

StorageWorks
RAID Array 200 Subsystems
Controller Installation and
Standalone Configuration Utility
User's Guide

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Revision Record

This Revision Record provides a concise publication history of this manual. It lists the manual revision levels, release dates, and reasons for the revisions. It also describes how the changes to affected pages are marked in the manual.

The following revision history lists all revisions of this publication and their effective dates. The publication part number is included in the Revision Level column, with the last entry denoting the latest revision. This publication supports StorageWorks RAID Array 200 Subsystems.

Revision Level	Date	Summary of Changes
EK–SWRA2–IG. A01	April 1994	Original release. This release supports 1- and 3- channel EISA RAID controllers and the StorageWorks RAID Array 200 Standalone Configuration Utility.
EK–SWRA2–IG .B01	January 1995	This release adds support for 1- and 3- channel PCI RAID controllers.
EK–SWRA2–IG .C01	April 1995	This release adds <i>Chapter 9, Upgrading</i> , and <i>Appendix A, Installing Controller Options</i> . Organizational changes in Chapters 3, 6 and 7 simplify user operations by separating first time installation procedures from configuration change routines. Chapter 9 now contains all the rarely needed firmware upgrade procedures.

About This Guide

This section identifies the audience of this guide and describes the contents (chapter by chapter) and structure. In addition, this section includes a list of associated documents and the conventions used in this guide.

The StorageWorks RAID Array 200 Controller Installation and Standalone Configuration Utility User's Guide

This guide describes how to install a 1- or 3-channel, EISA, or PCI controller, and how to use the standalone configuration utility to configure and maintain an array of disks.

Intended Audience

This guide is written specifically for anyone who installs, configures, and operates StorageWorks RAID Array 200 Subsystems. You should be familiar with the following:

- System management of personal computers
- Basic hardware installation procedures
- System/EISA Configuration Utility
- SCSI devices
- Basic SCSI, RAID, and personal computer terminology

If you are not familiar with the above, contact your service representative for installation assistance.

Organization

This guide contains the following:

Chapter 1: Overview of RAID and the RAID Array 200

Overview of RAID and the RAID Array 200 discusses the definition of RAID, the different levels, key concepts, and also describes StorageWorks RAID Array 200 Subsystems.

Chapter 2: Preparing to Install

Preparing to Install defines the user-supplied hardware and software requirements, and provides preliminary procedures required prior to installing the subsystem including inventorying the components of a StorageWorks RAID Array 200 Subsystem. Chapter 2 also contains a tabular guide for installing the subsystem for the first time.

Chapter 3: Updating EISA Information

This chapter describes how to run the EISA Configuration Utility (ECU), and update your EISA information appropriately for the addition of your EISA-based RAID Array 200 Subsystem.

Chapter 4: 1-Channel RAID Controller Installation

1-channel RAID Controller Installation describes how to prepare a 1-channel, EISA or PCI controller for installation into your system, and how to install it. This chapter also describes how to attach the cable to connect the controller to an external storage enclosure, and how to connect the power cable to an external storage enclosure.

Chapter 5: 3-Channel RAID Controller Installation

3-channel RAID Controller Installation describes how to prepare a 3-channel, EISA or PCI controller for installation into your system, and how to install it. This chapter also describes how to attach the cable to connect the controller to an external storage enclosure, and how to attach the power cable to an external storage enclosure.

Chapter 6: Configuring Your Array

Configuring Your Array describes how to determine the version of your controller firmware, set controller parameters, and set fault management and battery backup options. This chapter also specifies how to configure your disk drive resources for the first time into drive groups, logical RAID drives, and hot spare drives, using either an automatic or interactive process.

Chapter 7: Maintaining the Array with the Standalone Configuration Utility

Maintaining the Array with the Standalone Configuration Utility describes how to use the standalone configuration utility to view the configuration of a RAID Array 200 subsystem, change its configuration, run parity check, perform tasks with the drives such as formatting and manually failing, and also rebuild a redundant logical RAID drive after a drive failure.

Chapter 8: Troubleshooting

Troubleshooting describes the storage enclosure status LEDs, methods for troubleshooting a variety of situations that you may encounter, and removal and replacement of storage enclosure components.

Chapter 9: Upgrading

This chapter describes how to upgrade the firmware for your EISA, or PCI RAID controller, and also how to update the BIOS for an intel-based system containing an EISA controller.

Appendix A: Installing Controller Options

Installing Controller Options provides procedures for installing cache memory in EISA RAID controllers and cache memory and battery backup on PCI RAID controllers.

NOTE

The Configuration Utility (and this document) uses the term 'MB' or 'megabyte' to mean 2^{20} or 1,048,576 bytes. The Configuration Utility reports only the formatted capacity.

Conventions

This guide uses the following conventions:

Style	Meaning
boldface monospace type	To be input by the user
plain monospace type	Screen text
<i>italic type</i>	For emphasis, manual titles, utilities, menus, and filenames

Special Notices

This guide uses in the following to emphasize specific information.

WARNING

WARNING indicates the presence of a hazard that can cause personal injury if the hazard is not avoided.

CAUTION

CAUTION indicates the presence of a hazard that might damage hardware or corrupt software.

NOTE

Notes provide additional information.

Related Documentation

Refer to the *RAID Array 200 Online Management Utility for your operating system User's Guide* for information on your operating system drive load procedure and the online management utilities.

Overview of RAID and RAID Array 200 Subsystems

This chapter presents definitions and descriptions of RAID (Redundant Array of Independent Disks) subsystems, including the levels of RAID available to users of StorageWorks RAID Array 200 Subsystems.

1.1 What is RAID?

Hardware RAID (Redundant Array of Independent Disks) is a set of multiple disk drives and a specialized array controller that manages how data is distributed across the disk drives.

Data for a given file is divided into segments (a group of blocks), which can be written across multiple drives. By utilizing more than one drive, RAID arrays provide three main benefits:

- Improved data availability through redundant configurations (RAID levels 1, 0 + 1, and 5)
- Improved I/O performance, higher data transfer rates compared to a single drive
- Increased scalability

1.1.1 Implementing RAID through Hardware, or through Software

RAID can be implemented in storage subsystems through dedicated hardware, or through software. In a hardware implementation the RAID algorithms run on the controller board attached to your server I/O bus. In a software implementation, the RAID algorithms run on your server CPU in concert with the operating system.

Hardware-based RAID promises the highest performance over the widest range of application loads. With Software-based RAID, the overhead of the RAID software increases as the load on the system increases. (This is especially true after a disk failure, when the original data must be reconstructed.) Therefore, the application software and the RAID software end up competing for host CPU cycles.

With software RAID, maximum request rates during reconstruction will be significantly lower, and reconstruction may take many more hours than with hardware-based RAID. Hardware-based RAID keeps reconstruction overhead off the CPU, minimizing the impact of drive failure on server operations. The possibility that software-based RAID will cost less is a compelling factor only if your system loads are consistently light, with few or no peak periods.

1.1.2 RAID Levels

This section describes only the RAID levels that StorageWorks RAID Array 200 Subsystems support. For information about RAID levels not described here, see *The Digital Guide to RAID Storage Technology*, EC-B1960-45.

StorageWorks RAID Array 200 Subsystems support the following RAID levels:

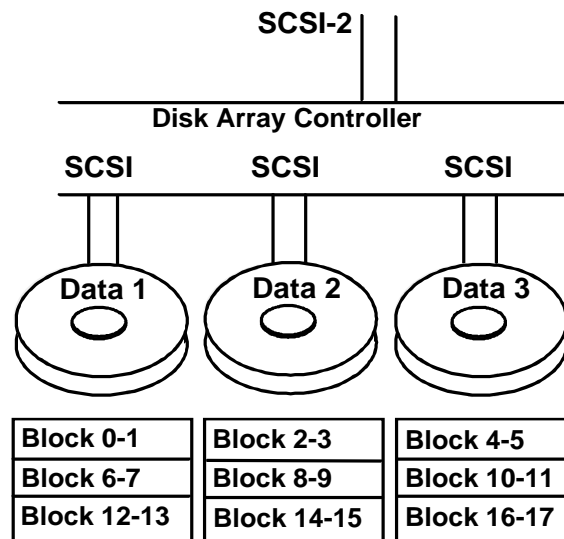
- RAID 0
- RAID 1
- RAID 0 + 1
- RAID 5
- Just a Bunch of Disks (JBOD)

1.1.2.1 RAID 0

RAID 0 writes data across the drives in the array, one segment at a time, as shown in Figure 1–1. This is known as striping.

Striping offers a high I/O rate when compared to the I/O rate of a single disk. RAID 0 does not provide redundancy, therefore, if any drive fails all data is lost. (Other RAID levels provide redundancy by generating array parity information for reconstructing data if a drive fails, or by mirroring disks).

Figure 1–1 RAID 0



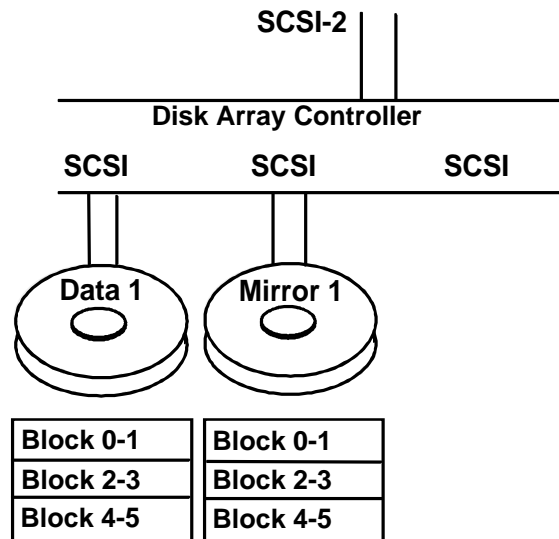
In figure 1–1 segments are defined as two blocks of 512 bytes each. Therefore, blocks 0 and 1 are written to data disk 1, blocks 2 and 3 are written to data disk 2 and so on.

1.1.2.2 RAID 1

RAID 1 writes a segment of data to two drives simultaneously, as shown in Figure 1–2. This is the simplest way to achieve data redundancy, known as mirroring. If one drive fails the controller can retrieve the data from the other drive in that set.

The cost of data storage is greater than for a single drive, since double the disk space is required. However, RAID 1 is a consideration for users where reliability is most important.

Figure 1–2 RAID 1



In Figure 1–2 each segment is defined as 2 blocks of 512 bytes each.

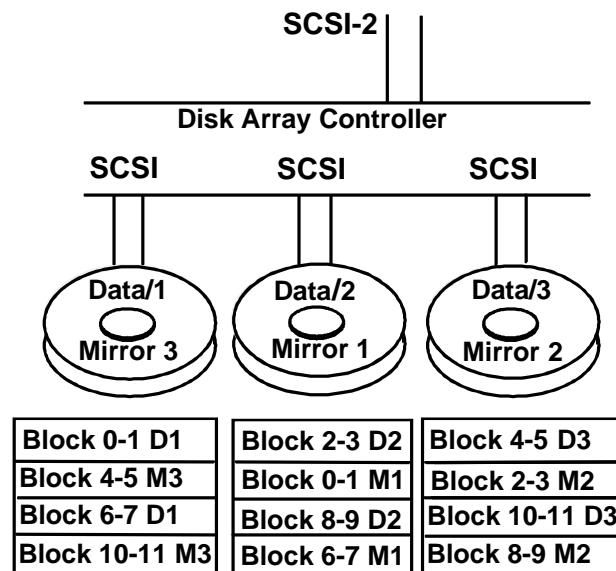
1.1.2.3 RAID 0 + 1

RAID 0 + 1 is a combination of striping and mirroring data, as shown in Figure 1–3.

RAID 0 + 1 writes data across the drives in the same striping fashion as RAID 0, and achieves redundancy by mirroring data similar to RAID 1. In RAID 0 + 1, unlike RAID 1, the data disks are also the mirror disks. RAID 0 + 1 mirrors data back onto the data disks rotated by 1 drive. Therefore, you can use an odd number of drives in a RAID 0 + 1 configuration whereas you need an even number of drives in a RAID 1 configuration.

You can continue to access data in a RAID 0 + 1 configuration with a single drive failure. However, you can not recover data in the event of multiple drive failures.

Figure 1–3 RAID 0 + 1

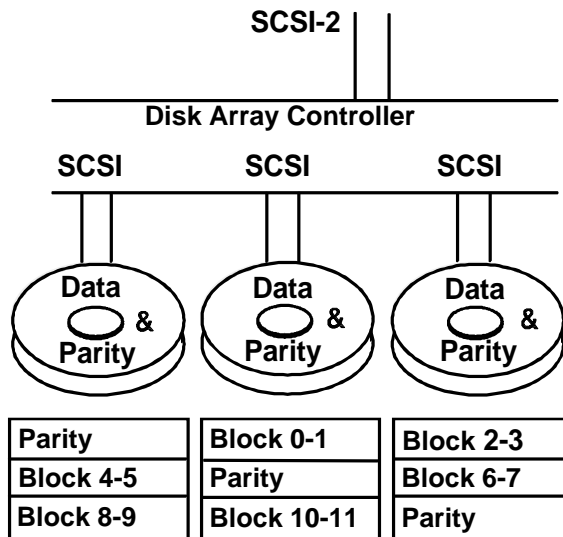


In Figure 1–3 each segment is defined as two blocks of 512 bytes each. Also, D1 refers to data disk 1, and M1 to mirror disk 1.

1.1.2.4 RAID 5

RAID 5 combines striping (writing data across a set of drives) and redundancy, as shown in Figure 1–4. RAID 5 provides redundancy by generating parity information. RAID 5 stripes both segments of data and parity information. If a single drive fails in a RAID 5 array, you can continue to use the array normally since the array controller automatically regenerates the data from the failed drive using data and parity blocks from other operational drives. All data remains accessible even when one drive fails. However, you can not recover data in the event of multiple drive failures.

Figure 1–4 RAID 5



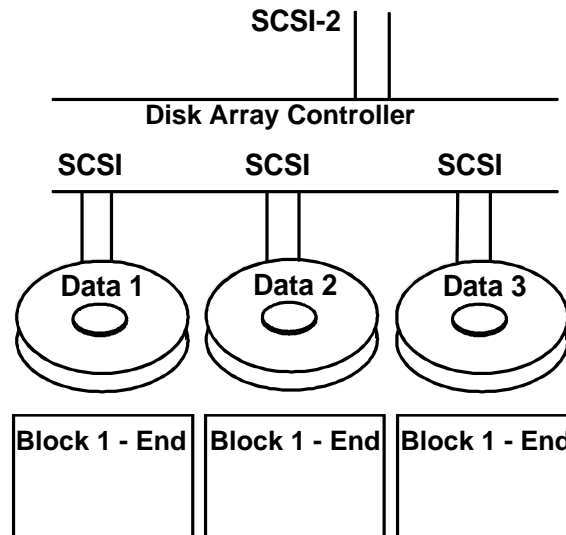
In Figure 1–4 each segment is defined as two blocks of 512 bytes each.

1.1.2.5 JBOD

JBOD (Just a Bunch Of Drives) allows you to install and access a disk in a StorageWorks RAID Array 200 Subsystem as a conventional disk drive. Figure 1–5 shows a JBOD configuration.

As with any non-RAID drive configuration, JBOD does not provide data redundancy.

Figure 1–5 A JBOD Configuration



1.2 Key Concepts

The following sections define key terminology used to describe and operate RAID arrays, or StorageWorks RAID Array 200 Subsystems.

1.2.1 Disk array

Disk array, or array refers to a set of disk drives and a specialized array controller. The array controller keeps track of how data is distributed across the drives.

1.2.2 Drive group

Drive group refers to a set of physical drives defined and addressed by the controller as a single unit.

1.2.3 Logical RAID drive

A logical RAID drive refers to an amount of storage space presented to the host operating system as a single storage device. Logical RAID drives differ from conventional storage devices in that the storage space of a logical drive is usually spread out over multiple disk drives (a drive group). In addition, logical RAID drives can provide redundancy. RAID 1, RAID 0 + 1 and RAID 5 configurations provide redundancy.

1.2.4 Write Caching

Write caching determines what procedure the logical drive controller uses to write data to the logical drive. StorageWorks RAID Array 200 Subsystems support the following write caching methods:

- *Write-Back caching*
- *Write-Through caching*

1.2.4.1 Write-Back caching

Write-Back caching refers to a caching policy in which the controller acknowledges that a write operation has completed successfully before data is written to the disks. If you choose this caching policy, you may increase the I/O performance of your RAID subsystem, but if there is a power failure with no battery backup, you risk losing the data in cache that is not yet written to the disks.

1.2.4.2 Write-Through caching

Write-Through caching refers to a caching policy in which the data is written to disk before the controller acknowledges that a write operation has completed successfully. If you choose this caching policy and there is a power failure without battery backup, you minimize the chance of data loss.

1.2.5 Hot Swapping

Hot swapping refers to the ability, in enclosures supporting StorageWorks fault management, to swap in a new drive as a replacement for a failed drive in a redundant configuration, while the subsystem power is turned-on, and connected to the system. All Digital storage enclosures, which are part of the RAID Array 200 Subsystems, support StorageWorks fault management signals.

These signals, provided on the backplanes of the shelves and supported by the RAID controller, allow the controller to “know” when a drive fails, and when the drive has been replaced so that automatic rebuilds occur for redundant RAID levels.

1.2.6 Hot Spare

Hot spare refers to a drive configured into the system to automatically replace a failed drive. If a disk fails in a redundant RAID level logical RAID drive, the hot spare will automatically replace the failed drive and the controller will rebuild from the remaining drives of the logical RAID drive.

1.3 About the Storage Works RAID Array 200 Subsystems

These unique products, ideal for desktop systems or workgroup servers, provide the power and flexibility of controller-based RAID with the scalability of StorageWorks packaging. StorageWorks RAID Array 200 Subsystems offer a broad choice of packaging and RAID levels that allow you to configure a powerful and flexible high-availability storage solution that meets your unique needs.

StorageWorks RAID Array 200 Subsystems offer the following features:

- Industry-standard EISA, or PCI bus interfaces
- Fast SCSI drive interface (single-ended, 10 MB/second maximum transfer rate for SWXCR-Ex, 20 MB/second for SWXCR-Px)
- 1 or 3 SCSI channels
- Support for multiple SWXCR controllers
 - RAID level 0, 1, 0 + 1, 5, and JBOD configurations
- 4 to 32 MB of read/write cache
- Multiple hot spare disk drives
- Hot swapping of disk drives
- Hot swapping of fans
- Mixed drive types within drive groups
- Mixed RAID levels within drive groups

1.3.1 StorageWorks RAID Array 200 Subsystem Components

A complete StorageWorks RAID Array 200 Subsystem includes the following hardware and software components:

Hardware

- An array of disks in storage enclosures
- A specialized array controller for implementing a RAID set

Software

- The RAID Array 200 Standalone Configuration Utility
- The RAID Array 200 Online Management Utility for each supported operating system.

1.3.2 An Array of Disks in a Storage Enclosure

StorageWorks RAID Array 200 Subsystems support the use of between 1 and 21 disk drives: (See Release Notes for a list of supported disk drives with part numbers.)

You can install these drives in a StorageWorks storage pedestal; or your system's internal storage enclosure.

1.3.3 A Specialized Array Controller for Implementing a RAID Set

StorageWorks RAID Array 200 Subsystems use a controller that combines the functionality of a RAID controller and a host adapter into a single, low-cost module that you install directly into your system. The StorageWorks RAID Array 200 RAID controllers come in the following configurations for computers with an EISA, or PCI bus:

EISA-bus

- SWXCR-EA 1-channel unit, supporting up to 7 disk drives
- SWXCR-EB 3-channel unit, supporting up to 21 disk drives

PCI-bus

- SWXCR-PA 1-channel unit, supporting up to 7 disk drives
- SWXCR-PB 3-channel unit, supporting up to 21 disk drives

1.3.4 The RAID Array 200 Standalone Configuration Utility

The RAID Array 200 Standalone Configuration Utility is MS-DOS, bootable software for Intel systems and ARC compliant for AXP systems. Use the standalone configuration utility to do the following:

- Configure your array (automatically or interactively) by:
 - Creating drive groups on which to configure logical RAID drives
 - Creating logical RAID drives by selecting RAID level, drive group and related parameters
- View or change your configuration
- Maintain the array
- Save and restore controller configuration
- The standalone utility also comes with a separate utility for you to use to update controller BIOS and controller firmware

1.3.5 The RAID Array 200 Online Management Utility for Your Operating System

The RAID Array 200 Online Management Utility runs with your operating system and allows you to do the following:

- Monitor the status of the array and receive alerts when the status changes
- Maintain the array
- Check and repair parity

Preparing to Install

This chapter presents the system requirements and, a detailed overview of the procedures required to install a StorageWorks RAID Array 200 Subsystem with an EISA or PCI bus.

2.1 Installation Overview

Thank you for purchasing a StorageWorks RAID Array 200 Subsystem.

Installing a StorageWorks RAID Array 200 Subsystem requires the following steps:

- Preparing to install
- Adding a controller entry to the EISA system configuration file (EISA RAID controllers only)
- Installing the RAID controller into your system
- Installing the storage enclosure (if applicable)
- Connecting the RAID controller and storage enclosure
- Setting controller options and parameters
- Configuring the Array
- Installing the online management utility for your operating system

Follow the chapters of this guide in the sequence described in Table 2–1 to install your controller for the first time.

Go to Chapter 9, to upgrade your controller's firmware or BIOS.

Table 2-1 Roadmap for Installing Your RAID Array 200 Subsystem for the First Time

Number of Channels	EISA	PCI
1-channel	Chapter 2 Preparing to Install Chapter 3 Updating EISA Information Chapter 4 Installing a 1-Channel Controller Chapter 6 <ul style="list-style-type: none">• Determining version of Controller firmware• Setting Controller Parameters• Configuring Your Array	Chapter 2 Preparing to Install Chapter 4 Installing a 1-Channel Controller Chapter 6 <ul style="list-style-type: none">• Determining version of Controller firmware• Setting Controller Parameters• Configuring Your Array
3-channel	Chapter 2 Preparing to Install Chapter 3 Updating EISA Information Chapter 5 Installing a 3-Channel Controller Chapter 6 <ul style="list-style-type: none">• Determining version of Controller firmware• Setting Controller Parameters• Configuring Your Array	Chapter 2 Preparing to Install Chapter 5 Installing a 3-Channel Controller Chapter 6 <ul style="list-style-type: none">• Determining version of Controller firmware• Setting Controller Parameters• Configuring Your Array

In addition to the chapter sequences specified in this table for installing your RAID Array 200, see the section in the *RAID Array 200 Online Management Utility for your operating system User's Guide* to install the online management utility.

2.2 Preparing to Install

You will need the following to install a StorageWorks RAID Array 200 Subsystem:

- A user supplied computer system
 - The associated system hardware manual
 - Appropriate tools to service your computer
 - Your System EISA Configuration Utility (ECU) diskette (EISA systems only)
- A user supplied operating system which supports StorageWorks RAID Array 200 Subsystems
- A StorageWorks RAID Array 200 Subsystem RAID controller, 1- or 3-channel, EISA or PCI
- A StorageWorks storage enclosure, or internal storage enclosure, and disk drives
- Appropriate connecting cables
- The RAID Array 200 Standalone Configuration Utility
- The RAID Array 200 Online Management Utility for your operating system

Before starting the installation, follow these steps:

- Verify the availability of user-supplied hardware and software
- Inventory what you received with the StorageWorks RAID Array 200 Controller kit and StorageWorks Storage Enclosure
- Verify the cables required for your subsystem configuration
- Back up your system disk, and make backup copies of your RAID Array 200 Standalone Configuration and Online Management for your operating system utilities diskettes

2.2.1 Verifying User Supplied Hardware and Software (System Requirements)

StorageWorks RAID Array 200 Subsystems require the following user-supplied hardware and software:

- Intel or AXP-based computer
 - A 3.5", 1.44 MB Floppy drive
 - Available EISA slots, either:
 - 1 slot required for a 1-channel EISA controller
 - (an additional slot (EISA, PCI or I/O punch out) required for a 3-channel PCI controller)
 - Available PCI slots
 - 1 slot required for either a 1- or 3- channel PCI controller
 - (an additional slot (EISA, PCI or I/O punch out) required for a 3-channel PCI controller)
 - 1–2 MB of disk space for installation and regular use
- One of the following operating systems (See supplier for supported platforms):
 - OpenVMS for AXP systems
 - Microsoft Windows NT for AXP systems
 - DEC OSF/1 for AXP
 - Microsoft Windows NT for Intel systems
 - SCO UNIX
 - Novell NetWare

2.2.2 Verifying the Controller Kit and Storage Enclosure

The specific components of the controller kit and storage enclosure vary depending upon whether you purchased a 1- or 3-channel controller and depending upon for which bus, and operating system you purchased it. The following Sections 2.2.2.1 and 2.2.2.2 specify the components you will receive for each subsystem configuration.

2.2.2.1 The Controller Kit

The Storage Works RAID Array 200 Subsystem controller kit includes the following components:

- One RAID controller, 1- or 3-channel, EISA or PCI
- One RAID Array 200 Standalone Configuration Utility
- RAID Array 200 Online Management Utilities for operating systems supported on Alpha-based systems, or on Intel-based systems
- The RAID Array 200 Online Management Utility for operating system user's guides
- This guide

2.2.2.2 The Storage Enclosure

The number of StorageWorks Storage Enclosures and disk drives that you received depends upon what you purchased for external storage capacity. See your storage enclosure's user's guide and packing list for a complete list of the components that come with the storage enclosure. Check your system documentation for information on internal storage resources.

2.2.3 Verifying the Cables Required for your Subsystem Configuration

Tables 2–2 and 2–3 describe the cables required to connect an EISA or PCI controller to an external storage enclosure. You order these cables separately; (see the Release Notes for current part numbers) they do not come as part of the purchase of your controller or storage enclosures.

Check your system documentation to determine what cables to purchase to connect your controller to internal storage.

Table 2-2 Required Cables for EISA Controllers

EISA Controller	Required Cables
1-channel controller	one 2 meter SCSI cable
3-channel controller	<ul style="list-style-type: none">• three 2 meter SCSI cables• one cable and bulkhead connector kit

Table 2-3 Required Cables for PCI Controller

PCI Controller	Required Cables
1-channel controller	one 1.5 meter SCSI cable
3-channel controller	<ul style="list-style-type: none">• three 1.5 meter SCSI cables• one 0.5 meter internal cable bulkhead assembly

2.2.4 Backing up Your System

Follow your normal procedures to back up your system disk before installing the subsystem and RAID utilities. In addition, make backup copies of your RAID Array 200 Standalone Configuration and Online Management utilities diskettes.

This completes the preparing to install procedures. Now you can begin the installation.

To install an EISA RAID controller go on to Chapter 3 to update your EISA configuration file.

To install a PCI RAID controller go on to Chapter 4 to install a 1-channel controller, or to Chapter 5 to install a 3-channel controller.

To upgrade your controller's firmware or BIOS, go to Chapter 9.

Updating EISA Information

This chapter describes the procedures required for updating EISA Configuration information on computer systems into which you install an EISA RAID controller. The procedures require you to run the EISA configuration (or system configuration) utility.

3.1 Updating EISA Information

You need to run the EISA Configuration Utility (ECU) to update the configuration information stored on nonvolatile memory in your system whenever you add or remove EISA controllers. The system BIOS uses the contents of the EISA nonvolatile memory during boot to initialize EISA controllers installed in your computer.

3.2 Running the ECU

You need to run the EISA Configuration Utility (ECU) to update the configuration information stored on nonvolatile memory in your system whenever you add or remove EISA controllers. The system BIOS uses the contents of the EISA nonvolatile memory during boot to initialize EISA controllers installed in your computer.

You need to do the following to update EISA information:

- Start the ECU
- Add new EISA boards to the ECU
- Set BIOS address and interrupt

In previous versions, certain EISA controller parameters were set through the ECU. The RAID Array 200 Standalone Configuration Utility now sets these parameters for both EISA and PCI controllers.

3.2.1 Starting the ECU

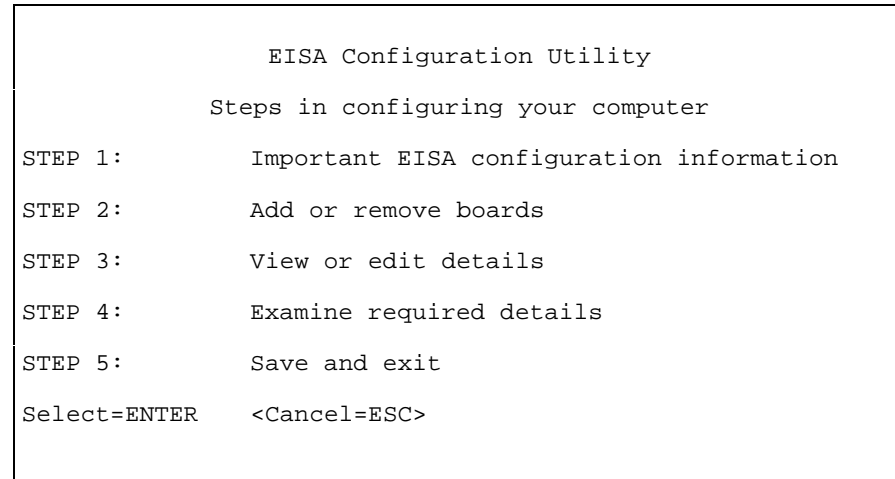
To run the ECU, follow these steps:

NOTE

ECU's differ from system to system. Check the procedures in this guide before you respond to screen prompts. For more information about using the ECU on your system, refer to your system documentation.

1. Remove the cover from your system and locate the empty EISA slots
2. Boot from your system ECU configuration diskette, for Intel-based systems. For AXP-based systems running DEC OSF/1 or VMS, boot to console prompt and type: **runecu**. For AXP-based systems running Microsoft Windows NT for AXP systems, choose *Run ECU From Floppy* from the ARC menu.
3. Select the function that configures your system and press the Enter key.
4. Follow the instructions for system configuration until a menu similar to Figure 3–1 displays on your screen.

Figure 3–1 EISA Configuration Utility Main Menu



5. Choose the Add or remove boards option (Step 2 in this example) and press the Enter key.

3.2.2 Adding a New Board to the ECU

To add a new board to the ECU, follow these steps:

1. A screen similar to the one shown in Figure 3–2 displays, listing the current EISA boards in your system. Look at your host system and find the empty EISA slots.

NOTE

The ECU screen displays only the EISA slots, not the ISA slots. The display may indicate that a slot is empty while in fact the board slot actually contains an ISA board. You must look at the slots.

Figure 3–2 The Add or Remove Board Screen

```

                Step 2:  Add or remove boardsHelp=F1
Listed are the boards and options detected in your
computer.
♦              To add boards or options which could not be
                detected, or which you plan to install, press
                Insert key.
♦              To move the highlighted board to another slot,
                press the F7 key.
♦              To remove the highlighted board from the
                configuration, press the Del key.
When you have completed this step, press the F10 key.
Slot  1 (Empty)
Slot  2 (Empty)
Slot  3 (Empty)
Slot  4 (Empty)
Slot  5 (Empty)
Slot  6 (Empty)
Add=INSERT    <Remove=DEL>    <Move=F7>    <Done=F10>
```

- To install an SWXCR-EA 1-channel controller, you need one empty EISA slot.
- To install an SWXCR-EB 3-channel controller, you need two empty EISA slots in close proximity, for cabling purposes, during the hardware installation. (If your system has additional punchout slots to accommodate SCSI channels, you need only one EISA slot).

2. Use your arrow keys to select an empty slot for the 1-channel controller and press the Insert key. The ECU displays a screen similar to Figure 3–3.

Figure 3–3 The Add Board Screen

```
Step 2: Add or remove boardsHelp=F1

Add

To add a board to the list, you must locate the diskette
containing the boards configuration (.CFG) file.

• If there is an option configuration diskette included
  with your board or option, insert that diskette and press
  ENTER.

• CFG files for many popular boards are on the SYSTEM
  CONFIGURATION diskette. To look for your .CFG file there,
  press ENTER.

• Other .CFG files are contained on the .CFG FILE LIBRARY
  diskette. To look for your .CFG file there, insert that
  diskette and press ENTER.

>Ok=ENTER<<Cancel=ESC>
```

3. Remove the ECU diskette and insert the RAID Array 200 Standalone Configuration Utility diskette for your operating system (this diskette contains the .CFG files) and press the Enter key. The ECU displays an add configuration file screen similar to Figure 3–4.

NOTE

The .CFG file on the RAID Array 200 Standalone Configuration Utility diskette is the most current .CFG file. Use this instead of any versions that may be on your system ECU diskette.

Figure 3-4 The Add Configuration File Screen

```
Step 2:  Add or remove boardsHelp=F1
        Add Configuration (CFG) file
Select a file to add.
Directory:  A:\*.CFG
!MLX0077.CFG Digital SWXCR-EA (1-ch) EISA RAID Cntlr
(Generic)
!MLX0075.CFG Digital SWXCR-EB (3-ch) EISA RAID Cntlr
(Generic)
AMLX0077.CFG SWXCR-EA (1-ch) EISA RAID Cntlr for OSF, VMS
AMLX0075.CFG SWXCR-EB (3-ch) EISA RAID Cntlr for OSF, VMS

Select=ENTER    (Sort=F6)    (Directory=F7)    (Cancel=ESC)
```

4. Select the appropriate .CFG file for your RAID controller as follows and press the Enter key:
 - Select !MLX0077.CFG for a 1-channel controller in an Intel-based computer running any operating system, or installed in an Alpha running Microsoft Windows NT for AXP systems
 - Select !MLX0075.CFG for a 3-channel controller in an Intel-based computer running any operating system, or installed in an Alpha running Microsoft Windows NT for AXP systems
 - Select AMLX0077.CFG for a 1-channel controller in an Alpha running OpenVMS for AXP systems, or DEC OSF/1
 - Select AMLX0075.CFG for a 3-channel controller in an Alpha running OpenVMS for AXP systems, or DEC OSF/1The utility displays a screen similar to Figure 3-5.

Figure 3–5 The Insert Diskette Screen

```
Destination Diskette

Insert the SYSTEM CONFIGURATION diskette.

Ok=ENTER      <Cancel=ESC>
```

5. Remove the RAID Array 200 Management Utility diskette, insert the ECU diskette, and press the Enter key. The ECU displays an add confirmation screen similar to Figure 3–6.

Figure 3–6 The Add Board Confirmation Screen

```
Step 2: Add or remove boards

Add confirmation

Board Name:Digital SWXCR-EA (1-ch) EISA RAID Cntlr
(Generic)

Ok=ENTER      <Cancel=ESC>
```

6. Press the Enter key to confirm the .CFG file. The ECU displays an add slot screen similar to Figure 3–7.

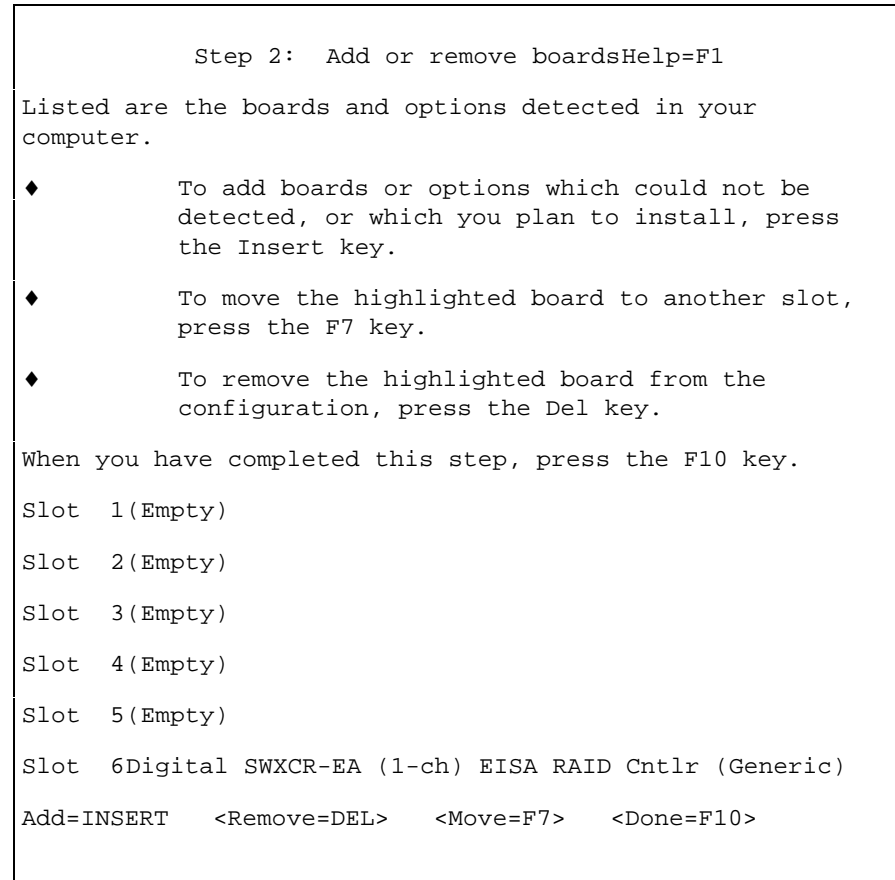
Figure 3–7 The Add Slot Screen

```

                                Add
Select an acceptable slot for the board and press ENTER.
Slot  1 (Empty)
Slot  2 (Empty)
Slot  3 (Empty)
Slot  4 (Empty)
Slot  5 (Empty)
Slot  6 (Empty)
The (→) indicates an acceptable slot for the board
>Ok=Enter<<Cancel=ESC>
```

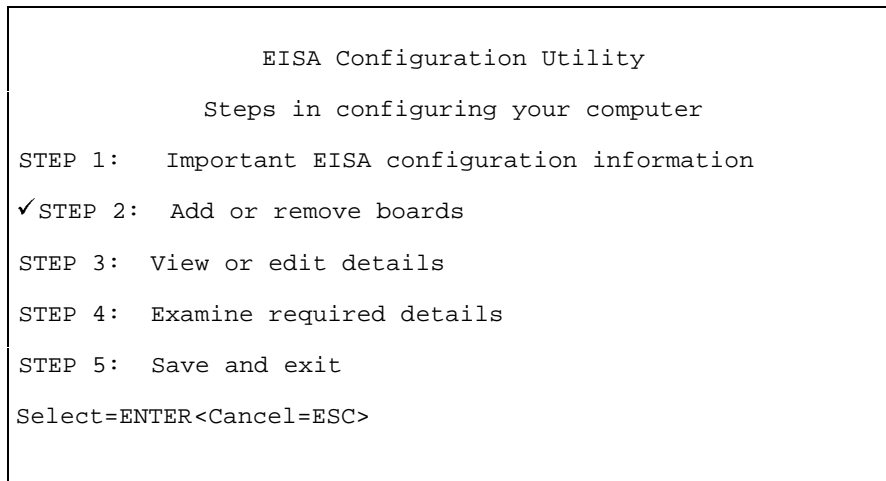
7. Select the slot where you want to install the controller (the slot appears highlighted) and press the Enter key. Figure 3–8 shows Slot 6 selected for the installation.

Figure 3–8 Add Slot Step 2



8. Press the F10 key. The *Steps in configuring your computer* menu appears similar to Figure 3–9.

Figure 3–9 The ECU Main Menu



3.2.3 Setting BIOS Address and Interrupt

The .CFG file that you copied during the *Add or remove boards* procedure sets the BIOS and Interrupt parameters with default values. You may need to change these settings as described in Steps 2 and 3.

NOTE

The *Add or remove boards* procedure sets the BIOS for Intel-based systems only; Alpha systems do not use the BIOS

1. Select the View or edit details option Step 3 in the sample screen shown in Figure 3–9 and press the Enter key. Scroll through the file until you find the slot number for the controller you are installing. The information for a 1-channel board appears similar to Figure 3–10. If installing a RAID controller in an Alpha system, go on to Step 3.

Figure 3–10 ECU Details for a 1-Channel Controller

BIOS (16K)	Base Address 0CC000H - Default	
Interrupt	Interrupt 11 (edge) - Default	
Edit=ENTER	<Edit Resources=F6>	<Advanced=F7>
<Done=F10>		

The display for a 3-channel board installation differs slightly.

2. Intel systems boot from the adapter board with the lowest BIOS address. If your system boots off an EISA adapter board, then you need to view the BIOS address of all the controllers installed in your system to make sure that the adapter from which you boot has the lowest BIOS address.
3. If your system already has more than one board installed, the ECU should assign a different interrupt to the new board you are installing. However, you can change the interrupt if you need to. Before you select an interrupt option, consult your system and operating system documentation to ensure that your system supports interrupts.

You can use the following interrupts to configure the RAID controller:

NOTE

OpenVMS for AXP systems and DEC OSF/1
support Edge Interrupts only

11 Level

11 Edge

12 Level

12 Edge

14 Level

14 Edge

15 Level

15 Edge

(Do not use Interrupt 15 for Novell NetWare. If the ECU assigns 15 to the RAID controller and you plan to use Novell NetWare, you will need to change the interrupt level.)

4. Press the F10 key when you finish setting these parameters. The *Steps in configuring your computer* appears similar to Figure 3-11.

Figure 3–11 The ECU Main Menu

```

                                EISA Configuration Utility
                                Steps in configuring your computer
STEP 1:  Important EISA configuration information
✓ STEP 2:  Add or remove boards
✓ STEP 3:  View or edit details
STEP 4:  Examine required details
STEP 5:  Save and exit
Select=ENTER      <Cancel=ESC>
```

5. Select the *Save and exit* option (Step 5 in this example) and press the Enter key. A save and exit screen appears similar to Figure 3–12.

Figure 3–12 The Save and Exit Screen

```
Step 5:  Save and Exit Help=F1

In order to complete the configuration process, you must
save your configuration. In this step, you must select
whether to save your configuration or discard your changes
before exiting this program.

If you choose to save, this program will save the new
configuration in your computer's nonvolatile memory and in
a file on your SYSTEM CONFIGURATION diskette, and then your
computer will be restarted for you.

If you choose to discard the configuration, any changes you
have made will be lost.

If you are finished configuring, remove the SYSTEM
CONFIGURATION diskette if it is in drive A and press ENTER
to restart your computer.

>Save the configuration and restart the computer.

Discard the configuration and return to the main
menu

>Select=Enter<    <Cancel=ESC>
```

6. Press Enter to save the configuration. A screen similar to Figure 3–13 appears.

Figure 3-13 The Reboot After Changing the ECU Screen

```
EISA Configuration Utility Help=F1

Your configuration file has been saved, and if possible a
backup SYSTEM.SCI file has been made on the current drive.

To complete your configuration, you must do one of the
following:

If you need to install boards or change switches and
jumpers on boards already installed, turn off your computer
and do so.

If you want to test your system or install an operating
system, press ENTER to restart your computer, run the
configuration utility again, and select the appropriate
main menu item.

If you are finished configuring, remove the SYSTEM
CONFIGURATION diskette if it is in drive A and press ENTER
to restart your computer.
```

7. Follow the directions on your screen to save and exit the ECU.
8. Remove the diskette and turn off the power to the host system, then turn on the power to the host system.

Now that you've updated the ECU, go on to Chapter 4 to install a 1-channel controller, or Chapter 5 to install a 3-channel controller.

Refer to the Roadmap, Table 2-1, for an overview of the complete installation process.

1-Channel RAID Controller Installation

This chapter contains the information needed to install either the EISA or PCI 1-Channel RAID Controller Board in a host computer.

The 1-channel RAID Controller Board combines the functionality of a SCSI-based RAID controller with the host computer's internal bus. The EISA or PCI 1-channel controllers each have two channel-0 connectors, one on the top of the printed circuit board and the second on the external connector. These connectors are electrically identical and mutually exclusive, that is, only one of the connectors can be used.

4.1 Installing the 1-Channel RAID Controller Board

CAUTION

To avoid static damage, wear a grounded wrist strap while installing the RAID controller board.

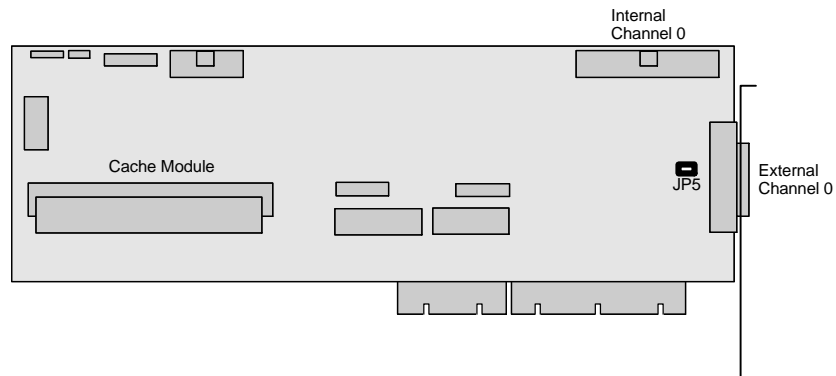
To install the RAID controller board, follow these steps.

1. Unpack the RAID controller board.
2. If the RAID controller board has uninstalled options, refer to *Appendix A* and install the options, then proceed with step 3, below.
3. Inspect the board and confirm that the jumper at JP5 is installed (for EISA - see Figure 4-1 and for PCI see Figure 4-2). This jumper terminates the SCSI bus on the host end of the bus and must be in place.
4. Install the RAID controller board in accordance with instructions in the following paragraph and your computer system manual.

EISA computer – in the slot selected when you ran the ECU

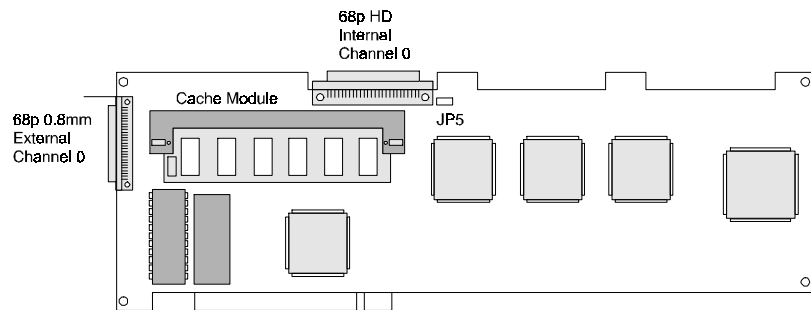
PCI computer – in any available PCI slot. When the system is powered-on, the host system will locate and establish communications with the PCI board.

Figure 4–1 Board Layout of the 1-Channel Controller (EISA Version)



MR0221

Figure 4–2 Board Layout of the 1-Channel Controller (PCI Version)



200-02

To perform the physical installation of the RAID Controller board, take precautions to protect the board from static discharge and follow these steps:

CAUTION

To protect the board from static discharge, wear an electrostatic discharge (ESD) wrist strap.

1. Turn off the power to your computer system and attached peripherals.
2. Unscrew and take off the remove the computer cover. Refer to the computer system manual for assistance in completing this procedure.
3. Locate an available EISA or PCI bus slot (as appropriate for your system). Unscrew and remove the outside slot cover. (Save the screw.)
4. Insert the RAID Controller into the slot. Press down on the top of the card until it seats firmly.

NOTE

PCI cards are designed with their components on the opposite side of non-PCI cards

5. Secure the RAID Controller with the screw previously used to secure the slot cover.
6. Reinstall the cover on your computer.

4.2 Cabling

Cabling from the RAID controller board can be to an internally mounted storage array or to the Expansion Storage Pedestal. If the board is connected to an internal array, refer to the documentation that came with the internal array to determine that it is properly configured. When using the Expansion Storage Pedestal, the proper installation of the Shelf_OK signal jumpers must be verified. The instructions for this verification are covered in the following paragraphs. The installation shown is an example, refer to the appropriate StorageWorks Storage Pedestal User's Guide for general setup and cabling information.

4.2.1 Shelf_OK Jumper Installation and Verification

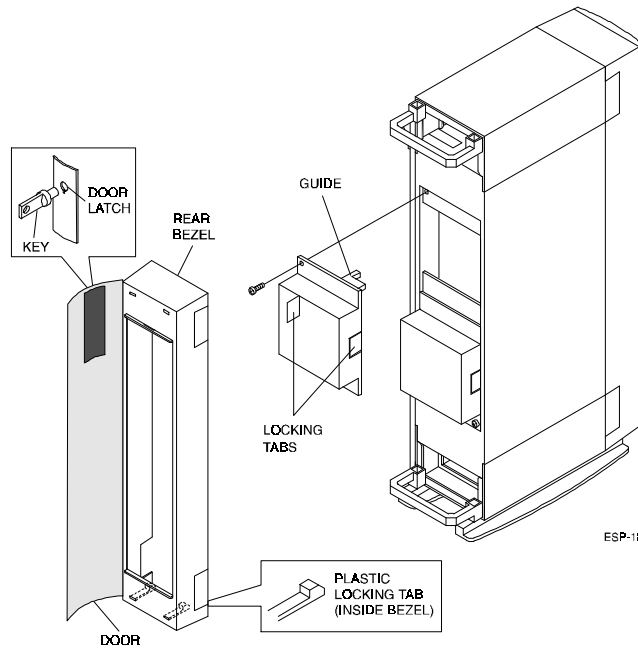
NOTE

SHELF_OK allows the fault signals from the Expansion Storage Pedestal to be fed back to the RAID Controller.

The Shelf_OK jumpers are located under the blowers on the rear of the pedestal. Use the following steps, as appropriate for your pedestal, to verify or install the jumpers.

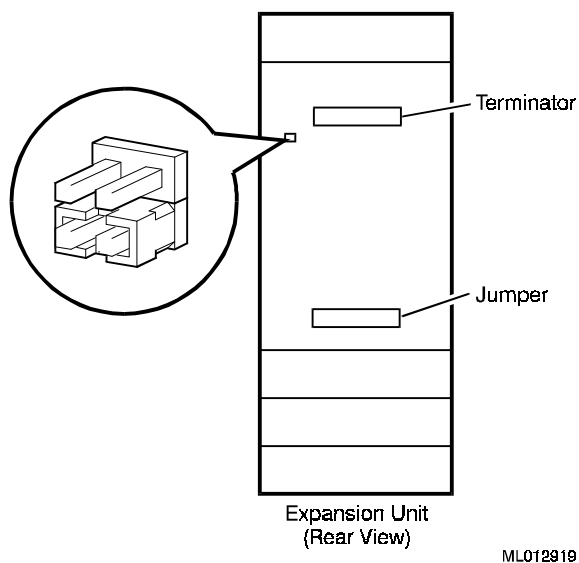
1. Open the door on the rear bezel and remove the bezel by pushing down on the locking tabs at the bottom of the bezel (see Figure 4-3).
2. Using a Phillips head screwdriver, remove the safety screw in the corner of each blower.
3. Press the side locking tabs to release the blower and pull the blower straight out to disconnect it from the power connector on the pedestal.

Figure 4-3 Removing a Blower



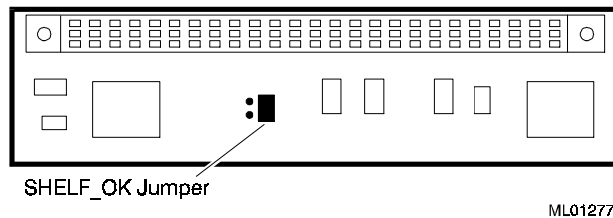
4. Determine if the pedestal's backplane has a jumper block located as shown in Figure 4-4. If it does, make sure that the pins are jumpered as shown in the balloon (this enables "Shelf_OK_External_Cables").
5. If there is no jumper block, it is necessary to remove both the SCSI backplane active terminator board and the SCSI backplane jumper board from the backplane to access the Shelf_OK jumpers.

Figure 4-4 Pedestal Backplane Active Terminator and Jumper Board Locations



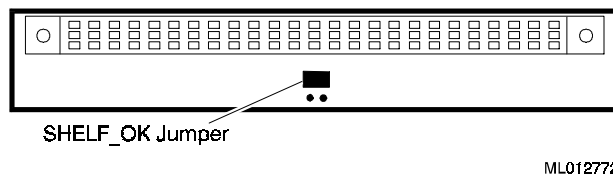
- Terminator** – Check that the SHELF_OK jumper is installed as shown in Figure 4-5.

Figure 4-5 Shelf_OK Jumper on the SCSI Backplane Terminator Board



7. **Jumper** – Check that the SHELF_OK jumper is installed as shown in Figure 4-6.

Figure 4–6 Shelf_OK Jumper on the Jumper



8. Replace both the SCSI backplane active terminator board and the SCSI backplane jumper board previously removed from the backplane.
9. Replace both blowers. Align each blower with its power connector on the pedestal's backplane and insert the blower straight in. Make sure that the locking tabs are firmly seated, and then replace the screws.

9. Replace both blowers. Align each blower with its power connector on the pedestal's backplane and insert the blower straight in. Make sure that the locking tabs are firmly seated, and then replace the screws.

4.2.2 SCSI Cable Installation

NOTE

The total length of the cabling for a specific installation should be as short as possible.

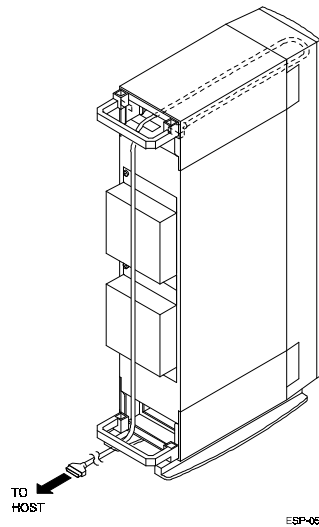
The inter-device cabling of SCSI devices is critical to proper operation of the system. A fast, narrow, single-ended SCSI bus as used in EISA and PCI applications can have a maximum length of 3 meters, including internal wiring and external cabling.

The Expansion Storage Pedestal has an internal wiring length equivalent to 1 meter of cabling, therefore, the external cabling cannot exceed 2 meters. There are three methods of routing the cable within the pedestal. Read each cable installation procedure and then choose the best one for your location, depending upon the length of the cable used and the appearance desired.

4.2.2.1 Cable Installation - Method 1

1. Open the front and rear bezel doors and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Thread one end of the SCSI cable under the rear handle of the pedestal base, and through the opening at the top of the pedestal to the front of the unit (see Figure 4-7).
3. Remove the filler panel *or* SBB from topmost slot of the pedestal.
4. Loop the cable down below the divider plate and connect the cable to connector JA1 (upper-left connector when viewed from the front) on the backplane (see Figure 4-7).
5. Replace the filler panel or SBB removed in step 2. Replace the front and rear bezels and ensure that the locking tabs snap into place at the bottom of each bezel.
6. Insert the other end of the SCSI cable into the appropriate RAID controller connector at the back of the host system.

Figure 4–7 Routing the SCSI Cable — Method 1



4.2.2.2 Cable Installation - Method 2

1. Open the front and rear bezel doors and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Remove a filler panel on the rear bezel that is closest to the host computer (see Figure 4-8).
3. Loop the cable below the divider plate and connect the cable to connector JA1 (upper-left connector when viewed from the front) on the internal side of the backplane (see Figure 4-9).
4. Replace the bezels ensuring that the locking tabs snap into place at the bottom of each bezel.
5. Insert the other end of the SCSI cable into the connector for the RAID controller (External Channel 0) at the back of the host system.

Figure 4–8 Removing a Knockout Panel

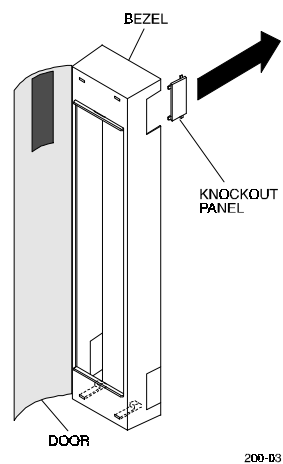
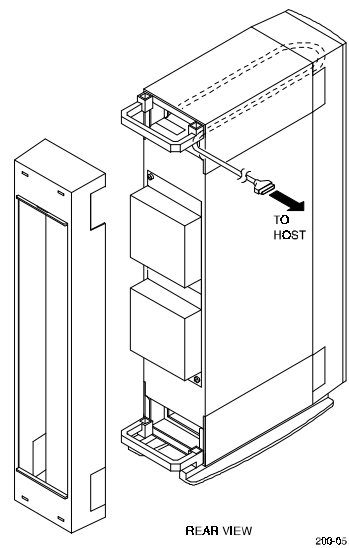


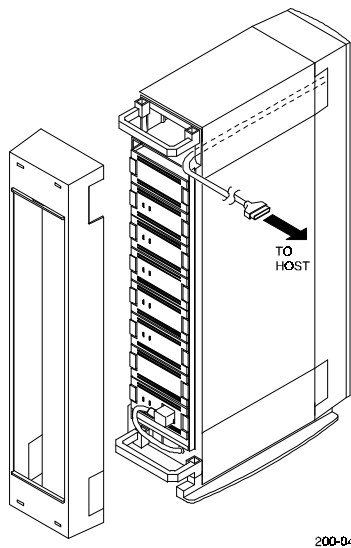
Figure 4–9 Routing the SCSI Cable — Method 2



4.2.2.3 Cable Installation — Method 3

1. Open the front and rear bezel doors and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Remove the filler panel on the front bezel that is closest to the host computer (see Figure 4-8).
3. Connect the cable to connector JA1 (upper-left connector when viewed from the front) on the internal side of the backplane (see Figure 4-10).
4. Replace the bezels ensuring that the locking tabs snap into place at the bottom of each bezel.
5. Insert the other end of the SCSI cable into the connector for the RAID controller connector (External Channel 0) at the back of the host system.

Figure 4-10 Routing the SCSI Cable — Method 3



4.2.2.4 Labeling the Installed Drives

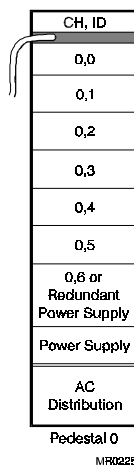
Label the disk drives that are installed in the Expansion Storage Pedestal to identify their Device Type, Channel, and SCSI ID (for example, Dev: RZ26L, CH: 0, ID: 1).

NOTE

The SCSI ID is determined by the slot number in the Expansion Storage Pedestal, as shown in Figure 4-11.

To support the Expansion Storage Pedestal's hot swap option, check the label on the power supply SBB to ensure it is BA35X-HA Rev. L01 or later.

Figure 4-11 Device Labels



CH, ID
0,0
0,1
0,2
0,3
0,4
0,5
0,6 or Redundant Power Supply
Power Supply
AC Distribution

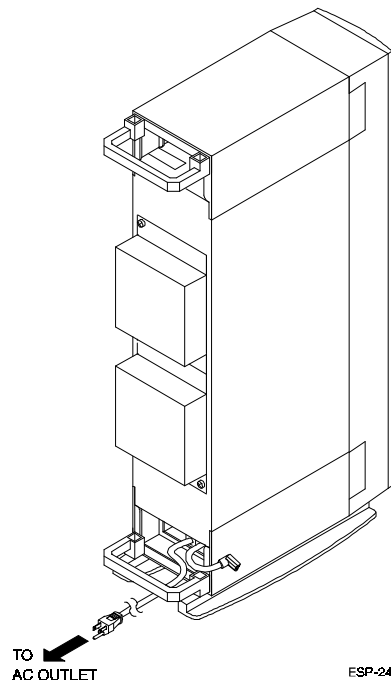
Pedestal 0

MR0225

4.2.3 Power Cable Installation

1. Remove the rear bezel.
2. Thread the female end of the ac power cable under the handle of the pedestal base and connect the cord to the ac receptacle on the ac distribution unit. (See Figure 4-12).
3. Connect the other end of the ac power cable to an ac power source.
4. Replace the front and rear bezel doors.
5. Power up the storage pedestal.
6. Power up the host computer system.

Figure 4-12 Power Cable Connection



7. On Intel systems with the BIOS enabled, a message similar to the following will appear during the boot process. This confirms proper installation of the RAID Controller.

SWXCR BIOS Version v.v
Digital Equipment Corporation
SWXCR Firmware Version x.x
SWXCR RAM: x Mbytes

or

The equivalent for PCI

If the message does not appear or the boot process aborts, refer to *Chapter 8, Troubleshooting*.

Compare the BIOS version shown on the monitor with the BIOS version listed in the Release Notes.

- If the version shown on the monitor is earlier (lower) than that listed in the Release Notes, go to Section 9.5 and update the BIOS. Then return here and continue with step 7.
- If the version shown on the monitor is the same as that listed in the Release Notes, BIOS update is not required. continue this installation procedure.

NOTE

The order in which you turn-on and -off your system and storage enclosures effects the operation of your RAID Array 200 Series Subsystem. If the RAID controller can not access the drives in your storage enclosures, it marks the drives as failed. Therefore to avoid the controller trying to access the drives with the storage enclosure turned off, power-on and off your system and storage enclosures in the following order:

Power-on

1. Storage enclosures **first**
2. System second

Power-off

1. System **first**
2. Storage enclosures second

If you inadvertently power down the storage subsystem first, refer to Chapter 8, Troubleshooting to determine how to reestablish proper operation.

To continue the installation process, go to Chapter 6 to:

- Determine the version of firmware in your controller.
- Set controller parameters.
- Configure your array.

Refer to the Roadmap, Table 2–1, for an overview of the steps to install the EISA or PCI controller for your RAID Array 200 Subsystem.

3-Channel RAID Controller Installation

This chapter contains the information needed to install either the EISA or PCI 3-Channel RAID Controller Board in a host computer.

The 3-channel RAID controller boards combine the functionality of a SCSI-based RAID controller with the host computer's internal EISA or PCI bus.

The EISA board has four connectors: two channel-0 connectors, a channel-1 connector, and a channel-2 connector. One of the Channel-0 connectors is on the EISA board's edge and the second is on an external connector. These connectors are electrically identical and mutually exclusive, that is, only one of the connectors can be used.

The PCI board has five connectors: two channel-0 connectors, two channel-1 connectors, and one channel-2 connector. Channel-0 and channel-1 each have a connector on the PCI board's edge and an external second connector. The connectors for each channel are electrically identical and mutually exclusive - only one of the connectors for each channel can be used. The edge connectors on the PCI board are of the 68-pin high-density type. The bulkhead connectors are 0.8-mm 68-pin connectors.

5.1 Installing the 3-Channel RAID Controller

CAUTION

To avoid static damage, wear a grounded wrist strap while installing the RAID controller board.

To install the RAID controller board, follow these steps.

1. Turn off power to the computer system and disconnect the power cable.
2. Remove the cover from the host computer system. Refer to the host system manual for general instructions on removing the cover and installing adapter boards.
3. Unpack the RAID controller board.
4. If the RAID controller board has uninstalled options, refer to Appendix A and install the options, then proceed with step 5, below.
5. Inspect the board and confirm that the termination jumpers are properly installed. These jumpers terminate the SCSI buses on the host end of the bus and must be in place. (See Table 5-1 and Figures 5-1 and 5-2.)

Table 5–1 SCSI Bus Termination Jumpers

	EISA	PCI
Channel 0	JP3	JP6
Channel 1	JP4	JP5
Channel 2	JP5	JP1

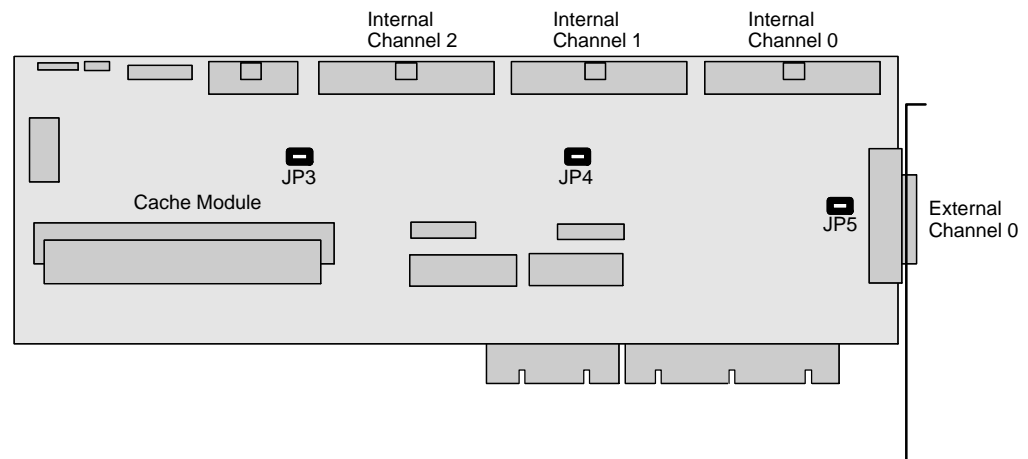
6. Install the RAID controller board.

NOTE

On some computer system bulkheads, various size knockout panels are provided for mounting external connectors. The channel-1/channel-2 EISA internal cable connector or the channel-2 PCI internal cable connector can be mounted in one of these knockout panels.

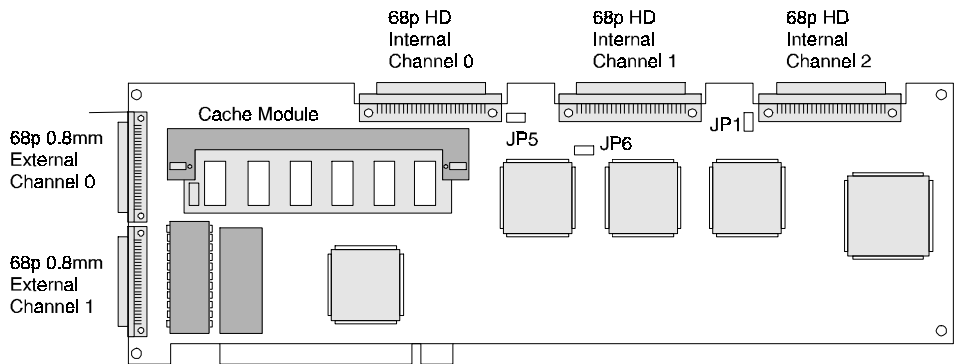
- EISA computer – in the slot selected when you ran the ECU. If a motherboard slot must be used for the channel-1/channel-2 bulkhead connector, it is suggested that the board be placed where there is a vacant slot adjacent to the EISA board.
- PCI computer – in any available PCI slot. If a motherboard slot must be used for the external channel-2 connector, it is suggested that the board be placed in the PCI slot adjacent to an EISA slot and the EISA slot used for the external connector. When the system is powered-on, the host system will locate and establish communications with the PCI board.

Figure 5–1 Board Layout of the 3-Channel Controller (EISA Version)



MR0217

Figure 5-2 Board Layout of the 3-Channel Controller (PCI Version)

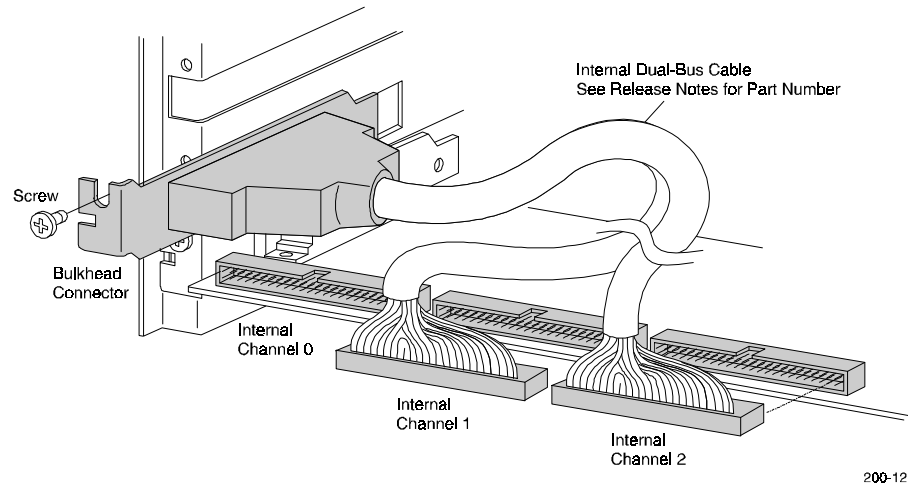


200-01

5.1.1 EISA Controller Internal Cabling

1. Orient the internal bus cable as shown in Figure 5-3. Insert the short internal cable connector into the internal channel-1 connector on the RAID controller.
2. Insert the long cable connector into the internal channel-2 connector.
3. Attach the bulkhead panel with its 68-pin connector to the host system bulkhead and tighten the screw.

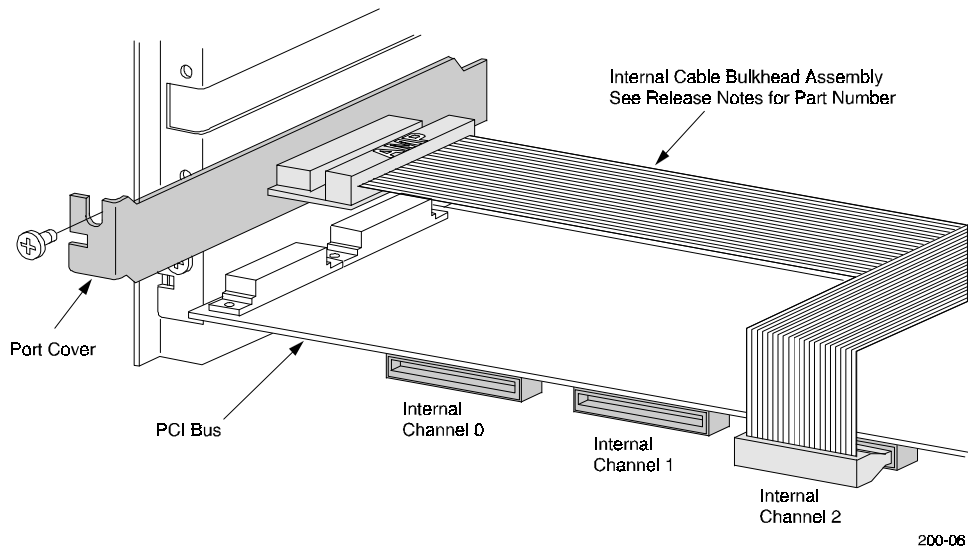
Figure 5–3 Internal Cable Connections for the 3-Channel EISA Controller



5.1.2 PCI Controller Internal Cabling

1. Orient the internal bus ribbon cable as shown in Figure 5-4 (PCI). Insert the 90 degree connector of the internal ribbon cable into the internal channel-2 edge connector on the PCI controller.
2. Fold the cable as shown.
3. Attach the bulkhead panel with its 68-pin connector to the host system bulkhead and tighten the screw.

Figure 5-4 Internal Cable Connections for the 3-Channel PCI Controller



5.2 Cabling

Cabling from the RAID controller board can be to an internally mounted storage array or to the Expansion Storage Pedestal. If the board is connected to an internal array, refer to the documentation that came with the array to see that it is properly configured. When using the Expansion Storage Pedestal, the proper installation of the Shelf_OK signal jumpers must be verified. The instructions for this verification are covered in the following paragraphs. The installation shown is an example, refer to the appropriate StorageWorks Storage Pedestal User's Guide for general setup and cabling information.

NOTE
Depending on your configuration, you can install one, two, or three storage pedestals on the RAID controller. Label the first pedestal as Pedestal 0. The other pedestals are labeled Pedestal 1 and Pedestal 2, respectively. Pedestal 0 connects to Channel 0, Pedestal 1 connects to Channel 1, and Pedestal 2 connects to Channel 2.

5.2.1 Shelf_OK Jumper Installation and Verification

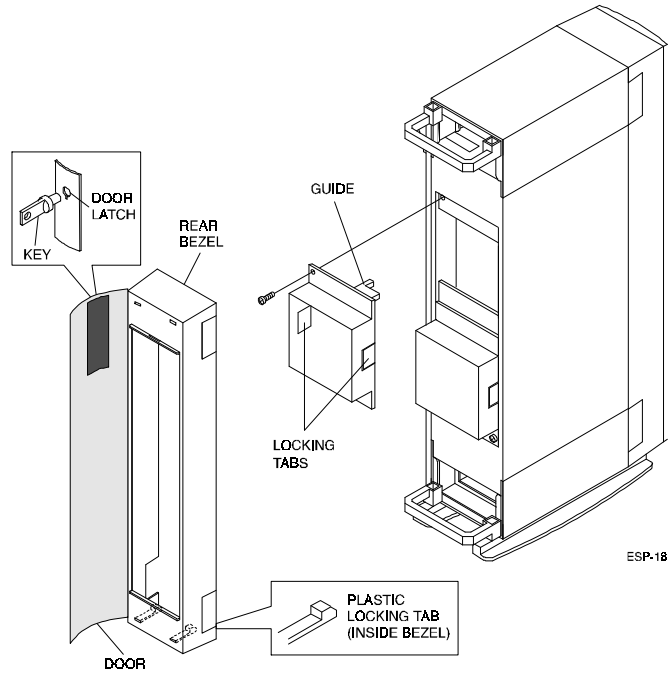
NOTE

SHELF_OK allows the fault signals from the Expansion Storage Pedestal to be fed back to the RAID Controller.

The Shelf_OK jumpers are located under the blowers on the rear of the pedestal. Use the following steps, as appropriate for your pedestal, to verify or install the jumpers.

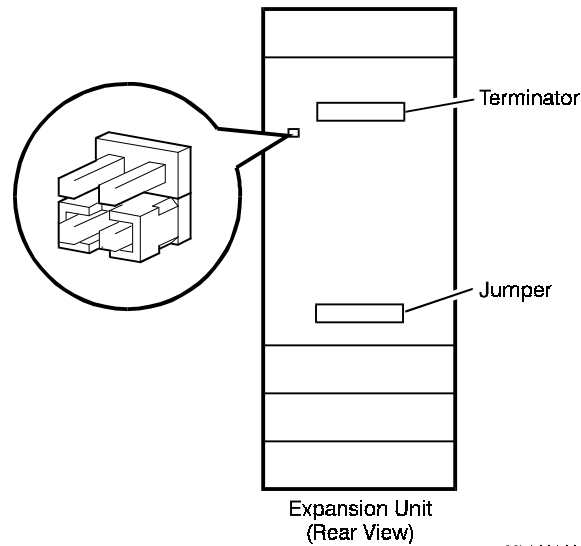
1. Open the door on the rear bezel and remove the bezel by pushing down on the locking tabs at the bottom of the bezel (see Figure 5-5).
2. Using a Phillips head screwdriver, remove the safety screw in the corner of each blower.
3. Press the side locking tabs to release the blower and pull the blower straight out to disconnect it from the power connector on the pedestal.

Figure 5-5 Removing a Blower



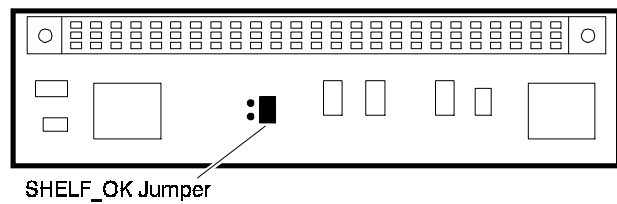
4. Determine if the pedestal's backplane has a jumper block located as shown in Figure 5-6. If it does, make sure that the pins are jumpered as shown in the balloon (this enables "Shelf_OK_External_Cables").
5. If there is no jumper block, it is necessary to remove both the SCSI backplane active terminator board and the SCSI backplane jumper board from the backplane.

Figure 5–6 Pedestal Backplane Active Terminator and Jumper Board Locations



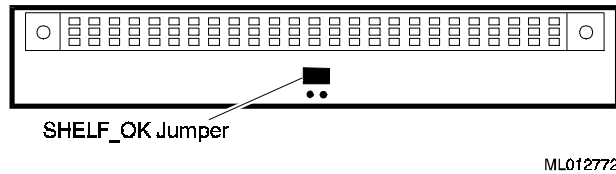
6. **Terminator** – Check that the SHELF_OK jumper is installed as shown in Figure 5–7.

Figure 5–7 Shelf_OK Jumper on the SCSI Backplane Terminator Board



7. **Jumper** – Check that the SHELF_OK jumper is installed as shown in Figure 5–8.

Figure 5–8 Shelf_OK Jumper on the Jumper



8. Replace both the SCSI backplane active terminator board and the SCSI backplane jumper board previously removed from the backplane.
9. Replace both blowers. Align each blower with its power connector on the pedestal's backplane and insert the blower straight in. Make sure that the locking tabs are firmly seated, and then replace the screws.

5.2.2 SCSI Cable Installation

NOTE

The total length of the cabling for a specific installation should be as short as possible.

The inter-device cabling of SCSI devices is critical to proper operation of the system. A fast, narrow, single-ended SCSI bus as used in EISA and PCI applications can have a maximum length of 3 meters, including internal wiring and external cabling. The EISA channel-1/channel-2 or the PCI channel-2 internal cable connected to the computer system backplane adds approximately 0.5 meter to the length of the SCSI bus.

Cabling external to the Expansion Storage Pedestal cannot exceed 2 meters. The Expansion Storage Pedestal has an internal wiring length of approximately 1 meter, therefore, the external cabling cannot exceed 2 meters. There are three methods of routing the cable within the pedestal. Read each cable installation procedure and then choose the best one for your location, depending upon the length of the cable used and the appearance desired.

Figures 5–9 and 5–10 show the cables and connections required to connect the EISA and PCI RAID 3-channel controller to the Expansion Storage Pedestal.

Figure 5–9 External Cable Connections — EISA

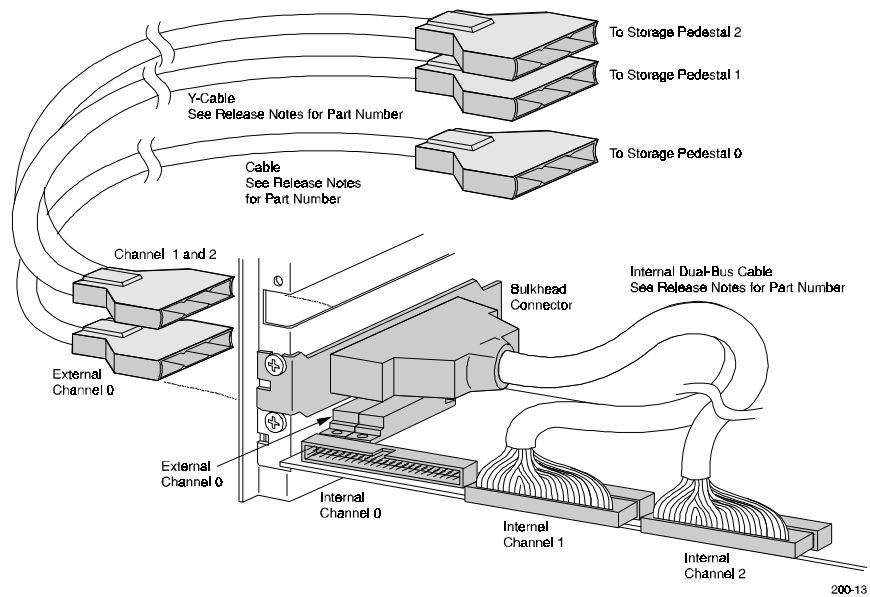
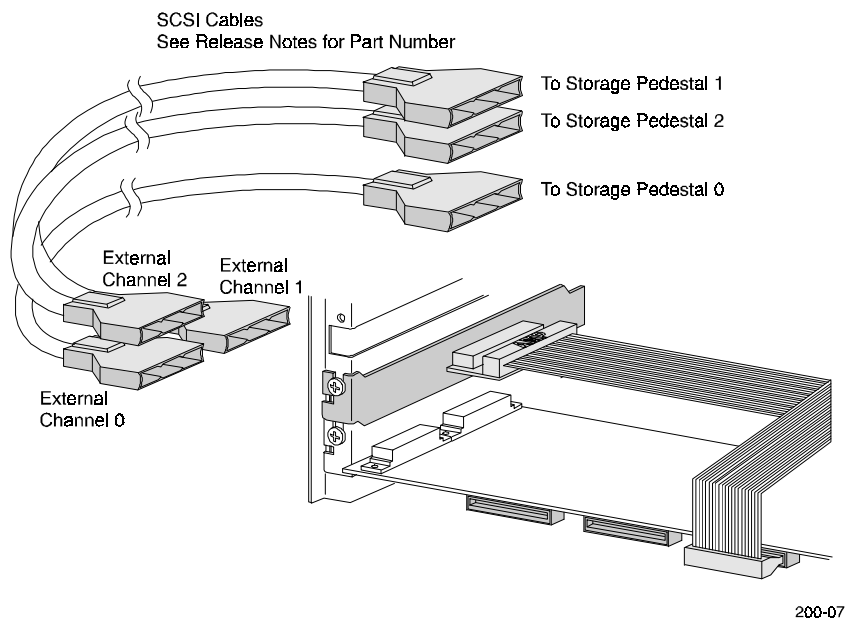


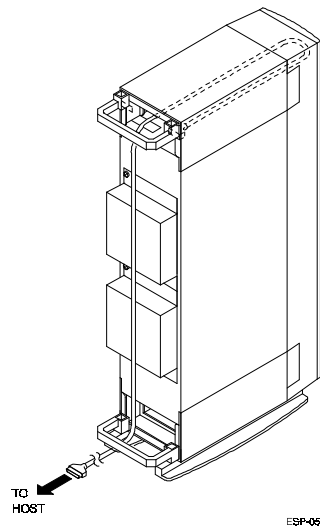
Figure 5–10 External Cable Connections — PCI



5.2.2.1 Cable Installation - Method 1

1. Open the front and rear bezel doors of each pedestal and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Thread one end of the SCSI cable under the rear handle of the pedestal base, and through the opening at the top of the pedestal to the front of the unit (see Figure 5–11).
3. Remove the knockout panel *or* SBB from slot 0 of the pedestal.
4. Loop the cable below the divider plate and connect the cable to connector JA1 (upper-left connector when viewed from the front) on the backplane (see Figure 5–11).
5. Replace the knockout panel or SBB in slot 0 and the front and rear bezels ensuring the locking tabs snap into place at the bottom of each bezel.
6. Insert the other end of the SCSI cable into the appropriate RAID controller connector at the back of the host system.

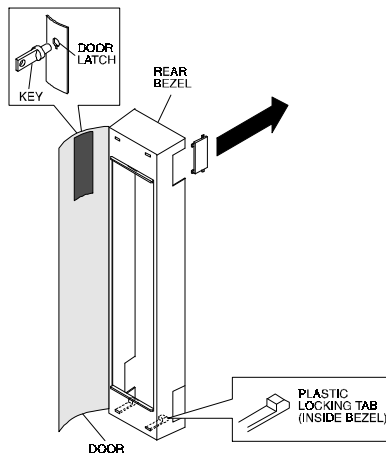
Figure 5–11 Routing the SCSI Cable — Method 1



5.2.2.2 Cable Installation - Method 2

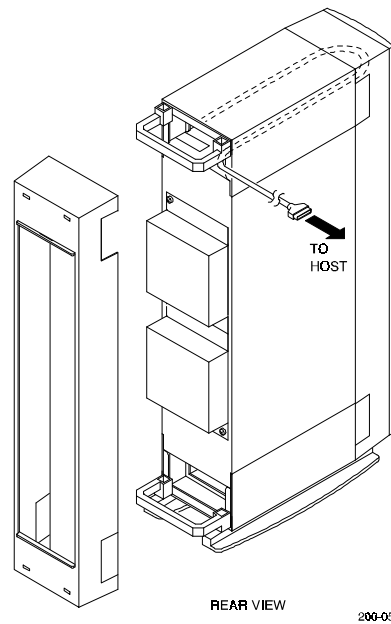
1. Open the front and rear bezel doors of each pedestal and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Remove a knockout panel on the rear bezel that is closest to the host computer and route the SCSI cable through the cutout. (See Figure 5–12).
3. Loop the cable below the divider plate and connect the cable to connector JA1 (upper-left connector when viewed from the front) on the internal side of the backplane (see Figure 5–13).
4. Replace the bezel, ensuring the locking tabs snap into place at the bottom of the bezel.
5. Insert the other end of the SCSI cable into the appropriate connector for the RAID controller at the back of the host system.

Figure 5–12 Removing a Knockout Panel



200-03

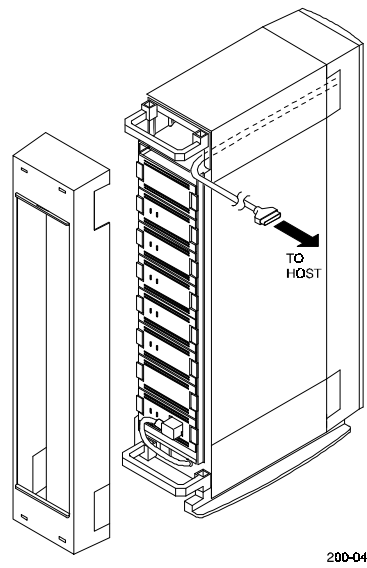
Figure 5–13 Routing the SCSI Cable — Method 2



5.2.2.3 Cable Installation — Method 3

1. Open the front and rear bezel doors of each pedestal and remove both bezels from the pedestal by pressing down on the locking tabs at the bottom of each bezel.
2. Remove a knockout panel on the front bezel that is closest to the host computer (see Figure 5–12).
3. Connect the cable to connector JA1 (upper-left connector when viewed from the front) on the internal side of the backplane (see Figure 5–14)
4. Replace the bezel ensuring the locking tabs snap into place at the bottom of the bezel.
5. Insert the other end of the SCSI cable into the appropriate RAID controller connector at the back of the host system.

Figure 5-14 Routing the SCSI Cable — Method 3



5.2.2.4 Labeling the Installed Drives

Label the disk drives that are installed in the Expansion Storage Pedestal to identify their Device Type, Channel, and SCSI ID (for example, Dev: RZ26L, CH: 0, ID: 1) (see Figure 5–15).

NOTE

The SCSI ID is determined by the slot number in the Expansion Storage Pedestal, as shown in Figure 5–15. Each pedestal (channels 0, 1, and 2) has SCSI ID numbers 0 through 6 corresponding to slots 0 through 6.

To support the Expansion Storage Pedestal's hot swap option, check the label on the power supply SBB to ensure it is BA35X-HA Rev. L01 or later.

Figure 5–15 Device Labels

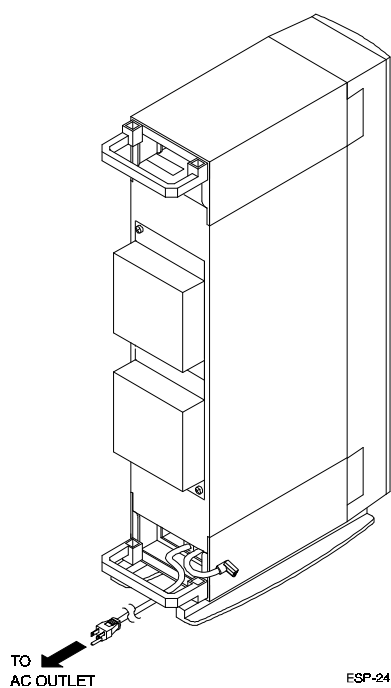
CH, ID	CH, ID	CH, ID
2,0	1,0	0,0
2,1	1,1	0,1
2,2	1,2	0,2
2,3	1,3	0,3
2,4	1,4	0,4
2,5	1,5	0,5
2,6 or Redundant Power Supply	1,6 or Redundant Power Supply	0,6 or Redundant Power Supply
Power Supply	Power Supply	Power Supply
AC Distribution	AC Distribution	AC Distribution
Pedestal 2	Pedestal 1	Pedestal 0

MFO222

5.2.3 Power Cable Installation

1. Open the rear bezel door of each pedestal and remove the rear bezel by pressing down on the locking tabs at the bottom of each bezel.
2. Thread the end of the ac power cable under the handle of the pedestal base and connect the cord to the ac receptacle on the ac distribution unit. (See Figure 5–16.)
3. Connect the end of the ac power cable to an ac power source.
4. Replace the front and rear bezel doors.
5. Power up the storage pedestal.
6. Power up the host computer system.

Figure 5–16 Power Cable Connection



7. On Intel systems with the BIOS enabled, a message similar to the following will appear during the boot process. This confirms proper installation of the RAID Controller.

SWXCR BIOS Version v.v
Digital Equipment Corpora- tion
SWXCR Firmware Version x.x
SWXCR RAM: x Mbytes

or

The equivalent for PCI

If the message does not appear or the boot process aborts, refer to *Chapter 8, Troubleshooting*.

Compare the BIOS version shown on the monitor with the BIOS version listed in the Release Notes.

- If the version shown on the monitor is earlier (lower) than that listed in the Release Notes, go to Section 9.5 and update the BIOS. Then return here and continue with step 7.
- If the version shown on the monitor is the same as that listed in the Release Notes, BIOS update is not required. continue this installation procedure.

NOTE

The order in which you turn-on and -off your system and storage enclosures affects the operation of your RAID Array 200 Series Subsystem. If the RAID controller can not access the drives in your storage enclosures, it marks the drives as failed. Therefore to avoid the controller trying to access the drives with the storage enclosure turned off, power-on and off your system and storage enclosures in the following order:

Power-on

1. Storage enclosures **first**
2. System second

Power-off

1. System **first**
2. Storage enclosures second

If you inadvertently power down the storage subsystem first, refer to Chapter 8, Troubleshooting to determine how to reestablish proper operation.

To continue the installation process, go to Chapter 6 to:

- Determine the version of firmware in your controller.
- Set controller parameters.
- Configure your array.

Refer to the Roadmap, Table 2–1, for an overview of the steps to install the EISA or PCI controller for your RAID Array 200 Subsystem.

Configuring Your Array

This chapter describes how to configure your array, automatically or interactively; including defining a spare drive, initializing a logical RAID drive; and saving the RAID configuration to a diskette.

6.1 Getting Started

After installing your StorageWorks RAID Array 200 Series Subsystem, you need to configure drive groups and logical RAID drives on your array.

If you configured your array previously and want to change the configuration, see Chapter 7.

Configuring your array requires the following steps:

- Invoking the standalone configuration utility
- Determining version (release number) of controller firmware
- Setting options
- Clearing the existing configuration (optional)
- Automatically or interactively configuring the array (creating drive groups and logical RAID drives)
- Defining hot spares (optional)
- Initializing logical RAID drives
- Saving the configuration to a diskette

6.1.1 Turning-On and -Off Your System and Storage Enclosures

The order in which you turn-on and -off your system and storage enclosures effects the operation of your RAID Array 200 Series Subsystem. If the RAID controller can not access the drives in your storage enclosures, it marks the drives as failed. Therefore, to avoid the controller trying to access the drives with the storage enclosure turned off, power-on and off your system and storage enclosures in the following order:

Power-on

1. Storage enclosures **first**
2. System second

Power-off

1. System **first**
2. Storage enclosures second

6.1.2 Invoking the Standalone Configuration Utility

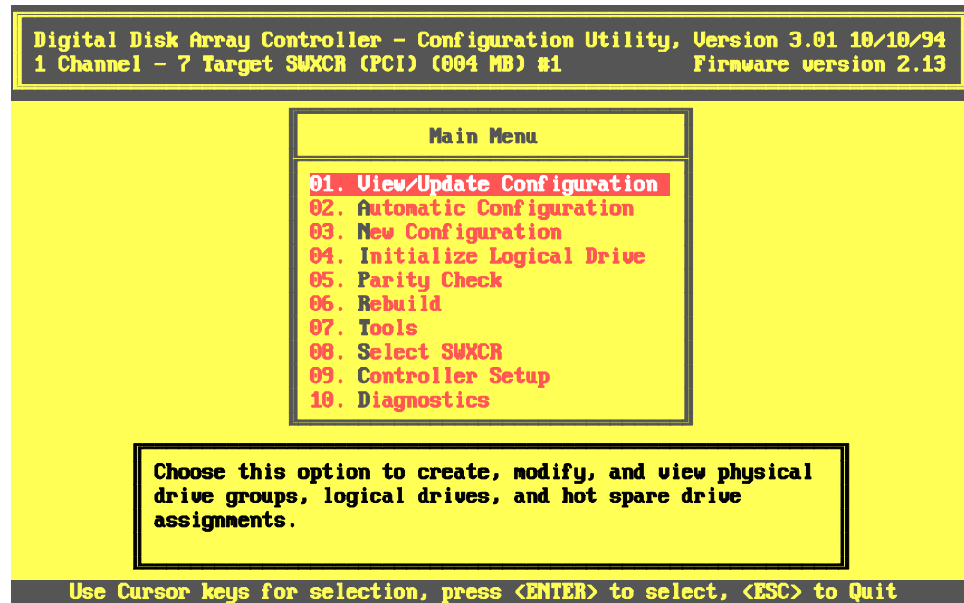
The procedure for invoking the standalone configuration utility varies based on your type of system. See the following system-specific instructions for Intel and AXP systems.

6.1.2.1 Invoking the Standalone Utility on Intel Systems

To invoke the standalone utility on an Intel (486 and up) system, follow these steps:

1. Insert the RAID Array 200 Standalone Configuration Utility for Intel Systems diskette in your floppy drive.
2. Start or reboot your computer, leaving the diskette in the floppy drive. Your computer boots from the RAID Array 200 Standalone Configuration Utility V3.0 for Intel Systems diskette rather than your hard disk.
3. Type: A:\SWXCR> **swxcrmgr**
The utility checks the drives, and then displays the main menu as shown in Figure 6-1.

Figure 6–1 The Main Menu of the Standalone Utility



Go to Sections 6.1.2.3 and 6.1.2.4 to learn how to use the utility, and then to Section 6.3 to set options.

6.1.2.2 Invoking the Standalone Utility on AXP Systems

To invoke the Standalone Utility on AXP systems, follow these steps:

1. Invoke the ARC console menu shown in Figure 6–2. Consult your AXP system documentation to invoke the ARC console.

Figure 6–2 The ARC Console for An AXP System

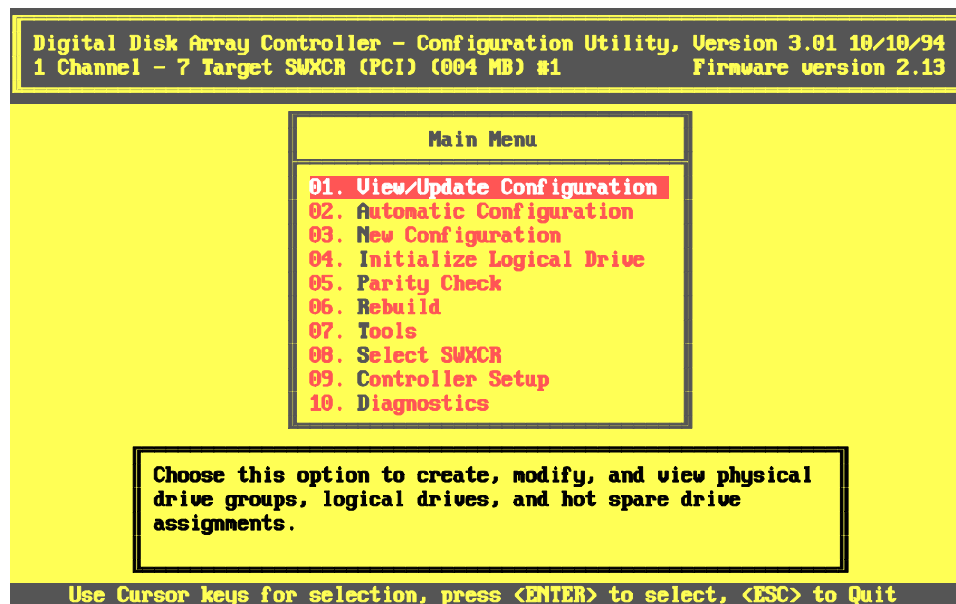
```
ARC Multiboot DEC Version 2.07
Copyright (c) 1993 Microsoft Corporation
Copyright (c) 1993 Digital Equipment Corporation

Boot Menu
  Boot Windows NT
  Boot an alternate operating system
  Run a program
  Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

2. Insert the RAID Array 200 Standalone Configuration Utility for AXP Systems diskette into your floppy drive.
3. Select the *Run a program* option from the AXP Boot menu. The system displays the *Program to run:* prompt.
4. Type: Program to Run: **A:swxcrmgr**
The utility checks the drives, and then displays the main menu as shown in Figure 6–3.

Figure 6–3 The Main Menu of the Standalone Utility



Go to Sections 6.1.2.3 and 6.1.2.4 to learn how to use the utility, and then to Section 6.3 to set options.

6.1.2.3 Using the Standalone Utility

From the standalone utility main menu, you can invoke each of the listed options.

Use the arrow keys to move through the menu and highlight your selection, or you can type the highlighted letter (usually the first letter of the option). Press the Enter key to select the option.

NOTE

You can use the Enter key or the Return key interchangeably.

As you move the cursor from one option to the next, the message window, as shown in Figure 6–3, changes to display a message for the highlighted option.

6.1.2.4 Exiting the Utilities

Press the Esc key twice from the main menu to exit the standalone utility. The utility prompts you to confirm that you want to exit. Select *Yes* and press the Enter key to exit.

6.2 Determining Version of Controller Firmware

1. Refer to the Release Notes to determine the current (latest) version of firmware for the type of controller you have, EISA or PCI.
2. View the main title bar of the Standalone Configuration Utility (SCU) to check the firmware version of your controller.
3. If the firmware versions in steps 1 and 2 are the same, continue with Section 6.3.
4. If the firmware version in step 2 is earlier (lower) than the current version listed in step 1, go to Chapter 9 to upgrade the firmware of your EISA or PCI controller. Continue with Section 6.3 after upgrading.

6.3 Setting Controller Parameters, and Fault Management and Battery Backup Options

You must complete the following preliminary procedures after installing your RAID controller and prior to configuring the array:

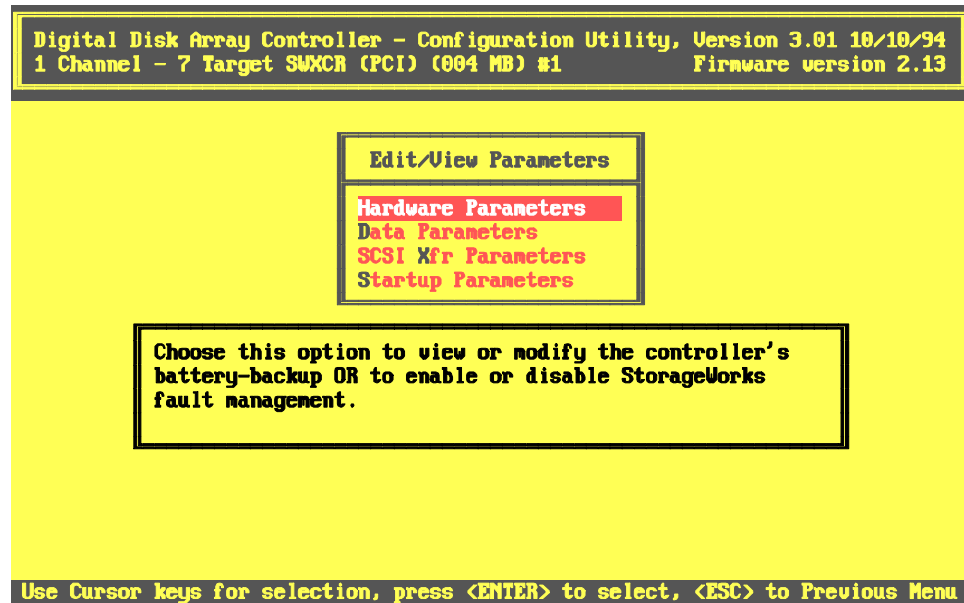
- Setting controller parameters
- Setting Fault Management and Battery Backup options

6.3.1 Setting Controller Parameters

You need to set parameters for your controller. Previously, to set these parameters for EISA controllers you needed to use the EISA Configuration Utility (ECU). Presently, you use the RAID Array 200 Series Standalone Configuration Utility to set these parameters for both EISA and PCI controllers

To access the controller parameters, use the up and down arrow keys to highlight the *Controller Setup* option on the main menu and press the Enter key to select it. The *Edit/View Parameters* menu appears as shown in Figure 6–4.

Figure 6–4 The Edit/View Parameters Menu

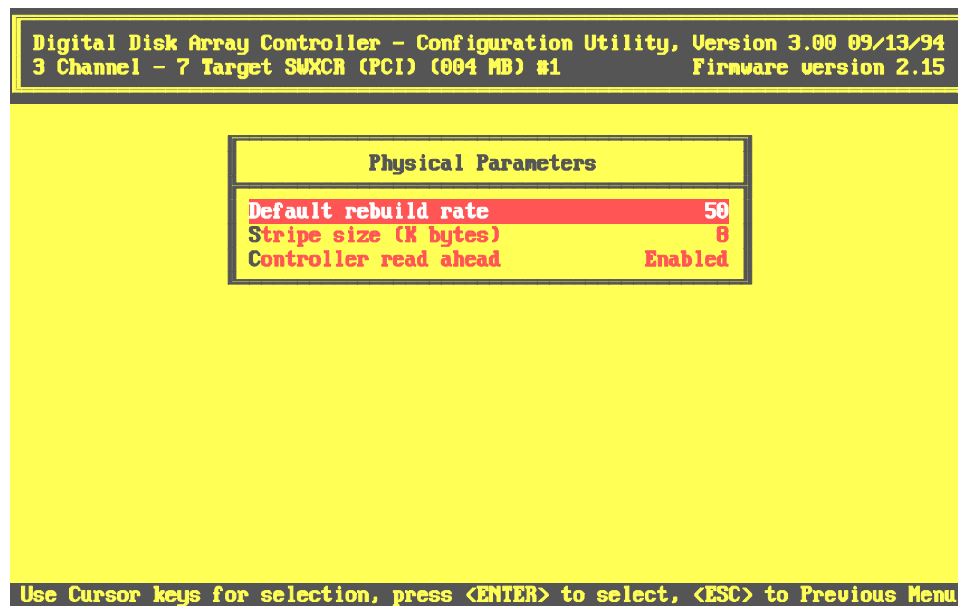


6.3.1.1 Completing the Controller Parameters

To set the *Controller Parameters*, follow these steps.

1. Use the arrow keys to highlight the *Data Parameters* option on the *Edit/View Parameters* menu and press the Enter key. The *Physical Parameters* screen appears, similar to the one shown in Figure 6–5, with the *Default rebuild rate* option highlighted.
2. Press the Enter key and a box appears at the bottom right corner of the screen in which you can type a rebuild rate from 0–50. The default rebuild rate, 50, is the fastest rate at which the system will rebuild data from a failed drive. You can not change the rebuild rate for a rebuild in progress.
3. Use the arrow keys to highlight the *Stripe size* option.

Figure 6–5 The Physical Parameters Screen



NOTE

You must set this option prior to creating logical drives. If you set this option when you have existing logical RAID drives, you will lose all of the data on the existing logical RAID drives.

Press the Enter key to scroll through the available data chunks sizes that the controller will stripe across disks. The default stripe size is 8K bytes.

4. Use the arrow keys to highlight the *Controller read ahead* option. This option is enabled by default. Leave *Controller Read Ahead* enabled for a subsystem processing primarily sequential, long file transfers. Disable *Controller read ahead* for a subsystem processing primarily small, or random transfers. Press the Enter key to disable this option.

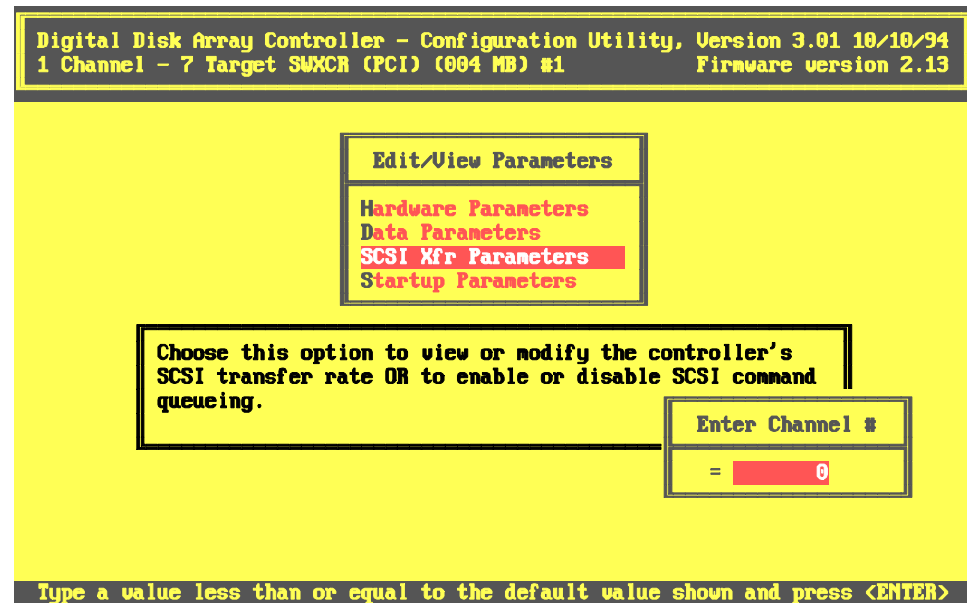
When you finish setting these options press Esc to return to the *Edit/View Parameters* menu.

6.3.1.2 Setting the SCSI Transfer Parameters

To set the *SCSI Transfer Parameters*, follow these steps.

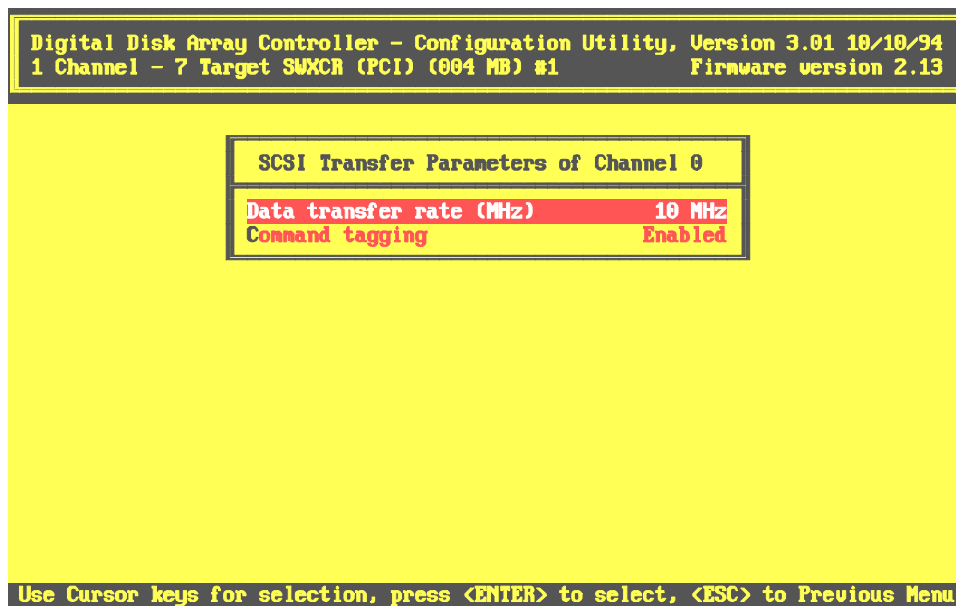
1. Use the arrow keys to highlight the *SCSI Xfr Parameters* option on the *Edit/View Parameters* menu and press the Enter key. An *Enter Channel #* box appears, similar to the one shown in Figure 6–6, at the bottom right of the screen.

Figure 6–6 Enter Channel Box Appears at Bottom Right



2. Enter a channel number of the attached controller and press the Enter key. The *SCSI Transfer Parameters of Channel x* screen appears similar to the one shown in Figure 6–7. The *Data transfer rate* option appears highlighted.

Figure 6–7 The SCSI Transfer Parameters for the Specified Channel



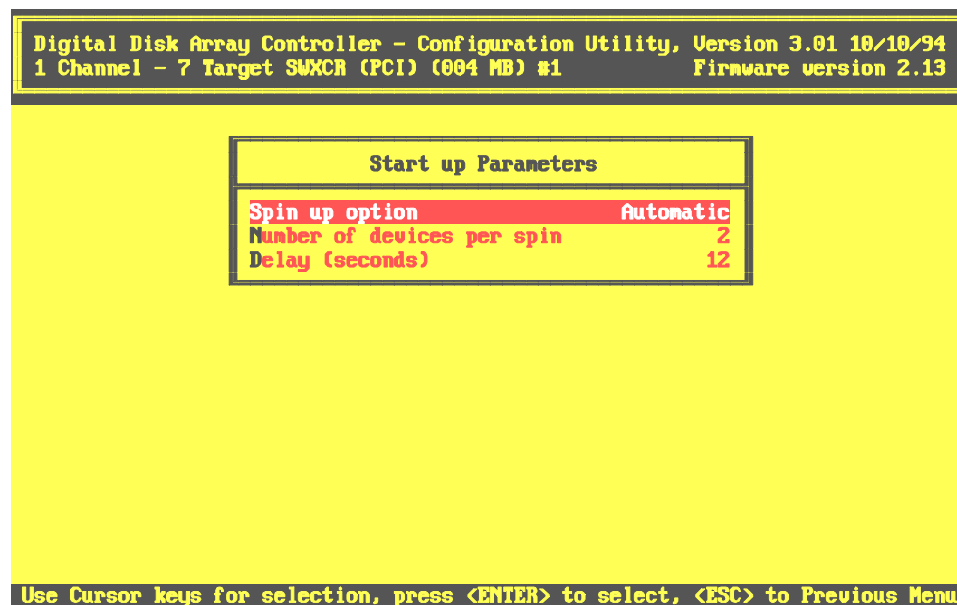
3. Press the Enter key to scroll through the *Data transfer rate* options. The default is 10 MHz. The 10 MHz setting provides the best performance, and supports only a 3 meter SCSI cable length. Select the 5 MHz setting if you plan to use a 6 meter SCSI cable. Select asynchronous only if the drives in your subsystem do not support synchronous operation.
4. Use the arrow keys to highlight the *Command tagging* option. Command tagging is enabled by default. Command tagging allows the controller to queue up to two commands to each drive. With command tagging disabled, the controller queues only a single command to each drive, which provides lower performance. Press the Enter key to disable command tagging, if required.
5. When you finish setting the SCSI Transfer Parameters for the specified channel, press Esc to return to the *Edit/View Parameters* menu.
6. Repeat Steps 1–5 until you have set these parameters for each channel on your controller.

6.3.1.3 Setting the Startup Parameters

To set the *Startup Parameters*, follow these steps.

1. Use the arrow keys to highlight the *Startup Parameters* option on the *Edit/View Parameters* menu and press the Enter key. The *Start up Parameters* menu appears, with the Spin up option highlighted shown in Figure 6–8.

Figure 6–8 The Start Up Parameters Menu



2. The *Spin up option* specifies whether the controller tells the drives when to spin up or whether the drives spin up on power up. The *Spin up option* is set to *automatic* by default. This setting causes the controller to startup the devices. Press the Enter key to change the setting to *On Power*, which causes the drives to spin up on power up.

When you set the Spin up option to *automatic*, you can specify how many devices you want the controller to spin up at a time in the *Number of devices per spin* field. You can also specify in the *Delay* field, for what interval the controller waits before spinning up the next number of devices. (The controller spins up 2 devices per spin at six seconds apart by default.)

To set the *Number of devices per spin*, or the number of seconds of *Delay*, use the arrow keys to highlight the options, then type a number. You can not change these parameters if you set the *Spin up option* to *On power*.

When you finish setting the *Startup Parameters*, you have completed setting the controller parameters. Press Esc to return to the *Edit/View Parameters* menu. Press the Esc key again to return to the main menu.

Now set the fault management and battery backup options

6.3.2 Setting Fault Management and Battery Backup Options

Before configuring the array for the first time, verify, and enable or disable the StorageWorks Fault Management and Battery Backup options as follows:

- **StorageWorks Fault Management**

If your RAID controller is connected to a StorageWorks enclosure, it supports Fault Management; enable this option. (Fault management enabled will allow you to perform a hot swap in the event of a disk failure.)

If your RAID controller is connected to non-StorageWorks storage enclosures or directly cabled to disk drives, disable this option.

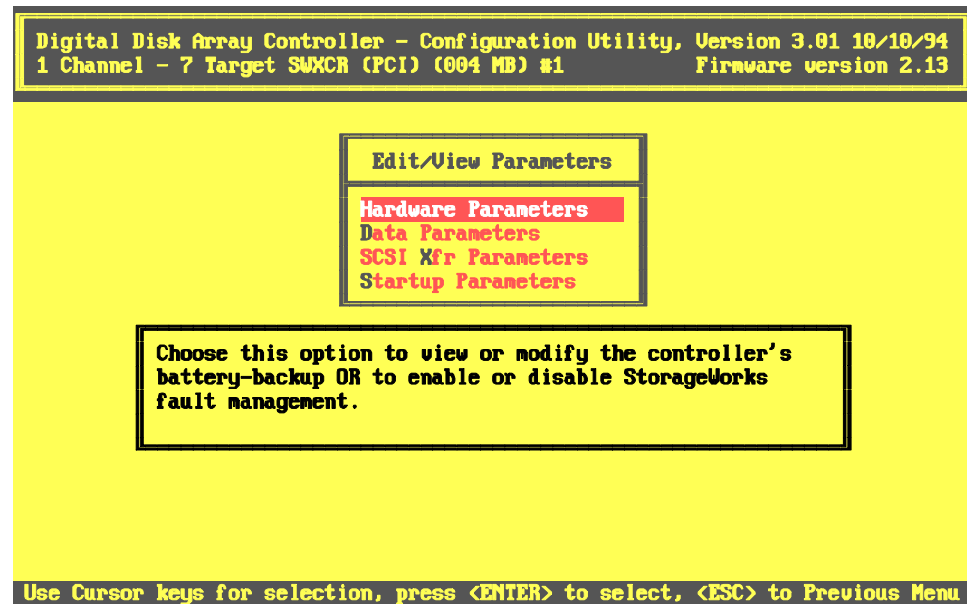
- **Battery Backup**

Verify with your sales representative whether your RAID controller supports battery backup. If your controller supports battery backup (and you purchased the option), you will need to enable the Battery Backup option. The Battery Backup option is disabled by default. If your controller doesn't support battery backup, verify that the Battery Backup option is disabled.

To set the *StorageWorks Fault Management* and *Battery Backup* options, follow these steps:

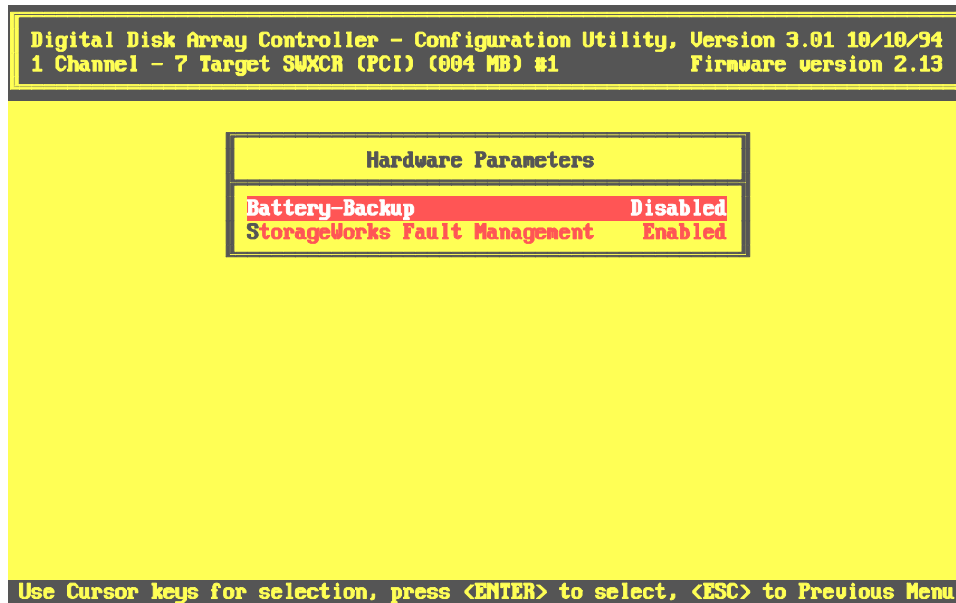
1. Select the *Controller Setup* option from the main menu. The utility displays an *Edit/View Parameter* menu, as shown in Figure 6–9.

Figure 6–9 Edit/View Parameter Menu



2. Use the arrow keys to highlight the *Hardware Parameters* option and press the Enter key. The utility displays the current status of the *StorageWorks Fault Management* and *Battery Backup* options, as shown in Figure 6–10.

Figure 6–10 The Hardware Parameters Screen



3. The *Battery Backup* option appears highlighted. Press the Enter key to change the setting if necessary.
4. Use the arrow keys to highlight the *StorageWorks Fault Management* option, and press the Enter key to change the setting, if necessary.
5. Press the Esc key to exit when you finish setting these options. The *Edit/View Parameters* menu appears.
6. Press the Esc key again to return to the main menu.
7. If you changed an option, the utility prompts you to save altered controller configuration. Select Yes to save the current status. The main menu appears.

NOTE

Any change to these options becomes effective the next time you reboot the system.

Now, go on to Section 6.4 to configure the array.

6.4 Configuring the Array

When you configure your array, you allocate your disk drive resources into drive groups and hot spares. You then create logical RAID drives, which allow your computer to view the combined disk space of each of the disk drives in the group as a single drive. You determine how you want to store data on a logical RAID drive by selecting a RAID level (RAID 0, 1, 0+1, 5, or Just a Bunch of Disks (JBOD)) when you create it.

6.4.1 Planning How to Recover from A Disk Failure

One of the major benefits of RAID is the ability to maintain data availability even in the event of a disk failure. RAID configurations utilizing redundant RAID levels (RAID 1, RAID 0 + 1, and RAID 5) can sustain the failure of one disk at any given time. Your RAID Array 200 Series Subsystem recovers from the failure of a disk by rebuilding the failed disk's data on a replacement disk. The RAID subsystem can achieve this through any one of the following methods:

- Hot Spare
- Hot Swap
- Manually rebuilding

Read the following descriptions of the methods of recovering from a disk failure to help you decide whether to create a hot spare drive when you configure your array.

NOTE
You cannot recover data from a drive that fails in a configuration with a non-redundant RAID level (RAID 0, JBOD) using tools provided with your RAID Array 200 Series Subsystem.

Hot Spare

A hot spare drive is a drive in your storage enclosure that you do not bind into a drive group, but designate as a hot spare. The drive remains unused and available in your storage enclosure until a disk fails from a drive group on which you configured a redundant logical RAID drive. Then, the RAID controller automatically starts to rebuild the failed drive's data onto the hot spare disk.

You can define a hot spare drive when you configure your array for the first time, or at another time. This drive must be of equal or greater capacity to the drives in the drive groups on which you will configure redundant logical RAID drives. Section 6.6.3 in this chapter describes defining a hot spare drive.

Hot Swap

Enable the StorageWorks Fault Management option, as described in Section 6.3.2, Setting Options, and you can perform a hot swap in the event of a failed drive (if your storage enclosure supports hot swapping). You perform a hot swap by removing the failed drive (a drive for which the RAID controller assigned a status of failed) from the storage enclosure. You then insert a working drive into the same slot of the storage enclosure from which you removed the failed drive. Shortly after you insert the replacement drive, the RAID controller automatically starts to rebuild the failed drive's data onto the replacement drive.

NOTE

It may take minutes for a rebuild to begin on a hot spare or after a hot swap, depending upon the rebuild rate and activity of the subsystem.

Manually

If a drive fails, and you did not define a hot spare drive, or do not have hot swap capability, you can manually issue a command to get the controller to rebuild the data from a failed drive onto a replacement drive. See Chapter 7, Section 7.5.3, for the complete procedure to rebuild a drive manually.

Now go on to Section 6.4.2 to begin configuring the array.

6.4.2 Planning the Configuration

You already started planning your configuration when you selected what to purchase for your StorageWorks RAID Array 200 Series Subsystem. Prior to actually configuring the subsystem, you need to plan how you want to maximize the resources that you purchased. To that end, this section includes two sample configurations to show you ways that you can configure to maximize the potential of your subsystem.

The following samples demonstrate configurations that feature:

- Data availability
- Drive connectivity and performance

6.4.2.1 Sample Configuration for Data Availability

The configuration shown by this example provides redundancy in the event of a drive or channel failure. The drive redundancy is achieved by the use of RAID 5 logical RAID drives. The channel redundancy is achieved by locating all the drives in a drive group on separate channels, whereby, if a channel fails, the subsystem would continue to work in the same manner that it would in the event of a disk failure.

In the configuration example shown in Table 6–1, we configured twenty-one, 1 GB capacity disk drives into 7 drive groups, on which we created 7 RAID 5 Logical RAID drives. For more information on the number of drives used in each group, and usable capacity, see Section 6.6.1 of this Chapter. For more information on the group type, See Chapter 1.

Table 6–1 Data Availability Configuration Through RAID 5

Drive Group	Number of Drives in Group	Drive Location	Group Type	Usable Capacity
A	3	Drive 1 = Ch 0, SCSI ID 0	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 0		
		Drive 3 = Ch 2, SCSI ID 0		
B	3	Drive 1 = Ch 0, SCSI ID 1	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 1		
		Drive 3 = Ch 2, SCSI ID 1		
↓				
G	3	Drive 1 = Ch 0, SCSI ID 6	RAID 5	2GB
		Drive 2 = Ch 1, SCSI ID 6		
		Drive 3 = Ch 2, SCSI ID 6		
Total	Total		Total	Total
7	21 drives		7 RAID 5	14 GB

This example shows all of the 21 drives in the subsystem being used in drive groups; however, you may want to create fewer drive groups and use some of the 21 drives as hot spare drives, on which the controller would automatically begin to rebuild data from a failed drive in one of these RAID 5 redundant group types.

6.4.2.2 Sample Configuration for Drive Connectivity and Performance

The configuration shown by this example provides drive connectivity and performance in the event that you want to configure the total possible number of drives, 21, and maximize their usable capacity. You can not achieve high availability with this configuration, because, in order to maximize usable capacity, and performance, you can not utilize redundancy.

In the configuration example shown in Table 6–2, we configured twenty-one, 1 GB capacity disk drives into 7 drive groups, on which we created 7 RAID 0 Logical RAID drives. For more information on the number of drives used in each group, and usable capacity, see Section 6.6.1 of this Chapter. For more information on the group type, See Chapter 1.

Table 6–2 Drive Connectivity and Performance Through RAID 0

Drive Group	Number of Drives in Group	Drive Location	Group Type	Usable Capacity of Group
A	3	Drive 1 = Ch 0, SCSI ID 0	RAID 0	3GB
		Drive 2 = Ch 1, SCSI ID 0		
		Drive 3 = Ch 2, SCSI ID 0		
B	3	Drive 1 = Ch 0, SCSI ID 1	RAID 0	3GB
↓		Drive 2 = Ch 1, SCSI ID 1		
		Drive 3 = Ch 2, SCSI ID 1		
G	3	Drive 1 = Ch 0, SCSI ID 6	RAID 0	3GB
		Drive 2 = Ch 1, SCSI ID 6		
		Drive 3 = Ch 2, SCSI ID 6		
Total	Total		Total	Total
7	21 drives		7 RAID 0	21 GB

6.4.3 Understanding the Configuration Methods

You can configure your array in either of the following ways:

- Automatically

You can configure automatically only if:

- You want to configure one RAID 5 logical RAID drive (requires between three and eight drives of same capacity)
- You want to configure up to 8 JBODs of any capacity

- Interactively

Configure interactively if you want to:

- Create more than one drive group
- Create more than one logical RAID drive
- Specify RAID levels
- Specify caching policy
- Define a hot spare

Your RAID subsystem stores the configuration information on flash EEPROM/NVRAM on the RAID controller. In the event that your RAID controller fails, you must restore your configuration from a backup copy on floppy disk, or create a new configuration to access the data on your subsystem.

6.5 Configuring Automatically

You can configure automatically only if:

- You want to configure one RAID 5 logical RAID drive (requires between three and eight drives of same capacity)
- You want to configure up to 8 JBODs of any capacity

To configure automatically, you must do the following:

- Select the *Automatic Configuration* option
- Initialize the logical drives
- Save your configuration to diskette

If you want to define a spare drive, you must configure interactively. See Section 6.6.3 to define a spare drive.

6.5.1 Selecting the Automatic Configuration Option

To configure automatically, follow these steps:

1. Select the *Automatic Configuration* option from the main menu and either one of the following things happens depending upon whether a configuration currently exists.

If a configuration currently exists, then the utility displays a warning message saying that a valid configuration exists and if you proceed, you will destroy it. A confirmation window also appears. See Step 2.

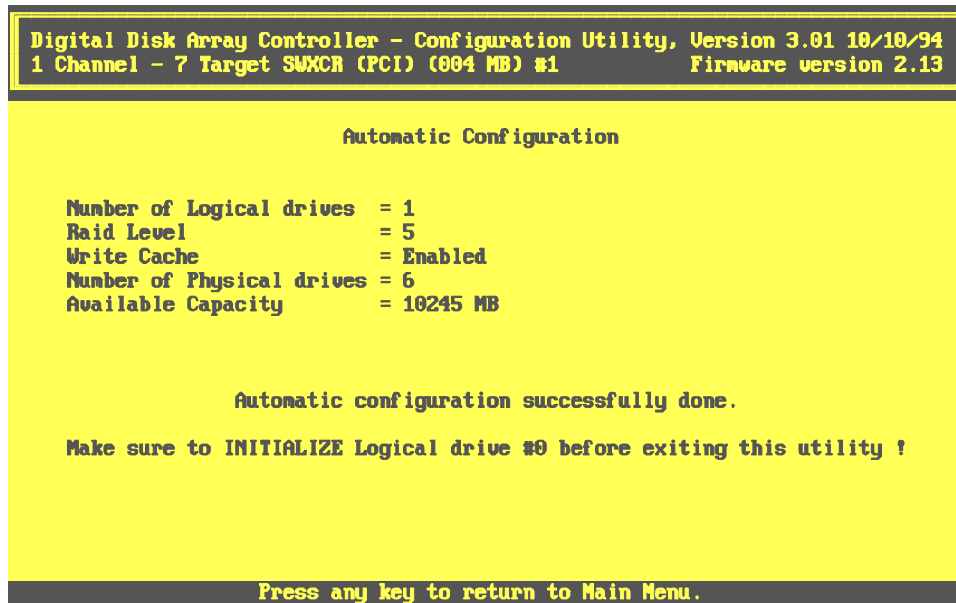
If no configuration currently exists, then the *Automatic Configuration* menu appears. Go to Step 3.

2. Select Yes to delete the current configuration (select No to quit without changing the configuration and to return to the main menu). The *Automatic Configuration* menu appears.
3. Use the arrow keys to highlight RAID 5 or JBOD and press the Enter key to select that configuration. The utility displays a window with this message:
Do you want to have Write Cache enabled?

4. Press the Enter key to select No. This sets the cache policy to Write Through (the recommended policy, see Section 6.6.2.2 Choosing a Caching Policy for a description of the cache options). The utility displays a window with *Automatic Configuration* at the top of the screen and the message, Saving configuration, please wait ..., at the bottom of the screen. The utility then displays a screen with your system configuration information, similar to the one shown in Figure 6–11.
5. Press any key to return to the main menu.

Now go to Section 6.5.2 to initialize the logical RAID drive.

Figure 6–11 The Automatic Configuration Screen



6.5.2 Initializing a Logical RAID Drive

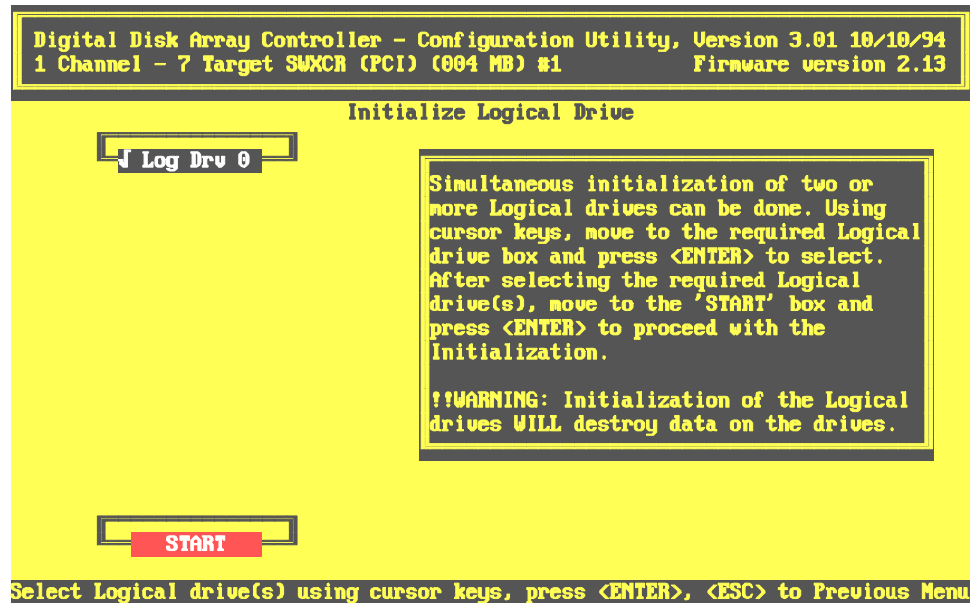
Initialize a logical RAID drive before you use it. The utility initializes the logical RAID drive by writing a pattern of zeros to it. This creates a starting parity for a logical RAID drive with parity, or starting data for a logical RAID drive which does not have parity.

CAUTION
Do not initialize a logical RAID drive if it has valid data. Initialization overwrites and destroys all data.
Also, after you initialize a logical RAID drive, do not change or rearrange the physical drives or cables. Otherwise, all data in the drive group can be lost.

To initialize a logical RAID drive, follow these steps.

1. From the main menu, select the *Initialize Logical Drive* option. The utility displays the *Initialize Logical Drive* screen, with logical RAID drive 0, as shown in Figure 6–12.
2. Use the arrow keys to move to logical RAID drive 0 and press the Enter key to select it. A check mark appears beside logical drive 0. Select any additional logical RAID drives that you created as JBODs. The utility automatically highlights the *Start* button after you select all logical RAID drives.

Figure 6–12 Initialize Logical Drive Screen



3. Press the Enter key. A confirmation window appears displaying the following message:
Do you want to proceed with initialization?
4. Select Yes. An *Initialize Logical Drive* status bar appears at top of screen indicating amount of initialization completed. The bar gradually fills as the initialization process completes. When done initializing, the utility prompts you to press any key to continue.
5. Press any key. The utility displays a message indicating that it is saving the configuration, then the main menu appears.

Go to Section 6.5.3 to continue with the next step of the installation, saving the RAID configuration to a diskette.

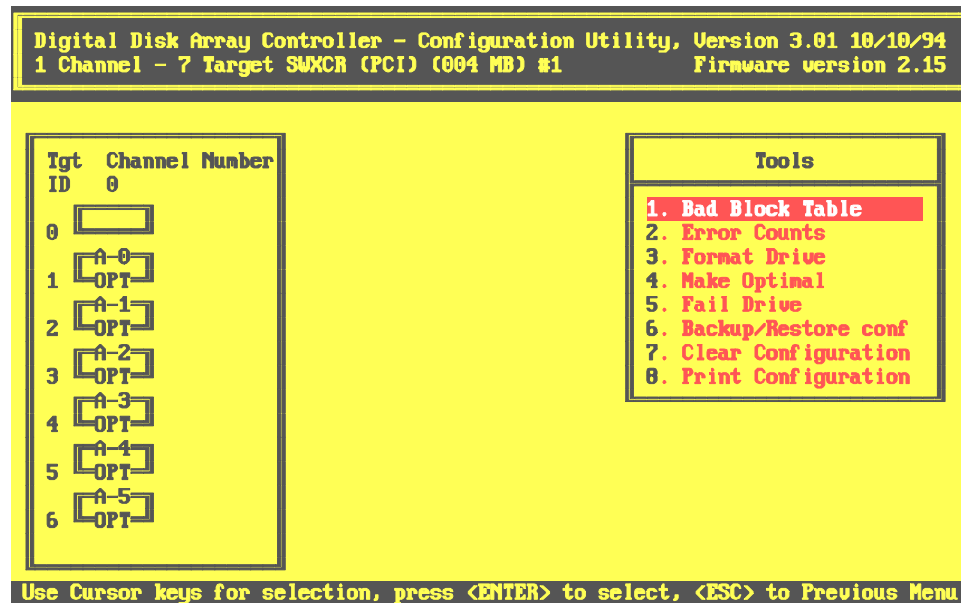
6.5.3 Saving the RAID Configuration to a Diskette

Save a copy of your RAID configuration on a diskette. Then, in the event that your controller ever fails, you can restore your configuration onto a new controller from a backup copy on floppy disk.

To save the configuration, follow these steps:

1. Insert a blank diskette in your system's floppy drive.
2. Press the Enter key to select the *Tools* option from the main menu. The utility displays the *Tools* menu, as shown in Figure 6–13.

Figure 6–13 The Tools Menu



3. Press the Enter key to select the *Backup/Restore Conf* option, to save the configuration information in a file. A brief message appears explaining this option.

4. Press any key to Continue. The *Backup/Restore Conf* menu appears.
5. Select *Backup* from the *Backup/Restore Conf* menu. The utility prompts you to enter a name for the file.
6. Enter the path (for example, a:) and an appropriate file name with up to eight characters and a three character file extension (for example, a:newconf.sav) and press the Enter key. The utility displays a message asking whether it should overwrite an existing file.
7. Press the Y key to save the new file. A message appears indicating that the utility is saving the configuration. The *Backup/Restore* menu then appears when the utility finishes saving the configuration.
Or,
Press the N key to return to the *Backup/Restore* menu without saving the file.
8. Press the Esc key to exit. The main menu appears.
9. Press Esc twice, then highlight *Yes* and press the Enter key to exit the utility.
10. Reboot your computer and start your operating system.

Go to the *RAID Array 200 Online Management Utility User's Guide* for your operating system for information on how to load the online management utility onto your system. The online management utility provides you with automatic notification of a change in status of the subsystem. Loading the online management utility onto your system completes the installation of your RAID Array 200 Series subsystem.

6.6 Configuring Interactively

Configure interactively to do the following:

- Create one or more drive groups
- Create one or more logical RAID drives
- Create a logical RAID drive of RAID level 0, 0 + 1, or 1
- Define spare drives
- Specify caching policy

To configure interactively, you must do the following:

- Create one or more drive groups
A drive group defines the drives that you want to work together as the available space for the logical RAID drives that you will create.
- Create Logical RAID drives
A logical RAID drive allows your system to see and respond to a drive group as a single drive and defines how your system will store data in that space, based on the RAID level selected. See Chapter 1 for a description of RAID levels.
- Add hot spares (optional)
A hot spare drive is a drive available in your subsystem for the controller to automatically begin to use, in the event of a disk failure from a redundant logical RAID drive, to store the data of the failed drive.
- Initialize the logical RAID drives
Initialize a logical RAID drive before you use it to ensure consistent RAID parity information.
- Save your configuration to diskette
Your RAID subsystem stores the configuration information on flash EEPROM/NVRAM on the RAID controller. In the event that your RAID controller fails, you must restore your configuration from a backup copy on floppy disk, or create a new configuration to access the data on your subsystem.

6.6.1 Creating a Drive Group

A drive group is from one to eight drives that operate as a single drive.

Determine how many drives to use for each drive group based on the following:

- The RAID levels of the logical RAID drives you will create
See Table 6–3 to see the minimum and maximum number of drives allowed for each RAID level. (You can create multiple logical RAID drives of varying RAID levels on a drive group.) See Chapter 1 for a discussion of RAID Levels.
- The amount of disk space you need

Table 6–3 shows the amount of storage available for unique data for each of the RAID levels.

Also, consider the capacities of each of the individual disks. The capacities of each of the individual disks are affected by the other disks in a group. Disk drives of varying capacities are limited to the capacity of the lowest capacity drive in the drive group. Table 6–4 provides examples of how the capacity of each individual drive affects the capacities of the other drives in the group. To maximize your disk space resources, use drives of the same capacity in a drive group.

If you plan to use more than one drive group, remember:

- Each disk can belong to only one drive group at a time.
- You can create a maximum of 8 drive groups.
- Also, after you create drive groups you must arrange them in the order in which you want to use them. (You must use all the available space on a drive group before you can use another one.) So, consider what data you want to put on which drive group, before arranging your drives, because you can only delete drive groups in the reverse order in which they were arranged. For example if you create drive groups a, b and c, and arrange them in that order, then you must delete drive groups c and b before you can delete drive group a.

Table 6–3 Number of Drives You Can Use In a Drive Group for Each RAID Level

RAID Level	Number of Drives in Drive Group	Amount of Storage Available for Unique Data	Data Redundancy
0	2 to 8	100%	No
1	2	50%	Yes
0 + 1	3 to 8	50%	Yes
5	3 to 8	66%—87%	Yes
JBOD	1	100%	No

NOTE

The following equation determines the amount of storage available for unique information in a RAID 5 logical RAID drive.

*usable space = total space * ((N-1)/N)* where N is the number of drives in the drive group.

Table 6–4 How the Capacity of Each Individual Drive Affects the Capacity of the Drive Group – Example Only

Drive Group	Drives	Drive's Capacity	Drive's Usable Capacity in this Group	Drive Group's Total Capacity
A	0	1 gigabyte	1 gigabyte	3 gigabytes (due to drive 0's capacity being 1 gigabyte)
	1	2 gigabyte	1 gigabyte	
	2	2 gigabyte	1 gigabyte	
B	0	2 gigabytes	2 gigabytes	6 gigabytes
	1	2 gigabytes	2 gigabytes	
	2	2 gigabytes	2 gigabytes	

Creating a drive group requires the following procedures:

- Defining a Drive Group
- Arranging a Drive Group

Determine how you want to allocate your drive resources then follow Sections 6.6.1.1 to 6.6.6 to configure the drives in your array.

6.6.1.1 Defining a Drive Group

Use this option to bind drives together into drive groups. To maximize your disk space resources, use drives of the same capacity in a drive group. (See Section 6.6.1 for more information on how to select drives for a drive group.)

To define a drive group, follow these steps:

1. Select the *New Configuration* option from the main menu and either one of the following things happens depending upon whether a configuration currently exists.

If a configuration currently exists, the utility displays a warning message saying that a valid configuration exists and if you proceed, you will destroy it. A confirmation window also appears. Go to Step 2.

If no configuration currently exists, then the utility displays the *New Configuration* menu as shown in Figure 6–14. The *New Configuration* menu appears with the *Define Drive Group* option highlighted. Go to Step 3.

2. Select Yes to delete the current configuration (select No to quit without changing the configuration and to return to the main menu). The utility displays the *New Configuration* menu as shown in Figure 6–14. The *New Configuration* menu appears with the *Define Drive Group* option highlighted.

Figure 6–14 The New Configuration Screen



3. Press the Enter key to select the *Define Drive Group* option. The utility displays a drive matrix that shows the drives connected to the adapter and the status of each, as shown in Figure 6–15. The *Create Group* function appears highlighted.

NOTE

If you are uncertain about the size of a particular drive, select the *Device Information* option on the *Define Drive Group* screen to check the size before you create a drive group.

Figure 6–15 The Group Definition Menu

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1Firmware version 2.13

Tgt ID	Channel Number
0	
1	RDY
2	RDY
3	RDY
4	RDY
5	RDY
6	RDY

Group Definition

1. Create Group
2. Cancel Group
3. Arrange Group
4. Device Information

GRP	DRUS	SIZE (MB)

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

- Press the Enter key to select the *Create Group* option. The cursor moves to the drive matrix.
- Position the cursor on each drive with a status of RDY(ready) that you want to add to the drive group, one at a time, and press the Enter key. The utility adds that drive to the drive group by changing its status from RDY to OPT (optimal); and assigning a group letter, and a sequence number to the drive as shown in Figure 6–16.

NOTE

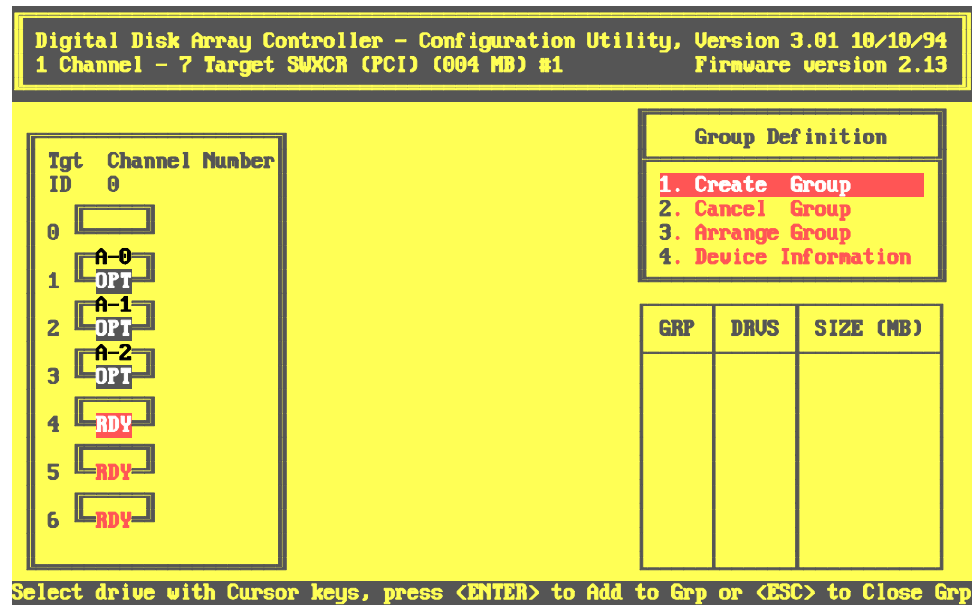
To maximize the I/O performance of your multichannel RAID subsystem, locate each member of a drive group on a separate SCSI channel. This allows the RAID controller concurrent access to the disk drives.

6. Press the Esc key after you add all the drives that you want for this drive group.
 7. Repeat Steps 3 through 6 of this procedure to create additional drive groups. If you plan to define a hot spare, leave at least one drive with RDY status. This drive must be of equal or greater capacity to the drives you assigned to drive groups.
- If you assign all the physical drives to drive groups, the system automatically highlights the *Arrange Group* option. Otherwise, press the Esc key and the cursor returns to the *Group Definition* menu. Go to Section 6.6.1.2, Arranging a Drive Group.

NOTE

If you select a drive for the drive group by mistake or you want to redefine a drive group, highlight the *Cancel Group* option and press the Enter key. The cursor appears on the first drive in a group on the matrix. Move the cursor to the drive group you want to cancel and press the Enter key. You can only delete drive groups in the reverse order in which you arranged them.

Figure 6–16 Each Drive Assigned to a Group Appears with the Group Letter and a Number



6.6.1.2 Arranging a Drive Group

Arrange drive groups to specify the order in which you want to use them. The configuration utility allows you to create logical RAID drives on only one drive group at a time. You must use all of the disk space available on a drive group before you can begin creating logical RAID drives on the next group.

To arrange the drive groups in the order in which you want to use them, follow these steps:

1. If the Arrange Group option does not already appear highlighted, use the arrow keys to highlight it and press the Enter key. The cursor moves to the first defined drive group.

NOTE
If you press the Esc key while arranging groups, you lose the unassigned drive groups and must recreate them.

2. Use the arrow keys to move the cursor to a drive in the group you want to arrange. Press the Enter key. The drive group and size information for the arranged drive group appears in the table at the lower-right side of the screen, as shown in Figure 6–17. If you defined only one drive group, the *New Configuration* menu appears with the *Define Logical Drive* option highlighted.

Otherwise, repeat this for each drive group that you defined. When you arrange the last drive group, the *New Configuration* menu appears with the *Define Logical Drive* option highlighted.

This completes the creation of your drive groups. Now, follow Section 6.6.2 to create logical RAID drives on your drive groups.

Figure 6-17 Arrange Drive Window

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1Firmware version 2.13

Tgt ID	Channel Number
0	<div><div></div><div>0</div><div>OPT</div></div>
1	<div><div></div><div>1</div><div>OPT</div></div>
2	<div><div></div><div>2</div><div>OPT</div></div>
3	<div><div></div><div>3</div><div>OPT</div></div>
4	<div><div></div><div>4</div><div>RDY</div></div>
5	<div><div></div><div>5</div><div>RDY</div></div>
6	<div><div></div><div>6</div><div>RDY</div></div>

Group Definition

1. Create Group

2. Cancel Group

3. Arrange Group

4. Device Information

GRP	DRUS	SIZE (MB)

For every Grp, select a drive of Grp and press <ENTER> to Arrange, <ESC> to quit

6.6.2 Creating a Logical RAID Drive

You create a logical RAID drive with part or all of the space available on a drive group. The logical drive allows your operating system to see and respond to that portion of the drive group as one physical drive. The logical RAID drive also defines how your system will store data on that disk space, based on the RAID level selected. To the operating system, there is no difference between a logical RAID drive and a single physical drive on a conventional disk controller.

You can create a maximum of 8 logical RAID drives per controller.

NOTE
For redundant RAID configurations, the controller will use some of the space for data redundancy purposes. See Table 6–3 for information on how much space is available for each RAID level on which you can store unique data.

Creating a logical RAID Drive requires the following procedures:

- Defining a logical RAID drive
- Choosing a write caching policy
- Saving the logical RAID drive configuration

6.6.2.1 Creating a Logical RAID Drive

To create a logical RAID drive, follow these steps:

1. Press the Enter key to select the *Define Logical Drive* option from the *New Configuration* menu. The *Logical Drive Definition* menu screen appears, as shown in Figure 6–18. The *Logical Drive Definition* menu screen displays an option menu, a table of the drive groups available for selection as logical RAID drives, and a table of the existing logical RAID drives.

Figure 6–18 Logical RAID Definition Menu

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		

Log Drv	Size (MB)	RAID	Write Mode

Logical Drive Definition	
1. Create Logical Drive	
2. Toggle Write Policy	

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

- Press Enter to select the *Create Logical Drive* option. A pop-up window displays a RAID level list, as shown in Figure 6–19. RAID levels require certain numbers of drives. (See Table 6–3 for a description of the number of drives required for each RAID level and Chapter 1 of this guide for a description of RAID levels) The utility will allow you to select only the RAID levels appropriate for the selected drive group.

Unavailable levels on the RAID Level list appear black (in this manual) gray on your screen; you cannot select them.

You can only create logical RAID drives on one drive group at a time and must use all of the space on a drive group before you can go on to the next one. You can only create logical RAID drives on the drive groups in the order in which they appear in the *Grp/Drvs* table.

Figure 6–19 Select RAID Level

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Log Drv	Size (MB)	RAID	Write Mode

RAID Level
 RAID 0
 RAID 1
 RAID 5
 RAID 0+1
 JBOD

Select a RAID Level using cursor keys and press <ENTER>, <ESC> to Previous Menu

3. Use the up and down arrow keys to move to the RAID level for the logical RAID drive and press the Enter key to select. The amount of space available on the first drive group in the *Grp/Drvs* table displays in a pop-up window.
4. Type the amount of space that you want to use for this logical RAID drive, and press the Enter key, or press the Enter key to select all available space. The utility displays the logical drive number, the RAID level and size of this logical RAID drive in the status block, as shown in Figure 6–20.

NOTE

If you create non-redundant logical RAID drives and redundant logical RAID drives on a drive group, only the portion of the drive group used by the redundant logical RAID drive is redundant.

Figure 6–20 Logical RAID Drive Status Block

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		

Log Drv	Size (MB)	RAID	Write Mode

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Logical Drive# = 0
 Raid Level = 5
 Capacity = 4096 MB

Do you want to Create this Logical drive ?
 NO
 YES

Choose YES to Create the above Logical drive, NO or <ESC> to Cancel.

5. Select Yes to confirm that you want to create this logical RAID drive. The utility adds the logical RAID drive to the list at the lower-left of the screen, and displays the write mode (caching policy), as shown in Figure 6–21.

Figure 6–21 The New Logical RAID Drive Appears in List at Bottom Left

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (804 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

6. Repeat Steps 1–5 for up to eight logical RAID drives, or until you use all the capacity of all the available drive groups, whichever comes first. You can only create logical RAID drives on one drive group at a time and must use all of the space on a drive group before you can go on to the next one. The utility displays each logical RAID drive in the table on the lower-left of the screen.

Now see Section 6.6.2.2 to select a caching policy for the logical RAID drives that you created.

Or if you do not want to use the logical RAID drives that you just created, press Esc. The *New Configuration* Menu appears. Press Esc again. The *Save Configuration* screen appears. Highlight No and press the Enter key. The Main menu appears.

6.6.2.2 Choosing a Caching Policy

The caching policy determines what procedure the RAID controller uses to write data to the logical drives. You can choose one of the following caching policies:

- *Write-Back caching:* A caching policy in which the controller acknowledges that a write operation has completed successfully before data is written to the disks. If you choose this caching policy, you may increase the I/O performance of your RAID subsystem.

We recommend that you select this caching policy only if your cache has battery backup and you have enabled the battery backup. Without a battery backup, if there is a power failure, you lose data in cache that is not yet written to the disks.

- *Write-Through caching:* A caching policy in which the data is written to disk before the controller acknowledges that a write operation is completed successfully. If you choose this caching policy and there is a power failure, you do not need a battery backup to minimize the chance of data loss. This is the StorageWorks RAID Array 200 subsystem default caching policy.

NOTE

We strongly recommend a Write-Through for the EISA controller or any controller without battery backup cache.

To change the caching policy, follow these steps:

1. Select the *Toggle Write Policy* option on the *Logical Drive Definition* menu. The cursor moves to the *Write Mode* column of the logical RAID drives list and highlights the write mode of the first logical RAID drive.
2. Press the Enter key to toggle the caching policy to Write-Back.
3. Use the arrow keys to move to another logical RAID drive and repeat Step 2 for each logical RAID.
4. When you finish selecting cache policy for your logical RAID drives, press the Esc key once. You return to the *Logical Drive Definition* menu.
5. Press the Esc key again to return to the *New Configuration* menu.

If you plan to use one or more of your drives as a spare drive, go on to Section 6.6.3 to define a hot spare drive. Otherwise, go to Section 6.6.4 to save the configuration of your array.

6.6.3 Defining Hot Spare Drives

Define a hot spare to keep a drive available in your subsystem on which the RAID controller can automatically start to rebuild information. A hot spare drive replaces a drive that fails from any drive group on which you created a redundant logical RAID drive only. The hot spare drive must have a capacity equal to, or greater than, the failed drive.

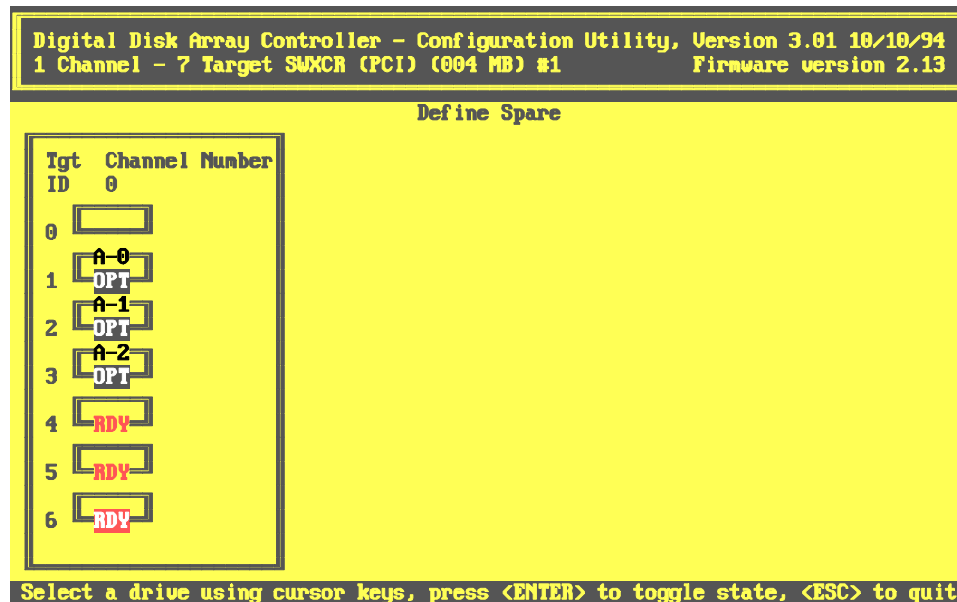
Once the controller writes data to a hot spare drive, the status of the hot spare changes to optimal, and that drive becomes a part of the same drive group from which a drive failed.

For more information on rebuilding drives, see the section on Rebuilding Drives, in Chapter 7, which describes each method available.

To define spare drives, follow these steps:

1. Use the up and down arrow keys to highlight the *Define Spare* option on the *New Configuration* menu and press the Enter key. The utility displays the *Define Spare* screen as shown in Figure 6–22.

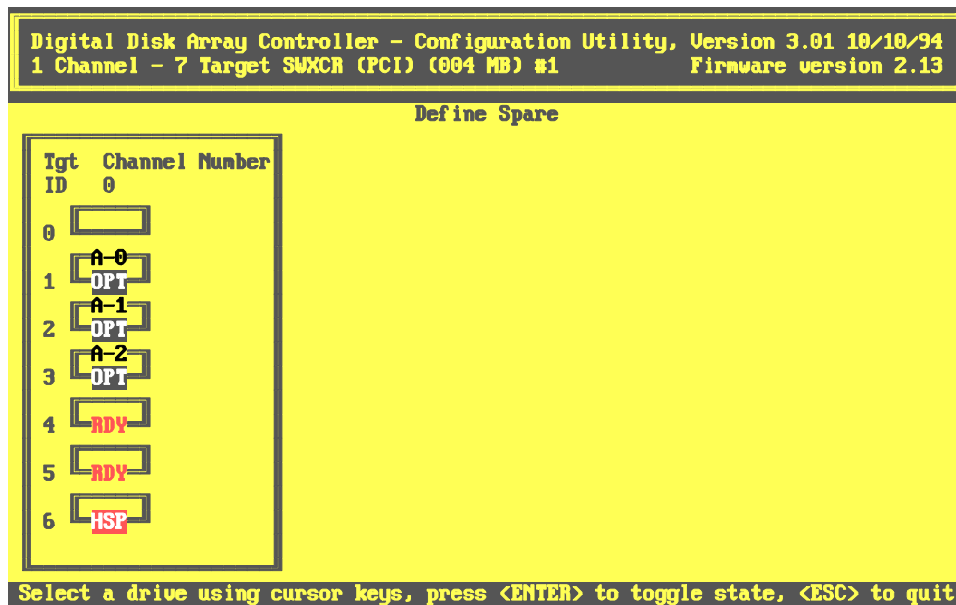
Figure 6–22 The Define a Hot Spare Screen



2. Use the arrow keys to select the drive with a status of RDY you want to define as a spare and press the Enter key. The utility changes the drive status to HSP (hot spare), as show in Figure 6–23.

If you select the wrong drive or decide that you do not want a hot spare drive, press the Enter key again. The status of the drive returns to its previous status.

Figure 6–23 The Status of the Selected Drive Changes to HSP



Now go on to Section 6.6.4 to save the configuration of your array.

6.6.4 Saving the Logical RAID Drive Configuration

To save the logical RAID drive configuration that you created, follow these steps:

1. Press the Esc key from the *New Configuration* menu or from the *Define Spare* screen. The utility displays a confirmation window, as shown in Figure 6–24.

Figure 6–24 Configuration Confirmation

Digital Disk Array Controller – Configuration Utility, Version 3.01 10/10/94
1 Channel – 7 Target SWXCR (PCI) (804 MB) #1 Firmware version 2.13

Grp/Drus	Size (MB)	Grp/Drus	Size (MB)
A / 3	6147		

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU

SAVE configuration ?

YES

NO

Choose YES to save configuration, NO to cancel and exit, <ESC> to quit

2. Use the up and down arrow keys to highlight Yes and press the Enter key to save the logical RAID drive configuration. The utility saves the configuration to the flash EEPROM/NVRAM and the main menu appears.

The controller stores the configuration that you created on flash EEPROM/NVRAM. Thereafter, the controller expects to see this configuration.

NOTE

If you start your system with the storage enclosure disconnected, with the storage enclosure's power turned-off, with different drives installed in subsystem slots, or with other physical changes, the system will abort the installation. (An Intel system will display the following BIOS message: `Installation Aborted. Alpha systems do not have BIOS.`)

The installation aborts, because the configuration that the controller sees does not match the configuration stored on the controller's NVRAM.

Reconcile the physical and stored configurations by returning your storage enclosure to its previous configuration, or rebooting your system from the standalone configuration diskette and changing the configuration stored on the controller.

Now, go to Section 6.6.5 to initialize the logical RAID drive.

6.6.5 Initializing a Logical RAID Drive

Initialize a logical RAID drive before you use it. The utility initializes the logical RAID drive by writing a pattern of zeros to it. This creates a starting parity for a logical RAID drive with parity, or starting data for a logical RAID drive which does not have parity.

CAUTION

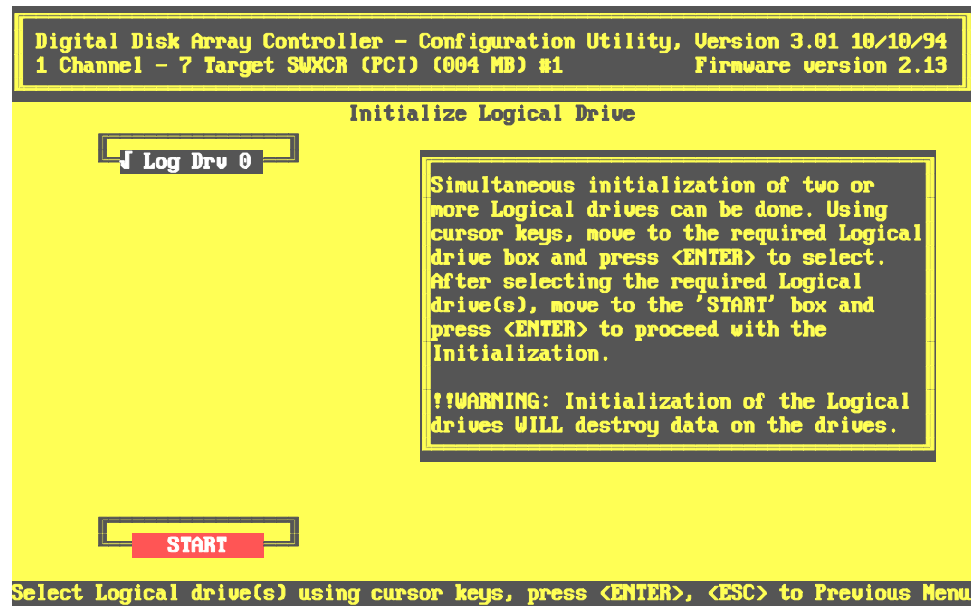
Do not initialize a logical RAID drive if it has valid data. Initialization overwrites and destroys all data.

Also, after you initialize a logical RAID drive, do not change or rearrange the physical drives or cables. Otherwise, all data in the drive group can be lost.

To initialize a logical RAID drive, follow these steps:

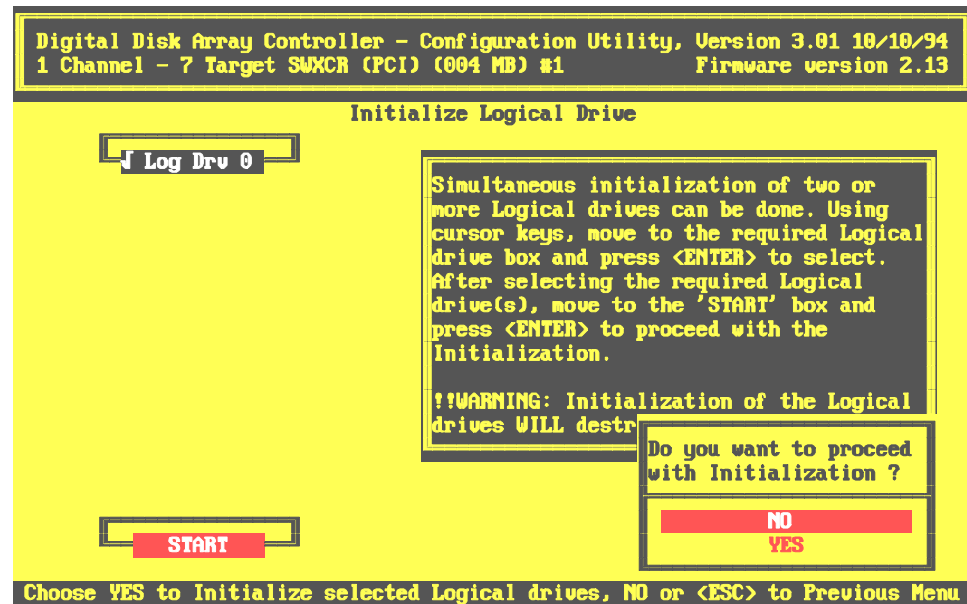
1. From the main menu, select the *Initialize Logical Drive* option. The utility displays the *Initialize Logical Drive* screen, with logical RAID drive 0, as shown in Figure 6–25.

Figure 6–25 Initialize Logical RAID Drive Screen



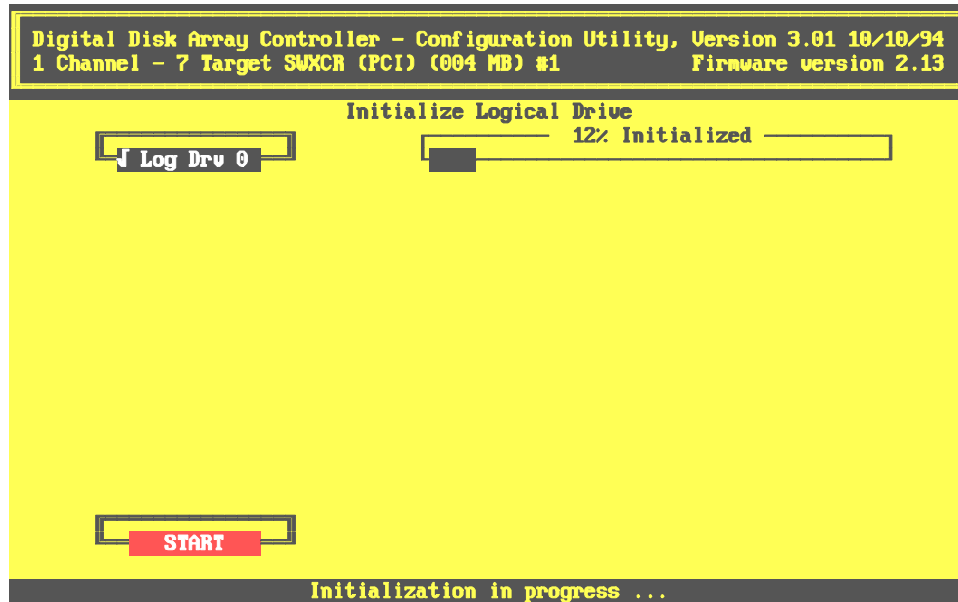
2. Use the arrow keys to move to each logical RAID drive that you want to initialize and press the Enter key to select it. A check mark appears beside each logical drive that you selected. Once you select all available logical drives, the utility automatically highlights the *Start* button. Otherwise use the arrow keys to move to the *Start* button
3. Press the Enter key. A confirmation window appears, as shown in Figure 6–26, displaying the following message:
Do you want to proceed with initialization?

Figure 6–26 Proceed with Initialization Confirmation Message



4. Select Yes. An *Initialize Logical Drive* status bar appears at top of screen, as shown in Figure 6–27, indicating amount of initialization completed. The bar gradually fills as the initialization process completes. When done initializing, the utility prompts you to press any key to continue.

Figure 6–27 Progress Bar Displays Status of Initialization



5. Press any key. The utility displays a message indicating that it is saving the configuration, then the main menu appears.

Go to Section 6.6.6 to continue with the next step of the installation, saving the configuration to a diskette.

6.6.6 Saving the RAID Configuration to a Diskette

Save a copy of your RAID configuration on a diskette. Then, in the event that your controller ever fails, you can restore your configuration onto a new controller from a backup copy on floppy diskette.

To save the configuration, follow these steps:

1. Insert a blank diskette in your system's floppy drive.
2. Use the arrow keys to highlight the *Tools* option from the main menu, and press the Enter key to select it. The utility displays the *Tools* menu.
3. Press the Enter key to select the *Backup/Restore Conf* option. A brief message appears explaining this option.
4. Press any key to Continue. The *Backup/Restore Conf* menu appears.
5. Select *Backup* from the *Backup/Restore Conf* menu. The utility prompts you to enter a name for the file.
6. Enter the path (for example, a:) and an appropriate file name with up to eight characters not including the file extension and press the Enter key. The utility displays a message asking whether it should overwrite an existing file.
7. Press the Y key to overwrite an existing file. A message appears indicating that the utility is saving the configuration. The *Backup/Restore* menu then appears when the utility finishes saving the configuration.
Or,
Press the N key to return to the *Backup/Restore* menu without saving the file.
8. Press the Esc key to exit. The main menu appears.
9. Press the Esc key twice, then highlight *Yes* and press the Enter key to exit the utility.
10. Reboot your system and start your operating system.

This completes the configuration of your array. If you installed your subsystem for the first time, go now to the RAID Array 200 Online Management Utility for your operating system User's Guide to load the online management utility onto your system. The online management utility provides you with automatic notification of a change in status of the subsystem. Loading the online management utility onto your system completes the installation of your RAID Array 200 Series subsystem.

Maintaining the Array with the Standalone Configuration Utility

This chapter presents information about maintaining the array with the standalone configuration utility. The tasks involve viewing the configuration, changing the configuration, checking parity, and working with drives

7.1 Introduction

Use the standalone configuration utility to maintain the subsystem in the following ways:

- View the configuration
- Change the configuration
- Check logical RAID drive parity
- Add a hot spare after initial configuration
- Fail a drive
- Make a drive optimal
- Format a drive
- Rebuild a drive
- View bad block information

In addition, the standalone configuration utility floppy diskette contains utilities to update Intel system's BIOS and the RAID controller firmware.

7.1.1 Turning-On and -Off Your System and Storage Enclosures

The order in which you turn-on and -off your system and storage enclosures effects the operation of your RAID Array 200 Series Subsystem. If the RAID controller can not access the drives in your storage enclosures, it marks the drives as failed. Therefore to avoid the controller trying to access the drives with the storage enclosure turned off, power-on and off your system and storage enclosures in the following order:

Power-on

1. Storage enclosures **first**
2. System second

Power-off

1. System **first**
2. Storage enclosures second

7.1.2 Using the Utility

Use the Standalone utility to configure and maintain your RAID Array 200 Subsystem. Use the standalone utility to initially configure your subsystem and then to maintain the subsystem by changing the configuration, if necessary, and to view the status of the logical and physical drives. In addition, use the standalone utility to rebuild and format the drives as necessary.

7.1.2.1 Invoking the Utility

You can invoke the utility on an Intel system or an AXP system. If you have an Intel system, refer to Section 7.1.2.1.1, Invoking the Utility on an Intel System. If you have an AXP system, refer to Section 7.1.2.1.2, Invoking the Utility on an AXP System.

NOTE

Turn on the power to your storage enclosure, before turning on the power to your computer and invoking the utility.

When you invoke the utility, the utility first checks the status of each drive. If the drive status changes after you invoke the utility (for example, if a drive fails or if you remove a drive), the utility does not display the change until the next time you invoke the utility.

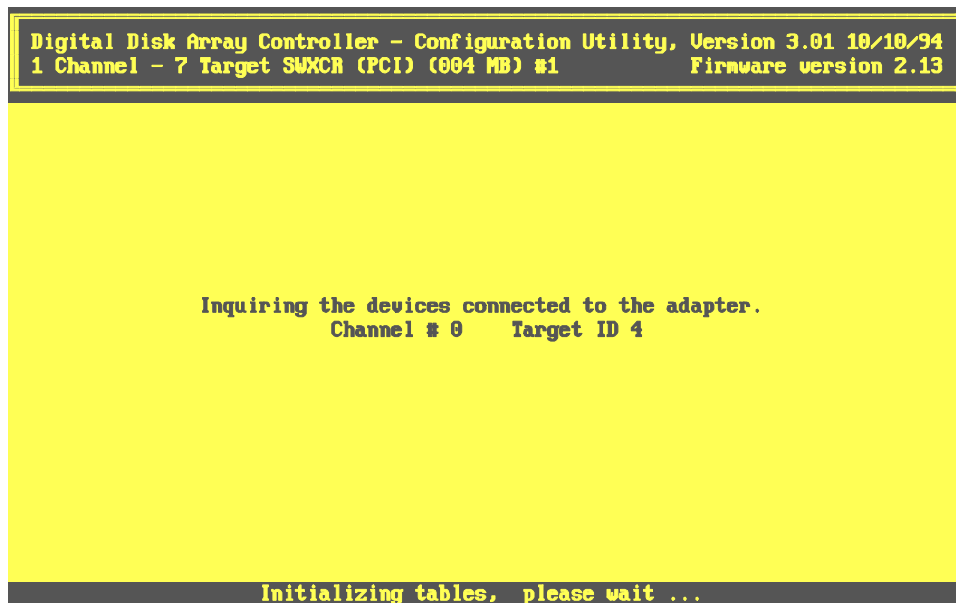
7.1.2.1.1 Invoking the Utility on an Intel System

To invoke the standalone configuration utility on an Intel System, follow these steps:

1. Insert the Standalone Configuration utility diskette for Intel Systems in your floppy drive and boot from that drive.
2. Type the following command at the prompt to invoke the utility:
`A:\SWXCR> swxcrmgr`

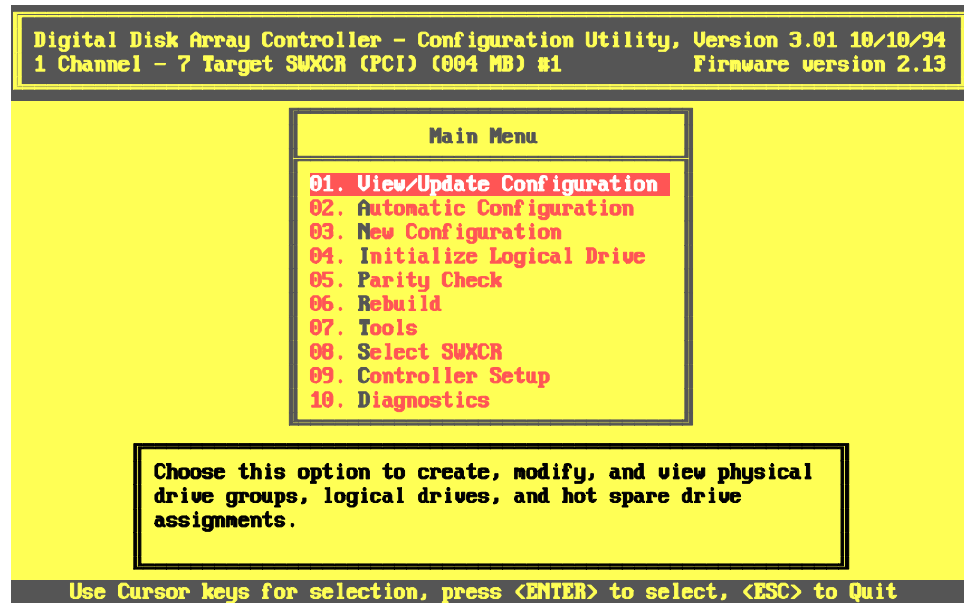
The utility inquires what devices are connected to the adapter and identifies them by Channel # and Target ID similar to the screen shown in Figure 7–1.

Figure 7–1 Introductory Screen



After inquiring the connected devices, the utility displays the main menu, as shown in Figure 7–2.

Figure 7–2 Main Menu



7.1.2.1.2 Invoking the Utility on an AXP System

To invoke the standalone configuration utility on an AXP system, you must first invoke the ARC console menu shown in Figure 7–3 on the ARC console. Consult your AXP system documentation to invoke ARC console menu.

7-3 The ARC Console for an AXP System

```
ARC Multiboot DEC Version 2.07
Copyright (c) 1993 Microsoft Corporation
Copyright (c) 1993 Digital Equipment Corporation

Boot Menu
    Boot Windows NT
    Boot an alternate operating system
    Run a program
    Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

To invoke the standalone configuration utility, follow these steps:

1. Insert the Standalone utility for AXP Systems diskette into your floppy drive.
2. Use the arrow keys to move to the *Run a Program* option, and then press the Enter key to select it. The AXP boot menu displays the program to run: prompt.
3. Type the following to run the utility from the A: drive:
Program to Run: **A:swxcrmgr**

After checking the drives, the utility displays the main menu as shown in Figure 7-2.

7.1.2.2 Navigating Through the Utility

Aside from invoking the utility, the Standalone utility operates the same in both the Intel and AXP system environments.

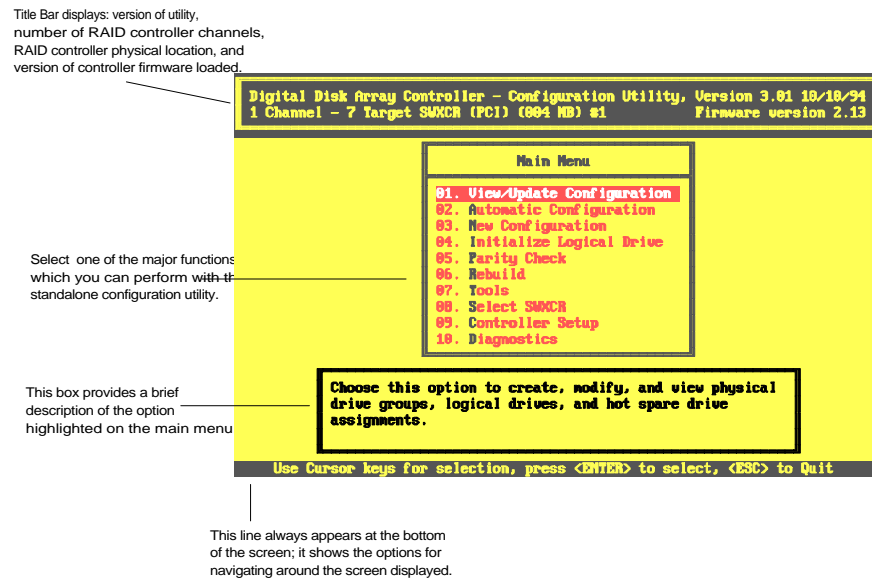
Once started, the utility displays the main menu options. Use the up and down arrow keys or type the highlighted letter (usually the first letter of the item) to move the cursor from one option to the next. A message window at the bottom of the screen displays a brief description of the highlighted option.

NOTE

You can use the Enter key or the Return key interchangeably.

Press the Enter key to select the highlighted option. A description of the main menu screen appears in Figure 7-4.

Figure 7-4 Elements of the Utility Screens



7.1.2.3 Exiting the Utility

At any time, you can exit the utility by pressing the Esc key twice from the main menu. The utility prompts you to confirm that you want to exit. Select *Yes* and press the Enter key to return to the MS-DOS prompt.

7.2 Viewing the RAID Subsystem Configuration

Use the standalone configuration utility to view and update the current subsystem configuration. You can view the following from the standalone utility:

- Which disk drives are bound into which drive groups
- Which logical RAID drives are associated with which drive groups
- The status of each disk drive installed in the subsystem
- The status of all the logical RAID drives configured into the subsystem

7.2.1 Viewing Disk Drive and Drive Group Information

Use the standalone configuration utility to view the following disk drive and drive group information:

- Status of each disk drive
- Which disk drives are associated with which drive groups
- Capacity of each drive group
- Capacity, channel number, and target id of each disk drive

NOTE

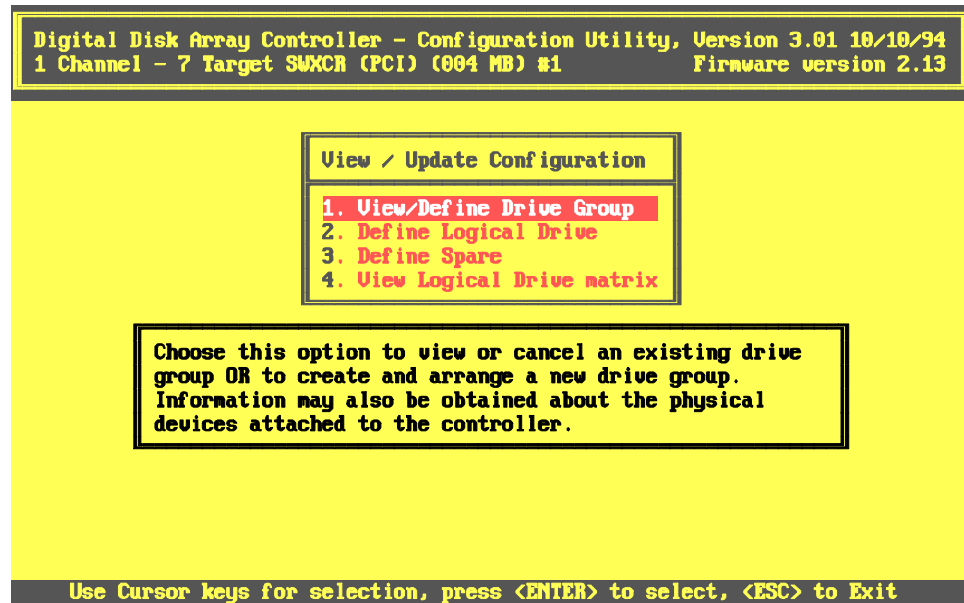
You can view disk drive status by selecting either the *View/Define Drive Group*, or the *View Logical Drive Matrix* options from the *View/Update Configuration* menu. Use the *View/Define Drive Group*, option to view disk drive status and additional disk drive information as described in this section.

Use *View Logical Drive Matrix* option to view disk drive status in addition to information about logical RAID drives as described in Section 7.2.2.

To view disk drive and drive group information, follow these steps:

1. Use the up and down arrow keys to select the *View/Update Configuration* option from the main menu and press the Enter key. The utility displays the *View/Update Configuration* menu as shown in Figure 7–5.

Figure 7–5 View/Update Configuration Screen



2. Use the up and down arrow keys to highlight the *View/Define Drive Group* option from the *View/Update Configuration* menu and press the Enter key. The Group Definition menu appears with a disk drive matrix and drive group table displayed, as shown in Figure 7–6.

Figure 7–6 Group Definition Menu

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94
Firmware version 2.13

Tgt ID	Channel Number
0	
1	A-0 OPT
2	A-1 OPT
3	A-2 OPT
4	RDY
5	RDY
6	HSP

Group Definition

1. Create Group
2. Cancel Group
3. Arrange Group
4. Device Information

GRP	DRUS	SIZE (MB)
A	3	6147

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

The drive matrix displays the following:

- Target ID
- Channel number
- Drive group designator, if any, which allows you to see which disks belong to which drive groups, and how many disks belong to the group, based on the numbers assigned to the drives, 0–7. For example drive A-2 is one of three drives in drive group A
- Status for each drive in the subsystem (Table 7–1 describes each status that a drive can have).

The drive group table displays the following:

- Each of the drive groups (A–H), 8 maximum
- The number of drives in each group
- The capacity of each drive group

Table 7–1 Drive Status

Display	Drive Status	Meaning
FLD	Failed	The device failed due to errors or you manually failed it.
FMT	Formatting	The device is formatting.
HSP	Hot spare	The device is configured as a hot spare for use in an automatic rebuild in the event of a disk failure in a redundant RAID configuration.
OPT	Optimal	The device is online and configured for use. Drives associated with a drive group appear with this status.
RDY	Ready	The device is spun up and ready to be used by the controller, but is not configured. Drives which are not associated with a drive group appear with this status.
UNF	Unformatted	The device was being formatted and you halted the format operation.
WOL	Write Only	The device is being rebuilt and is in write-only mode.

3. Use the up and down arrow keys to highlight the *Device Information* option on the *Group Definition* menu and press the Enter key. The cursor appears in the drive matrix.
4. Use the up and down arrow keys to move to the drive for which you want information and press the Enter key. The *Device Information* box replaces the Drive Group table, as shown in Figure 7-7.

Figure 7-7 Device Information

Digital Disk Array Controller - Configuration Utility, Version 3.00 08/03/94
3 Channel - 7 Target DAC960P, Bus# 0, Device# 7 **Firmware version 2.00**

Tgt ID	Channel Number		
	0	1	2
0			
1			
2		A-0 OPT	
3		A-1 OPT	
4			
5			
6			

Group Definition

1. Create Group
2. Cancel Group
3. Arrange Group
- 4. Device Information**

Device Information

Vendor : DEC
 Model No : R226 (C
 Revision : 392A

Size : 1001 MB
 Channel : 1
 Target : 2

Press any key to continue

5. The *Device Information* box displays information about the drive including its manufacturer, model number, firmware version, capacity, and its channel number and target ID.
6. Press the Esc key when you finish viewing information from the *Device Information* box, and the *Drive Group* table appears.
7. Press the Esc key again to return to the *View/Update Configuration* menu.

7.2.2 Viewing Logical RAID Drive Information

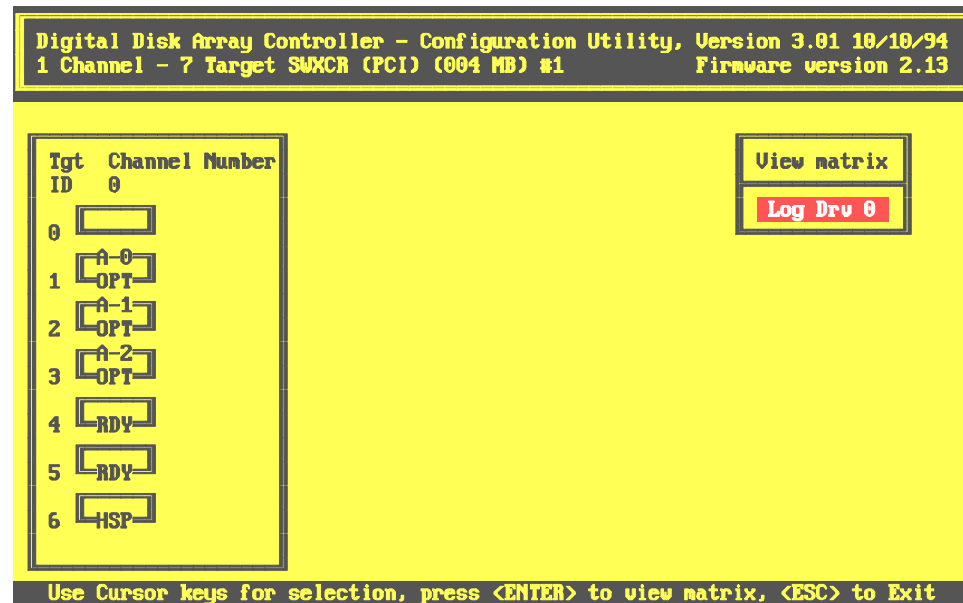
Use the standalone configuration utility to view the following disk drive information:

- Status of each disk drive
- Current logical RAID drive configuration
- Which logical RAID drives are associated with which drive groups

To view disk drive and logical RAID drive information, follow these steps:

1. Use the up and down arrow keys to select the *View/Update Configuration* option from the main menu and press the Enter key. The utility displays the *View/Update Configuration* menu as shown in Figure 7-2.
2. Use the up and down arrow keys to highlight the *View Logical Drive Matrix* option from the *View/Update Configuration* menu and press the Enter key. The *View Matrix* list appears on a screen with a drive matrix as shown in Figure 7-8.

Figure 7-8 View Matrix Screen



The *View Matrix* list displays all of the logical RAID drives configured onto the disk drives in your subsystem.

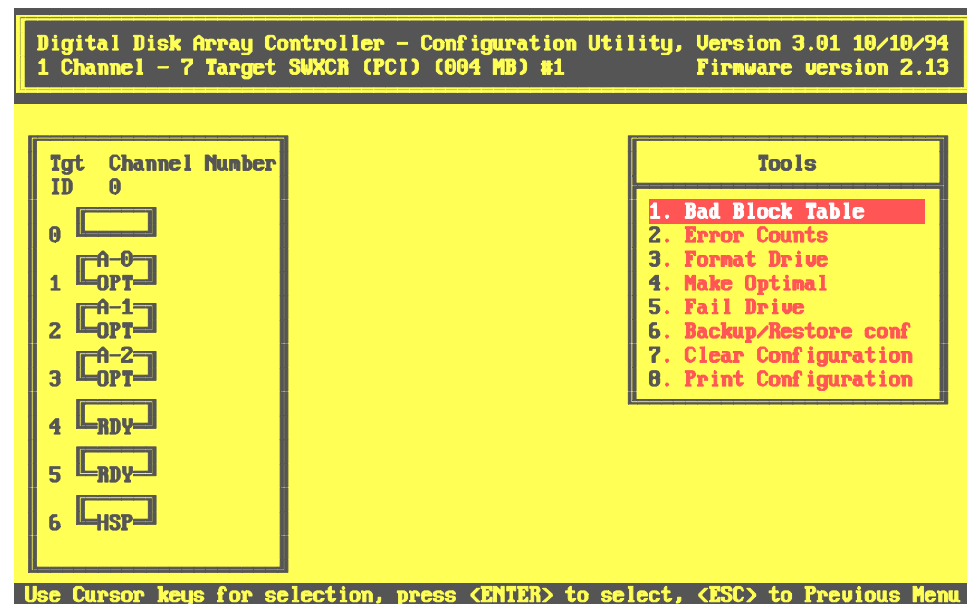
3. Use the up and down arrow keys to highlight a logical RAID drive and press the Enter key. The cursor moves to the drive matrix. It appears at disk drive 0 of the drive group associated with the selected logical RAID drive. The drive matrix displays:
 - Target ID
 - Channel number
 - Drive group designator, if any, which allows you to see which disks belong to which drive groups, and how many disk belong to the group, based on the numbers assigned to the drives, 0–7. For example drive B-2 is one of three drives in drive group B
 - Status for each drive in the subsystem (Table 7–1 describes each status that a drive can have)
4. Press the Enter key to return to the *View Matrix* list.
5. Press the Esc key to return to the *View/Update Configuration* menu when you finish viewing drive groups associated with logical RAID drives.

7.2.3 Viewing the Configuration through a Hard Copy Representation

You can view your configuration by printing out a hard copy representation of it. To print a representation of your configuration, follow these steps:

1. Select the *Tools* option from the main menu and press the Enter key. The *Tools* menu appears as shown in Figure 7–9.

Figure 7–9 Tools Menu



2. Use the up and down arrow keys to highlight the *Print Configuration* option from the *Tools* menu and press the Enter key. The following prompt appears:
Enter File Name
3. Enter a file name of up to 13 characters including path and extension, for example, enter: **config.sav** to create a config.sav file in the current directory, or **C:\config.sav** to create a config.sav file in the root directory. Then press the Enter key. The following prompt appears:
Existing File, if any will be overwritten!

4. Select Yes and press the Enter key if you want to create a file with the name that you specified. If a file with the same name already exists, the utility will write over it. Select No and press the Enter key to return to the previous menu without creating a file. When you select Yes, the following prompt appears: Saved configuration print file. Press any key to continue
5. Press any key and the *Tools* menu appears. Press the Esc key to return to the main menu.
6. Press the Esc key again, and the utility prompts you to confirm that you want to exit the utilities.
7. Select Yes to exit the utility. An MS-DOS prompt appears.
8. At the MS-DOS prompt Type: **print filename**, where filename is the name you specified for the print configuration file, including path, if any. For example, type: print c:\config.sav). A file similar to the following prints on the printer attached to your computer.

```
*****
**

Digital Disk Array Controller - Configuration Utility
                                *

•                               Version 2.20                               *
*****
**
```

CONFIGURATION INFORMATION OF :

=====

1 Channel - 7 Target SWXCR in Slot 3 Firmware version
1.97

DRIVE GROUP INFORMATION :

=====

Number of drive groups = 1

Group 0 : [0:0]

LOGICAL RAID DRIVE INFORMATION :

=====

Number of Logical RAID Drives = 1

Log. Drv #	Phy. Size	Raid Level	Eff. Size	Write Policy
------------	-----------	------------	-----------	--------------

=====	=====	=====	=====	=====
-------	-------	-------	-------	-------

0	4004 MB	5	3003 MB	Write Thru
---	---------	---	---------	------------

7.3 Changing Configurations

You can change the configuration of your drives in one or more of the following ways:

- Define a hot spare
- Add or remove a drive group
- Add or remove a logical RAID drive
- Change the RAID level of an existing logical RAID drive

You can change the configuration of the drives by using one of the following options on the main menu:

- New Configuration

Use the *New Configuration* option to delete the existing configuration and create an entirely new one. See Chapter 6: Configuring the Array to configure with this option.

- View/Update Configuration

Use the *View/Update Configuration* option to modify the existing configuration. The major steps involved with modifying an existing configuration (the specific procedures that you need to follow vary depending upon how you want to change the configuration) include the following:

- Creating a drive Group
A drive group defines the drives that you want to work together.
- Creating a logical RAID drive
A logical RAID drive allows your system to see and respond to a drive group as a single drive, and defines how your system will store data in that space, based on the RAID level selected. See Chapter 1 for a description of RAID levels.
- Adding hot spare drives
A hot spare drive is a drive available in your subsystem for the controller to automatically begin to use in the event of a disk failure.
- Initializing a logical RAID drive
You must initialize a logical RAID drive before you can use it to ensure consistent RAID parity information.

- **Saving a copy of the RAID configuration on a diskette**
Your RAID subsystem stores the configuration information on flash EEPROM/NVRAM on the RAID controller. In the event that your RAID controller fails, you must restore your configuration from a backup copy on floppy disk, otherwise you can not access your existing subsystem configuration.
- **Restoring a RAID configuration onto a new controller**
In the event that your RAID controller fails, you must restore your configuration from a backup copy on floppy disk to access your existing subsystem configuration.

7.3.1. Creating a Drive Group

You can create a drive at any time. After you initially configure the subsystem, you can create a drive group with drives that you did not previously configure into drive groups, or with new drives you add to the subsystem. You can also create new drive groups with drives that you previously configured into drive groups by first canceling the existing drive groups that you want to re-organize.

A drive group is from one to eight drives that operate as a single drive. You can create a maximum of 8 drive groups.

Determine how many drives to use for each drive group based on the following:

- The RAID levels of the logical RAID drives you will create
See Table 7–2 to see the minimum and maximum number of drives allowed for each RAID level. (You can create multiple logical RAID drives of varying RAID levels on a drive group.) See Chapter 1 for a discussion of RAID Levels.
- The amount of disk space you need
Table 7–2 shows the amount of storage available for unique data for each of the RAID levels.

Also, consider the capacities of each of the individual disks. The capacities of each of the individual disks are affected by the other disks in a group. Disk drives of varying capacities are limited to the capacity of the lowest capacity drive in the drive group. Table 6–4 in Chapter 6 provides examples of how the capacity of each individual drive affects the capacities of the other drives in the group. To maximize your disk space resources, use drives of the same capacity in a drive group.

If you plan to use more than one drive group, remember that each disk can belong to only one drive group at a time.

Table 7–2 Number of Drives You Can Use in a Drive Group for Each RAID Level

RAID Level	Number of Drives in Drive Group	Usable Storage	Data Redundancy
0	2 to 8	All	No
1	2	50%	Yes
0 + 1	3 to 8	50%	Yes
5	3 to 8	66%—87%	Yes
JBOD	1	All	No

NOTE

To maximize the I/O performance of your multichannel RAID subsystem, locate each member of a drive group on a separate SCSI channel. This allows the RAID controller concurrent access to the disk drives.

Also, the total capacity of a drive group is determined by the member with the least capacity. If you are uncertain about the size of a particular drive, select the *Device Information* option on the *Define Drive Group* screen to check the size before you create a drive group.

Creating a drive group requires the following procedures:

- Defining a Drive Group
- Arranging a Drive Group

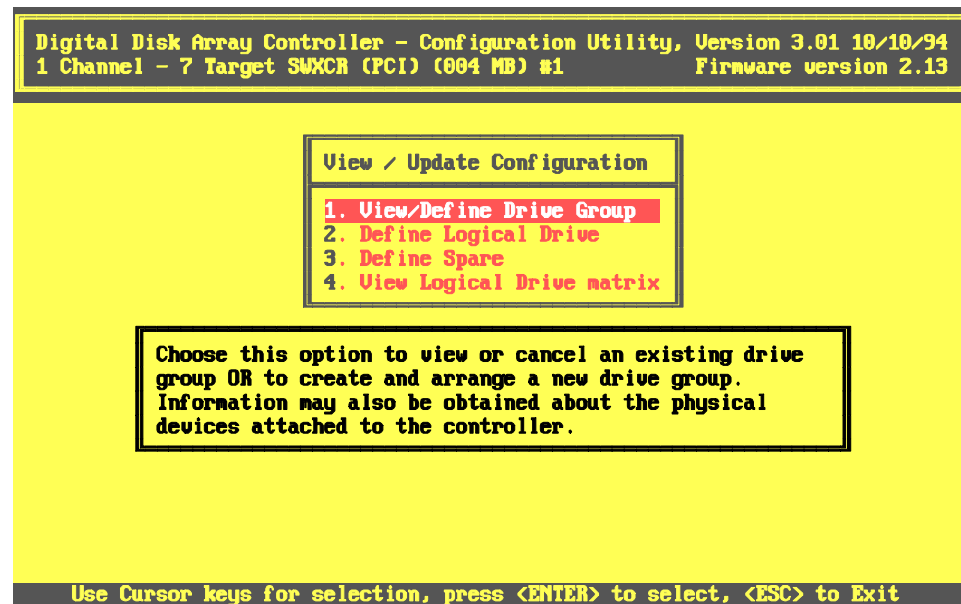
7.3.1.1 Defining a Drive Group

Use this option to bind drives together into drive groups.

To define a drive group, follow these steps:

1. Use the up and down arrow keys to highlight the *View/Update Configuration* option from the main menu and press Enter key to select it. The *View/Update Configuration* menu appears with the *View/Define Drive Group* option highlighted, as shown in Figure 7–10

Figure 7–10 View/Update Configuration Screen



2. Press the Enter key to select the *Define Drive Group* option. The utility displays a drive matrix that shows the drives connected to the adapter and the status of each, as shown in Figure 7–11. The *Create Group* function appears highlighted.

Figure 7–11 The Define Drive Group

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94
Firmware version 2.13

Tgt ID	Channel Number
0	
1	A-0 OPT
2	A-1 OPT
3	A-2 OPT
4	RDY
5	RDY
6	HSP

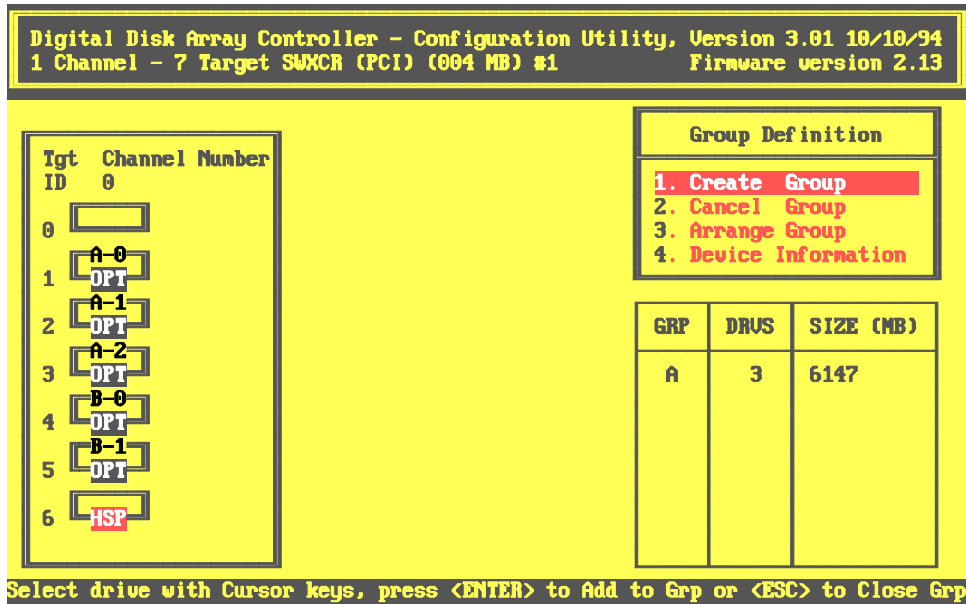
Group Definition
 1. Create Group
 2. Cancel Group
 3. Arrange Group
 4. Device Information

GRP	DRVS	SIZE (MB)
A	3	6147

Select drive with Cursor keys, press <ENTER> to Add to Grp or <ESC> to Close Grp

3. Press the Enter key to select the *Create Group* option. The cursor moves to the drive matrix.
4. Position the cursor on each drive you want to add to the drive group, one at a time, and press the Enter key. The utility adds that drive to the drive group by changing its status from RDY (ready) to OPT (optimal); and assigning a group letter and a sequence number to the drive, as shown in Figure 7–12.

Figure 7–12 Adding a New Drive Group



5. Press the Esc key after you add all the drives that you want for this drive group.
6. Repeat Steps 3 through 6 of this procedure to create additional drive groups. If you plan to define a hot spare, leave at least one drive with RDY (ready) status. This drive must be of equal or greater capacity to the drives you used in drive groups.
If you assign all the physical drives to drive groups, the utility automatically highlights the *Arrange Group* option. Otherwise, press the Esc key and the cursor returns to the *Group Definition* menu. Go to Section 7.3.1.2, Arranging a Drive Group.

NOTE

If you select a drive for the drive group by mistake or you want to redefine a drive group, highlight the *Cancel Group* option and press the Enter key. The cursor appears on the first drive in a group on the matrix. Move the cursor to the drive group you want to cancel and press the Enter key.

Check the drive groups that you defined to make sure you want these drive groups. Make any changes to the drive groups now. You can not cancel a group once you select the Arrange Group option.

7.3.1.2 Arranging a Drive Group

Arrange drive groups to specify the order in which you want to use them. The configuration utility allows you to create logical RAID drives on only one drive group at a time. You must use all of the disk space available on a drive group before you can begin creating logical RAID drives on the next group.

To arrange the drive groups in the order in which you want to use them, follow these steps,

1. If the *Arrange Group* option does not already appear highlighted, use the arrow keys to highlight it and press the Enter key. The cursor moves to the first defined drive group.

NOTE

If you press the ESC key while arranging groups, you lose the unassigned drive groups and must recreate them.

2. Use the arrow keys to move the cursor to a drive in the group you want to arrange. Press the Enter key. The drive group and size information for the arranged drive group appears in the table at the lower-right side of the screen, as shown in Figure 7–13. If you defined only one drive group, the *View/Update Configuration* menu appears with the *Define Logical Drive* option highlighted.

Otherwise, repeat this for each drive group that you defined. When you arrange the last drive group, the *New Configuration* menu appears with the *Define Logical Drive* option highlighted.

This completes the creation of your drive groups. Now, follow Section 7.3.2 to create logical RAID drives on your drive groups.

Figure 7–13 Arrange Drive Window

Digital Disk Array Controller - Configuration Utility, Version 3.00 09/13/94
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1
Firmware version 2.13

Tgt ID	Channel	Number
0		
1	A-0	OPT
2	A-1	OPT
3	A-2	OPT
4	B-0	OPT
5	B-1	OPT
6	HSP	

Group Definition

1. Create Group

2. Cancel Group

3. Arrange Group

4. Device Information

GRP	DRUS	SIZE (MB)
A	3	6147
B	2	4098

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

7.3.2 Creating a Logical RAID Drive

You create a logical RAID drive with part, or all of the space available on a drive group. The logical RAID drive allows your operating system to see and respond to the selected space of the drive group as one physical drive. The logical RAID drive also defines how your system will store data on that disk space, based on the RAID level selected. To the operating system, there is no difference between a logical RAID drive and a single physical drive on a conventional disk controller.

You can create a maximum of 8 logical RAID drives per controller.

NOTE

For redundant RAID configurations, the controller must use some of the space for data redundancy purposes. See Table 7-2 for information on how much space is available on which you can store unique data for each RAID level.

Creating a logical RAID Drive requires the following procedures:

- Defining a logical RAID Drive
- Choosing a write caching policy
- Saving the logical RAID Drive configuration

7.3.2.1 Creating a logical RAID Drive

To create a logical RAID drive, follow these steps:

1. Press the Enter key to select the *Define Logical Drive* option from the *View/Update Configuration* menu. The *Logical Drive Definition* menu screen appears, as shown in Figure 7-14. The *Logical Drive Definition* menu screen displays an option menu, a table of the drive groups available for selection as logical RAID drives, and a table of the existing logical RAID drives.

Figure 7–14 Logical RAID Definition Menu

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94 1 Channel - 7 Target SWXCR (PCI) (004 MB) #1 Firmware version 2.13																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Grp/Drvs</th> <th>Size (MB)</th> </tr> </thead> <tbody> <tr> <td>A / 3</td> <td>6147</td> </tr> <tr> <td>B / 2</td> <td>4098</td> </tr> </tbody> </table>	Grp/Drvs	Size (MB)	A / 3	6147	B / 2	4098	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Grp/Drvs</th> <th>Size (MB)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Grp/Drvs	Size (MB)			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">Logical Drive Definition</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1. Create Logical Drive</td> <td style="width: 50%;"></td> </tr> <tr> <td>2. Toggle Write Policy</td> <td></td> </tr> </tbody> </table>		Logical Drive Definition		1. Create Logical Drive		2. Toggle Write Policy	
Grp/Drvs	Size (MB)																		
A / 3	6147																		
B / 2	4098																		
Grp/Drvs	Size (MB)																		
Logical Drive Definition																			
1. Create Logical Drive																			
2. Toggle Write Policy																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Log Drv</th> <th>Size (MB)</th> <th>RAID</th> <th>Write Mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4098</td> <td>5</td> <td>WRITE THRU</td> </tr> </tbody> </table>				Log Drv	Size (MB)	RAID	Write Mode	0	4098	5	WRITE THRU								
Log Drv	Size (MB)	RAID	Write Mode																
0	4098	5	WRITE THRU																
Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu																			

2. Press Enter to select the *Create Logical Drive* option. A pop-up window, similar to the one shown in Figure 7–15, displays the RAID levels available for that logical RAID drive. Unavailable levels appear (black in this manual) gray (on you screen); you cannot select them.
 You can create logical RAID drives on one drive group at a time and must use all of the space on a drive group before you can go on to the next one. You can only create logical RAID drives on the drive groups in the order in which they appear in the *Grp/Drvs* table.

Figure 7–15 Logical RAID Definition Window

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		
B / 2	4098		

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU

RAID Level
 RAID 0
 RAID 1
 RAID 5
 RAID 0+1
 JBOD

Select a RAID Level using cursor keys and press <ENTER>, <ESC> to Previous Menu

3. Use the up and down arrow keys to move to a RAID level valid for the number of drives in this drive group (See Table 7–2 for a description of the number of drives required for each RAID level) and press the Enter key to select. A pop-up window appears, displaying the available space of the first drive group valid for this RAID level.
4. Type the amount of space that you want to use for this logical RAID drive, and press the Enter key, or press the Enter key to select all available space. Boxes appear, similar to the ones shown in Figure 7–16, displaying the number of the new logical RAID drive, its RAID level, and capacity. Another box prompts you to create this logical drive.

Figure 7–16 Create Logical Drive Confirmation

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		
B / 2	4098		

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Logical Drive# = 1
 Raid Level = 0
 Capacity = 4098 MB

Do you want to Create this Logical drive ?
 NO
 YES

Choose YES to Create the above Logical drive, NO or <ESC> to Cancel.

5. Select Yes to create this logical RAID drive. The utility adds the logical RAID drive to the list at the lower-left of the screen, similar to the screen shown in Figure 7–17
 Or,
 Select No if you do not want to create this logical RAID drive. The confirmation box disappears.

Figure 7–17 Displaying New Logical RAID Drive

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		
B / 2	4098		

Logical Drive Definition
 1. Create Logical Drive
 2. Toggle Write Policy

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU
1	4098	0	WRITE THRU

Use Cursor keys for selection, press <ENTER> to select, <ESC> to Previous Menu

6. Repeat Steps 1–5 for up to eight logical RAID drives, or until you use all the capacity of all the available drive groups, whichever comes first. You can only create logical RAID drives on one drive group at a time and must use all of the space on a drive group before you can go on to the next one. The utility displays each logical RAID drive in the table on the lower-left of the screen.

When you finish creating logical RAID drives see Section 7.3.2.2 to select a caching policy for the logical RAID drives that you created.

Or if you do not want to use the logical RAID drives that you just created, press ESC. The *View/Update Configuration* Menu appears. Press Esc again. The *Save Configuration* screen appears. Highlight No and press the Enter key. The Main menu appears.

7.3.2.2 Choosing a Caching Policy

The caching policy determines what procedure the RAID controller uses to write data to the logical drives. You can choose one of the following caching policies:

- *Write-Back caching:* A caching policy in which the controller acknowledges that a write operation has completed successfully before data is written to the disks. If you choose this caching policy, you may increase the I/O performance of your RAID subsystem.

We recommend that you select this caching policy only if your cache has battery backup and you have enabled the battery backup. Without a battery backup, if there is a power failure, you lose data in cache that is not yet written to the disks.

- *Write-Through caching:* A caching policy in which the data is written to disk before the controller acknowledges that a write operation is completed successfully. If you choose this caching policy and there is a power failure, you minimize the chance of data loss. This is the StorageWorks RAID Array 200 subsystem default caching policy.

NOTE

We strongly recommend a Write-Through caching policy to eliminate the chance of data loss due to a power failure.

To change the caching policy, follow these steps:

1. Use the up and down arrow keys to highlight the *Toggle Write Policy* option on the *Logical Drive Definition* menu and press the Enter key. The cursor moves to the *Write Mode* column of the logical RAID drives list and highlights the write mode of the first logical RAID drive.
2. Press the Enter key to toggle the caching policy to Write-Back.
3. Use the arrow keys to move to another logical RAID drive and repeat Steps 1 and 2 for each logical RAID.
4. When you finish selecting cache policy for your logical RAID drives, press the ESC key. The *Logical Drive Definition* menu appears.
5. Press the ESC key again. The *View/Update Configuration* menu appears.

If you plan to use one of your drives as a spare drive, go on to Section 7.3.3 to define a hot spare drive. Otherwise, go to Section 7.3.4 to save your array configuration.

7.3.3 Defining Hot Spare Drive

Define a hot spare to keep a drive available in your subsystem on which the RAID controller can automatically start to rebuild information from a drive that fails.

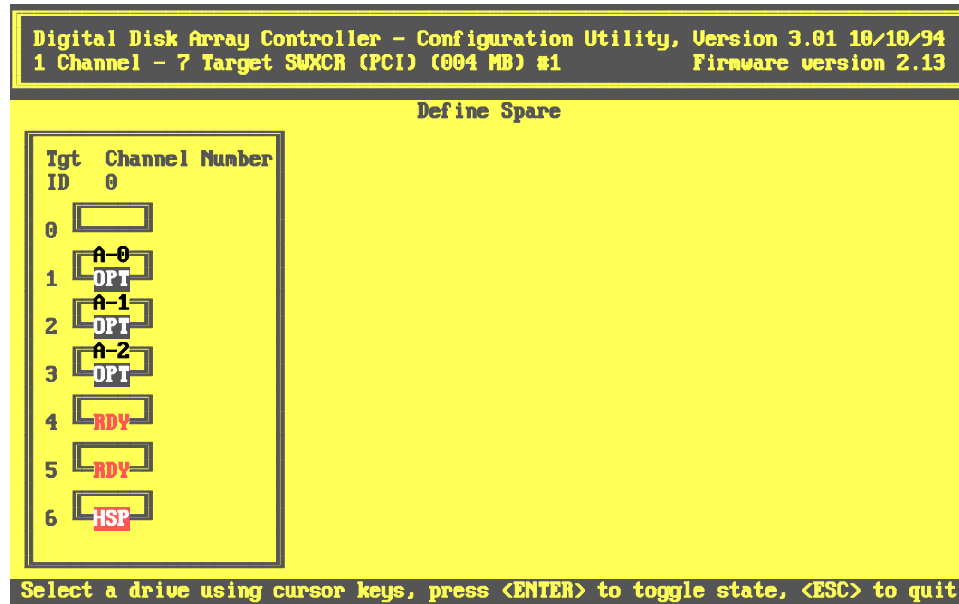
To define a spare drive, follow these steps:

1. Use the up and down arrow keys to highlight the *Define Spare* option on the *View/Update Configuration* menu and press the Enter key. The utility displays the *Define Spare* screen as shown in Figure 7–18.
2. Use the arrow keys to select the drive with a status of RDY you want to define as a spare and press the Enter key. The utility changes the drive status to HSP (hot spare).

If you select the wrong drive or decide that you do not want a hot spare drive, press the Enter key again. The status of the drive returns to its previous status.

Now go on to Section 7.3.4 to save the configuration of your array.

Figure 7-18 The Define Spare Drive Screen



7.3.4 Saving the Logical RAID Drive Configuration

To save the logical RAID drive configuration that you created, follow these steps:

1. Press the ESC key from the *Update/View Configuration* menu or from the *Define Spare* screen. The utility displays a confirmation window, as shown in Figure 7–19

Figure 7–19 Configuration Confirmation Screen

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94			
1 Channel - 7 Target SWXCR (PCI) (004 MB) #1		Firmware version 2.13	
Grp/Drvs	Size (MB)	Grp/Drvs	Size (MB)
A / 3	6147		
B / 2	4098		

SAVE configuration ?

YES

NO

Log Drv	Size (MB)	RAID	Write Mode
0	4098	5	WRITE THRU
1	4098	0	WRITE THRU

Choose YES to save configuration, NO to cancel and exit, <ESC> to quit

2. Select Yes to save the logical RAID drive configuration. The utility saves the configuration to the flash EEPROM/NVRAM and the main menu appears.

The configuration utility remembers the configuration that you created by storing it on flash EEPROM/NVRAM. Thereafter, your computer and the utility expect to see this configuration. See Section 7.1.1 for more information on how your system interacts with the stored configuration.

If you created a new logical RAID drive, go to Section 7.3.5 to initialize it.

7.3.5 Initializing a Logical RAID Drive

You must initialize a logical RAID drive before you can use it to ensure consistent RAID parity information. The utility initializes the logical RAID drive by writing a pattern of zeros to it. This creates a starting parity for a logical RAID drive with parity, or starting data for a logical RAID drive which does not have parity.

CAUTION

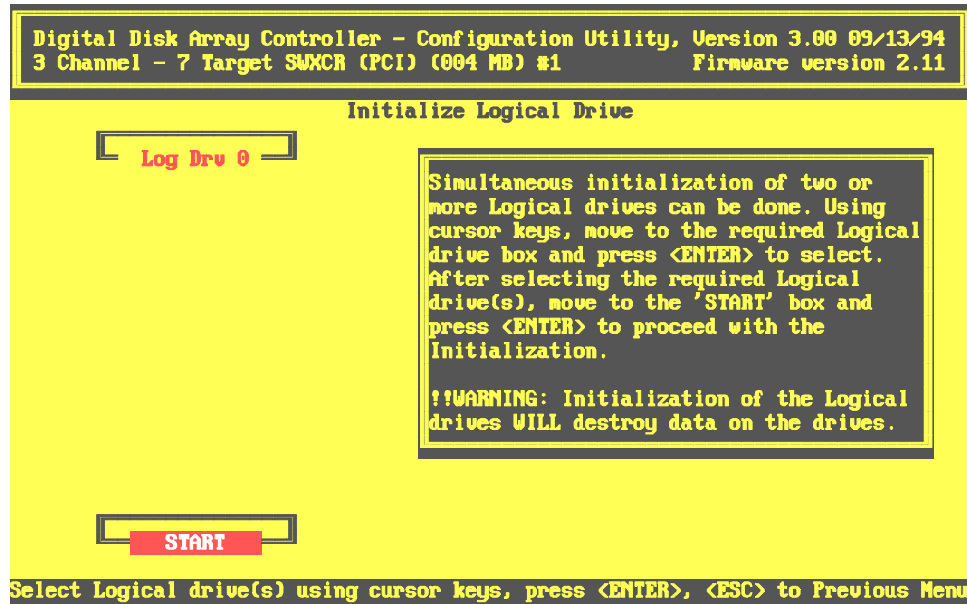
Do not initialize a logical RAID drive if it has valid data. Initialization overwrites and destroys all data.

Also, after you initialize a logical RAID drive, do not change or rearrange the physical drives or cables. Otherwise, all data in the drive group can be lost.

To initialize a logical RAID drive, follow these steps.

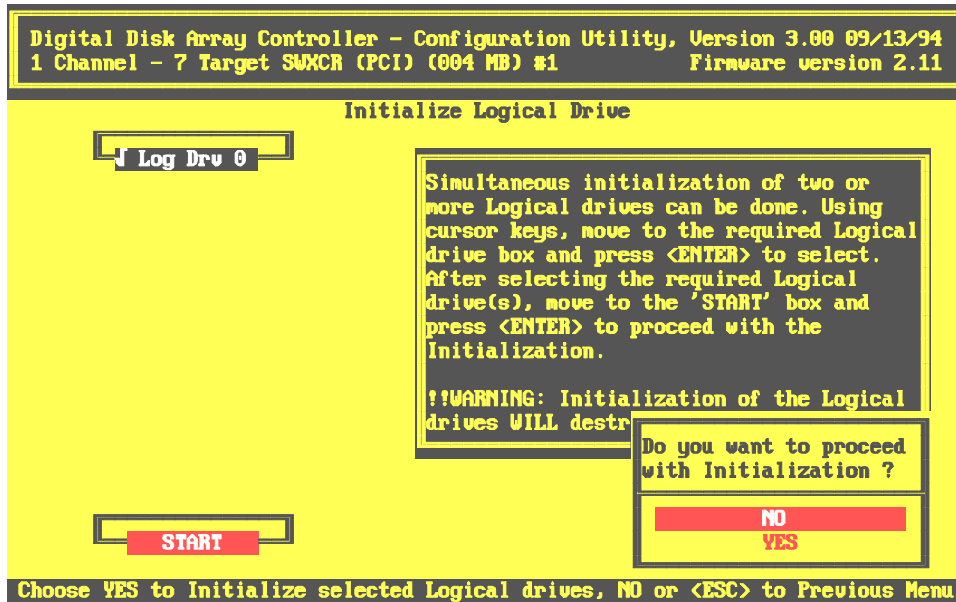
1. From the main menu, select the *Initialize Logical Drive* option menu and press the Enter key. The utility displays the *Initialize Logical Drive* screen, with each logical RAID drive that you created, similar to the screen shown in Figure 7–20.

Figure 7–20 Initialize Logical RAID Drive Screen



2. Use the arrow keys to move to each logical RAID drive that you just created and press the Enter key to select it. A check mark appears beside each logical drive selected. Once you select all available logical drives, the utility automatically highlights the *Start* button. Otherwise, use the arrow keys to move the cursor to the *Start* button.
3. Press the Enter key. A confirmation window appears as shown in Figure 7–21.

Figure 7–21 Initialization Confirmation Window



4. Select Yes. An *Initialize Logical Drive* status bar appears at the top of screen indicating amount of initialization completed. The bar gradually fills as the initialization process completes. When done initializing, the utility prompts you to press any key to continue.
5. Press any key. The utility displays a message indicating that it is saving the configuration, then the main menu appears.

Each time you update your configuration, save the updated configuration to diskette.

7.3.6 Saving a Copy of the RAID Configuration on a Diskette

Save a copy of your RAID configuration on a diskette, because the utility stores the configuration on EEPROM/NVRAM on the controller board. If your controller ever fails, you will need to restore the configuration from disk after you install a new controller.

To save the configuration, follow these steps:

1. Insert a blank diskette in your system's floppy drive.
2. Use the arrow keys to highlight the *Tools* option from the main menu, and press the Enter key to select it. The utility displays the *Tools* menu.
3. Press the Enter key to select the *Backup/Restore conf* option. A brief message appears explaining this option.
4. Press any key to Continue. The *Backup/Restore conf* menu appears.
5. Use the up and down arrow keys to highlight *Backup* from the *Backup/Restore conf* menu and press the Enter key to select it. The utility prompts you to enter a name for the file.
6. Enter the path (for example, a:) and an appropriate file name with up to eight characters not including the file extension and press the Enter key. The utility displays a message asking whether it should overwrite an existing file.
7. Press the Y key to overwrite an existing file. A message appears indicating that the utility is saving the configuration. The *Backup/Restore* menu then appears when the utility finishes saving the configuration.
Or,
Press the N key to return to the *Backup/Restore* menu without saving the file.
8. Press the ESC key to exit. The main menu appears.

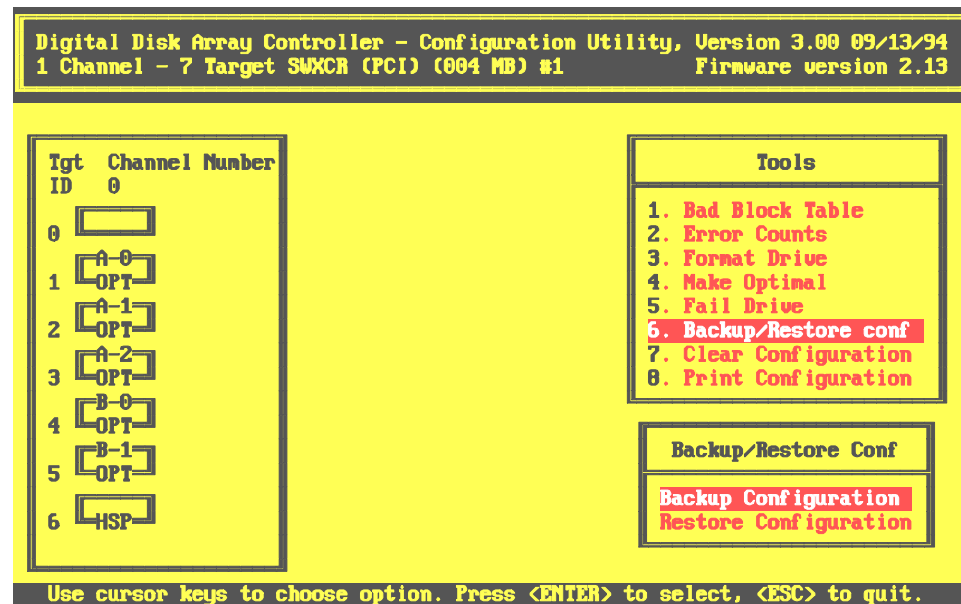
7.3.7 Restoring RAID Configuration onto a New Controller

In the event that your RAID controller fails, you will need to restore the configuration information onto the new RAID controller. You can restore the RAID configuration information if you saved a copy of the configuration onto a diskette.

To restore the configuration, follow these steps:

1. Insert the diskette with the previously saved configuration into the appropriate floppy drive.
2. Use the arrow keys to highlight the *Tools* option from the main menu and press the Enter key to select it.
3. Use the arrow keys to highlight the *Backup/Restore* option from the main menu and press the Enter key to select it. The *Backup/Restore* menu appears with the *Restore Configuration* option highlighted, as shown in Figure 7–22. The utility prompts you to use caution.

Figure 7–22 Backup/Restore Conf Menu



4. Press any key to continue. Press the Enter key to select the *Restore Configuration* option. The utility prompts you for a file name.
5. Enter the path (for example, a:) and the name of the saved configuration file and press the Enter key. The utility prompts you to confirm you want to restore.
6. Select Yes and press the Enter key. The utility begins reading the file and prompts you again to confirm that you want to restore the configuration.
7. Select yes and press the Enter key. The utility writes the configuration to Flash EEROM/NVRAM and indicates when it has successfully restored the configuration.
8. Press any key to continue.
9. Press the ESC key to return to the main menu.

7.3.8 Deleting a Drive Group or Logical RAID Drive

You use the same procedure to delete a drive group or a logical RAID drive.

If you delete a drive group, you will be deleting any logical RAID drives associated with it.

If you delete a logical RAID drive, you will be deleting the drive group on which it was configured and any other logical RAID drives configured on that drive group.

If you want to delete all logical RAID drives on your subsystem, see Section 7.3.9, *Clearing the Subsystem Configuration*.

Delete a drive group if you want to:

- Add another drive to the group
- Remove a drive from the group
- Create a new group using some of the drives in an existing group

Delete a logical RAID drive if you want to change its RAID level.

To determine which logical RAID drives use the disk space of a drive group, follow these steps:

1. Use the up and down arrow keys to highlight the *View Logical Drive Matrix* on the *View/Update Configuration* menu and press the Enter key. The logical RAID drive list screen appears.
2. Use the up and down arrow keys to highlight a logical RAID drive in the logical RAID drive list and press the Enter key. The cursor moves to the drive matrix. The drive group associated with the selected logical RAID drive appears highlighted.
3. Press the Enter key again to return to the logical RAID drive list to select another logical RAID drive.
4. Repeat steps 2 and 3 until you determine all of the logical RAID drives associated with a drive group.
5. Use your normal procedure to backup the data on all the logical RAID drives configured on the drive group that you want to delete.

NOTE

You can only delete drive groups in the reverse order in which they were arranged. For example if you create drive groups a, b and c, and arrange them in that order, then you must delete drive groups c and b before you can delete drive group a.

To delete a drive group or logical RAID drive, follow these steps:

1. Use the up and down arrow keys to highlight *View/Define Drive Group* on the *View/Update Configuration* menu and press the Enter key. The *Group Definition* menu appears.
2. Use the up and down arrow keys to highlight the *Cancel Group* option and press the Enter key. The cursor moves to the drive matrix.
3. Use the up and down arrow keys to move to any drive in the drive group that you want to delete and press the Enter key. The cursor appears again in the *Group Definition* menu.
4. Press the Esc key. The *View/Update Configuration* menu appears.
5. Press the Esc key again. The utility prompts you to save the configuration.
6. Use the up and down arrow keys to highlight Yes and press the Enter key. A message appears at the bottom of the screen indicating that the utility is saving the configuration. When the utility finishes, the main menu appears.

7.3.9 Clearing the RAID Subsystem Configuration

This option provides you with a quick way to delete the existing RAID configuration when you want to delete it without immediately creating a new one. You may want to use this option when troubleshooting/debugging your RAID subsystem. Otherwise, use the *New Configuration* option, which clears the configuration and then prompts you to create a new one.

To Clear the configuration, follow these steps:

1. Use your normal procedures to backup the information stored on your array prior to clearing the configuration.
2. Use the up and down arrow keys to highlight the *Tools* option on the main menu and press the Enter key. The *Tools* menu appears.
3. Use the up and down arrow keys to highlight the *Clear Configuration* option on the *Tools* menu and press the Enter key.

7.4 Running Parity Check/Repair

Use *Parity Check* on logical RAID drives with a redundant RAID level, such as, RAID 1, RAID 0+1, and RAID 5 to check the consistency of the RAID parity information. When you select *Parity Check*, the utility reads the data from the logical RAID drives and computes the parity for each series of blocks. Any discrepancies between the computed parity and the parity stored on the drive are indicated. The utility repairs parity inconsistencies by regenerating the data.

Check the parity of all of your logical RAID drives at a regular interval, and after a power failure or a utility crash to ensure the integrity of parity and reduce the chance of data loss.

To check the consistency of a logical RAID drive, follow these steps:

1. Select the *Parity Check* option on the main menu, and the utility displays the Parity Check screen (Figure 7–23).
2. Use the up and down arrow keys to highlight a logical RAID drive and press the Enter key to select it. The utility prompts you to enable automatic restoration.
3. Press the Enter key to select Yes for the utility to automatically restore errors that it finds while checking parity. The utility begins checking parity and a status bar appears at the top of the screen, similar to the screen shown in Figure 7–24. When the parity check completes, the utility displays a message indicating the status of the parity check as successful or failed.
4. If the check was successful, as shown in Figure 7–25, press any key to return to the main menu.

Figure 7–23 Parity Check Screen

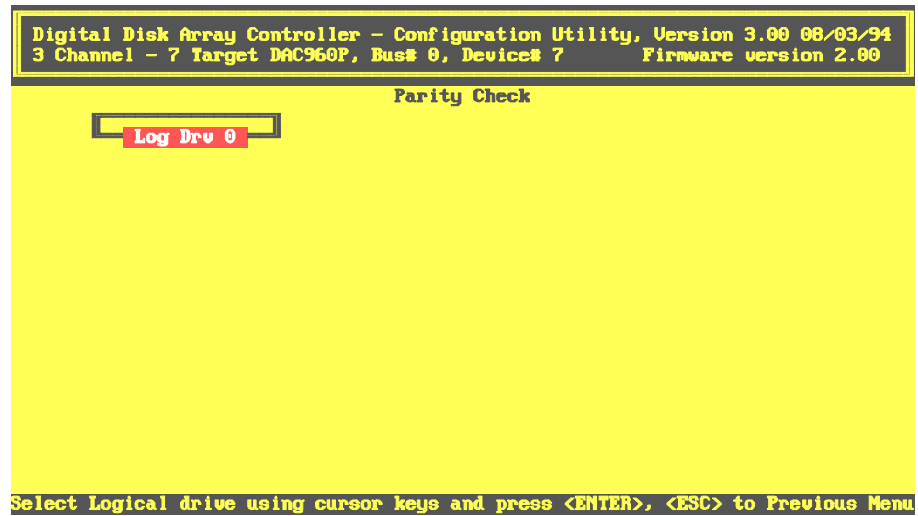
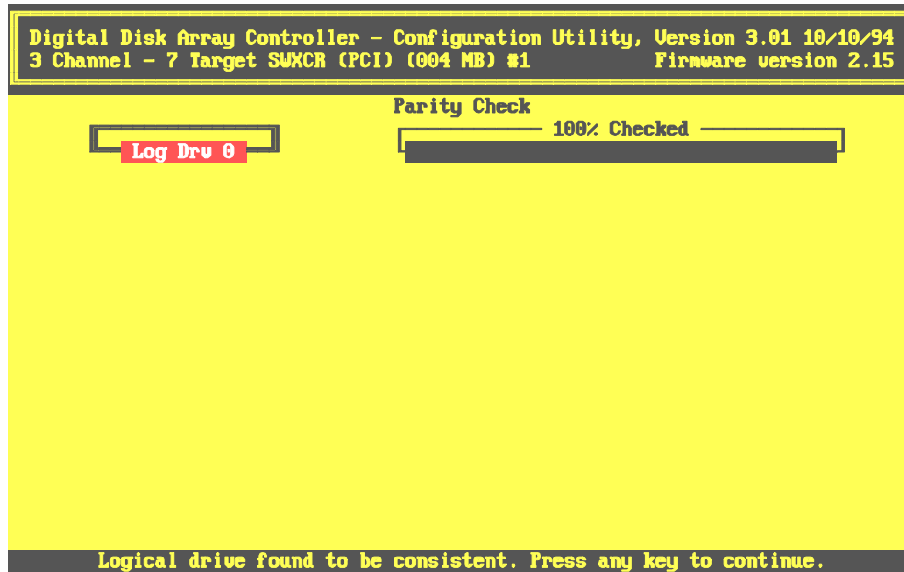


Figure 7–24 Parity Check Progress Screen



Figure 7–25 Parity Check Passed Screen



If the check fails, as shown in Figure 7–26, press any key to restore parity. A screen similar to Figure 7–27 appears. Press any key again to restore parity. The utility displays the results of the parity restoration on a screen similar to the one shown in Figure 7–28.

Figure 7-26 Parity Check Failed Screen

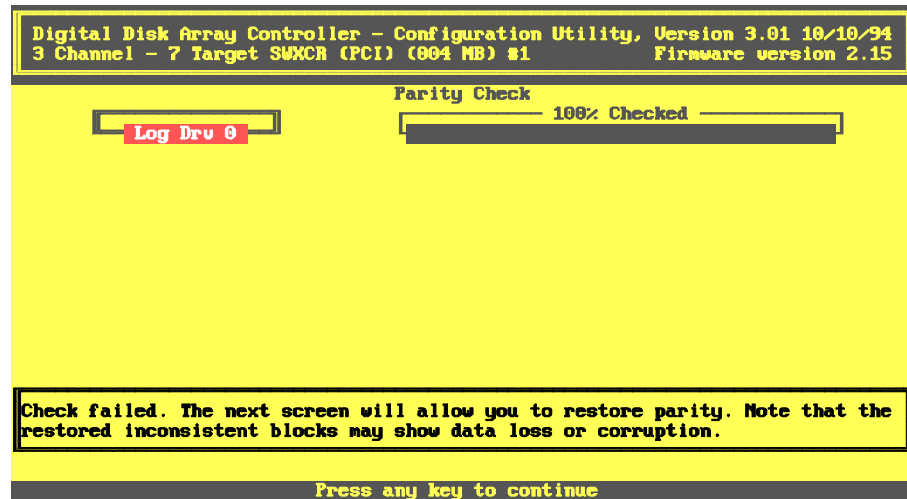


Figure 7-27 Restore Parity Screen

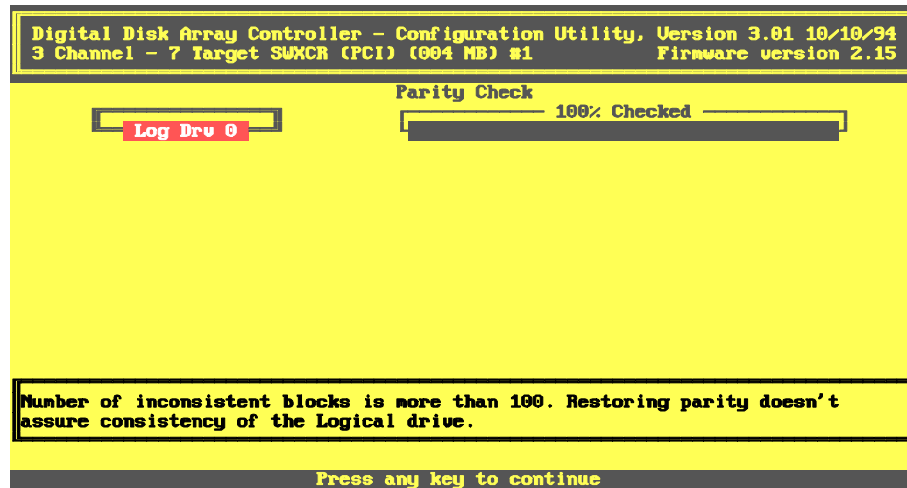
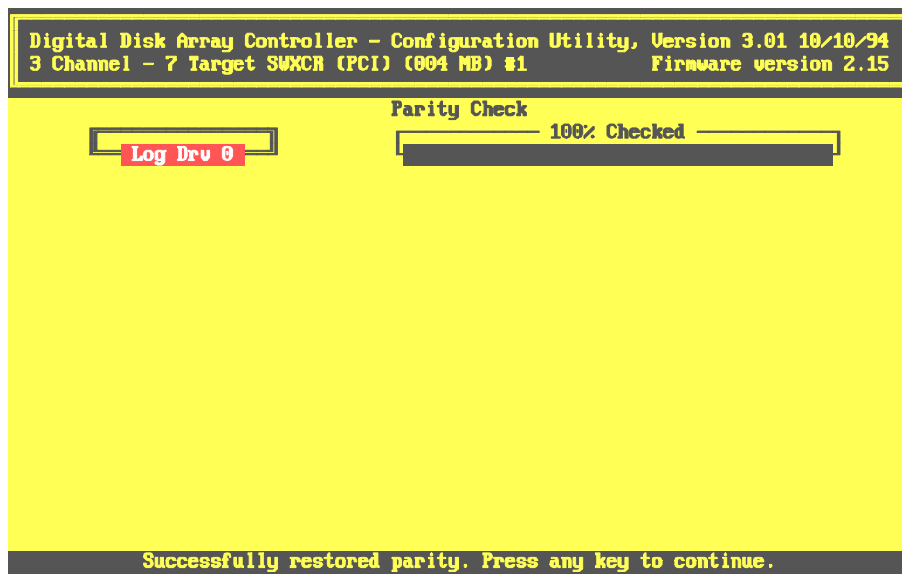


Figure 7–28 Parity Successfully Restored Screen



7.5 Working with Drives

This section describes the following activities you can perform with disk drives:

- Format a drive
- Fail a drive
- Rebuild a drive
- Mark a drive as optimal

You can access these options from the *Tools* menu.

In addition to these options, you can use the *View/Update Configuration* Option to create the following with disk drives: drive groups, logical RAID drives, hot spares.

7.5.1 Formatting a Drive

You can use the Standalone Configuration utility to perform a SCSI format of any unformatted drive with a RDY (ready) state, prior to using it in a drive group. It takes approximately 30 to 45 minutes for the utility to format a drive.

To format a disk drive, follow these steps:

1. Use the up and down arrow keys to highlight the *Tools* option from the main menu and press the Enter key to select it. The utility displays the *Tools* menu as shown in Figure 7–6.
2. Use the up and down arrow keys to highlight the *Format Drive* option and press the Enter key to select it.
3. The cursor moves to the first available drive in the matrix. The drives that you can format appear in blue and the drives that you cannot appear in gray.
4. Use the arrow keys to highlight the drive you want to format, and press the Enter key; the utility displays a warning message indicating all data will be lost.
5. Select Yes to confirm, and drive status changes to FMT (formatting).
6. Press the Esc key. The utility prompts you to choose whether to continue. Select Yes and the utility begins to format the drive. When the utility finishes formatting a drive, its changes the drive status from FMT (formatting) to RDY (ready).
Select No and the utility returns the drive status to its previous state and the cursor appears in the *Tools* menu.
7. When the format completes, press any key to continue. The main menu appears.

7.5.2 Failing a Drive

Use the *Fail Drive* option to change the status of a drive to failed when you want to prevent the controller from writing information to it. You would do this, for example, if you wanted to remove the drive from the storage enclosure, because you believed it was not operating properly.

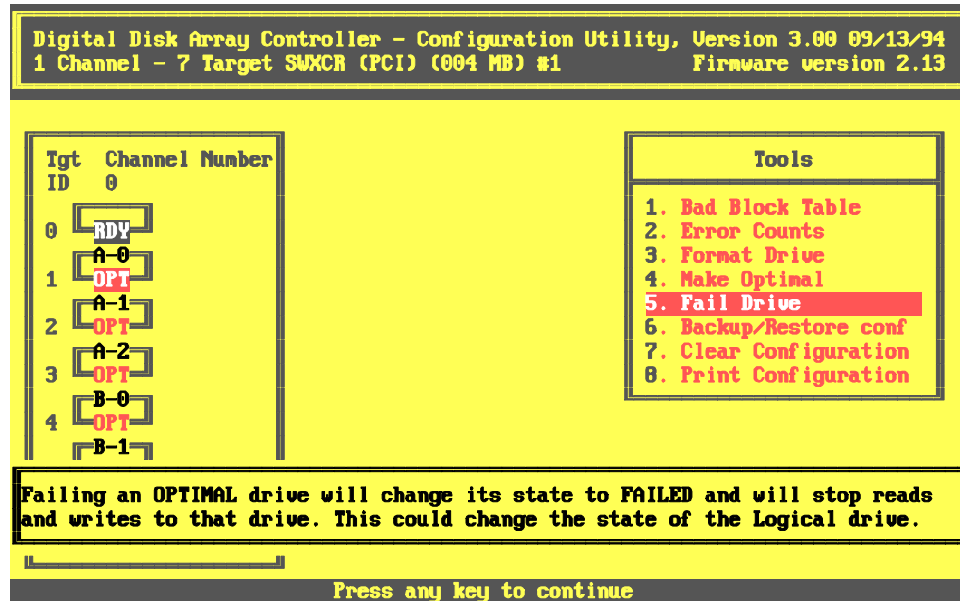
Failing a drive in a RAID 0 or JBOD configuration will result in the loss of all data, and you will need to restore the data from backup media.

Ensure optimal status for all drives in a RAID 1, RAID 0 + 1, or RAID 5 configuration before failing a drive. Failing a drive in a RAID 1, RAID 0 + 1, or RAID 5 configuration with a drive already failed will result in the loss of all data, and you will need to restore the data from backup media.

To fail a drive, follow these steps:

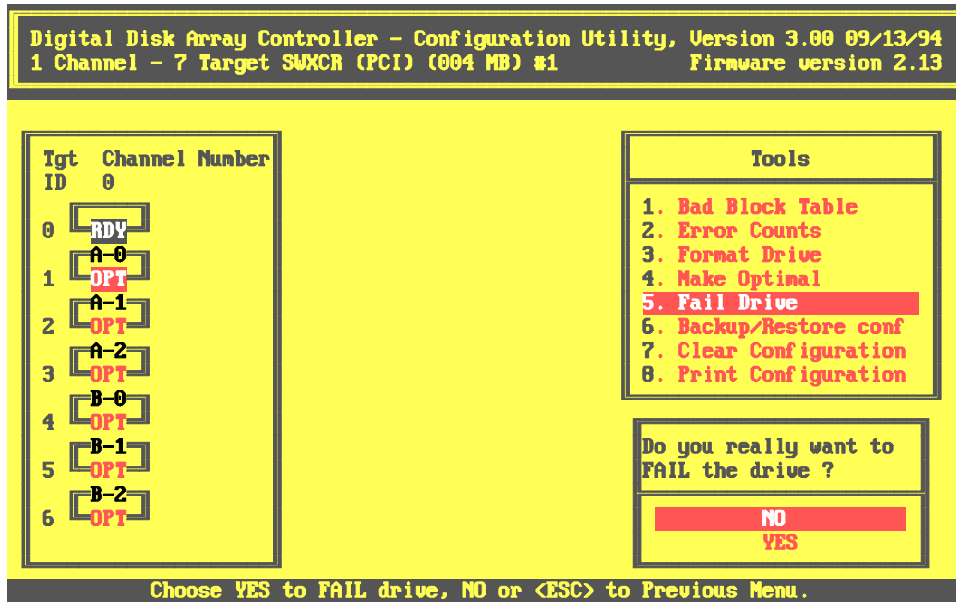
1. Use the up and down arrow key to highlight the *Tools* option from the main menu and press the Enter key to select it. The utility displays the *Tools* menu, shown in Figure 7–6.
2. Use the up and down arrow key to highlight the *Fail Drive* option, and press the Enter key. The cursor appears in the drive matrix. The drives you can fail appear in blue. The drives you cannot fail appear in gray.
3. Use the up and down arrow keys to highlight the drive you want to fail and press the Enter key. The utility displays a message similar to that shown in Figure 7–29.

Figure 7–29 The Message Displayed When You Select a Drive to Fail



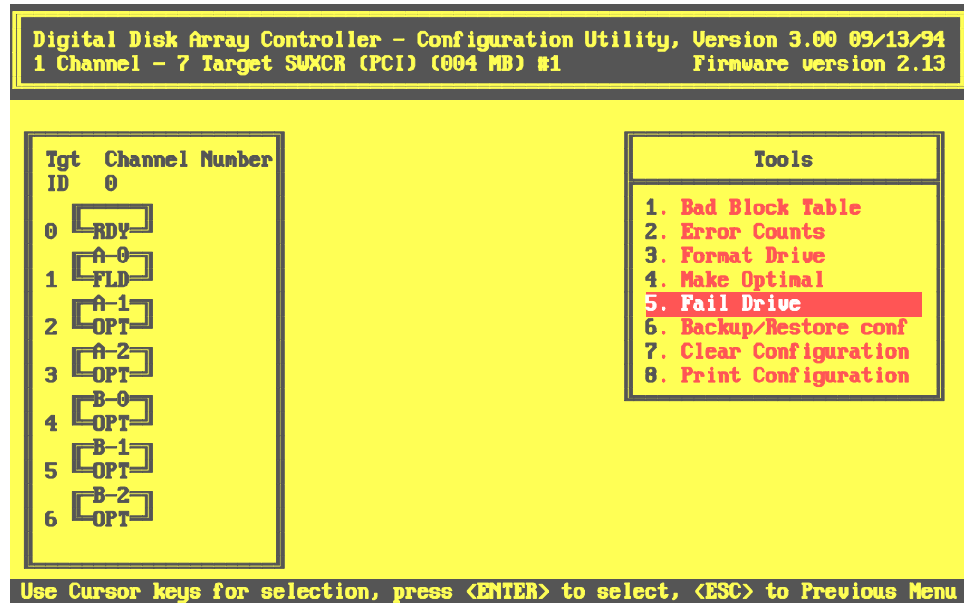
4. Press any key, and the utility displays a confirmation window as shown in Figure 7–30

Figure 7–30 The Utility Prompts you to Confirm Failing the Selected Drive



5. Highlight Yes and press the Enter key, and the utility spins down the selected drive. The status of the drive changes to FLD (failed), similar to the screen shown in Figure 7–31.

Figure 7-31 The Utility Changes the Drive Status to FLD



7.5.3 Rebuilding a Drive

Rebuilding a drive recreates a failed drive's data onto a replacement drive. You can rebuild a drive only for configurations with redundant RAID levels (RAID 1, RAID 0 + 1, and RAID 5). If a drive fails in a configuration without a redundant RAID level (RAID 0, JBOD) you can not recover data from the failed drive using the standalone configuration utility.

NOTE

Upon detection of a drive failure, replace the drive as soon as possible to minimize the chance of data loss because of a second drive failure.

If your storage enclosure has StorageWorks Fault Management support, then the controller will automatically start to rebuild the logical RAID drive when you replace a failed drive in a redundant RAID set. If a hot spare drive exists in the shelf, then you do not have to replace the failed drive, because a rebuild will automatically start on that hot spare device in the event of a drive failure in a redundant RAID set.

In addition, the controller supports queuing rebuilds. Therefore, in the event that a rebuild is in process and a drive should fail in another drive group, the controller will start a rebuild of that second logical RAID drive group after completing the first rebuild, given you replace the second failed drive or another hot spare is present in the shelf.

In the event that your storage enclosure does not have StorageWorks Fault Management, you can use the standalone configuration utility to manually rebuild a logical RAID drive after replacing a failed drive.

See Chapter 6 for a description of all the methods for Rebuilding a Drive.

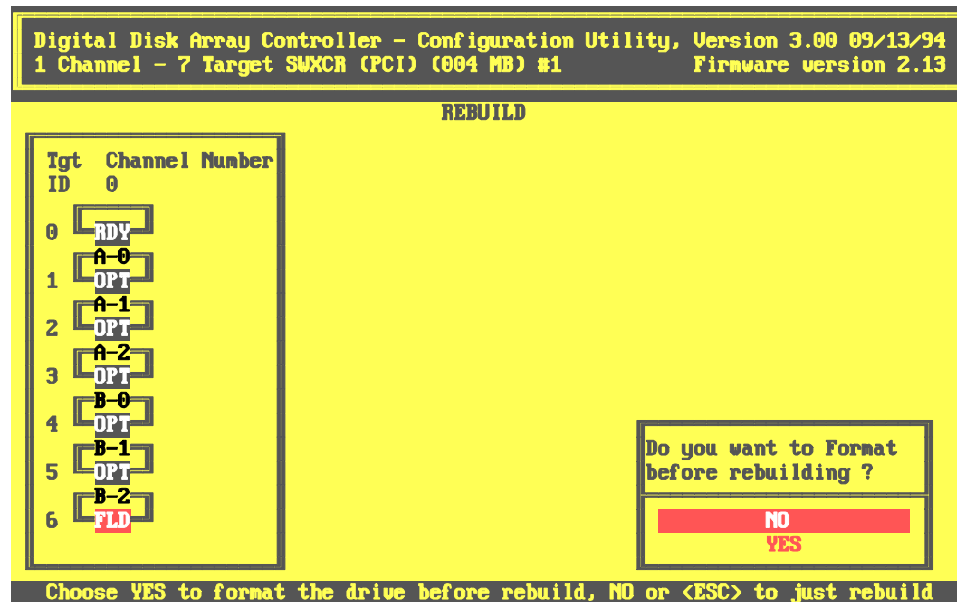
Use the *Rebuild* a drive option on the main menu if:

- You did not define a hot spare drive
- Your storage enclosure does not support hot swap capability
- You manually failed a drive and did not replace it
- You want to rebuild a drive while a rebuild is in progress

To manually rebuild a drive, follow these steps:

1. Replace the failed drive with a working drive.
2. Use the up and down arrow keys to highlight the *Rebuild* option in the main menu and press the Enter key to select it. The utility displays the drive matrix, showing the drives and their status.
3. Use the up and down arrow keys to highlight a drive with a FLD (failed) status and press the Enter key to select it.
4. A pop-up window appears, similar to the screen shown in Figure 7–32. The utility gives you the option of formatting the replacement drive prior to rebuilding the information from the failed drive. Press the enter key to select No to rebuild a drive without formatting, or highlight and press enter to select Yes to rebuild a drive after formatting. A status bar appears indicating either formatting or rebuilding. After formatting, the utility automatically begins rebuilding the drive.
5. When the rebuild progress bar displays 100%, press any key to continue. The main menu appears.

Figure 7–32 Choose Whether to Format Before Rebuilding



7.5.4 Troubleshooting a Failed Rebuild

Sometimes the utility fails to rebuild data onto a replacement disk. A rebuild failure occurs because of errors with one of the disks from which the utility tries to rebuild the data. For example, if you replace a failed drive from a drive group consisting of three drives on which you configured a logical RAID drive with parity, RAID 5, for instance, and the utility fails to rebuild data onto the replacement drive, one of the two drives in the group, not the replacement drive, has errors.

You will know that a rebuild failed when the status of the replacement drive remains WOL (write only). After a successful rebuild the status of the replacement drive changes to OPT (optimal).

Because the rebuild operation runs as a background process, the utility records any bad block errors that occur during a rebuild in a *Bad Block Table*. If a rebuild fails, check the *Bad Block Table* for errors.

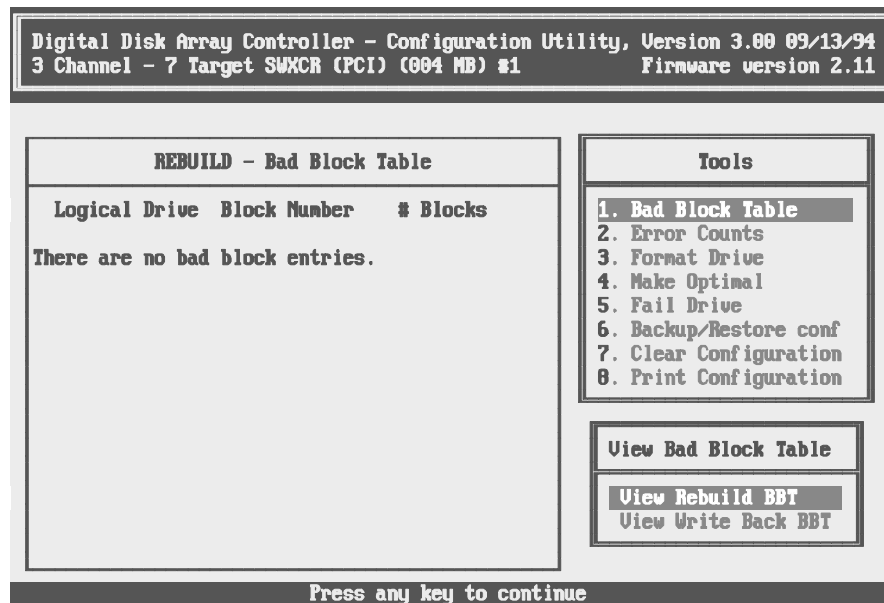
To view the *Bad Block Table*, invoke the standalone configuration utility, and follow these steps:

1. Use the up and down arrow keys to highlight the *Tools* option from the main menu; and press the Enter key to select it. The utility displays the *Tools* menu as shown in Figure 7–6.
2. Use the up and down arrow keys to highlight the *Bad Block Table* option from the *Tools* menu, and press the Enter key to select it. The utility displays the *View Bad Block Table* menu. You can select one of these options:
 - View Rebuild BBT
 - View Write Back BBTIf you have Write-Back cache enabled, the bad block table receives information on any errors encountered during a write. You can use the *View Write Back BBT* option on the *View Bad Block Table* menu to view this information. This option works like the *View Rebuild BBT*.
3. Select the *View Rebuild BBT*. The utility displays bad blocks on the logical RAID drive, if any, including the block number and the number of consecutive bad blocks encountered; as shown in Figure 7–33.
4. Press any key to return to the *Tools* menu; the utility clears *Rebuild Bad Block Table* once you exit it.
5. Press the Esc key to return to the *main* menu.

If the *Rebuild Bad Block Table* contains error entries, this indicates some internal error with one of the drives which the utility used to try to rebuild data. If no entries appear in the *Rebuild Bad Block Table*, check for physical problems, such as whether the drives in the drive group are properly seated, or if a connecting cable is loose.

Attempt to rebuild the data onto the replacement drive again. If the rebuild fails a second time, and bad block entries appear in the *Rebuild Bad Block Table*, you will need to reconstruct the data from backup media.

Figure 7-33 Bad Block Table Screen



7.5.5 Marking a Drive as Optimal

Use the *Make Optimal* option to change the status of a drive to optimal when you want the controller to write information to it. For example, if you mark a drive failed to remove it safely from the storage enclosure, you would then make it optimal when you returned it to the storage enclosure.

Do not use *Make Optimal* to change the status of a drive which replaces a disk drive that failed. Use the *Rebuild* option to properly replace a disk drive that failed. Otherwise, the drive may contain faulty data.

CAUTION

When you use this option, ensure the integrity of the data stored on all logical RAID drive(s) that use the failed drive. For example, do the following:

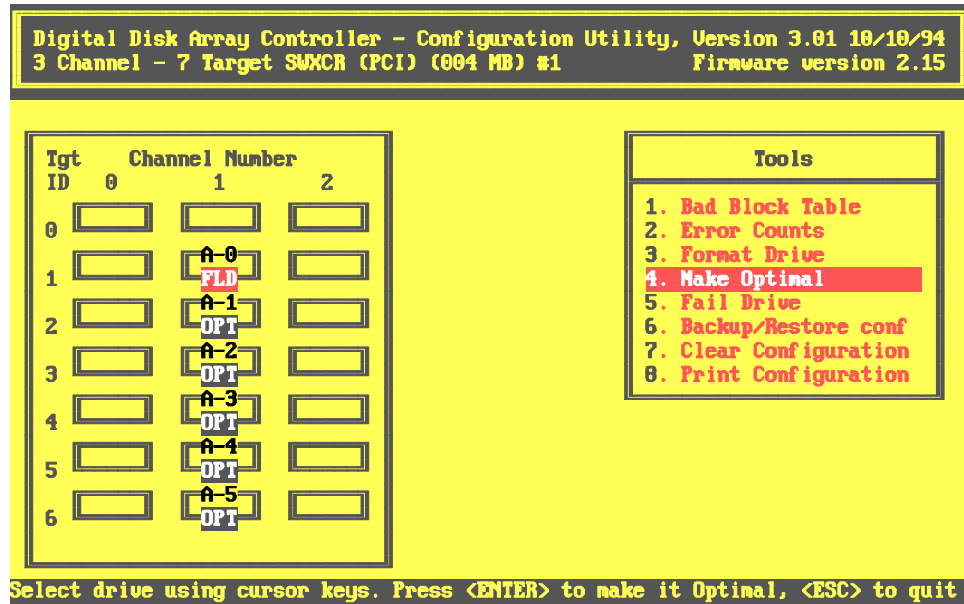
- For drives with a redundant RAID level (RAID 1, 0 + 1, or 5), use the *Parity Check* option from the *Tools* menu.
- Run an operating system file integrity check.
- Run a data integrity check of your files (application-specific).

If you detect corrupted files, you need to restore data from backups.

To change the status of a drive to optimal, follow these steps:

1. Use the up and down arrow keys to highlight the *Tools* option from the main menu; and press the Enter key. The utility displays the *Tools* menu, shown in Figure 7–6.
2. Use the up and down arrow keys to highlight the *Make Optimal* option from the *Tools* menu and press the Enter key. The cursor moves to the first drive in the matrix available for you to make optimal, as shown in Figure 7–34.

Figure 7-34 Mark a Drive Optimal



3. Use the arrow keys to move the cursor to the drive you want to change to optimal status and press the Enter key. The utility displays a warning message. Press any key to continue.
4. A confirmation window appears. Select Yes and the utility starts the drives, and changes state of the selected drive to optimal.
5. Press the ESC key to return to the main menu.

7.5.6 Drive Error Counts

The standalone configuration utility keeps a count of drive errors that occur while the utility is running. You can view the number of drive error occurrences and the general type of error (hard, soft, and others) in a table. View the table to see the number and nature of errors being produced by a drive. Use this information to determine the reliability of a drive and whether to replace it.

The Error Counts Table displays a maximum of 127 errors.

To view the error count for a drive, follow these steps.

1. Use the up and down arrow keys to highlight the *Tools* option on the main menu and press the Enter key to select it. The *Tools* menu appears.
2. Use the up and down arrow keys to highlight the *Error Count* option on the *Tools* menu and press the Enter key to select it. The cursor appears in the drive matrix.
3. Use the arrow keys to select the drive for which you want to view errors, and press the Enter key. The utility displays a screen similar to Figure 7–35.
4. After viewing the errors screen, press any key to return to the *Tools* menu.
5. Press the Esc key and the drive no longer appears highlighted.
6. Press the Esc key again to return to the main menu.

Figure 7-35 Error Count Window

Digital Disk Array Controller - Configuration Utility, Version 3.01 10/10/94
3 Channel - 7 Target SWXCR (PCI) (004 MB) #1Firmware version 2.15

Tgt ID	Channel Number	0	1	2
0				
1			A-0 OPT	
2			A-1 OPT	
3			A-2 OPT	
4			A-3 OPT	
5			A-4 OPT	
6			A-5 OPT	

Tools

1. Bad Block Table
2. Error Counts
3. Format Drive
4. Make Optimal
5. Fail Drive
6. Backup/Restore conf
7. Clear Configuration
8. Print Configuration

Channel # : 1
Target ID : 1
Parity Errors : 0
Soft Errors : 0
Hard Errors : 0
Misc. Errors : 0

Press any key to continue

Troubleshooting and Service Information

This chapter contains an overview of subsystem indicators, troubleshooting subsystem problems, and removal and replacement procedures.

8.1 Storage Pedestal Status Indicators (SBBs)

This section provides an overview of the operation of the various StorageWorks components. Review these sections before you start troubleshooting.

The StorageWorks Building Blocks (SBBs), contained in the Expansion Storage Pedestal, display error conditions or failures caused by the major pedestal components. This information is displayed by the LEDs (light emitting diodes) on the front of the power supply and drive. The following describes the signals representing these conditions or failures (states and functions) and how to interpret the LED displays.

8.1.1 Pedestal Status

The power supply LEDs monitor both cooling and power. A drive's LEDs indicate the status of that drive.

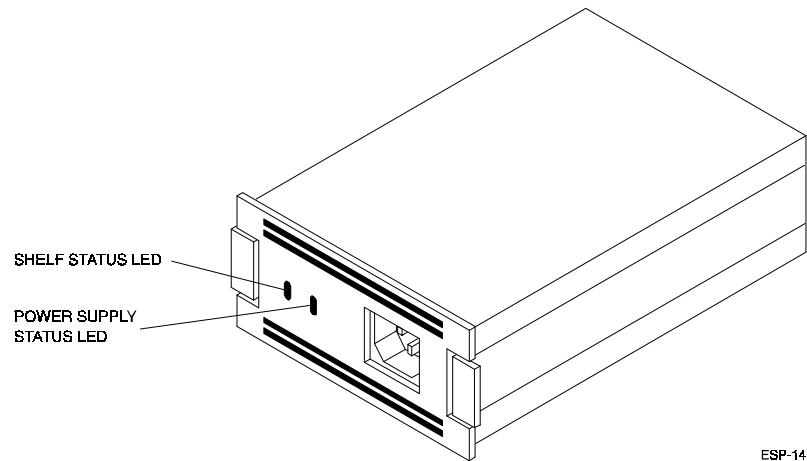
8.1.2 Power Supply LEDs

The blowers on the rear of the pedestal provide cooling and the power supply provides +5 V dc and +12 V dc to operate the storage devices. The power supply LEDs indicate the state of these pedestal components.

You can determine the status of both the pedestal blowers and each power supply by looking at the power supply LEDs (green) as shown in Figure 8-1. The left LED displays the pedestal cooling status and the right LED displays the power supply status. The LEDs indicate a fault when one of the following conditions occur:

- A power supply fault
- A blower failure
- An ac input power problem

Figure 8-1 Power Supply LEDs



ESP-14

Tables 8-1 and 8-2 describe the power supply LED codes.

Table 8–1 Pedestal and Single Power Supply (PS) Status LEDs

Shelf Status	Power Supply Status	Indicates
On	On	Normal. Pedestal functioning properly.
Off	On	Bad blower unit. Replace faulty blower.
Off	Off	Power supply bad. Replace faulty power supply.

NOTE

When the pedestal is equipped with two power supplies, you must observe the LEDs on both power supplies to determine the status.

Table 8–2 Pedestal and Dual Power Supply (PS) Status LEDs

Shelf Status	PS1	Shelf Status	PS2	Indicates
On	On	On	On	Normal.
Off	On	Off	On	Blower unit bad. Replace blower.
Off	Off	On	On	PS1 bad. Replace faulty supply.
On	On	Off	Off	PS2 bad. Replace faulty supply.
Off	Off	Off	Off	PS1 and/or PS2 bad. Possible input power problem.

8.1.3 Drive SBB Status LEDs

Figure 8-2 shows a typical 3.5-inch disk drive SBB. The SBB has two LED indicators that display the status of the device. The status conditions of the LEDs are listed in Table 8-3. The LEDs have three states: *on*, *off*, and *flashing*.

- The left LED (green) is the device activity LED and is on or flashing when the drive is active.
- The right LED (amber) is the drive fault LED and indicates an error condition when it is on (except when you turn the system on, at that time brief flashing is normal).

Figure 8–2 3.5-inch Disk Drive SBB LEDs

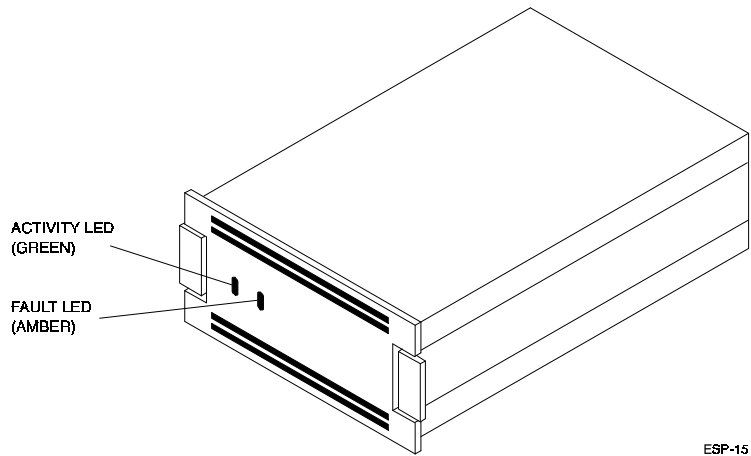


Table 8-3 shows the activity and fault status for the SBB LEDs and indicates what the status means.

Table 8–3 Disk Drive SBB Status LEDs

Activity Status	Fault Status	Indicates
On	Off	Normal: Device is operating properly.
Off	Off	Normal: Device is inactive and operating properly.
On	On	Error: Device is hung up. Replace the device.
Off	On	Error: Device is inactive and spun down. Replace the device.
On/Off	Flashing	Error: Device is active and spinning down due to the fault. (When you turn the system on, brief flashing is normal.)

8.2 Troubleshooting Your Subsystem

This section contains troubleshooting information to correct problems that are easy to fix. It also directs you to the appropriate documentation for further troubleshooting, if needed.

8.2.1 Before You Begin Troubleshooting

CAUTION

Always turn off the power to the host computer before you turn off the power to the storage pedestal(s).

Before starting to troubleshooting, perform the following preliminary checks:

Using storage devices other than the StorageWorks pedestal or shelves:

1. Turn off the host computer.
2. Turn off the power to the pedestal, shelves, and drives.
3. Check that the SCSI cables are connected correctly to the storage pedestal, shelves, and drives. Check for proper SCSI cable termination on both ends of the bus.
4. Turn the system on and see if the problem is resolved.

Using the StorageWorks storage pedestal or shelves:

Turn off the host computer.

1. Turn off power to the StorageWorks pedestal or shelves.
2. Check that the SCSI cables are connected correctly. Refer to Chapters 4 and 5 for cabling instructions.
3. Turn power on to the StorageWorks pedestal or shelves.
4. Verify that the LEDs on all the drives flash when power is applied.
5. Verify that the two LED indicators on each power supply are on.
6. Turn on the host computer and see if the problem is resolved.

8.2.2 Troubleshooting Techniques

When the controller or storage devices do not operate correctly, use the following information to diagnose the problem. The troubleshooting techniques described do not identify all possible problems with the RAID controller or StorageWorks pedestal or shelves, nor do the corrective actions suggested correct all problems.

To use Table 8-4, follow these steps:

1. Note the symptoms displayed by the controller, storage pedestal, or shelves.
2. See if the description of the problem in the *Symptom* column in Table 8-4 is similar to yours.
3. Check the conditions for that symptom in the *Possible Cause(s)* column. If more than one possible cause is given, check all of the possible causes in the order listed.
4. Follow the directions in the *Action(s) to Take* column.

Table 8–4 Troubleshooting Techniques

Symptom	Possible Cause(s)	Action(s) to Take
Drive SBB Fault Light is On	Drive failed.	Replace drive using the <i>Replacing a Drive SBB</i> section of this chapter.
Drive SBB Fault and Activity Lights are On	Drive failed or is hung.	Replace drive using the <i>Replacing a Drive SBB</i> section of this chapter.
Drive SBB Fault Light is Flashing	Drive failed and is spinning down.	Replace drive using the <i>Replacing a Drive SBB</i> section of this chapter.
Replaced Drive has not Spun Up	Drive not seen by the controller.	<ul style="list-style-type: none"> Manually rebuild the drive. Remove drive SBB, wait 20 seconds, reinsert drive SBB. Wait approximately one minute for the rebuild to start.
Multiple Drives in Pedestal/Shelf are Failed	There was a pedestal or shelf power failure.	<p>Check the monitor log to verify the drive or shelf failure. For multiple drive errors. Invoke the utilities and select the Bad Block option on the Tools menu of the utilities to check for bad blocks on the drives.</p> <p>Restore power to pedestal or shelf. Invoke the utilities and use the Make Optimal option on the Tools menu to change the state of any FLD (failed) drives to OPT (optimal).</p> <p>See the CAUTION under the Chapter 7 <i>paragraph Making Drives Optional</i> before using that option.</p>

Table 8–4 Troubleshooting Techniques (continued)

Symptom	Possible Cause(s)	Action(s) to Take
Random fault lights or all fault lights light by drives appear to be working.	Shelf supports StorageWorks Fault Management signals, but Fault Management is not enabled.	Enable StorageWorks Fault Management signals, see Section 6.2.2 of this guide.
Multiple Logical Drives are Dead	There was a pedestal or shelf power failure.	Check the monitor log to (1) verify the power failure or (2) for multiple drive errors. Invoke the utilities and select the Bad Block option on the Tools menu of the utilities to check for bad blocks on the drives. Refer to the action for <i>Multiple Drives in Pedestal/Shelf are Failed</i> on this table.
Drive has a WOL Status	<ul style="list-style-type: none"> • Drive is being rebuilt. • Drive rebuild failed. • Disk SBB inserted while rebuild in progress on another drive. 	<ul style="list-style-type: none"> • No action required. • Invoke the utilities and select the Bad Block option on the Tools menu of the utilities to check for bad blocks on the drives. • When the current rebuild completes, the controller will begin the rebuild on the new replacement drive.

Table 8–4 Troubleshooting Techniques (continued)

Symptom	Possible Cause(s)	Action(s) to Take
Drive has a WOL Status (Cont)	Shelf failure occurred resulting in the need for multiple rebuild operations to be initiated. (The controller can only rebuild one disk at a time. The remaining failed disks are left with a WOL status.)	<ul style="list-style-type: none"> • After the rebuild completes, fail the drive in WOL state using the on-line utilities. Use the manual rebuild procedure, described in Chapter 7, on the drive. Continue this operation for each drive in the WOL state. • Multiple rebuilds are queued and will be initiated by the controller one by one.
Auto Rebuild Not Started on Replacement Drive	Disk replaced while rebuild in progress on another drive.	Wait for completion of current rebuild operations. Start a manual rebuild on the replacement drive.
Drives not Seen by the Controller	<ul style="list-style-type: none"> • SCSI cable is not connected. • Incorrect SCSI termination • Duplicate SCSI IDs on bus. • Defective drive or drive SBB. • Improper insertion of a drive SBB. • Defective controller SCSI channels 	<ul style="list-style-type: none"> • Check SCSI cable(s) between the RAID controller and shelves. • Check that shelf terminators are properly inserted. • Check drive SCSI ID settings if not using StorageWorks shelves. • Replace with new drive SBB. • Remove and reinsert the drive SBB. • Replace the controller if needed.

Table 8–4 Troubleshooting Techniques (continued)

Symptom	Possible Cause(s)	Action(s) to Take
Automatic Rebuild Does Not Start	<ul style="list-style-type: none"> Automatic rebuild feature is not supported for one of the following reasons: A StorageWorks pedestal is not being used. Fault Management is disabled. Rebuild in progress on another logical RAID drive 	<ul style="list-style-type: none"> If you are using the StorageWorks pedestal perform the following: Verify that Fault Management is enabled. Refer to the <i>Setting Controller Parameters</i> and <i>Fault Management and Battery Backup Options</i> in Chapter 6. Remove the failed drive. Wait a minimum of 20 seconds and then insert the replacement drive. Wait approximately 1 minute for the rebuild to begin. Wait for completion of the rebuild in progress. If a rebuild does not start automatically after you inserted a new drive, then start a manual rebuild. If rebuild continuously fails to automatically start, contact your service representative.
Automatic Rebuild Starts and then Fails	<ul style="list-style-type: none"> You used a drive of smaller capacity to replace a failed drive. The new drive may be defective. Another drive in the drive group may have errors. 	<ul style="list-style-type: none"> Check to be sure that the replacement size is the proper type/capacity for the drive group. If the replacement drive consistently fails during the rebuild, it may be defective. Try another drive. Check drive error logs. Invoke the utilities and select the Bad Block option from the Tools menu to check for bad blocks on the drive.

Table 8–4 Troubleshooting Techniques (continued)

Symptom	Possible Cause(s)	Action(s) to Take
Rebuild Attempt Unsuccessful	You attempted to rebuild a drive in a nonredundant configuration (RAID 0 or JBOD) or multiple failures have occurred in a redundant RAID level configuration.	Restore your data from backup copies of the disks.
Rebuild Completes with Error	Error during rebuild.	Check drive logs. Determine whether the drive should be replaced with a new drive. Warning: This should be done only if no system operations to the drives have taken place since the error condition occurred.

Table 8–4 Troubleshooting Techniques (continued)

Symptom	Possible Cause(s)	Action(s) to Take
Rebuild Completes 100%, but Drive Status Remains WOL	<p>Errors occurred on a drive during a rebuild. The drive is in a WOL state.</p> <p>Errors occurred on one of the drives used in the rebuild. The replaced drive remains in the WOL state.</p>	<p>Check the drive error logs for information. Manually set the drive state back to optimal using the Standalone utilities.</p> <p>Warning: This should be done only if no system operations to the drives have taken place since the error condition occurred.</p> <p>The date will have to be restored from backup media as the rebuild can not complete successfully.</p>
Power Supply SBB Shelf Status and Power Supply Status LEDs are both Off	<ul style="list-style-type: none"> • Input power problem. • Shelf and power supply fault • You attempted to start a rebuild while a rebuild was in progress. • Bad terminators or cables. 	<ul style="list-style-type: none"> • Check for proper connection of input power. • Refer to the <i>Power Supply LEDs</i> and <i>Replacing a Power Supply SBB</i> sections of this chapter. • Wait for completion of the current rebuild in progress. • Replace the terminator or cable.

8.3 Error Messages and Recovery

This section lists error messages that can appear and provides suggestions for the action to take to resolve them.

Table 8–5 Error Messages

Diagnostic Messages		
Error/Problem	Probable Cause	Action(s) to Take
SWXCR fatal error - memory test failed!	<ul style="list-style-type: none"> • DRAM SIMMs are not properly inserted. • RAID Controller is defective. 	<ul style="list-style-type: none"> • Remove controller and reinsert the DRAM SIMMs • Replace with new RAID controller
SWXCR fatal error - command interface test failed!	Same as above.	Same as above.
SWXCR firmware checksum error - reload firmware	Power fail during the loading of new firmware.	Update firmware. Refer to Chapter 7 for details.
SWXCR hardware error	Problem with the controller.	<ul style="list-style-type: none"> • Remove controller and reinsert the DRAM SIMMs. • Replace with a new controller.
SWXCR configuration checksum error	Power failure while the controller was configuring itself. Mismatch between NVRAM configuration and EEPROM configuration.	No action required. Controller will use the configuration from the location that does not have a checksum error.

Table 8–5 Error Messages (continued)

BIOS Messages		
Error/Problem	Probable Cause	Action(s) to Take
Cannot find SWXCR in any slot: no drives installed	<ul style="list-style-type: none">• RAID controller not properly seated in EISA slot.• RAID BIOS is not enabled on the board in the lower EISA slot.• BIOS on more than one RAID controller is enabled.• Defective EISA slot.• Controller failure.	<ul style="list-style-type: none">• Remove and reseal the controller.• Rerun ECU and correct problem.• Rerun ECU and disable appropriate BIOS.• Try another EISA slot in your system.• Replace the controller.
SWXCR not responding - no drives installed	<ul style="list-style-type: none">• Incorrect firmware on controller.• Defective controller.	<ul style="list-style-type: none">• Reload correct firmware on controller.• Replace with new controller.

Figure 8–5 Error Messages (continued)

Error/Problem	Probable Cause	Action(s) to Take
No Logical drives found: None installed	<ul style="list-style-type: none"> • Logical RAID drives cannot be found. • A logical drive is not configured. • Configuration has been cleared. 	<ul style="list-style-type: none"> • Check configuration. <ol style="list-style-type: none"> 1. Shut off power to the system. 2. Shut off power to the drives. 3. Check for loose cabling. 4. Check that the cables are connected to the correct channels. 5. Turn on power to the drives. 6. Turn on power to the system. 7. Check that power LEDs are correct. 8. Reboot system and disk drives. • Run the standalone utilities to configure your drives into logical RAID drives. • Restore configuration from floppy.
SCSI device at Chn X Tgt y not responding	<ul style="list-style-type: none"> • SCSI cable is not connected. • SCSI termination is incorrect. • Drive is not powered up. • Drive is defective. • SCSI cable is defective. 	<ul style="list-style-type: none"> • Check SCSI cable connections. • Check termination is correct on the SCSI cable. • Turn on power to pedestal or shelves. • Replace the drive. • Replace the SCSI cable.

Figure 8–5 Error Messages (continued)

Error/Problem	Probable Cause	Action(s) to Take
Installation Abort	<ul style="list-style-type: none"> • Configuration change has occurred from last controller saved configuration. • No power to StorageWorks pedestal or shelves. • Drive failure on power-up. • Incorrect cabling. • Cable is defective. 	<ul style="list-style-type: none"> • In powering off a subsystem, the host computer must be powered down first, then the subsystem Fault Management enabled. Otherwise the controller will sense loss of power to the drives and assume that they have failed. Check for configuration issues due to power, cabling, or other hardware problems: <ol style="list-style-type: none"> 1. Shut off power to the host computer. 2. Shut off power to the drives. 3. Check for loose cabling. 4. Check that the cables are connected to the correct channels. 5. Turn on power to the drives. 6. Turn on power to the host computer. 7. Check that power LEDs are correct. 8. Reboot host computer and disk drives. <p>Check configuration by running the utilities:</p> <p>The utility provides a display of the current drive and RAID logical drive status. Determine the corrective action needed on the drives.</p> <p>You can choose to quit or save the current configuration.</p> <p>To quit, press the ESC key.</p> <p>To save the current configuration, press the S key. (This updates the controller's configuration with the current state of the drives and RAID logical drives.)</p>

Figure 8–5 Error Messages (continued)

Error/Problem	Probable Cause	Action(s) to Take
Installation Abort (continued)		<p>You can choose to ignore the configuration error and start a new configuration. This is done by overriding the display process by entering the following:</p> <p>SWXCRMGR -o</p> <p>You have the option of quitting from the utility or saving the new configuration.</p> <p>CAUTION: If you save this configuration you will lose your data.</p>
Mismatch between NVRAM & Flash EEPROM configurations	<ul style="list-style-type: none"> • Power failure occurred before the configuration data was updated to both the NVRAM and EEPROM. • Faulty NVRAM. 	<p>Run the Standalone utilities. Refer to Chapter 7 to determine which stored configuration (NVRAM or EEPROM), is the correct configuration.</p> <p>Replace the controller.</p>
Unidentified device found at Chn x Tgt y	<ul style="list-style-type: none"> • Drive was inadvertently replaced with new drive. • Failed drive was replaced with a new drive during a system power down. 	<ul style="list-style-type: none"> • Replace identified drive with original drive. • Start a manual rebuild on the replacement drive.
Warning: the firmware Flash EEPROM is reaching the end of its life. It should be replaced ASAP	Controller EEPROM is reaching its programmability limit.	Back up the configuration to diskette and then replace the controller.

Figure 8–5 Error Messages (continued)

Error/Problem	Probable Cause	Action(s) to Take
Warning: x system drive is degraded	Drive failed in a redundant RAID Logical Drive.	<ul style="list-style-type: none"> • Run the utilities to check the drive status. • Replace the appropriate failed drive.
Warning: x system drive is dead	<p>Drive failed in a non-redundant RAID Logical Drive (0 or JBOD).</p> <p>More than one drive failed in a redundant RAID level logical RAID drive (1, 0 + 1, 5).</p>	<p>Check all power, cabling, and hardware for proper operation.</p> <p>Data integrity can not be maintained, you must correct the situation and restore data from a backup source.</p> <p>Run the utilities.</p> <p>Identify failed drive or drives.</p> <p>Replace failed drive or drives.</p> <p>Reinitialize the RAID logical drive.</p> <p>Restore data from backup.</p>
Warning: the following SCSI devices are dead Chn x, Tgt y	Drive failed.	Run the utilities to identify failed drive. Replace drive using the <i>Replacing a Drive SBB</i> section of this chapter.
Configuration Error on SWXCR-E in Slot xx!!	An error has occurred in configuring the controller into the system.	Run the system EISA Configuration Utility (ECU) to correct problem.

Figure 8–5 Error Messages (continued)

Error/Problem	Probable Cause	Action(s) to Take
SWXCR RAM : 4 Mbytes Device identified for Chn 0, Tgt 1 found at Chn 0, Tgt 2 Device identified for Chn 0, Tgt 2 found at Chn 0, Tgt 1	Drives were removed and replaced in the wrong slot.	<ul style="list-style-type: none">• Use the message to identify the drives that have been misplaced.• Power off your system and StorageWorks pedestal or shelves.• Correct the problem.• Turn on the storage pedestal(s) and then the system.• Verify that no warning messages appear.
System abend under Novell NetWare	Novell NetWare does not support the SWXCR controller at interrupt 15	For the EISA board, run the ECU to set the interrupt level to another value.

8.4 Removal and Replacement

This section describes the following:

- Replacing a drive SBB
- Replacing a power supply SBB
- Replacing a blower
- Replace an RAID controller

8.4.1 Replacing a Drive SBB

CAUTION

Once a device has been configured by the RAID controller, moving the device to another bus or changing the device address can cause problems or loss of data.

Normally, a storage device is replaced when the device fault indicator is on as defined in Table 8-3. Ensure that you fail the drive and that the drive has spun down. To remove or replace a storage device, do the following.

CAUTION

Ensure the replacement SBB is the same type as the one being removed. Also, always use both hands when handling a device and be careful to prevent electrostatic discharge damage by not touching the device connector.

1. Open the door on the front bezel and remove the bezel from the pedestal by pushing down on the locking tabs at the bottom of the bezel.
2. Press the two locking tabs (see Figure 8-3) to release the drive SBB and remove the SBB.
3. Wait at least 20 seconds, then insert the replacement device into the guide slots and slowly push it in until it is fully seated and the mounting tabs engage the pedestal.
4. Observe the status LEDs on the new device. The green device activity LED is either on, flashing, or off, and the amber device fault LED is off.
5. Replace the front bezel and ensure the bezel locking tabs snap into place and close the bezel door.

8.4.2 Replacing a Power Supply SBB

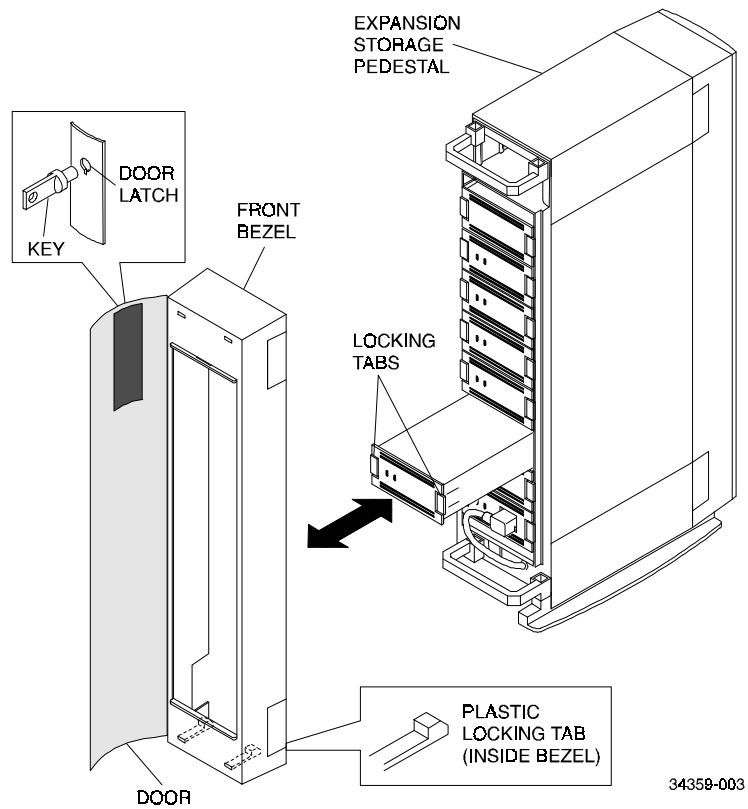
A power supply must be replaced when the LEDs indicate a fault condition (as indicated in Tables 8-1, 8-2, and 8-3).

Replacing a Primary Pedestal (Nonredundant) Power Supply

Use the following procedure to replace a pedestal primary power supply:

1. Shut down the host computer/server. Power down the pedestal by setting the power switch on the ac distribution unit to *off*. Remove the input power cable from the power supply.
2. Open the door on the front bezel and remove the bezel from the pedestal by pushing down on the locking tabs at the bottom of the bezel (see Figure 8-3). Press the two locking tabs to release the power supply SBB and slide it out of the pedestal (see Figure 8-3).
3. Insert the new power supply SBB into the guide slots and push it in until the tabs lock into place.
4. Reconnect the input power cable to the power supply and turn the ac distribution power switch to on.
5. Observe the power supply LEDs to ensure that the power supply is functioning properly (see Tables 8-1 and 8-2). Observe the LEDs on both the power supply and the storage devices for normal operating indications.
6. Replace the front bezel and ensure the bezel locking tabs snap into place and close the bezel door.
7. Turn on the host system.

Figure 8–3 Removing a Storage Device



8.4.3 Replacing a Redundant Power Supply

CAUTION

To support the warm-swap option, ensure that you replace the power supply SBB with a BA35X-HA Rev. L01 or later.

The warm-swapping method of replacing a power supply can be used when there are two power supplies. This method allows you to remove the defective power supply while the other power supply continues to supply dc power to the pedestal.

The input voltage for each ac power supply is controlled by a single switch on the ac distribution unit. Setting this switch to off removes power from all power supplies in the pedestal. To remove power from a single power supply, simply disconnect the power cable from that power supply and remove the unit.

Use the following procedure to replace a pedestal redundant power supply:

1. Open the door on the front bezel and remove the bezel from the pedestal by pushing down on the locking tabs at the bottom of the bezel. Unplug the power cord from the power supply SBB.
2. Press the two locking tabs to release the defective power supply SBB and slide it out of the pedestal (see Figure 8-3).
3. Insert the new power supply SBB into the guide slots and push it in until the tabs lock into place. Connect the power cord to the power supply SBB.
4. Observe the LEDs on the new power supply to ensure that the power supply is functioning properly (see Tables 8-1 and 8-2). Observe the LEDs on both the power supply and the storage devices for normal operating indications.
5. Replace the front bezel and ensure the bezel locking tabs snap into place and close the bezel door.

8.4.4 Replacing a Blower

WARNING
Due to hazardous high-current energy levels present in the backplane area, use extreme caution while swapping blowers. Keep all metal objects, including rings and jewelry, out of the blower/backplane cavity.

CAUTION
To prevent an overheating condition, the replacement blower should be readily available to immediately replace the faulty blower. When a blower is removed, the change in the airflow pattern reduces the cooling to the point that the pedestal can overheat in 60 seconds

The pedestal has two blowers mounted at the rear. Connectors on the backplane provide the +12 Volts dc required to operate the blowers. When either blower fails, the shelf status LED on the front of the power supply is extinguished (refer to Table 8-1).

As long as both blowers are installed and only one blower is operational, there is sufficient airflow to prevent an overheating condition. Figure 8-4 shows the removal of a blower.

To replace a blower, use the following procedure:

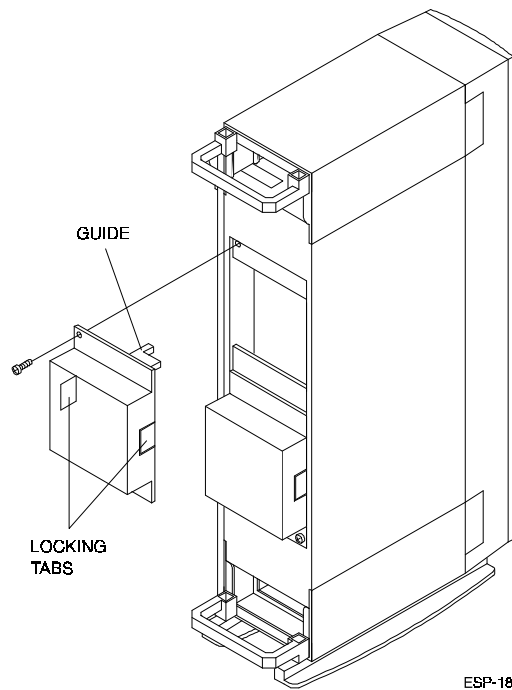
1. Have a replacement blower available.
2. Open the door on the rear bezel and determine which of the two blowers has failed by feeling the air flow at the bottom of each blower.
3. Remove the bezel from the pedestal by pushing down on the locking tabs at the bottom of the bezel.
4. Using a Phillips screwdriver, remove the safety screw in the corner of the defective blower.
5. Press the side locking tabs to release the blower.
6. Pull the blower straight out to disconnect it from the pedestal power connector.

7. Align the replacement blower connector and insert the module straight in, making sure that both locking tabs are firmly seated in the pedestal.
8. Replace the safety screw in the corner of the blower.
9. Verify that the pedestal and all SBBs are operating properly (refer to pedestal status, Tables 8-1 and 8-2).
10. Replace the rear bezel and ensure the bezel locking tabs snap into place.

NOTE

If the left power supply LED (pedestal status) does not come on and all the pedestal power supplies are operating, the second blower may have failed or the wrong blower was replaced.

Figure 8-4 Removing a Blower



8.4.5 Replacing the RAID Controller

The following procedure describes replacing a defective RAID controller. Use this procedure in the event that the ECU cannot find the controller or you suspect a controller problem.

The following procedure describes replacing the RAID controller.

1. Turn off the system.
2. Turn off the storage pedestal(s).
3. Disconnect the cable(s) connecting the controller to the storage pedestal(s).
4. Remove the defective controller.
5. Insert the new controller.
6. Reconnect the cable(s).
7. Turn on the storage pedestal(s) and then the system.
8. Invoke the utilities and restore the configuration (see *Restoring the Configuration from a Diskette* in Chapter 5).
9. Use the View/Update option on the main menu to verify the status of the drives.
10. If any drive has a FLD (*failed*) status, use the Rebuild option on the main menu to rebuild the drive.
11. Use the Parity Check option on the main menu to check the consistency of the logical RAID drive(s).
12. If you cannot recover, you need to reconfigure the array and restore your data from backup media.

8.4.6 Swapping EEPROM between Controllers

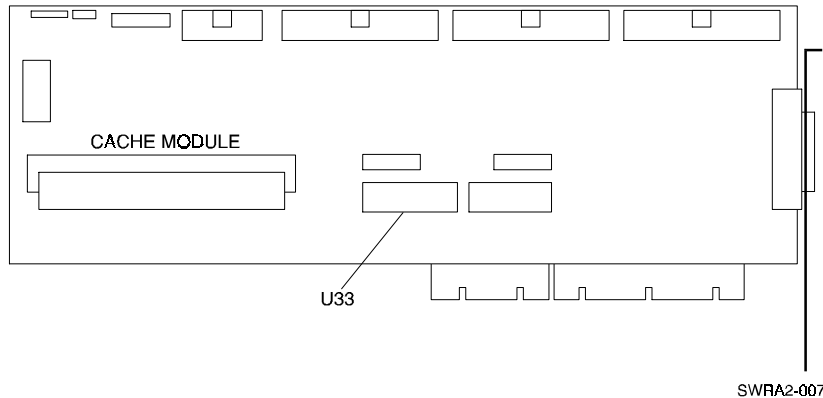
The following procedure describes removing the EEPROM from a defective RAID controller and inserting it into a new RAID controller. This procedure is used in the event that the existing configuration cannot be saved to a diskette.

CAUTIONS
To avoid static damage, follow adequate anti-static procedures when handling the RAID controller. For example, use the following procedure in a static protected area and be sure to use a static strap.
Take care not to bend the pins on the EEPROM. The pins must be perfectly aligned with the connector on the board before any insertion pressure is applied to the EEPROM.

To remove the EEPROM from the controller, follow these steps.

1. Turn off the system.
2. Turn off the storage pedestal(s).
3. Disconnect the cable(s) connecting the controller to the storage pedestal(s). Label cable(s) for future identification.
4. Remove the defective controller.
5. Make note of EISA slot where the board was located.
6. Carefully remove the EEPROM at U33 (Figure 8-5) from the new controller. Label EEPROM as "new" and set it aside carefully.
7. Carefully remove EEPROM at U33 from the defective controller and set controller aside (out of the way).
8. Carefully align the notches of the old EEPROM with the notch at connector U33 on the new RAID board to ensure that pin 1 is aligned correctly. Carefully insert the old EEPROM into position U33.
9. Install the new RAID board with the old EEPROM into the same EISA slot that the old RAID Board was in. Connect the previously labeled cable(s) to the correct storage pedestal connector(s), and power on the pedestal(s).

Figure 8–5 Locating EEPROM U33 on 1-Channel or 3-Channel Controller



10. Power on the system. The system displays the following message:
Mismatch between NVRAM and flash EEPROM
configuration.
Spinning up drives...
11. Invoke the utilities as described in Chapter 5. The utilities display the following message:
The NVRAM and flash EEPROM configurations do not
match. Proceeding further will allow selection be-
tween NVRAM and Flash configurations.
Press any key to continue.
12. Press a key. The utilities display the Load Configuration menu.
13. Select the Load Flash configuration option and press the Enter key. The utilities display all optimal and hot spare drives connected to the system.

14. Press S to save the displayed configuration and Esc to quit.
15. Press the reset button on your system or power the system off and then turn it back on to reboot.
16. Invoke the utilities as described in Chapter 5. Make sure that the system configuration matches the previous configuration.
17. Use the View/Update option on the main menu to verify the status of your drives.
18. Rebuild any failed drives.
19. Use the Parity Check option on the main menu to check the consistency of the logical RAID drive(s).

If you cannot recover, you need to reconfigure the array and restore your data from backup media.

Upgrading

This chapter describes the procedures required for updating EISA or PCI configuration information on computer systems into which you install an EISA or PCI RAID controller. The procedures require you to run the EISA or PCI configuration (or system configuration) utility.

9.1 Introduction

This chapter describes how to upgrade the firmware for your EISA, or PCI controller, and also how to update the BIOS for an intel-based system containing an EISA controller.

- To update firmware for an EISA controller, you must perform the following major steps:
 - Copy new version of firmware onto the controller.
 - Run the EISA Configuration Utility (ECU).
 - Reset ECU parameters through the standalone configuration utility.
 - Copy new version of BIOS onto the controller.
- To update firmware for a PCI controller, you must copy the new version of firmware onto the controller.
- To update the BIOS for your EISA controller in an intel-based system, refer to Section 9.5.

NOTE

Omit the next step if you have a PCI controller, or an EISA controller with firmware later than V1.99.

- For EISA controllers with V1.99 firmware, go to Section 9.4.2 and set the controller parameters before upgrading your firmware, then continue with Section 9.2.

9.1.1 Spanning

The new version of the utilities does not support the creation of spanned logical drives. However, the controller can still use existing spanned logical drives.

9.1.2 Striping

When setting parameters using the RAID Array 200 Standalone Configuration Utility, don't change stripe size from the existing setting. Changing this value will cause data loss on your logical RAID drives.

9.2 Updating Firmware

The procedure for updating firmware varies for Intel-based and AXP-based systems. See Section 9.2.1 to update the firmware for an Intel-based system, or Section 9.2.2 to update the firmware for an AXP-based system.

On systems with both EISA and PCI controllers, perform updates on EISA controllers first, then PCI controllers.

9.2.1 Updating the Firmware on an Intel System

To update your firmware on an Intel system, follow these steps:

1. With the system running, insert the latest RAID Array 200 Standalone Configuration Utility diskette for Intel Systems into your floppy drive.
2. Enter either of the following commands depending on whether you have single or multiple RAID controllers.

For a single RAID controller, type:

```
A:\SWXCR> SWXCRFW xxxx.xxx
```

where xxxx.xxx is the firmware filename (typically, SWXCRFWA, for EISA; SWXCRFWP, for PCI) and version of the firmware that you want to load: SWXCRFWA.215 (EISA), SWXCRFWP.219 (PCI), for example.

NOTE

If you have both EISA and PCI controllers to update, perform the next step for the EISA controller(s) first.

For multiple controllers, either EISA or PCI, type:

```
A:\SWXCR> SWXCRFW -v xxx
```

where xxx is the version of the firmware, 215 for EISA, or 219 for PCI.

After you enter either form of the command, the system displays messages similar to the following:

```
*****
*****
```

```
SWXCR Firmware Download Utility (V3.02, Nov 29, 1994)
```

```
*****
*****
```

This utility is used to upgrade the firmware on the SWXCR controller.

StorageWorks RAID Array 200 Controller Installation and Standalone Configuration Utility

```
*****
*****

SWXCR Controller supporting 7 targets per channel found at
slot 3

*****
*****

Hit any key to proceed. . . .

*****
*****

Current firmware version = 2.15

*****
*****

Reading file SWXCRFWA.215

*****
*****

The new code will now be flashed. If error occurs after
this, the flash EEPROM may be corrupted.

*****
*****

Hit any key to proceed. . . .

*****
*****

Programming (This could take up to 1 minute.). . . . first
SWXCR controller successfully programmed.

*****
*****

Hit any key to proceed. . . .
```



```
*****  
*****
```

```
PLEASE CYCLE SYSTEM POWER . . . .
```

3. Start the standalone utility, view the firmware version displayed on the main menu to verify the update. Then:
 - For a PCI controller, exit the utility, and remove the standalone utility diskette from the floppy drive. This completes the firmware update for PCI controllers, return to Section 6.3 to set controller parameters.
 - For an EISA controller no greater than version 1.99, go on to Section 9.3 to continue the firmware update process. For versions 2.00 or greater, remove the standalone utility diskette from the floppy drive. This completes the firmware update, return to Section 6.3 to set or check controller parameters.

9.2.2 Updating the Firmware on an AXP System

To update your firmware on an AXP-based system, follow these steps:

1. Consult your AXP system documentation to invoke the boot menu shown below.

```
ARC Multiboot DEC Version 2.07
Copyright © 1993 Microsoft Corporation
Copyright © 1993 Digital Equipment Corporation

Boot Menu
    Boot Windows NT
    Boot an alternate operating system
    Run a program
    Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

2. Insert the latest standalone configuration utility for AXP Systems floppy diskette into your floppy drive.
3. Use the up and down arrow keys to highlight the *Run a program* option, and press the Enter key to select it. The utility displays a prompt.
4. To run the utilities from the A: drive, do the following:

For a single RAID controller, type this command:

Program to Run: **A:\SWXCRFW xxxx.xxx**

where xxxx.xxx is the firmware filename (typically, SWXCRFWA, for EISA; SWXCRFWP, for PCI) and version of the firmware that you want to load; SWXCRFWA.215 (EISA), SWXCRFWP.219 (PCI), for example.

NOTE

If you have both EISA and PCI controllers to update, perform the next step for the EISA controller(s) first.

For multiple controllers, either EISA or PCI, type:

A:\SWXCRFW -v xxx

where xxx is the version of the firmware, 215 for EISA or 219 for PCI.

The system displays messages similar to the following:

```
*****
*****
```

SWXCR Firmware Download Utility (V3.02, Nov 29, 1994)

```
*****
*****
```

This utility is used to upgrade the firmware on the SWXCR controller.

```
*****
*****
```

SWXCR Controller supporting 7 targets per channel found at slot 3

```
*****
*****
```

Hit any key to proceed. . . .

```
*****
*****
```

Current firmware version = 2.15

```
*****
*****
```

Reading file SWXCRFWA.215

```
*****
*****
```

The new code will now be flashed. If error occurs after this, the flash EEPROM may be corrupted.

```
*****
*****

Hit any key to proceed. . . .

*****
*****

Programming (This could take up to 1 minute.). . . . first
SWXCR controller successfully programmed.

*****
*****

Hit any key to proceed. . . .

*****
*****

PLEASE CYCLE SYSTEM POWER . . . .
```

5. Start the standalone utility, view the firmware version displayed on the main menu to verify the update. Then:
 - For a PCI controller, or EISA version 2.0 or later, exit the utility and remove the standalone utility diskette from the floppy drive; this completes the firmware update. Return to Section 6.3 to set controller parameters.
 - For an EISA controller no greater than version 1.99, go on to Section 9.3 to continue the firmware update process. For versions 2.00 or greater, remove the standalone utility diskette from the floppy drive. This completes the firmware update, return to Section 6.3 to set or check controller parameters and configure the array.

9.3 Updating ECU File

If your EISA controller is version 1.99 or earlier, you need to run the EISA Configuration Utility (ECU) to update the configuration information stored on nonvolatile memory in your system whenever you add or remove EISA controllers. The system BIOS uses the contents of the EISA nonvolatile memory during boot to initialize EISA controllers installed in your computer.

You need to do the following to update EISA information:

- Start the ECU.
- View and record EISA parameters.

NOTE

Don't physically remove the EISA board in the next step. Just remove it from the system configuration.

- Remove EISA board from the ECU.
- Add EISA board to the ECU using new .CFG file on standalone utilities.
- Set BIOS address and interrupt.*

* Previously, in addition to BIOS address and interrupt level, you needed to set other parameters for EISA controllers through the ECU. Presently, you set all other parameters through the RAID Array 200 Standalone Configuration Utility for both EISA and PCI controllers.

9.3.1 Starting the ECU

To run the ECU, follow these steps:

NOTE

ECU's differ from system to system. Check the procedures in this guide before you respond to screen prompts. For more information about using the ECU on your system, refer to your system documentation.

1. Boot from your system ECU configuration diskette, for Intel-based systems. For AXP-based systems running DEC OSF/1 or OpenVMS for AXP systems, boot to console prompt and type: **runecu**. For AXP-based systems running Microsoft Windows NT for AXP systems choose *Run ECU From Floppy* from the ARC menu.
2. Select the function that configures your system and press the Enter key.
3. Follow the instructions for system configuration until a menu similar to Figure 9–1 displays on your screen.

Figure 9–1 EISA Configuration Utility Main Menu

```

                                EISA Configuration Utility
                                Steps in configuring your computer
STEP 1:      Important EISA configuration information
STEP 2:      Add or remove boards
STEP 3:      View or edit details
STEP 4:      Examine required details
STEP 5:      Save and exit
Select=ENTER  <Cancel=ESC>
```

4. Choose the View or edit details option (Step 3: in the example screen shown in Figure 9–1) and press the Enter key. Scroll through the file that now appears on your screen until you find the slot number referencing the controller you are updating. The information for a 1-channel board appears similar to Figure 9–2.

Figure 9–2 ECU Details for a 1-Channel Controller

Slot 5 - Digital SWXCR-EA EISA RAID Controller (1-channel)		
Disk Spin-up	2 disks every 6 seconds -	
	Default	
Channel 0 tag-queuing (SCSI-2)	Enable tag-queuing -	
	Default	
Channel 0 transfer rate (Max)	Synchronous, 10 MB/s	
	(fast) - Default	
BIOS (16K) Base Address	Disable BIOS	
Interrupt	Interrupt 11 (edge) -	
	Default	
Edit=ENTER <Edit Resources=F6> <Advanced=F7>		
<Done=F10>		

- Record the settings for these parameters on a piece of paper, so that you can reset the parameters later using the standalone configuration utility.
- Press the Esc key when you finish recording the parameter settings. The *Steps in configuring your computer* screen appears. Follow Section 9.4.3 to remove the board from the ECU.

9.3.2 Removing the Board From the ECU

To remove the board from the ECU, follow these steps:

- Choose the Add or remove boards option (Step 2: in the example screen shown in Figure 9–3), and press the enter key. A screen similar to the one shown in Figure 9–4 displays, listing the current EISA boards in your system.

Figure 9-3 The ECU Main Menu

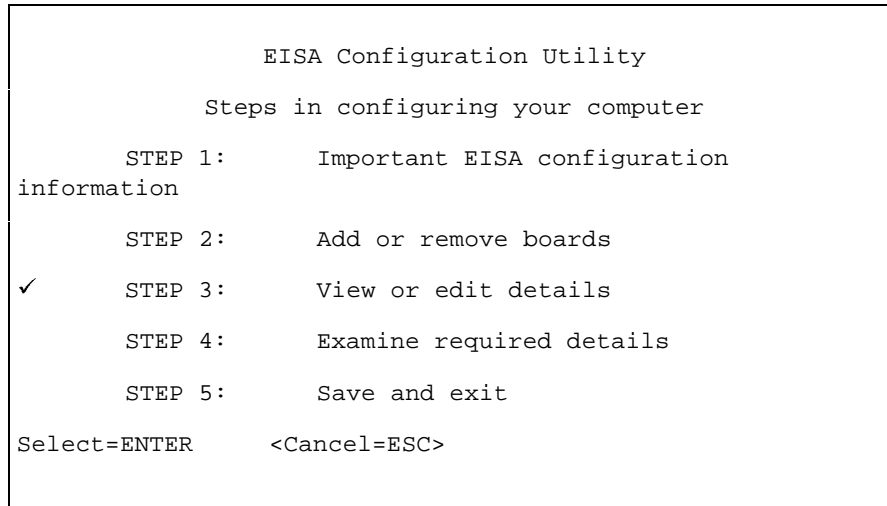


Figure 9-4 The Add or Remove Board Screen

```

Step 2:  Add or remove boards      Help=F1
Listed are the boards and options detected in your
computer.

♦ To add boards or options which could not be detected, or
  which you plan to install, press      Insert key.

♦ To move the highlighted board to another slot, press the
  F7 key.

♦ To remove the highlighted board from the
  configuration, press the Del key.

♦ When you have completed this step, press the F10 key.

Slot  1  (Empty)
Slot  2  (Empty)
Slot  3  (Empty)
Slot  4  (Empty)
Slot  5  Digital SWXCR-EA EISA RAID Controller (1-channel)
Slot  6  (Empty)

Add=INSERT    <Remove=DEL>    <Move=F7>    <Done=F10>

```

2. Write down the slot number of the controller board for future reference. Failure to get the controller back in the same slot will disturb the configuration. Use your arrow keys to select the controller and press the Delete key. The ECU displays a screen similar to Figure 9-5.

Figure 9-5 The Add Board Confirmation Screen

```

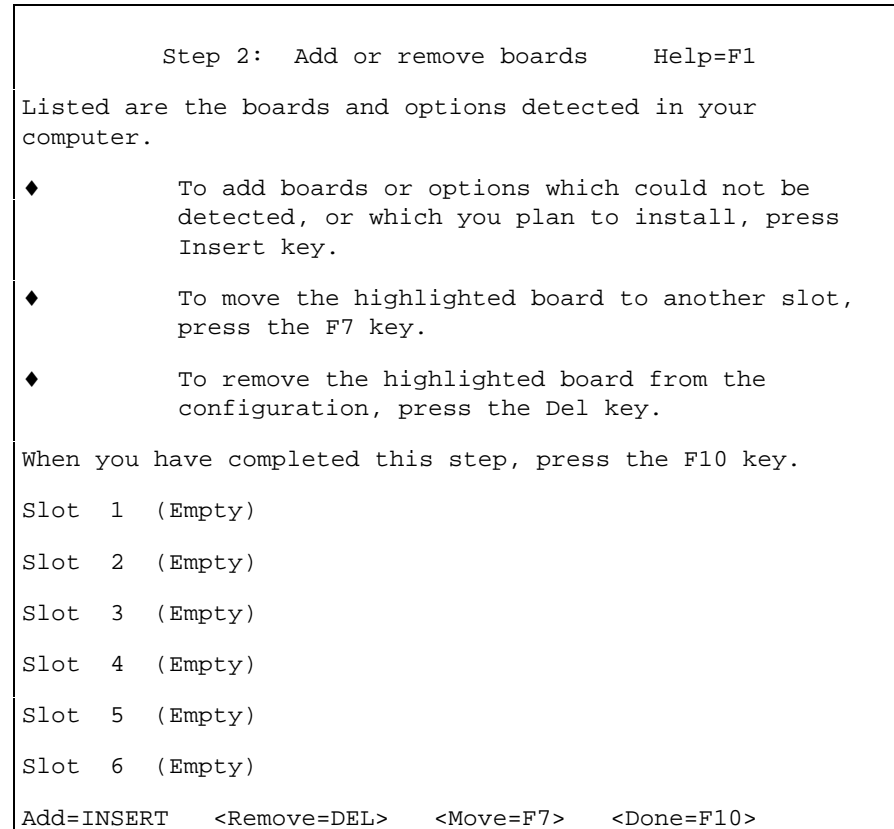
                Step 2:  Add or remove boards

                Remove confirmation

Board Name:Digital SWXCR-EA (1-ch) EISA RAID Cntlr
(Generic)

Ok=ENTER      <Cancel=ESC>
```

3. Press the Enter key and the *Add or remove boards* screen appears, similar to the screen shown in Figure 9-6. The controller you removed no longer displays on this screen.

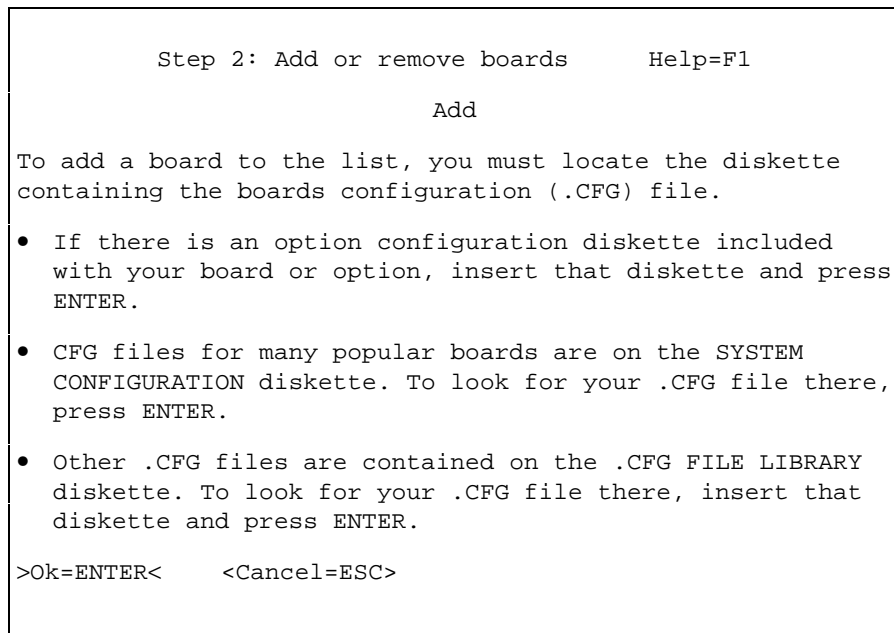
Figure 9-6 The Add or Remove Board Screen

9.3.3 Adding an Updated Board to the ECU

To add an updated board to the ECU, follow these steps:

1. Use the up and down arrow keys to select a slot in which to install the controller.
 - To install an SWXCR-EA 1-channel controller, you need one empty EISA slot.
 - To install an SWXCR-EB 3-channel controller, you need two empty EISA slots in close proximity, for cabling purposes, during the hardware installation. (If your system has additional punchout slots to accommodate SCSI channels, you need only one EISA slot).
2. Press the Insert key to add the board. The *Add* screen appears similar to the screen shown in Figure 9–7.

Figure 9–7 The Add Board Screen



3. Remove the ECU diskette and insert the RAID Array 200 Standalone Configuration Utility diskette for your operating system (this diskette contains the .CFG files) and press the Enter key. The ECU displays an *Add Configuration (CFG) file* screen similar to Figure 9–8.

NOTE

The .CFG file on the RAID Array 200 Standalone Configuration Utility diskette is the most current .CFG file. Use this instead of any versions that may be on your system ECU diskette.

Figure 9–8 The Add Configuration File Screen

```

Step 2:  Add or remove boards                      Help=F1
          Add Configuration (CFG) file
Select a file to add.
Directory:  A:\*.CFG
!MLX0077.CFG Digital SWXCR-EA (1-ch) EISA RAID Cntlr
(Generic)
!MLX0075.CFG Digital SWXCR-EB (3-ch) EISA RAID Cntlr
(Generic)
AMLX0077.CFG SWXCR-EA (1-ch) EISA RAID Cntlr for OSF, VMS
AMLX0075.CFG SWXCR-EB (3-ch) EISA RAID Cntlr for OSF, VMS

Select=ENTER   (Sort=F6)   (Directory=F7)   (Cancel=ESC)

```

4. Select the appropriate .CFG file for your RAID controller as follows and press the Enter key:
 - Select !MLX0077.CFG for a 1-channel controller in an Intel-based computer running any operating system, or in Alpha running Microsoft Windows NT for AXP systems
 - Select !MLX0075.CFG for a 3-channel controller in an Intel-based computer running any operating system, or in an Alpha running Microsoft Windows NT for AXP systems
 - Select AMLX0077.CFG for a 1-channel controller in an Alpha running OpenVMS for AXP systems, or DEC OSF/1
 - Select AMLX0075.CFG for a 3-channel controller in an Alpha running OpenVMS for AXP systems, or DEC OSF/1The utility displays a screen similar to Figure 9–9.

Figure 9–9 The Add Board Confirmation Screen

<p>Step 2: Add or remove boards</p> <p>Add confirmation</p> <p>Board Name:Digital SWXCR-EA (1-ch) EISA RAID Cntlr (Generic)</p> <p>Ok=ENTER <Cancel=ESC></p>

5. Press the Enter key to confirm the .CFG file. The ECU displays an add slot screen similar to Figure 9–10.

Figure 9–10 The Add Slot Screen

```

                                Add
Select an acceptable slot for the board and press ENTER.
Slot  1 (Empty)
Slot  2 (Empty)
Slot  3 (Empty)
Slot  4 (Empty)
Slot  5 (Empty)
Slot  6 (Empty)
The (→) indicates an acceptable slot for the board
>Ok=Enter<    <Cancel=ESC>
```

6. To install the controller, select the slot it was previously installed in. (This slot was noted in step 2 of Section 9.3.2.). Press the Enter key. Figure 9–11 shows Slot 6 selected for the installation.

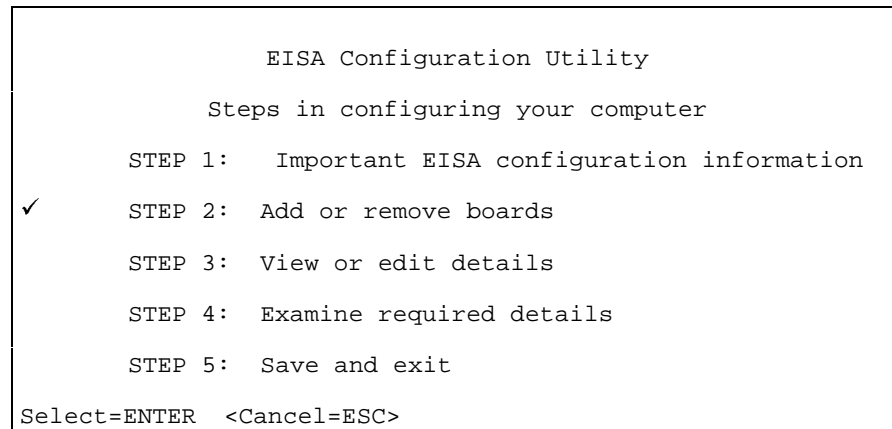
Figure 9-11 Add Slot Step 2

```

                Step 2:  Add or remove boards      Help=F1
Listed are the boards and options detected in your
computer.
♦              To add boards or options which could not be
the            detected, or which you plan to install, press
               Insert key.
♦              To move the highlighted board to another slot,
               press the F7 key.
♦              To remove the highlighted board from the
               configuration, press the Del key.
When you have completed this step, press the F10 key.
Slot  1 (Empty)
Slot  2 (Empty)
Slot  3 (Empty)
Slot  4 (Empty)
Slot  5 (Empty)
Slot  6 Digital SWXCR-EA (1-ch) EISA RAID Cntlr (Generic)
Add=INSERT    <Remove=DEL>    <Move=F7>    <Done=F10>
```


7. Press the F10 key. The *Steps in configuring your computer* menu appears similar to Figure 9–12.

Figure 9–12 The ECU Main Menu



9.3.4 Setting BIOS Address and Interrupt

The .CFG file that you copied during the *Add or remove boards* procedure sets the BIOS (for Intel-based systems only; Alpha systems do not use BIOS) and Interrupt parameters with default values.

You may need to change these settings.

To view and, if necessary, change these settings, follow these steps:

NOTE

Other parameters that you recorded prior to removing the controller will no longer appear in the View or edit details file. You must now use the standalone configuration utility to set these parameters. Section 9.4 describes how to do this.

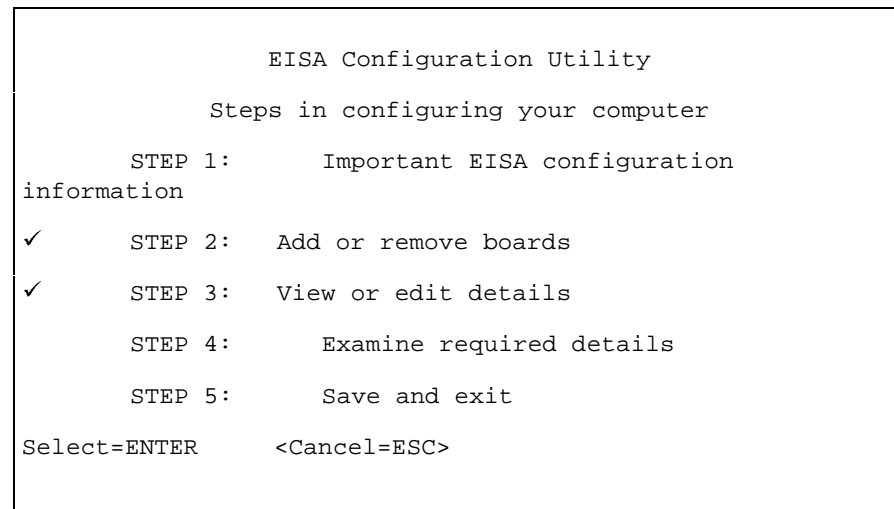
1. Select the View or edit details option Step 3 in the sample screen shown in Figure 9–12 and press the Enter key.
2. Scroll through the file that now appears on your screen until you find the slot number for the controller you are installing. The information for a 1-channel board appears similar to Figure 9–13. If installing a RAID controller in an Alpha system, go on to Step 4.

Figure 9–13 ECU Details for a 1-Channel Controller

Slot 5 - Digital SWXCR-EA EISA RAID Controller (1-channel)		
BIOS (16K)		Base Address 0CC000H -
		Default
Interrupt		Interrupt 11 (edge) -
		Default
Edit=ENTER	<Edit Resources=F6>	<Advanced=F7>
<Done=F10>		

The display for a 3-channel board installation differs slightly.

3. Set the BIOS address to the value previously recorded in step 5 of Section 9.3.1.
4. Set the interrupt level to the value previously recorded in step 5 of Section 9.3.1.
5. Press the F10 key when you finish setting these parameters. The *Steps in configuring your computer* appears similar to Figure 9–14.

Figure 9–14 The ECU Main Menu

6. Select the *Save and exit* option (Step 5 in this example) and press the Enter key. A save and exit screen appears similar to Figure 9–15.

Figure 9–15 The Save and Exit Screen

```
Step 5:  Save and Exit      Help=F1

In order to complete the configuration process, you must
save your configuration. In this step, you must select
whether to save your configuration or discard your changes
before exiting this program.

If you choose to save, this program will save the new
configuration in your computer's nonvolatile memory and in
a file on your SYSTEM CONFIGURATION diskette, and then your
computer will be restarted for you.

If you choose to discard the configuration, any changes you
have made will be lost.

If you are finished configuring, remove the SYSTEM
CONFIGURATION diskette if it is in drive A and press ENTER
to restart your computer.

>Save the configuration and restart the computer.

  Discard the configuration and return to the main
  menu

>Select=Enter<    <Cancel=ESC>
```

7. Press Enter to save the configuration. A screen similar to Figure 9–16 appears.

Figure 9-16 The Reboot After Changing the ECU Screen

```

EISA Configuration Utility      Help=F1

Your configuration file has been saved, and if possible a
backup SYSTEM.SCI file has been made on the current drive.

To complete your configuration, you must do one of the
following:

If you need to install boards or change switches and
jumpers on boards already installed, turn off your computer
and do so.

If you want to test your system or install an operating
system, press ENTER to restart your computer, run the
configuration utility again, and select the appropriate
main menu item.

If you are finished configuring, remove the SYSTEM
CONFIGURATION diskette if it is in drive A and press ENTER
to restart your computer.

```

8. Follow the directions on your screen to save and exit the ECU.
9. Remove the diskette and turn off the power.

9.4 Setting Controller Parameters

You must set the following after installing your RAID controller

- controller parameters
- Fault Management and Battery Backup options

Invoke the Standalone Configuration utility.

9.4.1 Invoking the Standalone Configuration Utility

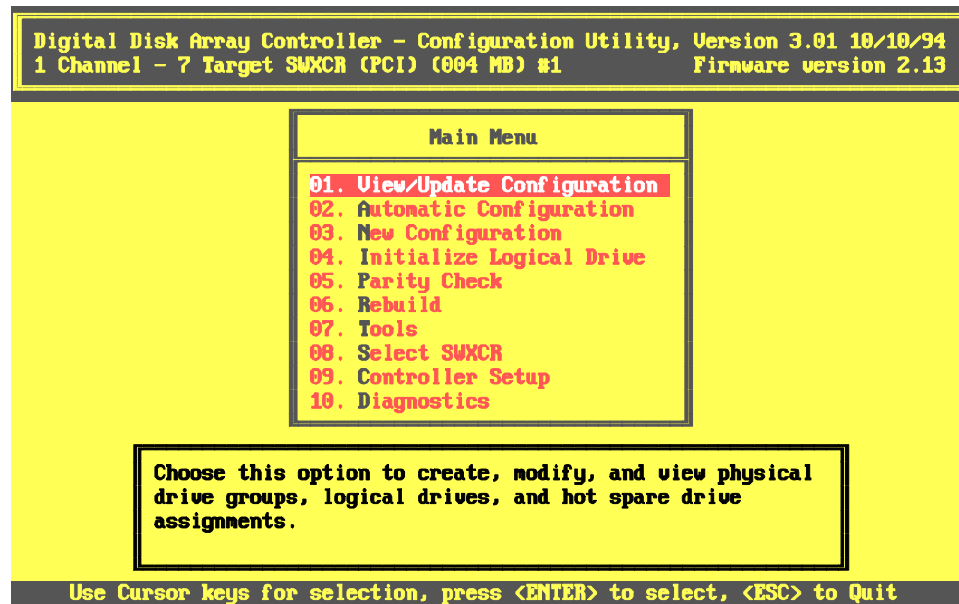
The procedure for invoking the standalone configuration utility varies based on your type of system. See the following system-specific instructions for Intel and AXP systems.

9.4.1.1 Invoking the Standalone Utility on Intel Systems

To invoke the standalone utility on an Intel (486 and up) system, follow these steps:

1. Insert the RAID Array 200 Standalone Configuration Utility for Intel Systems diskette in your floppy drive.
2. Start or reboot your computer, leaving the diskette in the floppy drive. Your computer boots from the RAID Array 200 Standalone Configuration Utility V3.0 for Intel Systems diskette rather than your hard disk.
3. Type: A:\SWXCR> **swxcrmgr**
The utility checks the drives, and then displays the main menu as shown in Figure 9-17.

Figure 9-17 The Main Menu of the Standalone Utility



Section 9.4.3 describes how to exit from the utility.

9.4.1.2 Invoking the Standalone Utility on AXP Systems

To invoke the Standalone Utility on AXP systems, follow these steps:

1. Invoke the ARC console menu shown in Figure 9–18. Consult your AXP system documentation to invoke the ARC console.

Figure 9–18 The ARC Console for An AXP System

```
ARC Multiboot DEC Version 2.07
Copyright (c) 1993 Microsoft Corporation
Copyright (c) 1993 Digital Equipment Corporation

Boot Menu
  Boot Windows NT
  Boot an alternate operating system
  Run a program
  Supplementary menu ...

Use the arrow keys to select, then press Enter.
```

2. Insert the RAID Array 200 Standalone Configuration Utility for AXP Systems diskette into your floppy drive.
3. Select the *Run a program* option from the AXP Boot menu. The system displays the *Program to run:* prompt.
4. Type: Program to Run: **A:swxcrmgr**
The utility checks the drives, and then displays the main menu as shown in Figure 9–19.

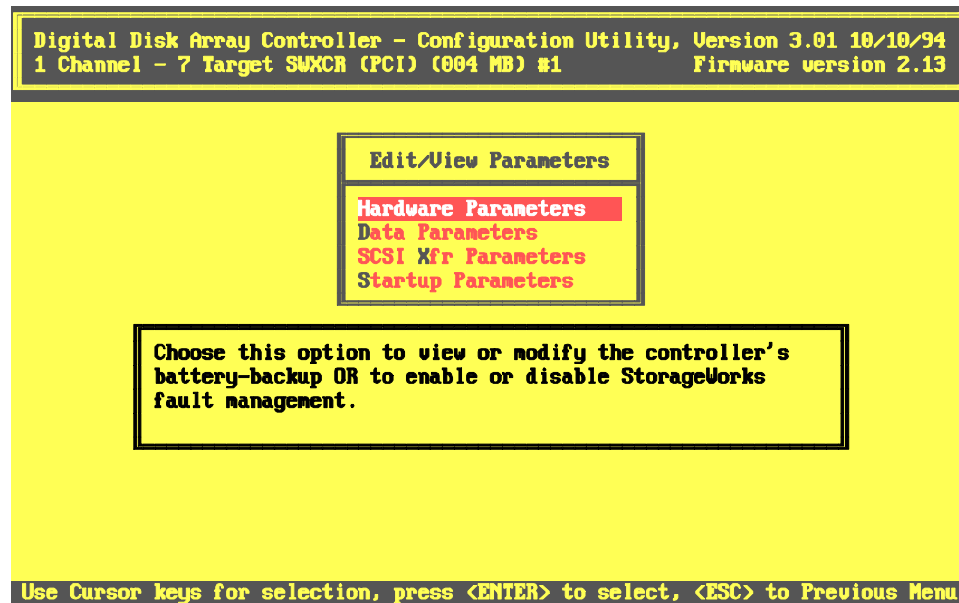
Section 9.4.2 describes how to set controller parameters.

9.4.2 Setting Controller Parameters

Previously, to set parameters, such as for EISA controllers you needed to use the EISA Configuration Utility (ECU). Presently, you use the Standalone Configuration Utility to set these parameters for both EISA and PCI controllers.

To access the controller parameters, use the up and down arrow keys to highlight the *Controller Setup* option on the main menu and press the Enter key to select it. The *Edit/View Parameters* menu appears as shown in Figure 9–19.

Figure 9–19 The Edit/View Parameters Menu

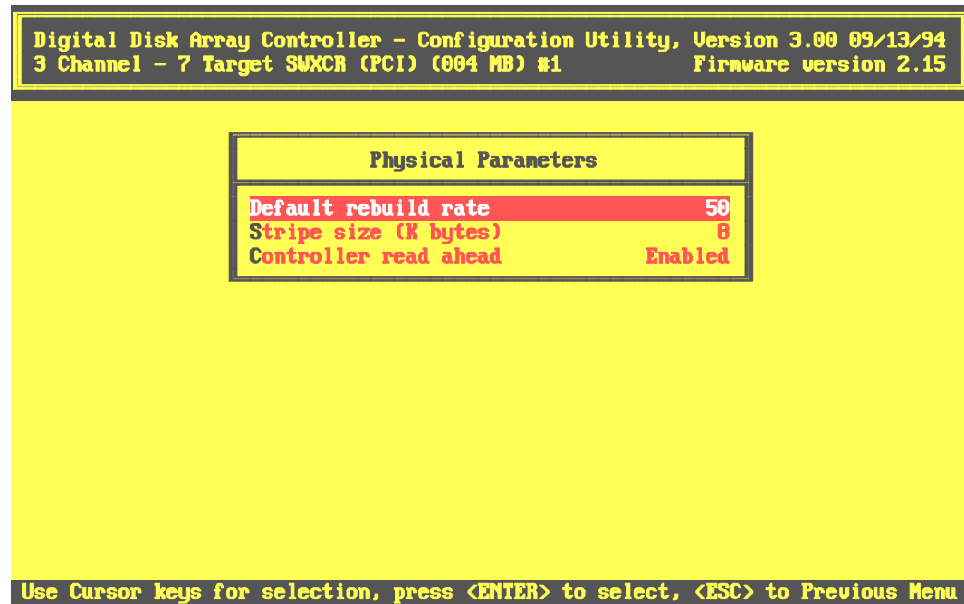


9.4.2.1 Completing the Controller Parameters

To set the *Controller Parameters*, follow these steps.

1. Use the arrow keys to highlight the *Data Parameters* option on the *Edit/View Parameters* menu and press the Enter key. The *Physical Parameters* screen appears, similar to the one shown in Figure 9–20, with the *Default rebuild rate* option highlighted.

Figure 9–20 The Physical Parameters Screen



2. Press the Enter key and a box appears at the bottom right corner of the screen in which you can type a rebuild rate from 0–50. The default rebuild rate, 50, is the fastest rate at which the system will rebuild data from a failed drive. You can not change the rebuild rate for a rebuild in progress.

3. Use the arrow keys to highlight the *Controller read ahead* option. This option is enabled by default. Leave *Controller Read Ahead* enabled for a subsystem processing primarily sequential, long file transfers. Disable *Controller read ahead* for a subsystem processing primarily small, or random transfers. Press the Enter key to disable this option.

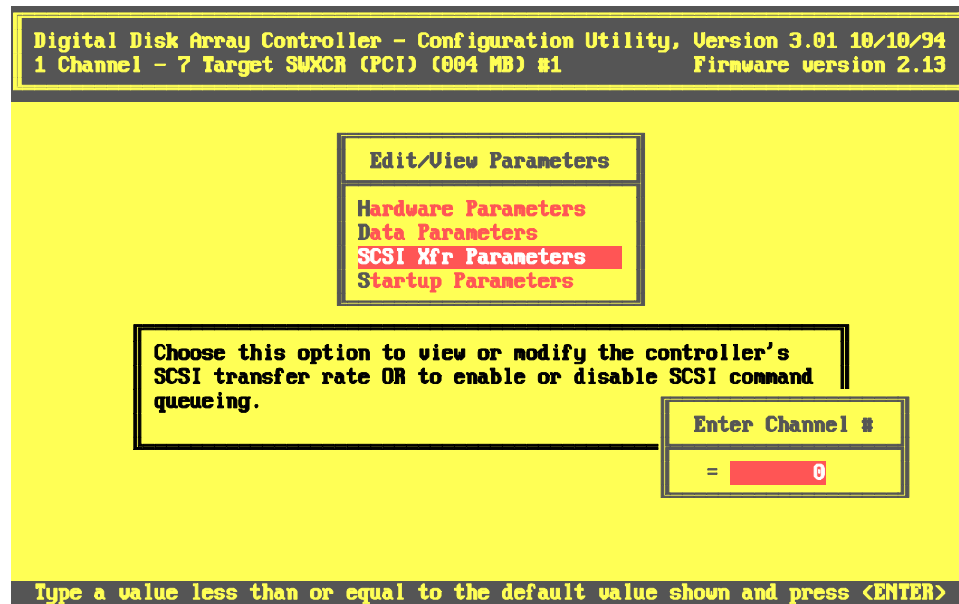
When you finish setting these options press Esc to return to the *Edit/View Parameters* menu.

9.4.2.2 Setting the SCSI Transfer Parameters

To set the *SCSI Transfer Parameters*, follow these steps.

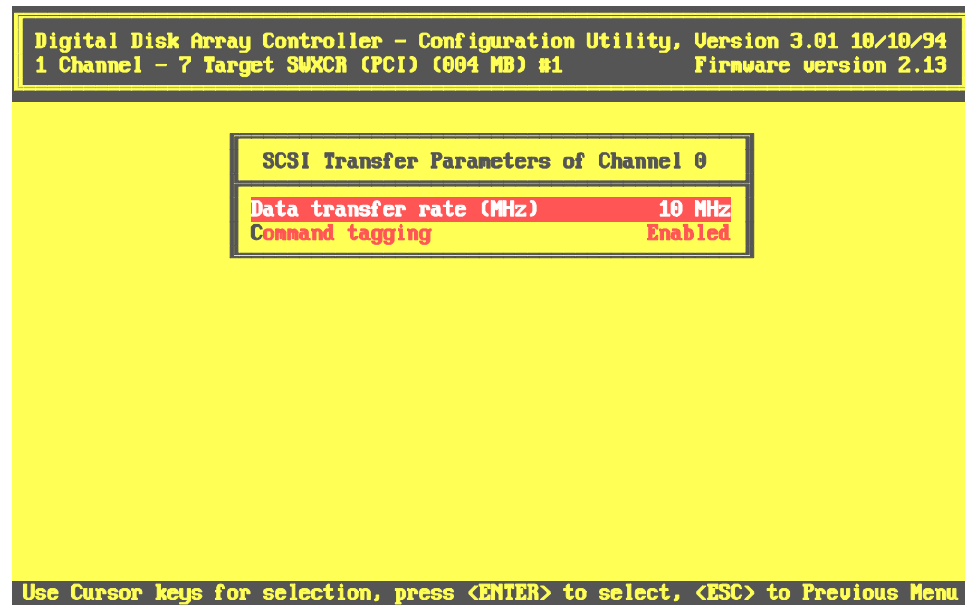
1. Use the arrow keys to highlight the *SCSI Xfr Parameters* option on the *Edit/View Parameters* menu and press the Enter key. An *Enter Channel #* box appears, similar to the one shown in Figure 9–21, at the bottom right of the screen.

Figure 9–21 Enter Channel Box Appears at Bottom Right



2. Enter the channel number of the attached controller and press the Enter key. The *SCSI Transfer Parameters of Channel x* screen appears similar to the one shown in Figure 9–22. The *Data transfer rate* option appears highlighted.

Figure 9–22 The SCSI Transfer Parameters for the Specified Channel



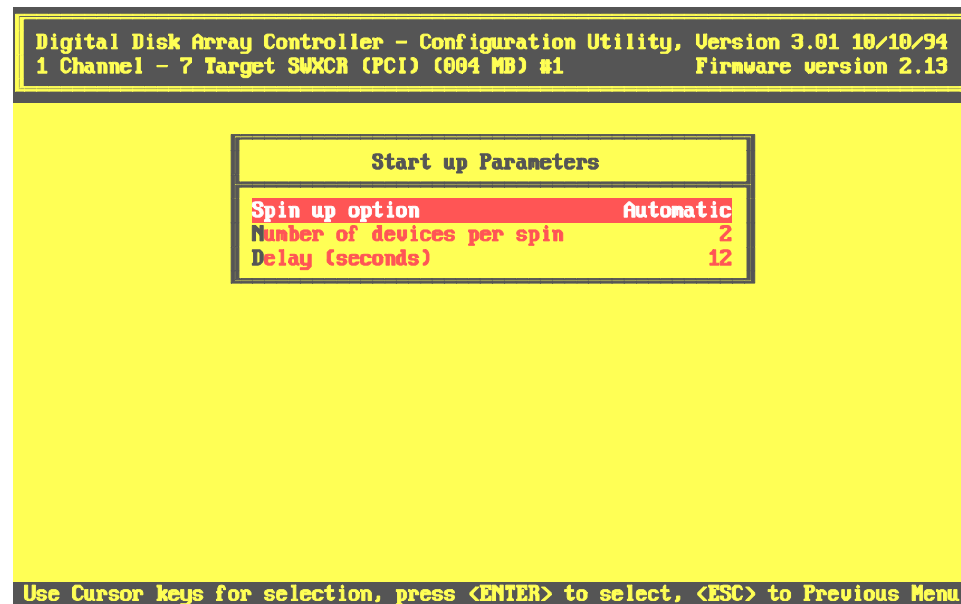
3. Press the Enter key to scroll through the *Data transfer rate* options. Select the original value previously noted.
4. Use the arrow keys to highlight the *Command tagging* option. Select the original setting(s) previously noted.
5. Set the SCSI Transfer Parameters for the specified channel to the original values previously noted. Press Esc to return to the *Edit/View Parameters* menu.
6. Repeat Steps 1–5 until you have set these parameters for each channel on your controller.

9.4.2.3 Setting the Startup Parameters

To set the *Startup Parameters*, follow these steps.

1. Use the arrow keys to highlight the *Startup Parameters* option on the *Edit/View Parameters* menu and press the Enter key. The *Start up Parameters* menu appears, with the Spin up option highlighted shown in Figure 9–23.

Figure 9–23 The Start Up Parameters Menu



2. The *Spin up option* specifies whether the controller tells the drives when to spin up or whether the drives spin up on power up. Use the original setting(s) previously noted.

When you finish setting the *Startup Parameters*, you have completed setting the controller parameters. Press Esc to return to the *Edit/View Parameters* menu. Press the Esc key again to return to the main menu.

9.4.3 Exiting the Utility

Press the Esc key twice from the main menu to exit the standalone utility. The utility prompts you to confirm that you want to exit. Select *Yes* and press the Enter key to exit. Return to Section 9.2 to upgrade your firmware, or to Section 6.3 to configure your array.

9.5 Updating BIOS for an Intel-Based System Containing an EISA Controller

This section describes how to update the BIOS for your EISA controller in an Intel-based system. You need to update BIOS in the event that the manufacturer should need to send you an update to your BIOS information. (For example, if the BIOS changes between controller boards and you require a new controller board.)

AXP systems do not require you to update BIOS information.

In addition, you do not need to follow a special BIOS update procedure for a PCI controller. A PCI controller firmware update includes any necessary BIOS update.

To update your BIOS for an EISA controller on an Intel-based system, follow these steps:

1. Insert the standalone configuration utility diskette for Intel Systems into your floppy drive and boot from that drive.
2. When your systems starts, enter one of the following commands to update BIOS for a single RAID controller, multiple RAID controllers, or to update multiple versions of the BIOS to multiple RAID controllers at the same time.

To update a single RAID controller, type:

```
A:\SWXCR>SWXCRBIO xxxx.xxx
```

where xxxx.xxx is the BIOS filename, and version of the BIOS that you want to load, SWXCRBIO.215, for example.

To update multiple controllers with a single version of the BIOS, type:

A:\SWXCR>**SWXCRBIO -v xxx**

where xxx is the version of the BIOS, 215 for example

To update multiple controllers with multiple versions of the BIOS, type:

A:\SWXCR>**SWXCRBIO xxxx.xxx xxxx.xxx**

where xxxx.xxx xxxx.xxx are the BIOS filenames and versions of the BIOS that you want to load, SWXCRBIO.xxx SWXCRBIO.xxx, for example.

When updating multiple versions of the BIOS to multiple controllers, you must specify:

- The BIOS filename and version extension as many times as you have controllers that you want to update
- The BIOS filenames in the slot order in which the controllers were installed

Thus if you have controllers in slots 1 and 2 for which you want to load a BIOS version xxx, and xxx; and a controller in slot 3 for which you want to load a BIOS version xxx, you would type, for example: **SWXCRBIO.xxx SWXCRBIO.xxx SWXCRBIO.xxx**

After you enter either form of the command, the system displays messages similar to the following:

SWXCR BIOS Write Utility Ver. 1.0 - January 4,
1993

Mylex Corporation

Writing EEPROM ...

Verifying EEPROM ...

SWXCR BIOS Write Completed

3. Press any key to reboot the system.

If you were directed to update BIOS in Chapter 4, return to Section 4.2.3, step 7.

If you were directed to update BIOS in Chapter 5, return to Section 5.2.3, step 7.



Installing Controller Options

This appendix contains procedures for installing cache memory and battery backup options on the 1 and 3-channel PCI RAID controllers. The same procedure applies for installing cache memory on the 1 and 3-channel EISA RAID controllers. (Battery backup is not applicable to EISA RAID controllers.)

A.1 Installing Cache Memory

This procedure applies to 1 and 3-channel PCI and EISA RAID controllers. A PCI RAID controller is shown in the illustrations.

CAUTION

To avoid static damage, wear a grounded wrist strap while working on the RAID controller board.

1. Unpack cache memory module and position it above its mounting site on RAID controller as shown in Figure A-1.

NOTE

If it ever becomes necessary to remove the cache memory module, use your thumbs to spread the spring-loaded tabs mentioned in the following step. Then withdraw the module from its mating connector.

2. Insert cache memory module connector into mating connector on mounting site until spring-loaded tabs click, indicating connector is seated.
3. Figure A-2 shows cache memory module installed on RAID controller.

Figure A-1 Installing Cache Memory Module on PCI RAID Controller

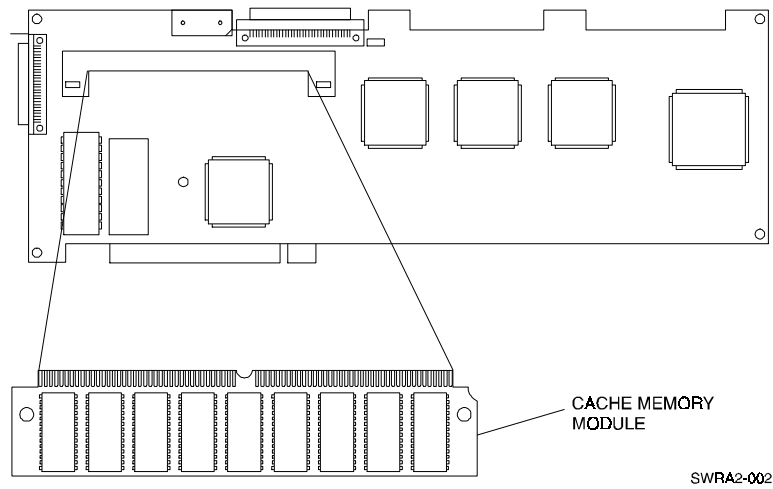
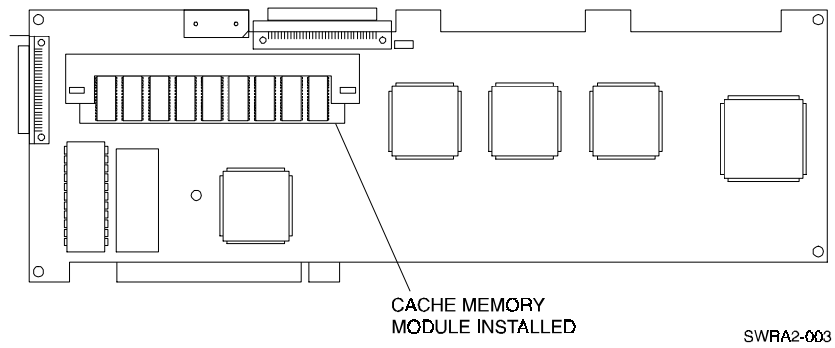


Figure A-2 Cache Memory Module Installed on PCI RAID Controller



A.2 Installing Battery Backup Board

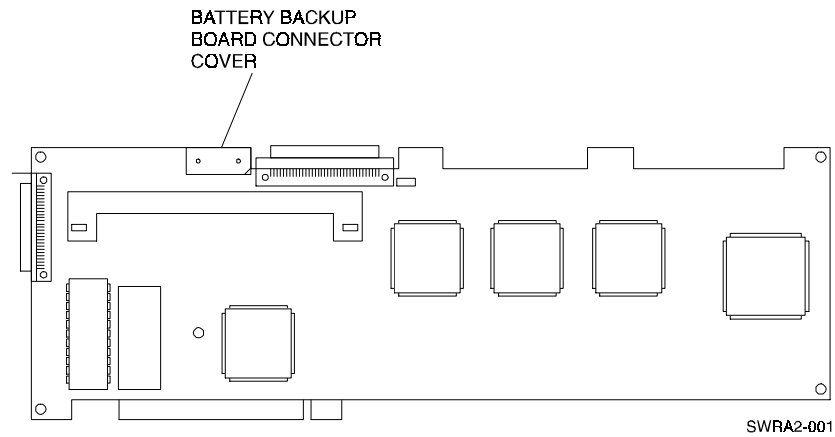
This procedure applies to 1 and 3-channel PCI RAID controllers, only.

CAUTION

To avoid static damage, wear a grounded wrist strap while working on the RAID controller board.

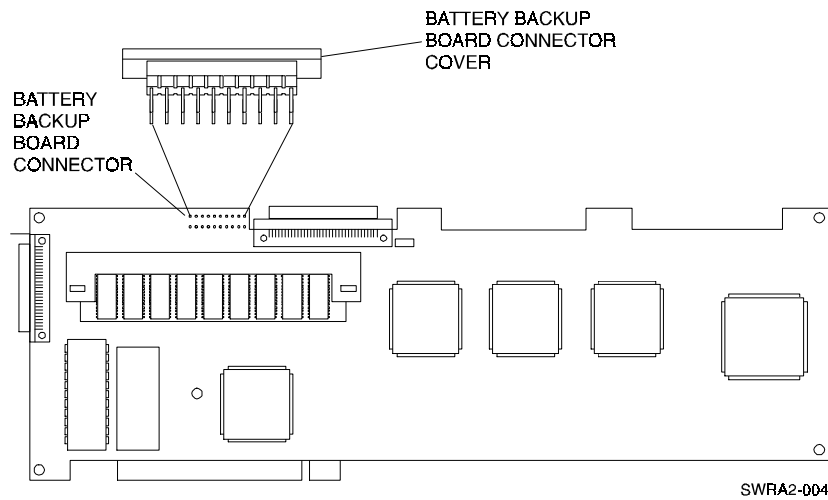
1. Position PCI RAID controller on workbench as shown in Figure A-3 and locate battery backup board connector cover.

Figure A-3 Location of Battery Backup Board Connector Cover



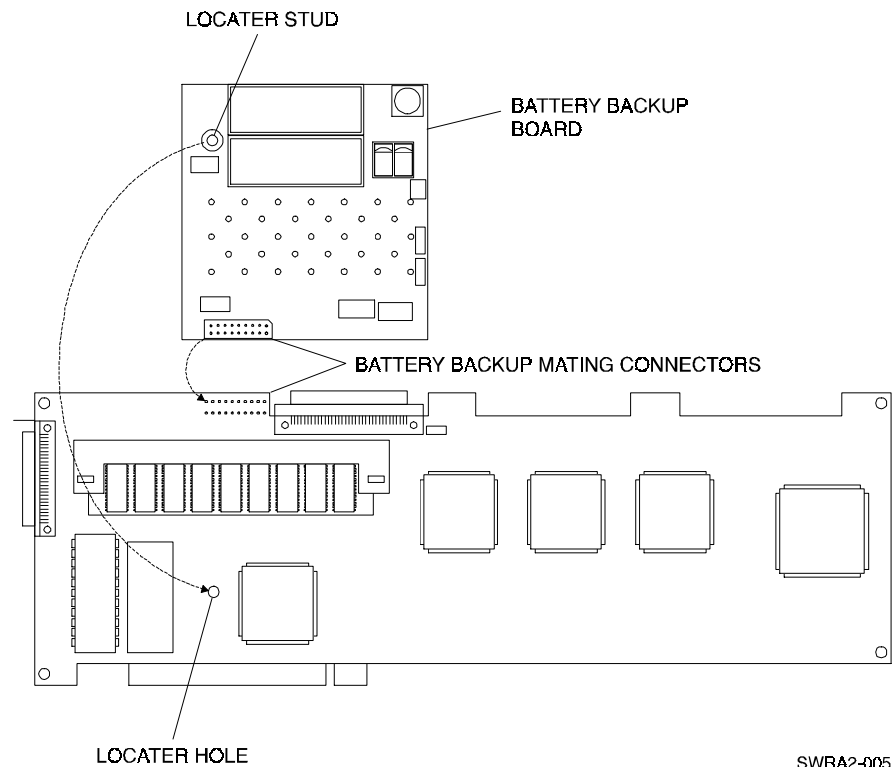
2. Remove battery backup board connector cover from battery backup board connector as shown in Figure A-4.

Figure A-4 Removing Battery Backup Board Connector Cover



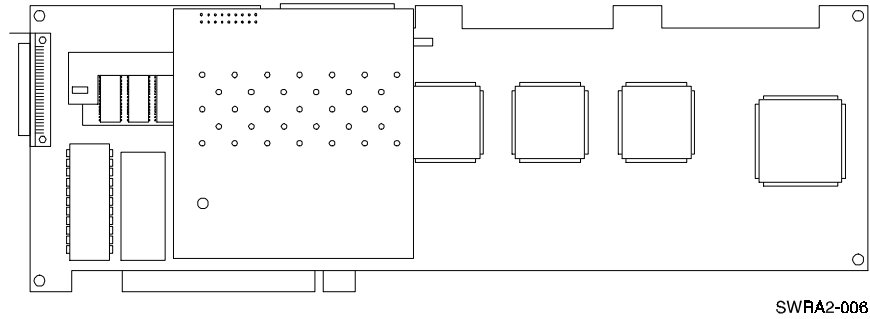
3. Install battery backup board on PCI RAID controller so battery backup connectors mate, and white plastic locator stud on battery backup board goes into locator hole on controller as shown in Figure A-5.

Figure A-5 Installing Battery Backup Board on PCI RAID Controller



4. Figure A-6 shows battery backup board installed on PCI RAID controller.

Figure A-6 Battery Backup Board Installed on PCI RAID Controller



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