Trionyx Electronics, Inc.

M-H8/A

64K Memory Board for the H8* Computer

The M-H8 64K memory board for the Heathkit* H8 computer has been redesigned so that all of the modifications which have accumulated over the last three years are now incorporated in the board layout. The H8 computer has reached a level of maturity which should make further changes to the memory board unnecessary. This new memory board is designated the M-H8/A.

The original M-H8 was introduced in September of 1979 and was the first 64K memory board available for the H8 computer. During the following three and one-half years, more than 1500 boards were sold. The new M-H8/A design is based on everything that has been learned during this time about the M-H8 memory board and the H8 computer.

The new M-H8/A has the following additional features:

Starting Address: Set for 0K or 8K
CPU Board: 8080A or Z80
2 MHz or 4 MHz Operation with 0 Wait States
Bank Select Capability

The M-H8 and M-H8/A memory boards feature stand-alone transparent refresh operation and are the only dynamic memory boards for the H8 computer which will support full DMA activity on the buss. DMA (Direct Memory Access) activity includes periods when the buss is not active and extended periods of write-only operation on the buss. These conditions can occur when the CPU board has relinquished control of the buss to another device, such as an intelligent disk controller or another CPU board.

The new M-H8/A 64K memory board is priced as follows:

Assembled	-	$ 300.00
Kit	-	250.00
PC Board	-	75.00

The above prices do not include memory chips. Memory chips are priced at $30.00 for a set of eight. These are specially selected high-speed memory chips (150 ns, 4116-2) for zero wait state operation at 4 MHz. Eight memory chips are required for each 16K x 8 bits of memory capacity. The M-H8/A has a total capacity of 64K x 8 bits of memory.

All memory boards are sold fully socketed, with all parts (excluding memory chips) necessary for 64K operation. The M-H8/A can be used in pairs for 16-bit operation with an 8086 processor on the Trionyx T-H90 motherboard. The M-H8/A is fully compatable with all Heath H8 hardware and software (both HDOS and CP/M).

* H8 and Heathkit are registered trademarks of the Heath Company.

M-H8/A MEMORY BOARD

Installation and Operation

The M-H8/A memory board is installed on the H8 buss in the location immediately behind the CPU board. The CPU board should be up front, behind the front panel board. The H8-8 (Org Zero) card can be located between the front panel and CPU boards. The serial I/O board is normally located toward the rear of the chassis. The disk controller may be located anywhere between the memory board and the serial I/O board. Optimum board locations may have to be found by experiment. The board locations are considerably less critical when using the Trionyx T-H9Ø motherboard in place of the original Heath H-5Ø buss board.

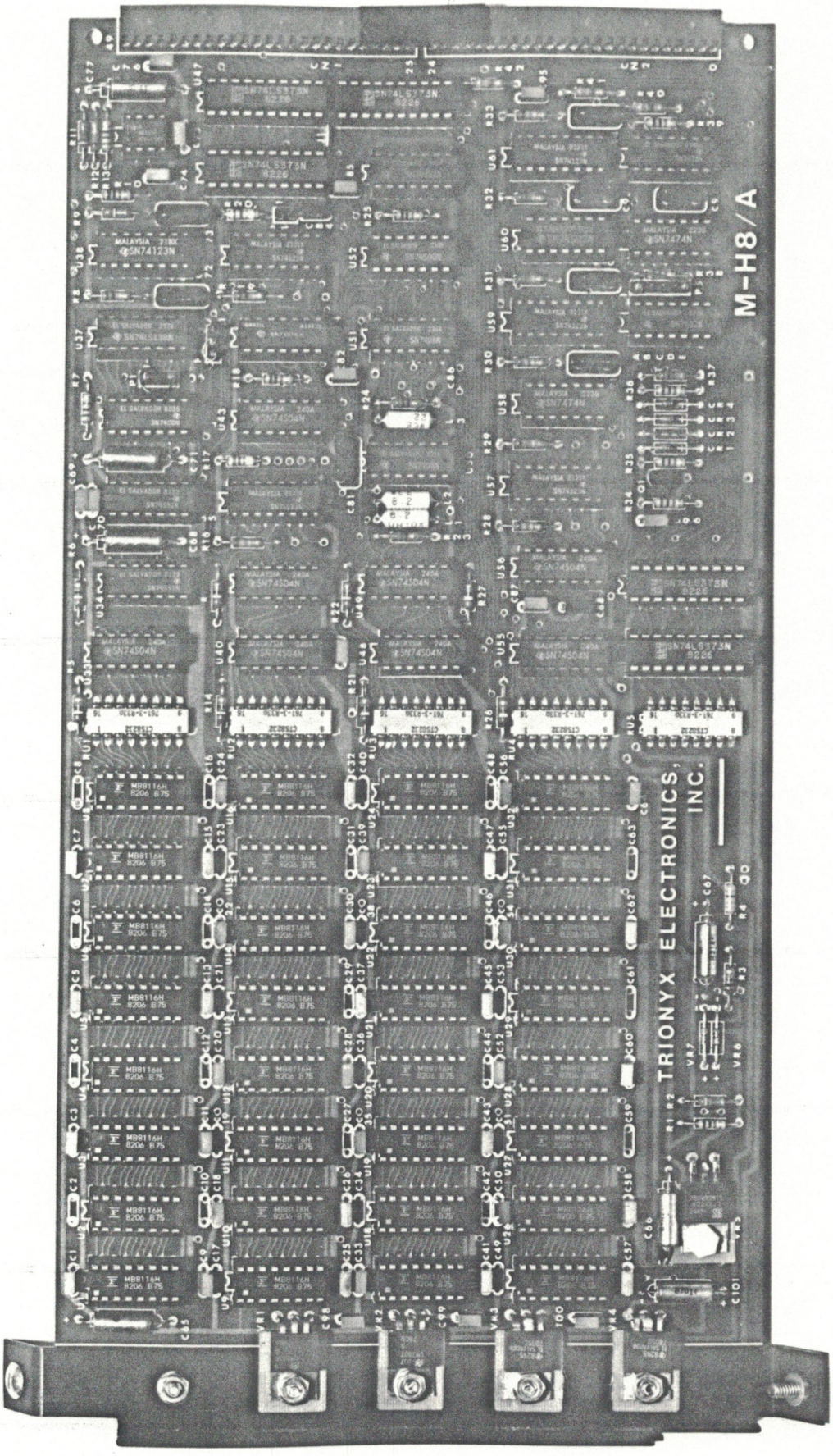
The buss board should have gold-plated connector pins. The original tin-plated pins used on the H-5Ø buss board are NOT satisfactory. Tin-plated buss pins MUST be replaced with gold. The boards which plug into the buss should also have gold-plated connectors. All tin-plated connectors used in the H8 computer should be replaced with gold. All later versions of the H8 computer have been shipped by the Heath Company with gold connectors.

HDOS version 1.6 will not boot with 64K of memory, enabled to start at ØK. A smaller size memory must be used with HDOS 1.6, unless it is patched to operate with a full 64K of memory. HDOS version 2.Ø is a significant improvement over HDOS 1.6 and should be used with all "Origin Zero" systems.

The M-H8/A memory will always occupy the lowest address space used. Memory boards used in conjunction with the M-H8/A should be set to operate in the address space immediately above that used by the M-H8/A. If the M-H8/A is fully populated with memory chips, no other memory boards will be used. If bank switching is used to increase the memory capacity beyond 64K, each memory bank is addressed independently.

The front panel reset function will have no effect on the memory. The memory can not be reset from the front panel. Memory data will be preserved whenever the system is reset. The power switch must be cycled (or turned on) to reset the memory flip/flop circuits. When cycling the power switch, the power should be held off for several seconds to allow the memory board filter capacitors to discharge.

If the front panel comes up, the memory is operating properly. The Heath front panel memory test may then be used to test all of the memory chips. Booting the system is another important test of memory operation. Several advanced memory test programs are also available on diskette to fully exercise the memory. These may be obtained from Trionyx Electronics at a nominal cost.


M-H8/A
TRIONYX ELECTRONICS, INC.

TRIONYX ELECTRONICS, INC., P.O. Box 5131, Santa Ana, CA 92704

This is a sampling of the response we have received from satisfied purchasers of our M-H8 64K memory board for the Heathkit H8 computer.

Dear Mr Perry;

First, let me say that I am thoroughly pleased with the quality and performance of the 64K Dynamic RAM board for the Heath H8. Purchased early last year.

I haven't had any problems with my memory board (or anything else in the system, for that matter). A good friend of mine also bought an M-H8 from you at my suggestion, and he is also quite happy with his.

Dear Sirs:

I have just installed your 64K memory board in my HEATH H8 and it worked beautifully the first time I plugged it in.

I was particularily impressed with the quality of the PC board and the well documented instructions.

Dear Sir:

I received the 48K M-H8 a week ago and have already assembled it. The board functions perfectly! Needless to say, I am very pleased with its operation.

Now I want to order a 16K expansion kit to complete the board. I regret not ordering first off the 64K (56K) board.

Dear Sir:
I read about your board in :PIP:, a newsletter from Po Box 1126 Neptune, NJ. They seemed to think your board was great so I think I will try one.

I thank you again for your speedy delivery of my memory kit and would be more than glad to recommend your board to any and all interested parties.

By the way, the board worked the first time I fired it up. Good work.

Dear Bill Perry:

Thought you might like to know my impression of your M-H8 kit.

Though it did not have the typical Heathkit step-by-step instructions, it went together with absolutely NO problems and has given No trouble since it's been up and running.

I have had no problems with your memory. My board, for which I obtained my own parts, has been operating with no problems for about five months.

P.S. Looks like your MH-8 board in my Heath H-8 has so impressed one of my local friends that there will shortly be another satisfied user in my area. It was fun to pack away my Heath 16K board the other day and watch as HDOS came up with 56K ram in the system!!

DEAR FRIENDS,
I HAVE JUST COMPLETED THE 64K MEMORY BOARD (M-H8) AND IT WORKS PERFECTLY, IT'S A SUPER BOARD!

P.S. I wrote BUSS and gave them a report on the high quality and good performance of this p roduct. I am sure others with the H-8 will appreciate it also. Please keep me informed of any new H-8 products you develop.

DEAR BILL,

I GOT MY HEATH H8 MEMORY BOARD FROM YOU ABOUT A MONTH AGO, AND HAVE THE FOLLOWING COMMENTS ABOUT IT:

1. THE QUALITY OF THE MATERIAL IS EXCELLENT.
2. HEATH COMPANY COULD TAKE LESSONS FROM YOU ON HOW TO SILK SCREEN A BOARD. IT IS NICE TO BE ABLE TO READ THE PART NUMBERS AFTER THE PARTS HAVE BEEN INSTALLED.
3. IT WAS PLUG IN AND PLAY.
4. MY ORDER WAS FOR 32K. I ADDED ANOTHER 32K OF 4116-4 (250 NS.) CHIPS, AND EVEN THOUGH THEY ARE SLOWER, THE BOARD STILL PERFORMS PERFECTLY.
5. I HAVE PRAISED THIS BOARD TO OTHER H8 OWNERS AND PROSPECTIVE OWNERS, AND I KNOW OF AT LEAST ONE ORDER YOU HAVE ALREADY RECEIVED.

I have been very impressed with the quality and pleased with the operation of your board.

Sincerely,

Dear Mr Perry,
You might be interested to know that my Trionyx board (populated to 48K) worked perfectly the day that I installed it and has had no problems since. Congratulations on a good product.

Dear Sirs:

I just want to tell you how pleased I am with your M-H8 Dynamic Memory board. First let me thank you for your prompt and very fast response to my order. I ordered the 16K kit version and completed assembly a few days after receipt. The memory worked perfectly as soon as I powered it up. I ran a repeating memory test on it for several hours with no problems. The quality of your parts is as you stated, first rate.

I have had no problem with your memory board and it is now at 48K with expansion to the full 64K capacity to occur shortly.
I thank you for your time and hope additional products will be forthcoming from your company.

Dear Trionyx,

I have been using my 64K board since early this year and I just wanted to let you know how happy I am with it.

Dear Bill--

The M-H8 with 32K arrived last week, and got everyone a bit excited. The board quality is super, very impressive.

Dear Trionyx

I have been using the M-H8 memory board by Mr. Myron Seibold for over six months. I have nothing but good things to say about this fine product. My system is of course, the Heath H-8, H-19 H-17 (two drives) and a Microtek serial printer. I run both C/PM and HDOS. I have yet to have a memory failure that I know of.

! I AM 100% SATISFIED WITH YOUR BOARD + YOUR BACK UP SERVICE. YOU CAN USE ME IN YOUR ADVERTISING ANYTIME!

Bill Perry:

I am interested in purchasing one of your H8 64K Memory Boards. I had called a few weeks back and asked you a few questions. I had also asked some members in a computer club I belong to about the board and two members have this board. Each have no complaints.

M-H8/A 64K MEMORY BOARD

ASSEMBLY INSTRUCTIONS

1. Install five (5) resistor modules at RU1 through RU5. The resistor modules are soldered directly to the printed circuit board. They are NOT installed in sockets. The resistor modules are nominally 39 ohms. This value is not critical and other values may be supplied.

2. Install the resistors (42) on the printed circuit board next. A forming tool will be useful to bend the resistor leads. Most of the resistor leads will be bent on Ø.5ØØ in. centers. R17 and R2Ø are bent on Ø.4ØØ in. centers. All resistors should be positioned flat against the board before soldering. The resistor leads may be dirty and will require careful soldering. After the leads are clipped, the solder connections should be touched up.

3. Install all capacitors (65) next. Observe polarity when installing the tantalum (7) filter capacitors. After the capacitor leads are clipped, the solder connections should be touched up.

   NOTE: It is not necessary to install all of the filter capacitors provided for in the memory chip array. Use the parts list to determine which capacitor locations should be populated.

4. Install 25-pin connectors (2) at CN1 and CN2. The connectors should fit tightly against the printed circuit board.

5. Install a short jumper wire at J1. Use no. 26 tinned buss wire and clear teflon sleeving. Install J1 flat against the board.

6. Install all of the integrated circuit sockets (66) next. It is desirable, but not strictly necessary, to observe polarity when installing these sockets. All of the integrated circuits mount in the same direction, with pin 1 toward the top of the board.

   Be sure all sockets mount flat against the printed circuit board. Soldering opposite corners of the sockets first is a good idea. These connections may then be reheated while pressing the sockets to the board. Do not clip the socket leads after soldering.

7. Install the inductors (3) at L1, L2 and L3. Be sure the 22 uh inductor is installed at L3.

8. Install the 2N24ØØ transistor at Q1. Be sure the transistor leads are properly inserted. Observe polarity (properly reference the flat edge) when installing the transistor.

9. Install the silicon diodes (4) at CR1 through CR4. Observe polarity when installing these diodes.

1Ø. Install the connector pin strips P1, P2, P4 and P5. Remove the center pin before installing a three-pin connector at P1. The height of all pins should be adjusted, before installation, so that they protrude an equal distance from each side of the hard rubber strips. This will reduce the height of the pins after they are installed.

The pins will slip in their rubber retaining strips if sufficient force is applied to the pins. All of the pins should be adjusted to the same height. The height of each pin can be repeatedly adjusted until this is achieved.

Be careful to mount the pin strips flat against the board so that they stand up straight from the board. After soldering, the pins protruding from the solder side of the board should be clipped. The solder connections can then be touched up.

11. Install the 5.1 volt zener diodes at VR6 and VR7. Be sure to observe diode polarity. The banded end is the cathode, which should be positioned toward the right side of the board.

12. Install the +12 volt regulator at VR5. Use a rubber heat transfer pad under the regulator. Mount the regulator using a plastic screw and nut. The plastic screw should install from the back of the board, with the head on the solder side.

13. Install the +5 volt regulators (4) at VR1 through VR4. The voltage regulators should be mounted on the metal mounting bracket, which acts as a heat sink, using the hardware provided. Use a rubber heat transfer pad under each voltage regulator. Mount each regulator using a 6-32 x 3/8 in. screw, lockwasher and nut. The screw heads should be on the solder side of the board. Use a fiber washer between the board and mounting bracket at each screw location.

    After the entire voltage regulator assembly is bolted in place, the voltage regulator leads are soldered to the board. After soldering the voltage leads, clip the leads and touch up the solder connections.

14. The board may now be cleaned in a vapor degreaser, if one is available, to remove rosin solder flux. All solder connections should be touched up, as required, before this is done.

    A new type of solder with a water soluble flux is now supplied with all Trionyx kits. The flux may be scrubbed off under running water with a stiff brush. A small vegatable cleaning brush is ideal for this purpose.

    When washing the board, care should be taken not to unduly wet the component side. This will facilitate drying of the board. Excess water should be shaken off the board after cleaning. The solder side of the board can then be patted with a paper towel. A portable hair dryer will rapidly complete the drying.

15. Install each of the integrated circuits in their respective sockets. Observe polarity when installing the integrated circuits. Be very careful not to bend any of the integrated circuit leads up under the package during installation. This is, by far, the greatest cause of failure after a board is assembled. It is impossible to detect bent leads after an integrated circuit is installed in the socket. The part must be removed to determine if a lead is bent under.

Integrated circuit leads are sprung out at an angle from the case to hold them in place on the printed circuit board during automated flow soldering. Integrated circuits are not normally installed in sockets. They are soldered directly to the printed circuit board. This reduces manufacturing costs and increases reliability. Troubleshooting, on the other hand, is considerably more difficult, as is part replacement.

Each integrated circuit should be carefully rolled on the workbench to bend the leads back so that they protrude exactly at right angles from the case for easy socket insertion. Failure to do this may result in poor electrical socket connections or bent under pins.

16. MEMORY CHIP INSTALLATION: Memory chips are installed following the same proceedure outlined above. In addition, it must be remembered that memory chips are MOS devices and must be handled with care to prevent damage from static charge. They should not be handled unnecessarily and should be kept in conducting tubes or on conducting foam until ready for installation.

    The board may be populated one row at a time using 8 memory chips per row. The first row is comprised of U1 through U8. The second row is U9 through U16. The third row is U17 through U24. The last row is U25 through U32. The rows must be populated in succession. Each row provides 16K x 8 bits of memory capacity.

17. The pin strips should now be programmed with wire wrapping wire. A wire wrapping tool should be used for this purpose. Insulated wire is required for P5. Bare wire may be used at the other locations.

    Instructions for programming the pin strips are contained on a separate sheet entitled "M-H8/A JUMPER INSTALLATION."

18. Install the connector key on connectors CN1 and CN2. Use the double adhesive film provided. Cut two pieces and install one under each side of the key.

19. Install a 6-32 truss-head screw at each end of the metal mounting bracket. These will be removed later to install the M-H8/A board in the H8 computer. Cut to size and install the plastic heat sink bumper on the metal mounting bracket.

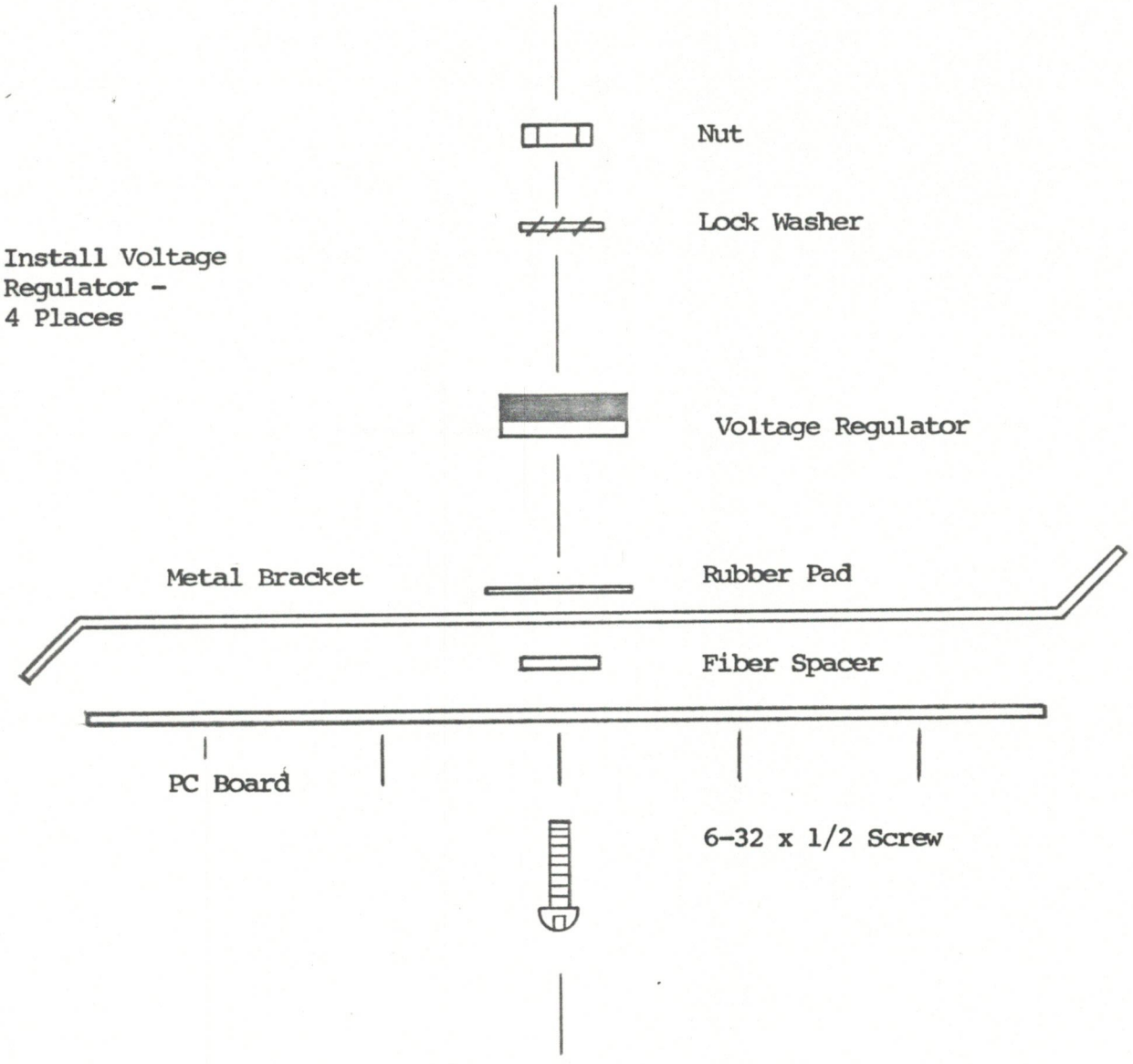
20. Provision exists on the M-H8/A printed circuit board to mount an optional "B" connector for use with the Trionyx T-H90 motherboard. The B connector is provided in the EC-TH90 expansion kit which may be obtained from Trionyx Electronics at additional cost ($15.00). This connector provides additional grounding of the M-H8/A to the motherboard. The connector should be installed using the two mounting holes provided on the M-H8/A printed circuit board.

    Ground wires should then be connected from the B connector ground pins to various ground points near these pins on the M-H8/A printed circuit board. Use no. 26 tinned buss wire for this purpose. All ground connections should be as short as possible. Additional signal lines can also be connected to the M-H8/A memory board from the T-H90 motherboard through the B connector.

21. This completes the assembly of the M-H8/A 64K memory board. Installation and operating instructions are supplied separately. This board is used in the Heathkit H8 computer. More than one M-H8/A memory board may be used in the H8 computer when used with the Trionyx X/2-H8 bank select card. The X/2 bank select card can select one of four memory boards, providing a total memory capacity of 256K bytes.

M-H8/A MEMORY BOARD

Component (Top) Side of Board



METAL BRACKET (HEAT SINK) ASSEMBLY

M-H8/A

TIMING ADJUSTMENT

The new M-H8/A has been designed to operate at both 2 MHz and 4 MHz without wait states. The same memory timing and configuration is used at both clock rates. The clock rate may be changed at any time without affecting memory operation. Most memory boards can be built from a kit without any timing adjustment required. Provision for a single timing adjustment has been made, however, to guarantee proper operation in all cases.

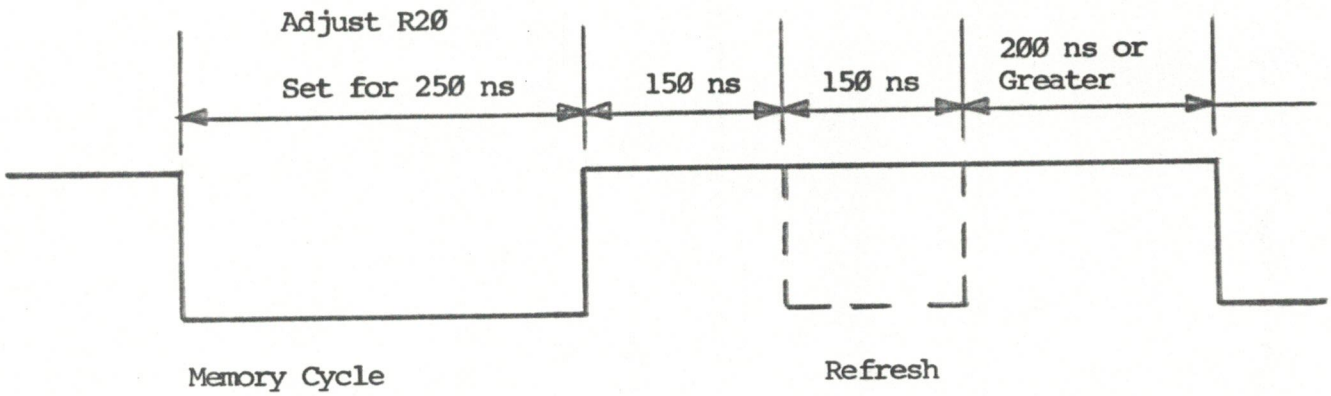


Fig. 1. RAS pulse width timing specification.

The value of resistor R2Ø (nominally 16K ohms) may be changed to adjust the memory cycle RAS pulse width to 25Ø ns (see Fig. 1). The pulse width should be adjusted to within 1Ø or 2Ø ns of this value. This is a very simple adjustment to make. An oscilloscope probe may be touched to pin 4 of any memory chip in the first row. The probe should be grounded to the bottom of one of the tantalum filter capacitors to provide a clean waveform for measurement. Scope sync may be provided by the waveform under test.

R2Ø mounts in extra large holes to facilitate insertion and removal. The pads for R2Ø are heavily built up on both sides of the board so that this part can be removed without damage to the board. Extra heat may be required to remove or solder this part.

Some type of memory operation is required to make this measurement. RAS timing may be observable even though the memory is not working properly. This is the only timing adjustment provided for on the memory board. If this timing adjustment can not be made, or if proper adjustment fails to result in reliable operation, the memory board should be returned to the factory for repair.

M-H8/A

PARTS SUBSTITUTIONS

Kit Builders

Kit builders may find that substitutions have been made for some of the parts specified in the parts list. All substitute parts have been fully evaluated and approved by our engineering department. They will perform in an identical manner as the originally specified part in all cases. Part substitutions are made to expedite kit shipments when the specified parts are difficult to obtain. The only difficulty with this may be identifying the substitute parts. In most cases, the substitutions will become obvious, using a process of elimination, checking all of the parts against the parts list. Please note that if the part quantity is greater than one, the entire quantity will have the same substitution.

Bare Board Builders

Bare board builders will have to substitute some parts. It is not expected that all of the parts specifically called out in the parts list can be obtained everywhere. Part substitutions, however, should be made with great care. The board may not operate reliably if improper part substitutions are made. There is little margin for error when running at 4 MHz with no wait states. Even when operating at 2 MHz, the memory board is still timed for 4 MHz.

The M-H8/A is a high-technology product of the highest quality. The memory board operates together with the CPU board as the very heart of the computer. Putting cheap parts on the memory board will not result in reliable system operation. High quality gold-plated connectors and IC sockets are recommended. Bad connections are, by far, the greatest cause of system problems. Cheap, tin IC sockets should definitely be avoided.

High quality filter capacitors should be used, especially in the memory chip area. Capacitor quality is a direct function of price. These capacitors are definitely an expense, because so many are used on the board. Cheap disk ceramic capacitors are common and should not be used.

NO integrated circuit substitutions of any kind should be made. "S" type parts are used to supply high-level drive for the memory chips. The entire memory board timing is based on the integrated circuit types specified. Do NOT substitute easy-to-obtain "LS" type parts for those specified. The 74123 dual one-shots should be either National or TI (Texas Instruments) manufactured parts. Do not use Stewart-Warner (SW) brand parts here. The Stewart-Warner parts seem to be quite common, and their timing is different.

The memory chips (RAMS) used on the M-H8/A must be premium quality 150 ns (4116-2) parts. Lower cost, slower RAMS should not be used. The M-H8/A is timed to operate at 4 MHz without wait states. This requires the use of high-quality memory chips.