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MICRO CORNUCOPIA

June 1983 The Single Board Systems Journal No. 12

All Wet!

Almost SOG

The Semi Official Get-together (SOG) is almost upon us so we need to get some idea how many of your are planning to come. If you are even thinking of coming, be sure to call or write immediately.

If you are planning to participate in the Friday afternoon raft trips (professionally guided) and/or the cookout which follows, you need to get your $25 per person to us by July 7 so we can reserve a place for you. See the article on the SOG in this issue, and be sure to let us know right away if you are even considering coming!

The Slicer

I've been bitten by the 16-bit bug. Whether the byte is fatal or not I'll soon know. I'm getting an 80186 based board called the Slicer from Slicer Computer Inc.

They placed a one-page ad in the May issue of Byte and got about 800 responses (so far) so they are working feverishly on the final versions of the monitor and bios so they can start shipping boards.

The 80186 is like an 8086 with a few extra math instructions, two DMA channels and 3 timers for starters.

The Slicer contains the 80186, up to 256K RAM, a 1797 double density controller (5 and 8 inch drives simultaneously), SASI interface, a 90 pin expansion interface, and two serial ports (up to 38.4 K baud). It does not have a video monitor on board so you you have to use a separate monitor. The board runs at 8 MHz with no wait states. It measures 5.85 by 11.75 inches.

At only $140 for the bare board with documentation, power connector, the monitor in two 2732s, and the source of monitor and BIOS—it should be just the ticket for those of us wanting to get our feet wet with a real 16-bit machine (rather than an 8-bit pretender). In fact, it looks like we're going to have a whole new system to fondle and fuss over in the pages of Micro C.

Come to the SOG and you'll have a chance to try out one of the first units in existence and meet Otto Baade, the designer.

CO-POWER-88

Guess what else you'll see at the SOG? I purchased Software Publishers CO-POWER-88 board (I already had SWP's dual density package) and now have my original BB I running single density Z80, double density Z80, and single/double density CP/M 86.

Anyway, Dana and I hooked up the 8088 board and got it running in just a few minutes. (It was the easiest MOD I've ever added to the BB. You boot up in CP/M 80 just like usual and you have the option of using the 8088 memory as a RAM disk (drive M:) or running a Z80 program which suddenly transports you into the domain of the 8088. However:

CP/M 86 Software

I don't have a speck of software to run on under CP/M 86 except the 8086 versions of ASM and ED (groan!) that came with it. I hadn't thought about that when I drooled over the new boards.

You've no doubt seen all those glowing ads about new software for CP/M 86, but look at the fine print (the prices) and you'll find that most of the packages are half-again as expensive as their CP/M 80 cousins.

I'm really spoiled by the 100-volume CPMug library I have in the corner and by all the great things you folks send in. For the 8088/86, I'm high and dry.

So, we're going to have to start a new library. If any of you know a mad 8086 programmer who is writing really great code and tossing crumbs of it here and there for hungry CP/M 86 users to snatch up, then by all means let us know. We'll all practice up on our snatching (I understand it looks very much like aerobics).

(continued on page 30)

LETTERS

Dear Editor,

I've found that Smartkey (see issue 5), is a particularly helpful utility program which allows redefinition of the console keyboard. Keys can even be redefined to generate strings.

For example, Wordstar lacks a left word deletion command. If you don't like the word you've just typed, you have to delete it one character at a time or else move the cursor to use the "delete word right" command. Smartkey lets you create a macro so that a single keystroke will delete the word to the left. Smartkey also lets you define cursor and function keys, especially helpful in speeding up multi-key commands. Smartprint, a companion program, really makes it easy to create a translation table for characters going to the printer.

FBN Software has moved. The new address is 16 Coles Place, Torrens ACT 2607, Australia. In the United States, Smartkey continues to be available from Lifeboat Associates, 1651 Third Avenue, New York NY 10028, phone (212) 860-0300, and from ICI Computers, PO Box 255, Aurora OR, 97002, phone (506) 678 2778.

John S. Allen
40 Rugg Rd
Allston, MA 02134

Dear Editor,

We have several Tandon Model 848 Thinline 8" drives here, both single and double sided models. We chose them because they were half height but were also pleased to find them sturdy, well made, and fast.

Then a problem . . .

We began to lose data, and I really mean lose data! After very short use (less than a week at a few hours a day) we found tracks on our Dysan disks which had been worn down to the plastic base. We could see right through the clear tracks on the disk!

We tried changing the drive mounting from horizontal to vertical but it didn't help. Then we turned to the service manual which stated:

"The head is loaded into contact with the recording medium whenever the drive lever is latched."

In other words, the heads are loaded against the disk and remain loaded as long as the latch is closed. So the head grinds away the track it's sitting on!

We also find that there is a head load option which consists of a head load solenoid, a couple of logic gates and some resistors. There is space on the circuit board for the parts but they aren't installed.

A call to Tandon headquarters revealed some interesting news. They are aware of the problem but they will not retrofit any Model 848 with head load option, nor will they sell parts for the modification. The person we talked to insisted that the option must be specified in the original order. (We talked to Renee at 213-993-6644, ext 425.)

She also implied that they will not service any drive which wasn't purchased from an authorized dealer and I don't know of any mail order outfits which are authorized dealers. So we are out of luck.

In a nutshell, the thinline 848's most of us are buying will, with relatively short use, destroy our disks. You can save yourself some of the grief if you keep the door unlatched as much as possible.

However, anyone planning on purchasing Tandons should insist on the head load option, or even better, consider buying someone else's drives.

Willard E Johnson
Department of Physics
California State University
Hayward, CA 94542

Editor's note:

Anyone have any inside scoop on Tandon? Is it really impossible to get this head load option?

You might take a look, Will, at enabling the DC motor timeout so that it will shut itself off immediately after a drive access, or use the BB motor control line to turn off the drive motor (and then set the timeout down to a couple of seconds). However, with their attitude toward support, perhaps it's best to stay away from them altogether.

Dear Editor,

Just a quick correction for BB II people. Port 88 is the baud rate generator for serial port B. Port 89 is the baud rate generator address for serial port A (opposite what was indicated in issue #11).

Jim Skinner
20435 SW Alexander
Aloha, OR 97006

Dear Editor,

I have recently joined the ranks of the BB II owners. The only real problem has been choosing a monitor. I've been lucky enough to have access to several monitors and would like to share my findings.

First, if you use the 50Hz patch provided in the documentation (from Taylor Electric), just about any 24/80 monitor will work with the BB II 7X9 controller. The only problem with the 50 Hz vertical rate is that it may beat against you 60 Hz AC. The resulting flicker is most pronounced on white and green monitors. With amber phosphor, the flicker is barely evident.

The patch is:

```
ODC,2
ODD,5F
ODC,0
ODD,6F
ODC,7
ODD,18
```

The Sanyo 18 MHz, 12" green—the USI Pi3 20 MHz, 12" amber—and the Amdek Video 100 12 MHz, 12" B&W, all work with the BB II. Depending on the monitor, you might need to change the parameter in the second line of the patch. I have used values between 57h and 5Fh. My choice among the three monitors listed is definitely the USI Pi3.

Also, my 7X9 display appeared to be twinkling because the video was randomly dropping dots. This is caused by glitching in the shift register U45. You can fix this by changing U33 from a 74LS30 to a 7430. Another way to fix the problem is to add a 22 pf capacitor between U31 pin 11 and ground.

The last problem is that the BB II composite video signal suffers from high frequency roll-off. So the horizontal lines appear to be brighter than the vertical lines. This is most apparent when the brightness is turned down low. The following mod should fix this.

1. Change U24 from a 74LS86 to a 74S86.
2. Change R13 from 1K to 750 ohms.
3. Add a 22 pf capacitor across R13 (the Sanyo needed 100 pf).

Cole Chevalier
17862 Fitch
Irvine, CA 92714

Dear Editor,

I use MicroPro's CalcStar spreadsheet for financial and inventory projections. The problem with CalcStar is that it keeps all data in memory so the size of the spreadsheet is quite limited.

I saw ads for Supersoft's Spreadsheet called Scratchpad. It touted their "VM" feature. I bought it knowing that it

would be somewhat slower (by definition).

I was really disappointed though with their tedious formula entry. It is so slow that entering a spreadsheet large enough to need virtual memory wouldn't likely occur during my lifetime. I feel that scratchpad would be a waste of money at $29.95 and I paid $212.00! I hope other SuperSoft products are easier to use.

Are there any Micro C readers who would like to work with me on a better spreadsheet?

John Allen
144 Yagi Lane RR #1
Bowling Green MO. 63334

Dear Editor,

I wonder if you or any readers might shed some light on several problems I have had with my Big Board.

I have noticed that cntl-S will sometimes cause an untimely end of the display (while TYPING out a file) rather than just stopping the text.

When I'm in WordStar with a parallel keyboard, the system can't accept keyboard input while it is doing anything else. Any character entered at this time will come out an "F". Occasionally a stray ":" will appear in the file, which is bad news if I'm going to be assembling it. I don't have these problems if I'm using a serial keyboard.

If I'm using WordStar to edit a file that is larger than will fit into RAM, I tend to get blocks of errors such as a string of e's or I'll just notice a chunk of text missing or duplicated. Any suggestions?

John F Ingham
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South Australia 5083

Editor's note:

A few shots in the dark. You may have a buffer in the serial keyboard (besides a couple of characters in the SIO) and let's see, serial port B generates interrupts but so does the keyboard PIO. During disk access, interrupts are disabled most of the time so you have to send characters quite slowly or the processor will miss them.

It sounds like your parallel keyboard is generating some garbage characters. If your keyboard cable is quite long you might get some glitching that would cause the cntl-S problem etc.

As for the large file problem, I'm at a total loss unless you have a marginal drive or a bad copy of WordStar. What say anyone?

And, by the way, thanks for the nice comments about Micro C.

Dear Editor,

Here is a small correction to Tony Ozrelic's C'ing Clearly on page 12 of issue #11. The line "answer = &query;" should read "answer = query;" or "answer = &query[0];". Page 89 of *The C Programming Language,* Kernighan and Ritchie state that the & operator can be applied only to variables and array elements. On page 94 they write: "pa = &a[0]" can also be written as "pa = a". I tried Tony's statement on my Zilog S8000 at work and got a warning.

I realize that this may appear to be picking nits, but after programming and teaching programming for almost ten years, I feel that nit picking perfectionists make the best programmers. But in the same breath I would like to praise Tony for doing the C column. I think he should be commended for doing a fine job.

Finally, I think Micro C is the most enjoyable computer magazine I've ever read. Please keep up the good work! You'll be hearing more from me when I get off my duff and submit something to either the C or Pascal columns.

A simple request: Does anyone know where I can locate the source of the Othello program on user disk #1? I'd really like to try extending it.

Adam S Moskowitz
221 Summer St #2
Somerville, MA 02143

Dear Editor,

I have been plagued by video jitter ever since I got my BB up and running. The symptom was that all the dots on a line would move back and forth about 1 dot width.

After verifying that I had the right crystal, adding extra filtering, checking the CRT, and everything else I could think of, I finally located the problem. It was caused by U51 and U38, the series one-shot combination used to generate the horizontal sync pulse.

I solved the problem by bypassing U38. Do this by bending out U38 pin 13, and adding a jumper on the bottom of the board from U51 pin 13 to U38 pin 13.

This modification shifted the screen image but my CRT had an adjustable delay.

The problem is caused either by variation in the width of U51's pulse or variation in the trigger point of U38. If you are having this problem, this fix may work, or you might try a different brand of one-shot.

Henry Holcomb
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■ ■ ■

256K In Detail - Part I

By Art Boehm

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The following article is much larger than I had planned. However, it covers not only specific hardware and software modifications but also tools and techniques. There should be something here for just about everyone.

Four Banks of RAM

Converting the Big Board to 262K is actually rather straightforward. Most of the work involves rearranging capacitors on the RAM voltage buses.

As Karl-Wilhelm Wacker noted in Micro C, issue 9, U82 (74LS241) has plenty of power to directly drive the RAM Write signal, and that opens a selector bit on U59 (pin 9) that can be used to select between two new bank bits (on pins 10 and 11) to drive A7 of the 64K RAMs.

The obvious choices for new bank bits are System PIO bits A4 (unused) and A5 (bell). If you really can't live without the bell and will never have more than three drives, you could use A2. Or if you never need a remote console, you could just assume the keyboard and use A3. But those bits require reworking PFM.

Incidently, we have had this modification running reliably on both 2.5 MHZ systems and those with the 4 MHZ modification described by Otto Hiller on page 3 of issue 3. The key to reliability is filtering, which is why a good deal of the modification involves rearranging the bypass caps.

The new bank bits control U13 through U46 (0000 to BFFF). U1 through U8 (C000 to FFFF, i.e. PFM) are not currently switched to avoid the "traveling through hyperspace" problem. You could use compatible 16K parts (i.e. 2118's) for U1 to U8, though we chose all 64K parts (e.g. 4164's or 6664's) to keep our future options open. (See Figure 1)

Since power-up reset selects input mode (and therefore a hi-Z signal) on the System PIO, when PFM moves itself out of the ROM it goes into "bank 3" (A5 and A4 are both high) if RAMs U1 through U8 were bank switched. But PFM promptly initializes the PIO port A bits 0 through 2 and 5 through 7 as outputs and these outputs are initially cleared (low) by power up.

So, as execution switches to "bank 1" (bit 5 is low and 4 is high) which of course is not PFM.

You can cure this problem by changing PFM INIT3 to put 030h into the port A output register after loading the vector (but before setting the mode). In addition you need to initialize all the bits except 3 as outputs.

Reworking the board

Before we actually make changes to the board, we must talk about how to rework a board as complex as the Big Board.

First, remember that it is full of static-sensitive components so be careful. Always ground or discharge (if you've never been discharged before, you ought to try it) yourself before touching the board, and especially before touching any MOS parts (like 65K RAMs).

Second, use the right tools. You would not cut picture frame molding with a chain saw, and you cannot rework a board with such small features without precision (but not necessarily expensive) tools.

Tools You'll Need

1. A 12-18 watt soldering iron with a precision point or micro-spade tip. Anything bigger risks foil delamination, burned components, or frequent solder bridges.

2. High quality 21-22 gauge (around 1/32") multi-core solder; the thicker stuff just blobs on and makes a mess.

3. Solder removal tools; narrow width (.025-.050) desoldering braid works good but nothing beats a vacuum desoldering tool. Radio Shack has a mini-desoldering tool (#64-2091) that works great and only costs $6.49. The rubber bulbs don't develop vacuum quick enough to do the job.

4. A wet sponge for keeping the solder tip clean and blob-free, or a combination iron holder and sponge.

5. An X-acto knife with a heavy duty handle (7/16" dia. or more) The thin handle version is not sturdy enough to cut tough foil without risking a snapped blade. Shallow angle blades have to be held too upright to cut easily (and safely).

6. A miniature (i.e. 4") needle or long nose pliers. You cannot get along without one, and it should have scored jaws and plastic coated handles.

7. A miniature flush cutting, angle blade pliers. Most other types of cutting pliers can't get in close enough or leave stubs that are too long (and may touch neighboring parts).

8. A needle pointed tweezers; the only reliable way to pickup fragments of 30 ga. wire or solder.

9. A set of jeweler's screwdrivers; you'll need them to adjust your glasses after staring at the board for 15 hours.

10. A way to drill .041" holes; a #59 drill is the correct size, but you need some way to hold it like a pin vise or miniature drill. You can get these drills with larger shanks for use in a Dremel moto tools.

11. Some 30 ga. wire and a 30 ga. wire stripper. Finer wire is too hard to work with (much less find or strip) and heavier wire makes too big a lump at the connection points. Besides, if you get some pre-stripped 2.5" lengths, they are exactly the right length for 80% of the jumpers you'll need.

12. A decent ohmmeter. This is included under rework tools because it is used to verify that your cuts and adds worked right (i.e. cuts are open and adds are shorts) before you try it out. This is especially necessary when working with the power and ground busing as this change does (+5V should not be shorted to ground when you are done).

Incidentally, cuts will not necessarily show as true opens due to other components. Mainly you are verifying that there are no shorts.

13. An IC puller and inserter. Big chips you can pry out successfully with a screwdriver. With little chips you get one end or three corners loose and when you grab it to get the rest, it flips over and buries its leads in your finger. Radio Shack has a nice puller/inserter combo (#276-1574) for $6.95. You can swap all 32 RAMs in 5 minutes with it.

Techniques

Now that you have all these fine new tools, let's talk about technique.

You'll be doing four basic things, removing components, adding components, cutting foils, and adding jumpers.

Removing components

Remove components by first remov-

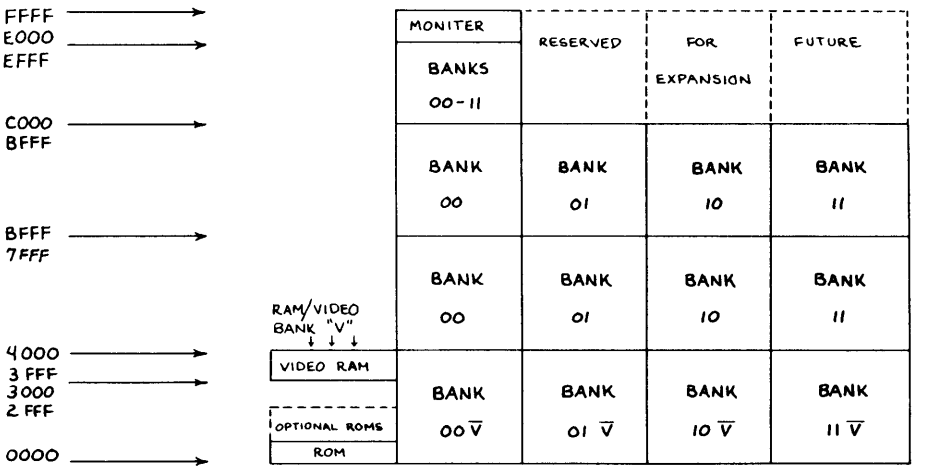


Figure 1 - Storage Bank Assignment

ing the solder from their leads with a solder sucker.

When you have done all the leads you should be able to pull the part out from the component side with a pliers with at most, a touch of the iron to the leads.

Adding components

You have to find a place for new components to reside. Small components (e.g. diodes, miniature resistors) can go on either the component side or the foil side. Larger components should go on the component side.

Small components can be tacked to a foil on the same side as the component. Scrape the protective coating off the foil and then bend the component lead to jog down and lay on the foil for at least 1/8" (more if you have room). The solder joint must provide mechanical strength.

Components can also be soldered into vias (the holes that get signals from one board side to the other), or can be inserted through new .041" holes to intercept foils or jumper wires on the other side of the board.

When you cannot solder to a foil on the other side, you must bend the leads for mechanical strength. If you grab the lead 1/8" above the hole and push diagonally down, you should get an L-shaped bend that will work.

By the way, before you drill a hole in the big board, mark your spot and hold the board up to the light to see what is on the other side. You might be surprised.

Cutting Runs

Cutting foils is quite simple. Make two cuts 1/32" to 1/16" apart through the foil and "lift" (remove) the piece between the cuts. On boards with quality copper like the Big Board, "lift" really means undercut and scrape. Always check your cuts with an ohmmeter to make sure they worked.

Adding Jumpers

Adding jumpers is similar to adding components, except it is nearly always done on the foil side. You can solder to runs, vias, socket pin, or component pin.

Use 30 guage wire and leave just a little slack (maybe 1/16" extra). On long runs, you can tack the wire to the board in a few places with RTV.

When soldering directly to a pin, watch closely for shorts to nearby pins and foils. To minimize this, melt the solder already on the pin/pad, and push or pull the stripped portion of wire down (into the solder) until it touches the pin and the insulation just touches the solder. Then clip off the excess wire flush with the solder. If the solder blob is too big, remove it and resolder the pin before again adding the jumper.

BB I Layout

You need to be thoroughly familiar with the layout of the Big Board. It has a component side and a foil side. It also has four quadrants—the CPU, RAM, Video, and I/O. We will use these terms for orientation.

The main ground plane is on the component side and is generally cross-hatched. There are three main voltage grids in the RAM quadrant: +5, -5, and +12.

The -5 and +12 come up the CPU/RAM edge on the foil side, and then run down each of the four RAM rows on the component side. These two supplies also have traces at 90 degrees down each of the eight RAM columns (on the foil side).

The +5V supply comes from between the video and I/O sections to the CPU side of the RAMs on the component side, and then forms a half-grid by running traces down each of the eight RAM columns on the foil side.

Bypassing

Filtering on the +5V grid is provided by a small capacitor on each end of the column traces (C1-8 and C78-85).

The filtering on -5V and +12V supplies is more complicated.

Each supply has a large capacitor on each of the four row traces, (notice that they alternate sides). C21, 38, 51, and 68 filter -5V, while C22, 37, 52, and 67 filter +12V.

The -12V and +5V supplies also have 20 small capacitors (between them) distributed in alternating, interlaced patterns down each of the eight RAM columns.

In odd numbered columns, the five capacitors (between the +5V filters) (e.g. C13, 25, 39, 55, and 70 in column 1) filter +12, -5, +12, -5, and +12. In the even numbered columns, the five capacitors between the +5V capacitors (e.g. C14, 26, 40, 56, and 71 in column 2) filter -5, +12, -5, +12, and -5.

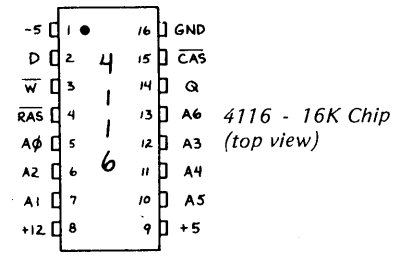
Changes

Now that you have all this straight, the following changes should make perfect sense (See Figures 2, 3, and 4).

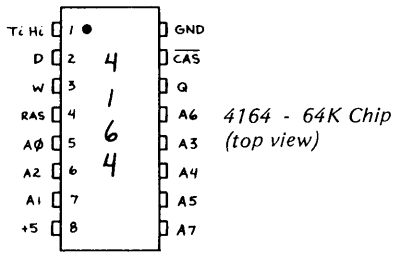
Pin 1 of the present RAMs is tied to the -5V grid. Remove all the filters from the -5V grid (we'll reuse the big capacitors later), cut the -5V supply, and tie the grid HIGH through a pullup and filter. Some 65K rams don't use this pin, but those with internal refresh need to have this pin tied high (to disable the function). (See Figure 2 for pinouts.)

Pin 9 of the present RAMs is tied to the +5V grid. Remove all 16 +5V filters for later reuse. This cuts off the +5V supply. We will also cut all eight column traces between rows 1 and 2. Pin 9 of the RAMs in row 1 will be tied together and to ground (C000-FFFF will always be located in bank 0). Pin 9 of the RAMs in row 4 (U39-46) will be tied together and to the output of R12, which connects to U59 pin 9.

(continued next page)



4116 - 16K Chip (top view)



4164 - 64K Chip (top view)

Figure 2 - RAM Chip Pinouts

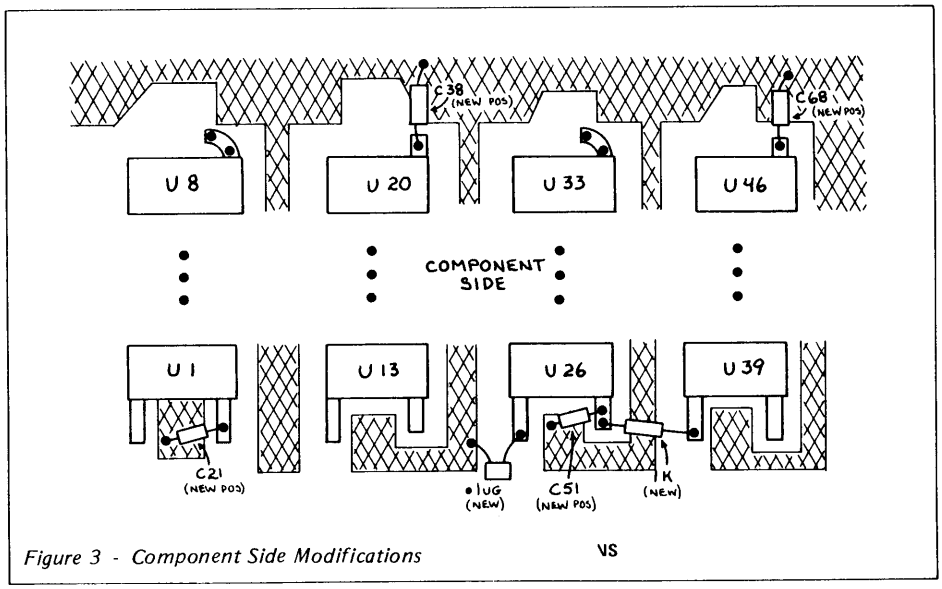


Figure 3 - Component Side Modifications

(256K In Detail continued)

Pin 8 of the present RAMs is tied to the +12V grid. Cut off the +12V supply, tie the grid to +5V, and add all the leftover capacitors for extra filtering.

Disconnect the WRB signal (U82 pin 5) from U59 and connect it to the RAM WRB grid directly. Separate U59 pins 11 and 10 and tie them to system PIO outputs A4 and A5.

Add extra bypass capacitors to the +5V supply in the video section to assure jitter free video, and replace the RAMs.

The actual step-by-step changes are as follows:

1. Remove the -5V filters: C14, 16, 18, 20; C25, 27, 29, 31; C40, 42, 44, 46; C55, 57, 59, 61; and C71, 73, 75, 77.

2. Remove and save the large -5V filters: C21, 38, 51, 68.

3. Reinstall C21, 38, 51, 68 in roughly their same locations as follows: locating the capacitor bodies on the ground plane, attach the plus leads to the old +12 (new +5) grid lines emerging from U1, 20, 26, and 39 (pin 8) by either tacking to the lines or using vias, and then tack the minus leads to the ground grid.

4. Isolate the +5 filters and new A7 nets by making the following cuts between:

Ui pin 9 and Ci for i=1, 2, 3, 4, 5, 6, 7, 8 (8 cuts)
Ui pin 9 and Ui+12 pin 9 for i=1, 2, 3, 4, 5, 6, 7, 8 (8 cuts)
Ui pin 9 and Ci+39 for i=39, 40, 41, 42, 43, 44, 45, 46 (8 cuts) (e.g. U39 p9 to C78, U40 p9 to C79, etc)

5. Tie together the new A7 nets by adding the following jumpers:

Ui pin 9 to Ui+1 pin 9 for i=1, 2, 3, 4, 5, 6, 7 (7 adds)
U1 pin 9 to ground (the uncut foil side of C1)
Ui pin 9 to Ui+1 pin 9 for i=39, 40, 41, 42, 43, 44, 45 (7 adds).

6. On the component side, locate the via by the pin 7 & 8 end of U56. Cut the trace between that via and where it goes under U57 (near pin 7). This isolates WRB from U59 pins 10 and 11.

7. Locate and mark U59 (and pin 9 for reference) on the foil side of the board. Cut the trace between U59 pins 10 and 11, thus isolating those inputs.

8. On the foil side, cut the trace leaving the U60 side of R12. Make the cut where the line jogs (around 1/2" from R12). This isolates the U59 driven WRB signal from the RAM WRB net.

9. Follow the trace you just cut toward the RAMs until you find the first via (around the old location of C68). Solder one end of a 33 ohm resistor in this via, point the free end toward the CPU.

10. Connect one end of a jumper wire to the free end of the 33 ohm resistor, and connect the other end to the via described in step 6 (find it again on the component side and stick a 30 ga. wire through it to locate it on the foil side). Trim the resistor lead with the attached jumper so that it doesn't short to anything. This connects the WRB signal to the RAM WRB net.

11. Run a jumper from U43 pin 9 to the U60 side of R12. This ties the new address selector bit to the RAM A7 grid.

12. Still on the foil side, locate U111, the system PIO. Pin 10 is connected by a component side trace to a via 1/4" from the pin (toward crystal Y3). Cut the trace from this via on the foil side, it goes to the power connector.

13. Attach the following jumpers on the foil side:

U111 pin 9 (Bell) to U59 pin 10 (new A14)
U111 pin 10 (Spare) to U59 pin 11 (new A7).

14. Tie 10K pullups to these new U59 inputs. Find a place to put two 10K resistors with one end of each tied to +5 and the other end available on the foil side to be jumpered to U59 pins 10 and 11.

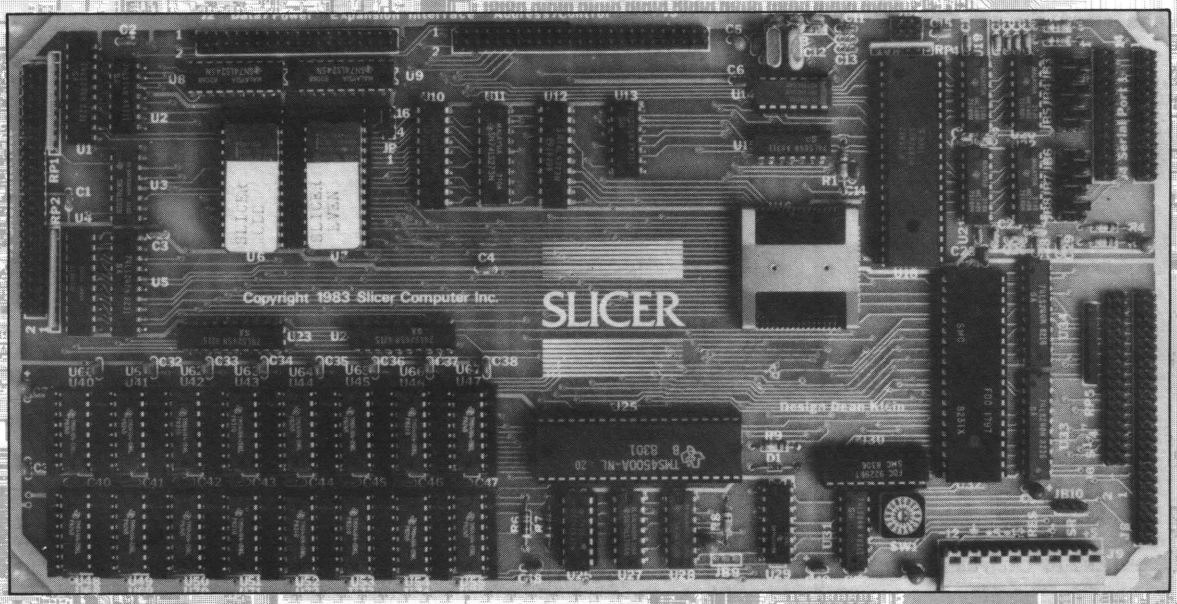
15. On the foil side, cut the -5V power supply trace near C67 next to where the +12V supply trace jogs. This disconnects -5V from the RAM pin 1 net.

16. Tie the just-isolated RAM pin 1 net HIGH by connecting it to the new +5 grid through a 1K resistor and to ground through a .1 uf capacitor. U39 pin 1 has 2 vias within 1/4" for one end of the resistor, the other end can be tacked to the new +5 trace coming from U26 pin 8. The trace from U26 pin 1 has a nearby via for one end of the capacitor, the other end should be tacked to the ground plane.

17. On the foil side, cut the main +12V power bus going to the RAMs up the CPU/RAM edge of the board; make the cut just inboard from TB1 (main power connector) pin 4, without disturbing the trace going toward the I/O section.

(continued on page 8)

Step up to a 16-BIT Powerhouse!



The "SLICER" is a HIGH PERFORMANCE single board computer based on the new, highly advanced Intel 80186 CPU. The board has these advanced features:

- *Full 8MHz 16-bit microprocessor having complete software compatibility with the 8086 and 8088*
- *Two full function RS232C serial ports with baud rates individually controlled by software.*
- *Baud rate for console port is acquired automatically.*
- *Floppy disk controller allows the combination of 5¼ and 8" disk drives, single or double sided, single or double density.*
- *SASI port for hard disk controller with data transfer rate of up to 2Mb per second.*
- *Memory capacity of 256KB ram on board plus up to 32KB of EPROM.*
- *90 line expansion interface with 20 bit latched address bus, 16 bit data bus and all important 80186 control signals.*
- *A high performance ROM monitor is included with all systems.*
- *BIOS for CP/M86* operating system included.*
- *Power requirements:*
  + 5 volt, ± 5% at 3 ampere max.
  + 12 volt, ± 10% at 60 milliampere max.
  − 12 volt, ± 10% at 50 milliampere max.
- *All this on a board the width of a 5¼" drive and only 11½ inches long.*
- *Sold in various kit forms from $140-$895. Assembled and tested $1,075. Quantity discounts available. Prices valid through July.*
- *Complete documentation included.*

Available Now!

This system is marketed and supported exclusively by:
***Note*: New name, address and telephone number.**

SLICER COMPUTER INC. 2543 Marshall St. N.E.
Minneapolis, MN 55418 phone (612) 788-9481

Mastercard, Visa, check, money order or C.O.D. orders accepted. Please allow 4-6 weeks for delivery.

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

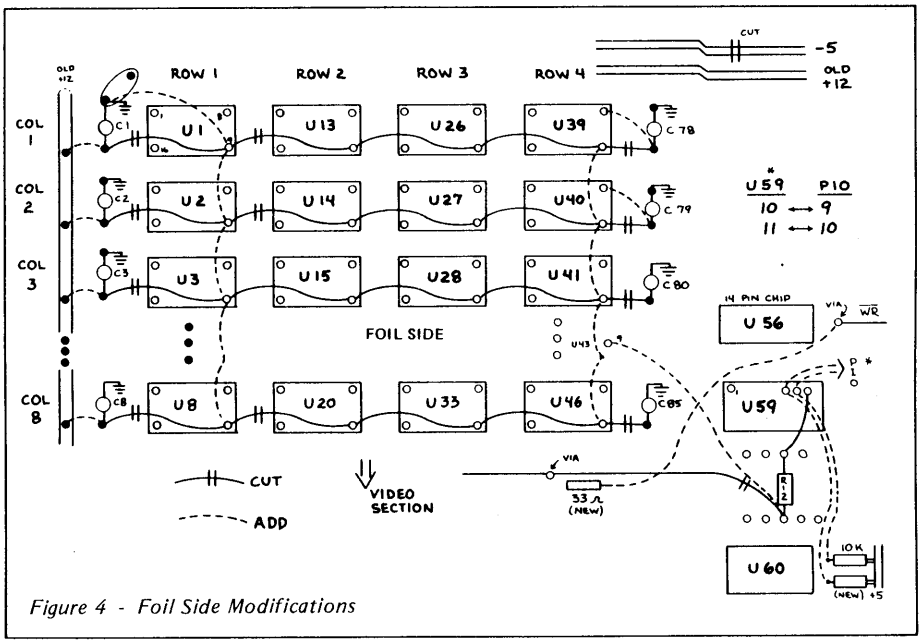


Figure 4 - Foil Side Modifications

(256K In Detail continued)

With a short piece of 20 ga. wire, jumper the just-cut end of the main +12V supply trace to TB1 pin 3 (+5 volts).

Roughly 3" from TB1, following the power bus toward the RAMs, there is a trace coming off the bus and going to a via by C112:

Cut the trace between the bus and the via, and run a jumper from the via to TB1 pin 4 (+12 volts).

If you had installed the RAM saver circuit, it is no longer needed and should be removed (patch up the +12V foil).

18. On the foil side, tie the +5 power supply to the old +12V by adding the following jumpers:

Ui pin 8 to Ci+26 cut foil end (+5V side) for i=39, 40, 41, 42, 43, 44, 45, 46 (8 adds)

19. On the foil side, tie the remaining filters to the +5V supply by tacking short jumpers from the cut foil end lead of C1, 2, 3, 4, 5, 6, 7, 8 to the old +12 (new +5) bus that runs next to them along the card edge.

20. To assure that the new demand (and noise) on +5V does not affect the video stability, add the following capacitors to the ground plane (by tacking or drilling) and vias in the +5 lines in the following places:

By U12 pin 14: a 1-10 uf tantalum capacitor (+ lead to +5V),
By U51 pin 16: a 1-10 uf tantalum capacitor (+ lead to +5V),
By U64 pin 18: a 50-100 uf min. electrolytic (- to ground).

21. Recheck all your work, test for shorts, and make sure the power supplies and ground are not shorted together. Look for solder blobs and splashes or wire fragments. Reflow any cold solder joints and clean up any resin deposits.

22. Pull out the 16K RAMs and carefully insert the 64K parts.

23. Update your Big Board documentation (i.e. prints) to reflect any changes you made.

Your board is now modified and ready to go. Carefully apply power and go for the magic prompt! If it doesn't work, recheck your work and proceed as if bringing up a new big board. You may have blown out something else while doing the modification. For related articles see Micro Cornucopia issue 4, page 16, and issue 9, page 8.

The list of parts needed to make the change is as follows:

You need 32 64K RAMS (or 24 64K RAMS and 8 compatible 16K RAMs). The RAMs should be 200ns or better (especially if you intend to go to 4 MHz).

resistors:
1—33 ohm (anti-ring damper)
1—1K ohm (net pullup)
2—10K ohm (input pullup)
capacitors:
1—.1 uf disc
2—5 uf tantalum
1—100 uf electrolytic

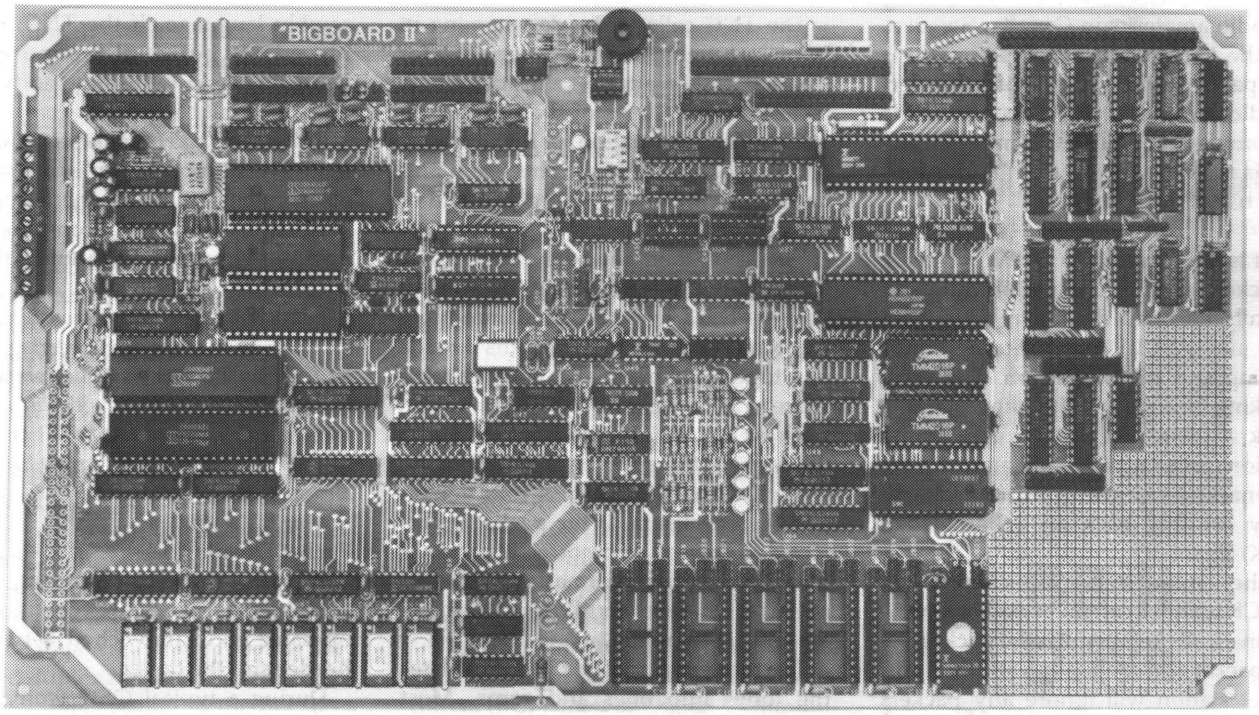
Editor's note: This is the hardware portion of this article. Next issue, we'll look at the software ramifications (heh, heh) of these mods. Art also included some really super information on correcting video shake for good. (Issue 13 is already looking pretty lucky.)

■ ■ ■

NEW LOWER PRICES! ***NOW IN "UNKIT"* FORM TOO!***

"BIG BOARD II"

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



$795 ASSEMBLED & TESTED $545 "UNKIT"* $245 PC BOARD WITH 16 PARTS

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

■ 4 MHz Z80-A CPU and Peripheral Chips

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

■ 64K Dynamic RAM + 4K Static CRT RAM + 24K E(E)PROM or Static RAM

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

■ Multiple-Density Controller for SS/DS Floppy Disks

The new Cal-Tex single-board computer has a multiple-density disk controller. It can use 1793 or 8877 controller chips since it generates the side signal with TTL parts. The board has two connectors for disk signals, one with 34 pins for 5.25" drives, the other with 50 pins for 8" drives.

■ Vastly Improved CRT Display

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

■ STD Bus

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

■ DMA

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

SIZE: 8.75" x 15.5"
POWER: +5V @ 3A, +-12V @ 0.1A

■ "SASI" Interface for Winchester Disks

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

■ Two Synchronous/Asynchronous Serial Ports

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

■ A Parallel Keyboard Port + Four Other Parallel Ports for User I/O

The new Cal-Tex single-board computer has one parallel port for an ASCII keyboard and four others for user-defined I/O.

■ Two Z80-A CTCs = Eight Programmable Counters/Timers

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

■ PROM Programming Circuitry

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

■ CP/M 2.2**

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

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* *The "unkit" is a fully-socketed, wave-soldered "Big Board II". It requires NO soldering. All an "unkit" purchaser must do is carefully insert the prime ICs we supply in the proper sockets and systematically proceed to bring up and test the board.*

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

CAL-TEX COMPUTERS, INC.

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