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MICRO CORNUCOPIA

THE SINGLE BOARD SYSTEMS JOURNAL

August 1982 No. 7

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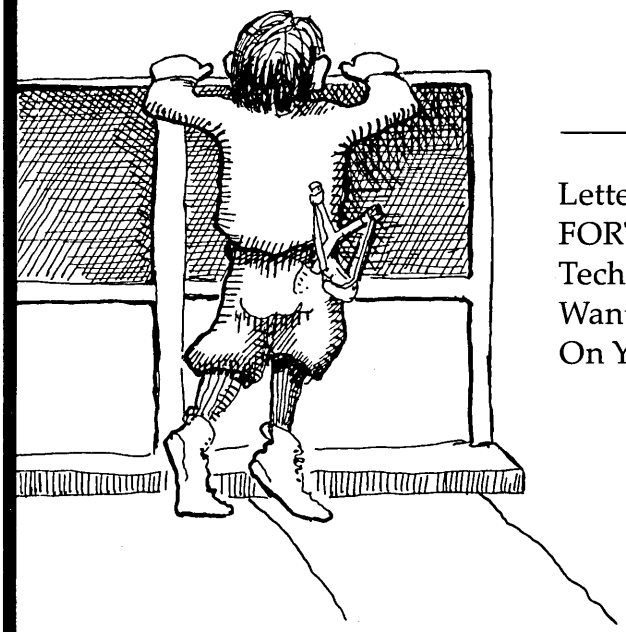

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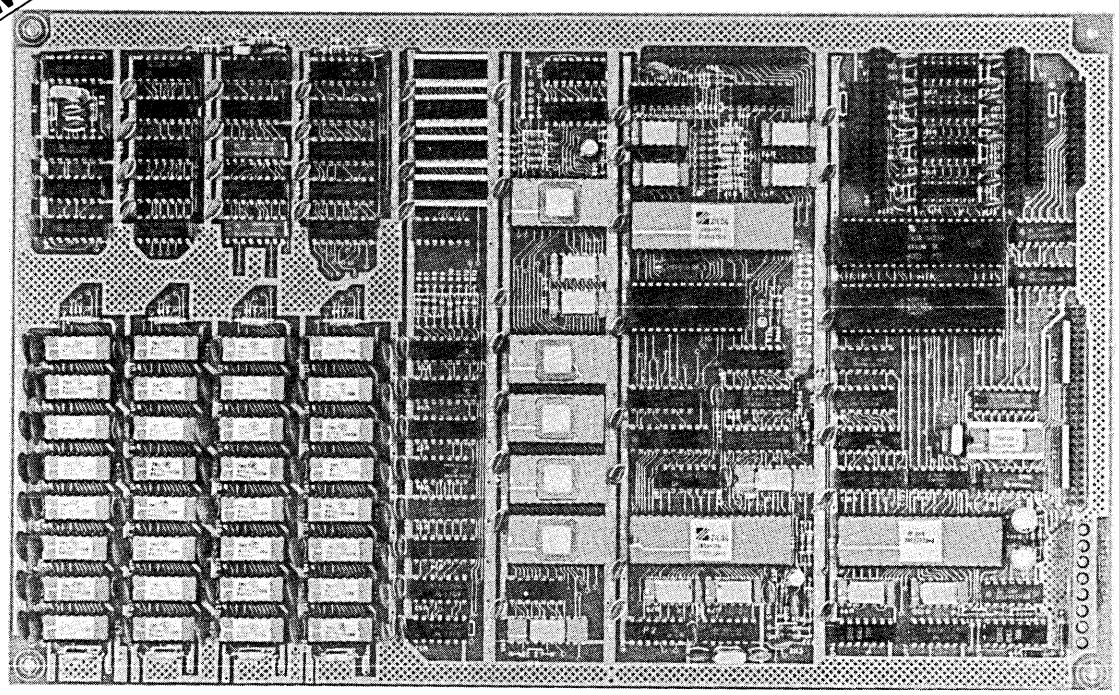

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MICRO CORNUCOPIA

August 1982 The Single Board Systems Journal No. 7

Happy Birthday

We're One

I was rummaging through my stack of Micro C's this morning looking for issue #3 when it hit me, I had a stack of six magazines to search through. Six magazines, and of course issue #3 was on the bottom. That kind of problem I can live with.

The Single Board Systems Journal

You may have noticed that the masthead has changed a bit. As the computer world and you, our audience change, Micro C is changing. We are going to continue providing the world's best support for the Big Board and Big Board II (the new Ferguson board) but we are also planning to stay on top of the latest in other single board systems plus, of course, systems languages. (We'll let the other magazines support the S-100, the SS-50, the minis, and other crumbs.)

We're going to do our best to support you. You are building and modifying the Big Board, the Xerox 820, and similar systems and you are deeply involved in some very interesting projects, all the way from writing new data base management systems to designing satellite packet switching networks. And most of you are doing this at home.

You are engineers, software designers, and heavy weight hobbyists. Most of you are using your system both as a way to continue your education in the computer field and as the basis for that hoped-for business of your own. The rest of you are already consulting, or manufacturing and marketing something for the computer market.

Nearly all of you are proficient in two or more languages. Many of you are using Cobol, Fortran, Algol, assembly language, or even Basic on your jobs. But you are also very interested and proficient in one or more of the more modern structured languages. Of these languages, Pascal is by far the most popular with FORTH and C a distant 2nd and 3rd. FORTH and C interest appears to be quite regionalized. FORTH interest is strongest in California while there appear to be pockets of experienced C'ers all along the West Coast and in the Bell Labs area.

The information flow within the whole Micro C group is tremendous. Ideas are going through here at a rate I wouldn't have imagined a year ago. The number of pages in each issue of Micro C is limited mostly by the cost of production, mailing, and help.

Can You C?

This is the issue a lot of you have been waiting for. The feature this month is the review of some of the more popular C packages. I had hoped to begin working on the reviews in March but I'm glad I didn't. All but two of the packages (Small C and Small C+) are either new or have been substantially updated in the last couple of months.

Of course, change is the norm in the software business but C has seen more than its share of change lately. I'm glad to see it the changes because C is finally achieving a price/performance ratio that puts many other languages to shame. (Pascal also has a new package that will shake things up in that arena. See below for more information.)

Drive with Caution

Issue #8 will feature information on disks and disk drives, but I feel that the following can't wait. Think twice (or three times) before using Maxell disks.

It turns out that Maxell achieves its long data life by putting a hard, slightly abrasive surface on its disks. This surface not only protects the disk but it keeps the heads clean by polishing them. So, not only do your heads wear out quickly (after a year of intermittent use), but the abrasive residue left on them substantially reduces the life of other brands of

(continued on page 20)

LETTERS

Dear Editor,

Here are a few patches for people who have our double density controller.

Big Board owners who have more than two drives should modify the CBIOS slightly so they can access drives C and D. First run DDSYSGEN and select a source drive. Hit your system reset so you can use the PFM monitor to change 1B04 from 02 to 04. Then G100, and use function 2 to place modified CP/M back onto the same disk. Now reset the system again and reboot CP/M.

Some drives can't get the head loaded and stable in 25ms. When this happens and you try to write to the disk you can cause some definite problems. You can increase the time the Big Board waits before writing by increasing R44 (schematic #4). An increase from 100K to about 130K increases the delay to about 33ms which should be sufficient.

Xerox did not include this one shot (U106) delay on the 820 and it has been creating problems, especially when users add double density.

You can reduce head banging on Shugart 801's by moving the B jumper to X. This way the heads remain loaded 15 for revolutions of the disk after the last access.

John McFarland
Software Publishers
2500 E Randol Mill Rd., Suite 125
Arlington, TX 76011

Dear Editor,

I though I'd drop you a note to let you know why I've reduced JRT Pascal from $295.00 to $29.95.

You see, the exploding number (over 500,000) of CP/M compatible systems makes it feasible to market in high volume. In fact, to further encourage the spread of JRT Pascal, I've partially lifted the copyright so you can pass it on to your friends as long as you don't resell it.

JRT Pascal is a most advanced implementation of a very elegant language and I think it deserves to be one of the most widely used CP/M languages.

James R Tyson
1891 23rd Ave
San Francisco, CA 94122

Dear Editor,

Just a short note to express my appreciation for the fine job you're doing with Micro C. Without it I would still be floundering around trying to get the ole BB up and running.

Mark Stieglitz's SCBIOS (user disk #2) is the best thing you guys have supplied yet. It works like a dream! I have connected a u82A printer to the PIO port (SCBIOS provides the parallel print driver) as follows:

u82A Signal	Wire Color	u82A Pin	BB J5 Pin	BB Signal
DSTB	Brown PINK	1	4	ARDY
D1	Blue BLK	2	6	D0
D2	O RG BRN	3	8	D1
D3	Green RED	4	10	D2
D4	Purple ORG	5	12	D3
D5	L Brown YLW	6	14	D4
D6	Gray BRN	7	16	D5
D7	Pink BLU	8	18	D6
D8	Red VIO	9	20	D7
BUSY	Blk GRY	11	2	STB
SIG GND	R/BK	14,16	ODD	GND
CHASSIS	R/GR	17	ODD	GND

Jumper BB J3 pins 1-2, 13-14, 15-16.

Mark C. Worley
1831 W Pioneer Apt 203
Irving, TX 75061

Dear Editor,

I enjoyed reading your critique of VEDIT, especially since I just received version 1.34. Unfortunately three bugs showed up.

First, the test wouldn't format. Second, I couldn't get the text to print via the 'print text' command. And third, the word wrap line size wouldn't configure correctly.

I called Rick Fourtson at CompuView and he mentioned that several Big board users are having difficulty with VEDIT. Rick said he would contact you for some possible leads on solving these problems and if necessary, VEDIT will be customized for the Big Board.

By the way, the third bug results when the customization assumes you've entered a HEX value for line length (not documented) while the command mode assumes you are entering a decimal number.

Rick Kobbe
8909 Corbin Drive
Everett, WA 98204

Editor's note:

I haven't heard from CompuView so I don't know what the status is of the bug fixes. I haven't had any problem using the print command and my format command works fairly well. Its problem is that it occasionally chops the first character off some words. I haven't contacted them because they appear to be working in an understaffed/overworked mode so fixes don't get accomplished very quickly.

Dear Editor,

I bought a bare Big Board early in 1981 and over a period of about 6 months, accumulated enough parts to bring it up. I'm using it with a Keytronics word processor keyboard and a converted TV set.

One of the problems I had with the board was extreme instability in the video crystal oscillator. The fix was easy. I put a 100 pf capacitor between U11 pin 13 and ground.

Be very careful with the 4 MHz mod in issue #2 page 4. The asymmetrical clock does not satisfy Z80 specs and I had a lot of problems trying to get it to run (I wiped out the directory on a disk).

My next project for the Big Board is to interface a graphics display to the parallel port, probably similar to the Micrograph display described in Byte. Then I could emulate a Tektronix 4010 graphics terminal. I would be very interested if other Big board owners have ideas on the subject.

Ken Stephenson
Physics Division
Argonne National Laboratory
Argonne, IL 60439

Dear Editor,

Sometimes it is nice to have a software selectable alternate character set for the Big Board. I noticed that half of the character generator is filled with FF's for blanking the screen during retrace. I decided to use the chip select pin on the 2716 instead. I've modified my board so I can select different character sets such as US, Swedish, German etc.

Mods: Cut the trace between U60 pin 8 and U73 pin 19. Connect U73 pin 19 to a spare PIO pin. Cut the trace between U25 pin 3 and U25 pin 4. Connect U25 pin 12 to U60 pin 9. Connect U25 pin 13 to U25 pin 3. Connect U25 pin 11 to U25 pin 4. Now reburn the character generator so that you have one set in each half of the EPROM. (See issue #6 page 8 for more information on designing your own character set.)

Thomas Hameenaho
Djaknegatan 7
S-754 23 Uppsala
Sweden

(continued on page 11)

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The C Reviews: C for the unC'ing

Introduction

By David Thompson

This is a rather hard introduction to write. Every time I get a chance to do anything in C, I am very impressed with it as an easy way to write things that I would otherwise write in assembly language.

However, Micro C's requirements on my time keep getting in the way of any kind of serious programming. So I haven't had a chance to really get up to speed with C the way I would like. Fortunately there are a number of strong C'ers in this area who were willing to lend a hand with these reviews.

What is C?

C is a structured language which looks in some respects quite similar to Pascal but unlike Pascal, C can also become incredibly cryptic.

While Pascal does a pretty good job of hiding the underlying system from the programmer (which encourages transportable code), C makes it relatively easy to pick bits. In fact, assembly language programmers should find the transition to C a happy one because they don't lose control over the machine.

C Benchmark Program

All the benchmark times were taken on one Big Board running 4MHz. Object file size is the size of the file on the disk (could be inflated by up to 127 bytes when loaded onto the disk). I used the Unica LS.COM utility to make the measurement.

A low-level, high-level language

Notice how the shades of assembly language creep into C in the #define statements. Also, floating point seems to be about the last thing people add to their C packages (if they add it at all) which is just about the reverse of the more business and scientific oriented languages such as basic, cobol, and fortran. In fact folks here were impressed when they learned that the latest version of C80 supported unsigned integers.

Floating point remains a significant feature of the language though it is rare enough to qualify as a status symbol. Having floating point means that you can write just about anything imaginable without leaving the C environment. As far as I know, only Aztec C and Whitesmith's have it built into the compiler. Whitesmith's C sells for about $700, the floating point version of Aztec C is $199.

At this point there appear to be three major divisions in the C world.

First there is Whitesmith's C, which is full-blown Bell Labs C, written and marketed by full-blown ex-Bell Labs compiler designers.

Second, is BDS C written by Leor Zolman and marketed by Lifeboat Associates. BDS C has been around long enough that it has developed quite a following, a user group with public domain software, and it has matured significantly as users have shaken loose bugs and deficiencies.

The third group began when Ron Cain wrote a C compiler called Small-C.

Small-C, a Beginning

Small-C has made C available to the masses because Ron Cain put it in the public domain. And even though it supports only a limited subset of C, people who try it are amazed at all the capabilities it does have and how well it works.

Small-C works so well for doing those small and not-so-small systems tasks (like writing extended C compilers) that it has spawned a number of extensions including Small-C+, CW/C, Q/C, C80, and probably Supersoft C.

Aztec C?

I have been looking forward to seeing what Manx Software Systems did with their latest version of Aztec C. Harry Suckow mentioned that they were working on a very complete "compete with Whitesmith's" version with all the bells and whistles (floating point, pointers to pointers, structures . . .). All this for around $200.00 and designed for micros rather than being designed for PDP-11s and then wrestled down just enough to fit in a 64K system.

I just received word that Aztec C II is on its way and that Manx software is offering a $50 discount to Micro C subscribers only. Until September 1st you can purchase the floating point C II package for $149 instead of $199. They also mentioned that S-100 Micro Systems and Byte will have reviews of Aztec C in their September issues.

For more information, contact Manx Software Systems, Box 55, Shrewsbury, NJ 07701. 201-780-4004.

Original benchmark program in C.

```
/* Eratosthenes Sieve Prime Number Program in C */
/* Uses local (automatic) variables */
#define TRUE    1
#define FALSE   0
#define SIZE    8190
#define SIZEP1  8191

char flags[SIZEP1];
main()  {
        int i, prime, k, count, iter;
          /* variables defined here are local */
        printf("10 iterations n");
        for (iter = 1; iter <= 10; iter++) {
                count = 0;
                for (i = 0; i <= SIZE; i++)
                        flags[i] = TRUE;
                for (i = 0; i <= SIZE; i++) {
                        if (flags[i]) {
                                prime = i + i + 3;
                                k = i + prime;
                                while (k <= SIZE) {
                                        flags[k] = FALSE;
                                        k += prime;
                                        }
                                count = count + 1;
                                }
                        }
                }
        printf(" n%d primes", count);
        }
```

Learning C

Those of your unfamiliar with C should not expect to learn the language from the manuals that come with the following packages. If you've had any contact at all with C you've no doubt heard of *The C Programming Language* by Kernighan and Richie (Prentice Hall). Its fame is justly deserved because it's a rare example of really excellent documentation and it's a first-class learning guide.

We're trying to make this book (and some other unusually fine volumes) available through Micro C.

Last Minute C News

Just as we were finishing up the reviews, I got word that we could distribute Small-C+. So, throwing caution (and profit motive) aside, I dropped the price to $24.00. See Bob Broughton's review for details about the package.

I also had a last-minute talk with Tony Ozrelic (L.A. Software) and he agreed (I twisted his arm a little) to do a C column. He would very much like to share the column with one or two other C'ers. Each column will include a short discussion about the language plus one or two short listings. If two more folks joined him, it would mean only two columns per year for each person.

Tony wrote the Programmer's Aid package in Small-C (see his ad in this issue) and some of the columns will include his experiences using Small-C. In others he will cover utilities you can write for the Big Board and other systems using this powerful subset of C.

Conclusion

The primary thing I see as I look over the the following reviews is the variety of inexpensive C packages which run under CP/M. Q/C shines for its documentation, utilities, and source. BDS C shines for its compiler. C80 shines for its price/performance ratio in a very substantial package. Small-C and Small-C+ are inexpensive ways to dig into a very interesting language. ■ ■ ■

Modified program for Small-C and Small-C+.

```
/* Eratosthenes Sieve Prime Number Program in C */
/* Special version for C's without printf() */
/* Uses while statements instead of for */
/* Also shows how variables are made global (static) */
#define TRUE 1
#define FALSE 0
#define SIZE 8190
#define SIZEP1 8191
int i, prime, k, iter, set;
  /* defining variables here makes them static */

char flags[SIZEP1];
int count;
main() {
        puts("10 iterations:  ");
        iter = 1;
        while (iter <= 10) {
                count = 0;
                i = 0;
                while (i <= SIZE) {
                        flags[i] = TRUE;
                        i++;
                }
                i = 0;
                while (i <= SIZE) {
                        if (flags[i]) {
                                prime = i + i + 3;
                                k = i + prime;
                                while (k <= SIZE) {
                                        flags[k] = FALSE;
                                        k = k + prime;
                                }
                                count = count + 1;
                        }
                i++;
                }
        iter++;
        }
        set = 10000;
        while(set > count)
                set = set/10;
        while(count > 0) {
                itoa(set);
                set = set/10;
        }
        puts(" primes");
}

itoa(compare)
int compare;
{
char digit;
        digit = '0';
        while (count >= compare) {
                count = count - compare;
                digit++;
        }
        putchar(digit);
}
```

C Reviews

Small-C (V 1.1)

Reviewed by Bill Randle
19585 SW Martin
Aloha, OR 97007

Written by –	Ron Cain
Distributed by –	The Code Works Box 550 Goleta, CA 93017
Price –	$19.95 (public domain)
Memory Requirements –	Approx. 40K

Features

The feature set of Small-C is used as the basis for the other C reviews, so the following is a short description of the feature set of Small-C. (Also see the table.)

Data Types: Small-C supports char (8-bits) and int (16-bits) data types. In addition, it supports pointer to character (char *) and pointer to integer (int *) types.

Variables can be either local or global (static). Variables which are declared within a function are private (local) to that function and are reinitialized each time the function is called. Variables which are declared before the first function are global (static) and are their values are available to all the functions in the program (and they are not reinitialized while the program is running). These variables are assigned memory locations rather than being placed on the stack.

(continued next page)

C Reviews

Run Time and I/O Library

Small-C includes only a minimal set of routines to support I/O. They include: exit (exit program), fclose (close a file), fopen (open a file), getc (read character from a file), getchar (read character from console), gets (read string from console), putc (write character to file), putchar (write character to console), puts (write string to console).

Documentation

Small-C comes with an 11 page User's Manual that provides information on how to run the compiler, how to use the I/O library, how to interface with assembly language subroutines and an appendix describing the compiler specifications. The manual makes no attempt to explain the C programming language and assumes you are familiar with C. It does include a bibliography of articles on C.

Ease of Use

The Small-C compiler is easy to use; the compiler prompts you for the required information which you answer with "y" or "n" and then you enter the source filename.

The compiler options are: C-text as comments in the asm listing, all or part of the program, stop after errors, and output filename. Input filenames are requested one at a time until the user indicates that there are no more. The output is 8080 assembly language which can be assembled by ASM or MAC.

I would prefer to use the command line for specifying the compilation options, and have the compiler set the rest to their default values. This way I wouldn't have to answer a series of questions each time I run the compiler. *(On the other hand you don't have to go back and look up the options. Editor)*

Code Size and Quality

Small-C is a single-pass compiler and thus does no optimizing. The compiler also does not calculate values at compile time, so the statement:

```
zzy = 2 + 3;
```

generates the 8080 code required to load 2, add 3, and store it in zzy instead of just storing 5 in zzy.

Compiler library routines are called to do common operations such as get integers from the stack or compare two integers. The entire library must be included as one of the files during the compile process. This makes the assembly file pretty large.

Conclusions

The Small-C compiler is well suited to the user who is just getting into the C language and wants an inexpensive, yet very functional compiler.

Since you get the source code for the compiler you can make custom modifications or patches, and you can add to the I/O library (which is written in 8080 assembly). The compiler is also a good example of a large working C program.

If I were doing a lot of serious C programming, though, I would probably go with a compiler that supported a larger set of the C language and supplied a more complete run-time I/O library.

Benchmark Results

The benchmark as it appeared in the Byte article will not run directly on Small-C since Small-C does not support the "for" statement so we substituted the "while" in its place. In addition, the Small-C library does not have a "printf" function and so we wrote one using "putchar" and "puts."

Compile Time	210 sec
Assembly Time	49 sec
Load Time	11 sec
Run Time	
-Original prog	53 sec
-Static Var	30 sec
Object File Size	2816

■ ■ ■

Small-C+

Reviewed by
Robert S. Broughton
Box 5191
Beaverton, OR 97006

Publisher–	Alpha Omega Computer Systems
Distributed by–	Micro Cornucopia 11740 NW West Rd Portland, Or 97229
Price–	$24.00
Memory Required–	Not Stated

Small-C+ began as a home project by a couple of programmers at Alpha Omega (there is something about Ron Cain's little compiler that attracts programmers) and turned into a good basic extension of Small-C.

It has Small-C features plus command line parsing via "argc" and "argv" which allows compiles to be performed from submit files without the "interactive" initiation mode. In addition, it has "for" and "do-while" loops and the "switch—case—default."

Since it is a later release than Small-C, numerous bugs that have shown up in Small-C have been fixed.

Strengths

This is a bargain C compiler. It works, and provides a tremendous bang for the buck. This is a marvelous low-budget way to learn C, and a good way to learn systems programming (C's forte).

Compilation is much faster than Small-C because the library does not have to be compiled each time. However, for this reason, you will need the Microsoft assembler (M80) and linker (L80), so plan on making that purchase if you don't already have them.

Weaknesses

Frankly, for the price, I can't see many weaknesses. I really appreciated Small-C+'s addition of "case" and "for."

However, I find the "do-while" statement of marginal benefit. As a matter of style, I prefer to test a condition before entering a loop (with a while) rather than test it at the end of a loop (as with the do-while).

Small-C, and Small-C+ both suffer from one omission that will cause you to stand on your head from time to time (might help your circulation). The compiler does not support the unary not (!) operation. So, for example, when you would like to test for the negation of some condition, and would like to have written:

```
if (!condition-name) a = a + 32;
```

you will have to write:

```
if (condition-name);
else a = a + 32;
```

Documentation

The 9 pages of documentation on disk is a little thin. Users of this package should look up the original articles on Small-C which appeared in Dr. Dobbs (Issues 45, 48, and 52). These articles provide the background you need to feel comfortable with Small-C+ (and Small-C).

Ease of use

The following are two of the options that you can specify when you run the compiler.

The first option tells the compiler to

interleave the C source (as comments) into the assembler language output file, so you can see the code generated by your C statements.

The second option (my favorite) instructs the compiler to stop at each error. (No more wondering about those things flying up the screen.)

Code size

This is a single-pass compiler, which means it will generate larger and probably less efficient code than a two-pass (optimizing) compiler. Inefficiencies like "store from" followed by "load to" the same register are possibilities, but the compiler isn't totally ignorant about generating good code.

Code quality

Even if you are an ace assembly programmer, you might pick up some good ideas from the code generated by this compiler (true of Small-C, its parent also).

General comments

Ron Cain did a tremendous service to the small computing community with his public gift of Small-C. Everyone who uses a C compiler on a micro has been affected by his contribution.

If you're going to be doing anything with C you ought to start with with at least this version of Small-C. Small-C+'s extensions and maturity are a significant advantage over the original.

Benchmark Results

Compile Time	29 sec
Assembly Time	22 sec
Link Time	22 sec
Run Time	
-Original prog	54 sec
-Static Var	32 sec
Object File Size	14,848

■ ■ ■

Q/C (V 1.1)

Reviewed by Bill Randle
19585 SW Martin
Aloha, OR 97007

Published by–	Quality Computer Systems
Distributed by–	The Code Works Box 550 Goleta, CA 93116
Price–	$95.00
Memory Required–	Greater than 48K

The Quality Computer Systems C compiler (Q/C) is an extension of the Small-C compiler. It has added several features over Small-C and includes an optimization phase and an excellent run time I/O and support library. The compiler generates assembly language output for either the Digital Research ASM/MAC or Microsoft M80 assembler.

Strengths

The main strengths of the Q/C package lie in three areas: the added features which make it much closer to 'standard' C, the very complete I/O and function library, and the excellent documentation.

Bob Broughton also took a look at this

(continued next page)

C at a Glance

The following table is by no means an exhaustive list of the facilities of each package (it does not include the library, for instance) but should present a reasonable overview.

Version	Sm-C	Sm-C+	Q/C	C80	SuprS	BDS C
Unary/Binary op						
Most	x	x				
All			x	x	x	x
Arrays						
One dim.	x	x				
Multi-dim.			x	x	x	x
Data types						
Char	x	x	x	x	x	x
Short			x			
Int	x	x	x	x	x	x
Unsigned				x	x	x
Pointers	x	x	x	x	x	x
Long						
Float						
Double						
Extern			x	x	x	x
Static			x	x		
Register			x	x	x	
Structure				x	x	x
Union						x
Initialize				x		
Casts					?	
Program Control						
if	x	x	x	x	x	x
if-else	x	x	x	x	x	x
for		x	x	x	x	x
while	x	x	x	x	x	x
do-while		x	x	x	x	x
switch		x	x	x	x	x
break	x	x	x	x	x	x
continue	x	x	x	x	x	x
return	x	x	x	x	x	x
return (exp)	x	x	x	x	x	x
goto			x	x	x	x
Preprocessor						
#define/undef	x	x	x	x	x	x
#include	x	x	x	x	x	x
#ifdef/ifndef				x	x	x
#if/else/endif				x	x	x
#asm/endasm	x	x	x	x	x	
Compiler output						
ASM/MAC	x		x	x	x	
M80/L80		x	x	x	x	
Object						x
Comp. Source	x	x	x			
Price	$20	$24	$95	$50	$200	$150

version and he commented, "Beyond the compiler, the best thing about Q/C is the documentation. It is complete, and written in a delightful style that I really envy. It's super."

"Plus the compiler lends itself well to serious program development. Because of the reasonably complete set of utilities and library functions, you can get to work right away after opening the box," he noted.

The function library includes many data conversion routines, type checking, string manipulation, and system functions.

The I/O library includes all the standards such as getc, putc, fopen and fclose, and so on for pages. It's incredibly complete.

The run time library is available as a .REL file which means that only the routines actually necessary are linked in to the object file. This keeps the file down to a reasonable size.

Weaknesses

The counterpart of the malloc (memory allocate) function "free" is not provided. This means that allocated memory space cannot be freed up to use over again. Once allocated, that's it.

Documentation

The documentation supplied with Q/C is an 88 page User's Manual with a one-page update for version 1.1. The manual is very well written and is divided into four chapters and three appendices. The chapters titles include, "Getting Started . . . Fast," "Using the Q/C Compiler," "Q/C Library Functions and Compiler Operation." The appendices include the differences between Q/C and full-blown C, Q/C Error Messages, and a Sample Compiler Output. The manual does not try to teach you the C language, however.

For a new user, chapter 3 which covers the library functions has a detailed description of each routine, its calling sequence and what is returned. For the expert who wants to go in and modify the compiler, the chapter on Compiler Operation provides the details of what's going on, including the structure of the symbol table and other goodies (this package includes the compiler source written in Q/C).

The manual, although not typeset, is well formatted and attractive.

Ease of Use

The compiler accepts arguments on the command line. Included in the options are: choice of assembler, including C source in the assembly output and so on. A run time trace option is particularly handy when debugging new programs.

It announces on the screen when entering and exiting each function (subroutine). The +label# option allows specifying the starting label number for internally generated labels. This is useful for compiling programs in sections and linking them together later with the linker.

Code Size and Quality

The code is somewhat smaller and faster than Small-C since Q/C does some optimization. The compiler library functions set or reset the zero flag in the processor as well as returning a zero or non-zero value. This allows a quick check of the zero flag rather than testing the HL registers for zero. Register use in general is also optimized over standard Small-C. The total program size is larger, however, because of the size of the library.

Conclusions

The Q/C compiler is a vast improvement over the original Small-C compiler. The additional features, the enhanced I/O library and the excellent documentation make this package ideal for substantial programming in C.

Benchmark Results

Compile Time	27 sec
Assembly Time	21 sec
Link Time	62 sec
Run Time	
-Original prog	49 sec
-Static Var	26 sec
Object File Size	15,744

■ ■ ■

C/80 (V2.0)

Reviewed by Andy Crump
3150 SW 180th Place
Aloha, OR 97006

Publisher–	The Software Toolworks 14478 Glorietta Dr Sherman Oaks, CA 91423
Price–	49.95
Memory Required–	48k CP/M

Walt Bilofsky has been giving the software market place fits with his low prices on quality software. It's obvious that C80 Version II is a significant addition to the C marketplace, but at $50, it looks like he's raising more fits.

Strengths

1. Initializers on declarations.
2. Conditional compilation.
3. Runtime command arguments including I/O redirections.
4. Conventional C I/O library.
5. Random access file I/O.
6. Dynamic storage allocation.
7. Runtime execution profile facility.
8. Selectable Microsoft Macro-80 compatibility
9. For CP/M, C/80 also comes with an absolute assembler.

Weaknesses

C/80 does not support floating point, and function calls must have the same number of arguments as the called functions. Also, declarations are only allowed at the start of a block.

Documentation

The manual (35 pages with index) assumes the reader is an experienced C programmer. It refers new C'ers to *The C Programming Language* by Kernighan and Ritchie.

The manual includes information about the I/O library, tricks for better programs, and some on the internals of the compiler. The list of compiler error messages also provides an explanation of possible causes for the errors.

The documentation is brief but concise. I don't feel that anything was left out, but it was obviously written for experienced programmers. I like the manual, but then I like the UNIX reference manual too.

Ease of use

The compiler is easy to use but still provides many options. The default options are very reasonable for normal program compilation. All the utilities such as the profiler and tracer were easy to use.

Code size–Code quality

There is approximately 2k added to the code for basic runtime facilities, but I think this is quite acceptable. The code actually generated is relatively efficient compared to other C compilers for the 8080 that I have seen. The 2K of additional overhead includes redirection of I/O which is VERY nice.

The bench mark run time is a good judge of code quality and C/80 runs very fast. The stack looks like it is being handle very much like Small-C which is not surprising since C80 is based on Small-C. The compiler can intersperse the C statements as comments in the assembly code and I really like this feature. Some of the internal labels could be named more consistently and a symbol table (in .SYM format) would be nice for use with Digital Research's SID.

General comments

This compiler for the C language is a very nice implementation for the 8080 CP/M system. It can generate M80 code or code for it's own assembler which is nice flexibility. I couldn't find any errors in the compiler but I only had time to try it out with a few programs.

It is one of the few C compilers for the 8080 that will run in a 40k TPA. The features that are not supported in C/80 are not really necessary for most systems programming or game development.

I would buy this compiler for all the above reasons plus the fact that hand optimizations can be performed on the assembly language code. I like this compiler and will use it for much of my systems development. *(Editor's note: Up until now, Andy has been an outspoken BDS C supporter.)*

Benchmark Results

Compile Time	21 sec
Assembly Time	17 sec
Link Time	29 sec
Run Time	
-Original prog	25 sec
-Static Var	25 sec
Object File Size	11,520

■ ■ ■

Supersoft C (V 1.1)

Reviewed by
Robert S. Broughton
Box 5191
Beaverton, OR 97006

Publisher–	Supersoft, Inc. PO Box 1628 Champaign, IL 61820
Price–	$200
Memory Required–	Greater than 48K

Supersoft C is the most expensive package in this review, and as such bears close scrutiny. It has been available for over 8 months but this version arrived just recently. The earlier versions have had more than their share of bugs.

Strengths

The two-pass compiler-optimizer is one of SuperSoft's strengths. The other is its ability to compile for either Digital Research or Microsoft assemblers.

Weaknesses

I would have liked to stop execution of the compiler by using control-c, but the compiler never checks the console for this. If you want to interrupt, it's necessary to reboot.

Also, error messages just fly by on the screen, because you have no provision for halting at the first error. *(Editor's note: The documentation does not define any of the error messages so you aren't missing very much.)*

There were lots and lots of multiply defined globals in the link step. Fortunately the linker ignores the redefinitions, but it does clutter up several screens with this garbage.

I probably should have removed or commented out the #include references to files that were already in the relocatable library.

Documentation

The 76 pages of documentation tried to cover the subject but it took several readings before I could follow what it was trying to say.

This appears to be a complex product but much of that complexity would disappear if the manual had been written by someone familiar with the compiler and with the English language. Plus, it contains some obvious contradictions.

(continued next page)

C Reviews

C COMPARE COMPILERS

New C/80 2.0 gives you all three: features, performance and price.

Compiler	Compiled Program Size (Bytes)	Loaded Size (with runtime support)	Compile and Load Time (secs)	Execute Time (secs)	Price
C/80 2.0[1]	**313**	**3181**	**90**	**24.8**	**$ 49.95**
Aztec C[1]	378	4657	139	33.0	$135
BDS C 1.44[1]	305	3696	54	44.0	$150
Supersoft C[3]	300	2500	92	26.0	$200
Tiny-c 2 Compiler[2]	(4)	(4)	96	930	$250
Whitesmith C[2]	290	7384	242	15.6	$750

Performance Comparison Using Benchmark Program Published in BYTE, September 1981

[1]Our results on 4 MHz Zenith Z89 with 8" disks.
[2]Results reprinted by permission from September 1981 BYTE; ©BYTE Publications Inc.
[3]From information sheet provided by manufacturer.
[4]Figures not available.

The new C/80 compiler, Version 2.0, supports **all** C language features except float, long, typedef, bit fields, and arguments to macros.

C/80 2.0 is available in disk formats for Heath/Zenith (HDOS & CP/M*), Osborne 1* and 8" standard CP/M systems. Price is $49.95; add $3 shipping ($2 for 5" disks); in CA add tax. Phone orders welcome.

*CP/M is a registered trademark of Digital Research. Osborne 1 is a registered trademark of Osborne Computer Company.

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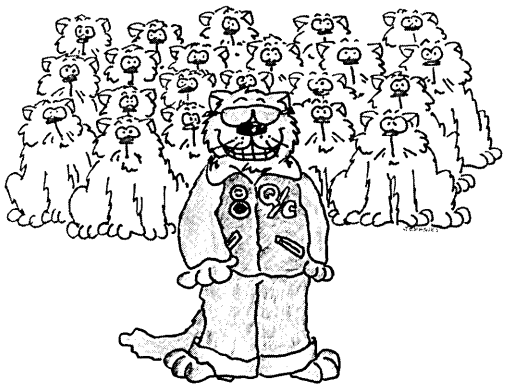

Q/C leads the pack of C compilers for CP/M. For only $95 you get an excellent compiler that is fully supported. And Q/C includes the *full source code* to the compiler! The 88-page manual sets standards for readability and clarity. (There is even a chapter on compiler internals.)

Get in front of the pack: write for details of the new Version 1.1 of Q/C.

THE CODE WORKS

5266 Hollister
Suite 224
Santa Barbara, CA 93111
(805) 683-1585

CP/M is a trademark of Digital Research.

For instance, at the beginning of chapter 4 it talks about adding your own code to the runtime file. "The advantage of doing this is that operational routines need not be recompiled and re-optimized each time the program is recompiled."

Later in that chapter it talks about the functions you have just added to the runtime file. "However, you will always be compiling in these functions whether you want them or not."

Ease of use

The options for the command line are many, but not many would be required for normal use. The submit file listed in the documentation substantially reduces the effort.

Code size

Even a short source program can generate quite a large intermediate file and com file.

I should note that this compiler was only reviewed using the Microsoft assembler and linker. There wasn't room on an 8" single density disk to compile more than the smallest program for Digital Research's ASM or MAC.

On medium size programs you should expect to see 'cannot write, disk full' type error messages even when using M80.

Code quality

One of the good features of this compiler is its two-pass compiler-optimizer combination. With a peephole optimizer of this sort, the compiler can easily reduce the code size by twenty-five percent.

General comments

Would I buy it? Probably not, especially as a first version of C. Only after running to the limit of Small-C would you appreciate a C compiler that's as close to K&R (mentioned above) as this one. This compiler does have structures and records and these features are important for professional use.

Benchmark Results

Compile Time	66 sec
Assembly Time	21 sec
Link Time	85 sec
Run Time	
-Original prog	34 sec
-Static Var	20 sec
Object File Size	28,288

■ ■ ■

BDS C (V 1.46)

Reviewed by Andy Crump
3150 SW 180th Place
Aloha, OR 97006

Publisher–	BD Software
Marketed by–	Lifeboat Associates 1651 Third Ave New York, NY 10028
Price –	$150
Memory Required –	32k CP/M

When he wrote BDS C and priced it at about one-quarter the going rate for Whitesmith's C, Leor Zolman made a major contribution to the layman's access to C. Over the years BDS C has become a true institution in the C community and has provided a first exposure for many now-experienced C hackers.

Strengths

BDS C features the following:

1. Conditional compilation.
2. Runtime command arguments including I/O redirections with special I/O packages.
4. Random access file I/O.
5. Dynamic storage allocation.
6. Comes with an relocatable assembler good only for use with the compiler.
7. Generates fast and small code.
8. Can generate ROMable code.

Weaknesses

BDS C supports only a limited number of data types, and function calls must have the same number of arguments as the called functions.

Documentation

The 175 page manual includes the Users guide, the handbook, an I/O tutorial, telnet manual (modem program), and bug fixes. This is a very complete document and is very helpful. It includes a list of common mistakes which is helpful for the beginning programmer.

The manual is delightfully written and experienced hackers find portions of it absolutely hilarious. It also includes lots of examples of compilations and techniques.

However, the manual has no index. It would be nice to have an index to the Standard Library functions for quick reference. Organization and packaging of the manual could be a lot better.

Ease of use

The compiler was easy to use even though it provides many options. The defaults are very reasonable for normal program compilation and rarely did I ever have to add a switch to do what I wanted. The compiler is quite fast because it is written in assembly language.

Code size

There is approximately 2k added to the code for basic runtime facilities, but I think this is acceptable. The code actually generated is relatively efficient compared to other C compilers for the 8080. In fact it is the best that I have seen in any C compiler under $200.

Code quality

This is difficult to say much about the code quality because BDS C produces a relocatable object module rather than assembly code. However, it must be good though since the .COM files are small and the code runs fast.

General comments

I personally think this is the best C compiler on the market for the money. It produces small and efficient code, and though you can't hand optimize, the compiler does a pretty good job. Besides who really wants to do hand optimization every time you compile a program. The compiler runs on small CP/M systems (unlike most of the C compilers on the market).

I use BDS C most of the time for my systems programming. There is a lot of software out there written for BDS C, including the Mince editor which I'm using to write this review. The C USER's GROUP maintains public domain BDS C programs for distribution.

I can also transport BDS C programs to UNIX version 7 on a PDP 4/70. This extends the power of my micro so that I can do development at home and run it at work or vice-versa.

Benchmark Results

Compile time	19 sec
Link time	15 sec
Run Time	
-Original prog	42 sec
-With -o compiler switch	27 sec
-Static variables and -o	15 sec
Object File Size	3456
-With -o compiler switch	3584

Note, this is the only compiler reviewed which allows speed optimization (-o compiler switch) by putting all code inline rather than using calls. Notice that the object code is slightly larger.

■ ■ ■

USER'S SOFTWARE

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Condor III (relational, w/ report writer)		995.00	735.00
Digital Research			
MAC (macro assembler)		90.00	78.00
ZSID (symbolic debugger for Z80)		100.00	86.00
PL/1-80		500.00	431.00
CBASIC 2		150.00	105.00
CB 80 (true compiler for CBASIC 2)		500.00	431.00
PASCAL MT+ VERSION 5.5		475.00	409.00
Ecosoft Microstat (advanced statistics)	+	295.00	255.00
Supervyz (simplifies CP/M)		95.00	62.00
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per module		600.00	443.00
interactive-per module		1000.00	738.00
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Level III (fed./partnership)		750.00	462.00
Micro Pro			
WORDSTAR (most popular word processor)		495.00	304.00
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WORDSTAR/MAILMERGE		645.00	396.00
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Macro 80	200.00	160.00
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Northwest Analytical Statpak	495.00	366.00
Oasis "The Word" (spell check & dict.)	75.00	56.00
"The Word Plus"	150.00	111.00
Sorcim Pascal/M	395.00	292.00
Supercalc	295.00	218.00
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Ratfor (Fortran Language Enhancer)	100.00	80.00
Tiny Pascal	85.00	68.00
Nemesis	40.00	32.00
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Crosstalk (Modem to CP/M file)	150.00	111.00
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Adventure International #1-12	129.00	96.00
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USER'S SOFTWARE 7812 White Oak Ave., Northridge, Ca. 91325

(Letters continued)

Dear Editor,

Just for the record, my Big board runs perfectly at 5 MHz with Z80A parts. (See issue #4 page 9 for the 5 MHz modification.)

Nelson Lewis
1005 Don Rovin Ln
Farmington, NM 87401

Dear Editor,

The following are my conclusions about Supersoft C and C/80 after putting both to substantial use.

Supersoft C appears to be a relatively complete version of C but many of its "features" are missing (including casts and sizeof). There are MANY significant bugs (including numerous new ones in version 1.1). Overhead is very high and if you don't have M80 and L80, look out! Using ASM, makes assembly source files 100K and up. The documentation is verbose and crucial information is often imbedded in thick text. Also, there is no index.

I have called Supersoft approx 1,000,000 times and their technical staff is reasonable though they usually just admit that a bug exists. I was once told that the compiler was a dynamic project and was stabilizing (who are they kidding). They also sell a floating point BCD package for $300 but it comes with no, none, zero documentation!

You may have detected my displeasure with Supersoft. I would recommend them to nobody.

C/80 is another story. It is very affordable—generates fast, compact code—has profile and trace for debugging and optimizing—has great error messages—and compiled programs support redirectable I/O.

Its weaknesses include—no free()—some utilities are not compatible with M80 (not difficult to fix)—no scanf()—and printf() does not do justification.

C80 has a few bugs—two routines in clibrary.rel don't have declared entry points—error messages when declaring global or static unions (but they compile properly)—and static functions should not be declared global for M80.

The manual is easy to read and formatted like *The C Programming Language*. It has very nice description of the error messages and, surprise, an index.

This compiler is very easy to use, and generates small, fast code. It has a clever way of dealing with auto variables making register variables almost unnecessary. On one of my programs (9K of source), Supersoft generates 20K of object code—C/80 generates 7K.

My conclusion is that C/80 is a giveaway at $50. It is the best deal in a C compiler that I've seen and I've also checked out BCS C and Whitesmith's C.

Peter Baker
1954 Haultain St.
Victoria, BC Canada

Editor's note:

I had to rewrite the above C information as a letter to the editor because it arrived too late to incorporate into the C articles.

Peter's reviews were so well done and contained such a wealth of hands-on information that it's sad I had to condense them. Thanks Peter.

Dear Editor,

I thought I'd let you know how I connected my Heathkit H-14 printer to my Big Board.

The printer 'busy' signal is inverted and though Heathkit has a modification

(continued on page 14)

FORTHwords

Column by Hampton G. Miller

PO Box 816
Carpinteria, CA 93013

Since Arne wrote UNIFORTH, he should be the world authority on it. So I'll let him pass on many wonderful things to us about that version of FORTH. Which leaves me in the not-too-uncomfortable position of being the champion of ROM FORTH (RF). I have quite a debt to the FORTH Interest Group and this gives me some opportunity to work it off.

In this column we will look at disk I/O error recovery and turn-key operation of ROM FORTH.

Disk Errors and PFM

Disk errors are a fact of life—everything wears out. However, the system can usually recover from disk read errors by retrying the read a few times. PFM does a couple of retries automatically before returning an error code but after a few years of "polishing," heads begin to lose their ability to read disk data. *(Editor's note, Hampton's drives have suffered through more than their share of Maxell disks.)*

This is a progressive problem. Lower signal amplitude means higher error rates, which means more retries, which means more disk and head wear, which means lower signal amplitude . . .

PFM retries only twice before giving up, and this isn't always sufficient. Unfortunately, some programs assume that PFM is magic and that disk errors will never happen. Or, if errors do happen they throw up their hands and give up.

An example is ROM FORTH (RF). After PFM fails on the third read, it returns an error status to RF which promptly dumps the status report on the floor and continues on as if nothing happened. This can sometimes result in a buffer full of "@"s instead of data. To make matters worse, FORTH may later try to write this bogus data over the original (but hard to read) data.

Remedies:

At RW3 + 4 replace

```
        LD      HL,RETRY
        DEC     (HL)
        JR      NZ,RW4-$
        OR      A
        RET
```

With

```
LD      A,7     ;DING!
        CALL    CONOUT
        NOP
        NOP
        NOP
```

This will retry forever, or until you are dingy from listening to the bell. A more elegant solution is:

At RW1 + 1 replace

```
    LD    (HL),2   ;TWO RETRIES
```

With

```
    LD    (HL),0   ;256 RETRIES
```

This will give you 256 blessedly silent retries. If you need more retries than that, it's time to clean or replace the heads.

Another option, of course, would be to return the error status to the FORTH program and let it decide how to proceed. (Are you listening ROB?)

Turn-Key FORTH

You've just finished loading a 200-screen FORTH program which took a while. Now what? Wouldn't it be nice if you didn't have to load it again every time you brought up the system? Well, you don't have to.

Listing #1 is a new floppy bootstrap. It loads the first 64K from the drive into RAM, restores the Z80 stack pointer, restores the processor's status from the

```
Screen 187
0  ( Z80 Machine Code for CLONE definition ) HEX
1  CREATE (CLONE)
2     D1 C,      ( POP DE         ; BUFFER ADDR )
3     C5 C,      ( PUSH BC        ; SAVE FORTH IP )
4     D5 C,      ( PUSH DE        ; FOR LATER RESTORE )
5     21 C, 0000 , ( LD HL,0      ; COPY STARTING AT ZERO )
6     01 C, 0104 , ( LD BC,104    ; FIRST HALF PAGE PLUS SP LOC )
7     ED C, B0 C,  ( LDIR         ; COPY IT TO SAFETY )
8
9     CD C, F01E , ( CALL HOME    ; FOR MONEY? )
10    0E C, 01 C,  ( LD C,1       ; SECTOR ONE )
11    21 C, 0080 , ( LD HL,0080   ; BUFFER ADDRESS )
12    CD C, F024 , ( CALL READ    ; LOAD THE BOOT BLOCK )
13    3A C, F025 , ( LD A,REAVCT+1 )
14    F5 C,        ( PUSH AF      ; SAVE IT FOR LATER RESTORE )
15 -->
```

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```
Screen 186
0  ( 3X5 Clone routine )
1  260 CONSTANT ANTSIZE
2  0 VARIABLE antsave ANTSIZE ALLOT
3
4  : clone
5     FLUSH EMPTY-BUFFERS
6     CR ." Remove data diskette and insert system diskette."
7     CR ." Type RETURN when ready..." query
8     ANTSAVE (clone) CR
9     CR ." Remove system diskette and insert data diskette."
10    CR ." Type RETURN when ready..." query CR ;
11 ;S
12
13
14
15
```

```
Screen 188
0  ( Z80 machine code for CLONE definition, continued )
1     3A C, F028 , ( LD A,WRTVCT+1 )
2     32 C, F025 , ( LD REAVCT+1,A )
3     CD C, 0083 , ( CALL SAVE    ; WRITE OUT RAM )
4     F1 C,        ( POP AF       ; READ VECTOR OLD VALUE )
5     32 C, F025 , ( LD REAVCT+1,A )
6     E1 C,        ( POP HL       ; GET FROM ADDR )
7     11 C, 0000 , ( LD DE, 0     ; GET TO ADDR )
8     01 C, 0104 , ( LD BC,104    ; LENGTH )
9     ED C, B0 C,  ( LDIR         ; COPY IT BACK )
10    C1 C,        ( POP BC       ; RESTORE FORTH IP )
11    C3 C, 002C , ( JP NEXT ) SMUDGE DECIMAL ;S
12
13
14
15
```

stack, and then returns to the caller.

Who called it? You did, of course, when you saved the entire contents of RAM onto the disk. Screen 186 contains the FORTH program to do that. Screens 187 and 188 contain a machine code assist routine.

The bootstrap has 2 entry points. PFM loads it at 0080H and jumps to it there. This causes the bootstrap to load the saved RAM image from disk. The second entry point is 0083H and is called by the machine code assist routine. This entry pushes all the Z80 register onto the stack before running the rest of of the bootstrap code. Thus you'd expect the 0083H entry to load the contents of RAM just like the 0080H entry, but it doesn't, it dumps RAM onto the disk.

The machine code assist routine changes the system slightly before calling 0083H. First, it pops the address of the data save area, stacks the FORTH Instruction Pointer(IP), and then restacks the data save address for safekeeping.

It moves the data from the area where the bootstrap will reside and copies the bootstrap loader into the area. Finally it changes the PFM read command to a write command (thus a read now does a write) and writes the RAM image out to the disk.

When execution reaches the RESTORE routine it doesn't matter whether we have just saved the contents of RAM or just restored them. RESTORE returns the machine to its original state including returning to the FORTH word which called the whole thing.

Caveats!

The routines as shown do not save the interrupt status of the Big Board. Also, they are being used on a single-drive system. I have made no attempt to select drive zero before merrily wiping out the first several tracks of data. You might also note that PFM is not copied out to the disk but that ROM FORTH is copied. Anyway, once you have done all this, you will be able to turn on your system, stick in your disk, type "B," and have both ROM FORTH and your application available immediately. Once this is set up, you can remove the ROMs that contain FORTH and still have full use of the language.

(continued next page)

```
                ;  BIG BOARD "SNAPSHOT" BOOTSTRAP BLOCK
                ;       HAMPTON G. MILLER       25-MAY-82


                ;  PFM VECTORED ROUTINE ADDRESSES
F00C            CONOUT  =       0F00CH
F01E            HOME    =       0F01EH
F021            SEEK    =       0F021H
F024            READ    =       0F024H


                ;  "PUBLISHED" ADDRESSES
0100            SAVESP  =       0100H

                ;  BOOT GETS LOADED HERE
0080                    $ = 080H


                ;  BOOTSTRAP ENTRY POINT
0080  C3  0099          JP      LOAD

                ; "SAVE" ENTRY POINT - SAVE MACHINE STATE
0083  F5                PUSH    AF
0084  C5                PUSH    BC
0085  D5                PUSH    DE
0086  E5                PUSH    HL
0087  08                EX      AF,AF'
0088  D9                EXX
0089  F5                PUSH    AF
008A  C5                PUSH    BC
008B  D5                PUSH    DE
008C  E5                PUSH    HL
008D  DD  E5            PUSH    IX
008F  FD  E5            PUSH    IY
0091  21  00B6          LD      HL,RESTORE      ; PUSH ADDRESS FOR RETURN TO RESTORE
0094  E5                PUSH    HL
0095  ED  73  0100      LD      (SAVESP),SP     ; STORE STACK POINTER AT PUBLISHED ADDRESS


                ;  EVERYBODY WINDS UP HERE . . .
0099  CD  F01E      LOAD:   CALL    HOME            ; START AT THE BEGINNING OF THE DISK
009C  01  0002              LD      BC,00002H       ; LOAD DISK CONTENTS INTO MEMORY, VERBATUM
009F  26  00                LD      H,0             ; START WITH ADDRESS 0
00A1  2E  00        LOOP:   LD      L,000H          ; DO LOWER HALF OF PAGE
00A3  CD  00C5              CALL    XFER
00A6  2E  80                LD      L,080H          ; NOW DO UPPER HALF
00A8  CD  00C5              CALL    XFER
00AB  24                    INC     H               ; POINT TO NEXT PAGE
00AC  7C                    LD      A,H
00AD  FE  F0                CP      0F0H            ; PFM?
00AF  20  F0                JR      NZ,LOOP         ; NO, KEEP GOING

00B1  ED  7B  0100          LD      SP,(SAVESP)     ; GET THE STORED STACK POINTER
00B5  C9                    RET                     ; AND RETURN TO "RESTORE"

    ;  RESTORE MACHINE STATE AND RETURN TO "CALLER"
00B6                RESTORE:
00B6  FD    E1              POP     IY
00B8  DD    E1              POP     IX
00BA  E1                    POP     HL
00BB  D1                    POP     DE
00BC  C1                    POP     BC
00BD  F1                    POP     AF
00BE  08                    EX      AF,AF'
00BF  D9                    EXX
00C0  E1                    POP     HL
00C1  D1                    POP     DE
00C2  C1                    POP     BC
00C3  F1                    POP     AF
00C4  C9                    RET

                ;  TRANSFER 128 BYTES BETWEEN DISK AND RAM
00C5  E5            XFER:   PUSH    HL              ; SAVE MEMORY ADDRESS
00C6  C5                    PUSH    BC              ; SAVE TRACK, SECTOR
00C7  CD  F024              CALL    READ            ; GET ASSIST FROM PFM...
00CA  16    3F              LD      D,'?'           ; TRANSFER ERROR WINS "?" ON TERMINAL
00CC  C4  00E6              CALL    NZ,OOPS         ; (CONDITION CODES FROM READ ARE STILL VALID)
00CF  C1                    POP     BC              ; RESTORE TRACK, SECTOR
00D0  0C                    INC     C               ; STEP SECTOR NUMBER
00D1  79                    LD      A,C             ; (GET SECTOR NUMBER FOR COMPARE)
00D2  FE    1B              CP      01BH            ; FINISHED TRACK?
00D4  20    0E              JR      NZ,10$          ; NO, JUST EXIT ROUTINE
00D6  0E    01              LD      C,1             ; YES, RESET SECTOR NUMBER
00D8  04                    INC     B               ; AND STEP TRACK NUMBER
00D9  C5                    PUSH    BC              ; (PRESERVE FROM PFM)
00DA  48                    LD      C,B             ; PUT TRACK NUMBER IN C
00DB  CD  F021              CALL    SEEK            ; GET ASSIST FROM PFM...
00DE  16    2A              LD      D,'*'           ; SEEK ERROR WINS "*" ON TERMINAL
00E0  C4  00E6              CALL    NZ,OOPS         ; (CONDITION CODES FROM SEEK ARE STILL VALID)
00E3  C1                    POP     BC              ; RESTORE TRACK, SECTOR
00E4  E1            10$:    POP     HL              ; RESTORE MEMORY ADDRESS
00E5  C9                    RET


                ;  HERE UPON I/O ERROR.  FLAG CHARACTER IN D
00E6  7A            OOPS:   LD      A,D             ; COPY ASCII ERROR CHARACTER TO A
00E7  C3  F00C              JP      CONOUT          ; OUTPUT TO CONSOLE AND RETURN

                            END
```

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(FORTHwords continued)

The First Time

Since the routines copy the bootstrap code off the floppy, you have to get the bootstrap onto the disk before you try to save your RAM contents. I put the code in place by using PFM to load in the bootstrap sector "R0 0 1". Then I enter the data using the "M" command and then write the data back out by changing the read command by hand to a write command and again type "R0 0 1". DON'T FORGET TO RESTORE THE PFM READ VECTOR!

You're going to have to do this for every disk you want to use as a "system" disk. Just to be safe, I put a routine in my data disk bootstrap sectors which prints out a message saying that this is a data disk, not a system disk. (So they give me a message rather than a boot and thus do no damage.)

Future Columns

I future issues I will describe how to interface the Western Digital WD1000 Hard Disk Controller to the Big Board and ROM FORTH, how to use serial port A with the DC Hayes SmartModem, and how to read and write DEC format floppies with the Big Board. ■ ■ ■

(Letters continued)

for the printer, it is very difficult once the kit is together. So I found an unused inverter (U118) on the Big Board.

The printer busy signal comes into the Big Board on J3 pin 4 (RTS). I placed a jumper between JB5 pin 18 and U118 pins 9 and 10. I placed another jumper between U118 pin 8 and JB5 pin 17. Using this mod along with the program PR.COM on user disk #1, I have my little printer going as fast as its little pins can print.

Now I have another problem. My Big Board generates a lot of interference on channel 5 and on my FM radio and intercom. Any solutions?

Wayne Roberts
Box 178
Morse, Saskatchewan
Canada S0H 3C0

Editor's note:

Any computer operated in an unshielded, unfiltered environment will interfere with everything from your stereo to your false teeth. All those square waves racing about on the board are really multiples of odd harmonics that go on just about forever. This is why commercial computer manufacturers have such a difficult time reducing their EMI (Electro Magnetic Interference) to levels acceptable by the government.

Basically, you have to seal the whole thing up in metal. Be sure that all the metal cabinet parts make good electrical connection with each other and that there are no large holes. Shield the video output cable. Then bypass all lines (keyboard, RS232, but not the video out) going in and out of the cabinet with .001 ufd ceramic disc capacitors.

Connect the capacitors between the the line and ground, making sure you keep the capacitor leads as short as possible. Use a standard power line filter for the 110/220V and you should have it.

If you still have trouble, use a hand radio and move it around the system to locate the places that need additional shielding (all the cables may have to be shielded). The alternative, of course, is to become a hermit or let your youngest fix the TV.

■ ■ ■

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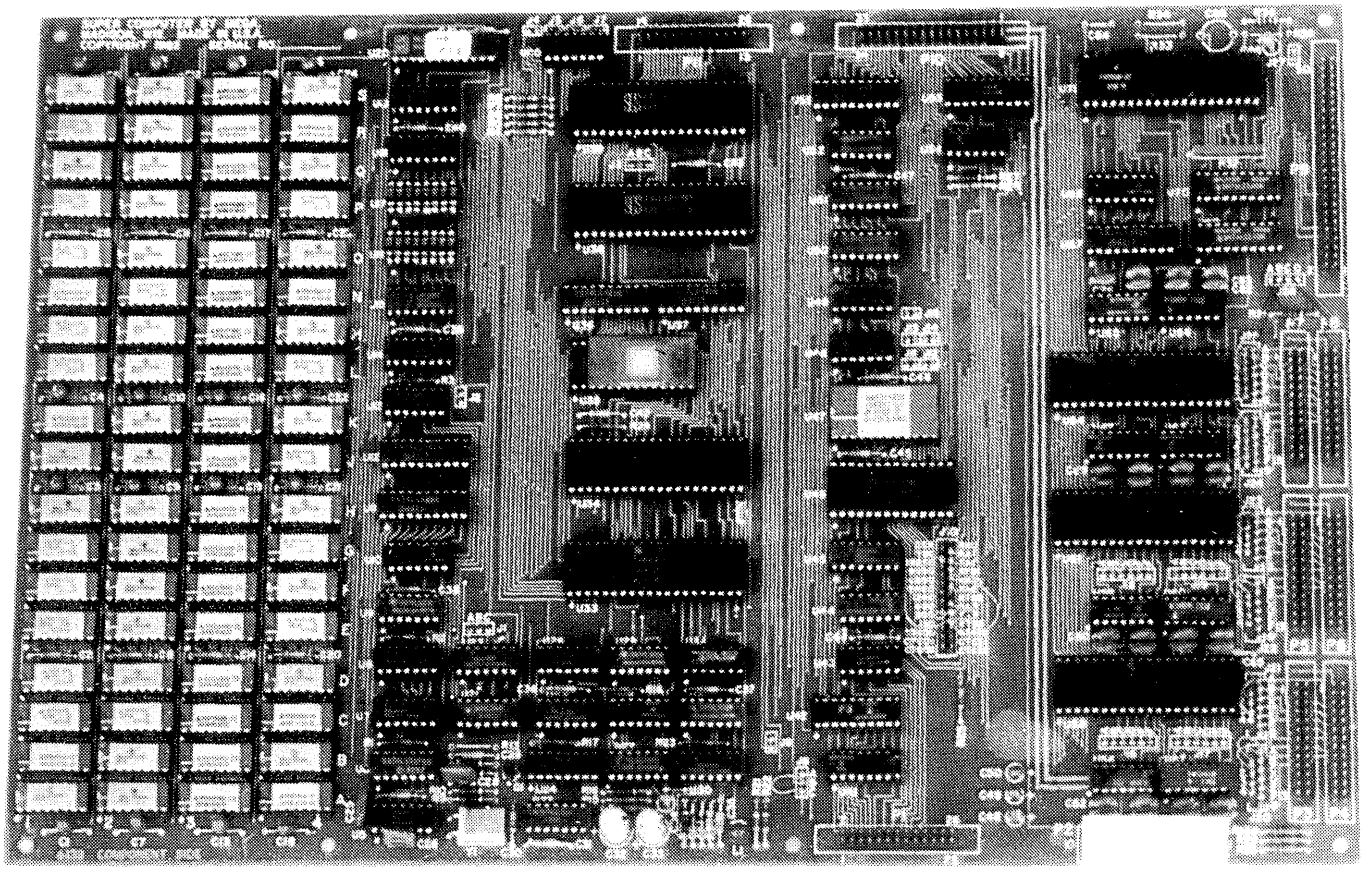

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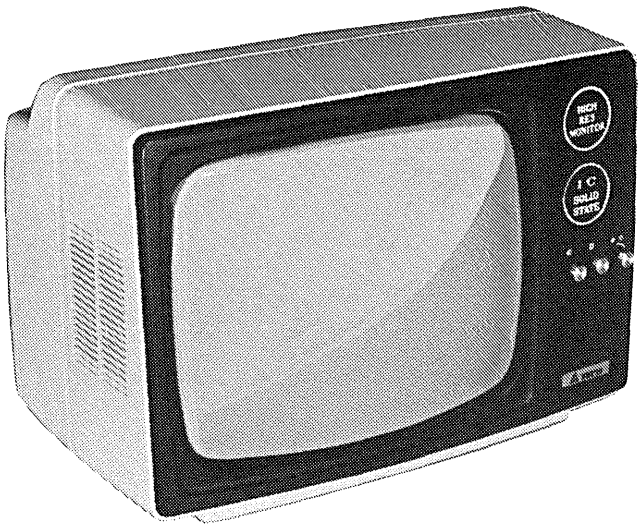

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Is Your Big Board in a State of Flux?

By David Thompson

I've got a project for all of you who hand-soldered your boards and didn't clean off the brown scungy residue. You need to clean your board.

That brown scungy residue is called flux. It is slightly acid to help clean the oxide off the parts you are soldering, however, it remains slightly acid forever and right now it is eating away at everything it's touching (that means your Big Board). If you listen closely you may even hear gnawing sounds.

There are special fluorocarbon-based flux removers that you can purchase, but I (and the rest of humanity) would appreciate it if you wouldn't use them. You see, any of these "innocuous" little cleaners you release into the atmosphere will spend the next 50 years doing a number on the ozone layer. The ozone layer filters out most of the ultraviolet radiation from the sun.

Fortunately, you can use good old isopropyl (rubbing) alcohol, even though it takes a little more effort (well worth it).

So go down to the local "five and dime" and get a BIG box of cotton balls and a pint (not a fifth) of alcohol. Now saturate a cotton ball etc. with alcohol and start rubbing. I usually work a small area at a time, making one pass over it to get it moist with the alcohol and then going back over it joint by joint until they all sparkle.

As you do this you have to keep turning the cotton so that you are really picking up the dissolved flux rather than just smearing it around. This is why you got a BIG box of cotton. Use it.

This is slow, uninteresting work, which makes it go well with Monday night baseball. In fact, a good extra-innings pitcher's duel narrated by Howard should leave you with an absolutely spotless board.

This also wouldn't be a bad project for any other equipment you have that's in a state of flux. ■ ■ ■

Adding 6K of RAM

By Christopher Brock

709 Gridley St
San Jose, CA 95127

If you are not using the last three ROM sockets, you can install 2716 compatible rams such as the Hitachi 6116. All it takes is one trace cut and one wire jumper.

Cut the trace on the bottom of the board between pins 21 and 24 of U67. This disconnects pin 21 of all the ROM sockets from the 5V line. Add a jumper from U59 pin 10 to U70 pin 21. This ties all the ROM sockets to the write enable signal. Now just plug in the 6116s. (The PFM ROM remains in U67.)

You can use PFM's memory test program to test this RAM. First lift out U111 and bend pin 7 out to the side before reinstalling. Now when you power up the system the lower 16K block is permanently switched out and you are in the ROM (and video RAM) bank.

Since PFM resides in the top part of memory, it signs on just like usual so you can use it to test the 6116s. Just for fun, you can also "F"ill locations 3000-3FFF (video RAM) with an ASCII character. (I'll bet you didn't know your video was so fast.)

When you are through testing and playing around, just return pin 7 of U111 to its rightful place. Now you can access this RAM anytime you set the bank select bit (bit 7 on the system PIO).

(Editor's note, this might be an interesting place to keep data that had just scrolled off the screen, so you could scroll back a screen or two during a 'TYPE' command etc.)

Inverted keyboard

Also quick comment about interfacing inverted keyboards. The Big Board has provision for inverted/non-inverted keyboard strobes but no provision for inverted keyboards. If you could replace U112 and U114 with non-inverting buffers that would take care of the problem. But the only pin-for-pin compatible replacements require pull up resistors. So I modified my PFM ROM. I changed location F499 from a 2F (complement A) to a 00 (no-op) and presto it worked. *(Beats typing upside down. Ed)*

■ ■ ■

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Technical Tips

The wires connecting your power supply to your system may be long enough that their inductance is allowing spikes to form at the system end (the -12V line is particularly bad). To clean up the problem, I added a 6 mfd 15V (or higher) tantalum capacitor from each DC pin on the power connector to ground.

Watch the polarity on the tantalums (remember that the minus lead goes to the supply on the -12V line). Tantalums usually have a '+' or paint stripe above the positive lead. Keep the leads as short as possible.

My scope shows that all the power is now quite clean. While I haven't seen problems resulting from trashy supplies, they could result in strange, erratic operation that would require a great deal of effort to diagnose. So, I figure the capacitors are pretty good insurance.

Frank Gentges
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Viewing 50 Hertz

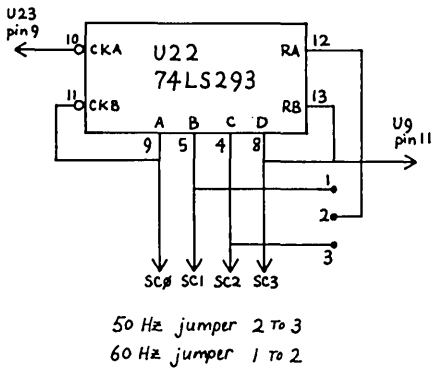
By Thomas Hameenaho

Djaknegatan 7
S-754 23 Uppsala
Sweden

Those of us living in the 50 Hz part of the world have a video wiggle problem even after changing to the new crystal. In fact, our problem is a 10 Hz wiggle produced by the beat between the 60 Hz vertical from the Big Board and our 50 Hz line frequency. Of course part of my problem might have been that I was using a modified portable TV.

So I took a close look at the video circuitry and found that U22 (74LS290) was used as a divide-by-ten. If I could change that chip to something that divided by 12 I would get 50 Hz.

The TTL data book indicated that a 74LS293 could divide by 12 so I removed the 74LS 290 from U22, and cut the run between U22 pin 3 and U22 pin 12 (top of the board). Then I jumpered U22 pin 4 to U22 pin 12 and jumpered U22 pin 8 to U22 pin 13 and plugged in the 74LS293.



Modified vertical sync generator.

Theory of Operation

The 74LS293 counts up until outputs C and D go high (binary 12). At this point the reset inputs restart the counter. If you want to change it back to 60 Hz, jumper U22 pin 12 to U22 pin 5 (instead of pin 4). Now it will count to 10.

Note: U96 is also a 74LS293 and it is the chip you remove when you do the standard 4 MHz modification so you might have a spare lying around.

Other Video Changes

I reduced the effective value of R25 (3.9K) to about 800 ohms by soldering a 1K resistor in parallel with it. This increased the size of the sync pulses which helped my monitor maintain sync. Plus, I removed C142 (33pf) to increase the sharpness of the characters. (You can also replace C142 with a small variable capacitor and then adjust it for the best looking characters.)

■ ■ ■

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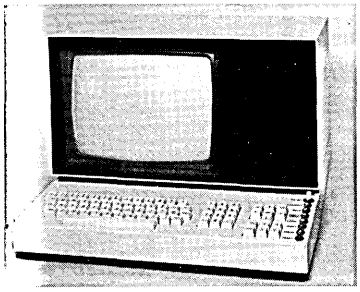

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ASCII Keyboard (used) with enclosure to match above monitor. 77 keys, 7 lighted pushbuttons, on/off sw. Requires 5 volts DC. Schematic included. Includes shift, tab, control and cursor control keys. Size; 19 × 4 × 5½.

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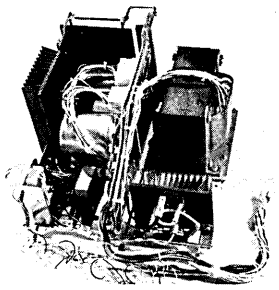
Modular power supply (missing regulator card) fits inside above monitor enclosure. Includes large transformer that outputs +8.5 volts @17 amps, +/−18 volts @1.5 amps each, +15 volts @ 1.5 amps (for monitor), three large capacitors (1-18kuf, 2-8kuf), 1−30 amp, 2−3 amp bridge rectifiers. The transformer and rectifiers/capacitors make a perfect unregulated SS-50/S-100 power supply. The schematic for the regulator card is available.



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(Editorial continued)

disks. (If you want long-life media and long-life heads, see issue #8.)

If you have more inside information or have had some good or bad experiences with Maxells or other disks, please drop me a note or call right away. We'll include your information in issue #8.

New Features

"Technical Tips" is a new regular feature replacing the Designer's Corner. I'm making this change for two reasons. First, most of the Designers Corners have been technical tips; and second, Frank Gentges sent in a disk containing 8 really spectacular technical tidbits. You'll see the first of these in this issue. (But don't be afraid to send in some of your own.)

"On Your Own" will cover a lot of the topics that I discuss with folks on a daily basis. This column will cover some of the business aspects of setting up and running your own computer-oriented mail order, designing, or consulting firm.

Fun

I have to admit that as much as I enjoy writing and editing and writing and editing and writing . . . into the wee hours of the morning, I also enjoy an occasional game of adventure.

Actually, there are many versions of adventure. My introduction to this sport was called Dungeons and it ran on a DEC 11-44. Dungeons was so large that only two users could play it at a time without bringing the machine to its knees.

If you think you might have an appropriately conniving, scheming, crafty, mind and if you accept the absurd as obvious, then you ought to either write for Micro C or check out the Adventure that DRC (of Texas) is selling for $29.95. (See the Adventure ad in issue #6.)

For those of you just starting in this field, a few tips. Maps or direction tables are invaluable (even the maze of 'passages all alike' is mappable if you drop the right hints in the right places). Also, keep track of the words the program understands. Even though a word might not do anything in your present situation, it will no doubt be useful sometime. Happy adventuring.

Also for $29.95

You can probably imagine my disbelief when I came across a full-blown Pascal Compiler for $29.95. I mean, a full ISO standard Pascal with 14 digit floating point, a very versatile linker, and a 130 page manual for less than the price of a Pascal MT+ manual!

I called Jim Tyson at JRT Systems Inc. and asked him if his compiler were really $29.95 or if his decimal place were having an "off by one" problem. (At $299.50 it still would have been the best deal on the market.) He verified the price and indicated that an earlier version had been on the market for $295, but he said that at $295, he couldn't compete with the big outfits with their big advertising budgets.

So he improved the product and cut the price by 90 percent.

All I can say is, hooray for the small entrepreneur. The folks who distribute Pascal M, Pascal MT+, and Pascal Z should be shaking in their three piece suits.

Happy Computing.

David Thompson
Editor & Publisher

On Your Own

By David Thompson

If Micro C seems like a strange place for a column on working for yourself, consider the following: most of you are engineers of one stripe or another, and most of you are already moonlighting to pick up some extra sheckles. So you are already working for yourselves.

Please feel free to contribute your ideas, experiences, and questions in this area. Also, let me know if you know about particularly good or bad information sources or opportunities in this area. This issue we'll talk about fees.

Charging for your services

As a consultant you should charge somewhere between three and four times what the job would pay if you were a full-time employee. You see, an employee who receives $12.00 per hour costs a company about $25.00 per hour figuring space, supervision, support, and benefits.

Plus:

1. A full-time employee is only about half as productive per hour as an independent contractor (coffee breaks, dental appointments, meetings, birthday parties, in-house battles, etc.)
2. The company has to keep the employee around even when there is a lull in the work load.
3. By using consultants, a company can get expertise for a project that it couldn't otherwise afford or expertise that it needs for only a short time. (This is especially important for small and startup companies.)

So, even at four times your normal wage you usually cost your client less per project than if the client added an employee. Plus, the project usually gets finished sooner.

There are some advantages and disadvantages to charging $40 and up per hour. The advantages include status and support.

For instance, if you ask for help drafting a schematic you'll get it. The client can't afford to pay you to do the drafting and he can't afford to have you sitting around.

Many new clients will try to dicker with you once you've told them the price. If they don't dicker then you've either come highly recommended or you're charging less than they expected. If they do dicker, be firm on your rate, you are basically telling your client that you are worth what you are asking. Also, no matter what price you set, some clients won't be satisfied, and others simply won't share more than the tiniest crumb with the person doing the work.

A local software outfit rummaged around for months trying to find someone who would write a standard CBIOS for $2,500. While they were rummaging, project completion slid farther and farther out and the end user was anxious. Meanwhile, the software outfit was charging the end user $25,000 for that CBIOS.

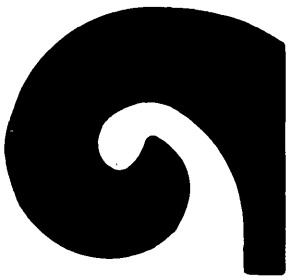
The fixed fee arrangement (can be lucrative if you know how to negotiate and estimate) is just one method companies use to minimize project expenses. Another way companies minimize expenses is by continually calling you on the phone for "a couple of quick questions" figuring you won't be charging them for that time. If it's a problem, tell them that you will be billing them for every minute after "hello" (and always say "hello" when you pick up the phone).

The fixed fee basis is particularly dangerous if there is any way for system requirements to change during the project. Any project you get involved with should be well defined from the beginning but when you contract for a fixed amount it should be spelled out absolutely to the letter. You or the client can still change the specifications during the project but do it by mutual written agreement only and make sure to include an adjustment of the fee in the negotiation.

All you're given in this world are time and smarts (and the resulting experience). If you want to give away your time and smarts and experience, that's fine, but know what you are giving away and at least make it a good cause.

Next issue we'll discuss how to make reasonably sure you get paid.

■ ■ ■



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DCU is the best solution for drive A.C. control.

Big Board owners no longer have to look for connectors,relays,and a place to put them. DCU comes complete with everything and is designed to be easily installed within all popular 8 in. drives.
DCU mounts on the disk AC connector and even energizes only on zero crossings.Aux output available for 2nd drive. (Big Board should have the CTC option)
Please order DCU/BB for Big Board systems,for all other systems order DCU and state type of drives and controller used in your system .

DCU is available in kit form for $18.95,or assembled $29.95.
For 30in. 2nd drive harness add $3.00

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TERMS:Include $1.50 for postage and handling.NYresidents add local tax. COD , Check or Money Order accepted.

For Sale

Bare Big Boards, parts, disk drives in stock.

Integrand 700DV vertical drive cabinet with power supply. Room for 2 or 3 drives & Big Board $275.

Stock horizontal drive cabinet with Borchert Power supply. Room for 2 horizontal drives and Big Board, $250.

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BIGBOARD 5 MEGABYTE WINCHESTER DISK

THE DUTCH CONNECTION IS READY

The **DUTCH CONNECTION** announced in the last issue of Micro Cornucopia will be in Portland on July 24th. Andy Bakkers of the Netherlands will be there to demonstrate and sell host adapters on the spot.

The **DUTCH CONNECTION** consists of a host adaptor PC board to connect your BIG BOARD PIØ output to an industry standard SASI (Shugart Associates Standard Interface) bus. You also get a CBIOS to integrate the Winchester disk with your CPM. And there are software utilities to system generate your new operating system; and utilities to check the disk hardware.

The price of The **DUTCH CONNECTION** is $239.50. This includes the PC Board, software and manual on an 8" floppy. Ribbon cable (40 wire with female end connectors) and shipping are extra.

You can get Winchester Drives and SASI standard controllers from a number of suppliers. The **DUTCH CONNECTION** as been tested with an XEBEC controller and a number of 6 megabyte drives. (XEBEC has advertised a controller and drive for $999.00.)

See it, try it, and buy it, at Portland on the 24th of July. Watch for dealer announcements in Micro Cornucopia.

Or order it direct from the North American importer:

Applied i

200 California Ave, Suite 205
Palo Alto CA, 94062 (415) 325-4800

Real Time Clock For Big Board Users $25.00

- ★ **No extra hardware required** - uses onboard Z80 CTC channels 0 and 1
- ★ **Easy setup of time and date**
- ★ **Allows timestamping of files and listings**
- ★ **Uses memory at EFOO - EFFF hex**
- ★ **Unix-like user interface through the use of CP/M .COM files** - no assembly language experience needed
- ★ **For CP/M 2.2 8" single sided, single density disk systems**

Programmer's Aid Package For CP/M Users $45.00

- ★ **Unix-flavored utilities** designed to make documentation and text processing easier
- ★ **Utilities include:** text formatter, "pretty" printer, file transliteration, word and character counting, file encryption/decryption and more - 9 programs in all
- ★ **For CP/M 2.2 8" single sided single density disk systems** - 48k RAM or more
- ★ **Users Manual only: $3.00** (refundable towards purchase)

To order, send check or money order for the appropriate amount to:

L.A. Software

6708 Melrose
Los Angeles
California 90038
213 / 932-0817

California residents add 6% sales tax
CP/M is a trademark of Digital Research
Unix is a trademark of Bell Telephone Labs
Copyright 1982 L.A. Software

Especially For The Big Board From Micro C

	US,CAN,MEX	Other Foreign
USER'S DISK #1	$15.00	$20.00

Over 200K of software especially for the Big Board.

Including:

1-Two fast disk copiers.
2-The manual for Small C+.
3-A Z80 assembler.
4-Two disk formatters.
5-Othello.
6-A serial print routine.
7-Modem software.
8-Documentation for all the above.

See issue #3, page 15 for more information about the disk. Also see "Using Modem7" in the same issue for information about configuring the modem software.

USER'S DISK #2	$15.00	$20.00

Especially for folks with single-drive systems and those who want to try their hand at extending an assembler. Also a new CBIOS with parallel printer interface. Returns to default drive on reboot, stifles head banging, supports CP/M 2.2 and 1.4. Step by step instructions for the simple incorporation into your CP/M (using only DDT and SYSGEN). CBIOS source also included.

Including:

1-Two single-disk copy programs, both with source.
2-The source of the Crowe Assembler.
3-New Crowe.com file with larger symbol table.
4-New CBIOS for CP/M 1.4 and 2.2 (& boot).
5-Disk mapper with source.
6-Documentation for all the above.

USER'S DISK #3	$15.00	$20.00

This is the disk for folks who are building Jim Monesmith's ROM programmer. Two versions of programmer software plus a disk file CRC checker. Also contains a sophisticated disk utility (DU77) and source for a substantially updated fast copy routine, plus more. (And documentation.)

Including:

1-Unmodified ROM programmer.
2-ROM programmer with CRC.
3-Disk file CRC checker.
4-Source of new fast copy.
5-Utility isolates bad disk sectors.
6-Reset bit 7 (unWordstar a file).
7-Print fancy page headings.
8-And more.

FREE

Your choice of either user's disk or the deluxe character ROM free if you send an article or software and a ROM or extra disk.

	US,CAN,MEX	Other Foreign
FORTH IN ROM	$65.00	$70.00
in fast ROM	$80.00	$85.00

Now, what you've all been waiting for—FORTH in ROM. This is standard FIG FORTH in three 2716's. FIG FORTH is standalone FORTH so you don't use CP/M at all. If you have disks, FIG FORTH handles the disk I/O. If not, you can still enjoy a most fascinating language. A simple FORTH line editor and a decompiler are available on disk.

FORTH editor & decompiler disk	$15.00	$20.00

TINY BASIC IN ROM	$35.00	$40.00
in fast ROM	$45.00	$50.00

This two-ROM set takes control of the system just like FORTH does, handling its own I/O, loading Basic programs and object code routines on and off the disk or out of the third ROM. This little Basic is great for controller and utility applications.

MORE ROMS

Fast monitor ROMs for speed freaks and our famous 'better than Texas' character ROM for screen freaks.

Fast Monitor ROM	$25.00	$30.00
Version 2.2 Character ROM	$25.00	$30.00

- Send Big Board number with monitor ROM orders.
- Monitor & char. ROMs $5.00 each if you send a fast ROM and a stamped, self-addressed return envelope.

BACK ISSUES(each)	$ 3.00	$ 5.00

Because of the demand from new subscribers (bless their hearts) we are keeping back issues in print.

ISSUE #1	ISSUE #2	ISSUE #3
Power Supply	Parallel Print	Four MHz Mods
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Video Wiggle	Shugart Jumpers	Safer Formatter
1/2 PFM.PRN	1/2 PFM.PRN	Reverse Video Cursor
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ISSUE #4	ISSUE #5	ISSUE #6
Keyboard Translation	Word Processing	EPROM Programmer
More 4 MHz Mods	Two Great Spells	Customizing Characters
Modems, Lync & SIOs	Two Text Editors	Double Density update
Undoing CP/M ERASE	Scribble, a Formatter	Terminal in FORTH
Plus More (20 pgs)	Plus More (20 pgs)	Plus More (24 pgs)

Screen Editor in Small C	$39.00	$44.00

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

They're Shipping!

On Saturday, July 9, I picked up the phone to hear a very excited voice cry "They've come, they've come!" (Fortunately Paul Revere gave better notice.)

Anyway, Cal-Tex is shipping the new system (now called the Big Board II) and there are suddenly a number of busy little parts collectors scurrying around collecting busy little parts. Such fun!

You can reach Cal-Tex at 780 Trimble Road, Suite 504, San Jose, CA, 95131. (408) 942-1424.

New From Micro C

The last few months I have been collecting books on "working for yourself." Most of them offer a few good ideas interspersed in a lot of filler but one two-volume set has an incredible amount of good, solid "start your own business" information.

They are called *Your Fortune in the Microcomputer Business* (sounds like one of those newspaper scams) but they're great.

Volume I covers selecting and starting your business while Volume II covers the nitty gritty details of keeping your enterprise going and growing.

Your Fortune in the Microcomputer Business

Prices $15.95 each plus $1.00 postage or $24.95 plus $1.50 postage for the pair.

Small-C+

Small-C+ is now available through Micro C. This is a simple, cleaned up version of Small-C with a some pretty neat extensions. For more information see the C reviews in this issue.

	US,CAN,MEX	Other Foreign
Price-	**$24.00**	**$29.00**

ANNOUNCING

DOUBLE DENSITY DISK INTERFACE FOR THE BIG BOARD

New floppy interface package for the Big Board lets you read and write single and double density disks with 128, 256, 512, and 1024 Bytes/sector.

The package includes:

1. Fully assembled and tested board, cable and connector to replace the 1771. Board contains 5 ICs including a Western Digital 1795.

2. An extended monitor in two 2716s.

3. A disk containing:
   - Disk formatting program. (128, 256,512,1024 bytes/sector)
   - Disk copying program.
   - An overlay for MOVCPM.COM
   - A double density SYSGEN

4. Documentation
   - Dependable 4MHz mod
   - New Big Board Jumpers
   - Complete Source for BIOS & Mon.

Sector size is determined by how the disk was formatted and is totally transparent to the user.

Disk capacity range from 241K for SS SD, 128 bytes/sector - to 1.3 Mbyte for DS, DD, 1024 bytes/sector.

Requires minor modification to Big Board and requires that Big Board run 4 MHz.

Price: $220

Otto Hiller Co.
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P.O. Box 1294
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Bring the flavor of Unix To your Z80-based CP/M system with Unica

"Unicum: a thing unique in its kind, especially an example of writing. Unica: the plural of unicum."

The Unica: a unique collection of programs supporting many features of the Unix operating system never before available under CP/M. The Unica are more than software tools; they are finely crafted instruments of surgical quality. Some of the Unica are:

bc - binary file compare
cat - catenate files
cp - copy one or more files
dm - disk map and statistics
hc - horizontal file catenation
ln - create file links (aliases)
ls - directory lister
mv - move (rename) files, even across users
rm - remove files
sc - source file compare, with resynchronization
srt - in-memory file sorter
sr - search multiple files for a pattern
sp - spelling error detector, with 20,000 word dictionary

Each Unicum understands several flags ("options" or"switches") which control program alternatives. No special"shell" is needed; Unica commands are typed to the standard CP/M command interpreter. The Unica package supports several Unix-like facilities, like filename user numbers:

sc data.bas;2 data.bas;3

(compares files belonging to user 2 and user 3); Wildcard patterns:

rm *tmp* -v

(types each filename containing the letters TMP and asks whether to delete the file);
I/O redirection:

ls -a ►list

(writes a directory listing of all files to file"list");
Pipes:

cat chap* ! sp ! srt ►lst:

(concatenates each file whose name starts with"chap", makes a list of mispelled words, sorts the list, and prints it on the listing device).

The Unica are written in XM-80, a low level language which combines rigorously checked procedure definition and invocation with the versatility of Z80 assembly language. XM-80 includes a language translator which turns XM-80 programs into source code for MACRO-80, the industry standard assembler from Microsoft. It also includes a MACRO-80 object library with over forty "software components", subroutine packages which are called to perform services such as piping, wildcard matching, output formatting, and device-independent I/O with buffers of any size from 1 to 64k bytes.

The source code for each Unicum main program (but not for the software component library) is provided. With the Unica and XM-80, you can customize each utility to your installation, and write your own applications quickly and efficiently. Programs which you write using XM-80 components are not subject to any licensing fee.

Extensive documentation includes tutorials, reference manuals, individual spec sheets for each component, and thorough descriptions of each Unicum.

Update policy: each Unica owner is informed when new Unica or components become available. At any time, and as often as you like, you can return the distribution disk with a $10 handling fee and get the current versions of the Unica and XM-80, with documentation for all new or changed software.

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