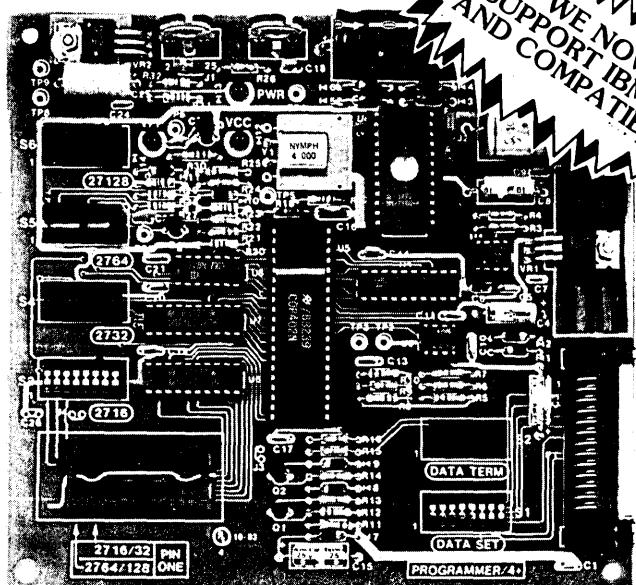
In addition, the wife of a friend was doing her thesis and she needed a database manager to handle her reference materials. I rewrote BOOKS to her specifications and produced REFERENCE, also on Volume 230.

Since then I've had letters and calls from libraries and scholars both in this country and overseas. One of the rewards of writing public domain software is the letters thanking you for the program which they are using.

## Contributions

If you want the enjoyment that comes from helping someone, how about contributing to SIG/M. We expect it to work. We expect it to have

(continued next page)



## A LOW COST ALTERNATIVE TO EPROM PROGRAMMING

- Reads and programs 2716, 2732, 2764, and 27128 EPROMS.
- Reads 2-16K ROMs.
- Direct connect to any RS232C terminal or computer.
- Plug selectable as either a data set or data terminal.
- All voltages made on board, (no power supplies needed).  
(User supplies power Xformer, 25.2 to 30 VAC C.T. 1 Amp.).
- Power electronically switched, (can't damage EPROMS).
- Zero insertion force socket for EPROM.
- Programs, verifies, and dumps in both ASCII and hex.
- Edit buffer (like DDT).
- Saves hex and/or image files to and from disk.
- Saves or loads all or partial buffer.
- Completely menu driven for ease of operation.
- Commands of Test, Read, Display, Save, Load, Program and more.
- Check sum calculation.
- All software on disk including well commented source code.
- Detailed owners manual including schematic
- All chips socketed.
- Not a kit! Completely built and tested.
- 48 hour dynamic burn-in and test before shipment.
- 90 day limited warranty on parts and workmanship.
- 24 hour return policy on repairs.
- Delivery from stock.

PROGRAMMER 4+ WITH OWNERS MANUAL AND DISK. \$199.95  
MS-DOS DISK ONLY \$15.00

Order from

**operiphco**

1659 Scott Blvd., Suite 1  
Santa Clara, CA 95050  
(408) 354-5084

VISA and MASTERCARD telephone orders welcome.

Please specify Disk format  
CP/M 8" IBM format, KAYPRO II, XEROX 820, OSBORNE I, others.

Please specify method of shipment, UPS or Postal Service.  
California residents add 6% Sales Tax. Dealer Inquiries invited.

(continued from page 57)

source code. We hope it will have full documentation, or at least enough documentation to enable someone to use the program. It can be machine specific. It can fit into a very limited envelope. It can be a new language, or an implementation of an old one.

(If anyone out there has written a version of Ada which he or she would like to donate to the public domain, we would love it. Rich Conn has available some 50 volumes of Ada applications, but as far as we know, there is not a decent compiler available commercially or non-commercially for a micro computer. Rich has already sent in the first two of the volumes, but we're holding off on them until we can get a compiler to test them out.)

#### PC/Blue Library Growing Rapidly

The PC/Blue library is fast catching up with the SIG/M library. We now have some 62 megs in SIG/M. The far newer PC/Blue is up to 55 megs. Our

average monthly release totals 1.2 megs; PC/Blue is averaging more than 3 megs. Of course, the commercial software market has changed in recent years. Just about everyone is writing in MS-DOS or for one of the new machines (Mac, Amiga, etc.). We used to see part-time developers trying to peddle their own products through small ads in the magazines. It seems to us that now most part-time developers are putting out their software as freeware, and most of what goes out on PC/Blue asks for money. None of the SIG/M software is freeware, so CP/M still has the bulk of true believers in public domain.

#### New PC/Blue Releases

Last issue we promised to take a closer look at some of the newer PC/Blue releases. As we said, most of it is freeware. However, don't even consider sending a donation unless you don't need the money.

PC/Blue 162 is a good example of how much quality software is available for nothing. On it you have a typing

tutor and an online DOS help program. Also on the disk is YARP (Yet Another Resident Program) which looks like a handy real time monitor. Quaid Software's OmniEdit is also on the disk as freeware. It allows you to do some elementary file editing. OmniEdit struck me as being of limited value. You may like it, and since it costs you only a few dollars to get all the programs on the disk, including YARP — why not try it.

PC/Blue 163 is Tom Rettig's dGenerate, an excellent dBASEIII screen generator. (My big discovery of 1985 came on a computer radio show where the trivia question was to identify Tom Rettig. Who played the boy who owned Lassie in the TV series?)

PC/Blue 164 has a general ledger and accounts receivable program. Volume 169 has a mailing list program as well as something called LEARN. LEARN creates computer assisted instruction (CAI) courses. We tried it and were pleased with the results.

PC/Blue 172 has a dBASEII screen generator and a handy utility program

## CACHE22+ CP/M 2.2 = CP/M Max!

CACHE22 is a front-end system program that buries all of CP/M 2.2 in banked memory. It helps 8080/Z80 computers to survive by providing up to 63.25K of TPA, plus the ability to speed disk operations, eliminate system tracks, and run Sidekick-style software without loss of transient program space. Complete source and installation manual, \$50.00.

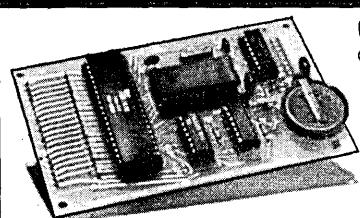
CP/M is a trademark of Digital Research Inc.  
Sidekick is a trademark of Borland International



**MIKEN OPTICAL COMPANY**

53 Abbott Avenue, Morristown, NJ 07960  
(201) 267-1210

**Ztime-J**  
**CALENDAR/CLOCK**  
**\$69 KIT**  
**NOW WITH FILE DATE STAMPING!**



- Works with any Z-80 based computer.
- Currently being used in Ampro, Kaypro 2, 4 & 10, Morrow, Northstar, Osborne, Xerox, Zorba and many other computers.
- Piggybacks in Z80 socket.
- Uses National MM58167 clock chip, as featured in May '82 Byte.
- Battery backup keeps time with CPU power off!
- Optional software is available for file date stamping, screen time displays, etc.
- Specify computer type when ordering.
- Packages available:

Fully assembled and tested	\$99.
Complete kit	\$69.
Bare board and software	\$29.
UPS ground shipping	\$ 3.

MASTERCARD, VISA, PERSONAL CHECKS,  
MONEY ORDERS & C.O.D.'S ACCEPTED.

N.Y. STATE RESIDENTS ADD 8% SALES TAX

**KCJ** KENMORE COMPUTER TECHNOLOGIES

P.O. Box 635, Kenmore, New York 14217 (716) 877-0617

to transfer copy between the most popular commercial PC word processors. Also on the disk is a fast format program if you have to format a lot of 5" disks. Once again, the practical utility of the program is kind of obscure.

I had a lot of fun with PC/Blue Volume 174 which contains ESIE (E)xpert (S)ystem (I)nference (E)ngine. I ran the demo program which identified animals, and really enjoyed it. When I get some time I'll try to create a system with it.

The last of the new releases worth mentioning is volume 175. It has an update of QMODEM, a good modem program, a virtual memory system for Symphony 1.1 which uses your hard disk to expand the utility of Symphony (without requiring an ABOVE BOARD) and PROINDEX, a good indexing system for text files that seems to do everything you expected from Star Index.

#### How To Order

SIG/M volumes are available on 8" SSSD disks for \$6 each (\$9 foreign) directly from SIG/M, Box 97, Iselin, NJ 08830. Printed catalogs are \$3 each (\$4 foreign). Disks in a variety of formats may be obtained through the worldwide SIG/M distribution network. The distributor list is included with the printed catalog. A disk version of the catalog (Volume 00) is available for \$6. PC/Blue volumes are \$7 each (\$10 foreign). The printed catalog is \$5. Both are available from the New York Amateur Computer Club, Box 100, Church Street Station, New York, NY 10008.

■ ■ ■

<u>OKIDATA PRINTER MICROLINE 80</u>	
7 X 9 IMPACT DOT MATRIX, NEW RIBBON	
80 CPS 10 CPI 6 OR 8 LINES PER INCH	
3 TO 12 INCH FORM FEED TRACTOR & FRICTION	
BUILT IN SELF TEST REMOVED FROM SERVICE	
PARALLEL INTERFACE (CENTRONICS COMP)	\$ 99.00
<u>WINCHESTER 20 MEG HARD DRIVE FULL HEIGHT</u>	
RODINE 204 ST-506 INTERFACE	\$350.00
PLEASE CALL FOR OTHER HARD DRIVES IN STOCK	
<u>KEYBOARD (MICROSWITCH) 113 KEYS 8 BIT ASCII</u>	
PARALLEL OUTPUT WITH CASE	
AND COMPLETE DOCUMENTATION	\$40.00
<u>SA800-2 DISK DRIVE CLEAN - USED</u>	\$59.00
<u>SA850 DISK DRIVE CLEAN - USED</u>	\$99.00
STANDARD MOUNTING - GUARANTEED 60 DAYS	
<u>CABINET FOR ABOVE HOLDS TWO DRIVES</u>	
POWER WIRING COMPLETED (AC AND DC)	
FAN AND INPUT AC WIRING DONE	
20 X 9 1/2 X 17 DEEP	\$60.00
<u>POWER SUPPLY FOR TWO DRIVES (SWITCHING)</u>	
WILL POWER DRIVES AND SBC 6 X 8 X 2 1/2	
5VDC @ 8 AMPS, +12VDC, -12VDC, -5VDC @	
.5 AMPS EA AND 24VDC @ 2 AMPS	\$50.00
<u>CABINET AND POWER SUPPLY TOGETHER</u>	\$100.00
<u>IBM XT CLONE SYSTEMS</u>	
TWO FLOPPY DISK DRIVES 640 K RAM INSTALLED	
150 WATT P/S KEYBOARD COLOR CARD	
SERIAL AND PARALLEL PORT CLOCK	\$700.00
20 MEG HARD DRIVE AND ONE FLOPPY	\$1150.00
<u>CLONE PARTS</u>	
MOTHERBOARD UP TO 640 K ON BOARD	\$125.00
COLOR GRAPHICS CARD	\$ 85.00
FLOPPY DISK CONTROLLER UP TO 4 DRIVES	\$ 45.00
HARD DISK CONTROLLER	\$125.00
DISK I/O CARD - FLOPPY DISK CONTROLLER	
RS-232 CLOCK PARALLEL GAME ADAPTER	\$110.00
CASE FLIP TOP STYLE	\$ 45.00
POWER SUPPLY 150 WATT	\$ 85.00
KEYBOARD AT STYLE	\$ 70.00
<u>QUME 142 HALF-HEIGHT FLOPPY DRIVE</u>	
IBM COMPATIBLE (LIMITED SUPPLY)	\$ 69.00
<u>CASCADE ELECTRONICS</u>	
ROUTE 1 BOX 8	FREE
RANDOLPH MN 55065	SHIPPING
507-645-7997	ON PREPAID ORDERS
COD ADD \$3 CREDIT CARD ADD 5%	MN ADD 6%
LIMITED TO STOCK ON HAND	EVENING CALL OK

## Turbo DOS, A Super Operating System

By Dave Hardy  
736 Notre Dame  
Grosse Pointe MI 48203

*Curious about Turbo DOS? Haven't heard about this flexible multiuser, multiprocessor operating system? Read on. Dave gives us a peek at this package, designed specifically for the S-100.*

This column begins a series of mini-reviews of Turbo DOS-capable S-100 hardware. Along with the usual S-100 tips, circuits, and reader feedback in "The S-100 Bus," I'll briefly look at the offerings of each manufacturer of S-100-based Turbo DOS products. Before these mini-reviews begin, I feel obligated, once more (and finally), to justify discussing an operating system in a hardware column. Please bear with me while I exorcise my guilt one last time ...

### Why Turbo DOS?

Turbo DOS is a software product (an operating system), not a piece of S-100 hardware. But Turbo DOS supports a special kind of S-100 configuration as well as special kinds of S-100 hardware that can outperform other small systems (including the ubiquitous IBM-PC). These qualities are so important that most new S-100 systems use Turbo DOS as their primary operating system.

Turbo DOS is the only operating system that uses all the S-100 bus' abilities, including (and especially) the ability of the S-100 bus to fully support up to 16 separate processors in a single box. In addition, several LAN (Local Area Network) options are available for S-100 machines that use Turbo DOS that can allow not only multiple processors within an S-100 frame, but also links between multiple S-100 frames (and between S-100 and non-S-100 systems).

The ability of Turbo DOS to support multiple processors in an S-100 box is further enhanced by its capacity to run

different TYPES of processors at the same time. Even more amazing is that a Turbo DOS host can simultaneously support different operating systems in its slave cards, including CP/M80, CP/M86, Concurrent DOS, MP/M, MP/M-86, generic MS-DOS, and even PC-DOS.

Combine all this with Turbo DOS' true multiuser operation (including full record and file locking), and it's light years ahead of other networks for small computer systems.

Incredibly, many other multiuser and file-server products available for the S-100 bus do NOT offer record or even file locking! I've had the misfortune of using one such system that, because of these limitations, allowed only one user at a time to operate on each logical drive. Perhaps this is the reason I'm so fond of Turbo DOS.

The Turbo DOS operating system works so well with the S-100 bus that I consider it almost a natural extension to it, and therefore, an integral part of the S-100 environment.

### S-100 Turbo DOS Configurations

Although the configuration of a Turbo DOS-based system can be rather complex, most TD systems have the following features in common:

1. Host Processor. The host processor is the computer that coordinates communications between each user processor in the system and the system resources, such as mass storage, printers, modems, and other peripheral devices. In the IEEE-696 S-100 world, the host processor is usually also the bus master. That is, it provides all permanent control signals to the S-100 bus and controls all bus cycles except when it gives control to a slave processor. In addition, the host processor also arbitrates simultaneous or conflicting requests from slave processors and grants control to them in some orderly manner.

2. One Slot Per User. Each user in the system is usually a single board computer, with at least CPU, RAM, and console I/O onboard. These single-board computers are called SLAVE boards because they operate as slaves to the host processor, and also because they usually operate within the IEEE-696 specification as a bus slave. Although it's possible to run several users from a single slave (a la MP/M, for example), this is not usually done.

3. Shared System Resources. As mentioned above, shared system resources are the peripheral devices available on the S-100 bus. These resources are accessible only through the host processor (and to the others via Turbo DOS system calls. This prevents two slaves from trying to use the same printer.

By passing all requests for a printer through the host processor, Turbo DOS can see that the printer is "assigned" to just one user at a time. Shared system resources also include all disk I/O, so that Turbo DOS can lock records and files. Shared system resources can also include interfaces to other networks like ARCnet or Net-Dos.

4. Private System Resources. Unlike shared resources, which are available to all slave processors via the S-100 bus, private system resources are connected directly to an individual slave processor. This way no other processor can access them either directly, or through the host processor.

Private system resources often include devices like modems that require high-speed, un-interruptible I/O paths to the slave processor.

For example, a Turbo DOS slave user who wanted to transfer information via a modem to a remote computer system would probably want to use a private modem (that is, a modem connected directly to it, not to the host processor). By doing this, he avoids



## Z SETS YOU FREE!

going through the host processor and thus avoids missing characters when the host is busy. Many slave boards available have a private parallel printer port and a private serial port just for this reason.

### Schematic Mail

I was surprised to receive almost 200 requests for the computer-generated FIFO board schematic that I mentioned in the January "S-100 Bus." It took a while to get all those schematics mailed out, but everyone who asked for them should have received them by now. If not, please drop me a nasty note at one of the following addresses:

CIS 70150,102, SOURCE TCH054, GENie DJHARDY, or voice at (313) 846-1055, and I'll drop them in the mail. (Don't forget to include a return address!) The original schematic has been enhanced to include two serial FIFOs, a printer port, an interrupt handler, and a printer interface. It's an E-sized plot on several 11"x14" sheets, so you'll need some tape if you want to make it into a single large drawing.

### Mini-Reviews To Come

The next "S-100 Bus" will include the first mini-review, starting with the Intercontinental Micro Systems products. Also in the review queue are Earth Computers, Peak Electronics, and Advanced Digital Corporation. If you'd like to see any others, please let me know. As always, I encourage reader feedback, and welcome questions, suggestions, comments, and ideas for future S-100 Bus columns.

■ ■ ■

**Z Operating System, an 8-bit OS that flies! Optimized HD64180/Z80 assembly language code — full software development system with proven linkable libraries of productive subroutines — relocating (ROM and RAM) macro assembler, linker, librarian, cross-reference table generator, debuggers, translators and disassemblers — ready to free you!**

High performance and flexibility! Productivity results from dynamically customized OS environments, matching operator, tasks and machine.

Real-time control kernel option allows quick software development for industrial control applications, other tools and utilities for office desk-top personal computing functions, local area networks to Ethernet, AppleTalk, Omnitel, ArcNet, PC-Net [Sytek] — from micro to mainframe command, control and communications. Distributed processing application programs are easily developed.

- Extreme organizational flexibility, each directory another environment
- Multiple Commands per line
- Aliases (complex series of commands known by simple names) with variable passing
- Named Directories with absolute password security
- Full-screen command line editing with previous command recall and execution
- Shells and Menu Generators, with shell variables
- Command-file search Paths, dynamically alterable
- Screen-oriented file manipulation and automatic archiving and backup
- 512 megabyte file sizes, 8 gigabyte disks handled
- Auto disk reset when changing floppies
- TCAP database handles characteristics of over 50 computers and terminals, more easily added
- Tree-structured online help and documentation subsystem
- 76 syntax-compatible support utilities

Your missing link has been found — Z! Now fly with eagles! Fast response, efficient resource utilization, link to rest of computing world — shop floor to executive suite, micro to corporate mainframe. Call 415/948-3820 for literature.



**Echelon, Inc.**

101 First Street • Suite 427 • Los Altos, CA 94022 • 415/948-3820

## THE COMPUTER JOURNAL

### Practical Programming & Hardware Projects

The Computer Journal is published bimonthly for those interested in programming their computers, interfacing to peripherals, and hardware construction.

Now expanded with in-depth articles covering Turbo Pascal, "C", Assembly Language, Kaypro, Ampro, Interfacing, plus CP/M and other operating systems.

**6 Issues (1 year) \$14 in US — VISA & MasterCard accepted  
190 Sullivan Crd., Columbia Falls, MT 59912 (406) 257-9119**

# Computing In The Netherlands

---

By Andy Bakkers  
de Gervelink 12  
7591 DT Dendkamp  
The Netherlands

## CP/M and communications are hot in Europe

*Europe dances to its own drummer. CP/M is hot, and they've been ahead of the US in communications. Andy also covers a public domain version of CP/M and a catalog of Taiwanese exporters.*

The latest craze in Holland is the FIDO net — supposed to be *the* mail box of all mail box systems. The software was written by Tom Jennings of San Francisco, and it's in the public domain.

There's one national node in Holland, and during the night the FIDO nodes start calling each other to exchange mail. The mail that arrives here in Holland is then distributed nationally over the 13 local nodes.

International connections are possible at the moment between the USA, UK, Sweden, and Holland, all at prices below the postage rate. Dedicate your home built PC clone as soon as possible to this new gadget.

The FIDO net control number in Portland is — HOST 105 500 1200 PDX\_PC Net P09.15032818322 Portland\_OR. I don't know what all the numbers mean, but its speed is 1200 baud. You can reach me via FIDO Host 3101, node 100.

### PC Clone Information

If you want information from the horse's mouth (so to speak) about PC clones, subscribe to the Asian Sources Computer Products, \$98 air mail. Order from Trade Media Ltd., c/o Wor-dright Enterprises, Inc., P.O. Box 358, Winnetka IL 60093-0359, phone (312) 256-7105. They publish eight different magazines on subjects ranging from timepieces and toys to sporting goods.

### CP/M's BDOS

Here's a public domain replacement for CP/M's BDOS. As you know, ZCPR2 and 3 can replace the CCP. Now there's also a much better BDOS

Figure 1 - Part of the Source Listing for P2DOS

```
; P2DOS -- Z80 Replacement disk operating system version 1.1
;
;*
;* Copyright (C) 1985 by: H.A.J. Ten Brugge
;* All rights reserved Molenstraat 33
;* NL-7491 BD Delden
;* The Netherlands
;* Tel...31-5407-1980
;*
;* P2DOS was written by Herman Ten Brugge, who assumes no
;* responsibility or liability for its use.
;* P2DOS is released to the public domain for
;* non-commercial use only.
;

; New features of P2DOS are:
; - Test console status after 256 characters output.
; This makes it possible to exit a program, after you
; hit accidentally a key, by typing ^S followed by ^C.
; - Error routines give more information.
; P2DOS error on D: BAD SECTOR
;     SELECT
;     FILE R/O
;     R/O
; FUNCTION =XXX (FILE =FILENAME.TYP)

; As you can see the error is displayed with the P2DOS function call.
; The option 'FILE =FILENAME.TYP' is only displayed if the P2DOS
; function uses a filename. After all errors a warm boot is done.

; - Public files are supported. You can access a public file from any
; user number. This makes it possible to put, for example, all .COM
; in a special user number and make all those files public. You can
; access all the files from any user number on the same disk.
; A public file is a file with bit F2 (Bit 7 from filename letter 2)
; set to one. Public files can only be referenced by their exact
; name and not by wild card characters.

; - Search path is implemented just as in ZCPR2 to find files on other
; drives and in other user areas. The files must be system files and
; must be referenced by their exact name as in public file names above.

; - Automatic date and time stamp is implemented. The creation date
; and time is set when the function make is executed. The update
; date and time is set as the file is closed. To let this feature
; work you need to have a real time clock and the correct P2BIOS
; driver routine. You also have to initialize your directory
; for time stamps.

; - File R/O error message occurs if one of the following file
; types is active:
;     PUBLIC FILE (F2)
;     FILE R/O      (T1)
;     SYSTEM FILE (T2)

; This means that a system file or public file cannot be erased
; accidentally.
```

replacement called P2DOS. Figure 1 shows part of the source listing.

### 1 GByte Disks

I've recently read about 1 GByte disks for CP/M. You can now put WordStar in A15: and declare it public and have no more problems.

I've put ZCPR2 and P2DOS together on a disk and written a small ZEX file. Since this is ZCPR's submit file, you can get a system by typing ZEX DOS 60 (if you want a 60K system).

I've implemented P2DOS and ZCPR2 for the Big Board II (of course) including time and date stamping.

### BBII Lives

I hope from my European update, you get the impression that the Big Board II is not dead yet. At least here in Holland the group is very active.

We're coming out with a Big Board Bulletin entirely devoted to technical modifications and improvements to the Big Board. And we have our Holland SOG planned for June 14, 1986. We'll be sure and tell you all about what happened when we attend SOG V in Bend.

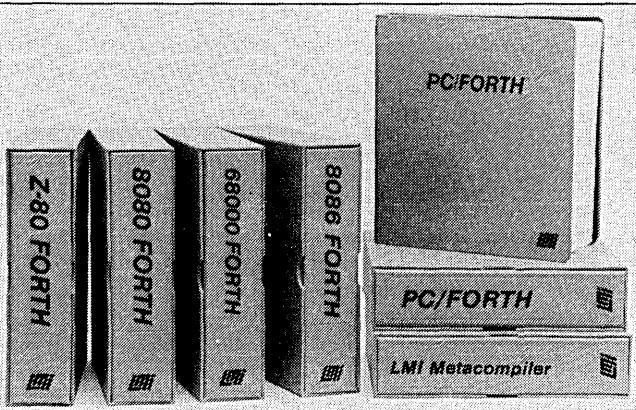
■ ■ ■

```

; - New function get time (200) is implemented to get the correct
; date and time. Entry DE is address to put time. The date and
; time record has the following layout:
;
; DATE: DEFS 2 DATE = 1 (SU 01-JAN-1978)
; HOUR: DEFS 1 HOUR IN BCD
; MINUTE: DEFS 1 MINUTE IN BCD
; SECOND: DEFS 1 SECOND IN BCD
;
; Function works only if correct P2BIOS function call is installed.
; - New function set time (201) is implemented to set the correct
; date and time. Entry DE is address new time. The date and time
; layout is as above. Function works only if correct P2BIOS function
; call is installed.
;
; - Disk size can be as large as 65536*16K=1 048 576 K BYTE=1 G BYTE
; - File size can be as large as 32*64*16K=32 768K BYTE=32 M BYTE
;
; You can enable/disable the functions mentioned above with the
; following data and addresses:
;
; - Enable path name by putting address of path in P2DOS+11H. If this
; value is 0000H no path is used. This address is normally set to 0040H.
;
; - Enable P2DOS time and date stamping by putting the correct P2BIOS
; address at P2DOS+13H. This address is normally set to the P2BIOS
; console status function.
;
; - You can enable the 256 character delay function by setting bit 0
; of address P2DOS+15H. This bit is normally set to 1.
;
; - You can enable public files by setting bit 1 of address P2DOS+15H
; to 1. This bit is normally set to 1.
;
; Entry addresses P2BIOS
;
; FUNC NAME INPUT PARAMETERS RETURNED VALUES
; 0 BOOT NONE NONE
; 1 WBOOT NONE NONE
; 2 CONST NONE A=OFFH IF READY
; A=000H IF NOT READY
; 3 CONIN NONE A=CONSOLE CHARACTER
; 4 CONOUT C=CONSOLE CHARACTER NONE
; 5 LIST C=LIST CHARACTER NONE
; 6 PUNCH C=PUNCH CHARACTER NONE
; 7 READER NONE A=READER CHARACTER
; 8 HOME NONE NONE
; 9 SELDSK C=DRIVE NUMBER (0..15) HL=DISK PARAMETER HEADER ADDRESS
; E=INIT SELECT FLAG HL=0000H IF INVALID DRIVE
; 10 SETTRK BC=TRACK NUMBER NONE
; 11 SECSEC BC=SECTOR NUMBER NONE
; 12 SETDMA BD=DMA ADDRESS NONE
; 13 READ NONE A=00H IF NO ERROR
; A=01H IF ERROR
; 14 WRITE C=0 WRITE DATA A=00H IF NO ERROR
; C=1 WRITE DIRECTORY A=01H IF ERROR
; C=2 WRITE NEW DATA
; 15 LISTST NONE A=000H IF READY
; A=OFFH IF NOT READY
; 16 SECTRN BC=LOGICAL SECTOR
; NUMBER HL=PHYSICAL SECTOR NUMBER
; DE=TRANSLATION TABLE
; ADDRESS
; XX TIME C=000H GET TIME HL=POINTER TO TIME TABLE
; C=OFFH UPDATE CLOCK HL+0:DATE LSB SINCE 1,1,1978
; HL=POINTER TO TIME
; TABLE HL+1:DATE MSB
; HL+2:HOURS (BCD)
; HL+3:MINUTES (BCD)
; HL+4:SECONDS (BCD)
;
```

(End of Listing)

# TOTAL CONTROL with LMI FORTH™



**For Programming Professionals:  
an expanding family of  
compatible, high-performance,  
Forth-83 Standard compilers  
for microcomputers**

#### For Development:

##### Interactive Forth-83 Interpreter/Compilers

- 16-bit and 32-bit implementations
- Full screen editor and assembler
- Uses standard operating system files
- 400 page manual written in plain English
- Options include software floating point, arithmetic coprocessor support, symbolic debugger, native code compilers, and graphics support

##### For Applications: Forth-83 Metacompiler

- Unique table-driven multi-pass Forth compiler
- Compiles compact ROMable or disk-based applications
- Excellent error handling
- Produces headerless code, compiles from intermediate states, and performs conditional compilation
- Cross-compiles to 8080, Z-80, 8086, 68000, and 6502
- No license fee or royalty for compiled applications

##### Support Services for registered users:

- Technical Assistance Hotline
- Periodic newsletters and low-cost updates
- Bulletin Board System

**Call or write for detailed product information  
and prices. Consulting and Educational Services  
available by special arrangement.**

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

**Overseas Distributors.**  
Germany: Forth-Systeme Angelika Flesch, D-7820 Titisee-Neustadt  
UK: System Science Ltd., London EC1A 9JX  
France: Micro-Sigma S.A.R.L., 75008 Paris  
Japan: Southern Pacific Ltd., Yokohama 220  
Australia: Wave-onic Associates, 6107 Wilson, W.A.

LEAP INTO A NEW DIMENSION



Full implementation of "C" with standard floating point, library, and I/O subroutines. UNIX VER 7 compatible. Produces relocatable 8080 (optional OZ80) assembler code. Relocating assembler and linker supplied with package or use Microsoft M80 and L80, SID/ZSID debugger interface. FAST COMPILE AND EXECUTION.

**AZTEC CII FOR CP/M \$199**  
(Special price for Micro C subscribers \$149)



**MANX**

software systems



Box 55, Shrewsbury, N.J. 07701  
(201) 780-4004

Also available for Apple DOS, HDOS, CP/M-86, PC-DOS

# uniforth™

**ANNOUNCING OUR  
NEW PRODUCTS**

Sampler (\$35) and/or

Professional Systems (from \$175) for...

*Apple ProDOS*

*Amiga*

*Micro VAX*

*Macintosh*

*IBM PC/AT*

*DEC Falcon*

UNIFORTH is a full-featured, floating-point, FORTH-83 Standard language available for most micro and mini computers.

Call or write for our free catalog or use our  
Bulletin Board (614-459-7736, 300/1200 Baud)  
for more detailed information.

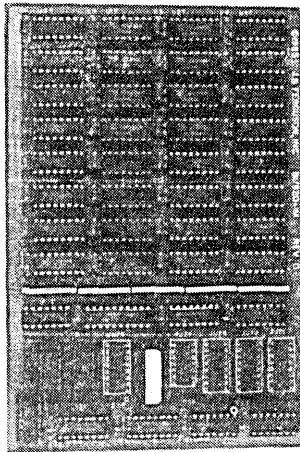
UNIFIED SOFTWARE SYSTEMS  
P.O. Box 21294, Columbus, OH 43221-0294  
(614) 459-7735

Get ready for  
something new

# J.B. FERGUSON, INC.

817-640-0207

## ONE MEGABYTE RAM EXPANSION BOARD FOR THE 820-1 AND THE BIGBOARD-1



This RAM expansion board allows you to expand the memory capacity of your 820-1 or your BIGBOARD-1 to one megabyte. When used with the RAM disk software supplied with the kit, this system will provide you with the FASTEST RAM disk that you can buy. This RAM board is easy to install, and involves no etch cuts or cables. This board plugs in to five device locations below the RAM array on the 820-1 or the BIGBOARD-1. This board uses none of your precious I/O -or- the CPU socket. The memory is organized as 64 pages of 16K. ANY of the 16K segments can occupy ANY 16K block that the CPU can address. ANY 16K segment can be moved into or out of the address space by writing a single byte to memory location OFFFF hex. This product comes with machine-drawn schematics, and a full theory of operation. Assembly, installation and test procedures are thoroughly documented. PAL code is included and extra PALS are available. A PAL is shipped with each board. RAM disk software is included with source on disk. Please specify 5 or 8 inch disk. Interconnect hardware is shipped with each board. Compatible with SWP and EMERALD MICROWARE double density mods. Size 4.5" x 6.5".

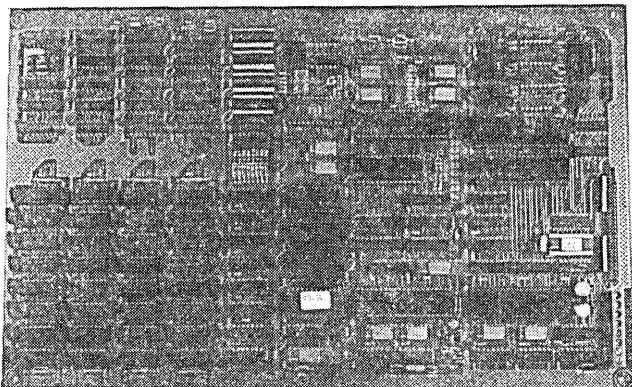
1 MEG UNKIT (PC board, interconnect hardware, doc, PAL and software).....	\$ 75.00
1 MEG KIT w/o RAM ( all TTL, sockets, resistors, capacitors, plus the UNKIT) ...	125.00
256K Dynamic RAM (board will accommodate 32 RAMs max) .....	ea 3.25
MONITOR ROM with mapper initialization (specify 820 -or- BIGBOARD) .....	10.00
EXTRA PAL.....	7.50

### BIGBOARD I

The most popular computer kit in history

The BIGBOARD-I has finally come home. We are now offering the computer that started all this at a new low price. This is the same design that was licensed to XEROX Corp. in 1981, which was introduced as the 820. This is also the same computer that was copied and now resides in several tens of thousands of portable computers around the world. Now that DRC's license has expired, we will be offering the computer in several forms:

BARE BOARD and DOC .....	\$75.00
UNKIT (PC Board, DOC, ROMs and terminal block)...	85.00
Hard-to-get parts.....	call
Special configurations.....	call



### UNIVERSAL COMPOSITE VIDEO ADAPTER.....\$25.00

This device was designed to interface any computer with TTL-compatible separate-sync video to a composite monitor. This board works with the 820-1, 820-2, BIGBOARD I and many other computers. RCA phono jack output.

820-2 etch 2, 11" x 17" schematics, set of 8 .....	\$ 15.00
820-1 etch 1, 11" x 17" schematics, set of 6 .....	15.00
820-1 CBIOS and ROM source, 5" or 8" disk .....	35.00
820 power connector (plugs into 820) .....	4.00
820 power connector (solders onto 820) .....	4.00
820-2 floppy disk controller schematic.....	10.00
CP/M PRIMER (XEROX CP/M HANDBOOK).....	7.50

### 820-2 COMPUTER BOARDS.....\$25.00

This board is the 4 MHz version of the popular 820-1. Only the ROMs, the disk controller, and the CPU are not included. The hex equivalents of ALL (including keyboard translator) ROMs are shipped with each board on disk. Schematics are included with each order.

### 820-2 FLOPPY DISK CONTROLLER.....\$35.00

This board is functionally identical to the 820-2 floppy P/W/A. This package consists of the PC board, the data separator ROM, a parts list and a set of schematics for the revision 5 floppy daughter board.

J.B. Ferguson, Inc.  
P.O. Box 300085  
Arlington, Texas 76010  
(817) 640-0207

TERMS: MasterCard/VISA, money order, certified check, UPS cash COD. Allow 2 weeks for personal or company checks to clear. Add \$5 for shipping/handling. Texas add 5.125% state sales tax.

By Mitchell Mlinar

1225 Fonthill Ave.  
Torrance CA 90503

## Processor Speed Isn't The Only Speed

*Is speed all it's cracked up to be? If your system is spending most of its time trying to find disk data or trying to store results then processor speed might not make much difference. Something else might, however...*

**I**t looks like Xerox is dumping the last of the 820-IIs and 16/8s. During a February employee sale, an 820-II with keyboard, disk drives (5.25" or 8"), and the CP/M distribution disk (which includes M80, L80, MBASIC, etc.) went for \$599. If you didn't want the disk drives, the cost dropped to \$245 (you still got the disk). For that price, EVERYONE can afford a computer, or a second one "just in case" (e.g. parts).

### Souped Up Storage

One problem in working with computers is speed. Computers are amazing speed demons, until you learn how to type! Then they suddenly screech to a halt. Examples:

1. Editing that 80K file with WordStar and trying to move from one end to the other.
2. Compiling and linking a relatively large program.
3. Working with that dBASE application that has 14-zillion records.

### You get the picture.

Have you ever considered upgrading your storage? Every time I go to upgrade a machine, the first thing I hear about is speed (2.5 to 4MHz, 4 to 5MHz, etc.). However, speed is less than a third of the issue!!! Unless you're currently operating in a RAM-drive or hard disk environment, processor speed should be #2 on the list. Number 1 should be storage. If I haven't convinced you yet, check out the statistics in Table 1.

Notice the large ratio, even between single density and double density formats and between 5.25" and 8" disk

Xerox Table 1: Timing Test on 4MHz QP/M System Using a 31K File.

(Times are in seconds. Storage/size is storage and sector size.)

Storage	Read	Write	Write w/verify	Storage/Size
5.25 SSSD	15.8	22.0	32.7	82K (128)
5.25 DSDD	7.8	18.8	25.7	390K (512)
8.00 SSSD	13.1	17.9	29.9	241K (128)
8.00 SSDD	3.8	7.7	12.2	670K (1024)
Hard disk	1.7	2.7	4.9	20M (512)
RAM disk	0.7	0.9	2.3	192K (128)

Xerox Table 2: Timing Test on 2.5MHz QP/M System Using a 31K File.

(Times are in seconds. Storage/size is storage and sector size.)

Storage	Read	Write	Write w/verify	Storage/Size
5.25 SSSD	15.4	22.3	33.3	82K (128)
5.25 DSDD	8.0	20.1	27.6	390K (512)
8.00 SSSD	13.9	18.6	31.0	241K (128)
8.00 SSDD	3.9	7.9	11.6	670K (1024)
RAM disk	0.8	1.3	3.8	192K (128)

formats. RAM drive is the fastest, but unfortunately is not permanent storage like the hard disk.

### Acid Test Time

I performed the same operation on a 2.5MHz system (this one doesn't have a hard drive). The results are shown in Table 2.

Surprised? Although 4MHz is almost twice as fast as 2.5MHz, both are greatly affected by the speed of the floppy disks. Only a few percent is gained by going to the higher clock rate. So sure, pop in those 5MHz dilithium crystals, but don't expect Warp 9 until the REAL horsepower is there. (Of course when you're doing something that requires lots of calculations or lots of writing to the screen, then processor speed becomes very significant.)

### Keeping A Low Profile

I've been getting a lot of questions regarding the high-profile versus the low-profile keyboard. From my own

experience (which is limited), the low-profile keyboard is MUCH better than the high-profile. A good indication of keyboard quality is hand fatigue and typing speed: both have improved in the short time I've used the low-profile.

If you currently have an 820-II or 16/8, moving up to the low-profile (that makes sense, doesn't it?) means simply installing the keyboard PROM into U36. (The low-profile keyboard uses the same cable and keyboard port.)

Installing a high-profile onto the 820-I may only be a matter of software, and takes about 1.5K of code. Whereas the high-profile keyboard transmitted the ASCII code of the character upon any keypress, the low-profile transmits two characters which must be decoded. Software can get real fancy, as the keyboard not only transmits upon keypress, but also on key release. (Software auto-repeat anyone?)

You'll need to purchase the 820-II technical manual to get a list of the keycodes and to see how Xerox decod-

ed the keyboard. And, if you have the money, that additional jack on back can be plugged into any two-button optical mouse. Of course, that is another software problem.

There's little software support for the low-profile keyboard on the 820-I. Plus2X ROMs from Emerald Microware allow owners of their double

density card who are willing to perform surgery to use the low-profile on the 820-I (the ROMs are 2732s); they are the only canned software for the 820-I I know of at present.



### SINGLE BOARD HIGH PERFORMANCE ENCLOSURE

#### FOR 820, BIG BOARD OR OTHER SINGLE BOARD COMPUTER

High Res 12" Motorola Monitor  
Big 200 Watt Power Supply  
All Wired Up & Ready To Slide In Your SBC \$169.00

#### A BEST BUY

Beautiful! Keytronics full parallel ASCII (hooks right up to 820 or BB) Keyboard with numeric keypad/function keys.  
A Best Buy \$39.00  
Extra for Keyboard Enclosure \$15.00  
MONITOR ONLY.....\$59.00  
BIG POWER SUPPLY ONLY.....\$35.00  
MATRIX KEYBOARDS.....\$15.00  
8" Disk Drive Shugart 810 Half Height.....\$99.00  
2 8" Disk Drives In Enclosure with power.....\$299.00  
2 5½" Disk Drives In Enclosure.....\$149.00

### XEROX 820-1 COMPUTERS

#### ENTIRE 820-I SYSTEM IN ENCLOSURE WITH KEYTRONICS KEYBOARD

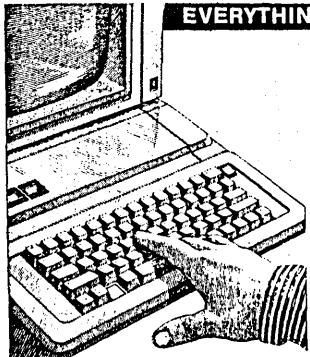
with 2 8" Drives.....	\$699.00
with 2 5½" Drives.....	\$599.00
with Diablo 630 Printer add.....	\$899.00
(Diablo sold only with complete system)	

DIGITAL RESEARCH CP/M WITH BIOS FOR 820-1 OR 820-11 INCLUDING LICENSE AND ALL MANUALS 100 AVAILABLE.....	\$49.00
ENCHANCED MICRO-CODE QPM BOOTABLE DISC SPECIAL WITH COMPUTER ONLY.....	\$45.00
CENTRONICS PARALLEL PRINTER CABLE 820-1 or 820-II.....	\$35.00
PARALLEL DRIVER(COM FILE).....	\$15.00

EVERYTHING WE SELL IS GUARANTEED TO WORK!

### SPECIAL ON CP/M SOFTWARE CLOSEOUT

NEW LICENSED DISK



### CRAIG'S COMPUTERS

All prices: plus shipping  
and handling

(213) 379-1342

WORDSTAR 3.3 or 3.01.....	\$99.00
SUPERSORT.....	\$50.00
SPELLSTAR.....	\$45.00
MAILMERGE.....	\$50.00

\* New AUTOLETTER for Dbase II★  
Write form letters or normal letters automatically  
to your clients, customers or anyone in your database  
without typing names and addresses!  
Also does single or multiple envelopes or labels.  
Add your own forms or letters.....\$99.00

### Xerox 820-1 & II

#### EPROM PROGRAMMER only \$89.95

- ✓ Programs 2716, 32, 32A, 64, 64A, 128, 256, and more.
- ✓ Connects to parallel port & uses system's power supply.
- ✓ Read, copy, verify, display, edit, checksum & save or load programs from disk.
- ✓ Completely built and tested.
- ✓ Includes software on 5½" or 8", user's manual, 40 pin ribbon cable ready to plug into the parallel port of your system.

SUPERIOR INTERNATIONAL  
11663 Denton Dr. # 104  
Dallas, Texas 75229  
(214)484-5072

### NEW... FLOPPY DISK CONTROLLER BOARD FOR THE XEROX 820-II

Direct replacement for the standard 820-II Floppy Daughter Board. Uses the FDC1793/9229B for reliable operation. Perfect for surplus 820-II boards.

Assembled/tested .....	\$109.95
Complete Kit.....	\$79.95
Bare Board w/9229B .....	\$59.95
Bare Board w/DOC .....	\$39.95

Include \$3.00 Shipping  
VISA/MC COD Add \$1.50

### REPAIR SERVICE XEROX 820 I/II BIG BOARD I

THE DATA MILL  
12 Crescent Court  
Montgomery, IL 60538  
312-892-6573

## XEROX® 820-1 & 2

Assembled  
& Tested

820-1	\$50.00	820-2	\$70.00
CP/M (8")	35.00	CP/M (8")	35.00
820-1 w/CP/M	70.00	820-2 w/CP/M	90.00

Xerox is a trademark of Xerox Corporation. CP/M is a trademark of Digital Research.

### OEM

Sips      Inductors  
Sockets    Regulators  
Linears    Resistors

### HOBBYIST

Pots      7400      Dips  
Caps      74LS      Chips  
Some ECL   and more...

5 1/4" DSDD  
80 Track 96 TPI  
Philips® Drives  
\$100.00

**Z80-B 6MHz \$4.50**

### 3P+N POWER SUPPLY

Single board power supply kit with  
2 positive fixed voltages. +1 and -1  
variable.

KIT \$54.95

Authorized dealer for:



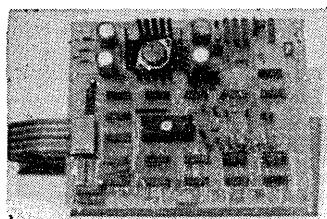
## E<sup>2</sup>I COMPUTER PRODUCTS

2273 American Ave. #8 - Hayward, CA 94545  
(415) 786-9203

TERMS: All orders are F.O.B. Hayward California - Prepayment or C.O.D. - California residents add sales tax - Prices subject to change without notice - Quantities limited to stock on hand.

## CP/M, MS-DOS EPROM PROGRAMMING SYSTEM

2708  
2758  
2516  
2716  
2732  
2764



2732A  
2764A  
27128  
27128A  
27256  
27CXX

- SOFTWARE AVAILABLE FOR CP/M-80, CP/M-86 AND MS-DOS SYSTEMS
- STAND ALONE BOARD - ELECTRONIC SWITCHING OF EPROM TYPES
- USES 24 VOLT XFMR FOR POWER - ALL SUPPLIES/TIMING ON BOARD
- NO PERSONALITY MODULES TO BUY - LARGE COMPREHENSIVE MANUAL

### \* \* PARALLEL PRINTER INTERFACE \* \*

CONNECTS TO ANY PARALLEL PRINTER INTERFACE - USES 8 OUTPUT DATA BITS AND ONE INPUT DATA BIT (BUSY LINE). BUSY LINE IS A HIGH SPEED SERIAL INPUT. FULL EPROM READING AND PROGRAMMING. UNIT MAY ALSO BE CONNECTED TO ONE 8 BIT INPUT/OUTPUT PORT.

### \* \* CONTROL PROGRAM COMMANDS \* \*

- |   |                             |
|---|-----------------------------|
| - PROGRAM EPROM(S) FROM DISK  | - SAVE EPROM(S) TO DISK     |
| - READ DISK FILE INTO RAM   | - PROGRAM EPROM(S) FROM RAM |
| - READ EPROM(S) INTO RAM  | - COMPARE EPROM WITH RAM    |
| - VERIFY EPROM IS ERASED  | - COPY EPROM                |
| - DISPLAY/MODIFY RAM - (MONITOR MODE) WITH 11 SUB COMMANDS<br>FILL-DUMP-XFER-BXAMINE-MODIFY-BIAS-PROGRAM-VERIFY, ETC) |                             |

ASSEMBLED & TESTED UNIT WITH COMPLETE DOCUMENTATION AND SOFTWARE ON DISKETTE ----> \$199  
PARTS KIT WITH SOFTWARE AND DOC->\$179 PCB, SOFTWARE & DOC->\$69 SOFTWARE ON 8 & 5 1/4 DISK FOR KAYPRO, OSBORNE, IBM & OTHER FMTS

TO ORDER SEND CHECK, MONEY ORDER, WRITE OR CALL

ANDRATECH  
P.O. BOX 222  
MILFORD, OHIO 45150  
(513) 752-7218

CALL OR WRITE FOR MORE INFORMATION -- ADD \$4.00 FOR SHIPPING  
OHIO RES. ADD 5.5% TAX -- VISA/M.C. ACCEPTED -- \$300 FOR COD

## ED/ASM-86

*The first truly integrated Editor, Assembler, Debugger, and Linker is now available from Oliver Computing Company.*

\* The Editor supports block move, block copy, partial save and partial load insertion. All text is tokenized for both efficiency of storage and very fast assembly time. FAST screen I/O and separate editor/debug windows.

\* The Assembler can be immediately invoked after any editing command. Output can be directed into memory, to a .COM file, .EXE, or to ED/ASM-86's own efficient .LNK file format. 8087/186/286 instructions supported. Macros and most standard pseudo-ops are supported.

UNIQUE to ED/ASM is its structured assembly language capability. No more wasted labels and time! Multiple segmented programs can be sent to .COM files.

\* The built in debugger supports symbolic disassembly, integration with the assembler, as well as disassembly of 8087/186/286 instructions. Display 8087 registers in scientific decimal format. SPLIT SCREEN debugging with a dynamic register window is easily invoked. Disassemble programs to disk file for easier analysis. "Single-step" data editing supported for bytes, words, double words, and 8087 floating constants in memory. You can "patch" assemble a line at a time with symbols from previous assembly (even define symbols as you go!).

\* The linker supports ED/ASM-86 link files, which can be created from virtually any valid ED/ASM-86 source file, even lines with multiple external symbols in expressions. (Note: not compatible with usual link format)

\* And many more features too extensive to be listed here.

All of these features exist in one integrated program. A typical development cycle with ED/ASM-86 consists of entering a program with the editor, or editing an existing program, typing "A:-IM" to assemble into memory, going into the debugger to immediately test the program. Then you go back to the editor for the next cycle.

ED/ASM was developed for Oliver Computing's own use, and has been used for over a year to enhance itself!

ED/ASM-86 is only \$95. Send check or M.O. to:  
Oliver Computing Company, P.O. Box 90140, Indianapolis, IN 46290  
for immediate delivery via UPS.

{ (317) 849-4450 }

## The Continuing Saga Of CCP/M

Laine brings us a smorgasbord of 86 events this time with some late news on PC Tech's X16, developments on the Ampro systems, and more CCP/M on the Slicer (with a few cutting comments about Turkish customs). Our man in Turkey seems to be surviving, but we're watching closely to see if too many baths (Turkish, of course) cause wrinkles in the cerebral processor.

I've gotten some interesting mail lately: "Dear sirs: (our company) has been traded with your esteemed company for a period. As all of us sincerely hope to furnish you with more better supply, we would very like to learn your comments about products, delivery, service, etc."

So, how 'bout it. Send me some MAIL, huh??? I don't pound on my keys just for the exercise, you know.

### Yet Another Evening ...

First, I've got a bit of news from our friends at PC Tech (Dean & Earl, you know, the Homer & Jethro of the computer set ...) as well as from Rick and Dave at Ampro.

### X Marks The Spot

PC Tech's X16 has been constantly improving (if that's possible) since it was introduced at the SOG last summer. The 8087 board is now working, and the SASI port is now full SCSI (seems like Dean had a talk with Rick Lehrbaum from Ampro. Is this all some kind of evil conspiracy or something??). Dean has been trying several different peripherals (tape controllers, graphics boards, hard disks, etc.) with the X16, and all seem to work with no problems.

Earl's ROM BIOS has been improving, also. It now has support for a winchester on the SCSI port. He reports that he's running a WD1002

controller with 1:3 interleave, and WD1003 with 1:1 (!!) interleave. (For comparison, my Slicer is currently using 1:7, although I plan to upgrade it to 1:3 or 4 soon.) Because of OS overhead and stepping time, the speedup obviously will not be 7 times, but I'm sure it'll still be significant, especially for sequential I/O.

*Editor's note: An interleave of 7 means that sector 2 is 7 sectors after sector 1, sector 3 comes 7 sectors after 2, and so on. They wrap around to get all the sectors on the track. Spacing sectors this way gives the system time to get ready to read the next sector. But an interleave of 7 means that it takes 7 revolutions of the disk to read a complete track. A system has to be very fast to read a disk with no interleave (an interleave of 1).*

The X16 ROM BIOS now automatically determines the controller type, number of drives, etc. and feeds it all to PC-DOS at boot time, so no extra device drivers are needed.

On the software compatibility side, Earl says that only one or two BASICA programs and a couple of copy protected programs still won't run on the X16. The problem with BASICA is, of course, that it uses an extra ROM that's copyrighted by IBM. The problem with the copy protected programs is more elusive, but he says it probably has something to do with software timing loops and different clock speeds. Nearly all PC software runs, though.

I heard in December that PC Tech would have a new "low cost" version of their board out after the first of the year (that means it should be ready to ship NOW), selling for under \$500 in quantities of 20 or so. This puts it right in line with boards of similar specs coming from Taiwan. Actually it's just slightly more expensive, but I've heard rumors of 30 percent DOA (dead on arrival) rates from Taiwan (and you

By Laine Stump

Development Foundation of Turkey  
Tunali Hilmi Cad. 22  
Ankara Turkey

wonder why I'm shaking in my slippers ...), so the small extra expense is definitely worth paying, especially when you consider the extra shipping and customs charges from Taiwan. Several U.S. companies are now discovering just this fact, and have been talking to PC Tech about supplying their motherboard needs in the future.

### Little Board News

I've also heard from Ampro that they have Turbo DOS running on their Little Board Plus and Little Board 186. For those who don't know, Turbo DOS is a mildly CCP/M compatible operating system supporting multiple CPUs. Usually each user has his own CPU, and one CPU handles disks and printers, etc. (although the disks and printers could be distributed over the whole system). An intriguing idea; I just wish I could convince somebody that I need 5 LB186s, 4 terminals, a huge winchester drive, and Turbo DOS. I would truly LOVE to play around with some multiprocessor stuff.

They also now have a 512K expansion board with two extra serial ports, a battery backed up clock, and an 8087 co-processor that fits on top of the LB 186 (which fits on top of a winchester controller, which fits on top of a winchester drive, which ...)

Ampro also plans to have Concurrent DOS (CCP/M) for the LB186/expansion board pair. They had it running with two users on a single LB when I heard from them, and probably have it running with the expansion board by now.

### Slicer CCP/M

I've been mostly happy (actually ecstatic) with CCP/M on the Slicer, but there are a few things which bother me. First, the parallel port on the expansion board is not supported.

(continued next page)

(continued from page 69)

Second, it doesn't automatically set the system time and date from the clock at boot time. The worst problem, however, is that anytime someone fires up a disk drive, everything slows down by about 130% (disk operation is all polled because of a bug in the DMA of early 186s).

If this were any other system, I'd be very disappointed, but this is the Slicer, and that means they included the source code to EVERYTHING on the distribution disk. When something on the Slicer doesn't quite measure up to my desires I don't think of it as a deficiency of the Slicer; I think of it as an exercise left for the user. After all, what fun would it be if everything worked perfectly straight out of the box? It's much more satisfying to hit the power switch and see the system come up with a message that you, yes YOU, had a small hand in making it work the way it does. (Why do you think I rewrote the entire Monitor ROM and BIOS for my Big Board, anyway?)

Since I could live with slightly slow screen paints during disk accesses and incorrect time stamps, I decided to add support for the parallel port first. This was fairly simple, owing mainly to the wonderful table-driven structure of the XIOS character I/O device drivers (once again, thanks Earl). After that, I kind of got busy with EXPRESS and resigned myself to just suffer with the rest for awhile.

As soon as I get this column written, I'm going to begin a fullscale upgrade of the Slicer XIOS. I hope this won't take more than a month or so of spare time. I will then send the results of my labors to Slicer for distribution.

#### Gifts(?) From Afar

Last week I got a notice that I had a package to pick up at the customs post office. Exactly 8 days later and four trips to customs, one official letter stating my purpose in Turkey and guaranteeing that I wouldn't sell the contents inside Turkey, several hours of paperwork by a colleague at DFT, two trips by camel train to Lhasa, Tibet, the tooth from a sabre toothed tiger, and a blessing from the Dah'lai

Lhama, I had a box full of disks from a friend in the U.S.

By the way, if anyone else sends me any disks, please PLEASE send no more than 3 to a package and send each package on a separate day. The guys at customs here know as much about computers as I know about making goat cheese (and what I know about it would probably curdle your blood). When they see a dozen diskettes in a box, they're sure that each one is worth about \$20 and that I'm going to sell them all and the Turkish government won't get its cut. So parcel them out, please?

#### Project Of The Month

Last issue I showed the basics needed to make an extended command processor for CCP/M (called SHELL). I promised to show this month how to add I/O redirection (like UNIX and MS-DOS) to the whole mess. Unfortunately, I've run out of room (actually, part of the last column was cut due to my running off at the mouth). Also,

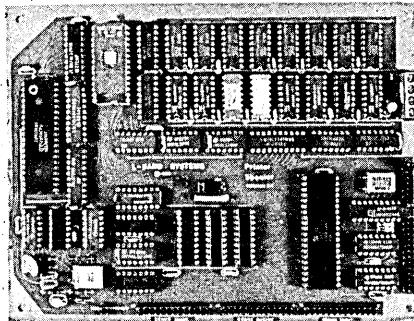
I have to admit that I don't have all the bugs chased away yet, so I guess it'll have to wait until next time.

In the meantime I'll tell those of you who are anxious that the way to do it is to modify the INT 224 vector (at location 0000:(224\*4)) to point to your own BDOS intercept routine that checks for console input and output and processes it accordingly. The intercept routine should make the actual calls to BDOS through INT 225 (which is set equal to INT 224 at boot time). You must remember that the INT 224 & 225 vectors are considered part of a process's environment and are therefore saved and restored on each task switch. Also remember that a new process inherits the INT 224 & 225 vectors of its parent (the process which created it — in our case, SHELL).

#### A Non-IBM Sidekick

By the way, this same method could be used for special "filters" under standard CP/M and MS-DOS, as well

## HARDWARE SPOOLER and INTERFACE CONVERTER



- 128 K PRINT BUFFER
- CENTRONICS OR SERIAL INPUT/OUTPUT
- MULTIPLE PROTOCOLS
- 5½ X 7½ INCH BOARD
- + 5 Volts at .75 Amp
- ± 12 Volts at .1 Amp

The L-BAND SYSTEMS hardware spooler is a Z80 based unit that provides a 128 K byte buffer and interface conversion between Centronics and serial. Input and output may be either parallel or serial at various baud rates and with several protocols. Multiple copy and single sheet feed are supported.

BARE BOARD with EPROM (2732) and program listings . . . . .	\$ 39.95
DISK with program source, 8-inch SSD . . . . .	10.95
MINI KIT board, EPROM, headers, crystals (less disk) . . . . .	59.95
*PARTIAL KIT all parts EXCEPT RAMS . . . . .	109.95
*ASSEMBLED and TESTED BOARD (128 K) . . . . .	259.95
WALL MOUNT POWER SUPPLY . . . . .	39.95

California Orders Add 6.5% Sales Tax  
Shipped via UPS — Check or Money Orders to:

### L-BAND SYSTEMS

1037 E. Lemon Ave.  
Monrovia, CA 91016  
(818) 357-0566

\*Not available for export.

as CCP/M. In these cases however, you'll have to save the old vector (INT 224 for CP/M and INT 21h for MS-DOS) since there's no duplicate in the interrupt tables in low memory (of course, you could PUT one there if you wanted ...). Some really nice Sidekick-like programs that wouldn't be IBM dependent could be created this way, although for something like Sidekick you'd need to do a "terminate but keep" system call so the intercept code would stay in memory while allowing you to go back to the command interpreter.

This is done in CP/M by executing system call 0 (Terminate Process) with register DL set to a 1.

In MS-DOS, use system call 31h (Terminate but Keep) with register DX set to the number of paragraphs (1 paragraph = 16 bytes) you want to keep.

If you want to put an intercept routine in memory and return to the command processor in Concurrent CP/M, after initializing the intercept vector

just release the console (function 93h), set the process's priority (function 91h) to OFFh (as low as it goes), and then do a "console attach" function (92h) which will effectively cause the process to be indefinitely (a fancy way of saying "forever") suspended.

### Some Ideas

Intercept routines could be used for much more than silly calculators (the TI on my desk works just fine) and ASCII tables (in the Z80 opcodes booklet, thanks). Some ideas of what to do with them:

1. Create new (B)DOS calls for things like extra I/O devices and fancy line input system calls.
2. Enhance existing system calls, for instance encrypting all output to a file according to a password.
3. Check an appointment calendar every time a system call is made to see if you're forgetting something.
4. Allow suspending the current program to run another upon input of a certain "wake up" key.

5. Log all accesses to a "sensitive" document (as well as making everyone log on to the computer) so you can tell who's been peeking.

The list goes on and on, so go out there and DO SOMETHING! OKAY???

### The End (Finis)

No more now. Next time we'll get back to SHELL. I finally have Microsoft's MASM and DRI's RASM. I might have a few words comparing them, too.

I'll also have some stories to tell about Taiwanese computers and manufacturers. We just got our first computer from Taiwan out of customs today, and I'm sure by the time I sit down to draw up the next column I'll have lots of great (horror) stories to tell.

Until then: Gule Gule, Au Revoir, catch you on the rebound, later on, peace baby, good bye.



## Write-Hand Man

### "Almost a Sidekick for CP/M"

Ted Silveira—Computer Currents, Aug. 27, 1985

### "WHM is ingenious and works as intended"

Jerry Pournelle, BYTE Magazine, Sept. 1985 (c) McGraw-Hill

#### Now available for CP/M 2.2, CP/M 3.0 and ZRDOS!

The convenience of *Sidekick* on your CP/M machine! Trigger Write-Hand-Man with a single keystroke and a window pops open to run desk accessories. Exit Write-Hand-Man and both the screen and program are restored. Use with any CP/M program and most any CP/M machine. Takes only 5K of memory.

#### FEATURES

Notepad for quick notes	File and Directory viewer
Appointment calendar	Quick access phonebook
HEX calculator	14 digit decimal calculator

#### BONUS

Add applications written by you or others! No other "Sidekick" lets you add applications. Dump screens, setup printers, communicate with other computers, display the date and time. Let your imagination run wild!

**\$49.95** (California residents add tax), shipping included. COD add \$2. Sorry, no credit cards or purchase orders. 30 day guarantee. Formats: 8 inch IBM, Northstar and most 5 inch (please specify).

Write-Hand-Man only works with CP/M 2.2, ZRDOS and CP/M 3.0 (please specify). Simple terminal configuration required. Not available for TurboDOS. Compatible with keyboard extenders, hard disks, and other accessories.

#### Poor Person Software

3721 Starr King Circle  
Palo Alto, CA 94306  
415-493-3735

Trademarks: Write-Hand-Man — Poor Person Software, CP/M—Digital Research, Sidekick—Borland International

## THE PROVEN MICRO FAMILY for all the INDUSTRY APPLICATIONS



• SLICER S.B.C. W 80186 CPU, 256K Ram, 32K Eprom, 2-RS232 Ports, SASI & Floppy Ports.	\$695.00
A&T . . . . .	595.00
128K Ram . . . . .	495.00
No Ram . . . . .	
• 1 MEG Memory/Port Exp. Board, up to 1 MEG additional Ram, 4 additional Serial Ports, Real Time Clock with Batt. Backup, A&T . . . . .	\$495.00
• PC Exp. Board, Monochrome Video & Keyboard Port, Spec. Graphics & Card Slots available, 8 pages of Video Memory, A&T . . . . .	\$495.00
• 8087 Math Co-Processor Board (without 8087 & C-Step CPU). A&T . . . . .	300.00
• 10MB Hard Disk ½H 5½" . . . . .	550.00
• WD 1002SH Controller Board . . . . .	200.00
• SLICER Enclosure, 135W Power Supply, Floppy & Hard Disk Drives & Misc. Support Hdw . . . . .	Call
• CP/M-86 (Digital Research Inc.) . . . . .	\$ 85.00
• CCP/M (Digital Research Inc.) . . . . .	250.00
• MS DOS (Micro-Soft Corp.) . . . . .	175.00
• NEWII M.A.C. & P.I.C. 80186 Boards . . . . .	Used as Stand Alone or with SLICER for Motion & Programmable I/O Control. M.A.C. is Multi-Axis Control Board which controls up to 4 Analog Outputs and 4 Incremental Encoder Inputs . . . . .
• P.I.C. Programmable Interface Control Board, 32 Inputs and 24 Outputs, 32KB Eprom, 4K Static Ram . . . . .	Call

2543 Marshall Street N.E.  
Minneapolis, MN 55418

(612) 788-9481  
BBS (612) 788-5909

# Porting A 68000 Assembler To The Atari ST

An introduction to 68000 assembly language.

*This is as good a look at 68000 addressing modes as I've seen. Bob looks at this from the inside as he defines how he's handling addressing with his assembler.*

*If you're thinking of moving from the Z80 or 8088 to the 68000 environment, definitely check this out.*

**A**bout a year ago, I decided to learn more about the 68000. I knew the Z80 inside out, and the 8086 family didn't seem to be much of an improvement on the Z80. Unfortunately, at that time the Macintosh was the only inexpensive 68000 system around, and is very much a closed boxed. HSC made a co-processor board that I could stick into my Kaypro, but I already had the co-power board, and co-processor boards don't allow much interaction with system hardware (since the system hardware is really the old Z80 hardware).

## My First 68000 System

I decided to build a small 68000 single board computer (similar to the one in the Jan. 1984 BYTE) and wait for the under-\$1000 system that Atari was just beginning to announce in the trade journals.

I needed an assembler for my little 68000 board. But assemblers are expensive, so I decided to write my own in C. Besides the cost savings, what better way to learn the instruction set of a microprocessor than to write an assembler for it? Also, by writing it in C I could port it to the Atari system if and when it became available.

## 68000 Registers

The 68000 is very much a programmer's processor compared to the Intel and Zilog CPUs. It contains 8 general purpose data registers (D0 to D7) which are functionally interchangeable. (There is no distinction between any of the data registers.)

There are 7 standard address registers (A0 to A6) plus A7 which holds the stack pointer. All registers are 32 bits, and data may be moved between registers in 32-bit (long word), 16-bit (word), and 8-bit (byte) chunks.

## Addressing Modes

In addition to its large number of general purpose registers the 68000 has a wide variety of addressing modes (for specifying the source and destination of an instruction). Deciding how to best use these was my first problem.

The basic addressing modes are pretty simple and are similar to most CPUs. The most basic mode is register direct — the source or destination operand is a register. For example:

move.l d0,d1

moves a long word (signified by the .l) from register d0 to register d1. Note that the operand order is source, destination the opposite of 8080, Z80, and 8086 assembler. In the case of register direct addressing the operands may be either data or address registers.

The immediate data mode is also common to most CPUs. In this mode the source operand is part of the instruction. For example:

move.b #10,d0

moves a byte (signified by the .b) value of 10 into the lower 8 bits of register d0. (The # indicates an immediate operand.)

## Absolute Addressing

The 68000 has two versions of the absolute addressing mode.

In the absolute long addressing mode a 32-bit address is specified as part of the instruction. For addressing data in the upper or lower 32K of address space the absolute short addressing mode may be used. In that

**By Robert G. Brown**  
53 Cliff Lane  
Levittown NY 11756  
(516) 935-2240

case a 2's compliment 16-bit integer is specified as part of the instruction, which is sign extended to 32 bits and used as the address of the operand. For example:

move.l 1000.w,100.l

moves the long word at address 1000 to address 100. The .w and .l in the operand fields indicate the short and long addressing mode respectively.

Another standard type of addressing mode is address register indirect in which the operand is at the memory location pointed to by an address register. For example:

move.w (a0),(a1)

moves a word (signified by the .w) from the location pointed to by a0 to the location pointed to by a1.

## Addressing Variations

There are several variations of address register indirect addressing on the 68000. Address register indirect with postincrement is one variation. In this case the operand is at the location pointed to by an address register. After the operand is fetched or stored, the address register is incremented by the length of the operand. (This is similar to the action the Z80 stack pointer takes on a POP instruction.) For example:

move.b (a0)+,(a1)+

moves a byte (signified by the .b) from the location pointed to by a0 to the location pointed to by a1. Then the values contained in a0 and a1 are incremented by 1.

The address register with predecrement is the exact opposite of the preceding mode. In this case the register decremented by the length of the operands and the operand are fetched or stored from the new location point-

ed to by the address register. (This is similar to the action the Z80 stack pointer takes on a PUSH.) For example:

```
move.l -(a0),-(a1)
```

decrements a0 and a1 by the length of a long word (yes, that's right — .l means long word), 4, and then moves the long word pointed to by a0 to the location pointed to by a1.

Yet another mode is address register indirect with displacement. In this mode the operand is found at the address created by summing the value in an address register with a sign extended 2's compliment 16-bit integer displacement. (This is similar to the IX and IY registers of the Z80.) For example:

```
move.w 10(a0),-10(a1)
```

moves a word from the memory location 10 greater than the value in a0 to the location -10 bytes away from the

location pointed to by a1.

The final address register mode is the address register indirect with index. In this mode the location of the operand is the sum of an address register, a signed extended 8-bit 2's compliment integer displacement and an index register. The index register may be either an address or data register and can be specified as the full 32-bit register or the lower 16 bits (sign extended to 32 bits). For example:

```
move.w 10(a0,d0.w),100(a1,a6.l)
```

calculates the source address from the value in a0, plus the sign extended value of the lower 16 bits in d0, plus 10. Then it calculates the destination address from the value in a1, plus the value in a6 (full 32 bits), plus 100. Then a word is moved from the source to the destination address.

Assembler implementation of the addressing modes described so far is pretty straightforward. With the absolute addressing modes, the absolute

address could be a straight numeric value or a label. For address register with displacement and address register with index, the displacement value could be specified by a symbol or by a direct numeric value.

The last two 68000 addressing modes are program counter relative, and it took a while to figure out how they should be implemented. I wanted my implementation to make sense and to be compatible with other 68000 assemblers.

#### The Program Counter

The program counter with index addressing mode is very similar to the address register with index addressing mode except the program counter is used instead of an address register. The address of the operand is determined by adding the value in the program counter with a sign extended 2's compliment 16-bit index.

Forcing the programmer to specify

(continued next page)

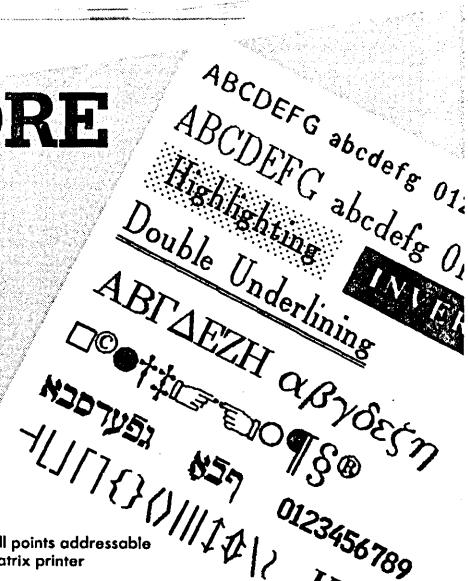
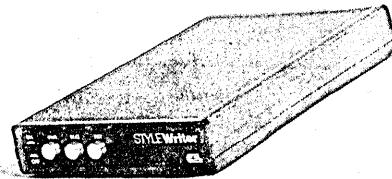
# STYLE Writer

For only \$59 extra . . .  
this high  
quality buffer  
gives you so much MORE

- Upgrade dot matrix printers\* to letter quality
- Over 100 type styles
- Double underlining, highlighting, inverse printing and right justification
- Foreign alphabets, scientific and mathematical characters
- Works with any computer, any software
- Basic stylewriter buffers come in 8K (\$139), 64K (\$169) & 128K (\$199) versions



For more information call 1-800-222-9073, (704) 525-4423  
or write • 818 Tyvola Rd./109 • Charlotte, NC 28210



\*Any all points addressable  
dot matrix printer

(continued from page 73)

an index to an address register makes sense because of the way address registers are used, but to implement the index the same way in a program counter relative mode doesn't make sense.

The usefulness of counter relative mode is its ability to access data that is within 32K of the current address more quickly than the absolute long addressing mode (only a 1 word index must be read compared to a 2 word address) and to access that data in a manner that is totally code position independent. So I implemented this mode like so:

```
move.w LABEL(pc),d0
```

In operation the word located at address LABEL is moved to register d0. The assembler calculates the index. This works the same as:

```
move.w LABEL.l,d0
```

with the differences being that the LABEL(pc) mode is slightly faster, the code produced using the LABEL(pc) mode may be loaded at any address, and in the LABEL(pc) case, LABEL must be within plus or minus 32K of the current address.

#### Program Counter With Index

The program counter with index addressing mode was implemented in the same manner. In this mode the operand address is the sum of the value of the program counter, signed extended 8-bit 2's compliment integer displacement and an index register. The index register may be either an address or data register and can be specified as the full 32-bit register or the lower 16 bits (sign extended to 32 bits). For example:

```
move.l LABEL(pc,d0.l),d1
```

moves a long word to register d1. The source address is the sum of the address LABEL and register d0. The assembler calculates the index from the difference between the current address and LABEL. LABEL must be within +129 bytes and -126 bytes of the start address of the instruction.

#### Whew!

After finishing the 68000's addressing modes and deciding what pseudo operations were most useful (I implemented define space, define constant, define constant block, ORG and EQU directives) the assembler started to come together. I wrote the boot code for my single board, ROMed it, and played with some simple routines.

#### Changing The Assembler For The ST

When my ST and development package arrived I knew I'd have to make several changes before my assembler would run on the ST.

The first change was one I had anticipated. The order of bytes in word and long word data on the 68000 is opposite of the Z80 and 8086. The 68000 stores data with the most significant byte (MSB) first (the Z80 stores the LSB first). In the Z80 version of the assembler all words and long words had to be flipped before being written to the object file. This code had to be rewritten for the 68000.

The rest of the changes had to do with the executable file format the ST uses. The ST operating system is GEMDOS which has many similarities to CP/M 68K and MS-DOS, with the addition of graphics support.

In CP/M 80 an executable (.com) file is an object file that always loads and runs from address 100 Hex. In GEMDOS the file must be able to load and run at any address. This allows the operating system to reside in lower memory but not be restricted to a certain size. It also makes multitasking possible (eventually).

Each executable file begins with a header, see Figure 1 for format.

As indicated by the header information, a GEMDOS executable file may contain up to 4 segments. The first is the text segment; it contains all the code. The second is the data segment; it contains the initialized data. Both the text and data segments occupy disk space, and in the case of the 68000 there is no need to distinguish between these two segments.

I believe that the separate definitions of these segments is due to the 8086 segmented addressing. In the case of the 8086 the data segment register would have to be set to point to the start of initialized data. For my 68000 assembler I elected to have only the text segment, since initialized data can also be stored there.

The third segment is the bss (block storage segment), which reserves storage for initialized data. Unlike most Z80 assemblers where DS directives take up disk space, the DS directives within the bss take up no disk space; they only reserve memory space. This directive is implemented on my assembler as a one-time option — once the bss directive is turned on, it stays on to the end of the file.

The forth segment is a symbol table. It's only necessary if the assembler produces linkable files. This assembler does not so there is no symbol table.

Following the header come the text and data segments (and symbol table if it exists). At the end of the file is the file relocation information.

When an executable GEMDOS file is loaded into memory, the relocation

Figure 1 - Format for Headers

address	length	comments
0000	word	always 601A
0002	long word	length of text segment
0006	long word	length of data segment
000A	long word	length of bss
000E	long word	length of symbol table
0012	long word	always 0
0016	long word	always 0
001A	word	always 0
001C		start of code

information is used to adjust the file for execution at its load address. The relocation information indicates the relative address of long words in the text segment. These must be adjusted for the load address of the file. A simple example should make this need somewhat clearer. The useless program:

```
start    nop      *do nothing
        jmp     start  *jump to start
end
```

is your basic endless loop. A nop is executed followed by a jump to the nop.

If this were assembled to run at address 000000 the label start would have a value of 0. If this program were loaded at address 1000 all references to start would have to be adjusted to have a value of 1000. In this case the long word in the jump instruction would have to be adjusted to 1000.

The relocation information has to indicate that byte 4 in the program

(the nop is at bytes 0 and 1, and the opcode for the jump is bytes 2 and 3) is a long word that must be adjusted for the load address.

#### Writer's Rules

This presents a problem for the assembler writer — what should be relocatable? After much thought I devised a set of rules that I think properly covers most circumstances.

1. Any expression that contains the current address operand (\*) is not relocatable. My reasoning is that the \* operand is only useful in expressions where a difference is taken between a label and the current address, producing a relative address, that should not be adjusted on loading.

2. All expressions that refer to a program label (even indirectly, for example: symbol equ label+2) are relocatable.

3. All other expressions are not relocatable. This allows a programmer to access an absolute address (via symbol).

#### Addressing Mode Restrictions

The relocation of files at load time places some restrictions on the use of some of the 68000 addressing modes.

1. The absolute short mode may not be used to reference a label. The assembler defaults to the absolute long mode unless explicitly specified.

2. The program counter relative addressing modes may not be used to reference absolute addresses.

#### Finally

Now that I have the assembler working I may turn my attention to modifying Small C to run on the ST. I would like to hear from any Micro C readers who are doing anything with Small C for the 68000 or are working with the ST.



1771 Junction Ave. • San Jose, CA 95112 • (408) 295-7171  
Shipping charged on all orders. Minimum order: \$15.00. Please call on all orders as items are limited to quantities on hand.  
Prices subject to change without notice. *C.O.D., Prepaid or Master Card or Visa orders only.*  
**NO OPEN ACCOUNTS / NO FOREIGN ORDERS, PLEASE!**

#### POWER SUPPLIES:

ACDC OEM 5N17-1, 5V@17A, 10"x5"x5", 14lbs.	\$45.00
Trygon LBS6-24-OV, 4.8-6.8V@24A, 6"x17"x8", 36 lbs.	\$60.00
Lambda LXS-D-5-OV, 5V@27.5A 7 1/2"x7 1/2"x9 1/4", 22 lbs.	\$60.00
Sorenson SSD9-50, 9V@50A switcher, 7 1/2"x5 1/2"x12 1/4", 13 lbs.	\$175.00
Standard Power 20A B 12, 12V@5A unregulated 4 1/2"x8 1/4"x5 1/2", 12 lbs.	\$20.00
ACDC 15N5-1, 15V@5A, 10"x4"x5", 6lbs.	\$75.00
Standard Power 200 B 16, 16V@12.5A unregulated 4 1/2"x8 1/4"x5 1/2", 12 lbs.	\$15.00
Sorenson SLC-20, 20V@5A, 5 1/4"x3 1/2"x8 1/4", 4 lbs.	\$40.00
Sorenson SSD24-8.5, 24V@8.5A 5 1/4"x3 1/2"x10", 5 lbs.	\$90.00
Astec AA11261, 5V@6A 28V@1A, unregulated switcher, 7 1/2"x4 1/2"x2"	\$50.00
130W power supply, IBM PC compatible	\$140.00
HB5-3, 5V@3A Linear, 4"x5"x2"	\$15.00
CP411, 5V@8A, -5V@3A, +12V@1.2A, -12V@1A, +24V@2.5A, 5A(surge) 16 1/2"x5"x3" Linear, (Good for 8" Hard Disks, and 5 1/4" Floppies)	\$35.00
CP417, 5V@4A, 12V@2.5A(Avg.) 7.5A(Surge) Linear, 8 1/2"x5"x3" (Good for 5 1/4" Hard Disks)	\$50.00
ACDC, 551-111, 5V@8A, ±12V@1.7A Linear, 11"x5"x3" (Good for 5 1/4" Floppies, or Low Current Hard Disks)	\$35.00
Osborne Power Supply +5V@2.5A, +12V@2.02A, -12V@1A Switcher, 6 1/4"x4"x2" (Good for 5 1/4" Floppies)	\$18.00

#### CASES WITH POWER SUPPLIES:

For one full ht., or two half ht. 5 1/4" floppies.	\$96.00
For one full ht. or two low pwr. half ht. hard disks.	\$200.00

#### DISK DRIVE BONANZA:

##### DISK DRIVES:

SURPLUS Tandon TM501-full ht., 5 megabyte formatted. One platter, two heads, access: 85 msec., 612 tracks, 306 cylinders, +12V@1.5A typical, 5 max, 5V@.8A	\$119.00
SURPLUS Tandon TM502-full ht., 10 megabyte formatted. Two platters, four heads, access: 85 msec., 1,224 tracks, 306 cylinders	\$225.00
SURPLUS TM 503-full ht., 15 megabyte formatted. Three platters, six heads, access: 85 msec., 1,836 tracks, 306 cylinders	\$340.00
SURPLUS TM 602S-full ht., 5 megabyte formatted. Twe platter <del>1 SOLD OUT</del> , access: 99 msec. 612 tracks, 1 cylinder	\$95.00
SURPLUS Tandon TM 603SE-full ht., 11 megabyte formatted. Three platter, six head, access: 137 msec. 1,380 tracks, 230 cylinders	\$225.00
NEW TEAC SD510, half ht., 10 megabyte, requires 130W power supply for P.C.	\$380.00
NEW Shugart SA455/Panasonic JA55112N- 5 1/4", half height, 48TPI, 40 track, 6msec. double sided	\$99.00
NEW TEAC FD55BV-48 TPI, 40 track, 6msec., half height, double sided	\$109.00
NEW TEAC FD55FV-5 1/4", half height, 96TPI, 80track, 3msec., double sided	\$149.00
NEW TEAC FD55 GFV-AT-5 1/4", 1.2 megabyte floppy for IBM PC-AT	\$175.00
NEW TEAC FD55F-3 1/4", 80 track, 135 TPI, double sided	\$180.00

#### DISK DRIVES: (continued)

NEW TEAC FD35E-3 1/2", 80 track, 135 TPI, single sided,	\$168.00
SURPLUS Shugart SA450-5 1/4", full height, 48 TPI, 40 track, 25 msec. track to track, double sided	\$75.00

#### HARD DISK CONTROLLER CARDS:

NEW DTC 5150 BX, for IBM PC- Without Data Cables	\$185.00
With Data Cables	\$195.00
NEW DTC 5250-will run two 5 1/4" floppies and two 5 1/4" hard disks. For example two TEAC FD55B, one Microscience HH725 20 megabyte fixed hard disk, and one Syquest SQ306R 5 megabyte removable hard disk.	\$360.00
NEW DTC 5290-For IBM PC-AT, will run 5 1/4" floppies and hard disks	\$325.00
NEW Western Digital WD1002-WX2-for IBM PC Without Data Cables	\$170.00
With Data Cables	\$180.00
NEW WD W1002-WA2-for IBM PC-AT Will run 5 1/4" floppies and hard disks	\$299.00

\* All drives with asterisk are compatible with the IBM PCTM as 360K or 380K drives. Half height drives may require mounting brackets or filler plates not supplied with the drive.

When ordering controller cards please indicate the model of drive you will be using, and the number of heads, cylinders and formatted capacity of the drive.

All drives carry a 90-day guarantee.

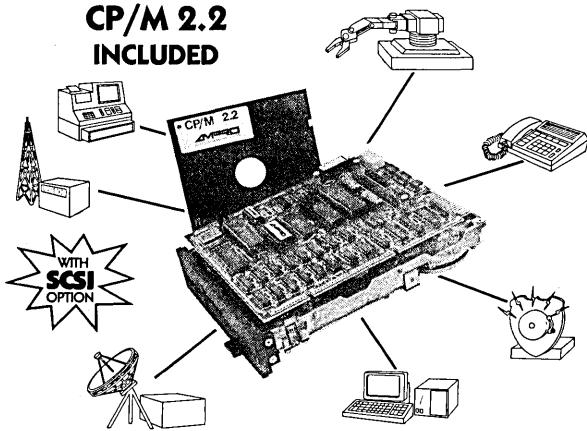
#### GAVILAN PARTS:

32K RAM Capsules	20.00
64K RAM Capsules (no plastic)	40.00
	3/100.00
Thermal Paper	3.50
Boot Rom Board with 56K Ram Drive	65.00
Printer Battery Packs	13.00

# Little Board™ .... \$249

The World's Least Expensive CP/M Engine

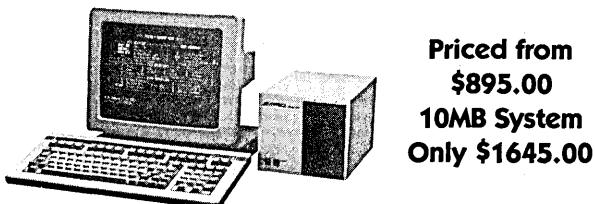
## CP/M 2.2 INCLUDED



- 4 MHz Z80A CPU, 64K RAM, Z80A CTC, 4-32K EPROM
- Mini/Micro Floppy Controller (1-4 Drives, Single/Double Density, 1-2 sided 40/80 track)
- 2 RS232C Serial Ports (75-9600 baud & 75-38, 400 baud), 1 Centronics Printer Port
- Power Requirement: +5VDC at .75A; +12VDC at .05A / On board -12V converter
- Only 5.75 x 7.75 inches, mounts directly to a 5-1/4" disk drive
- Comprehensive Software Included:
  - Enhanced CP/M 2.2 operating system with ZCPR3
  - Read/write/format dozens of floppy formats (IBM PC-DOS, KAYPRO, OSBORNE, MORROW...)
  - Menu-based system customization
  - Operator-friendly MENU shell
- OPTIONS:
  - Source Code
  - TurboDOS
  - ZRDOS
  - Hard disk expansion to 60 megabytes
  - SCSI/PLUS™ multi-master I/O expansion bus
  - Local Area Network
  - STD Bus Adapter

## BOOKSHELF™ Series 100

Fast, Compact, High Quality, Easy-to-use CP/M System



Priced from  
\$895.00  
10MB System  
Only \$1645.00

- Ready-to-use professional CP/M computer system
- Works with any RS232C ASCII terminal (not included)
- Network available
- Compact 7.3 x 6.5 x 10.5 inches, 12.5 pounds, all-metal construction
- Powerful and Versatile:
  - Based on Little Board single-board computer
  - One or two 400 or 800 KB floppy drives
  - 10-MB internal hard disk drive option
- Comprehensive Software Included:
  - Enhanced CP/M operating system with ZCPR3
  - Word processing, spreadsheet, relational database, spelling checker, and data encrypt/decrypt (T/MAKER III™)
  - Operator-friendly shells; Menu, Friendly™
  - Read/write and format dozens of floppy formats (IBM PC-DOS, KAYPRO, OSBORNE, MORROW...)
  - Menu-based system customization

### DISTRIBUTORS

**ARGENTINA:** FACTORIAL, S.A., (1) 41-0018, TLX 92408 **BELGIUM:** CENTRE ELECTRONIQUE LEMPEREUR, (041) 93-4541, TLX 42621 **CANADA:** DYNACOMP COMPUTER SYSTEMS LTD., (604) 872-7737 **ENGLAND:** QUANT SYSTEMS, (01) 253-8423, TLX 946240 REF:19003131 **FRANCE:** EGAL+, (1) 502-1800, TLX 620893 **SPAIN:** XENIOS INFORMATICA, 593-0829, TLX 50364 **AUSTRALIA:** ASP

**MICROCOMPUTERS,** (613) 500-0628 **BRAZIL:** CNC-DATA LEADER LTD., (41) 262-2262, TLX 041-6364 **DENMARK:** DANBIT, (03) 66-20-20, TLX 43558 **FINLAND:** SYMMETRIC OY, (0) 585-322, TLX 121394 **ISRAEL:** ALPHA TERMINALS, LTD., (3) 49-16-95, TLX 341667 **SWEDEN:** AB AKTA, (08) 54-20-20, TLX 13702 **USA:** CONTACT AMPRO COMPUTERS INC., TEL: (415) 962-0230 TELEX: 4940302

IBM®, IBM Corp.; Z80A®, Zilog, Inc.; CP/M®, Digital Research; ZCPR3™ & ZRDOS™, Echelon, Inc.; Turbo DOS®, Software 2000, Inc.; T/MAKER III™, T/Maker Co.

**AMPRO**  
COMPUTERS. INCORPORATED

67 East Evelyn Ave. • Mountain View, CA 94041 • (415) 962-0230 • TELEX 4940302

## EDITORIAL

(continued from page 2)

head for the slopes (or dinner), but on other days, 5 pm will see a discussion so hot that it won't let up until hungry mates start calling in missing-writer reports.

Latest topics have included: Private Domain, choice of articles (a lightly camouflaged way of discussing where we are going), how to increase circulation, what happened to all the drives, how to let people know that a particular company is particularly supportive or particularly otherwise.

Real answers don't show up very often, but the discussions are as good as those I remember in philosophy class. Philosophy was a great class.

### Articles

Lately, the hottest topic has been article selection (magazine direction). A year ago, a hardware mod to a Big Board was in, automatically. Now, it has to be very, very good.

Then, an inside look at CP/M 80 was a sure fire hit; now we check to see if there's a way to generalize it so owners of other systems can use the information. We're moving, feeling our way, and trying to keep up with the new, while maintaining reasonable support for the old.

Of course, when you get involved in a new system it takes some real effort up front. If the system turns into a slackwater pond, far from the mainstream, then it may well be a loser for us and for our readers who've purchased the system.

But it's not all cut and dried (an old fishing cliche). When you're sitting right up front, it's often difficult to know what's going to become a full blown river and what's going to dry up. For instance, should you develop software for the Commodore Amiga or the Atari ST? Both? Neither?

### In The Beginning

I started Micro C to support a single board computer kit called the Big Board. When you bought the Big Board you got a board and a bag full of parts. It was definitely a do-it-yourself system, but it wasn't a backwater system. Once all those parts were together (properly) they ran CP/M.

Now there are many board-level computers; some make sense, some don't.

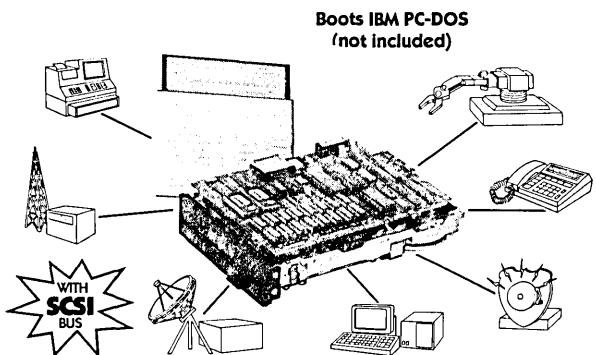
### Choices

An engineer takes a calculated risk when he designs a computer around a new operating system. If the operating system becomes popular and he has one of the first systems, then he could be immensely successful. If he chooses wrong, then he (and his early customers) could lose a lot of time and money.

The Slicer designers assumed that CP/M 86 would be a

# Little Board™ /186.... \$495

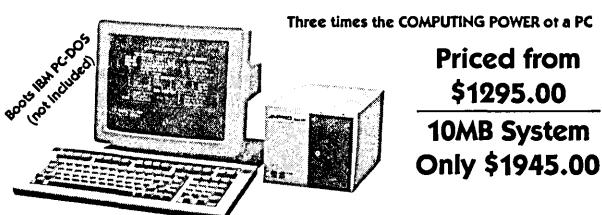
## High Performance, Low Cost PC-DOS Engine



- Three times the COMPUTING POWER of a PC
- Data and File Compatible with IBM PC, runs "MS-DOS generic" programs
- 8 MHz 80186 CPU, DMA, Counter/Timers, 128/512K RAM zero wait states, 16-128K EPROM
- Mini/Micro Floppy Controller (1-4 Drives, Single/Double Density, 1-2 sides, 40/80 track)
- 2 RS232C Serial Ports (50-38,400 baud), 1 Centronics Printer Port
- Only 5.75 x 7.75 inches, mounts directly to a 5-1/4" disk drive
- Power Requirement: +5VDC at 1.25A; +12VDC at .05A; On board -12V converter
- SCSI/PLUS™ multi-master I/O expansion bus
- Software Included:
  - PC-DOS compatible ROM-BIOS boots DOS 2.x and 3.x
  - Hard Disk support
- OPTIONS:
  - Expansion board with:
    - 128 or 512K additional RAM
    - 2 Sync/Acyclic RS232/422 serial ports
    - Battery backed Real Time Clock
    - 8087 Math Co-Processor
    - Buffered I/O Bus
    - STD Bus Adapter
    - Utilities source code
    - TurboDOS / Networking

# BOOKSHELF™ Series 200

## Fast, compact, high quality, versatile PC-DOS system



Three times the COMPUTING POWER of a PC

Priced from  
\$1295.00  
**10MB System  
Only \$1945.00**

- Data and File compatible with IBM PC-DOS 2.x and 3.x
- Runs "MS-DOS generic" programs (DBase II, Multiplan, Wordstar, Supercalc 2, Turbo Pascal, Fortran 77, Microsoft C, Lattice C, IBM Macro Assembler, Intel compilers & tools, GW Basic, etc.....)
- Works with any RS232C ASCII terminal (not included)
- Compact 7.3 x 6.5 x 10.5 inches, 12.5 pounds, all metal construction
- Based on Little Board/186
  - 512K RAM, no wait states
  - Two RS232 serial ports
  - One Centronics printer port
  - One or two 360 Kb floppy drives
  - 10MB internal hard disk drive option
- Software Included:
  - PC-DOS Compatible ROM-BIOS boots DOS 2.x and 3.x
  - Hard Disk Support
  - T/Maker III — Word processing, spreadsheet, relational database, spelling checker, and data encrypt/decrypt
- Expandable:
  - Floppy expansion to four drives
  - Hard disk and tape expansion
  - SCSI/PLUS™ multi-master I/O expansion bus

### DISTRIBUTORS

- ARGENTINA: FACTORIAL, S.A., (1) 41-0018, TLX 92408 BELGIUM: CENTRE ELECTRONIQUE LEAPEURER, (041) 33-4541, TLX 42621 CANADA: DYNACOMP COMPUTER SYSTEMS LTD., (604) 872-7737 ENGLAND: QUANT SYSTEMS, (01) 253-8423, TLX 946240 REF:19003131 FRANCE: EGAL+, (1) 502-1800, TLX 620893 SPAIN: XENIOS INFORMATICA, 593-0822, TLX 50364 AUSTRALIA: ASP
- MICROCOMPUTERS, (613) 500-0628 BRAZIL: CNC-DATA LEADER LTD., (41) 262-2269, TLX 041-6364 DENMARK: DANBIT, (03) 66-20-20, TLX 43558 FINLAND: SYMMETRIC OY, (0) 585-322, TLX 121394 ISRAEL: ALPHA TERMINALS, LTD., (3) 49-16-95, TLX 341667 SWEDEN: AB AKTA, (08) 54-20-20, TLX 13702 USA: CONTACT AMPRO COMPUTERS INC., TEL: (415) 962-0230 TELEX: 4940302

IBM®, IBM Corp.; 80186®, Intel Corp.; TurboDOS®, Software 2000, Inc., DBase II®, Ashton-Tate, Wordstar®, Micropro, Inc.; Supercalc 2®, Sorcom, Inc.; Turbo Pascal®, Borland, Int'l, Inc.; Microsoft®, GW Basic®, Multiplan®, Microsoft, Inc.; Lattice C®, Lattice, Inc.



67 East Evelyn Ave. • Mountain View, CA 94041 • (415) 962-0230 • TELEX 4940302

MICRO CORNUCOPIA, #29, April-May 1986

popular operating system, and for a short while it looked like they were right. After all, if straight CP/M 86 weren't going, there would soon be the concurrent version which would run MS-DOS software and support multiple tasks.

However, the hottest, fanciest packages were written by people who thought hardware was part of the operating system (see the C column in this issue). So even a system that supports generic MS-DOS has been left out. What can the generics run? A few compilers, assemblers, and an odd applications program or two.

The X-16 was the Slicer designers' response to the problems with the Slicer (which is still a nice machine if you don't need to run clone software). The Slicer graphics board, their first attempt at compatibility, hasn't really been PC compatible.

### New Processors, New Problems

Now, of course, we're including all kinds of new processors and operating systems. That means we've greatly expanded what we can talk about.

But what happens when someone comes up with an article about an assembled and tested single-board 68000 computer that runs OS-9? What's available for OS-9? A few compilers, assemblers, and an odd applications program. OS-9 has been around for a while and it has a lot to offer, but it's definitely a backwater operating system.

Do we just run articles about the PC, the Amiga, or the Atari ST? Nope. But until the 68000, for instance, gets a viable standard operating system (perhaps mimicking the Atari), it doesn't make sense for us to spend much time with expensive assembled and tested 68000 boards that run very little.

So what are we interested in? A build-it-yourself 68000/32032/80386 (or whatever) system. Even if you don't actually build it, the information about design and construction with one of the newest processors should be very enlightening.

And if you do build it, the experience alone will be worth the price of admission. If it also supported a standard operating system, graphics, sound — ran bunches of software — that'd be a real bonus.

But that's not all. Some folks are taking standard systems and going one step farther, e.g. the Definicon Board. Others are finding really inexpensive ways to build compatible systems without paying homage to Big Blue. There's really a lot to learn and much to do (about something).

### Concurrent CP/M

Every operating system has its supporters, and it seems

(continued on page 79)

# ERAC CO.

8280 Clairemont Mesa Blvd., Suite 117

San Diego, California 92111

(619) 569-1864

Call for our Test Equipment Mailer!

## KAYPRO EQUIPMENT

9" Amber CRT	\$39.00
9" Green Monitor	35.00
12" Green Monitor	45.00
81 Series ROM's	7.00
Keyboard (Kaypro)	75.00
Keyboard Siemens w/case	65.00
Wiring Harness	7.50

## KAYPRO MAINBOARDS

K2 With Sockets	\$39.00
K2 Populated - Tested	129.00
K2 with PR08-3 Mod.	239.00
<i>This one runs at 2.4 &amp; 5 MHz, up to 4 drives SS, DS, or Quad drives. New ROM has screen dump and step speed select. With manual &amp; software, tested and guaranteed 30 days.</i>	
K2 PR08-2 Mod. EXCHANGE	149.00
<i>We will update your K2 or K4 as above. Mail working Main board.</i>	

We can install double or quad drives and check complete package . . . . CALL  
K10 Populated - Tested . . . . 250.00  
WD1002-5 Hard Disk Controller . . . . 200.00  
WD1002-5 Hard Disk Controller . . . . 200.00  
Host Interface Board . . . . 5.00

## CABINETS

K10	\$45.00
<i>Bottom portion with front and back only.</i>	
CRT Bezel	12.00

## SUBSTITUTE CABINET

*This cabinet has a 12" green monitor on top that swivels left to right with a 3-position vertical movement. The base is 16"x18"x5" and contains a switching power supply. It has room for the main board, two drives, a modem and whatever else you want to stuff in it. It comes with a Siemens keyboard with case and is programmed like the Kaypro keyboard with many extra Wordstar and CPM commands. The whole cabinet is color-coordinated and sharp looking. Nobody will ever suspect this is a Kaypro. Now you can build the classiest Kaypro computer ever for less than \$550.00. The complete cabinet is a steal at . . . . \$179.00*

## MISC. CABLES

9" 50 Pin - 50 Pin Header	\$2.50
14" 40 Pin - 40 Pin Header	2.25
9" Hard Disk - 20 Pin Header	2.00
14" Dual Inline 16 Pin Male (2)	2.00
Coiled Keyboard Cable	1.50

Pioneer LD700 Laser Video Disk Player	\$299.00
Wireless Remote Control	.55.00

## ERAC CO.

8280 CLAIREMONT MESA BLVD., SUITE 117  
SAN DIEGO, CA 92111 (619) 569-1864

**HOURS:** Mon. - Fri. 9 - 6 — Sat. 10 - 4  
**TERMS:** VISA, MasterCard, Certified Checks, Money Order, NO COD. Visa and MasterCard add 3%. Personal checks must clear BEFORE we ship. Include shipping charges. California residents add 6% Sales Tax. For more info please call — DON'T WRITE! We don't have time to answer your letters.

## ★ SPECIALS ★

★★★★★★★★★★★★★★★★  
Bahco Wire Cutter "Swedish" . . . . 6.95  
★★★★★★★★★★★★★★

### CPU/SUPPORT

MC68000-8 CPU	\$12.50
C80186-3	27.00
C80186-6	9.00
Z80 CPU	1.00
Z80A CPU	2.50
Z80A PIO	2.50
Z80A SIO	5.00
Z80A DMA	10.00
8088	10.00
8089-3	29.00
D8742 CPU/EPROM 12 MHz	20.00
D8284A	3.00
D8288	9.00
4164-15	.90
41256-15	2.50
41256-12	2.75

### MODEM

TMS 99532 (Modem) . . . . \$12.00

### FLOPPY CONTROLLER

WD 1791	\$9.00
WD 1793	5.00
WD 1797	7.00
WD 2797	9.50

### BAUD GENERATOR

WD 8116 . . . . \$4.50

### MISCELLANEOUS

UC3524 Sw. Reg.	\$.85
WD1010	20.00
WD1014	28.00
WD1015	28.00
MM58167A Clock Chip	5.50
CA301 Op Amp	.35
CA083 Op Amp	.45
2N3055	.70
2N6852	1.00

### Voltage Regulators

LM323K + 5V - 3A	4.50
LM78H12 + 12V - 5A	5.00

6116 2Kx8 Static Ram . . . . 1.50

### VIDEO CONTROLLER

6545	\$7.00
6545A-1	8.00
6845	6.00

### EPROMS

2716	\$3.50
2732	3.75
2764	2.25
2764-25	3.50

### 74LS SERIES

HC00	\$.35
HCU04	.40
LS 125	.40
LS 373	.60
LS 375	.60
4073	.35
7406	.40

### SOLAR CELLS

2½" x 5/16", .5V .5A . . . . \$2.25

### LOW PROFILE IC SOCKETS

8 Pin	50 per Tube	\$.250
14 Pin	25 per Tube	1.50
16 Pin	25 per Tube	2.25
18 Pin	25 per Tube	2.50
20 Pin	20 per Tube	2.00
24 Pin	20 per Tube	2.50
28 Pin	10 per Tube	2.00
40 Pin	10 per Tube	1.60

### PRINTERS

Centronics 703	\$395.00
Centronics 588	225.00
Centronics P1	105.00
Teletype 43KSR	300.00
NEC 2000 with Single Bin	

Cut Sheet Feeder . . . . 1200.00  
Transtar 315 Color . . . . 375.00

### S100

CCS 2200 12 slot MF	\$375.00
CCS 2810A CPU	210.00
2065 64K RAM	250.00
2422 FDC 5 ¼" & 8"	325.00
2718 I/O 2 Ser., 2 Par	225.00

### POWER SUPPLIES

— WALL PLUG-IN TYPE —  
6VAC - .95A . . . . \$1.35  
— LINEAR —  
Condor Model CP731 DC Power Supply  
+ 14V-4A, + 5V-7A, ± 15V-.5A . \$16.00  
Power Supply with  
Nicad Pack 12V .5AH . . . . 6.50  
14KV DC/DC TV Power Supply . . . . 4.50  
+ 5V/1A, - 5V/1A, + 12V/1A,  
- 12V/2A, - 24V/.05A . . . . 15.00

### SWITCHERS

5V-9.5A, 12V-3.8A, 112V-.8A	\$.39.00
5V-3A, 12V-2A, 112V-.4A	.29.00
5V - 10A	.25.00

### FLOPPY DISK DRIVES

— 1/3 HEIGHT —  
Okidata DSDD . . . . \$109.00  
Supplied w/sub-panel to make ½ ht.

— ½ HEIGHT —  
Mitsubishi M4853 DS Quad . . . . \$139.00  
Qume Trak 142 5 ¼" DSDD . . . . 99.00  
Tandon TM 848-1 8" SSDD . . . . 149.00

### — STANDARD HEIGHT —

Shugart SA460 DS Quad - As is	\$.36.00
Shugart SA850 8" DSDD	.199.00
Remex RFD4000	.199.00
Persci 277 2x8"	.399.00
All Instruction Manuals	10.00

### TERMINALS

InterTube II Smart (B&W)	\$.225.00
InteColor 3602 Smart (Color)	.329.00

### MISCELLANEOUS

Headset/Boom Microphone	\$.3.95
Lead Acid D Cell 2V - 2.5A	1.50
Nicad Pack 12V .5AH	6.50
5 Blade Muffin Fans	7.50
Joystick 4 Switches 1" Knob	5.50
Elgar 400W Unint. Power Sup.	425.00
16-Pin Component Carrier, Gold	.25

## EDITORIAL

(continued from page 77)

that the more out of favor an operating system is, the stancher its supporters.

CP/M 86 and Concurrent CP/M (CCPM) have their strengths, especially CCPM. After all, what else can handle concurrent processes, be compatible with MS-DOS, and costs only \$300? (Or has it been dropped to \$60?)

In a way, it's unfortunate that Digital Research hasn't gotten its due in this lemming world, but then, maybe it's getting it. After all, who was tanning on the beach while hundreds of thousands of CP/M 80 users (including me) were struggling to pony up \$150 for a very simple operating system? For that \$150 we received manuals and support that established new lows for an already unmanualed and unsupported industry.

When I first saw Gary Kildall speak at the West Coast Computer Faire, Digital Research was riding a wave that looked unending. Millions of bucks were just rolling in as regular as the tide. But when IBM went looking for an operating system for their new PC they found the DR staff out basking on the sand and MicroSoft folks hard at work. Also, DR supposedly demanded \$400 per copy for their operating system; MicroSoft was willing to live with \$60. Guess who IBM picked?

Eventually CP/M 86 died. CP/M+ didn't do much (especially after DR announced it wasn't supporting it and wouldn't sell it to individuals). So DR was left with two orphan operating systems, and CP/M 80. Somehow it only seems right. After all, what's a wave going to do? It just cruises along until it runs head first into a beach.

### Hello World

Anyone who's had any contact with C can trace his roots back to "Hello world." The first program in *The C Programming Language* by Kernighan & Ritchie displays this message.

Since this book has been the C book since 1978 (really, the only C book for a good share of that time), just about every C'er has said hello to the world at least once.

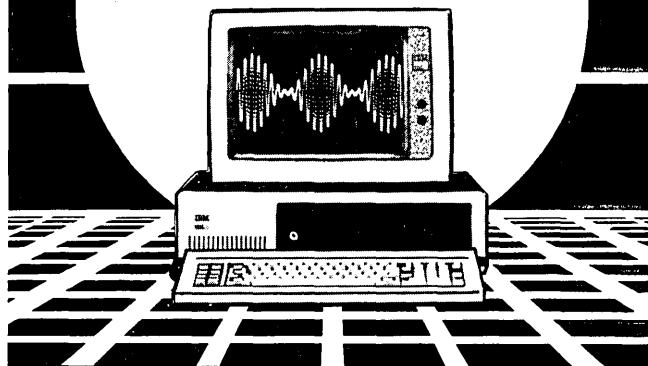
Lately, a lot more people have said their first hellos. C has replaced Pascal as the language for gurus. When I was using UNIX systems a few years ago, a lot of my coworkers were predicting that C would ride to fame and glory on UNIX's coattails.

But C has made it on its own (compare the number of C books in the store with the number of tomes aimed at UNIX). UNIX, if it makes it, will no doubt owe some of its success to C. There has always been a close relationship between C and UNIX. Dennis Ritchie (the co-author of the C manual) wrote UNIX for Bell Labs.

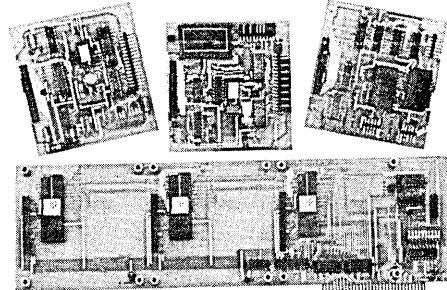
In the book, Ritchie comments: "The operating system,

(continued next page)

## WE BRING ENGINEERS, SCIENTISTS AND THE IBM-PC TOGETHER



### Modular Data Acquisition System



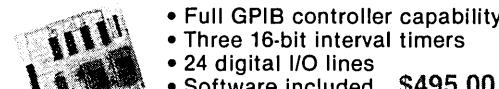
- |                          |                          |
|--------------------------|--------------------------|
| • 12-bit resolution      | • 8-bit resolution       |
| • 24-KHz throughput rate | • 30 KHz throughput rate |
| • 16 channel SE, 8 DI    | • 16 channel SE, 8 DI    |
| • LABSTAR Software       | • LABSTAR Software       |

\$690.00

- 8-bit resolution  
• 30 KHz throughput rate  
• 16 channel SE, 8 DI  
• LABSTAR Software

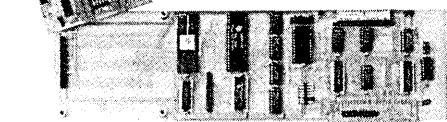
\$490.00

### IEEE-488 GPIB Multifunction Board

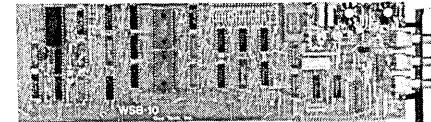


- Full GPIB controller capability
- Three 16-bit interval timers
- 24 digital I/O lines
- Software included

\$495.00

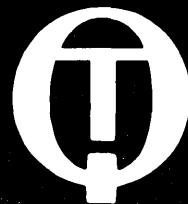


### Waveform Synthesizer Board



- Generates user-definable signal
- Up to 2000 points per envelop
- 200ns maximum output rate per point

\$795.00



**QUA TECH, INC.**

478 E. Exchange St.  
Akron, OH 44304  
(216) 434-3154

# EXPAND YOUR Productivity

CP/M MS DOS

**New:** The NEC V-20 improved 8088 Microprocessor — 10-45% increase in speed—just plug it in .. \$30.00

## Increase Memory . . .

- |  |         |
|--|---------|
| 1. Kaypro 16 256K-512K Memory Expansion .....  | \$69.95 |
| 2. Kaypro PC 256K-640K Memory Expansion .....  | \$69.95 |
| Both are simple plug-in installations; includes public domain RAM Disk software and other utility programs |         |

## Increase Visibility . . .

- |  |                            |
|--|----------------------------|
| 1. Composite Video Generator adds standard composite monitor to a Kaypro II or IV.....                   | <del>\$49.95</del> \$44.95 |
| 2. Composite Video Generator adds an unmodified composite monitor for Kaypro 1, 2-84, 2X, 4-84, 10 ..... | <del>\$89.95</del> \$84.95 |
| 3. External Monitor Adapter adds a TTL monitor to a Kaypro 1, 2-84, 2X, 4-84, 10 .....                   | <del>\$49.95</del> \$44.95 |

## Increase Programming Tools . . .

- |   |                              |
|---|------------------------------|
| 1. Color Graphics Board gives 16 colors, 32 sprites w/bit-mapped graphics; requires external monitor or TV; for any CP/M Kaypro ..... | <del>\$145.00</del> \$130.00 |
| 2. Deluxe TLC Logo "turtle" graphics language; for use with color graphics board .....  | \$129.95                     |
| 3. Color Board and Deluxe Logo package .....  | <del>199.95</del> \$179.95   |
| 4. Instant Grapher 2.1 gives labeled bar and line graphs; prints separate pattern for each color; use with color board only .....     | <del>\$40.00</del> \$29.95   |
| 5. Standard TLC Logo "turtle" graphics language uses internal graphics of Kaypro 1, 2-84, 2X, 4-84, 10.....                           | <del>\$99.00</del> \$79.00   |

## Increase Speed . . .

- |   |          |
|---|----------|
| 1. Electronic RAM Disk and Printer Buffer Combination — the ultimate add-on for Kaypro I, II, IV, 2X, 2-84, 4-84 & 10 computers. No longer will you need to wait for your Kaypro to slowly finish mundane tasks such as running a printer or waiting for floppy drives to turn when you have better things to do. |          |
| Tested RAM Disk without RAM chips.....  | \$295.00 |
| 256K RAM Disk .....   | \$345.00 |
| 512K RAM Disk .....   | \$395.00 |
| 768K RAM Disk .....   | \$445.00 |
| 1MB RAM Disk .....  | \$495.00 |
- \* Prices include all installation materials except for P10 Adapter Board required for Kaypro 10 w/out an external modem and optional on 1, 2-84, 2X, and 4-84.
2. Kaypro II to IV Upgrade includes 2.5 Mhz to 5 Mhz speed up, two 390K disk drives (DSDD) to replace the single sided drives; price does not include shipping .....

## Increase Challenge and Excitement . . .

Infocom's Interactive Adventure Games give hours of fun and education at a variety of skill levels. Old favorites and new releases.

\$5.00

Off Suggested  
Retail

CATALOG and COMPLETE DESCRIPTIONS AVAILABLE  
100's OF SOFTWARE LISTINGS FOR CP/M NOW AVAILABLE

MicroSphere, Inc.  
P.O. Box 1221  
Bend, Oregon 97709  
503-388-1194



## EDITORIAL

(continued from page 79)

the C compiler, and essentially all UNIX applications programs ... are written in C."

Hang on while I see if any of my eggs have laid chickens. We're obviously dealing with another case of immaterial conception (or was that immaculate deception?).

Despite its dubious beginnings, C has become the language of fanatics. C experience just about guarantees you a following (and a meal ticket) — and a C'er with artificial intelligence (inherited or otherwise) isn't safe on the streets, what with head hunters and all.

### C Vrs. FORTH

In some ways, C carries some of the same fascination as FORTH. FORTH is a language for insiders, because to the uninitiated it looks like pig Latin. C can be just as opaque.

FORTH forces you to understand what's going on inside the machine. C encourages the same.

Fortunately, however, C doesn't have to be obtuse. And, in fact, its conciseness can make the code even easier to read once you're familiar with its syntax (there are limits, however).

So, here we are with a C issue. Check out the C runoff, and start writing. You should be out to C if you're going anywhere at all.

### Which C?

That's a good question. See the Letters column and the C column for descriptions of two inexpensive Cs. For the expensive versions, (\$500 or so) the battle appears to be between Manx (Aztec C) and MicroSoft.

The main difference between the cheap versions and the expensive versions of C used to be floating point support. Now it's large model vrs. small model. In the small model you usually get 64K of code and 64K of data. In the large model you can choose to have code or data (or both) larger than 64K. The cheap compilers run the small model only. The expensive ones run both.

MicroSoft used to distribute Lattice, but now they have their own, and it's rumored to be better than Lattice. Aztec has been getting stronger and stronger (and cleaner and cleaner) as time and revisions roll by.

I like Manx because they're small, their error messages are very clear, their compiler is very fast, and I'm familiar with it, but when I listen to what others are saying (some of them have only MicroSoft C) it sounds like a horse race.

### Disappearing Drives

It has definitely been an interesting couple of months. Just after the first of January, Gary called a couple of cheap drive places — you know, the ones advertising \$79 apiece Mitsubishi double doubles. They were out. No drives.

So he called some of the more expensive places. They

too were out of stock. Even the buzzy little TEACs had vanished. Finally, after about two dozen calls, he located one Mitsu and four TEACs.

Where had all the drives gone? The general consensus around the office was that demand had caught up with supply. After all, memory prices have stabilized (or have started to back up) and suppliers are no longer pleading for orders.

However, I was suspicious. There were a lot of outfits in the back of Computer Shopper whose prices were still dropping. That meant they hadn't received much notice.

Also, a lot of people we called assumed they had drives in stock, and it was only when we insisted they look that they realized they were out (possibly a touch of scam there, but I wouldn't expect such sly trickery from all of them).

Allyn Franklin called a day later with some information about TEACs, so I took advantage of his nickel and asked if he knew what had happened to all the drives. The only thing he knew was that the quality of the drives he was getting on the surplus market had gone from marginal to absurd. (Kaypro has been forced to change brands on their new PCs, and the drives have been 100% dead on arrival.)

I mentioned I suspected that IBM might be gearing up for a big build of the PC-2s and might have hijacked three or four warehouses full of the little beasties.

Well, Allyn got on the horn to some old friends (like one of the founders of Tandon) and came back with the following: Tandon sued a group of Japanese drive manufacturers for violating Tandon patents. One of the primary defendants in that case was Mitsubishi, and because of the suit, Mitsubishi (and the others) stopped shipping drives into the U.S. Tandon finally lost the suit about a month ago, so the Japanese are again free to ship to the U.S. But for a while, at least, drives will be a bit short (quarter-height, say?).

#### Clonal Issue

It appears that big business has found out about the clones (what? they've forgotten IB...?). In fact, they are not only finding that the clones are cheaper, but also that they're generally more dependable.

More dependable? When IBM stands for "It's Better Made?" But IBM messed up when it discovered it could make more money by cutting costs to the bone. In the process they boned a lot of small manufacturers (drives, PC boards...), and those who wound up with the contracts have been pinching costs down to nothing.

While IBM was maximizing profits, the government of Taiwan was funding development of a BIOS ROM. It turned out to be a pretty good BIOS ROM.

The rest of the story is now unfolding. We'll no doubt see a PC-2 once the 80386 is available. I've heard that when the PC-2 shows up, IBM will drop prices on what's

(continued next page)

## Puzzles With Class

**E**veryone was a bit nervous that night. We'd taken a mid-term the previous evening and most of us expected great swaths of red across our papers. (In C class, both the compiler and the instructor can bite.)

Sure enough, Peter lived up to his reputation as one of the sneakiest C instructors ever turned loose on unsuspecting students (and this is an introductory C class). In fact, some of his teasers had been downright unfair.

For instance, consider the following C statements:

```
+ + * + + k;  
+ + + + k;  
m = j = 1 || k = 2;
```

Assuming m, j and k have already been defined as integers, and that we are following K&R C, what does each line do? Which lines (if any) are illegal? Does anyone even care?

Anyway, after rubbing our noses in our obvious shortcomings (he who holds the answer book holds power) Peter mentioned that he had run into a problem that he couldn't solve. (We were all ears.)

#### Insolvable Product

It turned out that the previous weekend, he and four other instructors had driven to Seattle to attend a programming conference. As they left Bend, one of them posed the following question:

"Two boys were having their purchases totalled at a cash register when the first boy noticed that the checker was hitting the times button rather than the plus. When he commented to the second boy, his friend told him not to worry, the total would come out the same either way."

"They purchased four items. They paid \$7.11. What was the price of each item? Is there only one solution?"

Well, four pads emerged from the luggage and five brains started scratching. But despite 20 hours locked together in a compact car, those brains came up with nothing, not even an elegant algorithm. (Aha! If it isn't in the answer book, instructors become almost mortal.)

#### A Solution?

Now it's your turn. If you can come up with something really elegant, get it in. We don't have a solution for this one, yet. After all, intelligence doesn't have to be academic, does it?

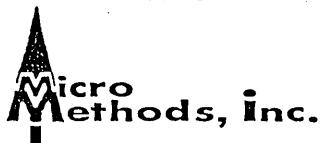
And, if you come up with some more computer solvable (or insolvable) teasers, get them in. Of course it wouldn't hurt if they are the product (and sum) of at least four good minds.

**RP/M2™ creates**

## **CP/M®2.2 compatible IBM PC**

1. Remove the 8088
2. Install the NEC µPD70108
3. Boot PC RP/M2

The NEC µPD70108 CPU chip is a fast 8088 that also executes 8080 machine code. PC RP/M2 is an **operating system**. Either standalone or with MSDOS present, PC RP/M2 provides the solid base of a genuine operating system reliably distinct from the facade created by an MSDOS interface. All 2.2 features are supported, plus file date and time stamping, fast virtual disk, iobyte redirection, terminal cursor positioning, color console display. PCPIP accesses MSDOS files; MODEMPC transfers files via serial port; SET-DISK redefines a drive to any of over 60 formats, allowing PC RP/M2 to directly process your existing CP/M files in their native form. System disk with manual and NEC µPD70108 (V20) \$129. Shipping \$5 (\$10 nonUS)  



118 SW First St. - Box G  
Warrenton, OR 97146  
**(503)861-1765**

ALL SALES SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. FREE COPY UPON REQUEST.

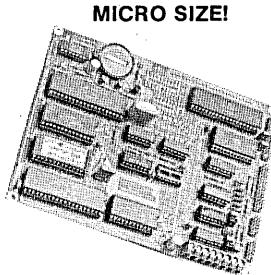
### **THE NEW 65/9028 VT ANSI VIDEO TERMINAL BOARD!**

#### \* FROM LINGER ENTERPRISES \*

A second generation, low cost, high performance, mini sized, single board for making your own RS232 Video Terminal. Use as a computer console or with a MODEM for hook up to any of the telephone-line computer services.

#### FEATURES:

- \* Uses the new SMC 9028 Video Controller Chip coupled with a 6502A CPU.
- \* RS-232 at 16 Baud Rates from 50 to 19,200
- \* On board printer port!
- \* 24 X 80 format (50/60 Hz).
- \* For 15,750 Hz (Horiz.) monitors.
- \* 3 Terminal Modes: H-19, ADM3A, and ANSI X 3.64-1979
- \* Wide and thin-line graphics.
- \* White characters on black background or reversed.
- \* Character Attributes: De-Inten, Inverse or Underline.
- \* Low Power: 5VDC @ .7A, ± 12VDC @ 20MA.
- \* Mini size: 6.5 X 5 inches.
- \* Composite or split video.
- \* 5 X 8 Dot Matrix characters (U/L case).
- \* Answer back capability.
- \* Battery backed up status memory.
- \* For ASCII parallel keyboard.



**\$99.95**  
(Full Kit)

SOURCE DISKETTE:  
PC/XT FORMAT  
5 1/4 IN. \$15

ADD \$40 FOR A&T

### **Digital Research Computers**

(OF TEXAS)

P.O. BOX 381450 • DUNCANVILLE TX 75138 • (214) 225-2309

Call or write for a free catalog on Z-80 or 6809 Single Board Computers, SS-50 Boards, and other S-100 products.

TERMS: Add \$3.00 postage. We pay balance. Orders under \$15 add 75¢ handling. No C.O.D. We accept Visa and MasterCard. Texas Res. add 5-1/8% Tax. Foreign orders (except Canada) add 20% P & H. Orders over \$50 add 85¢ for insurance.

## **EDITORIAL**

*(continued from page 81)*

left of the PC, XT, and AT stock by about 40 percent.

Meanwhile, 8MHz 8088 and 8086 turbo boards are showing up from Taiwan. Taiwanese may skip the 80186 and go heavily for the 80286 as soon as they've developed a new BIOS. Stay tuned.

#### **NEC's V20**

If you think the V20 is a big deal, you're not the only one. This 40-pin piece of magic not only runs 8088 code faster (even at 4.77 MHz) than the 8088, but it also runs 8080 code with the aplomb of a native. (The V30 is a magic 8086 that also runs 8080 code.)

Well, Intel is upset. In fact, Intel has its whole legal department working on a V repellent. And unless Intel comes up with a legal solution pretty soon, it could have real problems. After all, hardware manufacturers might discover the V20 (more performance at no additional cost), and that'll be it for the venerable (profitable) 8088.

The V20 is a simple plug-in replacement for the 8088, and yes, with no other changes to the system MS-DOS software does run faster. Plus, 8080 software also zings right along (now if it would run at 8MHz...).

See the PC speedup article in this issue for information on parts sources. Note that all V20s currently available are -5 parts (guaranteed to run 5MHz). NEC has had problems producing the -8 parts (8MHz). However, the -5 parts have been running up to 7 MHz just fine.

#### **Atari Vrs. Amiga**

As I write this I'm awaiting information from software firms that are using both the Commodore Amiga and the Atari ST. I've spent the last few weeks trying to get the C benchmarks to run on these machines so we'll have some idea (just an inkling, perhaps) of their performance relative to each other and relative to CP/M machines and PCs.

I called one of my favorite computer stores. They sell both the ST and the Amiga and are pretty knowledgeable folks. Surely if anyone had C packages and computers they did.

No luck. But I did find out that they've sold about 25 of each system. (I would have expected sales of well over a hundred of each.)

"Buyers are waiting for software, and they're waiting to see who's the winner."

A year ago it was much clearer who was going to win. But then Commodore was talking about \$800-\$1000 (for a complete package), and they were talking availability in June (or was it July, late August...).

A year later, the system is \$1998 (with color monitor and 512K), the operating system revision number has just been rolled (again), and there is very, very little software.

My contact noted that the Amiga is a pain to get

---

serviced under warranty, and the turnaround is long. Atari service, on the other hand, requires one phone call for a return authorization number, and the turnaround time is excellent. He noted that they've had just one minor problem with the STs. Two of the Amigas were dead on arrival.

"Right now, it's price vrs. bells and whistles. The complete ST is \$1000 and it has sound, graphics, and midi interface. The complete Amiga is \$2000. Its bells and whistles (sound, graphics, and multitasking) are better, but you'll have to decide for yourself if they're worth the extra \$1000."

They've had Amiga developers packages on order for months now, and though Commodore says it's shipping them, the store has yet to see one. The new Kickstart 1.1 (the Amiga operating system) has not crashed. But they found that many of the system's early problems could be traced to memory limitations. When people added the 256K memory expansion module (512K total) most of the problems disappeared.

People purchasing Amiga software should specify their Kickstart version. Some packages will run only under 1.0 (the early version), while others will run only under 1.1.

Many industry people expect the race to be close until the Amiga gets the promised PC emulation software. But if that's all people are waiting for, they might read issue #27. For \$1800 they could have both the ST and their very own, very PC compatible, clone.

Finally, time is of the essence to Commodore. The company has a bad reputation in the financial market, so its chances of raising cash are pretty slim. Plus, its cash position is weak, and it's been losing money — lots of money — for the past year. Amiga sales are critical to Commodore, even if the company is only trying to find a buyer.

#### Dealer Watch

D & D Discount Computers of Hawthorne CA has a full page ad in Computer Shopper and some pretty good prices. However, if our experience trying to get a couple of monitors is any indication, it might not be worth the effort.

We ordered two video monitors on 12/27/85. We insisted that they make sure the monitors were in stock before we placed the order. They said they were in stock and would be shipped the next day. A week later we received one monitor. In fact, by early February we still had only one monitor. (And we'd already received the VISA bill for both plus \$30 shipping.)

We've called them five times. Each time, the story has been different. "We shipped two monitors on January

(continued next page)

---

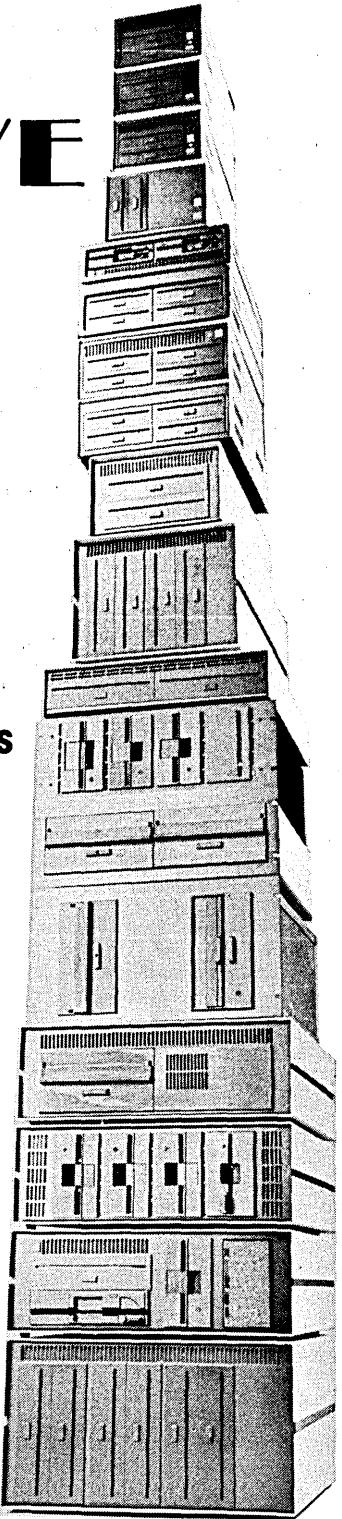
# DRIVE INN

Enclosure &  
power supplies  
for  
**FLOPPY,  
WINCHESTER,  
TAPE DRIVES,  
SINGLE BOARD  
COMPUTERS  
& S-100 SYSTEMS**

8 inch  
5 inch  
3 inch

**CUSTOMIZING  
AVAILABLE**

Call or write  
for free  
catalogs &  
application  
assistance



**INTEGRAND**  
RESEARCH CORPORATION

8620 Roosevelt Ave. • Visalia, CA 93291  
209/651-1203

TELEX 5106012830 (INTEGRAND UD)  
EZLINK 62926572

We accept BankAmericard/Visa  
and MasterCharge

## EDITORIAL

(continued from page 83)

2nd." "You only received one? We'll ship one tomorrow." (Two weeks pass...) "We show an order for two monitors, and they were shipped." (Another week...) "We'll get the second monitor out red label tomorrow." (Another week...) "We can't find your order, and we can't send a monitor to just anyone who calls." (At this point the phone lines got a bit warm.)

Later that day, they called back. "We found the order. It's for two monitors, and we're shipping the second monitor out red label today."

And, curiously enough, they did.

### SOG V

George is coming! George is coming! George Morrow called to say that he's already got the SOG on his calendar. He mentioned that of all the places where he spoke last year, the SOG was the best, most exciting group. So he wanted to make sure he got a speaking spot again this year. He'll be staying long enough this time to participate in those famous all-night semi-official discussions (SODs).

Also, Michael Frielings, Ph.D from MIT in artificial intelligence, will be speaking on developing tools for expert systems. (This is going to be fun, fun, fun.)

Trevor Marshall and the Definicon crew, Jack Dennon, Allyn Franklin, and numerous other stars from SOG IV have already thrown their speakers' hats into the ring for this year. Plus, Dave Rand will be back (by cutting short his vacation in Australia).

Oops, you're drooling all over this page and I haven't even given you the date, told you that SOG means Semi-Official Get-together, or mentioned that you should bring the whole family and make a vacation out of SOG (on your way to EXPO in Vancouver BC).

Anyway, it's July 24-27, Thursday through Sunday, and except for food, lodging, and rafting, it's free. It's our thanks to you for all your support for the past year.

Of course, this year's SOG starts off again with a splash. We'll kick it off with 2 1/2 hour (or all day) white water rafting on Thursday. Technical sessions (including computer co-pilot training) will follow on Friday, Saturday, and Sunday.

### Lodging

SOG V will be held at the college again, and the entire dorm is ours. If you want to be in the center of all the action, order your dorm room early. The dorm's lounge and rec room entertained those 24-hour-a-day SODs.

College administrator Ray Hoyt and his wife, Sue, were dorm parents last year (they were great). They were so impressed with the SOG IV group ("It was the most interesting, most intense group we had all summer,") that they're arranging to be dorm parents again this year.

(But since there's a new Hoyt arriving this spring, SOG V will be the only group they'll parent.)

But don't feel that you're locked out if you're not a dormie. Campers, trailers, pickups with shells, and people sacking in their cars had the entire parking area (surrounded by woods) to themselves.

There's also a very nice state campground just a few miles from the college that has everything — a river you can swim in, tent and trailer sites, and solar heated showers.

Plus, Bend is a resort community so we have more motel rooms than people. Motel rates run anywhere from \$25 per night to \$100. Write or call for the free SOG V information pamphlet.

### SOG Music

Friday night we made our own music. It was great, especially Joe Seibert on bagpipes. (People coming out of the mountains for weeks afterwards told of hearing strange wailings echoing about in the most remote areas.) Bring your woodwinds and horns and bagpipes and anything else, and we'll see what we can blow up. Synthesizers and midi controllers should take special note of this.

### SOG Philosophy

The semi-official get-together began simply as a day for Micro C readers to come together and share ideas. At SOG I, we didn't have any scheduled talks or recreation; it was just a day of food (potluck) and commiseration at our house.

SOG V will be four days of (semi) organized recreation and technical information held on a college campus. Last year we had 400+ attendees. This year (if you come) we'll no doubt beat that. The most important thing you bring is your ideas, and it's those ideas that have made SOG unique among computer conferences (and it's those ideas that are bringing George Morrow back for a second round).

### Finally

Enjoy yourself. If you don't already, then come to SOG and learn how. (We're only doing this for your own good, you know.)



David Thompson  
Editor & Publisher & SOG Attendee



See yourself in Bend  
this summer for  
three days of  
technical forums  
among the pines  
and junipers  
on the campus  
of Central Oregon  
Community College

---

---

### Thursday, July 24th SOG KICK-OFF

Once again we're kicking off the SOG with white water rafting followed by the kick-off cookout. If you're interested in safe thrills then sign up for one of these professionally guided trips.

- All day - includes transportation from the college, box lunch, 4 1/2 hours on the lower Deschutes River, and the Kick-off Cookout.
- 2 1/2 hour - includes transportation from the college, 1 1/2 hours on the river, and the cook-out.

Raft trip prices will be in the SOG registration packet.

### Friday - Sunday July 25th - 27th FREE TECHNICAL CONFERENCE

You'll meet the people who are writing the compilers (C, Modula, Pascal) and the interpreters (PROLOG), who are designing the boards (32032, 68020 . . .), and who are writing the articles.

- George Morrow (Morrow Computers) will be talking about computer directions.
- Trevor Marshall (Definicon Systems) will be talking in depth about the 68020.
- Michael Frieling (AI researcher) will discuss designing expert systems tools.
- Allyn Franklin (Drive Masters) will run a workshop on drive aligning.
- And much more! The schedule expands daily.

---

---

### TO REGISTER

Call or write for the SOG registration packet.

**DORM** The one dorm has 50 rooms which hold 2 people each. A room for Wednesday night through Sunday noon is only \$80 (that's \$40/person). If you have your heart set on a dorm room (the center for late-night discussions) call and tell us right away.

### MICRO CORNUCOPIA

P.O. Box 223  
Bend, Oregon 97709  
(503) 382-5060, 9-5, M-F

# LETTERS

(continued from page 4)

## Improving Theory Of Op

I have mixed feelings about your Kaypro 4-84 Theory of Operation. For instance, the CLOCK.AZM listing on pages 12 and 13 doesn't work! It is extremely aggravating to type two pages of assembly listing only to discover that there's a bug — somewhere. It certainly prints the word "Time:", but it does nothing else.

Another example is the section on page 3 concerned with INTERRUPT DECODE: five lines of text are not enough, except to pique your interest!

I'd like to make some suggestions.

First, a standard typographical solution to the boolean expression NOT is a hyphen-prefix (i.e., "VIDCS NOT" becomes "-VIDCS" as opposed to "VIDCS\*". This is standard in FORTH.

Second, I have taken some technical writing courses and can honestly say that your Theory of Op's overly terse style forces the reader to concentrate, read, and reread far too often. Your "fog index" is unduly high!

Also, why not include information on system "enhancements." Not the whole procedure, mind you, but info that can save you and the reader some time. For example, it should be apparent that only people interested in the guts of their machine will purchase this package, so why not explain how the Micro C (or MicroSphere, or Advent, etc.) ROM upgrades work and their benefits? Sure, it sounds like propaganda, but you know that the questions are bound to pop into the reader's mind; accommodate the reader and show that Micro C is indeed the helpful firm that supports its customers/readers.

Why not tell them how to add quad-density drives, a hard disk, a RAM-disk, or a color board. Granted, the costs and technology are ever-changing, but the questions and info remain the same, basically.

I apologize for ranting a bit, but alas, hindsight is almost invariably 20/20.

Peter Vassoff

19603 Bethel Church Rd.  
Manchester MI 48158

*Editor's note:*

Your questions and observations are bet-

ter than my answers, but here goes. We've had trouble typesetting listings. When we set the 84 Theory of Op, the typesetter we were using ate some characters and translated others. Despite proofing, the problem slipped through. See Figure 1 for the non-typeset version.

One of the advantages/disadvantages of publishing a magazine is that nothing stays the same. We've published information on the 2 to 4 upgrade in four magazines and in the Pro-8 manual. If it's frustrating for you, it's doubly frustrating (but exciting, too) for us.

I admit we could do a lot better job explaining our products, other people's products, modifications, etc. I have to

plead poverty of time. Gary, Larry, and I live computers (and Micro C), but there still aren't enough hours. If you, or anyone, would like to volunteer some time working on projects like this, we'd love to hear from you.

## Advice For Invalid Computer

Regarding "Home Care For The Invalid Computer (Part 1)" in Issue 27, page 49, I offer the following algorithm:

1. Check disk drive alignment (unless problem obviously is not disks).
2. Check power supply voltages.
3. Check all connections (David did

Figure 1 - Clock.AZM Routine

```
;*****  
;  
;***** CLOCK.AZM - a self installing interrupt service routine  
;***** for the real time clock on the Kaypro 4-84.  
;  
;***** The interrupt routine resides in hi ram starting  
;***** at OFF68h. This just misses the top of scratch  
;***** RAM in the PRO8u ROM.  
;  
;***** Assemble with Z80MR (disk K25)  
;***** A>z80mr clock  
;***** A>load clock  
;  
;***** This routine will work only until the next disk access (and  
;***** during subsequent disk activity) unless you add an EI  
;***** instruction at the label CONST in your BIOS.  
;***** Laine Stump 08/31/84  
;  
;  
ESC EQU 1Bh ;this is where interrupt routine will be  
HIRAM EQU OFF68h ;system port for selecting ROM  
BITPORT EQU 14h ;console output jump vector in ROM  
CONOUT EQU 45h ;  
  
ORG 100h  
  
LD HL,IMGADD ;load interrupt routine into hi memory  
LD DE,HIRAM  
LD BC,IMGLEN  
LDIR  
  
CALL PRINTLOW  
DEFB 'Initializing Real Time Clock..',0Dh,0Ah,0  
CALL INTCLK ;initialize clock, PIO, etc.  
RET ;return to CCP  
  
;(***) Real Time Clock Support Routines lrs 8/29/84  
;  
; Equates relating to RTC chip  
;  
CLKADD EQU 20h ;RTC 'register select' (actually PIO A data)  
CLKCTL EQU 22h ;RTC mode control (actually PIO A control)  
CLKDAT EQU 24h ;RTC data (after proper register selected w/CLKADD)  
  
MONTHS EQU 7 ;RTC registers containing these values (in BCD)  
DAYS EQU 6  
HOURS EQU 4  
MINUTES EQU 3  
SECONDS EQU 2
```

go into this somewhat).

#### 4. CLEAN, CLEAN, CLEAN.

5. Check power supply lines with an oscilloscope. Flat lines are nice. Bumps 7.7 milliseconds apart are nice if they account for more than a percent or so of the total voltage.

All of these things should be done BEFORE any board swapping is done, or you may find yourself frying yet another board. I know of a case where a service technician was dispatched 500 miles to fix a terminal in an office which had five of them. By the time he was done swapping boards, every terminal in the place was dead. The problem was a defective power supply

which was killing PC boards whenever they were swapped in. The diagnostic chart in the book said that for symptom X, you swap board Y. So that's what he did!

Another time, we swapped over a dozen chips, all of which had been soldered in originally. The problem was an open capacitor in the power supply, which meant that the system was "glitching" in the valleys between 60 Hz peaks.

**John Beckett**  
Director of Computer Services  
Southern College  
Collegedale TN 37315

```
;---- INTCLK - initialize clock chip & PIO for interrupts and enable them --
;INTCLK: DI      ;this first, just in case
    CALL  PRINTLOW   ;enable the status line
    DEFB  ESC,'B7'    ;and print the initial 'Time:' message there
    DEFB  ESC,'B6',ESC,'C4',ESC,'=','24+',' ',ESC,'B0',ESC,'B1'
    DEFB  ' Time: '
    DEFB  ESC,'C0',ESC,'C1',ESC,'C6',ESC,'B4',0

    LD    C,CLKCTL    ;now set up to send all the PIO mode control
    LD    HL,CLKTBL   ;address of table of bytes to send
    LD    B,CLKLEN    ;length of table
    OTIR
    LD    A,11h        ;select RTC 'interrupt control' register
    OUT   (CLKADD),A
    LD    A,4          ;tell it we want to interrupt every second
    OUT   (CLKDAT),A

    LD    A,10h        ;reset interrupt channel on clock
    OUT   (CLKADD),A
    IN    A,(CLKDAT)  ;by addressing and inputting from
                     ;int. status register

    LD    A,CLKVEC.SHR.8 ;now set up the CPU for running under interrupts
    LD    I,A          ;put page no. of interrupt vector 'table' in I
    IM    2            ;set mode 2 interrupts
    EI
    RET

; control bytes to send to PIO to init. for interrupts
CLKTBL: DEFB  11001111b  ;bit control mode, mask follows
    DEFB  01000000b  ;bit 6 input, others are output
    DEFB  CLKVEC.AND.OFFh ;interrupt vector at this add. + I reg.
    DEFB  10110111b  ;enable ints, OR, active hi. mask follows
    DEFB  10111111b  ;interrupt bit mask, interrupt on bit 6 only

CLKLEN EQU  $-CLKTBL
;---- console output routines during init -----
OUTLOW:
    LD    C,6
    CALL 5
    RET

PRINTLOW:
    EX    (SP),HL ; pop return address, points to text to print
    LD    A,(HL)  ; get a byte of text, stop on zero byte
    INC   HL
    EX    (SP),HL ; save new return address
    OR    A         ; is it a zero byte?
    RET   Z
    LD    E,A       ; no, so print it
    CALL  OUTLOW
    JR    PRINTLOW
```

#### Editor's note:

Thanks, John. You're absolutely right. In fact, I've been chasing a drive problem (the system wouldn't come up as long as the winchester was installed). The error message indicated that the floppy drive was defective.

Then I found that the problem went away when I swapped power supplies, so I started digging into power supplies. But, even with the best supply the problem came back. Replacing the color graphics board finally cured it.

Anyway, I've been learning a lot about supplies lately. For instance, on all three of the clone supplies I've dissected so far, the +12V line draws off the same pool of power that supplies the +5V. Plus, the designers assumed that regulating the +5V line was sufficient, so no need to regulate +12V separately.

On some supplies, the +5V regulator wasn't fast enough to keep changes in load on the 12V line from showing up as glitches on the +5 volts.

The power output from the supply looked fine (average voltages about 0.1V high and only about 300 mV ripple), but as a last resort I changed supplies. With the new supply the whole system came up and ran perfectly.

I tried the marginal supply on other PCs and had perfectly solid systems reduced to displaying memory parity errors or complaining of disk access problems. The problems all disappeared when I reinstalled the original supplies.

We are definitely on the lookout for really good quality supplies both for clones and for Kaypros so we can pass their names on. Any suggestions?

#### Readers' Skills Network

Do you have some kind of list or network to help people with certain skills get together with people who have ideas that need those skills? If so, I would like to add my name to the list. Presently I am bored with what I am doing, and am looking for a creative outlet for my talents.

My past experiences are: watch making/clock repair; teaching auto mechanics, machine shop and public speaking; 10 years in machine work

(continued next page)

(continued next page)

# LETTERS

up to aviation production and tool & die; 3 years as foreman of a NC/CNC/DNC machine shop; running my own engraving business in commercial signage; industrial panel work; wholesale manufacturing; and international mail order.

My computer experience goes back to about 1963 when I tinkered with IBM equipment. I really enjoy playing with hardware and programming. I'm just getting started in computer graphics.

**Paul Meistrell**  
2341 Pontiac St.  
Denver CO 80207

#### *Editor's note:*

*Here it is, Paul. Your name's on a lot of lists now. You sound like a natural resource for folks starting any number of new computer related businesses. Anyone interested should contact Paul right away.*

*In fact, anyone else like Paul who has experience and skills to offer to a group effort should drop us a note and we'll let everyone know. That's what Micro C is all about.*

#### Getting Jumpers Straight

I recently ordered a pair of half-height Panasonics from PC's Limited in Austin, Texas. The drives I got were marked "National," which is apparently what Panasonics are known as in most of the world. From the printing on the wrapper, I assumed they were manufactured for the domestic Japanese market.

There was no documentation of any sort, so I called PC's technical support number to find out about jumpers. The person who took my call had a "who cares" attitude and couldn't conceive of anyone mounting more than two drives in a computer. His answers did little to inspire my confidence. In the end, I was simply told they had no more information.

There are clusters of jumpers on the Nationals. The first set is marked 1,2,3,4, and MX. MX, as you told me on the phone, is for single-drive installations. PC's told me it should be jumpered. You said it shouldn't be.

The second set of clusters has a single pin marked MS, then pairs

marked MM,HM,HS,HL, and IV. PC's said both MM and IV should be jumpered. I never did find IV, but because Alan Barlow's Kaypro column (issue 27) had said to jumper HM, I suspected PC's was wrong. You confirmed that HM was the right pair to jumper.

So I jumpered HM and didn't jumper MX, as per your instructions. Nothing. The computer couldn't even find the A: drive. I discovered that the jumper on MX must be across pins 1 and 2 to function properly in a multi-drive setup. With no jumper at all, it loses its identity.

As for HM, the drive won't read the

disk with HM jumpered, but it will with the jumper on MM, where PC's told me to put it. PC's did make one mistake, though. They insisted that the terminator should go into the A: drive, while everything published in Micro C says it should go in the last drive on the cable. PC's advice is correct for an IBM (A: is the last drive on the PC), but not for my Kaypro.

I'm delighted that the jumpers didn't work quite as you predicted, because it's given me an opportunity to give something back.

**Robert Long**  
P.O.Box 600  
Housatonic MA 01236

#### *Clock.AZM Routine (continued from page 87)*

```
;*****  
; the following routine resides in Hi RAM. this way it will not  
; be overwritten by programs and will be 'visible' to the CPU  
; no matter which memory bank is switched in  
;*****  
IMGADD EQU    $  
OFFSET  EQU    HIRAM-IMGADD ;label to find routine before it is moved  
;  
---- CLKVEC - interrupt vector and interrupt service routine for RTC -----  
;  
CLKVEC EQU    $+OFFSET ;this will be label address in Hi memory  
DEFW    CLKVEC+2 ;this is int. vector, CPU jumps to address it  
;  
;contains  
; Clock interrupt service routine. First save cursor position and go to  
; status line. Print time, and then return  
;  
PUSH    AF ;save application's environment  
PUSH    BC  
PUSH    DE  
PUSH    HL  
IN     A,(BITPORT) ;also save whether we were in ROM or RAM  
PUSH    AF  
SET    7,A ;now switch in ROM so we can call  
OUT    (BITPORT),A ;CONOUT routine there  
;  
CALL    PRINT ;save cursor, go to stat line, set dim inverse video  
DEFB    ESC,'B6',ESC,'C4',ESC,'=','24+',7+',ESC,'B0',ESC,'B1',0  
LD     A,HOURS ;first output the current hour  
CALL    PRNUM  
CALL    PRINT  
DEFB    ':',0  
LD     A,MINUTES ;now the minute  
CALL    PRNUM  
CALL    PRINT  
DEFB    '.',0  
LD     A,SECONDS ;and finally the second  
CALL    PRNUM  
CALL    PRINT ;now restore to where we were  
DEFB    ' ',ESC,'C0',ESC,'C1',ESC,'C6',ESC,'B4',0  
LD     A,10h ;now acknowledge interrupt to clock  
OUT    (CLKADD),A ;by addressing and inputting from  
IN     A,(CLKDAT) ;int. status register
```

## Why Learn Z80?

I've had a Kaypro 4-84 for about a year. I use it most of the time at work and have written quite a bit of dBASE II code for various jobs and to control my Epson printer.

Since I've been considering another system to keep at home (IBM or clone) do you honestly think it would be worth my while to learn the Z80? Do you foresee your publication being as informative to users of MS-DOS and the allied chips as it is for CP/M and the Z80?

Next question: I recently installed a satellite system (TVRO). There must be a way to hook up my computer to

it (maybe using an SSB receiver?) and tapping into the wealth of data available. How would one utilize a computer to decode a microwave signal? If anyone has any experience with the necessary interfaces to access satellite signals, I would love to hear from them.

**John A Fabbri**  
P.O. Box 901  
Dayton NV 89403

### Editor's Note:

*I assume you're talking about learning Z80 assembly language, since you're no doubt comfortable using CP/M. It depends*

*on what you want to do. If I were planning to write 8088 assembly language I'd probably start writing for the Z80 first. It's so much simpler that you have half a chance of doing something useful before getting bogged down in the 8088's register mazes.*

*Will we be as informative in the PC arena as the CP/M world? Only time will tell. I'd like to do even better. Just look at PC Tech Journal (three piece suits and reviews of business applications) and you'll see why someone needs to do a Micro C for the clone world.*

*However, we'll not be content with clones. After all, the 32032, 32332, 68000, and 68020 processors (to name a few) are also very, very interesting. (And most of those CP/M machines haven't realized they're dead. Yet!)*



## INTEGRATED BIOS for BIGBOARD II

This BIOS adds special features to your Bigboard II floppydisk and/or Winchester system.

Read and write any 5" and/or 8" disk formats. 40 formats included (KayPro, Osborne, IBM-PC etc.)

Use any type of 5" and/or 8" drive (SS, DS, 40 - 77 - or 80 tracks). New SYSGEN works between 5" and 8".

### INCLUDES:

Bootable 5" disk utility programs, Big Board II manual, and 300 page ZCPR2 manual.

**Price: \$99.95 (5" 40 tr disks)**

**BIGBOARD II 256K RAM**  
pcb less memory chips, includes test software.

**Price: \$99.95 (Avail. 4/86)**

### SASI Interface

for BB I and Xerox 820-I. Includes pcb with components, BIOS, Formatter, and Sysgen. Requires Xebec controller version E or F.

**Price: \$99.95 (8" SS-SD only)**

### Andy Bakkers

de Gervelink 12 • 7591 DT Denekamp  
The Netherlands • Tel: 31-5413-2488  
Please pay with US\$ Money Order.  
MC or VISA welcome.

```
LD    A,10110111b      ;now reset PIO interrupts
OUT   (CLKCTL),A
LD    A,1011111b
OUT   (CLKCTL),A

POP   AF
OUT   (BITPORT),A      ;restore proper memory bank
POP   HL                ;restore application's environment
POP   DE
POP   BC
POP   AF
EI
RETI             ;reenable the interrupts
                  ;and reset interrupt flip flops

;----- PRTNUM - print number in clock chip reg. pointed to by A -----
;----- output will be as ASCII Decimal
PRTNUM EQU  $+OFFSET
OUT   ($CLKADD),A      ;select appropriate clock register
IN    A,($CLKDAT)       ;get the number there

PUSH  AF               ;save it while we convert & output hi nibble
AND   OF0h              ;strip low nibble
SRL   A                 ;shift hi nibble to low
SRL   A
SRL   A
SRL   A
OR    30h               ;make it ASCII decimal
LD    C,A               ;put in C for CONOUT
CALL  CONOUT            ;output to video

POP   AF               ;done with hi, now output low
AND   OFh               ;strip off hi nibble
OR    30h               ;make into ASCII decimal
LD    C,A
CALL  CONOUT            ;output to screen
RET

;----- PRINT - prints text to screen
PRINT EQU  $+OFFSET
EX    (SP),HL           ;pop return address, points to text to print
LD    A,(HL)             ;get a byte of text, stop on zero byte
INC   HL
EX    (SP),HL           ;save new return address
OR    A                 ;is it a zero byte?
RET
LD    C,A               ;no, so print it
CALL  CONOUT            ;output to screen
JR    PRINT-OFFSET

;----- IMGLEN - end of interrupt service routine.
IMGLEN EQU  $-IMGADD
END
```

# Real Time Clock Routine For The Kaypro 4

---

By Larry Fogg  
Micro C Staff

Turbo Pascal routine reads the built-in clock.

```
PROGRAM Time (Output);
{ Reads Kaypro clock chip ( U35 MM58167A )
  and displays time and date to console. }

CONST
  Year    = 9;           { Clock registers }
  Month   = 7;           Day     = 6;
  Hour    = 4;           Minute  = 3;

  Select  = 32;          { Register select port }
  Mode    = 34;          { Mode control port }
  Data    = 36;          { Data port }
  Input   = 79;          { PIO modes }
  Output  = 15;

TYPE
  Str1 = String[1]; { Str won't accept Char }
  Str2 = String[2];

VAR
  Date: String[8];   Time: String[5];

FUNCTION ReadClock (Register: Byte): Str2;
{ Get data from RTC. Data is stored two
  digits per register in BCD format }

VAR
  BCDValue, TensValue, OnesValue: Byte;
  TensAscii, OnesAscii: Str1;

BEGIN
  Port[Select] := Register;
  BCDValue := Port[Data];
  TensValue := BCDValue SHR 4;
  Str (TensValue, TensAscii);
  OnesValue := BCDValue AND 15;
  Str (OnesValue, OnesAscii);
  ReadClock := TensAscii + OnesAscii;
END; { ReadClock }

BEGIN { MAIN }
  Port[Mode] := Output;           { Set PIO to output mode }
  Date := ReadClock (Month) + '/' + ReadClock (Day) + '/' + ReadClock (Year);
  Time := ReadClock (Hour) + ':' + ReadClock (Minute);
  Writeln ('Today''s date is : ', Date);
  Writeln ('And the time is : ', Time);
  Port [Mode] := Input;          { Set PIO to input mode }
END.
```

Kaypro's clock and Kaypro's graphics have a lot in common; they're nice to have but there's no software support. Richard Brewster recently sent us an SBASIC routine which prints time and date to the Kaypro's screen. After a bit of massaging I came up with a Turbo Pascal (i.e. usable) translation of Richard's program.

The clock's registers hold data in binary coded decimal (BCD) format. This means that the high order four bits must be decoded for the tens digit, and the low order four bits for the ones digit. If you would like to have a SetClock procedure as well, just write a BCD encoding routine and send the results to the year, month, day, hour, minute, and seconds registers.

Richard noted that he originally saw errors from CLOCK after each cold boot. It turned out that the Z80 PIO was left in input mode and received garbage when the system was powered-down. The final line of the program corrects this by setting the PIO in output mode.



```
{ Let the RTC know what data we want }
{ Get the data }
{ Shift the high order nibble down }
{ Convert it to Ascii }
{ Mask the high order nibble }
{ Convert low order nibble to Ascii }
{ Concatenate Tens and Ones }
```

# MAKE YOUR KAYPRO SPECIAL!

## The Kaypro Disk Library

### 41 Disks of Selected Public Domain Software

KAYPRO DISK K1 Modem software	KAYPRO DISK K23 Fast Terminal software & New Bye
KAYPRO DISK K2 Utilities	KAYPRO DISK K24 MBASIC Games & Keyboard Translator
KAYPRO DISK K3 Games	KAYPRO DISK K25 Z80 Macro Assembler
KAYPRO DISK K4 Adventure	KAYPRO DISK K26 EPROM Programmer & Character Editor
KAYPRO DISK K5 MX-80 Graphics	KAYPRO DISK K27 Typing Tutor
KAYPRO DISK K6 Word Processing Utilities	KAYPRO DISK K28 Modem 730
KAYPRO DISK K7 Small C Vers 2 Compiler	KAYPRO DISK K29 Turbo Pascal Games I With Source
KAYPRO DISK K8 Small C Vers 2 Source	KAYPRO DISK K30 Turbo Pascal Games II With Source
KAYPRO DISK K9 ZCPR	KAYPRO DISK K31 Turbo Bulletin Board
KAYPRO DISK K10 Assemblers	KAYPRO DISK K32 FORTH-83, much fancier Forth
KAYPRO DISK K11 Library & Checkbook Programs	KAYPRO DISK K33 A super utilities disk
KAYPRO DISK K12 FORTH	KAYPRO DISK K34 5 games plus sources (mostly Turbo)
KAYPRO DISK K13 Source of fig-FORTH	KAYPRO DISK K35 Small C Compiler & Souce - Vers 2.1
KAYPRO DISK K14 Smartmodem Program	KAYPRO DISK K36 Small C Library of 100 functions
KAYPRO DISK K15 Hard Disk Utilities	KAYPRO DISK K37 Utilities Primer
KAYPRO DISK K16 Pascal Compiler	KAYPRO DISK K38 Pascal Runoff Winners 1st - 3rd
KAYPRO DISK K17 Z80 Tools	KAYPRO DISK K39 Pascal Runoff Winners 4th - 5th
KAYPRO DISK K18 System Diagnostics	KAYPRO DISK K40 Pascal Runoff Winners 6th
KAYPRO DISK K19 Prowriter Graphics	KAYPRO DISK K41 Express 1.0 TextEditor
KAYPRO DISK K20 Color Graphics Routines	
KAYPRO DISK K21 SBASIC Routines & Screen Dump	
KAYPRO DISK K22 ZCPR (Again)	

NEW LOW  
DISK PRICE!

Kaypro CP/M  
5 1/4" Disks

\$8.00 each ppd.

Effective April 15, 1986

## ROMS

### Pro-8 Version 3 for Kaypro 4-83

Features include:

1. Screen dump with selectable dump character.
2. Select slow or fast step rate for each drive.
3. Automatically figures out what type of drive you are using.

Plus: User selectable cursor (blinking or not), ignores nulls, and your choice of 1-4 drives of the 191K, 390K, and 784K variety. (Use of 3 or 4 drives requires decoder.)

Installation requires no cuts or jumpers. The ROM simply plugs into a Kaypro 4-83 (or II-83 with a Kaypro 4 processor board). If you have a Kaypro II with the original II processor board then you must do the II to 4 upgrade. See issue #21 for details. Your Kaypro II has the original II board if the monitor ROM (a 20-pin chip with paper stuck to its top) is marked 81-149. The 4 ROM is marked 81-232.



### for 84 KayPros

### Pro-884

This ROM lets you run any mix of quad density (784K) drives and double-sided double density drives as A: and B: on your 84 Kaypro. Plus, if you plug-in the decoder board, you can run up to four drives.

### Pro-884 MAX

The MAX gives you all the advantages of the Pro-884, plus faster screen scrolling, ZCPR in ROM (you 'warm boot' on any disk, whether it has system tracks or not), screen dump, ctrl-p type printer output, and VT52H/19 terminal emulation in addition to the original ADM3, to name a few. (We worked on this hummer for nearly a year.) If you need more information on the Pro-884s or our '83 compatible ROMs, call, write, or yell for our KayPro Users Catalog

### Pro-Monitor ROMS

Pro-8 Ver 3 .....	\$49.95
Pro-884 .....	\$59.95
Pro-884 MAX .....	\$79.95
Decoder Board .....	\$39.95

## Kaypro Add-Ons

### Eight Inch Adaptor Board

OK, you asked for it: the 8 inch adapter board for the Kaypro. Now you can have: 1. 4 drives 2. Up to 1.3 meg of storage per disk. 3. Access to SIGM and CPMug software. 4. Super fast data access. The circuit board, ROM, and disk in this package will let your Kaypro run up to four drives. A and B have to be 5" drives, C and D can be either 8" or 5". The eight inch drives can read and write single density, double density, or double-sided double density. Plus, if you have an 84 2 or 4 you get all the Pro-884 MAX features.

The 8" adapter board plugs right in (no cuts, jumpers, or soldering — unless you have a Kaypro II, then you have to do a II to 4 upgrade.) You supply the drives, cabinet, and power.

8" Adapter Board ..... \$190.00

## Schematic Packages

Finally, a schematic of your processor board, logically laid out on a single 24" by 36" sheet, plus a very complete, illustrated, Theory of Operation that's keyed to the schematic. You'll get information that's available nowhere else.

### KayPro Schematic Packages

Kaypro II & 4 (pre-84) .....	\$20
Kaypro 10 (pre-84) .....	\$20
Kaypro 84 series (II, 4 & 10) .....	\$20

## SPECIAL PRO-884 NOTE:

(And for 8" Adaptor Board)

The Pro-884s are sensitive to the version of CP/M you are running.

1. Neither the Pro-884 nor the Pro-884 Max will run on CP/M 2.2U. However, if you can locate a CP/M 2.2F or 2.2G system disk (your dealer should have a copy) you should be able to run our 884 monitors. (Don't try to boot F or G before you change monitors.)

2. There are two distinct versions of CP/M 2.2G. Only the Pro-884 Max is sensitive to the version of 2.2G you have - it's the ZCPR in ROM that's the problem. (If you have CP/M 2.2F then you have a Normal CP/M.) So, before ordering the Max boot up your original system disk and read the sign-on. If it's CP/M 2.2G then we need to know whether it is the high (normal) version or the low (minus) version.

To determine your G version (you'll become a G Whiz!):

A>DDT <cr>  
L5 <cr>  
(ddt's response)

The first line of the response will be a JMP D600 or a JMP D800. The JMP D600 means that you have a low (minus) version, and the JMP D800 means that it's a normal version. When you order your Pro-884 Max, be sure to specify whether you want the normal Max or the minus Max. Otherwise, we'll just guess that you need the normal Max.

# MICRO CORNUCOPIA

P.O. Box 223 • Bend, Oregon 97709

Order Number 9-5 PST (503) 382-5060 • Technical Information 9-Noon PST Only (503) 382-8048



# TECHNICAL TIPS

## Pascal Problems Repaired

The article by John Donovan on "Faster Screen Output With Turbo" in Micro C #26, p. 31, provided a good insight into a great many advanced applications — perhaps it should have been subtitled "Or the First Step to Animation, Windows, Etc." However, Mr. Donovan leads us astray in two places.

First, the "ord" function cannot be used with an array of type "char" as he had declared. ASCII values must be used.

Second, and even more important: direct assignment between arrays of the SAME type is definitely supported in Pascal; thus, there is no need to place an array inside a record just to assign values to its elements, nor is there any need to assign values from one array to another by using a loop. It can be done in one clean step: ThisArray := ThatArray;, where the arrays are of the same type. Also, an array can be used directly as a disk file "record" without having to use the special Pascal construction.

These seem to be common misconceptions, since I have read several articles discussing this.

Also, at least in Turbo, the "fillchar" procedure allows us to fill any or all of anything (especially good for initializing arrays) with a certain value. If smaller arrays were absolute addressed at different parts of the screen array, then the double "for" loop filling the "scratch" record with L's and R's could have been done using "fillchar" in two steps. I use "fillchar" to initialize an array and prevent garbage problems (unless it has already been initialized using a structured typed constant.) See the Plantz figure.

Alan C. Plantz  
7817 Hunter's Path  
Indianapolis IN 46224

## Fixing Z80 Sans Heat Sink

A letter in Issue #26 prompted me to write. Some clever soul put a heat sink on a Z80B so it would run at 5MHz, but as much as I admire his logic, that is not the best procedure.

The trouble is the clock at 5MHz. The Z80 is fussy about nothing except the shape of the clock input. It must be "this and that technical jargon

## Plantz Figure

```
program ArrayTest;

type
  GlobalArrayType = array [1..4] of integer;

const
  ThatArray : GlobalArrayType = (10,20,30,40);
  (* typed constant to initialize ThatArray *)

var
  ThisArray : GlobalArrayType;
  i : integer;

begin
  ClrScr;
  fillchar(ThisArray, sizeof(GlobalArrayType), 0);
  (* initialize ThisArray so every element is 0 *)
  writeln('Now the contents of ThisArray ...');
  writeln;
  for i := 1 to 4 do write(ThisArray[i]:5);
  writeln;
  ThisArray := ThatArray;
  (* Note the single statement here, NO for loop is
     needed to assign each element individually *)
  writeln('And after assignment, the contents of ThisArray ...');
  writeln;
  for i := 1 to 4 do write(ThisArray[i]:5);
  writeln;
end.
```

(30ns rise time max, Vcc -0.6, +0.3V, etc.)" or the operation of the processor becomes random, more or less. Also, this clock touchiness gets worse with temperature increases. That's why the heat sink works.

Unfortunately, the Kaypro computers suffer from a design error that, coupled with the Z80's fussy clock input, works OK at 2.5 and not so OK at 5MHz. The error is U67, the 74HCU04. Change it to a 74HC04 and the trouble will disappear. Probably.

The Kaypro's mother, the Big board, had a 74LS04 in this spot. That part did not get close enough to +5V for the Z80's clock, so a "pull up" transistor was added. Worked fine. The 83 Kaypro had room and holes for the same transistor circuit. You can see it on your board. One quick way to cure heat troubles with 5MHz is to add this transistor circuit, according to Micro C's plans on page 20 of Issue 14. (Editor's note: Read on for the best way to cure the problem.)

But somebody at Kaypro had a better idea — use high speed CMOS logic (74HCXX) for the clock inverters. Good idea. Unlike the 74LS TTL parts before it, the HC parts pull all the way up to the power supply "rail." Great. The Z80 clock is satisfied, and no transfer is needed.

The mistake was in the 74HC part

they chose. 74HCU04 stands for the unbuffered version of the 74HC04, and the U version is the part Kaypro used.

At first glance, the unbuffered chip would seem faster, and the specs show that it is — under CMOS conditions. The unbuffered part has one less gate delay than the buffered part and therefore saves a few nanoseconds. The trouble is that this speed advantage only holds when the load (the next gate down the line) is also CMOS. It is not true when the load is NMOS or TTL — like the Z80. The Z80 needs more drive current and that extra current slows down CMOS outputs. The buffered gate (74HC04, no U) has a higher current drive that more than makes up for the slight delay through the gate.

If you have heat trouble with the Kaypro 5MHz upgrades, change U67 to 74HC04. I know. I've done a lot of these upgrades in my business, and it is necessary.

One other thing. Watch out for long pieces of wire on the clock switch lines. They make a good antenna (which can pick up glitches from common RF) if you don't shield them. But if you do shield them, you might change the clock frequency and rise time because of the capacitance of the cable. Better yet, solder a 74LS00 gate on top of the PCB and switch the clock

through its gates with a 5V and ground signal.

Bend out all of the pins of a 74LS00 Quad, Two Input NAND gate except 4, 7, and 14. Solder those three to their mates on the 74LS293 in U86. (From here on, 00 stands for the 74LS00.)

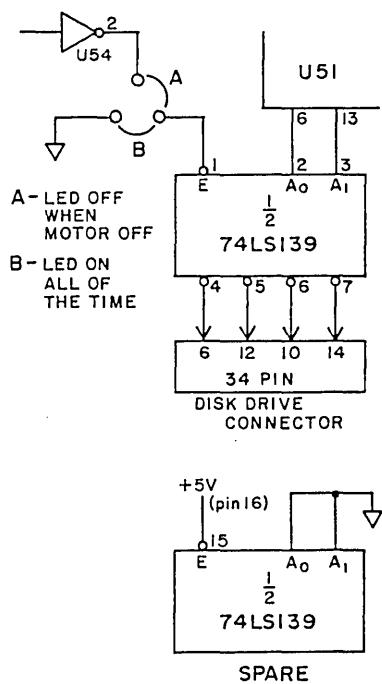
Jumper the following pairs: 00's pin 2 to 293's pin 5; 00's pin 3 to 00's pin 12; 00's pin 6 to 00's pin 13; and then jumper the 00's pins 14, 10, and 9 together. Take two 2.2K 1/4 watt resistors, connect one between pin 14 and pin 1, the other between pin 14 and pin 5 (on the 74LS00).

The three wires to the switch are then taken from pin 7 of the 74LS00 (which is the center or common switch contact), and pins 1 and 5 of the 74LS00 (which are the two controls for the clock speed). The switched clock output is on pin 11 of the 74LS00. That output should go through the 74HC04 to the Z80.

The above change is meant for machines that have already been modified to 5MHz by the Micro C method.

**Charles Johnsen**  
Your Computer Works  
19704 E Loyola Circle  
Aurora CO 80013

Pierce Figure - 4-Drive Decoder Circuit



### Kaypro Mod Using 74LS139

This modification for the Kaypro 2-84 or 4-84 allows you to install more than two drives. It's basically the same as using Micro C's plug-in Decoder Board, but takes quite a bit more time and uses a different chip. It's also cheaper.

Solder a socket into the 16-pin area marked SPARE near the front (center) of the board.

Cut the traces going to the floppy disk drive connector, pins 10 and 12 (cut them near the connector).

Jumper the following pins on the 74LS139: - pin 15 to pin 16 (to disable the other half of the IC) - pin 14 and pin 13 to pin 8 (also to disable other half) NOTE: Failure to disable the unused half of the LS139 can cause stray noise that can make life unpleasant.

Connect wires between the following pins:

- U51-6 to LS139 pin 2
- U51-13 to LS139 pin 2
- LS139 pin 4 to pin 6 of the 34-pin disk drive conn.
- LS139 pin 5 to pin 12 of the 34-pin disk drive conn.
- LS139 pin 6 to pin 10 of the 34-pin disk drive conn.
- LS139 pin 7 to pin 14 of the 34-pin disk drive conn.

To select the disk drives only when the motor is on (the LED goes off after an access) connect pin 1 of the LS139 to U54-2.

To leave the LEDs as God and Mr. Kay intended, connect pin 1 of the LS139 to pin 8 of the LS139 (ground).

NOTE: I found it best to use wire-wrap wire for all wiring except the four wires going to the 34-pin disk drive connector. For those, I used 4 strands of ribbon cable to keep them neat.

*Editor's note: The major difference between Troy's mod and those shown in Micro C #20, p. 64, and Micro C #21, p. 42 is that Troy uses a more readily available 74LS139 instead of the 7445 chip. Good work!*

**Troy L. Pierce**  
22 Fitzwatertown Rd Unit E-7  
Willow Grove PA 19090

### Homebrew Battery Holder

I recently had to perform some "surgery" on my 4-84 and its RTC. I have yet to understand why, but the yahoos at Kaypro decided to solder my battery back-up onto the main board. Yesterday, it broke. I was unable to find anyone who carried a battery holder for the oddball lithium battery, so after chewing all my nails off, I settled on a very simple course of action.

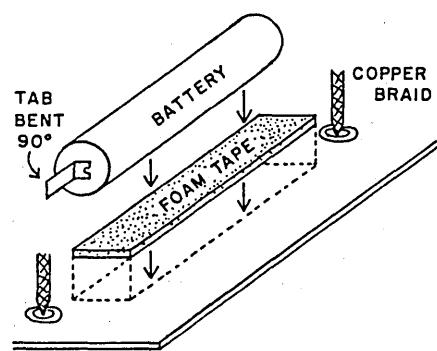
Using a solder wick, I cleaned up the solder points and forced the broken tabs through the board. I then cut two short lengths of this copper braid and tinned one end of each. Using sidecutters, I cut the tinned ends at a slight angle and twisted them slightly, forming a sort of rod or wire. These ends were then inserted into the old holes and soldered down.

After tinning the tabs on the ends of the battery, I then bent them at an angle, too. At this point, I used a piece of "Closed-cell Foam Tape" to form a pad where the battery previously sat on the board. Finally, I held the battery gently on the foam and soldered the copper braid to the tinned terminals. (See Vassoff figure.)

Although it may sound overly complex, this method offers two advantages over the crazy way the battery was originally mounted: first, to replace the battery I no longer have to desolder directly on the mainboard; second, due to flexibility of both the copper braid and the foamtape base, the system should be far more durable (not to mention forgiving!).

**Peter Vassoff**  
19603 Bethel Church Rd  
Manchester MI 48158

Vassoff Figure - Kaypro 4 Battery Installation



# PC RP/M2, A Designer's View Of A CP/M Emulator

---

By Jim and Jack Dennon

P.O. Box G  
Warrenton OR 97146

*Old CP/M programmers never die, they just port their operating systems over to new systems. In this case, Jack and Jim have modified their CP/M replacement to make it run on a clone with a V20 processor.*

*Since we are benchmarking several such CP/M emulators in this issue, it appears to be an excellent time to have them talk about how they put it together.*

**A**fter studying CCP and BDOS while writing "CP/M Revealed," we decided to write our own version of CP/M called RP/M. That was in 1982. RCP for "resident console processor" was our name for the CCP, and BDOS became RDOS for "resident disk operating system."

RP/M version 1 is essentially identical to CP/M 2.2 except for several additions:

1. Common access to user area zero from all user areas.
2. Paged TYPE display.
3. A "hard disk vector" that keeps non-dismountable disks logged.
4. Batch procedures on any drive.
5. Chaining built into RCP.

## The Evolution To RP/M2

We got requests from two OEMs for file date and time stamping. Another asked for extended disk addressing range. So in 1984 we started rewriting RCP and RDOS. The resulting system, RP/M2, includes a disk addressing range of over 64 megabytes, and some other features to support large disks, such as hash coded directory access.

Also, with the help of Ferrell Moultrie, who kept applying heavy loads to the system and analyzing the results with an ICE (in circuit emulator) we found a good fix for the host buffer management bug that I discussed at SOG IV. (Bob Lurie documented this bug in Microsystems in May of 1983;

under CP/M 2.2 a random write into an existing data block may result in lost information.)

It's a good fix because the right code takes less space than the wrong code. RP/M2 is written entirely in 8080 code, and RCP and RDOS occupy the same memory space as CCP and BDOS.

## Then Along Came The V20

As Randy Davis describes in Micro Cornucopia #27, and in Micro/Systems Journal, Nov/Dec 85, the V20 is a fast 8088 that also executes 8080 machine code. It's a perfect match for RP/M2, and we've been shipping systems since October. (We have found one problem — reading Kaypro 4 disks.)

The SETDISK utility we supply with PC RP/M2 redefines a floppy drive to any of 60 different CP/M 5.25" formats. Since we do all disk I/O through the PC ROM, we're presently unable to read the back side of a disk formatted by a Kaypro 4, or formatted for a Kaypro 4 by Uniform PC.

We can read a Kaypro 4 disk formatted by Media Master and one formatted with our SETDISK. However, right now our approach is to use the single-sided format for exchanges with Kaypros.

## Comparing The Systems

Figure 1 summarizes information on CP/M 2.2 compatible systems gleaned from magazine articles and ads over the past few months.

The information on functions "not supported" is mainly from Ted Drude's review that appears in the Feb. 1986 issue of Computer Shopper, page 85. Source Information is the only company we contacted. CPEmulator and UNIDOS are preprocessors reviewed by Randy Davis in Micro Cornucopia #27.

Of these systems, RP/M2 is the only stand-alone operating system. The others run under MS-DOS.

Unlike RP/M2, none of the MS-DOS

interface type systems that we're aware of supports all of CP/M2.2's BDOS and BIOS functions. (Editor's note: I believe that Blue Lightnin', a Z80 plug-in board, does support all of these calls.)

## The Memory Disk

PC RP/M2 uses slightly more than 64K of memory. The remaining memory is allocated as a memory disk called "M:" M is available the instant PC RP/M2 is booted up.

On a fully populated PC the memory disk will be over half a megabyte and is an excellent place to run assemblies. Just remember to copy files to a real disk before shutting down the system.

## Terminal Speed Or Color

Terminal cursor positioning emulation is built in for a long list of terminals. The IBM display isn't super fast even in nonemulating mode, so the best way to have the kind of terminal you want is to plug the real thing into one of the COM ports and use CONSOLEX to tell PC RP/M 2.2 where it is. At 9600 bps, a real Interube II, for example, is significantly faster than the IBM display.

But if you have a color card, you can use the IBM display and use COLOR to set any combination of text, background, and border colors.

CONSOLEX uses the table driven iobyte character I/O redirection facility built into BIOS88 to redirect console I/O to the selected COM port. READ, PUNCH, and LIST can also be redirected to physical devices: console, COM1, COM2, and LPT1. The redirection table permits installation of a custom driver for other devices.

## PCPIP

PCPIP is a modified version of RPMPPIP, a distant relative of CP/M PIP. The modifications allow PCPIP to directly call MS-DOS for displaying

Figure 1 - Comparison of CP/M Emulation Packages

Package name & vendor	type sys	price	V20 inc	DOS req	Z80 sup	BDOS functions not supported	CBIOS functions not supported
Media Master+ ZP/EM Intersecting ConCepts	SE	59.95	no	yes	no	IB, IF	08 through OE
CPEmulator Gtek, Inc.	SE	199.95	no	yes	yes	1F, 25, 26, 27	08 through OE
UNIDOS MicroSolutions	V/SE	69.95	no	yes	in SE	(DOS preprocessor)	
CP/EM The ICU Group	V/SE	79.95	no	yes	in SE	1B, 1E, 1F, 20	08-OB, OD-OE
EMULATOR GFI Electronics	V	49.95	no	yes	no	(DOS preprocessor)	
Acceler8/16 Intersecting ConCepts	V	99.95	yes	yes	no	1B, 1F	08 through OE
RUN/CPM Micro Interfaces	V	99.95	yes	yes	no	1B, 1F	08 through OE
Un/Emulator Weitsman & Wood	V	149.95	yes	yes	no	1B, 1E, 20, 22, 27	08 through OE
CP/Mulator Source Information	V	99.00	yes	yes	no	7, 8, 1E, 20, 28	08 through OE
PC RP/M2 microMethods	V	129.00	yes	no	no	All BDOS and CBIOS functions are supported	

SE = software emulation of 8080 and/or Z80 execution

V = V20/V30 execution of 8080 code

the DOS directory, and for reading and writing DOS files. A utility called CD can be used to change the DOS directory.

PCPIP has all of RPMPIP's capabilities, including archive copy mode and file compare. For example, you can directly compare an MS-DOS file with a CP/M file.

Users familiar with CP/M will feel at home with PC RP/M2. All the standard commands are available and almost all operate as expected. There are some minor differences. For example,

to erase all files, you have to say so twice, as in:

ERA C:.\* C:.\*

The TYPE display is paged at 24 lines. You can change the page size, or disable paging.

For the next SAVE or program load operation, you can set the TPA first word address to anywhere in memory. For example:

SAVE 0 \*

SAVE 1 ZERO.TMP

saves 0000 through 00FF in ZERO.TMP.

Swapped disks are automatically relogged, and there's a selectable search path for loading COM files. (The prompt shows the RP/M user number.)

You have file date and time stamps. You can run a batch job on any drive. You can have multiple batch streams and can switch from one to another conditionally on the state of a system

(continued next page)

(continued from page 95)

error flag. There's also a flaw table utility for locking out unuseable disk blocks.

#### Hash Codes And Tables

The file date and time are kept in the directory in a structure similar to that used in CP/M Plus; the date and time, however, are not encoded.

The hash code vectored directory access scheme is different from the

large table scheme used in CP/M Plus. RP/M2 uses a hash table of size 1,2,4,8,16,32,64,128, or 256 words. An entry in the hash table is a directory ordinal, or pointer to an entry in the disk directory.

The hash code is the sum of characters in the file name, masked to match the size of the hash table. When the hash vectored access fails to find a directory entry, the operation defaults to a linear search starting at the front of the directory.

The hash table always holds vectors to the most recently accessed directory entries, and provides immediate access on the second and subsequent references to the same directory entry.

Larger hash tables provide accelerated access to larger numbers of files open simultaneously. Even a hash table of size 1 significantly improves performance of a program that makes repeated references to the same directory entry — e.g. for opening and closing a file during database updates.

#### Memory

The memory structure of PC RP/M2 follows a conventional CP/M 2.2 arrangement. Page zero holds the warm-boot and RDOS entry vectors, and the default fcb and record buffer. User programs start at 0100H. The console processor is at DB00H, RDOS starts at E300H, and CBIOS begins at F100H.

#### CBIOS

The 8080 part of the CBIOS includes a "common" data area for communication with the 8088 part of the CBIOS that resides in the next segment. The CBIOS supports floppy disks and the memory disk. At present we access the hard disk only through PCPIP which calls MS-DOS for DOS file access. We're working on a CBIOS that directly accesses the hard disk as a CP/M device.

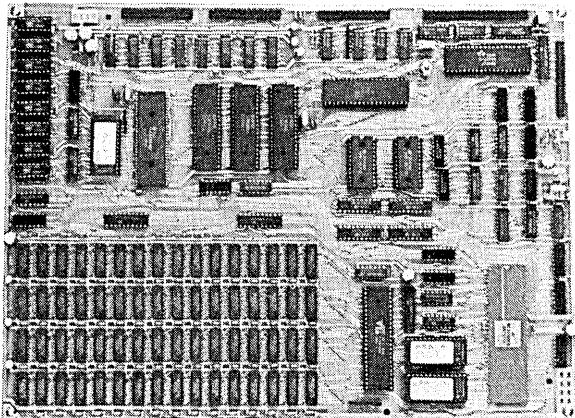
A considerable portion of the PC RP/M2 development effort has been directed toward making the full power of the PC/XT hardware accessible to the 8080 programmer. Direct calls to CBIOS88 can be used to access the entire 20-bit memory space, and the entire 16-bit I/O space of the PC.

#### Interrupt Service — Calling PC ROM BIOS

You can directly call any of the PC ROM interrupts.

We used this in DPTMOD (source is on the disk), which moves the default ROM BIOS diskette parameter table (DPT) to a buffer. It then modifies the step rate digit from C to D, changes the head settle time from 19H to 0FH, then moves the modified DPT to location 0000:0522H. Then it changes the vector at 0000:0078H to point to the modified table.

## MULTI - USER 68000 BOARD



### FEATURING:

- 8 MHZ 68000 CPU
- 2 Mega Bytes RAM
- Memory Mapping / Manager
- HD 64180 Co-Processor
- 8 Serial Ports
- Floppy Controller
- SCSI / SASI Interface
- Parallel Printer Port

Price: \$1500.00

**HAWTHORNE TECHNOLOGY**

8836 S.E. Stark, Portland, Oregon 97216  
(503) 254-2005

**NOW AVAILABLE for  
MS-DOS PC-DOS CPM-86 CCPM-86 CPM-80  
SPEED — POWER — VERSATILITY**

#### Utilities

We include a number of utilities which should make any CP/Mer feel right at home.

RPMPIP is a file copy utility that supports all the disk operations of CP/M's PIP and includes other features.

RSTAT is similar to CP/M STAT. RSTAT displays a sorted directory listing with file date and time stamps, displays file sizes, disk capacities, and disk space remaining, changes file attributes, and sets the iobyte.

MODEMPC is a Christensen protocol file transfer utility.

RTERM installs terminal cursor positioning emulation.

RDISK formats PC RP/M2 disks. We use the same SSDD and DSDD formats as CP/M86.

SETDISK installs an RSX that extends CBIOS to redefine a floppy drive to a selected CP/M format so that existing CP/M files can be processed without conversion.

KEYBD reconfigures the PC keyboard to U.K., French, German, Italian, Spanish, or DVORAK.

COLOR sets the character, background, and border colors, if you have a color card.

#### Refreshing Exceptions

Advances in computer technology usually have meant abandoning the past, rewriting code, and reinventing ways to do the same job in the new environment.

The V20 gives the old a new lease on life. It's an opportunity for us to continue using our existing software.



# EXPRESS 2.0

## FULL SCREEN EDITOR

**HIGH PERFORMANCE AT A FAIR PRICE**

**ONLY \$29.95**

8 Bit Versions

**\$34.95**

16 Bit Versions

**DOES YOUR TEXT EDITOR REMIND YOU OF A 1949 PACKARD....**

Stop abusing yourself. It's time to retire that doggy old clunker!  
**YOU DESERVE EXPRESS 2.0, the 280-Z of the editor world!**

#### EXPRESS 2.0 FEATURES

- FULL ACCESS TO CP/M USERS AREAS (up to 32) with any editor command!
- NAMED DIRECTORIES supported on MSDOS VERSION!
- MEMORY MAPPED VIDEO AVAILABLE FOR IBM PC and PC clones!
- BUILT-IN CP/M LIKE COMMANDS (RENAME, COPY, ERASE, TYPE, DIR, LOG)!
- POWERFUL KEYBOARD MACRO'S (as many as you want)!
- FULLY RECONFIGURABLE COMMAND KEYS (emulate any other editor if you like)!
- FAST, FAST, FAST SEARCH!
- TERMINAL DATA BASE..INSTANTLY configure for over 50 predefined terminals!
- FILES LARGER THAN MEMORY handled with ease!
- CONTROL and HIGH BIT CHARACTERS maybe entered and edited!
- DYNAMIC WORD WRAP/UNWRAP • FULL CURSOR CONTROL (and then some)
- EASY to SET TAB STOPS • GLOBAL/SELECTIVE/LITERAL/IGNORE CASE REPLACE
- FULL BLOCK INSTRUCTIONS including PRINT, SAVE, INCLUDE, MOVE, COPY, DELETE
- VARIABLE SPEED (FAST!) BI-DIRECTIONAL AUTO SCROLL • GOTO PAGE N / LINE N
- COMPACT on disk and in RAM. (even the 16 bit versions are only 25k bytes)!
- NOT COPY PROTECTED!
- AFFORDABLE..High performance at a fair price is our motto
- EXPRESS 1.0 SAMPLER available FREE on your Local Bulletin Board or for only \$10.00 from us. EXPRESS 1.0 is not just a demo. It is a real working editor with enough of the EXPRESS 2.0 features to demonstrate the POWER of EXPRESS.

#### Notes:

CP/M-80 version requires a Z-80 CPU running CP/M 2.2 or greater.

MSDOS version requires MSDOS/PCDOS 2.0 or higher.

We can support too many 5 inch disk formats to list them all. If you can't use one of the listed formats, please try to give us several options.

Please allow 4-6 weeks for delivery.

Gentlemen...I'm ready to step up to EXPRESS...please send the following:

copies of **EXPRESS 2.0** for CP/M-80 at \$29.95 + \$5.00 shipping and handling  
 copies of **EXPRESS 2.0** for CP/M-86 at \$34.95 + \$5.00 shipping and handling  
 copies of **EXPRESS 2.0** for MS/PCDOS at \$34.95 + \$5.00 shipping and handling  
 copies of **EXPRESS 1.0** for  CP/M-80  CP/M-86  MSDOS/PCDOS  
at \$10.00 + \$2.00 shipping and handling

COD - add \$3.50 Wash. Residents add 7.8% state sales tax

Make check or money order  
payable to:

**TCI**  
17733 205th Ave. NE  
Woodinville, Washington 98072

Shipping information:

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

Phone Day \_\_\_\_\_ Night \_\_\_\_\_

#### Disk format desired:

<input type="checkbox"/> Kaypro 2	SSDD	<input type="checkbox"/> Morrow MD2	SSDD	<input type="checkbox"/> 5" Xerox SSSD
<input type="checkbox"/> Kaypro 2X/IV/10	DSDD	<input type="checkbox"/> Morrow MD3	DSDD	<input type="checkbox"/> 5" Xerox SSSD
<input type="checkbox"/> Osborne 1	SSDD	<input type="checkbox"/> 5" MS/PCDOS STD	SSDD	<input type="checkbox"/> 5" Xerox DSDD
<input type="checkbox"/> Osborne 1	SSSD	<input type="checkbox"/> 5" MS/PCDOS STD	DSDD	<input type="checkbox"/> Zenith Z90 SSSD
<input type="checkbox"/> Epson QX-10	DSDD	<input type="checkbox"/> 5" IBM CPM-86 STD	SSDD	<input type="checkbox"/> 8" SSSD
<input type="checkbox"/> Other _____				

**TOMORROW'S COMPUTING INNOVATIONS**

By Gary Entsminger

# CP/M Emulators, More Pascal Winners, and The Games Works...

## CP/M Emulators

In some cases you can have your MS-DOS and CP/M, too.

I've tried several CP/M emulators with my V20 (for more information about this 8088 substitute see Micro C, Issue 27, pages 4-7), and I'm impressed (some of the time) by at least three of them — RPM2, RUNCPM, and CP/Mulator.

All three take advantage of the 8080 instruction set built into the V20, and all three can run under MS-DOS. RPM2 runs as a standalone operating system as well.

RUNCPM and CP/Mulator both run from a floppy, hard, or RAM disk and require you to change the .COM to .CPM extension of your CP/M files when running under MS-DOS. RUNCPM also allows you to select different drive formats and execute CP/M programs directly from CP/M disks (as .COM files).

When RPM2 boots the PC it becomes a CP/M lookalike operating system, down to every BDOS call. Neither RUNCPM nor CP/Mulator supports all BDOS calls, and consequently can run fewer programs.

OUT-THINK (from KAMASOFT), for example, won't work with emulators which don't support BDOS function 32 (Get/Set User Code). CP/Mulator doesn't support this function, and I assume RUNCPM doesn't either, since OUT-THINK won't work with either emulator correctly. But OUT-THINK does work correctly under RPM2.

In general, CP/M emulators work with programs written for the 8080, and don't run programs which directly access system hardware to read/write port addresses (for example, communication programs), or ones that use the Z80 instruction superset. So a lot of your favorite CP/M programs aren't going to run. Before you buy, ask for a list from the vendor.

All three emulators are fast enough

*Figure 1 - Benchmarks*

(for an explanation of benchmarking and C source code, see "Benchmarking Speedy PCs" this issue.)

SYSTEM	BENCH1	BENCH2	BENCH3
Kaypro 10 (4MHz)	478.2	244.6	39.0
PC (6.67MHz)	25.7	13.9	61.3
Blue Lightnin'	203.6	104.3	38.0
RUNCPM (6.77MHz)	329.0	169.2	34.3
CP/Mulator (6.77)	331.1	170.4	63.4
RPM2 (6.77MHz)	326.8	169.0	45.0

Blue Lightnin' is a Z80 plug-in board for clones.  
It runs at 9.25MHz.

to be useful (see Figure 1), even running on a straight vanilla 4.77MHz clone, they're faster than a Kaypro 10. All three come with V20s, replacement instructions, and software. RUNCPM and RPM2 also include CP/M disk emulation programs.

Two of the three manuals I used were in beta test form and were terse, but adequate. RPM2's manual is more complete and more technical. RUNCPM focuses more on introductory matters; CP/Mulator provides some good technical information (complete BDOS function differences between CP/Mulator and CP/M, for example). But all three emulators are easy enough to use; you shouldn't have many problems.

For more info on RUNCPM (costs \$99 with V20) contact —

Micro Interfaces Corporation  
6824 NW 169th St.  
Hialeah FL 33015  
(800) 637-7226

For info on CP/Mulator (costs \$99 with V20) —

Source Information  
P.O. Box 2974  
Warminster PA 18974  
(215) 628-4719

For RPM2 (\$129 with V20) contact —

Micro Methods  
118 SW 1st, Box G  
Warrenton OR 97146  
(503) 861-1765

## OUT-THINK

If you were frustrated by the complexity of KAMAS and just want good outline processing without a built-in programming language, try OUT-THINK, a new offering from KAMASOFT.

It's \$49, and offers an excellent on-line help menu, fast performance, and complete manual, so it's easy to begin to get organized. Fits most CP/M computers. From —

KAMASOFT  
2525 SW 224th Ave.  
P.O. Box 5549  
Aloha OR 97007  
(503) 649-3765

## Pascal Update

We misplaced a few Pascal Runoff names last issue in the Winner's Circle. But we're trying to make amends — see the names in Figure 2. They were all bona fide contestants in our contest. (One wrote to ask if he had to turn in his runoff T-shirt since his name didn't make the first list.)

### **PC Keyboard**

If you're in the market for a better keyboard for your personal clone, try Datadesk International's IBM style keyboard. For a limited time you can buy their keyboard (nice touch, handsome) with Superkey (from Borland) as a package for \$99.95. It's a Micro C deal. List price — \$129.95. Contact —

Datadesk International  
7650 Haskell Ave. Ste. A  
Van Nuys CA 91406  
(818) 780-1673

### **Micro C Bulletin Board**

We've updated the Micro C bulletin board from TBBS to ROS, so you should get better service.

ROS (Remote Operating System) was written by Steve Fox in Turbo Pascal and doesn't require any support software (such as BYE or XMODEM).

### **New programs added this month —**

1. Pascal Runoff winner, PROBE (in the Kaypro area)
  2. LIST, a very fast TYPE lookalike (the best TYPE I've used, with line up, line down, page up, and page down in 16 variable colors) (in the MS-DOS area)
  3. The source for ROFF4 (in the MS-DOS area)
  4. Z, a very swift, versatile directory program (in the MS-DOS area)  
and more.  
Call (503) 382-7643 and take a look around.  
To get started after you've signed on, enter —
- ?
- for the main menu.

Enter —

F  
for the file system (this also gives you a directory of NEW IN).

Enter —

C  
for change.

Enter —

MSDOS  
(or KAYPRO, or whatever) for area.

And enter —

S  
(and a filename) to have ROS send a file to you.

It's easy.

### **The Turbo Game Works**

Good. No one's watching. I think I'll play another game of Turbo Chess. (The bridge isn't bad either.)

With Turbo Pascal source code secrets, strategies, and an excellent manual, it's great fun from —

Borland International  
4585 Scotts Valley Dr  
Scotts Valley CA 95066

### **Fast Step Rate Mod For Kaypro 84s**

If you want to speed up (and quiet) the drives on your Kaypro 84, refer to Micro C, issue 27, page 46, Figure 1, and make these changes —

2 goes to U65 pin 13  
3 goes to U65 pin 4

U82 is really U44.

And that's all the Tidbits worth biting into this issue.



*Figure 2 - Pascal Update*

Robert Huston -- Menu/Batch processor  
Kenneth Grymala -- Logarithms  
Joseph Mortensen -- Mailing Labels  
Terry Smart -- Mailing List  
Norman Saunders -- Z Clock Utility  
Robert Schechter -- Address & Phone Directory  
Stephen Gilbertson -- Compound Interest  
Roy Hollinger -- Appointment Reminder  
Robert Friefield -- Trade Game  
Bryan Ashby -- File printer  
Michael Liddle -- Morse Code Interpreter  
Joe Magee -- Splits large hex file for prom burner  
William Mabee -- File Encryption  
Phil Strope -- Home Accounting  
Harrington Ingham -- Poetry Generator  
George Eldridge -- CP/M-MS-DOS File Transfer  
Dennis Crunkilton -- Inline Hex Code Generator  
Karl Keating -- Word Counter  
Einar Kjartansson -- Vertical Checkers  
John Donovan -- Access DBASE II Files

# WANT ADS

The following folks are reaching you for only 20 cents per word. If you would like to reach the same audience, send your words and 20 cents for each to Micro Cornucopia.

**Disk Drive Sales & Service.** Special Sale - Shugart SA 800-2 \$59; MPI 52S 5 1/4" DSDD full ht. \$55. TEC FB-501 5 1/4" SSDD half ht. \$49. Case w/pwr supply for two 1/2 ht. drives \$59. — Service — SA 800/801 \$25, SA 850/851 \$35, 5 1/4" SS \$30, DS \$40, 8" SS \$40, DS \$50. All drives and service guaranteed for 60 days. Documentation included with drives. Prices do not include parts or shipping. LDL ELECTRONICS, 13392 158th St. N., Jupiter, FL 33478 (305) 747-7384. 29LY

**Hardware for the Kaypro Computer** voice synthesizer unlimited speech \$70. EPROM programmers 2516, 2716, 2532, 2732, 2764 \$110. General purpose power supply used with EPROM programmers, \$30. All hardware comes in kit or bareboard form with software and schematics. Call or write Busch Computer, 395 Totoket Rd., Northford, CT 06472, (203) 484-0320. 29BU

**\$25 Keyboards** for computer builders - 83 keys, full ASCII; upper/lower case, all control characters, numeric pad, caps-lock, repeat, self-test! Brand new, hundreds sold to builders of Apples, Big Boards, Xerox 820s. Parallel output, positive TTL logic, strobe. Uses only 106mA of +5 volts. Custom case available. 90 day warranty unmodified. Keyboard \$25. Documentation (21 pgs)/cable pack \$5. Spare custom CPU/ROM \$4. All 3 (\$34 value) \$30. UPS additional, 5 lbs. Call/SASE for detailed spec sheet. Electrovalue Industrial Inc., Box 376-MC, Morris Plains, NJ 07950. (201) 267-1117. TF

**Public Domain UG Software Rental:** CP/M UG Vol 1-92 on 46 8" floppies, \$45, SIG/M UG Vol 1-246 on 108 8" floppies, \$155. PICONET Vol 1-34 on 17 8" floppies, \$25, Pascal-Z UG Vol 1-30 13 8" floppies, \$25, KUG (Charlottesville) 55 disks, \$65, IBM-PC SIG 1-454 PC-DOS, \$475, PC-Blue 1-175 MS-DOS, \$185, directory disks \$5 PP. Also available on 209 5.25" formats. Rental is for 7 days after receipt with 3 more days grace for return. Credit cards accepted (preferred). Downloading-disk format conversions. Call. User Group Software Automatic Update Service, \$7.50 per 2 volume set PP. 619-727-1015 info. 24 hrs. 619-941-0925 9-5. National Public Domain Software Center, 1533 Avohill, Vista, CA 92083. TF

**TBKUG/DataCOM Super Systems** (tm) proudly announces the arrival of the new SUPER System!! The remote multi-user database for the novice, the semi-pro, or seasoned hacker. Let your modem be your guide to the most current public domain for CP/M-80, MS/PC-DOS, TurboDOS, Turbo Pascal, Big Board, MEX, ZCPR3, CP/M-86, BASIC, Assembler, Kaypro, WordPro, and many other special interests. We are open 24 hours a day and accept 300, 1200, and 2400 baudrates. This is a multi-user TurboDOS-based S-100 system featuring state-of-the-art equipment and dedicated to serving all your telecommunications needs. Membership fees are: \$35 per year for standard access or \$125 per year gets you a VIP membership that includes UNLIMITED system usage and a monthly update disk of CP/M software in Kaypro format. Join over 700 other users who have made the "right" choice. Fees are refundable if you're not satisfied within the first 30 days! Contact Steve Sanders at: TBKUG/DataCOM, 2643 Cedarview Court, Clearwater, FL 33519, or call (813) 791-1454/55 by modem and download an application. 30

**Drive Cleaning Kit Sale!** 8" only, floppyclean with chemicals and carriers. Reg. \$69.95, now \$20 each + \$2 postage. Datalife Head Cleaning System, Reg. \$11.95 and extra head cleaning pack (10) Reg. \$20 - now just \$6 + \$2 postage. National Public Domain, 1533 Avohill Dr., Vista, CA 92084. 33

**"Getting Started With CBASIC"** - Workbook, tutorial style for beginners/intermediates in this powerful language. Fundamentals through file handling, user functions, etc. Ends confusion, frustrations! Only \$25/U.S. Four Corners Press, Hanover, MA 02339. 30LI

**For Sale: MK4128N-25** Mostek 128K dynamic RAM chips. Quantity 32. Asking \$2.50 ea. Used, but 100% functional. I no longer need them after upgrading my RAM disk. Joseph Prewitt, 8060 Greenwood Court, Terre Haute, IN 47802. (812) 299-8171. 29

**Affordable Engineering Software.** Check the Advertiser's Index for our ad in this issue. Call or write for free catalog describing all our products. BV Engineering, 29

**Stop Squinting!** Let MAGGIE! give your Kaypro a 40+ % larger display. Fifteen seconds to install or remove and no tools required. Satisfaction guaranteed. If you really like your little bitty screen better after 10 days, return MAGGIE! for a full refund. Send \$12 check or M.O. to Kay-Pal, 107 Hudson Dr., Hendersonville, NC 28739. Allow three weeks for delivery. 29GR

**Turbo Cheques!** We have developed the most comprehensive personal checkbook management program on the market today. Professionally developed, easy to use, supports color, hard disks, prints checks, security controls, extensive screen displays and reports. 125+ page User's Manual. A real value for only \$39.95. Makes balancing your checkbook every month a breeze. If not convinced, try our Demo Disk for only \$5.00! You'll be pleasantly surprised and you can't lose. If you don't like the Demo, we will refund your money. The Demo price will be credited towards the full version. IBM-PC/XT. CompuTech, Box 7000-309, Redondo Beach, CA 90277. 29FR

**Computer Doctor** - Will repair your SICK computer, drive, etc. Specializing in CP/M, Radio Shack, and IBM machines. Can also program EPROMS. SASE for more info. (314) 243-7160. Computer Doctor, Rt. #2, Box 190, Jackson, MO 63755. 29KR

**Wanted. Big Board I,** 2.5 MHz, working, board only. Garcia, 4325 Ridgepath Dr., Dayton, OH 45424, (513) 236-5342. 29GA

**Micromation S-100 bus computer.** Multiuser, one master two slaves, one Qume DT-8 DSDD and one Fujitsu 2302 20MB hard drive. Sell with or without terminals (adds Regent 25 and Televideo 925). Price \$750 - negotiable. Also Xerox 820-II with two SSDD drives and high profile keyboard. Price \$475 - negotiable. Malcolm Gray, 1502 Wagon Gap Trail, Houston, TX 77090. (713) 893-1726. 29

**XEBEC model #1410E Winchester controllers.** Used. Perfect condition. \$125. Jim Altman, P.O. Box 4548, Anaheim, CA 92803-4548 (714) 491-8951. 29

**For Sale: S-100 Main Frame** - 19 slots, active termination, reset button, key locked switch; two 8" DSDD Qume drives in cabinet with power supply; SDSystems SBC 200; SDSystems Expando III 64K expandable to 256K memory; SDSystems Versafloppy disk controller; CCS 4 port serial I/O; Coex 64K Static RAM; CP/M 80 all manual, etc. \$800. J. Vega, 641 N. Mariposa, L.A., CA 90004, (213) 661-5433. 29

**8086 Coprocessor** with 512K RAM for Xerox 820-II. Runs MS-DOS and CP/M 86. Sohl Source. (402) 895-3577. 29SO

**Slicer 80186** main and expansion boards, \$650 for both. 8" DSDD DC motor drive, \$75. Ron Battle, 1011 Yale NE, Albuquerque, NM 87106 (505) 842-8558. 29

**For Sale: Xerox 820-II motherboard** - \$135; base - \$10; monitor - \$25; keyboard with metal base & cable - \$32; Shugart SA1004 10 meg HD - \$185; SSSD 5 1/4" drive - \$38 with 820 drive cable. Western Digital WD1003 OSC Hard Disk controller card - \$108; TI 5 meg 5 1/4" full height HD drive - \$90; S-100 10 slot motherboard with connectors - \$28; Expando 64K RAM - \$48; Solid State music video Bd. - \$23; Versafloppy II/no ICs - \$10. Bob Stricklin, 2225 Arbor Crest, Carrollton, TX 75007, (214) 492-4218. 29

**Slicer board** for Sale; Best offer. 90% of parts. NOT assembled. Ken (513) 874-6382 before 10 p.m. EST. 29WI

**Want to Trade:** My RATFOR/C version of Kernighan & Plauger's "Software Tools" for the Pascal version. Mark Bohn, 96 S. Holman Way, Golden, CO 80401. 29

**CompuPro 816-A** system for sale with 380K memory, 512K M-drive H board, 8" drives, Televideo 950 terminal and software. Asking \$4500, make an offer. Contact Donald Howes, NW 1013 State St., Pullman, WA 99163, (509) 332-0515 eves and weekends. 29

■ ■ ■

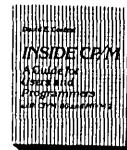
# T-SHIRTS



**ORDER  
YOUR MICRO C  
T-SHIRT TODAY!**

These user-friendly cream-colored shirts are formatted in mahogany border with black enhanced mode design. The fully integrated system is compatible to size S, M, L, and XL, for only \$6.95 ppd. (\$8.50 all foreign).

# BOOKS



## Inside CP/M

By David Cortesi  
\$27.95 (US, Can, Mex)  
\$37.95 (Other Foreign)  
This is one of the best books on CP/M for everyone, users and programmers. It's our reference here at Micro C.



## Your Fortune in the Micro Computer Business

By Victor Wild  
\$26.45 (US, Can, Mex)  
\$36.45 (Other Foreign)  
This is the best, most complete collection of working for yourself information that we've found.  
2 volumes.



## The Small C Handbook

By James Hendrix  
\$17.95 (US, Can, Mex)  
\$22.95 (Other Foreign)  
If you really want to solve the mysteries of the Small C compiler (or compilers in general) you'll want this book.

## MICRO CORNUCOPIA

P.O. Box 223  
Bend, Oregon 97709

# 8" CP/M 80 Disks from Micro Cornucopia

## USERS DISK #2

1-Two single disk drive copy programs, both with source  
2-Crowe Z80 Assembler source  
3-New Crowe.COM file, debugged version  
4-New CBIOS with parallel print driver & other extensions for CP/M 1.4 & 2.2  
5-Disk mapper with source

## USERS DISK #3

1-EPROM burning software for BB 1  
2-Reset bit 7 (unWordStar a file)  
3-Disk file CRC checker  
4-New fast copy program & source  
5-DU77, disk inspector/editor  
6-FINDBAD, isolates bad disk sectors  
7-Print fancy page headings

## USERS DISK #4

1-CBIOS, custom bios for Tandon drives  
2-ZCPR, dynamic CCP checks drive A for missing .COM files; improved commands  
3-ZCPBLOC, identifies CCP location

## USERS DISK #5

1-CAT, disk cataloging routines  
2-Modem 7 for Port A  
3-Modem 7 for Port B  
4-PACMAN, the arcade game  
5-FAST, buffers the disk to speed up assemblies  
6-NOLOCK, removes BB 1 shift lock  
7-VERIFY, cleanup & verify a flaky disk  
8-DUMPIX, enhanced for BB 1  
9-UNLOAD, create .HEX file from .COM file

## USERS DISK #6

1-REZ, 8080/Z80 disassembler, TDL mnemonics  
2-PRINTPRN, prints Crowe listings  
3-RUNPAC, run-time utility package for 8080 assembly language programs. Has 51 functions. Includes source which assembles under ASM

## USERS DISK #7

1-CHNGPFM, PFM monitor mods  
2-TERM, terminal routines let you set up BB as simple terminal, as a file receiver, or as a file sender  
3-Checkbook balancing package  
4-Disk Utilities - copy to memory, from memory, and dump

## USERS DISK #8

1-BDSCIO, custom BDSC I/O for BB 1 (both .h and .c)  
2-YAM, Yet Another Modem program in source & COM form. Turns BB into paging intelligent terminal, complete with printer interface, baud rates to 9600  
3-ROFF, text formatter  
4-SIGNS, prints large block letters

## USERS DISK #9

1-ADVENTURE, expanded 550 pt version  
2-Keyboard translation program  
3-CBIOS, serial & parallel printer interface  
4-EPROM programming package for BB II, for 2732s

## USERS DISK #10 - Lots of Disk Utilities

1-REBOOT, sets up the CP/M auto load  
2-SWEEP, directory/file transfer routine  
3-A, Lets BB 1 recognize a double sided drive as one drive with 494K of usable space  
4-FIX, super disk utility, does everything, much easier to use than DU77  
5-Compare files routine  
6-UNERA, retrieve erased files  
7-FIND, check all drives on system for a file  
8-MENU, menu program for CP/M

## USERS DISK #11 - Printer Utilities

1-Microline 92 printer routine  
2-Graphics display package for MX-80 with Graftrax, very fancy  
3-Epson MX80 setup for BB I with 59.5K CP/M

## USERS DISK #12 - Games for BB I

1-ALIENS, a fast, exciting arcade game  
2-ZCHESS, chess with a 1-6 level look ahead  
3-MASTERMIND, match wits with the computer  
4-BIO, Biorhythm charts complete with graphics on the BB I  
5-LIFE, so fast it's real animation!  
6-CRAPS, see how much you'd lose in Vegas  
7-WUMPUS, a caver's delight, kill the Wumpus or be killed  
8-PRESUP, similar to Othello  
9-Games, 7 games in one program, includes blackjack, maze and animal

## USERS DISK #13

1-ZSOURCE, disassembles to real Zilog mnemonics  
2-EX14, superset of submit or supersub  
3-MOVATCH, lets you use MOVECPM on other copies of CP/M  
4-XMON, 3K expanded BB I monitor, use in ROM or as overlay  
5-CURSOR, prompts you for cursor char you want  
6-UMPIRE, very fancy RAM test  
7-ZSIDFIX, display improvement for ZSID  
8-PIPPAT, modify PIP so you can reset system from within PIP  
9-@, Lets you use the BB as a calculator, including HEX  
10-SORT, sort package written in C80

## USERS DISK #14 - BB II Software

1-PRO32, latest 2732 reader & programmer  
2-SMODEM2, lets BB II talk to Hayes smartmodem  
3-GRAPDEMO, demonstrates BB II graphics (in BASIC)  
4-ATTRTEST, demonstrates BB II graphics (in JRT Pascal)  
5-INITSIO, initializes port B for 300 or 1200 baud  
6-MENU, displays menu of .COM files, enter number to run file  
7-SETCLK, sets realtime clock built into BB II  
8-PRINT2, modified print which accesses BB II clock  
9-BOX, draws a thin line box on screen  
10-ALIENS, space invaders arcade game  
11-LISTSET, printer interface, auto-enables RTS, ignores DCD

## USERS DISK #15 - Word Processing

1-EDIT, very fancy line editor similar to EX (Unix)  
2-TED, simple minded line editor  
3-TTYPE, typing training program written in BASIC  
4-TINYPLAN, very simple-minded spreadsheet.  
5-C80 Text Utilities  
6-CHOP, cuts off file after N bytes  
7-ENTAB, replace spaces with tabs where possible  
8-MS, double or triple spaces a file to output  
9-RTW, removes trailing spaces from file  
10-TRUNC, truncates each line to specified length  
11-WRAP, wraps at column 80, plus pretty printing, page #s...

## USERS DISK #16 - BB I Modem Software

1-RCPM27, list of U.S. bulletin boards  
2-SMODEM, interfaces BB I with Hayes Smartmodem  
3-PLINK66, easy to use with non-CP/M host  
4-BBPAT, menu selection of BAUD rate, bits/char, parity, & stop bits  
5-MODEM 7+, Modem 7 plus BBPAT, lets you talk to anything from port A

## USERS DISK #17 - Small C Version 2

SMALLC2, this substantially expanded version of Small C now includes for, goto, label, switch (case); external declarations; new preprocessor commands; expanded I/O includes redirection; initializers; plus 12 new expressions. The I/O and runtime libraries have been greatly expanded (including printf). Source & documentation on one disk.

## USERS DISK #18 - FORTH

IFORTH, this is Idaho FORTH which can be burned into ROM or loaded from disk. It replaces the PFM monitor & handles all the monitor functions.

## USERS DISK #19 - BB I Double Density

New BB I Monitor, BIOS, character ROM, Winchester Interface, ZCPR, and formatter from Trevor Marshall. See BB I expansion article in Issue #11.

## USERS DISK #20 - Assemblers

CROWEASM: This is the Crowe assembler modified so that it runs on any CP/M system (including the BB I, BB II, Xerox...). LASM: This assembler is similar to the ASM that comes with CP/M except that it can link files at assembly time. PRINTPRN: Print routine for CROWEASM.PRN files. LIBRARY: Utilities which let you combine many files into one, then you can run, type, or extract any file within the larger system.

## USERS DISK #21 - Winchester Utilities

BACKUP: Helps you back up the winchester onto multiple floppies. FLOPCOPY: Lets you make floppy copies (with only one floppy drive). BIGBURST: Backs up a very large winchester file onto multiple floppies. MULTCOPY: Use this like PIP but it prompts you to change disks. Accepts ambiguous file names. MDIR: Displays files in all user areas on selected drive.

## USERS DISK #22 - Pascal Compiler

This is a real Pascal compiler. It supports only a subset of the language (no records, pointers, booleans, reals or complex) but it generates a real .COM file. Everything is on this disk: the compiler, its source, example programs and documentation.

## USERS DISK #23 - Xerox Utilities

This disk contains Xerox specific utilities including a screen drump from Wayne Suga (with source); modifications for the SWP package including ZCPR, a new monitor, and a clock/calendar from Mitch Milnar; and Jim Mayhugh's new monitor (see issue 19). A very special disk for Xeroxers.

## USERS DISK #24 - Prowriter Graphics

This is a complete Prowriter printer graphics package written by the same Micro C subscriber who wrote the MX-80 graphics package. Plot points, lines, circles, boxes, and more. Examples, documentation.

## USERS DISK #25 - Z80 Macro Assembler

This is a real Z80 macro assembler! Syntax closely follows RMAC and MAC. Also includes pseudo-ops to support conditional assembly etc. No phase or relocatable code.

## USERS DISK #26 - BB II CP/M 3.0 Banked BIOS/Winchester

Support CP/M 3.0 Banked BIOS implementation for the BB I. Roy Epperson's software to support the Adaptec ACB-4000 SCSI and the Rodime R204 5" Winchester on the BB II (see issue #19). Plus more Winchester programs.

## USERS DISK #27 - BYE Remote CP/M System

BYE programs to run your BB I, BB II, OR XEROX 820-I as a remote CP/M system using a Hayes Smartmodem compatible modem. Includes programs to allow restricted access.

## USERS DISK #28 - VFILER and Extended Single Density

VFILER is a screen-oriented file manipulation utility, similar to SWEEP, CLEAN, and DISK. Also, Larry Blunk's documentation and software for implementing extended single density (334K) on eight inch disks.

## USERS DISK #29 - MODEM740

The latest incarnation of the immortal MODEM7 program. Too many features to list. Versions for both ports of BB I (Xerox 820) & BB II.

We Also Have 8" Disks  
For CP/M 86 Ask For Catalog

NEW LOW  
DISK PRICE!

8" CP/M Disks ..... \$8.00 each ppd.

Effective April 15, 1986

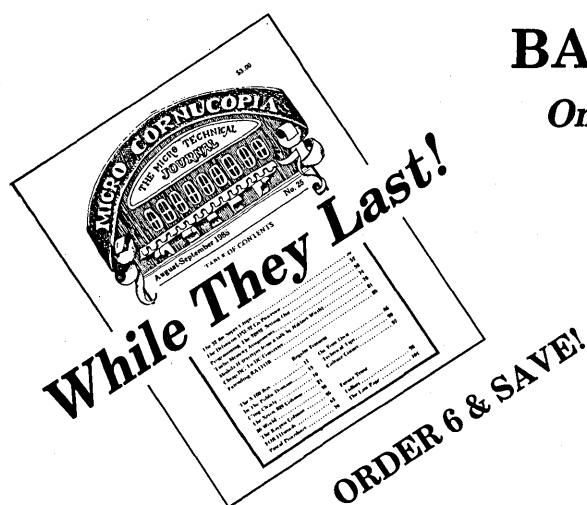
# MICRO CORNUCOPIA

P.O. Box 223 • Bend, Oregon 97709

Order Number 9-5 PST (503) 382-5060 • Technical Information 9-Noon PST Only (503) 382-8048



# WE'RE CLEARING THEM OUT!



## BACK ISSUES OF MICRO C

**Only \$1.50 each when you order 6 or more**

**All Foreign \$2.00 each for 6 or more**

(includes surface postage)

**ISSUE NO. 1 (8/81)**  
Power Supply  
RAM Protection  
Video Wiggle  
1/2 PFM, PRN  
16 pages

**ISSUE NO. 2 (10/81)**  
Parallel Print Driver  
Drive Motor Control  
Shugart Jumpers  
Program Storage Above PFM  
1/2 PFM, PRN  
16 pages

**ISSUE NO. 3 (12/81)**  
4MHz Mods  
Configuring Modem 7  
Safer Formatter  
Reverse Video Cursor  
FORTHwords Begins  
16 pages

**ISSUE NO. 4 (2/82)**  
Keyboard Translation  
More 4MHz Mods  
Modems, Lync, and SIOS  
Undoing CP/M ERASE  
Keyboard Encoder  
20 pages

**ISSUE NO. 5 (4/82)**  
Word Processing  
Two Great Spells  
Two Text Editors  
Double Density Review  
Scribble, A Formatter  
20 pages

**ISSUE NO. 6 (6/82)**  
BBI EPROM Programmer  
Customize Your Chars  
Double Density Update  
Self-Loading ROM  
Terminal In FORTH  
24 pages

**ISSUE NO. 7 (8/82)**  
6 Reviews Of C  
Adding 6K of RAM  
Viewing 50 Hz  
On Your Own Begins  
24 pages

**ISSUE NO. 8 (10/82)**  
Drive Maintenance  
Interfacing Drives  
Installing A New BIOS  
Flippy Floppies  
C'ing Clearly Begins  
Xerox 820 Begins  
28 pages

**ISSUE NO. 9 (12/82)**  
BBI EPROM Program  
Relocating Your CP/M  
Serial Print Driver  
Big Board I Fixes  
Bringing Up WordStar  
Cheap RAM Disk  
32 pages

**ISSUE NO. 10 (2/83)**  
Saving A Flaky Disk  
Hooking Win'z Disk  
The Disk Doctor  
JRT Fix  
Serial Board Interface  
Procedurez Begins  
36 pages

**ISSUE NO. 11 (4/83)**  
BBI Expansion  
BBI Details  
Dyna, RAM Disk Review  
Easier Real Video Cursor  
Planning Review  
Key Column Begins  
36 pages

**ISSUE NO. 12 (6/83)**  
256K For BBI  
Bringing Up BBII  
dBASE II  
Look At WordStar  
Double Sided Drives For BBI  
Packet Radio  
5MHz For Kaypro  
40 pages

**ISSUE NO. 13 (8/83)**  
CP/M Disk Directory  
More 256K For BBI  
Mini Front Panel  
Cheap Fast Modem  
Nevada COBOL Review  
BBI Printer Interface  
Kaypro Reverse Video Mod  
44 pages

**ISSUE NO. 14 (10/83)**  
BBII Installation  
The Perfect Terminal  
Interface To Electronic Typewriter  
BBI Video Size  
Video Jitter Fix  
Slice Column Begins  
Kaypro Color Graphics Review  
48 pages

**ISSUE NO. 15 (12/83)**  
Screen Dump Listing  
Fixing Serial Ports  
Playing Adventure  
SBASIC Columns Begins  
Upgrading Kaypro II To 4  
Upgrading Kaypro 4 To 8  
48 pages

**ISSUE NO. 16 (12/84)**  
Xerox 820 Column Restarts  
BBI Double Density  
BBII 5"8" Interface Fix  
Kaypro ZCPR Patch  
Adding Joystick To Color Graphics  
Recovering Text From Memory  
52 pages

**ISSUE NO. 17 (4/84)**  
Voice Synthesizer  
820 RAM Disk  
Kaypro Morse Code Interface  
68000-Based System Review  
Inside CP/M 86  
56 pages

**ISSUE NO. 18 (6/84)**  
Kaypro EPROM Programmer  
I/O Bytes A Primer  
Kaypro Joystick  
Serial To Parallel Interface  
Business COBOL  
60 pages

**ISSUE NO. 19 (8/84)**  
Adding Winchester To BBII  
6MHz On The BBI  
Bulletin Boards  
Track Buffering On Slicer  
4MHz For The 820-I  
64 pages

**ISSUE NO. 20 (10/84)**  
HSC 68000 Co-Processor  
DynaDisk For The BBII  
Serial Printer On BBI Sans SIO  
Cheap & Dirty Talker For Kaypro  
Extended 8" Single Density  
72 pages

**ISSUE NO. 21 (12/84)**  
Analog To Digital Interface  
Installing Turbo Pascal  
Low Intensity BBI Video  
Turbo Pascal, The Early Days  
80 pages

**ISSUE NO. 22 (2/85)**  
Xerox 820-II To A Kaypro-8  
Sound Generator For The STD Bus  
Reviews Of 256K RAM Expansion  
In The Public Domain Begins  
88 pages

**ISSUE NO. 23 (4/85)**  
Automatic Disk Relogging  
Interrupt Driven Serial Printer  
Low Cost EPROM Eraser  
Smart Video Controller  
Review: MicroSphere RAM Disk  
Future Tense Begins  
88 pages

**ISSUE NO. 24 (6/85)**  
C'ing Into Turbo Pascal  
8" Drives On The Kaypro  
48 Lines On A BBI  
68000 Vs. 80X86  
Soldering: The First Steps  
88 pages

**ISSUE NO. 25 (8/85)**  
Why I Wrote A Debugger  
The 32-Bit Super Chips  
Programming The 32032  
Modula II  
RS-232C: The Interface  
104 pages

**ISSUE NO. 26 (10/85)**  
Inside ZCPR3  
Two Megabytes On DS1-32  
SOG IV  
The Future Of Computing  
MS-DOS In The Public Domain  
Graphics In Turbo Pascal  
104 pages

## BACK ISSUES

U.S. Regular Price .....	\$3.00 each
6 or more 1/2 price .....	\$1.50 each
Regular Foreign Price (air mail) .....	\$5.00 each
6 or more (including Canada) .....	\$2.00 each

Surface Postage Included

## MICRO CORNUCOPIA

P.O. Box 223 • Bend, Oregon 97709

Order Number 9-5 PST (503) 382-5060 • Technical Information 9-Noon PST Only (503) 382-8048

If possible, please indicate  
alternate issue in case we  
are out of your choice.

# The Micro C MS-DOS Library

## MS-1 Essential Utilities

SWEEP, LU86403, LDIR103, WHEREIS,  
SQUEEZE, UNSQUEEZE, WASH

## MS-2 Cheap Assembler & Disassembler

CHASM, ASMGEN, MEMBRAIN, FSPOOL,  
UNWORDSTAR, RAMDISK, SDIR, SDIR SOURCE

## MS-3 Adventure

The original and most cussed adventure in C, with source.

## MS-4 Single User RBBS

A decent bulletin board with source.

## MS-5 File & Directory Utilities

UTIL, Z, VTYPE, ST, PROTECT, UNPROTECT

## MS-6 fig FORTH

We combined fig FORTH source (MS-7) with this disk so you get both on one disk for \$12.00.

## MS-8 Super Games

CASTLE, a graphic and conversational adventure (note: there's a bug that changes the game once it's been saved). TREKRUN, Star Trek Command adventure, and BOUNCING BABY

## MS-9 PC Musician, Pascal Games, Calculator

You might call this an educational disk. PC MUSICIAN teaches you music while you're writing songs. (They play right on the PC.) 15 PASCAL GAMES with source. The games aren't memorable but they are good examples of Turbo code (we include the source) PROGRAMMER'S CALCULATOR shows the internal workings of a stack, memory, and registers.

## MS-10 Modems

QMODEM and KERMIT

## MS-11 Multi-User RBBS 12.3

Multi-user Remote Bulletin Board System with source disk (MS-12) included free.

## MS-13 Editor & Formatter

ROFF4, PC-WRITE, and manuals on disk. Very popular freeware.

## MS-14 FORTH 83

## MS-15 Deskmate, Zap, Unerase

A sidekick lookalike, disk inspector, and more utilities.

## MS-16 Piano Man & Other Tunes

Turn your keyboard into a piano.

## MS-17 Arcade Games

PANGO, PYRAMID, BRICKS, and more.

## MS-18 Typing Tutor

A nice touch-typing practice tool. Keeps track of your keystrokes, errors, and practice time. Calculates accuracy and words/minute.

## MS-19 Prolog, XLisp

Introductory interpreters to improve your artificial intelligence.

### When ordering, please specify:

PC Standard 5 1/4", DS/DD, 360K .....\$8.00  
Kaypro 2000 3 1/2", DS/QD, 720K.....\$8.00

**NEW LOW DISK PRICE!**  
Effective April 15, 1986

## ADVERTISER'S INDEX

Advanced Concepts Engineering	25
Ampro Computers	76, 77
Andratech	68
Aprotek	15
BD Software	39
BV Engineering	31
Bakkens, Andy	89
Borland International	Inside Front Cover
Carolina Engineering Labs	73
Cascade Electronics	59
C.C. Software	44
Computer Helper Industries	54
Computer Journal	61
Computer Surplus Store	19
Computing Technology	42
CompuView	21
Craig's Computers	67
Data Desk	Inside Back Cover
The Data Mill	67
Decimation	36
Digital Dynamics	10
Digital Research	82
Echelon, Inc.	27, 61
EcoSoft	15
Emerald Microware	26
Epic Sales	11
ERAC Co.	78
E21 Computer	68
Ferguson Engineering	65
Hawthorne Technology	96
Holliston Computer	8
The ICU Group	43
Integrand	83
Intersecting Concepts	34
Kamasoft	5
Kenmore Computer Technologies	58
KYSO Technology	15
Laboratory Microsystems	64
L-Band Systems	70
Logitech, Inc.	41
Manx Software	64
Microcomputer Systems Consultants	52
Micro Cornucopia	90, 100-103
Micro Interfaces	46
Micro Methods	82
Micromint	7
Microprocessors Unlimited	10
MicroSphere	80
Micro Supply	22, 23
Miken Optical Co.	58
Mitek	37
National Public Domain Software	20
Oliver Computers	68
Orr Corp.	37
PC Tech	Back Cover
Periphco	57
PluPerfect Systems	49
Poor Person Software	71
Qua Tech	79
SBC Mart	42
Second City Software	53
Servo Computers	17
Slicer	71
Soft Advances	31
Source Information	19
Southern Pacific USA	10
Superior Electronics	67
Systems Peripherals Consultants	48
Tomorrow's Computing	97
Unified Software	64
United Products	1
Viking C Systems	17
Western Wares	19
Westwind Computers	55
WW Components	75

# MICRO CORNUCOPIA

P.O. Box 223 • Bend, Oregon 97709

Order Number 945 PST (503) 382-5060 • Technical Information 9-Noon PST Only (503) 382-8048

## Clones & Bones & Tomes

By Gary Entsminger

### PC Upgrades And Imperfections

I've had a good time improving my personal clone this month. (Some of us are never satisfied).

For you joining late, my PC started as a 4-layer Mega-XT Taiwanese IBM PC-compatible system board (a mouthful), video and multi-I/O cards, 2 floppies, keyboard, monitor, and a 135 watt power supply. In November, it cost me \$803, and I assembled it in an hour.

Now I'd pay \$40-\$100 more for a similar computer and have to wait longer for delivery of parts.

Teac and Mitsubishi drives have gone up in price from \$79 to \$100 (or so) each (when you can find them); main boards (with 640K on board) are \$250ish, a little spendier. And good monitors and good keyboards are a bit harder to come by.

If you're discount shopping for Keytronic keyboards, beware — most discounters are selling "keytronic style" not "Keytronic." And keytronic style varies from keyboard to keyboard. If you're really picky, you should buy where you can test first. (If it's really a Keytronic, it says Keytronic all over.)

### More Memory (I Needed It)

The first improvement my PC endured was an increase in memory on the main board from 128K to 640K. Memory costs about \$10 per 128K, and it's definitely worth it — my most important upgrade.

With 640K I can auto-install a 256K RAM disk (to speed up editing and compiling), add UNIFORM (to read Kaypro, Slicer, or just about any other disk format), Turbo Lightning (to correct my spelling quicker than a first grade teacher), SIDEKICK (for the Notepad and Calculator), and still have enough memory to run a 100K-plus program.

### V20 Speedup

I swapped my 8088 for a V20, and was pleasantly surprised when the V20 (a CPU containing both 8080 and 8088 instructions) sped up my clone

between 10% and 40%. (For the details of various speed tests, see "Benchmarking Speedy PCs," this issue.)

Then, after Larry and Dave decided to swap their PC's 14MHz crystals for 20s, I jumped at the chance to keep up. The new crystal provides a 6.77MHz clock and increases the PC's speed another 5-30%, for an overall speedup of at least 50%. The Norton utility test rated my PC at 1.7 (or not quite twice as fast as an IBM PC). The V20 cost \$15; the crystal cost \$2. The changes take 15 minutes.

But be warned. Changing the crystal isn't a perfect modification. The new clock speed creates problems if you have a color graphics board. The board uses the system clock (14.31818MHz) from its plug-in slot to generate the color signal (and the composite B&W). If you change the system crystal to 20MHz, then that's what the color board gets also. The color board doesn't care, but the monitor does, and with the faster horizontal, vertical, and video signals, it gets very confused and very unreadable. (See the speedup article for a simple addition that generates a new 14.31818 for the color board.)

Both color and monochrome adapters use 6845 controllers to produce the correct horizontal and vertical sync pulses needed by the CRT, but the monochrome adapter has its own clock. It couldn't care less what the processor does.

### Monochrome Is Delightful

I switched to a monochrome display, bought a monochrome (TTL) monitor, and the system runs great. In fact, if you're mainly word processing, a monochrome display is easier to read and easier on the eyes (although you don't get Turbo Lightning in brilliant color).

The monochrome display's high resolution stems from 14 scan lines instead of 8. And if you buy a Hercules (or compatible) card you get both the great text (all 14 scan lines) and great B&W graphics.

Most of the software I've tried runs correctly on the Hercules card (WordStar, VEDIT, Turbo Pascal, Turbo Chess, Turbo, etc.). But some programs for sure won't: Bouncing Baby on Micro C MS-DOS disk 8, for example.

A monochrome Hercules-compatible card costs \$95. A good TTL monitor costs at least \$100. We've tried (and like) the Magnavox, Princeton, and NEC low-end models.

### Taiwanese BIOS

If you've been curious about the clone BIOS, here's the latest: the Taiwanese government has decided it's better equipped to generate a clean (legal) ROM BIOS than a Taiwanese computer company would be.

According to William M. Raike (BYTE's Japan columnist), ERSO (the Electronics Research and Service Organization) has developed its own PC compatible BIOS which it licenses to its computer manufacturers.

ERSO is sponsored by the Taiwanese government and acts as legal negotiator with the U.S., thus letting small Taiwanese computer companies avoid legal entanglements and get on with the business of making very compatible, dependable, and inexpensive PC parts.

Supposedly, by involving itself in the copy market, the Taiwanese government discourages piracy.

### The Way Of Life

Lao Tzu, a famous Oriental born around 600 BC, and looking ahead to our age, wrote a note —

Knowledge studies others,  
Wisdom is self-known;  
Muscle masters brothers,  
Self-mastery is bone;  
Content need never borrow ...

and IBM, in their wisdom, looking ahead to another coming faster, added:

You'll thank us for the memory.



RISK FREE  
30-DAY MONEY-BACK GUARANTEE

NOW FOR YOUR IBM PC, XT, AT, AT&T, PC Jr. AND COMPATIBLES\*

# "THE PC HARDWARE BARGAIN OF THE YEAR"

Chuck Humble — Computer Editor



OUR NEW PC 8700 AT-STYLE KEYBOARD AND  
BORLAND'S SUPERKEY® SOFTWARE

*Offer expires  
5/31/86*

THE PC 8700 AT-STYLE KEYBOARD INCORPORATES EVERY IMPROVEMENT  
IBM DESIGNED INTO THEIR ADVANCED "AT" KEYBOARD. QUALITY SO  
GOOD, IT'S BACKED BY AN UNPRECEDENTED TWO-YEAR WARRANTY!

Advanced design features include:

- Separate Numeric Keypad simplifies data entry
- Status Lights for Cap, Num and Scroll Lock helps eliminate typing errors
- Extra-wide Control and Return Keys for ease of use
- Return Key placed in "standard typewriter" position for touch typists
- Selectric layout for Office Standardization
- Positive Tactile Feedback
- Keystrokes rated for 50 million keystrokes
- Made in USA
- 2-Year Warranty

BORLAND'S AWARD-WINNING SUPERKEY INCLUDED! GET THIS BEST-SELLING KEYBOARD ENHANCER SOFTWARE — VALUED AT \$69.95 — AS PART OF THIS AMAZING OFFER AND CAPTURE THE POWER OF MACROS!

SuperKey's macro capability is remarkable. It literally turns a thousand keystrokes into one. Features include:

- Exclusive screen data Cut & Paste
- Screen Privacy and Protection
- Time & Data Stamping
- ProKey Compatibility
- Data Encryption
- Keyboard Lock
- Keyboard layout customization
- Integration with SideKick
- Pull-Down Menus
- On-Line Help and much, much more!

Corporate and Institutional Purchase Agreements Available

**data**desk  
INTERNATIONAL

7650 Haskell Avenue Suite A  
Van Nuys, CA 91406

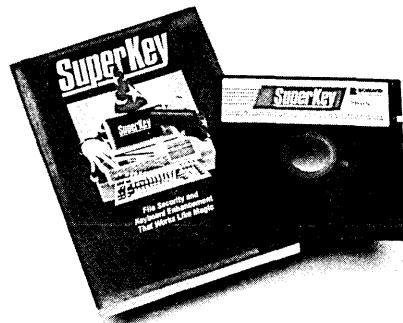
\* PC Jr., AT&T and Corona computers require adaptors available at a nominal fee. Call for pricing.

SuperKey and SIDEKICK are registered trademarks of Borland International, Inc.  
IBM, PC, XT and AT are registered trademarks of International Business Machines Corp.

Both  
Hardware & Software  
**\$129<sup>95</sup>**

*Introductory  
Offer #99.95*

INCLUDES BORLAND'S SUPERKEY  
AWARDED "BEST OF 1985" BY  
PC MAGAZINE



RETAILS ALONE FOR \$69.95

## CRITICS CHOICE

"The keyboard's construction is solid . . . also quick and responsive to the touch. It is ideal for anyone who wants to or has to replace their PC keyboard . . . At \$129.95 DataDesk's keyboard is a bargain. The PC 8700 keyboard with SuperKey for that price is a steal."

Computer Shop Talk, 3-3-86

"DataDesk International has designed a sturdy and handsome keyboard that has a tactile response . . . and bundled with SuperKey is the PC hardware bargain of the year."

Charles Humble — Computer Editor, The Oregonian

ORDER NOW — CALL TOLL FREE 800-826-5398; IN CA 800-592-9602  
or fill out coupon and include check or credit card number and mail to DataDesk  
International, 7650 Haskell Ave., Suite A, Van Nuys, CA 91406.

## SuperMacro Keys

PLEASE RUSH ME \_\_\_\_\_ KEYBOARD/SUPERKEY BUNDLES AT  
\$99.95 EACH. PLUS \$10 SHIPPING AND HANDLING IN THE U.S.A.

ENCLOSED IS MY CHECK FOR \$109.99 FOR EACH BUNDLE  
(\$116.45 FOR CA RES. — SALES TAX INCL.)

VISA    MC   NUMBER \_\_\_\_\_

EXP. DATE \_\_\_\_\_ SIGNATURE \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

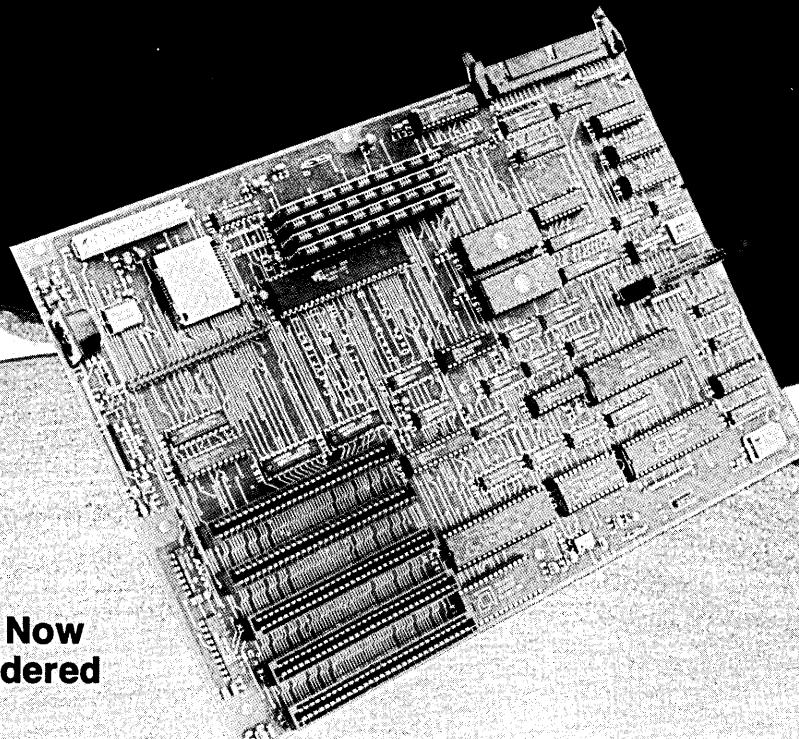
COMPUTER TYPE & MODEL \_\_\_\_\_

\* OFFER EXPIRES MAY 31, 1986

**NEW  
LOWER \$**

# the X-16A gives you Out of This World Performance

All Kits Now  
Fully Soldered



## PLUS PC COMPATABILITY!

### Features:

- 8 MHz 80186 microprocessor with true 16-bit data bus.
- True PC compatibility with our own custom ROM BIOS and PC cardslots for the video of your choice.
- Standard 512K zero wait DRAM, 640K or 1M options.
- 8087 numeric coprocessor port.
- On-board floppy disk controller for up to four 5 1/4" drives.
- On-board SCSI hard disk controller port.

**NEW**

Designed, Manufactured and Serviced by:

**PCTECH**

P.O. Box 128  
904 North 6th Street  
Lake City, MN 55041  
(612) 345-4555

COD, VISA, MASTER CARD, CERTIFIED FUNDS

### Kits

**NEW LOWER PRICES**

- |  |           |
|--|-----------|
| • Quick Kit.....   | \$ 625.00 |
| • Full Kit.....  | \$ 750.00 |
| • Assembled and Tested.....                              | \$ 850.00 |
| • 1/2 MEG Add-On .....                                   | \$ 150.00 |
| • XT Style, Enclosure .....                              | \$ 75.00  |
| • 150 Watt Power Supply .....                            | \$ 105.00 |
| • 5 1/4" 48 TPI DS<br>1/2 Height Floppy Disk Drive ..... | \$ 125.00 |
| • 8087-2 Coprocessor Board .....                         | \$ Call   |

**NEW**

### Total Solutions:

#### Assembled and Tested Systems

- Mono-Chrome System ..... \$ 1599.00  
Includes: 512K, Power Supply,  
Enclosures, Keyboard, Monitor,  
Two Drives, and Printer Port.
- Color System..... Call
- Quantity Discounts Upon Request
- Call For Info on Add-Ons, Hard Disks, Etc.