

MS670-BA/CA MOS Memory Option Installation Guide

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Contents

About This Manual

v

1 Description

- 1.1 BA440 System Enclosure 1-2
- 1.2 MS670 Memory Modules 1-2

2 Installation

- 2.1 Software Backup and Operating System Shutdown 2-1
- 2.2 Unpacking and Inspecting 2-1
- 2.3 Testing the Existing System 2-2
- 2.4 Checking the System Configuration 2-2
- 2.5 Powering Down the System 2-3
- 2.6 Installing Add-on MS670 Memory Module(s) 2-4

3 Testing the New Configuration

- 3.1 Power-Up Self-Tests 3-1
- 3.2 Acceptance Tests 3-2
- 3.3 System Verification 3-6

Index

Examples

3-1	Display With No Errors (VT Terminal Connected to Console SLU)	3-2
3-2	Sample Error Display	3-2

Figures

2-1	Pedestal Rotary Key Lock	2-3
2-2	Backplane Configuration	2-5
2-3	Memory Module Ratchet Handles	2-7

Tables

3-1	CSRs Associated with Each Memory Module	3-6
3-2	MCSR/Module Mapping	3-6

About This Manual

This manual contains a brief product description and installation information for the MS670-BA and MS670-CA (commonly referred to as the "MS670 memory module", or "memory module") MOS memory options. Installation will be accomplished by Customer Services or by authorized service personnel.

Chapter 1 provides a brief description of the MS670 memory module and its features.

Chapter 2 describes the installation of the MS670 memory module.

Chapter 3 describes the testing of the new configuration after the MS670 memory module has been installed.

1

Description

This chapter describes the BA440 enclosure and the MS670 memory modules. The BA440 enclosure is incorporated in the VAX 4000, model 300 system pedestal. The BA440 enclosure is an improved version of the BA200-series enclosure. Some of the features of the BA440 enclosure are listed below.

- Strong visual similarity to the BA200-series of enclosures, yet improves ease of use for the customer and service engineer.
- Top and bottom hinged front doors (instead of a front panel) for easier access to system components, and for system security.
- New single power supply provides more power, and is easy to install and repair.
- New backplane to accommodate the new high-density connector scheme (GMI) required for the MS670 memory module (specific to BA440 enclosure).
- New card cage to accommodate the new double-sided MS670 memory modules (specific to BA440 enclosure).
- New storage mounting area to accommodate "plug-in" mass storage devices (ISEs — Integrated Storage Elements).
- Strengthening members placed in the mass storage mounting area to: reduce shock and vibration to the storage devices; reduce the need for shock mounts and sway space; eliminate the need for shipping brackets.
- Individual control panel for each mass storage device to allow for easier installation and swapping of devices.
- The addition of a fan tray at the bottom of the enclosure to provide a better exhaust route for warm air.

The system pedestal has a unique backplane and card cage so that it can accommodate the new higher-density and double-sided MS670 memory modules. All mass-storage devices will also "plug" directly into this backplane.

The system pedestal houses up to three half- or full-height DSSI fixed-disk drives, such as the RF31 disk drive and the RF71 disk drive.

1.1 BA440 System Enclosure

The BA440 enclosure has a 12-slot backplane. The backplane houses seven Q-bus modules, one KA670 CPU module, and four MS670 memory modules in the maximum configuration. Other configurations may employ fewer than four memory modules.

The backplane implements the CD rows and the Q22 AB rows of the seven backplane slots dedicated for Q-bus. The other five slots are reserved for the KA670 CPU and the four MS670 memory modules.

In addition, the BA440 enclosure contains a console module (H3604) that fits over the KA670 CPU module (module designation L4000-AA/BA) and all four memory module slots.

The console module has a ribbon cable that connects between the console module and the KA670 CPU. A power connector (H3604 power paddle card) connects the console module to the system backplane.

The console module forms an electrical seal that complies with regulations for electromagnetic interference (EMI) for keeping radio frequency interference (generated by the system) in the enclosure, and keeping external radio frequencies from entering the enclosure. The module is designed to help guarantee proper airflow.

For more information on the BA440 enclosure, see *Entry Systems Service Information Kit* (QZ-K19AA-GZ).

1.2 MS670 Memory Modules

The MS670 memory modules are designed for systems that use the KA670 CPU in a BA440 enclosure. There are two types of memory modules for this system which include MS670-BA and MS670-CA.

The MS670-BA (module designation L4001-BA) is a standard, fingerless, quad-size circuit board that provides 32 Mbytes of MOS memory using 1x1 Megabit dynamic RAMs (DRAMs) in SOJ (small outline J) surface mount packages. The MS670 memory module uses 1 Megabit dynamic RAMs (DRAMs) in SOJ (small outline J) surface mount packages. The MS670-CA (module designation L4001-CA) is a similar quad-size circuit board that provides 64 Mbytes of MOS memory using 4x1 Megabit dynamic RAMs in SOJ surface mount packages. When required, the SOJ package allows the memory chips to be mounted on both sides of the memory module, thereby allowing for double the capacity per memory module.

Memory is arranged in a 39-bit wide array—32 bits of data and 7 bits of error correction code (ECC).

The KA670-based system allows for any combination of up to four MS670-BA/MS670-CA memory arrays. Memory modules connect to the KA670 CPU through the backplane on 150-pin, high-density connectors.

Operating System Support

VMS

VAXELN

See the KA670 maintenance manual for more details.

Diagnostic Support

MDM

KA670-A ROM-based
diagnostics

2

Installation

This chapter provides step-by-step procedures for software backup, powering down the system, unpacking, inspecting, installing, and testing the MS670 memory module(s) in a BA440 enclosure. This chapter also discusses system and module configuration.

WARNING

The following installation instructions provide specific directions for the safe installation of the memory. To protect yourself from possible shock or energy hazards, do not try to access or disassemble parts of the equipment other than those specified. Refer servicing of parts, other than those specified, to qualified personnel.

CAUTION

Only qualified service personnel should remove or install modules.

2.1 Software Backup and Operating System Shutdown

It is the responsibility of the customer to perform a software backup and shutdown of the operating system software.

Make sure the customer backs up the software and shuts down the operating system software before you perform the installation.

2.2 Unpacking and Inspecting

Perform the following steps to unpack and inspect the add-on memory module(s).

1. Unpack the shipment and check the contents as follows. If any item is missing or damaged:
 - Contact the customer's sales representative.
 - Contact the customer's delivery agent.

2. Look for external damage on the shipping package, such as tears, holes, or crushed corners.
3. Remove the memory module(s) in the antistatic bag from the package, but leave the memory module(s) in the antistatic bag.
4. Do not dispose of the packing material until you have installed the memory module(s) and tested the system successfully.
5. Put on your antistatic wrist strap. Attach the alligator clip to the metal chassis of the BA440 enclosure. Place the antistatic mat on your work surface. The ground strap has a snap that connects to the mat.
6. Remove the memory module(s) from the antistatic bag and place them on the antistatic mat.
7. Inspect the memory module(s) for damage that may have occurred during shipping. Carefully check for cracks, breaks, and loose components.

2.3 Testing the Existing System

Test the existing system as follows.

1. Turn the 1/0 power switch on (1 position).
2. Load the MicroVAX Diagnostic Monitor (MDM) from disk, tape, or Ethernet. Refer to the *MicroVAX Diagnostic Monitor Users Guide* (EK-AA-FM7AB-DN) for information on the usage of MDM.
3. Test the existing system to make sure it is running properly. Refer to the *KA670 CPU Systems Maintenance Manual* (EK-347AA-MG-001) for information on testing and troubleshooting.
4. After the successful completion of the test, turn the 1/0 power switch off (0 position).

2.4 Checking the System Configuration

Before you install the MS670 memory module(s), you must complete a system configuration worksheet for your BA440 enclosure. This step ensures that you will not exceed the system's limits for power and bus loads. Refer to the *BA440 Enclosure Maintenance Manual* (EK-348AA-MG) for information on system configuration.

The current and power requirements for the MS670 memory modules are as follows:

MS670-BA Current — 3.25 A at +5 V; Power — 16.25 W

MS670-CA Current — 4.75 A at +5 V; Power — 23.75 W

MS670-BA/CA Current — 0.0 A at +12 V — 0.0 W

You do not set any jumpers or switches on the memory module. The memory address for the memory module is mapped by the system configuration which is established by the system software.

2.5 Powering Down the System

1. Unlock the system door by turning the rotary key lock (Figure 2-1) to position three (lowest position). This unlocks both the top and bottom halves of the door. Swing the door open.
2. To power off the BA440 enclosure, place the I/O power switch (on the right front of the enclosure) to the 0 position.

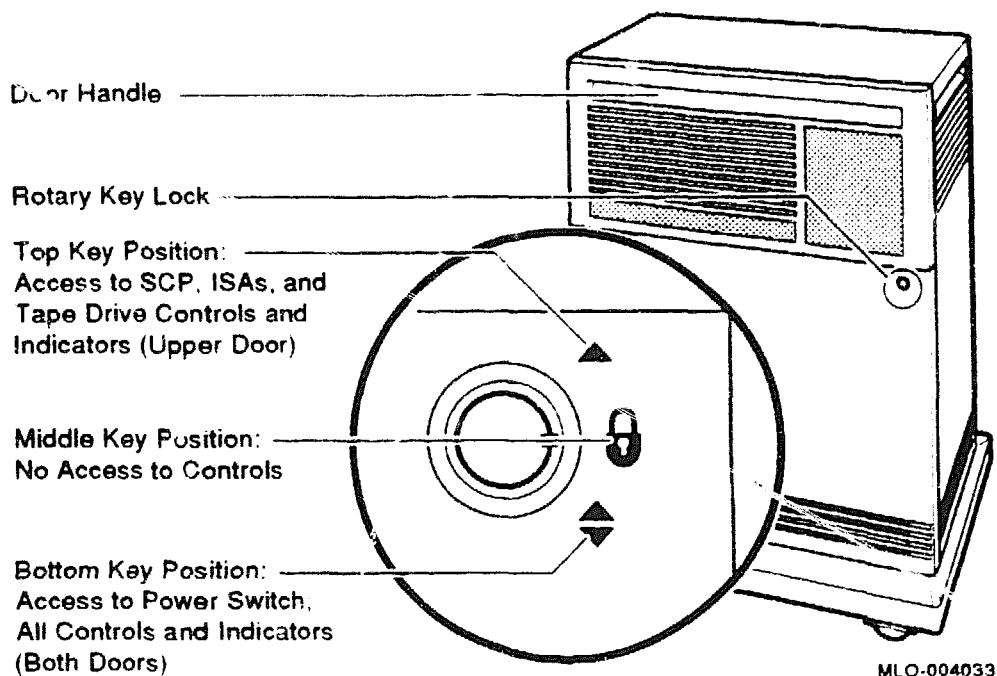


Figure 2-1 Pedestal Rotary Key Lock

2.6 Installing Add-on MS670 Memory Module(s)

Perform the following steps to install add-on MS670 memory module(s).

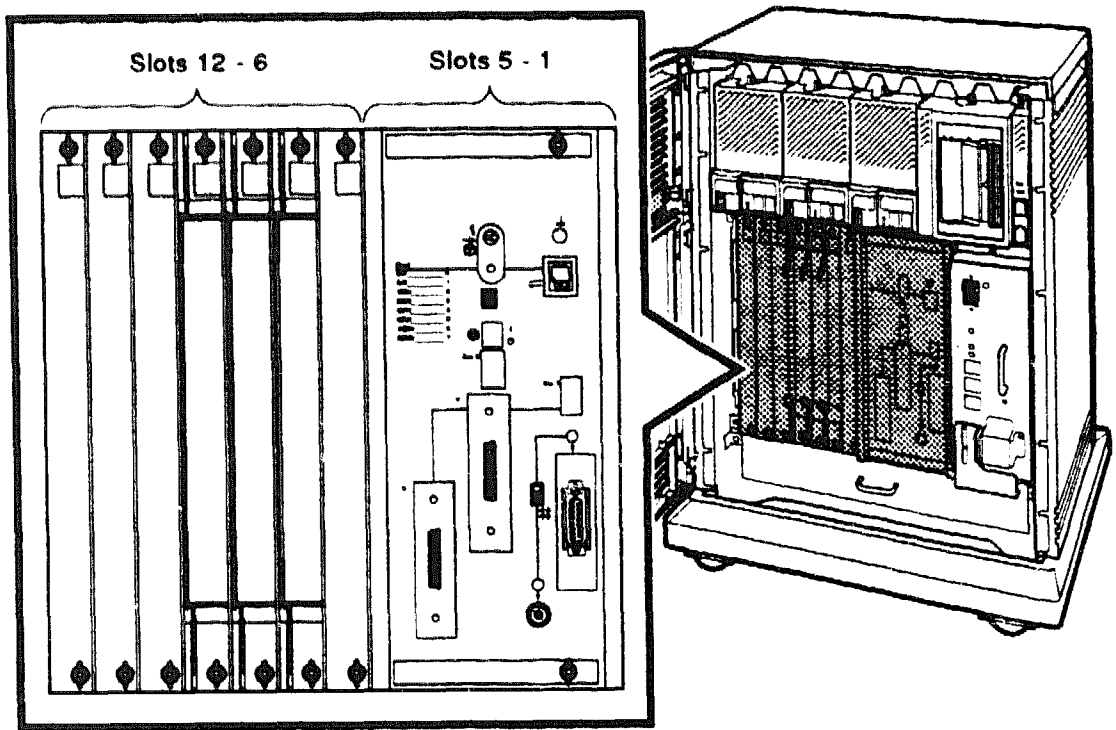
1. Two captive screws hold the console module (H3604) in place. To loosen, both screws should be turned counterclockwise. The console module is hinged on the left. Swing the assembly open. To tighten, both screws should be turned clockwise.

NOTE

The console module contains a hinged cover for the KA670 CPU module and the MS670 memory module(s). It also contains a ribbon cable which connects to the CPU module. A power harness connects to a paddle card which plugs into the backplane. This harness contains four wires and provides power to the console. The paddle card is located directly to the right of the CPU module.

2. The recommended procedure for installing memory module(s) into slots is to install the module(s) starting from the first empty slot, which is located on the right side of the paddle card (Figure 2-2). The H3604 power paddle card is located between the CPU module (slot 5) and the first memory module (slot 4).

The memory module(s) must be installed in adjacent slots with no empty slots between. Figure 2-2 shows the configuration. Slots 12 through 6 are Q-bus slots; slot 5 is the CPU slot; and slots 4 through 1 are the memory module slots. Figure 2-2 shows the H3604 console module in the closed position. The CPU and memory module(s) are located behind this cover.



MLO-004037

Figure 2-2 Backplane Configuration

NOTE

When plugging the memory module(s) into the backplane, the 150-pin connector mates with a 150-pin backplane connector. This backplane connector connects the CPU and all memory modules.

3. Make sure the ratchet handles on the memory module are facing you, and the 150-pin connector is facing to the right. Wearing the antistatic wrist strap, install the memory module in the first available memory slot to the right of the CPU. Ensure that the memory module is vertically aligned. Push the memory module in until the ratchet handles engage with the enclosure frame. Push the ratchet handles inward toward the rear of the cabinet until the memory module is firmly seated in the backplane. When the memory module is firmly seated, the ratchet handles will lock the module in place.

NOTE

MS670 memory modules are equipped with ratchet handles (Figure 2-3) which are shipped in a horizontal position. The ratchet handles are designed to keep the right amount of tension between the backplane and the module connector. This ratchet arrangement causes the memory modules to make tighter contact with the backplane bus and, thus, provides better system reliability as the memory modules are less likely to loosen in the backplane.

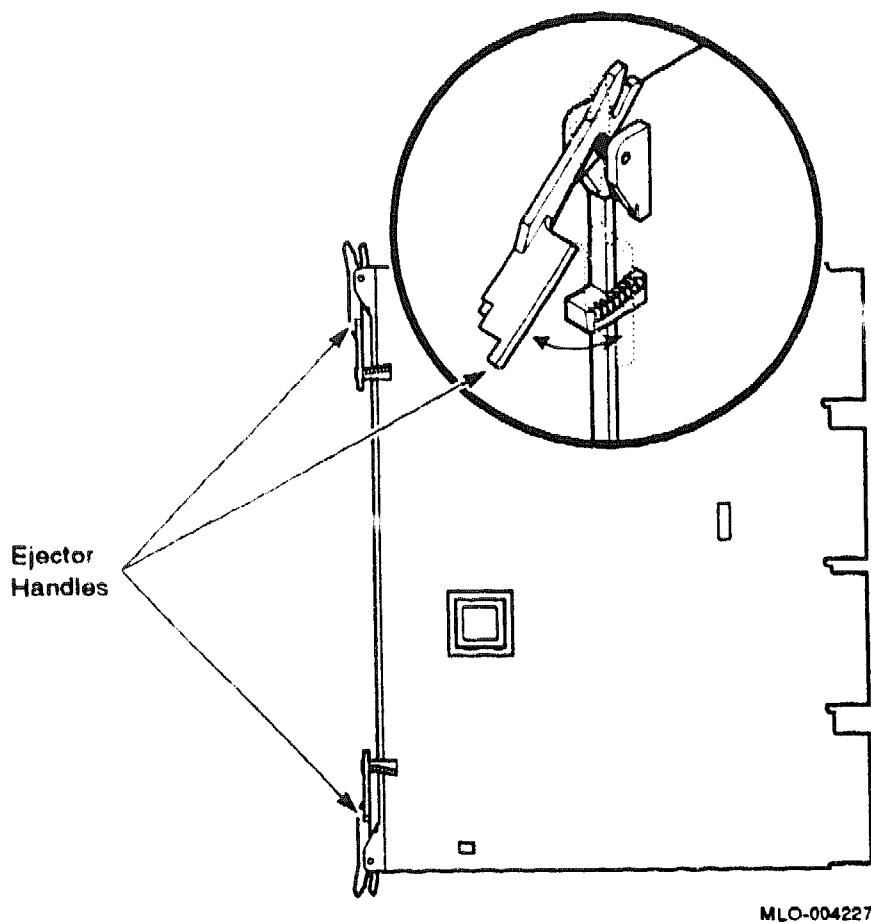


Figure 2-3 Memory Module Ratchet Handles

4. Close the H3604 console module and tighten the 1/4-turn captive screws.
5. To identify the memory module, place the MS670 option label (supplied in the option kit) in the proper location on the H3604 panel. Indicate the Revision number and memory option (BA or CA).
6. Run the verification tests described in the following chapter.

3

Testing the New Configuration

This chapter describes the tests and procedures you should use to complete the MS670 memory module installation.

3.1 Power-Up Self-Tests

The KA670 CPU has a ROM-based diagnostic facility. This facility is the primary diagnostic tool for troubleshooting and running acceptance tests on the CPU and memory subsystem.

The ROM-based diagnostics run automatically at power-up. You may also run them individually or as a whole, using the **T** test command (Section 3.2).

At power-up, the Diagnostic Executive program invokes the initial power-up tests (IPTs). While the tests are running, the LEDs on the CPU's console module display a hexadecimal countdown from F to 1. The console terminal also displays a countdown. This countdown varies slightly, depending on the different types of system consoles that use the serial line unit (SLU). An example of this is the VT series terminal.

Perform the power-up self-tests as follows.

1. Turn the 1/0 power switch on (1 position).
2. Observe the countdown display on the console to make sure the power-up self-tests run successfully. Example 3-1 shows a successful countdown display. Example 3-2 shows an error display.

3-2 Testing the New Configuration

KA670-A V3.1, VMB 2.11

Performing Normal System Tests

66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..

Tests completed

>>>

Example 3-1 Display With No Errors (VT Terminal Connected to Console SLU)

```
?81 2 02 FE 0060 0005 00 ; SUBTEST_81_02, DE_QBUS_MSCP.LIS
P1=20001468 P2=00000000 P3=2000146A P4=00000000 P5=20050E00
P6=00000001 P7=00000000 P8=00000000 P9=00000000 P10=01FC49D1
r0=000000E1 r1=2004E9BD r2=201405D5 r3=00000081 r4=20053CD7
r5=20053D07 r6=2006022E r7=00000000 r8=FFFFFFFF EPC=20052A37
Normal operation not possible
```

Example 3-2 Sample Error Display

The power-up self-tests should complete successfully. If the power-up self-tests do not complete successfully, refer to the *KA670 CPU System Maintenance Manual (EK-347AA-MG-001)* for detailed information on troubleshooting procedures.

3.2 Acceptance Tests

The acceptance tests are also part of the KA670 ROM-based diagnostics. After the power-up self-tests run successfully, perform the acceptance tests as follows.

1. >>> is the console prompt. At this prompt, type the following command.

>> >Unjam

The Unjam command performs a reset of the I/O bus.

2. Type the following command.

>>>Init

The Init command performs an initialization of the processor registers.

NOTE

Test 9E provides a complete list of ROM-based diagnostics including the acceptance tests. It is only necessary to run the acceptance tests which are described below.

3. Type the following command.

```
>>>R T 0 
```

This test invokes the power-up scripts. Typing R in the command line allows continuous passes of the power-up scripts. One pass is shown below. Run five error-free passes. Type Ctrl C to terminate the scripts.

```
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
```

If a hard error occurs, the screen will display an error dump listing the contents of the system registers at the time of the error. The example below shows a typical error dump. The error dump will vary from case to case. If an error occurs, refer to the *KA670 CPU System Maintenance Manual (EK-347AA-MG-001)*.

```
?81 2 02 FE 0060 0005 00          ; SUBTEST_81_02, DE_Q-bus_MSCP.LIS
P1=20001468 P2=00000000 P3=2000146A P4=00000000 P5=20051A00
P6=00000001 P7=00000000 P8=00000000 P9=00000000 P10=01FC49C5
r0=000000E1 r1=2004F6A9 r2=201405D5 r3=00000081 r4=20054B9F
r5=20054BCF r6=20060DF6 r7=00000000 r8=FFFFFFFF9 EPC=20053637
Normal operation not possible.
```

4. Type the following command.

```
>>>t 30 0 0 0 1 
```

This command enables mapping out of single-bit and multi-bit hard errors using test 30.

5. Type the following command.

```
>>>T A1 
```

This command line runs script A1 which runs the CPU and memory tests without resetting the bitmap to mark hard multi-bit ECC errors. It provides a quick check of memory since most tests run on a 256 Kbyte boundary.

6. Type the following command.

```
>>>T A8 
```

The above command line runs script A8 for one pass. This enables mapping out of hard single-bit and multi-bit errors, and runs script A7 for

3-4 Testing the New Configuration

one pass. Run script A7 for a second pass. To do this, type the following command.

```
>>>R T A7 
```

This command runs the memory tests only without resetting the bitmap. Type Ctrl C to terminate the script. This test may take up to 5 minutes per pass, depending on the amount of memory in the system. Most of the diagnostics test memory on a page boundary.

If any of the memory tests fail, they mark the bitmap and continue with no error printout to the console except for test 40 (Count bad pages). If any ECC errors are detected, they are reported in test 40. Refer to the *KA670 CPU System Maintenance Manual (EK-347AA-MG-001)* for details.

7. Type the following command.

```
>>>Show memory 
```

This command checks the memory configuration to make sure there are no missing memory modules. A sample printout is shown below.

```
Memory 0 : 00000000 to 001FFFFFF, 32Mb, 0 bad pages
```

```
Total of 32 MB, 0 bad pages, 112 reserved pages
```

```
>>>Show memory/full
```

```
Total of 32 MB, 0 bad pages, 112 reserved pages
```

```
Memory Bitmap
```

```
-01FF2000 to 01FF3FFF, 16 pages
```

```
Console Scratch Area
```

```
-01FF4000 to 01FF7FFF, 32 pages
```

```
Q-bus Map
```

```
-01FF8000 to 01FFFFFF, 64 pages
```

```
Scan of Bad Pages
```

```
>>>
```

In this example, memory 0 refers to the first memory module; memory 1 through 3 refer to subsequent MS670 memory modules. The Q-bus map always spans the top 32 Kbyte of good memory. The memory bitmap always spans 2 pages (1 Kbyte) per 4 Mbyte of memory configured.

8. Type the following command.

>>>T 9C Return

The system registers (in hexadecimal) are listed below.

```

SBR=01FB8000    SLR=00008015    SAVPC=80000011    SAVPSL=20054204    SCBB=20051A00
POBR=8C000000    POLR=00100A80    P1BR=00800000    P1LR=00600000    SID=0B000002
TODR=083CEBD8    ICCS=00000000    ACCS=00000000    MAPEN=00000000    BDMTR=20084000
TCR0=00000000    TIR0=00000000    TNIR0=00000000    TIVR0=00000078    BDMKR=0000007C
TCR1=00000001    TIR1=0714FF25    TNIR1=0000000F    TIVR1=0000007C    SCR=0000D000
RXCS=00000000    RXDB=00000011    TXCS=00000000    TXDB=00000030    DSER=00000000
PCSTS=00000808    PCERR=000044A0    PCIDX=000007F8    PCTAG=40000000    QBEAR=0000000F
BCSTS=01800000    BCCTL=0000000C    BCERR=200562C0    BCIDX=000007F0    DEAR=00000000
BCBTS=20000000    BCP1TS=21FF3804    BCP2TS=21FF3804    BCRFR=000198C0    QBMBR=01FF8000
BDR=B9FB08AD    DLEDR=0000000C    SSCCR=00D05570    CBTCR=00004000    IPCR0=0000
DSSI_1=06 (BUS_1)    PQBBR_1=02020022    PMCSR_1=00000000    SSHMA_1=00008A20
PSR_1=00000000    PESR_1=00000000    PFAR_1=00000000    PFR_1=00000000
DSSI_2=04 (BUS_0)    PQBBR_2=02020022    PMCSR_2=00000000    SSHMA_2=0000CA20
PSR_2=00000000    PESR_2=00000000    PFAR_2=00000000    PFR_2=00000000
NICSRO=1FFF0003    3=00004030    4=00004050    5=8039FF00    6=83E0F000    7=00000000
NICSRO9=04E204E2    10=00020000    11=00000000    12=00000000    13=00000000    15=0000FFFF
NISA=08-00-2B-12-79-79    RDES0=E820B941    1=1120B941    2=500201EF    3=00508F50
TDES0=FFFF8FD0    1=2CA9FFFF    2=64313011    3=FA56E900
MEM_FRU 1    MCSR_0=80000002    1=80800002    2=81000002    3=81800002
MEM_FRU 2    MCSR_4=00000006    5=00000006    6=00000006    7=00000006
MEM_FRU 3    MCSR_8=00000006    9=00000006    10=00000006    11=00000006
MEM_FRU 4    MCSR12=00000006    13=00000006    14=00000006    15=00000006
RMESR=00440044    RMEAR=00000000    RIOEAR=00080188    CEAR=00000000    MCDSR=260D0700

```

Each memory module has four associated memory configuration registers (MCSRs). A full capacity system has four memory modules and, consequently, bit 31 in all 16 memory configuration registers are set. Table 3-1, below, shows that memory module 0 has MCSRs 0 through 3 associated with it.

In the example above, note that MCSRs 0 through 3, have bit 31 set to 1. All other MCSRs have bit 31 set to 0. This indicates that only memory module 0 is present in the system.

Table 3-1, shows the CSRs associated with each memory module and the FRU input number.

Table 3-1 CSRs Associated with Each Memory Module

MCSR No.	Test FRU Input No.	Show Memory Identification
MCSR0-3	1	Memory module 0
MCSR4-7	2	Memory module 1
MCSR8-11	3	Memory module 2
MCSR12-15	4	Memory module 3

Use utility 9C to compare the contents of configuration registers (MCSR0-15) with the memory installed in the system.

One memory bank is enabled for each 4 Mbyte of memory. The MCSRs map to each memory module as shown in Table 3-2.

Table 3-2 MCSR/Module Mapping

MCSR No.	Memory Module	Slot
MCSR0-3	First MS670	4, closest to CPU
MCSR4-7	Second MS670	3
MCSR8-11	Third MS670	2
MCSR12-15	Fourth MS670	1, farthest from CPU

3.3 System Verification

Use the KA670 ROM-based diagnostics and the MicroVAX diagnostic monitor (MDM) to test a MicroVAX system. The MDM software provides the following five groups of menu-driven tests:

- | | |
|----------------------------------|-----------------------|
| 1. Verify mode functional tests | User or Field Service |
| 2. Verify mode exerciser tests | User or Field Service |
| 3. Service mode functional tests | Field Service |
| 4. Service mode exerciser tests | Field Service |
| 5. Utility tests | Field Service |

To verify the system, perform the following steps.

1. Perform the acceptance tests according to the procedures in the beginning of this chapter.
2. Place the tape labeled "MV DIAG MAINT TK50" into the TK drive.
3. Boot the MDM media by typing B MUA0. The screen shown below appears.

MDM Introductory Screen

```
MicroVAX Diagnostic Monitor      Release nnn Version Vxx.x
                                CONFIDENTIAL DIAGNOSTIC SOFTWARE
                                PROPERTY OF
                                DIGITAL EQUIPMENT CORPORATION
                                USE AUTHORIZED ONLY PURSUANT to a Valid Right-to-use License
                                Copyright (c) 1987, 1988, 1989
                                Digital Equipment Corporation
                                The current date and time is: 6-AUG-1989  15:14:57.18
                                Press the RETURN key to continue,
                                or enter the new date and time; then press the RETURN key.
                                (DD-MMM-YYYY HH:MM):
```

4. Type the appropriate date and hour. The screen shown below appears.

Mode Selection Screen

```
The current date and time is: 6-AUG-1989 15:15:21.23
Do you want to use Menu Mode or Command Line Mode?
  1 - Menu Mode
  2 - Command Line Mode
Type the number; then press the RETURN key.  >
```

5. Type 1 (main menu mode). The screen shown below appears.

MDM Main Menu

3-8 Testing the New Configuration

MAIN MENU

Release nnn Version Vxx.x

- 1 - Test the system
- 2 - Display the System Configuration and Devices
- 3 - Display the System Utilities Menu
- 4 - Display the Services Menu
- 5 - Display the Connect/Ignore Menu
- 6 - Select single device tests

Type the number; then press the RETURN key. >

6. Type 2. The system is now ready for testing and displays the system configuration and devices.
7. Press the Return key to continue.
8. Look at the list of devices displayed to make sure the new module is listed along with the existing modules and devices. If not, refer to the *KA670 CPU System Maintenance Manual (EK-347AA-MG-001)* and perform the appropriate troubleshooting procedures.
9. Type 1. This returns the main menu on the display. The screen will display the pass/fail condition of each device. If a device fails, refer to the *KA670 CPU System Maintenance Manual (EK-347AA-MG-001)* and perform the appropriate troubleshooting procedures.
10. Close and secure the front door of the system. Reboot the operating system and run AUTOGEN. Refer to *Guide to Setting Up a VMS System (AA-LA25A-TE)*, found in Volume 1A section 6 of the VMS documentation set (version 5.0).