

DIY Mass-Storage Module Upgrade
for
Data I/O Unisite, 2900, and 39xx Series Device Programmers
24-Apr-11
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PROGRAMMER PREREQUISITES:

- **FOR UNISITE...**
 - **The main board must be Data I/O P/N 701-2313-001 or later. Easy clue: If you open the top cover of the programmer, and it has a 64-pin DIP chip for its microprocessor, it is an OLD revision board and NOT compatible with the MSM. If you have a 68-pin PLCC or PGA-style microprocessor, the board IS compatible with the MSM.**
 - The programmer's EPROM (firmware) version must be 1.2 or higher (.BIN files for release 1.3 are included in this archive). Check the 28-pin EPROM chips, near the microprocessor, for part numbers 324-1721-009 and 324-1721-010 or higher.
 - You must have a full set of Unisite system software, of your desired version, on **true 720K floppy diskettes. 1.44MB disks will NOT work.**
 - The 22V10 PLD in socket U91 on the programmer's main board must be the 8MB memory version, Data I/O P/N 324-1852-002 (JED file included in this archive).
 - You must use Unisite system software release 4.51 or later.
- **FOR 2900/39xx:**
 - You must have a full set of 2900/39xx system software, **release 6.1 or higher**, on 1.44MB floppy disks. **720K disks will NOT work.**

MECHANICAL AND OVERALL

I've gone to a lot of effort to make the design resemble, in all ways including mechanical things like board shape, Data I/O's original. This means the mounting holes should all line up properly, as should the connectors, no matter if you're installing the thing in a 2900, 39xx series, or Unisite. The only kicker with the Unisite is you may have to fabricate a mounting bracket and a 60-position flat interconnect cable. In the Unisite, the MSM sits under the main board and over the fan. You will find empty holes for the bracket's screws in the base pan around the fan's perimeter.

CONNECTOR NOTES

If you're building the module for a UNISITE: You need to install the 60-pin header, P1, on the TOP (component side) of the board.

If you're building the module for a 2900 or 39XX System: You need to install the 78-pin header, P2, on the BOTTOM (solder side) of the board. **Be sure to cut pin 72 of the header away to match the keying in the 2900/3900 main board connector, as shown in the assembly photos.**

It is NOT recommended to install both the 60 and the 78-pin headers, unless you plan to use the board only for testing. There's too much chance of a short otherwise.

ELECTRICAL NOTES

- **REGARDING U14:** I found, during my own assembly, that it may not be practical to use an IC socket for U14 if you plan on using the specified Transcend or similar solid-state disk module. This is because the default connector orientation on said SSD places the board directly over U14. If it's in a socket, there's not enough vertical clearance, and the SSD will sit cockeyed on its connector.
- **WORKAROUNDS:** You can simply solder U14 directly to the board. Some SSD modules are also plated for a connector on either side of their board, so you could attach a 2mm SMD header to the unused side.
- **One other possibility** is to use a flat-cable arrangement instead of the 44-pin male header called out in the parts list (which you may want to do anyway if you plan on using an electromechanical disk drive). It's entirely up to you. Just make sure the pinouts match.
- **DISK DRIVE:** The board contains a standard-pinout 44-pin mini-IDE male connector header, and is designed to directly accept Transcend part number TS128MDOM44H-S. It will sit nearly flat on the board (or as flat as the connectors will allow). Note the smallest drive the MSM can use is 80MB.

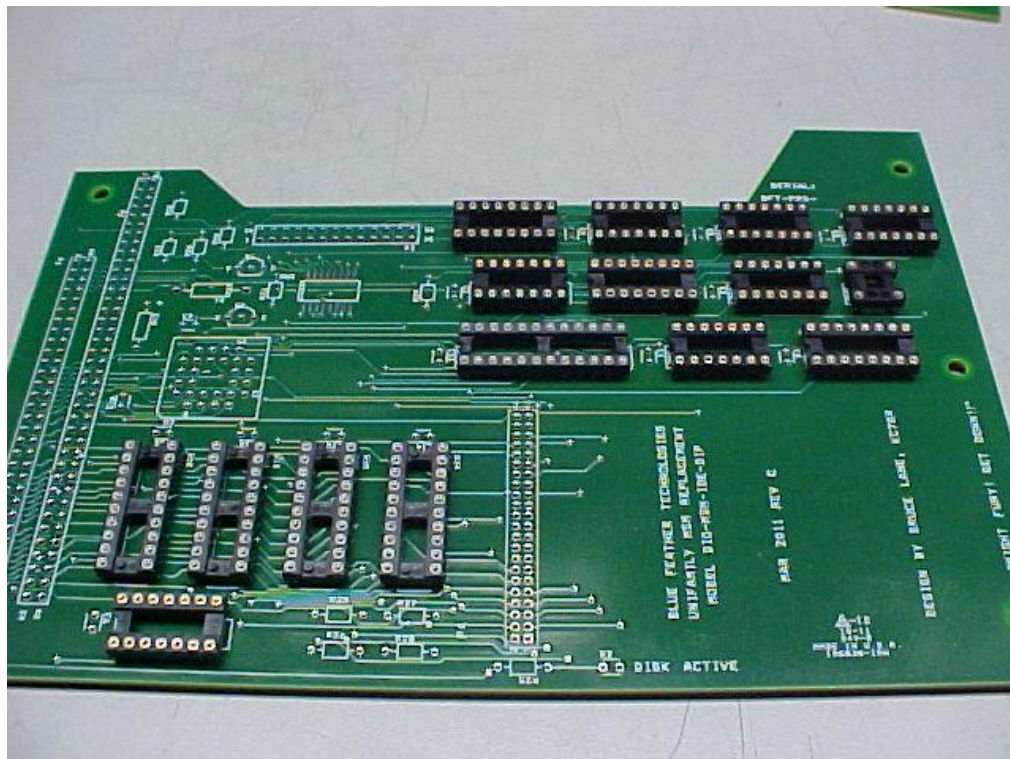
- You need not use a solid-state drive. The connector should, with appropriate cabling, accept any standard PATA drive with a matching 44-pin connector. Fabrication or procurement of the appropriate cabling or adapter is left up to the end user. Future revisions of the board may include a standard 40-pin PATA connector as well as the 44.
- Although you should be able to use just about any PATA mini-drive with the board, keep in mind you will not gain anything by installing a drive larger than 128MB. The programmer's firmware is hard-coded where the drive's partition sizes are concerned. Even 128MB is overkill.
- **22V10 PLD:** The JEDEC file necessary to create the appropriate PLD for the board to work is included in the ZIP archive. You will need a 28-pin PLCC packaged device, similar to Atmel's ATF22V10C-15, and (of course) a compatible programmer. The PLD's are readily available from most electronic supply houses, including Mouser (item #556-ATF22V10C-15JU) and DigiKey (item #ATF22V10C-15JU-ND). Hint: Mouser is usually cheaper.
- **IC TYPES AND SOCKETS:** I've been asked why I didn't use surface-mount devices as much as possible. The reasons are simple: Serviceability and "hobbyist-friendly" construction. Standard DIP IC's (and socketed PLCC's) certainly take up more space, but they make the board orders of magnitude easier to build and service. Feel free to use DIP sockets for your IC's if you wish. I certainly did. Nothing on the board operates at a frequency higher than 10MHz.
- **The only SMD component** is resistor network RN2. I had to keep it in SMD configuration because I literally started running out of space to place the other components. It's an SOIC-16, which should not be too difficult to hand-solder. I would recommend installing it as your first assembly step.
- The board is designed to use a through-hole PLCC socket for U7, the 22V10. I used 3M's part number 8428-21A1-RK-TP, available from Mouser.
- **The clock oscillator, X1,** though relatively non-critical, should be 50ppm tolerance, since that's what Data I/O used in their original design. I recommend CTS's part number MXO45HS-3C-10M0000, available from (again) Mouser. If you want to use a socket for it, I would suggest Aries Electronics part number 1108800, available from Mouser.

- **Pin Orientations:** The board is silk-screened with the component designators, and I've made it a point to distinguish Pin 1 on all DIP IC positions with a square pad. The same goes for the connectors. In short, Pin 1 position should be obvious. **If you have doubts, refer to the schematic or board layout diagrams, or get in touch with me! All horizontally-mounted IC's have Pin 1 on the lower left side. All vertically-mounted IC's have Pin 1 at the top left. U7, the PLCC, has Pin 1 (the beveled edge) facing to the lower left.**

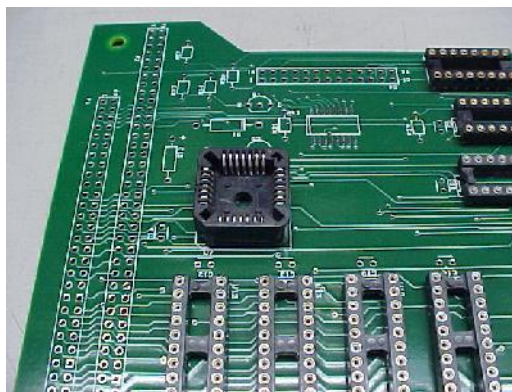
That's all for the notes. On to actually building the thing!

SUGGESTED ASSEMBLY STEPS

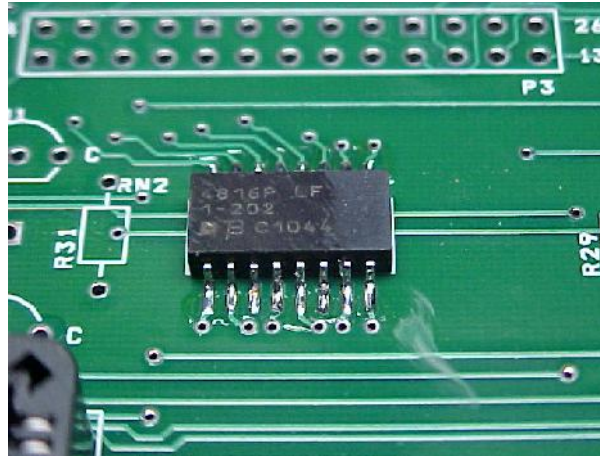
1. **Install all DIP sockets, and the oscillator socket for X1, if you're using them, or simply install all the DIP IC's.** The best method I've found is to lay the board, component side up, on a flat surface, then place all the parts in the appropriate locations. Next, place a sheet of stiff material (cardboard, another blank PC board, whatever) on top to keep things from falling out. Finally, flip the whole shebang over, pull the cardboard or whatever out while keeping light pressure on the board, and solder everything in place. **Make certain of Pin 1 orientation BEFORE you start soldering!**



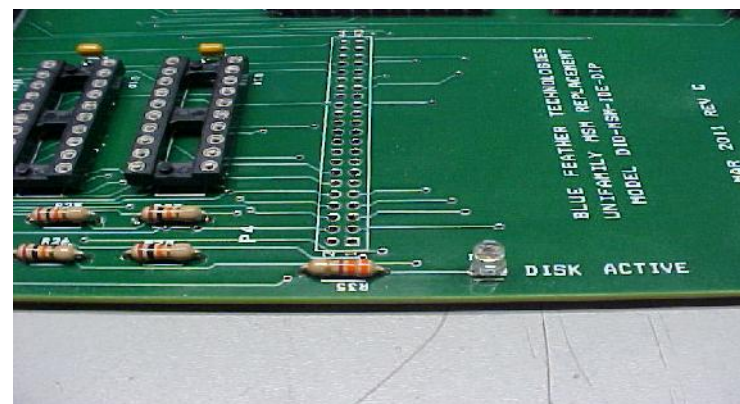
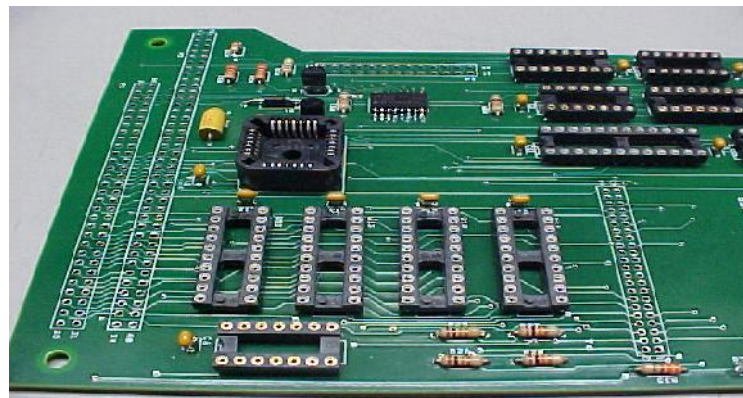
2. **Install the PLCC socket for U7.** Pin 1 faces the left side of the board (where the main I/O headers go). **Follow the silkscreen, see the photo.**



3. **Install RN2.** Follow the silkscreen outline for positioning, use a fine tip on your soldering pencil. There's more than enough pad to allow for hand soldering if you're careful. Try not to get solder in any of the vias.

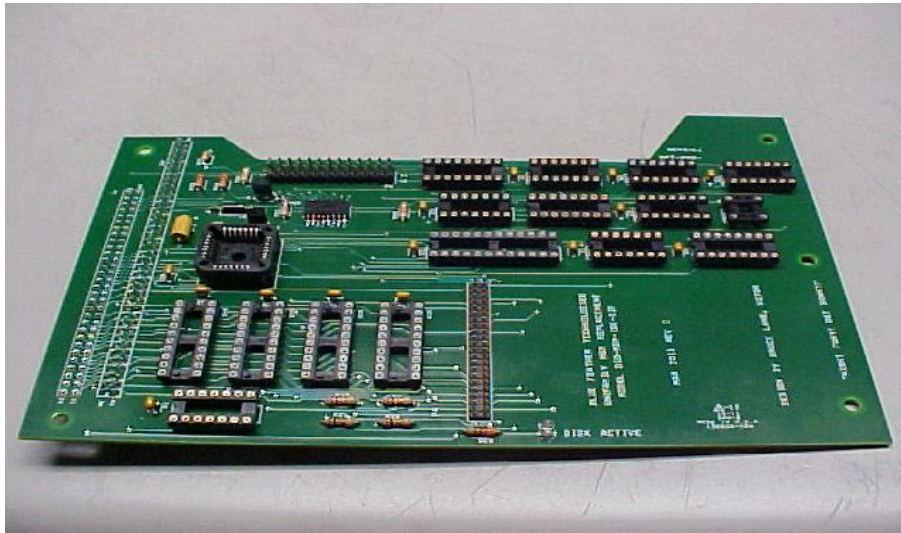


4. **Install the rest of the discrete components.** I found it easiest to do C1-C14 (the decoupling caps) first, then C15 and C16, then all the resistors, and finally the LED, transistors, and D1.

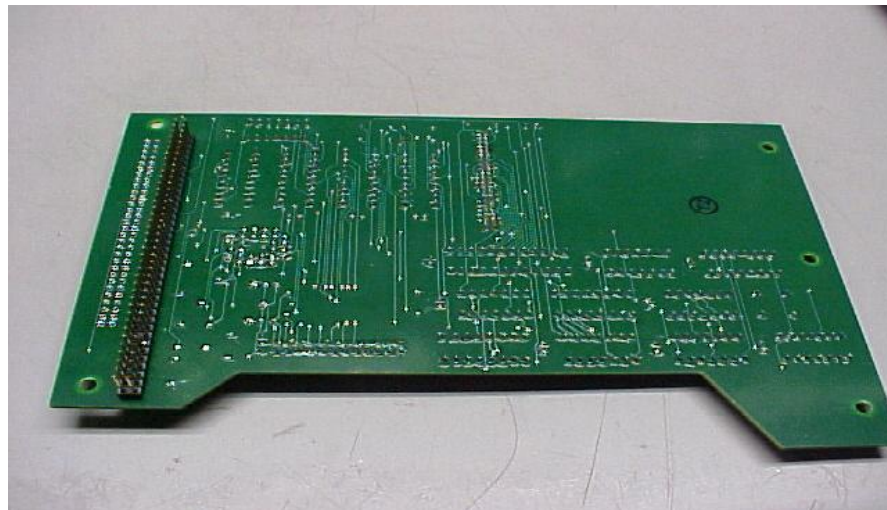


5. **Install the connector headers as follows:** If you're building the board for a **Unisite** programmer, you should install P1 (the 60 pin), P3 (the 26 pin) and P4 (the 44 pin 2mm disk header). **I do not recommend installing P2** (the 78 pin) in this configuration.

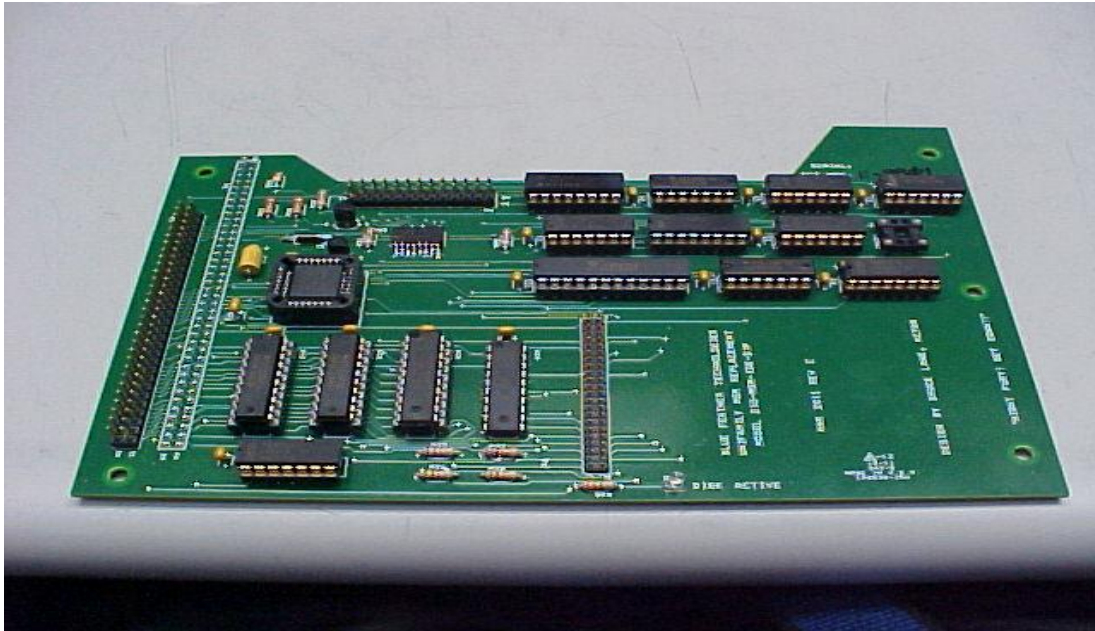
6. **If you're building for a 2900 or 39xx:** Install P2 (78 pin), P3 (26 pin) and P4 (44 pin, 2mm). **I do not recommend installing P1** (the 60 pin) for this configuration.



Built for 2900/39XX, Top View

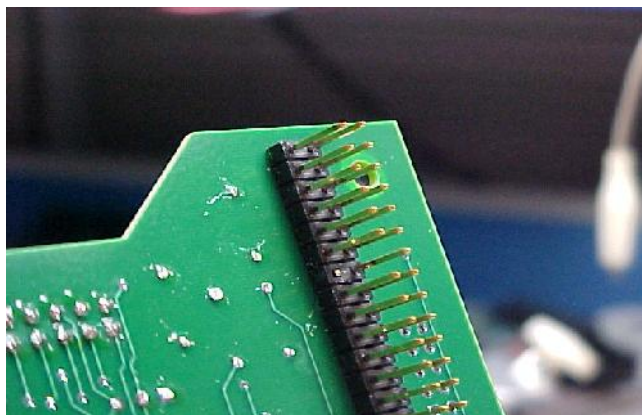


Built for 2900/39XX, Bottom View



Built for Unisite, Top View

7. **Install U7, the 22V10 PLD.** If you program your own, the checksum, once you program the file into your target device, should come up as 0x6F9A, no matter which JEDEC file you use (full or kernel).
8. **Install all other IC's and DIP resistor arrays into their sockets (if sockets were used).**
9. **Flip the board over and snip away Pin 72 on P2 (if installed).** Counting from the top edge of the board in the photo, it'll be the SEVENTH pin down on the inside row.



10. **Install your disk drive.** Pin 1 on the 44-position connector is in the lower RIGHT corner, and is marked on the silkscreen.

11. **Install the board in the programmer.** Get together a full set of software on floppies for whichever programmer you have, place the boot floppy in the programmer's A drive, and power up.
12. Once the programmer's menu screen comes up, and after you respond to the question about selecting a terminal type, you should see the self-test results screen come up, along with a complaint about the Mass Storage option failing and how you need to format Drive H.

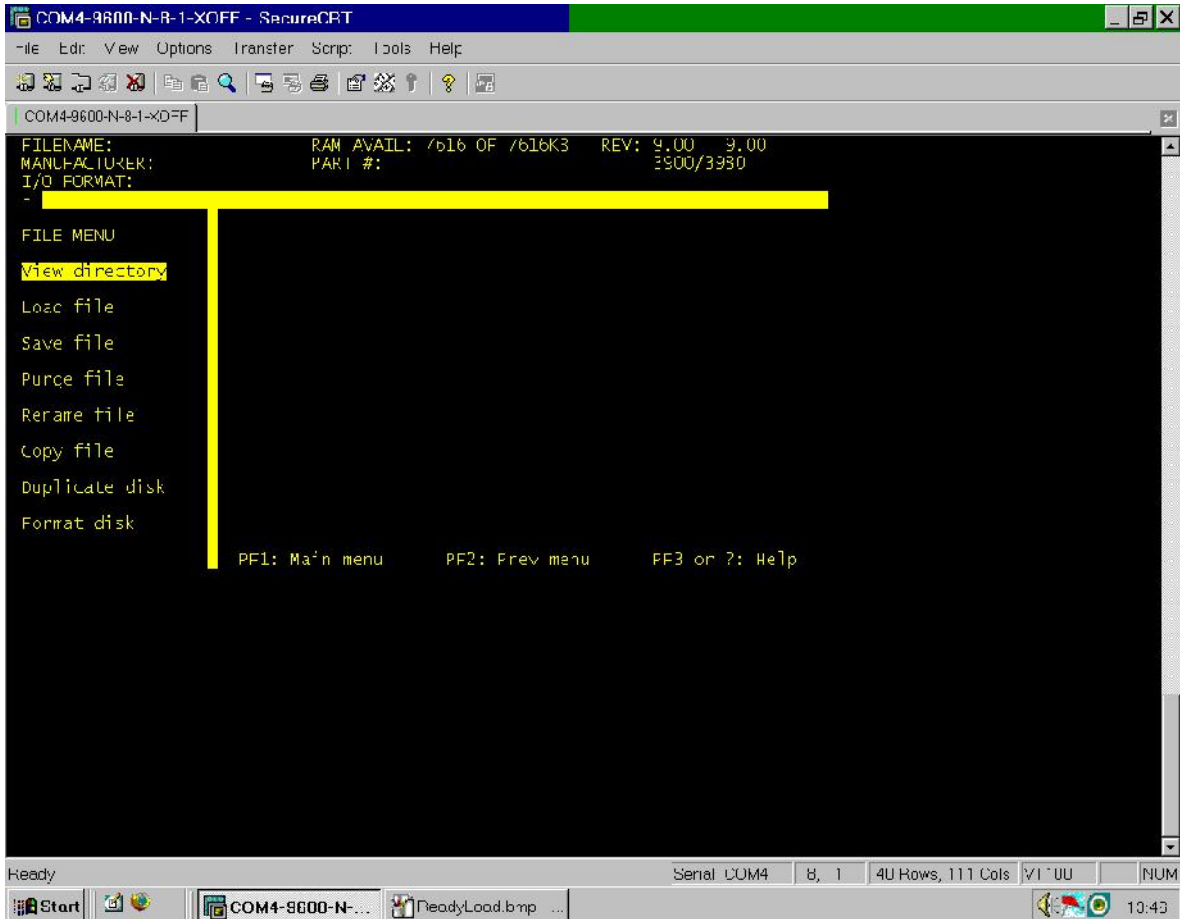
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COM4-9600-N-B-1-XOFF - SecureCRT
File Edit View Options Transfer Script Tools Help
COM4-9600-N-B-1-XOFF
FILENAME:          RAM AVAIL: 7616 OF 7616K3  REV: 9.00  9.00
MANUFACTURER:     PART #:          3900/3980
I/O FORMAT:
- POWER UP TEST FAILED: Mass Storage module mount error. Re-format drive H

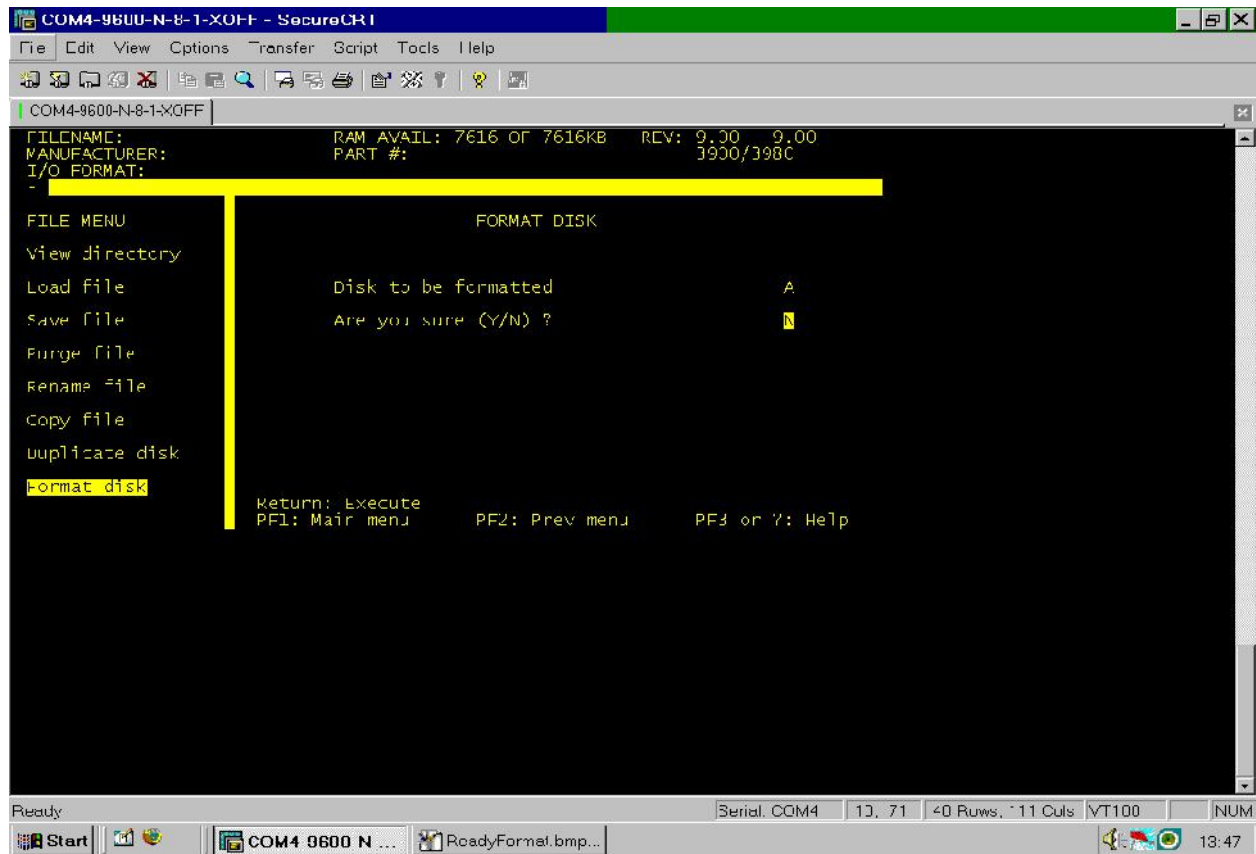
MORE COMMANDS          SYSTEM DIAGNOSTIC TESTS
Configure system       Calibration          PASS  Pin Control Unit    PASS
Device checks          EPROM              PASS  Serial ports        PASS
Edit data              System RAM         PASS  User RAM            PASS
File operations        Disk               PASS  Base/Adapter/Relays  ???
Job file               Mass Storage       FAIL
Remote control         Pin Driver Board #1 PASS  Pin Driver Board #2 PASS
Self-test              [P]Pass [F]Fail [?]Untested [-]Not installed
Transfer data          Perform All Tests   Test: node ONE PASS
Yield tally            Return: Execute
                      PF1: Main menu    PF2: Prev menu    PF3 or ?: Help
  
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Ready Serial COM4 21, 74 40 Rows, 111 Cols VT 00 NUM

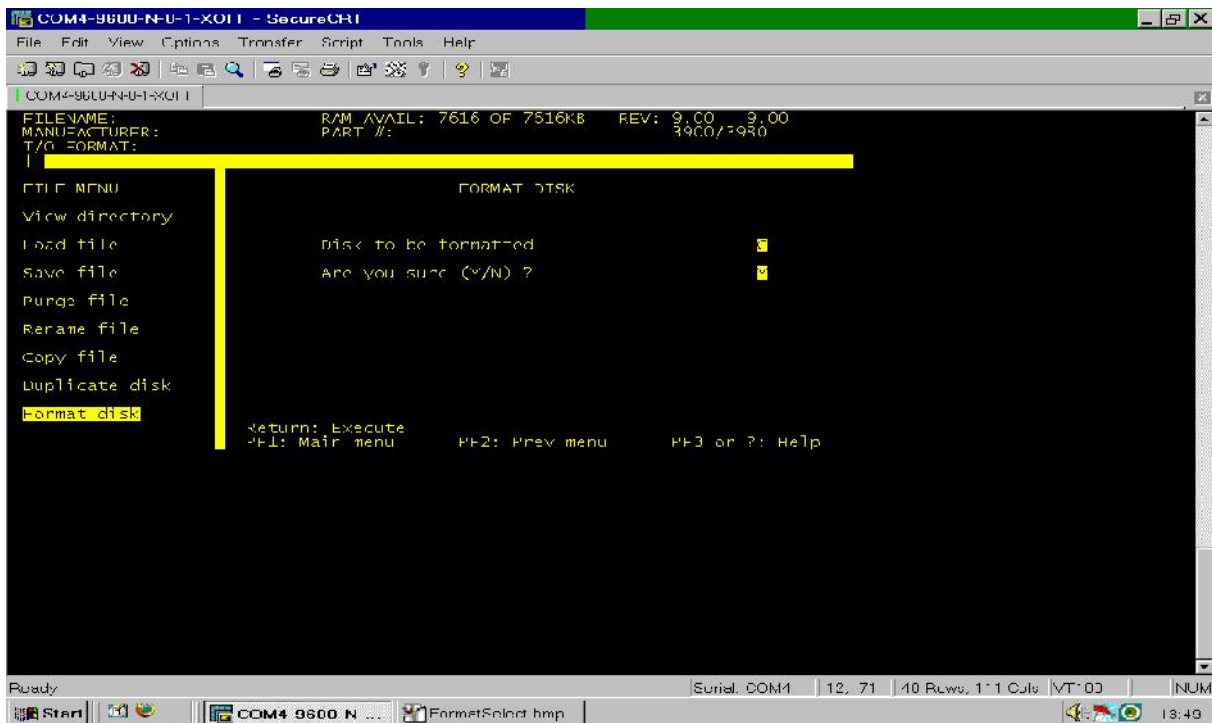
13. **Don't panic!** This is a perfectly normal indication when you have an unformatted (for the programmer) drive in the MSM. **Press F2, and either arrow the highlight to 'File Operations' and press enter, or simply press F.** This should get you to the following screen.



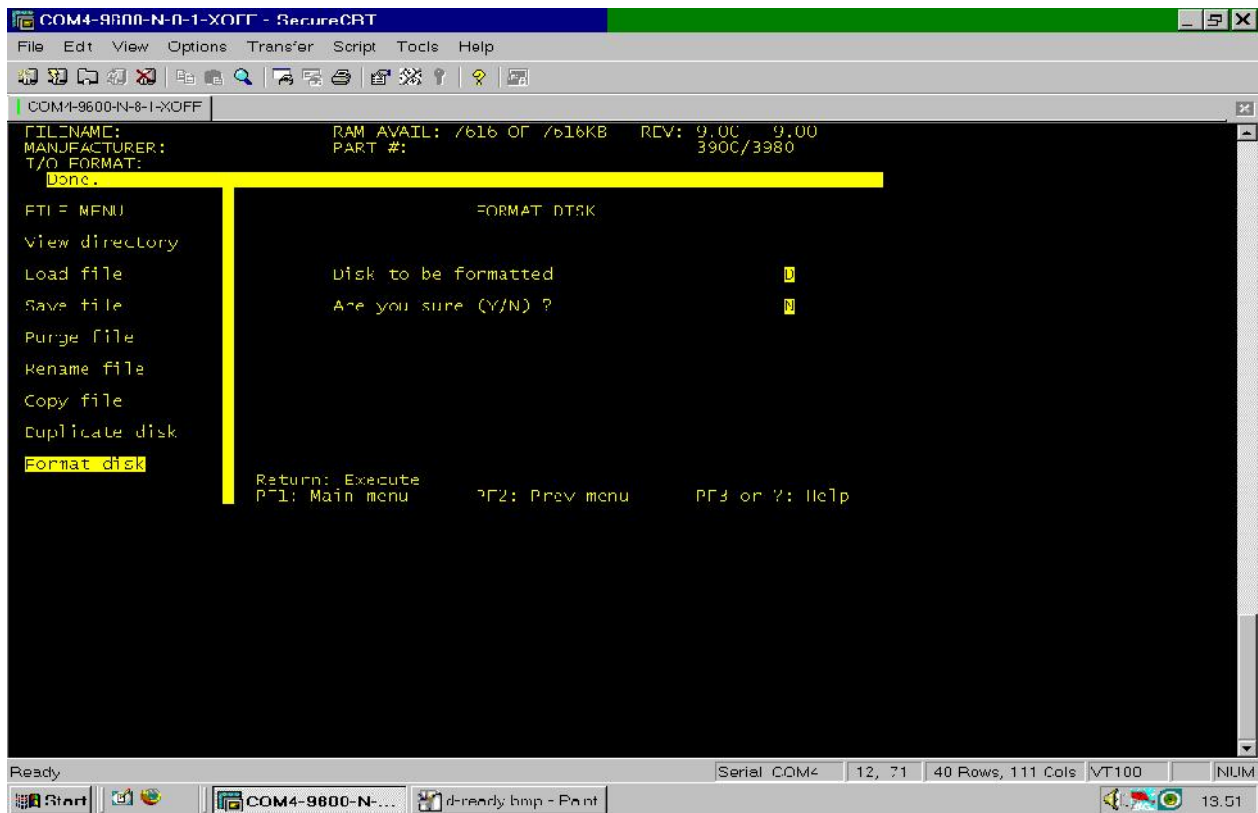
14. Either arrow down to 'Format Disk' and press Enter, or simply press F. Your next screen should now look like this.



15. From here, select C as the disk to be formatted, arrow down once, type Y, and press enter. You should get this.



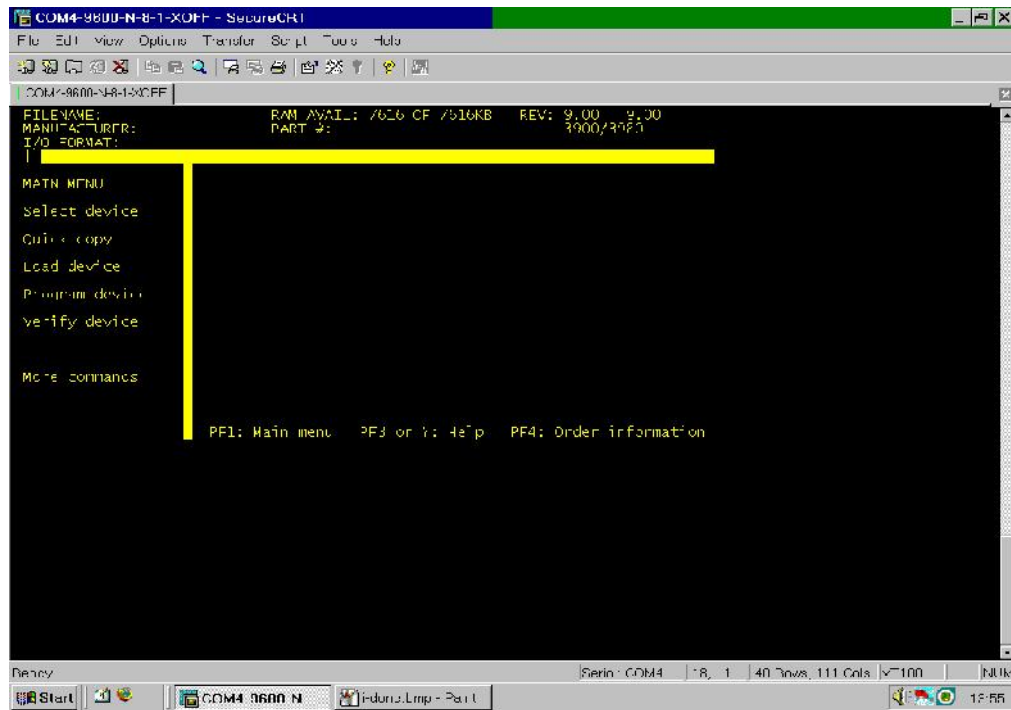
Followed by this...



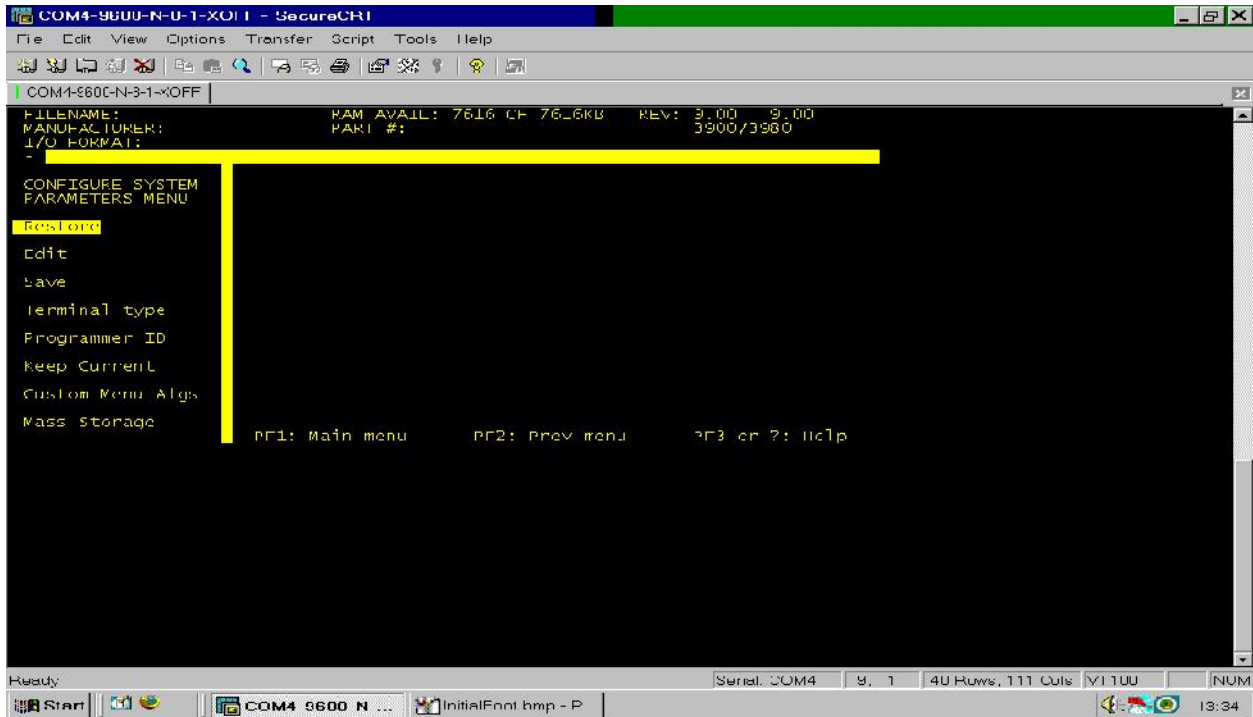
Except, of course, the drive letter shown will be 'C' (I forgot to capture one of the screens, sorry...)

16. **Repeat these operations** for drive letters D, H and I, in that sequence.

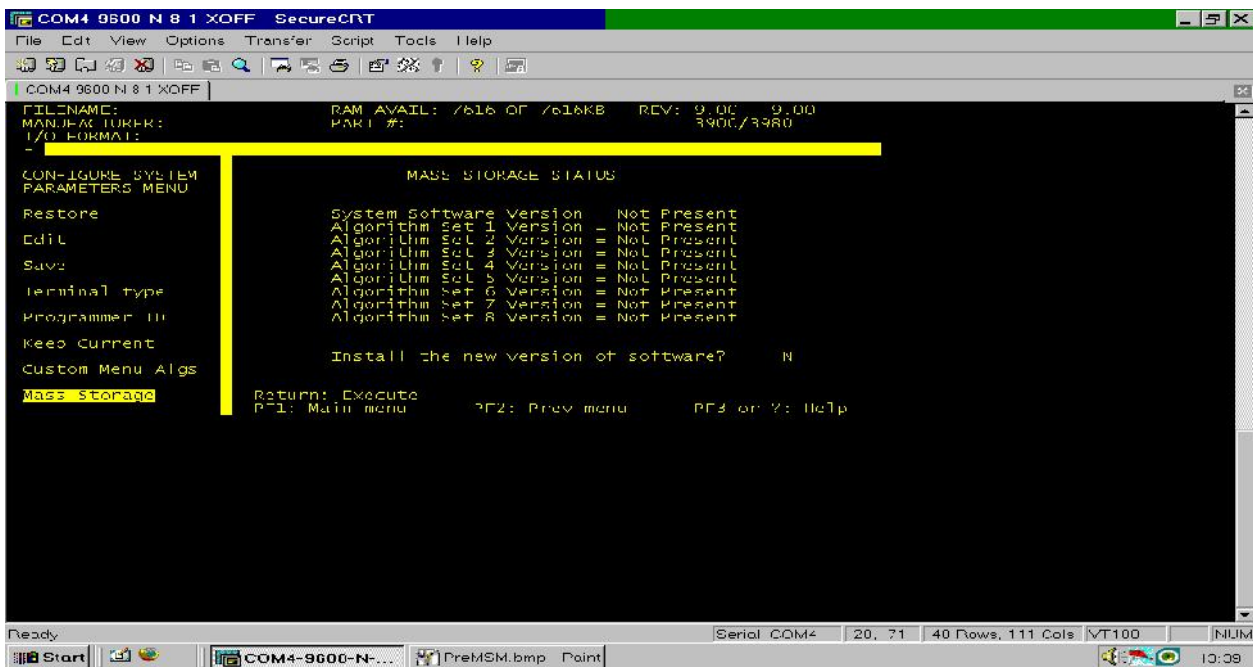
17. Once you get done formatting, press F1. This should get you back to the main menu as shown.



18. The next step is to transfer the system software and device algorithms to the MSM. From the main menu, arrow down to 'More Commands' and press enter, or simply press M. You should get this.

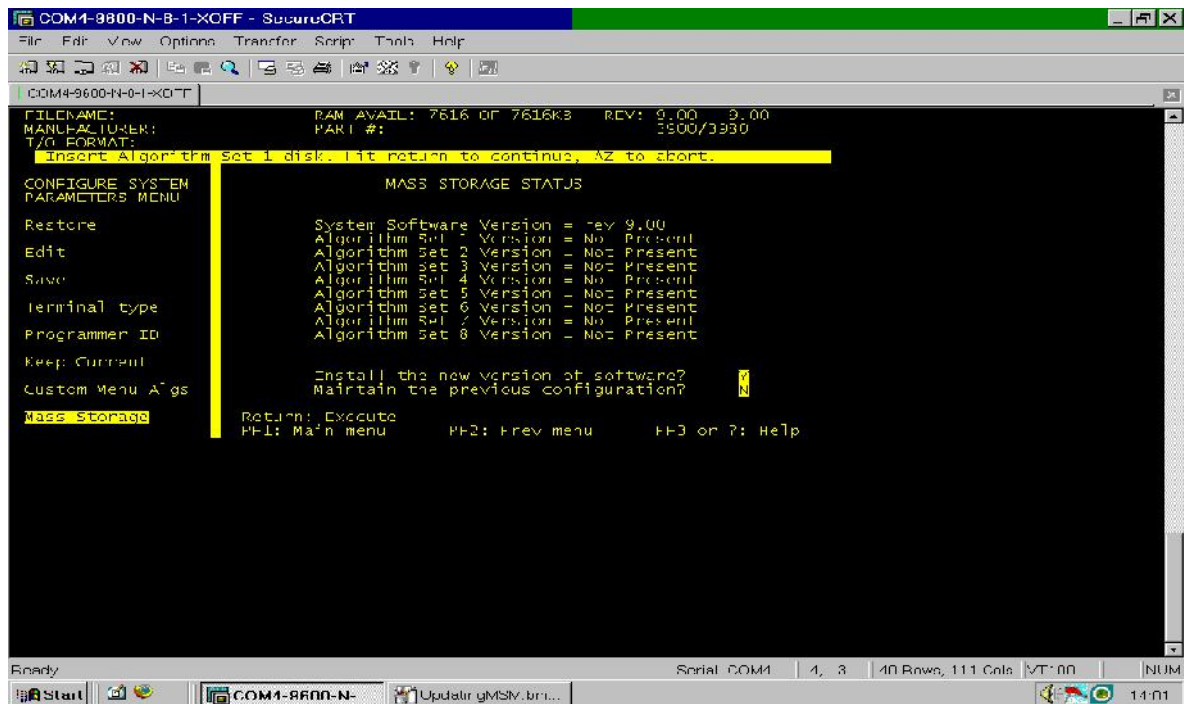
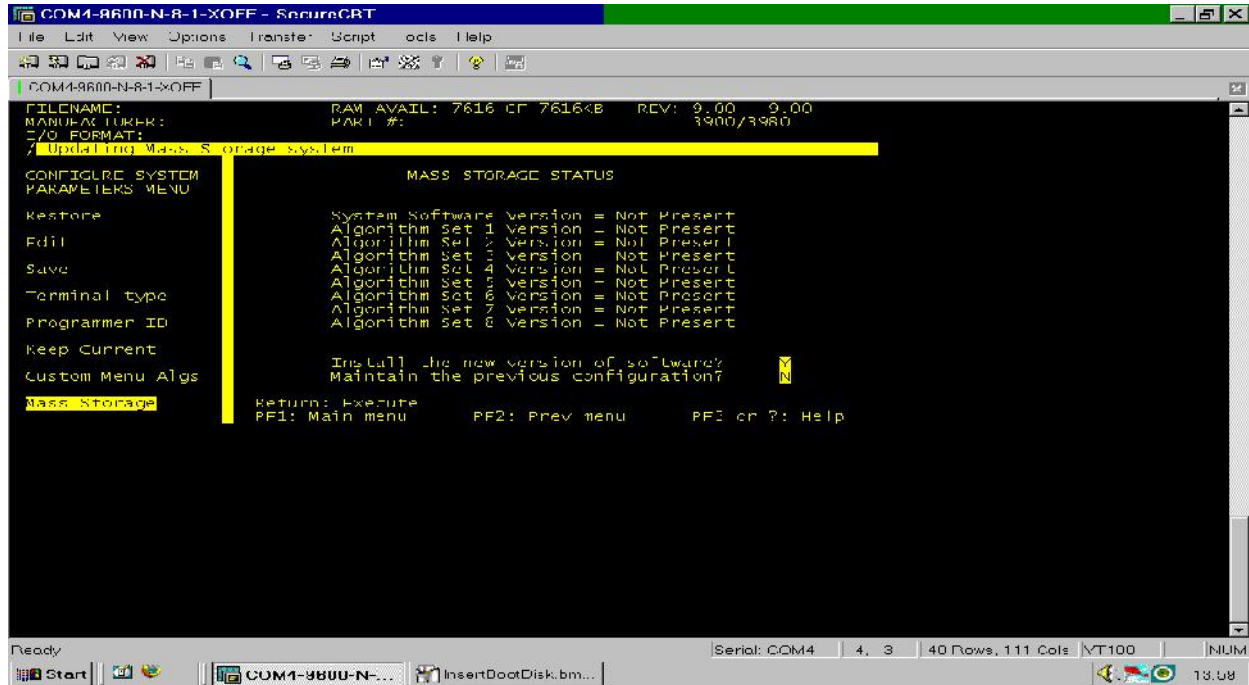


19. Press M to get to 'Mass Storage.' You should get something similar to this.

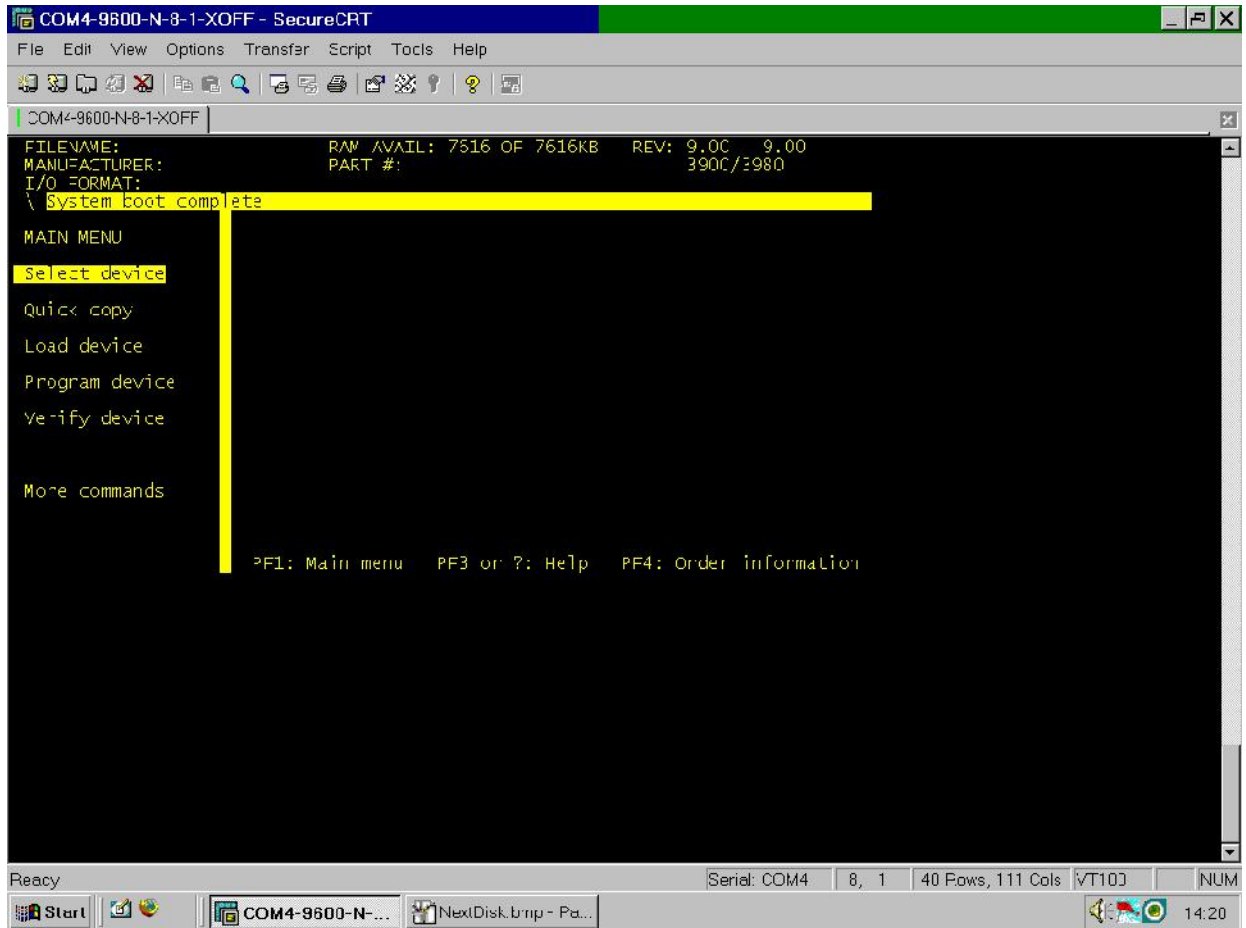


20. The letter under 'Install new version of software?' should have a flashing cursor over it. Type Y, and press enter. It will ask if you want to maintain the previous configuration. Leave it at the default (N)o, and press enter again. You should see this.

21. After the floppy drive thrashes for a while, you should see something similar to this.

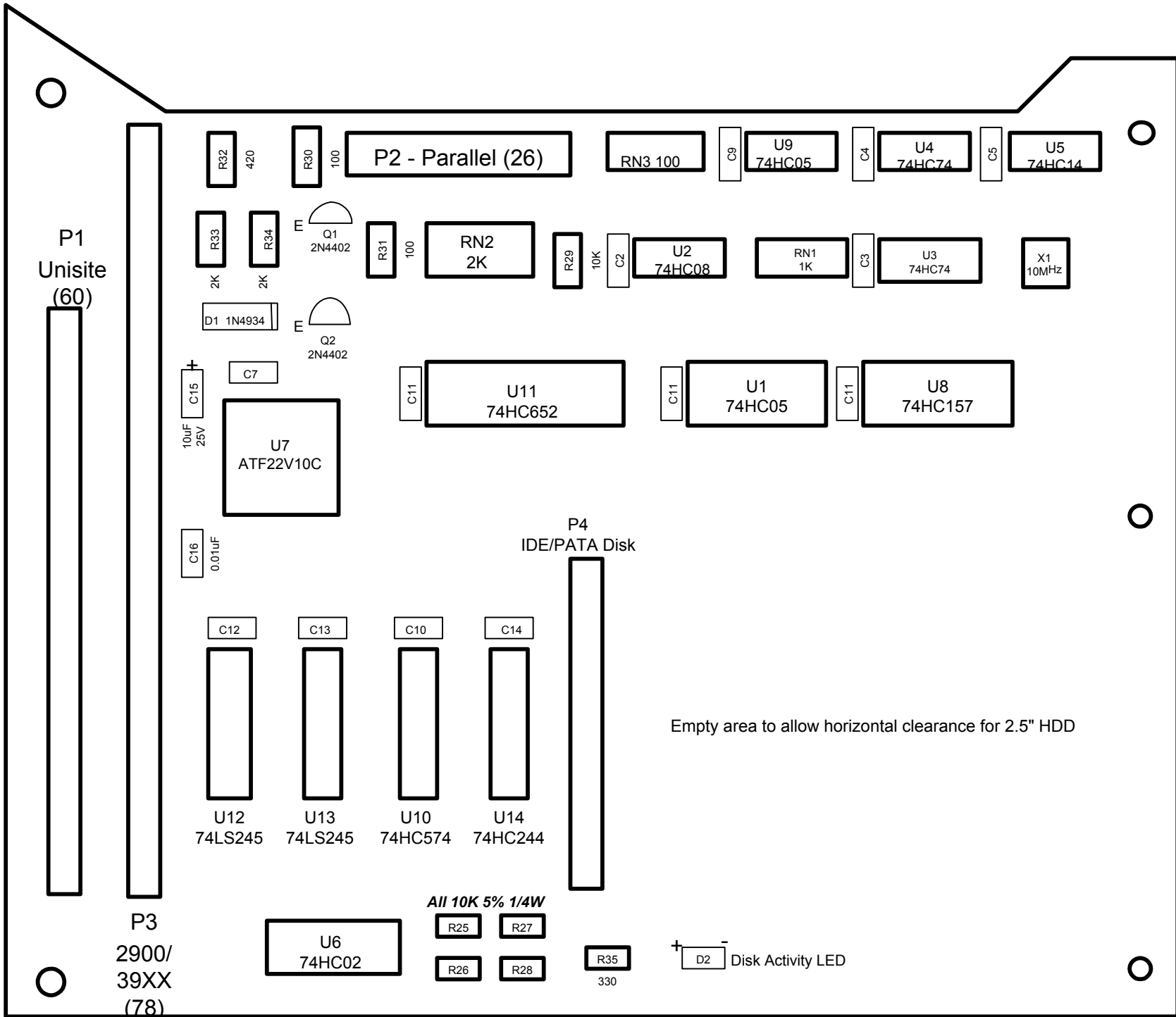


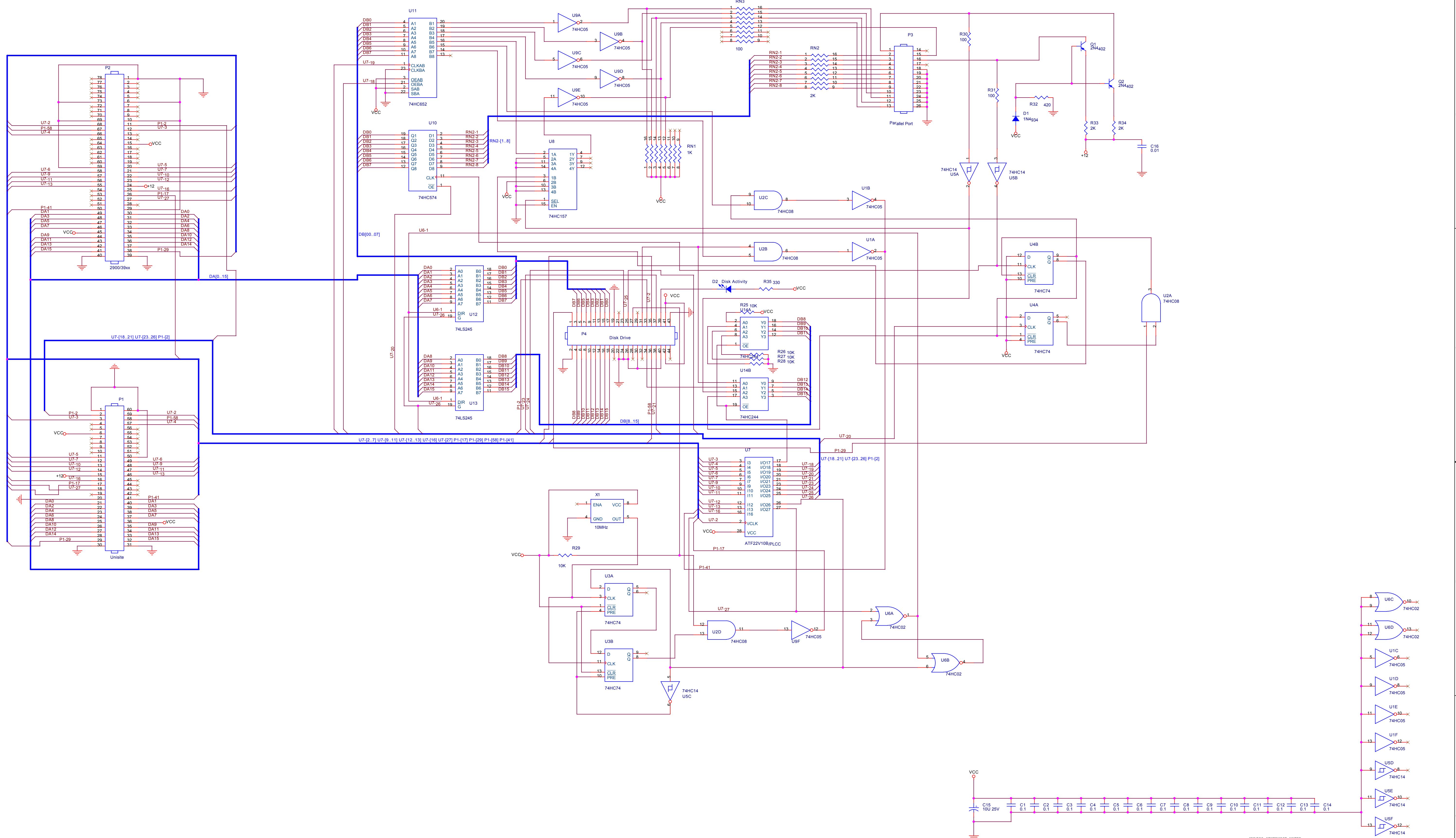
22. Follow the prompts to install the remaining disks, swapping floppies when asked. Once you get done, all the 'Algorithm Set' entries should show the version present.
23. **FINAL STEPS:** Remove any floppies left in the drive. Press ESC, then hold down CTRL and press W. This will initiate a warm reboot of the programmer. If all goes well, you should see something very similar to this screen within two minutes or less.



24. **Congratulations!** You just saved yourself at least \$1,800 over Data I/O's prices, and have given your programmer a great new lease on life. Happy tweaking!

Ref:	Qty:	Description:	Suggested Vendor:	Manufacturer & P/N:
C1-14	14	0.1uF 50V Ceramic Capacitor	Mouser	C320C104K5R5CA7301 (Kemet)
C15	1	10uF 25V Tantalum Axial Capacitor	Mouser	173D106X9025WE3 (Vishay)
C16	1	0.01uF 50V Ceramic Capacitor	Mouser	C320C103K5R5CA7301 (Kemet)
D1	1	1N4934 or Equivalent	Mouser	1N4934 (Fairchild)
D2	1	Green LED, 3mm, 0.100 Lead Space	Mouser	WP7104ZGC/G (Kingbright)
P1	1	60-pin male Berg header, 0.100 x 0.100	DigiKey	TSW-130-07-S-D (Samtec)
P2	1	78-pin male Berg header, 0.100 x 0.100	DigiKey	TSW-139-07-S-D (Samtec)
P3	1	26-pin male Berg header, 0.100 x 0.100	Mouser	77313-824-26LF (FCI)
P4	1	44-pin male Berg header, 2mm x 2mm	Mouser	151244-8422-RB (3M)
Q1, Q2	2	2N4402 or Equivalent	Mouser	MPS6253 (Fairchild)
RN1	1	1K Isolated Resistor Array	Mouser	MDP16031K00GD04 (Vishay)
RN2	1	2K Isolated Resistor Array, SOIC-16	Mouser	4816P-T01-202LF (Bourns)
RN3	1	100 ohm Iso Resistor Array	Mouser	MDP1603100RGD04 (Vishay)
R25-29	5	10K 5% 1/4W Film Resistor	Mouser	MFS1/4LCT52R103J (KOA Speer)
R30-31	2	100 ohm 5% 1/4W Film Resistor	Mouser	MFS1/4D52R1000F (KOA Speer)
R32	1	422 ohm 1% 1/4W Film Resistor	Mouser	MF1/4DCT52R4220F (KOA Speer)
R33-34	2	2K 1% 1/4W Film Resistor	Mouser	MFS1/4DCT52R2001F (KOA Speer)
R35	1	330 ohm 5% 1/4W Film Resistor	Mouser	MF1/4LCT52R331J (KOA Speer)
U1, U9	2	74HC05 Hex Inverter DIP14	Mouser	SN74HC05N (TI)
U2	1	74HC08 AND Gate DIP14	Mouser	TC74HC08AP(F) (Toshiba)
U3, U4	2	74HC74 Dual FF, DIP14	Mouser	SN74HC74N (TI)
U5	1	74HC14 Hex Inverter DIP14	Mouser	CD74HC14EE4 (TI)
U6	1	74HC02 Quad NAND, DIP14	Mouser	SN74HC02NE4 (TI)
U7	1	22V10 PLD, PLCC28	Mouser	ATF22V10C-10JU (Atmel)
U8	1	74HC157 MUX, DIP16	Mouser	74HC157N,652 (NXP)
U10	1	74HC574 Octal FF, DIP20	Mouser	SN74HC574N (TI)
U11	1	74HC652 Octal Bus TXCVR, DIP24	Mouser	SN74HCT652NT (TI)
U12, U13	2	74LS245 Octal Bus TXCVR, DIP20	Mouser	SN74LS245NE4 (TI)
U14	1	SN74HC244N Line Driver, Octal, DIP20	Mouser	SN74HC244N
X1	1	10MHz 50PPM Clock Osc. DIP8	Mouser	MXO45HS-3C-10M0000 (CTS)
XU-14	7	IC Socket, DIP14, Machine Pin	Allied Electronics	110-93-314-41-001000 (Mill-Max)
XU-16	3	IC Socket, DIP16, Machine Pin	Allied Electronics	110-93-316-41-001000 (Mill-Max)
XU-20	4	IC Socket, DIP20, Machine Pin	Allied Electronics	110-99-320-41-001000 (Mill-Max)
XU-24	1	IC Socket, DIP24, Machine Pin	Allied Electronics	110-99-324-41-001000 (Mill-Max)
XU-PLCC	1	IC Socket, PLCC28, Thru-Hole	Mouser	8428-11B1-RK-TP (3M)
Disk	1	128MB SSD PATA 44-pin	Transcendusa.com	TS128MDOM44H-S





UNLESS OTHERWISE NOTED:
 (1) All Resistors in Ohms.
 (2) All Capacitors in Microfarads.
 (3) Stray Neutrons Flux of up to 0.42t is acceptable.

File	Data I/O Unifamily MSM Replacement		Rev
Size	Document Number	BFT-MSM-IDE-DIP (Final)	C
Date	Sunday, March 27, 2011	Sheet	1 of 1