HEWLETT PACKARD

Service and
User Guide

Hewlett-Packard
A4800A PCI Ultra SCSI
Host Bus Adapter

A4800A PCI Ultra SCSI Host Bus Adapter Service and User Guide

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If you have any questions about the warranty for this product, contact your dealer or local Hewlett-Packard sales representative.

Safety Notices

	Denotes
WARNING	**A hazard that can cause personal injury**
Caution	A hazard that can cause hardware or software damage

Format Conventions

	Denotes
Note	Significant concepts or operating instructions
this font	Text to be typed verbatim: all commands, path names, file names, and directory names
`this font`	Text displayed on the screen

CONTENTS

1 Description and Specifications

2 Unpacking and Inspection

3 Installation

4 Maintenance

5 Regulatory Statements

Appendix A

Appendix B

Index

FIGURES

TABLES

1 DESCRIPTION AND SPECIFICATIONS

Description

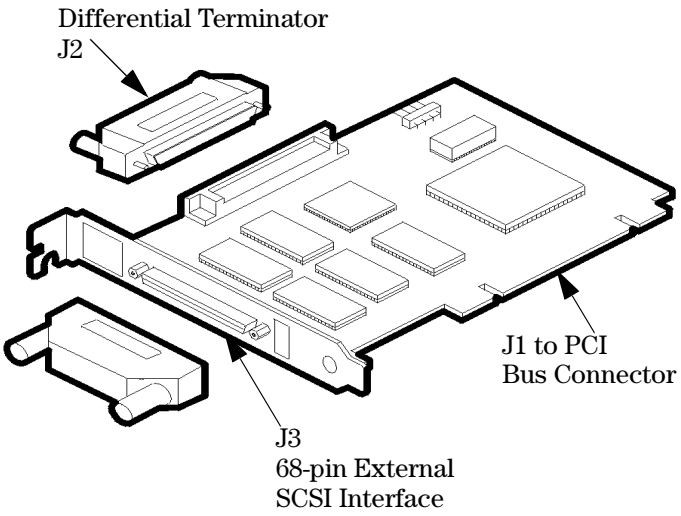

Figure 1 A4800A PCI Ultra HVD SCSI Controller

The PCI Ultra HVD SCSI controller board (product number A4800A) is an intelligent, high-performance, direct memory access (DMA) bus master SCSI host bus adapter for Hewlett-Packard 9000 V-Class servers. The adapter combines a SCSI executive processor and a PCI Local Bus interface in a single chip. This adapter supports bootable devices and can be used with hard drives, tape drives, and other differential SCSI devices. The adapter is HVD SCSI only.

This adapter may be supported on other servers. Consult with your Hewlett-Packard representative for more information on specific system configurations.

The PCI Ultra HVD SCSI controller features:

- Compliance with Intel PCI Local Bus Rev. 2.0 specification
- Compliance with ANSI X3.131-1994 SCSI-2 standard
- Support for asynchronous and synchronous transfer modes
- Synchronous SCSI data transfer rates:
  - Wide and Ultra SCSI (40 Mbytes/sec)
  - Ultra SCSI (20 Mbytes/sec)
  - Wide and Fast SCSI (20 Mbytes/sec) differential
  - Fast SCSI (10 Mbytes/sec) differential
  - Narrow (5 Mbytes/sec) differential
- Support for differential mode
- Support for up to 15 SCSI devices
- Support for logical unit numbers (LUNs) 0-7
- Support for bus master DMA
- 68-pin, high density SCSI connector
- Supports HVD SCSI devices only

Specifications

Table 1 Technical Specifications

Characteristic	Value
Form factor	127 mm x 82.55 mm (5.0 in x 3.25 in)
Operating power	5V dc ±5% @ 1.5 A
Operating temperature	5 to 55 degrees C (41 to 158 degrees F)
Relative humidity	5% to 90% (noncondensing)
Maximum dew point temperature	32 degrees C, 89.6 degrees F

Table 2 System Requirements

Server System	HP-UX Operating System	Quantity
V22xx	11.0	Minimum: 2 Maximum: 12
V25xx	11.0	Minimum: 1 Maximum: 12

Cable Specifications

The PCI Ultra SCSI controller supports differential HVD SCSI connections only. Internal cables for interconnection with the embedded CD-ROM, disk, and DAT tape drive are provided in the system (V-Class only).

The A5068A SCSI cable kit is required when connecting the controller to internal SCSI devices. For more information on connecting the controller to internal disk and tape devices, refer to the appropriate disk drive or tape drive product manual.

Table 3 A5068A SCSI Cable Kit

Description	Part Number
10-inch SCSI shielded cable with back shell	A4700-67086
68-pin HD SCSI Terminator	A4700-67098

For connection to external SCSI devices, you must provide one of the following differential SCSI cables.

Table 4 Differential SCSI Cables for V-Class

Description	Product Number	Option
5-meter 68-pin HD/68-pin HD Male inline terminator SCSI cable for V-Class	A3401A	875
10-meter 68-pin HD/68-pin HD Male inline terminator SCSI cable for V-Class	A3401A	851
2/5-meter 68-pin HD Male inline terminator SCSI cable for V-Class	A3401A	871
2/3-meter 68-pin HD Male inline terminator SCSI cable for V-Class	A3401A	873

2 UNPACKING AND INSPECTION

Unpacking and Inspection Procedures

Inspection

All shipping containers are designed to protect their components under normal shipping conditions. Carefully inspect each carton for signs of shipping damage before opening. Photograph any damage found and contact the transport carrier immediately.

Unpacking

Your bill of materials lists all equipment shipped from Hewlett-Packard. Use it as a checklist to ensure that all equipment has arrived.

To unpack the shipping container:

1. Remove each item from its shipping container.
2. Inspect each item as it is unpacked for any signs of shipping damage.
3. If equipment damage is found, document the damage and proceed to the next section.

Save all packing material until after operational checkout of the equipment. This enables equipment to be returned safely to Hewlett-Packard if required.

Damage Claims

If the equipment is damaged, complete a damage claim form and give it to the shipping representative. Claim forms are normally obtained from the shipping representative.

3 INSTALLATION

Configuration of V-Class

There are four Exemplar PCI I/O Board assemblies (PCI chassis) in the server. Two are located on the upper left side, and two are located on the lower right side. The PCI chassis on the left side are upright. The two on the right side are upside down. The PCI chassis are designated as follows:

- IOLF I/O Left Front
- IOLR I/O Left Rear
- IORF I/O Right Front
- IORR I/O Right Rear

Figure 2 shows the location of the PCI chassis.

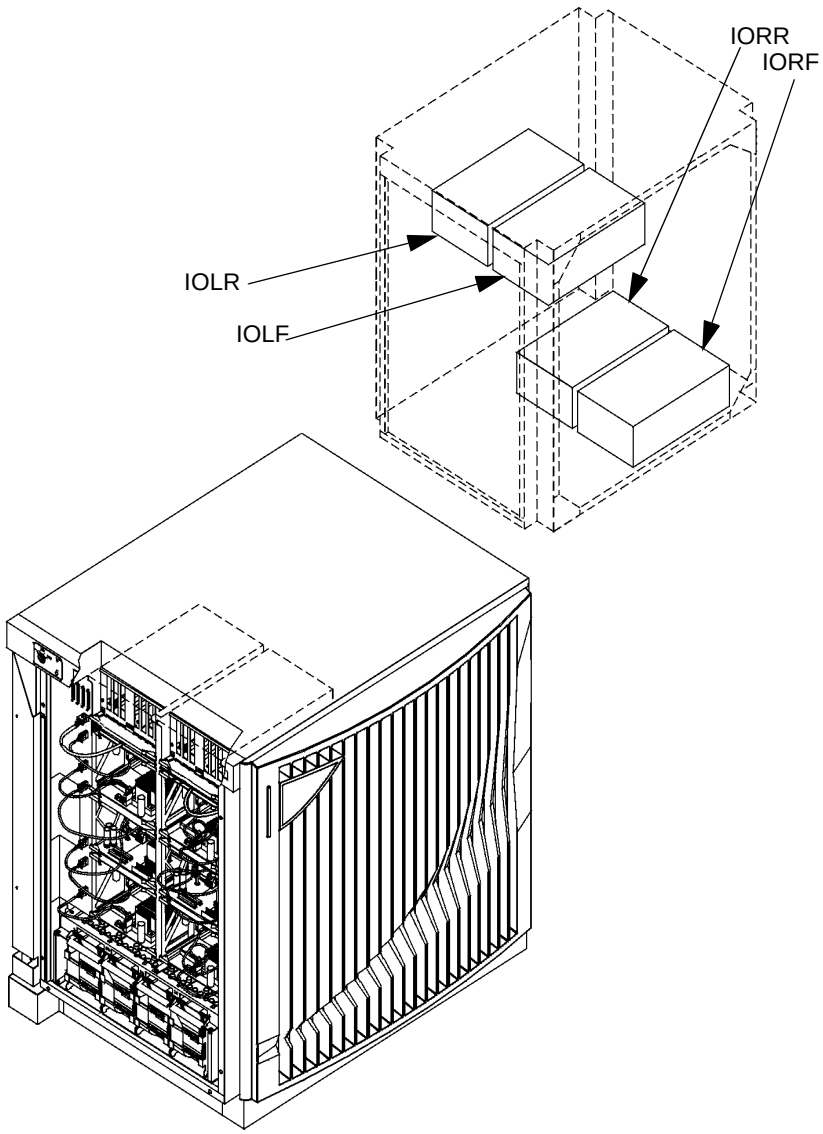

Figure 2 I/O Board Locations

Hardware Path

The hardware path for a SCSI device is reported by various utilities and commands.

Following is an example of the syntax for the V22xx:

EPIC#/Slot#/0.<SCSI ID>.0

Each V22xx PCI chassis has 6 PCI slots. Each Exemplar PCI Controller Interface (EPIC) in the PCI chassis controls three of those slots. The slots are numbered from left to right, 0 to 2, for each set of three, as shown in Table 5.

The PCI chassis is upside down on the right side. The slot numbering appears reversed. The fourth slot in the front cover of the PCI chassis (the right-most slot when the chassis is upright) is not used.

Each EPIC in the server has a unique ID, as shown in Figure 2; for example, EP1 controls slots 0, 1, and 2 of the PCI chassis designated IOLR (I/O Left Rear).

In the V25xx EPICs become SAGAs. The SAGAs in the B locations support 4 slots instead of only 3.

An example of SAGA locations mapped to card cage locations follows. Each card cage has two SAGA locations and these SAGA numbers are used to determine the I/O addresses. In the following example, the lower number is called SAGA B and the higher number is SAGA A.

Table 5 I/O cardcage EPIC/SAGA

I/O cardcage	EPIC/SAGA	Slots
IOLF	0 4	B A
IOLR	1 5	B A
IORR	6 2	A B
IORF	7 3	A B

SCSI Controller Placement

The PCI Ultra SCSI controller can be installed in any available PCI slot, within any available PCI chassis. Use the ioscan command at the HP-UX prompt or the IO command at the OBP prompt, to list the interface cards, disk devices, and tape drives already installed. See the ioscan(all) man pages for more information about ioscan options and usage. Use the help command at OBP to learn more about the IO command. Figure 3 shows a sample of the ioscan command's output.

```
# /usr/sbin/ioscan  -C disk

H/W Path    Class    Description
============================================
4/2/0.2.0   disk     SEAGATE ST19171W
| |   |
| |   |
| |   |
| |   |
| |   SCSI id
| PCI slot
SAGA or EPIC number
```

Figure 3 ioscan Example

Preparation

Electrostatic Discharge (ESD)

The PCI Ultra SCSI controller, as well as all other circuit boards, is highly susceptible to damage by electrostatic discharge during installation and routine maintenance procedures.

CAUTION *Do not handle circuit boards without a grounded wrist strap fastened to a good earth ground or to the system chassis.*

Antistatic Packaging

Circuit boards arrive in a specially designed bag that dissipates static electricity and serves as a shield against electrostatic fields while the board is in transit. Retain this bag and use it to store the circuit board if you remove it from the system for any reason.

The bag is not designed for use as a static dissipating mat. Do not use the antistatic bag for any other purpose than to enclose a circuit board. Holes in the bag render it useless as an antistatic measure. Therefore, it should always be completely closed and sealed when it contains a circuit board. Immediately discard and replace any bag that shows damage or wear.

Work Surface

Prepare an ESD-safe work surface large enough to accommodate the PCI chassis.

Personal Safety

Always ensure that both the operator panel and the power controller are turned off before removing or installing any components in the V-Class server.

Preinstallation Requirements

Tools Required

To install the PCI Ultra SCSI controller, you need a #1 and a #2 Phillips screwdriver.

Cables Required

If you intend to connect the PCI Ultra SCSI controller to an external SCSI device, you need to supply a differential SCSI cable that is long enough to reach the device. Part numbers for several different cable lengths are listed in the section titled “Specifications” in Chapter 1.

Overview of Installation on a V-Class System

Installing a PCI Ultra SCSI controller involves some minor disassembly of system components. The following list summarizes the installation steps. Detailed instructions follow.

1. Shut down the system.
2. Remove side skins and EMI panels.
3. Unplug the PCI chassis power cable.
4. Disconnect all SCSI and network cables attached to controllers in this PCI chassis. Mark or chart the connections for easy connection later.
5. Remove PCI chassis.
6. Remove the bracket on top of the PCI chassis.
7. Install the controller.

Note Install the A4700-67098 (1252-6520) differential terminator if the PCI Ultra SCSI controller will be configured with internal SCSI devices.

8. Reinstall the bracket on top of the PCI chassis.
9. Reinstall PCI chassis.
10. Plug in the PCI chassis power cable.
11. Reattach all SCSI and network cables to the proper controller.
12. Attach the new SCSI cable. If it is an external cable, route the cable through the cable channel.
13. Reinstall EMI panels and side skins.
14. Reboot the system.

Installing the PCI Ultra SCSI HVD Controller on a V-Class System

Shut Down the System

1. Shut down the system with the /etc/shutdown command.

The *time* argument can be used to schedule a timed shutdown or the keyword “now” can be used to shut down the system immediately.

/etc/shutdown -h now

Refer to the shutdown(1M) manpage for more information on /etc/shutdown.

2. Remove power to the system by turning the keyswitch on the operator panel to the **DC OFF** position.

CAUTION *Do not remove the PCI chassis without first removing power to the system. Failure to remove power before removing the PCI chassis will damage electronic components on the board assembly.*

3. Set the main circuit breaker to **OFF**. The main circuit breaker is located at the rear of the cabinet, as shown in Figure 4.

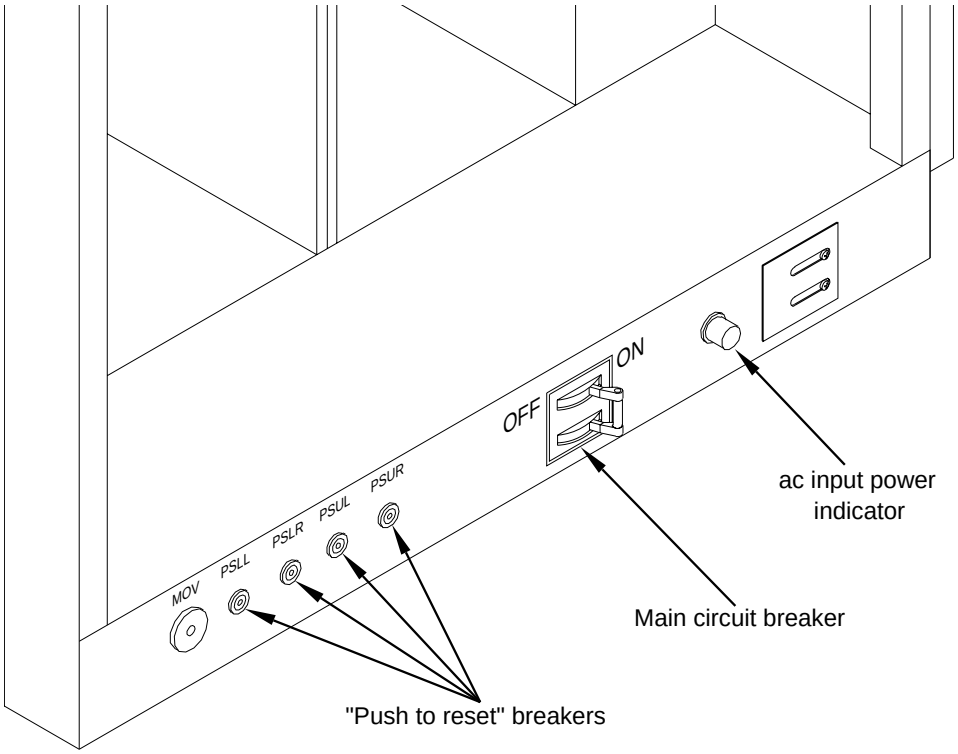

Figure 4 Main Circuit Breaker

Remove the PCI Chassis

1. Select the PCI chassis where you intend to install the controller. The server can contain from one to four PCI chassis, depending on your system configuration. You can install the PCI Ultra SCSI controller in any PCI chassis. However, the PCI chassis you are targeting for installation determines which side skin you need to remove in Step 2. Figure 5 shows the four possible locations of PCI chassis in the server.

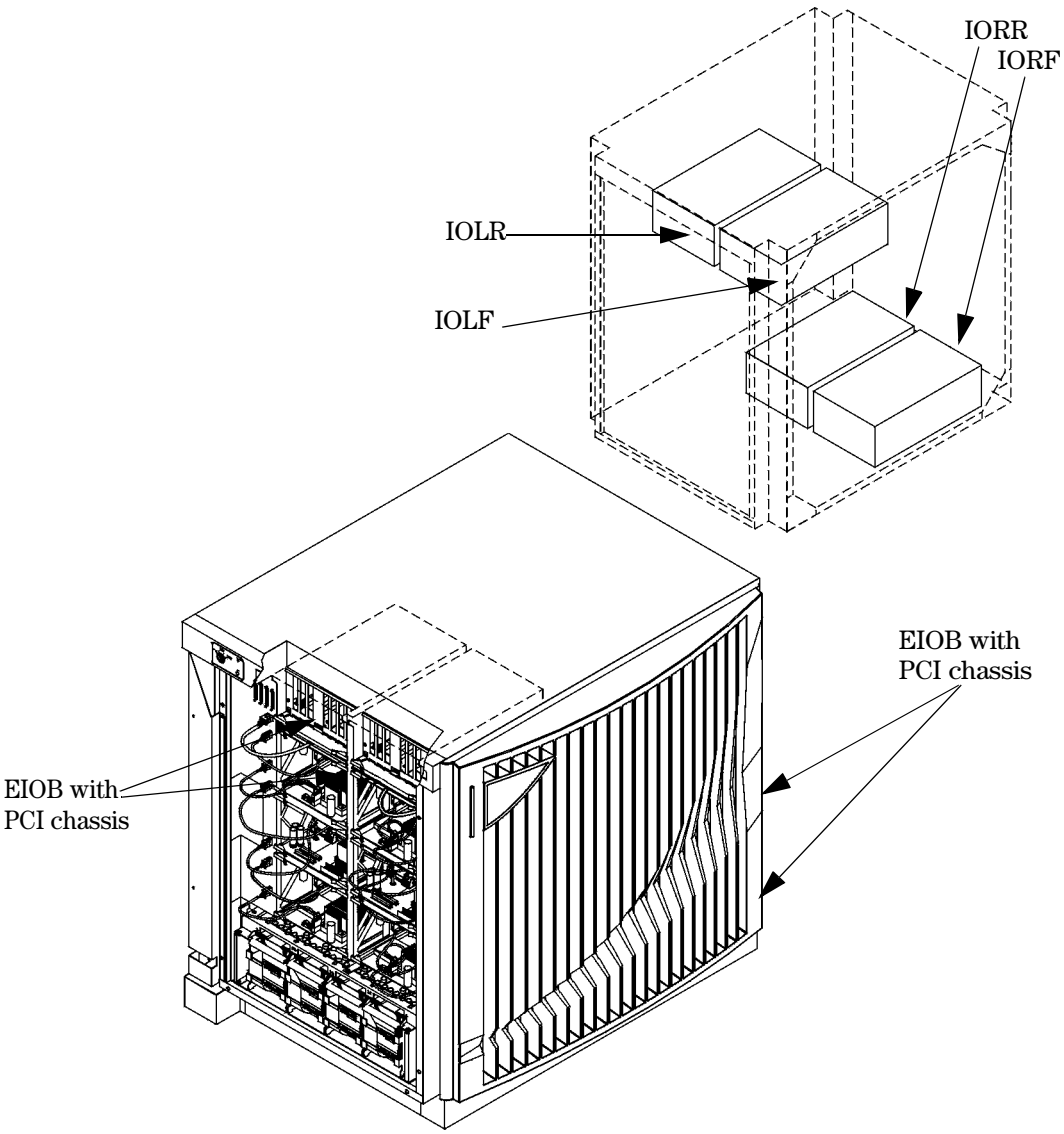

Figure 5 PCI Chassis Locations

2. Remove the left or right side cabinet skin by pulling from the top and bottom of the skin until it pops out. Each skin has a set of four catch pins that secure it to the server as shown in Figure 6.

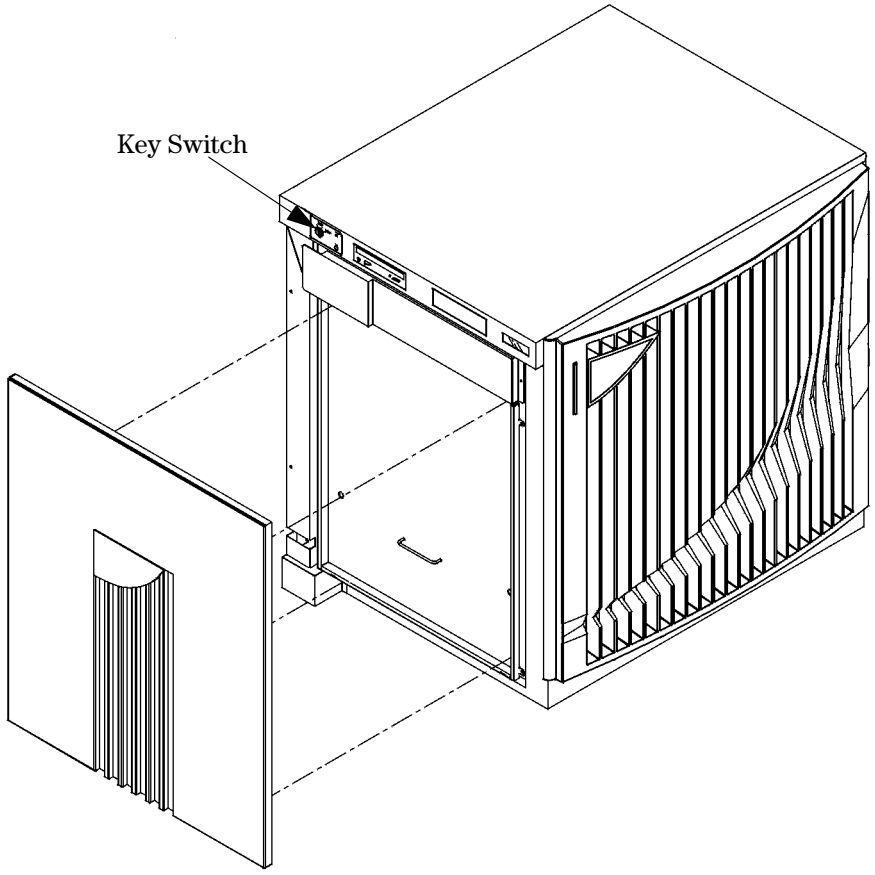

Figure 6 Removing Side Skins

3. Remove the EMI panel by removing the four screws that fasten the panel to the server as shown in Figure 7 and the screw retaining PCI cover.

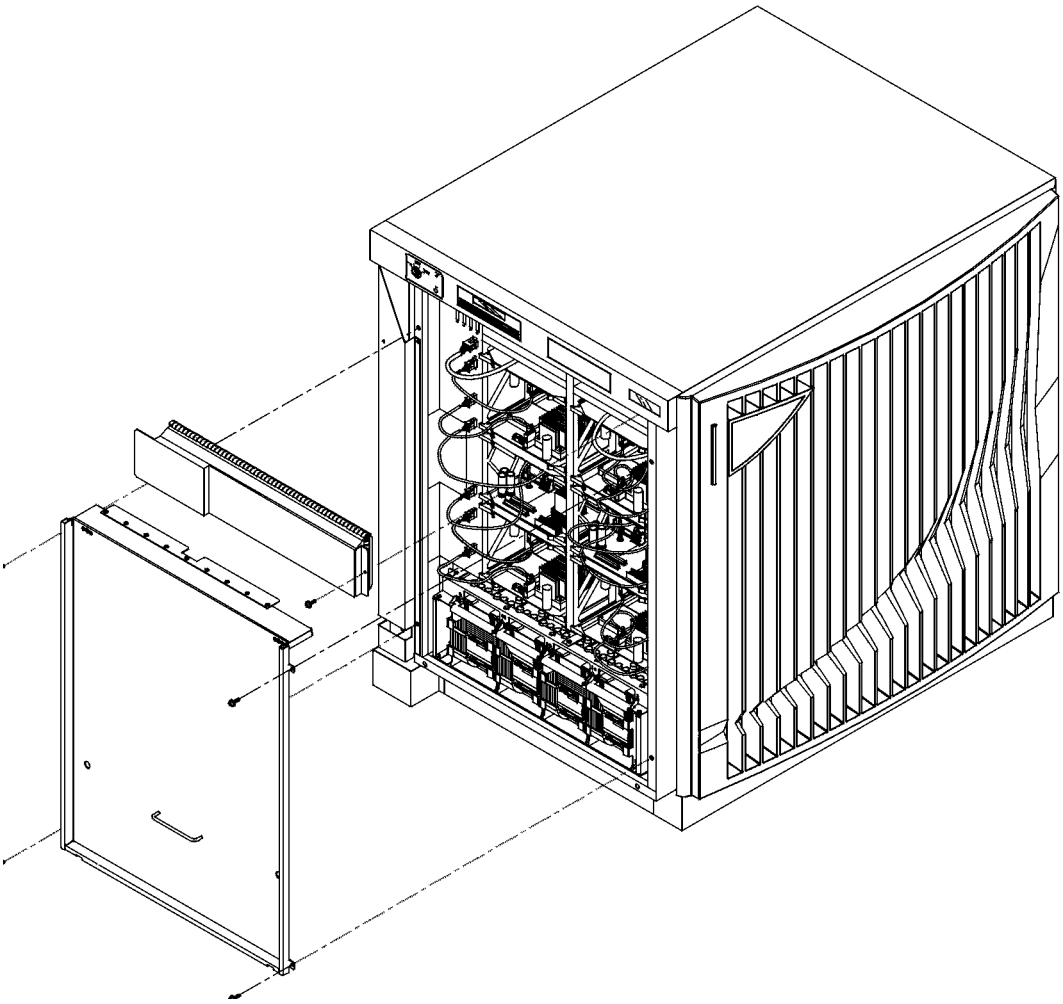

Figure 7 Removing EMI Panels

4. Unplug the power cable on the front of the target PCI chassis. The power connections are labeled on the chassis and are designated as follows:

   – IOLF I/O Left Front

   – IOLR I/O Left Rear

   – IORF I/O Right Front

   – IORR I/O Right Rear

   The IORF and IORR connectors are on the opposite side of the server near the bottom. Figure 8 shows the location of the IOLF and IOLR PCI chassis power connections.

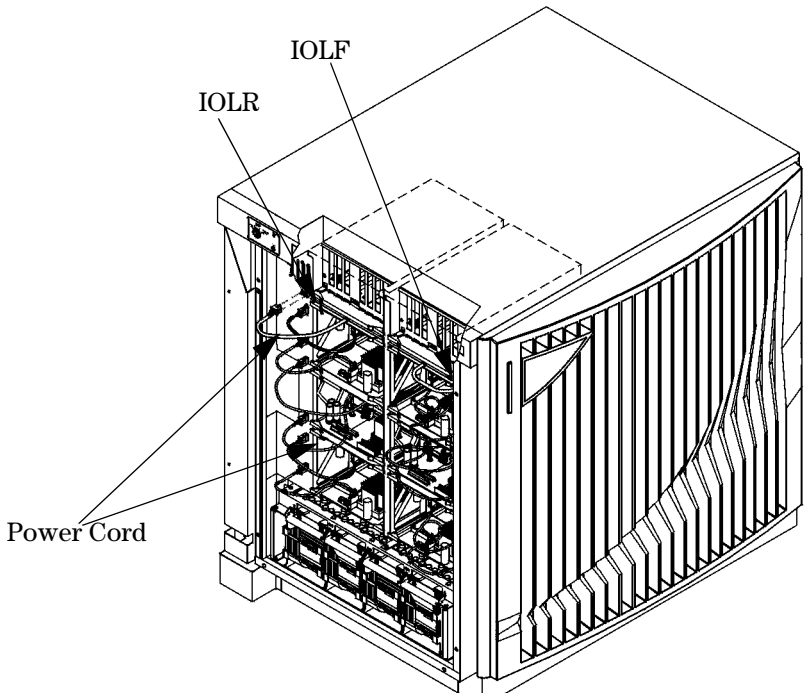

Figure 8 Unplugging the PCI Chassis Power Cable

5. Disconnect all SCSI and network cables attached to controllers in the PCI chassis. Mark or chart the connections for easy connection later.
6. Remove the PCI chassis from the server by pulling the two extractor levers on the front of the PCI chassis toward you until the PCI chassis is unseated from the Exemplar Node Routing Board (ENRB). Continue sliding the PCI chassis all the way out, taking care to put one hand underneath it for support (Figure 9).
7. Place the PCI chassis on a level work surface on a grounded static dissipating mat.

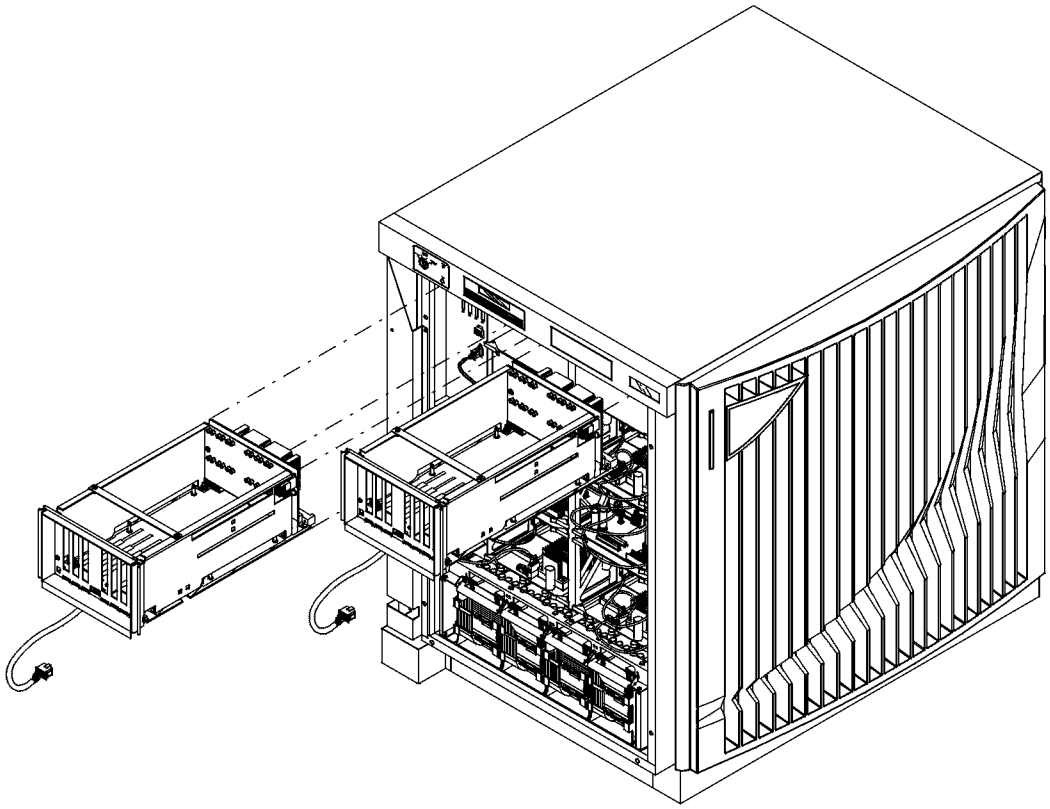

Figure 9 Removing the PCI Chassis

Install the Controller

1. Using a #2 Phillips screwdriver, remove the two screws that secure the bracket across the top of the PCI chassis, as shown in Figure 10.

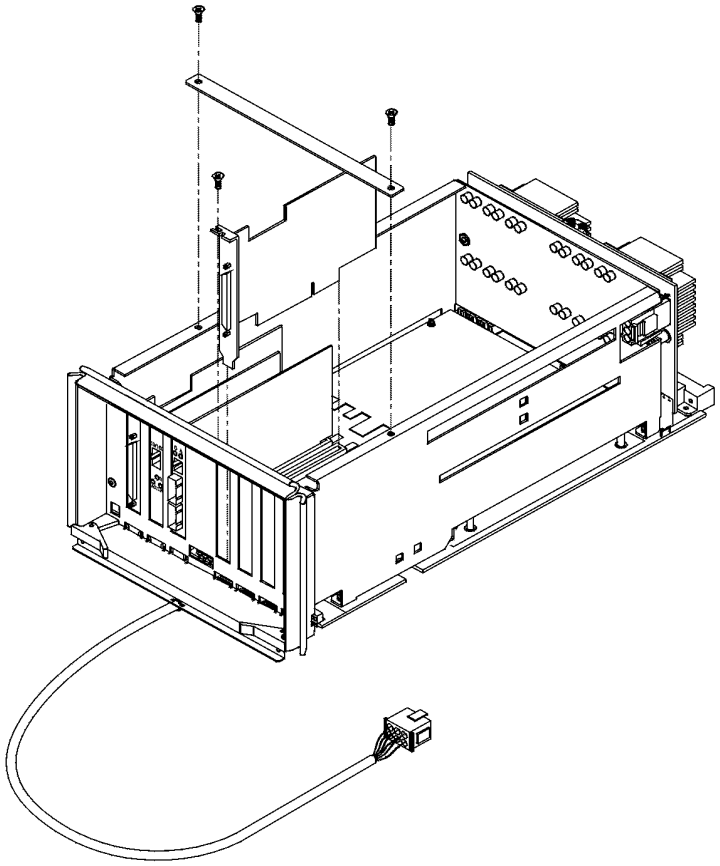

Figure 10 Installing the Controller

2. Select an available PCI slot and remove the PCI slot cover plate. Retain the screw for later use.
3. Insert the controller into the PCI slot as shown in Figure 10. Make sure the board is fully seated. If the package contains a terminator, place it somewhere for possible later use.
4. Secure the controller faceplate to the PCI chassis using the screw from the PCI slot cover plate.
5. Reinstall the bracket on top of the PCI chassis.

Reinstall the PCI Chassis

1. Line up the PCI chassis card edges with the guide rails as shown in Figure 11. Continue sliding the PCI chassis into the server until the PCI chassis edge is flush with the server chassis. Secure it using the two extractor levers.

Note The PCI chassis guide rails are set back several inches from the edge of the server chassis. Do not use the CPU guide rails closer to the edge of the server chassis.

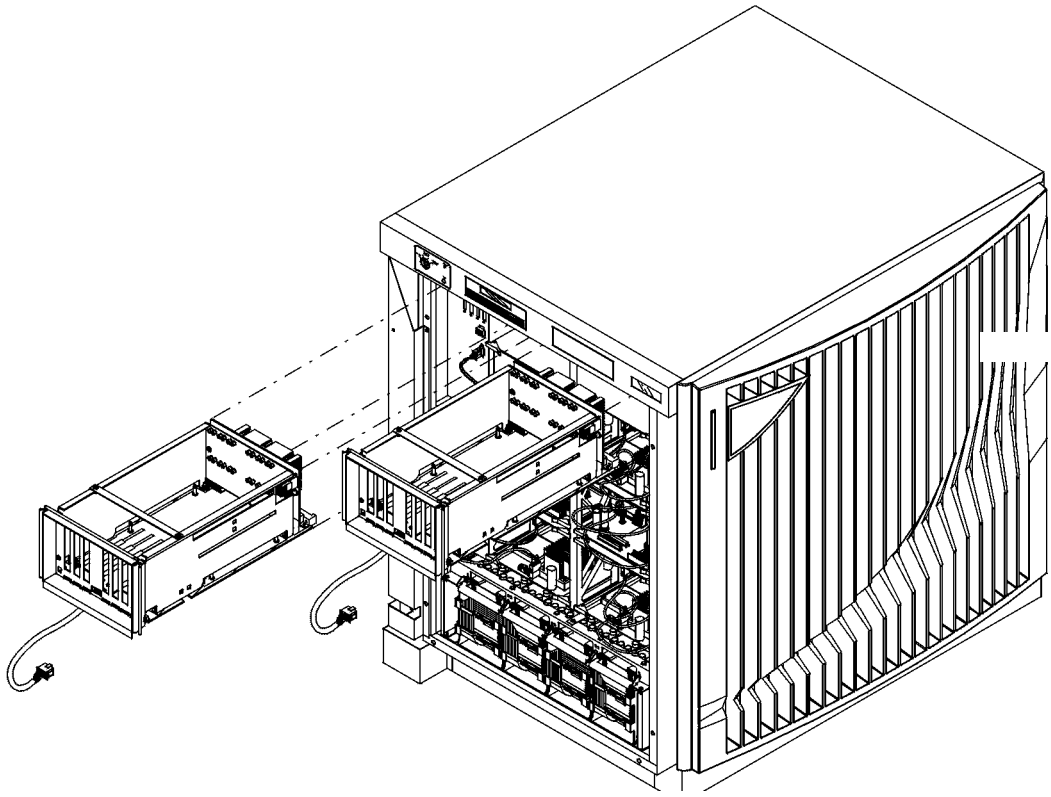

Figure 11 Reinstalling the PCI Chassis

2. Reattach the power cable on the front of the PCI chassis (see Figure 8 to locate the PCI chassis power connector).
3. Reattach any cables previously removed to their proper location.

Cabling

Note A cable for connecting the PCI Ultra SCSI controller to a disk tray A or B port connector is supplied with the A5068A product (see Table 3). Cables for connecting external devices are not supplied with the controller and must be purchased separately. Cable specifications are listed in chapter 1.

1. Attach the SCSI cable to the connector on the controller as shown in Figure 12. The example shows how to connect a shielded SCSI cable to a disk tray A or B port connector on the chassis. This cable is provided with the A5068A. You need to attach the differential terminator A4700-67098/1252-6520 to adapter cards cabled to internal disk trays.

   If you are connecting the controller to an external device, connect the external cable to the controller and route the cable through the cable channel at the rear edge of the server chassis. There are similar cable channels on the left and right rear edges of the chassis (refer to Figure 12). Attach the black terminated end of the cable to the A4800A card.

2. Attach the other end of the cable to the SCSI device or appropriate disk tray port.

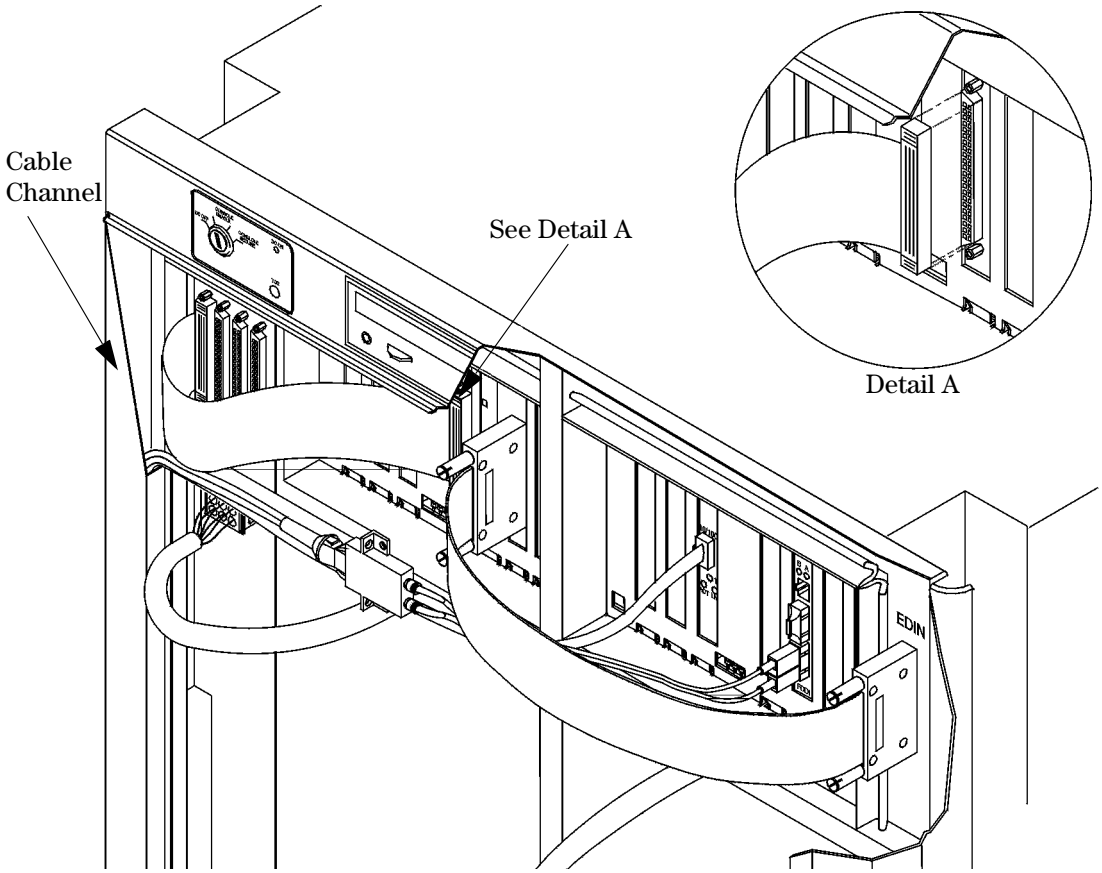

Figure 12 Connecting the SCSI Cable

Complete the Installation

1. Reinstall the EMI panels and side skins.
2. Restart the system by turning on the keyswitch on the operator panel.

Verifying Operation

After installing the adapter and attaching peripheral devices, verify that all components are working. Refer to your system documentation for information on verifying operation.

1. To verify that the adapter is correctly installed, execute the following command:

   ioscan -f

   The ioscan output might look like the following:

   ```
   ext_bus  0  0/0/0   c720 CLAIMED   INTERFACE  Ultra Wide SCSI
   ```

   The third column represents the hardware path of the slot in which the adapter is installed. For information about the ioscan command, refer to your operating system reference manual or the ioscan manpage

2. Verify that the adapter and driver display.
3. Verify that the devices you attached to the adapter display.

4 MAINTENANCE

General Troubleshooting

The A4800A host bus adapter is a single field replaceable unit (FRU) and does not contain any field-serviceable parts. Troubleshooting procedures described in this section are limited to verifying that the controller is operational and a valid connection is established.

General Procedure

1. Check the connection.

   Make sure that the correct cable is used, connected, and operating properly and that there are no bent pins in any of the connectors.

2. Check SCSI bus compatibility.

   Ensure transfer rate compatibility with the attached devices using the SCSI boot menu command.

3. Check the controller.

   Inspect the controller to make sure it is seated properly in the PCI bus slot. If necessary, power down the system, reseat the controller, and restart the system.

4. Run diagnostics.

   If a visual inspection of the controller and cable does not reveal any problems, or if an action taken as a result of the inspection does not produce a working controller, you may want to run diagnostics to determine whether the controller can communicate and respond to PCI bus instructions. Diagnostics are described in the next section.

   If diagnostics determine that the controller is defective, you must replace it. Contact your local Hewlett-Packard customer representative or call the HP Response Center.

Diagnostic Tests for V-Class

If you are experiencing problems with your SCSI devices and suspect that the controller may be malfunctioning, you can perform a diagnostic check of the controller to determine whether it is operational.

Note To run these diagnostics, you must reboot the system to the system Test Controller in standalone mode and run the cxtest utility.

Overview

The cxtest utility provides a graphical interface to the diagnostic environment. Diagnostic tests for the PCI Ultra SCSI controller are located in the io3000 suite of diagnostics. The io3000 diagnostic suite is organized into *classes*. Within each class are one or more diagnostic *subtests*. The PCI Ultra SCSI controller diagnostic classes are called the Class 12 Symbios Test.

Class 12 Symbios Test

The Class 12 Symbios diagnostic consists of five subtests.The subtests are grouped in classes beginning with verification of the most basic functionality and progressing toward more complex functionality, as follows:

- 1200 Symbios SCSI PCI configuration space test

  This test verifies the ability of the EPIC to access the Symbios SCSI controller through PCI configuration space. The PCI vendor ID and device ID fields are verified to be 0x1000 and 0x000f, respectively. Also, the ability to perform write and read operations on the base address registers is verified.

- 1205 Symbios SCSI PCI I/O and memory space test

  The Symbios SCSI controller is mapped in through PCI configuration space so that the controller's CSRs may be accessed through both PCI I/O and memory space. A pattern

is written to a scratch register (SCRATCHA) in the Symbios chip. The register is then read back to verify that the previous write succeeded.

- 1230 Symbios SCSI Scripts RAM test

  A simple “data equals address” pattern test of the SCRIPT RAM is performed.

- 1240 Symbios SCSI Interrupt test

  A simple SCRIPTS instruction is copied to SCRIPTS RAM on the Symbios controller. The SCRIPTS instruction is a simple INT opcode that, when executed by the Symbios chip, should cause a DMA interrupt to be logged. The DSP register of the Symbios chip is set to point to the instruction, and the ISTAT register is polled until the interrupt is detected or the allotted time has elapsed.

- 1250 Symbios SCSI DMA engine test

  A simple SCRIPT is written to Symbios SCRIPTS RAM, which contains a MEM MOVE opcode. The SCRIPT will copy 256 bytes from one section of SCRIPTS RAM to another SCRIPTS RAM area. Once the SCRIPT has completed, the test will verify that the original block of data was copied to the destination area.

Running SCSI Diagnostics

1. From the test station, reboot the system so that it boots the Test Controller in standalone mode instead of OBP. For specific instructions on booting the system to the Test Controller and operating in the diagnostic environment, refer to the *V-Class Diagnostics Guide*.
2. Execute cxtest:

   /spp/bin/cxtest -d

3. In the Tests menu, select io3000 to display the io3000 Class Menu dialog.
4. In the Class Menu dialog, select Class 12 Symbios Test. When you select a class, you select all the subtests within that class. You can, however, select specific subtests within a class by selecting the subtest button.

5. From the Class Menu dialog, select the Parameters button to specify the parameters of the test(s). The parameters are as follows:

EPIC — Identifies the PCI Interface Chip where the SCSI controller resides. Valid entries can be any of the values from the first column in Table 7.

Table 6 EPIC and PCI Slot Numbering

Parameter to Enter	EPIC	PCI Slots	Description
IOLF_B	0 (rear)	0, 1, 2	Left front EIOB, rear EPIC
IOLF_A	4 (front)	0, 1, 2	Left front EIOB, front EPIC
IOLR_B	1 (rear)	0, 1, 2	Left front EIOB, rear EPIC
IOLR_A	5 (front)	0, 1, 2	Left rear EIOB, front EPIC
IOLF_B	3 (rear)	0, 1, 2	Right front EIOB, rear EPIC
IOLF_A	7 (front)	0, 1, 2	Right front EIOB, front EPIC
IOLR_B	2 (rear)	0, 1, 2	Right rear EIOB, rear EPIC
IOLR_A	6 (front)	0, 1, 2	Right rear EIOB, front EPIC

Controller — Identifies the PCI slot number of the controller. The value can be 0, 1, 2, or 0xf. An entry of 0xf indicates that this device specification is unused.

Target device number — The target device number of the device (SCSI ID), expressed in hexadecimal. For diagnostic Class 12, this field is unused.

Logical Unit Number — The logical unit number of the device, expressed in hexadecimal. For diagnostic Class 12, this field is unused.

6. Click the Done button to close the Class Menu dialog.
7. Select Go from the cxtest Command menu to execute the tests.

The following message displays in the Console window:

```
Execution Starting . . . . . .
```

8. When the test terminates (successfully or unsuccessfully), the following message displays in the Console window:

   ```
   Execution Completed
   ```

   The results of the test display in the cxtest window.

   If the test fails, an error message displays. For a complete description of error messages, refer to the io3000 manpage and the *V-Class Diagnostics Guide*.

Upgrading Controller Firmware for V-Class

The PCI Ultra SCSI controller contains forth code that is required for the controller to be in the boot path.

Upgrading SCSI Forth Code

CAUTION *Do not overwrite the original released firmware filename when storing custom firmware on the test station.*

1. Load the new firmware onto the test station. Released firmware is stored in the /spp/firmware/ on the test station. Enter the following command:

   source /core@f0,f0000000/lan@0,d30000;15.99.111.99:/spp/firmware/pcirom.fth

2. Load the new firmware into the PCI Ultra SCSI card's flash using the obp fwcp command. The syntax for fwcp is:

   fwcp *test_station_ip_address:firmware_path tag*

test_station_ip_address	The ip address for the test station's ethernet connection to the server
firmware_path	The full path name of the source file
tag	The pull path name of the controller's flash RAM

   For each Symbios SCSI controller, perform the following command:

   fwcp 15.99.111.99:/spp/firmware/symbios.pcirom /pcirom@*Epic#(SAGA#),Slot#*

SCSI Bus Compatibility

Use the SCSI command to ensure SCSI controller and SCSI device compatibility by displaying and selecting SCSI bus parameters.

The SCSI command is available from the boot menu displayed after the test station has booted, provided autoboot is disabled.

```
Command                          Description
-------                          -----------
AUto [BOot|SEArch ON|OFF]         Display or set the specified flag
BOot [PRI|ALT|<path> <args>]      Boot from a specified path
BootTimer [time]                  Display or set boot delay time
CLEARPIM                          Clear PIM storage
CPUconfig [<proc>] [ON|OFF]       Configure/Deconfigure Processor
DEfault                           Set the sytem to defined values
DIsplay                           Display this menu
ForthMode                         Switch to the Forth OBP interface
IO                                List the I/O devices in the system
LS [<path>|flash]                 List the boot or flash volume
OS [hpux|sppux]                   Display/Select Operating System
PASSword                          Set the Forth password
PAth [PRI|ALT|CON] [<path>]       Display or modify a path
PDT [CLEAR|DEBUG]                Display/clear Non-Volatile PDT state
PIM_info [cpu#] [HPMC|TOC|LPMC]   Display PIM of current or any CPU
RESET [hard|debug]                Force a reset of the system
RESTrict [ON|OFF]                 Display/Select restricted access
                                  toForth
SCSI [INIT|RATE] [bus slot val]   List/Set SCSI controller parms
SEArch [<path>]                   Search for boot devices
SECure [ON|OFF]                   Display or set secure boot mode
TIme [cn:yr:mo:dy:hr:mn[:ss]]     Display or set the real-time clock
VErsion                           Display the firmware versions
Command:
```

Figure 13 Boot Menu

SCSI Command

The SCSI controller parameters can be displayed and modified using the SCSI command. The syntax for this command is:

SCSI rate *bus# slot# rate*

SCSI init *bus# slot# id#*

bus#	The bus number
slot#	The controller's slot number
rate	The SCSI controller's transfer rate 0: no limit 10: Fast SCSI 20: Ultra SCSI
id#	The SCSI ID number of the controller

Display and Set SCSI Transfer Rates

1. Display the SCSI transfer rate for a controller using the SCSI command.

   The following example lists the SCSI transfer rate for the controller on bus 5 slot 2:

   command: **SCSI rate 5 2**

   ```
   PCI device /5.2 = no limit
   ```

   Enter the command without specifying a bus or slot number to list transfer rates for all bus and slot numbers:

   command: **SCSI rate**

2. Set the SCSI transfer rate for a controller using the SCSI command.

   The following example sets the controller on bus 5 slot 2 to Fast SCSI and then displays the results:

   command: **SCSI rate 5 2 10**

command: **SCSI rate 5 2**

```
PCI device /5.2 = fast scsi
```

Display and Set Controller Initiator (SCSI) IDs

1. Display the initiator (SCSI) IDs for all controllers, buses, and slots using the SCSI command.

   The following example shows the SCSI ID for the controller on bus 5 slot 2.

   SCSI init 5 2

   ```
   PCI device /5.2 = 7
   ```

   Enter the command without specifying a bus or slot number to list initiator IDs for all bus and slot numbers:

   SCSI init

2. Set the initiator (SCSI) ID of a controller using the SCSI command.

   The following example sets bus 5 slot 2 to initiator ID 6 and displays the results:

   SCSI init 5 2 6

   SCSI init 5 2

   ```
   PCI device /5.2 = 6
   ```

Contacting Your HP Representative

If the equipment is covered by an HP service contract, document the problem as a service request and forward it to your HP representative. Include the following information where applicable:

- Describe the problem, including the events and symptoms leading up to the problem. Attempt to describe the source of the problem.

  Include HP-UX commands, communication subsystem commands, functionality of user programs, result codes and messages, and data that can reproduce the problem.

- Obtain the version, update, and fix information for all software. To check the version of the kernel, enter this command:

  uname -r

  To check patches, enter:

  what /stand/vmunix | grep scsi

  This allows HP to determine if the problem is already known and the correct software is installed at your site.

- Illustrate as clearly as possible the context of any messages. Record all error messages and numbers that appear at the user terminal and the system console.

- Prepare the formatted output and a copy of the log file for the HP representative to analyze.

- Prepare a listing of the HP-UX I/O configuration being used for the HP representative to analyze.

- Try to determine the general area within the software where the problem may exist. Refer to the appropriate reference manual and follow the guidelines on gathering information for that product.

- Document your interim (workaround) solution. The cause of the problem can sometimes be found by comparing the circumstances in which the problem occurs with the circumstances in which the problem does not occur.
- In the event of a system failure, obtain a full memory dump. If the directory **/var/adm/crash** exists, the HP-UX utility **/sbin/savecore** automatically executes during reboot to save the memory dump. HP recommends that you create the **/tmp/syscore** directory after successfully installing this product. Send the output of the system failure memory dump to the HP representative.

If the equipment is not covered by an HP service contract, there may be a charge for time and materials.

SCSI Sense Codes

The following example shows a typical SCSI error message.

```
 [+6708 72410001 002a9858 0:7] scsi disk: CHECK CONDITION on disk 0:6:5:0
        Read of logical block 509856, count 128
        disk sd45a, block 254920, 65536 bytes
        Valid = 1, Error code = 0x70
        Segment number = 0x00, Filemark = 0, EOM = 0, ILI = 0
        Sense key = 0x1, "RECOVERED ERROR"
        Information = 0x00 0x07 0xc7 0xe4
[+6709 72410001 002a9a10 0:7] scsi disk:      Additional sense length = 0x0a
        Command-specific information = 0x00 0x00 0x00 0x00
        Additional sense = 0x18, Qualifier = 0x01
        Field replaceable unit code = 0xea
        SKSV = 1, C/D = 0, BPV = 0, Bit pointer = 0
        Field pointer = 0x0003
```

The status (CHECK CONDITION) and sense key (RECOVERED ERROR) are interpreted. The Additional sense and Qualifier codes require interpretation. Use both codes to locate the interpretation. In the example, the Additional sense (0x18) and Qualifier (0x01) codes are interpreted as “recovered data with error correction and retries applied.”

Table 7 and Table 8 list all possible status and sense key codes. Table 9 interprets the Addtional sense and Qualifier codes contained in SCSI error messages reported by the console.

Table 7 SCSI Status Codes

SCSI Status Code	Name
0x00	good
0x02	check condition
0x04	condition met
0x08	busy
0x10	intermediate
0x14	intermediate - condition met
0x18	reservation conflict
0x22	command terminated
0x28	queue full

Table 8 SCSI Sense Keys

Sense Key	Name
0	no sense
0x1	recovered error
0x2	not ready
0x3	medium error
0x4	hardware error
0x5	illegal request
0x6	unit attention
0x7	data protect
0x8	blank check
0x9	vendor-specific
0xa	copy aborted
0xb	aborted command

Table 8 SCSI Sense Keys (cont'd)

Sense Key	Name
0xc	equal
0xd	volume overflow
0xe	miscompare
0xf	reserved

Table 9 SCSI Additional Sense and Qualifier Codes

Additional Sense Code	Qualifier Code	Description
0x00	0x00	no additional sense information
0x00	0x01	filemark detected
0x00	0x02	end-of-partition/medium detected
0x00	0x03	setmark detected
0x00	0x04	beginning of partition/medium detected
0x00	0x05	end-of-data detected
0x00	0x06	i/o process terminated
0x00	0x11	audio play operation in progress
0x00	0x12	audio play operation paused
0x00	0x13	audio play operation successfully completed
0x00	0x14	audio play operation stopped due to error
0x00	0x15	no current audio status to return
0x01	0x00	no index/sector signal
0x02	0x00	no seek complete
0x03	0x00	peripheral device write fault
0x03	0x01	no write current
0x03	0x02	excessive write errors
0x04	0x00	logical unit not ready, cause not reportable
0x04	0x01	logical unit in process of becoming ready

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x04	0x02	logical unit not ready, initializing command required
0x04	0x03	logical unit not ready, manual intervention required
0x04	0x04	logical unit not ready, format in progress
0x05	0x00	logical unit does not respond to selection
0x06	0x00	reference position found
0x07	0x00	multiple peripheral devices selected
0x08	0x00	logical unit communication failure
0x08	0x01	logical unit communication time-out
0x08	0x02	logical unit communication parity error
0x09	0x00	track following error
0x09	0x01	tracking servo failure
0x09	0x02	focus servo failure
0x09	0x03	spindle servo failure
0x0a	0x00	error log overflow
0x0c	0x00	write error
0x0c	0x01	write error recovered with auto reallocation
0x0c	0x02	write error - auto reallocation failed
0x10	0x00	id crc or ecc error
0x11	0x00	unrecovered read error
0x11	0x01	read retries exhausted
0x11	0x02	error too long to correct
0x11	0x03	multiple read errors
0x11	0x04	unrecovered read error - auto reallocate failed
0x11	0x05	l-ec uncorrectable error
0x11	0x06	circ unrecovered error
0x11	0x07	data resynchronization error
0x11	0x08	incomplete block read
0x11	0x09	no gap found

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x11	0x0a	miscorrected error
0x11	0x0b	unrecovered read error - recommend reassignment
0x11	0x0c	unrecovered read error - recommend rewrite the data
0x12	0x00	address mark not found for id field
0x13	0x00	address mark not found for data field
0x14	0x00	recorded entity not found
0x14	0x01	record not found
0x14	0x02	filemark or setmark not found
0x14	0x03	end-of-data not found
0x14	0x04	block sequence error
0x15	0x00	random positioning error
0x15	0x01	mechanical positioning error
0x15	0x02	positioning error detected by read of medium
0x16	0x00	data synchronization mark error
0x17	0x00	recovered data with no error correction applied
0x17	0x01	recovered data with retries
0x17	0x02	recovered data with positive head offset
0x17	0x03	recovered data with negative head offset
0x17	0x04	recovered data with retries and/or circ applied
0x17	0x05	recovered data using previous sector id
0x17	0x06	recovered data without ecc - data auto-reallocated
0x17	0x07	recovered data without ecc - recommend reassignment
0x17	0x08	recovered data without ecc - recommend rewrite
0x18	0x00	recovered data with error correction applied
0x18	0x01	recovered data with error correction and retries applied
0x18	0x02	recovered data - data auto-reallocated
0x18	0x03	recovered data with circ
0x18	0x04	recovered data with lec

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x18	0x05	recovered data - recommend reassignment
0x18	0x06	recovered data - recommend rewrite
0x19	0x00	defect list error
0x19	0x01	defect list not available
0x19	0x02	defect list error in primary list
0x19	0x03	defect list error in grown list
0x1a	0x00	parameter list length error
0x1b	0x00	synchronous data transfer error
0x1c	0x00	defect list not found
0x1c	0x01	primary defect list not found
0x1c	0x02	grown defect list not found
0x1d	0x00	miscompare during verify operation
0x1e	0x00	recovered id with ecc
0x20	0x00	invalid command operation code
0x21	0x00	logical block address out of range
0x21	0x01	invalid element address
0x22	0x00	illegal function
0x24	0x00	invalid field in cdb
0x25	0x00	logical unit not supported
0x26	0x00	invalid field in parameter list
0x26	0x01	parameter not supported
0x26	0x02	parameter value invalid
0x26	0x03	threshold parameters not supported
0x27	0x00	write protected
0x28	0x00	not ready to ready transition (medium may have changed)
0x28	0x01	import or export element accessed
0x29	0x00	power on, reset, or bus device reset occurred
0x2a	0x00	parameters changed

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x2a	0x01	mode parameters changed
0x2a	0x02	log parameters changed
0x2b	0x00	copy cannot execute since host cannot disconnect
0x2c	0x00	command sequence error
0x2c	0x01	too many windows specified
0x2f	0x00	commands cleared by another initiator
0x30	0x00	incompatible medium installed
0x30	0x01	cannot read medium - unknown format
0x30	0x02	cannot read medium - incompatible format
0x30	0x03	cleaning cartridge installed
0x31	0x00	medium format corrupted
0x32	0x00	no defect spare location available
0x32	0x01	defect list update failure
0x33	0x00	tape length error
0x36	0x00	ribbon, ink, or tower failure
0x37	0x00	rounded parameter
0x39	0x00	saving parameters not supported
0x3a	0x00	medium not present
0x3b	0x00	sequential positioning error
0x3b	0x01	tape position error at beginning-of-medium
0x3b	0x02	tape position error at end-of-medium
0x3b	0x03	tape or electronic vertical forms unit not ready
0x3b	0x04	slew failure
0x3b	0x05	paper jam
0x3b	0x06	failed to sense top-of-form
0x3b	0x07	failed to sense bottom-of-form
0x3b	0x08	reposition error
0x3b	0x09	read past end of medium

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x3b	0x0a	read past beginning of medium
0x3b	0x0b	position past end of medium
0x3b	0x0c	position past beginning of medium
0x3b	0x0d	medium destination element full
0x3b	0x0e	medium source element empty
0x3d	0x00	invalid bits in identify message
0x3e	0x00	logical unit has not self-configured yet
0x3f	0x00	target operating conditions have changed
0x3f	0x01	microcode has been changed
0x3f	0x02	changed operating definition
0x3f	0x03	inquiry data has changed
0x40	0x00	ram failure
0x40	nn	diagnostic failure on component nn
0x41	0x00	data path failure
0x42	0x00	power-on or self-test failure
0x43	0x00	message error
0x44	0x00	internal target failure
0x45	0x00	select or reselect failure
0x46	0x00	unsuccessful soft reset
0x47	0x00	scsi parity error
0x48	0x00	initiator detected error message received
0x49	0x00	invalid message error
0x4a	0x00	command phase error
0x4b	0x00	data phase error
0x4c	0x00	logical unit failed self-configuration
0x4e	0x00	overlapped commands attempted
0x50	0x00	write append error
0x50	0x01	write append position error

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x50	0x02	position error related to timing
0x51	0x00	erase failure
0x52	0x00	cartridge fault
0x53	0x00	media load or eject failed
0x53	0x01	unload tape failure
0x53	0x02	medium removal prevented
0x54	0x00	scsi to host system interface failure
0x55	0x00	system resource failure
0x56	0x00	reserved
0x57	0x00	unable to recover table of contents
0x58	0x00	generation does not exist
0x59	0x00	updated block read
0x5A	0x00	operator request or state change input (unspecified)
0x5A	0x01	operator medium removal request
0x5A	0x02	operator selected write protect
0x5A	0x030	operator selected write permit
0x5B	0x00	log exception
0x5B	0x01	threshold condition met
0x5B	0x02	log counter at maximum
0x5B	0x03	log list codes exhausted
0x5C	0x00	rpl status change
0x5C	0x01	spindles synchronized
0x5C	0x02	spindles not synchronozed
0x5D	0x00	reserved
0x5E	0x00	reserved
0x5F	0x00	reserved
0x60	0x00	lamp failure
0x61	0x00	video acquisition error

Table 9 SCSI Additional Sense and Qualifier Codes (cont'd)

Additional Sense Code	Qualifier Code	Description
0x61	0x01	unable to acquire video
0x61	0x02	out of focus
0x62	0x00	scan head positioning error
0x63	0x00	end of user area encountered on this track
0x64	0x00	illegal mode for this track
0x65	0x00	reserved
0x66	0x00	reserved
0x67	0x00	reserved
0x68	0x00	reserved
0x69	0x00	reserved
0x6A	0x00	reserved
0x6B	0x00	reserved
0x6C	0x00	reserved
0x6D	0x00	reserver
0x6E	0x00	reserved
0x6F	0x00	reserved

REGULATORY STATEMENTS

Regulatory Statement

A. FCC Statement (For U.S.A. Only)

The Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of the users of this product.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. The end user of this product should be aware that any changes or modifications made to this equipment without the approval of Hewlett-Packard could result in the product not meeting the Class A limits, in which case the FCC could void the user's authority to operate the equipment.

B. IEC Statement (Worldwide)

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

C. DOC Statement (Canada)

This Class A digital apparatus meets all requirements of the Canadian interference-Causing Equipment Regulations.

Cet appareil numerique do la classe A respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

D. Spécification ATI Classe A (France)

DECLARATION D'INSTALLATION ET DE MISE EN EXPLOITATION d'un matériel de traitement de l'information (ATI), classé A en fonction des niveaux de perturbations radioélectriques émis, définis dans la norme européenne EN 55022 concernant la Compatibilité Electromagnétique.

Cher Client,

Conformément à la Réglementation Française en vigueur l'installation ou le transfert d'installation, et l'exploitation de cet appareil de classe A, doivent faire l'objet d'une déclaration (en deux exemplaires) simultanément auprès des services suivants:

- Comité de Coordination des Télécommunications 20, avenue de Ségur - 75700 PARIS
- Préfecture du département du lieu d'exploitation

Le formulaire à utiliser est disponible auprès des préfectures.

La déclaration doit être faite dans les 30 jours suivant la mise en exploitation.

Le non respect de cette obligation peut être sanctionné par les peines prévues au code des Postes et Télécommunications et celles indiquées dans la loi du 31 mai 1993 susvisée.

Arrêté du 27 Mars 1993, publié au J.O. du 28 Mars - ATI

E. VCCI Statement (Japan)

この装置は，情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company
Enterprise Storage Solutions Division

Manufacturer's Address: 8000 Foothills Blvd.
Roseville, CA 95747
USA

declares, that the product

Product Name: Single Port FWD SCSI HBA

Model Number(s): A4800A

Product Options: N/A

conforms to the following Product Specifications:

Safety: IEC 950:1991 + A1, A2, A3, A4 / EN 60950:1992 + A1, A2, A3, A4
GB 4943-1995

EMC: CISPR 22:1993 / EN 55022:1994 - Class A[1]
GB 9254-1988
EN 50082-1:1992
IEC 801-2:1991 / prEN 55024-2:1992, 4 kV CD, 8 kV AD
IEC 801-3:1984 / prEN 55024-3:1991, 3 V/m
IEC 801-4:1988 / prEN 55024-4:1993, 0.5 kV Signal Lines
1 kV Power Lines

Supplementary Information:

The product here with complies with the requirements of the EMC Directive 89/336/EEC and carries the CE marking accordingly.

1) The Product was tested in a typical configuration with HP 9000 computer system.

Roseville, 10/6/98

Frank L. Sindelar, ESSD Quality Mgr.

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department HQ-TRE, Herrenberger Straße 130, D-71034 Böblingen (FAX: + 49-7031-14-3143)

APPENDIX A

PCI Overview

This appendix briefly introduces the PCI Local Bus. For a complete description of the bus, refer to the PCI Local Bus Specification, Revision 2.1. You can obtain a copy of the specification by contacting the following:

PCI Special Interest Group
P.O. Box 14070
Portland, OR
USA 97214

In the US call (800) 433-5177
International call 1 (503) 797-4207
Fax 1 (503) 234-6762

PCI Terminology

agent

An entity that operates on a computer bus.

arbitration boundary

A point at which bus mastership may be assumed by another master.

burst transfer

The basic bus transfer mechanism of PCI. A burst is made up of an address phase and one or more data phases.

bus device

A bus master or target.

Configuration Address Space

A set of 64 registers (DWORDS) used for configuration, initialization, and catastrophic error handling. This address space consists of two regions: a header region and a device-dependent region.

configuration cycle

Bus cycles used for system initialization and configuration via the Configuration Address Space.

controller

A PCI expansion card.

DAC (Dual Address Cycle)

A PCI transaction in which a 64-bit address is transferred across a 32-bit data path in two clock cycles.

master

A PCI module that can initiate a PCI transaction.

PCI interface

The whole block of logic that implements the PCI bus.

PCI Local Bus (Peripheral Component Interconnect bus)

Originally developed by Intel as a local bus for high-end PC systems, it now falls under the jurisdiction of the PCI Special Interest Group (PCI-SIG).

PMC (PCI Mezzanine Card)

A small form factor expansion card based on the PCI specification.

SAC (Single Address Cycle)

A PCI transaction in which a 32-bit address is transferred across a 32-bit data path in a single clock cycle.

target

A module that responds to a PCI transaction.

transaction

An atomic transfer of one or more bytes on the PCI bus. A transaction defines an arbitration boundary.

PCI Physical Characteristics

PCI defines two expansion card connectors: 5 volt and 3.3 volt signaling connectors. To accommodate both voltages and provide a smooth migration path between voltages, three electrical types are defined for expansion cards:

- 5 volt boards, which only plug into a 5 volt connector
- 3.3 volt boards, which only plug into 3.3 volt connectors
- Universal boards, which plug into either 5 volt or 3.3 volt connectors

Additionally, PCI specifies two form factors for expansion cards. One type is known as PMC (PCI Mezzanine Card), based on CMC IEEE P1386. Mezzanine cards have a form factor similar to an SBUS card. The other type is similar to an EISA bus card and is common in most PCs. PCI defines three sizes of these cards:

- Long
- Short
- Variable short length

It is not a requirement for any system to support all three sizes.

Two types of backplates are defined: ISA/EISA and Micro-Channel compatible.

APPENDIX B

SCSI Overview

SCSI (small computer systems interface) is an I/O bus protocol that uses a parallel bus connection between peripherals. The word “small” in the acronym is an inaccurate description of this popular interface. The SCSI interface is highly flexible and lends itself to a wide variety of applications in systems of all sizes.

SCSI protocol is the logical capabilities of the bus itself rather than the physical characteristics of the peripheral devices. The bus is designed to support up to 16 devices, including one or more hosts. Either asynchronous or synchronous transfer modes can be used, making a great variety of peripheral devices available.

SCSI Terminology

SCSI interfaces are generally classified using a combination of the following seven attributes:

- Ultra – Synchronous transfer rate of 20 MHz (50 nanosecond cycle time)
- Fast – Synchronous transfer rate of 10MHz (100 nanosecond cycle time)
- Slow – Synchronous transfer rate of 5MHz (200 nanosecond cycle time)
- Wide – 16-bit wide data path
- Narrow – 8-bit wide data path
- Single-ended – Cable/driver configuration intended for cabling devices that are in close physical proximity, such as in the same cabinet
- Differential – Cable/driver configuration intended for cabling devices between cabinets

The SCSI interface can support the following types of devices:

- Ultra-and-Wide
- Ultra-and-Narrow
- Fast-and-Wide
- Fast-and-Narrow
- Slow-and-Wide
- Slow-and-Narrow

The type of SCSI interface used depends on both the controller and the peripheral device's configuration. In addition, all SCSI devices support asynchronous transfers, which always use a narrow data path.

Devices on the SCSI bus are known as one of the following:

- Initiators – A device, such as a host system that requests another device on the bus to perform a SCSI operation
- Targets – The object of a request, such as a peripheral device

Some devices can function as both an Initiator and a Target, but usually a device is either one or the other.

Devices on the SCSI bus are characterized by:

- SCSI ID – A unique bus address, ranging from 0 to 15

  SCSI IDs 7–0 have the highest priority, and IDs 15–8 the lowest. Within each group, the device with the higher numbered ID has highest priority. ID 7 is normally reserved for the host/initiator, as in the PMC Ultra SCSI.
- Logical Unit – A physical or virtual peripheral device addressable through a target
- LUN – The Logical Unit Number; an encoded three-bit identifier for the logical unit

The continued logical connection between two devices is identified by:

- Nexus – A relationship or connection between devices that begins with the establishment of an initial connection and ends with the completion of the I/O process
- IT Nexus – A Nexus between initiator and target, established with the selection phase
- ITL Nexus – A Nexus between initiator, target, and logical unit, established with the Identify message

SCSI Bus Phases

Communication on the SCSI bus can occur only between two devices at any time.

The SCSI architecture includes eight distinct phases:

1. BUS FREE

   Indicates that there is no current I/O process and that the SCSI bus is available for a connection.

2. ARBITRATION

   Allows one SCSI device to gain control of the SCSI bus so that it can initiate or resume an I/O process.

3. SELECTION

   Allows an initiator to select a target for the purpose of requesting a target function.

4. RESELECTION

   A target may disconnect release control of the SCSI bus and allow it to go to the BUS FREE phase to perform an operation. RESELECTION, therefore, is the reacquisition of the SCSI bus to complete the I/O process begun in the initial connection made during a SELECTION phase.

5. COMMAND

6. DATA
7. STATUS
8. MESSAGE

   The COMMAND, DATA, STATUS, and MESSAGE phases are all grouped together as the information transfer phases. They are used to transfer data or control information via the DATA bus.

   The information transfer phases use one or more request/acknowledge handshakes to control the information transfer. Each request/acknowledge handshake allows the transfer of one byte or halfword of information.

   Synchronous data transfer is optional and only used in data phases if an agreement has been established between the initiator and target. The agreement specifies the request/acknowledge offset and the minimum transfer period.

SCSI devices are connected together in a daisy-chain fashion, making the signals common to all devices. Each end of the cable must be terminated with the characteristic impedance of the bus. The PCI Ultra SCSI controller does not have onboard terminators, and requires termination to be supplied in the cable or added optionally to the internal SCSI connector on the controller. The opposite end of the SCSI cable must also have an appropriate termination plug attached.

Ultra SCSI

Ultra SCSI (also called Fast-20) is also defined by ANSI. Ultra SCSI has double the performance of Fast SCSI.

An Ultra SCSI device can connect computers to other computers or to peripheral devices such as disk drives, tape drives, or CD-ROM drives.

Ultra SCSI allows up to 15 SCSI or Ultra SCSI devices to be connected to a single port in daisy chain fashion. Each SCSI device must have a unique SCSI ID. You must have Ultra SCSI devices to achieve Ultra SCSI transfer speeds, but the PCI Ultra SCSI controller is backwards compatible with slower SCSI devices.

INDEX

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Reader Comment Sheet

Hewlett-Packard A4800A PCI Ultra SCSI Service and User Guide

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	Agree				Disagree	N/A
The manual is well organized.	◯	◯	◯	◯	◯	◯
The information is technically accurate.	◯	◯	◯	◯	◯	◯
Information is easy to find.	◯	◯	◯	◯	◯	◯
Step-by-step procedures are easy to perform.	◯	◯	◯	◯	◯	◯
There are enough examples and pictures.	◯	◯	◯	◯	◯	◯
The examples and pictures are useful.	◯	◯	◯	◯	◯	◯

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