AcceleRAID 170LP

Installation Guide

DB11-000024-00 First Edition
08P5513

Electromagnetic Compatibility Notices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

•Reorient or relocate the receiving antenna.

•Increase the separation between the equipment and the receiver.

•Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

•Consult the dealer or an experienced radio/TV technician for help.

Shielded cables for SCSI connection external to the cabinet are used in the compliance testing of this Product. LSI Logic is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by LSI Logic. The correction of interferences caused by such unauthorized modification, substitution, or attachment will be the responsibility of the user.

The LSI Logic Mylex AcceleRAID 170LP is tested to comply with FCC standards for home or office use.

This Class B digital apparatus meets all requirements of the Canadian

Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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取扱説明書に従って正しい取り扱いをして下さい。

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

LSI Logic Corporation
North American Headquarters
Milpitas, CA
408.433.8000

FC Declaration of Conformity

Per FCC Part 2, Section 2.1077(a)

Manufacturer's Name:	LSI Logic Corporation
Manufacturer's Address:	North American Headquarters Milpitas, CA USA

Declares that the product:

Product Name:	AcceleRAID 170LP PCI to Ultra 160 SCSI RAID Controller
Model Number(s):	A170LP-1-16NB
Year of Manufacture:	2000

Conforms to the following Product Specification(s):

FCC:	CFR 47 Part 15, Subpart B, Section 15.107(e) and Section 15.109(g) Class B Digital Device tested per ANSI C63.4–1992 procedures

Supplementary Information:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CE Declaration of Conformity

Per 89\336\EEC

Responsible Party
Name: LSI Logic Corporation
Address: North American Headquarters
Milpitas, CA
U.S.A.

hereby declares that the product

Trade Name: AcceleRAID 170LP PCI to Ultra 160 SCSI RAID Controller
Fab 550167-01 Rev A

Model Number(s): A170LP-1-16NB

conforms to the following specifications

Standards: EN 50081-1:1992, Emissions
EN 55022:1998 Class B ITE radiated and conducted emissions

EN 50024:1998, Immunity
EN 61000-4-2:1998 Electrostatic Discharge
EN 61000-4-3:1998 Radiated Immunity
EN 61000-4-4:1995 Electrical Fast Transients/Burst
EN 61000-4-5:1995 Surges
EN 61000-4-6:1996 Conducted Immunity
EN 61000-4-11:1994 Supply Dips and Variations

CE Community of Europe

CE mark is rated for the AceleRAID 170LP as follows:

CISPR 22 Radiated Emission

EN55022, Generic immunity standard for the following:
IEC 801-2 ESD, IEC 801-3 Radiated, and IEC 801-4 EFT/Burst

Warning!

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

Achtung!

Dieses ist ein Gerät der Funkstörgrenzwertklasse B. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen aufreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Avertissement!

Cet appareil est un appareil de Classe B. Dans un environnement résidentiel cet appareil peut provoquer des brouillages radioélectriques. Dans ce cas, il peut être demandé à l'utilisateur de prendre des mésures appropriées.

Underwriters Laboratories Statement and Warning

Proprietary Rights Notice

Document Description

Document DB11-000024-00 First Edition. November 2002
This document describes the LSI Logic Corporation's Mylex AcceleRAID 170LP product for Software Kit 5.20 and will remain the official reference source for all revisions/releases of this product until rescinded by an update.

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About This Manual

This installation guide covers hardware set-up and configuration procedures necessary for the installation of a Mylex AcceleRAID 170LP single channel RAID controller.

Chapter 1 describes the controller, standard package contents, and user-supplied items necessary for installation.

Chapter 2 describes the steps to be performed prior to controller installation and the physical installation of the AcceleRAID 170LP single channel RAID controller.

Chapter 3 describes controller start-up and the BIOS resident utilities.

Appendix A provides hardware and environmental specifications.

Appendix B describes error messages and problem correction.

Appendix C describes the PCI Hot Plug feature.

Appendix D provides enclosure management information.

Conventions

Throughout the manual, the following conventions are used to describe user interaction with the product:

`prompt` This style of type indicates screen display messages

Enter Press the key labeled “Enter” (or “Delete”, etc.)

Note

Supplementary information that can have an effect on system performance.

Caution

Notification that a proscribed action has the *potential* to adversely affect equipment operation, system performance, or data integrity.

WARNING

Notification that a proscribed action will *definitely* result in equipment damage, data loss, or personal injury.

Contents

Chapter 1
Introduction

This chapter describes:

- **The AcceleRAID™ 170LP controller**
- **Standard package contents**
- **User supplied items**

Product Description

The Mylex AcceleRAID 170LP controller is a PCI to Ultra 160 SCSI single channel RAID controller with 32-bit, 33MHz PCI capability. The AcceleRAID 170LP supports one external and one internal Ultra 160 SCSI connector. The AcceleRAID 170LP controller provides the speed and functionality required by high demand server platforms. AcceleRAID 170LP achieves performance breakthroughs in PCI technology, eliminates storage bottlenecks, and delivers scalable performance. Enclosure Management and PCI Hot Plug are standard features. The AcceleRAID 170LP controller requires PCI 2.2 compliant slots.

The AcceleRAID 170LP comes with both a Standard PCI Bracket (Figure 1-1) for installation into a standard system chassis and a Low Profile PCI Bracket (Figure 1-2) for installation into a specially designed 2U chassis

.

Figure 1-1. AcceleRAID 170LP Controller with Standard Bracket

Figure 1-2. AcceleRAID 170LP Controller with Low Profile Bracket

Controller Features

Features of the AcceleRAID 170LP controller include:

- One QLogic ISP10160A chip to support one Ultra 160 SCSI LVD channel
- Intel i960RS RISC processor operating at 100MHz
- 16MB ECC SDRAM cache memory, soldered on board (fixed)
- PCI 2.2 compliant
- 1MB, 8-bit flash EEPROM for BIOS and code
- 32KB, 8-bit NVRAM for error log controller configuration
- Built-in configuration utilities (in BIOS)
- Write-through and write-back cache support
- PCI Hotplug capability allowing the AcceleRAID 170LP to be swapped with a replacement without powering down the system

> ⚠ ***Caution***
>
> Be sure the motherboard you are using supports PCI Hotplug before attempting to use this feature, or serious damage to the controller and/or the motherboard could result. (The motherboard must be PCI 2.2 compliant to use this feature.)

Channel Capabilities

15 Ultra 160 SCSI devices per channel

Controller Capabilities

- 15 physical drives in the drive group (array)
- 32 total logical drives on the controller
- Supports RAID levels 0, 1, 0+1, 3, 5, 10, 30, 50, and JBOD

Operating System Support

MS-DOS 6.x and above are supported using drivers that reside in the AcceleRAID BIOS. Drivers in the Disk Array Controller Software Kit, included with the AcceleRAID 170LP controller, support other popular operating systems. (Refer to5 the *PCI Disk Array Controller Drivers Installation Guide and User Manual*.)

Standard Package Contents

The following items are supplied with the standard shipping package:

Hardware

- AcceleRAID 170LP Disk Array Controller with documentation included on the CD-ROM and a printed Quick Installation Guide
- 16MB ECC cache memory, soldered on board (fixed)

Software

- On-board RAID EzAssist disk array controller configuration utility with documentation on CD-ROM and a printed Quick Configuration Guide
- Software Kit Driver diskettes with documentation on CD-ROM
- Global Array Manager (GAM) Server and Client software with documentation on CD-ROM

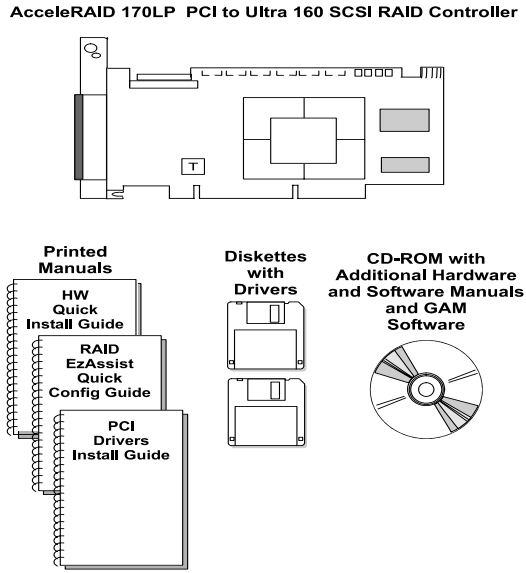


Figure 1-3. Standard Package Contents

User-supplied Items

The following user-supplied items are required to perform this installation:

- IBM-PC™ compatible host system with PCI 2.2 compliant slot
- Network operating system software (as required)
- SCSI cables to connect the controller and disk arrays (when used in a 2U chassis server, a low profile cable connector may be required)[1]
- Static grounding strap or electrostatic discharge (ESD) safe work area
- Disk array enclosure (or equivalent) with SCSI disk drives

1. It is recommended that you use an Amphenol® Fast 40 LVD, round cable and a Hitachi ® twisted pair, flat cable.

Chapter 2
Installation

This chapter describes:

- **Before You Begin**
- **Safety Considerations**
- **Installation Checklist**
- **Connectors, LEDs, Jumpers**
- **Installation Process**
- **SCSI Termination**
- **Setting SCSI Device IDs**
- **SCSI Cabling**
- **Limitations on Mixing SCSI Drives**

Mylex disk array controllers are designed to work in a variety of SCSI RAID application environments. Certain configuration steps need to be performed prior to installing the controller into a RAID environment. Each of the steps described in this chapter is part of the installation process.

Before You Begin

Installing the AcceleRAID 170LP single channel RAID controller is no more difficult than installing any 32-bit PCI adapter card. The AcceleRAID 170LP single channel controller connects into any PCI 2.2 compliant slot on the motherboard. Follow these steps and the installation procedures in this chapter.

Note

Recommended: Connect the AcceleRAID 170LP into a 32-bit PCI slot to reserve the 64-bit PCI slot for 64-bit controllers.

WARNING

Working with the system covers off and power applied to the system can result in shock and serious injury.

1. Power off the system and disconnect the power cables before starting the installation. Refer to the instructions provided in your system documentation. Do not disconnect cables or power cords while system power is on.
2. Check the size of the bracket installed on your controller. If necessary, change the bracket to match your installation needs.
3. Read all of the instructions in this chapter completely before proceeding. Follow the Notes, Cautions, and Warnings described in this manual and marked on the equipment.
4. Follow electrostatic discharge (ESD) safety procedures. Use a grounded wrist strap or ESD safe footwear, and work in an ESD safe area.
5. Make sure all SCSI conventions (cable type, cable length, termination, etc.) are followed, see Table 2-1.

Table 2-1. SCSI Formats and Bus Lengths

SCSI Trade Association (STA) Terms	Bus Speed, MB/Sec, Max.	Bus Width, Bits	Max. Bus Length, Meters		Max. Device Support (Including Controller)
			Single-ended	Low-Voltage Differential	
SCSI-1	5	8	6	-	8
Fast SCSI	10	8	3	-	8
Fast Wide SCSI	20	16	3	-	16
Ultra SCSI	20	8	1.5	-	8
Ultra SCSI	20	8	3	-	4
Wide Ultra SCSI	40	16	-	-	16*
Wide Ultra SCSI	40	16	1.5	-	8
Wide Ultra SCSI	40	16	3	-	4
Ultra2 SCSI	40	8	Not Defined	12†	8
Wide Ultra2 SCSI	80	16	Not Defined	12†	16
Ultra 160 SCSI	160	16	Not Defined	12	16

* The Maximum number of devices allowed on a Wide Ultra SCSI bus is 8, unless bus extender technology is used.

† This length can be extended to 25 meters if there are only 2 devices (e.g., the controller and one drive) on the bus in a point-to-point configuration.

Safety Considerations

Be sure to observe the following precautions before beginning the controller installation procedure:

⚠ *Caution*

Anti-static handling procedures are required. Leave the controller in its anti-static bag until it is time to plug the controller into the PCI slot. The use of a grounded wrist strap and other ESD protective measures are highly recommended.

STOP WARNING

Disconnect the system from the electrical wall outlet before opening the system cabinet. Working with the system covers off and power applied to the system can result in shock and serious injury.

Installation Checklist

GET READY

Note

It is recommended that you wear a grounded wrist strap when performing hardware installation procedures.

1. ____ Power off your computer system.
2. ____ Verify that you have the correct bracket installed on the controller.
3. ____ Remove the plate from the I/O access port to the PCI slot.
4. ____ Remove the AcceleRAID 170LP board from the anti-static bag.

GET SET

Note

Review Figure 2-1, Figure 2-2, Figure 2-3, Table 2-2, and Table 2-3 to get familiar with the layout of the AcceleRAID 170LP controller board and the Connectors, Jumpers, and LED descriptions.

5. ____ Plug the AcceleRAID 170LP board into a standard PCI slot.
6. ____ Secure the AcceleRAID 170LP board's mounting bracket with a screw or retainer.
7. ____ Connect the SCSI cable(s) from your drive(s) and/or device(s) to the SCSI channel.
8. ____ Check SCSI termination for internal and/or external devices.
9. ____ Check disk drives. Be sure termination is set to the *disabled* position on any disk drive(s) that will not be terminated. For more information, see the documentation that accompanied the disk drives.
10. ____ Set SCSI ID on the disk drive(s).
11. ____ Enable termination power on disk drive(s).
12. ____ Safety check the installation.

GO

13. ____ Go to Chapter 3, "Controller Board Start-up".

Connectors, LEDs, and Jumpers

There is one external and one internal Ultra 160 SCSI connector supported on the AcceleRAID 170LP controller shown in Figure 2-1, labeled as CH 0.

The AcceleRAID 170LP controller has four LEDs on the front side as shown in Figure 2-2 and described in Table 2-2. The LEDs indicate SE (single ended), LVD, terminator enabled, and FAIL modes.

SCSI jumpers should normally be set to their default settings, no adjustments are needed. Default jumper locations are shown in Figure 2-3 and are described in Table 2-3.

When you have checked the termination requirements, completed the connections of your desired SCSI devices, and other possible devices such as a CD-ROM drive or a tape drive, close your system with the cover.

PCI Hotplug

> ☞ **Note**
>
> Please see Appendix C for information on how to implement the Hotplug feature for your system's requirements.

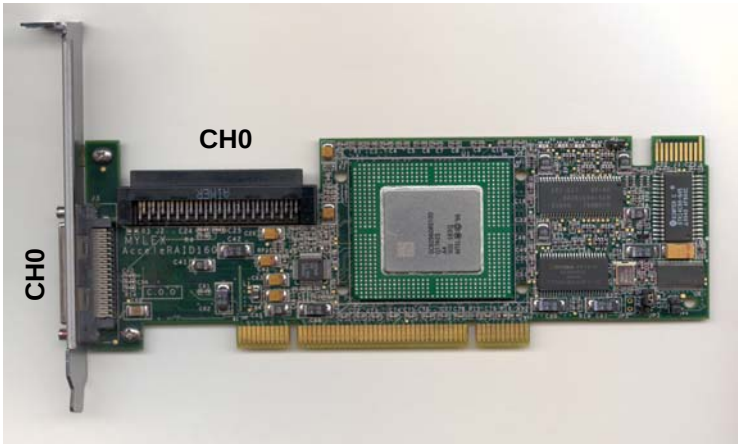


Figure 2-1. AcceleRAID 170LP Controller with Channel 0 Connectors

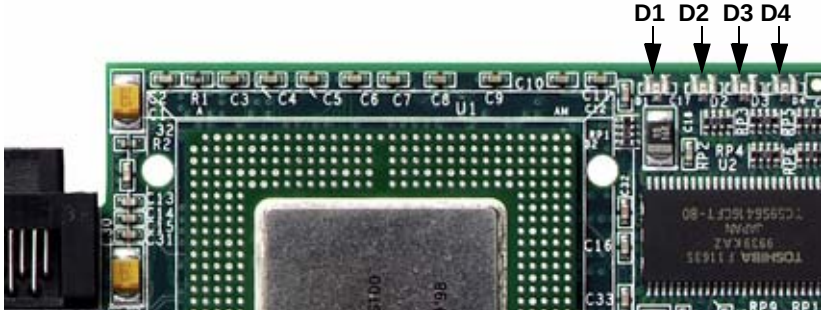


Figure 2-2. AcceleRAID 170LP LEDs

Table 2-2. LED Descriptions

D1	FAIL (Processor Self Test)
D2	TERM_LED (Terminator Enabled)
D3	SCSI_LVD Mode
D4	SCSI_SE (Single Ended) Mode

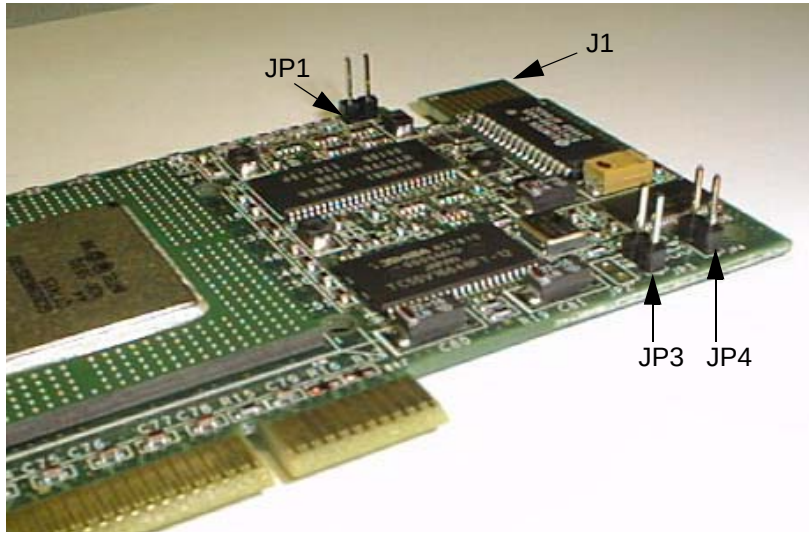


Figure 2-3. AcceleRAID 170LP Jumper Locations

Table 2-3. AcceleRAID 170LP Jumper Descriptions

JP1	SCSI Activities LED Header
JP3	Maintenance Mode
JP4	Cache Dirty (monitor cache write back) – LED Header
J1	Debug serial edge connector

Installation Process

Follow these installation steps:

1. Choose any available 32-bit or 64-bit PCI slot as shown in Figure 2-4.

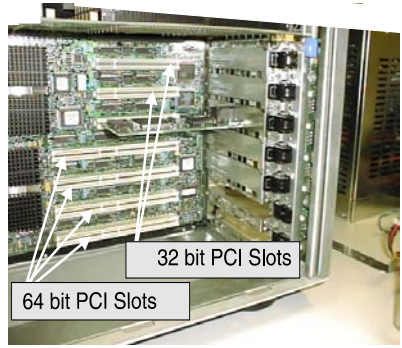


Figure 2-4. Choose an Available PCI Slot

2. Remove the metal cover plate from the slot's access port (at the back of the cabinet) usually by releasing the black clip as shown in Figure 2-5.

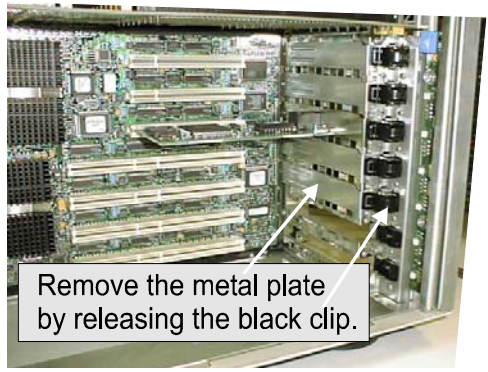


Figure 2-5. Remove the Metal Plate

⚠ *Caution*

Be sure to wear a ground wrist strap at all times.

3. Remove the AcceleRAID 170LP controller from the anti-static bag, by holding it at the edges, as shown in Figure 2-6.

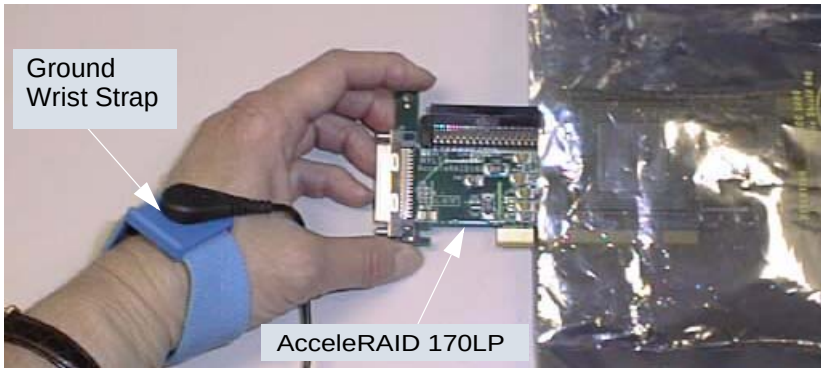


Figure 2-6. Remove the Controller from the Anti-static Bag

Installing the Controller Into a Standard Chassis

If you are using a specially designed 2U chassis, see “Installing the Controller Into a 2U Chassis” on page 2-11.

Note

If the controller has the Low Profile PCI bracket installed, replace it with the standard PCI bracket.

1. With the power off, plug (install) the AcceleRAID 170LP controller firmly into any 32-bit or 64-bit PCI slot as shown in Figure 2-7.

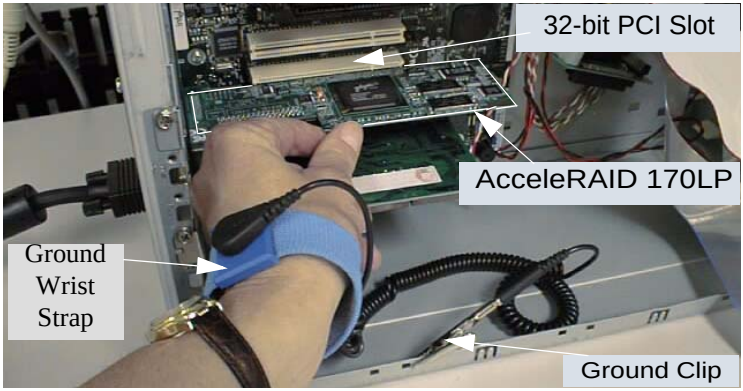


Figure 2-7. Plug the Controller Board into any 32-bit or 64-bit PCI Slot

2. Go on to “Preparing the SCSI Drives” on page 2-12.

Installing the Controller Into a 2U Chassis

Follow these installation steps: (You may need to check the manufacturer's installation instructions for your particular 2U chassis.)

> **Note**
>
> If the controller has the standard PCI bracket installed, replace it with the Low Profile PCI bracket.

1. Choose the riser adapter with an available PCI slot. In this case, it is presented on an angle (Figure 2-8).
2. With the power off, plug (install) the controller board firmly into the 32-bit PCI slot, and snap it into place (Figure 2-8).

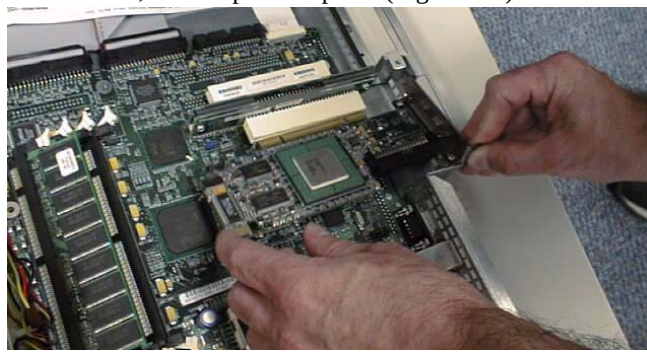


Figure 2-8. Plug the Controller into a 32-bit PCI Slot into the 2U Chassis

In the finished installation, the controller will be in a flat, horizontal position (Figure 2-9).

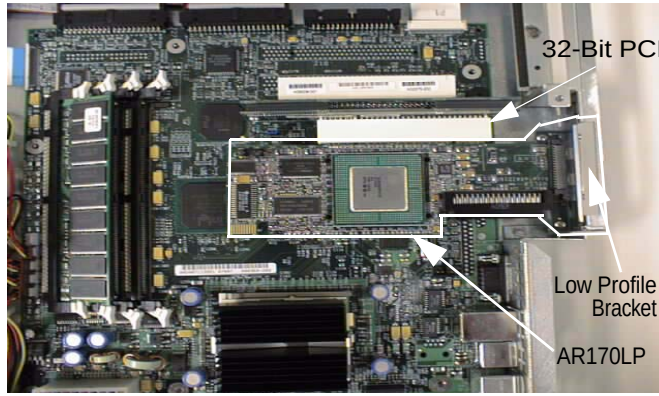


Figure 2-9. AcceleRAID 170LP Installed into a 2U Chassis

Preparing the SCSI Drives

To prepare the drives for installation, follow these steps:

1. Remove any terminators attached to the drive or set any drive termination jumpers to the *disabled* position.
2. Set the SCSI IDs on the drives, using a unique address between 0 and 15, but do not use address 7, as it is reserved for the controller. You may need to refer to the instructions that came with your disk drives.
3. Enable term power on the drives.

Refer to the drive manual for specific information about drive configuration settings.

Installing Cables and Setting Termination

Please refer to Table 2-4 on page 2-18 for SCSI Formats and Bus Length requirements.

4. There are three possible configurations to connect devices to the AcceleRAID 170LP controller:

   (a) Connect the SCSI cable from to the internal SCSI connector on the AcceleRAID 170LP controller to an internal disk drive set (Figure 2-10).

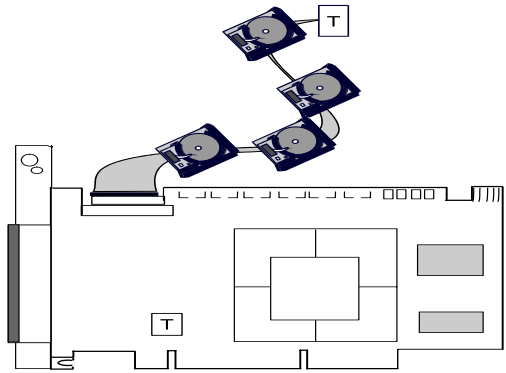


Figure 2-10. Connecting Internal Disk Drives to the AcceleRAID 170LP

(b) Connect the SCSI cable from the external SCSI connector on the AcceleRAID 170LP controller to an external drive set or external cabinet enclosure (Figure 2-11).

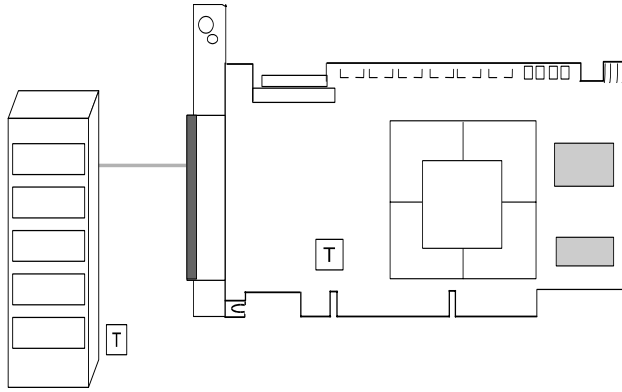


Figure 2-11. Connecting External Disk Drives to the AcceleRAID 170LP

(c) Connect internal devices as in (a), and external devices as in (b). The combined configuration is illustrated in Figure 2-12.

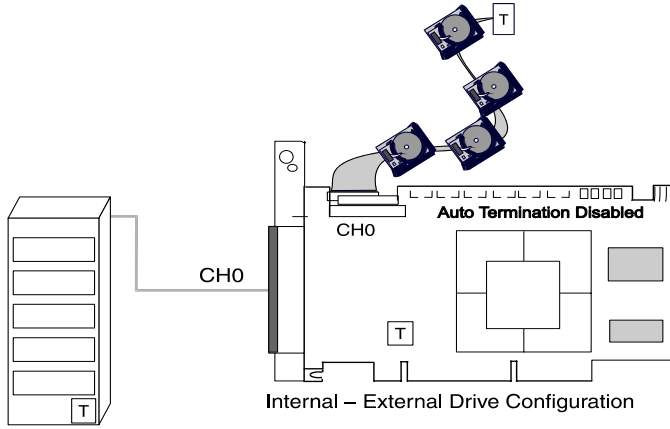


Figure 2-12. Combined Internal and External Configuration

Note

A combined configuration using both internal and external connectors works best with high quality cables. It is recommended that you use an Amphenol® Fast 40 LVD, round cable and a Hitachi® twisted pair, flat cable in this unique setup.

Note

In order to ensure an error free environment, the proper cable type designed for a certain SCSI speed must be used, please refer to Table 2-4 on page 2-18.

Note

To avoid problems caused by mixing drive types, please refer to "Limitations on Mixing SCSI Drives" on page 2-19.

SCSI Termination

Each end of a SCSI bus must be terminated to maintain proper voltage levels for SCSI control and data signals. The device used for this purpose is called a terminator. Termination devices can be built into a controller, a SCSI device, or attached to the end of a SCSI bus.

The AcceleRAID 170LP controller is equipped with automatic SCSI bus termination circuitry. If the controller is at the end of a SCSI bus, it automatically enables on-board termination. The controller can also detect whether single-ended (SE) or low-voltage differential (LVD) termination is required, and can automatically configure the appropriate termination type.

The end of the SCSI bus farthest from the controller must be terminated. See Figure 2-13 for an example of a SCSI device configuration connected to the internal SCSI channel.

Note

When connecting SCSI devices, it is better to terminate the ends of the SCSI bus itself, rather than to terminate the end devices on the bus. This allows hot swap devices to be added or removed from the SCSI bus without affecting termination.

Termination – Only Internal or Only External Devices

Check that the drive channel is properly terminated according to drawings below. Termination is indicated with a T enclosed in a square.

The AcceleRAID 170LP is equipped with automatic SCSI termination circuitry which handles automatic enabling and disabling of on-board termination. For example, if the controller board is at the end of the SCSI bus, it automatically *enables* on-board termination.

The end of the SCSI bus farthest from the controller board must have a terminator installed; the controller board automatically *enables* on-board termination. See Figure 2-13 for an example of an internal drive configuration. See Figure 2-14 for an example of an external drive configuration.

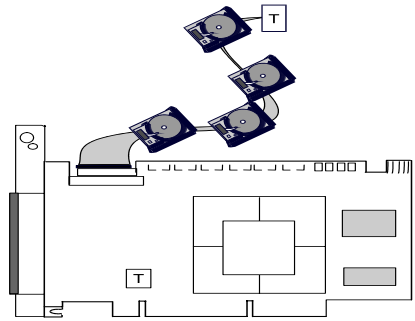


Figure 2-13. Termination with Internal Drive Configuration

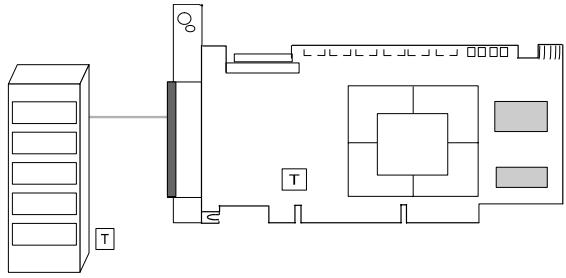


Figure 2-14. Termination with External Drive Configuration

Termination - Both Internal and External Devices

Check that the drive channel is properly terminated according to Figure 2-15. Termination is indicated with a T enclosed in a square.

If the controller board is in the middle of the SCSI bus, it automatically disables on-board termination. If some SCSI devices on the channel are connected to the internal connector, and some are connected to the external connector, the two ends of the SCSI bus farthest from the controller board must each be terminated.

See Figure 2-15 for an example of a combined internal and external termination configuration.

> **Note**
>
> It is better to terminate the ends of the SCSI bus itself than it is to terminate the end devices on the bus. This allows hot swap devices to be added or removed from the SCSI bus without affecting termination.

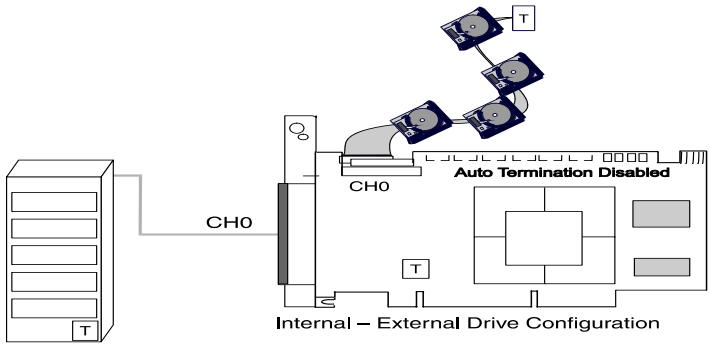


Figure 2-15. Termination with Internal and External Drive Configuration

Remove or set disk drive termination jumpers to the *disabled* position (if needed). Refer to the documentation furnished with your disk drives to determine if your termination jumpers need to be adjusted.

Setting SCSI Device IDs

5. Set the SCSI ID on the disk drives; ID 7 is reserved for the controller board (Figure 2-16).

> ☞ **Note**
>
> Each drive must have a unique ID chosen from 0 through 6 or 8 through 15. Be careful not to duplicate a drive address.
>
> **Remember:** ID 7 is reserved for the controller board; therefore, it cannot be used as a disk drive ID.
>
> ID's from 0 through 6 are usually for Narrow, 8-bit devices. However, the full range of SCSI ID addresses, 0 through 6 and 8 through 15 can be used for Wide, 16-bit devices.
>
> See your device documentation for instructions on how to set your particular disk drive's SCSI address.

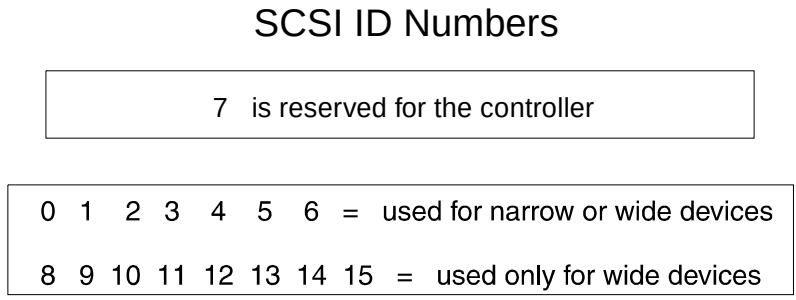


Figure 2-16. SCSI ID Numbers

SCSI Cabling

The controller supports one Ultra 160 SCSI channel which can support up to 15 SCSI devices (plus the controller itself).

LVD Mode

The controller supports Ultra 160 SCSI with LVD. If all drives attached to a controller drive channel support Ultra 160 SCSI with LVD, then that channel will operate at a maximum of 160MB/s burst speed. This setup allows a maximum SCSI bus length of up to 12 meters.

> **Note**
>
> The SCSI bus length can be extended up to 25 meters if only the controller and one drive are on the bus in a point-to-point configuration.

Single-ended Mode

If any device on the channel does *not* have LVD electrical characteristics, the channel will revert to single-ended operation mode. The SCSI bus lengths will then be limited to the single-ended bus lengths shown in Table 2-4.

Table 2-4. SCSI Formats and Bus Lengths

SCSI Trade Association (STA) Terms	Bus Speed, MB/Sec, Max.	Bus Width, Bits	Max. Bus Length, Meters		Max. Device Support (Including Controller)
			Single-ended	Low-Voltage Differential	
SCSI-1	5	8	6	-	8
Fast SCSI	10	8	3	-	8
Fast Wide SCSI	20	16	3	-	16
Ultra SCSI	20	8	1.5	-	8
Ultra SCSI	20	8	3	-	4
Wide Ultra SCSI	40	16	-	-	16*
Wide Ultra SCSI	40	16	1.5	-	8
Wide Ultra SCSI	40	16	3	-	4
Ultra2 SCSI	40	8	Not Defined	12†	8
Wide Ultra2 SCSI	80	16	Not Defined	12†	16
Ultra 160 SCSI	160	16	Not Defined	12	16

* The Maximum number of devices allowed on a Wide Ultra SCSI bus is 8, unless bus extender technology is used.

† This length can be extended to 25 meters if there are only 2 devices (e.g., the controller and one drive) on the bus in a point-to-point configuration.

Limitations on Mixing SCSI Drives

Narrow with Wide SCSI Drives

If you mix narrow and wide SCSI devices on the controller, use a converter that does not terminate the upper eight bits, and be sure to properly terminate the end of the bus with either a 16-bit terminator or a 16-bit device that has termination enabled.

LVD with Single-ended Drives

If LVD capable drives are installed on a channel with single-ended devices, all drives on the channel will operate as if they were single-ended devices. This will also limit the bus length to the single-ended bus length specified in Table 2-4.

Chapter 3
Controller Start-up

This chapter describes:

- **BIOS Options Sequence**
- **BIOS Configuration Utility (RAID EzAssist)**
- **Operating System, Device Drivers, GAM**
- **What to Check in Case of Problems**

This chapter describes the AcceleRAID 170LP RAID controller start-up procedures and messages produced by the BIOS during start-up or re-boot. This chapter also explains three BIOS options that are available for configuring controller operation.

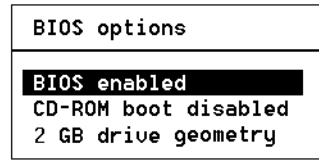
BIOS Options

After physically installing the controller and connecting the cabling, do the following if you need to set or modify a BIOS option. For more details, see "Setting BIOS Options" later in this chapter.

1. Power on the computer.
2. Watch the messages on the screen for the following prompt to be displayed:

   ```
   Press <ALT-M> for BIOS options
   ```

3. Press **Alt**–**M** to get into the *BIOS Options* menu.
4. The *BIOS Options* menu provides the following items to choose from:

5. To select any of the items in the menu, highlight the selection with the **Up Arrow** or **Down Arrow**. Press **Enter** to toggle any of the three items.

   Note

   BIOS must be enabled to toggle the CD-ROM boot option.

Setting BIOS Options

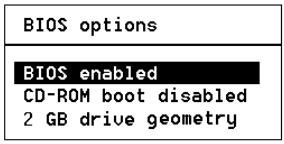
The available BIOS options are:

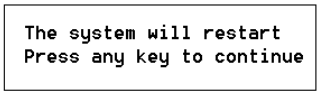
- BIOS disabled / enabled
- CD-ROM boot disabled / enabled
- 2GB / 8GB drive geometry

BIOS Disable or Enable

This option must be enabled in order to toggle the CD-ROM boot parameter shown in the BIOS Options menu. The BIOS must also be enabled in order to boot from any device (e.g., CD-ROM) or system drive configured on the controller, or to access any DOS partition on any drive configured on the controller.

When BIOS Disable or Enable is selected, the following message will be displayed.





Press the **Esc** key to restart the system and then watch the screen for the BIOS enabled and BIOS disabled messages.

CD-ROM Boot Disable or Enable

The default for this option is for the CD-ROM boot to be disabled (e.g., the system will boot from a hard drive, even if there is a bootable CD-ROM installed on the AcceleRAID 170LP). If the CD-ROM boot option is enabled, and if a bootable CD is installed in the CD-ROM drive connected to the Mylex controller, the system can boot from the CD. You will also get an option to bypass the CD-ROM boot feature.

If the CD-ROM boot option is enabled, the CD-ROM attached to the AcceleRAID 170LP will take priority over the disk drives. For example, under MS-DOS, the disk drive that is normally *Drive C* will become *Drive D*. All subsequent drive IDs will similarly be moved down.

Enable 8 GByte or 2 GByte Drives

This setting determines how the System ROM BIOS reads the Logical Drives for partitions. There is a 1024 Cylinder limitation by the System BIOS. The controller can be set to translate this into either 8 gigabytes (8 GB) or 2 gigabytes (2 GB). The default is 8 GB and will be fine for most installations.

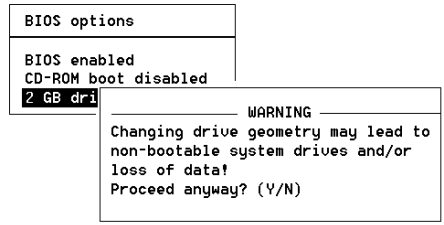
It may be more efficient to set this value to “2 GB Drives” if all of the System drives to be created will be using a FAT file system and will be equal to or less than 2 GB.

Note

Different Operating systems may not be able to use more than 2 GB in one partition. For instance, the MS-DOS file allocation table (FAT) can support only 2 GB partitions. Windows 95 OEM Service Release version 2 and later use the FAT32 file system and can support up to 4 GB. Microsoft Windows 3.51 supports FAT drives up to 4 GB. This limits the size of the boot partition in Windows NT to 4 GB. See your operating system manual for any drive size limitations.

Caution

Changing this setting after data has been stored will make the data unreadable. If you have already configured your array and have stored data, you should *not* change this setting.



Note

In the event that the RAID controller needs to be replaced, the current drive geometry will be restored

from the configuration on disk (COD).

BIOS Configuration Utility (RAID EzAssist)

RAID EzAssist is the on-board BIOS Configuration Utility used to build several types of RAID configurations. Refer to the *RAID EzAssist Configuration Utility User Reference Guide* or *RAID EzAssist Configuration Utility Quick Configuration Guide* for instructions on starting and using this utility.

Operating System

If an operating system is not already installed on the computer, it can be installed on a system disk connected to the Mylex controller. The operating system is installed along with the operating system device drivers.

Operating System Device Drivers

Device drivers that are compatible with the controller can be found in the Software Kit. For details on how to install and load drivers, refer to the *PCI Disk Array Controller Drivers Installation Guide and User Manual* available on the CD-ROM.

Global Array Manager (GAM) Server

The Global Array Manager Server software supports a variety of operating systems. For details on how to install GAM Server, refer to the *Global Array Manager Server Software Installation Guide and User Manual* available on CD-ROM.

Global Array Manager (GAM) Client

The controller can be configured using Global Array Manager Client. GAM Client can also be used from the server or a system client to monitor status and verify data integrity of disks connected to the controller while the system and disks are running.

For details on how to install and run GAM Client, refer to the *Global Array Manager Client Software Installation Guide and User Manual*.

In Case of Problems

If problems are encountered during start-up, check the following:

- Check SCSI cabling for loose connections, pin mismatches (make sure pin 1 on the cable matches pin 1 on the connector), bent pins, and damaged or crossed cables.
- Check cable length; this includes internal bus lengths in enclosures.
- Check termination.
- Check SCSI IDs on all drives.
- Check to see if any of the LED lights on the AcceleRAID 170LP controller are on.

  If the motherboard is PCI 2.2 compliant then at least one of these LED lights will be on: D1, D2, D3, D4.

Appendix A
AcceleRAID 170LP Specifications

General Hardware Specifications

AcceleRAID 170LP

Controller	**AcceleRAID 170LP**
CPU	i960RS microprocessor, 100MHz
Cache Memory	16MB ECC cache memory soldered on board (fixed)
	Write: Selectable, Write-Through or Write-Back Error Protection: ECC (Error Correction Code)
Firmware	ROM Type, Flash EEPROM, 1MB x 8
PCI	32 bit, 33MHz – Host 32 bit, 33MHz – Internal PCI
SCSI	Supports a single channel Ultra 160 SCSI LVD ISP10160A

Environmental Specifications

Controller	**AcceleRAID 170LP**	
Temperature	Operating	0°C to +50°C (+32°F to 131°F)
	Storage	-20°C to +70°C (-4°F to +158°F)
Humidity	Operating	10% to 90% relative humidity (non-condensing)
	Storage	10% to 90% relative humidity (non-condensing)
Altitude	Operating	Up to 3,048m (10,000 ft)
	Storage	Up to 15,240m (50,000 ft)
Form Factor	MD2 (Low Profile)	
	Length:	6.6 inches
	Width:	2.5 inches
	Maximum Component Height:	0.105 inches on the solder side of the board 0.570 inches on the component side of the board
Typical Power Consumption	at 5.0V	15 watts, maximum below 3A
MTBF		above 250,000 hours at 55°C

Appendix B
AcceleRAID 170LP Error Messages

Note

The firmware you are using may have these messages turned off. However, they are listed here for your reference.

Start-up Error Messages

The BIOS looks for any initialization message posted by the firmware during the start-up sequence. If a message is found, one of the following errors displays on screen and the installation process aborts.

```
AcceleRAID 160 fatal error--Memory test failed!
AcceleRAID 160 fatal error--Command interface test failed!
AcceleRAID 160 hardware error--Run Diagnostics to pinpoint
error
AcceleRAID 160 firmware checksum error--Reload firmware
```

Drive Check Error Messages

If the firmware finds a valid controller configuration, but it doesn't match the SCSI drives currently installed, one or more of the following messages display. Then, the BIOS prints out the following:

```
AcceleRAID 160 Configuration Checksum error--Run
configuration utility!
```

If the firmware detects that during the last power cycle the system was turned off abruptly leaving some incomplete write operations, the following message appears:

```
Recovery from mirror race in progress
WARNING: Dead SCSI devices (Channel Target) : x:y
```

The following messages may also appear:

```
AcceleRAID 160 cannot recover from Mirror Race!
Some system drives are inconsistent!
```

During the initialization, if the firmware fails to respond to the BIOS inquiry within two minutes, the following message displays:

```
AcceleRAID 160 not responding--no drives installed!
```

The BIOS then inquires the firmware for its version number and other information, and displays the following message:

```
AcceleRAID 160 Firmware Version x.xx
```

One or more of the following messages will be displayed if the firmware reports the following conditions:

```
Warning: X system drives offline
Warning: X system drives critical
WARNING: Dead SCSI devices (Channel : Target) : x:y
No system drives installed
X system drives installed
```

The BIOS repeats the same process for additional RAID controllers present in the system. Then it proceeds to boot, if possible, from the first system drive on the first controller.

Installation Abort

With Firmware 6.x, the installation aborted message is displayed when the BIOS finds that the configuration of the disk drives is different from what it senses at boot time. When this happens, and a new installation is not being attempted, the cause is often a faulty cable or missing drive, or a loose connection. Check all of the connectors, cables, drives, and try to boot. If the error persists, it most likely indicates a genuine failure and needs to be corrected. To correct it, boot and run the on-board BIOS Configuration Utility, RAID EzAssist (see Chapter 3). For more information, refer to the *RAID EzAssist Configuration Utility User Reference Guide* or *Quick Configuration Guide*.

With Firmware 6.x, if the BIOS displays a mismatch in the Configuration on Disk (COD) on all drives, then the following message will be displayed, “install abort”– no drives will be installed. If you get this message, boot and run RAID EzAssist, the on-board Mylex Disk Array Configuration Utility. See Chapter 3 to recover from the error. For more information, refer to the *RAID EzAssist Configuration Utility User Reference Guide* or *Quick Configuration Guide*.

System Reboot or Power Down

Status messages may also be available from LED indicators connected to the controller. The Cache Dirty indicator is especially important when preparing to power-down the system.

> ⚠ ***Caution***
>
> It is *very important* to make sure that all data is written to the disk before rebooting or powering down the system, or you may lose data. It is always a good idea to wait for 60 seconds or until all activity stops before resetting, rebooting, or powering off the system.

The AcceleRAID 170LP controller is a caching controller with 16MB (fixed) of cache memory. When the system reports that a write command was completed, data may still be in the cache waiting to be written to the disk drives.

Appendix C
PCI Hot Plug

Introduction

PCI Hot Plug is a feature that allows a PCI card to be replaced while the host system is still running. The term “Hot Plug” is somewhat misleading: the PCI card cannot simply be pulled out of the host system while the card is operating without risk to the card, the system, and the data on the system.

In order to replace a Hot Plug PCI card, a software command must be invoked to power off the card slot before the card can be removed. After the software indicates that the card is unloaded and the slot is powered off, a physical card retainer/switch must be released to allow the card to be removed from the PCI bus. At this point, the card can be replaced.

At this time, Mylex only supports Hot Replacement of PCI Hot Plug cards. Future releases are planned to support Hot Upgrade or Hot Expansion (adding a card).

Implementation

Aside from the general terms previously mentioned, PCI Hot Plug implementation is specific to the host hardware platform and the operating system running on it. Refer to your host system's documentation for specific details on how to implement PCI Hot Plug.

NetWare

When NetWare is installed on a system capable of PCI Hot Plug, the following four modules are installed:

- cpqsbd.nlm – This is the Compaq system bus driver (a different driver will be needed for a platform other than Compaq).
- ncm.nlm – This is the Novell Configuration Manager, which manages the PCI Hot Plug system.
- ncmcon.nlm – This is the Hot Plug user interface called the Novell Configuration Manager Console.

- odineb.nlm – This is a module combining the Open Data-link interface and the Novell Event Bus (NEB). The NEB controls the device drivers through the Open Data-link.

If the NetWare installation process determines that the server supports PCI Hot Plug and detects the appropriate driver, the installation process adds the following two LOAD commands to the autoexec.ncf file:

- LOAD sys:\system*driver_name*

  This command loads the bus driver (for Compaq, this is ***cpqsbd.nlm***). After this command is executed, NetWare autoloads ncm.nlm (Novel Configuration Manger).

- #LOAD sys:\system\ncmcon.nlm

  The # symbol comments out the command; however, if you want the Configuration Manager Console (ncmcon.nlm) to be loaded every time the system is started, remove the pound sign (#) at the beginning of the line.

  This command loads the Novell Configuration Manager Console, which then loads odineb.nlm. These commands can also be executed at the server console prompt.

Perform the following steps:

1. Install NetWare 5 Service Patch 1.
2. Install the Mylex GAM DMI driver.
3. Restart the server. The autoexec.ncf will execute and load the drivers and start *ncmcon.nlm* (the PCI Hot Plug user interface).

> ☞ **Note**
>
> If any LOAD line is commented out in *autoexec.ncf*, the corresponding driver can be loaded manually by executing the LOAD command (as listed in *autoexec.ncf*) at the server console prompt.

Windows NT

Windows NT requires additional software from the vendor who makes the system. Since this software is not a part of NT, the software needs to be installed after the operating system is loaded. Refer to your vendor's PCI Hot Plug documentation.

> ⚠ ***Caution***
>
> GAM drivers can stop PCI Hot Plug Boards from unloading. If this problem occurs, stop GAM and unload the GAM drivers before attempting to unload the PCI Hot Plug controller.

Known Windows NT Issues

- The *macdisk.sys* driver should not be loaded with a Mylex PCI Hot Plug board; if *macdisk.sys* is loaded, the system will hang upon shutdown.
- When you install a Mylex controller as a boot device and a Mylex driver has been installed prior to the installation of the Windows NT OS, Windows NT will not recognize the Mylex controller as a PCI Hot Plug device. To fix this, the driver must be reinstalled and the system rebooted.

  This problem occurs because PCI Hot Plug information does not get loaded into the Windows NT registry for the Mylex controller upon installation of Windows NT.

Windows 2000

Windows 2000 supports the PCI Hot Plug capability. No additional software is required.

Please refer to the Windows 2000 documentation for instructions on how to use the PCI Hot Plug feature.

Windows XP and .NET 32-bit

The released version of Windows XP and .NET 32-bit is intended to support the PCI Hot Plug capability. No additional software is required.

Please refer to the Windows XP or .NET 32-bit documentation for

instructions on how to use the PCI Hot Plug feature.

Appendix D
Enclosure Management

Introduction

Mylex's AcceleRAID controllers support the industry standard enclosure management protocol SCSI Accessed Fault-Tolerant Enclosures (SAF-TE). This feature allows the host to monitor drive enclosures and detect certain faults or operating environment conditions. The host can make a decision to shut down the system or issue a warning based on the type of fault detected. The AcceleRAID 170LP also supports SES (SCSI Enclosure System) cabinets.

SAF-TE

The SAF-TE protocol follows a specification jointly worked out by Conner Corporation and Intel Corporation. Enclosures that are compliant with this protocol are known as SCSI Accessed Fault-Tolerant Enclosures (SAF-TE). The protocol is compatible with standard SCSI buses and cabling.

The SAF-TE interface standard's objective is to provide a non-proprietary means of allowing third-party disks and controllers to be automatically integrated with peripheral enclosures that support:

- Status Signals (LEDs, audible alarms, LCDs, etc.)
- Hot swapping of drives
- Monitoring of fans, power supplies, and enclosure temperature

SCSI is the underlying transport mechanism for communicating enclosure information. All standard SCSI host adapters will work. There is no need to consider reserved signals or special cabling.

The SAF-TE interface can be implemented as a SCSI target that uses a SCSI port and an 8-bit microcontroller.

All communication is initiated by the host. The SAF-TE processor acts only in target mode. The SAF-TE processor is periodically polled by the host approximately every 2 to 10 seconds.

SES

The AcceleRAID 170LP supports SES (SCSI Enclosure System) cabinets. Please refer to the documentation supplied with your SES enclosure cabinet for details on how to take advantage of this feature.

Glossary

AcceleRAID™

The AcceleRAID family features high performance, cost effective SCSI to PCI RAID controllers and adapters for high-end desktops, workstations, entry-level and mid-range servers, and high-density ISP servers.

Active/Active

A synonym for *Dual Active* controllers. Under normal operating conditions, both controllers in a dual active controller configuration are actively processing I/O.

Active/Passive

A synonym for *Hot Standby.*

Active Termination

A type of terminator used in current SCSI channel setups, which utilizes an active voltage regulator, thus closely matching cable impedance. See also *In-Line Terminator.*

ANSI

American National Standards Institute, a standards organization that promotes and facilitates understanding among qualified members for the implementation of agreed upon code and signaling standards and conformity. ANSI represents the United States in the ISO (International Standards Organization).

Application Server

A centralized computer that holds and distributes application programs to users.

ASIC

Application-Specific Integrated Circuit, a chip created for a specific application.

Auto Swap

The exchange of a pre-installed replacement unit in a disk system for a defective one; the disk system performs the substitution without human intervention while continuing to carry out its normal functions (compare with *Hot Swap*).

Automatic Rebuild

Mylex controllers provide automatic rebuild capabilities in the event of a physical disk drive failure. The controller performs a rebuild operation automatically when a disk drive fails and both of the following conditions are true:

A standby or hot spare disk drive of identical or larger size is found attached to the same controller;

All system drives that are dependent on the failed disk drive are configured as a redundant array: RAID 1, RAID 3, RAID 5, or RAID 0+1.

During the automatic rebuild process, system activity continues; however, system performance may degrade slightly.

BBU

Battery Backup Unit, provides a battery backup for data currently stored in the on-board cache memory during intermittent power loss to the controller. In the event of a power failure, the BBU can hold data in the cache for a certain amount of time. Once power is restored the data can be saved to a disk.

Benchmarks

A set of conditions or criteria against which a product or system is measured. Computer trade magazine laboratories frequently test and compare several new computers or computer devices against the same set of application programs, user interactions, and contextual situations. The total context

against which all products are measured and compared is referred to as the benchmark. Programs can be specially designed to provide measurements for a particular operating system or application.

Berkeley RAID Levels

A family of disk array protection and mapping techniques described by Garth Gibson, Randy Katz, and David Patterson in papers written while they were performing research into I/O systems at the University of California at Berkeley. There are six Berkeley RAID levels, usually referred to as RAID Level 0 through RAID Level 5. See also *RAID Levels.*

Bridge RAID Controller

A device appearing as a single ID in a *Storage Area Network (SAN)*, but which bridges to multiple devices, typically used to control external RAID subsystems (compare to Internal PCI-based RAID subsystems, see *Internal RAID Controller*). A bridge RAID controller is often referred to as an *External RAID Controller.*

Bus

A set of conductors that connect the functional units in a computer and are the channels through which data is transferred. There are several types of bus channels, including serial, parallel, PCI, ISA, EISA, and MCA. See also *I/O Bus*.

Cables

The physical wires (copper or fibre optic) over which electrical signals are transmitted. Cables are used to connect peripherals (such as disk arrays) to computers and servers or to connect peripherals or components (such as tape drives or CD-ROMs) to each other.

Cache

A temporary storage area for frequently accessed or recently accessed data. Cache is used to speed up data transfer to and from a disk. See also *Caching.*

Caching

Allows data to be stored in a pre-designated area of a disk or RAM. Caching speeds up the operation of RAID systems, disk drives, computers and servers, or other peripheral devices. See also *Cache*.

CD-ROM

Compact Disk-Read Only Memory, a removable read-only storage device, similar to an audio compact laser disk, holding up to 640MB of data.

Channel

Any path used for the transfer of data and control of information between storage devices and a storage controller or I/O adapter. Also refers to one SCSI bus on a disk array controller. Each disk array controller provides at least one channel.

Cluster

A group of terminals or workstations attached to a common control unit or server, or a group of several servers, that share work and may be able to back each other up if one server fails.

CMOS

Complementary Metal Oxide Semiconductor, a chip that packs many components onto a very small semiconductor.

Cold Swap

The physical exchange of a replacement unit in a storage system for a defective one. The exchange requires human intervention and power must be removed from the storage system in order to perform the exchange (compare to *Warm Swap*, *Hot Swap*, and *Auto Swap*).

Controller

An adapter card, RAID controller, or other module that interprets and controls signals between a host and a peripheral device.

CPU

Central Processing Unit, the circuitry that performs the basic instructions that drive the computer.

Critical State

A *Logical Drive* is in a “critical” state if it has been configured at RAID level 1, 3, 5, or 0+1, and one (and only one) of its SCSI drives is not “online.” A logical drive is considered “critical” because any failure of another of its SCSI drives may result in a loss of data.

Note: I/O operation can only be performed with system drives that are online or critical.

Cylinder

The tracks of a disk storage device that can be accessed without repositioning the access mechanism.

DAC960 Series

Disk Array Controller 960 Series, a family of RAID controllers from Mylex Corporation. The DAC960 series includes both internal PCI-based RAID controllers and external RAID controllers. The DAC960 series controllers use Intel’s® i960 microprocessor.

DB-9

A type of connector used for serial interfaces.

Dedicated Hot Spare

A disk drive configured to replace a failed drive in a single or spanned disk array. Compare with *Global Hot Spare* and *Hot Spare*.

Degraded Mode

A RAID mode used when a component drive has failed.

Desktop PC

Standard processor based personal computer used as an individual station (not as a server).

Device Driver

A software program that controls a particular type of device attached to a computer, such as a RAID subsystem, printer, display, CD-ROM, disk drive, etc.

Differential

A protocol that transmits through a current loop rather than by changes in voltage, reducing susceptibility to electrical interference.

DIMM

Dual In-line Memory Module, a circuit board that has memory chips. Instead of installing two SIMMs for the 64-bit memory path on a Pentium® processor, one DIMM can be installed. See also *SIMM*.

Disk

A non-volatile, randomly addressable, re-writable data storage device, including rotating magnetic and optical disks as well as solid-state disks or other electronic storage elements.

Disk Array

A collection of disks from one or more commonly accessible disk systems configured to behave as a single, independent disk drive. Disk arrays, also known as RAID, allow disk drives to be used together to improve fault tolerance, performance, or both. Disk arrays are commonly used on servers and are becoming more popular on desktops and workstations.

Disk Drive

A device for the electronic digital storage of information.

Disk Failure Detection

A RAID controller automatically detects SCSI disk failures. A monitoring process running on the controller checks, among other things, elapsed time on all commands issued to disks. A time-out causes the disk to be “reset” and the command to be retried. If the command times out again, the controller could take the disk “offline.” Mylex DAC960 controllers also monitor SCSI bus parity errors and other potential problems. Any disk with too many errors will also be taken “offline.” See also *Offline*.

Disk System

A storage system capable of supporting only disks.

Disk Traveling, Drive Traveling

A process that occurs when the drives are placed in a different order than the original order. Disk traveling can occur whether or not a drive has failed.

Drive Groups, Drive Packs

A group of individual disk drives (preferably identical) that are logically tied to each other and are addressed as a single unit. In some cases this may be called a drive “pack” when referring to just the physical devices.

All the physical devices in a drive group should have the same size; otherwise, each of the disks in the group will effectively have the capacity of the smallest member. The total size of the drive group will be the size of the smallest disk in the group multiplied by the number of disks in the group. For example, if you have 4 disks of 400MB each and 1 disk of 200MB in a pack, the effective capacity available for use is only 1000MB (5x200), not 1800MB.

Dual Active

A pair of components, such as storage controllers in a failure tolerant storage system, that share a task or set of tasks when both are functioning normally. When one component of the pair fails, the other takes the entire load. Dual active controllers (also called *Active/Active* controllers) are connected to the same set of devices and provide a combination of higher I/O performance and greater failure tolerance than a single controller.

EDO

Extended Data Output, a type of random access memory (RAM) chip designed to improve the time to read from memory on faster microprocessors such as the Intel® Pentium®.

EISA

Extended Industry Standard Architecture, a bus standard for PCs extending the *ISA* architecture to 32 bits and allowing more than one CPU to share the bus.

Embedded Storage Controller

An intelligent storage controller that mounts in a host computer's housing and attaches directly to a host's memory bus with no intervening I/O adapter or I/O bus.

Ethernet

An Ethernet local area network (*LAN*) typically uses coaxial cable or special grades of twisted pair wires, and is the most widely installed local area network technology. The most commonly installed Ethernet systems are called 10BASE-T and provide transmission speeds up to 10 Mbps. See also *Fast Ethernet*.
10Base T: Supports Ethernet's 10 Mbps transmission speed. The most widely installed Ethernet local area networks (*LAN*s) use ordinary telephone twisted-pair wire. When used on Ethernet, this carrier medium is known as 10BASE-T. In addition to 10BASE-T, 10 megabit Ethernet can be implemented with these media types:

- 10BASE-2 (thinwire coaxial cable with a maximum segment length of 185 meters)
- 10BASE-5 (thickwire coaxial cable with a maximum segment length of 500 meters)
- 10BASE-F (fiber optic cable)

The "10" in the media type designation refers to the transmission speed of 10 Mbps. The "BASE" refers to baseband signaling, which means that only Ethernet signals are carried on the medium. The "T" represents twisted-pair;

the “2” and “5” refer to the coaxial cable segment length (the 185 meter length has been rounded up to “2” for 200); the “F” represents fiber optic cable.

External RAID Controller

A RAID controller in its own enclosure, rather than incorporated into a PC or server. External RAID controllers are often referred to as a *Bridge RAID Controller*. Mylex SANArray FL, FF, FFx, and Pro FF2 controllers are external RAID controllers. Compare with *Internal RAID Controller.*

Extranet

A private network that uses *Internet* protocols and the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses. An extranet can be viewed as part of a company's *Intranet* that is extended to users outside the company.

eXtremeRAID™

A family of Mylex RAID controllers which offer uncompromising fault tolerance, data availability, superior configuration, and management flexibility. The eXtremeRAID controllers use driver technology, which has won tpm-C benchmarks worldwide. With this technology, eXtremeRAID controllers provide the highest performance and most flexible RAID solution available today.

Failback

Restoring a failed system component’s share of a load to a replacement component.

Failover

A mode of operation for failure tolerant systems in which a component has failed and a redundant component has assumed its functions.

Failover Port

A fibre channel port capable of assuming I/O requests for another, failed port on the loop. During normal operation, a failover port may be active or inactive. Failover ports assume the same loop ID and, optionally, the same node from the failed port.

Failure

A detectable physical change in hardware, requiring replacement of the component.

Fast Ethernet

A local area network (*LAN*) transmission standard that provides a data rate of 100 megabits per second (referred to as *100BASE-T*). See also *Ethernet*. *100Base T*: In 100 Mbps (megabits per second) Ethernet (known as Fast Ethernet), three types of physical wiring can carry signals:

- 100BASE-T4 (four pairs of telephone twisted pair wire)
- 100BASE-TX (two pairs of data grade twisted-pair wire)
- 100BASE-FX (a two-strand fiber optic cable)

This designation is an IEEE shorthand identifier. The “100” in the media type designation refers to the transmission speed of 100 Mbps. The “BASE” refers to baseband signaling, which means that only Ethernet signals are carried on the medium. The “T4,” “TX,” and “FX” refer to the physical medium that carries the signal. (Through repeaters, media segments of different physical types can be used in the same system.)

Fast SCSI

Devices that increases the speed at which data is transferred as opposed to the volume of data. These devices using data rates up to 10 MHz. Compare with *Fast/Wide SCSI*, *Ultra SCSI (Fast 20 SCSI)*, *Ultra2 SCSI (Fast 40 SCSI)*, *Ultra160 SCSI (Ultra3 SCSI)*, and *Wide SCSI*.

Fast/Wide SCSI

SCSI devices using data rates up to 20 MHz. Compare with Fast SCSI, Ultra SCSI (Fast 20 SCSI), Ultra2 SCSI (Fast 40 SCSI), Ultra160 SCSI (Ultra3 SCSI), and Wide SCSI.

Fibre Channel

Technology for transmitting data between computer devices at a data rate of up to 2 Gbps (two billion bits per second), especially suited for connecting computer servers to shared storage devices and for interconnecting storage controllers and drives.

Fibre Channel is expected to replace the Small System Computer Interface (*SCSI*) as the transmission interface between servers and clustered storage devices. It is also more flexible: devices can be as far as ten kilometers (about six miles) apart. The longer distance requires optical fiber as the physical medium; however, fibre channels also work using coaxial cable and ordinary telephone twisted pair wires.

File Server

A computer shared by users over a Local Area Network (*LAN*) which provides user access to files on the LAN. Other types of servers perform application services (for example, mail servers, web servers) rather than just store files.

FlashPoint™

A family of Mylex SCSI host bus adapters.

Gigabit

10^9 (1,000,000,000) bits. Abbreviated as Gb.

Gigabyte

2^{30} (1,073,741,824) bytes. Abbreviated as G or GB.

Global Hot Spare

An extra, physical disk drive placed in an array and used to replace a failed drive in any disk array. A global spare automatically takes the place of a failed drive. See also *Auto Swap*, *Dedicated Hot Spare*, and *Hot Spare*.

Hard Disk

A magnetically coated disk substrate that spins inside a disk drive and is used as the storage medium for digital data.

Hard Disk Drive (HDD)

The main data storage unit of a computer.

HDM

Hardware Driver Module, a driver set required for SCSI adapters for use in an I_2O environment.

Host

Any computer system to which disks are attached and accessible for data storage and I/O.

Host Bus Adapter (HBA)

An I/O adapter that connects a host I/O bus to the host's storage memory system.

Host I/O Bus

An I/O bus used to connect a host computer to storage systems or storage devices.

Hot Plug

The process of adding or removing a device from a bus while transactions involving other devices are occurring over the bus. See also *PCI Hot Plug*.

Hot Replacement of Disks

The design of all Mylex controllers allows for the replacement of failed hard disk drives without interruption of system service. In the event of a SCSI drive failure on a properly configured system (where the data redundancy features of the controller are used), the system generates a message to alert the system operator.

When a replacement drive becomes available, the system operator can remove the failed disk drive, install a new disk drive, and instruct the controller to "rebuild" the data on the new drive, all without interrupting system operations. Once the rebuild is complete, the controller will be brought back into a fault tolerant state. See also *Hot Swap*.

Hot Spare

A physical disk drive not part of a system drive that the controller can use to automatically rebuild a critical system drive. The hot spare drive must have at least as much capacity as the largest disk drive in the array or the rebuild may not start. See also *Hot Standby* and *Standby Replacement of Disks*.

Hot Standby

A redundant component in a fault tolerant storage system that has power applied and is ready to operate, but which does not perform its task as long as the primary component for which it is standing by is functioning properly. See also *Hot Replacement of Disks* and *Hot Spare*.

Hot Swap

The exchange of a replacement unit in a storage system for a defective unit. The exchange requires human intervention, but the system can continue to perform its normal functions (compare with *Auto Swap*, *Cold Swap*, and *Warm Swap*). See also *Hot Replacement of Disks*.

In-Line Terminator

A plug attached to the end of a SCSI cable in order to initiate active termination. Used when SCSI devices on the cable do not have built-in termination. See also *Active Termination*.

Interface

A hardware or software protocol that manages the exchange of data between the hard disk drive and the computer. The most common interfaces for small computer systems are ATA (advanced technology attachment), also known as IDE (integrated drive electronics), and SCSI.

Internal RAID Controller

A controller circuit board that resides inside a computer or server. An internal RAID controller resides on a bus, such as the PCI bus. Examples the Mylex AcceleRAID and eXtremeRAID families.

Internet

A worldwide system of computers that is a public, cooperative, and self-sustaining facility accessible to tens of millions of users worldwide.

Intranet

A network contained within an enterprise, the main purpose of which is usually to share company information and computing resources among employees. An intranet can also be used to facilitate working in groups and for teleconferences.

I/O

Input/Output, the transmission of information between an external source and the computer.

I/O Bottleneck

Any resource in the I/O path whose performance limits the performance of a storage or I/O system.

I/O Bus

Any path used for the transfer of data and control information between I/O adapters and storage controllers or storage devices. See also *Bus*.

I_2O

Intelligent Input/Output, a driver that uses special I/O processes to eliminate I/O bottlenecks. The processes deal with interrupt handling, buffering, and data transfer. An I_2O driver also includes an OS-specific module (OSM), which handles higher-level OS details, and a hardware device module (*HDM*), which knows how to communicate with certain devices.

ISA

Industry Standard Architecture, a standard bus (computer interconnection) architecture associated with the IBM® AT® motherboard. It allows 16 bits at a time to flow between the motherboard circuitry and an expansion slot card and its associated device(s).

JBOD

Just A Bunch of Disks (Drives), a number of disk drives, usually in an enclosure. JBOD implies that the disks do not use RAID technology and function independently. All Mylex RAID controllers support JBOD mode. See also *RAID Levels*.

Jumper

A short piece of electrical conductor encased in plastic used to connect pins on a device to provide settings that the user can change. The settings remain constant during operation. For example, jumpers often set SCSI ID, termination, and IDE master/slave settings.

Kilobyte

2^{10} (1,024). Abbreviated as K or KB.

LAN

Local Area Network, a network of interconnected workstations sharing the resources of a single processor or server, typically within the area of a small office building.

Logical Drive

The logical devices presented to the operating system. System drives are presented as available disk drives, each with a capacity specified by the Mylex RAID controller.

Logical Drive States

A logical (system) drive can be *Online*, *Critical*, or *Offline*. Notice that the term “online” is used for both physical and logical drives. See also *Storage Device*.

LUN

Logical Unit Number, a SCSI representation of a system drive on a given channel and target ID. This may be a single device or an array of devices configured to behave as a single device.

LVD

Low Voltage Differential, a form of SCSI signaling introduced with *Ultra2 SCSI (Fast 40 SCSI)*. LVD uses data high and data low signal lines to increase transmission distances over those of single-ended (conventional SCSI signaling) lines. LVD allows for cable lengths of up to 12 meters (approximately 39 feet) with up to 15 drives. LVD also lowers noise, power usage, and amplitude.

LVD differs from conventional differential signaling in that only positive and negative values are distinguished, not voltage levels. Other advantages are that LVD devices consume less power and can sense single-ended devices on the bus and revert to single-ended signaling. Devices need to be Ultra2 SCSI LVD drives in order to take advantage of the LVD signaling. Mylex AcceleRAID, eXtremeRAID, and DAC FL controllers are LVD controllers.

Megabit

A million bits; used as a common unit of measure, relative to time in seconds, as an expression of a transmission technology's bandwidth or data transfer rates (abbreviated as Mb). Megabits per second (Mbps) is a frequent measure of bandwidth on a transmission medium.

Megabyte

2^{20} (1,048,576) bytes. One megabyte can store more than one million characters. Abbreviated as M or MB.

Mirrored Cache

A cache memory that has duplicate data from another controller. In the event of failure of the original controller, the second controller can take the cached data and place it on the disk array.

Mirrored Hard Drive

Two hard drives the computer sees as one unit. Information is stored simultaneously on each drive. If one hard disk drive fails, the other contains all of the cached data and the system can continue operating.

Mirroring

The complete duplication of data on one disk drive to another disk drive, this duplication occurs simultaneously with each write operation: each disk will be the mirror image of the other (also known as RAID Level 1, see *RAID Levels*). All Mylex RAID controllers support mirroring.

M.O.R.E.™

Mylex Online RAID Expansion, an advanced configuration mode that allows expansion of any unconfigured or hot spare drive into the expandable drive group while the controller is online with the host. For example, a system using a five-disk-drive RAID set can add another disk drive to create a six-disk-drive RAID set. The M.O.R.E. operation can be performed on all RAID levels except JBOD.

Mylex's Global Array Manager (GAM) supports two M.O.R.E. features:

- Expand Capacity allows logical drive expansion for FFx external controllers only.
- Expand Array allows array expansion for both PCI and FFx external controllers.

During the RAID set expansion process, which includes re-striping data from the old (smaller) RAID set to the new (expanded) RAID set, the controller continues to service host I/O requests.

MTBF

Mean Time Between Failures, the average time from start of use to failure in a large population of identical systems, computers, or devices.

MTDL

Mean Time until Data Loss, the average time from startup until a component failure causes a permanent loss of user data in a large population of disk arrays.

Narrow SCSI

8-bit wide standard SCSI. Compare with Fast SCSI, Fast/Wide SCSI, Ultra SCSI (Fast 20 SCSI), Ultra Wide SCSI, Ultra2 SCSI (Fast 40 SCSI), Ultra160 SCSI (Ultra3 SCSI), and Wide SCSI.

NOS

Network Operating System, an operating system that has special features for connecting computers and peripheral devices into a *LAN*.

NVRAM

Non-Volatile Random Access Memory, a memory unit equipped with a battery so that the data stays intact even after the main power had been switched off.

Offline

A *Logical Drive* is in an “offline” state if no data can be read from it or written to it. Offline does not apply to physical disk drives. System commands issued to offline logical drives are returned with an error status; no operations can be performed on offline logical drives. See also *Logical Drive States*, *Critical State*, and *Online*.

Online

A *Logical Drive* is in an “online” state if all of its participating SCSI drives have power and are operational. See also *Logical Drive States*, *Critical State*, and *Offline*.

Partitioning

Where the full usable storage capacity of a disk or array of disks appears to an operating environment in the form of several virtual disks whose entire capacity approximates that of the underlying disk or array.

PCB

Printed Circuit Board, also called cards or adapters, a thin plate consisting of chips and other electronic components.

PCI

Peripheral Component Interconnect, a standardized architecture that provides a high-speed data path between peripherals and the CPU. PCI is a high-performance, backplane interface, expansion slot architecture found on PC, Macintosh, and UNIX workstations. PCI cards are portable across hardware platforms with the help of various software drivers.

PCI Hot Plug

A feature that allows for the printed circuit board (*PCB*) to be replaced without powering down the entire system—an essential feature in newer PCI-based PCs. Mylex DAC960PG, DAC960PJ, AcceleRAID, and eXtremeRAID products are all PCI Hot Plug compatible. See also *Hot Plug*.

Peripheral

Any computer device that is not part of the essential computer, but is situated relatively close by.

Physical Device

Any device connected to some kind of hardware. For example, SCSI disk, fibre disk, network disk, RAM disk, etc.

Physical Disk Drive

A single hard disk drive. Each physical disk drive is assigned a unique identification address.

Platform

An underlying computer system on which application programs can run. A platform consists of an operating system, the computer system's coordinating program, and a microprocessor, the microchip in the computer that performs logic operations and manages data movement in the computer.

Plug and Play

The ability to install peripheral cards or other devices without requiring manual configuration by the user.

RAID

Redundant Array of Independent Disks, a collection of two or more disks working together in an array. Mylex RAID controllers implement this technology to connect up to 15 SCSI devices per channel. The different forms of RAID implementation are known as “RAID levels.” See also *Berkeley RAID Levels*, *Disk Array,* and *RAID Levels*.

The system manager or integrator selects the appropriate RAID level for a system. This decision will be based on which of the following are to be emphasized:

- Disk Capacity
- Data Availability (redundancy or fault tolerance)
- Disk Performance

RAID Adapters

See *RAID Controller*

RAID Advisory Board (RAB)

An association of companies whose primary intention is to standardize RAID storage systems. Mylex is a member of RAB.

RAID Controller

Low cost RAID controllers that use SCSI channels on the motherboard.

RAID Levels

Mylex disk array controllers support four RAID Advisory Board approved (RAID 0, RAID 1, RAID 3, and RAID 5), two special (RAID 0+1, and JBOD), and three spanned (RAID 10, 30, and 50) RAID levels. All DAC960, AcceleRAID, and eXtremeRAID series controllers support these RAID levels. See also *Berkeley RAID Levels*.

Level 0: Provides block "striping" across multiple drives, yielding higher performance than is possible with individual drives. This level does not provide any redundancy.

Level 1: Drives are paired and mirrored. All data is 100 percent duplicated on a drive of equivalent size.

Level 3: Data is "striped" across several physical drives. Maintains parity information which can be used for data recovery.

Level 5: Data is "striped" across several physical drives. For data redundancy, drives are encoded with rotated XOR redundancy.

Level 0+1: Combines RAID 0 striping and RAID 1 mirroring. This level provides redundancy through mirroring.

JBOD: Sometimes referred to as "Just a Bunch of Drives." Each drive is operated independently like a normal disk controller, or drives may be spanned and seen as a single drive. This level does not provide data redundancy.

Level 10: Combines RAID 0 striping and RAID 1 mirroring spanned across multiple drive groups (super drive group). This level provides redundancy through mirroring and better performance than Level 1 alone.

Level 30: Data is "striped" across multiple drive groups (super drive group). Maintains parity information, which can be used for data recovery.

Level 50: Data is "striped" across multiple drive groups (super drive group). For data redundancy, drives are encoded with rotated XOR redundancy.

Note: The host operating system drivers and software utilities remain unchanged regardless of the level of RAID installed. The controller makes the physical configuration and RAID level implementation.

RAID Migration

A feature in RAID subsystems that allows for changing a RAID level to another level without powering down the system.

Rebuild

The process of reconstructing data from a failed disk using data from other drives.

Redundancy

The inclusion of extra components of a given type in a system (beyond those the system requires to carry out its functions).

Replacement Table

A table that contains information regarding which SCSI devices have been replaced by others through standby replacement.

RISC

Reduced Instruction Set Computing, architecture for an application-specific processor.

RJ-11, RJ-45

Registered Jacks (sometimes described as RJ-XX), a series of telephone connection interfaces (receptacle and plug) that are registered with the U.S. Federal Communications Commission (FCC). The most common telephone jack is the RJ-11 jack, which can have six conductors but is usually implemented with four. The RJ-11 jack is likely to be the jack that your household or office phones are plugged into from the ordinary “untwisted” wire (sometimes called “gray satin” or “flat wire”) that people are most familiar with. The RJ-45 is a single-line jack for digital transmission over ordinary phone wire, either untwisted or twisted; the interface has eight pins or positions.

Rotated XOR Redundancy

XOR refers to the Boolean “Exclusive-OR” operator. Also known as *Parity*, a method of providing complete data redundancy while requiring only a fraction of the storage capacity of mirroring. In a system configured under RAID 3 or RAID 5 (which require at least three SCSI drives), all data and parity blocks are divided amongst the drives in such a way that if any single drive is removed (or fails), the data on it can be reconstructed using the data on the remaining drives. In any RAID 3 or RAID 5 array, the capacity allocated to redundancy is the equivalent of one drive.

RS-232C

Recommended Standard-232 revision C, a long-established standard that describes the physical interface and protocol for relatively low-speed serial data communication between computers and related devices. RS-232C is the interface that a computer uses to talk to and exchange data with your modem and other serial devices. It is an asynchronous 9 or 25-pin connector.

RS 422/423

Recommended Standard 422/423, a 32-pin serial connector that can be used for either synchronous or asynchronous transmission of data. The 422 is a differential line; the 423 is a single line.

RTC

Real-Time Clock, a clock that keeps track of the time with its own power supply.

SAF-TE

SCSI Accessed Fault-Tolerant Enclosure, an “open” specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, and cooling systems used in high availability *LAN* servers and storage subsystems. The specification is independent of hardware I/O cabling, operating systems, server platforms, and RAID implementation because the enclosure itself is treated as simply another device on the SCSI bus. Many other leading server, storage, and RAID controller manufacturers worldwide

have endorsed the SAF-TE specification. Products compliant with the SAF-TE specification will reduce the cost of managing storage enclosures, making it easier for a LAN administrator to obtain base-level fault-tolerant alert notification and status information. All Mylex RAID controllers feature SAF-TE.

SAN

See Storage Area Network

SCA

Single Connector Attachment, a type of interface designed to provide a standard connection, such as connection pins for power cables and data wires, for systems using hot swappable drives. It includes data channel, power, and ID configuration all in one connector. SCA drives connect to a SCSI backplane that provides power and configuration settings, such as SCSI IDE (integrated drive electronics), and termination of the SCSI bus.

SCSI

Small Computer System Interface, a technological standard that defines connections between computers and peripheral devices.

SCSI Adapters

Storage controllers for managing SCSI devices.

SCSI Drive

A disk drive equipped with a SCSI interface (sometimes referred to as a SCSI Disk). Each disk drive will be assigned a SCSI address (or SCSI ID), which is a number from 0 to 7 (0 to 15 under wide or Ultra SCSI). The SCSI address uniquely identifies the drive on the SCSI bus or channel.

SCSI Drive States

Refers to a SCSI drive's current operational status. At any given time, a SCSI drive can be in one of five states: *Ready, Online, Standby, Dead,* or *Rebuild*.

The controller stores the state of the attached SCSI drives in its non-volatile

memory. This information is retained even after power-off. Hence, if a SCSI disk is labeled “dead” in one session, it will stay in the “dead” state until a change is made either by using a system level utility or after a rebuild. Each state is described below.

Ready: A SCSI disk drive is in a “ready” state if it is powered on and is available to be configured during the current session but remains unconfigured.

Online: A SCSI disk drive is in an “online” state if is powered on, has been defined as a member of a drive group, and is operating properly.

Standby: A SCSI disk drive is in a “standby” state if it is powered on, is able to operate properly, and was NOT defined as part of any drive group.

Dead: A SCSI disk drive is in a “dead” state if it is not present, if it is present but not powered on, or if it failed to operate properly and was “killed” by the controller. When the controller detects a failure on a disk, it “kills” that disk by changing its state to “dead.” A “dead” SCSI drive can also be present and powered on, but a SCSI drive in a “dead” state does not participate in any I/O activity; no commands are issued to dead drives.

Rebuild: A SCSI disk drive is in a “rebuild” state while it is in the process of being rebuilt. During this process, data is regenerated and written to the disk drive. This state is also referred to as “Write-Only (WRO).”

SCSI Interrupt Steering Logic (SISL)

Architecture that allows a RAID controller, such as AcceleRAID 150, 200 or 250, to implement RAID on a system board-embedded SCSI bus or a set of SCSI busses.

Server

A computer program that provides and manages services to other computer programs on the same or other computers. The computer that a server program runs on is also frequently referred to as a server. See also *Application Server.*

SES

SCSI Enclosure Services, a standard for SCSI access to services within an

enclosure containing one or more SCSI devices. For disk drives, power supplies, cooling elements, and temperature sensors, the actions performed are the same as for SAF-TE monitoring. If a UPS is connected to any SES-monitored enclosures, and an AC failure or two minute warning is reported, conservative cache is enabled and all system drives are switched to write-through cache. Primarily used in fibre enclosures.

SIMM

Single In-line Memory Module, RAM packed on a small circuit board with a defined edge connector. Two SIMMs are required for a 64-bit memory path on a Pentium processor. See also *DIMM*.

SMART

Self-Monitoring Analysis and Reporting Technology, the industry standard reliability prediction indicator for both the ATA/IDE (advanced technology attachment/integrated drive electronics) and SCSI hard disk drives. Hard disk drives with SMART offer early warning of some hard disk failures so critical data can be protected.

Standard Disk Drive

This term refers to a hard disk drive with SCSI, IDE, or other interface, attached to the host system through a standard disk controller.

Standby Replacement of Disk

See also *Hot Spare*. One of the most important features the RAID controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance. The controller automatically carries out the rebuild operation when a SCSI disk drive fails and both of the following conditions are true:

A “standby” SCSI disk drive of identical size is found attached to the same controller;

All of the system drives that are dependent on the failed disk are redundant system drives, e.g., RAID 1, RAID 3, RAID 5, and RAID 0+1.

Note: The standby rebuild will only happen on the SAME DAC960 controller, never across DAC960 controllers.

During the automatic rebuild process, system activity continues as normal. System performance may degrade slightly during the rebuild process.

To use the standby rebuild feature, you should always maintain a standby SCSI disk in your system. When a disk fails, the standby disk will automatically replace the failed drive and the data will be rebuilt. The system administrator can disconnect and remove the bad disk and replace it with a new disk. The administrator can then make this new disk a standby.

The standby replacement table has a limit of 8 automatic replacements in any session (from power-on/reset to the next power-off/reset). When the limit of 8 is reached and a disk failure occurs, the standby replacement will occur but will not be recorded in the replacement table.

To clear the “standby replacement” table, reboot the system from a DOS bootable floppy, run the configuration utility and select the option ‘view/ update configuration’ from the main menu. A red box labeled ‘Drive Remap List’ will be displayed. Selecting the box will allow you to continue. You should save the configuration without making any changes, and exit the configuration utility. This will clear the replacement table. You may now proceed to boot your system and continue normal operations.

In normal use, the replacement table limit of 8 should not cause any problems. Assuming that a disk fails about once a year (drives we support generally come with a 5-year warranty), the system would run continuously for a minimum of 8 years before the table would need to be cleared.

Storage Area Network (SAN)

A high-speed, open-standard scalable network of storage devices and servers providing accelerated data access.

Storage Device

A collective term for disks, tape transports, and other mechanisms capable of non-volatile data storage.

Sub-System Storage

A collection of disks providing data storage space to a system user.

System Disk

The disk on which a system's operating software is stored.

System Drives

See *Logical Drives*

Target ID

The SCSI ID of a device attached to a controller. Each SCSI channel can have up to 15 attached SCSI devices (target ID from 0 to 6 and 8 to 15).

TCP/IP

Transmission Control Protocol/Internet Protocol, the basic communication language or protocol of the Internet. It can also be used as a communications protocol in intranets and extranets. When set up with direct access to the Internet, a computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

Terabyte

A measure of memory capacity, 2^{40} power; or roughly a thousand billion bytes (that is, a thousand gigabytes).

Terminator

A part used to end a SCSI bus.

Termination

A method of matching transmission impedance of a bus to eliminate signal reflections from the physical ends of the bus.

Thin File Server

A small server maximized for the sole purpose of serving files, as opposed to computing. See also *File Server.*

TPC-C, Tpm-C

The Transaction Processing Performance Council (TPC) is a standards organization that measures transaction throughput of systems. One of their benchmarks is Tpm-C, which reflects price and performance metrics. TPC-C reflects new order transaction rate, a benchmark for transaction speed. Mylex products have won consistently high TPC-C results.

Transfer Rate

The rate at which data moves between the host computer and storage, input, or output devices, usually expressed as a number of characters per second.

Ultra160 SCSI (Ultra3 SCSI)

The newest in SCSI technology, Ultra160 SCSI increases performance, reliability, and manageability. With transfer rates of 160 MBps, cyclical redundancy check, and the capability to automatically test the interface's performance level, the Ultra160 SCSI can keep up with fibre channel technology. Compare with *Fast SCSI*, *Fast/Wide SCSI*, *Narrow SCSI*, *Ultra Wide SCSI*, *Ultra SCSI (Fast 20 SCSI)*, *Ultra2 SCSI (Fast 40 SCSI)*, and *Wide SCSI*.

Ultra SCSI (Fast 20 SCSI)

A high performance SCSI protocol that has a bus speed of 20 Megabytes per second in the Narrow SCSI configuration and 40 MB in the Wide SCSI (Fast 20 Wide SCSI) configuration. Compare with *Fast SCSI, Fast/Wide SCSI, Narrow SCSI*, *Ultra Wide SCSI*, *Ultra2 SCSI (Fast 40 SCSI), Ultra160 SCSI (Ultra3 SCSI),* and *Wide SCSI*.

Ultra Wide SCSI

16-bit wide Ultra SCSI, double the speed of narrow SCSI. Compare with *Fast SCSI, Fast/Wide SCSI*, *Ultra SCSI*, *Ultra2 SCSI*, and *Ultra160 SCSI (Ultra3 SCSI),* and *Wide SCSI*.

Ultra2 SCSI (Fast 40 SCSI)

A higher performance SCSI protocol than Ultra SCSI. Ultra2 SCSI has a bus speed of 40 Megabytes per second in the Narrow SCSI configuration and 80

Megabytes in the Wide SCSI (Wide Ultra2 SCSI) configuration. Compare with *Fast SCSI*, *Fast/Wide SCSI*, *Narrow SCSI*, *Ultra SCSI (Fast 20 SCSI)*, *Ultra Wide SCSI*, *Ultra 160 SCSI (Ultra3 SCSI)*, and *Wide SCSI*.

WAN

Wide Area Network, a geographically broader telecommunication structure as opposed to a local area network (*LAN*) that comprises of two or more LANs. A wide area network may be composed entirely of private structures, but the term also seems to imply the inclusion of public networks and all kinds of transmission media.

Warm Swap

The exchange of a defective disk with a working disk while power is maintained to the system, but I/O operations have ceased. See also *Automatic Swap*, *Cold Swap*, and *Hot Swap*.

Web

A number of computers, servers, or networks linked together in a matrix. See also *Internet* and *Intranet*.

Wide SCSI

A SCSI protocol and signal definition providing 16-bit wide data path Compare with Fast SCSI, Fast/Wide SCSI, Narrow SCSI, Ultra SCSI (Fast 20 SCSI), Ultra Wide SCSI, Ultra2 SCSI (Fast 40 SCSI), and Ultra160 SCSI (Ultra3 SCSI).

Wintel

A computer trade industry term for personal computers based on the Intel® microprocessor and one of the Windows® operating systems from Microsoft®. The term “PC” has often been used for this purpose.

XOR

Exclusive “Or”, a computer language function that generates parity in RAID systems; “this or that but not both.”

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