MYLEX

AcceleRAID
Installation Guide

AcceleRAID 200™
(DAC960PTL-0)

AcceleRAID 250™
(DAC960PTL-1)
PCI to Ultra2 SCSI
RAID Controllers

Part Number 775007-00

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About This Manual

This installation guide covers hardware set-up and configuration procedures necessary for the installation of Mylex AcceleRAID PCI to Ultra SCSI RAID controllers.

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

Chapter 2 describes steps to be performed prior to controller installation.

Chapter 3 describes the physical installation of the controller.

Chapter 4 describes controller start-up and the BIOS resident utilities.

Appendix A describes hardware and environmental specifications.

Appendix B describes error messages and how to correct problems causing errors.

Appendix C provides regulatory 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

Glossary

This chapter describes:

- **Product description**
- **Standard package contents**
- **User supplied items**

AcceleRAID 200
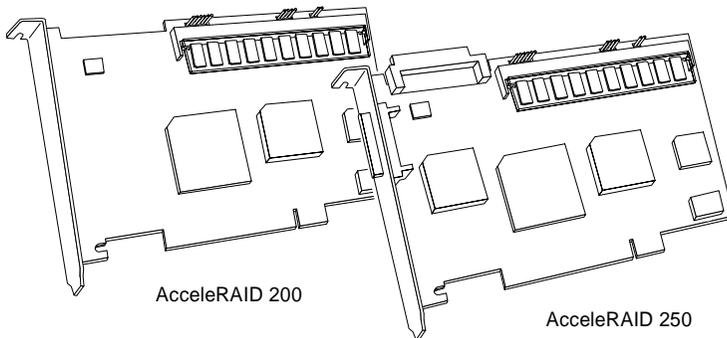
AcceleRAID 250

Figure 1-1. AcceleRAID Disk Array Controllers

Product Description

The Mylex AcceleRAID™ 200 (DAC960PTL-0™) and AcceleRAID™ 250 (DAC960PTL-1™) controllers are I_2O ready, half-length, PCI to Ultra2 SCSI RAID controllers designed to add RAID capability to SCSI channels that are resident on a system board. Mylex AcceleRAID controllers supply the necessary signals that enable SCSI Interrupt Steering Logic (SISL) hardware to capture and control the embedded SCSI channels(s) on the system board. This feature implements RAID capabilities on the system board resident SCSI channels.

The AcceleRAID 200 controller must reside in a PCI slot specifically pre-configured to support SISL. The AcceleRAID 250 may reside in the dedicated slot, or in any other PCI slot. System boards that support the AcceleRAID controllers include the Intel® N440BX server board.

Controller Features and Functions

AcceleRAID 200 Features:

- SISL to implement RAID on system board resident SCSI channels
- Support for Wide and Narrow Ultra2 SCSI LVD, and most other SCSI drive types

  ☞ **Note**

  > Supported SCSI drive types include SCSI-1, Fast SCSI, Wide Fast SCSI, Ultra SCSI, Wide Ultra SCSI, and Wide Ultra2 SCSI.

- Full support of RAID plug-and-play, for I_2O compliant system boards
- Supports RAID levels 0, 1, 3, 5, 0+1, 10, 30, 50, and JBOD on embedded SCSI controller(s)
- On-board, high performance RISC processor and EDO ECC DRAM cache for high speed, fault tolerant I/O transfers
- 512KB, 8-bit flash EEPROM for BIOS and code supports future enhancements through firmware upgrades

AcceleRAID 250 Features

Includes all of the features of the AcceleRAID 200, plus the following:

- An additional Wide Ultra2 SCSI RAID LVD channel on the controller to extend the number of channels on the system board
- Ability to operate in an ordinary (not specifically configured) PCI slot as a single channel controller

  ☞ **Note**

  > The AcceleRAID 250 will work as a single-channel, Wide Ultra2 SCSI LVD RAID controller with a system board that has an available PCI slot.

  > A specially configured, dedicated PCI slot is required to enable SISL, which allows the controller to add RAID capability to the system board's built-in SCSI channels.

Operating System Support

MS-DOS 5.x, 6.x, and above are supported using drivers that reside in the AcceleRAID BIOS. Many other popular operating systems are supported using software drivers in the Disk Array Controller Software Kit that is included with the AcceleRAID controller (see the *Disk Array Controller Software Kit Installation Guide and User Manual* – P/N 771929)

Standard Package Contents

The following items are supplied with the standard shipping package:

Hardware

- AcceleRAID 200 or AcceleRAID 250 Disk Array Controller with documentation

Software

- Disk Array Controller Configuration (DACCF) utility with documentation

- Disk Array Controller Software Kit (OS drivers, and GAM Server) with documentation

- Global Array Manager (GAM client) with documentation
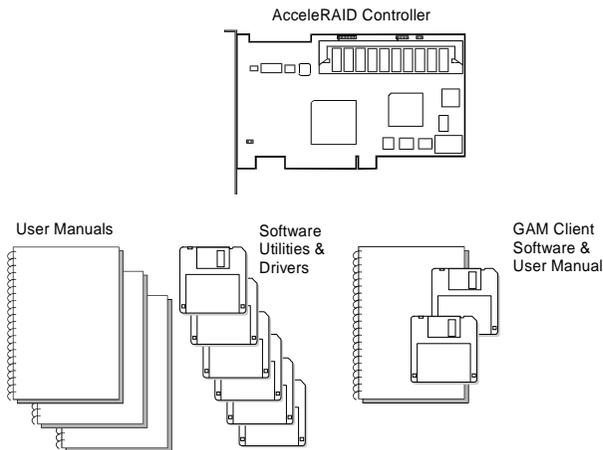
Figure 1-2. Standard Package Contents

User-supplied Items

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

- Compatible host system with a PCI slot prewired for SCSI Interrupt Steering Logic control of the embedded SCSI channel(s)

- Network operating system software (as required

- Static grounding strap or electrostatic discharge (ESD) safe work area

- Disk array enclosure (or equivalent) and SCSI disk drives

  ☞ **Note**

  The supported SCSI drive types include Ultra2 SCSI with LVD as well as the following single-ended SCSI types: SCSI-1, Fast SCSI, Wide Fast SCSI, Ultra SCSI, and Wide Ultra SCSI.

- SCSI cables to connect between the system board SCSI connectors and disk drives (and if an AcceleRAID 250 is installed, between the AcceleRAID controller and disk drives).
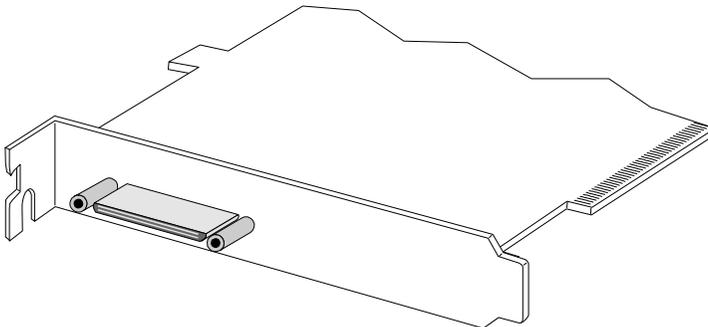
Figure 1-3. AcceleRAID 250 External Connector (0.8mm UHD Centronics 68F): 68-Pin Very High Density Cable Interconnect (VHDCI)
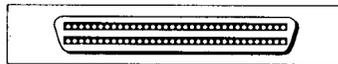
Figure 1-4. AcceleRAID 250 Internal Connector (HD DB68F): 68-Pin High Density

Chapter 2
Preinstallation Planning

This chapter describes:

- **SCSI termination**
- **SCSI cabling**
- **SCSI drive preparation**

There are some configuration steps that need to be performed prior to installing an AcceleRAID controller into the system. These steps include: checking the SCSI termination requirements, selecting the appropriate SCSI cabling, and preparing the SCSI drives for use in the array.

AcceleRAID 200
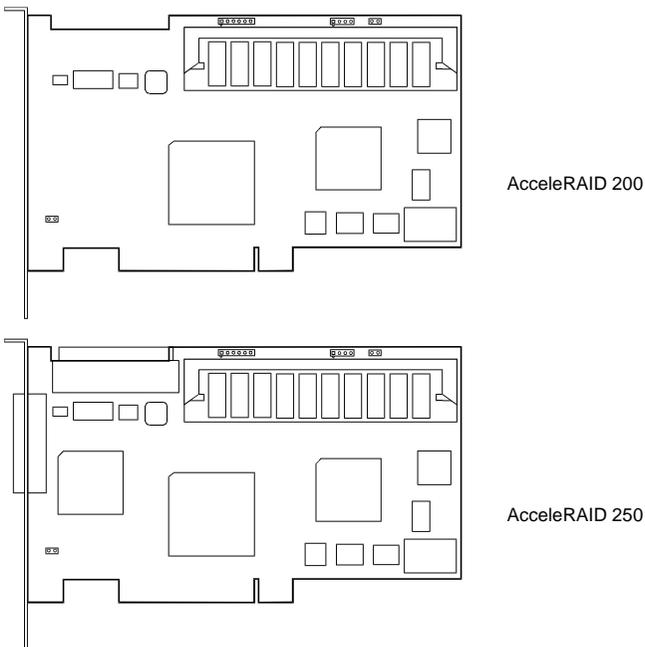
AcceleRAID 250

Figure 2-1. AcceleRAID Controllers

SCSI Termination

Correct termination is critical for the SCSI channels. Termination on the end of the cable connecting the disk drives (or other SCSI devices) is required.

If an AcceleRAID 250 is installed, the controller's termination is automatically set.

AcceleRAID 200 Termination

The system board contains the SCSI I/O chips and termination used by the AcceleRAID controller. Refer to the instructions and/or specifications furnished with the system board for information regarding how termination is implemented.

See Figure 2-2 for an example of terminating an internal – external drive configuration.

☞ Note

> For purposes of this discussion, it is assumed that the illustrated internal and external connectors are both on the same SCSI channel.
>
> 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.
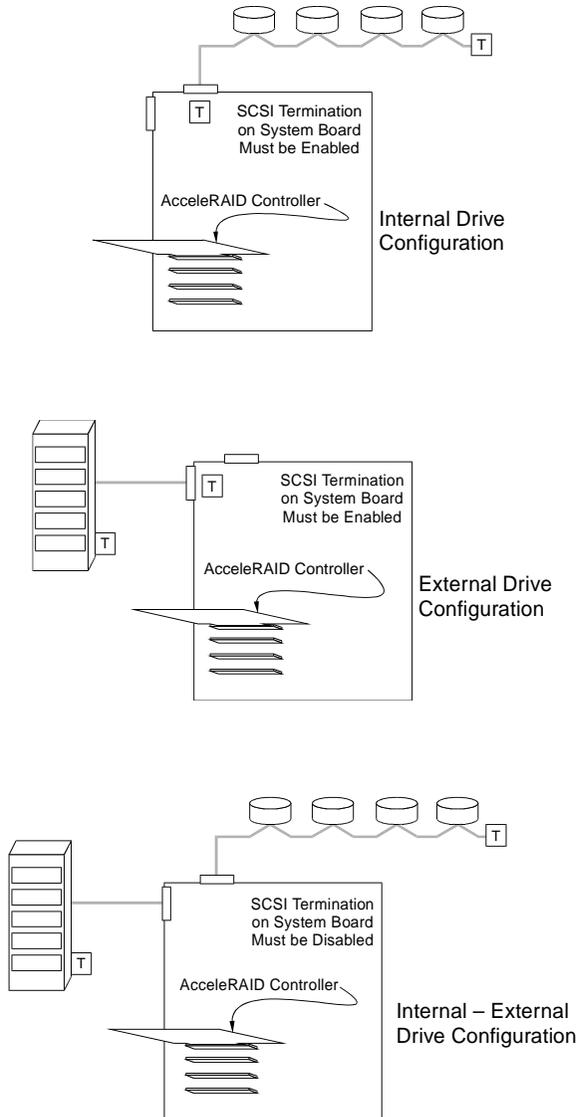
Figure 2-2. System Board SCSI Termination Examples

AcceleRAID 250 Termination

The AcceleRAID 250 is equipped with automatic SCSI termination circuitry. If the controller is at the end of the SCSI bus, it automatically enables on-board termination.

If all the SCSI devices on the channel are connected either to the internal connector or to the external connector, the end of the SCSI bus farthest from the controller must have a terminator installed. In this case, the controller automatically *enables* on-board termination. See Figure 2-3 for examples of internal or external drive configurations.

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 must each be terminated. In this case, the controller automatically *disables* on-board termination. See Figure 2-3 for an example of an internal – external drive configuration.

> ☞ **Note**
>
> The illustrated internal and external connectors are both on the same channel.
>
> 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.
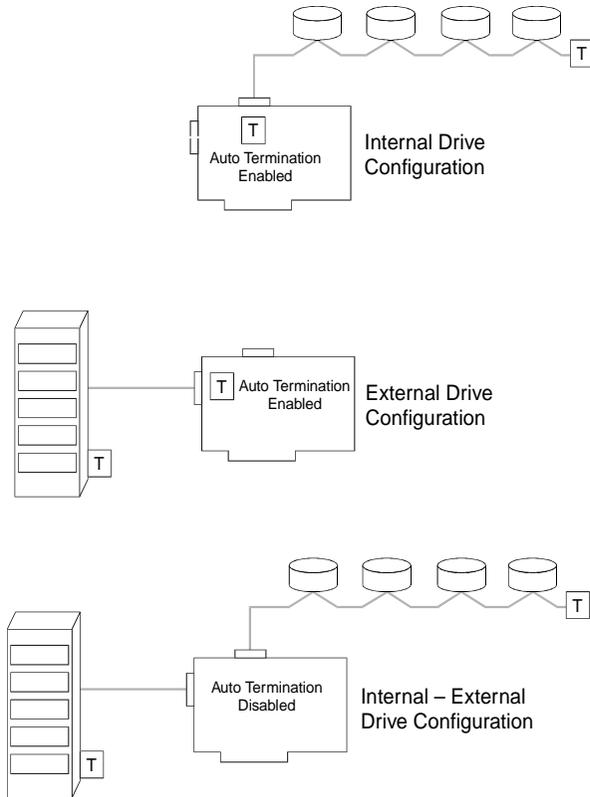
Figure 2-3. AcceleRAID 250 SCSI Termination Examples

SCSI Cabling

An Ultra SCSI or an Ultra2 SCSI channel supports up to 15 drives.

⚠ *Caution*

Wide and narrow SCSI drives must not be installed together on any one channel, or AcceleRAID controller malfunction may occur.

LVD Mode

The controller supports Ultra2 SCSI with LVD. If all drives attached to a controller drive channel support Ultra2 SCSI with LVD, then that channel will operate at 40 mega-transfers per second (or 80 MB with Wide Ultra2 SCSI). This setup allows a maximum SCSI bus length of up to 12 meters.

☞ **Note**

The SCSI bus length can be extended to 25 meters if only the controller and one drive are on the bus.

Single-ended Mode

If any device on the channel is *not* Ultra2 SCSI capable, 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 2-1.

Table 2-1. Supported SCSI Formats and Bus Lengths

SCSI Drive Type*	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

* SCSI Trade Association (STA) Terms

† The maximum number of devices allowed on a Wide Ultra SCSI bus is 8 unless bus extender technology is used

SCSI Drive Preparation

Prepare the drives for installation as follows:

- Remove any terminators attached to the drive or set any drive termination jumpers to the *disabled* position.

- Set the SCSI addresses on the drives.

  ☞ **Note**

    Each drive must have a unique ID chosen from 0 through 6 or 8 through 15. ID 7 cannot be used as a drive ID because it is reserved for the controller.

- Enable termination power on the drives.

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

☞ **Note**

  The supported SCSI drive types include Ultra2 SCSI with LVD as well as the following single-ended SCSI types: SCSI-1, Fast SCSI, Wide Fast SCSI, Ultra SCSI, Wide Ultra SCSI, and Wide Ultra2 SCSI.

⚠ *Caution*

  If wide drives are to be connected to a narrow SCSI connector (by a 68-pin to 50-pin adapter), the 8-bit bus width parameter must be set first, using DACCF.

  Instructions on how to force the 8-bit bus width are in the *Disk Array Controller Configuration Utilities (DACCF) Installation Guide and User Manual* (P/N 771953), under "Advanced Parameters."

Installation

This chapter describes:

- **Before you begin**
- **Connectors and Jumpers**
- **Safety considerations**
- **Installing the controller**

Before You Begin

Installing an AcceleRAID PCI to Ultra2 SCSI RAID controller is no more difficult than installing any PCI adapter card. Follow these steps and then follow the installation procedures in this chapter.

> 🛑 **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.**

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. 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.

3. Safety check the installation before powering on the system.

   - Make sure that all of the cabling Pin 1 locations are correct and that all cables are firmly seated in the connectors.

   - Make sure all SCSI conventions (cable type, cable length, termination, SCSI IDs, etc.) are followed.

Connectors and Jumpers

⚠ *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.

The AcceleRAID controller jumper locations are illustrated in Figure 3-1.
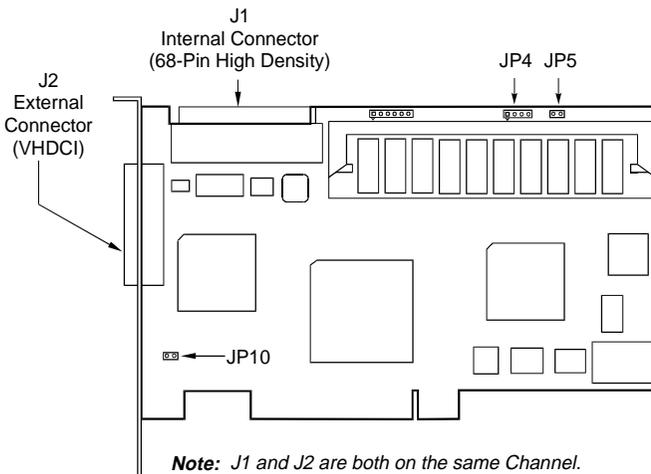
Figure 3-1. AcceleRAID Jumpers and Connectors

Table 3-1. AcceleRAID Jumper Descriptions

Component	Description	Default
JP4	Serial Port Connector for Debug (TTL level)	–
JP5	Not Used	Off
JP10	Enables SCSI Interrupt Steering Logic (SISL) control	On
J1	Channel 0 Internal Ultra2 SCSI LVD Connector – 68-Pin High Density	–
J2	Channel 0 External Ultra2 SCSI LVD Connector – 68-Pin Very High Density Cable Interconnect (VHDCI)	–

Installing the Controller

⚠ *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.

🛑 **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.**

Follow these steps:

1. Power-off all enclosures and the system components and disconnect their power cords.

2. Remove the covers or the cabinet as necessary to access the I/O slots on the system board.

3. Choose the PCI slot that is pre-wired for the AcceleRAID and remove the metal cover plate from the slot's access port (usually at the back of the cabinet). Save the retaining screw.

4. Plug the controller firmly into the PCI slot. Use the retaining screw to secure the controller by its mounting bracket.

⚠ *Caution*

> Plugging in an AcceleRAID 200 into the wrong slot may damage the controller's SISL control circuit and its ability to implement SISL on other installations.

5. Connect the cables from the disk array(s) to the drive channel port on:
   - the system board
   - the AcceleRAID 250
   - the system board and the AcceleRAID 250

⚠ *Caution*

> Wide and narrow SCSI drives must not be installed together on any one channel, or AcceleRAID controller malfunction may occur.

6. Look to confirm that all drive channels are properly terminated.

7. **Safety check** the installation.

8. Reconnect the power.

9. Proceed to the next chapter.

Chapter 4
Controller Start-up

This chapter describes:

- **Procedural overview**
- **Controller start-up**
- **Additional steps to set up an array**
- **What to check in case of problems**

This chapter describes the AcceleRAID 200 and AcceleRAID 250 controller start-up procedures and messages produced by the BIOS during start-up or re-boot. It explains the BIOS options that are available for configuring controller operation. This chapter also contains a brief introduction of necessary software configuration with references to additional documentation.

Procedural Overview

The steps covered in this chapter include:

1. Setting BIOS options

2. BIOS configuration utility – refer to the *Disk Array Controller Configuration Utilities (DACCF) Installation Guide and User Manual* (P/N 771953)

3. Loading the operating system and operating system drivers – refer to the *Disk Array Controller Software Kit Installation Guide and User Manual* (P/N 771929)

4. Installing Global Array Manager – refer to the *Global Array Manager Client Software Installation Guide and User Manual* (P/N 771961)

Controller Start-up

The controller start-up procedure is the first step in confirming that the controller is correctly installed and working properly. The start-up procedure should be performed prior to any software configuration.

BIOS Start-up Sequence

After physically installing the controller and connecting the cabling, do the following:

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:

   ```
   ┌─────────────────────────┐
   │ BIOS options            │
   ├─────────────────────────┤
   │ BIOS enabled            │
   │ CD-ROM boot disabled    │
   │ 8 GB drive geometry     │
   │ Configure MDAC          │
   └─────────────────────────┘
   ```
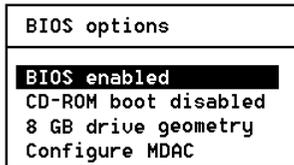
5. To select any of the items in the menu, highlight the selection with the **Up Arrow** or **Down Arrow**. Press **Enter** to toggle any of the first 3 items.

   ☞ **Note**

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

BIOS Configuration Utility

Mylex AcceleRAID controllers are capable of adding a BIOS-based configuration utility through select firmware upgrades. For more information about this feature, refer to the Technical Support page of the Mylex web site (www.mylex.com).

To run the Mylex Disk Array Controller Configuration Utility after it is installed, select *Configure MDAC* and press **Enter**.

The on board Mylex Disk Array Configuration Utility functions identically to DACCF. For detailed information on how to configure MDAC, refer to the *Disk Array Controller Configuration Utilities (DACCF) Installation Guide and User Manual* (P/N 771953).

Other BIOS Options

In addition to Configure MDAC, the other available BIOS options are:

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

BIOS Disable or Enable

This option must be enabled in order to change the following BIOS options. When BIOS Disable or Enable is selected, the following message will be displayed. Pressing any key will restart the system.

```
BIOS options

BIOS enabled
CD-ROM boot disabled
8 GB drive geometry
Configure MDAC
```

```
The system will restart
Press any key to continue
```

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. If a bootable CD is installed in the CD-ROM drive, the system can boot from the CD if this option is enabled.

If the CD-ROM boot option is enabled, the CD-ROM will take priority over the disk drives under the following conditions:

- If the bootable CD-ROM emulates a hard disk (e.g., the CD-ROM has a hard disk boot image), the CD-ROM becomes Drive C: and the first hard disk becomes Drive D:. Additional disk drive addresses are pushed out by one.

- If the bootable CD-ROM emulates a diskette (e.g., the CD-ROM has a diskette boot image), the CD-ROM becomes disk A: (and appears to be a 1.44MB disk) and the first diskette becomes disk B:.

- If the bootable CD-ROM is not emulating a hard drive, the CD-ROM becomes Drive R: and there is no additional drive address stuffing.

Enable 8GByte or 2GByte Drives

This setting affects how the BIOS reads the disk drives. Drive geometries can be toggled between 8 GB and 2 GB. The default is 2 GB. The drive geometry must be set, and then the drive must be formatted (or reformatted).

```
BIOS options

BIOS enabled
CD-ROM boot disabled
8 GB dri┌──────── WARNING ────────┐
Configur│ Changing drive geometry may lead to
        │ non-bootable system drives and/or
        │ loss of data!
        │ Proceed anyway? (Y/N)
        └──────────────────────────────────┘
```
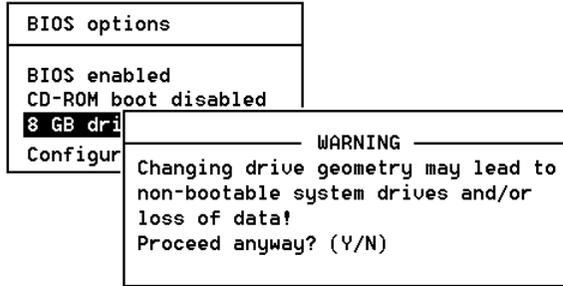
The default BIOS geometry of the controller is set to 2 GB. This means that the BIOS only sees the first 2 GB of any drive that has been configured on the controller. This is adequate in most applications, since BIOS is only used to boot the operating system. However, it does mean the operating system must be installed in the first 2 GB of the capacity of the configured drive. If this is not adequate, the BIOS geometry can be changed to 8 GB, allowing the BIOS to see the first 8 GB of capacity.

⚠ Caution

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

Additional Steps to Set Up an Array

Device Drivers

Device drivers that make the controller compatible with the supported operating systems can be found in the Mylex Disk Array Controller Software Kit. For details on how to install and load drivers, refer to the *Disk Array Controller Software Kit Installation Guide and User Manual* (P/N 771929).

Global Array Manager (GAM)

The controller can be configured using GAM. GAM 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, refer to the *Global Array Manager Client Software Installation Guide and User Manual* (P/N 771961). This manual can be obtained at no cost from the Mylex web site (www.mylex.com).

What to Check 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 termination.

- Check sure each drive on a SCSI channel has a unique SCSI ID other than 7.

Appendix A
AcceleRAID Specifications

General Hardware Specifications

AcceleRAID

Controller		DAC960PTL
CPU		Intel i960 RD® RISC 32-bit microprocessor, 66MHz
Memory		EDO ECC RAM, 60ns, 72-pin SIMM, n x 40 (Only Mylex supplied SIMMS) Minimum: 4 MB Optional: 8, 16, 32, 64, or 128 MB
Cache		Write: Selectable, Write Through or Write Back Error Protection: Error Correction Code (with 40-bit EDO RAM)
Firmware		ROM Type, Flash EEPROM, 512K x 8
PCI	I/O Processor:	Embedded in Intel i960 RD microprocessor
	Transfer Rate:	132 MB/second (burst)
SCSI	I/O Processor:	Symbios 53C895 on AcceleRAID 250. AcceleRAID supports 53C875, 53C876, 53C895, and 53C896 on system board
	Number of Controller Channels	DAC960PTL-0 – none on controller DAC960PTL-1 – 1 channel on controller

Environmental Specifications

Controller	**DAC960PTL**	
Temperature	Operating	0°C to +55°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	Length:	7.225 inches
	Width:	4.2 inches
	Maximum. Component Height:	0.105 inches solder side 0.570 component side.
	Board Width:	Not to exceed the width of one PCI slot

DAC960PTL Block Diagram

Figure A-1 shows the functional relationship between the Mylex AcceleRAID RAID Controller and the SCSI-capable system board. The SCSI chip interrupt line(s) are routed to a PCI bus slot specifically pre-configured to accept the controller.

Figure A-1. AcceleRAID and SCSI-Capable System Board

AcceleRAID Error Messages

Error Messages

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.

```
DAC960Pn fatal error--memory test failed

DAC960Pn fatal error--command interface test failed

DAC960Pn hardware error--run diagnostics to pinpoint error

DAC960Pn 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:

```
Unidentified device found at channel x....

Device identified for chn x, tgt y found at chn x', tgt y'

SCSI device at chn x, tgt y not responding
```

If any of the above messages are displayed, the firmware will not proceed any further in the initialization process, except to find other mismatches. Then, the BIOS prints out the following:

```
DAC960Pn 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
```

The following messages may also appear:

```
Adapter 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:

> DAC960P*n* not responding--no drives installed.

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

> DAC960P*n* 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 are offline
>
> Warning: *X* system drives are critical
>
> Warning: The following SCSI devices are dead--chn *x*, tgt *y*...
>
> No system drives found: None 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.

Aborted Installation

With Firmware 4.x, the installation aborted message is displayed when the BIOS finds that the configuration of the disk drives, as stored in the NVRAM and configuration on disk, is different from what it senses at boot time. When this happens, (and a brand new installation is not being attempted) the cause is often a faulty cable or 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, run the Disk Array Configuration Utility (see Chapter 4). For more information, refer to the *Disk Array Controller Configuration Utilities (DACCF) Installation Guide and User Manual* (P/N 771953).

NVRAM Error

With Firmware 4.x, if the BIOS displays a mismatch between the NVRAM and the COD, no drives will be installed. Normally this error will not be displayed. If it is, boot and run the on-board Mylex Disk Array

Configuration Utility (see Chapter 4). to recover from the error. For more information, refer to the *Disk Array Controller Configuration Utilities (DACCF) Installation Guide and User Manual*.

System Reboot or Power Down

Status messages may also be available from LED indicators on the front panel connected to the AcceleRAID. The Write Pending indicator is especially important when preparing to power-down the system.

The AcceleRAID is a caching controller with up to 128 MB of cache memory, data may still be in the cache waiting to be written to the disk drives, when the system reports that a write command was completed. 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 15 seconds before resetting or rebooting the system.

If using the 'Write Pending' LED indicator, wait 3 seconds after the LED has gone off before resetting or rebooting the system (the optional cache battery backup may also be used to prevent data loss).

Regulatory Information

FC Class B Compliance

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 residential installations. 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 not guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment 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:

1. Reorient or relocate the receiving antenna

2. Move the equipment away from the receiver

3. Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions.

All external connections should be made using shielded cables.

⚠ *Caution*

Only equipment certified to comply with Class B (computer input/output devices, terminals, printers, etc.) should be attached to this equipment.

Any changes or modifications to the equipment by the user not expressly approved by the grantee or manufacturer could void the user's authority to operate such equipment.

FC Declaration of Conformity

Manufacturer's Name: Mylex Corporation

Manufacturer's Address: 34551 Ardenwood Blvd.
Fremont, CA 94555-3607
USA

Declares that the product:
Product Name: AcceleRAID Ultra2 SCSI RAID Controller

Model Number(s):   **DAC960PTL-0** and **DAC960PTL-1**

Year of Manufacture: 1998

Conforms to the following Product Specification(s):

EMC: EN 50081-1:1992/EN 55022:1992 Class B
EN 50082-1:1992 - Generic Immunity

EN 61000-4-2:1995,4kV CD, 8kV AD
EN 50140:1995, 3 V/m, 80 - 1000 MHz, 80%
EN 61000-4-4:1995, 0.5kV I/O, 1kV Power

Supplementary Information:

The product herewith complies with the requirements to the EMC Directive 89/336/EEC

Declaration that the equipment specified above conforms to the above directive(s) and standard(s) is on file and available for inspection at the manufacturer's address cited above.

$C\epsilon$ Community of Europe

CE mark is rated for the AcceleRAID as follows:

CISPR 22 Radiated Emission

EN55022, EN5082-1 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

Glossary

Cache

Controller memory used to speed up data transfer to and from a disk.

Cache Flush

Refers to an operation where all unwritten blocks in a Write-Back Cache are written to the target disk. This operation is necessary before powering down the system.

Cache Line Size

See "Segment Size."

Channel

Refers to one SCSI bus on a disk array controller. Each disk array controller provides at least one channel.

Consistency Check

Refers to a process where the integrity of redundant data is verified. For example, a consistency check of a mirrored drive will make sure that the data on both drives of the mirrored pair is exactly the same. For RAID Level 5 redundancy, a consistency "connect" is a function that allows a target SCSI device (typically a disk drive that received a request to perform a relatively long I/O operation) to release the SCSI bus so that the controller can send commands to other devices. When the operation is complete and the SCSI bus is needed by the disconnected target again, it is "reconnected."

Disk Failure Detection

The 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 disk could be "killed" (taken "offline") by the controller (its state changed to "dead"). DAC960 controllers also monitor SCSI bus parity errors and other potential problems. Any disk with too many errors will also be 'killed'.

Disk Media Error Management

DAC960 controllers transparently manage SCSI disk media errors. Disks are programmed to report errors, even ECC-recoverable errors. If ECC EDO RAM is installed, the controller will correct ECC errors.

When a disk reports a media error during a read, the controller reads the data from the mirror (RAID 1 or 0+1), or computes the data from the other blocks (RAID 3, RAID 5), and writes the data back to the disk that encountered the error. If the write fails (media error on write), the controller issues a "reassign" command to the disk, and then writes the data to a new location. Since the problem has been resolved, no error is reported to the system.

When a disk reports a media error during a write, the controller issues a "reassign" command to the disk, and writes the data out to a new location on the disk.

Drive Groups (or 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. Up to eight (8) drives can be configured together as one drive group.

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 (4*200), not 1800MB.

Hot Replacement of Disks (Hot Swap)

The design of the DAC960 Series 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), system service continues without interruption. A message is generated by the system 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.

Logical Drive States

The state of a logical (system) drive can be either ONLINE, CRITICAL, or OFFLINE. Notice that the same term "online" is used for both physical and logical drives.

Online: A Logical Drive is in an "online" state if...

All of its participating SCSI drives are "online."

Critical: 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.

Offline: A Logical Drive is in an "offline" state if...

No data can be read from it or written to it.

System commands issued to offline logical drives are returned with an error status: no operations can be performed on offline logical drives. A logical drive can be "offline" under one of two situations described below:

- It is configured with a redundant RAID level (1, 3, 5, or 0+1), and two or more of its SCSI drives are not "online"; or

- It is configured at RAID level 0, JBOD, or in a spanned set, and one or more of its SCSI drives are not "online."

Logical Drives

See "System Drives."

LVD – Low Voltage Differential

Low Voltage Differential is a form of SCSI signalling that was introduced with Ultra2 SCSI. Low Voltage Differential allows cable lengths of up to 12 meters (approximately 39 feet) with up to 15 devices. The devices need to be Ultra2 SCSI LVD devices in order to take advantage of the LVD signalling.

LVD uses data high and data low signal lines to increase transmission distances over those of single-ended (conventional SCSI signalling). LVD differs from conventional differential signalling. LVDs advantages are that it consumes less power and it can sense single-ended devices on the bus and revert to single-ended signalling.

Mirroring

Refers to the 100 percent duplication of data on one disk drive to another disk drive. Each disk will be the mirror image of the other.

Pack

See "Drive Groups (or Drive Packs)."

Parity

See "Rotated XOR Redundancy."

PCI

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

RAID

RAID stands for Redundant Array of Independent Disks. The DAC960 controllers implement this technology to connect up to 15 SCSI devices per channel. Several different forms of RAID implementation have been defined. Each form is usually referred to as a "RAID level." All the RAID levels supported by DAC960 Series controllers are shown below.

The appropriate RAID level for a system is selected by the system manager or integrator. 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 Levels

The disk array controllers monitored by this utility support four RAID Advisory Board-approved (RAID 0, RAID 1, RAID 3, RAID 5) and two special RAID levels (RAID 0+1, and JBOD).

Level 0. Block "striping" across multiple drives is provided, 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. (Mylex RAID 6)

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. (Mylex RAID 7)

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

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

Replacement Table

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

Rotated XOR Redundancy

This term (also known as "parity") refers to 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 between 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. (XOR refers to the Boolean "Exclusive-OR" operator.) In any RAID 3 or RAID 5 array, the capacity allocated to redundancy is the equivalent of one drive.

SCSI

SCSI is an acronym for "Small Computer Systems Interface," although it is often used in large systems. The SCSI interface supports disk drives, tape drives, and CDROM drives. Narrow SCSI supports up to 7 devices on a channel, and Wide SCSI, Ultra SCSI, and Ultra2 SCSI support up to 15 devices on a channel.

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 of the states 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 it...

Is powered on; and

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; and

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; or

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 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

This is the architecture that allows a RAID controller, such as AcceleRAID to implement RAID on a system board-embedded SCSI bus or a set of SCSI busses.

Segment Size

The Segment Size function is set in conjunction with stripe size and represents the size of the data "chunk" that will be read or written at one time. Under DACCF, the segment size (also known as "cache line size") should be based on the stripe size you selected. The default segment size for Mylex DAC960 controllers is 8K.

Session

Refers to the period of time between any two consecutive system shutdowns. System shutdown may be either a power off/on, or a hardware reset.

SISL

See "SCSI Interrupt Steering Logic."

Standard Disk Drive

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

Standby Replacement of Disks ("Hot Spare")

The "Standby Replacement" (or "Hot Spare") is one of the most important features the controller provides to achieve automatic, non-stop service with a high degree of fault-tolerance. The rebuild operation will be carried out by the controller automatically 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, RAID 0+1.

   ☞ **Note**

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

A "Standby" disk can be created in one of two ways:

1. When a user runs DACCF utility, all disks attached to the controller that are NOT configured into any drive group will be automatically labeled as "standby" drives.

2. A disk may also be added (attached at a later time) to a running system and labeled as standby by using the "DAC960 Software Kit" (see appropriate chapters for DAC960 utilities for a particular operating system).

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.

Stripe Order

The order in which SCSI disk drives appear within a drive group. This order must be maintained, and is critical to the controller's ability to 'Rebuild' failed drives.

Stripe Size

The stripe size is defined as the size, in kilobytes (1024 bytes) of a single I/O operation. A stripe of data (data residing in actual physical disk sectors, which are logically ordered first to last) is divided over all disks in the drive group.

Stripe Width

The number of striped SCSI drives within a drive group.

Striping

Refers to the storing of a sequential block of incoming data across multiple SCSI drives in a group. For example, if there are 3 SCSI drives in a group, the data will be separated into blocks and block 1 of the data will be stored on SCSI drive 1, block 2 on SCSI drive 2, block 3 on SCSI drive 3, block 4 on SCSI drive 1, block 5 on SCSI drive 2 and so on. This storage method increases the disk system throughput by ensuring a balanced load among all drives.

System Drives

A system drive is equivalent to a "logical" drive. System drives are presented to the operating system as available disk drives, each with a capacity specified by the DAC960 Series controller.

Target ID

A target ID is the SCSI ID of a device attached to a DAC960 controller. Each SCSI channel can have up to 15 attached SCSI devices (target ID from 0 to 6, and 8 to 15).

Ultra SCSI

Ultra SCSI, or Fast 20 SCSI is a high performance SCSI protocol that has a bus speed of 20 MegaBytes per second in the Narrow SCSI configuration and 40 MegaBytes in the Wide SCSI (Fast 20 Wide SCSI) configuration.

Ultra2 SCSI

Ultra2 SCSI, or Fast 40 SCSI is 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.

Write-Back Cache

Refers to a caching strategy whereby write operations result in a completion signal being sent to the host operating system as soon as the cache (not the disk drive) receives the data to be written. The target SCSI drive will receive the data at a more appropriate time, in order to increase controller performance. An optional cache battery backup can be used to protect against data loss as a result of a power failure or system crash.

Write Through Cache

Refers to a caching strategy whereby data is written to the SCSI drive before a completion status is returned to the host operating system. This caching strategy is considered more secure, since a power failure will be less likely to cause loss of data. However, a write through cache results in a slightly lower performance.

MYLEX DAC960 Problem Report

Customer Identification	DAC960 Identification
Name: _____	Date: _____ Purchase Date: _____
Company: _____	Model _____
Address: _____	Invoice Number: _____
_____	Serial Number: _____
_____	# Chnls: _____ Cache: _____
Country: _____	Firmware Ver: _____ BIOS Ver: _____
	Make/Model/Size/Type of
Phone Number: _____	Drives: _____
Fax Number: _____	Disk: _____
	Non-Disk: _____

System Information

Motherboard: _____	CPU Speed: _____	BIOS Ver: _____
Video Adapter: _____	Network Card: _____	MB Memory: _____
Operating Sys: _____	Other Disk Ctrl: _____	Other Cards: _____

Pack Configuration

Indicate in matrix below 1, 2... for member of pack 1, pack 2... respectively. Indicate S, T, C, or O for Standby, Tape, CDROM and other drives.

Channel	SCSI ID						
	0	1	2	3	4	5	6
0							
1							
2							
3							
4							

System Drive Configuration

System Drive	Size	RAID Level	Write Back/ Thru
0			
1			
2			
3			
4			
5			
6			
7			

Problem Description

_____
_____
_____
_____
_____
_____
_____
_____

This DPR form has been included with your Mylex product as a convenience to both you and our Technical Services Department. If filled out completely, this will greatly assist Mylex personnel in quickly resolving any technical problems or questions you may have. Use the Mylex fax number (510) 745-7715 to transmit this form to the Technical Services Department, or mail to Mylex Corporation, Technical Services Department, 34551 Ardenwood Blvd., Fremont, CA 94555-3607

772014-DAC

Mylex Warranty - Customer Policy

Thank you for purchasing this Mylex product for your computer system. In addition to this high-quality product, your purchase entitles you to the warranty coverage set forth herein. In order to provide this warranty coverage, and to indicate your acceptance of this warranty, we must have the attached Warranty Registration Card completed and returned to us within 15 days of your purchase. Also, in order for us to provide you the highest level of service, we must know where you purchased your MYLEX product.

Three Year Limited Warranty

If at any time during the thirty six month period immediately following the date of original purchase of the MYLEX product enclosed herewith (the "PRODUCT") you discover one or more defects in the material or workmanship, MYLEX will repair, or at MYLEX's sole option, replace the PRODUCT. If the PRODUCT fails to operate at any time within seven days after the date of its original purchase, it will be replaced by MYLEX. Such repair or replacement will be your sole remedy against MYLEX, and MYLEX's only liability to you, for any failure or malfunction of the PRODUCT. The warranty set forth in this paragraph will be void if:

1. The PRODUCT has been installed in an improper manner or in an improper operating environment.

2. The PRODUCT has been modified or repaired by any party other than MYLEX or a MYLEX factory authorized service center.

3. The PRODUCT has been damaged.

Some MYLEX products will have a Warranty Expiration Date label affixed to the product itself. When present, the warranty period will extend through the last day of the month indicated.

This warranty will not apply to, and MYLEX provides no warranty for, any BIOS, software, ROM-based firmware, or any other PRODUCT developed or manufactured by any third party, whether included with this PRODUCT or not. Such warranty or warranties as are provided by third parties, to the extent permitted thereby, shall be made available, and are hereby assigned, by MYLEX to the purchaser of this PRODUCT.

If MYLEX issues a revision to the BIOS, firmware or software included with this PRODUCT within 30 days of your purchase, MYLEX will replace such firmware at no charge except handling fees.

Out of Warranty Service

Mylex products which are ineligible for warranty service may be serviced by MYLEX according to our standard price list, as modified from time to time. A current copy of the standard price list is available from the Technical Support Department.

Limitation of MYLEX Liability

MYLEX's liability arising from the sale, use and disposition of this PRODUCT shall in no event exceed the amount paid to MYLEX for this PRODUCT. MYLEX assumes no liability for damages arising from the use or failure of any MYLEX product. The WARRANY DESCRIBED ABOVE CONSTITUTES THE ONLY WARRANY MADE BY MYLEX. MYLEX EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES OF ANY KIND WHATSOEVER, WHETHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANT-ABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY EXPRESSLY EXCLUDED. IN NO EVENT WILL MYLEX BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUEN-TIAL DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OF DATA, USE, OR INCOME), EVEN IF ADVISED OF SUCH DAMAGES IN ADVANCE. Your sole remedies shall be as provided herein.

Returned Merchandise Procedures

If you suspect that there is a defect in the material or workmanship of this PRODUCT, you should contact the person or company from which you purchased it. That person or company may be able to solve the problem and if not, will be able to contact us for technical assistance or repair.

If it is determined that the PRODUCT must be returned to MYLEX for repair or replacement, contact MYLEX's Technical Support Department at 510-608-2400 before it is returned. Each returned item must have a separate Return Merchandise Authorization (RMA) number, provided by MYLEX.

The following rules apply to all returned items:

1. The PRODUCT must be returned either in its original packaging or in other packaging which is appropriate for the PRODUCT and the manner of shipment, and the RMA number must be displayed prominently on the outside of each such package.

2. If a PRODUCT is determined to be ineligible for warranty service, the customer will be notified before any further action is taken with the PRODUCT.

3. MYLEX will not be responsible for any loss or damage to property shipped with the RMA PRODUCT not originally sold by MYLEX (e.g., coprocessor chips, peripheral boards, memory modules, enclosures, power supplies, or any other accessories or attached items).

4. Any item returned to MYLEX without a valid RMA number will be returned to the shipper.

Products shipped to MYLEX must be shipped or mailed at the shipper's risk, freight prepaid, to the address below.

> Mylex Corporation
> 34551 Ardenwood Blvd.
> Fremont, California U.S.A.
> 94555-3607

Mylex will pay for return freight via such carrier as MYLEX shall deem appropriate.

Technical Support

MYLEX's Technical Support Department, to assist you in resolving problems with MYLEX products, is available through the world wide web. Contact the Technical Support web site through the Mylex Internet home page at www.mylex.com, or by e-mail at tsupport@mylex.com. In the U.S.A., the Technical Support Department can be reached by telephone at (510) 608-2400 or by FAX at (510) 745-7715. Current hours of operation, which are subject to change, are from 6:00 a.m. to 6:00 p.m. Pacific Time, Mondays through Fridays, **excluding U.S.A. national holidays.**

Included with the shipment of most MYLEX products is a System Problem Report (SPR) form. When contacting the Technical Support Department for assistance with an installation or compatibility problem, we recommend that this form be completed and sent by facsimile or mail to MYLEX. Completion of this form will allow our Technical Support Department to solve most technical problems expeditiously.

Mylex will make reasonable efforts to address compatibility problems which may arise with respect to third party products, but shall not be responsible for the compatibility of its products with the products of any third party. Customers are advised to verify each products compatibility with their installation before committing to any particular procurement plan.
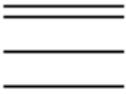
WARRANTY REGISTRATION CARD

To validate your warranty and receive any future updates concerning your product, you must complete and return this Warranty Registration Card within 10 days of purchase. (Please Print)

NAME: _____ COMPANY: _____

ADDRESS: _____ CITY: _____

STATE: _____ ZIP CODE: _____ COUNTRY: _____

TELEPHONE: _____ FAX NO: _____

DATE PURCHASED: _____ MODEL NO: _____ SERIAL NO: _____

PURCHASED FROM: _____

ADDRESS: _____ CITY: _____

STATE: _____ ZIP CODE: _____ COUNTRY: _____

In order for Mylex to better serve your needs, please complete the following:

1. How did you first learn about MYLEX products?
   ❏ Advertisement (Name of Pub) _____ ❏ Article Review ❏ Friend
   ❏ Retailer _____ ❏ Salesperson ❏ Other

2. Where will this product be used?
   ❏ Home ❏ Workplace

3. What other brands, if any, did you consider? _____

4. Please indicate the most common uses of your system:
   ❏ Personal ❏ Business ❏ Graphics (CAD/CAM or Business Graphics) ❏ Accounting
   ❏ Data Retrieval ❏ Multi-User ❏ Multi-Tasking ❏ Database

5. Which factor most influenced your purchase?
   ❏ Company Reputation ❏ Price ❏ Features (List) _____ ❏ Performance

6. What does your computer system include? (Please specify brand and model)
   ❏ System Unit _____ ❏ Peripherals _____
   ❏ Color Monitor _____ ❏ Monochrome Monitor _____

7. What add-ons or peripherals are you most considering for future purchase? _____

8. What best describes your occupation?
   ❏ Management/Administration ❏ Sales/Service ❏ Technical-Scientific/Engineering ❏ Student ❏ Other

9. Do you have any comments or suggestions? _____

10. Have you ever purchased Mylex products in the past?
    ❏ Yes ❏ No
    If yes, which products? _____

11. Who purchased this product?
    ❏ Individual ❏ Company

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mYLEX

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