

# Bull

## **Ultra SCSI PCI RAID Adapter Reference Guide**

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## Ultra SCSI PCI RAID Adapter Reference Guide

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### Hardware

November 1999

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## About This Book

This manual provides information for the Ultra SCSI PCI RAID Adapter. Topics covered include an introduction to the adapter, installing, and information about performing tasks necessary to manage an adapter and determine problems.

### Who Should Use This Book

This book is intended for system administrators and system programmers. These are persons responsible for installing and maintaining the system. To use this book, you must already be familiar with AIX commands, utilities, and procedures.

### How to Use This Book

The following overview briefly describes the contents of each chapter:

- Chapter 1, “Ultra SCSI PCI RAID Adapter Overview,” presents adapter concepts and features of the PCI RAID Adapter.
- Chapter 2, “Installing the Ultra SCSI PCI RAID Adapter,” provides procedures for the installation of the PCI RAID Adapter software.
- Chapter 3, “Managing the Ultra SCSI PCI RAID Adapter,” provides information and procedures for changing subsystem characteristics, creating, deleting, and managing disk arrays.
- Chapter 4, “Ultra SCSI PCI RAID Adapter Problem Determination and Recovery,” provides information to assist you in determining and recovering from error conditions.

### Highlighting

The following highlighting conventions are used in this book:

<b>Bold</b>	Identifies commands, subroutines, keywords, files, structures, directories, and other items whose names are predefined by the system. Also identifies graphical objects such as buttons, labels, and icons that the user selects.
<i>Italics</i>	Identifies parameters whose actual names or values are to be supplied by the user.



**Monospace** Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or information you should actually type.

## ISO 9000

ISO 9000 registered quality systems were used in the development and manufacturing of this product.

## Related Publications

The following books contain information about or related to the *Ultra SCSI PCI RAID Adapter*:

- *Diagnostic Information for Multiple Bus System*, Order Number SA38-0509.
- *The RAID book, A Source Book for Disk Array Technology*, Edition 4.  
Published by: The RAID Advisory Board, St. Peter, MN, 1994
- *AIX Version 4 System Management Guide: Operating System and Devices*, Order Number SC23-2525

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You can order publications from your sales representative or from your point of sale.

If you received a printed copy of *AIX and Related Products Documentation Overview* with your system, use that book for information on related publications and for instructions on ordering them.

To order additional copies of this book, use order number SC23-4302.



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## Chapter 1. Ultra SCSI PCI RAID Adapter Overview

Redundant Array of Inexpensive Disks (RAID) technology offers the user these primary features:

- Larger disk capacity
- Immediate availability/recovery of data
- Redundancy of data at a user-selected level
- Enhanced Performance

Using RAID technology, data is stored across a series of disk drives known as a *disk array*. Depending on the RAID level selected, this storage technique provides the data redundancy required for a secure system without depleting memory, and may have the further advantage of faster retrieval through multiple channel access. Also, in the event of hardware failure, a single disk drive can usually be replaced without interrupting normal system operation.

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### Disk Arrays

Disk arrays are groups of disk drives that work together with a specialized array controller to achieve higher data-transfer and input and output (I/O) rates than those provided by single large drives. The array controller keeps track of how the data is distributed across the drives.

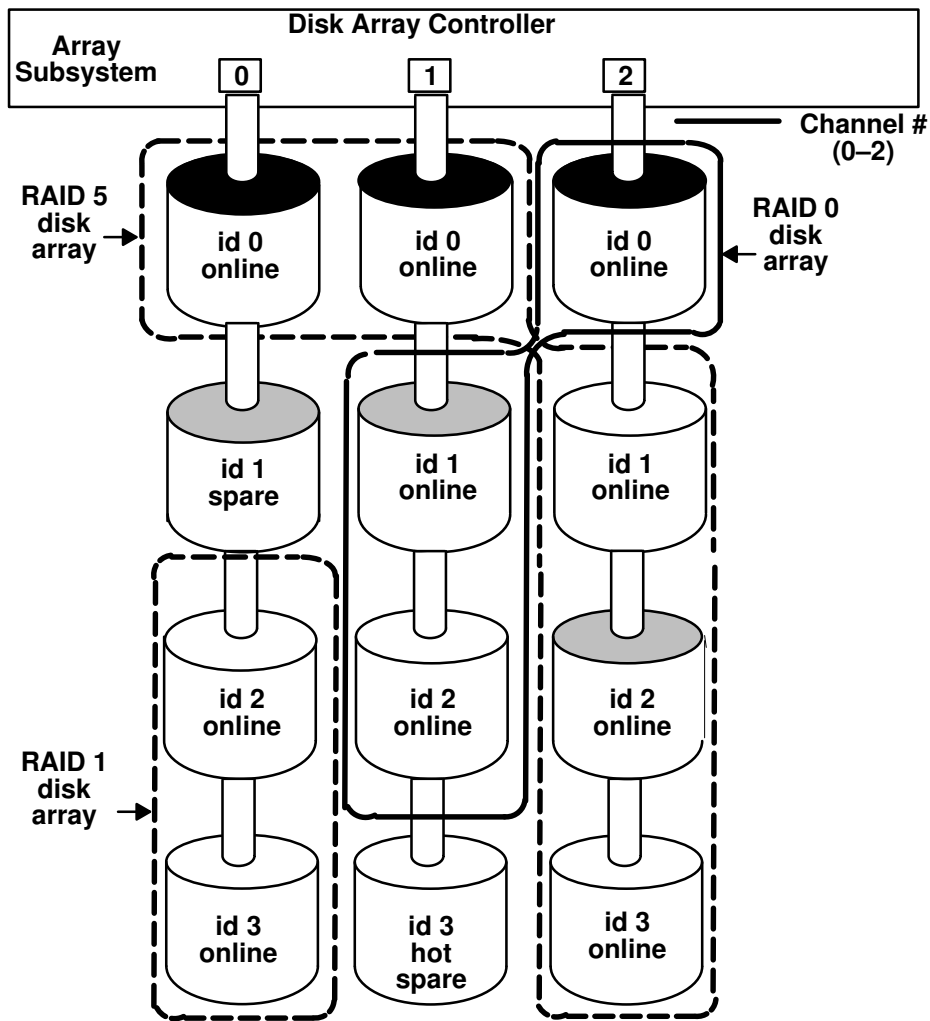
Redundant disk arrays can also provide data redundancy, so that no data is lost if a single drive in the array fails. Two methods of writing data to the disk drives are used in a RAID subsystem:

- |                  |  |
|------------------|--|
| <b>striping</b>  | Data for a given file may be written in stripe units to different drives in the array, rather than being written to a single drive. By using multiple drives, the array can provide higher data-transfer rates and higher I/O rates when compared to a single large drive. |
| <b>mirroring</b> | Data that is simultaneously written to two separate disks within the same array.   |



The method used for writing the data to an array is determined by the RAID level defined for that array and the number of drives used. "RAID Levels" on page 1-4 discusses the various RAID levels and their function in detail.

The Disk Arrays and Channels figure illustrates the terms used in describing disk arrays.



Disk Arrays and Channels



Each disk array is viewed as a single logical device with a unique disk name and location code.

Each disk array has its own array parameters (for example, RAID level and capacity). A disk array is treated as a single disk drive by the operating system. There are no special requirements for using it. AIX commands and utilities work on disk arrays just as they would with single non-RAID drives.

For example, after you configure a disk array with the PCI SCSI Disk Array Manager (PDAM), you can use AIX commands to make the disk array available to the system by adding it to a volume group, creating a file system on it, and so on. Raw I/O is also supported on disk arrays. When adding a disk array to your system, treat it in the same way you would treat a single disk drive.

**Note:** Diagnostic open and SCSI passthrough are not supported on disk arrays.

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## RAID Levels

Each *RAID level* reflects a different design architecture in terms of error recovery available when a part of the system fails. Depending on the RAID level chosen, (with the exception of RAID level 0), if a single drive fails within an array, the data from that disk can be reconstructed from the data stored on other hard drives within the array. This data can be reconstructed or “put back into service” with little or no impact to the users and programs that are using the the system at the time of the failure.

The levels of RAID supported varies between different hardware and software platforms, but the most common levels supported are 0,1, 3, and 5.

**Note:** The Ultra SCSI PCI RAID Adapter supports RAID levels 0, 1, and 5.

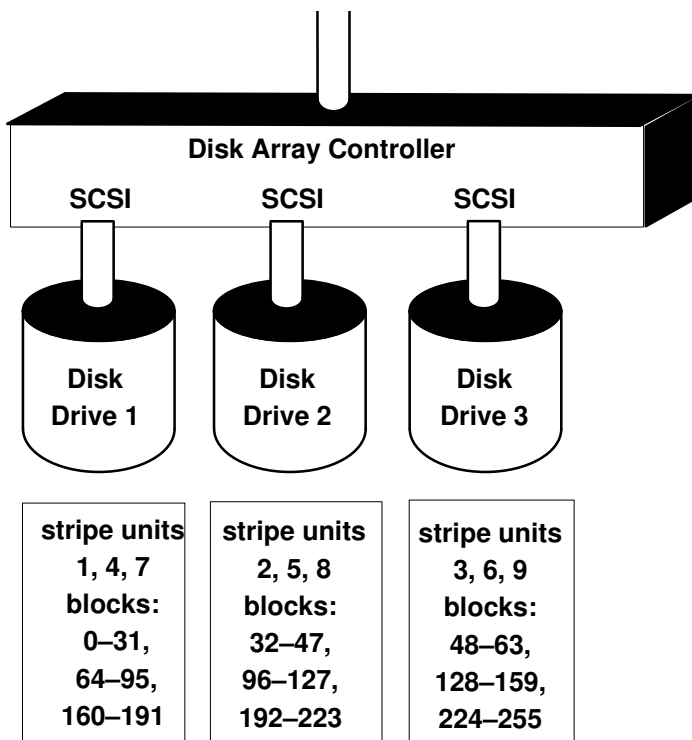
Each of the levels supported by the Ultra SCSI PCI RAID Adapter uses a different method of writing data to provide specific benefits with each method. For example, RAID level 5 creates *array parity* information in order to reconstruct data lost because of a drive failure in the array. RAID level 1 maintains a duplicate copy of the data in order to reconstruct data lost because of drive failure. RAID level 0 does not provide data redundancy, but it provides a potentially higher I/O rate. The following information provides details about RAID levels 0, 1, and 5.



## RAID Level 0

**Attention:** It is critical that you regularly back up data on a RAID level 0 array. This is the only way to recover data in the event of a disk drive failure. The ability to recover data on the array depends on the backup procedures you have established.

RAID level 0 writes data across the drives in the array, one stripe unit at a time. In this example, a stripe unit is defined as 32 blocks of 512 bytes each (16K stripe unit size), as shown in the RAID Level 0 figure. For a 128K write, blocks 0 through 31 are written to drive 1, blocks 32 through 47 are written to drive 2, blocks 48 through 63 are written to drive 3 and so on as each drive has a single stripe unit written to it. Finally, blocks 224 through 255 are written to drive 3 to complete the write operation.



RAID Level 0



The host system treats a RAID level 0 array like a standard disk drive. RAID level 0 errors are reported in the same way as normal drive errors, and the recovery procedures are the same as those used on a standard disk drive. For example, if a drive fails, the array controller returns the same errors that occur during a read or write retry failure. All data on the array may be lost. However, unlike other RAID levels, the array controller never marks a RAID level 0 array as degraded as the result of a drive failure. If a physical drive fails in a RAID 0 disk array, the disk array is marked as dead.

RAID level 0 offers a higher potential I/O rate, but is a non-redundant configuration. That is, there is no array parity information generated for the purpose of reconstructing data in the event of a drive failure. Therefore, there is no error recovery beyond what is normally provided on a single drive. All data in the array must be backed up regularly to protect against data loss.

## RAID Level 1

**Attention:** Though a RAID level 1 array has data redundancy, you should regularly back up data on the array. This is the only way to recover data in an event such as accidental file deletion or disaster recovery. You can continue to operate the array in degraded mode until you replace the drive. However, you should replace the drive as soon as possible. If you cannot replace the drive immediately, back up your data file by file to prevent potential data loss.

RAID level 1 transparently mirrors data by duplicating data stripes across drives. When data is written to a drive, it is also written to a mirrored stripe.

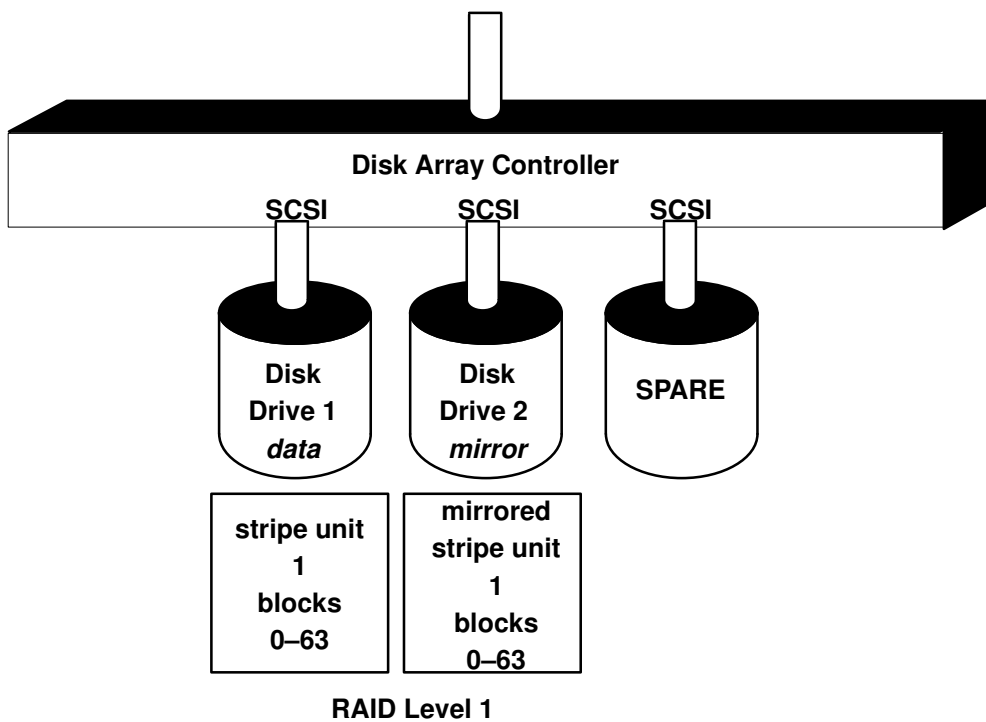
Traditionally, RAID level 1 has been used for critical fault-tolerant transaction processing. Mirrored data provides high reliability. When a small block size is used, mirrored data also provides a high I/O rate. However, RAID level 1 is a more costly RAID solution because it requires a mirrored data stripe for every physical drive in the array.

RAID level 1 writes data across the drives in the array, one stripe unit at a time. In this example, a stripe unit is defined as 64 blocks of 512 bytes each (32K stripe unit size) as shown in the RAID Level 1 figure. For a 32K write, blocks 0





through 63 are written to drive 1 and the mirrored data blocks 0-63 are written to the mirrored data drive .



If a single drive fails in a RAID level 1 array, you can continue to use the array. A RAID level 1 array operating with a single failed drive is said to be operating in *degraded mode*. Whenever you read or write to a disk array in degraded mode, the array controller retrieves the failed drive's data from its mirrored drive. Although you can continue to operate the RAID level 1 array with a failed drive, you should replace the drive and restore the array as soon as possible.

Using the Perform Consistency Check menu allows the array controller to compare the data drive and mirror to verify consistency after an abnormal system shutdown. See "Performing a Consistency Check on a Disk Array" on page 3-13.



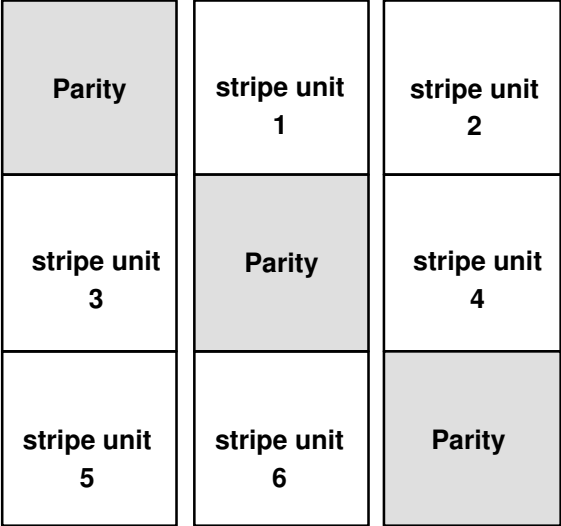
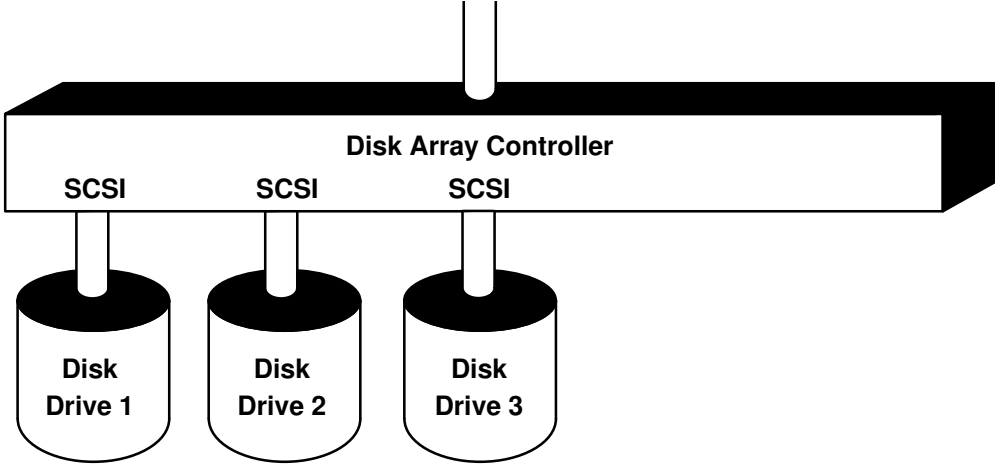
## RAID Level 5

**Attention:** Even though a RAID level 5 array maintains parity information, it is still important that you regularly back up data on the array. This is the only way to recover data, for example, in the event of accidental file deletion or disaster recovery. You can continue to operate the array in a degraded mode until you can replace the drive. You should replace the drive as soon as possible. If you cannot replace the drive almost immediately, you should back up your data file by file to prevent potential data loss.

RAID level 5 stripes data across all drives in the array one stripe unit at a time (a stripe unit can contain multiple blocks). RAID level 5 also writes array parity data. The parity data is spread across all the drives.



In the RAID Level 5 example figure, a stripe unit is defined as 64 blocks of 512 bytes each (32K stripe unit size).



**RAID Level 5**



Stripes are written as follows:

- Stripe 1 is written in the first position to drive 2
- Stripe 2 is written to drive 3
- Parity data for the data in stripes 1 and 2 are written to drive 1

If a drive fails in a RAID level 5 array, you can continue to use the array normally. A RAID level 5 array operating with a single failed drive is said to be operating in degraded mode. Whenever data is read from a degraded disk array, the array controller recalculates the data on the failed drive by using data and parity blocks on the operational drives.

For example, to recalculate data in data stripe unit 2 in the RAID level 5 figure (the first position on drive 3), the array controller would use the parity information from drive 1 and the data from drive 2 (data stripe unit 1) to reconstruct the data. This process is repeated to reconstruct each block of the failed drive, as needed, so you can continue to operate the RAID level 5 array.

The Perform Consistency Check menu allows the array controller to check the integrity of the array parity. If the array subsystem has an abnormal system shutdown, you may check and repair array parity/mirror on the affected disk array(s). See “Performing a Consistency Check on a Disk Array” on page 3-13 for more information.

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## Ultra SCSI PCI RAID Adapter Features

The major components of the Ultra SCSI subsystem are:

- Ultra SCSI PCI RAID Adapter. The SCSI controllers and RAID logic are located on the adapter.
- Disk Array. A collection of one or more SCSI disk drives.
- SCSI Disk Drives
- PCI SCSI Disk Array Manager (PDAM). (SMIT and command line interface)
- AIX device drivers

The components of the RAID subsystem combine to provide an advanced storage technique designed to secure online information while speeding file access through multiple, independent transactions.



## Ultra SCSI PCI RAID Adapter

The Ultra SCSI PCI RAID Adapter is an intelligent PCI adapter that has built-in support for RAID levels 0, 1 and 5. The Ultra SCSI PCI RAID Adapter serves as an interface between the host's PCI bus and the disk arrays attached to the SCSI busses.

The Ultra SCSI PCI RAID Adapter contains three Ultra SCSI controllers which manage the SCSI busses. The adapter manages all aspects of the SCSI bus protocol.

The RAID functions of the card are controlled by firmware that is executed on an embedded PowerPC RISC processor. Performance is enhanced through a non-volatile write cache on the adapter.

The Ultra SCSI PCI RAID Adapter supports background parity initialization. This feature permits disk arrays to be used immediately by the system (without having to wait for data parity/mirror to be initialized).

Consistency of the data (RAID levels 1 or 5) contained on the RAID arrays is monitored continuously through the use of the data scrubbing feature.

**Note:** The Ultra SCSI PCI RAID Adapter does not support boot devices.

## Disk Array

The disk array is an abstraction that combines one or more SCSI disk drives and presents them as a logical drive to the host. SCSI disk drives can be grouped together to form a disk array (RAID disk array). Refer to "Disk Array Overview" on page 1-13 for more information about disk arrays.

**Note:** The disk arrays do not support the root volume group (**rootvg**). No portion of **rootvg** should exist on a disk array.

## SCSI Disk Drives

Each SCSI bus supports attachment of up to 15 SCSI disk drives. A maximum of 45 disk drives per adapter are supported.

**Note:** SCSI devices other than disk drives are not supported on the Ultra SCSI PCI RAID Adapter.

## PCI SCSI Disk Array Manager

The Ultra SCSI PCI RAID Adapter is supported by the PCI SCSI Disk Array Manager (PDAM).



The RAID Manager is the only interface to the RAID configuration, monitoring, and recovery features of the Ultra SCSI PCI RAID Adapter. Some of the tasks performed using the PDAM include:

- Check device status for the disk array on your system.
- Create and delete disk arrays.
- Configure and reconfigure disk arrays.
- Change disk array configuration attributes.
- Check and repair array parity/mirror on disk array.
- Display information of physical drives and disk arrays.
- Reconstruct a RAID level 1, or 5 disk array after a single drive failure.
- Delete/recreate a RAID level 0 disk array after a drive failure, or a RAID level 1, or 5 disk array after multiple drive failures.
- Adapter configuration and error recovery options.

The PDAM is supported through the SMIT interface. Refer to the topic “Managing the Ultra SCSI PCI RAID Adapter” on page 3-1.

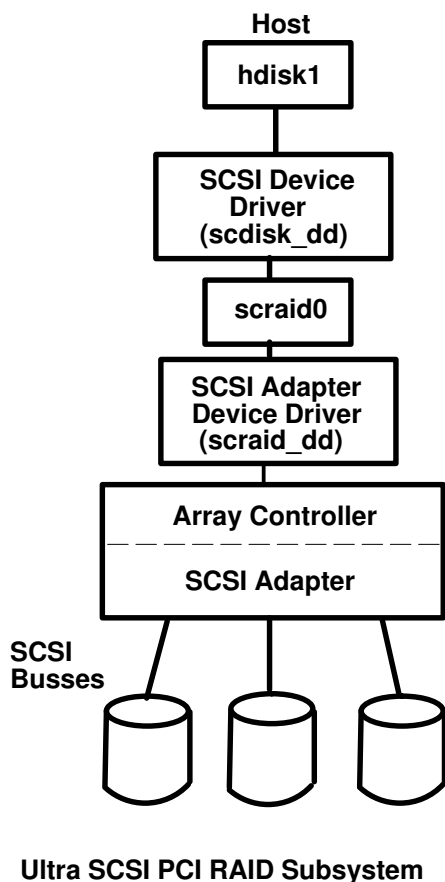


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## Disk Array Overview

The disk array is an abstraction that combines one or more SCSI disk drives and presents them as an logical drive to the host.

The figure below illustrates a typical configuration of a RAID disk array connected to a host system through an Ultra SCSI PCI RAID Adapter. This disk array is made up of three physical disks located on three separate SCSI buses. This configuration results in making the disk array available as `hdisk1`. The figure includes the logical names assigned by the system during configuration.





## Disk Array Parameters

Disk arrays are configured using the PDAM. Refer to “Managing the Ultra SCSI PCI RAID Adapter” on page 3-1 for additional information.

Each disk array has a set of parameters that determine how data is stored and accessed on it. Some of these parameters may differ for each array, while other parameters must be the same for all arrays created on the adapter. All disk arrays attached to an Ultra SCSI PCI RAID Adapter must share the same stripe unit size, reconstruction rate, and data scrubbing option. Before creating the first disk array, a stripe unit size (16K, 32K, or 64K), reconstruction rate (low, med, or high) must be selected. Once the first disk array is created, all subsequent disk arrays must have the same stripe unit size, reconstruction rate, and data scrubbing option. These parameters cannot be changed until all disk arrays on the adapter have been deleted.

You can define up to:

- Eight disk arrays per Ultra SCSI PCI RAID Adapter
- 16 physical drives per disk array

The disk array parameters table summarizes the more detailed descriptions that follow:

<b>Disk Array Parameters</b> (see Create an IBM PCI SCSI Disk Array and Change/Show IBM PCI SCSI Drive Status menus in SMIT)	
<b>Parameter</b>	<b>Meaning</b>
RAID Level	Determines how data is stored on the disk array, and whether there is data redundancy.
Size of Array (Mbs)	Size of the disk array.
Stripe Size**	Determines the amount of data written to a single drive in the disk array before the controller writes data on the next drive.
Reconstruction Rate**	Time between reconstruction operations.
Data Scrubbing**	Enables automatic perpetual background parity check for redundant RAID level (RAID 1, RAID 5) arrays.
Select Drives	Determines what drives make up the disk array.
Command Queue Depth	Size of command queue.





<b>Disk Array Parameters</b> (see Create an IBM PCI SCSI Disk Array and Change/Show IBM PCI SCSI Drive Status menus in SMIT)	
<b>Parameter</b>	<b>Meaning</b>
Read-ahead Enable	Enables read-ahead caching on a disk array.
** Parameters can be changed only from the Change/Show PCI SCSI RAID Adapter SMIT menu when no disk arrays exist on an adapter.	

**RAID Level** Determines how data is stored on the disk array. RAID Levels 1 and 5 offer data redundancy; RAID level 0 does not. Which levels you select depends on your storage and performance needs. See "RAID Levels" on page 1-4 for a discussion of all the RAID levels.

The RAID level dictates the minimum number of drives that can be included in the disk array and the realized capacity of the array. Refer to the following parameter descriptions.

**Size of Array** Size is determined by the RAID level, number of drives, and the capacity of those drives. On the Ultra SCSI PCI RAID Adapter, when a physical drive is selected to be part of a disk array, its entire capacity is used. Physical drives cannot be fragmented or spread across multiple disk arrays.

**Note:** It is recommended that each drive selected to be part of a disk array be of the same capacity. If drives differ in capacity, the array controller will use the capacity of smallest drive in the selected drive list to determine the usable capacity of all the drives when creating the disk array.

To determine the size of a disk array you want to create on your array subsystem, you need to know the capacity of a single drive. To determine this value, select the **Change/Show PCI SCSI Drive Status** option from the PCI SCSI Disk Array Manager menu in SMIT.

Each time you create a new disk array from spare drives, use the following formulas to determine the maximum size of the disk array you can create. This calculation depends on both the RAID level of the disk array you want to create and the size of the drives:



- RAID level 0** Multiply the number of drives by the drive capacity.
- RAID level 1** Multiply the number of drives by the drive capacity and divide by 2.
- RAID level 5** Multiply one less than the number of drives by the drive capacity.

The resulting capacity for each of the preceding calculations yields the approximate size of the disk array.

**Stripe Size** Specifies the amount of data written on a single drive in the disk array before the controller continues writing the data on the next drive in the disk array. For example, if the stripe unit size of a RAID level 0 disk array is 16384 bytes(16K), the controller will write 16384 bytes of data on drive 1, the next 16384 bytes of data on drive 2, the next on drive 3, and so on.

The adapter supports stripe sizes of 16K(16384), 32K(32768) and 64K(65536).

#### **Reconstruction Rate**

Controls the rate of data reconstruction on RAID level 1 and 5 disk arrays(data on a RAID level 0 array cannot be reconstructed). This parameter controls the amount of resources the adapter allocates for the reconstruction. This is a Ultra SCSI PCI RAID Adapter attribute and can only be modified before the first disk array is created. Low, medium and high rates are supported.

#### **Data Scrubbing**

Determines if data scrubbing is enabled on the redundant RAID level (RAID 1 and RAID 5) disk arrays on the adapter. Data scrubbing refers to an automatic consistency check performed by the adapter on a small number of data stripes at regular periodic intervals. This feature monitors the accessibility and consistency of the data on redundant RAID level arrays and can identify problems in RAID arrays independent of any host access to the data contained on those arrays. Data scrubbing is an attribute of the Ultra SCSI PCI RAID adapter and its value can only be modified when no disk arrays exist on the adapter.



### **Select Drives: Channel SCSI ID**

Defines the drives included in the disk array. Individual drives are identified by channel number and SCSI ID.

The RAID level of the disk array sets some restrictions on drive selection:

- 0** Each disk array is allowed 1 to 16 drives.
- 1** Each disk array is allowed 2 to 16 drives.
- 5** Each disk array is allowed 3 to 16 drives.

**Note:** The drives you select for a disk array depend on your storage and performance needs. Drives should be dispersed amongst separate SCSI channels as much as possible.

### **Command Queue Depth**

Allows the user to customize the depth of the adapter command queue utilized for a particular disk array. Supported queue depths range from 8 to 64 (default value for this parameter is **8**). Customizing this parameter for your particular system may improve performance.

### **Read Ahead Enable**

Enables and disables the adapter's read ahead data caching. When enabled, the adapter always reads to the end of a stripe on read operations.

## **Identify Drives and Disk Arrays**

There are times when you need to determine the AIX logical name of a disk array, which volume groups your disk array are in, or which logical volumes are on a given disk array. For example, to back up data after a drive in an array fails, you need to know the drives and logical volumes or file systems affected by that failure.



The table below explains how to make a connection between physical disks, disk arrays, and AIX.

Task	Tools and Procedures
Find the physical disk(s) that make up a disk array.	The PCI Disk Array Manager (PDAM):The <b>List all PCI SCSI RAID Drives</b> option in the <b>Change/Show PCI SCSI RAID Drive Status</b> displays all disk arrays as well as the SCSI disks that make up the disk array.
Determine the logical volumes and file systems on a disk array.	SMIT or the <b>lspv</b> command: From the console, enter <b>lspv -l hdisk</b> , where <i>hdisk</i> is the disk name of the disk array you want to check. The resulting display shows all the logical volumes and file systems on the disk array.
Determine which disk arrays are in what volume groups.	Either SMIT or the <b>lspv</b> command: From the console, enter <b>lspv</b> . The resulting display shows the disk contents of all the volume groups on your system.

### Disk Array Device Names and Location Codes

Disk arrays are assigned names using the *hdisk* form, the same as any other disk storage unit in AIX. These names are automatically assigned whenever you create a disk array with the PDAM. The names are deleted when you delete the disk array. You can display these names and the location codes associated with them by using the **List IBM PCI SCSI Disk Arrays** option using PDAM.

The location codes used for disk arrays differ slightly from those used by most other disks in this operating system. In addition to identifying the SCSI controller, as all AIX location codes do (in the second from the last digit), a disk array location code also contains the disk array number (in the last digit of the location code) allocated by the Ultra SCSI PCI RAID Adapter. For example, the standard AIX Version 4 location code has the following format:

00-02-01-5,0

Each field helps identify the location of the disk controller. The second digit of the second field (2) identifies the slot location of the adapter. The fourth field (5) identifies the id of the disk array. On most SCSI disks this field refers to the SCSI id. Disk arrays are typically made up of several physical SCSI disks with several SCSI ids. For the disk array, this field refers to the index into the



adapters list of disk arrays. The last field (0) identifies the logical unit number of the disk array. This field is always 0 for disk arrays.

For example, you may see a display similar to the following when you select the **List IBM PCI SCSI Disk Arrays** option using PDAM.

In this sample display, there are four disk arrays (disk array 00 through 03) attached to one Ultra SCSI PCI RAID Adapter (slot 1).

```
hdisk1  Available Raid 5 04-01-00-0,0 2064 MB Status OPTIMAL
        hdisk1  01 Channel 0 ID 1  ONLINE
        hdisk1  12 Channel 1 ID 2  ONLINE
        hdisk1  23 Channel 2 ID 3  ONLINE

hdisk2  Available Raid 1 04-01-00-1,0 2048 MB Status OPTIMAL
        hdisk2  02 Channel 0 ID 2  ONLINE
        hdisk2  10 Channel 1 ID 0  ONLINE

hdisk3  Available Raid 0 04-01-00-2,0 3072 MB Status OPTIMAL
        hdisk3  03 Channel 0 ID 3  ONLINE
        hdisk3  11 Channel 1 ID 1  ONLINE
        hdisk3  20 Channel 2 ID 0  ONLINE

hdisk4  Defined Raid 0 04-01-3,0 2144 MB Status DEAD
        hdisk4  00 Channel 0 ID 0  FAILED DRIVE
```

## Disk Array ODM Information

The operating system stores information about each device that can be connected to it in a database maintained by the Object Data Manager (ODM). The information stored about each device includes the following:

- Device class, subclass, and type
- Device parent
- Device location code
- Connection point
- Attributes.

The following sections describe the values stored for each of these categories for the Ultra SCSI PCI RAID Adapter.



## Device Class, Subclass, and Type

A device's class, subclass, and type unambiguously identify it to the operating system. With this information, the operating system can locate the device's record in the Object Data Manager (ODM) and obtain other information stored in the database about the device.

Together, a device's class, subclass, and type make up the unique type. The Ultra SCSI PCI RAID Adapter's unique type is **adapter/pci/14102e00**.

### Device Class

Describes the general category of devices that the device belongs. For example, all printers are in the *printer class*. The Ultra SCSI PCI RAID Adapter belongs to the device class called *adapter class*.

### Device Subclass

Describes how the device is connected to the host, typically the type of adapter through which the system communicates with the device. For example, for standard SCSI disks, the value would be *scsi*. The Ultra SCSI PCI RAID Adapter communicates with the host using a PCI bus hence the subclass is PCI.

### Device Type

Describes the characteristics of a particular device within a class. For example, for a standard SCSI disk, the type can be a description of its storage capacity, such as *2gb*. To uniquely identify the Ultra SCSI PCI RAID Adapter within its class, the PCI configuration signature(device id/vendor id) is used. The Ultra SCSI's PCI signature is 0x14102e00.

### Device Parent

A device's parent is the device that must be configured or defined before the device itself may be configured or defined. A device can only have a single parent. For example, the parent device of a standard SCSI disk is the SCSI adapter, because the system cannot communicate with the disk drive without going through the adapter. The parent device is specified by its system-assigned name, such as *scsi0*, *scsi1*, or *vscsi*. The parent of the Ultra SCSI PCI RAID Adapter is the PCI bus to which it is attached. This is normally bus0 or bus1.



## Device Location Code

On AIX systems, all devices have device location codes that uniquely identify them to the system. The Ultra SCSI PCI RAID Adapter's location code conforms to existing PCI adapters on the AIX platform. The location code is of the form: 04-0N where N is the slot number. Disk array attached to the Ultra SCSI PCI RAID Adapter follow the location code convention of existing SCSI disks and are of the form: 04-0N-00-00. The last nibble indicates the ID and LUN of the device. For Ultra SCSI PCI RAID Adapter attached disk array, the LUN field will always be zero and the ID field will be the index into the adapter's list of disk arrays. These location codes follow AIX convention for adapters and devices. See *AIX Version 4 System Management Guide: Operating System and Devices* for a thorough description of all of the location code fields.

## Ultra SCSI PCI RAID Adapter AIX Configuration

As with any device connected to an AIX system, the Ultra SCSI PCI RAID Adapter must be defined and configured before it can be accessed.

- A device is defined when the system creates a record for it in the Customized Database portion of the Object Data Manager (ODM). The ODM database contains information about all the devices that can be connected to the system. In the ODM database, device information is stored in an object relationship. The ODM database stores generic descriptions of the various supported devices in its Predefined database. For each instance of a particular device type, the system creates a separate copy of the predefined record.
- A device is configured when all necessary device drivers are loaded into the kernel and all other components necessary for communication with the device are configured. When configuration is completed, the device is marked as available.

At boot time, or whenever you invoke the **cfgmgr** command, the AIX operating system configures the Ultra SCSI PCI RAID Adapter and any previously created disk arrays automatically.







---

## Chapter 2. Installing the Ultra SCSI PCI RAID Adapter Software

In order to correctly install the Ultra SCSI PCI RAID Adapter software, complete the following steps carefully. Failure to follow these steps may result in errors that will not allow further configuration of the Ultra SCSI PCI RAID Adapter.

This chapter contains information about:

- Installing the Ultra SCSI PCI RAID Adapter Software
- Installing a Ultra SCSI PCI RAID Adapter Software Update
- Verifying the Ultra SCSI PCI RAID Adapter Software Installation.

---

### Installing an Ultra SCSI PCI RAID Adapter on AIX Version 4

This section describes the steps for installing the Ultra SCSI PCI RAID Adapter software for the first time on AIX Version 4. Note that it is often not necessary to install the Ultra SCSI PCI RAID Adapter software as a separate step. If the Ultra SCSI PCI RAID Adapter was installed in the system when the required level of AIX version 4 was installed, then all the necessary software for the adapter was installed.

**Notes:** AIX Version 4.2 or later is necessary for Ultra SCSI PCI RAID Adapter support.

1. The PCI RAID Adapter requires AIX Version 4.2 or later.
2. Do not run the diagnostics on the Ultra SCSI PCI RAID Adapter at any stage during the installation of the Ultra SCSI PCI RAID Adapter software. Wait until installation is complete before running diagnostics. In most cases, it is unnecessary to run diagnostics following installation. See the section on Ultra SCSI PCI RAID Adapter Service Aids to determine if diagnostics are required.



3. Array controller microcode is distributed on the Ultra SCSI PCI RAID Adapter Controller Microcode diskette.

**Note:** Downloading of array controller microcode is not usually required because those files are already installed on the adapter. Read and follow any instructions shipped with the Ultra SCSI PCI RAID Adapter for situations in which download is required.

## Prerequisite

Ensure that the Ultra SCSI PCI RAID Adapter software is not already installed by using the command:

```
lslpp -l devices.pci.14102e00.rte
```

If the software is not installed, the following messages is displayed:

```
lslpp: 0504-132 Fileset devices.pci.14102e00.rte not installed
```

## Procedure

1. Insert the install media into the machine.

At this point the software can be installed using SMIT or on the command line using the **cfgmgr** command.

To install the software using the **cfgmgr** command, the Ultra SCSI PCI RAID Adapter must be in the machine.

2. To install the software from the command line, type **cfgmgr -i devicename**

**Note:** *devicename* can be a directory or a device (ie. /dev/rmt0).

To install the software using SMIT, follow steps 3 through 7.

3. Run the **smit** command and select:

- a. **Software Installation and Maintenance**
- b. **Install and Update Software**
- c. **Install/Update Selectable Software (Custom Install)**
- d. **Install/Update From All Available Software Packages**

4. Select **Input Device** using F4.

Select **SOFTWARE to Install** using F4 to display the list of install images on the tape or CD-ROM.



Then select **devices.pci.14102e00 ALL**. Press Enter to begin the installation process.

During the installation process, the screen will display messages while the Ultra SCSI PCI RAID Adapter software is loaded onto the system. If the messages indicate that the installation was not successful, repeat the installation procedure or contact your service representative.

The screen will look similar to the following:

```
Install/Update from All Available Software Packages

Type or select values in entry fields.
Press Enter AFTER making all desired changes.
                                     [Entry Fields]

* INPUT device / directory for software   /dev/rmt0
* SOFTWARE to install                     [devices.pci.14102e00 ALL]+
PREVIEW only? (install operation will NOT occur) no
+
COMMIT software updates?                  no      +
SAVE replaced files?                      yes      +
ALTERNATE save directory                  [ ]
AUTOMATICALLY install requisite software? yes      +
EXTEND file systems if space needed?      yes      +
VERIFY software?                          no       +
OVERWRITE same or newer versions?        no       +
VERIFY install and check file sizes?     no       +
DETAILED output?                          no       +

F1=Help      F2=Refresh      F3=Cancel      F4=List
F5=Undo      F6=Command    F7=Edit       F8=Image
F9=Shell     F10=Exit       Enter=Do
```

5. To make the Ultra SCSI PCI RAID Adapter available, type **cfgmgr** at the command line and press Enter. Alternatively, you may shutdown the system and restart it.
6. Verify the Ultra SCSI PCI RAID Adapter software and controller connections (see page 2-5, “”).



7. Ensure that all Ultra SCSI PCI RAID Adapters are in the available state.

**Note:** If the instructions shipped with the Ultra SCSI PCI RAID Adapter require downloading of microcode, those actions will begin at this point.

The installation of the Ultra SCSI PCI RAID Adapter hardware and software is now complete.

---

## Installing a Ultra SCSI PCI RAID Adapter Software Update

This checklist describes the steps required to update the Ultra SCSI PCI RAID Adapter software on a host system that is already running the Ultra SCSI PCI RAID Adapter software.

### Procedure

1. Insert the new Ultra SCSI PCI RAID Adapter software media into the media device.
2. From SMIT, select:
  - a. **Software Installation & Maintenance**
  - b. **Install and Update Software**
  - c. **Install/Update Selectable Software (Custom Install)**
  - d. **Install/update from all Available Software Packages**
3. Select **SOFTWARE to Install** using F4 to display the list of install images on the tape.
4. Select **devices.pci.14102e00 ALL**. Toggle COMMIT software to **no** and SAVE replaced files to **yes**.
5. Press Enter to begin the installation process.



The screen will look similar to the following:

```

Install/Update from All Available Software Packages

Type or select values in entry fields.
Press Enter AFTER making all desired changes.
                                     [Entry Fields]

* INPUT device / directory for software    /dev/rmt0
* SOFTWARE to install                      [devices.pci.14102e00 ALL]+
PREVIEW only? (install operation will NOT occur) no    +
COMMIT software updates?                       no    +
SAVE replaced files?                           yes    +
ALTERNATE save directory                       [ ]
AUTOMATICALLY install requisite software?      yes    +
EXTEND file systems if space needed?           yes    +
VERIFY software?                              no     +
OVERWRITE same or newer versions?             no     +
VERIFY install and check file sizes?          no     +
DETAILED output?                             no     +

F1=Help           F2=Refresh           F3=Cancel           F4=List
F5=Undo           F6=Command           F7=Edit            F8=Image
F9=Shell          F10=Exit            Enter=Do

```

6. Press Enter to begin the installation process.

During the installation process, the screen will display messages while the Ultra SCSI PCI RAID Adapter software is loaded onto the system. If the messages indicate that the installation was not successful, repeat the installation procedure or contact your service representative.

7. Type the **cfgmgr** command to make the Ultra SCSI PCI RAID Adapter available and press Enter. Alternatively, you may shutdown and restart the system.

8. Verify the Ultra SCSI PCI RAID Adapter software and controller connections.

---

## Verifying the Ultra SCSI PCI RAID Adapter Software Installation

1. For AIX Version 4.2 or later, verify the Ultra SCSI PCI RAID Adapter software installation by entering the following command:



```
lslpp -l devices.pci.14102e00.rte
```

The displayed text should indicate that the Ultra SCSI PCI RAID Adapter Software is in the Committed state.

2. After you have verified the installation, go to “Managing the Ultra SCSI PCI RAID Adapter” on page 3-1.



---

## Chapter 3. Managing the Ultra SCSI PCI RAID Adapter

You can manage the Ultra SCSI PCI RAID Adapter by using the PCI SCSI Disk Array Manager (PDAM), System Management Interface Tool (SMIT), or for some tasks, the AIX command line. In most instances, disk arrays are managed by using SMIT.

### Procedure

1. To start the PDAM, take the following path through SMIT:

- a. Run the **smit** command.
- b. Select **Devices**
- c. Select **Disk Array**
- d. Select **IBM PCI SCSI Disk Array**

From this panel you can change attributes of the Ultra SCSI PCI RAID Adapter, configure the adapter, or start the PDAM:

```
IBM PCI SCSI Disk Array
PCI SCSI Disk Array Manager
Configure a Defined PCI SCSI RAID Adapter
Change/Show PCI SCSI RAID Adapter
```

2. To change adapter parameters, select the **Change/Show PCI SCSI RAID Adapter** option of the PDAM panel.
3. Select the Ultra SCSI PCI RAID Adapter you want to work with and press Enter. The following panel will be displayed:

```
Change/Show PCI SCSI RAID Adapter

PCI SCSI RAID Adapter          scraid1
Battery Backup Enabled         no           +
Stripe Size (in KBytes)       16           +
Reconstruction Rate           med          +
Data Scrubbing Enabled        yes          +
```

4. Use the arrow keys to select the field to be altered. Change the values and press Enter.



**Stripe Size** This parameter specifies the amount of data that will be accessed (striped) across a single physical disk in a disk array before accessing data on the next disk in the disk array. Supported stripe sizes are 16K, 32K and 64K.

**Battery Backup** You should change this to yes **only** if the system is equipped with an Uninterrupted Power Supply (UPS). This parameter may be changed at any time, but will not take effect until the next system reboot.

**Reconstruction Rate** This parameter specifies the rate at which a drive reconstruction (data rebuild) will occur. If the rate is set to low, the reconstruction will be performed at a slower rate but overall system performance should not be impacted during reconstructs. The opposite is true if the rate is set to high.

**Data Scrubbing** This parameter specifies whether data scrubbing will be enabled on redundant level disk arrays created on this adapter. A value of yes indicates that at a regular periodic interval, a consistency check will be performed by the adapter on a small number of data stripes.

**Note:** The Stripe Size, Reconstruction Rate, and Data Scrubbing parameters may only be changed if **no** disk arrays are currently configured on this Ultra SCSI PCI RAID Adapter.





---

## Starting the PCI SCSI Disk Array Manager

1. To start the PDAM, take the following SMIT fast path:

```
smit pdam
```

2. From the PDAM panel, select the PCI SCSI Disk Array Manager option. The screen then displays the PCI SCSI Disk Array Manager panel.

### PCI SCSI Disk Array Manager

```
List PCI SCSI Disk Arrays
Create a PCI SCSI Disk Array
Delete a PCI SCSI Disk Array
Configure a Defined PCI SCSI Disk Array
Change/Show a PCI SCSI Disk Array
Reconstruct a PCI SCSI Disk Array
Revive a FAILED Drive in a PCI SCSI Disk Array
Fail a Drive in a PCI SCSI Disk Array
Change/Show PCI SCSI RAID Drive Status
Perform Consistency Check
Display Status of Adapter Write Cache
Recovery Options
```

---

## Creating a Disk Array

Use the following procedure to create or recreate a disk array:

1. Select the **Create a PCI SCSI Disk Array** option.
2. When prompted, select a **PCI SCSI RAID Adapter**.
3. When prompted, select the **RAID level**.
4. When prompted, select each drive you want in the disk array.

The following considerations apply when assigning drives:

### **RAID LEVEL**

- 0** Each disk array is allowed 1 to 16 physical SCSI disk drives.
- 1** Each disk array is allowed 2 to 16 drives.
- 5** Each disk array is allowed 3 to 16 drives.



**Note:** The drives you select for a disk array depend on your storage and performance needs.

- After selecting the drives for the disk array, the **Create a PCI SCSI Disk Array** panel containing the disk array parameters is displayed. Use the Down Arrow or Enter key to select the value you want to change, and then enter the new value.

**Note:** You cannot change the RAID Level parameter or selected drives without restarting the creation procedure.

An example Create a PCI SCSI Disk Array SMIT panel follows:

```

Create a PCI SCSI Disk Array

[Entry Fields]
PCI SCSI RAID Adapter          scraid0
RAID Level                      0
Stripe Size (KBytes)           64
Size of Array (MBytes)         , 1024
* Select Drives: Channel-SCSI ID 01
Command Queue Depth            8 +
Read Ahead Enabled              yes +
Initialize Parity                yes +

```

Refer to the following information to determine the values you may use for the disk array parameters:

- RAID Level** This parameter was selected on a previous panel and cannot be changed.
- Stripe Size** This parameter can be changed but not from this panel. See "Changing PCI RAID Adapter Parameters" on page NO TAG.
- Size of Array** This parameter is calculated as the maximum size for the drives and the RAID level specified and may not be changed from this panel.
- Command Queue Depth** This parameter can be changed from this panel. This parameter allows you to customize the depth of the adapter command queue for this disk array.
- Read Ahead Enabled** This parameter can be changed. See "Changing PCI RAID Adapter Parameters" on page NO TAG.



**Initialize Parity** This parameter should *never* be changed to `no`. If parity is not initialized at disk array creation, data reconstruction capabilities may be compromised.

**Select Drives: Channel–SCSI ID**

These are the physical drives that were selected to be part of the disk array.

**Note:** The AIX Logical Volume Manager has a limit of 1016 physical partitions per physical volume. For the default physical partition size of 4MB, this translates to a maximum physical volume size of approximately 4GB. Larger physical volumes can be configured by increasing the physical partition size. You will know you have exceeded the 1016 physical partitions per physical volume (hdisk) if you receive this message while trying to create a volume group on a disk array:

```
0516-862 mkvg: Unable to create volume group
```

6. After you have set all the parameters you want to set, press Enter.

After you press Enter, if the Initialize Parity parameter was set to yes, the Ultra SCSI PCI RAID Adapter automatically initializes the parity/mirror on the new disk array in the background. The disk array is available for use while the parity/mirror is being initialized. Progress of the parity/mirror initialization can be monitored by using the List PCI SCSI Disk Arrays option of PDAM.

**Note:** Parity/mirror initialization is not applicable to RAID level 0 disk arrays.

7. If you need to configure more disk arrays, return to step 1. If you do not need to configure more disk arrays, exit PDAM.
8. Create AIX filesystems on the disk arrays. See “Adding Disk Arrays to the AIX Operating System” on page 3-18 for more information.



---

## Modifying and Displaying Drive Status

Using the **Change/Show PCI SCSI RAID Drive Status** option, you can display the status of the physical drives and disk arrays, add a spare drive, add a hot spare drive, delete a spare drive, remove a failed drive, or display a physical drive's Vital Product Data (VPD).

Change/Show PCI SCSI RAID Drive Status

List all PCI SCSI RAID Drives  
Remove a Spare Drive  
Add a Spare Drive  
Add a Hot Spare Drive  
Remove a FAILED Drive  
Display Vital Product Data

There are three possible values that may be displayed for the status of a disk array and seven possible values that may be displayed for the status of a physical drive.

### **Disk Array States**

The state of a disk array is uniquely determined by the states of the physical drives that make up the disk array. Depending on the number of Failed physical drives, replacement of a Failed drive with a good drive may change the state of the disk array from Dead to Degraded or Optimal after data rebuild. When a Failed physical drive is replaced in a Degraded disk array, the data is rebuilt onto the replaced drive before the disk array state transitions to the Optimal. The figure below depicts the valid disk array state transitions.

- |                 |   |
|-----------------|---|
| <b>Optimal</b>  | All physical drives in the disk array are Online.   |
| <b>Degraded</b> | One of the physical drives that is part of a redundant disk array is in the Failed state. |



**Dead** For a non-redundant disk array, this state indicates that one or more physical drives are in the Failed state. For a redundant disk array, this state indicates that two or more physical drives are in the Failed state. A Dead disk array is not accessible.

### **Physical Disk States**

**Online** The drive is part of a disk array and is functioning properly.

**Spare** The drive is connected to and spun up by the Ultra SCSI PCI RAID Adapter but not configured into a disk array. This drive is available for the creation of a disk array.

**Failed** The drive was Failed by the Ultra SCSI PCI RAID Adapter or the user and must be replaced. A drive may go to the Failed state if one of the following conditions occur:

- Drive does not respond to selection.
- Drive Failed to spin-up.
- Fail in inquiry or read capacity.
- Fail to read or write reserve area.
- Drive fails to respond to SCSI commands.
- Inquiry, capacity, serial number and SCSI ID do not match configuration data stored on the adapter NVRAM.
- User failed the drive using PDAM.

**Reconstruct** The drive is undergoing a data reconstruction operation.

**Warning** The drive has been put into a Warning state as the result of Preventative Failure Analysis (PFA) error reported by the disk. The severity of this status depends on the RAID level of the disk array.

In all cases, the Warning drive should be replaced as soon as possible.

**Hot Spare** The drive automatically replaces an equivalent Failed drive in a redundant disk array.

**Non Existent** A drive is marked as non existent if no device is detected at a particular channel/SCSI ID location.

When the **Change/Show Drive Status** option is used to change the status of a drive, the state or status of the drive is changed. The following table describes the various actions performed and the new status of the drive after the action is complete.



Modifying Drive Status	
How To Modify:	Status Becomes:
Add a Spare drive	Spare
Delete a Spare/Failed drive	Non Existent
Add a Hot-spare	Hot-spare

## View the Current Disk Array Status

To see the current status of the drive, select the **List All PCI SCSI Disk Arrays** option.

A display similar to the following appears:

```
hdisk1 Available Raid 5 04-01-00-0,0 2064 MB Status OPTIMAL
    hdisk1 01 Channel 0 ID 1 ONLINE
    hdisk1 12 Channel 1 ID 2 ONLINE
    hdisk1 23 Channel 2 ID 3 ONLINE

hdisk2 Available Raid 1 04-01-00-1,0 2048 MB Status OPTIMAL
    hdisk2 02 Channel 0 ID 2 ONLINE
    hdisk2 10 Channel 1 ID 0 ONLINE

hdisk3 Available Raid 0 04-01-00-2,0 3072 MB Status OPTIMAL
    hdisk3 03 Channel 0 ID 3 ONLINE
    hdisk3 11 Channel 1 ID 1 ONLINE
    hdisk3 20 Channel 2 ID 0 ONLINE
```

## Add a Spare Drive

This option is used to have the Ultra SCSI PCI RAID Adapter recognize a physical drive that has been added to the system subsequent to the last reboot (hot-plugged). If the drive was attached to the adapter before the last reboot, no user intervention is required as the adapter will recognize the new device during the boot process. Adding a drive through software causes the Ultra SCSI PCI RAID Adapter to change the drive status from Non-Existent to Spare, thus making the drive available to create a disk array.

1. Attach a physical drive with a unique SCSI ID to one of the available SCSI channels on the Ultra SCSI PCI RAID Adapter.



2. Select the **Change/Show PCI SCSI RAID Drive Status** option of the PCI SCSI Disk Array Manager panel. Each disk array and its associated disks are displayed.
3. Select the **Add a Spare Drive** option.
4. Select the drive with the Non-Existent status which is located at the channel/SCSI ID location desired and press Enter.

The drive state should now be Spare and the drive can now be used to create a disk array.

## Delete a Spare or Failed Drive

A drive must be deleted if it is to be removed from the Ultra SCSI PCI RAID Adapter and not subsequently replaced. Deleting a drive through software causes the Ultra SCSI PCI RAID Adapter to change the drive status from Spare or Failed to Non-Existent. You cannot delete a drive that is part of a disk array. See “Deleting Disk Arrays from the Operating System” on page 3-20 to delete the disk array. Next, delete the drive and physically remove the drive from the system.

1. Select the **Change/Show PCI SCSI RAID Drive Status** option of the PCI SCSI Disk Array Manager panel. All disks, Ultra SCSI PCI RAID Adapters, and associated disks are displayed.
2. Select the **Remove a Spare Drive** or **Remove a Failed Drive** option of the PCI SCSI Disk Array Manager panel. For the **Remove a Spare Drive** option, all spare drives are displayed. For the **Remove a Failed Drive** option, all Failed drives are displayed.
3. Select the drive to be deleted and press Enter.

## Fail a Drive

**Attention:** Do not fail a drive in a RAID level 0 disk array unless you want to replace the drive. RAID level 0 has no redundancy. Once a drive is Failed in a RAID level 0 disk array, it is unlikely that the data can be recovered. Do not fail a drive in a RAID level 1 or 5 disk array if the disk array is already degraded. See “Restoring and Recovering Disk Arrays” on page 4-10 for instructions on which drives to fail and when to fail them.

You can place a drive in the Failed state when you want to replace a drive in Warning state and restore or reconstruct a disk array. Failing a drive through software causes the Ultra SCSI PCI RAID Adapter to change the drive status



from Warning to Failed. Once a drive is Failed, the Ultra SCSI PCI RAID Adapter cannot access that drive's data until you reconstruct the drive data.

1. Select the **Fail a Drive in a PCI SCSI Disk Array** option. Each disk array and its associated disks are displayed.
2. Select the drive to be Failed and press enter.

**Attention:** If you fail a drive, you may lose data redundancy or data.

The status of the selected drive changes from Online/Warning to Failed.

Repeat steps 1 and 2 until you have failed all the drives you want to fail.

**Attention:** Do not fail more than one Online drive in a single disk array. Failing two drives with this procedure could result in the loss of all data on the disk array.

**Note:** A drive that has been Failed manually using the Fail a Drive in a PCI SCSI Disk Array option will be called out by Diagnostics as needing replacement. This is not necessarily true as the drive may have been functioning properly when the drive was Failed. See "Reviving a Failed Drive" on page 3-12.





---

## Removing a Disk Array

To change the RAID level, drive selection, or size of an existing disk array, use the “Delete a PCI SCSI Disk Array” procedure on page 3-11.

### Delete a PCI SCSI Disk Array

Delete the disk array first in order to complete any of the following tasks:

- Change the RAID level of a disk array
- Change the drives that make up a disk array
- Change the stripe size of the adapter

If the disk array is part of a volume group, you must first back up all files in the logical volumes and file systems on the disk array and remove the disk array from its volume group. See “Deleting Disk Arrays from the Operating System” on page 3-20.

1. Start SMIT by entering:

```
smit pdam
```

2. Select the **Delete a PCI SCSI Disk Array** option. A display similar to the following appears:

Move cursor to desired item and press Enter.

```
hdisk1 Available Raid 5 04-01-00-0,0 2064 MB Status OPTIMAL
  hdisk1  01 Channel 0 ID 1  ONLINE
  hdisk1  12 Channel 1 ID 2  ONLINE
  hdisk1  23 Channel 2 ID 3  ONLINE

hdisk2 Available Raid 1 04-01-00-1,0 2048 MB Status OPTIMAL
  hdisk2  02 Channel 0 ID 2  ONLINE
  hdisk2  10 Channel 1 ID 0  ONLINE

hdisk3 Available Raid 0 04-01-00-2,0 3072 MB Status OPTIMAL
  hdisk3  03 Channel 0 ID 3  ONLINE
  hdisk3  11 Channel 1 ID 1  ONLINE
  hdisk3  20 Channel 2 ID 0  ONLINE
```



3. Select the disk array you want to delete and press Enter.

When the disk array has been deleted, the physical drives may change to one of the following states:

- Online drives go to Spare
- Warning drives go to Spare
- Failed drives remain Failed

---

## Reviving a Failed Drive

**Attention:** Caution should be used when using the **Revive a Failed Drive** option as it may lead to corrupted data. As an example, consider a RAID level 0 disk array that is in the Dead state because one physical drive went to the Failed state. If the Failed physical drive was replaced with a good drive and the **Revive a Failed Drive** option was used, the status of the disk array would change to Optimal because all of the drives in the disk array are online. The disk array is now accessible but the data on the replaced drive is not valid. The proper recovery in this example would have been to delete and recreate the disk array (after replacing the Failed drive) and restoring the data from the backup copy. The Revive a Failed Drive option cannot be used on a failed drive which is part of a Degraded RAID array. A Reconstruct operation must be performed if you wish to revive a failed drive which is part of a Degraded RAID array.



---

## Assigning Hot Spare Drives

Hot Spare drives are used to automatically replace Failed drives with drives of equivalent capacity in a redundant RAID environment.

1. Select the **Change/Show PCI SCSI RAID Drive Status** option.
2. Select the **Add a Hot Spare Drive** option. Select the Ultra SCSI PCI RAID Adapter you want to work with and press Enter.
3. Select the drive to be the hot spare and press Enter.

The drive state will transition to Hot Spare. On subsequent drive failures, reconstruction of Failed drives occur automatically for redundant disk arrays.

---

## Transitioning a Hot Spare Drive to a Spare Drive

The state of an existing hot spare drive may be changed to spare drive by following these steps:

1. Select the **Change/Show PCI SCSI RAID Drive Status** option.
2. Select the **Add a Spare Drive** option.
3. Select the Ultra SCSI PCI RAID Adapter you want to work with and press Enter.
4. Select the hot spare drive you want to change to spare drive and press Enter.

The hot spare drive will transition to a spare drive.

---

## Performing a Consistency Check on a Disk Array

The consistency check of a RAID level 5 disk array determines if the computed parity matches the actual parity on the disk array. Performing a consistency check on a RAID level 1 disk array compares the data contained on the primary copy of the data with the secondary copy of the data. If `no` is specified for the **Enable Automatic Consistency Repair** option, then an error will be returned if an inconsistency is found. At this point, the user can either restore the data



using the most recent backup or rerun check consistency with the **Enable Automatic Consistency Repair** option set to `yes`. In the latter case, the Ultra SCSI PCI RAID Adapter will attempt to repair the parity/mirror. Note that restoring consistency may result in loss of valid data for the blocks found to be inconsistent.

To perform a consistency check on a disk array, follow these steps:

1. Select the **Perform Consistency Check** option.
2. Select the disk array to perform the consistency check upon. Select `yes/no` for the **Enable Automatic Consistency Repair** option and press Enter.

**Note:** The **Check Consistency** option can only be run on disk arrays that are in the Optimal state.

---

## Reconstructing a Failed Drive

You can reconstruct a drive after replacing a Failed drive in a degraded RAID level 1 or 5 disk array.

**Note:** Only one reconstruct at a time is supported on the Ultra SCSI PCI RAID Adapter.

To reconstruct a Failed drive, follow these steps:

1. Replace the Failed drive with a working drive.  
To transition this drive to the **Reconstructing** state and begin the rebuild:
2. Select the **Reconstruct a PCI SCSI Disk Array** option.
3. Select any Spare drive you wish to rebuild onto or leave the default value of the Failed drive if it has been replaced.

**Note:** PDAM defaults to the Failed drive when selecting a drive to rebuild. The user can choose the default or any spare drive of equal (or greater) capacity on the adapter.



---

## Change/Show PCI SCSI Disk Array Parameters

This section describes how to change the RAID level, drive selection, or size of array parameters on an existing disk array. If you want to change any of these values of a disk array, you must first back up the data in all logical volumes and file systems on the disk array, delete the logical volumes and file systems from the disk array, and then remove the disk array from its volume group before continuing. You must then delete the disk array and recreate using the new parameters.

**Attention:** Failure to back up data before deleting the disk array will result in a loss of data.

Use the following procedure to change the RAID level, drive selection, or size of the array of an existing disk array:

1. Back up the data if there is any data in the logical volumes or file systems on the disk array.
2. Unmount all file systems on the disk array you want to reconfigure.
3. Delete all logical volumes and file systems from the disk array you want to reconfigure, and remove the disk array from its volume group.
4. Delete the disk array. See “Removing a Disk Array” on page 3-11 for more information.
5. Recreate the disk array using the new parameters. See “Creating a Disk Array” on page 3-3 for more information.

---

## Configuration Synchronization

Configuration synchronization makes the configuration on the Ultra SCSI PCI RAID Adapter consistent with the configuration on the disk arrays. This is useful in cases where the configurations are out of sync. For example, when an adapter is replaced but the user would like to continue to use the drives configured in the same way, configuration synchronization should be used.

1. Select the **Recovery Options** option.
2. Select **Resolve PCI SCSI RAID Adapter Configuration**.



From this panel you can select:

Display/Accept Configuration Changes  
Accept the Configuration on Drives  
Retry the Current Configuration

To synchronize to the configuration stored on the adapter, select the **Display/Accept Configuration Changes** option. To synchronize to the configuration on the drives (for example, adapter replacement), select the **Accept the Configuration on Drives** option.

The following options include:

#### **Display/Accept Configuration Changes**

If a PCI SCSI RAID configuration conflict is detected during a boot sequence, an error will be posted in the system error log. This option will allow you to view any drive state change and/or any unidentified drives within an existing Disk Array. Once you have viewed the changes, you may choose to accept them. Alternatively, you may modify the existing hardware to your needs and execute the Retry Current Configuration option.

#### **Accept Configuration on Drives**

Allows you to synchronize the PCI SCSI RAID configuration with the configuration currently stored on the majority of the physical drives. This would typically be done only in the case of a PCI SCSI RAID adapter replacement.

**Note:** Following an Accept Configuration on Drives option, the Ultra SCSI PCI RAID Adapter will automatically perform a Consistency Check with Auto-Repair on all redundant level RAID arrays. Progress of the Consistency Check can be monitored using the List PCI SCSI Disk Arrays option of PDAM.

#### **Retry Current Configuration**

Allows you to perform a configuration reset that will cause the adapter to verify that all of the physical disk drives are detected and responding. If the adapter is unable to detect all of the physical disks which were previously attached to the adapter, an error is returned and a configuration conflict will exist.



---

## Clearing a Configuration

**Attention:** This option should be used with extreme **CAUTION**. All disk arrays and data associated with the selected adapter may be **DESTROYED!** Selecting this option is equivalent to deleting all disk arrays configured on the adapter. This is an error recovery option normally used by your service representatives.

1. Select the **Recovery Options** option of the PCI SCSI Disk Array Manager panel.
2. Select **Clear PCI SCSI RAID Adapter Configuration**.
3. Select the adapter to clear the configuration on and press Enter.

---

## Adapter Replacement

A configuration conflict may result when a Ultra SCSI PCI RAID Adapter within a configured system is replaced (possibly due to a defective adapter). The configuration stored on the adapter may be out of sync with the configuration stored on the drives. The configuration can be restored by synchronizing the adapter configuration with the drive configuration. This can be accomplished using the **Accept Configuration on Drives** option under PDAM's Recovery Options. Use the following to replace the Ultra SCSI PCI RAID Adapter:

1. Start the SMIT PDAM by entering the following command:  

```
smit pdam
```
2. Select the **Recovery Options** option.
3. Select **Resolve PCI SCSI RAID Adapter Configuration** option.
4. Select **Accept Configuration on Drives** option.
5. Select the adapter that was replaced.

**Note:** Following an Accept Configuration on Drives option, the Ultra SCSI PCI RAID Adapter will automatically perform a Consistency Check with Auto-Repair on all redundant level RAID arrays. Progress of the Consistency Check can be monitored using the List PCI SCSI Disk Arrays option of PDAM.



---

## Adding Disk Arrays to the AIX Operating System

After you configure a disk array using the PDAM, you can add the disk array to a volume group and create logical volumes and file systems on it before using it. Use standard AIX procedures to do this and treat the array in the same way you would treat a single disk drive. You can also access the disk array using raw IO.

### Notes:

1. Ultra SCSI PCI RAID Adapter is not supported as a boot device.
2. PCI SCSI disk arrays do not support the root volume group.

**Attention:** The AIX Logical Volume Manager has a limit of 1016 physical partitions in a physical volume. When creating AIX volume groups, select a physical partition size sufficiently large so that you don't have more than 1016 physical partitions per physical volume. For example, if you are creating a volume group composed of a RAID 5 disk array composed of 5 physical disks of 2GB each, use a physical partition size of 8MB minimum; the default size of 4MB will exceed the 1016 physical partition limit.

You will know you have exceeded the 1016 physical partitions per physical volume (hdisk) if you receive this message while trying to create a volume group on a disk array (hdisk):

```
0516-862 mkvg: Unable to create volume group
```

Do not mix hdisk with different RAID characteristics in the same volume group. If you mix RAID 0 and RAID 5 hdisk, and a file system has partitions on both hdisk, a drive failure in the RAID 0 disk array will cause you to lose all your data in the file system.

If performance is important, you should plan your volume groups and logical volume placement before you create them because recreating them and restoring your data can be time-consuming. Contact your point of sale to get performance planning assistance or more information.

The following procedure gives the basic steps required to create a file system on a configured disk array so that you can use it. This procedure makes the disk array its own volume group and creates a single logical volume or file system on it. To add the disk array to an existing volume group, extend a logical





volume or file system onto it, or to change other file system options, see the procedures covered in your AIX system documentation.

1. From the SMIT System Management panel, select **Physical & Logical Storage**.
2. From the Physical & Logical Storage panel, select **Logical Volume Manager**.
3. From the Logical Volume Manager panel, select **Volume Group**.
4. Select the **Add A Volume Group** option from the Volume Group screen.
5. Enter values for the Add A Volume Group panel fields, as follows:

**VOLUME GROUP name**

Enter a volume group name.

**PHYSICAL VOLUME names**

Enter the hard disk name of the configured disk array. Press F4 to display a list of options.

**Activate volume group AUTOMATICALLY at system restart?**

Indicate whether you want the volume to be automatically activated whenever you restart the system.

**ACTIVATE volume group after it is created?**

Indicate whether you want the volume to be automatically activated when you are finished creating it (that is, when you exit SMIT).

**Volume group MAJOR NUMBER**

Give the volume a volume number or leave this option blank.

6. Press Enter to save these values. Then press the F3 key until you return to the Physical & Logical Storage panel.
7. Select the **File Systems** option from the Physical & Logical Storage panel.
8. Select the **Add / Change / Show / Delete File Systems** option from the File Systems panel.
9. Select the **Journaled File System** option from the Add / Change / Show / Delete File Systems panel. A list of volume groups is displayed.
10. Select **Add a Journaled File System** from the Journaled File System panel.



11. Select the volume group that you just created from the list of names displayed.
12. Enter values for the Journaled File System fields, as follows:

**SIZE of file system**

Enter the size, in number of 512-byte blocks, that you want to assign to the file system. Any size up to the limit of the volume group or 2GB can be entered, although the size will be set to a multiple of the partition size.

**MOUNT POINT** Enter a mount point for the file system. This is the directory you will enter to access the file system.

**Mount AUTOMATICALLY at system restart?**

Select **yes** or **no**, depending on whether you want this file system mounted automatically after the system is started.

**PERMISSIONS** Leave this at **read/write**.

**Mount OPTIONS**

Enter the mount options or leave this field blank.

13. Press Enter to create the journaled file system.

After completing this procedure, you can mount and use the newly created file system, using the specified mount point.

---

## Deleting Disk Arrays from the Operating System

**Attention:** Failure to back up any data before performing this procedure could result in the loss of all data on the disk arrays.

It is necessary to delete a disk array whenever you want to change or modify disk array parameters. The procedures required are basically the reverse of those used to add disk arrays.

For each disk array you want to delete, perform the following procedure:

1. Back up any data on the disk array. There may be more than one logical volume and file system on the drive. To find out which logical volumes or file systems are on the disk array, see “Identify Drives and Disk Arrays” on page 1-17.



2. Unmount any file systems on the disk array.

Delete any file systems on the disk array using the following steps:

1. Return to the Logical Volume Manager panel.
2. Select the **File Systems** option from the Logical Volume Manager panel.
3. Select the **Add / Change / Show / Delete File Systems** option from the File Systems panel.
4. Select the **Journalled File System** option from the Add / Change / Show / Delete File Systems panel. A list of volume groups is displayed.
5. Select **Delete a Journalled File System** from the Journalled File System panel.
6. Select the file system to be removed.

Delete any logical volumes on the disk array using the the following steps:

1. From the SMIT System Management panel, select **Physical & Logical Storage**.
2. From the Physical & Logical Storage panel, select **Logical Volume Manager**.
3. From the Logical Volume Manager panel, select **Logical Volumes**.
4. Select the **Remove a Logical Volume** option from the Logical Volumes panel.
5. Select the logical volume to be removed.

Remove the disk array from its volume group using the following steps:

1. Return to the **Logical Volume Manager** panel.
2. Select the **Volumes Group** option from the Logical Volume Manager panel.
3. Select either the **Remove a Volume Group** or **Set Characteristics of a Volume Group** option, depending on whether there are other physical volumes in the volume group.

To find out which volume group the disk array is in, see “Identifying Drives and Disk Arrays” on page 1-17. Then go to “Delete a PCI SCSI Disk Array” on page 3-11 to delete the disk array using PDAM.



### **Extending Logical Volumes and Disk Arrays**

You can extend an existing logical volume onto a disk array just as you can with any other disk storage device. However, you should remember that the data reliability of a combined logical volume is only as great as the reliability of its weakest part. For example, if you combine a RAID level 5 disk array and a RAID level 0 disk array into the same logical volume, the resulting volume has the data redundancy protection of a RAID level 0 disk array (that is, none). Even though the RAID level 5 portion of the logical volume has data redundancy, if the RAID level 0 portion fails, the whole volume may become unusable, and all data on the volume will be lost. However, a RAID level 1 and a RAID level 5 logical volume would offer data redundancy.



---

## Chapter 4. Ultra SCSI PCI RAID Adapter Problem Determination and Recovery

This chapter provides information to assist you in determining and recovering from error conditions. The following topics are discussed in detail:

- Identifying and recovering from drive failures. If a drive attached to the Ultra SCSI PCI RAID Adapter fails, procedures are provided by the PCI SCSI Disk Array Manager (PDAM) for removing and replacing the failed drive.
- Instructions on how to recover the data from the failed drive (in redundant environment) or restoring the data from the drive (on non-redundant environments) are included.
- Information describing the various RAID levels and how drive failures are handled by each of the levels.
- Instructions on how to replace a Ultra SCSI PCI RAID Adapter.
- Information describing how to detect and resolve array configuration conflicts.

You may also refer to the informational error messages returned by the Ultra SCSI PCI RAID Adapter device driver. These include alertable error messages and AIX error log entries on page 4-23.

---

### Drive Failures and Disk Arrays

The Ultra SCSI PCI RAID Adapter handles drive failures differently, depending on the RAID level involved.

#### Drive Status

There are seven possible values that may be displayed for the status of a physical drive and three possible values that may be displayed for the status of a disk array.



The PDAM displays the following status:

### **Disk Array States**

The state of a disk array is uniquely determined by the states of the physical drives that make up the disk array. Depending on the number of Failed physical drives, replacement of a Failed drive with a good drive may change the state of the disk array from Dead to Degraded or Optimal after data rebuild. When a Failed physical drive is replaced in a Degraded disk array, the data is rebuilt onto the replaced drive before the disk array state transitions to the Optimal.

- |                 |  |
|-----------------|--|
| <b>Optimal</b>  | The disk array is in good functional state.  |
| <b>Degraded</b> | One of the physical drives that is part of a disk array is in the Failed state.  |
| <b>Dead</b>     | For a non-redundant disk array, this state indicates that one or more physical drives are in the Failed state. For a redundant disk array, this state indicates that two or more physical drives are in the Failed state. A Dead disk array is not accessible. |

### **Physical Disk States**

- |                    |   |
|--------------------|---|
| <b>Online</b>      | The drive is part of a disk array and is in good functional state.  |
| <b>Spare</b>       | The drive is connected to the adapter, but not configured into a disk array. This drive is available to for the creation of a disk array.   |
| <b>Failed</b>      | <p>The drive was Failed by the Ultra SCSI PCI RAID Adapter or by the user and must be replaced. A drive goes to Failed state when one of the following conditions occur:</p> <ul style="list-style-type: none"><li>• Drive does not respond to selection.</li><li>• Drive Failed to spin-up.</li><li>• Fail in inquiry or read capacity.</li><li>• Fail to read or write reserve area.</li><li>• Drive fails to respond to SCSI commands.</li><li>• Inquiry, capacity, serial number and SCSI ID do not match configuration data stored on the adapter NVRAM.</li><li>• User failed the drive using PDAM.</li></ul> |
| <b>Reconstruct</b> | The drive is undergoing a data reconstruction operation.  |



- Warning** The drive has set its Predictive Failure Analysis (PFA) indication. Although the drive may remain functional, this an indication that a serious failure of the drive is imminent. The severity of this status depends to some extent on the RAID level of the disk array.
- The Warning drive should be replaced as soon as possible.
- Hot Spare** The drive automatically replaces an equivalent Failed drive in a redundant disk array.
- Non Existent** A drive location is marked as non existent if no disk was detected at that channel/SCSI ID.

## Disk Array Failures

This section contains information on disk array drive failures:

- RAID Level 0
- RAID Level 1
- RAID Level 5.

### RAID Level 0

When read or write errors occur on one or more drives in a RAID level 0 disk array, the drive state changes from Online to Failed or Warning. Follow the steps below:

1. You should attempt to back up the files on all logical volumes and file systems on the disk array. If the error is not serious, you may be able to recover the data.
2. Regardless of whether the backup succeeds, use the PDAM to identify the disk drive on which the error occurred.
3. Delete all the logical volumes and file systems on the disk array.
4. Remove the disk array from the volume group.
5. Replace the Failed or Warning drive and use the PDAM to revive the replaced drive.
6. Add the disk array back to a volume group.
7. Recreate the logical volumes and file systems on it.
8. Copy data back to the restored disk array from your backup media.



## **RAID Level 1**

This section describes drive failures on a RAID level 1 disk array, and the disk array and drive status values that result from such failures.

### **Single-Drive Failures**

Whenever a single drive in a RAID level 1 disk array transitions to the Failed state, the disk array status changes to Degraded. The disk array remains functional because the data on the Failed drive can be accessed from the mirrored stripe.

Whenever a drive is marked as Failed, you should replace it as soon as possible. If a Hot-spare drive was defined, the adapter may reconstruct the data on the drive automatically. If a Hot-spare reconstruct was not initiated by the adapter, then using the PDAM, initiate a reconstruct on the failed drive following replacement. If you cannot replace the drive immediately, back up the files on all logical volumes and file systems on the disk array and replace the drive when you can.

### **Multiple-Drive Failures**

Whenever the second drive in a RAID level 1 disk array has experienced read or write errors, the adapter takes the following actions:

- If the error is a recoverable read error, then the disk array status remains Degraded and an entry is posted in the error log.
- If the error is an unrecoverable error, and the drive is the mirrored pair of a drive that is already Failed, the drive status changes to Failed. The disk array status changes to Dead.

**Note:** Only one Failed drive per RAID level 1 disk array is supported on the Ultra SCSI PCI RAID Adapter.

## **RAID Level 5**

This section describes drive failures on a RAID level 5 disk array, and the disk array and drive statuses that result from such failures.

### **Single-Drive Failure**

Whenever a single drive in a RAID level 5 disk array transitions to the Failed state, the disk array status changes to Degraded. The disk array remains functional because the data on the Failed drive can be reconstructed using parity and data on the remaining drives.





Whenever a drive is marked as Failed, you should replace it as soon as possible. If a Hot-spare drive was defined, the adapter may reconstruct the data on the drive automatically. If a Hot-spare reconstruct was not initiated by the adapter, then using the PDAM, initiate a reconstruct on the failed drive following replacement. If you cannot replace the drive immediately, back up the files on all logical volumes and file systems on the disk array and replace the drive as soon possible.

### **Multiple-Drive Failures**

If a second drive in a RAID level 5 disk array experiences read or write errors, the adapter takes the following actions:

- If the error is a recoverable read error, then the drive status remains Degraded and an entry is posted in the error log.
- If the errors are unrecoverable, the drive status changes to Failed. The disk array status changes to Dead.

If the disk array status is Degraded, you will be able to reconstruct the data on the disk array by replacing the Failed drive, and reconstructing the data on the drive. If the disk array status is Dead, you will have to replace the Failed drives and then delete and recreate the disk array (after deleting the logical volumes and file systems on the disk array and removing the disk array from the volume group). You must then add the disk array back to a volume group, recreate the logical volumes and file systems on it, and copy data back to the restored disk array from your backup media.

---

## **Reconstructing Redundant Disk Arrays after Drive Failure**

Reconstruction is a process used to restore a degraded RAID level 1 or 5 disk array to its original state after a single drive has been replaced. During reconstruction, the adapter recalculates the data on the drive that was replaced, using data and parity from the other drives in the disk array. The controller then writes this data to the replaced drive. Although RAID level 1 does not have parity, the adapter can reconstruct data on a RAID level 1 disk array by copying data from the mirrored stripe.

If a Hot-spare has been defined, the adapter automatically initiates the reconstruction process after a drive status changes to Failed. If a Hot-spare of appropriate capacity had not previously been defined, the reconstruct must be initiated by the user after replacing the Failed drive. Once reconstruction is



initiated (either by the user or the adapter), the adapter completes the following actions:

- Copies special array configuration information files to the new drive
- Recalculates the data and/or parity from the data and parity on the other disk array drives
- Writes the recalculated data and parity to the new drive.

The disk array remains accessible while the Reconstruction is in progress. However, in some cases (for example, if you have two Warning drives in a RAID level 5 disk array ) you should stop using the logical volumes and file systems on the disk array to prevent subsequent drive failure and data loss.

Drive reconstruction may have a varying impact on system I/O performance. The disk array continues to operate in degraded mode. The reconstruction rate is a tunable attribute that must be selected before any disk arrays are configured on the adapter. See the section on Reconstruction Rate for additional information.

If there are multiple-drive failures in a RAID level 1 or 5 disk array (at least two Failed drives), you may not be able to reconstruct the drive data. To restore a RAID level 1 or 5 disk array to a working state in this case, you need to replace the drives and recreate the disk array (after deleting the logical volumes and file systems on the disk array and removing the disk array from the volume group). You must then add the disk array back to a volume group, recreate the logical volumes and file systems on it, and copy data back to the restored disk array from your backup media.



**Notes:**

1. Only one reconstruct can be in progress at any given time on the Ultra SCSI PCI RAID Adapter. Concurrent reconstructs are not supported.
2. Allow reconstruction to complete before running diagnostics. Running diagnostics on the Ultra SCSI PCI RAID Adapter during a reconstruct will kill the reconstruction. If a reconstruction fails, it may be restarted using PDAM.

## The Reconstruction Rate – Low, Medium, High

The rate at which a reconstruction occurs depends on the value of the reconstruction rate parameter. This parameter determines how much resource the adapter allocates for reconstructions. When the adapter reconstructs data on a drive, it divides the adapter's internal resources between reconstruction and normal I/O operations. As reconstruction rate increases, system I/O performance and reconstruction time may decrease. These parameters control only the rate of data reconstruction, not total reconstruction time.

## Change Reconstruction Rate Parameters

Use this procedure to change the Reconstruction Rate parameters.

**Note:** The **Reconstruction Rate** attribute may only be changed prior to the creation of any disk arrays on the adapter. Once a disk array has been configured on an adapter, the **Reconstruction Rate** cannot be changed. In order to modify the **Reconstruction Rate**, all disk arrays on the adapter must first be removed.

1. Start the SMIT PDAM:

```
smit pdam
```

2. Select the device (hdisk) name of the disk array you want.
3. Select the **Change/Show IBM PCI SCSI RAID Adapter** option.
4. Select an adapter when prompted.
5. Select the **Reconstruction Rate** option and enter the new value for this field.
6. Press Enter to make the changes and exit SMIT.



---

## Checking Consistency (Check and Repair Array Parity)

**Note:** The **Check Consistency** option applies only to RAID levels 1 and 5. RAID level 0 is a non-redundant array and therefore cannot be checked and repaired. RAID level 1 does not have parity either, but a parity check compares data on the mirrored drives. In addition, the RAID level 1 or 5 disk array must be at Optimal status in order to run check consistency.

Check consistency performs the following functions:

- Scans the disk array and checks the array parity for each block in the disk array. On a RAID level 1 disk array, Parity Check compares the data on each mirror, stripe by stripe.
- Repairs any array parity errors found during the parity check. On a RAID level 1 disk array, the adapter changes the data on the mirror stripe to make it match the data on the data disk. On a RAID level 5 disk array, the controller changes the parity so that it is consistent with the data.

The data is not repaired if array parity errors result from corrupted data. Only the array parity is repaired. Array parity is used in RAID Level 5 disk arrays to enable data to be reconstructed if a single drive fails. Checking and repairing parity helps ensure that you can recover after a drive failure.

**Note:** Upon creation of a disk array, if the parity/mirror is not initialized (Initialize Parity=**no**), then the **Check Consistency** option will encounter inconsistencies. It is recommended that the parity/mirror be initialized at disk array creation. This applies to only RAID levels 1 and 5. RAID level 0 is a non-redundant array and therefore cannot be initialized.

## Perform Check Consistency

Always maintain backup files, even with RAID level 1 and 5 disk arrays.

1. Start the SMIT PCI SCSI Disk Array Manager:

```
smit pdam
```

2. Select the **Perform Check Consistency** option.



3. Select the device (hdisk) name of the disk array you want to check and repair.

**Note:** Setting the **Enable Automatic Consistency Repair** option to `yes` will enable the adapter to attempt to repair any inconsistencies encountered.

You must run Check Consistency on each disk array separately.

4. When all the entries are correct, press Enter to perform the check on the selected disk arrays.
5. Repeat steps 3 through 4 as needed to check and repair additional disk arrays.

**Attention:** It is assumed the data is good and the parity is bad if an inconsistency is found when repairing a RAID level 5 array. Always maintain backup files also for RAID level 1 and 5 disk arrays. Backups are the most reliable method of restoring data.



---

## Restoring and Recovering Disk Arrays

Disk arrays may be restored to a working state after drive failure using several methods. Procedures for disk array restoration are provided for each of the RAID levels because each level may have a unique recovery process. To restore a disk array, refer “Restoring a RAID Disk Array” on page 4-14.

Error recovery procedures are also provided for various disk array status values. Refer to the following information:

- Delete a Spare or Failed Drive on page 3-9.
- Add a Spare Drive on page 3-8.
- Reviving a Failed Drive on page 3-12.
- Reconstructing a Failed Drive on page 3-14.

Restoring a disk array is the process of returning the disk array to the Optimal state after a drive failure. The tasks involved depend on the RAID level of the disk array and on how many drives have Failed or have experienced errors:

- Single-drive failures in RAID levels 1 and 5 are easily restored without losing data and without shutting down the disk array.
- Multiple-drive failures, or single-drive failures on RAID level 0, are treated like non-array drive failures in AIX. Delete the logical volumes, file systems, and volume groups on the disk array. Replace the drive, recreate the disk array and AIX file structures, and restore the data from the backup copy.

**Note:** Single-drive failures on redundant RAID Levels 1 and 5 are recoverable. The user should identify the Failed drive, physically remove it from the subsystem, and replace it with another drive. The user may then initiate a reconstruct on the Failed drive. Alternatively the user may reconstruct the data using an available Spare drive. The current Failed drive will remain Failed but will no longer exist as part of the disk array. This task is intended to be performed by the system administrator, and involves no reorganization or deletion of file systems or volume groups.

You need to replace a drive when one of the following events occur:

- The AIX error log facility sends a message indicating a disk array component failure (a drive state transitioned to Failed).
- You see a disk array status other than Optimal displayed by the **List all PCI SCSI RAID Arrays** option.
- You see a drive status other than Online or Spare displayed by the **List all**



**PCI SCSI RAID Arrays** option.

The recovery tasks are summarized in the RAID Recovery Tasks Summary tables that follow. See “Restoring a RAID Disk Array ” on page 4-14 for more detailed information.

<b>RAID Level 0 Recovery Tasks Summary</b>	
<b>Disk Array and Drive Status</b>	<b>Recovery Steps</b>
Disk array status is Dead.	<ol style="list-style-type: none"><li>1. Delete the file systems and logical volumes on the affected disk array and remove the disk array from the volume groups (see “Deleting Disk Arrays from the Operating System” on page 3-20).</li><li>2. Replace failed drives.</li><li>3. Delete and recreate the disk array.</li><li>4. Create new logical volumes and file systems on restored units (see “Adding Disk Arrays to the Operating System” on page 3-18).</li><li>5. Copy backed-up data to the restored logical volumes or file systems.</li></ol>

<b>RAID Level 1 Recovery Tasks Summary</b>	
<b>Disk Array and Drive Status</b>	<b>Recovery Steps</b>
Disk array status is Optimal, one or more drives have status of Warning.	<ol style="list-style-type: none"><li>1. If the PDAM displays two or more drives within a disk array that have the Warning state, stop using all file systems and logical volumes on the affected disk arrays and attempt to back up all files in those logical volumes before continuing.</li><li>2. One at a time, fail each drive (using the PDAM) that is in the Warning state. Replace the Warning drive, and reconstruct the data on it.</li></ol>
Disk array status is Degraded. Drive status shows a Failed drive.	<ol style="list-style-type: none"><li>1. Replace the Failed drive.</li><li>2. Using PDAM, reconstruct the data on the replaced drive.</li></ol>



<b>RAID Level 1 Recovery Tasks Summary</b>	
<b>Disk Array and Drive Status</b>	<b>Recovery Steps</b>
Disk array status is Dead. Drive status shows two or more Failed drives.	<ol style="list-style-type: none"><li>1. Delete the file systems and logical volumes on the affected disk arrays, and remove the disk arrays from their volume groups (see “Deleting Disk Arrays from the Operating System” on page 3-20).</li><li>2. Delete the Dead disk array. The Failed drives will remain Failed drives outside of a disk array. Delete the Failed drives from the system using PDAM, then physically replace the Failed drives. Add the drives back into the system as Spare drives using PDAM. Replace the Failed drives and revive the drive to the Spare state. Recreate the disk array.</li><li>3. Create new logical volumes and file systems on the restored units (see “Adding Disk Arrays to the Operating System” on page 3-18).</li><li>4. Copy backed-up data to the restored file systems or logical volumes.</li></ol>





<b>RAID Level 5 Recovery Tasks Summary</b>	
<b>Disk Array and Drive Status</b>	<b>Recovery Steps</b>
Disk array status is Optimal.	<ol style="list-style-type: none"><li>1. If the PDAM displays two or more drives within a disk array that have the Warning state, stop using all file systems and logical volumes on the affected disk arrays immediately and attempt to back up all files in those logical volumes before continuing.</li><li>2. One at a time, fail each drive (using the PDAM) that is in the Warning state. Replace the Warning drive, and reconstruct the data on it.</li></ol>
Disk array status is Degraded. Drive status shows one Failed drive.	<ol style="list-style-type: none"><li>1. Replace the Failed drive.</li><li>2. Reconstruct the data on the Failed drive by using the PDAM.</li></ol>
Disk array status is Dead. Drive status shows two or more Failed drives.	<ol style="list-style-type: none"><li>1. Delete the file systems and logical volumes on the affected disk arrays, and remove the disk arrays from their volume groups (see "Deleting Disk Arrays from the Operating System" on page 3-20).</li><li>2. Delete the Dead disk array. Delete the Failed drives from the system using PDAM, then physically replace the Failed drives. Add the drives back into the system as Spare drives using PDAM. Recreate the disk array.</li><li>3. Create new logical volumes and file systems on the restored units (see "Adding Disk Arrays to the Operating System" on page 3-18).</li><li>4. Copy backed-up data to the restored file systems or logical volumes.</li></ol>



## Restoring a Disk Array

Use the following procedure to restore a disk array:

1. Determine the degree to which the drive fault has affected the disk array. This can be accomplished with the PDAM. This will report any drives that have had errors.
2. Start the SMIT PCI SCSI Disk Array Manager by entering the following command:  

```
smit pdam
```
3. Select the **List all PCI SCSI Disk Arrays** option from the PCI disk array Manager menu. This will return the status of each disk array and the status of each drive within the disk array.
4. If a disk array status is Optimal, but one or more drives are in the Warning state, then the drive(s) has exceeded its soft error threshold. Go to “Replacing Warning Drives” on page 4-14, and complete the procedure.
5. If a disk array status is Degraded and the **List all PCI SCSI RAID ARRAY** option shows the Failed drive, go to “Replacing Failed Drives ” on page 4-14, and complete the procedure.
6. If the disk array status is Dead, then go to “Replacing a Dead Disk Array ” on page 4-16.

## Replacing Failed or Warning Drives (RAID Levels 1 and 5)

Use the following procedure to replace a Failed or Warning drive in a RAID level 1 or 5 disk array. If a drive in a disk array has a status of Failed, the disk array will have a status of Degraded. If one or more drives in a disk array have a status of Warning, the disk array status will remain Optimal.

1. Start the PDAM by entering the following command:  

```
smit pdam
```
2. Select the **Change/Show PCI SCSI Drive Status** option.
3. Locate the Failed or Warning drive.
4. Replace the drive with a good drive of equal or greater capacity.



**Attention:** If the replaced drive was a Warning drive, it is necessary to fail the drive before continuing to the next step. See the Fail a Drive section in Chapter 4. Do not fail more than one drive at a time, even if you need to replace more than one drive. Fail and reconstruct the drives one at a time. After you fail a drive, physically replace it. Replacing all the drives at once will result in the loss of all data on the disk array.

**Note:** If a service request number (SRN) is needed for the device, it will be necessary to run hardware diagnostics. See the *Diagnostic Information for Multiple Bus Systems* for complete instructions on running system diagnostics.

5. After you have physically replaced the drive, initiate a reconstruct on the replaced drive. Alternatively, the user may reconstruct onto any Spare drive. The Failed drive will remain Failed but will no longer be part of the disk array. The status of the replaced drive should change to Reconstructing.

**Note:** If reconstruction does not start automatically (a **hotspare** was not in place), select the **Reconstruct an IBM PCI SCSI Disk Array** option from the PDAM main menu to initiate reconstruction manually.

Wait for reconstruction to finish. The drive status of the replaced drive changes to Online, and the status of the affected disk array changes to Optimal.

6. After you have replaced and reconstructed all the Failed drives, exit PDAM.

**Attention:** Do not use this procedure to replace drives in a RAID level 0 array. For that procedure, see the “Replacing a Dead Disk Array” section on page 4-16. If there are two or more drives that need to be replaced, stop using all logical volumes and file systems on the disk array immediately. Back up all logical volumes on the disk array before continuing.



## Replacing a Dead or Optimal Array

This procedure is essentially the same procedure you would use to replace a Failed non-array disk drive in the AIX operating system. Use this procedure to restore disk arrays in the following circumstances:

- All RAID level 0 disk arrays with a status of Dead or Optimal.

**Note:** A RAID level 0 disk array that has a drive in the Warning state will be in the Optimal state. A RAID level 0 disk array that has a drive in the Failed state will be in the Dead state.

- A RAID level 1 disk array with a status of Dead.
  - A RAID level 5 disk array with a status of Dead.
1. For a RAID level 0 disk array that is Optimal, attempt to back up the files in all the logical volumes and file systems on the disk array.
  2. Remove all logical volumes and file systems on the disk array affected by the bad drive. See “Deleting Disk Arrays from the AIX Operating System” on page 3-20.
  3. Start the PCI SCSI Disk Array Manager by entering the following command:

```
smit pdam
```

4. Select the **Change/Show PCI SCSI Drive Status** option.
  5. Locate the drive that the PDAM displays as Failed or Warning.
- Note:** If the drive is in the Warning state, fail the drive manually before continuing. See “Reviving a Failed Drive” on page 3-12.
6. Delete the disk array. Select the **Delete a PCI SCSI Disk Array** option from the PDAM main menu. Select the appropriate disk array and press Enter.
  7. The Failed drives will remain Failed outside of the disk array. Select the **Remove a Failed Drive** option from PDAM and remove the Failed drive from the system. Physically replace the drives, adding them back to the system using the **Add a Spare Drive** option.
  8. Recreate the disk array. Use the **Create a PCI SCSI Disk Array** option from the PDAM main menu.
  9. Create new logical volumes and file systems on the restored disk arrays (see “Adding Disk Arrays to the Operating System” on page 3-18).
  10. Copy backed-up data back to the restored logical volumes and file systems.



## Replacing the Ultra SCSI PCI RAID Adapter

A configuration conflict may result when a Ultra SCSI PCI RAID Adapter within a configured system is replaced (possibly due to a defective adapter). The configuration stored on the adapter may be out of sync with the configuration stored on the drives. The configuration can be restored by synchronizing the adapter configuration with the drive configuration. This can be accomplished using the **Accept Configuration on Drives** option under **PDAM's Recovery Options**. Use the following to replace the Ultra SCSI PCI RAID Adapter:

1. Start the SMIT PDAM by entering the following command:

```
smit pdam
```

2. Select the **Recovery Options** option.
3. Select **Resolve PCI SCSI RAID Adapter Configuration** option.
4. Select **Accept Configuration on Drives** option.
5. Select the adapter that was replaced.

**Note:** Following an Accept Configuration on Drives option, the Ultra SCSI PCI RAID Adapter will automatically perform a Consistency Check with Auto-Repair on all redundant level RAID arrays. Progress of the Consistency Check can be monitored using the List PCI SCSI Disk Arrays option of PDAM.

## Detecting and Resolving Array Configuration Conflicts

An array configuration conflict exists when, during adapter configuration, the adapter is unable to detect an Online, Warning, Spare, or Hot-spare disk drive. All disk arrays (hdisks) associated with the adapter will remain in the Defined state when this condition occurs. An array configuration conflict can only exist following adapter configuration. It is, therefore, most likely to occur during system reboot, but can also be seen if the adapter is configured during runtime (for example, changed from the Defined to Available state). No PDAM operations are supported until the configuration conflict is resolved. Attempting to perform any PDAM operation will result in the following error:

```
sraid0 A conflicting Disk Array configuration has been
detected. Please proceed to the 'Display/Accept
Configuration Changes' option under the Recovery Options
panel to resolve.
-0016 - RAID Adapter command has failed.
```



Also, the following message is displayed and mail is sent to the root user when the conflict is first detected:

```
A condition has been detected that requires immediate
attention. A physical disk drive previously configured on
the IBM PCI SCSI RAID adapter scraid0 was not detected
during adapter configuration. The physical disk has
either been removed or is not detectable. Proceed to the
IBM PCI SCSI Disk Array Manager Recovery Options where
you can either accept that the drive is missing
(Display/Accept Configuration Changes), or attempt again
to detect the disk (Retry Current Configuration). Until
one of these options is successfully executed, no logical
RAID disks will be made available on this adapter.
```

An entry is also posted to the system error log indicating an array configuration conflict exists. The error log entry appears as follows:

```
9A1495A2 0308113896 U H scraid0 ARRAY CONFIGURATION
ERROR
```

The error log entry in its expanded form appears as follows:

```
-----
LABEL:          SCSI_ARRAY_ERR6
IDENTIFIER:     9A1495A2
```



Date/Time: Fri Mar 8 11:38:38  
Sequence Number: 9  
Machine Id: 00300001C400  
Node Id: drool  
Class: H  
Type: UNKN  
Resource Name: scraid0  
Resource Class: adapter  
Resource Type: 14102e00  
Location: 04-07  
VPD:

Part Number.....12345678  
EC Level.....1234567890  
Serial Number.....12345678  
FRU Number.....12345678  
Manufacturer.....IBM000  
Displayable Message.....PCIRAI  
Diagnostic Level.....01  
Device Driver Level.....01  
Loadable Microcode Level....96064!  
ROS Level and ID..... P10809

Description

ARRAY CONFIGURATION ERROR

Probable Causes

ARRAY COMPONENT UNDETECTABLE

Failure Causes

DISK DRIVE  
CABLE LOOSE OR DEFECTIVE  
SCSI BACKPLANE  
SCSI REPEATER

Recommended Actions

PERFORM DISK ARRAY MANAGER RECOVERY ACTIONS

Detail Data

SENSE DATA

0000 0052 0000 0708 0000 0000 0000 0000 0000 0000 0000  
0000 0000 0000 0000 0000

Any of the following indicate the presence of an array configuration conflict:  
error from PDAM, alertable message, or error log entry.



## Resolving Disk Array Configuration Conflicts

An action must be taken to resolve the conflict when an array configuration conflict occurs. No disk arrays configured on the adapter are available to the system until the conflict is resolved.

**Note:** The conflict should be handled as described in the “Replacing the Ultra SCSI PCI RAID Adapter” on page 4-17 if an array configuration conflict occurs subsequent to an adapter replacement. An Array configuration conflict resulting from an adapter replacement should not be resolved by synchronizing to the configuration on the adapter.

If the disk drive(s) which was not detected was part of an array, the array(s) associated with the disk drive(s) and its contents are displayed along with the status of the array prior to the conflict being detected. The location of the undetected disk drive and the state previous to being undetected are included.

The following information is displayed:

```
hdisk2  Raid 5 04-07-00-0,0 2144 MB Status OPTIMAL
      hdisk2  20 Channel 2 ID 0  ONLINE
      hdisk2  21 Channel 2 ID 1  ONLINE
      hdisk2  25 Channel 2 ID 5  ONLINE
Channel 2 ID 0 indicates change from status ONLINE to
status FAILED DRIVE
```

Once it has been determined which specific disk drives are involved in the array configuration conflict, take the following actions to resolve the conflict:

### Retry Current Configuration

1. Select the **Recovery Options** option of the PDAM
2. Select the **Resolve PCI SCSI RAID Adapter Configuration** option.
3. Select **Retry Current Configuration**.

This action causes the adapter to attempt to detect the missing disk drives. This option would be selected after making some adjustment to the hardware that may affect the adapter’s ability to detect the disk drive; for example, powering on an external disk enclosure or reattaching a loose cable connection. If the adapter is successful in detecting the missing disk drives, then a good completion is indicated by this option, all disk arrays associated with the adapter are configured (for example, made Available), and the conflict is resolved. If the adapter is not successful in detecting the missing disk drives, then the array configuration conflict has not been resolved. See “Messages and Error Log Templates” on page 4-23 or contact your service representative.





## Accept Configuration Changes

1. Select the **Recovery Options** option of the PDAM.
2. Select **Resolve PCI SCSI RAID Adapter Configuration**.
3. Select **Display/Accept Configuration Changes**.
4. Select the adapter reporting the conflict.
5. Change the **Display only** option to **NO**.

The array configuration is updated to reflect an Online, Spare, or Hot-spare disk drive is now in the Failed state. If any disk arrays are affected by failed drives, the state of that array is updated to reflect the disk failure. All Optimal and Degraded disk arrays are brought to the Available state, and the conflict is resolved.

User action is required to resolve array configuration conflicts. This allows the user to prevent arrays from becoming Failed or Degraded for reasons such as neglecting to supply power to a disk enclosure or connecting an SCSI cable. In these instances, the failure can be remedied without an array having become Degraded or Failed, and an unnecessary reconstruct operation may be avoided.

## Resolving Common Problems

**Symptom:** The Ultra SCSI PCI RAID Adapter is in the Defined state.

**Action:** Attempt to configure the Defined adapter instance.

1. Use the `smit devices` fast path.
2. Select **Disk Array** option.
3. Select the **IBM 2493 PCI SCSI Disk Array** option.
4. Select the **Configure a Defined PCI SCSI RAID Adapter** option.
5. Select the adapter instance.



If this action fails to configure the adapter, verify the adapter is still located in the described PCI slot, and run diagnostics on the adapter.

**Symptom:** The Ultra SCSI PCI RAID Adapter is in the Available state, but all associated arrays (hdisks) are in the Defined state.

**Action:** If the adapter was just replaced, follow the steps described in “Replacing the Ultra SCSI PCI RAID Adapter” on page 4-17.

If an array configuration conflict exists, follow the steps described in “Detecting and Resolving Array Configuration Conflicts” on page 4-17.

If it is a Failed disk array that will not configure, it is left in the Defined state and is not accessible.

**Symptom:** A disk drive attached to the Ultra SCSI PCI RAID Adapter is not recognized by the adapter.

**Action:** Attempt to configure the device. See “Add a Spare Drive” on page 3-8.

**Note:** If the drive was attached to the adapter before the last reboot, no user intervention is required. The adapter should recognize the new device during the boot process.

Determine if there is a device or cabling problem.

1. If the new device introduces a SCSI ID conflict, more than one device may be affected. Check the ID cable that is part of the hot-plug drive carrier.
2. See *Diagnostic Information for Multiple Bus System* for procedures about SCSI problem isolation. Follow the steps for cabling and devices.



---

## Messages and Error Log Templates

This section contains alertable messages and error log templates.

### Temporary RAID Adapter Error

IDENTIFIER 51F6CEBE

Label: SCSI\_ARRAY\_ERR1

Class: H

Type: TEMP

Loggable: YES    Reportable: YES    Alertable: NO

Description

ADAPTER ERROR

Probable Causes

ADAPTER MICROCODE

ADAPTER HARDWARE

Failure Causes

ADAPTER MICROCODE

ADAPTER HARDWARE

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Permanent RAID Adapter Error

IDENTIFIER 1EB75C3D

Label: SCSI\_ARRAY\_ERR2

Class: H

Type: PERM

Loggable: YES    Reportable: YES    Alertable: NO

Description

ADAPTER ERROR

Probable Causes

ADAPTER MICROCODE

ADAPTER HARDWARE

Failure Causes

ADAPTER MICROCODE

ADAPTER HARDWARE

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Temporary Array SCSI Bus Error

IDENTIFIER 1D57AC2F

Label: SCSI\_ARRAY\_ERR3

Class: H

Type: TEMP

Loggable: YES    Reportable: YES    Alertable: NO

Description

SCSI BUS ERROR

Probable Causes

SCSI BACKPLANE

SCSI REPEATER

CABLE

DISK DRIVE ELECTRONICS

Failure Causes

SCSI BACKPLANE

SCSI REPEATER

CABLE LOOSE OR DEFECTIVE

DISK DRIVE ELECTRONICS

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Temporary Physical Volume Error

IDENTIFIER 5ABCCC6B

Label: SCSI\_ARRAY\_ERR4

Class: H

Type: TEMP

Loggable: YES Reportable: YES Alertable: NO

Description

DISK OPERATION ERROR

Probable Causes

DASD MEDIA

DASD DEVICE

Failure Causes

DASD MEDIA

DISK DRIVE

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Permanent Physical Volume Error

IDENTIFIER 15FD5EE8

Label: SCSI\_ARRAY\_ERR5

Class: H

Type: PERM

Loggable: YES    Reportable: YES    Alertable: NO

Description

DISK OPERATION ERROR

Probable Causes

DASD MEDIA

DASD DEVICE

Failure Causes

DASD MEDIA

DISK DRIVE

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Array Configuration Error

IDENTIFIER 9A1495A2

Label: SCSI\_ARRAY\_ERR6

Class: H

Type: UNKN

Loggable: YES    Reportable: YES    Alertable: NO

Description

ARRAY CONFIGURATION ERROR

Probable Causes

ARRAY COMPONENT UNDETECTABLE

Failure Causes

DISK DRIVE

CABLE LOOSE OR DEFECTIVE

SCSI BACKPLANE

SCSI REPEATER

Recommended Actions

PERFORM DISK ARRAY MANAGER RECOVERY ACTIONS

Detail Data

SENSE DATA





## Array Component Failure

IDENTIFIER F084AF4B

Label: SCSI\_ARRAY\_ERR7

Class: H

Type: UNKN

Loggable: YES    Reportable: YES    Alertable: NO

Description

ARRAY COMPONENT FAILURE

Probable Causes

DASD DEVICE

CABLE

SCSI BACKPLANE

SCSI REPEATER

Failure Causes

DISK DRIVE

CABLE LOOSE OR DEFECTIVE

SCSI BACKPLANE

SCSI REPEATER

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Temporary Unknown Software Failure

IDENTIFIER DF7F0DED

Label: SCSI\_ARRAY\_ERR8

Class: S

Type: TEMP

Loggable: YES Reportable: YES Alertable: NO

Description

SOFTWARE PROGRAM ERROR

Probable Causes

SOFTWARE PROGRAM

ADAPTER MICROCODE

Failure Causes

SOFTWARE PROGRAM

ADAPTER MICROCODE

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA

SENSE DATA



## Recovered RAID Adapter Error

IDENTIFIER 8AC43378

Label: SCSI\_ARRAY\_ERR9

Class: H

Type: TEMP

Loggable: YES    Reportable: YES    Alertable: NO

Description  
ADAPTER ERROR

Probable Causes

DASD DEVICE

CABLE

SCSI BACKPLANE

SCSI REPEATER

Failure Causes

DISK DRIVE

CABLE LOOSE OR DEFECTIVE

SCSI BACKPLANE

SCSI REPEATER

Recommended Actions

PERFORM PROBLEM DETERMINATION PROCEDURES

Detail Data

SENSE DATA



## Alertable Messages

### SCSI\_ARRAY\_ERR6

A condition has been detected that requires immediate attention. A physical disk drive previously configured on the IBM PCI SCSI RAID adapter scraidN was not detected during adapter configuration.

The physical disk has either been removed or is not detectable. Proceed to the IBM PCI SCSI Disk Array Manager Recovery Options where you can either accept that the drive is missing (Display/Accept Configuration Changes), or attempt again to detect the disk (Retry Current Configuration). Until one of these options is successfully executed, no logical RAID disks will be made available on this adapter.

### SCSI\_ARRAY\_ERR7

A condition has been detected that requires immediate attention. A physical disk drive that is part of a logical RAID disk configured on the IBM PCI SCSI RAID adapter scraidN has failed. The corresponding logical RAID disk is now either degraded or offline. Proceed to the List IBM PCI SCSI Disk Arrays option in the IBM PCI SCSI Disk Array Manager to determine which physical disk has failed and if a hotspare rebuild has been initiated.

See “Resolving Disk Array Configuration Conflicts” on page 4-20 for more information.

---

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L



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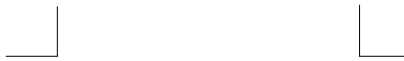


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