<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The BBII and the Winny</td>
<td>5</td>
</tr>
<tr>
<td>6MHz on the BB-I</td>
<td>10</td>
</tr>
<tr>
<td>Bulletin Boards, Getting It Together</td>
<td>13</td>
</tr>
<tr>
<td>Pascal Procedures</td>
<td>15</td>
</tr>
<tr>
<td>The Yin and Yang of EPROM Programmers</td>
<td>19</td>
</tr>
<tr>
<td>Kaypro Column</td>
<td>20</td>
</tr>
<tr>
<td>SBASIC Column</td>
<td>22</td>
</tr>
<tr>
<td>Track Buffering on the Slicer</td>
<td>25</td>
</tr>
<tr>
<td>C'ing Clearly</td>
<td>30</td>
</tr>
<tr>
<td>FORTHwords</td>
<td>32</td>
</tr>
<tr>
<td>Xerox 820 Column</td>
<td>34</td>
</tr>
<tr>
<td>4MHz for the 820-I</td>
<td>36</td>
</tr>
<tr>
<td>EZ Prommer for the BBI and 820</td>
<td>43</td>
</tr>
<tr>
<td>On Your Own</td>
<td>53</td>
</tr>
<tr>
<td>BB-I Directory for Micro C</td>
<td>55</td>
</tr>
<tr>
<td>Technical Tips</td>
<td>60</td>
</tr>
</tbody>
</table>
THE BIG BOARD PROJECT: With thousands sold worldwide and over two years of field experience, the Big Board may just be one of the most reliable single board computers available today. This is the same design that was licensed by Xerox Corp. as the basis for their 820 computer. The Big Board gives you the right mix of needed computing features all on one board. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

- 64K RAM
  Use Industry standard 4116 RAM’s. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

- Z-80 CPU
  Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERRUPTS. Fully buffered and runs 8080 software.

- SERIAL I/O (OPTIONAL)
  Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clock can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminus. Supports mode 2 int. Price for all parts and connectors: $39.95

- BASIC I/O
  Consists of separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

- BLANK PC BOARD — $99.95
  The blank Big Board PC Board comes complete with full documentation (including schematics), the character ROM, the PFM 3.3 MONITOR ROM, and a diskette with the source of our BIOS, BOOT, and PFM 3.3 MONITOR.

- 24 x 80 CHARACTER VIDEO
  With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 217U style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix — Upper & Lower Case.

- FLOPPY DISC CONTROLLER
  Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M or Z-80.

- TWO PORT PARALLEL I/O (OPTIONAL)
  Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. Uses selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $19.95

- REAL TIME CLOCK (OPTIONAL)
  Uses Z-80 RTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $9.95

- CP/M* 2.2 FOR BIG BOARD
  The popular CP/M* D.O.S. to run on Big Board is available for $139.00.

- DOUBLE DENSITY ADAPTER BOARD — $149.95 (A&T)
  Requires no cuts or MODS to an existing Big Board. Gives up to 670K storage on a single sided 8 in. diskette. With software to patch your CP/M* 2.2.

Digital Research Computers
(OF TEXAS)
P.O. BOX 461565 • GARLAND, TEXAS 75046 • (214) 271-3538

TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD’s for the Big Board only with a $75 deposit. Balance UPS COD. Add $4.00 shipping. USA and CANADA ONLY

*TRADEMARK OF DIGITAL RESEARCH. NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE ORIGINATORS OF CP/M SOFTWARE
**1 TO 4 PIECE DOMESTIC USA PRICE.
Here Come The Androids!

New Directions

You only have to spend a few minutes with a good science fiction novel to realize that we’re not yet really expecting very much of computers. At least not yet.

Sandy and I have computers in our house, and they are very smart as computers go, but none of them has ever offered to fix tea, and then clean up the dishes afterwards. (And then there is the newspaper.) I mean, even the simple task of vacuuming the carpet or mowing the lawn is beyond the fanciest IBM. (Sometimes I wonder if these machines are really so stupid: after all, I don’t enjoy mowing the lawn either.)

The Problem Is

People are aiming too low when they design systems and software. There is a bunch of ostriches out there trying to create artificial intelligence. What they are really creating is a simple data base that tells the computer whether an action did or didn’t work in a previous situation. Big deal!

What they really need to work on is anticipatory logic. You know, the computer figures out what the human needs to know before the human asks. Then once the human has the answer, all he needs to do is figure out what his question must have been. (Just think, people could sit around dreaming up the ultimate question, knowing that they already had the answer.)

But seriously, there are a lot of people satisfied letting computers cling to their classic roles such as word processing (what I’m doing as I write this), data base manipulation, calculating, accounting, and software development. And, a lot of you are wondering what great new thing someone will come up with for computers to do (and we all know that whoever comes up with the idea will probably become immensely famous and even more immensely rich). So, why not come up with the ideas yourself? Look closely at the computer’s standard input from the outside world—it’s a crumby keyboard. Look at how a computer talks back—it’s a large, irritating cathode ray tube or a pin-head printer. And everyone’s falling over everyone else trying to come out with the next fad color for a video tube.

What other possibilities are there for communication? My gosh, there are more possibilities than there are computers. Why, just look at all the ways people communicate and they don’t even have an RS-232 port! People hold hands, they cross their legs, they nuzzle, they smile, they scream, they wrinkle their brows, they walk away, they cry, they carry on heated discussions in a cold sweat. People have even been known to lend a hand, hug a child, or kiss a loved one. I have yet to see a keyboard facilitate this kind of communication (and people wonder why computers seem cold and lifeless).

There are many obvious extensions to the computer, speech synthesis, speech recognition, and environmental testing (temperature, pressure, air velocity, object proximity, sound levels ...). There are new communications possibilities (like packet switching) that open up many new ways for computers to share information.

Why not have computers drive cars (or whatever we would use for transporting our bodies and possessions)? Sure engineers have looked at this problem but they were auto manufacturing engineers trying to plug computers into classical auto technology. Why start with classical anything? Mass transportation is an obvious option but what happens when people want to have personal, inexpensive transportation at the destination?

Try playing think-tank with some friends some evening and see you come
Dear Editor,

There is a glitch in the WCOUNT.COM program on the K2 disk.

I counted words in several chapters of a manuscript using this and got 27,168. I counted the same words using The Word (Oasis) and got 22,716. The error on each chapter was about the same, and the correct word count from the The Word was 83.61% of that done by WCOUNT.COM.

I made a file on WordStar, being "Now is the time for all good men to come to the aid of their party," typed out four times with two CRs after each one, a total of 8. The Word counted correctly, 64 words. WCOUNT.COM got 72.

So I think WCOUNT.COM must count CRs as one word. This makes quite a difference in a long double spaced manuscript if that is true. The cure might take 83.61% of the WCOUNT.COM number. Or it might be better to rewrite this program.

Thomas P. Leary
218 So 95
Omaha NE 68102

Editor's note:
Yep, you're right. I tried it myself and WCOUNT is in error. Darn it! I'm beginning to suspect that WCOUNT was written by a novelist who was paid by the word. The counts are definitely fiction! Unfortunately we don't have the author's name, or the original manuscript.

Dear Editor,

I would like to express my discouragement at the small number of articles relating to the BB-II. I see the emphasis shifting from BB-I to Kaypro (just look at the user disks released since BB-II came on line). I like your magazine and look forward to its arrival. Unfortunately, my expectations are dashed when I look at the table of contents. Little, very little on BB-II.

Any encouraging words for the future?

J. Wytasma
9 Pitch Pine
Topsham ME 04086

Editor's note:
See the feature article in this issue.

Dear Editor,

Just a short note to say how much I really enjoy Micro C. I don't bother you with phone calls because I understand first hand the time consuming aspects of writing and producing a newsletter/magazine. I wish my own newsletter were as diverse and rich in useful information. However, I do try. I find that Ralph Freshours' experience (On Your Own in #17) strikingly parallels my own experience in producing The Piece of Kayne National Newsletter.

My issues are running 17 pages without ads and we've been charging a better $8/year (now $10). It costs over $10/year to produce and mail. The newsletter will survive, but it loses money, and my resources are limited. Possibly you could suggest a few tricks to help?

Steve Bender
NATKUG 212-776-2909
Box 28360
Queens Village NY 11428

Editor's note:
You might try raising your subscription rates.

Dear Editor,

I recently subscribed to your fine journal and got the back issues that dealt with the Xerox 820. A friend of mine and I bought some of the bare boards and put them together. We have them running now but not without a great deal of weeping, wailing, and gnashing of teeth. I thought perhaps our problems and solutions might be of help to your other readers.

1. The system clock and video clock crystals would not oscillate. By removing C90 and C26, we were able to get them started. The frequency is a bit low and might be corrected by adding a small capacitor in series with the crystals but so far we haven't done this.

2. The operation was very erratic. Some chips would work in some sockets, but not in others. Sometimes the keyboard would not input. Our test equipment is not very sophisticated but we decided that 2N2905(Q1) transistor was not doing its job.

Here in the boonies you try what you have on hand and our final selection was a TIP30 which is in a TO220 case and looks out of place and requires screwing the leads around to make it fit the board. It works like a charm, however, and cured problems in both boards.

3. There wasn't any output at 4MHz or 2MHz from U12. There are two spare gates on U9 so jumper E2 was removed and pin 9 of U9 was connected to pin 12 of U9. Pin 8 of U9 was connected to 11 of U9. This adds an extra buffer to the oscillator and sharpens the rise and fall time of the oscillator signals.

Probably higher activity crystals and a handful of 2N2905s would have made these changes unnecessary, but the changes worked for us.

Ken Stone
641 Grant Avenue
Twin Falls ID 83301

Dear Editor,

I don't know where y'all stand on Build Your Own Z80 Computer by Steve Ciarcia, Byte Books (1981), but this book is great for learning what all those chips do. He doesn't try to cover everything (flop disks aren't included for example), but if you understand everything in this book, you're probably equipped to tackle the subject. You might consider a review, or at least a mention for readers who want to get into hardware, but don't know where to start.

Roger G. Smith
Rt. 2 Box 366
Laurel MS 39440

Dear Editor,

Come on, guys, it's not funny. I protected every file I've got with your "Password" routine when the disk arrived, and now I can't remember half of what they're coded with.

Another thing, you can't change the password but you can add another one. Now some of my files have two codes.

I sure hope someone there knows the solution to this, it's been real bad news running home for masters while I'm explaining to my wife why I bought a computer. And don't tell me the same genius wrote "Adventure."

P.S. What are the DS's, DW's and DB's mentioned in the ZESOURCE documentation? Is this similar to having DT's? Did the "Password" author have DT's?

Jack Long
6910 Renwick Suite C
Houston TX 77081

Editor's note:
Sorry jack, there's no way back. You should make a copy of your unprotected file before using password on it. This allows you to replace the protected file if you forget your password.

However, if worse comes to worse, I've heard that you can use DDT or DUMPX to read the original file.
Dear Editor,

I wanted to send you this letter as a personal thank you for the time Dana Cotant spent on the telephone with me the other day. I do realize that all of you at Micro C must find calls like mine the last word in frustration. I also realize that you are not in any way obligated to provide this service.

The only excuse that I, and others like me, can present in defense of our selfish demand on your time, is that you are about the only source of good, usable information around when it comes to some problems. The fifteen minutes that I spent on the telephone with you gave me enough information to eventually find and rectify the problem with my Kaypro. The two and a half hours that I spent on the telephone talking to Kaypro and my dealer yielded nothing but an immense headache.

The only way that I can repay you for this invaluable assistance is to patronize your magazine in every way that is available to me, by subscribing, and purchasing your disks and ROM's. I hope that this helps to compensate you, in some small way, for the massive demand on your time that phone calls represent.

Any policy that you are forced to adopt concerning calls would be completely understandable. But I, for one, am truly grateful for the assistance that you have provided me.

Joe Fitzpatrick
1539 N Bronson #18
Hollywood CA 90028

Dear Editor,

A speedup swap of CPU's gave these results: An SGS Z80A would not run at 2.5MHz with cover on. An SGS Z80B would run at 4MHz but not at 5 with the cover on. I even installed the Q1 speed-up circuit with little improvement.

So I tried a different tack. On U67, I tied pin 9 to 11, (inputs of two sections paralleled); cut the ground trace to 11; tied pin 10 (output of new section), to U63 pin 6; cut trace to pin 6. All leads were on the bottom side of the board. Then I removed Q1, R26 (1.2K, a heavy load for a CMOS!), and R25 (200 ohms).

Unfortunately, the ground trace to U67, pin 11, runs under the socket (on the top side of the board). You have to remove the socket in order to cut the trace.

The easiest way to remove the socket is to cut up its plastic body with cutters and then unsolder the pins one at a time. Use a straw to blow the solder from the socket holes while you heat them.

Now use an Exacto knife to cut through the trace in 2 places about 1/8 inch apart, then take a hot iron and push the cut trace off the board. After cutting the trace, solder in a new solder-tail socket.

Even extra heat doesn't stop it now!

Harvey DeGering
1245 E. Washington Blvd.
Pasadena CA 91104

Dear Editor,

I have a BB-II which I built up from the bare board. I have experienced the two seconds of agony before that first beep and the ecstasy that followed.

My BB-II runs great and I am impressed with its performance. However, I need complete system documentation to make full use of BB-II's capabilities. I have contacted Cal-Tex several times concerning documentation, and although I have received the updated schematics, there seems to be no system documentation forthcoming. Also, there is the matter of the new version of the monitor ROM that is mentioned in Micro C occasionally. Cal-Tex says the new version is still under test and cannot be released. I understand the monitor ROM cursor fix works, why not release that along with instructions on installation?

As a customer of Cal-Tex I am not sure what I can expect, but BB-II as a product, deserves better treatment than this.

I would like to thank Micro C and all contributors as I have used you in substitute for much of the documentation that could have come from Cal-Tex.

Michael P. Parvin
5200 SW 3rd Court
Plantation FL 33317

Editor's note:

Try contacting Jim Ferguson at Ferguson Engineering for information on the BB-II. Jim, bless his soul, is providing what support he can for the system (the advertisements in Micro C under the name Ferguson Engineering).

Dear Editor,

I am looking for a book or books that explain the complete inner workings of a microcomputer in nontechnical language. I would like to find a book that explains byte by byte what occurs from the moment the computer is turned on, through common operations, and until it is turned off. I know this might be a tall order, and such a book may not exist.

Let me know if you know of such a book, or if you would be interested writing a fairly short (under 50 pages) theory of operation for a reasonable fee. What is reasonable... that is the question... let me know if you are interested. It wouldn't have to be anything too elaborate.

Thank you! I like your publication, having just received a back sample issue. A bit complicated though. Not your mass-oriented magazine. Do you have to go to an expensive electronics school to be able to understand microcomputer electronics and assembly programming? What other options are there?

Locke Highleyman
1125 Oak Grove Avenue
San Marino CA 91108

Editor's note:

There are many facets to this field and it is easy to get lost. However, four of the main areas of study for a CP/M user are CP/M, the hardware end of computers, applications programs, and languages.

I think the best book on CP/M for a broad mix of users is Inside CP/M. See this column for information on a hardware book by Ciarcica. There are numerous books on Perfect Software and Micro Pro (applications), and I recommend a text on Pascal and a copy of Turbo Pascal for the language end of things.

Dear Editor,

Your new character ROM is very nice, and the new monitor seems to handle the 5 MHz upgrade very well. My computer is going like a bat out of hell!

My keyboard was hanging up at 5 MHz. I replaced the SIO with the 'A variety, and the problem has vanished. I also replaced both PIOs (with me it's either all or nothing). I had been getting a few disk errors; now that problem is gone too. Thank you so much for your help over the phone.

My friends are relieved too. A young lady I know has a Kaypro that had constant disk errors. I don't know how she lived with them, they were so bad. The dealers scared her off with the old $50/hour "gee whiz" shrug of the shoulders. I did the driver fix in issue #11, and now she thinks I'm a whiz. Of course, I gave her your address and phone number, giving credit where it is due.

Geoffrey S. Knauth
Harvard University
56 Linnaean Street
Cambridge MA 02138

(Letters continued on page 44)
Jim Ferguson, the designer of the "Big Board" distributed by Digital Research Computers, has produced a stunning new computer that Cal-Tex Computers has been shipping for a year. Called "Big Board II", it has the following features:

- **4 MHz Z80-A CPU and Peripheral Chips**
  The new Ferguson computer runs at 4 MHz. Its Monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.

- **64K Dynamic RAM + 4K Static CRT RAM + 24K E(PROM or Static RAM**
  "Big Board II" has three memory banks. The first memory bank has eight 4164 DRAMs that provide 60K of user space and 4K of monitor space. The second memory bank has two 2Kx8 SRAMs for the memory-mapped CRT display and space for six 2732As, 2Kx8 static-RAMs, or pin-compatible EPROMS. The third memory bank is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board or assembled and tested, it comes with a 2732 EPROM containing Russell Smith's superb Monitor.

- **Multiple-Density Controller for SS/DS Floppy Disks**
  The new Cal-Tex single-board computer has a multiple-density disk controller. It can use 1703 or 8877 controller chips since it generates the side signal with TTL parts. The board has two connectors for disk signals, one with 34 pins for 8.5" drives, and the other with 50 pins for 8" drives.

- **Vastly Improved CRT Display**
  The new Ferguson SBC uses a 6845 CRT controller and SMC 8002 video attributes controller to produce a display rivaling the display of quality terminals. There are three display modes: Character, block-graphics, and line-graphics. The board emulates an ADM-31 with 24 lines of 80 characters formed by a 7x9 dot matrix.

- **STD Bus**
  The new Ferguson computer has an STD Bus port for easy system expansion.

- **DMA**
  The new Ferguson computer has a Z80-A DMA chip that will allow byte-wise data transfers at 500 KBytes per second and bit-serial transfers via the Z80-A SIO at 880 Kbits per second with minimal processor overhead. When a hard-disc subsystem is added, the DMA chip makes impressive disk performance possible.

---

**NEW LOWER PRICES!**

**“BIG BOARD II”**

**4 MHz Z80-A SINGLE BOARD COMPUTER WITH “SASI” HARD-DISK INTERFACE**

**$545 ASSEMBLED & TESTED**

Terms: Orders paid for with a cashier's check or bank card will be shipped within three working days. Orders paid for with a personal check will be shipped within three weeks. Add $5 for packing & shipping in North America.

---

**$145 PC BOARD WITH 16 PARTS**

**SIZE: 8.75" x 15.5"**

**POWER: +5V @ 3A, +-12V @ 0.1A**

- **“SASI” Interface for Winchester Disks**
  Our "Big Board II" implements the Host portion of the "Shugart Associates Systems Interface." Adding a Winchester disk drive is no harder than attaching a floppy-disk drive. A user simply 1) runs a fifty-conductor ribbon cable from a header on the board to a Xebec controller that costs only $295 and implements the controller portion of the SASI interface, 2) cables the controller to a Seagate Technology ST-506 hard disk or one compatible with it, and 3) provides power for the controller-card and drive. Since our CBIOs contains code for communicating with hard-disks, that's all a user has to do to add a Winchester to a system!

- **Two Synchronous/Asynchronous Serial Ports**
  With a Z80-A SIO/I O and a Z80-A CTC as a baud-rate generator, the new Ferguson computer has two full RS232-C ports. It autobauds on both.

- **A Parallel Keyboard Port + Four Other Parallel Ports for User I/O**
  The new Cal-Tex single-board computer has one parallel port for an ASCII keyboard and four others for user-defined I/O.

- **Two Z80-A CTCs + Eight Programmable Counters/Timers**
  The new Ferguson computer has two Z80-A CTCs. One is used to clock data into and out of the Z80-A SIO/I O, while the other is for systems and applications use.

- **PROM Programming Circuitry**
  The new Cal-Tex SBC has circuity for programming 2716s, 2732(As), or pin-compatible EEPROMs.

- **CP/M 2.2**
  CP/M with Russell Smith's CBIOs for the new Cal-Tex computer is available for $150. The CBIOs is available separately for $25.

---

**CAL-TEX COMPUTERS, INC.**

780 E. TRIMBLE ROAD #504 • SAN JOSE, CA 95131 • (408) 942-1424

Micro Cornucopia, Number 19, August 1984
The BB II and the Winny

By Roy Epperson

Cal-Tex’s Big Board II hardware supports the ANSC XST9.2 SCSI (Small Computer System Interface) interface, commonly known as the “SASI” interface. The CBIOS supplied by Cal-Tex provides the software support for the XEBEC, Inc. SASI controller and 5¼ Winchester Hard Disk and a maximum of 8 Mbytes of storage.

I will discuss two modifications made to the CBIOS to support multiple logical disks on a single Winchester Hard Disk and the Host Adapter Software necessary to support the Adaptec, Inc., ACB-4000 Series Disk Controller.

The implementation uses the Adaptec, Inc., ACB-4000 SCSI Winchester Disk Controller and the Rodime R204 5¼ Winchester Hard Disk. Although the discussion is specifically directed towards the BBII the same theory applies directly to other systems.

Why logical disks?

A logical disk is the division of a larger physical disk into smaller units. There are several reasons for defining logical disks on a single physical disk:

1. CP/M limits the data on any one disk to 8 Mbytes. A 23 Mbyte disk system gives you 15 Mbytes of good reasons for forgoing to logical disks.
2. With logical disks you can divide the storage into application areas.
3. You can create a floppy-size logical disk to make it easier to duplicate real floppy disks.

The storage capacity of a Winchester disk depends on:

1. The number of recording surfaces.
2. The number of cylinders (tracks) per surface.
3. The number of sectors per cylinder.

For my implementation, this could be:

<table>
<thead>
<tr>
<th>Sector</th>
<th>256</th>
<th>512</th>
<th>1024</th>
</tr>
</thead>
<tbody>
<tr>
<td>sec/sq</td>
<td>33</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>track</td>
<td>256</td>
<td>512</td>
<td>1024</td>
</tr>
<tr>
<td>drive</td>
<td>8,4,160</td>
<td>46,080</td>
<td>23,592,960</td>
</tr>
<tr>
<td>Tot. Bytes</td>
<td>21,626,880</td>
<td>23,592,960</td>
<td></td>
</tr>
</tbody>
</table>

Available tracks = 2560 = 320 tracks/surface X 8 surfaces. This assumes that there are no bad sectors found when formatting the Winchester. You’ll have to create at least 3 logical drives to use all the space available on the drive.

The data is defined in the file, XEBEC-MAC. You install the Winchester code by setting the variable WINCH to be ONE in the appropriate “build file”; SWxxxx.mac, DSxxxx.MAC, or SSxxxx.MAC.

The following code is added to the system:

1. In the “build file”, the Disk Parameter Data structures are located in the SCRATCH memory area of the BBII monitor.
2. In the same file, the file XEBEC-MAC is inserted after the the INCLUDEBLOCK.MAC statement and before the calculation of BIOSLEN.
3. In ONESECT.MAC, code is added to reset the SASI bus controller.
4. In DEBLOCK.MAC, code is added to the SELDISK to setup and return the necessary DPH pointers.

After building a CP/M operating system with this CBIOS, the hard disk is accessible by referencing the letter one greater than the highest drive letter defined.

Design/Implementation Decisions

The basic decisions for this implementation were:

1. We will make minimal changes to the deblocking routines supplied in Cal-Tex’s DEBLOCK.MAC file. (The only change occurred in the SELDISK routine.)
2. We will use large sectors to maximize the disk’s storage capacity. The ACB-4000 can support 23 Mbytes with either 512 or 1024 bytes sectors. The 1024 byte sectors were chosen since that is the size of the floppy disk buffer.
3. Each logical disk will be the same size. Once I had the modified BIOS running, I tried varying the sizes of the logical disks. The additional memory required, however, made this unfeasible.
4. I chose the Adaptec, Inc., ACB-4000 Disk Controller because:
   a. Defect handling is done by the controller on a sector level and is transparent to the host.
   b. It uses a 32 bit ECC and correction of single burst errors of 8 bits. All ID and data fields are ECC protected.
   c. It has a 1024 byte FIFO for communicating with the host adapter.
   d. Cylinders may be formatted in 256, 512, or 1024 byte sectors, selectable by setting the appropriate byte in the FORMAT disk command.
   e. Once a drive is formatted using an ACB-4000, all necessary interface data is stored on the disk. Thus the host adapter can read the disk and select its file system characteristics appropriately.
   f. It supports two independent drives.
   g. The controller supports a variety of interleave factors selectable when FORMATTING the disk (see Figure 1).
5. The Rodime, Ltd, R204 5¼ Winchester Hard Disk is the big brother in the R200 Series. See Figure 2 for features.

(continued next page)
THE BBII AND THE WINNY

(continued from page 5)

Modifications to the SELDISK Routine.
Since I chose to use the same data structure as defined for the floppy disks, the SELDISK routine was the only routine I had to change. This routine returns the appropriate DPH (Disk Parameter Header) for the selected disk.

The memory map for the data structure is shown in Figure 3. Two references describe the DPH (Disk Parameter Header), the DPB (Disk Parameter Block), Check Bytes, and Allocation Bytes. They are:
1. "Inside CP/M, A Guide for Users and Programmers" by David E. Cortesi and available from Micro C.

Five bytes are used by the deblocking algorithms. The first byte defines the sector length of the disk. When the floppy disks are being used, SELDISK reads an ID field on the CP/M directory track to determine the sector size. Legal values are:

- 00 for 128 byte sectors
- 01 for 256 byte sectors
- 10 for 512 byte sectors
- 11 for 1024 byte sectors

The second byte defines the number of CP/M 128 byte sectors per physical disk sector. The calculation is (disk sector size/128) - 1.

The third and fourth bytes contain the physical disk sector size (in bytes). This information does not appear to be used by the DEBLOCK.MAC routines.

The fifth byte contains flags used by the deblocking algorithms.

The code added to SELDISK by conditional assembly is shown in Figure 4. The code marked by the comment fields ';REE' determines the correct pointer to return to CP/M when selecting a floppy or logical disk on the hard disk.

Memory Requirements
SELDISK and the interface routines between CP/M and the SASI controller use about 638 bytes. The above disk data structure requires some additional memory.

Two factors control the size of this memory. One is the number of logical disks defined, and the other is determined by the size of the CP/M Block Allocation Size (BLS) and the physical size of the hard disk.

There are 36 bytes used for each logical disk, 16 for the DPH, 15 for the DPB, and 5 for the DEBLOCK data.

The majority is consumed by the size of the physical disk and the BLS factor chosen. CP/M stores the status of each available block in the Allocation bit map. A one signifies that the block is used, a zero it's free. Each byte of memory stores the status of eight BLS locations. The total allocation memory size necessary regardless of the number on logical disks used is:

\[ \text{ALSM} = \frac{((\text{physical disk size})/\text{(block allocation size)})}{8} \]

For this implementation, the ALSM sizes could be:

<table>
<thead>
<tr>
<th>BLS</th>
<th>BLS bks</th>
<th>ALSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1024</td>
<td>23040</td>
<td>288</td>
</tr>
<tr>
<td>2048</td>
<td>46080</td>
<td>1440</td>
</tr>
<tr>
<td>4096</td>
<td>5760</td>
<td>360</td>
</tr>
<tr>
<td>8192</td>
<td>2880</td>
<td>720</td>
</tr>
<tr>
<td>16384</td>
<td>11520</td>
<td>180</td>
</tr>
</tbody>
</table>

The memory requirement for the Winchester disk structure is:

\[ \text{diskmem} = \text{WINCH} \times 36 + \text{ALSM} \]

Where: diskmem is in bytes and WINCH is the number of logical disks.

The system distributed by Cal-Tex locates this storage area up in the SCRATCH memory area of the monitor. With my implementation of the Winchester and two double sided, double density floppies, it was necessary to move the 'diskmem' down below the monitor and move CP/M down.

Interface Software

The communications software between CP/M and the ACB-4000 was done in two files.

ACB4000.MAC, is a standalone file. It receives two pointers; one to the command to be sent and the other to the data buffer location. The routine returns the completion status in the accumulator and in a PUBLIC data area.

![Figure 3 - Disk Data Structure](image)

Bytes consumed:
- DPH = 16 bytes, fixed by CP/M
- DPB = 15 bytes, fixed by CP/M
- DEBLOCK = 5 bytes, fixed
- Check bytes = directories/4 if the media is removable otherwise it is zero.
- Allocation bytes = diskblocks/8

where diskblocks = (logical disk bytes)/BLS

Micro Cornucopia, Number 19, August 1984
The second file, ADAPTEC.MAC, converts the requested disk, track and sector information and read/write request from the CP/M call into the appropriate command format for the ACB-4000.MAC routines. This file also reports SASI error messages to the console.

Host Adapter Software
Comments in the ACB4000.MAC routines describe the details of the protocol. The routines supplied by Cal-Tex in XEBEC.MAC are similar to ACB-4000.MAC. However, the most noticeable difference is that the Cal-Tex software does not use the SCSI handshake protocol.

In XEBEC.MAC the command is built and then output by an OTIR instruction. This same method is used to send and receive the sector information.

The SCSI protocol specifies that once the SCSI controller is ready, it controls the bus. It does this by setting the appropriate bits in its status port for the host adapter software to read. Two bits are used. The “request” (REQ) comes from the SCSI to the host, and the “acknowledge” (ACK) returns to the SCSI.

The BIOS uses a flip-flop to handle the REQ/ACK handshaking. The SCSI REQ line transition sets the DMAREQ line and the ACK line is set to the “non ACK” state. When the CPU or DMA reads or writes to the SCSI data port, the results of the previous SCSI REQ are reversed. The DMAREQ status line is jumpered between JB7-5 and JB9-5. When the BIOS’s SELMUX port is set to 00011111, the SCSI DMAREQ will appear on the DMAs Ready bit.

The routines in the file, except for four, were adapted to the Z80 mnemonics from the suggested protocol implemented in the Adaptec, Inc., “ACB-4000 Winchester Disk Controller OEM Manual.” Two of the routines program the DMA’s Selmux and update several MONITOR variables. The other two routines, S-RD and S-WRT, were modified to use the DMA controller if a single block read or write command were sent. The OTIR/INIR method was not used because it does not follow the handshake protocol.

Once the DMA is started, the program enters a read loop waiting for the SCSI status port to leave the DATA mode. When this occurs, the DMA is through transferring data. The DMA is programmed to do byte transfers. For each instruction in the status loop, one byte of data is transferred between the Host Adapter and the SCSI device. The minimum length status loop is:

\[
\text{loop:: in } a,(\text{port}) \quad \text{and} \quad \text{mask} \quad \text{jr condition,loop}
\]
The routine DOWINCH does the conversion, builds the appropriate block number was: ACB-4000.MAC.\[loop: \]noret the disk, track and sector information to the appropriate block number.

The routines in ADAPTED.MAC convert the disk, track and sector information to the appropriate block number. The routine DOWINCH does the conversion, builds the appropriate command and calls SASIDRV routine in ACB4000.MAC. When control is returned to DOWINCH, any errors are reported to the console.

The method I used to convert the disk, track and sector numbers to the correct physical block numbers.

1. Subtract the number of floppy disks from the disk requested.
2. Multiply the result by the number of physical blocks per logical disk to obtain the offset from the beginning of the physical device to the desired logical disks.
3. Multiply the number of sectors per track by the track number and add the sector number.
4. Add the results obtained in steps 3 and 4 and you have the physical block number associated with the disk, track, and sector requested by CP/M.

You could also use the DPB's OFF variable which defines the number of reserved tracks at the beginning of a disk. I chose not to use this variable, leaving it for future use.

The file also contains the data to define the physical characteristics of the drive used and the necessary logical disk characteristics. The selection of the file system involves many trade-offs which will not be discussed. Pages 229 to 242 of "Inside CP/M" discusses the factors to consider. In the data referenced by the pointer WINSTUFF a variable BEXM is defined. Additions were made to MACRO.MAC to calculate BEXM and is shown in Figure 5.

**Installation**

To install the software for your system, the following files must be modified:

1. your favorite "build file"; SWxxxxx.mac, DSxxx.MAC, or SSxxx.MAC.
2. DEBLOCK.MAC
3. ADAPTEC.MAC

Build File modifications

1. Define the appropriate MSIZE value. This most likely will be 57 or 58 depending on the size of your hard disk.
2. Define WINCH to equal the number of logical disks you want on the hard disk. Add the variable WINDIR to define the number of directory entries.
3. See Figure 6 for the rest of the gory details.

**DEBLOCK.MAC modifications**

In the DEBLOCK.MAC file make the modifications shown in Figure 3.

**ADAPTEC.MAC modifications**

In the ADAPTEC.MAC file define the following variables:

1. WSECTOR—the number of sectors per track.
2. WBYTES—the number of bytes per sector.
3. WHEAD—the number of heads.
4. WCYL—the number of cylinders.
5. WBADSEC—the number of bad sectors found during the format.

In the disk characteristics table, WINSTUFF, define the number of RESERVED tracks, the sector length as noted, the deblock mask, and bytes per sector.

Now assemble, link and install the file as you would another CBIOs for the BBII. You should now have a logical disk system installed on your SCSI port. Good luck filling it up.

**The Adaptec Controller**

One feature of the ACB-4000 is it is necessary to FORMAT the Winchester using an ACB-4000. The controller stores the disk characteristics on the disk itself. First to format a disk, a MODE SELECT command is issued which passes the majority of format characteristics to the controller. The data passed is: block size, cylinder count, head count, reduced write current cylinder, write precompensation cylinder, landing zone position, and step rate. The additional data passed with the FORMAT UNIT command is: the logical unit number, the fill character to use if the default of 6cH, the interleave factor, and if the appropriate flag is set, a list of bad blocks.

Prior to being able to use the "logical disk" system discussed above one must format their disk. I hope to clean up a utility program written in Aztec C and make it available to Micro C subscribers which allows:

1. setting MODE SELECT parameters
2. reading MODE parameters from a formatted disk
3. FORMATTING a disk
4. VERIFYing a disk
5. dumping a physical block(s)
6. writing a physical block(s)

I found this tool invaluable while implementing the above system and would recommend you either getting or making a copy of a similar tool.

The controller I have has a bug in the firmware which does not fill the entire sector with the fill character. The write block routine of the above utility solved that problem until ADAPTEC sent me a new version of the firmware.

**Acknowledgements**

I would like to thank the Micro C group for providing this forum and their help on this article, Jim Fisher at ADAPTEC, Inc., and Nolan Abbenhaus, MEDIA Distributing, for their assistance in getting the system and making it work.

*ACB4000.MAC and ADAPTEC.MAC will be available soon on a Micro C Users Disk.*
Figure 5 - Modifications to MACROS.MAC

```
IF DSIZE GT 255
  IF BSIZE LT 2
    PRINTX /BLOCK SIZE MUST BE GREATER THAN 1K WHEN DIR > 255/
  ELSE
    RSHFT DEFL 4
  ENDIF
ELSE
  RSHFT DEFL 3
ENDIF
BEXM DEFL (BMASK SHR RSHFT) OR OH
```

Figure 6 - Build File Modifications

Change the following:

```c
IF WINCH
  INCLUDE YESEC.MAC
ENDIF
```

to read:

```c
IF WINCH
  INCLUDE ADAPTEC.MAC
  INCLUDE ACB4000.MAC
ENDIF
```

AFTER the statement:

```c
BIOSLEN EQU (($ AND -128)+128)-CBIOS
```

ADD the statements:

```c
IF WINCH
  WDPH MACRO
  LOCAL BASE1
  BASE1: DEFS 16 ;DISK PARAMETER HEADER
  DEFS 15 ;DISK PARAMETER BLOCK
  DEFS 4 ;DEBLOCK PARAMETERS
  DEFS 1 ;DEBLOCK FLAGS
  DEFS (MAXBLK/8) ;ALLOCATION VECTOR
  ENDM
  WDPHTAB EQU $
  REPT WINCH ;CREATE HARD DISK DATA AREA
  WDPH
  ENDM
  WDPHSIZ EQU ($-WDPHTAB)/WINCH
  WEND EQU $
```

In the section of code following:

```c
ORQ SCRATCH
```

Delete the IF WINCH ...... ENDIR statements inclusively.

I recommend inserting the following conditional in any "build file." It will save you a lot of head scratching. After the calculation of BIOSLEN insert:

```c
IF BIOSLEN GT 3072
  PRINTX /BIOS LENGTH GREATER THAN 24 SECTORS, WILL NOT FIT ON TRACK 0/
ENDIF
```

EasyFlow is a program which helps you to produce neat, accurate flowcharts. You describe the flowchart using a simple flowchart description language; EasyFlow then produces a complete flowchart. EasyFlow is excellent for describing procedures of all kinds - not just for programming.

- Fast: 12 seconds for a typical chart.
- Command language easy to learn.
- Easily adapts to all printers.
- Standard flowcharting shapes included.
- User defined shapes easily added.
- User selected line drawing characters.
- Charts up to 5 by 11 shapes in size.
- Explicit, meaningful error messages.
- Fully documented with many examples.
- Ten demonstration flowcharts included.
- Special printer drivers included for MX80 and u92 that produce small flowcharts directly on 8.5 x 11 inch paper.

$49.95 ($59.95 in Canada + 7% PST in Ontario)

Runs on Z80 CPM 2.2 machines with 38K TPA.
Available on SSSD 8" and Kaypro 5" disks.
Other 5" formats: call.

Available by check, money order or Visa:

HavenTree Software Limited
R.R. #1, Seeley's Bay, Ontario, Canada, K0H 2N0
(613) 542-7270

Micro Cornucopia, Number 19, August 1984
6MHz On The BB-I

By Larry J. Blunk

My Big Board is amazing. Born a 2.5 MHz pluggie, it now clips along at 6 MHz without so much as catching its breath. Your BB-I can play screamers if you make the following modifications:

1. Replace Y2 with a 24MHz crystal. This is a rare part but it and most of the other parts required for this mod are available from Microware Exceltek (the address is listed at the end of the article). The crystal is $2.75.

2. Replace the Z80 parts with Z80B's (Microware sells Z80B-CPU's, P10's, and CTC's for $8.25 each).

3. Remove U97. Get a 74LS92 ($0.69 from Microware) and bend out pins 9, 12, and 14. Place the BS92 in socket U97.

4. Make the following mods on the bottom of the board. Cut the trace which leads from pin 11 of U97 to the feed-thru hole under U96. Cut the trace connecting pins 8 and 10 of U97. Cut the trace leading from pin 8 of U97 to the feed-thru hole near U98, pin 16. Connect a jumper from this feed-thru to U97, pin 11.


5. Move the Z80 clock line up from pin 4 to pin 5 of U96.

6. Move the MUXC line up from pin 4 to pin 3 of U76, and likewise, move the CAS line up from pin 5 to pin 4 of U76.

7. Replace U77 with a 74S04.

8. Your monitor should be burned in the upper half of a 2732A-250 or 200 (a PFM monitor burned into a 2732A-250 is available from Micro C for $29.95). I am also using 150 ns RAM but you could probably get 200 ns RAM to work (I can’t guarantee this).

If you have problems, try replacing Q2 with a MPS3640 and putting 33 ohm resistors in series with the collector of Q2 and pin 8 of U77. Also place a 3K resistor across pins 3 and 7 of U77. These mods were suggested by Trevor Marshall in Micro C #11.

Making your BB-I ‘wait’

I have included the modification below. There are two versions of the mod. One for systems running 5 or 4 MHz (it inserts one wait state into EPROM accesses). The other is for those who run at 6 MHz (where it is necessary to insert 2 wait states to run 450 ns devices). The only additional part required is a 74LS74.

For far too long, Big Board owners have ignored a handy little pin on the Z80. The WAIT line (pin 24) was meant to stretch access times for slow memory and I/O devices. One of the slowest devices on the big board is the Monitor EPROM that comes with the BB. At a processor speed of 2.5 MHz, the 450 ns access time of the EPROM presents no problem. However, at speeds of 4 MHz or higher the EPROM is just too slow.

Most people who speed up their BB-I replace their 450 ns EPROM with a faster device. This is silly when you consider that the Monitor EPROM is active for only a split second after power-up or the tap of the reset button. By selectively using the WAIT line you can keep your old 450 ns 2716’s without affecting the overall performance of your BB. (Editor’s note: Those with Kaypros and similar machines which are continuously accessing the ROM do slow down, however, when they use wait states.)

Critical Timing

Before discussing the actual mod, I’d like to review the Z80 memory access timings. The Z80 has two types of memory accesses. The first type is the instruction Op code (or M1) fetch, the second type covers all other writes and reads (other than the Op code fetch). The Op code fetch occurs at the beginning of each instruction. It has the most critical timing requirements allowing only 1½ clock cycles for a memory device to send out its data. All other reads and writes allocate 2 clock cycles for the reading and writing of data.

In calculating the response time of a particular device you must also take into consideration the propagation delays of decoders and buffers. Here is where the WAIT line becomes important. By pulling this line low when a particular memory device is selected you can add one or more cycles to the access times above. Each of these additional cycles is called a wait state.

You can calculate the number wait states needed for a memory device with a particular access time using a worst-case scenario.

The following can be used for the BB-I when accessing one of the EPROM’s: Tclk*1.5 + Tw*Tclk - PD(U84) - PD(U78,79) = EPROM access time from CE.

Tclk is the period of the system clock, Tw is the number of wait states inserted, PD(U84) is the propagation delay of U84 from the falling edge of the pin 4 enable line (24 ns, worst case), and PD(U78,79)

Figure 1 - Circuit to Generate Single Wait State

Figure 2 - Circuit to Generate Two Wait States

Figure 3 - Circuit to Enable Wait States for Two ROMs & Instruction Fetches

Micro Cornucopia, Number 19, August 1984
is the propagation delay from input to output of U78 and U79 (18 ns, worst case).

Using an example, consider the case when the system clock is 5 MHz (200 ns period). With no wait states, under worst case conditions, the access time of the EPROM should be less than or equal to (200*1.5 - 24 - 18), or 258 ns. However, by inserting just one wait state, we will increase the worst case access time to 458 ns. This means, with one wait state inserted for EPROM accesses, you can easily operate a 450 ns device at 5 MHz.

Now, the step-by-step mods. There are two variations. The first is for those who are running at 4 or 5 MHz. While the second is for those daring souls who attempt 6 MHz.

4 or 5 MHz modification
1. All you need for this mod is 2 flip-flops. There are 2 spare flip-flops on the board, however, they are a good distance apart. This means long jumpers, which I personally don't like. Therefore, I recommend mounting a 74LS74 on top of one of the two LS74's that have an unused flip-flop (U108 in particular).

2. With the above in mind, get an extra 74LS74. Bend out pins 1-6, 8-10, and 12. Remove U108 and place the LS74 with the bent up pins on top of it. Now carefully solder pins 7, 11, 13, and 14 of the two IC's together. Finally, place the assembly back in socket U108.

3. Now separate the WAIT line (pin 24) from +5 so that we can use it. First cut the trace on the underside of the board which connects pins 24 and 25 (BUSRQ) of U80. Second, flip the board over and cut the trace which leads to pin 24, U80 from a feed-thru hole (this is the +5 line for WAIT and BUSRQ). Finally, on the underside of the board, connect a jumper from the feed-thru hole to pin 25, U80 (this restores +5 to BUSRQ).

4. Add the following jumpers: pin 11, U108 to pin 25, U111 (this is the system clock), pin 13, U108 to pin 14, U108 (ties RESET of flip-flops high), pin 10, LS74 on top of U108 to pin 14, U108 (ties SET of the top F-F hi), and pin 15, U84 to pin 12, U108 (RCE0, select for first EPROM).

NOTE: If using more than one EPROM, use a free AND gate to AND their selects together and connect the output to pin 12, pin 9, U108 to pin 24, U80 (this is the WAIT line), pin 9, U108 to pin 12, LS74 on top of U108, and pin 9, LS74 on top of U108 to pin 10, U108 (clears WAIT after one cycle).

The above mods will cause one wait state to be inserted for every EPROM access (both Op code and normal read fetches). This allows a 450 ns EPROM to be run at up to 5 MHz. If you're having troubles with your Dynamic RAM accesses, you can insert a wait state for every M1 access by ANDing the M1 line with the EPROM select line and use this as input to pin 12, U108. This should give slow Dynamic RAMs enough time to run pretty fast. You will lose a little performance, but you will save yourself the cost of a whole new set of RAM.

6 MHz operation
If your system is running 6 MHz you will have to insert two wait states in every EPROM access in order to get 450 ns devices to work. Inserting two wait states is not much more difficult than inserting one.

1. First, perform all mods as above, except for the last jumper.

2. Add the following jumpers: pin 3, LS74 on top of U108 to pin 11, U108 (the clock line), pin 9, LS74 on top of U108 to pin 2, LS74 on top of U108, pins 1 and 4, LS74 on top of U108 +5 (tie SET and RESET hi), and pin 5, LS74 on top of U108 to pin 10, U108.

I can personally verify that this mod works (inserting 2 wait states to run a 450 ns EPROM at 6 MHz) and I can see no reason why the single wait mod won't work also.

Microware Exceltek
PO Box 5143
South San Francisco CA 94080
415-872-2195
Add $2.50 for shipping

Figure 4 - Memory Timing Without Wait States

Figure 5 - Memory Timing With Wait States
SINGLE BOARD COMPUTER CHASSIS & POWER SUPPLY
$275
Built like a tank
won’t break the bank!

2901
SINGLE BOARD COMPUTER CHASSIS AND
REGULATED POWER SUPPLIES COMPLETELY
ASSEMBLED AND TESTED.
Cabinet size: 20”w x 22.4”d x 7.5”h. Cabinet painted
dove grey; front, back and side accents black. Mounts 2
SHUGART SA851R EIGHT INCH FLOPPY DISK DRIVES
or MECHANICAL EQUIVALENT*. Lighted reset switch on front
panel. Lamp supplied, but not connected. 4 DB25, 1 Delta
50, 1 Centronics connector cutouts, 2 switched ac
receptacles, 6’ three wire line cord, EMI filter, 70CFM fan
with washable dust filter, line fuse, power switch on rear
panel. P2901 removable module power supply: +5@3A,
+12@.5A -12@.5A for computer; +5@2.5A,
+24@2.5A-4A peak, -5@.25A for disk drives. Includes
power cable from power supply to computer (uninter-
terminated wires at computer end) and power cable to 2
disk drives (specify single or double sided drives when
ordering).

POWER SUPPLY & ENCLOSURE AVAILABLE
SEPARATELY

IN STOCK

INTEGRAND
8620 Roosevelt Ave./Visalia, CA 93291
209/651-1203
We accept BankAmericard, Visa and MasterCard
We've had a lot of questions from folks who are dialing up bulletin boards but not having much success transferring files.

The heart of most bulletin boards is a program called BYE.COM (see disks K14 and K23). When the sysop (system operator) runs BYE, it sets his system to automatically answer the phone (through a Hayes smartmodem or equivalent) and either log the caller directly into CP/M (called RCPM or Remote CP/M) or run a special program. This is usually a standard RBBS (Remote Bulletin Board System) program which lets you, the caller, view or leave messages.

Quite often the RBBS's also let you drop out of the RBBS program into CP/M – (RCPM remember). At this point you can view the directory and transfer programs, but we're getting ahead of ourselves.

Getting Ready to Call an RBBS

When you call a bulletin board, you run your modem program (let's say MODEM7+). In modem7+ you will be asked for baud rate, parity, bits per character, and stop bits as you enter. Select 0 for 300 baud or 2 for 1200 baud (depending on the type of modem you have) and then 0's for all the rest of the questions (i.e. 8 bits per character, no parity, one stop bit). Then, to get into the terminal mode, enter

\[ T(\text{cr}) \text{ ; enter terminal mode} \]

Assuming you have the modem connected to your computer but not connected to the phone line, you will dial the bulletin board system on a regular phone, then when you hear the answering tone (after a couple of rings), switch the modem into the phone line (most modems have a built-in switch) and then hang up the phone. (The order is important here.)

Now, you should hit your carriage return (cr) key (about twice a second) until the bulletin board signs onto your screen. Its first question will be, how many nulls. Answer "0." Its next question may be whether you can handle lower case (some older systems can't). Say "y."

Most remote systems are RBBS's so you will have a chance to view or leave messages. Also, you will usually be allowed to exit to CP/M. It is in CP/M mode that you can transfer files. When you arrive in CP/M you will see:

\[ A0 \]

Where A is the drive and the 0 is the user area. To change to a different user area or drive you enter:

\[ A0\text{USER} 1<\text{cr}> ; \text{select user area 1} \]

or

\[ A0\text{USER} 7<\text{cr}> ; \text{select user area 7} \]

or

\[ A7B<\text{cr}> ; \text{select drive B:} \]

In the CP/M mode you can browse through the available directories just as you would on your own system. To see the directory in a particular user area, you usually enter:

\[ A0\text{DIR}<\text{cr}> ; \text{Displays directory} \]

Lets say you are on drive A user 0 in the bulletin board system and you wish to see a file (let's say CRC.OBJ) that you wish to copy into your own system. You enter:

\[ \text{See Figure 1 - Receive Files} \]

If you wish to transfer a file (say FIND.COM) from your system into the remote bulletin board (they really appreciate this), you enter:

\[ \text{See Figure 2 - Send Files} \]

This exits you back into CP/M. Now, don't forget to disconnect your modem from the phone line. (Your mother-in-law will be furious if she can't get through with the latest.)

If you are going to be copying numerous files from the bulletin board to your own system, make sure you have disk space. It's pretty easy to get flustered when a transfer halts in mid stream. But don't worry, the XMODEM program will time-out at the other end. You won't leave the remote system hanging very long.

\[ \text{Figure 1 - Receiving Files From a Bulletin Board} \]

\[ A0\text{XMODEM S CRC.OBJ}<\text{cr}> ; \text{ok xmode, send me CRC.OBJ} \]

\[ \text{E} ; \text{get into command mode on your own} \]

\[ \text{R CRC.OBJ}<\text{cr}> ; \text{tells your own modem program to} \]

\[ \text{receive the file} \]

When the transfer is complete, enter:

\[ T<\text{cr}> ; \text{this puts you back into terminal mode} \]

\[ \text{Figure 2 - Sending Files To a Bulletin Board} \]

\[ A0\text{XMODEM R FIND.COM}<\text{cr}> ; \text{ok xmode, you're about to receive FIND.COM} \]

\[ \text{E} ; \text{back to command mode on your own system} \]

\[ S FIND.COM<\text{cr}> ; \text{tells your own modem program to send FIND.COM} \]

\[ T<\text{cr}> ; \text{get back into terminal mode when finished} \]

At the end of the session, you enter:

\[ A0\text{BYE} \]

Which tells BYE.COM that you are through and it signs off the bulletin board system. Then you enter:

\[ \text{'E} \]

\[ \text{CPM<cr>} \]

Micro Cornucopia, Number 19, August 1984
This is THE PASCAL COMPILER
You’ve Been Hearing About

"It’s almost certainly better than IBM’s Pascal for the PC... Recommended."  
Jerry Pournelle  
Byng, May 1984

$49.95

"If you don’t have CP/M [for your Apple], Turbo Pascal is reason enough to buy it."
Cary Hara  
Softalk Apple, May 1984

And Now It’s Even Better Than You’ve Heard!

- Windowing (IBM PC, XT, jr. or true compatibles)
- Color, Sound and Graphics Support (IBM PC, XT, jr. or true compatibles)
- Optional 8087 Support (available at an additional charge)
- Automatic Overlays
- A Full-Screen Editor that’s even better than ever
- Full Heap Management—via dispose procedure
- Full Support of Operating System Facilities
- No license fees. You can sell the programs you write with Turbo Pascal without extra cost.

Yes. We still include Microcalc ... the sample spreadsheet written with Turbo Pascal. You can study the source code to learn how a spreadsheet is written ... it’s right on the disk.* And, if you’re running Turbo Pascal with the 8087 option, you’ll never have seen a spreadsheet calculate this fast before!

*Except Commodore 64 CP/M.

Order Your Copy of TURBO PASCAL® VERSION 2.0 Today
For VISA and MasterCard orders call toll free:
In California:

Check  Money Order  VISA  Master Card
Card #:  Exp. date:  

Dealer & Distributor Inquiries Welcome 408-438-8400

Choose One (please add $5.00 for shipping and handling for U.S. orders. Shipped UPS)
____ Turbo Pascal 2.0 $49.95 + $5.00
____ Turbo Pascal with 8087 support $89.95 + $5.00
____ Update (1.0 to 2.0) Must be accompanied by the original master $29.95 + $5.00
____ Update (1.0 to 8087) Must be accompanied by the original master $69.95 + $5.00

Borland International
4113 Scotts Valley Drive
Scotts Valley, California 95066
TELEX: 172373

My system is: 8 bit  16 bit  
Operating System: CP/M 80  
CP/M 86  MS DOS  PC DOS  
Computer:  
Disk Format:  
Please be sure model number & format are correct.

Name:  
Address:  
City/State/Zip:  
Telephone:  

California residents add 6% sales tax. Outside U.S.A. add $15.00 (if outside of U.S.A. payment must be by bank draft payable in the U.S. and in U.S. dollars.) Sorry, no C.O.D. or Purchase Orders.
Pascal Procedures

By John P. Jones

This column is a collection of bits and pieces; various odds and ends of interest to Pascal freaks like myself.

Standard Pascal

Standard Pascal has some significant shortcomings. For this reason most authors of Pascal compilers have added numerous extensions to the language. The problem is that not all the extensions have been implemented with the same syntax or features. The programmer is then faced with a dilemma: should programs be written for maximum portability using only standard features, or should they take advantage of the additional features a compiler provides?

The most important factor in the decision is whether the program is intended for private use. If the source program will never be sold or contributed to the public domain then by all means use all the facilities your compiler provides. Similarly, if the program will only be distributed as an executable .COM file there is no reason not to use non-standard language features.

Since built-in extensions will likely be more efficient than the equivalent routine written using only the standard, there is an advantage to using extensions. In addition, using an extended feature will reduce programming time since the compiler has done part of the work for you.

You should restrict yourself to standard pascal if the source is to be the distribution medium and the end users are expected to modify it for their compilers; or if you plan on running the program under more than one compiler. If you find you must use non-standard features in these circumstances, they should be heavily commented on both their actions and how they deviate from the standard.

Software Tools

A tool is an instrument used to perform a useful function. How is this concept applied to software? In its broadest sense, any functional program or subroutine can be considered a software tool.

Many real tools, however, have a significant amount of generality in their use. A hammer would be less useful if it could only drive a single kind of nail and a screwdriver would have less utility if it could be used on only one size screw (I won't consider the non-standard extension of using a hammer to drive a screw). A well designed software tool should be useful in more than a single situation or program.

Figures 1 and 2, written for Turbo Pascal, show two versions of a procedure for loading a set of machine language subroutines into memory. This is a specific instance of the general case of loading a binary file into memory.

The procedure in Figure 1 is equivalent to a single screw size screwdriver. It can be used only to load a single file of fixed length into an absolute memory area.

Figure 2, however, is a more generalized tool. Since the filename, destination and number of 128 byte records are all passed as parameters to the procedure, it can be used to load any binary file into any memory area. Although there is a little more work in setting up the generalized version, once it is debugged and running the routine can be used in virtually any program without modification.

Overlays in Turbo Pascal Version 2.0

Turbo Pascal version 2.0 is now available. For CP/M-80, the most significant addition is an automatic overlay mechanism. Overlays are portions of program code which are loaded into memory only when called and they share the same area in memory.

Overlays are very useful for larger

(continued next page)
programs and are the method of choice for programs with code/data space larger than available memory.

The Turbo Pascal implementation of overlays is particularly easy to use. By prefixing the reserved word OVERLAY to a procedure declaration the compiler will create a file for the overlay code and at run-time will load the appropriate overlays when needed.

Figure 3 contains the skeleton of a program that uses overlays. The compiler will generate two files for overlay code and reserve two areas in the program for their execution. The first file will contain the code for INIT-VARS, INSTRUCTIONS, and PROCESS-INPUT and program area will be reserved for the largest of the routines. The second file/area will be for the menu procedures.

In the main program, calls to any of the overlay procedures will cause them to be loaded from disk (unless already resident) and then executed.

The example also illustrates the type of routines that are good candidates for overlays. Initializations routines and instructions are often called a single time at start up and are not subsequently needed. Menu displays are human oriented, and the short delays associated with loading them from disk will not generally affect overall performance. You should also note that one of the program’s main processing procedures is included in the first overlay area. If this were not done, the first area would be dead space after the initialization and instructions had been performed.

Turbo Pascal allows for nesting of overlays. When this is done, an additional file and an area within the higher level overlay area will be created.

Version 2.0 also supports the standard procedure DISPOSE(var) to free dynamic variable space. It is NOT compatible with the MARK/RELEASE method and both methods should not be used in the same program.

Turbo Tips

When debugging Turbo programs in memory mode with one of the machine code debuggers like DDT, SID or ZSID you can set breakpoints and examine/modify variables even though at run

```pascal
program example;
  overlay procedure init_vars;
  [overlay procedures wanted in the same overlay area must be contiguous]
  overlay procedure instructions;
  overlay procedure process_input;
  procedure useful; [non-overlay procedure terminates this area]
  overlay procedure sub_menu_0; [start of second overlay area]
  overlay procedure sub_menu_1;
  overlay procedure sub_menu_2;
  overlay procedure main_menu;
begin [example]
  init_vars;
  instructions;
  main_menu;
  .
  .
  end.
```

Figure 4 - Pascal Symbol Table

```
00 1E 73 F6 B7
00 B3 45 4C 42 41 49 52 41 56
...ELBAIRAV...
G F E D C B A
```

Figure 5 - Running Turbo Program under ZSID

```
A>zsid turbo.com
ZSID VERS 1.4
NEXT PC END
7800 0100 BIFF
#g
;g command executes Turbo, which can be run normally. After the program is entered and compiled with the breakpoints needed run with the Turbo R command.
*8156
;breakpoint executed @ 8156, you can now look at the symbol table and examine/modify variables.
#xp
; fix the pc
P=8156 8157
; to instruction beyond breakpoint
#g
;continue from breakpoint
*8143
;next breakpoint reached
.
etc.
```
THE LITTLE BOARD®
OEM — INDUSTRIAL — SCIENTIFIC
SECOND GENERATION SINGLE BOARD COMPUTER KIT!
4 MHZ Z80® CPU! 64K RAM! DOUBLE DENSITY!

FREE CP/M® 2.2!!!
A $139 VALUE! A FREE 5-1/4 IN. CP/M 2.2
DISKETTE IS INCLUDED
WITH EACH KIT.

A. & T. UNITS $349

FULLY SOCKETED! PERFECT MATE TO OUR ZRT-80 TERMINAL BOARD. THROUGH SPECIAL ARRANGEMENT WITH AMPRO COMPUTERS, WE ARE PLEASED TO OFFER THEIR LITTLE BOARD® IN KIT FORM.

FEATURES:
- 4 MHZ Z80 CPU!
- DOUBLE DENSITY (5-1/4 IN.) FLOPPY CONTROLLER
- 64K DYNAMIC RAM!
- CENTRONICS STYLE PARALLEL PRINTER PORT
- USES +5VDC @ .75 A. AND +12VDC @ 50MA
- TWO RS232 SERIAL PORTS
- SAME SIZE AS A MINI FLOPPY
- 2732 BOOT EPROM

$295.00
(COMPLETE KIT)

MINI-SIZE: ONLY
5-3/4 x 7-3/4 INCHES

LITTLE BOARD® — AMPRO Z80® — ZILOG CP/M® DIGITAL RESEARCH (CA.)

Digital Research Computers
(OF TEXAS)
P.O. BOX 461565 • GARLAND, TEXAS 75046 • (214) 271-3538

TERMS: Shipments will be made approximately 3 to 5 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's with a $75 deposit. Balance UPS COD. Add $4.00 shipping.

USA AND CANADA ONLY

time you don’t know their addresses.
The statement, inline ($FF), places a RST 38H instruction which is used by the
debuggers noted above for breakpoints.
Since you are running in memory mode,
when the breakpoint is reached and you
are back in the debugger, you can exam­
ine the symbol table with the Dump
command.

To find the symbol table, first look at
the jump address at locations 5 & 6 to
find the base of the debugger code. The
top of the symbol table, which grows
downward, will be 400H below the de­
bugger. The entry for (var variable3 : in­
teger) looks like Figure 4.

In Figure 4, Field B is the symbol type,
04 = var, 02 = const, 03 = type, other
values not yet determined. Field C is the
nesting depth, globals will all be level 0.
Field D is the upper case symbol name
with the characters in reverse order and
the high order bit of the last character
set. Field E is not yet determined but for
all cases so far examined is 0. F is the
address of the variable in standard byte re­
versed order and field G is a two byte
data type code.

The top part of the symbol table has
entries for all the pre-defined constants,
variables and types that Turbo supports.
Non-scalar variables have more complex
symbol table entries and finding the lo­
cation of things like fields of records will
be more involved.

After you have examined/modified a
variable, the program can be restarted by
first using the debugger XP command to
modify the program counter value to
the breakpoint value +1, then doing a G to
that location.

Warning! The symbol table will only
be in memory if you are compiling to
Memory so this technique will not help
for a .COM file. Also, when I tried to ex­
ecute another program with the debug­
ger and Turbo resident, it blew up on re­
turn. I guess you can’t have everything.

Figure 5 is a sample session to illus­
trate this technique. I’ve had fun digging
into the guts of Turbo and have been im­
pressed with what I found.

Editor’s Note:
Due to a foul-up in the inscrutable edi­
torial department, the “main” portion of
issue #18’s program was not printed. Figure 6 (in this issue) is the rest of that
program.

---

Figure 6 - Main Portion of Program in Issue 18

```pascal
begin (* Main program *)
  write ('Enter name of character data file: ');
  readln (filename);
  assign(chfile,filename);
  rewrite(chfile);
  repeat
  do_grid;
  write(prompts);
  get_char_data;
  write(chfile,char_desc);
  gotoxy(1,24);
  write('Another char? ');
  read(ch);
  until upcase(ch) <> 'Y';
  close(chfile);
  end.
```
The Cost Efficient EPROM Programmer

$995.00 COMPLETE
Dealer inquiries welcome.

DISPLAY:
• Bright 1" high display system
• Progress indicated during programming
• Error messages

KEYBOARD:
• Full travel entry keys
• Auto repeat
• Illuminated function indicators

INTERFACE:
• RS-232C for data transfer
• 110-19.2K baud
• X-on X-off control of serial data

FUNCTIONS:
• Fast and standard programming algorithms
• Single key commands
• Search finds data strings up to 256 bytes long
• Electronic signatures for easy data error I.D.
• "FF" skipping for max programming speed
• User sets memory boundaries
• 15 commands including move, edit, fill, search, etc. functions
• Extended mode reads EPROM sets

GENERAL:
• Stand alone operation, external terminal not needed for full command set
• Total support
• 28 pin sockets
• Faulty EPROMS indicated at socket
• Programs 1 to 128K devices
• Built in diagnostics
• No calibration required
• No personality modules to buy
• Programs new CMOS EPROMS
• Printer interface option
• Complete with 128K buffer

ALSO AVAILABLE FROM SCC:

The Cost Efficient Erasing Units
FIVE TIMES THE CAPACITY OF OTHER UNITS, FOR LESS THAN $200!

FEATURES INCLUDE:
• Unique wave design
• Efficient bulb design
• All-steel, heavy duty design
• Quick erasure time
• Efficient
• Reliable
• Safe

• Affordable and economical
• Portable, easy to use
• EPROMS
• Micro computer
• Industrial design
• Production environment ready
• Timer included

Three Models Available:
EU-156...over 150 chips
$195.00
EU-312...over 300 chips
$359.95
EU-1050...over 1000 chips
(EPROM or Micro Computer)
CALL!

QUICK DELIVERY ON ALL PRODUCTS!
FOR FURTHER INFORMATION ON SCC's COST EFFICIENT PROGRAMMERS AND ERASING UNITS CALL

SOUTHERN COMPUTER CORPORATION
3720 N. Stratford Rd., Atlanta, GA 30342, 404-231-5363
Yin and Yang of EPROM Programmers

By David Thompson

Have you ever wanted to have a magazine of your own so you could blow a little steam (especially after you felt you’d been royally shafted)? Well, right now, I’m glad I have a magazine.

In my search for a cheap EPROM programmer that would burn 8 ROMs at a time, I ran into a smallish but interesting looking ad in Byte. It mentioned an independent version of the Data I/O for just under $1000 (of course, once you added the serial port and software you weren’t under $1000, but what the heck). After calling the number and finding out that the unit was supposed to program everything from a 2716 to an incautious dishwasher, I ordered it.

That was a mistake.

It arrived looking like it had been wrapped in swaddling newspapers and tossed into a cardboard box (it had). As I picked it out of the box, something clunked. It turned out that the power transformer had broken loose and had been beat up (it had). As I threw it into a cardboard box (it had). As I picked it up, something clunked. It turned out that the power transformer had broken loose and had been beat up (it had). As I threw it into a cardboard box (it had). As I picked it out of the box, something clunked. It turned out that the power transformer had broken loose and had begun beating innocent transistors senseless.

After checking for obvious electrical damage, I tried the unit. I worked, sorta. It burned 2716s, but not 2732s.

I checked through the documentation to see if there was some information on the hardware. There was nothing. No theory of operation, no schematic, no diagnostics, no nothin’.

I called them and though they refused to send another unit (or a schematic), they did give me a return authorization number. A month or so (and a couple of phone calls) later, we finally got back our money, minus almost $200, their 15% restocking charge.

Southern Comfort

Meanwhile, we found a super neat gang programmer. It is made by Southern Computer Company, it has lots of RAM so I can load a ROM into RAM, modify the data via the built-in keypad (or through the RS-232 port) and burn another ROM.

It generates CRCs, verifies programming, verifies blank ROMs, does a neat self-check, and all kinds of other nifty things. Dorcas, Tracey, and Cary really like using it and it was about $200 cheaper than the G-TEK unit. (Plus, it really looks like someone did a quality job on the hardware.) But, best of all, it works!

If you buy something from G-TeK, my condolences. If you want to get ahold of a great $995.00 gang programmer, then get ahold of the following folks:

Southern Computer Corporation
3720 N Stratford Rd NE
Atlanta, Ga 30342
404-231-5363

Everybody wants to have a mag-
It's interesting to compare the original Kaypro II and 4 with the new 84 versions. Of course, the new boards run faster (4 MHz vrs 2.5 MHz) and they are fancier (graphics and all). But the new boards have a problem.

You see, the new 84 boards have no buffers on the address and data lines, at least not until you get to the SASI (winstonchester) interface. There 11 inputs hanging directly on each data line on the original Kaypro 10 and 13 inputs on each line on the new 84 boards with the modem. The Z80 was not meant to drive that many inputs.

A little history on this subject: The original 8080 was designed to drive half of one TTL gate so manufacturers made special low drain buffers to hang directly on the outputs of the 8080. The newer 8080A (they sold for about $300 each when first released) could drive two or three standard TTL gates directly!

You can still spot those circuit designers who have been working with systems for a while. Without fail, they'll only connect one or two devices directly to the processor's data and address pins (and one of the devices will be a buffer). Everything else will be tied to the buffered address and data lines. Most buffers can drive a dozen LS inputs and a Mac Truck without breathing hard.

When a Z80 output has to drive too many devices, the signal rise time gets kinda long. When driving one or two devices, a Z80 will pull up the address line in 5 or 10ns (nano-seconds, which stands for billionths of a second). On the new 84 systems, the rise time is running between 30 and 40 ns. Most designers get nervous at 20 ns.

Kaypro technical support has been getting numerous calls about new systems going to lunch while auto-dialing or something like that. Their standard answer is that the customer should replace the Z80A with a Z80H (a version of the Z80 capable of running 8 MHz). Presumably the Z80H has stronger output drivers that can zip those lines up and down at great speeds, but the H chips are not cheap, nor are they available just anywhere. I called some of the outfits that advertise parts in the back of Byte and none of them had Z80Hs. (Plus, wholesalers in this area want over $30 for each.)

However, when one of MicroSphere's systems flaked we found that it became very solid when we replaced the Z80A with a Z80B (rise time improved by 10 ns. But be forewarned that a Z80B is supposed to be identical to a Z80A except that when it was tested at the factory it ran a little faster. Z80Bs are available just about anywhere for $10 to $18. (You can even purchase them from Micro C for $12.00, postpaid.)

Aligning a Fickle Drive

Tandon drives have a reputation for being difficult to align. Sometimes the problem is that the drive is twisted out of alignment as it is bolted back into the cabinet but that is not the only cause of alignment headaches.

The stepper motor drives the read/write head via a pulley and a metal band (called a taut band). The taut band seems to work very well, but the pulley sometimes gets loose. If the pulley is loose, you may be able to align the drive down to a gnat's earlobe only to find that a short time later, it's out again. You may also find that you can't align the drive using the concentric screw on the rear of the drive (the pulley has slipped too far).

The pulley is held in place by a hose clamp (Dana's words) that's clamped by a small Allen screw. Tighten down the screw and then see if you can still align the drive using the concentric on the rear. (You'll have to remove the drive's circuit board to expose the clamp.) If the concentric won't adjust far enough, you'll have to loosen the clamp and then move the pulley slightly with respect to the stepper shaft. Then tighten down the clamp and try again.

Kaypro 10 and 84 drive problems

The system latch on the Kaypro 10 is tied directly to the drive interface which means that the drive select and side select lines are unbuffered (where have we heard this before). Well, the system latch is a 74LS244 and when it tries to pull down a line tied high with a 150 ohm terminating resistor, it has trouble. Too much trouble.

If your 10 or 84 system is having trouble reading, writing, or formatting disks, you should replace the 150 ohm terminating pack with something greater than 400 ohms. This little fix sure cleaned up the floppy problems on our old 10.

Kaypro 10 Schematic & Theory of Op

We've finally done it! The 24" by 36" single-sheet schematic (plus theory of operation) package for the current Kaypro 10 is finally ready! Eric Roby spent months working on the schematic, block diagrams, and theory of operation.

In the process, he came up with a package that rivals the very popular one that Dana did for the Kaypro II.

The theory of operation includes thorough coverage of the serial and parallel ports as well as the video section. Eric even included listings (in assembly language as well as a little Pascal) for those of you who want to write your own port or screen-graphics programs. And, like the original Kaypro II package, the theory of operation and the block diagrams are keyed to the schematic so you can follow a signal component by component.

This is the detailed information on the main processor board that Kaypro didn't put in its "service" manual for only $20.00!

Also, 84 Schematic Package

Because of popular demand (reader insistence) we're also scrambling to finish the new schematic package for the 84 processor boards (should be ready by mid August). This package will include everything in the Kaypro 10 package but it will cover the new II-84, 4-84, and 10-84 systems (you know, the IIs with the half-wide drives and the 4s and 10s with the built-in modems). Again, only $20.00 buys the package.

Morrow

Most of you probably remember the comments I made about the new Morrow MD11. You know, they use the Z80 to increment the address lines while they use little TTL ICs to transfer data between the drive (either hard or floppy) and memory.

(continued next column)
SPEED UP YOUR KAYPRO BY A FACTOR OF 10

Electronic RAM disk for the Kaypro — Expandable to 1 MB
Think of the possibilities for time savings!
Blow the hard disk off the map in cost!
This RAM disk (designed by Tony Ozrelic) is perfect for many users
where time is of the essence:

<table>
<thead>
<tr>
<th>SWAP FILES</th>
<th>COMPILERS</th>
<th>DISK ACCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ 256K, 512K or 1mb memory space</td>
<td>★ External cabinet supplied</td>
<td>★ External cabinet supplied</td>
</tr>
<tr>
<td>★ Dual Centronics connectors — one to Kaypro, one to printer</td>
<td>★ Separate +5 volt power input; +5 volt connector for Kaypro supplied</td>
<td>★ Separate +5 volt power input; +5 volt connector for Kaypro supplied</td>
</tr>
<tr>
<td>★ 32 sockets accept either 64K, 128K or 256K DRAM</td>
<td>★ Only 1K of Kaypro memory needed for operation</td>
<td>★ Only 1K of Kaypro memory needed for operation</td>
</tr>
<tr>
<td>★ Printer Buffer included</td>
<td>★ Socketed/without RAM $199.00</td>
<td>★ Socketed/without RAM $199.00</td>
</tr>
</tbody>
</table>

Features:

Call for our RAM prices—we will stuff and test.

Color Graphics Board for Kaypro 2, 4, 2-84 & 10 $245.00
Color Graphics Board Software
TLC LOGO—standard version — $99.95
deluxe version — $129.95
Special! Color Board & deluxe version of LOGO — $299.95
Instant Grapher $30.00

MICROSphere, INC., P.O. Box 1221, Bend, OR 97709/503-388-1194
KAYPRO is a registered trademark of the Kaypro Corporation.

(Kaypro Column continued)

This gives them a very fast data transfer with very few parts (almost no big parts at all) because they don’t have a floppy controller or a winchester controller in their new MD11.

The word I’m getting now is that MD11s are becoming famous for going to lunch before noon. This is reportedly due to the very critical timing between the TTL parts and the Z80 during data transfers.

Because Morrow is using the circuitry to do several tasks (controlling memory, controlling the floppy, and controlling the winchester) the company is faced with a major redesign if it wants to change any one of those tasks. An otherwise simple change to the winchester timing would have significant impact on the floppy or RAM timing.

It’s almost like self-modifiable code, conceptually interesting but a nightmare to debug.

Morrow Power Supplies

Also, Morrow hard disk systems have been plagued with power supply problems, and at $400 per supply, users become very nervous people around warranty expiration time. The MD-11 belonging to the BAMDUA folks (they publish the Morrow Review Magazine) has gone through three supplies during the warranty period.

Morrow Company recently changed suppliers on the supply in hopes that the problems would go away, but the new supply (made in Japan) seems to have just as many failures, it’s just that different components are failing.

Morrow doesn’t even appear to have parts to fix the supplies. One repair facility that asked for parts, received instead, some defective supplies (of both types) from which to scrounge components.

$17.95 + $1.50 Shipping (Continental U.S.A.)
Washington Residents Add $1.45 Sales Tax
Cashier Checks & Money Orders Shipped Promptly
(Personal Checks Must Clear — 2 Weeks.)
(Prices & Configuration subject to change without notice.)

The Best Accessory
You’ll Ever Buy For Your Kaypro™

ORDER FROM:
TWIST, INC.
P.O. Box 1406, Renton, WA 98057

A NEW TWIST

FAT JACK READING RACK
★ SEE COPY-SCREEN/KEYBOARD AT THE SAME TIME.
★ EASILY ATTACHED TO ANY KAYPRO™
★ 16" WIDE - AND STRONG
FULLY SUPPORTS - BOOKS, MAGAZINES • REPORTS
WITH UNIQUE PAGECLIP™
Dealer and group inquiries invited.

ONLY $17.95 + $1.50 Shipping (Continental U.S.A.)
Washington Residents Add $1.45 Sales Tax
Cashier Checks & Money Orders Shipped Promptly
(Personal Checks Must Clear — 2 Weeks.)
(Prices & Configuration subject to change without notice.)

The Best Accessory
You’ll Ever Buy For Your Kaypro™

LINK YOUR GANG TOGETHER
Control up to 4 AC devices at one time with your Kaypro™ computer.
• Without tying up either your RS232 or Centronics Port
• 7500v isolation between computer and controlled devices
• No moving parts
• Simple plug in installation to your computer
• Requires no soldering or cutting in your Kaypro™
• Software examples in Basic and Z80 Assembly Language
• Easy to create your own specialized programs

Includes:
• Fully assembled and tested printed circuit board
• 3/8" diskette with software examples and documentation
• Plug in adapter and cable for the Kaypro™ II and IV
• Ask about versions for Kaypro™ II or IV

ONLY $39.95 (plus $2.00 shipping & handling)
30 day Money Back Guarantee
Send check, money orders, or inquiries for THE MASTER SWITCH to
ZIPPE SYSTEMS
6520 Selma Ave., Box 528
Los Angeles, California 90028

Kaypro is a trademark of Kaypro Corporation

21
For those of you who haven't heard of Murphy's Law or discount its importance, well, I used to think like you do.

Sorta Failure
About three weeks ago, I started on this column in earnest (I was visiting in earnest at the time). I was planning to unveil a program for sorting the files generated by the check writing routine we've been developing.

That program was to use the famous "quicksort" routine devised by C.A.R. Hoare. It was to have divided the unsorted file into sub files, sorting them and later merging them into a single sorted file. Unfortunately the merge didn't work. In fact, even the quicksort algorithm didn't work in SBASIC.

For about two weeks, I worked at the program (forsaking the quicksort routine, I analyzed and re-analyzed the merging process), compiling, and re-compiling all to no avail. Finally, I called Dave Thompson and confessed that I would not be able to provide a working program for this month's column. Dave was sympathetic, but he almost sounded enthusiastic. "You're having problems," he said. "Quicksort won't work in SBASIC, huh. Well, that's terrific. Just the sort of challenge our readers need."

I had gotten quicksort to work in Turbo Pascal but not in SBASIC though it was the same program.

I assumed the reason had something to do with the "Scope of Recursion" as mentioned in the SBASIC manual. Dave suggested that I write a column describing my difficulties with the sorting program or maybe just present the Turbo and SBASIC versions of quicksort so that we could collectively see why it didn't work in SBASIC. So I came right home and pared the SBASIC quicksort routine down to essentials and compiled it. It worked! What's Dave gonna think of me now?

Sorta Success
As near as I can figure, my problem had to do with using records I had read from a disk file. To make matters worse, my A drive started behaving strangely around disks, not reading them or only reading parts. I am putting this together using my B drive as the default and hoping that everything will hold together until I can get things fixed.

Dave's idea was a good one. The working SBASIC version of quicksort is very similar to the Turbo Pascal version. I have included both in this month's column. The version is a recursive one and shows the power of recursive programming techniques.

How Quicksort Works
Very quickly, the procedure chooses an element in the middle of the array to be sorted. This separates the array into two sub-arrays. Then, starting at the ends, it searches inward until it finds a value in the lower sub-array that is larger than the value of the middle element and a value in the upper array smaller than the middle element. Then it swaps these two elements.

When it is done with this middle element, it performs the same process on the upper array. Then on the upper array of the upper array and so on until all the upper sub-arrays are sorted. Then it back out and sorts the lower sub-arrays.

The process is reasonably visible in this recursive format, once you have an idea what it's trying to accomplish. Those of you in the SBASIC and Turbo camps should be interested in seeing what the competition looks like.

SBASIC Versus Pascal
A question I have heard more than once now is that if SBASIC is so similar to Pascal, why not just program in Pascal? I think Pascal has a lot of neat constructs. I have come to appreciate some of them more having programmed in SBASIC.

Sometimes though, Pascal has too much magic. Where there is too much magic, there is too little understanding. In SBASIC, some of the seams show. Seeing the seams in SBASIC and seeing

```
Rem Quicksort in SBASIC
dim char a(100)

procedure sort(bottom,top = integer)
   var lower_ptr, upper_ptr = integer
   var middle_element, temp = char
   lower_ptr = bottom
   upper_ptr = top
   middle_element = a((bottom+top) / 2)
   repeat begin
      while a(lower_ptr) < middle_element do lower_ptr = lower_ptr + 1
      while middle_element < a(upper_ptr) do upper_ptr = upper_ptr - 1
      if lower_ptr <= upper_ptr then begin
         temp = a(lower_ptr)
         a(lower_ptr) = a(upper_ptr)
         a(upper_ptr) = temp
         lower_ptr = lower_ptr + 1
         upper_ptr = upper_ptr - 1
      end
   end until lower_ptr > upper_ptr
   if bottom < upper_ptr then sort bottom,upper_ptr
   if lower_ptr < top then sort lower_ptr,top
end

var i,j = integer
begin
   i = 0;
   repeat begin
      i = i + 1
      input2 a(i)
   end until a(i) = 'Z'
   sort 1,i
   j = 0
   print
   repeat begin
      j = j + 1
      print a(j)
   end until j = i
end
```

Figure 1 - Quicksort in SBASIC
the similarity between SBASIC and Pascal, I can guess where the seams are in Pascal. Some of the magic is gone but understanding is better anyway.

A neat construct in both languages is the structural element. If you look at the program segments in all three columns, you will notice that there is not a single GOTO in any of them. The programs do not miss them. The procedural elements are very similar to GOSUBS except that in SBASIC the reference to a subroutine can be by name instead of line number making the program easier to understand and maintain. Also, SBASIC allows the passing of parameters to procedures and functions. This helps to maintain the modularity of programs.

One problem with SBASIC is that it does not allow the passing of a "variable parameter." Variable parameters are a Pascal concept.

If you write an SBASIC procedure to swap two variables, and pass the two variables to the procedure, the procedure will set up local variables swap those two variables and then return control to the main part of the program leaving the original variables untouched. There are two ways around this. One is to make the variables global to the procedure. But this destroys the modularity of the procedure. The other is to pass the memory addresses of the main variables to the swap procedure, base the procedure variables at the same locations and then perform the swap and return to the main part of the program.

But this is so time consuming that it's easier to manually swap the variables as needed.

Generally, whenever you perform the same operation twice, you save memory by writing a procedure or function and then using the procedure in the places where needed. As the program is compiled, machine language instructions are established in one place in memory.

Then, when the subroutine is called by the program, the address the computer receives its next instruction from is changed to the beginning of the subroutine. Also, a well written subroutine provides for consistent results in any operation. Lastly, it improves understandability to give operations meaningful titles.

The Nesting Instinct

You may notice on your screen as you compile a program that the line numbers are listed, followed by a colon, followed by another number that ranges from zero up to 5 or 6 or so. This number is the level of nesting. It should increase by one upon entry into any program block and decrease by one upon exit.

If your compiler tells you "Undefined line number(s)." you have either referenced a non-existent line number (line numbers you program in rather than those assigned by the compiler) or you have failed to close a block structure.

If you failed to close a block structure, the level of nesting number at the end of the program will not be zero. If you don't know where the problem is, compile your program using the .bble extension. Then use your word processor to examine the .prn file produced to find the program block that does not begin and end with the same level of nesting.

No EOF

Finally, a few words about my difficulties with the sorting program. SBASIC does not have a record pointer (at least not documented). It also does not have an end of file indicator.

Because of these omissions, you must figure out one your own, how to avoid reading beyond the end of the file. One method that doesn't work is the "on error" statement. SBASIC allows only an "on error go to" and no "on error go sub." This means that although you can keep your program from bombing, you can't return the operator to the place where the error occurred. You might as well bomb.

There are basically two workable approaches. One is to put your own marker (continued on page 61)
COMMUNICATIONS
LOVE AFFAIR FROM
SWAP FILE FULL

The SIGNALMAN MARK XII BRILLIANT (not "") MODEM does it all without a loudspeaker to wake your spouse. For KAYPRO®

»»$380.00««

110/300/1200 baud Hayes™ compatible. INCLUDED (at NO cost) software to use it. 26 entry USER CHANGABLE directory; auto-dial/answer, Baud and file speed control, file utilities and more in SIGXII. COM plus Communication utility programs and other handy stuff with instructions on disk. Prewritten 10 entry PERMANENT directory.

Send SASE for more information.

To Order: please print your name and address (no p.o. box), 10 exact names and numbers (including 1 and area code if needed) for Permanent Directory, send $380.00, California residents add 6%, in Money Order or Check (add 2 weeks). COD orders add $5.00 (Cash or Money order only on COD). No phone orders yet.

We ship prepaid UPS

SWAP FILE FULL
25530 Ave. Stanford, #203
Valencia, CA 91355

Powerful Single Board Computer
Includes CP/M Plus (3.0 banked)

$599

Assembled, Tested
Includes CP/M 3.0 on disk with all manuals

Model MSC-ICO

All Features Fully Supported By CP/M Plus

• 280A, 4 MHZ. No wait states
• 128Kb Banked RAM, 60Kb TPA
• 80 x 24 line high speed video
• Disk Controller (up to 4 drives)
  8"SS/SD, DS/DD (1.2 Mb)
  5"SS/DD, DS/DD, OHD (1.2Mb)
Use 5"and 8" simultaneously
  Both 5" and 8" connectors built-in
• Two programmable RS232C ports
• Centronics printer port
• 16 bit TTL I/O port
• Parallel keyboard input port
• Clock calendar with battery backup
• Expansion bus for enhancements
• Requires only +5V 1.2A, + - 12V 0.1A

MSC-ICO +5" OHD (1.2 Mb) drive $975

Manufactured by:
Southern Pacific Limited, 1-3-18 Santomi Bldg.
Tsurumichuo, Tsurumi, Yokohama, JAPAN 230
TEL: 045-501-8842 TLX: 3822320 SPACIF J
USA Distributor:
ARTISOFT, Inc., 2450 East Speedway, Suite 4
Tucson, Arizona 85719, TEL: (602) 327-4305

STOR*MOR : Plated Media
• DELPHI 15 MB Portable Hard Disk Drive System $1999

BEE*MOR ENTERPRISES
22 - 182nd Avenue East
Sumner, WA 98390
(206) 862-6310
9 - 5 Pacific Time

DESCRIPTION  COST  WT  SHIP
1. STORE*MORDelphi 15MB Hard Disk $1,999.00 12# $6
2. ACCENT*MOR Diacrit. Accent ROM 200.00 1# $2
3. VU*MOR Copy Stand 19.95 3# $3

TERMS: M/C, VISA, COD, Money Order, Registered Check. Two week delay for checks.
SHIPPING: UPS in Continental US, P.P. insured Outside US, Prepaid. Tax 7.8% for Washington Residents. Kaypro is a registered Trademark of Kaypro Corp., WordStar is a trademark of MicroPro.
One area of computer operation where CPU speed has little effect on performance is in IO operations such as transferring data to and from the terminal, a serial port, or the disk drives.

Of these, disk IO is often the most irritating. A terminal, operating at a reasonable baud rate, can read a keyboard faster than a person can type, and display text faster than a person can read. And, CP/M-86's printer spooler means that the printer doesn't tie up the system for any length of time. That leaves disk IO as the area of computer operation where we most often have to wait for the computer.

As processors get more and more powerful, disk IO becomes more and more the limiting factor on system throughput. There are a couple of ways to dramatically speed up disk IO and both use system RAM. A RAM disk is the fastest sort of "disk" IO, and a track buffer dramatically speeds up IO on real disks.

Sector Read/Write
On a typical CP/M system, most disk IO time is spent waiting for the proper sector to come under the read/write head. To illustrate, consider the operation of reading a file from the traditional eight inch single sided, single density CP/M disk. A CP/M file usually occupies several sectors. These sectors are not spread randomly over the disk, but tend to be consecutive. So, to read a CP/M file there will be one long seek to read the first sector. Subsequent sectors will require no seek, or a seek to the next track. Thus most sector reads require no seek, or a very short seek.

Since after one sector is read, the next will be in position to be read, one might think that there should be no waiting for the next sector. However some time is required for CP/M to process a sector, during this time the next sector may go by. It will then be a full revolution before the next sector is ready to read, and it will take 26 revolutions to read a track.

CP/M reduces this wait by rearranging the order of the sectors on the track. The rearrangement is done in software. Logical sector 2 is physical sector 7, logical sector 3 is physical sector 13, and so on. This way it takes only 6 revolutions to read a track. One nasty result of this is that, without track buffering, no matter how fast your CPU is, it will take 6 revolutions to read a track.

Track Buffering
With track buffering, whenever CP/M requests a sector, the whole track containing that sector is read into a buffer. Since no processing of the data takes place between sectors the whole track can be read in one disk revolution. The track buffer then becomes a small RAM disk. Subsequent reads and writes to that track are just RAM transfers.

With track buffering, when CP/M requests a read or write, a check must be made on which track is in the buffer. If the right track is in the buffer then the read or write is only a RAM transfer. If a different track is in the buffer then the buffer must be written to disk, to record any changes. Then the new track is read in. To avoid unnecessary writes, the Slicer software keeps track of which sectors have been changed. Sectors which have not been changed are not written.

A big problem with this method surfaces when the disk is changed. For the first read or write to the new disk, the buffered track is still from the old disk. Either the sector returned to CP/M will be from the old disk, or the buffered track will be written to the wrong disk. Thus it is important to flush the track buffer whenever there is a possibility of a disk change.

A Flushed Buffer
In the Slicer BIOS, the track buffer is flushed whenever there is a write to the directory, or a warm boot. Closing a file causes a write to the directory. So once a file is closed, disks can be changed, or the computer can be shut off, without losing information. The track buffer can also be flushed by typing control-C which generates a warm boot.

When the Slicer flushes the track buffer, the data in the buffer is marked as invalid. The next disk read or write operation forces a track read. This guarantees that if the disk is changed, the right track will be put into the buffer. Situations may arise where the Slicer does an unnecessary track read. Suppose a write to the directory has just occurred. This will flush the buffer, and mark the buffer contents as invalid.

Now suppose the next operation is a directory read (which is very likely). The directory is currently in the buffer, so a track read is not needed. However, since the Slicer has marked the buffer as invalid, the track will be reread. This makes track buffering a disadvantage with a command like ERA *, * which does a lot of directory writes. Each directory write causes the buffer to be flushed and then re-read. More on this later.

Errors can be confusing. A CP/M read can cause a disk write if the buffer must be flushed. Similarly, a CP/M write may require a disk read to load the buffer. So, for instance, when CP/M reads a sector, a disk write error may occur (on a different track, perhaps even on a different drive). On the Slicer, the BIOS does the
error handling itself. The disk, track, and sector of the error are reported, and the user is given the option of trying again, or aborting.

**HOME Flush**

Recently I was looking for a reason for the HOME routine in the BIOS. Stephen Hope of Lancashire U. K. sent me a letter with some suggestions. He says that CP/M-86 uses HOME to tell the BIOS that a possible disk change is about to take place. This makes HOME a good place for the track buffer.

In his letter, Stephen points out that the decisions to flush the track buffer and to invalidate the buffer’s contents should be separated. The contents can be marked as invalid when a HOME is requested. Then it is not necessary to invalidate the contents on each directory write. This makes the ERA command significantly faster. Figure 1 shows how to imbed these changes into the BIOS.

Stephen notes that a call to HOME may not be followed by a call to SETTRK. He has put a call SETTRK in HOME. The actual seek is done by READ or WRITE, so the SETTRK call will not slow things down. Thus, it does not hurt to have a call to SETTRK in HOME, even if it turns out to be unnecessary.

**ASM86**

One complaint I have with ASM86, is that it doesn’t work well with the type ahead buffer. If a key is pressed while an assembly is going on, ASM86 gives the message ‘USER BREAK (Y/N)’ and waits for an answer. I would rather be able to put CCP commands into the type ahead buffer during an assembly than abort the assembly. ASM86 puts an equal sign at the start of each line in a listing when that line was generated by an INCLUDE file. Often my entire program is in INCLUDE files so the equal signs just clutter up the listings. (I know this is unimportant, but since I was taking apart ASM86 to remove ‘USER BREAK’ I thought I might as well remove the ‘=’ also.)

Figure 2 details the changes I made to ASM86.

These changes are for version 1.1. Do not make these changes if you have a different version (which is unlikely).

**Disk Drive Names**

I have been talking with a few people who, for one reason or another, want a Slicer system with no floppies, only a hard disk. The biggest problem with doing away with the floppies is that CP/M-86 requires drive A: to be on line for all warm boots. On the Slicer, drive A: must be a floppy disk.

One way around this problem is to change the drive names in the BIOS. A drive is selected by the SELDSK routine in the BIOS. Entry to SELDSK requires CL to hold the drive name. You could, for example, check whether CL is 0, for A:, and if so change it to 7, for H:. Now anytime CP/M requests drive A: it gets the hard disk. It is a good idea to also change a 7 to a 0, otherwise it would be impossible to access physical disk 0.

Renaming drives can be handy at other times also. If your work disk is drive M: then floppies may not be needed (not until you power down). Also you may have submit programs, or other programs, which expect disks in particular drives.

A very nice way to rename drives was shown to me by Mark Johnson. Mark put a short translate table (figure 3) into the BIOS, and checks it on every call to SELDSK.
Figure 4 - Routine to Set Drives

```
INCLUDE CODES1
NOLIST

CNTL EQU -40H
CR EQU CNTL + 'M'
LF EQU CNTL + 'J'

; CCP command line trailer
DSEG
ORG 80H
CHDLINE RB 80H

; SELDSK location in jump table.
SSEG
ORG 251BH
SELDSK RW 1

CSEG

; Get location of disk name table. Name table is 16 bytes before SELDSK routine in BIOS. BIOS segment is in SS, SELDSK offset is determined by looking at the BIOS jump table.
MOV BP, SELDSK + 1
ADD BP, OFFSET SELDSK + 3 - 16

; Process command line. First two characters which look like drive names are used. All other characters are ignored. Thus things like colons, equal signs, spaces can be used. If less than two drive names are found than no swap is done.
MOV SI, OFFSET CHDLINE
CALL GETNAME
JC REPORT
MOV DL, AL
CALL GETNAME
JC REPORT
JC GETNAME
HADNAME:
RET

; Swap drives in DL and DH.
SUB BX, BX
XCHG BL, DH ; Now drives BX, DX
MOV SI, BX
MOV DI, DX
MOV AL, [BP+SI] ; Now drives SI, DI
XCHG AL, [BP+DI]
MOV [BP+SI], AL

; Display current drive name translation table on CRT.
REPORT:
MON MESSAGE
DB CR, LF, 'Original ', 0

ORGFLP:
MOV CX, 16
SUB AL, CL
MON CONOUT
LOOP ORGFLP

MON MESSAGE
DB CR, LF, 'Modified ', 0

MOV CX, 16
MOV SI, BP
MODLP:
LODS SS:AL
ADD AL, 'A'
MON CONOUT
LOOP MODLP
RETFL

; Get the next drive name from command.
; Characters which do not look like drive names are ignored. Drive number returned in AL. Carry set if no drive name found.
GETNAME:
LDSB
OR AL, AL
JZ NONAME
JC GETNAME
CMP AL, 16
JC HAVENAME
SUB AL, 'A' - 'A'
JC GETNAME
CMP AL, 16
JNC GETNAME
HAVENAME:
RET

Listing End
```

If a modified table is put into the BIOS then the name translation is present as soon as CPM is loaded. The program DISKNAME (figure 4) will allow you to change names after CPM is booted.

The file CODES1.A86 contains code macros for the new 80186 instructions, (which are not used in DISKNAME) and macros for monitor calls (which are used in DISKNAME). I use this file with almost all programs. It should be on one of your Slicer distribution disks.

This program will only work if the above BIOS modification has been made. It will destroy other BIOSs. It is a good idea to do a Ctrl-C after renaming disks to force CP/M to go through DSKSEL. The program could be improved by adding a check for the modified BIOS, and adding a call to DSKSEL. I have been lazy.

DISKNAME A: -> B: will swap drives A: and B:. DISKNAME ? will display the translation table. For lazy typists DISKNAME AB and DISKNAME are shorter versions of the above.

These name changes are only in effect while you are in CPM. In the monitor the drive names are the same as always. To boot from the hard disk you must still type B4. Autoboot and the B command still boot drive A. The EPROMs must be modified to change the autoboot and B command.

If you want to attempt this, the locations in the L3x EPROMS are 30E8H (187H even) for the autoboot, and 18F5H (C7AH odd) for the B command. Use the monitor naming conventions when changing the boot disk. 0 for A:, 1 for B:, 2 for C:, 3 for D:, 4 for H: (Booting off of M: is not recommended).
Slicer Computer System

Real 16-Bit Computer Board with 80186, 256K Bytes RAM - 64K Bytes EPROM, Two RS232C Ports and Floppy Controller for 8", 5½" and 3½".

System Includes:

- SLICER Computer Board
- SLICER Enclosure
- Two 5½" Drives
- 96 TPI D.S.D.D.
- 800K Bytes/Drive
- 6 MS Step Rate Terminal
- Power Supply
- CP/M 86*

Expansion Capabilities

Price: $3,495.00
Price (w/o Terminal): $2,995.00

Prices S.T.C. w/o N Mastercard, Visa, Check, Money Order or UPS COD orders accepted

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

Slicer Enclosure

SPECIFICATIONS

14½"W x 6"H x 15"D
Rigid construction of upper and lower chassis accommodates various computer configurations

- SLICER 16-Bit Computer X X
- SLICER Expansion Board X X
- Future SLICER Boards X
- Power Supply X X X
- Two 5½" HH Floppies X X
- Hard Disk & Controller X
- Four DB 25 & Two 50 pin prepunched connector holes (Standard)

Enclosure Price ............... $125.00
With power supply, line cord & switches ............... $245.00
With two 5½" 96 TPI drives ........... $795.00

Plus UPS Shipping Charges
Prices S.T.C. w/o N Mastercard, Visa, Check, Money Order or UPS C.O.D. orders accepted
A SINGLE BOARD COMPUTER FEATURING THE INTEL 80186

THE SLICER

- Full 8MHz 16-bit microprocessor having complete software compatibility with the 8086 and 8088
- 256K Bytes of RAM plus 64K bytes of EPROM memory capacity on board
- Floppy disk controller can run a combination of 8", 5-1/4", and 3-1/2" drives simultaneously
- SASI port for hard disk controller
- Two full function RS232C serial ports with individually controlled baud rates from 50 to 38.4K baud
- 8K of EPROM contains drivers for peripherals, commands for hardware checkout and software testing
- Source for monitor and bios included on disk
- Bios for CP/M 86* supports 8", 5¼", and 3½" drives, the Xebec 1410 and Western Digital WD 1002 SHD ** controller for hard disks
- Board size 6" x 12" power requirements +5 @ 3A, +12V @ 60mA, −12V @ 50mA
- Complete documentation included

Sold in various forms:
- Assembled and tested ................. $1105  $1125
- Full Kit ................................ 925  945
- Easy Kit (hard to get parts) .......... 480  500
- Bare Kit (board, Rom, Doc, and Disk) .... 150
- CP/M 86* available ..................... 85
- Regular U.P.S. shipping within continental U.S. is included.

6 MHz 8 MHz

THE SLICER EXPANSION BOARD

- 256K bytes dynamic RAM using the TMS4500 DRAM controller
- 2 RS232C serial asynchronous ports using the Signetics SC2881 serial communications circuit with baud rates selectable from 38.4K baud to 50 baud
- 2 RS232C serial asynchronous ports using the Zilog 8530 SCC with header connectors for synchronous communications personality cards
- Real Time Clock with battery back-up using the CDP6821 RTCCircuit, on-board or off-board battery
- Parallel printer port for Centronics-type printers
- Same size as the SLICER, Power: 5V @ 1.5A, +12 @ 200 mA – 12V @ 100 mA

Sold in various forms:
- Assembled and tested ................. $800.00
- Full Kit ................................ 650.00
- Memory Board ......................... 450.00
- 3 Port Board and Clock ................. 225.00
- Bare Board and Doc ..................... 95.00
- Regular U.P.S. shipping within continental U.S. is included.

Prices subject to change without notice

*CP/M a trademark of Digital Research, Inc.

**New items

SLICER COMPUTERS INC. 2543 Marshall St. N.E.
Minneapolis, MN 55418 (612) 788-9481
Dear Tony (Abbigale) Ozrelic,

Help!

Your column in Micro C got me interested in C. I am not a programmer, and thought a good way to start would be with the Kernighan and Ritchie book and User Disk #17 (small c compiler, version 2). I have worked mainly with assembly language.

I have mixed feelings about public domain software. On one hand, it's free; on the other, it seems that Sturgeon's Law applies: 90% of everything is trash, and in the case of public domain software, the remaining 10% has a hard time running right.

Small-c is now past its prime. When it was developed, the only C compilers available were on minis or cost 300-500 bucks for micros. Even though the compiler has been "improved," it seems that it is still harder to use than the cheap C compilers now on the market. It is still offered though, to guys like you who want to tinker with a new language. Now this is too bad; it sours people on the use of C to solve problems. Who wants to build a house with a tack hammer and a hacksaw? I sympathize with you; in the process of writing this column, I spent two hours (easy) trying to get small-c 2 going. Here is how I did it.

How I Did It

First, I read all the documentation on the disk. The file SAMPLE.DOC has the best instructions for using small-c. Then I copied the following files to my disk: my editor, my utilities (PIP, X-DIR, ASM, LOAD, etc), SMC.COM (the small-c compiler), *.c (all the C library files), and hello.c. I did not copy the cc.c* files.

Look at the HELLO.C listing. Here you see a small-c program to write "hello, world!" onto the screen. The #include files help the compiler by adding into the program some canned definitions and subroutines; STDIOA.H defines names such as YES and NO so that your program can use them (if need be). These names are NOT variables; they are used by the compiler's preprocessor to insert the values associated with them into the program before it is compiled. This is C's way of defining constants.

IOLIB.ASM has all the subroutines needed by C to access your disk via CP/M, and CALL.ASM (a lousy name) has the primitive subroutines needed to do 16-bit adds, multiplies, divides, equals, etc.

Whew. This is a lot of stuff just for one little program! But we're not done yet; at the bottom of HELLO.C is another set of includes—these are the C language subroutines (the others were assembly language subroutines) needed for our program. All told, we need more than 50k of source to support our little program!

Now you know why commercial C compilers nowadays come with an as-
sembler and a linker. You assemble your program and link it with the runtime library (i.e., all the other stuff), which has been pre-compiled. This is a great time and space saver.

Don't get the idea that this program compiled right off, 'cause it didn't. I tried to cut corners by using an #include at the bottom of HELLO to another include file instead of all those separate includes. This did not work since small-c does not allow nested include files. Rats. So I put in all the includes like it said to in the file instead of all those separate includes. Compiled right off, 'cause it didn't. I tried the bottom of to cut corners by using an #include at the bottom of HELLO to another include file instead of all those separate includes.

Snail-C Compiler

Well, it compiled this time. It took about two minutes to compile the 1k HELLO program into a 7k .COM file, which is pretty slow. I'm using a 5MHz Z80 with a ram disk! The compiler also produced about 54k of .ASM file to hand to the assembler. Now you know why small-c is public domain. Most users would be pulling their hair out if they had to use such tools.

The Moral of the Story

Well, Mike, I got it to work, and I found out a couple of interesting things: (1) FOLLOW THE DIRECTIONS, and (2) DON'T STOP TRYING.

A corollary to this is STEPWISE REFINEMENT. I am a great believer in this principle; it has worked for me quite well over the years. Stepwise refinement starts with something simple that does part of the job, and then is progressively refined to the point where does all of the job. The next step in this example would be to get each of the C libraries compiled and assembled, and then all libraries linked together into one big CRUNLIB.REL. This would then be used as a library for a different assembler; one that would allow you to compile only HELLO,C and link it to the runtime library.

Style or Taste?

While browsing through the C libraries and compiler, I noticed that the guys who modified this compiler did not write nice code, at least code the way I like it (figure 1).

Their way is sloppy and hard to read. It is also a bad example for beginners; they look at this stuff and don't understand it, and expect not to understand it because, well, that's just the way it is. Then they start writing it that way, too. Ick!

Calling All Capitalists

Well, if there is one benefit to public domain small-c, it is that it showed people there is a market for cheap C compilers. Trouble is, you need a $180 assembler/linker if you want to speed up your cheap compiler.

The Code Works people picked up on this and are now offering an almost M80 compatible assembler/linker (called CWA) for their Q/C compiler for $35.00. That's right, less than forty bucks.

It is written expressly for Z80 machines, so it is faster and smaller than M80, and the linker is smaller so you can link bigger programs with it. The minor drawback to it is that CWA does not recognize 8080 mnemonics or macros as Microsoft's M80 does, but for a cheap, fast compiler/assembler/linker, this combination is hard to beat.

I know, I know, you've heard me rant about Q/C before, but I still maintain that it is an excellent way for the beginner to learn C. You get lots of (well written) source code plus an excellent manual.

A Parting Shot

Well, Mike, that's about it. Do yourself a favor and bust loose with a few bucks; it's worth it.
I've spent so much of the last month at various meetings that I am only hitting on three cylinders. Why do so many good meetings have to occur at equally spaced two-week intervals? This column reports on one of these meetings, the Rochester FORTH Conference on Real-Time Applications, along with some more programming examples. But first, a few words from our sponsors.

Vendor News
TI FORTH was finally released around Christmas. This public domain fig-based model for the TI 99/4 was originally planned as a TI-supported product before the 99/4 went under. From reading the manual, it looks like TI FORTH is a good freebie; it has an assembler, sound and graphics support, and floating point. Check with local user's groups for your free copy.

A new floating point standard has been proposed by the FORTH Vendor's Group. Check with Linda Kahn at Micromotion for a copy.

Laboratory Microsystems has quietly raised the price of their Z80 FORTH to $100.

I've looked at MACFORTH (Creative Solutions) for the Macintosh and it is good. Check the three-tiered pricing policy before ordering though. You can't precompile images unless you order the $2500 developers' package.

Rochester FORTH Conference
I just got back from the Rochester meeting, one of the two big paper presentation conferences on FORTH given every year. The conference is hosted by the Laboratory for Laser Energetics at the University of Rochester. Larry Forsley has been promoting FORTH at UR for many years. In fact, his URTH was my first taste of FORTH back in 1976.

If you want to see the latest FORTH products, meet with vendors, and participate in large non-technical forums, go to the FIG National Convention in October. If you are serious about FORTH, want to see how others are using the language, and perhaps get hints or even outright help from FORTH experts, go to one of the Conferences.

This Rochester Conference was one of the most enjoyable meetings that I've gone to in a decade. Some 50 papers were presented over a 4-day period of non-stop activity. There is no way in which I can describe each paper, so I've broken them up into groups for this report. All 50 papers will appear in the Proceedings (600+ pages at last count).

Interest in FORTH Engines (that is, CPU's with FORTH as their native language) remains high. The Rockwell 65F11 chip was demonstrated, along with a discussion by Randy Dumse of its minimal outer interpreter (Randy was the chief architect of the F11 FORTH). His minimal outer interpreter does not require FIND or word headers as it accepts numeric input only. If the number is prefixed with a "W," it is considered as an absolute address and executed. This method may be primitive, but it allows you to debug on the target system with only 50 bytes of overhead! Ballard and Henshaw have implemented a bit-slice FORTH engine in the Hopkins Ultraviolet Telescope, to be flown on Space Shuttle in 1986. Several investigators have other bit-slice versions on paper.

New FORTH implementations on the VAX (both UNIX and VMS), the NCR/32, 65816 and MA2301 were described. The 65816 is a 16-bit 6502 and is a pin-for-pin replacement with about 4 times the processing power. The MA2301 is a neat NISC800 (Z80) system developed by National, with functional elements in boxes typically 2x3x1 inches in size and stackable. A full 64K 4MHz system with power supply, parallel and serial ports and a disk drive controller will fit in your hand and can be powered by two 9-volt batteries! The NCR/32 has a very interesting architecture that suits FORTH exceedingly well. One of its novel features is a delayed jump. Instead of dumping the prefetch queue, it executes all instructions stored there before executing a jump.

In this manner you can build some very efficient loops if you put the conditional test in the middle of the loop instead of at the end. FORTH, Inc. has written a very fast FORTH that takes advantage of the NCR/32 architecture.

Some of the applications described include OMNITERM2 (a very powerful communications package for TRS80 and IBM PC computers), Nicolet laboratory instruments, the Allen EPA Emissions Analyzer, several astronomical instru-
ment controlling programs, and some robotics. One group modified the popular robot arm toy seen at Radio Shack by installing Hall effect position encoders. Another lab is using a FORTH-controlled arm to automate sample testing. A third company is using an electric golf cart smartly FORTH controlled to move printed circuit boards between assembly lines.

Two papers presented ideas that I considered novel. Mitch Bradley described a technique used in EMACS called command completion. Instead of typing a word completely, you can just enter the first few characters and have FORTH search its dictionary for any possible matches. I've also heard of an earlier FORTH that used a fuzzy algorithm to find the word that most closely matched the string that you poorly entered. As a touch typist, neither version is of much use to me, but I know many programmers for which command completion would be a blessing!

Urieli in his REPTIL variation of FORTH replaces the traditional "OK" prompt with one containing more information. A ">>" is preceded by zero to five characters, indicating the execution state, current number of stack parameters, open files, etc., so that you can tell at a glance the current status of your system.

By far the most interesting paper was given by Tom Sargent, who has developed a VME-bus CAD/CAM system used to design printed circuit boards. Programmed in FORTH, the system uses multi-68000 CPUs in conjunction with a bit-slice graphics engine. Tom brought a videotape of the console in operation, and its demonstrated speed and image quality were breathtaking.

Place your order now for a copy of the proceedings! You won't be disappointed.

Clearing the Data Stack

Recently, a reader wrote in to describe his method of emptying the data stack. At first glance, I thought that his solution was superfluous. Fig-FORTH systems have the word SPI, which replaces the stack pointer with its initial coldstart value, thereby performing a stack clear.

Then I looked at the 83 Standard. SPI is not a standard word, nor is SO, the user variable in fig-FORTH that contains the stack coldstart value. Therefore, to be strictly correct, you have to brute-force drop any value that is on the data stack with a DO-LOOP to make your program portable. An example is shown in Figure 1.

Of course, for your own system, you can probably find a quicker method of performing the same task.

User's Corner: Combining BCD Digits

One of the projects that I'm working on is an automated photoelectric photometer. This is a device that counts photons of light coming from a star, and displays the counts (a measure of intensity) on an LED digital readout. We were interfacing the counter to a micro through a parallel port. Each digit of the 6 figure display was brought separately over the parallel port, and then had to be recom­bined to form a double-precision 6 decimal-digit value.

A programmer with little FORTH experience wrote the first packing word, called BCD1 in Screen 1. It took 6 stack values, where each ranged between 0 and 9, and combined them into a single number. I think you can follow the logic: each digit was multiplied by its appropriate power of ten and then added to a double-precision summing variable.

While BCD1 works, it is slow and definitely not an example of good FORTH programming. Its primary flaw is the use of a named variable instead of summing directly on the stack. BCD2 is a modification that leaves the intermediate sum on the stack.

BCD1 and BCD2 are still slow. One cause of the crawl is the high digit, which must be multiplied by 100,000 (more than 16 bits). They get around this problem by using two 16-bit multiplies instead of just one. Very few FORTHs have a 32-bit multiply and must use this separation technique.

All of the multiplies are by powers of 10. A trick is used in BCD3: the current sum is multiplied by 10 (a BCD "left shift") and the next lower digit added. By the time all 6 digits have been added, the highest digit will be shifted to its correct location. This same trick is used in NUMBER in fig-FORTH systems. Multiplies by 10 can be accomplished with only 4 adds, much faster than using the general purpose multiply algorithm. First, a copy is made of the original number. The copy is added to itself (multiply by 2) and this intermediate result is added to itself (multiply by 4). Next, you add the original value to the current value (multiply by 5) and finally add this sum to itself (multiply by 10). Since a double-precision duplicate and add words are available, you can perform 32-bit multiply-by-ten operations in this manner.

BCD4 is an even faster solution to the problem. The packing is performed in sets of 3 digits, well within the 16-bit integer limit. Then the most significant set is multiplied by 1000 and added to the least significant set. Note how much shorter and clearer BCD4 is than earlier versions! TRIO uses the same basic approach to digit combination as used in BCD1 and BCD2. TRIO2 is similar to BCD3 in that it uses the left shift algorithm. The advantage to TRIO2 is that it uses 16-bit multiply-by-ten operations, which are much simpler to code. Finally, the word 10* demonstrates how you can write the innermost word in assembly language to speed up the conversion as much as possible. The BCD1 conversion is about 4 times slower than BCD4 with TRIO2 and 10*.

What this example demonstrates is the power of FORTH. You can code an application using brute-force techniques learned from other languages, and it will work. With a little knowledge of how FORTH works, you can write compact code that will outperform most other high-level languages.

I hope you all have a chance to get to the SOG. If not, enjoy your summers!
Before I get into the hardware/software goodies, a couple words about the state of Xerox. As of this writing, Xerox has stopped producing both the 820-II and 16/8 except for in-house limited production runs.

The cap is on REALLY tight about their next computer; IBM compatible is the consensus. However, if the Xerox 1910 portable computer “elimination before production” policy still holds, I would not hold my breath. By the way, the company that was going to deliver thousands of those portables to Xerox, filed for bankruptcy.

**Autoboot Patch**

In the previous article, I mentioned that the BIOS could be patched for “autoboot” capability. Autoboot, when installed in BIOS, allows CP/M to execute a particular program at power-up, or automatically cold boot.

Actually, it is the CCP (Command Control Processor) which executes the command whenever the CCP is loaded. However, since the CCP is reloaded into memory on every cold or warm boot, the “autoboot command” will execute whenever ctrl-C is pressed or a program finishes execution unless redundancy has been removed.

Figure 1 is the patch necessary to add autoboot capability to SWP’s dual-density system; the patches are done in BIOS while operating under DDT and DD-SYSGEN (The patches are for the Mar 1982 version of dual-density).

Although this rework adds autoboot capability, it does not provide the actual autoboot command. AUTOBOOT.COM on the Xerox user disk B23 (editor’s note: I know, it was B22 last issue ... we goofed) was specifically designed for SWP’s dual-density system to force execution of any program (or no program) on cold boot. However, this can also be done under DDT in DD-SYSGEN.

1) Load in DD-SYSGEN under DDT and execute:

```
DDT DD-SYSGEN.COM
```

Read in the system tracks of a disk which has autoboot capability.

2) Examine locations 3007H through 3008H; these are your autoboot command locations. Location 3007H is the length of your command followed by the zero terminated command in locations 3008H and beyond. For example, to execute STAT at cold boot, change location 3007H to 4, “STAT” in locations 3008H to 300BH, and 00H in 300CH. A null command is specified by setting 3007H to zero.

3) Write the new system tracks to the desired disk. -G,100.

Although AUTOBOOT.COM does the same thing much easier, if you are too impatient, that is the procedure.

**Update**

For those of you who read the first part of this series, you might have noted the head load delay circuit included by the editor. After a thorough examination of the 820 board, I could not figure out why Xerox did NOT install it. The major component needed, the 74LS123, is already on the board waiting to be used!

In order to modify your board, you will need a 15-25W soldering iron, a 100k 1/4 Watt resistor, a 1 uF capacitor, and some 30 gauge wire-wrap wire (all available at Radio Shack).

You will need to open up your 820 display. Remove the two screws at the top of the unit and slide off the cover. Unplug everything that connects to the main logic board. Don’t worry; it’s all keyed so you can’t plug the wrong cable into the wrong plug. Remove the dual-density card from the disk controller socket if one is installed; the board can not come out with this in. The disk controller socket is immediately behind the DISK connector on the back of the board. Remove the four screws at each corner of the “mother” board and pull the board out of the rear of the machine.

1) The only “disconnection” which has to be made is to pin 23 of the disk controller (U109). Since a major bus runs through this point, I do not recommend cutting the PC board. Instead, pull out either your 1771 disk controller (if you do not have dual density) or take the double-density board, bend out pin 23, and re-install so pin 23 is free. Wait to re-install the double-density board until the mother board has been put back.

2) Keeping the leads as short as possible, solder the resistor on the BACKSIDE of the board between pins 16 and 15 of the 74LS123 chip (U27).

3) Solder the capacitor on the top side between pins 15 and 14 of U27.

4) Solder a wire between pins 3 and 16 of U27.

5) Solder a wire between pins 1 and 8 of U27.

6) Solder a wire between pin 11 of U118 (7406 chip) and pin 2 of U27.

7) Finally, solder a wire between pin 4 of U27 to the free lead (pin 23) of the disk controller (U109).

8) Put the computer back together!
The Xerox now operate error-free at a faster step rate to excuse not to build this one. These values to 6 ms. Not a stockholder. When Radio Shack you probably have seen more disk con­ tion of previous circuits. Not only did I know how to handle a voltmeter or are somewhat concerned about your talents, get a technical friend to do it while you go out and buy pizza and beer.

The 120 volt AC line must pass through the board to BOTH drives. This requires that both disk drive AC connectors have their BROWN colored leads cut and stripped 3 or 4 inches from the drive. Use some extra 18 or 20 gauge wire to connect between the board (point B) and these two wires forming a single junction. Solder sparingly and tape tightly. Using one of the remaining free leads, connect a wire from it to the board (point A). Tape the other spare lead to prevent accidental shorting.

With the new monitor on user disk B23, you can now adjust the start and delay until stop times of your 8 inch drives. Now us 8 inch users can have computing just as quiet as the that having over 70 files on a disk makes viewing IMPOSSIBLE using the CCP/ZCPR DIR command. Consequently, I removed DIR and I use D.COM which is a version of the SD series of directory programs floating around in public domain.

The file D.COM, which is included on the disk, is a 2K program which displays a nice sorted directory with file size, used space, and remaining space all shown. It is very nice; I have it on all my disks.

Figure 2 - Yet Another Drive Power Controller

It is likely that your disk system will now operate error-free at a faster step rate. The Xerox 820-I monitor sets the step rate to 10 ms for 8 inch to 30 ms for 5½ inch; you may want to lower both these values to 6 ms.

Another Disk Controller ??!

As a subscriber to Micro Cornucopia, you probably have seen more disk controller circuits in this magazine than Micro C issues you have received. Here is yet another one which is a conglomera­tion of previous circuits. Not only did I want the circuit to be cheap, but I also wanted it to be extremely reliable. Since mine has worked flawlessly for over a year (about 1000 hours of operation), if you do not have one by now there is no excuse not to build this one.

Figure 2 contains the circuit I used with Radio Shack part numbers (no, I am not a stockholder). When Radio Shack parts work for that long, you can bet the parts have not been stressed in the slightest.

Figure 3 - Floppy Delay Circuit for 820

There are two things to remember before installing this circuit:

1) If your unit is under warranty, hope your disk drives never go belly up. Xerox has the policy that any tampering voids the service contract. Your processor and keyboard service contract will still be in­ tact, however.

2) You will be cutting and soldering inside the disk drive unit. If you do not know how to handle a voltmeter or are somewhat concerned about your talents, get a technical friend to do it while you go out and buy pizza and beer.

After the circuit is built, locate the +5v and ground lines on the power supply board (counting from the bottom, pins 1-3 are +5 and pins 4-8 are ground on my system). Use these lines for power to your board.

The 120 volt AC line must pass through the board to BOTH drives. This requires that both disk drive AC connectors have their BROWN colored leads cut and stripped 3 or 4 inches from the drive. Use some extra 18 or 20 gauge wire to connect between the board (point B) and these two wires forming a single junction. Solder sparingly and tape tightly. Using one of the remaining free leads, connect a wire from it to the board (point A). Tape the other spare lead to prevent accidental shorting.

With the new monitor on user disk B23, you can now adjust the start and delay until stop times of your 8 inch drives. Now us 8 inch users can have computing just as quiet as the 5½ inch users.

More Notes on B23

A 16-bit timer is now available in the monitor work area. Using the first part of the real-time CTC (CTC 2) registers, a 16-bit counter is updated every 10.75 milliseconds. This can be used for program timing or other applications. The 16-bit timer is named TIKCNT in the Xerox monitor which is located at FF57 and FF58 in memory.

Using the capabilities of the Z80-CTC chip, a real-time clock has been incor­ porated into the monitor. Although not very accurate, it is adequate for most sys­ tems for a period of a day (accuracy de­ pends on your crystal; a crystal running exactly 2.5 MHz gains one second every 4 hours, 20 minutes, and 25 seconds).

Another feature of the new monitor is an optional screen display of time. On cold boot, the clock status flag (CLKSTA) located at FFDB is set to zero which dis­ ables screen display. By changing CLKSTA to a non-zero value, the upper right line on the CRT will display the time. This takes very little processor time as the screen is only updated when the time changes, once a second. Note that ZCPRX also uses this location for its time on/off commands.

Along with the real-time clock, a cal­ endar has been incorporated into the monitor. This is a fully functioning 12 month calendar; however, it does not check for leap years. In order to have a functioning calendar, the real-time clock must also be active.

ZCPRX

As part of the new system, I have modified ZCPR to take advantage of the new date and time features of the moni­ tor. In order to do this, however, I had to remove something.

I have discovered over the last year that having over 70 files on a disk makes viewing IMPOSSIBLE using the CCP/ZCPR DIR command. Consequently, I removed DIR and I use D.COM which is a version of the SD series of directory programs floating around in public domain.

The file D.COM, which is included on the disk, is a 2K program which displays a nice sorted directory with file size, used space, and remaining space all shown. It is very nice; I have it on all my disks.
The XEROX 820-I has recently become available from a wide range of sources at a price quite attractive to anyone interested in building a reasonably priced computer. The 820 board is a second cousin to the original big board and will run most, if not all, of the software available for the BB-I.

However, the 820-I does have a few drawbacks. It was built to run at 2.5Mhz, has only two sockets available for 2716 type EPROMS, and uses those two sockets for a monitor that includes a "Typewriter" function that would seldom, if ever, be used. The 820-I will only support two eight inch disk drives, and because it runs at 2.5Mhz, it will only support the IBM 3741 (single density) format.

820-I Mods

By applying the following hardware and software modifications to your Xerox 820-I, you could:

1) Increase the clock speed to 4Mhz
2) Increase the Eprom capacity to two 2732 type proms
3) Add a 24 hour time-of-day display
4) Add a video on/off control to turn the display off during times of extended keyboard or display inactivity (>4 mins)
5) Upgrade the system monitor to support the above.

The hardware portion of this modification will be covered first. When referring to the cut/add instructions, reference will be made to the "A" and "B" sides of the PC board. The "A" side of the board is the component side of the board and the "B" side is the solder side (underside) of the board.

If you are purchasing one of the bare boards available from B.G. Micro, I suggest that you make all of the cuts prior to installing the sockets. The traces are much easier to see and get to with an X-acto blade and errors can be more easily corrected.

If you are making these changes to an already assembled board, be very careful. Take time to make sure the trace you are cutting is really the correct one. Traces sometimes take off at strange angles once they are hidden underneath chips and sockets. If you're not 100 percent sure that it's the right trace, check it with an ohmmeter. It may take a little longer but it's usually worth the effort.

4Mhz Mod

The 4Mhz modification is similar to the modifications for the BBI described by Otto Hiller in issue #3 of Micro C. The clock is a true 50/50 signal and meets the setup and hold times of the Z80A. I suggest using 200-250ns RAM chips as a minimum in order to allow sufficient RAS precharge time.

**Figure 1 - 4 Mhz Modification**

**CUTS:**
- U10-4 A side
- U11-4 B side
- U11-5 B side

**ADDS:**
- U10-5 to U12-8 B side
- U12-10 to U9-3 B side
- U14-4 to U12-9 B side
- U11-3 to U71-1 B side
- U11-4 to U25-11 B side

**REMOVE:**
- U12 (74LS390)

**INSTALL:**
- Y2 20 Mhz Crystal

**Figure 2**

**CUTS:**
- U64-18 A side

**ADDS:**
- U62-14 to U34B-1
- U62-15 to U34B-2
- U63-18 B side
- U64-18 A side

**Figure 3**

**CUTS:**
- J1-3 B side
- U45-1 B side
- U16-8 A side

**ADDS:**
- U45-1 to U34B-8
- U16-8 to U34B-9
- U105-9 to U34B-10

The software portion of this modification will be covered second. When referring to the cut/add instructions, reference will be made to the "A" and "B" sides of the PC board. The "A" side of the board is the component side of the board and the "B" side is the solder side (underside) of the board. The hardware modification will be covered first. When referring to the cut/add instructions, reference will be made to the "A" and "B" sides of the PC board. The "A" side of the board is the component side of the board and the "B" side is the solder side (underside) of the board. The hardware modification will be covered second. When referring to the cut/add instructions, reference will be made to the "A" and "B" sides of the PC board. The "A" side of the board is the component side of the board and the "B" side is the solder side (underside) of the board.

The 4Mhz modification is similar to the modifications for the BBI described by Otto Hiller in issue #3 of Micro C. The clock is a true 50/50 signal and meets the setup and hold times of the Z80A. I suggest using 200-250ns RAM chips as a minimum in order to allow sufficient RAS precharge time.

**Additional Mods**

The following modifications require the addition of a Z4LS08 and XEROX has been kind enough to provide us with a spare chip location between U34 and U36. Insert a 14 pin socket, solder it in and install the Z4LS08 in the new socket. I'll call this U34B for the remainder of this article.

The change from 2716 to 2732 EPROMS involves the use of "flying leads" (Editor's note: the name came from a Barnum and Bailey trapeze troupe) on the component (A) side of the board. We have to pull a pin because the Xerox board is has four layers of circuitry. You see, Xerox sandwiched +5 and ground layers between the normal "A" and "B" signal planes of the PC board.

This is an excellent practice since it helps reduce noise problems, frees up additional signal channels, and reduces ground loop problems. The problem arises when a chip input is tied to power or ground. This is the problem with pin 21 of the EPROMs.

Pin 21 of a 2716 is normally tied to VCC when being used in the data read mode. This pin becomes the A11 input on a 2732. Since the leg of the socket on the 820-I is tied directly to the power plane, it is necessary to take a new 24 pin socket, bend pin 21 of the socket out to a horizontal position, and insert the new socket into the old EPROM socket. This "flying lead" is then connected to a via hole near U35-1 which supplies signal A11 from U35-1. This is done to both EPROM sockets in addition to those in figure 2.

**Figure 3**

**CUTS:**
- J1-3 B side
- U45-1 B side
- U16-8 A side

**ADDS:**
- U45-1 to U34B-8
- U16-8 to U34B-9
- U105-9 to U34B-10

The software to run all the above is in the new system monitor that I am releasing to Micro C for non-commercial use (User disk B23). The monitor is still compatible with the BB-I version of CP/M 2.2. The monitor includes all the old Xerox 820-I monitor functions except the T (typewriter) function.
**The Little Board®**

**Quantity One... $349**

The world’s simplest and least expensive single-board computer

*Substantial Quantity discounts available*

- 4MHz Z80A CPU, 64K RAM
- Two RS232 serial ports
- Mini floppy controller
- On-board -12V converter
- Only 5.75 x 7.75 inches
- Power Requirement: +5VDC @ .75A; +12VDC @ .05A
- Screws directly onto a mini floppy drive

All this... and CP/M® 2.2 also!

**BIG BOARD**

**XEROX 820**

Get the parallel I/O you need after you’ve used up that one PIO on your computer. The board also has a battery backed up clock-calendar chip. Interface that with a simple triac circuit and have your computer turn itself on and off.

- Up to 4 extra PIO's
- Lithium cell backup for clock
- Easy assembly & installation
- Stand by interrupt output from clock

Bare PCB. 29.95
Complete kit 99.95
Assembled & tested 129.95
Shipping 2.50

Goodin Peripherals
Send check or M.O. to Goodin Peripherals
P.O. Box 5867 Reno Nevada 89513
Please allow 3-6 weeks for delivery

The monitor also includes an integrated 24 hour time-of-day clock, a set clock command (S) that will prompt you for the correct date and time when invoked, a clock on/off toggle (T) command, the video on/off control, an initialization table for channel A of the SIO, and XON/XOFF flow control for channel B of the SIO (I use that for my printer).

If you really like the old XEROX monitor and want to keep it, then you must change two locations (figure 4) in order to boot your system at 4MHz.

**Figure 5 - 4 MHz Upgrade for 820**

**Figure 6 - 2732 Chip Enable Circuit**
MAXIMIZE YOUR KAYPRO®-FORMANCE

EXTERNAL MONITOR ADAPTOR
Kaypro 2 & 4

The External Monitor Adaptor (EMA) provides the ability for the Kaypro 2 or 4 to drive an external video monitor or projection TV. Simple plug-in installation requires no soldering or wiring. Complete illustrated instructions are included. EMA for Kaypro 2 & 4. .......... $69.95

EXTERNAl MONITOR & ADAPTOR
Kaypro 2, 4, 10, & Robie

The Kaypro 2, 4, 10 and Robie produce video which is not compatible with standard composite video monitors. However, with our EMA for Kaypro 2 & 4 and specially modified monitor, you can still enjoy all the benefits of a larger CRT.

Monitor: This specially modified monitor is a 12" Comrex CR-S600. It features a high contrast display. No soldering or wiring is required. Complete illustrated instructions are included. Please specify Kaypro model when ordering.

EMAs for Kaypro 2, 4, 10 & Robie...$99.95
EMAs for Kaypro 10...$109.95
Monitor, Green or Amber...$159.95

12ft KEYBOARD CABLE
For all Kaypro Computers

This 12ft Keyboard Cable is manufactured to replace the original 6ft cable. Not just a telephone cord, it is designed to meet the exact requirements of the Kaypro. Guaranteed to work.
12ft Keyboard Cable. ........ $12.95

UNIFORM
For all models except the Robie

Allows your Kaypro to read and write up to 55 character by 25 line display. Available in either GREEN or AMBER. Please specify color when ordering.
EMAs for the Kaypro 2, 4, 10 and Robie. .......... $69.95

ANTI-GLARE SCREEN
For all Kaypro Computers

Reduces eyestrain by increasing contrast and reducing glare. It makes working with your Kaypro less tiring and more enjoyable. Contour fitted exactly, it offers an undistorted view of the entire CRT. Attaches directly to the CRT and requires no assembly. Please specify SMOKE or GREEN when ordering.

Anti-Glare Screen ........ $24.95

KAYPRO COVERS
For all models except the Robie

Beautiful yet rugged, these covers help protect your investment. They are made from durable weather resistant Sunbrella. Includes two pockets for carrying your manuals, diskettes, etc. Please specify Black or Navy when ordering.

Kaypro Cover. ........ $34.95

PRINTER CABLES

These high quality RS-232 cables are designed to work with your particular printer and the Kaypro computer. No additional jumpers or other modifications are required. Simply plug it in and start printing. Available in two lengths for your added convenience. Each cable is fully tested and guaranteed. Available for all Kaypro computers. Please specify make and model of printer when ordering.

Available for:
- Gemini
- Epson
- Brother
- Silver Reed
- Prowriter

RS-232 Serial
6ft-$17.95 12ft-$22.95

Centronics Parallel
6ft-$24.95 10ft-$28.95

UNIVERSAL MODEM CABLES

These high quality RS-232 cables are configured for most modems used with the Kaypro computer. 2ft - $19.95 4ft - $22.95

5 MHz TURBOBOARD
For the Kaypro 2 & 4

The TurboBoard allows your Kaypro 2 or 4 to compute at twice the standard speed. Word processors, spreadsheet programs, etc. will run much faster. The speed (2.5MHz or 5MHz) is switch selectable and can be changed at any time without affecting the operation of the computer. Installation requires only minimal technical ability and no soldering is required. Complete illustrated instructions are included.

TurboBoard .......... $99.95

DEALER INQUIRIES WELCOME.

Call Today
National 1-800-821-8778
California 1-800-521-7182

All items are warranted for 90 days. Money cheerfully refunded if not completely satisfied. VISA and MasterCard are welcome. Please add $1.50 for COD. UPS surface freight paid on all orders. California residents please add 6% sales tax.
ProGRAPHICS PUTS
THE PRO IN KAYPRO®

ProGRAPHICS gives your Kaypro 2 or 4 the ultimate in video display as well as graphic capability. ProGRAPHICS emulates the popular Televideo 925/950 terminal at the same time retaining full compatibility with existing software. Simple plug-in installation requires no soldering or other modifications. Here are just some of ProGRAPHICS' capabilities:

- 25 x 80 character display
- 8 x 10 character matrix with true descenders
- non-scrolling 25th status line showing:
  - user input information, OR
  - current cursor position
  - user programmable relative time clock
  - screen attribute on/off status indicator
  - graphics mode enable/disable indicator
  - key click on/off indicator
- both block (160 x 50 resolution) and thin line graphics
- user selectable character and screen attribute including:
  - reverse video
  - half intensity
  - normal
- real software selectable cursor, including your choice of:
  - block
  - underline
  - blinking (fast or slow)
  - non-blinking
  - invisible

In addition, ProGRAPHICS gives you these features:

- an overlay program allowing Wordstar to use the new video attributes, and other features, making it much easier and faster to use.
- built-in monitor adaptor for connection to an external video monitor.
- the ability for your Kaypro to display video data 80% faster than stock.
- allows it to work at 9600 in telecommunications and terminal modes.
- fast, snow free scrolling.
- two demo programs (bar graph and keyboard test) complete with source code.
- complete with all necessary hardware, software and illustrated installation instructions.

PLUS: ProGRAPHICS is fully compatible with our 5MHz TurboBoard, Plu*Perfect's CP/M 2.2E, SWP's CO-POWER-88 and Micro Cornucopia's Pro-8 ROM.

Character Comparison

<table>
<thead>
<tr>
<th>ProGRAPHICS VIDEO</th>
<th>KAYPRO STANDARD VIDEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Formed Characters</td>
<td>No True Descenders</td>
</tr>
<tr>
<td>True Character Descenders</td>
<td>Simulated Cursor</td>
</tr>
<tr>
<td>True Cursor</td>
<td>Improved Aspect Ratio</td>
</tr>
</tbody>
</table>

ProGRAPHICS SYSTEM ......................... $299.00

Warranted for 90 days. Money cheerfully refunded if not completely satisfied.

CALL TODAY
National 1-800-821-8778
California 1-800-521-7182

Visa and MasterCard are welcome. Please add $1.50 for C.O.D. UPS surface freight paid on all orders. California residents please add 6% sales tax.

DEALER INQUIRIES WELCOME.

ProGRAPHICS is fully compatible with our 5MHz TurboBoard, Plu*Perfect's CP/M 2.2E, SWP's CO-POWER-88 and Micro Cornucopia's Pro-8 ROM.

KAYPRO SYSTEM .............................. $299.00

Warranted for 90 days. Money cheerfully refunded if not completely satisfied.

advent products, inc.
3154 F E. La Palma Avenue, Anaheim, CA 92806 • (714) 997-0800

Kaypro is a registered trademark of Kaypro Corporation. CP/M is a registered trademark of Digital Research. Wordstar is a registered trademark of MicroPro International. CO-POWER-88 is a registered trademark of SWP Microcomputer Products.

Character Comparison

<table>
<thead>
<tr>
<th>Kaypro 2 or</th>
<th>Kaypro 2 or</th>
</tr>
</thead>
<tbody>
<tr>
<td>e programs</td>
<td>e programs</td>
</tr>
<tr>
<td>atly increa</td>
<td>atly increa</td>
</tr>
</tbody>
</table>

ADVENT ProGRAPHICS VIDEO
- Fully Formed Characters
- True Character Descenders
- True Cursor
- Improved Aspect Ratio

KAYPRO STANDARD VIDEO
- No True Descenders
- Simulated Cursor
PROGRAMMER/4+

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.

Order from

L-Band Systems
1037 E. Lemon Ave.
Monrovia, CA 91016
(818) 357-0566

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.

HARDWARE SPOOLER
and INTERFACE CONVERTER

Hardware spooler buffers your printing tasks — Download a 60K listing in 50 seconds!!
Converts to Centronics Interface without Losing Your Parallel Ports

- Input: Centronics Parallel or Serial (110 to 9600 Baud)
- Output: Centronics Parallel or Serial (110-9600 Baud)
- 128 K Buffer (up to 70 pages)
- +5V at 575mA, ±12V at 80mA
- Uses readily available parts (280 base system)
- Form Feed Control for single sheet feeding
- 5% x 71/2 inch circuit board

Bare Board, Documentation, Listing for ROM ............... $29.95
ROM (2732A with program) .... 10.95
Disk with Source Code ......... 10.95

Shipped via Prepaid UPS — No COD or P.O. Box —
Check or Money Order to:

L-Band Systems
1037 E. Lemon Ave.
Monrovia, CA 91016
(818) 357-0566
Programs
Complete
Interfaces
EASY
~rA
STEP UP
DISPLAY YOU CAN BUY...
NO
MBER (619) 579 - 2435
ONLY $89.95
SCREENS
We provide you with the
THE
MATTER
TO
SION
An AMBER display
A clear, sharp, bright,
EASY TO SEE screen
NO MATTER HOW BRIGHT
THE ROOM LIGHT IS.
ONLY $89.95
EASY TO INSTALL YOURSELF
AMBER VISIONS
878 Jackman St.
Ste. 192
El Cajon, CA 92020
(619) 579 - 2435

Big Board I Dual Drive Enclosure
Because of the unprecedented popularity of the original Big Board, we felt there
would be a good market for an attractive yet low cost custom enclosure.
We have designed THE perfect enclosure for your Big Board and two eight inch
Drives.

FEATURES:
* Custom Designed for the original Big Board
* Heavy Duty all aluminum construction.
* Mounts Two SA800/801R or equiv. drives (Vertically).
* Has extra space for Switching or Linear Power Supplies.
* Attractive painted cream finish with natural aluminum pre-punched backplate.
* Pre-punched cut outs for cooling fan, 3 DB25 conn., video conn, keyboard conn.,
an off switch, AC power filter/plug, fuse, reset switch, and cooling slabs.
* Built in stand offs for mounting Big Board.
* Can also be used for a dual drive enclosure for other systems besides the Big
Board.
* 20 x 12 x 10.25 inches in size.

NEW LOWER PRICE: $69.95 (add $4 UPS) Buy 2 or more at $65 ea.
(Units shipped unassembled)
Limited Qty. of mating PAMOTOR 8500D muffin fans avail. at $12.
Limited Qty. of CDE APF600CEE 6 amp AC 3 wire receptical and
line filter that fits our enclosure are avail. at $3.50 each.
Limited Qty. of 50 conductor dual drive ribbon cable and
connector assemblies for your Big Board. These feature GOLD
Winchester Electronics connectors! $15 each.
Add extra $1 UPS on above 3 items. We accept VISA, MC, money
orders, or cash. Personal checks OK but cause an extra 2 week
delay for clearing. Texas residents add 5% sales tax. We ship to USA
and Canada only. $15 min. order. No phone orders yet
ODD BALL ELECTRONICS
P.O. Box 879
DUNCANVILLE, TEXAS 75116

Big Board I Dual Drive Enclosure
Because of the unprecedented popularity of the original Big Board, we felt there
would be a good market for an attractive yet low cost custom enclosure.
We have designed THE perfect enclosure for your Big Board and two eight inch
Drives.

FEATURES:
* Custom Designed for the original Big Board
* Heavy Duty all aluminum construction.
* Mounts Two SA800/801R or equiv. drives (Vertically).
* Has extra space for Switching or Linear Power Supplies.
* Attractive painted cream finish with natural aluminum pre-punched backplate.
* Pre-punched cut outs for cooling fan, 3 DB25 conn., video conn, keyboard conn.,
an off switch, AC power filter/plug, fuse, reset switch, and cooling slabs.
* Built in stand offs for mounting Big Board.
* Can also be used for a dual drive enclosure for other systems besides the Big
Board.
* 20 x 12 x 10.25 inches in size.

NEW LOWER PRICE: $69.95 (add $4 UPS) Buy 2 or more at $65 ea.
(Units shipped unassembled)
Limited Qty. of mating PAMOTOR 8500D muffin fans avail. at $12.
Limited Qty. of CDE APF600CEE 6 amp AC 3 wire receptical and
line filter that fits our enclosure are avail. at $3.50 each.
Limited Qty. of 50 conductor dual drive ribbon cable and
connector assemblies for your Big Board. These feature GOLD
Winchester Electronics connectors! $15 each.
Add extra $1 UPS on above 3 items. We accept VISA, MC, money
orders, or cash. Personal checks OK but cause an extra 2 week
delay for clearing. Texas residents add 5% sales tax. We ship to USA
and Canada only. $15 min. order. No phone orders yet
ODD BALL ELECTRONICS
P.O. Box 879
DUNCANVILLE, TEXAS 75116

EPROM PROGRAMMER

interfaces to the BBI (XEROX 820) parallel port
Requires +5v @ .3A, +25v @ .1A, interface cable
1. Software and schematic
2. Bareboard and schematic
3. Software and bareboard
4. Software and kit (less ZIFs)
5. Software and full kit
6. Programmer A + T
   S/H within N.A.
   S/H foreign orders
Big Board II software and source
   (uses BB II sockets for programming)
Software is delivered on a 8 inch SS SD floppy disk
- Program, Verify, Load and check for Erased
  Intel Epropms 2716, 2732(A), 2764, 27128
  T.I. Epropms 2516, 2522, 2564
  Xicor EEprom 2816A
- Uses 16k bytes of system memory as a buffer, allowing you to
  work with up to 8 2716 EPROPs at the same time
- Upload and Download Intel Hex Files
- Edit the data in the 16k byte memory buffer
- Define your own addresses for the memory buffer
- Complete screen error messages
- Software source included
- Menu driven
- Interfaces with most Z80 CP/M systems
options (available later)
- EPROM Emulator
- Adapters for single chip processors

all prices shown are in US funds

Big Board I (XEROX 820) PORT EXPANDER
- interfaces through the Z80 CPU socket and 1 jumper to connect
  the 'IEC-IEI' daisy chain
- adds 2 PIOs, SIO, CTC, and a DMA controller
- FULL MODE 2 INTERRUPT OPERATION
- Works with 2.5MHz and 4MHz systems
- Complete documentation

STAND ALONE U.I.E.
- 256k bytes of RAM with DMA capability
- 4 fully buffered 8 bit parallel ports
- 4 MHz - use Z80A parts and 200 nsec dynamic RAM
- 2.5 MHz - use Z80 parts and 250 nsec dynamic RAM
- configurable EPROM socket (2716 thru 27256)
- 4 fully buffered 8 bit parallel ports
- 2 configurable RS232C serial ports
- Complete documentation

all prices shown are in US funds

Big Board I Dual Drive Enclosure
Because of the unprecedented popularity of the original Big Board, we felt there
would be a good market for an attractive yet low cost custom enclosure.
We have designed THE perfect enclosure for your Big Board and two eight inch
Drives.

FEATURES:
* Custom Designed for the original Big Board
* Heavy Duty all aluminum construction.
* Mounts Two SA800/801R or equiv. drives (Vertically).
* Has extra space for Switching or Linear Power Supplies.
* Attractive painted cream finish with natural aluminum pre-punched backplate.
* Pre-punched cut outs for cooling fan, 3 DB25 conn., video conn, keyboard conn.,
an off switch, AC power filter/plug, fuse, reset switch, and cooling slabs.
* Built in stand offs for mounting Big Board.
* Can also be used for a dual drive enclosure for other systems besides the Big
Board.
* 20 x 12 x 10.25 inches in size.

NEW LOWER PRICE: $69.95 (add $4 UPS) Buy 2 or more at $65 ea.
(Units shipped unassembled)
Limited Qty. of mating PAMOTOR 8500D muffin fans avail. at $12.
Limited Qty. of CDE APF600CEE 6 amp AC 3 wire receptical and
line filter that fits our enclosure are avail. at $3.50 each.
Limited Qty. of 50 conductor dual drive ribbon cable and
connector assemblies for your Big Board. These feature GOLD
Winchester Electronics connectors! $15 each.
Add extra $1 UPS on above 3 items. We accept VISA, MC, money
orders, or cash. Personal checks OK but cause an extra 2 week
delay for clearing. Texas residents add 5% sales tax. We ship to USA
and Canada only. $15 min. order. No phone orders yet
ODD BALL ELECTRONICS
P.O. Box 879
DUNCANVILLE, TEXAS 75116

Big Board I Dual Drive Enclosure
Because of the unprecedented popularity of the original Big Board, we felt there
would be a good market for an attractive yet low cost custom enclosure.
We have designed THE perfect enclosure for your Big Board and two eight inch
Drives.

FEATURES:
* Custom Designed for the original Big Board
* Heavy Duty all aluminum construction.
* Mounts Two SA800/801R or equiv. drives (Vertically).
* Has extra space for Switching or Linear Power Supplies.
* Attractive painted cream finish with natural aluminum pre-punched backplate.
* Pre-punched cut outs for cooling fan, 3 DB25 conn., video conn, keyboard conn.,
an off switch, AC power filter/plug, fuse, reset switch, and cooling slabs.
* Built in stand offs for mounting Big Board.
* Can also be used for a dual drive enclosure for other systems besides the Big
Board.
* 20 x 12 x 10.25 inches in size.

NEW LOWER PRICE: $69.95 (add $4 UPS) Buy 2 or more at $65 ea.
(Units shipped unassembled)
Limited Qty. of mating PAMOTOR 8500D muffin fans avail. at $12.
Limited Qty. of CDE APF600CEE 6 amp AC 3 wire receptical and
line filter that fits our enclosure are avail. at $3.50 each.
Limited Qty. of 50 conductor dual drive ribbon cable and
connector assemblies for your Big Board. These feature GOLD
Winchester Electronics connectors! $15 each.
Add extra $1 UPS on above 3 items. We accept VISA, MC, money
orders, or cash. Personal checks OK but cause an extra 2 week
delay for clearing. Texas residents add 5% sales tax. We ship to USA
and Canada only. $15 min. order. No phone orders yet
ODD BALL ELECTRONICS
P.O. Box 879
DUNCANVILLE, TEXAS 75116
BIG VOICE KIT

- 1400 BUILT-IN WORDS PLUS UNLIMITED PHONETIC SPEECH CAPABILITY
- DATA RATE: 3.5 bytes/sec typical (2 bytes/word or phoneme)
- PLUGS DIRECTLY ONTO GPIO "A"

BIG VOICE KIT INCLUDES:

- HIGH QUALITY BARE BOARD
- 1400 WORDS IN EPROM
- USER/ASSY MANUAL w/schem.
- SOFTWARE: WORD SOURCE, DEMO & SUPPORT PROGRAMS, ON 8" sssd FLOPPY DISK

$70. kit / $150. ass'd & tested all ppd. (Texas res. add 6%) state whether B/B or Xerox

9910 LEAWOOD BLVD.
HOUSTON, TEXAS 77099
tel. (713) 495-6185

COMPUSOPHIC SYSTEMS
Dept. 111 • 2525 SW 224th Ave
Aloha, Oregon 97006 • (503) 649-3765

KAMAS is a trademark of Compusophic Systems. Kaypro is a trademark of Kaypro Corporation.

FOR SALE

SA800-2 Disk Drive ........ $ 99
SA850 Disk Drive ........ $199
Guaranteed 60 Days
Standard Mounting

Switching Power Supply
±5, ±12, ±24; Will power 2 drives and BB ............ $ 60

Keyboard by Microsworth
113 Hall Effect Keys, 8 Bit output with DOC, with case .......... $ 40

SA800 Head ................ $ 10
SA850 Head ................ $ 35
SA800 Stepper ............. $ 10
SA850 Stepper ............. $ 25

Cascade Electronics
Route 1 Box 8
Randolph, MN 55065
507-645-7997

Credit Card ADD 5%
MN add 6% sales tax

NOW FOR XEROX 820
BB & BBII

LOW COST DISK CONTROLLER

SAVE WEAR AND TEAR ON YOUR DISK DRIVES AND FLOPPIES WITH THE MODEL 381. ALL SOLID STATE RELAY. SMALL ENOUGH TO FIT EASILY INSIDE YOUR DISK DRIVE. THE 381 CAN BE INSTALLED IN MINUTES. YOUR BIG BOARD WILL THEN TURN YOUR DRIVES ON AND OFF AUTOMATICALLY AS THEY ARE NEEDED.

- FEATURES -
* SMALL SIZE - 1.75 X 1.40 X 0.35
* FAST INSTALLATION -DIAGRAM INCLUDED
* ZERO CROSSING - ELIMINATES ALL SWITCHING NOISE
* TRIAC OUTPUT - NO MECHANICAL PARTS
* DVD FILTER - INCLUDED
* LOW COST - ONLY $9.99 EACH
* 1 YEAR WARRANTY
* 30 DAY MONEY BACK GUARANTEE

PHENIX
COMPANY OF CALIFORNIA
159 SOUTH MICHIGAN STREET
SANTA ANA, CALIFORNIA 92701
(714) 547-4316

CALIF. RES. ADD 6.5% SALES TAX
ADD $1.89 EA. POSTAGE & HANDLING
PLEASE SPECIFY BB, BBII OR XEROX.
*NOTE: XEROX 820 REQUIRES ONE RELAY PER DISK DRIVE
EZ Prommer For The BB-I and 820

Review By Jay C. Jaecckel

Over the weekend I installed an eprom burner from Optronics Technology with the hopes of burning some 2764's for my MORROW MD-11 hard disk system, and some 2732's for the terminal that a friend of mine did some graphics characters for. My board came fully assembled (you only save $35 if you put it together yourself) but when I added power and configured a shunt it did not work. A close inspection of the board revealed that one 4040 chip was missing. After a trip to the local parts store and $1.85 for the chip I tried the board again. No Success. A call to the manufacturer (can you believe someone was there on Saturday?) revealed that the cable was not configured correctly. A jumper had to be added to connect to J11 on my 820-II board. The jumper was shown on the schematic but not included on the cable. Perhaps they sent me the big board version?

The use of EZ PROGRAMMER is very easy, as the software is all menu driven and self explanatory. Earlier versions of the software as well as a MAC file were included. The version I had does 2716, 2732, 2732A, and 2764's.

Commands included are:

- Dump Memory
- Check for Erase EPROM
- Read EPROM into Memory
- Load File into Memory
- Save Memory into File
- Compare EPROM with Memory
- Program EPROM with Memory
- Cyclic Redundancy Check on EPROM
- Cyclic Redundancy Check on Memory
- Return to EPROM Selection Menu

A reed relay is provided so that power to the EPROM is on only when the EPROM is written to or read, and an LED is provided to show when power is on at the EPROM socket. The “Dump Memory” feature shows both hex and ASCII, however a debugger like DDT, or ZSID is required to make changes to EPROM code. I especially like the CRC checking facility both for verification of integrity but also as a revision check. It seems that I have a habit of mislabeling or not labeling things unless I write the label immediately. Disks, EPROMS and other things have a habit of stacking up around here.

A jumper is provided for programming at either 21 volts or 25 volts and pots are provided to adjust the voltage for both jumper settings. During the burn process a time and number of bytes burned graph is displayed so that one can judge how long the current process will take. After burning the EPROM a compare with memory can be done to verify that the EPROM was burned correctly.

The circuit board and components are of good quality but I would recommend building an enclosure right away as the board is a bit thin. I would have liked to see a zero-insertion-force socket for the “personality module” as well as the EPROM, but you can’t have everything at this price.

I went to the local electrical supply company and picked up an ultra-violet SYLVA NIA G8T5 germicidal fluorescent tube (12") with a suitable fixture for about $30.00 that seems to erase EPROMS very nicely in about 6 to 10 minutes. This method does not provide for eye protection but a little cautious use seems better than spending $60-$150 for a commercial EPROM eraser. The EZ PROGRAMMER menu has a “check for erased EPROM” on the menu as well as an automatic check before the EPROM is burned.

I found this product to be one of the least expensive programmers on the market that programs 2764’s. This particular board is drawing power from my XEROX and only requires a 5 volt connection for power (specs indicate only 250 MA) as it has its own switching IC to step up to 21 or 25 volts for burning. The documentation is on the “thin” side, however, schematics and source for the software are included on disk. I would recommend this product as a good buy for anyone who needs to program most of the popular EPROMS out there.

OPTRONICS TECHNOLOGY
PO BOX 81
PITTSFORD, NY 14534
(716) 377-0369
Price as tested $125.00

E Z PROMMER
EPROM PROGRAMMER
FOR THE BIG BOARD AND XEROX 820

FEATURES:
- Supports 2716, 2732, 2732A, 2764, 27128, 27252
- Easily installed with only two connections
- No external supply needed, all power derived from +5 Volts
- All power controlled by software
- Extensive MENU driven software to Read, Program, Save, Load, Verify CRC check, Dump, Erase check complete with source code
- Over one year of troublefree use.

EZPROMMER
A&T w/Harness, Disk ....$125
Kit with Disk ............$90

APL
CHARACTER GENERATOR
FOR XEROX 820-II

Upgrade kit allows the 820-II to display all the standard characters and attributes while permitting the display of all APL characters. Kit includes ROM and software.

APL UPGRADE KIT ...$49.95

NY RES. ADD LOCAL TAX. POSTAGE AND HANDLING $2.00
VISA, MC, CHECK or COD
716-377-0369

O P T R O N I C S
TECHNOLOGY
P.O. BOX 81
PITTSFORD, NY 14534
As a relative novice on the inner workings of CP/M, I found Mastering CP/M by Alan Miller most enlightening. It presents a well written treatment of how CP/M operates and how to interface with its inner workings.

For example, the Alan shows how to use the CP/M BDOS (basic disk operating system) to print a character or a string of characters on the console. This eliminates the need to use PPM-80 or your system monitor for this or similar functions, making your programs compatible with other CP/M systems.

The author's selects a task (such as ringing the console bell) and then explains the portions of CP/M which are needed to accomplish that task. In this case, all that is used is the BDOS (basic disk operating system) call to output a character to the console. (Incidently, the "basic" in BDOS and BIOS refers to "elementary" or "fundamental"; it does not refer to the BASIC programming language).

Chapter by Chapter

Chapter One contains an elementary level discussion of how CP/M is organized and how it runs.

Chapter Two, "Duplicating and Altering CP/M Disks," shows how to alter the BIOS and write the altered version to a disk.

Chapter Three, "Adding Features to BIOS," continues to meddle in CP/M's inner workings, and explains the I0BYTE.

Chapter Four introduces macros, showing how to use Digital Research's MAC and ASM assemblers as well as Microsoft's M80. Alan lists several macros and explains their functions.

Chapter Five explains how to use the BDOS for non-disk functions, such as writing and reading console characters. Chapters Six and Seven cover reading and writing disk files with BDOS. Chapter Eight discusses the CP/M disk directory.

Anyone who really follows the book will wind up getting very familiar with DDT while viewing what is really happening inside CP/M.

The book contains over 40 system macros (with complete listings) which perform BDOS calls; compare two blocks of information; display the I0BYTE value; read single disk sectors; and write single disk sectors.

8080

8080 mnemonics are used throughout, although Z-80 tidbits are thrown in when appropriate. One appendix lists the Z-80 and 8080 instruction sets, both alphabetically and numerically, and each instruction is explained. Two other appendices list the ASCII character set and all the CP/M BDOS functions, making this a neat reference package.

Conclusion

Overall, the book is great. I would have appreciated a bit more detail in some instances, but I'm a slow learner. This book, while starting at the beginner's level, is not for the casual CP/M user.

If you just want to know how to use PIP and SAVE, it's not for you. It's aimed at the serious machine-language programmer who wants to write assembly language programs to run under CP/M. If you'd like an enthusiastic second opinion, this book is also reviewed in the December 83 issue of Byte, p598.

Mastering CP/M

By Alan R. Miller

Sybex, Inc. 1983

400 pages.
**CALL WREN!**

**DISKS:**

<table>
<thead>
<tr>
<th>Dyson</th>
<th>Verbatim</th>
</tr>
</thead>
<tbody>
<tr>
<td>5¼ SSDD</td>
<td>5¼ SSDD</td>
</tr>
<tr>
<td>$3.40</td>
<td>$2.70</td>
</tr>
<tr>
<td>5¼ DSDP</td>
<td>5¼ DSDP</td>
</tr>
<tr>
<td>$4.45</td>
<td>$3.75</td>
</tr>
<tr>
<td>5¼ SSDP</td>
<td>5¼ SSDP</td>
</tr>
<tr>
<td>$4.85</td>
<td>$3.50</td>
</tr>
<tr>
<td>5¼ DSDP</td>
<td>5¼ DSDP</td>
</tr>
<tr>
<td>$5.40</td>
<td>$4.75</td>
</tr>
<tr>
<td>8 SSDP</td>
<td>8 SSDP</td>
</tr>
<tr>
<td>$3.85</td>
<td>$3.10</td>
</tr>
<tr>
<td>8 SSDP</td>
<td>8 SSDP</td>
</tr>
<tr>
<td>$4.85</td>
<td>$3.40</td>
</tr>
<tr>
<td>8 DSDP</td>
<td>8 DSDP</td>
</tr>
<tr>
<td>$5.40</td>
<td>$3.80</td>
</tr>
</tbody>
</table>

Disk Mailers 10 for $5.00, 100 for $40.00.

**PRINTERS:**

Oki
- 82 A S & P 8.5 Carr. 120 CPS $ 325.
- 83 A S & P 13.5 Carr. 120 CPS 575.
- 84 P S 13.6 Carr. 200 CPS 975.
- 92 P S 8.5 Carr. 160 CPS 1065.
- 92 S S 8.5 Carr. 160 CPS 900.
- 2350 S 13.6 Carr. 350 CPS 2025.

**DRIVES:**

Tandon 848-1 8 SSDD 325.
Tandon 848-2 8 DSDP 375.
Tandon 100-1 5¼ SSDD 175.
Tandon 100-2 5¼ DSDP 235.

513-931-7160

Minimum Order 150.00

BB II USERS

**COLOR GRAPHICS FOR THE STD-BUS**

JUST LOOK AT THESE FEATURES:
- OUTPUTS RGB AND/OR COMPOSITE VIDEO
- USES TEXAS INST. TMS9928 OR TMS9128 (MUST USE TMS9128 FOR COMPOSITE)
- 16K LOW COST VIDEO RAM
- 15 UNIQUE COLORS PLUS TRANSPARENT
- 32 SPRITES PLUS PATTERN AND BACKDROP PLANE
- 256h X 192v RESOLUTION
- RCA TYPE OUTPUT CONNECTORS
- PCB SOLDER MASKED AND SILKSCREENED
- GOLD PLATED FINGERS
- SOFTWARE AVAILABLE FROM MICROSHPHERE
- LICENSED GRAPHIC EDITOR AND LOGO
- BARE PCB AND DOCUMENTATION $49.95

Send check or money order to:
TOM WOODROW
2075 TREEWOOD
SAN JOSE CA. 95132

CA. RESIDENTS ADD 6.5% sales tax

sales in USA only

or send s.a.s.e for more info

---

**Run Out of Disk Space on Your Xerox 820-1?**

**How About 784K on a 5¼" Drive?**

UPGRADE YOUR 820-1 TO DOUBLE DENSITY KAYPRO COMPATIBILITY, AND RUN 4 OR 5 MHZ WITH UP TO 4 DISK DRIVES, 8" AND 5¼" AT THE SAME TIME!

**X-8 ROM PACKAGE**
- 5 MHZ 2732 ROM; 5¼" DISK WITH FORMAT PROGRAM, CUSTOM BIOS, AND INSTALLATION PROGRAMS; AND MANUAL
- BANK SELECTED; CAN USE 63K OR 64K CP/M
- USES PARALLEL KEYBOARD AND HARDWARE VIDEO SCROLL (FOR FAST SCREEN RESPONSE)
- SERIAL AND CENTRONICS PRINTER DRIVERS
- AUTO-BOOTS, READS, AND WRITES KAYPRO FORMAT
- KAYPRO II – 191K ON SSDP, 40 TRACK, 5¼"
- KAYPRO 4 – 360K ON DSDP, 40 TRACK, 5¼"
- KAYPRO 8 – 784K ON SSDP, 80 TRACK, 5¼"
- 98% SOFTWARE COMPATIBLE WITH KAYPRO II

**X120 DOUBLE DENSITY CONTROLLER BOARD**
- DESIGNED SPECIFICALLY FOR THE XEROX 820-1 USING WD2791 OR WD2793 DISK CONTROLLER CHIP WITH BUILT-IN DATA SEPARATOR
- CAN RUN 5¼" AND 8" DRIVES AT THE SAME TIME WITH STANDARD 34 AND 50 PIN DRIVE CONNECTORS ON DAUGHTER BOARD
- MAINTAINS SIGNALS TO EXISTING 820 BOARD CONNECTORS
- DECODED DRIVE SELECT LINES FOR FOUR DRIVES
- ENABLES PRECOMPENSATION SELECTION FOR 8" OR 5¼" DRIVES
- COMPOSITE VIDEO ADAPTOR ON BOARD

**PRICING**
- X-8 ROM PACKAGE .................. $ 49.95
- X120 BARE BOARD WITH DOCUMENTATION $ 26.00
- X120 BOARD A&T WITH DOCUMENTATION ... $140.00
- X-8 ROM PACKAGE AND X120 BARE BOARD $ 72.00
- X-8 ROM PACKAGE AND X120 BOARD A&T ... $180.00

**CUSTOM CABINETS**
- DESK TOP ENCLOSURE FOR TWO HORIZONTAL MOUNTED FULL HEIGHT (FOUR HALF HEIGHT) DRIVES, WITH SPACE FOR POWER SUPPLY AND 820 BOARD (OR OTHER SIMILAR BOARD)
- PORTABLE ENCLOSURE FOR DRIVES, KEYBOARD, POWER SUPPLY, MONITOR, AND BOARD

INSTALLATION OF ROM AND BOARD REQUIRE A SMALL NUMBER OF MODIFICATIONS TO YOUR 820 BOARD. CONTROLLER BOARDS REQUIRE ADJUSTMENT AFTER ASSEMBLY.

PRICES FOR CASH, CHECK, OR MONEY ORDER. ADD 3% FOR VISA/MASTERCARD, $3.00 PER ORDER SHIPPING AND HANDLING, $6.00 FOR COD.

---

**EMERALD MICROWARE**

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

---

Micro Cornucopia, Number 19, August 1984
Micro Cornucopia

KAYPRO USERS DISKS
for KayPro II, 4 and 10

$12.00 each

KAYPRO Disk K1
Modem software
This disk is absolutely priceless if you will be using a modem to communicate with bulletin boards, other micros or mainframes.
MODEMPAT.COM: Menus selection of baud rate, bits/character, stop bits, & parity for serial port.
MODEM7.COM: Very popular version of MODEM7 configured for the KayPro.
MODEM7+: This is MODEM7 & MODEM-PAT combined - you can communicate with anything!
KMDM795.COM: Super-version of MODEM7 set up for KayPro.
TERM.MAC: Commented disassembly of the TERM program you get with your KayPro so you can compile it for another interface.
SC. USQ.COM: Programs to squeeze and unequize files for faster transfer.

KAYPRO Disk K2
Utilities
Really oodles of spiffy little (and big) programs to help you get full use of your KayPro.
ZSOURCE.COM: A true Zilog format disassemble for 8080 and 8085 (Z80) machine language. Now you can turn .COM files into .MAC files.
UNERA.COM: Simply enter "UNERA" followed by the name of the file you just erased and presto, the erased file is back! A lifesaver.
FINDBD.COM: Checks an entire disk, reports backed-up files for faster transfer.
FINDBD54.COM: Checks an entire disk, reports backed-up files for faster transfer.
RENTA.COM: Checks an entire disk, reports backed-up files for faster transfer.
ZCPR: The big news on this disk is the self-installing version ZCPR available only from Micro C. Once you have ZCPR in your CP/M, you'll never go back to straight CP/M! For instance, ZCPR searches drive A for any program not found on drive B, so, even an empty disk in drive A and B appears to contain every program on A. It's great for text editors, compilers, etc. Works on KayPro versions 4.0 and up.
DUMPX. DUMP: A super replacement for SELECT. Plus many more: TREK, FIX, FIND, SNOOPY, ALIENS and others.

KAYPRO Disk K10
Assemblers
We've received a lot of requests for a 280 assembler. So Dana put in some long hours getting the Crowe 280 assembler to run on the KayPro (and every other machine). CROWESC: This is a first class 280 assembler. We use this assembler daily (and we included its source). Takes standard Zilog mnemonics.
LASM: This is a more powerful version of the ASM assembler you received with the KayPro. This will link multiple programs together at assembly time.
PRINTER: This program makes it easy to print the listing files generated by the Crowe assembler.

KAYPRO Disk K11
Library & Checkbook Programs
CHECKS: This has been a very popular group of programs. Categories checks so you can keep track which are tax deductible and which get charged to the right account.
LIBR: This is a complete set of library routines which let your group files into a single file called a library. Then CP/M sees them as a single program, but with the library routines you can list them out separately, run them separately, or divide them up at any level. Almost like a unix environment.
DISPLAY: A very powerful version of the ASMX assembler you received with the KayPro. This will link multiple programs together at assembly time.
PRINT: This program makes it easy to print the listing files generated by the Crowe assembler.

KAYPRO Disk K12
FORTH
Yep, this is FORTH, one of the most unique, most extendable languages known, and for a paltry $12.00. This disk contains not just one FORTH, but two, along with an editor, decompiler and XSORT assembler! The editor even uses the cursor control keys.
FORTH: This is true fig-FORTH.
KFORH: A very nicely extended version of fig-FORTH.
PLUS: All the rest of the FORTH goodies. (Forth Heaven!)

KAYPRO Disk K13
Source of fig-FORTH
All this disk contains is the 40K ASM source of fig-FORTH with the hooks in place for the KayPro. This disk is for FORTH hackers who just can't leave anything alone. (Look, you probably have faults, too.) The source of FORTH is here because there isn't room on K12. This is the only disk that isn't stuffed.

KAYPRO Disk K14
Smartmodem Programs
This disk is the disk for if you have a Smartmodem compatible modem.
SMODEM: Smartmodem program set up for the KayPro.
XMODEM: Lets you remotely control your KayPro from a distant computer.
KAYERM: This is the information you need to run or write modem software on the KayPro.

KAYPRO Disk K15
Hard Disk Utilities
This disk is for the KayPro 10 or any KayPro with a Write-protect drive. With this program you can not only copy backup files (with printed directories of the backup disks), you can also break up large files. The backed-up files are re-encoded (as they are with KayPro's backup routine) so you can access them on any system.

KAYPRO Disk K16
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.

KAYPRO Disk K17
ZIP utilities
This is for those of you who are into 280 assembly language.
XLA: This disk is a very good 8080 to CP/M translation routine.
DASM.COM: An easier to use version of ZZ-SOURCE.COM. This full disk file includes source and documentation for both routines.

KAYPRO Disk K18
System Diagnostics
Just as we finished editing and proofreading the routines on this disk, we received a copy of KayPro's diagnostic disk. The memory test and drive exercise routines on this disk are more powerful than KayPro's. (Plus, its only $12.15) Set up for KayPro II and 4.

KAYPRO Disk K19
Prowriter Printer Graphics Packages
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.

KAYPRO Disk K20
Color Graphics Routines
PACMAN.COM: The source routine written for MicroSphere's color graphics board.
PIE.COM: PIE Chart generator.
SKETCH.COM: An easy way to sketch color graphic designs. You can even use a joystick with this software (see Micro C issue #18 for joystick interface).

KAYPRO Disk K21
SBASIC Routines & Screen Dump
SBASIC: Finally a disk of SBASIC software. There are some good examples of structured programming on this disk (including one program written both ways so you can see the difference).
SCREEN DUMP: This is a screen dump for all Kaypros new and old. You can buy a similar package elsewhere for $60.

KAYPRO Disk K22
ZCPR (Again)
This disk is filled with ZCPR files. You get ZCPR for the KayPro II, KayPro 4, and the KayPro 10. This version is fixed so that you can pass control characters (such as \n and \r) to the system. You can choose to have it recognize the semi-colon for drive select (as well as the colon). You can enter "B:" or "B:" to select drive B. Super neat!

KAYPRO Disk K23
Fast Terminal Software & New BYE
This disk contains the terminal programs for all Kaypros. If you are tired of being limited to 1200 baud when you use your Kaypro as a terminal then take heart. With these programs your Kaypro can outrun the big boys by receiving and sending up to 19,200 baud without any change to the character! Also, a new version of BYE that not only lets you run your Kaypro remotely, but also figures out whether you have a 63K or 64K system so it will run with any Kaypro using an external modem.
**Something special for your Kaypro!**

---

**New Schematic Packages**

Finally, a complete schematic for your portable Kaypro, 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 detail information on your processor board that's available nowhere else.

For instance, those of you with the 10 and new 84 systems get a thorough rundown on your video section complete with sample video control programs in assembly language and Pascal. Of course, all packages contain serial and parallel port details and programming examples as well as complete coverage of the processor, clock, I/O, and disk controller (information that is not even available in Kaypro's own Dealer Service Manual!).

**Kaypro Schematic Packages**

<table>
<thead>
<tr>
<th>Kaypro II &amp; 4 (pre-84)</th>
<th>$20.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaypro 10 (pre-84)</td>
<td>$20.00</td>
</tr>
<tr>
<td>Kaypro 84 series (II,4,10)</td>
<td>$20.00</td>
</tr>
</tbody>
</table>

All prices include Postage

For more detailed ROM information see page 48.

---

**Pro-8 ROM Package**

The PRO-8 package from Micro Cornucopia upgrades your KayPro 4 to a KayPro 8 with 784K bytes (96 directory entries) per Tandon 100-4 (or equivalent) quad-density drive. Plus, you can select your own cursor character and change it at will.

The package includes the new PRO-8 monitor ROM, a disk of formatters and copiers, and printed instructions. (We even tell you how to turn your KayPro II into a KayPro 4.) All you add is one or two double-sided double-density (390K), or double-sided quad-density (784K) drives. You get over 1.5 Megabytes on a two-drive quad-density system!

This new system can read, write, and format KayPro II and KayPro 4 disks as well as KayPro 8 disks. And it recognizes each disk type automatically!

All this for only $499!

Watch Micro Cornucopia for more KayPro compatibles.

Call or write for information on the other KayPro II and 4 ROMS from Micro Cornucopia.

---

**Plus-4 Decoder Board**

With this nifty little plug-in board, your Pro-8 ROM can access up to four 514" drives. You just plug a four-drive 34-pin cable into this board and you can add up to two additional drives.

Now you can run any mix of 191K, 390K, and 784K drives as drives A, B, C, and D. You can run your original drives as A and B then add 380K or 784K drives outboard as C and D. You can even run four half-wides inside your original Kaypro!

The Plus-4 Decoder Board for only $399

Watch for 4-84 and 10-84 compatible ROMs coming soon.

---

**Micro Cornucopia**

P.O. Box 222
Bend, OR 97709
503-382-8048
9-5 Pacific Time
Monday-Friday

---

**Kaypro Disk K24**

MBASIC Games & Keyboard Translator

We sifted through many, many games before coming up with these gems. All will work on any Kaypro and all come in MBASIC source.

USOPEN shows you the fairway on the screen. You select the club and direction for each stroke. After you reach the green the display shifts to show details of the green and flag. For one to four players.

DUCK is an offshoot of aliens (pardon the pun). Hunter tries to shoot down ducks while ducks try to bomb the hunter. (Much fairer than real life.)

CASTLE is an adventure in which you select your attributes (strength, dexterity, and intelligence) and you get to purchase arms and protection. Great documentation and very interesting game.

KSTROKES is a keyboard translator similar to Smartkey. Bill Forbes did an excellent job creating this program. You can create and save translation files on disk. The program even includes a table which generates WordStar commands from the Kaypro's keypad! You can define 8 keystrokes at up to 63 characters each.

---

**Kaypro Disk K25**

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.

---

**Kaypro Disk K26**

EPROM Programmer & Character Editor

This is the software for the Kaypro EPPROM programmer written up in Issue #18. This software and the programmer turn your Kaypro into a very powerful development system. You can read ROMs, write ROMs, save data on disk and restore data from disk. Plus, you get a character editor which will help you design custom character ROMs for the non-graphic Kaypros!

---

**Kaypro Disk K27**

Typing Tutor

A complete typing tutor for beginners and experts. Written in Australia, it comes complete with source. This was customized for Kaypro II, 4 and 10 by Barry Cole of WLAUG.

The documentation says you can learn to touch type in 8 hours (probably a little longer for mortals).

---

**REMEMBER**

FREE USERS DISKS

In exchange for submitted software or articles

---

**NEW!**

New Schematic Packages

<table>
<thead>
<tr>
<th>Kaypro II &amp; 4 (pre-84)</th>
<th>$20.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaypro 10 (pre-84)</td>
<td>$20.00</td>
</tr>
<tr>
<td>Kaypro 84 series (II,4,10)</td>
<td>$20.00</td>
</tr>
</tbody>
</table>

All prices include Postage

For more detailed ROM information see page 48.

---

**Pro-8 ROM Package**

The PRO-8 package from Micro Cornucopia upgrades your KayPro 4 to a KayPro 8 with 784K bytes (96 directory entries) per Tandon 100-4 (or equivalent) quad-density drive. Plus, you can select your own cursor character and change it at will.

The package includes the new PRO-8 monitor ROM, a disk of formatters and copiers, and printed instructions. (We even tell you how to turn your KayPro II into a KayPro 4.) All you add is one or two double-sided double-density (390K), or double-sided quad-density (784K) drives. You get over 1.5 Megabytes on a two-drive quad-density system!

This new system can read, write, and format KayPro II and KayPro 4 disks as well as KayPro 8 disks. And it recognizes each disk type automatically!

All this for only $499!

Watch Micro Cornucopia for more KayPro compatibles.

Call or write for information on the other KayPro II and 4 ROMS from Micro Cornucopia.

---

**Plus-4 Decoder Board**

With this nifty little plug-in board, your Pro-8 ROM can access up to four 514" drives. You just plug a four-drive 34-pin cable into this board and you can add up to two additional drives.

Now you can run any mix of 191K, 390K, and 784K drives as drives A, B, C, and D. You can run your original drives as A and B then add 380K or 784K drives outboard as C and D. You can even run four half-wides inside your original Kaypro!

The Plus-4 Decoder Board for only $399

Watch for 4-84 and 10-84 compatible ROMs coming soon.

---

**Micro Cornucopia**

P.O. Box 222
Bend, OR 97709
503-382-8048
9-5 Pacific Time
Monday-Friday
More Goodies

CP/M 86

8" CP/M-86 Disk $15.00 each

DISK 66-1 — Disk Utilities
D.COM/A86; SD.COM/A86; XDIR.COM/A86; Three extended directory programs. Each does it differently, so we included all three.
FILE.EXT.COM/A86: Disk status program with good display format.
PAGE.COM/A86: A text paging program. Displays 24 lines and generates 8060 source for the ASCII assembler.
PRINT.COM/A86: File printing routine. Puts a header at the top of each page along with page number and file name.
MUCH.TEXT.COM/A86: Counts words and lines in a text file.
ERQ.COM/A86: Selective file erase program. Displays all selected files and then asks you one at a time for a /Y/N.
INUSE.COM/A86: Prints "In Use" on your terminal and asks for a password. It will not release the console until you enter the password.
FINDBAD.COM/A86: Finds and collects bad sectors on a disk. If there are no bad sectors, information on the disk is unaltered.
Disk 66-2 — DU and Modem Programs
DU-V75.COM/A86/DOC: This is the popular disk utility from CP/M-80. It lets you read, write, and modify disk sectors.
MODEM4.COM/A86: This is a modem program set up for the Slicer. This program includes a built-in help file.
MODEM7.COM/A86/DOC: This modem disk would be complete without this standard. This is modem set up for the Slicer. It displays a menu when it is called.
Disk 66-3 — Small C
C86.COM: This is the original Small C compiler which appeared in Dr. Dobbs Journal in 1980. It runs under CP/M-80 and generates 8060 source for the ASCII assembler.
C86.COM: This is the C86 compiler which runs under CP/M-80. This 8080 program produces 8060 assembly language.
C86LIB.A86: This is the C86 I/O library.
SMALLC86.DOC: Documentation on Small C.
CP/M86: Source of the C86 compiler.

OTHER GOODIES

Screen Editor in Small C $39.00
A simple but full function screen text editor plus a text formatter, all written in Small C by Edward Ream. This package includes the editor and formatter OUT files for the Big Board, Small C itself, and source code for all. With the documentation this is over 400K on a floppy disk. Edward is selling this package for $50, you can buy it from us for $39 (and Ed gets a royalty). Where else can you get an editor, a formatter, a C compiler, and source for all, for under $40?

More ROMS: Fast monitor ROMs for speed freaks and our famous 'better than Texas' character ROM (V2.3) for screen freaks.
Fast Monitor ROM BB $29.95
Deluxe Character ROM BB $29.95

BB II DRIVE INTERFACE

For 2¼" and 3" Drives
Andy Bakkers is making this special software package available through Micro C. Complete source, HEX, & documentation files on an 8" SS SD disk. Also outlines on disk the hardware changes needed.
$29.95

ROMs from Micro Cornucopia

There are two ROMs in each Kaypro, a monitor ROM and a character ROM. The Monitor ROM supplies information for the Z80 processor on such things as how to get information from the disk drives, and which character to use as a cursor. The character ROM works entirely in the video circuit and it determines what the characters look like on the screen (for instance, does the "P" have a high, small cross bar, or a lower, longer one of the Micro C character ROM). When you speed up your Kaypro, you are speeding up the processor clock so you have to use a monitor ROM that will also run at the higher speed. You are not changing the video clock when you speed up the Kaypro so you don't need to change the character ROM (unless you want the nicer looking character set). Since the monitor ROM tells the processor how to do disk accesses you are going to have to change that ROM in order to upgrade to larger drives.

Pro-Monitor II for Kaypro 8

1. This ROM is a fast part so you can run 4 or 5 MHz with your Kaypro II. It gives you a non-blinking block cursor (much less irritating), though you can specify a standard blinking underline if you prefer it.
2. It does faster disk accesses (even if you don't speed up your system).
3. It throws away null characters (those little asterisks that sometimes garble the screen during data communications).
4. Includes complete printed instructions for simple plug-in installation (takes 5 minutes).

Pro-Monitor 4 for Kaypro 4

This ROM does everything the Pro-Monitor II does, only it's for a Kaypro 4. Though the ROM that comes in your Kaypro will run 4 or 5 MHz (unlike the ROM that comes in the II), this ROM also gives you:
1. Non-blinking block cursor. 3. Throws away null characters.
2. Faster disk accesses. 4. Complete printed instructions simple plug-in installation (takes 5 min).

Pro-Monitor 8 package for Kaypro 4

This ROM package does everything the Pro-Monitor II and 4 do (it will run at 5 MHz, ignores nulls, has the fast disk accesses). In fact, even if you will be using your original 191K or 390K drives for now, you can use this ROM package. The Pro-Monitor 8 features include:
1. You get 784K per disk with quad density (96 ppi, double sided) Tandon 100-4 (or equivalent) drives.
2. You can use any combination of Tandon 100-1 (Kaypro II), 100-2 (Kaypro 4), or 100-4 drives as drives A and B.
3. You can boot from any disk with normal system tracks (Kaypro II, Kaypro 4, or Kaypro 8). The disk needs no modification.
4. You can choose any character (including space) as a cursor and you can choose to make the character blink or not blink. Plus, you can change the cursor at will.
5. You get a disk which contains a new copy routine for copying and formatting 784K disks, and a drive diagnostic routine for checking out the quad density drives.
6. You get complete printed instructions for installation of ROM and drives (takes 10 to 15 minutes, including drives).
7. The installation requires no cuts or jumpers, everything simply plugs into a Kaypro 4. (If you have a Kaypro II, see the modification article in Micro C issue 15 to turn your II into a 4.)

Pro-Character ROM (for Kaypro II and 4)

The character ROM gives you a nicer looking character set. Kaypros have come with two different character ROMs, the early character ROMs had a rotten g, y, q, f, and t; and commas and semi-colons that were poor quality parts so they generated snow as information scrolled up the screen. This white fletty snow disappears when you install a Pro-Character ROM.

The character ROM comes in two flavors:
1. The standard Greek Pro-Character has the nicer character set plus the standard Kaypro Greek characters.
2. The Clean Pro-Character has the nicer character set but no Greek characters. This is the ROM for people who get strange Greek characters on the screen when interfacing with Mainframe systems.
3. Complete printed instructions for simple plug-in installation (takes 5 minutes).

Note: These ROMs will not work in the Kaypro 10 or the latest Kaypro 4 with graphics (it contains the Kaypro 10 board). We are working on new ROMs for these systems.

Prices:
Pro-Monitor II $29.95
Pro-Monitor 4 $29.95
Pro-Monitor 8 package $49.95
Pro-Character (either Greek or Clean) $29.95
Pro-Set II (Pro-Monitor II & Pro-Character) $55.00
Pro-Set 4 (Pro-Monitor IV & Pro-Character) $55.00
Pro-Set 8 (Pro-Monitor 8 package & Pro-Character) $70.00
<table>
<thead>
<tr>
<th>Users Disk</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>USERS DISK #1</td>
<td>Two fast disk copiers, two disk formats, manual for Small C+5 - Modem 7, Crowe 280 Assembler, 6-15, 7-Serial 11-BIOS, very simple-minded spreadsheet.</td>
</tr>
<tr>
<td>USERS DISK #2</td>
<td>One single disk drive copy programs, both with source.</td>
</tr>
<tr>
<td>USERS DISK #3</td>
<td>EPROM burning software for BB I and II, reset bit 7 (un) for seek bad disk sectors.</td>
</tr>
<tr>
<td>USERS DISK #4</td>
<td>One-CAT, disk cataloging routines, two-Modem 7 for Port A, three-Modem 7 for Port B, four-Pacman, the arcade game.</td>
</tr>
<tr>
<td>USERS DISK #5</td>
<td>Checkbook program, two-Printprn, prints Crowe listings, four-New fast copy program &amp; source, five-DDUT, disk inspector/editor.</td>
</tr>
<tr>
<td>USERS DISK #6</td>
<td>CBios, custom boot for Tandon drives, two-ZCPR, dynamically checks drive A for missing improved commands, three-ZCPRBLOC, identifies CP/M sector.</td>
</tr>
<tr>
<td>USERS DISK #7</td>
<td>One-CHNPFP, extended monitor interface, two-TERM, terminal monitor routines that set up BB I as a simple terminal, as a file receiver, or as a file sender.</td>
</tr>
<tr>
<td>USERS DISK #8</td>
<td>E-PROM programming package for BB II, 2732 only.</td>
</tr>
<tr>
<td>USERS DISK #9</td>
<td>BDSCIO, custom BDSC 1 I/O for BB I (both .h and .l), two-YAM, Yet Another Modern program in source &amp; .COM form. Turns BB into paging intelligent terminal, complete with printer interface, baud rates to 9600.</td>
</tr>
<tr>
<td>USERS DISK #10</td>
<td>One-ADVENTURE, expanded 550 pt version, two-KEYBOARD, translation program, three-CBios, serial &amp; parallel printer interface.</td>
</tr>
<tr>
<td>USERS DISK #11</td>
<td>FORTH, this is FORTH which can be burned into ROM or loaded from disk. It replaces the FFM monitor &amp; handles all the monitor functions. See issue #11 FORTH column for more info about FORTH and this disk.</td>
</tr>
<tr>
<td>USERS DISK #12</td>
<td>Games for BB I and II, one-ALIENS, a fast, exciting arcade game, two-CHESS, chess with 1-6 level look ahead, three-MASTERMIND, matrix sets with the computer.</td>
</tr>
<tr>
<td>USERS DISK #13</td>
<td>General Utilities, BB I and II-Source, disassembles to real zilog mnemonics, two-EX14, superb of submit or suppress, three-MOVECPM, lets you use MOVECPM on other copies of CP/M, four-XMON, 3K expanded BB I monitor, use in ROM or as overlay.</td>
</tr>
<tr>
<td>USERS DISK #14</td>
<td>CURSOR, prompts you for cursor char you want, USEM1, very fancy RAM test, ZSIDFIX, improvement for ZSID, IFP32, flags the caver's delight, LIFE, so fast it's real animation!</td>
</tr>
<tr>
<td>USERS DISK #15</td>
<td>Set up the BB I as a calculator, including HEX, SORT, sort package written in C80.</td>
</tr>
<tr>
<td>USERS DISK #16</td>
<td>BB II Software-PRO32, latest 2732 reader &amp; programmer, two-SMOM2EM2, lets BB I talk to Hayes Smartmodem, three-GRAPHEMO demonstrates BB II graphics in BASIC, four-ATTTEST, demonstrates BB II graphics in JRT Pascal.</td>
</tr>
<tr>
<td>USERS DISK #17</td>
<td>Initialize ports for 300 or 1200 baud, Menu, displays menu of .COM files, enter number to return to main menu.</td>
</tr>
<tr>
<td>USERS DISK #18</td>
<td>SetSCLK, sets realtime clock built into BB II, PRINTI, modified print which accesses BB II clock, nine-BIO, draws a thin line box on screen determined by HL and BC.</td>
</tr>
<tr>
<td>USERS DISK #19</td>
<td>Small, space invaders Arcade game, eleven-LIST, printer interface, auto-enables RTS, ignores DCD.</td>
</tr>
<tr>
<td>USERS DISK #20</td>
<td>Word Processing-EDIT, very fancy line editor similar to EX (Unix). Includes help menu, programmable key, and full manual on disk.</td>
</tr>
<tr>
<td>USERS DISK #21</td>
<td>Two-TEXT, simple minded line editor, easy to learn &amp; use, Very fast, three-TYTYPE, typing training program written in BASIC, four-TINPLAN, very simple-minded spreadsheet.</td>
</tr>
<tr>
<td>USERS DISK #22</td>
<td>Five-C50 Text Utilities, six-C50, cuts off after N bytes, seven-ENTAB, replaces spaces with tabs where possible, eight-M5, double or triple spaces a file to output, nine-T2, replaces trailing spaces from file.</td>
</tr>
<tr>
<td>USERS DISK #23</td>
<td>Ten-Trunc, truncates each line to specified length, eleven-WRAP, wraps at column 80, plus pretty pretty printing, page #4.</td>
</tr>
<tr>
<td>USERS DISK #24</td>
<td>BB I and II and Xerox 820 Users Disks-BIPOSS, latest 2732 reader, enhanced CP/M auto load, G-SWEEP, directory/file transfer routine, three-Lets BB I recognize a double sided drive as one drive.</td>
</tr>
<tr>
<td>USERS DISK #25</td>
<td>Fix, super disk utility, does everything, much easier to use than DUD7, five-Compare files routine.</td>
</tr>
<tr>
<td>USERS DISK #26</td>
<td>UNER, retrieve erased files, seven-FIND, checks drives on system for a file, eight-MENU, menu program for CP/M.</td>
</tr>
<tr>
<td>USERS DISK #27</td>
<td>Nine-MOD, enhanced disk catalog program, ten-Drive single copy drive program that does track by track copies rather than file by file.</td>
</tr>
<tr>
<td>USERS DISK #28</td>
<td>Printer Utilities-Printro 92 printer routine, two-Graphs display package for MX-80 with Grabtrak, very fancy, three-Epson MX80 setup for BB I with 59.5K CP/M, four-Epson MX80 setup for any CP/M, lets you set print modes.</td>
</tr>
<tr>
<td>USERS DISK #29</td>
<td>Five-Micro print driver, Ports A &amp; B.</td>
</tr>
<tr>
<td>USERS DISK #30</td>
<td>Games for BB I and II-ALIENS, a fast, exciting arcade game, two-CHESS, chess with 1-6 level look ahead, three-MASTERMIND, matrix sets with the computer.</td>
</tr>
<tr>
<td>USERS DISK #31</td>
<td>Life, so fast it's real animation!-6-GRAPHEMO, demonstrates BB II graphics in BASIC, LIFE, so fast it's real animation!</td>
</tr>
<tr>
<td>USERS DISK #32</td>
<td>Utilities-Printro 92 printer routine, two-Graphs display package for MX-80 with Grabtrak, very fancy, three-Epson MX80 setup for BB I with 59.5K CP/M, four-Epson MX80 setup for any CP/M, lets you set print modes.</td>
</tr>
<tr>
<td>USERS DISK #33</td>
<td>Five-Micro print driver, Ports A &amp; B.</td>
</tr>
<tr>
<td>USERS DISK #34</td>
<td>Games for BB I and II-ALIENS, a fast, exciting arcade game, two-CHESS, chess with 1-6 level look ahead, three-MASTERMIND, matrix sets with the computer.</td>
</tr>
<tr>
<td>USERS DISK #35</td>
<td>Life, so fast it's real animation!-6-GRAPHEMO, demonstrates BB II graphics in BASIC, LIFE, so fast it's real animation!</td>
</tr>
<tr>
<td>USERS DISK #36</td>
<td>Utilities-Printro 92 printer routine, two-Graphs display package for MX-80 with Grabtrak, very fancy, three-Epson MX80 setup for BB I with 59.5K CP/M, four-Epson MX80 setup for any CP/M, lets you set print modes.</td>
</tr>
<tr>
<td>USERS DISK #37</td>
<td>Five-Micro print driver, Ports A &amp; B.</td>
</tr>
</tbody>
</table>
up with. Don’t limit yourself by making any physical assumptions about computers or people or environments, and don’t limit yourself to a single problem, there are plenty to go around. The science fiction section of your local library has all kinds of mind-expansion material if you need to jump-start the old thinker.

It’s Gettin’ Heavy

I’m sure that you’ve noticed that Micro C has been getting bigger and bigger. Well, it’s been getting heavier and heavier at the same time.

We’ve looked at getting a second class mailing permit but second class costs almost as much as first class and the service is reportedly no better than bulk rate. So, we’ve continued the first class and bulk rate options.

It’s now costing us more than $1.00 per copy for first class postage in the U.S., Canada, and Mexico and more than $3.50 per copy for many foreign countries. So, we’re raising our first class U.S., Canada, and Mexican rates to $22 per year and our foreign rates to $30 per year. Bulk rate costs us only about 12 cents per copy so the bulk rate subscriptions will remain at $16.

Payment For Articles

We are now at the point where we can actually pay for articles. (We began paying for columns about 6 months ago.) Here is how it will work.

When you send in an article or techtip, be sure to let us know which disk you’d like in return. The disk will be sent out as soon as we receive your submission.

After submissions show up in the magazine, we pay authors as follows: Techtips authors will receive 3 copies of the magazine and a Micro C authors tee shirt. Authors of regular articles will receive 3 copies of the magazine, $25.00, and the Micro C authors tee shirt.

There will be one (occasionally two) special feature article in each issue. The author of that article will receive a special edition of the authors tee shirt, 5 copies of the magazine, and $75.00.

We are starting the program with this issue. The tee shirts will be sent out as soon as we come up with a design that is suitably incredible (or incredibly suitable). We are also working on another Micro C tee shirt for all the rest of you good folks. See Issue 20 for details.

The decision on which submissions will be run as articles and which as techtips, will remain, as usual, with the editorial department (i.e., blame Eric).

Computer Mags: Trade Press or Free Press?

There has been a good deal of discussion lately about the relationship between the computer magazines and their advertisers. The problem is that some publications think nothing of providing special editorial treatment (editorial means anything that is not advertising) for regular advertisers while other publications separately editorial from advertising.

The significance to both the consumer and the advertiser is obvious. Advertisers know that a positive mention in an article can be much more valuable than many pages of advertising. Readers have their guard up when reading advertising, while they often believe what they read from folks who don’t appear to have a stake in the product.

The trade press has been famous for filling its editorial pages with rewrites of public relations handouts and with articles written by the companies the articles are about. Electronic Design and Electronic Design News are two very well known publications which use this technique. (In fact, any publication which is distributed free is, almost certainly, a trade press type publication.)

A very common variation on this theme is the publication that will not say anything at all if it can’t say something nice. You can spot these publications by reading the reviews and product descriptions for an issue or two. If they are almost universally positive, then don’t put much stock in their contents.

If the publication states up front the connections between the writers and the subjects then you are forewarned that the article may be biased. In some cases, of course, the only way to get information about a new IC or system is from the designer’s own pen. (Actually even that is misleading because almost every article written by a designer is really written by a ghost writer and edited by a marketing manager.)

Journalistic Tradition

There is a tradition among journalists that dictates that reporters present the facts straight. They pride themselves with being professional enough to keep their personal feelings and extraneous pressures from coloring the information. Obviously, this in not always possible. I majored in journalism in college and the head of the journalism department was a wiley veteran of the newspaper world who smoked and drank and swore. Her name was Wilma Morrison and she smoked on campus, drank off campus, and swore both places.

She showed us writing from famous reporters and then expected even better from us. Many a time it seemed impossible to satisfy her as she mercilessly demanded rewrite after rewrite.

She taught us such a passion for objectivity and honesty that many of us were really shocked when we ventured out into the real world of big newspapers, bigger television networks, and even bigger advertising accounts.

Computer Publications, A Decision

Now, there is this whole new group of publications sprouting forth. Computer publications. We as readers can let computer publications become a trade press or we can force these new publications to adopt the same standards that we expect of news organizations.

Byte seems to be moving toward more
lend them an ear. I mean, everyone has pull a few punches (though some people have regretted holding off on my criticism.) Sometimes I like dBASE II, Byte, Dr Dobbs, and the Slicer folks are the only ones I’m allowing to write a column in Micro C on their own product. You see, they are doing so many neat new things with it, and they are such a wealth of general information that even I enjoy the material they send in. Very unusual.

Sometimes I like dBASE II, Byte, Dr Dobbs, and M80.

I don’t like SuperSoft’s anything. I don’t like MicroSoft’s BASIC. I don’t like Macrosoft’s anything. I don’t like slow mail order houses who promise that they will ship that day, and when you call them back, you find out that they are expecting stock (Jade has been guilty of this), and I don’t like oysters in any form. (And that’s the squishy truth.)

Prejudices

I really like the Big Board I. I have three of them and they work year in and year out, flawlessly. I have SWP dual density boards and they have been absolutely solid. I really like LA Software’s RAM disk and Turbo Pascal because both are VERY fast.

Pretending that it is not the Slicer I really like is an obvious rip, then I tell people. I get into a real bind when the product itself is really good but the support is really bad (or vice versa). In these situations I do my best with quiet diplomacy. Failing that, I start grumbling in Micro C. (Look, if everything were white and black, I wouldn’t be getting so many grey hairs.)

Some Confessions

My hands aren’t totally clean, my columns aren’t totally objective, and I do pull a few punches (though some people might dispute that).

Bring me your little shops, your start-ups, and your huddled masses, for I will lend them an ear. I mean, everyone has his hobby, and mine is small entrepreneurs (as opposed to tall, fat, entrepreneur). This means that if someone comes out with a new product that shows good thought but doesn’t quite make it, I’ll reserve judgement for a while to see if he can clean it up. Meanwhile, people will be getting a less than ideal product. There are times when I have regretted holding off on my criticism. (On the other hand, when someone like the Fat Jack Reading Rack folks spiffy up their product and then send new parts to everyone, even those who didn’t have problems...)

If a product is an obvious rip, then I tell people.

Some journalistic standards and away from the hidden ties that it has been accused of recently. (Although it is sometimes impossible to detect hidden connections between free-lance writers and the products they are reviewing.) I heard a rumor that one of the PC magazines was recently told to fire a staff reviewer because he did a negative product review (the manufacturer was a big advertiser). No doubt, the expected shakeout of some publications to sell their souls (or what’s left of them) in order to hang onto advertisers while others try to survive by selling clean, objective information. It will be interesting to see which type succeeds.

Custom Stands for other computers also available.

Send Checks or Money Orders to:

D & LN Company
1780 Golden Gate Dr.
Pocatello, ID 83201
(208) 238-0785

$95.95 / with slot $103.95
w 20” h 16” d 14”

PUT IT ALL TOGETHER

This computer stand is also a printer stand. You can use half the desk space. Designed to be effective and attractive.

Built of smoked acrylic to match your machine.

Micro Cornucopia, Number 19, August 1984

51
HIGHLAND MICROKIT

KAYPRO SPEEDUP

For 2.5 MHz Models
SIMPLE INSTALLATION
4 OR 5 MHz OPERATION

- MICRO C CIRCUIT DESIGN IN KIT FORM
- NO ALTERATION OF ORIGINAL PARTS
- MONEY BACK GUARANTEE OF SATISFACTION

Return for 100% REFUND if you do not like the speedup, or if it does not work on your machine.

INCLUDES:
Z80B Microprocessor
Monitor Eprom (Model 2A only)
Original Kaypro routines in a faster part
Gold Switch/Contacts
Plug-In Components for all Circuit Modifications
Detailed, illustrated instructions

For Kaypro II's & IV's manufactured before Sept. 1983 (all IC's socketed).

Kaypro II Kit 2A $39.95
Kaypro IV Kit 4A $34.95
(Order No. 4A if you have installed a MICRO C Custom Pro Monitor EPROM in your II)

For Kaypro II's & IV's with small IC's soldered to board.

Serious installation is required. You must desolder two IC's and install sockets. Money back guarantee still applies. (Sockets need not be removed for returns; plug-in restoration of original circuit. Free replacement of IC's damaged during desoldering.

Order Kit 4B $39.95

HIGHLAND MICROKIT
P.O. Box 21C
Highland, MD 20777

---NEW PRODUCTS FOR BB AND KAYPRO!---

All those who have lusted after several add-ons for the Big Board I, but been discouraged by the shortage of parallel ports, take notice! Now you can run all the add-ons at once with the

Parallel Port Expander.....$189 assembled, $59 board + instructions
- eight I/O ports, compatible with Big Board I&II and Kaypro II&IV.
- operate 2 parallel printers, rom burner, hard disk, and Dynadisk!
- and if you are a real hog, parallel four expanders for 32 ports!
- bios with three printer drivers (1 serial) selected by IOBYTE.
- installation instructions for all mentioned devices included.
- adapt Big Board add-ons to the Kaypro.

THE ULTIMATE 255 CONTINUOUS CHARACTER AND REVERSE VIDEO CURSOR BIG BOARD I AND KAYPRO II&IV MOD

Now you can have a significant increase in the writing power of your system, with the ability to key in, display, edit, and print 212 characters, including continuous line graphics. Other features are blinking or constant reverse video cursor, character sets to match NEC 8023 and C.Itoh Prowriter, key labels, reverse video fields, install program for Perfect Writer, a growing library of software, and improvements in the monitor rom. The mod comes assembled and tested and requires about 45 minutes to install. Software included to define custom characters and down-load them to printers. Coming features include graphics software, circuit board layout tools and prototyping services, and H19 and IBMPC emulation.

NEC Extended character set (C.Itoh has same set, just re-arranged):

The Ultimate Video Mod..................................$189.00
Perfect Writer..............................................$209.00

Cash price with U.S. shipping; Visa/MC/Net30 add 38, COD $6.
Dealer inquiries invited - quantity discounts available.

Widener Consulting
2835 NE Brogden
Hillsboro, OR 97124
(503) 648-0363

Micro Cornucopia, Number 19, August 1984
On Your Own

By David Thompson

This is the second half of the adventure we started in issue #18. In the last issue, I discussed some of the problems that designers face starting a company. The start-up we are discussing is very real though the participants’ names have been changed to protect them from the company they work for. (They have designed a bit-slice version of Z80 that should run about 36 times faster than the original Zilog 4 MHz part.)

In this column we will cover three additional subjects, free help, deadlines, and advertising.

Getting Free Help

When we left Jim and his brother in episode 1, they were faced with the perilous task of compensating those who contributed time and effort to the cause (while preserving the company’s cash).

This task may sound impossible, but it is really quite easy. Those giving of their time and expertise will receive special stock for their efforts. Initially the stock is really quite easy. Those giving of their time and expertise will receive special stock for their efforts. Initially the stock was issued shares. At the same time each person agrees to contribute x hours to the project over the next year. At the end of the year, additional special shares (different class from the stock that was purchased with dollars) are issued to those who follow through on their part of the agreement.

Deadlines

One of the most irritating parts of working for a large corporation is that you are always faced with deadlines. Many times they appear to be arbitrarily set by people whose sole purpose in life is harassment. On the other hand, a small start-up has to have deadlines because without them, nothing happens.

Advertising

Advertising campaigns create very real deadlines. In fact, many small companies would do no scheduling at all if they could simply place an ad one day and see it in print the next. Of course, with monthly and bi-monthly publications (some of them with 30 to 60 day lead time) that isn’t possible. After all, if there is a four month delay between placing an ad and seeing it in print, there is a lot of incentive to place the ad ahead of time.

Of course, the product needs to be ready to ship when the ad appears, and this is the way non-trivial deadlines are created. (This also creates incredible opportunities for Murphy.)

Some non-technical people have asked me why computer people seem so harried. Well, if you are involved in a start-up (and I’ve seen some multi-million dollar companies that were still acting like start-ups) you are always faced with a possible deadline that becomes more and more impossible as the time approaches.

Meeting a deadline is important for four reasons.

1. Once people have made a decision to purchase a product, they are anxious to get it. If you can’t ship, you can’t accept money (even though this is the time when you most need it). Don’t succumb to the temptation to use money that you haven’t earned yet (unless you want to guarantee the demise of your new company).

2. It is easy to get a reputation for shipping slowly if your ads are running long before product is ready.

3. Once the advertising starts, you have a new drain on your resources. It’s very important to begin shipping products and earning revenue very quickly.

4. You can assume that if you have come up with a zingy new idea, there are ten other companies also working on the same thing. Being first in the market is only an advantage if you can ship product and it’s good product. If you can’t ship product for a while, it makes it a lot easier for others to get into the market. In fact, your advertising might actually give your competition its ideas. (Look at Smartkey, there are dozens of folks now doing variations on this important theme.)

JRT Pascal is a classic example of what happens when you advertise a product long before it is ready. You stay afloat on the early orders (by cashing them right away) but you are actually just digging a deeper and deeper hole. Keep the early chapters of your company’s books clean so you don’t wind up skipping to chapter 11.

IT'S EASY TO USE!

Just enter "SPELLSYS", select which disks you'll use, and file you're checking. Then SpellSys takes over. Everything is self-promoting—so sit back and relax.

Word Review Operations

C . . . show Context in file
L . . . Lookup word in dictionary
M . . . Misspelled (correct file to.....)
D . . . put in user Dictionary
I . . . Ignore
N . . . Next word
P . . . Previous word
E . . . Exit review
? . . (or any other key) displays menu

ORDER AT NO RISK!

Check out the manual and if you don't agree that SpellSys is a super bargain, just return the package with the disk unopened within 30 days and we'll refund your money.

MICROGROUP

P.O. Box 65 Bend, OR 97709
MC (503) 382-8048 Visa

*CP/M is a trademark of Digital Research

SPELLYSYS $29.95 ppd. in US & Can
Other Foreign add $5.00
Requirements 32K CP/M*
Formats: 8" SS SD or
5" SS DD for KayPro, Xerox,
Osborne, Morrow, Superbrain.

Micro Cornucopia, Number 19, August 1984

53
SWP's CO-POWER-88 makes Z80, CP/M microcomputers IBM-PC compatible!

CO-POWER-88 is a 16-bit 8088 coprocessor for Z80 CP/M computers. Both versions of CO-POWER-88, 128k and 256k RAM, include both MSDOS, and RAM drive software, complete with MSDOS, IBM-PC compatibility.

Simple commands move system control between the Z80 and 8088 processor. CO-POWER-88's RAM can be used in CP/M as a RAM drive!

128k CO-POWER-88 w/MSDOS & RAM Drive ............... $400.00
256k CO-POWER-88 w/MSDOS & RAM Drive ............... $500.00
CP/M-86 .............................................. $70.00

ATR8000: SWP's $499.95 CP/M Computer

SWP's ATR8000 is a 64k RAM, Z80A, 4 MHz computer that includes double density CP/M 2.2. The ATR-8000 runs up to four disk drives that are any mixture of size (5 1/4" and 8"), type (single-sided and double-sided), and density (single, double and quad). The ATR8000 has an RS-232 port for a modem or serial printer and includes software for both. There's also a parallel port with a parallel printer driver. The ATR8000 interfaces to an RS-232 terminal or to an ATARI home computer. Software includes a program that allows the ATR8000 to use CP/M disks from other computers. The ATR8000 can be upgraded to also run CP/M-86 and MSDOS by adding CO-POWER-88.

Bigboard Dual Density

We've just released a new version!

Hardware
- A daughter board that plugs into the 1771 socket. With this board the system employs automatic density select.
- Instructions tell how to run 5 1/4" drives. A 50-34 pin disk drive adapter board is included with 5 1/4" disk orders.

Software V#061983
- One 8" version includes the code to make a 60k double density CP/M for:
  8" SS 2.5 MHz
  8" DS 2.5 MHz
  8" SS 4 MHz
  8" DS 4 MHz
  5 1/4" SS 2.5 MHz
- Printer drivers are built-in, selectable in the IOBYTE.
- Easy to change port parameters.
- 8" SSDD disk storage is 674k; DS is twice as much! 5 1/4" is 183k.
- Includes DDINIT for SD and DD initializing and DDSYSGEN for DD sy甚么ng.
- Special features have been added including a deluxe pause, screen print and clock.
- Source code is available for $25 after you sign a disclosure agreement.

For Orders: We accept MasterCard, Visa, Money Orders or checks. Shipping charges and applicable taxes will be added. Call or write for delivery time. Prices and specifications subject to change without notice.

Trademarks: CO-POWER-88, ATR8000, SWP, Inc.; Z80, Zilog; CP/M, CP/M-86, Digital Research, Inc.; IBM-PC, IBM, MSDOS, Microsoft; Kaypro, Kaypro Corp.; Zorba, Mod Comp., Inc.; Xerox, Xerox Corp.; Actrix, Actrix Corp.; Osborne, Osborne Computer.

2500 E Randol Mill Rd. - 125
Arlington, Texas 76011
817/469-1181
817/861-0421
BB-I Directory For Micro C

By Victor Dolcourt

The price of the Digital Research Computers BB-I has dropped so low that many people who still believe in 8 bit systems will just have to buy one. Our friends at DRC, however, have recognized that the BB-I is "not a consumer or personal computer."

What they really mean is that the documentation is so thin that a subscription to Micro C is just about the only sane way to attempt to bring up and operate a BB-I system. The letters, editorial answers to questions, technical tips, and articles have produced a body of information which is nearly indispensable.

While building my BB-I, I classified these hints by category and then sorted the index by issue (in descending order beginning with issue #16). I chose descending order to highlight the most up-to-date information. Before I made the index, I spent a lot of time spinning my wheels looking for that article (or was it a letter?) on the @#**%$ fix.

**** CP/M and PFM ****
Shift lock CP/M and PFM #15, p3
Disk directory CP/M and PFM #13, p4
CBIOS in Intel mnemonics CP/M and PFM #13, p28
Bug in PFM dump CP/M and PFM #11, p3
INT 21h byte CP/M and PFM #10, p4
Relocating CP/M CP/M and PFM #9, p9
Changing CBiOs CP/M and PFM #8, p17
Step rate CP/M and PFM #8, p25
Cursor change CP/M and PFM #5, p2
PFM-80 CP/M and PFM #5, p5
PFM-80 errata CP/M and PFM #5, p5
Standard 60K CP/M CBiOs CP/M and PFM #2, p4
PFM patch for serial printer CP/M and PFM #2, p8
Monitor listing CP/M and PFM #1, p10

**** DISK DRIVES & DISK CONTROLLER ****
SWP dual density DISK Controller #17, p37
Double density DISK Controller #16, p6
1771 pull up DISK Controller #13, p29
Connector errata (BB documentation) DISK Controller #13, p28
Double density DISK Controller #11, p4
Shugart jumpers DISK Controller #10, p2
Qume DT-B DISK Controller #8, p8
Step rate DISK Controller #8, p25
Step rate DISK Controller #8, p25
Increasing driver current DISK Controller #6, p7
Shugart 901 DISK Controller #6, p7
Shugart jumpers DISK Controller #2, p6

**** HIGHER SPEED MODIFICATIONS ****
6 MHz modification Higher Speed modifications #19, p10
Timing loop adjustment Higher Speed modifications #14, p2
5 MHz Higher Speed modifications #11, p4
Easy and reliable 4 MHz Higher Speed modifications #10, p32
Editorial Higher Speed modifications #6, p21
Use of 2716-1 Higher Speed modifications #4, p2
3.5 MHz Higher Speed modifications #4, p9
More reliable 4 MHz Higher Speed modifications #4, p9
5 MHz Higher Speed modifications #4, p9
4 MHz modification Higher Speed modifications #3, p3
4 MHz modification Higher Speed modifications #3, p3
4 MHz (again) Higher Speed modifications #2, p4

**** MISCELLANEOUS ****
Bulletin board Miscellaneous #18, p3
Speech synthesizer Miscellaneous #17, p4
Bell signal Miscellaneous #13, p36
Big board fixes Miscellaneous #9, p8
Wordstar speed up Miscellaneous #9, p23
RAM Disk Miscellaneous #9, p23
Bell Miscellaneous #9, p25
Bell Miscellaneous #6, p21
Expanding the character set Miscellaneous #7, p2
Inverted keyboard Miscellaneous #7, p17
Expanding the character set Miscellaneous #6, p8
EPROM programmer Miscellaneous #6, p5

**** MEMORY EXPANSION ****
RAM Update Memory Expansion #19, p60
Errata Memory Expansion #13, p3
256K Modification Part II Memory Expansion #13, p7
256K Modification Part I Memory Expansion #12, p4
64K chips Memory Expansion #11, p4
Add 6K of RAM Memory Expansion #7, p17

**** MOTOR CONTROL ****
Fix for control described in #8 Motor Control #10, p32
AC Motor control Motor Control #8, p25
Relay motor control Motor Control #6, p10
Disk drive motor control Motor Control #2, p5

**** PRINTER INTERFACES & PORTS ****
Parallel interface fix Printer Interfaces & Ports #18, p57
Serial port Printer Interfaces & Ports #15, p10
Olivetti Praxis interface Printer Interfaces & Ports #14, p11
Centronics parallel type interface Printer Interfaces & Ports #14, p45
Centronics modification Printer Interfaces & Ports #13, p2
MX-80 connect. & double printing prob. Printer Interfaces & Ports #10, p3
Serial tutorial Printer Interfaces & Ports #9, p17
Serial printer driver Printer Interfaces & Ports #9, p16
PR Program Printer Interfaces & Ports #8, p2
PFM operation Printer Interfaces & Ports #8, p2
280 SIO family Printer Interfaces & Ports #5, p4
Port A fix Printer Interfaces & Ports #5, p4
Parallel printer driver Printer Interfaces & Ports #2, p3
CP/M patch for serial printer Printer Interfaces & Ports #2, p5

**** TROUBLE SHOOTING ****
Minor problems Trouble shooting #17, p2
Big board fixes Trouble shooting #9, p8
PFM operation Trouble shooting #8, p2
Big board notes Trouble shooting #4, p5
Bring up BB 1 Trouble shooting #4, p17
Keyboard bit 7 Trouble shooting #3, p9
Notes from Garland Texas Trouble shooting #1, p3

**** VIDEO ****
Flashing screen Video #18, p2
Composite video fix Video #18, p57
Ball Brothers Mon. (sep. video/timing) Video #14, p3
Emulating an ADM-3 (term. charact.) Video #14, p8
Jitter fix (stabilizing timing) Video #14, p10
Size Video #14, p8
Jitter fix Video #13, p36
Jitter fix Video #12, p3
6X10 dot matrix Video #12, p38
Separate sync and video Video #10, p2
Improving Video #10, p32
50 Hz Video #7, p19
Improving sharpness Video #7, p19
Jitter Video #4, p5
Reversing cursor Video #3, p6

Micro Cornucopia, Number 19, August 1984 55
Calendar/Clock

$69 Kit

- Uses National MM58167 clock chip, as featured in May '82 Byte.
- Works with any Z-80 based computer with clk < 5.5 MHz.
- Keeps time from months to 10,000ths of a second.
- Battery backup keeps time w/power off!
- Batteries are available at Radio Shack stores.
- Easy to use software included to set and read the clock in BDS C, JRT Pascal, and Microsoft Basic.
- All source code is included!
- Software is available on 8" SSD, 5" Xerox 820, Kaypro 2, Osborne, Northstar, Cromemco, and Apple disks and over a modem for other computers.
- Packages available:
  Fully assembled and tested $99
  Complete Kit $69
  Bare board and software $29
  Extender cable option $14
  (for non-piggyback installation)

EPROM Programmer

$39 Kit

- Programs 2716, 2516, and 2532 EPROMS (just what Big Board users require)
- All software written in BDS C and source code is included.
- Plugs into parallel port with no trace cuts!
- Software on 8" SSD and Xerox 820 5"
- An unbelievable value!

Kenmore Computer Technologies
20 Landers Road
Kenmore, New York 14217
(716) 877-0617
NOW FOR ALL KAYPROS!

CP/M 2.2E
Enhancements for the CP/M operating system

- Fastcopy. Full disk copy in 44 sec. (single-sided)
- Public files. One copy of WordStar, dBase for all user numbers.
- Mix single & double-sided disks.
- Type-ahead keyboard

Plu*Perfect Writer
Enhancements for Perfect Writer versions 1.03 and 1.20

- One-touch commands—using any keypad key—plus normal keypad mode.
- Switch to overwrite mode.
- Variable-size swap file, up to entire disk.
- Built-in directory listing.
- Change disks and automatic warm-boot.
- Change user number (v1.20)

The Backgrounder
—with definable keys—

Suspend any program to:
- Print the screen
- Use a Help key
- Read disk directory

Fully-definable keys:
- Every key is redefinable—up to 255 characters
- All regular keys are still available
- Create, change and save definitions while running a program.
- Automatically load customized definitions for each program

Background printing:
- Print files while running programs.

The Backgrounder — It's like having a second computer!

See Your Dealer or Purchase Direct
All products supplied with extensive, fully tested documentation.

Plu*Perfect Systems
BOX 1494 • IDYLLWILD, CA 92340 • 714-659-4432

Orders outside North America — actual airmail shipping with payment by card or check drawn on a U.S. bank.

* Robie owners: inquire about installation procedures.
* Previous customers: send original disk plus $5 to upgrade to latest versions.

Trademarks: The Backgrounder (Plu*Perfect Systems), Kaypro (Kaypro Corp), CP/M (Digital Research), Perfect Writer (Perfect Software), WordStar (MicroPro), dBase (Ashton-Tate).

Attention HP 3000 Users:

PRINT on parallel printer — emulates HP thermal

MOVE ASCII files between HP disk and Kaypro disk.
(Upload requires one-time access to SPL)

UNPROTECTED floppy disk includes manual

Now for Kaypro 4+ and 10

Scroll: 255 Characters wide
200-700 lines vertical

Order MuNet/Kaypro from:
Computer Service Department • Southern College • Colledale, TN 37315 • (615) 238-2080
BIG BOARD
COLOR GRAPHICS
$29.95 Bare
Board
TMS 9918A Based Graphics System
256H-192V ★ 16 Colors
★ 32 Simultaneous Fast Moving Sprites
★ Composite Video Output
★ Highest Quality PC Construction
★ Software includes Character & Sprite Editor
★ Demo Program in Pascal & Basic
★ Drivers are above the monitor for use
With High Level Languages
Requires 1 trace cut and 1 jumper (see adding 6K of Ram Micro C#7)
Plugs into U70 (U70 still available for Prom with jumper)
TMS9918A Graphics Chip *345*

Check ★ Money Order ★ COD

GRAPHTECH
P.O. Box 1185, McPherson, KS 67460 — (316) 241-6330
Call for Availability & Price of Parts Kit
Kansas Residents Add 4% Tax/Include $3 For Postage & Handling
Allow Four to Six Weeks for Delivery

EXPAND YOUR BIG BOARD
GIVE YOUR BBI A PRESENT: EXPAND IT!
This versatile expansion system features a Z80 daughter board for direct "on the bus" expansion of memory and I/O. The main board allows you to add on the most popular Big Board accessories all on one board:

BANK-SWITCHED MEMORY: 64K to 1 Mbyte of dynamic RAM with "delay line" timing and 8K to 32K of EPROM or battery-backed STATIC RAM. Advanced "HOLE" memory mapping for ultra-fast RAMdisk operation.
Z80 I/O: One SIO, two PIOs, and one CTC. TI SIO and PIOs are fully buffered with the same header connections as the BB I.
OTHER I/O: One ADC0808 8-input 8-bit A/D converter, two DAC 808 8-bit D/A converters, one AY-3-8910 programmable sound generator, and one MM58167 battery-backed real-time clock.

* SIMPLE PIGGYBACK INSTALLATION - NO MODIFICATIONS TO BB I NEEDED! *
Main board is the same size as the BB I and runs at 2.5 or 4 MHz
Versatile connection scheme allows for further expansion

RAMdisk software provided (.COM and .MAC) for SWP DD or standard DRC CBIOS
It installs a 250K drive M: and patches the MM58167 as the clock display. The patch can be easily modified for other types of CBIOS. Also included are system checkout and utility software.

All parts (except delay line) are easily obtainable. We provide source lists. Pro-quality schematics on two large blueprints for easy reference.

$99.95 Bare daughter and main boards (solder-masked and silk-screened), documentation, and 8-in. SSSD software disk
$16.95 Delay line
Shipping and handling, add: U.S.A., $5.00; Canada, $8.00. Sorry, no other exports. Check or money order only; no CODs. Delivery: stock to 6 weeks.

For free 5-page spec sheet, please write or call:
Rivendell Audiocomp, P.O. Box 28937, San Diego, CA 92128

Rivendell Audiocomp
Custom Audio and Computer Design 619-451-3424

XEROX 820 USERS
NEED MORE I/O??
2 PIO'S
1 SIO
SASI INTERFACE
SOUND GENERATOR
REAL TIME CLOCK
USES THE NATIONAL 58167
REAL TIME CLOCK
TI 76496 COMPLEX SOUND
GENERATOR
BARE BOARD $54.95

COMPOSITE VIDEO INTERFACE
BARE BOARD $19.95
WE ACCEPT
CHECK, MONEY ORDER
MASTER CHARGE, VISA

GRD TECHNIQUES
PO BOX 6383
BRIDGEPORT CT 06606
203-374-3660

HIGHLIGHTS
12", P3I Green, Non Composite, Separate Sync Required, 27 MHz Video Bandwidth, 12 VDC @ 1.5 A.
Vertical Sync: 47-82 Hz
Horizontal Sync (Jumper Selectable):
• PERFECT FOR BIG BOARD II
WHEN USING 9x11 CHARACTER SET
NEW with schematic shipping weight 10 lbs

MONITOR ONLY .................... $62.50

PLASTIC ENCLOSURE
as pictured above. Size 17x14x12". Room inside for mounting above monitor, power supply, & S.B.C.
• PERFECT FIT FOR XEROX 820-II BOARD!
NEW, SHIPPING WEIGHT 12.5 lbs
ENCLOSURE ONLY ................ $40.00

KEYBOARD & ENCLOSURE
80-key XY scanned microprocessor controlled ASC II encoder kit. ROM source code supplied. 17x8.5x3"
New, with schematics, weight 8 lbs

KEYBOARD, ENCODER KIT, ENCLOSURE .......... $50.00

Regulated power supply: 6 outputs: 5v @ 4A, +/-12v @ 2A, +24v @ 2A, +5v @ 2A.
14x4x3", 10 lbs, New.
REGULATED POWER SUPPLY .................. $35.00

ARKON ENGINEERING
P.O. Box 60, Rome NY 13440
(315) 336-4381 or (339-2232 evenings)
TERMS: Prepaid or UPS COD (Cash or Certified Checks Only)

HIGH PERFORMANCE VIDEO MONITOR

BALL BCX-200 HP Monitor
12", P3I Green, Non Composite, Separate Sync Required, 27 MHz Video Bandwidth, 12 VDC @ 1.5 A.
Vertical Sync: 47-82 Hz
Horizontal Sync (Jumper Selectable):
• PERFECT FOR XEROX 820-II BOARD!
NEW, SHIPPING WEIGHT 12.5 lbs
ENCLOSURE ONLY ................ $40.00

PLASTIC ENCLOSURE
as pictured above. Size 17x14x12". Room inside for mounting above monitor, power supply, & S.B.C.
• PERFECT FIT FOR XEROX 820-II BOARD!
NEW, SHIPPING WEIGHT 12.5 lbs
ENCLOSURE ONLY ................ $40.00

KEYBOARD & ENCLOSURE
80-key XY scanned microprocessor controlled ASC II encoder kit. ROM source code supplied. 17x8.5x3"
New, with schematics, weight 8 lbs

KEYBOARD, ENCODER KIT, ENCLOSURE .......... $50.00

Regulated power supply: 6 outputs: 5v @ 4A, +/-12v @ 2A, +24v @ 2A, +5v @ 2A.
14x4x3", 10 lbs, New.
REGULATED POWER SUPPLY .................. $35.00

ARKON ENGINEERING
P.O. Box 60, Rome NY 13440
(315) 336-4381 or (339-2232 evenings)
TERMS: Prepaid or UPS COD (Cash or Certified Checks Only)
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.

Full size photo copy of bare Big Board I (both sides). Invaluable for finding traces under ICs! Send $1.00 to: Carl Jones, 459 Alexandra Way, Grass Valley CA 95945.

NEW SOFTWARE A 100 question quiz to tune-up your Z80 assembly language know-how. Use it as a fast review, a serious study, or as a game. Makes learning easy. Self-prompting. Choice answer keeps track of your score. On 8" SSSD disk. Runs on Z80 64K CP/M 2.2 computers. $49.95 USA & Canada money-orders (in US funds) only. ZQUIZ, PO Box 3775, Stn B, Winnipeg, Manitoba Canada R2W 3R6.

Z80 MICRO-CONTROLLER with parallel I/O ports. Can start XYZ motors and stop them at desired encoder position settings via keypad commands. An introduction to automation. Schematics, parts list, X-Y grid, wiring lists, and software monitor in ROM, $85.00. Source and doc on 8" SSSD disk for further software customizing via your Z80 64K CP/M 2.2 computer, $65.00. Do it yourself. USA and Canada money-orders (in US funds) only. CONTROLLER, PO Box 3775, Stn B, Winnipeg, Manitoba Canada R2W 3R6.

BBI ROM Terminal Emulator. Menu-driven selection of SIO port, baud rate, parity, etc. Interrupt-driven I/O loafs at 9600 baud. Uses one EPROM slot. $29.95 ppd ($34.95 for 2716-1). Unified Software Systems, PO Box 2644, New Carrollton MD 20784.

SCAN The two player computer strategy game is now available. Deploy fighter aircraft, fly under radar, position AWAC aircraft, and seek out your opponent’s home base; but beware of opponent missile bases and your aircraft missile fuel levels. Introductory price of only $14.99. CP/M or MBASIC versions. 64K required. Mail $14.99 for Kaypro 2 disk format currently in stock and specify CP/M or MBASIC version. Or call for different disk format availability. Easy Software, 8199 W Campbell Ave., Phoenix AZ 85033, 602-949-9253. AZ residents add 6%.

Big Board with all options installed. Cabinet (Oddball Electronics), Siemens FD 100-8 disk drive (room for one more), power supply, fan, keyboard, CP/M+ software, $460. Zenith 12" green monitor, $45. John Griffin, R1 Box 146-C, Eatonville WA 98328. 206-847-6747.

64K RAM CHIPS of Prime quality 300ns 64K dynamic ram chips perfect for use in DynaDisk. 8 for $35, add $1.50 for shipping. Send check or money order plus appropriate sales tax to: Soroban Systems Inc, 1640 Mohawk St, Los Angeles CA 90026.

WANT TO BUY XEROX 820-II 5.25" DSDD drives. Will pay cash or will trade 8" SSDD drives for same. Would consider purchase of 820-I15.25" DSDD system complete. Edwin Bideau III, 123 West Main, Chanute KS 66720, 316-431-2720.

SUMMER SALE Morrow, Smith-Corona, Qantex printers, terminals, Alpha Micro, 3M telex, 5" winchester drives, Xebec, Cromemco, Otrauno, Wicat. send for list. Polygon Industries, PO Box 24615, New Orleans LA 70184, 504-282-5372.

BB-I Fully Assembled Basic options, runs good, in sturdy cabinet, box fan, Power I power supply, all $400. Monitor 18mh $30, JRT Pascall $20. Need to sell for tuition, make offer. 206-631-0411, Bruce Stewart, 281 St SE, Kent WA 98042.

SUPERB MAILING LIST PROGRAM stores and manages names and addresses that can be revised at any time. Its size is limited only by the disk storage available. The address labels may be code selected and printed in five different formats on your computer paper or on label rolls. In addition to the name and address fields there are four additional fields in each record for telephone number, date and two amount fields if desired. At any time the entire roster may be printed out. For CP/M 2.2 based systems with two disk drives and printer capable module included. Supplied on 8" SSSD, 5.25" Kaypro and many others (please write). Special introductory offer by ABLE DATA SOFTWARE INC., PO Box 86923, Station C, North Vancouver, BC V7L 4P6. Only USA $19.95 postpaid check or money order.

Xerox 820 Boards factory assembled and tested. $150, includes shipping, manual, schematics, ROM source code listing. Call evenings 415-964-2573, or write Jiri Kratt, 575 S Rengstorfs, Apt 150, Mountain View CA 94040.

Public Domain Software Rental: CP/M UG Vol 1-92 on 46 8" Flippines $45.00, SIG/M UG Vol 1-170 on 85 8" Flippines $85.00, PICONET Vol 1-34 on 17 8" Flippines $25.00, Pascal-Z UG Vol 1-25 13 8" Flippines $20.00, UG Games 20 Vols of the best ones $20.00, UG Modern 20 Vols of the best $20.00, UG Business 20 Vols of the best $25.00, UG Utilities 10 Vols of the best $20.00. Rental is for 7 days after receipt with 3 more days grace for return. Credit cards accepted (preferred). 5" disk formats also available. Downloading disk format conversions. Call User Group Software Automatic Update Service—$7.50 per 2 volume set PF. 619-727-1015 24 hrs. 619-941-0925 info. P.J.’s National Public Domain Software Center, 1062 Taylor Street, Vista CA 92083.


BB-1, 2 TANDON 848-1, power supply, maxi keyboard, and $500 in software. All only $795. Jim 305-255-2924.
TECHNICAL TIPS

Inverting the Negative Sync on the Xerox 820-1

2. Solder a thin, insulated wire (wire-wrap wire for example) from pin 5 of the socket of U117 to pin 11 of the socket of U89.
3. Solder a wire from pin 10 socket U89 to the bent-out pin 5 on U117. Route wire through hole near C72.

Bertrand Berlin
33 Ellen Ct.
Wayside NJ 07712

BB-I RAM Update

I have done both Marshall’s (issue #11) and Boehm’s (#12, 13) 256K mods. I wanted 4164 DDRAM because I planned on using a DynaDisk when I started and I wanted a fast way to test the memory chips.

Both mods work fine, but they do not work the same way. With the Boehm mod you must have all 256K to run, period, because the memory is “interleaved.” 16K of each bank is used for each lower 48K block and the upper unswitched bank uses only 16K of the chips. The PIO simply supplies a memory address offset.

With the Marshall mod, you should use one, three or four banks (two banks will only be 64K, same as one bank). Since I don’t know of any CP/M 2.2 BB software that uses the extra memory, I am running only a single bank using the Marshall mod. To do this, pin 9 of U1-8 RAM must be tied back to U59 (74157) pin 9. It should only be grounded if using bank switching. I just tied the U110 (LS10) lines high, and have not used the PIO bits.

If the system will not run with only one bank in, there are problems with U10, U110 or U8.1 (the chip added per the mod) not switching as it should. Also, be sure that one of the other Micro C mods doesn’t already use U110!

A. Scott Fredrickson
6730 Rancho Adobe Drive
Sacramento CA 95828

Nickel Boards

Here are some tips for users of the nickel plated version of the Xerox 820 board.

Do not use too small a soldering iron tip. A 1/16 inch tip will not conduct heat fast enough. A 1/8 inch chisel tip is best; the idea is to get as big a thermal contact area as possible between the iron and the pad being soldered. Use an iron coated tip. Copper does not stand up to the hammering it gets when soldering this board.

Use thin (22 gauge) solder and be absolutely certain that it is 60/40 alloy. Some solder sold for electronic purposes is 50/50 and is useless with this board. Do not use too much solder nor allow it to accumulate with the iron, and be fanatical about wiping the iron and cleaning the component leads.

In view of the soldering problems, I expected all sorts of difficulties with bad joints, but in fact the board came up very easily after correction of two careless errors. I tried it first without the video mod suggested by B-G Micro. The mod is, however, worthwhile and provides a much cleaner display.

I had difficulty obtaining a 1771 disk controller chip locally, and in the end used a 1791 instead. To accommodate this, I modified the socket by removing the contacts for pin 1, 25, and 33. The chip specification says that pin 27 should be fed with inverted raw head data, and that the read clock polarity is unimportant, so I pulled U94 (74LS08) and replaced it by a 7404 with pins 4 and 10 clipped off.

The chess fix in Tech Tips (issue #15) is also required for the Xerox 820. As printed, however, it leaves out the essential step in the fix. I inserted opcodes CB BB at 1F03 in order to reset bit 7 in register E, but presumably it could be ANDed out in the accumulator.

Richard Parsons
RR#1 Mount Albert
Ontario Canada LOG 1M0

Kaypro Drive Lights

One of my long-standing irritations with the Kaypro was that the drive indicator lights remain on all the time, not just during a disk access. So I fixed that ...

I pulled out the Tandon manual (the source I found in Micro C) and started in with the logic on the drive card. I wanted to see the light during a drive select and a motor enable. I found the two lines, traced my circuit out, implemented it, and presto. Indicator lights when I want them, ONLY during a disk access!

Figure 1 - ZCHESS Fix

<table>
<thead>
<tr>
<th>PP05</th>
<th>2c 16Mar00</th>
</tr>
</thead>
<tbody>
<tr>
<td>1f00</td>
<td>2w1 ( e,c2 \langle or \rangle )</td>
</tr>
<tr>
<td>1f02</td>
<td>and ( 7f \langle or \rangle )</td>
</tr>
<tr>
<td>1f04</td>
<td>mov ( e,a \langle or \rangle )</td>
</tr>
<tr>
<td>1f05</td>
<td>ret ( \langle or \rangle )</td>
</tr>
<tr>
<td>1f06</td>
<td>( \langle or \rangle )</td>
</tr>
</tbody>
</table>

Figure 2 - Drive Indicator Light Fix

BEFORE:

AFTER:

Brief Instructions

1. Remove the drives (as outlined in Micro C #13).
2. Remove the board from the drive.
3. Cut the trace between chip 2c pins 1 and 2.
4. Jumper chip 2c pin 2 to chip 4f pin 5.
5. Remove jumpers w6, w7, and w9 (this varies, I had two different boards in my computer, but both were similar).
6. Make sure the hs jumper is in place (first pin pair 1-16 of shunt 1e the drive address jumper).
7. Remove the cr 23 unused (in the Kaypro).
8. Jumper chip 3e pin 3 (I found this as one of the pads of w6) to chip 2c pin 3.
9. Reinstall.

I used some of the circuitry that was not being used, and used a NOR that had the inputs tied to produce an inverter.

This installation took about an hour for the first of the drives and about twenty minutes for the second. I am just a beginning hacker (I try!). And this worked the first time.

Peter Pressley
1151 Montalban Dr.
San Luis Obispo CA 93401
BB-I Video Fix Fix

In Wesley Ebisuaki's tech tip of issue #18, we erroneously suggested that you could solder a resistor between pins 8 and 16 of 74LS136. Well, that chip has only 14 pins so the resistor is actually between pins 8 and 14 (If yours happens to be a 16-pin 74LS136 just cut off the two extra pins before doing this (from either end)).

Drive Box for the 820-II

I just came across a neat little thing for hanging 8 or 5 inch drives on the same 820-II system.

The answer is to build an interface box to be plugged into the 820-II disk drive connector, then plug an 8 inch drive into a connector on the box and a 5 inch drive into another connector on the box. This requires no internal changes to the 820-II or the disk drive.

Pin 5 from the 820-II is the drive select 1 (DS1) line; pin 6 is the drive select 2 (DS2). By switching the drives, 8 or 5 inch, to pin 5 or 6 from the computer you can select "A" (DS1) as either 8 or 5 inch; and the same with "B" (DS2). The 820-II selects its drive by pulling DS1 or DS2 low.

The secret is to use this low to pull pin 2 low when 5 inch drives are selected. The two diodes (see figure) do this for us and feed the low to pin 2 from the computer when DS1 or DS2 are switched to the 5 inch drives. The pin 2 from the 8 inch drive is not used.

The 8 and 5 select line (pin 5) from the 820-II is pulled high internally. As long as pin 2 is high, the 820-II assumes 8 inch drives are connected. By plugging in 5 inch drives, pin 2 is pulled low telling the 820-II it has 5 inch drives connected.

With the switches on the box, you can select A drive to be 8 and B drive to be 5 or vice versa and use PIP or SWEEP to download or upload files. Select both drives to be 8 or 5 inch and the system will operate normally.

Use caution when initializing 5 inch disks. Throw both switches to 5 inch and cold boot the system with a 5 inch CP/M system on the A drive or the computer will assume 8 and try to initialize it as 8 inch.

The computer must be turned on before the box or the computer will not come on.

This box will not work on the 820-I. Dick Miller from Xerox is the originator of this tip.

R. L. Robinson
19141 Stingray Lane
Huntington Beach CA 92646

Figure 3 - 5" & 8" Drive Interface for Xerox

SBASIC COLUMN

(continued from page 23)

at the end of the file after the last legitimate record. When your program finds this marker, it knows it has reached the end of the file. The other is to use, say, the zeroth record in the file to indicate how many records there are in the file and then keep track of where you are with a separate pointer variable. When your pointer equals the filesize variable, you know you've reached the end of the file.

This second method was my approach. To organize things, all reading from the file should be done from one procedure that also increments the file pointer. Unfortunately, such a procedure must read global variables and must be written specifically for the file variables in this file. Such a procedure is not portable and so is not universal tool for handling files. It's a method for coping.

Now that I've seen that quicksort works in SBASIC, I should have the final kinks worked out of my file sorting routine. I would appreciate hearing from anyone who has solutions to some of my problems.
BIG BOARD USERS
SYSTEM MODIFIER PROGRAM -- $29.95
Manual only -- $3
  • Allows easier system modifications by not involving the system tracks
  • Provides screen dumps and time display on demand through escape commands
  • Automatically runs any program on a cold boot
  • Includes both serial and parallel I/O drivers
  • Fully implements the IOBYTE
  • Is all in a single program that loads into high memory and extends the PPM monitor
  • Includes menu driven configuration program
SWITCHING POWER SUPPLY -- $50
  • 5 volts at 20 amps
  • Fully tested
  • Call for availability

C & D ENTERPRISES
75 North Street
Saco, Maine, 04072
(207)-282-4401
Add $2 for shipping

POWER SUPPLY
For the BIG BOARD and other SBC’s
Assembled, tested and burned-in 48 hours
  • + 5V @ 4A + DVP, 24V @ 2.5A, ± 12V @ .2A
  • All supplies have over-current protection
  • Bell circuit and Piezo speaker for BB
  • Low line warning circuit - brew out
  • Input 105-120 VAC 50/60 Hz @ 1.0 A
  • 4.5”H, 3.8”D, 11”L - 5 lb.

S-BASIC TUTORIAL
140 pages, including index, of letter size sheets for 3-ring binder covering the aspects of S-Basic Programming (with references to M-Basic)

Send $20.00 money order (to cover cost for copying and mailing) to:
Sven Erlandsson
3268 Leon Brisebois
Ile Bizard, Quebec
Canada, H9C 1W2

S-BASIC MEMORANDUM
LISTEN! Your computer could be talking to you through the BIG MOUTH from ASTROTRONICS.

True speech synthesis for ANY computer through your printer port (parallel or serial).
Using our BIG MOUTH speech synthesizer with its 286 CPU and SSI-263 third generation phonetic speech synthesizer.
  • Text to speech
  • Will run on any computer
  • No software required
  • 400 character buffer
  • Embed phonemes in text for those special words that don’t fit the rules, names foreign words etc.
  • Programmable:
    • vocal-tract frequency
    • intonation rate
    • duration
    • pitch
    • articulation amplitude
    • for all 64 phonemes
  • Can be programmed to make sound effects and can even be programmed it to SING!!

$125
The BIG MOUTH kit all parts inc.
PCB, 286, SSI-263
EPROM & Inst.
(714) 734-6006
1137 TOPAZ ST.
CORONA, CA 91720
Shipping & handling $1.50
California res. add 6% tax

DOUBLE DENSITY HARDWARE
DAUGHTER BOARD FOR THE WD2795 DDS CONTROLLER

Cheep!

AMP CONNECTORS FOR YOUR DISK DRIVE
KIT OF 2 EACH WITH PINS
$5
Plus $1 S & H

IN STOCK!

FOR THE BIG BOARD
The “LA CAJA” Enclosure w/Power Supply
$299
PLUS $20 S & H

IN STOCK!

STANDARD FEATURES INCLUDE
  • Power Supply
    5V @ 4A + DVP, 24V @ 2.5A, ± 12V @ .2A
  • All voltages are current protected
  • Reset Switch
  • Fan
  • Key-Lock Power
  • Solid State AC Relay
  • Bell Circuit and Piezo Speaker
  • 2 AC Outlets, One Switched
  • Color, Beige and Chocolate
  • 6” H x 12” W x 16” D 24”W for 2 Drive Unit

“La Caja” can be supplied fully wired for the Big Board with all ports disk DC and timed AC for $150.00

IN STOCK!

LOW COST DAISY WHEEL PRINTER
BIG BOARD COMPATIBLE

CABLES AVAILABLE

IN STOCK!

brother HR-15
LOW COST DAISY WHEEL PRINTER

PARALLEL
PLUS $20 SHIPPING

$499

PARALLEL PLUS $20 SHIPPING

California residents add 6% tax on all items — phone evenings California time

IN STOCK!

AstroTronics MICROSYSTEMS
(714) 734-6006
1137 TOPAZ ST.
CORONA, CA 91720
Micro C works because it is a central information exchange for the doers in this crazy industry. So we encourage you to share your trials and tribulations. That way we can invent new wheels rather than redoing the old ones over and over.

What kind of exciting adventure (misadventure) are you working on?

What information would you like to see in Micro C?

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Price Each</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SUBSCRIPTION (1 year—6 issues)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ New □ Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ $16 (Bulk)</td>
<td>U.S.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ $22 (1st Class)</td>
<td>Can &amp; Mex</td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ $30 (Air Mail)</td>
<td>Other Foreign</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$15</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>USERS DISKS — 8” SSSD, CP/M #’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CP/M 86 DISKS — 8” SSSD #’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KAYPRO DISKS for the 11, 4, &amp; 10 — 5” SSDD #’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BACK ISSUES #’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OTHER ITEMS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prices include media, package, 1st Class postage (Air Mail for Other Foreign)

Check or money order enclosed (US funds only, payable on a US bank)

Make checks payable: MICRO CORNUCOPIA

TOTAL ENCLOSED

Card No. ___________ Exp. ___________ Signature

Visa    MasterCard

NAME ____________________________ PHONE (?) ____________________________

ADDRESS ____________________________________________________________

CITY ____________________________ STATE ____________ ZIP ____________
### BACK ISSUES

<table>
<thead>
<tr>
<th>Issue</th>
<th>Price</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO. 1 (8/81)</td>
<td>$3.00</td>
<td>Power Supply, RAM Protection, Video Wiggles, and more</td>
</tr>
<tr>
<td>NO. 2 (10/81)</td>
<td>$5.00</td>
<td>Drive Maintenance, Interfacing Drives, Installing a New BIOS, and more</td>
</tr>
<tr>
<td>NO. 3 (12/81)</td>
<td>$3.00</td>
<td>4 MHz Mods, Configuring Modem 7, Safer Formatter, and more</td>
</tr>
<tr>
<td>NO. 4 (2/82)</td>
<td>$5.00</td>
<td>Keyboard Translation, More 4 MHz Mods, and more</td>
</tr>
<tr>
<td>NO. 5 (4/82)</td>
<td>$3.00</td>
<td>Word Processing, Two Great Spells, Two Text Editors, and more</td>
</tr>
<tr>
<td>NO. 6 (6/82)</td>
<td>$5.00</td>
<td>BB IEFPROM Programmer, Customize YourChars, and more</td>
</tr>
<tr>
<td>NO. 7 (8/82)</td>
<td>$5.00</td>
<td>6 Reviews of C, Adding 6K of RAM, Viewing 50 Hz, and more</td>
</tr>
<tr>
<td>NO. 8 (10/82)</td>
<td>$5.00</td>
<td>Drive Maintenance, Interfacing Drives, Installing a New BIOS, and more</td>
</tr>
<tr>
<td>NO. 9 (12/82)</td>
<td>$3.00</td>
<td>BB II EPROM Program, Relocating Your CP/M, Serial Print Driver, and more</td>
</tr>
<tr>
<td>NO. 10 (2/83)</td>
<td>$3.00</td>
<td>Saving a Flaky Disk, Hooking Wini to BB II, The Disk Inspector, and more</td>
</tr>
<tr>
<td>NO. 11 (4/83)</td>
<td>$3.00</td>
<td>BB I Expansions, BB II Details, Dyna, RAM Disk Review, and more</td>
</tr>
<tr>
<td>NO. 12 (6/83)</td>
<td>$3.00</td>
<td>256K for BB I, Bringing Up BB II, dBase II, Look at WordStar, and more</td>
</tr>
<tr>
<td>NO. 13 (8/83)</td>
<td>$5.00</td>
<td>CP/M Disk Directory, More 256K for BB I, Mini Front Panel, and more</td>
</tr>
</tbody>
</table>

### BOOKS

By Kas P.  
Price: $26.45 (US, Can, Mex)  
This is one of the best books on CP/M. It covers the whole spectrum of users from novice to guru. There are a few books that include more programming examples but none work better for the whole range of users and this book is perfect for reference use. Micro C's copy of inside CP/M is showing definite signs of overuse.

- **Inside CP/M**  
  Price: $27.95 (US, Can, Mex)  
  This is one of the best books on CP/M. It covers the whole spectrum of users from novice to guru. There are a few books that include more programming examples but none work better for the whole range of users and this book is perfect for reference use. Micro C's copy of inside CP/M is showing definite signs of overuse.
**FERGUSON ENGINEERING**
817-640-0207

**BIGBOARD-1 / 820-1 256K RAM EXPANSION MODULE**

Now you can add 192K of RAM to your Bigboard-1 or 820-1 in a clean and efficient manner. This module can be used as a RAM disk, a spooler buffer, a disk cache or anything that requires more memory than the basic 64K. This module uses none of your precious I/O. Instead, it plugs into five device sockets below the existing RAM array as a daughter board. It adds only 1/2 inch to the overall height of the computer board. The interface is accomplished with absolutely NO wires, cables or jumpers. The interconnect hardware, PAL and difficult-to-obtain discrete components are provided with the bare board, kit and tested versions. Only 7 TTL devices are required.

This memory array resides in the address space of the CPU as 16 blocks of 16K. Any 16K physical block can be mapped into any 16K logical block addressable by the CPU. A bipolar RAM mapper controls which 16K blocks the CPU has access to. The mapper is configured by easily-understood single-byte commands written to memory location OFFFH. This extremely flexible architecture will accommodate a wide variety of applications, such as MPM, CPM+ and a host of high-speed data acquisition tasks. This RAM upgrade will work at 4 Mhz. This product comes with complete schematics and a full theory of operation with many programming examples. Assembly, installation and test procedures are thoroughly documented. PAL code is not available.

We have modified XDRIVE, a public-domain RAM disk software package, to run with the 820-256K. By the end of the 2nd quarter, we will have a CACHE BIOS melded with ZCP that will give you nearly all the flexibility of CPM+ at a fraction of the cost.

**BARE BOARD & DOCUMENTATION ..................... $ 67.50**
KIT W/O RAM ........................................... 95.00
2.5 Mhz A&T (250 nS RAM) .......................... 325.00
4.0 Mhz A&T (150 nS RAM) .......................... 375.00
NEW MONITOR ROM SOURCE & XDRIVE SOFTWARE .......... 45.00
64K 250 nS MK 4564 - 25 ............................ 5.10

**UNINTERRUPTABLE POWER SUPPLY**

**UPS 5-200**

$195.00

+5 V @ 8.5 AMPS, +12 V @ 7.2 AMPS
−12V @ .5 AMP, + 24V @ 2 AMPS (4A PK)

This supply is designed to power entire computer systems with Winchester and floppy disk subsystems, as well as providing emergency battery backup capability. Designed to meet the needs of single-board Winchester systems.

24V 4.5 AH battery pack, BP-1 .......................... $55.00

**FEATURES:**

High Reliability
High Efficiency (75% TYP.)
High Power - 200 Watts
25 Khz Switching Frequency (inaudible)
Soft Start
Built-In Quick-Response Q.V.P.
Cycle-By-Cycle Fold-Back Current Limiting
Drop-Out Immunity for up to 250 Ms (without battery)
Uninterruptable (with addition of BP-1 battery pack)
5 Output Voltages

**ACCOMMODATES**

• Z80, Z80A, OR Z80B Series Parts
• Dual RS232 Serial I/O W/Current Loop Option on "A" Channel (both strappable as terminal or modem in RS232 Mode)
• 16 Programmable Baud Rates on each serial channel
• 32 Bits Buffered Parallel I/O Assignable on 4 Bit Boundaries, W/Strappable Handshake Polarity (2xZ80-PIO)
• 4 Channels of Counter-Timer, 4 Inputs, 3 Outputs
• Accommodates 16K Mix of Ram or Rom or EEPROM on 2K Boundaries in 2716 or 2016 or XICOR EEPROM
• 2.3" x 10" Sea of Holes Prototyping Area
• All I/O Fully Mode II Interrupt Compatible
• Watchdog Timer for Long-Term Unattended Operation

Rom monitor and source listing .......................... $ 35.00

**TERMS:** Master Card/VISA add 3%, money order, certified check, UPS cash COD. Allow 2 weeks for personal or company checks to clear. Shipping/handling extra. Texas order add 5% tax.

**GENERAL PURPOSE INDUSTRIAL CONTROLLER**

**LB-1**

$75.00

Bare Board & Doc
Full implementation of ‘C’ with standard floating point, library, and I/O subroutines. UNIX VER 7 compatible. Produces relocatable 8080 (optional 0Z80) assembler code. Relocating assembler and linker supplied with package or use Microsoft M80 and L80, SID/ZSID debugger interface. FAST COMPILATION AND EXECUTION.

AZTEC CII FOR CP/M $199
(Special price for Micro C subscribers $149)

Also available for Apple DOS, HDOS, CP/M-86, PC-DOS

---

Tired of the slowness of BASIC? Find that the bugs in FORTRAN are bugging you? Step up to FORTH, the language that gives you total control over your computer! UNIFORTH is the only version of FORTH available either “captured” under an operating system (such as CP/M), or “standalone”, acting as its own operating system. Our standalone versions are customized to your single board computer, providing serial and parallel port support, a real-time clock, formatting, fast disk copy, and disk access up to twice as fast as CP/M! All systems are FORTH-79, and include a video editor, macro assembler, debugger, decompiler, top-notch documentation, and much more. Write for our free brochure, or order direct from the special Micro-C reader prices listed below.

UNIFORTH Version

<table>
<thead>
<tr>
<th>System</th>
<th>Integer</th>
<th>Floating</th>
<th>Multi-</th>
<th>Multi-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Point</td>
<td>Tasking</td>
</tr>
<tr>
<td>Big Board</td>
<td>$ 60</td>
<td>$100</td>
<td>$125</td>
<td>$150</td>
</tr>
<tr>
<td>Big Board II</td>
<td>80</td>
<td>125</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Slicer</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Any CPM-80</td>
<td>60</td>
<td>100</td>
<td>150</td>
<td>200</td>
</tr>
</tbody>
</table>

Unified Software Systems
P.O. Box 2644, New Carrollton, MD 20784, 301/552-9590
DEC, VAX, PDP-11, REX-11 (TM) Digital Equipment Corp; CP/M (TM) Digital Research; MS-DOS (TM) Microsoft; VIC-20 (TM) Commodore

---

Prices shown above are for June 2, 1984. Please call for new discount & current prices. Prices subject to change. Please expect higher prices on some parts due to world wide shortages. Shipping and Insurance extra. Cash discount prices shown. Small orders received by 6 PM CST can usually be delivered to you by the next morning, via Federal Express Standard Air ($5.99)

---

MICRO CORNUCOPIA
The Single Board Systems Journal

P.O. BOX 223
BEND, OREGON 97709