RAMDISK

REFERENCE
MANUAL

HORIZON COMPUTER. LIMITED
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Users Manual by D. R. Romer
Construction Guide by R. Gries
ROS modifications by J. Peter Hoddie

The CONSUMER assumes full risk and liability for direct or consequential damages arrising from attempted construction of the HRD+ Ramdisk.

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Fully constructed HRD+ RAMDISKS are available with a 90 day limited warrenty for an additional cost covering parts and labor. Contact BUD MILLS SERVICES for current list of Dealers or Builders.

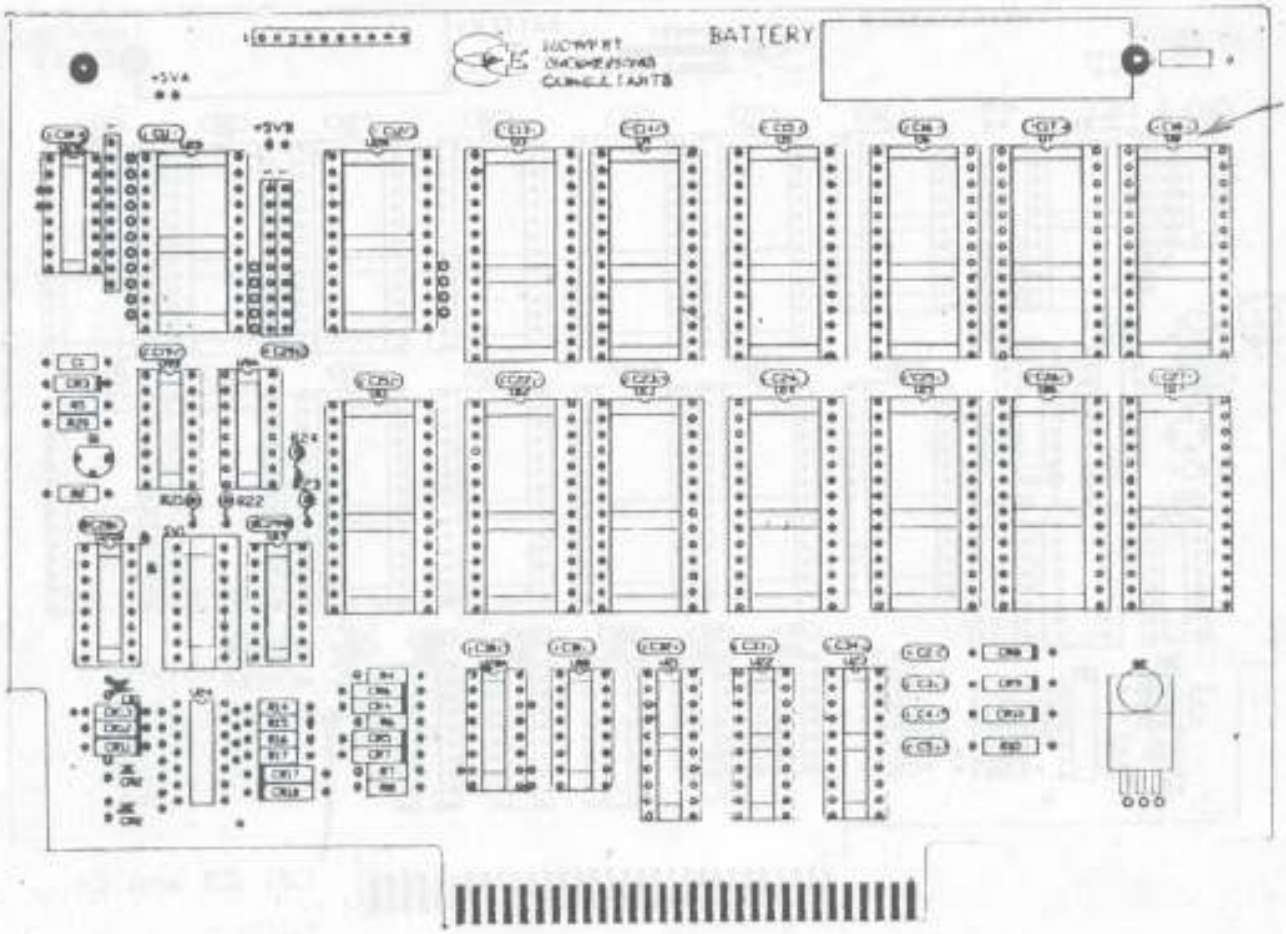
Prior familiarity with construction of digital circuits is assumed. Read all construction suggestions and notes provided with instructions figures before proceeding. The following pages show progressive stages in completion of the HRD+ RAMDISK. If you encounter a problem or have a question at any step DO NOT PROCEED UNTIL THE PROBLEM IS RESOLVED. If you have any questions contact: Bud Mills at (419) 385-5946.

Although static can be a problem with CMOS devices (i.e. the 6264LP15 or 62256LP12) we have not seen a single case of IC damage under ordinary handling procedures; nor have we seen problems do to excessive heat. While you may decide to take precautions against excessive static and heat transfer, remember that it is equally important THAT ALL SOLDER CONNECTIONS ARE OF GOOD INTEGRITY.

Use a low wattage (about 25 watts) SOLDERING PENCIL and fine 60:40 tin/lead solder. DO NOT USE a soldering gun or acid core solder! Make sure that sufficient solder is supplied to all connections with good wet-out, but that there are no solder bridges between connections. Upon completion of all soldering, remove flux from the solder side of the board with a commercial flux remover.

When inserting IC's bend the pins to fit the socket by placing the IC on it's side on a flat surface. Bend the pins against the surface by moving the body of the IC. Make sure all pins are properly aligned with the socket holes and that all pins actually go into the socket holes upon insertion.

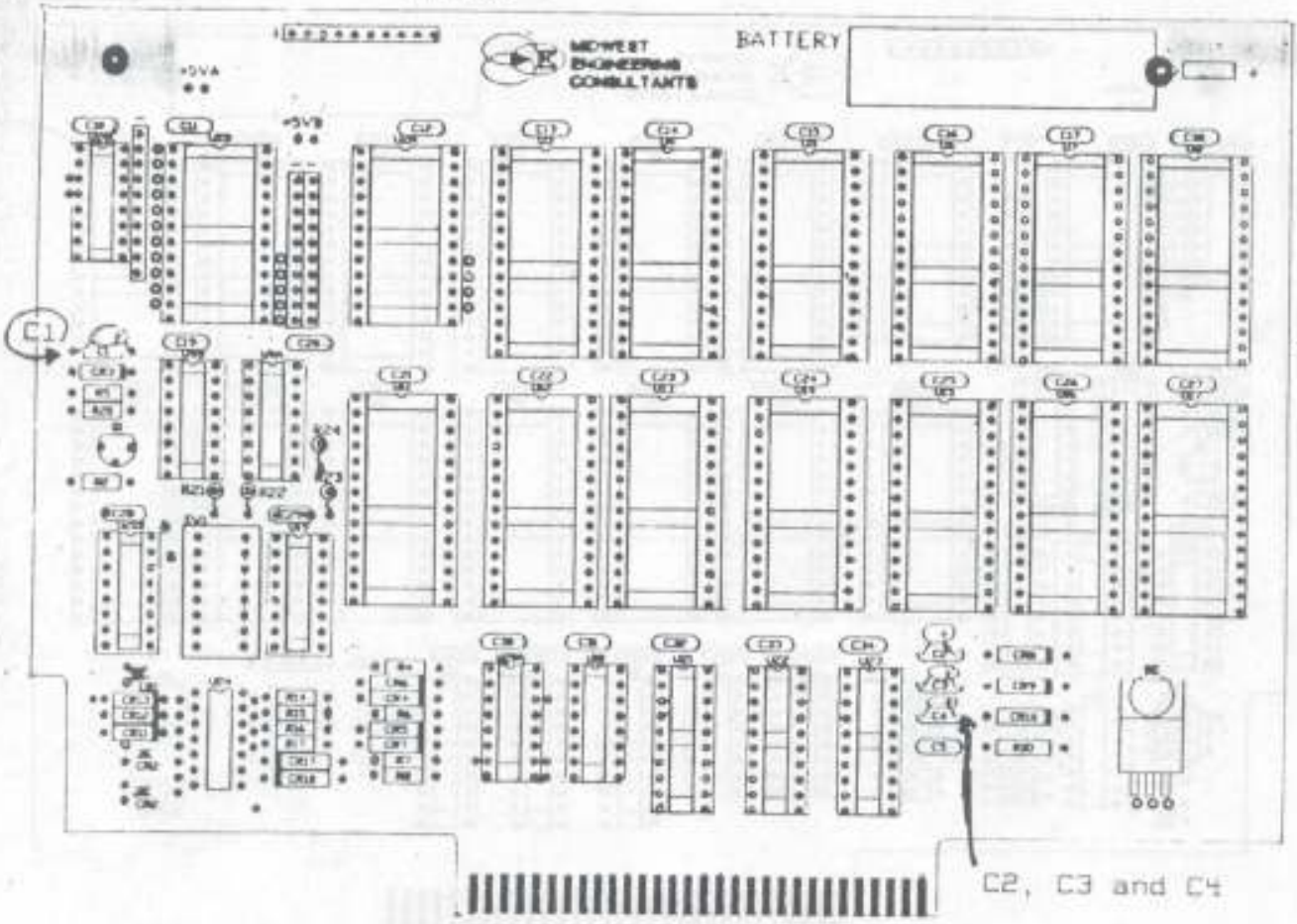
FIGURE 1



THE IC SOCKETS (See Figure 1)

This requires 13 - 28 pin IC sockets, 2-24 pin sockets, 3-20 pin sockets, 8-16 pin sockets and 1-14 pin socket. Put them in the board with the notch facing upward and solder them in. It usually works best to place a piece of rigid cardboard over the top of the sockets and the CAREFULLY FLIP the board into position and begin soldering. I always tack the opposite corner pins before removing the cardboard. I can then go back and adjust any socket that is not fully seated by reheating the appropiate pin. Proceed to solder ALL the remaining pins. Remember, TOO much solder may fill the socket and render it useless or may create a solder bridge on the top side of the board under the socket. This is tedious work and care must be taken not to bridge to adjacent pads or lines. If any bridges are created the board will crash in testing.

FIGURE 2



THE CAPACITORS (See Figure 2)

This requires 26 - .1 uf capacitors with .2 inch lead spacing. Insert them in C5, and C10 thru C34. Insert a 1uf tantalum capacitor in C1 so that the positive polarity end faces right (printing toward bottom edge of card. This is the power-up timing cap. Insert 3 - 10uf tantalums with + polarity facing right in C2, C3 and C4.

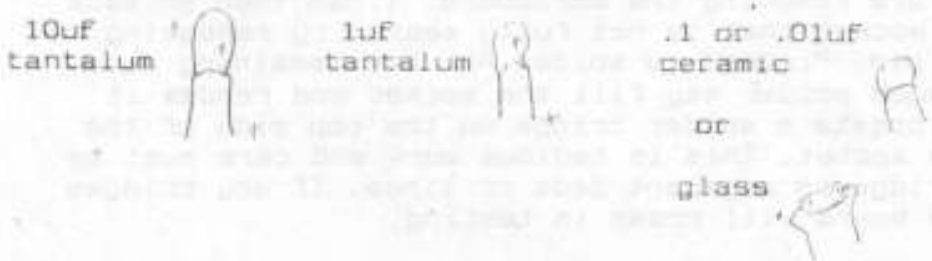
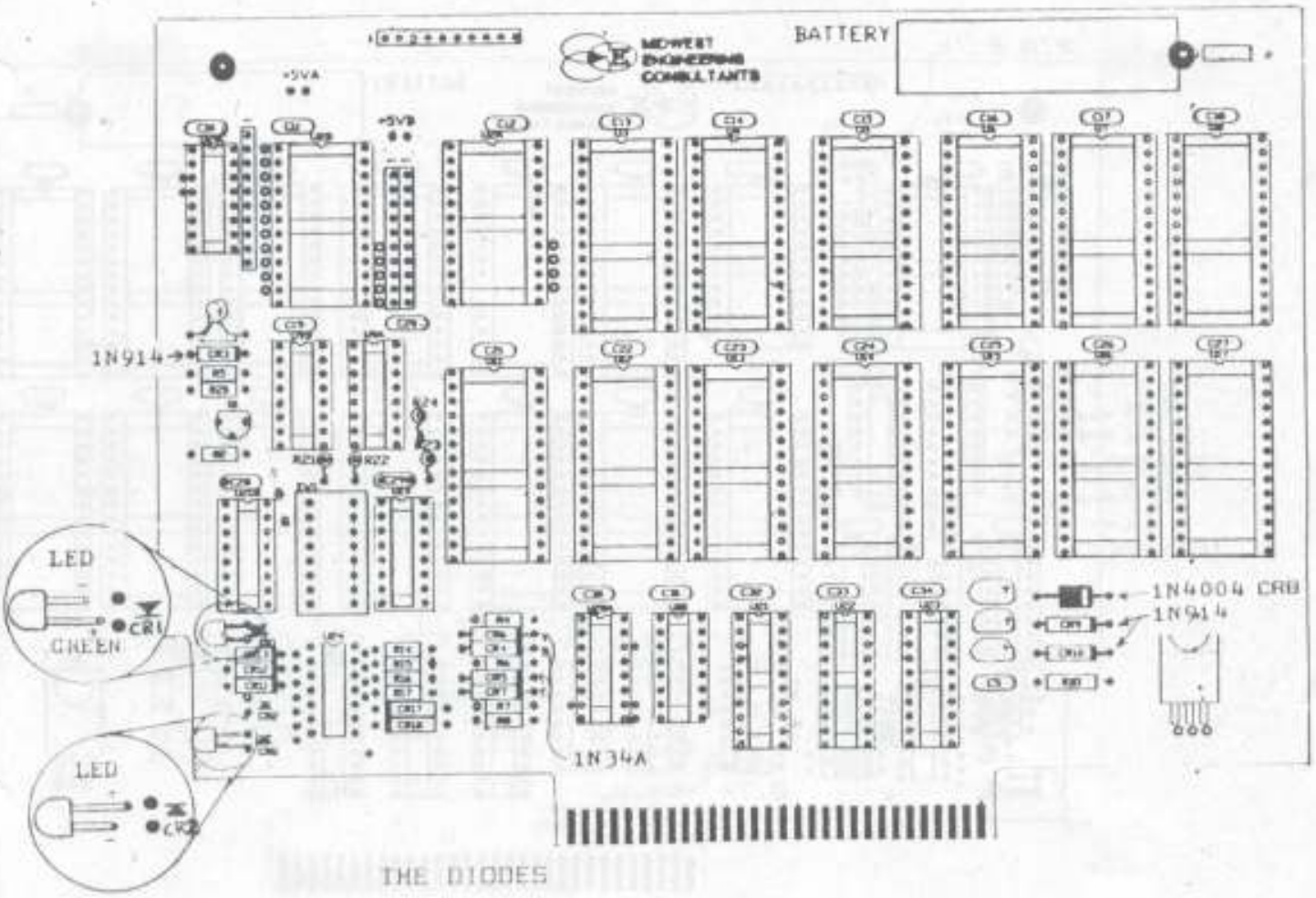


FIGURE 3



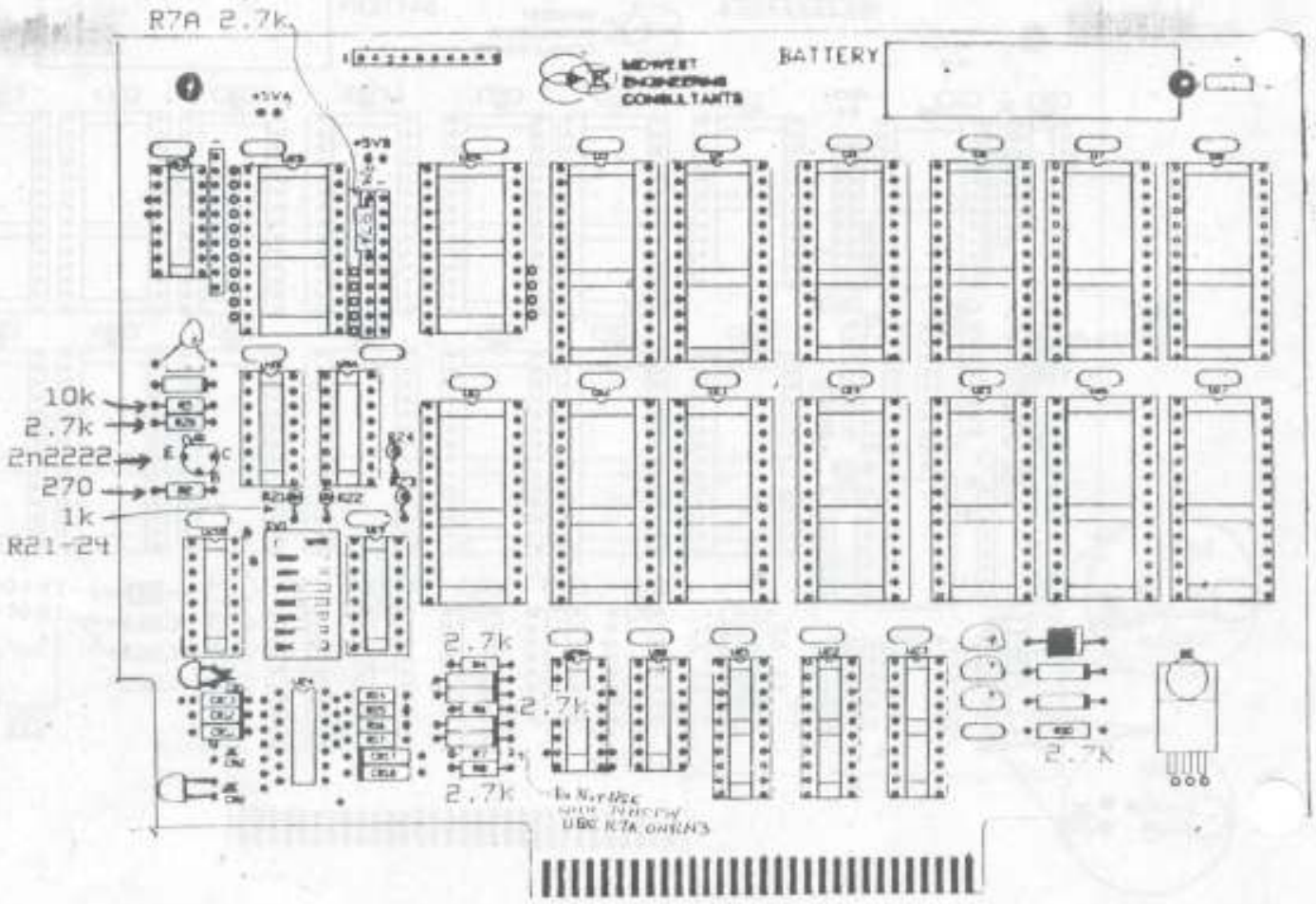
THE DIODES

Refer to Figure 3 for diode placement. Three diode types are shown: CR3, CR9, and CR10 are 1N914 silicon diodes; CR4, CR5, CR6, and CR7 are 1N34A germanium diodes; and CR8 is a 1N4004 rectifier diode. Although similar in appearance, the 1N914 silicon diodes are smaller than the 1N34A germanium diodes.

Diodes are polar. In the ->| notation the arrow points toward the cathode (-). Silicon are germanium diodes have a black or blue band on one end to indicate the cathode (-) lead. The rectifier diode will likely be black with a silver cathode band. Make sure the components you are working with are banded (glass bypass capacitors look similar but are not banded), and make sure you orient each diode with the cathode band in the direction shown in Figure 3.

Next install the 2 Light Emitting Diodes (LED's). CR1 must be green or yellow. CR2 may be any color of LED. LED's have polarity, and the cathode (-) of those you are using will be indicated by a flat side on the LED body or the shorter of the two leads. Orient the LED's as shown in the inset. CR2 should be installed so that the lens points toward the front of the card but does not extend past the card edge.

FIGURE 4



THE RESISTORS (See Figure 4)

Mount resistors R2 - R8 and R10 as shown. Although resistors have no polarity, you may orient them so that the color codes can be read from left to right. Resistor values and corresponding color codes are as follows:

R2	270	Red Violet Brown	R6	2.7K	Red Violet Red
R3 and R7		Not Used	R7A	2.7K	Red Violet Red
R4	2.7K	Red Violet Red	R8	2.7K	Red Violet Red
R5	10K	Brown Black Orange	R10	2.7K	Red Violet Red
R20	2.7K	Red Violet Red			
R21-R24	1K	Brown Black Red	R1 AND R9		(See Figure 5)

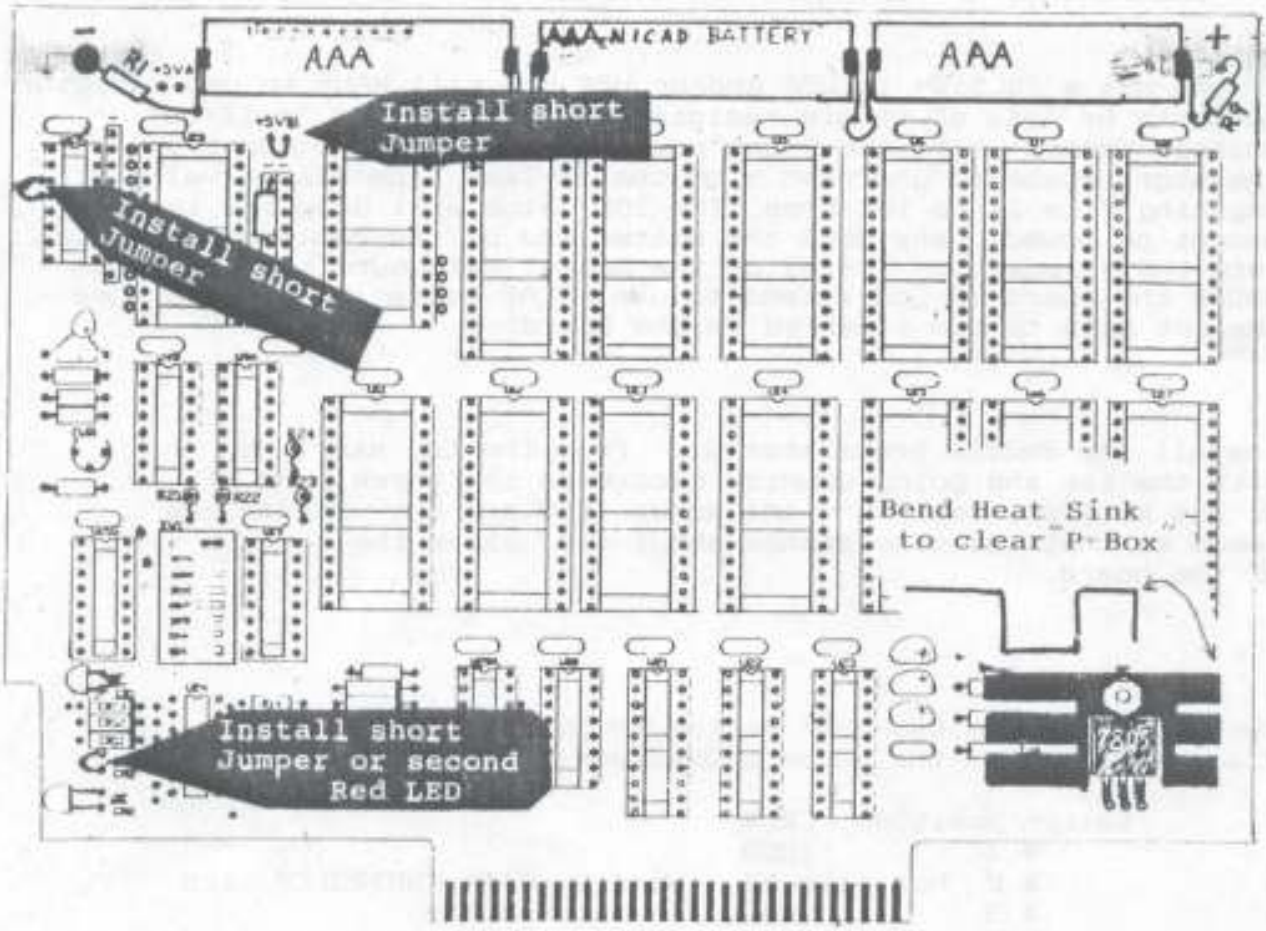
IF you use a 74LS154 in U2A and/or U2B you will HAVE to use resistor networks or lots of single resistors to provide the "pull-up" voltage needed while the P-Box power is turned off. About the resistor networks, you need 4 of the 10 lead type with a value of anything from 1k to 10k ohms. The 10k value will draw the least amount of power. Make SURE the dotted end of the resistor pack goes into the #1 position listed on the board! Make sure that RN1 goes UNDER the board if you intend to use NICAD batteries -- make sure the dot goes to pin 1 marked on the board!

Install the 2N2222 transistor Q1. From the top starting with the tab and going counter clockwise the three pins of Q1 are emitter, base, and collector (E B and C). Solder the leads so that the case stands about 1/4" above the surface of the board.

Install the 8-position DIP switch in 16 pin socket. Place switch 5 in the ON or CLOSED position as shown.

Switch position	CRU#	
# 1	1000	
# 2	Not allowed	Used by DISK CONTROLER Card
# 3	1200	
# 4	not allowed	Used by RS232 Card
# 5	1400	
# 6	1500	
# 7	1600	
# 8	1700	

FIGURE 5



THE POWER OPTIONS (See Figure 5)

Lightly sand the underside of each battery holder to promote adhesion. Rotate the solder tabs on each battery holder so they are parallel with the surface of the board. Observing correct polarity, with batteries in place, use five minute epoxy to cement the holders to the board surface. Leave space between the holders as shown. When the cement has set, use short lengths of wire to connect the center holder with the two end holders.

Solder a 33 ohm resistor, R1 (orange orange black) to the board and the negative end of the left battery holder. Solder a 33 ohm resistor, R9 (orange orange black) to the board and the positive end of the right battery holder. Connect R9 to the right of CR16.

Solder the 7805 voltage regulator in place making sure that the hole in the tab lines up with the hole in the board. Install a heat sink on top of the tab with a 6-32 1/4" machine screw and nut.

POWER OPTIONS Continued.

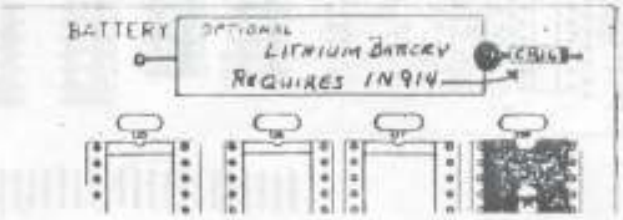
Solder a jumper between the pads beside U20C pins 3 4.

Solder a jumper or a second RED LED in the other holes at CR2.
(If you use two LEDS at CR2, then change R2 to >50 <100 ohms)

Solder a jumper between the pads by +5VA OR +5VB.
Choose the +5VA only if U2A and/or U2B are 74LS154N
Choose the +5VB if Using 74HC154N in the U2 sockets.
Note: Using a 74LS154 with the +5VB will increase the load on the batteries and will cause loss of data.

We normaly supply and recommend AAA NiCad Rechargable batteries, however you could use regular AAA DRY batteries with a protective diode (CR16). The 3.5v Lithium Cell is also Acceptable with a protective diode (should last 5 to 10 years).
the REGULAR batteries may last up to a year before they have to replaced. CAUTION you MUST use a protective diode with the REGULAR or LITHIUM BATTERIES...
Do not use the diode on the NiCad Batteries (inhibits charging).

LITHIUM BATTERY INSTALLATION FIGURE



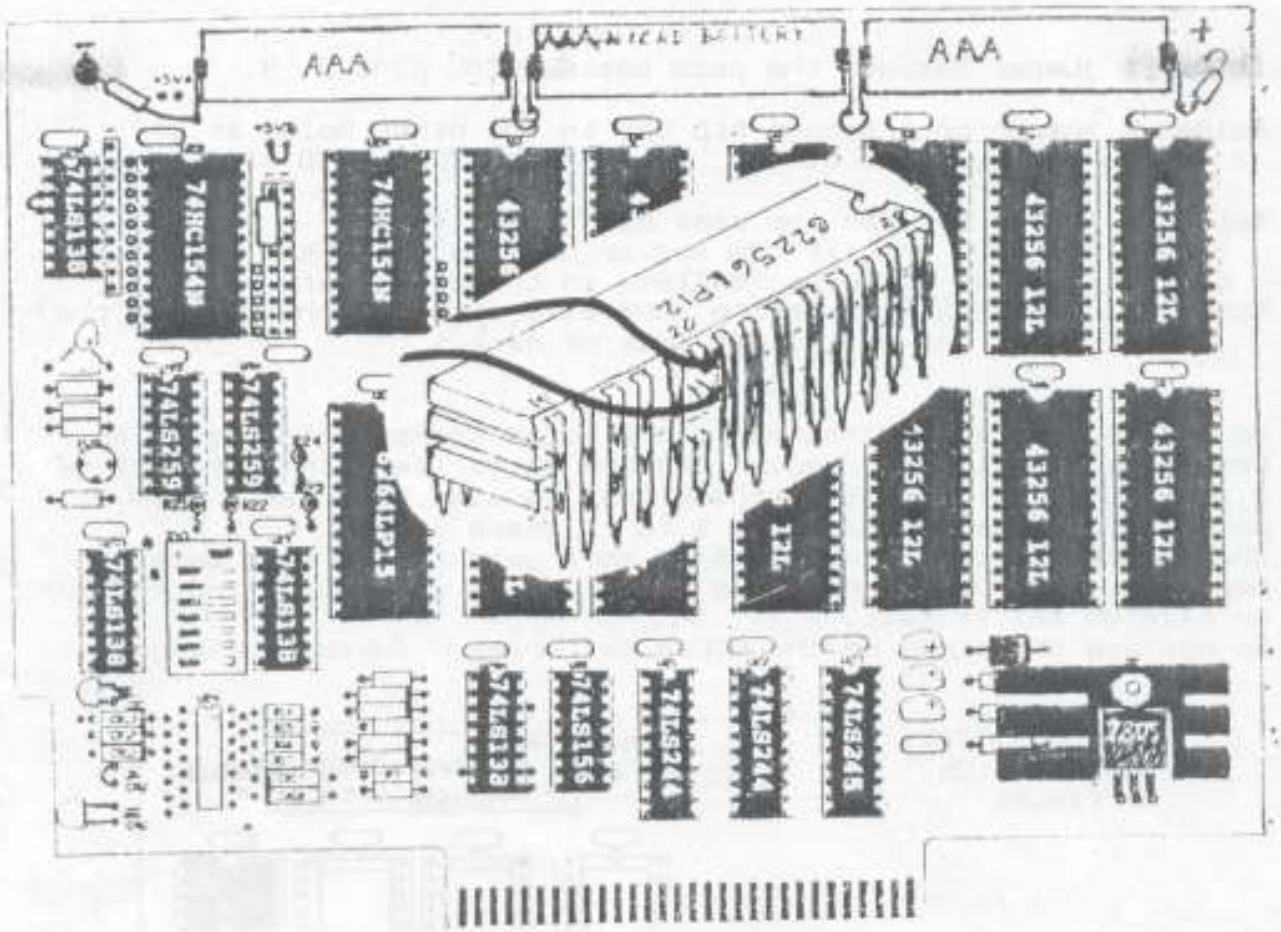
Your RAMDISK is almost ready to test in your P-BOX. But before we PLUG it in, Lets go back and RECHECK ALL of the steps and carefully examine ALL solder connections. Use a flux remover to clean up all connections (an old toothbrush helps). A magnifing glass is also recommended to help you check the connections.

If the results at any step are not as described STOP AND CORRECT THE PROBLEM BEFORE PROCEEDING.

With NO IC's inserted, place the card in the Peripheral Expansion Box and switch on the power. The CR1 LED should light and the CR2 LED should not light. CR1 LED cannot be seen from the front of the PEB, you must look down from the top. CR1 will be dim and very hard to see.

IF CR1 does not light up then something is wrong.. TURN OFF the P-BOX and recheck everything.

FIGURE 6



THE INTEGRATED CIRCUITS (SEE FIGURE 6

Insert all IC's except the MEMORY CHIPS. Make sure the notch of each IC points toward the battery holder and that the labels on the IC backs are oriented as shown in Figure 6. Install U11, the 6264LP-15 nearest the left side of the board. TO AVOID MEMORY DAMAGE, NEVER PLACE THE CARD IN THE PE-BOX WITHOUT ITS BATTERIES! Run the MEGTEST program as described in the MEGTEST Instructions. As the program runs, the CP2 LED should turn on and off. If the program stops or has errors check that the DIP switch setting and the CPU address MEGTEST is testing match. If the DIP switch setting is correct check the germanium diodes. We have found that the germanium diodes CR4 CR7 can be the problem. The diodes can be replaced with Radio Shack Cat. No. 276-1123. More often we find an "open" solder connection. Another cause may be a defective chip, try replacing U18, U20 after rechecking the DIP Swi setting.

Next insert the 62256LP12 or 43256-12L MEMORY chips per the following chart. Re-run the MEGTEST program. This time, selecting the MEG CARD option. No bad chips should be found.

IMPORTANT: If you are building your card at less than 384K then you MUST insert the Memory Chips in the following sockets.

First 96K:	U17	U8	U16
192K:	U7	U15	U6
288K:	U14	U5	U13
384K:	U4	U12	U3

(the twelve sockets will each have one memory chip inserted)

Note: you can add more chips (even one at a time) but you must follow the order of U17,U8,U16,U7,U15,U6,U14,U5,U13,U4,U12,U3.

After testing the remaining chips proceed to stack and solder the memory chips for U3 thru U8, U12 and U13, three chips high. Do not solder pin 20 on any chip. Looking at at IC from the top with notch up, pin 20 is the sixth from the bottom on the right side. Bend the remaining pins inward so they make firm contact when placed over the bottom IC. Making sure notches are matched, place top IC (pin 20 bent out) over the bottom IC. Repeat for the third level. Stack chips U14 thru U17 two high. Bend pin 20 outward on each of the upper chips. All pins on the bottom chip should be clean, straight, and free of excess solder for proper fit in the sockets. Keep the ends of the bottom IC pins free of solder and scrape off flux before reinsertion. THE INTEGRITY OF EACH SOLDER JOINT IS VERY IMPORTANT. After soldering and carefully inspecting as IC pair, re-heat each joint to INSURE GOOD WET-OUT OF BOTH PINS. Attach a wire to each bent out pin 20, each wire should be long enough to reach pin 1 thru pin 17 of the U2B socket. Make sure there NO solder bridges between adjacent pins. Proceed to insert the chip stacks and connect the wires (Chip Select Control Leads).

Chip Select CONTROL LEAD ASSIGNMENTS

The "order" of assignment is critical to proper operation of the HRD+ RAMDISK, above 384K. The first 12 chip select leads to pin 20 of each memory socket are hardwired in the board directly to U2A. The next four appear next to the U2A socket holes 13, 14, 15, 16. (This will take you up to 512K). next leads are connected next to holes by U2B pin 1 thru pin 11, and pin 13 thru pin 17 (in ASCENDING 1,2,3 order). The physical location of the 62256 memory chips is limited only to sockets U3 thru U8 and U12 thru U17 and should not exceed three high unless you want to sacrifice the adjacent slot in your PEB or if you are expanding beyond one meg.

After you have connected the last control lead, recheck all connections, and re-run the MEGTEST, all chips should test good. Proceed to configure your card to (L)oad the RDS , (C)onfigure to devide and initialize the available memory into the size drives that YOU want, (E)dit to enter the page 3 MENU selections and assign the DRIVE numbers.
PRINT out the DOCS file and read it for a better understanding of how the MENU and RDS work.....

PARTS LIST FOR HRD+ RAMDISK

Quan.	Part Discription.
1	7805 Voltage Regulator
1 - 2	74HC154 (see note 1 below)
4	74LS138
1	74LS156
2	74LS244
1	74LS245
2	74LS259
1	6264LP-12
-->	62256LP-12 or 43256-12l (see note 2)
1	14 pin socket
8	16 " "
3	20 " "
2	24 " "
13	28 " "
1	2N2222 Transistor
4	1N34A Diode (radio shack)
3	1N914 "
1	1N4001 to 1N4004
1	LED (Green)
1	LED (Red)
1	DIP Switch
3	NiCad AAA Battery
3	AAA Battery Holders
1	10l Resistor
6	2.7k "
4	1k "
2	270 "
2	33 "
1	1uf Tantalum Capacitor
3	10uf " "
26	.1 or .01uf Capacitors (these may be Ceramic or Glass)
1	Heat Sink for the Regulator

Note 1: One 74HC154N will support 512k of Memory. A second 74HC154N will be needed for 512k to One MEG. If you use 74LS154N you will also HAVE to use "pullup resistors" RN1-4.

This chip MUST be .600 wide "N" package

Note 2: The Hitachi HM62256 LP12 and the NEC 43256 12L are "equivelent" Each of these chips provide 32k of Memory in our circuit. The size that you want to build will determine the number of chips to obtain. 3x32=96k, 6x32=196k, 8x32=256k, 12x32=384k, 16x32=512k and so on,,,, 32x32=1024k (ONE MEG+)

APPENDIX 1

MEGTEST INSTRUCTIONS For Use on TI OR GENEVE....

Insert the System Disk into Drive one.

Memory chips can fail, and so can any of the other components of your RAMDISK. In order to facilitate a test of your RAMDISK memory, a TI BASIC program called MEGTEST has been included on the System Master diskette. MEGTEST wipes out the ENTIRE contents of the RAMDISK including the operating system, so make sure you copy important files to a floppy diskette before running MEGTEST. After running MEGTEST, the operating system must be reloaded.

Troubleshooting with MEGTEST will identify the chip # for the bottom layer of chips, jack # for the next four chips and also the pin number of the second U2 so you can trace or "pull" the control lead to physically identify the chip in trouble if you have any

The Extended Basic "Load" program DSK1.LOAD provides a menu selection to load MEGTEST. The MEGTEST program rolls up a SWITCH assignment MENU and asks for the number of your DIP SWITCH setting.

The test Menu will then appear;

[U] for U11 TEST
[M] MEMORY TEST
[L] LOOP TEST

When "U" is Selected the U11 chip is Tested. When "M" is Selected the program asks how many chips are installed. Enter the number of 32K memory chips.

It then proceeds to fill the ENTIRE memory on the card with a series of eighteen special numbers and subsequently test each of the 32K chips on your card to see if they retain the values written. If you have a single-sided RAMDISK, 3 chips will be tested for each fill number -- 6 for a double-sided; 12 for DSDD; 16 for 512K; 32 for One MEG.

The [L] loop test is only used to positivily identify a bad chip using a Digital Voltmeter or Digital Probe. The chip under test will be pulsed on and off to allow a test measurmet (HI LO) to verify the physical location of the chip under test. MEGTEST does identify the "JACK" number or the U2B Pin that controls the chip with errors.

You may find one or more bad memory chips. Alternatively, you may find that for certain numbers several chips appear bad. An even more rigorous test is the Disk Manager II comprehensive test. Test 6 of the series has been able to locate problems on double-sided cards that no other test detects. All such problems have been due to poor solder connections on piggy-backed IC's. If you find errors, that you cannot correct, contact us regarding repair of your card.

Note: To use DM2 you will have to configure the card with 7.3 in a TI994A, renumber the drives to two(2) and three(3) (DM2 won't read above four(4) drives) and test each drive individually.

APPENDIX 2

IN CASE OF DIFFICULTY

Problems and "bugs" of various kinds have been found with many computer products, and the HRD+ RAMDISK will probably be no different in this regard. However, because the operating system for the card is in RAM, we can correct software problems by sending you a new disk. You can help us to improve your RAMDISK by letting us know about the kinds of problems you experience in a way that will help us identify and correct the problem.

Whenever you experience a problem in using your RAMDISK, there are several questions you should try to answer. The first is:

Is the Problem the Repeatable?

Using the same piece of software or the same disk, can you make the problem happen consistently. (While ramdom problems are difficult to diagnose, we would still like to know about them.) If the problem is repeatable, try making it happen after powering-down your system and waiting several minutes. Also try it immediately after re-loading the operating system (this will not affect the contents of your disk). Any information you can provide to pin down the factors which cause the problem will be of help.

Is the Problem Specific to the RAMDISK?

If you make a sector copy of the RAMDISK contents to a floppy, set the RAMDISK number at 6, and try the problem situation again using a floppy drive in place of the RAMDISK, does the problem occur? If so, it may not be related to the RAMDISK. In the process of RAMDISK software development there have been many times we thought there were problems with the RAMDISK only to discover the true source of the problem was elsewhere in the system.

Is the Problem Hardware Related?

Use the MEGTEST to check the HRD+ RAMDISK

If you do not find errors, the problem is likely to be in the software which controls the RAMDISK. When you have verified that the problem is repeatable, that it is specific to the RAMDISK, and that your hardware tests OK, please notify us of your problem so that it can be corrected.

No Access to Floppy Drives

If your system appears normal on power-up, but locks up when you try to access your floppy drives, re-load the operating system as follows: Power-down and wait two minutes. Remove the card and turn DIP switch 1 to the OFF or OPEN position. Turn switch 3 to the ON or CLOSED position to set the CRU base address at >1200. This will allow the disk controller card to be accessed before the RAMDISK. Re-install the card and load the operating system as usual. Power-down again and wait two minutes. Then remove the card and re-set the DIP switches as desired.

System Lock-Up on Power-Up

Occasionally (especially if you choose to experiment with writing your own routines for the card) you may find that when you turn on your computer, you get a blank screen and that the computer is "locked-up". If you find that this happens only when the RAMDISK is plugged into the PE-Box, bad data has found its way into the RAMDISK operating system memory, and the operating system must be re-loaded. (Power down and WAIT TWO MINUTES before removing the RAMDISK card.)

Before the operating system can be re-loaded, the card must be made "invisible" to the system. If you have Mini Memory or DEBUG on a SUPER-CART module, simply turn on the card (using the CRU command and entering a 1 for the appropriate base address). When you see the LED light, set the contents of CPU memory address >4000 to 0 (it should be >AA01 initially).

IF LIGHT IS ALREADY ON DO THIS ANY WAY.

Alternatively, you can follow this procedure with Editor/Assembler.

1) Power-down the console and PE-Box;

2) Turn on the console FIRST, then the PE-Box;

3) Enter E/A

4) Select Option 5

5) Make sure system disk is in Drive 1 and type in DSK1.CF6

6) Re-load the RAMDISK operating system.

If this program fails to work the only other alternative is to power-down the system, remove the RAMDISK, and take out one of the three NI-CAD batteries. Allow the card to stand for at least 15 to 30 minutes so the memory contents are lost. Then re-insert the battery and place the card back in the PE-Box. (RUNNING THE CARD WITHOUT ALL THREE NI-CAD BATTERIES IN PLACE MAY CAUSE DAMAGE TO THE MEMORY CHIPS!)

WAIT 2 MIN+

Your system should now power-up normally. Re-load the operating system as usual.

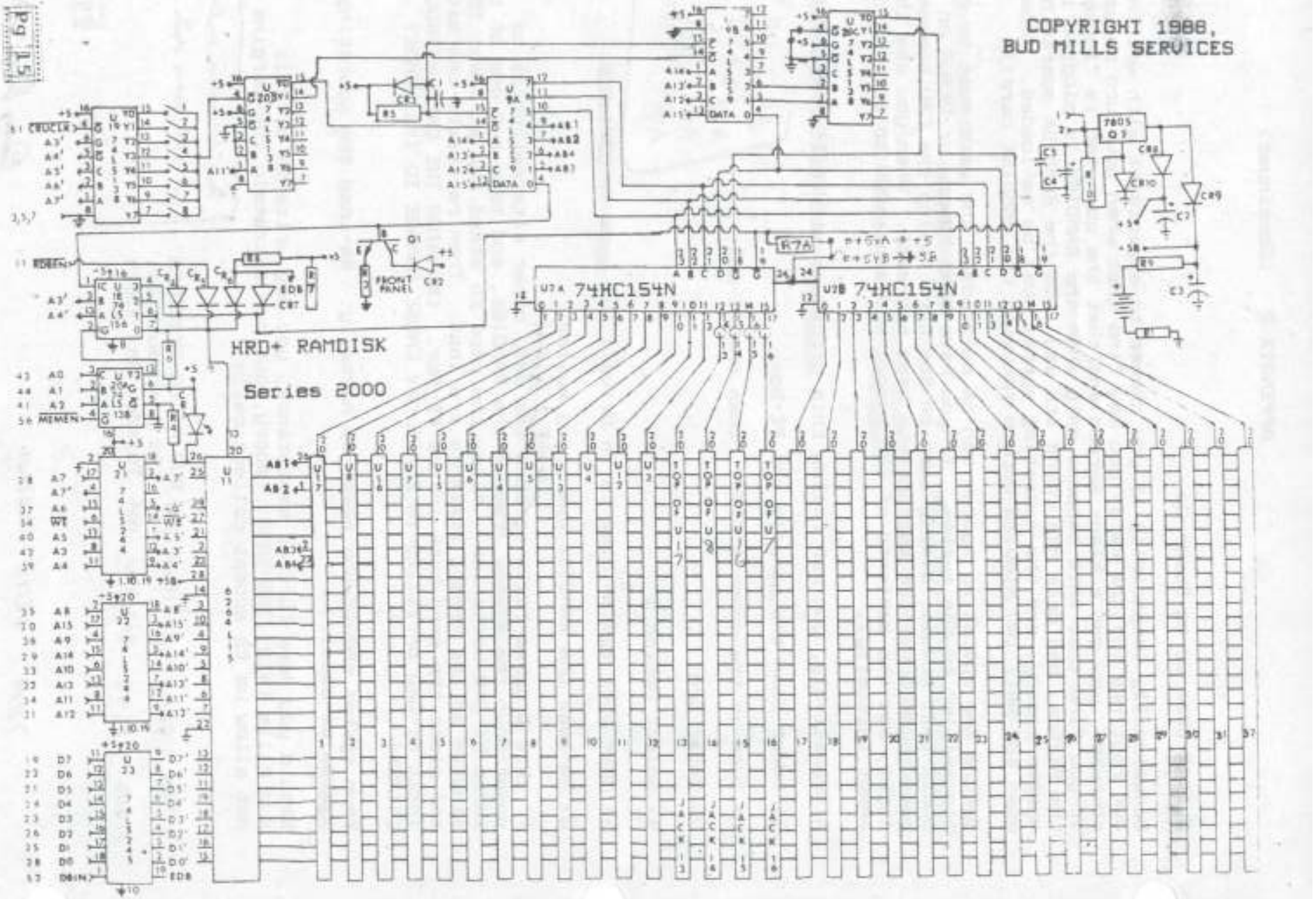
Should you need further assistance, you may write to or call Bud Mills (419) 385-5946 (sorry, but our extremely low margins will not allow us to accept collect calls.)

> CRU num enter C + addr
> CPU num enter 0 + addr

>1500 8K*8 HORIZON 256K BUD MILLS SERVICES
166 Dartmouth Dr.
>1600 8K*8 HORIZON 128K Toledo, Oh. 43614

>1100 DRIVE CONTROL
>1300 RS232 PIO
>1400 32K*8 HORIZON 512K

Easy Bug reset = "."
" " previous screen = "A10"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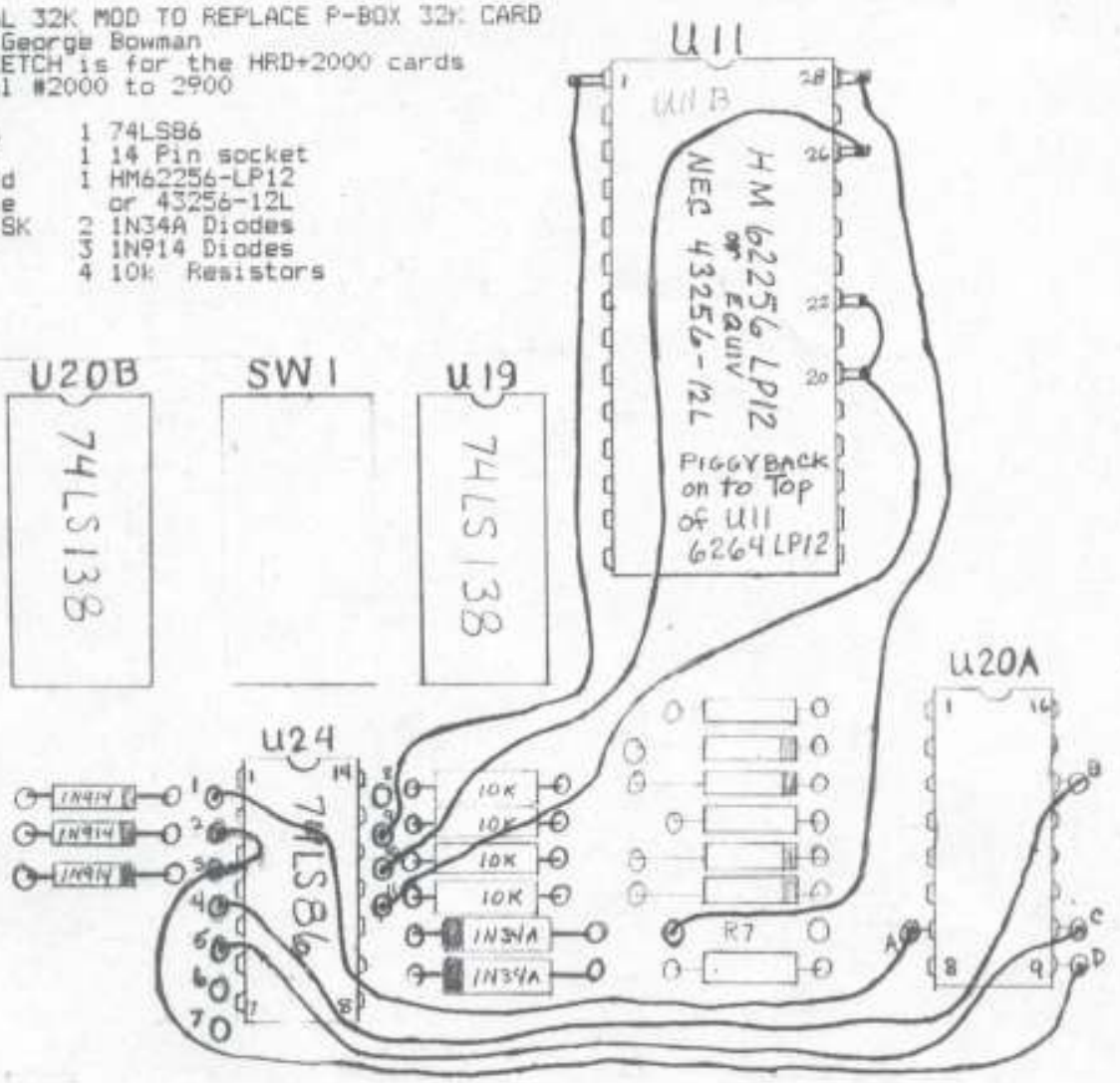
BUD MILLS SERVICES
HRD+ RAMDISK
Series 2000
U27A 74HC154N
U28 74HC154N
FRONT PANEL
7805

OPTIONAL 32K MOD TO REPLACE P-BOX 32K CARD
by George Bowman
This SKETCH is for the HRD+2000 cards
Serial #2000 to 2900

Parts	1	74LS86
list	1	14 Pin socket
to add	1	HM62256-LP12
on the		or 43256-12L
RAMDISK	2	1N34A Diodes
	3	1N914 Diodes
	4	10k Resistors



The memory MUST be installed on top of the U11 memory chip. The control pins and pin 28 (Vcc) must be isolated from the RAMDISK circuit. To prepare the 32k memory for use, bend out pins 1,20,22, 26,and 28. Wires will be attached to connect to the control circuit. The remaining pins will be piggy-back soldered to the U11 memory chip on the Ramdisk (see fig.6 for reference). Please note that the address and data lines are shared and the separation of the control lines assure proper data handling.

Using the above sketch for reference, Proceed....
Install 3 1N914 diodes in CR11,12,13 as shown in sketch, and
4 10k resistors in R14,15,16,17 and 2 1N34A diodes in CR17,18.
Locate the HOLES marked on sketch 1,2,3,4,5,9,10,11,A,B,C,D.
Holes 1 thru 11 are beside U24, holes A - D are by U20A.
Connect a wire from

	hole "1" to hole "A"		
	hole "2" to hole "3" and hole "D"	by U20A	
by	hole "4" to hole "B"		
U24	hole "5" to hole "C"		
	hole "9" to pin 1	of the 32k	
	hole "10" to pin 26	memory chip	
	hole "11" to pins 20 and 22	U11 B	

front hole of R7 (+5v) to pin 28

The easiest way to test the new 32k Memory is to remove the OLD 32k card, insert this NEW 32k and Ramdisk, turn on the system, enter Extended Basic, and type SIZE and return. The Computer should respond with:

11840 BYTES OF STACK FREE
24488 BYTES OF PROGRAM
SPACE FREE

A big deviation in the Numbers will indicate a problem. A final test will be to load and run an assembly language program like DM1000. If a problem exists the Program will not run.