

Preliminary Announcement – **Z80 CPU BOARD** for the **H8***

* H8 is a Registered Trademark of the Heath Company

- Programmable Clock Rate – 2 MHZ / 4 MHZ
(Clock Rate Under Software Control)
- Calendar Clock With NiCad Battery and Charging Circuit
- Arithmetic Chip (9511A/9512) ● Random Number Generator
- Front End Bus Termination Network ● Heavy Duty Bus Drivers

Fully Compatible With All Heath H8 Hardware and Software
Available In Several Assembled and Kit Versions

PC Board Only – \$ 75.00
With Documentation

— Availability Date:
September 1981

Preliminary Announcement – **MASS MEMORY** for **H8/H89***

* H8 & H89 are Registered Trademarks of the Heath Company

- Completely Solid State Mass Storage Unit –
Has No Moving Parts – Low Power Dissipation
- Silent Operation No Maintenance Required
- High Speed Access and Data Transfer Rate
- Expandable Memory Capacity from 128K Bytes
to 5 Megabytes
- Self Contained in Cabinet with Power Supply

Base Price under \$500.00 — Available November 1981

Software Available For the Following Individual Applications:

- 1 – Floppy Disc Drive Emulator – Can Mount and Dismount Any
Floppy Disc, 5-1/4 in. or 8 in., Single or Dual Density
- 2 – Expanded RAM Memory – Memory Management Available for
Both Single User and Multi-User Applications
- 3 – Stand Alone Mass Storage Peripheral – Available with
Battery Back Up, Magnetic Tape Back Up, and ECC –
Electronic Error Checking and Correction

TRIONYX ELECTRONICS, INC.
P.O. BOX 5131, SANTA ANA, CA 92704

Trionyx Electronics. Inc.

The Future of the H8* Computer

We feel that the H8 is one of the best computers ever devised. It is quite economical, very flexible, and has become extremely powerful. Very good software is now available for the H8. The H8 is ideally suited to the serious hobbyist, experimenter, and electronics hardware buff.

Trionyx is "adopting" the H8 with this announcement and will soon be supplying entire computers, including the cabinet and all of the standard pc board modules. In this way, the H8 computer will remain on the market in its present form, throughout the 1980s.

The H8 was originally introduced by the Heath Company. The acquisition of Heath by the Zenith Corporation has profoundly affected the development of the H8 computer. Zenith is not interested in the H8 or the original Heath markets. The new Zenith computers will be directed toward a considerably different (and much larger) market.

It has always been an open question whether the new 16-bit MPU chips could ever replace the enormously popular and well established 8080 based 8-bit chips. IBM has apparently settled this question with their entry into the personal computer market with a 16-bit machine. The development of 16-bit software now seems assured.

Trionyx will soon offer a 16-bit CPU board for the H8 computer based on the 8086 MPU chip. The 8086 uses an external 16 bit buss and the Trionyx T-H90 motherboard will be required for use with this 16 bit CPU board. A new front panel (with firmware monitor) and new memory boards will also be produced. The original memory boards can be used for the lower 16-bit byte.

The new 16-bit Trionyx CPU board will run at 6 MHz. with the T-H90 motherboard and will work in tandem with the present Trionyx Z-H8 Z80 CPU board in the H8 computer. The two boards will operate in the computer at the same time with software switching to share the buss. The Trionyx Z-H8 CPU board can be purchased at the present time.

The Trionyx 16-bit CPU board will operate with CP/M-86**, which is and should remain the most popular 16-bit operating system for microcomputers. The Trionyx 16-bit CPU will also emulate both the new Zenith Z-100 and the IBM 16-bit computers and will run on all of their software.

The Trionyx 16-bit hardware for the H8 computer will become available sometime in 1983, probably toward the end of the year. This should be a very attractive and economical way for H8 owners to build up their machines and stay abreast of computer technology.

* H8 is a registered trademark of the Heath Company.

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

Trionyx Electronics, Inc.

New Product Development Schedule for the H8* Computer

The first product introduced by Trionyx Electronics, Inc. for the H8 computer was the M-H8 single card 64K memory. This product has proven extremely popular - nearly 1000 have been sold as of June 1981. Sales remain strong and the M-H8 is still being produced in its original form. This is high testimony indeed for a product in such a rapidly changing technological market!

We are now working on a sophisticated Z80 CPU board for the H8 computer. This board will have a dual 2 MHz / 4 Mhz clock rate under software control. Control of the clock rate in this way has enormous significance. The applications for this are very many.

It became apparent after the introduction of ORG ZERO to the bus by Heath that serious problems existed with the H8 motherboard. In addition, the Heath version of the Z80 CPU board was to be limited to 2 MHz operation only, for reasons which have now become obvious. At Trionyx Electronics, Inc., we decided to correct the motherboard problems before finishing the Z80 CPU board.

We are offering a solid state, completely random access mass storage peripheral to the H8/H89 market. This is a general purpose memory unit intended for the widest possible application. Once this device is perfected for the H8, it will be offered for other computer busses. This mass memory unit can be used in a great many different ways, including that of a floppy disc emulator. A single mechanical drive can individually mount any number of diskettes into the mass memory unit where they can then all be accessed by the operating system software. Imagine mounting both sides of a disc one side at a time into the mass memory unit and then operating the memory unit as a dual sided floppy disc drive! Applications for this kind of mass memory are virtually unlimited and will be dependent on the software available. All computer systems will probably use this kind of memory in the future.

We will be working on many new H8 products in the future. Our development schedule tentatively looks something like this:

<u>1981</u>	<u>1982</u>	<u>1983</u>
- New Motherboard	- Voice Synthesis	- Radio Controlled Robot
- Z80 CPU Board	- High Resolution Color Graphics	- Other Projects
- Mass Memory Unit	- 16 Bit CPU Board	

These are the main things we will be working on. Other projects now under consideration include such items as memory management hardware and software, a hexadecimal front control panel and a new cabinet with RFI shielding, forced air cooling and a larger power supply.

We realize a small but steady profit on the H8 computer products we sell. This is a viable business. However, our business is primarily concerned with memory board design and repair for commercial computer systems. The H8 computer provides us with the opportunity to create interesting and imaginative products which might not be marketable at the present time for commercial systems. There should be no doubt regarding our capability to support the H8 computer on an indefinite basis. Our engineering capability is second to none.

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Trionyx Electronics, Inc.

Mass Memory for the H8 Computer

Our mass memory will be initially offered in abbreviated form on boards which will plug directly into the H8 buss. A controller board will be used with either one or two memory boards. Each memory board will contain up to 64 memory chips. The boards may be configured to use either 16K or 64K memory chips. The memory capacity will vary from 128K to 1 megabyte! This memory can be used to emulate conventional disk drive data storage. Software drivers for both HDOS and CP/M will be supplied on a diskette for this purpose. This memory may be used in conjunction with regular disk drives.

This product is currently under development and will be available about November 30, 1982. A prototype has been working for more than a year. The memory boards will be sold without memory chips. Memory chips may be purchased separately. Prices are as follows:

Memory boards	MM-H8	Assembled	\$ 275.00
		Kit	200.00
Memory Chips	Set of 8	16K	\$ 30.00
		64K	150.00
Controller Board	MC-H8	Assembled	\$ 300.00
		Kit	225.00

One controller board is required for use with one or two memory boards. An overhead cable is supplied with the controller board. The memory is expanded in 128K increments, from 128K to 1,096K. 128K of RAM storage is equivalent to a single 5-1/4 in. diskette. The RAM storage system does not use the operating overhead storage space required on the diskette. A single floppy disk drive is required to load data into, and remove data from, the RAM disk emulator.

The mass memory has many advantages over conventional floppy disk drives. It is initially less expensive to purchase and may be expanded in size at any time. It is much easier to maintain: A memory test will be supplied to locate defective memory chips, which may be easily replaced. It is perfectly quiet. It is extremely reliable. It is very, very fast. It can emulate ANY kind of floppy disk (or Winchester) drive - double density, double sided, 5-1/4 in., 8 in. - anything at all.

The mass memory may be used with either the original Heath buss or the new Trionyx T-H90 motherboard for the H8 computer. It will be able to use the auxiliary slots on the T-H90 motherboard, however, in order to conserve board positions in the H8 computer. The memory boards will not consume very much power and will run cool. This mass memory is an exciting addition to the H8 computer and will greatly increase its value and power.

Trionyx Electronics, Inc.

MASS MEMORY for the H8/H89* COMPUTERS

A prototype of our new mass memory for the Heath H8 and H89 computers has been completed and is now working very well as a floppy disk drive emulator. Both the hardware and software have been demonstrated to work properly in this application. Operation of this unit is very impressive. Conversion of the design to production is in process at this time.

The mass memory is a complicated unit from an initial production standpoint, consisting of several different printed circuit boards, a cabinet and self-contained power supply. The schedule for initial shipments has been extended until the middle of 1982 so that more resources can be allocated at the present time to new products for the H8 computer, itself.

The mass memory unit is based on 16K/64K dynamic RAM technology. Using 16K RAMS the mass memory will have a total capacity of 1.2 megabytes. With 64K RAMS the capacity will be 5 megabytes. The mass memory unit can contain up to eight 128K memory boards, using 16K RAMS. The same memory boards can be used with either 16K RAMS or 64K RAMS.

Using RAM memory chips, the mass memory will be a very high speed, random access unit. It will be extremely versatile. It can be used as a supplement for main memory or used to emulate any type of mass storage peripheral. It can be used to emulate several floppy disk drives or a single winchester drive.

Mass memory based on RAM memory chips is becoming increasingly price competitive with mechanical storage. Magnetic storage peripherals may soon become obsolete, as has main-frame core memory. RAM is also becoming the dominant solid-state memory technology for all applications. CCD and bubble type memories should soon be overcome by new RAM developments.

The Trionyx mass memory unit will be expandable in size by simply adding additional memory boards. The basic unit will sell with a single memory board. Other important features such as battery backup, magnetic-tape backup and electronic error correction will be available as add-on options. A single floppy disk drive will be built in to mount and dismount floppy disks. A single drive can mount several floppy disks into the mass memory. Different software packages will be available for many applications.

The Trionyx mass memory unit will initially be available for the Heath H8 and H89 computers. It will later be made available for a number of other computer busses. The H8 computer is a very powerful and versatile machine. Many peripherals and considerable software are now available for the H8. It is not likely that the H8 computer will soon be replaced. The 8 bit machine has become very well established and should be able to hold its own in the microcomputer market for some time.

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Trionyx Electronics. Inc.

C-H8 Disk Controller - Ordering Information

October 1982

The hardware design for our C-H8 universal disk controller is complete. The printed circuit board layout has also been completed and a number of boards have been built and assembled. Our software experts are now working with the assembled C-H8. Microcode is being developed for the C-H8 firmware and the HDOS and CP/M device drivers are being written. The system configuration programs are also under development. Documentation must be prepared after the software development has been completed.

Orders are now being taken for the C-H8. The first shipments should be made before the end of this year. This product has proved to be very popular and a lengthly waiting list has developed. All new orders for the C-H8 will be promptly acknowledged and a number issued on the waiting list. Shipments will be made according to the numbers issued on the waiting list. Assembled and kit version waiting list numbers will be separate.

The cost of this product was greatly underestimated. There are 55 integrated circuits on the C-H8 board. Three of these together will cost us more than \$100.00. All of the integrated circuits will be installed in gold-plated sockets.

The price of the C-H8 must be increased from that originally announced. Effective November 1st, the prices will be as follows:

C-H8	Assembled	\$ 550.00
	Kit	450.00

These prices should be final. A bare-board version of the C-H8 will not be made available.

The Winchester SASI-buss daughter board for the C-H8 will be available separately at additional cost. The price of the assembled board will be \$200.00. The kit version will be \$150.00. Shipments of the SASI-buss daughter board for the C-H8 are scheduled to begin early next year.

We have been asked many questions about this product since it was first announced. Included is additional information concerning the C-H8, based upon these questions and the completion of the design.

Trionyx Electronics, Inc.

C-H8 Universal Disk Controller - Specification and Features

The C-H8 is an Intelligent, general-purpose floppy disk controller designed for use with the Heathkit H8 computer. The C-H8 is an extremely sophisticated high-technology product using state-of-the-art devices. The design is based on an 8085 microprocessor clocked at 5 MHz. The microprocessor program is contained in a 2764 (8K x 8 bit) monitor EPROM.

The C-H8 uses the recently available Western Digital 2793 floppy disk controller chip. The following integrated circuits are also used: 2601 USART, 8219 Buss Controller, 6331 PROM (32 x 8), 74S271 PROM (256 x 8), a pair of 2212 Non-Volatile (Shaded) RAMS (256 x 4), and a 4016 Read/Write RAM (2K x 8 - Expandable to 8K x 8).

The C-H8 is the only disk controller needed in the H8 computer. It has been designed to perform any conceivable disk operation. The C-H8 will control as many as four 5 in. drives and four 8 in. drives at one time. Both the 5 in. drives and 8 in. drives may be either single or double density as well as single or double sided, in any combination. In addition, the 5 in. drives may be either 40 track or 96 track (TPI).

The C-H8 will operate the original H-17 disk drives in exactly the same way as the original H-17 controller, using the original H-17 software. The H17 drives may be operated in either the original single density mode or as double density drives. Double density operation will double the storage capacity of the H-17 drives.

The C-H8 is media compatible with the Heath H-17, H-37 and H-47 drives. Data may be read from disks formatted for any of these drives and transferred as desired. 5 in. hard sector and soft sector disks may be used interchangeably in the same drive without reconfiguring the system.

Separate cables are used for the 5 in. drives and the 8 in. drives. All of the 5 in. drives are connected on one cable, while the 8 in. drives are connected on the other cable. A 34-pin connector is used with the 5 in. drive cable and a 50-pin connector is used with the 8 in. drive cable.

Provision has been made to plug an auxiliary small-sized "daughter" board onto the C-H8. Several types of daughter boards are planned. These boards will make full use of the microprocessor capabilities of the C-H8.

The first daughter board which will be available for the C-H8 will interface a SASI buss to the C-H8 to operate a Xebec "Winchester" hard disk drive. A complete 5 Megabyte Xebec system can now be purchased for about \$1300.00. An additional 5 Megabyte drive can be added for \$700.00. Both 10 and 20 Megabyte Xebec drives are planned for the future.

The C-H8 will be able to operate either two 5 megabyte, two 10 Megabyte or two 20 megabyte Xebec drives using the daughter board, at the same time as the 5 in. and 8 in. floppy disk drives. An additional cable connector will be provided on the daughter board to connect to the Xebec system.

Other daughter boards planned will connect directly to other types of Winchester drives, such as the H-67. A cache memory daughter board is also planned. This board will provide up to 64K bytes of cache memory for use with the floppy disk drives.

The daughter boards will be approximately 6 in. square and will plug into the left side of the C-H8 from behind, solder-side to solder-side.

The C-H8 will operate with either the original 8080 CPU board or a Z80 CPU board in the H8 computer. The 8085 microprocessor chip on the C-H8, operating at 5 MHz, can keep up with the double density byte transfer rate required by the controller.

The C-H8, operating with its own memory - both RAM and ROM, will require less space in the H8 main memory. This will free main memory space in the H8 for program storage.

The C-H8 features hardware DMA (Direct Memory Access) operation. This will increase the data transfer rate from the disk to the main memory. A small plug-in pc board will mount on the CPU board to effect DMA control of the H8 buss. This board will plug into one of the IC sockets on the CPU board and connect to the C-H8 through a short ribbon cable.

The C-H8 will operate with any CPU board currently in use with the H8 computer. This includes the Heath 8080, Heath Z80, Trionyx Z80 and DG Z80 CPU boards. A different DMA connector board will be used in each case.

A cache memory option will be available for the C-H8 main board. This will provide 6K bytes of memory to store the most recent and frequently used accesses to the disk. Considerable time will be saved by-passing the disk to re-access this data. A highly efficient cache memory routine will be used to update and maintain the cache memory.

A daughter board will be available to increase the cache memory storage to 64K bytes. Only one daughter board can be used at a time with the C-H8. Use of the cache memory daughter board will preclude use of a Winchester interface daughter board. In this case, or if more than 64K of cache memory is desired, the Mass Memory boards planned for the H8 can be used instead of cache memory. The Mass Memory is extremely powerful and can also be used instead of a Winchester drive or additional floppy disk drives.

The C-H8 board layout follows that now established by Trionyx as a standard for the H8. The reverse heat sink arrangement is used with a transistor power supply. Provision has been made for a T-H90 expansion connector. Ample power supply filtering is included. The parts used are the highest quality obtainable.

The C-H8 may be hardware (jumper wire) configured to use any of a number of different types of RAMs and EPROMs. Certain other hardware options are also selectable in this manner. The entire C-H8 system configuration, however, is done on a software basis, using the operator's console (H19). The system is easily configured by identifying the types of drives used, and the operating modes desired, through the use of self-prompting software.

This is a one-time-only operation. The system configuration is stored in special non-volatile RAM located on the C-H8 board. The system drive configuration may be changed or altered as desired, at any time, using the software, from the operator's console. The C-H8 may be configured for any mix or combination of different types of drives. The individual drives may be identified in any sequence desired. Any port address may be used to select the C-H8. An address selection switch is located on the board.

The HDOS and CP/M device drivers required for use with the C-H8 will be relatively simple and easy to modify. This is a primary advantage of an intelligent controller. The C-H8 will be readily transportable between different types of CPU boards. Trionyx plans a 16-bit CPU board for the H8 in the near future. This will use an 8086 microprocessor and operate with both IBM PC and Zenith Z-100 software.

Several other 16-bit CPU boards are also planned. In addition, 8-bit CPU boards to emulate other personal computers, and use their software, are under investigation. The intelligent C-H8 controller can be used with any of these boards. The C-H8 also has the built-in capability to provide DMA operation throughout a 20 bit address space.

A Zenith distributor recently demonstrated a new Z-100 in our facility. The graphics were very impressive, but probably not really important. The most important thing about the Z-100 is that it can operate with IBM PC software! We feel that all of the significant features of the Z-100, including the color graphics, can be readily emulated using the H8 box. It is our intention to do just this. We will improve on all of the Z-100 features when they are individually repackaged for the H8. A Z-100 equivalent will then become available, one section at a time, on a more affordable basis.

"Meets today's needs - and tomorrow's too:" This reference to the H8 computer appears on page 70 of the latest (No. 859) Heathkit catalog. We feel that the buss-orientated structure of the H8 allows it to be continuously updated to incorporate the latest technical developments and allow it to remain competitive with all new entries in the small computer field.

A QUICK REFERENCE SUMMARY GUIDE

for

HDOS 2.0*

and

CP/M 2.2**

Written By
Robert D. Sutton

Published By

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

HDOS 2.0 Summary Guide (42 double-sided pages)	\$15.00 each, postpaid.
CP/M 2.2 Summary Guide (32 double-sided pages)	\$15.00 each, postpaid.
Both Manuals Above (Set of 2)	\$25.00 each, postpaid.

Trionyx Electronics, Inc. is pleased to offer the above summary guides for HDOS 2.0 and CP/M 2.2. These are very well written and comprehensive guides for the two most popular operating systems for the Heathkit H8* computer. These guides are intended to be used by those already familiar with the system software who need to occasionally refresh their memories with regard to certain points of system operation. They also provide a review of system operation and an overview of the entire system software.

These guides cover a considerable amount of software in addition to the actual operating systems. M Basic, Fortran-80, the Music Board, Autoscribe, the PI Editor, are only a few of these. These reference guides will not be set aside after they are received. They will be out all the time and used constantly with the computer. They will be the number 1 reference manual used with the computer. Each manual is attractively bound in a soft cover for easy handling.

* H8 and HDOS are registered trademarks of the Heath Co.

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

NEW PRODUCT ANNOUNCEMENT

VOLTAGE CONVERTER

for the

TRIONYX M-H8 64K MEMORY for the HEATHKIT H8* COMPUTER

* H8 is a registered trademark of the Heath Company in Benton Harbor, Michigan

Model VC-MH8

\$19.50 Kit

\$29.50 Assembled

\$49.50 Assembled and Installed

Use +8 Volts Only With the 4116 Dynamic Memory Chip

The M-H8 64K dynamic Memory from Trionyx Electronics uses all three power supply voltages on the Heathkit H8 computer bus: +18 Volts, +8 Volts and -18 Volts. The 4116 dynamic memory chip used on the M-H8 memory board uses +12 Volts, +5 Volts and -5 Volts. These voltages are obtained from the three voltages supplied on the H8 bus and are supplied to the memory chips through voltage regulators on the M-H8 memory board.

Only small amounts of current are drawn from the +18 Volt and -18 Volt H8 power supply and the Trionyx M-H8 memory should work with most H8 computer configurations. However, for some applications, the H8 computer +18 Volt and -18 Volt power supply may be fully loaded and unable to supply the M-H8 memory board. In this case, the VC-MH8 voltage converter can be used to convert the M-H8 memory for operation with the H8 +8 Volt power supply only. The VC-MH8 voltage converter uses the H8 +8 Volt power supply to generate both +12 Volts and -5 Volts for the 4116 memory chips used on the M-H8 memory board.

The VC-MH8 voltage converter consists of a tiny 1 in. x 4 in. printed circuit board holding 26 parts which permanently mounts on the M-H8 memory board, using short plastic spacers and riser wires, just below the memory chip area, in place of the +12 Volt and -5 Volt regulator circuit parts.

SPECIFICATIONS:

Input: +6 to +12 Volts (+8 Volts nominal)

Output: +12 Volts at 100 ma.
- 5 Volts at 5 ma.

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PHONE ORDERS WELCOME (714) 830-2092

TRIONYX ELECTRONICS, INC.
P.O. BOX 5131, SANTA ANA, CA 92704

TRIONYX ELECTRONICS, INC.

MEMORY TEST for the HEATHKIT H8* COMPUTER

TRY THIS MEMORY TEST

This is a significant test of memory capability. Inability to perform this simple test will restrict the application of your computer in several important areas. Trionyx Electronics, Inc. and other manufacturers are developing a number of new products for the H8* computer and it is important that they be supported by properly working memory.

- 1) Boot HDOS - Get System Prompt.
- 2) Reset the Computer. Simultaneously depress the 0 and RST keys on the H8 front panel. Hold for 10 to 15 seconds.

The CPU board must remain reset throughout this period. This simulates a HOLD command on the computer bus.

- 3) Load the Program Counter (PC Register) with 040 100 (warm boot).
- 4) Push GO. The system should automatically return to HDOS.

Any well designed computer memory will pass this test. Both Heath and Trionyx memory boards for the H8 computer will pass this test using the Heath 8080A CPU board.

* H8 is a registered trademark of the Heath Company

— **TRIONYX
ELECTRONICS**

BOX 5131-C, SANTA ANA, CA 92704

The M-H8 64K memory board by Trionyx Electronics, Inc. is the only dynamic memory board available for the Heathkit H8* computer which has stand alone refresh. This independent refresh mode enables the memory to retain data when the computer is reset or when the CPU is disconnected from the bus when the bus HOLD signal is asserted.

The HOLD signal is used to transfer control of the computer bus from the CPU to another device. This is a common practice in commercial systems and provision to do this in the H8 computer is a part of the original design by the Heath Company. Most dynamic memories for commercial computers require stand alone refresh and this will be a requirement for the H8 computer as it is upgraded to more advanced levels.

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Electronic Engineering TIMES

Issue 215

Circulation Over 100,000

The Newspaper For Technical-

The Bubble Bursts—

By Warren Andrews

SANTA CLARA, CA — Three down and one to go. That was the score after National Semiconductor bowed out of the magnetic-bubble memory business last week.

Earlier this year, Texas Instruments dropped its bubble-memory division and Rockwell International withdrew from commercial production of the devices. This leaves Intel as the only American company supporting a major effort in bubble memories.

Magnetic-bubble memories,

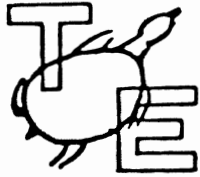
which offer high-density, non-volatile storage with immunity to harsh environments, were initially viewed by the electronics industry as a promising alternative to disk and conventional solid-state devices. Though some Japanese and European companies also produce bubble memories and Motorola has a limited production effort, National's withdrawal casts a shadow over the future of the business.

First 256-k RAM Chip In Limited Sampling In U.S. And Japan

By Stan Baker

TOKYO — The first 256-kbit dynamic RAM chip has been formally announced by OKI Electric Industry at ceremonies commemorating the firm's 100th year in business. Engineering samples are available in Japan and the United States, but are strictly controlled.

The part, numbered MSM37256, is organized 256 k × 1, uses redundant memory cells (an additional 6 k cells), has an access time of 100 ns, cycle time of 200 ns, and comes in a 16-pin ceramic DIP. It uses a 256-cycle refresh scheme and pin one is designated as A8. It operates from a single 5-V power supply and dissipates 20 mW at standby and 300 mW in operation. The die size is 5 × 9 mm and the part is processed in double-poly NMOS.



Specialty
Electronic
Products

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- 4) Push GO. The system should automatically return to HDOS.

Any well designed computer memory can pass this test. Both HEATH and TRIONYX memory boards for the H8 computer will pass this test. It may be important for some future applications that the memory board in your computer also pass this test.

* H8 is a registered trademark of the Heath Company.

TRIONYX ELECTRONICS, INC.

MEMORY TEST for the HEATHKIT H8* COMPUTER

TRY THIS MEMORY TEST

This is a significant test of memory capability. Inability to perform this simple test will restrict the application of your computer in several important areas. Trionyx Electronics, Inc. and other manufacturers are developing a number of new products for the H8* computer and it is important that they be supported by properly working memory.

- 1) Boot HDOS - Get System Prompt.
- 2) Reset the Computer. Simultaneously depress the 0 and RST keys on the H8 front panel. Hold for 10 to 15 seconds.

The CPU board must remain reset throughout this period. This simulates a HOLD command on the computer bus.

- 3) Load the Program Counter (PC Register) with 040 100 (warm boot).
- 4) Push GO. The system should automatically return to HDOS.

Any well designed computer memory will pass this test. Both Heath and Trionyx memory boards for the H8 computer will pass this test using the Heath 8080A CPU board.

* H8 is a registered trademark of the Heath Company

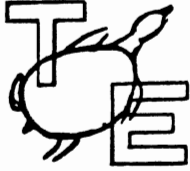
— **TRIONYX
ELECTRONICS**

BOX 5131-C, SANTA ANA, CA 92704

The M-H8 64K memory board by Trionyx Electronics, Inc. is the only dynamic memory board available for the Heathkit H8* computer which has stand alone refresh. This independent refresh mode enables the memory to retain data when the computer is reset or when the CPU is disconnected from the bus when the bus HOLD signal is asserted.

The HOLD signal is used to transfer control of the computer bus from the CPU to another device. This is a common practice in commercial systems and provision to do this in the H8 computer is a part of the original design by the Heath Company. Most dynamic memories for commercial computers require stand alone refresh and this will be a requirement for the H8 computer as it is upgraded to more advanced levels.

* H8 is a registered trademark of the Heath Company.



Specialty
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TRIONYX ELECTRONICS

P.O. Box 5131, Santa Ana, California

92704

NEW REPAIR POLICY

Effective March 30, 1981, we are instituting a new repair policy for our computer products.

1) Assembled boards:

Boards purchased assembled are guaranteed for a period of one year following the date of purchase. We will repair assembled boards without charge during this time. These boards will be returned prepaid.

2) Kits:

A service fee of \$25.00 will be charged to repair and return all boards assembled from kits. We will replace all kit-supplied defective parts free of charge during the first year following purchase.

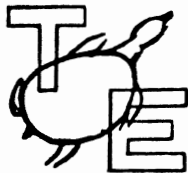
3) Bare Boards:

A service fee of \$100.00 will be charged to repair and return all boards assembled from bare boards. We will also charge to replace any defective or functionally incorrect parts. The parts prices are published in our parts lists.

Boards must be fully assembled to be eligible for repair. It is very important to use high-quality IC sockets for bare boards. We produce high-quality products of sophisticated design. Bare boards should be built using parts and workmanship which complement the quality of our boards.

Our warranty is intended to cover defects in parts and workmanship and is void in all cases where the boards have been subject to obvious abuse, whether electrical, mechanical or otherwise.

Please allow 30 days for all repairs. Payment must be received before repaired boards can be returned.



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TRIONYX ELECTRONICS, INC.

P.O. Box 5131, Santa Ana, CA 92704

15 October 1981

Memo to all H8* Computer owners:

We would like to announce at this time that we are offering a repair service for the Heathkit H8 computer. This service will cost \$50.00, plus parts and return shipping, and will be limited to the H8 CPU box. The CPU box should contain all of the Heath pc boards, as well as any of our boards purchased. Our new T-H90 motherboard must be installed in the H8 CPU box or ordered with the repair service.

The primary purpose of this repair service is to encourage H8 owners to use our products. The Heath Company and many local Heathkit Electronic Centers will not service H8 computers with products obtained from outside manufacturers. Many H8 owners depend upon the availability of this service and are reluctant to purchase non-Heath products for their H8 computers for this reason.

We will repair both Heath and Trionyx boards in the H8 CPU box. H8 owners may now purchase any of our products for the H8 computer and make use of our full H8 computer CPU box repair service.

Yours very truly,

Bill Perry
President

BP/ms

Trionyx Electronics, Inc.

H8* COMPUTER REPAIR SERVICE

Trionyx Electronics, Inc. is now offering a repair service for the H8* computer CPU box. This includes the H8 chassis, power supply, and all of the following Heath printed circuit boards: Front Panel, CPU (8080A or Z80), Memory Boards, H17 controller, H8-4 serial interface card and Org Zero card.

The H8 computer CPU box must have a Trionyx T-H90 motherboard installed to qualify for our repair service. We will install a motherboard if requested. Assembled T-H90 motherboards are priced as follows:

T-H90	Completely Assembled	\$250.00
T-H90	Heath Equivalent Assembled	175.00

Our price to service an H8 CPU box is \$50.00. The cost of replacement parts is additional. Return shipping is also additional and is \$20.00 within the United States and Canada. We must receive payment of \$70.00 to start work on any H8 CPU box sent to us for service. Any Trionyx kits or bare boards included with the H8 CPU box (Memory, Z80 board, etc.), if found defective, will be billed separately for service. No additional charge will be made for motherboard installation, if one is ordered with the repair service.

H8 CPU boxes sent to us for service will be returned fully functional and reliable operation will be guaranteed. The motherboard will be implemented to the highest level required for this purpose, on an individual basis. Parts will also be replaced on all boards, as required, to guarantee reliable operation. We can quote the total price for service in each case before changing any parts, but will require a minimum payment of \$70.00 to evaluate and return the unit, in any case.

As the H8 computer becomes more complex, system problems may arise which are very difficult for an individual user to solve. System problems exist when particular pc boards work individually, but will not work together. Most system problems are related to the computer bus. A systems approach must be taken to solve some of the more difficult problems involving computer reliability. We have a number of H8 computers and are in a position to freely interchange pc boards in order to identify particular types of problems.

Three to four weeks will normally be required to service and return an H8 CPU box sent to us for repair. All units to be repaired should be sent to Trionyx Electronics, Inc., 2287 S. Grand Ave., Santa Ana, CA 92705. All shipments should be fully insured. Our H8 computer repair service is limited to the CPU box, itself. We do not service the computer peripherals.

* H8 is a registered trademark of the Heath Company.

Introducing -

THE NEW H8* COMPUTER

* H8 is a Registered Trademark of the Heath Company



PC Board Mounts Additional Pair of Connectors to Plug Into 90 Pin Bus



Optional 40 Pin Connector Assembly
Converts H8 Boards to 90 Pin Bus



Fully Assembled Motherboard - \$250.00

Featuring the TRIONYX T-H90 MOTHERBOARD A Professional-Quality Bus for the H8 Computer

- 3-Layer Board Has Center Ground Plane

- Designed For 4 MHZ Bus Operation

- 7 Auxillary Positions For Port Addressable Bus Interface Cards

- Completely Compatable With Original H8 Computer

● 90 Pin Bus Has:

- Additional Ground Connections For Reliable Operation
- 8 Additional Data Bits For 16 Bit CPU Board
- Additional Address Lines For Expanded Memory Capacity
- Bank Select Lines For Memory Management
- Additional Lines For Special Control Signals and Future Defined Functions

PC Board \$ 75.00

25 Pin Gold Connectors - Set of 20 \$45.00
- Build Motherboard to Original H8 Standard

20 Pin Gold Connectors - Set of 18 \$34.00
- Add Additional 40 Pins for 90 Pin Bus

25 Pin Gold Connectors - Set of 14 \$35.00
- Add 7 Auxillary Card Positions

Power Supply Parts for Motherboard \$16.00
- Includes Extra +18 Volt Filter Capacitor

Bus Termination Card - Complete Kit \$29.50

PC Board Connector Expansion Kit \$15.00
- Adapts Original H8 PC Boards to 90 Pin Bus:
Contains PC Board, Two 20 Pin Connectors,
Mounting Blocks and Hardware - One Kit
Required Per PC Board

The new T-H90 Motherboard has been designed to provide completely reliable operation of the H8 computer through the use of gold-plated connectors and a well grounded bus. The bus has been expanded from 50 to 90 lines and 7 additional card slots have been added. Full implementation of the Motherboard functions will transform the H8 into a commercial grade computer.

Check • Money Order • VISA • MASTERCARD • C.O.D.

Phone Orders Welcome (714) 830-2092 - Send For Free Brochure

TRIONYX ELECTRONICS, INC.

P.O. BOX 5131, SANTA ANA, CA 92704

Trionyx Electronics, Inc.

New H8* Motherboard = New H8 Computer

The motherboard which carries the computer bus lines is the very heart of the computer. The motherboard is to the computer hardware what the operating system is to the computer software. All of the transactions between the computer boards take place on the computer bus. The functions of the computer, its capabilities and its limitations, are determined by the signal lines defined on the bus.

The present Heath H8 motherboard is very poorly designed. Originally supplied with tin-plated connectors, Heath is now shipping both kit and assembled versions of the H8 computer with gold-plated connectors. This was very quietly done. Those who supported Heath most, by purchasing their product when it was first introduced, are now struggling with tin connectors without any notification that they can be the cause of the most exasperating kinds of system problems.

This is true of most of the products Heath has sold for their computers. Designs are continuously upgraded and improved without any notification to prior purchasers that there are ways to improve their equipment. The policy at Trionyx Electronics, Inc. is very different. Improvements to our designs are published and distributed free of charge to all purchasers, often with parts included. We hope that this service has been noted and is appreciated. We feel that the computer hardware should be supported in exactly the same manner as the software.

The H8 motherboard is very poorly grounded from a signal transmission point of view. This causes distortion of the signals appearing on the bus - which results in unreliable system operation. System operation is then affected by the location and sequence of the boards plugged into the bus. Some boards will work better in some systems than others. The H8 computer has only a single ground connection from the boards to the bus and only one ground line on the bus. This does not work well and is simply not acceptable.

There are no unassigned signal lines on the H8 motherboard. There is no provision for memory expansion or additional control signals. The memory read command is not asserted until 200 nanoseconds after the memory addresses are applied to the bus. This is an incredible waste of memory access time. A memory request signal is needed to begin memory cycles ahead of the memory read and write commands. The 50 pin bus severely limits expansion of the capabilities of the H8 computer.

What is Heath's answer to these problems? It is widely understood at this time that Heath will discontinue production of the H8 and soon offer an entirely new computer to the H8 user's market. This new computer will presumably have a 16 bit processor and a Winchester-type mass storage device. It will have to have a completely different bus structure.

The H8 is still a very good computer. We like the H8 very much and will continue to produce new products for it. The H8 computer still has enormous potential for development in its present form. We challenge the Heath Company to produce a new computer which can compete with the H8 - upgraded with new products which will be developed by Trionyx Electronics., Inc.

New high-technology products for the H8 computer cannot be developed using the present motherboard. In particular, 4 MHz CPU operation requires a well grounded bus. The use of new LSI integrated circuit packages on high component density printed circuit boards which will be produced by Trionyx Electronics, Inc. will enable the H8 computer to employ many new hardware products within the confines of the present chassis, using the Trionyx T-H90 Motherboard.

* H8 is a registered trademark of the Heath Company in Benton Harbor, Michigan.

New T-H90 Motherboard for the H8* Computer

The T-H90 Motherboard is the basis of a system to upgrade the performance of the H8 computer to commercial standards. New hardware products can be produced for the H8 computer which take advantage of the additional signal lines defined on the expanded bus. Most important, the entire bus is electrically referenced to ground so that it may be passively terminated in order to eliminate line reflections which cause signal distortion.

The original versions of the H8 computer were supplied by the Heath Company with tin-plated motherboard connectors. These connectors are not reliable and sooner or later will cause difficult-to-isolate system problems. These tin connectors should be replaced with gold-plated connectors. The necessity for doing this is now very well established. This is more than reason enough to purchase a new motherboard.

The new Trionyx T-H90 motherboard is completely compatible with the H8 computer in every way and can be used simply as a replacement for the original motherboard. Use of the additional connectors and card locations provided on the T-H90 motherboard is optional. The extra connectors can be added to the motherboard at any time. The power supply parts can be easily removed from the original motherboard and installed on the T-H90. An extra +18 volt filter capacitor can be added, if desired, to increase the +18 volt current output.

Seven additional card slots have been added to the T-H90 motherboard. These have 50 pin connectors which combine signal lines from the original H8 bus with some of the new lines added to make up the T-H90 bus. These connectors are intended to interface the bus with various peripheral devices. Short cards with special connectors, similar to the Heath HA8-8 card, can be used to plug into these slots. The Heath HA8-8 (extended configuration) card, in fact, should be plugged into one of these slots just behind the CPU card.

The additional signal grounding provided on the T-H90 motherboard may be sufficient in itself to provide reliable system operation in many instances. In this case, nothing further need be done. However, the real advantage of the T-H90 motherboard lies in the availability of additional ground connections along the length of each connector for the boards which plug into the bus. Adding additional ground connections from the bus to each plug-in board will increase system reliability by a very large order. An adaptor kit is available to convert the original Heath boards to the full 90 pin bus on the T-H90 motherboard. Small wires are soldered to the Heath boards from pads on the connector adaptor board. Complete instructions are included with each adaptor kit.

Reflections can cause problems on any unterminated bus. If problems persist after each of the plug-in printed circuit boards are well grounded on the bus, a terminator card should be added to the last connection slot on the bus. Ideally, both ends of the bus should be terminated. A bus termination network has been included on the new Trionyx Z80 CPU board for the H8, which should be located at the front of the bus, immediately behind the front panel board.

Finally, the bus drivers on each card must have the capability of driving the terminated bus. If the bus drivers cannot drive a terminated bus, neither can they drive an unterminated bus. This point is very important. An unterminated bus presents an A-C load of the same impedance as the bus terminations. Inability to drive this load will result in distorted signals on the unterminated bus. It is also important that the bus receivers do not load the bus. Trionyx Electronics, Inc. will soon announce tiny bus driver and receiver modules for the original H8 cards which will plug into the sockets for the present integrated circuit bus drivers and receivers.

* H8 is a registered trademark of the Heath Company.

T-H90 MOTHERBOARD

Fully Assembled	-	-	-	-	-	-	\$250.00
Heath Equivalent, Assembled	-	-	-	-	-	-	175.00

The new T-H90 motherboard for the H8* computer is an exact replacement for the original Heath H8 motherboard.

No modifications whatever are required to use the Heath H8 printed circuit boards with the T-H90 motherboard.

The center-layer ground plane on the T-H90 motherboard provides significant improvement in the signal transmission characteristics of the bus, without the need for additional ground connections to the bus.

Additional ground connections to the bus can be made using either the T-H90 pc board connector expansion kits or the new GC-TH90 ground connector kit. The addition of ground wires or additional connectors to the printed circuit boards is completely optional.

The T-H90 motherboard can be used simply as a replacement for the Heath H8 motherboard, making use of the gold connectors and the center-layer ground plane.

The T-H90 motherboard also has many advanced features that can be implemented individually at any time to transform the H8 computer into a very advanced machine.

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TRIONYX ELECTRONICS, INC.

P.O. Box 5131, Santa Ana, CA 92704

TRIONYX ELECTRONICS, INC.

TERMINATION CARD - T-H90 Motherboard

The termination card for the T-H90 motherboard for the H8 computer is designed to plug into both the "A" and "B" connector pairs at the last position (Pl0) on the bus. The termination card will electrically terminate all lines on the bus at this position. Prices for the termination card are as follows:

TC-TH90	Kit	\$29.00
TC-TH90	Assembled	39.00

Recent tests have shown that the center ground plane on the T-H90 motherboard, by itself, provides a significant improvement in the signal transmission characteristics of the bus. The termination card and the additional ground connections on the second ("B") connector will not be needed with the motherboard, in most cases.

The auxillary ("B") connectors need not be installed on the H8 printed circuit board modules until it is desired to use the additional bus signals on the T-H90 motherboard. Installing these connectors simply to use the additional T-H90 motherboard ground connections will, however, provide a increase in the margin of reliability already obtained with the ground plane.

The termination card for the T-H90 motherboard has been designed to not only electrically terminate the bus, but also to configure the bus on an individual basis between the three connector types ("A", "B" and "C"). The bus must be configured for some of the new product options which will soon become available for use with the motherboard. The termination card will be necessary to configure the bus when using these new boards.

The bus terminations, themselves, will be "split" type terminations chosen to match the characteristics of TTL drivers, while terminating the bus in its characteristic impedance. This type of termination is standard in the computer industry and is far superior to so-called "active" terminations, which are simple pull-up resistors, which do not properly terminate on the bus.

The TC-TH90 termination card is a dual-purpose bus termination and connector configuration card. The connector configuration options can be used without installing termination resistors on the card. The termination resistors will require heavy-duty drivers on the bus. This means that the "LS" type TTL bus drivers on each printed circuit board plugged into the bus will have to be replaced with "S" type TTL bus drivers.

Trionyx Electronics, Inc.

"HALF BOARD" Series for the H8* Computer

Trionyx Electronics will soon be introducing a number of utility circuits individually packaged on "half boards", 6 in. x 6 in., designed to plug into the auxillary positions on the new Trionyx T-H90 motherboard for the H8 computer.

These half boards will be similar in concept to the Heath ORG ZERO card and like the ORG ZERO card will plug backwards into the bus. Many of the half boards can also be used with the standard Heath motherboard. The T-H90 motherboard, however, has 7 auxillary half board positions, in addition to the 10 standard board positions, and can contain more modules than the Heath motherboard.

The initial half board offering will be a calendar clock card. The calendar clock card will be available in January, 1982. An arithmetic chip (ALU) card will soon follow. Additional half boards will be introduced at regular intervals. The following is a list of some of the half boards planned for the H8:

- Calendar Clock
- Arithmetic Chip (ALU)
- EPROM (Program or Use)
- Memory Board Bank Select Port
- Random Number Generator
- Voice Synthesis
- Appliance (AC Outlet) Control
- Analog to Digital Converter
- Digital to Analog Converter
- Serial Cassette I/O
- Mass Memory Controller
- ROM Card
- Battery Backup Regulator
- Serial Port
- Parallel Port

All half boards will be available as kits, assembled boards, or bare boards with complete documentation. Software utilities will also be provided for each board. These half boards will make it possible to simply and economically upgrade the H8 computer into a very powerful and versatile machine. The outward appearance of the H8 will not be altered in any way.

* H8 is a registered trademark of the Heath Company.

Trionyx Electronics, Inc.

CALENDAR CLOCK

Half Board for the H8* Computer

The Calendar Clock is the first of a series of "half boards", 6 in. x 6 in. in size, which will be offered for the H8 computer. These half boards are designed to plug backwards into the auxillary slots on the new T-H90 motherboard for the H8. The calendar clock half board will also plug into any slot on the standard Heath motherboard.

The calendar clock board will supply time information including the year, month, date, day of the week, hour, minute and second. Either a 12 hour or 24 hour format may be software selected. The clock chip used is the MSM 5832. The clock is crystal controlled and may be adjusted with a trimmer capacitor.

The calendar clock half board should be available in January of 1982. Prices for the calendar clock board are as follows:

C/2-H8	Assembled and Tested	\$175.00
C/2-H8	Complete Parts Kit	150.00
C/2-H8	Bare Board	75.00

The calendar clock board has CPU interrupt capability for time-task programs. The interrupt level is jumper selectable. The interrupt rate will be software selected.

The calendar clock chip runs on a rechargeable nickel-cadmium battery mounted on the board and is completely independent of the system power line. A charging circuit is included which recharges the battery whenever the computer is running. The battery has a lifetime of more than five years and will run the clock chip more than a month between charges.

Software utilities include complete diagnostics, the initial clock set up routine, an interrupt service utility and a system patch for clock interrogation on boot up. The clock can be interrogated at any time by the user at the operating system level. On boot up, the correct date will be entered automatically, without a pause. At midnight, the date will automatically be changed if the computer is running.

The calendar clock board is selected through an I/O port address on the bus. The particular address is switch selectable on the board. Heavy duty bus drivers are included for use with a terminated bus. An instruction sheet will provide information to custom interface the calendar clock with the user's software.

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GROUND CONNECTOR KIT

for the

T-H90 MOTHERBOARD

Kit, GC-TH90 - - - \$10.00 each, postpaid

Each kit contains sufficient material to add ground connections to as many as 6 printed circuit boards:

- 12 - Individual Pin Connector Assemblies
(Insulated pin connectors with wires attached)
- 1 - 25 Pin Gold Connector Strip
(Cut single pins to install at motherboard ground locations)

Complete Instructions Included

The GC-TH90 Ground Connector Kit provides an extremely simple and very effective method of grounding the printed circuit boards which plug into the T-H90 motherboard for the H8* computer.

The Ground Connector Kit consists of pre-wired, insulated pin connectors which are soldered to ground points on the various printed circuit boards and individually plug on the ground pins provided on the motherboard auxillary ("B") connectors. The wires on the pin connectors are cut to the proper length before soldering to the printed circuit boards.

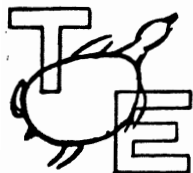
The ground connectors will plug on either the "B" connector ground pins or individual ground pins installed in place of the "B" connectors on the motherboard. An average of two ground connectors will be used for each printed circuit board.

The GC-TH90 Ground Connector Kit is used in place of the T-H90 PC Board Connector Expansion Kits when the motherboard "B" connectors are used only to provide ground connections for the printed circuit boards. The Connector Expansion Kits are necessary to use the additional bus lines provided on the T-H90 motherboard.

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TRIONYX ELECTRONICS, INC.

P.O. Box 5131, Santa Ana, CA 92704



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P.O. Box 5131, Santa Ana, CA 92704

Z80 CPU Board for the Heathkit H8 Computer

Our new Z80 CPU board for the H8 is a high quality product with many advanced features. A very significant and exclusive function is software control of the clock rate between 2 MHz and 4 MHz. The Heath ORG ZERO circuits will be included, as will all of the significant features of the new Heath Z80 board. Provision has been made for front-end bus termination resistors and heavy duty bus drivers. Our Z80 board will use the standard Heath H8 firmware (front panel monitor ROM).

Software utilities will be supplied on disk to operate our Z80 CPU board with the H8 at 4 MHz. These can readily be patched into the system. Only one simple hardware modification will be required to use our Z80 board with the H8 computer. The Z80 clock rate may be changed at any time during operation between 2 MHz and 4 MHz using either system or program software. Many programs have been written for the H8 using timing loops based upon a 2 MHz clock.

There wasn't room on the Z80 board for the calendar clock or the arithmetic chip, as originally advertised. Instead, these circuits will be sold individually on "half boards", 6 in. x 6 in., similar in concept to the Heath ORG ZERO card. The half boards are designed to plug backwards into the auxillary slots on our new T-H90 motherboard for the H8. They will also plug into the standard Heath motherboard positions. A large number of additional half boards are planned for the H8 computer.

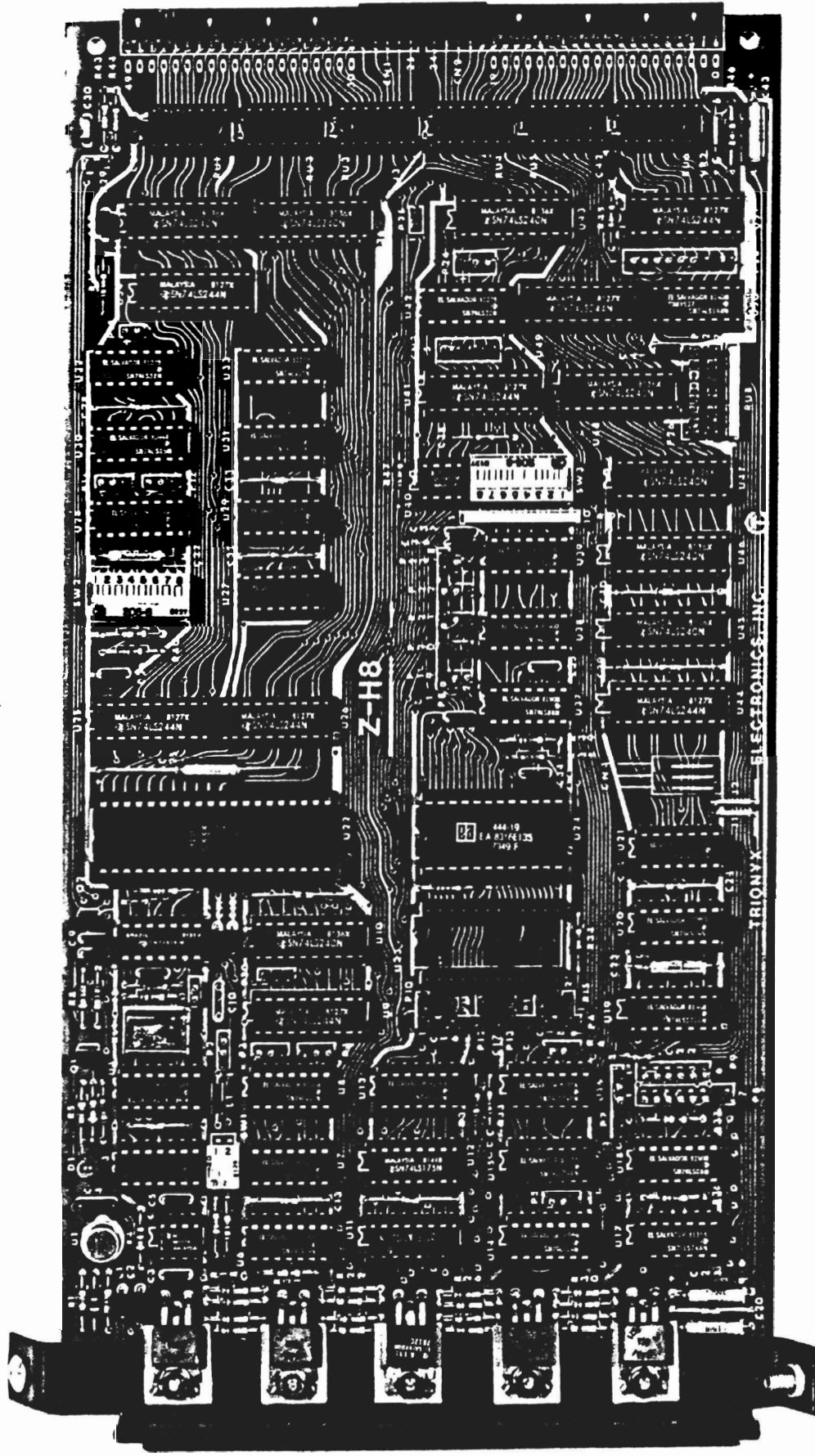
Our Prices for the Z80 CPU board are as follows:

Bare Board with Documentation	\$ 75.00
Complete Parts Kit	200.00
Assembled and Tested	250.00

Our Z80 CPU board has been designated the Z-H8 and shipments are now scheduled to begin around the end of October. Advance orders are being accepted at this time.

Model Z-H8

Z80 CPU BOARD for the H8*

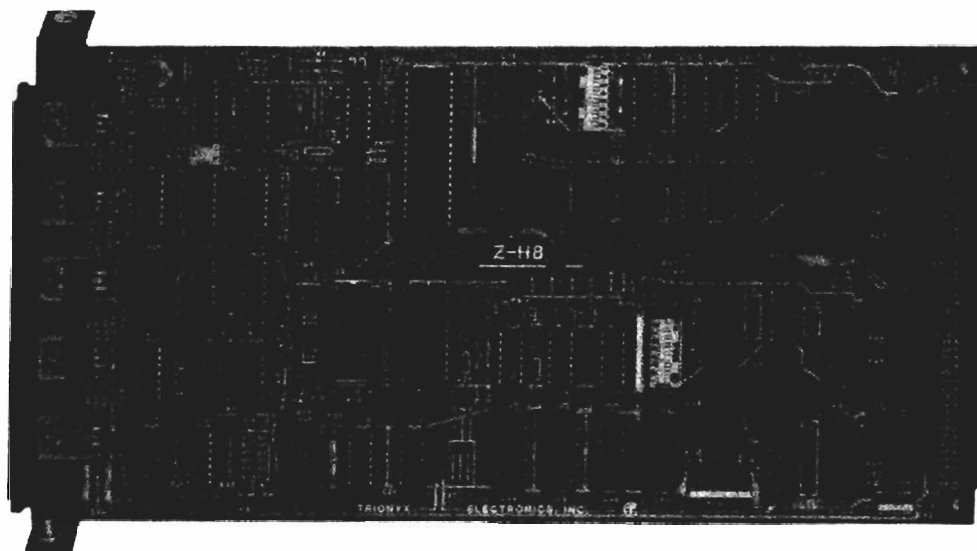


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TRIONYX ELECTRONICS, INC.

Z80 CPU BOARD for the H8*

* H8 is a Registered Trademark of the Heath Company



Model Z-H8

\$ 300.00 Assembled

\$ 250.00 Kit

Programmable Clock Rate — 2 MHz or 4 MHz Operation

Clock Rate under Software Control — May Be Changed at Any Time

Selection of Wait States (None, 1/2, 1 or 2) at 4 MHz

Buss Termination Network • 51 Integrated Circuits • Transistor Power Supply

Includes Heath Extended Configuration (ORG ZERO) Circuits

Exclusive Z80 Front Panel Monitor ROM — Based Upon Heath XCON-8 ROM

Exclusive Software Speed Utilities (For Both HDOS* and CP/M) on Diskette**

Fully Compatable With All Heath H8* Hardware and Software

* H8 and HDOS are Registered Trademarks of the Heath Company.

** CP/M is a Registered Trademark of Digital Research.

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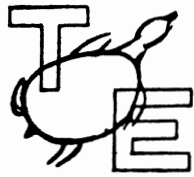
P.O. BOX 5131, SANTA ANA, CA 92704

A COMPARASON OF THE THREE Z80 CPU BOARDS AVAILABLE FOR THE H8* COMPUTER:

Features:	Trionyx	Heath	D.G.
Number of Integrated Circuits	51	35	25
Gold Plated IC Sockets and Connectors	Yes	No	No
Fully Buffered Z80 MPU Chip	Yes	No	No
4 MHz. Operation	Yes	No	Yes
Dynamic Switching of System Clock Between 2 and 4 MHz. Using either System or Program software	Yes	-	No
Multiple Wait State Circuit (4 MHz.)	Yes	-	No
Hardware Implementation of the 8080 INT Signal for Single Step Operation	Yes	Yes	No
Software Control of All Three Z80 Interrupt Modes (0, 1, 2), including Software Disable of the Non-Maskable Interrupt	Yes	No	No
Early Memory Write Signal (Required)	Yes	Yes	No
Fully 8080A Compatible I/O Structuring	Yes	Yes	No
Heath Extended Configuration Option (ORG ZERO)	Yes	Yes	No
Z80 Front Panel Monitor Available	Yes	No!	Yes
Two Fully Functional Processor Status Ports	Yes	No	No
Buss Termination	Yes	No	No
Fully Heath Compatible	Yes	Yes	No
Available in Kit Form	Yes	No!	No

The Trionyx Z-H8 Z80 CPU board contains a 4 ampere transistor regulated power supply which nominally supplies one ampere of current. Also available on the board are +12 volts and -5 volts. The Z-H8 has been laid out to accommodate an expansion connector (optional) for the T-H90 motherboard. A choice of a number of different circuit configurations is provided through the use of wire-wrap jumper pins. No soldering to the board is required. An LED indicates 4 MHz. operation. This LED can be relocated to the H8 front panel.

* H8 is a Registered Trademark of the Heath Company



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P.O. Box 5131, Santa Ana, CA 92704

Z80 CPU Board for the Heathkit H8 Computer

Our new Z80 CPU board for the H8 is a high quality product with many advanced features. A very significant and exclusive function is software control of the clock rate between 2 MHz and 4 MHz. The Heath ORG ZERO circuits will be included, as will all of the significant features of the new Heath Z80 board. Provision has been made for front-end bus termination resistors and heavy duty bus drivers. Our Z80 board will use the standard Heath H8 firmware (front panel monitor ROM).

Software utilities will be supplied on disk to operate our Z80 CPU board with the H8 at 4 MHz. These can readily be patched into the system. Only one simple hardware modification will be required to use our Z80 board with the H8 computer. The Z80 clock rate may be changed at any time during operation between 2 MHz and 4 MHz using either system or program software. Many programs have been written for the H8 using timing loops based upon a 2 MHz clock.

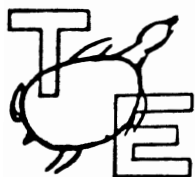
There wasn't room on the Z80 board for the calendar clock or the arithmetic chip, as originally advertised. Instead, these circuits will be sold individually on "half boards", 6 in. x 6 in., similar in concept to the Heath ORG ZERO card. The half boards are designed to plug backwards into the auxillary slots on our new T-H90 motherboard for the H8. They will also plug into the standard Heath motherboard positions. A large number of additional half boards are planned for the H8 computer.

Our Prices for the Z80 CPU board are as follows:

Bare Board with Documentation	\$ 75.00	\$ 125
Complete Parts Kit	200.00	250
Assembled and Tested	250.00	300

Our Z80 CPU board has been designated the Z-H8 and shipments are now scheduled to begin around the end of ~~October~~. Advance orders are being accepted at this time.

FEBRUARY
1982



Specialty
Electronic
Products

TRIONYX ELECTRONICS, INC.

P.O. Box 5131, Santa Ana, CA 92704

FW-Z80 FRONT PANEL MONITOR FIRMWARE

for the

HEATHKIT Z80 CPU BOARD (HAB-6) for the H8* COMPUTER

The FW-Z80 firmware package was originally developed by Trionyx Electronics for the Trionyx Z-H8 Z80 CPU board for the H8 computer. The Trionyx Z-H8 CPU board is completely compatible in every respect with the Heathkit H8 computer and, in addition, provides all of the functions of the Heath HAB-6 Z80 CPU board. The front panel firmware developed for the Z-H8, therefore, will also work with the Heath HAB-6 Z80 CPU board in the H8 computer. The FW-Z80 firmware package is sold separately for this purpose.

The FW-Z80 firmware is contained in a 2732 EPROM. The 2732 is a high-performance, reliable and very popular part for this application. The Heath HAB-6 CPU board, however, is designed to accommodate a 2532 EPROM, only. (The Trionyx Z-H8 CPU board, in comparison, may readily be programmed with jumper pins to use ANY type of EPROM available.)

The Heath HAB-6 Z80 CPU board may be modified to use the 2732 EPROM with a single etch cut and two short jumper wires on the solder-side of the printed circuit board. One of the Heath jumpers must also be removed on the component side of the board and another Heath jumper installed. Instructions to do this are provided with each FW-Z80 firmware package.

The FW-Z80 EPROM is inserted in the HAB-6 ROM socket, in place of the existing Heath front panel monitor ROM. FW-Z80 fully supports Heath XCON-8 (ORG ZERO). The Heath H-17 Controller ROM is then installed in the remaining 24-pin socket on the HAB-6 board. FW-Z80 requires the use of the H17 controller ROM. (FW-Z80 contains many functions in addition to those of XCON-8, which results in insufficient space for the controller ROM code.)

FW-Z80 provides access to all of the additional registers on the Z80 Microprocessor. Many special control features have also been added. The Heath Company is not supporting their HAB-6 CPU board with front panel control firmware at this time. The Trionyx FW-Z80 firmware package should enhance the operation of the H8 computer, whether the Trionyx Z-H8, or the Heath HAB-6, Z80 CPU boards are used.

* H8 is a registered trademark of the Heath Company.

Z80 PANEL MONITOR

for the

H8* COMPUTER

Professional Firmware for the H8 by the Ultimeth Corporation

FW-Z80	-	With Z-H8 Purchase	-	-	\$ 20.00
	-	Purchased Alone	-	-	\$ 50.00

Trionyx Electronics has commissioned the Ultimeth Corporation to develop a comprehensive firmware package to use with our new Z80 CPU board for the H8 computer. This professionally designed firmware package will perform all the functions of the Heath XCON-8 front panel ROM and, in addition, provide access to all of the registers and functions of the Z80 MPU chip using the H8 front panel keypad and display. The Z80 chip has many functions in addition to those of the original 8080A MPU chip.

The FW-Z80 firmware will be supplied on a specially selected, fast, 350 ns access time EPROM. The EPROMS will be programmed in our own facility and will be completely compatible with all H8 hardware and software. The FW-Z80 may be used with either the Heath or Trionyx Z80 CPU boards.

The FW-Z80 firmware package will include complete operating instructions as well as the entire listing of the program. The FW-Z80 firmware may be purchased at the lower price either with or after purchase of the Trionyx Z-H8 CPU board for the H8. The FW-Z80 firmware may be purchased at the higher price for use with the Heath HA-8-6 Z80 CPU board for the H8.

The H8 computer will operate more reliably at both 2 and 4 MHz with this high speed, high quality firmware package.

* H8 is a registered trademark of the Heath Company.

TRIONYX ELECTRONICS, INC.

P.O. Box 5131, Santa Ana, CA 92704

Effective January 1st, our prices have been finalized as follows:

Z-H8 Assembled	\$ 300.00
Kit	250.00
Bare Board	125.00

The above prices include complete documentation, the Z80 programmer's manual, 2MHZ/4MHZ software utilities on a 5-1/4 in. disk, and our exclusive FW-Z80 front panel monitor ROM.

The Z-H8 uses 51 integrated circuits. The assembled board is fully socketed. All connectors and IC sockets are gold plated.

The Z-H8 CPU board provides dynamic switching of the clock rate between 2 MHZ and 4 MHZ, as a primary feature. The clock rate is under software control and may be changed at any time between 2 MHZ and 4 MHZ, as often as desired. The clock rate may be changed by the operator using system level commands, or automatically, at the program level, using port IN or OUT commands. The program, itself, can change the clock rate.

Many user interactive programs (such as games) have been written using timing loops based on a 2 MHZ clock. These must be run at 2 MHZ. Other programs (such as assembling a lengthy text file) take undesirably long periods of time to run. 4 MHZ operation would be desired in these cases.

No modification whatever is made to the H8 computer. The Z-H8 CPU board simply plugs into the bus in place of the existing CPU board.

The wait state circuits on the Z-H8 allow system optimization at 4 MHZ with many different types of memory boards. Any one of the following wait states may be selected: No wait states, 1/2 wait state, 1 wait state or 2 wait states. A 1/2 wait state is a wait state on the M1 cycle, only. We originally had 1-1/2 wait states instead of 2 wait states, but decided that a geometric series in this case was more desirable than an arithmetic series.

The Heath static boards for the H8 typically require wait states at 4 MHz. An 8K memory board may require a 1/2 wait state, while a 16K board will need 1 wait state. If faster RAMS are used, the Heath static memory boards can run without wait states. The new Heath 64K dynamic memory board may require 2 wait states to operate at 4 MHz.

The wait states are selected on a switch on the Z-H8 which may be read on a special processor status port by the software. This is necessary to provide the proper disk constants when operating at 4 MHz. The wait state circuit uses a proprietary PROM (Trionyx part number 100201) which is available separately for \$10.00 to Z-H8 bare board buyers.

DO NOT BUY A Z80 WITHOUT FRONT PANEL MONITOR SUPPORT! Very sound advice! Heath does not support their Z80 CPU board for the H8 computer. Our Z80 front panel monitor (FW-Z80) is the best available for the H8 and may be used with the Heath Z80 CPU board as well as the Z-H8.

FW-Z80 is based upon the Heath XCON-8 front panel monitor and fully supports XCON-8 and provides all of the functions of the XCON-8 monitor. The Z-H8 Z80 CPU board contains the HA8-8 "extended configuration" circuitry for "ORG ZERO".

FW-Z80 also provides access to all of the additional registers used on the Z80 chip. Data may be either read or altered using any of three modes: Binary, Split Octal, or Hexadecimal. Binary is useful when examining the Flags register. A special Flags register display is also available where the set flags are individually identified.

FW-Z80 has additional advanced features, such as register pair extended display. This allows the operator to monitor the data at a memory location whose address is contained in the register pair being displayed. This can be used in single-step operation where the next instruction is displayed along with the program count. Port monitor mode is another feature, which allows display of the data at an I/O port address.

FW-Z80 is supplied with our Z-H8 CPU boards at the new pricing. It is also available separately for Heath H8-6 owners for \$50.00.

#: 27587 Sec. 2
Sb: #Z-H8
 20-Feb-82 21:04:09
Fm: JIM MERRITT 70265,1366
To: TOM JORGENSEN 7007,642

TOM, I AM TRYING TO GET A COPY OF THE PARTS LIST FOR THE Z-H8 BOARD I DEFINETLY AM GOING TO BUY EITHER THE BARE BOARD OR THE KIT. I HAVE A LARGE SUPPLY OF TTL CHIPS AND AM TRYING TO FIND OUT HOW COST EFFECTIVE IT WOULD BE TO GO WITH THE BARE BOARD AS OPPOSED TO THE KIT. I ONLY NEED A PARTS LISTING OF PARTS FOR THE BOARD. DO YOU THINK THAT YOU OR TRIONYX COULD GET A COPY OF THE LIST TO ME? IF SO PLEASE LEAVE ME A MESSAGE ON THE BOARD. THANKS FOR YOUR HELP, JIM MERRITT 117 MALLOW LN. NEWARK,DEL. 19702

#: 27611 Sec. 2
Sb: #27587-Z-H8
 21-Feb-82 03:35:23
Fm: CP-MIG Tom Jorgenson 70007,642
To: JIM MERRITT 70265,1366

Jim-

Sent you a message about this earlier, don't know what happened to it...

I don't have a parts list for the Z-H8 board, but couldn't give it to you even if I had (non-disclosure agreement); would still have to refer you to Trionyx for that. Really doubt if it's cost-effectivrr to wire it yourself --- even with a stockpile of chips, the basic hardware (LOTs of connectors and sockets and such) could easily run up to their price category.

It really is the best Z80 board for the H8 out in my opinion. Steve Bard is one hell of a designer!! It's really nice to have a 4MHz Z80 that doesn't fight you! (i.e. set your own wait states, terminated buss, LOTs of jumper options, CPU status port, software toggleable clock, accurate disk timing constants under varying conditions, fantastic firmward package, etc.).

Best regards, Tom

Trionyx Electronics, Inc.

Z-H8 Design Effort

The Z-H8 CPU board for the H8* computer is a professionally designed product meeting the highest standards. The Z-H8 has been under development for more than a year and is a result of the effort at Trionyx Electronics to upgrade the H8 computer into a state-of-the-art, professional-quality machine. We would like to present the team that brought this product to the marketplace.

Program Management

Bill Perry President, Trionyx Electronics

Myron Seibold Dir. of Eng., Trionyx Electronics

Project Engineer

Steve Bard Staff Engineer, Trionyx Electronics

Hardware Consultant

John Warren Warren Engineering

Software Consultant

Dean Gibson Ultimeth Corporation

Software Utilities

Tom Jorgenson Software Wizardry, Inc.

Firmware Package

Bob Mathias, Jr. Custom Programming

John Belsher Custom Programming

* H8 is a registered trademark of the Heath Company.

#: 25459 Sec. 2
Sb: Trionyx Z80
27-Jan-82 21:18:58
Fm: CP-MIG Tom Jorgenson 70007,642
To: All

Wanted to leave this msg earlier, but the system dumped me!

I got my Trionyx Z80 card today and thought I'd share my first impressions (as requested by one or two of you)...

The materials used on the card are top notch components and board design. The etching used on the card and the board type match the former 64K RAM card I also have from them — excellent!!

One interesting departure from other Heath-compatible boards is the heat sink assembly, the heat sink on this card is of anodized aluminum and of a physical design which allows a better layout of the (5) on-board voltage regulators — a neat arrangement.

The board is very densely packed, there is room for very little more when the traces on the board are considered — but the layout is still very neat and clean even so.

There are two on-board DIP switches for user options plus a LARGE number of pin-type connectors (H8-4 style) as well, just off the top of my head, I'd say around 50 or 60 of these pins. These pin connections do not use the jumpers as on the H8-4 board, but instead are wire-wrapped together to make the connections. It would have been nicer (though not especially important — they still look and behave quite fine as is) to have the jumpers instead, but when you look at all the various connections possible, they would have probably been impractical.

I did have one minor quirk in my assembly (s/n 3) in that the heat-sink bracket is just a tad over-sized and this causes the board bracket to bend about 1/8" from front to back — but this is probably just because it is a new card and is not objectionable.

Installation was quite easy. Moved the H17 ROM from the controller card to the Z80 card (per instructions) and pulled out the old 0-org config card (no longer need it) and old 8080 and went (cont'd)

along my merry way — until I found my Tandon drive wouldn't function. A call to Steve Bard (hero) quickly (30 secs) identified the problem. I'd stupidly forgotten to change one jumper option to put side-select on pin 18 — this I attribute to the fact that I don't yet have the complete .doc package (will not happen to anyone else) and my own stupidity.

In operation the board behaves flawlessly!! The first obvious change is that it comes up in hex mode. The software support allows (if memory serves) binary, octal, hex, and decimal displays and offers full z80 support (both register pairs, etc.) — I particularly like the register-deferred mode of displaying memory and the port monitor routine.

I won't say much about the SPEED utilities, since I wrote them — except that they will allow you to change clock rates 'on the fly', or as prologues. It's also possible to 'come up' in 4MHz on BOOT automatically via jumper options, but right now I'm still booting at 2 and going to 4 via SPEED. If one is in either 2 or 4 with either jumper configuration he can still change to the other simply by running the SPEED utility.

So far I haven't had much opportunity to test out the difference in clock rates, since everything I've done has been disk-dependent; but IT SURE IS NICE to FINALLY be able to run programs like MTN, SARGON, ZCPR, and the like — never realized how much I 'missed' them before.

In summary, I've been trying to be tough on the board, since I did some of the work on it in order to be fair about my evaluation — but it's definitely the BEST of the lot!! Steve did a wonderful job designing this board — and his user-prejudice shows, because it's done the way a USER would want to see the card. Virtually every phase is configurable via jumpers, the clock is user-friendly and toggleable in either direction, the front-panel monitor is a wonderfully thorough implementation (thanks to Bob Mathias, the author of CPS), and I very much recommend the card to Z80 buyers.

Best regards, Tom

#: 26719 Sec. 0
Sb: #TRIONYX Z80 CPU
 11-Feb-82 18:39:44
Fm: TRIONYX (Myron Seibold) 70340,270
To: ALL

The Heath Company has confirmed that the HA8-6 Z80 CPU board is no longer being shipped. Heath will not commit to a new ship date: Shipments of the board are on indefinite hold at this time. The reason for this is that the boards do not work properly in a significant number of user H8 systems. (The HA8-6 boards are tested at the Heath factory before shipment.)

H8 system problems of this type have been very extensively studied at Trionyx Electronics. The solution is to use a properly grounded motherboard in the computer. The Trionyx T-H90 motherboard is now being used on a routine basis to solve a wide variety of H8 system problems.

The Trionyx T-H90 motherboard also reduces RFI generated by the H8 to a very remarkable extent. Users report television interference is reduced more than 80 percent! This certainly proves our motherboard is doing something good.

The T-H90 motherboard will be required for use with our new Z-H8 Z80 CPU board for the H8, in most cases. We have already seen evidence of this. Using our motherboard makes the difference. No conclusion can be drawn from this other than that the Heath motherboard is inadequate.

The T-H90 motherboard is a 3-layer board with a center ground plane. The board is expensive to produce and is sold with gold-plated connectors. The bare T-H90 board sells for \$75.00. A set of 20 25-pin gold connector strips sells for \$45.00. The power supply parts are \$16.00.

This message is no. 5 of a series.

Myron Seibold
Trionyx Electronics, Inc.

#: 29309 Sec. 0
Sb: Z-H8 CPU BOARD
17-Mar-82 21:40:43
Fm: TRIONYX (Myron Seibold) 70340,270
To: ALL

The Trionyx M-H8 memory board was introduced 2-1/2 years ago as the first 64K memory for the H8 computer. The H8 computer has changed considerably since this time. Sales of the M-H8 memory have remained strong and are strong today. For this reason, the M-H8 has not been upgraded or superceeded.

The M-H8 is still the only 64K memory board available for the H8 in kit form. Most of our customers are able to assemble this kit successfully. The circuit timing on the board is relaxed to facilitate kit and bare-board assembly.

The M-H8 in its present configuration will run with a Z80 CPU at 4 MHz. with 2 wait states. This results in a 30% speed increase over 2 MHz. The Heath version of the H8 computer operates at 2 MHz., only. Until the Trionyx Z80 CPU board was recently introduced, there was no reason to run the M-H8 memory at 4 MHz. with no wait states.

The M-H8 memory board may readily be retimed to run at 4 MHz. with no wait states. The timing adjustments should be done in our plant by trained persons using a set-up established for this purpose, to insure reliable operation of the board.

After May 1st of this year, M-H8 boards may be returned to Trionyx to be modified to operate at 4 MHz. with zero wait states. We will charge \$50.00 for this service. It should be noted that many Heath static memory boards for the H8 require 1 or 2 wait states to run at 4 MHz.

This message is no. 6 of a series.

Myron Seibold
Trionyx Electronics, Inc.

#: 31391 Sec. 0
Sb: Z-H8 CPU Board
 16-Apr-82 18:38:35
Fm: TRIONYX (Myron Seibold) 70340,270
To: ALL

The Trionyx Z-H8 Z80 CPU board project for the H8 computer has now been completed. The FW-Z80 front panel monitor firmware has been upgraded to work with both HUG RDT and HDOS DEBUG. Patches are also available for HUG RDT to allow it to run with the original version of FW-Z80.

The 4 MHz. zero-wait-state modification for the Trionyx M-H8 memory board has now been defined. Memory boards MUST be returned to the factory for modification. A charge of \$50.00 will be made for this service. After modification, the memory boards will no longer operate with the 8080A CPU board. The memory WILL work, however, without wait states at either 2 or 4 MHz. with ANY H8 Z80 CPU board.

The purpose of this message is to announce our next major product offering for the H8 computer. This will be a double density H17 floppy disk controller board for the H8 buss. This product will be designated the C-H8 and will be available late this summer. Work on this project is already at an advanced stage at this time.

The C-H8 will be a highly intelligent, universal floppy disk controller board designed for maximum application. Most of the questions about it can be answered "YES!". It will contain a microprocessor and firmware monitor and can work with either an 8080A or a Z80 CPU board. It will handle both 5-1/4 in. and 8 in. drives in any mode of operation and will be the only floppy disk controller needed in the H8 computer.

This message is no. 7 of a series.

Z-H8 CPU

Memory Wait States at 4 MHz.

Wait states must be used with most memory boards when operating the H8 computer at 4 MHz. The Heath 8K static memory boards typically require a 1/2 wait state, while the 16K Heath static boards need one full wait state (a 1/2 wait state is a wait state with the M1 cycle, only). This requirement will vary for each system.

Wait states are set using switch SW1 on the Z-H8 CPU board. Any one of four wait state conditions may be established: No wait states, 1/2 wait state, 1 wait state or 2 wait states. Refer to the Z-H8 configuration information for the switch settings.

The Trionyx M-H8 memory will normally require 2 wait states to operate at 4 Mhz. in the H8. The H8 will run 30% faster at 4 MHz. with 2 wait states than it will at 2 MHz with no wait states.

If the Trionyx M-H8 memory board will not run at 4 MHz. with 2 wait states, the refresh cycle time may readily be shortened to accomplish this:

- 1 - Remove C84 (56 PF)
- 2 - Replace R17 with 4.7K
- 3 - Replace R20 with 51K
- 4 - Replace R28 with 4.7K

The Trionyx M-H8 memory board may also be modified to run at 4 MHz. with NO wait states. This modification is extensive and will vary with each board. The timing circuits must be adjusted using an oscilloscope. This should be done at the Trionyx facility to insure reliable operation of the memory.

M-H8 memory boards may be returned for the 4 mhz. zero wait state modification beginning April 15, 1982. We will charge \$50.00 per board for this service.

Please note that 4 MHz. operation of the H8 computer is not provided by the Heath Company.

* H8 is a registered trademark of the Heath Company.

Z-H8 CPU

H8* Motherboard

The Heath Company does not support 4 MHz. operation for the H8 computer. This is due to reliability problems which may be encountered with different systems. Neither the H8 printed circuit boards nor the H8 motherboard were designed to operate at 4 MHz.

Some H8 systems will operate more reliably at 4 MHz. than others. Use of the Trionyx T-H90 motherboard for the H8 is very strongly recommended for 4 MHz. operation. Most of the H8 reliability problems will be eliminated using the T-H90 motherboard. This will be true at both 2 MHz. and 4 MHz. Some H8 systems may not operate at either speed using the Z-H8 CPU board without the T-H90 motherboard.

The T-H90 motherboard provides a very quiet, high-speed computer bus designed to the same standards used in commercial systems. The T-H90 is a 3-layer board with a center ground plane. Signal lines are etched on both outer sides of the board for a 90-pin bus. A significant number of distributed ground connections are available for each board that plugs into the bus. The bus may also be terminated, if desired.

A very significant reduction in television interference provides a compelling demonstration of the effectiveness of the T-H90 motherboard.

Some of the H8 printed circuit boards may also present problems at 4 MHz. IC112 (SN7403) on the H8 front panel in particular should be replaced in the event of difficulty. Several different chips or a faster chip with the same function should be tried.

The H8 computer was originally designed as a low-cost cassette system for hobbyists. The H11 was to provide a professional-quality system. It did not work out like this at all. The H8 has become immensely popular and is now being used in ways never imagined by its creators. The H8 hardware, in particular the motherboard, needs to be improved to support the new demands being placed upon it.

Trionyx Electronics is dedicated to providing hardware to upgrade the H8 computer into a machine meeting professional standards. The Trionyx T-H90 motherboard is sufficiently flexible to allow the H8 to be used for almost any purpose. Much new hardware can now be developed for the H8 based on the high-speed T-H90 90-pin bus.

* H8 is a registered trademark of the Heath Company.