

*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.*

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## 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 This ROM precluded the use of more than 48K of memory or CP/M. It has been superseded in all production units by 444-66, which allows the ROM based 48K mode, the ROM based 56K mode, and an all RAM 64K mode.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)

|     | <u>JJ501</u> | <u>JJ502</u> | <u>JJ503</u> | <u>JJ504</u> |
|-----|--------------|--------------|--------------|--------------|
| 16K | 0            | 0            | 0            | 0 (or B)     |
| 32K | 1            | 0            | 0            | 0 (or B)     |
| 48K | 0            | 1            | 0            | 0 (or B)     |

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:

|     | <u>JJ501</u> | <u>JJ502</u> | <u>JJ503</u> |
|-----|--------------|--------------|--------------|
| 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 sector 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:

| <u>Name</u> | <u>Part Number</u> | <u>Manual Part No.</u> |
|-------------|--------------------|------------------------|
| 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 sector 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 sector 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.

\*MTR-90 was previously 444-84. 444-142 is an update of 444-84, containing a minor modification which improves boot reliability when you are using 96 tpi drives.

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:   | JJ505 | JJ506 | JJ507 | JJ508    |
|----------------|-------|-------|-------|----------|
| Newer Units:   | JJ504 | JJ505 | JJ506 | 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 × 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.

## 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

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:

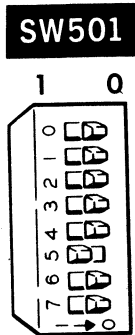
| <u>Section 7</u> | <u>Section 6</u> | <u>Baud Rate</u> |
|------------------|------------------|------------------|
| 0                | 0                | 9,600            |
| 0                | 1                | 19,200           |
| 1                | 0                | 38,400           |
| 1                | 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.

## Setting SW501 with MTR-89

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



| <u>SWITCH</u> | <u>SETTING</u> | <u>DESCRIPTION</u>   |
|---------------|----------------|--|
| 1,0           | 00*            | Port 174(7CH)/177Q(7FH) has an H-88-1 controlled disk (normal) |
|               | 01             | Port 174/177Q has an H/Z-47 type disk                          |
|               | 10             | Undefined  |
|               | 11             | Undefined  |
| 3,2           | 00**           | Port 170(78H)/173Q(7BH) is not in use (normal without H/Z-47)  |
|               | 01             | Port 170/173Q has an H/Z-47 (normal with H-47)                 |
|               | 10             | Undefined  |
|               | 11             | Undefined  |
| 4             | 0              | Boots from device at port 174/177Q (H-88-1, normal)            |
|               | 1              | Boots from device at port 170/173Q (H/Z-47)                    |
| 5             | 0              | Performs memory test upon boot up (not currently supported)    |
|               | 1              | Does not perform memory test (normal)                          |
| 6             | 0              | Sets Console to 9600 baud (normal)                             |
|               | 1              | Sets Console to 19,200 baud (not currently supported)          |
| 7             | 0              | Normal boot (normal)   |
|               | 1              | 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 | 00 | Port 174(7CH)/177Q(7FH) is H-88-1 controlled disk  |
|     | 01 | Port 174(7CH)/177Q(7FH) is H/Z-47 disk             |
|     | 10 | Port 174(7CH)/177Q(7FH) is Z-67 disk               |
|     | 11 | Undefined  |
| 3,2 | 00 | Port 170(78H)/173Q(7BH) is Z-89-37 controlled disk |
|     | 01 | Port 170(78H)/173Q(7BH) is H/Z-47 disk             |
|     | 10 | Port 170(78H)/173Q(7BH) is Z-67 disk               |
|     | 11 | 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  $\Omega$  (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.

## DRIVE PROGRAMMING

Drive programming is illustrated in Pictorials 1, 2 and 3. There were some early H-17-1 drives which are different than those shown. These are covered in the H-17 manuals, but they have not been used for several years.

The use of H-17-4 drives with the hard sectored controller (giving 400K bytes of storage) is not supported at this time and is not expected to be supported in the future.

The use of H-17-4 drives **internally** within the H/Z-89 is not supported at this time, but is expected to be supported in early 1982. The track width and signal levels coming off the read head are substantially less than those found in the H-17-1, and the reduced signal to noise ratio which results prevents reliable operation on the inner tracks in a significant minority of units. Improved shielding for the internal drive is under development and will eliminate the problem.

## MEDIA

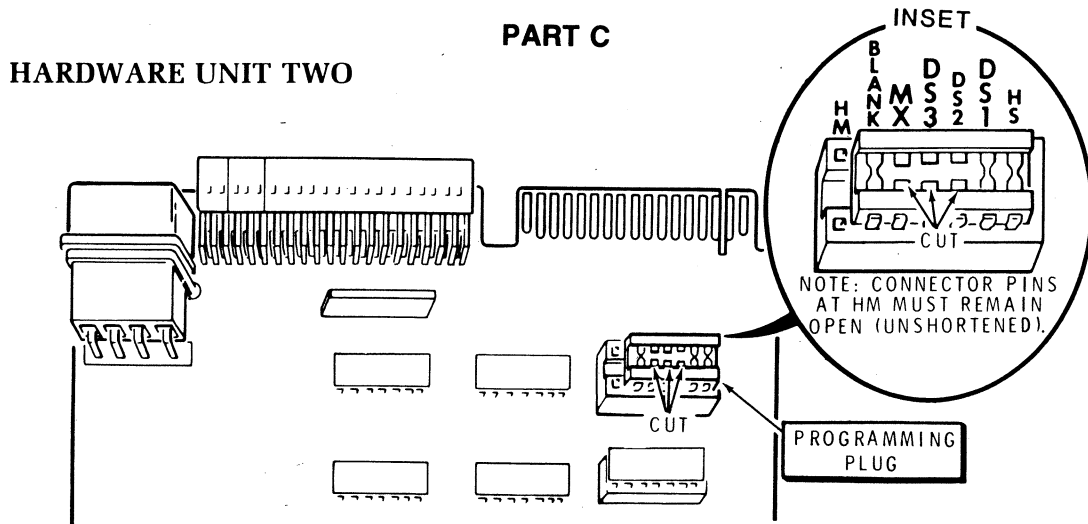
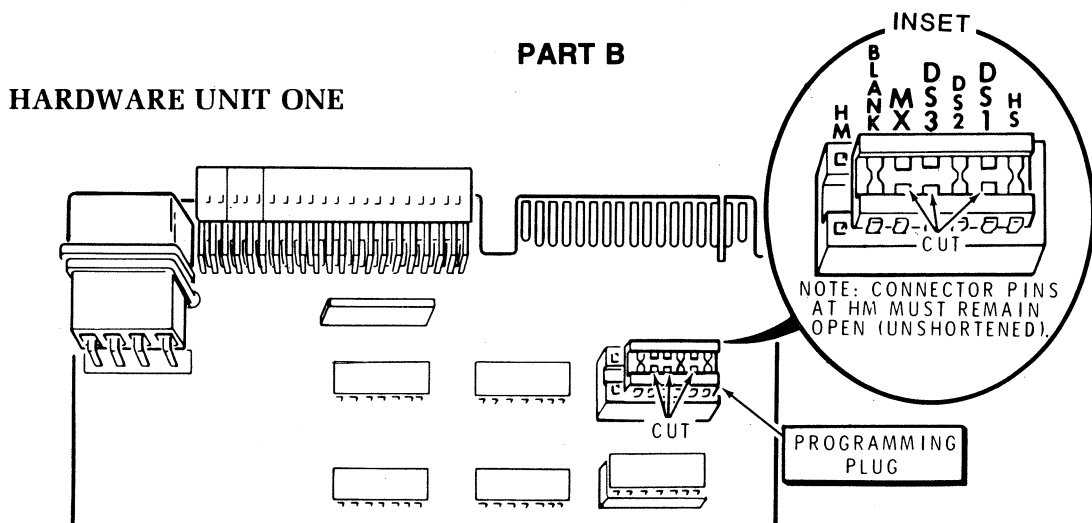
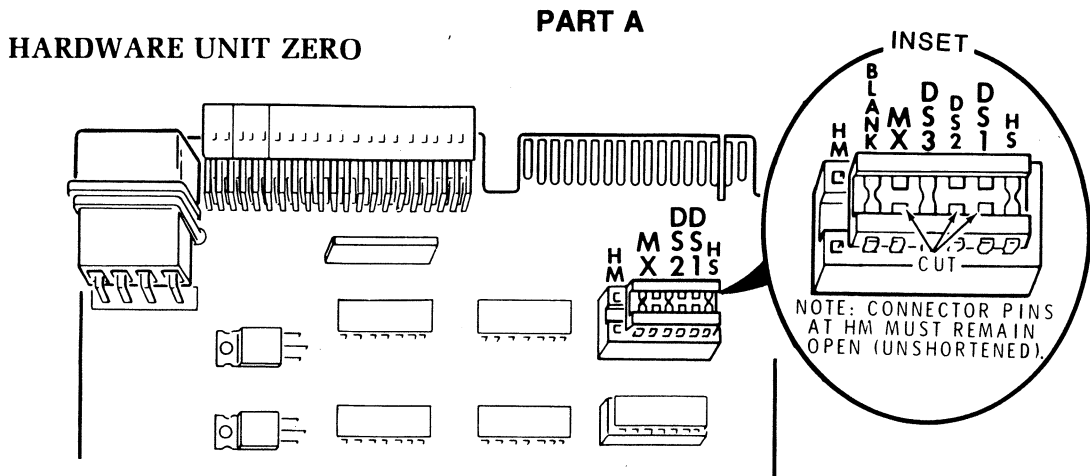
H-17-4 drives should **only** be used with media certified for 96 or 100 TPI service; double-density recording should only be done on diskettes which are certified for such use.

We do not recommend the use of "flippy" diskettes. The liner used to trap oxide, dust, and other contaminants inside the diskette jacket has a nap (grain) to it, and reversal of diskette rotational direction (as occurs when a diskette is turned over) can release a large portion of the trapped contaminants, with undesirable results.

We specifically recommend against using head cleaning diskettes; and besides, it is not necessary. It is unlikely that disk heads will **ever** require cleaning.



# H-17-1 Programming With Hard-Sector Controller (H-88-1)

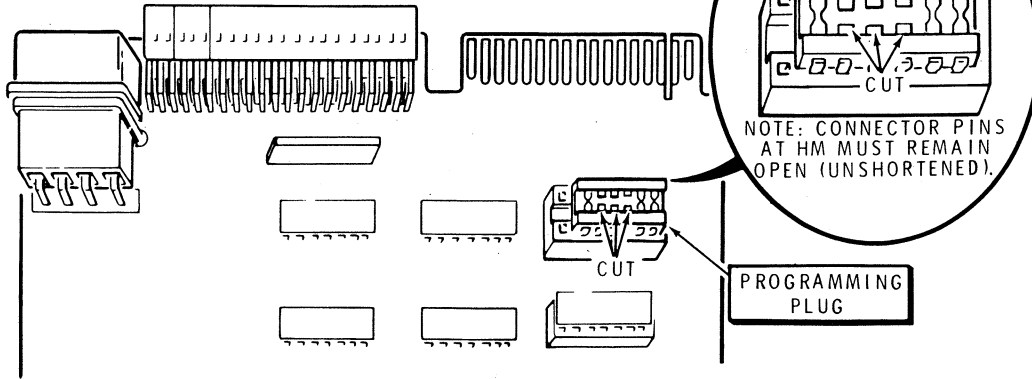


PICTORIAL 1

# H-17-1 Programming With Soft-Sector Controller (Z-89-37)

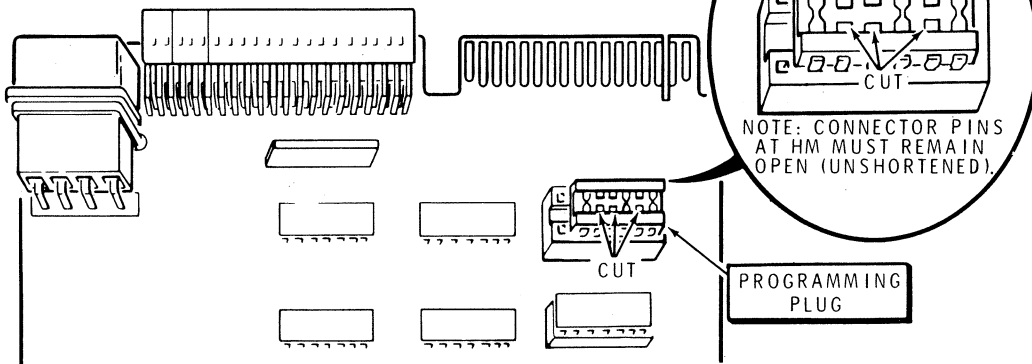
## PART A

### HARDWARE UNIT ZERO



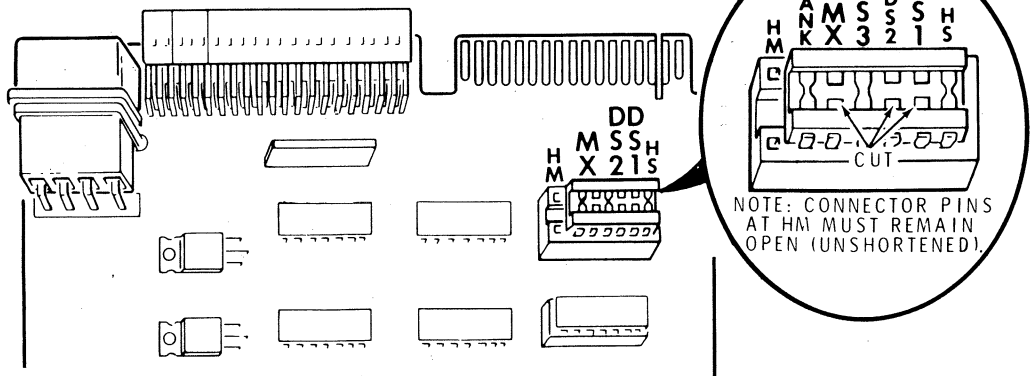
## PART B

### HARDWARE UNIT ONE



## PART C

### HARDWARE UNIT TWO

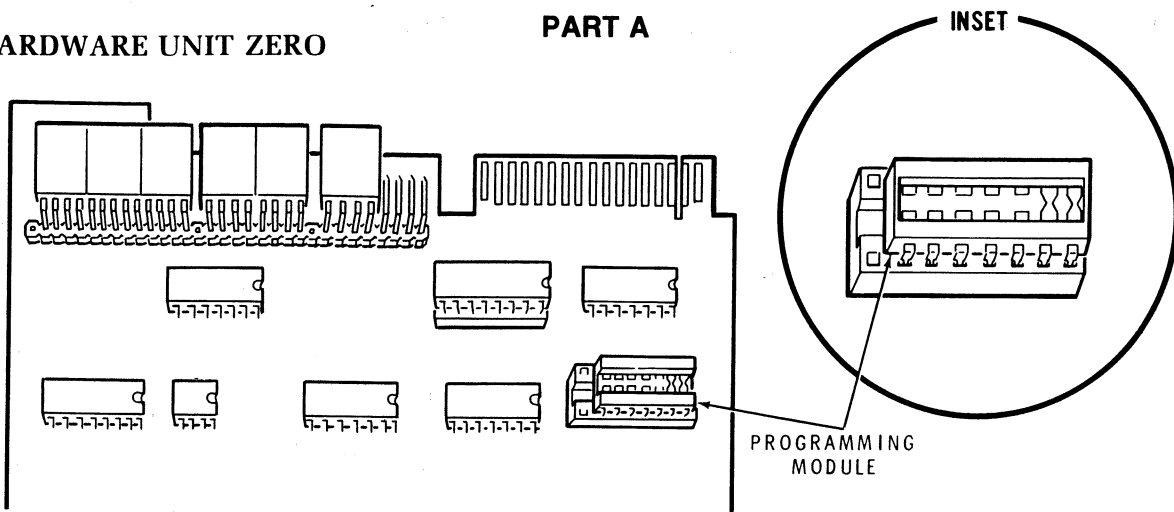


PICTORIAL 2

# H-17-4 Programming With Soft-Sector Controller (Z-89-37)

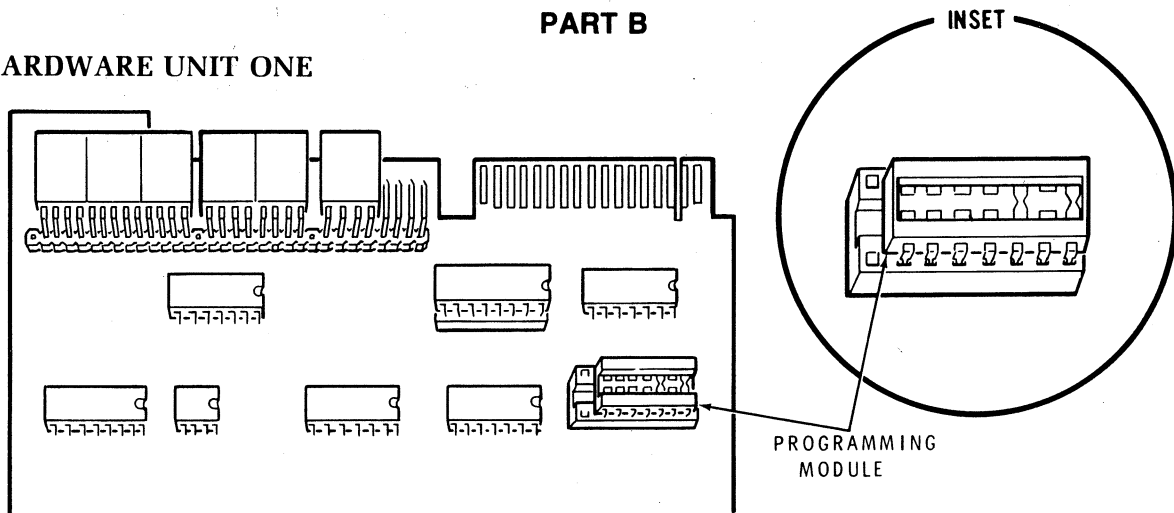
HARDWARE UNIT ZERO

PART A



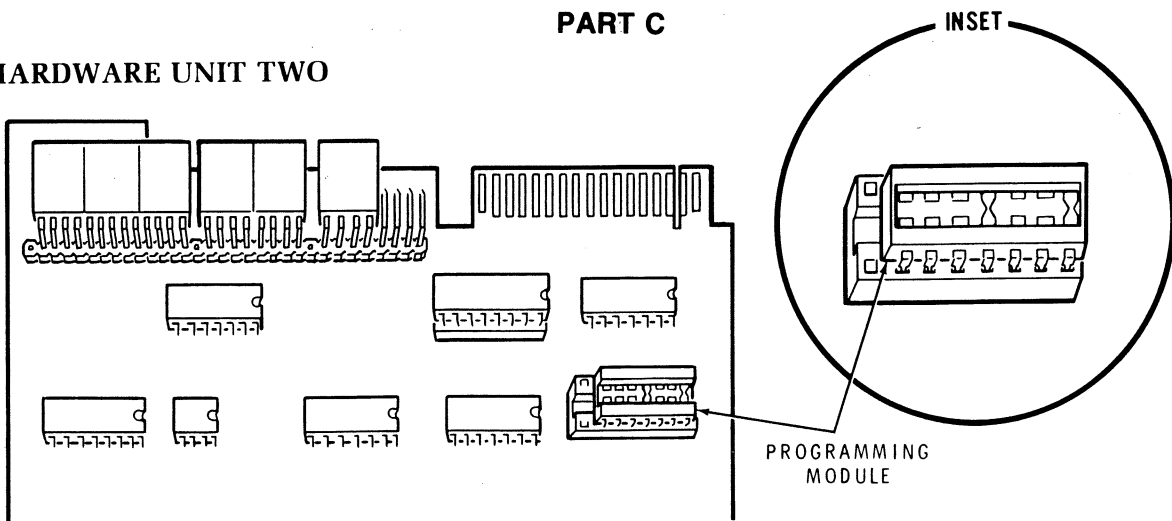
HARDWARE UNIT ONE

PART B



HARDWARE UNIT TWO

PART C



PICTORIAL 3

# ROTATIONAL SPEED TEST

Perform the rotational speed tests as described in your system software documentation. See Pictorial 4 for the adjustment locations.

