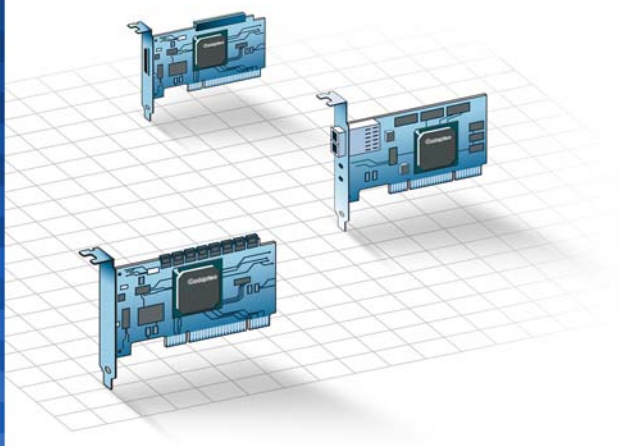
adaptec

SERIAL ATTACHED SCSI
48300 CONTROLLER
Installation and User's Guide



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- The TSID number is included on a white, bar-coded label, like this example:

- Affix a copy of the TSID label to the CD jacket so that you don't lose it.

North America

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Federal Communications Commission Radio Frequency Interference Statement

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. However, if this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.
- Use a shielded and properly grounded I/O cable and power cable to ensure compliance of this unit to the specified limits of the rules.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Adaptec, Inc. ASR-4000SAS/ASR-4800SAS/ ASR-4805SAS

Tested to Comply With FCC Standards

FOR HOME OR OFFICE USE

European Union Compliance Statement

This Information Technology Equipment has been tested and found to comply with EMC Directive 89/336/EEC, as amended by 92/31/EEC and 93/68/EEC, in accordance with:

- EN55022 (1998) Emissions
- EN55024 (1998) Immunity:
  - EN61000-4-2 (1998) Electrostatic discharge: ±4 kV contact, ±8 kV air
  - EN61000-4-3 (1998) Radiated immunity
  - EN61000-4-4 (1995) Electrical fast transients/burst: ±1 kV AC, ±0.5 kV I/O
  - EN61000-4-5 (1995) Surges ±1 kV differential mode, ±2 kV common mode
  - EN61000-4-6 (1996) Conducted immunity: 3 V
  - EN61000-4-11 (1994) Supply dips and variation: 30% and 100%

In addition, all equipment requiring U.L. listing has been found to comply with EMC Directive 73/23/EEC as amended by 93/68/EEC in accordance with EN60950 with amendments A1, A2, A3, A4, A11.

Australian/New Zealand Compliance Statement

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to the Australian/New Zealand standard AS/NZS 3548 set out by the Spectrum Management Agency.

Canadian Compliance Statement

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Japanese Compliance (Voluntary Control Council Initiative)

This equipment complies to class B Information Technology equipment based on VCCI (Voluntary Control Council for Interface). This equipment is designed for home use but it may causes radio frequency interference problem if used too near to a television or radio. Please handle it correctly per this documentation.

Contents

Introduction

Installing the HostRAID Controller and Drives

Installing the Driver

Managing Your Storage Space

Using the Adaptec RAID Configuration Utility

Adaptec Flash Utility (AFU)

Using the Command Line Utility

Introduction to SAS

Introduction 1

In this chapter...

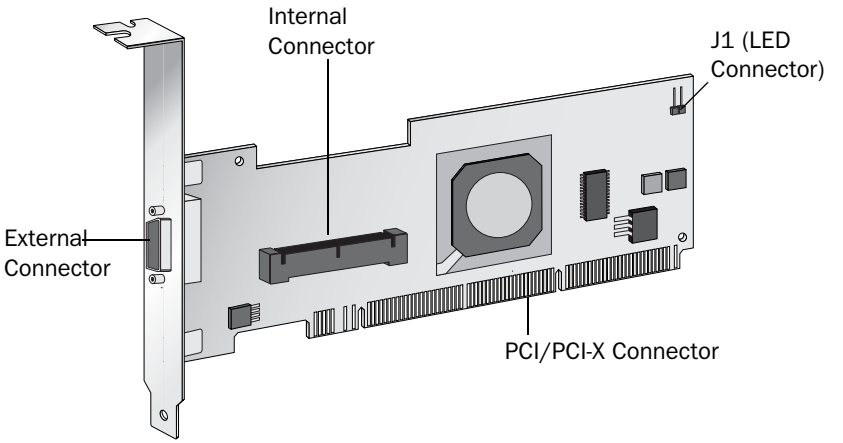
This Installation and User's Guide explains how to install your Adaptec SAS 48300 HostRAID controller. It also describes the utilities included in your HostRAID controller kit, and provides a basic overview of Serial Attached SCSI (SAS) technology.

Serial Attached SCSI (SAS) on the Adaptec HostRAID Controller

The Adaptec SAS 48300 is a low-profile PCI-X to 8-Phy SAS 1.0 HostRAID controller that enables you to connect SAS or SATA I and SATA II devices, such as hard disk drives, to an Intel-based computer with 64-bit PCI/PCI-X expansion slots.

SAS is the next-generation enterprise-class storage interface technology replacing the parallel SCSI interface. It uses a point-to-point connection for devices including initiators, targets, and expanders, and a routable protocol to connect up to 128 devices. It offers much faster communication and easier configuration. In addition, SAS provides device compatibility to Serial ATA (SATA) and uses similar cabling.

The Adaptec SAS HostRAID controller has an internal 4X SFF-8484 SAS 1.1 6-meter connector and an external 4X SFF-8470 SAS 1.0 8-meter connector with a maximum throughput of 3.0 Gb/sec (300 MB/sec). SAS allows for a cable with a compact design and length of up to 8 meters for optimal connectivity and airflow inside enclosures. For more information about SAS, see *Introduction to SAS* on page D80



The Adaptec SAS HostRAID controller supports:

- Compliance with SAS specification 1.0
- Physical and software compatibility with SAS and SATA-II hard disk drives
- Standard 2.5 and 3.5 inch SAS hard disk drives
- SES-2 support for disk drive enclosures

See *HostRAID Controller Features* on page 16 for more information on the Adaptec SAS HostRAID controller. For more information on SAS, see *Introduction to SAS* on page D80.

Kit Contents

Your Adaptec HostRAID controller kit includes:

- Adaptec SAS 48300 HostRAID controller with full-size bracket
- RAID Installation CD (Bootable)
  - Device Drivers
  - *Adaptec Serial Attached SCSI 48300 Controller Installation and User's Guide* (this guide)
  - Readme File
- Adaptec Storage Manager CD
  - Adaptec Storage Manager application
  - Readme Files
  - HostRAID Configuration Utility (HRCONF)
- Low-profile bracket
- One SAS x4 to SAS/SATA (4) x1 internal fan-out cable
- *Adaptec Serial Attached SCSI 48300 Controller Quick Install Guide* (printed)

Overview of the Installation Process

This section provides an overview of how to install and configure the Adaptec HostRAID controller:

1 Install and configure the HostRAID controller and hard disk drives, as described in *Installing the HostRAID Controller and Drives* on page 22.

2 Install the HostRAID controller driver, as described in *Installing the Driver* on page 31.

3 Install Adaptec Storage Manager as described in *Installing Adaptec Storage Manager* on page 37.

System Requirements and Compatibility

This section summarizes the following system requirements:

- *Drive Requirements*
- *Hardware Requirements*
- *Operating System Compatibility*

Drive Requirements

You need to have enough drives available for the RAID array level you want to build. For details, see *Understanding RAID* on page E89.

Note: Arrays work best when all array members (drives) are identical.

Hardware Requirements

The following list summarizes the hardware requirements:

- Intel Pentium, or equivalent, processor
- A motherboard that meets the following compatibility requirements:
  - Complies with the *PCI Local Bus Specification, Revision 2.2* and higher.
  - Supports multifunction devices where one of the devices is a PCI bridge.
  - Provides large memory-mapped address ranges.

- At least 256 MB of RAM
- An available 64-bit PCI /PCI-X slot
- 40 MB of free drive space
- 16-bit SVGA color monitor with a resolution of at least 800 x 600
- CD drive
- SAS interface cables

Note: Adaptec recommends only using Adaptec SAS cables. For more information on cables, see the Adaptec website at www.adaptec.com.

Operating System Compatibility

The following operating systems are supported:

- Microsoft® Windows®
  - Windows 2000—32-bit
  - Windows 2003—32-bit, x64
  - Windows XP—32-bit, x64
- Red Hat Linux
  - RHEL 3.0—OOB, QU5, QU6, 32-bit, x64
  - RHEL 4.0—OOB, U1, 32-bit, x64
- SuSE Linux
  - Professional 9.1, 9.2, 9.3, 32-bit, x64
  - SLES 9.0—OOB, SP1, SP2, 32-bit, x64
  - United Linux 1.0 (SLES 8)—OOB, SP3, SP4, 32-bit , x64
- Novell NetWare 6.5, SP4—32-bit

Note: For the latest drivers, go to www.adaptec.com.

HostRAID Controller Features

This section contains the following subsections:

Features Overview

The Adaptec SAS HostRAID controller offers the following features:

- RAID levels 0, 1, and 10.
- Supports *PCI Local Bus Specification*, Revision 2.2 or higher.
- 64-bit, 66/100/133-MHz PCI-X interface compatible with 64-bit PCI slots.
- Operating system independent configuration and RAID creation using the Adaptec RAID Configuration (ARC) utility.
- Flash ROM for easy updates of HostRAID controller firmware.
- Using Adaptec Storage Manager, event logging and broadcasting, including messaging for alphanumeric pagers.
- HostRAID® integrated RAID technology for reliable performance and full data protection.

Adaptec SAS 48300 HostRAID Controller Features Summary

The following table summarizes the features of the Adaptec SAS HostRAID controller.

Specification	Feature
Form factor	Low-profile
PCI compatibility	PCI/PCI-X
PCI bus width (max)	64-bit
PCI bus speed (max)	133 MHz
Ports	8
Drives per port	1
Total devices	8
Total devices (using expander technology)	16
Connectors, internal	1
Connectors, external	1
Cables supplied	One SAS x4 to SAS/SATA (4) x1 internal fan-out cable
RAID levels	0, 1, 10
Simple volume	Yes
Disk Drives	SAS (3.0Gb), SATA I (1.5Gb), SATA II (1.5Gb)
Hotspares	Yes
Native Command Queuing (NCQ)	Yes
Automatic failover	Yes
Audible alarm	No

Advanced RAID Features

The Adaptec SAS HostRAID controller supports the following advanced features:

- **SAS/SATA Disk Hot Plug**—Allows you to add and remove disks without shutting down your system.

Hotspares

The Adaptec SAS HostRAID controller supports hotspares—drives that are reserved to replace a failing drive in a redundant array. If a drive fails, the hotspare will replace it and the array is automatically rebuilt.

The Adaptec SAS HostRAID controller supports global hotspares, which protects every fault tolerant array that the drive has enough available capacity to protect.

About the Documentation

The documentation set for the Adaptec HostRAID controllers includes:

- **Readme text file**—Contains additional technical information about device compatibility, operating system support, and drivers.
- **Installation and User's Guide** (this book)—PDF file on the RAID Installation CD with complete information to install and configure the Adaptec SAS HostRAID controller and attached hard disk drives.
- **Quick Installation Guide**— Printed manual with information to quickly install and configure the Adaptec SAS HostRAID controller and attached hard disk drives.

To view the PDF documents, you need Acrobat Reader or Viewer installed on your computer. For details, see *Installing the Adobe Acrobat Reader* on page 19.

Using the CDs

- The RAID installation CD contains software, drivers, and documentation. You can use the CD the following ways:
  - *Booting from the CD with No Operating System*
  - *Using the CD Autorun in Windows*
- The Adaptec Storage Manager CD contains the application software to create and manage RAID arrays. Refer to *Using the CD Autorun in Windows* to use the Autorun feature.

Booting from the CD with No Operating System

The RAID Installation CD is bootable. You can use it to start a computer that has no operating system and configure an array (provided your computer is set up to recognize bootable CDs).

Note: Verify that your computer supports bootable CDs by entering system Setup and checking the settings.

Using the CD Autorun in Windows

To use the Autorun executable, autorun.exe, start Windows and insert the CD. Your computer automatically reads the CD if it is set up to do so.

Note: If your computer *does not* automatically read the CD, you can prompt it to read the CD by clicking on autorun.exe **from the root directory.**

Installing the Adobe Acrobat Reader

Adobe Acrobat Reader allows you to view the PDF files on the product installation CD. Adobe Acrobat Reader is available from Adobe as a free download. For details, visit www.adobe.com.

Software Tools Overview

The Adaptec SAS HostRAID controller includes the following tools to configure and manage your storage devices:

- **Adaptec RAID Configuration (ARC) Utility**—BIOS-based utility that contains the following components:
  - **Array Configuration Utility (ACU)**—Storage management utility. Used to create, configure, and manage arrays. Also available as a DOS-based executable (see below). For details, see *Using the Adaptec RAID Configuration Utility* on page A48.
  - **Serial*Select* Utility**—Device management utility. Used to verify the hardware configuration of the HostRAID controller and the drives. For details, see *Using the Adaptec RAID Configuration Utility* on page A55.
  - **Disk Utilities**—Drive management utility. Used to format and verify drives. For details, see *Using the Adaptec RAID Configuration Utility* on page A58.
- **Adaptec Storage Manager**—Storage management application with a graphical user interface (GUI). Used to create, configure, and manage arrays. For details, see *About Adaptec Storage Manager* on page 37.
- **HRCONF Command Line Utility**—command line program used to create and manage arrays.
- **Adaptec Flash Utility (AFU)**—DOS utility. Used to update, save, or verify the HostRAID controller firmware, BIOS, and Adaptec RAID Configuration Utility versions. For details, see *Adaptec Flash Utility (AFU)* on page B60.

Safety Information

To ensure your personal safety, as well as the safety of your equipment:

- Keep your work area and the computer clean and clear of debris.
- Before opening the system cabinet, unplug the power cord.

Electrostatic Discharge

Electrostatic Discharge (ESD) is a natural by-product of human activity. ESD is produced by materials that accumulate and retain electrical charges which are transferred to people or other objects upon contact.

⚠ **Caution:** ESD can damage electronic components when they are improperly handled and can result in total or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components.

To prevent ESD damage:

- Use an ESD wrist or ankle strap and ensure that it makes skin contact. Connect the equipment end of the strap to an unpainted metal surface on the chassis. If a wrist strap is not available, ground yourself by touching the metal chassis before handling the HostRAID controller or any other part of the computer.
- Avoid touching the HostRAID controller against your clothing. The wrist strap protects components from ESD voltages present on the body only. ESD voltages on clothing can still cause damage.
- Handle your HostRAID controller by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- When you need to put your HostRAID controller down, use an antistatic surface such as the bag supplied in your kit.
- If you plan to return the HostRAID controller to Adaptec, put it back in its antistatic bag immediately.

Installing the HostRAID Controller and Drives 2

In this chapter...

This chapter explains how to install your Adaptec SAS 48300 HostRAID controller, and how to install and connect disk drives.

SAS Drives and Cables

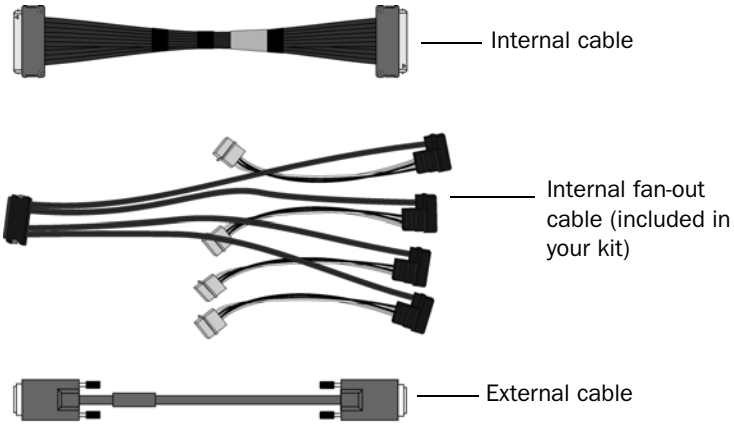
To install the Adaptec SAS 48300 HostRAID controller and drives, you need equal numbers of each of the following:

- SAS/SATA disk drives
- SAS cables

Configuration of SAS/SATA drives is simple for the following reasons:

- There are no jumpers or switches to set on SAS HostRAID controllers or SAS/SATA disk drives.
- All connectors are keyed so that you can insert them in only one direction.
- Some cable connectors are identical, so you don't need to worry about which end to attach to the HostRAID controller and which end to the drive.

There are various different SAS cables you can use to connect your HostRAID controller and drives. The following are examples you are likely to use:



Note: Adaptec recommends only using Adaptec SAS cables. For more information on cables, see the Adaptec website at www.adaptec.com.

Installing the HostRAID Controller and Drives

To install the Adaptec SAS 48300 HostRAID controller and drives:

1 If you have a a low-profile computer cabinet, replace the original full-height bracket with the low-profile bracket supplied in the Adaptec HostRAID controller kit.

2 Turn off your computer.

3 Ground yourself by touching the system chassis. See *Safety Information* on page 21 for more information.

4 Unplug the power cord.

5 Open the system cabinet.

6 Select an available 64-bit slot that is compliant with PCI/PCI-X Local Bus Specification 2.2 or higher.

Note: You'll get better performance if you use a PCI-X slot.

---

7 Remove the cover from the PCI/PCI-X slot.

8 Install the HostRAID controller in the PCI/PCI-X slot and secure the controller bracket to the chassis.

9 Connect the computer's disk activity LED cable (J1) to the appropriate connector on the HostRAID controller.

Ensure that the positive lead of the LED cable, usually a red wire or a wire marked with a red stripe, is attached to pin 1 and the negative lead, usually a black wire, is attached to pin 2.

10 Install and connect any internal drives using the appropriate cable. See *Connecting Disk Drive Options* for more information.

11 Close the computer cabinet.

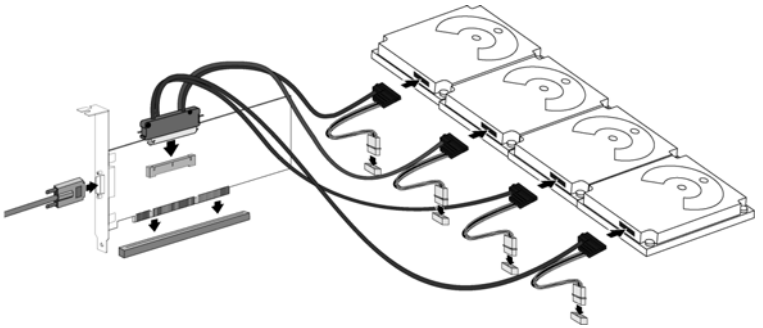
12 Connect any external cables and drives to the HostRAID controller.

Connecting Disk Drive Options

With SAS, you can connect internal disk drives in various ways—from simple direct connection to highly flexible storage topologies. These options allow you to mix SAS and SATA drives and increase the number of drives you can connect to.

Direct Connection

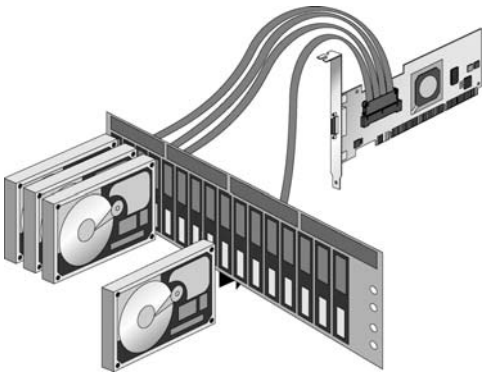
Using the appropriate internal or external cable, connect the HostRAID controller to any internal or external disk drives.



Installing the HostRAID Controller to a Backplane

Follow these steps to install your HostRAID controller on a backplane:

1. Using the appropriate cable, connect the HostRAID controller to the backplane of your system.
2. Connect your disk drive to the backplane connector.

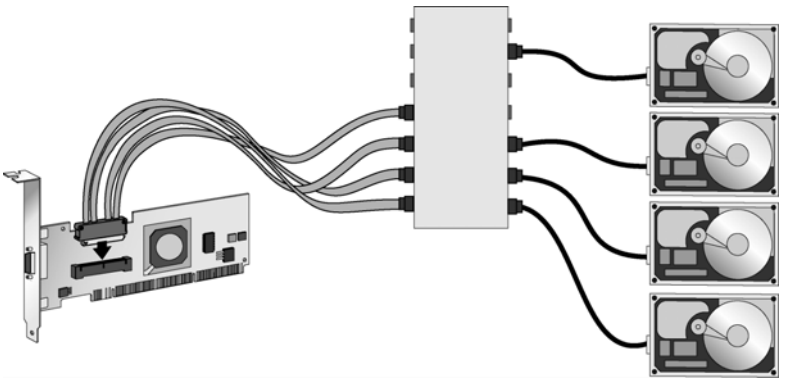


Installing the HostRAID Controller to a SAS Expander

You can use a SAS edge expander to connect multiple hard disk drives to your HostRAID controller or multiple controllers. Commands can be sent down one link and data returned on another in a separate connection to increase fault tolerance. Using a SAS expander and dual-port SAS drives and SATA drives with 2-port adapters, you can design redundant systems for maximum fault-tolerance.

To install the Adaptec SAS 48300 HostRAID controller to a SAS expander:

1. Using the appropriate cable, connect the HostRAID controller to a PHY connector on the expander.
2. Connect a cable from a PHYconnector on the expander to a hard disk drive.



Determining the Boot HostRAID Controller

Note: If your system will contain two or more bootable HostRAID controllers, read this section. Otherwise, skip this section.

The Adaptec SAS 48300 HostRAID controller supports bootable drives and arrays. The default setting of the HostRAID controller and system Setup allows you to install and boot from either a disk drive connected to the motherboard, or from a drive or array connected to the HostRAID controller.

If you already have an operating system installed on a disk drive connected to the motherboard and you want to boot a second operating system from the Adaptec SAS 48300 HostRAID controller:

Note: Selecting the boot controller is done under the system BIOS Setup Utility. Launching the system BIOS Setup Utility varies, see your operating system user's manual for more information.

1. Enter the system Setup.
2. Navigate to the disk drive boot sequence.
3. Move the boot controller to the top of the list.

Using Adaptec RAID Configuration Utility to Create a Bootable RAID Array

Note: If you want to install an operating system on a drive or array connected to your Adaptec SAS HostRAID controller, read this section. Otherwise, skip to installing the driver in your existing operating system, as described in *Installing the Driver* on page 31.

This procedure allows you to create a bootable RAID 0, 1, or 10 array on which you can install your operating system.

To create the RAID:

1. Install the HostRAID controller and drives, as described in *Installing the HostRAID Controller and Drives* on page 24.
2. Turn on the computer, press **Ctrl**+**A** to enter the Adaptec RAID Configuration Utility utility.

   If you have only one HostRAID controller, then skip to the next step. If more than one Adaptec SAS HostRAID controller is installed, the first screen shows the controllers present. Highlight the HostRAID controller you want to use, then press **Enter**. The Adaptec RAID Configuration utility screen is displayed.
3. Press **Enter** to select **Array Configuration Utility**.
4. Using the arrow keys, highlight **Create Array**, then press **Enter**.
5. Using the arrow keys as in Step 4, highlight the drive for the array, then press **Insert** for each highlighted drive.
6. Press **Enter**.

7 On the next screen, respond as follows:

Array Type	Select a RAID type, then press **Enter**.
Array Label	Type a name of no more than 15 characters, then press **Enter**.
Stripe Size	Select stripe size, then press Enter. (N/A for RAID 1.)
Create RAID via	Select RAID option, then press Enter. (No Init is the only option for RAID 0.)
[Done]	Press Enter.

The Creating Array window is displayed.

Note: RAID 1 and RAID 10, in clearing state the array is not available to the operating system until clearing process is complete.

8 Press **Enter** to continue with the array configuration.

Note: You can start using the array now. But, for a RAID 1 and RAID 10, performance is reduced until the build process is complete.

9 Press **Esc** until the Exit Utility window is displayed.

10 Highlight **Yes**, then press **Enter**.

The computer restarts.

11 Create the driver disk and install the driver as described in *Installing the Driver* on page 31.

3 Installing the Driver

In this chapter...

This chapter explains how to install your Adaptec RAID HostRAID controller driver and an operating system onto a bootable array.

Note: To install the driver on an existing operating system, see page 33 for Windows and page 35 for Linux.

Overview of the Driver Installation Process

Adaptec recommends the following driver installation procedure:

1 Create a driver disk. See *Creating the Driver Disk* on page 31 for details.

2 Identify the appropriate installation procedure for your computer.

You need to know the operating system and whether you are installing the driver while also installing the operating system, or installing the driver onto a system that already has the operating system installed.

3 Familiarize yourself with the supported RAID types. You will need to select a RAID type during your driver installation. See *Understanding RAID* on page 89 for details.

4 Read and understand the entire installation procedure.

5 Proceed with the installation.

Creating the Driver Disk

Note: If you are adding the HostRAID controller to a Linux system that was already installed, you do not need to create a driver disk; skip this section.

Before you install your driver, you will need to create a driver disk. To create the driver disk:

1 Set your system BIOS so that your computer boots from the CD drive.

2 Insert the Adaptec CD and turn on the computer.

3 Follow instructions and respond to prompts as necessary to get to the Adaptec Start Menu.

4 Click **Create Driver Disk**, from the Main Menu.

5 Select one of the operating systems from the list:

- Windows
- Linux
- Netware

6 Select the type of operating system.

7 Select the version of the operating system.

8 When prompted, insert a floppy disk, then click **OK**.

The computer creates the driver disk.

Installing the Windows Driver

This section contains the following procedures:

- *Installing the Driver When You Install Windows*
- *Installing the Driver in an Existing Windows System*

Installing the Driver When You Install Windows

To install the driver while also installing the Windows operating system, follow these steps:

1 Install and configure the HostRAID controller and disk drives, as described in *Installing the HostRAID Controller and Drives* on page 24.

2 If you want to create a bootable RAID array on which you can install your operating system, refer to *Using Adaptec RAID Configuration Utility to Create a Bootable RAID Array* on page 28. Otherwise, skip to Step 3

3 Create the driver disk, as described on *Creating the Driver Disk* on page 31. When finished, remove the driver disk.

4 Insert the Windows setup CD and restart the computer to begin the Windows installation.

5 When prompted to install a third-party driver, press **F6**.

Note: When F6 is active, a prompt appears at the bottom of the screen for only 5 seconds. If you miss your chance to press F6, restart the computer.

---

6 Insert the driver floppy disk and wait until prompted to install a driver. Press **S** to specify that the driver is on the floppy disk, then press **Enter**. The computer reads the disk.

7 When the Adaptec driver is found, press **Enter**. Respond to the on-screen instructions to complete the installation.

Installing the Driver in an Existing Windows System

To install the driver in an existing operating system:

1. Install and configure the HostRAID controller and disk drives, as described in *Installing the HostRAID Controller and Drives* on page 24.
2. Create the driver disk, as described on *Creating the Driver Disk* on page 31. When finished, remove the driver disk.
3. Start Windows. Windows launches the Found New Hardware Wizard, which searches for the driver.
4. Insert the driver floppy disk, select the floppy disk drive as the source, then click **Next**.
5. Click **Next** in the two subsequent windows and follow the on-screen instructions to complete the driver installation.
6. Remove the driver disk and restart the computer.

Installing the Linux Module

This section contains the following procedures:

- *Installing the Module When You Install Red Hat or SuSE*
- *Installing the Module in an Existing Linux System*

Note: For the most up-to-date information on Adaptec's support of Linux, visit www.adaptec.com.

Installing the Module When You Install Red Hat or SuSE

To install the module while also installing the Red Hat or SuSE operating system, follow these steps:

1. Install and configure the HostRAID controller and disk drives, as described in *Installing the HostRAID Controller and Drives* on page 24.
2. If you want to create a bootable RAID array on which you can install your operating system, refer to *Using Adaptec RAID Configuration Utility to Create a Bootable RAID Array* on page 28. Otherwise, skip to Step 3
3. Create the driver disk, as described in *Creating the Driver Disk* on page 31. When finished, remove the driver disk.
4. Insert the first Red Hat or SuSE installation CD and restart the computer to begin the operating system installation.
5. When the Red Hat or SuSE Welcome screen appears, do the following:
   - **For Red Hat:** Type `linux dd` at the Boot: prompt. When prompted, insert the driver disk, then select **OK**.
   - **For SLES 8:** Press the **Alt** key to have it prompt for a driver disk, then select **Installation**.
   - **For SLES 9:** Press **F6** to have it prompt for a driver disk, then select **Installation**.
6. Follow the prompts to set up your preferred environment.
7. If you are installing other third-party devices, proceed with the installation of those devices. Otherwise, select **Done**.

8 Proceed with the Linux installation according to the Red Hat or SuSE instructions.

Installing the Module in an Existing Linux System

To install the module in an existing Red Hat or SuSE Linux system:

1 Insert and mount the RAID Installation CD.

2 Install the module RPM by typing:

rpm -Uvh mount-point/xxx/yyy.rpm

where **mount-point** is the specific mount point on the Linux system, **xxx** is the driver path, and **yyy.rpm** is the rpm file.

3 Reboot your computer to complete the installation.

4 Run fdisk, mkfs, and create mount points for any new drives.

Managing Your Storage Space

4

In this chapter...

Once you have installed your Adaptec HostRAID controller, disk drives (or other devices), and device driver, you can begin to build and manage your storage space.

This chapter introduces Adaptec Storage Manager, and describes the other utilities included with your Adaptec HostRAID controller.

About Adaptec Storage Manager

Adaptec Storage Manager is a full-featured software application that helps you build a storage space for your online data, using Adaptec HostRAID controllers and disk drives.

With Adaptec Storage Manager, you can group disk drives into logical drives and build in redundancy to protect your data and improve system performance.

You can also use Adaptec Storage Manager to monitor and manage all the HostRAID controllers and disk drives in your storage space from a single location.

When Adaptec Storage Manager is installed on a computer, the *Adaptec Storage Manager agent* is also installed automatically. The agent is like a service that keeps your storage space running. It's designed to run in the background, without user intervention, and its job is to monitor and manage system health, event notifications, tasks schedules, and other on-going processes on that system. It sends notices when tasks are completed successfully, and sounds an alarm when errors or failures occur on that system.

The agent uses less memory than the full application. If your storage space includes systems that won't be connected to monitors (and therefore won't require the user interface), you can choose to run the *agent only* on those systems instead of the full application. For more information, refer to the *Adaptec Storage Manager User's Guide* or online Help.

Installing Adaptec Storage Manager

Adaptec Storage Manager is included on the Adaptec Storage Manager Installation CD. For installation instructions, refer to the *Adaptec Storage Manager User's Guide*, also included on the Adaptec Storage Manager Installation CD.

About the HostRAID Controller Configuration Utility

The HostRAID Controller Configuration Utility (HRCONF) is a command line utility that you can use to perform some basic array and configuration management functions.

With HRCONF, you can:

- Create and delete logical drives
- Modify and copy configuration settings
- Recover from disk drive failures and troubleshoot

HRCONF and the *Command Line Interface (CLI) User's Guide*, which describes how to use HRCONF, are included on the Adaptec Storage Manager Installation CD.

Note: Adaptec recommends that only advanced users familiar with command line interfaces use HRCONF.

About the Adaptec RAID Controller Utility

The Adaptec RAID Controller utility is a BIOS-based utility that you can use to create and manage HostRAID controllers, disk drives and other devices, and arrays. The Adaptec RAID Controller utility comprises these tools:

- **Array Configuration Utility(ACU)**—For creating and managing arrays, and initializing and rescanning disk drives. (ACU for DOS is also available. See *Using the Adaptec RAID Configuration Utility* on page 48.)
- **A -*Select* utility**—Serial*Select*, SATA*Select*, or SCSI*Select*, for modifying your HostRAID controller and disk drive settings.
- **Disk Utilities**—For formatting or verifying disk drives.

The Adaptec HostRAID Controller utility is included in your controller's BIOS. For more information, see *About the Adaptec RAID Controller Utility* on page 38.

Note: The Adaptec HostRAID Controller utility is primarily intended to configure your system before an operating system has been installed.

About the Adaptec Flash Utility

The Adaptec Flash Utility (AFU) is a text-based DOS utility that you can use to update, save, or verify your HostRAID controller's firmware BIOS and Non-Volatile Random Access Memory (NVRAM).

Caution: Although the AFU contains safeguards to prevent you from accidentally damaging your HostRAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your HostRAID controller inoperable. Adaptec recommends that only advanced users familiar with working in DOS use the AFU.

Which Utility Should I Use?

To create a bootable array, Adaptec recommends that you use the BIOS-based ACU (see page 38).

For all subsequent storage management tasks, Adaptec recommends that you install and use Adaptec Storage Manager (see page 37). As a full-featured software application with a graphical user interface, it is the easiest to use and offers the widest range of management functions.

SAS Drives and Cables

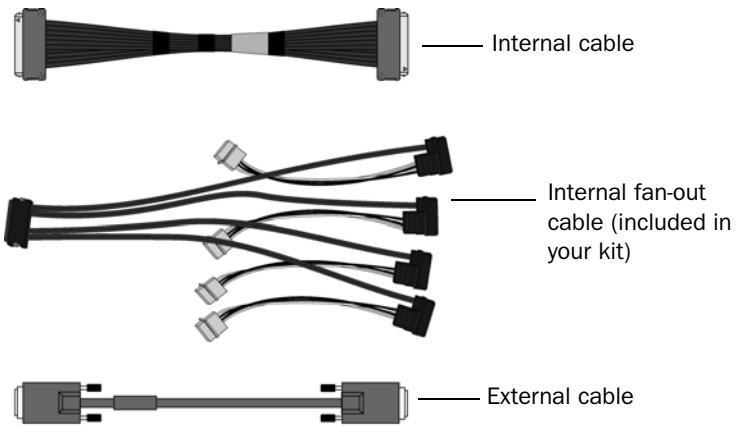
To install the Adaptec SAS HostRAID controller and drives, you need equal numbers of each of the following:

- SAS/SATA disk drives
- SAS cables

Configuration of SAS/SATA drives is simple for the following reasons:

- There are no jumpers or switches to set on SAS HostRAID controllers or SAS/SATA disk drives.
- All connectors are keyed so that you can insert them in only one direction.
- Some cable connectors are identical, so you don't need to worry about which end to attach to the HostRAID controller and which end to the drive.

There are various different SAS cables you can use to connect your HostRAID controller and drives. The following are examples you are likely to use:



Note: Adaptec recommends only using Adaptec SAS cables. For more information on cables, see the Adaptec website at www.adaptec.com.

Installing the HostRAID Controller and Drives

To install the Adaptec SAS HostRAID controller and drives:

1 If you have a a low-profile computer cabinet, replace the original full-height bracket with the low-profile bracket supplied in Adaptec HostRAID controller kit.

2 Turn off your computer.

3 Ground yourself by touching the system chassis. See *Safety Information* on page 21 for more information.

4 Unplug the power cord.

5 Open the system cabinet.

6 Select an available 64-bit slot that is compliant with PCI/PCI-X Local Bus Specification 2.2 or higher.

Note: You'll get better performance if you use a PCI-X slot.

---

7 Remove the cover from the PCI/PCI-X slot.

8 Install the HostRAID controller in the PCI/PCI-X slot and secure the controller bracket to the chassis.

9 Connect the computer's disk activity LED cable to the appropriate connector on the HostRAID controller.

Ensure that the positive lead of the LED cable, usually a red wire or a wire marked with a red stripe, is attached to pin 1 and the negative lead, usually a black wire, is attached to pin 2.

10 Install and connect any internal drives using the appropriate cable. See *Connecting Disk Drive Options* for more information.

11 Close the computer cabinet.

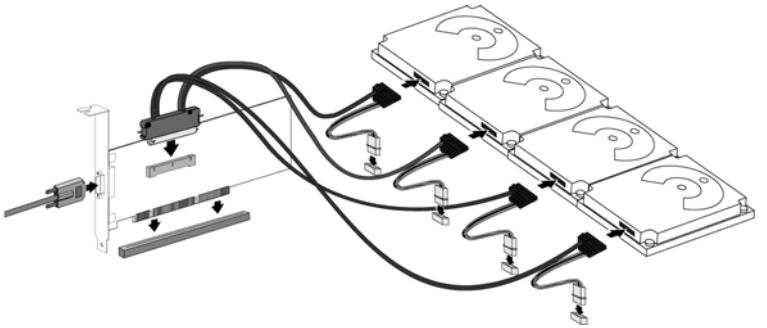
12 Connect any external cables and drives to the HostRAID controller.

Connecting Disk Drive Options

With SAS, you can connect internal disk drives in various ways— from simple direct connection to highly flexible storage topologies. These options allow you to mix SAS and SATA drives and increase the number of drives you can connect to.

Direct Connection

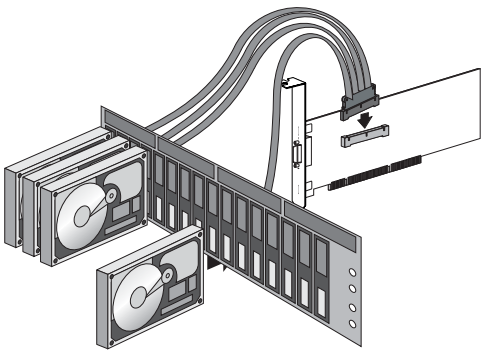
Using the appropriate internal or external cable, connect the HostRAID controller to any internal or external disk drives.



Installing the HostRAID Controller to a Backplane

Follow these steps to install your HostRAID controller on a backplane:

1. Using the appropriate cable, connect the HostRAID controller to the backplane of your system.
2. Connect your disk drive to the backplane connector.

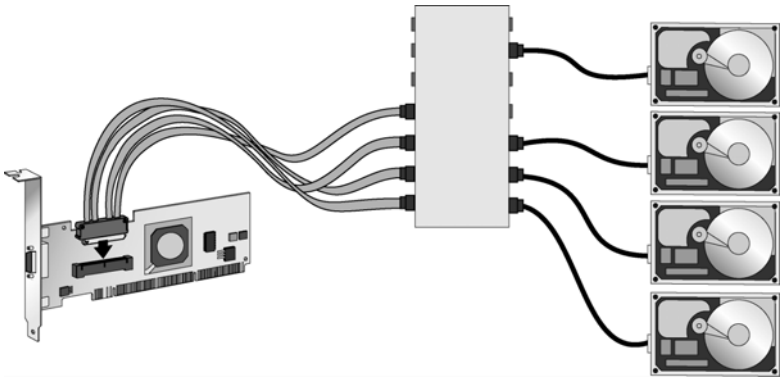


Installing the HostRAID Controller to a SAS Expander

You can use a SAS edge expander to connect multiple hard disk drives to your HostRAID controller or multiple HostRAID controllers. Commands can be sent down one link and data returned on another in a separate connection to increase fault tolerance. Using a SAS expander and dual-port SAS drives and SATA drives with 2-port adapters, you can design redundant systems for maximum fault-tolerance.

To install the Adaptec SAS HostRAID controller to a SAS expander:

1. Using the appropriate cable, connect the HostRAID controller to a PHY connector on the expander.
2. Connect a cable from a PHYconnector on the expander to a hard disk drive.



Determining the Boot Controller

Note: If your system will contain two or more bootable controllers, read this section. Otherwise, skip this section.

The Adaptec SAS HostRAID controller supports bootable drives and arrays. The default setting of the controller and system Setup allows you to install and boot from either a disk drive connected to the motherboard, or from a drive or array connected to the controller.

If you already have an operating system installed on a disk drive connected to the motherboard and you want to boot a second operating system from the Adaptec SAS HostRAID controller:

1 Enter the system Setup.

2 Navigate to the disk drive boot sequence.

3 Move the boot controller to the top of the list.

Using Adaptec RAID Configuration Utility to Create a Bootable RAID Array

Note: If you want to install an operating system on a drive or array connected to your Adaptec SAS HostRAID controller, read this section. Otherwise, skip to installing the driver in your existing operating system, as described in *Installing the Driver* on page 31.

This procedure allows you to create a bootable RAID 0, 1, or 10 array on which you can install your operating system.

To create the RAID:

1 Install the HostRAID controller and drives, as described in *Installing the HostRAID Controller and Drives* on page 41.

2 Turn on the computer, press **Ctrl**+**A** to enter the Adaptec RAID Configuration utility.

   If you have only one HostRAID controller, then skip to the next step. If more than one Adaptec SAS HostRAID controller is installed, the first screen shows the controllers present. Highlight the HostRAID controller you want to use, then press **Enter**. The Adaptec RAID Configuration utility screen is displayed.

3 Press **Enter** to select **Array Configuration Utility**.

4 Using the arrow keys, highlight **Configure Drives**, then press **Enter** to configure all drives.

5 Using the arrow keys, highlight the drives to be used for the array, then press **Insert** for each highlighted drive.

   The utility displays the selected drives to create the array.

6 Press **Enter**.

   A warning is displayed—this is normal.

7 Press **Y**, then **Enter**.

   The selected drives are initialized, then the ACU screen is displayed.

8 Using the arrow keys, highlight **Create Array**, then press **Enter**.

9 Using the arrow keys as in Step 5, highlight the drive for the array, then press **Insert** for each highlighted drive.

10 Press **Enter**.

11 On the next screen, respond as follows:

Array Type	Select a RAID type, then press **Enter**.
Array Label	Type a name of no more than 15 characters, then press **Enter**.
Stripe Size	Select stripe size, then press Enter. (N/A for RAID 1.)
Create RAID via	Select RAID option, then press Enter. (No Init and Migrate are the only options for RAID 0.)
[Done]	Press Enter.

The Creating Array window is displayed.

Note: RAID 1 and RAID 10 clearing is not available to the operating system until clearing operation is complete.

12 Press **Enter** to continue with the array configuration.

Note: You can start using the array now. But, for a RAID 1, performance is reduced until the build process is complete.

13 Press **Esc** until the Exit Utility window is displayed.

14 Highlight **Yes**, then press **Enter**.

The computer restarts.

Create the driver disk and install the driver as described in *Installing the Driver* on page 31.

Using the Adaptec RAID Configuration Utility

A

In this Appendix...

The Adaptec HostRAID Controller utility is a BIOS-based utility that you can use to create and manage HostRAID controllers, disk drives and other devices, and arrays.

Note: Adaptec recommends that only advanced users familiar with working in a computer BIOS use the Adaptec HostRAID Controller utility tools. For more information, see *Managing Your Storage Space* on page 36

HostRAID—Overview

The Adaptec RAID Configuration (ARC) utility is part of the HostRAID controller BIOS. The utility includes:

- **Array Configuration Utility (ACU)**—Used to create, configure, and manage arrays, and make arrays bootable. Also used to configure and rescan drives.
- **Serial*Select* Utility**—Used to change device and HostRAID controller settings.
- **Disk Utilities**—Used to format or verify media.

To run the Adaptec RAID Configuration utility, press **Ctrl+A** when prompted by the following message during system startup:

Press <Ctrl><A> for Adaptec RAID Configuration Utility

The Adaptec RAID Controller menu presents the following options:

- Array Configuration Utility
- Serial*Select* Utility
- Disk Utilities

To select a menu option in Adaptec RAID Configuration Utility, browse with the arrow keys, then press **Enter**. Sometimes, selecting an option displays another menu; to return to the previous menu at any time, press **Esc**.

Using the Array Configuration Utility

The Array Configuration Utility (ACU) allows you to perform these tasks:

- *Creating Arrays*
- *Managing Arrays*
- *Adding/Deleting Hotspares*
- *Configure Disk Drives*
- *Rebuilding Arrays*
- *Verifying Arrays*

Creating Arrays

Before creating arrays, make sure the disks for the array are connected and installed in your system. Note that disks with no usable space are shown in gray and cannot be used. See *Configure Disk Drives* on page 53.

To create an array:

1. Turn on your computer and press **Ctrl+A** when prompted to access the Adaptec RAID Configuration utility.
2. From the ARC menu, select **Array Configuration Utility** (**ACU**).
3. From the ACU menu, select **Create Array**.
4. Select the disks for the new array, then press **Insert**. To deselect any disk, highlight the disk then press **Delete**.
5. Press **Enter** when both disks for the new array are selected. The Array Properties menu displays.

Assigning Array Properties

Note: Once the array is created and its properties are assigned, you cannot change the array properties using the ACU. Instead, use Adaptec Storage Manager (See *About Adaptec Storage Manager* on page 37 for details.)

To assign properties to the new array:

1. In the Array Properties menu, select an array type then press **Enter**.

   Only the available array types, RAID 0, RAID 1, and RAID 10 are displayed. RAID 0 and RAID 1 requires two drives. RAID 10 requires four drives.
2. Type in an *optional* label of no more than 15 characters for the array, then press **Enter**.
3. For RAID 0, select the desired stripe size. Available stripe sizes are 16, 32, and 64 KB (default).

   Note: Adaptec recommends that you *do not* change the default.

4 The options under **Create RAID via** allows you to select between the different creation methods for RAID 0, RAID 1, and RAID 10. The following table gives examples of when each is appropriate.

RAID Type	Create RAID via	When Appropriate
RAID 0	Quick Init	Creating a RAID 0 on new drives.
RAID 0	Migrate	Creating a RAID 0 and you want to preserve data on an existing drive. You will be asked to select the source drive. The contents of the source drive are preserved and any data on the new drive is lost.
RAID 1	Build	Creating a RAID 1 and you want to preserve data on an existing drive. You will be asked to select the source drive. The contents of the source drive are preserved and any data on the new drive is lost.
RAID 1, RAID 10	Clear	Creating a RAID 1 or 10 on new drives, or when you want to ensure that the new array contains no existing data.
RAID 1, RAID 10	Quick Init	Fastest way to create a RAID 1 or 10. Appropriate when using new drives.

Notes:

- Before adding a new drive to an array, back up any data contained on the new drive. Otherwise, all data will be lost.
- If you stop the Build or Clear process on a RAID 1 or RAID 10 from ACU, you can restart it by pressing **Ctrl+R**.
- A RAID 1or RAID 10 created using the Quick Init option may return some data miscompares if you later run a consistency check. This is normal and is not a cause for concern.
- The ACU allows you to use drives of different sizes in a RAID 1. However, during a build operation, only the smaller drive can be selected as the source drive.
- RAID 1 or RAID 10 clearing is not available to the operating system until clearing operation is complete.

5 When you are finished, press **Done**.

Managing Arrays

Select the **Manage Arrays** option to perform these tasks:

- *Viewing Array Properties*
- *Adding/Removing a Bootable Array*
- *Deleting Arrays*

The following sections describe these operations in greater detail.

Viewing Array Properties

To view the properties of an existing array:

1. From the ACU menu, select **Manage Arrays**.
2. From the List of Arrays dialog box, select the array you want to view then press **Enter**.

   The Array Properties dialog box appears, showing detailed information on the array. The physical disks associated with the array are displayed here.
3. Press **Esc** to return to the previous menu.

Adding/Removing a Bootable Array

To make an array bootable:

1. From the Main menu, select **Manage Arrays**.
2. From the List of Arrays, select the array you want to make bootable, then press **Ctrl+B**. An asterisk will appear next to the bootable array.
3. To make the array nonbootable, select it then press **Ctrl+B**. The asterisk will disappear next to the array indicating that it is nonbootable.

Deleting Arrays

Caution: Back up the data on an array before you delete it. Otherwise, all data on the array is lost. Deleted arrays cannot be restored.

To delete an existing array:

1. From the ACU menu, select **Manage Arrays**.
2. Select the array you wish to delete, then press **Delete**.
3. In the Array Properties dialog box, select **Delete** then press **Enter**. A warning message appears.
4. If you press **Yes**, select the member when the following prompt is displayed:

   To delete the partition table, choose which member:
   member #0, member #1, both, none

5. Press **Esc** to return to the previous menu.

Adding/Deleting Hotspares

Select the **Add/Delete Hotspare** option to add, delete, or view hot spares.

1. From the ACU menu, select **Add/Delete Hotspare**.
2. Use the up and down arrow keys to highlight the disk you want to designate as a Hotspare, then select **Insert**>**Enter**.
3. Press **Yes** when the following prompt is displayed:

   Do you want to create a spare? (Yes/No)

   The Spare you have selected appears in the Selected Drive menu.

Configure Disk Drives

Caution: If the drive is used in an array, you may not be able to use the array again. *Do not* configure a drive that is part of a boot array. To determine which disks are associated with a particular array, see *Viewing Array Properties* on page 51.
You will not be able to configure the drive if there is a legacy partition table or valid Master boot record (MBR) already existing. You will need to run a disk partitioning software like Fdisk to delete the partition.

To configure drives:

1. From the Main menu, select **Configure Drives**.
2. Use the up and down arrow keys to highlight the disk you wish to configure, then press **Insert**.
3. Repeat Step 2 if you want to add another drive to be configured.
4. Press **Enter**.
5. Read the warning message and ensure that you have selected the correct disk drives to configure. Type **Y** to continue.

Rebuilding Arrays

Note: Rebuilding applies to Fault Tolerant arrays (RAID 1 and RAID 10) only. If a spare does not exist and a disk drive fails, you need to create a spare before you can rebuild an array. See *Adding/Deleting Hotspares* on page 52 before continuing your Rebuild.

By replacing a failed drive of a RAID 1 array with a new drive, you can Rebuild to get the array to Optimal status and assume fault tolerance. You can perform a Rebuild in the following ways:

System Shutdown Rebuild

Note: This section applies only when an operating system and drivers are installed.

You can shut down the system and replace the failed drive with a new one (of equal or greater capacity). When the system is booted, you can assign the new drive as a spare, and this will start the Rebuild task. All the data from the good drive is copied to the new one, and the original RAID 1 array is recreated.

Manual Rebuild

1. From the Main Menu, select **Manage Arrays**. From the List of Arrays, select the array you want to Rebuild.
2. Press **Ctrl+R** to Rebuild.

Verifying Arrays

If you are notified of a mismatch of data during a RAID 1 build, follow these steps to verify the arrays:

Note: The Verify option is available only if the array is Optimal. If the array has failed, you must rebuild the array.

1. Highlight the array you want to verify.
2. Press **Ctrl+S**.
3. When the Verify is complete, you are notified of any errors found during the Verify operation.

Using Serial*Select*

The Serial*Select* utility allows you to change the BIOS and HostRAID controller and device settings without opening the computer cabinet.

For information on the Serial*Select* options, see *SerialSelect Options* on page 56. To access Serial*Select*:

1. Restart the computer, then press **Ctrl**+**A** when prompted to access the Adaptec RAID Configuration utility.
2. If multiple HostRAID controllers are installed, select the HostRAID controller you want to configure, then press **Enter**.
3. From the ARC menu, select **Serial*Select* Utility**.

   To select a menu option, browse with the arrow keys to the option, then press **Enter**. In some cases, selecting an option displays another menu. You can return to the previous menu at any time by pressing **Esc**.

   To restore the original Serial*Select* default values, press **F6** from within the SAS Driver and Controller Configuration screens.
4. To exit SerialSelect, press **Esc** until a message prompts you to exit (if you changed any settings, you are prompted to save the changes before you exit).
5. At the prompt, select **Yes** to exit, then press any key to restart the computer. Any changes you made in Serial*Select* take effect after the computer restarts.

Serial*Select* Options

The following table lists the available and default settings for each Serial*Select* option and the descriptions of each option. The default settings are appropriate for most systems and appear in bold type in the table. Adaptec recommends that you do not change the settings.

Serial*Select* Options	Available Settings	Description
Controller Configuration		
Runtime BIOS	**Enabled** Disabled Disabled:Scan bus	Controls the state of the BIOS at POST time. When **Enabled**, the HostRAID controller BIOS allows the controller to act as a bootable device. Disabling the BIOS allows another suitable HostRAID controller to act as the boot device.
BBS Support	**Device** Controller	When BBS support is set to **Device** base, the system's BIOS will list each attached bootable device to the HostRAID controller as individual entry. When BBS support is set to Controller base, the system's BIOS will only list the HostRAID controller in the system boot order. This is useful in a multi-HostRAID controller configuration.
RAID Support	**Enabled** Disabled	When there are active arrays in the system, will not allow you to **Disable** RAID support.
POST Banner Display	**Enabled** Disabled	When **Enabled**, the Adaptec banner, version, and copyright is displayed. When Disabled, the Adaptec banner, version, and copyright is not displayed.

SerialSelect Options	Available Settings	Description
CTRL-A Message Display	**Enabled** Disabled	When set to **Enabled**, the SAS HostRAID controller BIOS displays the Press <Ctrl> <A> for Adaptec RAID Configuration Utility message on your screen during system bootup. If this setting is disabled, you can still invoke the Adaptec RAID Configuration utility by pressing **Ctrl+A** after the SAS card BIOS banner appears.
Physical Drives Display during Post	**Enabled** Disabled	When **Enabled**, attached physical devices are displayed during system POST. Displaying the devices adds a few seconds to the overall POST time.
PHY Configuration		
PHY Rate	**Auto**, 1.5, 3.0	The data transfer rate between the HostRAID controller and devices. The default setting is **Automatic**, which allows the SAS card to adjust the speed as needed. **Note:** SATA-II targets are negotiated at 1.5 Gbps only.
SAS Address	**0**-F	Specifies the last digit of a 64-bit SAS address of the HostRAID controller, device, and each port using a globally unique worldwide name (WWN) identifier.
Controller Properties		
PCI Slot: Bus: Device:Function	None	Displays the path of the storage devices in a Host RAID controller.
Interrupt (IRQ) Channel	None	Displays interrupt

SerialSelect Options	Available Settings	Description
I/O Port Address	None	Displays I/O port address
Device ID	None	Displays device ID
Controller Serial Number	None	Displays controller serial number
Controller WWN	None	Displays the controller World Wide Name

Using the Disk Utilities

The disk utilities allow you to format or verify the media of the hard disk drives.

To use the disk utilities:

1. Restart your computer and press **Ctrl+A** when prompted to access the Adaptec RAID Configuration utility.
2. If multiple HostRAID controllers are installed, select the controller you want to configure, then press **Enter**.
3. From the ARC menu, select **Disk Utilities**.
4. Select the desired disk, then press **Enter**.

   You are offered the following options:

   - **Format Disk**—Performs a low-level format to SAS disk drive while simulating a low-level format to SATA disk drive by writing zeros to the entire drive. SATA drives are low-level formatted at the factory and do not need to be low-level formatted again.

     ⚠ **Caution:** Formatting destroys all data on the disk. Be sure to back up your data before performing this operation.

   - **Verify Disk Media**—Scans the media of a disk drive for defects.
   - **Write Cache**—Enabled providing maximum performance.
   - **Connection Rate**—Set the connection rate to 1.5Gbps or 3.0 Gbps.

- **Mark bootable**—Marks the drive as a boot device.
- **Indicate LED**—A green LED on an enclosure blinks when a disk drive is active and remains solid when it is idle.

Adaptec Flash Utility (AFU)

B

In this Appendix...

This chapter describes how to use the Adaptec Flash Utility (AFU), a text-based DOS utility that you can use to update, save, or verify the HostRAID controller's firmware BIOS.

⚠ **Caution:** Although the AFU contains safeguards to prevent you from accidentally damaging your HostRAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your HostRAID controller inoperable. Adaptec recommends that only advanced users familiar with working in DOS use the AFU. For more information, see *Managing Your Storage Space* on page 36.

Introduction

The Adaptec Flash Utility (AFU) is a DOS utility used to update, save, or verify the HostRAID controller's firmware BIOS.

⚠ **Caution:** The AFU is easy to use and contains safeguards to prevent you from accidentally damaging the HostRAID controller's flash contents. Still, *you must be careful to use the AFU correctly*, otherwise, you could render the HostRAID controller inoperable.

The AFU is used to:

- **Update**—Updates all the flash components on a HostRAID controller with the flash image data from a User Flash Image (UFI) file.

  The AFU updates the HostRAID controller's flash by reading UFI files and writing them to the controller's flash components.

  Note: The UFI includes the HostRAID controller's type, thereby ensuring that the AFU uses the correct file.

- **Save**—Updates and verifies the BIOS image of the controller.
- **Verify**—Reads the contents of a HostRAID controller's flash components and compares it to the contents of the specified UFI file.
- **Version**—Displays version information about a HostRAID controller's flash components.
- **List**—Lists all supported HostRAID controllers detected in your system.

System Requirements

The requirements for AFU are as follows:

- MS–DOS version 5.0 or later. It cannot run from a DOS command prompt window under any version of Windows.

  Note: You cannot create a bootable floppy using Windows 2000.

- At least 8 MB of extended memory.

Compatibility

The AFU has the following compatibility issues:

- Supports HIMEM.SYS; compatible with other DOS drivers running under HIMEM.SYS (for example, SMARTDRV.SYS and SETVER.SYS).
- *Does not support* DOS extenders installed in memory, such as EMM386.SYS and DOS4GW.

Running the AFU from the GUI

The easy way to run the AFU is to use its Graphical User Interface (GUI). If you prefer to run the AFU from the command line, see *Running the AFU from the Command Line* on page 63.

To access the AFU:

1. Shut down your operating system and reboot to DOS from a bootable MS-DOS floppy disk or from a DOS partition on a bootable drive. (You can use the drive connected to the HostRAID controller you are updating.)

   Note: When updating the HostRAID controller flash, controller activity is not possible. Before you can use the HostRAID controller again, complete the flash operation and restart the computer.

2. At the DOS command prompt (typically A:\>), type **AFU** and press **Enter**.

   The AFU's main menu is displayed.

3 Select **Select Controllers** and select the Adaptec HostRAID controllers to be flashed. When selecting a single controller, the system automatically selects it. When selecting multiple controllers, use the space bar, then press **Enter**.

4 Select **Select an Operation** and choose one of the available options. Then follow the on-screen instructions.

Running the AFU from the Command Line

At the DOS command prompt (typically A:\>), type AFU followed by a command and any switches. The AFU processes the command, prompts you to insert additional floppy disks as needed, exits, and reports success or an error message code. The available commands are summarized below, in alphabetical order.

HELP

The HELP command displays a summary of AFU functions and command switches.

Examples

The following are examples of command syntax that will work to get help:

A:\> AFU HELP

A:\> AFU /?

LIST

The LIST command displays the AFU-supported HostRAID controllers installed on your computer. Use this command to see which HostRAID controllers are installed, or to identify the ID numbers assigned to each physical controller.

You do not have to restart the computer after completing this command.

Example

This example shows a typical system response to a **LIST** command:

```
A:\> AFU LIST
Adaptec Flash Utility V1.0-0 B1406
(c)Adaptec Inc. 1999–2005. All Rights Reserved.
Controllers Detected and Recognized:
Controller #0 (03:01:00) Adaptec ASC-48300
```

SAVE

The SAVE command saves the contents of a HostRAID controller's flash in a UFI file. The name of the UFI file is based on the HostRAID controller type and cannot be changed.

Command Syntax

The command syntax for the SAVE command is as follows:

```
AFU SAVE [/C<Controller ID>] [/D <UFI File Path>]
```

Command Switches

The following switches are available:

- /C <Controller ID> is one or more HostRAID controller IDs representing the set of controllers on which to perform the specified command. The default is 0, which means that if the computer has multiple HostRAID controllers, the AFU defaults to controller 0 unless you specify otherwise.

  You can specify a single HostRAID controller ID, for example:

  /C 0

  multiple IDs separated by commas, for example:

  /C 0,2

  or **ALL** to indicate all HostRAID controllers.

Note: If you are using multiple HostRAID controllers, you must specify the controller you want by using the /C switch; otherwise, the AFU displays an error message and exits. You cannot select ALL HostRAID controllers when specifying SAVE.

- /D <UFI File Path> specifies the path (drive and directory) where the UFI files are located. If you do not specify the /D switch, the AFU looks for, or creates, UFI files in the default location.

Note: You cannot specify the name of a UFI file, only its path. UFI filenames are predefined, based on the HostRAID controller type.

Examples

In the following example, the AFU saves flash contents from HostRAID controller 0 to a UFI file in the current default drive and directory:

```
A:\> AFU SAVE /C 0
```

In the following example, the AFU saves flash contents from Controller 1 to a UFI file in **C:\UFI_FILES**.

```
A:\> AFU SAVE /C 1 /D C:\UFI_FILES
```

UPDATE

The UPDATE command updates a HostRAID controller's flash components from the flash image data in a UFI file. You can use the UPDATE command to update a single HostRAID controller's flash components or to update multiple HostRAID controllers on your computer.

You must restart the computer following an UPDATE command.

Command Syntax

The command syntax for the UPDATE command is as follows:

```
AFU UPDATE [/C<Controller ID>] [/D <UFI File Path>]
```

Command Switches

For details on the /C and /D switches, see the *SAVE* command on page 64.

Examples

The following example shows a typical system response after an update has been performed:

```
A:\> AFU UPDATE /C 0
Adaptec Flash Utility V1.0-0 B1406
(c)Adaptec Inc. 1999–2005. All Rights Reserved.

Updating Controller 0 (Adaptec ASC-48300)
Reading flash image file (Build 1406)
AFU is about to update firmware on controller(s) Adaptec ASC-48300
***PLEASE DO NOT REBOOT THE SYSTEM DURING THE UPDATE***
This might take a few minutes.
Writing Adaptec ASC-48300 (4MB) Flash Image to controller 0...OK.
Verifying...OK
Please restart the computer to allow firmware changes to take effect.
```

VERIFY

The VERIFY command compares the contents of each of the flash components on a HostRAID controller to the corresponding image in a UFI file and indicates whether they match. Use this command to determine whether a HostRAID controller's flash components are up-to-date when compared to a specific UFI file.

Command Syntax

The command syntax for the VERIFY command is as follows:

```
AFU VERIFY [/C<Controller ID>] [/D <UFI File Path>]
```

Command Switches

For details on the /C and /D switches, see the *SAVE* command on page 64.

Example

The following example shows a typical system response after a verify command has been performed:

```
A:\> AFU VERIFY /C 0
Adaptec Flash Utility V1.0-0 B1406
(c)Adaptec Inc. 1999–2005. All Rights Reserved.

Reading flash image file (Build 1406)
Controller #0: Adaptec ASC-48300
File: Checksum: 642C [VALID] (Build 1406)
File: Checksum: 642C [VALID] (Build 1406)
Verified Successfully
```

VERSION

The VERSION command displays version information about the flash components on a HostRAID controller.

Command Syntax

The command syntax for the VERSION command is as follows:

```
AFU VERSION [/C<Controller ID>]
```

Command Switches

For details on the /C switch, see the *SAVE* command on page 64.

Example

The following example displays version information about all supported HostRAID controllers:

```
A:\> AFU VERSION /C 0
Adaptec Flash Utility V1.0-0 B1406
(c)Adaptec Inc. 1999–2005. All Rights Reserved.

Version Information for Controller #0 (Adaptec ASC-48300)
ROM: Build 1406 [VALID]
```

AFU Command Line – Step-by-Step

This section provides step-by step instructions for updating the flash.

To update the flash using the AFU command line:

1 Shut down the computer.

2 Insert the bootable disk that contains the AFU utility.

3 Turn on the computer.

4 Enter the system setup utility and verify that your computer is set up to boot from the bootable disk.

5 *If you have multiple HostRAID controllers only*—At the DOS prompt, type **afu list** and press **Enter**.

This command displays the Adaptec SAS HostRAID controllers in your system. Note the HostRAID controller number for the controller you want to update; you may need it in Step 6 to perform the update.

6 You can update the flash using any of the following alternatives:

a **Updating the Flash on a Single HostRAID Controller**—To flash the firmware on a single HostRAID controller, type:

afu update /C <*controller_number*>

Where ***controller_number*** is the number of the controller whose firmware you are updating. For example, to upgrade Controller 0, type:

afu update /C 0

b **Updating the Flash on Multiple Controllers**—To flash the firmware on multiple HostRAID controllers, type:

afu update /C <*controller_number_a*>,<*controller_number_b*>

Where **<*controller_number_a*>** and **<*controller_number_b*>** are the number of one of the Adaptec HostRAID controllers whose firmware you are updating.

To upgrade HostRAID controllers 0, 2, and 3 for example, type:

afu update /C 0, 2, 3

c **Updating the Flash on All HostRAID Controllers Simultaneously**—To flash the firmware on all HostRAID controllers, type:

afu update /C all

Note: The UFI file identifies the appropriate HostRAID controllers, so you do not have to worry about flashing the wrong controller.

---

7 The AFU prompts you to put in the first firmware disk.

When it detects that the disk is in the drive, the AFU reads the part of the firmware image contained on the first disk.

8 When prompted, remove the first firmware disk and insert the second firmware disk.

9 If necessary, repeat Step 8 until the process is complete.

Using the Command Line Utility

C

In this appendix...

This chapter explains how to use the command line utility interactively or in batch mode. With interactive mode, enter commands at the prompt. In batch mode, create scripts and run the script in the appropriate shell. For example:

Environment	Batch File	Run Script
Windows	`.bat`	`CMD.EXE`
Linux/Unix	`.sh`	`sh / bash`

In either mode, if your command fails, you immediately see an error message of `Command failed`. Other script messages that you can get are `Command completed successfully`, or `Command aborted`.

Available commands are described on the following pages, in alphabetical order.

HRCONF Commands

Perform the following functions from the command line:

HRCCONF COMMANDS		
backup	getstatus	romupdate
create	getversion	setconfig
delete	rescan	setstate
getconfig	restore	

Command

`hrconf Backup`

What it does

For large-scale deployments, stores the current controller and disk drive configuration setting to a specific file. Stored files can be used with the `RESTORE` command to restore to another controller or disk drive. To restore, the controller or disk drive must have the same configuration as it did before the backup. For example: the same type of controller, same number and type of disk drives with same IDs and channels).

Syntax

`hrconf backup <Controller#> <File Name>`

Parameters

`Controller#` is the controller number

`File Name` is the relative or absolute path with filename

Example

`hrconf backup 1 c:\windows\hr2200`

Return values

`SUCCESS: 0x00` indicates the command completed successfully

`FAILURE: 0x01` indicates the command failed

Command

`hrconf create`

What it does

Creates logical drives. You must provide the channel and device ID of the physical drives. On redundant logical drives, HRCONF performs autosynchronization.

Syntax

```
hrconf create <Controller#> LOGICALDRIVE
[Options] <Size> <RAID#> <CHANNEL# DRIVE#>
[CHANNEL# DRIVE#] ... [noprompt]
```

Parameters

`Controller#` is the controller number

`Logicaldrive` indicates the logical drive stripe size with the following options:

- `Stripesize:` Optional parameters for specifying a stripe size. `STRIPE` is specified in kilobytes: 16, 32, and 64 are supported.
- `Name:` Optional parameter for specifying the name of the logical drive to be created.
- `Init_Priority:` Initialization Priority for logical drive to be created. Valid parameters are either `HIGH`, `MED`, or `LOW`.
- `Init_Method:` Initialization method for the logical drive. Valid options include: `NORMAL`, `CLEAR`, `QUICK`.

`Size` indicates the size of the logical drive. `MAX` is the only size option available.

`RAID#` indicates the RAID level for the logical drive (0, 1, 10 volume).

`Channel#` is the channel number for the device.

`Drive#` is the device number for the device.

`noprompt:` No prompt for confirmation.

Example

```
hrconf create 1 logicaldrive stripesize 64 max
0 1 0 1 1 1 2
```

Return values

`SUCCESS: 0x00` successful termination

`FAILURE: 0x01` bad arguments or internal error

Command

```
hrconf delete
```

What it does

Deletes a logical drive. All data stored on the logical drive will be lost. Spanned drives can't be deleted with this function.

Syntax

```
hrconf delete <Controller#> LOGICALDRIVE
<LogicalDrive#> [noprompt]
```

Parameters

`Controller#` is the controller number

`LogicalDrive#` is the number of the logical drive to be deleted

Example

```
hrconf delete 1
logicaldrive 1
noprompt
```

Return values

`SUCCESS: 0x00` successful termination

`FAILURE: 0x01` bad arguments or internal error

Command

`hrconf getconfig`

What it does

Lists information about the controllers, logical drives, and physical drives. This information can include (but is not limited to) the following items:

- Controller type
- BIOS, boot block, device driver, and firmware versions
- Logical drive status, RAID level, and size
- Physical drive type, device ID, presence of PFA
- Physical drive state

Syntax

`hrconf getconfig <Controller#> [AD/LD/PD/AL]`

Parameters

`Controller` is the controller number

`AD/LD/PD/AL` options:

- `AD:` Adapter information only
- `LD:` Logical drive information only
- `PD:` Physical device information only
- `AL:` All information (optional)

Example

`hrconf getconfig 1 ad`

Return values

`SUCCESS: 0x00` successful termination

`FAILURE: 0x01` bad arguments or internal error

Command

```
hrconf getstatus
```

What it does

The GETSTATUS function displays the status of any background command that is currently running.

Syntax

```
hrconf getstatus <Controller#>
```

Parameters

`Controller#` is the controller number

Example

```
hrconf getstatus 1
```

Return values

`SUCCESS: 0x00` successful termination

`FAILURE: 0x01` bad arguments or internal error

Command

```
hrconf getversion
```

What it does

Returns the BIOS and driver version information for all controllers.

Syntax

```
hrconf getversion
```

Parameters

`Controller#` is the controller number

Example

```
hrconf getversion<Controller#>
```

Return values

`controllers found: 0`

`SUCCESS: 0x00` successful termination

`FAILURE: 0x01`

Command

`hrconf rescan`

What it does

Enables the controller to check for the removal of any disk drives in the ready state and to check for the connection of any new disk drives to the controller. The command returns when the rescan is complete.

Syntax

`hrconf rescan<Controller#>`

Parameters

`Controller#` is the controller number

Example

`hrconf rescan 1`

Return values

`SUCCESS: 0x00` indicates the command completed

`FAILURE: 0x01` indicates the command failed

Command

`hrconf restore`

What it does

Restores the controller configuration by importing it's configuration settings from a specified file. Deletes the current configuration. The file must have been saved through the `BACKUP` command from a controller of the same type, same number, and type of physical drives with same channels and device IDs. A reboot is required for the configuration change to take effect.

Syntax

```
hrconf restore <Controller#> <Filename>
[noprompt]
```

Parameters

`Controller#` is the controller number

`Filename` is the name of the file to read the configuration from

`noprompt:` No prompt for confirmation.

Example

```
hrconf restore 1 c:\windows\hr2200 noprompt
```

Return values

`SUCCESS: 0x00` indicates the command completed successfully

`FAILURE: 0x01` indicates the command failed

`BAD_PATH: 0xFF` indicates that the path provided is incorrect

`FAILURE: 0xFE` indicates an error occurred writing the configuration file

Command

```
hrconf romupdate
```

What it does

Updates the controller or enclosure firmware. The ROM image file must be in the same directory prior to invoking `hrconf`.

Syntax

```
hrconf romupdate ROMUPDATE <Controller#>
[CONTROLLER] <Filename>
```

Parameters

`Controller#` is the controller number

`File Name` is the relative or absolute path with filename

Example

```
hrconf romupdate 1 controller as4830.ufi
```

Return values

`SUCCESS: 0x00` indicates the command completed successfully

`FAILURE: 0x01` indicates the command failed

Command

`hrconf setconfig`

What it does

Resets the controller's configuration.

Syntax

```
hrconf setconfig <Controller#> DEFAULT
[noprompt]
```

Parameters

`Controller#` is the controller number

`Default:` Resets the controller's configuration. Logical drives are deleted, hard drives are reset to the ready state, and any controller settings are reset to default values.

`noprompt:` No prompt for confirmation.

Example

```
hrconf setconfig 1 default noprompt
```

Return values

`SUCCESS: 0x00` indicates the command completed successfully

`FAILURE: 0x01` indicates the command failed

Command

`hrconf setstate`

What it does

Redefine the state of a physical device from its current state to the designated state (Hotspare).

Syntax

```
hrconf setstate <Controller#> <Channel#>
<Device#> <State> [LOGICALDRIVE <LD#>[LD#] ... ]
```

Parameters

`Controller#` is the controller number

`channel#` is the channel number for the drive

`device#` is the device number for the drive

`State:`

- `HSP`: Create a hot spare from a ready drive
- `RDY`: Remove a hot spare designation
- `DDD`: Force a drive offline

Example

```
hrconf setstate 1 0 1 HSP
hrconf setstate 1 0 2 RDY
hrconf setstate 1 0 2 RBL
```

Return values

`SUCCESS: 0x00` indicates the command completed successfully

`FAILURE: 0x01` indicates the command failed

Introduction to SAS

D

In this appendix...

This section provides a basic overview of the main features of Serial Attached SCSI (*SAS*), introduces some common SAS terms, and explains how SAS differs from parallel SCSI.

Note: For technical articles and tutorials about SAS, refer to the SCSI Trade Association (STA™) Web site at www.scsita.org.

Terminology Used in This Chapter

For convenience, SAS HBAs and SAS HostRAID controllers are referred to generically in this chapter as *SAS cards*. HBAs, HostRAID controllers, disk drives, and external disk drive enclosures are referred to as *end devices* and expanders are referred to as *expander devices*.

For convenience, this chapter refers to end devices and expander devices collectively as *SAS devices*.

What is SAS?

Legacy parallel SCSI is an interface that lets devices such as computers and disk drives communicate with each other. Parallel SCSI moves multiple bits of data *in parallel* (at the same time), using the SCSI command set.

Serial Attached SCSI (*SAS*) is an evolution of parallel SCSI to a point-to-point serial interface. SAS also uses the SCSI command set, but moves multiple bits of data one at a time. SAS links end devices through direct-attach connections, or through expander devices.

SAS cards can typically support up to 128 end devices and can communicate with both SAS and SATA devices. (You can add 128 end devices—or even more—with the use of SAS expanders. See page 87.)

Note: Although you can use both SAS and SATA disk drives in the same *SAS domain* (see page 87), Adaptec recommends that you not combine SAS and SATA disk drives within the same array or logical drive. The difference in performance between the two types of disk drives may adversely affect the performance of the array.

Data can move in both directions simultaneously across a SAS connection (called a *link*—see page 82). Link speed is 600 MB/sec in full-duplex mode. A SAS card with eight links has a maximum bandwidth of 4800 MB/sec in full-duplex mode.

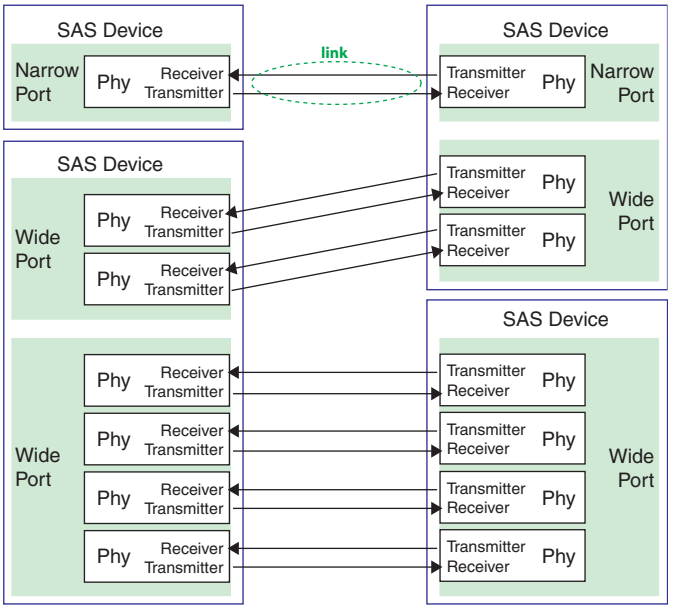
Although they share the SCSI command set, SAS is conceptually different from parallel SCSI physically, and has its own types of connectors, cables, connection options, and terminology, as described in the rest of this chapter.

To compare SAS to parallel SCSI, see *How is SAS Different from Parallel SCSI?* on page 88.

How Do SAS Devices Communicate?

SAS devices communicate with each other through links. A *link* is a physical connection between two phys.

As shown below, SAS devices contain ports (see page 83), ports contain *phys* (see below), and each phy contains one transmitter and one receiver—one *transceiver*. A phy can belong to one port only.



What's a Phy?

Phys are part of the physical communication connection between SAS devices. Each phy contains a transceiver that sends data back and forth between SAS devices.

When a connection is formed between two end devices, a link can is established from a phy in one port to a phy in the other port. As shown in the figure above, a wide port can support multiple independent links simultaneously.

Phys are internal, within SAS connectors (see page 84).

SAS cables physically connect one or more phys on one SAS device to one or more phys on another SAS device.

What's a SAS Port?

Note: Because the physical link between SAS devices is from phy to phy, rather than port to port, a "port" is more of a virtual concept, different from what is normally considered a port on other types of HostRAID controllers and storage devices.

A *port* is one or more phys. A *narrow port* contains one phy. A *wide port* typically contains four phys.

Each port has its own unique SAS address (see page 85), and all the phys in a port share that same SAS address.

SAS card port options vary. A SAS card with four phys could be configured with one wide port, with two wide ports that comprise two phys, or with four narrow ports each containing one phy. (A wide port with four phys is referred to as a *4-wide* or *4x* port.)

What's a SAS Address?

Each SAS port is identified with a unique SAS address, which is shared by all phys on that port.

For example, a SAS disk drive might have two narrow ports. Each port has one unique SAS address. The single phy in each port uses its port's SAS address.

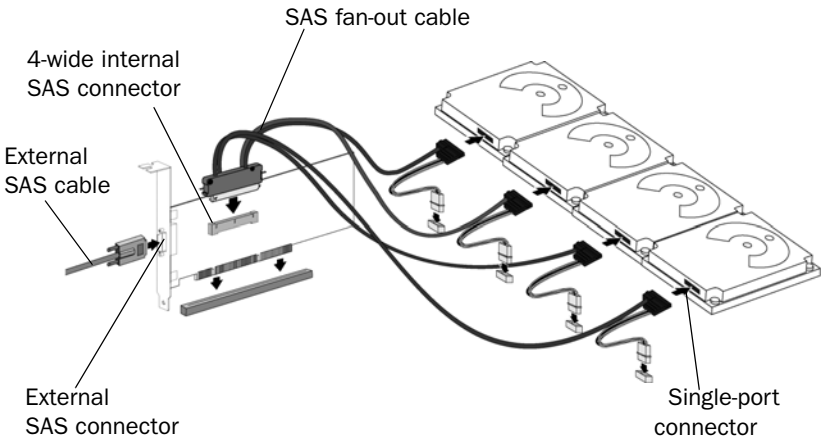
In another example, a SAS device might have one 4-wide port. That port has one SAS address, which is shared by all four phys in the port.

Unlike SCSI devices and SCSI IDs, SAS devices self-configure their SAS addresses. User intervention is not required to set SAS addresses, and SAS addresses cannot be modified.

What's a SAS Connector?

A SAS connector is the physical plug or receptacle that you see on a SAS device. It supports the power and signal line cable. It's what you plug a SAS cable into, or the end of the SAS cable that's being plugged in.

A connector is what forms physical links between phys.



Some SAS connectors can support multiple links. The number of links a SAS connector can support is referred to as its *width*. *Narrow* connectors support a single link; *wide* connectors support up to four links.

A single SAS device may have one or more connectors. A single SAS connector may help form links between more than two SAS devices. (For instance, as shown in the figure above, the 4-wide internal SAS connector forms links with four independent disk drives.)

What do SAS Cables Look Like?

Internal SAS cables are narrower than internal parallel SCSI cables. The connectors vary in size depending on the number of links they support, from single link connectors to 4-wide (or larger) connectors. Internal octopus cables (shown below) let you attach four disk drives to a single 4-wide connector.

4x wide-to-4x wide internal SAS cable

Internal SAS-to-SATA fan-out cable (SAS-to-SAS fan-out cables are also available)

External SAS cable

An example of some internal SAS cables and an external SAS cable are shown in the figure above.

How are Disk Drives Identified in SAS?

In the BIOS and in the management utilities (see page 85), disk drives are identified with numbers in this format:

XX:YY:ZZ

where XX is the disk drive count number, YY is the enclosure number, and ZZ is the slot number (within the enclosure). If the disk drive is not installed in an enclosure, a double dashes (--) appear instead of YY and ZZ (for instance, 01:--:--).

In parallel SCSI, XX is the disk drive's channel number, YY is the target number, and ZZ is the logical unit number (LUN).

What are the SAS Connection Options?

You can connect end devices to each other through direct cable connections and through backplane connections. When you use one or more expander devices (see page 87), you can create large configurations.

Direct-attach Connections

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SAS card with SAS cables. One disk drive is attached to one SAS connector with one SAS cable (or multiple disk drives are attached to one SAS connector with one octopus cable). The figure on page 84 shows an example of direct-attach connections.

The number of direct-attached disk drives is limited to the number of *phys* supported by the SAS card. (Note that there may be multiple phys within a single connector. See page 85.)

Backplane Connections

In a backplane connection, disk drives and SAS cards are attached to and communicate with each other through a system backplane.

The number of end devices is limited to the number of slots available on the backplane. For example, the Adaptec S50 enclosure, which contains an expander, is a backplane connection that supports up to 12 SAS or SATA disk drives.

Some backplanes support daisy-chain expansion to other backplanes. For example, you can daisy-chain (connect one to the next) up to nine Adaptec S50 enclosures to a single SAS card in a host system.

SAS Expander Connections

A SAS expander device literally expands the number of end devices that you can connect together. Expander devices, typically embedded into a system backplane (see page 86), support large configurations of SAS end devices, including SAS cards and SAS and SATA disk drives. With expander devices, you can build large and complex storage topologies.

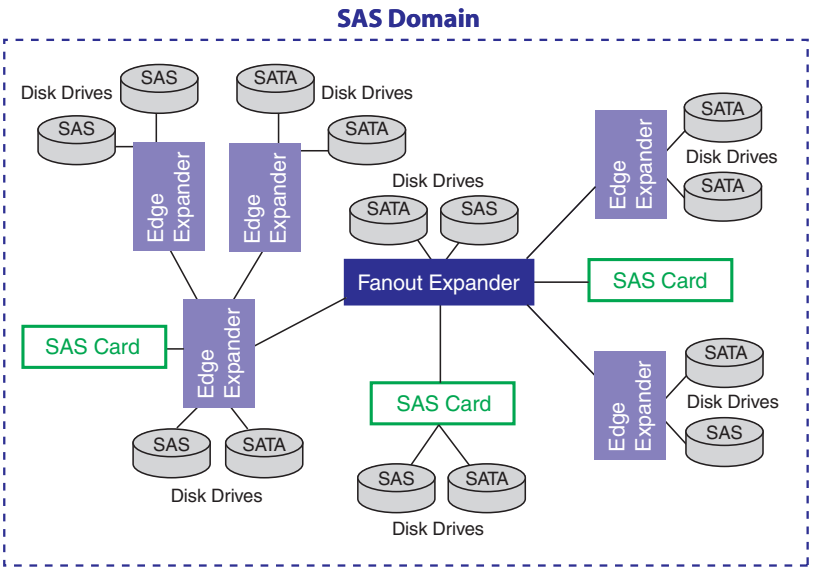
There are two types of SAS expanders: *fanout expanders* and *edge expanders*. Each performs a different role in a storage system. (For more information about how SAS expanders work, refer to the STA Web site at www.scsita.org.)

You can connect up to 128 SAS ports to an edge expander. (A single edge expander can therefore support up to 128 SAS addresses.)

You can connect up to 128 edge expanders to a fanout expander.

You can use only one fanout expander in any single SAS *domain* (a topology of SAS—and possibly SATA—end devices and expander devices). A single SAS domain can therefore comprise up to 16,384 SAS ports (and therefore up to 16,384 SAS addresses).

The figure below illustrates (in very basic terms) a SAS domain and shows how SAS cards, SAS and SATA disk drives, and expander devices can fit together in a large data storage topology.



How is SAS Different from Parallel SCSI?

In summary, although SAS and parallel SCSI both use the SCSI command set, how they move data from one place to another is very different. To support point-to-point *serial* data transport, SAS introduces new types of connectors, cables, connection options, and terminology.

Generally speaking, SAS is faster and more flexible than parallel SCSI, and provides more options for building your storage space. SAS lets you mix SAS and SATA disk drives together, and lets you connect many, *many* more devices.

The table below describes many of the main differences between the two interfaces.

Parallel SCSI	Serial Attached SCSI
Parallel interface	Serial interface
Maximum speed 320 MB/sec shared by all devices on the bus	Maximum speed 600 MB/sec per phy when in full-duplex mode
Supports SCSI devices only	Supports SATA and SAS disk drives simultaneously
Up to 16 devices per SCSI channel	More than 128 disk drives per SAS card, using an expander (see page 87)
Supports single-port devices only	Supports single- and dual-port devices
Uses SCSI IDs to differentiate between devices connected to the same adapter	Uses unique SAS addresses to differentiate between devices
User intervention required to set SCSI IDs	SAS addresses self-configured by SAS devices
Requires bus termination	Requires no bus termination
Standard SCSI connectors	SAS connectors (see page 85)

Understanding RAID

E

In this Appendix...

This appendix describes the RAID levels supported by your Adaptec SAS 48300 HostRAID controller, and provides a basic overview of each to help you select the best level of protection for your data storage.

Understanding Drive Segments

A drive segment is a disk drive or portion of a disk drive that is used to create an array. A disk drive can include both RAID segments (segments that are part of an array) and available segments. Each segment can be part of only one logical device at a time. If a disk drive is not part of any logical device, the entire disk is an available segment.

Selecting the Best RAID Level

A RAID (Redundant Array of Independent Disks) provides better performance and reliability from combinations of drives than is possible with the same total storage space without RAID.

When you create arrays (or logical drives), you can assign a RAID level to protect your data. Each RAID level offers a unique combination of performance and redundancy. RAID levels also vary by the number of disk drives they support.

The following table shows the number of drives needed and supported for the Adaptec SAS 48300 HostRAID controller according to RAID level.

Array Type	Minimum Drives Required	Maximum Drives Supported
RAID 0	2	4
RAID 1	2	2
RAID 10	4	4

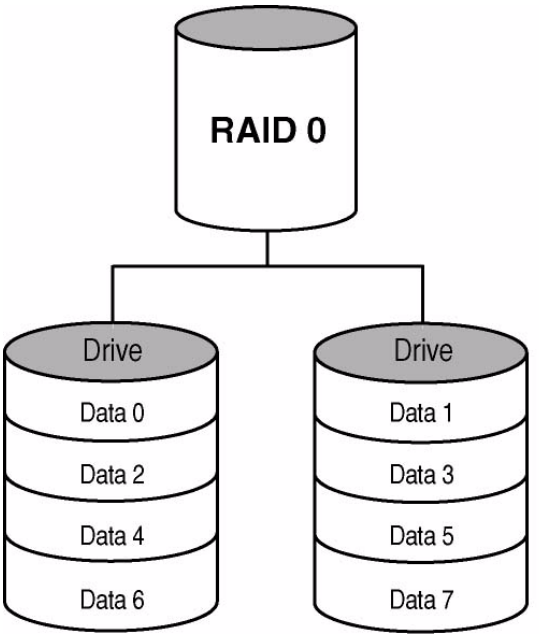
Note: Select RAID drives of equal capacity and performance. Otherwise, the RAID tends to be limited in capacity and performance to that of the smallest and slowest drive.

RAID 0

An array with RAID 0 includes two or more disk drives and provides data *striping*, where data is distributed evenly across the disk drives in equal-sized sections.

RAID 0 arrays do not maintain redundant data, so they offer no data protection. However, compared to an equal-sized group of independent disks, a RAID 0 array provides improved I/O performance.

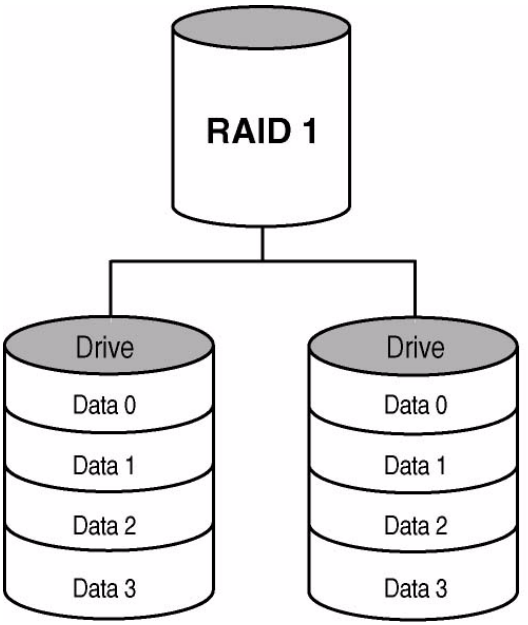
Drive segment size is limited to the size of the smallest disk drive in the array. For instance, an array with two 250 GB disk drives and two 400 GB disk drives can create a RAID 0 drive segment of 250 GB, for a total of 1000 GB for the volume, as shown below.



RAID 1 Arrays

A RAID 1 array is built from two disk drives, where one disk drive is a *mirror* of the other (the same data is stored on each disk drive). Compared to independent disk drives, RAID 1 arrays provide improved performance, with twice the read rate and an equal write rate of single disks. However, capacity is only 50 percent of independent disk drives.

If the RAID 1 array is built from different- sized disk drives, the free space, drive segment size is the size of the smaller disk drive, as shown below.

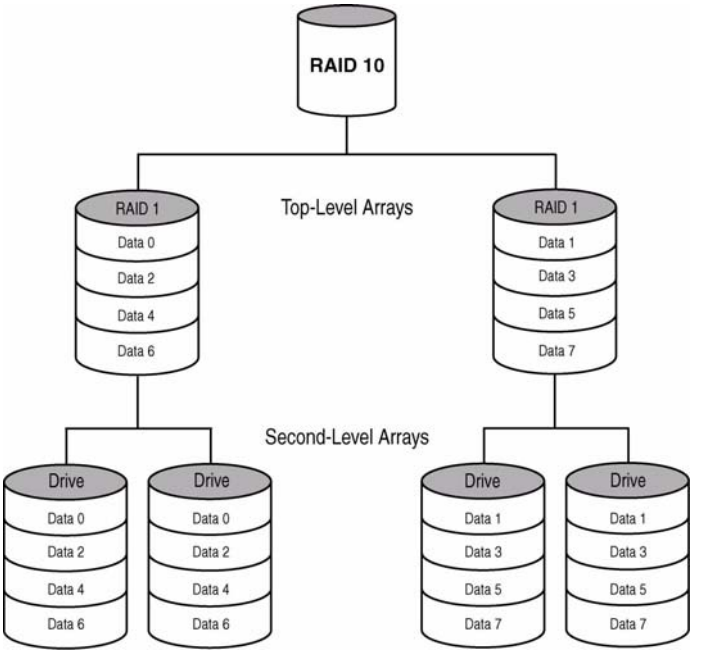


RAID 10

A RAID 10 array is built from two or more equal-sized RAID 1 arrays. Adaptec HostRAID controllers support a maximum number of four disk drives in a RAID 10 array and two spare drives.

Data in a RAID 10 array is both striped and mirrored. Mirroring provides data protection, and striping improves performance.

Drive segment size is limited to the size of the smallest disk drive in the array. For instance, an array with two 250 GB disk drives and two 400 GB disk drives can create two mirrored drive segments of 250 GB, for a total of 500 GB for the array, as shown below.



Specifications

F

Environmental Specifications

Ambient temperature without battery backup module	0 °C to 50 °C
Relative humidity	10% to 90%, noncondensing
Altitude	up to 3,000 meters

Note: Forced airflow is recommended, but not required.

DC Power Requirements

Ripple and noise	50 mV peak-to-peak (max)
DC Voltage	5 V ± 0.5 V, 3.3 V

Current Requirements

HostRAID Controller Model	Nominal Current	Maximum Current (A)
ASC-48300	1.215A	1.322A

Glossary

A

activity

See *task*.

ACU

Array Configuration Utility. Used to create, configure, and manage arrays from the HostRAID controller's BIOS or MS-DOS.

array

A logical disk created from available space and made up of one or more partitions on one or more physical disks. Arrays are typically used to provide data redundancy or enhanced I/O performance. See also *container*, *volume*, *spanned volume*, and *See also mirrored array/mirroring and See also mirrored array/mirroring and See also mirrored array/mirroring and ...*.

Also known as a *container*.

array configuration

See *configure drives*.

available space/partition

Unused space on an configured disk from which logical devices (arrays) are created. When an array is deleted, the space that it used is returned to the available space pool.

B

background consistency check

Consistency check performed as a background process.

bad partition

partition that is in an unknown state.

bootable array

Array configured as the boot device.

build

Background initialization of a redundant array. The array is accessible throughout. RAID 1 copies the contents of the primary drive to a secondary drive. See also *clear*.

bus

See *channel*.

C

cache

Fast-access memory on the HostRAID controller that serves as intermediate storage for data that is read from, or written to, drives.

capacity

Total usable space available in megabytes or gigabytes.

channel

Any path, or *bus*, used for the transfer of data between storage devices and a HostRAID controller.

chunk

See *stripe*.

clear

Foreground initialization of a fault-tolerant array. A *clear* operation zeros all blocks of the array. The array is not accessible until the clear task is complete.

concatenation

Joining of physical or logical drives in sequential order.

configure drives

Process of preparing a disk for use by the HostRAID controller. When a disk is initialized, the HostRAID controller records the RAID signature on the disk.

configured array

An array that is ready for data reads and writes. Arrays can be configured by *build* or *clear*.

container

See *array*.

D

dead partition

See *failed*.

degraded

A redundant (for example, a RAID 1) array in which one or more members have failed. The data is intact but redundancy has been compromised. Any further failure would cause the array to fail and result in data loss.

dirty data

Data that has been written to a *cache*, but which has not been "flushed" out to its final destination.

disk

A nonremovable platter in a disk drive, or removable media used in a CD drive, floppy disk drive, or Zip drive. See also *disk ID*, *drive*, and *hard disk, hard disk drive*.

disk ID

Unique disk identifier that consists of the channel number, ID, and LUN (channel:ID:LUN), for example, 1:04:0. See also *channel*.

domain

All the devices that may communicate with each other.

drive

Device used for storing data. May contain one or more removable or nonremovable, writable or read only media. See also *hard disk, hard disk drive*.

drive LED

Indicator light that illuminates during read or write operations.

E

event

Notification or alert from the system, indicating that a change has occurred.

event log

File used to maintain information about prior HostRAID controller activities or errors.

event notification

Process for transmitting events.

F

failed

State of a non*redundant* array that has suffered a single drive failure, or a redundant array that has suffered multiple drive failures. A failed array is inaccessible and data is lost.

failed partition

A *partition* that is no longer usable by an array because it is either logically bad and therefore no longer needed, or physically damaged.

failover drive

See *hotspare*.

fault-tolerant array

Refers to an array that can continue to function after a disk drive failure without loss of data. See also *redundant*.

foreign disk

Disk that has previously been configured on another Adaptec HostRAID controller. The RAID signature on the disk allows the HostRAID controller to identify whether or not the disk was configured on the controller it is currently connected to.

free space/partition

See *available space/partition*.

H

hard disk, hard disk drive

Basic unit of nonvolatile, nonremovable, magnetic storage media. See also *drive*.

hot swap

To remove a component from a system and install a new component while the power is on and the system is running.

hotspare

A hard disk drive, an array member, that is not used in day-to-day data storage but, instead, is reserved for use as a replacement for one of the other drives in the array in the event of a failure.

I

impacted

An impacted array is one which has been created, but for some reason the initial build operation did not complete. All member drives are present and operational, and all data written to the array is protected. To optimize the array, run a Verify with Fix task.

L

legacy disk

Disk that contained a valid *partition* table when connected to the HostRAID controller. The HostRAID controller manages the disk as a legacy disk array where there is a one-to-one logical-to-physical mapping of array to disk.

logical device

Volume comprised of space from one or more physical drives and presented to the operating system as if it were a single storage unit.

low-level format

Process performed by the drive firmware that completely removes the file system from the disk.

M

migration

See *reconfiguration*.

mirrored array/mirroring

See *RAID 1 Arrays* on page 92.

monitoring

Process of receiving, displaying, and logging system events.

multipartition array

Array with multiple operating systems or MS-DOS partitions.

O

offline array

Array that can no longer be accessed.

optimal

The state of an array when it is fully operational. For redundant arrays, the entire array is protected.

P

partition

Contiguous area of a physical drive that makes up some or all of an array. When an array is created, space is automatically converted into partitions.

pathway

All links between two end devices.

phantom object

Object that represents a component that cannot be configured by the HostRAID controller management software; for example, a missing drive.

PHY

The electronics that controls bit transmission. There is a PHY at each end of a physical link.

Physical link

The connectors and cables that connect devices.

Port

One or more PHYs with a single SAS address, connected to an equal number of PHYs with a single SAS address.

Q

quick init

An array configured using the Quick Init option is available immediately, with no on-going background controller activity. All data written to an array that has been quick configured is protected.

R

RAID

Redundant Array of Independent Disks (alternative definition Redundant Array of Inexpensive Disks).

RAID 0

A *single-level array* consisting of two or more equal-sized segments residing on different disks. RAID 0 distributes data evenly across its respective drives in equal-sized sections called *stripe*s. RAID 0 arrays are not redundant.

RAID 1

Single-level array consisting of two equal segments residing on two different drives. Provides redundancy by storing identical copies on two drives.

See also *mirrored array/mirroring*.

RAID 10

Spanned array consisting of two or more equal-sized RAID 1 arrays. Provides redundancy by striping and mirroring. Mirroring provides data protection, and striping improves performance.

See also *mirrored array/mirroring* and *See also mirrored array/mirroring and ..*

RAID signature

The area on each disk reserved for use by the HostRAIDcontroller.

RAID volume

Concatenates two or more arrays of the same type.

rebuild

Background regeneration of redundant data on a RAID 1.

reconfiguration

Process of expanding an array or migrating an array from one RAID type to another; changing the *stripe size* of a RAID 0, or moving a logical device's *partitions* to other disks.

redundant

The ability of an array to maintain operability when one or more hardware failures occur. RAID 1 is an example of a redundant array. In the event of a drive failure, redundant arrays can be restored to normal operation by replacing the failed drive and rebuilding the array.

rescan

Process of updating the current screen to show all currently available resources.

S

SAS domain

A domain that contains one or more SAS devices and a service delivery subsystem. A SAS domain may be a SCSI domain.

segment

Disk drive or portion of a disk drive used to create a logical device. A disk can include RAID segments and available segments. A RAID segment is part of a logical device; it can be used by only one logical device at a time. Available segments can be used to define a new logical device. If the disk is not part of any logical device, the entire disk is an available segment.

Serial ATA (SATA)

A successor to ATA that uses a serial, instead of parallel, interface.

Serial Attached SCSI (SAS)

A successor to SCSI that uses a serial, instead of parallel, interface.

simple volume

A volume made up of disk space from a single disk. It can consist of a single region on a disk or concatenated, multiple regions of the same disk.

single-level array

Array created from one or more partitions. See also *volume*, *spanned volume*, *See also mirrored array/mirroring and See also mirrored array/mirroring and See also mirrored array/mirroring and ...*, and *RAID 1 Arrays* on page 92.

spanned volume

A simple volume that spans two or more drives.

spare

See *hotspare*.

stripe

Contiguous set of data distributed across all the disks in an array. A striped array distributes data evenly across all members in equal-sized sections called *stripes*.

stripe size

The amount of data in each section of a striped array.

striped array

See *See also mirrored array/mirroring and See also mirrored array/mirroring and See also mirrored array/mirroring and ...*.

T

task

An operation that occurs only on the HostRAID controller, asynchronous to all other operations; for example, initializing a disk or verifying an array. Some tasks can take an extended period of time, particularly if the HostRAID controller is also performing intensive data I/O while the task is running.

V

volume

See *simple volume*, *spanned volume*.

Index

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

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Part Number: CDP-00118-01-A, Rev. A
JB 10/05