Memory Channel

User's Guide

Order Number: EK–PCIMC–UG. A01

This book presents the hardware, installation, and verification
information needed to install and prepare a Memory Channel
cluster for booting an operating system.

Contents

Figures

Tables

Preface

Intended Audience

This manual is written for customers with Memory Channel cluster hardware. It includes information on configuration, installation, verification, and troubleshooting. Do not mix this hardware with any earlier versions of Memory Channel hardware.

Document Structure

This manual uses a structured documentation design. Topics are organized into small sections for efficient reference. Each topic begins with an abstract. You can quickly gain a comprehensive overview by reading only the abstracts. Next is an illustration or example, which also provides quick reference. Last in the structure is descriptive text or instructions.

This manual has four chapters, as follows:

- **Chapter 1, Hardware and Configuration,** describes the Memory Channel hardware, option kits, and configuration requirements.

- **Chapter 2, Installation**, shows how to install the Memory Channel PCI adapter and hub.

- **Chapter 3, Verification,** shows how to verify the installation of the hardware prior to installing the operating system or scientific application.

- **Chapter 4, Troubleshooting,** explains how to proceed if problems arise.

Conventions

The AlphaServer 2100 console output is used as the default console in examples. Changes for other supported systems' consoles are noted only when the output varies considerably from the default example. For additional information on your systems' consoles, refer to your system user's guides.

All references to AlphaServer 8X00 systems also apply to GS 60/140 systems.

For More Information

Memory Channel Hardware Documentation

P/N	Title
EK–CCMFB–IN	*Memory Channel Installation Card*
EK–PCIMC–SV	*Memory Channel Service Information*

Online Documentation Related to Memory Channel Systems

Address or URL	Information
http://www.digital.com/info/ alphaserver/products.html or ftp://ftp.digital.com/pub/Digital/ Alpha/systems/	Click on the system of your choice; then click on "docs/" and select the desired item.
http://ftp.digital.com/pub/Digital/ Alpha/firmware or ftp://ftp.digital.com/pub/Digital/Alpha/ firmware	Firmware for the AlphaServer systems
http://www.digital.com/info/SOC	*DIGITAL Systems and Options Catalog*, a hardware ordering and configuration guide

DIGITAL UNIX Documentation Related to Memory Channel

P/N	Title
AA–ROJAC–TE	TruCluster Software™ *Products Release Notes*
AA–R88GA–TE	TruCluster Software *Products Hardware Configuration Guide*
AA–R88HA–TE	TruCluster Software *Products Software Installation Guide*
AA–R88JA–TE	TruCluster Software *Products Administration Guide*
AA–R88KA–TE	TruCluster Production Server Software *Datagram Service Application Programming Interfaces Guide*
AA-QL8BC–TE	TruCluster Production Server Software *Application Programming Interfaces Guide*
AA-QTN4C–TE	TruCluster Production Server Software *Memory Channel Application Programming Interfaces Guide*
EK–BA350–CG	*StorageWorks™ Solutions: Configuration Guide*

OpenVMS Documentation Related to Memory Channel

P/N	Title
AA–Q28LB–TK	*Guidelines for OpenVMS Cluster Configurations*
AA–QSBTB–TE	*OpenVMS Version 7.1 Release Notes*

DECevent Documentation

P/N	Title
AA–QAA6B–TE	*DECevent Release Notes for DIGITAL UNIX Users*
AA–QAA4C–TE	*DECevent Analysis and Notification Utility for DIGITAL UNIX User and Reference Guide*
AA–Q73LD–TE	*DECevent Analysis and Notification Utility for OpenVMS User and Reference Guide*
AA–QAA5C–TE	*DECevent Event Management Utility for DIGITAL UNIX Installation Guide*
AA–Q73JD–TE	*DECevent Event Management Utility for OpenVMS Installation Guide*
AA–QAA3C–TE	*DECevent Translation and Reporting Utility for DIGITAL UNIX User and Reference Guide*
AA–Q73KD–TE	*DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide*
AA–QE26B–TE	*The DECevent Graphical User Interface User's Guide*

Chapter 1

Hardware and Configuration

This chapter introduces the Memory Channel (MC) technology and describes the hardware components. Sections include:

- Memory Channel Hardware

- Option Kits

- Memory Channel Configurations

- Multi-Channel Configurations

- System Configuration Requirements

- Operating System Requirements

**Check your system requirements
before installing hardware
(see Section 1.5).**

UG21A-99

1.1 Memory Channel Hardware

The Memory Channel hardware components are the CCMAB PCI adapter, the BN39B link cable, the CCMHB hub, and the CCMLB linecard. Fiber communication requires the CCMFB optics module and BN34R fiber optics cable.

Figure 1-1   Memory Channel Hardware

CCMAB PCI Adapter

BN39B Cable

CCMLB Linecard

CCMFB Module

CCMHB Hub

BN34R Cable

UG211-99
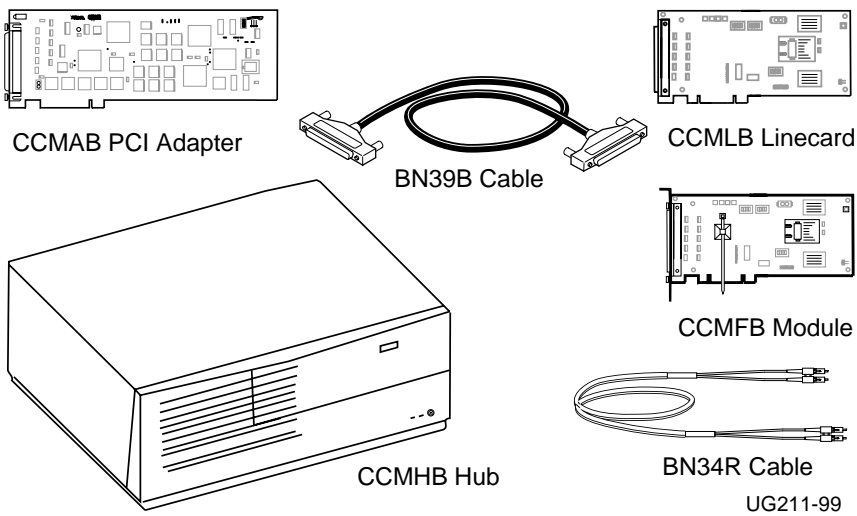
NOTE: Memory Channel Version 2 components are not to be mixed with Version 1.0 or 1.5 components.

- The CCMAB PCI adapter is a standard PCI module supported on servers with PCI. At least one CCMAB adapter is installed in each cluster member's PCI bus.

- The CCMHB hub is a PC-class enclosure with a motherboard, linecards, power supply, and cooling system. One linecard is dedicated to each member of the cluster. The hub supports up to eight nodes.

- The black BN39B link cable connects each CCMAB PCI adapter to the CCMHB hub in standard hub mode (two or more systems) or to another CCMAB in virtual hub mode (two systems only). The cable is available in 4 and 10 meter (13.1 and 32.8-ft) lengths and is a 100-wire cable (50 twisted pairs).   A 1-meter version (BN39B-01) is used when using fiber optics.

- Two CCMFB modules and a BN34R fiber optics cable are used when connecting two nodes using fiber optics. Each CCMFB fiber optics module occupies one PCI slot (or hub slot) and is connected to the CCMAB adapter with the BN39B-01 cable. The CCMFB converts the BN39B signal and transmits it by the BN34R fiber optics cable to the other system's CCMFB. There it is converted and transmitted by the second BN39B to the second system's CCMAB. The BN34R single-mode fiber cable is available in two lengths, 10 meters and 31 meters (32.8 and 101.7-ft).

Table 1-1   CCMHB Specifications

Environmental				
Temperature	10° to 40° C (50° to 104° F) operating			
	−40° to 66° C (−40° to 151° F) storage			
Humidity	10% to 90% RH noncondensing			
Physical				
Weight	14.5 Kg (32 pounds)			
Dimensions	46 cm x 43 cm x 13 cm (18 in. x 17 in. x 5 in.)			
Electrical				
Input voltage (nominal)	100–120 VAC		220–240 VAC	
Input frequency	50–60 Hz		50–60 Hz	
Peak input current (steady state)	1.6 A		0.9 A	
Power consumption (typical)	100 W		100 W	
Acoustical				
Declared values per ISO 9296 and ISO 7779	Sound Power Level LwAd, B		Sound Pressure Level LpAm, dBA	
Product	Idle	Operate	Idle	Operate
	5.2	5.2	36	36

[Current values for specific configurations are available from Compaq representatives. 1 B = 10 dBA.]

1.2 Option Kits

The MC hardware is available in seven option kits: the hub (CCMHB), the PCI adapter (CCMAB), the hub linecard (CCMLB), the optics module (CCMFB), a link cable (BN39B), a fiber cable (BN34R), and a rackmount kit (2T-MAVRK).

Figure 1-2   Basic Option Kits
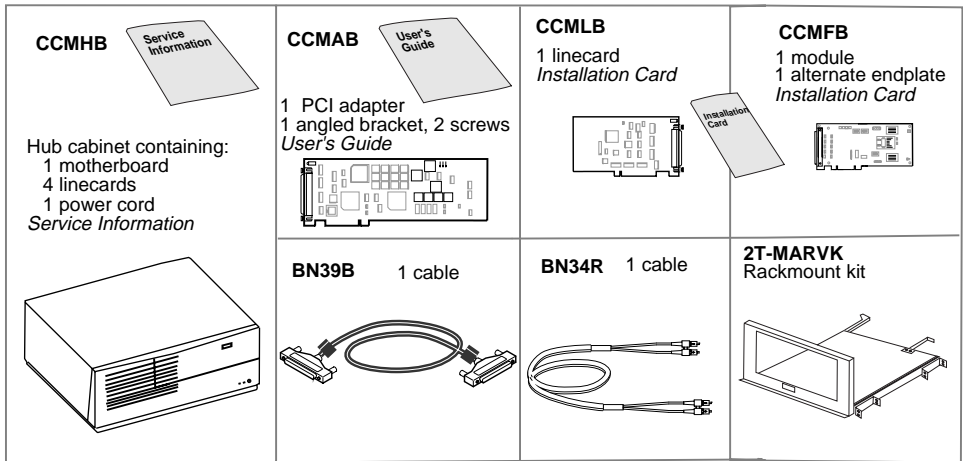
UG212-99

Figure 1-3   Option Kit Numbering

CCM *a b - nm*

Memory Channel prefix

Option variations

Component type:
PCI Adapter (CCMAB) = A
Optics Module (CCMFB) = F
Hub (CCMHB) = H
Linecard (CCMLB) = L

Component version:
B = Memory Channel 2
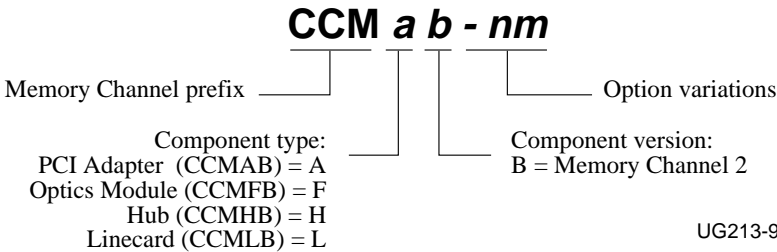
UG213-99

You will use two or more of the following option kits when installing or upgrading a system:

CCMAB-AA   MC PCI adapter, one needed for each system in the cluster. Comes with a straight extender installed on the card. An angled bracket with two screws is also enclosed and is used instead of the straight extender for some PCI slots.
The hub is not required in a two-node system. You can connect two systems with two CCMAB adapters, cabling them directly together (virtual hub mode) with one cable, the BN39B.

CCMHB-AA   Hub, required for a cluster of three or more nodes (standard hub mode). Includes a power supply, fan, and additional logic. Ships with four linecards installed. For a cluster with five or more fiber nodes, an additional hub, the CCMHB-BA version with no linecards, is used.

CCMLB-AA   Hub linecard. One linecard is needed for each CCMAB in a standard hub mode cluster. Extra linecards can be ordered and installed in the hub as spares or for failover.

CCMFB-AA   Optics module, required when the fiber optics cable, BN34R, is used. The CCMFB comes with two endplates; the attached one is used when installing the CCMFB in a PCI slot. The alternate is used when installing the CCMFB in a hub.

BN39B-01,   A link cable with sleeved ferrite beads. You need one cable for
-04, -10   virtual hub mode, and one per system for standard hub mode, using a CCMHB hub. The cable is available in 1 meter (used with fiber optics), 4 meter, and 10 meter (3.3, 13.1, and 32.8 ft) lengths.

BN34R-10, -31   Fiber optics cable that connects two CCMFB modules. The cable is available in 10 meter (32.8 feet) and 31 meter (101.7 feet) lengths. Greater separations are possible using premises wiring.

2T-MAVRK-AA   Rackmount kit for installing a CCMHB hub in a 19-inch English or metric rackmount cabinet. Contact your local Compaq Customer Support Center for installation.

The *Memory Channel User's Guide* ships with the CCMAB kit, and the *Memory Channel Service Information* ships with the CCMHB kit.

For more information:

DIGITAL Systems and Options Catalog

1.3 Memory Channel Configurations

There are two basic modes of operation. In virtual hub (VH) mode, two systems (nodes) are connected directly with no hub. In standard hub mode, two or more nodes are connected through a hub. Each node may be configured with two hubs and/or two adapters to provide a multi-channel configuration for high availability.

Figure 1-4   Virtual Hub Mode
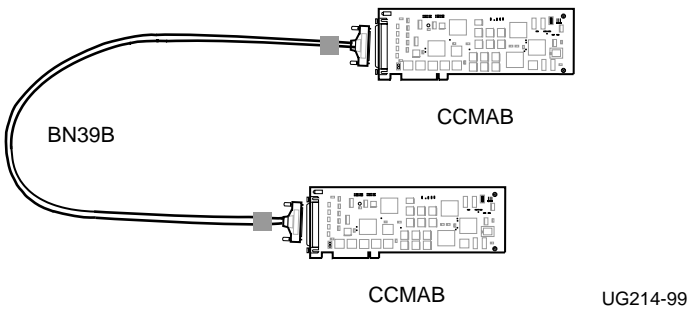
Figure 1-5   Standard Hub Mode
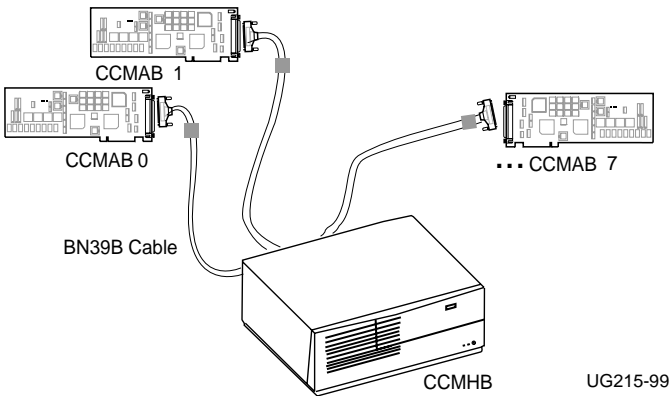
The CCMAB adapter's jumpers are set differently for each mode. See Section 2.3, Set Jumpers on CCMAB Adapters.

Depending on your operating system, a multi-channel configuration may be dual active paths (OpenVMS) or redundant paths for failover (DIGITAL UNIX). See Section 1.4, Multi-Channel Configurations.

Figure 1-4 illustrates a simple virtual hub configuration (see Figure 2-8 for a virtual hub configuration with fiber optics).

Figure 1-5 illustrates a simple standard hub configuration and Figure 1-6 illustrates a standard hub configuration using both copper and fiber cables. The hub can handle up to eight nodes, any number of which can be fiber. If more than five nodes are fiber, a second hub is required. If seven nodes are fiber, two hubs suffice with seven linecards and two fiber modules in one hub and five fiber modules in the second hub. If all eight nodes are fiber, three hubs are required; all eight linecards are installed in one hub and four fiber modules are installed in each of the other two hubs.

Figure 1-6 Mixed Copper and Fiber Cable Configuration

Mixed Copper (BN39B) and Fiber (BN34R) Configuation

UG216-99
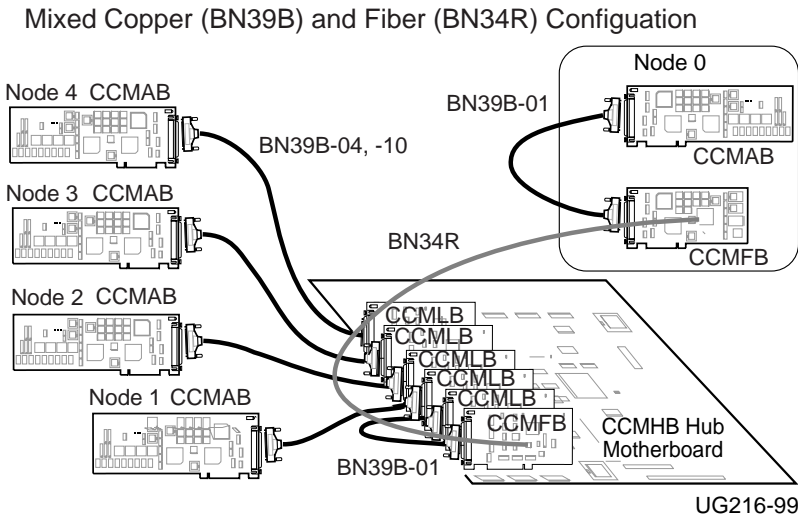
1.4 Multi-Channel Configurations

Each system or node may be configured with two Memory Channel adapters and two hubs to provide a multi-channel configuration for high availability.

Figure 1-7   Virtual Hub Multi-Channel Configuration
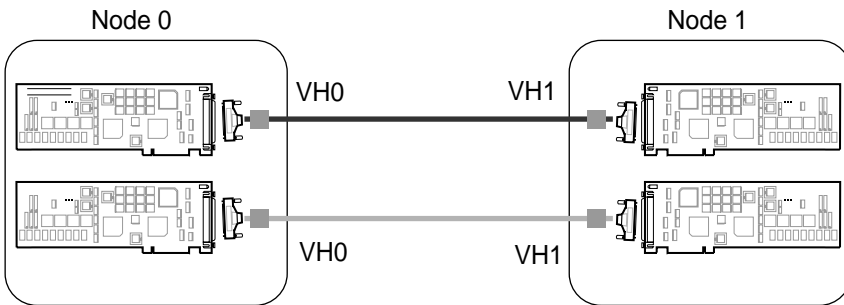
UG217-99

Figure 1-8   Standard Hub Mode Multi-Channel Configuration
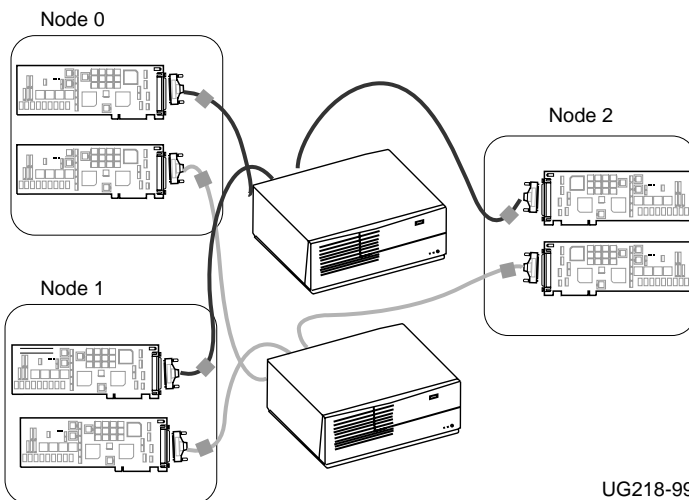
UG218-99

In a virtual hub multi-channel configuration, each of the two CCMABs in one node must have jumpers set the same, both to VH0 or both to VH1, as shown in Figure 1-7. (See Section 2.3, Set Jumpers on CCMAB Adapters.)

If you have two CCMAB adapters in each node in a standard hub system, each CCMAB must be connected to different hubs (Figure 1-8). That is, you may not connect one system's PCI bus to the same hub twice.

The operation of the multi-channel configuration depends on your operating system. When your system powers up, both CCMAB adapters come online. When your operating system boots, the operating system controls the status of the adapters.

DIGITAL UNIX Operating System

When DIGITAL UNIX boots, one MC channel and its CCMABs become active; the other rail and its CCMABs remain idle, ready for failover.

DIGITAL UNIX takes the node IDs of the cluster members from the cabling and jumper settings. In virtual hub mode, the node ID is determined by the CCMAB jumper settings.

Likewise, in a standard hub mode redundant configuration, each system must maintain its node ID. To accomplish this, cable both CCMABs in each system to the same linecard slot on each hub backplane. Node ID in standard hub mode is determined by the linecard slot to which the adapter is connected. When systems are cabled to each hub in the same way, on failover, node ID will not change.

OpenVMS Operating System

When OpenVMS boots, both MC channels are active initially with potential dynamic load balancing. If there is a failover, dynamic load balancing will be restored when all members of the cluster are rebooted. OpenVMS does not have any slot or node ID restrictions.

Figure 1-9 compares connecting a CCMAB adapter to another CCMAB adapter or CCMLB linecard with the BN39B link cable or with a BN34R fiber cable.

Figure 1-9   Copper and Fiber Cabling
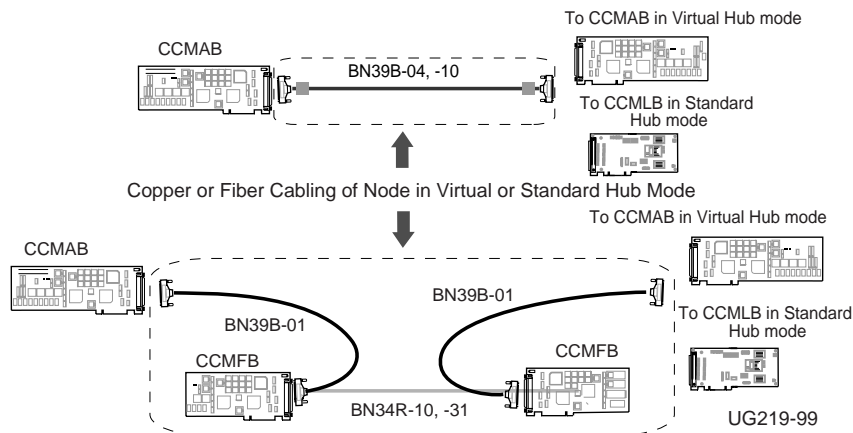
Figure 1-10   Multi-Channel Configuration using Fiber
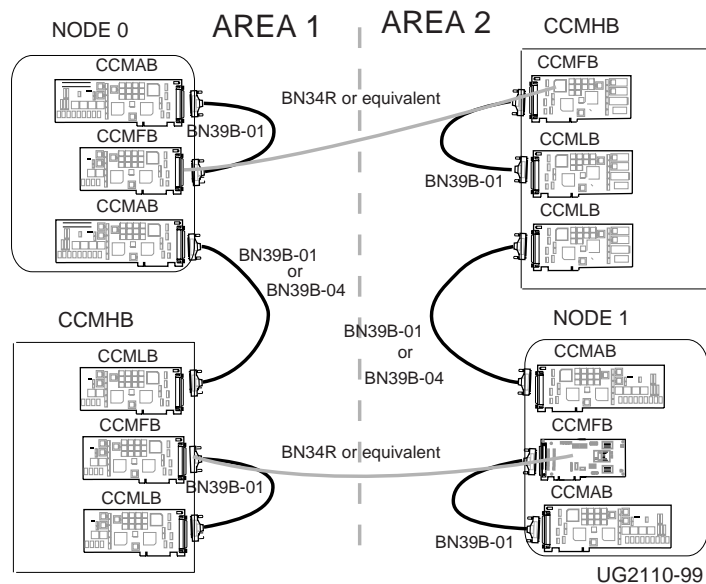
Figure 1-10 illustrates a multi-channel configuration with systems located in areas separated by up to three kilometers while Figure 1-11 illustrates an alternate configuration using fiber.

Figure 1-11   Alternate Multi-Channel Configuration using Fiber
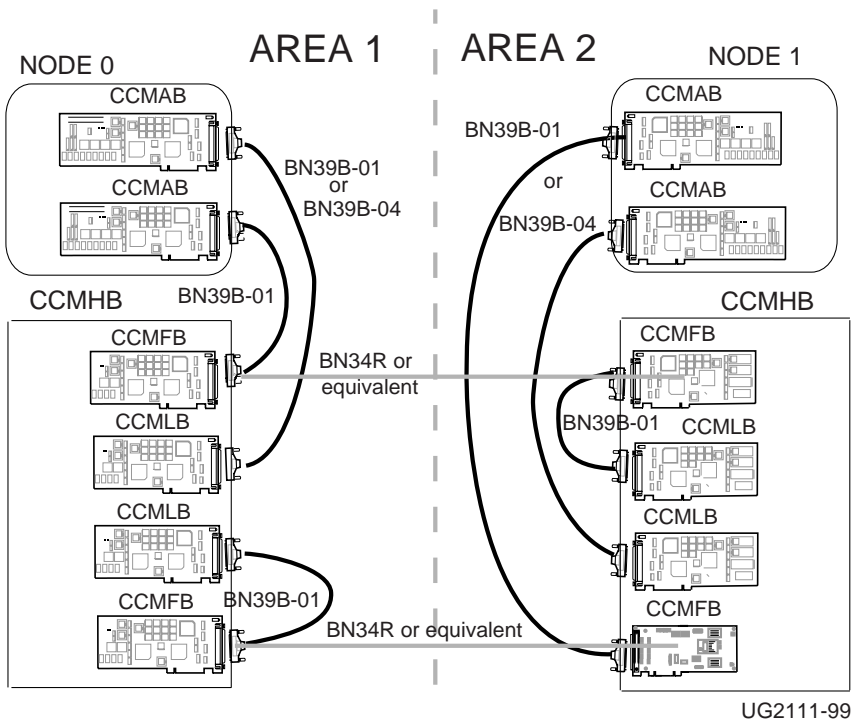
1.5 System Configuration Requirements

Your system-level applications or operating systems may place restrictions on the hardware not covered here. Check your system documentation and release notes. Console firmware for all systems must be at 5.0 Rev or higher. See also Section 1.6, Operating System Requirements.

1.5.1 AlphaServer 800/1000/1000A Requirements

- Runs OpenVMS or DIGITAL UNIX operating systems.

- For the AlphaServer 1000A, CCMAB adapters must be in PCI slots 11, 12, and 13, the top three slots.

1.5.2 AlphaServer 2000/2100 Requirements

- Check your system for Memory Channel readiness as shown in Example 1-1.

Example 1-1   Checking the AlphaServer 2000/2100 for MC Readiness

```
P00>>> examine -b econfig:20008   ❶
econfig:            20008 04       ❷
```

❶   At the console prompt, enter **examine -b econfig:20008**.

❷   If a hexadecimal value of **04** or greater is returned, your I/O module supports Memory Channel.

If you receive a value of less than four, contact your local Compaq Support Service Center for an upgrade. If your system is not hardware-ready for Memory Channel and you install MC hardware and power up, console error message #1 will result (see Section 4.1).

1.5.3 AlphaServer 2100A Requirements

- CCMAB adapter must be installed in one of the bottom four slots (see Figure 2-4). CCMAB adapters may not be installed in slots 0 through 3 or at power-up Memory Channel console error message #3 will result (see Section 4.1).

1.5.4 AlphaServer 4000/4100 Requirements

Under DIGITAL UNIX V4.0F with TruCluster Software V1.6

- For a single-channel configuration, the CCMAB adapter may be in any PCI slot.

- For a redundant configuration, the second CCMAB adapter must be on the same PCI bus as the first adapter, and in a higher slot number than the first adapter.

Under OpenVMS V7.1-1H2

- The CCMAB adapter(s) may be in any PCI slot.

1.5.5 AlphaServer 8200/8400 Requirements

- In a DWLPA, CCMAB adapters must be installed in PCI slots 0 through 7. No slot restrictions in the DWLPB.

- Under DIGITAL UNIX with multi-channel configurations, both CCMAB adapters must be in the same DWLPA/DWLPB card cage.

- Under OpenVMS with multi-channel configurations, only one CCMAB adapter may be in a DWLPA. You may have two CCMABs in a DWLPB, one in a DWLPA and one in a DWLPB, or one CCMAB in each of two DWLPAs.

1.5.6 Additional AlphaServer Requirements

For a current list of all supported systems, see the *DIGITAL Systems and Options Catalog.* Check your Memory Channel release notes for any additional requirements.

For more information:

Section 1.6, Operating System Requirements
Section 2.4, Install the CCMAB Adapters

1.6 Operating System Requirements

Your operating system may place restrictions on the hardware not covered here. Check your software documentation and release notes. See also Section 1.5, System Configuration Requirements.

1.6.1 DIGITAL UNIX Requirements

- Version V4.0F and TruCluster V1.6.

- When installing TruCluster Production Server Software, each system must have a KZPSA PCI-to-SCSI or KZPBA UltraSCSI adapter and shared SCSI devices if highly available services are desired.

- Unique SCSI ID, cable length limitations, and required slots are described in the TruCluster Software Products *Hardware Configuration Guide*.

1.6.2 OpenVMS Requirements

- Version 7.1-1H2 or higher.

- Each system must have an adapter (CI, DSSI, SCSI) for booting a system disk. The expected configurations are a shared SCSI bus, or a CI device with HSJ disk servers.

For more information:

Section 1.5, System Configuration Requirements
Section 2.4, Install the CCMAB Adapters
TruCluster Software Products *Hardware Configuration Guide*
Guidelines for OpenVMS Cluster Configurations

Chapter 2

Installation

This chapter describes the installation of Memory Channel hardware. Sections include:

- Overview
- Prepare the Systems
- Set Jumpers on CCMAB Adapters
    - — J1 – Hub Mode
    - — J3 – Window Size
    - — J4 – Page Size
    - — J5 – AlphaServer 8X00 Mode
    - — J10, J11 – Fiber Optics Mode
- Install the CCMAB Adapters
    - — Determine PCI Slot Position
    - — Install Adapter at Each Node
- Install CCMHB Hub
    - — Up to Four Linecards with No Fiber
    - — More Than Four Linecards or with Fiber
- Power Up and Check Status LEDs

2.1 Overview

Figure 2-1 shows the steps to install a Memory Channel system. *NOTE: Do not use the CCMAB module with the BN12N cable or attach a CCMAB module to a CCMAA module.*

Figure 2-1 Installation Overview

Step	Action	Reference
1	Prepare systems for MC hardware	Section 2.2
2	Set jumpers on CCMAB adapters	Section 2.3
3	Install CCMAB adapters	Section 2.4
4	Standard Hub Mode? Yes → Install CCMHB hub	Section 2.5
	No	Section 2.6
5	Power up systems, and check status LEDs	
	Proceed to verification	Chapter 3
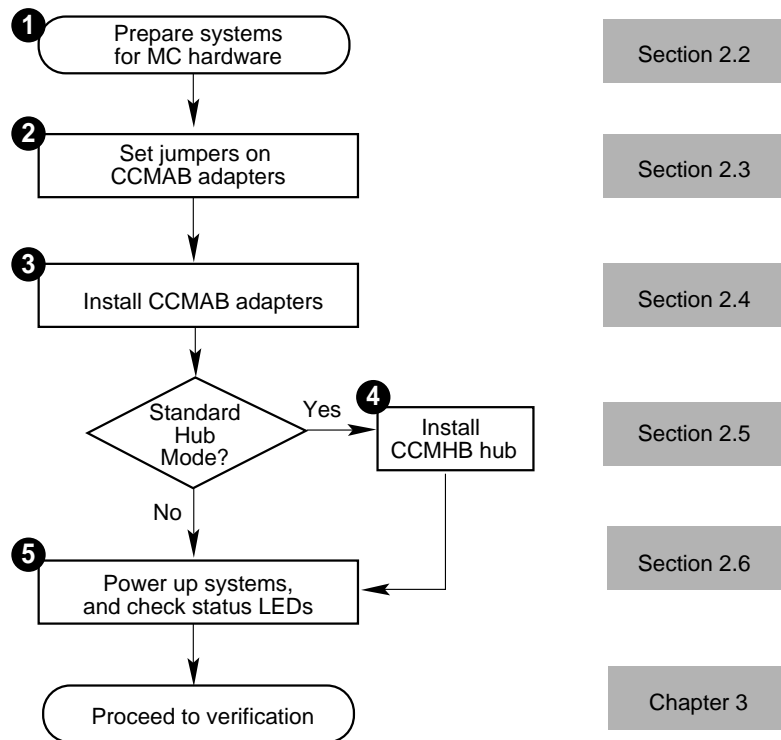
UG221-99

This chapter describes the complete MC hardware installation. An overview of these steps is shown in Figure 2-1. If you are installing a multi-channel configuration (see Section 1.4), repeat these steps on the second system.

❶ Prepare systems for MC hardware (see Section 2.2):

- Power off all systems.
- Position the systems within cable length of the hub (virtual or CCMHB).
- Open the system cabinets for access to the PCI.

❷ Set the jumpers on the CCMAB PCI adapters (see Section 2.3).

❸ Install the CCMAB adapters in each system's PCI (see Section 2.4).

- Determine PCI slot position.
- Determine correct module extension; change if needed.
- Install CCMAB adapter in PCI slot and cable.
  – For fiber, attach BN34R cable to CCMFB fiber optics module, install CCMFB in PCI slot, and connect CCMAB to CCMFB using 1-meter long BN39B-01 cable.
- For a virtual hub installation, skip step ❹ and go directly to step ❺.

❹ For a standard hub installation, install the hub (see Section 2.5). Check the input voltage selection switch on the hub.

- For more than four nodes, install additional CCMLB linecards.
- For fiber, install CCMFB fiber optics modules and cable:
  – Attach alternate endplate to CCMFB fiber optics module, attach BN34R fiber cable to CCMFB, install CCMFB in proper hub slot, and connect CCMLB to CCMFB using BN39B-01 cable.
  – Attach all BN34R cables from nodes to hub CCMFB fiber optics modules.

❺ Power up systems; check adapter placement and status LEDs (see Section 2.6).

Proceed to verification.

For more information:

DIGITAL Systems and Options Catalog
Your system's *AlphaServer Installation Guide*
TruCluster Software Products Hardware Configuration Guide
Guidelines for OpenVMS Cluster Configurations

2.2 Prepare the Systems

Perform an orderly shutdown of all systems. Position the systems within cable length of the hub, and open each cabinet to access the PCI card cage.

**Figure 2-2   Sample Configuration:
Four-Node AlphaServer 8400 MC Cluster with SCSI**
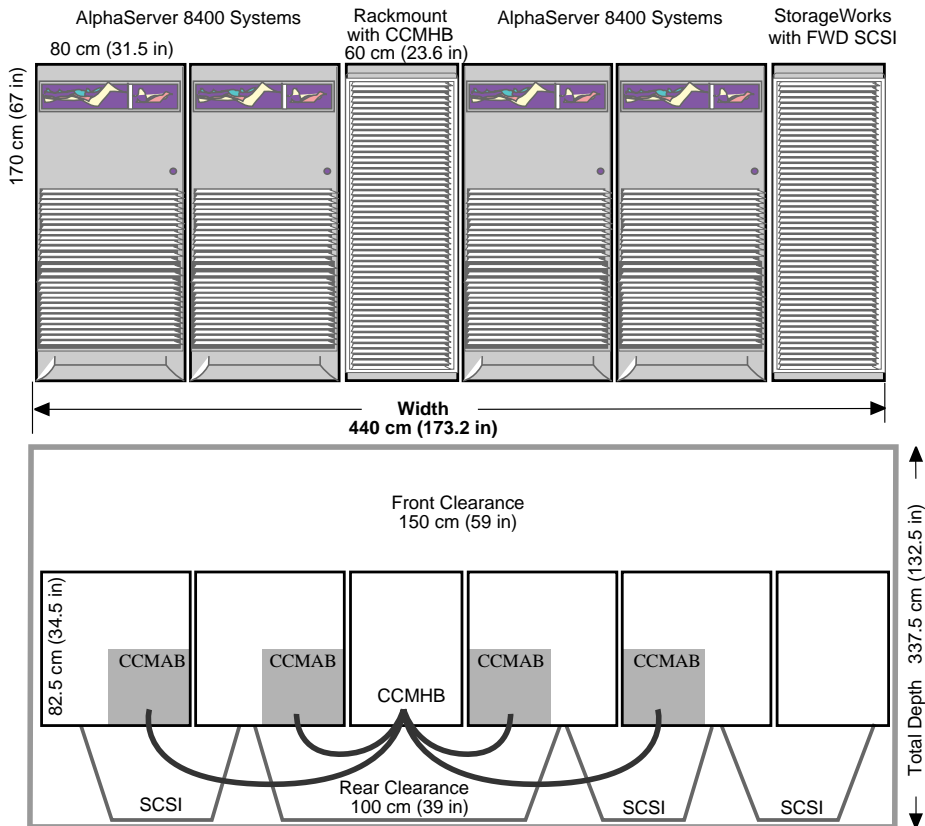
Prepare the systems for Memory Channel installation, as follows.

1 Shut down systems

1. Perform an orderly shutdown of the operating system.

2. Switch the system control panel to Off.

3. Shut off power within the system by setting the AC On/Off switch on each power supply to Off, or set the circuit breaker to Off, depending on the system's design.

4. Unplug the system power cord.

2 Position systems

Determine your configuration footprint and clearances.

If your operating system has additional hardware support requirements, plan for cabling limitations. Lay out the cables in preparation for installation.

The BN39B cable is available in 4 meter (13.1 ft) and 10 meter (32.8 ft) lengths. With fiber optics, much longer distances are achievable. Systems must be close enough to cable the backplanes to one another or to the hub.

3 Remove system panels

Open your system cabinet to access the PCI slots.

For more information:
DIGITAL Systems and Options Catalog
Your system's *AlphaServer Installation Guide*
Your operating system configuration requirements

2.3 Set Jumpers on CCMAB Adapters

Each CCMAB adapter has jumpers that must be set for hub mode, operating system, and for fiber optics.

Figure 2-3   CCMAB Jumpers

UG223-99
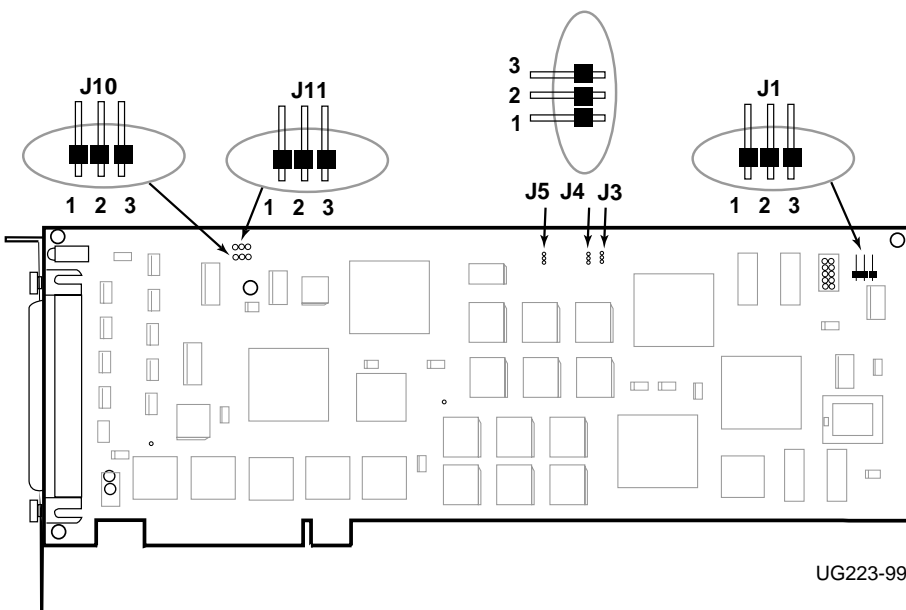
The CCMAB adapter ships with the following default settings:

- J1, Hub mode – Standard hub mode
- J3, Window size – 128MB
- J4, Page size – 8KB
- J5, 8X00 – 8X00 mode NOT selected
- J10, Optics clock enable – No fiber
- J11, Fiber enable – No fiber

Whenever you install a CCMAB adapter, you must set the jumpers for your configuration. The jumper numbers are on the adapter next to the jumpers.

1. Use an ESD ground strap when handling the modules.

2. Unpack the CCMAB PCI adapter.

3. Hold the adapter by the edges and set it on a secure, static-free surface.

4. Set the CCMAB jumpers for your configuration. If you are installing a redundant configuration under DIGITAL UNIX, both the first and second CCMAB adapters are jumpered the same way within a system.

2.3.1 J1 - Hub Mode

J1 is used to configure the module for one of three modes of operation depending on the cluster configuration. In virtual hub (VH) mode, two systems are cabled together directly without a hub. In VH mode, the J1 jumper on one CCMAB adapter must be set to Virtual Hub Node 0 (VH0) and the J1 jumper on the other CCMAB to Virtual Hub Node 1 (VH1). The J1 setting determines the node ID.

If the module is connected to an CCMHB hub (standard hub mode), then it is configured in standard (STD) mode and all CCMAB adapters must have the same J1 jumper configuration. If you are upgrading from a two-node virtual hub to a standard mode configuration with a CCMHB, check and change the J1 jumpers on all CCMAB adapters.

1 2 3	Standard Hub Mode (with hub hardware)
■■ ■	All Nodes: Jumper middle and left pins
	Virtual Hub Mode (no hub present)
■ ■■	Node 0: Jumper middle and right pin (VH0)
■ ■ ■	Node 1: No jumpers set (VH1)
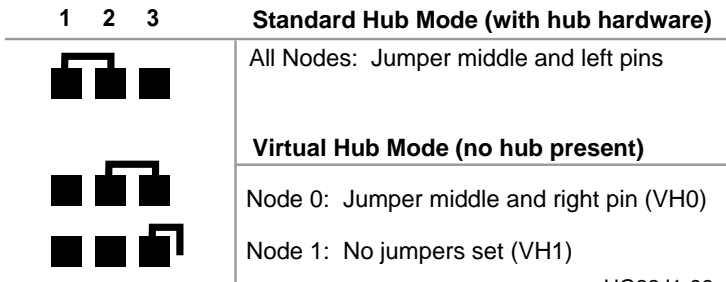
UG22J1-99

2.3.2 J3 - Window Size

This jumper selects either 128MB or 512MB MC address space. The size must be determined by jumper, since firmware that allocates PCI address space does so at power-up. OpenVMS uses the 128MB setting and DIGITAL UNIX uses the 512MB setting.

Window Size
128MB   512MB

J3   3
     2
     1

UG22J3-99
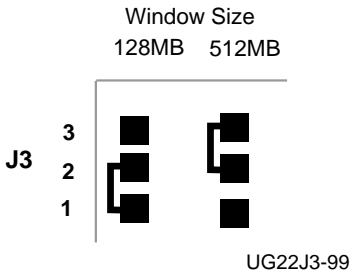
2.3.3 J4 - Page Size

Selects the size of each MC page. All nodes in the cluster must be configured with the same page size. Present operating systems use 8KB; 4KB is reserved for future use. This jumper may be overridden by the Module Configuration Register (MODCFG).

Page Size
8KB   4KB
(VMS/UNIX)

J4   3
     2
     1

UG22J4-99
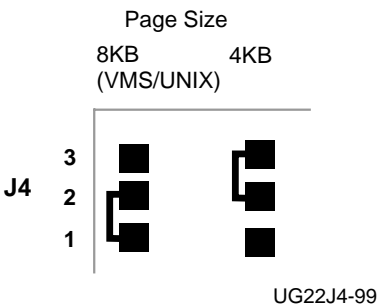
2.3.4 J5 - AlphaServer 8X00 Mode

Increases the maximum sustainable bandwidth of 8X00 platforms by 10MB/s. If this jumper is inadvertently set in any other platform, the maximum sustainable bandwidth will decrease by 10MB/s. This jumper may be overridden by the Module Configuration Register (MODCFG) in case the jumper is not installed properly.

8X00 Mode

8X00
mode   NOT
selected   selected

J5   3
      2
      1

UG22J5-99
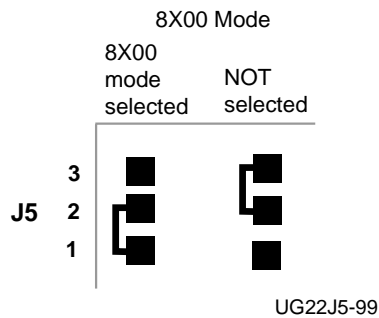
2.3.5 J10, J11 - Fiber Optics Mode

J10 (Optics Clock Enable) and J11 (Fiber Enable) must both be set the same way: *on* for fiber, when the CCMFB fiber optics module and BN34R fiber cable are used (see Section 2.6.4).

Fiber Off   Fiber On

1   2   3   1   2   3

J11   J11

J10   J10

UG2J1011-99
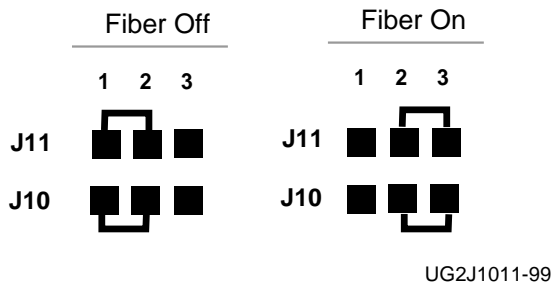
For more information:

Memory Channel Service Information

2.4 Install the CCMAB Adapters

2.4.1 Determine PCI Slot Position

**Determine the PCI slot for CCMAB installation carefully. Redundant systems
must have the mca0 module in the lower slot position. Installation in an EISA
slot will damage the CCMAB adapter. Check the slot position and change the
extender plate, if necessary. If using fiber, refer to CCMFB placement in 2.4.2.**

Table 2-1 CCMAB PCI Slot Position by System

AlphaServer	CCMAB PCI Slot Position
800/1000/	Any PCI slot
1000A	Slots 11, 12, 13
2000 family	See Table 2-2
4000/4100	Any PCI slot.
8200/8400	In a DWLPA, CCMAB adapters must be installed in slots 0 to 7. No slot restrictions in the DWLPB.
	OpenVMS: Only one CCMAB adapter may be in a DWLPA. You may have two CCMABs in a DWLPB, one in a DWLPA and one in a DWLPB, or one CCMAB in each of two DWLPAs.
	DIGITAL UNIX: Both CCMAB adapters must be in the same DWLPA/DWLPB, with the first adapter (mca0) in the lower slot.

1 Determine PCI slot position in each system

You will check slot positions in Section 2.4.1, and during verification in Section 3.7.

For DIGITAL UNIX in a multi-channel configuration, the first CCMAB adapter (to
be mca0) must be in the lowest available slot the console sees. The second CCMAB
(mcb0) adapter must be in the higher slot. This must be consistent across all
members of the MC cluster. All mca0's are attached to one hub, all mcb0's are
attached to the second hub.

For OpenVMS in a multi-channel configuration, the only restriction is that both
CCMABs from one system may not be attached to the same hub. The placement of
the CCMABs in the PCI bus relative to their hub connection is not important to
OpenVMS.

2 AlphaServer 2000/2100 family: check console slot positions

The console on the AlphaServer 2100 rackmount system "counts" the physical slots in opposite order from the 2000 family standalone systems. The standalone's bottom PCI slot is slot 8, while in the rackmount this same physical slot is slot 6. Figure 2-4 shows you the AlphaServer 2000 family's available slot positions at the bulkhead. Table 2-2 shows how these consoles count the slots differently.

Figure 2-4   Bulkheads for AlphaServer 2000/2100/2100RM/2100A
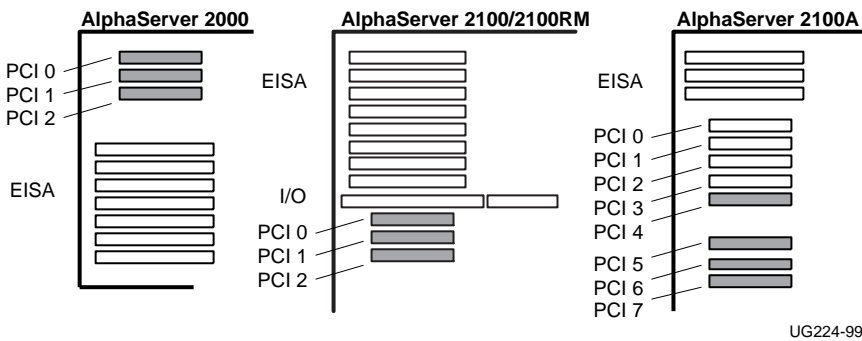
Table 2-2   Console ID and Bulkhead Numbers for PCI Slots

Bulkhead	2000	2100	2100 RM	2100A
PCI 0	Slot 1	Slot 6	Slot 8	Do not install CCMAB
PCI 1	Slot 2	Slot 7	Slot 7	Do not install CCMAB
PCI 2	Slot 3	Slot 8	Slot 6	Do not install CCMAB
PCI 3	—	—	—	Do not install CCMAB
PCI 4	—	—	—	Slot 6
PCI 5	—	—	—	Slot 7
PCI 6	—	—	—	Slot 8
PCI 7	—	—	—	Slot 9

3 Change the CCMAB adapter extender plate, if necessary

The adapter comes with a straight extender installed. Some systems require changing the extender to the angled bracket. Look at the physical slot you have chosen and change the extender plate if necessary.

2.4.2 Install Adapter at Each Node

Install the CCMAB adapter(s) in the PCI slots determined in Section 2.4.1. Secure the adapter's end connector to the system cabinet by securing the screws to the PCI bulkhead.   Attach the BN39B cable to the CCMAB connector. *NOTE: Do not use the BC12N cable with a CCMAB adapter, and do not connect a CCMAB adapter to a CCMAA adapter.*

Figure 2-5   BN39B Link Cable

UG225-99
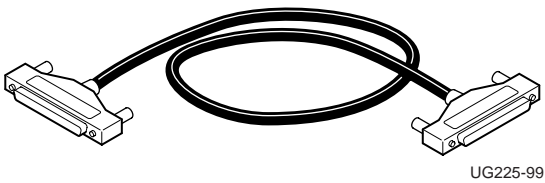
Table 2-3 BN39B Link Cable

Part Number	Option Number	Description
17-04563-01	BN39B-10	10-meter (32.8-ft) cable
17-04563-02	BN39B-04	4-meter (13.1-ft) cable
17-04563-03	BN39B-01	1-meter (3.3-ft) cable used with the CCMFB fiber optics module

If you are installing a redundant configuration, label each end of the BN39B cables with the system and adapter they connect (for example, "Node 1/mca0" and "Node 1/mcb0"). This labeling will save you time with checking for crossed rails as well as any future maintenance of the cluster.

1. Secure the CCMAB adapter(s) at the backplane, tightening the screw to hold it. This connects the module to ground.

2. If you are installing a redundant configuration, install the second CCMAB adapter now.

3. Cable the CCMAB adapter. With no fiber, go to **1 With No Fiber**, which follows. With fiber, skip **1 With No fiber** and go to **2 With Fiber**.

1 With No Fiber

1. Attach the labeled BN39B-04 or BN39B-10 link cable to each CCMAB adapter at the bulkhead.

2. Replace system panels. Repeat at all nodes. If you are installing a standard hub system, go to Section 2.5, Install Hub. Otherwise go to Section 2.6, Power Up and Check Status LEDs.

2 With Fiber

Each CCMFB fiber optics module occupies one PCI slot and is connected to the CCMAB adapter with the 1-meter long BN39B-01 cable. The CCMFB converts the BN39B signal and transmits it by the BN34R fiber optics cable to the other system's CCMFB. There it is converted and transmitted by the second BN39B-01 to the second system's CCMAB.

The BN34R single-mode fiber cable is available in two lengths, as shown in Table 2-4. If longer distances are required, an appropriately terminated drop cord can be used to connect to existing premises $9.0\,\mu$ Singlemode wiring, up to 2000 meters in length. To be compatible with the CCMFB optical transceiver, a low-profile SC duplex connector must be used. A connector height of 9.7mm (.38 inches) is readily available.

Table 2-4 BN34R Fiber Optics Cable

Part Number	Option Number	Description
17-04773-06	BN34R-10	10-meter (32.8-ft) cable
17-04773-09	BN34R-31	31-meter (101.7-ft) cable

Figure 2-6 Cabling at Node with Fiber Optics
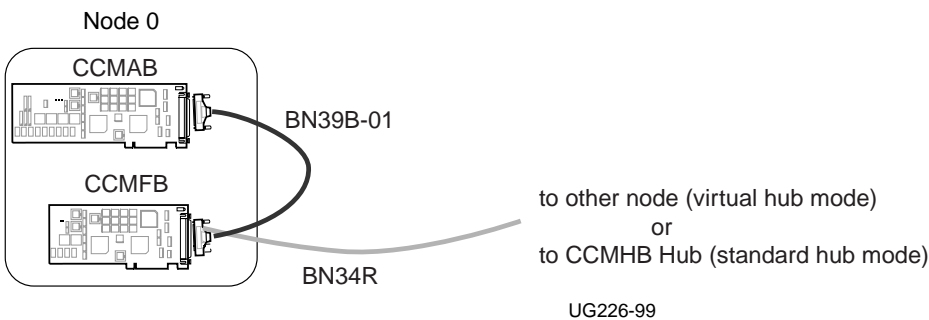
Figure 2-7   CCMFB Optics Module and BN34R Fiber Cable

PCI Endplate (74-52532-01)   Side View

D

A

C   B

E

Hub Endplate (74-52531-01)   UG227-98
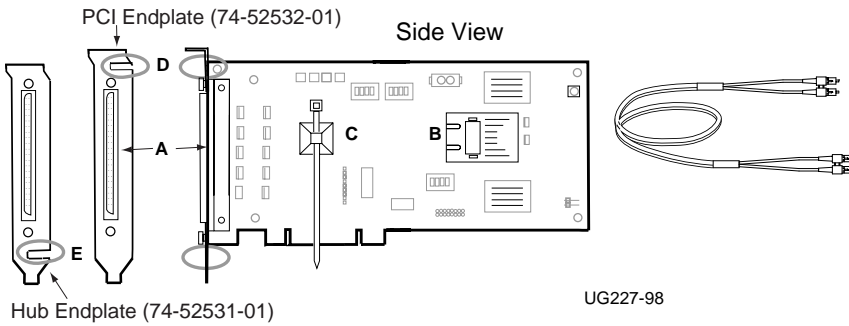
CAUTION: Handle fiber optics cables with care. Avoid sharp bends to avoid damage to the fiber. The minimum recommended bend radius for the BN34R cable is 5.08 cm (2 inches). Do not touch the unprotected plug ends. Any standard optical cleaning kit is acceptable to clean fiber cables.

Install the CCMFB module as follows:

1. Thread one end of the BN34R fiber optics cable through the PCI bulkhead slot and through the slot near the top of the endplate (see D, Figure 2-7). Remove the cable tip protectors and insert the Simplex connectors into the transceiver (see B, Figure 2-7) until they click in place. Tie-wrap the cable to the module using the tie-wrap (see C, Figure 2-7).

2. Seat the CCMFB module firmly into the PCI backplane and secure the module to the PCI card cage with the mounting screw. *NOTE: The CCMFB fiber module only gets power from the PCI slot. Software does not see the CCMFB in the slot, so there are no slot placement restrictions.*

3. Attach the 1-meter BN39B-01 link cable from the CCMAB adapter to the CCMFB optics module connector (see A, Figure 2-7). *NOTE: Make certain CCMAB jumpers J10, J11 are set to Fiber On (See Section 2.3).*

4. If installing a redundant configuration, install second adapter and fiber module.

5. Replace system panels. Repeat at all nodes. If you are installing a standard hub system, go to Section 2.5, Install CCMHB Hub. Otherwise go to Section 2.6, Power Up and Check Status LEDs.

2.5 Install the CCMHB Hub

If you have three or more systems, you will install a CCMHB hub. Unpack the hub, attach the power cord, check power switch setting, and plug in. Prepare to cable.

Figure 2-8   Hub (Rear View)

**CAUTION: Check voltage switch setting
before plugging into the wall outlet.
Incorrect voltage could damage your unit.**

Slot No.   7   6   5   4   3/opto 2/opto 1/opto 0/opto opto only

115

230
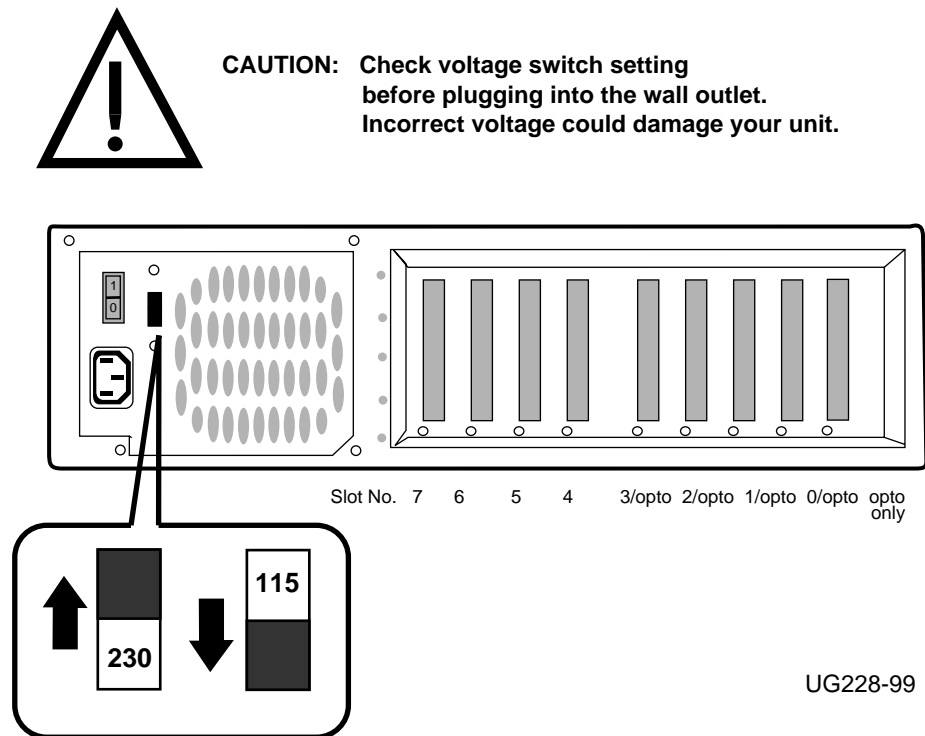
UG228-99

NOTE: Do not install CCMLA linecards in a CCMHB hub.

The CCMHB-AA hub comes with four linecards installed in slots 0/opto, 2/opto, 4, and 6 (see Figure 2-8). A blank endplate, secured with one screw, is installed in each of the remaining five slots to cover the opening in the rear of the hub.

Console system node ID is determined in standard hub mode by the slot number of the linecard cabled. DIGITAL UNIX uses this console information directly, while OpenVMS assigns its own node ID.

Slot number on the hub determines system node ID. The BN39B cable in slot 0 attaches to the system that reports as node 0. Slot 1 reports that system as node 1, and so on.

If you are installing a system with four or less linecards and no fiber, go to Section 2.5.1. Otherwise go to Section 2.5.2, More Than Four Linecards or with Fiber.

2.5.1 Up to Four Linecards with No Fiber

1. Position the hub horizontally as shown in Figure 2-8, allowing for clearance. The front must be clear to allow for airflow through the bezel.

2. Insert the power cord into the rear bulkhead.

3. Check the voltage selection switch.

   Locate this switch on the back hub panel next to the power cord receptacle, and check that it is switched to your service (115V or 230V). To change the voltage selection, insert a sharp point and slide the switch to the correct position.

4. Attach the BN39B cables to the hub.

5. Go to Section 2.6, Power Up and Check Status LEDs.

2.5.2 More Than Four Linecards or with Fiber

To install additional CCMLB linecards or CCMFB fiber optics modules, you must remove the hub top panel. Position the hub horizontally, insert the power cord into the rear bulkhead, check the voltage selection switch, and remove the top panel, as follows.

Figure 2-9   Removing Hub Top Panel
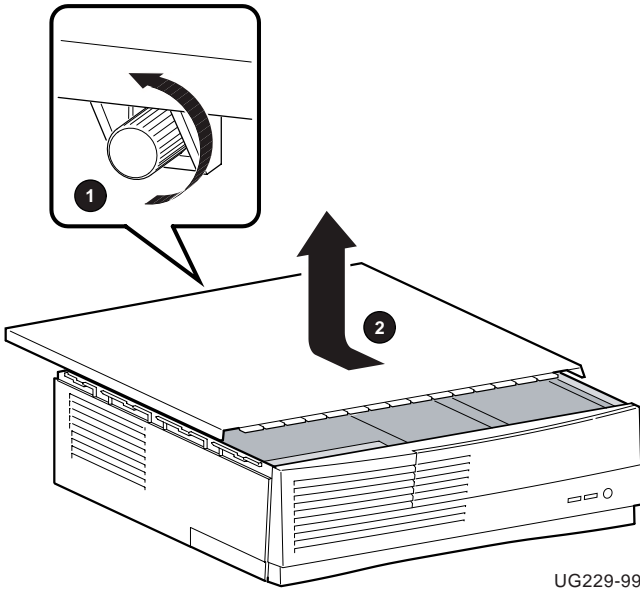
UG229-99

1. Make certain the hub is powered down. Unplug the power cord from the wall outlet. Wait at least 15 seconds to allow time for the power supply capacitors to discharge safely.

2. Locate the thumbscrew ❶, at the rear of the hub, that fastens the top cover to the rear panel in the upper center of the back panel. Loosen the thumbscrew by turning it counterclockwise. You may need to use a flathead screwdriver.

3. Brace the back panel of the box with one hand while pulling the top cover toward you ❷ with the other. The lip of the cover is useful to gain a firm grip. It is a tight fit, so it may require a strong pull. Lift panel off and set aside.

4. Install linecards; see **1 Install the CCMLB Linecard**, which follows. If you are installing fiber, go to **2 Install Fiber Optics**.

1 Install the CCMLB Linecard

Each CCMLB linecard has a 100-pin connector that attaches to a black BN39B cable. This cable either attaches to a CCMAB adapter module installed on each system's PCI bus or to a CCMFB installed in the hub. The CCMHB hub comes with linecards installed in slots 0/opto, 2/opto, 4, and 6. If you are adding one, two, three, or four more linecards, they can be installed in hub slots 1/opto, 3/opto, 5, or 7 (i.e., linecards can be installed in any hub slot except the "opto only" slot). Fiber modules can only be installed in hub slots opto only, 0/opto, 1/opto, 2/opto, and 3/opto. You may need to move linecards to higher slot numbers to make room for fiber modules. Additional hubs may be used to hold fiber modules; all linecards must be placed in one hub.

Figure 2-10   CCMLB Linecard

End View   Side View

J3 J2   UG2210-99
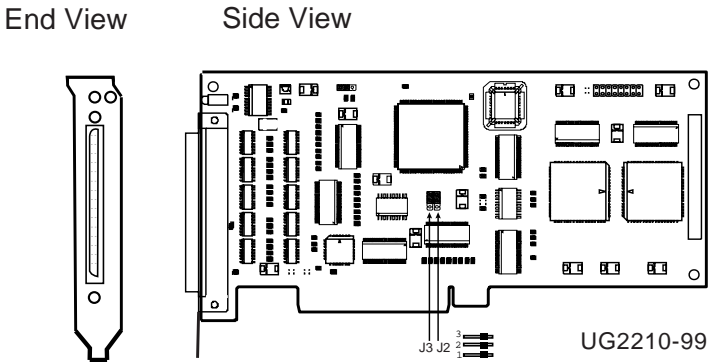
NOTE: The default settings of the CCMLB J2 and J3 jumpers are fiber off.

Fiber Off   Fiber On

J3   J2   J3   J2

UG2CLBJ-99
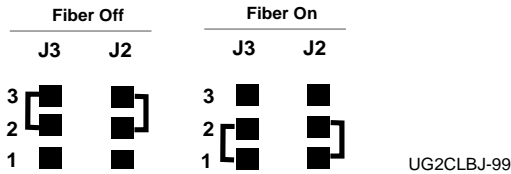
Install additional CCMLB linecards as follows:

1. If fiber will be used, set the J2, J3 jumpers to fiber on.

2. Remove the blank endplate covering the rear hub slot.

3. Seat the linecard firmly in the connector on the motherboard and secure it to the card cage with the mounting screw.

4. Attach the end of the BN39B link cable from the CCMAB PCI adapter or the CCMFB fiber module to the linecard. Repeat for each additional linecard installed. For more than four cables, you may need to move the ferrite beads on the cables to fit the cables into the hub slots (see Figure 2-11). Slide the bead away from the connector to the new position. Keep the ferrite bead as close to the connector as possible.

5. If you are installing fiber, go to **2 Install Fiber Optics**. Otherwise, reinstall the top panel and go to Section 2.6, Power Up and Check Status LEDs.

Figure 2-11   Cabling BN39B to the CCMHB Hub

Slot No.   7   6   5   4   3/opto 2/opto 1/opto 0/opto opto only

UG2211-99
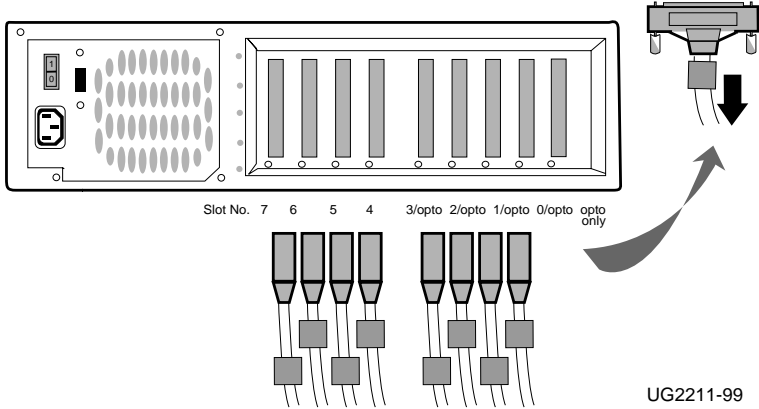
2 Install Fiber Optics

Install the CCMFB module in the hub as follows:

1. Make certain the CCMLB jumpers are set to Fiber On (see Figure 2-10).

2. Remove the CCMFB endplate and replace it with the alternate endplate. Use a 3/16-inch nutdriver to remove the two hex-head standoff fasteners. Holding the module with the endplate up, remove the two Phillips screws on side 2 (back side) of the module.
    Lift the endplate off carefully, making certain the EMI gasket between the endplate and module remains in position. Slip the alternate endplate (having slot E at the bottom) over the connector and attach it with the same screws and fasteners.

3. Thread the optics cable through the slot near the bottom of the endplate (see E, Figure 2-7). Remove the cable tip protectors and insert the Simplex connectors into the transceiver (see B, Figure 2-7) until they click in place. Secure the cable to the module using the tie-wrap (see C, Figure 2-7).

4. Thread one end of the BN34R fiber optics cable through the slot of the CCMHB hub in which the CCMFB will be installed (if there is a blank endplate covering the slot, remove it).

5. CCMFB modules can be installed in five slots: opto only, 0/opto, 1/opto, 2/opto, and 3/opto. If you are installing the CCMFB in opto only, remove the plastic filler that is installed in the motherboard connector. Seat the CCMFB module firmly into the motherboard slot and secure it to the hub with the mounting screw.

6. Attach the 1-meter BN39B-01 link cable from the CCMLB adapter to the CCMFB optics module connector (see A, Figure 2-7).

7. Repeat steps 1 through 6 for each CCMFB module.

8. Replace the hub cover and proceed to Section 2.6, Power Up and Check Status LEDs.

2.6 Power Up and Check Status LEDs

Power up each system. Check CCMAB adapter placement and the status LEDs on the CCMAB adapters and the CCMLB linecards, if present.

Example 2-1 Check Adapter Placement

```
P00>>> init                                        ❶
VMS PALcode V1.20-3, OSF PALcode V1.22-1


starting console on CPU 0
Testing Memory bank 0
Testing Memory bank 1
Configuring Memory Modules
probing hose 0, PCI
probing PCI-to-EISA bridge, bus 1
bus 0, slot 0 -- ewa -- DECchip 21040-AA
bus 0, slot 1 -- pka -- NCR 53C810
bus 1, slot 6 -- vga -- Compaq Qvision
bus 0, slot 6 -- pkb -- DEC KZPSA
bus 0, slot 7 -- mca -- DEC PCI MC          ❷
bus 0, slot 8 -- mcb -- DEC PCI MC          ❷
AlphaServer 2100 Console V5.2-54, built on July 29 1998 at
19:58:46
```

1 Power Up and Check placement on PCI bus

❶ Power up each system. Enter an **init** command to start power-up tests. With an AlphaServer 8200/8400, enter the **show configuration** command to check the CCMAB adapter placement.

❷ Check the placement of the CCMAB adapters. Both should report to the console here. Check that the adapter designated mca resides in the lower slot. Check placement against system requirements (see 1, Install CCMAB adapter).

2 Check Status LEDs

Check the status LEDs on the CCMAB adapters and CCMLB linecards, if present. Two LEDs on each CCMAB adapter and CCMLB linecard show the connection status. Use these LEDs to verify all nodes and hubs are properly connected.

*   Verify that only the left LED on all CCMAB adapters is amber

*   Verify that both LEDs on all CCMLB linecards are amber

If no LEDs are lit, check the system for power.

If only the right LED is amber, there is no connection to the remote system or hub.

*   Verify power is on at the remote system

*   Verify that all cables are properly inserted

*   Verify jumper settings on CCMAB adapters and CCMLB linecards

Refer to Figures 2-12 and 2-13 for more information on LED status.

Figure 2-12   Checking CCMAB Status LEDs

CCMAB Adapter

End View   Side View

LEDs   Condition

			Condition
Off	Off	○ ○	Power off, or faulty adapter module.
Amber	Off	◐ ○	Properly connected to remote node. Normal power up state.
Amber	Amber	◐ ◐	Node has booted and is wating for remote node to boot.
Green	Green	● ●	Online, in use by operating system.
Off	Amber	○ ◐	Not connected to remote node. Normal when not connected to remote node or remote node powered off. Check standard mode jumper setting, Fiber on jumper settings on CCMLB and CCMAB, and for bent pins on both ends of cable connector.

UG2212-99

Left LED - closest to etch ⌐ ⌐ Right LED - Component side

Figure 2-13   Checking CCMLB Status LEDs

End View   Side View

J3 J2
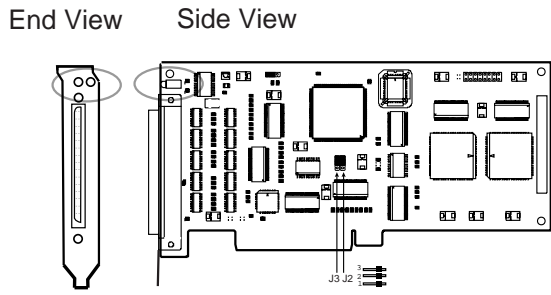
LEDs   Condition

		LEDs	Condition
Off	Off	○○	Power off, or faulty linecard module.
Amber	Amber	◐◐	Properly connected to remote node. Normal power up state.
Green	Green	●●	Online, in use by operating system.
Off	Amber	○◐	Not connected to remote node. Normal when not connected to remote node or remote node powered off. Check standard mode jumper setting, Fiber on jumper settings on CCMLB and CCMAB, and for bent pins on both ends of cable connector.

UG2213-99

Left LED - closest to etch ⬆ ⬆ Right LED - Component side

Chapter 3

Verification

This chapter describes Memory Channel hardware verification using diagnostics.
Sections include:

- Overview

- Verify Console Supports Memory Channel

- Update Console, If Required

- Run the mc_diag Diagnostic

- Run the mc_cable Diagnostic   (Single-Channel Configuration)

- Run the mc_cable Diagnostic   (Multi-Channel Configuration)

- Check for Crossed Rails   (Multi-Channel Configuration)

- Prepare to Boot Your Operating System

3.1 Overview

To verify the installation, first make sure the version of each console program supports Memory Channel. If not, update the console. Next, check that the console reports the CCMAB adapters in the system's PCI. Then proceed with MC diagnostics.

Figure 3-1   Verification Overview
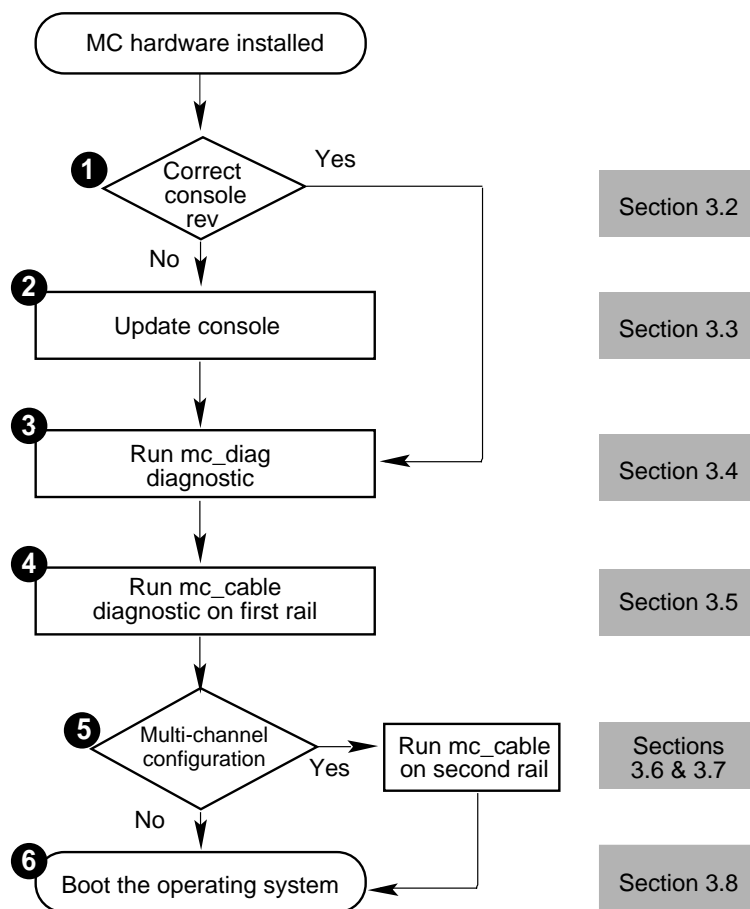
UG231-99

❶ Check that each system console supports Memory Channel. The method to verify support differs between machines.
See Section 3.2, Verify Console supports Memory Channel.

❷ Upgrade the console to the required revision, if needed.
See Section 3.3, Update Console, If Required.

❸ Run **mc_diag** on each system to check the CCMAB adapter.
See Section 3.4, Run the mc_diag Diagnostic.

❹ Run **mc_cable** on each system to check the cables, the CCMHB linecards, and connections. See Sections 3.5 and 3.6, Run the mc_cable Diagnostic.

❺ If you are installing a multi-channel system, power off one of the hubs and check the mc_cable output for crossed rails. See Section 3.7, Check for Crossed Rails (Multi-Channel Configuration).

❻ Set any console parameters required by your operating system prior to installing or booting the operating system. See Section 3.8, Prepare to Boot Your Operating System.

After booting, run the System Verification Software (formerly known as DEC VET). For more information, see the *Memory Channel Service Information*.

3.2 Verify Console Supports Memory Channel

Using console commands, check that MC diagnostic commands are supported in each system console. If they are not, update the console firmware.

Example 3-1   Verify MC Diagnostics in Console

```
P00>>> init                      ❶

P00>>> ls mc_*                   ❷
     mc_cable    mc_diag
P00>>>


P00>>> ls mc_*
no files found                   ❸
```

AlphaServer 4000/4100 and 8200/8400:

```
Pnn>>> init                      ❶
Pnn>>> load mc_diag              ❷
Pnn>>>


Pnn>>> load mc_diag
     Overlay mc_diag not found   ❸
```

Bring each system to the console prompt, or halt the system by pressing the Halt button on the control panel. The console prompt appears on the screen.

❶ Initialize your system to reset the registers.

❷ Enter the command shown for your system.
Current AlphaServer 4000/4100 and 8200/8400 consoles include Memory Channel diagnostics and this command activates them. For other systems, enter **ls** to list the commands.

If the system output is as shown at ❷, your system is ready for testing Memory Channel. Proceed to Section 3.4, Run the mc_diag Diagnostic.

❸ If the Memory Channel diagnostics are not present, you will receive one of these error messages. This indicates that you need to update your console. Proceed to Section 3.3, Update Console, If Required.

3.3 Update Console, If Required

Find the most recent console file for your system from the AlphaServer Firmware Update CD (AG-RCFB*-BS), kit number QZ-003AA-E8, or on the Internet (see Table 3-1). Follow the instructions for your system to update your console.

Table 3-1   AlphaServer Firmware Internet Locations

Source	Address
ftp	ftp://ftp.digital.com/pub/Digital/Alpha/firmware
WWW	http://ftp.digital.com/pub/Digital/Alpha/firmware

AlphaServer firmware is now available online. You can locate the files as shown in Table 3-1. The most recent firmware (if released since the last CD) is found at:

ftp://ftp.digital.com/pub/Digital/Alpha/firmware /interim/

The files are structured similarly to those on the firmware CD, and are separated by CD release. For example, the contents of the V5.3 firmware CD are located at:

ftp://ftp.digital.com/pub/Digital/Alpha/firmware/v5.3/

If you are using the AlphaServer Firmware CD, read the following files in the CD [DOC] directory:

alpha*_v*(_fw_relnotes.ps or *alpha*_v**_fw_relnote.txt*
where * = the model number of your AlphaServer and
  ** = the highest version level on the disk

Whether you are working from the Internet or from the firmware CD, the steps for updating your console are described in detail. The overview of the steps includes:

1. Copy (via FTP) the Firmware Release Notes for your system from the Internet area:
   ftp://ftp.digital.com/pub/Digital/firmware/v5.3/doc.

2. Print and read the release notes. The release notes provide the name(s) of the firmware update utility file(s) you need to run on your Alpha system, and they walk you through the firmware update procedure.

3. Copy the firmware update utility file(s) to your local disk from the appropriate directory (where xxx is a subdirectory designated for your system):
   ftp://ftp.digital.com/pub/Digital/firmware/v5.3/xxx/

4. After you have copied the desired update utility files from the Internet, you can use the files on your system in a variety of ways, depending on your particular target Alpha system. The five methods supported on specific Alpha systems include BOOTP net, MOP net, FAT floppy, boot floppy, and system disk.

For more information:
AlphaServer 2X00 Loadable Firmware Update Utility   *User Guide and Release Notes*

3.4 Run the mc_diag Diagnostic

Mc_diag tests the internal logic of the CCMAB adapter up to the connector. The output of this diagnostic is the same for virtual and standard hub modes. Enter the mc_diag command on each system. In multi-channel configurations, both modules are tested in each system.
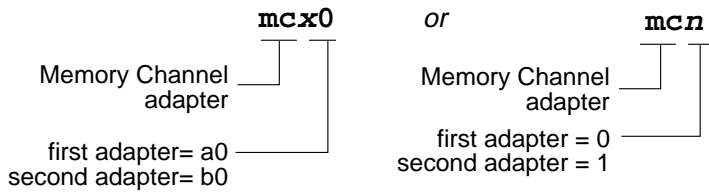
Figure 3-2   Testing the CCMAB Adapters
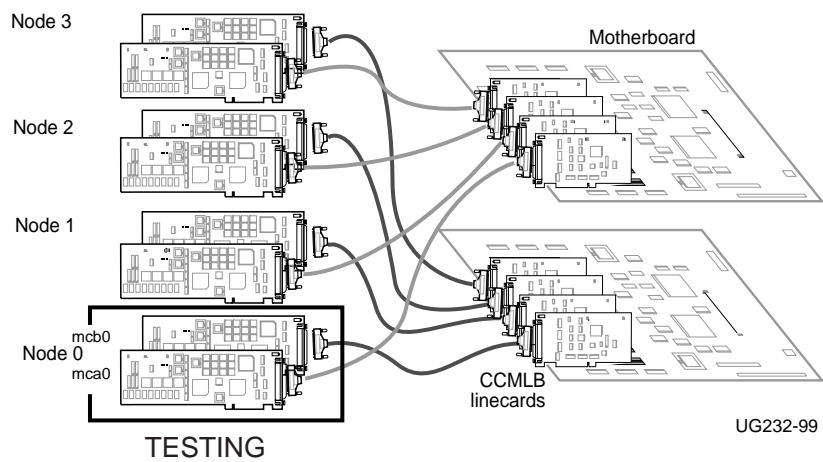
Example 3-2   Running mc_diag on Each System

```
P00>>> init                        ❶
P00>>> mc_diag                     ❷
Testing MC-Adapter(s)
Adapter mca0,  Passed             ❸
Adapter mcb0,  Passed             ❹
              ❺

P00>>>
```

❶ Initialize your system to reset the registers.

❷ Enter the console command **mc_diag**.

Run this diagnostic on each system to test the CCMAB adapters. These diagnostics test internal logic of the CCMAB adapter up to the connector.

❸ The first CCMAB adapter that the console found, mca0, passed.

❹ If a second adapter is installed in the system, the diagnostic tests and reports status of the second CCMAB here.

❺ Console notation for reporting adapters may be a three or four place notation, to be read as shown here.

```
              mcx0        or              mcn
Memory Channel __|  |               Memory Channel __|  |
       adapter                             adapter
  first adapter= a0 ___|             first adapter = 0 ___|
 second adapter= b0                 second adapter = 1
```
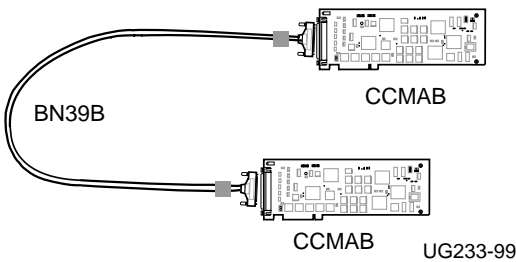
UG2NOM-99

3.5 Run the mc_cable Diagnostic (Single-Channel Configuration)

Mc_cable tests from the CCMAB connector, over the cables, and through the linecards to other cluster members. Run on each system at the same time.

3.5.1 Running mc_cable in Virtual Hub Mode

Figure 3-3   Testing the Adapters and Cable

BN39B

CCMAB

CCMAB

UG233-99

Example 3-3   Running mc_cable in Virtual Hub Mode

Node 0, VH0 comes online first	Step	Node 1, VH1 comes online second
`P00>>> init`	❶	`P00>>> init`
`P00>>> mc_cable`	❷	`P00>>> mc_cable`
`To exit MC_CABLE, type <CTRL/C>`		`To exit MC_CABLE, type <CTRL/C>`
`mca0 node id 0 is online`	❸	`mca0 node id 1 is online`
`No Response from node 1 on mca0`	❹	
`Response from node 1 on mca0`	❺	`Response from node 0 on mca0`
`^C`	❻	`mca0 is offline`
	❼	`^C`

The mc_cable diagnostic tests the cable, adapters, and vertual hub logic when in virtual hub mode.

❶   Enter an **init** command to clear the registers on both systems.

❷   Enter **mc_cable** on node 0 and node 1.

❸   Both nodes report adapter is online.

❹   Expect to receive notice on one node that the other node is not yet responding. It just means that this node came online first.

❺   Both nodes should then report response from the other node. The data is flowing through the MC hardware and all components are verified.

❻   Entering a Ctrl/C on node 0 results in node 1's mca0 CCMAB adapter reporting offline.

❼   Entering a Ctrl/C on node 1 stops mc_cable on this node. No notice is given on node 0 because it is already offline.

3.5.2 Running mc_cable in Standard Hub Mode

Figure 3-4 Testing the Cables, Hub Linecards, and Motherboard

Node 3 CCMAB
Node 2 CCMAB
Node 1 CCMAB
Node 0 CCMAB

Motherboard

CCMLB
linecards

TESTING

UG234-99
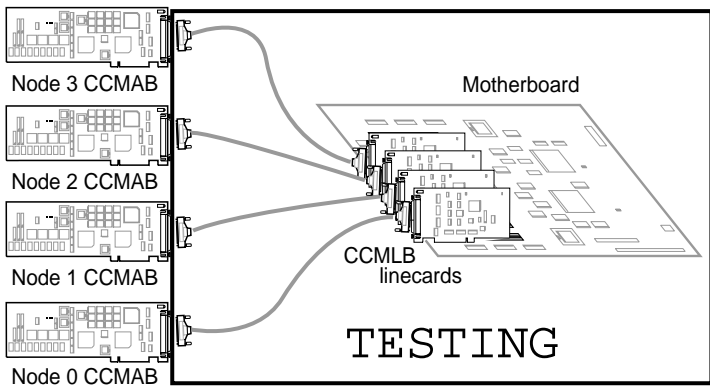
Example 3-4 Running mc_cable on Node 1, Single-Channel Configuration in Standard Hub Mode

```
P00>>> init                                      ❶
P00>>> mc_cable                                  ❷
  to exit MC_CABLE, type <CTRL/C>
mca0 node id 1 is online                         ❸
No Response from node 0 on mca0
No Response from node 2 on mca0
No Response from node 3 on mca0
No Response from node 4 on mca0
No Response from node 5 on mca0
No Response from node 6 on mca0
No Response from node 7 on mca0
Response from node 3 on mca0                      ❹
Response from node 0 on mca0                      ❺
Response from node 2 on mca0                      ❻
 ^C                                              ❼
P00>>>
```

The mc_cable diagnostic tests the cables between systems and the logic that connects them in the hub, including the linecards. Mc_cable reports changes in node status and continues to run until it is halted using Ctrl/C (^C).

The example shown is a four-node single-channel configuration.

❶   Enter an **init** command to reset the registers.

❷   Enter the **mc_cable** command.

❸   The CCMAB adapter on node 1 is online. The diagnostic scans for responses from other nodes. Here, no other systems have yet responded.

❹   The CCMAB adapter from node 3 responds to node 1. This means that node 3 is online running mc_cable, and node 1 recognizes node 3's response and reports it. If you were to look at node 3's output of mc_cable, it would at this point be reporting node 3 online with node 1 responding, each system showing one adapter.

     As you bring each system up and run mc_cable, each system's output will report response from the additional nodes as they join the cluster.

❺   Next, node 0 joins the cluster running mc_cable. The order of the nodes reporting reflects the order in which you started up the mc_cable diagnostic on each respective system.

❻   Node 2 joins the cluster.

     When you have started mc_cable on all nodes, check each system's output. Each system's mc_cable output should show its own CCMAB adapter online and be reporting response from all the other nodes.

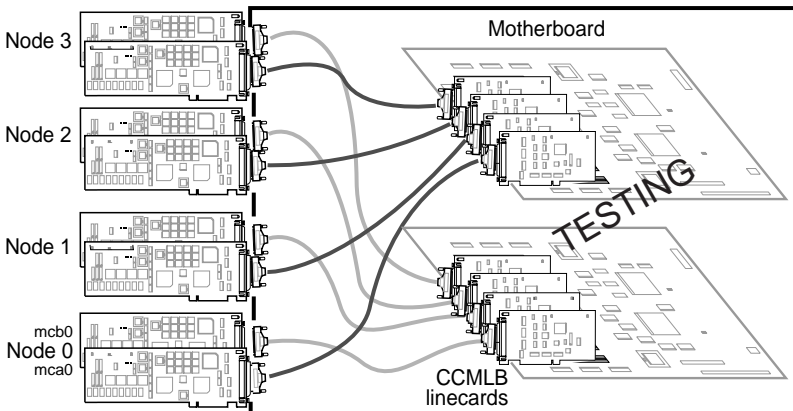❼   To exit mc_cable, enter a Ctrl/C. The console prompt returns.

| **For more information:** |
| Chapter 4, Troubleshooting |

3.6 Run the mc_cable Diagnostic (Multi-Channel Configuration)

In a multi-channel configuration, mc_cable tests the first CCMAB adapter, polls the hub, and then tests the second CCMAB.

Figure 3-5 Testing a Multi-Channel Configuration with mc_cable

UG235-99

Example 3-5 Running mc_cable on Node 1, Multi-Channel Configuration

```
P00>>> init                                    ❶
P00>>> mc_cable                                ❷
To exit MC_CABLE, type <CTRL/C>
mca0 node id 1 is online                       ❸
No Response from node 0 on mca0
No Response from node 2 on mca0
No Response from node 3 on mca0
No Response from node 4 on mca0
No Response from node 5 on mca0
No Response from node 6 on mca0
No Response from node 7 on mca0
mcb0 node id 1 is online                       ❹
```

```
No Response from node 0 on mcb0
No Response from node 2 on mcb0
No Response from node 3 on mcb0
No Response from node 4 on mcb0
No Response from node 5 on mcb0
No Response from node 6 on mcb0
No Response from node 7 on mcb0
Response from node 3 on mca0          ❺
Response from node 3 on mcb0          ❺
Response from node 0 on mca0          ❻
Response from node 0 on mcb0          ❻
Response from node 2 on mca0          ❼
Response from node 2 on mcb0          ❼
^C                                    ❽
P00>>>
```

The example shown is a four-node multi-channel configuration, standard hub mode.

❶   Enter an **init** command to reset the registers.

❷   Enter the **mc_cable** command.

❸   The first CCMAB adapter, mca0, on node 1 is online. The diagnostic scans for responses from other nodes. Here, no other systems have yet responded.

❹   The second CCMAB adapter, mcb0, on node 1 is online. The diagnostic scans for other nodes responding. None found yet.

❺   Two CCMAB adapters from node 3 respond to node 1. This means that node 3 is online running mc_cable, and node 1 recognizes node 3's response and reports it.

❻   Next, node 0 joins the cluster running mc_cable.

❼   Node 2 joins the cluster.

     When you have started mc_cable on all nodes, check each system's output. Each system's mc_cable output should show its own CCMAB adapters online and be reporting response from all the other nodes.

❽   To exit mc_cable, enter a Ctrl/C. The console prompt returns.
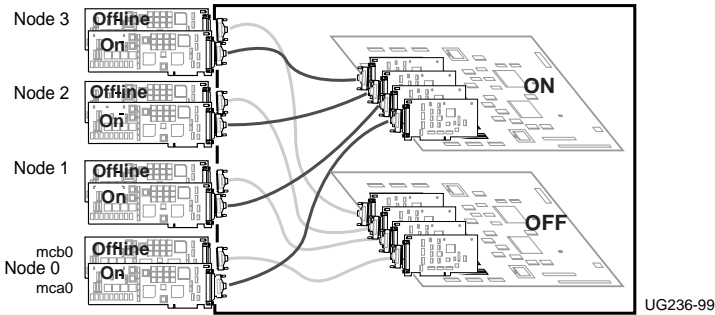
For more information:
Chapter 4, Troubleshooting

3.7 Check for Crossed Rails (Multi-Channel Configuration)

With mc_cable running on all systems, turn off the second hub and check output. If all CCMAB adapters designated mcb0 go offline, no rails are crossed.

Figure 3-6   Testing for Crossed Rails with mc_cable

UG236-99

Example 3-6   Checking Cabling for Crossed Rails

Node 1 comes online first under mc_cable	Node 3 comes online second
P00>>> mc_cable ❶	P00>>> mc_cable ❶
To exit MC_CABLE, type <CTRL/C>	To exit MC_CABLE, type <CTRL/C>
mca0 node id 1 is online	mca0 node id 3 is online
No Response from node 0 on mca0	No Response from node 0 on mca0
No Response from node 2 on mca0	Response from node 1 on mca0
No Response from node 3 on mca0	No Response from node 2 on mca0
No Response from node 4 on mca0	No Response from node 4 on mca0
No Response from node 5 on mca0	No Response from node 5 on mca0
No Response from node 6 on mca0	No Response from node 6 on mca0
No Response from node 7 on mca0	No Response from node 7 on mca0
mcb0 node id 1 is online	mcb0 node id 3 is online
No Response from node 0 on mcb0	No Response from node 0 on mcb0
No Response from node 2 on mcb0	Response from node 1 on mcb0
No Response from node 3 on mcb0	No Response from node 2 on mcb0
No Response from node 4 on mcb0	No Response from node 4 on mcb0
No Response from node 5 on mcb0	No Response from node 5 on mcb0
No Response from node 6 on mcb0	No Response from node 6 on mcb0

```
No Response from node 7 on mcb0          No Response from node 7 on mcb0
Response from node 3 on mca0             Response from node 0 on mca0
Response from node 3 on mcb0             Response from node 0 on mcb0
Response from node 0 on mca0             Response from node 2 on mca0
Response from node 0 on mcb0             Response from node 2 on mcb0
Response from node 2 on mca0             mcb0 is offline          ❷
Response from node 2 on mcb0
mcb0 is offline          ❷
```

Node 0 comes online third	Node 2 comes online fourth
| ```
P00>>> mc_cable                   ❶
to exit MC_CABLE, type <CTRL/C>
mca0 node id 0 is online
Response from node 1 on mca0
NoResponse from node 2 on mca0
Response from node 3 on mca0
No Response from node 4 on mca0
No Response from node 5 on mca0
No Response from node 6 on mca0
No Response from node 7 on mca0
mcb0 node id 0 is online
Response from node 1 on mcb0
No Response from node 2 on mcb0
Response from node 3 on mcb0
No Response from node 4 on mcb0
No Response from node 5 on mcb0
No Response from node 6 on mcb0
No Response from node 7 on mcb0
Response from node 2 on mca0
Response from node 2 on mcb0
mcb0 is offline          ❷
``` | ```
P00>>> mc_cable                   ❶
to exit MC_CABLE, type <CTRL/C>
mca0 node id 2 is online
Response from node 0 on mca0
Response from node 1 on mca0
Response from node 3 on mca0
No Response from node 4 on mca0
No Response from node 5 on mca0
No Response from node 6 on mca0
No Response from node 7 on mca0
mcb0 node id 2 is online
Response from node 0 on mcb0
Response from node 1 on mcb0
Response from node 3 on mcb0
No Response from node 4 on mcb0
No Response from node 5 on mcb0
No Response from node 6 on mcb0
No Response from node 7 on mcb0
mcb0 is offline          ❷
``` |

❶ Run **mc_cable** on all nodes. Check that each system sees all nodes. In this example, each node comes online with both mca0 and mcb0 CCMAB adapters, and when all systems are running mc_cable, all systems report response from all other CCMAB adapters in the cluster.

❷ Now, turn off the second hub, which should be connected to all CCMAB adapters in the second position, or the higher slot numbers reporting as mcb0. Each system should report that its own mcb0 is offline.

If any system reports an **mca0** as offline (instead of an mcb0), then this system has crossed rails. Switch the BN39B cables on the backplane of the system with crossed rails, restore power to the hub, and then turn it off again to check new cabling.

3.8 Prepare to Boot Your Operating System

You have verified that all MC components report under diagnostics. Check your operating system requirements for any additional hardware devices it may require to be installed and console parameters that need to be set.

Example 3-7   Verification of AlphaServer 2100RM Configuration

```
P00>>> sho conf  ❶
               Digital Equipment Corporation
                  AlphaServer 2100 4/200


SRM Console V4.6-201   VMS PALcode V5.56-4, OSF PALcode X1.45-9


Component    Status      Module ID
CPU 0          P        B2020-AA DECchip (tm) 21064-3
CPU 2          P        B2020-AA DECchip (tm) 21064-3
Memory 1       P        B2021-CA 128 MB
Memory 3       P        B2021-BA  64 MB
I/O                     B2110-AAp
                        dva0.0.0.1000.0    RX26/RX23
Slot Option             Hose 0, Bus 0, PCI
0   DECchip 21040-AA  ewa0.0.0.0.0         08-00-2B-E6-08-E5
1   NCR 53C810        pka0.7.0.1.0         SCSI Bus ID 7
                      dka200.2.0.1.0       RZ28
                      dka500.5.0.1.0       RRD43
2   Intel 82375EB                          Bridge to Bus 1, EISA
6   DEC PCI MC  ❷                          Rev: 20, mca0  ❷
8   DEC KZPSA  ❸      pkb0.0.0.8.0         SCSI Bus ID 0
                      dkb100.1.0.8.0       RZ26
                      dkb200.2.0.8.0       RZ26


Slot  Option           Hose 0, Bus 1, EISA
8    Compaq Qvision
```

```
P00>>> show version                        ❹

version                  V4.6-201 Aug 14 1998 11:54:23


P00>>> boot                                 ❺
```

You have run the mc_cable diagnostic to verify that the console program recognizes
all installed MC components. If your operating system has additional hardware
requirements, install and verify these components now. Refer to your operating
system documentation for instructions.

❶   In this example, the **show configuration** command is run on an AlphaServer
        2100 RM system with two CPUs and two memories.

❷   The system has one CCMAB adapter in slot 6. The console sees this adapter as
        mca0.

❸   One KZPSA resides in slot 8. DIGITAL UNIX requires a KZPSA adapter to
        run TruCluster.

❹   The **show version** command checks the console firmware level. This
        information also is at the beginning of the **show config** command.

❺   To boot the operating system, enter **boot** or **b** at the console prompt.

After booting, run the System Verification Software (formerly known as DEC VET).
For more information, see the *Memory Channel Service Information*.

For more information:

TruCluster Software *Hardware Configuration*
Guidelines for OpenVMS Cluster Configurations
Software Product Description
Your AlphaServer system's *Owner's Guide*
Your operating system documentation and release notes

Chapter 4

Troubleshooting

This chapter describes basic Memory Channel troubleshooting procedures. Topics covered include:

- Console Error Messages and Overview

- Troubleshooting with mc_diag

- Troubleshooting with mc_cable
    - — Understanding mc_cable
    - — Changes Reported by mc_cable

- Cable Troubleshooting

- CCMAB Troubleshooting Checklist

- Operating System Errors

- Boot Problems

For more information:

Your AlphaServer system's *User's Guide*
Your AlphaServer system's *Service Information*

4.1 Console Error Messages and Overview

In addition to the physical installation of the hardware, you can check three main areas where troubleshooting information is collected.

Figure 4-1   Troubleshooting Overview

UG241-99

Example 4-1   Console Error Messages at Power-Up

①
```
*******************************************************
** Memory Channel hardware requirement ERROR  # 1    **
** See release notes, or Memory Channel User's Guide **
*******************************************************
```

②
```
*******************************************************
** Memory Channel hardware requirement ERROR  # 2    **
** See release notes, or Memory Channel User's Guide **
*******************************************************
```

③
```
*******************************************************
** Memory Channel hardware requirement ERROR  # 3    **
** See release notes, or Memory Channel User's Guide **
*******************************************************
```

Three levels of troubleshooting information are available:

❶ At power-up, the console checks the system hardware revision levels required for MC clusters. If the system hardware does not support MC clusters, the console will report one of three error messages. Internal test of MC module logic is not done during power-up. Contact your local Compaq Customer Support Service Center.

   ① **For AlphaServer 2000/2100:** An upgrade is needed.
       Contact your local Compaq Customer Support Service Center.

   ② **For AlphaServer 8200/8400:** In a DWLPA, CCMAB adapters must be installed in PCI slots 0 through 7. No slot restrictions in the DWLPB. Under DIGITAL UNIX with multi-channel configurations, both CCMAB adapters must be in the same DWLPA/DWLPB card cage. Under OpenVMS with multi-channel configurations, only one CCMAB adapter may be in a DWLPA. You may have two CCMABs in a DWLPB, one in a DWLPA and one in a DWLPB, or one CCMAB adapter in each of two DWLPAs.
       If the error message remains, an upgrade is needed.
       Contact your local Compaq Customer Support Service Center.

   ③ **For AlphaServer 1000A/2100A:** Check your CCMAB modules. They must be installed before the bridge.

   The **show config** console command can be used to confirm that the CCMAB modules are reporting to the system console. The **show version** command reports the installed console firmware revision level.

❷ The MC diagnostics, **mc_cable** and **mc_diag**, check most of the logic of the MC hardware. These two diagnostics are invoked only at the system console and do not execute during power-up. See Section 4.2, Troubleshooting with mc_diag, and Section 4.3, Troubleshooting with mc_cable.

   The diagnostics check the cables (see Section 4.4, Cable Troubleshooting).

❸ Registers specific to MC can be read from console level, and these registers report errors in the system error log. Each operating system supporting Memory Channel has an error log. DECevent is designed for field service to analyze the system error log. See Section 4.6, Operating System Errors.

4.2 Troubleshooting with mc_diag

Mc_diag tests the internal logic of the CCMAB adapter up to the connector. On a system in a multi-channel configuration, mc_diag tests both CCMAB adapters in the system. Error messages indicate replacement.

Figure 4-2 Troubleshooting the CCMAB Adapter with mc_diag

Example 4-2 Errors with mc_diag

```
P00>>> init
         :
         :
P00>>> mc_diag
Testing MC-Adapter(s)
Adapter mca0,  Passed      ❶
```

Possible error messages

```
Adapter mcb0 failed T-3    ❷
Adapter mcb0 failed T-12   ❷
```

Possible error in entering command

```
P00>>> run mc_diag         ❸
loading ARC firmware
```

The mc_diag diagnostic tests all CCMAB adapters in a system. In this example, two CCMAB adapters are tested, and the second CCMAB fails.

❶ The first CCMAB adapter on this node passed the internal logic tests and reports to the console. If an installed CCMAB does not report here, assume the console does not see it and check installation (see Section 4.5, CCMAB Troubleshooting Checklist).

❷ These error messages indicate that the CCMAB noted failed the internal logic tests. If you receive either error message, replace the failing adapter.

❸ Here, the command was entered incorrectly. The word **run** should not have been entered. The system will hang while it looks for an ARC utility.

If you enter **mc_diag** and the console prompt returns with no written response at all, the CCMAB adapter is not reporting. Check the adapter's physical installation, its seating in the PCI, the cable connections, and run the diagnostic again.

4.3 Troubleshooting with mc_cable

4.3.1 Understanding mc_cable

The mc_cable diagnostic reports changes in cluster status as they occur, and it continues to run until halted using Ctrl/C (^C). Run it on all nodes at the same time.

Figure 4-3 Testing the Cables, Hub Linecards, and Motherboard

Node 3 CCMAB

Node 2 CCMAB

Node 1 CCMAB

Node 0 CCMAB

Motherboard

CCMLB linecards

TESTING

UG243-99

Example 4-3 Running mc_cable on Node 0

```
P00>>> init
P00>>> mc_cable
To exit MC_CABLE, type <CTRL/C>
mca0 node id 0 is online          ❶
No Response from node 1 on mca0
No Response from node 2 on mca0
Response from node 3 on mca0      ❷
```

The diagnostic runs first through all the mca0 connections, and then moves to check all the mcb0 connections. Next, it reports any change states that have occurred since the first polling of the CCMAB adapter paths.

If the node cannot go online and **mc_cable** hangs, first check the jumper positions. The CCMAB adapters may not be set for the correct hub mode. Next, move the cable to another CCMAB on another node and see if this CCMAB can come online. If not, replace the cable.

❶ The first (mca0) CCMAB adapter on node 0 reports online. At this point, the diagnostic has run through the CCMAB adapter, and tested the cable and the linecard. The diagnostic has checked that the CCMAB signal can reach the hub. So far, no response has been received from another node.

CCMAB, Node 0

UG24TS1-99

❷ Next, the diagnostic looks for other nodes that are online running mc_cable. It checks each CCMLB linecard position on the motherboard and reports if a CCMAB can be reached. Expect to receive notice that other nodes are not yet responding when you first start mc_cable. As other nodes join, notice of their reporting is given. When other nodes respond, the data is flowing through the MC hardware as shown below.

UG24TS2-99

4.3.2 Changes Reported by mc_cable

When all components have reported, mc_cable will report any changes in the cluster status.

Example 4-4   Change States Reported by mc_cable

```
mca0 is offline                    ❶
mca0 node id 0 is online           ❷
Response from node 3 on mca0       ❸
No Response from node 3 on mca0    ❹
```

❶ Here, node 0's CCMAB mca0 adapter has gone offline but mc_cable continues
   to run, listening for MC cluster status. The connection has been lost between
   the CCMAB adapter and the CCMHB hub.

   - Check that the hub has power.
   - Check the cable connections.
   - Check the cable connector pins.

❷ Node 0's CCMAB mca0 adapter has come back online. Mc_cable reports its
   presence.

❸ When an adapter running mc_cable goes offline and then comes back online, it
   repolls its cluster to see what nodes are reporting. Here, node 3's response is
   reported again by node 0 when node 0's CCMAB mca0 adapter comes back
   online.

❹ Node 3 has stopped reporting. Possible condition is that node 3's mc_cable
   was halted.

4.4 Cable Troubleshooting

Cable function is tested by mc_cable. Cable errors can be introduced through improper handling of the cable pins.

Figure 4-4   BN39B Cable

UG244-99

Cables are functioning correctly when the mc_cable diagnostic runs without errors (see Section 4.3, Troubleshooting with mc_cable).

The 100 pins on the connectors can be bent by improper handling. Rocking the connector across its shortest axis may cause the pins to bend, and bent pins can result in improper signals or grounding, which can cause errors.

- Inspect the cable connections for bent pins.

- Check that the connectors are firmly connected to their receptacles with the screws tightened. Loose connections can also cause intermittent errors.

- Make certain the systems are positioned so the cables are not stretched; they should be slack between connections.

4.5 CCMAB Troubleshooting Checklist

Typical troubleshooting conditions are listed with suggested action and where to find the instructions in this manual.

Symptom	Suggested Action	Section
Does not report to console	• Reseat the adapter, or place it in another PCI slot. If it still does not report, replace the CCMAB adapter.	2.4
Does not report online to mc_cable	• Jumpers must be set for the hub mode used. Check jumper positions.	2.3
	• Check cable.	4.5
	• Check power to CCMHB hub; it may be off.	2.5
	• Check seating of module in PCI.	2.4
	• Virtual hub mode: Run mc_cable on the other node.	3.5
	• Multi-channel configuration: Check for crossed rails.	3.7
Does not respond to mc_cable running on another node.	• Check jumpers on all CCMAB adapters. Must be in correct hub mode.	2.3
	• Check cable connection. Make sure the cable is attached finger-tight.	4.5
	• Check the cable by moving it to a different linecard and running mc_cable again.	4.5
	• Change to virtual hub mode and check the cable.	4.4
Reports intermittently	• Not screwed into the PCI bulkhead tightly enough. The module must be seated firmly to make a good connection.	2.4
	• Check cables.	4.5
Fails mc_diag	• An internal logic failure. Replace adapter.	2.4

4.6 Operating System Errors

Errors may be detected by the operating system. In that case, consider the following:

- MC errors logged to event logger.

- Fatal errors will cause the node to go offline.

- Other nodes will detect the failing node and log the event.

- Check the error logs from all nodes in the cluster.

4.7 Boot Problems

Check your system user's guide and your operating system manual for full booting information. A basic troubleshooting checklist is given here.

If there are problems booting, troubleshoot as follows:

```
┌─────────────────────┐
│ Check Boot Specifi- │
│ cation and Boot Device │
└─────────────────────┘
```
- Check the boot status message.
- Is the correct boot device specified?
- Check that the boot device specified is listed in the console display.
- If the boot device is not listed, check all physical connections.
- Did the boot device pass self-test?
- Enter a **show device** or **show net** command and check that the I/O devices listed match the real configuration.

UG24BP-99

Check your operating system error log for further information.

For more information:

Memory Channel Service Information

Index