Adaptec SCSI RAID

Storage Management Software

User's Guide

adaptec®

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Storage Manager on ROM

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Overview

Storage Manager on ROM (SMOR) is a BIOS-based setup utility that lets you configure your Adaptec SCSI RAID controller without loading an operating system and using Storage Manager. You can also use SMOR to perform basic array configuration. SMOR makes the initial setup of your SCSI RAID controller and RAID storage easier and faster.

To configure your hardware and create disk arrays when Storage Manager is not available, run SMOR during the system boot. This is especially useful for a new system where you need to create disk arrays before you install the operating system.

After your storage subsystem is configured, install your operating system according to the appropriate procedure in the *Installation Guide* for your controller. For access to all of the advanced features of your controller, install the version of Storage Manager specific to your operating system.

Follow these steps to run SMOR and configure a new system:

1. Press **Ctrl+A** when the Adaptec BIOS message appears during boot to start SMOR.
2. Inspect the hardware configuration as shown by SMOR.
   a. Verify that all peripheral devices and controllers are shown. If any devices are missing from the display, exit SMOR and check your hardware connections.
   b. View the Information window for each controller to verify that all installed expansion and memory modules are shown. Note the IRQ and Address displayed in the Configuration window. The IRQ and Address values may be required during installation of your operating system.
3. Create disk arrays (see *Array Operations* on page 1-21). Array groups can be created or modified at any time after system installation. However, if the boot device will be an array, that array must be created before the operating system is installed.
4. Exit SMOR when you are finished with the configuration tasks. Arrays that were created or modified start building at this time. For large arrays, this process may take several hours. You can perform other activities on the system while the build operation continues.

The array groups being built can be accessed while the build is in progress. However, access time will be slower until the build is complete.

If you have exited SMOR and you want to monitor the progress of the build operation, you can view the Array Group Information window for the array in Storage Manger. See Chapter 2, *Storage Manager* for additional information.

Keyboard Reference

The navigation keys work in a similar fashion to those of Windows Explorer. Use these keys to move around in SMOR:

Menu Control

Alt + (Menu Highlight)	Select the corresponding menu or menu item.
Enter	Initiate an action.
Up / Down Arrows	Move between menu choices.
Esc	Return to Tree View.

Left Pane - Tree View Control

Up / Down Arrows	Move between elements within the tree.
Left / Right Arrows	Scroll the tree left and right.
+	Expand the current branch, showing the devices attached to it. The element must be preceded by +.
–	Collapse the current branch. The element must be preceded by –.
Tab	Move to the right pane — Information View.

Right Pane – Information View Control

Alt + (Tab Highlight)	Select and go to the corresponding Tab Page within the information View.
Tab	Move to the next field in the window.
Shift-Tab	Move to the previous field in the window.
Space	Select or deselect an item (checkboxes or radio buttons).
Up / Down Arrows	Change a combo box value.
Esc	Return to Tree View.

Menu Reference

The SMOR Main Menu changes dynamically depending on what is selected in the tree view. The following is a complete list of possible selections. Some items may not be available depending on the device selected.

File

Read System Config	Rescan the system – unsaved configuration changes are lost.
Set System Config	Save and enable configuration changes.
Exit	Quit SMOR.

RAID

Create…	Create a new array.
Delete	Delete the currently selected array.
Rebuild	Rebuild a RAID 1, 5, 0/1 or 0/5 array.
Stop Build	Stop building or rebuilding an array.

Action

Make Hotspare	Designate the currently selected drive as a hot spare.
Remove Hotspare	Make the currently selected hot spare available for use by the operating system.
Format Drive	Low-level format a currently selected drive.
Flash HBA	Update the firmware, I_2O BIOS or SMOR image in controller ROM.
Test Alarm	Test the audible alarm on the controller.
Silence Alarm	Turn off the audible alarm on the controller.
Make Boot Floppy	Make a bootable disk that runs SMOR.

Help

About…	Display version information for SMOR.

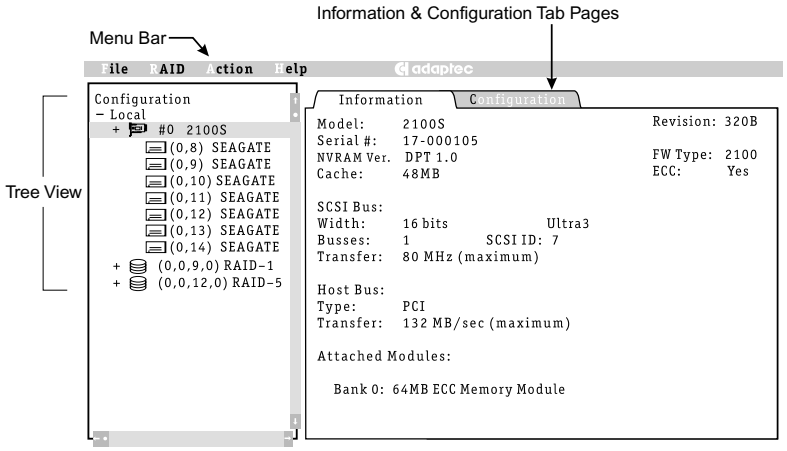
Icon Reference

SMOR uses the following icons in Tree View:

Controller | Disk | CD-ROM | Array | Tape | Other Device

Screen Layout

The SMOR interface works like the Windows Explorer tree-structured interface. The screen is divided into three major components: a menu bar across the top of the screen and two display panes below the menu bar.



The Menu Bar

To open a specific menu, press **Alt+highlighted** letter of the menu name. After a menu is open, you can select a specific menu item by pressing the key for the letter highlighted on the menu item. For example, to select the Read System Config item on the File menu, press **Alt+F** to open the File menu, then press **R** to select **Read System Config**.

Note: Depending on your configuration, not all menu items may be available. Unavailable menu items are shown in a low-contrast color.

The Left Pane – Tree View

The Tree View, displayed in the left pane, is the central control for SMOR. This view displays a tree structure that represents the organization of the Adaptec storage subsystem. This includes Adaptec controllers, storage devices, and arrays detected by SMOR. By moving the highlight with the up and down arrows, you can select items you want to view or configure. As items are highlighted, the associated information on the item is displayed in the Information View (display pane on the right side).

If an item in the Tree View is preceded by +, pressing the **Enter** or **+** key expands the tree, showing the devices associated with or attached to that item. If an item is preceded by –, pressing the **Enter** or **–** key will collapse that portion of the tree, hiding the devices under that item.

If the text for an item is larger than the width of the Tree View pane, you can scroll the pane horizontally by using the left and right arrow keys.

The Right Pane – Information View

To the right of the component tree is the Information View pane. This area displays information related to the currently selected item in the tree. The specific information displayed in the Information View varies depending on the item selected. When there are separate types of information available for the selected item, the Information View is separated into tab pages. Tab pages are generally information or configuration parameters that are related to the selected item.

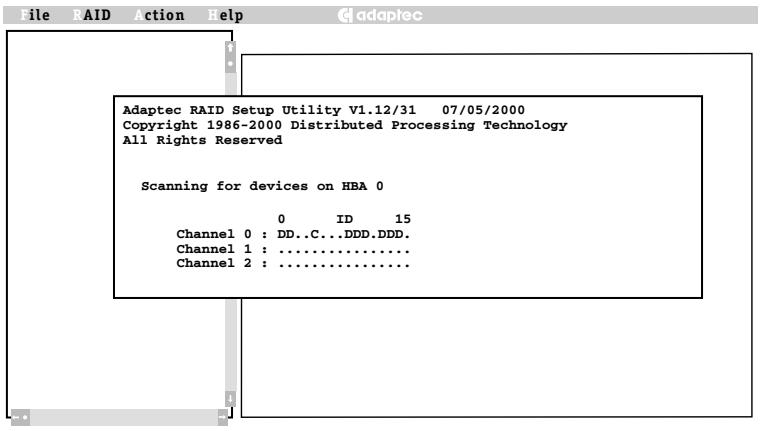
To select a specific tab page within the Information View, press **Alt+highlighted** letter on the tab. For example, to change to a controller's Configuration tab, press **Alt+C**. You can also press the Tab key when in the Tree View to move over to the currently displayed Information View tab page. On a tab page within the Information View, you can move between the items with the Tab or **Shift+Tab** keys. See the *Keyboard Reference* on page 1-3 for additional details on changing between the Tree and Information Views, using the menu bar, and navigating within the SMOR interface.

Within the Information View, select an item to configure by using the **Tab** or **Shift+Tab** keys to move the highlight to the item. Items that cannot be selected are shown in black. The way in which you change an item depends on the type of control associated with the item. Checkboxes are toggled by using the **Spacebar**. List-box items (for example, Transfer Rate) are changed using the up and down arrow keys. List box items can be recognized by the downward pointing arrow at the right of the item.

To leave the Information pane and return to the Tree View, press **Esc**. If you have changed the configuration, you are prompted: Save changes?. Press **Tab** to select Yes or No and press **Enter**.

Note: The items shown in the Information View, and the settings for those items, will vary depending on the particular type of controller, device, or array selected in the Tree View.

Running SMOR



Start SMOR by pressing **Ctrl+A** when the Adaptec I_2O BIOS message appears on the screen during the boot sequence.

The letters that appear during the initial device scan process are:

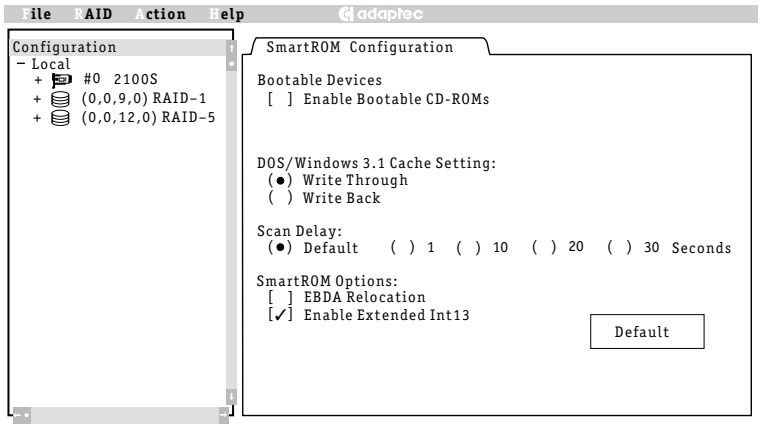
C	CD-ROM
D	Disk drive
E	Scanner, SAF-TE or intelligent RAID enclosure.
H	Hot spare drives
T	Tape device
0, 1, 5	Physical arrays identified by the RAID level

The position of a letter corresponds to the SCSI ID assigned to that device.

Information and Configuration Views

When you highlight an item within the Tree View, the corresponding Information View is displayed.

Adaptec I_2O BIOS Settings



The example above is the default Information View when SMOR starts. The settings in this view affect the Adaptec I_2O BIOS and all the Adaptec controllers in your system. To view or change these settings, highlight Adaptec Configuration in the Tree View.

Controller Parameter	Default	Optional Settings
Enable Bootable CD-ROMs	Disabled	Enabled
DOS / Windows 3.1 Cache Setting	Write Through	Write Back
Scan Delay (seconds)	1	1, 10, 20, 30
Smart ROM Options		
EBDA Relocation	Disabled	Enabled
Enable Extended Int13	Enabled	Disabled

Enable Bootable CD-ROMs

If you select **Enable Bootable CD-ROMs**, the Adaptec controller attempts to detect a bootable CD-ROM that uses the El-Torito format. This option is disabled by default, because some bootable CD-ROMs contain device-specific boot code that will not work with Adaptec controllers.

DOS/Windows 3.1 Cache Setting

This parameter determines how the controller responds to Int13 write commands under DOS and certain operating system installation programs. The default is **Write Through** to avoid problems that can occur during operating system installation if write-back caching is enabled. After the operating system is installed, you can change to **Write Back** caching for improved performance.

Change this setting back to **Write Through** during future operating system installs or upgrades to avoid problems.

Note: This cache setting has no effect on controller cache operation under Windows NT, UNIX, or NetWare.

Scan Delay

Some SCSI devices require a time interval between power on and SCSI bus reset and scan or they do not respond correctly. If devices are not displayed in the Tree View after power on, set the delay to a longer interval.

EBDA Relocation

This setting determines the way that SCSI RAID controllers handle Extended BIOS Data Area (EBDA) relocation. You can enable this feature to help avoid conflicts with other adapter cards if the controller is installed in a host system with other adapters that follow standard EBDA relocation rules.

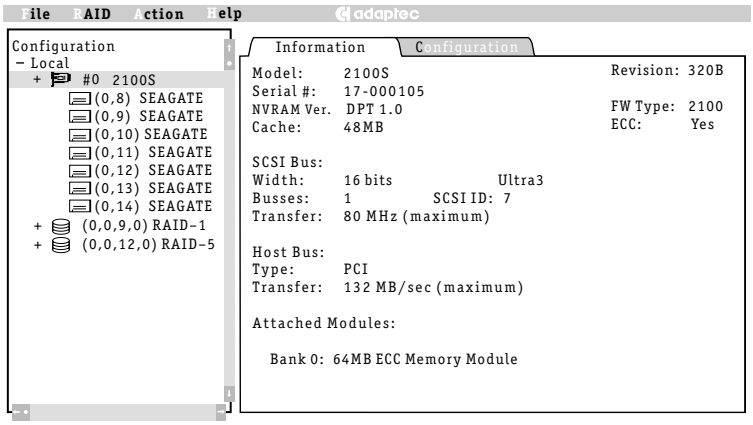
Enable Extended Int13

This setting enables extended Logical Block Addressing (LBA) for disk devices. Logical block addressing enables operating system access to disks larger than 8.6 GB. You should not change this setting.

Controller Information Windows

To view or change the configuration of an Adaptec RAID controller, highlight the controller in the Tree View. Two tabs are available: Information and Configuration.

Information Tab



The Information Tab for a controller displays general information reported by that controller. Some of the fields have special conditions:

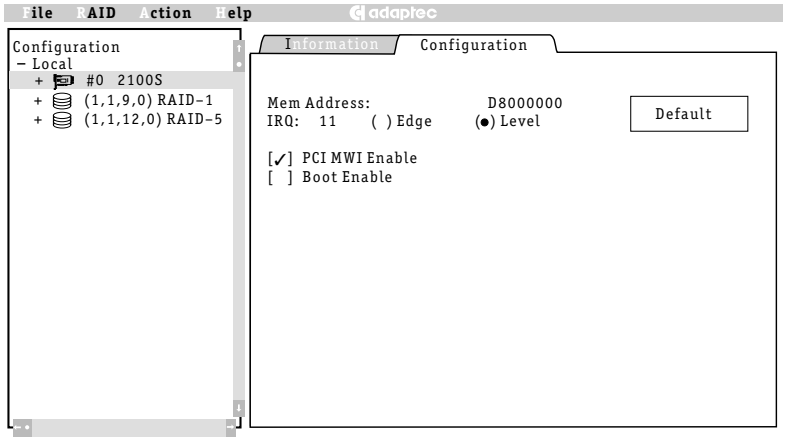
Model	Adaptec controller model ID
Serial #	Controller serial number
NVRAM Ver.	Version number for NVRAM settings.
Cache	Amount of installed cache memory
Revision	Controller firmware version
FW Type	Firmware type
ECC	Shows Yes is ECC memory is installed
SCSI Bus	
Width	Bus width: 8-bit or 16-bit
Busses	Number of busses on the controller
SCSI ID	SCSI ID assigned to controller

Transfer	Maximum possible transfer rate
Host Bus	
Bus Type	Always PCI
Transfer	Host PCI transfer rate: 132 MB / sec for 32-bit PCI bus 264 MB / sec for 64-bit PCI bus
Attached modules	Identifies installed Bus Expansion and memory modules.

Memory modules are reported as Bank *n*: *nn*MB ECC. Starting with Bank 0. ECC is displayed only when ECC memory is installed.

Note: Adaptec SCSI RAID controllers report a cache size 16 MB less than the total installed memory value because the controller uses the first 16 MB as RAM for the onboard processor.

Configuration Tab



Mem Address, IRQ

These are display only fields for information purposes. The values in the Mem Address and IRQ fields may be needed when you configure your operating system.

PCI MWI Enable

Do not change this setting unless instructed to do so by Technical Support.

Boot Enable

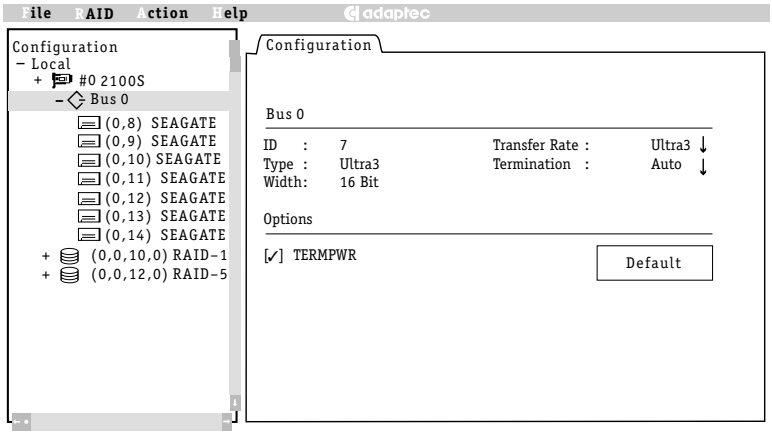
This setting lets you modify the system boot process for host systems with multiple peripheral controllers in cases where the Adaptec I_2O BIOS does not provide effective or appropriate default operation.

The setting is enabled by default. The host system will use the controller whose BIOS has the lowest address as the booting controller. Therefore, in a system with multiple controllers, you must ensure that the Adaptec I_2O BIOS occupies the lowest address if you want the Adaptec controller to be the booting controller.

In systems with multiple Adaptec SCSI RAID controllers, the Adaptec controller in the lowest PCI slot number will be assigned the lowest BIOS address, and will be the booting controller.

If you disable this option, the Adaptec controller is not used as a boot device.

Bus Configuration Tab



This tab page lets you modify the hardware parameters for the highlighted controller bus.

Select **Default** to reset the parameters on this tab to their default values.

Controller Parameter	Default	Optional Settings
ID	7	0 – 6 (SCSI)
Type	As reported	N / A
Width	As reported	N / A
Transfer Rate (in MHz for numeric values)	Maximum allowed for the controller	Ultra3, Ultra2, Ultra, 10, 8, 5 Asynchronous
Termination	Auto	On, Off, High Only
TERMPWR	On	Auto, Off

Note: Fibre Channel IDs are display only. They cannot be changed. "As reported" means that the field displays the value returned by the controller firmware.

Bus

Each peripheral bus on a controller is assigned a number. Numbering starts with 0 for the first bus, 1 for the second bus and so on.

ID

SCSI RAID controllers are configured by default at SCSI ID 7. This value should not be changed unless required for special configurations.

Type

This is the type of SCSI bus (Ultra, Ultra2, Ultra3, etc.).

Width

The width of the parallel SCSI bus (8-bit or 16-bit).

Transfer Rate

Adaptec controllers automatically negotiate with each SCSI device at power-up or reset to set the maximum SCSI transfer rate. This parameter limits the SCSI transfer rate to the value selected. This setting should not be changed except when you are troubleshooting SCSI bus errors.

Note: If setting this parameter to 5 MHz eliminates SCSI bus data errors, this is usually an indication that the SCSI bus is too long or that the bus is not terminated correctly.

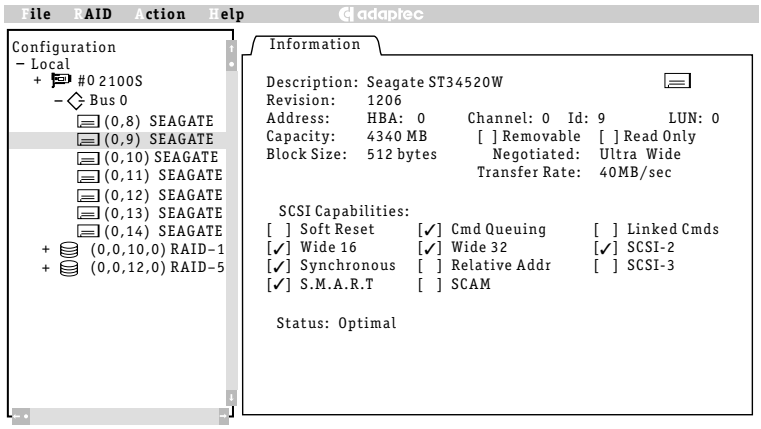
Termination

This setting controls the SCSI termination for the controller and bus. The default value (**Auto**) should not be changed, unless both internal and external cables are attached to the controller or you are using an 8-bit (Narrow) cable. Refer to the *Configuring SCSI Termination* section in the *SCSI RAID Installation Guide* for information on setting this parameter.

TERMPWR

By default SCSI RAID controllers supply termination power for other SCSI devices through the TERMPWR line on the SCSI cable.

Device Information



Individual devices are listed in the Tree View under the controller to which they are connected. Highlight a device to view its Information tab page.

The Device Information tab displays general device information and configuration. This view is divided into three parts: identification information, **SCSI Capabilities** and **Status**.

The identification section displays a general description of the highlighted device:

Description	Manufacturer name and model number as reported by the device, followed by the icon for the device.
Revision	Device firmware version.
Address	Device address in the form HBA *n*, Channel *n*, ID *n*, LUN *n*. Display contains as much information as necessary to unambiguously define the address of the device.
Capacity	Device capacity in megabytes (MB). For removable media, the reported capacity is for the currently inserted media or No Media Inserted if no media is inserted. Tape drives do not report media.
Removable Read Only	As reported by the device.

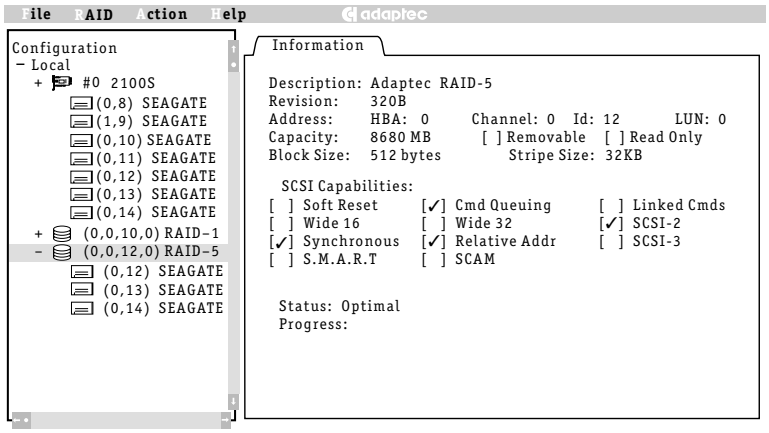
Block Size	Block size reported by device.
Negotiated	Bus speed negotiated between the device and the controller.
Transfer Rate	Maximum transfer rate for negotiated bus speed and transfer path (8-bit, 16-bit)

The SCSI Capabilities section is a list of capabilities defined in the SCSI specifications which are recognized or used by Adaptec controllers. A check mark next to an item indicates that the peripheral device supports that particular SCSI feature.

The following Status conditions can be indicated for attached devices:

Dead	Device failed to respond to controller commands. If the device becomes available, it will only change status after the system configuration is read or the host is restarted.
Failed	Drive failure occurred.
Impacted	An operation is being performed that results in performance degradation in response to server I/O requests.
Missing	Drive is physically missing or will not respond to commands on the device bus.
Optional	Device is fully functional.
Uninitialized	Drive is operational but has been initialized as part of an array.
Verify	Verify operation is being performed on the array. I/O performance will be affected.
Warning	This status indicates that failure may be imminent on a device with a S.M.A.R.T. failure prediction.

Array and Array Group Information



SCSI RAID controllers implement RAID 0, 1, or 5 disk arrays in hardware. RAID 0 arrays are composed of any combination of individual drives. RAID 1 arrays always are composed of two drives. RAID 5 arrays contain three or more drives.

After the arrays have been created, one or more arrays of the same RAID level can be combined into a multilevel RAID (see *Creating a Multilevel RAID* on page 1-23). Arrays are striped into multilevel RAIDs by the controller firmware. All the drives in an array or multilevel RAID must be attached to the same controller, and appear to the host as a single Logical Storage Unit (LSU).

The Information window for any array may be viewed by highlighting that array.

Note: Arrays do not start building until a **Set System Config** action has been performed.

The Array Information window displays general array information and hardware configuration. It is divided into three parts: identification, **SCSI Capabilities**, and **Status**.

The identification section displays a general description of the highlighted array:

Description	RAID level used for the array.
Revision	Firmware revision of the controller to which the array is attached.
Address	Array address in the form HBA *n*, Channel *n*, IN *n*, LUN *n*. Display contains as much information as necessary to unambiguously define the address of the device. *Arrays always are assigned the lowest logical address of any device in the array.*
Capacity	The usable capacity of the array in megabytes (MB). The available capacity depends upon the RAID level of that array.
Removable	As reported by the devices in the array.
Read Only	As reported by the devices in the array.
Block Size	The sector (block) size of the selected device in bytes. For disk drives, the value should be 512. *If the size is other than 512, use SMOR to do a low level format and create 512-byte sectors.*
Stripe Size	Displays the stripe size used to create the array.

The SCSI Capabilities section displays the SCSI capabilities of the array, as reported to the operating system. The capabilities reported depend on the devices that were used to create the array.

The Status field displays the current status of the array. A progress indicator (a numeric percentage of completion) can also appear if the array is building or rebuilding. See the following table for array status definitions.

Building	The array is being built.
Created	The array or device is defined but ***not*** initialized.
Dead	A write-back cache command to the array failed. This is an unrecoverable failure.
Degraded	A single drive in the array failed; array performance is degraded.
Impacted	A verification is being performed on the array; I/O performance is affected.
Optimal	The array is fully functional.
Pending	The array has been created and the build is queued on the controller, but not yet started.
Rebuilding	Data is being rebuilt onto a drive in the array.

Setting the Configuration

There are two configuration options on the File menu:

- **Read System Config**

  Causes SMOR to rescan to detect any changes in hardware configuration or status. Any changes that have been made and not saved are lost. This operation is run automatically when SMOR is started.

- **Set System Config**

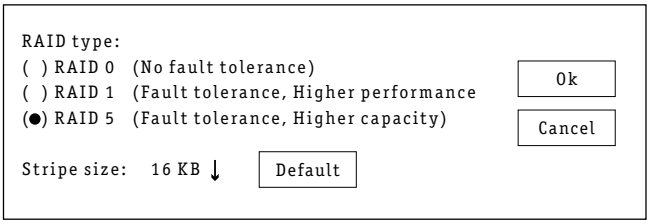
  Causes SMOR to save changes that have been made to the storage subsystem configuration in the controller memory. If any array groups or multilevel RAIDs have been created or modified, this operation causes the controller to initiate a build operation on the new groups.

Array Operations

You can use SMOR to create or manage disk arrays. The following sections describe how to use SMOR to create arrays and multilevel RAIDs, delete arrays, assign hot spare drives, and rebuild an array.

Creating an Array

1 Select **RAID–Create**.



2 When the RAID type dialog appears, select the RAID level you want to use. The Stripe size is selected automatically; however you can select a different stripe size value by highlighting the field and using the up and down arrow keys to change the stripe size.

Note: Although you can change the stripe size, Adaptec recommends using the default value. This value has been selected for optimum performance based on the type of disk array you want to create.

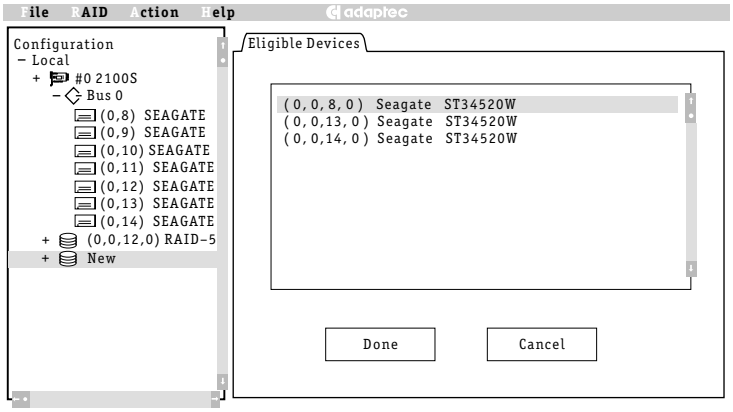
a When you are ready to proceed, select **Ok**.

b The Eligible Devices list will appear. Devices on this screen can be either individual disk drives or previously created array groups. Array groups appear in the list when you select RAID 0 and eligible array groups exist.

3 Select the devices you want to include in the array:

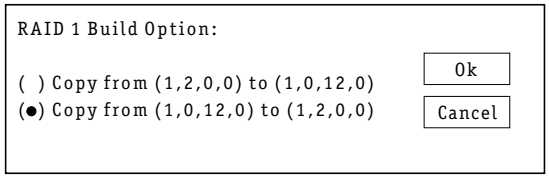
a To add devices to the array, highlight the device and press the **Spacebar**. A check mark appears next to the device to indicate that it has been selected. You might need to scroll the display down to view all eligible devices.

b To remove a previously selected device from the array, highlight the device and press the **Spacebar**.



4 When you are finished selecting drives for the new array, select **Done**.

5 If you are creating a RAID 1 array, the RAID-1 Build Option dialog appears. RAID 1 arrays are built by copying the existing data from one device to the other. Select the direction for the copy, then select **Ok**.



6 Select **File–Set System Config** to start the build process. The array you have created will begin building at this time. If you have created multiple arrays, they are built serially in the order they were defined. Alternatively, you can exit SMOR. You will be prompted to save the configuration changes. If you choose to save the configuration and have defined arrays, the build process will begin.

For large redundant arrays, the build process can take several hours to complete. You can exit SMOR and perform other activities on the system while the build continues. An array being built can be accessed during the build process.

If you exit SMOR and you want to monitor the progress of the build operation, you can use the Array Group Information window for the array in Storage Manger. See Chapter 2, *Storage Manager* for additional information.

Creating a Multilevel RAID

Creating a multilevel RAID (RAID 0/1 or 0/5) is similar to creating a normal RAID 1 or RAID 5 array group. Do the following to create a RAID 0/1 or RAID 0/5 multilevel RAID:

1. Create and build your array groups as described in *Creating an Array* on page 1-21. *Do not* initiate the build process on any arrays that you intend to use in a multilevel RAID.
2. After your initial array groups are created, select **RAID–Create** again.
3. Select **RAID 0** for the RAID type and click on **Ok**.
4. Select two or more arrays of the same type from the Eligible Devices list and click on **Done**.

Note: You cannot combine arrays that use different RAID levels.

5. Select **File–Set System Config** to begin the build process for the multilevel RAID.

The Tree View will display the multilevel RAID LSU as:

(*x*,*x*,*x*,*x*) FW RAID-0

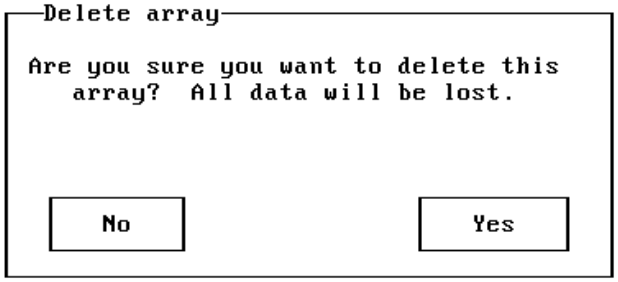
with the array groups listed where disk drives would normally be listed. Selecting an array group component will branch to the disk drives for that array group. The LSU address will be the lowest address of the array logical addresses that make up the multilevel RAID.

Deleting an Array

To delete an array, follow the steps below:

1. In the left pane, highlight the array that you want to remove, then select **RAID–Delete**.

2 You will be warned that all data will be lost. Select **Yes** or **No**. The array configuration for the devices is not deleted until you select **File–Set System Config** or exit SMOR and choose to save your changes.



Hot Spares

Any disk drive not assigned to an array or in use by the operating system can be designated as a hot spare. Hot spares automatically replace failed drives in RAID 1 or RAID 5 arrays and are not accessible by the operating system for other use. A hot spare can protect drives of equal or lesser capacity attached to any peripheral bus on the same controller.

To assign a drive as a hot spare:

1 Highlight the drive you want to use in the left pane.

2 Select **Action–Make Hotspare**.

Selecting **Action–Remove Hotspare** will cause the selected hot spare drive to be reassigned as a normal disk drive which is accessible by the operating system.

Refer to *Hot Spares* on page 2-40 for additional information.

Rebuilding a Failed Array

If a drive in a RAID 1 or RAID 5 array fails and the drive is not protected by a hot spare, use the following procedure to replace the failed drive.

1. Remove and replace the failed drive according the procedures in your hardware documentation.
2. When the failed drive has been replaced, choose **RAID–Rebuild Array** to start the rebuild process.

The status of the array will change to ***Rebuilding*** (view the Information window for that array). When the rebuild is complete, the array status will change to ***Optimal***.

Formatting a Drive

Formatting SCSI hard drives is not normally required. However, if you have a drive that was previously formatted with a sector size other than 512 bytes, SCSI RAID controllers can perform a low-level format operation and create a 512 byte / sector format.

Caution: *Do not* remove power from the drive until the format operation is completed. Doing so can cause some drives to be left in an indeterminate state that will require return to the manufacturer for repair or replacement.

Low-level formatting large capacity drives can take considerable time. Use the following procedure to perform a low-level format on a disk drive.

1. Highlight the drive to be formatted
2. Select **Action–Format Drive**.
3. Select **Ok** and confirm. To determine if the format has completed, view the Information window for that drive.

Upgrading Firmware

SMOR includes a feature that lets you upgrade the firmware on your SCSI RAID controller. This option (**Flash HBA**) is listed on the Action menu when a controller is selected in the Tree View. The **Flash HBA** option lets you install the latest Adaptec controller firmware, I_2O BIOS and SMOR utility software. All components should be updated at the same time to ensure reliable operation.

Note: There is no way to backup the controller firmware. When you upgrade to the latest firmware, the previous firmware image is replaced by the new one.

The SCSI RAID controller firmware, Adaptec I_2O BIOS and SMOR utility are contained in Flash ROM and can be upgraded by using SMOR. Each component must be upgraded as a separate operation. Adaptec periodically releases updated firmware, I_2O BIOS and SMOR software. You can obtain the latest files from your technical support representative.

- Firmware image upgrades are contained in a *xxxxxxxx*.ima file, where the 8-character file name consists of the 4-digit controller model and a 4-digit release number.
- Adaptec I_2O BIOS images are contained in a file named i2obios.xxx (where, *xxx* is the version number).
- SMOR updates are contained in a file named smor*yyyy.xxx*. Where, *yyyy* is the build number and the file extension (*xxx*) is the version number.

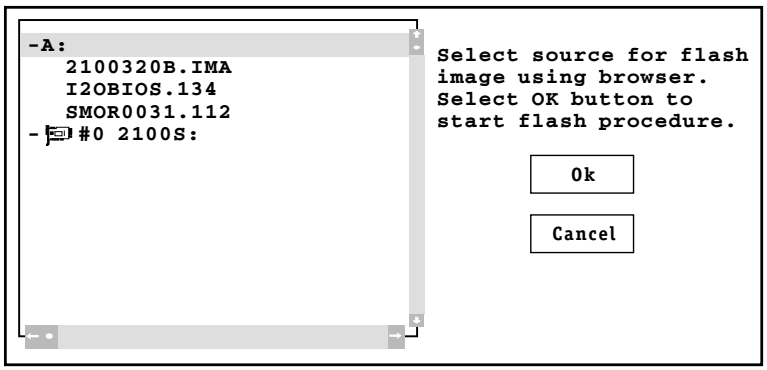
It is much easier to perform the following procedure if the image files are placed in the root directory of the source disk.

Do the following to upgrade controller firmware, I_2O BIOS, or SMOR utility:

1. Insert the disk containing the image files in the floppy disk drive of the system where the controller is installed. Skip this step if you are using image files on a system disk.

2 In the Tree View, select the controller that you want to update.

3 Select **Action–Flash HBA**. The source file browser will appear.



4 In the source file browser window, select the disk drive that contains the image files. Press **Enter** to expand the drive listing.

5 Highlight the image file you want to use and select **Ok** to update the controller flash ROM. After the controller reads the image, it will display the version number of the component you selected. Select **Yes** to confirm. A progress indicator will appear showing the progress of the different stages of the flash operation.

If the operation does not complete successfully, refer to the procedures for recovering from an incomplete or failed flash ROM upgrade in the *Troubleshooting* section of the *SCSI RAID Installation Guide*.

Creating a SMOR Boot Disk

In some situations it is not possible to access SMOR using the **Ctrl+A** key combination. The **Action–Make Boot Floppy** option lets you create a bootable floppy disk that can start a version of SMOR that is stored on the disk. This lets you use SMOR to perform configuration or troubleshooting procedures when you cannot start the utility from the controller BIOS.

The **Make Boot Floppy** menu item is available regardless of what is selected in the device tree.

To create a SMOR boot disk:

1. Insert a blank disk into the floppy disk drive.
2. Select **Action–Make Boot Floppy**.
3. When prompted, select **Yes** to create the bootable disk. A progress indicator will appear showing the progress of the disk creation. When the operation is finished, the progress meter will close.

To use the bootable disk with SMOR:

1. Insert the bootable disk you created into your floppy disk drive.
2. Power on or restart your system. The system will boot from the disk and start SMOR automatically. If the system attempts to boot from another device, you will need to change the boot order setting in your system BIOS setup. Refer to your system documentation for information about changing this setting.
3. Use this version of SMOR to perform whatever tasks are necessary to configure your storage subsystem.
4. When you are finished, remove the disk from the floppy disk drive. Select **File–Exit** to exit SMOR.

Note: Exiting will automatically restart your computer, if you leave the bootable disk in the floppy disk drive, it will restart SMOR.

2

Storage Manager

In this Chapter

Introduction

Adaptec's Storage Manager gives you complete control over your storage subsystem. You can manage your storage locally or remotely across a network.

Storage Manager lets you check your equipment configuration, configure your controller, create and manage your disk arrays, and provides online event logging and performance statistics.

SCSI RAID controllers also include Storage Manager on ROM, which lets you build disk arrays prior to installing your operating system and Storage Manager. See Chapter 1 for additional information about Storage Manager on ROM.

Adaptec Storage Manager is included with your SCSI RAID controller. This utility performs several functions:

- Check or modify hardware configuration.
- Allows you to create, expand, or delete disk arrays.
- Provides online functions for the Adaptec storage subsystem such as event logging and notification, array status and I/O statistics.
- Provides remote access to Adaptec hardware and attached storage devices across a TCP/IP network.

Storage Manager versions for supported operating systems are on the Adaptec SCSI RAID CD-ROM included in your controller kit.

System Requirements

- Pentium class or equivalent CPU
- SVGA color monitor and video adapter
- Network connection (for remote communication services)

Storage Manager software requires approximately 4 MB of free space for installation. Storage Manager can be installed on a computer with one of the following operating systems:

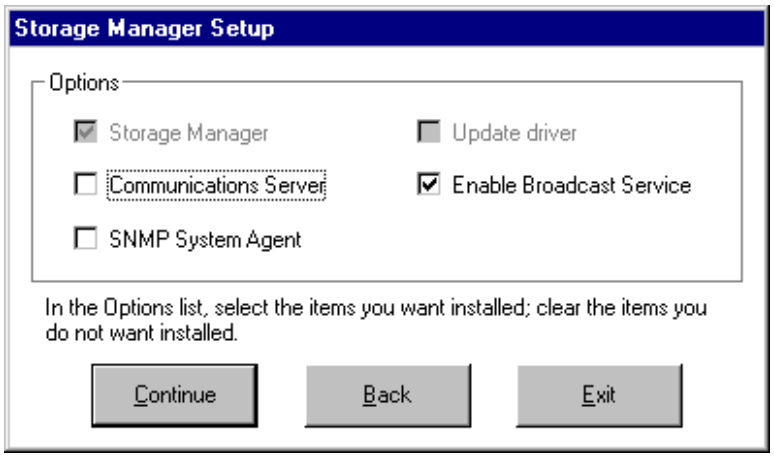
- Windows 2000
- Windows 95/98
- Windows NT 4.0 (Service Pack 6 or later)
- SCO OpenServer 5
- SCO UnixWare 7.x

Note: The versions of Storage Manager for SCO platforms uses the Motif graphical user interface. Run the Motif version of Storage Manager with the display set for 256 colors only. Any other setting can cause Storage Manager to display incorrect colors.

Before running Storage Manager, be sure that your mouse driver is installed. Access to some features of Storage Manager requires the use of a pointing device in place of the keyboard.

To install the Adaptec communication server software, ensure that Communications Server is selected in the Adaptec Storage Manager Setup dialog. Refer to *Remote Communication* on page 2-46 for

detailed information about using the remote communication feature.



Running Storage Manager

You can run Storage Manager

- On the same computer that contains the Adaptec hardware and peripheral devices (local operation).
- Remotely across a TCP/IP network. This lets you view and configure servers from remote locations.
- In Demo Mode, where Storage Manager simulates a storage subsystem that contains various types of Adaptec controllers and peripheral devices. This lets you experiment with various storage configurations.

Using Storage Manager Locally

Storage Manager initially scans for Adaptec hardware installed on the computer on which it is run. If one or more Adaptec controllers are found, the storage subsystem hardware configuration is displayed.

Using Storage Manager Remotely

Windows 2000, Windows NT or Windows 95/98 host systems can be viewed and configured across a TCP/IP network from Windows 2000, Windows NT, or Windows 95/98 clients running Storage Manager.

Windows 2000, Windows NT, Windows 95/98, NetWare, and SCO UNIX systems can be viewed and configured across a TCP/IP network from Windows 2000, Windows NT, Windows 95/98, or SCO UNIX clients running Storage Manager.

Storage Manager on ROM

Storage Manager on ROM (SMOR) is a ROM-based version of Storage Manager which is provided on your SCSI RAID controller. If you are installing a new system, use SMOR to configure your RAID subsystem prior to installing your operating system.

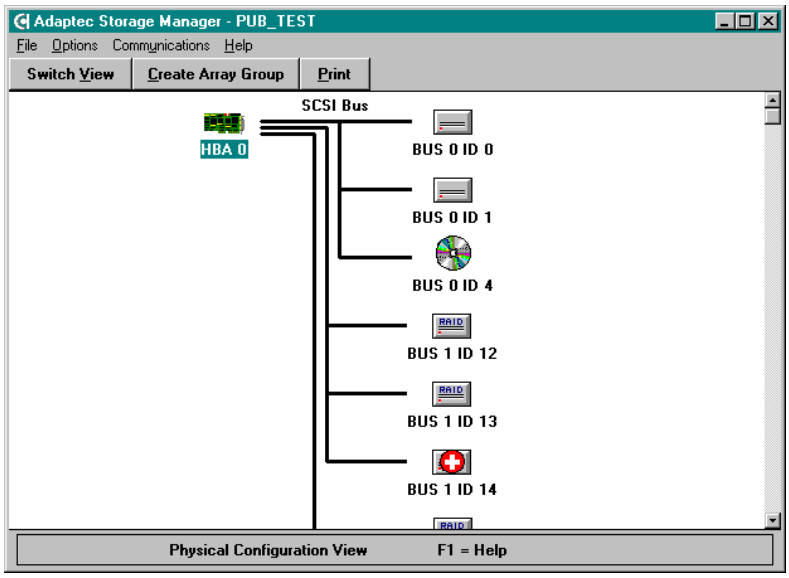
You can access SMOR during the system boot by pressing **Ctrl+A** after the Adaptec I_2O BIOS is loaded. Refer to Chapter 1 for more information.

Physical Configuration View

The first window displayed by Storage Manager is the Physical Configuration View. This window displays each Adaptec controller in the system along with the peripheral buses and attached devices. Icons representing disk drives, CD-ROMs, tapes, printers, bridge controllers, scanners and jukeboxes are displayed. Devices are sorted by controller number and device ID from lowest to highest. To see a list of all icons and their meaning, select **Help – Legend of Icons** in Storage Manager.

Disk drives that are part of an array have the word RAID on the drive icon. Disk drives that are assigned as hot spares icons have a red circle with a white cross on the drive icon. Select **Legend of Icons** from the Storage Manager Help menu to see a list of the various icons and their meaning.

The Switch View button toggles between the Physical Configuration View and the Logical Configuration View window. Create Array Group starts the process of creating a RAID logical disk. Print will print a text report of the subsystem configuration.

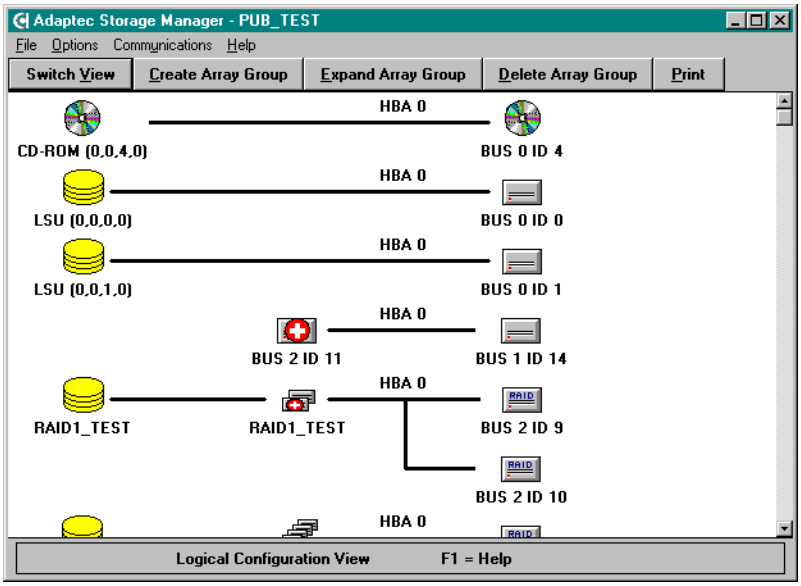


Logical Configuration View

On the right side of the Logical Configuration View window are all physical devices that are attached to Adaptec controllers. On the left side of the window are the associated logical devices as seen by the host computer.

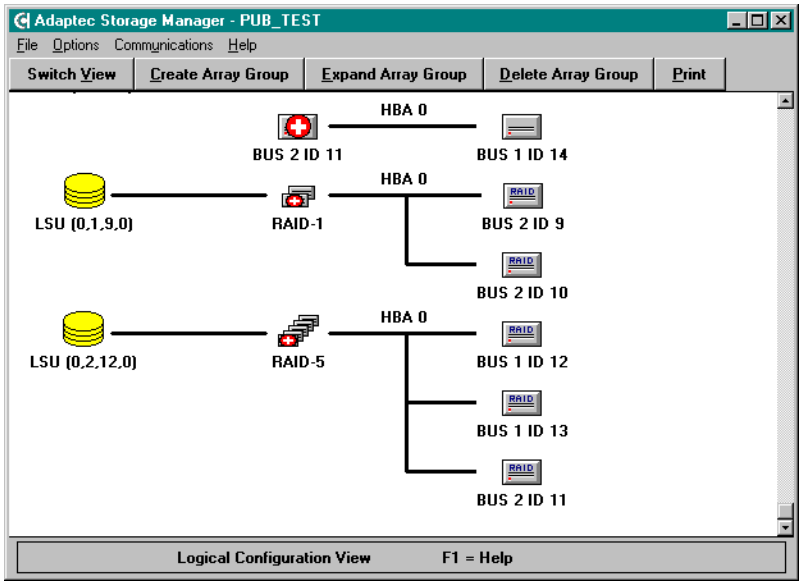
Non-disk devices use the same icon for both logical and physical views. Disks drives can be seen either as individual drives or as members of arrays. In either case, the drive or array is represented on the left side of the window as a Logical Storage Unit (LSU). Arrays that make up a multilevel RAID are displayed as RAID 1 or RAID 5 icons that appear between the LSU icon on the left and the drives on the right.

Devices are displayed in order of device type, with all non-disk devices displayed first, followed by all disk drives not assigned to an array, hot spares, and finally, all arrays by RAID level.



Logical Device Address

Every device and array is assigned a logical device address by Storage Manager. This is the address used by the host operating system to access the device or array. Logical device addresses appear in parentheses under the logical device and LSU icons on the Logical Configuration View window.



The complete logical device address is composed of four fields (HBA, Bus, Device, and Logical Unit Number [LUN]) and is assigned to devices as follows:

HBA (Host Bus Adapter): The controller to which the device is attached. PCI bus slots are scanned from lowest to highest looking for Adaptec controllers. As Adaptec controllers are found they are assigned numbers incrementally, starting with 0.

Bus: The controller bus to which the device is attached. SCSI RAID controllers can have up to three buses.

Device: The unique ID for that device. For an array this is the lowest ID among the drives that make up the array.

LUN: for that device (normally 0).

Note: Array groups are automatically assigned an address that corresponds to the lowest logical device address used by a device in that array group. For example, if the lowest member device address for an array is HBA:0 Bus:1 ID:12 LUN:0, the LSU address will be HBA:0 Bus:1 ID:12 LUN:0.

When an array group has been created, its logical device address will not change if the drive with the lowest ID is replaced by a hot spare. When a hot spare replacement occurs, the failed drive automatically becomes the new hot spare. If you choose not to use that drive as a hot spare, Storage Manager will prompt you to select an unused logical device address for that drive.

Status

Status is reported by SCSI RAID controllers for arrays and drives. Some status conditions are indicated by Storage Manager through status flags on the drive or array icons. More detailed status information can be obtained by viewing the Information window for that drive or array. Changes in status conditions are logged and can also be broadcast to selected recipients.

The following table lists the general status conditions that can be indicated for drives or arrays. The actual status message may include additional details.

Building	The array is being built.
Created	The array or device is defined but not initialized.
Dead	A write-back cache to the array command failed. This is an unrecoverable failure.
Degraded	A single drive in the array has failed; array performance is affected.
Impacted	A verification is being performed on the array; I/O performance is affected.
Optimal	The array is fully functional.
Pending	The array has been created and the build is queued on the controller, but is not yet started.
Rebuilding	Data is being rebuilt onto a drive in the array.

Information Windows

Double click on a controller or device icon to display an Information window for that controller or device.

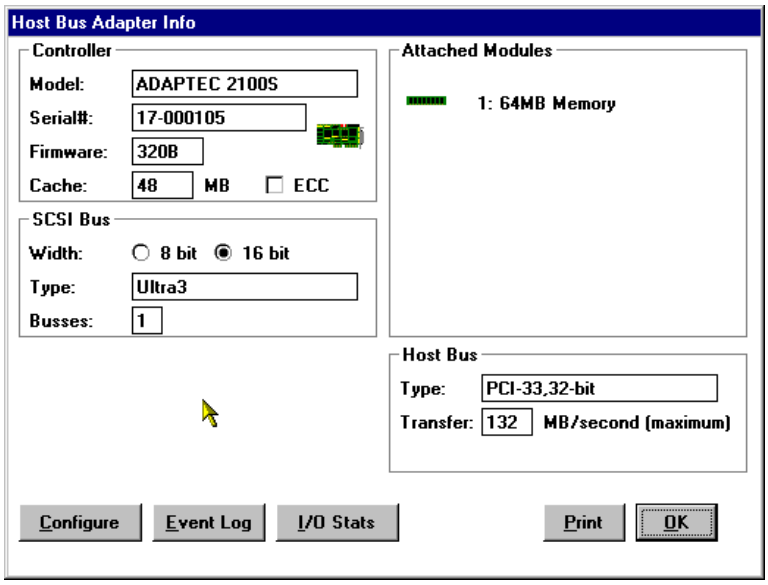
Host Bus Adapter Information Window

The Host Bus Adapter Info window displays configuration information reported by that controller.

The Controller section displays the Model, Serial #, Firmware revision, and amount of installed cache. ECC is checked only if ECC memory is installed.

The Attached Modules section shows the expansion modules and type and capacity of memory modules installed.

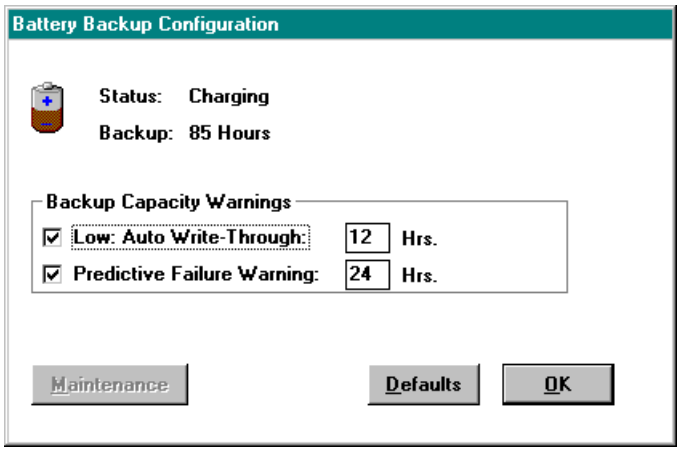
The SCSI Bus and Host Bus sections display the current configuration of the respective bus. Buttons available include **Configure**, **Event Log**, **I/O Stats**, and **Print**.



Battery Backup Configuration

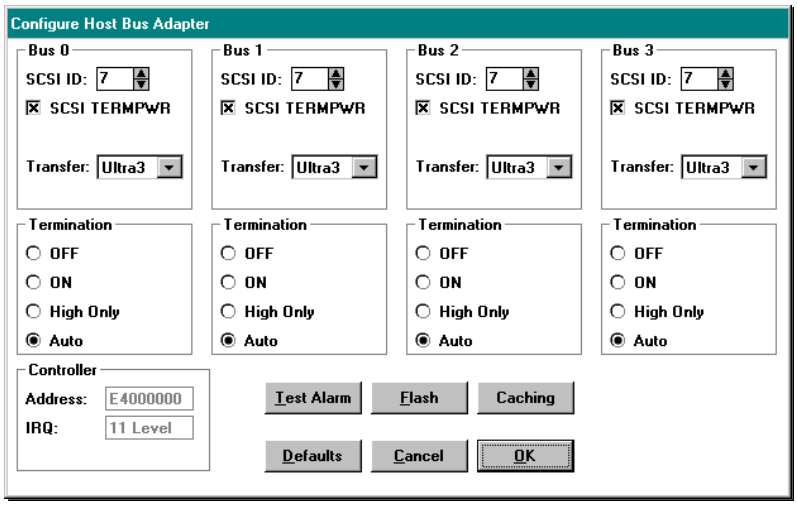
Note: During the initial calibration or maintenance cycle for a Battery Backup Module, the controller operates in Write-Through mode to ensure data is always written to the array.

This option lets you view the status of the Battery Backup Module and set operating parameters when the battery capacity reaches a predetermined level. The battery Status and available backup capacity (in hours) is displayed. The Backup value is monitored periodically by software and changes whenever the battery pack is charging or discharging. You can use the Backup Capacity Warnings settings to set a threshold for entering Write-Through mode and issuing failure warnings when the battery charge drops below the defined level.



HBA Configuration

To modify hardware parameters for the SCSI RAID controller click the **Configure** button in the Host Bus Adapter Info window. The Configure Host Bus Adapter window appears.



Buttons available are:

Test Alarm	Tests the audible alarm on the controller.
Flash	Displays the Flash Configuration dialog to update the controller firmware and BIOS.
Caching	Selects the controller cache parameters.
Defaults	Resets the controller configuration to factory default settings.
Cancel	Cancels any changes you have made and returns to the Host Bus Adapter Info window.

Note: The specific buttons you see depend on the controller model and configuration.

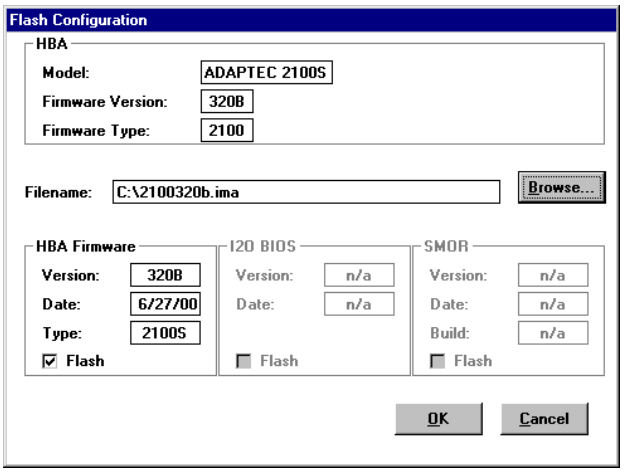
SCSI ID	Adaptec controllers are set at ID 7 by default. The ID for a SCSI RAID Fibre Channel controller can change dynamically as the Fibre Channel loop self-configures. Refer to *the SCSI RAID Installation Guide* for more information about selecting an alternate SCSI ID.
SCSI TERMPWR	By default SCSI RAID controllers supply termination power through the TERMPWR line on the SCSI cable. This setting does not normally need to be changed.
Transfer	The maximum possible SCSI transfer rate. SCSI RAID controllers automatically negotiate with each SCSI device at power-up, or reset, to determine the maximum SCSI transfer rate. *This parameter should not be changed except when troubleshooting SCSI bus errors.* If data errors are eliminated by setting the value to a lower rate, there might be problems with the length of the bus or the bus termination.

Termination	This parameter sets SCSI termination for the controller. The default (**Auto**) should not be changed unless both internal and external Wide SCSI cables or 8-bit (Narrow) cables are connected to the controller. Refer to the *SCSI RAID Installation Guide* for information about configuring SCSI bus termination.
Address, IRQ	These fields display the controller memory address and IRQ value assigned by the host BIOS. These values cannot be changed.

Flash Configuration

This dialog is displayed when you click on the Flash button in the Configure Host Bus Adapter window.

Note: It is easier to perform an update if the image files are placed in the root directory of a disk. Each component must be upgraded as a separate operation. Flash operations are not supported over remote connections.



The current controller Model, Firmware Version, and, Firmware Type are displayed. To specify an image file for the flash operation, you can type a path and filename in the Filename field or click on **Browse** to use a standard file selection dialog.

Firmware images are contained in a *xxxxxxxx*.ima file, where the 8-character file name consists of the 4-digit controller model and a 4-digit release number. An Adaptec I_2O BIOS image is contained in a file named i2obios.*xxx* (where, *xxx* is the version number). SMOR updates are contained in a file named smor*yyyy.xxx*. Where, *yyyy* is the version number and the file extension (*xxx*) is the build number. You can obtain the latest files by contacting your technical support representative.

When you select an image file, Storage Manager reads the file to determine the type image selected: firmware, I_2O BIOS, or SMOR. The Version, Date and Type are displayed in the corresponding section of the dialog.

Click **OK** to begin the flash operation. Click **Cancel** to return to the Configure Host Bus Adapter window.

Controller Caching for Windows NT

The SCSI RAID controller manages its data cache according to built-in algorithms. If you are using Windows NT 4.0, do the following to ensure optimum performance:

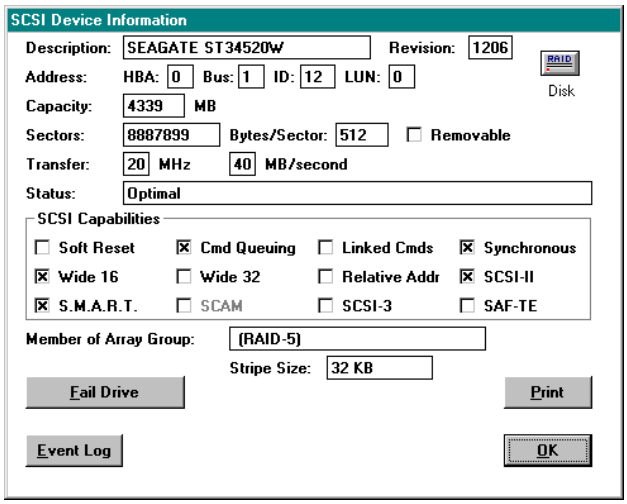
1. Click **Caching** in the Configure Host Bus Adapter window to display the HBA Caching Configuration dialog.
2. When the HBA Caching Configuration dialog appears, change both of the settings to Advisory.

   The *Advisory* setting allows the Adaptec controller to use its own algorithms for cache management. This is more efficient than allowing the operating system to direct the cache operation.
3. Click **OK** to exit the dialog and save the changes.
4. Reboot the Windows NT system to enable the new settings.

Note: If you reset the NVRAM on the controller, the changes to your cache settings may not be retained. In that case, repeat this procedure to ensure optimum performance under Windows NT.

Device Information Window

This window displays the following information:



Description	The manufacturer and model.
Revision	The drive firmware version.
Address	The logical address of the device.
Capacity	Storage capacity of the device in megabytes.

For removable-media disk devices, capacity is reported for the currently inserted media. Disk devices also display the number of sectors on the media along with the physical and logical sector size.

Other information such as the transfer rate, whether the device supports removable media are also reported depending on the system configuration.

The current device Status is displayed. General status conditions (other than Optimal) are also indicated by colored flags on the

device icon. SCSI Capabilities shows which supported features are enabled [x] for the device.

Members of an array display the name and RAID level of the array to which they belong and the Stripe Size for the array.

Various buttons are available depending upon the type of device. Disk drive devices will have an Event Log and I/O Stats button. Disk drives that are not members of arrays have Make Hotspare, Configure and Format buttons. Print is always available.

Disk drives that are members of arrays display a Fail Drive button.

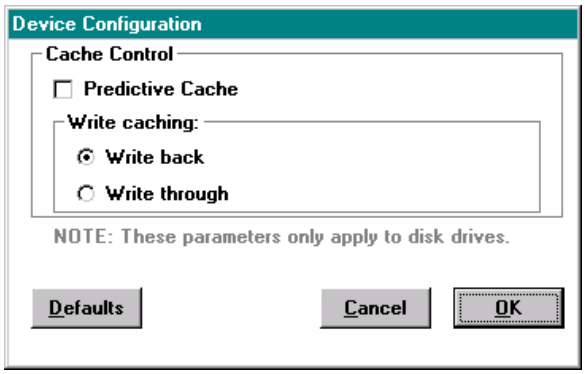
If the drive is a hot spare, the Remove Hotspare button replaces the Make Hotspare button.

Caching Configuration

Clicking the Configure button in the SCSI Device Information or the Array Group Information window displays the Device Configuration dialog. This dialog lets you change the caching parameters for your controller.

Click **Defaults** to set the cache operation to the default setting.

Click **Cancel** to exit this dialog without saving changes. Click **OK** to exit with changes.



Write-back defers writes to disk until after command completion and generally provides better performance. Write-through writes all data to disk for each Write command before command complete

status is returned to the host. The data can also be cached for subsequent read commands.

The Predictive Cache check box enables and disables the predictive caching feature on SCSI RAID controllers. This feature is disabled by default.

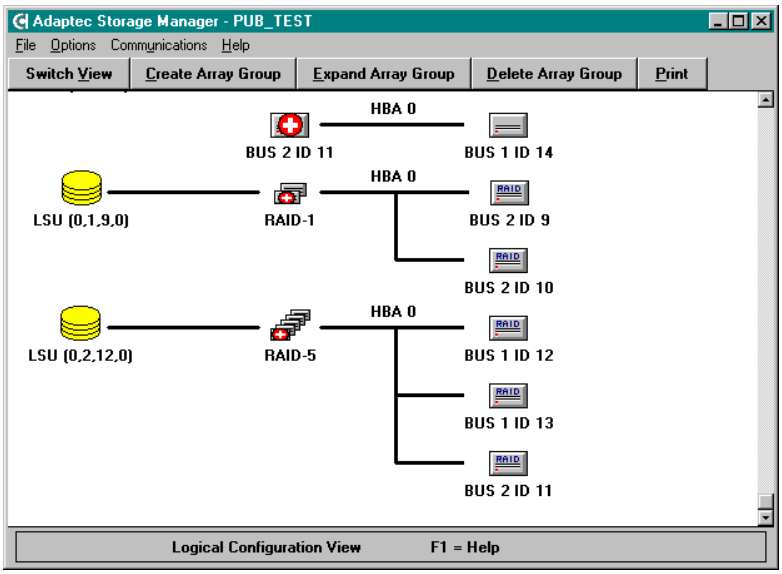
Predictive caching reduces average disk access time by determining when the host is requesting data that it read previously and reading in additional sequential data before it is actually requested. This can provide enhanced performance if your application is single-threaded or has a small number of outstanding I/O requests pending at any one time. If you do not have this type of system, there is no benefit from predictive caching and using it will adversely affect overall performance.

Array Groups

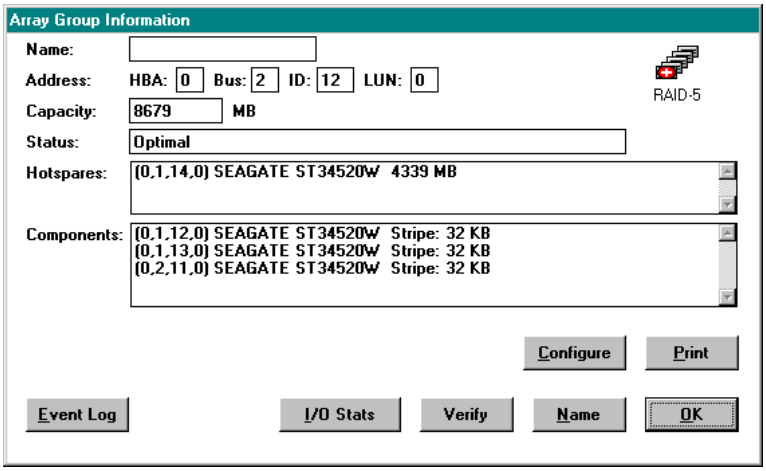
The tool bar at the top of the Logical Configuration View window contains Create Array Group, Expand Array Group (Windows NT and Windows 2000 only), and Delete Array Group buttons. The Expand Array Group button allows you to add drives to an existing array and dynamically resize the logical drive.

SCSI RAID controllers can implement any combination of RAID level 0, 1, or 5 disk arrays. RAID 0 arrays can be any combination of individual drives. RAID 1 arrays are composed of two drives. RAID 5 arrays must contain at least three drives. One or more arrays of the same RAID level can be combined into a multilevel RAID. (This is also referred to as RAID 0/1 for multiple RAID 1 arrays or RAID 0/5 for multiple RAID 5 arrays.) The drives in a multilevel RAID appear as a single LSU to the host computer.

Note: All drives in an array must be attached to the same controller. For controllers with drives on multiple SCSI bus channels, arrays are built using the drives in the order in which they were selected regardless of the bus to which the drive is attached. This behavior can be used to create fault-tolerant SCSI bus configurations using pairs of drives on alternate channels in a RAID 1 or RAID 0/1 array or with drives distributed across all channels for a RAID 5 or RAID 0/5 array.



From the Logical Configuration View, you can double click on an array group icon to display the Array Group Information window. Information windows for arrays that are part of a multilevel RAID can be viewed by double clicking on the icons for those arrays.



The Array Group Information window displays the following information:

Name	The descriptive name assigned to the array. An icon in the upper right corner of the window indicates the RAID level.
Address	This is the logical device address used by the host operating system to access the logical drive. The address is the same as the lowest device address in the array.
Capacity	The total usable storage capacity of the array in megabytes (MB).
Status	The current status of the array as reported by the controller.
Hotspares	Displays a list of any hot spare drives that are available to protect the array in the event of a drive failure.
Components	Displays the logical address, model, and stripe size for each member of the array. If this a multilevel RAID Information window, the list displays the address or name and stripe size for each disk array that is a member of the multilevel RAID.

Note: The availability of the various buttons depends on the current configuration and state of the array.

Buttons include **Configure**, **Print**, **Event Log**, **I/O Stats**, **Verify**, and **Name**.

A **Rebuild** button will appear for redundant arrays that have a failed drive.

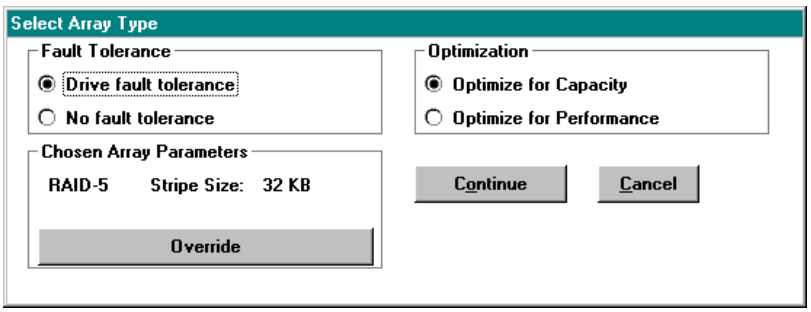
For arrays that are building or rebuilding, a **Stop Bld** button is displayed. For arrays that have a build pending, a **Build** button is displayed.

Arrays running a Verify operation will have a **Stop Vfy** button.

Creating an Array Group

To create an array group, do the following:

1. Select the **Create Array Group** button.
2. The Select Array Type dialog appears.



   a. Select the desired Fault Tolerance: Drive fault tolerance (RAID 1 or 5) or No fault tolerance (RAID 0)

   b. Select the desired Optimization: Optimize for Capacity (RAID 5) or Optimize for Performance (RAID 1).

c As you make your selections, the Chosen Array Parameters change to indicate which RAID level and stripe size best fit your selection.

d You can customize the RAID level and stripe size defaults by selecting the **Override** button.

3 Click **Continue** to select the drives you want to use. The Logical Configuration View window will appear with the caption Choosing Drives for Array (RAID *n*), where *n* is the RAID level chosen. Select the drives you want to use in the array group as follows:

a To add drives

- Mark each drive to be added by clicking on it. A green check mark indicates that a drive is selected.
- Click **Include Drive** to add the marked drives to the new array group. You may need to scroll the window to view the array group.

b To remove drives

- Click on the drive icons you want to remove and then click **Remove Drive**.
- During the drive selection process some drives might be displayed in a blue color. This indicates that these drives cannot be included in the array unless you change the configuration. You must either select more drives for the array or remove one or more drives from the array. See *Array Groups* on page 2-18 for rules regarding the number of drives that can be included in arrays.

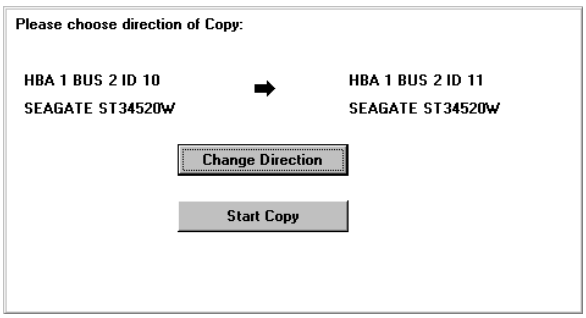
4 When you finish selecting the drives to be included in the new array group, click **Done**. The icon for the array group will appear with a black flag until you start the build process by saving your changes.

5 When you are finished creating arrays, exit Storage Manager. You will be prompted to save the configuration changes. If you save the configuration, the build operation will start

automatically. If you have created multiple arrays, they are built one at a time in the order they were created. You can also start the build without exiting Storage Manager by selecting **File–Set System Configuration**.

Note: For large redundant arrays, this process can take several hours to complete. You can exit Storage Manager and perform other activities on the system while the build continues. The arrays being built can be accessed during the build as nonredundant arrays. The arrays will be redundant when the build is complete.

6 RAID 1 arrays are created by copying the data on one drive of the mirrored pair to the other. If you have specified a RAID 1 array, you are prompted to select the direction of the copy.



If you want to monitor the progress of the build operation, display the Array Group Information window for the new array group. The build progress is displayed as a percentage of completion in the Status field. You can also view the Information window for an array that is a member of a multilevel RAID to monitor the progress for that component of the multilevel RAID.

Naming an Array Group

Click the **Name** button in the Array Group Information window to assign a unique name to an array group or multilevel RAID. This name will be displayed under the array icon and other locations that display the array identifier. The name can be 1 to 13 characters in length.

Note: You must restart the host computer before the new array name will take effect.

Array Expansion

Note: Array expansion is available only for arrays created with Adaptec SCSI RAID controllers running in a Windows NT or Windows 2000 host system using NTFS.

The array expansion feature lets you increase your storage capacity by adding one or more drives to your RAID 0 and RAID 5 arrays while your system remains online. As additional drives are added, the controller redistributes the data on the array, placing the new space at the end of the LSU and increasing the size of the logical drive as seen by Windows NT or Windows 2000.

Before this feature was available, to increase the size of an array you had to backup the data on the array, shutdown the host system, delete the old array, and then build a larger array that included the new drives. After the larger array was built, you would reinstall the operating system (if necessary) and restore the data from the backup. This entire process could keep your system off-line for at least one day and possibly longer.

The array expansion feature lets you add the new drives to the array while the system is active and users are logged in and accessing data. After the array is expanded, use Windows NT or Windows 2000 Disk Administrator to add the additional space to the volume set of the array, then shutdown the system and restart. When the system restarts, Windows NT and Windows 2000 recognizes the additional space as part of the existing logical drive.

Note: There is a significant impact on system performance during array expansion. The relative priorities given to system performance and the array expansion process can be adjusted in the Storage Manager by setting the Background Task Priority (see page 2-41).

Array expansion maintains the performance gains of RAID 0 and RAID 5, spreading accesses randomly across the drives in the array.

The Adaptec controller presents the same number of LSUs to the operating system after the expansion. There is no need for manual load balancing, which would be required if the new space were presented as an additional LSU.

Requirements and Restrictions

Expand refers to the process of adding additional space to an existing array group using the array expansion feature. Extend refers to the process of adding the new space created by the array expansion to the existing Windows NT or Windows 2000 volume (LSU).

Array expansion has the following system requirements:

- Windows 2000, Windows NT Server or Windows NT Workstation (NT Version 4.0 with the most recent Service Pack).
- Array expansion requires the I_2O OSM supplied by Adaptec.
- The Microsoft-supplied OSM *does not* support array expansion.
- Array expansion and volume extension is supported only for RAID 0 or RAID 5 array groups using the NTFS file system.
- You cannot extend a volume that has a FAT partition. The expanded space must be added as a separate LSU.
- You cannot extend the Windows NT or Windows 2000 boot partition.
- The array must have *Optimal* status before beginning the expansion. If the array status is not *Optimal*, correct the problem and complete a rebuild of the existing array before continuing with expansion.

Note: If a drive fails during expansion, the expansion will complete successfully. However, the new, larger array will be in a degraded state until the problem is fixed. If there is a hot spare associated with the array, the degraded array is rebuilt using the hot spare. If there is no hot spare, replace the defective drive, and start a rebuild of the array.

- Each new drive added to an array must be at least equal to the capacity of the smallest capacity drive already in the array.
- In any RAID configuration, the drive with the least capacity in the array determines the usable capacity of all the drives in the array. Therefore, there is no advantage in adding a drive with a capacity larger than the smallest capacity drive already in the array.

Expanding an Array Group

Caution: Adaptec recommends that you backup your data before performing an operation that affects the configuration of a disk array. *Do not* power off the host system while the expansion operation is running.

To expand an existing array group, do the following:

1. Connect the additional drives to the peripheral bus and power-on the drives. Refer to Chapter 3 of the *SCSI RAID Installation Guide* if necessary.

Note: If the drives are not in hot-pluggable carriers, power down the system before adding drives to the peripheral bus.

2. Start Storage Manager and click on **Switch View** to change to the Logical Configuration View.
3. Select the array group to which you want to add drives by clicking the corresponding RAID 0 or RAID 5 icon.
4. Select **Expand Array Group**.

5. Mark the drives to be added to the array by clicking on them. A green check mark indicates that a drive is selected.
6. Select **Include Drive**. This will cause the marked drives to join the existing array group. The drives to be added are now marked New.
7. When you are finished choosing drives, select **Done**. The icon for the array group appears with a black flag until the expansion process is started.
8. Select **File–Set System Configuration** to start the array expansion. The status flag on the array group turns blue and the flags on the components turn white during the expansion process. You can perform other activity on the system while the expansion continues, because the array is fully functional during the expansion process.

Note: For large arrays, the expansion can take several hours to complete. Host I/O activity can prolong the expansion process.

If you want to monitor the progress of the expansion operation, you can use Storage Manager to view the Array Group Information window. Status is *Expanding* during the expansion process, *Optimal* when it has completed.

Reconfiguring After an Array Expansion

When the array expansion is complete, do the following to allow Windows 2000 or Windows NT to recognize the additional space:

1. Shut down and restart the system.

Note: When restarting, Windows will run chkdsk to verify the new space. This might take an extended period of time for large volumes.

2. Start Disk Administrator. The new space appears as Free Space at the end of the existing logical drive.
3. Select both the original logical drive and the free space by highlighting both segments.

4 Select **Partition–Extend Volume Set**... Select **Yes** when prompted to the save your changes and to restart Windows 2000 or Windows NT.

Use the rdisk.exe utility to update your emergency repair disk with the new disk configuration information.

Deleting an Array Group

To delete an array group, do the following:

1 From the Logical Configuration View window, select the LSU or array group icon of the array you want to delete. Then select **Delete Array Group**.

2 Select **OK** when the confirmation message appears to complete the delete operation. Click **Cancel** to exit without deleting the array group.

An array is not physically deleted until you exit Storage Manager and choose to save changes or select **File–Set System Configuration**.

Saving the Subsystem Configuration

The Storage Manager File menu has the following four options:

Read System Configuration: Causes Storage Manager to read the current hardware configuration. Any changes that have been made and not saved are lost. This operation also occurs automatically when Storage Manager is started.

Set System Configuration: Causes Storage Manager to save any changes that you made to the storage subsystem configuration. If any arrays have been created or modified, this action causes the controller to start build operations for the new arrays.

Load Configuration File: Lets you load a previously saved configuration into Storage Manager and apply it to the current hardware.

Save Configuration File: Lets you save the current configuration, or any changes to that configuration, to a file for later use. This feature allows storage subsystems to be

configured for other machines with the same size and type drives, then later loaded from the configuration file.

Note: If you reset the NVRAM on the controller, any changes to your controller parameters return to the factory defaults.

Events

Events are generated for detected fault conditions as well as subsystem status changes. The events are grouped into four categories as follows:

Soft Error: An operation on a disk drive that caused an error but was successful after a retry.

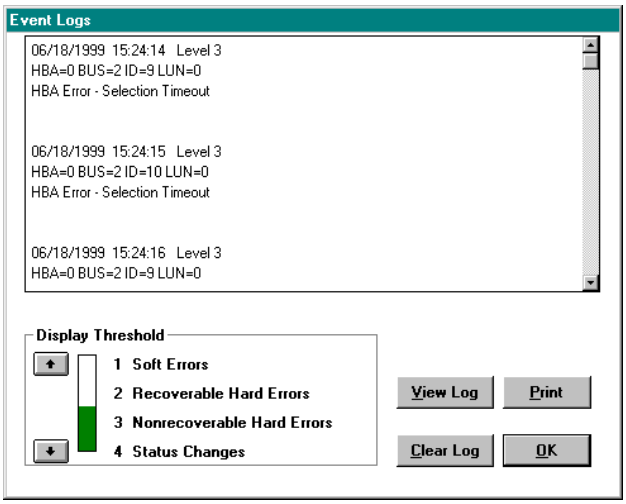
Recoverable Hard Error: An error on a disk drive, controller, or peripheral bus, where the data was recovered using ECC or from redundant array information.

Nonrecoverable Hard Error: An error on a disk drive, controller, or peripheral bus where the data could not be recovered using ECC or from redundant array information.

Status Change: The status of an array or drive changed. Examples of this would be a drive or array failure or an array build or rebuild operation that was initiated or completed.

Event Logging

When events occur, they are automatically logged in the cache on the SCSI RAID controller where they occurred. In addition, you can specify that Storage Manager maintain an event log on disk (see *Event Notification* on page 2-31). The contents of the event log can be displayed by clicking Event Log in any controller, drive, or array Information window. Only the events reported for the selected device or array are displayed.



When the Event Log button is selected, the Event Logs window appears. The Event Logs window lets you specify that the display be limited only to events of a specific level or higher (the default is level 4).

Note: Some important events may not be displayed by the default level. You should select one of the higher event levels to ensure that you are aware of significant errors that might have occurred.

Click on the arrow buttons to adjust the Display Threshold to the desired level.

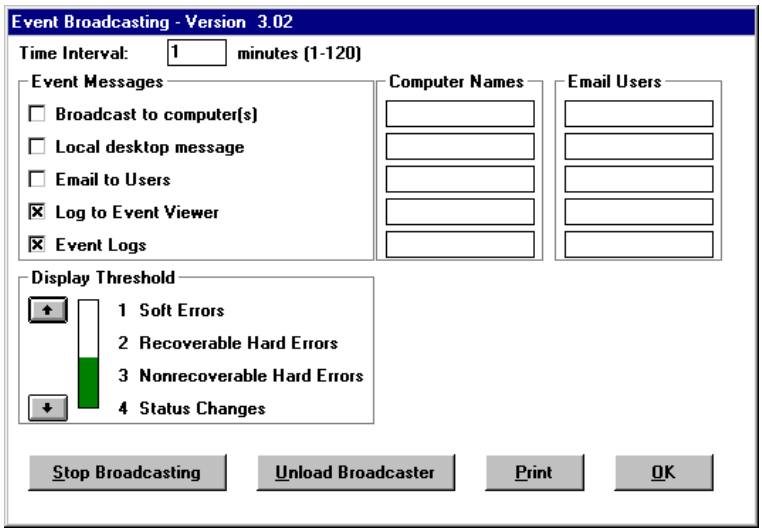
Click **View Log** to see the event messages whose levels match the selected levels.

Click **Print** to print the event messages currently shown in the event log list.

Note: Only the visible event messages are printed. If you want to print specific messages, scroll the list until the messages are visible, then click on **Print**.

Event Notification

If your operating system supports a Broadcaster, Storage Manager lets you specify that event messages be sent to users, groups, devices, through e-mail, to the system error log and the Adaptec log file. Select **Options–Event Broadcast Control** to display the Event Broadcasting dialog. The options in the Event Broadcasting dialog may vary depending upon your operating system.



Click **Stop Broadcasting** to stop Storage Manager from sending event messages to the locations or addresses specified.

Click **Unload Broadcaster** to remove the Broadcaster service from the current set of active services.

You can select or modify the following parameters:

Time Interval	Specified time interval at which point the Broadcaster will read the event logs of all Adaptec controllers with cache. Any new event messages are broadcast to each specified destination (based on the Display Threshold setting).
Broadcast to Computer(s)	Enable this option to send event messages to each system in the Computer Names list.
Local Desktop Message	Enable this option to have event messages displayed on the local system desktop.

EMail to Users	Enable this option to mail event messages to each e-mail address in the Email Users list.
Log to Event Viewer	Enable this option to also log and display event messages in the Windows NT Event Viewer
Event Logs	Enable this option to also log event messages in a permanent log file.
Computer Names/Email Users	Use these fields to specify a list of computer systems or e-mail addresses that are to receive broadcast messages.
Display Threshold	Click on the arrow buttons to adjust the indicator to the threshold you want to use for reporting events. Messages will be broadcast for all events whose levels match those selected.

Pager Event Messaging

Adaptec Storage Manager for Windows 2000 and Windows NT can also send event messages to alphanumeric paging devices. The messages are sent as e-mail to pagers that support e-mail text message delivery.

Note: This feature should work with any alphanumeric paging system that supports message delivery via e-mail. Contact your service provider for specific information.

The following procedure applies to the system that is running the Storage Manager Event Logger to monitor Adaptec controllers and attached disk arrays.

To configure alphanumeric pager support, do the following:

1. Ensure your pager is working and activated through a service provider.
2. Establish a permanent connection to an Internet Service Provider (ISP) or create Dial-up Networking connection to your ISP.
3. Configure your e-mail client software to access your Internet mail server.

4 Determine the e-mail addresses for the people you want to receive event messages.

5 In Storage Manager

   a Set the **Display Threshold** to the level where you want to start broadcast messages.

   b Enable E-Mail to Users in the Event Broadcasting dialog (**Options–Event Broadcast Control**).

   c Enter the e-mail addresses for the pagers in the E-Mail Users list.

   d Click **OK** to exit the dialog and save the changes.

When the Event Broadcaster is active, the Event Logger will send text messages for selected events to the pager using the e-mail address you specified.

Broadcasters

Broadcasters for Windows 2000 and Windows NT 4 are provided on the Adaptec media. Broadcasters for Windows 2000, Windows NT, SCO UNIX and SCO UnixWare are provided on the Adaptec media. The Broadcaster collects events logged by Adaptec controllers in the host computer on which that broadcaster is running. The Broadcaster records these events to files for each controller for use by Storage Manager. Additionally, events whose levels are greater than or equal to the current Broadcast Threshold are sent to destinations as specified in the Storage Manager Event Broadcasting dialog (see *Event Notification* on page 2-31).

Broadcaster for NetWare

A Broadcaster is provided for NetWare versions 4.2 and 5. The Broadcaster collects events from Adaptec controllers and records them to files in the sys:\system\dpt directory for use by Storage Manager. Additionally, events are broadcast to the system console, the system error log file, or to users as specified in the Storage Manager Event Broadcasting dialog.

If a you want to receive broadcast messages from the Broadcaster module (dptnwmsg.nlm) you must be logged in to the NetWare server from a client workstation and your NetWare user name must

be in the dptelog.ini file as `user=user_name`. Multiple names can be specified by separate entries.

Installing the Broadcaster

The Adaptec driver disk for NetWare contains the Broadcaster for NetWare. When this disk is installed, the Broadcaster is placed, by default, in the sys:\system\adaptec directory on the server. During Broadcaster installation, you will be prompted to specify if the Broadcaster is to be loaded automatically when the server is booted. Doing so will allow events to be gathered and recorded without user intervention.

Stopping/Restarting the Broadcaster

The Broadcaster is a NetWare Loadable Module (NLM) that can be loaded or unloaded from the server's command prompt:

`unload dptelog`	Unloads the Broadcaster
`load sys:\system\dpt\dptelog`	Loads the Broadcaster

Viewing Events

Events can be viewed on a network workstation through the Event Log Display window in Storage Manager (see *Event Logging* on page 2-29). Events can also be viewed by examining the System Error Log file sys$log.err on the server if the Broadcaster has been configured to send events to that file.

Broadcaster for SCO UNIX Systems

Adaptec provides a Broadcaster for SCO OpenServer 5, and SCO UnixWare 7. The Broadcaster collects events from Adaptec controllers and saves them to files in the /usr/dpt directory for use by Storage Manager. Events can also be sent to an ASCII file, specified devices, or e-mailed to users as specified in the Event Broadcasting dialog.

Installing the Broadcaster

The Adaptec driver disk for SCO contains the Broadcaster for SCO. When you install the software on this disk, the Broadcaster is copied to /usr/dpt. During Broadcaster installation, you are prompted to

specify if the Broadcaster will be loaded automatically when the system is started in multiuser mode.

If you specify automatic loading, events are gathered and recorded without user intervention. This also copies a script file, s33dpt, to the /etc/rc2.d directory. This script automatically loads the Broadcaster as a background process when the system goes into multi-user mode.

Note: *Do not* use the s33dpt script file for UnixWare 7 Broadcaster operation.

Stopping/Restarting the Broadcaster

A script file (dptlog) is provided that lets you stop and restart the Broadcaster from the UNIX prompt. Use the following commands to stop or start the Broadcaster:

`dptlog stop`	Stops the Broadcaster
`dptlog start`	Restarts the Broadcaster

Viewing Events

Events can be viewed from the system console or a terminal by using the Event Logs window in Storage Manager (see *Event Logging* on page 2-29).

Broadcaster for Windows NT & Windows 2000

The Windows NT or Windows 2000 Broadcaster collects events from Adaptec controllers and records them to files in the c:\program files\storage manager subdirectory for use by Storage Manager. Additionally, events are sent to the Windows NT or Windows 2000 Event Viewer or e-mailed to users as specified in the Event Broadcasting dialog.

Installing the Broadcaster

When the Adaptec installation program runs, the Broadcaster is copied to the c:\program files\storage manager subdirectory by default. The Broadcaster is installed as a Windows service and runs automatically whenever the system is started. This allows events to be gathered and recorded without user intervention.

Stopping/Restarting the Broadcaster

Because the Adaptec Broadcaster is a Windows Service it must be managed from one of the Windows NT or Windows 2000 service management applications.

- The Broadcaster can be controlled using the Services Control Panel. Services are accessed by selecting the Services icon in the Control Panel folder.
- Highlight the Storage Manager Broadcaster entry in the Services list. Then click on **Start** or **Stop** to start or stop the Broadcaster service.
- The Broadcaster also can be started or stopped from a command line prompt by using the NET command as follows:

`net start dptserv`	Starts the Broadcaster
`net stop dptserv`	Stops the Broadcaster

Viewing Events

Events can be viewed either through the Event Log Display window in Storage Manager (see *Event Logging* on page 2-29) or the Windows NT or Windows 2000 Event Viewer. The Event Viewer is part of the Windows NT and Windows 2000 operating systems.

To run the Event Viewer, select Event Viewer from the Administrative Tools group on the Start menu. The Event Viewer lets you view events that have been placed in the System, Security, and Application logs. To view Adaptec events, select Log–Application.

This window displays a list of the events submitted to the Application Log by the Adaptec Broadcaster, as well as other applications. Events are single-line entries that contain the following information:

Icon	An icon that indicates the severity level for the event. Adaptec events can be assigned severity levels of Error, Warning, Information, Operation, or Unknown.
Date	The date the event was logged by the controller.
Time	The time the event was logged by the controller.

Source	The software component that triggered the event. This can be an application, a component of Windows NT or Windows 2000, or a device driver. Adaptec events can have dptelog, dpteng32, or dptscom in their Source field.
Category	Adaptec events can display None, Operation, Warning, or a hexadecimal event code.
Event ID	A number assigned by the Broadcaster to identify the event for Windows NT or Windows 2000.
User	Adaptec events always display N/A.
Computer	The name of the computer where the event occurred.

Additional information about an event can be obtained by selecting View–Detail. The Description and Data fields display additional information about the event. The Description field contains a detailed text description of the event. The Data field contains the original Adaptec Event Log data, generated by the controller. This data might be requested by your technical support representative when troubleshooting problems.

Event information can be saved by the Event Viewer to a file. If the file is saved in text format then only the event description is saved. Archiving in Event Log (.evt) file format saves all event information which can then be sent to another person for troubleshooting purposes.

Formatting Drives

SCSI RAID controllers can perform a low-level format on attached hard disk drives. This function is available from the SCSI Device Information window in Storage Manager. SCSI RAID controllers format drives in standard 512-byte format.

A low-level format is not normally required before using a disk drive. However, if a drive has been previously formatted with a different sector size, it must be reformatted with 512-byte sectors before it can be recognized by the SCSI RAID controller.

Caution: *Do not* power down the drive or reboot the computer until after the format operation is complete. Doing so can cause drives to be left in an unusable state and require them to be returned to the manufacturer for repair.

To perform a low-level format on a disk drive:

1. Click **Format** in the drive's SCSI Device Information window. The Format Options dialog appears.
2. Click **Format** in the Format Options dialog to start the operation.
3. You can now exit Storage Manager. The format operation will continue even though Storage Manager is not running.

To determine if the format has finished, run Storage Manager and look at the drive's icon. A blue flag indicates that the format is still in progress. If the drive icon has no flag, the format is complete.

Drive Failures

Drive failures are indicated by flags on the icons associated with the array or multilevel RAID and individual drives. Failure conditions are indicated as follows:

A drive belonging to an array group fails.	The drive icon displays a red flag in both the Physical and Logical Configuration Views.
The failed drive belongs to a RAID 0 array group.	The icon for the failed drive displays a black flag. Loss of any drive in a RAID 0 array means the array has failed and data on that array has been lost.
The failed drive belongs to a RAID 1, 10, 5, or 50 array group.	The array icon displays a yellow flag, indicating that the array is currently running in degraded mode. If two or more drives belonging to the same array show a red flag, the yellow flag on the array changes to red, indicating that the array has failed and that data has been lost.

Audible Alarm

Adaptec controllers with expandable caching capability have an audible alarm. The failure of a drive which is a member of an array attached to the controller causes the audible alarm to sound. The alarm stops automatically (after the initial system scan) when you start Storage Manager or SMOR.

Alarms that occur while Storage Manager is running can be stopped by selecting **Options–Turn Off Audible Alarms**.

Rebuilding a Degraded Array

Note: You can select Rebuild even if the failed drive has not been replaced and try using the drive again. If the rebuild attempt is not successful, replace the drive before starting another rebuild.

When a drive in a RAID 1 or RAID 5 array fails, and that drive is not protected by a hot spare, do the following to restore the array to Optimal status:

1. Replace the failed drive according to the procedure in your hardware documentation.
2. After the failed drive has been replaced, choose the Logical Configuration View in Storage Manager.
3. Double click the array group icon to open the Array Group Information window.
4. Click **Rebuild** in the Array Group Information window to start the rebuild process.

The drive will display a white flag to indicate that a rebuild operation is in process. The array and LSU icons will display yellow flags. The percentage completion of the rebuild operation is displayed in the Array Group Information window. When the rebuild is complete, the flags will disappear and the array status should be Optimal.

Hot Spares

To assign a drive as a hot spare, click **Make Hotspare** in the drive's SCSI Device Information window. Click **Remove Hotspare** to reassign an existing hot spare drive as a normal drive.

You should reboot your operating system to ensure that the hot spare drive is recognized correctly.

Any drive that is not assigned to an array can be assigned as a hot spare. Hot spares are reserved to automatically replace failed drives in RAID 1 or 0/1 and RAID 5 or 0/5 arrays and cannot be accessed by the operating system for data storage. Hot spares can only protect drives of equal or less capacity that are attached to the same controller as the hot spare.

When a drive failure occurs in an array protected by a hot spare, the controller automatically starts rebuilding data onto the hot spare. During this process, Storage Manager swaps the positions of the failed drive and the hot spare in the Logical Configuration View. The failed drive will appear with a red failed flag in the former position of the hot spare, and the hot spare will appear as a member of the array group with a white flag indicating that a rebuild operation is in process. The array and LSU icons appear with yellow (degraded) flags.

When the rebuild is complete, the hot spare icon and flags will disappear and the drive will be displayed as a normal member of the array. The red flag will remain on the failed drive until that drive is replaced or returned to *Optimal* status.

Do the following to replace the failed drive:

1. Follow the steps in your hardware documentation to remove and replace the failed drive.
2. Click **Make Optimal** in the new drive's Information window. The new drive will become the hot spare, replacing the previous hot spare that is now a member of the rebuilt array group.

Note: You can select **Make Optimal** without replacing the drive if you want to try using the drive again. If the operation fails, you should replace the drive.

Verify

Note: Data inconsistencies should not occur under normal conditions. However, a power failure that interrupts an array write operation can cause inconsistencies. Making the data consistent again through the Verify function does not ensure that the new consistent data is the correct data.

Running a Verify operation for RAID 1 and RAID 5 arrays ensures that the redundant information contained in the array is consistent. This operation is performed by the SCSI RAID controller concurrent with normal system operation and requires no user or host computer intervention.

To start data verification on an array, select **Verify** in the Array Group Information window.

If any inconsistencies in the data redundancy are found, they are made consistent.

- For RAID 1 arrays, the mirrored drive pairs are compared sector by sector to ensure that both drives contain identical data.
- For RAID 5 arrays, parity is recalculated and checked against the stored parity information.
- For RAID 0, only a disk media ECC check is performed.

Running Verify on an array that is in a degraded state can result in significantly reduced I/O performance. Although there is no impact on the host CPU, system I/O performance can be affected due to increased demand on controller resources. If this is a concern, use the Background Task Priority feature to assign a lower-level priority to background processes.

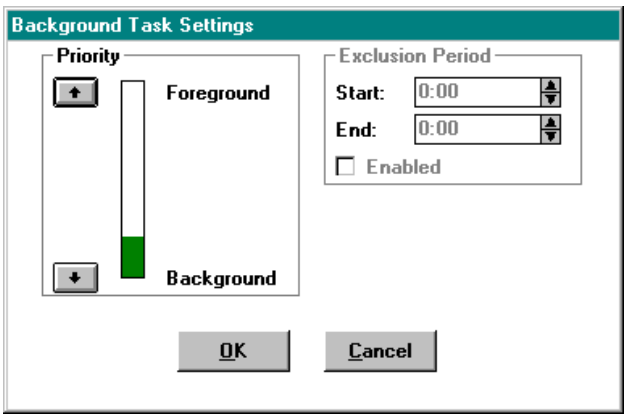
Background Task Priority

You can run a rebuild or verification operation without taking an array offline. These operations are performed as background tasks on the SCSI RAID controller and are transparent to the host operating system. However, the controller interleaves I/O from the operating system with I/O from the background task and this can

affect system performance. The relative priority given to I/O from the operating system and the background task can be controlled by selecting **Options–Background Task Priority**.

The Priority section of the dialog assigns the background task priority for all Adaptec controllers in the host computer. Set the task priority by using the arrow buttons to move the indicator. The indicator moves between Background and Foreground in ten increments.

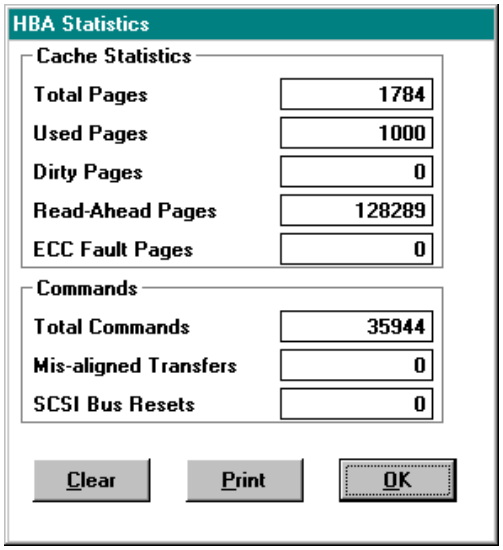
If the indicator is closer to Background, background tasks are processed only when there is no disk I/O from the host for a period of at least 250 milliseconds. As the indicator is moved toward Foreground, more of the controller resources are allocated to background tasks. All of the resources are allocated to background tasks during periods when there is no disk I/O from the host system.



I/O Statistics

SCSI RAID controllers keep a cumulative record of I/O operations in cache RAM for use in analyzing the efficiency of the storage subsystem. You can view this data by selecting **I/O Stats** in the Information window for any, controller, drive, or array. By analyzing these statistics, the array configuration, cache, and stripe size can be optimized for your particular system configuration.

Controller I/O Statistics



Click the **I/O Stats** button in the Host Bus Adapter Information window to see cache statistics for that controller. These statistics include:

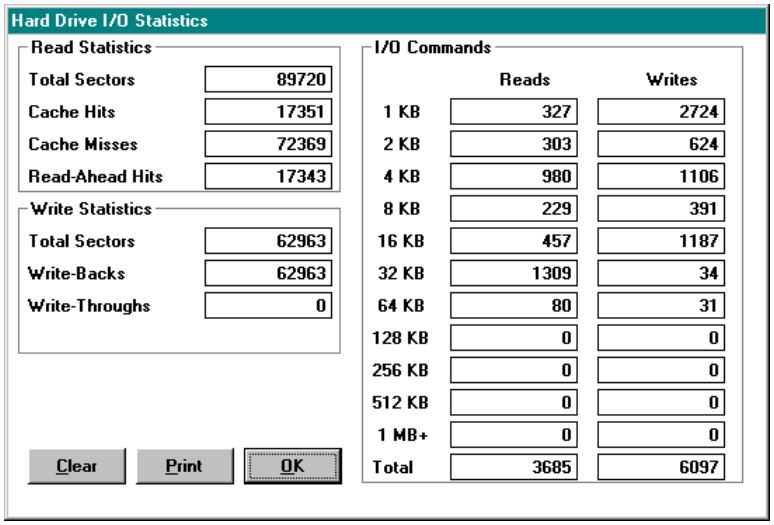
Cache Statistics

Total Pages	The total number of pages contained in the controller cache.
Used Pages	The number of pages that currently contain disk data.
Dirty Pages	The number of pages that contain dirty data.
Read-Ahead Pages	The number of cache pages that contain data that has been loaded from disk as a result of Read-ahead functions.
ECC Fault Pages	The number of pages that have been mapped for non-use after a RAM fault was discovered by the controller ECC feature.

Command Statistics

Total Commands	The total number of commands received from the host computer. This includes Read and Write commands and other commands that may not involve device I/O.
Misaligned Transfer	The number of commands that required data to be transferred starting at a RAM address location that was not an even byte value.
SCSI Bus Resets	The total number of SCSI bus resets that have been issued by the controller. A large number of resets can indicate a problem with the SCSI bus or an attached device.

Device I/O Statistics



Write-Backs + Write-Throughs = the total number of sectors written to disk by the controller. However, in RAID 1 arrays, (Write-Backs + Write-Throughs) can be up to twice the value of Total Sectors because each sector written from the host results in a write to each mirrored disk. In RAID 5 arrays, each write from the host can generate up to two disk reads and two disk writes. If the controller has cache memory, this can result in the actual number of sectors read from or written to disk being reported as less than this value.

I/O Commands	The number of Read and Write commands issued by the computer to the controller. If you use RAID and caching, the number of commands issued to the drives can differ significantly from this value.
Total Sectors	The total number of sectors read and written from the host computer.
Cache Hits	The total number of sectors (read or written from the host computer) that were found in the controller cache and did not require a disk access.
Read-Ahead Hits	The number of the cache hits for data read requests satisfied by data held in the cache from previous disk read-ahead operations.
Write-Backs	The number of sectors written to disk that were held in the controller cache and written some time after the host Write command reported as completed.
Write-Throughs	The number of sectors written directly to disk before the Write command ended.

Environments with a large number of sequential reads should generate a high number of Read-Ahead Hits relative to Total Sectors. These hits reduce the number of seek operations and increase performance. The Read-Ahead Hits count can be increased by adding more cache memory to the controller. A high percentage of 4 KB or smaller I/O operations also indicates that increasing the controller cache would be beneficial.

If cache hits are low, adding more cache RAM can also increase the hit count. Systems with a large number of disk writes also derive significant performance benefits from the controller cache.

For RAID 0 and RAID 5 arrays, the default stripe size is set for optimal performance in most environments. However, some specific environments can benefit from smaller or larger stripes. For example, when a RAID 5 write operation accesses all drives there will be a large number of stripe crossings. By using a larger stripe size, the RAID 5 parity data can be generated more efficiently. This results in better write performance. However, if the write crosses

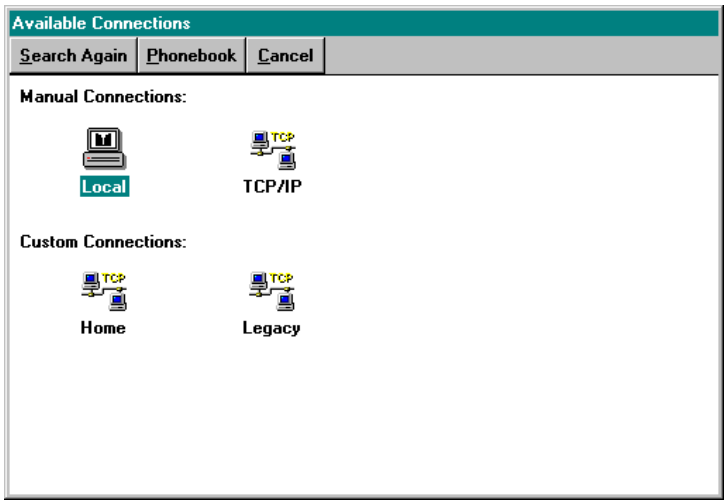
one or more stripes but does not involve all of the drives, the performance will be less efficient with the larger stripe size.

You should select the stripe size relative to both the I/O segment size and the number of drives in the array, so that most I/O operations either

- Do not cross stripes and involve only a single drive
- Cross many stripes and involve all the drives in the array.

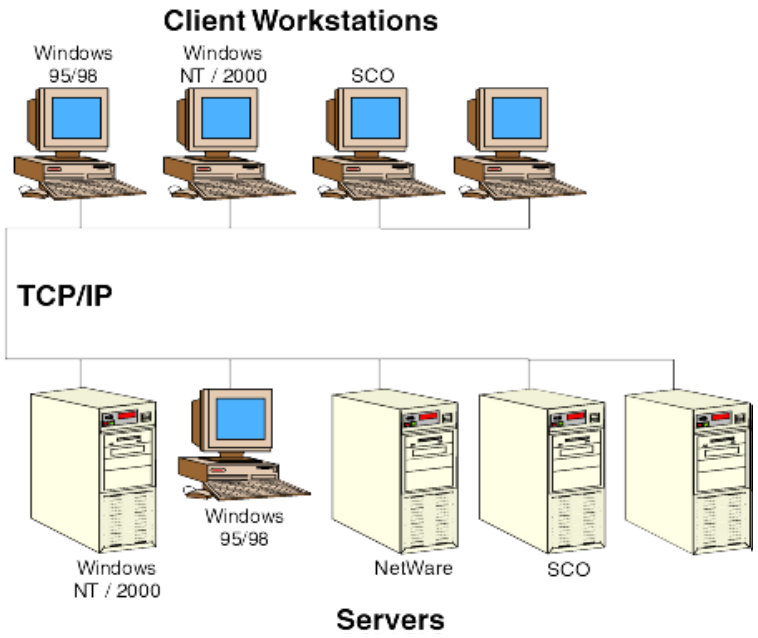
Remote Communication

The Storage Manager Remote Communication feature lets you use Storage Manager running on your local workstation to manage remote server systems that contain Adaptec controllers. The Available Connections window shows the types of connections you can use and any predefined connections you have created.



Communicating Across a Network

Storage Manager can run as a client/server application across a network using a TCP/IP connection. The Storage Manager client runs on a supported workstation operating system and connects to one of the supported networked servers running the Adaptec communication engine. The following illustration shows the supported workstation and server connections for a TCP/IP network.



Installation and Configuration

Remote Communication uses both workstation-based and server-based software components. The workstation (client) remote communication software is automatically installed during Storage Manager setup. You are given the option whether to install the Communication Server software when you run the Storage Manager setup program on an operating system that supports a Adaptec communication server (Windows 2000, Windows NT, Windows 95/98, NetWare or SCO platforms).

You must configure Remote Communication before it can be used. For both workstations and servers, this is done by editing the Storage Manager configuration file (dptmgr.ini)**.** There may be additional server configuration steps, depending on your operating system. You must have physical connections between the servers and client workstations.

Note: Under Windows 95/98, the server must be started manually by selecting the Adaptec Communication Server icon. This version of the communication server runs in a DOS window.

Editing the Configuration File

Both the workstation and server communication engines use the Storage Manager configuration file (dptmgr.ini). This file is contained in the directory in which you installed Storage Manager.

The OPTIONS section of the file controls the behavior of the communication server. To control the display of messages from the server, change the Verbose parameter:

```
[OPTIONS]
Verbose=x
```

where *x* is:

0	No messages
1	Basic messages (such as errors, connects and disconnects)
2	More messages (option 1 messages + socket numbers and TCP/IP addresses)
3	All messages (option 2 messages + message tracing)

The default is 1.

The MODULES section of the file tells the communication server which protocol setting you want to use for communication.

`[MODULES]`	Specify as many as needed
`TCP`	Communication server will use TCP protocol

The following list shows all supported options. The value listed is the default; optional values are in parentheses.

`[TCP]`	TCP/IP protocol

SOCKET=2091	TCP socket on which to listen. Can be any valid socket number.

Setting up the Server

If you are using an operating system that supports the Adaptec communication server and selected the Communication Server option during Storage Manager setup, the server was automatically installed at that time. Additional steps may be required to complete the installation, depending on your operating system. Most operating systems require setting up a user name and / or password before the server can be accessed. The default password is *password*.

Novell NetWare

Logging in to a NetWare server requires a user name and password. The user name and password are unique to the Adaptec communication module (dptcom.nlm). Logging on through a Storage Manager client with remote communication does not log on to the NetWare server.

If a you want to receive broadcast messages from the Adaptec Broadcaster module (dptnwmsg.nlm) you must be logged in to the NetWare server from a client workstation and your NetWare user name must be in the dptelog.ini file as user=*user_name*.

Windows 2000 or Windows NT Server

Under Windows 2000 and Windows NT, the server is installed as a service named Adaptec Communication Service and starts automatically when Windows starts.

Windows 2000 or Windows NT server access requires both a user name and password. The user name must be defined through the Windows 2000 or Windows NT User Manager. Additionally, the user name must have Administrator level privileges.

For Windows NT 4, you also need to setup the user account by performing the following steps:

1. Login with Administrator privileges.
2. From the Start menu select **Programs–Administrative Tools–User Manager**.
3. Select **Policies-User Rights** and check the **Show Advanced User Rights** box when the User Rights Policy dialog appears.

4. Grant the Act as part of the operating system and Log on as batch job rights to the Administrators group.
5. Reboot the system before you attempt to use Remote Communication.

Windows 95/98

Under Windows 95/98, the communication server is installed as a DOS command line application. You can start the communication server by double clicking on Communication Server in the Storage Manager folder on the Start menu.

The Windows 95/98 server is accessed by a password only; a user name is not required. The initial default password is `password`. To change the password, run Change Communication Password from the Storage Manager folder in the Start menu.

SCO UNIX

Under SCO UNIX, a communication server entry is placed into the rc.d files, which causes it to be started when the system is booted into multiuser mode.

During installation, the file dptcom.chk is created in the directory into which Storage Manager is installed. The ownership of this file is set to root/root, and permissions are -rw-rw---(6608).

Access to SCO servers requires both a user name and password. After determining that the user name and password are valid on the system on which it is running, the communication server will attempt to open dptcom.chk using the user name.

Connecting Servers and Workstations

The Storage Manager client must have a physical connection to connect to a remote server.

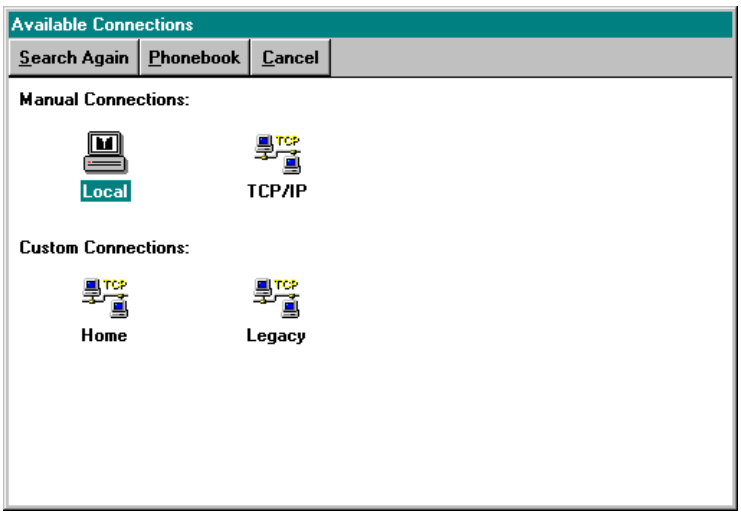
Servers and workstations communicating by TCP/IP must be connected by a local area network (LAN) or the Internet. Some operating systems may require additional TCP/IP protocol configuration before use. Refer to your operating system documentation for more information.

The client workstation specifies the TCP/IP address of the server, along with a user name and password as required by the server.

Connecting to Remote Systems

Select **Communication–Make Connection** to use Storage Manager to manage Adaptec hardware in a remote server system using the Remote Communication feature. This menu item displays the Available Connections window.

Note: You can also use the `IP=`*`address`* command line parameter when you start Storage Manager. This parameter causes Storage Manager to connect to the remote system at the specified IP address instead of the default *Local* connection.



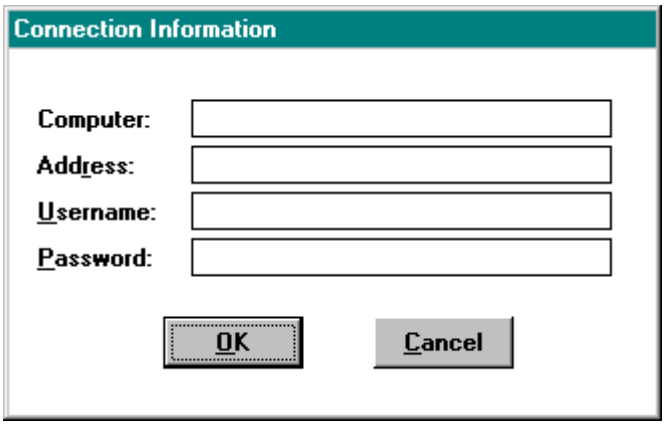
From this window, you can make a connection either by selecting one of the available protocols under Manual Connections and entering the name, address, and password of the server; or by selecting an entry under Custom Connections. Custom Connections are those for which you previously stored address information in the Phonebook (see *Using the Phonebook* on page 2-53 for more information).

Note: Attempting to connect to a NetWare host that is down or attempting to connect to a SCO OpenServer 5 host when another connection exists can freeze or otherwise disable the Storage Manager client workstation.

Making a Manual Connection

Under the Manual Connections section of the Available Connections window, there is one icon for each protocol that you configured in the dptmgr.ini file, and an icon for the system you are using (Local).

To make a connection to a remote system, double click the icon that represents the protocol that your workstation uses to connect to that system. (To select the system from which you are running Storage Manager, select the **Local** icon). For icons except Local, the Connection Information dialog is displayed. Enter the address, user name (if required), and password for the server selected. Refer to *Connecting Servers and Workstations* on page 2-50 for more information.

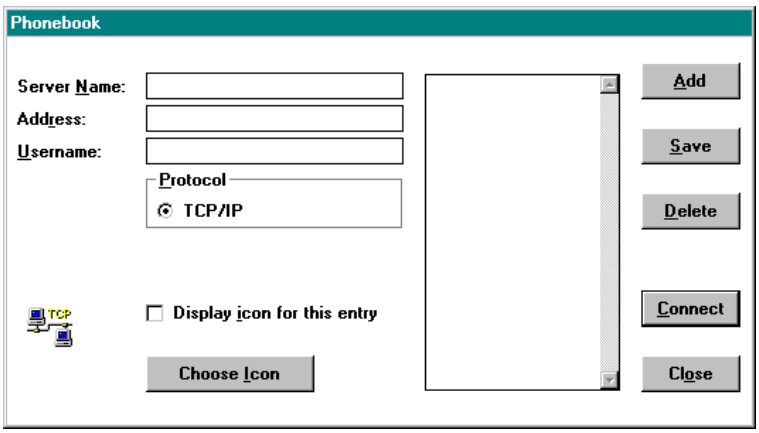


When you click OK, Storage Manager attempts to connect to the remote system. If the connection is successful, Storage Manager scans the Adaptec hardware on the remote system. When the hardware scan is complete, the Physical Configuration View window for the remote system appears.

Using the Phonebook

You can save the server name, address, user name, and protocol of systems you frequently access in the Phonebook. After you have entered data for a system, you can place an icon under Custom Connections to make future connections to that system without having to re-enter the connection information each time.

To make an entry in the Phonebook, fill in the appropriate fields.



Select **Display icon for this entry** if you want an icon for this connection displayed in the Available Connections window. You can customize the icon to be used by clicking **Choose Icon**.

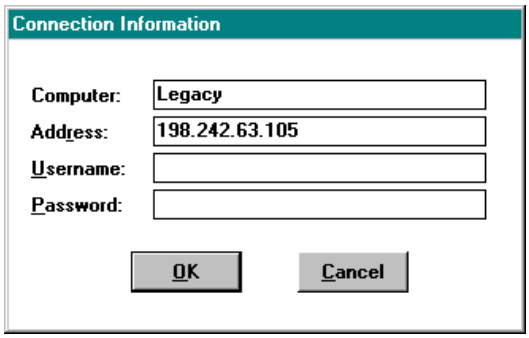
Click **Add** to add the new entry. Click **Delete** to remove unwanted entries. When you are finished, click **Save** to save your changes.

To make a connection from within the Phonebook, highlight the desired system and click **Connect**.

Using a Custom Connection

Under the Custom Connections section of the Available Connections window, there is one icon for each system that you marked for display in the Phonebook.

To make a connection to a remote system, double click the icon. The Connection Information dialog appears. Enter the password of the server selected. Refer to *Connecting Servers and Workstations* on page 2-50 for details.



When you click **OK**, Storage Manager will attempt to connect to the remote system. If the connection is successful, Storage Manager scans the Adaptec hardware on the remote system. After the scan is complete the Physical Configuration View window for the remote system appears.

Note: You can also use the `IP=`*`address`* command line parameter when you start Storage Manager. This parameter causes Storage Manager to connect to the remote system at a specified IP address instead of the default Local connection.

3

Command Line Utility

In this Chapter

Introduction

The command line utility (RAIDUTIL) performs operations as soon as it has enough information from the command line to do so. The utility does not parse the entire command line before starting an operation. Operations are performed in series up to the first failure encountered.

If the utility does not have all of the information necessary when it attempts to perform an action, it will report an error. It is possible for the utility to partially succeed. That is, it was able to perform the first *n* actions, then encountered something it could not do. In this case, the utility will exit with an appropriate error message. Each operation attempted results in a one-line pass or fail indicator displayed on the screen unless the *Quiet* mode is specified.

In general, you can perform multiple operations on one command line. However, make sure you are aware of the groupings and restrictions to ensure that the functions are carried out correctly.

Known Restrictions

The parameters -g, -l, -r, -s, and -z are used together for Logical Drive creation. If used, these parameters must precede the -g parameter.

If you are doing multiple Logical Drive creations on the same command line, make sure that you put commas between the drives specified for the -g parameter.

Exit Status

0 Error-free termination

1 Error termination (the message log will contain the error information)

Command Line Summary

Switch	Description
-c	Specify controller OS relative
-d	Specify controller BIOS relative
-g	Specify drive group
-l	Specify new logical drive RAID Level
-s	Specify logical drive capacity
-z	Specify logical drive stripe size
-D	Delete logical drives
-h	Create hot spare drive
-H	Delete hot spare drive
-r	Specify task rate
-a	Action (Task) control
-A	Alarm status and control
-C	Load / Save configuration
-w	Write caching
-Z	Reset / clear embedded RAID information
-X	Reset NVRAM configuration
-F	Flash update controller firmware
-L	List devices
-I	Display inquiry information
-q	Quiet mode
-e	Display or delete Event Log messages
-f	Force state
-P	Output pagination
-E	Expand disk array
-?	Display utility usage information

Command Line Parameters

The *device address* is in the form `d#b#t#d#`, where

The first d# is the controller number (starting with 0).

b# is the bus number

t# is the device id (0–15)

The second d# is the logical unit number (LUN).

This physical device address format is used in many of the commands to specify which device is to be targeted. To specify all devices on a bus, you can specify d#b#. You can specify all devices on a controller as simply d#. You can display device information by using the List (-L) command.

Logical Drive Create/Delete Switches

-c, -d Specify controller

This switch specifies the RAID controller to which all subsequent parameters will apply. It is required for all operations

You can specify a device which is attached to the controller, from which the controller number will be derived, or you can enter the relative controller number directly.

Use `-c` to specify the controller using the ID assigned to the controller by your operating system.

Use `-d` to specify the controller ID in BIOS format. Adaptec controllers are numbered starting from 0 according to their PCI slot location. The boot controller or the controller in the lowest number PCI slot is ID `d0`.

-g Specify drive group

This switch specifies which physical drives are to be used as the new logical drive. The device addresses should be entered in the d#b#t#d# format. Commas must be used to separate drives. This switch is required for logical drive creation and must be the last parameter in the array creation command sequence.

Multilevel arrays (0/1 and 0/5) can be created by separating drive groups with the + character.

The number of drives supported are:

- RAID 0 - 2 to 64 drives
- RAID 1 - 2 to 64 drives (as pairs)
- RAID 5 - 3 to 64 drives

-l [0, 1, 5] Specify new logical drive RAID Level

This parameter specifies the logical drive RAID level. If this switch is omitted, RAID 5 is the default.

-s Specify Logical Drive capacity

Specifies the new logical drive's capacity in megabytes (1024^2).

If this switch is omitted or if the specified capacity entered exceeds the maximum available, the maximum possible logical drive is created based on the capacity of the physical drives.

-z Specify logical drive stripe size

Specifies the stripe size (in KB) for new RAID 0 and RAID 5 logical drives. This switch is ignored for RAID 1.

Valid Stripe sizes are: 8, 16, 32, 64, and 128 (KB). If this parameter is omitted, a default stripe size is used. The default is selected by the controller firmware based on the number of drives in the array.

-D Delete logical drives

This command deletes the specified drives and returns their capacity to unassigned space. If **all** is specified, then all logical drives on the controller are deleted. Logical drives are specified by the device address. Use commas to separate drive addresses. If Quiet (-q) mode is not used, a confirmation message is displayed.

Examples:

```
RAIDUTIL –l 5 –g d0b0t0d0,d0b0t1d0,d0b0t2d0
```

This command will create a RAID 5 array, consisting of device IDs 1, 2, and 3 on controller 0/bus 0.

```
RAIDUTIL –l5 –g
d0b0t0d0,d0b0t1d0,d0b0t2d0+d0b1t8d0,d0b10t9d0,
d0b1t10d0
```

This command will create a RAID 0/5 array, consisting of device IDs 1, 2, and 3 on controller 0/bus 0 and device IDs 8, 9, and 10 on controller 0/bus 1.

Hot Spare Control

-h Create hot spare drive

This switch creates one or more stand-alone hot spare drives. The drives must physically exist and may not contain any logical drive segments. Reboot your system after creating hot spare drives to ensure they are recognized correctly.

Specify certain logical drives by the device address. Commas must be used to separate drives.

```
RAIDUTIL -d1 –h 015
```

Makes ID 15 controller 1 a hot spare

Note: The –r parameter can follow this switch to set the rebuild priority for the new hot spare.

-H Delete hot spare drive

This switch deletes one or more stand-alone hot spare drives. The capacity is returned to unassigned space.

Specify the hot spare drives by the device address. Commas must be used to separate drive addresses. Specify *all* to delete all stand-alone hot spare drives.

Operating Parameters

-r Specify task rate

This switch sets a task priority for the device or logical drive. The parameter can be 0 – 9; with 0 being the slowest and 9 being the fastest. You can also specify the rate as follows:

-r slow = 1

-r medslow = 3

-r med = 5

-r medfast = 7

-r fast = 9

The device address is required. Specify logical drives by their device addresses. You can set the rate for all logical drives on a controller by using the device address of the controller.

-C Load or save configuration

This switch has two options:

load loads the specified configuration file.

save saves the current configuration to the file name specified.

A file name must follow the load or save parameter. This is a .DSM file, which can also be loaded or saved using Storage Manager.

-w Write Caching

Options are on and off. The default (on) uses Write-Back caching. Off sets the operation to Write-Though caching. Specify drives using the device address.

Controller Specific Options

-Z Clear embedded RAID information

This option destroys all RAID information pertaining to disk arrays and logical drives for the specified device. Specify logical drives by using the device address.

All specified drives become individual, unassigned physical drives after this command is used.

Caution: There is no procedure to reverse the effect of the -Z operation. This option is a method of last resort for deleting conflicting RAID table information.

-X Reset NVRAM Configuration

This option resets the controller NVRAM to the factory default settings.

-F Update controller firmware, BIOS, SMOR, or NVRAM

This option updates the controller flash memory (EEPROM). Specify an image file name on the command line.

Note: The -F switch does not work on Novell NetWare systems. Use SMOR to update the controller flash memory. See *Upgrading Firmware* on page 1-26 for additional information.

-a Action (Task) control

This switch has the following options which allow you to control tasks on the controller:

List	Shows tasks for the controller.
Build	Starts build of logical drive.
Rebuild	Starts rebuild on logical drive.
Verify	Starts a verify operation.
Stop	Terminates active task on drive.

Specify drives by the device address.

General Information Display Parameters

-L List devices

Specify drives by the device address. The parameters for this switch are:

Controller	Displays a list of all Adaptec controllers in the system.
Physical	Displays all attached devices to the specified controller.
Logical	Displays a list of all logical drives on the controller, by logical drive number.
Spare	Displays a list of all stand-alone hot spare drives.
RAID	Displays a list of all configured RAIDs.
Array Speed	Displays a list of the bus speed of all connected drives.
Redirect	Displays any redirected devices.
Version	Displays the controller firmware, SMOR, NVRAM, and BIOS version numbers.
Cache	Displays the device caching mode.
Inquiry	Displays the device capabilities as reported to the controller.
Battery	Displays information about the battery backup module.
All	Prints out all of the above.

Note: If a controller is not specified then each controller is listed, along with all devices on each controller.

-I Display inquiry information

This switch displays controller specific information, including firmware revision, BIOS version, and serial number. Specify drives by the device address.

-A Alarm status and control

When no parameters follow the switch, the alarm status and enable flags are displayed.

on	Forces the audible alarm to sound.
off	Silences the audible alarm when it is on.
enable	Allow the alarm to be heard when a failure occurs.
disable	Prevents the alarm from sounding for any reason.

-e Display or delete Event Log messages

This switch lets you display or delete the entries in the controller event log using the following parameters:

soft	Display all log data (Level 1).
recov	Display only recoverable hard errors (Level 2)
nonrecov	Display only nonrecoverable hard errors (Level 3)
status	Display only status changes (Level 4)
delete	Delete all log entries for the controller.
d#	The target controller ID for this command.

Examples:

```
RAIDUTIL -e soft -d0
```

displays all log entries for controller 0.

```
RAIDUTIL -e delete d1
```

Deletes all event log entries on controller 1.

-f Force State

Forces an array to an Optimal status or Failed status.

```
RAIDUTIL -f optimal d1b1t0d0
```

will force the device at address d1b1t0d0 to an Optimal status.

```
RAIDUTIL -f fail d1b1t0d0
```

will force the device at address d1b1t0d0 to a Failed status.

-P Output pagination

Limits output to 22 lines, then prompts to press **Enter** to continue. Pressing **Enter** prints another 22 lines.

Use this switch to prevent lengthy output from -L from scrolling off the screen.

```
RAIDUTIL -P -L   All
```

-E Expand disk array

This command lets you add additional capacity to an existing RAID 5 disk array. Specify an existing logical drive array and one or more additional disk drives after the -E command. This command switch is valid only for Windows NT and Windows 2000 systems using the NTFS file system.

```
RAIDUTIL -E d0b0t0d0 d0b0t4d0,d0b0t4d0
```

Where d0b0t0d0 is the RAID 5 disk array and d0b0t4d0,d0b0t4d0 are two drives you want to add to the array.

-q Quiet mode

This switch suppresses display of messages while the utility is running. This can be useful when running it from a script or batch file.

Note: Because all command line switches are processed sequentially, this option only suppresses output starting from the point where it appears in the command line.

-? Display utility usage information

This option displays a summary of the command usage information. This includes all command line switches and brief definitions.

A

SNMP and DMI

In this Chapter

Introduction

Computer systems are made up of physical components that include items such as motherboards, CPUs, RAID controllers, software, memory and also components such as logical drives derived from disk arrays. Simple Network Management Protocol (SNMP) lets you obtain basic Adaptec hardware configuration and status information from an SNMP-based management console. You can also receive SNMP Traps, which are messages about changes in the hardware status. These messages alert you to important events that affect the Adaptec hardware and attached devices. The Desktop Management Interface (DMI) is a standard developed by the Desktop Management Task Force (DMTF) to manage computer systems and their components locally or remotely.

Simple Network Management Protocol

Simple Network Management Protocol (SNMP) is a group of network management specifications, which includes the protocol itself, the definition of the database and associated concepts. SNMP

is widely used and supported on a variety of servers, workstations, bridges, routers, and hubs. SNMP support also includes other computer system resources, such as SCSI, Fibre Channel, and RAID controllers.

SNMP implementations vary from simple device information display and collection of statistics, to complex configuration management systems. SNMP is implemented by creating a *Management Information Base* (MIB) that describes the objects to be managed. SNMP establishes standards to access and manage various types of data regarding attached resources within a computer network.

Management Information Base

As with any network management system, the core component of SNMP is the database containing the information about the objects to be managed. For SNMP this is referred to as the Management Information Base or MIB. A MIB is written using the ASN.1 (Abstract Syntax Notation One) format as described in ISO 8825-2. This format allows the exchange of structured data, especially between application programs over networks, by describing data structures in a form that is independent of machine architecture and application software.

Every system resource to be managed is represented as an object and the MIB is a collection of these objects. In a network environment each system (workstation or server) maintains a copy of the MIB containing the current status of the objects which it defines. The MIB information is kept up-to-date by a software agent. At the operating system level, there is a Master Agent that controls the system MIB. Each vendor for a managed resource (such as Adaptec) also supplies a subagent that contributes its own MIB to the system MIB. This subagent also responds to requests from the Master Agent for information as needed.

Note: For additional security all of the Adaptec MIB data is read-only. The Adaptec SNMP feature is intended only for gathering inventory information and for processing status and alert information.

Management Console

The SNMP management console is usually a client workstation running SNMP-based management software. The console software can be from any vendor who provides SNMP management console software.

Adaptec MIB Information

The specific hardware and configuration information in the Adaptec MIB includes groups for the following:

- Adaptec SCSI system modules
- Adaptec SCSI controllers
- Adaptec SCSI busses
- Adaptec SCSI devices
- Adaptec SCSI arrays
- Adaptec SCSI statistics
- Adaptec SCSI events

Refer to the MIB itself for the exact contents of each of these groups. The following lists are the groups' contents:

Adaptec SCSI System Modules group identifies the versions, creation date and various capabilities of the software modules. The following specific modules are included:

- Adaptec SNMP subagent
- Adaptec SNMP engine
- Adaptec SCSI driver
- Adaptec SCSI logger
- MIB revision information

Adaptec SCSI Controller group is a list of all Adaptec controllers in the system. This group contains the following information for each Controller:

- Controller number
- Controller vendor
- Firmware version
- Address
- IRQ
- IRQ Type
- Host bus type
- Max transfer rate
- Controller modules (RAID, expansion, caching, DIMMs)

Adaptec SCSI Bus group is a list of the SCSI busses with a set of parameters which describe and control a SCSI bus. These parameters include:

- SCSI bus number
- SCSI bus width
- SCSI bus type
- SCSI bus transfer rate
- Adaptec controller SCSI ID (on this bus)

Adaptec SCSI Device group is a list of SCSI devices managed by the Adaptec SCSI subsystem and represents the physical configuration. For each device in the system there is

- Device SCSI address information:
  - Controller
  - Bus
  - ID
  - LUN
- Device SCSI Inquiry data
- Device capacity and block size
- Device RAID level and status (Optimal, Failed, etc.)

Adaptec SCSI Array group contains all the RAID-specific information within the Adaptec SCSI subsystem. For each array there are

- Configuration parameters
- SCSI address information
- Background task information

Adaptec SCSI Statistics group contains statistical information regarding the Adaptec SCSI controllers, SCSI devices and arrays. For each SCSI controller, there are statistics on

- Cache pages
- Commands
- Transfers

For Devices and Arrays there are statistics on

- Cache hits / misses
- Stripe boundary crossings
- Physical I / O commands (read / write)

Adaptec SCSI Events group is used to send traps on controller event log entries. These event log entries are converted to SNMP traps and are identical to those used by the Adaptec Logger / Broadcaster. The specific traps are listed in the MIB.

What's Included

The Adaptec SNMP software components are included on the CD-ROM in the Adaptec controller package. Specific components vary by operating system.

The Windows 95 / 98 and Windows NT components are installed from a diskette that you create from the CD-ROM. The components are as follows:

- Adaptec Event Logger
- SNMP Event Logger extensions
- Adaptec SNMP subagent
- Adaptec MIB

System Requirements

The Adaptec SNMP feature has the following system requirements:

- The TCP/IP network protocol must be enabled on your system. Refer to your operating system documentation for information about installing the TCP/IP protocol.
- The SNMP Service for your operating system must be installed.

Hardware Support

The Adaptec SNMP agent is designed to work with all Adaptec SCSSI RAID controllers. The specific controller information available will vary depending on whether or not that device has RAID or cache capability.

Management Consoles

The Adaptec SNMP agent conforms to the SNMP Version 1 specification. Adaptec has developed and tested this feature to work with various operating systems that provide built-in SNMP capability.

Operating Systems and Platforms Supported

The following environments support management of Adaptec hardware from an SNMP management console:

- Novell NetWare 4.2, 5.x
- SCO UnixWare 7.1
- Windows 95/98
- Windows NT 4.0
- Windows 2000

Installing Adaptec SNMP Support

The following topics describe how to install Adaptec SNMP subagent software components and how to install SNMP support for Microsoft Windows 95/98, Windows NT 4.0 and Windows 2000.

Note: Ensure that your operating system has SNMP support enabled before installing the Adaptec subagent software.

The Adaptec SNMP agent can be installed during the Adaptec Storage Manager installation process. The Setup utility displays a Select Components dialog that includes a check box for the Adaptec SNMP software. To install this feature, check the box labeled **SNMP Agent**.

By default this check box is not checked. Continue with the installation according to the installation procedure for your operating system in *SCSI RAID Installation Guide*.

Installing SNMP for Microsoft Windows NT / 2000

If your operating system is Windows NT or Windows 2000, refer to the Microsoft Windows NT or Windows 2000 documentation for information about installing the Windows SNMP Service.

Installing SNMP for Microsoft Windows 95

If your operating system is Windows 95, the SNMP Service must be installed by following these steps:

1. Insert the Microsoft Windows 95 Installation CD-ROM into your CD-ROM drive. If the Autostart window appears, close the window.
2. Launch the Network icon in Control Panel. Click **Add** and select **Service** as the type of network component to install.
3. Click Add, then click the Have Disk button. Browse to the admin\nettools\snmp directory on the CD-ROM. The file snmp.inf will be selected. Click **OK**.
4. Click **OK** in the Install From Disk window. The Microsoft SNMP agent will be selected. Click **OK** to complete the installation.

Installing SNMP for Microsoft Windows 98

If your operating system is Windows 98, the SNMP Service must be installed by following these steps:

1. Insert the Microsoft Windows 98 Installation CD-ROM into your CD-ROM drive. If the Autostart window appears, close the window.
2. Launch the Network icon in Control Panel. Click **Add** and select **Service** as the type of network component to install.
3. Click **Add**, then click the **Have Disk** button. Browse to the \tools\reskit\netadmin directory on the CD-ROM. The file snmp.inf will be selected. Click **OK**.
4. Click **OK** in the Install From Disk window. The Microsoft SNMP agent will be selected.
5. Click **OK** to complete the installation.

Operation

Before you can view information about your Adaptec hardware, you must install the Adaptec MIB into the Management Console database. During the installation of the SNMP feature, the Adaptec MIB is installed by default in

\program files\storage manager\dptscsi.mib.

Refer to your SNMP Management Console documentation for more information about adding this MIB to your existing database.

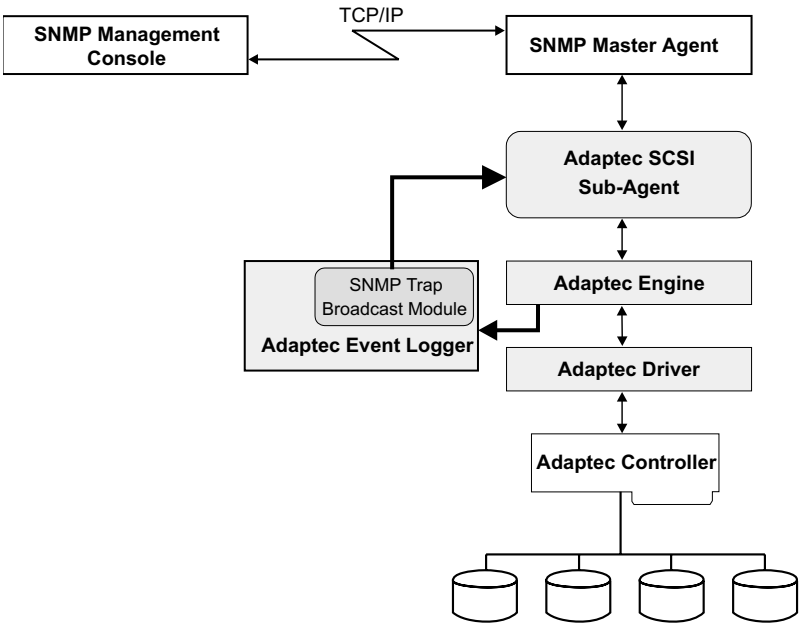
The Adaptec SNMP subagent can be accessed from any SNMP Management Console.

SNMP Software Overview

This section describes the architecture of the Adaptec SNMP functions in a platform independent manner.

The Adaptec SNMP software architecture is an addition to the current Adaptec software components. The components used in the SNMP implementation are the Adaptec Engine, Event Logger / Broadcaster and operating system device driver. The Adaptec Engine is used to gather all information on the system configuration and to perform the defined management functions. An SNMP trap

broadcast module has been added to the Event Logger to handle messages that are intended specifically for the SNMP console.



Adaptec SNMP Subagent

The Adaptec SNMP subagent attaches to the operating system-specific Master Agent to handle SNMP requests for objects defined that are defined in the Adaptec MIB. It also broadcasts the Adaptec specific Traps to the designated management consoles.

The design and implementation of the Adaptec SNMP subagent complies with the operating system-specific implementations of the SNMP specification. This assures compatibility and functionality within each operating system environment. On the client side, all SNMP management consoles are supported.

Adaptec SNMP Trap Broadcaster Module

The SNMP Trap implementation uses the Broadcaster feature of the Adaptec Event Logger. The Event Logger has individual broadcast modules that have complete control over how events are received from the Event Logger. The modules define what events are to be sent and how they want to receive the event information. Each broadcast module has control over which events are to be broadcast, how they are broadcast and where they are sent.

An SNMP Trap Broadcast module controls all Adaptec SNMP traps. The SNMP Trap Broadcast module registers with the Adaptec Event Logger to receive all events generated for the Adaptec subsystem. This module then forwards all events to the Adaptec SNMP subagent for processing and delivery to the SNMP Master Agent.

Desktop Management Interface

The Desktop Management Interface (DMI) and SNMP are very similar services. The Desktop Management Taskforce (DMTF) has defined a mapping standard that allows SNMP and DMI components to work together. The Adaptec DMI component instrumentation conforms to the version 2.0 of the DMI specification. The DMI Management Application and Service Provider (DMI version 2.0) must be present on the system so that the Adaptec DMI support can function.

DMI consists of three components:

- A Management Application
- A Service Provider
- Component Instrumentation.

Management Application

The Management Application (MI) is a customer-supplied module and is the interface that allows a user to locally or remotely manage the components of a computer system.

Service Provider

The Service Provider (SP) manages the communication between the MI and the Component Instrumentation (CI). The MI can request information from the CI or the CI can notify the MI of specific events (failed drives, high temperature, and so on) through the SP. The SP also maintains a database of components that are defined by Management Information Format (MIF) files.

Component Instrumentation

The Component Instrumentation (CI) handles requests for component information from the SP and alerts the SP of any events that occur.

System Requirements

Adaptec only supplies a read-only Component Instrumentation and Mass Storage (.MIF) file. Both the Management Application and the SP must be provided by the your operating system or computer system vendor.

Hardware Support

The Adaptec Component Instrumentation is designed to work with all Adaptec SCSI RAID controllers. The specific controller information available will vary depending on whether or not that device has RAID or cache capability.

Operating Systems and Platforms Supported

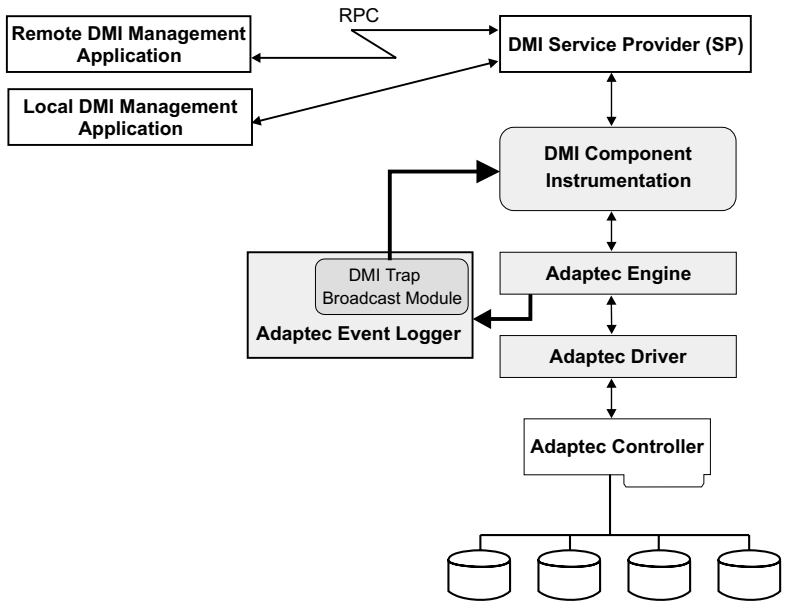
The following environments allow DMI management of Adaptec hardware:

- Windows 95/98
- Windows NT 4.0 Workstation and Server versions
- Windows 2000

The Adaptec CI

At startup time the CI gathers information about Adaptec SCSI RAID controllers and stores this information in a DMI format table. When an inquiry is made for a particular attribute it is obtained from this table for static information or through the engine for dynamic information.

The Adaptec CI sends event notification up to the SP for events that are reported by the Broadcaster module. These events include high or low voltage, high temperature, drive failure, and RAID status changes.



Installing DMI Support

Adaptec supplies the CI only. The SP and MI must be provided by the operating system or other third-party. The CI consists of the Adaptec engine, Broadcaster, I_2O driver, firmware, and CI module. The CI module is a separate add-on that is installed only if Storage Manager is already installed.

Included Modules

The Adaptec DMI software modules are included on the CD-ROM with the Adaptec controller. The Windows 95/98, Windows NT and Windows 2000 modules are on the Adaptec CD-ROM. The modules are as follows:

Adaptec Event Logger

DMI Event Logger Extensions

Adaptec RAID Engine

Adaptec Driver

Adaptec Component Instrumentation

Adaptec MIF

DMI-Specific Files

AdptDmic.exe
This is the component instrumentation application.

AdptDmic.mif
This is the Adaptec Mass Storage MIF

AdptDmic.dll
Generic DLL used by the CI.

AdptSal.dll
Platform specific DLL used by the CI.

AdptDmi.dll
DMI Trap Broadcast Module

MIF Groups

The following is a list of groups contained in the Adaptec Mass Storage MIF file. The attributes for each group are not included here, see the ADMPDMI.MIF file for details.

DMTF - ComponentID

DMTF - FRU

DMTF - Storage Devices

EventGeneration - DMTF Storage Devices

DMTF - Storage Controller

EventGeneration - DMTF Storage Controller

DMTF - Bus Port

DMTF - Fibre Channel Bus Port Extensions

DMTF - SSA Bus Port Extensions

DMTF - Aggregate Physical Extent

DMTF - Aggregate Protected Space Extent

DMTF - Volume Set

EventGeneration - DMTF Volume Set

DMTF - Redundancy Group

EventGeneration - DMTF Redundancy Group

DMTF - Mass Storage Association

EventGeneration - DMTF Mass Storage Association

DMTF - Bus Port Association

DMTF - Component Spare Association

DMTF - SubComponent Software

DMTF - Mass Storage Statistics

DMTF - System Cache

DMTF - Cache Performance Table

DMTF - Operational State

DMTF - Worldwide Identifier