**adaptec**®

# Adaptec SATA/SAS
# 1405, 1045 Controller
# Installation and User's Guide
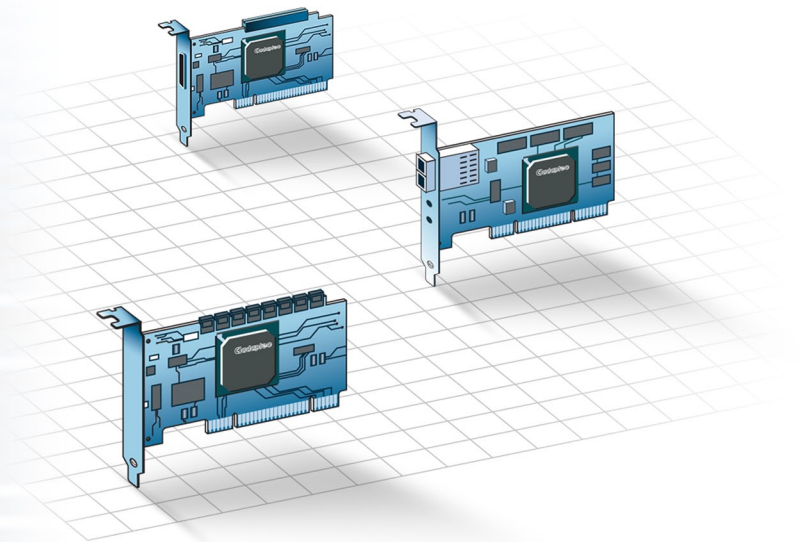
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### Technical Support Identification (TSID) Number

● Before contacting Technical Support, you need your product unique TSID number. The TSID number identifies your product and support status.

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

```
THIS TSID NUMBER WILL      TSID: PTNNNNNNYYWW
BE REQUIRED WHEN           (1P) PRODUCT P/N: PPPPPPPPPPPPPPPPP
CONTACTING TECHNICAL       ||||||| |||| |||||||| |||| |||| ||||
SUPPORT.
                           (S) PRODUCT S/N: XXXXXXXXXXXXXX
                           |||||| |||| |||| |||||| |||| ||||| |||| |||| ||| |||
```

● Affix a copy of the TSID label to the CD jacket so that you don't lose it. In addition, it's recommended that you register your product so that you have easy access to your TSID when contacting Customer Support.

**Note:** The phone numbers below are subject to change. Please visit the Support section of www.adaptec.com for the most up to date contact information.

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4. For more information on how to obtain warranty service, write or telephone Adaptec at 691 South Milpitas Boulevard, Milpitas, CA 95035, (800) 959-7274.

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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. | ASC-1045/ASC-1405 |

**FC** Tested to Comply
With FCC Standards
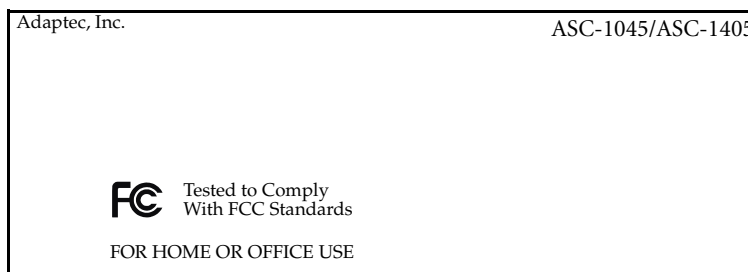
FOR HOME OR OFFICE USE

### 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.

# Contents

## A    Introduction to SAS

## B    SAS Controller LED and I2C and SGPIO Connector Reference

## C    Safety Information

## D    Technical Specifications

## Glossary

## Index

# About This Guide

# 1

**In this chapter...**

This *Installation and User's Guide* explains how to install the Adaptec® SATA/SAS 1405, 1045 Controller. It also describes the utilities included in the controller kit, and provides a basic overview of technology.

## What You Need to Know Before You Begin

You should be familiar with computer hardware, data storage, and the characteristics of input/output (I/O) technology used by your controller. Because SAS is a newer I/O technology, an introduction is provided in the Appendix A.

## Terminology Used in this Guide

Many of the terms and concepts referred to in this *Guide* have multiple names. To maintain consistency, they are represented as:

- Controller (also known as host bus adapter, board)
- Disk drive (also known as hard disk, hard drive, or hard disk drive)
- Tape (also known as tape drive)

## How to Find More Information

You can find more information about your controller, and the software and utilities also included along with these documents:

- *Readme.txt-* describes details about updated product information and known issues; located on the Controller Installation CD.
- *Adaptec SATA/SAS 1405, 1045 Controller QuickStart Guide-* describes how to use the controller in an existing operating system.

# About SATA/SAS Controllers

# 2

**In this chapter...**

This chapter provides an overview of SATA/SAS 1405, 1045 Controller features.

## SATA/SAS Controller Features

- Supports SAS and SATA tape drives, autoloaders and libraries.

- Supports SAS and SATA disk drives.

- Supports DVD, Expanders, Disk Enclosures and Backplanes.

# About the Adaptec SATA/SAS 1405 Controller

The Adaptec SATA/SAS 1405 controller is a low-profile PCIe controller with these features:



| | |
|---|---|
| Form factor | Low-profile |
| Bus compatibility | PCIe |
| PCIe bus width | x4 |
| PCIe bus speed | 2.5 Gbps |
| Phys | 4 |
| Connectors, internal | 1 mini-SAS x4 (SFF-8087) |
| Simple volume | Yes |
| Disk drives | SAS (3.0 Gbps), SATA I (1.5 Gbps), SATA II (3.0 Gbps) |
| Maximum number of devices | 4 direct-attached devices or up to 128 using expander technology |
| Enclosure management support | I2C and SGPIO |
| Native Command Queuing (NCQ) | Yes |

# About the Adaptec SATA/SAS 1045 Controller

The Adaptec SATA/SAS 1045 controller is a low-profile PCIe controller with these features:



| | |
|---|---|
| Form factor | Low-profile |
| Bus compatibility | PCIe |
| PCIe bus width | x4 |
| PCIe bus speed | 2.5 Gbps |
| Phys | 4 |
| Connectors, external | 1 mini-SAS x4 (SFF-8088) |
| Simple volume | Yes |
| Disk drives | SAS (3.0 Gbps), SATA I (1.5 Gbps), SATA II (3.0 Gbps) |
| Maximum number of devices | 4 direct-attached devices or up to 128 using expander technology |
| Enclosure management support | Supported via SAS expander |
| Native Command Queuing (NCQ) | Yes |

# Package Contents and System Requirements

# 3

This chapter lists the contents of SATA/SAS 1405, 1045 controller kit and the system requirements that must be met to successfully install and use the controller.

## Package Contents

- Adaptec SATA/SAS 1405 or 1045 Controller
- Embedded in the controller's BIOS are these utilities::
  - **Configuration Utility** - Used to modify the controller and disk drive settings
  - **Disk Utilities** - Used to format and verify disk drives
- Adaptec installation CD containing:
  - Drivers for the Adaptec controller
  - Product Documentation for the Adaptec SATA/SAS 1405 or 1045 Controller
  - Readme files
- Cable (1405 kit only)
- Low-profile bracket
- *Adaptec SATA/SAS 1405, 1045 Controller Quickstart Guide*

## System Requirements

- PC-compatible computer with Intel Pentium, or equivalent processor
- A motherboard with these features:
  - Complies with the *PCI Local Bus Specification, Revision 2.2 and higher*
  - Supports multifunction devices where one of the devices is a PCI bridge
  - Large memory-mapped address ranges

    Note: Refer to the Readme file on the controller Installation CD for additional motherboard compatibility information.
- Any one of these operating systems:
  - Microsoft® Windows® Server 2003, XP, Vista and Windows Server 2008
  - Red Hat Enterprise Linux - 4, 5
  - SUSE Linux Enterprise Server- 9, 10

    Note: 32-bit and 64 bit versions are supported. For up-to-date operating system version support, visit www.adaptec.com.
- At least 256 MB of RAM
- Available PCIe slot
- 40 MB of free drive space
- 16-bit SVGA color monitor with a resolution of at least 800 x 600
- CD drive
- Appropriate interface cables

# Installing the SATA/SAS Controller and Disk Drives

# 4

**In this chapter...**

This chapter explains how to install the SATA/SAS 1405, 1045 controller, and how to connect the disk drives.

# Before You Begin

- Read the Safety Information on page 60.

- Familiarize yourself with the SATA/SAS 1405, 1045 controller's physical features page 12.

- Ensure that you have the proper cables for your controller and devices page 19.

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

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

# Installing the SATA/SAS Controller

This section describes how to install your SATA/SAS 1405, 1045 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 the PCI expansion slot and remove the slot cover, as shown at the right.

For the best performance, use the available slot that's compatible with your SATA/SAS 1405, 1045 controller (see Chapter 2).

PCIe bus compatibility is marked to the controller figures in *About SATA/SAS Controllers* on page 11.

⚠ **Caution:** Touch a grounded metal object before handling the SAS controller.

**3** As shown at right, insert the SATA/SAS controller into the expansion slot and press down gently but firmly until it clicks into place. When installed properly, the SAS 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 the SATA/SAS controller's I2C connector (not available on all models) to an I2C connector on a backplane or enclosure, using an I2C cable.

**6** Connect your devices, following the instructions on page 20 for SATA/SAS controllers.
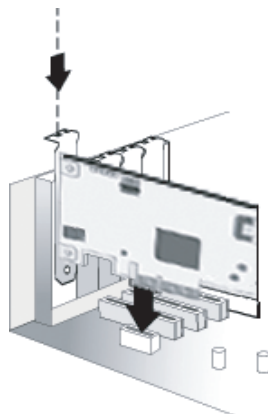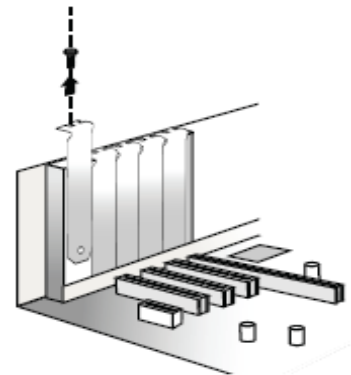
# Selecting Disk Drives and Cables

### Disk Drives

The Adaptec SATA/SAS controller supports both SAS and SATA disk drives. For more information about compatible disk drives, visit the Adaptec Web site at www.adaptec.com/compatibility.

### Cables

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



Internal Mini SAS x4 (SFF-8087) to SATA fanout cable - connects Mini SAS controller to a maximum of four SATA devices or a backplane.



Internal Mini SAS x4 (SFF-8087) to SAS (4) x1 (SFF-8482) fanout cable with removable power - connects controller to a maximum four SATA/SAS devices.



Internal Mini SAS x4 (SFF-8087) to SATA fanout cable with sideband - connects controller to a maximum of four SATA devices or a backplane.
Note: The sideband (SFF-8448) connector is used to connect with a managed backplane or enclosure.



Internal Mini SAS (SFF-8087) to SAS x4 (SFF-8484) - connects to SATA/SAS backplane

External Mini SAS x4 (SFF-8088) to Mini SAS x4 (SFF-8088) - connects to an external device (i.e. tape drive) or backplane.

External Mini SAS x4 (SFF-8088) to SAS x4 (SFF-8470) - connects to an external device (i.e. tape drive) or backplane

Use high-quality cables to connect your controller to your internal or external device(s).Adaptec recommends using only Adaptec SATA/SAS cables. For more information or to purchase cables, visit the Adaptec Web site at www.adaptec.com.

# Connecting Devices to SATA/SAS Controllers

You can connect SAS or SATA disk drives, tape drives, DVD-ROM drives, or a combination of these devices as well as backplanes, enclosures, or SAS expanders to your SAS controller. See www.adaptec.com/compatibility for a list of compatible devices. There are no jumpers or switches to set before installation.

The following are the options in which the SATA/SAS controller is connected to target devices.

● *Connecting Disk Drives Directly to the SATA/SAS Controller* on page 20

● *Connecting to a Backplane* on page 21

● *Connecting to a DVD-ROM* on page 22

● *Connecting to a SAS Expander* on page 22

● *Connecting to SATA/SAS Tape Drives* on page 22

## Connecting Disk Drives Directly to the SATA/SAS Controller

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SATA/SAS controller with SAS cables. The number of direct-attached disk drives is limited to four per SAS connector. For more information, see *Direct-Attach Connections* on page 54.

**1** Install your internal SAS or SATA disk drives, following the instructions in your system's documentation.

**2**   Use internal SAS cables to connect the disk drives to the SATA/SAS controller.



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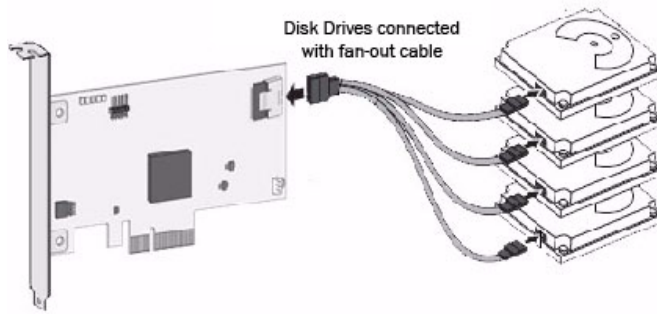
**Note:** SAS fan-out cables are also available with an additional sideband (SFF-8448) cable that carries SGPIO signals for enclosure management. This additional sideband cable is not used with direct-attached disk drives.

**3**   When you have installed and connected all disk drives to the SATA/SAS controller, close your computer cabinet, and reconnect the power cord.

## Connecting to a Backplane

In a backplane connection, disk drives and SATA/SAS controllers are connected to and communicate with each other through a backplane. An alternate method of backplane connection, the SATA/SAS controller can also be connected with backplane along with expanders.

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.

**1**   Install one or more internal SAS or SATA disk drives in to the backplane. Refer to your backplane's documentation for more information.

**2**   Use an internal or external SAS cable to connect the SATA/SAS controller to the backplane.



Disk drives
on backplane

Controller
connected to
backplane
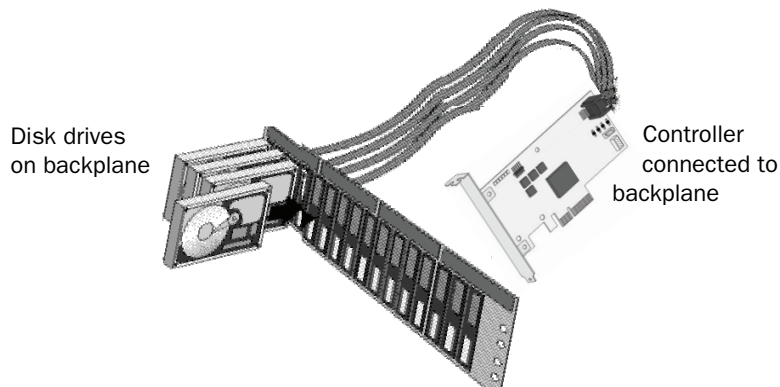
**3**   When all internal disk drives have been installed and connected, close your computer cabinet, reconnect the power cord.

## Connecting to a DVD-ROM

In a direct-attach connection, DVD-ROM drives are connected directly to a SAS controller with SAS cables. The number of direct-attached devices is limited to four per SAS connector. For more information, see *Direct-Attach Connections* on page 54.

You can connect SATA DVD-ROM drives to your SATA/SAS controller. There are no jumpers or switches to set before installation. (See www.adaptec.com/compatibility for a list of compatible devices.)

**1**  Install your DVD-ROM. Refer to your system's documentation for more information.

**2**  Use a SAS cable to connect the SATA/SAS controller to the DVD-ROM.

**3**  When all devices have been installed and connected, close your computer cabinet and reconnect the power cord.

## Connecting to a SAS Expander

You can use a SAS expander to connect a maximum of 128 end devices to your SATA/SAS controller.

To install the SATA/SAS controller to a SAS expander:

**1**  Using the appropriate cable, connect the SATA/SAS controller to the expander's PHY connector.

**2**  Connect a cable from the expander's PHY connector to a disk drive.
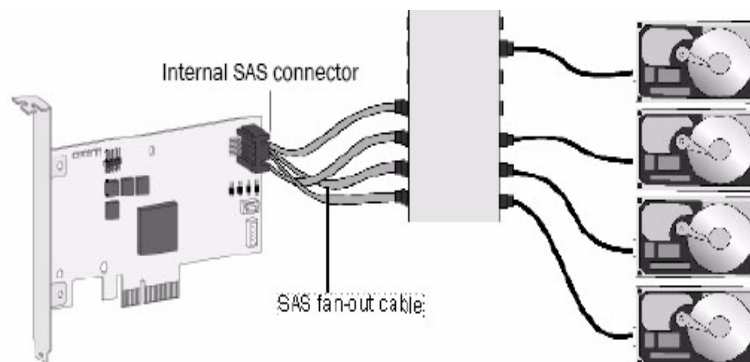


## Connecting to SATA/SAS Tape Drives

You can connect internal or external SAS or SATA Tape Drives to your SATA/SAS controller. (See www.adaptec.com/compatibility for a list of compatible devices.)

**1**  Connect one or more SAS or SATA tape drives to the controller. Refer to your tape drive's documentation for more information.

**2**  Use the appropriate SAS cable to connect to the tape drive.

**3**  When all devices have been installed and connected, close your computer cabinet, reconnect the power cord.

# Checking Your Controller and Devices

Once you have installed your controller and connected your devices, you can use the Adaptec Configuration Utility (ACU) to check your controller and devices, as described below:

**1** Turn on your computer.

**2** When the Adaptec screen appears, press Ctrl+A to enter the ACU.

**3** Select the SATA/SAS controller to verify the hardware configuration of the controller and the drives.

**4** If your drives have already been used in another system, select Disk Utilities. For more information see *Using the Disk Utilities* on page 35.

Check whether all the devices are available, if anything appears to be missing, power down the computer and check the connections.

# Setting the Boot Controller

**Note:** If your system does not contain more than one bootable controller, skip this section.

Adaptec SATA/SAS controllers supports bootable disk drives. The default setting of the SATA/SAS controller and system setup allows you to install and boot from either a disk drive connected to the motherboard, or from a drive connected to the SATA/SAS controller.

**Note:** Selecting the boot controller is done using the system BIOS Setup Utility. Launching the system BIOS Setup Utility varies depending on your computer model. Refer to your computer documentation for instructions on how to access the system BIOS.

**1** Enter the system BIOS Setup.

**2** Navigate to the disk drive boot sequence.

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

# Installing the Driver and an Operating System

# 5

**In this chapter...**

This chapter explains how to install the controller driver and an operating system.

**Note:** To install the driver on an existing operating system, see .

## Before You Begin

- Install and connect your controller and disk drives, (see ).

- Create a driver disk (see the following section).

## Creating a Driver Disk

Before you install the driver, you must create a driver disk. You 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's documentation).

2   Boot your computer from the bootable SATA/SAS Installation CD.

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

4   Select any one of the operating systems from the list:

- Windows

- Linux

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

6   The system creates the driver disk.

7   Remove and label the driver disk.

8   Continue with the instructions for your operating system:

- *Installing with Windows* on page 25

- *Installing with Red Hat Enterprise Linux* on page 26

- *Installing with SUSE Linux Enterprise Server* on page 26

## Installing with Windows

You will need your Windows Installation CD to complete this task. To install the SATA/SAS 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. If you are using Windows Vista and Windows Server 2008, click **Load Driver** to locate the driver and then click **Next.**

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**.

6   The computer reads the disk.

7   When the Adaptec SATA/SAS driver is found, press **Enter**.

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

## Installing with Red Hat Enterprise Linux

You will need your Red Hat Installation CD to complete this task. To install the SATA/SAS controller driver while installing Red Hat Enterprise Linux:

**1**   Insert the Red Hat Installation CD.

**2**   Restart the computer.

**3**   When the Red Hat Welcome screen displays, 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 Red Hat Enterprise Linux installation, following the instructions included with your operating system.

## Installing with SUSE Linux Enterprise Server

To install the controller driver while installing SUSE Linux Enterprise Server:

**1**   Insert the SUSE Installation CD.

**2**   Restart your computer.

**3**   When the SUSE (SLES 9 and 10) installation selection screen displays, press the F6 key, select installation option from the Menu, then press Enter.

**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 SUSE Linux Enterprise Server installation, following the instructions included with your operating system.

# Installing the Driver on an Existing Operating System

# 6

**In this chapter...**

This chapter explains how to install your controller driver on an existing operating system.

## Before You Begin

Before you begin, install and connect your controller and disk drives (see page 18).

You must also create a driver disk (see next section) 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.

## Creating a Driver Disk

Before you install your driver, you will need to create a driver disk. 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's documentation.)

2   Turn on your computer, then insert the Installation CD included in your controller kit.

3   Follow the on-screen instructions to get to the Adaptec Start Menu.

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

5   Select one of the operating systems from this list:

   ●   Windows XP/2003, Vista and Windows Server 2008

   ●   Red Hat Linux Enterprise 4, 5 and SUSE Linux Enterprise Server 9, 10

6   Select the version of the operating system.

7   When prompted, insert the floppy disk, and then click **OK**.

   The system creates the driver disk.

8   Remove and label the driver disk.

9   Continue the driver installation for your operating system:

   ●   *Installing on Windows XP or Windows 2003* (next section)

   ●   *Installing on Windows Vista or Windows Server 2008* on page 29

   ●   *Installing on Red Hat or SUSE Linux Enterprise Server* on page 29

## Installing on Windows XP or Windows 2003

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.

# Installing on Windows Vista or Windows Server 2008

**1**   Insert the Windows setup CD.

**2**   Right-click the **Computer** and select **Manage**.

**3**   From the **Computer Management**, select **Device Manager** to open the list.

**4**   Under **Other Devices**, select **SAS Controller.**

**5**   Right-click **SAS Controller** and select **Update Driver Software**.

**6**   Browse the installation path of the driver and click **Next**.

**7**   Once the installation is complete a message appears "Windows has finished installing the driver software for this device".

# Installing on Red Hat or SUSE Linux Enterprise Server

To install the module on Red Hat or SUSE Linux Enterprise Server:

**1**   Insert and mount the Installation CD:

```
Red Hat—mount /dev/cdrom /mnt/cdrom
SuSE—mount /dev/cdrom /media/cdrom
```

**2**   Install the module RPM:

```
rpm -ivh 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**   Once the installation is complete, verify if the adpinv.ko is available in the following location.

```
/lib/modules/current-kernel/kernel/drivers/scsi
```

**4**   Now restart the system to successfully load the driver packages.

# Configuring the Controller Utility

# 7

**In this chapter...**

This chapter explains how to configure the BIOS settings.

Before you begin, familiarize yourself with the controller's physical features. See Chapter 2, *About SATA/SAS Controllers*.

# Using the Adaptec Configuration Utility

The Adaptec Configuration Utility (ACU) allows you to manage and configure the Adaptec SATA/SAS controller and the respective devices that are connected to it.

When the system is detecting the SATA/SAS controller, it will display the 16-digit Adapter WWN.

**Note:** The controller can not be used if the WWN address is not displayed.

Once the WWN address appears, press the <Ctrl> and <A> keys simultaneously when prompted to access the Adaptec SATA/SAS BIOS.

**Note:** Use the arrow keys to highlight an item and then press <Enter> to select an option. To return to the previous menu, press <ESC>.

# Starting Adaptec Configuration Utility

To start the Adaptec Configuration Utility,

**1**   Turn on your computer and press **Ctrl+A** to run the ACU.

**2**   The Adaptec SATA/SAS controller that are available in the system are displayed as shown below:



**3**   In the ACU menu, use the arrow key to select the appropriate controller and press <Enter>.

## Exiting Configuration Utility

Once you have completed the configuration, press <ESC> to exit and click **Yes** to save the changes.  The system will then reboot.  If you do not wish to save the changes, click **No** to go back to the initial menu of the CTRL+A utility.

## Using the Controller Configuration Utility

The following options are displayed in the ACU.

- **Controller Configuration** - Using the Controller Configuration, you can modify the Controller settings.
- **Disk Utilities** - Using the Disk Utility, you can verify, format, or locate drives, set a bootable device, set the PHY rate, rewind a tape device, and locate a slot in an enclosure.
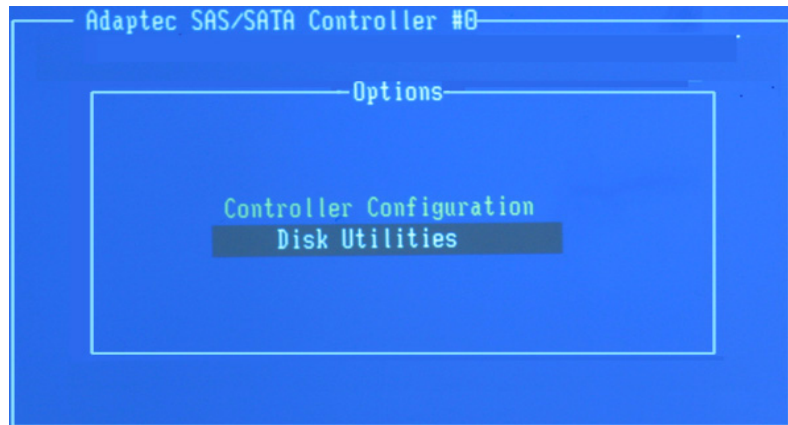
The Controller Configuration menu displays the following options:

- Controller Properties
- Controller Configuration
- PHY Configuration
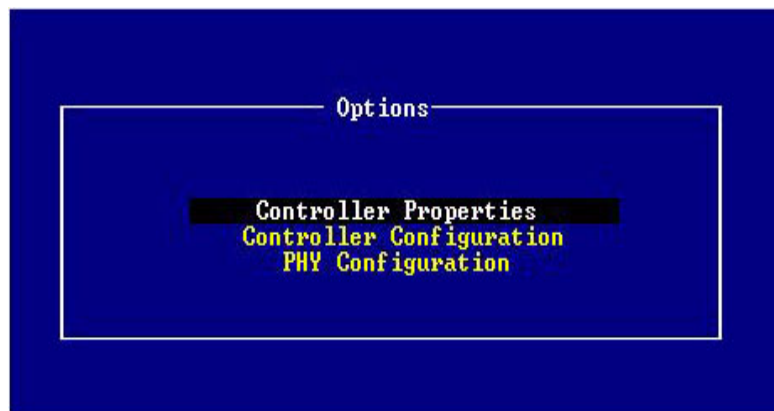


## Viewing the Controller Properties

Use the arrow keys to select Configuration Utility and press <Enter> to access the Controller Properties.

The Controller Properties displays the following information.

- PCI slot number in which the SATA/SAS controller is connected

- Interrupt (IRQ) channel and I/O Port address of the selected controller

- Device ID and the Serial Number of the SATA/SAS controller

- Worldwide name of the controller

- ASIC Revision number of the controller

Note: The Controller Properties Information can not be modified.

## Setting the Controller Configuration

Use the arrow keys to select Configuration Utility and press <Enter> to access the Controller Configuration.



The Controller Configuration displays the following default settings.

- Runtime BIOS - Enable

    If the **Runtime BIOS** is set to **Disable**, it will not discover the devices that are connected to the controller, and does not hook the INT13, INT19 handler. Selecting the option **Enable** will discover all the devices that are connected to the controller and hooks the INT13, INT19 handler.

- BBS Support - Controller

  If the **BBS Support** is **Controller,** the system will boot from the Controller, and set the disk that you wish to boot as **Set Bootable.** If you want to boot the system from one of the devices connected, then select the option **Device** in the **BBS Support.**

- POST Banner Display - Enable

  If the **POST Banner Display** is **Enable,** then every time the system boots a POST message is displayed which show the controller information, the number of physical devices that are connected to the system etc. To disable the POST messages, select the option **Disable.**

- CTRL-A Message Display - Enable

  If the **CTRL+A Message Display** option is **Enable,** it will display the CTRL A message during the POST operation. Selecting the option **Disable** will stop the CTRL+A message from being displayed during the POST operation.

- PD Display During POST - Enable

  If the **PD Display During POST** option is **Enable,** it will display all the physical devices that are connected to the system during the POST banner display. Selecting the option **Disable** will stop the physical devices from being displayed during the POST Banner Display.

- Bootable DVD/CD-ROM Support- Enable

  If the **Bootable DVD/CD-ROM Support** option is **Enable,** it will boot from either DVD/CD-ROM. Selecting the option **Disable** will not boot from DVD/CD-ROM.

**Note:** To load the default settings, press <F6>.

## Viewing the PHY Configuration

Use the arrow keys to select Configuration Utility and press <Enter> to access the PHY Configuration.
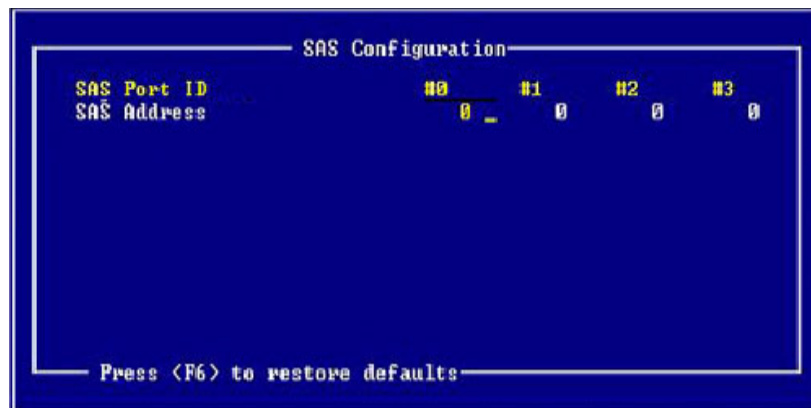


You can set the SAS address for each of the 4 PHYs separately. Use the arrow keys to select the required values and then <Enter> to confirm the changes.

**Note:** To load the default settings, press <F6>.

# Using the Disk Utilities

The Disk Utilities allow you to verify, format, or locate a drive, and set a disk as bootable device.

## To access the Disk Utilities

Press CTRL + A to access the Adaptec Configuration Utility. From the **Options** menu, select **Disk Utilities.** The disks/devices that are connected are displayed in the Disk Utilities.

```
─── Select SAS/SATA Disk and press <Enter>───
Device   Box   Slot       Model                    FW Rev
  #00     FF    FF     SEAGATE ST3146854SS         0003
  #01     FF    FF     MAXTOR  ATLAS10K5_300SAS    BK00
 +#02     FF    FF     Maxtor 7L250S0              BACE1C90
  #03     FF    FF
  #04     FF    FF            Format Disk
  #05     FF    FF         Verify Disk Media
  #06     FF    FF           Indicate LED
  #07     FF    FF        Write Cache Setting
                           Connection Rate
                             Set Bootable

   + Denotes bootable drive, % denotes formatting in progress
```
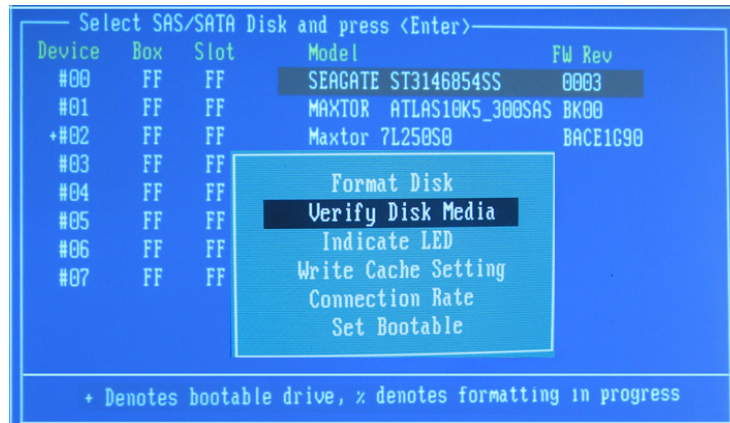
The following operations can be performed in the Disk Utility.

**1**   Format a Disk

**2**   Verify a Disk

**3**   Locate a Disk

**4**   Enable/Disable the Write Cache setting

**5**   View the PHY connection rate for the Disk

**6**   Set a Bootable Device

**7**   Rewind/Eject for Tape Devices

**8**   Locate a SES Slot for Enclosures

**Note:** The Rewind and Eject option can be accessed when you click on any of the Tape Device.

### Formatting a Disk

**1**   Select the disk you want to format and press <Enter>.

**2**   Now select **Format Disk** and press <Enter>.

**3**   A confirmation window appears. Click **Yes** to format or **No** to cancel.

**Note:** The device that is ready to format is indicated with "%" symbol.

### Verifying a Disk

**1**   Select the disk you want to verify and press <Enter>.

**2**   Now select **Verify Disk Media** and press <Enter>.

**3**   A confirmation window appears. Click **Yes** to verify the disk or **No** to cancel.

## Locating a Disk

**1**   Select the disk you want to locate and press <Enter>.

**2**   Now select **Indicate a LED** and press <Enter>. The following options are displayed.

●   **Blink LED on all drives** - Use this option to blink on all drives to ensure that the drives are working properly.

●   **Blink LED on specific drive** - Use this option to locate a specific drive.

## Enabling/Disabling a Write Cache

**1**   Select the device/disk and press <Enter>.

**2**   Now select **Write Cache Setting** and press <Enter>.

●   Select **Enable** to enable the Drive Write Cache and improve I/O performance.

●   Select **Disable** to disable the Drive Write Cache and minimize I/O performance.

## Viewing the PHY connection rate for the Disk

**1**   Select the device/disk and press <Enter>.

**2**   Now select **Connection Rate** and press <Enter>.

**3**   The PHY connection rate of the device/disk is displayed.

## Setting a Bootable Device

**1**   Select the device you wish to mark as a bootable device and press <Enter>.

**2**   Now select **Set Bootable** and press <Enter>.

●   Select **Enable** to boot from the device.

●   Select **Disable** to disable the marked bootable device.

**Note:** You can set only one device as a bootable device.

```
┌── Select SAS/SATA Disk and press <Enter>──────────┐
│ Device   Box    Slot       Model              FW Rev   │
│   #00     FF     FF     SEAGATE ST3146854SS    0003     │
│   #01     FF     FF     MAXTOR  ATLAS10K5_300SAS BK00   │
│  +#02     FF     FF     Maxtor 7L250S0         BACE1G90 │
│   #03     FF     FF     No Device                       │
│   #04     FF     FF     No Device                       │
│   #05     FF     FF     No Device                       │
│   #06     FF     FF     No Device                       │
│   #07     FF     FF     No Device                       │
│                                                         │
│                                                         │
│   + Denotes bootable drive, % denotes formatting in progress │
└─────────────────────────────────────────────────┘
```

**3** The device that is set as a bootable device is indicated with "+" symbol in the screen.

**Note:** The selected bootable device will be the boot device when "BBS Support" has been set to "Controller" on the "Controller Configuration" menu. See

If the **BBS Support** option is set to **Device,** the system BIOS can boot from any of the attached SATA/SAS devices.

## Locating a SES Slot for Enclosures and Expanders

**1** Select the SES device and press <Enter>. The following option appears.

● **Blink LED on all slots** - Use this option to blink on all slots to ensure that all the slots in the Backplane and Expanders are working properly.

● **Blink LED on specific slot** - Use this option to locate a specific slot.

## Rewinding/Ejecting for Tape Devices

Select **Rewind** to rewind the tape and select **Eject** to eject the tape.

# Enclosure Management Support   8

This chapter discusses the Enclosure Management support for Adaptec SATA/SAS 1405 Controller when connected to Internal Enclosures or Backplanes.

The Enclosure Management support is provided in both BIOS and Driver. In the BIOS, it helps you to associate the slot numbers displayed in Ctrl+A utility with the physical slot numbers on the backplanes using the Indicate LED. See *Using the Disk Utilities* on page 35 In the Drivers, it helps you to identify the faulty drives by displaying failure LEDs.

# Connecting Drive LED Control Cables

Drive LED Control Cables helps you to detect/verify the faulty drives and slots in the Backplane or Enclosure. Using an internal SATA fan-out cable, connect the controller to the SATA/SAS of the backplance. Ensure that the first data connector of the fan-out cable is connected to the port 0 of the backplane and rest of the other connectors respectively. Note that the port 0 starts at the bottom of the connector.

Note: Depending on the jumper settings, the Backplane can be configured to use either I2C or SGPIO.

Internal Mini SAS x4 (SFF-8087) to SATA fanout cable with sideband - connects controller to a maximum of four SATA devices or a backplane.
Note: The sideband (SFF-8448) connector is used to connect with a managed backplane or enclosure.

The four data connectors in the fan-out end must be connected to the SATA/SAS ports present in the enclosure. The sideband connector is connected to the I2C interface of backplane, and this helps in enabling the function of drive LEDs.

Internal Mini SAS (SFF-8087) to SAS x4 (SFF-8484) - connects to SATA/SAS backplane

Using Mini SAS (SFF-8087) cable, the SATA/SAS controller is connected to the Internal Enclosure or Backplane. This has a built-in I2C connector, which helps in enabling the function of drive LEDs.

# Behavioral Pattern of Drive LED

● Initialization of drives - If a SAS drive is present, the LED will blink continously till the I/O operation is initiated. If a SATA drive is present, the LED glows once and then stops.

● Read/Write operation in the disk -If a SAS drive is present, the LED will blink continously till the I/O operation is complete. If a SATA drive is present, the LED will glow till the I/O operation is complete.

● Faulty conditions - If you encounter any errors such as bad sectors or drive failure, the Fault LED will glow red untill the problem is rectified.

● Locate Disk and Slots - If you want to locate any disk/slot using the controller's configuration utility, the Indicate LED option allows you to blink the LED on the particular disk/slots. See *Using the Disk Utilities* on page 35

# Solving Problems

# 9

**In this chapter...**

This chapter provides basic troubleshooting information and solutions for solving your SATA/SAS controller problems.

# Troubleshooting Checklist

If you encounter difficulties installing or using the SATA/SAS controller, check these items first:

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

● Try disconnecting and reconnecting devices from the SATA/SAS controller.

● Check if the SATA/SAS controller is installed in a compatible expansion slot. To double-check the bus compatibility of your controller, see *SATA/SAS Controller Features* on page 12. To double-check the PCIe slot compatibility of your system/motherboard, refer to the system's documentation.

● Ensure that the SATA/SAS controller is firmly seated and secured in the PCIe expansion slot.

● If the SATA/SAS controller is not detected during system boot, try installing it in a different expansion slot. See *Installing the SATA/SAS Controller* on page 18 for instructions.

● Did the driver install correctly?

● 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 and the Adaptec Support Knowledgebase at ask.adaptec.com.

# Using the Adaptec Flash Utility for DOS

# 10

## In this chapter...

This chapter describes the Adaptec Flash Utility (AFU) and explains how to update, save, and verify the SATA/SAS controller's BIOS.

⚠ **Caution:** Although the AFU contains safeguards to prevent from accidentally damaging the SATA/SAS controller's flash contents, it is important to use the AFU carefully to avoid rendering your SATA/SAS controller inoperable. Adaptec recommends that only the advance user must use the AFU.

## Introduction

The AFU is a DOS utility, which allows you to update, save and verify the SATA/SAS controller's BIOS.

## System Requirements

The following are the requirements of AFU:

● MS–DOS version 5.0 or later. It cannot run from a DOS command prompt window.

● At least 8 MB of extended memory.

## Compatibility Information

The AFU has the following compatibility issues:

● Supports HIMEM.SYS and is 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

Before running the AFU, the following tasks must be completed.

● *Obtaining the BIOS Kit*

● *Creating the BIOS Kit on Floppy Disks*

### Obtaining the BIOS Kit

The SATA/SAS controller BIOS can be acquired on any one of the following:

● SATA/SAS Installation CD—Contains the AFU executable (AFU.exe) and a separate flash image. The flash image may comprise multiple User Flash Image (UFI) files.

● Adaptec Web site (www.adaptec.com)—Go to this website to download the updated version of AFU.

### Creating the BIOS Kit on Floppy Disks

To create the BIOS Kit floppy disks:

**1** Create a bootable MS–DOS floppy disk and copy these files to it:

● AFU.exe

● ASx*xxx*01.ufi

where *xxxx* is the model number of the controller.

Note: Most of the controller model numbers have a suffix. Before copying, check if the appropriate .ufi file is used.

# Running the AFU

The AFU can be executed in two ways:

● *Running the Menu-Based AFU*

● *Running the AFU from the Command Line*

## Running the Menu-Based AFU

The easiest way to run the AFU is to use its GUI. If you prefer to run the AFU from the command line, see *Running the AFU from the Command Line*.

To access the AFU:

**1** Shut down the operating system and reboot to DOS from a bootable MS-DOS floppy disk or from a DOS partition on a bootable drive.

Note: When updating the SATA/SAS controller flash, controller activity is not possible. To use the SATA/SAS controller, complete the flash operation and restart the computer.

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

The AFU's main menu is displayed.

**3** From the **Select Controllers** option, select the Adaptec SATA/SAS controllers to be flashed. If there is a single controller, the system automatically selects the specified controller. If there are multiple controllers, use the spacebar and arrow down to select the appropriate controller and press **Enter**.

**4** From the **Select and Operation** option, select any one of these options to follow the on-screen instructions.

● **Update flash image** - Updates all the flash components on a SATA/SAS controller with the flash image data from a User Flash Image (UFI) file. The AFU updates the SATA/SAS controller's flash by reading UFI files and writing them to the controller's flash components.

Note: The UFI includes the SATA/SAS controller's type, thereby ensuring that the AFU uses the appropriate file.

● **Save flash image** - Saves the contents of a SATA/SAS controller's flash in a UFI file.

● **Verify flash image** - Reads the contents of a SATA/SAS controller's flash components and compares it to the contents of the UFI file.

● **Display flash information** - Displays version information about a SATA/SAS controller's flash components.

● **List** - Lists all supported SATA/SAS controllers detected in your system.

## Running the AFU from the Command Line

At the DOS command prompt (typically A:\>), type AFU followed by a command and any switches. The AFU commands are summarized in an alphabetical order.

## AFU Commands

You can manage the SATA/SAS controller's BIOS using these commands:

- *HELP* (next section)

- *LIST* on page 46

- *SAVE* on page 46

- *UPDATE* on page 47

- *VERIFY* on page 48

- *VERSION* on page 48

## HELP

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

### Examples

The following are the examples of command syntax that will display the help:

```
A:\> AFU HELP

A:\> AFU /?
```

## LIST

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

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

### Example

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

```
A:\> AFU LIST

Adaptec Flash Utility V1.0
(c)Adaptec Inc. 1999-2008. All Rights Reserved.
Controllers Detected and Recognized:
Controller #0 (03:01:00) ASC-1045/1405
```

## SAVE

The SAVE command saves the contents of a SATA/SAS controller's flash in a UFI file. The name of the UFI file is based on the SATA/SAS controller type and it cannot be modified.

### Command Syntax

The command syntax for the SAVE command is as follows:

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

### Command Switches

The following switches are available:

- /C *<Controller ID>* is the SATA/SAS controller(s) IDs representing the set of controller(s) on which the command can be performed. By default, the AFU value set is Controller 0.

The default value 0 indicates that there are multiple SATA/SAS controllers in the system, and the values can be modified whenever needed.

- /C 0 specifies that there is a single SATA/SAS controller ID, for example:`/C 0`

- /C 0, 2 specifies that there are multiple IDs separated by commas, for example: `/C 0,2`

- ALL represents that there are all SATA/SAS controllers.

**Note:** If you are using multiple SATA/SAS controllers, specify the controller by using the /C switch; otherwise the AFU displays an error message and the application is closed. You cannot select ALL SATA/SAS controllers when you define SAVE.

- /D <*UFI File Path*> specifies the path (drive and directory) where the UFI files are located. If you do not specify the /D switch, the AFU tries to search and create the UFI files in the default location.

**Note:** The path of the UFI file must be specified in the default location. The UFI filenames are predefined, based on the SATA/SAS controller type.

### Examples

The below example indicates that the AFU saves the flash contents from Controller 0 to a UFI file in the current default drive and directory:

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

The below example shows that the AFU saves the flash contents from Controller 1 to a UFI file in C:\UFI_FILES.

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

### UPDATE

The UPDATE command updates a SATA/SAS controller's flash components from the flash image data in to the controller. The UPDATE command is used to update a single SATA/SAS controller's flash components or multiple SATA/SAS controllers.

You must restart the computer following an UPDATE command.

### Command Syntax

The command syntax for the UPDATE command is as follows:

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

### Command Switches

For details on the /C and /D switches, see *SAVE* on page 46.

### Examples

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

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

```
Adaptec Flash Utility V1.0
(c)Adaptec Inc. 1999-2008. All Rights Reserved.
Updating Controller 0 (ASC-1045/1405)
Reading flash image file (Build 0018)
AFU is about to update BIOS on controller(s) Adaptec ASC-1045
***PLEASE DO NOT REBOOT THE SYSTEM DURING THE UPDATE***
This might take a few minutes.
Writing ASC-1045/1405 Flash Image to controller 0...OK.
Please restart your computer for the new BIOS changes to take effect.
```

### VERIFY

The VERIFY command compares the contents of the flash components on a SATA/SAS controller to the corresponding image in a UFI file, and determines whether the SAS controller's flash components are up-to-date.

### Command Syntax

The command syntax for the VERIFY command is as follows:

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

### Command Switches

For details on the /C and /D switches, see *SAVE* on page 46.

### Example

The below example shows a typical system response after a VERIFY command is performed:

```
A:\> AFU VERIFY /C 0
Adaptec Flash Utility V1.0
(c)Adaptec Inc. 1999-2008. All Rights Reserved.
Reading flash image file (Build 0018)
Controller #0: ASC-1045/1405
File: Checksum: 642C [VALID] (Build 1406)
Verified Successfully
```

### VERSION

The VERSION command displays the version information about the flash components on a SATA/SAS controller.

### Command Syntax

The command syntax for the VERSION command is as follows:

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

### Command Switches

For details on the /C switch, see *SAVE* on page 46.

### Example

The below example displays the version information about all supported SATA/SAS controllers:

```
A:\> AFU VERSION /C 0
Adaptec Flash Utility V1.0
(c)Adaptec Inc. 1999-2008. All Rights Reserved.
Version Information for Controller #0 (ASC-1045/1405)
ROM: Build 0018 [VALID]
```

## Updating Flash Using AFU Command Line

This section provides step-by step instructions to update the flash.

**1**  Create the BIOS kit on floppy disks (see page 44).

**2**  Power off your computer and insert the AFU floppy disk, and then power on your computer.

 If the computer has not been set up to boot from the bootable floppy disk, enter the system setup utility to change the setting.

**3**  If there are multiple controllers and the specified controller update is not known, type AFU LIST and  press **Enter**. Then, go to next step.

**4**  At the DOS command, type AFU followed by a command (see page 45) and any one of the relevant switches you want.

**5**  Update the flash using the relevant instructions that suits your requirement.

 ● **To update a single** SATA/SAS **controller**:

 AFU UPDATE /C *<cont_number>*

 Where *<cont_number>* is the number of the SATA/SAS controller whose BIOS you want to update. For example, to upgrade the Controller 0, type AFU UPDATE /C 0

 ● **To update multiple** SATA/SAS **controllers**:

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

 Where *<controller_number_a>* and *<controller_number_b>* is the numbers of the Adaptec SATA/SAS controllers of the BIOS you want to update. For example, to upgrade controllers 0, 2, and 3, type AFU UPDATE /C 0, 2, 3.

 ● **To update all** SATA/SAS **controllers simultaneously**:

 AFU UPDATE /C all

**6**  The AFU reads the disk and updates the flash.

# Introduction to SAS

# A

**In this chapter...**

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 Appendix

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

*SAS devices* collectively refers to end devices and expander 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*, 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 controllers 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. For more information, see *SAS Expander Connections* on page 54.

Although you can use both SAS and SATA disk drives in the same *SAS domain*, 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 next section). Link speed is 600 MB/sec in full-duplex mode. A SAS controller with eight links has a maximum bandwidth of 4800 MB/sec in full-duplex mode.

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

To compare SAS to parallel SCSI, see page 55.

# 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 which contain *phys* (see next section), and each phy contains one transmitter and one receiver (one transceiver*)*. A phy can belong to one port only.
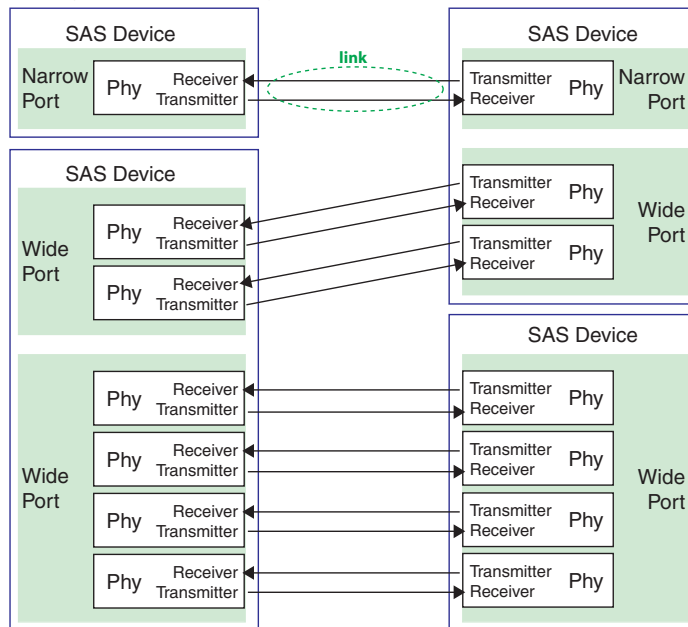


# What's a Phy?

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 53).

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 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 53), and all the phys in a port share that same SAS address.

SAS controller port options vary. A SAS controller 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 supports the power and signal line cable. It's what you plug a SAS cable into, or the end of the SAS cable that's being plugged in.

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

A single SAS device may have one or more connectors. You can use a single SAS connector to inter-link more than two SAS devices. For example, in the figure on page 52, the 4-wide internal SAS connector forms links with four independent disk drives.

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.

## What do SAS Cables Look Like?

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

For an example of some internal SAS or mini-SAS cables and an external SAS cable, see *Selecting Disk Drives and Cables* on page 19.

## How are Disk Drives Identified in SAS?

In the BIOS and in the management utilities, disk drives are identified with numbers in this format:

XX:YY:ZZ

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

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

# What are the SAS Connection Options?

You can connect end devices to each other through direct cable connections and through backplane connections. When you use one or more expander devices (see page 54), you can create large configurations.

### Direct-Attach Connections

In a direct-attach connection, SAS or SATA disk drives are connected directly to a SAS controller with SAS cables. One disk drive is connected to one SAS connector with one SAS cable or multiple disk drives are connected to one SAS connector with one fan-out cable. The figure on page 20 shows an example of direct-attach connections.

The number of direct-connected disk drives is limited to the number of phys supported by the SAS controller.

Note: There may be multiple phys within a single connector. See page 53.

### Backplane Connections

In a backplane connection, disk drives and SAS controllers are connected to and communicate with each other through a system backplane. The figure on page 20 shows an example of backplane connections.

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 SATA/SAS Controllers* on page 11 for your SATA/SAS controller Activity LED connections and locations.

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 up to nine Adaptec S50 enclosures to a single SAS controller 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 22), support large configurations of SAS end devices, including SAS controllers and SAS and SATA disk drives. With expander devices, you can build large and complex storage topologies.

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

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

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

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

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



**SAS Domain**
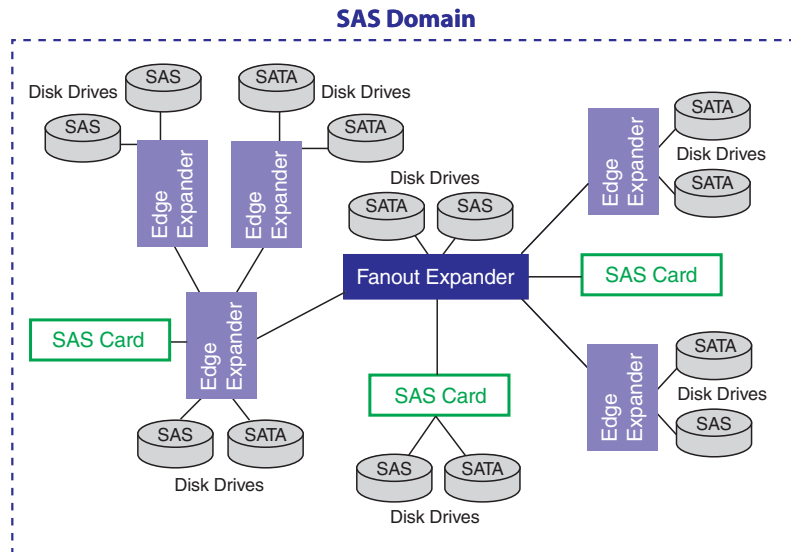
## How is SAS Different from Parallel SCSI?

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

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

The following 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 600 MB/sec per phy when in full-duplex mode |
| Supports SCSI devices only | Supports SAS and SATA disk drives simultaneously |
| Up to 16 devices per SCSI channel | More than 128 disk drives per SAS controller, using an expander (see page 54) |
| 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 |

| Parallel SCSI | Serial Attached SCSI |
|---|---|
| Requires bus termination | Requires no bus termination |
| Standard SCSI connectors | SAS connectors (see page 19) |

# SAS Controller LED and I2C and SGPIO Connector Reference

**B**

**In this appendix...**

This chapter provides an activity LED and I2C and SGPIO connector reference for Adaptec SATA/SAS controllers.

## Adaptec 1045 LED Connector Specification

| 2259500-R | ASC-1045 ROHS SINGLE |
|---|---|

- **Adaptec 1045 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

J1

| Pin Number | Signal | Description |
|---|---|---|
| 2 | BUSYLED- | Aggregate Cathode |
| 1 | +3.3V | Aggregate Anode |

**Note:** Aggregate LED signals only. There is *no* I2C function on this controller as all ports are external.

## Adaptec 1405 LED and I2C and SGPIO Connector Specification

| 2256100-R | ASC-1405 ROHS Kit |
|---|---|
| 2256000-R | ASC-1405 ROHS SINGLE |

- **Adaptec 1405 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

J1

| Pin Number | Signal | Description |
|---|---|---|
| 2 | BUSYLED- | Aggregate Cathode |
| 1 | +3.3V | Aggregate Anode |

**Note:** Aggregate LED signals only. I2C signals are contained within the side band signals of the SFF-8087 connector.

### SFF-8087 I2C Connector J7

| Pin Number | Signal | Description |
| --- | --- | --- |
| B8 | I2C_CLK | SB0 - 2W_SCL |
| B9 | I2C_DATA | SB1- 2W_SDA |
| B10 | GND | SB2 - Ground |
| A9 | GND | SB3 - Ground |
| A10 | RST_OUT | SB4 - Reset |
| A11 | BKPL_ADR | SB5 - Backplane Address |
| B11 | CTRL_ID | SB6 - Controller Type |
| A8 | BKPL_ID | SB7- Backplane Type |

### SFF-8087 SGPIO Connector J7

| Pin Number | Signal | Description |
| --- | --- | --- |
| B8 | S_CLK | SB0 - SClock |
| B9 | S_LOAD | SB1- SLoad |
| B10 | GND | SB2 - Ground |
| A9 | GND | SB3 - Ground |
| A10 | SDATA_OUT | SB4 - SDataOut |
| A11 | SDATA_IN | SB5 - SDataIn |
| B11 | CTRL_ID | SB6 - Controller Type |
| A8 | BKPL_ID | SB7- Backplane Type |

# Adaptec 1405 I2C Connector Specification

- **Adaptec 1405 I2C Board Connector:** Molex 22-43-6030 or equivalent

- **I2C Mating Cable Connector:** Molex 22-43-3030 or equivalent

### J4

| Pin Number | Signal | Description |
| --- | --- | --- |
| 1 | I2C_DATA | I2C_Data |
| 2 | GND | Ground |
| 3 | I2C_CLK | I2C Clock |

**Note:** I2C signals are contained within the side band signals of the SFF-8087 J7 connector.

# Safety Information

**C**

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

**D**

**In this chapter...**

## Environmental Specifications

| | |
|---|---|
| Ambient temperature without forced airflow | 0°C to 55°C |
| Relative humidity | 10% to 90%, noncondensing |
| Altitude | up to 3,000 meters |

**Note:** Forced airflow is recommended, but not required.

## DC Power Requirements

| PCIe | DC Voltage | 3.3V @ 1.4 A (4.62W) typical |
|---|---|---|

# Glossary

## A

**activity**
See *task*.

**AFU**
Adaptec Configuration Utility. An application used to update, save and verify the SATA/SAS controller's BIOS.

**ATA**
AT Bus Attachment. Standard parallel interface to IDE hard disks typically used in desktop computers and some entry-level servers. Serial ATA (SATA), is a successor to parallel ATA, which is sometimes referred to as PATA.

## B

**bad segment**
Segment that is in an unknown state.

**bus**
See *channel*.

## C

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

**capacity**
Total usable space available in megabytes or gigabytes.

**channel**
Any path, or bus, used for the transfer of data and the control of information between storage devices and a controller. For SATA channels, each channel has a single drive capacity.

### check point
A feature that enables you to exit the ACU when an operation is in progress and be able to continue without interruption. The driver then resumes the operation from where the BIOS left off and the BIOS resumes the operation where the driver left off.

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

### concatenation
Joining of physical or logical drives in sequential order.

### configure
Process of preparing a disk for use by the controller. When a disk is configured, the controller records the signature on the disk.

# D

### disk
Physical disk drive. Randomly accessible, rewriteable data storage device. Also called hard disk.

### disk ID
Unique disk identifier that consists of the channel number, SATA ID. For example, (channel:ID:LUN) 1:04:0. See *channel*.

### drive LED
Disk indicator LED that illuminates during read or write operations.

# E

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

### event log
File used to maintain information about prior controller activities or errors.

### event notification
Process for transmitting events.

# F

### foreign disk
Disk that has previously been configured on another Adaptec SATA/SAS controller. The SATA/SAS signature on the disk allows the SATA/SAS controller to identify whether or not the disk was configured on the controller it is currently connected to.

# H

### hard disk drive
Basic unit of nonvolatile, nonremovable, magnetic storage media. See *disk*.

### hot spare
A spare hard disk that automatically replaces a failed hard disk on any array associated with any HBA.

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

# I

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

### initialize
See *configure*.

# L

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

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

# M

### monitoring
Process of receiving, displaying, and logging system events.

# P

### partition
A section of a disk storage device created by the operating system disk management program, in which data and/or software programs are stored. Computers have a primary operating system partition that contains the special files needed to boot the computer. Each operating system partition is assigned a unique drive letter, such as C or D. A single disk device can have multiple partitions.

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

# R

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

# S

### Serial Attached SCSI (SAS)
An evolution of parallel SCSI to a point-to-point serial interface

### Serial ATA (SATA)
A successor to ATA that uses a serial, instead of parallel, interface.

### signature
The area on each disk reserved for use by the SATA/SAS controller.

### simple volume

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

## T

### task

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

## V

### volume

See *simple volume*.

# Index

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