Configuration Tool and Utilities v3.21 Operation Manual

for Fusion RAID Storage Systems

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1.0 ATTO Configuration Tool Overview

About the Configuration Tool

The ATTO Configuration Tool is a utility program that displays information about installed controllers, drivers and drives, and provides a mechanism to configure installed controllers.

This program executes under:

- Mac OS X 10.4 or later
- Windows Vista /XP/Server 2003/2000
- Linux 2.6 kernel, x86 and x64

Note: *Java version 1.5 or later must be installed.*

The ATTO Configuration Tool displays:

- The name of the Sonnet RAID controller (*listed as an ExpressSAS Rxxx adapter*)
- Information about the drivers controlling the Sonnet RAID controller, including version information for both the currently executing driver and the flash image
- Information about drives attached to the Sonnet RAID controller

You may use the Configuration Tool to:

- Manage RAID groups
- Configure RAID Event notifications
- Modify the RAID controller's NVRAM settings
- Revert to default factory settings
- Update the RAID controller's flash image
- Update firmware on huge disk arrays

The factory settings on your Sonnet RAID controller should provide excellent performance for a wide range of applications. However, some applications may benefit from modification of the controller's NVRAM settings that tune the controller for a specific performance range.

Configuration Tool Launch

1. Locate the application icon in the folder created during installation.
2. Double-click the ATTO Configuration icon to start the application.

WARNING: Back up system data when installing or changing hardware configurations.

Note: *The Sonnet RAID controller is designed to operate properly using factory settings. Entering invalid or incorrect NVRAM settings may cause your Sonnet RAID controller to function incorrectly.*

The main screen has three panes: Device Listing, Configuration Options and Status. See **Figure 1** on page 3.

ATTO Configuration Tool Navigation

The Device Listing pane at the left of the window lists all devices (controllers and drives) currently connected to the system.

Expand the **device tree** to reveal additional detail on connected devices.

Support Note: In the **Device Listing** pane of the ATTO Configuration Tool window, the Sonnet RAID controller is identified as an ExpressSAS Rxxx.

The Configuration Options pane provides information and options for a device highlighted in the device listing.

If you highlight a device in the **Device Listing** pane, tabs and panes are displayed for that device.

The following chart specifies the tabs that are displayed for the indicated device type.

Tree Node	Tab(s) Displayed
Controller	Basic Info, Flash, RAID, RAID CLI, Advanced
Channel	NVRAM, PCI Info
RAID Groups	Basic Info, Flash
Local Host	Basic Info, Notifications

The following tabs are displayed in the Configuration Options pane when you select a specific controller in the Device Listing pane.

- The **Basic Info** tab provides information about the Sonnet RAID controller when it is highlighted in the Device Listing pane, or the computer if localhost is highlighted. You cannot make changes from these screens. See **Figure 2** on page 3 and **Figure 3** on page 4.
- The **Flash** tab provides information about the current flash version programmed on the highlighted controller. See **Figure 4** on page 4.

  Click the Browse button at the bottom of the tab to search for new flash files on your system such as FlashBundle_2007_02_27.R380.

  Once you've selected the flash file, click the Update button to automatically update your Sonnet RAID controller.
- The **RAID** tab provides information about attached drives, their RAID group and hot spare associations, and their operating status. See **Figure 5** on page 5.
- The **RAID CLI** tab provides access to the command line interface, which, as an alternative to application menu-based commands, enables the use of ASCII-based commands to control configuration and diagnostic tasks. See **Figure 6** on page 5.

1.0 ATTO Configuration Tool Overview

ATTO Configuration Tool Navigation (continued)

- The **Advanced** tab does not function with the Sonnet RAID controller; clicking this tab merely displays a message.

- When you select a specific channel under the Sonnet RAID controller in the Device Listing pane, the **NVRAM** tab displays the NVRAM parameters applicable to the Sonnet RAID controller and channel selected. Refer to NVRAM Settings on page 7, and Configuration Tool Troubleshooting on page 25 for information about NVRAM settings.

- The Sonnet RAID controller's information is displayed in the **PCI Info** tab. See **Figure 7** on page 6.

- The current status of the **Configuration Tool** is represented in the **Status** pane at the bottom of the window.

About window

The **About** window, displayed when About is selected from the Help menu, lists the ATTO Configuration Tool's version number. See **Figure 8** on page 6.

1.0 ATTO Configuration Tool Overview

Opening Screen

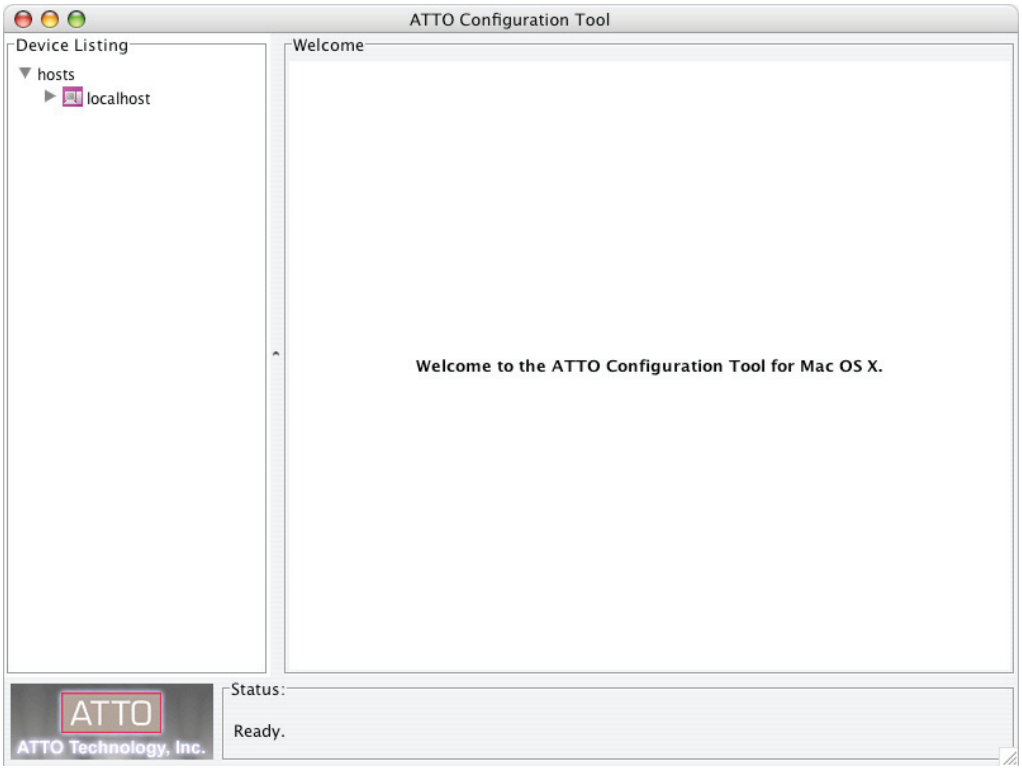

Figure 1

Basic Info tab when Local Host chosen in the Device Listing pane

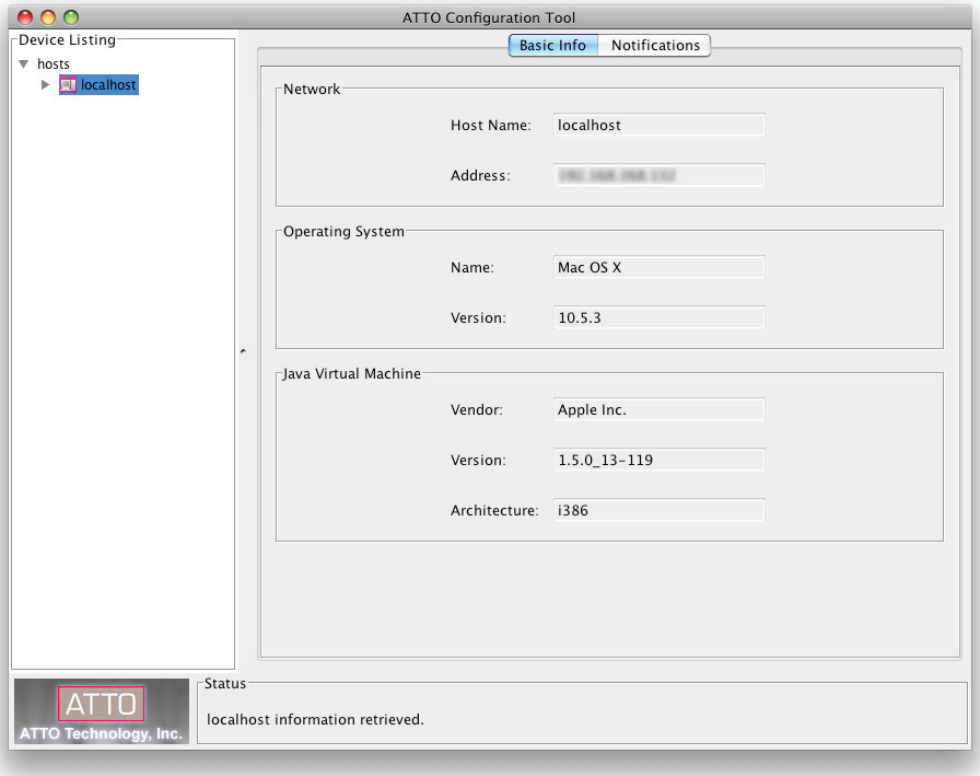

Figure 2

1.0 ATTO Configuration Tool Overview

Basic Info tab when the Sonnet RAID controller is chosen in the Device Listing pane

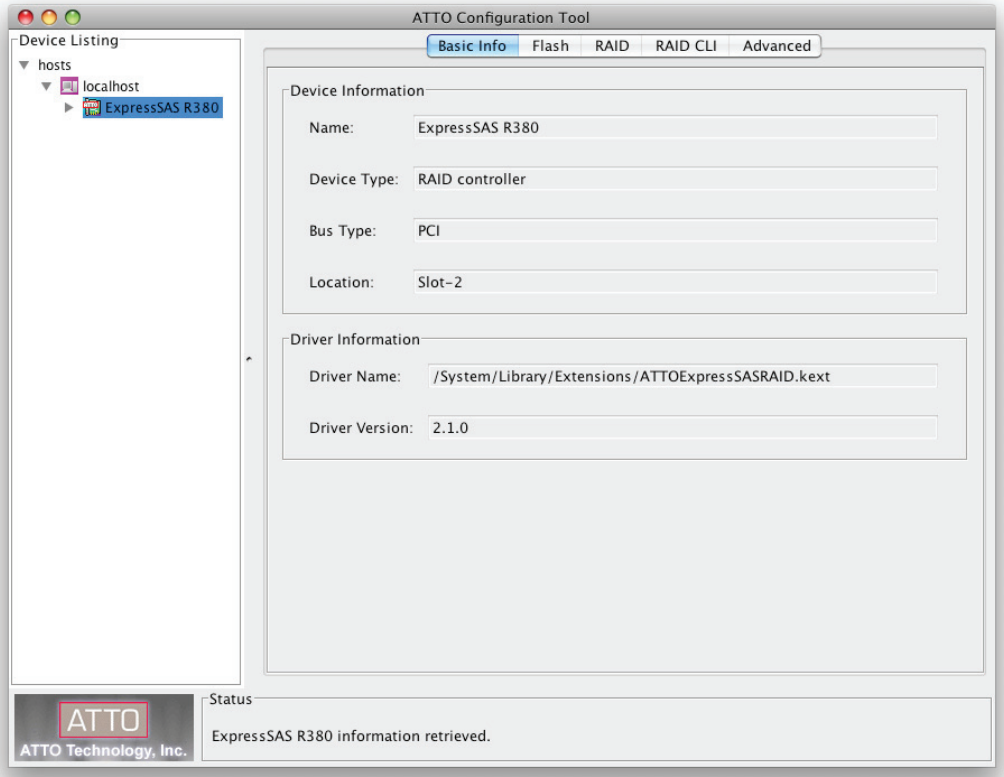

Figure 3

Flash tab when the Sonnet RAID controller is chosen in the Device Listing pane

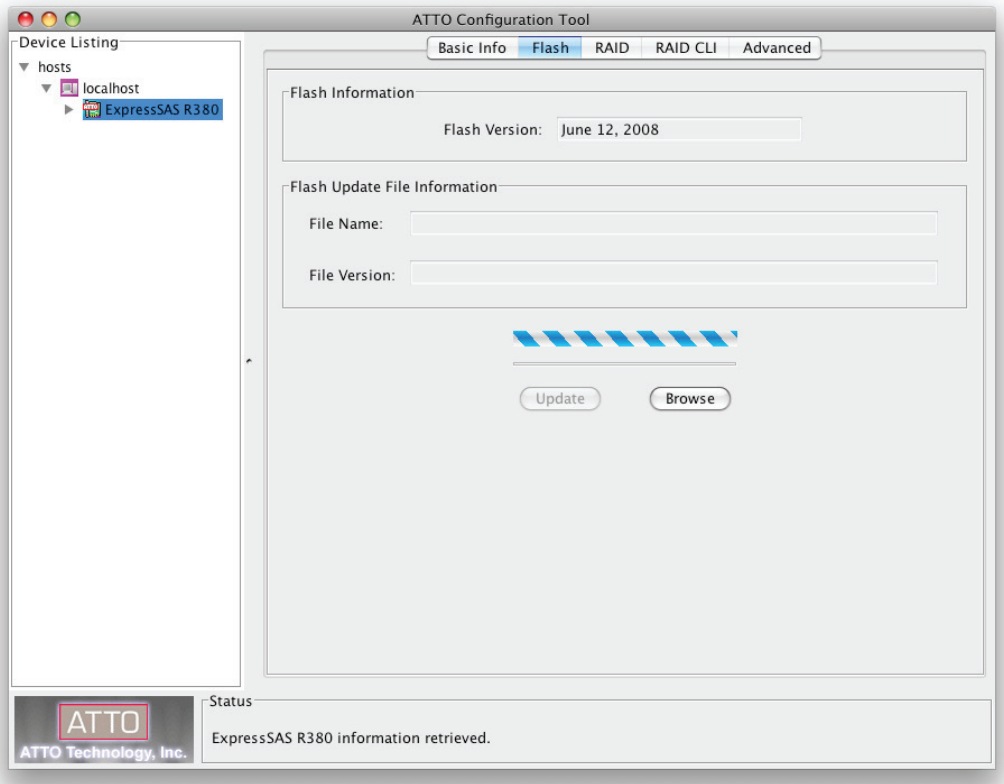

Figure 4

1.0 ATTO Configuration Tool Overview

RAID tab when the Sonnet RAID controller is chosen in the Device Listing pane

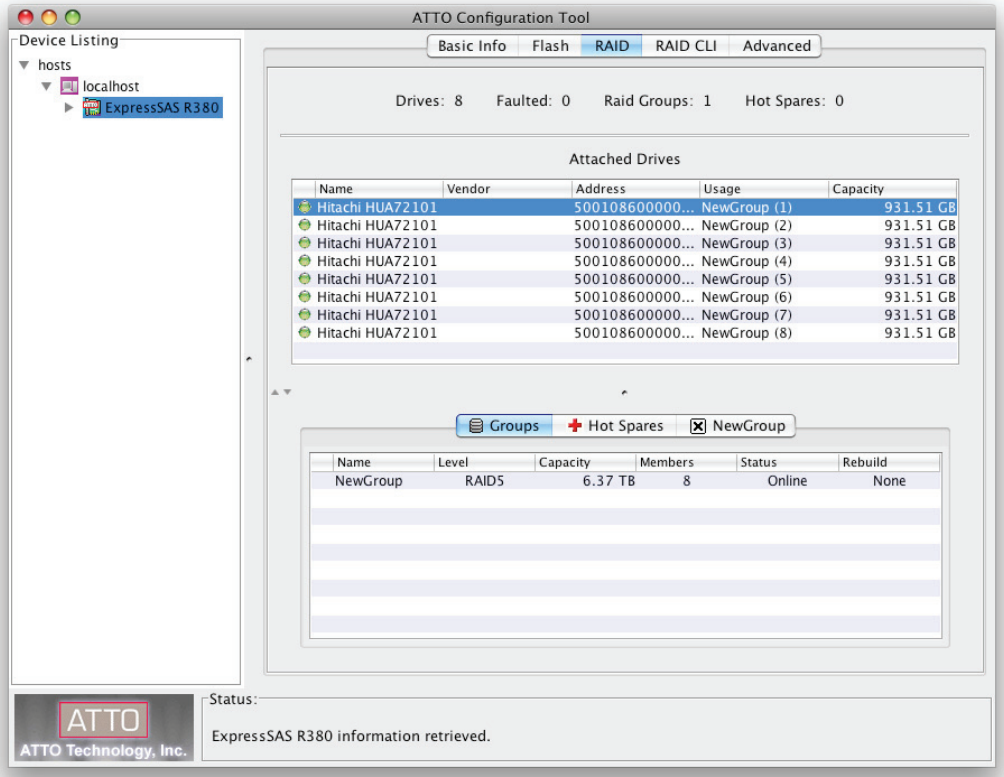

Figure 5

RAID CLI tab when the Sonnet RAID controller is chosen in the Device Listing pane

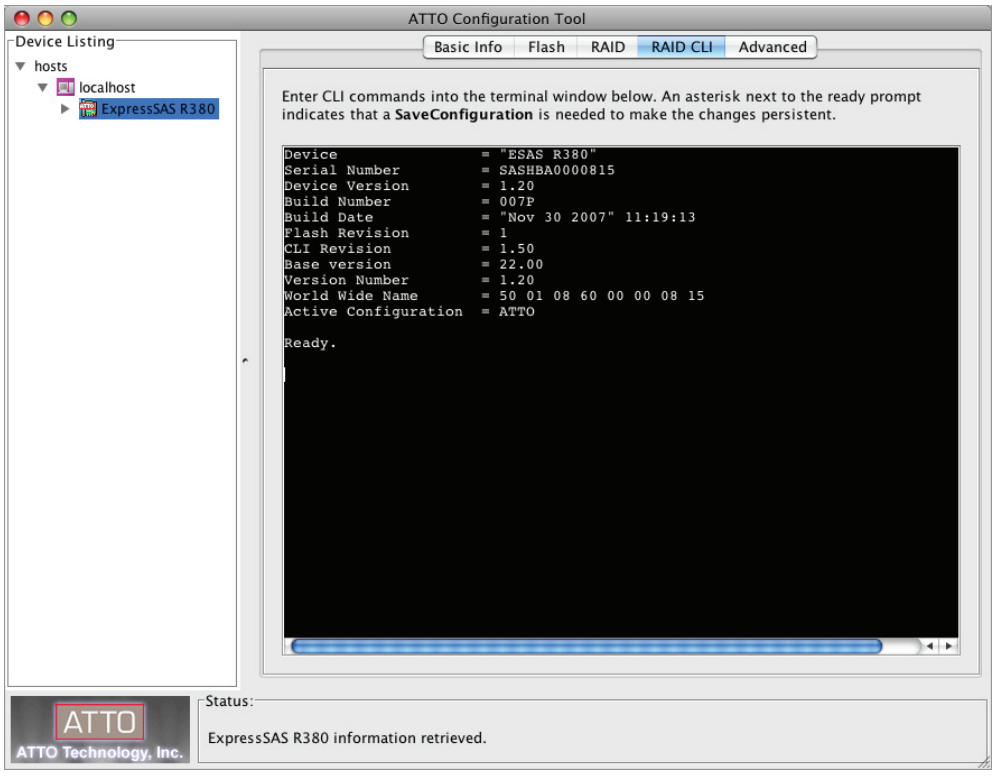

Figure 6

1.0 ATTO Configuration Tool Overview

PCI Info tab

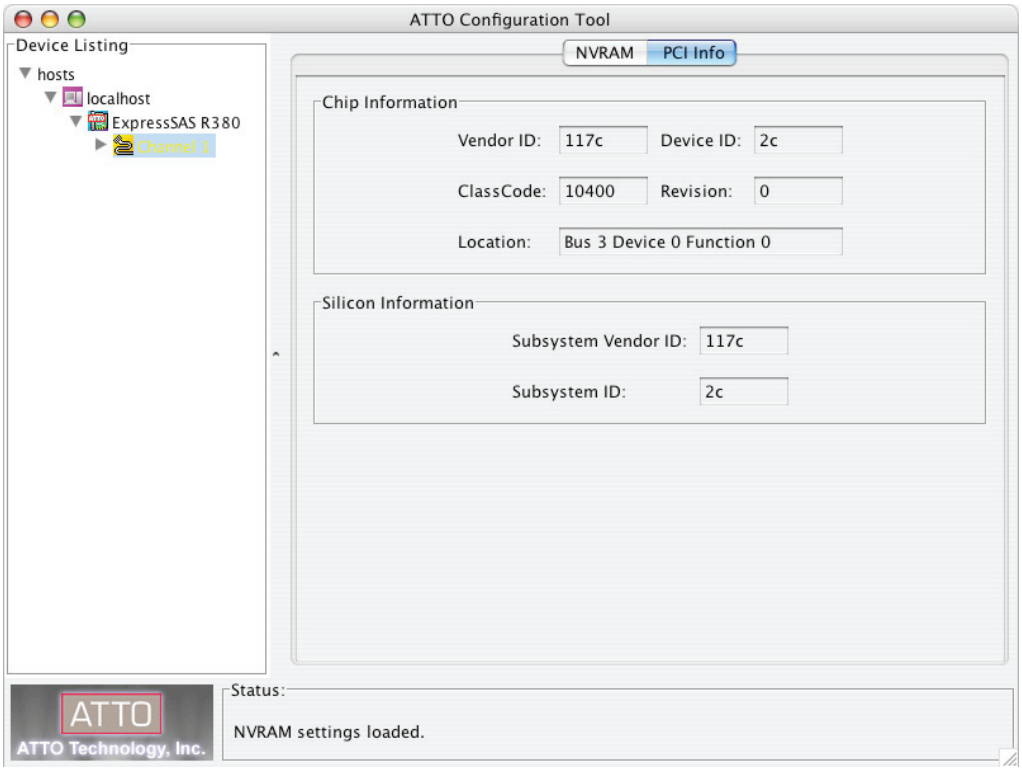

Figure 7

About Configuration Tool window

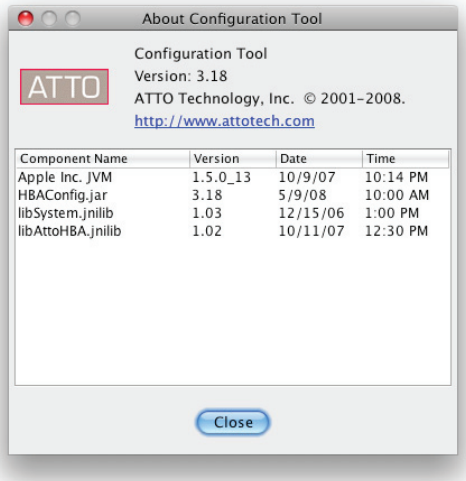

Figure 8

1.1 NVRAM Settings

The settings in the NVRAM tab vary depending upon the operating system.

The Sonnet RAID controller is designed to operate properly using factory settings. Entering invalid or incorrect settings when using an NVRAM configuration utility such as the ATTO Configuration Tool may cause your controller to function incorrectly. See **Figure 9** on page 8.

WARNING: Back up system data when installing or changing hardware configurations.

Use caution when making changes to NVRAM settings and only make changes to those with which you are familiar. Once you have made the desired changes, click Commit to save the changes. Click Save to name and save an NVRAM configuration. Click Load to load a saved NVRAM configuration. *Changes do not take effect until you reboot the system.*

If you do not want to make any changes, you may choose one of the following

- **Defaults**: restores the controller to factory default settings. The **Commit** button must be clicked to save any changes.

- **Restore**: reverts to the NVRAM settings saved the last time the **Commit** button was used. Clicking **Commit** is not necessary.

Support Note: The SAS address is a globally-unique identifier assigned to devices such as the Sonnet RAID controller, and is similar to an Ethernet adapter's MAC address.

SAS Address
Read only

Displays the SAS address assigned to the controller. The value cannot be modified.

Boot Driver (Windows only)
Choices: enabled, scan only, disabled
Default: disabled

If enabled and disk drives are detected during the bus scan, the BIOS driver remains resident. If disabled, the BIOS starts, resets the controller chip and unloads the driver.

If **Scan Only** is selected, the BIOS driver scans the bus and displays the devices attached, then unloads itself after a brief delay.

Heartbeat
Choices: enabled, disabled
Default: enabled

When enabled, the Sonnet RAID controller's firmware is required to respond to periodic activity. If the firmware does not respond, the system driver resets the firmware on the controller.

Device Wait Time
Choices: 1–255 seconds
Default: 3

Specifies the number of seconds that the driver waits for devices to appear.

Device Wait Count
Choices: 1–255 devices
Default: 1

Specifies the number of devices that must appear in order to cancel the Device Wait Time period.

Spinup Delay
Choices: 0-20 seconds
Default: 0

Specifies the number of seconds each SAS port waits for disk drives to spin up.

1.1 NVRAM Settings

NVRAM settings tab

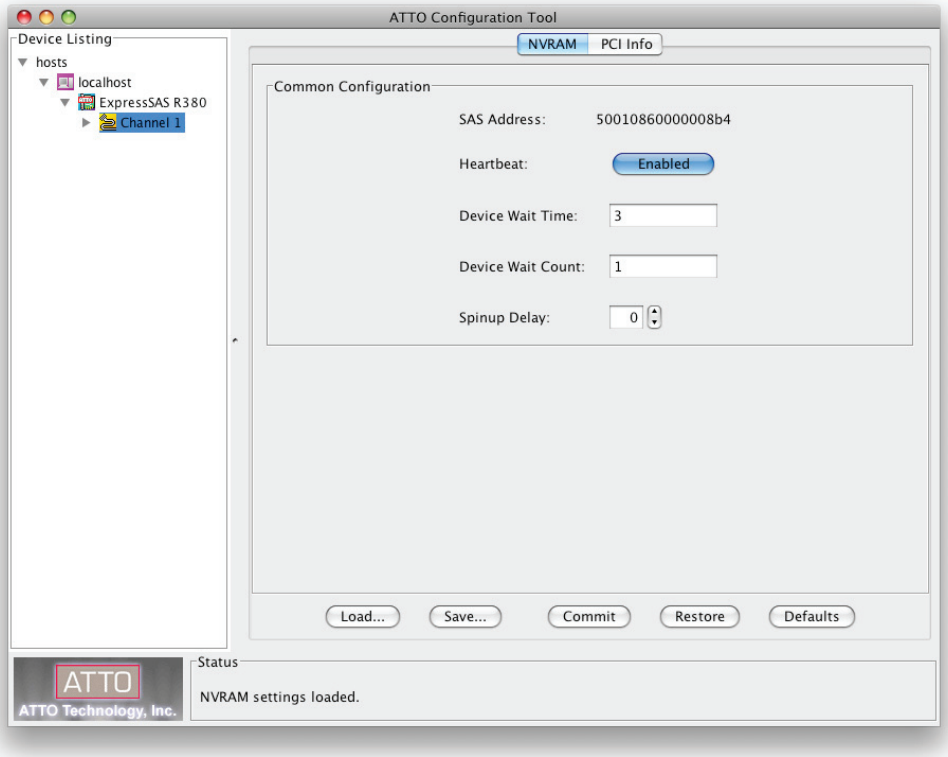

Figure 9

1.2 RAID Settings

Support Note: In Fusion RAID systems shipped from Sonnet with hard drives installed, the drives are formatted Mac OS Extended (Journaled), and configured as a single RAID 5 RAID group. If you need to change the configuration, use the ATTO Configuration Tool and the operating system software tools to reformat and reconfigure the drives. See page xii for Quick Format instructions for Mac OS and Windows users.

The ATTO Configuration Tool provides the capability to configure disk storage into RAID groups or Hot Spare drives.

Note: *Even an individual JBOD disk is considered to be a RAID group.*

Use the ATTO Configuration Tool to set up RAID groups on your Sonnet RAID controller in one of the following RAID levels:

- JBOD
- RAID Level 0
- RAID Level 1
- RAID Level 4
- RAID Level 5
- RAID Level 6
- RAID Level 10
- DVRAID

Support Note: DVRAID is a customized, protected RAID 4 configuration. It is optimized for increased digital video playback performance when compared to that obtained from a RAID 5 configuration. DVRAID's write performance is decreased in order to accomplish this optimization.

DVRAID RAID groups may be set up automatically by the ATTO Configuration Tool. All other RAID configurations require customized input.

Each RAID group may be divided into one or more partitions; each partition appears to the host operating system as a virtual disk.

Windows Support Note: In order to create RAID volumes larger than 2TB under Windows, you must do one of the following: Select the 4KB sector size when creating a custom RAID group (not DVRAID). -OR- Use the software configuration tools included with the Fusion storage to create volumes up to 2TB, concatenate (link together in a virtual chain) the volumes, and then format as NTFS. -OR- Use GPT formatting. Note that drives and volumes with GPT formatting are not visible to any version of Windows XP Professional, nor to the 32-bit version of Windows Server 2003 SP1.

You may use the command line interface pane from the **RAID CLI** tab in the ATTO Configuration Tool to set up or modify various parameters (Refer to Appendix A). **However, the menu-based procedures listed in this chapter are the preferred procedures for setting up RAID configurations for the Sonnet RAID controller.**

Preliminary Configuration Steps

1. Launch the ATTO Configuration Tool application.

2. The Configuration Tool main screen appears. See **Figure 10** on page 12 for an overview of the screen. In the **Device Listing** pane on the left side of the window, click ExpressSAS Rxxx under **localhost**.

Support Note: In the **Device Listing** pane of the ATTO Configuration Tool window, the Sonnet RAID controller is identified as an ExpressSAS Rxxx.

3. Click the RAID tab; attached drives are displayed in the top pane, while RAID groups and Hot Spares are displayed in the bottom pane.

DVRAID RAID Group Setup

The DVRAID wizard automatically sets up a DVRAID RAID group using all available drives attached to the Sonnet RAID controller. If you do not want all available drives set up in a DVRAID RAID group, either remove the drives from the drive enclosure, or select Custom RAID setup.

WARNING: After selecting the DVRAID, RAID 4, RAID 5, or RAID 6 option, **configuration of a set of eight 1TB drives can take up to 4 hours (or up to 2 hours with 500GB drives).**

1. After completing Preliminary Configuration Steps on this page, select RAID Management > Create Group > DVRAID Setup from the application menu.

2. A dialog window will pop up, asking whether you want to perform an Express Setup Operation of DVRAID; click **Yes**. The ATTO Configuration Tool automatically uses all unassigned drives to create a DVRAID RAID group. While the RAID group is being created, a message box displays and the panes display the RAID groups.

3. *The RAID group must still be formatted by your computer's operating system software before it becomes available for use.* For Mac users, use Disk Utility; for Windows users, use Disk Management. For more information on drive formatting, see Mac OS Drive Formatting or Windows Drive Formatting on page 11.

4. After formatting, RAID groups may be used during the setup operation, but performance is limited until setup is complete.

1.2 RAID Settings

Custom RAID Group Setup

1. After completing Preliminary Configuration Steps on page 9, select RAID Management > Create Group > Customized from the application menu.

2. Select the first set of options to configure the new RAID group. See **Figure 11** on page 12.

   • **Name:** name the RAID group or use the one assigned by the Configuration Tool. The name must be unique and no more than 14 characters.

   • **Level**: select a RAID group level from the drop-down box.

Support Note: Descriptions of basic RAID levels can be found on the Wikipedia.org Web site at the following address: http://en.wikipedia.org/wiki/RAID#Standard_levels

   • **Interleave**: select an interleave value. The default value is 64 KB.

Support Note: The interleave value of 128KB offers the best performance for most SATA drives.

   • **Mirror Count**: select the number of mirror groups when RAID 1 or RAID 10 RAID groups are created.

   • **Initialize**: select Advanced or Express.

Support Note: When the Advanced Initialize option is selected, parity blocks are calculated and the RAID group is thoroughly scanned and subjected to a complete Write/Verify operation to map out any bad blocks on the drives before the RAID group is made available for use.

When the Express Initialize option is chosen, drives are not scanned and subjected to the Write/Verify operation, but parity blocks are calculated and the RAID group may be used during the initialization.

3. Click **Next**. Select the drives in the top pane and drag them into the device area in the bottom pane. See **Figure 12** on page 13.

4. Click **Next**. Select the next set of options to configure the new RAID group. See **Figure 13** on page 13.

   • **Sector Size:** select a sector size from the drop down box. The default is 512 bytes.

Windows Support Note: Choosing the 4K sector size enables the creation and use of RAID volumes larger than 2TB on systems running Windows XP 32-bit.

   • **Speed Read:** select Always, Adaptive, or Never. The default is Adaptive.

Support Note: For the Speed Read option, select Always if you expect to work with large sequential files (video, for example), Never if you expect most of the files are smaller in size (general storage, database, etc.), or Adaptive if you expect mixed use or don't know.

   • **Rebuild Priority:** select High, Same, or Low. The default is Low.

   • **Auto Rebuild:** on or off.

5. If you want the RAID group to be presented as one virtual disk (partition), click **Finish**. If you want more than one virtual disk (partition), click **Next (**see **Figure 14** on page 14), and then select one of the following options:

   • leave as one partition
   • partition by count
   • partition by size

   If you choose to split the RAID group by count or capacity, you must enter additional information.

6. If you have not already done so, click **Finish**.

7. A confirmation dialog box asks you to approve the configuration you have chosen. Click **Yes**. See **Figure 15** on page 14.

8. *Every RAID group must be formatted by your computer's operating system software before it becomes available for use*; Mac users will use Disk Utility, while Windows users will use Disk Management. For more information on drive formatting, see Mac OS Drive Formatting or Windows Drive Formatting on page 11.

1.2 RAID Settings

Mac OS Drive Formatting

1. Depending on how you configure your setup, a *Disk Insertion* window stating that there is an unreadable volume will appear at some point during the RAID group creation process; click Initialize, and then Disk Utility will open.

2. In the *Disk Utility* window, each RAID group you created using the ATTO Configuration Tool will appear as a single volume. Select the volume, and then click the Erase tab at the top of the window.

3. Click the Erase button; a window will appear asking you to approve your choice; click Erase.

4. Repeat steps 2 and 3 for each remaining unformatted RAID group, and then close Disk Utility.

5. Depending on how you configured the RAID groups, the volumes may already be mounted and present on the desktop. If you created a DVRAID, RAID 4, RAID 5, or RAID 6 RAID group, configuration will take much longer. You may check on the process by double-clicking the volume name in the lower pane of the *ATTO Configuration Tool* window.

Windows Drive Formatting

1. Select Computer Management From the Windows Start menu. If Computer Management is not available in the Start Menu, select Start > Control Panel > Administrative Tools. In the *Administrative Tools* window, double-click Computer Management.

2. In the *Computer Management* window, click Storage on the left, and then double-click Disk Management.

3. When the *Initialize Disk* window appears, click OK.

4. In the *Disk Management* window, each RAID group you created will appear (listed as "unallocated") as a single volume. Right-click where the word "unallocated" appears, and then select New Simple Volume.

5. When the Welcome to the *New Simple Volume Wizard* window appears, click next to start the process.

6. Follow the remaining steps to complete the process.

Note: *If you do not select the quick format option, formatting will take much longer to complete.*

7. Repeat steps 4–6 for each remaining "unallocated" disk.

8. Depending on how you configured the RAID groups, the volumes may already be available to the system. If you created a DVRAID, RAID 4, RAID 5, or RAID 6 RAID group, configuration will take much longer. You may check on the process by double-clicking the volume name in the lower pane of the *ATTO Configuration Tool* window.

9. Once all the RAID groups have been formatted, they are ready to use.

1.2 RAID Settings

Configuration Tool main screen with the RAID tab selected

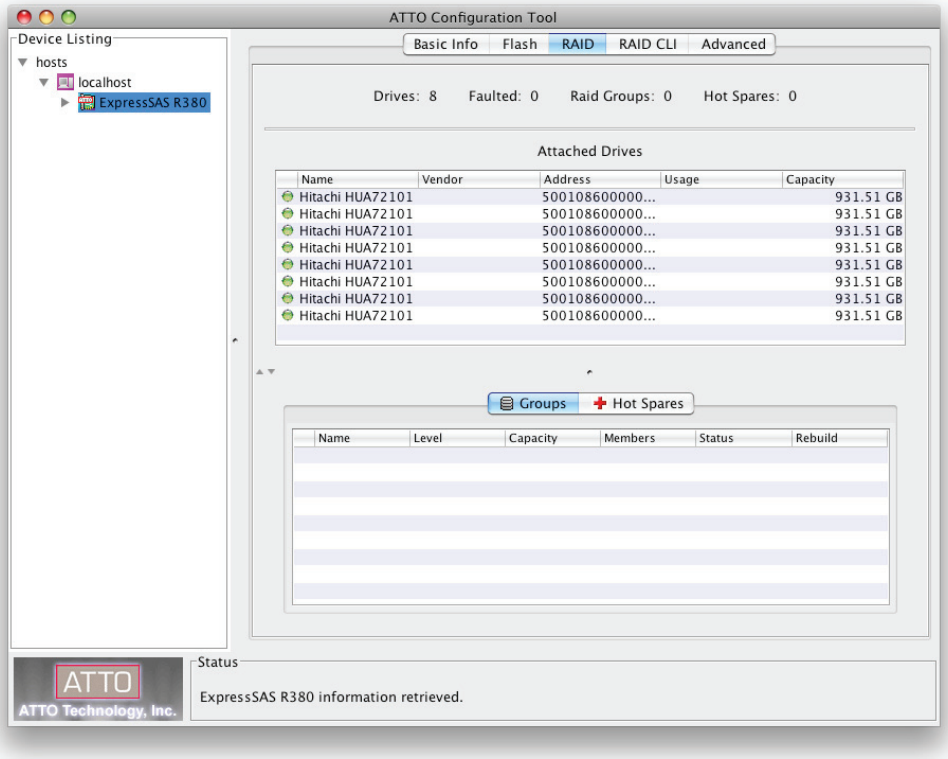

Figure 10

Select the options to create new, custom RAID groups

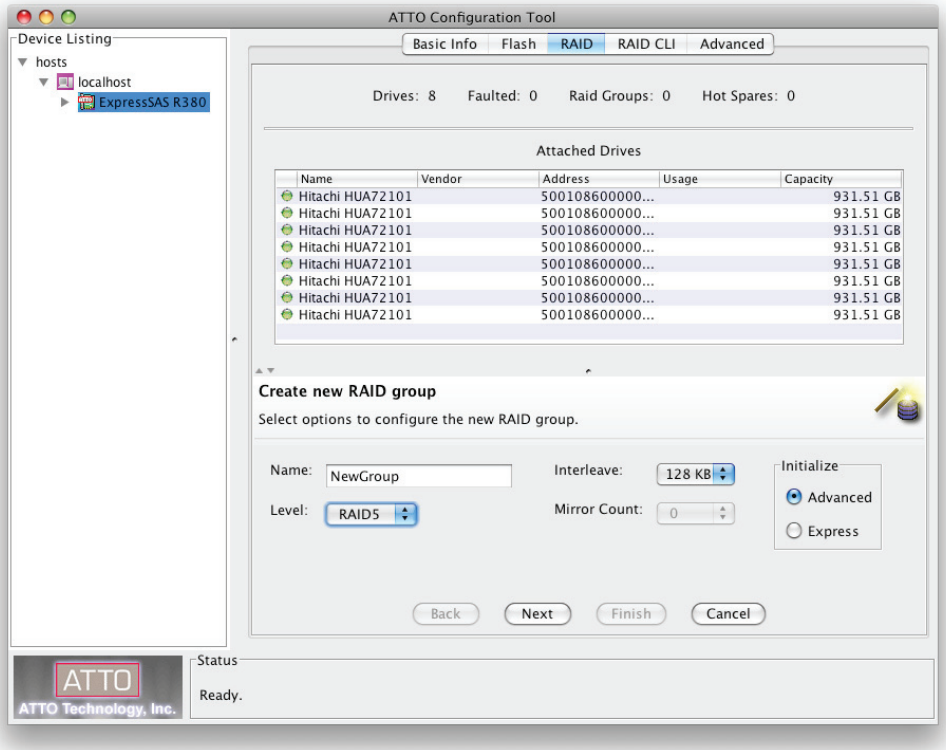

Figure 11

1.2 RAID Settings

RAID group drives selected

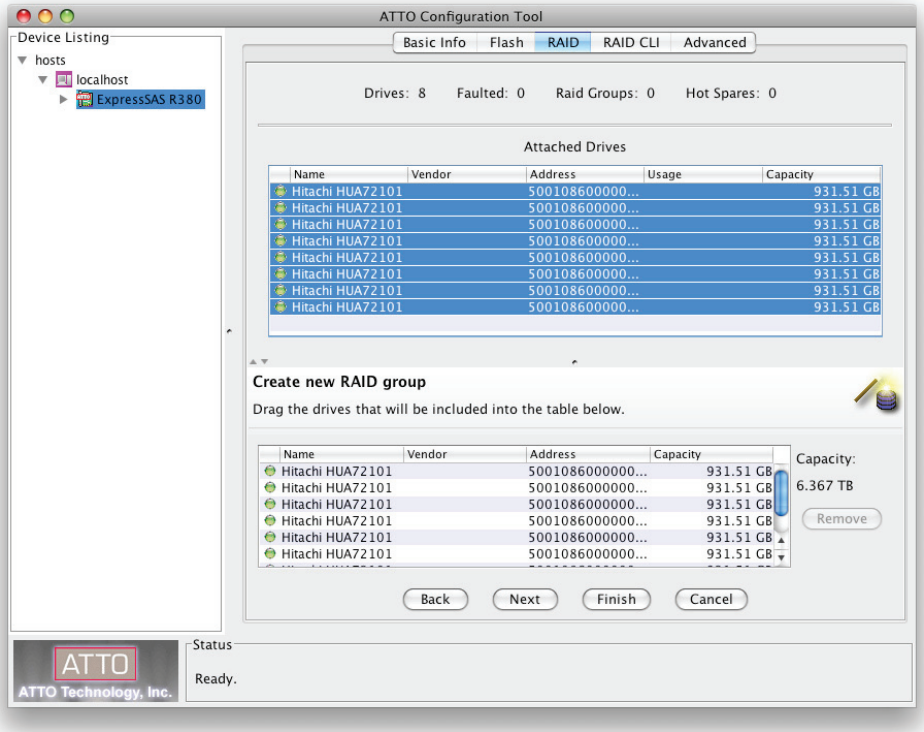

Figure 12

Select more options to create new, custom RAID groups

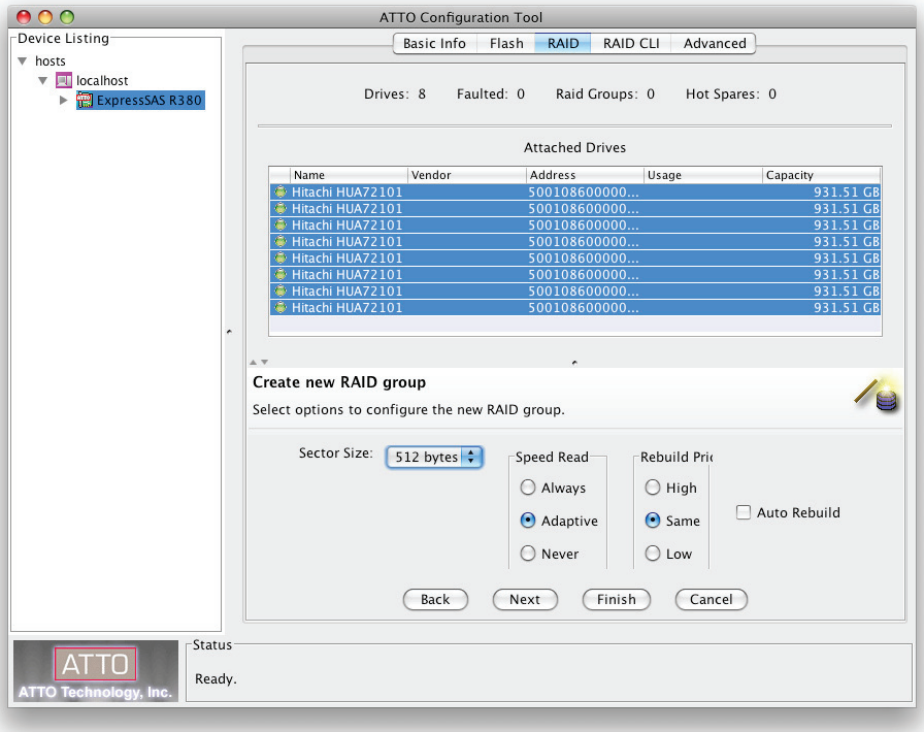

Figure 13

1.2 RAID Settings

Select the number of partitions for the new RAID group

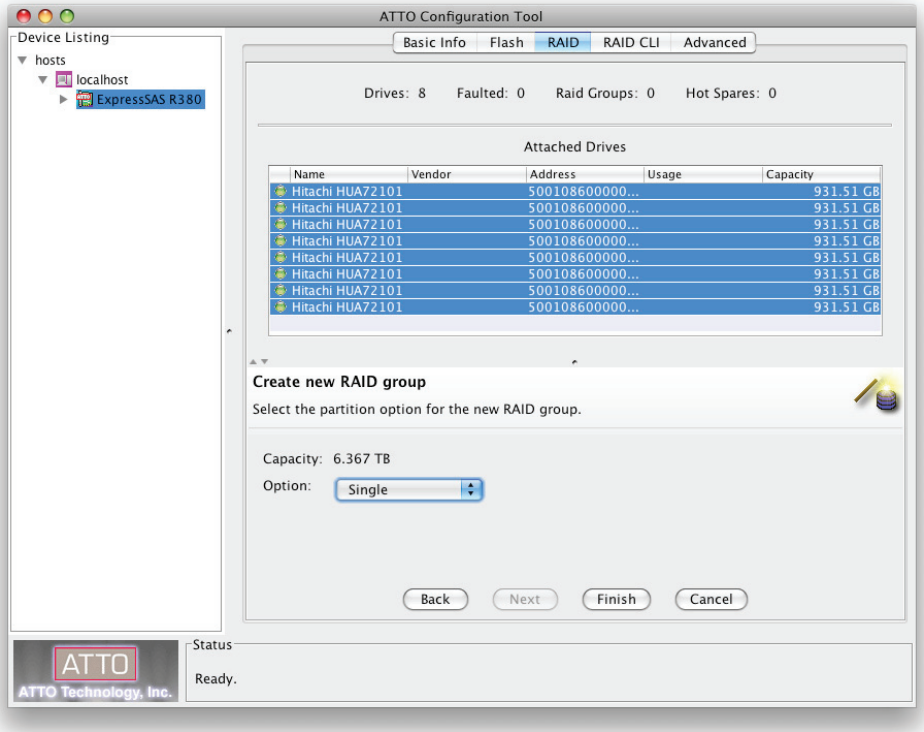

Figure 14

Confirm the custom RAID group options

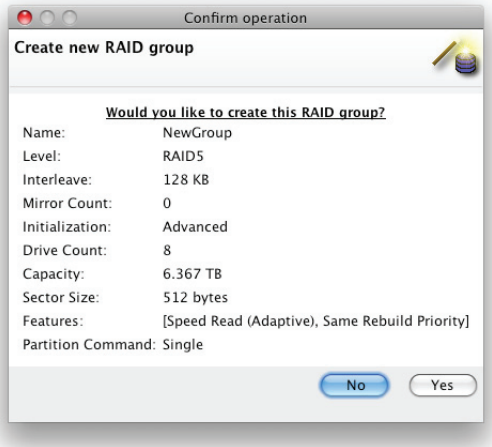

Figure 15

1.2 RAID Settings

Hot Spares Usage

If a drive in a RAID group becomes degraded or faulted, your RAID group will lose some redundancy until a new member (drive) is rebuilt into it. You can automate this procedure by designating one or more drives as Hot Spares. You may set up a pool of Hot Spare drives of different sizes appropriate for your RAID groups.

Support Note: Hard drives in the Hot Spare pool should be of appropriate capacity to the RAID group so that smaller drives are not replaced by much larger Hot Spare drives.

If the Sonnet RAID controller detects a faulted drive in a RAID group with a designated Hot Spare:

- The controller searches the Hot Spare pool for the smallest drive of sufficient capacity to substitute for the faulted drive.
- The faulted drive is replaced with the drive from the Hot Spare pool.
- The Sonnet RAID controller begins an automatic rebuild of the RAID groups.

Select RAID Management > New Hot Spare (or Delete Hot Spare) from the application menu, and then follow the instructions on the screen.

RAID Group Management Overview

The ATTO Configuration Tool interface may be used to replace a failed drive, add capacity to a RAID group, or change a RAID group's current RAID level configuration to a new one.

WARNING: Data can be compromised or lost when deleting storage or rearranging storage configurations.

The ATTO Configuration Tool interface guides you step by step through many procedures which allow you to modify your storage and RAID configurations. Read all notes and cautions carefully as you go to ensure the best performance and use of your storage. Many of these procedures are only available with drives that are not currently part of a RAID group, are not designated as a Hot Spare, or were offline when you initially set up RAID configurations.

Support Note: An unallocated drive or unallocated storage is storage which is not part of a RAID group, not designated as a Hot Spare or was offline when you initially set up a RAID configuration using the ATTO Configuration Tool interface.

RAID Group Capacity Expansion

Select RAID Management > Expand Capacity from the application menu, and then follow the instructions on the screen. Depending on the RAID configuration, you may need to add more than one drive at a time.

WARNING: Adding drives to an existing RAID group may adversely impact performance. You cannot reverse this operation unless you delete the RAID group.

RAID Level Migration

Changing a RAID group from one RAID level to another is called migration. The following migration levels are supported:

- JBOD to RAID Level 0
- JBOD to RAID Level 1
- RAID Level 0 to RAID Level 10
- RAID Level 1 to RAID 10
- N-way mirroring: add additional redundancy to RAID Level 1

Select RAID Management > Migrate RAID Level from the application menu, and then follow the instructions on the screen.

RAID Group Deletion

You may delete a group using the ATTO Configuration Tool. Select RAID Management > Delete Group from the application menu, and then follow the instructions on the screen.

WARNING: Data can be compromised or lost when deleting storage or rearranging storage configurations.

RAID Group Rebuilding

If a RAID group becomes compromised, you must rebuild it. Select RAID Management > Rebuild Group from the application menu, and then follow the instructions on the screen.

Support Note: A RAID group rebuild may take up to eight hours to complete, depending on the operating system, drive capacities, and RAID configuration.

You may pause the RAID group rebuild process by selecting the RAID group in the lower pane, and then selecting RAID Management > Pause Rebuild from the application menu. To restart the rebuild, select the RAID group in the bottom pane, and then select RAID Management > Resume Rebuild from the application menu.

1.3 Drive and RAID Group Monitoring

The ATTO Configuration Tool provides information on individual drives and RAID groups.

Use the ATTO Configuration Tool to gather basic or detailed information about the drives connected to the Sonnet RAID controller, and operational status on the RAID groups created with them.

Basic Drive Information

Open the ATTO Configuration Tool and expand the device tree in the Device Listing pane until ExpressSAS Rxxx appears, and then click to highlight it. In the Attached Drives pane, information for all the drives is displayed. See **Figure 16** on page 19.

- **LED icon**: Indicates operational status of the drives. Green = online, red = faulted
- **Name**: Displays the drive's model number
- **Vendor**: Not used
- **Address**: Displays the SAS address generated by the Sonnet RAID controller
- **Usage**: Identifies how the drive is being used. If it is part of a RAID group, the group name and member number are displayed. If it is a Hot Spare, it is listed as a Hot Spare.
- **Capacity**: Displays the drive's formatted capacity.

Detailed Drive Information

In the Attached Drives pane, double-click a drive name for detailed information. See **Figure 17** on page 19.

- **Status**: Displays the drive's operating status. OK is displayed if it is functioning normally. If there is a problem, Faulted or Error is displayed.
- **Type**: Displays the type of media (disk, tape, etc.)
- **Name**: Displays the drive's model number
- **Vendor**: Not used; always displays Not Available
- **Serial**: Displays the drive's serial number
- **Address**: Displays the SAS address generated by the Sonnet RAID controller
- **Speed**: Displays the drive's interface speed (1.5 or 3 Gb/s)
- **Revision**: Displays the drive's firmware revision
- **LUN**: Displays the logical unit number, which is the number assigned to drive's RAID group
- **Index**: Displays the RAID group index number
- **Capacity**: Displays the drive's formatted capacity
- **Usage**: Identifies how the drive is being used. If it is part of a RAID group, the group name and member number are displayed. If it is a Hot Spare, it is listed as a Hot Spare.
- **Sector Size**: Displays the drive's sector size

RAID Group Information

In the bottom pane, click the Groups tab to display RAID groups. See **Figure 16** on page 19.

- **Name**: Displays the name of the RAID group
- **Level**: Indicates the RAID level formatting for the RAID group
- **Capacity**: Indicates the formatted, configured capacity of the RAID group
- **Members**: Identifies the number of drives comprising the RAID group
- **Status**: Displays the operating status for the RAID group. ONLINE indicates that there are no faulted drives and the group is fully operational; DEGRADED indicates that one drive in the group has failed and it should be replaced as soon as possible; OFFLINE indicates more than one drive in the group has failed or is missing and the RAID group is non-operational; REBUILD indicates that a drive in the group is rebuilding, and the group is still operational, but running in degraded mode.
- **Rebuild**: Specifies the general condition of the RAID group. None indicates no rebuild is taking place, nor is it necessary; Rebuilding indicates that the RAID group is degraded, and is in the process of rebuilding; Paused indicates that a rebuild was interrupted and needs to be restarted to finish.

Individual Drive Identification

You may identify individual drives in the Fusion drive enclosure using the ATTO Configuration Tool to turn on LEDs in the enclosure.

1. Launch the ATTO Configuration Tool application.
2. Expand the device tree to show the ExpressSAS Rxxx, and then click the RAID tab. Drive status for all drives connected to the Sonnet RAID controller will be displayed.
3. Click on the specific drive you want to identify in the Attached Drives list.

1.3 Drive and RAID Group Monitoring

Individual Drive Identification (continued)

4. Select RAID Management > Locate > Drive from the application menu. If the drive does not support this method of identification, a message will appear in the bottom pane; go to the next step. Otherwise, look at the Fusion enclosure; the drive activity LED for the specific drive will be lit. After one minute, the LED will turn off.

5. Double-click a drive in the top pane to display detailed information, and note the index number for the drive. Close the detailed drive information window.

6. Click the RAID CLI tab, and then type "Blockdevidentify *x*", where *x* is the index number. Look at the Fusion enclosure; the drive activity LED for the specific drive will be lit.

Note: *Type "Blockdevidstop" to turn off the LED.*

S.M.A.R.T. Data Monitoring

Self-Monitoring, Analysis and Reporting Technology, or S.M.A.R.T., is a monitoring system for SATA drives to detect and report on various indicators of drive health. The S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) monitoring feature monitors and reports the status of SATA drive health using certain parameters recorded by the drives. Notification is sent when the values exceed certain pre-determined values.

Use the ATTO Configuration Tool to view the files that record changes to an individual drive's S.M.A.R.T. parameters. The files are permanent and can be viewed independently whether you have enabled monitoring or not.

S.M.A.R.T. Monitoring Enabling and Disabling

You may enable or disable the monitoring feature at any time. Monitoring is disabled by default; if you want to use the feature, you must enable it.

1. Launch the ATTO Configuration Tool application.

2. Expand the device tree to show the ExpressSAS Rxxx, and then click the RAID tab.

3. Select RAID Management > Monitor S.M.A.R.T. from the application menu to enable (indicated with a check mark) or disable monitoring.

S.M.A.R.T. Status Checking

The ATTO Configuration Tool interface displays the latest S.M.A.R.T. status record for a selected drive. All attributes reported by the drive are listed with each attribute's **Threshold**, **Worst**, **Current** and **Raw** value; the threshold value is the value at which notification of a problem is generated by the software.

If there has been a change from a previous S.M.A.R.T. status record, an arrow indicates the change direction, either higher or lower. See **Figure 18** on page 20.

The S.M.A.R.T. status display also contains information such as the date and time the S.M.A.R.T. status was recorded, the total number of records for this drive, and the current monitoring status (enabled or disabled).

You may move to previous or subsequent records, query the drive or refresh the view using controls on the interface. Control-click (or right-click) a single drive in the Attached Drives panel, and select S.M.A.R.T. Status from the sub-menu to view the record.

- Use the left arrow or right arrow control to move between S.M.A.R.T. status records.

- Use the Refresh button to query the drive for the latest values. If any values are different from the most recent record, a new record is created and displayed.

S.M.A.R.T. Attribute Filtering

Each of the S.M.A.R.T. status attributes is assigned one or more classification types:

- performance
- error rate
- event count
- critical

The S.M.A.R.T. Status dialog box can be filtered to display any combination of these types. The default view is to display all types.

1. Open the S.M.A.R.T. Status box, and then control-click (or right-click) in the table area where the attribute values are displayed.

2. Each classification type that is visible has a check mark. Select any classification type to change the check mark.

S.M.A.R.T. Notifications

When S.M.A.R.T. monitoring is enabled, status is collected from each SATA drive at 60 minute intervals. If the data is different than the previous status, a S.M.A.R.T. status record is added to the S.M.A.R.T. status file for that drive. A notification of the S.M.A.R.T. status difference is generated based upon the current settings in the Notifications panel. Refer to Notifications on page 21.

The notification level of S.M.A.R.T. status is determined as follows:

- **INFO:** None of the status values was below the threshold value.

- **WARNING:** One or more of the status values was below a threshold value but none was classified as critical.

- **CRITICAL:** One or more of the status values was below a threshold value and one was classified critical.

1.3 Drive and RAID Group Monitoring

Drive information displayed with RAID tab selected

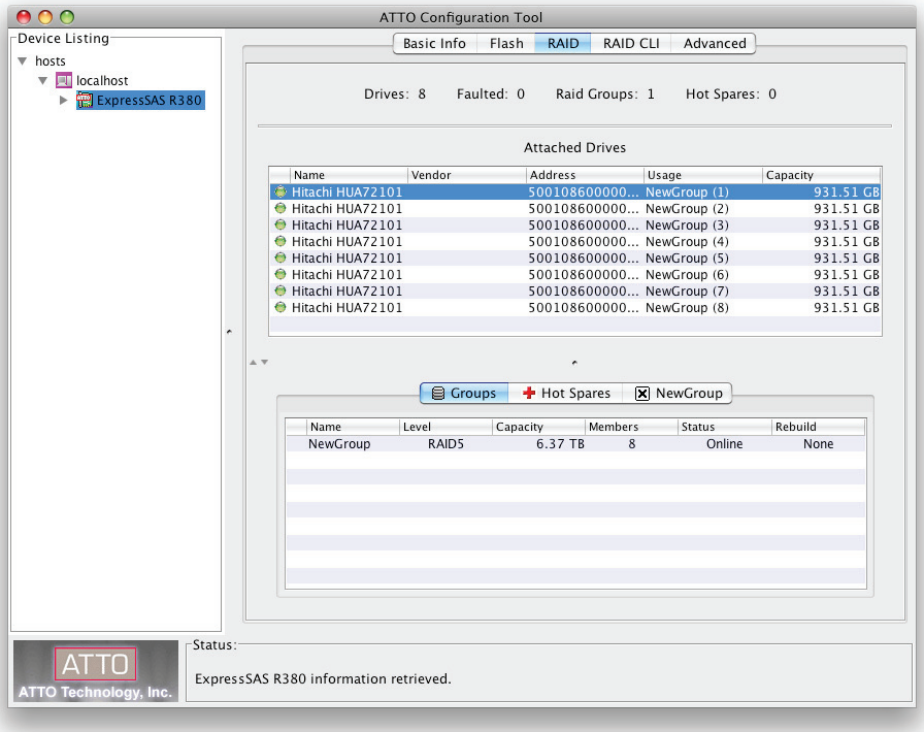

Figure 16

Detailed drive information

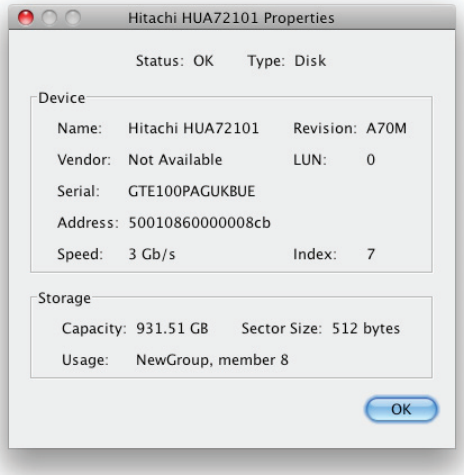

Figure 17

1.3 Drive and RAID Group Monitoring

S.M.A.R.T. status displayed for a specific drive

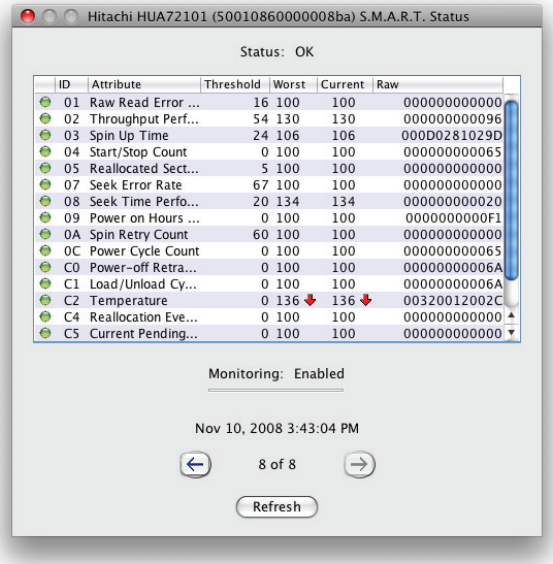

Figure 18

1.4 Notifications

The ATTO Configuration Tool provides a way to issue notifications via audible or visual alerts when a RAID event occurs.

RAID events are divided into three categories:

- **Critical events** are ones in which a serious problem has occurred and the administrator of the RAID group should perform corrective action.
- **Warning events** are less serious but still warrant recording and notification at some level.
- **Information alerts** provide supportive information about warnings or critical events.

Drop-down boxes on the Notifications pane allow you to choose the type of event which prompts an alert. See **Figure 19** on page 22.

- **Critical**: only Critical events are reported
- **Warning**: all Warnings and Critical events are reported
- **All**: all Critical, Warning and Information events are reported
- **None**: no event is reported. The None level is useful in E-mail notification because you can set up E-mail addresses to which alerts might be sent at some future time.

You may choose any combination of notifications on the Notification pane as needed. The notifications are specified at the host system level and apply to all Sonnet RAID controllers installed in the host system.

Basic Alerts

You can select an audible alert, a visual alert, or both for a particular category of events. Select a notification level using the drop-down box next to the Audible and Visual labels on the Notifications screen.

Audible alert uses the computer's speaker to sound an alarm for 5 seconds.

Visual alert uses a system modal pop-up to display a message. You must close the pop-up using the pop-up's button.

Support Note: The visual alert option is not available on systems running Linux, nor on systems running Mac OS X and using version 3.1.0 software.

Logging

Logging notification records the type of event as text in a log file you specify. Select the location, name and size of the file.

- An integer value is added to the log name. When the log file reaches its size limitation, a new file is generated with a sequential integer value added to the log name. When the second log file reaches its size limitation, logging overwrites the first log file. The two log files are automatically rotated.

E-Mail Alert

E-mail notification sends a message to the designated E-mail addresses when the event level from the drop down box is reached.

- You may specify several notification addresses on each line in the E-mail section of the Notifications pane, each separated by commas, for any event level.
- You must complete the IP address or name of the server and sender.
- You may specify a user name and password for the mail server if one is required.
- A critical event E-mail notification is sent after a 10-second delay to allow several related events to be reported in the same message. All other notification E-mails are sent at 15-minute intervals.

1.4 Notifications

Configuration Tool Notifications screen

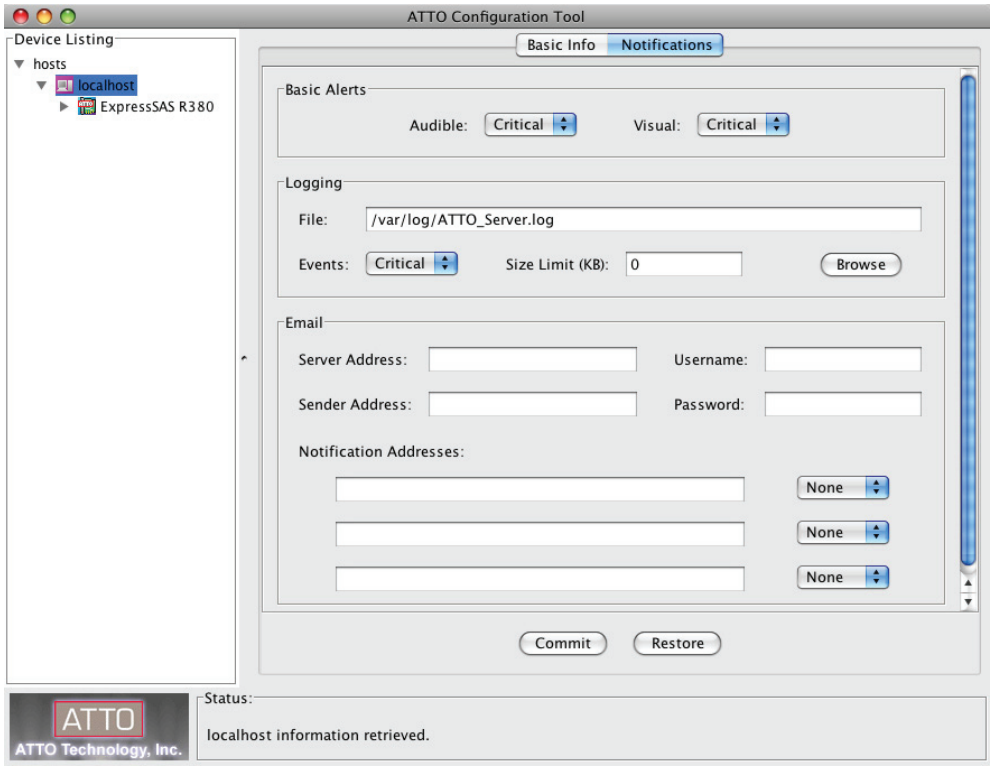

Figure 19

1.5 Diagnose and Replace a Faulted Drive

A drive error may occur that will cause a RAID group to become degraded. This section will help you to identify and replace the bad drive.

When an error occurs that requires a drive to be replaced, the ATTO Configuration Tool will issue visual, audible, and E-mail notifications (only when configured to do so).

Support Note: The Sonnet RAID controller is unable to automatically turn on fault lights in the drive enclosure, so the ATTO Configuration Tool must be used to activate the LED for the faulted drive.

Faulted Drive Identification

After a drive failure notification has appeared,

1. Launch the ATTO Configuration Tool application.

2. Expand the device tree to show the ExpressSAS Rxxx, and then click the RAID tab. Drive status for all drives connected to the Sonnet RAID controller will be displayed. The faulted or degraded drive will have a red LED icon next to it.

Support Note: If you have configured your setup to include a Hot Spare drive, the ATTO Configuration Tool will automatically start rebuilding the RAID group using the Hot Spare drive.

3. Click on the faulted or degraded drive you want to identify in the Attached Drives list.

4. Select RAID Management > Locate > Drive from the application menu. If the drive does not support this method of identification, a message will appear in the bottom pane; go to the next step. Otherwise, look at the Fusion enclosure; the drive activity LED for the specific drive will be lit. After one minute, the LED will turn off.

5. Double-click the faulted or degraded drive in the top pane to display detailed information, and note the index number for the drive. Close the detailed drive information window.

6. Click the RAID CLI tab, and then type "Blockdevidentify *x*", where *x* is the index number. Look at the Fusion enclosure; the drive activity LED for the specific drive will be lit.

Note: *Type "Blockdevidstop" to turn off the LED.*

Faulted Drive Replacement

Once you have identified the faulted drive, you must replace it and rebuild the affected RAID group.

1. Swap out the faulted drive.

2. Launch the ATTO Configuration Tool application.

3. Expand the device tree to show the ExpressSAS Rxxx, and then click to highlight the degraded RAID group.

4. Select RAID Management > Rebuild from the application menu; a tab for the RAID group will open, and you will be prompted to drag a free drive on top of the one being replaced. See **Figure 19** on page 24.

5. After starting the rebuild, you may use the RAID group, but its performance will be reduced until the rebuild is complete.

Support Note: A RAID group rebuild may take up to eight hours to complete, depending on the operating system, drive capacities, and RAID configuration.

1.5 Diagnosing and Replacing a Faulted Drive

RAID group rebuild

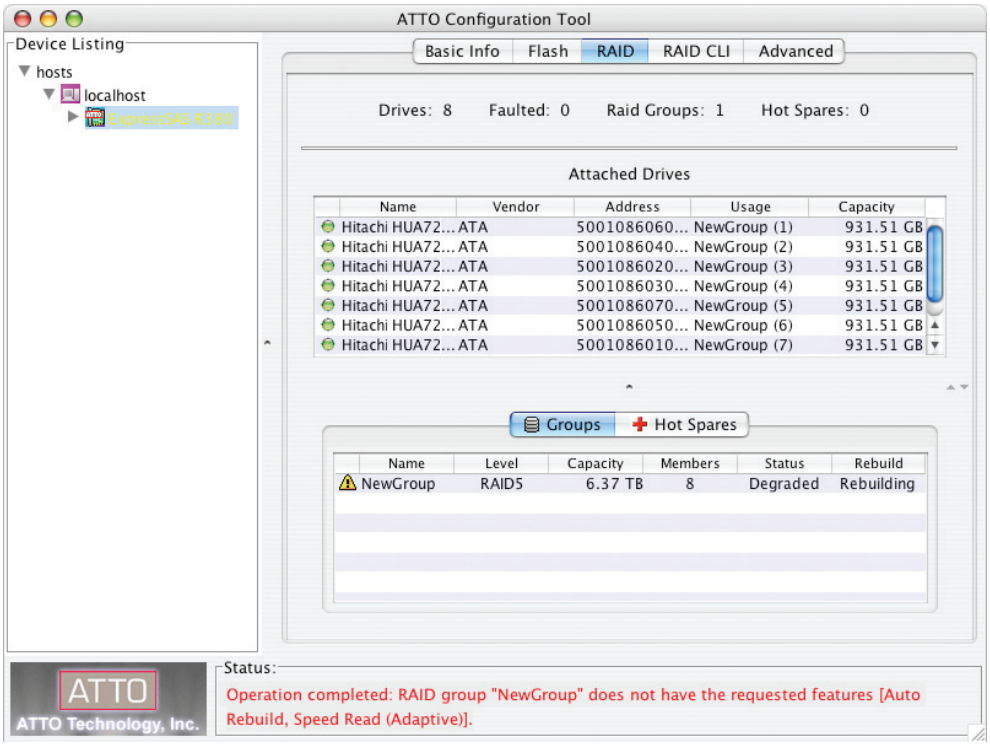

Figure 20

1.6 Configuration Tool Troubleshooting

You may see an error message informing you about an unexpected event or incorrect information discovered by the application. Using the help text presented with the error message, correct the issue before proceeding.

Warnings and error messages are displayed in the **Status** pane.

Messages from NVRAM Tab Actions

- **An error occurred loading NVRAM data.**
  The first time a channel is highlighted, the Configuration Tool attempts to read NVRAM from the card. This message usually indicates that the Configuration Tool could not communicate with the driver, probably because the application does not support the driver version in use.

- **Warning: NVRAM could not be read, defaults returned**.
  NVRAM is corrupt and the driver returns to the default configuration. The defaults are presented via the graphical user interface. These defaults may be modified but the defaults or modifications must be committed (saved) in order to correct NVRAM.

- **An error occurred updating the NVRAM.**
  The driver cannot load the new settings on the card; no changes are made to the card.

- **Feature bounds checking.**
  When the **Commit** button is clicked, each NVRAM feature is validated before being sent to the card. If any one of these features is deemed inappropriate based on the implemented checks, further NVRAM feature validation checks are stopped and the message is displayed, for example: **Execution Throttle is greater than the maximum allowable value of 255. No NVRAM configuration changes have been made to your card.** The exact message varies based on the first field with an out-of-range value.

Messages from Flash Tab Actions

- **This is not a flash file, or it is corrupt.**
  The ATTO-created flash file is corrupt or the Configuration Tool does not recognize the file as a flash file. Only ATTO-created flash files may be selected using the flash file dialog box.

- **This HBA is not compatible with the selected flash file.**
  ATTO flash files are created based on the type of card flashed. Only certain ATTO flash files are compatible with the Sonnet RAID controller. When a flash file is selected, it is inspected for compatibility.

- **A valid file was not selected.**
  You clicked the Cancel button on the flash file selection dialog.

- **An error occurred reading from the flash file, the file may be corrupt.**
  You selected a compatible flash file but the contents are corrupt.

- **An error occurred updating the flash.**
  You tried to flash a card when the firmware was not able to accept a flash.

- **The card has been prepared for firmware updating, but the machine must be rebooted for the changes to take effect. You need to repeat this process after rebooting to actually update the firmware.**
  Some firmware upgrades need to prepare the existing firmware in order to successfully update the controller. Rebooting allows the changes made during the preparation process to take effect, and the same file should be flashed again.

2.0 Windows Only - ATTO Disk Benchmark

The ATTO Utilities for Windows are installed from the CD that was included with your Sonnet RAID controller. Only one utility, Disk Benchmark, may be used with your Sonnet RAID storage system.

Disk Benchmark measures peak and sustained throughput for disk reads and writes. See **Figure 21** on page 28. You may locate the Disk Benchmark application in the ATTO HBA Utilities folder within your system's Applications folder.

1. Launch the application.
2. Select the drive letter for the disk to benchmark.
3. Select the transfer sizes to test.
4. Select the I/O option.
5. Click the Start button.
6. Wait for benchmark to run through the desired transfer sizes.
7. The Test Results Display at the bottom of the window is updated as the test progresses. The y-axis of the graph represents the transfer sizes in the selected range. The x-axis represents the transfer speeds in MB/sec. I/O speeds in KB/sec. for each transfer size are displayed textually to the right of the graph.
8. Click the Stop button to stop the test. When the test completes, the results can be saved or printed.

If errors were detected, a dialog box displays the errors in a table with the following four columns and a button:

- **Benchmark Transfer Size**: transfer size at which the error occurred
- **Buffer Index**: index into the data block at which the error occurred
- **Actual Value**: the value read from the file
- **Expected Value**: the value written to the file
- **Log to File**: Logs the error table to a *.log file and closes the dialog. The file is given the same name as the test file and saved in the same directory. If the test was not previously saved, errors are logged to the generic file Bench32Error.log in the root of the test drive. If the log file already exists, the new errors are appended to the previously recorded errors. This is the only way to save detected errors. They are not saved in the test document file.

If the I/O comparison option was selected and errors were not detected, the message "No errors detected" is displayed.

Support Note: Additional information on using Disk Benchmark is available by accessing the Help menu in the application.

Benchmark Fields

The benchmark fields include:

- **Drive**: Select the logical drive to benchmark. A test can be performed on any system drive.
- **Transfer Size**: Select the range of transfer sizes used for reading and writing data to the test drive. Transfer speeds are displayed for each size in the range. If the first size is greater than the second size, the test is not performed for any transfer size.
- **Total Length**: Select the total size of the data file to be created on the test drive. This file is deleted when testing completes.
- **Direct I/O**: If this option is checked, file I/O on the test drive is performed with no system buffering or caching. Combine this option with **Overlapped I/O** for maximum asynchronous performance

Radio Button Group

- **Overlapped I/O** performs queued I/O. Upon selection, the **Queue Depth** option displays to select the maximum number of read or write commands that may be executed simultaneously.
- **I/O Comparison** compares the data read from the test file to the data written on a per block basis. You can select the data pattern for comparison from the **Test Pattern** drop-down box.
- **Run Continuously** runs the test continuously for a specified number of minutes. The test stops before the specified time if any errors are detected.
- **Neither**: Select if you do not want to perform overlapped I/O or I/O comparisons.

The following fields do not affect the benchmark but are informational, providing documentation of the test environment.

- **Stripe Group**: If the test drive is a stripe group, select its name from the list box. The names and quantities of drives in the stripe group are printed to the Description box. Select Clear to clear the contents of the Description box.
- **Controlled by** displays all Sonnet RAID controllers in the system.
- **Description**: Enter additional information about the test that can be saved or printed. Be sure to enter additional information after making a selection from the Stripe Group dropdown box, as this erases the current description.

2.0 Windows Only - ATTO Disk Benchmark

Multiple Benchmark Testing

Disk Benchmark supports four command line parameters for uninterrupted testing:

- **testfile** opens and executes the test named **testfile** with the extension **.bmk**.
- **textfile** opens the text file named **textfile**. This file contains a list of test file names that have an extension of **.bmk**. Each test in this list is opened and executed in order. Stopping one test in the list prevents further tests from being executed. Error logging is the same as the command line parameter testfile, but all errors generated from all tests in the list are logged to one file: textfile.log.
- **/p testfile**: Same as **testfile**, only the test is printed to the default system printer instead of being executed.
- **/p textfile**: Same as **textfile**, only the tests in the list are printed to the default system printer instead of being executed.

Disk Benchmark screens before and after a test has been run

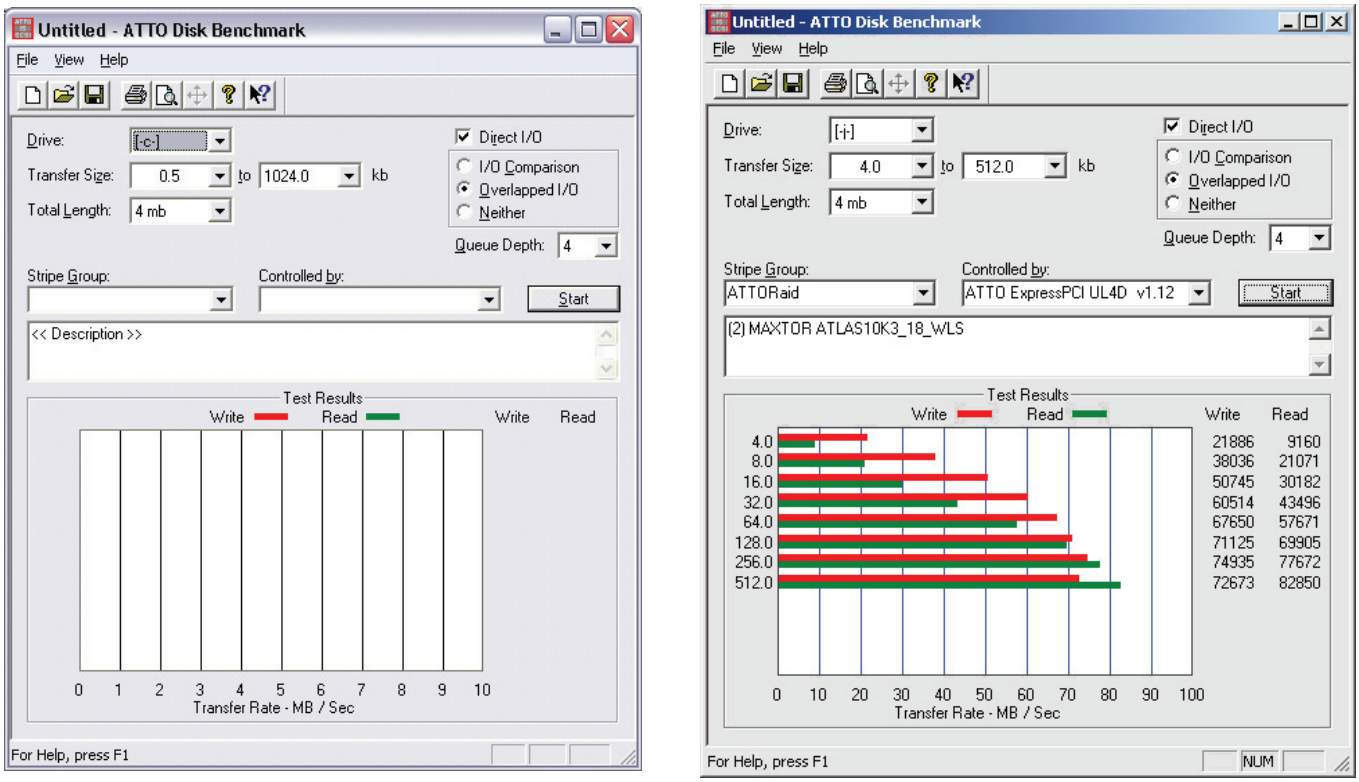

Figure 21

2.1 ATTO Disk Benchmark Troubleshooting

The following suggestions may help if you encounter problems with Disk Benchmark.

- Use Windows Device Manager to check and verify that all drives are visible to the operating system.
- If drives are not listed, check the connections between the drive enclosure and the RAID controller card, and verify that all drives are fully seated in their bays.
- Make sure that the enclosure is powered up and has completed its self check before booting your computer.
- Reboot your system any time you make changes to a RAID group (after the RAID group has been rebuilt).
- As a last resort, you may use the ATTO Boot Configuration Utility to low level format a troublesome device. However, this erases all information on the disk.
- Have you partitioned your drive, and then activated that partition?
- Did you format the drives for use with your operating system?

If problems persist, contact Sonnet customer service.

Appendix A - CLI ASCII-Based Interface

The command line interface (CLI) uses ASCII commands typed in the CLI window.

WARNING: Do not use CLI unless you are directed to by a Sonnet technician, as changing parameters may cause loss of data and/or disruption to performance and reliability of the Sonnet RAID controller. The ATTO Configuration Tool interface is the preferred method to operate and manage the Sonnet RAID controller.

The command line interface (CLI) uses a set of ASCII-based commands to control configuration and diagnostic tasks. See **Figure 6** on page 5.

- CLI commands are context sensitive and generally follow a standard format
  `Get|Set] Command [Parameter1|Parameter2]`
  followed by the **return** or **enter** key
- CLI commands are case insensitive: you may type all upper or all lower case, or a mixture. Upper and lower case in this manual and the **help** screen are for clarification only.
- Commands generally have three types of operation: get, set and immediate.
- The get form returns the value of a parameter or setting and is an informational command.
- Responses to get commands are followed by **Ready**.
- The set form is an action that changes the value of a parameter or configuration setting. It may require a **SaveConfiguration** command and a restart of the system before it is implemented. The restart can be accomplished using a separate **FirmwareRestart** command. A number of set commands may be issued before the **SaveConfiguration** command.
- Responses to **set** commands are either an error message or **Ready. ***. The asterisk indicates you must use a **SaveConfiguration** command to finalize the **set** command.
- Set commands which do not require a **SaveConfiguration** command, defined as immediate commands, are immediately executed.

Support Note: Using certain CLI commands during normal operation can cause a performance drop. Once command actions are complete, performance should return to normal levels.

Figure A-1 *Symbols, typefaces, and abbreviations used to indicate functions and elements of the command line interface used in this manual.*

Symbol	Indicates
[ ]	Required entry
< >	Optional entry
|	pick one of
-	a range (6 – 9 = 6, 7, 8, 9)
BlockDevID	index designation of a block device not assigned to any other RAID group; the index of a block device provided by the BlockDevScan CLI command. 0<=n<=63
DevIndex	index designation of the RAID member
GroupName	the name of the RAID group to which the block device is assigned, or blank if the drive is available
MemberIndex	index designation of a RAID group member
PartID	index designation of a partition as found in the PartitionDisplay command
tid	Target ID 0<=n<=255

Appendix A - CLI ASCII-Based Interface

CLI Error Messages

The following error messages may be returned by the Command line Interface

```
ERROR Invalid Command. Type 'Help' for command list.

ERROR Command Not Processed

ERROR Wrong/Missing Parameters

ERROR Invalid Hot Spare Serial Number

ERROR Invalid RAID GroupName

ERROR Invalid RAID Group State

ERROR Insufficient number of RAID Group members

ERROR RAID Group does not exist

ERROR No RAID Groups found

ERROR Invalid RAID Type

ERROR RAID Group is already unmapped

ERROR Invalid Block Device Index

ERROR Invalid RAID MemberIndex

ERROR Invalid RAID Member State

ERROR Missing RAID Member

ERROR Invalid RAID Member Capacity

ERROR Invalid Partition Index

ERROR Maximum number of RAID Groups exceeded

ERROR Maximum number of Partitions exceeded

ERROR Invalid number of Partitions

ERROR Maximum number of RAID Members exceeded

ERROR Maximum stripe width

ERROR Invalid number of Partitions specified

ERROR Invalid Span Depth specified

ERROR Cannot perform operation on mapped Partition

ERROR Cannot perform operation. RAID Group has mapped Partitions

ERROR Cannot perform operation. RAID Group has Outstanding Commands

ERROR Block Device at specified index no longer available

ERROR Insufficient RAID Group members for RAID type

ERROR Incorrect number of RAID Group members for QuickVideo configuration

ERROR Invalid Virtual Drive ID

ERROR Specified capacity is invalid

ERROR Too many Indices specified.

ERROR Only one add storage operation is permitted at any given time.

ERROR No free block devices

ERROR Cannot benchmark a drive that is being initialized

ERROR Specified drive is not being monitored
```

Appendix A - CLI ASCII-Based Interface

CLI Summary

The following chart summarizes the Command Line Interface commands, their defaults, and an example of how to enter the commands. Please note that commands which have no default values have a blank entry in that column of the table.

WARNING: Do not use the CLI unless you are directed to by a Sonnet technician, as changing parameters may cause loss of data and/or disruption to performance and reliability of the Fusion storage system.

Command	Default	Example
AutoMap		automap
AutoMapOnBoot	disabled	set automaponboot enabled
AutoResume	rebuild, initialize = all enabled; erase = all disabled	set autoresume erase disabled G1
BlockDevClean		blockdevclean 30
BlockDevIdentify		blockdevidentify 30
BlockDevIDStop		blockdevidstop
BlockDevScan		blockdevscan
BootDelay	0	set bootdelay 125
ClearEventLog		cleareventlog
Date		set date 03/03/2009
DefaultInterleave	128	set defaultinterleave 64
DriveHealth	disabled	setdrivehealth enabled
DriveHealthDisplay		drivehealthdisplay all
DriveHealthStatus		drivehealthstatus
DeleteAllMaps		deleteallmaps
DriveTest		drivetest begin
DriveTestClearList		drivetestclearlist all
DriveTestConfig	not initiated	set drivetestconfig read
DriveTestList		get drivetestlist all
DriveTestStatus		get driveteststatus
DumpConfiguration		dumpconfiguration
DumpEventLog		dumpeventlog
EventLog	enabled	set eventlog disabled
EventLogFilter	all all all	set eventlogfilter gen info all
Help		help eventlog
HSAdd		hsadd 3
HSDisplay		hsdisplay
HSRemove		hsremove 3

Appendix A - CLI ASCII-Based Interface

Command	Default	Example
Info		info
IsReserved		isreserved
Metrics		metrics display all
Partition		partition alpha1 6 4 GB
PartitionDisplay		partitiondisplay alpha1
PartitionMerge		partitionmerge all
PartitionSplit		partitionsplit alpha1 22 2
PartitionWriteCache		set partitionwritecache enabled
RAIDRebuildPriority	same	set raidrebuildpriority low
RAIDSpeedWriteLimit	8	set raidspeedwritelimit 15
Reserve		reserve
RestoreConfiguration		restoreconfiguration default
RGAddStorage		rgaddstorage g1 span commit
RGAutoRebuild	disabled	set rgautorebuild all enabled
RGCancelAddStorage		rgcanceladdstorage g1
RGCommit		rgcommit all
RGCreate		rgcreate g1 raid0
RGDelete		rgdelete all
RGDiskWriteCache		set rgdiskwritecache rg1 enabled
RGDisplay		rgdisplay all
RGErase		rgerase g1
RGHaltConversion		rghaltconversion g1
RGHaltErase		rghalterase g1
RGHaltInitialization		rghaltinitialization g1
RGHaltRebuild		rghaltrebuild g1
RGHDParameter	0	set rghdparameter rg 16
RGMemberAdd		rgmemberadd g1 22
RGMemberRemove		rgmemberremove g1 22
RGRebuild		rgrebuild g1
RGResumeConversion		rgresumeconversion g1
RGResumeErase		rgresumeerase g1
RGResumeInitialization		rgresumeinitialization g1
RGResumeRebuild		rgresumerebuild g1
RGSectorSize	512	setrgsectorsize g1 8192
RGSpanDepth	1	set rgspandepth g1 22
RGSpeedRead	all disabled	set rgspeedread g1 enabled

Appendix A - CLI ASCII-Based Interface

Command	Default	Example
RGUnmap		rgunmap g1
RGWaitTimeout	5	rgwaittimeout 30
RMState		set rmstate g1 online
RMStatus		rmstatus g1
Route		route host 1 raid alpha1 6
RouteDisplay		routedisplay 03 124
SASTargets		sastargets
SaveConfiguration		saveconfiguration
SerialNumber		get serialnumber
Time		set time 03:32:30
TimeZone	EST	set timezone pst
VerboseMode	enabled	set verbosemode disabled
VirtualDriveInfo		virtualdriveinfo
WrapEventLog	enabled	set wrapeventlog disabled

Appendix A - CLI ASCII-Based Interface

CLI Command Explanations

Command line interface commands are listed alphabetically with explanations of what they are used for, their defaults and syntax.

WARNING: Using CLI without contacting a Sonnet technician is not recommended because changing parameters may cause loss of data and/or disruption to performance and reliability of the Fusion storage system.

- **AutoMap**
  Maps RAID groups created with the Configuration Tool to the operating system, where they are then discovered as single storage devices. It is possible to create a RAID group that remains hidden from the operating system, and thus not seen by Disk Utility, the Finder, or other system discovery tools.

```
AutoMap
```

- **AutoMapOnBoot**
  Regulates the automatic detection and mapping of RAID groups at startup.

  Default: disabled

```
set AutoMapOnBoot [enabled | disabled]
get AutoMapOnBoot
```

- **AutoResume**
  Regulates the automatic continue feature for interrupted rebuild and erase operations at startup. If AutoResume is enabled, all interrupted rebuild and erase operations are continued at startup. If no GroupName is specified, all existing RAID groups are affected.

  Default: all disabled

```
set AutoResume [Rebuild | Erase | Write Pattern | all] [enabled | disabled] <GroupName>
```

- **BlockDevClean**
  Removes any RAID configuration data from the block device with the specified BlockDevID.

WARNING: All RAID group setup information is lost when the BlockDevClean command is performed, therefore all data is lost. Back up your files before performing this command.

```
BlockDevClean [BlockDevID]
```

- **BlockDevIdentify**
  Turns on a drive activity LED on the Fusion drive enclosure for one minute if it is accessible.

WARNING: The BlockDevIdentify command is intended for diagnostic purposes only. Executing this command may adversely impact the performance and throughput of the Fusion storage system for the time that the LED is illuminated.

```
BlockDevIdentify <Groupname> [BlockDevID | MemberIndex]
```

- **BlockDevIDStop**
  Turns off the drive activity LED on the Fusion drive enclosure that was activated with the BlockDevIdentify command.

```
BlockDevIDStop
```

- **BlockDevScan**
  Lists all currently connected physical drives along with any potential RAID group association. Each block device listed is assigned a unique index at the time of the scan to identify drives for other CLI operations.

```
BlockDevScan
```

- **BootDelay**
  Regulates the delay in seconds which the unit waits after startup before allowing hosts to detect discovered targets. The value 0 constitutes no delay.

  Default: 0

```
set BootDelay [0 - 255]
get BootDelay
```

- **ClearEventLog**
  Clears the contents of the event log. No new entries are recorded until ClearEventLog has completed.

```
ClearEventLog
```

- **Date**
  Regulates the current date for this unit. The date range is 01/01/2000 to 12/31/2099.

```
set Date [MM]/[DD]/[YYYY]
get Date
```

- **DefaultInterleave**
  Assigns or retrieves the system-default interleave size for new RAID groups, where the interleave size is expressed as the number of 512-byte blocks. If an interleave size is not explicitly specified when a RAID group is created, then the DefaultInterleave value is used. **Note**: *Although changing the default interleave size may improve performance, it may degrade performance.*

  Default: 128
  `set DefaultInterleave [8KB | 16KB | 32KB | 64KB | 128KB | 256KB | 512KB | 1024KB | 2048KB ]`
  `get DefaultInterleave`

- **DeleteAllMaps**
  Removes all mapped devices from the map table.

  `DeleteAllMaps` (requires a SaveConfiguration command)

- **DriveHealth**
  Changes the system's ability to acquire drive health data from connected drives. Issuing this command during I/O operations may adversely affect performance.

  Default: disabled
  `set DriveHealth [enabled | disabled]`
  `get DriveHealth`

- **DriveHealthDisplay**
  Retrieves and displays S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) data from SATA drives. Issuing this command during I/O operations may adversely affect performance.

  `DriveHealthDisplay [BlockDevID | all]`

- **DriveHealthStatus**
  Displays the status of the currently running drive test but does not display performance metrics. If a block device ID is not running or cannot be found, its state will be idle and percent complete will be 0.

  get `DriveHealthStatus <drive [BlockDevID]>`

- **DriveTest**
  Regulates a drive test with the previously specified configuration (refer to **DriveTestConfig**) and drive list (refer to **DriveTestList**). Drives being tested are not available for RAID configuration or RAID operations. Only one test can be run at a time.

  `DriveTest [Begin | Cancel]`

- **DriveTestClearList**
  Specifies the drive to be removed from the drive test list. the drive BlockDevID parameter removes the specified drive from the list. The all parameter removes all drives from the list.

  `DriveTestClearList [BlockDevId | all]`

- **DriveTestConfig**
  Configures the next drive test to perform one of the following operations: The test is not started until the DriveTest Begin command is given.

  init: initialize, destructive, write-only
  read: non-destructive, read-only
  verify: destructive verify
  init-verify: destructive write-read-verify

  `set DriveTestConfig [init | read | verify | init-verify]`
  `get DriveTestConfig`

- **DriveTestList**
  Specifies drives to be run in the next drive test including drives which are not part of a RAID group and not Hot Spares. The all parameter automatically chooses eligible drives. The test is not started until the DriveTest Begin command is given.

  `set DriveTestList [drive [BlockDevID] | all]`
  `get DriveTestList`

- **DriveTestStatus**
  Displays the status of the currently running drive test but does not display performance metrics. If a block device ID is not running or cannot be found, its state is idle and percent complete is 0.

  `get DriveTestStatus <drive [BlockDevID]>`

- **DumpConfiguration**
  Displays a unit's configuration to the management interface.

  `DumpConfiguration`

- **DumpEventLog**
  Dumps the contents of the entire event log to the management interface. No events are recorded until the command has been completed.

  `DumpEventLog`

- **EventLog**
  Regulates event logging. When enabled, records various system errors to the event log.

  Default: enabled
  `set EventLog [enabled | disabled]`
  `get EventLog`

- **EventLogFilter**
  Filters data from specific unit subsystems and levels when event logging is enabled. The specific entries supported are platform-dependent. For set commands, the final parameter indicates whether or not events from the specified subsystem and level are displayed.

  Default: all all all
  ```
  set EventLogFilter [subsys | all] [event level | all] [all |none]
  get EventLogFilter [subsystem] [level]
  ```

- **Help**
  Displays a list of available commands. If command name is specified, displays detailed command-specific information

  ```
  Help <command name>
  ```

- **HSAdd**
  Assigns a Block Device to the Hot Spare pool.

  ```
  HSAdd [BlockDevID]
  ```

- **HSDisplay**
  Lists all devices in the Hot Spare pool.

  ```
  HSDisplay
  ```

- **HSRemove**
  Removes a Block Device from the Hot Spare pool

  ```
  HSRemove [BlockDevID]
  ```

- **Info**
  Displays version numbers and other production information for key components.

  ```
  Info
  ```

- **IsReserved**
  Displays the reservation status of the current services session or interface.

  ```
  IsReserved
  ```

- **Metrics**
  Controls the collection of standard data metrics within a product based on the command parameters.

  ```
  Metrics [Start | Stop | Display] [drive [BlockDevID] | all | running]
  ```

- **Partition**
  Creates a specified partition to the specified capacity in Gigabytes (GB), Megabytes (MB), or blocks. The specified capacity must be smaller than the specified partition's current capacity. A new partition is created to acquire the remainder of the original partition's space. **VirtualDriveInfo** displays characteristics and statistics for all the available virtual drives or any available virtual drive identified by its virtual drive ID.

  ```
  Partition [GroupName] [PartIndex] [capacity] [GB | MB | blocks]
  ```

- **PartitionDisplay**
  Lists all the partitions available in the specified RAID group. The partitions are listed contiguously (as opposed to index order).

  ```
  PartitionDisplay [GroupName]
  ```

- **PartitionMerge**
  Combines the specified contiguous partitions into one partition. PartIdx is the index of a partition as found in PartitionDisplay. All indicates that all partitions in the RAID group are merged into a single Virtual Disk. The RAID group must not be in a NEW state. None of the partitions to merge may be mapped.

  ```
  PartitionMerge [GroupName] [[[PartIdx] [2-128]] | All]
  ```

- **PartitionSplit**
  Divides the specified partition into one or more partitions whose capacities are evenly distributed among the capacity of the original partition. The partition to split cannot be mapped and the RAID group must not be in a NEW state.

  ```
  PartitionSplit [GroupName] [PartIdx] [1-128]
  ```

- **PartitionWriteCache**
  If enabled, allows higher write performance with a small risk of data loss after a system failure. If disabled, provides a higher level of data integrity with lower write performance.

  ```
  set PartitionWriteCache [GroupName] [PartIndex] [enabled | disabled]
  get PartitionWriteCache [GroupName] [PartIndex]
  ```

- **RAIDSpeedWriteLimit**
  Regulates the limit on the coalescing factor. A very low limit is recommended for multiple initiators; a high limit is recommended for multiple streams of sequential write I/O.

  Default: 8
  ```
  set RAIDSpeedWriteLimit [0 - 256]
  get RAIDSpeedWriteLimit
  ```

- **RAIDRebuildPriority**
  Sets or displays the RAID rebuild priority. A RAID rebuild priority set to high gives higher priority to RAID rebuilds and lower priority to the processing of simultaneous I/O transactions. A RAID rebuild priority set to low gives lower priority to the rebuild and a higher priority to I/O transactions. Set same, the RAID rebuild and processing of I/O transactions is the same.

  Default: same
  ```
  set RAIDRebuildPriority [high | low | same]
  get RAIDRebuildPriority
  ```

- **Reserve**
  Reports the state of CLI reservation for the current CLI session. If the command reports that Reservations are enabled, then another CLI session has control of parameter modification on the unit.

  ```
  Reserve
  ```

- **RestoreConfiguration**
  Issued with the default option, forces the unit NVRAM settings to their original defaults. The saved option undoes any changes made to this session since the last save.

  ```
  RestoreConfiguration [Default | Saved]
  ```

- **RGAddStorage**
  Adds additional storage to an existing RAID group. **Mirror**, **Stripe**, or **Span** specifies the method used to expand the storage. Optional parameter list **BlockDeviceID** specifies up to 10 available block devices, provided by the **BlockDevScan** command, to be added to the RAID group. If this list is omitted, the command **RGMemberAdd** must be used. Optional parameter **commit** runs the **RGCommit** command automatically and all user data is erased from each new member drive. If the parameter is omitted, the command **RGCommit** must be entered. **RGCancelAddStorage** can be used at any time before the commit command is used to cancel the process. specifies that the **RGCommit** command is run automatically. **Note**: *Mirrors cannot be added to a RAID 4, RAID 5, RAID 6, or DVRAID RAID group.*

  ```
  RGAddStorage [GroupName] [Mirror | Stripe |
  Span] <BlockDeviceID... <commit>
  ```

- **RGAutoRebuild**
  Regulates whether a RAID group automatically rebuilds.

  Default: disabled
  ```
  set RGAutoRebuild [GroupName | all] [enabled |
  disabled]
  get set RGAutoRebuild [GroupName | all]
  ```

- **RGCancelAddStorage**
  Cancels the **RGAddStorage** command.

  ```
  RGCancelAddStorage [GroupName]
  ```

- **RGCommit**
  Stamps a NEW RAID group's configuration to its member drives. After this command, a RAID group can be considered operational and transitions from the NEW state to the Online, Degraded, or Offline state depending on the health of the selected member drives. **RGCommit** also stamps an existing RAID group's configuration to its member drives as storage is being added. If the init option is specified, previous user configuration information is erased from each member drive.

  ```
  RGCommit [GroupName | all] [init]
  ```

- **RGCreate**
  Creates a new empty RAID group. The optional value after the RAID group type parameter represents the desired interleave for the RAID group, where the interleave size is expressed as the number of 512-byte blocks. If this value is not provided then the system-default interleave size is used (refer to **DefaultInterleave**).

  ```
  RGCreate [GroupName] [RAID [ 0 | 1 | 10 | 4 | 5
  | 6 ] | JBOD] <8KB | 16KB | 32KB | 64KB | 128KB
  | 256KB | 512KB | 1024KB | 2048KB>
  ```

- **RGDelete**
  Deletes all RAID groups or the specified RAID group.

  ```
  RGDelete [GroupName | all]
  ```

- **RGDiskWriteCache**
  If enabled, produces higher write performance with a small risk of data loss after a system failure. If disabled, drives are updated at the expense of some write performance.

  ```
  set RGDiskWriteCache [GroupName | all] [enabled
  | disabled]
  get RGDiskWriteCache [GroupName | all]
  ```

- **RGDisplay**
  Displays status information for a single RAID group, or if **All** is used, all available RAID groups.

  ```
  RGDisplay [GroupName | all ]
  ```

- **RGErase**
  Erases the data from the specified existing RAID group. **Note**: *All data is lost if you use the RGErase command.*

  ```
  RGErase [GroupName]
  ```

- **RGHaltConversion**
  Stops the conversion on the specified existing RAID group.

```
RGHaltConversion [GroupName]
```

- **RGHaltErase**
  Stops the erase on the specified existing RAID group.

```
RGHaltErase [GroupName]
```

- **RGHaltInitialization**
  Stops the initialization process on the specified existing RAID group.

```
RGHaltErase [GroupName]
```

- **RGHaltRebuild**
  Stops the rebuild(s) on the specified existing RAID group. **MemberIndex** specifies the RAID member whose rebuild is stopped. If no **MemberIndex** is specified, all rebuilds on that RAID group are stopped.

```
RGHaltRebuild [GroupName] <MemberIndex>
```

- **RGHDParameter**
  Shows or sets the HD value for all RAID groups.

```
set RGHDParameter [GroupName | all] [0-6]
get RGHDParameter [GroupName | all]
```

- **RGMemberAdd**
  Adds up to 10 available block devices to a new RAID group (the RAID group cannot have been saved using the **RGCommit** command). If all is specified, then all unused blocks will be added to the RAID group until the maximum number of RAID group members has been met. The command resets the number of RAID group partitions to 1

```
RGMemberAdd [GroupName| all] [BlockDevID]
```

- **RGMemberRemove**
  Removes a RAID member from a new RAID group (the RAID group cannot have been saved using the **RGCommit** command). Resets the number of partitions to 1.

```
RGMemberRemove [GroupName] [BlockDevID]
```

- **RGRebuild**
  Rebuilds the specified existing RAID group. If no member is specified, all degraded members are rebuilt. Optional parameter **BlockDevID** allows an available block device to be substituted for the RAID Member currently assigned to the member index. If a RAID group has been configured as RAID 6, two RAID group members can be rebuilt at once

```
RGRebuild [GroupName] <<MemberIndex>
<BlockDevID> <and MemberIndex2 <BlockDevID2>>>>
```

- **RGResumeConversion**
  Continues the stopped conversion on the specified existing RAID group.

```
RGResumeConversion [GroupName]
```

- **RGResumeErase**
  Continues the erase on the specified existing RAID group.

  RGResumeErase [GroupName]

- **RGResumeInitialization**
  Continues the initialization on the specified existing RAID group.

  RGResumeInitialization [GroupName]

- **RGResumeRebuild**
  Continues the rebuild(s) on the specified existing RAID group. If no **MemberIndex** is specified, all stopped rebuilds on that RAID group are continued. For RAID 6 groups, if a MemberIndex is specified, all halted RAID members on the span with that MemberIndex resume as well.

```
RGResumeRebuild [GroupName] <MemberIndex>
```

- **RGSpanDepth**
  Regulates the span depth on the specified existing RAID group. The RAID group must be RAID Level 0, RAID Level 1, RAID Level 5, or RAID Level 10.

  Default: 1

```
set RGSpanDepth [GroupName] [SpanDepth [1-32]]
get RGSpanDepth [GroupName]
```

- **RGSpeedRead**
  Performs look-ahead during reads from RAID group member disks for all or the specified RAID group.

  Default: disabled

```
set RGSpeedRead [GroupName | all] [enabled |
disabled]
get RGSpeedRead [GroupName | all]
```

- **RGUnmap**
  Removes all mapped partitions for a RAID group from the routing table. The partitions themselves are unaffected but they are inaccessible to initiators.

```
RGUnmap [GroupName | all]
```

- **RGWaitTimeout**
  Regulates the maximum time in seconds that the system waits to discover previously configured RAID groups attached to the controller.

  Default: 5
  ```
  set RGWaitTimeout [1-300]
  get RGWaitTimeout
  ```

- **RMState**
  Regulates the state of the specified existing RAID group member(s). The RAID group may not be in the new state. If no **MemberIndex** is specified, the status of all members of the specified RAID group is set. **Note**: *Members undergoing rebuild are not changed. Rebuilds on these members must first be stopped.*

  ```
  set RMState [GroupName] <MemberIndex> [Online | Degraded | Unavailable | Faulted]
  ```

- **RMStatus**
  Displays the status of all RAID group members within the specified RAID group or a specific RAID member within the specified RAID group.

  ```
  RMStatus [GroupName] <MemberIndex>
  ```

- **Route**
  Assigns a RAID partition to a target ID on the host system. If a map with the specified target ID already exists, the map is overwritten. Use **delete** with a target ID to remove the map.

  ```
  Route [host] [TID] [RAID] [GroupName] [PartIndex]] | SAS {SASIndex]] | Delete]
  ```

- **RouteDisplay**
  Displays a list of host protocol address to target destination device mappings.

  ```
  RouteDisplay [host] <tid>
  ```

- **SASTargets**
  Lists the physical devices that are connected to all SAS ports.

  ```
  SASTargets
  ```

- **SaveConfiguration**
  Issued with the **restart** option, cycles unit power after saving configuration changes. The **norestart** option saves changes without restarting. **Note:** *Certain modifications require a system restart.*

  ```
  SaveConfiguration
  ```

- **SerialNumber**
  Reports the unique serial number for the Sonnet RAID controller using a 13-character field. The first seven alphanumeric characters represent the product name; the last six digits are the unit's unique number.

  ```
  get SerialNumber
  ```

- **Time**
  Controls or displays the current time as clocked by the unit in 24 hour format.

  ```
  set Time [HH: MM: SS]
  get Time
  ```

- **TimeZone**
  Controls or displays the time zone or an offset from GMT for the unit.

  Default: EST
  ```
  set TimeZone [[EST | CST | MST | PST] | [+/-HH: MM]]
  get TimeZone
  ```

- **VerboseMode**
  Controls the level of detail in CLI **Help** output and command response output.

  Default: enabled
  ```
  set VerboseMode [enabled | disabled]
  get VerboseMode
  ```

- **VirtualDriveInfo**
  Displays characteristics and statistics for all the available virtual drives or any available virtual drive identified by its virtual drive ID.

  ```
  VirtualDriveInfo <Virtual Drive ID>
  ```

- **WrapEventLog**
  When enabled, the unit logs up to 2,048 event entries before wrapping (overwriting the first entries). If disabled, the unit stops logging event entries when the buffer is full.

  Default: enabled
  ```
  set WrapEventLog [enabled | disabled]
  get WrapEventLog
  ```

Appendix B - Quick Drive Format Instructions

If your Sonnet Fusion RAID storage system shipped with pre-installed hard disk drives, the following information will assist you to reformat the drives per your needs.

In Fusion RAID systems shipped from Sonnet with hard disk drives installed, the drives are formatted Mac OS Extended (Journaled), and configured as a single RAID 5 RAID group. If you need to change the configuration, use the ATTO Configuration Tool and the operating system software tools to reformat and reconfigure the drives.

Mac OS Users' Instructions

1. Follow all the steps in the included documentation to install the software and the Sonnet RAID controller, and to set up and connect the Fusion RAID drive enclosure.

2. Start your computer, and then turn on the Fusion drive enclosure; the RAID volume should appear on the desktop.

3. Drag the volume to the trash (changes to an eject icon) to eject it.

4. Launch the ATTO Configuration Tool.

5. Select RAID Management > Delete Group from the application menu.

6. When the *Delete Confirmation* window appears, click Yes.

7. Set up new RAID groups following the instructions on pages 9 and 10 of this manual.

WARNING: After selecting the DVRAID, RAID Level 4, or RAID Level 5 option, **configuration of a set of eight 1TB drives can take up to 4 hours (or up to 2 hours with 500GB drives).**

8. Depending on how you configure your setup, a *Disk Insertion* window will appear at some point stating that there is an unreadable volume; click Initialize, and then Disk Utility will open.

9. In the *Disk Utility* window, each RAID group you created using the ATTO Configuration Tool will appear as a single volume. Select the volume, and then click the Erase tab at the top of the window.

10. Click Erase; a window will appear asking you to approve your choice.

11. Click Erase.

12. Repeat steps 7–11 for each remaining unformatted RAID group.

13. Close Disk Utility.

14. Depending on how you configured the RAID groups, the volumes may already be mounted and present on the desktop. If you created a DVRAID, RAID Level 4, or RAID Level 5 group, configuration will take much longer. You may check on the process by double-clicking the RAID group name in the lower pane of the *ATTO Configuration Tool* window.

Windows Users' Instructions

1. Follow all the steps in the included documentation to install the software and the Sonnet RAID controller, and to set up and connect the Fusion RAID enclosure.

2. Start your computer, and then turn on the Fusion drive enclosure.

3. Launch the ATTO Configuration Tool.

4. Expand the device tree in the Device Listing section on the left side of the window until ExpressSAS Rxxx is displayed, and then click ExpressSAS Rxxx.

5. Click the RAID tab.

6. In the Groups pane, you will see the RAID group that Sonnet created (not usable in a Windows system); click the group.

7. Select RAID Management > Delete Group from the application menu.

8. When the *Delete Confirmation* window appears, click Yes.

9. Set up new RAID groups following the instructions on pages 9 and 10.

WARNING: After selecting the DVRAID, RAID Level 4, or RAID Level 5 option, **configuration of a set of eight 1TB drives can take up to 4 hours (or up to 2 hours with 500GB drives).**

10. Select Computer Management From the Windows Start menu. If Computer Management is not available in the Start Menu, select Start > Control Panel > Administrative Tools. In the *Administrative Tools* window, double-click Computer Management.

11. In the *Computer Management* window, click Storage on the left, and then double-click Disk Management.

12. When the *Initialize Disk* window appears, click OK.

13. In the *Disk Management* window, each RAID group you created will appear (listed as "unallocated") as a single volume. Right-click where the word "unallocated" appears, and then select New Simple Volume.

Appendix B - Quick Drive Format Instructions

Windows Users' Instructions (continued)

14. When the Welcome to the *New Simple Volume Wizard* window appears, click next to start the process.

15. Follow the remaining steps to complete the process.

Note: *If you do not select the quick format option, this process will take much longer to complete.*

16. Repeat steps 13–15 for each remaining "unallocated" disk.

17. Depending on how you configured the RAID groups, the volumes may already be available to use. If you created a DVRAID, RAID Level 4, or RAID Level 5 group, configuration will take much longer. You may check on the process by double-clicking the RAID group name in the lower pane of the ATTO Configuration Tool window.

18. Once all the RAID groups have been formatted, they are ready to use.

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