MEMORY CHANNEL™

Service Information

Order Number: EK–PCIRM–SV. B01

This information is for Digital service engineers. It includes maintenance and service information for PCI MEMORY CHANNEL subsystems and instructions for removal and replacement of field-replaceable units (FRUs).

Digital Equipment Corporation
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Preface

Intended Audience

This manual is written for field service engineers and self-maintenance customers who require information to maintain and service MEMORY CHANNEL cluster 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 are descriptive text or instructions.

This manual has three chapters and one appendix as follows:

- **Chapter 1, Field-Replaceable Units,** gives specifications, maintenance, and removal and replacement information on the field-replaceable units and the rackmount option.

- **Chapter 2, Verification,** shows how to verify the hardware installation prior to installing the operating system.

- **Chapter 3, Troubleshooting,** tells how to proceed if problems arise, and provides basic information on error log information, DECevent, and MEMORY CHANNEL registers.

- **Appendix A, Other Parts,** gives removal and replacement procedures for parts to be serviced by Manufacturing or by Repair Centers.

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.

For More Information

MEMORY CHANNEL Hardware Documentation

P/N	Title
EK–PCIRM–UG	*User's Guide*
EK–PCIRM–SV	*Service Information*
AK–R2V9A–CA	*Service Information (diskette)*

Online Documentation Related to MEMORY CHANNEL Systems

Address or URL	Information
http://www.digital.com/info/ alphaserver/products.html or ftp.digital.com/pub/Digital/ Alpha/systems/as**00/docs	Click on the system of your choice; then click on the "technical resources" hot spot.
http://ftp.digital.com/pub/Digital/ Alpha/firmware or ftp://ftp.digital.com/pub/Digital/Alpha/ firmware	Firmware update files for the AlphaServer systems
http://www.digital.com/info/SOC	*Digital Systems and Options Catalog* Hardware ordering and configuration guide

Digital UNIX Documentation Related to MEMORY CHANNEL

P/N	Title
AA–QL8KA–TE	TruCluster Software™ *Release Notes*
AA–QL8LA–TE	TruCluster Software *Hardware Configuration*
AA–QL8MA–TE	TruCluster Software *Software Installation and Configuration*
AA–QL8NA–TE	TruCluster Software *Cluster Administration*
AA–QL8PA–TE	TruCluster Software *Application Programming Interfaces*
AA–QTN4A–TE	TruCluster Software *Digital UNIX Driver for MEMORY CHANNEL*
EK–BA350–CG	*StorageWorks™ Solutions*: *Configuration Guide*
EY–4326–51	*Oracle7™ Parallel Server*

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–QAA3C–TE	*DECevent Translation and Reporting Utility for Digital UNIX User and Reference Guide*
AA–QAA5C–TE	*DECevent Event Management Utility for Digital UNIX Installation Guide*
AA–QE26C–TE	*The DECevent Graphical User Interface User's Guide*
AA–Q73LD–TE	*DECevent Analysis and Notification Utility for OpenVMS User and Reference Guide*
AA–Q73KD–TE	*DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide*
AA–Q73JD–TE	*DECevent Event Management Utility Installation Guide for OpenVMS*

Chapter 1
Field-Replaceable Units

This chapter describes MEMORY CHANNEL (MC) field-replaceable units (FRUs), their order numbers, location, and specifications. It describes the diagnostic LEDs and removal and replacement of each FRU. Sections include:

- Overview
- Configuration Requirements
- MC Field-Replaceable Units
- CCMAA Adapter
- Link Cable
- CCMHA Hub
- Hub Panel Removal
- CCMLA Linecard
- Hub Fan Assembly
- Hub Power Cords
- Optional Rackmount Kit

1.1 Overview

A basic MEMORY CHANNEL configuration consists of AlphaServer systems, with a CCMAA adapter module installed on each system's PCI bus, connected to a CCMHA hub by a link cable.

Figure 1-1   Sample MEMORY CHANNEL Configuration

CCMAA 1

CCMAA 0

CCMAA 7

BC12N Cable

. . .

CCMHA
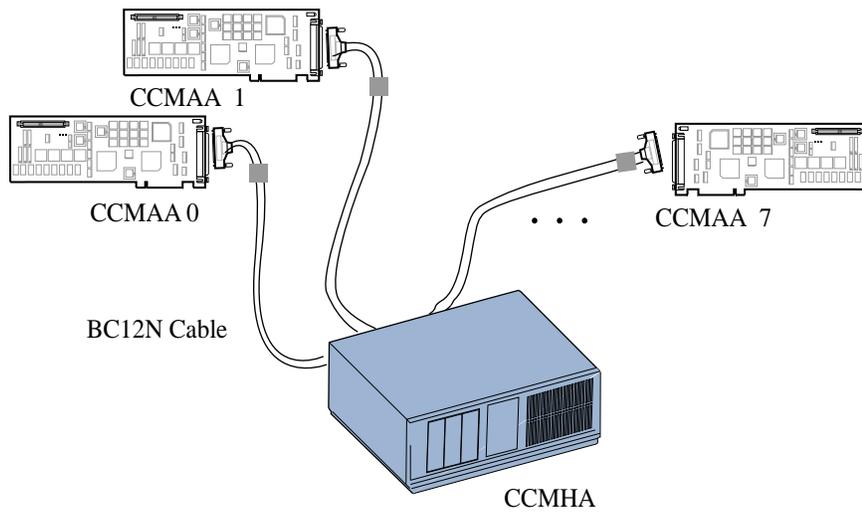
bx0816a-96

Figure 1-1 shows a typical MEMORY CHANNEL configuration, utilizing a hub which is required for three or more systems in an MC cluster. It consists of several Alpha-Server systems, each having a CCMAA adapter module installed on the system's PCI bus. Each adapter module is connected to the CCMHA hub by a link cable (BC12N).

With two AlphaServer systems, a virtual hub (no hub) configuration is also possible by connecting the two CCMAA adapters directly to each other using the link cable (see Figure 1-2).

Figure 1-2   Virtual Hub MEMORY CHANNEL Configuration

CCMAA   BC12N   CCMAA

bx0813h-96

Field-Replaceable Units   **1-3**
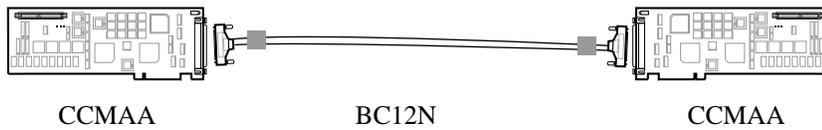
1.2 Configuration Requirements

Console firmware must be at the revision level that supports MC. Also, some AlphaServer 2000/2100s require upgrades to support MC.

1.2.1 AlphaServer 1000/1000A Requirements

- Console firmware must be at 4.6 Rev or higher.

- Runs OpenVMS operating system only.

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

1.2.2 AlphaServer 2000/2100 Requirements

- Console firmware minimum revision is 4.3 for Digital UNIX and 4.6 for OpenVMS.

- Check your system for MEMORY CHANNEL readiness as shown in Example 1-1.

Example 1-1 Checking the AlphaServer 2000/2100 for 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 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 3.1). If a value of less than four is displayed, the system requires a hardware upgrade to support MEMORY CHANNEL. The customer must order the required upgrade (see Table 1-1). Install the upgrade and proceed with installation.

Table 1-1 AlphaServer 2000/2100 Upgrades

AlphaServer	Order	to Upgrade	to Rev
2000	H3095-AA	B2111-AA backplane	H or higher
2100	H3096-AA	B2110-AA standard I/O module	L or higher

1.2.3 AlphaServer 2100A Requirements

- Console firmware minimum revision is 4.3 for Digital UNIX and 4.6 for OpenVMS.

- CCMAA adapter must be installed in one of the bottom four slots (see Figure 1-5). CCMAA adapters may not be installed in slots 0 through 3 or at power-up MEMORY CHANNEL console error message #3 will result (see Section 3.1).

For more information

AlphaServer 2000/2100/2100RM/2100 CAB Series Service Guide EK–KN450–SV
Mandatory AlphaServer 2xxx Flash ROM Update EK–B2110–CL

1.2.4 AlphaServer 4000/4100 Requirements

- Console firmware minimum revision is V2.0-3.

Under Digital UNIX V4.0A with TruCluster Software V1.4

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

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

Under Digital UNIX V3.2G with TruCluster Software V1.0

- For a single-channel configuration, the CCMAA adapter must be in PCI 0, slot 2.

- For a redundant configuration, the CCMAA adapters must be in PCI 0, slots 2 and 3.

Under OpenVMS

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

1.2.5 AlphaServer 8200/8400 Requirements

- Console firmware minimum revision is 2.3 for Digital UNIX and 4.0-4 for OpenVMS.

- CCMAA adapters may be installed in any DWLPB slot (slots 0–12). With the DWLPA[1], CCMAA adapters must be installed in PCI slots 0 through 7. CCMAA adapters may not be installed in slots 8 through 11 or at power-up MEMORY CHANNEL console error message #2 will result (see Section 3.1).

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

- Under OpenVMS with multi-channel configurations, only one CCMAA adapter may be in a DWLPA. You may have two CCMAAs in a DWLPB, or one in a DWLPA and one in a DWLPB.

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[1] This restriction only applies to DWLPAs with motherboard number 54-23468-01. This restriction does not apply to DWLPAs with motherboard number 54-24721-01.

1.2.6 Additional AlphaServer Requirements

For a current list of all supported systems, refer to the *Digital Systems and Options Catalog.* Check your MEMORY CHANNEL release notes for any additional requirements.

1.2.7 Digital UNIX Requirements

- Version 3.2D or higher.

- When installing the Digital UNIX TruCluster Software, each system must have a KZPSA SCSI adapter and shared SCSI devices.

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

1.2.8 OpenVMS Requirements

- Version 7.1 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 1.4, CCMAA Adapter
TruCluster Software *Hardware Configuration*
Guidelines for OpenVMS Cluster Configurations

1.3 MC Field-Replaceable Units

MEMORY CHANNEL FRUs include the CCMAA adapter module, the link cable, and the CCMHA hub. The hub has FRUs inside (linecards and fan assembly). The hub also has a rackmount option kit, CCMRA.

Figure 1-3   MEMORY CHANNEL FRUs

bx0856e-96
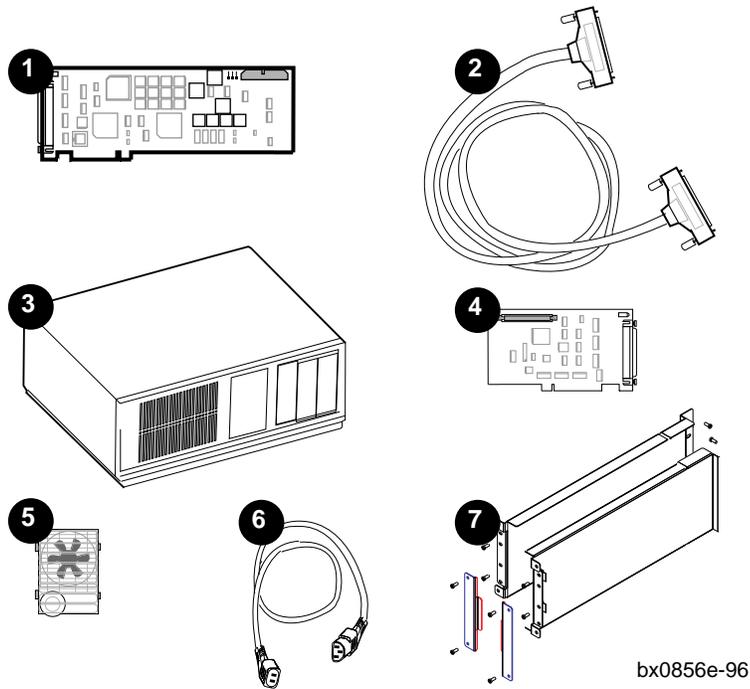
Table 1-2 lists the MEMORY CHANNEL FRUs.

Table 1-2 MEMORY CHANNEL Field-Replaceable Units

Part Number	Option Number	Description
54-23663-01, -02	CCMAA-AA, -BA	PCI adapter module
17-04091-01	BC12N-10	Link cable
70-32780-01	CCMHA	Hub (without linecards)
70-30795-02		(with four linecards)
54-23665-01	CCMLA	Linecard
70-31242-01		Fan assembly
See Section 1-10 for the hub power cord numbers		Power cord

The removal and replacement procedures for the following FRUs comprise the remainder of this chapter:

❶   CCMAA adapter module

❷   Link cable

❸   CCMHA hub

❹   CCMLA linecard

❺   Hub fan assembly

❻   Hub power cord

❼   Optional CCMRA rackmount kit

MEMORY CHANNEL Option Nomenclature

CCM *a b - nm*

MEMORY CHANNEL prefix

Component type:
PCI Adapter (CCMAA) = A
Hub (CCMHA) = H
Linecard (CCMLA) = L
Rackmount (CCMRA) = R

Option variations

Component version:
A = Initial design
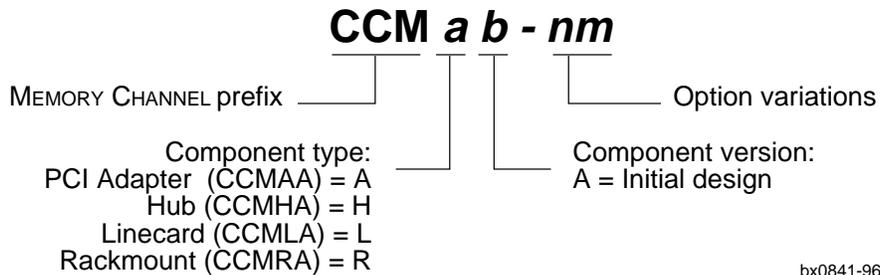
bx0841-96

1.4 CCMAA Adapter

1.4.1 Hub Mode Jumpers

The CCMAA adapter ships in two versions: –AA and –BA. Each CCMAA adapter has hub mode jumpers. You must set the jumper pins differently for virtual hub mode and standard mode.

Figure 1-4 Setting the CCMAA Hub Mode Jumpers
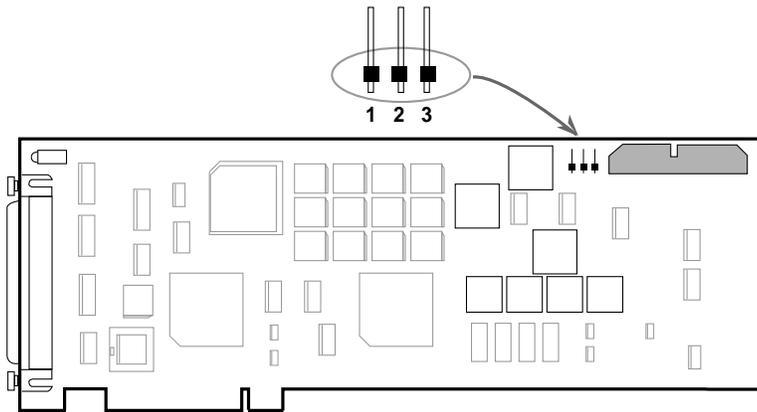
bx0853-96

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)

bx0853e-96

The CCMAA adapter comes in two versions: –AA and –BA. The CCMAA–BA transfers data at twice the speed of the CCMAA–AA. Both adapters are compatible with each other. You may install them in the same MC cluster.

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

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

2. Unpack the CCMAA PCI adapter.

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

4. Set the CCMAA jumpers for your configuration to either standard mode (with a hub) or virtual hub mode (two systems only). If you are installing a redundant configuration under Digital UNIX, both the first and second CCMAA adapters are jumpered the same way within a system.

Jumpers are located in the corner of the CCMAA adapter near the connector as shown in Figure 1-4.

Standard Hub Mode

In a cluster with a hub, all CCMAA adapters must have the same jumper configuration.

If you are upgrading from a two-node virtual hub to a standard mode configuration with a CCMHA, check and change the jumpers on all CCMAA adapters.

Virtual Hub Mode

In VH mode, two systems are cabled together directly without a hub.

In VH mode, each CCMAA adapter must be jumpered differently, and the jumpering determines the node ID.

1.4.2 CCMAA Adapter PCI Slot Position

Determine the PCI slot for CCMAA installation carefully. Systems with multi-channel hardware must have the first module (mca0) in the lower slot position.

Table 1-3   CCMAA PCI Slot Position by System

AlphaServer	CCMAA PCI Slot Position
1000	Any PCI slot
1000A	Slots 11, 12, 13
2000 family	See Table 1-4
4000/4100	OpenVMS: Any PCI slot
	Digital UNIX: 4.0A with TruCluster V1.4: Any PCI slot.
	Digital UNIX: 3.2G with TruCluster V1.0: PCI0 slots 2 and 3.
8200/8400	In a DWLPA, CCMAA adapters must be installed in slots 0 to 7. No slot restrictions in the DWLPB.
	OpenVMS: Only one CCMAA adapter may be in a DWLPA with motherboard number 54-23468-01. With motherboard number 54-24721-01, two may be installed in a DWLPA. You may have two CCMAAs in a DWLPB card cage, or one in a DWLPA and one in a DWLPB.
	Digital UNIX: Both CCMAA 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

For Digital UNIX in a multi-channel configuration, the first CCMAA adapter (to be mca0) must be in the lowest available slot the console sees. The second CCMAA (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 CCMAAs from one system may not be attached to the same hub. The placement of the CCMAAs 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 1-5 shows you the AlphaServer 2000 family's available slot positions at the bulkhead. Table 1-3 shows how these consoles count the slots differently.

Figure 1-5   Bulkheads for AlphaServer 2000/2100/2100RM/2100A

bx-0878-96
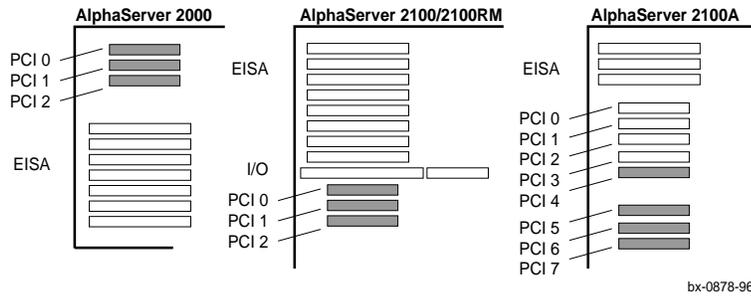
Table 1-4   Console ID and Bulkhead Numbers for AlphaServer 2000s

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

3 Change the CCMAA 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.

1.4.3 CCMAA Adapter Removal and Replacement

The CCMAA adapters are installed in the PCI slots as described in Section 1.4.2. Placement is checked using console commands. The adapter's end connector is attached to the PCI bulkhead. The BC12N cable is attached to the CCMAA connector.

Example 1-2   Set Bus Probe Algorithm and Confirm Placement

```
P00>>> show bus_*                               ❶
bus_probe_algorithm     new                     ❷

P00>>> init                                     ❸
VMS PALcode X5.48-117, OSF PALcode X1.35-81

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            ❹
bus 0, slot 8 -- mcb -- DEC PCI MC            ❹
AlphaServer 2100 Console V4.3-222, built on Nov 29 1995 at
19:58:46
```

Removal

To remove the CCMAA adapter, follow directions in your system owner's manual for removing and replacing PCI adapters. Use a ground strap when handling the module, and hold the module by the edges.

Replacement

If you are installing a multi-channel configuration, label each end of the 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 CCMAA adapter at the backplane, tightening the screw to hold it. This connects the module to ground.

2. Attach the link cable (see Section 1.5) to the CCMAA adapter at the bulkhead.

3. With a multi-channel configuration, install and cable the second adapter.

4. Replace system panels.

Check placement on PCI bus

❶ Check the bus probe algorithms on all systems by entering the **show bus_*** command.

❷ <u>For AlphaServer 2000 Family:</u> On each node, set bus algorithm to **new**. (It is not necessary to do this for other systems; the bus algorithm is programmed to poll modules from the lowest to highest slot position.)

❸ Enter an **initialize** command to start power-up tests.

❹ Check the placement of the CCMAA adapters. Both should report to the console here. Check that the adapter designated mca0 resides in the lower slot. Check placement against system requirements (see 1 above).

1.4.4 CCMAA Adapter LEDs

Power up each system. Check the status LEDs on the CCMAA adapters and the CCMLA linecards, if present. LED information is identical for the CCMAA-AA and the CCMAA-BA.

Figure 1-6 CCMAA Adapter and CCMLA Linecard LEDs

Off	Off	○○	No power, or hub not okay.
Amber	Off	◑○	Hub powered on. CCMAA offline or no power.
Green	Green	●●	Online; running cluster software or mc_cable diagnostics.

Off	Off	○○	Both CCMAAs offline.
Off	Amber	○◑	VH0 offline, VH1 active.
Amber	Off	◑○	VH0 active, VH1 offline.
Green	Green	●●	Online; running cluster software or mc_cable diagnostics.
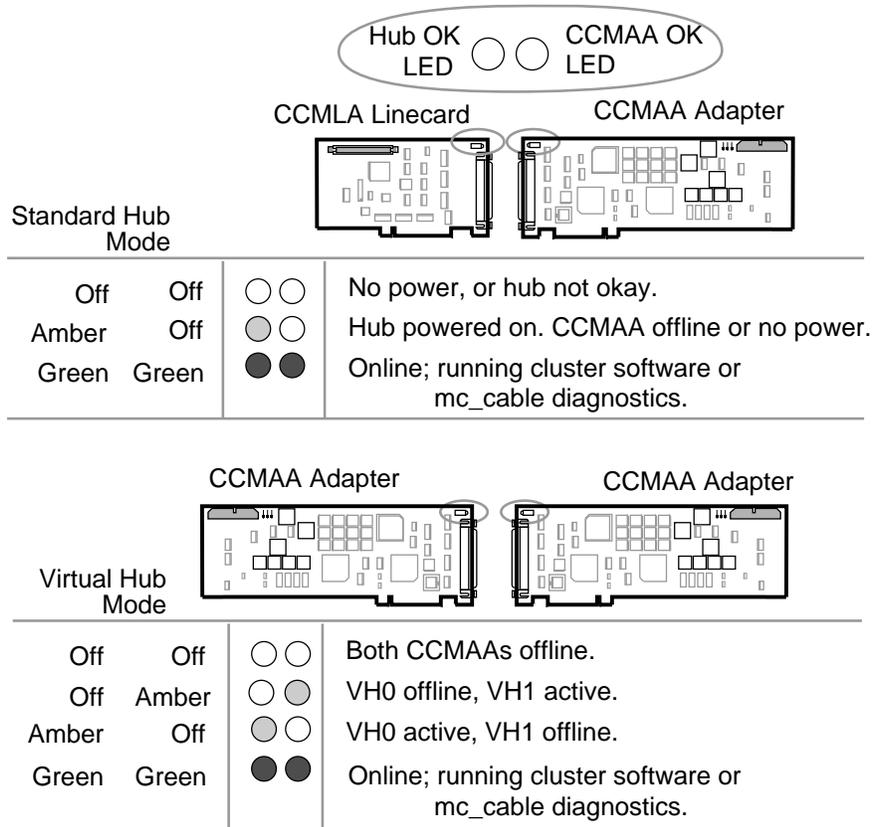
bx0886m-96

- The CCMAA adapter has two LEDs, a Hub OK LED on the left and a CCMAA OK LED on the right.

- Each LED has three states: off, amber, and green.

- The LEDs are in the upper corner of the module, near the connector, and can be read through the PCI backplate.

- These LEDs and their respective positions and meanings correspond to the two LEDs on each CCMLA linecard in the hub as well.

- The Hub OK LED lights as soon as the hub is powered on.

- When software begins a handshake sequence between the CCMAA adapter and the CCMLA linecard, both LEDs light, turning to green.

1.5 Link Cable

The BC12N is a 10-foot (3.05 m) cable with two 100-pin connectors. It connects the CCMAA adapter from a node to the hub when in standard mode or connects two CCMAA adapters when in virtual mode.

Figure 1-7   BC12N Cable
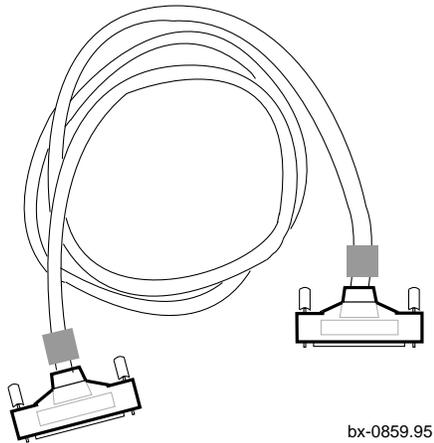
bx-0859.95

Each connector, provided with embedded screws, has 50 signal pins and 50 ground pins. Install the connectors carefully. Bent pins can cause errors. The cluster may run with bent pins initially, but errors from bent pins may show up later. Each end of the cable has a ferrite bead, located near the connector. With adapters in adjacent slots, the ferrite bead positions may have to be adjusted to allow the cables to fit.

To check cable connection, or to install snugly, rock the connector gently from side to side, not up and down.

A custom cable length of 12.5 feet is available for special configurations. Contact the product manager for servicing information.

Removal

If you are installing a multi-channel configuration, label each end of the 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.

The cable has two identical 100-pin dual in-line keyed connectors.

One connector is always attached to a CCMAA adapter in a system. The second connector is attached to the hub (in standard mode) or to another CCMAA adapter (virtual hub mode) in a second system. The ferrite beads of cables may interfere with each other. In this case, slide one or both beads slightly, keeping as close to the connectors as possible, until they fit (see Figure 1-8).

1. Loosen the embedded thumbscrews by turning counterclockwise.
2. Gently pull the cable connector from the receptacle on the back of the hub.

Figure 1-8   Cabling BC12N to the CCMHA Hub

Slot No.   7   6   5   4   3   2   1   0

bx0866a-95
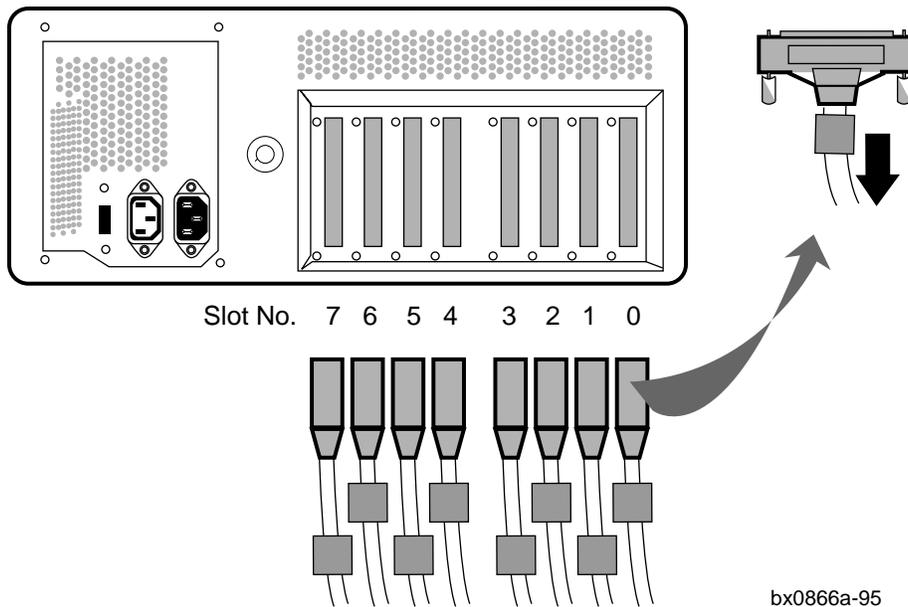
Replacement

•   To replace, reverse steps 1 and 2 above.

1.6 CCMHA Hub

The CCMHA hub can hold up to eight linecards. The hub has two FRUs: line-cards and the fan assembly. The hub is also available with no linecards (P/N 70-32780-01). If you are installing this version, you will need to swap the linecards from the hub you are replacing.

Figure 1-9 Hub, Rear View

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

bx0867-96

Slot No.   7 6 5 4   3 2 1 0

115

230

bx0866-95
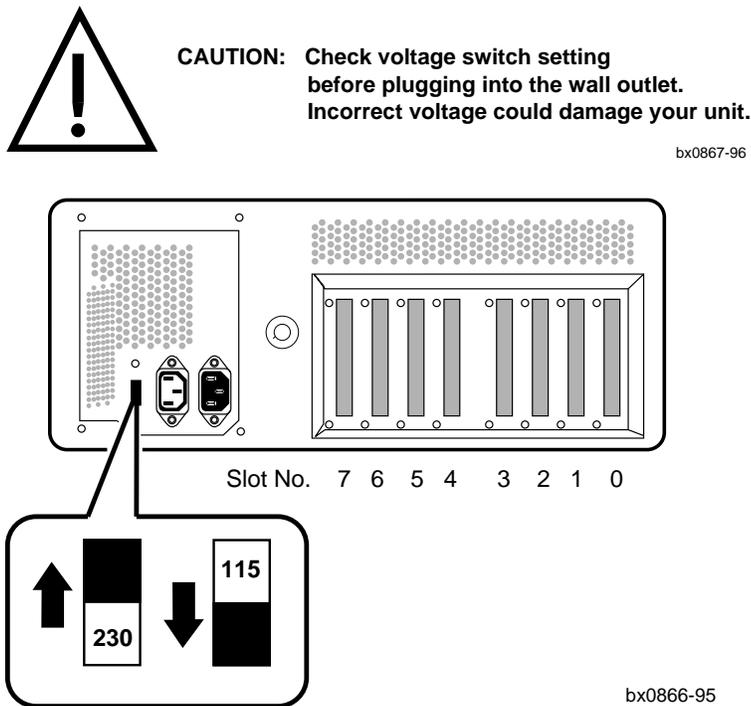
NOTE: You must set the voltage selection switch before powering up the hub.

The 70-30795-01 hub revision does not have a voltage selection switch. For this unit, which has self-regulating voltage selection, disregard step 3 of the Replacement procedure.

Table 1-5 Hub Specifications

Environmental				
Temperature	0° to 40° C (32° to 104° F) operating			
	−20° to 95° C (−4° to 203° F) storage			
Humidity	Up to 95% RH noncondensing			
Physical				
Weight	13 Kg (28 pounds)			
Dimensions	43.2 cm x 43.2 cm x 43.2 cm (17 in. x 17 in. x 17 in.)			
Electrical				
Input voltage (nominal)	100–120 VAC		220–240 VAC	
Input frequency	50–60 Hz		50–60 Hz	
Peak input current (steady state)	3.0 + 2.0 (Aux) A		1.5 + 1.0 (Aux) A	
Power consumption (typical)	140 W		140 W	
AC receptacle output current (nominal)	2 A		1 A	
Acoustical				
Declared values per ISO 9296 and ISO 7779	Sound Power Level LwAd, B		Sound Pressure Level LpAm, dBA	
Product	Idle	Operate	Idle	Operate
	5.0	5.0	36	36

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

Removal

1. Push in the power button to power down the hub. Unplug and remove the power cord.

2. Note the position of each cable, label, and disconnect. The cabled slot position determines node ID of cluster members. Returning cables and linecards to the same slots helps with troubleshooting, introducing fewer variables.

Replacement

1. Unpack and place the new hub into place.

2. Install linecards and connect cables to their previous position.

3. Check voltage selection switch and set to correct voltage.

4. Attach the power cord to the hub and plug it in.

5. Turn the hub on by pushing in the power button on the front of the hub control panel.

1.7 Hub Panel Removal

You may have to remove one or more panels to access the hub components.

Figure 1-10   Removing Hub Panels
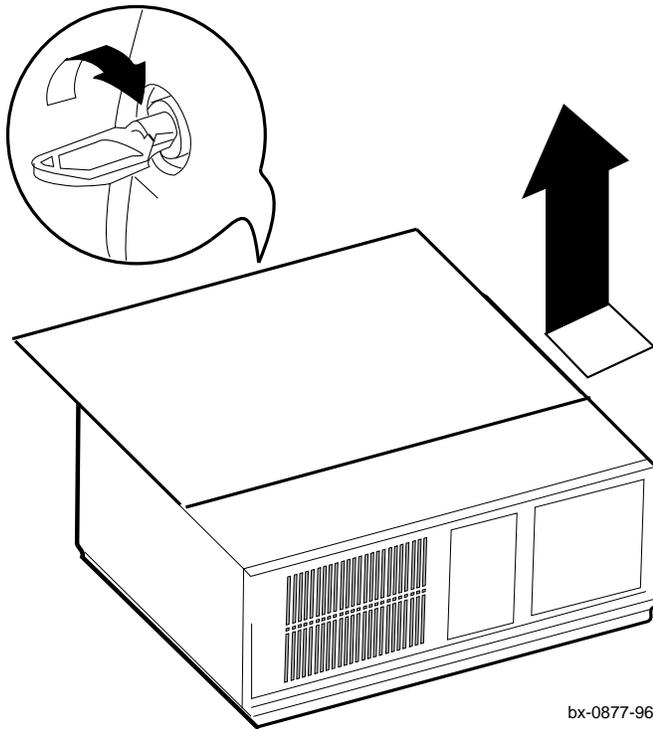
bx-0877-96

Removal

1. Push in the power button to power down the hub. Unplug and remove the power cord.

2. Unlock the back panel by rotating the key clockwise to its open position. The lock is open when the key is parallel to the short side of the back panel.

3. Pull the hub panel off by using the finger hold at the front edge of the panel. Pull the top panel toward you while holding the main unit steady with your other hand. It is a tight fit, so it may require a strong pull to loosen the panel.

4. Pull the panel back and off. Place to the side.

Replacement

1. To replace, seat the top panel on the hub with the edge 2 inches from the front. Holding the unit steady, push the back of the panel in with force until the clips catch and hold.

2. Secure the panel by turning the key counterclockwise to the lock position, parallel to the long edge of the rear panel.

1.8 CCMLA Linecard

Eight CCMLA linecards (P/N 54-23665-01) can be installed in the hub. Each linecard has two diagnostic LEDs visible from the rear of the hub.

Figure 1-11   CCMLA Linecard

LEDs
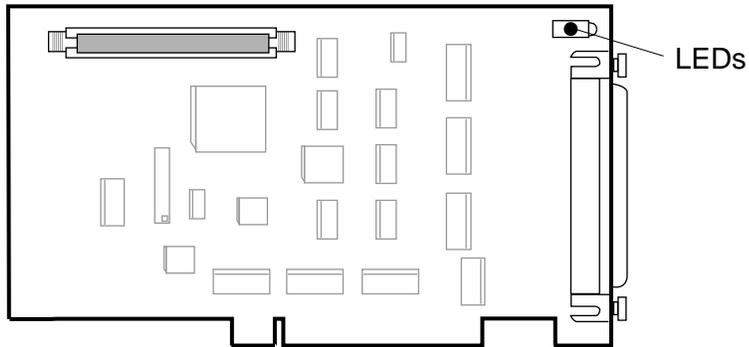
bx0855-96

Removal

1. Power down and remove the hub's top panel (see Section 1.7).
2. Note the position and label the cable connected to the linecard and disconnect. Return the cable to the same slot; position determines node ID of cluster members.
3. Remove the mounting screw that secures the linecard to the card cage.
4. Remove the linecard by pulling it straight up and out of the slot connector.

Replacement

1. Install the new linecard in the same slot. Seat it firmly in the connector on the motherboard. If the linecard is not installed correctly, it may not function correctly.

2. Secure the linecard to the card cage with the mounting screw.

3. Reconnect the cable.

4. Reinstall the top panel.

5. Power up and check the LEDs.

Figure 1-12 CCMLA LEDs
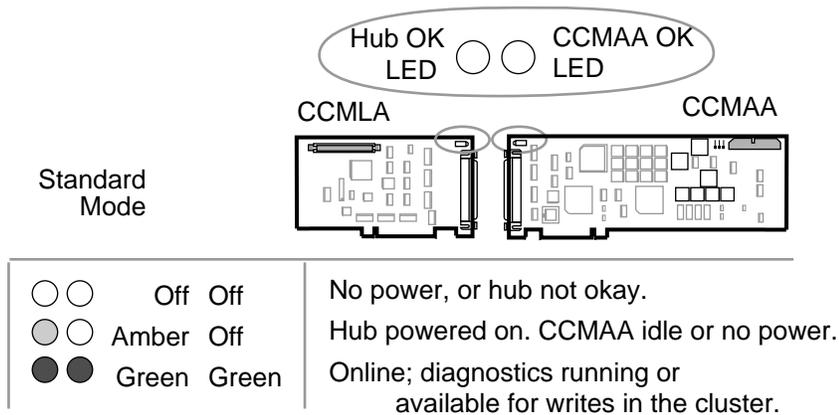
bx0884n-95

Two LEDs are in the upper corner near the connector. The LEDs can be seen through the back of the hub. Each LED has three states: off, amber, and green. The left LED is the Hub OK LED and indicates the status of the hub. The right LED is the CCMAA OK LED. These LEDs and their respective positions and meanings are the same as the two LEDs on each CCMAA adapter.

1.9 Hub Fan Assembly

The fan (P/N 70-31242-01 or 70-30797-01) is located behind the control panel and is secured to the system unit by clips. The fan unit is 7 inches (17.8 cm) high, 5.25 inches (13.3 cm) wide, and 2 inches (5.1 cm) deep.

Figure 1-13   Hub Fan Assembly

Tabs   Clips
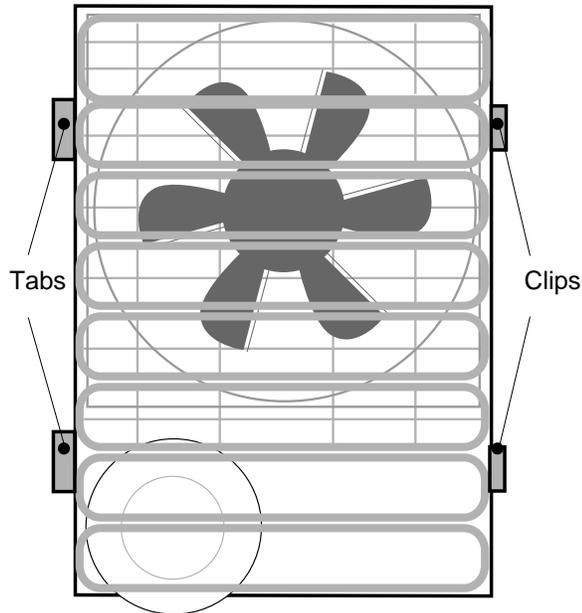
bx-0860-96

The fan assembly includes the fan and its housing. Most hubs (70-30795-02) contain the 70-31242-01 fan assembly. However, a few hubs (70-30795-01) will have fans with part numbers of 70-30797-01, which have a self-regulating power supply (there is no voltage switch).

NOTE: If you remove the 70-30797-01 fan, you must upgrade to the 70-31242-01 fan and new power supply.

The fan assembly may need replacement if:

- The fan fails to turn; no sound and no suction of air into the unit.
- The linecards fail repeatedly; may be due to overheating, caused by a faulty fan unit.
- If you are replacing a 70-30795-01 hub's power supply, see Section A.4.

Removal

1. Power down the hub.
2. Remove the top panel (see Section 1.7).
3. Disconnect the power cord from the power supply.
4. Disconnect the temperature sensor from the front of the fan assembly; the sensor is wrapped with the power lead.
5. Depress the two plastic clips on the front cabinet that hold the fan in the frame, tilt the fan assembly out, and carefully pull it away from the hub.[1]

Replacement

1. Insert the lower tabs of the fan assembly into the slots on the front frame.
2. Tilt the fan up and press into the frame until the clips lock.
3. Thread the power cord through the side panel.
4. Connect the fan cable to the power supply.
5. Clip the temperature sensor onto the front of the fan assembly.
6. Replace any linecards you removed for access.
7. Replace the top panel.
8. Power up the hub.

---

[1]You may need to remove some linecards or disconnect the wires from the control panel to remove the fan.

1.10 Hub Power Cords

The hub ships with the power cord assigned to the country of destination. Figure 1-14 illustrates several hub power cords and their receptacles.

Figure 1-14   Hub Power Cords and Receptacles

USA/Canada/Japan BN25A-01

UK/Ireland BN35B-01

Central Europe BN35B-07

Switzerland BN35B-02

bx0864-96
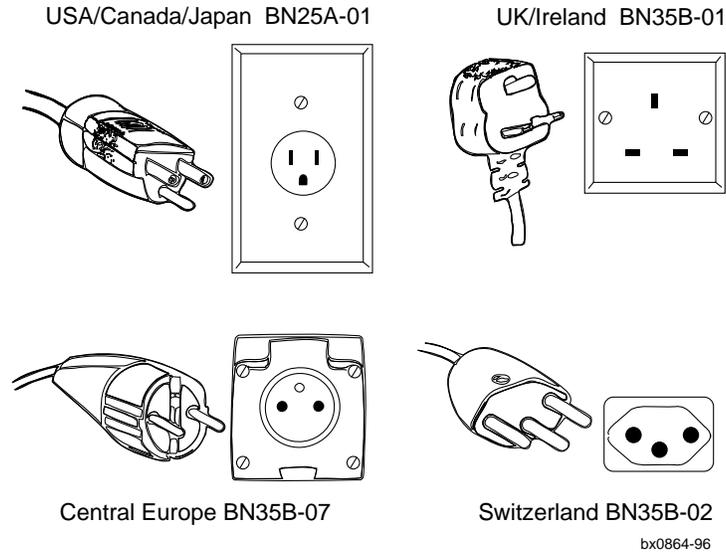
All CCMHA-AA hubs ship with a BN35A-01 (North American) power cord, which will be redundant in areas that do not use this type of cord.

Table 1-6 lists the hub power cord for various countries.

Table 1-6 Hub Power Cords

Name	Part No.	Country	Alternates
BN35A-01	17-04357-01	N. American/Japan	
BN35B-08	17-04364-08	Australia/ New Zealand	BN25P-2E/17-00198-12
BN35B-07	17-04364-07	Central Europe	BN03A-2E/17-00199-17
BN35B-01	17-04364-01	United Kingdom/ Ireland	BN19B-2E/BN26D-2E 17-00209-18, -19
BN35B-02	17-04364-02	Switzerland	BN04A-2E/17-00210-11
BN35B-06	17-04364-06	Denmark	
BN35B-04	17-04364-04	Italy	BN19M-2E/17-00364-18
BN35B-03	17-04364-03	Egypt/India	BN22X-2E/17-00456-14
BN35B-05	17-04364-05	Israel	BN22M-2E/17-00457-14

1.11 Optional Rackmount Kit

The CCMRA rackmount kit contains rails and brackets to install the CCMHA hub into a rackmount cabinet. The brackets and rails can be mounted in both metric and non-metric cabinets.

Figure 1-15   CCMRA Rackmount Kit

bx0843B-96
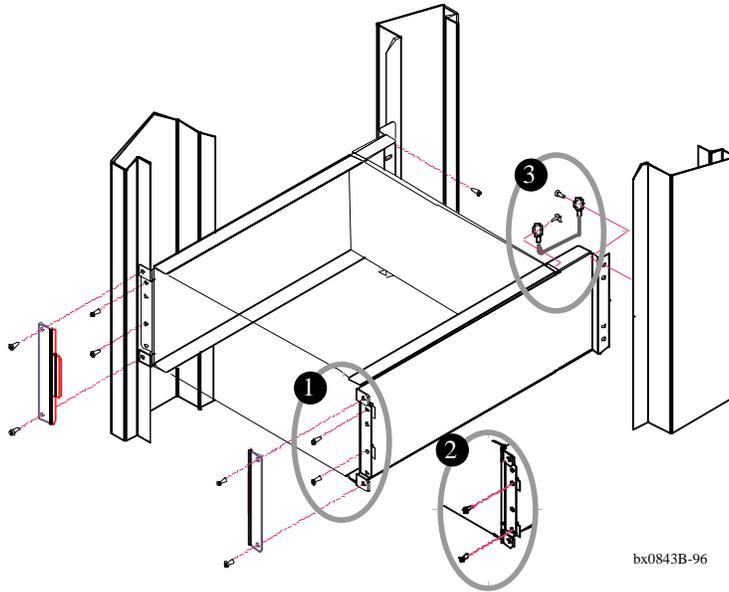
Table 1-7 CCMRA Kit Contents

Part Number	Quantity	Description
74-50264-02	1	Left hub mounting bracket
74-50264-01	1	Right hub mounting bracket
74-50265-01	2	Rear bracket
74-50649-01	4	Protective strip
90-09984-22	8	Screw, machine M5 pan 16 mm (hub to mounting bracket)
90-09984-23	4	Screw, machine M5 pan 8 mm (rear bracket to rack)
90-06668-01	4	Washer, plain
90-07786-04	8	Nut, U-nut M5 (for hub to rack mounting screws)
12-13756-01	1	Wire, ground
EK–PCIRM–SV	1	*MEMORY CHANNEL Service Information*

Installation

1. Attach the right (74-50264-01) and left (74-50264-02) mounting brackets to the rack, using four 16 mm screws (90-09984-22) and four nuts (90-07786-04) and two washers (90-06668-01) in only the rear slots of each bracket.
   For metric installations, use holes 1 and 3 (see ❶, Figure 1-15).
   For nonmetric system mounting, use holes 2 and 4 (see ❷).

2. Apply a protective strip (74-50649-01) to the top and bottom rail of each mounting bracket.

3. Attach the two rear brackets (74-50265-01), using two 8 mm screws (90-09984-23) for each bracket. Slide the hub into the mounting brackets until stopped by the rear brackets.

4. Attach the ground wire ❸ (12-13756-01), using two screws (90-09984-22), to the top right-hand corner of the hub, and the other end to the top hole, on the right side mounting bracket (74-50264-01).

Chapter 2

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

2.1 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 CCMAA adapters in the system's PCI. Then proceed with MC diagnostics.

Figure 2-1   Verification Overview
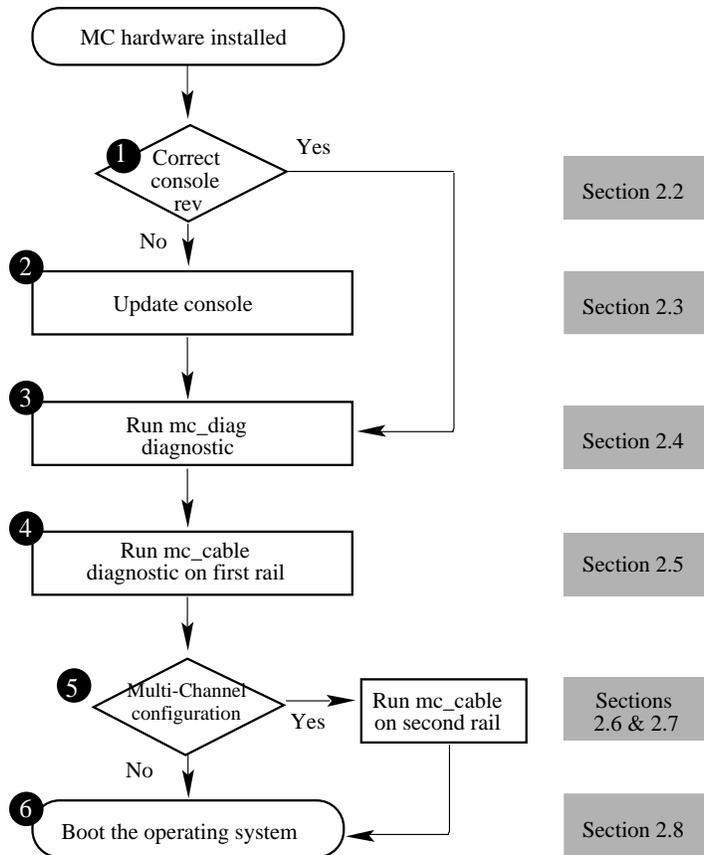
bx0827b-96

❶ Check that each system console supports MEMORY CHANNEL. The method to verify support differs between machines.
See Section 2.2, Verify Console Supports MEMORY CHANNEL.

❷ Upgrade the console to the required revision, if needed.
See Section 2.3, Update Console, If Required

❸ Run **mc_diag** on each system to check the CCMAA adapter.
See Section 2.4, Run the mc_diag Diagnostic.

❹ Run **mc_cable** on each system to check the cables, the CCMHA linecards, and connections. See Sections 2.5 and 2.6, 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 2.7, 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 2.8, Prepare to Boot Your Operating System.

2.2 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 2-1   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.
In the AlphaServer 4000/4100 and 8200/8400 systems, MEMORY CHANNEL diagnostics are latent in recent consoles 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 2.4, 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 2.3, Update Console, If Required.

2.3 Update Console, If Required

Find the most recent console file for your system from the AlphaServer Firmware Update CD (AG-PTMW*-BS) or on the Internet (see Table 2-1).   Follow the instructions for your system to update your console.

Table 2-1   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 2-1. 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 V3.4 firmware CD are located at:

>   ftp://ftp.digital.com/pub/Digital/firmware/v3.4/

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

If you are working from the Internet, the steps for updating your console are described in detail in the Alpha Firmware Internet Readme text located at:

ftp://ftp.digital.com/pub/Digital/Alpha/firmware/readme.txt

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/Alpha/firmware/v3.7/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:
   ftp://ftp.digital.com/pub/Digital/Alpha/firmware/v3.7/xxx/

   where xxx is a subdirectory designated for your system.

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
http://www.service.digital.com/info/alphaserver/products.html

---

2.4 Run the mc_diag Diagnostic

Mc_diag tests the internal logic of the CCMAA 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 redundant configurations, both modules are tested in each system.

Figure 2-2 Testing the CCMAA Adapters

bx0807a-96
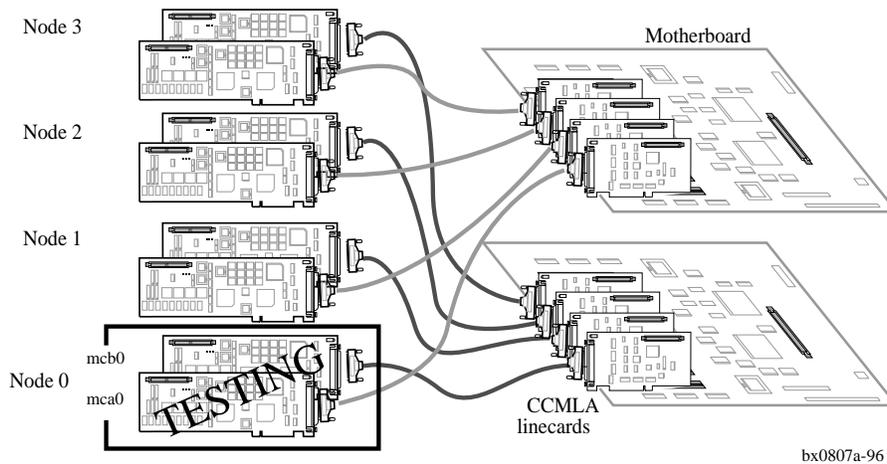
Example 2-2   Running mc_diag on Each System

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

P00>>>
```

You can run mc_diag with a -d option to check registers, for troubleshooting. See Sections 3.2 and 4.2.

❶   Initialize your system to reset the registers.

❷   Enter the console command **mc_diag**.

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

❸   The first CCMAA 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 CCMAA here.

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


```
                     mcx0          or          mcn
CCMAA adapter ___|   |___                CCMAA adapter ___|   |
first adapter= a0  ─────┘                first adapter = 0 ─────┘
second adapter= b0                       second adapter = 1
```
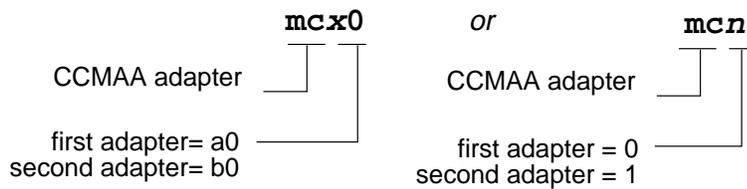
bx0841b-95

For more information:
Section 3.4, Troubleshooting with mc_diag
Section 3.10, Reading MEMORY CHANNEL Registers

2.5 Run the mc_cable Diagnostic
(Single-Channel Configuration)

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

Figure 2-3   Testing the Cables, Hub Linecards, and Motherboard

Node 3 CCMAA

Node 2 CCMAA

Node 1 CCMAA

Node 0 CCMAA

Motherboard

TESTING

CCMLA
linecards
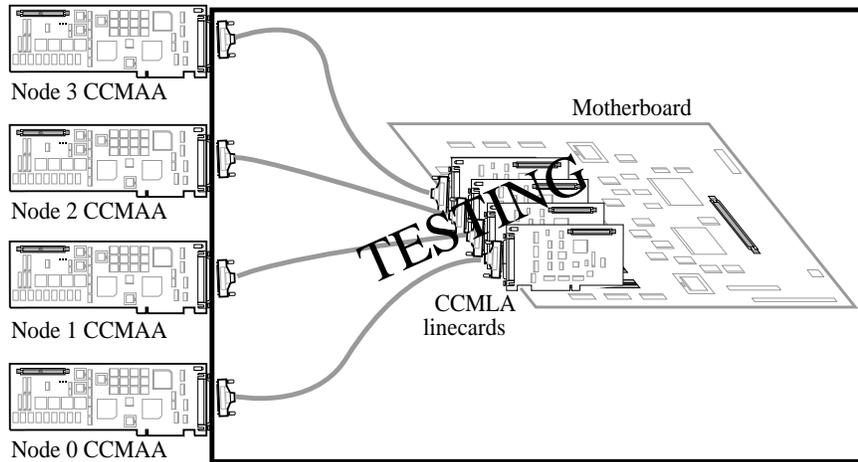
bx0809-96

Example 2-3   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. In a virtual hub system, it tests the cable and the virtual hub logic. Mc_cable reports changes in cable status and continues to run until it is halted using Ctrl/C (^C).

The example shown is a four-node single-channel configuration, standard hub mode. (An example of a two-node virtual hub mode configuration is given in Example 3-5.)

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

❷   Enter the **mc_cable** command.

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

❹   The CCMAA 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 CCMAA 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 3, Troubleshooting

2.6 Run the mc_cable Diagnostic (Multi-Channel Configuration)

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

Figure 2-4   Multi-Channel Configuration Running mc_cable

bx0808a-96
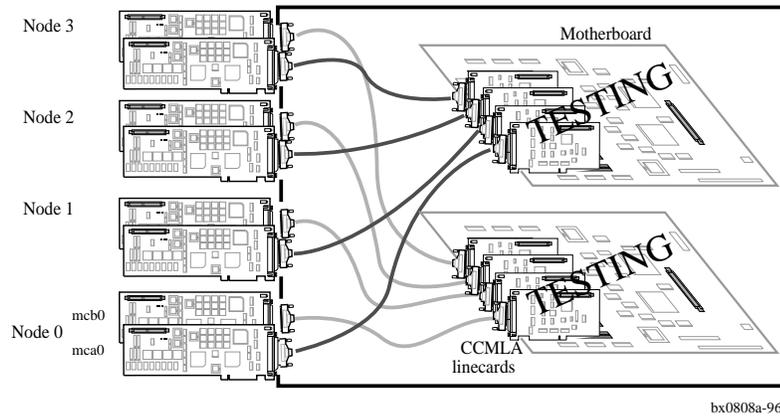
Example 2-4   Running mc_cable on Node 1, Multi-Channel Configuration

```
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 **initialize** command to reset the registers.

❷   Enter the **mc_cable** command.

❸   The first CCMAA 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 CCMAA adapter, mcb0, on node 1 is online. The diagnostic scans for other nodes responding. None found yet.

❺   Two CCMAA 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 CCMAA adapter 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 3, Troubleshooting

2.7 Check for Crossed Rails (Multi-Channel Configuration)

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

Figure 2-5   Running mc_cable to Check Multi-Channel Cabling
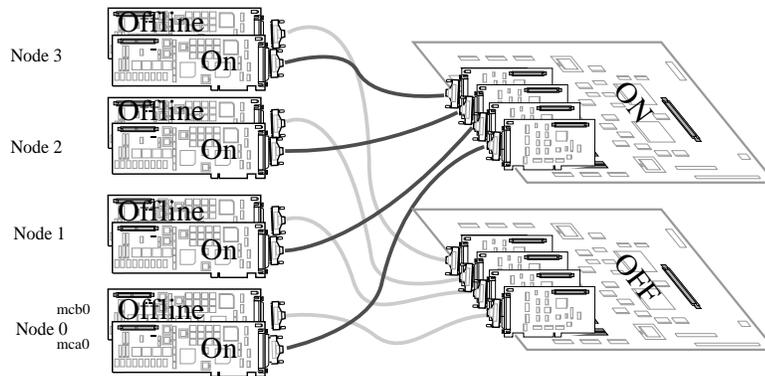
bx0808b-96

Example 2-5   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   P00>>> mc_cable              ❶
To exit MC_CABLE, type <CTRL/C>  To exit MC_CABLE, type <CTRL/C>
mca0 node id 0 is online         mca0 node id 1 is online
Response from node 1 on mca0     Response from node 0 on mca0
NoResponse from node 2 on mca0   Response from node 1 on mca0
Response from node 3 on mca0     Response from node 3 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 0 is online         mcb0 node id 1 is online
Response from node 1 on mcb0     Response from node 0 on mcb0
No Response from node 2 on mcb0  Response from node 1 on mcb0
Response from node 3 on mcb0     Response from node 3 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 2 on mca0     mcb0 is offline              ❷
Response from node 2 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 CCMAA adapters, and when all systems are running mc_cable, all systems report response from all other CCMAA adapters in the cluster.

❷   Now, turn off the redundant hub, which should be connected to all CCMAA adapters in the redundant 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 BC12N 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.

2.8 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 2-6   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: b, 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>>> set bus_probe_algorithm new        ❹


P00>>> show version                       ❺
version                V4.6-201 Aug 15 1996 11:54:23


P00>>> boot                               ❻
```

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 CCMAA 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   For Digital UNIX, set bus algorithm to **new**.
      For OpenVMS: set bus algorithm to **old**.

      Additional environment variables may be set. See your operating system documentation and the *Software Product Description* for more information.

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

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

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

Chapter 3

Troubleshooting

This chapter describes basic MEMORY CHANNEL troubleshooting procedures, using diagnostics and using the error log. Topics covered include:

- Console Error Messages and Overview

- Operating System Errors

- Boot Problems

- Troubleshooting with mc_diag

- Troubleshooting with mc_cable

- Changes Reported by mc_cable

- Using Virtual Hub Mode to Troubleshoot

- Cable Troubleshooting

- CCMAA Troubleshooting Checklist

- Error Logging

- Fault Isolation

- Reading MC Registers

- MC Registers and Address Space Allocation
  Link Control and Status Register (LCSR)
  MC Error Register (MCERR)
  MC Port Register (MCPORT)
  PCI Receive (from MC) Base Address Register (PRBAR)
  PCI Status and Control Register (CFG04H)
  Configuration Longword 10h Register (CFG10H)

For more information:

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

3.1 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 3-1   Troubleshooting Overview
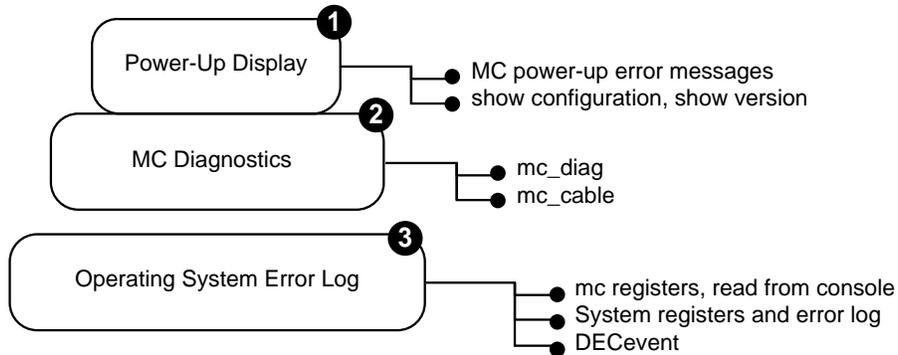
bx-0844-96

Example 3-1   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 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.

    ① **For AlphaServer 2000/2100:** An upgrade is needed. See Section 1.2.2, AlphaServer 2000/2100 Requirements.

    ② **For AlphaServer 8200/8400:** In a DWLPA[1], CCMAA adapters must be installed in PCI slots 0 through 7. No slot restrictions in the DWLPB. Under Digital UNIX with multi-channel configurations, both CCMAA adapters must be in the same DWLPA/DWLPB card cage. Under OpenVMS with multi-channel configurations, only one CCMAA adapter may be in a DWLPA. You may have two CCMAAs in a DWLPB, one in a DWLPA and one in a DWLPB, or one CCMAA adapter in each of two DWLPAs.
If the error message persists, an upgrade is needed.
Contact your local Digital Customer Support Service Center.

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

The **show configuration** console command can be used to confirm that the CCMAA 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 3.4, Troubleshooting with mc_diag, and Section 3.5, Troubleshooting with mc_cable.

The diagnostics check the cables (see Section 3.7, Cable Troubleshooting). And by changing your mode from standard to virtual hub, you can troubleshoot components. See Section 3.8, CCMAA Troubleshooting Checklist.

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 Digital field service to analyze the system error log. See Section 3.2, Operating System Errors and Section 3.9, Error Logging.

_____

[1] This restriction only applies to DWLPAs with motherboard number 54-23468-01. This restriction does not apply to DWLPAs with motherboard number 54-24721-01.

3.2 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.

3.3 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.

BX0527-94

Check your operating system error log for further information.

3.4 Troubleshooting with mc_diag

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

Figure 3-2 Troubleshooting the CCMAA Adapter with mc_diag

bx0807a-96
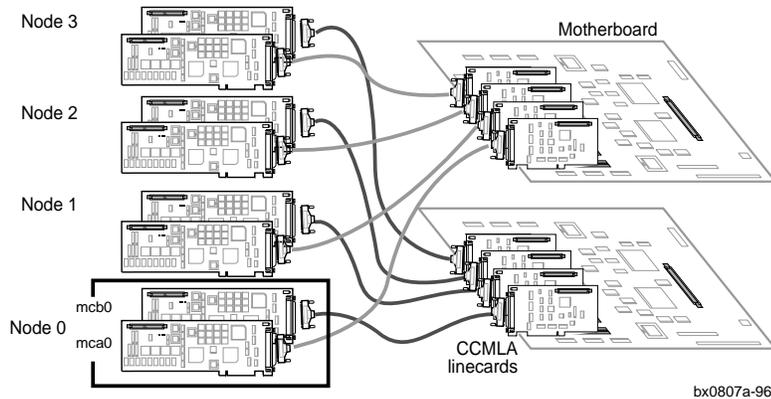
Example 3-2 Errors with mc_diag

```
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 CCMAA adapters in a system. In this example, two CCMAA adapters are tested, and the second CCMAA fails.

❶ The first CCMAA adapter on this node passed the internal logic tests and reports to the console. If an installed CCMAA does not report here, assume the console does not see it and check installation (see Section 3.8, CCMAA Troubleshooting Checklist).

❷ These error messages indicate that the CCMAA 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 CCMAA adapter is not reporting. Check the adapter's physical installation, its seating in the PCI, the cable connections, and run the diagnostic again.

For more information:

Section 2.4, Run the mc_diag Diagnostic
Section 3.10, Reading MEMORY CHANNEL Registers

3.5 Troubleshooting with mc_cable

3.5.1 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 3-3 Testing the Cables, Hub Linecards, and
Motherboard
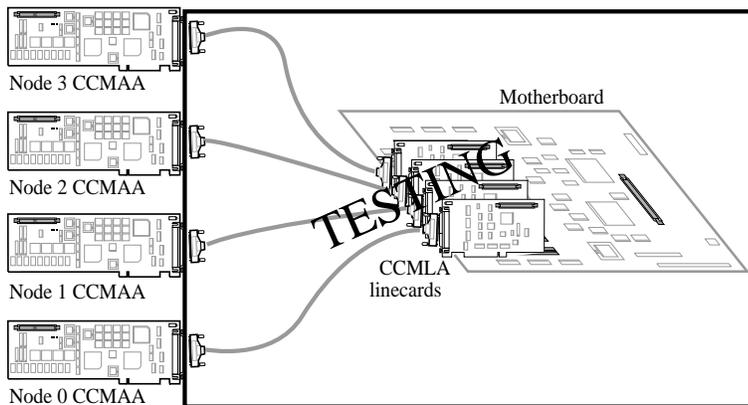
bx0809-96

Example 3-3 Running mc_cable on Node 1

```
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
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     ❷
mcb0 node id 0 is online            ❸
Response from node 3 on mca0
```

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 CCMAA adapter paths.

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

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

CCMAA, Node 0

bx0809a-95
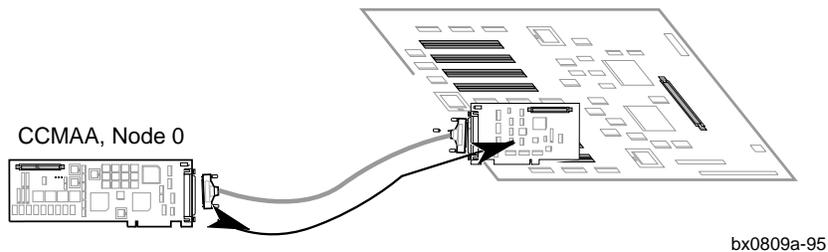
❷ Next, the diagnostic looks for other nodes that are online running mc_cable. It checks each CCMLA linecard position on the motherboard and reports if a CCMAA can be reached. Expect to receive notice that other nodes are not yet responding when you first start mc_cable. As other nodes join, notice of their reporting is given. When other nodes respond, the data is flowing through the MC hardware as shown below.

bx0809b-95
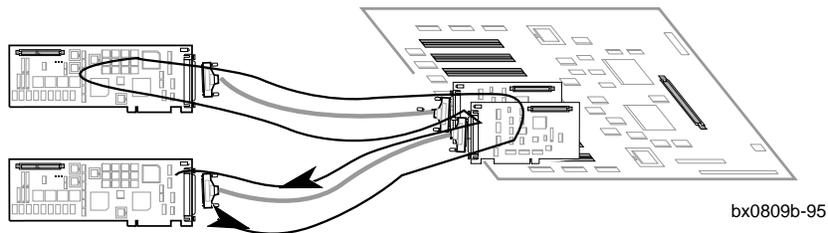
❸ Now the diagnostic checks the second adapter, if present, and all of its connections in the multi-channel cluster.

3.5.2 Changes Reported by mc_cable

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

Example 3-4 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 CCMAA mca0 adapter has gone offline but mc_cable continues to run, listening for MC cluster status. The connection has been lost between the CCMAA adapter and the CCMHA hub.

- Check that the hub has power.

- Check the cable connections.

- Check the cable connector pins.

❷   Node 0's CCMAA 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 re-polls its cluster to see what nodes are reporting. Here, node 3's response is reported again by node 0 when node 0's CCMAA mca0 adapter comes back online.

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

3.6 Using Virtual Hub Mode to Troubleshoot

To isolate problems with hardware in standard hub mode, change the jumpers on the CCMAAs you wish to test and cable them in virtual hub mode.

Figure 3-4   Troubleshooting in Virtual Hub Mode

CCMAA   BC12N-10   CCMAA

bx0813h-95

Node 0: Jumper middle and right pin (VH0)

Node 1: No jumpers set (VH1)

bx0853f-96
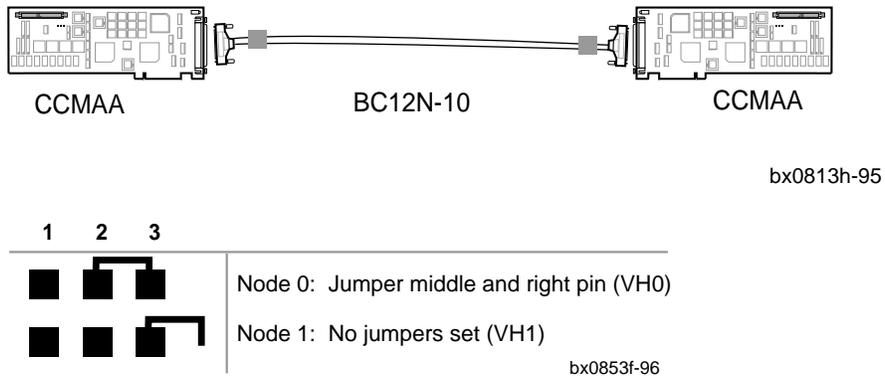
Example 3-5   Running mc_cable in Virtual Hub Mode

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

With a standard hub system of three or more nodes, you can check cluster components by switching two of the nodes to a virtual hub configuration and running the mc_diag and mc_cable diagnostics. This eliminates the hub and tests both adapters and cables, allowing you to isolate problems more completely.

You must change the CCMAA jumpers when changing between standard and virtual hub mode.

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

❷   Enter **mc_cable** on node 0.

❸   The CCMAA adapter on node 0 immediately reports online. The diagnostic has checked that the CCMAA signal can reach the virtual hub mode partner, node 1. So far, no response has been received because node 1 is not yet online running the mc_cable diagnostic**.**

❹   Expect to receive notice on node 0 that the other node is not yet responding when you first start mc_cable. Proceed to node 1 and enter **mc_cable**.

❺   When node 1 comes online running mc_cable, notice of its response is given to node 0.

❻   Node 1 receives response back from node 0. The data is flowing through the MC hardware and all components are verified.

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

❽   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.

If node 1 does not report, replace the cable and try again.

If the diagnostic still does not run successfully, reset the jumpers and connect to another CCMAA adapter and run it again. A failure here suggests that node 0's CCMAA is at fault and needs to be replaced. See Section 1.4.3, CCMAA Adapter Removal and Replacement.

3.7 Cable Troubleshooting

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

Figure 3-5   BC12N Cable

bx-0859.95
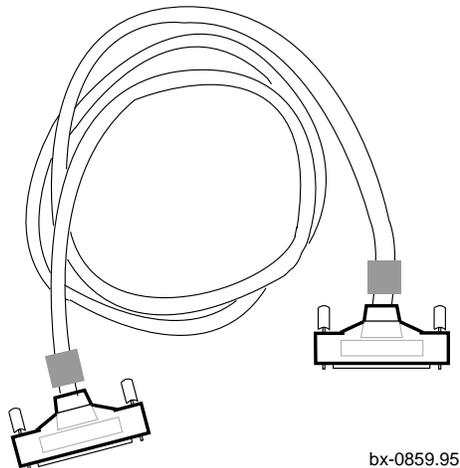
Cables are functioning correctly when the mc_cable diagnostic runs without errors (see Section 3.5, Troubleshooting with mc_cable).

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 signal 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.

- Check system positions for pulling on the cables. The cables can be taut but not tight between connections.

3.8 CCMAA Troubleshooting Checklist

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

CCMAA is functioning correctly when both LEDs blink on during module reset. Prior to going online, in virtual hub mode, both LEDs are off. In standard mode, the Hub OK LED is amber, and the CCMAA LED is off.

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 CCMAA adapter.	1.4.3
Does not report online to mc_cable	• Jumpers must be set for the hub mode used. Check jumper positions.	1.4.1
	• Check cable.	3.7
	• Check power to CCMHA hub; it may be off.	1.6
	• Check seating of module in PCI.	1.4.3
	• Virtual hub mode: Run mc_cable on the other node.	2.5
	• Multi-channel configuration: Check for crossed rails.	2.7
Does not respond to mc_cable running on another node	• Check jumpers on all CCMAA adapters. Must be in correct hub mode.	1.4.1
	• Check cable connection; make sure the cable is attached finger-tight.	1.5
	• Check the cable by moving it to a different linecard and running mc_cable again.	1.5
	• Change to virtual hub mode and check the cable.	3.6
Reports intermittently	• Not screwed into the PCI bulkhead tightly enough. The module must be seated firmly to make a good connection.	1.4.3
	• Check cables.	1.5
Fails mc_diag	• An internal logic failure. Replace adapter.	1.4.3
HUB OK LED off hub mode	• Check the CCMAA jumpers for correct setting.	1.4.1
	• Check the cable connections and pins.	1.5
	• Check the LED on the CCMLA linecard.	1.8
Both LEDs stay amber after power-up	• Reseat CCMAA in PCI slot.	1.4.3
	• Remove cable; if LEDs stay on and not blinking, replace CCMAA adapter.	1.4.3

3.9 Error Logging

This section describes the format and content of the PCI MEMORY CHANNEL adapter error event entry and an overview of the DECevent utility, which can be used to diagnose problems associated with MEMORY CHANNEL hardware.

3.9.1 Error Log Overview

All errors detected and reported by MEMORY CHANNEL adapters are logged by driver and operating system code using the format described below. The entry contains all the information necessary to enable symptom-directed diagnosis (SDD), fault isolation and repair, utilizing the bit-to-text report generation and analysis capabilities of fault management tools such as DECevent.

The complete event log entry comprises an operating system event log entry header and hardware platform-specific information followed by PCI device information describing the specific error event detected by the MEMORY CHANNEL adapter, as follows:

- Operating system header

- Hardware platform information

- PCI device error event information

The format and content of the event log entry header is specific to each operating system.

The hardware platform information includes a longword of platform-specific PCI identification information and a longword containing the address of the device's configuration header address which provides explicit PCI device identification. A third longword describes the size of the PCI device error information subpacket. Figure 3-6 shows the format and content of the PCI device error information subpacket logged for CCMAA adapter errors. The format of the subpacket is modeled after the PCI Configuration Space Header.

Figure 3-6 MEMORY CHANNEL Error Information Subpacket

31 24	23 16	15 08	07 00	Offset
Device ID		Vendor ID		00
PCI BusStatus		PCI BusControl		04
BaseClass	SubClass	RegProg	RevisionID	08
BIST	HeaderType	Latency	CacheLine	0C
PCITbar			WindowCntl	10
MaxLatency	MinGrant	IntrPin	IntrLine	14
PCTData				18
MCLcsr				1C
PCIRbar				20
MCError				24
MCPort				28

3.9.2 MEMORY CHANNEL Adapter Event Report Generation Using DECevent

Digital UNIX logs MEMORY CHANNEL adapter errors as "Adapter Type Errors" (entry type 105). To select MEMORY CHANNEL adapter event log entries for DECevent translation report generation, enter the following command:

On Digital UNIX systems:

```
dia -i osf_entry=105
```

On OpenVMS systems:

```
$diagnose/translate/include=mca0
                            mcb0
```

If other types of adapter errors are in the event log, they are also included in the report. Example 3-6 is a sample DECevent (fault management tool) report from a Digital UNIX MEMORY CHANNEL adapter error event entry. Example 3-7 is an OpenVMS example. The DECevent report is described in the sections that follow.

3.9.3 Symptom-Directed Diagnosis Using the MC Error Event Entry

Information from the MC error event entry is displayed in the report in three places:

- The first section displays entry header information that identifies the system, event type, and timestamp.

- The second section (PCI Dev Config Data) displays PCI device configuration header information and displays the state of the PCI bus portion of the MC adapter. The contents of PCI bus control and status registers are displayed in the PCI BCR bits and PCI BSR bits and fields in this section of the report. These fields display the state of PCI bus-related error flags.

- The third section of the report (MC Adapter CSRs) displays the CCMAA adapter's control and status registers and displays the state of the MEMORY CHANNEL portion of the adapter and any errors detected during MEMORY CHANNEL transactions. The significant MEMORY CHANNEL error flags in the Link Control and Status Register (LCSR) and MC Error Register (MCERR) are displayed in the Link Control and Status Register and MC Error Register fields in this section of the report.

Asserted errors in PCI BCR bits and PCI BSR bits usually indicate a problem between the CCMAA adapter and the PCI bus. Check the event log for any error event entries logged by other PCI devices in the same time frame that might be related and assist in isolating the fault.

Asserted errors in the Link Control and Status Register and MC Error Register fields indicate a problem on the MEMORY CHANNEL portion of the adapter. Depending on the specific error condition, the fault may be isolated to the reporting CCMAA adapter, the link cable, the associated hub linecard, the hub, or the sending node. Check the system event logs of the other nodes in the cluster for any additional MC error event entries that may have been logged in the same time frame.

The sample MC error event report in Example 3-6 indicates the MC adapter detected a page control table (PCT) parity error (MCERR <31>) while attempting to perform an MC transmit operation.

The DECevent report is divided into three sections:

❶   Section 1 displays entry header information, identifying the system, timestamp, and event type.

Example 3-6   DECevent Report Sample (Digital UNIX)

```
**************************** ENTRY   1 ****************************
Logging OS                 ❶        2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number               3.
Timestamp of occurrence             16-AUG-1995 18:28:37
Host name                           tweetyrm

System type register       x00000009 AlphaServer 2x00
Number of CPUs (mpnum)     x00000003
CPU logging event (mperr)  x00000000

Event validity                      1. O/S claims event is valid
Event severity                      3. High Priority
Entry type                        105. Adapter Type Errors

---- Device Profile ----
Unit                                0
Product Name                        MEMORY CHANNEL System
Vendor                              DIGITAL
```

❷   Section 2 displays PCI device configuration header information, displaying
     the state of the PCI bus portion of the MC adapter. The contents of the
     PCI bus control and status registers are displayed.

Example 3-6 DECevent Report Sample (Digital UNIX)
(Continued)

```
-- PCI Dev Config Data - ❷
Vendor ID                       x0011 Digital Development System No. 17.
Device ID                       x0018 MEMORY CHANNEL Adapter for PCI Bus

Bus Control/Status Reg
    PCI BCR Bits  <15:00>       x0146  IO Space Disabled
                                       Memory Space Enabled
                                       Bus Master Enabled
                                       Special Cycles Operation Disabled
                                       Memory Write Invalidate Disabled
                                       PCI Data Parity Error Enabled
                                       Wait Cycle Disabled
                                       PCI Address Parity Error Enabled
    PCI BSR Bits  <31:16>       x0400  PCI DEVSEL Timing ------- x0001
Revision ID                     x0B  Release 11
Class Code
  Reg Program Field             x00  Level Programming Not Implemented
  Sub Class Code                x80  Network Controller Type Not Defined
  Base Class Code               x02  Network Controller

Cache Line Size                 x00  Feature not implemented
Latency Timer Value             xF8  Increments of 8 PCI clock cycles
Header Type Field               x00  Single Description Adapter/
                                        STD Configuration
Built-In Selftest               x00  No Built-In Selftest
MC Transmit Base Address
  Window Control                x00  Transmit Window in PCI Memory
  Base Address             xC00000  Transmit Base Address --- x000000
                                     PCITbar Field --------- Not Recognized
Intr Routing Code               x04
IntrPin Field                   x01  PCI INTA Interrupt
Min Grant                       x00  No major latency requirements
Max Grant                       x00  No major latency requirements
```

The third section of the DECevent report displays the CCMAA adapter's control and status registers:

❸   Section 3 displays the state of the MEMORY CHANNEL portion of the adapter and any errors detected during MEMORY CHANNEL transactions. LCSR and MCERR error flags are displayed.

Example 3-6   DECevent Report Sample (Digital UNIX) (Continued)

```
--- MC Adapter CSRs ---  ❸
Link Control/State Reg
    LCSR    Bits <15:00>  x8279  MC Transmit Path Error
                                 MC Receive Error Interrupt Enabled
                                 MC Transmit Error Interrupt Enabled
                                 MC Interrupt Enabled
                                 Port Change Interrupt Enabled
                                 MC Receive Pending - FIFO
                                 Interrupt Summary
    LCSR    Bits <31:16>  x0078  Node 0 - Link Online
                                 Node 1 - Link Online
                                 Node 2 - Link Online
                                 Node 3 - Link Online
Receive Base Address
    Low Byte Bits <15:00>  x0000
    Base Add Bits <31:16>  x0800
MC Error Register
    ER      Bits <15:00>  x0190 Invalid Data
    ER      Bits <31:16>  x8000 Heartbeat Timeout Disabled
                                PCT Transmit Parity Error
MC Port Register
    PR      Bits <15:00>  x0190 Invalid Data
    PR      Bits <31:16>  x7243 Cluster Node ID --------- x0003
                                Adapter Hub Type -MC Hub Configuration
                                Port Status    -Timeout 0.75-1.5 sec
                                               - Link Online Disable
                                               - Adapter OK
                                               - Link Online
                                               - Hub OK
```

Example 3-7   DECevent Report Sample (OpenVMS)[1]

```
************************* ENTRY   32 *******************************
Logging OS                       1. OpenVMS
System Architecture              2. Alpha
OS version                          X6BI-SSB
Event sequence number           59.
Timestamp of occurrence             31-OCT-1996 14:19:35
Time since reboot                   0 Day(s) 0:56:41
Host name                           LYNX05

System Model                        AlphaServer 2100A 5/250

Entry type                     100. Logged Message

---- Device Profile ----
Unit                                LYNX05$MCA0
Product Name                        Memory Channel Adapter

---- MSCP Logged Msg ----        0. Unrecognized Logged Message Type
Logged message type code            Logged Message Body:

Count of valid bytes:           96.

         15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
  0000:   00000002  0000019C  FFFFFFFF  810C9840   *@..............*
  0010:   73207265  74706164  6120434D  07358009   *..5.MC adapter s*
  0020:   682D6C61  65522073  61206465  74726174   *tarted as Real-h*
  0030:   0000654D  0000002E  6576616C  53206275   *ub Slave....Me..*
  0040:   00000000  00000000  00000000  00000000   *...............*
  0050:   00000000  00000000  00000000  00000000   *...............*
```

_____

[1] DIAGNOSE/TRANSLATER/INCLUDE=MCA0

Example 3-7 DECevent Report Sample (OpenVMS)[1]

```
*********************** ENTRY  142 ***************************

Logging OS                      1. OpenVMS
System Architecture             2. Alpha
OS version                         X6BI-SSB
Event sequence number         169.
Timestamp of occurrence            31-OCT-1996 14:33:19
Time since reboot                  0 Day(s) 1:10:26
Host name                          LYNX05

System Model                       AlphaServer 2100A 5/250
Entry type                      98. Asynchronous Device Attention

---- Device Profile ----
Unit                               LYNX05$MCB0
Product Name                       Memory Channel Adapter

-- PCI Dev Config Data -
Vendor ID                 x1011  Digital Equipment Corporation
Device ID                 x0018  Memory Channel Adapter for PCI Bus

Bus Control/Status Reg
    PCI BCR Bits  <15:00>  x0146  IO Space Disabled
                                  Memory Space Enabled
                                  Bus Master Enabled
                                  Special Cycles Operation Disabled
                                  Memory Write Invalidate Disabled
                                  PCI Data Parity Error Enabled
                                  Wait Cycle Disabled
                                  PCI Address Parity Error Enabled
    PCI BSR Bits  <31:16>  x0400  PCI DEVSEL Timing ------- x0001

Revision ID               x0B  Release 11
Class Code
 Reg Program Field         x00  Level Programming Not Implemented
 Sub Class Code            x80  Network Controller Type Not Defined
 Base Class Code           x02  Network Controller

Cache Line Size            x00  Feature not implemented
Latency Timer Value        xF8  Increments of 8 PCI clock cycles
```

---

[1] DIAGNOSE/TRANS/INCLUDE=ATTEN ERRLOG.OLD;-2

**Example 3-7   DECevent Report Sample (OpenVMS)
(Continued)**

```
Header Type Field             x00  Single Function
                                   Adapter/STDConfiguration
Built-In Selftest             x00  No Built-In Selftest MC Transmit Base
Address
  Window Control              x08  PCI Transmit Window Prefetchable
                                   PCI Window Type -- Code Not Recognized
  Base Address          xC80000
Intr Routing Code             x28
IntrPin Field                 x01  PCI INTA Interrupt
Min Grant                     x00  No major latency requirements
Max Grant                     x00  No major latency requirements
--- MC Adapter CSRs ---
Link Control/State Reg
  LCSR   Bits  <15:00>  x807A  MC Receive Path Error
                                   MC Receive Error Interrupt Enabled
                                   MC Transmit Error Interrupt Enabled
                                   MC Interrupt Enabled
                                   Port Change Interrupt Enabled
                                   Interrupt Summary
  LCSR   Bits  <31:16>  x02A8  Node 0 - Link Online
                                   Node 2 - Link Online
                                   Node 4 - Link Online
                                   Node 6 - Link Online

Receive Base Address
  Low Byte Bits <15:00>  x0000
  Base Add Bits <31:16>  x3000
MC Error Register
  ER     Bits  <15:00>  x0001  Invalid Data
  ER     Bits  <31:16>  x0200  Heartbeat Timeout Disabled
                                   MC Receive Header or C/A Parity Error

MC Port Register
  PR     Bits  <15:00>  x0001  Invalid Data
  PR     Bits  <31:16>  x7244  Cluster Node ID --------- x0004
                                   Adapter Hub Type -MC Hub Configuration
                                   Port Status  - Timeout 0.75-1.5 sec
                                                - Link Online Disable
                                                - Adapter OK
                                                - Link Online
                                                - Hub OK
```

Example 3-7 DECevent Report Sample (OpenVMS) (Continued)

```
---   MC Cluster Info   ---
 Cluster Status QuadWord: x0000000000000002
                                     Status ---   Community Operational
        Node Status ----

              Node 0:     x000000000000000B
                                     State  -----  Code Not Recognized
              Node 1:     x0000000000000000
                                     State  -----  Uninitialized
              Node 2:     x000000000000000B
                                     State  -----  Code Not Recognized
              Node 3:     x0000000000000000
                                     State  -----  Uninitialized
              Node 4:     x000000000000000B
                                     State  -----  Code Not Recognized
              Node 5:     x0000000000000000
                                     State  -----  Uninitialized
              Node 6:     x000000000000000B
                                     State  -----  Code Not Recognized
              Node 7:     x0000000000000000
                                     State  -----  Uninitialized

----- Software Info -----
UCB$x_ERRCNT                        1. Errors This Unit
UCB$L_DEVCHAR1            x00400000  Error Logging
LYNX05>
************************ ENTRY   32 *******************************
```

3.9.4 Fault Isolation

The MC adapter error event reports, produced by the DECevent utility, will assist in isolating faults associated with MC errors (with the CCMAA-AA adapter module) to a field-replaceable unit. In most cases, the event log of all nodes in the cluster should be examined using DECevent to determine the suspect FRU and the appropriate repair action. The log should also be checked for other potentially related PCI device entries to determine whether the problem is associated with the MC adapter, other PCI devices, bus bridges or the PCI interconnect.

3.9.4.1 PCI Specific Problems

Detected Address Parity Error (PCI Bus Status Bits 31 & 30)

The adapter detected a PCI address parity error while not the master. The source of the bad address may be the source device (PCI bridge or another adapter), bus backplane, or the CCMAA bus adapter that detected and reported the error.

Fault Isolation Hints:

For three or more functioning devices on the bus (including the CCMAA and bus bridge):

At least one other device will also have detected and reported this error if the fault is associated with the source device or bus backplane. If there are multiple occurrences of the error reported by the same devices with the exception of one, then the one device that has not reported this error is the source of the bad address and should be replaced.

If the CCMAA is the only device reporting this error (multiple occurrences), then replace the CCMAA module. If the event log indicates that all devices on the bus have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

For two functioning devices (CCMAA and bus bridge):

If the event log indicates that CCMAA module is the only device reporting this error, then either the CCMAA module or the bus bridge is defective.

If the event log indicates that both the bus bridge and CCMAA have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

PCI Detected Write Data Parity Error (PCI Bus Status Bit 31 and Bit 30=0)

The adapter detected a PCI write data parity error while a slave. The source of the bad data may be the source device (PCI bus bridge or another adapter) PCI bus backplane, or the CCMAA bus adapter that detected and reported the error.

Fault Isolation Hints:

Check for a PCI error entry in the same time frame from another device on the same bus indicating a "PCI Write Data Parity Error While Master." Such an entry identifies the initiator (master) device and source of the data.

For three or more functioning devices on the bus (including the CCMAA and bus bridge):

If other devices on the bus report the same error condition along with associated entries from the same initiator device indicating a "Data Parity Error While Master," then replace that device.

If the CCMAA is the only device reporting this error (multiple occurrences), then replace the CCMAA module.

If the event log indicates that all devices on the bus have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

For two functioning devices (CCMAA and bus bridge):

If the event log indicates that CCMAA module is the only device reporting this error, then either the CCMAA module or the bus bridge is defective.

If the event log indicates that both the bus bridge and CCMAA have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

Received Master Abort (PCI Bus Status Bit 29)

The CCMAA adapter terminated the PCI bus transaction with a master abort sequence indicating that no target device claimed the transaction.

Fault Isolation Hints:

Check for a pattern of other devices on this bus reporting the same error with the exception of one. The software could be sending a nonexistent address.

Received Target Abort (PCI Bus Status Bit 28)

The CCMAA adapter terminated the PCI bus transaction due to a signaled target abort, indicating the target either detected a fatal error or will never be able to respond to the transaction.

Fault Isolation Hints:

Check for other devices on this bus reporting an error in the same time frame.

PCI Write Data Parity Error While Master (PCI Bus Status Bit 24)

The CCMAA adapter detected the assertion of PERR# by the target (slave) device while it was PCI bus master. This indicates that the target device detected a data parity error on a write from the CCMAA adapter (MC write receive). This would typically indicate a problem on the PCI side of the CCMAA.

Fault Isolation Hints:

There should be an associated error log entry from the target device indicating a "Write Data Parity Error."

For three or more functioning devices on the bus (including the CCMAA and bus bridge):

If other devices on the bus report the same error condition along with associated entries from the same target device indicating a "Write Data Parity Error," then replace that device.

If the CCMAA is the only device reporting this error (multiple occurrences and multiple target devices), then replace the CCMAA module.

If the event log indicates that all devices on the bus have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

For two functioning devices (CCMAA and bus bridge):

If the event log indicates that the CCMAA module is the only device reporting this error, then either the CCMAA module or the bus bridge is defective.

If the event log indicates that both the bus bridge and CCMAA have reported this error at least once, then the bus backplane is suspect and should be replaced if this pattern of errors continues.

3.9.4.2 MEMORY CHANNEL Specific Problems

Hub Request Timeout (MC Error Bit 30) (Fatal Error)

The MC adapter did not receive Link Grant within the defined period after the assertion of the Link Request. This indicates that the MC hardware is in an unrecoverable state.

Fault Isolation Hints:

Check for CCMAA adapter error log entries on other nodes in the cluster indicating the same error to assist in isolating the fault to a particular CCMAA, cable, linecard, or the hub hardware. Check link cable connectors before replacing any modules.

Heartbeat Timeout (MC Error Bits 29 & 27) (Fatal Error)

The CCMAA adapter logic determined that this node had not generated at least one MC transmit transaction within the heartbeat timeout period.

Fault Isolation Hints:

The heartbeat is basically a keep alive indicator between the CCMAA and its associated host system node. A heartbeat timeout indicates a problem with the node rather than the CCMAA and associated MC hardware.

Page Control Table Transmit Parity Error (MC Error Bit 31)

The CCMAA adapter detected bad parity in the page control table while attempting to perform an MC transmit operation.

Fault Isolation Hints:

Bad parity is written to unused pages. Software problems could cause this error. If software is not the problem, change the CCMAA adapter module.

Hub Detected Transmit Parity Error (MC Error Bit 28)

The hub detected bad parity on an MC Transmit Write from this CCMAA adapter.

Fault Isolation Hints:

Check the event logs on other nodes for indications of the same error. If there are, then the fault is associated with the hub motherboard. If there are other types of hub-related errors reported by other nodes as well, then the fault may be associated with the hub power supply.

If this is the only CCMAA reporting this error, then check the link cable (seating and pins). The problem may be associated with this CCMAA module, the link cable, or the associated CCMLA linecard. The final and least likely possibility is that the problem could be associated with the hub motherboard.

Unknown Transmit Path Error (MC LCSR Bit 0 only)

An error event entry was logged for this MC adapter with the MC Transmit Path Error Summary bit set in the LCSR with no other specific transmit path errors set (no errors in the PCI Status and Control and MCERR registers). This could indicate a problem with the adapter's transmit path error detection logic or the TPE bit.

Fault Isolation Hints:

If multiple occurrences of this error syndrome are reported, change the CCMAA adapter.

MC Receive Buffer Overflow (MC Error Bit 26)

The CCMAA adapter attempted to load the receive FIFO buffer when the FIFO was full. This indicates an unrecoverable error in the flow control hardware.

Fault Isolation Hints:

Check the event logs on other nodes for indications of the same error. If there are, then the fault is associated with the hub motherboard. If there are other types of hub-related errors reported by other nodes as well, then the fault may be associated with the hub power supply.

If this is the only CCMAA reporting multiple occurrences of this error, then check the link cable seating. The problem may be associated with this CCMAA module, the link cable, or the associated CCMLA linecard.

MC Receive Header or C/A Parity Error (MC Error Bit 25)

The CCMAA adapter detected a parity error on an MC receive header or C/A cycle.

Fault Isolation Hints:

Check the event logs on other nodes for indications of the same error. If there are, then the fault is associated with the hub motherboard. If there are other types of hub-related errors reported by other nodes as well, then the fault may be associated with the hub power supply.

If this is the only CCMAA reporting multiple occurrences of this error, then check the link cable connector seating. The problem may be associated with this CCMAA module, the link cable, or the associated CCMLA linecard.

MC Receive Data Parity Error (MC Error Bit 24)

The CCMAA adapter detected a parity error on an MC receive data cycle.

Fault Isolation Hints:

Check the event logs on other nodes for indications of the same error. If there are, then the fault is associated with the hub motherboard. If there are other types of hub-related errors reported by other nodes as well, then the fault may be associated with the hub power supply.

If this is the only CCMAA reporting multiple occurrences of this error, then check the link cable seating. The problem may be associated with this CCMAA module, the link cable, or the associated CCMLA linecard.

MC Receive Vertical Parity Error (MC Error Bit 23) (Fatal Error)

The CCMAA adapter detected a vertical parity error on an MC receive packet that did not have any horizontal parity errors (MC receive data parity error). Since the hub does not check vertical parity, the problem could have originated at the transmitting node's adapter, link cable, or linecard, with the hub, or with the receiving node's linecard, link cable, and adapter.

Fault Isolation Hints:

Check the event logs on other nodes for indications of the same error. If there are, then the fault is associated with the hub motherboard. If there are other types of hub-related errors reported by other nodes as well, then the fault may be associated with the hub power supply.

If this is the only CCMAA reporting multiple occurrences of this error, then check the link cable connector seating. The problem may be associated with this CCMAA module, the link cable, or the associated CCMLA linecard.

Receive Page Control Table Parity Error (MC Error Bit 21)

The CCMAA adapter detected a parity error while reading a page control table entry for an MC receive.

Fault Isolation Hints:

This could indicate a problem with the software. If not, check the CCMAA module.

Receive Command Framing Error (MC Error Bit 19) (Fatal Error)

The CCMAA adapter's receive path logic detected a mismatch between the redundantly stored MC write command bits.

Fault Isolation Hints:

Replace the CCMAA module.

Unknown Receive Path Error (MC LCSR Bit 01 only)

An error event entry was logged for this CCMAA adapter with the MC Receive Path Error Summary bit set in the LCSR with no other specific transmit path errors set. This could indicate a problem with the adapter's receive path error checking logic or the RPE bit itself.

Fault Isolation Hints:

If multiple occurrences of this error syndrome are reported, change the CCMAA adapter.

Unknown Error Syndrome

An MC adapter error event entry was logged, but no error bits were asserted in the entry.

Fault Isolation Hints:

This could indicate a problem with the software. Check other systems in the cluster for similar occurrences.

3.10 Reading MEMORY CHANNEL Registers

Running mc_diag with the -d option displays the MC register contents (see Example 3-8). Register contents are also displayed when mc_cable detects errors (see Example 3-9).

Example 3-8   Running mc_diag with -d Option

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

P00>>>
P00>>> mc_diag -d               ❹
mca0 - 00000804  01000000  42010000  00000000  04000006 c0000008
           ^          ^          ^          ^          ^          ^
           |          |          |          |          |          |
          LCSR       MCERR      MCPORT     PRBAR      CFG04      CFG10
           ①          ②          ③          ④          ⑤          ⑥
```

❶   Initialize your system to reset the registers.

❷   Enter the console command **mc_diag**.

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

❸   The CCMAA adapter mca0 passed.

❹   Using the **-d** option dumps out the register contents without changing them (no testing is done).

The register contents are displayed in hex format. In Example 3-8, the right-most LCSR value is 4. This represents bits 0 through 3 of the register. Referring to the LCSR register diagram in Section 3.11 indicates bit <2> is set, meaning virtual hub mode is selected. See Section 3.11 for a description of the six registers shown in Examples 3-8 and 3-9.

Acronym	Description	See
① LCSR	Link Control and Status Register	Section 3.11.1
② MCERR	MC Error Register	Section 3.11.2
③ MCPORT	MC Port Register	Section 3.11.3
④ PRBAR	PCI Receive (from MC) Base Address Register	Section 3.11.4
⑤ CFG04	PCI Status and Control Register	Section 3.11.5
⑥ CFG10	Configuration Longword 10H Register	Section 3.11.6

Example 3-9 Mc_cable Detecting Errors

```
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
Response from node 0 on mca0
Detected errors on                       ❹
mca0 - 00004006  01000000  42010000  00000000  04000006 c0000008
            ^          ^          ^         ^         ^         ^
            |          |          |         |         |         |
           LCSR      MCERR      MCPORT    PRBAR     CFG04H    CFG10H
mca0 is offline
  ^C                                     ❺
P00>>>
```

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

Example 3-9 shows a two-node single configuration, virtual hub mode.

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

❷ Enter the **mc_cable** command.

❸ The CCMAA adapter mca0 on node 1 is online. The diagnostic scans for responses from other nodes. Here, the other system has not yet responded.

❹ When an error is detected, mc_cable displays the register contents in hex format. See Section 3.11 for a description of the six registers shown in Example 3-9. In this example, node 1's mca0 came online and when it was able to communicate with node 0, it detected transmit errors, reports them here, and takes itself offline.

Next node 1's mcao will come online again and attempt to reconnect.

❺ This output will continue to repeat until Ctrl/C stops mc_cable.

3.11 MC Registers and Address Space Allocation

Conventions used in register descriptions and in references to bits and fields are as follows:

- Registers are referred to by their mnemonics, such as **MCERR** register for the **MEMORY CHANNEL Error Register**.

- Bits and fields are enclosed in angle brackets (for example, bit **<31>** and bits **<31:16>**). Bits are usually specified by their numbers or names enclosed in angle brackets adjacent to the register mnemonic, such as **CFG10<31:27>** or **CFG10<PTBAR>,** which are equivalent designations.

- The **Type** column entry of a register description table may include the initialization value of the bits. For example, entry "R/W, 0" indicates a read/write bit that is initialized to 0.

The following abbreviations are used to indicate the access type of the bit(s):

Acronym	Access Type
R	Read only; writes ignored.
R/W	Read/write.
W1C	Read/write one to clear; unaltered by a write of zero.

Six registers are useful in diagnosing MEMORY CHANNEL problems. Four of these (LCSR, MCERR[1], MCPORT, and PRBAR) reside in the PCI Transmit Window (see Table 3-1) and two (CFG04H and CFG10H) in PCI Configuration Space.

Table 3-1   PCI Transmit Window Address Allocation

PTBAR+00000	PCT R/W Access
PTBAR+3FFFF	(256 KB)
PTBAR+40000	CSR Registers
PTBAR+41FFF	(8 KB)
PTBAR+42000	MC Transmit Space
PTBAR+7FFFFFF	128 MB

---

[1] MCERR bits 25, 24, and 23 are different for CCMAA-AA and CCMAA-BA adapters; see Table 3-3.

3.11.1 Link Control and Status Register (LCSR)
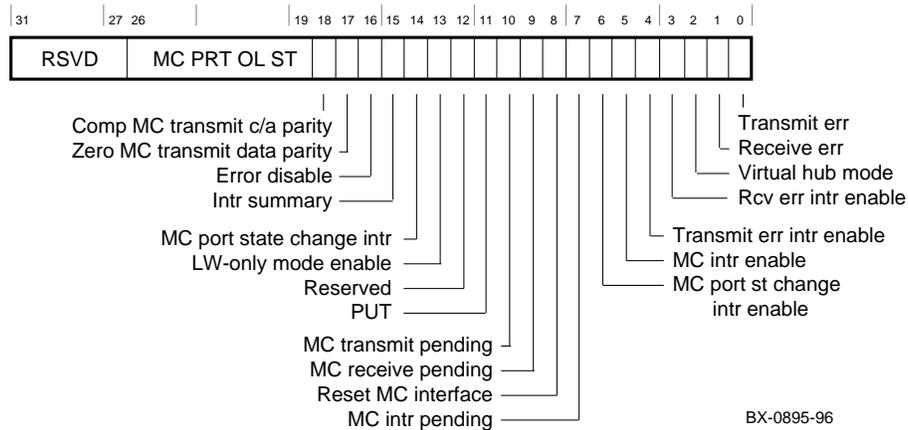
Table 3-2 LCSR Register (PTBAR + 40000) Bits

Name	Bit(s)	Type	Description
RSVD	<31:27>	R, 0	Read as zeros.
MC Port Online State - Nodes [7:0]	<26:19>	R, 0	In hub-based systems, this field reflects the MC port online state of all nodes in the cluster. This field is undefined in virtual hub systems.
Complement MC Transmit C/A Parity	<18>	R/W, 0	When set, the adapter will complement the parity on all MC transmit command/address cycles.
Zero Transmit Data Parity	<17>	R/W, 0	When set, the adapter will zero the parity on all MC transmit data cycles.
MC Error Disable	<16>	R/W, 0	When set, the fundamental error state bits, TPE and RPE (LCSR<1,0>), are disabled. This effectively disables all MC error detection and recovery logic. Only used for debug.
Interrupt Summary	<15>	R, 0	This bit represents the logical OR of all interrupting conditions from this adapter. Conditions: 1) TPE interrupt 2) RPE interrupt 3) MC interrupt 4) MC port state change interrupt.

Table 3-2   LCSR Register (PTBAR + 40000) Bits (Continued)

Name	Bit(s)	Type	Description
MC Port State Change Interrupt	<14>	W1C, 0	This bit is set whenever the adapter has generated an interrupt request based on a change in the MC port state (local online, link online, etc.). LCSR<6> must be set to enable the generation of MC port state change interrupts.
LW-Only Mode Enable	<13>	R/W, 0	When set, the adapter performs all writes as single longword cycles. For the CCMAA-BA adapter, this bit is reserved.
Reserved	<12>	R/W, 0	Reserved.
PUT	<11>	R/W, 1	When set, the adapter's Link OK signal remains deasserted and the adapter is limited to local online operation, the power-up testing (PUT) state.
MC Transmit Pending	<10>	R, 0	This bit is set when there is at least one packet in the MC-Transmit FIFO.
MC Receive Pending	<9>	R, 0	This bit is set when there is at least one packet in the MC-Receive FIFO.
Reset MC Interface	<8>	R/W, 0	Reset MC interface.
MC Interrupt Pending	<7>	W1C, 0	This bit is set on the receipt of an MC write to a page with INTR (from page control table)=1.
MC Port State Cng Intr Enbl	<6>	R/W, 0	When set, enables the generation of a PCI interrupt on any MC port state change.
MC Interrupt Enable	<5>	R/W, 0	When set, enables the generation of a PCI interrupt on receipt of an MC write to a page with INTR=1.
MC Trans Err Intr Enable	<4>	R/W, 0	When set, enables the generation of a PCI interrupt on the occurrence of an MC transmit path error.
MC Rcv Error Intr Enable	<3>	R/W, 0	When set, enables the generation of a PCI interrupt on the occurrence of an MC receive path error.
Virtual Hub Mode	<2>	R, 0	This bit is set if the adapter is configured in a virtual hub cluster (either as the VH0 or VH1 node); it is a 0 if the adapter is connected to a hub.
MC Rcv Path Err Summary	<1>	W1C, 0	This bit is set when any MC receive path error occurs.
MC Trans Path Error Summary	<0>	W1C, 0	This bit is set when any MC transmit path error occurs.

3.11.2 MC Error Register (MCERR)

BX-0894-96
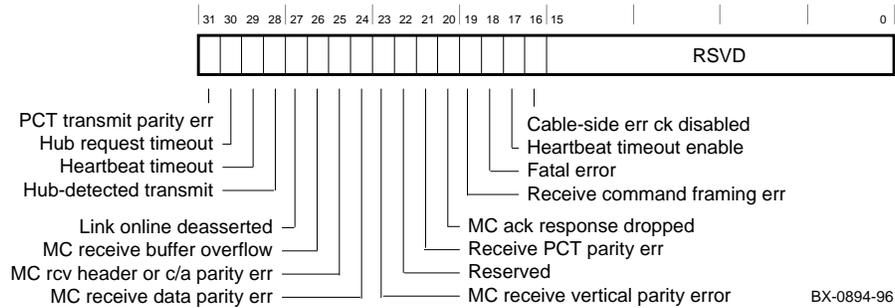
Table 3-3 MCERR Register (PTBAR + 41000) Bits

Name	Bit(s)	Type	Description
PCT Transmit Parity Error	<31>	W1C, 0	Set whenever the adapter detects a page control table (PCT) parity error while attempting to perform an MC transmit operation. Since software is responsible to load good parity into each PCT entry, this error may be tested by deliberately loading bad parity. Response: Parity error detected => TPE is set, error interrupt generated, packet is loaded into the XMIT FIFO and marked BAD; packet is later flushed (no MC transmit results) by the Link side of the adapter.
Hub Request Timeout	<30>	W1C, 0	Set whenever the adapter does not receive Link Grant within a defined period after the assertion of Link Request. The hardware assumes this indicates that the MC hardware is in an unrecoverable state and forces the adapter to the fatal state. Response: Request timeout detected =>Adapter sets the error bit, goes to fatal link error state, and Link Adapter OK is deasserted; in response, hub deasserts Link Online.
Heartbeat Timeout (HBTO)	<29>	W1C, 0	Set if the adapter detects a heartbeat timeout. See bit <17> description. Response: Heartbeat timeout detected =>Adapter sets this bit and TPE/RPE, goes to the fatal link error state, this adapter's Link OK signal is deasserted; Link Online is then deasserted.

Table 3-3   MCERR Register (PTBAR + 41000) Bits (Continued)

Name	Bit(s)	Type	Description
Hub-Detected Transmit Parity Error	<28>	W1C, 0	Set whenever the hub detects a parity error on an MC transmit write. The hub informs the current master of this parity error. The transmitter for the errored transaction sets its TPE bit; all receivers ignore the transaction. Response: Parity error occurs on cable from current transmitter to hub => hub detects MC parity error, signals current transmitter, hub asserts Link Parity Error to abort this write to all receivers, current transmitter adapter sets this bit, sets TPE, and interrupts.
Link Online Deasserted	<27>	W1C, 0	Set whenever the Link Online signal transitions from asserted to deasserted. In a hub-based system (hub type =01), this is a fatal error. Several fatal error conditions detected by the hub are manifested at the adapter as a deassertion of the Link Online signal. They include Heartbeat Timeout (HBTO) and Suppress Timeout (STO). In a virtual hub system, this bit indicates that one of the nodes has gone offline, but this is not a fatal error to the remaining node.
MC Receive Buffer Overflow	<26>	W1C, 0	Set if the adapter attempts to load the receive FIFO when the FIFO is full. Can only occur as a result of an unrecoverable flow control hardware error. Response: Receive FIFO overflow=>Adapter sets this bit and RPE, goes to the fatal link error state, deasserts its Link OK signal; then deasserts Link Online.
MC Receive Header or C/A Parity Error	<25>	W1C, 0	Set if the adapter detects a parity error on an MC Receive Header or C/A cycle. Response: Receive MC Header Parity Error Detected=>Adapter sets error bit, asserts RPE, and the entire write is discarded prior to the PCI interface. Response: Receive C/A Parity Error Detected=>Adapter sets the error bit, asserts RPE, and the write is sent on the PCI with the byte masks for all data cycles deasserted; the data in the target location remains unchanged. This may result in an NXM if the address was changed to an unmapped address. For the CCMAA-BA adapter, this bit includes both header and parity errors.
MC Receive Data Parity Error	<24>	W1C, 0	Set whenever the adapter detects a parity error on an MC receive data cycle. Response: Receive MC Receive Data Parity Error Detected=>Adapter sets the error bit, asserts RPE, and the write is sent on the PCI. Good parity is generated for all data cycles, and the byte masks are deasserted for all parity error data cycles. For the CCMAA-BA adapter, MC Rcv data PE is combined with bit <25>, and this bit is MC Receive Vertical Parity Error.

Table 3-3 MCERR Register (PTBAR + 41000) Bits (Continued)

Name	Bit(s)	Type	Description
MC Receive Vertical Parity Error	<23>	W1C, 0	Set whenever the adapter detects a vertical parity error on an MC receive packet that had no horizontal parity errors (since VPE is designed to assure that no undetected errors occur). Response: Receive MC Receive Vertical Parity Error Detected=>Adapter sets the error bit and assets RPE. For the CCMAA-BA adapter, Verital Parity Error has moved to bit <24> and is non-fatal. This bit is not used.
Reserved	<22>	R, 0	Reserved.
Receive PCT Parity Error	<21>	W1C, 0	Set whenever a parity error is detected when reading the PCT entry for an MC receive. The adapter hardware does not check PCT parity on direct reads of the PCT. Response: Receive PCT Parity Error Detected=> Adapter sets the error bit, asserts RPE, and the write is sent on to the PCI with the byte masks for all data cycles deasserted; the data in the target location remains unchanged. This behavior might result in an NXM if the address had been to an unmapped address (that is, REN=0).
MC ACK Response Dropped (status)	<20>	W1C, 0	A dropped MC ACK response is a permitted event. This bit is implemented to allow the OS to retry.
Receive Command Framing Error	<19>	W1C, 0	Set whenever the receive path logic, which unloads the receive FIFO, detects a mismatch between the redundantly stored MC write command bits. The hardware assumes the MC hardware is in an unrecoverable state and forces the adapter port to the fatal error state.
Fatal Error	<18>	R/W, 0	Fatal error detected.
Heartbeat Timeout Enable	<17>		When set, the adapter logic enforces an HBTO which will force the MC port offline if at least one MC transmit transaction is not generated by this node within the HBTO period. The HBTO period is selected by RMPORT<26>. This should only be enabled in virtual hub systems. In hub-based systems, the hub supports the HBTO functionality.
Cable-Side Error Checking Disabled	<16>	R/W, 0	When set, disables parity checking and reporting link-side parity errors. Link-side parity errors are all logged in this register. They include transmit and receive PCT parity errors and received horizontal and vertical parity errors.
RSVD	<15:0>	R, 0	Reserved.

3.11.3 MC Port Register (MCPORT)
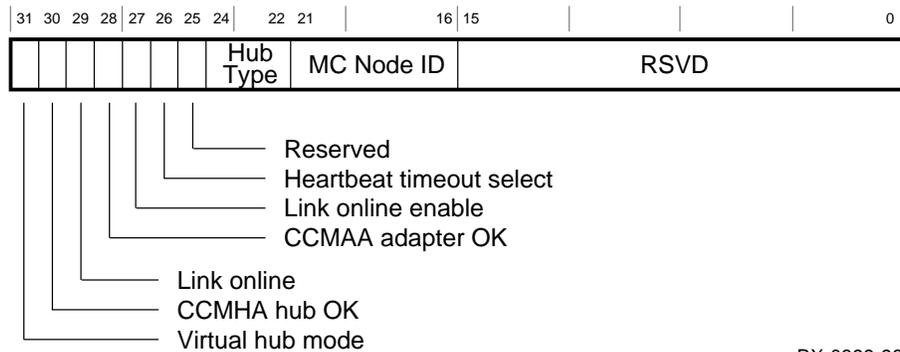
BX-0899-96

Table 3-4 MCPORT Register (PTBAR + 41004) Bits

Name	Bit(s)	Type	Function
Virtual Hub Mode	<31>	R, n	This bit reflects the state of the VHM jumper on the adapter. When set, indicates adapter is configured as part of a virtual hub cluster and that this adapter is node 0 and will provide the link arbitration.
CCMHA Hub OK	<30>	R, 0	When set, indicates the Link Hub OK signal is asserted.
Link Online	<29>	R, 0	When set, indicates the Link Online signal is asserted.
CCMAA Adapter OK	<28>	R, 0	When set, indicates the Link Adapter OK signal is asserted.
Link Online Enable (OLEN)	<27>	R/W, 0	When set, enables adapter to enter Link Online state. Adapter hardware automatically clears OLEN in the transition to the Link Online state. This clearing makes certain the adapter does not exit and reenter the Link Online state for a cable removal and replacement.
Heartbeat Timeout Select	<26>	R/W, 0	This bit selects the value of the Heartbeat timeout (HBTO). When set, HBTO equals 8 seconds; when clear, HBTO equals 2 seconds.
RSVD	<25>	R, 0	Reserved.
Hub Type	<24:22>	R, 1	In a cluster with a hub, this field is loaded as part of the adapter initialization. First generation hubs load this field with 01h. This field powers up to a 00h and remains 00h in a virtual hub configuration.

Table 3-4   MCPORT Register (PTBAR + 41004) Bits (Continued)

Name	Bit(s)	Type	Function
MC Node ID	<21:16>	R, n	This field contains the node ID used by the MC protocol for transaction routing. The hub assures that each node is assigned a unique node ID based on the physical slot in the hub to which the cable is attached. The 8-node hub assigns node IDs 0 - 7. For a node connected to a hub, this field is loaded from the hub linecard as part of the adapter online sequence. In a virtual hub configuration, the virtual hub node VH0 is always assigned node ID 0 and the other node (VH1) is assigned node ID 1.
RSVD	<15:0>	R, 0	Reserved.

3.11.4 PCI Receive (from MC) Base Address Register (PRBAR)

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Table 3-5   PCI Receive (from MC) Base Address Register (PRBAR) Bits

Name	Bit(s)	Type	Description
PCI Receive Base Address (PRBAR)	<31:27>	R/W, 0	Defines the window in PCI memory space that the MC adapter writes to. Used to map MEMORY CHANNEL DMA writes to host scatter/gather space.
	<26:0>		Not used.

3.11.5 PCI Status and Control Register (CFG04H)

BX-0897-95
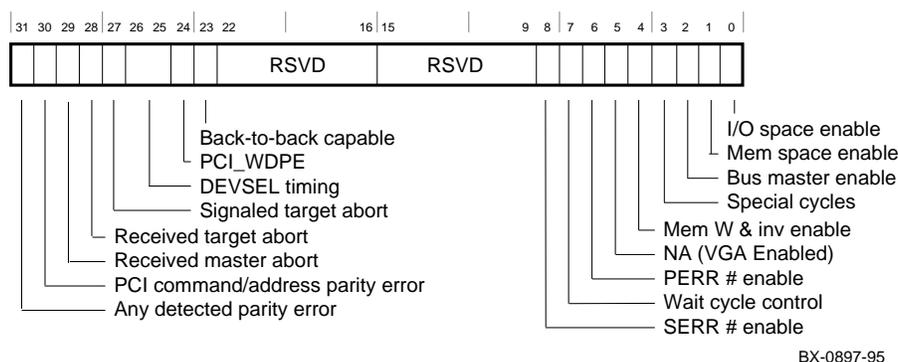
Table 3-6 PCI Status and Control Register (CFG04H) Bits

Name	Bit(s)	Type	Description
Any Detected Parity Error	<31>	W1C, 0	Set whenever the adapter detects any PCI parity error, even if parity error handling is disabled (as controlled by bit <8>). Two types of PCI parity errors are detected: write data parity error as a slave and address parity errors when the adapter is not the master ("potential" slave).
PCI Command/ Address Parity Error	<30>	W1C, 0	Set whenever the adapter asserts SERR PCI signal. The adapter asserts SERR# whenever it detects an address parity error and the adapter is not the master and SERR# Enable is set (bit <8>). This error indicates a parity error on a PCI write that potentially was an MC write, so the adapter asserts the Transmit Path Error bit (TPE, LCSR<00>).
Received Master Abort	<29>	W1C, 0	Set whenever the adapter's master transaction on the PCI bus is terminated with a master abort sequence.
Received Target Abort	<28>	W1C, 0	Set whenever the adapter's master transaction on the PCI bus is terminated with a target abort sequence.
Signaled Target Abort	<27>	R, 0	The adapter will never issue a target abort.
DEVSEL Timing	<26:25>	R, 10b	These bits encode the timing of the PCI DEVSEL for the adapter. These bits are encoded as 10b and indicate the slowest time the adapter asserts DEVSEL for any bus command except Configuration Read/Write.

Table 3-6   PCI Status and Control Register (CFG04H) Bits (Continued)

Name	Bit(s)	Type	Description
PCI Write Data Parity Error while Master	<24>	W1C, 0	Set whenever the adapter detects an assertion of PERR# by the slave while it is the PCI bus master and the parity error response bit <6> is set. PERR# is asserted by the slave on a write to indicate a data parity error. This error indicates a parity error occurred on an MC write, so the adapter asserts the Receive Path Error bit (RPE, LCSR<1>).
Back-To-Back Capable	<23>	R, 0	Returns zero indicating the adapter is NOT capable of accepting back-to-back transactions when the transactions are not to the same agent.
RSVD	<22:9>	R, 0	Reserved.
SERR # Enable	<8>	R/W, 0	When enabled and on the detection of a PCI address parity error on a transaction for which it is not the master, the adapter drives the PCI SERR line and sets the TPE bit (LCSR<0>).
Wait Cycle Control	<7>	R, 0	Hardwired to zero, indicating the adapter does not support address/data stepping.
PERR # enable	<6>	R/W. 0	Controls the adapter's response to data parity errors. When set, the adapter asserts PERR# when it detects a write data parity error while it is the slave. When clear, the adapter ignores all data parity errors and completes the transaction as though parity were correct.
NA (VGA Control)	<5>	R, 0	Hardwired to zero.
Mem Write and Invalidate Enable	<4>	R, 0	This is the enable bit for using the Memory Write and Invalidate command. Hardwired to zero since the adapter never generates Memory Write and Invalidate commands.
Special Cycles	<3>	R, 0	Controls an adapter's action on "special cycle" operations. Hardwired to zero since the adapter does not support special cycle operations.
Bus Master Enable	<2>	R/W, 0	When set, allows the adapter to act as PCI bus master. When clear, the adapter cannot generate PCI accesses.
Memory Space Enable	<1>	R/W, 0	When set, the adapter can respond to PCI memory space accesses. When clear, the adapter cannot respond.
I/O Space Enable	<0>	R, 0	Controls adapter response to I/O space accesses. Hardwired to zero since the adapter does not support I/O space operations.

3.11.6 Configuration Longword 10h Register (CFG10H)

```
  31        27 26                                              4  3  2  1  0
 ┌─────────┬──────────────────────────────────────────┬─────┬──┬──┬──┐
 │  PTBAR  │           MC Transmit Window             │     │  │  │  │
 └─────────┴──────────────────────────────────────────┴─────┴──┴──┴──┘
```

                     PCI transmit window pre-fetchable ──┐
                          PCI transmit window type ───────┐
                 PC transmit window memory space ──────────┐

BX-0896-95
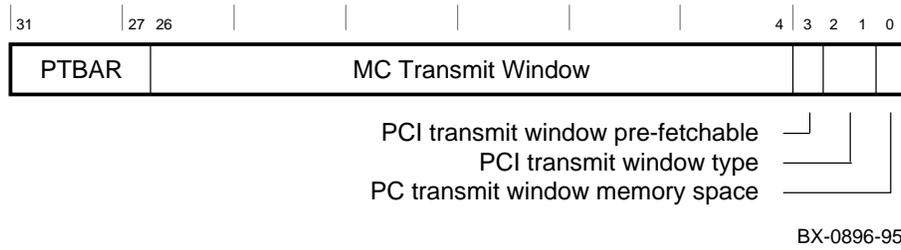
Table 3-7 Configuration Longword 10h Register (CFG10H) Bits

Name	Bit(s)	Type	Description
PCI (to MC) Transmit Base Address (PTBAR)	<31:27>	R/W, 0	Defines the window in PCI memory space that will select this adapter for MC transmits. Used to map PCI write transactions to the MC.
PCI Transmit Window Prefetchable	<3>	R, 1	Returns a one, normally indicating the adapter window is prefetchable. The one assures the PCI MC Adapter Transmit Window is in PCI dense space.
PCI Transmit Window Type	<2:1>	R, 0	Returns 00b, indicating that this window can be placed anywhere within a 32b PCI address space as long as it is naturally aligned based on the window size.
PCI Transmit Window Memory Space	<0>	R, 0	Read as zero, indicating that this window is in PCI memory space.

Appendix A

Other Parts

This appendix is intended for use by Manufacturing and Repair Centers. It describes the other parts in the CCMHA hub, their order numbers, and location. It describes how to check the motherboard, hub control panel, and hub power supply. Removal and replacement procedures are also given.

Sections include:

- Hub Parts Overview
- Motherboard
- Hub Control Panel
- Hub Power Supply

A.1 Hub Parts Overview

**The CCMHA hub contains the following parts: motherboard, linecards, fan
assembly, control panel, and power supply.**

Figure A-1   CCMHA Hub, Front View

bx0850a-95
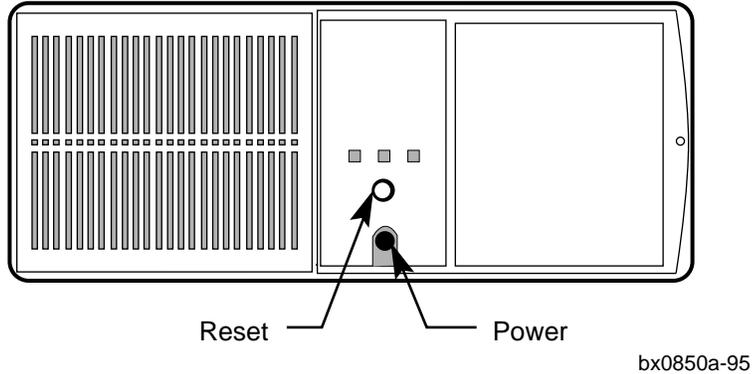
Chapter 1 contains removal and replacement procedures for the following FRUs:

- Hub - Section 1.6
- Hub panels - Section 1.7
- Hub linecards - Section 1.8
- Hub fan assembly - Section 1.9
- Hub power cords - Section 1.10

Table A-1 lists the hub parts not intended to be replaced in the field.

Table A-1 Other CCMHA Parts and Part Numbers

Part Number	Description
54-23667-01	Motherboard
54-22088-01	Control panel
30-41069-02	Power supply

Figure A-2 Parts in the Hub

bx0851-95
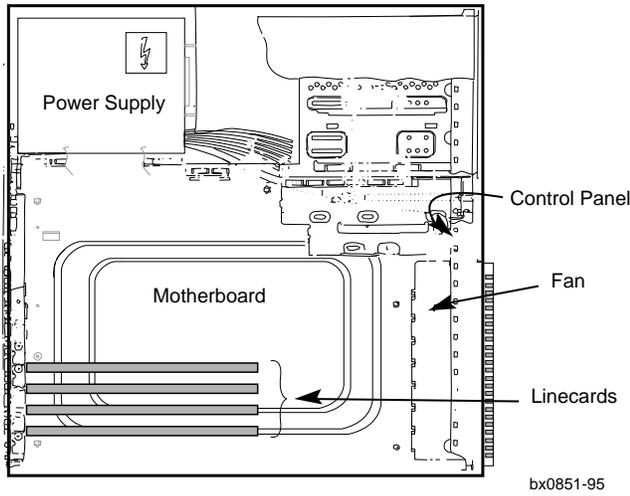
A.2 Motherboard

The motherboard (P/N 54-23667-01) is the base of the hub and holds up to eight linecards. It has no onboard LEDs. The jumpers are factory set and are not to be changed.

Figure A-3 Motherboard

bx0854a-96
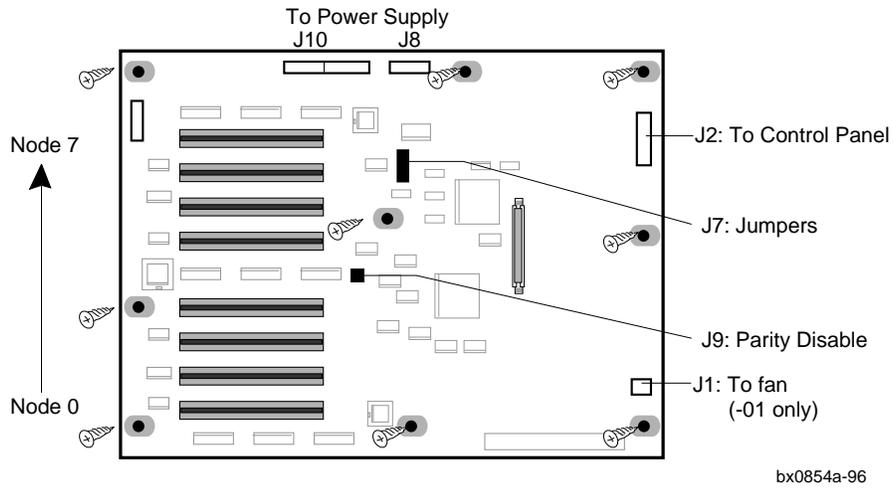
Figure A-4 Jumper Settings

bx0854d-96
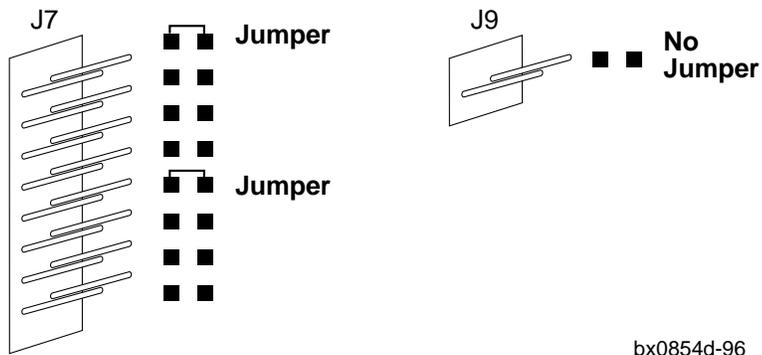
Checking the Motherboard

The motherboard has no diagnostic LEDs. You may need to replace the motherboard if any of the following conditions appear:

- A linecard's Hub OK LED does not light. Try moving a linecard you know to be good to the failing slot location. If this linecard also fails, then the problem is in the connection.

- The hub reports intermittent failures of more than one linecard.

Removal

1. Label and remove all the link cables. Connect the cables to the same linecard slots when you reconnect the system. Position of the cables determines node ID for cluster members.

2. Power off and remove the power cord.

3. Remove the top panel (see Hub Panel Removal, Section 1.7).

4. Remove all linecards from the motherboard and place them on a stable, static-free surface. It is recommended that you label or note the positions of linecards as you remove them so that you can return them to the same slots. Doing this makes it easier to debug problems.

5. Note the routing and disconnect all cables connected to the motherboard at J10, J8, J2, and J1.

6. Cabinet piece 70-80806-01 covers a corner of the motherboard. Remove it by pushing on the clip near the wires going to J8 and pull the metal assembly out and clear of the board.

7. Using a small Phillips screwdriver with either a magnetic head or a captive cage, remove the nine screws that secure the motherboard to the hub enclosure. It is easy to lose these screws in the enclosure, so you will want to have the magnetic head or captive cage.

8. Holding the motherboard at the edges, lift it up and out of the hub.

Replacement

- To install the new motherboard, reverse the steps above.

A.3 Hub Control Panel

The hub control panel (P/N 54-22088-01) is a small circuit board providing LED status on the hub.

Figure A-5   Hub Control Panel
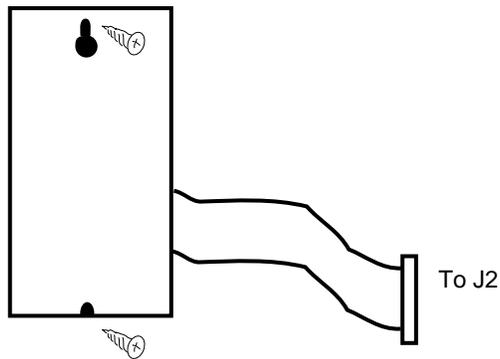
bx-0861-95

Checking the Control Panel

• If the LEDs on the linecards in the hub indicate Hub OK, but the green power LED on the control panel is not lit, the control panel needs to be replaced.

• Replacement is indicated when cabling connections and components have been checked and the LEDs still fail to light.

Removal

1. Power down the hub.

2. Remove the top panel.

3. Cabinet piece 70-80806-01 is covering the control panel. Remove the metal piece by pushing on the clip near the wires going to J8 and remove the metal assembly.

4. Disconnect the cable from the back of the control panel that connects to J2 on the motherboard.

5. Loosen the screw at the top and remove the screw at the bottom of the control panel. You do not need to remove the top screw.

6. Lift the panel up and out.

Replacement

- To install the new control panel, reverse the steps above.

NOTE: When inserting the new panel, pay attention to the reset button cap. It may become disconnected from the old panel and sit in the reset button hole. Using a small screwdriver or punch, push the button out back into the cabinet and reseat on its stem. Then proceed.

A.4 Hub Power Supply

The hub power supply (P/N 30-39882-01) provides two voltages: +12V and +5V. These voltages are used by the motherboard, linecards, fan, and control panel.

Figure A-6   Hub Power Supply
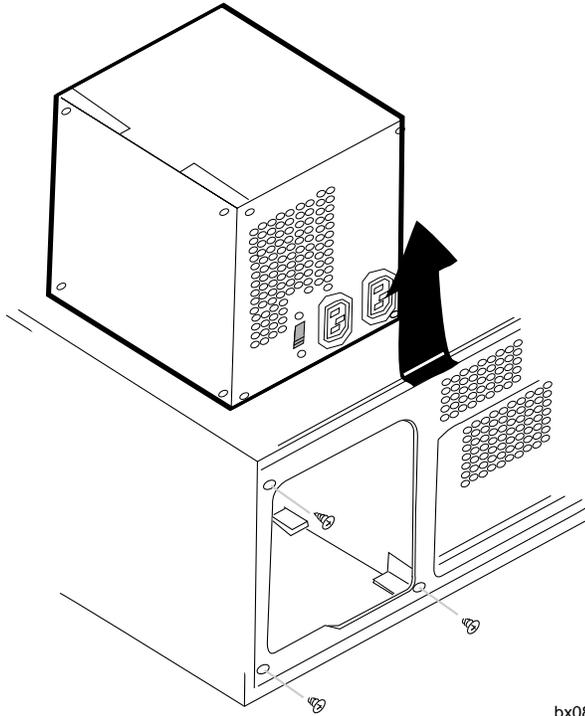
bx0852-95

Most hubs will be CCMHA-AB or higher. For the CCMHA-AA hubs, the 30-39882-01 power supply does not have a voltage switch; it is self-regulating. If you need to replace the 30-39882-01 power supply in a CCMHA-AA hub, you need to replace both the power supply with the 30-41069-02 power supply and the fan with a 70-31242-01 part number.

Three conditions indicate that a power supply needs replacing:

- The CCMAA adapter LEDs all indicate CCMAA OK but the Hub OK LED does not light, and the linecards do not light in the hub.

- The hub does not power up at all. No LEDs light on the control panel or on the linecards.

- The fan is not moving when power is on (not receiving power from the power supply).

Removal

NOTE: After you power down the MC cluster, do not disconnect the power cord from the hub or power receptacle for at least 20 seconds. This allows all voltage to go to ground.

1. Unplug and remove the power cord from the hub after waiting at least 20 seconds.

2. Remove the top panel.

3. Label and remove the link cables from the rear of the hub.

4. Disconnect the three cables from the motherboard, the fan, and the temperature sensor from the front of the fan assembly.

5. Disconnect the hub on/off switch and remove; remove the button bracket.

6. Using a Phillips screwdriver, remove the four screws on the back of the system unit that secure the power supply assembly to the inside of the hub frame.

7. Push the power supply forward to clear the front edge of the frame. Lift the power supply assembly slightly to clear the lower edge of the frame. Tilt the inside edge of the assembly to lift it out easily.

8. Lift the power supply assembly up and out of the frame.

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

bx0867-96

Replacement

To install a new power supply unit, reverse the steps above.

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