

\$3.00

August-September 1985

No. 25

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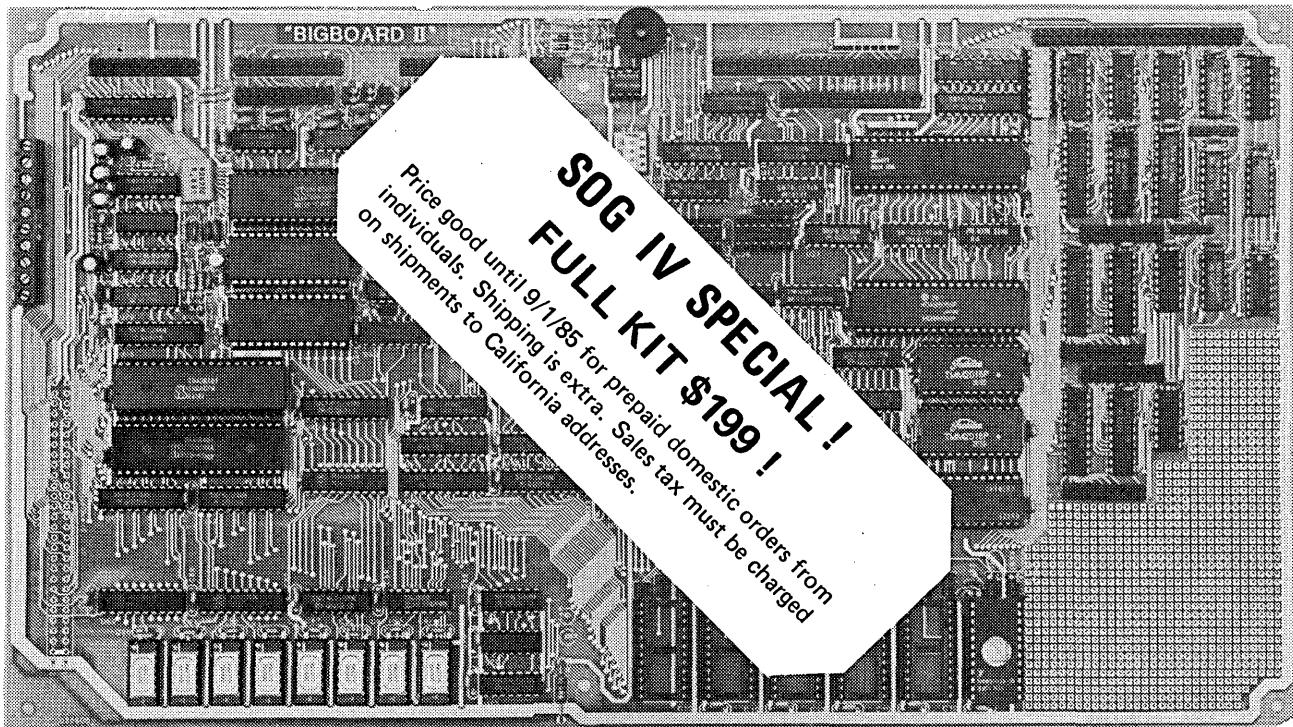
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## "BIG BOARD II"

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



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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(P)ROM 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.

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##### ■ 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.

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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

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##### ■ 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.

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Application to mail at second class postage rates is pending at Bend, OR 97701 and additional entries. Published bimonthly by Micro Cornucopia Inc., 155 NW Hawthorne, Bend, OR 97701. Postmaster: Send address change to Micro Cornucopia, PO Box 223, Bend, OR 97709.

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ISSN 0747-587X

■ ■ ■

# MICRO CORNUCOPIA

Aug. - Sept. 1985      The Micro Technical Journal      No. 25



## Short And...

those of you whose sensibilities have been battered.

### 86 World

We have renamed and revised the Slicer Column to "86 World." Actually, the column has been changing for quite some time. Laine has written some really interesting stuff on 8086 assembly language and operating systems, but since they've been hidden under the name of Slicer, very few of you have noticed them. (Watch for the new 80186-based systems coming to the SOG.)

So we've taken Laine out of the closet and turned him loose on the whole field of 8086, 80186, 80286, and 80386 ... operating systems, assemblers, compilers, boards, you name it.

86 World is a particularly appropriate name for this column. You see, Laine's off to see the world. Right after SOG IV, he'll be spending a couple of years in Turkey where he will be designing computer systems to help automate agriculture. He'll continue doing his column during his stay there.

I'm sure he'll welcome cards, letters, and visits from anyone — especially visits from mobile hackers of the feminine set.

### Running Off Is Running On

The response to the Pascal Runoff is absolutely super. A week after the first announcement of the contest, we had six entries — neat stuff, too — and submissions (projects for the underwater Navy) are continuing to roll in.

So take your keyboard in hand and submerge yourself in that one great program to end all programs. (Get a picture of your family to take with you so you'll be able to recognize them after you've finished.)

### A Thorne By Any Other Name

Thorne EMI has found out what happens when you take reasonably good software packages and shoot them in the feet.

(continued on page 94)

### New Processors

This issue has really turned into a new-processor issue. We have three articles covering the new 32-bit processors (mostly the 32032). Arnie Henden takes a close look in the FORTH column at how these fancy devices are designed. Plus, the Slicer column is broadening to cover the whole gamut of Intel chips (see below). Of course, Tidbits is still playing the "what's new" game. Only the editorial remains aloof — a quiet haven for

# LETTERS

## In Defense Of Well Written Prose

Ever since the Issue 22 editorial, I've been thinking about how thoroughly hung up one can become over some absurdly simple thing. I believe we readers could have eventually deduced the Thompson Algorithm for the half-fold then three-fold for reducing 8 1/2" X 11" sheets to fit small envelopes, but I really can't claim credit for brilliance. As a matter of fact, I remembered how to do it.

I'm 73 years old, and when I was young there were no Size 10 envelopes (not where I worked, anyhow). If you didn't half-fold-three-fold, you couldn't mail a letter, so most of us puzzled out some solution to this environmental challenge. The Thompson Algorithm for Insertion Procedure, though, certainly does clear up what could be a tricky problem for someone younger.

This leads to another topic. One of the biggest defects in the documentation of computer programs is an assumption on the part of the writer that the user actually knows something. Simple directions do not have to be given in a condescending or a cutesy-pootsy manner. A little simple expository prose about the most elementary things is often received with great appreciation, even by the cognoscenti. I am not one of that elite group, but, as I said above, I'm 73, and I've been at this since card sorters and the IBM 650. I spend a lot of time calling long-distance about things that should have been put in simple English in the first few pages of the manual.

Even in my professional work, I am surprised how often I am hung on some simple matter and can't find the answer in books which ought to contain the information. The following happened just a few nights ago as I was writing a report about a patient.

I came across a respiratory rate of 18 breaths per minute in the record. That's pretty fast breathing for a patient lying quietly in bed, I thought, so I wrote "tachypnea." That's medical hog-Graeco-Latin for fast breathing. Then I got to thinking,

this report is for a nonphysician. I ought to document the normal range of respiratory rate. I looked in two brand-new textbooks of medicine (which I had just recently purchased for \$75 each), but the information was not there. I looked in a two-volume loose-leaf text of medicine for which I annually pay \$100 for monthly updates. No luck. I used to teach physiology. I looked in three fat textbooks of human physiology. No go. There was lots of talk about tachypnea in all of these works, but not word one about a formal definition of what IS tachypnea, in numbers, that is.

(Just so you won't lie awake all night wondering, I found the following in a German textbook: mean respiratory rate, men, resting: 11.7 breaths per minute; 95% range: 10.1-13.1; Fruhmann, G., Zeitsch Exp Med, 1964;138:1.)

I suppose if you can't find some of the elementary facts of life in six medical textbooks, it's too much to hope to find the simple but necessary facts in a program document.

George R. Meneely, MD  
514 Southfield Rd.  
Shreveport LA 71106

### Editor's note:

*Thanks, George. Your letter is a breath of fresh air (11.7 times a minute).*

## Using WordStar With Patches

I have WordStar version 3.3 and found a piece of public domain software called ANYCODE which is a patch that steals calls to WordStar's print routine and allows a custom interpretation of printer control codes imbedded in your text. However, I found that the area the patch was designed to go into was already being used in some way to support the Kaypro 4. I then tried to add the patch outside of WordStar and enlarge the WordStar load module to include it. WordStar, being much brighter than I, knows how big it is supposed to be. Hence, the patch

works only under certain circumstances and is entirely destroyed under other conditions.

How do I arbitrarily increase the size of WordStar to include patches? Or is there a better way?

Roger G. Fordham  
4050 E. Sacaton St.  
Phoenix AZ 85044

## High On Micro C

It was with great joy that I greeted the arrival of Issue 23. I leafed through it and read the articles of immediate interest, then tucked it into my bag for the flight home. The flight was delayed (something about not being able to screw the right wing back on properly), so much so, that by the time we queued up for the takeoff, we had already been in the plane three hours. Out of kindness (or perhaps to keep from getting lynched) the flight attendants opened up the bar. When we arrived we were so well lubricated that we had not only forgiven, but forgotten everything.

I awoke with a jolt that night when I remembered my issue of Micro C was still in the seat pocket on the airplane, between the plastic safety card and the funny little bag with the twist tie across the top.

I had a lousy weekend.

I come to you now with a tear in my eye and a check in my hand and ask that you send me another issue #23.

I will never drink and read Micro C again.

Julian R. Bryttan  
1926 Prairie Square #311  
Schaumburg IL 60195

### Editor's note:

*It staggers me to think what Micro C drives some folks to do. If you are now subscribing because of an issue #23 you found in an airline pocket, you might send Julian something as a thank you (anything but a drink).*

## Kaypros In Zaire

I have found your publication very interesting and most helpful, but a

# LETTERS

little overwhelming at my present stage. I suppose this would be true of anyone who read 11 issues in a little over a week. Much of it is way over my head, but I have found that just reading, even when I do not completely understand, is a great help in expanding my horizons. I have learned a lot about my Kaypro II from the tips and suggestions in Micro C, and have even done a few of the modifications.

There are about 10 Kaypro users here in Kinshasa, Zaire, and all are as new to computers as I am. We have a very informal Kaypro users group, but only one of us is technically oriented and he's leaving soon, so we are really hurting. It's kind of like the blind leading the blind.

Most of what I get now is from manuals, but as you have pointed out, manuals are not the best way to learn about computers or programs. So I have a question for you. I would like to upgrade my Kaypro II to a 4 and install the Pro-8 ROM for possible future expansion. Since I already have the Pro-Monitor II on the machine, do I have to do the 4 mod first before I install the 8, or can I go directly to the 8?

Gordon L. Bottemiller  
C.B.Z.O.  
P.B. 4728  
Kinshasa II, Rep. of Zaire

#### *Editor's note:*

You obviously have an 83 Kaypro II (with a real Kaypro II processor board). You will have to do the II to 4 upgrade in order to run the Pro-8 monitor. You won't have to change your drives right away, however.

Also, don't let your problems with Micro C drive you to drink. It'll only make things worse (see the previous letter).

#### Disk Box Stash

I recently replaced two full-height SSDD drives with two half-height DSQD TEACs (you guessed it: from Cal. Digital). This left a large empty cavern where drive B used to be. I

found this space to be a perfect place to stash two boxes of diskettes during transportation. Furthermore, by using a blank drive bezel (leftover from an IBM PC upgrade) which snaps perfectly into place, everything can be hidden away safe and sound (kind of like an Osborne pocket).

Roy Trevino  
709 Kofa Avenue  
Parker AZ 85344

#### *Editor's note:*

*Look closely at your screen, Roy. If the letters are really tiny and the system displays only 52 columns, I'd take out the disk holder.*

#### Turbo Utilities For CP/M-80

I am programming in Turbo Pascal under CP/M 80. I would like to contact others who are using CP/M 80 so as to exchange ideas, tips, and utilities. There seems to be a flood of IBM Turbo utilities, but very little for CP/M 80. Thanks for your help.

Ralph E. Freshour  
Box 7000-309  
Redondo Beach CA 90277

#### *Editor's note:*

*There's also a Turbo section on the Micro C bulletin board. There isn't much there yet, but if you'll log on and share ideas and programs, there'll be more. The number is 503-382-7643. It's 300 and 1200 baud, 8 bits per char, no parity, 1 stop bit, 24 hours.*

#### Kaypro Lockup Problem

Last year I managed to speed up my old (1982) Kaypro II from 2.5 to 5MHz, with a toggle switch between the two speeds. I even added a muffin fan in the back.

For many months all went well. But yesterday, while in Perfect Writer/PluPerfect at 5MHz for less than an hour, I got keyboard lockup! No way could I save the partial letter in memory. I toggled to 2.5MHz, reset, and everything seemed to be OK again.

Today, it's locking up on both

speeds. What could it be??

I can't remember all the mods I've made with your help, so what I'm asking for is a list of all the new chips in best "final" configuration — what you have learned from subscribers and experience to be the best new components. For example, U67 should have a Z80B SIO made by Zilog, etc., etc.

I'm sure I have installed most of these, but perhaps not all, and such a list would enable me to see what remains to be modified.

Harald S. Gibson  
444-36th St.  
Manhattan Beach CA 90266-3208

#### *Editor's note:*

*Your problems don't seem to be speed sensitive (at least your computer-related problems). A number of people have written to us about problems with power connectors (e.g., between the power supply and the main board, the drives, and the video monitor). Some good contact spray cleaner and exercising of all the plugs (pushups) wouldn't hurt at all.*

*Also, you might want to try firmly seating (or reseating) all the socketed chips on your board, especially the larger ones. (Keep your seat and read the following letter.)*

#### In Search Of Exo

I have recently purchased a used Exo single board computer and did not get the wiring and interface documentation with it. It also had an excellent set of business programs (AP, AR, GL and Payroll) for which I would like to get the source code and documentation. The programs were written in C-BASIC and are the best I've seen. I wonder if any readers might know how to contact Exo, if they are still around, or might have the documentation.

J. E. McMurray  
P.O. Box 6772  
Columbia SC 29260

*(continued on page 88)*

# Why I Wrote A Debugger

By Richard Amyx

994 N. Second Street  
San Jose CA 95112  
408-287-8572

If you are using a Z80-based CP/M system and are programming in assembly language (or you plan on trying your hand at this sport), then a debugger should be part of your toolkit.

## What Is A Debugger, Anyway?

"Debugger" is the slang term for a program monitor, a special routine that lets you interrupt the execution of a program and observe the condition of the CPU registers — examine the contents of memory — modify the contents of the CPU registers and memory — and perform other tests to help you find the source of programming errors.

## Why Use A Debugger?

When you're writing and testing a program in a high-level language and you encounter unexpected results or strange answers, it's usually easy to track down the problem. In many cases, the language provides you with messages that tell you the kind of mistake you've made and its location in the program.

With an interpreted language such as MBASIC, for example, you can break into the program at any point and display the values of variables. With a compiled language, the compiler will usually indicate syntactic or structural errors, and you can easily include "print" or "write" statements in your source to check the progress of your program.

But with assembly language programs, you don't get any help beyond identification of language errors that prevent the assembler from doing its job.

Once you begin executing your assembled program, you're on your own. Sometimes, you may simply get unexpected results. Other times, a program may get "lost." That is, it may be misdirected to an area of memory that does not contain an executable instruction, and the results can be bizarre, amusing, or destructive (usually it's all three).

You could write diagnostic messages into the program, but that's quite tedious to do in assembly code,

even if you knew exactly where to put the diagnostic message.

## Why Not DDT?

After all, it comes with every CP/M system. There is one strong reason against using DDT: a debugger must be written specifically for the system CPU. DDT was written for the 8080 and is of limited use in Z80 systems. In particular, the Z80 has more registers than the 8080 and its instruction set is quite a bit larger. What you need is something that will do for the Z80 what DDT does for the 8080.

## Enter DEBUG!

Shortly after I began using Micro C's CROWECPM assembler to do some experimenting with the video controller chip in my Kaypro 4-84, I wished I had a Z80 debugger to help with the task. I shopped around and quickly decided that, as a hobbyist just wanting to experiment, I could not justify the cost of one of the professional assemblers/debuggers. After mulling the situation over for a while, I decided that writing a debugger shouldn't be too difficult and that it might be an interesting exercise. The results of my efforts — called DEBUG! — serve as illustration for the remainder of this article.

## The Assembled Listing

In order to use a debugger effectively, you must have an assembler listing of the program you're debugging. Figure 1 shows the assembler listing for a short demonstration program.

First, let's take a look at the information you get from the assembled listing. The leftmost column shows the addresses at which the instructions or storage areas are located. The second column shows the assembled machine code for the mnemonic instruction, with addresses in low byte-high byte order (for example, 312401, the first executable instruction (31), is the Z80 machine code meaning "put the value 0124H into the SP register"). The third column contains labels. The fourth and fifth columns contain the source code instructions, and anything to the right of a semicolon is a comment.

Following the source code is the symbol table which shows the location of all the labels. (Labels are to assembly language what line numbers are to BASIC. They are places you can access or jump to.)

The line-by-line comments (they follow the semicolons) describe what happens in each step of the program. If you can't yet read assembly code well enough to be able to understand

Figure 1 - Assembled listing of demonstration program

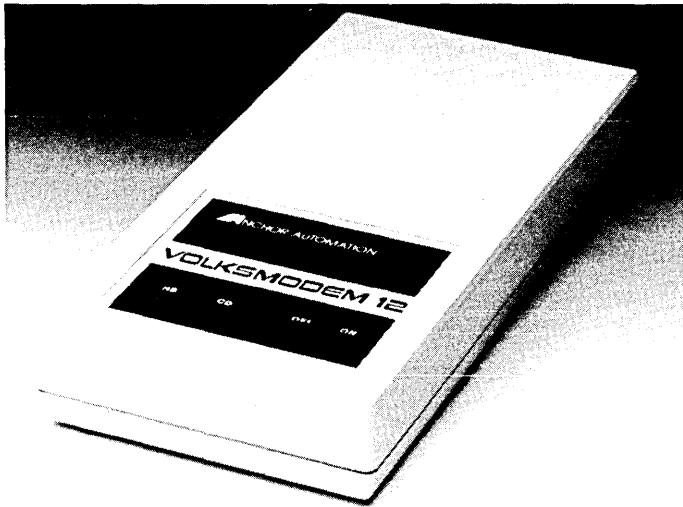
0000	TITLE	'DEBUG DEMO'	
0100	ORG	100H	
0100 312401	LD	SP,STACK	; USE OUR STACK, NOT CP/M'S.
0103 FF	RST	3BH	; INVOKE DEBUG.
0104 AF	XOR	A	; THIS SETS Z(ERO) FLAG.
0105 3E11	LD	A,11H	; PUT SOMETHING
0107 013322	LD	BC,2233H	; VISIBLE IN THE
010A 115544	LD	DE,4455H	; REGISTERS,
010D 217766	LD	HL,6677H	; THEN SHOW
0110 C5	PUSH	BC	; BC AND DE ON THE
0111 D5	PUSH	DE	; STACK, TOO.
0112 08	EX	AF,AF'	; NOW EXCHANGE
0113 D9	EXX		; THE REGISTERS,
0114 3E02	LD	A,2	; THEN ADD 3 + 2 SO
0116 010300	LD	BC,3	; THE RESULT WILL
0119 81	ADD	A,C	; SHOW IN A.
011A C30000	JP	0	; THAT'S ALL WE WANT
011D	DEFS	7	; TO DO; WARM BOOT.
011D	STACK:	DEFB	; A 4-WORD STACK
0124 00	END	0	; STARTING HERE.
0000			; OF DEBUGDEM.

STACK 0124



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(continued from page 5)

tain CPU operations. The numbers following the AF and A'F' register names show their contents.

Note that the A register does indeed contain 5, the result of adding 2 and 3. But the 44 in the F' register cannot be interpreted so quickly. Therefore, the letters (or dashes) to the right of the numeric values are used to show the status of the bits (flags) in the F register. Performing an exclusive OR on the A register (now the A' register, with the registers exchanged) created a zero result; hence, bit 6, the zero (Z) flag, was set to 1.

Also, because the exclusive OR resulted in an even number of bits (zero) in the accumulator, the parity (P) flag was set. Other flags indicate Sign, Half-carry, Negative, and Carry. The "x" in bits 5 and 3 means that those bits are not used by the CPU; a dash means that the flag for that bit is not set (is 0).

If you're just getting started in assembly language programming, some of this explanation may border on gobbledegook. (Maybe more than border.)

Fortunately, there are two books that spell everything out in detail and that I highly recommend: "The Z80 Microcomputer Handbook" by William Barden, Jr. (Howard W. Sams & Co., Inc.), and "Z80 and 8080 Assembly Language Programming" by Kathe Spracklen (Hayden Book Company, Inc.). The Spracklen book is especially helpful to CP/M users because it presents 8080 code and Z80 code side by side, and even if you do have a Z80 system you will inevitably run up against 8080 code somewhere along the line.

### Back To Figure 2

The clump of numbers toward the bottom of the display shows the contents of a 128-byte "page" of memory (and what's on display here is the demo program, starting at 0100H). Below the memory display is a line showing the breakpoints that are set; the last line is used for command entry and error message reporting. There are a number of things you can do with DEBUG! when the display is active:

- Page memory display forward or back
- Continue from the current breakpoint
- Single-step through the program under test
- Clear all breakpoints or a specified breakpoint
- Set a breakpoint
- Display a specified area of memory
- Perform hexadecimal arithmetic
- Jump to a specified address
- Fill an area of memory with a specified byte
- Modify the contents of a specified address
- Change the value in any register pair
- Search memory for a string of bytes
- Move the contents of one area of memory to another.

These functions let you see exactly the condition of the CPU and memory at any time and make changes for "what if" testing. The single-stepper is a particularly powerful tool when you're not sure what's happening in a program.

A debugger is an extremely valuable instructional aid. When I first began working with assembly programming, I found it quite abstract in comparison to high-level language programming. I read and reread explanations of what the various instructions did, but for a long time I was left with a "so what?" feeling. Sure, I could understand what happened with any instruction, but I had a tough time relating that to what I wanted to do.

My brother, who has dabbled with assembly language, dropped by while I was working on the debugger. When I finished explaining to him what I was doing, he remarked, "Gee, I wish I'd had this when I was fiddling with the assembler. It sure makes things clear."

### How Does A Debugger Work?

So what's the big mystery about debuggers? Actually, there isn't much of a mystery, or I wouldn't have been able to write one.

Implementing DEBUG! involved one trick, one standard procedure, and

one item of caution throughout. The trick is to make the program "self-calling," a misnomer in itself. While there are several ways a debugger could be invoked initially, there has to be a way for it to call itself for breakpoints or single-stepping (which is an internally set breakpoint at each executable instruction).

The Z80 provides eight one-byte reset (RST) instructions, which CP/M has chosen not to implement. The reset instructions direct the CPU to preset addresses, with the additional characteristic of pushing the address of the next program instruction onto the stack, just as a call does.

RST 38H, the one I chose to use, transfers program execution to address 38H, the same address DDT uses. The initialization portion of DEBUG! overwrites the jump-to-DDT instruction at 38H with a jump to DEBUG!. In this way, the RST 38H (0FFH) coded into the program invokes DEBUG!.

After that, any time a breakpoint is set, the program code byte at the breakpoint address is replaced by FFH, and when that instruction is encountered, DEBUG! becomes active (and the substituted code byte is restored). Thus, DEBUG! is not really self-calling: the user program code is altered to create the call. The standard procedure is to "preserve the user's environment."

### Protecting The User

What this means is that the absolute first thing DEBUG! does is save the user's SP, PC, and contents of the PC (the return address pushed onto the stack by the RST instruction) and push all the user's register values onto the DEBUG! stack. This is exactly the same thing that's done in any interrupt-driven program. Once the user's environment is preserved, DEBUG! can skitter around and do pretty much whatever it wants, as long as it doesn't mess up the user's program or the system.

The caution throughout is to be very sure that the stack is restored upon completion of any action. The last thing DEBUG! does before re-

(continued on page 9)

PS Computers Presents the...

# PS Turbo 640

For those of you that mistook me for Bill Gates from Microsoft, let me clarify things. I'm Dave Carlin of PS Computers in Palm Springs, California. The differences are pretty basic. Bill reads the Wall Street Journal, wears glasses and writes great software. I read USA Today, wear soft contacts and build great hardware.

Now that you know who I am, or at least who I am not, let's get to the point.

**Problem.** Since I got into computers two years ago they have been a constant source of fascination and frustration.

Fascination due to the immense power and control that the personal computer has allowed me over my daily business activities; frustration due to the hundreds of hours I've spent making hardware and software cooperate with one another.

No doubt about it, once you get all the pieces put together correctly you have at your command an incredible tool. There is absolutely no limit to the number and type of tasks that you can accomplish with greater speed, better accuracy and stronger impact; all with far less effort. The trade off however has been the time, energy and uncertainty involved in finding the best buy on the right equipment, then getting all the parts to function as one.

Because I have personally gone through hours of long distance phone calls to hardware manufacturers and waited days for call backs that never happened. Because I have found myself so many times in front of a screen filled with meaningless greek characters at 2 AM unable to get the computer to print a simple business letter. Because I would not wish this type of agony on anyone. This is why I have put together the PS Turbo 640.

**Solution.** What happened was... a few months ago I discovered a source of computer mother boards that run IBM type software faster than the IBM PC. They're a genuine product of Taiwan and they are beautiful! I bought cases, keyboards, cables and disk drives; built the Turbo 640 and put it to work. Right now I have three PS Turbo 640s linked as a network running Dbase III and Lotus day in and day out in my business. The PS Turbo 640 works, it works well and it works faster than the IBM PC.

An oral surgeon friend saw my network and asked me to build one up for him. One of the Turbo 640's on the network is in his operatory. It runs a program I wrote in Turbo Pascal for his anesthesia records - not a single glitch. (The 640 seems totally immune to the effects of Nitrous Oxide.)

**More than compatible.** Though I have a private pilot's license and quite a few hours flying high performance aircraft, I've never taken the time to learn to use the Flight Simulator program from Microsoft. Some of my friends have and it runs beautifully on the 640.

The phrase "IBM compatibility" is an understatement with my computers; the PS Turbo 640 is just flat out a better machine.

Peter Norton publishes a program that rates computers as to speed and compatibility with the IBM PC. In the normal mode of operation the PS Turbo 640 rates a 1.0 which indicates a 1 to 1 equivalency. In the high speed mode (selected with two keystrokes, no switches or rebooting) the 640 scores a 1.4; that's 40% faster than an IBM PC.

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**The specs.** 640 K of memory (the maximum contiguous memory that the PC can address - and they're all 150 nanosecond chips). A keyboard that is very similar to the Key Tronics 5151 (yes all the horror stories about the keyboards that come stock with IBM PCs are true). Two serial ports, a parallel printer port and a game port (you can't beat that). Battery powered clock (keeps track of the time and date while the computer is off). A monochrome graphics card that gives you crisp monochrome text and lets you use color and graphic software on a monochrome monitor displayed as sixteen shades of grey (amber). An amber monitor (very chic). Two 360 K disk drives (AKA Half Height Double Sided Double Density). Two front panel LEDs (one to indicate that you left the computer on from the night before [it's ok, that doesn't hurt it] and the other to tell you if the processor is in the high speed mode or just going IBM speed). Eight expansion slots (two are used by the multifunction card and monitor card, four full sized and two short slots are available) Five available ROM sockets and two bus connection points (load programs stored on your own ROMs). 135 watt power supply (ready for upgrading to a hard disk). User's book and complete technical information (the user's part is easy - the tech part is very technical).

A computer without software is basically a solid state boat anchor and a rather poor one at that. When you buy the Turbo 640 I want you to be able to start using it the moment you take it out of the box.

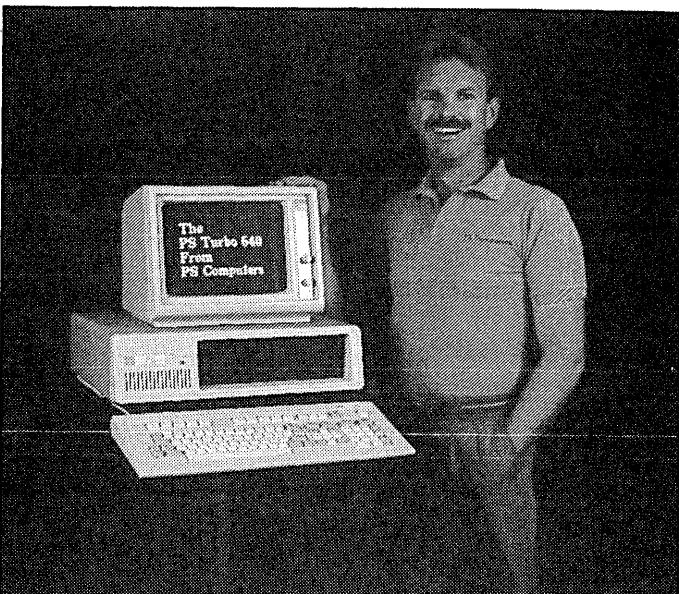
**All this and software too.** First there's Microsoft DOS. DOS is the program that brings the computer to life. Typically some version of it is run on all IBM PCs prior to running application programs. "And it came to pass that this was called booting the computer". I'm not crazy about the term, but everyone does it. The full DOS manual from Microsoft is included.

There is complete software for the multifunction card that allows you to partition your memory into RAM disks and a printer buffer.

Perhaps you've heard about Sidekick from Philippe Kahn at Borland. InfoWorld voted it the Software Product of the Year. Well it's good code but I'm not including it with the Turbo 640. What I am including is a product that I like better, has essentially the same functions but in my opinion is easier to use - PopUps from Bellsoft. Regardless of how deep into your spreadsheet, database or master's thesis (revisions) you might be, two key strokes will put a notepad, calculator or any of 5 other utilities on your screen. Make notes, perform calculations, set an alarm, check your calendar or perform DOS functions. When you're finished just hit the escape key; the PopUps disappear from the screen and you're back into your program. This is the PopUp Deskset from Bellsoft, it's potent software and it's part of the PS Turbo 640 system.

**Don't wait.** If you're ready for this kind of computing then the PS Turbo 640 is the machine you need. Call me with your American Express Card account number or mail me a cashier's check. I will personally see to it that a Turbo 640 is shipped to you via UPS the next business day.

Open the box, plug the monitor and the keyboard into the computer then plug the computer into the wall socket. Turn the computer and monitor on, stick in any software designed to run on the IBM PC and go to work. No chips to put in backwards, no little multicolored wires to push onto the wrong connector and no switches to set.



**Money back.** If the PS Turbo 640 doesn't perform like I've said then return it to me. Just put one copy of your invoice in the box and send it back. I will make sure that credit is issued on your credit card or a cashier's check is mailed out to you, the same business day that we receive the unit.

I've told you quite a bit about what you get when you buy the Turbo 640; now let me tell about something you won't get. You won't get put on hold if you have occasion to call the technical support division number. That's because there isn't a technical support number. Once the machine is on it looks like, acts like and runs like a properly configured IBM PC, just a little faster.

This is the part where I have to get a little tough. I've sold you what I feel is the ideal configuration of an IBM type PC. You have gotten the absolute best buy for your money on earth. I can not however, learn how to use it for you. Follow the directions in the book, remember that no matter how much you pay for your software it's probably not perfect, and most of all don't give up - whatever time it takes to get proficient at your particular software application will ultimately be all worthwhile.

**Warranty.** The warranty on the Turbo 640 is simple. If anything goes wrong in the first six months, send it back. The unit will be repaired and shipped back to you two days after we receive it.

In case of an out of warranty hardware problem (how many million dollars does it cost for the space shuttle to place defective satellites into random orbit?) or if you have a question concerning operation (that isn't answered by the manual), you have three options:

One, write me a card or letter. These are answered the same day as received via MCI Mail. Two, sign onto the PS Computer 24 hour bulletin board, post your message and then sign on later for the answer. (admittedly hard to do if you didn't decide to get a modem or the computer I sold you broke [see option one]) Or three, find out where I live (probably the least convenient for both of us).

**Placing your order.** The 800 number puts you in touch with an operator here at PS Computers whose function is to take the necessary information, quickly and accurately, period. I've given you the highlights of the system in this ad. If you need to know more about specific features drop me a line. Sure it seems like it might be a bit more trouble than calling; but you won't be reaching a busy signal and your answer will be in writing.

You have my word that the PS Turbo 640 has been accurately represented on this page and is in fact the absolute best buy for your dollars. If for any reason you don't like the 640 then you also have my word that upon our receiving the system, those dollars will be returned to you, immediately.

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## DEBUGGER

(continued from page 7)

turning control to the user program is restore the user's environment to the registers and the stack.

Otherwise, virtually everything DEBUG! does is just various arrangements of memory moves or standard algorithms. Single-stepping is interesting in that it is a software emulation of CPU action. DEBUG! looks ahead one step to see what the CPU's going to do next, then sets a breakpoint at the appropriate address. A bit tedious to code, perhaps, but hardly magical or mysterious.

DEBUG!, which takes up 3042 bytes, is completely relocatable above address 0DA6H. This means that if I am working on a program that will reside at the bottom of memory, DEBUG! can sit at the top of memory (I usually keep it just below E000H, the top of the TPA in the 4-84). If I'm working on a program that runs in high memory, I can move DEBUG! down to a spot where it will be out of the way.

For example, I used Micro C's DUMP484 to make the printed display used in Figure 2. DUMP484 resides at the top of memory, and the demo program is at the very bottom. So I relocated DEBUG! to end at 5000H, well below DUMP484 and well above the demo program. I also made the maximum possible use of standard CP/M calls in writing DEBUG! so it would run on any CP/M system with an addressable cursor. It is customized for the Kaypro to the extent of a few cursor locations and the cursor positioning routine — elements that can easily be changed.

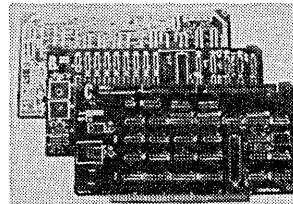
DEBUG! was written for CROW-ECPM, which makes use of only standard Z80 instructions, so a macro is not required to assemble it. Yes, DEBUG! could contain many more features and functions. A debugger seems to be one of those programs onto which you could add bells and whistles until there was no memory left for a program to use it. What I've got now suits my (current) needs — and the price was absolutely right.

Editor's note: DEBUG! (along with other goodies) will be on Micro C User Disk K37.



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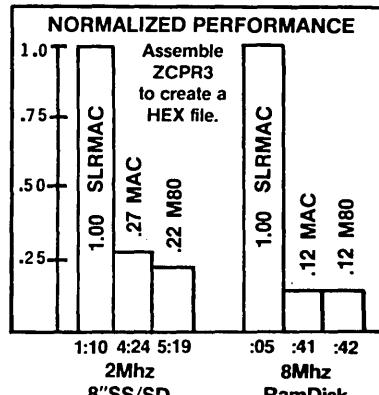
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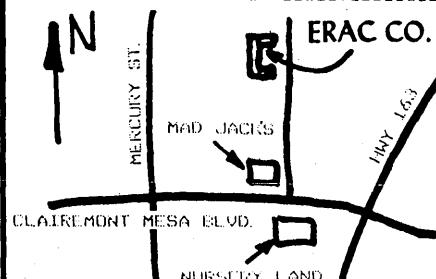
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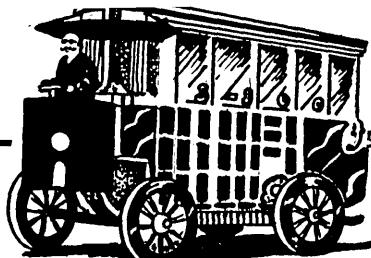
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# The S-100 Bus

By Dave Hardy



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As I mentioned last month, multi-processing is probably the greatest advantage of the S-100 (IEEE-696) bus. The S-100 bus performs its multi-processing magic by using something called Temporary Master Access (TMA).

An integral part of the IEEE-696 standard, TMA is the process that lets another processor take over the system to perform data transfers between itself and other devices attached to the S-100 bus.

## How The Magic Works

The S-100 bus is designed to support up to 16 processors, and it selects between them by using a simple Request/Acknowledge/Transfer protocol. The whole process works like this:

First, the processor that wants to take temporary control of the bus issues a request by asserting the S-100 bus's HOLD\* line. It then waits for the permanent bus master to finish its current bus cycle and respond with the Hold Acknowledge signal, called pHLDA.

Once it sees the pHLDA signal, the requesting processor turns off the permanent master's bus drivers, and turns on its own drivers to take control of the address, data, control, and status busses. After it has done all that, it is in total control of the S-100 bus, and can function exactly as if it were the only processor on the bus. At this point, the requesting processor is called the Temporary Master because it controls the entire S-100 bus, but it must return control to the Permanent Master when it has finished using the bus.

The point of all of this (in case you missed the June/July issue), is that TMA makes it possible for several separate computers to operate in the same S-100 box at the same time, and share all of the S-100 frame's peripherals, including hard disks, printers, modems, and just about anything else that can be plugged into the S-100 bus, without any hardware conflicts.

Several manufacturers make temporary master processor boards designed to operate in the S-100 TMA environment. These complete single-

board computer systems are called slave boards, because of their relationship to the S-100 master processor.

Virtually all of these slave boards are designed to run a CP/M-like operating system called TurboDos that allows each of the slave processors to appear to its operator as a single-user CP/M machine. Because of the low cost of these boards (typically \$300-\$600), a powerful multi-user system can be built in the S-100 bus at a fraction of the cost of any other method.

## Some Alternatives

If you don't like multi-processing, the S-100 bus can also be set up as part of a network. Unlike multi-processing, where several CPUs live in the same S-100 box, networking requires just one processor, and lets your S-100 machine share files and data with other computers that may be miles away.

There are several networking schemes that can be used on an S-100 machine. Probably the most versatile is EtherNet, a high-speed coaxial network used on many large computers. Although it is more expensive than multi-processing, EtherNet has the advantage of letting your machine talk to other computers that are not plugged into the S-100 bus.

## S-100 Toolbox

Like all bus-oriented, plug-in systems, S-100 boards and frames have connectors that sometimes get dirty. In fact, about 50 percent of all of the S-100 problems I have had in the last 10 years have been because of dirty edge connectors on S-100 boards, or damaged sockets in an S-100 frame.

There's not much you can do about a bad socket (except replace it), but edge connectors can be cleaned with some isopropyl alcohol and a rag. Because the pads on most edge connectors are plated with a few mils of gold, it is not a good idea to simply rub off the dirt and tarnish with an eraser.

Having been the victim of bad edge connectors that had been erased by well meaning users, even the idea of

using a pencil eraser on a gold-plated connector used to make me cringe, not only because of the damage to the gold plating, but also because of the oily residue left behind by the eraser.

But about a year ago, I discovered that one eraser, the Mars Staedtler Rasor 52730, not only cleans the connector without damage to the gold plating, but also leaves no residue.

Since that time, I have used the Mars eraser with excellent results, and have decided to make it a permanent resident in my S-100 toolbox.

## Handy Circuits

Readers have sent me a few examples of simple circuits that can be used to trouble-shoot sick S-100 machines. Future columns will be devoted to these suggestions, but the following circuit is mentioned here because it is so simple that I have overlooked it in the past (just assumed that everybody has one, I guess).

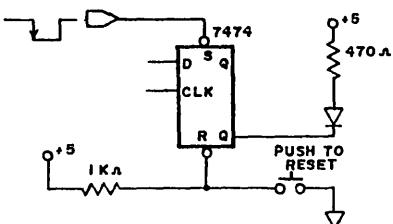


Figure 1 shows a super-simple "pulse catcher" that you can use to see a pulse on any TTL line. To catch a negative-going pulse, just connect an inverter in front. I have logic probes and analyzers all over the place here, and have just never thought of mentioning what is probably the simplest piece of test equipment around. In spite of its simplicity, this circuit (or any pulse catcher/logic probe) is often invaluable.

## Next Time

Next time, we're going to get into the technical aspects of multiple processors on the S-100 bus, including the IEEE-696 bus arbitration procedure, and a circuit that will let older S-100 boards use bus arbitration; plus, a simple battery backup circuit for an S-100 machine, and some reader feedback.

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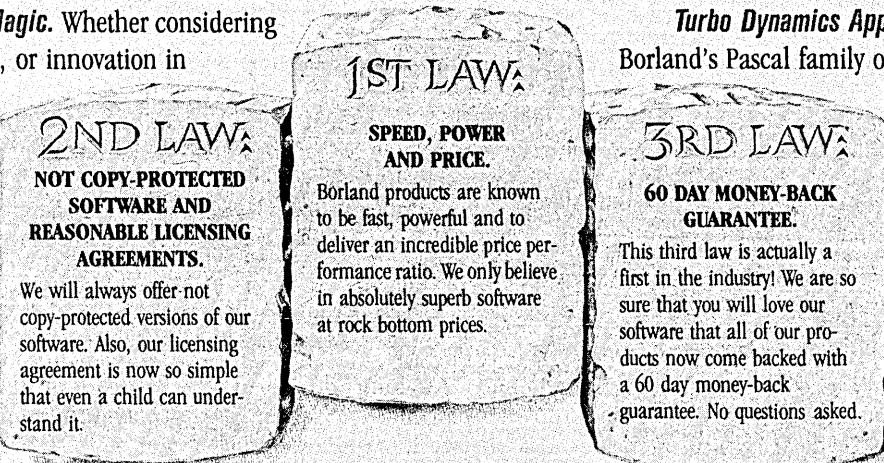


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# In The Public Domain

By Stephen M. Leon

200 Winston Drive  
Cliffside Park NJ 07010

Following Sol Libes' footsteps is hard enough. Writing a column in an area of computing he created is doubly difficult. But following Sol and disagreeing with him rather vehemently — that's really tough!

## By Way Of Introduction...

I came into the world of computing with the TRS-80 model one. I never had an Altair or an Imsai, so I have to use a special calculator to add or subtract in hex. My TRS-80 is still sitting in the den with its Omikron mapper, eight inch drives, Holmes speedup, and 58K of memory. That 58K modification was made very early in the game so I could learn Pascal.

Next to the TRS-80 is a CompuPro with 512K of memory, two eight inch and two five inch drives, and the ability to run CP/M 80, CP/M 86 and MS-DOS. A Wyse 100 terminal sits on the desk for the CompuPro, and on the other side of the desk is an IBM PC with 640K, a 20 meg hard disk, two floppies, an Everex color board, and a black and white monitor. A fourth monitor in the den seemed out of place, so a Sears color TV-monitor combination gives the PC its color.

In mid-1982, I volunteered to help Hank Kee edit the SIG/M library. We were then doing volume 65. Today we are up to volume 230. That comes out to about 40 megs of software since I started the job! I try to test every program we release, and when I can't get one to work, I indicate that in the documentation. If you consider that we release only 25 percent of what is submitted, one might call me a non-professional professional software tester.

## What Comes In And Goes Out

Not all of our programs come directly from the authors. Some of them are sent to us by sysops from almost every country.

How do we decide what goes into the library? First, the program has to work, or be an interesting enough attempt to justify its release so perhaps someone else can get it to work. It doesn't have to be perfect.

Nor does it have to meet a test of universality (or we never would have released an eight volume Yale Bright Star catalog, SIG/M 31-38). It should be, at least, semi-professional. It can be copyright protected and released to the public domain, but we do not issue anything that has a copyright without the author's release.

A distinguished writer, Herbert A. Simon, defined a management philosophy that I consider the goal of SIG/M software. We aim not to be perfect, but to satisfy. Much of our software is excellent, but some of it could certainly use improvement! We try to provide source code with the program so users can upgrade. More in another column on those who carry upgrading to the edge of sanity.

I disagree with Sol and Hank with respect to distribution of freeware. A lot of people put considerable time and effort into SIG/M. We are not paid. In fact, it costs us both time and money to do this job. If someone wants to engage my services in a commercial venture, I expect to be paid for it. The same holds true for SIG/M. Therefore, SIG/M does not knowingly release any software for which the author seeks a donation or any kind of payment for registration or a manual, etc. We suggest to the author that he go someplace else for free distribution. More on this in subsequent articles.

Enough background. Let's get down to serious business.

## Our McIntosh Is A REC

The winner of the 1985 Computer Hobbyist of the Year award was Professor Harold V. McIntosh of the Microcomputer Applications Department of the Institute of Science at Puebla University, Puebla, Mexico.

If you use either CP/M 80 or CP/M 86 and do your homework, you'll know why the Trenton Computer Festival committee honored him. McIntosh developed a tool called REC — Regular Expression Compiler — which can perform mind boggling tasks.

REC is currently spread over eight volumes (SIG/M 164-167, 173 and 213-

215). It is a compiler-compiler. In any area of formula or regularity, you can have it write a program to perform an assigned task. One of the samples that Prof. McIntosh provided included a program that translates CP/M 80 ASM code to CP/M 86 A86 code. Another converts ACT assembly language to A86 code. McIntosh rewrote the string find program FIND, gave us a whole series of DUMP and binary compare programs, redid DDT, created a new version of HELP, allowed us to run squeezed or unsqueezed programs from inside a library, etc., etc., etc.

At the Trenton show Rich Conn (an award recipient from another year) offered 50 volumes of software for public domain release. We told him to hold off. Why? Because, while these volumes include everything from word processing on up, they are all in ADA and require a micro computer compiler that's not available yet.

McIntosh has programs to translate LISP and C to REC and then to 80 or 86 code. With REC, an ADA programmer can translate ADA to any other language. With REC, you can translate dBASEII or III into C or some other language without using the high priced conversion programs that are starting to appear on the market. The possibilities of REC are limited only by the skill of its user.

## dBASE Applications As Learning Tools

The SIG/M library contains a wealth of tools for the experienced programmer. It also contains lots of help for the rest of us. dBASEII programs are very popular. Our first dBASE release was a demonstration mailing list program based on Adam Green's book (SIG/M 110).

In a later volume we released the operational mode of this mailing list program (SIG/M 199). To keep track of disk orders and shipments we wrote a dual data base dBASE program (SIG/M 129). We later released updating modules to the inventory data

(continued on page 15)

# Do it yourself...

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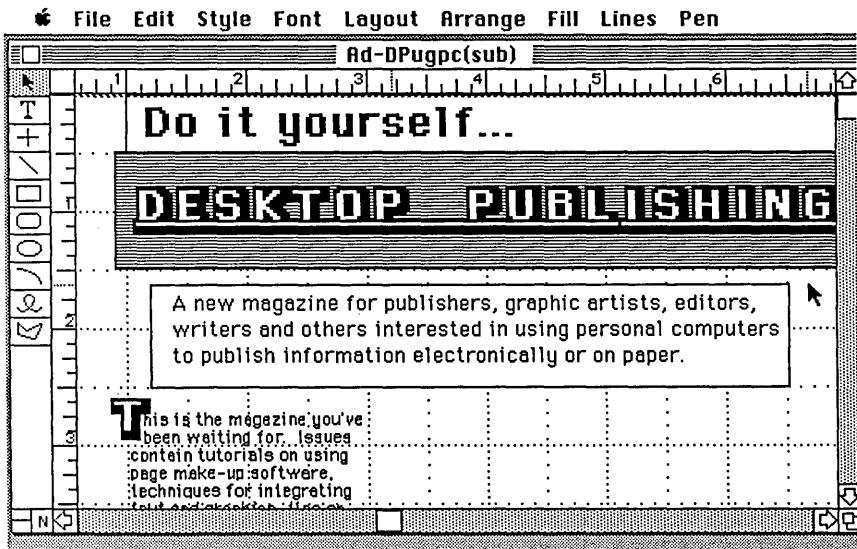
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base for dBASE version 2.4 (SIG/M 155). The inventory program is an excellent tutorial as well as a working program.

A different inventory program was released on SIG/M 155. On that same disk are checkbook, mailing list, and periodical tracking programs. On volumes 199 and 200 we put the SIG/M Property Manager, a 320K dBASE program for tenanted real estate. It does everything from sending rent bills to preparing financial statements.

SIG/M 223 contains programs to do your genealogy, balance your check book, and manage your church. Our latest dBASE release is a series of three programs for scholars and others to keep track of reference material (SIG/M 230).

I have written many of the SIG/M dBASE programs to meet specific needs of my office or of SIG/M. But in

the code, we try to show users how they can modify the programs for their own applications.

#### The PC-DOS/MS-DOS Crowd

The dBASE programs run under CP/M 80, CP/M 86 or MS-DOS. Property Manager is available in IBM format (PC/BLUE 75) as are Mail Manager (PC/BLUE 34) and Inventory Manager (PC/BLUE 43).

While I'm on the subject of the PC/BLUE library, let's take a look at volume 73. There are no programs on it, just 68 articles on "Tips, Notes and Techniques for the IBM PC." One day you may be looking for just the information in one of those articles (see Figure 1).

SIG/M and PC/BLUE printed catalogs can be ordered from SIG/M, Box 97, Iselin, NJ 08830. The price is \$3 each (\$4 foreign). SIG/M disks are \$6 each (\$9 foreign) from SIG/M. PC/

BLUE disks are \$7 (\$10 foreign) from the New York Amateur Computer Club, Box 100 Church Street Station, New York, NY 10008. Software is also available via the world wide public domain software distribution network.

#### Next Month

Next issue the topic will be how to generate your own nuclear power — i.e. public utilities. In the meantime, if you have written some software that others may find helpful, useful, or interesting, why not contribute it to the SIG/M or PC/BLUE libraries?



Figure 1 - PC/BLUE Volume 73

Name	Description	Name	Description
ALBERT .NL	Personal Editor	LEHRMAN .NL	The IBM PC Color Display
BARBER .NL	Why Join A User Group	MACK .NL	Using Random Files In BASIC
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CUMMING .NL	Quick Start - DOS 2.0+ - IBM PC	ROSE .NL	Making Life Easier with Macros
DAVIS .NL	Running DOS Commands in BASIC	SCHIEVE .NL	Computer Based Instruction
DIXON .NL	IBM Pascal Compiler v2.00	SCHNELL .NL	Alternate Colors in Medium Res Mode
EXPNDTAB.ASM	Expand TAB Character Into Blanks	SCHNELL1.NL	Graphics on the PCjr
FOULGER1.NL	WP in Personal Editor	SCREEN .BAS	referenced by Crebs.NL
FOULGER2.NL	Understanding LOGO	SCRIPTPC.NL	Words from the Author
GASTON .NL	Tracking Time Spent Programming	SHARP .NL	PCjr - First Impressions
GLASS .NL	Determining BASIC Environment	TARNOFF .NL	A View of APL
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# C'ing Clearly

By Ron Miller

1157 Ellison Dr.  
Pensacola FL 32503

You hear lots of reasons for switching to the C language: program speed, structured programming, portability (mainly of interest to software designers), ease in building libraries, adaptability, and code efficiency.

I'd like to add another reason to the list. C is a language that lets you slice right through the syntax and the commands and specify bits, bytes, addresses, and ports.

You can program merrily along with variables and structures defining your reality until you have to do something that isn't prescribed in the book. Then you're forced to step back and start thinking of strings as arrays of bytes beginning at certain memory locations, and of integers as 16-bit sequences, perhaps in reverse-byte format.

Though the assembly language programmer doesn't have a chance to forget what really is happening, he is often so busy rewriting loops, designing tests, and planning elementary routines that it's hard for him to keep track of the bigger picture.

That's where C comes in. Writing in C is like being an assembly language programmer with a crackerjack secretary.

The secretary takes care of the routine correspondence and filing so

you can concentrate on the really critical issues.

Such is true, of course, for all compilers and interpreters. C, however, never lets you forget that your secretary is there and that the daily schedule doesn't appear on your desk by spontaneous generation.

## Bailing Out

To illustrate the literal-mindedness of C and offer a technique to use for your own programs, let's use C to divert character-in (conin) calls in CP/M.

Suppose you wanted to test every new character from the keyboard for a certain input, and when that character appeared, you made something special happen.

You'll need to test all characters as they come into the CPU, before Microsoft, DRI, Aztec, or whatever you're running gets its mitts on them.

To keep things practical, let's consider a "longjump" routine that lets you bail out of a complex program, when going on means disaster and cold booting means starting over from scratch.

Wouldn't it be nice to be able to leap tall nested loops in a single stroke, landing at some safe point in the program?

You could test all characters read from the keyboard; if one is ASCII 27 (ESC), reset the stack pointer and the CPU and — voila! — you're back again at your safe point. It would be like beaming from here to there in Star Trek.

Pulling off this feat involves two separate projects: designing the long-jump routines and crafting the diversionary routine. Let's do the diversion first.

## Diverting Conin

At the head of our program we will do a little pointer work that depends upon two characteristics of CP/M systems known to all hackers: first, that the BIOS routines in high memory are headed by a series of three-byte jump statements (called a jump table). The second jump is to warm boot; the fourth jump is to the conin (get a character) routine.

Second, we also know that the address of the warm boot jump is stored at address 01H.

Since this is C, we can treat the BIOS routines like functions we have written ourselves. We can use pointers to alter the parameters in the functions and even use a function pointer to alter the flow of a BIOS call. As any C programmer knows, a pointer is

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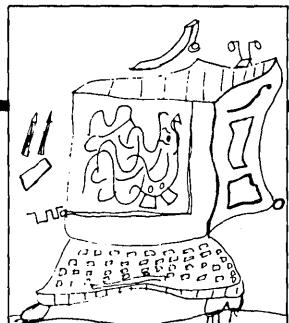
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just a shorthand way to have somebody else — the compiler — access bytes in the memory.

We're going to change the conin jump address so a jump to conin will actually jump to our own little character checking routine. Then our routine will call the real conin and it will return the character to our little check routine. We, of course, check to see if conin sent us the character we want. If so, we do whatever devilment we've planned. Otherwise, we simply return the character to the routine which called conin in the first place.

It's only in this character check function (called "swerve" below) that a bit of assembly language must be used, since CP/M expects console characters in the A register. Notice how casually the patch is made. (I knew that an ordinary return wouldn't

(continued next page)



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work because playing with C has taught me that HL is the return register in Z80 implementations of C.)

### Booting Yourself Back In Line

Tinkering with the warm boot jump statement is just good manners. We need to restore the conin jump statement after the program is finished, or else we'd continue our checking right into the next program.

To do this I simply change the warm boot jump address so it really jumps to a routine that patches the conin jump back to its original state. So any jump to address 00H restores the table before you actually get the warm boot. Figure 1 shows the details.

Notice that a global variable "conback" is just an address for the assembler and can be treated as such in an assembly language routine. Automatic variables (variables within functions) can't be seen by other functions.

### The Longjump Routines

The functions which alter the jump table are written in assembly language. Since we are operating in C, including assembly language is pretty easy.

Figure 2 illustrates the process for Software Toolworks C/80. C/80 creates 8080 code and passes variables by pushing them in reverse order onto the stack. (Slight alterations may be needed to load the DE and HL registers in other versions of C.) Please note that the compiler takes care of the addresses, the origin, etc.

What I did was devise a function ("setjmp") that stores the present stack and CPU data in a six-byte array. A call to setjmp can be placed at the point or points in the program to which we wish to beat our hasty retreat.

Another function ("longjmp") reads the array and restores the stack and CPU to the prior condition. Since I'm not evangelizing on assembly language, I'll just offer the routines. My apologies for not writing in Z80 mnemonics, but C/80 can't digest

Figure 1 - Patching the BIOS Jump Routine Back to its Original State

```
#define OOPS 27      /*or whatever you wish to use*/
#define CLRSCR 26     /*clear screen: Kaypro this time*/
#define WBOOT 1
#include <printf.c>  /*<stdio.h> in other implementations*/
#include <scanf.c>

unsigned wbadd,*utilptr,*wbptr;
char conback,jbuf[6],swerve(),(*funct)(),restore();
/*********/
main()
{
    char line[80];

    utilptr = WBOOT;      /*get addr of warm boot jump statement*/
    wbptr = 1+utilptr;   /*get the pointer to the warm boot routine in bios*/
    wbadd = *wbptr;       /*squirrel away pointer for restoration later */
    *wbptr = restore;    /*assure that all boots go through restore() */
    utilptr = 7+utilptr; /*get the pointer to conin routine in bios*/
    funct = utilptr;     /*direct the function pointer to conin routine*/
    *utilptr = swerve;   /*assure that all console calls pass through swerve()*/
    setjmp(jbuf);        /*store CPU state, stack pointer, and top of stack*/
    printf("cDump and return\n\n",CLRSCR); /*trivial: here's where the real*/
    printf("Enter something!\n");           /*program belongs instead*/
    while(1) scanf("%s",line); /*scanf calls bdos, which calls bios;
                                program loops until ^C*/
}

/*********/
char swerve()          /*test the conin characters for "OOPS"*/
{
    (*funct)();
    /*call (not jump to) conin so it returns through here*/
    #asm
        STA    conback    /*return by conin is in register A*/
    #endasm
    if(conback==OOPS) longjmp(jbuf); /*if OOPS, then longjmp*/
    else{
    #asm
        LDA    conback    /*since bdos expects the character in A*/
    #endasm
    }
}

/*********/
char restore()          /*restore bios jump table before warm boot*/
{
    *wbptr = wbadd;      /*restore warm boot pointer*/
    *utilptr = funct;   /*restore conin pointer*/
    funct = wbadd;      /*redirect function pointer to warm boot routine*/
    (*funct)();          /*call--i.e., jump to--warm boot*/
}

setjmp(buf)
char *buf;
```

them so I fool it with "DB" declarations. If you aren't into assembly language you'll have to take this section on faith.

If Software Toolworks wonders whether I resent having to use 8080 code — I do, I do, I do.

### Applications

The program is pretty trivial, designed merely to demonstrate the jump routines. This type of diversion,

however, has numerous applications.

A public domain screen dump program from Micro C uses an assembly language variant of this technique. I assume that Borland's Sidekick does, too. CP/M BDOS does it with certain control characters.

A C program can easily be designed to run in high memory to act as a filter for any piece of commercial software. I've patched Perfect Writer and Perfect Calc to display directories

# CP/M 86

8" CP/M-86 Disk \$15.00 each

## DISK 86-1 — Disk Utilities

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.

## DISK 86-4 — IBM Mainframe Interchange/RESOURCE 8086

XBIOS.A86: A new BIOS that supports a real time clock.

RES86.CMD: A disk management program for transferring files between CP/M-86 and IBM 374X mainframe environments.

SDI86.CMD: An 8086 version of the RESOURCE disassembler.

## DISK 86-5&6 — FIG Forth

Disks 5 and 6 are a complete two disk set of FIG Forth 83.

F83.CMD: The standard Fig Forth 83.

META86.CMD: The Forth compiler.

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

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For 5 1/4" and 8" Drives

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Figure 2 - Assembly Language retreat for Software Toolworks' C/80

```
/*argument is a global array of length 6 for storing CPU and stack state */
{
#asm

    POP    H      ;return address popped
    POP    D      ;buffer address into DE
    PUSH   D
    PUSH   H      ;(SP) now at bottom of stack--to go to buf[4]&[5]
    LXI   H,0      ;SP into HL
    DAD   SP
    PUSH   H      ;SP below (SP) on stack--to buf[2]&[3]
    PUSH   B      ;BC below that--to buf[0]&[1]
    DCX   H      ;getting HL pointer to new bottom of stack
    DCX   H
    DCX   H
    LXI   B,6      ;load 6 chars
    DB    0EDH,0B0H ;Z80 LDIR--filling buf from the stack
    POP    B      ;restore stack
    POP    H

#endifasm
}
=====
longjmp(buf)
char *buf;
{
#asm

    POP    PSW     ;present return into PSW (AF)
    POP    H      ;buffer address into HL
    PUSH   PSW
    MOV    C,M     ;restore BC from buf[0]&[1]
    INX   H
    MOV    B,M     ;put SP into DE
    INX   H
    MOV    E,M     ;put SP onto stack
    INX   H
    MOV    D,M     ;return address into DE
    INX   H
    MOV    D,M     ;present return to stack
    PUSH   PSW     ;present return into HL
    DB    0D9H     ;Z80 EXX -- save registers
    POP    H      ;get old SP off stack
    SPHL
    DB    0D9H     ;and set SP to old value
    PUSH   D      ;EXX again
    ;pop return

#endifasm
}
```

Of course, there's nothing special using a diversion.

about conin. With a bit of ingenuity, practically anything can be redirected almost anywhere else. BDOS doesn't have to know that it's not getting those characters from the file it called.

The point is that the C programmer can tinker with the BIOS about as easily as he can write a standard program. It's the physically-oriented nature of C that encourages him to

remember that there is a machine under there.

I remember about two years ago when, with fear and trembling, I first started looking into Basic. I played with PRINT for at least three weeks without thinking much about the difference between real numbers and integers. But no one could use C for 13 seconds without being aware of the difference.



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  - Rom monitor functions with menu of options
  - Centronics and serial printer drivers included, selectable using IOBYTE
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  - Automatically selects disk formats for:  
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Kaypro 4 - 390K, DSDD, 48 TPI, 5 1/4"  
Kaypro 8 - 784K, DSQD, 96 TPI, 5 1/4"  
Xerox 820-1 - 82K, SSSD, 48TPI, 5 1/4"  
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  - Works with X120 board for double density
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  - Enables real time clock
  - Has Xerox rom monitor commands
  - Works with the X120 board for double density
- PLUS2 Rom Set ..... \$ 49.95

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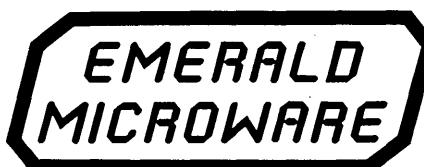
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# Xerox 820 Column

By Mitch Mlinar

1225 Fonthill Ave.  
Torrance CA 90503

**H**old the presses! Xerox has resumed production of the 16/8 computer. The old reliable 820-II with the 8086 card has been re-introduced as Xerox's low-end word processor (Spellbinder is the word processor included).

The computer is an 820-II with 16-bit capability, and Spellbinder is a pretty decent WP, so this "low-end WP" is adequate for most people. This means that the 820-II will be around for awhile.

The "new" system now has a disk expansion module (which finally adds support for 5.25" rigid disks) and a low-profile keyboard. Unfortunately, it looks like a bundled system: you can't buy just the 820-II 8-bit system. I don't have prices; contact Xerox for more information.

## Spare Parts

It looks like sources for 820 and 820-II boards are drying up fast. Since 820 production has stopped, that supply is expected to diminish. However, 16/8s (upgraded 820-IIs made in-house) should keep that supply going, right? Wrong! The story I've been hearing is that the Xerox manufacturing outlet (XMO) will be closed before year's end. With the XMO doing such a booming business, the question is "why are they closing?"

Xerox has a policy of destroying key parts of a system, so even if you had all the spare pieces, you still couldn't build an identical system. (The only 820 item I've never been able to purchase from XMO is the 8" disk drive case.)

Evidently, word has reached the upper echelon that complete 820s (among other products) can be assembled from the surplus pieces at a big savings. Judging from the XMO's large volume, obviously there are still many people eager to buy. An 820-II now costs about \$2800, but you can buy parts for a complete system for under \$400. So is it any wonder why the manufacturing outlet is doing a booming business?

## Real-Time Clocks

I've had several inquiries about real-

time clocks, so I'll deviate from my intended column for a moment to discuss two of them I recently purchased: the Ztime-I and the Optronics MC-1.

### Ztime-I

**Z**time-I: By Kenmore Computer Technologies (KCT), this real-time clock is based on the National Semiconductor MM58167A. The chip is directly interfaceable to microprocessors and offers timing down to 1000th of a second, (it is certainly not accurate at that level since the system uses a standard 32,768 Hz crystal).

There's no year register in the clock, but with a bit of fancy programming using a couple of the 8 latches available, you can get around this problem.

KCT offers a neat little board for \$69 in kit form and \$99 assembled. The easy-to-assemble kit comes with 4 chips and a small collection of resistors, capacitors, and diodes. I recommend the kit over the assembled version.

The assembled board plugs into the Z80 socket, and the Z80 plugs into the Ztime-I board. With no trimming capacitor, it is easy to gain/lose a few seconds a day. If you build the kit, get a trimmer — you will not regret it.

Operation of the Ztime-I is simple: all necessary programs, including source, are included for reading and setting the clock. An assembly language programmer will have little trouble, as all clock registers have their own ports (as well as some other control) which sit across 32 Z80 I/O ports.

### Optronics MC-1

**O**ptronics MC-1: The MC-1 is a real-time clock based on the Oki MSM5832. The MC-1 comes assembled and is plugged into the parallel port inside the 820. \$69 buys you the works. Although it lacks the manual for the chip (KCT includes one), the disk is full of software slanted towards 820 and 820-II users.

Among the date and time programs for the 820 series there is one which acts like an alarm clock on the 820-II

(or 16/8). It is cute, although I have yet to find a use for it.

One feature I do like is the write-protect jumper on the board; one cannot accidentally (through an errant program or system crash) change the time in the clock. Just install the jumper when setting the clock and remove it when you are done.

## Summing Up

Both boards do the job, and will keep doing it for about three years with the lithium battery. The Ztime-I is easier to install, does not require power supply cables, and does not eat up the parallel port (important if you already have a parallel printer there). However, the MC-1 costs less, has a write-protect jumper, and does not eat up 32 I/O ports. If you have or plan any expansions to your Z80 bus, 32 lost ports could hurt.

QP/M users will also find that Ztime-I requires conversion from BCD to binary, whereas the MC-1 does not. If you pinned my shoulders to the mat and asked me which one I would buy again, I'd say the Ztime-I. Although my pocketbook favors MC-1, that parallel port is already taken on my last non-real-time clock system.

## 629A Vrs. 644A

820 owners should be aware that there are two versions of the 820 board floating around: etch 1 and etch 2. Look at the part number on the edge of the board: if the last three digits are 629, then you have an etch 1. If the digits are 644, then you have an etch 2.

Etch 1 is the earlier board which has funny video to support Ball monitors and a faulty parallel port (they forgot to ground the odd-numbered pins — something you will have to do before you plug in a printer). Etch 2 added true double-sided support for the 5.25" drives, changed the floppy disk data/clock circuitry, fixed the video and parallel port layout, and cleaned up power distribution.

*(continued on page 23)*

# **EXTRA . . . EXTRA . . . EXTRA . . . EXTRA . . .**

According to leading publications, the PC market is in the midst of a fullblown shakeout. IBM, KAYPRO, OSBORNE and most other PC manufacturers are initiating cutbacks and layoffs due to slumping sales. Their increasing advertising dollar brings less & less results. At the same time sales for the ZORBA portable computer, the computer that is only advertised in a few choice periodicals and relies heavily on satisfied user testimonials, are showing a steady increase.

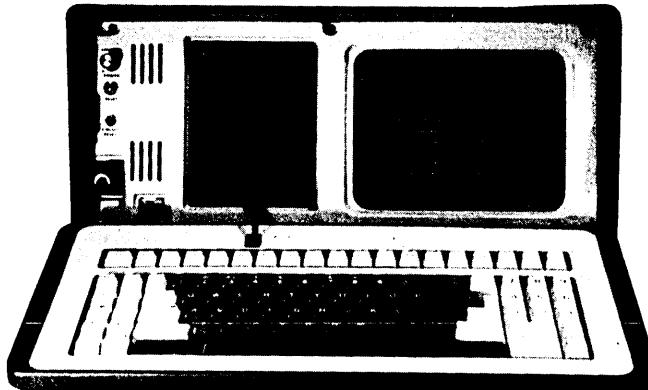
It's no secret, the public is learning what industrial users have known for years. That is: that for daily operation of word-processors, spreadsheets and databases, the trendy options are rarely used and the flashy machines that house them are really no faster, no more reliable and much more expensive.

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Built-in disk interchange formats: Xerox 820 (SD, DD), Kaycomp (DD), DEC VT-180 (SD), Osborne (SD) and IBM-PC (eg. CPM/86) and Televideo 802 (Read/Write and Format compatibility) (Expandable to 82 Formats)

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Width	-17.5 inches (44.45 cm)
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Depth	-16.0 inches (40.64 cm)
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Display Tube: 9" diagonal, Green or Amber High resolution display circuitry 60 Hz refresh rate

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128 ASCII Characters  
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Z80A CPU running at 4 Mhz with no wait states  
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## XEROX 820 COLUMN

(continued from page 21)

When buying 820 parts, be conscious of possible "etch version" specific hardware. The Xerox 820 Software Technical Manual contains both sets of schematics and can be helpful in determining if there are any conflicts.

Thanks to Dan Costello for suggesting this insert and including a beautiful set of "difference" schematics. Although I have schematics for both versions, the hardware differences are not always clear. I have included a description of the differences in a file called 820DIFF.12 on the RQP/M.

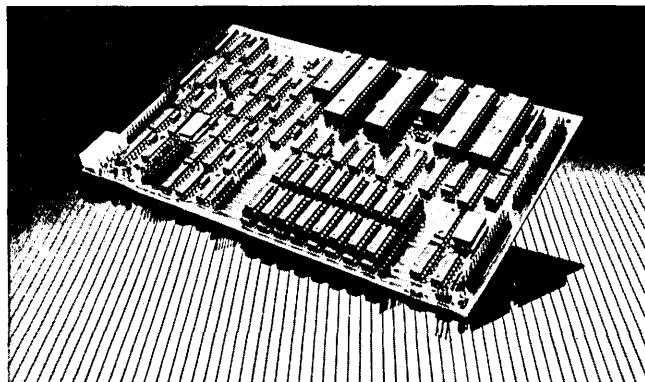
### RQP/M

What? Did he say RQP/M? Yes, folks. After a long delay due to moving (and destroying) some computer hardware, my RQP/M is finally on-line. Disk space is still limited (the 20-Mbyte system was one indirect casualty), but there is a disk rotation order until full storage capability is restored.

Besides 820 stuff, there is space for Kaypro, Big Board, Little Board, and QP/M users. The number to call is (213) 320-9309; it will answer around-the-clock except when being used by yours truly. I hope many will call with questions, answers, and CONTRIBUTIONS. Of particular interest are sources for 820/820-II/16-8 parts and prices; a file called 820COST.LST contains the latest prices and places that users have submitted on the BBS or I have found in magazines.

### Interrupts

Sorry, but I've run out of space this time. Next time I'll make sure to interrupt (sic) any tidbits until after interrupts are discussed.



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Deref	19	CNC	31
Matmult	42	115	N/A

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

We've also expanded the library (120 functions), the user's manual and compile-time switches (including multiple non-fatal error messages). The price is still \$250.00 and includes Microsoft's MACRO 80. As an option, we will supply Eco-C with the SLR Systems assembler-linker-librarian for \$295.00 (up to six times faster than MACRO 80).

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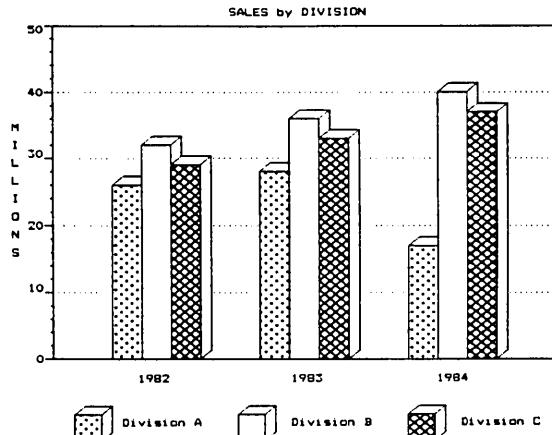
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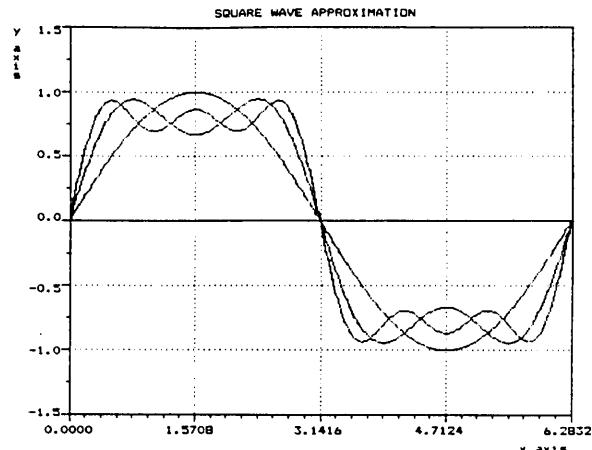
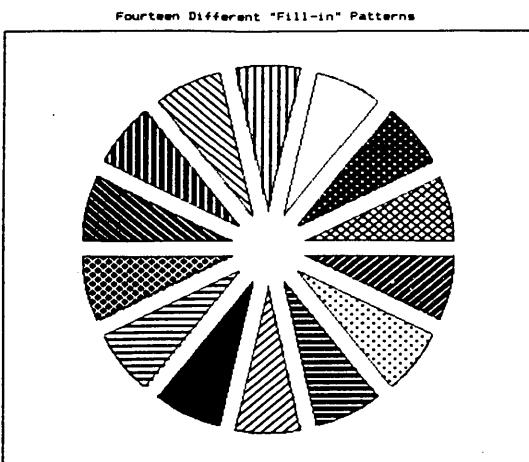
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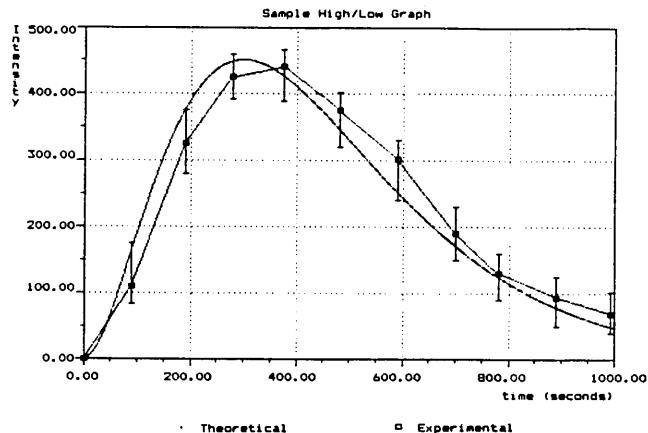
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# Xerox Monitor Modifications

By Thomas Rockwell

45 Allandale Ave.  
Rochester NY 14610

I would never want to take away from the great accomplishment of either the original or the Xerox version of the PFM-80 monitor. When I think back to my initial exposure to PFM-80 (reading through Micro C even before I got my 820 board up and running!) I thought it was indeed Pretty F&%\$# Magical, and I'm still amazed at its abilities.

However, there were a few unexplained gremlins that bothered me. After I had hammered out all the hardware bugs, the gremlins were still there. So, it was time to attack the software. After many hours of studying PFM-80 I've discovered where some of the gremlins hide out.

Right now is a good time to dig out an old copy of Micro C #1 and turn to the PFM Monitor Listing on page 10. (Actually, the listing is split between issues #1 and #2.)

## Gremlin #1

The first gremlin I found was the infamous Drive Select on power-up. Where did he come from?

```
line 237:  
DEFB 00000000B  
;DE-SELECT ROMS,ENABLE DRIVE 0
```

Bit 2 does the drive select. This must be set to 1 to de-select the drives and to 0 to select them. To power up with no drive select then line 237 should read:

```
DEFB 00000100B  
;DE-SELECT ROMS, ENABLE DRIVE 0
```

This will de-select the ROM bank, enable drive 0 and turn on the disk AC. I do not have a Disk AC relay so this part is theoretical but if you want TURN-ON to take care of turning on the AC as it should:

```
DEFB 01000100B  
;DE-SELECT ROMS, ENABLE DRIVE 0  
;BUT NO DRIVE SEL OR DISK AC YET
```

After this change, I don't worry about powering the system up and down with the disks in the drives. I have been doing this for over three months and haven't had a single unrequested head load nor have I lost even a single bit of disk data.

If you're interested in why I changed

these bits, take a quick look at what is written to BITDAT (SYSPPIO Port A) in Figure 1.

Also, I noticed that the drive select was on for the same amount of time that the drive AC was supposed to be on after a disk de-select. Why?

For some reason the system was doing an interrupt service routine to DSXTRMR (line 973). But how did it get there? In line 237 we were turning ON the disk AC so it could be turned off exactly as it was supposed to. I spent months verifying this.

Figure 1 - Bit Changes

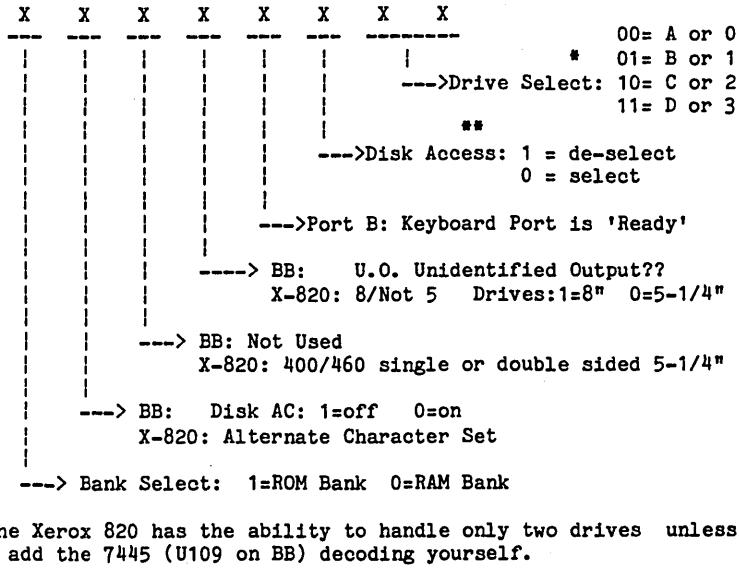


Figure 2 - Autoboot Routine

```

AUTOBT EQU TRUE

SIGNON: EI
  CALL PNEXT
  DB '... System monitor 3.66 ..' ;@  

  DB CR,LF,0 ;@  

  IF AUTOBT ;if you power up your system all together
    ;it is best to wait a couple of seconds @
    MVI A,2 ;set up for a 2 second delay @
    STA MOTOR ;use motor countdown timer with CTC3
    DLAY1: CALL PAUSE ;as the 1 second clock, motors are off
    LDA MOTOR ;at this point so we won't hurt anything @
    ANI OFFH ;set flags
    JRNZ DLAY1

    CALL BOOT ;do an autoboot for the sophisticated user
    CALL PNEXT ;print an error message if boot fails @
    DB CR,LF
    DB 'Disk in A? Enter B <CR> to boot CP/M' ;@  

    DB CR,LF,0 ; and then we enter the monitor @
    ENDIF

    JMP WARM ;GO ENTER MONITOR
  
```

### Gremlin #2

I found another gremlin in the disk drive PIO. Have you ever been computing along and suddenly your computer does a warm boot? Where did that come from?

```
line 233:  
DEFB 00011000B  
;MAKE BITS 4 AND 3 BE INPUTS
```

This looks like a simple enough instruction. But the PIO was expecting an interrupt vector when it got this command, and poof!, an interrupt vector to FF18H is born. (The number above is an 18H and FF00H is added to this number on an interrupt request.) The address FF18 belongs to SYSVEC which is not set to anything since we didn't expect to use it. It is still zero from the zeroing of the scratch RAM (line 50).

So on an interrupt request from the PIO, the processor gets its new Program Counter from FF18H (0000H) and this happens to be the Jump to Warm Boot address of CP/M. This sequence would never start if the interrupts were disabled but the command to disable interrupts is 0110 0111B. This section of code should read:

```
line 231: DEFB 4,BITCTL  
line 232: DEFB 11001111B  
;SET SYSPIO PORT A TO  
;BIT MODE==> MODE 3  
new line: DEFB SYSVEC  
;INTERRUPT VECTOR  
line 233: DEFB 00011000B  
;MAKE BITS 4 AND 3 BE INPUTS  
line 234: DEFB 01100111B  
;INTERRUPTS DISABLED
```

I don't know why an interrupt was generated other than to say they weren't disabled as we thought they were and Murphy's Law says, "If interrupts aren't disabled, you'll probably get a few to point out the oversight." (I really don't buy this and I am still looking for the reason.)

### Autoboot

I find that 99% of my power-ups are destined for CP/M and only 1% are to the monitor. So I've implemented the routine shown in Figure 2 to do an autoboot after waiting 2 seconds (to give slow power supplies time to crank up).

If there is a boot error, you'll get an error message and automatic access to the monitor. I've surrounded the auto-boot region of the monitor with an IF statement. Thus, an AUTOBT EQU FALSE will cancel this feature.

P.S. I must say "hats off" to a homeowner and his product—the EZ-PROM from Optronics Technology. It is just fantastic. It helped make all these ROM changes possible.

■ ■ ■

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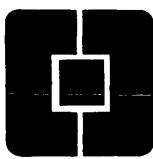
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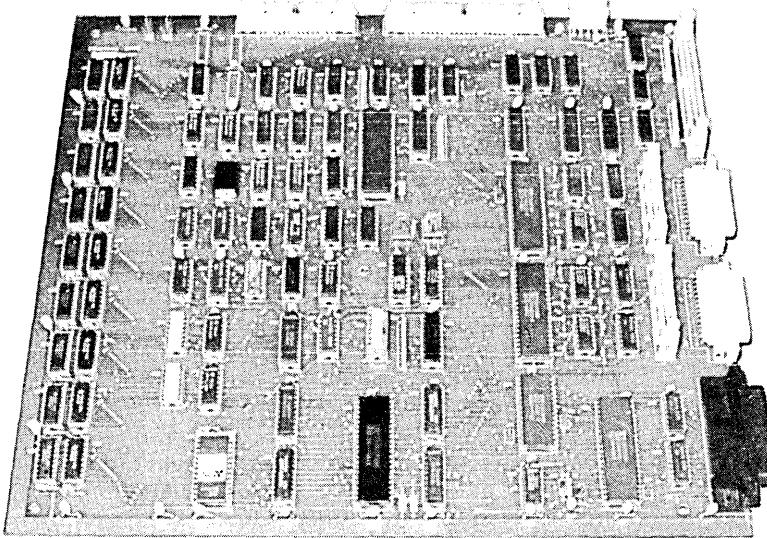
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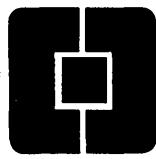
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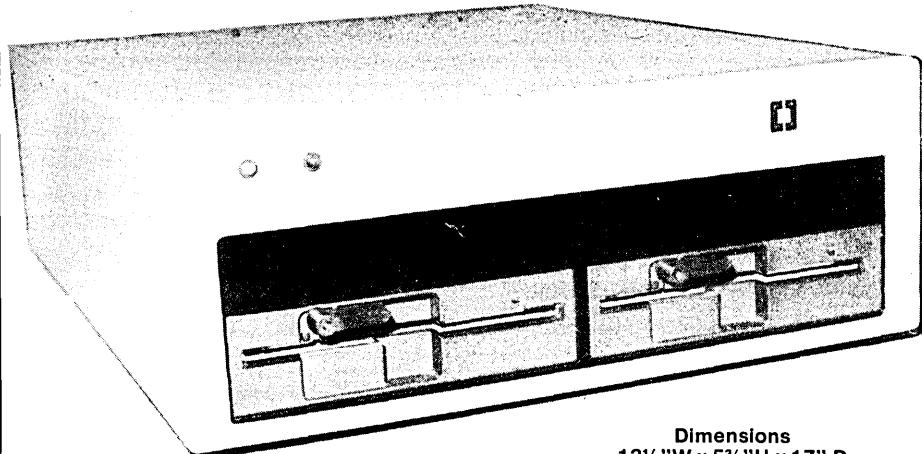
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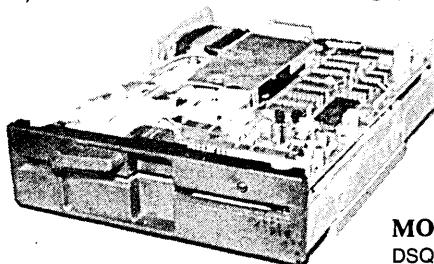
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# Direct BDOS Calls In CP/M

By Thomas Geldner

3746 29th Street  
San Diego CA 92104

**D**iscussion among three programmers at the local watering hole:

Joe: Well, Sam, what's new?

Sam: Oh, the usual. I'm porting a modified Phoneyx Op-Sys to the Grumblefratch 0286 using conversational interrupt drivers and an I/O slave driver. Should be finished in a day or two. How 'bout you?

Joe: Yeah, well, I'm doing a clipper based on the IEEE-487 JPZ standard for GMC multi-bus applications.

Sam: What's up with you, Bill?

Bill: Gee, guys, I just read Tom Geldner's latest article in Micro C, and now I can beep the console bell!

... as Joe and Sam slowly move away.

In issue #24, we spent our time rehashing the memory locations of the various parts of CP/M, and things were pretty theoretical (at least the practical value may not have been immediately apparent). This month, we'll take a small detour as promised, and explore something a little more useful: Direct BDOS calls. The illustrations will be done in a variety of ways including your first (and probably last) assembly language example. And yes, you're going to learn how to "beep the console bell." (Gosh, Maude, this sounds exciting!)

## Review

Programs use the BDOS and, occasionally, the BIOS to perform Input/Output tasks. The BDOS handles all disk drive related functions and most console activity (keyboard input, printer output, CRT output, etc.). The BIOS does specific hardware related tasks and occasionally handles console activity, but is used primarily by the BDOS as its window to the world.

When you write a program in a high-level language such as Turbo, access to CP/M is provided for you in the form of statements such as Read and Write. (The equivalents for BASIC include PRINT, INPUT, GET, and PUT statements.) When you tell Turbo to display a character on the screen, Turbo actually tells the BDOS to do it. BDOS in turn tells the BIOS

Figure 1 - Assembly Language program to 'beep the console bell'

```
; BEEP the Console bell
ORG 100H ;start where programs start
;
BDOS EQU 0005H ;BDOS entry vector
CONOUT EQU 02H ;BDOS CONSOLE OUTPUT function
BELL EQU 07H ;ASCII bell character
;
MVI C,CONOUT ;load Register C with function number
MVI E,BELL ;load register E with bell char
JMP BDOS ;go to address 0005
JMP 0 ;Jump back to cp/m
```

Figure 2 - LOAD.COM

```
A>ASM BEEP <== creates file BEEP.HEX on A: Drive
A>LOAD BEEP <== creates file BEEP.COM on A: Drive
```

to do it, and then the BIOS does it.

## Accessing The BDOS

Access to the BDOS takes the form of function calls. (This is true both in assembler and in high-level languages.) There are 38 CP/M 80 BDOS functions available, doing such things as resetting disk drives, deleting files, and printing. To have the BDOS perform one of its functions, you put information in your 8080 or Z80's registers (information that BDOS needs) and then call BDOS.

Don't panic if you know nothing about registers. Doing a BDOS call is sort of like baking a cake. If you just follow the recipe, everything will come out OK (as long as you don't open the oven door at the wrong time).

## The Two Parts Of A BDOS Call

There are two main ingredients in a BDOS call. The first is the number of the function being called. Each of the 38 available functions has been assigned a number from 00H to 26H (37 decimal). For example, the SYSTEM RESET function is 00, CONSOLE INPUT is 01, CONSOLE OUTPUT is 02, etc. The function number is always placed in the C register.

The second ingredient is optional and is called an Entry Parameter (or parameters). The Entry Parameter can be a character to be sent to the screen or printer, a memory address, or some other value that BDOS will use. (There is also an Exit Parameter which we will deal with later. This is a

result, though, and not an ingredient.)

Assuming we wish to use the BDOS to send a character to the console, we would put the character to be sent in Register E and put the function number 02 (CONSOLE OUTPUT) in register C.

Now, once the registers are loaded your program can CALL (or JUMP) to location 0005 (the BDOS Entry Vector). At location 0005 is a JUMP to the address specified at locations 0006 and 0007 (the location of BDOS).

Once the JUMP to BDOS is completed, function 2 will be executed. When function 2 is finished, the BDOS will do a RETURN, thus sending execution back to where it started.

Now, let's see how we get the ingredients to the right places at the right times.

## Assembly Language Programming 1A

As promised, Figure 1 shows our first assembly language program "beep the console bell" using BDOS function 2, CONSOLE OUTPUT.

To use, type Figure 1 exactly as shown using Perfect Writer, WordStar, or any other word processor and save as a file called BEEP.ASM. Use TABS to separate the columns, and in WordStar, use the non-document mode. (You don't have to enter the semicolons and the comments with them.) Assemble using ASM.COM, then load using LOAD.COM as shown in Figure 2.

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Now, you can run BEEP.COM just as you would anything else. Simply enter "BEEP" and hit RETURN. You should hear the console bell ring once, and then you will be returned to the A>. (See, you really do have mastery over the little beeper.)

I don't intend to conduct a tutorial on how to program in assembler (I wouldn't know how, anyway), but here's a brief explanation of what's happening in this program.

First, the assembler is told where the program is to ORIGINATE using the statement "ORG 100H". Under CP/M, a program that will operate by itself will normally originate at 100H (where CP/M places control after it loads a .com file).

Next, we establish some EQUATES which make the program easier to read. In this case, the assembler is told that the CONSTANT BELL has the value 07, BDOS is 0005, and CONOUT is 02. (Note that ASM doesn't care whether we enter a number as 5, 05, or 0005. Programmers do this for clarity's sake. Memory locations are usually entered with four numbers such as 0005 or 0F7EF (note the leading 0 if the first character is a letter), byte values are entered as two digits such as 01 or 7F.

Now we get to the meat of the program. The things we've done previously have been instructions to the assembler (ASM.COM). The next instructions produce the actual Z80/8080 code. The first instruction, MVI C,CONOUT, means to MOVE IMMEDIATE the value of CONOUT into register C of the CPU. Since the assembler has been told that CONOUT is always 5, this has the effect of loading register C with a 5. The next instruction loads register E with the value 2. You could have loaded the numbers directly instead of giving them names first, but the program would have been harder to understand.

The next instruction activates the BDOS by JUMPing to it. BASIC programmers can think of this as a GOSUB where the BDOS itself is the subroutine. After the BDOS is

through executing function 2, it will RETURN program execution to wherever it came from, in this case, our program.

The final instruction, JMP 0, sends control back to CP/M.

Now let's look at our program using DDT.

```
A>
DDT BEEP.COM<cr> <== you type
DDT VERS 2.2      <== DDT responds
NEXT PC           "
0180 0100          "
-d100,108         <== you type
```

This will display the first 8 byte values in HEX and ASCII. You should find the following:

```
100 0E 02 1E 07 C3 05 00 00 .....
```

The first 6 hex bytes are the actual machine language instructions that resulted from our original assembler source file! Now let's disassemble BEEP by using DDT's List command. Just type an L and hit RETURN. You should see:

```
0100 MVI C,02
0102 MVI E,07
0104 JMP 0005
0107 NOP <== means NO OPERATION
          (all the zeros)
0108 NOP
```

Recognize the guts of our assembly listing?

### Turbo, SBASIC And dBASEII Beeper

Again, since this is not an assembly language column, let's go back to the higher world and see how direct BDOS calls are made.

Here's what BEEP looks like in Turbo Pascal:

```
begin
  Bdos($02,$07);
end;
```

Since Borland has conveniently provided us with a Bdos Procedure, specifying addresses and registers is unnecessary. (There is also a BdoshL Function and a Bdos Function for those BDOS calls requiring access to the HL registers or A register. More on this later.)

(continued on page 33)

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## DIRECT BDOS CALL IN CP/M

(continued from page 31)

In dBASEII things are even less obvious. From the dot prompt enter:

```
. poke 52000,14,2,30,7,195,5,0  
. set call to 52000  
. call
```

First, we select an area of memory not normally used by dBASEII and POKE the decimal numeric equivalent of our assembler produced BEEP.COM program into it. This statement has the form:

```
POKE address,  
<data byte>[,<data byte>...]
```

Then we give dBASEII the address to be CALLED with the SET CALL TO command. Finally, we do a CALL that tells dBASE to go to the address specified previously and execute the instructions there.

### Now For Something Useful!

Obviously, this hasn't been the most constructive application for direct BDOS calls. Heck, PRINT CHR(7) or Write(G) will work just fine, thank you. So what IS the most constructive application? The answer is: anything your high-level language doesn't allow you to do directly. And to answer the question "What doesn't my high-level language allow me to do?" you'll need to know what the BDOS functions can do.

There are two ways of finding out what the BDOS functions are. The first is to attempt to read the Digital Research CP/M manual that came with your computer. Good luck! This little gem ranks right up there with the SBASIC manual for the all time worst word collection.

The recommended way is to get one of the many books available on CP/M. My personal favorite is Thom Hogan's "CP/M User Guide," copyright 1982, Osborne/McGraw-Hill. It's an excellent guide for the non-assembly programmer. There are many others, but most are either too simple or else intended for the assembly language programmer. (Editor's note: "Inside CP/M," available from B. Dalton or Micro C, is also a good book for this use.)

Now, as promised, here's something practical (at least I think it's practical). For lack of anything better, let's call this the "What is the currently logged disk drive?" procedure.

We all know that most high-level languages, acting through CP/M, will automatically save a file (if you don't specify the drive) to the currently logged drive. There may be an occasion, however, when we ALWAYS want to save a file or look for a file on the disk that was logged the first time the program was run.

For example, suppose you have an optional help file that your program can access. The assumption is made that this help file will always be found on the same disk as the main program. Once the main program is started, if we subsequently allow the user to change the logged disk drive, the program may be unable to find the help file again. One way to get around this is to force the user to always run the program from the A: drive. Not a very classy solution.

A better way is to figure out which drive was logged at the time the program was originally run, and then use that drive throughout to specify the help file. We do this with BDOS Function 19 (hex), RETURN CURRENT DISK. (The Editor again: Libraries would use this function a lot if they started loaning floppies.) Here's a Turbo program that does this:

```
var DiskDrive: Char;  
  
begin  
  DiskDrive := Char(Bdos($19)+$41);  
  Writeln(DiskDrive);  
end.
```

Note that in this example, the BDOS Function is used. This is similar to, but not the same as, the BDOS Procedure. The BDOS Function in Turbo is used without an entry parameter, and the result returned is the value found in the A register of the Z80 or 8080. In this case, the result will be 0 for the A: drive, 1 for the B: drive, and so on. Here, we convert the value to a drive letter (+\$41). One usage might be:

```
FileName :=  
           CurrentDrive + ':' + FileName;
```

This will allow us to search for a file on the currently logged drive, and then get back to the file even if the logged drive has been changed.

### End Of Pedantic Lecture #3

There are certainly other ways of accomplishing the things I've illustrated in this article. Your comments and suggestions are always welcome. In fact, good questions and/or problems will form the basis for future articles.



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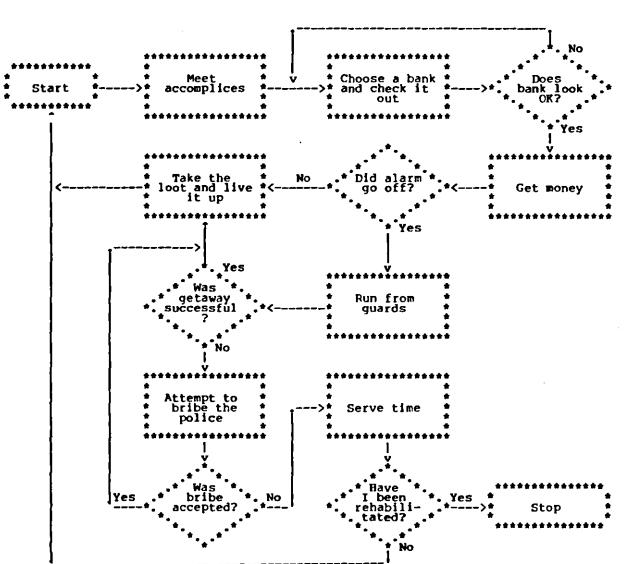
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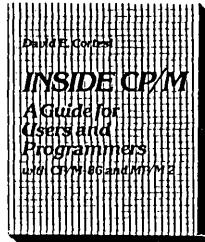
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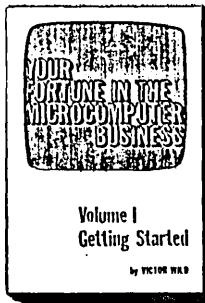
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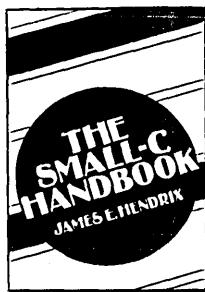
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# RS-232C: The Interface

By Larry Kraemer

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If you are like most folks, you aren't comfortable with an RS-232 interface. Actually, many feel that if God had intended man to understand a serial interface he wouldn't have let a committee design it (and there is no question that it was designed by committee).

To be precise, RS-232C is an interface defined by the EIA (Electronics Industry Association) for low speed serial data communication.

The RS-232C standard is a piece of paper issued by that committee which defines such things as voltage levels, loading characteristics, timing relationships, and signal responsibilities.

How do you tell if you have a serial interface that needs understanding? Usually you'll see a female 25-pin connector mounted on the back of your computer (a DB-26S). The connector will probably be marked "printer" or "modem."

## DTEs And DCEs

There are two main classes of RS-232C devices — DTE (Data Terminal Equipment) and DCE (Data Communications Equipment). Terminals, computers, and printers are usually DTEs; modems are DCEs. The point of all this is that the esteemed EIA committee assumed you'd want to connect a DCE to a DTE. They set it up so that you could usually connect the two together simply by connecting pin 1 to pin 1, pin 2 to pin 2, and so on, up to pin 25.

You can also interface DCE to DCE (or DTE to DTE), but you must build a special cable in which some of the signal and control lines are crossed. A null modem cable which allows you to directly connect two computers is an example of such a special cable.

RS-232C is intended for short (50 feet or less), low-speed serial communication. Low speed normally means 19,200 baud (bits per second) or less although 38,400 baud and higher is becoming more and more common. Serial communication means that all the information is moving one bit at a time down a single signal line. (It's like blowing peas through a straw.)

Most parallel interfaces send data 8 bits at a time.

## Is It Simplex?

RS-232C defines simplex, half-duplex, and full-duplex communication.

A simplex channel is one way (for example: from a computer to a printer). In half-duplex, data may travel either direction but only one direction at a time. In a full-duplex channel, data may travel in both directions simultaneously.

Standard 300 and 1200 baud modems are full-duplex, so you can see characters on your own screen as you enter them on your keyboard. The characters are being echoed back from the remote system.

## The Electrical Definitions

The RS-232 interface is made up of 25 signals or lines. (A line is defined as a continuous wire from one device to another.) In the simplest case, an interface may be implemented with as few as two wires.

## Most Common Signals

The control lines go high (+12V) when they are true and low (-12V) when they are false. On the other hand, the data lines (pins 2 & 3) go low for a "1" bit and high for a "0" bit, just backward from what you might guess. If you are checking any of these lines, use a voltmeter, not a logic probe.

## Pin 1: CG — Chassis Ground

This is frame ground and insures that the two devices are at the same potential, which prevents electrical shock to the operator. It's optional and isn't used as the reference for any other circuit.

## Pin 2: TD — Transmit Data

TD is the path by which serial data is sent from the DTE to DCE.

## Pin 3: RD — Receive Data

This line is the path for sending serial data from the DCE to DTE.

## Pin 4: RTS — Request To Send

RTS is the signal that indicates the DTE wishes to send data to the DCE. When it is high (true), the DCE knows that the DTE is ready to send.

## Pin 5: CTS — Clear To Send

CTS is a signal from the DCE that indicates it is ready to receive data from the DTE. Normally this line will be low (off). When the DTE raises RTS the DCE will raise CTS allowing the DTE to send data.

## Pin 6: DSR — Data Set Ready

This signal informs the DTE that the DCE is alive and well. It's normally kept high by the DCE.

## Pin 7: SG — Signal Ground

SG is the neutral or return line for all the other signals. It must always be present.

## Pin 8: DCD — Data Carrier Detect

This signal from the DCE (modem) tells the DTE (computer) that the modem sees a carrier (is the phone off the hook?).

## Pin 15: TC — Transmit Clock

TC provides the clock for the transmitter section of a synchronous DTE. It may or may not be running at the same rate as the receiver clock, and must be present on synchronous interfaces. (Very few systems are set up for synchronous communication, so pins 15 and 17 are seldom used.)

## Pin 17: RC — Receiver Clock

RC provides the clock for the receiver section of a synchronous DTE, and may or may not be running at the same rate as the transmitter clock. It must be present on synchronous interfaces. Both RC and TC are provided by the DCE.

## Pin 20: DTR — Data Terminal Ready

This circuit provides the signal that informs the DCE that the DTE is OK. It's pulled high by the DTE at power-up and left there. Note that a typical

(continued next page)

DCE must have an incoming DTR before it will function normally.

Figure 1 shows the signal names of the entire RS-232 interface.

#### Types Of Data Communications

There are two ways to send data serially: asynchronously and synchronously.

#### Asynchronous Data

Asynchronous serial data is sent character by character. The bits within a character are sent with very precise timing. Once the character is sent there is a pause or signal of some sort to tell the system to get ready for the next character.

Normally, during an inter-character gap the line is at a logic 1 state. When the character starts, a start bit (logic 0) is always first. Once the start bit has occurred, the other data bits follow, least significant bit first.

There are normally 7 or 8 data bits sometimes followed by a parity bit. When running with even parity the parity bit will be set or reset to make an even number of ones in each character. In odd parity, the bit will be set to make an odd number of ones.

In theory, parity should catch most bit errors because things wouldn't come out even (or odd) if one bit gets crunched by the phone line. However, if two bits get crunched in the same character, there is a good chance that the parity check won't catch the error. (For this reason, parity has largely been replaced by CRCs and check sums.)

Following the parity bit (if used) are 1, 1 1/2, or 2 stop bits. These stop bits are always a logic 1 and simply insure that the line is idle for between one and two bit time(s) while the hardware re-cycles for the next start bit. Of course, the line can remain in an idle (low) condition for an indefinite period if another character isn't ready to be sent. The stop bits are simply a measure of the minimum time that the line must remain low before the receiving system will recognize the start of another character.

#### Synchronous Data

Synchronous data transfer means that the sending and receiving units are synchronized by a constant clock

signal. This clock makes sure that the two units won't get out of step so that strings of characters can be sent without stop bits or start bits. The

Figure 1 - RS-232C interface circuits

PIN	NAME	EIA	CCITT	DTE	DCE	FUNCTION
1	CG	AA	101	--	--	Chassis Ground
2	TD	BA	103	>>	<<	Transmit Data
3	RD	BB	104			Receive Data
4	RTS	CA	105	>>	<<	Request To Send
5	CTS	CB	106			Clear To Send
6	DSR	CC	107		<<	Data Set Ready
7	SG	AB	102	--	--	Signal Ground
8	DCD	CF	109		<<	Data Carrier Detect
9*					<<	Pos Test Voltage
10*					<<	Neg Test Voltage
11						Not Used (usually)
12+	SCDC	SCF	122		<<	Secondary DCD
13+	SCTS	SCB	121		<<	Secondary CTS
14+	STD	SBA	118	>>	<<	Secondary TD
15#	TC	DB	114		<<	Transmit Clock
16+	SRD	SBB	119		<<	Secondary RD
17#	RC	DD	115		<<	Receive Clock
18						Not used (usually)
19+	SRTS	SCA	120	>>		Secondary RTS
20	DTR	CD	108.2	>>		Data Terminal Ready
21*	SQ	CG	110		<<	Signal Quality
22	RI	CE	125		<<	Ring Indicator
23*		CH	111	>>	<<	Data Rate Selector
		CI	112		<<	Data Rate Selector
24*	XTC	DA	113	>>		Ext. TC
25*				>>		Busy

\* Denotes rarely used

+ Denotes only if secondary channel implemented

# Denotes only on synchronous interfaces

>> Denotes from DTE to DCE

<< Denotes from DCE to DTE

-- Denotes Ground line

CCITT = International Telegraph and Telephone Consultative Committee

Figure 2 - Transferring an 'A'

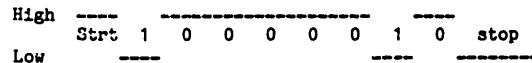


Figure 3 - Three ways to hook up DTE to DTE or DCE to DCE devices.  
Note pin reversals, and that pin 20 may be used in a full-handshake system.

#### NONE MODEM    NO HANDSHAKE    FULL HANDSHAKE

1-----1	1-----1	1-----1
2-----3	2-----3	2-----3
3-----2	3-----2	3-----2
4-    -4	7-----7	4-----5
5-    -5	5-    -5	5-----4
7-----7	6-    -6	7-----7
6-    -6	8-    -8	6-----8
8-    -8	20-    -20	-20
20-    -20		8-    -6
		20-    -1

NOTE: Pin 1 is optional for Chassis Ground between Terminals.

strings (often called blocks) of data usually have special beginning and ending characters which identify the string and contain check sums.

Synchronous data transmissions are normally more intelligent than asynchronous (smarter operators). Packet networks such as X.25 often transfer data synchronously.

#### Final Details

The data transfer speed (baud rate) is usually determined by the serial clock. The number of bits per character is usually handled by the UART or SIO chip. (Most data communications are done at 8 bits/character, 1 stop bit, no parity.)

To send an ASCII "A" (41 hex), the SIO would output 0100 0001 (binary) with the right-hand 1 being the least significant bit, and the left most 0 being the most significant bit. Figure 2 shows what you'd see on the data

output pin of the RS-232 connector. Bit flow is from left to right, and note again that the least significant bit is sent first.

Logic 1 is low as shown.

#### Non-Standard Wiring Connections

There are several ways of hooking together two devices of the same type (DTE — DTE, or DCE — DCE).

If only one-way communication is required, you'll need at least two wires, one data line, and pin 7 ground. All handshaking conditions can be satisfied by looping back the appropriate signals on both ends of the cable (see Figure 3 — Null Modem diagram). The three typical connections are null modem, no handshake, and full handshake.

Figure 3 shows the necessary wiring. Note that the manufacturer may wire the device either as a DTE or DCE, so you need to read the manual.

(I know, it's a last resort, but...)

I hope this info saves you some time; I've spent many hours uncovering it the hard way.



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# 86 World

By Laine Stump

Micro C Staff

**H**ey, Wait! DON'T TURN THAT PAGE! It's still me, only the name has been changed to protect the incompetent. That's right, this is the latest incarnation of The Slicer Column. We've changed the name because many new readers have no idea what a Slicer is ("some kinda tater masher, huh, Joe Bob?" "Naw, Frank Chuck, I think it's the name of that new slash murderer down in San Francisco.").

Along with being more descriptive of the column's contents, the new title will give me more latitude in my discussions (not that I have had a latitude problem in the past. An attitude problem perhaps...).

The '86' part means that I will be covering anything happening with machines that use the 8088, 8086, 80188, 80186, 80286 (80386, 80486 ???) processors. I wouldn't mind covering the 68000 as well, but the line must be drawn somewhere. Maybe later — hint, hint. (Editor's note: Hold on, there. Leave something for the rest of us!)

By the way, when I say "anything" I don't mean reviews of new spreadsheets and databases. I will restrict my software opinions to programs that can be considered "system" software or programmer's tools (i.e., compilers and editors, but not word processors).

Of course, none of this means I'll be ignoring the Slicer. Since the 86 system I have is a Slicer, the content of the column will necessarily be heavily Slicer-oriented. There will probably be very little change from the past — just a broadened perspective. This broadening will take awhile though, since I have to get the information before I can report on it.

## Turkey Talk (Fowl Play)

"World" may seem a bit ambitious to use in the title of a mere magazine column, but this truly will be a "world class" column. After months of weighing different career choices, I have finally chosen not to make a choice. Instead, I'll be leaving the U.S. in mid-August for a two year stay in

Ankara, Turkey, where I'll be working for The Development Foundation of Turkey.

This will put a crimp in my telephone habits, but I hope I'll be able to use Telex and the mail to keep on top of new developments (anybody have a spare satellite channel I can borrow?). Maybe someone could come up with an inexpensive world-wide network system based on shortwave radios (gotta be some dollars in that one).

DFT helps farmers in rural areas modernize their operations. I'll attempt to put computer technology into use in as many places as are technically and financially feasible. If anyone out there has been involved in anything related to this, I would really love to hear from you. This is going to be the biggest challenge I've ever faced, and aid will not go unnoticed.

Eventually, I'll be able to let you know my address in Ankara. In the meantime, just send any letters to Micro C, and they'll be forwarded.

## New Products

Slicer intends to release at least two new products at the SOG this year. The first is something they introduced at last year's SOG, but still needed time to mature. Yep, that's right, you can finally buy Concurrent CP/M for the Slicer. And it's not just plain old vanilla CCP/M — it can window on both the PC video board and any serial terminal with cursor positioning commands. You can even connect multiple terminals and have windows on all of them (if you're feeling really schizophrenic).

Performance seems to be extremely good — one person in Australia reportedly has more than six terminals on his system, and it still performs acceptably. They're working on the PC-DOS emulation module, too; it may not be ready in time for the SOG, but very soon you'll be able to run CP/M and MS-DOS programs concurrently.

The other product is really a variation of an existing product. Slicer will now be selling a 1 megabyte expansion

board as well as the original 256K version. It has the four serial ports, the printer port, and the clock just like the 256K unit, but it uses 256K DRAMs to fit an entire megabyte of RAM onto a single board.

Since the 80186 can directly access only 1 megabyte at a time, and more than 256K of that is already taken up by the memory on the main Slicer board, the RAM is split up into four chunks of 256K. The first 256K resides immediately above the Slicer's 256K; the other three banks of 256K can be switched in one at a time into the first 256K of memory space (one of these banks is mapped slightly differently to allow access to video memory at the same time). All of the bank switching and mapping is done with PALs, so you should be able to easily modify the mapping for custom applications.

Having this much memory opens the door for some incredible multi-track disk buffering schemes. It also may be possible to put parts of the operating system into a bank that's switched out most of the time, leaving more memory open for applications.

## Project X

Also to be announced at the SOG is PC Tech's "Project X," now called "The Scepter," I understand. This is an 80186 board that magically fits into the same space as an IBM motherboard. This allows you poor unfortunates with aging PCs to upgrade your system without giving up that precious white cabinet and silver emblem.

The Scepter can run at either 8MHz or 10MHz. It has a socket for a floating point chip (the 8087, I assume), a SASI port for connecting a Winchester drive, and identical floppy hardware to the IBM. There is no onboard video circuitry, but there are five PC-type cardslots so you can plug in any video card you like (a Hercules hi-res, maybe?). I haven't seen one yet (nobody has), but it appears that the only thing not PC compatible on the board is the clock speed (and the performance). More on this one after I

have seen it in the flesh.

Ampro will be officially releasing its 80186 Little Board at the SOG, too (it has their SCSI/Plus multi-master bus and runs at 8 MHz).

#### New User Disks

Since everyone else is releasing new products, I've decided to release some of my own. I've put together two new CP/M 86 user disks, #7 and #8.

Disk #7 contains: VFILER, a screen oriented SWEEP-type utility, ARCHIVE for automatically backing up all files modified since the last backup, expansion board clock routines written in Turbo Pascal, and several other programs. Aside from the clock programs, everything on this disk should work on any CP/M 86 system.

Disk #8 has the latest Slicer BIOS, a new STRANGE program that allows the Slicer to read both Morrow and Kaypro format 5 inch disks, and lots of other great stuff. The BIOS now supports CP/M's IOBYTE feature as well as printing the current time and date during cold boot if the expansion board clock is installed. Double-sided 5 inch IBM format is supported in the BIOS, so it's no longer necessary to use STRANGE to read IBM disks.

We'd like to assemble more CP/M 86 disks as well as MS-DOS disks, so send anything useful to Micro C and get a free user disk of your choice.

By the way, I discovered the other day that MODEM7 from disk #1 would not run on my Slicer with the PC video board installed. Following the advice given in the video board manual, I made the stack larger and reassembled; now it works fine.

#### Half Tracked Format

To allow formatting 40 track formats on 80 track drives on the Slicer, edit SLIFORM.A86 and change the drive-type bytes of the 40 track formats to indicate a "half-track" format, then reassemble. It's better to format 40 track disks on a 40 track

(continued on page 41)

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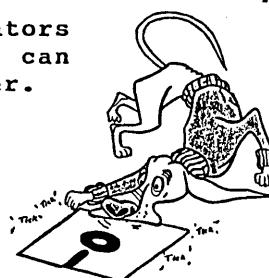
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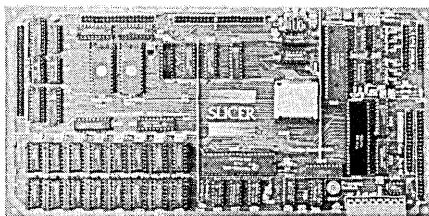
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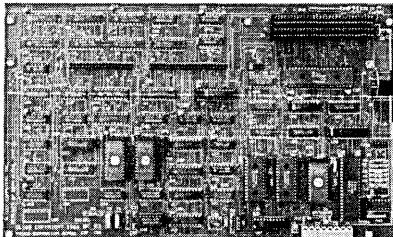


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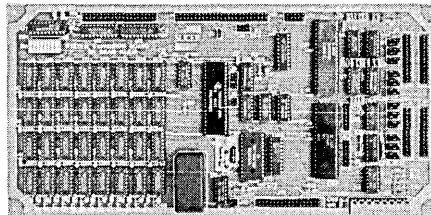


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drive, but when you're like me and don't have a 40 track drive, there's no alternative.

The drive type byte is the very first byte in each table of disk info in SLIFORM. To indicate a half-track format, just change bit 2 from 0 to 1. For example: 1011B becomes 1111B.

#### AT Drives

Also included on User Disk #8 is the new code that must be patched into the Slicer ROMs to allow proper operation of the new drives used on the IBM AT. These drives can look identical to either an 8 inch or a 5 inch drive. When in 8 inch mode, you can use any of the Slicer 8 inch formats (i.e., you get 1.3 megs on a 5 inch double-sided floppy!). These drives are still more expensive than the quad density 5 inch drives, but I have heard

of prices in the \$200 range.

Both software and hardware changes are necessary to properly use the full capability of these drives. Without changing the software they could be used in 8 inch mode, but that wouldn't be nearly as nice as auto selecting 5 or 8 inch modes.

The following description of the hardware and software changes needed to add this capability to the Slicer is a direct transcription (with some editorial remarks added) of information sent to me by Brian Schieferstein and Richard Herr of Gilford Instrument Laboratories in Oberlin, Ohio. Thanks, guys. Hope you don't mind if I plagiarize a little...

#### Schieferstein & Herr's Auto Select

IBM PC/AT compatible 1.6M byte 5-1/4 inch (Shugart SA475 et. al.)

modifications for the Slicer —

To implement SA475 type drives on the Slicer, two signals must be added to J6 (5-1/4 inch floppy connector). To add these signals, make the following modifications to the Slicer board:

1. Open your Hymnals to page 3 of the Slicer schematics. Say a short prayer to the God of Cold Solder Joints.

2. Lift U31 pin 12 out of the socket. This removes the default ready signal when in MINI mode.

3. Connect J7 pin 22 to J6 pin 34. Now we can get a READY signal from drives on J6.

4. Connect the MINI signal from U31 pin 13 to U35 pins 1 & 2. (Note that we are using a NAND gate as an inverter here. The newly disconnected

(continued next page)

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inverter on U31 could be used instead, but that would require cutting a trace.) (Remember: THINK first, then do.)

5. Connect U35 pin 3 to J6 pin 2. This is the speed control signal.

These modifications will not function properly in the 5-1/4 inch mode with the current software due to the way the READY signal is changed (but really isn't) after the drive is selected. This can be corrected with the patches to the version 1.3 monitor EPROMS in Figure 1. These changes will automatically select any Slicer compatible format (8 inch or 5 inch) in the two speed drive. To put these changes into the EPROM code, type them into a file and use an INCLUDE statement to include the new code in SLICER.A86 just after the INCLUDE PATCHES statement, then reassemble and burn the new EPROMS.

#### Video Board Bugs (And Fixes)

While we're on the subject of hardware mods, there is a slight timing problem on some of the earlier Slicer video boards. This mistiming causes the "underline" attribute to work intermittently (i.e., flashing), if at all. Slicer has corrected the problem by changing one of the PALs, but you can fix it yourself with just a single 10pF capacitor.

Connect the capacitor between U36 pin 8 and ground. This slows the leading edge of the BLANK signal slightly and clears up the problem.

There is also a bug (actually an undocumented unfeature) in the earlier video board software. The video attribute setting commands were mistakenly put in the ROM as ESC-a and ESC-b instead of IBM's ESC-b and ESC-c. This was changed in later versions of the ROM. If your manual doesn't list these commands at all then you probably have the version with incorrect commands; the problem was discovered and corrected when the new commands were being added to the manual. If you have the older ROMs, call Slicer about an update.

Figure 1 - Patches to the Version 1.3 Monitor EPROMS

```

;      5-20-85. implements drive select for dual speed
;      5 1/4" drives such as the Shugart SA475.
;      FLOPSEL and SELFLOP are modified.

PATCHNEW1:
        ORG      OFFSET FLOPSEL
;Select floppy disk.

NEWFLOPSEL:
        MOV     DX,SYSPOST+12 ;Min1?
        MOV     AL,DTYPE[DI]
        OUT    DX,AL
        MOV     DX,SYSPOST+14 ;Double density?
        SHR    AL,1
        XOR    AL,1
        OUT    DX,AL
        MOV     AL,SECLOW   ;Motor on for up
        MOV     AH,DSTIME   ;Set deselect time
        ADD    AH,AL
        MOV     DESELECT,AH
        ADD    AL,FDTIME    ;and shut off time
        MOV     FDSTOP,AL
        MOV     AL,FDMOTOR
        TEST   AL,DUOUT
        JNZ    NEWFLOP6
        CALL   DUHIGH      ;Turn drive on.
        MOV     AL,COUNT    ;Give it time
        ADD    AL,FDELAY   ;to get up to speed.

NEWFLOP5:
        CMP     AL,COUNT
        JNZ    NEWFLOP5

NEWFLOP6:
        MOV     CX,4
        MOV     AL,DISK[BX]  ;Select.
        MOV     DX,SYSPOST+10 ;Drive 0.
        MOV     AH,DL        ;Compute lower part of
        SUB    AH,AL        ;address for selected
        SUB    AH,AL        ;drive

NEWFLOPO:
        MOV     AL,0          ;Deselect all drives
        CMP     AH,DL        ;except the one that
        JNZ    NEWFLOP4
        INC    AL            ;matches AH

NEWFLOP4:
        OUT    DX,AL
        SUB    DL,2
        LOOP   NEWFLOPO
        RET

        ORG      OFFSET SELFLOP
NEWSSELFLOP:
        PUSH   BX
        MOV    BX,DSKPTR    ;Set xlate to do nothing
        MOV    WORD PTR 2[BX],OFFSET ROMRET
        POP    BX
        AND    DTYPE[DI],FLOPPY+MINI+DOUBLE
        CALL   FLOPSEL
        PUSH   WORD PTR STEPRATE[DI] ;remove verify
        AND    STEPRATE[DI],NOT 4
        MOV    LSTTRK[BX],-1
        MOV    TRACK[BX],2   ;calibrate then seek track 2
        MOV    SIDE[BX],24H  ;read address
        PUSH   DSKSEG       ;set disk memory
        PUSH   DSKMEM       ;to select buffer
        MOV    DSKSEG,SEG SELBUF
        MOV    DSKMEM,OFFSET SELBUF
        MOV    SECLEN[DI],6

```

```

CALL    NEWFDTRY      ;try to read
JZ     NEWFD8        ;did it work?
XOR    DTYP[D1],DOUBLE ;if not flip density
CALL    NEWFDTRY      ;if this didn't work
JZ     NEWFD8        ;if double density worked
MOV    DX,SYSPORT+10  ;Drive 0.
MOV    CX,4
NEWFD0: XOR   AL,AL      ;Deselect all drives
OUT   DX,AL
SUB   DL,2
LOOP
CALL   NEWFDO
XOR   DTYP[D1],MINI   ;try opposite speed
CALL   FLOPSEL
CALL   NEWFDTRY
JZ    NEWFD8        ;did it work?
XOR   DTYP[D1],DOUBLE ;if not flip density
CALL   NEWFDTRY
JNZ   NEWFD2        ;if this didn't work
;
NEWFD8: MOV   AL,SELEUF  ;get track number
CMP   AL,2          ;at track 2? (not sure)
JZ    NEWFD3        ;because verify is off
CMP   AL,1          ;track 1?
JNZ   NEWFD4        ;if not give up
OR    DTYP[D1],HALFTRK ;try half track.
MOV   LSTTRK[BX],1
CALL   NEWFDTRY
JNZ   NEWFD4        ;give up if error
CMP   BYTE PTR SELEUF,2
JNZ   NEWFD4        ;or not track 2
NEWFD3: MOV   AL,SELEUF+3 ;have adr. info.
PUSH  AX
MOV   SIDE[BX],25H
CALL   DMASETUP      ;Try side 2
CALL   FLOPOP
POP   CX
JNZ   NEWFD5        ;If error
TEST  SELBUF+1,1    ;or side 1 then SS
JZ    NEWFD5        ;else set DS flag
OR    CL,4
PUSH  BX
MOV   BX,DSKPTR      ;and xlate routine
MOV   WORD PTR 2[BX],OFFSET TWOSIDE
POP   BX
NEWFD5: MOV   CH,CL      ;sector length code in CH
AND   CL,3          ;put length in AX
MOV   AX,128
SHL   AX,CL
MOV   SECLEN[D1],AX  ;and store it
JMPS  NEWFD6
;
NEWFD2: MOV   DTYP[D1],FLOPPY
MOV   CH,80H        ;disk read error
JMPS  NEWFD6
;
NEWFD4: MOV   CH,40H      ;can't figure it out
NEWFD6: MOV   SIDE[BX],0
JMP   PATCHNEW1      ;finish in patch area
;
ORG   OFFSET PATCHNEW1
;
POP   DSKMEM        ;restore disk pointers
POP   DSKSEG
POP   AX
MOV   STEPRATE[D1],AL ;and step rate
MOV   AL,CH          ;length or error code
RET
;
NEWFDTRY:
CALL   DMASETUP
JMP   PATCH8        ;try to read, then return

```

*End of Listing*

I discovered both of these problems on my own and was thinking, as I dialed the phone, of how fun it was finding new bugs and being the first to tell the developers about it. I told Earl (Hinrichs at Slicer) about the underline problem, and he said "Okay, we found that a few days ago. The fix is..." Then he told me about the attribute bug before I even had a chance to mention it. Geez, come on, let me have a little fun, huh? Even I, Laine Stump, need a little ego boost now and then.

#### The Wini Works

Speaking of things being fixed (don't ever say that around your male cat — you may never see him again), my aging 506 Winchester drive is again functioning. The problem was just a blown chip on the Slicer board, probably from plugging in the first Western Digital controller I received (it was the wrong model). It has now worked flawlessly for two months.

#### Next Please

Brian Schieferstein and Richard Herr also sent me instructions for using 256K DRAMs on an expansion board to get 512K on one board. I'll be trying to use the same technique to put 512K on the main Slicer board. I may have space to take a quick look at assembly language programming and I/O redirection under MS-DOS, too. I/O redirection capabilities simplify many assembly programs greatly, since there is no need to explicitly open and close files, etc.

While I'm on the subject of things for the future: Dave and I (and now Earl, I hear) have been looking for information on the MIDI (Musical Instrument Digital Interface) standard. I've had no luck, and neither had Dave last time I spoke with him. Anyone who has information on this (or any other computer/musical type things), drop us a line.

P.S. No Commodores, please.



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Typical speed increases you can expect to see using MicroSphere's RAM disk:

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	Floppy Disk	RAM Disk
Recalc 14K Perfect Calc	9:31.25	1:17.78
Load LADDER.COM	9.38*	2.12*
Load Printer Buffer		24.61*

20K file, 11 pages, 2586 words, using

PIP to the LST device

\*Time in seconds

Comes complete with cabinet, cables, software and connectors.

**TLC LOGO** for Kaypro Computers. Easy and exciting language for all ages.

TLC LOGO is an exceptionally complete logo with vectors, multiple turtles, full floating point decimals and extremely fast program execution.

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**Time comparison of 3 common Logo programs currently offered:**

	DR LOGO	TLC LOGO	Apple LOGO
	320k IBM PC	64k Z80	64k Apple IIe
Circle test	10 seconds	3 seconds	22 seconds
PolySpiral1	17	4	11
PolySpiral2	out of stack	7	out of stack
Square Test	27	10	41
Four Bugs	78	6	N/A
(req. 4 turtles)			

Times provided by The Lisp Company . . . (note: out of stack indicates inadequate implementation of "tail recursion") DR LOGO is copyright Digital Research Company, Apple Logo is copyright Apple Computer Company, and TLC Logo is copyright the Lisp Company.

Standard Version of TLC Logo ..... 99.95

Deluxe Version of TLC Logo ..... 129.95

**Special: Color Board and Deluxe TLC Logo ..... 199.95**

**A NEW DIMENSION FOR KAYPRO COMPUTERS:** Color Graphics Board. Features 16 colors, 32 sprites, 256x192 bit mapped graphics. 16K of RAM on the color board itself allows creation of graphics without losing internal memory of the Kaypro.

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Color board/Kaypro II, 4, 2-84, 2X, 4-84, ..... 145.00

10 & Robie, ..... 145.00

**INSTANT GRAPHER 2.1** (For use with Color Graphics Board) Creates bar charts, stacked bar charts, hi/low, line graphs from keyboard, Perfect Calc, CalcStar or text files. Single and Double size dumpscreen to printer, each color prints a different pattern on a standard dot matrix printer ..... \$40.00

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### Composite video generator:

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ZVM 123 Composite Green ..... \$114.00

ZVM 135 Composite Color/RGB/Green Hi Res. ..... \$500.00



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# DG/Systems' Media Master

Review by Peter Matsunaga

1928 Iwaho Place  
Honolulu HI 96819

I spend a lot of time on an IBM-PC (my mainstay at work) and a Kaypro II. Until recently, I didn't need to transfer files between these machines. Now I do—mostly Turbo Pascal source files, numerical data files, and text files.

There are only a handful of transfer programs on the market. For PC-DOS, there's Vertex Systems' Xeno Copy (\$149). For CP/M, Micro Solutions' Uniform (\$70) and DG/Systems' Media Master (\$30) are possibilities.

I saw DG/Systems' ad in Micro C, and the price was right. Delivery took one week.

Media Master allows two-way data file transfers between Kaypro II and 24 other single-sided formats. It supports mass copies and deletions, has a utility to list disk directories on the screen or on the printer, and can initialize new diskettes in any of the 25 formats.

**Media Master's menu offers these options:**

1. COPY files
2. PRINT directory
3. DISPLAY directory
4. LOG in a new diskette
5. ERASE files(s)
6. VERIFY on write toggle
7. FORMAT a diskette
8. EXIT to CP/M

To log in a new disk, insert the foreign diskette into the drive of choice, and type 4, cr>, followed by a drive designation. A list of 25 format options appears on the screen. If you make the proper choice, voila, you get the disk's directory.

After the new disk is logged in, Media Master can transfer files, delete files, or write the directory to the printer. The copy and delete commands accommodate wild card (\*.\*) file names. The logged drive can also be used with other diskettes of the same format; it is not necessary to log in each disk.

## Performance

There are a few things that Media Master doesn't do. It won't let you run PC-DOS .COM files on the Kaypro, nor can applications programs read or write to the foreign disk.

Because Media Master is designed to run on a machine with single-sided drives, you can't read or write double-sided disks (in any format). While I have used single-sided diskettes formatted on the IBM without problems, the Media Master manual advises that the safest course is to use disks formatted by Media Master.

## Comments

The program would benefit from a few additions like drive and format status information on the main menu screen. (Editor's note: The biggest problem is that you can't just configure a drive for a certain type of disk and then access that disk with other programs like pip, type, or wash. The single-sided limitation is also a problem.)

Also, I prefer mnemonics to number commands on the main menu, having been brainwashed by daily exposure to other software. Occasionally, my fingers succumb to a vagrant compulsion to type an 'L' to log in a disk, an 'F' to format, etc. To Media Master's credit, nothing happens until I type a '4', the correct command. Media Master doesn't permit syntax errors but waits instead for you to get it right.

I have used Media Master after running Micro C's dump24 (a screen dump program). It turns out that erasing a file under Media Master causes a screen dump to the printer.

Overall, I think Media Master does everything it claims to do.



*NOTE: Since this article was typeset, DG/Systems has changed its name to Spectre Technologies.*



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Note: Requires Microsoft's M80 & L80 assembler & linker to setup Slave BMON.

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# Kaypro Column

By David Thompson

A lot of people have called asking if the 8" interface for the Kaypro really exists. Yes, it does (in the flesh or a facsimile), and it's available.

You get the Pro-8 version 2 features (if you have an 83 Kaypro), or the Pro-8 MAX features (if you have an 84 Kaypro). With either you can run up to four drives on your system. A: and B: can be any type of 5" drive; C: and D: can be any type of 5" or 8" drive. Double-sided 8" drives will read and write single-sided, single density 241K disks (like the SIG/M disks) as well as single- and double-sided double density disks (600K and 1.2 meg). That's 16 sectors of 512 bytes per sector, 77 tracks.

If there's room in your system, the monitor will also read and write 1024 bytes per sector in double density. This gives you 670K per single-sided disk and 1.34 meg per double-sided disk. You can make room by moving CP/M down 1K.

The price for the 8" board is \$190. You need to specify whether your system is '83 or '84. If you have a Kaypro II-83 (the monitor ROM's paper reads 81-149), then you'll need to do the II to 4 upgrade. See issue #15 or #24 for upgrade information.

It's easy to install the board. Just unplug the 1793 floppy disk controller chip, plug in our board, and then plug in the 5" and 8" drive cables.

You supply the 8" drive(s), cabinet, power supply, and cables. There are many sources for drives, and many different types of 8" drives. Siemens drives are the standard on the surplus market. They aren't the best because the stepper motors die if you use them a lot, but they're cheap (\$100 - \$130 single-sided and about twice that for double-sided).

Cascade Electronics usually has a variety of slightly used Shugarts. Check with them; their drives and service are consistently good, and they also may have power supplies and cabinets. Their number is 507-645-7997.

If you want to go fancy, you might consider the Mitsubishi 8" half-height double-sided units. They look good, and they don't require 110V AC, so

you can run them in portables.

Some say it's a contradiction to talk about portable systems with 8" drives, but you can ignore those people.

## 286i

Most of the systems in our office haven't seen their boxes or their tops since the day they arrived (unless they're systems we built, which means they never had tops). However, our second 286i sits forlornly on the floor in its unopened box.

It's not that we don't have great plans for the system. We do. In fact, we've spent a good deal of time trying to add a hard drive to the 286i. We haven't even gotten it to select the Winnie. The system supposedly supports a number of different hard disks (they are numbered between 1 and 14), but we don't have a comprehensive list yet. The 20 meg Tulin TL200 Series, the 10 meg Shugarts, and the 20 meg Seagates work (at least in Portland and Solana Beach). Rodime, High-Technology, and the Seagate ST-506 have had problems. Xenix requires type 2 drives to work, and PC-DOS is limited to 30 meg per drive. (Whew.)

The Rodime drive we tried was never selected. We checked the drive select lines, and none corresponded with the hard disk select light on the 286i's front panel. After we returned our first system to Kaypro, they called and said that it interfaced properly with a #2 drive (type #2 in the AT Diagnostics). If you're adding a Winchester, you have to purchase the AT's advanced diagnostics from IBM (\$270) in order to format the Winnie.

Kaypro doesn't supply MS-DOS 3 with the system: you have to purchase that from an IBM dealer (it'll cost you \$60).

When Kaypro chose to ship their \$4500 system without a Winchester, they said it was to "allow" users to install drives of their choice. You'd think they could at least write a disk formatter and supply a \$60 copy of the operating system.

Kaypro says it's negotiating with

Microsoft for a multi-user version of MS-DOS to include with the 286i. We have heard rumors, however, that one of the bugs still residing in the 80286 makes it impossible to support multiprocessing or multi-user. As for the formatter, I think they need to write one.

I tried formatting some ordinary floppies as 1.2 meg in the 286i. Our Mag Media disks that format perfectly as quad density (784K) work very poorly at the higher density.

1.2 meg format is 96 tpi (80 tracks per side) like the quad density, but the disks spin at 360 rpm instead of 300 rpm — and the data is written at 500K bits/second (like 8" double density) instead of 250K bits/second. So the number of tracks is the same as quad density, but there's almost twice as much data crammed into each track.

The double density Mag Media disks format to about 800K usable space after formatting. At least MS-DOS automatically traps the bad sectors, but with a disk that marginal, I wonder how long it will take before errors show up.

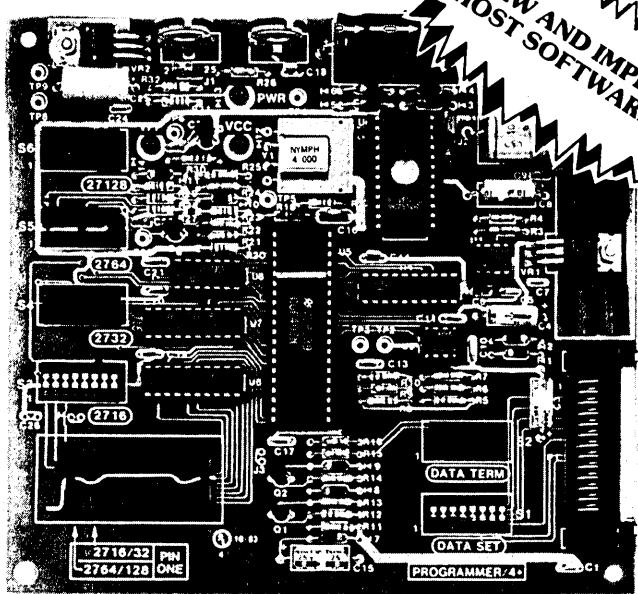
So I have to figure on spending \$4 each for the high density disks. Fortunately, the system can read 360K disks, and if you need to write data onto these standard format disks, you can exchange a double-sided 48 tpi drive for one of the 1.2 meg drives.

## Three 286is

The 286i is now available in three versions — a stripped down model with one 1.2 med drive, a rigid/floppy controller board, 512K RAM, and GWBasic for \$2995; a spiffier model with two 1.2 meg floppies, controller, 512K RAM, graphics/parallel card, parallel/series card. GWBasic and MicroPro software for \$4550; and a 20 meg hard disk model with Winchester, one 1.2 floppy, controller board, 640K RAM, parallel/serial card, and GWBasic for \$4795.

The internal design of all models is very AT-like, except Kaypro is using 256K DRAMs instead of 64K chips piggybacked (a la AT).

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## Kaypro 10 Hard Disk Failure

Jeff Brown, Kaypro's district manager in Oregon, says he's been seeing a lot of hard disk failures on the Kaypro 10's that are directly related to heat (usually a clogged fan) or inadequate power protection. The first is easily remedied.

For the second, he suggests you use a dedicated power line (don't run your coffee pot or air conditioner on the same connection), and make sure that you have good solid +12V (+ or -.35V) to the disk and the controller. It's best to use an uninterruptable 110V source (UPS) for triple A insurance (some service companies won't sell extended warranty contracts on hard disk systems that don't have UPS because of hard disk failures from power-related accidents).



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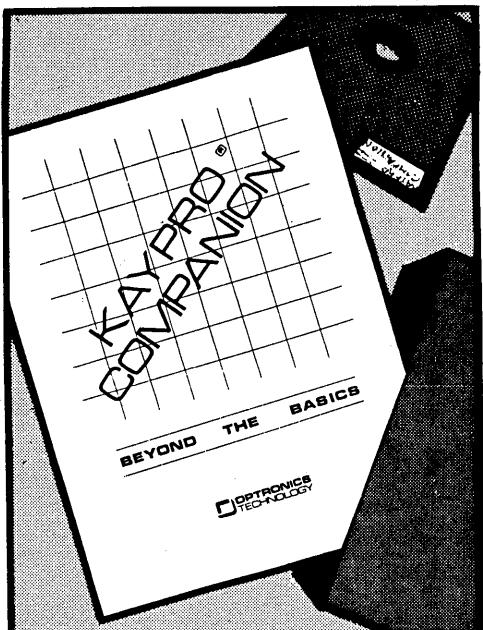
Developed by Marty Mendelsohn and Jim Thompson of Las Vegas Kaypro Users Group.

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# Color Speedometer For The Kaypro

By Mike Sweeney

2659 Beverly Dr  
Medford OR 97504

The 5MHz speed up on the older Kaypro IIs is one of the truly great mods. But remembering your speed setting can be another matter.

I've formatted disks at 2.5MHz, and then jumped into another application without switching back to 5MHz. By the time I realized things had really slowed down, I was in too deep to back out for a speed change. And if I'm running too fast (for a formatter, for instance) I've really got problems.

Even if I do remember to check which speed I'm at, I still don't like reaching behind the computer to feel the switch position or push the reset button.

## Fix

I decided to experiment with a tri-color LED (light emitting diode) that changed colors when the dc polarity was reversed. LEDs glow yellow on AC voltage and either red or green on DC voltage, depending on polarity.

I substituted the existing red DC power LED on the front of a Kaypro with a tri-color LED. Then I replaced the single-pole double-throw speed switch with a 3-pole double-throw switch, using one pole for the speed select and the other two poles for reversing the DC power to the LED.

## Moving The Switch

Relocating the switch and the reset button to the front panel ends all the hopping up and down to reach the back of the Kaypro, and makes the wiring short and neat. The switch and reset button can be left in back, however, if you don't want to drill the front panel, or if you need the exercise.

## How To Wire (Figure 1)

Remove the old power indicator LED by pulling off the collar inside. Then push the LED in from the front and cut the wires close to LED.

Solder some jumper wires on the new LED. Then install and connect it to the center studs of two of the poles on the new switch. Connect the 2 wires that previously went to the power LED, to the top studs of the same 2 poles.

Connect jumpers (making an X) between the top stud of each pole and the bottom stud of the opposite pole. Move

the speed select wires to the new switch using the third pole set. Reverse LED wires and/or speed select wires as necessary to get the speed and color of your choice.

## Results

Now at 2.5MHz, my power light glows red, just like a normal Kaypro, but when I switch to 5MHz the power light glows green. Plus the switch and reset button are right at my finger tips.

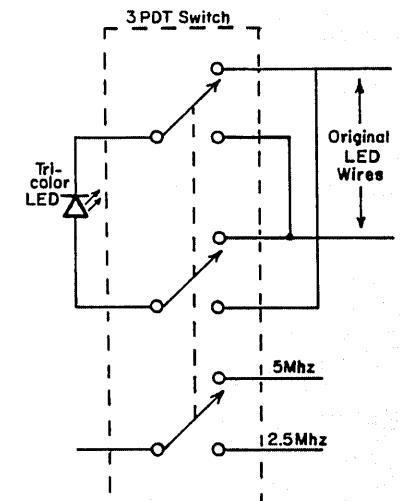
## Tip

When drilling the front panel, stick a piece of tape on the inside of the new hole to catch drill chips. Silver duct tape works well. If you really want to keep things sanitary, turn on your vacuum cleaner and hold the hose up next to the drill bit.

## Parts

Both the tri-color LED #276-035 and the 3PDT switch #275-661 are available at Radio Shack.

Figure 1 - Rewiring



# Out "keys" the competition!

Thinking about buying a "key" program? (You know, the names all start with words like "smart", "magic", "pro", etc.) Looking for a faster, easier way to calc? Process words or databases? Yes? Then you owe it to yourself (and your computer) to check out XtraKey. Quite frankly, we think it's the best. At any price! (And wait 'till you see our price.) Just like those other "keys", XtraKey lets you redefine your regular keyboard keys to be anything you want. A word, a paragraph, a series of commands... whatever you hate to type over and over again! Change or make up new definitions anytime. Even while running a favorite program like WordStar or dBASE II! Unlike other "keys", there's no limit on definition length.\* Plus our advanced XShift feature lets individual keys have up to 16 meanings.

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# The 32-Bit Super Chips

By Trevor Marshall, George Scolaro  
Dave Rand, Tom King, and Vince Williams

Definicon Systems, Inc.  
21042 Vintage St.  
Chatsworth CA 91311  
818-341-5654

Most designs come about because of an unfilled need. That was certainly the case when we sat down to design a 32032 co-processor system for PCs and PC-clones. But first a little background.

During 1983 and 1984, a group of us at Definicon developed some advanced signal processing software.

One of our most successful algorithms used a time to frequency-domain conversion technique which required many floating point calculations, but it gave better resolution than a standard fast Fourier transform.

## Benchmarks Vrs. Fortran

The program was written in FORTRAN and initially we ran it on a VAX 11-780 minicomputer, but we soon moved the program over to an HP9000. A typical analysis took about 15 minutes on the HP.

But the cost of the HP9000, about \$60,000, seemed a bit high. After all, who wanted to pay that much just to run a piece of software? So during 1985 we converted our programs to run on IBM XTs. We ran a number of benchmarks on an Eagle Turbo (an XT clone) and on a real XT, and concluded that the Eagle was about twice as fast as the IBM. (The Eagle runs an 8086 processor and 8087 math co-processor, while the XT runs an 8088 and 8087.)

In fact, the benchmarks indicated that the Eagle's performance should nearly equal the HP9000's. But after we finished transferring over the FORTRAN source, we found that the Eagle took seven times as long as we had predicted.

I couldn't see any reason why a minicomputer like the HP9000 should run that much faster than a micro, especially considering the benchmark times. So I investigated! (Of course, a benchmark is just a small fragment of code, and it's obvious that benchmark results do not necessarily reflect performance on a larger, more complex program.)

## Wherein Lies The Discrepancy

If we examine the data for the Sieve of Eratosthenes (the Prime Number Sieve) in Table 1, we see that for n8191 the difference in execution speed between the XT and the VAX11/780 is about 10 to 1. However, by increasing the size of the searched array to 40,000 numbers (rather than 8191), the difference widens to 55 to 1.

The program flow has not changed, but the larger size of the problem shows some problems with the Intel processors. (If we want to identify the primes in 80,000 numbers, then compilers running on the PC-XT or PC-AT won't work. They place a 64K limit on the number of elements of an array.)

## Floating Point Benchmarks

We devised the FLT benchmark to exercise the floating point processors. The benchmark consists of a few arithmetic operations inside a loop. The FLOAT benchmark also exercises array handling.

The 8087 and 80287 arithmetic processors ran about 1/20 MFLOP (1 MFLOP = 1 million Floating Point Operations per second). In fact, the 4MHz 80287 in the PC-AT ran slightly slower than the 4.77MHz 8087 in the PC-XT!

The VAX11/780 clocked in at about 1 MFLOP, or 20 times faster. The major problem with the 8086/80286/(80386) family is not shown in these benchmarks, however.

## 64K Addressing

If we had been able to take the sieve above 64K elements we would have found that the Intel processors slow down even farther. Whenever any data, code, or stack structure exceeds 64K, you must check the segment you're in before doing an access. Even business programs (such as 123 and dBASE) are slowed substantially by segment checking.

The 68000 and 32000 series processors are not affected by this overhead, since they can usually access many megabytes of address without segmentation.

Consequently, late in 1984, we reluctantly accepted that 8-bit (8088) or 16-bit (8086,80186,80286) processors had significant limitations. We also accepted the fact that 32-bit microprocessors have something significant to offer.

## 32-Bit World

There really is only one operational 32-bit microprocessor — the National Semiconductor NS32032. I will not argue this point, but merely state that the 80386 is currently just a pipe dream, and the bug lists I have seen for samples of the 68020 still cover several pages. At the time I wrote this article, even the Intel 80286 was not fully functional in all modes.

## Bugs In The 68020 Set

1. The barrel shifter does not work.
2. The co-processor interface does not work.
3. The data sheet AC characteristics cannot be met.

In addition, the floating point co-processor works only at unacceptably slow clock speeds and does not yet talk properly to the CPU. (If ya' want a number, take a number, any number!)

Motorola has never demonstrated a complete 68020/68881 system (not even at the trade shows) and has continued to use the 12.5MHz 68020 demo I first saw at NCC in mid-1984. This demo, incidentally, gives vastly different benchmark times depending on whether you select Single Run or Continuous mode. Try it at the next trade show, and see if you can get an explanation for this irregularity!

In fairness, I have seen a 12.5MHz 68020 running non-virtual UNIX in 68000 emulation mode.

Motorola does not admit having bugs any longer. (The last official bug list was distributed in 1984.) Still, time will be the ultimate arbiter.

To put this all into perspective, National made its first NS32016 in September 1980. In December 1984, it was sufficiently operational to release to production.

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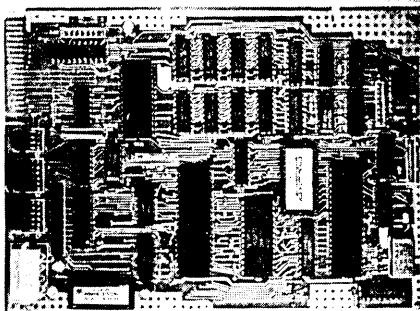
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### Availability

The full 32-bit bus version, the NS32032, is not yet fully functional, but we have provided fixes on the DSI-32 for its remaining problems, and they do not affect the performance or operation in any way. Motorola built the first 68020 in 1984, and Intel promises the first 80386 in December 1985.

One of the really exciting things about the new super chips is the enhanced instruction set. Cast into these little pieces of silicon are all kinds of gems. But that's also the reason why the 32032 has taken so long to get to market and why it will probably be quite a while before the 80386 and the 68020 are really ready.

### Complexity

The problem with building these advanced processors is that they have to do EVERYTHING. When you program in assembler, you have to keep track of which registers do direct arithmetic operations, which ones will accept memory indirection, and so on.

On the 32-bit processors, it's easy to know which instructions allow which addressing mode. You can use any addressing mode with any instruction.

For example,

ADDD 100000, LAST

adds immediate 100,000 to the 32-bit memory location LAST.

ADDB 8, LAST

treats LAST as a byte memory location and adds 8 to it.

ADDF 1.31978, LAST

adds immediate the floating point number 1.31978 to LAST (treating it as a 4-byte floating point number).

DIVL FIRST, LAST

divides the two memory locations FIRST by LAST, treating them as double precision 8-byte floating point

numbers, and places the result in LAST.

EXTSD 6(R1), R0, 4, 11

EXTRACTS the Short bit field from the Double precision 32-bit word at the address in R1 plus 6, puts it into R0 (right justified), starting at bit 4 for 11 bits.

### Making Them Work

Two problems with producing these chips should be immediately apparent. First, it is not a trivial matter to get these instructions to work the first time. Second, it is quite difficult to adequately test all the instructions after the chip has been manufactured.

Conversely, these sophisticated chips make it much easier to write efficient software. In general, anything you want to do, they can do.

In addition, compilers can do much more optimization, and produce much more compact code.



# The Definicon DSI-32 Co-Processor

By Trevor Marshall, George Scolaro,  
Dave Rand, Tom King, and Vince Williams

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21042 Vintage St.  
Chatsworth CA 91311  
818-341-5654

Once we realized the need for a real 32-bit system and had checked out the options (32032, 68020, and 80386) -- see the previous article by Trevor, et. al., in this issue -- we started to design the system.

After pricing hardware for a complete standalone system, we decided to plug our 32-bit microcomputer (the DSI-32) into an IBM PC clone. Not only does the PC offer all the I/O peripherals we needed (we even have a 1/2" magnetic tape drive on one of our development machines), but it also has a processor which can handle files for the 32032.

In addition, MS-DOS (or PC-DOS) is not unlike CP/M. It has sufficient additional features (such as subdirec-

tories and almost all of the enhancements given by programs such as ZCPR3) to make it useful for applications development.

We were also pleased with Concurrent DOS (from Digital Research). In addition to all the features of MS-DOS, it offers multiple consoles with up to three background tasks. This environment makes software development a pleasure!

The DSI-32 uses a 10MHz 32032 CPU running at about 1.5 MIPS (million instructions per second) with a 32081 Floating Point unit (about 1/3 MFLOPS) and optional 32082 memory management unit for a true virtual software interface.

Two 38.4 KBaud RS-232 serial ports

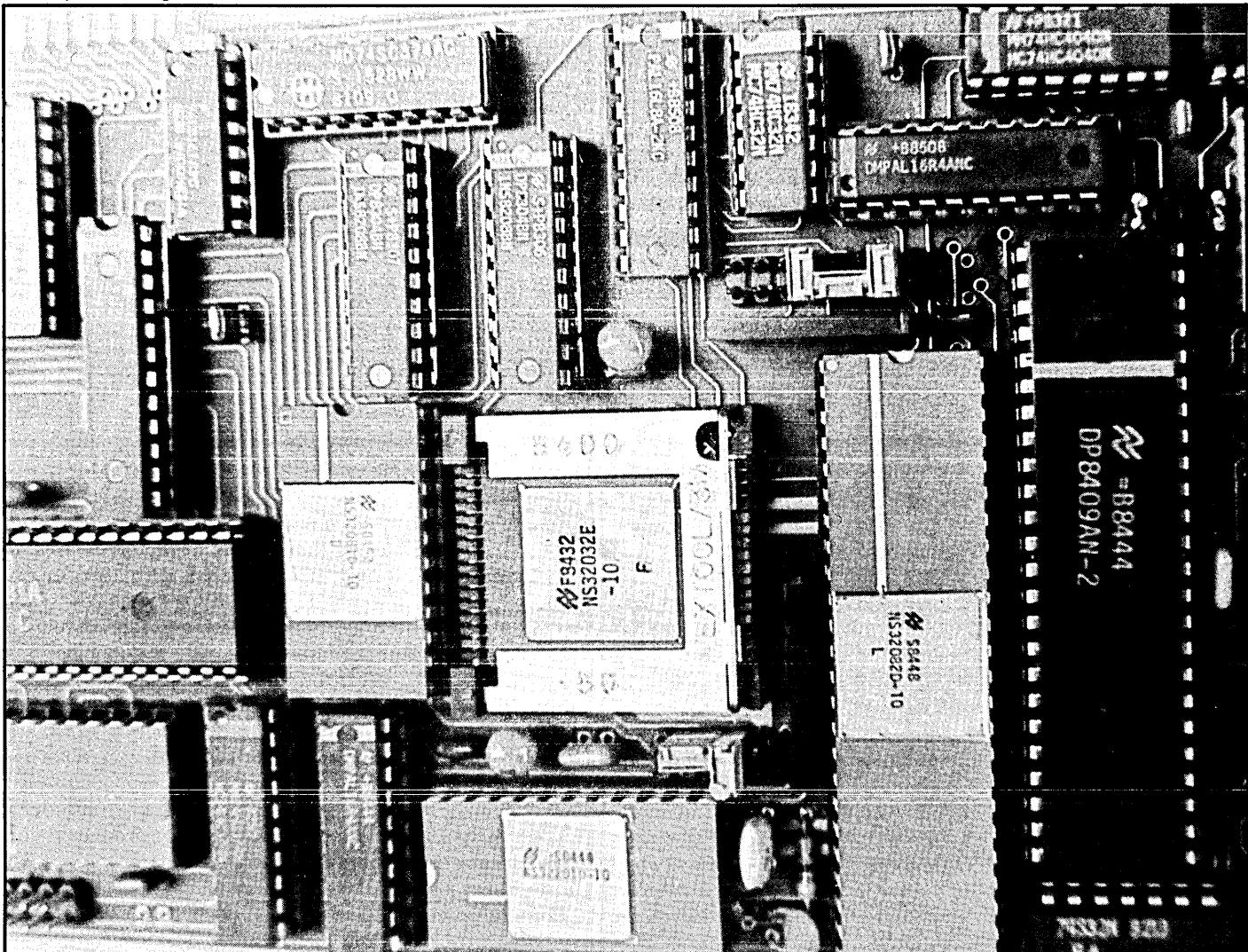
handle high speed I/O totally independently of the PC. In addition, direct port I/O and memory access for the 8086 environment is provided to the 32032 through the software interface.

The host 8086 (or 8088) can access all the 16-Mbyte logical address space of the 32032 in addition to the added serial ports. Data is transferred from the DSI-32 using Direct Memory Access, so the 32032 usually only misses one or two 100 nsec T states for each byte transferred to the 8086.

## Writing A Program

To write a program for the DSI-32, you first edit the source file (in C, Pascal, FORTRAN, FORTH, Tiny

Close-up of 10 Meg. 32032



BASIC, or Assembler) using your favorite MS-DOS editor (we use WordStar and Vedit). Then you run the appropriate Definicon compiler, assembler, and linker to produce an executable 32032 program.

For example, let's develop a program called HELLO.C which says "Hello World." First we edit the source (in C) using WordStar and compile it using

```
CC HELLO.C
```

assemble the resulting source code with

```
AS HELLO
```

and link the object modules with

```
LINK IND=HELLO
```

Finally it is run with the MS-DOS command

```
LOAD HELLO
```

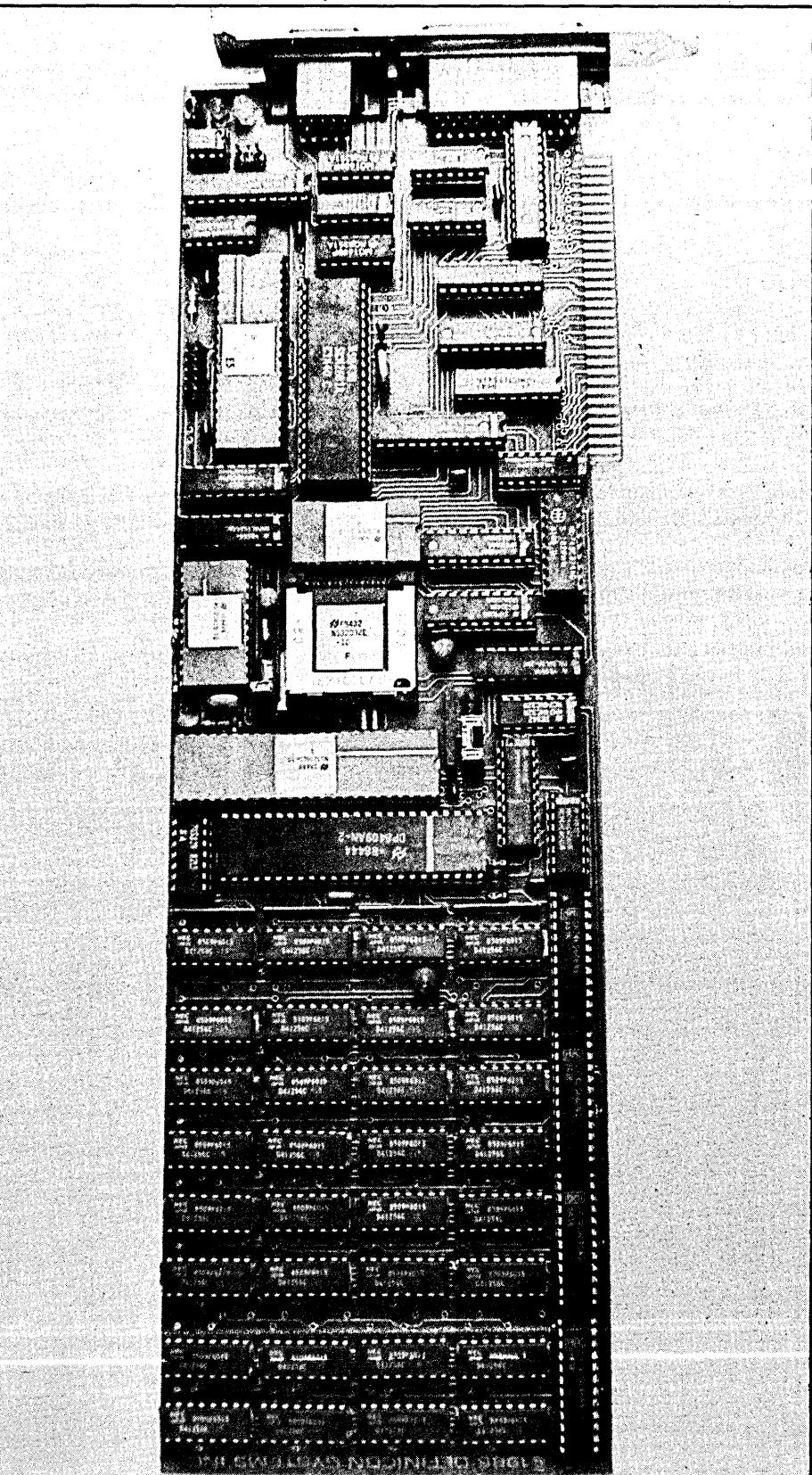
This invokes the 32000 loader, which reads the 32000 executable HELLO.E32 file off the disk, loads it into the DSI-32 memory, tells the 32000 to commence execution, and then stays resident to service I/O requests from the 32000 program. When execution is complete the loader exits and passes control back to DOS.

We took a shortcut with the linking. The command IND=HELLO means that the linker takes its constructional data from an indirect file called HELLO.IND. See Figure 1 for the file.

Because of the complex information needed by the linker, it is always easier to prepare this indirect file when you write the application, then invoke it automatically as you compile. This also allows a BATCH job to run the complete compilation, assembly, and linkage process automatically.

Note that 32000 code is totally position independent, and the linker does not perform relocation. It builds

DSI-32 Co-Processor Board with 1 Mbyte of RAM



(continued next page)

## DEFINICON DSI-32 CO-PROCESSOR

(continued from page 53)

a series of MODULE TABLES (one for each code module) that contain data for the CPU's static base and control registers. These registers are loaded from the table each time the table's corresponding module is executed.

### Definicon's Monitor

Finally, Definicon has a MONITOR program for debugging. It allows in-line disassembly (including full floating point operands), run to breakpoints, execution trace, display, fill and substitute memory, display of CPU control registers, display of CPU data registers, display of the Floating Point Unit's registers, and display of the Memory Management Unit's registers. Its commands are similar to DDT and DEBUG.

### Availability

The DSI-32 is available both in kit form and fully assembled. Call for information about assembled and test-

ed boards. The kits are a special deal to Micro C readers and are available from Definicon at the address shown at the top of this article.

### Assembling The Kit

If you have never assembled a microcomputer kit, contact your user's group, or enlist an expert's help before you attempt construction. And be sure to observe static safety procedures when you handle ICs. Definicon assumes no responsibility for replacement of components which have been mishandled or incorrectly inserted into their sockets. Definicon's liability is limited solely to the replacement of those components which were faulty at the time of shipment.

### Starter Kit

32032 CPU — 6MHz clock rate

32081 FPU — 6MHz clock rate

256K Bytes of RAM (32, 64K chips)

Wave soldered, partially tested, printed circuit board, fully socketed

Full set of ICs and instructions for assembly

Diagnostic software disk

Simplified NSX compatible assembler/linker/loader

MS-DOS interface software, advanced debug monitor

Public Domain software disk (supplied upon request)

Cost: \$995.00

### Advanced Kit

32082 CPU — Full 10MHz, no wait states

32081 FPU — Full 10MHz, no wait states

1 Megabyte of RAM (32, 256K chips)

Wave soldered, partially tested, printed circuit board, fully socketed

Full set of ICs and instructions for assembly

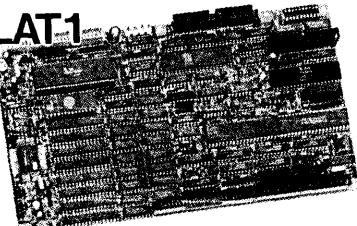
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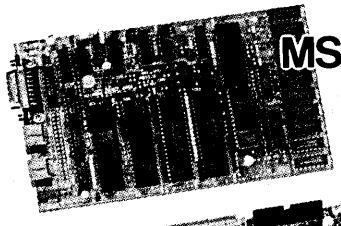
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Public domain compilers/interpreters will be available for FORTH, Small C, Pascal, and Tiny BASIC. The disk containing these programs will be included free (but only if you ask for it).

The DSI-32 is suitable for use with any IBM PC clone (but your money back is the only guarantee of compatibility we can offer).

#### Commercial Software

1. Green Hills C Compiler: Kernighan and Ritchie plus full Berkeley 4.2 UNIX extensions.

2. Green Hills Pascal Compiler: Full Berkeley 4.2 UNIX compatible plus many extensions.

3. Green Hills FORTRAN Compiler: ANSI FORTRAN 77 plus full Berkeley 4.2 UNIX extensions.

4. Definicon/Computer Systems Design NS32000 Assembler/Linker: Advanced National Semiconductor NSX syntax assembler with the GENIX extensions required by Green Hills compilers. Supports fully relocatable code and "Pascal like" high level

Figure 1 - File HELLO.IND

```
EXEC=HELLO      ;Call the executable program 'HELLO'  
MODULE=CLIB/SB_START=2000,NOCOPY ;Use static base for CLIB  
CODE=4000        ;Program load address  
RAM=0..FFFFF    ;We have 1 megabyte of RAM to use up  
STACK=+4000      ;Allocate 16K of stack somewhere  
MOD=80          ;Set the module table at 80H  
[[ DT ]]
```

constructs. Linker supports assembler output syntax and fully relocatable code, including named COMMON blocks and initialized statics.

5. Definicon/Computer Systems Design NS32000 Library Manager and Programmer's utilities: LIB32 program to form and examine libraries of object modules, assembly and high level language examples for direct (OEM) interface to the Definicon MS/PC-DOS interface.

NOTE: The C and Pascal compilers will run in 256K in a limited way. The FORTRAN compiler will not run in 256K.

#### Prices of Commercial Software

Library manager/Programmer's utilities \$49; Assembler/Linker purchased separately \$149; One compiler (your choice), including assembler/linker \$299; Two compilers including assembler/linker (one purchase) \$499; Three compilers, incl. assembler/linker (one

purchase) \$649; Any compiler, purchased alone, (needs assembler above) \$249.

Note: Green Hills Software is making these compilers available at prices well below those of the identical compilers for their original UNIX environment. Prices in the above table are specially discounted for Micro C readers.

A hard disk is almost essential if you want to run the Green Hills compilers (which range up to 250K of code).

The only support that Definicon can offer to purchasers of this software is a guarantee to check out written bug reports promptly. We assume that Micro C readers are proficient in the basic programming syntax of a language, and the documentation provided reflects this assumption.



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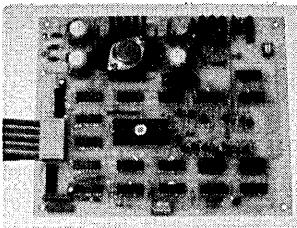
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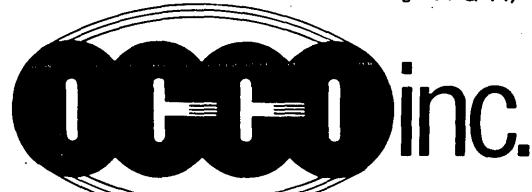
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# Programming The 32032: Setting Out

By Gary Entsminger and Bruce Berryhill

Micro C Staff

It looks like National Semiconductor has a winner this time, so we'll skip the jokes. (Jokes have been a National Pastime for years.)

The 32032 has eight 32-bit general purpose registers and eight dedicated registers. The contents of any general purpose register can be used as base pointer, index value, or data. Data can be either 8-, 16-, or 32-bit. Take a look at Figure 1 for details on the dedicated registers.

## Integer & Floating Point Instructions

The 32032 instruction set is comprehensive enough to keep even Niklaus Wirth busy. Integer instructions operate on 8-, 16-, and 32-bit elements —

```
Add(ADD)
Subtract(SUB)
Negate(NEG)
Absolute Value(ABS)
Multiply(MUL)
Divide(DIV)
Modulus(MOD)
Quotient(QUO)
Remainder(REM)
Move(MOV)
Compare(CMP).
```

by adding a length suffix: B, W, or D to the instruction —

```
ADDB, ADDW, ADDD
MOVB, MOVW, MOVD
```

The complete syntax for an ADD is —

```
ADDi source, destination
```

"i" represents integer length character.

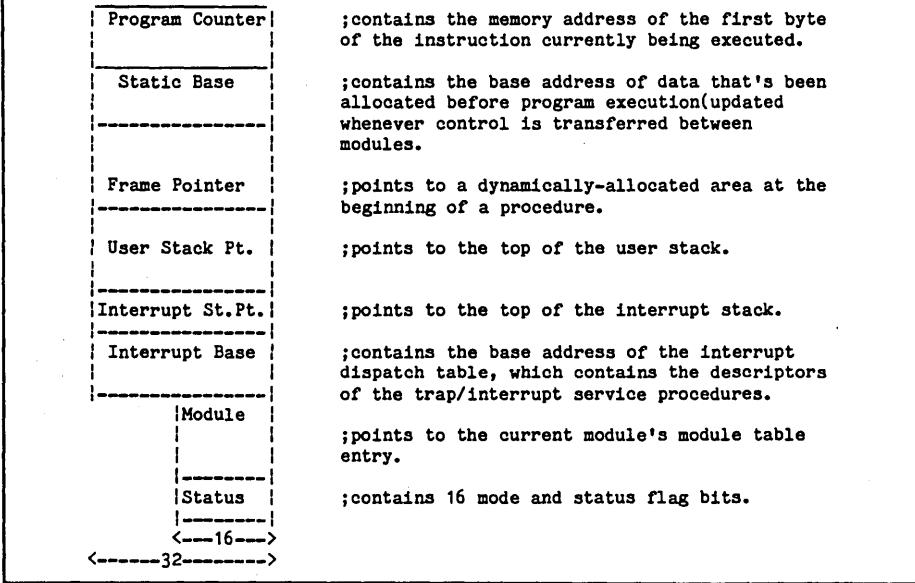
Floating point arithmetic can be either single or double precision by adding a suffix: "f" (float) or "l" (long float) to the general form of the instruction. For example, a Negate instruction would have the syntax —

```
NEGf source, destination
```

The floating point instructions are —

```
Add(ADD)
Subtract(SUB)
Multiply(MUL)
Divide(DIV)
Negate(NEG)
Absolute Value(ABS)
Compare(CMP)
Move(MOV)
```

Figure 1 - Eight dedicated registers



If you're converting a floating point number to an integer, you need to specify the integer width, using the suffixes FB, FW, FD, LB, LW, LD —

```
ROUNDFB F0, R0
```

rounds the single precision number in register F0 to a 1-byte integer and places the result in the low-order byte of register R0. The remaining bytes of R0 are unaffected.

## Logical, Bit, String, And Array

The Logical Instructions are —

```
And(AND)
Or(OR)
Bit Clear(BIC)
Exclusive Or(XOR)
Complement(COM)
Arithmetic Shift(ASH)
Logical Shift(LSH)
Rotate(ROT)
Boolean(NOT),(SCOND)
```

The bit instructions are (for when you really need to get into those small spaces) —

```
Test Bit(TBIT)
Set Bit(SBIT)
Clear Bit(CBIT)
Invert Bit(IBIT)
Find First Set Bit(FFS)
Convert To Bit Pointer(CVTP)
```

The bit field instructions are —

```
Extract Field(EXT)
Extract Field Short(EXTS)
Insert Field(INS)
Insert Field Short(INSS)
```

The string instructions are —

```
Move String(MOVS)
Compare String(CMPS)
Skip String(SKPS)
```

Array instructions are —

```
Bounds check(CHECK)
Calculate Index(INDEX)
```

Logical, Bit, Bit Field, String, and Array instructions all accept the same length suffixes. Add B, W, or D depending on whether you're accessing a byte, word, or double word.

## Processor Control And Service

The remainder of the 32032 instruction set is made up of branches, local procedure calls/returns, external procedure calls/returns, explicit trap instructions, trap/interrupt returns, effective address, context instructions, register/stack manipulation, and memory management. We won't list all of them; instead, we'll try to give you the flavor of a couple of the more interesting. For example, let's say you're calling a procedure in Pascal.

Figure 2 - The Stack

The stack after the execution of -- BSR PROC1		
2000	-----  {FP}	
2004	Return Addr of Calling Prg	
2008	Passed Parameter(y)	
200A	Passed Parameter(x)	

The stack after the execution of -- ENTER [R7,R6],28		
1FDF	>  contents of register 7   < {FP-36}	
1FE4	>  contents of register 6   < {FP-32}	
Stack Pointer	>    < {FP-28}	
1FFF	-----	
Frame Pointer	>  local variable   < {FP}	
2004	Return Addr of Calling Prg  < {FP+4}	
2008	Passed Parameter(y)	
200A	Passed Parameter(x)  < {FP+12}	

Four instructions handle subroutine calls and returns (hope they're happy ones). They are BSR, RETURN, ENTER, and EXIT.

BSR and RETURN handle the simple minded subroutine call where you push onto the stack the parameters you're passing and then branch (BSR) to the subroutine. The RETURN instruction discards the passed parameters from the top of the stack when you're done.

ENTER and EXIT are additional instructions you use when entering and exiting a subroutine. ENTER allocates space on the stack for the subroutine's local variables and saves any or all of the values in the processor's registers. EXIT does the reverse, restoring the registers and discarding the local variable space.

#### Frame Pointing

A frame is a region of the stack which contains the parameters passed to the procedure, the procedure's local variables, and its saved registers. The Frame Pointer (a dedicated register) points just below the passed parameters to the first local variable (See Figure 2). The Stack Pointer points just beyond the end of the frame.

#### Invoking A Procedure

The three instructions beginning with MOVD (-8)(FP),TOS make up the procedure calling sequence (see Figure 3).

A procedure's parameters are accessed by adding a positive displacement to the address in the Frame Pointer. Local variables are accessed with the same addressing mode but

Figure 3 - Procedure Calling Sequence

```

Program Main;
Procedure PROC1 (x,y:INTEGER);
Begin
  ...
End;

Begin {Main Program}
PROC1 (a,b);

End.

translates to--

MOVD (-8)(FP),TOS ; Copy double-word local variable
(a) from its location at FP-8, and
push it onto the stack. It will become
passed parameter (x) in PROC1's frame.
MOVD (-12)(FP),TOS ; Copy double-word local variable
(b) from its location at FP-12, and
push it onto the stack.
BSR PROC1           ; Call the local procedure at the address
                     ; PROC1, and push the address of the next
                     ; sequential instruction on to the stack.

PROC1:
ENTER [R7,R6],28   ; Push the Frame Pointer onto the stack,
                     ; and load the Frame Pointer from the
                     ; Stack Pointer. Subtract 28 from the
                     ; Stack Pointer, lengthening the stack
                     ; by 28 bytes, making room for variables.
                     ; Push registers 7 and 6 onto
                     ; the stack (to save them).

.
.
.

EXIT [R7,R6]        ; pop 6 and 7, restoring those registers,
                     ; load the Stack Pointer from the
                     ; Frame Pointer, and pop the Frame Pointer.
                     ; Add 8 to the Stack Pointer,
                     ; effectively removing 8 bytes of the stack,
                     ; pop the address of the next sequential
                     ; instruction (that we saved during
                     ; BSR), and load it into the Program
                     ; Counter (Register), transferring control.

RET 8

```

use negative displacements.

In our example, we're pushing copies of the local variables (a and b) onto the stack. These will become parameters when the called procedure executes. See Figure 2.

#### External Procedures

The 32032 supports program modules (one of its selling points) which are accessed via a module table. External procedures are procedures outside the current module. To call one —

```

CXP      ;call external procedure
or,
CXPD    ;call external procedure
         with descriptor
Then,
RXP     ;return from external
         procedure

```

(continued next page)

## SETTING OUT

(continued from page 59)

to return control to the calling procedure.

These instructions work with Module and Link Tables to locate the called procedure. With this system the calling procedure doesn't need to know the absolute address of another (external) procedure. So memory can be used more efficiently, and memory bookkeeping can be handled in one place (the Link Table). Each module takes care of itself, without knowing where anything else is located. The Link Table is the only part of a module which must know absolute addresses.

### Multi-tasking

In multi-tasking operations the efficient use of memory requires that a procedure be locatable anywhere. (Unlike single-user systems, there is no guarantee that a specific location like 100H will be available.)

This use of "virtual memory" frees the programmer from the restraints of physical memory. You can think linearly even though memory is actually being partitioned. (Partitioning is used to divide up memory so multiple processes can reside there at the same time. It is not 8086-like segmenting.)

For example, let's say you've got 1000 bytes of free memory (let's say addresses 1000-2000), but your program is larger than 1000 bytes. You start out by loading 1000 bytes of your program into memory and running it.

A JUMP to an address not currently in memory generates a page fault. (A page fault means we need more of the program). So a JUMP to program address 1500 (would be to memory address 2500 since we're starting from 1000) forces the system to go to the disk and overlay the next 1000 bytes of the program into the 1000-2000 portion of memory. Then execution continues.

### Supervisors And Users

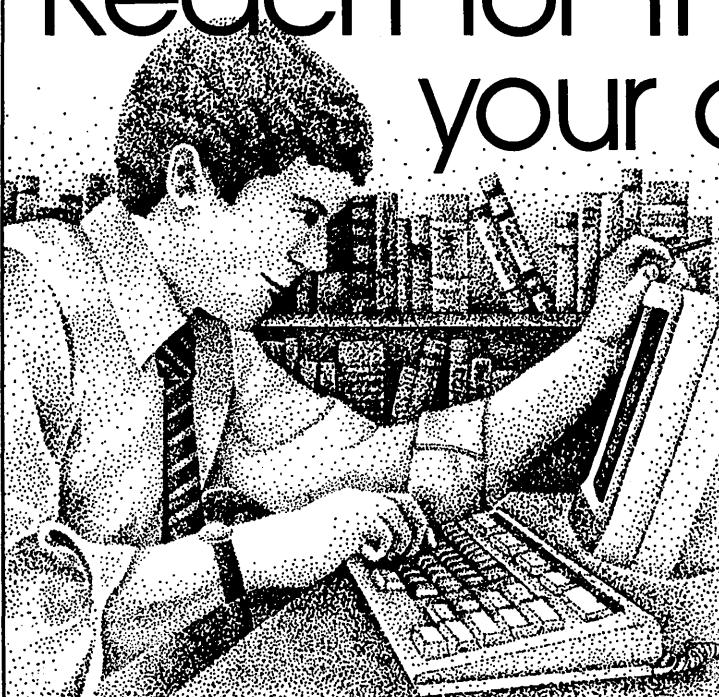
The 32032 was designed to be a 32-bit COMPUTING SYSTEM. All system-level features are designed in. Currently the MMU (Memory Management Unit) and the FPU (Floating Point Unit) are separate chips, but National Semiconductor intends one day to have the entire system on one super chip.

Definicon's 32032-based board (DSI-32) is current microcomputer state-of-the-art (or thereabouts), and plugs into a PC clone using the PC's microprocessor (8088 or 8086) for I/O.

By using Concurrent DOS (which allows background tasking using MS-DOS software), you can edit a file with the 8088 for instance, while the DSI-32 is executing another program. A lot of MS-DOS software will run under Concurrent DOS, so this really opens up the possibilities.

Supervisor requests allow the 32032 and the 8088 (8086) to talk to each other.

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If you need to write a character, open a file, or write to a file, for examples, send the 8088 the appropriate supervisor request by loading the request number and other particulars into 2 or 3 registers.

### Finally

The 32032 has some powerful features, so don't be surprised if co-processor boards begin infiltrating PCs world-wide.

Co-processors that can communicate with MS-DOS or UNIX will be very popular, if the chips are available. Insiders claim National Semiconductor finally has it together and can get the chips out (and we're not talking potatoes). Let's cross our fingers.



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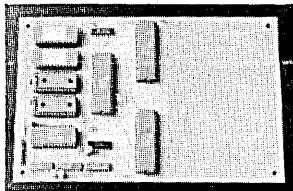
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See review in MicroCornucopia Issue #22 (Feb 1985).

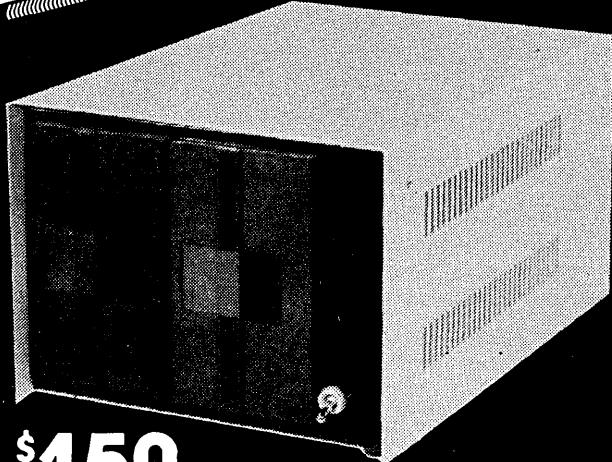
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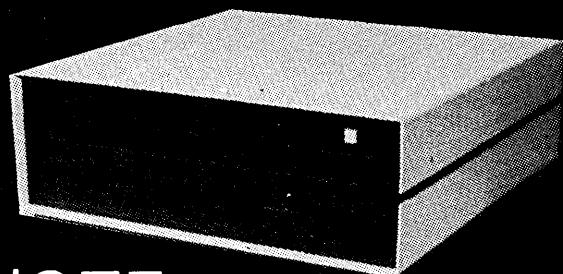
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# FORTHwords

By Arne A. Henden

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A FORTH Engine can be loosely defined as any single board computer that has FORTH built into it. There are three main approaches to building a FORTH Engine: FORTH in ROM, Microprogrammed FORTH, and the FORTH Processor. I'll cover all three in this column.

## FORTH In ROM

A general purpose microprocessor such as the Z80 can be used in conjunction with ROM memory to emulate a FORTH computer. For example, the ROM FORTH or Idaho FORTH ROM sets that were sold by Micro C enabled the Big Board I to execute FORTH upon reset. This ROM technique is not limited to FORTH. The IBM PC, Commodore 64, and other personal computers have BASIC in ROM. Even monitor ROMs fit into this category, since they accept keyboard commands.

The primary advantage of FORTH in ROM is the ease of implementation, since any general-purpose micro can be programmed to execute FORTH. But in all cases, the ROM eats into the available program space. Since few micros have the register set or addressing modes for efficient FORTH, ROM implementations tend to be slower than the other two methods.

## Microprogrammed FORTH

Think of a microprogrammable processor as one with a limited internal instruction set that uses short subroutines to handle the more complex instructions. In effect, such a processor is both a processor and a ROM as described above. The microcode resides on a separate internal bus and controls the processor. In fact, from the outside you only see the microcode, not the processor.

The 68000, 8086, 80186, and 80286 are examples of microcoded processors. Each clock cycle of the 68000, for instance, consists of several internal microcycles.

Most 16-bit micros use microcode since it's easier to develop microcode than to do the same complex instruc-

tions in hardware. The difference between the 8086 and the 80286 is that more functions on the 80286 are implemented in hardware, using fewer microcycles for each instruction.

You can buy microprogrammable processors, normally called bit-slice processors. Given that such CPUs can emulate any instruction set, it makes sense to microcode FORTH. The H4TH engine is a good example, where a 4-bit processor executes FORTH instructions. A 16-bit addition needs at least four microcycles since only 4 bits of the result can be obtained at once. For this reason, the H4TH is not the fastest FORTH engine even at its internal 14MHz clock rate. A 16-bit chip such as the AMD29100, or a 32-bit chip such as the NCR/32 might be better choices.

Here again, FORTH is not the only language that can be implemented in microcode. The Pascal engine of the late 1970s and the Modula II engine are other examples. The LSI-11 and MicroVAX are microcoded processors.

## The FORTH Processor

Even the bit-slice processors use an underlying general purpose chip to emulate FORTH. The best design would be a custom chip with special circuitry to implement FORTH instructions directly. NEXT best would be a single instruction instead of several microcycles. Obviously, this is the fastest and most efficient method, requiring only a single chip with no emulation. Unfortunately, it is also the hardest approach. Someone has to design such a chip and convince a semiconductor company to invest huge sums of money to create the mask and produce the chip.

Charles Moore (the inventor of FORTH) started such a project several years ago, and has recently succeeded. The March 21, 1985 issue of Electronics Design introduced the Novix microprocessor — a single chip FORTH engine. The first chip to be released, the NC4000A, will run at a clock rate of 8MHz and is capable of executing the Sieve benchmark in 0.4 seconds, about the speed of optimized

68000 assembly language. A 16-bit processor, the NC4000A can use 64Kb of memory for program space and can store data in a 128Kb region.

The Novix chip is the most novel micro to be released in years. Its speed is such that dedicated controllers can be programmed in a high-level language instead of assembly language. Look for the Novix in many products in the future.

## Comparing The Three

Each of the three approaches listed above has strong points. While the slowest and most memory wasteful, FORTH in ROM can use available coprocessors such as the 8087, as well as family members such as the Z80 DMA.

The microprogrammed FORTH uses conventional techniques, with arithmetic accelerator chips available to speed operations. For example, the NCR/32 has an accelerator that can perform floating-point operations in two clock cycles.

The FORTH processor has the most potential in speed and compactness, but may be more expensive, does not have co-processors, and has limited memory space.

Figure 1 shows benchmarks for the three reviewed systems as well as two common computers. Read my earlier columns on benchmarking for information about the individual tests. The H4TH compares favorably with the VAX, though the latter is a 32-bit implementation.

For further FORTH engine references, see The Journal of FORTH Application and Research (v.2 n.1 1984) and A Bibliography of FORTH References (1984), both available from the Institute for Applied FORTH Research, Inc., 70 Elmwood Ave., Rochester, NY 14611.

Of all the high-level languages currently in vogue, FORTH appears to be the one targeted towards hardware implementation. It behooves you, therefore, to get familiar with the language before your boss tosses a

(continued next page)

chip on your desk with the comment, "Have this project ready for me tomorrow."

### The Rockwell Chip

Rockwell introduced the 65F11 microcontroller chip in 1983. The chip includes a serial port (up to 7200 baud at 1MHz clock and 9600 baud for the 2MHz chip), two 8-bit parallel ports, counter/timers, 3K bytes of masked ROM, and 192 bytes of RAM. It can address up to 16K bytes of external memory directly, or one of the parallel ports can be used to bank select into a much larger memory space.

The unique feature of this controller chip is the tiny FORTH that resides in the ROM. Its 133 words can be used as-is, with a primitive micromonitor or "outer interpreter" that understands numbers and can execute

Figure 1 - Benchmarks

	VAX	H4TH	Vesta	100sq	Sampler
Test	11/750	Engine	SBC98	65F11	IBM PC
T1 (loop)	5.0	4.6	55	130	24
T2 (I++)	17	15	127	560	92
T3 (I*/)	6.3	217	220	5790	152
T4 (e!)	18	10	115	333	75
T5 (C0,C1)	19	13	118	293	75
T6 (D+)	15	49	102	280	59
T7 (flit,fix)	9.7	212			630
T8 (F*)	16	1652			927
T9 (F/)	22	1534			2711
T10 (F+)	16	645			525
T12 (sqrt)	56	12520			13880
T13 (log)	113	12660			46280
T14 (exp)	72	15250			33550
T15 (atan)	64	59140			50910
T16 (sin)	90	22740			36660
T18 (cmove)	95		1026	4910	844
Sieve	7.1	4.0	55		32

words. The 65F12 is functionally identical, with three additional 8-bit parallel ports.

You can implement a working 65F11 system with just the chip, a

TTL latch, and up to 1K of EPROM. However, the more normal development configuration includes Rockwell's 8K byte development ROM, providing 200 additional words includ-

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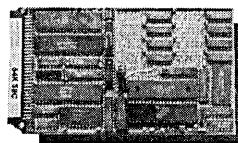
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ing a line editor, an assembler, a complete FORTH system, and EPROM programming capability. The CPU/ROM set is easily interfaced to a 1793 floppy disk controller for mass storage.

NMI has incorporated the 65F11 into a tiny (100 millimeter square) board of impressive power. In addition to the 65F11 and the development ROM, there are three RAM/ROM sockets, RS-232 interface circuitry, and parallel port buffers. Only a single 5V power supply is required. One of the sockets can program 2764s directly. The documentation includes the 200+ page Rockwell FORTH manual, data sheets, and a 33-page hardware manual.

Rockwell has provided a useful set of words in the development ROM. You can target compile: headers can be compiled separately from word bodies. Only the bodies need be

burned for dedicated applications. Autoexecution of a word during startup is possible by placing an A55A (hex) pattern on a 1K boundary; the startup software then assumes the code field address of a word is in the next two bytes and executes that word directly. The ROM has all the normal disk commands as well as the ability to format a disk.

Both low- and high-level interrupts are supported. A page zero location contains an interrupt status word. One bit is used for enable/disable, and 1 bit indicates a pending interrupt. The actual interrupt is processed by a low-level word which sets the pending bit. When NEXT is executed, it checks the request bit and vectors to a user-defined high-level processing routine. Any one of 16 different interrupt sources can be serviced, including serial in/out, counter/timers, etc.

The memory sockets are mirrored so

they appear in more than one place in the memory space. This permits developing code at one location, burning the PROM, and then relocating it at a different address either by physically moving the EPROM or by changing a jumper.

#### How The System Rates

I like the BASIC system. In a small space you have enough interface to the outside world to perform many dedicated control tasks. The built-in kernel provides run-time support, so you can pack considerable code into the external memory. Therefore, as a controller the card has potential.

As a development system, however, it is greatly lacking. It doesn't have a good line editor, much less a video editor. You would have to purchase the \$340 development board to have

(continued on page 67)

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disk access. The 8K development ROM leaves only half of the 16K byte external memory for your program. The 65F11 is BASICally a 6502 processor, and at 1MHz it's quite slow.

I'd suggest using a host computer to perform development and editing, and then downloading to the 65F11 to test. Note that the built-in micromonitor provides debug capability at the customer's site with only the addition of a serial terminal. Without case, ROM, or power supply the system can be purchased in quantity for \$150 or less, providing high-level control for a custom project at low cost.

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(65F12)  
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#### The Vesta SBC-88

The SBC-88 is an example of a small single-board computer that has sufficient EPROM space to incorporate an extensive FORTH, BASIC, or other ROM-based high-level language.

Its 5.5x6.5" footprint includes: a 4MHz 8088, 8 or 16Kb ROM, four additional memory sockets for up to 32Kb RAM/ROM, an RS-232 serial port at up to 9600 baud, two 8-bit parallel ports, seven individually addressable inputs and seven outputs, and an 8-channel A/D (8 or 10-bit). One of the RAM sockets includes provision for programming. The sockets support 2Kx8 or 8Kx8 RAM/EPROM devices. The A/D is a National ADC0804, and has a maximum conversion speed of about 200 microseconds. The optional power supply includes a reset button, EPROM programming voltage, BSR transmitter, and a 120Hz clock signal.

The board comes with 10 pages of hardware description and a schematic. I really like the BASIC board, and

think it's one of the best bargains in the controller market. However, I have several complaints about the hardware.

The I/O and serial cables use DIP connectors instead of the usual dual in-line headers. In addition, the DIP connectors aren't on the edge of the board, but instead form the second row of sockets. The EPROM socket isn't Zero Insertion Force (ZIF). Power is always present at the programming socket, so you can't copy an EPROM to RAM, remove it, and program a duplicate (you usually destroy the program). Ground is not available on the parallel port DIPs. Instead, you must run a separate lead (why use a socket at all if this kind of kludge is necessary?).

Two different ROM operating systems were available at the time I wrote this: an 8K BASIC and an 8K FORTH.

#### BASIC Vrs. FORTH

Vesta has spent more time on the BASIC ROM. It includes a primitive download capability as well as Intel Hex file support, printer toggle, timer wait, autostart, line editor, EPROM programming, period measurement from an input port transition, and buffered A/D collection. The A/D data can be plotted using crude character graphics on the console or printer. The documentation is 32 pages of function description plus a partial listing of the BIOS.

The FORTH ROM is quite primitive, supporting the Fig model with a full line editor, EPROM programming capability, and A/D input words. Its documentation consists of the Fig-FORTH vocabulary list, a few pages of supplemental words, and a partial listing of the BIOS.

We used the FORTH to develop an automatic power line monitor for a customer and were frustrated at every turn. There are several bugs, such as the lack of printer toggle, ordering of timer words not following their double-precision integer convention, incorrect rotation of the eight 128-byte block buffers, and documented words

that were missing from the ROM. The Fig line editor is clumsy when you are used to a video editor. The 'C' command will insert unwanted nulls into blocks.

After a few weeks, we quit using the SBC88 as a development board. Instead, the source code was developed, edited, and tested on a host computer before downloading to the SBC88. This method worked well enough to get the project out the door. The serial line is preset to 4800 baud at power-up, but when using FORTH we had to slow the baud rate down to 1200 to prevent character loss.

#### Deciding

If I had to choose between the BASIC and FORTH ROMs I would take the BASIC because of the additional functions. Its major deficiency is the usual slowness of BASIC, which can be important in controller applications. However, I like the board, and the price is right.

I've made arrangements with Vesta to distribute a specially configured UNIFORTH in place of their FORTH ROM. The SBC88 UNIFORTH is FORTH-83 Standard and includes a video editor, assembler, download, autoload, printer control, time/date stamping, floating point, buffered A/D, and primitive graphics (amazing what you can fit into 16Kb when you try!). We've also included a 200-page manual. Check with Vesta for availability and pricing.

SBC-88  
Vesta Technology, Inc.  
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Full board: \$169.95  
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Power supply: \$79.95

#### H4TH By Hartronix

As you might expect from the price differences shown below, you are in a different ballpark with the H4TH

(continued next page)

system. The basic 6.6x11.0" board includes the microprocessor, 32Kb RAM, calendar/clock, two RS-232 ports (to 38.4K baud), a floppy disk controller (supports two 800Kb 5" floppies), and a 500K baud high speed serial port. The optional case/power supply/floppy combination includes three expansion slots for more memory, serial channels, or CRT controller.

The system is well built though definitely utilitarian. The box won't win any designer awards, but everything fits well. A 2" ring binder contains the hardware and software documentation. My system came with preliminary documentation that was not user-friendly, but was almost useable if you were a proficient FORTH programmer. They have recently hired a technical writer and promise better documentation Real Soon Now.

The H4TH engine is a 4-bit processor that executes FORTH as its native (microprogrammed) instruction set. It is fast, as shown in the benchmarks, executing FORTH as fast as a VAX 11/750. It can run the Sieve benchmark as fast as the IBM PC can run optimized assembly language. Since the processor is microprogrammed, they have included a virtual computer that looks like an expanded PDP-11 (if you wish to use assembly language instead of FORTH). They also provide an assembler to create new microprograms for the processor (to add new instructions).

The major hardware limitation is that you are locked into their proprietary bus. They will provide interface information so you can wirewrap your own cards, but I doubt any second-source manufacturers will enhance Hartronix's selection of peripherals.

#### Software

The software is impressive in some areas, and deficient in others. You get a full multi-user system, with memory management, a breakpoint monitor, tree-structured file system, local labels, and a line editor. Files are time/date stamped, and have version num-

bers (though a new version overwrites the current file).

However, the formatting program supports only one format (presumably, so does sector r/w), so transporting software becomes more difficult.

No user protection is provided on the formatter: no "are you sure" type messages, and no indication of how the formatting is progressing. An optional floating point package is available, but it needs work.

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The TAN/ARCTAN function has bugs, the word set is not consistent with the proposed floating point standard, numeric entry involves the use of a separate exponent, and the IEEE numeric format is not used. The Fig line editor is usable, but a full screen editor should be provided (all other vendors do, and this is billed as a development system). I never used the virtual computer or the target compiler since no documentation was provided for these features.

Hartronix supports the FORTH-83 Standard for the most part. Their division is floored — the first vendor I've seen that really supports this aspect of the Standard. Divide by zero is trapped, but overflow is not. Stack underflow is trapped, but words like ROT that do not change the stack depth will work even if insufficient parameters exist. I was hoping a

microprogrammed system could implement proper stack error checking.

My major complaint with the software is that Hartronix has redefined many standard words: CONSTANT becomes CON, VARIABLE becomes VAR, etc. They use word addressing instead of byte addressing. This means you get 128Kb address space using a 16-bit FORTH, but must kludge string and other byte-addressed operations.

I converted a word-addressed FORTH on a PDP-11 to a byte-addressed system and don't recommend the experience. You run across many circumstances (such as 'I + C@' and '1 +LOOP') where you continually get burned in transporting software unless you fully understand both the source and destination systems, as well as what the application does.

If someone needed a high-speed FORTH development system, or had some application that needed the multi-user features, I wouldn't hesitate recommending this system — when the documentation is finished. You may need to port your development tools (such as the video editor) from your current system before much programming is accomplished. I'm harsh on the system because it has great potential but hasn't reached full maturity yet. Give this system another six months and it should have excellent software and documentation to complement the hardware.

H4TH Engine  
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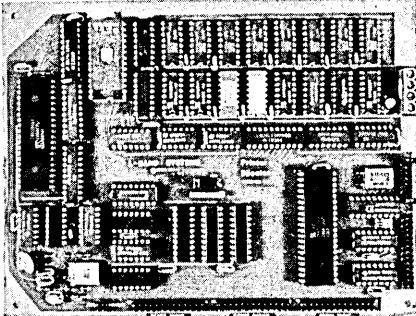
#### Summing Up

I've examined FORTH engines in general and three implementations in particular. For compactness and low cost, the ROM FORTH single-board computers are good choices for dedicated controller and other OEM applications.

For situations where high performance is required, the microcoded FORTH engines or the single-chip Novix are wise choices. Consider these products in your next custom application. The ease of programming in a high-level language will shorten the development cycle and usually result in a higher quality product.



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# Pascal Procedures

By John P. Jones

6245 Columbia Ave.  
St. Louis MO 63139

In this column I'll give you a few pointers on pointers. Actually, it'll be more than a few pointers — we're going to wade right into this non-trivial subject. As you'll see, pointers can be a very powerful tool, but a lot of people don't use them because they don't understand them. We'll begin by looking at allocation of variables, and then we'll see what that has to do with pointers.

## Static & Dynamic Variables

Variables declared in the PROGRAM section and in non-recursive procedures are static variables. This means their storage is allocated and fixed at compile time. Two mechanisms are built into Pascal for creation and use of variables at run time — recursive procedure calls and dynamic variables.

Procedures compiled with recursion enabled will, when called, generate new copies of their internal variables on the recursion stack. On return from the procedure, their space is released for other use. This is all transparent to the programmer and application.

## Pointers

The other mechanism for run-time variable allocation involves pointer variables.

A pointer is a variable which contains the address of a variable instead of the data itself. Pointers are declared by prefixing the pointer character ('^') to a variable type.

```
type
  strarray = array[0..5] of string[16];
  intptr = ^integer;
  aryptr = ^strarray;

var
  dynint : intptr;
```

Pointers can be assigned and compared in much the same way as other variables. The primary function of pointers, however, is to allow for the creation and use of dynamic variables. Free memory is assigned to the heap, and this area is available for newly created dynamic variables. The statement:

```
new(dynint);
```

will create a variable of type INTEGER on the heap, assign the integer's address to dynint, and reduce the size of the heap by one integer's storage space.

```
dynint-----> | dynint^ | -----
```

Dynamic variables are accessed by using the pointer character as a suffix to the pointer name. So the above says that "dynint" is the address while "dynint^" is the value contained at the address.

```
dynint^ := 3;
otherintvar := dynint^;
```

Two mutually exclusive mechanisms are used for de-allocating heap space. Your compiler will have one or both of them.

```
dispose(dynint);
```

Dispose is the complement of New and will do what its name implies — dispose of the storage for dynint .

The other method for reclaiming heap space is called "Mark" and it lets you mark a variable so you can reclaim it and everything beyond it.

```
Mark(dynint);
```

This places a marker on the heap at dynint 's position. Later, when the statement: RELEASE(dynint) is executed, all space allocated from dynint^ onward will be de-allocated. If your compiler provides both methods, results will be unpredictable if you use both in the same program.

If this were as far as the story went, dynamic variables would not be much more useful than statics. Since pointers can point to records and can also be fields of records, uses for dynamic variables are limited only by the imagination.

## Linked Lists

Given the following declarations,

```
type
  listptr = ^listitem;

  listitem = record
    itemdata : datatype;
    nxt_item : listptr;
  end;

var
  root, item : listptr;
```

we can construct a simple linked list. The pointer root is our anchor on the world, and it points to the start of the list. The list is initialized with:

```
root := nil; { nil is the pre-defined value for a null pointer }
```

and items are added in this way:

```
new(item); { create new var }
item^.itemdata := data;
{ the field "itemdata" in record pointed to by item is assigned contents of data }
item^.nxt_item := root;
{ link to prev. data }
root := item; { reestablish anchor }
```

Singly linked lists as shown in Figure 1 can be useful, but they have disadvantages. First, the components can only be accessed serially from the previous item. Another disadvantage is that insertions and deletions can be cumbersome. Also, if you use a list like this, all procedures that access it must be sure to check for an empty list.

## The First Shall Remain So

By using an additional reference pointer that always points to the oldest item, a structure called a queue is formed. See Figure 2.

In this example, items are added using the pointer LAST, in a way similar to the above for a simple list. The additional factor to consider is that the initial item should be added with the pointer FIRST. Removal of items from this queue can be done as shown in Figure 3.

A queue is thus a first in, first out structure, while the earlier simple linked list is a last in, first out device.

## Double Trouble

As mentioned above, insertions and deletions in these singly linked lists are cumbersome. At the cost of a little more storage, doubly linked lists have a much cleaner implementation of these functions.

```
type
  dblptr = ^dbl_item;

  dbl_item = record
    data : datatype;
    before, after : dblptr;
  end;

var
  root, crnt, nxt : dblptr;
```

With these declarations, each list item has two linkages to the other list items. BEFORE, the backward pointer, points to the preceding item, while AFTER, the forward pointer, points to the succeeding item. If the forward

(continued on page 73)

Figure 1 - A four member linked list

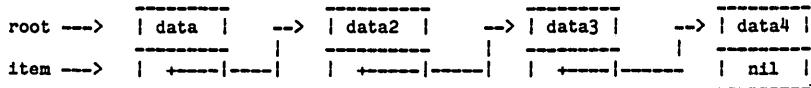


Figure 2 - Forming a structure

```
var
  first, last : lstptr;
```

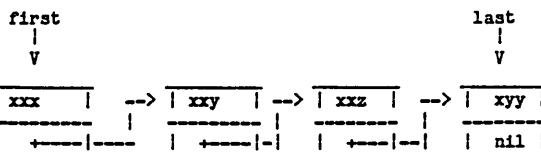


Figure 3 - Removing items from a queue

```
item := first; { retrieve item }
if first <> nil { if list not empty }
then begin
  first := first^.nxt_item; { make the second first }
  if first = nil then last := nil; { executed if list now empty }
end;
```

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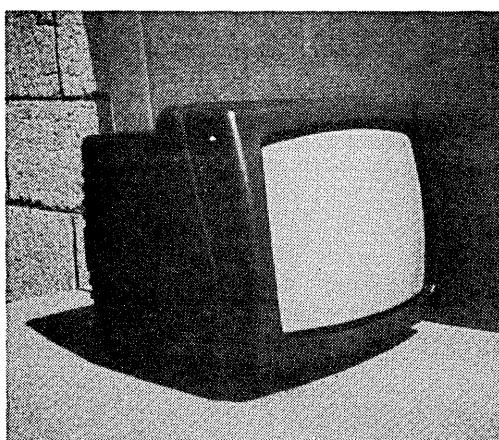
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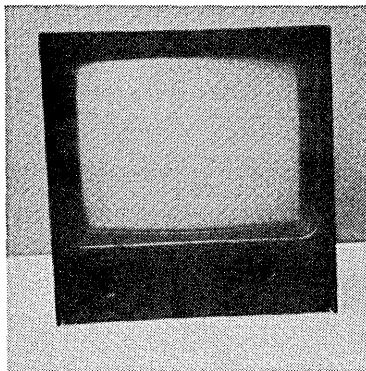
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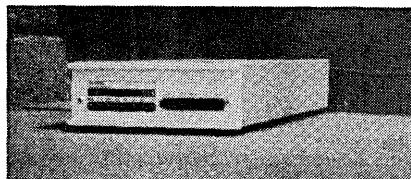
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## I.C.'s

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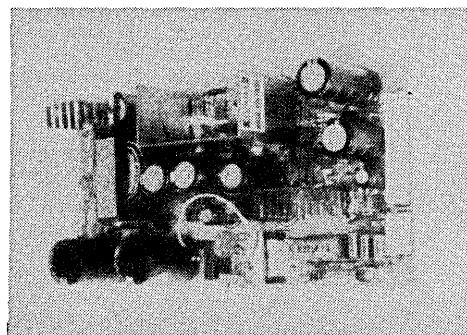
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## PASCAL PROCEDURES

(continued from page 71)

pointer of the last item points to the first item, and the backward pointer of the first item points to the last item, you get a doubly linked ring. An empty ring can be defined as a single dummy item with both forward and backward pointers pointing to itself. See Figure 4 for a doubly linked ring.

To insert nxt after crnt:

```
nxt^.after := crnt^.after;
{ nxt's forward := crnt's forward }
nxt^.before := crnt;
{ nxt's backward := crnt }
crnt^.after^.before := nxt;
{ crnt's successor points to nxt }
crnt^.after := nxt;
{ crnt's forward points to nxt }
```

To insert nxt before crnt:

```
nxt^.after := crnt;
{ what comments would you make? }
nxt^.before := crnt^.before;
crnt^.before^.after := nxt;
{ field "after" in record pointed
  to by "before" in record pointed
  to by "crnt" is assigned nxt }

crnt^.before := nxt;
```

Deletions are even simpler. To delete crnt:

```
crnt^.after^.before := crnt^.before;
crnt^.before^.after := crnt^.after;
```

Since a ring has no ends, when you traverse a ring, you have to remember where you start.

```
nxt := crnt^.after;
while nxt <> crnt do
begin
  process_item;
  nxt := nxt^.after
end;
```

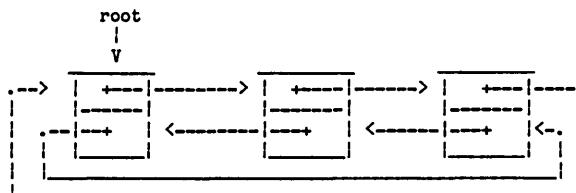
### Trees

When a record contains multiple pointers to other records of the same type, a structure called a tree can be formed. If the tree is constructed (grown? no, groan) so that each node can point to two other nodes, left and right, the result is a binary tree.

```
type
  nodeptr = ^node;

  node = record
    data : datatype;
    left, right : nodeptr;
  end;
```

Figure 4 - Doubly linked ring



If the insert procedure is written so that the new item traverses the left branch if it is less than the current node's data or the right branch if greater than, a binary search tree is formed. One important characteristic of a binary search tree is that a traversal that always visits the left subtree, then the node followed by the right subtree will yield an ordered (sorted) sequence of data.

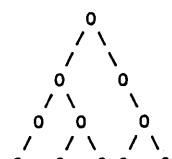
Caution: If the data is entered into a binary search tree in ordered sequence, the result is a linear list. For optimum results, the data should come in randomly.

### Homework Assignment

Pull out your favorite Pascal text and use it to expand on this brief look at dynamic data structures — they are one of Pascal's greatest strengths. Especially when working with lists and trees, it is very helpful to draw pictures and diagrams. They will often make the difference between "I don't understand" and "Gee, that's clever."

### Turbo Power

Shortly after sending in the column for issue 24, I received a copy of Turbo Power! for review. This utility is written in Turbo Pascal and can be either run standalone, or from within Turbo with the eXecute command. TP provides facilities to compare, copy, rename, delete, and type files or groups of files. If you are running



Example of Binary Tree

standard CP/M 80, TP is well worth the \$25 price. On the other hand, if you have ZCPR2 or ZCPR3, most of the facilities are available as transients which can be run individually with the eXecute command.

Installation is simple, and necessary, since the program is highly screen oriented in its operation. For the version I received, Turbo version 2 was required to install the program, since my modified Big Board terminal software did not match any of the terminals in the standard installation. Once installed, TP will run under Turbo version 3.

The program works as stated in the ads and documentation, and I found only one problem with it. If the overlay file, TP.000, is not on the currently logged disk, the program will abort when some functions are attempted. It could have been written to check for the overlay file's absence and lock out the functions that need it.

The seven-page manual is sufficient, since on-screen instructions are clear and most of the commands are either obvious or logical. The few places where additional detail is needed are covered in the documentation. I would suggest some expansion of the manual for novices to CP/M, especially on the subject of wild card characters.

The program is well thought out, and provides most of the 'bells and whistles' that previously would have required leaving Turbo. Recommended.

Turbo Power! is available from:

Pascal Power!
 5666 La Jolla Blvd., Ste. 136
 La Jolla CA 92037



# Turbo Memory Assignments

By James R. Shiflett

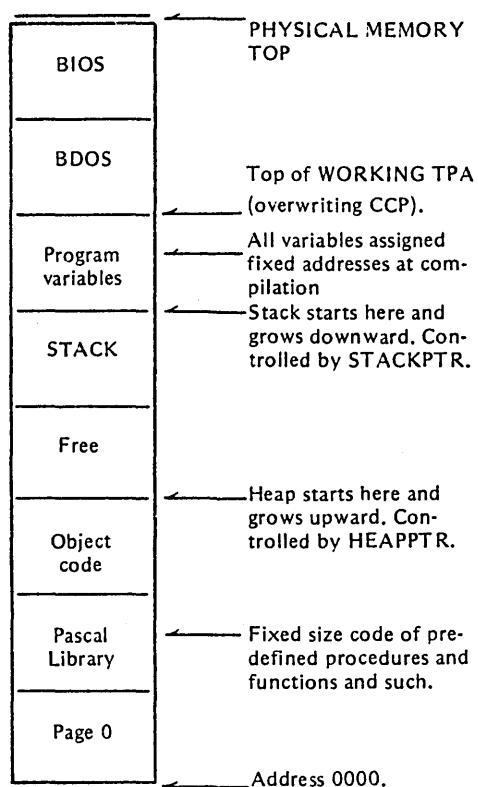
PO Box 1236  
Stafford TX 77477

In the April 1985 issue of Micro C, Tom Geldner mistakenly stated that programs written in Turbo Pascal for CP/M 80 cannot dynamically adjust their memory usage to match the computer's available memory.

While it's understandable that Tom would believe this, especially in light of the fact that even Borland's technical support staff know of no solution, it is nonetheless quite false. The Turbo reference manual explains that the memory of a compiled program is normally organized as shown in Figure 1.

The memory addresses assigned for

Figure 1 - Normal arrangement of memory



all variables are assigned at compile time and they are placed right under BDOS. If the compiling computer has more room than the computer it will be running on, then really bad things happen.

The Turbo Pascal Reference Manual suggests you lower the END ADDRESS during the compilation to restrict the highest address the program can use. This works, but has one major disadvantage: the memory above the specified END ADDRESS is unavailable to the program (unless you know a trick).

A more reasonable solution is to

Figure 2 - Rearranging to utilize full available memory

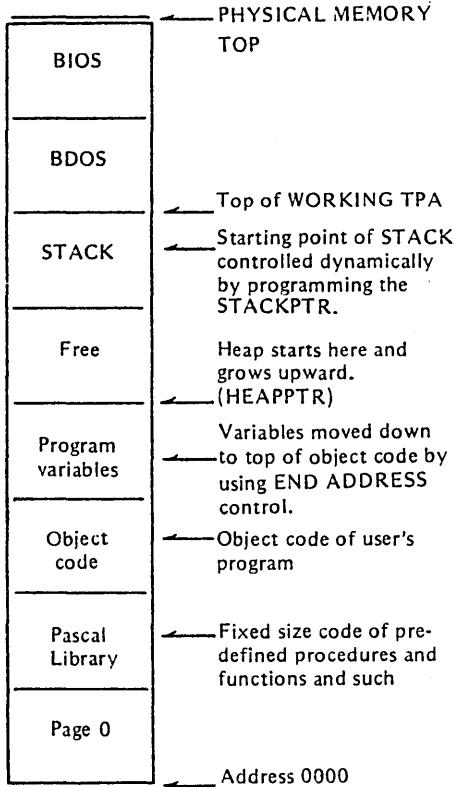


Figure 3 - Initializing the Heap and Stacks

```
var
  MemTop : integer absolute $6 ; (* Where CP/M keeps its Mem. Size info *)
begin (* Main body of program *)
  StackPtr := MemTop - $826 ; (* place stack pointer below CCP *)
  RecurPtr := StackPtr - $400 ; (* place recursive stk 1K lower *)
  HeapPtr := $840F ; (* SET COMPILER END ADDR. BELOW THIS VALUE *)
```

rearrange the structure of the memory assignments to avoid putting the fixed location items at the top of memory. My solution forces Turbo to put the variables just slightly above the object code. Then the HEAPPTR and STACKPTRs can be dynamically adjusted to utilize full available memory. Figure 2 illustrates this.

You can implement this arrangement easily, and it makes all the machine's memory available to the program where it needs it most — in the Heap and Stacks.

## Simple Solution

The commands shown in Figure 3 are placed in the program so that they're the first commands executed.

That's all it takes. The specific values shown are from a program I'm preparing for release this summer called Le-Menu. It's a user friendly operating shell for CP/M that's written in Turbo Pascal (with a few assembly language subroutines for efficient CP/M interfacing). I'm writing it specifically to demonstrate a number of the advanced techniques I've developed in two years of intensive Turbo Pascal programming. (What good are neat algorithms if they're never shared?)

During the development and debugging phase of a program I simply let Turbo use its default END ADDRESS. When I'm ready to release a version to the public I run Turbo in the COM mode to create a disk file image. This gives the following report:

```
Code : 19487 bytes (1FC9-6BE8)
Free : 24136 bytes (6BE9-CA31)
Data : 5640 bytes (CA32-E03A)
```

I can now add the size of the DATA group to the CODE group's top address and calculate the desired END ADDRESS to give to the compiler. For the above example I used 6BE8h + (E03Ah-CA32h). To play it safe, I add a little and round up to the next page. Therefore I set the HEAPPTR to \$840F (16 bytes above the END ADDRESS). I set the Turbo compiler option END ADDRESS to 8400h and recompile the program (no real time lost since Turbo is so fast).

The report:

Code : 19487 bytes (1FC9-6BE8)  
Free : 526 bytes (6BE9-6DF7)  
Data : 5640 bytes (6DF8-8400)

The size of the disk program is unchanged, but the result is a program that can execute properly on nearly all CP/M systems while retaining optimum memory.

Turbo Pascal is such a powerful implementation that it can be viewed as much a revolution in language utility as it is a revolution in quality software marketing and pricing. I hope others will apply the "nothing's impossible" attitude to Turbo and help raise the general level of public expertise.

■ ■ ■

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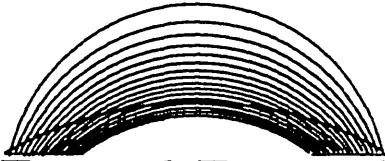
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## Pascal Power!

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\*\*\* Press Release \*\*\*

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With the ability to operate on an arbitrary subset of files, the TurboPower user can quickly initiate compound tasks, such as backing up those files (and only those files) that have been changed since the previous backup. The users' guide illustrates how TurboPower can be used to quickly accomplish many complex tasks.

TurboPower is highly graphic and simple to use with a single keystroke, the user operates on objects that TurboPower places on the screen.

TurboPower is currently available by sending \$24.95 check or money order to Pascal Power, 5666 La Jolla Blvd., Suite 136, La Jolla, California 92037. TurboPower is available for all CPM/80 versions of Turbo Pascal in 5 1/4" disk formats.

# Modula II, An Overview

## Excerpts From A Talk By Niklaus Wirth

*Editor's note: On June 1, I participated in a meeting led by Niklaus Wirth. The meeting was attended by a small group of hard-core hackers, most of them from the Sacramento, California area.*

*Since then, I have spent quite a bit of time reading about Modula II, and I'm fascinated. So fascinated, in fact, that I found it almost impossible to write this article. After three false starts (any one of which could have filled half of Micro C) I decided to go back to my tape of the meeting and see how Niklaus himself presented the language. He did an admirable overview of the language, plus he covered a number of other interesting topics.*

*He premised his discussion about Modula II by noting that the language was the answer to a problem — to create a single language with which he could do all the programming on his Lilith computer.*

*What follows are Niklaus' own words, only lightly edited. (Comments in parentheses are mine.) I think you'll enjoy this overview of an incredible language by a very special person.*

**I**t was 1976, 1977 and multi-user was the big thing — time sharing, UNIX, multi-processor systems.

I knew that the single language was one thing that would keep the Lilith project sufficiently simple that we would have some hope of being able to do it.

### Which Language To Use?

Pascal would have been a favorite choice, of course, but if you are really serious about a single language there are some things where Pascal, pure Pascal at least, is not good enough. And we wanted to build a system that rested on clear-cut, well-defined concepts — not Pascal with things glued on.

This resulted in Modula II, which is basically a merger of Pascal and Modula I. Modula I had been designed as an experiment in 1974 - 1976. We

wanted to get into multi-programming, explore methodologies for designing programs that are safe, pure, correct. And instead of setting up rules, we ended up formulating these rules in terms of a language.

Modula I had the very important concept of a module, but apart from that it was really an elementary language. Obviously not good enough if you wanted to have a system with a single language.

### What Makes Modula II Interesting?

It is in the tradition of the structured languages, Algol and Pascal. In addition, it has those things that Pascal lacks for writing larger systems — primarily the module structure.

A module is hard to explain in a few sentences, but crudely said, it is a collection of procedures and data structures around which you build an intransparent fence. Then you can poke holes in the fence. Then you can say these and these objects are visible from the outside, and conversely you can say these and these objects outside are visible from the inside. They are unidirectional holes (innies or outies) called import and export.

### Separate Compilation

What makes this concept particularly useful is the combination of separate compilation — by no means a minor feat.

We have a strongly typed language (every variable must be declared). By that we mean that the program has quite a bit of redundancy which the compiler can utilize to do a consistency check on types.

Think of FORTRAN which has separate compilation. If you call a subroutine which you bring in from somewhere else, and you happened to forget one of the subroutine's parameters or the parameter's type, you don't know this until you execute the program.

When you have structures, all these things are based on the concept of type, so it's essential that you don't lose type checking when you cross

module bounds.

We found that the effort it took us was drastically reduced because we had a highly structured language with separate compilation, which makes it possible to work in teams.

Why? Because the separately compiled modules are first divided into two parts, a concept that was developed at Xerox Park. And I merged that concept into the module concept of Modula.

### The Two-Part Module

There is a definition part and an implementation part of the module. In the definition part you declare types and procedures which are going to be seen from the outside. Those objects are exported. In the implementation part you declare all the things that aren't exported.

That's precisely what we needed for system design. In a large group, you first design a system's definition modules, and the group must agree on these modules. Then individuals can go and work on their respective implementations. It sounds a bit too ideal — certainly an abbreviated sketch of what it really is.

The language covers only the syntactic aspects. You know which procedures are exported, and how many parameters.

The semantics are not checked. There you need the trustworthiness of your colleagues. For instance, you must be able to trust that if someone writes a mathematical routine he will not name it 'sine' and compute the cosine. That would not be checked by the compiler.

Modula satisfies most of the aspects of system design. I mean all these things that ADA offers a solution for.

### Modula Vrs. ADA

First of all, a very significant advantage of Modula over ADA is that it is here. We at the institute have worked on it now for six years, and it's proven to be useful.

Furthermore, Modula II compilers are effective and efficient.

And last, the language can be

defined in a manual of not more than 30 pages. In a way, I am proud to say it is only 30 pages, but in a way I'm ashamed it's so much. Because when you do significant system design you just can't afford to have a manual that is stacked with stuff.

I designed a new version of the Modula II compiler in the last two years in my spare time.

#### Compiler Size

This Modula is about 5,000 lines of source code. That compares extremely well with Mesa at 50,000 lines or ADA with 100,000. And I must tell you very frankly that 5,000 lines is about the limit which I can honestly say I understand. I got back to the compiler a few weeks ago, and boy o' boy, certain things I have to study again until I understand exactly why I did this or that.

If someone offers you a compiler and says it is written in its own language, ask him how long it takes to compile itself. Mine is now less than two minutes on the Lilith computer. The first Modula compiler took about half an hour on the same machine.

Let me not extend my monologue too much. Some of you aren't very much interested in these details. May I open the floor for questions and you direct me.

*(Throughout the rest of the article, the bold-faced lines are questions from other attendees.)*

#### You have no feel for Turbo Pascal or Turbo Modula II?

Not about Turbo Modula, but Turbo Pascal I know is a very compact system, very handy. I think it is a very good system. But don't make the mistake of trying to use it for large programs, because it is slow running.

As far as I know it is a system well suited for introductory programming courses and fast compilation with the

immediate integration of the editor. Good for debugging.

I mean that is the main reason that I did Modula, because all the compilers that were becoming available in Pascal were fine for toy programs, fine for introductory courses, but I would like to show that structured programming languages are not just for the school. Their real value comes when you do big systems. For that you need efficient compilation.

#### Are you using Turbo Pascal for teaching?

No, we are not. For the introductory courses we use Apple IIIs. (Loud chuckling from the group.)

**You were here for a sabbatical (8 years ago) and the result of that was Modula II. Now you're here again. What have you got coming?**

I came here because it is a chance to learn something new. And as a teacher in a field which expands so rapidly, this is an absolute necessity. I came this time to learn something about LSI design.

I did a revision of Algorithms and Data Structures that's coming out in August. It's based on Modula.

We do have a new work station under development based on the National 32000 processor. One of the extra benefits of my compiler was that I understood it completely so could target it easily to other machines. So I did for the 32000. I will also design an operating system for that machine.

**I got converted to Turbo Pascal. Now I understand Borland is coming out with Modula II. Have you heard about this?**

I have heard indirectly about this, but I'm not sure.

**Does the 32032 bother you because of the size of the instruction set? In other words, if you can't document it in 30 pages, it's too big?**

It bothers me as a compiler writer, but as a Modula programmer, the compiler protects you from all that. I can compare the two compilers because the first prototype of the work station is now operational.

The 32016 system takes 1.6 times as long to compile, and the same ratio holds for code length. The same program is 1.6 times longer compiled for the 32000. It turns out that most of the additional code length is due to the fact that the shortest address length is 8 bits whereas on the Lilith it is 4 bits. If you measure code you see that over 50 percent of addresses are offsets between 0 and 15.

**What's the fundamental difference between modules in Modula, and functions in C?**

First of all, in a module you can have a bunch of procedures, so the module can have several entry points. Furthermore, you can have types and variables that you export.

For instance, you can define a file system and a block that hides from you all the administration that takes care of allocating storage on the disk and so forth. You explain in the definition module only an abstraction of the file system. Someone who is using that file system will not have access to the disk. Instead, he must go through this module, so you can guarantee that certain things are satisfied. Data integrity is guaranteed.

You could write a module that defines a type 'complex number,' and the procedures you provide are the basic operators. You can guarantee that certain things are guaranteed.

When you compile an implementation module it generates code. When you compile a definition module you don't generate code, just a symbol table.

Later, when you compile a module that imports from (modules) A and B and C and so on, the compiler goes to fetch the symbol files that were

*(continued next page)*

## **MODULA II**

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(continued from page 77)

generated when compiling those definition modules.

When I designed this latest compiler I found I had to make a major change to the data structure. It would be absolutely unthinkable to do that if I had coded in assembly language, because it would be guaranteed to overlook some consequences. Here the compiler tells you.

You can import a standard module called SYSTEM, and in there you have defined a type address that's compatible with all kinds of pointer types, so it works against (doesn't do) type checking. So you better import things from system when you are willing to take all the responsibility.

For instance, it is possible to program the storage allocation, garbage collection. It's also possible to program device drivers because it is possible to access specific machine registers.

People who have written extended Pascal have added the same things, but here it is not indecent to do it because the programmer is encouraged to introduce these low level features in only one or two modules. For instance, a device driver module. So in all the big part of his system he has the full type safety of Modula and still has access to the low level facilities.

### **What are the problems you face that are unique to Europe?**

The language is less of a problem than you might think. A lot of people, especially those in computation centers, develop their own Yiddish — a very strange combination of German, Swiss-German, and English. It even goes into their publications.

For our students, that isn't a particularly big problem. I recommend that they read English journals. You must teach in German — in high German which is a foreign language for us.

Certainly the big impetus in our field is from the U.S., and that gap continues to grow, especially in hardware. In the U.S., you do a job quickly, and if it doesn't work you buy more memory. It's so easy to do that.

### **What should we be watching for from Europe?**

It's a bit presumptuous to say that Europeans think out a problem more thoroughly, but at least I've found that when I develop a system it pays off that I think very thoroughly about the system before I start coding.

With all these personal computers at every desk, people forget this. I remember 20 years ago when we carried around card decks — you surely thought carefully before you put your cards in the deck. If there was an error it cost you half a day. I'm not saying I'd like to go back, but resources, when they become cheap they are wasted.

I would hope that if anything comes out of Europe it is in the area of systematic methodologies. I would point out the work of Dijkstra and Hoare which is first rate.

If I have any recommendation for teaching programming it would be to introduce more of that style programming. I'm afraid this is very unpopular because it means that you need mathematics and mathematical thinking. We have, in my opinion, badly neglected the use of mathematics in computer science. We are always using it the other way around. We solve mathematical problems with the aid of the computer, but we should start doing it the other way around — solving computing problems with mathematical methods.

I have never written a large program where I follow Dijkstra/Hoare in minute detail everywhere, but I must say that by acquiring this way of thinking about programs, the places where the algorithm becomes sophisticated I will write down the variants. Making them explicit helps me tremendously.

On the one side what makes programming safer, more effective, are tools for programming in the large: the module, type checking. On the other side, for programming in the small are mathematical methods: rigorous methods: clean, clear thinking; and I wish people would use these earlier.

### **What is your opinion of artificial intelligence?**

I must say that my opinion of artificial intelligence is very, very low.

#### **Artificially low?**

When I ask what is artificial intelligence I never get a clear answer. If I ask what has artificial intelligence produced in solid results I never get a clear answer. They have been living for the last 25 years on big promises and big money from the Department of Defense which thinks that sometime the break will happen.

Of course, they are in an unlucky position because if they really produce a result, it's not artificial intelligence anymore. But by and large, it is a euphemism for extensive searching methods.

### **What are your comments about personal computing in the Soviet Union?**

I know very little about it. But I'm not deaf. The fact that you hear little about it probably says something. I was in Hungary 1 1/2 years ago, and they are very eager to learn. Even in the research centers they struggle with tools that we had 10 years ago. And to get an 8080, that is remarkable.

### **How do the Japanese fit into the software field?**

The Japanese are beyond the period of just being good at copying our things. They have recognized that software is very important. They have become very active, and I have had several visitors from Japan who are interested in Modula.

If you look at the market now in software there isn't much there, but I would expect to see things happening in the next 10 years.

On the other hand, I think this great fear by Americans that they will be rolled over by the Japanese is vastly exaggerated. It's a business trick. And mind you, it's the artificial intelligence people who make a big

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noise about it. The fifth generation thing.

And the poor Japanese — they've been taken in, too. I'll bet that in three or four years they'll come out and say there hasn't been much accomplished. Maybe they'll do something with multi-processing, but don't expect too much.

**How do we get increases in software productivity to match our increases in hardware power?**

These are two different things. Surely we have made big advances in producing software, but they are not as big as in the area of hardware. If you want to be fair you have to compare how much we have learned to develop software and hardware quicker. Not quicker hardware. As far as I have heard, developing the 68000 processor cost more than developing the 7090 computer which filled this whole room. So hardware advances are not all that much different than software.

Designing a complex system is an intensive intellectual activity. It takes time and brains, be it software or hardware. As a matter of fact, it's unfair to say that hardware has made more progress than software — chips cost 100 times less than 10 years ago while software costs go up, and while we have not learned to design hardware cheaply, we have learned to duplicate it cheaply. Copying a piece of hardware is almost as cheap as duplicating a magnetic tape. That would be the fair comparison.

The design process is always expensive, even with artificial intelligence in the offing.

**I understand that Dijkstra has been working on a method of proving the correctness of software. Have you heard anything about that?**

He is working on a method of developing a program with the proof inherent. That's a significant difference.

He is working on a book which should come out late this year. The

book which best exposes his theories has the somewhat presumptuous title 'The Science of Programming.' I think it is well written, but it is too heavy. It consists of three parts, of which the middle one is the smallest but most important.

The first part is a lengthy introduction into mathematical logic and predicate calculus. The middle part is the exposition of Dijkstra programming, and the third part tries to apply these methods. I think the second part is well worthwhile.

Dijkstra is now a professor at the University of Texas at Austin. There is a whole group at the U of Texas, so I wouldn't be surprised if something good came out of there. Also Professor Hoare is going there on a sabbatical next year. They are massing.

**I understand that you originally wrote Pascal for teaching and didn't intend it for the business environment. Is that true?**

I hear that all the time. I don't know. Wouldn't someone be a fool if he designed something just to use in the classroom and afterwards it was no good? That would be cheating the students.

It is true that I designed it with the classroom in mind. At the time, we had Algol compilers, which were lousy, and a FORTRAN compiler, and I was looking for something that people couldn't say was lousy.

Also, I was in the business of writing compilers and systems software. I had developed Algol W in a working group, and I wasn't happy with what came out of there. It was a product that had the burden of being developed by 30 people. With Pascal I was freed from that, and I definitely wanted a language that was good for systems engineering.

Commercial use is a good test of a language, and I want Modula to be used commercially.



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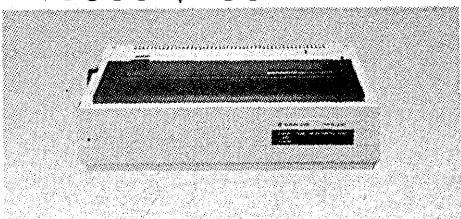
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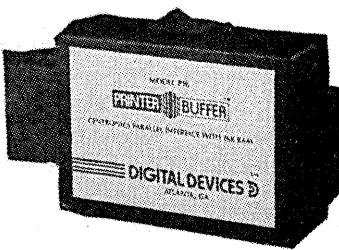
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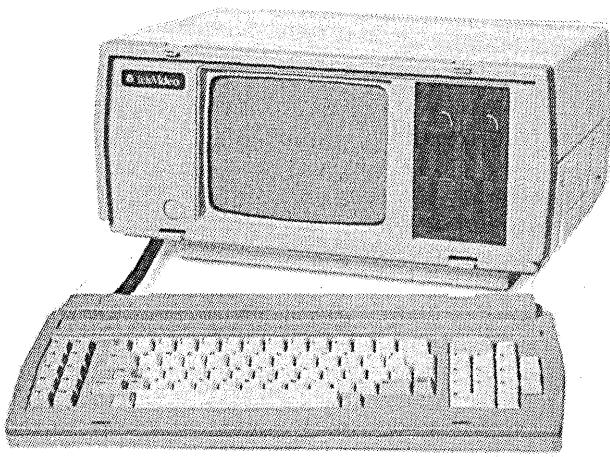


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# Cheap DC To DC Converter

By Bob Ghormley

5800 Jones Pl NW  
Albuquerque NM 87120  
(505) 831-1991

Old TVs used to generate their 20,000V picture tube anode voltage directly from 110VAC. The transformer they used was huge (and expensive). Now TVs use a high frequency oscillator (the horizontal) running off 12VDC to do the same thing, quite inexpensively.

With the advent of inexpensive DC to DC converter chips (high frequency oscillators), you too can take one voltage (5V) and generate another voltage (25V, for instance). The input voltage can be whatever you have, usually 5V or 12V — and depending on device, the output can be anywhere between -25V and +25V. You probably wouldn't run an 8" drive off one of these circuits — most are only good for 20 to 500 milliamperes (500 mA is 1/2 of an amp), but they are perfect if you need 25V for programming ROMs, or + and -12V for an RS-232 interface.

The DC to DC converter described below uses +5V to provide the +25V needed to program most proms. It employs a TL497 integrated circuit and a few other commonly available components, fits on a few square inches of board, and costs less than \$10 to build. The output voltage is variable and regulated.

The rest of the article talks about how to customize the circuit, but if you only want +25V, you can stop reading here. Just turn to the schematic (Figure 1), and start building.

## Designing

I found the TL497 specs in a TI voltage regulator handbook. The section on the 497 was labeled "Bulletin No. DL-S 112422, June 1976 — revised September 1977," but you shouldn't need the tech data. I've included the pinout diagram (Figure 2), the configuration I used (Figure 1), the matching design equations (Figure 3), and the timing capacitor/on-time chart (Figure 4).

You can use different regulator configurations which produce negative voltage, higher current, or a voltage lower than the supply voltage. But you're on your own for these.

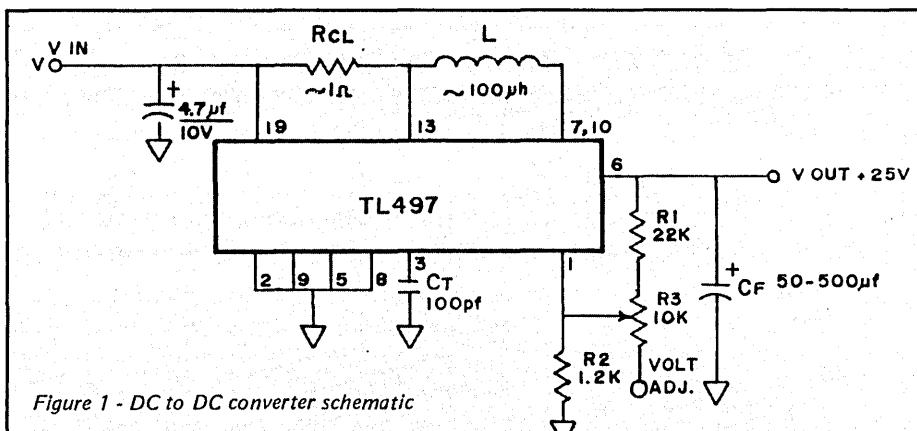


Figure 1 - DC to DC converter schematic

Figure 2 - Pinout diagram

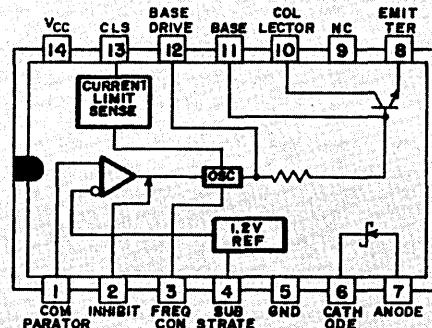


Figure 3 - Design equations

$$\begin{aligned} \bullet \quad I_{PK} &= 2 I_{LOAD \ max} \frac{V_O - V_I}{V_I} + 1 \\ \bullet \quad L (\mu H) &= \frac{V_I}{I_{PK}} t_{on} (\mu s) \\ \text{Choose } L \text{ (50 to } 500 \mu H\text{), calculate } t_{on} \text{ (25 to } 150 \mu s\text{)} \\ \bullet \quad C_T (pF) &\approx 12 t_{on} (\mu s) \\ \bullet \quad R_1 = (V_O - 1.2) k\Omega \\ \bullet \quad R_{CL} &= \frac{0.5 V}{I_{PK}} \\ \bullet \quad C_F (\mu F) &\approx t_{on} \left[ \frac{V_I}{V_O} I_{PK} + I_{LOAD} \right] / V_{RIPPLE} (PK) \end{aligned}$$

Figure 4 - Timing capacitor/on-time chart

TIMING CAPACITOR, $C_T$ (pF)	100	150	200	250	350	400	500	750	1000	1500	2000
ON-TIME (μs)	11	15	19	22	26	32	44	56	80	120	180

## Performing

The circuit (with my values) puts out 35 or 40mA at 25V and varies less than 0.1V from no load to a 35mA load. PROM data sheets list the programming voltage/current requirements as 25V plus or minus 1V at 30mA max for 2716s, and 25.5V plus or minus 1V at 35mA max for 2732s (except for Intel 2732As which require 21V plus or minus 0.5V at 30mA max). When tested at an output of 35mA continuously, the TL497 was barely warm (it's rated at 500mA, but that sounds awfully high).

## Getting Started

Using the design equation (see Figure 3),  $V_{subI}$  (the input voltage)= 5 V ;  $V_{subO}$  (the output voltage)=25V;  $I_{sub LOAD \ max}$ =35mA.

Let  $L=100 \mu H$  (more on this in the construction section). Let ripple voltage ( $V_{subRIPPLE}$ )=0.05V.

Solving the equations, we get  $I_{subPK}=0.36$ ;  $T_{subON}$  (the time the chip is on)=7.2 microseconds.

Now, exercise some engineering judgment and scoot  $T_{subON}$  up to 11

(continued next page)

microseconds, then select a timing capacitor value of 100pF from the table (Figure 4). (I prefer picking a value from the table to pushing a chip to its limit.)

Next, solve the R1 and RsubCL equations. R1=24.8K. The current limiting resistor (RsubCL)=2.8 Ohms. I found I needed to lower RsubCL to 1 Ohm to keep the output voltage from drooping at a 35mA load.

Finally, CsubF 23mF. Use whatever you have with a voltage rating above 30V or so. I used a 500mF electrolyte. The input capacitor across the +5v line is just for insurance (good design?) to prevent load changes at the TL497 input from being fed back down the line as voltage changes to other logic devices. Now that we've laboriously designed this dude, let's talk components.

### Components

L, the inductor (see Figure 3), must have a low internal resistance (less than an Ohm, I'd guess). I used a Radio Shack #273-102A (about \$1), 100 uHenry at 2 Amps. The TL497 came from Jameco (\$3.25 or so).

The resistor combination R1-R2-R3 determines the output voltage. If these resistors heat up and change resistance, the output voltage may vary, so you might want to use precision resistors with low temperature coefficients for R1 and R2. But it shouldn't be necessary.

RS3 can be a multiturn trimpot, or may be replaced with a fixed resistor. As shown, R3 will vary the output voltage from 21V to 30V.

CsubT isn't critical. I used a disk ceramic.

For CsubF, a tantalum capacitor works best, but a 200 or 300mF electrolyte should work fine. The transient response of a tantalum is superior, and it'll last longer.

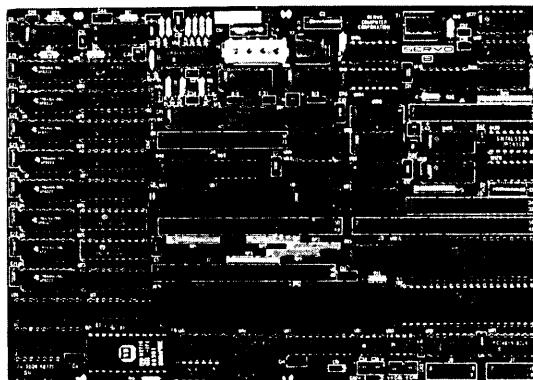
The current limiting resistor is a garden variety carbon. (Watch out for those cute little tomatoes in your resistor patch.)

### Constructing And Checking

I wirewrapped mine, gluing the larger components to the perfboard with RTV, and wire-wrapping directly onto the leads. Gross, but effective. And cheap.

When you complete the power supply, test it by hooking up a load

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resistor which will draw 35mA (680 Ohms at 1 Watt) across the output. Leave it on for a few minutes and then check for smoke. Monitor the output voltage while connecting and disconnecting the load to ensure that it doesn't vary appreciably.

Everything worked the first time for me (much to my amazement), so I don't have any troubleshooting advice to offer. If you need help, call or write me.

### A Gotcha

Pin 14 of the TL497 is B+ (+5 in this example), but the ground pin is

pin 5, not pin 7 as we've come to expect.

### Credits

Don Black, an especially adept Air Force hardware engineer who kept the Airborne Laser Laboratory's instrumentation working for several years, suggested this circuit. Thanks, Don.

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# Goodies 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
- 2-The manual for Small C
- 3-Crowe Z80 Assembler
- 4-Two disk formatters
- 5-Modem 7
- 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-E PROM burning software for BB 1
- 2-Reset bit 7 (unWordStar a file)
- 3-Disk file CRC checker
- 4-New fast copy program & source
- 5-DU77, disk inspector/editor
- 6-FINDBAD, isolates bad disk sectors
- 7-Print fancy page headings

## USERS DISK #4

- 1-CBIOS, custom bios for Tandon drives
- 2-ZCPR, dynamite CCP checks drive A for missing .COM files; improved commands
- 3-ZCPRBLOC, 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-DUMPX, enhanced for BB 1
- 9-UNLOAD, creates .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-E PROM programming package for BB II, 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 U77
- 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-MOVATCH, lets you use MOVECPM on other copies of CP/M
- 4-XMON, 3K expanded BB I monitor, use in ROM or as overlay.
- 5-CURSOR, prompts you for cursor char you want
- 6-UMPIRE, very fancy RAM test
- 7-ZSIDFIX, display improvement for ZSID
- 8-PIPPAT, modify PIP so you can reset system from within PIP
- 9-@, Lets you use the BB as a calculator, including HEX
- 10-SORT, sort package written in C80.

## USERS DISK #14 - BB II Software

- 1-PRO32, latest 2732 reader & programmer
- 2-SMODEM2, lets BB II talk to Hayes Smartmodem
- 3-GRAFDEMO, demonstrates BB II graphics (in BASIC)
- 4-ATTRTEST, demonstrates BB II graphics (in JRT Pascal)
- 5-INITIO, 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.

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**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.Z80 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

**BACKUP:** Helps you back-up the Winchester onto multiple floppies. Creates a catalog of the files on each disk and includes the date of the latest backup. Will not back-up an unchanged file more than once. Plus many more super features.

**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 unsqueezed. Enter UNSQ \*.\* and it will check every file on the disk. All squeezed files will be unsqueezed.

## USERS DISK #22 - Pascal Compiler

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

## USERS DISK #23 - Xerox Utilities

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

## USERS DISK #24 - Prowriter Graphics

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

## USERS DISK #25 - Z80 Macro Assembler

This is a real Z80 macro assembler! Syntax closely follows RMAC and MAC. Also includes pseudo-ops to support conditional assembly etc. No phase or relocatable code.

## USERS DISK #26 - BBII CP/M 3.0 Banked BIOS / Winchester Support

CP/M 3.0 Banked BIOS implementation for the BBII. Roy Epperson's software to support the Adaptec ACB-4000 SCSI and the Rodime R204 5" Winchester on the BBII (see issue #19). Plus more Winchester programs.

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# Extending RATFOR

By Keith H. Bierman

7017 Deveron Ridge Road  
Canoga Park CA 91307

I need to port software from micro to mainframe and that leaves out Turbo Pascal, unless Mr. Kahn has forthcoming versions of IBM 370, CDC, UNIVAC, and VAX. FORTRAN 77, however, is available for everything but the Z80. Many F77 features are available in RATFOR, a FORTRAN preprocessor.

## RATFOR, Where Art Thou?

Where does one get RATFOR (not to mention FORTRAN) for the Z80? It turns out that The Software Toolworks has RATFOR (rational FORTRAN) for a mere \$50 (a real buy), and Microsoft has a FORTRAN for the Z80 (though it's not \$50). In the following piece, I'll cover a few ideas for extending this RATFOR to work with FORTRAN 80.

## RATFOR, What For?

Nothing can be done about the lack of CHARACTER as a native datatype—but you can get IF-THEN-ELSE, DO-END-DO (ala VAX), and, with a minor mod or two, regular DO loops (the ST RATFOR package specifically states that normal DO loops are verboten).

The Software Toolworks package includes a nice reference guide, but the definitive work on RATFOR is "Software Tools" by Kernighan and Plauger. It is a classic.

*Editor's note: There are two versions of "Software Tools." The original one has examples written in RATFOR. In the later one the examples were transliterated into Pascal.*

For those of you who aren't familiar with RATFOR, a couple of comments. At first glance, RATFOR code looks a lot like C. In fact, it is somewhat a cross between C and Pascal and is quite easy to learn if you are familiar with either language.

If I had to write code for a FORTRAN machine, I would definitely write in RATFOR so I could see what my code was doing. Then I'd let my system translate the RATFOR source into FORTRAN. The one disadvantage of RATFOR environment is that the translator's output must still be compiled before you can test a program.

Following is Figure 1. The resulting output will look extremely funny, but it will work.



```
"Conventional" RATFOR uses {} (like C) to delimit things
like

    DO I=1, N;{
        stuff
        more stuff
    }

Adding define(ENDDO,{}) to the list of standard "defines"
(primitive MACRO'S) allows us to write

    DO I=1, N;{
        stuff
        more stuff
    ENDDO

Just like a VAX (except for ;, which one globally deletes on
port up)

Adding

define(THEN,{} define(ELSE,) else {} define(ENDIF,{})

makes

    IF (condition) THEN
        stuff
    ELSE
        more stuff
    ENDIF

Which is just like standard F77.

The only fly left is the SW RAT package to insist that one
NOT use

    DO 100 J=1, 199
        stuff
100   CONTINUE

To allow this, we must modify the RATFOR preprocessor itself;
since the source is provided (the original authors placed it
in PD, modified versions may not be). The offending subroutine
is called "docode" if it is made to read
```

Figure 1 - DO Loop modification

```
# decode - generate code for beginning of do
#
# MODIFIED to allow standard FORTRAN do if desired
#
subroutine docode(lab)
integer labgen
integer lab
    character lexstr(MAXTOK) #for normal do logic
    character gettok,type      # ratfor functions
    character junk      # temp store

#
# string dostr "do"
character dostr(4)
data dostr/LETD, LETO, BLANK, EOS/

call outtab    # space to start of line
call outstr(dostr)  # write "do"
call outch(BLANK) #
lab = labgen(2) # make some labels

    junk = gettok(lexstr,MAXTOK) #peek at next token
    call pbstr(lexstr)      # ... put it back
        # if normal a FORTRAN do
        if (type(lexstr(1)) = LETTER) {
            call eatup
            call outdon          # just put it out
            return
        }
        call outnum(lab)           #
    call outch(BLANK)      # regular logic
    call eatup
    call outdon
    return
end
```

# On Your Own

By David Thompson

I intended the following to be part of the editorial, so it's mostly opinion. But it is also too important to languish in the editorial (in my opinion anyway).

This is a discussion of freeware or "user supported software," and I have moved it into this column. It's a very significant option for those of you who are trying to market software.

## Freeware?

There is lots of controversy about freeware. First of all, what is it? Most people define it as publicly distributed, copyrighted software which contains a plea (or pitch) for money.

In other words, national public domain organizations, local user groups, friends, and bulletin boards are the distributors. Many people are exposed to the programs, and those who find them valuable are encouraged to become licensed (paid-up) owners.

In one sense, there isn't too much difference between freeware and commercial software. People pay up front for commercial packages and then distribute them (despite threats of dire consequences) to their friends. Eventually, many users of this kind of "freeware" pay up, so they have licensed copies. (This usually happens when a newer, fancier version hits the streets and they buy a copy to share with their original benefactor.)

In the legitimate freeware system the original copies are free, but end users are encouraged to buy a license. Purchase of a license usually entitles the user to one or more of the following:

1. A free upgrade to a more powerful version.
2. A more complete or printed manual.
3. Additional utilities or sample files.
4. Source.
5. Notification of new versions or fixes.
6. Support via phone, mail, or the author's bulletin board.
7. A feeling of self-righteousness.

## Crippled Software

Commercial software houses have been releasing crippled versions of their programs to get people hooked on their products. Often the only difference between these cheap or free copies and their expensive brethren is a bit of code that limits you to: 200 entries (an accounting package), or 300 baud (a modem package), or a 5K source file (an assembler or compiler). You pay the full license fee to get the full-blown package (or to learn how to turn off the stifle).

Now we're seeing the same trips from freeware houses. They are releasing crippled copies to the public domain, and once people have invested considerable time learning how to use the program, or entering data, bam! Pay up or else!

## PC-Calc

Some of the freeware houses are releasing partial documentation to encourage users to buy a manual. One that comes to mind is PC-Calc. The documentation with their spreadsheet tells you just enough to get started. It even tells you where information has been left out.

Then they threaten an aggressive suit (much worse than double breasted wool) against anyone who adds the missing pieces to their documentation.

Actually, they would probably have trouble winning a case against someone who sat down and through trial and error figured out all the commands. As long as he hadn't seen their printed manual (and didn't use their words or style), they wouldn't have copyright protection.

They came down with a really heavy trip (sounded a lot like a chain letter) that tried to make me feel like a scum for not sending them \$75 even though I haven't used their spreadsheet (and don't plan to). They even threatened me with unknown (but terrible) things if I removed their threats.

What a bummer. I was sorry I saw the package.

Another package took a much friendlier approach. Not only did it put me on my honor (and of course

I'm as honorable as anyone I know), but they told me I could send whatever I wished. I might be willing to try that package and would send money if I found it valuable.

What I'm finding is that freeware is not much different than commercial software. There are friendly folks, and there are heavy-handed ripoffs.

## Mixed Feelings

I have mixed feelings about freeware. In one sense people are taking advantage of the public domain distribution channels for their own profit. A lot of dedicated people are volunteering their time to put together quality public domain disks (including writing and modifying software). (A significant percentage of the disks we ship are in exchange for software donations and articles.)

Steve Leon, head of SIG/M and columnist in Micro C, refuses to put freeware on SIG/M disks. He doesn't want to donate his time (and his organization's resources) to making profits for commercial software writers. This is no doubt one reason why I haven't seen any freeware aimed at CP/M 80. (See Steve's column in this issue.)

Meanwhile, PC-Blue, the MS-DOS public domain distributor that is closely associated with SIG/M, has lots of freeware on its disks. It appears that freeware makes up more than half the new public domain disks for the PC.

## On The Other Hand

In most cases, the sources of freeware are individual hackers trying to support themselves writing commercial (or almost commercial) quality software. There is no other way, that I know of, for these people to get their software into the market place.

The top promotional agencies say it takes over \$1,000,000 to launch a new software product. This is just for the advertising and the parties. (I'm not sure who the parties are for — maybe for the promotional agencies.)

A few of the freeware programs have generated over \$100,000 in li-

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cense fees, which would make any author very happy. However, a large software house couldn't live on that kind of return if it had spent a million big ones for starters.

So where do I stand? I'm still dancing around a bit (and I'm playing the tune by ear), but from the authors I will not accept:

### **Heavy Trips**

This means no chain letters, no threats of dire consequences, no lambasting. We all should be able to feel good about ourselves. If we receive something that was released for copying and passing around, then we shouldn't feel guilty about using it.

### **Crippled Software**

This is a little bit difficult. I have no problem with someone coming out with a better, fancier version to encourage people to upgrade from the free version, but the free version had better be complete and usable. Forever.

### **Now For The Users:**

You have some responsibility in this, too. There is a lot of freeware out there that is feature-for-feature competitive with commercial software costing 10 or 20 times as much. If you and I support these folks, there'll be a steady stream of inexpensive software out there (like Borland is doing in the commercial sector).

We're helping ourselves when we support these writers because over the last 12 months a lot of software houses have died or been swallowed up by the large ones. In one year, the number of software publishers that are actively advertising their products has dropped from 4200 to 400.

We could wind up with a few large software houses dominating the commercial scene and charging whatever they wish. Freeware could keep that from happening by making it easy for individuals to market their software without having to sell their souls (or their ideas) to venture capitalists.

Quite a few people have asked me how they can sell their programs

inexpensively. There are a number of reasons why they can't do that in the commercial market (unless they are writing something that will sell millions of copies like Borland is doing).

1. Advertising is expensive. Unless you have a very special audience that you can reach cheaply, you will pay a lot for space and production to reach a lot of people who aren't interested in your product.

2. Dealers and distributors would rather make 60 percent of \$400 than 60 percent of \$40. And with display space at a premium they are not likely to carry inexpensive packages.

3. Software support is very time consuming. Even if your package is perfect (unlike Thorne) you'll spend a good deal of time coaching new users. ("You sent me a defective program. It won't boot on my system.")

### **Conclusion**

So, for all these reasons, I think freeware is worthwhile. Steve Leon has a valid point. A lot of people donate their time to gather and distribute public domain software.

On the other hand, they are contributing to a good cause when they help the public get even better software and they help programmers reap a real benefit from their efforts.

One last thought. Freeware should meet the same standards that we expect from commercial software, from the point of view of usefulness, freedom from bugs, and documentation (on disk). Anything less constitutes abuse of those who distribute the software and those who are asked to pay for it.



# LETTERS

## Kaypro Power Connectors & Co-Power 88

I called you after I installed a Pro-8 and found that my disk drives began turning themselves on at strange times. You were right that neither the Pro-8 nor the decoder board was the problem.

As you suggested, I tried replacing the PIOs, 74S04s, power supply, and virtually every other replaceable chip. Nothing helped. However, I accidentally discovered that the +5V connector on the main board (from the power supply) was dirty, causing a slow drift from 4.9V to 3.7V. At 3.7V my Mitsubishi quads got the message to start spinning. By that time everything was so flaky that I would have to power down for 10 to 20 minutes before I could run at all. All I had to do to fix the problem was clean the connections.

My Kaypro II is one of the originals (serial # in the 1700s). Despite the new higher rated power supply, the screen still twitches. I wonder if the connectors . . . Also, I have a tip for Co-Power users. If SmartKey, QuickKey, Fkey, etc. don't run when you have the Co-Power RAM configured as the A: drive, try the following:

1. Enter "RAMDISK A,Y" (to bring up

the RAM disk as A: and initialize the directory).

2. Press the reset button.
3. Call up Smartkey, QuickKey, or whatever.

4. Enter "RAMDISK A,N" so the RAM disk locates itself below the Smartkey, etc. and both run without problems. (My 13-year-old son figured this out.)

Ron Rock  
P.O. Box 211  
Flossmoor IL 60422

## Kaypro Speed-up Compatibility

Since I bought my trusty Kaypro II in January 1983, I have maintained a "hands-out" attitude ("If it ain't broke, don't fix it"), but I am fascinated with the thought that it might run faster. So, I'm going to try a speedup, as well as your improved character set.

My main concern is that PluPerfect Writer, Backgrounder, and CP/M 2.2E may not operate properly at the new speed. I use them heavily, and have read conflicting reports on the success of the speed-up with them. Can you offer the definitive answer?

Also, please try not to ignore the older Kaypro owners with "Perfect" software and older hardware—we're still out here!

Jim Chernoff  
1351 Royal Way #19  
San Luis Obispo CA 93401

### Editor's note:

*I know you are out there. In fact, the older IIIs and 4s are the most dependable systems that Kaypro has manufactured (occasionally the drives, data separators, and power supplies give trouble).*

*There is no reason that the speedup should affect the programs you mentioned. Your disk formatter/copier will probably not work at 5MHz, and games get too fast for mortals (though not too fast for 10-year-olds), so you should definitely add the 2.5 to 5MHz switch.*

## Smart Answering Machine

I have considered buying an answering machine, but many of my telephone counterparts, like my Dad, would rather

hang up than talk to a recorder (can't say I blame them). On top of that, a growing number of people who would like to talk to me have computers and modems. So how about an electronic mail answering machine? (Great idea for some ambitious entrepreneur.)

Rig the system to sense the number that is calling before answering. If it's Dad on the other line, the system doesn't answer.

Upon answering (it's not Dad), the system then announces that I'm not home and allows the caller to leave a message either by voice or by a RBBS style hookup. If you want to get classy, digitize the voice message and store it on the disk, removing the requirement for a cassette.

This has to be a small, fairly simple machine that my Aunt Mary can hook up and operate. Seems to me the technology exists, but just needs to be adapted to the application. If you fully integrate it with the phone, as some companies are starting to do with dumb terminals, you might get a hot consumer item.

Rex A. Buddenberg  
Naval Postgraduate School  
SMC #1309  
Monterey CA 93943

### Editor's note:

*Hi Rex, interesting idea. I'm not sure how the answering device could know the number of the calling phone (although the FBI does it on TV two or three times a week). If that were possible, they wouldn't need call back procedures to provide security for the big mainframes.*

*If the caller had a special tone generator (blue box, anyone?) into which he could enter a code, then the system could decide how to act based on the code received. However, before the receiving system could hear the code it would have to "pick up the phone." Any other ideas, anyone?*

## Expanding RAM On The SWP

I have a question about expanding the RAM on the SWP co-processor board. My board, installed in a Kaypro 4-84, is the 256K version, and I'd like to expand it to 512K or higher, if possible. I've read about the expanded version offered by SWP, and replacing my present board is

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# LETTERS

probably the best way to go. It's also probably the most expensive considering our present US/CAN exchange rate. Instead, I would like to buy the parts up here and install the board myself, thus getting my feet wet in making modifications to my Kaypro.

I've heard you can replace RAM chips with ones of higher value. A friend told me he did this to an IBM and had to install another DIP switch. A second friend told me an additional ROM chip was needed.

Obviously, there's a difference of opinion which I hope the readers of Micro C will straighten out for me. If there's anyone out there who would like to help a novice computerist get started, I'd sure appreciate the help.

**Jim Dalgliesh**  
79 Athlone Drive  
Winnipeg Manitoba Canada R3J 3K9

#### *Editor's note:*

*Contact SWP and see if they would sell you the non-memory parts and software you'd need. Otherwise, if you are just using your SWP board as a RAM drive you might want to check into MicroSphere's unpopulated RAM disk. It goes to 1 Meg if you fully stuff it.*

#### **Simple System Patch**

Could you publish a simple operating system patch so the delete key would duplicate the function of the backspace key? This has got to be one of the most frustrating problems for beginners, but I guess most of us tend to forget about it after a while.

Seems to me it should only involve a single hex digit, installed with the DDT S command. All we need to figure out is which hex digit, and where it should go. Installation could use SYSGEN and a temporary file like the submit files on your K-22 ZCPR disk.

**Leon H. Braskamp**  
1459 Via Cortez  
Placentia CA 92670

#### **Programmers' Blues**

I work for a consumer software publisher, and in case you're not aware, consumer software publishing and distribu-

tion is in shambles. Inventories have remained high, drying up new orders for the publishers. Add to this the fact that now over 2000 software companies are competing for about 100 spots on the retail shelves, and you have quite an interesting brew. This has resulted in the falling prices that we've all seen, and the incredible failure rate of software publishers.

I wouldn't feel too bad for these guys, though. They don't really treat us programmers all that well. We're blessed with royalties of 5 to 15 percent payable whenever cash flow permits, usually at least six months after a completed program is delivered (it can take that long just to sell into and collect from distributors and retailers). And we pay for any marketing, management, or personnel problems with lost sales and lost royalties.

Therefore, I've decided to start a programmer-owned software publishing company, and I'd like to invite any interested Micro C readers to contact me. We'll publish our own software and distribute direct. Each of us will have the buying power and advertising clout of a publisher, but will retain control of our products. This type of arrangement means that a quality program can be sold at a very attractive price, while still providing a reasonable income for the programmer. We might even have a little fun.

**Michael Fitzgerald**  
1924 N. 6th Street  
Concord CA 94519

#### *Editor's note:*

*Good idea, Michael. I can see some problems such as documentation, support (phone type), software quality control (so a few marginal products don't ruin the company for the good products), sharing advertising costs, etc. However, it could still work.*

#### **Rah, Rah, Rivendell**

I recently purchased an expansion board from Rivendell Audiocomp in Poway, CA and am now in the process of building it.

The Theory of Operations Manual is excellent. The Assembly Manual is not quite of Heathkit quality, but is more

than adequate to build and debug the board. Rivendell is to be complimented on an excellent job.

**Robert B. Base**  
7600 France Avenue South  
Edina MN 55435

#### **HSC Co-processor Compatibility**

My Kaypro II has recently become a Kaypro 8 thanks to your Pro-8 ROM. I used TEAC 55s and traded in my old Tandons. I also added an HSC CO16-1668 co-processor, and both modifications are compatible. I thought that readers might like to know this because apparently the SWP 8088 co-processor will not operate without at least drive A: being an original Kaypro part.

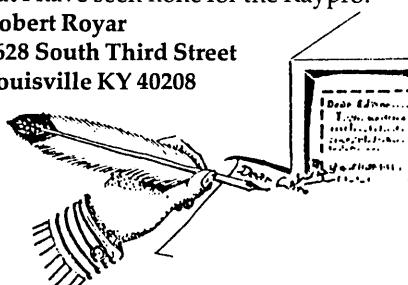
Also, the review of the HSC 1668 in Issue 20 must have been of an older model because HSC is now shipping cross compilers and sources as part of the original package.

Now for the questions. I've begun using the Waltz Lisp interpreter and would like to hear from anyone out there who has worked with it or another Z80 Lisp. I am interested in programs (for writing courses) that ask questions, save the answers, and then allow the student to edit and rearrange those answers.

Second, I have an old Timex (Z80 based) computer with 16K of RAM which I am sure can, somehow, be turned into a print spooler for the Kaypro, but I have no idea how to do it. If anyone has any suggestions about what to do with an old Timex, save using it as a high tech door stop, I would be glad to hear about it.

Finally, now that I have this HSC processor, I figure there is some way its ROM can be fooled into becoming bank switched memory for the Z80. You have run articles in the past about bank switching on single board computers, but I have seen none for the Kaypro.

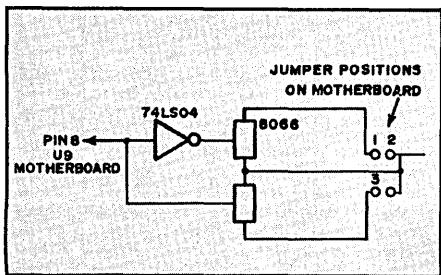
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# TECHNICAL TIPS

## Enabling Shift Keys

I wanted a spare keyboard with lots of keys, so I ordered the \$40 job advertised by Cascade Electronics. It is a used Micro Switch board in a good quality case with Hall-effect switches and should last forever. There is just one problem with it. You select upper or lower case letters with a jumper requiring removal of the motherboard. I cobbled up the circuit shown below to enable UC/LC with the shift keys.



This keyboard requires nearly one amp of +5 volts, whereas keyboards with mechanical switches need only 100 millamps or so.

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## Bringing Up Xerox To 4MHz

One of the Letters To The Editor, Issue 3, Dec. 1981, tells how to bring a BB up to 4MHz. I've now modified two Xerox 820-1s, and they both worked with no difficulty the first time I powered them up. Following is my little contribution to your fine publication. It is merely a Xerox numbering of the original article, but I hope it will help someone as much as that letter helped me.

1. Change the crystal from 20MHz to 16MHz.
2. Remove and discard U12.
3. Change U9 from 74LS04 to 7404.
4. Cut trace from U10 pin 4.
5. Cut the trace from U11 pins 4 and 5.
6. Connect U11 pin 3 to the trace from U11 pin 4.
7. Connect U11 pin 4 to the trace from U11 pin 5.

8. Run a jumper from U10 pin 5 to U12 pin 8.
9. Run a jumper from U9 pin 3 to U10 pin 5.
10. Run a jumper from U10 pin 4 to U12 pin 9.

Incidentally, the best automatic disk drive shutoff unit I've run into (for drives with 110V motors) is CMR's ASU-2A. It does its job well (auto-turnoff of drives), can also control external 110 volt appliances, and can be controlled from an external device, too. Write to CMR, P.O. Box 7022, Alexandria VA 22307, for more info.

Bill Bretzius  
1902 Ancilla Court  
Alexandria VA 22307

## Jumpering Toshiba Drives

I recently installed two new drives in my Kaypro. I chose Toshiba NDO4D Model FDD5401-EOK01, which are double-sided 48 tpi units. I read in issue #21 about a mod which would make the drive lights work the way they were always supposed to.

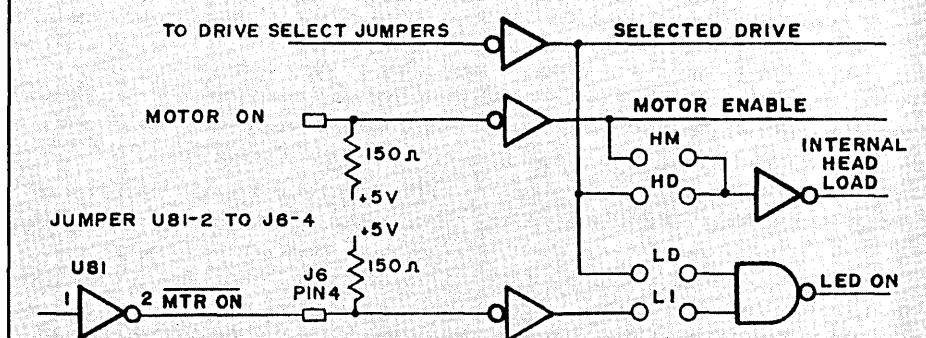
This mod was part of the 4-drive decoder circuit which I was not particularly interested in at that time, so I tried something on my own.

The Toshiba drives have a LED jumper option in addition to the HM/HS head load option. The options are LI, which gives you a drive light with an in use signal, and LD, which gives you a light with a drive select signal. With the LI option jumpered, I got no light at all. With the LD option I got a drive light on the logged-in drive just as always. A third option was to jumper both the LI and the LD option, which would give a light whenever both a drive select signal and an in use signal were present.

The Kaypro was not set up with an in use signal, so I did the signal by jumpering from U81 pin 2 (motor on) to J6 pin 4 (in use). Actually you can trace U81 pin 2 to a solder pad right next to J6. That did it. Figure 1 shows the jumper configuration and the LI, LD, HM Table.

Ron Lokey  
1020 East 12th  
Colorado City TX 79512

Figure 1 - Toshiba drive jumpering options

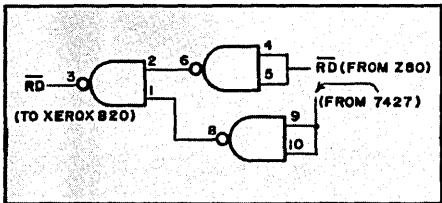


LI	LED comes on when In Use is set to 1. If LD is shorted also, LED comes on only when the drive is selected.	Shorted
LD	LED comes on when Drive Select is set to 1. If LI is shorted also, LED comes on only when In Use is logic 1.	Open
HM	Head loading is controlled with the Motor On signal.	Shorted
HD	Head loading is controlled with the Drive Select signal.	Open

# TECHNICAL TIPS

## Tips On Articles In Issue 22

The Z80 to S-100 interface in Issue 22 was very interesting. I believe you were right about there being a mistake in the RD/ logic. The circuit as shown gates the data from the S-100 bus into the Z80 at the proper time, but the single board system RD/ is not disabled. I believe the circuit should be as shown below.



The statement about no modifications to the S-100 board is also misleading. The clock circuit must be disabled. If the S-100 card generates any signals from a higher frequency than the Z80 clock and divides down to get the clock, it may be rather difficult to generate all the required signals. If you choose the S-100 board carefully you should be able to simply pull out the clock generation chip.

The sound generator for the STD bus was also a good article. It mentioned the WAIT/line and the conflict with the onboard wait state generator. The problem is caused because this line is supposed to be an open collector line, but the Caltex mod (it may now be a regular "feature") drives it as a standard TTL load. The modification to the BBII suggested in the article solves the problem on that end, but the sound board also drives this line as a standard TTL load. This will work fine as long as it is the only board driving the line. A better solution would be to add an open collector gate to the sound board.

Jim Skinner  
20435 SW Alexander  
Aloha OR 97006

## Excessive BDOS Errors

Otto Hiller double density users that experience excessive BDOS errors should replace R1, the 4.7K write pre-compensation resistor going to pin 17 of the WD2143-03 four phase clock

generator, with a lower value like 2.7K. The problem shows up at track 2CH and high tracks where bit density is high. Disks formatted with the new value will be clean, but disks formatted with the old value resistor will continue to give trouble.

The circuit is very much like the one in Micro C Issue 11, page 5. Users of this system with a similar problem might try setting the pot to 2.2 or 2.7k and reformat their disks before trying to use them.

Joseph Malik  
221 Bradley Dr.  
Wilmington NC 28403

## Cold Solder Joints

My Kaypro 2-83 crashed and wouldn't read disks when warm. It did OK with the top off, most of the time, but a fan didn't help. The problem turned out to be a cold solder joint on the power supply board where the plug for the power cable is located. The power supply had several of these bad joints, causing the drives to occasionally get 2 volts instead of 5. Not an obvious problem, but one that's easy to check out and fix!

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Albany OR 97321

## MITE Software Hints

I own a Kaypro 2-84 and was impressed with the communications package I received from Mycroft Labs to upgrade to the MITE software.

There are two installation options (F and G on the Portable Computer installation menu) available for the 2-84. One requires that either U35 (a Z80A PIO) be installed or pins 22 and 24 of U35's socket be jumpered. This option uses the Z80's interrupt system to service the incoming data stream. The other option requires no modifications, but uses a polling scheme and suffers from problems in synchronizing the simultaneous display and printing of incoming data.

If one elects the option of installing U35 (necessary if the Real Time Clock is to be added) then the CP/M (version

2.2G) supplied with the 2-84 needs to be modified to initialize the PIO. Examination of the operating system indicates that a functionally useless subroutine at F87F through F88B is called during a cold boot. Replacing the code at these locations with:

```
3E 17 D3 22 D3 23 ED 4D 00 00 00 00 C9
```

will initialize the PIO when a cold boot occurs and allow MITE to work correctly.

Additionally, the code at F6BA through F6D0 initializes the Z80A SIOs that handle the printer and modem serial ports. All initial values are stored in a table extending from F647 to F660. The modem baud rate is at location F647, and that for the printer at F648. The data at locations F64A through F654 controls the configuration of the serial printer port; that located at F655 through F65F controls the configuration of the modem port. You'll need to change the table entries if you want to change the default values for the serial ports. Information on the required values can be found in a SIO specification sheet.

Changes to any of the above locations can be made by using the following procedure:

```
First with a system disk in drive A
save the system image by entering:
SYSGEN
A
<return>
<return>
SAVE 40 CPMGG.COM
```

```
To edit the CP/M image enter:
DDT CPMGG.COM
```

```
Make the required changes using DDT
commands — CP/M starts at 0980
(i.e. E000-0980)
```

```
Enter:
^C
```

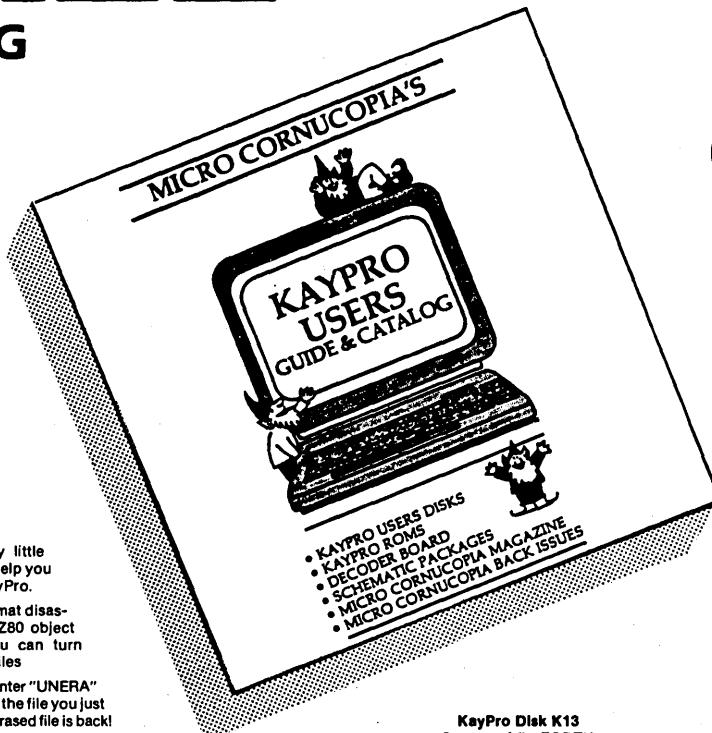
```
To install the edited image enter:
SYSGEN
<return>
A
<return>
<return>
```

Jim Hays  
2401 53rd Ave. SW  
Seattle WA 98116



# FREE

## CATALOG



**KeyPro Disk K1**  
Modem software

**KeyPro Disk K2**  
Utilities

Really oodles of spiffy little (and big) programs to help you get full use of your KayPro.

**DASM:** 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!

**FINDBS4.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 is 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.

**UNSPOOL.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.

**KeyPro Disk K3**  
Games

**KeyPro 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.

**KeyPro Disk K5**  
MX-80 Graphics

**KeyPro Disk K6**  
Word Processing Utilities

**KeyPro Disk K7**  
Small C Version 2 Compiler

**KeyPro Disk K8**  
Small C Version 2 Source

**KeyPro Disk K9**  
ZCPR

**KeyPro Disk K10**  
Assemblers

**KeyPro Disk K11**  
Library & Checkbook Programs

**CHECKS:** This has been a very popular group of programs. Categorizes checks so you can keep track of which are tax deductible and which get charged to which projects. Includes source and 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 file, 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.

**KeyPro Disk K12**  
FORTH

**KeyPro Disk K13**  
Source of fig-FORTH

**KeyPro Disk K14**  
Smartmodem Program

**KeyPro Disk K15**  
Hard Disk Utilities

**KeyPro Disk K16**  
Pascal Compiler

**KeyPro Disk K17**  
Z80 Tools

**KeyPro Disk K18**  
System Diagnosis

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 & 4.

**KeyPro Disk K19**  
Prowriter Graphics

**KeyPro Disk K20**  
Color Graphics Routines

**KeyPro 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 KayPro's new and old. You can buy a similar package elsewhere for \$60.

**KeyPro Disk K22**  
ZCPR (Again)

This disk is filled with ZCPR files. You get ZCPR for the KayPro II, KayPro 4, and the KayPro 10. This version is fixed so that you can pass control characters from the keyboard to the printer, 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!

**ZCPR:** 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.

**KeyPro Disk K23**  
Fast Terminal Software & New BYE

**KeyPro 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

Write or call  
for a free catalog

(also included with each order from)

**MICRO CORNUCOPIA**

P.O. Box 223 Bend, OR 97709

(503) 382-5060

9-5 PST Monday-Friday

DISK \$12.00 ea.  
postage paid



## KAYPRO USERS DISKS

for Kaypro II, 4 and 10

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 the 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 a 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.

**KeyPro Disk K25**  
Z80 Macro Assembler

**KeyPro Disk K26**  
EPROM Programmer & Character Editor

**KeyPro 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).

**KeyPro Disk K28**  
Modem 730

**KeyPro Disk K29**

Turbo Pascal Games 1 With Source

**KeyPro Disk K30**

Turbo Pascal Games II With Source

**KeyPro Disk K31**

Turbo Bulletin Board

Complete Bulletin Board Package for only \$12

**KeyPro Disk K32**

Forth-83 Much Fancier Forth

**KeyPro Disk K33**

A super utilities disk containing:

NewSweep, NullI, Superzap, & VDO-KP.

**KeyPro Disk K34**

Five games plus source (mostly Turbo);

includes improved Othello and Eliza.

**KeyPro Disk K35**

Small C Compiler & Source — Vers 2.1;

(Requires Microsoft's M80)

**KeyPro Disk K36**

Small C Library of 100 Functions.

# PRICELESS

## UPGRADES

### Schematic Packages

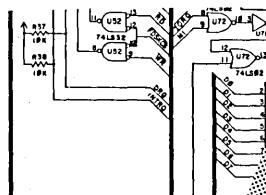
Finally, a complete schematic for your portable Kaypro, logically laid out on a single 24" by 36" sheet, plus a very complete illustrated Theory of Operation that's keyed to the schematic. You'll get detail information on your processor board that's available nowhere else.

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
Kaypro 10 (pre-84) .....	\$20
Kaypro 84 series (II & 4) .....	\$20

All prices include postage.



## Pro-884 Max Monitor

The ROM that does everything but wash the dishes is here! There's so much stuff in this ROM, even we didn't think it would fit! The PRO-884 MAX ROM does everything the PRO-884 does, PLUS IT:

- Emulates a DEC VT-52 or Heath H-19 video terminal (both the display and keyboard).
- Does FASTER screen output.
- Has ZCPR1 in ROM, eliminating the need for a system disk in drive A; during a warm boot.
- Dumps the screen to your printer at the touch of a single (user definable) key.
- Sends characters going to the screen to your printer regardless of the program you are running.
- Displays the time on the Kaypro's status line (Kaypro 4-84s only). Because of battery backup, the time does not have to be re-entered each time you power up.
- Inserts the time and date into text while you are running your favorite text editor (4-84 only).

Prices:  
Pro-8 Version 2 Pkg. ....  
Pro-884 Pkg. ....  
Pro-884 Max Pkg. ....

## ROM'S from Micro Comucopia

NEW!!

### Pro-8 Version 2 for Kaypro 4

Guess what we've just upgraded. The venerable Pro-8 now has a version 2 and it's really neat! The new features include:

- Screen dump with selectable dump character.
- Select slow or fast step rate for each drive.
- ROM that automatically figures out what type of drive you are using.
- No more delays when using both single and double sided disks.
- And, it's still only \$49.95 for ROM, Pro-8 features such as: user selectable cursor (blinking or not), ignores nulls, and your choice of 1-4 drives of the 191K, 390K, and 784K variety. (Use of 3 or 4 drives requires drive decoder.)

Installation requires no cuts or jumpers. The ROM simply plugs into a Kaypro 4-83 (or II-83 with a Kaypro 4 processor board) If you have a Kaypro II with the original II processor board then you must do the II to II upgrade. See issue #22 for details. Your Kaypro II has the original II board if the monitor ROM (a 20-pin chip with paper stuck to its top) is marked with 81-149. The 4 ROM is marked 81-232. If you already have a Pro-8, you can upgrade to version 2 for half price. Call or write for details.

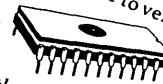
NEW!!

### Pro-884 Monitor

The long-awaited PRO-8 ROM for the Kaypro 2-84 and 4-84s is ready! You have not saved your nickels and dimes in vain! The PRO-884 ROM does everything your old Kaypro ROM does, plus it:

- Gives you 784k bytes of storage per disk (with quad-density 80-track, double-sided drives).
- Uses any combination of Kaypro II, IV, or quad-density drives, disks.
- Includes software to let you format and copy II, IV, or quad-density disks.
- Comes with complete printed instructions on ROM installation and tips on installing quad-density drives.
- Runs up to four drives with the Plus-4 Decoder Board.

Installation of ROM takes just five minutes and requires no cuts or jumpers.



NEW!!

## Pro-884 Max Monitor

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- Inserts the time and date into text while you are running your favorite text editor (4-84 only).

Prices:  
Pro-8 Version 2 Pkg. ....  
Pro-884 Pkg. ....  
Pro-884 Max Pkg. ....

49.95  
59.95  
79.95

## PLUS-4 Decoder Board

With this nifty little plug-in board, your Pro-8 ROM can access up to four 5½" 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 onboard as C and D. You can even run four half-wides inside your original Kaypro!

The Plus-4 Decoder Board for only \$39.95 Watch for 4-84 and 10-84 compatible ROMs coming soon.



### SPECIAL PRO-884 NOTE:

The Pro-884s are sensitive to the version of CP/M you are running.

1. Neither the Pro-884 nor the Pro-884 Max will run on CP/M 2.2U. However, if you can locate a CP/M 2.2F or 2.2G system disk (your dealer should have a copy) you should be able to run our 884 monitors. (Don't try to boot For G before you change monitors.)

2. There are two distinct versions of CP/M 2.2G. Only the Pro-884 Max is sensitive to the version of 2.2G you have - it's the ZCPR1 ROM that's the problem. (If you have CP/M 2.2F, then you have a Normal CP/M.) So, before ordering the Max, boot up your original system disk and read the sign-on. If it's CP/M 2.2G then we need to know whether it is the high (normal) version or the low (minus) version.

To determine your G version (you'll become a G Whiz!):

A DDT cr  
L5 cr  
(ddt's response)

The first line of the response will be a JMP D600 or a JMP D800. The JMP D600 means that you have a low (minus) version, and the JMP D800 means that it's a normal version. When you order your Pro-884 Max, be sure to specify whether you want the normal Max or the minus Max. Otherwise, we'll just guess that you need the normal Max.

The Perfect software packages have always had their share of problems. For instance, they got no awards for speed, and creating a new printer interface led more than a few to swear off hard copy altogether. In addition, Perfect's software support group got about as many calls as their counterparts at Ashton-Tate. (Just a guess — but I wouldn't be surprised if the original Perfect writer and formatter weren't copies of Mince and Scribble, an editor and formatter written in BDS C and sold for many years within the BDS C users group.)

When the Perfect package was dropped by Kaypro (they got tired of all the calls, too), the Perfect people just about disappeared (how many perfect people do you know?). The software and the name were bought up by Thorne, which rewrote some of the code and then rereleased the programs, aiming their ads at current Perfect users.

But Thorne added copy protection, some of the programs ran slower than the originals, and the new Perfect filer couldn't read files created by the older version. Pow, pow, pow!

They did a really bad job with the copy protection. We got some calls from folks who had found that the program wouldn't run with some systems (including ones which contained the Pro-8). They went back to their original ROMs to make the packages run, but after finding the other problems, they were reinstalling the Pro-8s and returning the new Perfect packages. Pow!

If you're going to do copy protection, you do your darndest to make sure the software is going to run when it's supposed to. The worst thing you can do is create a program that isn't robust enough to work dependably. Pow!

Anyway, I just got word that Profiles will no longer be carrying advertising for Thorne. The staff at the magazine is getting tired of complaints about the new Perfect. Ka-booom!!

It would really be unfortunate if these blunders meant that the early Perfect series would no longer be

available. A lot of people wouldn't trade their original Perfect writer for three copies of WordStar and a Mickey Mantle baseball card. Heck, if Thorne sold the original writer, calc, and filer for \$50 a set (without support) they'd probably do just fine.

### Kaypro 1

Speaking of the original Perfect package, I understand that Kaypro is again shipping it with the Kaypro 1. Yep, the Kaypro 1 is a Kaypro 4-83 with two double-sided drives and the original Perfect package for \$995. It's amazing what happens when a company has a warehouse full of spare parts.

On the other hand, I'd rather see them ship systems out the front door at cheap prices than see them dump parts to the tin recyclers.

### Using Canons From Scratch

We just got a report that a few of the 2/3 height Canon drives are eating disks (for brunch). According to one caller, a quick head load/unload cycle can scratch a track so badly that the disk can't be reused.

He also mentioned that BG Micro has had only 40 drives returned out of 8000 units (not a bad average at all).

Keeping the head loaded all the time and then turning the drive motor off to minimize disk wear (what Tandon has been doing all along) sounds like the safest bet.

### SOG

If you've been following Micro C for any length of time (over five minutes), you've become accustomed to hearing about SOG. Well, I don't know what to say about it this time.

You'll see this issue after the SOG (or during the SOG if you show up in Bend), but I haven't the slightest idea how it turned out, since today is May 13.

I could, however, do some anticipatory journalism.

### Anticipatory Journalism

Anticipatory journalists announced that Dewey had lost to Truman. They also announced: the Z800 (and they are still announcing it), MicroSoft's

Windows (but we can see right through that one), the Japanese computer invasion (actually, the Japanese are scared to death that Commodore will start marketing in Japan), and the demise of CP/M.

With that kind of hysterical precedence, there is no question that I must come up with some definitive anticipatory copy about the SOG. So here it is:

For those of you who missed the SOG, I'm happy to announce that the event went off without a hitch. The weather was clear with highs around 85 (unless you prefer it a little cooler) and lows in the mid 40s (that's as high as our lows go).

Over 25,000 happy folks rafted down the McKenzie River. We set a new record when we stuffed 814 freaked programmers into a single raft (or was it 814 single programmers into a freaked raft). I understand that it was the first time a 6-ton load of rank beginners shot that stretch of river without a guide (he just didn't fit in). Next year we'll be rafting in the Queen Mary (another first).

Philippe Kahn announced that Borland's secretly working on a BASIC interpreter for the Apple II. He said that after turning Z80s and 8088s into speed freaks he had a burning desire to see how slow a computer could go. Plus, he's been fascinated by BASIC ever since he discovered mazes.

Integrand announced the hacker's cabinet. This ordinary looking cabinet not only holds your system, drives, and power supply, but it also holds hundreds of tiny antennas. When you press the interference button on the front panel, the top ejects, implanting itself in your ceiling and employing the antennas, all of them connected to your system clock. No one within a radius of one mile can receive a usable FM, AM, or TV signal.

This little gem really shuts down Johnny Carson when you're into more important things (like computing). Note: this cabinet has not yet received FCC approval.

The Ampro folks announced a big change for the little (board) company. It's the Jumbo Board, and it's a really

hush-hush operation. Funded by the Department of Defense, this system should be completely secure because it is constructed entirely out of (very) discrete components.

They were unable to display the system at the SOG because the main board was too large to fit on a flatcar. Assembly is supposed to be finished by 1990. Debugging will be expensive because of the long-distance phone charges between engineers working at opposite ends.

We had to cut SOG IV a bit short because of reports of a worldwide technology crisis. It appears that having that many hackers away from their terminals that long has been a major setback for mankind (and womankind).

Finally, if you believe all this, you've been reading the editorial too long.

#### Culture Corner Interrupts Serious Meeting

The first indication anyone had that George Morrow (you know, Morrow Computers) had arrived at the Sacramento Micro Users Group (SMUG) 10th anniversary celebration was a loud guffaw at the back of the hall.

While waiting to speak, he had made the mistake of picking up a copy of Micro C #23 and reading the Culture Corner ("Confusing At Catastrophe Manor").

As he started his talk, George held up the copy of Micro C and strongly suggested that everyone read page 82. He said the joke at Jerry Pournelle was "right on."

Bill Godbout (of CompuPro) also read that Culture Corner, and during his talk added: "I'll tell you how Jerry Pournelle got Ezekial II."

"Several years ago we sent a computer to Byte for review. It was a loaner, and they had it for 30 or 60 days and then sent it to Jerry Pournelle.

"One day, when the evaluation period had just about expired, someone called and said he had an evaluation machine from us and he didn't want to return it, so how much would it cost to keep it.

"Linda Barlow got the call, and it was one of her good days, so instead of telling him ten times the list price, she looked up her retail prices, told him, and bang, 10 days later here was a check in the mail. From Jerry Pournelle.

Pournelle also asked for a review machine from Morrow, but no one in the Morrow organization recognized the name, so they said to hell with him.

"One time in Atlanta or San Francisco, George and I and Jerry Pournelle and a bunch of other people were having dinner together when Jerry asked George when he was going to send him (Pournelle) a Morrow. Jerry is a little hard of hearing, so George's response was loud enough for the whole restaurant to hear.

"George said, 'I'm not, and anyone in my organization who sends you one will be fired.'"

At this point, George Morrow spoke up from the audience. "Bill, I figured that if he bought one from you, he could buy one from me."

#### Jerry Pournelle Gets Micro C Free

I was sitting there thinking smugly that I hadn't given Jerry anything (very self-righteously). However, just weeks after I returned from Sacramento, I received a letter from Kevin Rhoads ordering (and paying for) a 1-

year subscription to Micro C for Jerry Pournelle.

So now Dr. Pournelle has a free subscription to Micro C.

#### Contradictions

During his talk in Sacramento, Bill Godbout mentioned some common phrases that are self-contradictory. The formal term is, I believe, "oxymoron," but the term makes no more sense than the phrases it describes (which is, perhaps, appropriate).

#### Some oxymorons to think about:

Civil servant

Athletic scholarship

Military intelligence

Fiduciary trust

Artificial intelligence

Postal service

Petty cash

Electrical engineer (I just stuck this in on an impulse.)

If you come up with some of your own — especially computer related — keep them to yourself. We're confused enough already.



David Thompson  
A Sensible Oxymoron



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Superb mailing list program stores and manages names and addresses that can be revised at any time. Its size is limited only by the disk storage available. The address labels may be code selected and printed in five different formats on your computer paper or on label rolls. In addition to the name and address fields, there are four more fields in each record for telephone number, date, and two amount fields if desired. At any time the entire roster may be printed out. For CP/M 2.2 based systems with two disk drives and printer capable of 132 columns for maximum usage. Terminal installation program module included. Supplied on 8" SSSD, 5.25" Kaypro and many others (please write). Special introductory offer by ABLE DATA SOFTWARE, Inc., PO Box 86923, Station C, North Vancouver, BC V7L 4P6. Only USA \$19.95 postpaid check or money order. Offer expires August 31/85.

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Public Domain UG Software Rental: CP/M UG Vol 1-92 on 46 8" floppies, \$45, SIG/M UG Vol 1-216 on 108 8" floppies, \$125. PICONET Vol 1-34 on 17 8" floppies, \$25, Pascal-Z UG Vol 1-25 13 8" floppies, \$25, KUG (Charlottesville) 39 disks, \$25, IBM-PC SIG 1-300 PC-DOS, \$325, PC-Blue 1-110 MS-DOS, \$125, directory disks \$5 PP. Also available on 209 5.25" formats. Rental is for 7 days after receipt with 3 more days grace for return. Credit cards accepted (preferred). Downloading-disk format conversions. Call. User Group Software Automatic Update Service, \$7.50 per 2 volume set PP. 619-727-1015 24 hrs. 619-941-0925 info. 9-5. National Public Domain Software Center, 1533 Avohill, Vista, CA 92083.

8" drive Cleaning Kits - 12 cleaning disks and carrier jacket made by Datalife, regular price, \$29.95. Close out price just \$6.00 each plus \$2.00 postage. Limit 2. P.D. Software, 1533 Avohill, Vista, CA 92083.

Xerox 820-II disk drive adaptor. Allows connection of 2 8" and 2 5" drives. Upload or download software. Send for free color photo. Kit \$50. Assembled \$70. Merit Computer, 1658 Westport Road, Merritt Island, FL 32952. (305) 452-4655.

5.25" hard disk controller, DTC-510A, BIOS source on 8" floppy, \$125. Qume 5.25" DSDD half height floppy, 2 for \$125. Many S-100 boards. Please request listing of excess equipment. Noor Singh, P.O. BOX 807, Santa Cruz, NM 87567. (505) 753-2211.

Xerox 820-I, complete working board with SWP DD disk controller card & software \$170.00// Boschert power supply for dual 8" drives & two SA801 drives \$250.00//SA1403D hard disk controller card, SA1004 8" hard disk upgrade for 820-II \$400.00//P.D.C. Box 1217, Costa Mesa, CA 92626.

Two new universal data systems, 300/1200 model 212A modems. Cost \$625. Sell both for \$500 with manual & ASCOM. P.D.C., Box 1217, Costa Mesa, CA 92626.

Xerox 820-II, complete. Two 5.25" drives, manuals; 820-I board with or separate. Gary L. Smith (703) 759-9160, (703) 442-6312, 10404 Artemel Lane, Great Falls, VA 22066.

Big Board II system. In Tek 8500 series box with power supply, 2 Shugart 8" SSDD drives, keyboard, NO monitor (recommend Amdek 300). Runs good. CP/M 2.2, HW documentation. Some software extras including user's disk 9, 14, 15. \$550. J. Binkley, 1945 SW 139th, Beaverton, OR 94055. (503) 626-7720.

SE Florida BB I active users group. Call Mike. Evenings 1-305-923-9934.

For Sale - BB I system: 5mhz, dual drives, dyna disk, serial print driver in BIOS, serial hardware implemented. Fully enclosed & cooled. Scads of software includes language compilers, WP, DBMS, dev tools. Includes Zenith green screen and all hdw & swf documentation. An honest system. I'll throw in a PIO/RTC expander PCB! \$1250.00. D.L. Carlyle, 1107 Horseshoe Lane, Blacksburg, VA 24060. (703) 639-8456 days. (703) 552-6981 eves.

New bulletin board system in Montana! Features: 300/1200 baud, software downloading (games, utilities, languages, database, others), classified ads, etc. For more information, call Curt at 406-728-1097. To join the Pony Express Bulletin Board, please send \$25 annual subscription to Curt Porteus, Structured Data Systems, 211 W. Front, Missoula, MT 59802, or go online 406-728-1088.

\$100 equipment, Integrand 15 slot motherboard \$65, Jade Double D disk controller (factory assembled) with documentation \$250, 32K static RAM board \$50. Also Novation Cat 300 baud acoustic modem \$50, CDC 9404 8" SSDD drive, 220v model with transformer for 117v \$60. H. Regan, Box 4486, Rockville, MD 20850.

CBASIC Version 2.38 original Digital Research disk with manual and 1 backup copy. 8" CP/M 3740 format. Runs on Big Board 1. \$52.00 includes postage. No personal checks please. Chris Beachy, Box 4645, APO, NY. 09755

20 Megabyte 5.25" hard disk. New. Seagate ST506 standard. Manual included. \$299 each. Limited quantities. B.W. Systems, P.O. Box 9791, Austin, TX 78766. (512) 255-8350.

12" green monitor. New Motorola with anti-glare. No case. 30 Mhz band width. 110/220 power. STD TTL split video/sync. \$2 complete docs. \$36 plus shipping monitor. Many available. Bob Bruner, 10220 N. 39th Lane, Phoenix, AZ 85015. (602) 978-6252.

For Sale: Compupro CPU-Z 4mhz \$125.00 6mb \$135.00. Cromemco Tuart w/cables \$125.00. PMMI-103 modem works to 600 baud \$150.00. Integrand X/5 mainframe \$150.00. Any two items less 10%. All tested & working. (219) 665-9945. Al Marshall. 408 Oakwood, Angola, IN 46703.

Xerox 820-I boards, complete and tested - \$95.00. Xerox ASCII keyboard with case and cable - \$55.00. (313) 974-5409. P.O. Box 4268, Ann Arbor, MI 48106.

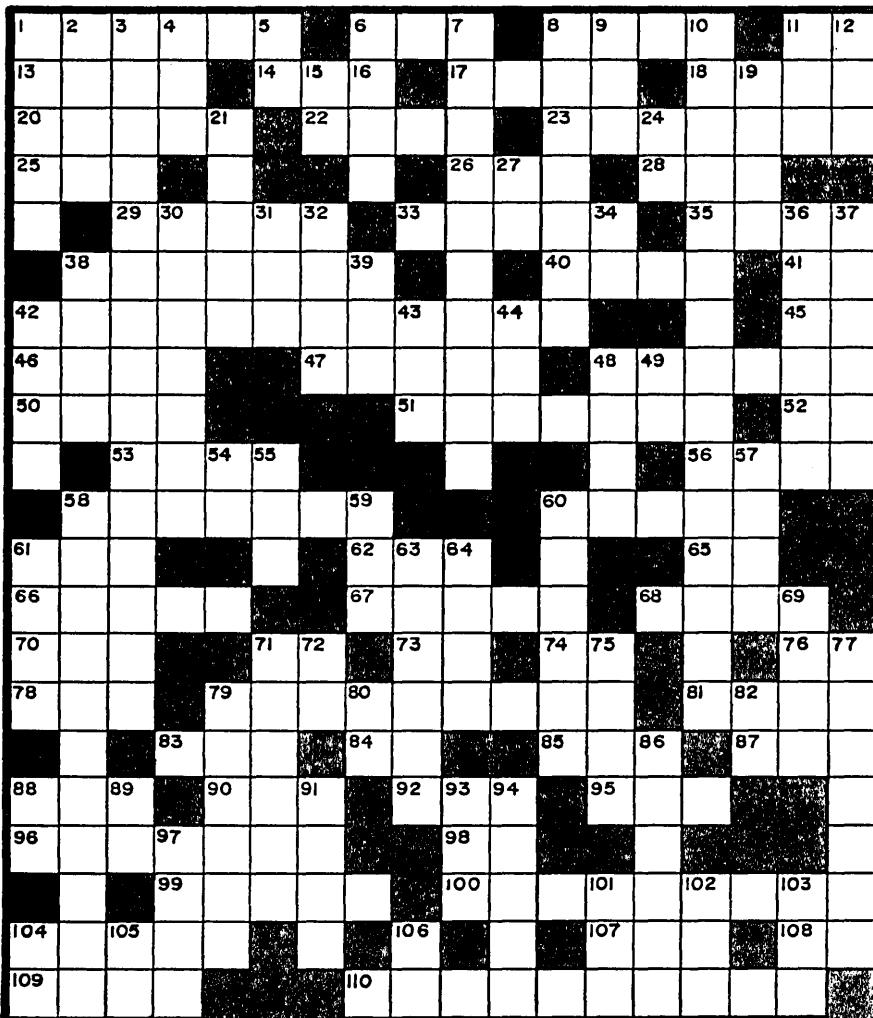
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# Crossword #2

**Across**

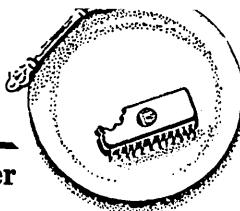
- 1 Mitts \_\_\_\_\_.  
 6 Does nothing.  
 8 Any \_\_\_\_ in a storm.  
 11 Preliminary Degree.  
 13 Iterative programming structure.  
 14 Sorrow.  
 17 Not well done.  
 18 Two bytes.  
 20 President of Microsoft.  
 22 Itinerant programmer.  
 23 Unusual resistance.  
 25 Electrical suffix.  
 26 A million.  
 28 Japanese sash.  
 29 Keyboard addition.  
 33 Stop.  
 35 Positive \_\_\_\_\_.  
 38 Seedy part of a Macintosh.  
 40 Aid.  
 41 I.\_\_\_\_\_.  
 42 Kid's undetailed schematic.  
 45 Tuberculosis.  
 46 Norwegian capital.  
 47 What we want to do with Dana.  
 48 Little boards.  
 50 237 in hex.  
 51 Allocate a variable.  
 52 Iron.  
 53 Original equipment manufacturers.  
 56 SOG mass transportation.  
 58 Micro C staff.  
 60 Single user transportation.  
 61 Dynamite.  
 62 A programming language.  
 65 Invert it.  
 66 What rock climbers do.  
 67 Very impressive flower.  
 68 On \_\_\_\_\_ and needles.  
 70 Desert state university.  
 71 Kind of loop.  
 73 Secret service.  
 74 Letter post script.  
 76 Comes before AB.  
 78 Down\_\_\_\_\_.  
 79 Track 2, Sector 1 (On a SD 8").  
 81 Kind of gate.  
 83 Hotshot.  
 84 Prosecutor.  
 85 (Googolplex)<sup>0</sup>  
 87 Light emitting device.  
 88 Subtrac opposite.  
 90 Fuss.  
 92 Low power display.  
 95 Antique operating system.  
 96 High \_\_\_\_\_.  
 98 Kind of gate.  
 99 Button of last resort.  
 100 Binary galaxy members.  
 104 \_\_\_\_\_ mouth (with 96 across).  
 107 Current measurement.  
 108 Operating system.  
 109  $1 + 3 + 4 + 5 =$  \_\_\_\_\_.  
 110 Bend.

**Down**

- 1 Early language.  
 2 Translates .HEX to .COM.  
 3 Standard TTL driver.  
 4 Mimic.  
 5 Read/Write.  
 6 Vegas lights.  
 7 Digital blow torch.  
 8 Executable code.  
 9 Output enable device.  
 10 Half-nibble company.  
 11 Surrounds the elbow.  
 12 Classifieds.  
 15 Exclamation.  
 19 Reds' state.  
 21 In a rut.  
 24 FORTRAN loop.  
 27 Easy out.  
 30 Assemble-language programmer.  
 31 Inverse DOS.  
 32 Micro C techie.  
 34 Terbium symbol.  
 36 On.  
 37 Underwater Navy group.  
 38 In addition.  
 39 Programmable array logic.  
 42 Warm or cold.  
 43 Programmer-in-chief.  
 44 Power plant regulator.  
 48 43690 or -21846.  
 49 Mrs. spouse.  
 54 Yuppie sports car (of the '60s).  
 55 Statistical package.  
 57 Related to.  
 58 Two complements.  
 59 \_\_\_\_\_ fly.  
 60 Darth Vader's Lunchbox.  
 61 Built a better one?  
 63 Language of Wirth.  
 64 Linked \_\_\_\_\_.  
 69 What the computer industry isn't.  
 71 One way devices.  
 72 A logic gate.  
 75 Everything but the kitchen \_\_\_\_\_.  
 77 155 NW Hawthorne.  
 79 Captain Crunch.  
 80 Talking horse or word processor.  
 82 Aluminum symbol.  
 86 Electronic high school dance.  
 88 \_\_\_\_\_ soon as possible.  
 89 Negative prefix.  
 91 Sandwich cookie.  
 93 Corn on the \_\_\_\_\_.  
 94 Shugart 5" or 8" \_\_\_\_\_.  
 97 High school dance.  
 101 Women's Air Force.  
 102 Post Office on the tracks.  
 103 PC or MS.  
 104 Hangs out with Pa.  
 105 Terminal Unit.  
 106 Input/Output.

# Tidbits

By Gary Entsminger



Future Tense Editor

Thanks for the prompt response to our Turbo Pascal programming contest. It's going to be a lively competition, judging from the first entries. Code and documentation have been clear as snowmelt. (What a chilling thought.)

No doubt, Z80 romantics are already dreaming up uses for a 1 megabyte RAMdisk (one of the grand prizes). Bruce couldn't wait (of course he isn't eligible anyway, being a Micro C staffer). His Kaypro already has one of MicroSphere's 1 meg screamers along with four drives (an 8", two 5" quads, and a 5" 48tpi) and 5MHz. He connected his RAMdisk to a separate power supply, so it stays loaded around the clock.

If you want to know more about the RAMdisk contact:

MicroSphere, Inc.  
P.O. Box 1221  
Bend OR 97709  
503-388-1194

## A Write Hand Person

It's been a good week for CP/M. Poor Person Software has released a semi-Sidekick, with notepad, calendar, file and directory viewing, phonebook, and communication programs included. Perhaps more importantly, you can write your own programs to be called from Write Hand Man. Your programs need to be in assembly language, so you'll need some talent here, but Poor Person helps by providing a sample shell to get you started.

As is, Write Hand Man's notepad and view commands are useful. You enable Write Hand Man after you boot up —

WHM on

Then, with a single command (that you define) you create the Write Hand Man window, and in a second you're "jotting" or "reading" a note, or viewing a directory or file. Two escapes and you're back to the file you were editing.

One flaw — Write Hand Man doesn't refresh the screen. Your editor will have to take that responsibility. But that's no big deal in WordStar or Vedit. Costs \$49.95.

## For more info:

Poor Person Software  
3721 Starr King Circle  
Palo Alto CA 94306  
415-493-3735

## Micro C Bulletin Board

Thanks for your support and suggestions. Lots of users have been patient as we work out the kinks in the system.

If you need a fullscreen file debugger, we've added EDFILE.COM in the NEW directory. EDFILE has a handy search function and lengthy documentation (in EDFILE.DOC). We don't have source, but it's useful as is.

Also Eric N. Skousen has contributed a Micro C index. It'll be on the bulletin board and available on a user disk for those of you without modems. Thanks, Eric.

Keep calling: 503-382-7643.

## Xerox 8" Adaptor

Merit Computer is selling a disk drive adaptor which enables the Xerox 820-II to run 5" or 8" drives.

It's available in kit for \$50, and assembled and tested for \$70. Fits on the rear of your 820.

## Contact:

Merit Computer  
1658 Westport Rd.  
Merritt Island FL 32952  
305-452-4655

## Surplus

Erac Co. in San Diego is advertising Kaypro mainboards, monitors, keyboards, and other miscellaneous parts.

8280 Clairemont Mesa Blvd.,  
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## Speed Tidbits

The Cray-2 has the largest internal memory in the world with 2 billion bytes. Its top speed is 1.2 billion FLOPS (floating point operations per second). It's 6-10 times faster than the Cray-1 (you were worried?), and maybe 50,000 times faster than a Kaypro 484.

In terms of how fast we used to be — what took about a year (and 72 dozen pencils) in the early 1950s takes about a second now. So who needs speed?

Simulators are current bigtime speed users. Scientific and military researchers play the "what if" game and depend on oodles of details for accuracy. Engineers can create lifelike worlds with fast computers capable of high resolution graphics. In theory, our knowledge of the world increases as we add more and more details. To a computer, that means more data.

Two sci-fi novels I read recently address the subjects — simulation and speed — in rather offbeat fashion. If you like "serious" SCIENCE fiction, try Stanislaw Lem's "The Chain Of Chance" and Philip Dick's "Ubik." They're both short, thought-provoking, and depict highly-plausible futures of advanced human beings. Lem's simulator uses a computer to piece together the "mystery," and Dick's characters, who have computing power of a sort, use themselves to solve the puzzle.

Both are in paperback, and have been around for years, so you should be able to find them in a library or used book store for \$1 or so each.

## New From Micro C

We've been working hard to improve our user disks, and have just finished Kaypro Disks 33, 34, 35, 36 and CP/M 86 Disks 7 and 8 (see Laine's 86 World for details on these last two).

K33 is a utilities disk containing some very useful programs:

NSP207.COM — an excellent file utility written by Dave Rand.

NULU11.COM — a program for creating, manipulating, and extracting libraries.

SUPERZAP.COM — a full screen debugger.

VDO-KP.COM — a fast, mini-editor that's small and easy to use.

All are well documented. (What's this, a change in policy?)

K34 is a games disk (DBlick, Eliza, Germs, Othello, Cribbage). This inverse video version of Othello is the best public domain one I've seen. All the games come in Turbo Pascal

source, except Othello (written in FORTRAN), so besides having fun playing, you'll have examples of Turbo programming.

K35 and K36 are Fred Scacchitti's upgrade of the Small C compiler (version 2.1) and C library. He's incorporated Jim Hendrix's additions and added a few of his own tricks. 35 is the compiler and source (in a library), and 36 is a library of around 100 functions (also in a library). Thanks for the good work, Fred.

#### Forth 83

C.H. Ting's "Inside F83" should be a valuable addition to your FORTH

library. It's chocked full of information (288 pages), and definitely written for the knowledgeable.

Ting carefully explains F83's source and new features, using MS-DOS for examples.

It's not a light volume (weighs at least two pounds), and Ting has lapses in grammar (does the name tell you something?), but it's FORTH. \$25 in paperback.

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Mountain View CA 94040  
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And that's Tidbits!



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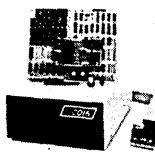
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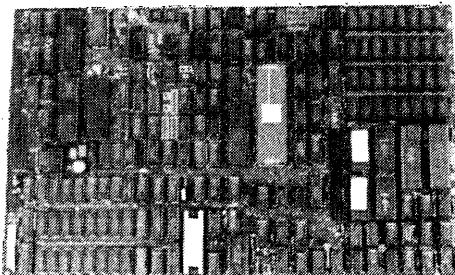
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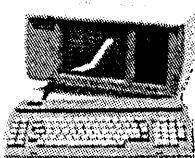
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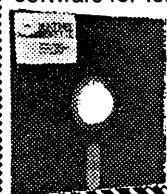
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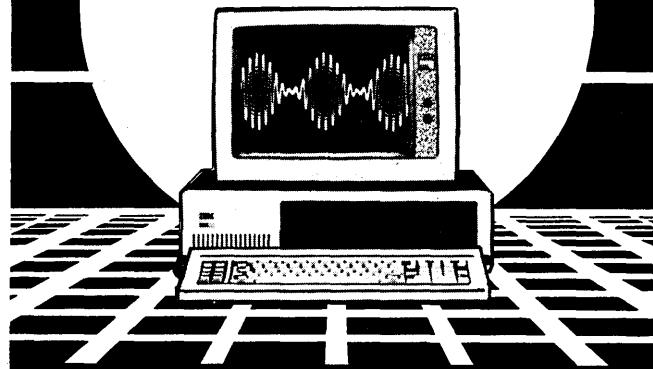
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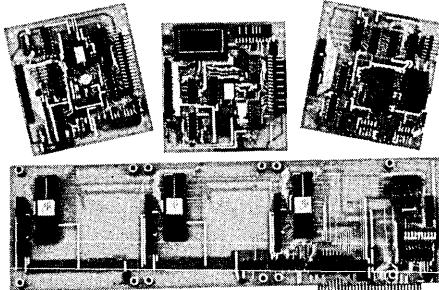
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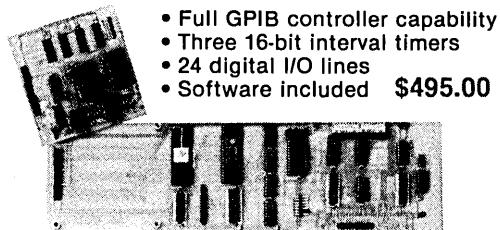
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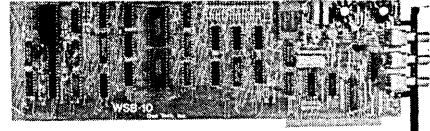
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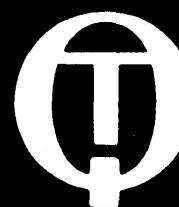


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# The Pascal Runoff

I'm not going to beat around the bush about this contest (see the Editorial for bush beating). In short, we're having a contest, you're invited (in fact, we're not inviting anyone else), and the prizes are really spiffy.

## So Let's Get To The Prizes

The Grand Prize is your choice of a Microsphere 1 Megabyte RAM DISK or Trevor Marshall's 32032 Coprocessor kit. It's the full 1 megabyte 32032 board that plugs into the K16 or any other PC clone.

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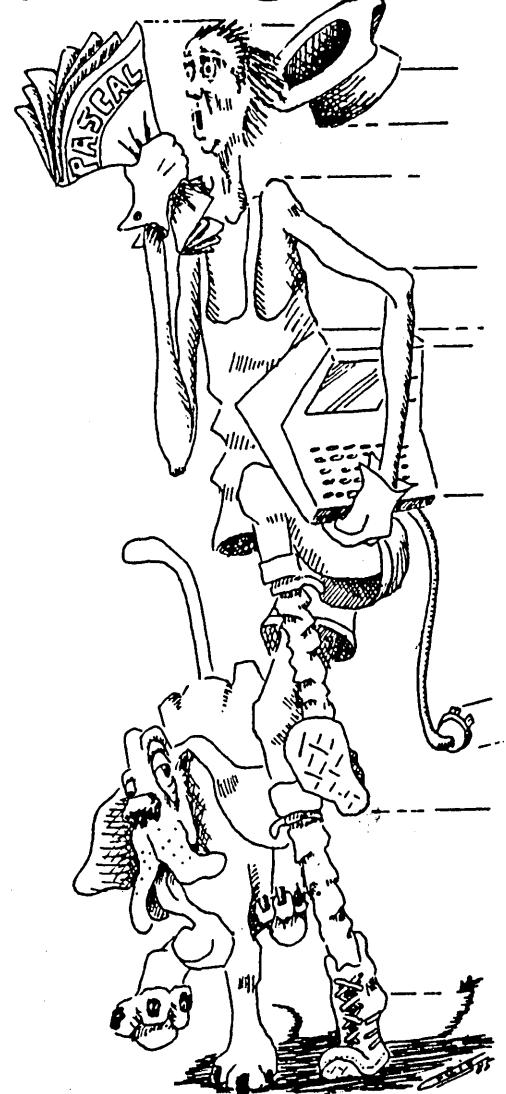
This contest is intended to encourage concise, clear programming style.

Contest deadline is November 1, and we'll announce the winners in the February-March '86 issue of Micro C.

## Scoring

Programs will be judged by Philippe Kahn and the Micro Cornucopia staff on a point system. Total points decide the winner.

- 0-15 for ALGORITHM
- 0-15 for READABILITY OF CODE
- 0-30 for FUNCTIONALITY  
(including ease of use)
- 0-20 for ORIGINALITY
- 0-20 for DOCUMENTATION



So Start Programming . . . An editor, a business application, a game, a utility, something educational - anything that interests you probably interests us. Just make sure the program you submit is original, unpublished, and written by you in Turbo Pascal during 1985.

## PS -

Hackers in other languages, stay tuned. Your contest is coming.

Any version of Turbo Pascal is OK - 2.0, 3.0, CP/M, MS-DOS

## Program

Title: \_\_\_\_\_

Purpose: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

NOTE: I hereby release this program to the Public Domain and give Micro Cornucopia the right to print this listing.

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**Free Pascal Runoff T-shirt**      Size:  S  M  L  XL      (For the first 100 entrants.)  
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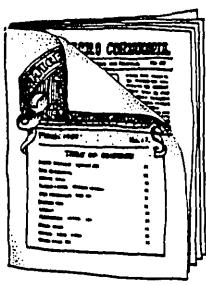
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# The Last Page

By Gary Entsminger

Micro C Staff

There's just enough room left in Micro C this issue for a little logic, so we'll close a few circuits.

## Analog Or Digital?

These two systems differ in the way they represent information. In an analog system data are represented by a continuously varying signal (wavelike). In a digital system data are represented discretely — in bits that have set values — either 0s or 1s (OFF or ON).

Your stereo is an analog system (probably). Your computer is digital (unless it's a very early Heathkit). For information about analog systems read RollingStone or Stereo Review. For digital — stay in tune with Micro Cornucopia.

## In A Digital

Circuits open and close to control the flow of information. A gate is a simple circuit which originally (in the 1950s) was made up of individual transistors, resistors, and diodes. The big breakthrough of the early 1960s was discovering how to combine some of these transistors, resistors, and diodes (which made up a gate) on one piece of silicon. This was called Small-Scale Integration (SSI), and it changed the world.

The first integrated circuit consisted of fewer than 12 gates on a square about the thickness of paper and the width of a pencil lead. The gates or circuits were connected to the outside world via tiny wires.

By the 1970s, LSI (Large-Scale Integration) was rolling, and as many as 50,000 parts were squeezed onto a single chip.

## Buffers

A buffer is the simplest device in your computer. It outputs whatever it gets for an input, either straight or inverted. Buffers are often used when there are lots of inputs listening to the same signal line (say a data line or address line). It takes a lot of output to drive such a line, and most processors, for instance, don't have very strong outputs. So we stick a buffer

between the processor and all those inputs.

Buffers can also protect the computer from the outside world. The most common RS-232 line drivers and receivers are simple inverting buffers (1488 drivers and 1489 receivers). All Kaypros, Big Boards, and Xeroxes use these.

The 1488 drivers change the .7V and 4V (off-on) TTL signals to the +12 and -12V (space-mark) RS-232 signals. The 1489 receivers change the +12 and -12V RS-232 signals back to .7V and 4V, the standard off-on signal levels inside the computer. The 1488s and 1489s are also designed to shrug off the static and other electrical garbage that would destroy less hardy chips.

## Build A Buffer

Now let's see how a simple buffer works. (Go ahead and build it, then use a voltmeter or LED to see what's happening.) You can use any garden variety NPN transistor, but the 2N2222A (or equivalent) costs about \$1 and is commonly available at Radio Shack and other parts houses.

A transistor has an emitter, base, and collector (E, B, and C). Before you leave the store, make sure you know which lead is which — lead identification may be marked on the transistor or on the packaging, or the dealer may have to look it up.

You can think of your transistor as a sensitive switch. A small amount of current flowing into the base (B) and out the emitter (E) allows a larger amount of current (about 100 times as much) to flow into the collector (C) and out the emitter (E).

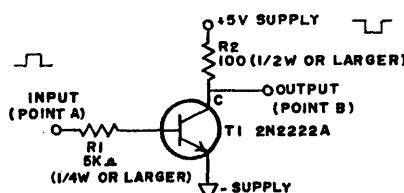


Figure 1 shows how to connect up your 2N2222 transistor (or equivalent) and two resistors to make a standard inverting buffer. (When the input goes

high, the output goes low.) Connect the input to ground to force it low. Connect it to +5V (or whatever your supply voltage is) to force it high.

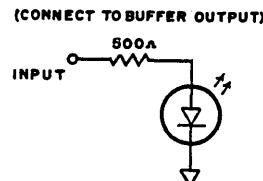


Figure 2 shows how to make an LED monitor. The LED is simply a diode (it only conducts current in one direction) that glows when current flows through it. The LED will glow when its input is high.

## Circuit Theory

When the input (A) goes high (5V), about 1/1000 of an amp flows through R1 (5V/5000 ohms .001 amp) into the base of T1 and out the emitter to ground. This allows up to 1/10 of an amp (100 times as much) current to flow into the collector and out the emitter to ground. This collector current must also pass through R2 which acts like a narrow spot in the current's path.

When the T1 is turned on (conducting) it's easier for current to get through it than through R2. So the output point (B) will be effectively connected to ground (the output will be close to 0V).

When the input voltage (at A) to this circuit goes low the current flow through R1 stops. So there is no more current flow into the base of T1 and out the emitter. So the transistor "turns off," no longer allowing current to flow into the collector and out the emitter to ground.

Now the output (B) is completely disconnected from ground (T1 is shut off), but it is still connected to +5V by R2. So the output (B) goes high (to 5V).

All this is a long explanation of a very simple circuit. Next, we'll try our hand at a non-inverting buffer and eventually build some AND and OR gates (it only seems logical).

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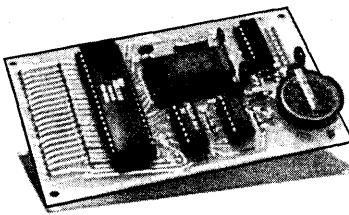
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