



# RAID Array 230/Plus Subsystem RAID Management Utility for Windows NT

---

## User's Guide

AA-R07DA-TE

**Digital Equipment Corporation  
Maynard, Massachusetts**

**Initial Printing, November, 1996**

---

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation. Digital Equipment Corporation assumes no responsibility for any errors that might appear in this document.

The software described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license. No responsibility is assumed for the use or reliability of software or equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

Copyright © Digital Equipment Corporation. 1996  
All rights reserved.

Printed in U.S.A.

The following are third-party trademarks:  
Microsoft and MS-DOS are registered trademarks of Microsoft Corporation.  
Windows NT is a trademark of Microsoft Corporation.  
Mylex is a registered trademark of Mylex Corporation.

The following are trademarks of Digital Equipment Corporation:  
The Digital logo and StorageWorks.

---

# *Contents*

---

- Revision Record** ..... v
- About This Guide** .....vii
- 1 Installing the RAID Management Utility for Windows NT**
  - 1.1 Load the Windows NT Driver ..... 1-1
    - 1.1.1 If Windows NT Is Already Installed on Your Computer ..... 1-1
    - 1.1.2 If Windows NT Is Not Already Installed on Your Computer ..... 1-2
  - 1.2 Install RAID Array 230/Plus RAID Management Utilities ..... 1-2
  - 1.3 Partition a Logical RAID Drive ..... 1-2
  - 1.4 Format the Partition ..... 1-3
  - 1.5 Installing a Tape or CD-ROM Device ..... 1-3
- 2 Using the Utilities**
  - 2.1 Monitoring the Subsystem ..... 2-1
  - 2.2 Managing the Subsystem ..... 2-1
  - 2.3 Finding Out About the Configuration ..... 2-3
    - 2.3.1 About the Logical RAID Drive ..... 2-3
    - 2.3.2 About Logical Drive Mapping ..... 2-3
    - 2.3.3 About the Drive Information ..... 2-4
    - 2.3.4 About Making a Hot Spare ..... 2-6
  - 2.4 Maintaining the Subsystem ..... 2-6
    - 2.4.1 Rebuilding a Disk Drive ..... 2-8
    - 2.4.2 Controlling the Rebuilding Rate ..... 2-8
    - 2.4.3 Failing a Disk Drive ..... 2-9
    - 2.4.4 Checking the Logical RAID Drive Consistency ..... 2-10
- Readers Comment Form**.....Inside Back Cover

**Figures**

2-1	Map of a Logical RAID Drive .....	2-4
2-2	Display of the Current Disk Array .....	2-4
2-3	Actions for Maintaining the RAID Subsystem .....	2-7
2-4	Dialog Box for the Parity Check .....	2-10

**Tables**

2-1	Functions of the Utility – Management Menu .....	2-2
2-2	Functions of the Utility– Configuration Menu .....	2-2
2-3	Specifications for a Logical Drive .....	2-3
2-4	Type of Errors .....	2-5

## *Revision Record*

---

*This Revision Record provides a concise publication history of this manual. It lists the manual revision levels, release dates, and reasons for the revisions.*

---

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

<b>Revision Level</b>	<b>Date</b>	<b>Summary of Changes</b>
AA-R07DA-TE	November 1996	Original release. This release supports the StorageWorks RAID Array 230/Plus RAID Management Utility for Windows NT.



## *About This Guide*

---

*This guide describes how to install and load the StorageWorks RAID Array 230/Plus RAID Management Utility for Windows NT and how to monitor and maintain your RAID Array 230/Plus Subsystem.*

---

### **Audience**

This guide supports the user of a Windows NT system with a StorageWorks RAID Array 230/Plus Subsystem. You should be familiar with StorageWorks RAID terminology.

### **Related Documentation**

*RAID Array 230/Plus RAID Configuration Utility User's Guide*

*RAID Array 230/Plus Release Notes*

*Microsoft Windows NT Operating System* documentation.

Consult the Release Notes accompanying your software kit for the latest RAID Array 200 Documentation titles and part numbers.

#### **NOTE**

Please read the Release Notes accompanying your RAID Array 230/Plus software kit for important information not found in this manual.

### **Organization**

This guide contains the following sections:

**Chapter 1: *Installing the Software*** — Describes how to load the Windows NT driver and the configuration utilities on a system with an existing Windows NT operating system and on one in which Windows NT is not yet installed.

**Chapter 2: *Using the Utilities*** — Describes how to use the utilities to monitor and maintain the StorageWorks RAID Array 230/Plus Subsystem.

## Typographic Conventions

This guide uses the following conventions:

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

## Glossary

*Adapter:* This manual uses the terms *adapter* and *controller* interchangeably. A controller is a specific kind of adapter.

*Dead:* Condition of a logical drive when two or more associated physical devices in a redundant logical drive are FAILED, or one or more associated physical devices in a non-redundant logical drive have FAILED.

*Degraded:* The resultant condition of logical drive(s) when one physical device associated with the redundant logical drive is FAILED.

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

*Drive group:* A set of disk devices that are addressed as a single unit.

*FAILED:* A disk drive is not accessible by the controller.

*GB:* The size in gigabytes. A gigabyte equals 1 073 741 824 bytes.

*Hot Spare:* A good disk drive that has been designated to be used when another physical drive fails in a redundant logical drive.

*Logical RAID drive:* A section of storage space presented to the operating system as a single virtual device.

*MB:* The size in megabytes. A megabyte equals 1 048 576 bytes.

*Optimal:* The logical drive(s) and the associated physical device(s) are in good condition.

*Parity Check:* A logical drive is being tested for consistency.

*RAID:* An acronym for a redundant array of independent (or inexpensive) disks.

*RAID level:* A value that specifies the type of data management in an array of drives.

*Rebuild:* The process of transferring data to a replacement hard disk.



*Write-back caching:* A caching policy in which the controller acknowledges that a write operation has completed successfully before the 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 risk losing data in cache that is not yet written to the disks. This risk can be reduced by use of the battery backup option when write-back caching is employed.

*Write Only:* Status of a physical device during the Rebuild process.

*Write-through caching:* A caching policy in which the data is written to the disks before the controller acknowledges that a write operation has completed successfully. If you choose this caching policy and there is a power failure, you minimize the chance of data loss.



# 1

## *Installing the RAID Management Utility for Windows NT*

---

*After installing and configuring the RAID Subsystem, you can now install the StorageWorks RAID Array 230/Plus Management Utility for Windows NT. The software consists of the Monitor utility and the RAID Management utility.*

---

### **1.1 Load the Windows NT Driver**

The procedure for loading the Windows NT driver software depends on whether the Windows NT operating system is installed or is going to be installed at the same time as the RAID Subsystem software. If you have not yet installed the RA230/Plus controller, follow the instructions for doing so in the *RAID Array 230/Plus Subsystem Installation Guide* before proceeding with the driver installation.

#### **1.1.1 If Windows NT Is Already Installed on Your Computer**

This procedure copies the driver software to the system disk. Before you perform this procedure:

- Log into the Windows NT system with Administrator privileges.
- Verify that you have at least 1 MB of free disk space.

Refer to your *Microsoft Windows NT Operating System* documentation for instructions to add a SCSI adapter to your system. During this procedure you will be asked for the type of adapter to be added. The RA230/Plus controller uses the Mylex DAC960/SWXCR-EX device driver. Complete the SCSI device installation procedure using the driver provided on your Windows NT distribution media.

Shut down the system and reboot Windows NT. If the system fails to start properly, see the *Microsoft Windows NT Operating System* documentation for troubleshooting information.

The driver is now installed and the controller is active.

### **1.1.2 If Windows NT Is Not Already Installed on Your Computer**

Follow the directions from Microsoft Windows NT Installation Guide to install Windows NT onto your platform. The installation procedure will perform mass storage device detection and identify the presence of a RAID Array 200 series controller as a Mylex DAC960/ SWXCR-EX device. Confirm this when prompted and complete the installation Windows NT on your system.

After completing the installation of Windows NT, the driver is now installed and the controller is active. Follow the on-line instructions to complete the installation of the Windows NT operating system.

## **1.2 Install the RAID Array 230/Plus RAID Management Utilities**

This procedure creates a StorageWorks program group and icons for the utilities by installing the executable files to a user-specified directory. The monitor utility is installed as a system service. This setup utility can also be used to remove the RAID Array 230/Plus RAID Management Utilities.

1. Insert the RAID Array 230/Plus RAID Management Utility for Windows NT floppy diskette into your system's floppy drive.
2. From the Program Manager's File menu, choose Run.
3. Type **a:\setup** and follow the instructions to either install or remove the RAID Management Utilities.
4. When the process is complete, the system displays the icons in the StorageWorks program group.
5. To start the monitor service, reboot the operating system, or start the service manually from the control panel.

## **1.3 Partition a Logical RAID Drive**

Each logical RAID drive in the RAID Subsystem must be partitioned. Use the Windows NT Disk Administrator to partition the logical RAID drives according to your storage requirements. See the chapter on the Disk Administrator in Microsoft's *Windows NT System Guide* for more information on partitioning. The following procedure partitions a logical RAID drive.

1. In the Administrator Tools window, click on the Disk Administrator icon to display a graphic representation of the existing partitions. The free space represents the disk space of the logical RAID drive.
2. Choose Create from the Partition menu.

3. Specify the size of the new partition. The Disk Administrator assigns a letter to identify the logical RAID drive. Repeat for each partition.
4. When you are finished partitioning, choose Commit Changes Now from the Partition menu and proceed to format the partition as explained in the next section.

#### 1.4 Format the Partition

Format the logical RAID drive in the same way you format other drives. To format from the *Tools* menu within the Disk Administrator, see the chapter on the Disk Administrator in Microsoft's *Windows NT System Guide*. The following procedure formats a logical RAID drive from an MS-DOS window.

##### NOTE

Do not define a Windows NT bootable partition larger than 2 GB. Refer to your Microsoft *Windows NT System Guide* for additional information on partition size for bootable partitions.

1. Click on the MS-DOS Prompt icon.
2. Type **format /fs:file\_system x:** where *file\_system* is one of the Windows NT formatting options and *x* is the letter assigned to the logical RAID drive.
3. Enter a label at the prompt.
4. Type **Exit** to return to Windows NT.

The Windows NT operating system can now use the RAID Subsystem.

#### 1.5 Installing a Tape or CD-ROM Device

The RA230/Plus supports Tape and CD-ROM devices under the Windows NT operating system. You can install any Tape or CD-ROM device that is listed in the Release Notes.



# 2

## *Using the Utilities*

---

*The RAID Array 230/Plus RAID Management Utility for Windows NT provides the following utilities to maintain the RAID Subsystem: SWXCR Monitor shows the status of the subsystem and the SWXCR Manager displays or changes the configuration of the disk drives. Using information reported by the Monitor, use the Manager to take action.*

---

### **2.1 Monitoring the Subsystem**

The Monitor utility runs continuously to record the actions of the controllers. It forwards actions recorded about logical drives and failed disk drives to the Windows NT Event Viewer.

To view significant controller actions, use this procedure:

1. Invoke the Event Viewer in the Administrative Tools program group.
2. Select Application from the *Log* menu.
3. Look for entries with the label: *swxcrsrv*

#### **NOTE**

The state of the array may be monitored remotely via the *Event Viewer* using the "Select Computer" menu selection.

### **2.2 Managing the Subsystem**

The utility displays the current configuration and status of the disk drives. Use this utility to make the following changes:

- Rebuild a *Failed* disk drive.
- *Fail* a disk drive in order to replace it with another.
- Check the consistency of a logical drive.

To invoke the utility, click on the Manager icon; another window opens with the Management, Configuration, and Help menus available. The functions available on the Management menu are listed in Table 2 –1. The functions available on the Configuration menu are listed in Table 2 –2.

**Table 2–1 Functions of the Utility — Management Menu**

Function	Meaning
Select Adapter	Specifies the controller. All information displayed by the other functions refers to this controller.
Rebuild Rate	Specifies the priority of a rebuild operation.
Rebuild Drive	Reconstructs the data from a failed disk drive onto a new one.
Parity Check	Checks the consistency of data in the disks of a logical drive with a redundant level.
Fail Drive	Changes the state from OPT (optimal) to FAIL.
Make Optimal	Changes the state from FAIL to OPT.

**Table 2–2 Functions of the Utility — Configuration Menu**

Function	Meaning
Select Adapter	Specifies the controller. All information displayed by the other functions refers to this controller.
Logical Drive	Displays the status and errors of the logical drive.
Logical Drive Mapping	Identifies the disk drives in a logical drive.
Device Information	Displays the current configuration, status, and errors of drives.
Make HotSpare	Makes a failed disk drive a HotSpare.

If the subsystem has two controllers, use the Select Adapter function to specify the controller with which you want to work. If the subsystem has one controller, you do not need to identify it. Use the following procedure to specify the controller or to find out how many are installed:

1. Click on the Select Adapter function on the Options menu. The Manager utility displays a dialog box with buttons labeled for each controller.
2. Click on the button for the controller you want. All the information and actions of the remaining Manager functions affect the disk drives of this controller.

To exit from the utility, click on the window's Close button.



## 2.3 Finding Out About the Configuration

If you are investigating a problem with a disk drive, use *Configuration* menu. To find out how a disk array has been configured, follow these steps:

1. Use the Logical Drive function to find out how many logical drives have been defined.
2. Use the Logical Drive Mapping function to find out which physical disk drives are in which logical drives.
3. Use the Device Information function to find out about a specific disk drive.
4. Use the Make HotSpare function if you want to make a failed drive a hot spare.

### 2.3.1 About the Logical Drive

Use the Logical Drive function to display information about the collection of disk drives. When you click on this function, the Manager utility displays a dialog box with the information shown in Table 2–3. You cannot change any of these specifications.

**Table 2–3 Specifications for a Logical Drive**

Number	RAID Level	Write Policy	Size	Status
0 through 7	0, 1	WTH (Write-through)	MBs	Optimal
	0+1, 5	WB (Write-back)		Degraded
	JBOD			Dead

For an explanation of the terms used in the table, see the Glossary section of *About this Manual* in this guide.

### 2.3.2 About Logical Drive Mapping

Use the Logical Drive Mapping function to display information about the drive groups within each logical drive. When you click on this function, the Manager utility displays a dialog box that shows the specifications for each logical drive, similar to Figure 2–1.

**Figure 2-1 Map of a Logical Drive**

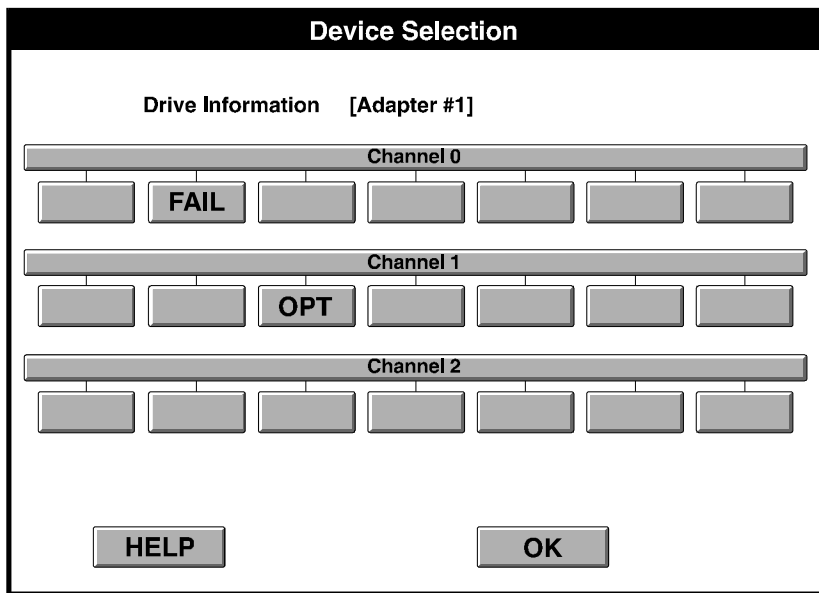
```
Logical Drive 0
  RAID 1
    Span 0 [Channel:Id]> 0:1 1:2
```

The display shows how the physical disk drives have been assigned to the logical drives. The disks are identified by channel and position, using the form: *channel ID::SCSI ID*.

### 2.3.3 About the Drive Information

Use the Device Information function to display information about the way the disk drives are operating. When you click on this function, the utility displays the graphic representation of the disk array shown in Figure 2-2. Each box represents a disk drive and the box label is the status of the disk drive: optimal, failed, or spare. The utility identifies non-disk devices with TAP (for Tape), or CD (for CD-ROM) in their boxes instead of a status.

**Figure 2-2 Display of the Current Disk Array**



R07DA-001

To find out more about a particular disk drive, click on its box. The utility displays a catalog of the errors that have been logged for the disk drive, as described in Table 2–4. The controller fails a disk drive with too many hard, parity, or miscellaneous errors, but it does not act on soft errors. If the disk drive is accumulating soft errors, you must replace the disk drive. After selecting OK, the Device Selection menu is redisplayed.

**NOTE**

All counters are reset to zero on each power cycle of the controller.

**Table 2–4 Type of Errors**

<b>Errors</b>	<b>Description</b>	<b>Limits</b>
Soft	Condition or data errors	Replace the disk drive when the rate of errors increases or the count exceeds 100
Hard	Hardware malfunction	Controller fails the drive at about 2 - 4 errors
Parity	SCSI bus error during transfer	
Miscellaneous	Time out, for example	Controller fails the drive at about 40 errors
Model Type	Identifies the type of drive	

### 2.3.4 About Making a Hot Spare

**NOTE**

The Hot Spare must have a storage capacity equal to or greater than any drive it would potentially replace.

Use the Make HotSpare function to designate a drive as one to be used for an automatic rebuild. The drive must have a FAIL status and not be part of a drive group. When you click on this function, the utility displays a graphic representation of the disk array similar to that shown in Figure 2 –2. Any drive that is failed can be selected to make a hot spare.

## 2.4 Maintaining the Subsystem

Your maintenance goal is to keep the logical drives in the Optimal state. This means that all disk drives assigned to the logical drive are available. If a disk drive fails, what happens next depends on the following conditions:

- RAID level
- Whether or not a hot spare disk drive is available
- Whether or not another disk drive fails before you restore the logical drive to the Optimal state
- Logical drive consistency

Use the chart in Figure 2–3 to determine your actions. To minimize the chance of data loss, replace a FAILED disk drive as soon as possible.

**Figure 2–3 Actions for Maintaining the Subsystem**

<b>If a disk drive fails on a RAID 0 or JBOD subsystem:</b>	
<p>Status of logical drive changes from Optimal to Dead.</p> <p>You replace the failed disk drive.</p> <p>You restore the data from a backup source.</p>	
<b>If a disk drive fails on a RAID 1, 0+1, or 5 subsystem:</b>	
Status of logical drive changes from Optimal to Degraded	
<b>Hot Spare available:</b>	<b>No Hot Spare available:</b>
<p>Controller rebuilds data on the hot spare.</p> <p>Status of logical drive returns to Optimal.</p> <p>You replace the failed disk drive. If the controller's StorageWorks Fault Management has been enabled, the new disk becomes the hot spare automatically. If StorageWorks Fault Management is not enabled, you define the new disk as the hot spare using the utility.</p>	<p>You replace the disk drive.</p> <p>Controller rebuilds data on the new disk drive automatically if Fault Management is enabled, otherwise you will have to use the Rebuild option.</p> <p>Status of logical drive returns to Optimal.</p> <p>You may want to consider designating a hot spare.</p>
<b>If a second disk drive fails in the same logical drive:</b>	
<p>Status of logical drive changes from Degraded to Dead.</p> <p>You replace the failed disk drives.</p> <p>Initialize the logical drive using the utility</p> <p>Status of logical drive changes from Dead to Optimal</p> <p>Restore data from a backup source</p>	

### 2.4.1 Rebuilding a Disk Drive

If you have a nonredundant configuration (RAID 0) and a disk drive fails, all of the data is lost. If the disk drives are in a redundant configuration (RAID 1, RAID 0+1, and RAID 5) and a disk drive fails, you can rebuild the disk drive by reconstructing the data. A rebuild of a disk drive occurs in the following ways:

- **Hot Spare:** If one of the disk drives is defined as a hot spare, the controller rebuilds the data onto the hot spare automatically.
- **Hot Swap:** If the controller's Fault Management option has been enabled and you replace a disk drive while the subsystem is operating, the controller rebuilds the data onto the new disk automatically.
- **Manual Rebuild:** If you failed a disk drive or if an automatic rebuild is in progress, you can start the rebuild process.

To perform a manual rebuild, use the following procedure.

Remove the failed disk drive and put in a new disk drive. The status of the new disk drive remains as FAIL.

1. Click on the Rebuild Drive function on the Options menu. The controller starts the new disk drive.
2. Select the disk drive from the graphic display. The controller rebuilds the data on the new disk drive. The rebuild status bar gradually fills as the process completes. During the process, the status is displayed as three dots (. . .)
3. When the bar displays 100%, click on the OK button in the confirmation box. The status is now OPT.

### 2.4.2 Controlling the Rebuilding Rate

The rebuilding process runs at the priority you designate. Use the Rebuild Rate function to specify the priority of the rebuild process, whether performed automatically or manually.

A rate of 50 is the fastest and causes the rebuild process to run at equal priority with other disk operations. The rate of 0 is the slowest, and causes the process to run only when there is no other disk activity. As a guideline, allow 20 minutes to rebuild 1 GB of data when the rebuild rate is set at 50 with minimal disk activity.

1. Click on the Rebuild Rate option. The dialog box displays a slider scale that runs from 0 to 50.
2. Click on the bar or the arrow buttons to specify a rate. Do not attempt to drag the slider. The rate is updated.
3. Click on OK. The new rate is in effect.

### 2.4.3 Failing a Disk Drive

Drives log different types of errors. For most types of errors, when a drive logs many of them, the controller will automatically fail it to stop activity to that drive. The controller will not fail a drive logging many soft errors. Therefore, if a drive logs many soft errors, to stop activity to it, you need to manually fail that drive. To fail a disk drive, follow these steps:

#### NOTE

When you click on a disk drive, the utility fails the drive immediately, without a confirmation step. If you click on the wrong disk drive, use the Rebuild Drive to recover the data.

When a disk drive is manually failed, it is expected that the user will replace the disk drive. Therefore, a Hot Spare will not be used to perform a Rebuild of the logical drive.

1. Select the Fail Drive function. The utility displays a graphic similar to Figure 2-2.
2. Click on the disk drive. The status changes to FAIL. The status of the logical drive is now Degraded.

### 2.4.4 Checking the Logical Drive Consistency

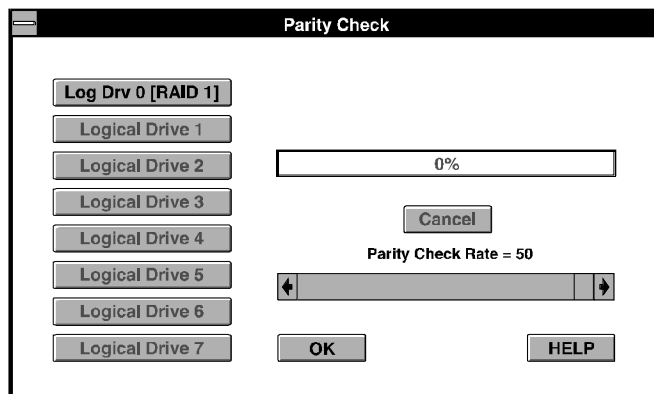
Use the Parity Check function to check a logical drive for the consistency of the parity information. Run this utility after a power failure or system crash to verify the integrity of parity information on logical drives. This utility is only available for redundant RAID levels (RAID 1, RAID 0 + 1, and RAID 5).

The Parity Check function reads the data from the logical drive and computes the expected parity information for each series of blocks. It compares the computed parity to the stored parity information on the drives and can rebuild the data if needed. If you choose not to fix the inconsistent parity information, your data may not be reconstructed correctly when you rebuild a disk drive.

To perform a parity check, use the following procedure:

1. Click on the Parity Check function. The Manager utility displays a dialog box similar to Figure 2–4.
2. To change the priority of the operation, click on the Parity Check Rate bar or its arrows.
3. Click on the logical drive.
4. Click on OK. The utility asks if you want to rebuild the data if the parity check is inconsistent.
5. Click on Yes. The utility checks the data and reports its progress as a percent. You can interrupt the check at any time by clicking on the Cancel button. When the checking process is completed, the utility displays a confirmation box.
6. Select Yes to confirm.

Figure 2–4 Dialog Box for the Parity Check



R07DA-002



## *Reader's Comments*

**Manual Order Number:**  
AA-R07DA-TE

Digital is committed to providing the best products and services. Since our manuals are important components of our products, we value your comments, corrections, and suggestions for improvements. Please take a few minutes to fill out and return this form. Attach additional sheets, if necessary. Thank you.

<b>Manual Rating</b>	Excellent	Good	Fair	Poor
Accuracy (correct presentation of facts)	[ ]	[ ]	[ ]	[ ]
Completeness (adequate information)	[ ]	[ ]	[ ]	[ ]
Clarity (easy to understand)	[ ]	[ ]	[ ]	[ ]
Organization (logical sequence of information)	[ ]	[ ]	[ ]	[ ]
Layout (easy to follow subject matter)	[ ]	[ ]	[ ]	[ ]
Indexing (easy to locate desired information)	[ ]	[ ]	[ ]	[ ]

**Errors Noted** (include page, paragraph, table or figure number) \_\_\_\_\_

**Most-Liked Features:** \_\_\_\_\_

**Least-Liked Feature** \_\_\_\_\_

**Suggestions for Improvement** \_\_\_\_\_

<b>Return Address:</b>	Name _____ Phone _____
Digital Equipment Corporation	Title _____
Customer Research	Company _____
Response Center	Street Address _____
334 South Street, SHR3-2/W3	Mail Stop _____
Shrewsbury, MA 01545	City _____ State _____ ZIP _____
	Country (if other than USA) _____

