OMNI
16K STATIC RAM

MANUAL

REV. 2.2

PRELIMINARY

OMNI SYSTEMS INC.
P.O. BOX 7536, UNIV. STATION
PROVO, UTAH 84602

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3. THEORY OF OPERATION

The board uses EMM SEMI 4200A 4K X 1 static RAMS. The support circuitry is low power Schottky except for the 74154 and 7407. There are 3 power supplies.

Selecting the address of the 4K blocks of memory is accomplished by a 74154 driven by the 4 high order address bits A12-A15. There are 16 outputs, all of which are normally high except the one selected which is low. The four desired address blocks are jumpered to the four selection inputs which enable memory protection circuitry, are ORed together to enable, with other signals, the Read Output Buffers, and other protect circuitry, and, through 74LS32s (IC B) and 7417s (IC A), enable the 4 rows of memory chips. Address bits 0-11 are connected to each 4200A. On the negative edge of the Chip Select (pin 17-active low) the address lines, the input data (pin 6), and the $\overline{R}/W$ signal, (pin 12) are clocked into the 4200A. This clocking is accomplished by either the MWRT signal if writing, or by PDBIN if reading. Each of these signals is the cycle time of the MPU (500 ns on the 8080). The $\overline{R}/W$ is enabled by MWRT ANDed with the protect status. When using the front panel to deposit in memory, Chip Select must be enabled differently. When the CPU is stopped, PDBIN is continuously high, causing the addressed Chip Select to be continuously enabled. The deposit switch fires a one shot which injects a pulse onto the MWRT line, leaving the CPU in its M1 state. In order to clock MWRT into the $\overline{R}/W$ pin of the 4200A, the CS must first be disabled, then re-enabled. This is accomplished by delaying the enable 150ms. If modifications are made to run at speeds faster than 375ns there is a delay only when PDBIN and MWRT come on at the same time or in other words, when depositing from the front panel.

The output buffers (74368 or 8098) are enabled, by board select (BS) being high (see paging description), by one of the 4 4K blocks being selected (pin 8 of ICC), and by the SMEMR signal.

Paging is accomplished by assigning each board of a given address block a hardware number. Output port "FA" is used to swap the desired board in and all others out by outputing the number of the desired board. The 74LS136, open collector exclusive OR gates act as a comparator for "My page" selection. There is a certain amount of flexibility built into this feature that permits using it in different ways. It must be remembered that if you are executing instructions, say in the 1st 4K, and you swap pages, the CPU will fetch the next instruction from the next location of the 1st 4K of the new page. This can be tricky! One way to use the paging feature is to have one board that is not pageable at all. (This is done by removing IC J and using pins 2, 7, 10, and 15 of J to ground, pin 8), and changing pages of boards in a different address range, executing from the non-pageable address range.

There is another way to use this feature in order to use two separate packages of software that reside at the same area in address range (usually starting at 0000). In fact, one can be used to load the other. In this mode, one board is set up as usual, and another has a jumper from A15 to one of the page select inputs. No jumper is placed on that input to ground, E.G. The first board is set up as page 0 (address 0000-3FFF). The second is page 1 and the jumper from A15 goes to bit 0 of the page select. When page 0 is selected, the first board acts as normal and is swapped in. The second board will now act as address 8000-BFFF swapped in and a program operating in the 1st 16K can load, say from floppy disk, by DMA, into 8000-BFFF. The page can now be swapped to 1 and the second board will now be addressed as 0000-3FFF. The first will just be swapped out. Only 2 boards can be used in this way in a given address range, though both could be made to change address when swapped out (by jumpering A15 to a different page bit on each). More information on this will be distributed at a later date.

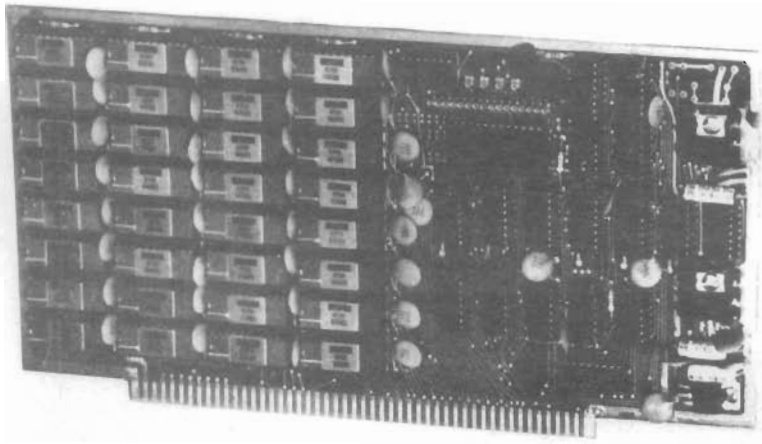
The transition from one page to another is facilitated by making sure that the first instruction in the new page is located at the address after the page swap instruction in the old page. The page swap is done by outputing the number of the new page (bottom 3 bits) to port "FA", E.G. Page 1

```
MVI  A,1
OUT  FA
```

Memory protection can be done using the protect switch on the front panel on the Altair (if the mods have been made), or in any case by outputting a byte to port "FB". Memory is protected in 4K blocks, and is done from the front panel by protecting or unprotecting whatever 4K block is being addressed with the CPU stopped. Software protect is done by the bottom 4 bits of the byte output to port "FB", one bit being assigned to each 4K block. If the bit is a one, the block will be protected. If it is a zero, it will be unprotected. Protection is done by 4 74LS74s. The protect data input to the flip flops is output from a 74LS157 multiplexer, which selects either the protect signal (when in wait state), or the data bus. The clock for the flip flips is derived from the "FB" output signal or the protect or unprotect signals. Unprotect is capacitively coupled, so only a pulse comes through, because the signal is tied high in the IMSAI. The clock of the 74LS74s is enabled by the 4K block selects of the 4 blocks. The outputs are also enabled by the same and the OR of them is gated to the $\overline{R}/W$ line. It also goes to $\overline{PS}$ on the bus. If a write operation is attempted into protected memory, pin 6 of IC U goes high. This can be tied to any of the interupt lines to cause an interupt.

OMNI 16K STATIC RAM

* S-100 BUSS COMPATABLE
* LOW COST
* STATIC NO REFRESH
* Z80 FAST-250 ns
* LOW PROFILE I.C. SOCKETS
* PAGING INCLUDED
* 4K ADDRESSABLE BLOCKS
* MEMORY PROTECT
* BATTERY BACKUP PROVISION
* CONSTRUCTION MANUAL
* BATTERY BATTERY BACKUP POSITION
* CONSTRUCTION MANUAL



DESCRIPTION:

This OMNI 16K static Random Access Memory is designed to be constructed by the average electronics neophyte. It will plug directly into an Altair 8800, IMS 8080, Polymorphics 88,Cromemco Z80 and other universal S-100 bussed systems. It features very low power consumption (less than 1 amp worst case). Very fast speeds (250 ns access time), large 16K Byte capacity on a single PC board, battery backup provision, and includes paging on board for over 1/2 Megabyte of software addressable memory. It uses 4K x 1 true static memories (No refresh), has quality low profile sockets for every I.C., uses hardware and software memory protection for each of the 4K block of memory, allows each 4K block of memory to be separately addressed to allow placement of ROM etc, in between RAM addresses These features with 16K of memory in one slot make this Memory System an outstanding value.

PRELIMINARY

FEATURES & SPECIFICATION:

* Large capacity 16384 Bytes (8 Bits) of memory
* Uses EMM SEMI 4200A 4096 x 1 bit Static Random Access Memory Chips
* Low Profile I.C. sockets for all support & memory chips
* Fast 250 ns board access time ...No wait states at Z80 speeds
* Low power, + 16V@200 ma, + 8V@300 ma, -16V@30 ma.typical
* Paging included for swapping 8 pages at each address for over 1/2 Megabyte of addressable memory
* Hardware & Software memory write protect of each 4K block of memory
* Vectored interrupt when attempts are made to write in protected memory, if desired.
* Provision on board for battery backup
* S-100 Bus Compatable (Altair, IMSAI, Poly 88, etc.) JUST PLUG IN !!!!!
* Each 4K of memory can be independently addressed
* Single high quality Epoxy Glass P. C. Board with plated thru holes
* Gold plated edge connector
* Green Solder Mask P.C. board for easy construction
* 32 memory chips and 20 support chips
* Full documentation and instruction manual

DELIVERY: Off the shelf to 60 days

PRICES: ASSEMBLED .....$529.00 16K Kit .....$459.00 12K Kit .....$354.00 9K Kit.....$249.00 4K Kit.....$149.00
4K Expansion Kit .....$115.00 Construction Manual.....$1.75

QUANTITY DISCOUNTS: 5 Boards.....5% Discount 10 Boards....10% Discount

DEALER & OEM INQUIRIES INVITED!

CASHIERS CHECK OR MONEY ORDER PREFERRED.....personal check delays shipping two weeks, C.O.D. CHARGES: $3.00 per board

PURCHASE ORDERS: ADD 5% for Handling. TERMS: NET 30....NO DISCOUNT, 1 1/2% PER MONTH CHARGED ON OVERDUE ACCOUNTS

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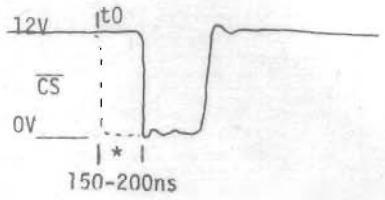
10. CHECKOUT AND TROUBLE SHOOTING GUIDE REV 0.1

When making changes in the board, turn the power off.
Reset the machine and set all the address switches down. Now set A15 to one (up), and raise the examine switch. The LED for A15 should come on. Next, set each of the address switches, in turn, to one, and examine each. All and only the switches raised should have corresponding LEDs lit at any time. Now set the A15 switch back to zero, and examine. Continue setting each address switch in turn to zero, eamining each time. Each LED should go off. These tests will show any address lines shorted to each other or to ground on the PC board.

Now insert the left row of memory chips and address it to 0000. Reset the machine and try depositing in location 0000. Use the same method as indicated for checking address shorts, using the data switches. If two data lines seem to be shorted together, the problem is on the PC board or bad memory chips. A PC board problem could be either a short on the PC board, a solder bridge, or a faulty 74368. If a low bit pulls another bit low, the short is probably on the data input(to the memory chip) or the output of the 74368. If a high bit pulls another high, the short is between the output of the memory chip and the input to the 74368. If the problem is a bit shorted to ground, these same guide lines are valid. If there are bad bits not shorted together, there may be a bad memory chip. This can be checked by swapping chips. Another common problem is a pin on the memory chip bent under it. If the bottom or top four bits seem bad, the problem is likely a bad 74368 or one with the power supply not hooked to it, or with a problem with the enable(pin 1). If deposit won't work at all, there could be a problem with the protect circuitry. To chck this, remove IC U and very carefully bend out pin 8. Re-insert IC U and try the board again. If this rectifies the problem, check out the protect circuitry, and replace pin 8. If not, an oscilloscope will likely be needed to debug the board. In such case, use a dual trace scope with one probe on the $\overline{R}/W$ line(pin 8 of IC V or pin 12 of the 4200s), and the other on the Chip Select of the row of chips being addressed. The scope should be triggered on the $\overline{R}/W$ signal. In the front panel mode(deposit switch), $\overline{R}/W$ will probably be two pulses less than 100ms long (not too critical). Chip Select should be low, then go high for 150 ns before returning to low. If you set up a program in another memory to write into the memory being tested, see figure for how signals should look the with the program in a loop, with the scope set up as above This is for unmodified board.



On a modified board (Z-80), the $\overline{R}/W$ and Chip Select lines should look similar for a write operation (Chip Select will look like and inverted $\overline{R}/W$), except for a delay in the CS line(10-25ns). For a deposit operation, there there should be a delay where the CS goes off before it comes back on.

To test the protect circuitry, enter the following program:

```
0000  DB FF    GO:  IN   FF
0002  D3 FB         OUT  FB
0004  C3 00 00      JMP  GO
```

Run and set sense switch 0 up. Stop the machine and try depositing in the 4K block addressed as the right row of memory chips (don't over-write the program). It should not deposit. Try this for each 4K block (with sense switches 1,2,and 3). If you have an Altair, the protect light should come on when the protected block is addressed.

A simple test of the pageing feature can be accomplished by the following program:

```
GO:  IN   FF
     OUT  FA
     JMP  GO
```

Run the program and turn sense switch 0 on. The LED on the board should go off and the program should crash. For more complete tests, software should be developed around the users pageing configuration.

A running test of the memory can be accomplished with the following short program on an IMSAI:

```
GO:  IN   FF
     STA  LOC
     LDA  LOC
     XRI  FF
     OUT  FF
     JMP  GO
```

The sense switches should be output on the output LEDs.

Also inlcuded is a more comlete memory test program that tests all of memory. See section 11.

If you become totaly discouraged or frustrated with debugging your 16 K board, OMNI Systems Inc. will do it for you, as explained in the warranty section, but be sure and check your soldering first.

PRELIMINARY

CAUTION

FAILURE TO OBSERVE THESE IMPORTANT PRECAUTIONS WILL VOID WARRANTY

1. Read all material before beginning construction.
2. Do not leave out any construction step.
3. Do not use nonstandard parts or unspecified substitutions.
4. Use extreme care with static-sensitive chips to prevent static discharge damage.
5. Use only a 25-45 watt electronic soldering iron for assembly of your
6. Use only electronic quality rosin core solder.
7. Do not INSERT CHIPS IN SOCKETS BEFORE ALL SOLDERING ON THE BOARD IS COMPLETED.
8. Do not perform any solder work on a board while power is applied.
9. DO NOT press the top of the iron on the pad or trace. This will cause the trace to "lift" off the board which will result in permanent damage.
10. Use only specified AC Power.
11. Do not apply power to any board or circuit before checking each component and each trace.
12. Do Not plug or unplug boards while power is on.
13. Do not plug or unplug a chip from a socket while power is applied.
14. Do not attempt repairs beyong your level of skill. Some repair operations are quite demanding to prevent damage to the board or the component.
15. Fill out warranty cards and mail to OMNI Systems Inc.

PRELIMINARY

4. UNPACKING AND INSPECTION

Remove all safe components from their packages EXCEPT DO NOT handle or EXTRACT THE 4200 Memory IC Chips from their containers or packages until last step of assembly. Improper handling these MOS IC Chips is unsafe and can destroy them electronically. Inspect each component carefully for damage in shipping. If any components are damaged beyond repair, contact the carrier for adjustments. Next check each component against the PARTS LIST to get acquainted with each and check for extra or missing ones. If extra valuable parts are found, please return them to the factory. If any parts are missing, write the factory for replacement (See 12. "Warranty & Registration").

5. OMI 16K RAM STATIC PARTS LIST. REV 0.2

1	P. C. Board	
1	7417	IC A
1	74LS00	IC M
1	74LS02	IC T
1	74LS04	IC U
1	74LS08	IC V
1	74LS10	IC L
1	74LS20	IC C
1	74LS30	IC S
3	74LS32	IC B,F,N
2	74LS74	IC E,P
1	74154	IC D
1	74LS136	IC H
1	74LS157	IC K
1	74LS175	IC J
2	74368 (8098)	IC R,W
1	7805 or LM340T-5	IC Y
1	7812 or LM340T-12	IC X
1	79M05 or LM320MP-5	IC Z
1	LED	
45	.1 Mfd 50V Capacitors	
3	22 or 33 Mfd 25 V Electrolitic Capacitors	
1	500 Pf. Capacitor	
1	2K ohm 7 Resistor network	
4	470 Ohm resistor	
2	2.2K Ohm Resistor	
1	10K Ohm Resistor	
1	15K Ohm Resistor	
14	14 pin sockets (in tube)	
4	16 pin sockets	
1	24 pin socket	
32	22 Pin Sockets	
1	20 Pin lead carrier	
3	Bolts	
3	Nuts	
2	Heat sinks	
1	220 Ohm resistor	
32	4200 Memory chips	

PRELIMINARY

6. CONSTRUCTION HINTS REV 0.0

A. GENERAL

There may be items about which you are not completely sure during assembly. Should this occur, DO NOT CONTINUE. Study the manual to see if you can resolve your question, or seek the help of someone more knowledgeable in digital electronics or write the Factory.

B. WORKPLACE

This kit does not require much space to work in, but enough table surface should be available for the piece being worked on. The work area should be very well lit, preferably on either side and slightly behind the project to help eliminate shadows. You may want to protect the table surface with cardboard or newspaper.

C. TOOLS

Tools which are useful to the Kit are a screw-driver, a small pair of flush-cutting diagonal cutters, small needle-nosed pliers, and a wire stripper, should be available for testing. Do not attempt to assemble the kit until you have reasonable tools; damaged parts cannot be replaced under warranty.

D. SOLDERING IRONS

The most important single item in assembly is the soldering iron. There are a great many tools available with the name "Soldering iron". The problem with most of these are that they are too big and too hot; as are most soldering "guns". Proper soldering irons are easily available at any local hobbyist electronics outlet, and they are not expensive. Use a 25 - 45watt iron with a small tip, such as an Ungar 776 with a 7155 tip. A temperature-controlled tip model such as the Weller W-TCP with a small 700°F tip is well worth the extra cost. Plated tips, though slightly more expensive, last very much longer and give superior service. The tip of the iron must be kept clean to work well, by wiping on a wet sponge quickly. A damp rag will serve as well, though less convenient. The tip must be kept adequately tinned, appear bright and shiny at all times to avoid an oxide coating forming, by melting a small amount of solder onto the tip.

E. SOLDER

Using the proper solder is as important as using the proper iron, and there are many solders to choose among. A solder with multiple cores of rosin (or resin) flux should be sufficient. Absolutely avoid any solders using an acid flux, as they are corrosive and will typically damage a printed circuit. The best ratio of tin to use is 63% tin, 37% lead, called 63/37 or eutectic. Much more common is the 60/40,. Avoid using 50/50 or 40/60, etc. For fine electronics work a fine gauge solder should be used, such as #20 (from #19 to #22 is OK). ERSIN Multicore or KESTER are two good brands.

F. SOLDERING

Almost every problem with an assembled kit is a soldering problem. If you have never soldered before, or if you have done some soldering but do not yet have facility in making good soldering joints both quickly and every time, practice before beginning assembly on a printed circuit board. The importance of good solder joints is just too great to convey adequately here, also they're very easy to do.

For a joint to solder correctly, enough heat from the tip of the iron must be applied so that both foil pad and component lead get hot enough to melt the solder and "wet" the joint (flows smoothly on both the lead and pad). As soon as the joint has wet, remove the solder, then the iron from the joint and inspect immediately. Careful inspection of each joint is the key to successful soldering. Solder should be applied to joint not just to the iron. Watch the joint carefully. You should be able to see the solder flow onto the two surfaces. It should flow smoothly around the lead. If you see that the solder has flowed only on one side of the lead, or formed a rounded ball lead, the iron should be re-applied to heat the joint enough for the solder to flow into it. For the normal joint, only a small amount of solder is needed (3/16" of 20 gauge). Only 2 to 4 seconds of heat applied from the iron is necessary. More heat and solder will be needed for some joints with larger leads, holes or large foil areas. If less than the correct amount of heat is used along with too much solder, a blob which can easily bridge to neighboring pads or forms traces causing short circuits. The solder bridge can often be removed by running the hot iron lightly down the shorted trace, re-melting the solder at the shorted point and pulling it away with the iron. Do not leave iron on traces or pads too long when soldering or fixing a short, as overheated traces easily come off the board. Special care must be exercised for any component removal operation. Inspect your boards very carefully for any such solder drips, shorts near soldered leads, incompletely soldered leads, cold solder joints and unsoldered leads. A 100% inspection of soldering should catch 99% of all problems before the board is even turned on. The completed unit will typically run when first turned on if the soldering was done correctly.

G. MOS IC HANDLING

Some of the chips in the kit are MOS type chips which are sensitive to static electricity and other large transient voltages on their pins which can damage them.

Wear cotton fabric or other non-static forming fabrics. Low humidity should be avoided in the work area. Keeping everything involved (chip, board, iron, tools, boxes, chip containers, work surfaces and you) at the same potential by physical contact between them. Handle chips from the ends rather than the pins. Always touch the chip's container or surface it is on before picking up the chip. Also touch a surface or container before placing the chip back in it. Touch a PC board before inserting the chip. Touch the soldering iron to the work surfaces or to a small piece of metal foil on the work surface before touching it to the PC board for soldering. In general, make sure the chip is not the path for any static discharge. Save MOS IC insertion as the last steps in assembly to avoid unnecessary exposure.

H. I.C.'s

All I.C.'s must be inserted with pin 1 in the correct location to avoid damaging the I.C. Pin 1 is indicated by a rounded or square notch in the center of the end near Pin 1 and/or a slightly depressed or raised dot in the corner of the chip next to Pin 1. Many I.C.'s have a 4 digit e.g. 7425 code which would indicate manufacture in the 25th week of 1974. Do not confuse these with the device number which will have manufacturer-dependent suffixes and prefixes. e.g., SN7404N is a 7404 type chip. On the PC board, or in the documentation, some Pin 1 indication will be found, such as a square pad, a dot, an arrow or the note "typical" or similar mark, showing Pin 1 direction.

The board or the chip is very likely to be damaged if there is a need to unsolder an IC chip that was soldered in with Pin 1 in the wrong direction. Unless you are absolutely sure you can unsolder it yourself without damage, you should send the board back to the factory. Remember that with plated-through holes, pins are not only soldered on the top but also inside and through the hole to the other side which makes it significantly more difficult to remove.

I. POLARITY

Most electronic components will not work if connected backwards and will have a mark of some sort to indicate which way is correct. The printed circuit board or documentation will also indicate which direction such components go or give a "typical" example. Diodes will typically have a band around the body, next to the cathode end. This corresponds to the bar on the typical diode symbol. A diode symbol for mounting direction should be found on the board or assembly diagram.

Tantalum and electrolytic capacitors have a plus mark typically a + sign on the body of the capacitor to indicate the plus lead. There will be a mark on the board or assembly diagram of direction to mount it. A capacitor is usually destroyed explosively if power is applied to it in the reverse direction, so check your assembly carefully.

J. MOUNTING & INSERTING

Resistor and capacitors can be inserted, one at a time, their leads bent and soldered later. Disc ceramic capacitors often have the dipped insulation extending down the leads, preventing installation all the way into the board. This may be broken off by pliers, until the bare wire is level with the bottom of the capacitor.

All discrete components should be held close to the board while being soldered by putting a slight bend in the lead behind the board so the component wil not fall out when inverted. Components not in place look sloppy and are harder to move once soldered.

When inserting the I.C.s in sockets in the board, take special care with each and every chip to observe that:

1. Pin one is in the correct direction according to markings on the board or assembly instructions, and

2. After inserting the chip, every pin went through the hole properly instead of catching on the edge of a hole and bending under the chip. After inserting one or two chips, get a feel for how much pressure is needed. If any chips seem to take more pressure, perhaps one or more pins are not lined up with the holes properly.

Voltage regulators are usually supplied with a heat sink and mounting hardware. The three leads must be bent down at the proper lengths to match the solder pads, with needle-nose pliers. The regulator can be fastened to the board along with the heat sink, using the short 6-32 screw from the back. The regulator should be held to prevent turning while tightening enough to insure good heat conductivity. Heat conducting grease may be used if desired.

7. ASSEMBLY INSTRUCTIONS REV. 0.2

- ☐ A. Study "Unpacking & Inspection" and "Construction Hints" before proceeding.
- ☐ B. Lay printed circuit board upright with front (Component) side showing. (Gold Plated edge connector down and side with " c OSI 1977 16K STATIC RAM REV. X.XX" at lower left corner of board). (See Assembly Drawing).
- ☐ C. Insert all IC Sockets into printed Circuit board on component side with Pin 1 indexes toward left side or top of board. DON'T SOLDER! ("Pin I indicated on Printed Circuit Board for most IC's).
- ☐ D. Place a flat piece of stiff cardboard on top of IC Sockets to hold them in place.
- ☐ E. Holding the cardboard against the IC Sockets, TURN OVER the printed Circuit Board and lay it on a Flat surface.
- ☐ F. Press printed circuit board against cardboard to seat IC sockets with maximum pin length out of printed circuit board.
- ☐ G. At only two of the diagonal corners of each IC Socket, SOLDER one pin at each of opposite two corners.
- ☐ H. Lift printed circuit board, remove cardboard and check that IC Sockets are flat against board. If not, press on top of socket with reheating two opposite pins.
- ☐ I. Solder remaining pins of all IC Sockets according to soldering ideas in "Construction Hints."
- ☐ J. Place regulators against printed Circuit Board, bend leads to go through solder holes while lined up with mounting holes.
- ☐ K. APPLY Thermal Compound (optional) to back of regulators. Insert screws to back side of printed circuit board. MOUNT, heat sink & regulators on printed circuit board with washer and nut and tighten without binding.
- ☐ L. ADD any modifications / Jumpers to PC Bd. called for in any Revision Notes.
- ☐ M. Insert and solder the 28 individual Augut Jumper Sockets for memory and page address jumper selections.
- ☐ N. Insert, Solder and Clip excess leads for 9 resistors plus resistor network (pin 1 of network also to left).

7. Assembly Instructions Rev. 0.2

☐ O. Insert, Solder and CLIP excess leads for 45 ea Disc ceramic and 3 ea round capacitors, observing proper polarity.

☐ P. INSERT, Solder and CLIP excess leads for LED (light emitting diodes). CAUTION: Excess heat could damage LED.

☐ Q. Carefully EXAMINE, fully soldered board for omitted, cold or bridged solder connections. Thoroughly INSPECT all components and connections for proper location, etc.

☐ R. Insert into computer or externally CONNECT to Power and check voltages from regulators.
CAUTION: Short circuits could cause explosive damage.

☐ S. REVIEW "Cautions" section of manual on Handling IC's.
INSTALL all support (not memory) IC's in their sockets.

☐ T. Again carefully & thoroughly CHECK for proper location of all components and connections, proper position of pin 1. or bent pins on all IC's and recheck everything for any possible errors.

☐ U. Place memory address and Page jumpers on board. Check everything again!

☐ V. Do power check (step R) again.

☐ W. Go to "Checkout & Trouble Shooting" Section of manual.

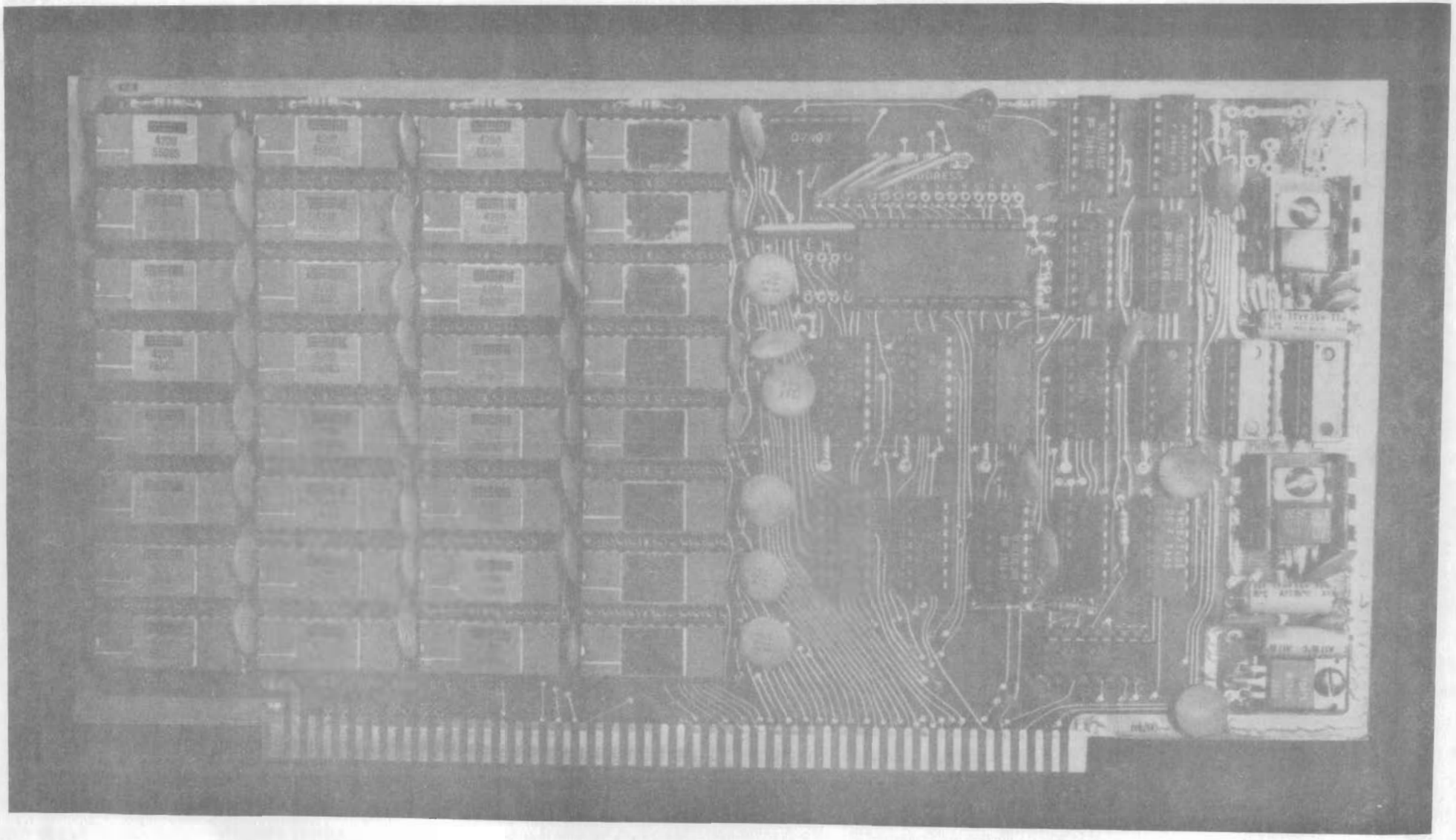
NOTE:
version 2.1 needs PC board modification in order to protect memory from the Altair front panel and also to run faster than 375ns. On later versions the proper traces will be included on the board. See figures in modifications section for details on these mods.

There are also two trees that need to be cut and four jumpers that need to be added on the board for normal operation. See assembly drawings for details. Also put the IC socket for IC T in upside down(not the IC, just the socket).

The documentation on the protect and 250ns(Z-80) modificaions was not prepared at the time of shipping. In order to get boards into your hands we have shipped without it rather than delaying shipping any further. This documentation will be sent to you when complete.

The same applies to the battery backup provision.

PRELIMINARY

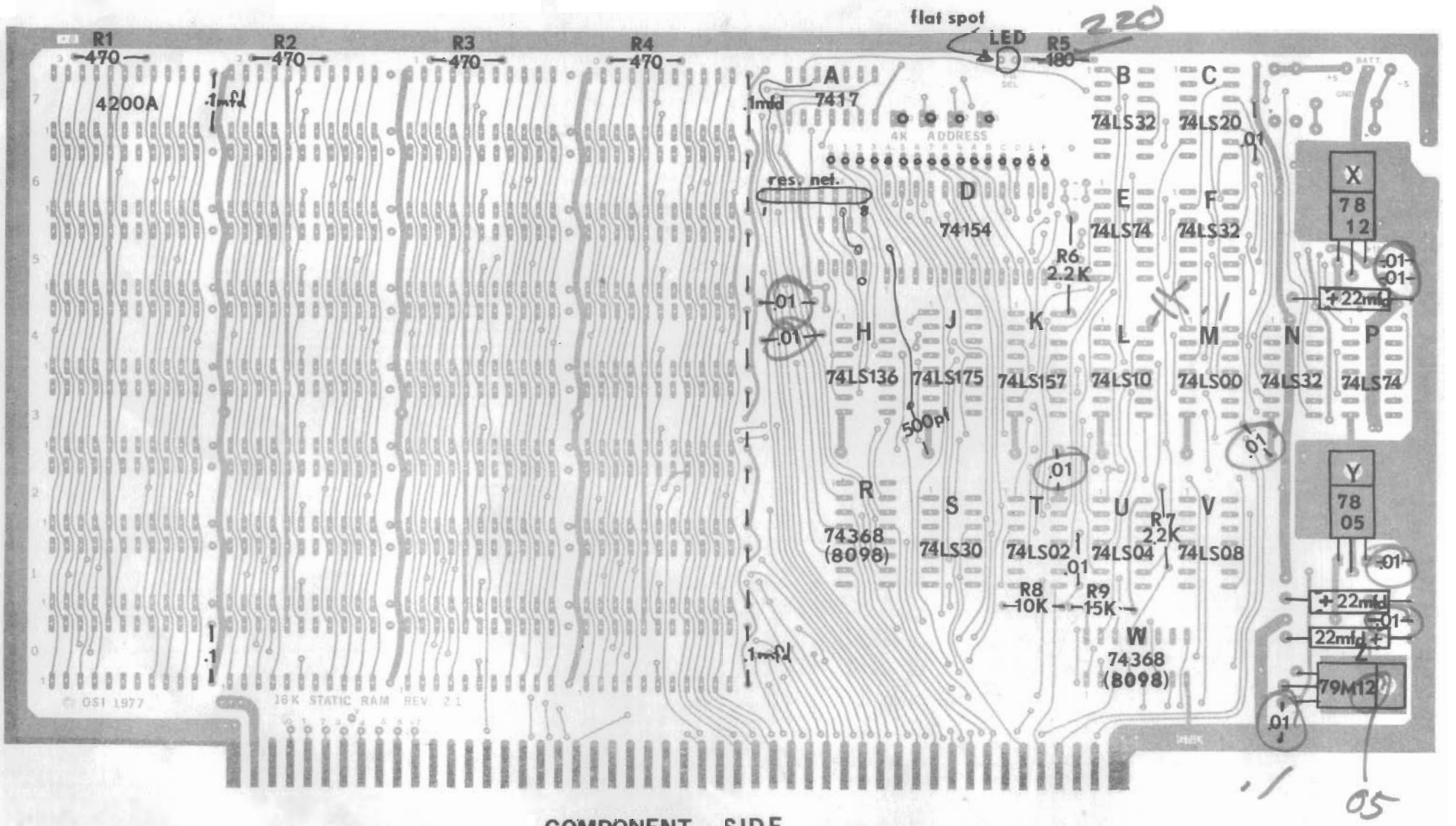


COMPLETED BOARD

REV 2.1

PRELIMINARY

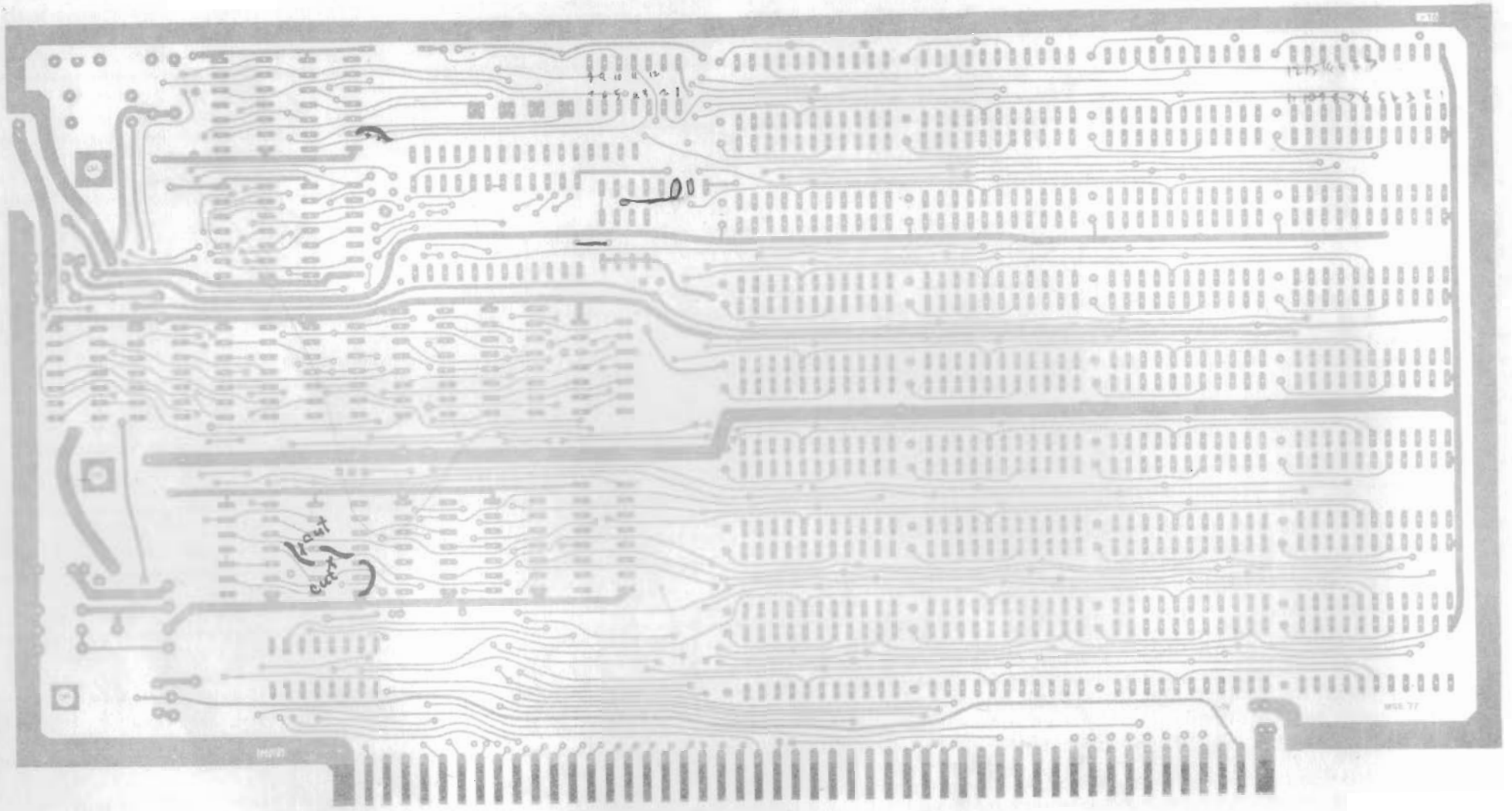
8. ASSEMBLY DRAWING REV 0.2



COMPONENT SIDE

PRELIMINARY

8. Assembly drawing cont. REV 0.2

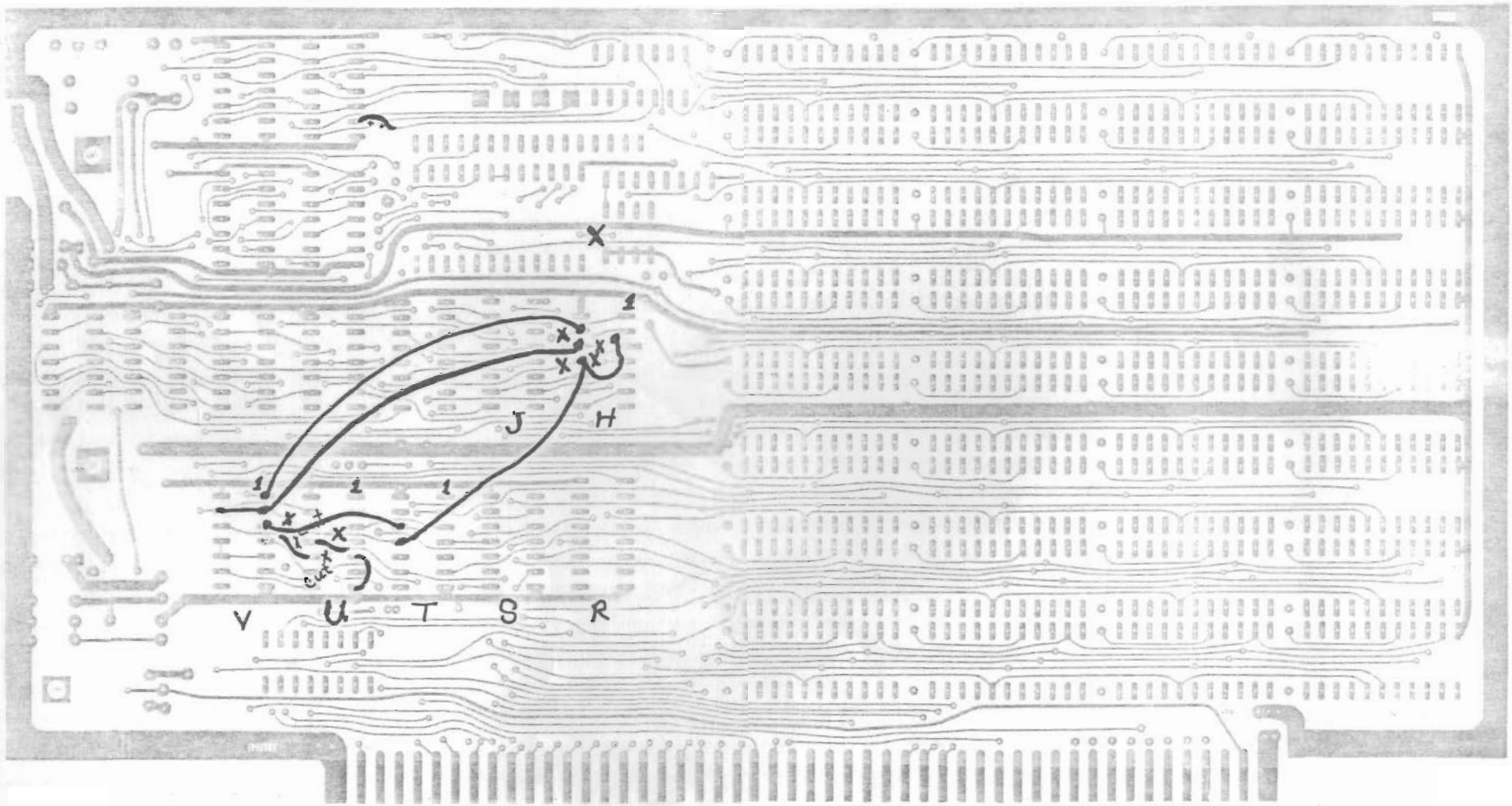


FOIL SIDE

Install jumpers shown

PRELIMINARY

8. Assembly drawing cont. REV 0.2



FOIL SIDE

X cut trace

Install jumpers shown

11. 8080 MEMORY TEST AND CLEAR PROGRAM REV 0.3

EXECUTE INFORMATION

1. Manually check the first 70 memory locations (up to 46H.) by depositing first all zeros successfully then all ones.

2. Reset & load test program from source listing below and reset again.

3. Set "Sense Switches" for highest address and Test Pattern

	SETS HIGHEST ADDRESS A15	A14	A13	A12	SETS TEST PATTERN A11	A10	A9	A8
0-4K	0	0	0	0	Duplicated to 8 Bits			
0-8K	0	0	0	1	runs complimented then			
0-12K	0	0	1	0	runs uncomplimented			
0-16K	0	0	1	1				
Etc.								

4. Run

5. If tests OK "Interrupt enable" Lights up and sense switch pattern shows in output port FF. All address locations past program will have pattern in them which can be all zeros or all ones.

6. If Tests Bad - address lights show address just before bad location
   A. Stop - DO NOT RESET
   B. Single step once to see bad location & data which would be either the test pattern or its compliment if location were OK. Correct test pattern is outputed to port FF.

PRELIMINARY

SOURCE LISTING
Will run at 0000H. To Relocate for ROM , change underlined addresses.

```
00  11 47 00        LXI   D,047H
03  DB FF           IN    FFH
05  07              RLC   A
06  07              RLC   A
07  07              RLC   A
08  07              RLC   A
09  E6 F0           ANI   F0H
0B  47              MOV   B,A
0C  DB FF           IN    FFH
0E  E6 0F           ANI   0FH
10  80              ADD   B
11  2F              CMA
12  47              MOV   B,A
13  DB FF           IN    FFH
15  E6 F0           ANI   F0H
17  C6 10           ADI   10H
19  CA 42 00        JZ    FF
1C  4F              MOV   C,A
1D  62        LOOP: MOV   H,D
1E  6B              MOV   L,E
1F  70              MOV   M,B
20  7E              MOV   A,M
21  B8              CMP   B
22  CA 2D 00        JZ    COMP
25  78        BAD:  MOV   A,B
26  D3 FF           OUT   FFH
28  3E E9           MVI   A,E9H
2A  2B              DCX   H
2B  77              MOV   M,A
2C  E9              PCHL
2D  2E  2F          CMA
2E  77              MOV   M,A
2F  7E              MOV   A,M
30  2F              CMA
31  B8              CMP   B
32  C2 25 00        JNZ   BAD
35  13              INX   D
36  79              MOV   A,C
37  BA              CMP   D
38  C2 1D 00        JNZ   LOOP
3B  DB FF           IN    FFH
3D  2F              CMA
3E  D3 FF           OUT   FFH
40  FB              EI
41  76              HLT
42  2F        FF:   CMA
43  4F              MOV   C,A
44  C3 1D 00        JMP   LOOP
```

12. Warranty cont.

C. WHAT TO SEND

The effectiveness of our technical assistance depends on the information you furnish. If you need Warranty or repair services, be sure to include:

Name, address, Area Code and Phone Number.

Date of Purchase.

Part number and description as shown in the parts list.

Board name, Serial number of board, and revision number.

Copy of all correspondence and notes relevant to the problem.

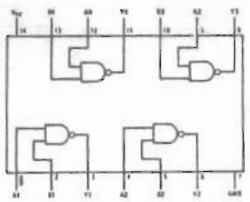
A Complete and exact description of the problem.

Everything you have done in attempting to correct the problem, all switch positions, connections to other equipment, system configuration, operation proceedure, voltage readings and other information that you think might be useful.

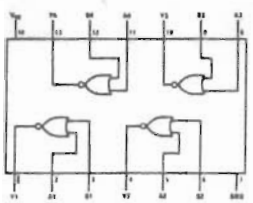
The equipment to be repaired should be carefully and well packed and all of the above sent to:

OMNI SYSTEMS INC.
Service & Repair Center
P. O. Box 7536 Univ. Sta.
Provo, Utah, 84602

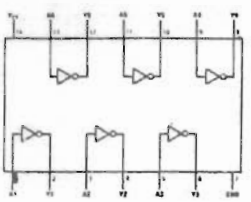
13. IC Pinout REV 0.0



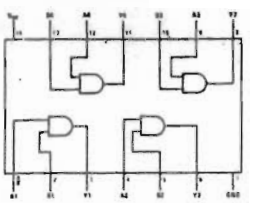
5400/7400(J), (N); 54H00/74H00(J), (N); 54L00/74L00(J), (N); 54LS00/74LS00(J),(N),(W); 74S00(N)



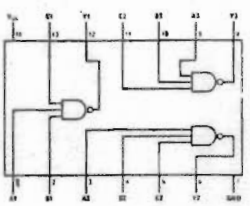
5402/7402(J), (N); 54L02/74L02(J), (N); 54LS02/74LS02(J), (N), (W); 74S02(N)



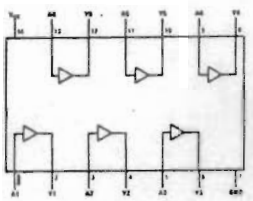
5404/7404(J), (N); 54H04/74H04(J), (N); 54L04/74L04(J), (N); 54LS04/74LS04(J), (N),(W); 74S04(N)



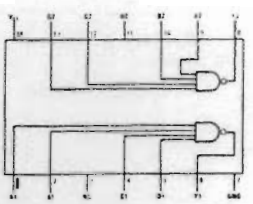
5408/7408(J), (N), (W); 54H08/74H08(J), (N); 54L08/74L08(J), (N), (W); 54LS08/74LS08(J), (N), (W)



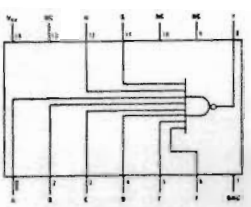
5410/7410(J), (N); 54H10/74H10(J), (N); 54L10/74L10(J), (N); 54LS10/74LS10(J), (N), (W); 74S10(N)



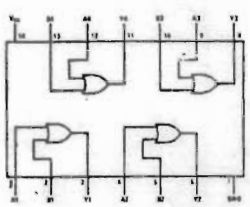
5417/7417(J),(N),(W)



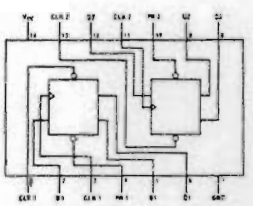
5420/7420(J), (N); 54H20/74H20(J),(N); 54L20/74L20(J),(N); 54LS20/74LS20(J),(N),(W); 74S20(N)



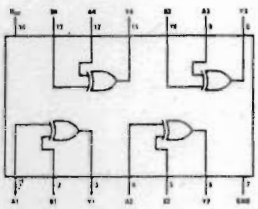
5430/7430(J),(N);54H30/74H30(J),(N); 54L30/74L30(J),(N);54LS30/74LS30(J),(N),(W) 74S30(N)



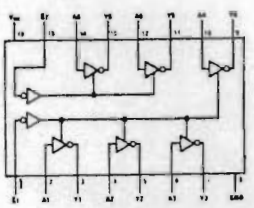
5432/7432(J),(N),(W);54L32/74L32(J),(N),(W); 54LS32/74LS32(J),(N),(W)



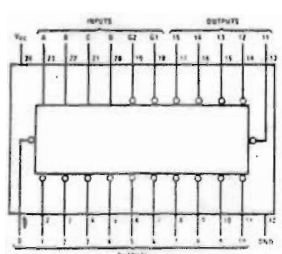
5474/7474(J),(N); 54H74/74H74(J),(N); 54L74/74L74(J),(N); 54LS74/74LS74(J),(N),(W); 74S74(N)



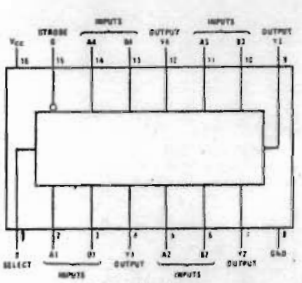
54LS138/74LS138(J), (N), (W) 74S138(N)



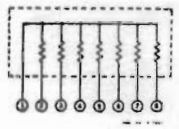
54388(J), (W)/74368(J), (N), (W); 54LS368/74LS368(J), (N), (W)



5415A/7415A(J), (N), (F); 54LS155/74LS155(J), (N), (F)



54157(J), (W); 74157(J), (N), (W); 54L157A/74L157A(J), (N), (W); 54LS157/74LS157(J), (N), (W); 74S157(N)



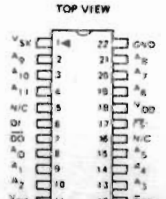
CIRCUIT PD
(Available in Type 256C or 256C)

22 PIN DUAL IN-LINE

PIN	SYMBOL	FUNCTION
1	V_{SK}	Supply Voltage (+5V)
2	A_9	Address Input
3	A_{10}	Address Input
4	A_{11}	Address Input
5	N/C	
6	D_I	Data In
7	$\overline{D_O}$	Data Out
8	A_8	Address Input
9	A_1	Address Input
10	A_2	Address Input
11	V_{BB}	Supply Voltage (5V)
12	$\overline{R/W}$	Read/Write Input
13	A_3	Address Input
14	A_4	Address Input
15	A_5	Address Input
16	N/C	
17	$\overline{CS}$	Chip Select
18	V_{DD}	Supply Voltage (+12V)
19	A_6	Address Input
20	A_7	Address Input
21	A_8	Address Input
22	GND	Ground

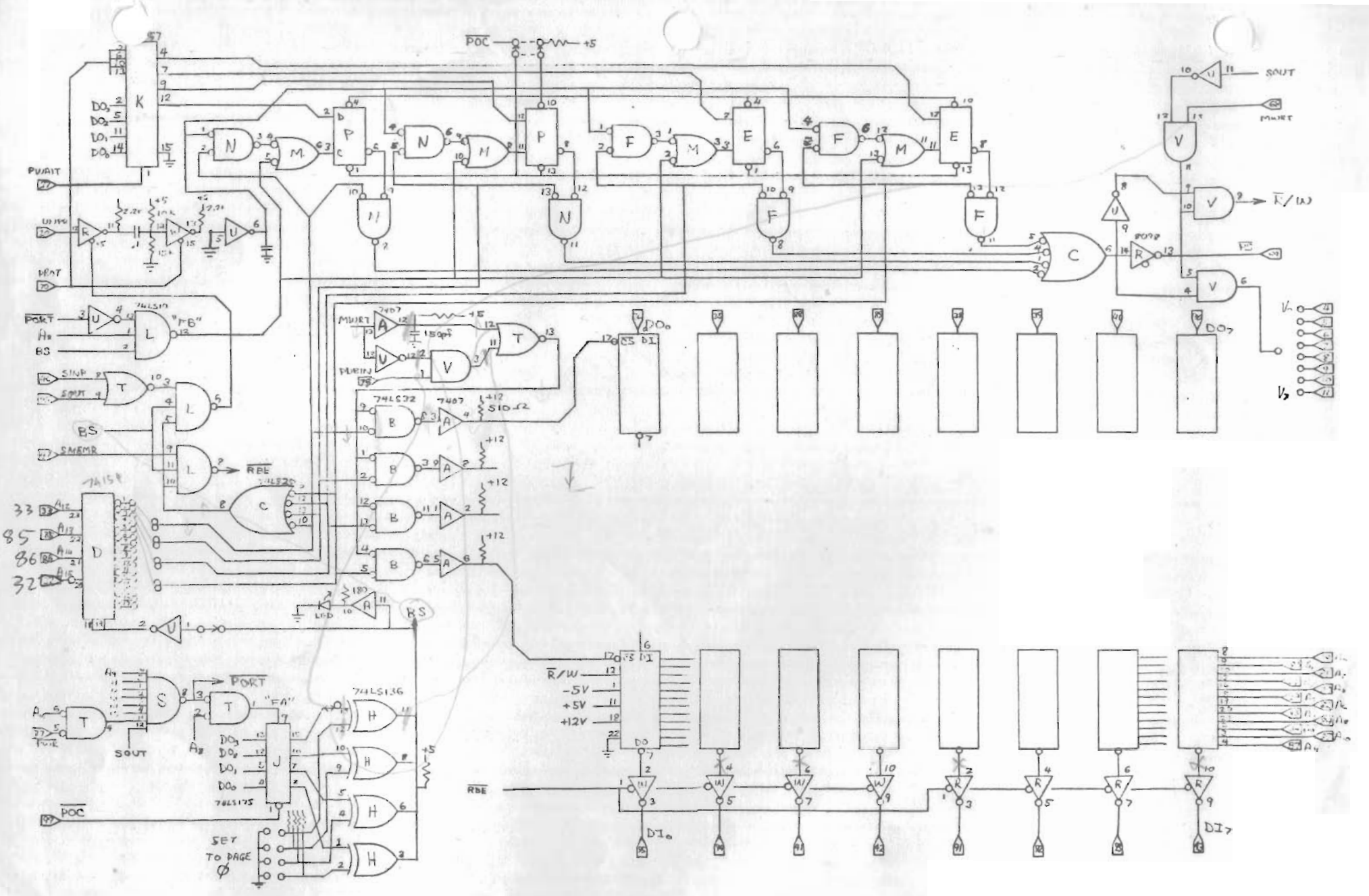
4200A

TOP VIEW



PIN ASSIGNMENT

PRELIMINARY



14. Schematic diagram REV 2.2

OMNI 16K STATIC RAM

PRELIMINARY