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MONITOR EPROM 444-84B

for the

HEATH/ZENITH Z89 and Z90

COMPUTER SYSTEMS

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## TABLE OF CONTENTS

1.0 The Monitor Program .....	1
2.0 Command Set .....	2
3.0 SW501 Definitions and Usage .....	5
4.0 MMS I/O Board Configuration .....	7
5.0 Notes for Programmers .....	8
Appendix A - Designating Boot Drive .....	9
Appendix B - MMS I/O Decode PROMS .....	12
Appendix C - Installation Details .....	13

## IF YOU HAVE PROBLEMS -----

1. Most problems result from failure to follow instructions EXACTLY. Return to the manual and review the procedure. Start at the beginning and retrace each step, keeping written notes of any possible deviations from what should have happened. If the problem is still not resolved, make a written record of the FULL configuration prior to calling your dealer for assistance. As a minimum, note all hardware components, including make and model numbers (revision dates, serial numbers, etc. may be necessary to find a defective hardware element) and note all software in use by name and version number (version numbers usually appear in the sign-on string). Use SETUP and DRIVES to obtain a complete operating system description.

2. Call your dealer with the above information, preferably with the computer at hand. (Call Magnolia ONLY if you purchased direct; to assure the best quality support, we have found it vital to have the dealer involved from the beginning).

3. How things work together is the responsibility of the Systems Integrator. If you bought a system or subsystem from a single source, then that supplier is responsible for those pieces working together. If you bought components or subsystems from multiple suppliers, then YOU have assumed the role of Systems Integrator and must expect to perform that function, or pay someone to perform it for you. Magnolia products are designed, and priced, for non-experts putting together a few standard configurations, while allowing experts a great deal of flexibility in meeting special requirements. Magnolia's responsibility in the latter situation is limited to providing the features we document and meeting appropriate industry standards.

## 1.0 THE MONITOR PROGRAM

This Monitor EPROM is intended to be a functional replacement for standard Heath/Zenith parts with the ability to "BOOT" from many additional disk types. Although many of the features of the standard Heath/Zenith parts are included, Magnolia Microsystems cannot guarantee compatibility with any software packages for the '89 attempting to use routines in the standard parts.

This Monitor EPROM displays the prompt "MMS:" instead of the usual "I-:" to remind the user that a different monitor prom is in use.

This package includes parts to allow it to be installed in EITHER a Z89 (U516 marked 444-41) or a Z90 (U516 marked 444-83). Detailed installation instructions are located in Appendix C.

The Zenith I/O decode PROM at U550 (usually marked "444-61") must be replaced with an MMS PROM when MMS disk I/O boards are installed in the machine:

Board Number	Requires U550 PROM '444-61x' where "x" is:
77314 (Corvus/Remex)	A, B, or C
77315 (CAMEO)	A, B, or C
77316 (Dbl Den Disk)	C only
77317 (ACT/XCOMP)	A, B, or C
77320 (SASI)	A, B, or C

The required prom is included with each MMS I/O board. For other MMS I/O boards, see the respective board manual if it is of a later revision date than this document.

**2.0 COMMAND SET**

The following commands are supported by the MMS Monitor EPROM set. All operator inputs are underlined, data output by the computer is not. The symbol (cr) indicates that the RETURN or ENTER key is to be pressed. Pressing the DELETE key instead will abort the command.

**2.1 B - Boot the disk operating system**

Several options exist when booting the operating system. They will be discussed in increasing level of complexity (which is also decreasing likelihood of use).

MMS: Boot (cr)

The operating system loads from the disk drive which has been designated as the "Default Boot Device". Frequently, this is the only command you will use. Details on how to define the "Default Boot Device" are given in Section 3.2.

MMS: Boot drive.designator (cr)

The operating system will be loaded from the controller/drive combination specified by "drive.designator". Two optional methods may be used to specify a drive:

- o A Physical Drive Number, as in previous MMS prom sets
- o A Controller Designator, followed by an (optional) Logical Unit Number

Valid "drive.designator" options are listed in Appendix A.

MMS: Boot drive.designatorcommand.string (cr)

The operating system will be loaded from the drive specified, and the "command.string" will be passed to the operating system which is loaded. This option is normally used ONLY with SASI-bus Winchester subsystems such as the Zenith Z67. See your operating system software documentation for details on the "command.string" portion of the command line.

If a "?" together with a "beep" occur immediately after entering a "Boot" command line an invalid "drive.designator" has been entered.

If the "?" and "beep" occur after a several second delay, either the the selected controller is not installed; the drive is not turned on; no diskette is in the drive; or the drive door is not shut.

**2.2 M - Dynamic Memory Test**

The memory test has been significantly enhanced, now testing 64K of RAM (not just the 56K tested by Zenith proms). This new algorithm also reports hardware defects not previously found.

MMS: Memory Test(cr) .... will test ALL (up to 64K) of RAM

Top Of Memory: FFFF ..... for 64K, 3FFF=16K, 7FFF=32K, BFFF=48K

01 ..... Pass Counter (Decimal)

XXXX YY \* ..... Error at location XXXX (hexidecimal)

Bit at YY in error: ie, 02 = bit 1 error

Use "SHIFT/RESET" to end the test after the Pass Counter exceeds 80.

**2.3 R - Set Console Baud Rate**

MMS: Rate -n (mmm Baud)(cr)

The baud rate used for communication between the terminal and CPU boards inside the computer is set to the value specified. Valid designators are:

A -	110	F -	1800	J -	4800
B -	150	G -	2000	K -	7200
C -	300	H -	2400	L -	9600
D -	600	I -	3600	M -	19200
E -	1200				

Note that these are the letters used to set baud rate in the H19 'ESC r' command sequence. Shift/Reset returns the terminal to its default baud rate.

**2.4 T - Enter Terminal Emulation Mode**

MMS: Terminal Mode(cr)

This command initializes the Z80's MODEM (DTE) port to the current console baud rate, with all subsequent data passed directly back and forth between the DTE port and the Z19 terminal. Shift/Reset returns the normal monitor prompt.

**2.5 V - Display Firmware Version Number**

MMS: Version n

MMS: -

The internal version number of the PROM firmware will be displayed.

## 2.6 Debugging Commands

All memory-related commands use Hexidecimal notation.

The syntax for the SUBSTITUTE command now resembles that of the CP/M DDT utility:

MMS: Substitute nnnn(cr) .... displays the contents of location nnnn  
 MMS: nnnn yy(cr) ..... changes memory and increments location  
 MMS: nnnn (cr) ..... increments location pointer  
 MMS: : ..... returns to command level  
 MMS: - ..... decrements location pointer

## PROGRAM COUNTER:

MMS: Program Counter nnnn(cr) ... will display the current value of PC  
 MMS: Program Counter nnnn(cr) will set the PC to nnnn

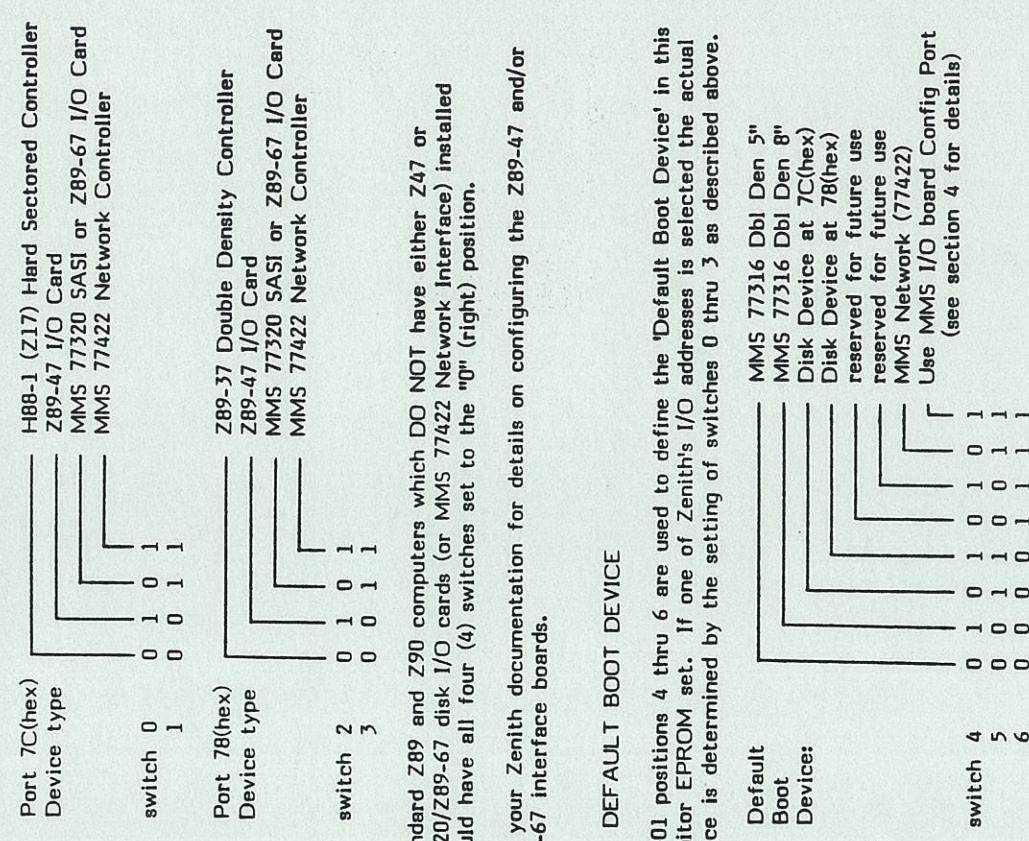
## GO (Execute):

MMS: Go nnnn(cr) ..... begins execution at HEX location nnnn  
 MMS: Go (cr) ..... begins execution at PC location

## 3.0 SW501 DEFINITIONS AND USAGE

### 3.1 ZENITH DISK I/O ADDRESS USAGE

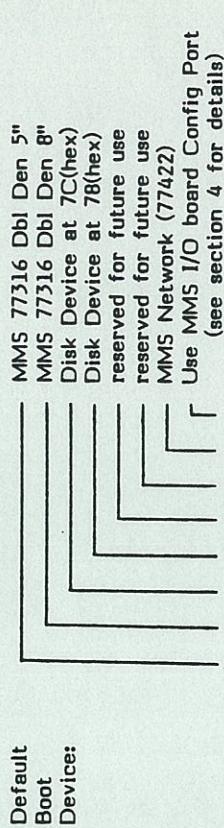
The first four sections of SW501 are used to define what boards are installed at the two standard Zenith I/O addresses: 78H and 7CH.



### 3.2 DEFAULT BOOT DEVICE

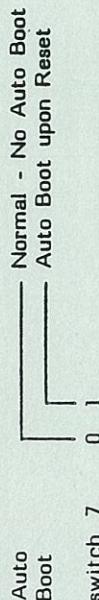
Standard Z89 and Z90 computers which DO NOT have either Z47 or 77320/Z89-67 disk I/O cards (or MMS 77422 Network Interface) installed should have all four (4) switches set to the "0" (right) position.

See your Zenith documentation for details on configuring the Z89-47 and/or Z89-67 interface boards.



**3.3 AUTO BOOT ON RESET**

SW501 section 7 continues its usual function of determining if the computer will automatically attempt to boot from the default device when it is reset or first powered up.

**3.4 CONSOLE BAUD RATE**

Console Baud Rate, which was previously defined by SW501-6, is now automatically determined every time the computer is reset. (This may cause a few stray characters to momentarily appear before the MMS; prompt is displayed.) The following console baud rates are supported:

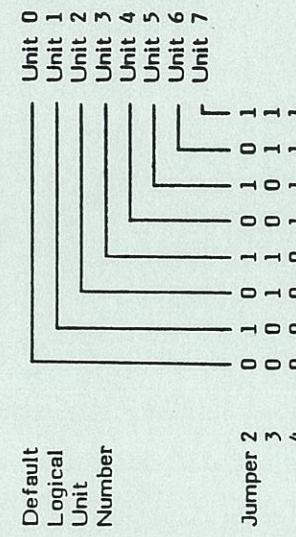
38400  
19200  
9600  
4800  
2400  
1200  
600

Standard Z89 consoles are set for 9600 baud operation, and only experienced users should attempt to use other speeds. Standard consoles will not provide satisfactory operation at over 9600 baud.

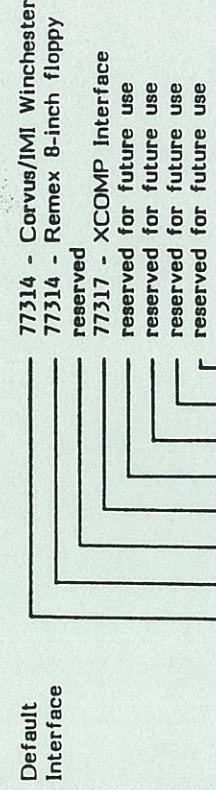
**4.0 MMS I/O BOARD CONFIGURATION PORT**

Some MMS disk I/O boards (77314, 77315, 77317) contain a strappable 6-bit input port at location A1 which has jumper positions labeled "7 6 5 4 3 2".

This port extends the "Default Boot Device" selections possible beyond those allowed by the limited positions on SW501 on the CPU board. It is divided into two sections: bits 2, 3, and 4 determine the logical unit number on the default controller; bits 5, 6, and 7 determine the default interface and/or controller. No jumper implies "0", a jumper forces a "1".

**4.1 DEFAULT LOGICAL UNIT NUMBER**

Jumper 2  
3  
4

**4.2 DEFAULT BOOT CONTROLLER**

Jumper 5  
6  
7

For example, if SW501 switches 4, 5, and 6 are all set to "1" (left) and a 77314 board with NO jumpers is installed, the computer will attempt to boot from the first section of the Corvus/IMI drive when the Boot (cr) command is entered.

## 5.0 NOTES FOR PROGRAMMERS

### 5.1 MMS MONITOR EPROM ENTRY POINTS

Most entry points are DIFFERENT from those in standard Heath/Zenith EPROMs, with the following exceptions:

```
0000  INTERRUPT0
0008  INTERRUPT1
0010  INTERRUPT2
0018  INTERRUPT3
0020  INTERRUPT4
0028  INTERRUPT5
0030  INTERRUPT6
0038  INTERRUPT7
```

NMI handler for H8 compatibility

```
0137  JMP PIN; required to boot Zenith CP/M on Z47
0260  HORN; delay routine
0613  JMP DAT; required to boot Zenith CP/M on Z47
      NOP
      JMP COM
```

All current releases of Zenith CP/M have been tested and boot correctly. However, other software which attempts to make ROM calls may not operate properly.

### 5.2 RAM USAGE AND INITIALIZATION

This monitor program uses the following RAM locations, most of which are also used by Heath/Zenith PROMs:

```
2000 ; variable storage
..
..
207F ; last byte used
2080 ; first user RAM, boot routine gets loaded here
DFFF ; stack (in 64K machine, always at top of memory)
```

The following RAM locations (among others) are used to pass data to the operating system when the "Boot" command is executed:

```
2034 ; physical drive number used for boot
2036 ; last byte output to GPIO port
2037 ; Z89-37 INTRQ return address
2131 ; device relative logical unit number
2150 ; zenith boot device port number (78/7CH)
```

## APPENDIX A -- DESIGNATING THE BOOT DRIVE

Section 2.1 describes three different ways to specify a boot device, two of which require the operator to enter a "drive.designator". Two optional methods may be used to specify a drive:

### Physical Drive Number

MMS: Boot physical.drive.number<sub>(CR)</sub>

A one- or two-digit decimal number is entered following the Boot entry, uniquely defining the desired drive. Valid options are listed in the third column of the following table. For example, to boot from the 1st 8" floppy disk drive on the MMS 77316 Double Density Controller:

MMS: Boot 2<sub>(CR)</sub>

### Controller Designator and optional Logical Unit Number

MMS: Boot controller.lettercontroller.letter<sub>(CR)</sub>

A letter which designates the desired controller is entered following the 'Boot' entry. Valid options are listed in first column of the following table. For example, to boot from the drive described above:

MMS: Boot I1<sub>(CR)</sub>

Note that the letter entered is displayed TWICE to avoid any possibility of confusion with the single letters used by CP/M as logical drive names.

Also, the letter "A" (used by CP/M to designate the first logical device) has been reserved to indicate the "default boot device", thus both

MMS: Boot AA<sub>(CR)</sub> and

MMS: Boot \_L<sub>(CR)</sub>

boot from the device defined by SW501 (and perhaps the configuration port).

Optionally, the desired "logical unit number" can be entered after the "controller designator". For example, to boot from the second partition of a Corvus Winchester drive (physical drive number 16), you may enter:

MMS: Boot HH-1<sub>(CR)</sub>

Or, if the Corvus subsystem has been designated as the "default boot device":

MMS: Boot AA-1<sub>(CR)</sub>

Or, if that specific "logical unit number" has been defined on the configuration port:

MMS: Boot \_L<sub>(CR)</sub>

## VALID DRIVE DESIGNATORS

Controller Code	Logical Unit No	Physical Drive No	Comments	Controller Code	Logical Unit No	Physical Drive No	Comments
A -- Default Controller specified by SW501 and/or Configuration Port				I -- MMS 77316 Double Density Disk Controller - 8" Floppy Drives			
0	base+0	0	Default Controller, specified unit	0	29		
1	base+1	1	Maximum unit depends on controller type	1	30		
etc	base+n	2		2	31		
B -- Z17 Single-Density 10-Sector Controller				3	32		
0	0	0		J -- MMS 77316 Double Density Disk Controller - 5" Floppy Drives			
1	1	1		0	33		
2		2		1	34		
C -- Z89-37 5" Double Density Controller				2	35		
0	46	46	Remember, Zenith CP/M only supports 3 drives	3	36		
1	47	47					
2	48	48					
3	49	49					
D -- Z89-47 Interface to Z47 (Remex) 8" Floppy Disk Subsystem				K -- MMS 77317 Interface to XCOMP Winchester Controller			
0	(5)	46	Note: Bootable only with "D(cr)" or "DD-0" through "DD-3", not with "5" thru "8"	0	37		
1	(6)			L -- Reserved			
2	(7)			M -- MMS 77318 128K RAM 'Invisible Disk'			
3	(8)			N -- MMS Network			
E -- Z89-67 Interface to Z67 Winchester/Floppy Subsystem				O -- MMS 77320 SASI-bus Interface -- Controller 0			
0	3	3		0 - 9	Network Server 0 through 9		
1	4	4					
F -- Reserved for future Zenith disk I/O devices				P -- MMS 77320 SASI-bus Interface -- Controller 1			
G -- MMS 77314 Interface to Remex (Z47) 8" Floppy Disk Subsystem				Q -- MMS 77320 SASI-bus Interface -- Controller 2			
0	5	5		R -- MMS 77320 SASI-bus Interface -- Controller 3			
1	6	6		S -- MMS 77320 SASI-bus Interface -- Controller 4			
2	7	7		T -- MMS 77320 SASI-bus Interface -- Controller 5			
3	8	8		U -- MMS 77320 SASI-bus Interface -- Controller 6			
H -- MMS 77314 Interface to Corvus (IMI) Winchester Subsystem				V -- MMS 77320 SASI-bus Interface -- Controller 7			
0	15	15					
1	16	16					
2	17	17					
3	18	18					
4	19	19					
5	20	20					
6	21	21					
7	22	22					
8	23	23	Note: Usually not bootable				
							Note: Each SASI controller supports 4 logical units
							W-Z -- Reserved for future MMS Disk I/O products

#### APPENDIX B -- MMS I/O DECODER PROM

ADDRESS BLOCK (hex)	PROM OUTPUTS (active low)(1)	FUNCTION
G N T S S L C F	0 1 1 1 1 1 1 1	MMS 77316 DD Controller
P M E E P A L	0 1 1 1 1 1 1 1	Unused
I I R R R S P	0 1 1 1 1 1 1 1	MMS 77316 DD Controller
O M 1 0 S Y	0 1 1 1 1 0 1 1	MMS internal test fixtures
00-37	1 1 1 1 1 1 1 1	Not Decoded
38-39(2) 3A (2) 3B-3F(2)	0 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1	MMS 77317 ACT/XCOMP I/O
40-47*	1 1 1 0 0 0 1 1	MMS 77315 CAMEO I/O
48-4F*	1 1 1 0 1 0 1 1	Unused
50-56* 57	1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1	MMS 77314 Corvus I/O
58-59* 5A-5B* 5C * 5D-5F *	1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 0 1 1 1	MMS 77314 REMEX I/O MMS 77314, 15, 17 Configuration Port Unused
60-77	1 1 1 1 1 1 1 1	Not Decoded
78-7B 7C-7F	1 1 1 1 1 1 0 1 1 1 1 1 1 0 0	Zenith Disk I/O Zenith Disk I/O
80-CF	1 1 1 1 1 1 1 1	Not Decoded - "HDOS reserved"
D0-D7 D8-DF E0-E7 E8-EF F0-F1 F2 F8-F9 FA-FB FC-FF	1 1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 1 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1	Auxiliary Printer (DCE) (3rd 8250) Modem (DTE) (bottom 8250) Printer (LP DCE) (top 8250) System Console NMI (H8 Front Panel) GPIO Not Decoded NMI Not Decoded

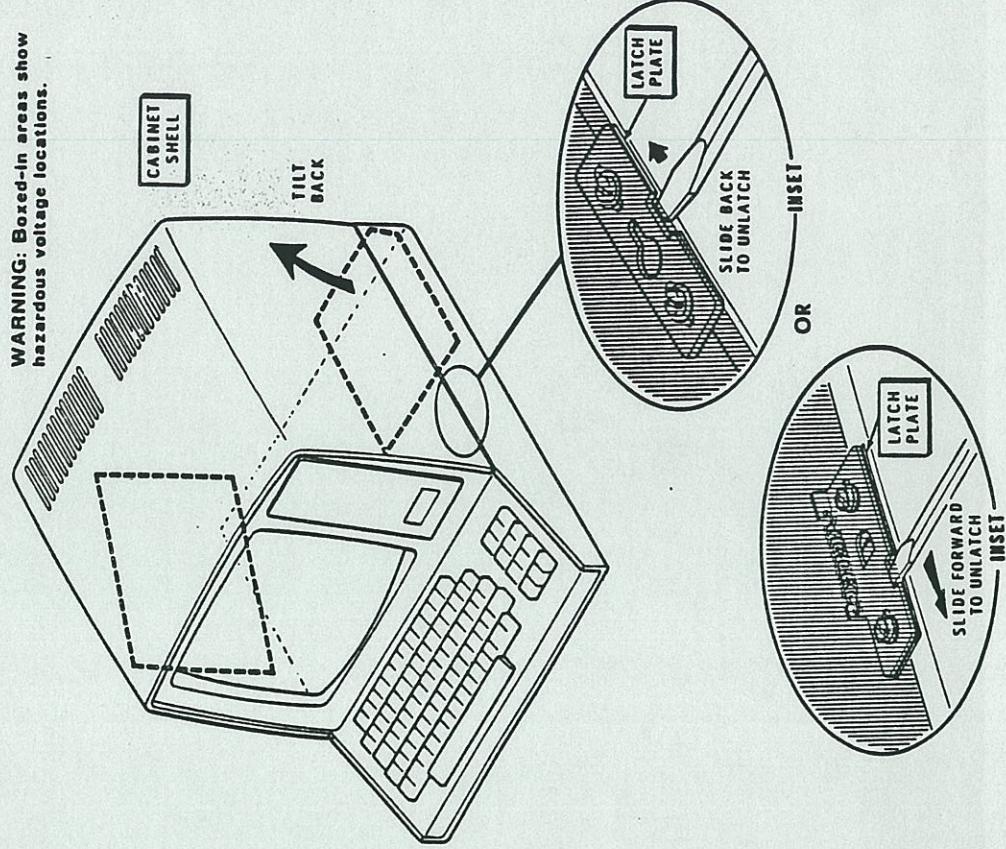
(1) See Zenith Schematic Drawings for circuit details

(2) Decoded only with 444-61C PROM. Do not attempt to access without MMS DD Controller card installed as GPIO port will be accessed instead.

\* Note that SER1, SER0, and LP lines are ENCODED with MMS PROMs. Do not attempt to access a port between 40 and 5F with a Heath/Zenith serial I/O board installed as one or more 8250 ACE UARTs may be inadvertently accessed.

#### APPENDIX C -- PROM INSTALLATION DETAILS

1. Remove the cover from your '89 or '90:
  - Turn the computer off and unplug the line cord.
  - Release the cover latch plates. Refer to the inset on the illustration.
  - Tilt the cabinet shell back until it clears the vertical logic boards.
  - Unplug the fan cable.
  - Remove the shell from the hinges and set aside.



## 2. Change the Monitor EPROM

**NOTE:** All IC's are easily damaged by static electricity. Keep them in black conductive foam when not installed in the computer. Avoid wearing static-generating garments when handling them, and discharge yourself to the metal chassis of the computer before touching any parts inside.

If your computer contains a RAM-expansion board on P503 and P509, carefully remove it to gain access to the EPROM section of the CPU board.

The following parts upgrade a Z89 to allow it to use the same 4K Monitor EPROM as a Z90:

- o 444-83 (Replacement for 444-41 in U516)
- o Jumper Wire (3-inch)

Simply ignore these parts if not needed in your computer.

Referring to the illustration on the next page as required, find the part number on the IC at U516. If it is 444-83, SKIP TO STEP 2.2. If it is 444-41, perform step 2.1 first.

### 2.1 Convert to 4K (Z90) EPROM Compatibility if U516 is marked 444-41

Remove the IC from the socket at U516 and replace it with the enclosed 444-83 PROM. Make sure to install the new part with the notched end "up".

Locate the four (4) jumper blocks adjacent to U518 and U519. Remove the jumper block from the TOP set of posts (J505 or J506) and replace it with one end of the enclosed 3-inch jumper wire assembly so that all 3 pins insert into the connector. Connect the other end to P508, such that the center pin is on pin 14 (P508 is numbered from top-to-bottom).

Place the remaining three (3) jumper blocks in the "down" position, as shown in the CPU board illustration on the next page.

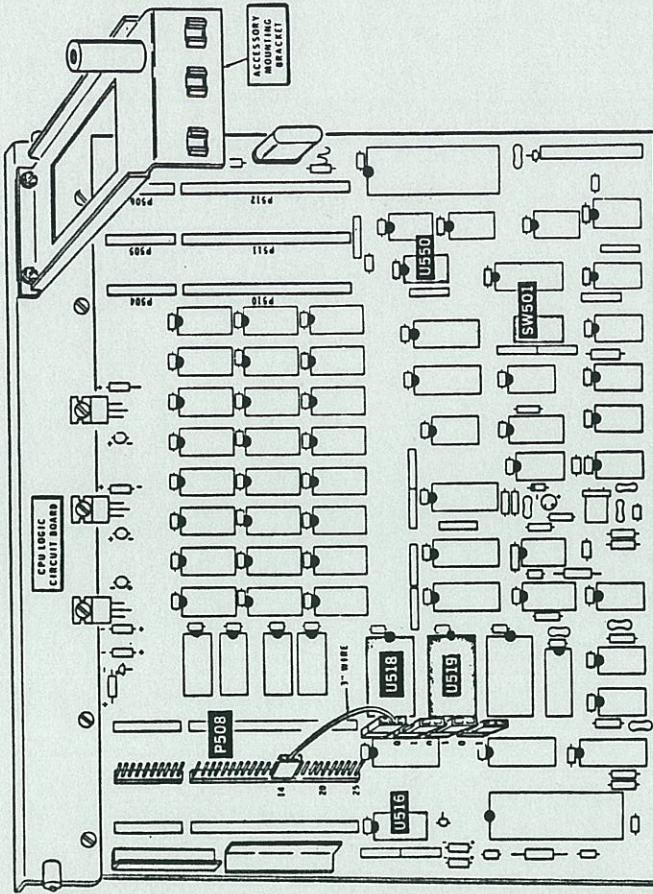
Your computer is now compatible with the 4K Monitor EPROM as used in the Z90. Be sure to inform suppliers of this when ordering additional products. Also, reverse the above steps if you ever re-install your original 2K Monitor EPROM.

### 2.2 Install Replacement EPROM

Remove the IC from U518 (and U519 if installed) and save in black conductive foam.

Install the new "MMS-84A" EPROM in U518. Make sure that the notched end of the IC is on the RIGHT end.

## CPU BOARD ILLUSTRATION



3. Upgrade your I/O Decode PROM (U550) if required

- If you are installing the FIRST Magnolia I/O board in this computer, replace the IC at U550 with the new I/O decode prom included with the I/O board.

- If you are installing the SECOND Magnolia I/O board in this computer, check the I/O decode prom chart and determine if the I/O decode prom needs to be changed.

4. Set SW501 to the proper configuration

- Refer to the chart in section 3.1 above and use SW501 sections 0 through 3 to describe what Zenith disk I/O cards you have installed in your computer. If you DO NOT have either a Z89-47, Z89-67, or MMS 7732 interface (or 77422 Network Controller) installed, all four switches should already be in the "0" (right) position.

- Refer to the chart in section 3.2 above and set sections 4 through 6 to define the correct default boot device. If you have been using a Zenith controller, set these switches to boot from it, not your new MMS controller.

- Until the installation is complete and checked out, make sure that section 7 is in the "0" (right) position to inhibit any attempt to "auto boot".

5. Re-install your RAM-expansion board onto P503 and P509 (if removed) and replace the cover on the computer (reverse the steps in 1. above).

- Test the operation of the new PROMS. In case of difficulty, see your dealer. Consultation with Magnolia Microsystems personnel is available at our usual consulting rates if you did not purchase the PROMs directly from MMS.

- Verify that the computer still "beeps" (usually twice) when turned on and when SHIFT/RESET.

- Verify that the MMS: prompt appears after the unit warms up. You should ignore the random characters which appear momentarily in the upper left corner of the screen as the PROM determines the terminal baud when SHIFT/RESET.

- Verify that the Memory Test finds all of your RAM present and that it all passes the new test.

- Verify that you can still "boot" from the various disk drives you had previously installed. Remember that the boot syntax may have changed from your prior PROM.

7. Continue with the installation of any new Magnolia I/O boards as required.

# # #