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August 1984

No. 19

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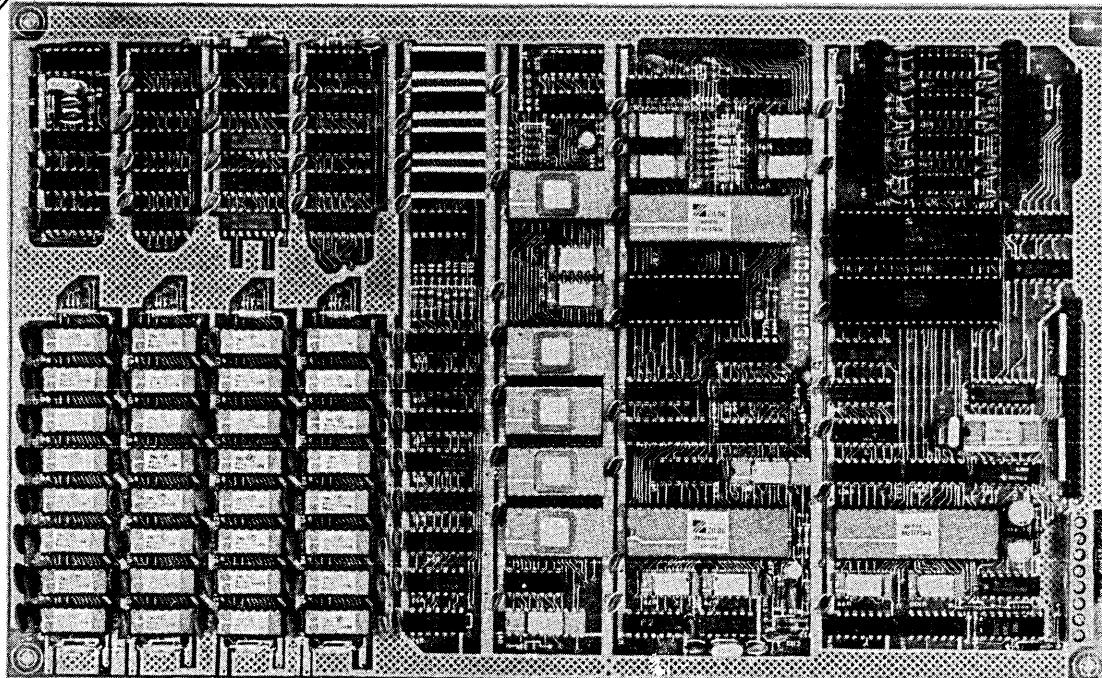
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MICRO CORNUCOPIA

August 1984 The Single Board Systems Journal No. 19

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 snarl, 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

(continued on page 50)

LETTERS

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 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 be to 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. Wytsma
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 Kayke National Newsletter.

My issues are running 17 pages without ads and we've been charging a meager \$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 (floppy 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 phone 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 speedup 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 $\frac{1}{8}$ 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 (he advertises 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 writ-

ing 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 Ciarcia. 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)

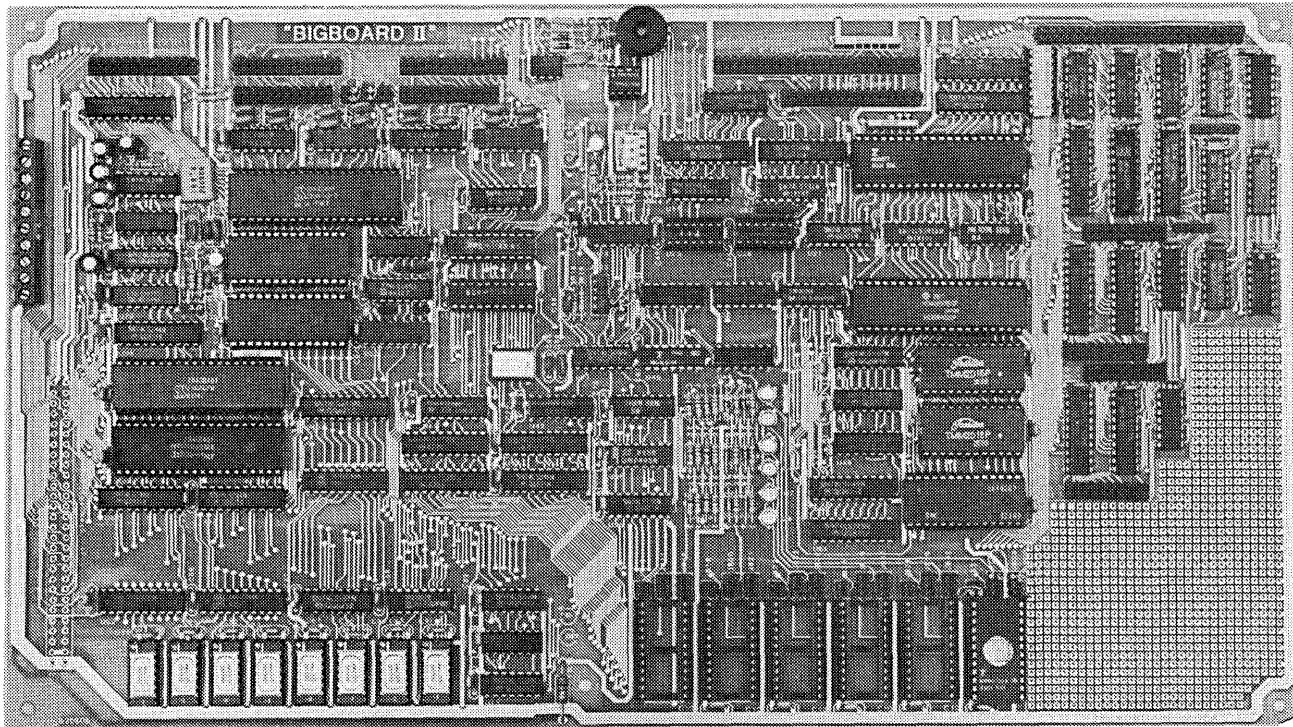
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"BIG BOARD II"

4 MHz Z80-A SINGLE BOARD COMPUTER WITH "SASI" HARD-DISK INTERFACE



\$545 ASSEMBLED & TESTED

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(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 EEPROMS. 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 1793 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 5.25" drives, 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-disk subsystem is added, the DMA chip makes impressive disk performance possible.

\$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/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/O, while the other is for systems and applications use.

■ PROM Programming Circuitry

The new Cal-Tex SBC has circuitry for programming 2716s, 2732(A)s, 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.

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

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.

CAL-TEX COMPUTERS, INC.

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The BB II and the Winny

By Roy Epperson

1825 NW 138th Ave
Portland OR 97229

Cal-Tex's Big Board II hardware supports the ANSC X3T9.2 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 5 1/4 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 5 1/4 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 going 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:

Sector size	sect per track	sect per drive	Tot. Bytes
256	33	84,480	21,626,880
512	18	46,080	23,592,960
1024	9	23,040	23,592,960

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.

Figure 1 - Double Density Interleave

Sector size	Interleave factor	Sectors/Track
256	1	32
256	not 1	33
512	1	17
512	not 1	18
1024	1	9
1024	not 1	9

Figure 2 - Features of the Rodime R204 Winchester

Number of disks	4
Number of surfaces	8
Number of heads	8
Number of cylinders	320
Unformatted capacity	26.67 Mbytes
Transfer rate	5 Mbytes/second
Seek (with settling)	
track to track	18 milliseconds
Average	90 milliseconds
Maximum	215 milliseconds

The Distribution CBIOS

The current BB II winchester description is:

CP/M Block Allocation Size:	4k
Number of BLS blocks:	1224
Number of Directory Entries:	512
Bytes per sector:	256
Total bytes of storage:	5 Meg

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 INCLUDE DEBLOCK.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 pointer.

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 unfeasable.

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 5 1/4 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.

2. "CP/M Operating System Manual" by Digital Research, Inc.

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 $((\text{disk sector size})/128) - 1$.

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:

$$\text{ALSM} = ((\text{physical disk size})/(\text{block allocation size}))/8$$

For this implementation, the ALSM sizes could be:

BLS	BLS blks	ALSM
1024	23040	2880
2048	11520	1440
4096	5760	720
8192	2880	360
16384	1440	180

The memory requirement for the Winchester disk structure is:

$$\text{diskmem} = \text{WINCH} * 36 + \text{ALSM}$$

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

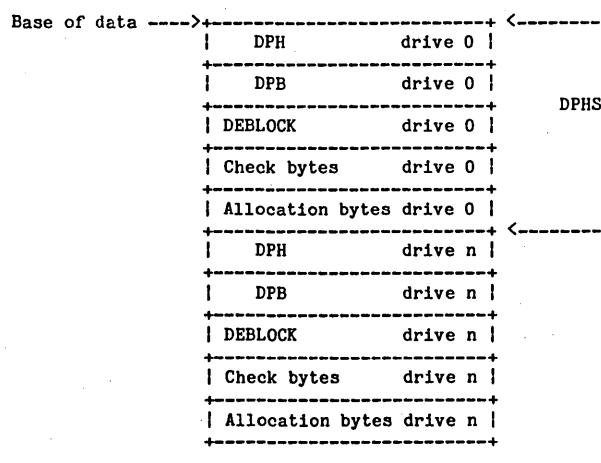
The system distributed by Cal-Tex locates this storage area up in the SCRATCH memory area of the monitor. With my implementation of the Winchester and two double sided, double density floppies, it was necessary to move the 'diskmem' down below the monitor and move CP/M down.

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



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)

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 BBII 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 BBII's SELMUX port is set to 0001111, 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

Figure 4 - Modifications to SELDISK

```

; SELDISK:
LD   HL,0          ;PREP TO CHECK FOR MAX DISK#
LD   A,C
CP   NFLOPPY+WINCH
RET  NC            ;ERROR (HL=0) IF DISK# TOO BIG

LD   (DISK),A       ;REE THE MODIFICATION BEGINS HERE
; INC  A           ;REE MOVE TO LOCATION BELOW
; IF   WINCH        ;REE ADD THE FOLLOWING IF CONSTRUCT
; CP   NFLOPPY      ;REE SEE IF DISK IS A FLOPPY
; JR   C,SELFL       ;REE YES, JUMP TO FLOPPY'S ROUTINES
; LD   BC,WDPHSIZ   ;REE ITS A HARD DISK
; LD   HL,WDPHTAB-WDPHSIZ ;REE MAKE BEGINNING POINTER
; SUB  NFLOPPY      ;REE REMOVE FLOPPY OFFSET
; JR   SDSK1         ;REE JUMP TO INCREMENT TO THE CORRECT DISK
; ENDIF

; SELFL: LD   BC,DPHSIZ ;REE ADD THE LABEL
;         LD   HL,DPHTAB-DPHSIZ
SDSK1: INC  A           ;REE RELOCATED INSTRUCTION AND ADD LABEL
SDSK2: ADD  HL,BC       ;REE NO CHANGE
DEC   A
JR   NZ,SDSK2
LD   (DPHTR),HL        ;STORE POINTER TO DISK'S DPH ENTRY
BIT   0,E              ;TEST LOG-ON VECTOR BIT FOR DRIVE
RET   NZ               ;EXIT IF DRIVE IS LOGGED-ON

PUSH  HL
POP   IX
BIT   0,(IX+FLAGS)    ;TEST DRIVE PRE-SELECTED FLAG
RET   NZ               ;EXIT IF DRIVE FORMAT ALREADY KNOWN

CALL  FLUSH           ;FINISH ANY DEFERRED DISK OPERATIONS
LD   A,RESERV
LD   (TRACK),A         ;SEEK DIRECTORY TRACK FOR FORMAT CHECK

; PARAMS:
IF   WINCH
LD   HL,WINSTUFF
LD   (PRMPTR),HL        ;SELECT WINCHESTER DISK PARAMS
LD   A,(DISK)
CP   NFLOPPY
; JP   Z,PARM10
; JP   NC,PARM10        ;CHANGE THE JUMP CONDITIONAL TO THIS
;                     ;SKIP FLOPPY FORMAT FOR HARD DISK
;                     ;LAST CHANGE IN THIS FILE
ENDIF
XOR   A
LD   (HSTSEC),A         ;SET SECTOR# TO ZERO TO INDICATE
; PARM1: LD   A,SIDSEL+OFF ; EXPLORATORY READ OPERATION

```

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:

```

loop:: in   a,(port)
      and  mask
      jr   condition,loop

```

The program length is 3 instructions, 6 bytes and 29 T-states long. A 1024 bytes sector takes 2.475 milliseconds to transfer. By adding a series of nops, the transfer period can be reduced by increasing the number of bytes transferred per

(continued next page)

THE BBII AND THE WINNY

(continued from page 7)

loop. For this loop, the transfer period is reduced to 1.568 ms.

```
loop::  nop
        nop
        nop
        nop
        nop
        in    a,(port)
        and   mask
        jr    condition,loop
```

CP/M Interface Software

When CP/M uses a disk, it makes several requests to the BIOS before doing the read or write. It selects the desired disk number, track, and sector and then issues the appropriate read or write request. The sequence stores the necessary data for floppy disk controllers. However, SCSI controllers communicate in physical block numbers.

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 block number was:

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, DSxxxx.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 features 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 not 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.*



FLOWCHARTER

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

    RSHFT DEFL 3
    ENDIF

BEXM DEFL (BMASK SHR RSHFT) OR OH

```

Figure 6 - Build File Modifications

Change the following:

```

IF      WINCH
INCLUDE XEBEC.MAC
ENDIF

```

to read:

```

IF      WINCH
INCLUDE ADAPTEC.MAC
INCLUDE ACB4000.MAC
ENDIF

```

AFTER the statement:

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

ADD the statements:

```

;
IF      WINCH
WDPH  MACRO
LOCAL  BASE1
BASE1: DEF5   16      ;DISK PARAMETER HEADER
DEF5   15      ;DISK PARAMETER BLOCK
DEF5   4       ;DEBLOCK PARAMETERS
DEF5   1       ;DEBLOCK FLAGS
DEF5   (MAXBLK/8) ;ALLOCATION VECTOR
ENDM

;
WDPTH TAB EQU   $      ;CREATE HARD DISK DATA AREA
REPT   WINCH
WDPH
ENDM
WDPSHSIZ EQU   ($-WDPTH TAB)/WINCH
WEND   EQU   $

```

In the section of code following:

```
ORG     SCRATCH
```

Delete the IF WINCH ENDIF statements inclusively.

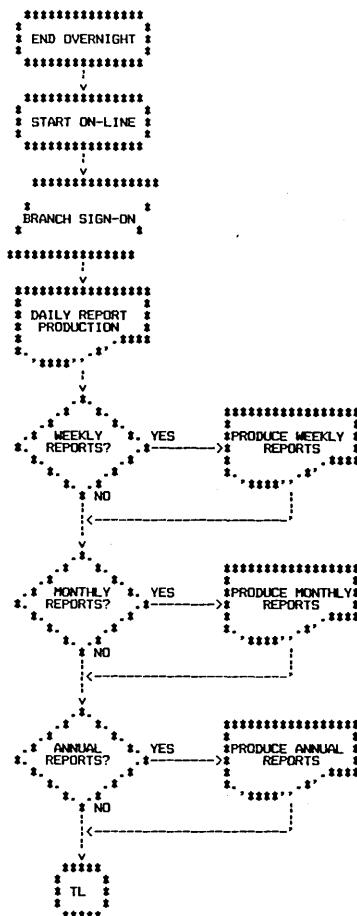
I recommend inserting the following conditional in any "build file." It will save you a lot of head scratching. After the calculation of BIOSLEN insert:

```

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

```

END



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6MHz On The BB-I

By Larry J. Blunk

2972 Briarcliff
Ann Arbor MI 48105
313-663-6171

My Big Board is amazing. Born a 2.5 MHz plugger, it now clips along at 6 MHz without so much as catching its breath. Your BB-I can play screamer 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, PIO's, and CTC's for \$8.25 each).

3. Remove U97. Get a 74LS92 (\$.69 from Microware) and bend out pins 9, 12, and 14. Place the LS92 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.

Jumper pins 7 and 10 of U97. Jumper pins 5 and 14 of U97. Jumper pins 8 and 9 of U97. Connect a jumper from pin 1 of U97 to pin 11 of U96.

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 stated that it was necessary to replace the monitor EPROM with a 250 ns (or faster) part. That's not exactly true. With the aid of a simple wait state generator, it is possible to run plain old 450 ns 2716's at 6 MHz without any problems.

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 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: $T_{clk} * 1.5 + T_w * T_{clk} - PD(U84) - PD(U78,79)$ = EPROM access time from CE.

T_{clk} is the period of the system clock, T_w 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

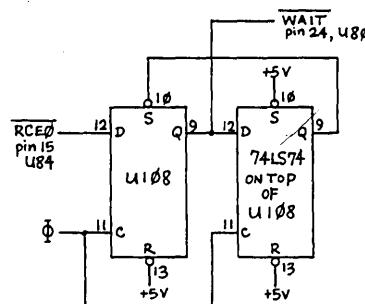


Figure 2 - Circuit to Generate Two Wait States

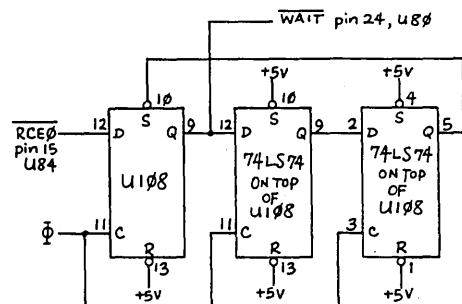
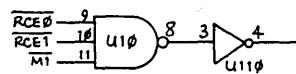


Figure 3 - Circuit to Enable Wait States for Two ROMs & Instruction Fetches



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 $(200 \times 1.5 - 24 - 18)$, 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 to +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.

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Figure 4 - Memory Timing Without Wait States

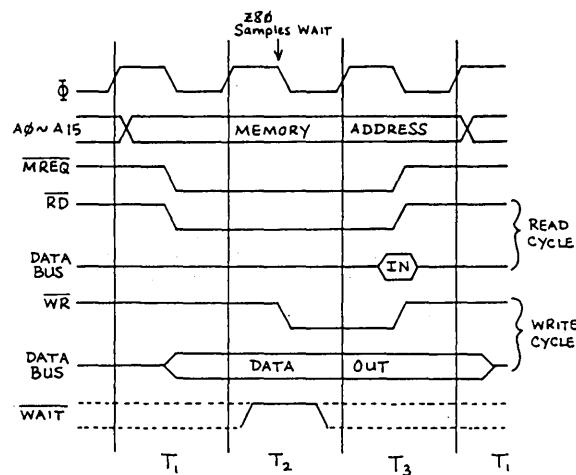
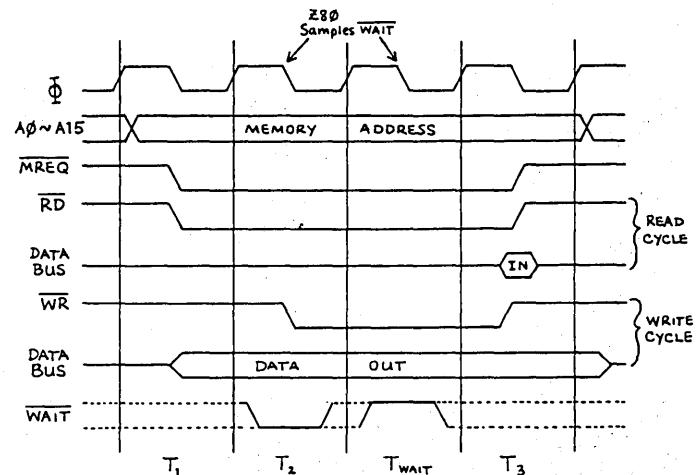


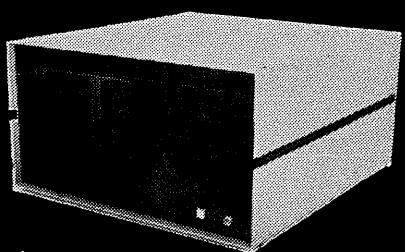
Figure 5 - Memory Timing With Wait States



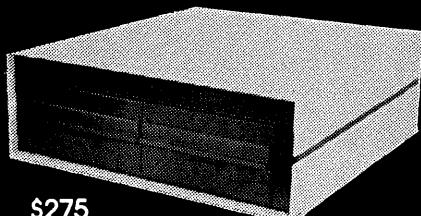
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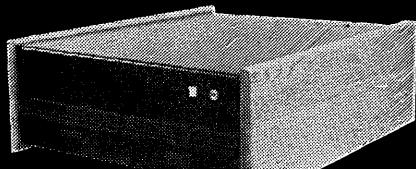
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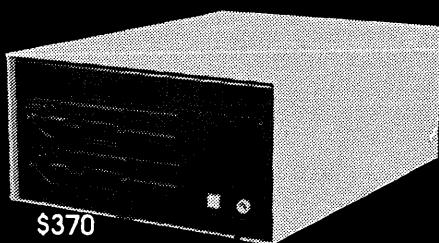
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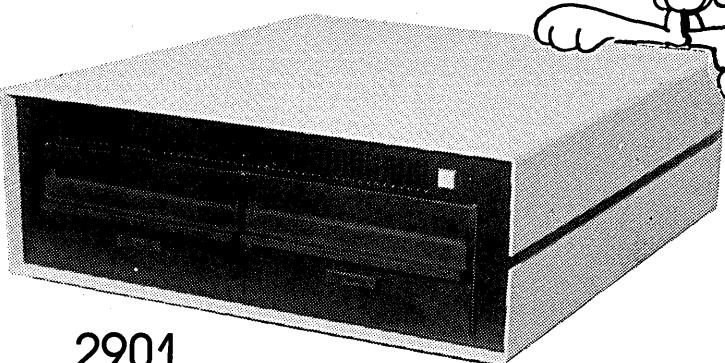
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Bulletin Boards, Getting It Together

By David Thompson

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(cr) ;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>USER 1<cr> ; select user area 1  
A1>  
  
or  
  
A0>USER 7<cr> ; select user area 7  
A7>  
  
or  
  
A7>B:<cr> ; select drive B:  
B7:
```

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>DIR<cr> ; Displays directory

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

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:

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.



Figure 1 - Receiving Files From a Bulletin Board

```
A0>XMODEM S CRC.OBJ<cr> ; ok xmodem, send me CRC.OBJ  
^E ; get into command mode on your own  
R CRC.OBJ<cr> ; modem program  
; tells your own modem program to  
; receive the file
```

When the transfer is complete, enter:

T<cr> ; this puts you back into terminal mode

Figure 2 - Sending Files To a Bulletin Board

```
A0>XMODEM R FIND.COM<cr> ; ok xmodem, you're about to receive FIND.COM  
^E ; back to command mode on your own system  
S FIND.COM<cr> ; tells your own modem program to send FIND.COM  
T<cr> ; get back into terminal mode when finished
```

At the end of the session, you enter:

A0>BYE

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

^E

CPM<cr>

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Pascal Procedures

By John P. Jones

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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)

Figure 1 - Limited Version of Load Routine

```
procedure load_grafix;
var
  routines : array[0..255] of byte absolute $D600;
  code : file;      { Untyped files not supported by JRT Pascal }

begin
  assign (code, 'B:TGRAFIX.COM');
  reset (code);
  blockread (code, routines, 2);

{ blockread is a non-standard procedure for reading data from
untyped files directly into variable area. The syntax is quite
different for Pascal MT/+ and for JRT Pascal you will have to
write your own blockread procedure. Use a file of char reset in
binary mode for JRT. }

  close (code);
end;
```

Figure 2 - General Purpose Version of Load Routine

```
{ In the main program declarations : }

type
  str20 : string[20];
var
  routines : array [0..size] of byte; {should be multiple of 128}
  fname : str20;

{ now the general purpose routine }
procedure load_binary (fname : str20; var where : integer;
                      nrecs : integer);
var
  code : file;
begin
  assign (code,fname);
  reset (code);
  blockread (code, where, nrecs);
  close (code);
end;

{ the calling statement will look like the following }
load_binary (fname, routines[0], (size mod 128) + 1);
```

PASCAL PROCEDURES

(continued from page 15)

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. Initialization 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

Figure 3 - Example of Overlay

```
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 00 04 10 ...s....ELBAIRAV...

G F E D C B A

Figure 5 - Running Turbo Program under ZSID

```
>zsid turbo.com
ZSID VERS 1.4
NEXT PC END
7800 0100 B7FF
#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

*81A3 ;next breakpoint reached
.
.
etc.
```

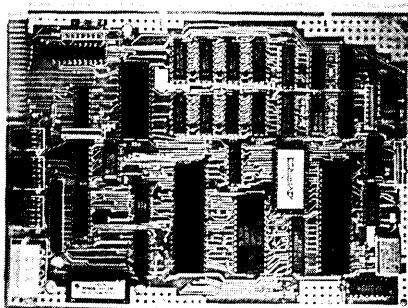
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time you don't know their addresses. The statement, inline (\$FF), places a RST 38H instruction which is used by the debuggers noted above for breakpoints. Since you are running in memory mode, when the breakpoint is reached and you are back in the debugger, you can examine 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 debugger. The entry for (var variable3 : integer) 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 reversed 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 location 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 execute another program with the debug-

ger and Turbo resident, it blew up on return. I guess you can't have everything.

Figure 5 is a sample session to illustrate this technique. I've had fun digging into the guts of Turbo and have been impressed with what I found.

Editor's Note:

Due to a foul-up in the inscrutable editorial department, the "main" portion of issue #18's program was not printed. Figure 6 (in this issue) is the rest of that program.

■ ■ ■

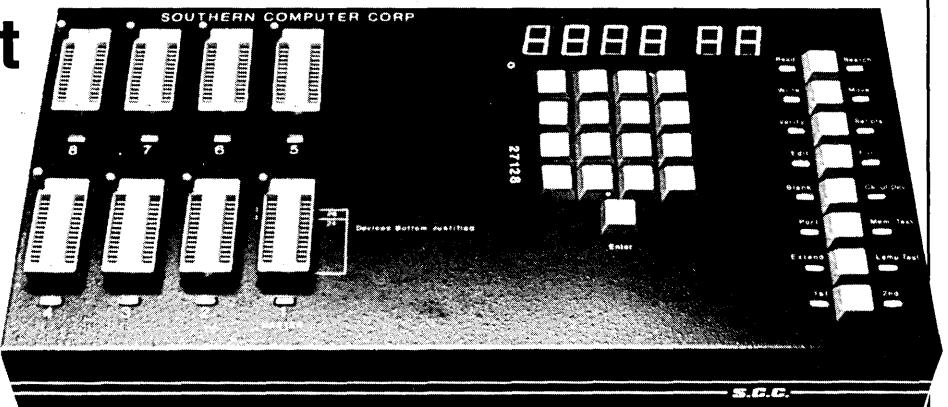
Figure 6 - Main Portion of Program in Issue 18

```
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 uppercase(ch) <> 'Y';
  close(chfile);
end.
```

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Yin and Yang of EPROM Programmers

By David Thompson

Have you ever wanted to have a magazine of your own so you could blow off 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 incalcitrant 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 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. (Boy did they have my number!)

Anyway, I returned the unit, and in a week, it returned. Fixed.

Two weeks later, it died again. It didn't say it had died, for all it indicated, it was still burning ROMs right and left and verifying them just as fast. The only problem was that the data was getting put in the wrong places.

Hearing that I was an editor, they sent along another product they were particularly proud of, a single ROM version of their 8-banger (probably so I would have something to use while I was playing "Who's got the programmer" with their big unit).

I took a close look at it before firing it up. It had four cheap self-tapping screws on the bottom of the cabinet. In fact, the

cheap screw heads had scratched up my desk before I realized the unit was defected. (This is my best shot folks.)

The zero-insertion-force socket came off in my hands (it was simply plugged into a cheap wire-wrap socket), and the RS-232 plug on the back of the unit was male so I couldn't use a standard serial cable. (I looked inside too, and the whole circuit was designed by oversight.) The documentation was 4th generation xerox. (Look, when I'm irritated, I'm irritated.)

After the gang-programmer failed the second time, I called them, and told them I wanted my money back. They said OK and gave me another 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:

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The Kaypro Column

By David Thompson

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 (winchester) 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 each for them.)

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 trou-

ble 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)

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(*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 war-

ranty 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.



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SBASIC Column

By Jack Rodenhi

1317 W. College Ave.
Lompoc CA 93436

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?

Sortid 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 hop-

ing 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 comes 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

Figure 1 - Quicksort in SBASIC

```
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
```

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 .bbb 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 goto" 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

Figure 2 - Quicksort in Turbo Pascal

```
{Quicksort in Pascal}
{$A-}
var a: array[1..100] of char;

procedure sort(bottom,top: integer);
  var lower_ptr, upper_ptr: integer;
    middle_element, temp: char;
  begin lower_ptr := bottom;
    upper_ptr := top;
    middle_element := a[(bottom+top) div 2];
  repeat
    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;
    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
    i := i + 1;
    read(kbd,a[i]);
    writeln(a[i]);
  until a[i] = 'Z';
  sort(1,i);
  writeln;
  j := 0;
  repeat
    j := j + 1;
    writeln(a[j]);
  until j = i
end.
```

(continued on page 61)

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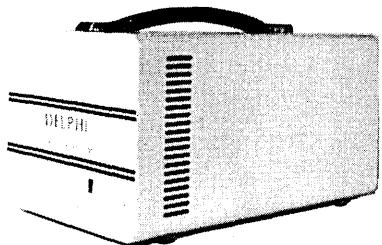
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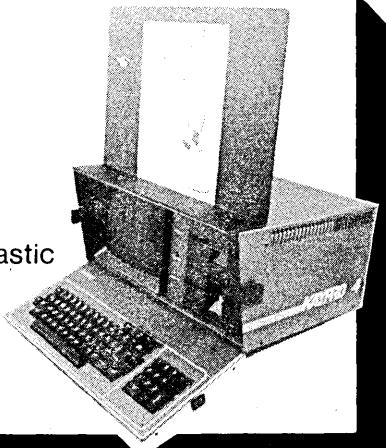
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Track Buffering On the Slicer

By Earl Hinrichs

2543 Marshall Street NE
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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

(continued next page)

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TRACK BUFFERING ON THE SLICER

(continued from page 25)

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 to flush 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).

Figure 1 - BIOS Changes to Speed ERA

1. In WBOOT add 'MOV BUFDPH,0' after 'POP ES'
 2. Replace BHOME with
- ```
BHOME: PUSH ES ;Flush track buffer.
 CALL FLUSHBUF
 CMP CPMDISK,7
 JC BH0
 MOV BUFDPH,0 ;Invalidate buffer for
 BH0: SUB CX,CX ;removable disks.
 CALL SETTRK
 POP ES
 RET
```
3. Remove the 'MOV BUFDPH,0' near the end of FLUSHBUF.

Figure 2 - Upgrades to ASM86

```
A>DDT86
-RASM86.CMD
 START END
XXXX:0000 XXXX:667F
-A180
XXXX:0180 JMPS 193 (Jump around 'USER BREAK' check)
XXXX:0182 .
-S192B
XXXX:192B 3D 20
XXXX:192B 82 .
-WASM86.CMD
-^C
```

Figure 3 - BIOS Changes to Allow Renaming Drives

```
DISKNAME$ DB 0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 (new)
SELDISK:
 SUB CH,CH
 MOV BX,CX
 MOV CL,DISKNAME$[BX] (new)
 MOV BX,CX (new)
```

The above table is set up to do no translation.  
Rearranging the numbers in the first line changes  
disk names. The following table swaps A: and H:

```
DISKNAME$ DB 7,1,2,3,4,5,6,0,8,9,10,11,12,13,14,15
```

### 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
CMDLINE RB 80H

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

CSEG

;Get location of disk name table. Name table is 16
;bytes before SELDISK routine in BIOS. BIOS segment
;is in SS, SELDISK offset is determined by looking
;at the BIOS jump table.
MOV BP,SELDISK + 1
ADD BP,OFFSET SELDISK + 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 CMDLINE
CALL GETNAME
JC REPORT
MOV DL,AL
CALL GETNAME
JC REPORT
MOV DH,AL

;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 DB MESSAGE
 CR,LF,'Original ',0

ORGLP: MOV CX,16
 MOV AL,'Q'
 SUB AL,CL
 MON CONOUT
 LOOP ORGLP

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

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

RETF

;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:
LODSB
OR AL,AL
JZ NONAME
SUB AL,'A'
JC GETNAME
CMP AL,16
JC HAVENAME
SUB AL,'a' - 'A'
JC GETNAME
CMP AL,16
JNC GETNAME

HAVENAME:
NONAME:
CMC
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 I.3x EPROMS are 30EH (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).



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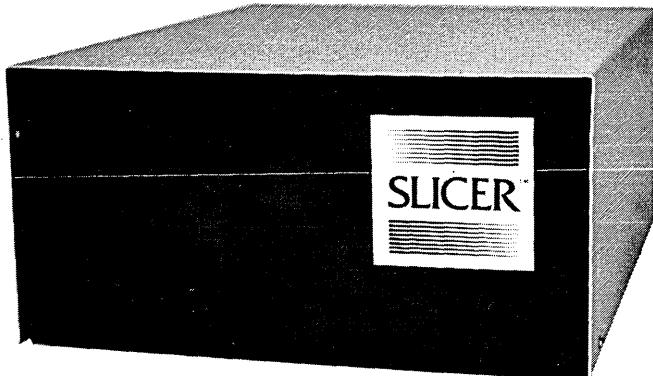
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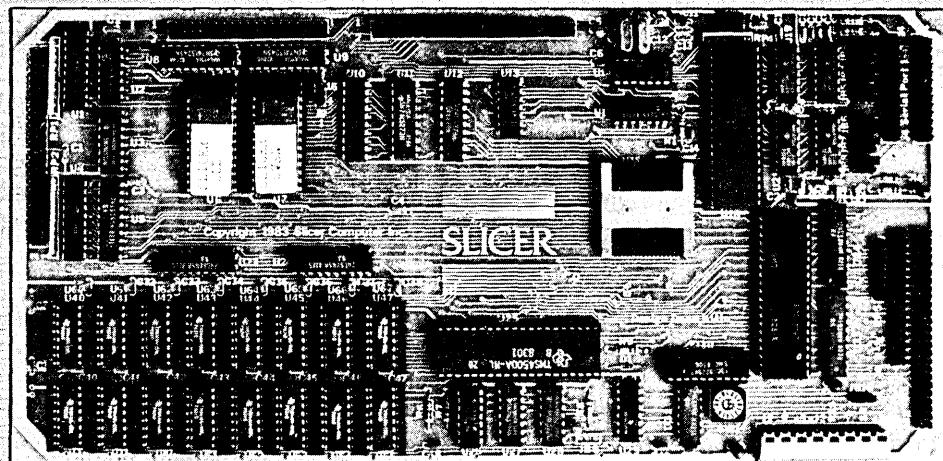


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# C'ing Clearly

By Tony Ozrelic

I got a letter from one Mike Cebula, of Silver Springs MD, the other day. Here is a slightly edited version:

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.

The problem is that it takes a great deal of fumbling around to figure out what is needed to compile a program from the files on the disk. I wrote a simple program in C to print one line on by screen. Eventually I got it to compile, assemble and link with no errors. However, the program ran with no output to my screen and returned me to CP/M.

Then I tried to compile C from the user disk, had no errors, and got a 35k .COM file (the same as the original compiler), but it went to Peoria when I tried to run it. How about using your column to run small-c through a few examples?

Sincerely,  
Mike Cebula

Figure 1 - Sample Small C Code

```
They write: if(condition)
{dothis;dothat;dotheother;}

I write: if(condition) {
 do_this;
 do_that;
 do_the_other;
}
```

Figure 2 - Submit File to Compile C Program

```
C.SUB

; erase the old file to give us a little more room
era $1.com
; now compile $1.c
smc $1.c >$1.asm
; assemble the.$1.asm file into a $1.hex file
b:asm $1.aaz
; erase the .asm file - we don't need it any more
era $1.asm
; turn the .hex file into an executable .com file
load $1
; and get rid of the .hex file
era $1.hex
```

Dear Mike,

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\* \* 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-

Figure 3 - Simple Program for Small C

```
HELLO.C

/* hello - a simple c program */

#include <stdioa.h>
#include <iolib.asm>
#include <call.asm>

main()
{
 printf("hello, world\n");
}

/* lib.c -- function library
*/
/* Copyright 1982 J. E. Hendrix
*/
#define NOCCARGC /* don't pass arg count to functions */
/* called by these functions */
#include "abs.c"
#include " dtoi.c"
#include " itod.c"
#include " itou.c"
#include " itox.c"
#include " left.c"
#include " out.c"
#include " printf.c"
#include " sign.c"
#include " strcmp.c"
#include " utoi.c"
#include " xtoi.c"
```

---

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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 directions (if all else fails..). I then used the submit file C.SUB to compile the file.

### 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 it 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 that 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.



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# FORTHwords

By Arne A. Henden

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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 NSC800 (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-

```
SCREEN #1
0 (Various schemes to encode BCD numbers)
1 2VARIABLE SUM (temporary summing variable)
2 : BCD1 (n1 - n6 --- d1 ...encode 6 digits)
3 1000 * 100 U# SUM 2! 10000 U# SUM 2@ D+ SUM 2!
4 1000 U# SUM 2@ D+ SUM 2! 100 U# SUM 2@ D+ SUM 2!
5 10 U# SUM 2@ D+ SUM 2! S->D SUM 2@ D+ ;
6 : BCD2 (n1 - n6 --- d1 ...another method)
7 1000 * 100 U# ROT 10000 U# D+ ROT 1000 U# D+
8 ROT 100 U# D+ ROT 10 U# D+ ROT S->D D+ ;
9 : D10* (d1 --- d2 ...where d2=d1*10)
10 2DUP 2DUP D+ 2DUP D+ 2DUP D+ ;
11 : BCD3 (n1 - n6 --- d1 ...yet another!)
12 S->D D10* ROT S->D D+ D10* ROT S->D D+ D10*
13 ROT S->D D+ D10* ROT S->D D+ D10* ROT S->D D+ ;
14 -->
15

SCREEN #2
0 (Continuation of BCD conversions)
1 : TRIO (n1 n2 n3 --- n4 ...add 3 digits together)
2 100 * SWAP 10 * + +
3 : BCD4 (n1 - n6 --- d1 ...final version)
4 TRIO >R TRIO S->D R> 1000 U# D+ ;
5 : TRIO2 (n1 n2 n3 --- n4 ...10* version)
6 10 * + 10 * + ;
7 CODE 10* (UNIFORTH Z80 version of integer mult x 10)
8 HL POP, (fetch the number to multiply)
9 H D LD, (make copy)
10 L E LD,
11 HL HL ADD, (multiply by 2)
12 HL HL ADD, (multiply by 4)
13 DE HL ADD, (multiply by 5)
14 HL HL ADD, (multiply by 10)
15 HPUSH, END-CODE (push value back to tos b4 end)
```

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 SP!, which replaces the stack pointer with its initial coldstart value, thereby performing a stack clear.

Then I looked at the 83 Standard. SP! is not a standard word, nor is S0, the us-

*Figure 1 - Brute Force Stack Clear Routine*

```
: CLRSTK (--- clear the stack)
DEPTH DUP IF 0 DO DROP LOOP ELSE DROP THEN ;
```

er 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!



# Xerox 820 Column

By Mitch Mlinar

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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 1810 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 DDSYSGEN (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 DDSYSGEN.

1) Load in DDSYSGEN under DDT and execute:

```
d>DDT DDSYSGEN.COM
-G,387
```

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

2) Examine locations 3007H through 3080H; these are your autoboot com-

mand 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, solder, a 100k 1/4 Watt or 1/8 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 double 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

Figure 1 - 820 Autoboot Patch

1) Load in DDSYSGEN under DDT and fetch the system tracks:

```
d>DDT DDSYSGEN.COM
-G,387
```

2) Examine locations around 1AB0 for a JMP D400 command.

```
-L1AB0
```

```
1AB0 ...
...
1AB7 JMP D400
```

3) Check that space is free in BIOS beyond 1FEFH.

```
-L1FEE
```

```
1FEE NOP
1FEF NOP
...
NOPs should occur up through 1FFFH.
```

4) Add the following code:

```
-A1AB7 (or wherever the JMP
D400 occurred)
```

```
1AB7 JMP EFEE
1ABA .
```

```
-A1FEE
```

```
1FEE LDA 4
1FF1 MOV C,A
1FF2 LXI H,EFFF
1FF5 MOV A,M
1FF6 MOV M,L
1FF7 ORA A
1FF8 JNZ D403
1FFB MOV C,A
1FFC JMP D400
1FFF NOP
2000 .
```

5) Continue execution of DDSYSGEN and store the new system tracks.

```
-G6DB,6F3 (This calculates new
checkbytes for the
SWP loader.)
```

```
-G100
```

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!

Figure 2 - Yet Another Drive Power Controller

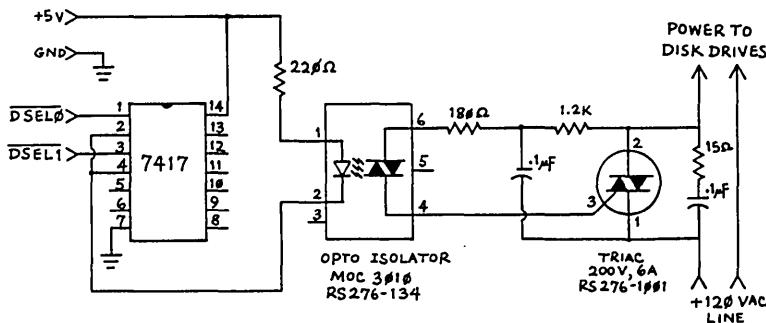
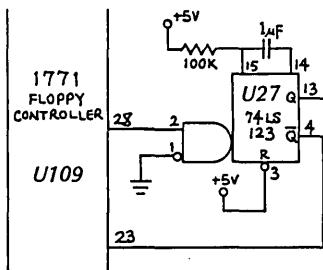


Figure 3 - Floppy Delay Circuit for 820



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 5 $\frac{1}{4}$  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.

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 intact, 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 5 $\frac{1}{4}$  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 incorporated into the monitor. Although not very accurate, it is adequate for most systems for a period of a day (accuracy depends 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 FFD7 is set to zero which disables 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 calendar 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 monitor. 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.



# 4Mhz For The 820-I

By Jim Mayhugh

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Erial NJ 08081  
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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    |
|          | U10-4      to U12-9      B side    |
|          | U11-3      to U71-1      B side    |
|          | U11-4      to U25-11      B side   |
| REMOVE:  | U12 (74LS290)<br>Y2 20 Mhz Crystal |
| INSTALL: | Y2 16 Mhz crystal                  |

## Additional Mods

The following modifications require the addition of a 74LS08 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 74LS08 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 2

|       |                       |
|-------|-----------------------|
| CUTS: | U62-14      B side    |
|       | U62-15      B side    |
|       | U63-18      A side    |
|       | U64-18      A side    |
| ADDS: | U62-14      to U34B-1 |
|       | U62-15      to U34B-2 |
|       | U64-18      to U34B-3 |
|       | U62-13      to U34B-4 |
|       | U62-12      to U34B-5 |
|       | U63-18      to U34B-6 |

I often leave my computer unattended while it is doing a lengthy assembly or print operation. Since there is no easy way to control the intensity of my CRT, I was concerned that I might burn the CRT screen if I there were no screen activity for a long time.

So I added the video on/off control and timer to turn off my display if there was no keyboard or display activity for more than about 4 minutes.

Basically, I just inserted an AND gate between the blink logic of the CRT display and toggle one input with a spare output from the PIO that controls the keyboard. Since I am using eight inch drives, I had no need for the 5 inch drive controls on the PIO. I selected PA5 as my video toggle and made the changes shown in figure 3.

Figure 3

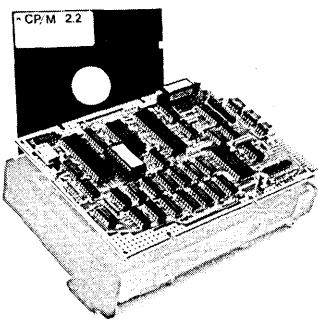
|       |                        |
|-------|------------------------|
| CUTS: | J1-3      B side       |
|       | U45-1      B side      |
|       | U16-8      A side      |
| ADDS: | U45-1      to U34B-8   |
|       | U16-8      to U34B-9   |
|       | U105-9      to U34B-10 |

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.

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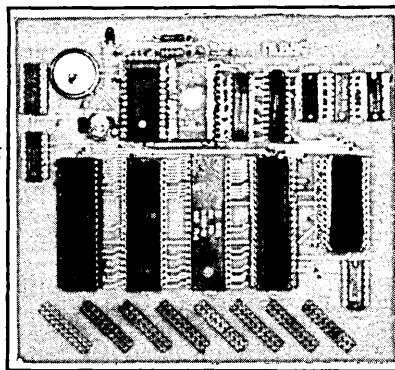
## XEROX 820

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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 4

| LOCATION | CHANGE TO |
|----------|-----------|
| F101     | A8        |
| F6E4     | FA        |



Figure 5 - 4 MHz Upgrade for 820

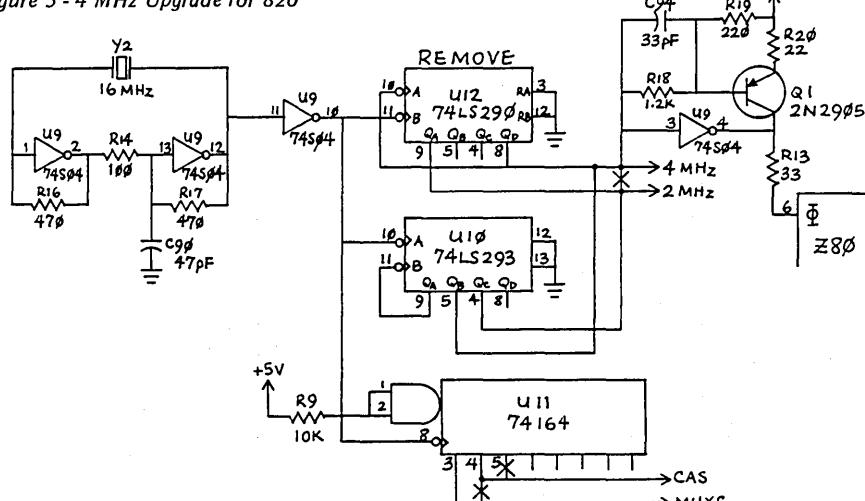
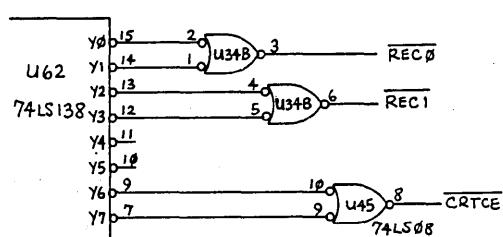
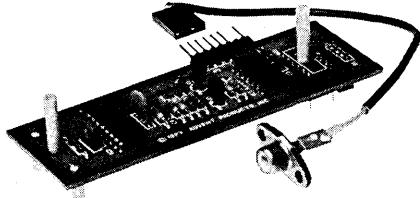


Figure 6 - 2732 Chip Enable Circuit



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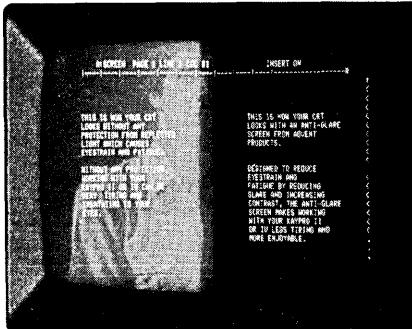
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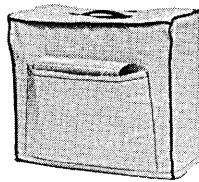
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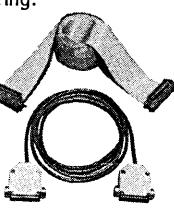
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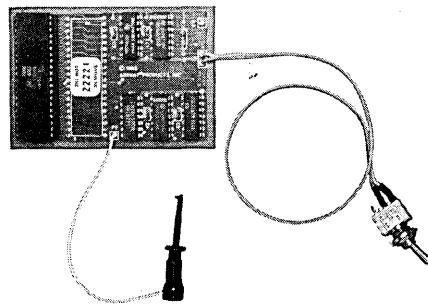
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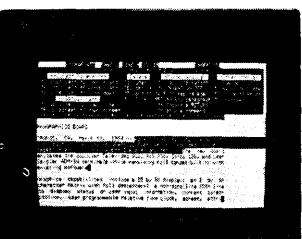
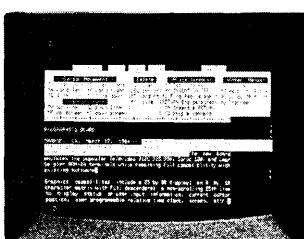
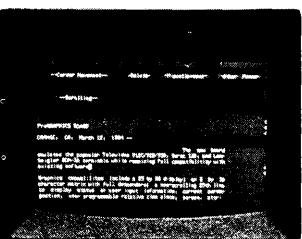
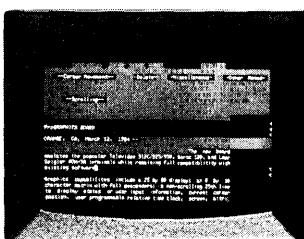
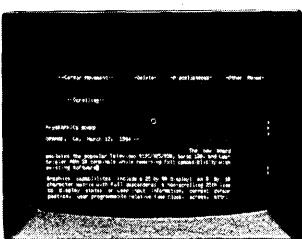
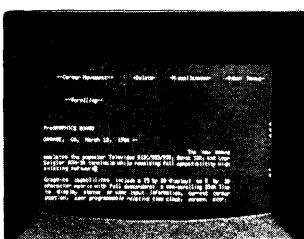
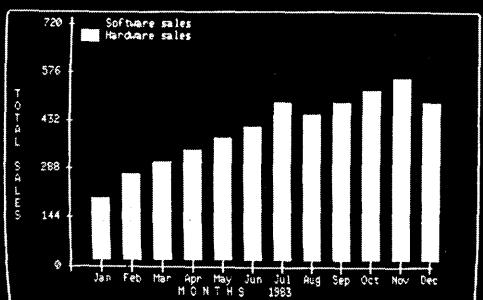
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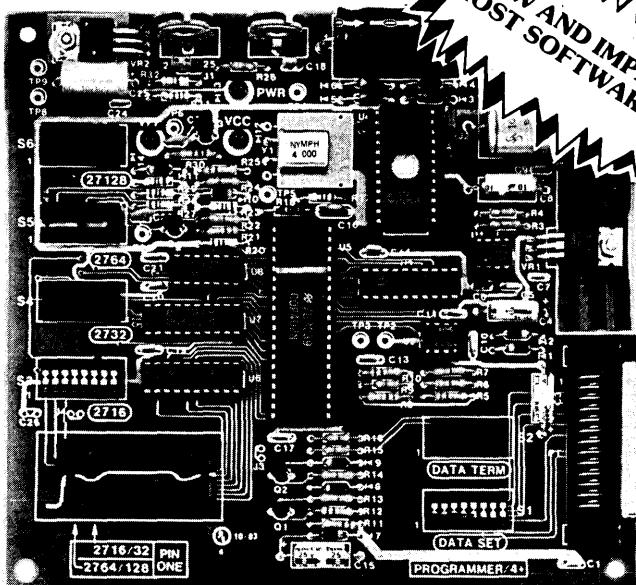
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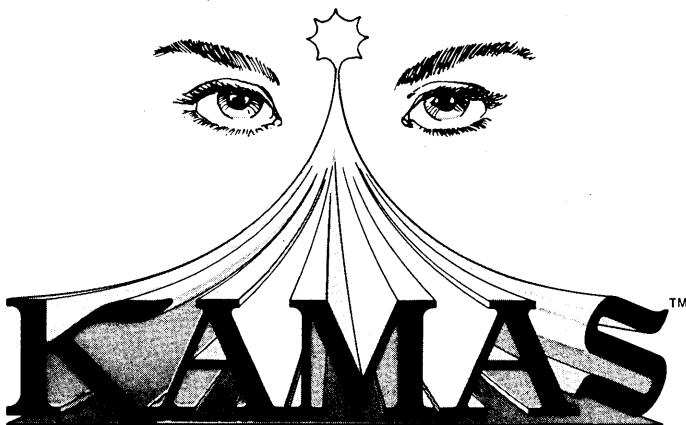
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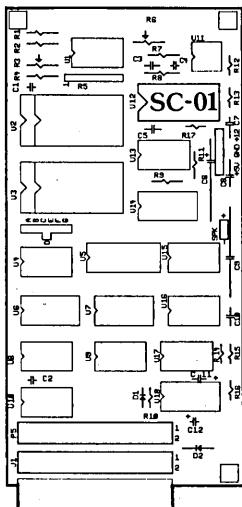
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# EZ Prommer For The BB-I and 820

Review By Jay C. Jaeckel

418 Kings Way  
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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 SYLVANIA G8T5 germicidal fluorescent tube (12") with a suitable fixture for about \$30.00 that seems to erase EPROMS very nicely in about 6-10 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.

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# LETTERS

## MASTERING CP/M

Review by Bob Ghormley,  
K0BV

5800 Jones PI NW  
Albuquerque NM 87120

(continued from page 3)

Dear Editor,

Turbo Pascal is great! As an "old" engineer who has written programs mostly in BASIC it is refreshing to be able to write programs that can "grow" and not become MONSTERS. It's fast even at 2.5MHz. Not like some "Sick" BASICs I've known.

P.S. To hell with BYTE. I did let that subscription expire. Keep up the good work and maintain your integrity! It's nice to have a magazine that's more than a mouth full of marshmallows.

Tarno Coleman  
1293 31st Ct NW  
Salem OR 97304

Dear Editor,

I bought my Kaypro to fight the state. If the Governor, Attorney General, and the Board of Pharmacy disappear you'll know my Kaypro got them.

Frank Nichols  
5246 SE 62  
Portland OR 97206

Dear Editor,

I have satisfactorily installed the 5 MHz speedup and am in the process of finding which of my programs will work at the faster speed. Perfect Writer seems to work all right, but PluPerfect writer doesn't. All is well until it begins swapping, then it goes bananas.

I thought it would be interesting to try the benchmark programs used in the April issue of BYTE to compare the Rainbow 100 to the Victor 9000 and the IBM PC. See Figure 1 for the results.

Michael R. Fenn  
PO Box 23555-167  
San Diego CA 92123

Figure 1 - Benchmark Times

| Benchmark         | IBM PC | KPRO<br>2.5 MHz | KPRO<br>5 MHz |
|-------------------|--------|-----------------|---------------|
| Empty do-loop     | 6.4    | 9.6             | 4.9           |
| Division          | 23.8   | 38.1            | 19.3          |
| Subroutine jump   | 12.4   | 15.5            | 7.9           |
| MID\$(substring), | 23.0   | 28.3            | 14.3          |
| Prime number      | 190.0  | 197.6           | 98.9          |
| Disk-write        | 32.0   | 42.8            | 32.7          |
| Disk-read         | 22.9   | 37.9            | 14.7          |

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 PFM-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. (Incidentally, 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.

Dear Editor,

Now that I'm finally subscribing, I thought I could include a few bits of helpful info on the BB-I.

For a custom cursor, change location FF76h to the desired character code. Set bit 7 if you want it to blink (A C1h will give a blinking A). The video mod in #14 works great and the 3.5MHz mod per issue #4 gives a noticeable 40% improvement.

I have interfaced a Promblaster to the BB and will burn proms via modem link for interested parties. I am now looking for cheap 64K DRAMs for my Dyna Disk and a reasonably priced Dbase type program, any suggestions?

Scott Burton  
544 Walnut  
San Carlos CA 94070

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

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

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

#### X-8 ROM PACKAGE

5 MHZ 2732 ROM; 5 1/4" 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 SSDD, 40 TRACK, 5 1/4"
- KAYPRO 4 - 360K ON DSDD, 40 TRACK, 5 1/4"
- KAYPRO 8 - 784K ON DSDD, 80 TRACK, 5 1/4"
- 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 5 1/4" 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 5 1/4" DRIVES
- COMPOSITE VIDEO ADAPTOR ON BOARD

#### PRICING

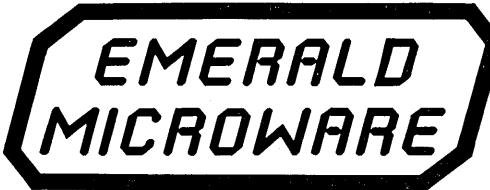
|                                          |          |
|------------------------------------------|----------|
| - X-8 ROM PACKAGE .....                  | \$ 49.95 |
| - X120 BARE BOARD WITH DOCUMENTATION ..  | \$ 26.00 |
| - X120 BOARD A&T WITH DOCUMENTATION ..   | \$140.00 |
| - X-8 ROM PACKAGE AND 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.



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# Micro Cornucopia

## KAYPRO USERS DISKS for KayPro II, 4 and 10

\$12<sup>00</sup> 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:** Menu selection of baud rate, bits/character, stop bits, & parity for serial port.

**MODEM7.COM:** Very popular MODEM 7 configured for KayPro.

**MODEM7+.COM:** This is MODEM7 & MODEMPAT 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 configure it for any interface.

**SQ/USQ.COM:** Programs to squeeze and unsqueeze 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.

**ZESOURCE.COM:** A true Zilog format disassembler for 8080 and Z80 object(.COM) files. 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.

**FINDBD54.COM:** Checks an entire disk, reports bad sectors, and then creates a special file containing those sectors. You save a bundle on disks.

**CAT2:** This a group of programs which create and maintain a single directory of all the programs you have on all your disks. Even keeps track of which programs are backed up and which aren't.

**UNSPPOOL.COM:** Use your KayPro II and print files at the same time. Doesn't slow down system response!

**DUMPX, DU-77, COMPARE, SUPERSUB, FORMFEED, DIR-DUMP, . . .** and all have documentation on disk.

### KayPro Disk K3 Games

**PACMAN.COM:** Despite the KayPro's lack of graphics, this one looks and plays amazingly like the real thing! Keep it hidden.

**ZCHESS.COM:** Chess with a 1-6 level look ahead.

**OTHELLO.COM:** You learn it in minutes, master it in years.

**BIO.COM:** Generates custom graphic biorhythm.

**MM.COM:** Master Mind.

**WUMPUS.COM:** Classic wumpus hunting.

### KayPro Disk K4 Adventure

This disk contains one 191K game, Adventure. **ADV.COM:** This is the latest, greatest, most cussed adventure ever devised by half-mortals. This is the 550-point version so the cave is greatly expanded and the creatures are much smarter.

### KayPro Disk K5 MX-80 Graphics

A complete Epson MX-80 printer graphics package including example files. (Same as K19.)

### KayPro Disk K6 Word Processing Utilities

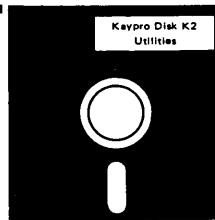
A powerful line oriented text editor that looks like Unix's EX, plus a scad of text utilities written in C which handles pretty printing, shortening a file, multiple space output, add tabs, remove trailing whitespace, and more. Also includes ROFF.COM a very neat text formatter.

### KayPro Disk K7 Small C Version 2 Compiler

This is a greatly extended version of Ron Cain's Small C compiler. Version 2 has more expressions and larger library, true subset of Unix C. Disk contains compiler, documentation, and library—everything you need.

### KayPro Disk K8 Small C Version 2 Source

This disk contains the source (written in Small C) of the Small C version 2 compiler. Get K8 if you want to try extending the compiler. (You must have K7.)



### KayPro Disk K9 ZPCR

**ZPCR:** The big news on this disk is the self-installing version ZPCR available only from Micro C. Once you have ZPCR in your CP/M, you'll never go back to straight CP/M! For instance, ZPCR searches drive A for any program not found on drive B, so, even an empty disk in drive B appears to contain every program on A. It's great for text editors, compilers, etc. Works on KayPro II and 4.

**EX14:** a super replacement for SUBMIT. Plus many more: TREK, FIX, FIND, SNOOPY ALIENS and DIF2.

### KayPro Disk K10 Assemblers

We've received a lot of requests for a Z80 assembler. So Dana put in some long hours getting the Crowe Z80 assembler to run on the KayPro (and every other Z80 machine).

**CROWECPM:** This is a first class Z80 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.

**PRINTPRN:** 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 which projects. Includes source and excellent example check files. Very powerful.

**LIBR:** This is a complete set of library routines which let you 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 again. Almost like a unix environment.

**DISPLAY, VLIST, PGLST:** Additional screen and print utilities.

### 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 8080 assembler! The editor even uses the cursor control keys.

**FORTH:** This is true fig-FORTH.

**KFORTH:** 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 is the disk for you if you have a Smartmodem compatible modem.

**SMODEMK:** Smartmodem program set up for the KayPro (and source).

**XMODEM:** Lets you remotely control your KayPro from a distant computer.

**KAYTERM:** This is the information you need to run or write modem software on the KayPro.

The following are full disks of software assembled for the KayPro. Each program has a .DOC (documentation) file and many come with source.

### KayPro Disk K15 Hard Disk Utilities

This disk is for the KayPro 10 or any KayPro with a Winchester drive. With these routines you can not only backup files (with printed directories of the backup disks), you can also break up large files. The backed-up files are not 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 Z80 Tools

This is for those of you who are into Z80 assembly language.

**XLATE.COM:** A very good 8080 to Z80 translation routine.

**DASM.COM:** An easier to use version of ZZ-SOURCE (the Z80 disassembler). This full disk includes source and documentation for both routines.

### KayPro Disk K18 System Diagnostics

Just as we finished editing 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 versions. (Plus, it's only \$12!) Setup for KayPro II and 4.

### KayPro Disk K19 Prowriter Graphics

This is a complete Prowriter printer graphics package written by the same Micro C subscriber who wrote the MX-80 graphics package. Plot points, lines, circles, boxes, and more. Examples, documentation.

### KayPro Disk K20 Color Graphics Routines

**PACMAN.COM:** This is a deluxe version of pacman 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 ZPCR (Again)

This disk is filled with ZPCR files. You get ZPCR for the Kaypro II, Kaypro 4, and the Kaypro 10. This version is fixed so that you can pass control characters (such as cntl-P) to the system and you can choose to have it recognize the semi-colon for drive select (as well as the colon). So you can enter "B;" or "B:" to select drive B. Super neat!

**ZPCR:** for those of you who don't know, makes CP/M a lot friendlier. It searches drive A for any COM file it doesn't find on the current drive, the TYPE command scrolls text 24 lines at a time, and a new LIST command outputs a file to the printer.

### KayPro Disk K23

#### Fast Terminal Software & New BYE

This disk contains interrupt-driven 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 dropping a single 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!

## 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 EPROM 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 WLAKUG.

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 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

|                                  |         |
|----------------------------------|---------|
| Kaypro II & 4 (pre-84) .....     | \$20.00 |
| Kaypro 10 (pre-84) .....         | \$20.00 |
| Kaypro 84 series (II,4,10) ..... | \$20.00 |

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 \$4995!

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 5 1/4" 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 \$3995

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

## Micro Cornucopia



P.O. Box 223  
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 86-1 — Disk Utilities

**D.CMD/A86,** **SD.CMD/A86,** **XDIR.CMD/A86:** Three extended directory programs. Each does it differently, so we included all three.

**FILE-EXT.CMD/A86:** Disk status program with good display format.

**PAGE.CMD/A86:** A text paging program. Displays 24 lines at a time.

**PRINT.CMD/A86:** File printing routine. Puts a header at the top of each page along with page number and file name.

**MUCHTEXT.CMD/A86:** Counts words and lines in a text file.

**ERQ.CMD/A86:** Selective file erase program. Displays all selected files and then asks you one at a time for a Y/N.

**INUSE.CMD/A86:** Prints "In Use" on your terminal and asks for a password. It will not release the console until you enter the password.

**FINDBAD.CMD/A86:** Finds and collects bad sectors on a disk. If there are no bad sectors, information on the disk is unaltered.

### Disk 86-2 — DU and Modem Programs

**DU-V75.CMD/A86/DOC:** This is the popular disk utility from CP/M 80. It lets you read, write, and modify disk sectors.

**MODEM4.CMD/A86:** This is a modem program set up for the Slicer. This program includes a built-in help file.

**MODEM7SL.CMD/A86/DOC:** No modem disk would be complete without this standard. This is modem7 set up for the Slicer. It displays a menu when it is called.

### Disk 86-3 — Small C

**C86.CMD:** This is the original Small C compiler which appeared in Dr Dobbs Journal in 1980. It runs under CPM-86 and generates 8086 source for the ASM86 assembler.

**C86.COM:** This is the C86 compiler which runs under CPM-80. This 8080 program produces 8086 assembly language.

**C86LIB.A86:** This is the C86 I/O library.

**SMALLC86.DOC:** Documentation on Small C. **C????.C:** 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 .COM files setup 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 BB1 .....** \$29.95  
**Deluxe Character ROM BB1 .....** \$29.95

### BB II DRIVE INTERFACE

For 5 1/4" and 8" 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 "i" 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 II

1. This ROM is a fast part so you can run 4 or 5 MHz with your Kaypro II.
2. It gives you a non-blinking block cursor (much less irritating), though you can specify a standard blinking underline if you prefer it.
3. It does faster disk accesses (even if you don't speed up your system).
4. It throws away null characters (those little asterisks that sometimes garble the screen during data communications).
5. 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 4 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 tpi, 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 as well as commas and semi-colons that were hard to tell from periods and colons. On the newer systems (manufactured since Sept 83) half of the characters (notably the g) have been improved, but they haven't gone all the way.

Also, many of the older character ROMs were poor quality parts so they generated snow as information scrolled up the screen. This white flecky 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 4 & Pro-Character) .....         | 55.00 |
| Pro-Set 8 (Pro-Monitor 8 package & Pro-Character) ..... | 70.00 |

## Micro Cornucopia



P.O. Box 223  
Bend, OR 97709  
503-382-8048  
9-5 Pacific Time  
Monday-Friday

# From Micro Cornucopia

## BB I, BB II, and XEROX 820 USERS DISKS

The following are full 8" disks of software. Each program has a .DOC (documentation) file and many come with source.

### USERS DISK #1

- 1-Two fast disk copiers
- 4-Two disk formatters
- 2-The manual for Small C+ 5-Modem 7
- 3-Crowe Z80 Assembler
- 6-Othello
- 7-Serial print routine-Port B

### USERS DISK #2

- 1-Two single disk drive copy programs, both with source
- 2-Crowe Z80 Assembler source
- 3-New Crowe.COM file, debugged version
- 4-New CBIOS with parallel print driver & other extensions for CP/M 1.4 & 2.2
- 5-Disk mapper with source

### USERS DISK #3

- 1-EPROM burning software for BB 1
- 2-Reset bit 7 (unWordStar a file)
- 3-Disk file CRC checker
- 4-New fast copy program & source
- 5-DU77, disk inspector/editor
- 6-FINDBAD, isolated bad disk sectors
- 7-Print fancy page headings

### USERS DISK #4

- 1-CBIOS, custom bios for Tandon drives
- 2-ZCPR, dynamite CCP checks drive A for missing .COM files; improved commands
- 3-ZCPRLBLOC, identifies CCP location

### USERS DISK #5

- 1-CAT, disk cataloging routines
- 2-Modem 7 for Port A
- 3-Modem 7 for Port B
- 4-PACMAN, the arcade game
- 5-FAST, buffers the disk to speed up assemblies
- 6-NOLOCK, removes BB 1 shift lock
- 7-VERIFY, cleanup & verify a flaky disk
- 8-DUMPC, enhanced for BB 1
- 9-UNLOAD, create .HEX file from .COM file

### USERS DISK #6

- 1-REZ, 8080/Z80 disassembler, TDL mnemonics
- 2-PRINTPRN, prints Crowe listings
- 3-RUNPAC, run-time utility package for 8080 assembly language programs. Has 51 functions. Includes source which assembles under ASM.

### USERS DISK #7

- 1-CHNGPFM, PFM monitor mods
- 2-TERM, terminal routines let you set up BB as simple terminal, as a file receiver, or as a file sender
- 3-Checkbook balancing package
- 4-Disk Utilities - copy to memory, from memory, and dump.

### USERS DISK #8

- 1-BDSCIO, custom BDSC I/O for BB 1 (both .h and .c)
- 2-YAM, Yet Another Modem program in source & .COM form. Turns BB into paging intelligent terminal, complete with printer interface, baud rates to 9600.
- 3-ROFF, text formatter
- 4-SIGNS, prints large block letters

### USERS DISK #9

- 1-ADVENTURE, expanded 550 pt version
- 2-Keyboard translation program
- 3-CBIOS, serial & parallel printer interface
- 4-EPROM programming package for BBII, for 2732s only

### USERS DISK #10 - Lots of Disk Utilities

- 1-REBOOT, sets up the CP/M auto load
- 2-SWEEP, directory/file transfer routine
- 3-A, Lets BB I recognize a double sided drive as one drive with 494K of usable space
- 4-FIX, super disk utility, does everything, much easier to use than DU77
- 5-Compare files routine
- 6-UNERA, retrieve erased files
- 7-FIND, check all drives on system for a file
- 8-MENU, menu program for CP/M
- 9-NEWCAT, enhanced disk catalog program
- 10-Single drive copy program that does track by track copies rather than file by file

### USERS DISK #11 - Printer Utilities

- 1-Microline 92 printer routine
- 2-Graphics display package for MX-80 with Graftrax, very fancy
- 3-Epson MX80 setup for BB 1 with 59.5K CP/M
- 4-Epson MX8 setup for any CP/M, lets you set print modes.
- 5-Micro Tek print driver, Ports A & B

### USERS DISK #12 - Games for BB I

- 1-ALIENS, a fast, exciting arcade game
- 2-ZCHESS, chess with a 1-6 level look ahead
- 3-MASTERMIND, match wits with the computer
- 4-BIO, Biorhythm charts complete with graphics on the BB I
- 5-LIFE, so fast it's real animation!
- 6-CRAPS, see how much you'd lose in Vegas
- 7-WUMPUS, a caver's delight, kill the Wumpus or be killed
- 8-PRESSUP, similar to Othello
- 9-GAMES, 7 games in one program, includes blackjack, maze and animal

### USERS DISK #13 - General Utilities, BB 1

- 1-ZZSOURCE, disassembles to real Zilog mnemonics
- 2-EX14, superset of submit or supersub
- 3-MOVPATCH, lets you use MOVECPM on other copies of CP/M
- 4-XMON, 3K expanded BB I monitor, use in ROM or as overlay .
- 5-CURSOR, prompts you for cursor char you want
- 6-UMPIRE, very fancy RAM test
- 7-ZSIDFIX, display improvement for ZSID
- 8-PIPPAT, modify PIP so you can reset system from within PIP
- 9-@, Lets you use the BB as a calculator, including HEX
- 10-SORT, sort package written in C80.

### USERS DISK #14 - BB II Software

- 1-PRO32, latest 2732 reader & programmer
- 2-SMODEM2, lets BB II talk to Hayes Smartmodem
- 3-GRAFDEMO, demonstrates BB II graphics (in BASIC)
- 4-ATTRTEST, demonstrates BB II graphics (in JRT Pascal)
- 5-INITSIO, initializes port B for 300 or 1200 baud
- 6-MENU, displays menu of .COM files, enter number to run file
- 7-SETCLK, sets realtime clock built into BB II
- 8-PRINT2, modified print which accesses BB II clock
- 9-BOX, draws a thin line box on screen determined by HL and BC
- 10-ALIENS, space invaders arcade game
- 11-LISTSET, printer interface, auto-enables RTS, ignores DCD.

### USERS DISK #15 - Word Processing

- 1-EDIT, very fancy line editor similar to EX (Unix). Includes help menu, programmable key, and full manual on disk.
- 2-TED, simple minded line editor, easy to learn & use. Very fast.

### 3-TTYPE, typing training program written in BASIC

- 4-TINYPLAN, very simple-minded spreadsheet. Whets your appetite for a fancy one.

### 5-C80 Text Utilities

- 6-CHOP, cuts off file after N bytes
- 7-ENTAB, replace spaces with tabs where possible
- 8-MS, double or triple spaces a file to output
- 9-RTW, removes trailing spaces from file
- 10-TRUNC, truncates each line to specified length
- 11-WRAP, wraps at column 80, plus pretty printing, page #s ...

### USERS DISK #16 - BB I Modem Software

- 1-RCPM27, list of U.S. bulletin boards
- 2-SMODEM, interfaces BB I with Hayes Smartmodem
- 3-PLINK66, easy to use with non-CP/M host, for port A
- 4-BBPAT, menu selection of BAUD rate, bits/char, parity, & stop bits
- 5-MODEM 7+, Modem 7 plus BBPAT, lets you talk to anything from port A

### USERS DISK #17 - Small C version 2

SMALLC2, this substantially expanded version of Small C now includes for, goto, label, switch (case); external declarations; new preprocessor commands; expanded I/O includes redirection, initializers; plus 12 new expressions. The I/O and runtime libraries have been greatly expanded (including printf). Source & documentation on one full disk.

### USERS DISK #18 - FORTH

IFORTH, this is Idaho FORTH which can be burned into ROM or loaded from disk. It replaces the PFM monitor & handles all the monitor functions. See issue #11 FORTH column for more info about IFORTH and this disk.

### USERS DISK #19 - BB I Double Density

New BB I monitor, BIOS, character ROM, Winchester Interface, ZCPR, and formatter from Trevor Marshall. See BB I expansion article in Issue #11.

### USERS DISK #20 - Assemblers

CROWEASM: This is the Crowe assembler modified so that it runs on any CP/M system (including the BB I, BB II, Xerox ...). Includes .COM, .280 and .DOC files.

LASM: This assembler is similar to the ASM that comes with CP/M except that it can link files at assembly time.

PRINTPRN: Print routine for CROWEASM.PRN files.

LIBRARY: Utilities which let you combine many files into one, then you can run, type, or extract any file within the larger system.

### USERS DISK #21 - Winchester Utilities

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FLOPCOPY: Lets you make floppy copies (with only one floppy drive) by using the winchester as a buffer.

BIGBURST: Backs up a very large winchester file onto multiple floppies. Joins the copies to recreate the original file.

MULTCOPY: Use this like PIP but it prompts you to change disks. Accepts ambiguous file names.

MDIR: Displays files in all user areas on selected drive. Many features.

MAKE, MOVE: PIP-like utilities that make it easy to move files between user areas.

SWEET: The famous disk cleanup and transfer routine that does just about everything you can do with TYPE, ERA, DIR, and PIP.

UNSQ: This is the latest, greatest file unsqueezer. Enter UNSQ \*.\* and it will check every file on the disk. All squeezed files will be unsqueezed.

## 8" Users Disks

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NEW!

### USERS DISK #22 - Pascal Compiler

This is a real Pascal compiler. It supports only a subset of the language (no records, pointers, booleans, reals or complex) but it generates a real .COM file. Everything is on this disk: the compiler, its source, example programs and documentation.

### NEW! USERS DISK #23 - Xerox Utilities

This disk contains Xerox specific utilities including a screen dump from Wayne Sugai (with source); modifications for the SWP package including ZCPR, a new monitor, and a clock/calendar from Mitch Mlinar; and Jim Mayburgh's new monitor (see issue 19). A very special disk for Xeroxers.

### REMEMBER

FREE Users Disks in exchange  
for submitted software or articles

## HERE COME THE ANDROIDS!

(continued from page 1)

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 tech-tips, 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 religiously separate 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.

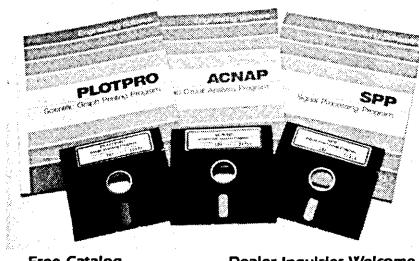
The trade press has been famous for filling its editorial pages with rewrites of public relations handouts and with articles written by the companies the articles are about. Electronic Design and Electronic Design News are two very well known publications which use this technique. (In fact, any publication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

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### 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 is 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

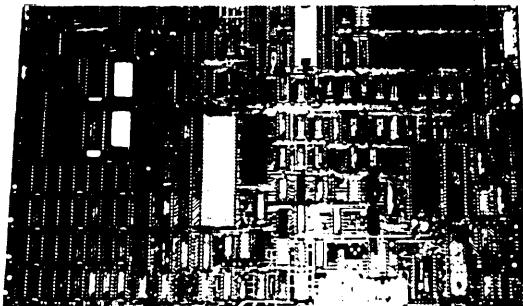
Now, there is this whole new group of publications sprouting forth. Computer publications. We as readers can let computer publications become a trade press or we can force these new publications to adopt the same standards that we expect of news organizations.

Byte seems to be moving toward more



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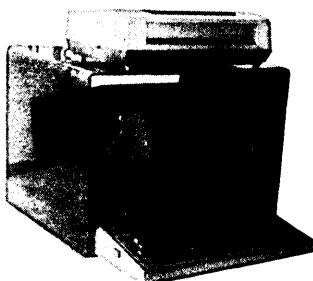
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journalistic standards and away from the hidden ties that it has been accused of recently. (Although it is sometimes impossible to detect hidden connections between free-lance writers and the products they are reviewing.) I heard a rumor that one of 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 computer magazines will cause 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.

### 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, entrepre-

neurs). 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.

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.)

### 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.

I really like the Slicer though we are not yet using the Slicer for much yet because of limited software. In fact, 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 MicroSoft's BASIC. I don't like SuperSoft'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.)

David J. Thompson  
Editor & Publisher



# 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 will be worth less than the paper it's printed on, but through these folks efforts, it could become very valuable.

When members pony up their initial cash (as we discussed last time), they are 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 (a 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 times) that isn't possible. After all, if

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*micragroup*

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, then 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.

- 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).

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

- Once the advertising starts, you

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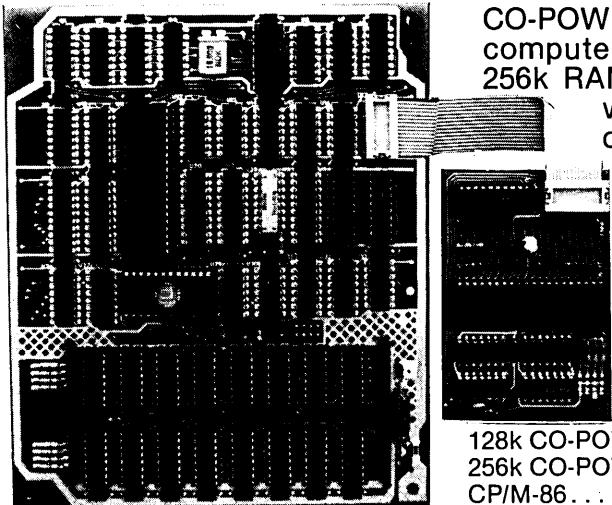
have a new drain on your resources. It's very important to begin shipping products and earning revenue very quickly.

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.



# **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! Currently available for Kaypro, Bigboard, Zorba, Xerox 820-II, Actrix, Osborne, and ATR8000 computers.

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| 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 $\frac{1}{4}$ " 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 $\frac{1}{4}$ " drives. A 50-34 pin disk drive adapter board is included with 5 $\frac{1}{4}$ " disk orders.

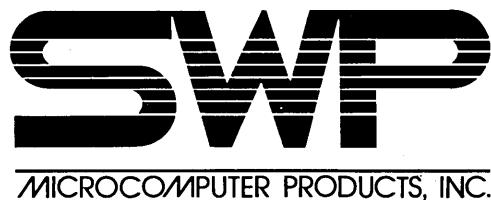
### **Software V#061983**

- 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 $\frac{1}{4}$ " 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 $\frac{1}{4}$ " is 183k.
- Includes DDINIT for SD and DD initializing and DDSYSGEN for DD sysgening.
- 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.



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# BB-I Directory For Micro C

By Victor Dolcourt

763 Silkoak Way  
Sunnyvale CA 94086

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 time spinning my wheels looking for that article (or was it a letter?) on the @#\*\*%\$ fix.



## \*\*\*\* CP/M and PFM \*\*\*\*

|                               |          |
|-------------------------------|----------|
| Shift lock                    | #15, p3  |
| Disk directory                | #13, p4  |
| CBIOS in Intel mnemonics      | #13, p28 |
| Bug in PFM dump               | #11, p3  |
| LST:                          | #10, p4  |
| Relocating CP/M               | #9, p9   |
| Changing CBIOS                | #8, p17  |
| Step rate                     | #8, p25  |
| Cursor change                 | #5, p2   |
| PFM-80                        | #5, p5   |
| PFM-80 errata                 | #5, p5   |
| Standard 60K CP/M CBIOS       | #2, p4   |
| CP/M patch for serial printer | #2, p5   |
| Monitor listing               | #2, p8   |
| Monitor listing               | #1, p10  |

## \*\*\*\* DISK DRIVES & DISK CONTROLLER \*\*\*\*

|                                     |          |
|-------------------------------------|----------|
| SWP dual density                    | #17, p37 |
| Double density                      | #16, p6  |
| 1771 pull up                        | #13, p29 |
| Connector errata (BB documentation) | #13, p28 |
| Double density                      | #11, p4  |
| Shugart jumpers                     | #10, p2  |
| Qume DT-8                           | #8, p8   |
| Step rate                           | #8, p25  |
| Increasing driver current           | #8, p25  |
| Shugart 901                         | #6, p7   |
| Shugart jumpers                     | #2, p6   |

## \*\*\*\* HIGHER SPEED MODIFICATIONS \*\*\*\*

|                         |          |
|-------------------------|----------|
| 6 MHz modification      | #19, p10 |
| Timing loop adjustment  | #14, p2  |
| 5 MHz                   | #11, p4  |
| Easy and reliable 4 MHz | #10, p32 |
| Editorial               | #6, p21  |
| Use of 2716-1           | #4, p2   |
| 3.5 MHz                 | #4, p9   |
| More reliable 4 MHz     | #4, p9   |
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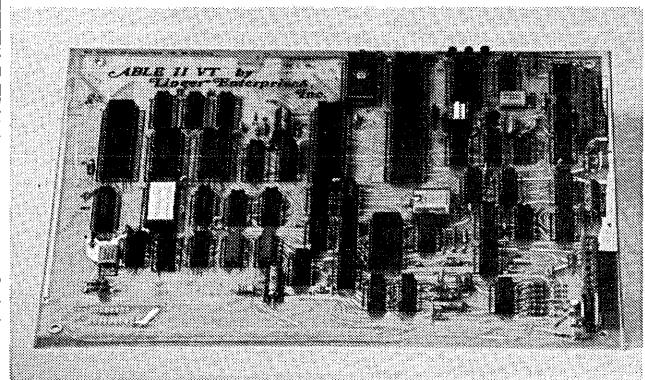
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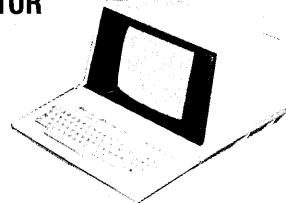
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# TECHNICAL TIPS

## Inverting the Negative Sync on the Xerox 820-I

1. Remove U117. Bend out pin 5. Reinsert U117 into socket.
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 be only 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**

Figure 1 - ZCHESS Fix

DDT ZCHESS.COM

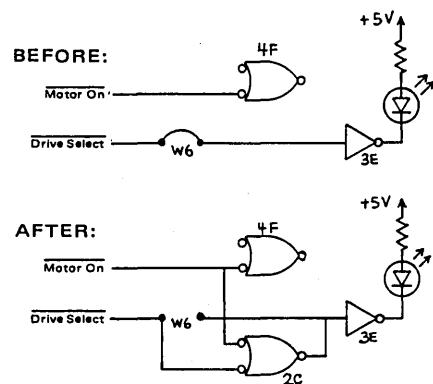
```
-a1f00
1F00 mvi c,2 <cr>
1F02 ani 7f <cr>
1F04 mov e,a <cr>
1F05 ret <cr>
1F06 <cr>
^C
```

## 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 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 2 - Drive Indicator Light Fix



## 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**

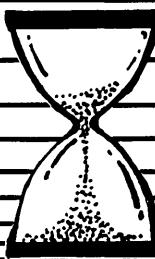
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### BB-I Video Fix Fix

In Wesley Ebisuzaki'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.

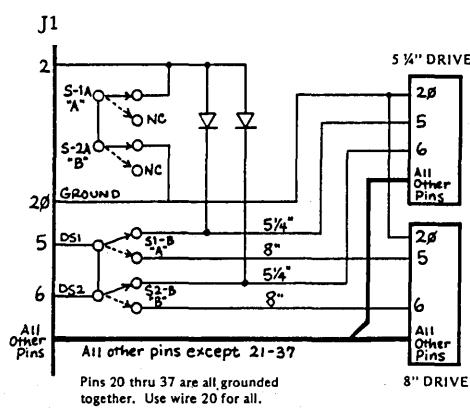
This box will not work on the 820-I.

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.

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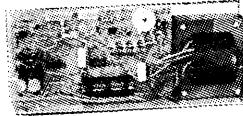
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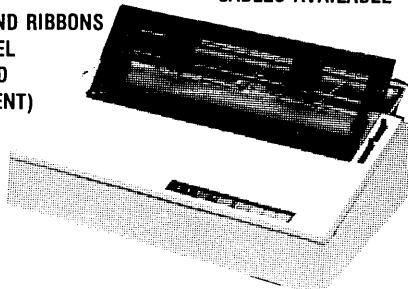
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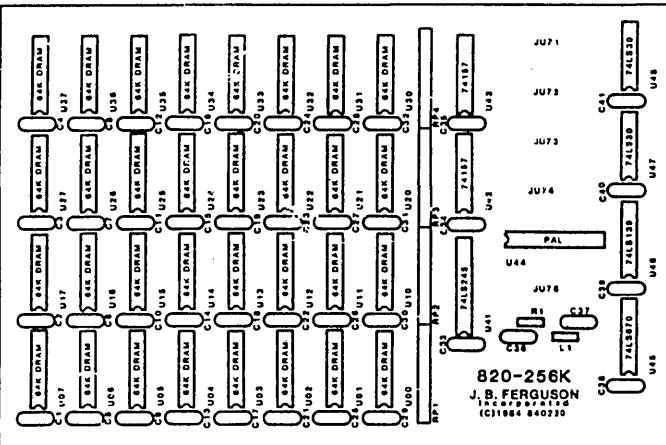
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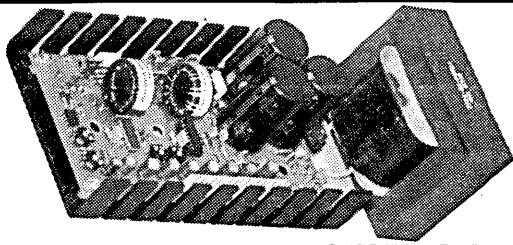
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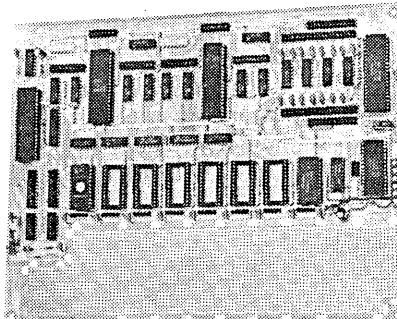
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