A Special Offer for All Z-H8
Printed Circuit Board Buyers -

Now that you have had the opportunity to examine our new Z-H8 printed circuit board and document package, we are certain you are very much impressed with the quality of this product. It is likely much more than you expected.

The Trionyx Z-H8 Z80 CPU board for the H8* computer is a very sophisticated, high-technology product. The board should be built using the highest quality parts obtainable for commercial applications.

The number of components required to assemble the Z-H8 printed circuit board is very considerable. This may not be fully appreciated by all those who purchase the bare printed circuit board.

PC board buyers may purchase a complete parts kit for their boards by ordering a parts kit package and simply deducting the price already paid for the board from the cost of a Z-H8 Kit (currently $250.00). Inform us that you are a previous board buyer. We will then send you a complete kit of parts (less any parts you may have ordered with the board), without a printed circuit board and document package.

We very strongly urge this approach be taken. It is unlikely that any significant savings can be realized obtaining the parts separately. It is very important to use high-quality components for this product. Gold-plated sockets are supplied for all of the integrated circuits in our parts kit. High-quality filter capacitors are essential. Part substitutions are not advised.

Our repair charge for a Z-H8 assembled from a bare-board purchase is $100.00. We cannot guarantee to repair this type of board in every case. Boards which require excessive rework will not be repaired. Our repair charge for a Z-H8 assembled from a kit purchase is only $25.00. This should be considered when deciding to upgrade to a kit.
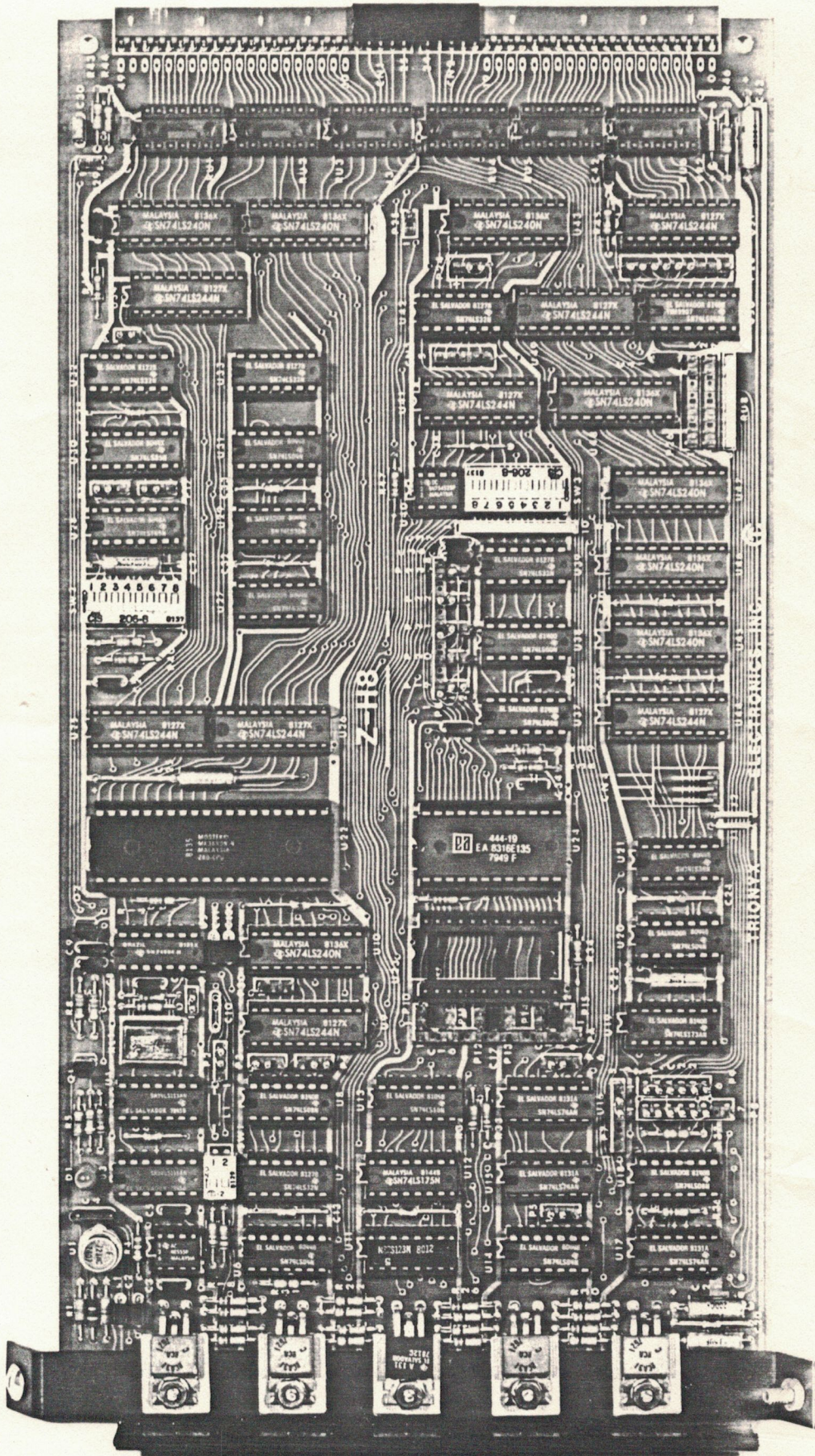
Thank you very much,

Bill Perry

Bill Perry
President

* H8 is a registered trademark of the Heath Company.

Model Z-H8

Z80 CPU BOARD for the H8*

TRIONYX ELECTRONICS, INC.

* 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 reliabily 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.

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.
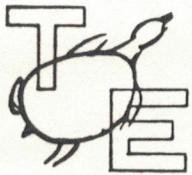
Z80 CPU Board for the Heathkit H8 Computer

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

250
125
$125

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.

November 1982

Trionyx Electronics, Inc.

Z-H8

Extended Performance Modification No. 04

CP/M Bios Modifications for Trionyx SPEED Routine

The Trionyx SPEED routine for CP/M was originally written for the
H17 version of the Heath BIOS. The SPEED routine must be
modified for use with the Heath H17/H37 BIOS and the H17/H47
Bios. This will allow the SPEED routine to be used when
operating the H37 or H47 disk drives under CP/M. No changes are
required to the HDOS version of SPEED to use these drives.

Use the CP/M editor (ED) to modify SPEED.ASM on the Trionyx Z-H8
Utility Disk. The last 6 DW statements are to be modified at the
end of the SPEED.ASM file:

OLD (H17)	NEW (H17/H37)	NEW (H17/H47)
0595H	05EDH	0601H
059DH	05F5H	0609H
079DH	07F5H	0809H
07A8H	0800H	0814H
07BDH	0815H	0829H
07C9H	0821H	0835H

Exit the editor, after making the 6 changes in the file code as
indicated above for the appropriate case.

Assemble the edited file, using ASM. This will create the file
SPEED.HEX.

Run DDT. Read the new file SPEED.HEX into memory. Return to
CP/M, using the GO command. Save ^5^SPEED.COM. This will place
an image of the file in memory on the disk. This is an
executable file which will be used as the new SPEED routine.
Intermediary files created on the disk can now be removed.

June 1982

Trionyx Electronics, Inc.

Z-H8

Extended Performance Modification No. 00

Interrupt Line Pull-Up Resistors

The two interrupt lines (INT 10-L and INT 20-L) on the special
short cable from the H8 front panel board to the H8 CPU board
require pull-up resistors on the CPU board. These were
inadvertently omitted on the Z-H8 Z80 CPU board.

These two lines can easily be pulled up by running a pair of
short jumper wires from P28 to RU6 on the solder side of the Z-H8
CPU board. Use #30 rework wire and connect as follows:

        P28-2 to RU6-2

        P28-3 to RU6-4

In the event that a buss expansion (B) connector is added to the
Z-H8 CPU board, do not connect lines 5 and 8 (count from 0) on
this connector.

This modification should be made to all Z-H8 CPU boards to insure
reliable operation.

October 1982

Trionyx Electronics, Inc.

Z-H8

Extended Performance Modification No. 01

Removal of U51

Integrated Circuit U51 is not required on the Z-H8 CPU board for
most applications. System reliability may be improved in some
instances when this part is removed.

When U51 is removed, eight jumper wires must be added in order to
maintain circuit continuity. These are short, straight
connections which may be may be added on the solder side of the
printed circuit board by wiring across the socket pins for U51.
Alternately, a socket header may be installed in place of U51 and
the header pins wired accordingly.

The following connections must be made at location U51 when U51
is removed. Connect at U51, pins:

                          2 to 18
                          3 to 17
                          4 to 16
                          5 to 15
                          6 to 14
                          7 to 13
                          8 to 12
                          9 to 11

If the Z-H8 is being assembled from a kit, these jumpers may be
installed in place of a socket at U51. The socket may also be
removed from an assembled board, if desired, and the jumpers
installed in its place.

It is recommended that this modification be made to all Z-H8 CPU
boards to insure reliable operation.

November 1982

Trionyx Electronics, Inc.

Z-H8

Extended Performance Modification No. 02

Heath H37 Disk Controller Installation

The Heath H37 Disk Controller for the H8 computer must be installed with a Z80 CPU board. Either the Heath Z80 CPU board or the Trionyx Z80 CPU board may be used. Both the Heath and the Trionyx Z80 CPU boards must be modified to use the H37 Disk Controller.

Modification of the Trionyx Z-H8 CPU board for use with the H37 Disk Controller is relatively simple. First, perform Z-H8 modification 01. This is required to use the Z-H8 with the H37 Disk controller.

Second, remove Integrated Circuits U49 and U50. Connect a jumper wire from U49-pin 1 to U49-pin 6.

Install the H37 Cable header in the socket for U50.

Note that Integrated Circuits U49, U50 and U51 are not used after the Z-H8 CPU board has been modified to operate with the H37 disk controller.

Either the Heath or Trionyx Z80 monitor ROMs may be used with the Z-H8 CPU board after modification to use the H37 Disk Controller. The Z-H8 must be configured for the particular monitor ROMs used.

The new Heath Z80 monitor allows booting of the H37 drives. The H37 drives must be used as secondary units with the Trionyx monitor (FW-Z80) or the original Heath XCON-8 monitor.

Trionyx Electronics, Inc.

Z-H8

Extended Performance Modification No. Ø3

Installation of Heath Boot ROM 2

The Heath H37 disk controller for the H8 computer may be used
with the Trionyx Z-H8 Z8Ø CPU board, using the Trionyx FW-Z8Ø
monitor ROM. In this case, an H17 drive must be used as the boot
device. After booting, the H37 drives can then be accessed.
The H17 drives and controller must be used as part of the system.
In most applications, this is desirable, as much software will be
available only on the original hard sectored disks.

The new Heath monitor, Boot ROM 2, may be used with the Z-H8 CPU
board in place of the Trionyx Z-H8 monitor, FW-Z8Ø. This will
allow booting of the H37 drives. The new Heath monitor allows
booting from ANY of the drives used on the system! Most of the
features of the Trionyx FW-Z8Ø monitor have been incorporated in
the new Heath ROM. Since it is supplied with the H37 controller,
it may be desirable to install it on the Z-H8 CPU board.

To install the Heath Boot ROM 2 on the Trionyx Z-H8 CPU board,
use the following proceedure:

1) Retain the H17 ROM at U23. It is not necessary to
    install the XCON-8 ROM, according to the Heath
    instructions.

2) Change the settings on switch module SW2 so that
    positions 5 and 6 are OFF and 7 and 8 are ON.
    Positions 1 through 4 remain OFF.

3) Modify the programming pins for U24 to operate with
    the Heath ROM as follows:

    Remove the jumper between PB-1 and P23-1.

    Remove the jumper between P19-1 and P19-2.

    Connect a jumper between PB-1 and P2Ø-2.

    Connect a jumper between PB-8 and P23-1.

The Trionyx Monitor FW-Z8Ø will not be upgraded to support the
Heath H37 controller. Instead, the new features of Boot ROM 2
will be added to FW-Z8Ø to support the new C-H8 Trionyx universal
disk controller. The Trionyx C-H8 disk controller will support
all of the functions of the Heath H37 controller. The C-H8 will
also provide a considerable number of other features, including
operation of 8 in. floppy disk drives.

The C-H8 disk controller will allow 8 in. drives to be used on
the system at the same time as both hard and soft sectored 5-1/4
in. drives. This will provide access to all three types of
recording media at the same time.

```
#: 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 inadaquate.

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.

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) quicly (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

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 JORGENSON 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-effectivr 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