EXP~700

INSTALLATION AND OPERATORS GUIDE

for the

HEATH/ZENITH 88, 89 AND 90 DIGITAL COMPUTERS

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LIMITED 90 DAY WARRANTY

Kres Engineering warrants this product to be free from defects in materials and workmanship for a period of 90 days following purchase. Defective products will be repaired or replaced at the discretion of Kres when examination discloses that a defect exists. No products returned for repair will be accepted unless accompanied by a Kres return authorization number.

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INTRODUCTION

Everyone's computer seems to shrink with age. This shrinkage is usually first noticed when the memory that came with your computer becomes too confining. So you added another 16K of RAM, and then another. At first 100K of disk storage seemed enormous, but that too rapidly shrank. So you added an additional disk drive and it's enough. For now... There are a magnitude of boards available for your computer and it always seems to be wanting more and more. But where to put them. Your key is "The Expansion" from KRES, ready now to unlock the world of all the products you've needed and wanted. The possibilities are now up to you.

CAPABILITIES OF THE EXPANSION

Your KRES Expansion is a very powerful addition to your computer. The ability to have seven accessory cards in your system is just the beginning. As you add more boards, you have the option of defining your system to be completely compatible with Heath/Zenith. When conflicts between boards arise, the use of KRES Shadow Operation will allow you to resolve these conflicts without ever modifying a single line of software. Or as your needs change you can easily redefine your system by just flipping a few of the conveniently located switches.

The added four slots are designed to accept three completely different card types. Two of these are those already defined by Heath/Zenith. The third is the AMBI-bus card as offered by KRES and some other vendors. And with the easy to use card cage adding additional boards to your system is a breeze. Your KRES Expansion contains sockets for 16K of RAM (random access memory) allowing you to have a total of 64K. This saves you the cost of buying an upgrade memory board. A connector along the bottom edge of the expansion is designed to accept a special 2/4 MHz processor clock upgrade module doubling the processing speed of your computer. This is the ESM-240. This module and the KRES expansion give your system exceptional processing power.

This manual describes the capabilities and uses of the KRES Expansion. It is written to instruct as well as inform, and should prove useful not only to install the expansion but also as a reference for daily operation. This manual has been written for easy use by owners from the technically inept as well as the technically adept. It has been organized in sections beginning with the simple operation of your computer stepping through the installation and operation of your expansion. It ends with a section discussing the expansion's advanced features. After stepping your way through this manual, you should have a general familiarity with the concepts and features of the expansion. The sections of this manual are summarized below:

- . Electrical Specifications
- . Basic Introduction to your Expansion (Level 0)
- . Installation and Checkout
- . Really Using your Expansion (Level I)
- . Advanced Operation of the Expansion (Level II)
- . In case of Difficulty
- . Circuit Description
- . Replacement Parts List
- . Semiconductor Identification.

PARTS LIST

Unpack the Expansion kit and check each part against the following list. Any part that is packed in an individual envelope should be returned to the envelope after it has been checked against the list. Do not discard any of the packing materials until all parts are accounted for.

QTY	DESCRIPTION	LOCATION
*** *** ***		ويتو ويتو جيو بينو بينو جيو ويتو
1	EXP-700 Printed Circuit Card	
1	l6 Pin jumper cable	
1	20 Pin jumper cable	
1	Single wire jumper	
1	I.C. Removal tool	
4	6-32 x 1/4 inch screws	Hardware Pack
1	#6 nut	Hardware Pack
1	#6 Nylon washer	Hardware Pack
2	LONG Hexagonal Standoffs	Hardware pack
1	SHORT Hexagonal Standoff	Hardware Pack

EXP-700 INSTALLATION INSTRUCTIONS

Be sure to follow ALL of the steps in this section when installing the expansion. Any deviations from or alterations to these procedures will lead to a improperly installed expansion and may result in damage to the computer system. It is highly recommended to read the Operators Guide (see table of contents) before installing the expansion. After the expansion has been installed this section should be reread.

CABINET REMOVAL

() Disconnect the computer line cord from the AC outlet.

Refer to Pictorial 1 and 1A to remove the cabinet shell from the rest of the computer.

() Insert the blade of a small screwdriver in the latch plate, and slide as shown in the inset drawing.

- () Repeat this for the latch plate on the other side of the computer.
- () Carefully tilt the cabinet back.
- () Unplug the fan.
- () Remove the lid.
- () Set the cabinet shell aside.



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PICTORIAL 1.



PICTORIAL 1A

CPU CARD REMOVAL

BEFORE PROCEEDING MAKE SURE THAT YOU HAVE REMOVED THE LINE CORD FROM THE AC OUTLET TO PREVENT HAZARD OF ELECTRICAL SHOCK

Refer to Pictorial 2 to remove the CPU card from the computer in the following steps.

() Remove all the accessory cards from the computer and set them aside. Be sure to mark all connecting cables for easy reinstallation.

() Remove the two screws that hold the CPU card in place and set them aside.

BE SURE TO MARK ORIENTATION AND LOCATION OF ANY PLUGS YOU MUST REMOVE FROM THE CPU CARD OR ACCESSORY BOARDS SO YOU MAY REINSTALL THEM PROPERLY LATER. MANY OF THE CABLES LOOK ALIKE. BE CERTAIN TO MARK WHERE THEY BELONG AS WELL AS THEIR PROPER ORIENTATION. (USUALLY NOTING THE COLOR OF THE WIRE ON ONE END OF THE CABLE AND ITS PLACEMENT ON THE CONNECTOR IS SUFFICIENT TO REORIENT THE CABLES PROPERLY).

() Unplug P514 and P515 located at along the left edge of your CPU card.

- () Unplug P516 along the top edge of your CPU card.
- () Slide the CPU card up and out of its guides.
- () Remove P513 along the lower right edge of your CPU.

The CPU card should now be completely removed. Set it flat on a work area.



MOUNTING HARDWARE

Refer to Pictorial 3, of the CPU board, to perfom each of the following steps.

() Remove the package marked hardware from the expansion kit. Place the contents in a small open container.

() Remove the three hexagonal standoffs. NOTE: Two of the standoffs are the same length, the third is slightly shorter (about 60 thousanths of an inch).

() Install one of the LONG standoffs in each of the two holes marked LONG in figure 3. Tighten these down snugly.

() Remove the screw and nut assembly from the hole marked short in the figure.

0) Insert the SHORT standoff through this hole and use a #6 nut to secure it in place. Tighten this assembly.

This completes the hardware additions to your computer. Next you will install the Expansion and it's related cables.



CAUTION:

In the following steps you will need to remove and install ICs. To remove an IC, use the puller furnished by grasping the IC at each end, squeezing and pulling up, as shown in pictorial 4. To reinstall an IC a few precautions must be taken. The pins on many IC's are bent out at an angle and will not align with a socket. Trying to install an IC without first bending the pins in may damage the IC pins or the socket. To straighten pins on an IC, lay it down on its side and very carefully roll it towards the pins as shown in pictorial 4 to bend the lower pins into place. Turn the IC over and similarly bend the pins on the other side. Before installing the IC in its socket, make sure the pin 1 end of the IC is over the index mark on the CPU board. Make sure all pins are started into the socket, then press firmly. CAUTION: an IC pin can become bent under the IC yet will appear as though it is installed correctly. Figure 4 also illustrates the proper installation of an IC in its socket.

Many of the I.C.s that you will be handling are sensitive to static electricity. Care should be exercised when handling these parts. Once you are holding one of these parts do not set it down. If you do, then before retouching it place one hand on the workbench first, then pick up the I.C.. This will equalize the static electricity. You will be told when a part to be handled is statically sensitive.

STEP-BY-STEP INSTRUCTIONS

Before you install an IC, lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.



CAUTION: Integrated circuits (IC's) are complex electronic devices that perform many complicated functins in the circuit. These devices can be damaged during installation. Read all of the following information before you install the IC's.

The pins on the IC's may be bent out at an angle, so they do not line up with the holes in the IC socket. DO NOT try to install an IC without first bending the pins as described below. To do so may damage the IC pins or the socket, causing intermittent contact. Make sure that the pin 1 end of the IC is positioned over the index mark on the circuit board (see the detail at the top of this page). Also make sure that all of the pins are started into the socket. Then press the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.





PICTORIAL 4

CABLES AND I.C. INSTALLATION

() Place the Expansion Board on the table next to the CPU card. In the following steps you will be transfering I.C.'s from the CPU card to the Expansion.

() On the CPU card loacate U550 (see pictorial 3). It is located below bus connector P510. This I.C. is the I/O decoder ROM and should have a white sticker on it's top surface. Remove this I.C..

() Place this I.C. in the socket labeled U550 on your expansion board. This socket is located on the lower right hand side of the Expansion immediately above the red connector S4. NOTE: Be sure that pin #1 is to the LEFT.

() Locate the 20 pin jumper cable supplied with the expansion kit. This cable assembly should have one end marked with a yellow dot. NOTE: This cable has been pre-bent. DO NOT straighten it out.

() Plug the "yellow dot" end of this assembly into the socket on the CPU card labeled U550. This is the same place the I.C. was removed in the previous steps. NOTE: Make sure pin one of this plug is up (toward the top of the CPU card).

CAUTION: IN THE FOLLOWING STEPS YOU WILL BE DEALING WITH STATICALLY SENSITIVE I.C.S. READ THE SECTION ON I.C. HANDLING BEFORE PERFORMING THESE STEPS.

() In the center of your CPU card there are three rows of I.C.s (or sockets). These are the main memory. The lower left most of these is labeled U533. Remove this I.C. and place it in the socket along the bottom of the expansion labeled U41. This socket is located next to the raised socket labeled S2. NOTE: At first glance U41's location may not appear to contain a socket at all, but it does. These are special "zero profile" sockets.

() Locate the 16 pin jumper cable supplied with the Expansion. Both ends of this cable are identical, and have a white arrow pointing to pin #1.

() Install one end of this jumper cable, white arrow up into the CPU card socket labeled U533. This is the same socket where the removed memory I.C. was located.

MEMORY EXPANSION AND CONFIGURATION

CURRENTLY A 64K SYSTEM

IF YOU COMPUTER WAS 64K SYSTEM CONTAINING NOTE: Α THE HEATH/ZENITH 16K MEMORY EXPANSION CARD THEN YOU WILL NEED TO "NOT PERFORM THE FOLLOWING STEPS. **OTHERWISE SKIP TO THE** CURRENTLY 64K SYSTEM" SECTION. SEE PICTORIAL 5 TO SEE IF YOU MANUFACTURERS HAVE THIS CARD. THERE ARE OTHER OF SIMILAR PRODUCTS. THE STEPS FOR TRANSFERING THESE PRODUCTS TO THE EXPANSION MAY BE SLIGHTLY DIFFERENT.

() The 16K memory expansion card you removed from your system contains 9 memory I.C.s. Remove these I.C.s starting with Ul on the card and transfer them to the "zero profile" sockets on the expansion, starting with U42. See the table below for a summary of this operation.

16K CARD EXPANSION

Ul	>	U42
U2	>	U43
U 3	>	U44
U4	>	U45
U5	>	U46
U6	>	U47
U7		U48
U8	>	U49

() This should leave only one I.C. in the 64K memory card. There is also one empty socket left on the CPU card. This should be the upper left corner of the memory I.C. block. This socket is labeled U549. Remove the I.C. from the 16K memory card and place it in the CPU socket U549. The 16K memory card may now be set aside, for it has been replaced by the Expansion.

CONTINUE HERE IF NOT CURRENTLY A 64K SYSTEM

If you plan to upgrade your system to 64K now is the time to do this. To upgrade at a later time will require the removal of your expansion and CPU card. If you wish to upgrade at this time then purchase from your local HEATH/ZENITH representative a 16K memory expansion kit (Part number H-88-2). This kit contains eight memory I.C.s. An upgrade kit containing these I.C.s is also available from Kres. If you do not wish to upgrade at this time then skip to the "EXPANSION INSTALLATION" section.

() Install these eight I.C.s in the sockets on the Expansion labeled U42 thru U49.

() Refer to the memory size configuration section of your user's guide for the proper configuration of the CPU's jumpers.

PICTORIAL 5



EXPANSION INSTALLATION

You are now ready to install the expansion board outo the CPU card. In the following steps care must be taken to insure that all steps are followed exactly as described. Also many pins will be engageing simultaneously and careful alignment is necessary to avoid damage to either the CPU or the Expansion.

Refer to Pictorial 6 for the following steps.

() Make sure the two ribbon cables that were previously installed on the CPU card are bent flat toward the BOTTOM of the card. This will allow clearance for the Expansion board.

() Look at the back side of the Expansion. There are four red sockets, two on the left side and two on the right side. NOTE: The right side is the side with the small cutout for the crystal.

() Carefully place the expansion onto the CPU card making sure that the Expansion's two left hand sockets line up with the pins of (P507,P501), (P509,P503) on the CPU card. The two right hand sockets should line up with the pins of (P510,P504), (P512,P506) on the CPU card. NOTE: Make sure that there is no vertical shift between the plugs and sockets and that all pins line up with their corresponding sockets. Be sure that the power connector "S1" is seated on top of the power pins. S1 is located underneath the card cage.

() Slowly press the left hand side of the expansion down onto the CPU's pins. Continue pressing until the connectors are fully seated.

() Repeat the above step for the right hand side of the expansion.

() Carefully check to see that all pins are seated in their corresponding sockets.

() Press the power connector S1 onto the power supply pins.

() The expansion should now be firmly seated onto the CPU card and you should have two jumper cables exiting from between the CPU card and the expansion board.

() Carefully fold the end of the 16 pin jumper cable (left hand cable) up and plug it into S2 on the Expansion. Make sure the white arrow is to the top.

() In a similar fashion bring the 20 pin jumper (right) up and plug it into S3. Make sure that pin one on this jumper is to the left.

Again refer to Pictorial 6 for the following steps.

() Use two 6-32 by 1/4 inch screws from the hardware pack to secure the expansion board corners to the CPU card.

() Use one $6-32 \times 1/4$ inch screw and one #6 nylon flat washer to secure the center of the expansion to the CPU.

This completes the installation of the expansion onto the CPU card.



JUMPER CONFIGURATIONS

There are single wire jumper cables used by Heath/Zenith to configure the computer system for different monitor ROMs (MTR-88,89,90) and for different memory sizes. This section is for the reinstallation of these jumpers in a system containing an expansion. If a step listed below applies to your system then perform it, otherwise skip to the next step.

() If you have the MTR-90 monitor ROM, or any ROM superseding MTR-89, then take the single wire jumper that used to go from JJ505 on the CPU card to left hand bus pin #14 and install it from JJ505 to P3 on the expansion board (see pictorial 7).

() If before you installed the expansion you had a short single wire jumper going from your 16K memory expansion board to the CPU card (see pictorial 8), then reinstall this jumper from the CPU card to P5 on the expansion.

() If your computer has an "A" in its name then skip this step. If not then turn over the CPU card. If there are jumper wires in the back side of the CPU then skip this step. If neither of the above apply then you have an older system, and will need to install a jumper wire. This is the same jumper used by Heath/Zenith for older systems.

> () Locate the single wire jumper supplied with the expansion kit. Connect this jumper from JJ503 (in the lower middle of the CPU card) to P5 (closest to the memory I.C.s) on the expansion. This is the same jumper that used to go from JJ503 to pin #17 on one of the left hand slots (see pictorial 9). Pin #17 has been replaced by P5 on the expansion.

NOTE : Manufacturers of support products for this H/Z-89,90 computer may have utilized jumper wires for their own operation. If you have any of these products, refer to their installation instructions for the reinstallation of the jumpers. Remember, signals from the old LEFT HAND BUS are now the top rows of pins on slots "A" thru "D". Pin #14 of this bus has been brought to expansion plug P3, and pin #17 to P5.



PICTORIAL 8







REINSTALLATION OF CPU CARD AND EXPANSION

Before you reinstall the Expansion and CPU card make sure that all of the **blue jumpers and switches** are set for a standard system as shown in pictorial 10. Also make sure that the power supply jumper shunt is still firmly down on P2.

() Remove the long gold angle brace from the kit. This brace goes from the video board on the bottom of the computer to the bottom of the card cage.

() Refer to Pictorial 11 for the following steps.

() Loosen the screw, shown in pictorial 11, enough to slide the slotted end of the brace underneath the screw head. Loosely retighten the screw.

You are now ready to reassemble your computer. In the following steps, be certain to reinstall all cables to their original locations with exactly the same orientation as when you removed them.

() Reinstall your CPU card referring back to Pictorial 2 if necessary.

() Reinstall P513 along the lower right edge of your CPU. Be sure the black wire is up.

() Begin to slide the CPU card into the plastic guides located on the metal brackets on either side of the machine. (On the non "A" model machines - the H/Z89 or 90 rather than the H/Z89A or 90A - these card guides are not continuous so extra care must be taken to assure that the CPU card does not miss one or more of these supports.

() As you continue to slide the CPU card down into the guides, properly reinstall all connectors to the accessory boards.

() Reinstall the two screws that hold the CPU card in place.

() Reconnect P514 (yellow wire up) and P515 (green wire up) along the left edge of your CPU card.

() Connect the three wire power cable to Pl on the top of the Expansion. The orange wire should be to the Right.

() Use a 6-32 by 1/4 inch screw to fasten the top of the diagonal support brace to the bottom of the card cage. This brace contains a captive nut. If your computer has an "A" designation in it's name, then put this screw through the slot in the cage nearest to the expansion board. If not then use the other slot. Securely tighten this screw.

() Securely tighten the screw on the video board.



Means red showing for switches

PICTORIAL 10



PICTORIAL 11

FINAL CHECK OUT AND TESTING

() Verify that all cables, jumpers, switches, and plugs are configured as stated in the installation section.

() Connect your computer to an AC outlet and turn the power on. It should beep just as before (most units beep twice) followed by the H: prompt on the screen. If not, go back and recheck your installation to be certain all steps have been followed properly. Most failures at this stage can be traced to bent under pins, connectors improperly reinstalled or inadvertently pulled loose. If all checks out well then you now have an EXPANDED computer.

() Disconnect the power cord and perform the remaining steps.

() Reinstall all accessory cards. Refer to the section on installation of cards for use of the four horizontal slots.

() Refer to Pictorials (1,1A) and reverse the procedure to reinstall the cabinet shell. Do not forget to reconnect the fan cable.

() Make one last check of all connectors to be certain they are properly installed and none have been omitted or have pulled loose.

This completes the installation for your expansion. For information on it's operation and use see the Operator's Guide section.

OPERATOR'S GUIDE

In the following section the features and powers of the expansion will be discussed in detail. Some of these features are subtle and may require a little technical ability. The EXP-700 expansion board can be broken down into several independent sections as outlined below. Please refer to pictorial 12 and the physical expansion as aids in better understanding each of these sections.

- . The Right Hand Slots (L, M, R)
- . The Four Horizontal Slots (A, B, C, D)
- Port Decoding Switches SW1 SW8
- Special Function Switch SW9
- . Jumper Options
- . Special Jumper JJ1

Means red showing for switches



PICTORIAL 12

THE SEVEN BUS SLOTS

The card slots on the Kres Expansion are located in two different groups. Three of these slots are mounted vertically on the right hand side of the expansion and four are located horizontally in the center of the expansion. It is these four horizontal slots that have expanded your computer. Each of these slot groups is discussed below.

RIGHT HAND SLOTS L, M, R

The three right hand vertical slots on the expansion are virtually identical to the original three slots from your original computer. Their I/O definition has not been altered. They have just been relocated up onto the expansion. There is only one slight difference between the left most of these vertical slots (slot "L") and it's original definition. This slot has the ability to be electrically interchanged with horizontal slot "A". This feature will be covered in detail later in the section on special switch SW9.

HORIZONTAL SLOTS A, B, C, D

It is the four horizontal slots that contain the real power of the expansion. In this section only slot "A" will be discussed, but slots "B", "C" and "D" function in virtually the same fashion. You will notice that the horizontal slots are different then the vertical slots in that they are made up of four plugs (P500,499 and P600,604 for slot "A") instead of two. This forms two parallel rows of pins. The top row of pins (P500,499) are electrically identical to the pins that used to exist on the left hand side of your CPU before the expansion was installed. These pins will accept any standard card designed to operate on the left hand side of the computer. The 16K memory expansion card was one of these, but it has been replaced by the expansion. The bottom row of these pins (P600,604 for slot "A") are the I/O expansion pins. It is these plugs that are almost identical to the original right hand vertical plugs. These rows of pins will accept any standard size card designed for operation on the original right hand bus.

Each of the four horizontal slots will also accept special "AMBI BUS" cards which will plug into both rows of pins. Several of these cards are offered by KRES. There are NINE switches SW1 - SW9 located across the top of the expansion (see pictorial 13 below). The first eight of these SW1 - SW8 are used to redefine the port assignments for the I/O pins (#9 - #12) on the horizontal slots A, B, C and D. These switches allow the I/O assignments on pins 9 -12 to be set to any of the 32 eight port boundaries in the I/O map of 0 - 255 decimal. The ninth switch SW9 will be covered in another section. These first eight switches are used in pairs. Thus SW1 and SW2 are for the top most slot "A". SW3 and SW4 are for slot "B", SW5 and SW6 for slot "C" and finally SW7, SW8 are for slot "D". Each of these switches contain 10 independent switch sections. Thus a total of twenty switch sections are required to fully select the port assignments for the four I/O pins on each horizontal slot. NOTE: For simplicity most switch references will refer to those used for slot "A". Those for slots B, C, and D are identical.

Pictorial 13



As was noted above, 2 complete switches (20 switch segments) are required to fully define the port decoding for the four I/O pins (pins 9, 10, 11, 12) on a horizontal slot. For example on the top slot "A" sections 1 through 5 on SW1 select the eight port boundry address for BUS PIN #9. Sections 6 thru 10 are for PIN #10. PINS #11 and #12 are controlled by sections 1 thru 5 and 6 thru 10 of SW2. This pattern is repeated for the remaining three horizontal slots B, C and D using (SW3, SW4), (SW5, SW6), (SW7,SW8). A summary of this port selection is shown in pictorials 14 and 15 below. Remember the five switches segments for each I/O pin will allow the port assignment to be selected to any eight port boundary from 0 to 255 decimal. A table of switch configuration to port address in decimal, octal and hexadecimal is given in the Appendix (see table I).



Figure 14

SW 1,3,5,7

SW 2,4,6,8

Pictorial 15

Pictorial 15 shows the actual layout of the four horizontal slots and the definition of SW1-SW8 as they relate to I/O pins 9 - 12.



QUICK SUMMARY OF SWITCH TO PIN AND SLOT ASSIGNMENTS

Refer to pictorials 14 and 15 when using this summary. Switch sections 1 thru 5 of the ODD numbered switches (1,3,5,7) select the port address of BUS PIN number 9 on the horizontal expansion slots. Sections 6 thru 10 of these same switches select the port address for BUS PIN number 10. The EVEN numbered switches (2,4,6,8) are used to select the port addresses for PINS 11 and 12. Sections 1 thru 5 are for PIN 11 and sections 6 thru 10 are for PIN 12. Thus two switch blocks are required to fully set the port addresses of each horizontal slot.

Switch blocks 1 and 2 are used to set the port addresses for horizontal slot "A". This is the top slot. Switch blocks 3 and 4 are used for slot "B". This is the second slot down from the top. Switch blocks 5 and 6 are for slot "C", and blocks 7 and 8 are for slot "D". Slot "D" is the bottom most horizontal slot.

ORIGINAL SYSTEM CONFIGURATION

In the original Heath/Zenith computer the I/O pins 9 thru 12 were defined to specific port locations by a port decoder ROM. These definitions are as shown below. For a detailed description of the ports reserved for and used by Heath/Zenith see Table II in the Appendix. The switches on the expansion have been set as shown below to make the four horizontal slots identical in definition to the original system. Refer to pictorial 16 for the proper inital setting of these switches.

PIN #	ORIGINAL PORT DEFINITION	SET TO ON EXPANSION
9	320-327 I/O SERLO	320-327
10	330-337 I/O SERL1	330-337
11	340-347 I/O SERL2	340-347
12	170-177 DISK 1/0	170-177
	370-371 I/O CASS	



1

Means red showing for switches

SPECIAL FUNCTION SWITCH SW9

There is one more switch located in the upper right corner of the expansion. This is switch SW9. It is this switch that allows many of the powerful features on the expansion to be selected. Α breakdown of the switch sections and their functions is shown in pictorial 17 below. Sections 1 thru 5 for this switch are used to set the eight port boundry location of the on-board port used by the expansion. These switches will select any one of the 32 possible boundries. Their setting is identical to that for SW1 thru SW8. Even though eight ports are decoded, the expansion only uses one of these. In the standard configuration (see pictorial 12) these switches are set to ports 70-77 hexadecimal. This port has two functions. The first is to allow access to a four bit latch on the expansion. The contents of this latch will be discussed later in this section. The second function is for use with the (ESM-240) clock module mentioned earlier. Details of this are discussed in the ESM-240 manual.

Pictorial 17

•	• • • • • • • • • • • • • • • • • • • •
SECTION 1	
SECTION 2	
SECTION 3	
SECTION 4	
SECTION 5	
SECTION 6	····· ··· ···· ······
SECTION 7	
	· •·*• •••• ••••
SECTION 8	· ••• ••• •••
SECTION 9	
SECTION 10	

Selection of onboard Kres port to any 8 port boundry.

Enable/disable "A"

Enable/disable "B"

Enable/disable "C"

Enable/disable "D"

Board exchange "A" and "L"

SHADOW OPERATION

One of the most powerful features of the expansion is "SHADOW OPERATION". It is this feature that allows you to make boards electrically appear and disappear from the system. When the computer is powered up or when shift reset is pressed these four switch sections determine which of the slots "A" thru "D" will be electrically enabled. If a slot is enabled then it will respond to port addresses as selected by it's address switches SW1~SW8. If it is disabled then it will not respond to any I/O requests. Thus it has electrically vanished from the system. If during these power up or reset sequences the segment is off, then that slot is disabled. If it is on then that slot will be enabled. These switch segments will only change the enable status during power-up or reset. If you want to change the enable status of slots "A" thru "D" by not turning off the power or reseting the system, this can be done under software control. The port selected by the first five sections of SW9 when written to can change the enable status. The lower nibble bits 0-3 control the status of the slots. Bit 0 is for slot "A", bit 1 for slot "B", bit 2 for "C", and bit 3 for slot "D". These bits are active low. That is that a "zero" will enable a slot and a "one" disable the slot. See the table below for a definition of the enable combinations. Once a slot has been configured under software control it will return to the default condition selected on SW9 sections 6 thru 9 on the next reset or power up.

LOWER	R NIB	BLE B	ITS		HOR	IZONT	AL SL	OTS
0	1	2	3	l l	"A"	"B"	"C"	"D"
	ويد ورد ورد ورد در	وسر وند وسر وند وند	وشو وشو وشد وشو وسو	ب هانه هند هنه هنه هنه هنو ه				يند يند مند
OFF	OFF	OFF	OFF		D	D	D	D
OFF	OFF	OFF	ON		D	D	D	Ε
OFF	OFF	ON	OFF		D	D	E	D
OFF	OFF	ON	ON		D	D	E	Е
OFF	ON	OFF	OFF		D	Е	D	D
OFF	ON	OFF	ON		D	Ε	D	E
OFF	ON	ON	OFF		D	Е	Е	D
OFF	ON	ON	ON		D	Е	E	Е
ON	OFF	OFF	OFF		Ε	D	D	D
ON	OFF	OFF	ON		Е	D	D	E
ON	OFF	ON	OFF		E	D	E	D
ON	OFF	ON	ON		E	D	E	Е
ON	ON	OFF	OFF		E	E	D	D
ON	ON	OFF	ON		Е	Е	D	E
ON	ON	ON	OFF		Е	Е	Е	D
ON	ON	ON	ON		Е	E	Е	Е

D= Horizontal slot Disabled. E= Horizontal slot Enabled.

BOARD EXCHANGE

Finally there is section 10 of SW9. This switch allows the port definition of Pins #9 thru #12 on the left most vertical slot (L) to be electrically exchanged with those of the top horizontal slot (A). When the switch is in the "off" position the two slots are left unchanged. When the switch is in the "on" position, they are exchanged. This feature is called "BOARD EXCHANGE". The chart below gives an example of this exchange operation which assumes that slot (A) has been set to port blocks 0, 10, 20 and 30 octal. The usefulness of this feature may seem unclear at this time, but familiarity with the expansion will change this.

PIN	#	PORTS	SLOT (L)	PORTS SLOT	(A)	SECTION	10
9		320)-327	000-007		OFF	
10		330)-337	010-017		OFF	
11		340)-347	020-027		OFF	
12		170)-177	030-037		OFF	
9		000	0-007	320-327		ON	
10		010	0-017	330-337		ON	
11		020)-027	340-347		ON	
12		030	0-037	170-177		ON	

JUMPER OPTIONS

The expansion contains many special jumpers and jumper blocks. These jumpers allow subtle but powerful configurations to be made. See the expansion and pictorial 12 for the locations of these jumpers.

Just to the left of the horizontal slots there are four blocks of four jumpers. One of these blocks is for each slot (A thru D). On the original Heath/Zenith left hand bus definition there are four pins which have never been used. These are 16, 17, 18 and 20. The previously mentioned jumpers allow these four pins to be defined as in the original system (jumpers to the left) or to be redefined as signals brought up to P4 on the expansion (jumpers to the right). Kres offers a separate "ROM JUMPER" board option which will allow these pins to be redefined as address lines Al3, Al4, Al5 and Memory This jumper board brings these signals up to P4 from the Request. memory decoder ROM on the CPU card. Since there are sixteen of these jumpers this redefinition can be done slot by slot, pin by pin.

Just to the right of the four horizontal slots and to the right of slot R there are several single jumpers. These allow for the redefinition of the 2MHz clock line, Pin #13 on the bus. In the down position pin #13 is defined as in the original computer to be the processor clock. In the up position these lines are redefined to a signal on S4 at the bottom of the expansion. Plug S4 is reserved for use with the Kres two - four MHz clock card (ESM-240). With this module in place and a jumper up, Pin #13 will follow the processor clock speed of either 2 or 4 MHz.

SPECIAL JUMPER JJ1

There is one more jumper located between SW8 and SW9. If you have an I/O board in your system that has moved the interrupt circuitry onto itself, then this jumper should be in the up position. Otherwise it should be down. The H/Z-37 disk controller card is one such product.

INSTALLATION OF EXPANSION CARDS

As mention earlier in this guide, three different types of cards can be installed into the expansion. These are standard right hand cards, standard left hand cards and special AMBI-BUS cards. The procedure for installing each of these card types is outlined below. Before reading this section carefuly examine the actual expansion card cage. You will notice that there are actually eight slots. Four of these are wide and four are narrow. One wide and one narrow slot are used for each horizontal card, depending on the type.

STANDARD RIGHT HAND CARDS

To insert a standard right hand card into slot "A" place the top end of the card into the uppermost "WIDE" slot in the card guide. Slowly slide the card toward the expansion. When all pins in the expansion are aligned with the plug on the card then firmly press the card onto the pins. The card should rest in the bottom of the guide.

AMBI BUS CARD

To insert an Ambi Bus card into slot "A" place the top end of the card into the uppermost "WIDE" slot in the card guide. Slowly slide the card toward the expansion. When all pins in the expansion are aligned with the plug on the card then firmly press the card onto the pins. The card should rest in the top of the guide.

STANDARD LEFT HAND CARD

To insert a standard left hand card into slot "A" turn the card upside down and place the top end of the card into the uppermost "NARROW" slot in the card guide. Slowly slide the card toward the expansion. When all pins in the expansion are aligned with the plug on the card then firmly press the card onto the pins.

NOTE: Remember there are actually eight slots in the card guides. Two of these are for each of the four slots. The narrow slots are for the left hand cards and the wide ones are for the right hand and ambi bus cards. EXP-700

APPENDIX

TABLE ISWITCH CONFIGURATION TO PORT ADDRESS

Table I below shows the thirty two different switch configurations possible for the five switches used to assign port blocks on the expansion. Each of these configurations shows five switch sections. These correspond to either section 1 thru 5 or 6 thru 10 for SW1- SW8, or sections 1 thru 5 for SW9. In these configuration drawings, the symble XX indicates that the switch is depresed.

This convention should not be confused with that in pictorial 12 in which the darkened area is where the red on the section is showing. Thus "XX" to the left is the switch OFF and "XX" to the right is the switch ON.

XX PORT	XX PORT	XX PORT
IXX 000-007 OCT	XX 010-017 OCT	IXX I 020-027 OCT
XX 00- 07 HEX	XX 08-OF HEX	XX 10-17 HEX
		XXI 016-023 DEC
• *******	• • • • • • • • • • • •	• vie vie vie vie vie •
XX PORT	XX PORT	XX PORT
XX 030-037 OCT	XX 040-047 OCT	XX 050-057 OCT
XX 18- 1F HEX	XX 20- 27 HEX	XX 28- 2F HEX
XX 024-031 DEC	XX 032-039 DEC	XX 040-047 DEC
• • • • • • • • • •	I	• • • • • • • • • • • • •
	• • • • • • • • • • • •	••••••
XX PORT	XX PORT	XX PORT
XX 060-067 OCT	XX 070-077 OCT	XX 100-107 OCT
XX 30- 37 HEX	XX 38- 3F HEX	XX 40- 47 HEX
XX 048~057 DEC	XX 056- 063 DEC	XX 064-071 DEC
		XX
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XX XX XX XX XX XX	PORT 110-117 48- 4F 072-079	OCT HEX DEC	XX XX XX XX XX XX	PORT 120-127 50- 57 080-087	OCT HEX DEC	XX XX XX XX XX XX	PORT 130-137 58- 5F 088-095	OCT HEX DEC
XX XX XX XX XX XX	PORT 140-147 60- 67 096-103	OCT HEX DEC	XX XX XX XX XX	PORT 150-157 68- 6F 104-111	OCT HEX DEC	XX XX XX XX XX XX	PORT 160-167 70-77 H 112-119	OCT HEX DEC
XX XX XX XX XX XX	PORT 170-177 78- 7F 120-127	OCT HEX DEC	XX XX XX XX XX XX	PORT 200-207 80- 87 128-135	OCT HEX DEC	XX XX XX XX XX XX	PORT 210-217 88- 8F 136-143	OCT HEX DEC
XX XX XX XX XX	PORT 220-227 90- 97 144-151	OCT HEX DEC	XX XX XX XX XX XX	PORT 230-237 99- 9F 152-159	OCT HEX DEC	XX XX XX XX XX	PORT 240-247 A0- A7 160-167	OCT HEX DEC
XX XX XX XX XX XX	PORT 250-257 A8- AF 168-175	OCT HEX DEC	XX XX XX XX XX XX	PORT 260-267 B0- B7 176-183	OCT HEX DEC	XX XX XX XX XX XX	PORT 270-277 B8- BF 184-191	OCT HEX DEC

• • • • • • • • • •		ي جندو جانب ونان ونان ونان
XX PORT XX 300~307 OCT XX C0~ C7 HEX	XX PORT XX 310-317 OCT XX C8- CF HEX	XX PORT XX 320-327 OCT XX D0- D7 HEX
XX 192-199 DEC XX 	XX 200-207 DEC XX	XX 208-215 DEC XX
XX PORT XX 330-337 OCT XX D8- DF HEX XX 216-223 DEC XX	XX PORT XX 340-347 OCT XX E0- E7 HEX XX 224-231 DEC XX	XX PORT XX 350-357 OCT XX E8-EF HEX XX 232-239 DEC XX
XX PORT XX 360-367 OCT XX F0- F7 HEX XX 240-247 DEC	XX PORT XX 370-377 OCT XX F8- FF HEX XX 248-255 DEC XX	

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H-88/H-89/Z-89/Z-90

Configuration Guide

In order to make its computer systems as flexible and as useful as possible, the Heath Company and Zenith Data Systems have developed several Configurations of the H-88, H-89, Z-89, and Z-90 series of computers. This application note has been prepared to assist users and service personnel in selecting and verifying the proper configuration for their desired application.

HEATH COMPANY BENTON HARBOR, MICHIGAN 49022 ZENITH DATA SYSTEMS SAINT JOSEPH, MICHIGAN 49085 597-2571-01

Printed in the United States of America

FIRMWARE

Memory Decode ROM

The memory decode ROM is located at U517 on the CPU board. Two ROMs have been used. Part number 444-42 was originally used. This ROM precluded the use of more than 48K of memory or CP/M. It has been superseded in all production units by 444-66, which allows the ROM based 48K mode, the ROM based 56K mode, and an all RAM 64K mode. All users should upgrade to this part regardless of configuration. There are **no** negative consequences connected with this upgrade.

Associated with this ROM are three or four jumpers, JJ501 thru JJ504. Older CPU boards have all four jumpers; they should be set as follows:

When using the Old ROM (444-42)

JJ501	JJ502	<u>JJ503</u>	JJ504
0	0	0	0 (or B)
1	0	0	0 (or B)
0	1	0	0 (or B)
	<u>JJ501</u> 0 1 0	JJ501 JJ502 0 0 1 0 0 1	JJ501 JJ502 JJ503 0 0 0 1 0 0 0 1 0

When using the New ROM (444-66)

16K	0	0	**	0 (or B)
32K	1	0	**	0 (or B)
48K	0	1	**	0 (or B)
64K*	1	1	**	0 (or B)

Newer CPU boards (which only have three jumpers, JJ501 through JJ503) are supplied with the new decode ROM (444-66) already installed and the jumper wire incorporated directly into the PC board foil. These boards should not be used with the old ROM (444-42). The jumpers should be set as follows:

	JJ501	JJ502	JJ503
16K	0	0	0 (or B)
32K	1	0	0 (or B)
48K	0	1	0 (or B)
64K	1	1	0 (or B)

*Requires the WH-88-16 accessory PC board.

^{**}A jumper is required between the center pin of JJ503 and pin 17 of P509, or P4 of WH-88-16 (which connects to pin 17 of P509). This jumper may have been soldered on the back of the CPU board during manufacture (for Z-89-FA and some other models), or it may be ordered as part number 134-1120 and installed by the user. Neither tools nor soldering are required.

I/O Decode ROM

The I/O decode ROM is located at U550 on the CPU board. Two parts are available: 444-43 and 444-61.

Part number 444-43 supports the hard sector single-density 5" disk system (H-88-1), the three-port serial I/O card (HA-88-3), and cassette tape (H-88-5) in the expansion area.

Part number 444-61 supports two disk devices and the three-port serial I/O card, but does not support cassette tape.

Users with cassette tape must use 444-43. Users who have only the serial I/O accessory and a 5" single density hard sectored disk system may use either part; other users should use part number 444-61.

Code ROM

The code ROM is located at U518. Three ROMS are available:

Name	Part Number	Manual Part No.
MTR-88	444-40	595-2349
MTR-89	444-62	595-2508
MTR-90	444-84	595-2696

Each of these is normally supplied with full source code and a user manual.

MTR-88 is used with cassette tape and the H-88-1 hard sectored single-density 5 disk system. It cannot be used with other types of disk systems. MTR-88 will not work with CP/M versions 2.2.03 and later.

MTR-89 supports both the 5" hard sectored single-density disk and the H/Z-47 dual 8" floppy disk. Cassette tape is not supported.

MTR-90 is a general purpose Part which supports all disk mass storage devices (H-77, Z-87, H/Z-47, Z-37, Z-67). Cassette tape, however, is **not** supported. This part is supplied with Z-89-37 and Z-89-67 Because this is a 4K part while both MTR-88 and MTR-89 are 2K parts, the secondary address decoder must be changed to use this part.

The secondary address decoder is located at U516.

Two parts are available, 444-41 and 444-83.

Part No. 444-41 is used with MTR-88 and MTR-89. Part No. 444-83 is used with MTR-90.

There are four jumper wires associated with the code ROM and the secondary address decoder These are either JJ505, JJ506, JJ507 and JJ508 (on older units) or JJ504, JJ505, JJ506 and JJ507 (on newer units). These should be set as follows:

Older Units: Newer Units:	JJ505 JJ504	JJ506 JJ505	JJ507 JJ506	JJ508 JJ507
MTR-88, MTR-89	0	0	0	1 (or B)
MTR-90	1	*	1	1 (or B)

OTHER CONFIGURATION ITEMS

Unless use is confined to cassette tape, the following parts should be installed:

Part number 444-19, the HDOS ROM, at U520. Two 2114 1K \times 4 RAMs (part no. 443-764) at U523 and U525. A 78H12 (442-650) on the power supply at U103 (only required if an internal drive is installed).

In order to use the WH-88-16 memory expansion, it is necessary to change U562 from a 74LS132 (443-792) to a 74S132 (443-901).

Current production units use a 78H05 (442-651) at U101 instead of an LM309K (442-30). In addition, U101, U102 and U103 are mounted with heat sinks (215-658) and thermal compound (352-31). These changes improve the power output and heat dissipation capacity of the power supply. They are required and included with the Z-89-37 disk controller, and may be incorporated into any unit if power supply and/or heat problems are encountered.

^{*}A jumper should be installed between the center pin of JJ506 (or JJ505) and pin 14 of P508 when you are using an MTR-90. Part number 134-1159 may be used. Neither tools nor soldering are required.

Page 5

DIP SWITCH SETTINGS

DIP switch SW501 is used to program the initial power-up configuration. Its settings depend on and vary with the monitor ROM used.

Setting SW501 with MTR-88

- 5

Only the three most significant bits are used, switch sections 5, 6 and 7

Sections 6 and 7 select the power up baud rate used for communication with the terminal (which is normally the internal H-19 terminal logic board). The four options are:

Section 7	Section 6	Baud Rate
0	0	9,600
0	1	19,200
1	0	38,400
1	1	57,600

The selected baud rate must match the baud rate set at S401 on the terminal logic board. The standard terminal logic board firmware only supports 9,600 baud at this time (19,200 can be selected and used, but characters will occasionally be lost). Therefore, both sections 6 and 7 will normally be set to zero.

You can use switch section 5 to force a memory test on reset or power up. To force the test, set the switch to "0" Since the test will not stop until the switch is reset, you must set the switch to "1" before you can use the computer for normal operation.

SW501

1

0

Setting SW501 with MTR-89

The settings of SW501 for use with MTR-89 are defined below:

.

SWITCH SETTING DESCRIPTION

1,0		00* 01 10 11	Port 174(7CH)/177Q(7FH) has an H-88-1 controlled disk (normal) Port 174/177Q has an H/Z-47 type disk Undefined Undefined
3,2	{	00** 01 10 11	Port 170(78H)/173Q(7BH) is not in use (normal without H/Z-47) Port 170/173Q has an H/Z-47 (normal with H-47) Undefined Undefined
4	{	0 1	Boots from device at port 174/177Q (H-88-1 normal) Boots from device at port 170/173Q (H/Z-47)
5	{	0 1	Performs memory test upon boot up (not currently supported) Does not perform memory test (normal)
6	{	0 1	Sets Console to 9600 baud (normal) Sets Console to 19,200 baud (not currently supported)
7	{	0 1	Normal boot (normal) Auto boot on power up or reset (not recommended)

Setting SW501 with MTR-90

The settings of SW501 for use with MTR-90 are the same as those for use with MTR-89 except that positions 0, 1, 2 and 3 are redefined as follows:

1,0	$ \left\{\begin{array}{c} 00\\ 01\\ 10\\ 11 \end{array} \right. $	Port 174(7CH)/177Q(7FH) is H-88-1 controlled disk Port 174(7CH)/177Q(7FH) is H/Z-47 disk Port 174(7CH)/177Q(7FH) is Z-67 disk Undefined
3,2	<pre> 00 01 10 11 </pre>	Port 170(78H)/173Q(7BH) is Z-89-37 controlled disk Port 170(78H)/173Q(7BH) is H/Z-47 disk Port 170(78H)/173Q(7BH) is Z-67 disk Undefined

*Right column is switch 0.

**Right column is switch 2.

USING THE EXPANSION SLOTS

The H-88-1 hard sectored disk controller should be installed at P506/P512, the right connector in the right expansion area.

The H-88-3, HA-88-3 and Z-89-11 serial I/O boards should be installed at P505/P511, the center connector in the right expansion area.

The Z-89-37 soft sectored double-density disk controller and the H-88-5 cassette I/O card should be installed at P504/P510, the left connector in the right expansion area.

Z-89-47 and Z-89-67 interface boards may be installed in either the right or left positions in the right expansion area (P506/P512 or P504/P510). However, they must be jumpered differently, depending on which of these positions are actually used. See the appropriate manual supplied with the interface. If both a Z-89-47 and a Z-89-67 board are used (together), the Z-89-67 should be installed at P506/P512.

The WH-88-16 memory expansion should be installed at P503/P509, the right expansion slot in the left expansion area.

WRITE PROTECT PULLUP

A 4700 Ω (6-472) pullup resistor is required between pins 1 and 12 of P512. This resistor is provided on the hard sectored disk controller (H-88-1) usually installed at P512. It is also included on Z-89-67, with a jumper connector to enable or disable it, depending on whether the Z-89-67 is installed at P506/P512 or P504/P510 (the pullup must be disabled if P504/P510 is used). Customers desiring to use a Z-89-47 at P506/P512 (either by itself or in conjunction with a Z-89-37 interface installed at P504/P510) will have to install this resistor between pins 1 and 12 of P512 on the Z-89-47 interface board. Customers who have no interface installed at P506/P512 should install part number 100-1816 directly on P512. This part is supplied with Z-89-37