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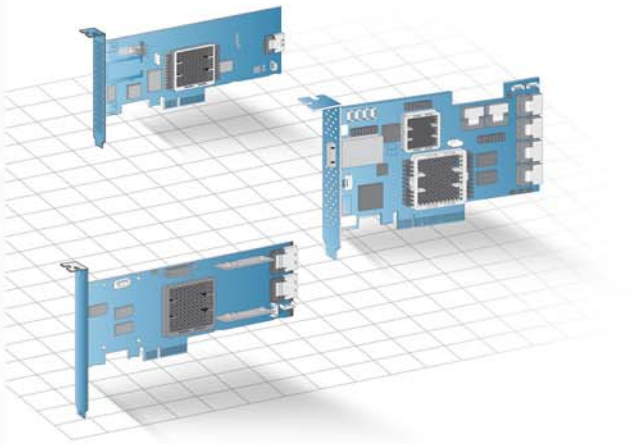
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adaptec®

Serial Attached SCSI RAID Controllers

Installation and User's Guide



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Regulatory Compliance Statements

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.

Use only with the listed ITE:

Adaptec RAID 5085/Adaptec RAID 5405/Adaptec RAID 5445/
Adaptec RAID 5805/
ASR-3405/ASR-3805/ASR-3085/ASR-31205/ASR-31605/
Adaptec RAID 51245/Adaptec RAID 51645/Adaptec RAID 52445/
Adaptec RAID 2045/Adaptec RAID 2405

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+A1:2000+A2:2003) Emissions
- EN55024 (1998+A1:2001+A2:2003) Immunity:
  - EN61000-4-2 (1995) Electrostatic discharge: ±4 kV contact, ±8 kV air
  - EN61000-4-3 (1996) 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.

Caution: Risk of explosion if the battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

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About This Guide

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

These RAID controller models are described in this *Guide*:

- Adaptec RAID 3085
- Adaptec RAID 3405
- Adaptec RAID 3805
- Adaptec RAID 5085
- Adaptec RAID 5405
- Adaptec RAID 5445
- Adaptec RAID 5805
- Adaptec RAID 31205
- Adaptec RAID 31605
- Adaptec RAID 51245
- Adaptec RAID 51645
- Adaptec RAID 52445
- Adaptec RAID 2045
- Adaptec RAID 2405

What You Need to Know Before You Begin

You should be familiar with computer hardware, data storage, RAID technology, and SAS and Serial ATA (SATA) technology. (For an introduction to SAS, see page 67.)

You should also be familiar with Direct-Attached Storage (DAS) or Network-Attached Storage (NAS)—whichever is appropriate for your storage space—and Storage Area Network (SAN) concepts and technology.

Note: Because this *Guide* covers multiple Adaptec RAID products, some of the features and functions described may not be available for your controller. For more information, see *About Your RAID Controller* on page 16.

Terminology Used in this Guide

Because you can use your Adaptec RAID controller to manage data storage in a variety of configurations from DAS to NAS to SAN, the generic term "storage space" is used to refer to controller(s) and disk drives being managed with Adaptec Storage Manager™ or the other utilities described in this *Guide*.

Many of the terms and concepts referred to in this *Guide* are known to computer users by multiple names. This *Guide* uses these terms:

- Controller (also known as adapter, board, or card)
- Disk drive (also known as hard disk, hard drive, or hard disk drive)
- Enclosure (also known as a RAID enclosure, storage enclosure, or JBOD enclosure)
- Array (also known as a container or logical drive)

  Note: In DAS environments, Adaptec Storage Manager refers to arrays as logical drives. Why? Your RAID controller creates *arrays*, which your operating system (and Adaptec Storage Manager) recognizes as *logical drives*.
  In NAS environments, Adaptec Storage Manager displays both arrays and logical drives. For more information, refer to the *Adaptec Storage Manager User's Guide* on the Adaptec Storage Manager Installation CD.

How to Find More Information

You can find more information about your Adaptec RAID controller and the software and utilities included with it by referring to these documents:

- *Readme.txt*—Includes updated product information and known issues; located on the RAID Installation CD.
- *Adaptec Storage Manager User's Guide*—Describes how to install and use the Adaptec Storage Manager software (see page 60) to manage your direct attached storage; located on the Adaptec Storage Manager Installation CD.
- *Adaptec Storage Manager Online Help*—Describes how to use the Adaptec Storage Manager software; accessible from the main window of Adaptec Storage Manager.
- *Adaptec RAID Controller Command Line Utility User's Guide*—Describes how to use the included Adaptec RAID Controller Configuration (ARCCONF) command line utility (see page 60) to perform basic array and configuration management functions; located on the Adaptec Storage Manager Installation CD.

Kit Contents and System Requirements

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System Requirements 14

This chapter lists the contents of your Adaptec RAID controller kit and the system requirements that must be met for you to successfully install and use your controller.

Kit Contents

- Adaptec RAID controller
- RAID Installation CD (bootable), including controller drivers, and this *Guide*
- Adaptec Storage Manager Installation CD (not bootable), including user guides for Adaptec Storage Manager and the ARCCONF command line utility
- Cables (Not all kits contain cables. If your kit does, the type and quantity vary—for cable information about your controller, visit the Adaptec Web site at www.adaptec.com.)
- (*Selected models only*) Low-profile bracket
- *Adaptec Serial Attached SCSI RAID Controllers Quick Start Guide*

System Requirements

- PC-compatible computer with Intel Pentium, or equivalent, processor
- Motherboard with these features:
  - Compliant with *PCI Local Bus Specification,* Revision 2.2 or later
  - Support for multifunction devices where one of the devices is a PCI bridge
  - Large memory-mapped address ranges

  Refer to the Readme file on the RAID installation CD for additional motherboard compatibility information.
- One of these operating systems:
  - Microsoft® Windows® Server 2008, Windows Vista™, Windows Server 2003 (Enterprise and Standard with SP2, 32-bit and 64-bit), Windows XP (32-bit and 64-bit)
  - Red Hat® Enterprise Linux 4 Server, Red Hat Enterprise Linux 5 Server (32-bit and 64-bit)
  - SUSE Linux ES 10.0 (32-bit and 64-bit)

    Note: For the latest on Adaptec's support of Linux, or to download driver sources, visit the Support area of the Adaptec Web site at www.adaptec.com.

  - SCO® OpenServer® 6.0
  - UnixWare® 7.1.4
  - Sun® Solaris™ 10, Solaris 10 x86 U4, Solaris 10 x64 U4
  - VMware ESX Server 3.0.2, 3.5 (storage management must be done by command-line, BIOS utility, or remote GUI connection—see page 83)
  - FreeBSD 6.2, 6.3

  Note: For up-to-date operating system version support, visit the Adaptec Web Site at www.adaptec.com. From the main menu select Support>Knowledgebase>Find Answers. Select your controller type and OS support to generate a list of supported operating systems.

- 128 MB (or more) of RAM
- Available compatible PCIe slot (depending on your controller model—see the descriptions starting on page 16)
- 20 MB of free disk drive space
- 16-bit SVGA color monitor with a resolution of at least 800 x 600

- CD drive

About Your RAID Controller

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This chapter provides an overview of standard Adaptec RAID controller features, and describes the unique features of your controller. It also explains how to upgrade your controller with enhanced features.

Standard RAID Controller Features

- Support for SAS, SATA, and SATA II disk drives
- Flash ROM for updates to controller firmware, BIOS, and the Adaptec RAID Configuration utility
- Disk drive hot-swapping
- Event logging and broadcasting including email and SNMP messages
- Multiple options for creating and managing RAID arrays—A full software application (Adaptec Storage Manager), a BIOS-based utility (ACU), a command line utility (ARCCONF), and a DOS utility (see *Managing Your Storage Space* on page 59)
- Native command queuing (NCQ), which lets disk drives arrange commands into the most efficient order for optimum performance
- Support for disk drive enclosures with SES2 enclosure management hardware
- Support for a battery backup module (see page 18)
- Audible alarm
- Power-management of disk drives in your storage space to reduce cooling and electricity costs (see page 85)
- I/O statistics logging and automatic forwarding for remote analysis ("call home")

Array-level Features

Note: Not all features are supported by all controllers. For more information, refer to the Adaptec Storage Manager User's Guide or online Help.

- Support for RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, simple volumes, and spanned volumes
- Support for JBOD disks (appear as a physical disk drives to the operating system; not redundant)
- Support for hot spares (global and dedicated)
- Support for automatic failover, so arrays are automatically rebuilt when a failed disk drive is replaced (applies to redundant arrays in SES2- or SAF-TE-enabled disk drive enclosures *only*)
- Optimized disk utilization, which ensures that the full capacity of all disk drives can be used, even if the disk drives vary in size
- Online capacity expansion, so you can increase the capacity of an array without recreating it
- Support for array migration from one RAID level to another

Advanced Data Protection Suite

- **Copyback Hot Spare**—You can use this feature to move data from a hot spare back to its original location after a failed disk drive is replaced.
- **Striped Mirror (RAID 1E)**—A RAID 1 Enhanced array is similar to a RAID 1 array except that data is both mirrored *and* striped, and more disk drives can be included.

- **Hot Space (RAID 5EE)**—A RAID 5EE array is similar to a RAID 5 array except that it includes a distributed spare and must be built from a minimum of four disk drives.
- **Dual Drive Failure Protection (RAID 6)**—A RAID 6 array is similar to a RAID 5 array except that it includes *two* independent sets of parity data instead of one.
- **Dual Drive Failure Protection (RAID 60)**—A RAID 60 array is similar to a RAID 50 array except that it includes *four* independent sets of parity data instead of two.

Adding Enhanced Features

As your storage needs change, you can enhance data protection and improve performance by upgrading your Adaptec controller with extra features.

Currently, Adaptec offers the snapshot function as an upgrade feature which can be activated with a feature key (sold separately). A *snapshot* is a frozen image of a logical drive at a particular point in time. You can use this feature to back up your data to tape, clone a disk drive, or copy the data to multiple servers.

Note: Snapshots are supported on Adaptec 3-series controllers only. They are available only for Windows and Linux operating systems.

To purchase a feature key, contact your Adaptec Reseller or refer to the Adaptec Web site at www.adaptec.com. To unlock the enhanced features with a feature key, see the following section.

Using a Feature Key to Unlock Enhanced Features

When you receive a feature key, use Adaptec Storage Manager to unlock the new features. For step-by-step instructions, follow the instructions in the online Help or the *Adaptec Storage Manager User's Guide* on the Adaptec Storage Manager Installation CD.

Adding a Battery Backup Module

This table shows the battery model supported by your Adaptec RAID controller.

RAID Controller	Battery Model
Adaptec RAID 5085/Adaptec RAID 5405/Adaptec RAID 5445/Adaptec RAID 5805/ Adaptec 51245/Adaptec 51645/Adaptec 52445 Adaptec RAID 3085/Adaptec RAID 3805/Adaptec RAID 3405 Adaptec RAID 31205/Adaptec RAID 31605	Adaptec Battery Module 800 Adaptec Battery Module 800T

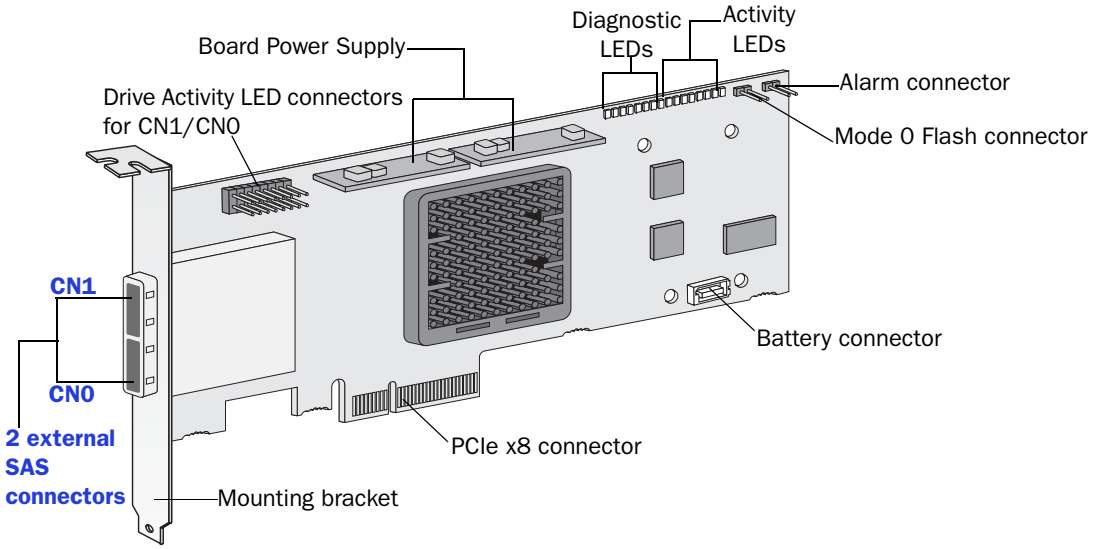
To purchase a battery backup module, refer to the Adaptec Web site at www.adaptec.com.

Upgrading the Controller Firmware

To upgrade the firmware on your Adaptec RAID controller, follow the instructions in *Using the Adaptec Flash Utility* on page 102. You can also use the Adaptec Storage Manager to upgrade your controller firmware, refer to the *Adaptec Storage Manager User's Guide.*

About the Adaptec RAID 3085

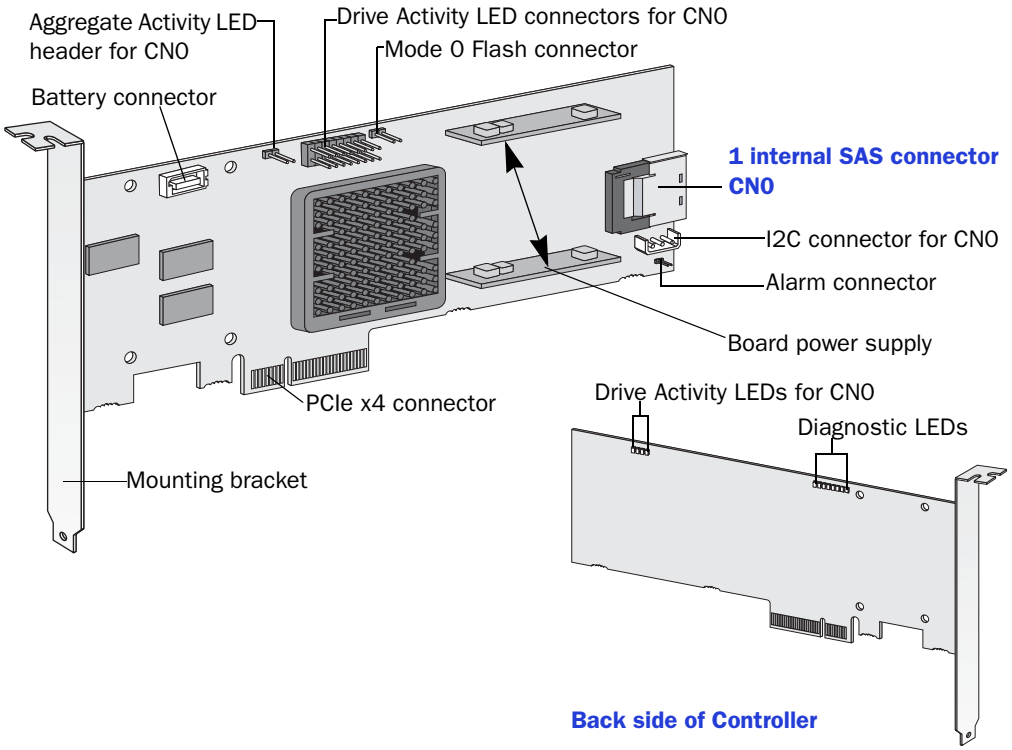
The Adaptec RAID 3085 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus Compatibility	PCIe
PCIe Bus Width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	8
Standard cache	256 MB DDR2
Connectors, external	2 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	8 (or up to 100 with expanders)
Enclosure support	I2C and SGPIO (Serial General Purpose Output)
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 3405

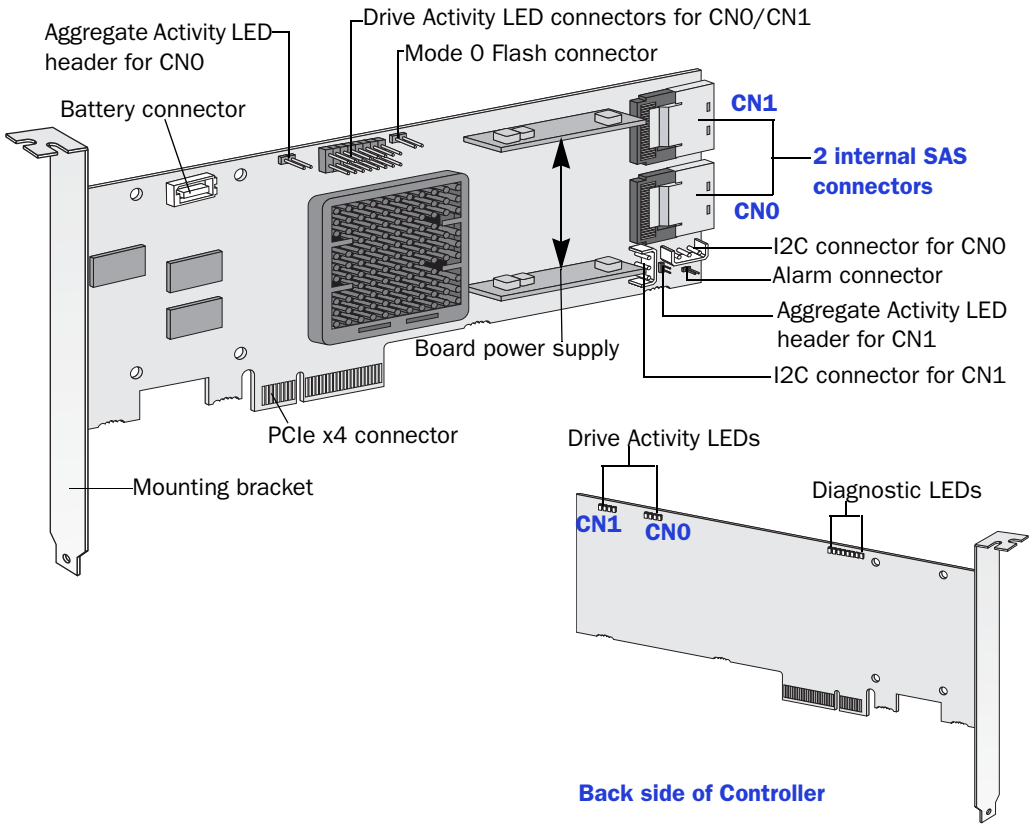
The Adaptec RAID 3405 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x4
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	4
Standard cache	128 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 (or up to 100 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 3805

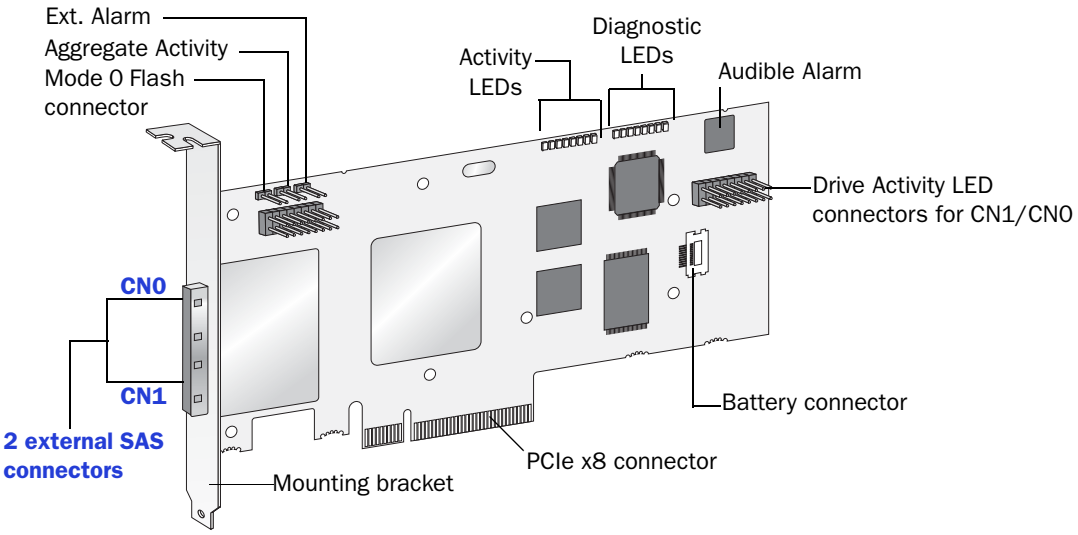
The Adaptec RAID 3805 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x4
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	8
Standard cache	128 MB DDR2
Connectors, internal	2 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	8 (or up to 100 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 5085

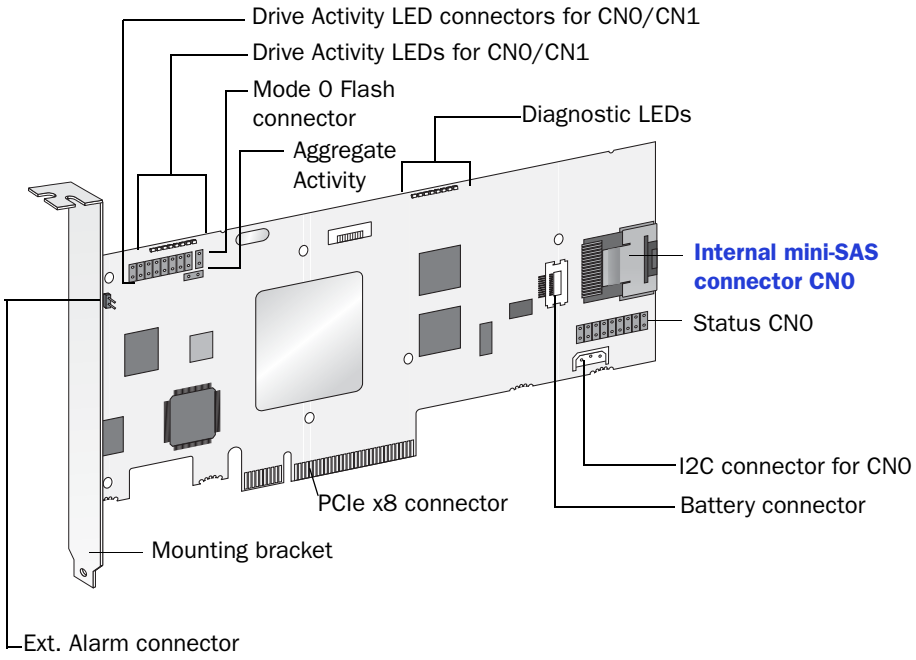
The Adaptec RAID 5085 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors, external	2 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO (Serial General Purpose Output)
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 5405

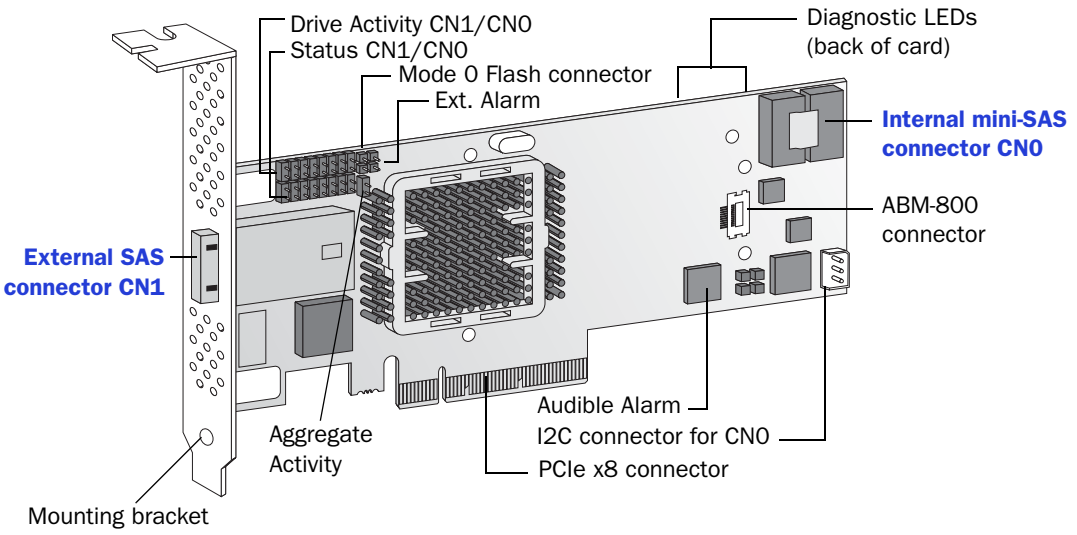
The Adaptec RAID 5405 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	4
Standard cache	256 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 5445

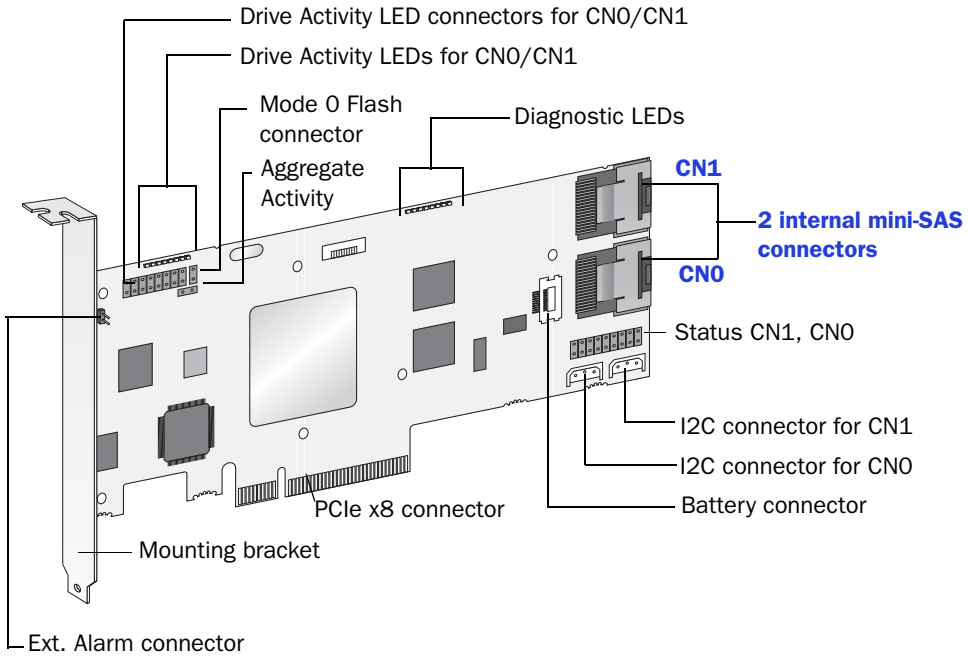
The Adaptec RAID 5445 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors	1 mini-SAS x4 (SFF-8087) internal 1 mini-SAS x4 (SFF-8088) external
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 5805

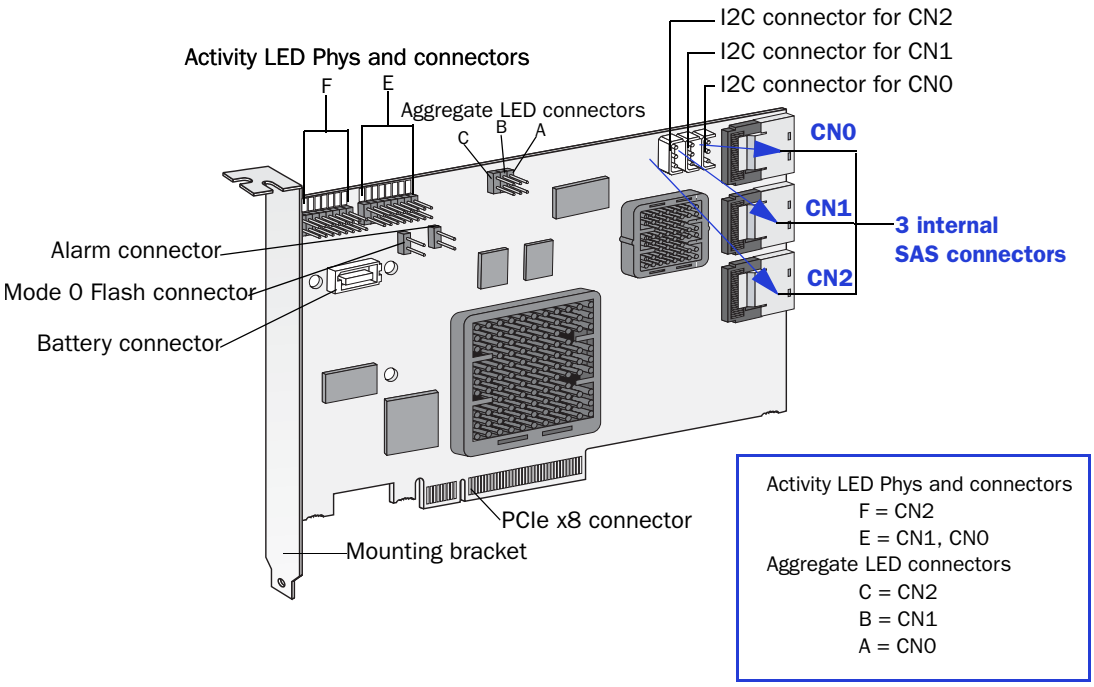
The Adaptec RAID 5805 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	8
Standard cache	512 MB DDR2
Connectors, internal	2 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	8 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 31205

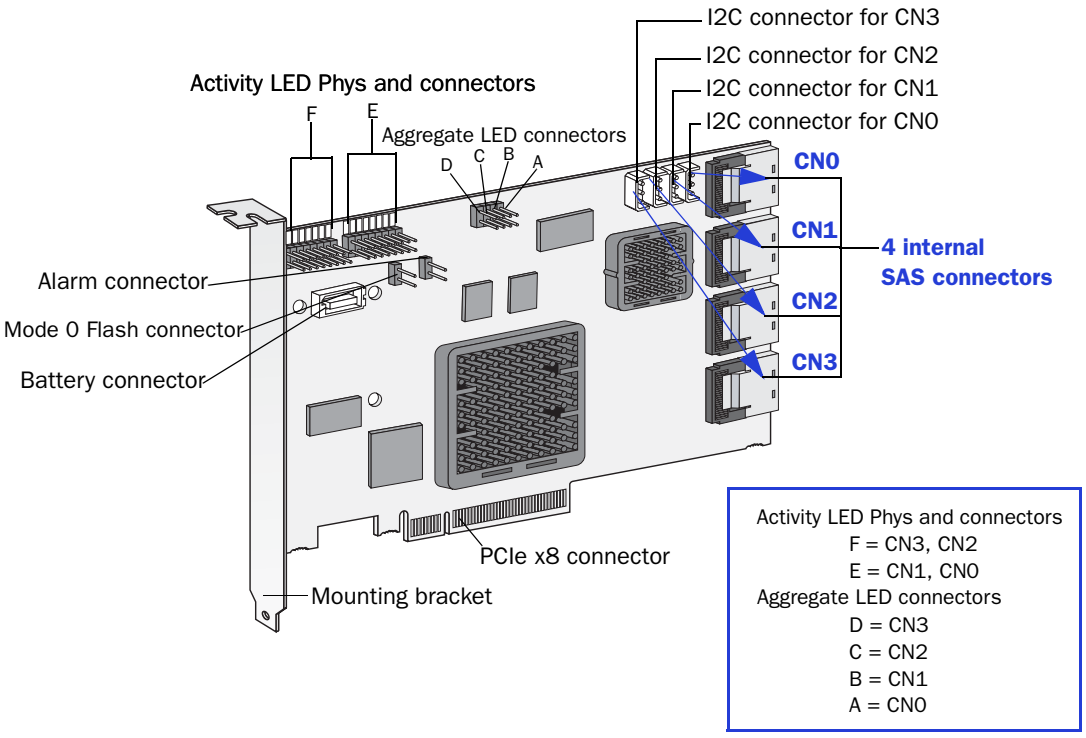
The Adaptec RAID 31205 is a SAS RAID controller with these features:



Form Factor	Half-size
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	12
Standard cache	256 MB DDR2
Connectors, internal	3 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	12 (or up to 100 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 31605

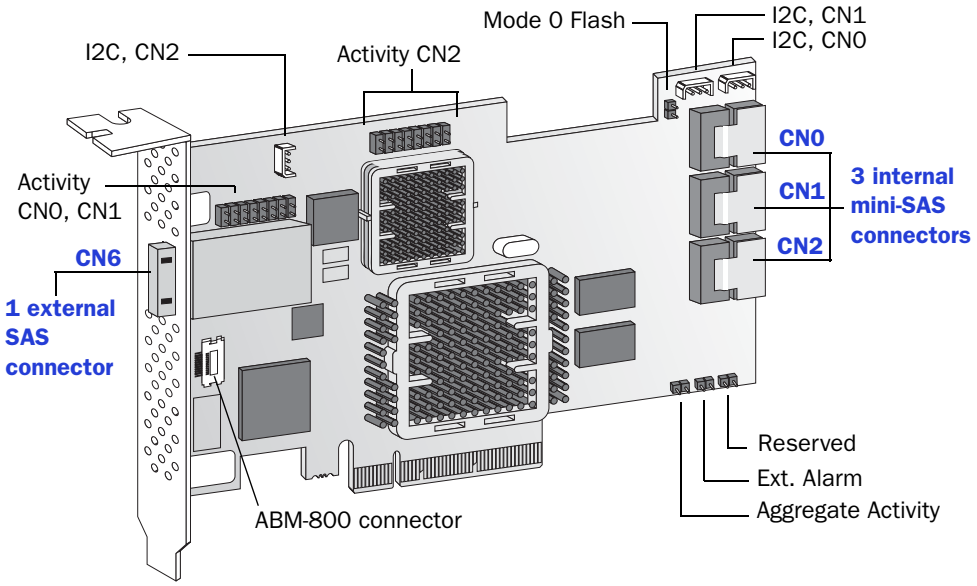
The Adaptec RAID 31605 is a SAS RAID controller with these features:



Form Factor	Half-size
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	16
Standard cache	256 MB DDR2
Connectors, internal	4 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	16 (or up to 100 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 51245

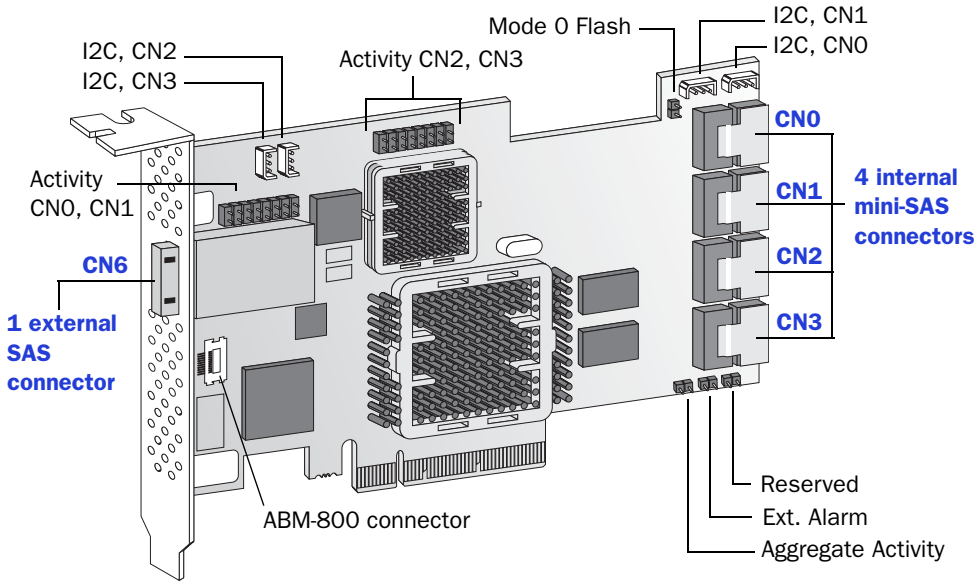
The Adaptec RAID 51245 is a SAS RAID controller with these features:



Form Factor	Full Height, Half Length
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	16
Standard cache	512 MB DDR2
Connectors, Internal	3 mini-SAS x4 (SFF-8087)
Connectors, Exteneral	1 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	16 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 51645

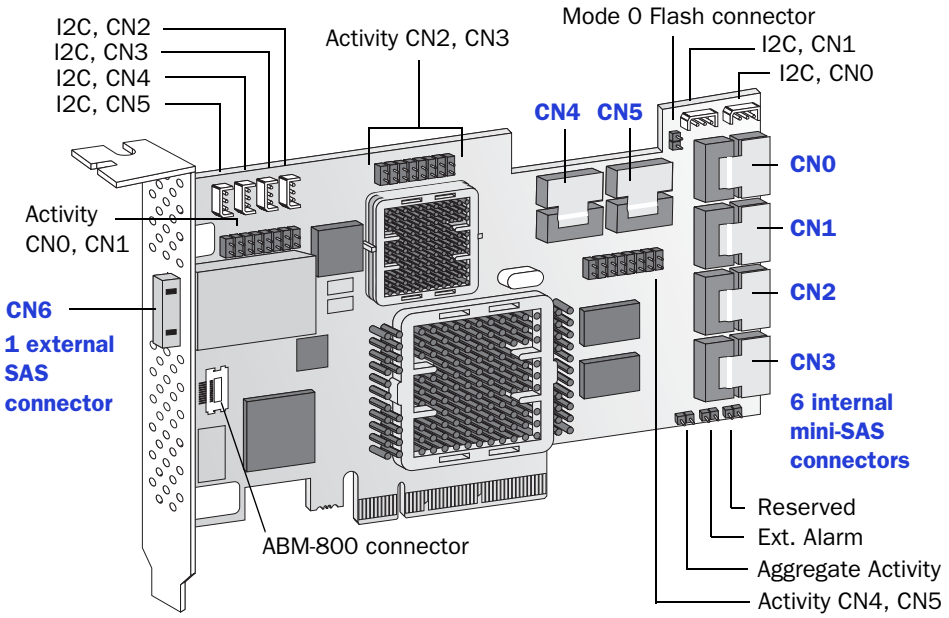
The Adaptec RAID 51645 is a SAS RAID controller with these features:



Form Factor	Full Height, Half Length
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	20
Standard cache	512 MB DDR2
Connectors, Internal	4 mini-SAS x4 (SFF-8087)
Connectors, Exteneral	1 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	20 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 52445

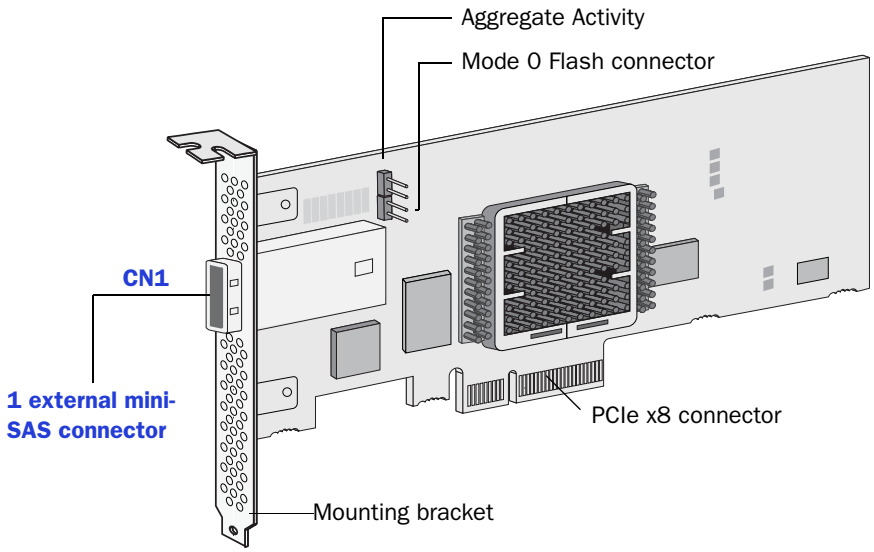
The Adaptec RAID 52445 is a SAS RAID controller with these features:



Form Factor	Full Height, Half Length
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	28
Standard cache	512 MB DDR2
Connectors, Internal	6 mini-SAS x4 (SFF-8087)
Connectors, Exteneral	1 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	28 direct-attached (or up to 256 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	Yes
Battery Backup Module	Adaptec Battery Module 800 (sold separately—see page 18)

About the Adaptec RAID 2045

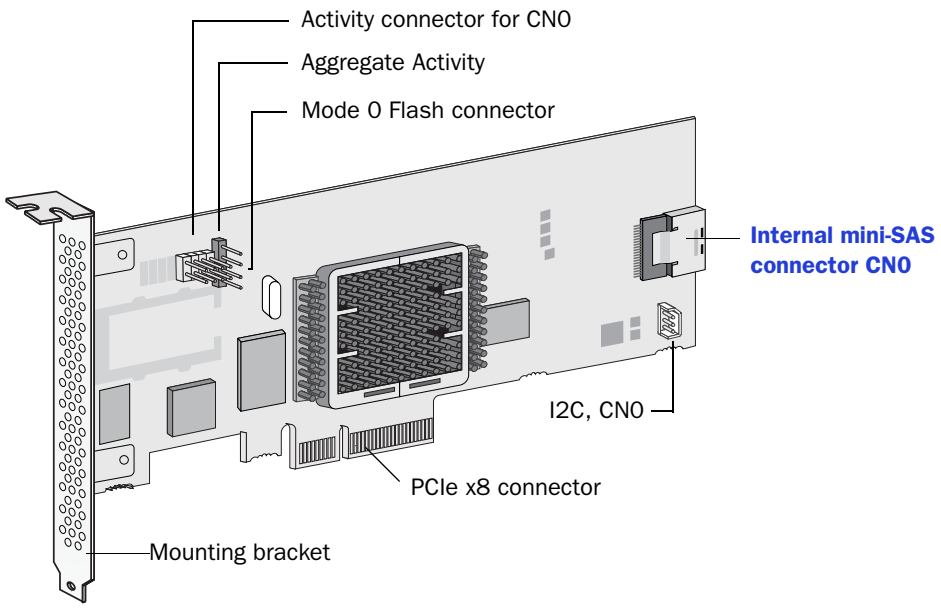
The Adaptec RAID 2045 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	4
Standard cache	128 MB DDR2
Connectors, external	1 mini-SAS x4 (SFF-8088)
Maximum number of disk drives	4 direct-attached (or up to 128 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	No
Battery Backup Module	No

About the Adaptec RAID 2405

The Adaptec RAID 2405 is a SAS RAID controller with these features:



Form Factor	Low-profile MD2
Bus compatibility	PCIe
PCIe bus width	x8
PCIe bus speed	2.5 Gb/s
Phys (Unified Serial Ports)	4
Standard cache	128 MB DDR2
Connectors, internal	1 mini-SAS x4 (SFF-8087)
Maximum number of disk drives	4 direct-attached (or up to 128 with expanders)
Enclosure Support	I2C and SGPIO
Onboard speaker	No
Battery Backup Module	No

Getting Started

4

In this chapter...

Choosing a RAID Level 34

Selecting Disk Drives and Cables 35

Installation Options 36

Basic Installation Steps 37

This chapter provides the basic information you need to set up your disk drives and arrays the way you want them. It also describes the options you have for installing your Adaptec controller and disk drives, and creating arrays for data storage.

Note: Before you begin, familiarize yourself with your Adaptec controller's physical features and the RAID levels that it supports (see *About Your RAID Controller* on page 16).

Choosing a RAID Level

This section provides a brief overview of the RAID levels supported by your Adaptec RAID controller, including the minimum and maximum number of disk drives required by each.

- **RAID 0 (Non-redundant Array)**—Stripes data across multiple disk drives. Improved performance but no redundancy (see page 75).
- **RAID 1 Array**—Created from two disk drives where one disk drive is a *mirror* of the other (the same data is stored on each disk drive). Redundancy, but reduced capacity (see page 76).
- **RAID 1E Array**—Similar to a RAID 1 array except that data is mirrored *and* striped, and more disk drives can be included (see page 76).
- **RAID 5 Array**—Stripes data for improved performance and uses *parity* data to provide redundancy (see page 78).
- **RAID 5EE Array**—Similar to a RAID 5 array, but includes a distributed spare and must include a minimum of four disk drives (see page 79).
- **RAID 10 Array**—Built from two or more equal-sized RAID 1 arrays, stripes and mirrors data across multiple disk drives. Redundancy and improved performance (see page 77).
- **RAID 50 Array**—Built from multiple disk drives configured as two or more RAID 5 arrays, stripes stored data and parity data across all disk drives (see page 80).
- **RAID 6 Array**—Similar to a RAID 5 array except that it includes *two* independent sets of parity data instead of one (see page 81).
- **RAID 60 Array**—Similar to a RAID 50 array except that it includes *four* independent sets of parity data instead of two (see page 81).

Use the table on page 82 to see how many disk drives you must connect to your RAID controller to support the RAID level you want.

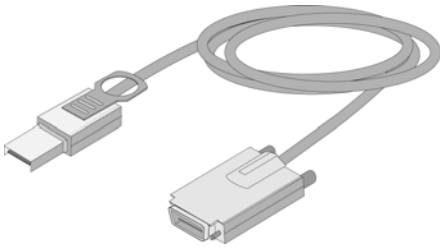
Selecting Disk Drives and Cables

Disk Drives

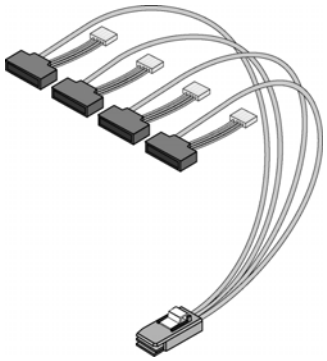
Your SAS controller supports both SAS and SATA disk drives. When selecting disk drives for your RAID array, ensure that all the disk drives have the same performance level. You can use different-sized disk drives in the array, but the array will be limited to the capacity of the smallest and slowest disk drive. For more information about arrays, refer to the *Adaptec Storage Manager User's Guide* or online Help. For more information about compatible disk drives, refer to the Adaptec Web site at www.adaptec.com/compatibility.

Cables

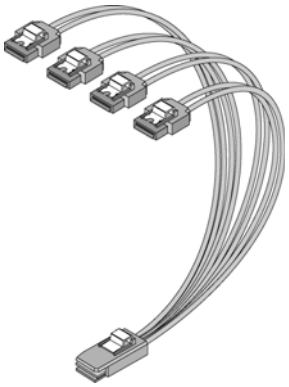
Depending on your requirements, you can use any of these cables:



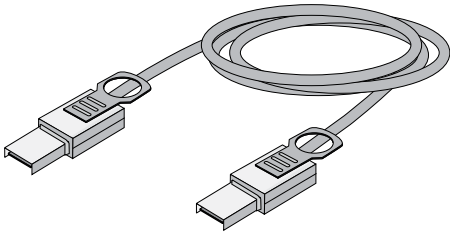
External mini-SAS (SFF-8088 to SFF-8470)—Connects to an external SAS enclosure.



Internal mini-SAS with power (SFF-8087 to SFF-8482)—Connects to four SAS or SATA disk drives.



Internal mini-SAS to SATA fan-out (SFF-8087 to 4x SATA)—Connects to four SATA disk drives.



External mini-SAS to mini-SAS (SFF-8088 to SFF-8088)—Connects to a backplane or enclosure.



Internal mini-SAS to mini-SAS (SFF-8087 to SFF-8087)—Connects to a backplane or enclosure.

Cable connectors are keyed so that you can't insert them incorrectly.

Adaptec recommends using only Adaptec SAS cables. For more information or to purchase cables, visit the Adaptec Web site at www.adaptec.com.

Installation Options

When you install your Adaptec controller, you can choose to create a bootable array and then install your operating system and the controller driver on that array.

Alternatively, you can complete a standard installation, where the controller driver is installed on an existing operating system.

Basic Installation Steps

This section describes the installation process. Follow the steps for the installation option you've chosen.

Installing with an Operating System

1. Install and connect your controller and internal disk drives (see page 38).

   If your controller has an external connector, you can connect external disk drives as well (or instead).

2. Set the boot controller (see page 44).
3. Create a bootable array (see page 44).
4. Install your operating system and the controller driver (see page 48.)
5. Install Adaptec Storage Manager and begin to manage your data storage (see page 59).

Installing on an Existing Operating System

1. Install and connect your controller and internal disk drives (see page 38).

   If your controller has an external connector, you can connect external disk drives as well (or instead).

2. Install the controller driver (see page 54).
3. Install Adaptec Storage Manager and begin to manage your data storage (see page 59).

Installing the Controller and Disk Drives

5

In this chapter...

Before You Begin 39

Installing the Controller 39

Connecting Disk Drives to Your Controllers 40

Connecting External Devices 41

Next Steps 42

This chapter explains how to install your Adaptec RAID controller, and how to install and connect internal and external disk drives.

Before You Begin

- Read *Safety Information* on page 137.
- Familiarize yourself with your Adaptec RAID controller's physical features and the RAID levels that it supports (see page 16).
- Ensure you have the right quantity of disk drives for the RAID level you want to use for your arrays (see page 35).
- Ensure that you have the proper cables for your controller and disk drives (see page 35).
- If you are installing a low-profile RAID controller into a low-profile computer cabinet, replace the original full-height bracket with the low-profile bracket included in the kit.

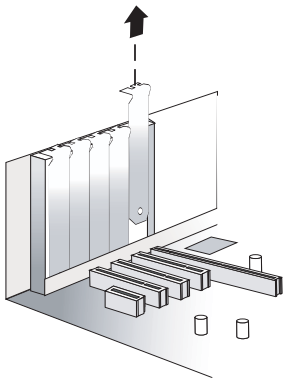
  Caution: Handle the controller by its bracket or edges only.

Installing the Controller

This section describes how to install your Adaptec RAID controller into your computer cabinet.

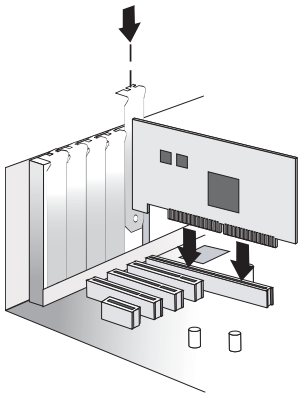
1. Turn off your computer and disconnect the power cord. Open the cabinet, following the manufacturer's instructions.
2. Select an available PCIe expansion slot that's compatible with your RAID controller and remove the slot cover, as shown at right. (PCIe bus compatibility is marked to the controller figures in *About Your RAID Controller* on page 16.)

   Caution: Touch a grounded metal object before handling the RAID controller.



3. As shown at right, insert the RAID controller into the expansion slot and press down gently but firmly until it clicks into place. When installed properly, the RAID controller should appear level with the expansion slot.
4. Secure the bracket in the expansion slot, using the retention device (for instance, a screw or lever) supplied with your computer.
5. Connect your computer's disk activity LED cable to the LED connector on the controller (marked on the figures in *About Your RAID Controller* on page 16).

   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.



6. **Optional**—Connect your RAID controller's I2C connector (not available on all models) to an I2C connector on an internal backplane or enclosure, using an I2C cable. For more connection details, see *About Your RAID Controller* on page 16.
7. Prepare and install your internal disk drives, following the instructions in *Connecting Disk Drives to Your Controllers* on page 40.

   If you are not installing internal disk drives, close your computer cabinet, reattach the power cord, then continue with *Connecting External Devices* on page 41.

Connecting Disk Drives to Your Controllers

You can connect SAS disk drives, SATA disk drives, or a combination of both to your SAS RAID controller. (See www.adaptec.com/compatibility for a list of compatible disk drives.) There are no jumpers or switches to set before installation.

If you plan to build a bootable array using internal disk drives, ensure you install at least the minimum number disk drives required to support the RAID level you want. See page 34 for more information.

Note: Although you can connect both SAS and SATA disk drives to your SAS controller, Adaptec recommends that you *not* combine SAS and SATA disk drives within the same array or logical drive. See page 68 for more information.

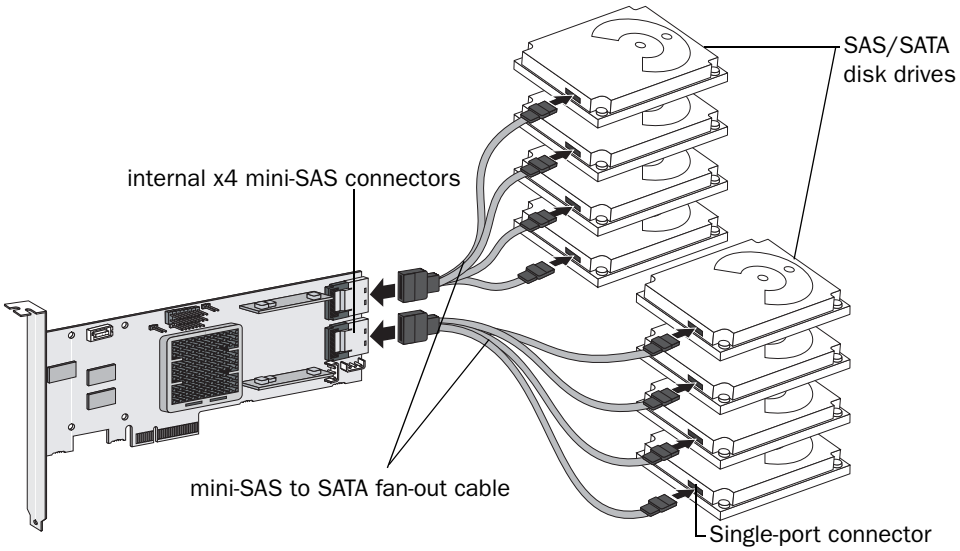
You have two connection options:

- To connect directly to the controller, see the following section.
- To connect to a backplane, see page 41.

Connecting Directly to the Controller

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SAS card with SAS cables.The number of direct-attached disk drives is limited to four per internal SAS connector. (For more information about direct-attach connections, see page 71.)

1. Install your internal SAS or SATA disk drives, following the instructions in your system's documentation.
2. Use internal SAS or mini-SAS cables to attach the disk drives to the controller, as shown in the following example.



Note: SAS fan-out cables are also available with an additional sideband (SFF-8448) cable that caries SGPIO signals for enclosure management. This additional sideband cable is not used with direct-attached disk drives.

3 When all internal disk drives have been installed and attached to the controller, close your computer cabinet, reattach the power cord, then continue with *Connecting External Devices* on page 41.

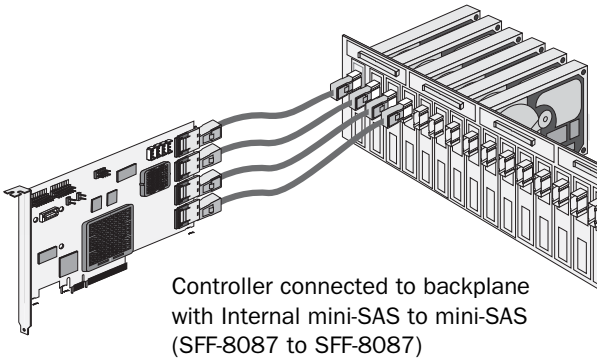
Connecting to a System Backplane

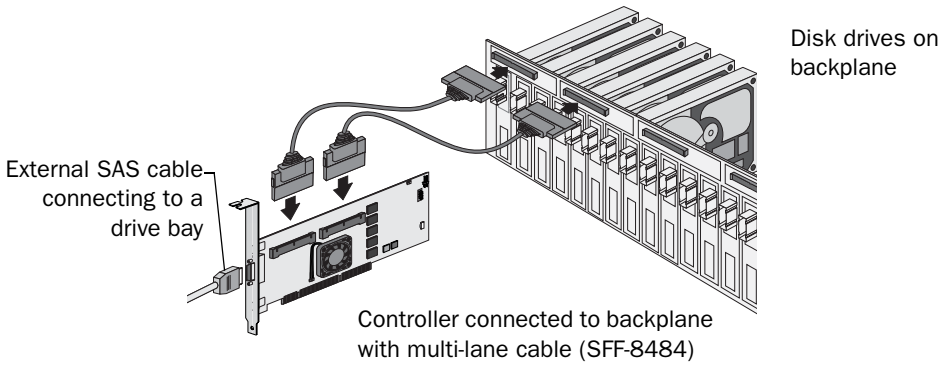
In a backplane connection, disk drives and SAS cards are attached to and communicate with each other through a system backplane.

The number of disk drives is limited to the number of slots available on the backplane. Some backplanes have embedded SAS expanders and can support up to 128 end devices. (For more information about backplane and expander connections, see page 71.)

1 Connect one or more internal SAS or SATA disk drives to the backplane. (Refer to your system's documentation for more information.)

2 Use an internal SAS cable to connect the controller to the backplane, as shown in the examples on page 41.





3 When all internal disk drives have been installed and connected, close your computer cabinet, reattach the power cord, then continue with *Connecting External Devices* on page 41.

Connecting External Devices

Note: If you are not connecting any external devices, see the following section, *Next Steps*.

Use high-quality cables to connect your controller to your external device(s), such as disk drives or disk drive enclosures.

Adaptec recommends using only Adaptec cables. For more information or to purchase cables, visit the Adaptec Web site at www.adaptec.com.

Next Steps

If you are installing the controller driver *and* an operating system onto a bootable array, continue with *Creating a Bootable Array* on page 43.

If you are completing a standard installation onto an existing operating system, continue with *Installing the Driver on an Existing Operating System* on page 54.

Creating a Bootable Array

6

In this chapter...

Setting the Boot Controller 44

Creating an Array 44

Making Your Array Bootable 47

This chapter explains how to set your Adaptec controller to be the boot controller, and how to create a bootable array.

Note: If you are completing a standard installation onto an existing operating system, you don't have to complete this task. Skip to *Installing the Driver on an Existing Operating System* on page 54.

Setting the Boot Controller

Note: If your system won't contain more than one bootable controller, skip to the next section, *Creating an Array*.

Your Adaptec RAID controller supports bootable disk drives and bootable arrays. To enable your system to boot from either a disk drive or an array connected to your controller:

1 Enter the system setup.

2 Navigate to the drive boot sequence.

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

For more information, refer to your computer documentation.

Creating an Array

This section explains how to create an array.

A RAID 5 array is created in the examples shown in this section because RAID 5 provides the most security and best performance with a minimum of three disk drives. However, you can choose to create an array with a different RAID level; you can also change array level later, after the operating system is installed.

You can create an array using any of these tools:

- **Array Configuration Utility** (ACU)—BIOS-based menus and keyboard navigation (see the following section).
- **Adaptec Storage Manager**—Graphical software application (running from a bootable RAID installation CD) that you can navigate with your mouse (see page 60).
- **ARCCONF**—Command line utility. For instructions, refer to the *Adaptec RAID Controller Command Line Utility User's Guide.*

You can use either tool, but the ACU utility is the quicker and easier tool for this task.

Note: Adaptec recommends that you *not* combine SAS and SATA disk drives within the same array. Adaptec Storage Manager generates a warning if you try to create a logical drive using a combination of SAS and SATA disk drives. See page 68 for more information.

Creating an Array with the ACU

The ACU is menu-based and instructions for completing tasks appear on-screen. Menus can be navigated using the arrows, Enter, Esc, and other keys on your keyboard.

To create a RAID 5 array:

1 Power on your computer. When prompted, press **Ctrl+A** to enter the ARC utility.

Note: During boot up, if your system has insufficient memory the following message will display. *"Adaptec RAID Configuration Utility will load after, system initialization. Please wait... Or press <Enter> Key to attempt loading the utility forcibly [Generally, not recommended]"*

2 If you have more than one controller of the same model or family in your computer, select your controller, then press **Enter**.

3 Select **Array Configuration Utility**, then press **Enter**.

4 Select **Initialize Drives**, then press **Enter**.

5 Select at least three disk drives for the array, press **Insert** for each selected disk drive, then press **Enter**.

Caution: During initialization, all data is deleted from the disk. Before continuing, back up any data you want to keep.

6 Press **Y**, then press **Enter**.

The selected disk drives are initialized, then the ACU screen appears.

7 Select **Create Array**, then press **Enter**.

8 Select the disk drives that were just initialized, press **Insert** for each selected disk drive, then press **Enter**.

9 When the Array Properties screen opens, follow the instructions in the following table.

Property Line	Entry or Selection
Array Type	Select **RAID 5**, then press **Enter**.
Array Label	Type a name, then press **Enter**.
Array Size	Press **Enter**, then press **Enter** again to use the default granularity of GB.
Stripe Size	Press **Enter** to use the default (256 KB).
Read Caching	Press **Enter** to use the default (Yes).
Write Caching	Press **Enter** to use the default (Enable always).
Create RAID via	Press **Enter** to use the default (Build/Verify).
[Done]	Press **Enter**.

10 When a cache warning message displays, type Y.

11 Once the array is created, a message displays telling you that the array can now be used. Press any key to return to the ACU Menu.

You can start using the array immediately. However, performance is reduced until the build process is complete.

12 Press **Esc** until the Exit utility window appears.

13 Select **Yes**, then press **Enter**.

The computer restarts.

14 Continue with *Making Your Array Bootable* on page 47.

Creating an Array with Adaptec Storage Manager

This section describes how to use the Adaptec Storage Manager configuration wizard to build a RAID 5 array.

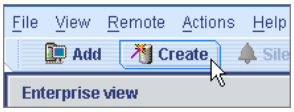
Note: You will need the Adaptec Storage Manager Installation CD to complete this task.

To create a RAID 5 array:

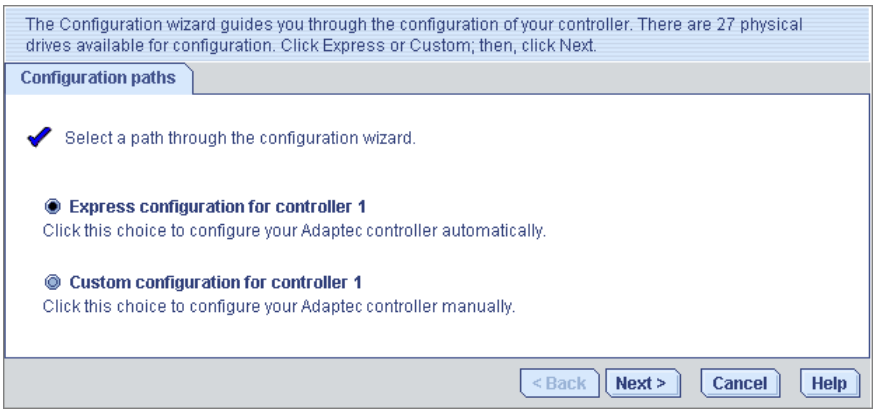
1. Insert the Adaptec Storage Manager Installation CD into your CD drive, then restart your computer.
2. When prompted, select the language you want, then press **Enter**.
3. Review the license information, then press **Enter**.

   The main menu opens.
4. Click **Launch Configuration Utility**.

   Adaptec Storage Manager opens.
5. Click **Create**.



   The Configuration wizard opens.

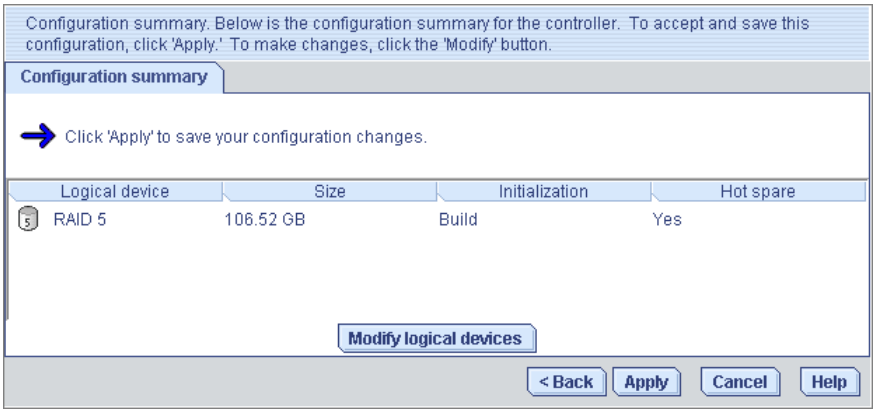


6. Select **Express configuration...**, then click **Next**.

7 Review the information that is displayed.

Note: In DAS environments, Adaptec Storage Manager uses the term *logical drives* when referring to *arrays* (see page 12).

In this example, Adaptec Storage Manager has used thirteen equal-sized disk drives to automatically create one logical drive with RAID 5 and a hot spare.



To exclude specific disk drives from the logical drive, specify a size for the logical drive, or to make other changes to the configuration, click **Modify logical devices**.

8 Click **Apply**, then click **Yes** when prompted to confirm applying your new configuration.

Adaptec Storage Manager builds the logical drive.

The configuration is saved on the Adaptec controller (as an "array", see page 12) and on the physical disk drives.

9 Partition and format your logical drive.

The logical drive you created appears as a physical disk drive on your operating system. You *must* partition and format these logical drives before you can use them to store data.

10 Close all windows, then click **Reboot** to restart your system.

11 Remove the Adaptec Storage Manager Installation CD.

For information on installing and using Adaptec Storage Manager as a full software application, refer to the *Adaptec Storage Manager User's Guide* or online Help.

12 Continue with the following section.

Making Your Array Bootable

Use the ACU to make the array bootable (see *Creating Bootable Arrays* on page 85).

Then continue with *Installing the Driver and an Operating System* on page 48.

Installing the Driver and an Operating System

7

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Installing with FreeBSD 53

This chapter explains how to install your Adaptec RAID controller driver and an operating system onto a bootable array (see page 43).

To install the driver on an existing operating system, see page 54.

Before You Begin

- Install and connect your Adaptec RAID controller and internal disk drives (see page 38).
- Create a bootable array (see page 43).
- Create a driver disk (see the following section).

Note: For up-to-date operating system version support, visit the Adaptec Web Site at www.adaptec.com. From the main menu select Support>Knowledgebase>Find Answers. Select your controller type and OS support to generate a list of supported operating systems and to download the latest drivers.

Creating a Driver Disk

Note: You will need a floppy disk to complete this task.

To create a driver disk:

1. Set your system BIOS so that your computer boots from the CD drive. (For instructions, refer to your computer documentation.)
2. Turn on your computer, then insert the RAID Installation CD included in your RAID controller kit.
3. Follow the on-screen instructions to get to the Adaptec Start Menu.
4. Click **Create Driver Disk(s) for Installing/Updating your OS**, then select your operating system.

   Note: *Linux only*—If prompted, select your operating system *and* then the version.
5. When prompted, insert a floppy disk, then click **OK**.

   The system creates the driver disk.
6. Remove and label the driver disk.
7. Continue with the instructions for your operating system:
   - For Windows, see page 49.
   - For Red Hat Linux, see page 51.
   - For SUSE Linux, see page 51.
   - For OpenServer, see page 51.
   - For UnixWare, see page 52.
   - For Solaris, see page 52
   - For VMware, see page 53.
   - For FreeBSD, see page 53.

Installing with Windows

Note: You will need your Windows Installation CD to complete this task.

Installing with Windows Server 2003 or Windows XP

To install the Adaptec RAID controller driver while installing Windows:

1 Insert your Windows CD, then restart the computer.

2 Follow the on-screen instructions to begin the Windows installation.

3 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 your computer.

4 Insert the driver disk, then wait until you are prompted to install a driver.

5 Press **S** to specify that the driver is on a floppy disk, then press **Enter**.

The computer reads the disk.

6 When the Adaptec driver is found, press **Enter**.

7 Follow the on-screen instructions to complete the installation.

8 Continue with *Managing Your Storage Space* on page 59.

Installing with Windows Server 2008 or Windows Vista

To install the Adaptec RAID controller driver while installing Windows:

1 Insert your Windows CD, then restart the computer.

2 Follow the on-screen instructions to begin the Windows installation.

3 When prompted to specify a location for Windows, select **Load Driver**.

4 Insert the driver disk, then click **OK**.

5 When the Adaptec driver is found, press **Next**.

6 Click **Next** again to accept the default partition configuration, or refer to your Windows documentation to configure partitions manually.

7 Follow the on-screen instructions to complete the installation.

8 Continue with *Managing Your Storage Space* on page 59.

Installing with Red Hat Linux

Note: You will need your Red Hat Installation CD to complete this task.

To install the Adaptec RAID controller driver while installing Red Hat Linux:

1. Insert the first Red Hat Installation CD.
2. Restart your computer.
3. When the Red Hat Welcome screen appears, type `linux dd` at the Boot: prompt.
4. When prompted, insert the driver disk, then select **OK**.
5. Follow the prompts to set up the environment you want.
6. If you are installing other third-party devices, install them now. Otherwise, select **Done**.
7. Complete the Linux installation, following the instructions included with your operating system.
8. Continue with *Managing Your Storage Space* on page 59.

Installing with SUSE Linux

To install the Adaptec RAID controller driver while installing SUSE Linux:

1. Insert the first SUSE Installation CD.
2. Restart your computer.
3. When the SUSE installation selection screen appears, choose the type of installation you want, then press the **F6** key to indicate the use of a driver disk. (If F6 is not shown on the screen, you may have an older version of SUSE; press the **Alt** key instead.)
4. When prompted, insert the driver disk, then press any key to continue.
5. Follow the prompts to set up the environment you want.
6. If you are installing other third-party devices, install them now. Otherwise, select **Back**.
7. Complete the Linux installation, following the instructions included with your operating system.
8. Continue with *Managing Your Storage Space* on page 59.

Installing with OpenServer

Note: You will need your OpenServer Installation CD to complete this task.

To install the driver when installing OpenServer:

1. Insert the OpenServer Installation CD.
2. Restart your computer.
3. Follow the on-screen instructions to begin the OpenServer installation.
4. When prompted to load more HBA drivers, insert the driver disk, then select **Yes**. (To load more HBA drivers, repeat this step.)

5 When all drivers have loaded, select **No**.

6 Complete the OpenServer installation, following the instructions included with your operating system.

7 Continue with *Managing Your Storage Space* on page 59.

Installing with UnixWare

Note: You will need your UnixWare Installation CD to complete this task.

To install the driver when installing UnixWare:

1 Insert the UnixWare Installation CD.

2 Restart your computer.

3 Follow the on-screen instructions to begin the UnixWare installation.

4 When prompted to load more HBA drivers, insert the driver disk, then select **Yes**. (To load more HBA drivers, repeat this step.)

5 When all drivers have loaded, select **No**.

6 Complete the UnixWare installation, following the instructions included with your operating system.

7 Continue with *Managing Your Storage Space* on page 59.

Installing with Solaris

Note: This task is not necessary if you are installing Solaris 10 Update 2 or later. Instead, you can choose to install Solaris using the in-box driver and update it either during or after the installation is complete, if required. You will need a floppy disk to complete this task.

To create a driver disk:

1 Start your computer.

2 Interrupt the autoboot, press the **ESC** key. The Device Configuration Assistant (DCA) Utility will open.

3 Select **F4_Add Driver**.

4 Insert a floppy disk.

5 Complete the Solaris installation, following the instructions included with your operating system.

Installing with VMware

Note: You will need your VMware Installation CD to complete this task.

To install the driver when installing VMware:

1 Insert the VMware Installation CD.

2 Restart your computer.

3 Follow the on-screen instructions to begin the VMware installation.

Note: The VMware embedded driver will see the device and install.

4 Complete the VMware installation, following the instructions included with your operating system.

Note: Currently, the Adaptec Storage Manager GUI is not supported on VMware. To create and manage arrays, you must connect to the VMware machine from a remote GUI or use the ARCCONF utility. See page 61 for more information.

Installing with FreeBSD

Note: You will need your FreeBSD Installation CD to complete this task.

To install the driver when installing FreeBSD:

1 Insert the FreeBSD Installation CD.

2 Restart your computer.

3 When the FreeBSD start screen opens, select **6** to escape to loader prompt.

4 Type `load kernel`.

5 Insert the driver floppy disk.

6 Type `load disk0:aacu.ko`.

If the driver fails to load, run lsdev and check for the floppy disk drive. Then, try again with the appropriate device.

7 Type `boot`.

8 Complete the FreeBSD installation, following the instructions included with your operating system.

9 Reboot your computer, then remove the driver disk.

10 Repeat Steps 3 through 7 the first time you boot the operating system to load the drivers again for the initial bootup.

Installing the Driver on an Existing Operating System

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Installing on FreeBSD 58

This chapter explains how to install your Adaptec RAID controller driver.

Note: To install the driver while you're installing an operating system, see page 48.

Before You Begin

Before you begin, install and connect your Adaptec RAID controller and internal disk drives (see page 38).

You must also create a driver disk (see page 49) before you begin installing the controller driver.

Note: For up-to-date operating system version support, visit the Adaptec Web Site at www.adaptec.com. From the main menu select Support>Knowledgebase>Find Answers. Select your controller type and OS support to generate a list of supported operating systems and to download the latest drivers.

Creating a Driver Disk

Note: You will need a floppy disk to complete this task.

To create a driver disk:

1. Set your system BIOS so that your computer boots from the CD drive. (For instructions, refer to your computer documentation.)
2. Turn on your computer, then insert the RAID Installation CD included in your RAID controller kit.
3. Follow the on-screen instructions to get to the Adaptec Start Menu.
4. Click **Create Driver Disk(s) for Installing/Updating your OS**, then select your operating system.

   Note: *Linux only*—If prompted, select your operating system *and* then the version.
5. When prompted, insert a floppy disk, then click **OK**.

   The system creates the driver disk.
6. Remove and label the driver disk.
7. Continue with the instructions for your operating system:
   - For Windows, see page 56.
   - For Red Hat or SUSE Linux, see page 56.
   - For OpenServer, see page 57.
   - For UnixWare, see page 57.
   - For Solaris, see page 57.
   - For VMware, see page 58.
   - For FreeBSD, see page 58.

Installing on Windows

Follow the instructions in this section for your version of Windows.

Installing on Windows Server 2003 or Windows XP

To install the driver on Windows:

1. Start or restart Windows.

   The Found New Hardware Wizard opens and searches for the driver.

2. Insert the driver disk, select **Floppy drive**, then click **Next**.
3. Click **Next**, then click **Next** again.
4. Follow the on-screen instructions to complete the driver installation.
5. Remove the driver disk and restart your computer.
6. Continue with *Managing Your Storage Space* on page 59.

Installing with Windows Server 2008 or Windows Vista

1. Start or restart Windows.

   The Found New Hardware Wizard opens and searches for the driver.

2. Insert the driver disk, then select **Locate and Install Driver Software...** and **Don't Search Online**.
3. Click **Next**, then click **Close**.
4. When the installation is complete, remove the driver disk and restart your computer.
5. Continue with *Managing Your Storage Space* on page 59.

Installing on Red Hat or SUSE Linux

To install the module on Red Hat or SUSE Linux:

1. Insert and mount the RAID Installation CD:

   Red Hat: `mount /dev/cdrom /mnt/cdrom`
   SUSE: `mount /dev/cdrom /media/cdrom`

2. Install the module RPM:

   `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 ensure the driver loaded correctly.
4. Run fdisk, mkfs, and create mount points for any new disk drives.
5. Continue with *Managing Your Storage Space* on page 59.

Installing on OpenServer

To install the driver on OpenServer:

1. Start your computer, then insert the driver disk.
2. Begin the driver package installer:

   ```
   pkgadd -d diskette1
   ```

3. At the installer prompt, type `go`.
4. Select **1** for the aacraid package.
5. When the installation is complete, select **q** to quit the installer.
6. Reboot your computer and remove the driver disk.
7. Continue with *Managing Your Storage Space* on page 59.

Installing on UnixWare

To install the driver on UnixWare:

1. Start your computer, then insert the driver disk.
2. Begin the driver package installer:

   ```
   pkgadd -d diskette1
   ```

3. At the installer prompt, type `go`.
4. Select **1** for the aacraid package.
5. When the installation is complete, select **q** to quit the installer.
6. Reboot your computer and remove the driver disk.
7. Continue with *Managing Your Storage Space* on page 59.

Installing on Solaris

To install the driver on Solaris:

1. Start your computer.
2. Check for any pre-existing Adaptec driver by performing a `pkginfo SUNWaac` in a terminal window. If there is no pre-existing Adaptec driver on your computer, continue with Step 3. If an Adaptec driver is already installed on your computer, perform a `pkgrm SUNWaac` to remove it.

   Caution: If your operating system currently boots from the Adaptec controller, *do not* reset your computer after you remove the pre-existing Adaptec driver. Instead, follow the steps in this section to install a new driver before rebooting your computer.

3. Insert and mount the driver disk:

   ```
   volcheck
   ```

4. Change to the driver installer directory:

   ```
   cd /floppy/floppy0/DU/sol_210/i86pc/Tools
   ```

5 Start the driver installer:

```
./install.sh -i
```

6 Reboot your computer, then remove the driver disk.

7 Continue with *Managing Your Storage Space* on page 59.

Installing on VMware

Note: The embedded driver provided by VMware should be suitable for most applications. If an updated driver is needed, use the following procedure.

To install the driver on VMware:

1 Start your computer, then insert the driver disk.

2 At the console screen of the VMware server, mount the Adaptec Installation CD:

```
mount –r /dev/cdrom /mnt/cdrom.
```

3 Install the module RPM:

```
rpm -i --force VMware-3.5-64607-esx-drivers-scsi-aacraid-1.1.5-2457.i586.rpm
```

4 Follow the on-screen instructions to save the boot image and run the vmware-mkinitrd command manually.

5 Reboot your computer and remove the driver disk.

Note: Currently, the Adaptec Storage Manager GUI is not supported on VMware. To create and manage arrays, you must connect to the VMware machine from a remote GUI or use the ARCCONF utility. See page 61 for more information.

Installing on FreeBSD

To install the driver on FreeBSD:

1 Start your computer.

2 Insert and mount the driver disk:

```
mount -t msdos /dev/fd0 /mnt
```

3 Copy the driver package to the /tmp directory:

```
cp /mnt/aac-02.00.00-x.tgz /tmp
```

4 Install the driver package:

```
pkg_add /tmp/aac-02.00.00-x.tgz
```

5 Reboot your computer, then remove the driver disk.

Managing Your Storage Space

9

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Once you have installed your Adaptec RAID 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 RAID 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 RAID 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.

From a single workstation, you can use Adaptec Storage Manager to monitor and manage all the controllers and disk drives in your storage space, including DAS and NAS.

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, task 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 online Help, or to the *Adaptec Storage Manager User's Guide* on the Adaptec Storage Manager Installation CD.

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 Adaptec RAID Controller Configuration Utility

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

With ARCCONF, you can:

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

ARCCONF and the *Adaptec RAID Controller Command Line Utility User's Guide*, which describes how to use ARCCONF, are included on the Adaptec Storage Manager Installation CD.

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

About the Adaptec RAID Configuration Utility

The Adaptec RAID Configuration (ARC) utility is a BIOS-based utility that you can use to create and manage controllers, disk drives and other devices, and arrays. The ARC 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 page 92.)
- **Serial*Select***—For modifying your controller and disk drive settings.
- **Disk Utilities**—For formatting or verifying disk drives.

The ARC utility is included in your controller's BIOS. For more information, see *Using the Adaptec RAID Configuration Utility* on page 83.

Note: The ARC utility is primarily intended for preoperating system installation configuration.

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 RAID controller's firmware BIOS and Non-Volatile Random Access Memory (NVRAM).

Caution: Although the AFU contains safeguards to prevent you from accidentally damaging your RAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your RAID controller inoperable.Adaptec recommends that only advanced users familiar with working in DOS use the AFU. You can also use Adaptec Storage Manager to update the controller firmware/BIOS. See the *Adaptec Storage Manager User's Guide* for more information.

Which Utility Should I Use?

To create a bootable array, Adaptec recommends that you use the BIOS-based ACU (See *Using the Adaptec RAID Configuration Utility* on page 83).

For all subsequent storage management tasks, Adaptec recommends that you install and use Adaptec Storage Manager (see page 60). 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.

Solving Problems

10

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Resetting the Controller 65

This chapter provides basic troubleshooting information and solutions for solving controller problems.

Troubleshooting Checklist

If you encounter difficulties installing or using your Adaptec RAID controller, check these items first:

- With your computer powered off, check the connections to each disk drive, power supply, LED connector, and so on.

  Try disconnecting and reconnecting disk drives from the Adaptec RAID controller.

- Check that your Adaptec RAID controller is installed in a compatible PCIe expansion slot. To double-check the bus compatibility of your controller, see *About Your RAID Controller* on page 16.
- Ensure that your Adaptec RAID controller is firmly seated and secured in the PCIe expansion slot.
- If your Adaptec RAID controller is not detected during system boot, try installing it in a different compatible expansion slot. (See page 39 for instructions.)
- Did the driver install correctly?
- If you have external disk drives (or other devices), are they powered on?
- Check the Readme on your installation CD for compatibility issues and known problems.

If you are still unable to resolve a problem, you can find additional troubleshooting information and direction on the Adaptec Web site at www.adaptec.com or the Support Knowledgebase at ask.adaptec.com.

Monitoring Disk Drives Status

You can use the 'blink' feature of Adaptec Storage Manager to monitor the status of your SAS and SATA disk drives. When you blink a specific disk drive or set of disk drives, the LED(s) on the selected disk drives flash.

This table describes the LED flash states.

Controller Device State	Slot State	LED Flash State
Failed	Device is faulty	On
Rebuilding	Device is rebuilding	Slow flash
Blink	Identify the device	Fast flash
Other	No error	Off

For more information about backplanes, see *Backplane Connections* on page 71. For more information about using Adaptec Storage Manager to monitor your disk drives, refer to the *Adaptec Storage Manager User's Guide* or the online Help.

Silencing the Alarm

If your Adaptec RAID controller includes an alarm, the alarm will sound when an error occurs. To silence the alarm, use Adaptec Storage Manager (see *Managing Your Storage Space* on page 59.) OR Serial*Select* (see *Modifying Your Controller's Configuration* on page 88.)

Recovering from a Disk Drive Failure

This section explains how to recover when a disk drive fails:

- If the array was protected by a hot spare (see page 64).
- If the array was *not* protected by a hot spare (see page 64).
- If there is a disk drive failure in more than one array simultaneously (see page 64).
- If it is a RAID 0 array (see page 65).
- If multiple disk drives fail within the same array (see page 65).

Note: In DAS environments, Adaptec Storage Manager uses the term *logical drives* when referring to *arrays* (see page 12).

Failed Disk Drive Protected by a Hot Spare

When an array is protected by a hot spare, if a disk drive in that array fails the hot spare is automatically incorporated into the array and takes over for the failed drive.

To recover from the failure:

1. Remove and replace the failed disk drive.
2. **If copyback is not enabled**—In Adaptec Storage Manager, remove the 'hot spare' designation from the original hot spare (the disk drive that was built into the array). Then, designate a new hot spare to protect the arrays on that controller.

   If copyback is enabled—Data is automatically moved back to its original location once the controller detects that the failed drive has been replaced. No action is required.

Failed Disk Drive Not Protected by a Hot Spare

When a array is not protected by a hot spare, if a disk drive in that array fails, remove and replace the failed disk drive. The controller detects the new disk drive and begins to rebuild the array.

If the controller fails to rebuild the array, check that the cables, disk drives, and controllers are properly installed and connected. Make sure that the new disk drive is equal or greater in size than the failed disk drive. Then, if necessary, use Adaptec Storage Manager to rebuild the array. For instructions, refer to the *Adaptec Storage Manager User's Guide* or online Help.

Failure in Multiple Arrays Simultaneously

If there's a disk drive failure in more than one array at the same time (one failure per array), and the arrays have hot spares protecting them, the controller rebuilds the arrays with these limitations:

- A hot spare must be of equal or greater size than the failed disk drive it's replacing.
- Failed disk drives are replaced with hot spares in the order in which they failed. (The array that includes the disk drive that failed first is rebuilt first, assuming an appropriate hot spare is available—see bullet above.)

If there are more disk drive failures than hot spares, see *Failed Disk Drive Not Protected by a Hot Spare*.

If copyback is enabled, data is moved back to its original location once the controller detects that the failed drive has been replaced.

Disk Drive Failure in a RAID 0 Array

Because RAID 0 volumes do not include redundancy, if a disk drive fails in a RAID 0 array, the data can't be recovered.

Correct the cause of the failure or replace the failed disk drives. Then, restore your data (if available).

Multiple Failures in the Same Array

Except in RAID 6 and RAID 60 arrays (see page 74), if more than one disk drive fails at the same time in the same array, the data normally can't be recovered.

You *may* be able to recover the data by forcing the logical drive online or by recreating the logical drive without the initialization step. You can use the BIOS utility, ACU (see page 61), the command-line utility, ARCCONF, or Adaptec Storage Manager. For more information, refer to the *Adaptec RAID Controller Command Line Interface User's Guide* and the *Adaptec. Storage Manager User's Guide*.

Note: In some instances, RAID 10 and RAID 50 arrays *may* survive multiple disk drive failures, depending on which disk drives fail.

Resetting the Controller

This section explains how to reset (or *Mode 0 flash*) your Adaptec RAID controller. You may want to do this if the controller becomes inoperable, or if a firmware upgrade is unsuccessful.

To reset your Adaptec RAID controller:

1. Download the firmware version currently installed on your controller from www.adaptec.com
2. Extract the downloaded files to a folder on your local hard drive (for example, C:\Download\Drivers).
3. Create a bootable MS–DOS floppy disk and copy the AFU.exe file to it. Copy the first firmware image to the same floppy disk.
4. Create additional bootable MS–DOS floppy disks and copy each additional firmware image to its own floppy disk.
5. Power off your computer, disconnect the power cord, then open the cabinet following the manufacturer's instructions.
6. Disconnect all cables from the controller, then attach a shorting jumper to the Mode 0 flash connector. (To locate the Mode 0 flash connector on your Adaptec RAID controller, see the figures in *About Your RAID Controller* on page 16.)
7. Reconnect the power cord, power on your computer, then boot to the floppy disk containing the AFU.exe file (see Step 3).
8. At the prompt, type `a:\afu update /c x`

   where `x` is the controller number.

9 Insert the other floppy disks when prompted.

10 When the flash is complete, power off your computer, disconnect the power cord, then remove the jumper.

11 Close the computer cabinet, reconnect the power cord, then power on your computer.

The controller should boot correctly.

Introduction to SAS

A

In this appendix...

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What's a Phy? 69
What's a SAS Port? 70
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What do SAS Cables Look Like? 70
How are Disk Drives Identified in SAS? 71
What are the SAS Connection Options? 71
How is SAS Different from Parallel SCSI? 73

This section provides a basic overview of the main features of 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 RAID controllers are referred to generically in this chapter as *SAS cards*. HBAs, RAID 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.

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 72.)

Note: Although you can use both SAS and SATA disk drives in the same *SAS domain* (see page 72), 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 69). Link speed is 300 MB/sec in half-duplex mode. Therefore, a SAS card with eight links has a bandwidth of 2400 MB/sec.

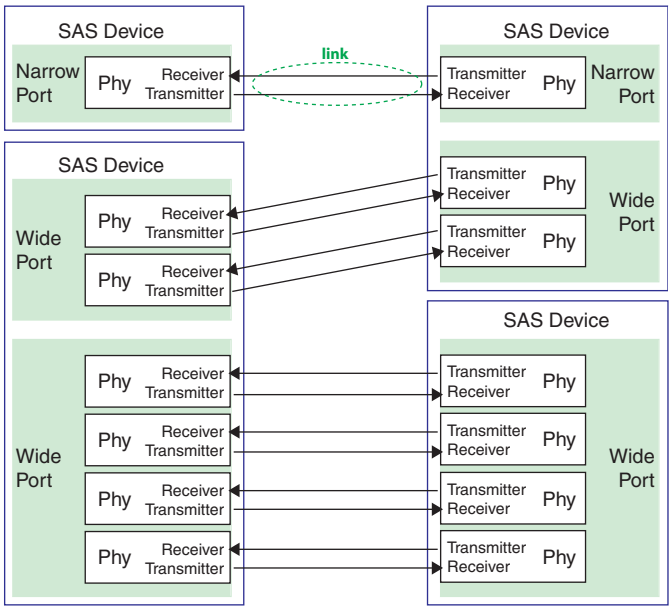
Although they share the SCSI command set, SAS is conceptually different from parallel SCSI physically, and has its own types of connectors, cables, connection options, and terminology, as described in the rest of this chapter.

To compare SAS to parallel SCSI, see *How is SAS Different from Parallel SCSI?* on page 73.

How Do SAS Devices Communicate?

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

As shown in the following figure, SAS devices contain ports (see page 70), ports contain *phys*, 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 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 70).

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 RAID 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 71), 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 or mini-SAS connector is the physical plug or receptacle that you see on a SAS device. It's what you plug a SAS cable into, or the end of the SAS cable that's being plugged in. (See *Cables* on page 35.)

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 supports more than 1 link.

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 on page 40, the 4-wide internal SAS connector forms links with four independent disk drives.)

What do SAS Cables Look Like?

Internal standard 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 fan-out cables let you attach four disk drives to a single 4-wide connector.

Mini-SAS connectors support both internal and external SAS connections. The mini-SAS connectors are smaller than the standard SAS internal and external connectors. Mini-SAS connectors support single and multilinks with the ability to scale to future speed needs.

For examples of some internal SAS/mini-SAS cables and an external SAS/mini-SAS cables, see *Cables* on page 35.

How are Disk Drives Identified in SAS?

In the BIOS and in the management utilities (see *Identifying Disk Drives* on page 90), disk drives are identified in the following formats:

- CNX:DevY = Device Y is attached to Connector X (see *Direct-attach Connections* below for more information)
- BoxX:SlotX = Enclosure X is attached to a disk drive in Slot X (see *Backplane Connections* below for more information)
- ExpX:PhyX = Expander X is attached to Phy X (see *SAS Expander Connections* below for more information)

where X is the count number.

Note: Devices other than disk drives (CDROM, tape drives, etc...) are listed in order after your system disk drives.

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 72), 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 or mini-SAS cables. One disk drive is attached to one SAS/mini-SAS connector with one SAS/mini-SAS cable (or multiple disk drives are attached to one SAS/mini-SAS connector with one fan-out cable). The figure on page 40 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 72.)

Backplane Connections

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

There are two types of backplane connections, *passive* and *active*. When connecting to either backplane, it's important to properly connect your disk drive LEDs in order to identify disk drive conditions. See *About Your RAID Controller* on page 16 for your RAID controller Activity LED connections and locations.

Once you have connected to a backplane, the Adaptec Storage Manager enables you to manage your disk drives. For more information, refer to the *Adaptec Storage Manager User's Guide* on the Adaptec Storage Manager Installation CD.

.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 71), 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.

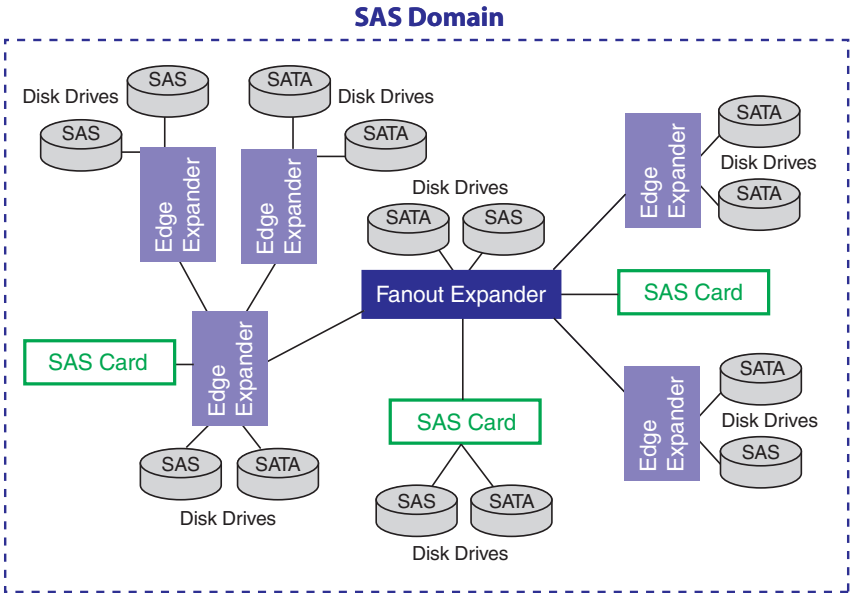
There are two types of SAS expanders: *fanout expanders* and *edge expanders*. Each performs a different role in a storage system. (For more information about how SAS expanders work, refer to the STA Web site at www.scsita.org.)

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 including the fanout expander).

The next figure 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.

This table 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 300 MB/sec per phy when in half-duplex mode
Supports SCSI devices only	Supports SATA and SAS disk drives simultaneously
Up to 16 devices per SCSI channel	More than 100 disk drives per SAS card, using an expander (see page 72) or 50 SATAII disk drives.
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 35)

Understanding RAID

B

In this appendix...

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Selecting the Best RAID Level 82

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.

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

Understanding Drive Segments

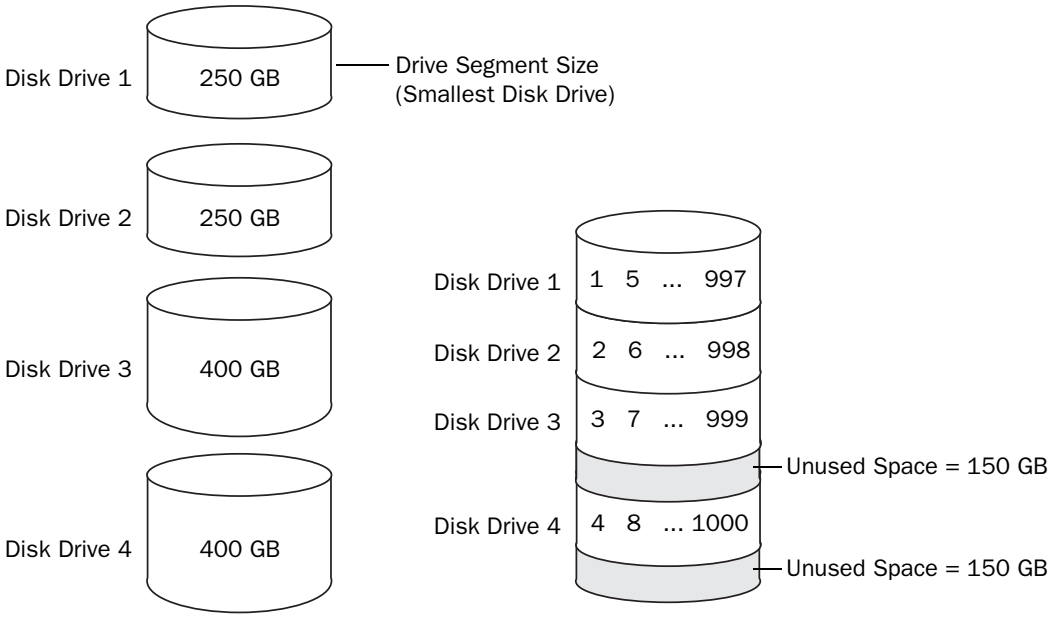
A *drive segment* is a disk drive or portion of a disk drive that is used to create an array. A disk drive can include both *RAID segments* (segments that are part of an array) and available segments. Each segment can be part of only one logical device at a time. If a disk drive is not part of any logical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

Non-redundant Arrays (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. However, RAID 0 arrays do not maintain redundant data, so they offer *no data protection*.

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 in this figure.

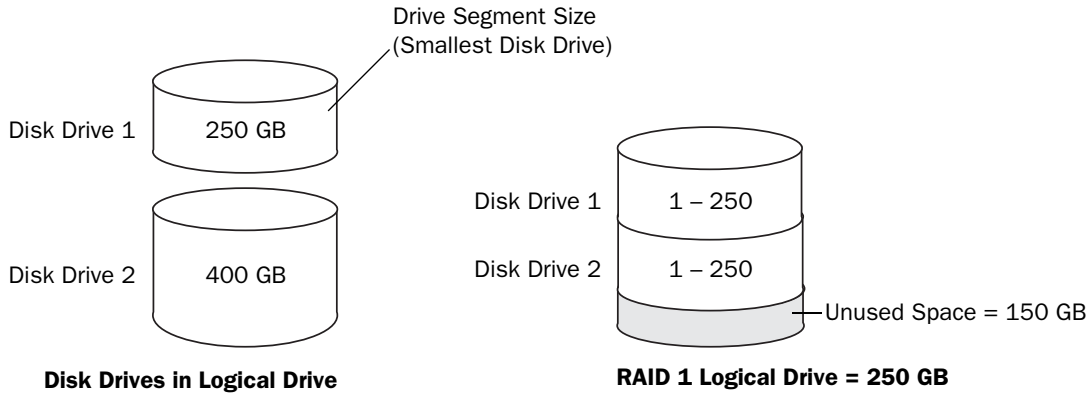


Disk Drives in Logical Drive **RAID 0 Logical Drive = 1000 GB**

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 in this figure.

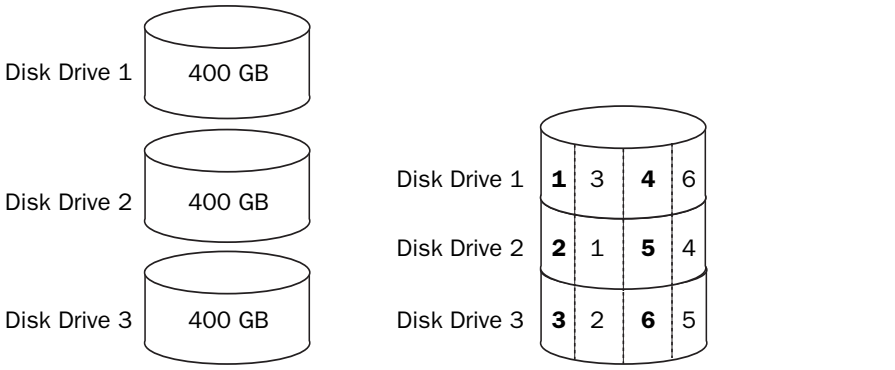


Disk Drives in Logical Drive **RAID 1 Logical Drive = 250 GB**

RAID 1 Enhanced Arrays

A RAID 1 Enhanced (RAID 1E) array—also known as a *striped mirror*—is similar to a RAID 1 array except that data is both mirrored *and* striped, and more disk drives can be included. A RAID 1E array can be built from three or more disk drives.

In this example, the large bold numbers represent the striped data, and the smaller, non-bold numbers represent the mirrored data stripes.

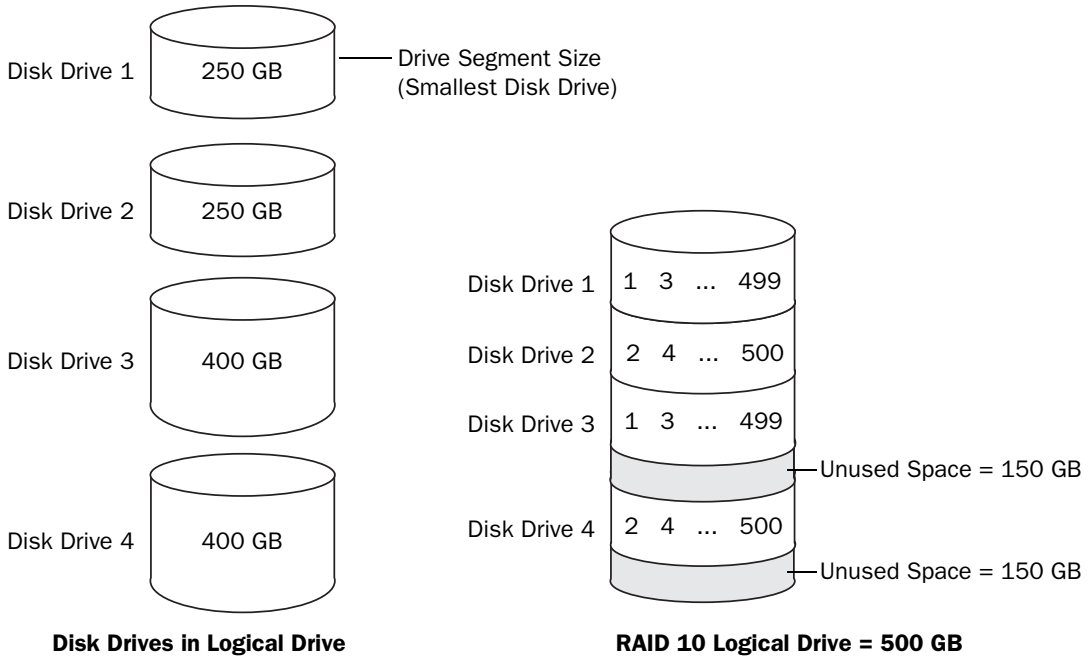


Disk Drives in Logical Drive **RAID 1E Logical Drive = 600 GB**

RAID 10 Arrays

A RAID 10 array is built from two or more equal-sized RAID 1 arrays. 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 in this figure.

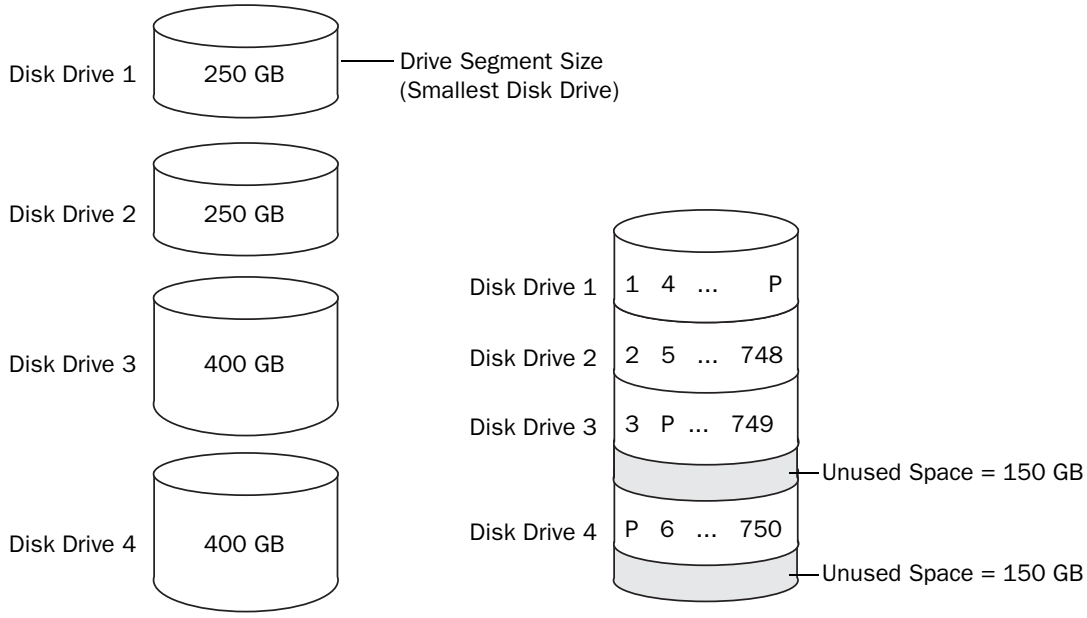


RAID 5 Arrays

A RAID 5 array is built from a minimum of three disk drives, and uses data striping and *parity* data to provide redundancy. Parity data provides data protection, and striping improves performance.

Parity data is an error-correcting redundancy that's used to re-create data if a disk drive fails. In RAID 5 arrays, parity data (represented by Ps in the next figure) is striped evenly across the disk drives with the stored data.

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 contain 750 GB of stored data and 250 GB of parity data, as shown in this figure.



Disk Drives in Logical Drive

RAID 5 Logical Drive = 750 GB plus Parity

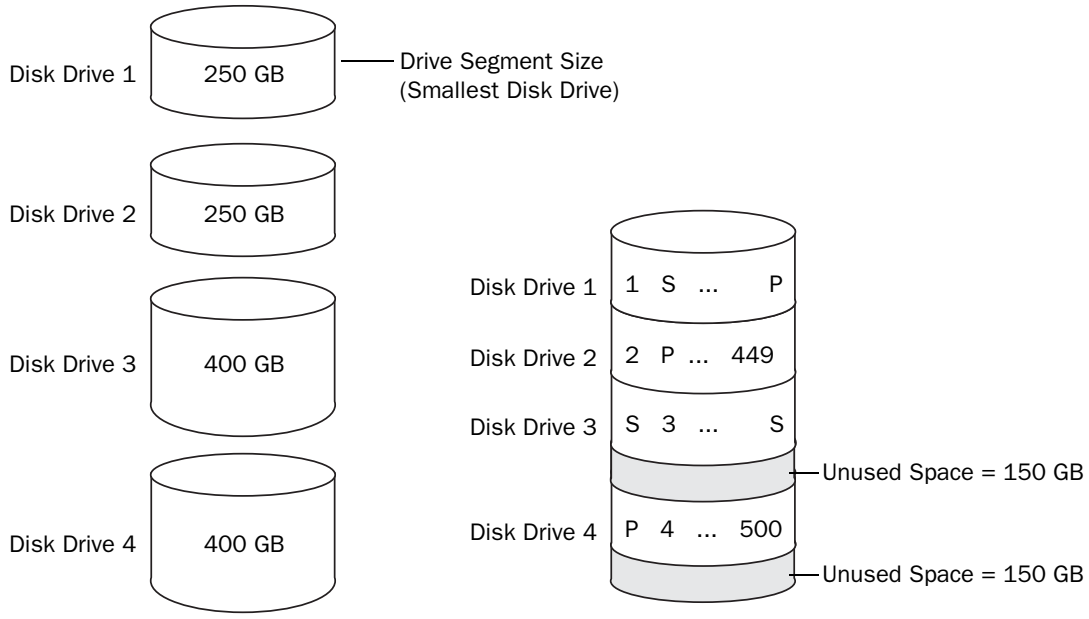
RAID 5EE Arrays

A RAID 5EE array—also known as a *hot space*—is similar to a RAID 5 array except that it includes a *distributed spare* drive and must be built from a minimum of four disk drives.

Unlike a hot spare, a distributed spare is striped evenly across the disk drives with the stored data and parity data, and can't be shared with other logical disk drives. A distributed spare improves the speed at which the array is rebuilt following a disk drive failure.

A RAID 5EE array protects your data and increases read and write speeds. However, capacity is reduced by two disk drives' worth of space, which is for parity data and spare data.

In this figure, S represents the distributed spare, P represents the distributed parity data.



Disk Drives in Logical Drive

Based on the drive segment sizes used: RAID 5EE Logical Drive = 500 GB plus parity and hot spare.

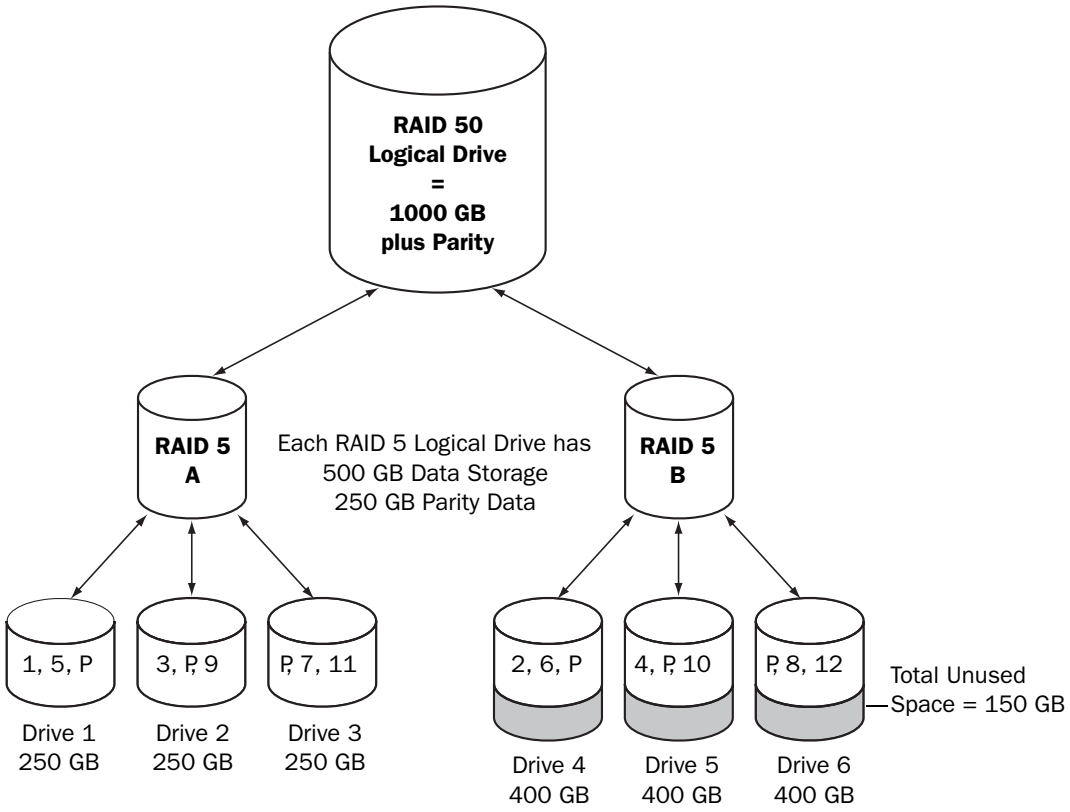
RAID 50 Arrays

A RAID 50 array is built from six to forty-eight disk drives configured as two or more RAID 5 arrays, and stripes stored data and parity data across all disk drives in both RAID 5 arrays. (For more information, see *RAID 5 Arrays* on page 78.)

The parity data provides data protection, and striping improves performance. RAID 50 arrays also provide high data transfer speeds.

Drive segment size is limited to the size of the smallest disk drive in the array. For example, three 250 GB disk drives and three 400 GB disk drives comprise two equal-sized RAID 5 arrays with 500 GB of stored data and 250 GB of parity data. The RAID 50 array can therefore contain 1000 GB (2 x 500 GB) of stored data and 500 GB of parity data.

In this figure, P represents the distributed parity data.

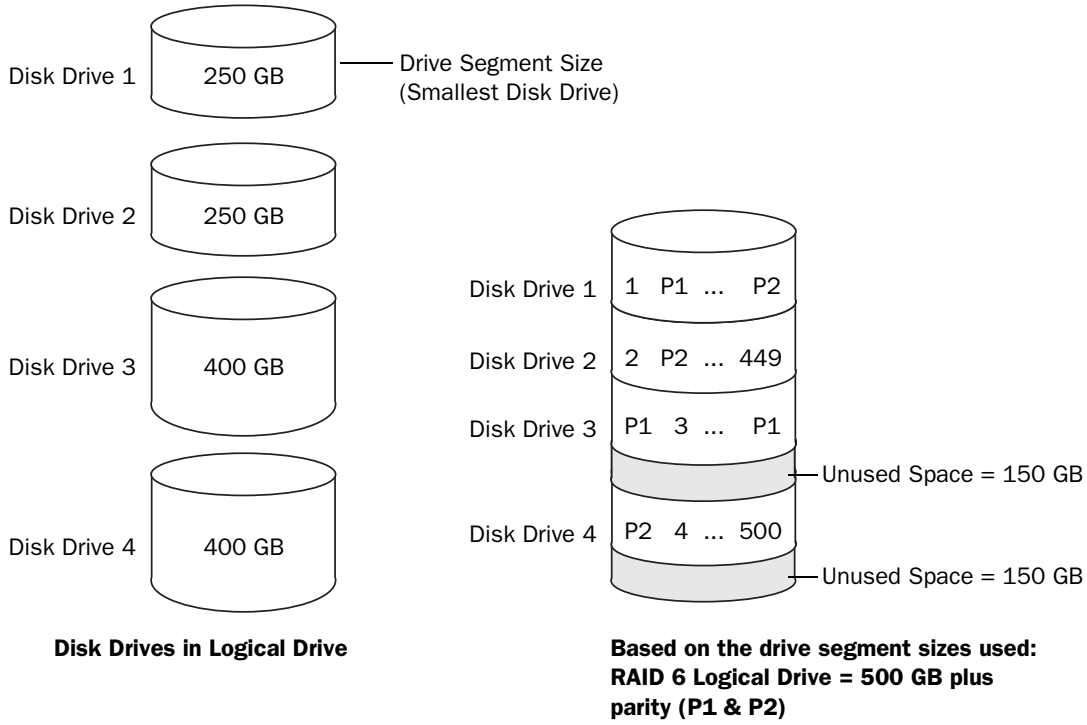


RAID 6 Arrays

A RAID 6 array—also known as dual drive failure protection—is similar to a RAID 5 array because it uses data striping and parity data to provide redundancy. However, RAID 6 arrays include *two* independent sets of parity data instead of one. Both sets of parity data are striped separately across all disk drives in the array.

RAID 6 arrays provide extra protection for your data because they can recover from two simultaneous disk drive failures. However, the extra parity calculation slows performance (compared to RAID 5 arrays).

RAID 6 arrays must be built from at least four disk drives. Maximum stripe size depends on the number of disk drives in the array.



Disk Drives in Logical Drive

Based on the drive segment sizes used: RAID 6 Logical Drive = 500 GB plus parity (P1 & P2)

RAID 60 Arrays

Similar to a RAID 50 array (see page 80), a RAID 60 array—also known as dual drive failure protection—is built from eight disk drives configured as two or more RAID 6 arrays, and stripes stored data and two sets of parity data across all disk drives in both RAID 6 arrays.

Two sets of parity data provide enhanced data protection, and striping improves performance. RAID 60 arrays also provide high data transfer speeds.

Selecting the Best RAID Level

Use this table to select the RAID levels that are most appropriate for the logical drives on your storage space, based on the number of available disk drives and your requirements for performance and reliability.

RAID Level	Redundancy	Disk Drive Usage	Read Performance	Write Performance	Built-in Hot Spare	Minimum Disk Drives
RAID 0	No	100%	◆◆◆	◆◆◆	No	2
RAID 1	Yes	50%	◆◆	◆◆	No	2
RAID 1E	Yes	50%	◆◆	◆◆	No	3
RAID 10	Yes	50%	◆◆	◆◆	No	4
RAID 5	Yes	67 – 94%	◆◆◆	◆	No	3
RAID 5EE	Yes	50 – 88%	◆◆◆	◆	Yes	4
RAID 50	Yes	67 – 94%	◆◆◆	◆	No	6
RAID 6	Yes	50 – 88%	◆◆	◆	No	4
RAID 60	Yes	50 – 88%	◆◆	◆	No	8

Disk drive usage, read performance, and write performance depend on the number of drives in the logical drive. In general, the more drives, the better the performance.

Using the Adaptec RAID Configuration Utility

C

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Using the ACU to Create and Manage Arrays 84
Using the ACU to Create and Manage JBODs 86
Using SerialSelect to Modify Controller Settings 87
Formatting and Verifying Disk Drives 89
Locating Disk Drives 90
Identifying Disk Drives 90
Viewing the Event Log 91

The Adaptec RAID Configuration (ARC) utility is a BIOS-based utility that you can use to create and manage controllers, disk drives and other devices, and arrays.

Note: Adaptec recommends that only advanced users familiar with working in a computer BIOS use the ARC utility tools. For more information, see *Managing Your Storage Space* on page 59.

Introduction to the ARC Utility

The ARC utility comprises these tools:

- **The Array Configuration Utility** (ACU)—For creating and managing arrays, and initializing and rescanning disk drives (see page 84).

  Note: Also available—ACU for DOS. See page 92.

- **Serial*Select***—For modifying your controller and disk drive settings (see page 87).
- **Disk Utilities**—For formatting or verifying disk drives (see page 89).

Running the ARC Utility

If your Adaptec controller is connected to a RAID enclosure, power on your enclosure (or enclosures) before you power on your computer.

Start or restart your computer. When prompted, press **Ctrl+A**.

During boot up, if your system has insufficient memory this message displays:

> "Adaptec RAID Configuration Utility will load after, system initialization. Please wait... Or press <Enter> Key to attempt loading the utility forcibly [Generally, not recommended]"

Note: The first time you power on your computer after you install a new controller, the BIOS may display a configuration that doesn't match your system's configuration. This is normal.

Navigating the ARC Utility

All the tools within the ARC utility are menu-based and instructions for completing tasks appear on-screen. Menus can be navigated using the arrows, Enter, Esc, and other keys on your keyboard.

Using the ACU to Create and Manage Arrays

To open the ACU, start the ARC utility (see page 84). If you have more than one controller, select your controller, then press **Enter**. Select **Array Configuration Utility**, then press **Enter**.

Follow the on-screen instructions to create and manage arrays, and initialize, rescan, and erase disk drives.

Creating a New Array

To begin creating an array, select **Create Arrays** from the main ACU menu.

Only disk drives that can be used in a new array are available for selection. (Disk drives must be initialized before they can be used in an array. See *Initializing Disk Drives* on page 86 for more information.)

Use the Array Properties menu to modify the array's RAID level, size, name, stripe size, and caching settings.

Note: For more information about RAID levels and using disk drives to create arrays, see *Choosing a RAID Level* on page 34.

Managing Existing Arrays

To view or modify existing arrays, select **Manage Arrays** from the main ACU menu.

From the Manage Arrays menu, you can:

- View the properties of an array.

  Note: Failed drives are displayed in a different text color.

- Make an array bootable (see *Creating Bootable Arrays* on page 85).
- Assign or remove hot spares.
- Modify power management settings.
- Delete an array.

  Caution: Before deleting an array, back up the data to avoid permanently losing it.

Creating Bootable Arrays

Note: You may need to change the system BIOS to modify the boot order. For more information, refer to your computer documentation.

The controller always uses the lowest numbered array as its bootable array.

To make an array bootable:

1. Select **Manage Arrays** from the main ACU menu.
2. Select the array that you want to make bootable, then press **Ctrl+B**.

   Note: You cannot make an array bootable while it's building, verifying, or rebuilding.

   The array's number changes to Array 00, which makes this array the controller's boot array.
3. Restart your computer.

Modifying Power Management Settings

Power management settings switch the array to low power state when it is inactive for a specific time.

To modify power management settings:

1. Select **Manage Arrays** from the main ACU menu.
2. Select the array, then press **Ctrl+W**.

   In the power management console, enter these details:

Option	Description
Power Management	When enabled, switches the array to low power state, when the array/ drive is inactive.
Slow Down Drive After	The duration of inactive state of the array/drive after which itis slowed down to low power mode. This is an optional setting. **Note:** The disk drive should support low power mode.

Option	Description
Power Off Drive After	The duration of inactive state of the array/drive after which it is powered off. This is an optional setting. **Note:** Power Off Drive After duration should be greater than Slow Down Drive After Duration.
Verify Drive After	The regular time interval at which the system performs a health check of the array/drive.

Initializing Disk Drives

If a disk drive appears grayed-out (unavailable for use in a new array), it may need to be initialized.

To begin initializing a disk drive, select **Initialize Drives** from the main ACU menu.

Caution: Do not initialize a disk drive that is part of an array. Initializing a disk drive that's part of an array may make the array unusable.
Back up all data from your disk drive before you initialize it.

Rescanning Disk Drives

To begin rescanning a disk drive, select **Rescan Drives** from the main ACU menu.

Secure Erasing Disk Drives

When you perform a secure erase on a disk drive, all data on that disk drive is completely and irretrievably eradicated. Secure erase performs three distinct writing passes to the disk drive being erased—it does not just write zeros.

Performing a secure erase takes up to six times longer than clearing (or zeroing) a disk drive. You may want to perform a secure erase only on disk drives that contain confidential or classified information.

Note: To erase (or zero) a disk drive with non-classified information, you may choose to *format* it (see page 89) instead, or *clear* it using Adaptec Storage Manager—both options take much less time than the secure erase option.

To begin a secure erase, select **Secure Erase** from the main ACU menu, then select **Y** (yes). To return to the main ACU menu once the secure erase has begun, press **Esc**.

The selected disk drive(s) cannot be used until the erase is complete.

Stopping a Secure Erase

To stop a secure erase in progress:

1. In the main ACU window, select **Secure Erase**.
2. Select the disk drive being secure erased, then press **Ctrl+Q**.

   The secure erase stops and the ACU returns to its main window.

Using the ACU to Create and Manage JBODs

To open the ACU, start the ARC utility (see page 84). If you have more than one controller, select your controller, then press **Enter**. Select **Array Configuration Utility**, then press **Enter**.

Follow the on-screen instructions to create and manage JBODs.

Creating a New JBOD

To begin creating a JBOD, select **Create JBOD** from the main ACU menu.

All the supported disk drives are displayed. Select a disk drive and **Enter**.

Managing Existing JBODs

To delete or morph existing JBODs into volumes, select **Manage JBODs** from the main ACU menu.

From the Manage JBODs menu, you can:

- Morph a JBOD into a volume.
- Delete a JBOD

Converting a JBOD Into a Volume

You can convert any JBOD into a volume.

1. Select **Manage JBODs** from the main ACU menu.
2. Select the JBOD that you want to morph into a volume and press **Ctrl**+V.

Using Serial*Select* to Modify Controller Settings

The Serial*Select* utility is a tool for modifying the settings of your controller and the disk drives connected to it.

Opening Serial*Select*

To open Serial*Select*, start the ARC utility (see page 84), select **Serial*Select***, then press **Enter**.

Follow the on-screen instructions to modify the settings of your controller and connected disk drives as required.

Applying Changes and Exiting

1. To exit Serial*Select,* press **Esc** until you are prompted to exit.

   If you modified any settings, you are prompted to save the changes before you exit.
2. Select **Yes** to exit, then press any key to restart your computer.

   Any changes you made take effect after the computer restarts.

Modifying Your Controller's Configuration

Note: Default controller settings are suitable for most computers. Adaptec recommends that you *do not* change the default setting.

To modify your controller's basic settings, select **Controller Configuration** from the main Serial*Select* menu.

To modify your controller's power management settings, select **Advanced Configuration**.

Note: The PHY settings are read-only and not editable.

This section describes the controller configuration options. Some options may not be available for your controller.

General Controller Settings

Note: Default settings are shown in **bold** type.

Option	Description
Drive's Write Cache	When enabled, write cache is enabled on the disk drive. When disabled, write cache is not used on the disk drive. **Caution**—When write cache is enabled, there is a slight possibility of data loss or corruption during a power failure.
Runtime BIOS	When **enabled**, the controller BIOS allows the controller to act as a bootable device. Disabling the BIOS allows another controller to act as a bootable device.
Automatic Failover	When **enabled**, the controller automatically rebuilds an array when a failed disk drive is replaced. When disabled, the array must be rebuilt manually.
Array Background Consistency Check	When enabled, the controller constantly verifies a redundant array. Note that there may be a significant performance reduction. Default is **disabled**.
Array-based BBS Support	When enabled in systems that support BBS, the controller presents attached bootable devices up to the BIOS for boot device selection. This is relevant for logical arrays. Default is **disabled**.
SATA Native Command Queuing (NCQ)	When **enabled**, NCQ is enabled. Disable this feature if you want to attach more than 48 SATA II disk drives. Only available with SATA II disk drives.
Physical Drives Display During POST	When enabled, connected disk drives are displayed during system Power On Self Test (POST). Displaying the disk drives adds a few seconds to the overall POST time. Default is **disabled**.
DVD/CD-ROM Boot Support	When **enabled**, the system can be booted from a bootable CD. (This setting is not available on all RAID controller models.) **Note**—CD's are not supported by current software.
Removable Media Devices Boot Support	When **enabled**, removable media devices, such as CD drives, are supported. (This setting is not available on all RAID controller models.)
Alarm Control	When enabled, the alarm sounds. Default is **enabled**. **Note**—When the alarm is turned off (disabled), it will automatically turn back on after a reboot.

Power Management Settings

Note: When power management is disabled, no related options will be displayed.

Note: Make sure the operating system driver supports power management.

Note: Default settings are shown in **bold** type.

Option	Description
Power Management Settings	When enabled, switches the system to low power state, based on the specified settings.
Time Zone	The time zone of the place in which the system is located. Time specific power management settings are implemented based on the set time zone. By default, it is set to 00:00. The valid range for the time zone settings is -12:00 to +12:00.
Stay Awake Start	The time from which the system should operate in the full power mode, irrespective of other power management settings, daily. By default it is set to 00:00. The valid range is 00:00 to 23:59.
Stay Awake End	The time till which the system should operate in the full power mode, irrespective of other power management settings, daily. By default it is set to 00:00. The valid range is 00:00 to 23:59.
Spin Up Limit (Internal)	The number of internal drives to be spun up at any given moment. By default it is set to 0. In the default setting, all the internal drives will spin up.
Spin Up Limit (External)	The number of external drives to be spun up at any given moment. By default it is set to 0. In the default setting, all the external drives will spin up.

PHY Settings

Note: These settings are not available on the Adaptec RAID 31205 or Adaptec RAID 31605 controllers.

Note: These details are read-only and non-editable.

Option	Description
PHY Rate	The data transfer rate between the controller and devices. The default setting is **Auto**, which allows the SAS card to adjust the data transfer rate as required.
CRC Checking	When enabled, determines whether the controller verifies the accuracy of data transfer on the serial bus. Default setting is **Yes** (enabled). Set to No (disabled) *only* if the controller is connected to a device that does not support CRC Checking.
SAS Address	In a situation where you want each phy on a controller to be in a different SAS domain, this setting specifies a unique world-wide name for each phy. Default is **0**. **Note:** This setting is for SAS address conflict resolution only and should otherwise remain at its default value.

Formatting and Verifying Disk Drives

You can use the disk utilities to low-level format or verify your disk drives. (New disk drives are low-level formatted at the factory and do not need to be low-level formatted again.)

Caution: Before you format a disk drive, back up all data. Formatting destroys all data on a disk drive.

To format or verify a disk drive:

1 Start the ARC utility (see page 84).

2 Select the controller you want, then press **Enter**.

3 Select **Disk Utilities**.

4 Select the disk drive you want, then press **Enter**.

5 Select **Format Disk** or **Verify Disk Media**.

Locating Disk Drives

Note: This feature is only available with disk drives that have an activity LED.

You can use the Identify Drive feature to physically locate a disk drive by blinking the LED.

To locate a disk drive:

1 Start the ARC utility (see page 84).

2 Select the controller you want, then press **Enter**.

3 Select **Disk Utilities**.

4 Select the disk drive you want, then press **Enter**.

5 Select **Identify Drive**, then press **Enter**.

6 When you have finished locating your disk drive, press any key to stop the blinking.

Identifying Disk Drives

You can identify disk drives by viewing the list of disk drives on your system. Only physical drives that display during POST are shown.

To identify a disk drive:

1 Start the ARC utility (see page 84).

2 Select the controller you want, then press **Enter**.

3 Select **Disk Utilities**.

The Disk Utilities view will provide you with the following information:

Location	Model	Rev#	Speed	Size
CN1=DEV1 Box0=Slot0 Exp0=phy0	The manufacturer information.	The revision number of the disk drive.	The speed of the disk drive.	The size of the disk drive.

The location information of a disk drive is determined by three types of connections:

- Direct attached drives—The connection is determined by the cable connected to a device, for example CN1 (connector 1) is connected to DEV1 (device 1). For more information, see *Direct-attach Connections* on page 71.

- Storage Enclosure Processor (SEP) managed devices—The connection is determined by an active backplane. Box0 (enclosure 0) is connected to slot0 (disk drive slot 0 in the enclosure). For more information, see *Backplane Connections* on page 71.
- Expanders—The connections is determinded by an expander. Exp0 (expander 0) is connected to phy0 (phy 0 within a connector). For more information, see *SAS Expander Connections* on page 72.

Note: Devices other than disk drives (CDROM, tape drives, etc...) are listed in order after your system disk drives.

Viewing the Event Log

The BIOS-based event log records all firmware events, such as configuration changes, array creation, and boot activity.

Some events are not stored indefinitely—the event log is cleared of any non-persistent events each time you restart your computer; additionally, once the log is full, new events overwrite old events.

To view the event log:

1. Start the ARC utility (see page 84).
2. Select the controller you want, then press **Enter**.
3. When the ARC utility menu appears, then press **Ctrl**+**P**.
4. Select **Controller Log Information**, then press **Enter**.

   The current event log opens.

Using the Array Configuration Utility for DOS

D

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This chapter describes the Array Configuration Utility (ACU) for DOS, a text-based utility that you can use to create, configure, and manage arrays. (A BIOS-based ACU is also available. See page 84.)

Note: Adaptec recommends that only advanced users familiar with working in DOS use the ACU for DOS utility. For more information, see *Managing Your Storage Space* on page 59.

Getting Started

Note: You need a bootable floppy disk to complete this task.

The ACU for DOS runs from a floppy disk which you can create using the RAID Installation CD that came in your Adaptec RAID controller kit.

To create the ACU floppy disk:

1. Insert your RAID Installation CD into the CD drive, then browse to this file:

   packages/firmware/*controllermodel*/acu.exe

   Where *controllermodel* is the model number of your Adaptec RAID controller.

2. Insert a bootable floppy disk and copy the acu.exe file to it.

3. Continue in one of two ways:

   - Work in the ACU using menus (see the following section)
   - Run the ACU using scripts (see page 94)

Working in the ACU Using Menus

To work in the ACU using menus:

1. Insert the ACU floppy disk (see *Getting Started* above), then start or restart your computer.

   The computer boots to the DOS command line.

2. Type `ACU` on the command line, then press **Enter**.

   The ACU is menu-based and instructions for completing tasks appear on-screen. Menus can be navigated using the arrow, Enter, Esc, and other keys on your keyboard.

   For more information about completing tasks, see *Using the ACU to Create and Manage Arrays* on page 84.

Running the ACU Using Scripts

To work in the ACU using scripts:

1 Insert the ACU floppy disk (see page 93), then start or restart your computer.

The computer boots to the DOS command line.

2 Type ACU on the command line, specify a script file, and specify *either* the /P *or* /R switches listed in the following table. (Don't specify both.)

You may also add one or both of the optional switches.

Note: Command line syntax is *not* case sensitive.

Switch	Description
/P <*file*>	**Playback Mode**—The ACU reads the contents of the specified script file and creates arrays and configures channel settings based on the keywords defined in the script. See page 94.
/R <*file*>	**Record Mode**—The ACU writes a RAID controller's existing array configuration to a specified script file, which lets you create the same configuration by running the ACU in playback mode (/P switch) with the resulting script. See page 95.
/L <*file*>	**(Optional) Log Filename Switch**—If you include this switch, the ACU records its activity and any errors it encounters in the log file. If you do not include this switch, the ACU displays activity and errors on the screen. The *file* is a standard MS-DOS file, which can include a drive, directory, filename, and extension. Only the filename and extension (.log) are required. If no drive or directory is specified, the file is placed in the same location as the ACU executable.
/C <*number*>	**(Optional) Controller Number Switch**—In systems with more than one controller, this switch specifies which controller to change, where *number* is the controller number. The default controller number is **0**. **Note—**The number assigned to a particular controller depends on the controller's physical PCI slot and the order in which your system scans its PCI slots.

About Playback Mode

In this mode, the ACU reads the contents of the specified script file and creates arrays based on the keywords specified in the script.

The syntax is `ACU /P <file>` where *file* is the name of the script file. The file parameter can include a drive, directory, filename, and extension. If no drive or directory is specified, the script file used should be placed in the same location as the ACU executable.

Note: The script file syntax allows only one hot spare to be assigned to an array. Therefore, when recording a RAID 10, the ACU can't map hot spares assigned to the individual mirror sets in the resulting script file. Instead, the ACU creates a single list for all hot spares assigned to the RAID 10. For more information, see *Method Keyword* on page 98.

About Record Mode

Note: You can also create a script file manually (see the following section).

In Record Mode, the ACU writes a RAID controller's existing array configuration to a specified script file, which lets you create the same configuration by running the ACU in Playback Mode (/P switch) with the resulting script.

You can only record one RAID controller at a time with Record Mode. Record multiple RAID controllers separately using separate script files.

The syntax is `ACU /R <file>` where *file* is the name of the script file. The file parameter can include a drive, directory, filename, and extension, but only the filename and extension are required. If no drive or directory is specified, the file is placed in the same location as the ACU executable.

The ACU supports only a subset of available array types. If it encounters an array it can't create, a warning displays (or is recorded in the log file, if the /L switch is used); no keywords for that array are recorded in its script file.

When recording an array, the ACU always uses the default Wait setting (equivalent to Wait=Yes) unless you edit the script file and include Wait=No in the array's definition block. For more information, see *Wait Keyword* on page 99.

Creating the Script File Manually

Script files contain blocks:

- Array definition block keywords (see page 96)
- **Optional**—ACU error codes (see page 99)

The syntax rules are:

- Each keyword must start its own line.
- Syntax is *not* case sensitive.

Entering Comments in the Script File

To enter a comment in the script file, start with a pound character (#). You can start anywhere on a line. For a sample script that includes comments, see *Sample Scripts* on page 100.

Array Definition Block Keywords

The array definition block always begins with the keyword Array and ends with the keyword End. The other *required* array definition keywords are Drives and Type.

Array definition keywords and descriptions are listed in this table.

Keyword	Required?	Description
Array	Yes	Indicates the start of an array definition block. No default. See page 96.
Drives	Yes	Specifies the disk drives used in creating the array. No default. See page 96.
End	Yes	Indicates the end of an array definition block. No default. See page 97.
HotspareDrives	No	Specifies hot spares to assign to the array. No default. See page 97.
InitializeAll	No	Indicates whether to initialize all the drives connected to the controller. Default is **No**. See page 97.
Method	Yes	Indicates the method (Build/Verify, Clear, or Quick Init) to use when creating a redundant array. Default is **Build**. See page 98.
ReadCache	No	Indicates whether read caching is enabled for this array. Default is **Yes**. See page 98.
Size	No	Specifies the size of the array. Default is **Maximum**. See page 98.
StripeSize	No	Specifies size of contiguous I/O, in bytes. Default is **256**. See page 98.
Type	Yes	Indicates the type of array to create. No default. See page 99.
Wait	No	Indicates whether the ACU should wait for the new array's Build/Verify or Clear to complete before continuing. Default is **Yes**. See page 99.
WriteCache	No	Indicates whether write caching is enabled for this array. Default is **Yes**. See page 99.

Array Keyword

Array is a required keyword, indicating the start of an array definition block. The syntax is `Array=<label>`, where *label* is an optional alphanumeric string.

For example:

```
Array=MyData
```

Drives Keyword

Drives is a required keyword, specifying the devices to use in creating the array. There is no default value.

A disk drive is identified by its channel number, ID (target), and LUN, separated by colons; for example, `0:0:0` or `0:1:0`. Separate multiple disk drive identifiers with commas.

Prior to creating any new arrays, the ACU initializes any drives specified by the `Drives` keyword. If a disk drive is specified in more than one array definition block in a script, it is initialized only once.

⚠ **Caution:** Any disk drive specified within the script file is initialized, which destroys any data on that disk drive.

For example:

```
Drives=0:0:0
Drives=0:0:0,0:1:0,0:2:0
```

End Keyword

End is a required keyword, indicating the end of the block.

HotspareDrives Keyword

Hotspare Drives is an optional keyword, specifying the hot spares to assign to the array. The syntax for listing hot spares is the same as the *Drives Keyword* on page 96. If Hotspare Drives is not specified, no hot spares are assigned to the array.

For example:

```
HotspareDrives=0:0:0,0:1:0
```

The same disk drive can be assigned to protect multiple arrays (as a pool spare). Once a pool spare is used by a failed disk drive, however, it is no longer available to protect the other arrays its assigned to.

This keyword does *not* verify that the available space on the specified hot spares is sufficient to serve as failover for the array.

When assigning hot spares to a multilevel array, Hotspare Drives assigns all the hot spares in the list to *all* arrays within the multilevel array.

InitializeAll Keyword

If you want the ACU to initialize all drives connected to the controller and delete any existing arrays before any new arrays are created, even those that are not specified in any Drives keyword definition, specify InitializeAll=Yes. Otherwise, the ACU initializes only those drives specified by the Drives keyword.

Caution: Initializing a disk drive automatically deletes any existing arrays with that disk drive as their member.

Possible values:

- **Yes**—Initialize all drives.
- **No** (*default*)—Do not initialize all drives; only those drives specified with the `Drives` keyword are initialized.

For example:

```
#Initialize the drives prior array creation.
InitializeAll=Yes
```

InitializeAll is a global keyword that you need to specify only once.

InitializeAll is always performed prior to array creation regardless of its position in the script.

If both InitializeAll=Yes and InitializeAll=No are specified in the same script file, InitializeAll=Yes is always the overriding value.

If an array is deleted during a Build/Verify process, the process is automatically terminated.

Method Keyword

Method is an optional keyword, indicating which method to use when creating a redundant (RAID 1, 1E, 10, 5, 5EE, 50, 6 and 60) array. Possible values:

- **Build** (the *default*)—Perform a Build/Verify process on the array. Takes longer than Clear, but allows you to begin using the array immediately.
- **Clear**—Clear the array. Faster than a Build/Verify process, but you have to wait for the operation to be completed before you can begin using the array.
- **Quick Init**—Makes the array available immediately, but does not accomplish a Build/Verify. Parity and mirror information is created as data is written to the disk drive (called full-stripe write mode), which reduces overall array performance. Maximum performance is achieved by starting and completing a Build/Verify.
- **Skip Init**—If multiple disk drives fail in the same logical drive, you may be able to recover the data by recreating the logical drive *without* the initialization step. Omitting the initialization step reconstructs the logical drive metadata without modifying or destroying any other data on the disks.

For example:

```
Method=Build
```

ReadCache Keyword

ReadCache indicates whether the array uses read caching.

Possible values:

- **Yes** (*default*)—Enable read caching.
- **No**—Disable read caching.

For example:

```
ReadCache=Yes
```

Size Keyword

The Size keyword specifies the size of the array. Specify Maximum (the default) to create an array using the maximum available space, based on the array type and drives selected. Otherwise, specify the size as an integer or a decimal number, followed by the unit keyword MB (megabytes), GB (gigabytes), or TB (terabytes).

Note: A unit keyword is required with a numeric size value. If no unit keyword is specified, the ACU exits with an error.

For example:

```
Size=2.5GB
Size=300MB
Size=Maximum
```

StripeSize Keyword

The StripeSize keyword specifies the stripe size (in KB) written to each member of a striped array (RAID 0, 10, 5, 5, 5EE, 50, 6 or 60).

The possible values for StripeSize are 16, 32, 64, 128, 256, 512 and 1024 KB. Default is **256**.

For example:

```
StripeSize=256
```

Type Keyword

Type is a required keyword, indicating the array type. There is no default value. The possible values: Volume, RAID0, RAID1, RAID5, RAID10, or RAID50.

Depending on the RAID levels supported by your RAID controller, additional possible values are: RAID1E, RAID5EE, RAID6, RAID60.

Wait Keyword

Wait is an optional keyword that you can use to tell the ACU to allow the ACU to continue while the Build/Verify or Clear completes in the background; specify Wait=No. Otherwise, the ACU waits by default.

If the host is powered off before the Build/Verify or Clear process completes and is then restarted, the process resumes without any user intervention.

For example:

```
Wait=Yes
Wait=No
```

WriteCache Keyword

The WriteCache keyword indicates whether write caching is used for this array if write caching is supported for the system. Possible values are as follows:

- **Yes** (*default*)—Enable the write cache.
- **No**—Disable the write cache.

Setting an array's WriteCache keyword to Yes might result in data loss or corruption during a power failure.

For example:

```
WriteCache=Yes
```

ACU Error Codes

When the ACU detects an error, it reports the error and exits immediately. If a log file is specified, the ACU writes the error code to the log file. Otherwise, it displays the error code on the screen.

The possible error messages returned by the ACU are listed in this table.

Code	Description
0	**ACU ran without changes**—ACU exited with no errors (success) and no report is required.
1	**No controller found**.
2	**Syntax or logical error in the script file**—The ACU encountered an invalid command or keyword in the specified script file.
3	**Unable to open file**.
4	**Error in the command line parameters**—You passed an invalid command-line switch to the ACU. (See *Running the ACU Using Scripts* on page 94 for a list of valid command-line switches.)

Code	Description
5	**Unable to read system configuration**—The ACU was unable to get the configuration information from the specified controller.
6	**No drives detected**.
7	**Specified drive not found in system**.
8	**Specified array size too small**—You specified an array size that is smaller than the minimum size allowed for this array.
9	**Specified array size too big**—You specified an array size that is larger than the maximum size allowed for this array.
10	**Number of drives do not match the array type**—The number of drives you selected is invalid for the type of array specified.
11	**Unable to initialize drive**.
12	**Error occurred while creating array**.
13	**Too many spare drives assigned**—You attempted to assign more than the maximum number of hot spares allowed for the specified array.
14	**Insufficient memory to run the application**.
15	**Incorrect controller number**.
16	**Controller not responding**.
17	**Build/Verify/Clear failed**.
18	**Cannot use drives on shared channel.**
21	**Failed in getting kernel version. Unknown product ID.**
22	**Kernel timeout in writing command.**
23	**No RAID channels available**
24	**Error: wrong stripe size in creating array - script mode.**
100	**You ran ACU and made changes**—The ACU exited with no errors (success) and you must restart the computer.

Sample Scripts

This command invokes the ACU and creates arrays on controller 1 based on the array keywords defined in the script file A:\RAID.ACU. It also configures Channel 0 and saves a log of the operation in the log file C:\RAID.LOG:

```
A:\> ACU /P A:\RAID.ACU /L C:\RAID.LOG /C1
```

This sample script file is the RAID.ACU script as referred to in the ACU command above. This script creates these arrays—a 500 MB single-disk volume, and a 2-GB two-disk drive RAID 1 with a hot spare:

```
# Create a 500MB volume labeled 'MySystem'
Array=MySystem
Type=Volume
Size=500MB
Drives=0:0:0
End

# Create a 2GB mirror labeled 'MyMirror'
Array=MyMirror
Type=RAID1
Size=2GB
```

```
# Use drives 1 and 2
Drives=0:1:0,0:2:0
# Disable write cache
WriteCache=No

# Assign 1 spare drive
HotspareDrives=0:3:0
End
```

This sample script file creates a maximum-size three-disk-drive RAID 5:

```
# Create a maximum size RAID 5 labeled 'MyData'
Array=MyData
Type=RAID5
Size=Maximum

# Use the maximum stripe size
StripeSize=1024

# Clear the array (don't build/verify it)
Method=Clear

# Don't wait for clear to complete
Wait=No

# Use drives 0, 1, 2
Drives=0:0:0, 0:1:0, 0:2:0
End
```

Using the Adaptec Flash Utility

E

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Updating the Flash Using the AFU Command Line 108

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 RAID controller's firmware BIOS and NVRAM.

Caution: Although the AFU contains safeguards to prevent you from accidentally damaging your RAID controller's flash contents, it is still important to use the AFU carefully and correctly to avoid rendering your RAID 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 59.

System Requirements

- MS–DOS version 5.0 or later.

  Note: You can't run the AFU from a DOS command prompt window under any version of Windows.

- At least 8 MB of extended memory.

Compatibility Notes

- 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.

Before You Begin

1. Obtain the firmware (see the following section).
2. Create firmware disks (see page 104).

There are two ways to run the AFU:

1. Using the AFU menus (see page 104)
2. From the command line (see page 105)

Obtaining the Firmware

To obtain RAID controller firmware, go to:

- **The RAID Installation CD**—Includes the AFU executable (AFU.exe) and a separate flash image. The flash image may comprise multiple User Flash Image (UFI) files.
- **The Adaptec Web site**—Download a new firmware file to get the most recent version of firmware/BIOS and AFU.

  See www.adaptec.com for more information.

Creating the Firmware Update Disks

To create the firmware update disks:

1 Copy these files to empty, formatted floppy disks, a USB flash drive, or a writable CD:

- AFU.exe
- A*xxx*01.ufi

where *xxx* is the model number of your controller.

Note: Most controller model numbers have a suffix (for example Adaptec RAID 3405). Check that the .ufi file is the correct file for your controller before copying.

2 If using floppy disks, copy each additional Axxxx0x.ufi file to a separate floppy disk. (Some RAID controllers have two UFI files; some have four. Each goes onto its own floppy disk.)

3 To use a menu-based AFU, see the following section.

To run the AFU from the command line, see page 105.

Running the Menu-based AFU

To run the menu-based 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 a disk drive connected to the controller you are updating.) If your computer isn't set up to boot from the bootable floppy disk, enter the system setup utility and change the setting.

2 Insert the firmware update disk (created using the steps above) containing AFU.exe

3 At the DOS command prompt, type `AFU` with no arguments.

The AFU's main menu is displayed.

4 Select **Select Controllers**, then select the Adaptec RAID controller(s) to be flashed.

To update multiple RAID controllers in the same system, update the boot controller's flash first, restart the computer, then update the flash for the remaining controllers.

5 Select **Select an Operation**.

6 Choose the operation you want, then follow the on-screen instructions to complete the task:

- **Update flash image**—Updates all the flash components on a RAID controller with the flash image data from the UFI file.
- **Save flash image**—Reads the contents of a RAID controller's flash components and saves the data to a UFI file, which you can use to restore a RAID controller's flash if required.
- **Verify flash image**—Reads the contents of a RAID controller's flash components and compares it to the contents of the specified UFI file.
- **Display flash information**—Displays version information about a RAID controller's flash components.
- **List flash image**—Lists all supported RAID controllers detected on your system.

7 Complete the flash operation and restart your computer before trying to use the RAID controller again. (You can not use your RAID controller while you are updating its flash.)

The AFU processes the selected command, prompts you to insert additional floppy disks as needed, and reports either success or an error message code.

Running the AFU from the Command Line

Note: You can also run a menu-based AFU (see page 104).

To run the AFU from the command line:

1 Shut down your operating system and reboot to DOS from a bootable DOS floppy disk or from a DOS partition on a bootable drive. (You can use a disk connected to the controller you're updating.) If your computer isn't set up to boot from the bootable floppy disk, enter the system setup utility to change the setting.

2 Insert the firmware update disk containing AFU.exe

3 At the DOS command, type AFU followed by a command (see page 105) and any switches you want.

Note: To find a controller number, type `AFU LIST`, then press **Enter**.

The AFU processes the command, prompts you to insert additional floppy disks as needed, exits, and reports either success or an error message code.

To update a RAID controller's flash using the command line utility ARCCONF, see page 108.

AFU Commands

This section lists the available AFU commands.

List

Displays the AFU-supported RAID controllers installed on your computer. Also displays the ID numbers assigned to each controller.

You don't have to restart the computer after completing this command.

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

```
A:\> AFU LIST
Adaptec Flash Utility V4.0-0 B5749
(c)Adaptec Inc. 1999-2005. All Rights Reserved.
Controllers Detected and Recognized:
Controller #0 (03:05:00) Adaptec RAID 31205
```

Save

Saves the contents of a RAID controller's flash in a UFI file. The name of the UFI file is based on the controller type and can't be changed.

You must restart the computer following a SAVE command.

The command syntax for the SAVE command is

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

These switches are available:

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

  For example:

  To specify a single RAID controller ID: `/C 0`

  To specify multiple IDs separated by commas: `/C 0,2`

  To indicate all RAID controllers: `ALL`

  If you are using multiple RAID controllers, you must specify the controller you want by using the /C switch; otherwise, the AFU displays an error message and exits.

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

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

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

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

  In this 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

Updates the flash components of one or more RAID controllers on your computer from the flash image data in a UFI file. You must restart the computer following an UPDATE command.

The command syntax for the UPDATE command is:

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

This example shows a typical system response after an update.

```
A:\> AFU UPDATE /C 0
Adaptec Flash Utility V4.0-0 B5749
(c)Adaptec Inc. 1999-2005. All Rights Reserved.
Updating Controller 0 (Adaptec RAID 31205)
Reading flash image file (Build 5749)
AFU is about to update firmware on controllers Adaptec RAID 31205
***PLEASE DO NOT REBOOT THE SYSTEM DURING THE UPDATE***
This might take a few minutes.
Writing Adaptec RAID 31205 (4MB) Flash Image to controller 0...OK.
Verifying...OK
Please restart the computer to allow firmware changes to take effect.
```

Verify

Compares the contents of each of the flash components on a RAID controller to the corresponding image in a UFI file, and indicates whether they match. After using the VERIFY command, you must restart the computer.

The command syntax for the VERIFY command is as follows:

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

This example shows a typical system response after a VERIFY command.

```
A:\> AFU VERIFY /C 0
Adaptec Flash Utility V4.0-0 B5749
(c)Adaptec Inc. 1999-2005. All Rights Reserved.
Reading flash image file (Build 5748)
Controller #0: Adaptec RAID 31205
ROM: Checksum: 797B [VALID] (Build 5748)
File: Checksum: 797B [VALID] (Build 5748)
             Image Compares Correctly
```

Version

Displays version information about the flash components on a RAID controller. After using the VERSION command, restart your computer.

The command syntax for the VERSION command is:

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

This example displays version information about all supported RAID controllers.

```
A:\> AFU VERSION /C 0
Adaptec Flash Utility V4.0-0 B5749
(c)Adaptec Inc. 1999-2005. All Rights Reserved.
Version Information for Controller #0 (Adaptec RAID 31205)
ROM: Build 5748 [VALID] Fri Sep 27 13:28:40 EDT 2005
A:\> AFU VERSION /C ALL
```

Help

Displays a summary of AFU functions and command switches. For example:

```
A:\> AFU HELP
```

```
A:\> AFU /?
```

Updating the Flash Using the AFU Command Line

1. Create the firmware update disks (see page 104).
2. Shut down your operating system and reboot to DOS from a bootable DOS floppy disk or from a DOS partition on a bootable drive. (You can use a disk connected to the controller you're updating.) If your computer isn't set up to boot from the bootable floppy disk or a bootable device other than a disk drive, enter the system setup utility to change the setting.
3. Insert the firmware update disk containing AFU.exe
4. At the DOS command, if you have multiple controllers and you don't know the number of the controller you want to update, type `AFU LIST`, then press **Enter**. Otherwise, skip to the next step.
5. At the DOS command, type AFU followed by a command (see page 105) and any switches you want.
6. Update the flash using the instructions suitable for your requirements:
   - **To update a single RAID controller**:

     `AFU UPDATE /C <cont_number>`

     Where *<cont_number>* is the number of the RAID controller whose firmware you are updating. For example, to upgrade Controller 0, type `AFU UPDATE /C 0`
   - **To update multiple RAID controllers**:

     `AFU UPDATE /C <cont_number_a>,<cont_number_b>`

     Where *<controller_number_a>* and *<controller_number_b>* are the numbers of the Adaptec RAID controllers whose firmware you are updating. For example, to upgrade controllers 0, 2, and 3, type `AFU UPDATE /C 0, 2, 3`
   - **To update all RAID controllers simultaneously**:

     `AFU UPDATE /C all`

     Note: The UFI file identifies the RAID controllers, so you don't have to worry about flashing the wrong controller.
7. When prompted, insert the first firmware disk into your floppy disk drive.

   The AFU reads the first disk.
8. When prompted, remove the first firmware disk and insert the second firmware disk into your floppy disk drive.
9. Repeat Step 8 as required until the flash update is complete.

Controller LED and I2C Connector Quick Reference

F

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This chapter provides a reference guide for Adaptec® RAID controllers of Activity LED and I2C connectors.

Adaptec RAID 3085 LED Connector Specification

2251600-R	ASR-3085 RoHS Kit
2251600JA-R	ASR-3085/JA RoHS Kit
2252200-R	ASR-3085 RoHS Single
2252300-R	ASR-3085/256MB RoHS Single

- **Adaptec RAID 3085 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent
- **LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J10:

J10 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	CONNECTOR J3-PORT0 Anode	2
2	ACT0_7_LED_L (0)	CONNECTOR J3-PORT0 Cathode	1
3	+3.3V	CONNECTOR J3-PORT1 Anode	4
4	ACT0_7_LED_L (1)	CONNECTOR J3-PORT1 Cathode	3
5	+3.3V	CONNECTOR J3-PORT2 Anode	6
6	ACT0_7_LED_L (2)	CONNECTOR J3-PORT2 Cathode	5
7	+3.3V	CONNECTOR J3-PORT3 Anode	8
8	ACT0_7_LED_L (3)	CONNECTOR J3-PORT3 Cathode	7
9	+3.3V	CONNECTOR J5-PORT0 Anode	10
10	ACT0_7_LED_L (4)	CONNECTOR J5-PORT0 Cathode	9
11	+3.3V	CONNECTOR J5-PORT1 Anode	12
12	ACT0_7_LED_L (5)	CONNECTOR J5-PORT1 Cathode	11
13	+3.3V	CONNECTOR J5-PORT2 Anode	14
14	ACT0_7_LED_L (6)	CONNECTOR J5-PORT2 Cathode	13
15	+3.3V	CONNECTOR J5-PORT3 Anode	16
16	ACT0_7_LED_L (7)	CONNECTOR J5-PORT3 Cathode	15

Adaptec RAID 3405 LED and I2C Connector Specification

2251800-R	ASR-3405 RoHS KIT
2251800JA-R	ASR-3405/JA RoHS KIT
2251900-R	ASR-3405 RoHS Single

- **Adaptec RAID 3405 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent.
- **LED Mating Cable Connector:** Molex 22-55-2081 or equivalent.

J10:

J10 Pin Number	Signal	Description	22-55-2081 Pin Number
9	+3.3V	CONNECTOR J5-PORT0 Anode	2
10	ACT0_7_LED_L (7)	CONNECTOR J5-PORT0 Cathode	1
11	+3.3V	CONNECTOR J5-PORT1 Anode	4
12	ACT0_7_LED_L (6)	CONNECTOR J5-PORT1 Cathode	3
13	+3.3V	CONNECTOR J5-PORT2 Anode	6
14	ACT0_7_LED_L (5)	CONNECTOR J5-PORT2 Cathode	5
15	+3.3V	CONNECTOR J5-PORT3 Anode	8
16	ACT0_7_LED_L (4)	CONNECTOR J5-PORT3 Cathode	7

- **Adaptec RAID 3405 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent.
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent.

J12:

Pin Number	Signal	Description
2	AGGREGATE4_7_L	Aggregate Cathode - Connector J5 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 3405 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J8:

Note: The following pins are tied to Sideband Signals of SFF-8087 connector J5 (Ports 0-3)

Pin Number	Signal	Description
1	I2CDATA	I2C Data
2	GND	Ground
3	I2CCLK	I2C Clock

Note: I2C signals are also routed through the SFF-8087 internal connector J5

SFF-8087 Connector J5:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONB	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONB	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONB	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONB	SB5 - Backplane Address	SB5 - SDataIn

Pin Number	Signal	I2C Description	SGPIO Description
B11	CONTROLLER_TYPEB_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEB	SB7 – Backplane Type	SB7 – Backplane Type

Adaptec RAID 3805 LED and I2C Connector Specification

2252100-R	ASR-3805 RoHS Kit
2252100JA-R	ASR-3805/JA RoHS Kit
2252200-R	ASR-3805 RoHS Single
2252300-R	ASR-3805/256MB RoHS Single

- **Adaptec RAID 3805 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent
- **LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J10:

J10 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	CONNECTOR J3-PORT0 Anode	2
2	ACT0_7_LED_L (3)	CONNECTOR J3-PORT0 Cathode	1
3	+3.3V	CONNECTOR J3-PORT1 Anode	4
4	ACT0_7_LED_L (2)	CONNECTOR J3-PORT1 Cathode	3
5	+3.3V	CONNECTOR J3-PORT2 Anode	6
6	ACT0_7_LED_L (1)	CONNECTOR J3-PORT2 Cathode	5
7	+3.3V	CONNECTOR J3-PORT3 Anode	8
8	ACT0_7_LED_L (0)	CONNECTOR J3-PORT3 Cathode	7
9	+3.3V	CONNECTOR J5-PORT0 Anode	10
10	ACT0_7_LED_L (7)	CONNECTOR J5-PORT0 Cathode	9
11	+3.3V	CONNECTOR J5-PORT1 Anode	12
12	ACT0_7_LED_L (6)	CONNECTOR J5-PORT1 Cathode	11
13	+3.3V	CONNECTOR J5-PORT2 Anode	14
14	ACT0_7_LED_L (5)	CONNECTOR J5-PORT2 Cathode	13
15	+3.3V	CONNECTOR J5-PORT3 Anode	16
16	ACT0_7_LED_L (4)	CONNECTOR J5-PORT3 Cathode	15

- **Adaptec RAID 3805 Aggregate Activity LED Board Connector**: Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J11:

Pin Number	Signal	Description
2	AGGREGATE0_3_L	Aggregate Cathode – Connector J3 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 3805 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

Pin Number	Signal	Description
2	AGGREGATE4_7_L	Aggregate Cathode – Connector J5 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 3805 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J7:

Pin Number	Signal	Description
1	SDA	I2C Data – Connector J3 Ports 0-3
2	GND	Ground
3	SCL	I2C Clock – Connector J3 Ports 0-3

Note: Tied to Sideband Signals of SFF-8087 J3 (Ports 0-3)

- **Adaptec RAID 3805 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J8:

The following pins are tied to Sideband Signals of SFF-8087 connector J5 (Ports 0-3)

Pin Number	Signal	Description
1	I2CDATA	I2C Data – Connector J5 Ports 0-3
2	GND	Ground
3	I2CCLK	I2C Clock – Connector J5 Ports 0-3

Note: I2C signals are also routed through the SFF-8087 internal connectors J3 and J5

SFF-8087 Connector J3:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONA	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONA	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground

Pin Number	Signal	I2C Description	SGPIO Description
A10	SB4_CONA	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONA	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEA_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEA	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J5:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONB	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONB	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONB	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONB	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEB_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEB	SB7 – Backplane Type	SB7 – Backplane Type

Adaptec RAID 5085 LED Connector Specification

2249100-R	ASR-5085/512MB RoHS SGL

- **Adaptec RAID 5085 Activity LED Header Connector:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN1, LANE 2	LED Cathode	13

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
15	+3.3V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- **Adaptec RAID 5085 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 5085 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	

- **Adaptec RAID 5085 Status LED Board Connector:** Molex 10-89-7162 or equivalent
- **Status LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J14:

J14 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	STATUS CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	STATUS CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	STATUS CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	STATUS CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	STATUS CN1, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	STATUS CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	STATUS CN1, LANE 2	LED Cathode	13

J14 Pin Number	Signal	Description	22-55-2161 Pin Number
15	+3.3V	LED Anode	16
16	STATUS CN1, LANE 3	LED Cathode	15

Adaptec RAID 5405 LED and I2C Connector Specification

2258100-R	ASR-5405 RoHS KIT
2258100JA-R	ASR-5405/JA RoHS KIT
2258200-R	ASR-5405 RoHS Single

- **Adaptec RAID 5405 Activity LED Header Connector:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7

- **Adaptec RAID 5405 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 5405 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 5405 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

- **Adaptec RAID 5405 Status LED Board Connector:** Molex 10-89-7162 or equivalent
- **Status LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J14:

J14 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	STATUS CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	STATUS CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	STATUS CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	STATUS CN0, LANE 3	LED Cathode	7

Adaptec RAID 5445 LED and I2C Connector Specification

2228800-R	ASR-5445 RoHS Kit
2228800JA-R	ASR-5445/JA RoHS Kit
2244900-R	ASR-5445/512MB RoHS SGL

- **Adaptec RAID 5445 Activity LED Header Connector:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN1, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- **Adaptec RAID 5445 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 5445 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 5445 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

- **Adaptec RAID 5445 Status LED Board Connector:** Molex 10-89-7162 or equivalent
- **Status LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J14:

J14 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	STATUS CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	STATUS CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	STATUS CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	STATUS CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	STATUS CN1, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	STATUS CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	STATUS CN1, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	STATUS CN1, LANE 3	LED Cathode	15

Adaptec RAID 5805 LED and I2C Connector Specification

2244100-R	ASR-5805 RoHS KIT
2244100JA-R	ASR-5805/JA RoHS KIT
2244300-R	ASR-5805/512MB RoHS Single

- **Adaptec RAID 5805 Activity LED Header Connector:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN1, LANE 0	LED Cathode	9

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
11	+3.3V	LED Anode	12
12	ACTIVITY CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN1, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN1, LANE 3	LED Cathode	15

- **Adaptec RAID 5805 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 5805 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 5805 I2C CN0 Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

- **Adaptec RAID 5805 I2C CN1 Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J5:

J5 Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

- **Adaptec RAID 5805 Status LED Board Connector:** Molex 10-89-7162 or equivalent
- **Status LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J14:

J14 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	STATUS CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	STATUS CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	STATUS CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	STATUS CN0, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	STATUS CN1, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	STATUS CN1, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	STATUS CN1, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	STATUS CN1, LANE 3	LED Cathode	15

Adaptec RAID 31205 LED and I2C Connector Specification

2252500-R	ASR-31205 RoHS Single
2252400-R	ASR-31205 RoHS Kit

- **Adaptec RAID 31205 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent
- **LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J10:

J10 Pin Number	Signal	Description	22-55-2161
1	+3.3V	CONNECTOR J3-PORT0 Anode	2
2	ACT0_7_LED_L (0)	CONNECTOR J3-PORT0 Cathode	1
3	+3.3V	CONNECTOR J3-PORT1 Anode	4
4	ACT0_7_LED_L (1)	CONNECTOR J3-PORT1 Cathode	3
5	+3.3V	CONNECTOR J3-PORT2 Anode	6
6	ACT0_7_LED_L (2)	CONNECTOR J3-PORT2 Cathode	5
7	+3.3V	CONNECTOR J3-PORT3 Anode	8
8	ACT0_7_LED_L (3)	CONNECTOR J3-PORT3 Cathode	7
9	+3.3V	CONNECTOR J5-PORT0 Anode	10

J10 Pin Number	Signal	Description	22-55-2161
10	ACT0_7_LED_L (4)	CONNECTOR J5-PORT0 Cathode	9
11	+3.3V	CONNECTOR J5-PORT1 Anode	12
12	ACT0_7_LED_L (5)	CONNECTOR J5-PORT1 Cathode	11
13	+3.3V	CONNECTOR J5-PORT2 Anode	14
14	ACT0_7_LED_L (6)	CONNECTOR J5-PORT2 Cathode	13
15	+3.3V	CONNECTOR J5-PORT3 Anode	16
16	ACT0_7_LED_L (7)	CONNECTOR J5-PORT3 Cathode	15

- **Adaptec RAID 31205 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent
- **LED Mating Cable Connector:** Molex 22-55-2081 or equivalent

J17:

Pin Number	Signal	Description	22-55-2081 Pin Number
1	+3.3V	CONNECTOR J18-PORT0 Anode	2
2	ACT8_15_LED_L (0)	CONNECTOR J18-PORT0 Cathode	1
3	+3.3V	CONNECTOR J18-PORT1 Anode	4
4	ACT8_15_LED_L (1)	CONNECTOR J18-PORT1 Cathode	3
5	+3.3V	CONNECTOR J18-PORT2 Anode	6
6	ACT8_15_LED_L (2)	CONNECTOR J18-PORT2 Cathode	5
7	+3.3V	CONNECTOR J18-PORT3 Anode	8
8	ACT8_15_LED_L (3)	CONNECTOR J18-PORT3 Cathode	7

- **Adaptec RAID 31205 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J11:

Pin Number	Signal	Description
2	AGGREGATE0_3_L	Aggregate Cathode – Connector J3 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31205 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

Pin Number	Signal	Description
2	AGGREGATE4_7_L	Aggregate Cathode – Connector J5 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31205 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J15:

Pin Number	Signal	Description
2	AGGREGATE8_11_L	Aggregate Cathode – Connector J18 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31205 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J7:

The following pins are tied to Sideband Signals of SFF-8087 connector J3 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_A	I2C Data – Connector J3 Ports 0-3
2	GND	Ground
3	SCL_A	I2C Clock – Connector J3 Ports 0-3

- **Adaptec RAID 31205 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J8:

The following pins are tied to Sideband Signals of SFF-8087 connector J5 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_B	I2C Data – Connector J5 Ports 0-3
2	GND	Ground
3	SCL_B	I2C Clock – Connector J5 Ports 0-3

- **Adaptec RAID 31205 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J19:

The following pins are tied to Sideband Signals of SFF-8087 connector J18 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_C	I2C Data – Connector J18 Ports 0-3
2	GND	Ground
3	SCL_C	I2C Clock – Connector J18 Ports 0-3

- I2C signals are also routed through the SFF-8087 internal connectors J3, J5, andJ18

SFF-8087 Connector J3:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONA	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONA	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONA	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONA	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEA_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEA	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J5:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONB	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONB	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONB	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONB	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEB_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEB	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J18:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONC	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONC	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONC	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONC	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEC_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEC	SB7 – Backplane Type	SB7 – Backplane Type

Adaptec RAID 31605 LED and I2C Connector Specification

2252800-R	ASR-31605 RoHS Single
2252700-R	ASR-31605 RoHS Kit

- **Adaptec RAID 31605 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent

- **LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J10:

Board Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	CONNECTOR J3-PORT0 Anode	2
2	ACT0_7_LED_L (0)	CONNECTOR J3-PORT0 Cathode	1
3	+3.3V	CONNECTOR J3-PORT1 Anode	4
4	ACT0_7_LED_L (1)	CONNECTOR J3-PORT1 Cathode	3
5	+3.3V	CONNECTOR J3-PORT2 Anode	6
6	ACT0_7_LED_L (2)	CONNECTOR J3-PORT2 Cathode	5
7	+3.3V	CONNECTOR J3-PORT3 Anode	8
8	ACT0_7_LED_L (3)	CONNECTOR J3-PORT3 Cathode	7
9	+3.3V	CONNECTOR J5-PORT0 Anode	10
10	ACT0_7_LED_L (4)	CONNECTOR J5-PORT0 Cathode	9
11	+3.3V	CONNECTOR J5-PORT1 Anode	12
12	ACT0_7_LED_L (5)	CONNECTOR J5-PORT1 Cathode	11
13	+3.3V	CONNECTOR J5-PORT2 Anode	14
14	ACT0_7_LED_L (6)	CONNECTOR J5-PORT2 Cathode	13
15	+3.3V	CONNECTOR J5-PORT3 Anode	16
16	ACT0_7_LED_L (7)	CONNECTOR J5-PORT3 Cathode	15

- **Adaptec RAID 31605 LED Board Connector:** Molex 10-89-7162 2.54mm 2x8 Header or equivalent
- **LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J17:

Board Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	CONNECTOR J18-PORT0 Anode	2
2	ACT8_15_LED_L (0)	CONNECTOR J18-PORT0 Cathode	1
3	+3.3V	CONNECTOR J18-PORT1 Anode	4
4	ACT8_15_LED_L (1)	CONNECTOR J18-PORT1 Cathode	3
5	+3.3V	CONNECTOR J18-PORT2 Anode	6
6	ACT8_15_LED_L (2)	CONNECTOR J18-PORT2 Cathode	5
7	+3.3V	CONNECTOR J18-PORT3 Anode	8
8	ACT8_15_LED_L (3)	CONNECTOR J18-PORT3 Cathode	7
9	+3.3V	CONNECTOR J14-PORT0 Anode	10
10	ACT8_15_LED_L (4)	CONNECTOR J14-PORT0 Cathode	9
11	+3.3V	CONNECTOR J14-PORT1 Anode	12
12	ACT8_15_LED_L (5)	CONNECTOR J14-PORT1 Cathode	11
13	+3.3V	CONNECTOR J14-PORT2 Anode	14
14	ACT8_15_LED_L (6)	CONNECTOR J14-PORT2 Cathode	13

Board Pin Number	Signal	Description	22-55-2161 Pin Number
15	+3.3V	CONNECTOR J14-PORT3 Anode	16
16	ACT8_15_LED_L (7)	CONNECTOR J14-PORT3 Cathode	15

- **Adaptec RAID 31605 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J11:

Pin Number	Signal	Description
2	AGGREGATE0_3_L	Aggregate Cathode – Connector J3 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31605 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

Pin Number	Signal	Description
2	AGGREGATE4_7_L	Aggregate Cathode – Connector J5 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31605 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J15:

Pin Number	Signal	Description
2	AGGREGATE8_11_L	Aggregate Cathode – Connector J18 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31605 Aggregate Activity LED Board Connector:** Molex 22-28-8022 2.54mm 1x2 RA Header or equivalent
- **LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J16:

Pin Number	Signal	Description
2	AGGREGATE12_15_L	Aggregate Cathode – Connector J14 Ports 0-3
1	+3.3V	Aggregate Anode

- **Adaptec RAID 31605 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J7:

The following pins are tied to Sideband Signals of SFF-8087 connector J3 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_A	I2C Data – Connector J3 Ports 0-3
2	GND	Ground
3	SCL_A	I2C Clock – Connector J3 Ports 0-3

- **Adaptec RAID 31605 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J8:

The following pins are tied to Sideband Signals of SFF-8087 connector J5 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_B	I2C Data – Connector J5 Ports 0-3
2	GND	Ground
3	SCL_B	I2C Clock – Connector J5 Ports 0-3

- **Adaptec RAID 31605 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J19:

The following pins are tied to Sideband Signals of SFF-8087 connector J18 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_C	I2C Data – Connector J18 Ports 0-3
2	GND	Ground
3	SCL_C	I2C Clock – Connector J18 Ports 0-3

- **Adaptec RAID 31605 I2C Board Connector:** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J20:

The following pins are tied to Sideband Signals of SFF-8087 connector J14 (Ports 0-3)

Pin Number	Signal	Description
1	SDA_C	I2C Data – Connector J14 Ports 0-3
2	GND	Ground
3	SCL_C	I2C Clock – Connector J14 Ports 0-3

- I2C signals are also routed through the SFF-8087 internal connectors J3, J5, J18 and J14

SFF-8087 Connector J3:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONA	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONA	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground

Pin Number	Signal	I2C Description	SGPIO Description
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONA	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONA	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEA_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEA	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J5:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONB	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONB	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONB	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONB	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEB_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEB	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J18:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_CONC	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_CONC	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_CONC	SB4 - Reset	SB4 - SDataOut
A11	SB5_CONC	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPEC_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPEC	SB7 – Backplane Type	SB7 – Backplane Type

SFF-8087 Connector J14:

Pin Number	Signal	I2C Description	SGPIO Description
B8	SB0_COND	SB0 - 2W_SCL	SB0 - SClock
B9	SB1_COND	SB1- 2W_SDA	SB1- SLoad
B10	GND	SB2 - Ground	SB2 - Ground
A9	GND	SB3 - Ground	SB3 - Ground
A10	SB4_COND	SB4 - Reset	SB4 - SDataOut
A11	SB5_COND	SB5 - Backplane Address	SB5 - SDataIn
B11	CONTROLLER_TYPED_BUF	SB6 – Controller Type	SB6 – Controller Type
A8	BACKPLANE_TYPED	SB7 – Backplane Type	SB7 – Backplane Type

Adaptec RAID 51245 LED and I2C Connector Specification

2258400-R	ASR-51245 RoHS Kit
2258300-R	ASR-51245 RoHS Single

- **Adaptec RAID 51245 Activity LED Header Connector for CN0/CN1:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J3:

J3 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN1, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN1, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN1, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN1, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN0, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN0, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN0, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN0, LANE 3	LED Cathode	15

- **Adaptec RAID 51245 Activity LED Board Connector for CN2:** Molex 10-89-7162 or equivalent
- **Activity LED Mating Cable Connector:** Molex 22-55-2161 or equivalent

J1:

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
1	Unused	Unused	2
2	Unused	Unused	1
3	Unused	Unused	4
4	Unused	Unused	3
5	Unused	Unused	6
6	Unused	Unused	5
7	Unused	Unused	8

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
8	Unused	Unused	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN2, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN2, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN2, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN2, LANE 3	LED Cathode	15

- **Adaptec RAID 51245 Aggregate Activity LED Board Connector:** Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector:** Molex 50-57-9002 or equivalent

J10:

J10 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 51245 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 51245 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J28, J29, J30:

J2*x* Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

Adaptec RAID 51645 LED and I2C Connector Specification

2258500-R	ASR-51645 RoHS Kit
2258600-R	ASR-51645 RoHS Single

- **Adaptec RAID 51645 Activity LED Header Connector for CN0/CN1:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J3:

J3 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN1, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN1, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN1, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN1, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN0, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN0, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN0, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN0, LANE 3	LED Cathode	15

- **Adaptec RAID 51645 Activity LED Board Connector for CN2/CN3**: Molex 10-89-7162 or equivalent
- **Activity LED Mating Cable Connector**: Molex 22-55-2161 or equivalent

J1:

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN3, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN3, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN3, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
8	ACTIVITY CN3, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN2, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN2, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN2, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN2, LANE 3	LED Cathode	15

- **Adaptec RAID 51645 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J10:

J10 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 51645 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 51645 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J27, J28, J29, J30:

J2*x* Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

Adaptec RAID 52445 LED and I2C Connector Specification

2258800-R	ASR-52445 RoHS Kit
2258700-R	ASR-52445 RoHS Single

- **Adaptec RAID 52445 Activity LED Header Connector for CN0/CN1:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J3:

J3 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN1, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN1, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN1, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN1, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN0, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN0, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN0, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN0, LANE 3	LED Cathode	15

- **Adaptec RAID 52445 Activity LED Board Connector for CN2/CN3**: Molex 10-89-7162 or equivalent
- **Activity LED Mating Cable Connector**: Molex 22-55-2161 or equivalent

J1:

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN3, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN3, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN3, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8

J1 Pin Number	Signal	Description	22-55-2161 Pin Number
8	ACTIVITY CN3, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN2, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN2, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN2, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN2, LANE 3	LED Cathode	15

- **Adaptec RAID 52445 Activity LED Header Connector for CN4/CN5:** Molex 10-89-7162 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2161 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN4, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN4, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN4, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN4, LANE 3	LED Cathode	7
9	+3.3V	LED Anode	10
10	ACTIVITY CN5, LANE 0	LED Cathode	9
11	+3.3V	LED Anode	12
12	ACTIVITY CN5, LANE 1	LED Cathode	11
13	+3.3V	LED Anode	14
14	ACTIVITY CN5, LANE 2	LED Cathode	13
15	+3.3V	LED Anode	16
16	ACTIVITY CN5, LANE 3	LED Cathode	15

- **Adaptec RAID 52445 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J10:

J10 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 52445 External Alarm Connector:** Molex 22-28-4023 or equivalent
- **Alarm Mating Cable Connector:** Molex 50-57-9002 or equivalent

J12:

J12 Pin Number	Signal	Description
2	~2kHz Square Wave	Open collector transistor
1	+3.3V	—

- **Adaptec RAID 52445 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J25, J26, J27, J28, J29, J30:

J2*x* Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

Adaptec RAID 2045 LED Connector Specification

2260300-R	ASR-2045 RoHS SGL

- **Adaptec RAID 2045 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

Adaptec RAID 2405 LED and I2C Connector Specification

2260100-R	ASR-2405 RoHS KIT
2260100JA-R	ASR-2405/JA RoHS KIT
2260200-R	ASR-2405 RoHS SGL

- **Adaptec RAID 2405 Activity LED Header Connector:** Molex 10-89-7082 or equivalent
- **Activity LED Header Mating Cable Connector:** Molex 22-55-2081 or equivalent

J2:

J2 Pin Number	Signal	Description	22-55-2161 Pin Number
1	+3.3V	LED Anode	2
2	ACTIVITY CN0, LANE 0	LED Cathode	1
3	+3.3V	LED Anode	4
4	ACTIVITY CN0, LANE 1	LED Cathode	3
5	+3.3V	LED Anode	6
6	ACTIVITY CN0, LANE 2	LED Cathode	5
7	+3.3V	LED Anode	8
8	ACTIVITY CN0, LANE 3	LED Cathode	7

- **Adaptec RAID 2405 Aggregate Activity LED Board Connector**: Molex 22-28-4023 or equivalent
- **Aggregate LED Mating Cable Connector**: Molex 50-57-9002 or equivalent

J1:

J1 Pin Number	Signal	Description
2	ACTIVITY	LED Cathode
1	+3.3V	LED Anode

- **Adaptec RAID 2405 I2C Board Connector :** Molex 22-43-6030 or equivalent
- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

J4:

J4 Pin Number	Signal
3	I2C Clock
2	Ground
1	I2C Data

Safety Information

G

To ensure your personal safety and 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 (ESD)

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 controller or any other part of the computer.
- Avoid touching the controller against your clothing. The wrist strap protects components from ESD on the body only.
- Handle the controller by its bracket or edges only. Avoid touching the printed circuit board or the connectors.
- Put the controller down only on an antistatic surface such as the bag supplied in your kit.
- If you are returning the controller to Adaptec, put it back in its antistatic bag immediately.

Technical Specifications

H

In this appendix...

Environmental Specifications 139

DC Power Requirements 139

Current Requirements 139

Environmental Specifications

Note: With a Battery Backup Unit (BBU), the ambient temperature should not exceed 40 °C

Ambient temperature without forced airflow	0 °C to 40 °C
Ambient temperature with forced airflow	0 °C to 55 °C
Relative humidity	10% to 90%, noncondensing
Altitude	Up to 3,000 meters

Note: Forced airflow is recommended.

DC Power Requirements

Bus Type	Description	Requirements
PCIe	Ripple and noise	50 mV peak-to-peak (max)
PCIe	DC Voltage	3.3 V ± 9%, 12 V ± 8%

Current Requirements

Adaptec Model	Typical Current
Adaptec RAID 5085	0.45 A @ 3.3 VDC; 1.0 A @ 12.0 VDC
Adaptec RAID 5805	0.45 A @ 3.3 VDC; 1.0 A @ 12.0 VDC
Adaptec RAID 5405	0.45A @ 3.3VDC; 0.94A @ 12.0VDC
Adaptec RAID 5445	0.45A @ 3.3VDC; 1.0A @ 12.0VDC
Adaptec RAID 51245	0.47A @ 3.3VDC; 1.68A @ 12.0VDC
Adaptec RAID 51645	0.47A @ 3.3VDC; 1.72A @ 12.0VDC
Adaptec RAID 52445	0.47A @ 3.3VDC; 1.78A @ 12.0VDC
Adaptec RAID 3085	1.04 A @ 3.3 VDC; 0.98 A @ 12.0 VDC
Adaptec RAID 3405	1.0 A @ 3.3 VDC; 1.0 A @ 12.0 VDC
Adaptec RAID 3805	1.0 A @ 3.3 VDC; 1.0 A @ 12.0 VDC
Adaptec RAID 31205	1.05 A @ 3.3 VDC; 1.48 A @ 12.0 VDC
Adaptec RAID 31605	1.05 A @ 3.3 VDC; 1.48 A @ 12.0 VDC
Adaptec RAID 2045	0.43A @ 3.3VDC; 0.83A @ 12.0VDC
Adaptec RAID 2405	0.43A @ 3.3VDC; 0.83A @ 12.0VDC

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Part Number: CDP-00243-01-A Rev. A
JB 06/08

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