~~~~~~

Z-205 Memory Card
User's Manual

Dynamic RAM Expansion Card
Z-100 Series Computers

Introduction

The Z-205 Expansion RAM (Random Access Memory) Card gives your H/Z-100 series computer an additional 256Kb of random access memory. Additional RAM capability is available, up to a total of 768Kb, by adding one or more of these cards to the Z-100 computer. The main board of your computer must be fully populated with 192Kb of 64Kb RAM chips.

A variety of RAM configurations is available to you, using the switches incorporated in each card. This configuration capability is especially useful whenever you need to troubleshoot, or configure the added memory around, or in support of existing memory.

This manual contains all of the information you will need to use the numerous features of your Z-205 Expansion RAM Card. Please read it carefully before attempting to use your expansion card.

Specifications

Memory Size - 262,144 bytes x 9 (1-parity) in four banks of 65,536.

Memory Chip Type - 64k x 1 Dynamic RAM, 5-volt single supply on board.

Addressing - 256K contiguous address locations, configurable on 64K boundaries within 1 of 16 1-megabyte blocks.

Parity - Byte parity for error detection.

Access Time - 317ns maximum, using 200ns RAM.

Width - 256K x 8 + parity or 128K x 16 + byte parity. Automatic width selection via S-100 bus 16REQ/16ACK signals.

Wait States - 0, 1, 2, or 3, user-selectable.

Bus Interface - S-100, proposed IEEE Standard 696.

Refresh - Transparent, on board, independent of bus.

Power Requirements - 8-11 volts DC at 1.2A maximum.

Disassembly and Reassembly

Please see the other articles on the Z-100 LifeLine Website for disassembling and reassembling the Z-100. As a minimum, you must remove the cover to gain access to the S-100 bus card cage located at the rear of the Z-100 computer.

Typical Configuration

The following typical configuration instructions will allow you to access the full 256K RAM on your expansion card. Typical configuration data for H/Z-100 owners who use **more** than one card can be found under Switches, following Detailed Configuration and Jumpers. For special applications that require **less** than 256K RAM, or for system information for other than Zenith products, refer to the next section, Detailed Configuration.

Refer to the figure on the next page for the following steps. Jumper all Z-205 Cards as described in these three steps:

[ ] Position the card as shown on a flat work surface.

[ ] Place a programming jumper on J6 (no wait states).

[ ] Place a programming jumper on J7, pins 4 and 5, and another on J7, pins 2 and 3 (normal operation using all four banks).

On the first card only:

[ ] Set the DIP (Dual-in-line Pack) switch SW1 positions 3, 4, and 7 to the OFF (1) position, and all others to the ON (0), (98h) position.
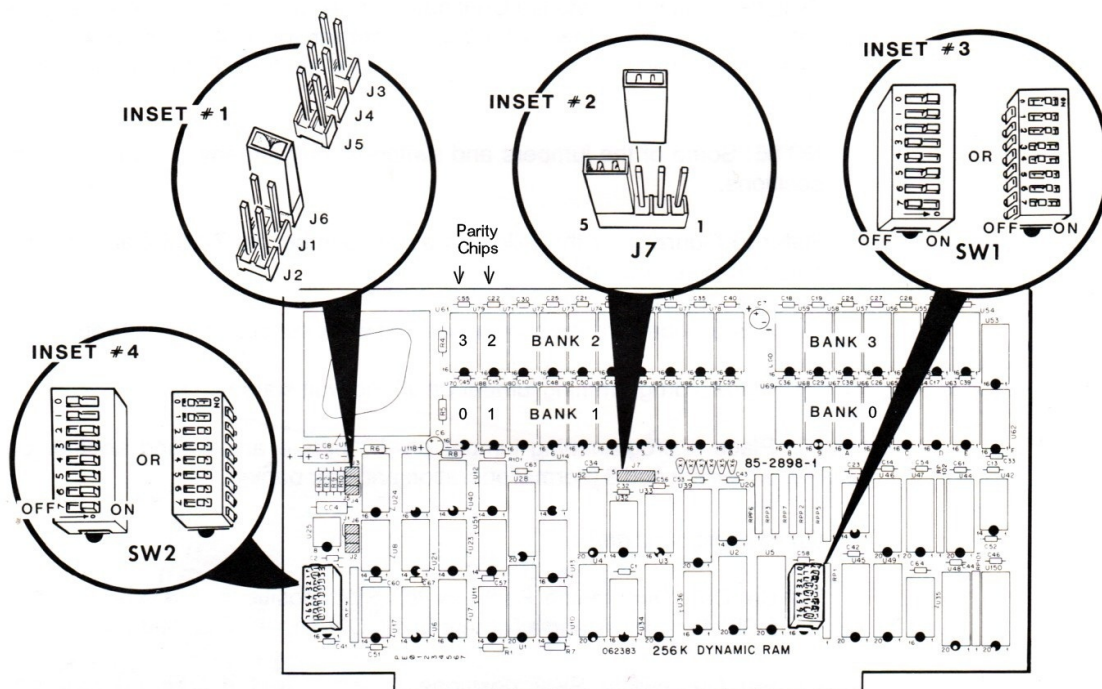
[ ] Set the DIP switch SW2 positions 0 and 1 to the OFF (1) position (030000h), and all others to the ON (0) position.

Note: Each additional card requires a different SW1/SW2 setting, as explained under Switches.

This completes the basic configuration for the first Z-205 Dynamic RAM Expansion Card. Repeat these steps for each additional card (with different SW1/SW2 switch settings). Then proceed to Installation.

WARNING: Your H/Z-100 computer **must have the full 192Kb RAM** installed. If it contains only 128K RAM when the Z-205 Card is configured to respond to addresses in the 20000h-5FFFFh range, it is possible to damage the data bus buffers on the motherboard or damage the Card!

Typical Z-205 RAM Card Configuration

Legend:

Bank 0	Used in 64K configuration.
Banks 0, 1	Used in 128K configuration.
Banks 0,1,2,3	Used in 256K configuration.

NOTE: It is possible to select any configuration on the fully populated card.

Jumper and Switch Locations and Settings

The information in this section enables users of the Z-205 Expansion RAM Card to configure their card(s) for a non-Zenith S-100 bus computer, or to make modifications or a customized configuration for their H/Z-100 series computer.

Jumpers

Table 1. RAM Capacity Selection:

J1	J2	Comments
O	O	256Kb
I	O	128Kb
O	I	Not defined
I	I	64Kb

Note: I = Install Jumper
      O = Open (NO jumper)

J1 – Open for 256Kb. Add jumper for 128Kb and 64Kb operation, as shown in Table 1.

J2 – Open for 256Kb and 128Kb. Add jumper for 64Kb operation.

To program desired Wait State, install one jumper as detailed in Table 2.

Table 2. Wait State Selection:

JUMPER	J6	J5	J4	J3
Wait States	0	1	2	3

CAUTION: Select only **ONE** of the above jumpers for Wait States. Any attempt to select **more than one jumper will result in damage to U24, and a system failure.**

J7 – For normal operation with 128Kb or 256Kb, place jumpers on pins 2 & 3, and 4 & 5.

For 8-bit only, with 1-bank (64Kb operation), place jumpers on pins 1 & 2, and 3 & 4.

2

Switches
DIP switches SW1 and SW2 are used as follows:

SW1 - The Z-205 Card uses one I/O (input/output) port address to control and monitor the parity error circuitry. SW1, an 8-position switch, permits you to select any one of 256 possible address locations as the I/O port address. For example, to select address 98h (Hex), set SW1 as shown in Table 3.

Note: Heath/Zenith Data Systems computers use port address **98h** for the first 192Kb-448Kb, **99h** for the next segment, 448K-704Kb, and **9Ah** for the final segment, 704K-960Kb.

Table 3. Setting 98h Address (First Z-205 Card)

Address Bit:	A7	A6	A5	A4	A3	A2	A1	A0
Position	7	6	5	4	3	2	1	0
ON/OFF		OFF	ON	ON	OFF	OFF	ON	ON	ON
	<	9		><	8		>	

SW2 - The Z-205 Card is addressed as a single (256Kb) block of contiguous memory start-ing on ANY 64Kb boundary. The starting address is selected by SW2, an 8-position switch. To access the full 256Kb RAM, starting with address location 030000h (where the motherboard 192Kb ends), set SW2 as shown in Table 4.

Table 4. Setting 030000h Address (First Card)

Address Bit:	A23	A22	A21	A20	A19	A18	A17	A16
Position	7	6	5	4	3	2	1	0
ON/OFF	ON	ON	ON	ON	ON	ON	OFF	OFF
	<	0		><	3		>	

To configure a second card for use in a Z-100 system, set switch SW1 to 99h and SW2 to 070000h as indicated in Table 5.

Table 5. Setting 99h and 070000h Address (Second Card)

Address Bit:	A7	A6	A5	A4	A3	A2	A1	A0
Position	7	6	5	4	3	2	1	0
ON/OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
	<	9		><	9		>	

AND

Address Bit:	A23	A22	A21	A20	A19	A18	A17	A16
Position	7	6	5	4	3	2	1	0
ON/OFF	ON	ON	ON	ON	ON	OFF	OFF	OFF
	<	0		><	7		>	

To configure a third card for use in a Z-100 system, set switch SW1 to 9Ah and SW2 to 0B0000h as indicated in Table 6.

Table 6. Setting 9Ah and 0B0000h Address (Third Card)

Address Bit:	A7	A6	A5	A4	A3	A2	A1	A0
Position	7	6	5	4	3	2	1	0
ON/OFF	OFF	ON	ON	OFF	OFF	ON	OFF	ON
	<	9		><	A		>	

AND

Address Bit:	A23	A22	A21	A20	A19	A18	A17	A16
Position	7	6	5	4	3	2	1	0
ON/OFF	ON	ON	ON	ON	OFF	ON	OFF	OFF
	<	0		><	B		>	

Note: The third expansion card may **FAIL** to provide expansion memory for some applications because the expansion RAM overlaps the video RAM address space.

Input/Output Port
A single input/output (I/O) port, as selected by SW1) is used for parity control and status monitoring. The representations in Table 7 show the input data from the memory board and what the information (being sent as output data) from the CPU will look like. Both representations are of a byte type.

Table 7. Output Data from CPU [Byte]

Parity
Parity Generator - The parity generator is an on-board circuit that writes a 1 into the parity RAM when the incoming byte has an even number of 1's. It writes a 0 into the parity RAM when the incoming byte has an odd number of 1's. You can disable this function by writing a data word with bit 4 set to 0, and outputting this byte to the I/O port selected by SW1.

Error Flag Enable/Disable - The parity error interrupt is gated out by writing a data byte with bit 6 set to 0, and outputting this byte to the I/O port.

Error Flag - The error flag is set by on-board circuitry when the parity detected during the read cycle is even (or incorrect). To clear an error flag: output XX01XXXX and then XX11XXXX to the I/O port.

Note: On power up, the parity generator and error flag circuits are disabled. Thus, you must enable these circuits by software commands. Enable them by writing a 1 to bits 4, 5, and 6, then, outputting the byte to the I/O port.
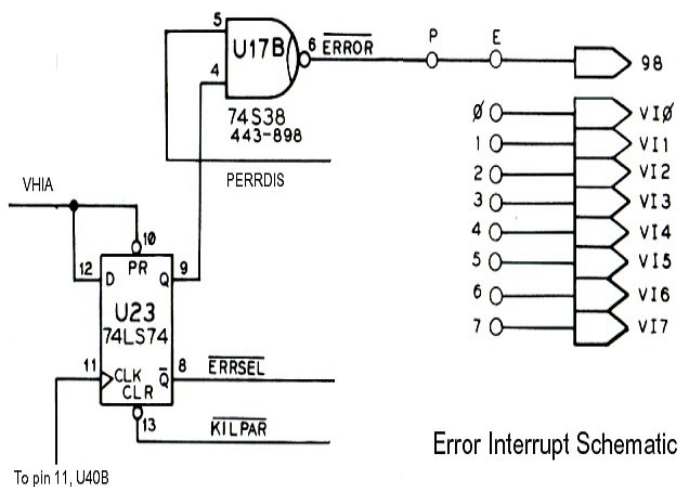
Table 8. Error Flag Data

INPUT DATA	7	6	5	4	3	2	1	
	X	X	X	X	X	X	X	

0 = Error from Memory Board
1 = No Error

NOTE: X = Don't care.

Parity Error from Memory Board - If a parity error occurs, you can determine which memory board is involved by inputting from the I/O port and checking bit 0. If an error did occur, bit 0 will be set to 0. If not, bit 0 will be 1.

Error Interrupt - If you want to use one of the S-100 interrupt lines to handle parity errors, use a sharp knife to cut the trace between P and E (lower left-hand side near the S-100 bus connector) **on the foil side** of the board. Then, solder a jumper wire between P and the desired interrupt line, 0-7, as shown in the schematic here:

Error Interrupt Schematic

Installation
Notes:
1. Be sure the DIP switches, SW1 and SW2, and the programming jumpers are set in the correct positions **before** you install each card. (See settings under Switches in the Configuration section.)

2. Depending upon the S-100 bus slots that you use, disconnect any interfering cables from other boards to install the Z-205 card and reinstall the cables when the installation has been completed. **The Z-205 card may be placed in any open S-100 bus slot.**

Refer to Figure 1 for the following steps:

WARNING: Be sure the computer line cord is disconnected from the AC receptacle to avoid personal injury or damage to your computer.

[ ] Select vacant slots in the S-100 bus card cage that do not interfere with the cables to the other boards.

Note: If installing more than one Z-205 RAM Card, it is recommended to place a label along the top edge of each to identify the board, "Z-205 Card #1", #2, and #3.

[ ] Insert the Z-205 Cards with the components facing the front of the computer, as shown in Figure 1. Seat each card firmly by pushing straight down.

Initial Tests
Use the following procedures to test your installed Z-205 RAM Expansion Cards.

Be sure the DIP switches, SW1 and SW2, on each card and the programming jumpers are in the correct positions **before** you install the card. (See Switches in the Configuration section.)

[ ] Turn your computer and monitor ON.

[ ] At the prompt, enter the following commands exactly as shown.

```
F       [Your computer will complete the
        word, FILL]
FILL    [and you answer by typing the rest
        of the line shown:]
{CR}    [Press the RETURN key]
```

For testing the **First Card:**

```
FILL    3000:0-FFFF,33{CR}
FILL    4000:0-FFFF,44{CR}
FILL    5000:0-FFFF,55{CR}
FILL    6000:0-FFFF,66{CR}
```

If you have a **Second Card,** continue:

```
FILL    7000:0-FFFF,77{CR}
FILL    8000:0-FFFF,88{CR}
FILL    9000:0-FFFF,99{CR}
FILL    A000:0-FFFF,AA{CR}
```

If you have a **Third Card,** enter:

```
FILL    B000:0-FFFF,BB{CR}
FILL    C000:0-FFFF,CC{CR}
FILL    D000:0-FFFF,DD{CR}
FILL    E000:0-FFFF,EE{CR}
```

Note: The banks shown in the diagram given in the Configuration section of the original Zenith Z-205 Manual, do not directly reflect the banks being tested here. Banks 0 and 1 are switched! I have corrected the diagram to reflect the actual Bank numbers.
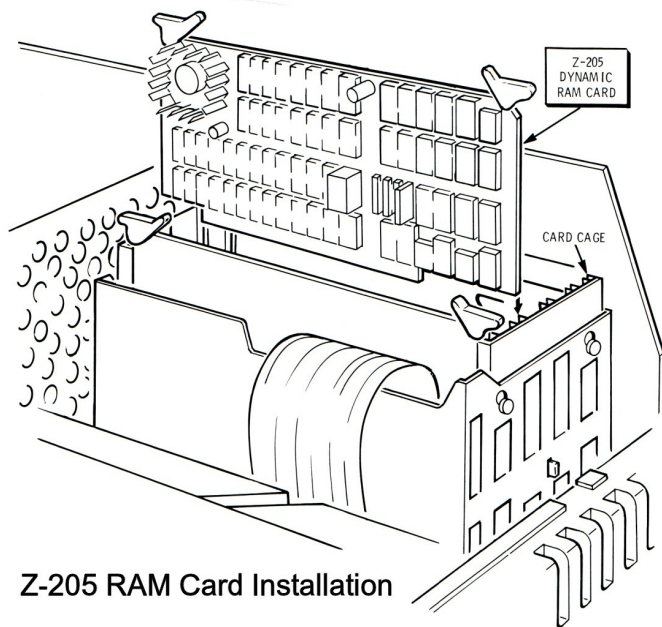
Z-205 RAM Card Installation

Figure 1

Running The Test
Refer to Table 9, Screen Display, as you run
this part of the test.

Notes:
    * Every time you power off, the Fill data
entered above is lost from memory and must be
entered again. While the data may remain after a
warm boot, {CTRL}{RESET}, if you attempted to
boot or do some other operations, this data may
become corrupted as the computer performs those
other operations.
    * The data displayed is **NOT** the full block
of data, just the first 16 bytes and the last
112 bytes in each 64Kb block. To see a different
area in the block, you must adjust the range of
the command.

Testing the First Card:
[ ] To display the first 16 bytes and the last
    112 bytes in the first 64K block, enter:
       DUMP 3000:FF90-000F{CR}

[ ] To display data from the next 64K block:
       DUMP 4000:FF90-000F{CR}

[ ] To display data from the next 64K block:
       DUMP 5000:FF90-000F{CR}

[ ] To display data from the last 64K block:
       DUMP 6000:FF90-000F{CR}

Testing the Second Card:
[ ] To display the first 16 bytes and the last
    112 bytes in the first 64K block, enter:
       DUMP 7000:FF90-000F{CR}

[ ] To display data from the next 64K block:
       DUMP 8000:FF90-000F{CR}

[ ] To display data from the next 64K block:
       DUMP 9000:FF90-000F{CR}

[ ] To display data from the last 64K block:
       DUMP A000:FF90-000F{CR}

Similarly, you can continue with any Third Card.

Screen Display:
This completes the data entry for the Initial
Test. Table 9 shows the display as the memory
test is cycled. Your screen display should
resemble this display. If you experience any
difficulties, refer to the In Case of Difficulty
section of this manual.

Table 9.   Screen Display*

```
3000:FF90 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFA0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFB0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFC0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFD0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFE0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:FFF0 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333
3000:0000 33 33 33 33 33 33 33 33-33 33 33 33 33 33 33 33 3333333333333333

4000:FF90 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFA0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFB0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFC0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFD0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFE0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:FFF0 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD
4000:0000 44 44 44 44 44 44 44 44-44 44 44 44 44 44 44 44 DDDDDDDDDDDDDDDD

5000:FF90 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFA0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFB0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFC0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFD0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFE0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:FFF0 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU
5000:0000 55 55 55 55 55 55 55 55-55 55 55 55 55 55 55 55 UUUUUUUUUUUUUUUU

6000:FF90 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:FFA0 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:FFB0 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:FFC0 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:FFD0 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:FFE0 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
6000:0000 66 66 66 66 66 66 66 66-66 66 66 66 66 66 66 66 FFFFFFFFFFFFFFFF
```

* Only 25 lines of the display can be shown on the screen at one time.

Assembly
[ ] With power disconnected, reconnect any
cables that were previously disconnected.

[ ] Replace the computer cover. Enjoy.

In Case of Difficulty

The Z-205 Dynamic RAM Expansion Card is considered by Zenith to be too complex for user servicing. However, we no longer have the option to return a malfunctioning board to Zenith for servicing.

I will be happy to do my best to repair the board, or replace it with another, for a fee. A copy of my price list is on the Z-100 LifeLine Website. However, the cost of shipping makes repairs very expensive for a simple repair.

So, let us see if there are some functions that we users can accomplish on our own. Here are some common problems, and possible solutions:

Problems May Vary:
1. System responds with Parity or Bus Error.
2. Z-100 will not boot to Floppy or Hard Drive. Boot sequence stalls about half way through.
3. If you press {S}ystem on early ROM chips, or {L}ook on later ROM chips, the 256Kb Z205 Card may **not** be fully recognized; may show: 192K, 256K, 320K, or 384K, instead of the full 448K that it should. It may even show intermediate values or erratically changing numbers depending upon if the RAM failure was a single bit, or an entire chip failure.

Tip: If {S} shows 192K, the card is not being recognized at all; it is probably a major failure of one RAM chip in bank 0. Likewise, if {S} shows 256K, it is probably the major failure of a chip in Bank 1. For 320K, check Bank 2, and for 384K, check Bank 3. While you can probably boot, DIAG will NOT recognize the memory above the amount listed by {S}, so it will not be of much help. Run the Tests given in this Article. For my chips the test display showed alternating numbers, such as 32,33,32,33, etc. for the entire block. You can not miss it. Replace the chips in that Bank until you find the right one.

Tip: If {S} shows the full amount of RAM on the Card, you will probably get the Parity Errors or be unable to boot. It is probably only a minor failure (a bad bit) in one of the chips. Again, all you can do is run the Tests given in this Article.

Solutions to Any or All of the Above:
1. Check switch SW1 for correct settings per the Configuration section of this article.
2. Check/replace the four parity chips located at the extreme left of the two rows of RAM chips on the top of the card. Replace all four, and if that fixes the problem, then replace one at a time to locate the bad chip.
3. If the problem continues, check/replace the two 9-bit parity generator/checker, 74LS280 chips at U42 and U43.
4. If you can boot, run DIAG and follow its recommendations - though you may see **false** bad chips on the motherboard until the Z-205 card works. To check, remove the Z-205 card and run DIAG again. Remember, the ROM Memory Test only checks the first few banks of RAM on the motherboard, so you need to run DIAG to check everything. However, it only checks the amount of RAM found by the ROM {S}ystem command.

Problem:
1. System fails to operate. Can **NOT** boot.
2. The ROM {S}ystem command may **NOT** show the full amount of RAM in the system. It may show any 64K boundary above the 192Kb RAM on the Motherboard.

Solution:
1. Check J6 and J7 for proper jumper settings.
2. Check settings on SW1 and SW2.
3. Check to be sure the card is properly seated in the card cage.
4. Visually inspect the Z-205 Card; check all solder joints on the solder side; check all components on the component side, including all pins on ICs, particularly any that you recently changed.
5. Run through the solutions to previous issues.

Problem:
System fails the initial tests; displays all "FF" in place of the data entered earlier; the display is something other than expected.

Solution:
1. Check switch settings to ensure proper configuration. Code "FF" display shows that the bank under test is either not addressed or not present. Try entering the data again.
2. Switch SW2 is in the wrong position, causing errors in the display. Enter the test data again and repeat the tests.

Troubleshooting Notes:
1. Booting or running another program on the computer will disrupt or overwrite the test data you may have initially entered. Reenter the data and run the tests again.
2. Occasionally, a strange value inconsistent with the other display data may show a weak RAM chip. Do not worry about this yet. Leave this for DIAG to detect, when you finally get it to work, and it can give you a chip number to change.
3. A major chip failure, one that usually prevents the entire RAM bank from being recognized and forcing boot and parity issues, may show on the display as alternating numbers, such as 32,33,32,33, etc. for the entire block of the display. You can not miss it. Replace the chips in that Bank until you find the right one.
4. For troubleshooting purposes, you can install a jumper at J1 to force using only Banks 0 and 1 (for 128Kb), even if the Z-205 card is fully populated. This would allow you to swap any RAM chips from Banks 2 & 3 to Banks 0 & 1 for testing. The ROM {S}ystem command should show 320Kb RAM in the system.

I hope you found the above information helpful. If you have any questions or comments, please email me at:
z100lifeline@swvagts.com

Cheers,

Steven W. Vagts