StorageWorks RAID Array 200
Subsystem Family

Installation and Configuration Guide

Order Number: EK-SWRA2-IG. A01

You must read this guide before you refer to the software user's guide to install and configure your subsystem correctly.

Digital Equipment Corporation
Maynard, Massachusetts

April 1994

The FCC wants you to know...

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

The user may find the following booklet prepared by the Federal Communications Commission helpful: *How to Identify and Resolve Radio-TV Interference Problems.* This booklet is available from the U.S. Government Printing Office, Washington, D.C., 20402. Stock No. 004-00398-5.

All external cables connecting to this basic unit need to be shielded. For cables connecting to option boards, see the option manual or installation instructions.

This digital apparatus does not exceed the Class B limits for radio noise emissions set out in the radio interference regulations of the Canadian Department of Communications.

この装置は、第二種情報装置（住宅地域又はその隣接した地域において使用されるべき情報装置）で住宅地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）基準に適合しております。

しかし、本装置をラジオ、テレビジョン受信機に近接してご使用になると、受信障害の原因となることがあります。

取扱説明書に従って正しい取り扱いをして下さい。

This equipment is in the 2nd Class category (information equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council For Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in such residential area.

When used near a radio or TV receiver, it may become the cause of radio interference.

Read the instructions for correct handling.

This equipment meets or exceeds requirements for safety in the U.S. (UL 1950), Canada (CSA C22.2 No. 950), and Europe (EN 60950/IEC 950) with Nordic requirements.

This equipment meets or exceeds the ergonomic requirements of ZH1/618 and is certified to bear the GS mark by TUV Rheinland of Taiwan Ltd.

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About This Guide

Introduction

This guide describes how you install, configure, operate, and troubleshoot the StorageWorks RAID Array 200 Family Subsystem. It helps to familiarize you with all aspects of the RAID subsystem and provides a reference for questions you may have.

Audience

This guide is written specifically for anyone who installs, configures, and operates the StorageWorks RAID Array 200 Family Subsystem. 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 (Refer to the *Acronyms and Abbreviations* in this section of the guide.)

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

Related Documentation

Refer to the *StorageWorks RAID Array 200 Subsystem Family Software User's Guide* for information on your operating system drive load procedure and on-line RAID utilities.

Organization

This guide contains the following:

- Chapter 1: *Product Description* —Provides an overview of the StorageWorks RAID Array 200 Subsystem including features, configurations, and system requirements. A RAID overview is also provided.
- Chapter 2: *Running the EISA Configuration Utility (ECU)*—Describes how you verify the availability of user-supplied hardware and software, how you inventory what you received with the StorageWorks RAID Array 200 Subsystem and how you run the ECU.
- Chapter 3: *Installing the SWXCR-EA 1-Channel Controller*—Describes how you install the RAID controller in your host system and install the storage pedestal and disk drives and connect the cables.
- Chapter 4: *Installing the SWXCR-EB 3-Channel Controller*—Describes how you install the RAID controller in your host system and install the storage pedestals and disk drives and connect the cables.
- Chapter 5: *Using the Standalone RAID Configuration Utility*—Includes background information, system requirements, information on how you invoke the utilities, configuration, and array maintenance information.
- Chapter 6: *Troubleshooting and Service Information*—Describes the status of the SBB LED indicators and how you replace the components in the pedestal. It presents a brief troubleshooting approach in the event of a pedestal component malfunction and software errors and recovery actions for those errors.
- Appendix A: *Specifications*—Includes physical and environmental specifications for the StorageWorks RAID Array 200 Subsystem Family.
- Appendix B: *Illustrated Parts List*—Includes the replacement part numbers and an illustration of the StorageWorks storage pedestal.
- Appendix C: *MS-DOS Verification Procedure*—Contains a verification procedure to test your RAID subsystem under the MS-DOS operating system.

Terminology

Some of the terms you need to understand as you read this guide are defined as follows:

Disk array: A set of disk drives and a specialized array controller. The array controller keeps track of how data is distributed across the drives.

Drive group: A set of drives logically tied together and addressed as a single unit.

ECU: EISA (System) Configuration Utility is used to configure EISA option boards.

JBOD: Sometimes referred to as "just a bunch of disks." Each drive operates independently and is seen by the operating system as a single drive. There is no data redundancy in this RAID configuration.

Logical RAID drive: A section of storage space presented to the host operating system as a single physical drive.

RAID: An acronym for a redundant array of independent (sometimes referred to as inexpensive) disks.

RAID level: A numerical designator (0 to 5) assigned to each scheme of data management possible in an array of drives. RAID levels supported by the SWXCR controller include the following: RAID 0, RAID 0 + 1, RAID 1, and RAID 5.

SBB: System building block. A modular carrier plus the individual mechanical and electromechanical interface required to mount it into a standard shelf. Any device conforming to shelf mechanical and electrical standards is considered an SBB.

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, but 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.

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

The following conventions are used in this guide:

Convention Example	Description
`bold text`	Represents text or commands you must enter.
`italics text`	Indicates titles of manuals, chapters, sections of chapters, new terms, and is used for emphasis.
`c:\windows>`	Monospaced text indicates file names, path names, directories, or screen text.
<Enter>	Angle brackets surrounding text represents a key on the keyboard. Used in screen displays only.
[Ctrl]+[Alt]+[Del]	A plus sign indicates that the keys shown should be pressed at the same time.
⇒	A right arrow indicates a reference to additional information.
1 234 567	Spaces are used in large numbers instead of commas.

Acronyms and Abbreviations

The following acronyms and abbreviations are used in this guide:

Acronym	Meaning
BIOS	Basic input/output system
DMA	Direct memory access
DRAM	Dynamic random access memory
IDE	Integrated drive electronics
ISA	Industry standard architecture
EISA	Extended industry standard architecture
MS-DOS	Microsoft Disk Operating System
POST	Power-on self test
ROM	Read only memory
SCSI	Small computer system interface
SIMM	Single in-line memory modules
VGA	Video graphics array
Windows	Microsoft Windows application software

Abbreviation	Meaning
KB	A KB suffix to a numerical value indicates size in kilobytes. For example, 640 KB, 7168 KB, and so on. A kilobyte equals 1024 bytes.
MB	An MB suffix to a numerical value indicates size in megabytes. For example, 1 MB, 256 MB, and so on. A megabyte equals 1 048 576 bytes.
GB	A GB suffix to a numerical value indicates size in gigabytes. For example, 1 GB, 256 GB, and so on. A gigabyte equals 1 073 741 824 bytes.

Special Notices

Three kinds of special notices are used in this guide 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.

1

Product Description

Introduction

The following topics are described in this chapter:

- Features
- Configurations
- RAID overview
- System requirements
- Verifying the components

Features

The innovative design of the RAID Array 200 Subsystem's SWXCR controller incorporates all the functionality of a SCSI-based RAID controller with an EISA-based host adapter into a single, low-cost module that you can install directly into your system. The SWXCR RAID controller supports a wide variety of RAID levels including: 0, 1, 0 + 1, 5, and JBOD (just a bunch of disks).

This unique product, which is ideal for desktop systems or workgroup servers, provides the power and flexibility of controller-based RAID with the scaleability of StorageWorks packaging. The StorageWorks RAID Array 200 Subsystem Family offers 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.

The StorageWorks RAID Array 200 Subsystem Family has the following features:

- Industry-standard EISA bus interface
- SCSI drive interface (single-ended, 10 MB/second maximum)
- 1 or 3 SCSI channels by means of a scaleable architecture
- Multiple SWXCR controllers (2)
- RAID levels 0, 1, 0 + 1, 5, and JBOD are all supported
- Cache support of 4 MB (with planned future expansion)
- Hot spare disk drives
- Hot swapping of disk drives
- Mixed drive types within drive groups

Configurations

The StorageWorks RAID Array 200 Subsystem Family is available in the following configurations:

- SWXCR-EA 1-channel unit connected to a BA350-KB storage pedestal (or equivalent), supporting up to 7 disk drives
- SWXCR-EB 3-channel unit connected to 1 to 3 BA350-KB storage pedestals (or equivalent), supporting up to 21 disk drives

The following disk drives are supported:

- RZ25L (535 MB)
- RZ26 (1 GB - SWXD3-SA)
- RZ26L (1GB - SWXD3-SC)
- RZ28 (2 GB - SWXD3-SB)

Consult your supplier for additional supported disks.

A single controller can support up to eight drive groups. Following these general rules when you configure your array:

- Maximum number of drive groups: 8
- Maximum number of drives in each drive group: 8
- Maximum number of logical RAID drives: 8

RAID Overview

RAID (redundant array of independent disks) is a modular, integrated, end-user solution that provides three main benefits:

- Improved data availability
- Improved I/O performance
- Increased scaleability

A RAID array is a set of multiple disk drives and a specialized array controller that manages how data is distributed across disk drives.

Data for a given file is divided into segments, which can be written across multiple drives. A segment is a group of blocks that is continuous data which can be stored on a disk drive. By using more than one drive, the array can provide higher data transfer rates when compared to a single large drive. Depending on the RAID level used, arrays can also provide redundancy to protect data availability.

As you configure your subsystem, select the RAID level appropriate for your computing environment.

Raid Levels

RAID 0, 1, 0 + 1, 5 and JBOD are supported by the StorageWorks RAID Array 200 Subsystem Family and offer data redundancy/performance.

Raid 0

RAID 0 stripes data across the drives in the array, one segment at a time. RAID 0 offers a high I/O rate, but is a nonredundant configuration. No array parity information is generated for reconstructing data if a drive fails.

Raid 1

RAID 1 transparently mirrors data by writing data to two drives simultaneously. This is the simplest way of to achieve data redundancy. 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.

Raid 0 + 1

RAID 0 + 1 is achieved in a multidrive RAID set by the combination of striping mirrored sets. RAID 0 + 1 provides data redundancy and is beneficial for any critical high-availability application. If a drive fails in a RAID 0 + 1 array, you can continue to use the array normally since data from its mirrored drive is automatically retrieved.

Raid 5

RAID 5 combines striping (writing data across the set of drives) and storing parity across all drives. If a 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.

JBOD

JBOD is an acronym for "just a bunch of drives." This mode allows a disk drive to be accessed independently similar to using a non-RAID SCSI disk controller. This mode does not provide any data redundancy.

Logical RAID Drive States

The logical RAID drive or grouping of drives can be in different states. There are four possible states as shown in Figure 1-1 and described in Table 1-1.

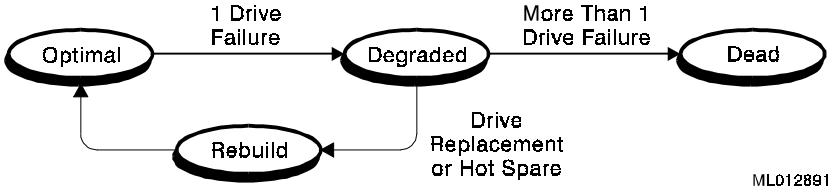


Figure 1-1. Logical RAID Drive State Diagram

Table 1-1. Logical RAID Drive States

States	Description
Optimal	The array is operating at an optimal level. This is the condition during normal operation.
Degraded	The logical RAID drive is operating in degraded mode. The array is still functioning, but a single drive could have failed. This state is only valid for RAID levels that provide redundancy (1, 0 + 1, 3, and 5). To return the logical RAID drive unit to optimal, rebuild (reconstruction) of the data must be done.
Dead	The logical RAID drive unit is no longer functioning. This is typical when two or more drives have failed.
Rebuild (Reconstruction)	The controller is currently rebuilding the logical RAID drive unit using good data and parity information. This state is valid only for RAID levels, 1, 0 + 1, 3, and 5 which provide redundancy.

Drive Number and RAID Level

The choice of RAID level for logical RAID drives depends on the number of drives within a drive group. The following table lists the RAID levels for drive group and RAID level requirements.

RAID Level	Drives in Drive Group	Usable Storage	Data Redundancy
0	2—8	All	No
1	2	50%	Yes
0 + 1	3—8	50%	Yes
5	3—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.

System Requirements

The StorageWorks RAID Array 200 Subsystem Family requires the following user-supplied hardware:

- Intel or AXP-based computer system with VGA monitor and keyboard:
  - One floppy drive (3.5-inch, 1.44 MB)
  - EISA backplane
  - Associated system manual
  - Your system ECU diskette
  - EISA slot(s)
- One for the SWXCR-EA (1-channel board)
- Two for the SWXCR-EB (3-channel board)
- Appropriate tools to service your computer

Verifying the Components

The StorageWorks RAID Array 200 Subsystem Family platform kit provides the following components:

- Software and documentation kit appropriate for your system and your operating system
  - Standalone RAID Array 200 Software for your system (3.5-inch diskette)
    - for AXP systems — Part Number AK-Q6TFA-CA
    - for Intel systems — Part Number AK-Q6TKA-CA
  - On-line RAID Array 200 Software specific to your operating system
  - This manual
  - Software User's Guide specific to your operating system

and either

- SWXCR-EA 1-channel controller with:
  - One BA350-KB storage pedestal
  - One to seven disk drives
  - One 2-meter SCSI cable (BN21H-02)

or

- SWXCR-EB 3-channel controller with
  - One to three BA350-KB storage pedestals
  - One to twenty-one disk drives
  - One 2-meter SCSI cable (BN21H-02)
  - One cable and bulkhead connector kit (CK-SWXCR-AA)
    - One internal dual-bus cable (17-03998-01)
    - One external Y SCSI cable (17-04000-01)
- Optional accessories (for example, redundant power supply(ies) (BA35X-HA)

2

Using the EISA Configuration Utility

Introduction

This chapter describes the major steps for running the EISA Configuration Utility (ECU). Your system documentation may call this utility the System Configuration Utility (SCU).

You use the ECU to configure your system's EISA nonvolatile memory whenever you add or remove EISA controllers. When you boot your system, the system BIOS uses the contents of the EISA nonvolatile memory to initialize your system's EISA controllers.

Order of Installation

We recommended you install your subsystem in this order:

1. Run the ECU.
2. Install the RAID controller.
3. Connect the cables and storage pedestal(s).
4. Label and install the disk drives.

To install a second controller (1-channel or 3-channel), repeat the above installation procedures. If you have two controllers, Controller 1 is the controller that is in the EISA slot with the lowest EISA slot number and Controller 2 is the other controller.

Running the ECU

NOTE

At any time, you can press the ESC key to exit the ECU and begin again.

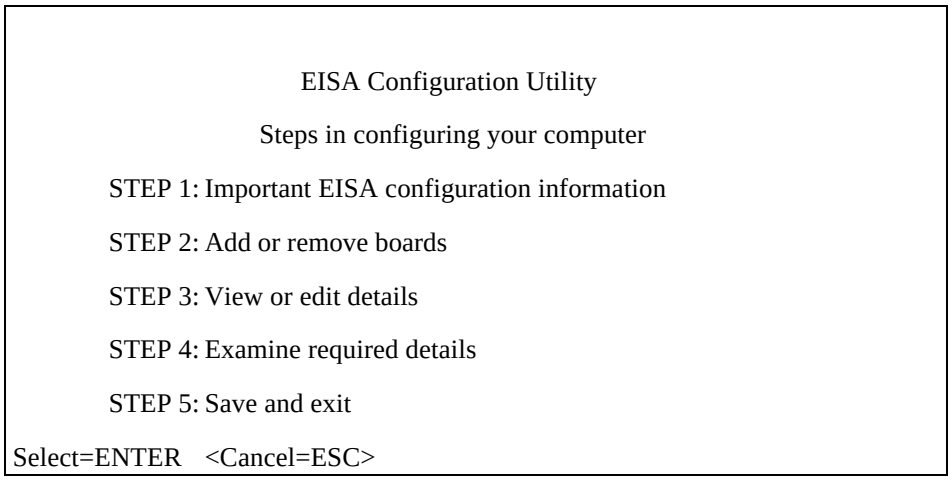
To run the ECU, follow these steps:

1. Remove the cover from your system and locate the empty board slots. The SWXCR controller is an EISA DMA (direct memory access) device. Refer to your system documentation for any restrictions about installing such devices. For more information about using the ECU on your system, refer to your system documentation.
2. Boot from your system ECU configuration diskette. Select the function that configures your system and press the Enter key.

NOTE

ECUs differ from system to system. Check the procedures in this guide before you respond to screen prompts.

3. Follow the instructions for system configuration until a menu similar to the following displays on your screen.



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

5. A message similar to the following displays on your screen 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.

```
                    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   DPT SCSI Host Bus Adapter (PM2012B2/9X)

Slot  3   (Empty)

Slot  4   (Empty)

Slot  5   (Empty)

Slot  6   (Empty)

Add=INSERT    <Remove=DEL>    <Move=F7>    <Done=F10>
```

- If you are installing an SWXCR-EA 1-channel controller, you need one empty EISA slot.
- If you are installing an SWZCR-EB 3-channel controller, you need two empty EISA slots in close proximity for cabling purposes during the hardware installation.

6. Use your arrow keys to select an empty slot for the 1-channel controller (or two slots for the 3-channel controller) and press the Insert key. The following menu displays on your screen.

```
                    Step 2: Add or remove boards          Help=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>
```

Note that you are doing the first item on the bulleted list.

Use the .CFG file on the Standalone RAID Array 200 Family Software diskette instead of any versions that may be on your system ECU diskette.

7. Remove the ECU diskette and insert the option configuration diskette labeled, the Standalone RAID Array 200 Software diskette for your system platform (the diskette that contains the .CFG files) and press the Enter key. A message similar to the following displays on your 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)
```

8. Select the .CFG file for your RAID controller and press the Enter key. A message screen similar to the following displays on your screen.

```
                                Destination Diskette


Insert the SYSTEM CONFIGURATION diskette.


Ok=ENTER     <Cancel=ESC>
```

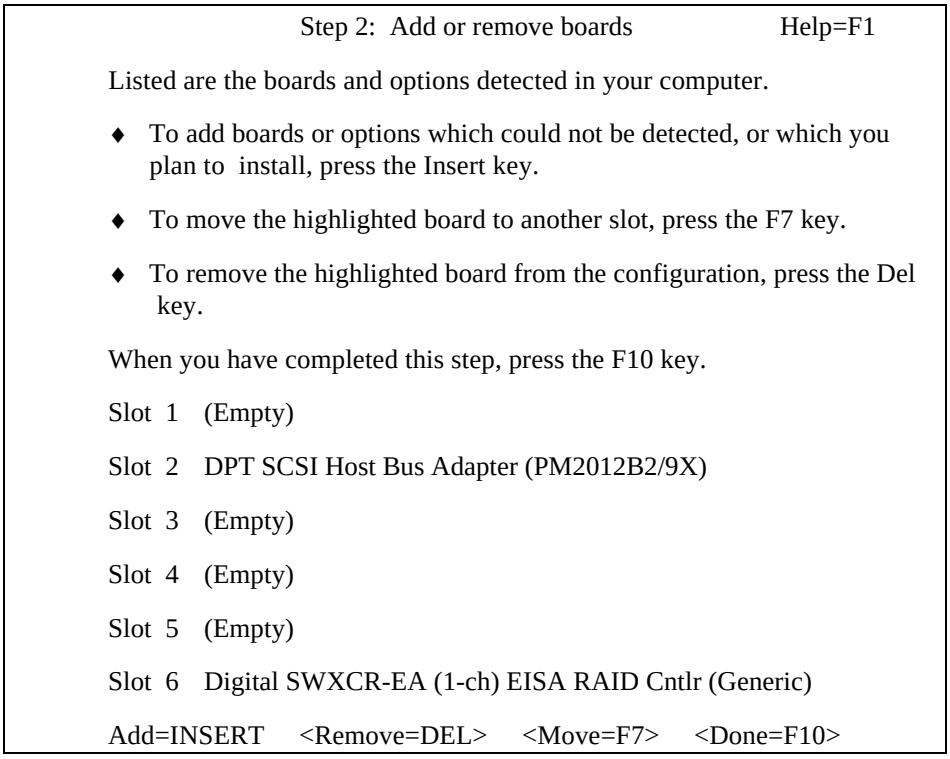
9. Remove the Standalone RAID Array 200 Software diskette, insert the ECU diskette, and press the Enter key. An add confirmation message, similar to the following, displays on your screen.

```
                    Step 2:  Add or remove boards

                          Add confirmation

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


Ok=ENTER     <Cancel=ESC>
```

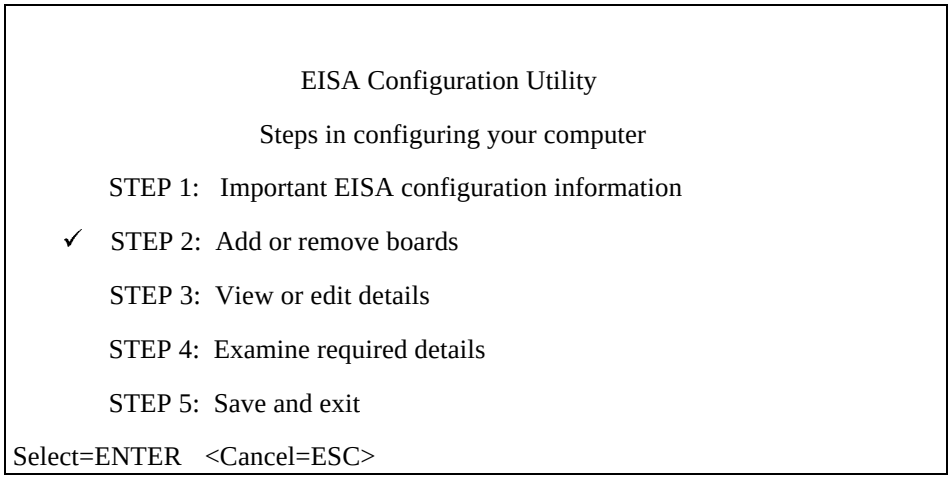
10. Press the Enter key to confirm the .CFG file. A message similar to the following displays on your screen.

```
                                  Add

Select an acceptable slot for the board and press ENTER.

        Slot  1    (Empty)

        Slot  2    DPT SCSI Host Bus Adapter (PM2012B2/9X)

        Slot  3    (Empty)

        Slot  4    (Empty)

        Slot  5    (Empty)

        Slot  6     (Empty)

The (→) indicates an acceptable slot for the board

>Ok=Enter<        <Cancel=ESC>
```

11. Select the slot where you want to install the controller (the slot is highlighted) and press the Enter key. The following example shows that Slot 6 is selected for the installation.



12. Press the F10 key. You return to the *Steps in configuring your computer* menu. A display similar to the following appears on your screen.



13. Select the View or edit details option (Step 3 in this example) and press the Enter key. Scroll through the file until you find the slot number for the controller you are installing. The information display for a 1-channel board installation is similar to the following.

NOTE

The slot you are looking for has the "Added" identifier on the right side of the screen display.

```
Slot 6 - Digital SWXCR-EA (1-ch) EISA RAID Cntlr (Generic)          Added

disk spin-up options.....2 disks started every 6 secs-
                         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.....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.

14. Ensure that the controller board is configured with these recommended option defaults.

Option	Default Setting
Disk spin-up options	2 disks started every 6 seconds - Default
Tag-queuing	Enable tag-queuing - Default
Transfer-rate	Synchronous, 10 MB/s (FAST) - Default
BIOS	For AXP systems, disable this option. For Intel systems, enable this option. See the note below.

With regard to the Interrupt (level), if your system already has more than one board installed, the ECU should assign a different interrupt level to the new board you are installing. Before you select the edge/interrupt option, consult your system documentation to ensure that your system supports edge interrupts.

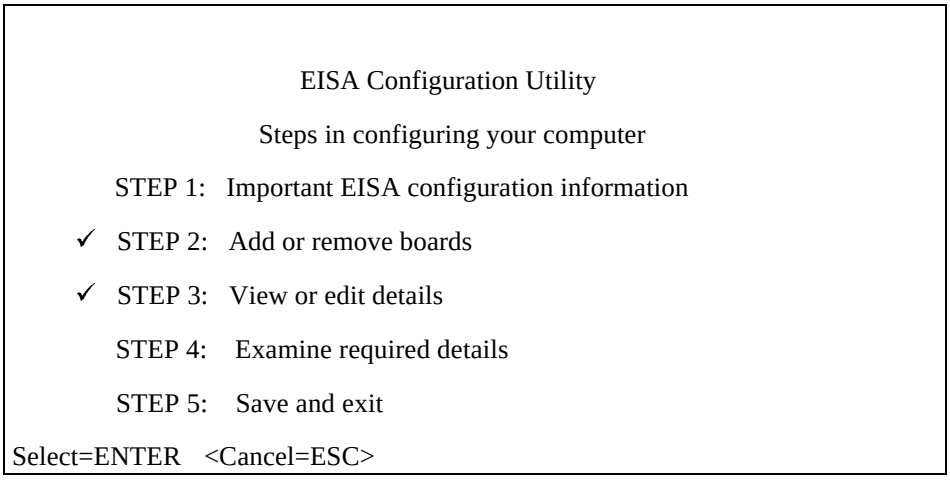
You can configure the RAID controller interrupt levels to these settings:

11 Level	11 Edge	
12 Level	12 Edge	
15 Level	15 Edge	(For NetWare only, do not use Level 15.)

NOTE for Intel Systems

If your boot device is an EISA adapter, verify that the BIOS address of the SWXCR controller is set to a value greater than that of the adapter from which you boot your computer.
If you are installing a second SWXCR controller, you must disable the BIOS on the second controller.

15. Press the F10 key. You return to the *Steps in configuring your computer* menu. A menu similar to the following displays on your screen.



16. Select the Save and exit option (Step 5 in this example) and press the Enter key. Your screen displays a message similar to the following.

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.
Ok=ENTER

17. Follow the directions on your screen displays until you save and exit the ECU.

18. Remove the diskette and turn off the host system.

    - If you are installing an SWXCR-EA 1-channel controller, go to Chapter 3 to continue with the hardware installation of your subsystem.
    - If you are installing an SWXCR-EB 3-channel controller, go to Chapter 4 to continue with the hardware installation of your subsystem.

3

Installing the SWXCR-EA 1-Channel RAID Controller

Introduction

This chapter describes the major steps for installing the 1-channel controller:

- Installing the 1-channel controller in the host system.
- Installing the storage pedestal and the disk drives, and connecting the cables.

Installing the 1-Channel RAID Controller

CAUTION

To avoid static damage, follow adequate antistatic procedures when you handle the RAID controller.

To install the RAID controller, follow these steps.

1. Refer to your host system manual for general instructions on installing adapters.
2. Unpack the RAID controller.

3. Confirm that the jumper at JP5 (onboard termination enabled) is installed. See Figure 3-1. If the jumper is not present, you must insert one or notify your supplier.

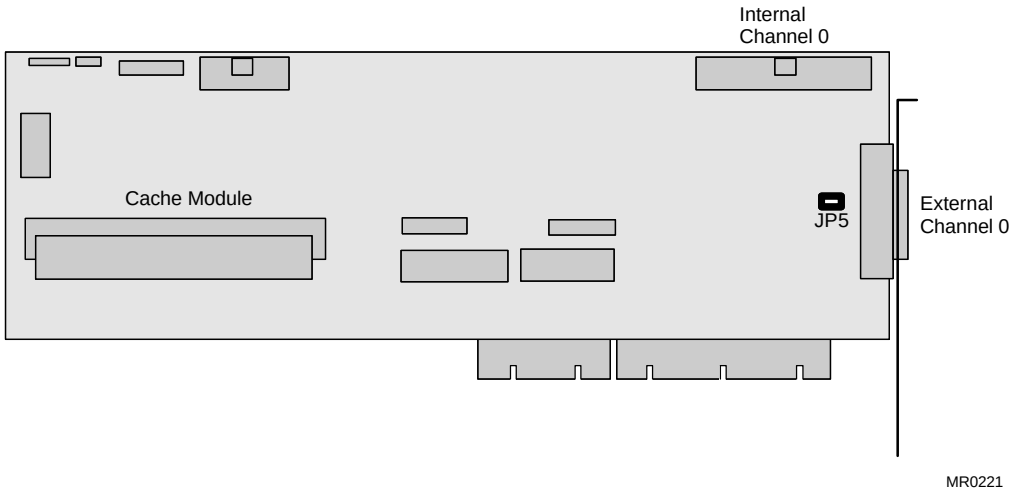


Figure 3-1. Jumper Location on the 1-Channel Controller

4. Install the RAID controller in the slot you selected when you ran the ECU.

Installing the Cable and the Storage Pedestal

This section describes the cabling and installation procedure for the storage pedestal. If you are installing a system with embedded disk drives, refer to that system's documentation for instructions on cabling.

NOTE

If the SCSI port is set to the default values of synchronous and 10 MB/s (FAST), the total cable length cannot exceed three meters (two meters for the cable and one meter for the storage pedestal).

To install the storage pedestal and make the cable connections, follow these steps.

1. Unpack the BN21H-02 cable and the storage pedestal. Place the storage pedestal where it is to be used. Label it Pedestal 0.
2. Unlock and open the front and rear bezel doors. See Figure 3-2.

3. Remove the front and rear bezels from the storage pedestal by pushing down on the locking tabs at the bottom of each bezel. See Figure 3-2.

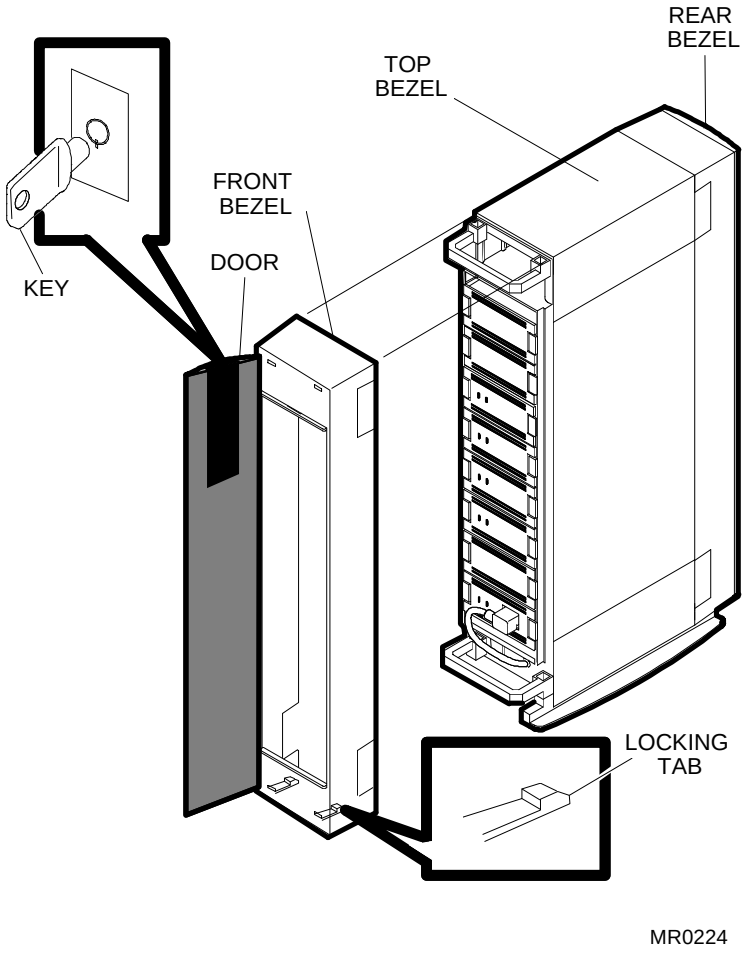


Figure 3-2. Removing a Bezel

4. At the rear of the storage pedestal, use a Phillips screwdriver to remove the safety screw in each corner of the two blowers. See Figure 3-3.

5. To remove a blower, press the locking tabs on the sides of the blower and pull the blower straight out to disconnect it.

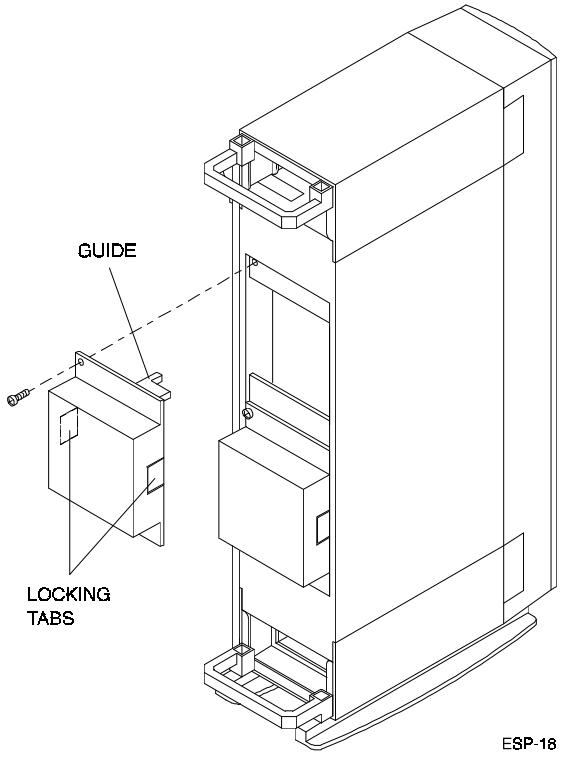


Figure 3-3. Removing the Blowers

6. Remove the second blower to see the whole backplane.

   The appearance of the backplane depends upon the version of the StorageWorks storage pedestal that you have. After you remove the blowers, determine if your pedestal has jumper pins next to the Slot 2 connector on the rear of the backplane. See blowup of detail on Figure 3-4.

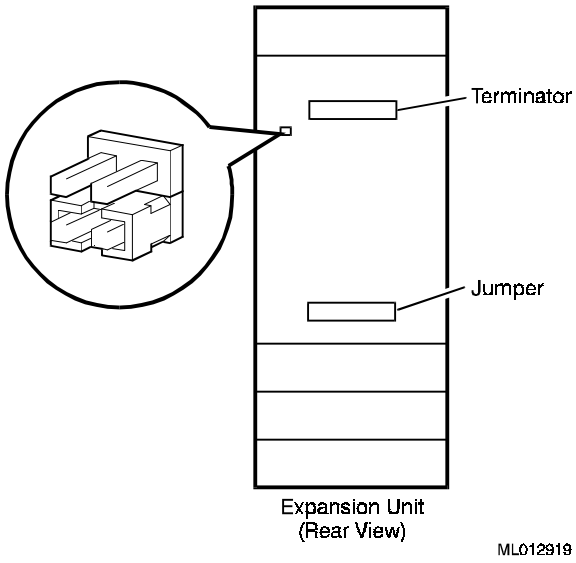


Figure 3-4. Terminator and Jumper Locations

- If jumper pins are **not** present on the backplane and the terminator and jumper are installed as shown in Figure 3-4, go to Step 7.
- If jumper pins are present, install a jumper in the Shelf_OK_External_Cables position as in Figure 3-4.

7. Remove the terminator and check that the SHELF_OK jumper is installed as shown in Figure 3-5. Replace the terminator.

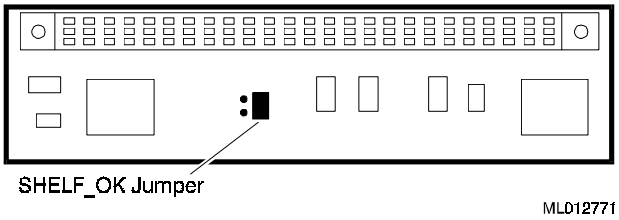


Figure 3-5. SHELF_OK Jumper on the Terminator

NOTE

The SHELF_OK jumper allows the fault signals from the storage pedestal to be fed back to the RAID controller. If your jumper/terminator has SHELF_OK jumper pins, then a jumper must be installed in the SHELF-OK position. If this SHELF_OK jumper is missing, insert one or notify your supplier.

8. Remove the jumper and check that the SHELF_OK jumper is installed on as shown in Figure 3-6. Replace the jumper.

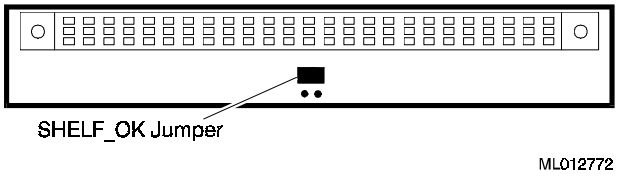


Figure 3-6. SHELF_OK Jumper on the Jumper

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

10. Remove the blank panels (and any disk drives) from the front of the storage pedestal. See Figure 3-7.

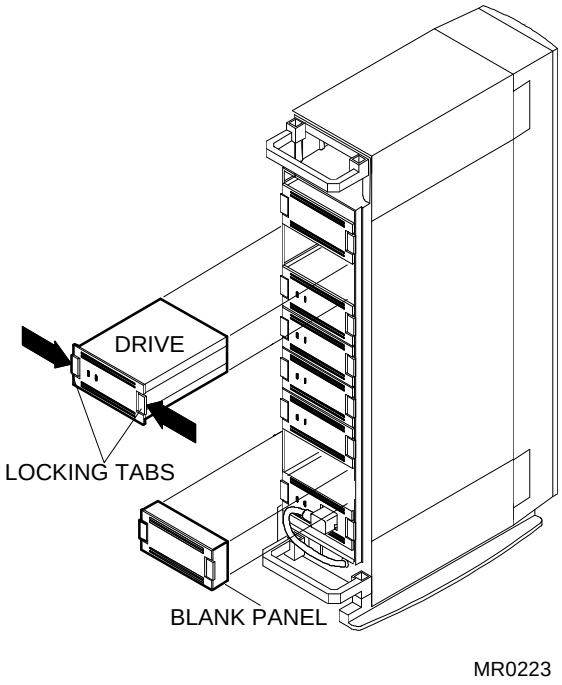


Figure 3-7. Removing a Disk Drive or a Blank Panel

11. Thread one end of the BN21H-02 cable under the rear handle of the storage pedestal, as shown in Figure 3-8. Then thread the cable through the opening at the top of the storage pedestal and toward the front of the pedestal.

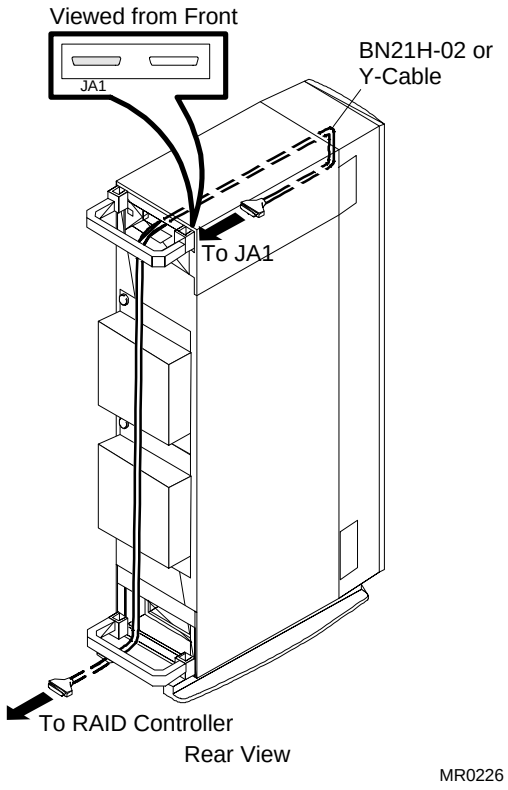


Figure 3-8. External Cable Routing

12. Loop the cable down below the divider plate and connect it to connector JA1 (upper-left connector when viewed from the front) on the storage pedestal. See Figure 3-9.

13. Insert the other end of the cable into the connector for the RAID controller (external channel 0) at the back of the host system. See Figure 3-9.

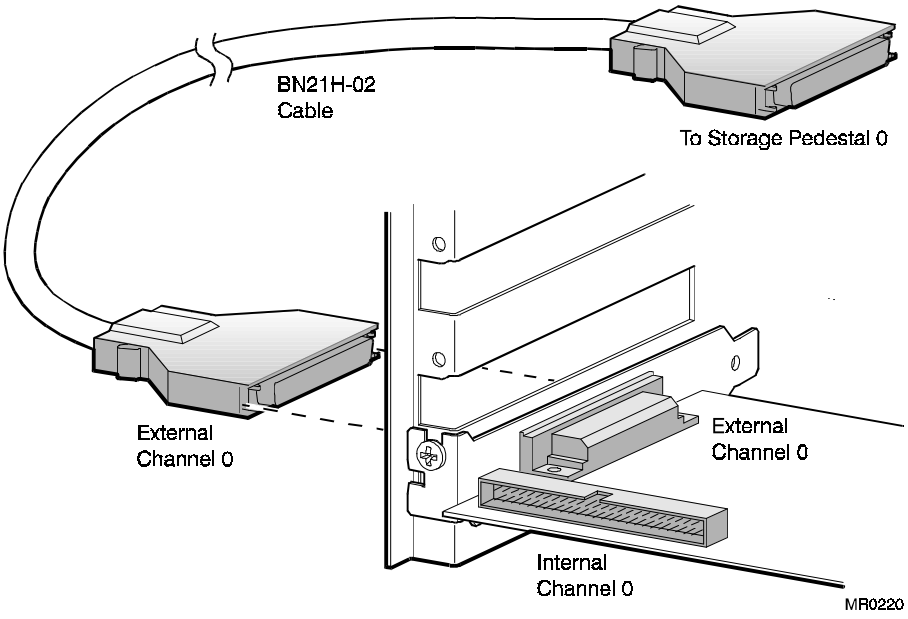


Figure 3-9. Cable Connections

14. Thread the female end of the ac power cable under the handle of the storage pedestal. Insert it into the ac receptacle on the ac distribution unit.
15. After you consult the pedestal configuration diagram (Figure 3-10), label the disk drives with the following information:
    - Device type
    - Channel
    - SCSI ID

    For example:

    Dev: RZ26L

    CH: 0

    ID: 1

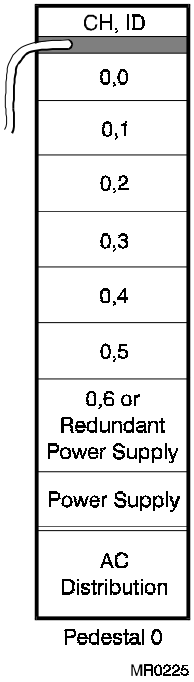


Figure 3-10. Device Labels

NOTE

These rules apply to device addresses for the storage pedestal:

- The default device addresses use the slot number in the storage pedestal, as shown in Figure 3-10.
- The available addresses for each slot in the storage pedestal are 0 through 6.

16. Install the labeled drives in the storage pedestals using the configuration layout shown in Figure 3-10.
17. To support the hot swap option, verify that all power supply SBBs (BA35X-HA) are Rev. L01 or later.
18. Connect the other end of the ac power cable to an ac power source.
19. Replace the front and rear bezel doors.
20. Power up the storage pedestal.
21. Power up the host system.

22. On Intel systems with the BIOS enabled, you can confirm proper installation of the RAID controller when you see a message similar to the following during the boot process.

```
SWXCR BIOS Version x.x

Digital Equipment Corporation

SWXCR Firmware Version x.x

SWXCR RAM: x Mbytes
```

If you do not get these messages or the installation aborts, refer to Chapter 6 of this manual for troubleshooting and service information.

At this point, you used the ECU to inform your host system about the new RAID controller (Chapter 2) and you added the RAID controller (this chapter). Now turn to Chapter 5 to configure the RAID controller to use the disk devices.

4

Installing the SWXCR-EB 3-Channel RAID Controller

Introduction

This chapter describes the major steps for installing the SWXCR-EB 3-channel controller:

- Installing the RAID controller in the host system
- Installing the storage pedestals and disk drives, and connecting the cables

Installing the 3-Channel RAID Controller

CAUTION

To avoid static damage, follow adequate antistatic procedures when you handle the RAID controller.

To install the RAID controller, you follow these steps.

1. Refer to your host system manual for general instructions on installing adapters.
2. Unpack the RAID controller.

3. Confirm that jumpers at JP3, JP4, and JP5 (onboard termination enabled) are installed. See Figure 4-1. If a jumper is missing, you must insert one or notify your supplier.

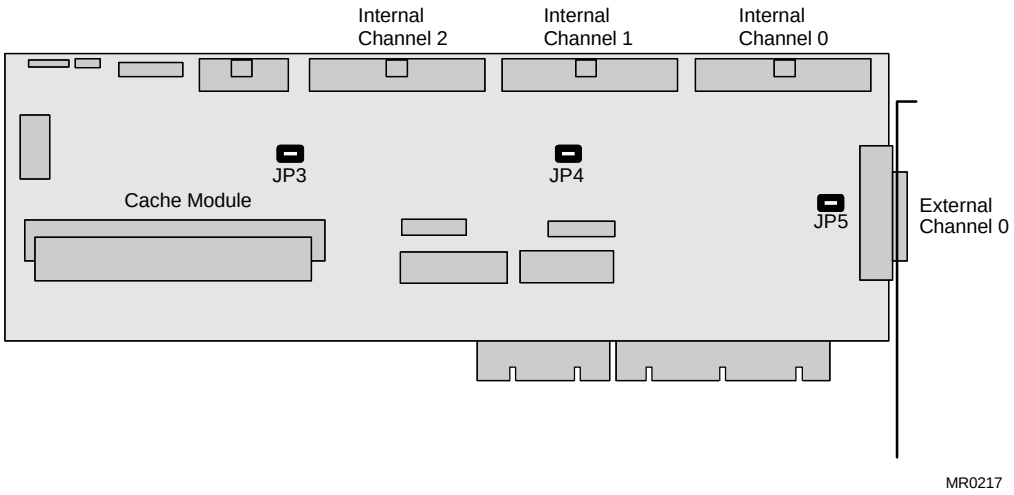


Figure 4-1. Jumper Locations on the 3-Channel Controller

4. Install the RAID controller in the slot you selected when you ran the ECU.

5. Orient the internal dual-bus cable as shown in Figure 4-2. Insert the short cable connector into the internal channel 1 connector on the RAID controller.
6. Insert the long cable connector into the internal channel 2 connector.
7. Attach the bulkhead panel with its 68-pin connector to the host system bulkhead and tighten the screw.

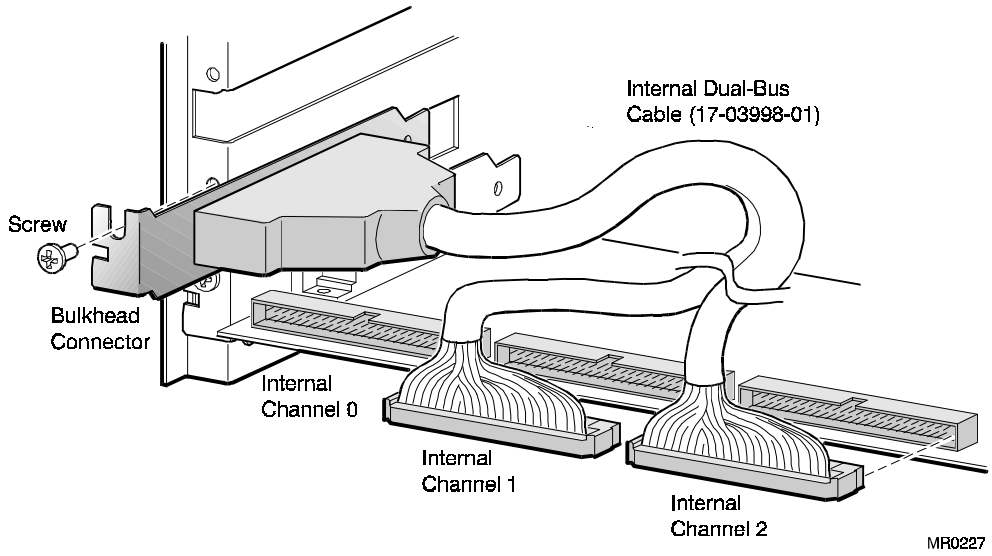


Figure 4-2. Internal Cable Connections for the 3-Channel Controller

Installing Cables and Storage Pedestals

This chapter describes the cabling and installation procedure for the storage pedestals. If you are installing a system with embedded disk drives, refer to that system's documentation for cabling instructions.

NOTE

If the SCSI port is set to the default values of synchronous and 10 MB/s (FAST), the total cable length cannot exceed three meters (two meters for the cable and one meter for the storage pedestal).

To install the storage pedestals and make the cable connections, you follow these steps.

1. Unpack the Y-cable, the BN21H-02 2-meter cable, and the storage pedestals. Place the storage pedestals where they are to be used and label them.

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. Any 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.

2. Unlock and open the front and rear bezel doors. See Figure 4-3.

3. Remove all front and rear bezel doors from the storage pedestals by pushing down on the locking tabs at the bottom of each bezel. See Figure 4-3.

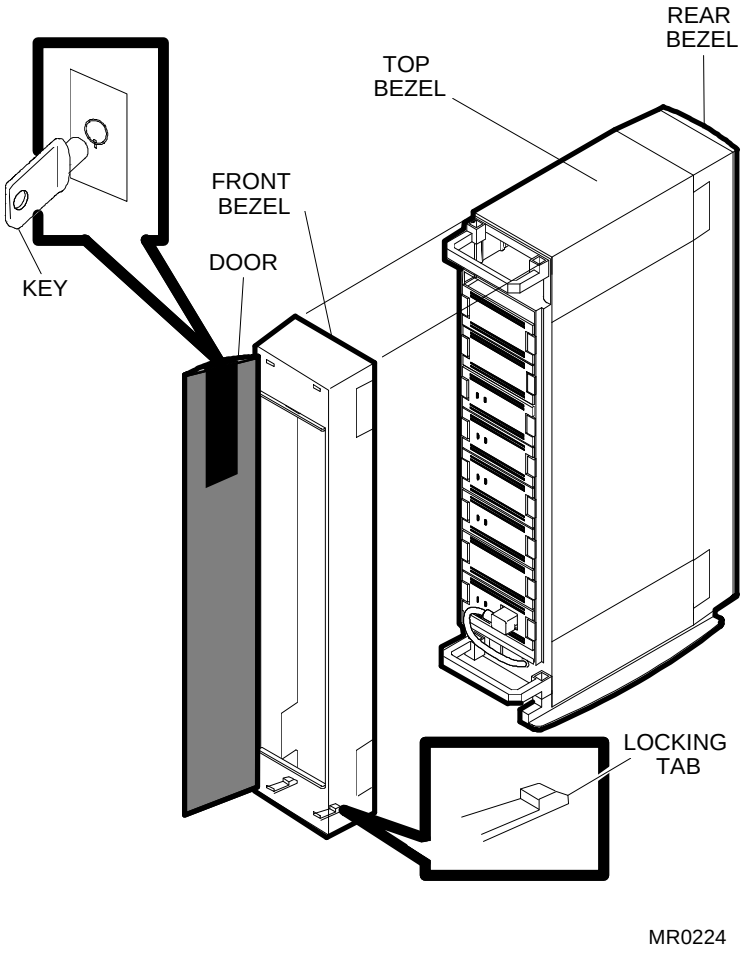


Figure 4-3. Removing a Bezel

4. At the rear of the storage pedestal, use a Phillips screwdriver to remove the safety screw in each corner of each blower. See Figure 4-4.

5. To remove a blower, press the locking tabs on the sides of the blower and pull the blower straight out to disconnect it.

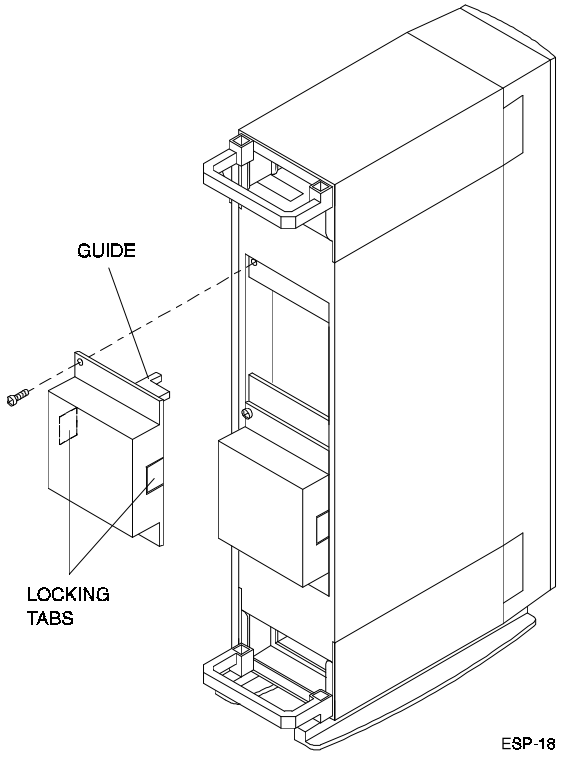


Figure 4-4. Removing the Blowers

6. Remove the second blower to see the whole backplane.

   The appearance of the backplane depends upon the version of the StorageWorks pedestal that you have. After you remove the blowers, determine if your pedestal has jumper pins next to the Slot 2 connector on the rear of the backplane. See blowup of detail on Figure 4-5.

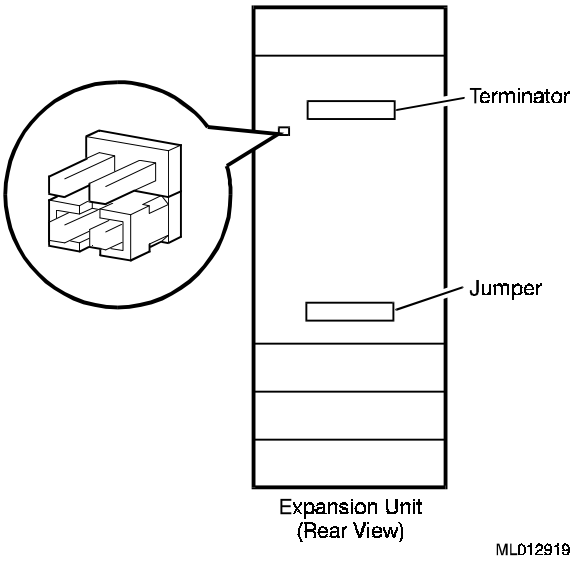


Figure 4-5. Terminator and Jumper Locations

- If jumper pins are **not** present on the backplane and the terminator and the jumper are installed as shown in Figure 4-5, go to Step 7.
- If jumper pins are present, install a jumper in the Shelf_OK_External_Cables position as in Figure 4-5.

7. Remove the terminator and check that the SHELF_OK jumper is installed as shown in Figure 4-6. Replace the terminator.

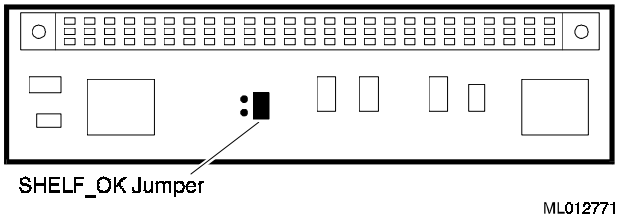


Figure 4-6. SHELF_OK Jumper on the Terminator

NOTE

The SHELF_OK jumper allows the fault signals from the storage pedestal to be fed back to the RAID controller. If your jumper/terminator has SHELF_OK jumper pins, then a jumper must be installed in the SHELF-OK position. If this SHELF_OK jumper is missing, insert one or notify your supplier.

8. Remove the jumper and check that the SHELF_OK jumper is installed on as shown in Figure 4-7. Replace the jumper.

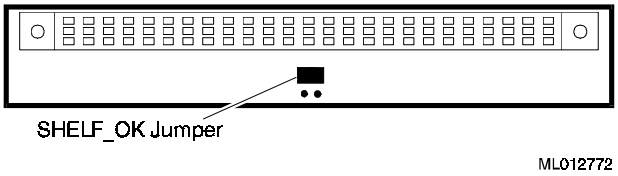


Figure 4-7. SHELF_OK Jumper on the Jumper

9. Replace both blowers. Align each blower connector with its power connector and insert the blower straight in. Make sure that the locking tabs are firmly seated. Then replace the screws.

10. Remove the disk drives and any blank panels from the front of storage pedestals. See Figure 4-8.

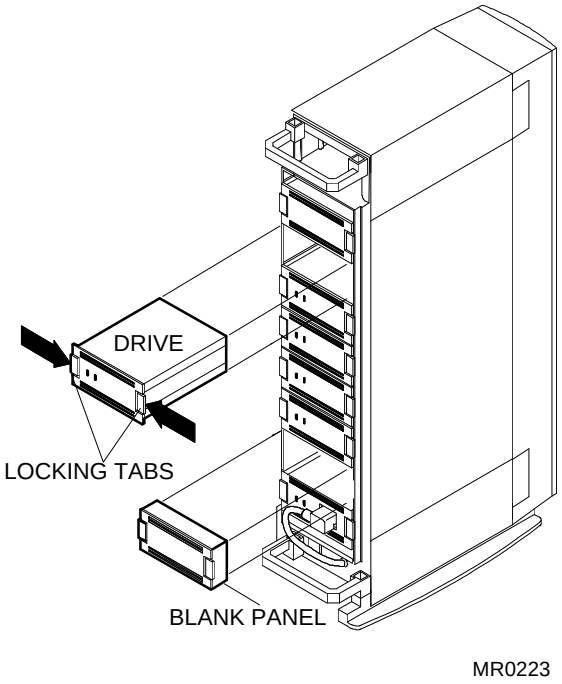


Figure 4-8. Removing a Disk Drive or a Blank Panel

11. Thread one end of the BN21H-02 cable under the rear handle of Pedestal 0, as shown in Figure 4-9. Then thread the cable through the opening at the top and toward the front of the storage pedestal.

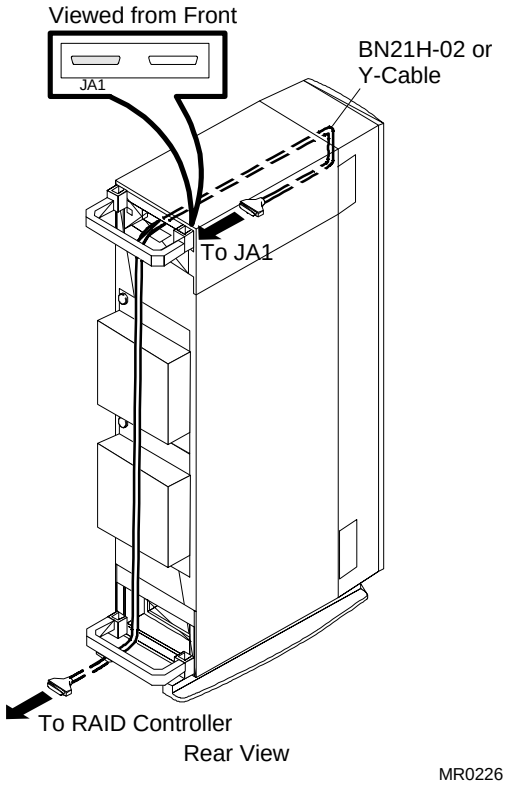


Figure 4-9. Cable Routing

12. Loop the BN21H-02 cable down below the divider plate and connect the cable to connector JA1 (upper-left connector when viewed from the front) on Pedestal 0. See Figure 4-9.

13. Insert the other end of the BN21H-02 cable into the connector for the RAID controller (External Channel 0) at the back of the host system. See Figure 4-10.

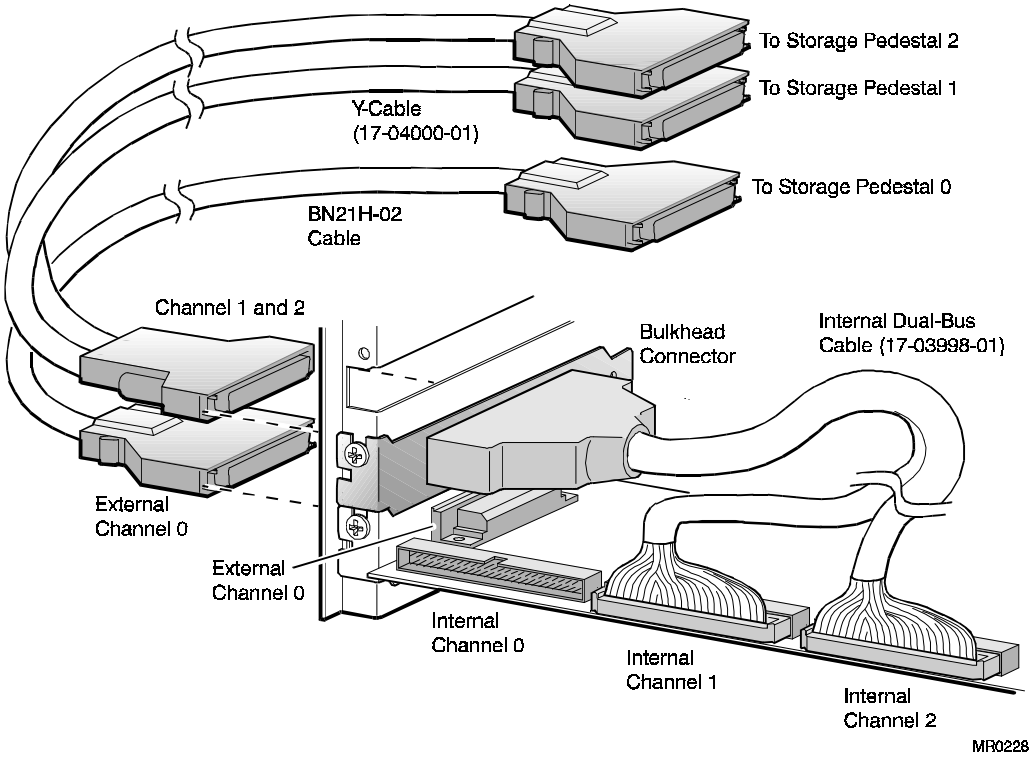


Figure 4-10. External Cable Connections

14. Thread the Y-cable connector labeled Channel 1 under the rear handle of Pedestal 1, and through the opening at the top of the pedestal. See Figure 4-9.

15. Loop the Channel 1 connector down below the divider plate of Pedestal 1 and connect the cable to connector JA1 (upper-left connector when viewed from the front) on the storage pedestal. See Figure 4-10.

16. If you are using a third storage pedestal, thread the Y-cable connector labeled Channel 2 under the rear handle of Pedestal 2, and through the opening at the top of the storage pedestal. See Figure 4-9. If you are not using Pedestal 2, coil the Channel 2 cable.

17. Loop the Channel 2 connector down below the divider plate of Pedestal 2 and connect the cable to connector JA1 (upper-left connector viewed from the front) on the storage pedestal. See Figure 4-10.

18. Insert the 68-pin connector into the external channel 1/2 connector on the bulkhead of the host system. See Figure 4-10.

19. After you consult the pedestal configuration diagram (Figure 4-11), label the disk drives with this information:

    - Device type
    - Channel
    - SCSI ID

    For example:

    Dev: RZ26L

    CH: 0

    ID: 1

NOTE

The following rules apply to device addresses for the storage pedestal:

- The default device addresses use the slot number in the storage pedestal, as shown in Figure 4-11.
- The available addresses for each slot in the storage pedestal are 0 through 6.

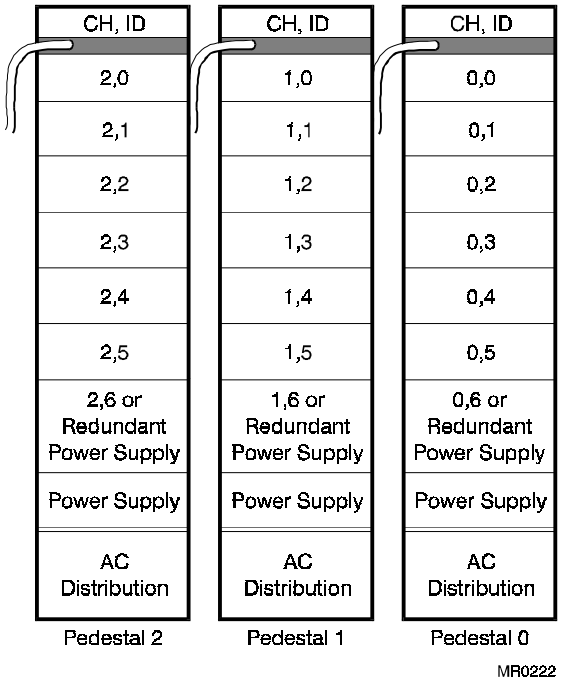


Figure 4-11. Device Labels

20. Insert the drives into the storage pedestal according to the layout shown in Figure 4-11.
21. To support the hot swap option, verify that all power supply SBBs (BA35X-HA) are Rev. L01 or later.
22. Insert the optional redundant power supply SBBs into the designated slots. See Figure 4-11.
23. Thread the female end of the ac power cable under the handle of each storage pedestal. Connect the cable to the ac receptacle on the ac distribution unit. The ac extension cable is not used in this configuration.
24. Connect the other end of the ac power cable to an ac power source.
25. Replace the front and rear bezel doors.
26. Power up the storage pedestal.
27. Power up the host system.
28. On Intel systems with the BIOS enabled, you can confirm proper installation of the RAID controller when you see a message similar to the following during the boot process.

```
SWXCR BIOS Version x.x

Digital Equipment Corporation

SWXCR Firmware Version x.x

SWXCR RAM: x Mbytes
```

If you do not get a similar message, refer to Chapter 6 of this manual for troubleshooting and service information.

At this point, you used the ECU to inform your host system about the new RAID controller (Chapter 2) and you added the RAID controller (this chapter). Now turn to Chapter 5 to configure the RAID controller to use the disk devices.

5

Using the Standalone RAID Configuration Utilities

Introduction

This chapter contains the following topics:

- Background information
- System requirements
- Invoke the utilities
- Exit the utilities
- Initial configuration of the SWXCR RAID controller
- Configuration information
- Array maintenance information

Background

Use the Standalone RAID Array 200 Software to configure and maintain your StorageWorks RAID Array 200 Subsystem.

Before you can use your RAID subsystem, you must configure the disks into drive groups, and then configure logical RAID drives (see the terminology section of this guide) at a particular RAID level using the Standalone RAID Array 200 Software.

Once you complete the configuration process, the configuration data is saved in the RAID controller's flash EEPROM/NVRAM (the controller's memory). However, you should also save the configuration data to a file on a diskette so that you can restore it in case the controller is ever replaced.

System Requirements

You must have the following to run the utility:

- An Intel or Alpha AXP system with a VGA monitor and a keyboard
- One floppy disk drive (3.5-inch, 1.44 MB)
- SWXCR controller installed and all disk drives connected and powered on.

Before You Begin

Make a backup copy of the Standalone RAID Array 200 Software diskettes (the Intel x86 or AXP diskette, whichever you are using on your system) on a PC using this procedure.

1. Copy the diskette using the MS-DOS **diskcopy** command (see your MS-DOS manual for detailed instructions on how to use this command).
2. Label the new diskette and store the original diskette in a safe place.

Files Contained on the Diskette

The following is a list of the files for the SWXCR controller contained on your Standalone RAID Array 200 Software diskette:

File Names	Description
RELEASE.TXT	Release information
!MLX0077 CFG	SWXCR-EA 1-channel ECU configuration file (Generic)
!MLX0075.CFG	SWXCR-EB 3-channel ECU configuration file (Generic)
AMLX0077 CFG	SWXCR-EA 1-channel ECU configuration file for OSF, OpenVMS
AMLX0075.CFG	SWXCR-EB 3-channel ECU configuration file for OSF, OpenVMS
!!CFG.NDX	Configuration file for ECU
SWXCRMGR.EXE	Standalone RAID Configuration Utility
SWXCRFW.EXE	SWXCR Firmware Download Utility
SWXCRFW.nnn (version)	SWXCR Firmware
SWXCRBIO.EXE	SWXCR BIOS Download Utility
SWXCRBIO.nnn (version)	SWXCR BIOS
DACD.EXE	Diagnostic stub (reserved for future use)

Invoking the Utilities

You can invoke the utilities on an Intel system or an AXP system. If you have an Intel system, refer to the "Invoking the Utilities on Intel Systems" section of this chapter. If you have an AXP system, refer to the "Invoking the Utilities on AXP Systems" section of this chapter.

Before you power on and boot your system to invoke the utilities, be sure that all storage pedestals are powered on.

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

Invoking the Utilities on Intel Systems

1. Insert the Standalone RAID Array 200 Software Vx.x for Intel Systems diskette in your floppy drive and boot from that drive.
2. Enter this command at the prompt:

   ```
   A:\SWXCR> SWXCRMGR
   ```

   After checking the drives, the system displays the main menu of the utilities as shown in Figure 5-1.

Invoking the Utilities on AXP Systems

Consult your AXP system documentation to invoke this boot menu.

```
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.
```

1. Insert the Standalone RAID Array 200 Software Vx.x for AXP Systems diskette into your floppy drive.
2. To select the Run a program option, use the arrow key and press the Enter key. The system displays a prompt.
3. To run the utilities from the A: drive, enter the following:

   ```
   Program to Run: A:SWXCRMGR
   ```

   After checking the drives, the system displays the main menu as shown in Figure 5-1.

Figure 5-1 shows the main menu screen. From this menu, you can invoke each of the utilities. As you move the cursor from one option to the next, the message window changes to display a message for the highlighted option.

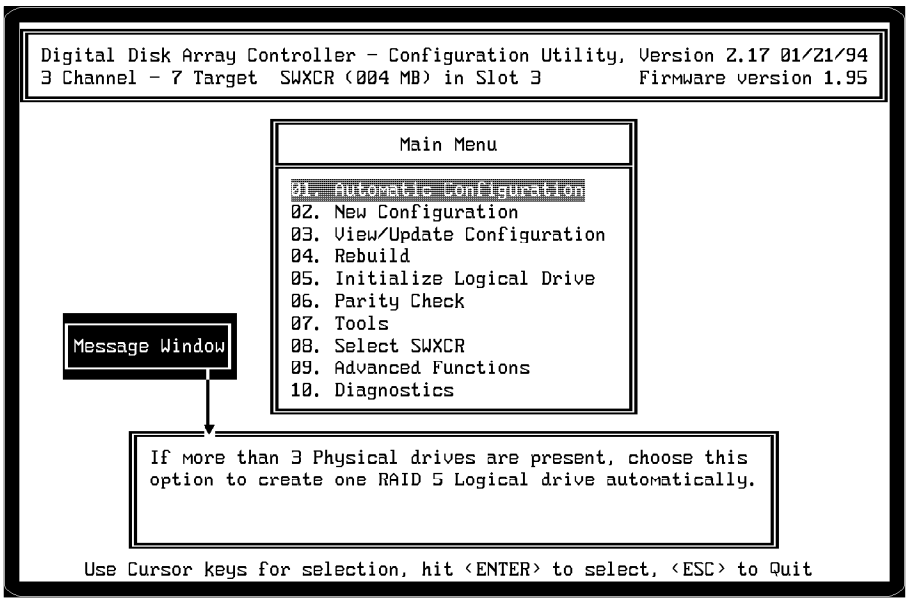


Figure 5-1. Main Menu Screen

NOTE

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

From this point on, the description of the utilities is the same for both Intel and AXP systems.

Use the arrow keys to move through the menu, highlight your selection, and then press the Enter key to select the option you want. From the main menu, you can type the highlighted letter (usually the first letter of the menu item) for your selection and then press the Enter (or Return) key.

Exiting the Utilities

At any time, you can exit the utilities by pressing the ESC key from the main menu. The system prompts you to confirm that you want to exit the utilities. Select Yes to return to the MS-DOS prompt.

Configuring the RAID Subsystem

The following tasks are involved in configuring your subsystem.

- Initial installation of the subsystem requires setting the these options:
  - Fault Management
  - Battery Backup

  You only need to set these options once. The settings become effective when the system is rebooted.

- There are two ways to configure the RAID Subsystem. Depending upon your specific hardware configuration and needs, select one of these:
  - **Automatic Configuration**

    You can only use this option if your RAID subsystem has between three and eight drives and you want all of the drives configured as either RAID 5 or JBOD.

  - **Interactive Configuration**

    You use this option to configure your RAID subsystem with the utilities. During the procedure, you use the utilities to perform the following steps:

    - Configure one or more drive groups
    - Configure one or more logical RAID drives
      - Specify RAID levels
      - Specify caching policy

- Initialize drives with RAID parity information
- Specify a hot spare drive if you choose to include one

Initial Configuration of the RAID Controller

At the initial installation, set the Fault Management and Battery Backup options. You only need to set these options once.

For the Fault Management option, consider the following:

- If your RAID controller is connected to StorageWorks pedestals or to shelves that support fault management, enable this option.
- If your RAID controller is connected to non-StorageWorks storage shelves or directly to disk drives by means of ribbon cables, disable this option.

Since the Battery Backup option is not supported, verify that it is disabled.

To set the Fault Management option, proceed as follows.

Step	Action	Result
1	Select the Advanced Functions option from the main menu.	The system displays an Edit/View Parameter menu.
2	Use the arrow keys to highlight the Hardware Parameters option and press the Enter key.	The system displays the current status of both options, similar to Figure 5-2.
3	Use the arrow keys to highlight the option and to change the status of an option, then press the Enter key.	The system toggles the option between Enable and Disable each time you press the Enter key.
4	Press the ESC key.	You return to the Edit/View Parameter menu.
5	Press the ESC key again. If you changed the status of an option, save the current status by selecting the Yes option at the prompt.	The system returns you to the main menu.

NOTE

Any change to the Fault Management setting becomes effective the next time the system is rebooted.

Figure 5-2 shows the Hardware Parameters screen.

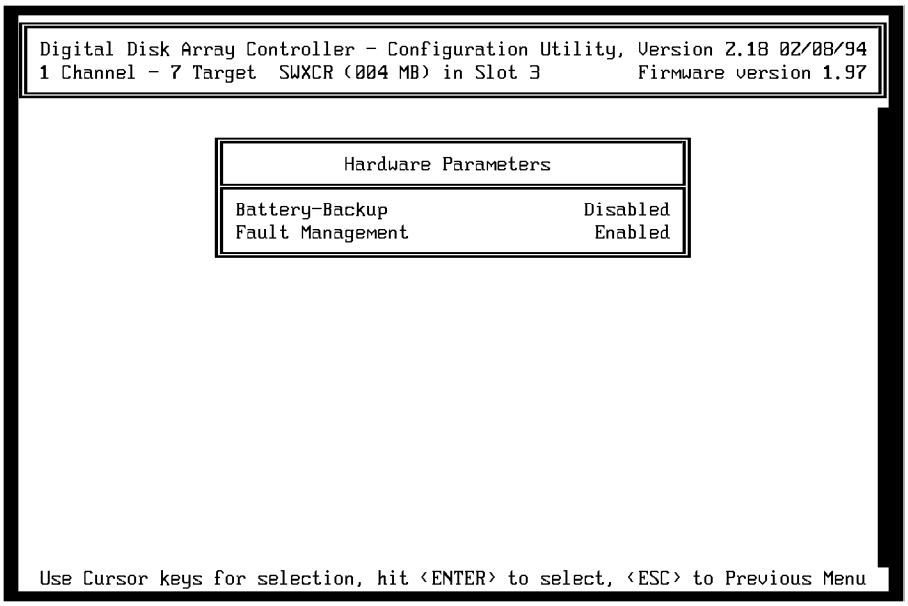


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Figure 5-2. Hardware Parameters Screen

Using the Automatic Configuration Option

You can use this procedure if you have three to eight drives in your subsystem that you want to configure as either RAID 5 or JBOD. Use the procedure for automatic configuration as described below.

If you plan to define one of your drives as a hot spare drive, you must do the following:

1. Exit the utility.
2. Remove the drive you want to designate as your hot spare drive.
3. Reinvoke the utility.
4. Use the procedure for automatic configuration below.
5. Go to the section of this chapter called, "Adding a Hot Spare after Initial Configuration."

Step	Action	Result
1	Select the Automatic Configuration option from the main menu.	The system displays a warning message saying that a valid configuration exists and if you proceed, you will destroy it. There is also a confirmation window.
2	Select Yes if you want to proceed. If you select No, the system returns you to the main menu.	The system displays a window with this message: `Do you want Write Cache enabled?`

Continued on the next page.

Step	Action	Result
3	Select No to set the cache policy to Write Through (the recommended policy).	The system displays a window with this message at the bottom of the screen: `Saving configuration, please wait ...` The system then displays a screen with your system configuration information. See Figure 5-3.
4	Press any key to return to the main menu.	
5	From the main menu, select the Initialize Logical Drive option described later in this chapter.	

Figure 5-3 shows the Automatic Configuration screen. This screen displays the configuration information that results from using the Automatic Configuration option.

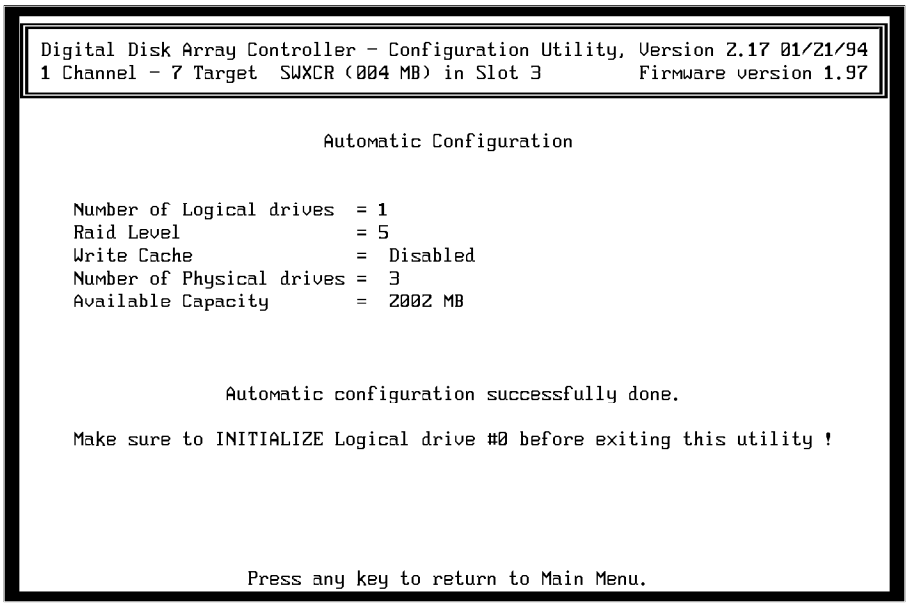

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Figure 5-3. Automatic Configuration Screen

To complete the automatic configuration of your subsystem, go to the section entitled, Initializing a Logical RAID Drive, on Page 5-27.

Configuring the RAID Subsystem Interactively

A number of tasks are required to configure your subsystem interactively. The procedures for these tasks are described in the following sections.

Step	Action	See Page
1	Create one or more drive groups.	P. 5-18
2	Create one or more logical RAID drives, including specifying their RAID levels and cache policy.	P. 5-23
3	Designate a hot spare drive (optional)	P. 5-25
4	Initialize each logical RAID drive.	P. 5-27

Creating a Drive Group

A single controller can support up to eight drive groups. Remember these general rules when you configure your array:

- Maximum number of drive groups: 8
- Maximum number of drives in each drive group: 8
- Maximum number of logical RAID drives: 8

The choice of RAID level for logical RAID drives depends on the number of drives within a drive group. This table shows the RAID levels for drive group/RAID level requirements.

RAID Level	Drives in Drive Group	Usable Storage	Data Redundancy
0	2—8	All	No
1	2	50%	Yes
0 + 1	3—8	50%	Yes
5	3—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.

Understanding Drive Status

The SWXCR controller assigns a drive status to each SCSI device. The drive status changes as you use the utilities. The utilities display the drive status as follows.

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 (within a redundant RAID configuration) for use in an automatic rebuild in the event of a failure.
OPT	Optimal	The device is on line and configured for use.
RDY	Ready	The device is spun up and ready to be used by the controller, but is not configured.
UNF	Unformatted	The device was being formatted and you halted the format operation.
WOL	Write Only	The device is being rebuilt and is in a write-only mode.

To begin the configuration process, first you create a drive group.

NOTE

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, use the Device Information option on the Define Drive Group screen to check the size before you create a drive group.

If you select a drive for the drive group by mistake or you want to redefine a drive group, use the Cancel Group option and begin again. However, you can only use the Cancel Group option until you arrange the drive groups. Once you use the Arrange Group option, the Cancel Group option does not function.

Step	Action	Result
1	Select the New Configuration option from the main menu.	The system displays a screen like Figure 5-4. The Define Drive Group function is highlighted.
2	Press the Enter key to select the Define Drive Group option.	The system displays a drive matrix that shows the drives connected to the adapter and the status of each. See Figure 5-5. The Create Group function on the screen's menu is highlighted.

Continue to the next step.

Figure 5-4 shows the New Configuration screen. From this screen, you can select the Define Group option, the Define Logical Drive option, or the Define Spare option.

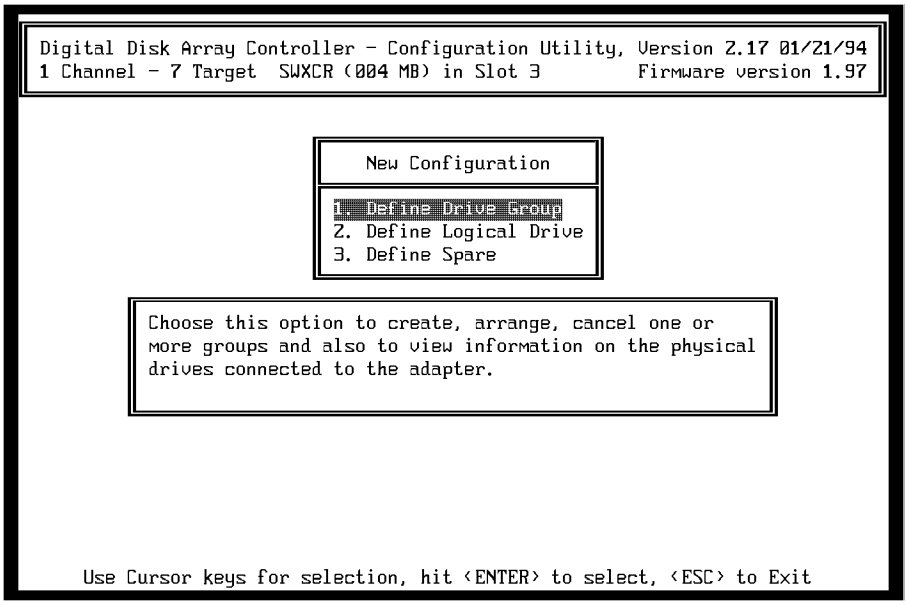

Figure 5-4. New Configuration Screen

Figure 5-5 shows the Define Drive Group screen. From this screen, you can create a drive group, cancel a group you created, arrange the drive group(s), and display information about your drive groups.

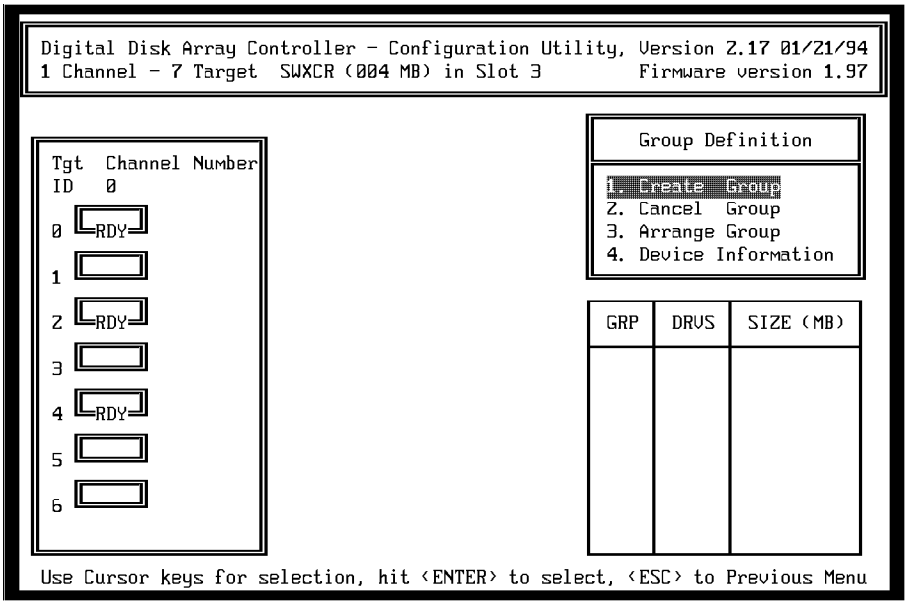

Figure 5-5. Define Drive Group Screen

Step	Action	Result
3	Press the Enter key to select the Create Group option on the menu.	The cursor moves to the drive matrix.
4	Position the cursor on the drive you want to add to the drive group and press the Enter key. Add other drives to the drive group by repeating this step. If you plan to specify a hot spare drive, leave at least one drive of equal or greater capacity to the other drives in the RDY (ready) state.	The system adds that drive to the drive group. The RDY (ready) status next changes to OPT (optimal). The drive is assigned a group letter and a sequence number. If you assign all the physical devices to drive groups, the system automatically highlights the Arrange Group option and you can continue at Step 7.
5	To declare the end of the drive group, press the ESC key.	The system returns to the Group Definition screen as shown in Figure 5-5.
6	Repeat Steps 3 through 5 of this procedure for each additional drive group. When you have set up all your drive groups, go on to the next step to arrange the groups.	Each new drive group is assigned a different group letter and the drives in the group are assigned a sequence number.

Continued on the next page.

Step	Action	Result
7	If the cursor is not on the Group Definition menu, press the ESC key. Then use the arrow keys to highlight the Arrange Group option and press the Enter key.	The cursor moves to the drive pictorial on this screen.
	NOTE: In Step 8, when all drive groups are arranged, the system returns you to the New Configuration menu and highlights the Define Logical Drive option.	
8	Use the arrow keys to move the cursor to a drive in the group you want to arrange. Press the Enter key.	• If you have arranged all drive groups, see the next section of this chapter, "Creating a Logical RAID Drive" for a description of the steps for this procedure. • If you have not arranged all drive groups, the drive group and size information for arranged drive groups is displayed in the table at the lower-right side of the screen, as shown in Figure 5-5.
9	Repeat Step 8 for all drive groups. NOTE: Be careful not to press the ESC key because you lose the remaining drive groups and must recreate them. When you have set up all your drive groups, go on to the next step to create logical RAID drives.	As each drive group is arranged, its information is added to the table.

To continue the configuration of a new disk array, specify the logical RAID drives.

Creating a Logical RAID Drive

A *logical RAID drive* is presented to the host operating system as one physical drive. To the operating system, there is no difference between a controller logical RAID drive and a single physical drive on a conventional disk controller. A logical RAID drive consists of part or all of any drive group.

NOTE

For a RAID 5 configuration, the controller must use some of the space for parity information. When you specify the size, calculate the usable space according to this formula:
usable space = *total space* * (N-1/N) where N is the number of drives in the drive group.

Step	Action	Result
1	Select the Define Logical Drive option.	A screen shows the drive groups available for selection as logical RAID drives.
2	Select the Create Logical Drive option.	A pop-up window displays the RAID levels available for that logical RAID drive. Unavailable levels are still visible but you cannot select them.
3	Select the RAID level for the logical RAID drive.	A pop-up window displays the usable size of the logical RAID drive.
4	Enter a size for the new logical RAID drive.	The status block is updated with the RAID level and size of the logical RAID drive.
5	Confirm that you want to create this logical RAID drive. Select Yes.	The system adds the logical RAID drive to the list at the lower-left of the screen.

Continued on the next page.

Step	Action	Result
6	Repeat this procedure for up to eight logical RAID drives, or until all the capacity of the selected drive group is used.	Each new logical RAID drive is added to the table on the lower-left of the screen.
7	Choose a caching policy. The default policy is Write-Thru (Through). To change the cache policy, select the Toggle Write Policy option on the menu. **NOTE**: Digital strongly recommends a Write-Through caching policy to eliminate the chance of data loss due to a power failure. See the Terminology section in the *About this Guide* portion of this manual.	The cursor moves to the right-hand column of the list of logical RAID drives and highlights the Write-Thru of the first logical RAID drive.
8	Press the Enter key to toggle the caching policy to the alternative: Write-Back. Use the arrow keys to move to another logical RAID drive.	
9	When you are finished with the cache policy, press the ESC key once.	You return to the Logical Drive Definition menu.
10	Press the ESC key again.	You return to the New Configuration menu.
11	Press the ESC key again.	The system displays a confirmation window.
12	Select Yes in the confirmation box.	The configuration is saved to the flash EEPROM/NVRAM. The system returns you to the main menu. You can now initialize the logical RAID drives.

Defining a Hot Spare Drive

If your business cannot tolerate data loss or downtime due to drive failures, you should keep a drive available in the array as a hot spare for automatic rebuilds.

Follow this procedure to create a hot spare drive.

Step	Action	Result
1	Select the View Update option from the main menu.	The system displays the View/Update Configuration menu as shown in Figure 5-8.
2	Select the Define Spare option.	The system displays the Define Spare menu as shown in Figure 5-6.
3	Use the arrow keys to select the drive you want to define as a spare and press the Enter key.	The system changes the drive status to HSP (hot spare).
4	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.
5	Press the ESC key.	The system displays a confirmation window that asks if you want to save your configuration.
6	Select Yes.	The system saves your configuration and returns you to the main menu.

Figure 5-6 shows the Define Spare screen. In this example, you can only see Channel 0 because it corresponds to an SWXCR-EA 1-channel controller. If your RAID subsystem uses an SWXCR-EB 3-channel controller, the display would show channels 0, 1, and 2. Note that the drive in Target ID 4 of channel 0 in this example shows a drive status of HSP. This drive is defined as the hot spare.

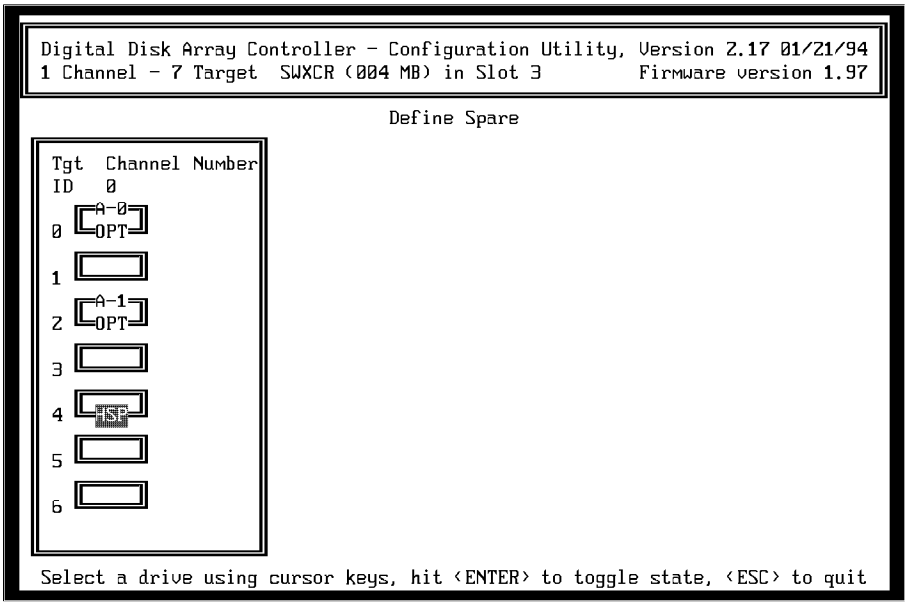

Figure 5-6. Define Spare Screen

Initializing a Logical RAID Drive

Before you can use a logical RAID drive, it must be initialized to ensure consistent RAID parity information. For RAID levels that provide redundancy, this step is crucial to ensure that the RAID parity information is consistent from the beginning.

CAUTION

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

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.

Step	Action	Result
1	From the main menu, select the Initialize Logical Drive option.	The system displays the Initialize Logical Drive screen, showing each of the eight possible logical RAID drives.
2	You can initialize more than one logical RAID drive. Use the arrow keys to select the logical RAID drives you want to initialize and press the Return key.	
3	Use the arrow keys to select the Start button and press the Return key.	The system warns you that the initialization of the logical RAID drives destroys data on the drives.
4	Select Yes in the confirmation box.	The status bar gradually fills as the initialization process completes and asks you to continue by pressing any key when done. The system saves the configuration and returns you to the main menu.

The logical RAID device is ready for use.

Saving the Configuration to a Diskette

Digital strongly recommends that you save your configuration to a file on a diskette at this point. In the event that your controller fails, you need a backup of your configuration file in order to restore your original configuration on your new controller.

You can use a formatted diskette or save the file to the diskette that you are using to run the utilities.

To save the configuration, proceed as follows.

Step	Action	Result
1	Insert the diskette.	
2	From the main menu, select the Tools option.	The system displays the Tools menu. See Figure 5-7.
3	To save the configuration information in a file, select the Backup/Restore conf option.	The system displays the Backup/Restore conf menu.
4	Select Backup from the Backup/Restore conf menu.	The system prompts for the name of the file.
5	Enter an appropriate file name with up to eight characters not including the file extension. For example: `PCNAME_1`	The system creates the file in your current directory.
6	Press the ESC key to exit.	The system returns to the main menu.

Figure 5-7 shows the Tools screen. From this screen, you can review the bad block table, list the error count, format a drive, change a drive status to optimal, fail a drive, back up or restore your configuration, clear your configuration, or print your configuration to a file.

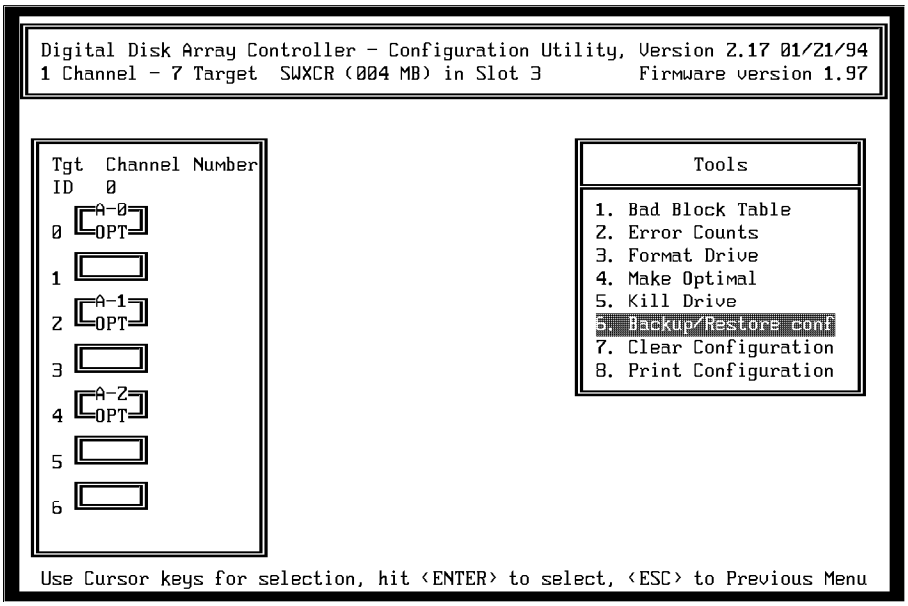

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Figure 5-7. Tools Screen

Next Steps

You can either repeat the previous procedure to create additional logical RAID drives or exit the utilities and boot your operating system to initialize the logical RAID drives you just created.

For information about using the utilities under your operating system, refer to the *StorageWorks RAID Array 200 Subsystem User's Guide* specific to your operating system.

If you are using an Intel system, refer to Appendix C for a verification procedure that you can use to test your subsystem.

Maintaining Your RAID Subsystem

To maintain your RAID subsystem, use the utilities to do the following:

- View the current configuration
- Print the current configuration
- Check drive information
- Check logical RAID drive consistency
- Add a hot spare after initial configuration
- Fail a physical drive
- Rebuild a drive
  - View bad block information
  - Make a drive optimal
- Restore a configuration from diskette
- Format a drive
- Update the firmware
- Update the BIOS

The procedures for these tasks are described in the following sections.

Viewing and Updating Your Configuration Information

You can use the View/Update Configuration option from the main menu to view or change an existing configuration.

To view your configuration, select the View/Update Configuration option from the main menu. The system displays the View/Update Configuration menu as shown in Figure 5-8.

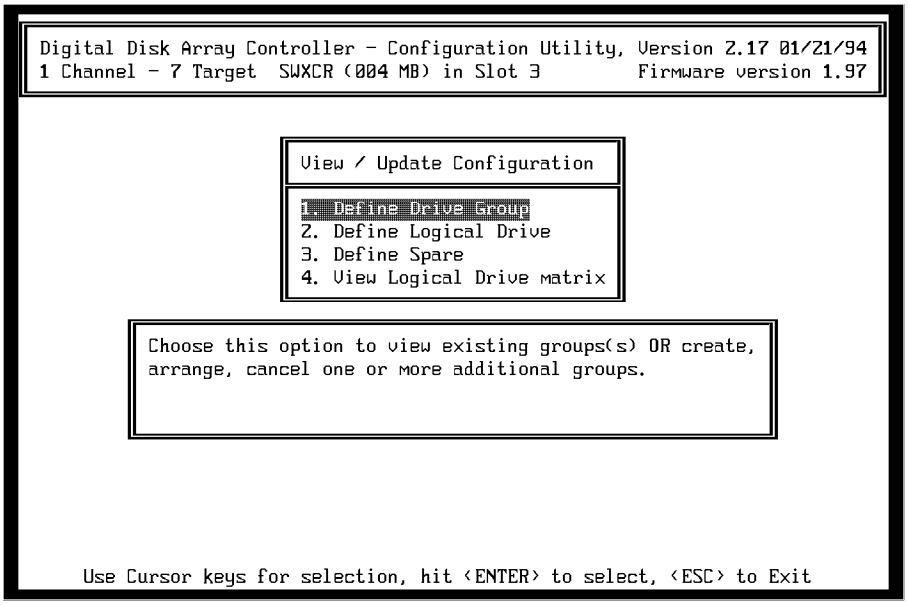

Figure 5-8 . View/Update Configuration Screen

The View/Update Configuration screen contains some of the same options as the New Configuration menu described in the section, "Configuring the RAID Subsystem." However these options all operate on the current configuration to modify it.

This menu's unique option is the View Logical Matrix option. Use this option to display the current configuration before you make any changes.

Step	Action	Result
1	Select the View Logical Drive Matrix option.	The system displays the View matrix screen as shown in Figure 5-9.
2	Press the ESC key.	The system displays the View/Update Configuration screen as shown in Figure 5-8.
3	Press the ESC key to exit.	The system returns you to the main menu.

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 (within a redundant RAID configuration) for use in an automatic rebuild in the event of a failure.
OPT	Optimal	The device is on line and configured for use.
RDY	Ready	The device is spun up and ready to be used by the controller, but is it not configured.
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.

Figure 5-8 shows the View Matrix screen. From this screen you can see the drives and their status.

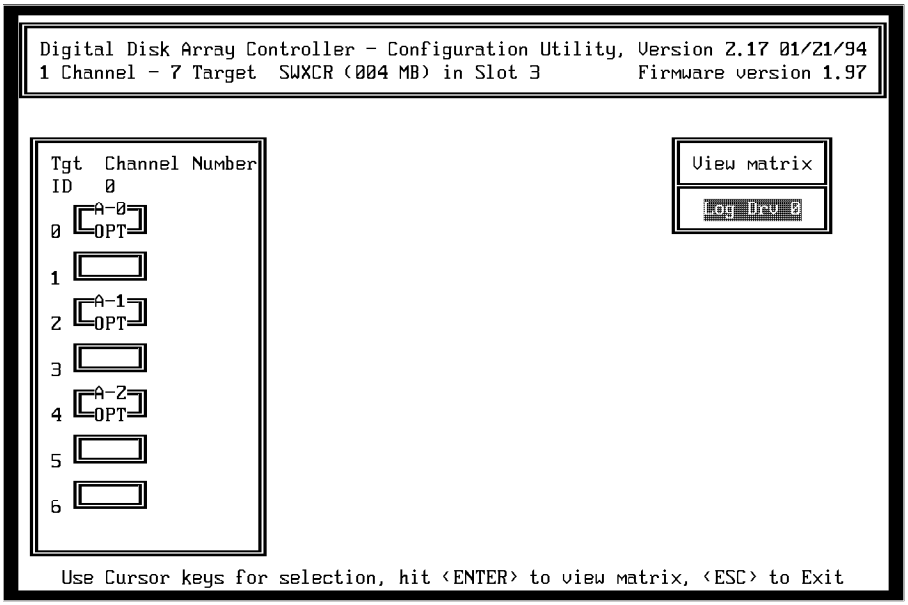

Figure 5-9 . View Matrix Screen

Printing Your Configuration Information

To print your existing configuration, use the Print Configuration option as follows.

Step	Action	Result
1	Select the Tools option from the main menu.	The system displays the Tools screen as shown in Figure 5-7.
2	Select the Print Configuration option.	The system displays this prompt: `Enter File Name`
3	Enter an eight-character file name (including the file extension) for the log file that saves the configuration information. Then press the Enter key.	The system displays this message: `Existing File, if any will be overwritten!`
4	Select yes to save the information to the file you specified, or select No and press the ESC key to return to the previous menu.	When you select Yes, the system displays this message: `Saved configuration print file. Press any key to continue.`
5	Press the ESC key to return to the main menu.	
6	To exit the utilities, press the ESC key again.	The system prompts you to confirm that you want to exit the utilities.
7	Select Yes to return to the MS-DOS prompt.	
8	Print the file you saved to your printer.	The file is similar to the following example.

Example of a Print Configuration File

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

Checking Drive Information

To check your drive information, use the Device Information option as follows.

Step	Action	Result
1	Select the View/Update Configuration option from the main menu.	The system displays the View/Update Configuration screen as shown in Figure 5-8.
2	Select the Define Drive Group option.	The system displays the Define Drive Group screen as shown in Figure 5-5.
3	Select the Device Information option from the Group Definition portion of the screen.	The cursor moves to the Drive Matrix portion of the screen.
4	Use the arrow keys to move the cursor to the drive for which you want information and press the Enter key.	The system displays the drive information at the lower-right of the screen as shown in Figure 5-10.
5	Continue to select drives and display their information. When you finish, press any key to stop displaying information, but to continue to use this menu. Press the ESC key to return to the View /Update Configuration screen.	The system displays the View/Update Configuration screen.
6	Press the ESC key again to return to the main menu.	The system displays the main menu.

Figure 5-10 shows the Device Information for a selected disk.

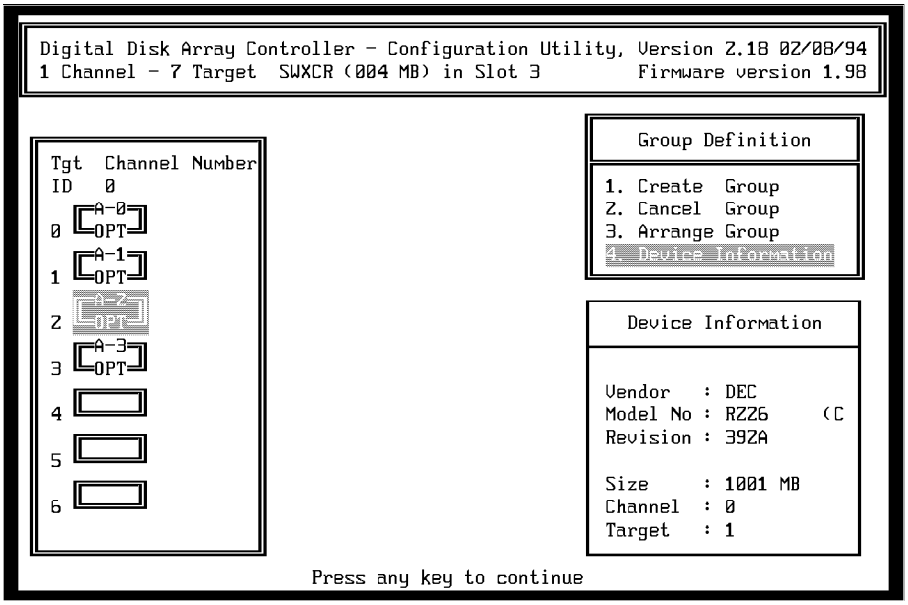

Figure 5-8 . Device Information

Checking Logical RAID Drive Consistency (Parity Check/Repair)

Use the Parity Check/Repair utility to check a logical RAID drive for the consistency of the RAID parity information. Run this utility after a power failure or a system crash to verify the integrity of parity information on logical RAID drives in the array.

NOTE

This utility is only available for redundant RAID levels (for example, RAID 1, RAID 0 + 1, and RAID 5).

This utility reads the data from the logical RAID drives and computes the expected parity information for each series of blocks. The computed parity information is then compared with the parity information stored on the disks. Any discrepancies between the two are flagged.

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

Step	Action	Result
1	Select the Parity Check option on the main menu.	The system displays the Parity Check screen and lists the logical RAID drives.
2	Select a logical RAID drive to check the consistency of the parity information on the logical RAID drive.	The parity check status bar in the center of the screen displays the status of the consistency check. The bar gradually fills as the process completes.
3	If the utility detects any fault with the disk, the system displays a message. Follow the instructions at the bottom of the screen.	
4	To fix inconsistent RAID parity information on a logical RAID drive, enter Yes when queried by the utility. **NOTE:** If you choose not to fix inconsistent RAID parity information, your data may not be regenerated correctly if a drive fails.	
5	When the bar displays 100%, press any key to continue.	The system returns you to the main menu.

Adding a Hot Spare Drive after Initial Configuration

If your business cannot tolerate data loss or downtime due to drive failures, you should keep a drive available in the array as a hot spare for automatic rebuilds.

If you plan to define one of your drives as a hot spare drive, you must do the following:

1. Exit the utility.
2. Insert the drive you want to designate as your hot spare drive.
3. Invoke the utility.
4. Use the procedure for creating a hot spare below.
5. Save your new configuration to a diskette as described on Page 5-29.

Step	Action	Result
1	Select the View/Update Configuration option from the main menu.	The system displays the View /Update Configuration menu as shown in Figure 5-8.
2	Select the Define Spare option from the View/Update Configuration menu.	The system displays the Define Spare menu as shown in Figure 5-6.
3	Use the arrow keys to select the drive you want to define as a spare and press the Enter key.	The system changes the drive status to HSP (hot spare).
4	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.
5	Press the ESC key.	The system displays a confirmation window that asks if you want to save your configuration.
6	Select Yes.	The system saves your configuration and returns you to the main menu.

Failing a Drive

A drive can fail due to errors on the device or because you manually failed it. If the utility records errors on a drive in your array, you may want to manually fail and then replace the drive before a permanent failure occurs.

To fail a drive, proceed as follows.

Step	Action	Result
1	Select the Tools option from the main menu.	The system displays the Tools menu as shown in Figure 5-7.
2	Select the Kill Drive option.	The system displays the drive matrix. The drives you can fail are highlighted. The drives you cannot select are grayed out (drives with a status of RDY (ready) or FLD (failed) cannot be selected.

3	Use the arrow keys to select the drive you want to fail and press the Return key.	The system displays a message similar to this:
		`Killing an OPTIMAL drive will change its state to FAILED and will stop reads and writes to that drive. This could change the state of the logical drive.`
		The system displays this message while the utility fails the drive.
		`Press any key to continue`

Continued on the next page.

Step	Action	Result
4	Press any key.	The system displays a confirmation window.
5	Select Yes.	The system spins down the drive. The status of the drive changes to FLD (failed).
6	Pull out the drive and replace it with a new drive.	The system automatically rebuilds on the new drive.

Manual Rebuild of a Drive (Reconstruction)

A *rebuild* is a process of recreating data on a new drive in a configuration with a redundant RAID level (for example, RAID 1, RAID 0 + 1, and RAID 5). If your logical RAID drive was configured with a RAID level that does not support data redundancy, all data is lost if a drive fails.

There are three ways to rebuild a drive.

With a Hot Spare

If you defined a spare drive, when a SCSI drive fails, the RAID controller automatically starts to rebuild the information on a hot spare. A hot spare is set to write only so data is not corrupted during the rebuild.

With a Hot Swap

If you replace a drive while the RAID subsystem is operating and you enabled the Fault Management option (as described earlier in this chapter) the RAID controller automatically starts the rebuild. This operation is called a *hot swap*.

NOTE

It may take up to one minute for the automatic rebuild to begin.

For a Manual Rebuild

You can rebuild a SCSI drive that you failed manually or a drive that could not be rebuilt because either an automatic rebuild is in progress or the Fault Management option was not enabled.

NOTE

To minimize the chance of data loss due to a second drive failure, upon detection of a drive failure, replace the drive as soon as possible.

To manually rebuild data of a failed physical drive (if you have not defined a hot spare drive), follow these steps.

Step	Action	Result
1	Remove the failed drive from the RAID subsystem and replace it with a new drive.	
2	Go to the main menu and select the Rebuild option.	The system displays a screen with the drive matrix, showing the drives and their status. The new drive is recognized by the system and spun up. The status of the new drive remains FLD (failed) until the rebuild begins.
3	Select the drive to be rebuilt. The drive you select must have a FLD (failed) status.	The rebuild status bar gradually fills as the process completes.
4	When the bar displays 100%, press any key to continue.	The system returns you to the main menu.

Viewing the Bad Blocks on a Drive

During a rebuild, the bad block table receives entries from a rebuild with errors. If you are using the Rebuild option to rebuild a disk and the rebuild fails, the drive remains in the WOL (write only) state. You can use the Bad Block Table option to view the bad blocks.

Step	Action	Result
1	Select the Tools option from the main menu.	The system displays the Tools menu as shown in Figure 5-7.
2	Select the Bad Block Table option from the Tools menu.	The system displays the View Bad Block Table menu at the lower-left side of the screen. You can select one of these options: • View Rebuild BBT • View Write Back BBT
3	Select the View Rebuild BBT.	The system displays bad blocks on the logical RAID drive including the block number and the number of consecutive bad blocks encountered.
4	Press any key to return to the View Bad Block Table menu.	The system clears Rebuild Bad Block Table once it is read. You can save it to a file.
5	Press the ESC key to return to the main menu.	The system displays the main menu.

If 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 described above.

Making a Drive Optimal

In some circumstances described in the *Troubleshooting Your Subsystem* section of Chapter 6, you may have to use the Make Optimal option to change the state of a drive from failed (FLD) to (OPT) optimal. If you use this method to change the state of a drive instead of using the Rebuild option, 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 corrupted files are detected, you have to restore data from backups.

To change the status of a drive to optimal, use these steps.

Step	Action	Result
1	Select the Tools option from the main menu.	The system displays the Tools menu as shown in Figure 5-7.
2	Select the Make Optimal option from the Tools menu.	The cursor moves to the Drive Matrix.
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 system changes the state of the FLD (failed) drive to OPT (optimal).
4	Press the ESC key to return to the main menu.	The system displays the main menu.

Restoring the Subsystem Configuration from a Diskette

To restore your configuration information due to RAID controller replacement, use the file containing the configuration you saved on a diskette (the procedure for saving your configuration information was described earlier in this chapter).

To restore the configuration, proceed as follows.

Step	Action	Result
1	Insert the diskette.	
2	Select the Tools option from the main menu.	The system displays the Tools menu as shown in Figure 5-7.
3	Select the Backup/Restore option.	The system warns you of the result.
4	Press any key to continue.	The system prompts you for a file name.
5	Enter the name of the file with the configuration information.	The system asks if you want to restore the configuration.
6	Select Yes.	The system reports that the file has been restored and asks you again to confirm that you want to restore the configuration.
7	Select Yes.	The system reports that the contents of the file has been written to the RAID controller's memory. When the process is complete, the system reports success.
8	Press the ESC key to exit from the display.	

Formatting the Drive

All Digital Equipment Corporation drives are preformatted, so formatting the drives is optional. You can only format those drives that have not been configured.

Step	Action	Result
1	From the main menu, select the Tools option.	The system displays the Tools menu as shown in Figure 5-7.
2	Select the Format Drive option.	The cursor moves to the first available drive in the matrix.
3	Use the arrow keys to highlight the drive you want to format and press the Enter key.	The system warns you of the consequences and asks you to confirm.
4	Select Yes to confirm.	Drive status changes from UNF (unformatted) to FMT (formatting).
5	Repeat Steps 3 and 4 for each drive you want to format.	
6	When you have selected one or more drives, press the ESC key.	The system asks you to confirm.
7	Select Yes to confirm.	Formatting begins. When a disk is formatted, its status changes from FMT (formatting) to RDY (ready).
8	When the format is complete, press any key to continue.	The system returns you to the main menu.

Updating the BIOS

You do not need to update the BIOS for AXP systems.

To update your BIOS on an Intel system, insert the standalone RAID Array 200 Software Vx.x for Intel Systems diskette in your floppy drive and boot from that drive.

For a single controller, type this command:

A:\SWXCR>**SWXCRBIO SWXCRBIO.*nnn***

where *nnn* refers to the BIOS version you want to load.

For two controllers, type this command:

A:\SWXCR>**SWXCRBIO SWXCRBIO.*nnn* SWXCRBIO.*nnn***

where *nnn* refers to the BIOS version you want to load.

The system displays these messages.

```
SWXCR BIOS Write Utility Ver. 1.0  -  January 4, 1993
Mylex Corporation

Writing EEPROM ...
Verifying EEPROM ...

SWXCR BIOS Write Completed

Press any key to reboot the system
```

Updating the Firmware

To update your controller's firmware, proceed as follows.

Updating the Firmware on an Intel System

To update your firmware on an Intel system, insert the standalone RAID Array 200 Software Vx.x for Intel Systems diskette into your floppy drive and boot from that drive.

For a single controller, type this command:

A:\SWXCR>**SWXCRFW SWXCRFW.*nnn***

where *nnn* refers to the firmware version you want to load.

For two controllers, type this command:

A:\SWXCR>**SWXCRFW SWXCRFW.*nnn* SWXCRFW.*nnn***

where *nnn* refers to the firmware version you want to load.

The system displays these messages:

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

       SWXCR Firmware Download Utility (V2.21, Jun 02, 1993)

****************************************************************

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

****************************************************************

SWXCR Controller supporting 7 targets per channel found at slot 3
```

Updating the Firmware on an AXP System

For AXP systems, consult your AXP system documentation to invoke this boot menu.

```
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.
```

1. Insert the Standalone RAID Array 200 Software Vx.x for AXP Systems diskette into your floppy drive.
2. To select the Run a program option, use the arrow key and press the Enter key. The system displays a prompt.
3. To run the utilities from the A: drive, do the following:

   For a single controller, type this command:

   Program to Run: **A:SWXCRFW SWXCRFW.*nnn***

   where *nnn* refers to the firmware version you want to load.

   For two controllers, type this command:

   Program to Run: **A:SWXCRFW SWXCRFW.*nnn*SWXCRFW.*nnn***

   where *nnn* refers to the firmware version you want to load.

The system displays the following messages.

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

        SWXCR Firmware Download Utility (V2.21, Jun 02, 1993)

************************************************************

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

************************************************************

SWXCR Controller supporting 7 targets per channel found at slot 3
```

6

Troubleshooting and Service Information

Introduction

This chapter describes the following:

- Overview of subsystem indicators
- Troubleshooting subsystem problems
- Removal and replacement

Overview of Subsystem Operations

The following sections provide an overview of operations for the StorageWorks components. Review these sections before you start troubleshooting.

Storage Pedestal Status Indicators (SBBs)

The expansion storage pedestal identifies error conditions or failures caused by the major pedestal components such as the blowers, power supplies, or drives. This status displays on the power supply and drive LEDs (light emitting diodes). The following sections describe the logic signals representing these conditions or failures (states and functions) and how to interpret the LED displays.

Pedestal Status

The power supply LEDs monitor both cooling and power. The blowers on the rear of the pedestal provide cooling and the pedestal power supply provides +5 V dc and +12 V dc to operate the storage devices. The power supply LEDs indicate the state of the pedestal components. The LEDs indicate a fault when one of the following conditions occur:

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

Power Supply LEDs

You can determine the status of both the pedestal blowers and the power supplies by looking at the power supply green LEDs as shown in Figure 6-1. The left LED displays the pedestal status and the right LED displays the power supply status.

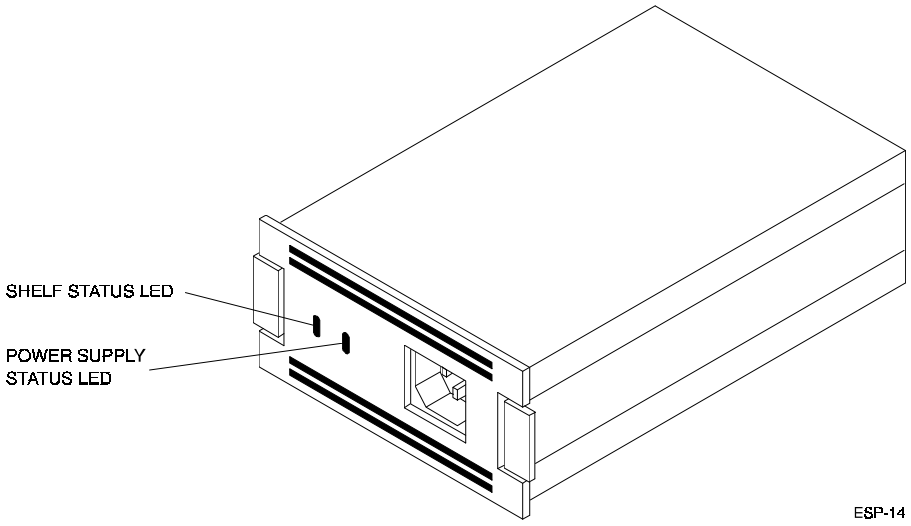

Figure 6-1. Power Supply LEDs

- When the left LED is on, both the pedestal blowers and the power supplies are functioning properly.
- When the left LED is off, either a pedestal blower or a power supply is not functioning properly.

Tables 6-1 and 6-2 describe the power supply LED codes.

Table 6-1. 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 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 6-2. 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.

Drive SBB Status LEDs

Figures 6-2 shows the 3.5-inch disk drive. The drive has two LED indicators that display the status of the device. The status conditions of the LEDs are listed in Table 6-3. 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).

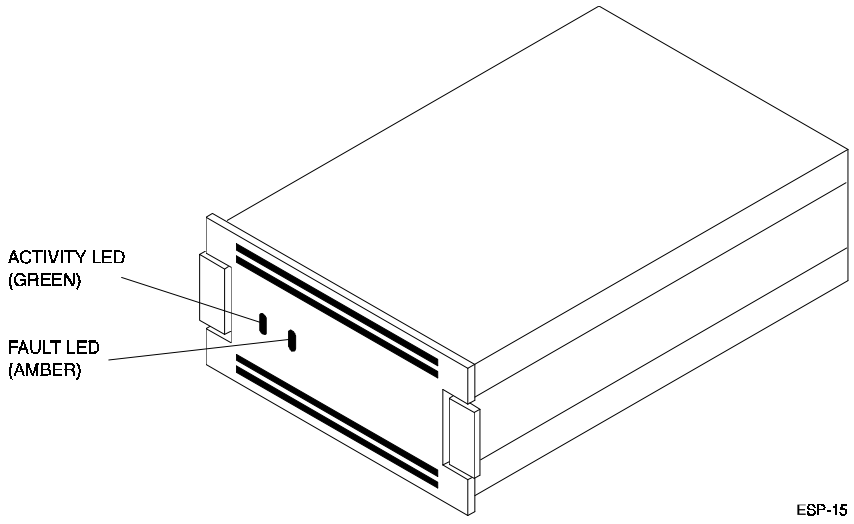

Figure 6-2. 3.5-inch SBB LEDs

Table 6-3 shows the activity and fault status for the SBB LEDs and indicates what the status means.

Table 6-3. 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.)

Troubleshooting Your Subsystem

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

Before You Begin Troubleshooting

NOTE

Always turn off the power to your system before you turn off the power to your storage pedestal(s).

To determine what the problem with your SWXCR controller is when using packaging other than the StorageWorks pedestal or shelves, follow these steps:

1. Turn off your host system.
2. Turn off the power to your pedestal, shelves, and drives.
3. Check to see that the SCSI cables are connected correctly to the storage pedestal, shelves, and drives. Check for proper SCSI cable termination.

If you are using the StorageWorks storage pedestal or shelves with your SWXCR controller, follow these steps:

1. Turn off your host system.
2. Turn off power to your StorageWorks pedestal or shelves.
3. Check to see that the SCSI cables are connected correctly. Refer to Chapters 3 and 4, for proper cabling instructions.
4. Turn the StorageWorks pedestal or shelves back on.

5. Verify that all the drives LEDs flash on when you turn the power on.
6. Verify that the two LED indicators on the power supplies are on.
7. Turn on your system and see if the problem is now resolved.

Troubleshooting Techniques

When the controller or subsystem does not operate correctly, use the information in this section to diagnose the problem. The troubleshooting techniques described do not identify all possible problems with the SWXCR controller or StorageWorks pedestal or shelves, nor do the corrective actions suggested correct all problems.

To use Table 6-4, follow these steps:

1. Note the symptoms of the problem displayed by the controller, storage pedestal, or shelves.
2. See if the description of the problem in the *Symptom* column in Table 6-4 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 6-4. Troubleshooting Techniques

Symptom	Possible Cause(s)	Action(s) to Take
Drive SBB Fault Light is On	Drive failed.	Replace drive using the *Replacing a Drive SBB* section of this chapter.
Drive SBB Fault and Activity Lights are On	Drive failed or is hung.	Replace drive using the *Replacing a Drive SBB* section of this chapter.
Drive SBB Fault Light is Flashing	Drive failed and is spinning down.	Replace drive using the *Replacing a Drive SBB* section of this chapter.

Continued on the next page.

Symptom	Possible Cause(s)	Action(s) to Take
Replaced Drive has not Spun Up	Drive not seen by the controller.	• 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.	Check the monitor log to verify the power failure or 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. 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). See the caution under the *Making Drives Optimal* section in Chapter 5 before you proceed to use that option.
Multiple Logical Drives are Dead	There was a pedestal or shelf power failure.	Check the monitor log to verify the power failure or 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 "Multiple Drives in Pedestal/Shelf are Failed" on this table.

Continued on the next page.

Symptom	Possible Cause(s)	Action(s) to Take
Drive has a WOL Status	Drive is being rebuilt. Rebuild failed drive. Disk replaced while rebuild in progress on another drive. 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 will be left with a WOL status.)	• 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. • Wait for completion of current rebuild operations. Start a manual rebuild on the new replacement drive. • After the rebuild completes, fail the drive in WOL state using the on-line utilities. Use the manual rebuild procedure described in Chapter 5 on that drive. Continue this operation for each drive in the WOL state. • Rebuild cannot work if multiple drives are in the WOL state within the same drive group.
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 new replacement drive.

Continued on the next page.

Symptom	Possible Cause(s)	Action(s) to Take
Failed Drive LED Status is Lost After Power Cycle with an Automatic Replacement by a Hot Spare	The controller does not maintain the drive LED status or failed status when a drive is not configured as part of a RAID logical drive.	Check the monitor log to verify power failure. You should remove the failed drive as soon as possible to prevent the drive from being used in future configurations.
Drives not Seen by the Controller	• 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.	• Check SCSI between the SWXCR controller and shelves. • Check 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.

Continued on the next page.

Symptom	Possible Cause(s)	Action(s) to Take
Automatic Rebuild Does Not Start	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.	If you are using the StorageWorks pedestal perform the following: • Verify that Fault Management is enabled. Refer to the *Initial Configuration of the RAID Controller* section of Chapter 5. • Remove the failed drive and insert the replacement drive. Be sure to wait a minimum of 20 seconds before reinserting the replacement drive. Wait approximately 1 minute for the rebuild to begin. • Wait for completion of the rebuild in progress.
Automatic Rebuild Starts and then Fails	• 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.	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.

Continued on the next page.

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 occured in a redundant RAID level configuration.	You must 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 only be done if no system operations have occurred to the drives since the error condition has occurred.
Rebuild Completes 100%, but Drive Status Remains WOL	Errors occurred on a drive during a rebuild. The drive is in a WOL state.	Check the drive error logs for information. Manually set the drive state back to optimal using the Standalone utilities. **Warning:** This should only be done if no system operations have occurred to the drives since the error condition has occurred.
Controller not Seen on System Boot	• Incorrect seating of controller. • Incorrect ECU configuration setting. • Controller failure.	• Remove and reseat controller into system. • Run the system ECU and check configuration parameters. • Replace the controller.

Continued on the next page.

Symptom	Possible Cause(s)	Action(s) to Take
Power Supply SBB Shelf Status is Off.	Shelf fault.	Refer to the *Power Supply LEDs* and *Replacing a Power Supply SBB* sections of this chapter.
Power Supply SBB Shelf Status and Power Supply Status LEDs are both Off.	• Input power problem. • Shelf and power supply fault. • You attempted to start a rebuild while a rebuild was in progress. • Bad terminators or cables.	• Check for proper connection of input power. • Refer to the *Power Supply LEDs* and *Replacing a Power Supply SBB* sections of this chapter. • Wait for completion of the current rebuild in progress. • Replace the terminator or cable.

Understanding Messages and Error Recovery

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

Diagnostic Messages		
Error/Problem	**Possible Cause(s)**	**Action(s) To Take**
`SWXCR fatal error - memory test failed!`	• DRAM Simms are not properly inserted. • SWXCR Controller is defective.	• Remove controller and reinsert the DRAM Simms • Replace with new SWXCR 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.	Reload firmware. Refer to Chapter 5 for details.
`SWXCR hardware error`	Problem with the controller.	• 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.

Continued on the next page.

BIOS Messages		
Error/Problem	**Possible Cause(s)**	**Action(s) To Take**
`Cannot find SWXCR in any slot: no drives installed`	• SWXCR not properly seated in EISA slot. • SWXCR BIOS is not enabled on the board in the lower EISA slot. • BIOS on more than on SWXCR controller is enabled. • Defective EISA slot. • Controller failure.	• Remove and reseat 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`	• Incorrect firmware on controller. • Defective controller.	• Reload correct firmware on controller. • Replace with new controller.

Continued on the next page.

Error/Problem	Possible Cause(s)	Action(s) To Take
`No Logical drives found: None installed`	• Logical RAID drives cannot be found.	• Check configuration. 1. Shut off the power to the system. 2. Shut off the power to the drives. 3. Check for loose cabling. 4. Check that the cables are connected to the correct channels. 5. Turn on the power to the system. 6. Check that the power LEDs are correct. 7. Reboot the system and disk drives.
	• A logical drive is not configured. • Configuration has been cleared.	• Run the standalone utilities to configure your drives into logical RAID drives. • Restore configuration from floppy.

Continued on the next page.

Error/Problem	Possible Cause(s)	Action(s) To Take
`SCSI device at Chn X Tgt y not responding`	• SCSI cable is not connected. • SCSI termination is incorrect. • Drive is not powered up. • Drive is defective. • SCSI cable is defective.	• 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.
`Installation Abort`	• 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.	• Check for configuration issues due to power, cabling , or other hardware problems: 1. Shut off the power to the system. 2. Shut off the power to the drives. 3. Check for loose cabling. 4. Check that the cables are connected to the correct channels. 5. Turn on the power to the system. 6. Check that the power LEDs are correct. 7. Reboot the system and disk drives.

Continued on the next page.

Error/Problem	Possible Cause(s)	Action(s) To Take
`Installation Abort (continued)`		• Check configuration by running the utilities: The utility provides you a display of the current drive and RAID logical drive status. Determine the corrective action needed on the drives. You can choose to quit or save the current configuration. To quit, press the ESC key. 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.) You can choose to ignore the configuration error to start a new configuration. This can be done by overriding the display process by entering the following: `SWXCRMGR -o` You have the option of quitting from the utility or saving the new configuration. **Warning:** If you save this configuration you will lose your data.

Continued on the next page.

Error/Problem	Possible Cause(s)	Action(s) To Take
`Mismatch between NVRAM & Flash EEPROM configurations`	• Power failure occurred before the configuration data was updated to both the NVRAM and EEPROM. • Faulty NVRAM.	Run the Standalone utilities. Refer to Chapter 5 for more information. Replace the controller.
`Unidentified device found at Chn x Tgt y`	• Drive was inadvertently replaced with new drive. • Failed drive was replaced with a new drive during a system power down.	• 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.
`Warning: x system drive is degraded`	Drive failed in a redundant RAID Logical Drive.	• Run the utilities to check the drive status. • Replace the appropriate failed drive.

Continued on the next page.

Error/Problem	Possible Cause(s)	Action(s) To Take
`Warning: x system drive is dead`	Drive failed in a nonredundant RAID Logical Drive (0 or JBOD). More than one drive failed in a redundant RAID level logical RAID drive (1, 0 + 1, 5).	Check all power, cabling, and hardware for proper operation. Data integrity can not be maintained, you must correct the situation and restore data from a backup source. 1. Run the utilities. 2. Identify failed drive or drives. 3. Replace failed drive or drives. 4. Reinitialize the RAID logical drive. 5. Restore data from backup.
`Warning: the following SCSI devices are dead Chn x, Tgt y`	Drive failed.	Run the utilities to identify failed drive. Replace drive using the *Replacing a Drive SBB* 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.

Continued on the next page.

Error/Problem	Possible Cause(s)	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.	1. Use the message to identify the drives that have been misplaced.
		2. Power off your system and StorageWorks pedestal or shelves.
		3. Correct the problem.
		4. Turn on the storage pedestal(s) and then the system.
		5. Verify that no warning messages appear.

Removal and Replacement

This section describes the following:

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

Replacing a Drive SBB

CAUTION

Once a device has been configured by the SWXCR 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 6-3. 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 replaced. Also, always use both hands when handling a device and be careful not to touch the device connector to prevent electrostatic discharge damage.

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 to release the device, and pull the unit until the rear connector disengages from the backplane connector (approximately one inch).
3. Remove the SBB as shown in Figure 6-3.
4. Wait 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.
5. 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.
6. Replace the front bezel and ensure the bezel locking tabs snap into place and close the bezel door.

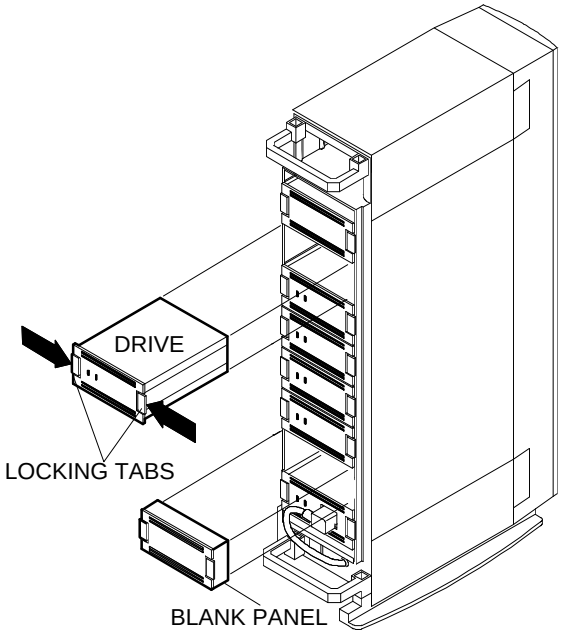

Figure 6-3. Removing a Storage Device

Replacing a Power Supply SBB

You need to replace a power supply when the LEDs indicate a fault condition as outlined in Tables 6-1, 6-2, and 6-3.

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

The input power for each ac power supply is controlled by a 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.

CAUTION

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

Replacing a Primary Pedestal (Nonredundant) Power Supply

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

1. Shut down your system and then power down the pedestal by setting the power switch on the ac distribution to *off* and 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.
3. Press the two locking tabs to release the unit, and slide it out of the pedestal (similar to replacing a drive as shown in Figure 6-3).
4. Insert the replacement supply into the guide slots and push it in until the tabs lock into place.
5. Reconnect the input power cable to the power supply and turn the power switch on the ac distribution to on.
6. Observe the LEDs and ensure the power supply is functioning properly (refer to Tables 6-1 and 6-2). Observe the LEDs on both the power supply and the storage devices for normal operating indications.
7. Replace the front bezel and ensure the bezel locking tabs snap into place and close the bezel door.
8. Turn on your system.

Replacing a Redundant Power Supply

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.
2. Press the two locking tabs to release the unit, and slide it out of the pedestal (similar to replacing a drive as shown in Figure 6-3).
3. Insert the replacement redundant supply into the guide slots and push it in until the tabs lock into place.
4. Reconnect the input power cable to the redundant power supply and turn the power switch on the ac distribution to on.
5. Observe the LEDs and ensure the power supply is functioning properly (refer to Tables 6-1 and 6-2). 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.

Replacing a Blower

WARNING

Due to hazardous high-current energy levels present in the backplane area, use extreme caution while swapping blowers in the following procedure. 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 during the following procedure.

The pedestal has two blowers mounted at the rear. Connectors on the backplane provide the +12 Volts dc to operate the blowers. As long as one blower is operational, there is sufficient airflow to prevent an overheating condition. When either blower fails, the left shelf status LED on the power supply goes off (refer to Table 6-1). 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. Figure 6-4 shows the removal of a blower.

To replace a blower, use the following procedure:

1. Determine which of the two blowers has failed by feeling the air flow at the bottom of each blower.
2. Open the door on the rear bezel and remove the bezel from the pedestal by pushing down on the locking tabs at the bottom of the bezel.
3. Using a Phillips screwdriver, remove the safety screw in the corner of the blower.
4. Press the side locking tabs to release the blower.
5. Pull the blower straight out to disconnect it from the pedestal power connector.
6. Align the replacement blower connector and insert the module straight in, making sure that both locking tabs are firmly seated in the pedestal.
7. Replace the safety screw in the corner of the blower.
8. Verify that the pedestal and all SBBs are operating properly (refer to pedestal status, Tables 6-1 and 6-2).
9. 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.

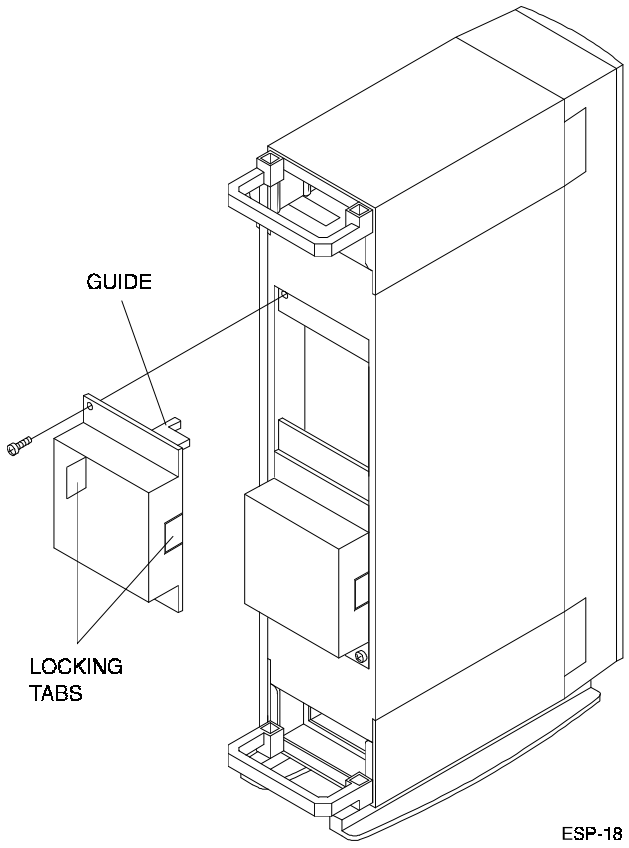

Figure 6-4. Removing a Blower

Replacing the SWXCR Controller

The following procedure describes replacing a defective SWXCR 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 SWXCR controller.

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

Replacing the Controller (and Swapping the EEPROM)

The following procedure describes swapping the EEPROM from a defective SWXCR controller to a new SWXCR controller. Use this procedure in the event that you cannot save the existing configuration to a diskette.

CAUTION

To avoid static damage, follow adequate antistatic 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.

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

Step	Action
1	1. Power off system and storage pedestal(s). 2. Disconnect the cable(s) that connects the controller to the storage pedestal(s) and remove the defective controller. 3. Make note of EISA slot where the board was located.
2	Carefully remove the EEPROM at U33 from the new controller. Label it as "new" and set it aside carefully.
3	Carefully remove EEPROM at U33 from the defective controller and set it aside (out of the way).
4	Take the new board and align the notches of the old EEPROM with the notch at U33 on the new controller to ensure that pin 1 is aligned correctly. Carefully insert the old EEPROM into position U33. **WARNING:** Do **not** bend the pins on the EEPROM.

Continued on the next page.

Step	Action	Result
5	Install the new controller with the old EEPROM into the same EISA slot that the original controller was in. Connect the cable(s) to the storage pedestal(s) and power on the pedestal(s).	

6	Power on the system.	The system displays the following message:
		`Mismatch between NVRAM and flash EEPROM configuration.`
		`Spinning up drives...`

7	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 between NVRAM and Flash configurations.`
		`Press any key to continue`

Continued on the next page.

Step	Action	Result
8	Press a key.	The utilities display the Load Configuration menu.
9	Select the Load FLASH configuration option and press the Enter key.	The utilities display all optimal and hot spare drives connected to the system. The utilities display the following message: `Press 'S' to save the displayed configuration and exit, <ESC> to quit`

10	Press the S key.	The utilities display the following message:
		`Saving configuration, please wait....`
		`Please REBOOT the System HARD reset ONLY`

11	Press the reset button on your system or power the system off and then turn it back on.	

Continued on the next page.

Step	Action
12	Invoke the utilities as described in Chapter 5. Make sure that the system configuration matches the previous configuration.
13	Use the View/Update option on the main menu to verify the status of your drives.
14	Rebuild any failed drives.
15	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.

A

Specifications

This appendix describes the physical and environmental specifications for the StorageWorks RAID Array 200 Subsystem Family products.

Input Power Requirements

Input power requirements for a BA350-KB storage pedestal are determined by the number and type of power units and system building block (SBB) devices.

Power Units

The enclosure can have a redundant power unit to ensure that a power unit failure does not disable the unit. In most cases, battery backup units (BBUs) can be combined with the pedestal power unit to provide extended system data integrity. Table A-1 contains the specifications for the BA350-KB power supply.

Table A-1. BA350-KB Storage Pedestal Power Units

Specifications	BA350–KB
Power unit type	AC input
Input voltage range	90–264 V ac
Nominal input voltage	110 V ac ≈ 2 Amps
Autoranging feature	Yes
Output voltages	12 V dc 5 V dc
Output power	131 W

Sequential device spin-up at 4-second interval mandatory

Charging voltage

Controller Power Requirements

Table A-2 contains the SWXCR controller power requirements.

Table A-2. SWXCR Controller Power Requirements

SWXCR-Ex	Specifications
+5 V dc	+/- 5% @ 3.5 Amps
+12 V dc	+/- 5% @ 0.1 Amps

Physical Specifications

Table A-3 lists the physical specifications of the storage pedestal and system building blocks (SBBs).

NOTE

Depth specifications do not include service area requirements. Position the portable deskside expansion enclosures to allow a front or rear service area of 762 millimeters (30 inches).

Table A-3. StorageWorks Storage Pedestal Physical Specifications

Description	Height mm (in)	Width mm (in)	Depth mm (in)
Storage Pedestal			
Deskside expansion enclosure	578 (22.75)	203 (8.0)	400 (15.75)
System Building Blocks			
3½-inch SBB	121 (4.8)	51 (2.0)	216 (8.5)

Environmental Specifications

StorageWorks environmental specifications in Table A-4 are the same as for other Digital storage devices.

Table A-4. Environmental Specifications

Condition	Specification
Temperature	+10° to +35° C (+50° to +95° F) Deduct 1.8° C for each 1000 m (1.0° F for each 1000 ft) of altitude Maximum temperature gradient 11° C/hr (20° F/hr) ±2° C/hr (4° F/hr)
Rate of change	3° C (5.4° F)
Step change	3° C (5.4° F)
Altitude	From sea level to 2400 m (8000 ft)
Inlet air volume	0.026 cubic m per second (50 cubic ft per minute)
Relative humidity	10% to 90% (non condensing) Maximum wet bulb temperature: 28° C (82° F) Minimum dew point: 2° C (36° F)

Continued on the next page.

Condition	Specification
	Maximum Nonoperating or Storage Environment (Range)
Temperature	
Nonoperating	+18° to +29° C (+65° to +85° F)
Storage	-10° to +55° C (-14° to + 131° F)
Relative humidity	
Nonoperating	10% to 90% (non condensing)
Storage	8% to 95% in original shipping container (non condensing); otherwise, 50% (non condensing)
Altitude	From -300 m (-1000 ft) to +3600 m (+12,000 ft) MSL
Storage period	for periods of up to 3 months

NOTE

Equipment moved from a storage or a transit environment to an operational environment must be allowed to stabilize to the operating environment.

SBB Environmental Stabilization

To ensure proper operation of Digital Equipment Corporation storage devices, the SBB temperature must be within 18–29° C (65-85° F).

CAUTION

Always stabilize storage devices in the operating environment prior to installation or operation. Otherwise, the media or associated electronics may be damaged when power is applied to the unit.

If condensation is visible on the outside of the storage device:

Stabilize the device and the SBB in the operating environment for 6 hours or until the condensation is no longer visible, whichever is longer. Do not insert the storage device into the shelf until it is fully stabilized.

If condensation is not visible on the outside of the storage device:

Let the SBB stabilize at room temperature for at least an hour.

B

Illustrated Parts List

This appendix shows the parts for the StorageWorks storage pedestal.

Table B-1. Illustrated Parts List for the Storage Pedestal

Item	Part Number	Description
1	BA35X-HA	131 W universal AC power supply
2		N/A
3		N/A
4	SWxx3-xx	3.5-inch disk drive
5	BA35X-PA	3.5-inch filler panel
6	BA35X-MA	Fan carrier (blower) assembly
7	BA35X-MB	SCSI backplane active terminator board
8	BA35X-MC	SCSI backplane jumper board*
9	70-29914-01	AC distribution unit

* Part number located on back of part.

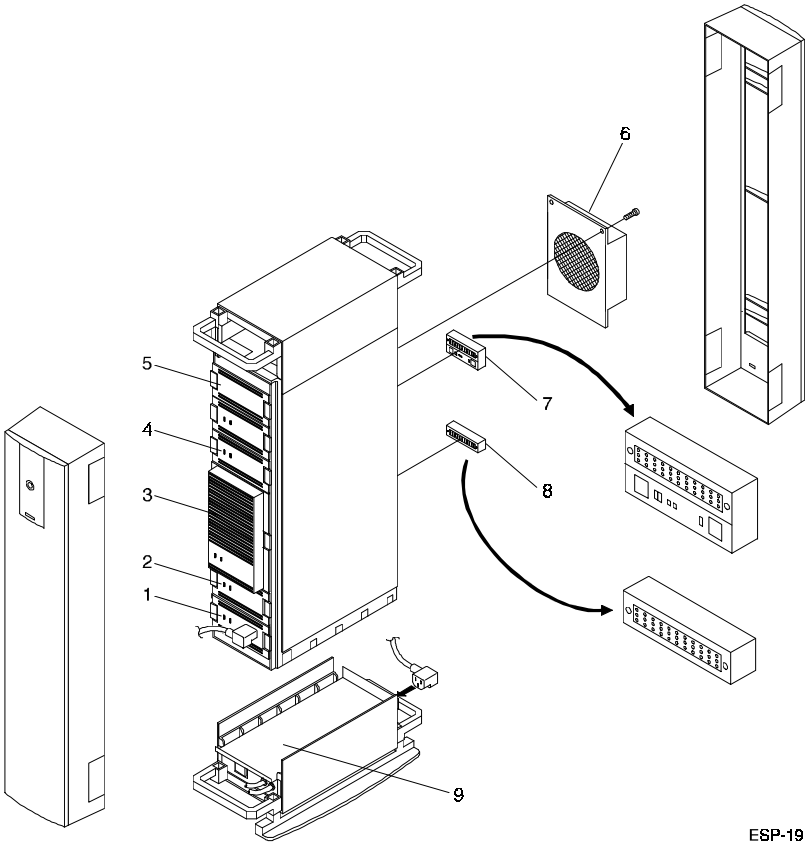

Figure B-1. Pedestal Field Replaceable Parts

C

MS-DOS Verification Procedure

This appendix describes the MS-DOS verification procedure for the Standalone RAID Array 200 Software.

Verifying the Subsystem under MS-DOS

For Intel system only, you can verify the operation of your subsystem using the Standalone RAID Array 200 Software diskette to create an MS-DOS file system on your subsystem (for testing purposes).

Use the following steps to test your subsystem.

1. Boot your system using the Standalone RAID Array Software Vx.x for Intel Systems diskette.
2. Create and initialize a logical RAID drive (see Chapter 5).
3. Exit the utilities.
4. Run the **fdisk** utility to create a DOS partition on your subsystem.

NOTE

Consult your MS-DOS system manual for information on the fdisk utility. The maximum size for an MS-DOS file system is 2048 blocks.

5. Use the **format** command to format the MS-DOS file system.
6. Copy files from a diskette to the file system.

Using the Controller under Windows V3.1

In order to use the SWXCR controller under the Windows V3.1 operating system, the SWXCRWIN.SYS driver that is included on the Standalone RAID Array 200 Software diskette must be loaded into your CONFIG.SYS file using the following command:

```
DEVICE=C:\DOS\SWXCRWIN.SYS
```

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