



ATTO ThunderLink™ and ThunderStream™ Desklink Device Installation and Operation Manual

ATTO ThunderStream SC 3808

10-Gigabit Thunderbolt™ to 6-Gigabit SAS/SATA RAID Storage Controller

ATTO ThunderLink FC 2162

20-Gigabit Thunderbolt™ 2 to 16-Gigabit Fibre Channel Storage Controller

ATTO ThunderLink FC 2082

20-Gigabit Thunderbolt™ 2 to 8-Gigabit Fibre Channel Storage Controller

ATTO ThunderLink NS 2102

20-Gigabit Thunderbolt™ 2 to 10-Gigabit Ethernet Storage Controller

ATTO ThunderLink NT 2102

20-Gigabit Thunderbolt™ 2 to 10-Gigabit Ethernet Storage Controller

ATTO ThunderLink NS 1101

10-Gigabit Thunderbolt™ to 10-Gigabit Ethernet Storage Controller

ATTO ThunderLink NT 1102

10-Gigabit Thunderbolt™ to 10-Gigabit Ethernet Storage Controller

ATTO ThunderLink FC 1082

10-Gigabit Thunderbolt™ to 8-Gigabit Fibre Channel Storage Controller

ATTO ThunderLink SH 1068

10-Gigabit Thunderbolt™ to 6-Gigabit SAS/SATA Storage Controller

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1.0 Desklink Device Installation

This manual gives you information for installing and configuring your Desklink Device. For more information, refer to the ATTO Utilities Installation and Operation Manual.

Verifying packaging contents

- Note the serial number of your ThunderLink or ThunderStream unit: _____
 - AC adapter and power cord
 - Getting Started Guide
 - Installation CD containing:
 - Desklink Device drivers
 - Configuration utilities
 - Manual



CAUTION

Desklink Devices contain components that are sensitive to electrostatic discharge (ESD). ESD can cause damage to these components. Do not attempt to open the Desklink Device enclosure as it will void your warranty. Always back up your system data before changing or installing any hardware.

Installing the Desklink Device



CAUTION

For Windows PC: the Thunderbolt™ certified device driver must be installed before plugging in the device for it to function properly. Please follow the [Windows](#) instructions under [Installing Drivers](#) before proceeding.

- 1 Ensure you have the following prerequisites:
 - Thunderbolt technology-enabled host.
 - A Thunderbolt cable.
 - A storage device (SAS/SATA, Fibre Channel or Ethernet) cable.
 - Compatible storage (SAS/SATA, Fibre Channel or Ethernet).
- 2 Ensure that power to the storage device is off.
- 3 Connect the AC adapter to the Desklink Device and the power cord to a power point.
- 4 Connect the storage to the Desklink Device via the storage device cables.
- 5 Connect your Desklink Device to your laptop or other computing device via Thunderbolt cable.
- 6 Power on the storage.

Installing Drivers

Mac OS X

Downloading drivers from the ATTO website

- 1 Power on your system and log in as a user with proper administrative privileges.
- 2 Go to www.attotech.com.
- 3 On the main menu, click **Downloads**.
- 4 Register or log in if previously registered.
- 5 Select **Thunderbolt Desklink Devices** from the product list.
- 6 Select your model.
- 7 From the table, find your Operating System.
- 8 Click on the entry for the latest driver.
- 9 A download window appears. Follow the instructions for downloading the driver.
Select a download destination and run the self-extracting executable file.
- 10 Continue with the driver installation as described on the following pages for your Operating System.

Downloading drivers from the installation CD

- 1 Power on your system and log in as a user with proper administrative privileges.
- 2 Insert the Installation CD.
- 3 After the CD mounts, open the appropriate volume (ThunderStream or ThunderLink series) on the desktop.
- 4 Open the folder corresponding to the host's Operating System.
- 5 Open the **Drivers** folder.
- 6 Open the folder corresponding to the correct product model.
- 7 Launch the installer package.
- 8 Follow the on-screen instructions.

Windows

Downloading drivers from the ATTO website

- 1 Power on your system and log in as a user with proper administrative privileges.
- 2 Go to www.attotech.com.
- 3 On the main menu, click **Downloads**.
- 4 Register or log in if previously registered.
- 5 Select **Thunderbolt Desklink Devices** from the product list.
- 6 Select your model.

- 7 From the table, find your Operating System.
- 8 Click on the entry for the latest driver.
- 9 A download window appears. Follow the instructions for downloading the driver.
Select a download destination and run the self-extracting executable file.
- 10 Continue with the driver installation as described on the following pages for your Operating System.

Downloading drivers from the installation CD

- 1 Power on your system and log in as a user with proper administrative privileges.
- 2 Insert the Installation CD. The ATTO Installation CD guide should appear.
- 3 Navigate to the appropriate CD drive to view the volume (ThunderStream or ThunderLink series).
- 4 Open the folder corresponding to the host's Operating System.
- 5 Open the **Drivers** folder.
- 6 Open the folder corresponding to the correct product model.
- 7 Launch the installer package.
- 8 Follow the on-screen instructions.

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2.0 ATTO ConfigTool

The ATTO ConfigTool provides an effective mechanism to configure your Desklinc Device and RAID storage. Features include:

- The names of ATTO storage controllers installed in the host
- Information about the devices attached to ATTO storage controllers
- Information about the drivers and firmware controlling the storage controllers, including version information

You may also use the ATTO ConfigTool to:

- Update the flash image when a new version is released by ATTO
- Modify the NVRAM settings
- Manage RAID groups
- Configure RAID notifications
- Revert to default factory settings

Pre-Installation

The latest version of Oracle® Java is recommended for use with the ATTO ConfigTool. It can be obtained through a Software Update (OS X) or via java.com (Windows).

To install the ATTO ConfigTool:

- OS X - mount the .dmg file
- Windows - run the .exe file

Installation

The ATTO ConfigTool now includes two components: a GUI Application and a system service. Either, or both, of these components can be installed on a host, depending on the functionality desired. This creates several different use cases, described below:

- A host with both the GUI Application and the system service installed will be able to discover and manage local and remote hosts. This is the most comprehensive management capability. During installation of the ATTO ConfigTool select **FULL** installation for this coverage level.
- A host with only the GUI Application installed will be able to discover and manage remote hosts. This host will not be able to discover and manage any ATTO storage controllers installed on the same host. During installation of the ATTO ConfigTool select **APPLICATION ONLY** for this coverage level.

- A host with only the system service installed can be discovered and managed remotely, but it cannot be managed locally (the GUI Application is required for local management). It is common to have multiple hosts with only the system service installed being managed by a single host remotely. To set up a host without any local management capabilities, refer to the OS specific instructions below.

Instructions for FULL or APPLICATION ONLY installation:

- 1 Launch the ATTO ConfigTool Installer
 - Run the ConfigTool_4xx file
- 2 Select FULL or APPLICATION ONLY as desired
- 3 Follow the on-screen instructions

Instructions for SYSTEM SERVICE ONLY installation:

- 1 Launch the ATTO ConfigTool system service Installer
 - OS X - Run the attocfgd.mpkg file in the Service folder
 - Windows - Run the setup.exe in the Service folder
- 2 Follow the on-screen instructions

Using the ATTO ConfigTool

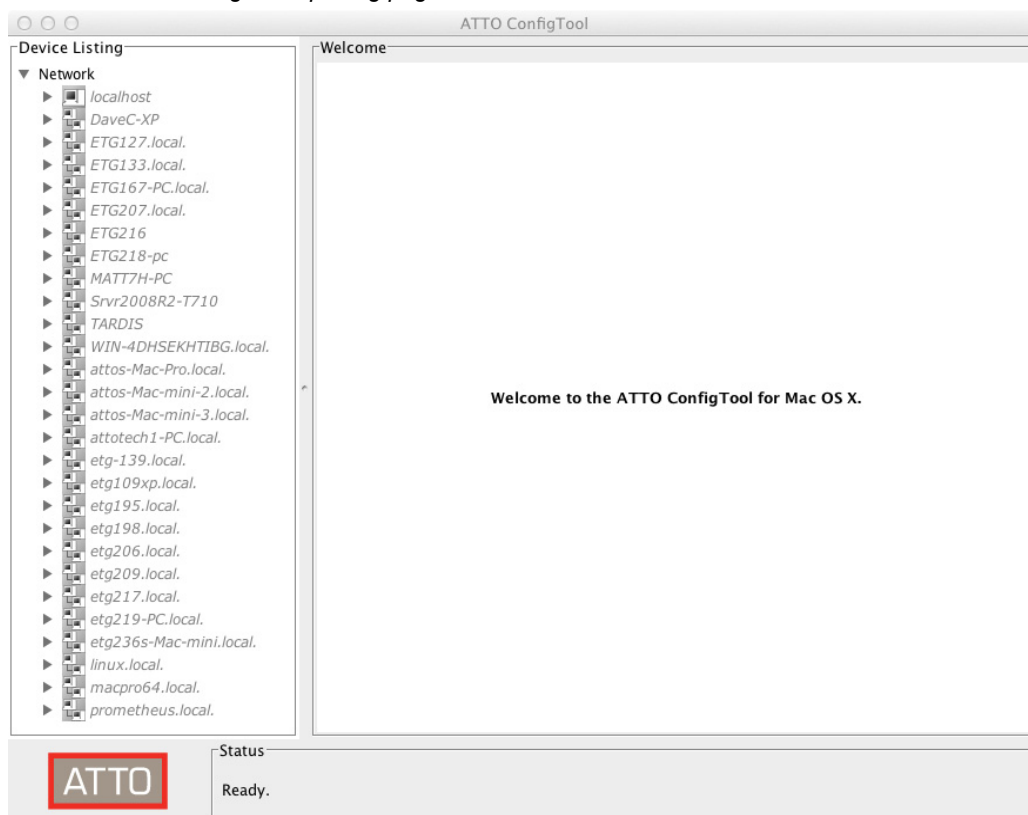
To use the ATTO ConfigTool, locate and double-click the application icon. The main page has three windows: **Device Listing**, **Configuration Options** and **Status**. The **Device Listing** window at the left of the display page lists local and remote hosts found on the network, as well as currently connected devices. You are required to login to manage any host. Once you login, the **device tree** will expand to reveal additional details on connected storage controllers.

The **Configuration Options** window in the right window pane provides information and options for a device highlighted in the device listing. If you highlight a device in the **Device Listing**, tabs and panels display for that device. The following chart lists the tabs displayed for each device type in the device listing tree.

Tree node	Tabs displayed
Network	Host Tab
Host	Basic Info, Notifications, SNMP
Storage Controller	Basic Info, Flash, RAID, RAID CLI, Tasks
Channel	Basic Info, NVRAM
Devices	Basic Info, Flash, SES

The **Status** window provides general information about host and storage controller settings.

Exhibit 2.0-1 The ATTO ConfigTool opening page.



Navigating the ConfigTool

Host Discovery

The ATTO ConfigTool is able to discover hosts automatically, as well as manually. A host will be discovered and displayed in the **Device Listing** only if the system service is installed and running on the host. A host that only has the GUI Application installed will not be displayed in the **Device Listing**.

Automatic Discovery

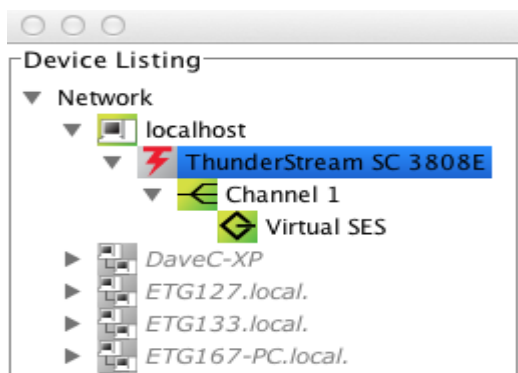
Hosts on the local subnet are automatically discovered and placed into the **Device Listing**.

Manual Discovery

A host can be found manually by using the Network menu and selecting “Find host”. The IP address or hostname of the remote host is required.

Host Login Status

The GUI Application must login into each host before that host can be managed or configured.



The GUI Application indicates the login status for a host as follows:

- A host that is not logged in will display the host icon and the text as gray and italicized.
- A host that is logged in will display the host icon with a green background and black non-italicized text.
- A host that was logged in but the host is rebooting will display the host icon and text as gray and italicized with a strike through.

Login to a Host

A login is started when the host's Device Listing tree is expanded. A login dialogue box displays and you must enter a username and password. The username and password of an administrator for the host is required to proceed.

- In Windows and Mac OS X, the login information is checked against any user in the Administrators group.

If three successive login attempts fail, the GUI Application will be locked out from the host for three minutes.

Once a login is established, the icon of the host is highlighted green and the text becomes black with normal font.

Select a Host

Select any host by clicking on it in the **Device Listing** window. The following tabs display in the **Configuration Options** window:

- The **Basic Info** tab displays information about the booted operating system on that host. It also shows scheduled reboot information and provides the ability to install a driver on that host. See [Exhibit 2.0-2 on page 7](#).
- The **Notification** tab allows you to set up notification of certain events in the ThunderStream storage controller. Refer to [Setup RAID Notification on page 14](#) or see [Exhibit 2.1-6 on page 16](#).

Select a Storage Controller

The following tabs display in the **Configuration Options** window when you select a specific storage controller in the **Device Listing** window.

- The **Basic Info** tab provides basic information about the device currently highlighted in the device listing. See [Exhibit 2.0-3 on page 8](#).
- The **Flash** tab provides information about the current revision of flash loaded on the highlighted storage controller and allows you to update the flash. See [Exhibit 2.0-4 on page 8](#).
- The **RAID** tab allows you to manage RAID groups. See [Exhibit 2.1-0 on page 9](#).
- The **RAID CLI** tab allows experienced users to manage the RAID adapter using a Command Line Interface.
- The **Tasks** tab displays information about tasks that are scheduled to run. In this tab, users can reschedule a task or remove the scheduled task.

Select a Channel

The following tabs display in the **Configuration Options** window when you select a specific channel in the **Device Listing** window:

- The **Basic Info** tab displays PCI information for the selected channel.
- The **NVRAM** tab displays the NVRAM parameters of the selected channel.

Driver update

A storage controller driver can be installed or upgraded on a host by going to the **Basic Info** tab for that host, choosing a driver package in the driver update section and clicking update. The driver package is the .exe (Windows) or .dmg (Mac OS X) file available on the ATTO product CD or downloaded from the ATTO website. If a reboot is required, the GUI will prompt once the install completes. If a driver was installed that has no matching storage controller, the GUI will prompt to shutdown and install the storage controller.



Note

ATTO storage controllers are designed to operate properly using factory settings. Entering invalid or incorrect settings when using an NVRAM configuration utility such as the ATTO ConfigTool may cause your storage controller to function incorrectly.

Select a Device

The following tabs display in the **Configuration Options** window when you select a specific device in the **Device Listing** window:

- The **Basic Info** tab displays information about the selected device.
- The **Flash** tab provides a tool to update the firmware of the selected device. The flash tool is only available for devices that support flash update.
- The **SES** tab displays SES (SCSI Enclosure Services) status information, such as power supplies and fans, for SES devices.

About panel

The **About** panel, selected from the **About** menu item in the **Help** menu, is an informational page which displays a list of components installed for the ATTO ConfigTool, the tool's version number and ATTO Technology contact information.



Note

It is important to keep firmware and drivers up-to-date for optimal performance. Refer to the product release notes (PRNs) on the ATTO web site download page for additional information.

System Reboot

A host can be rebooted using its **Basic info** tab. Select “Restart” and optionally provide a message. The host will reboot in one minute. The **Message** area will be updated to reflect the fact that the host has a scheduled reboot and display the time the reboot will occur.

Exhibit 2.0-2 The **Basic Info** tab when you choose a **Host** from the **Device Listing**.

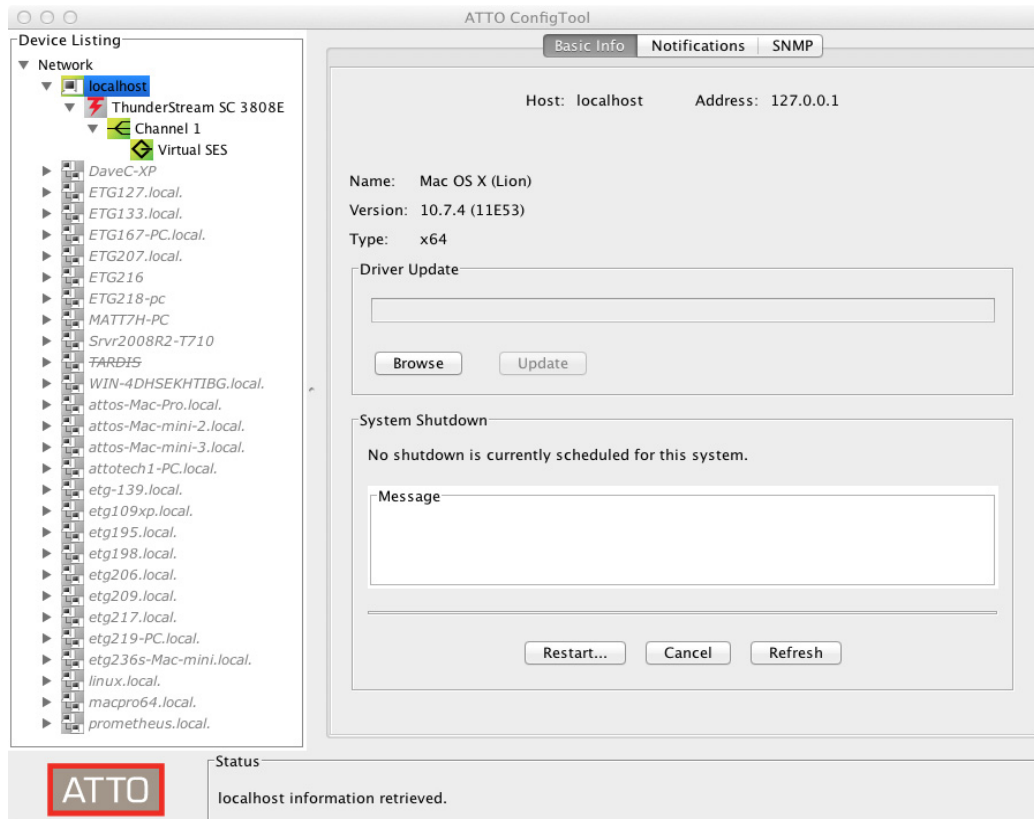


Exhibit 2.0-3 The **Basic Info** tab when a storage controller is chosen from the **Device Listing**.

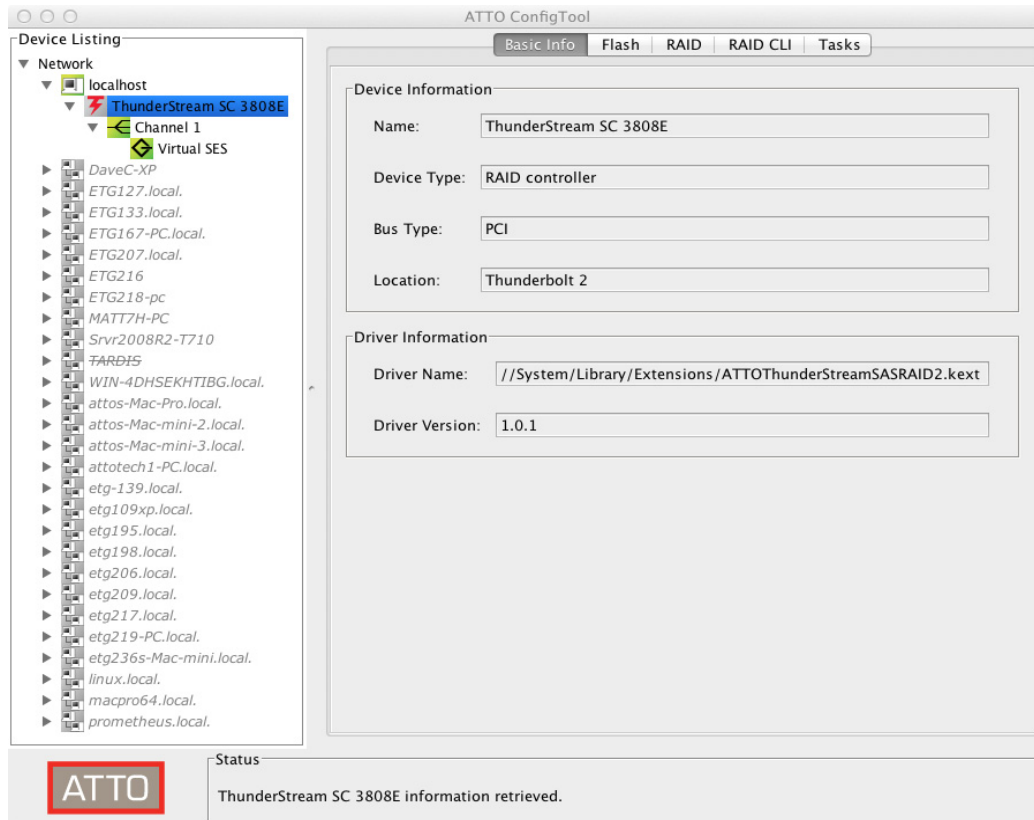
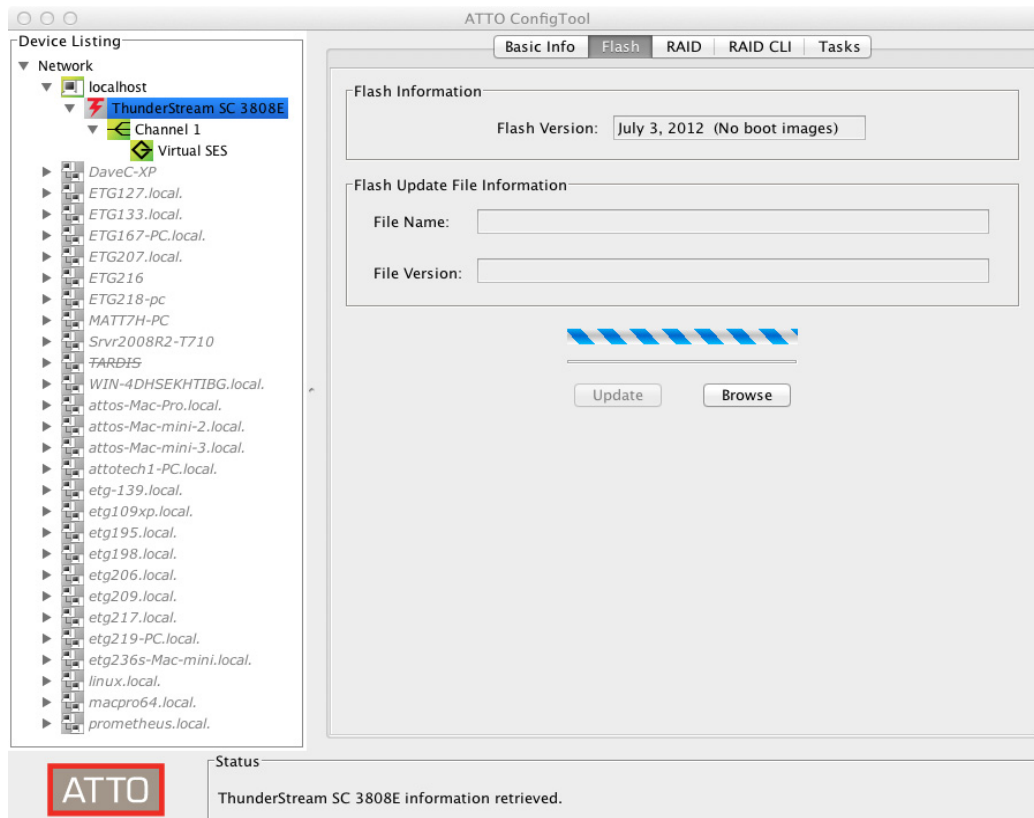


Exhibit 2.0-4 The **Flash** tab.



2.1 RAID Configuration

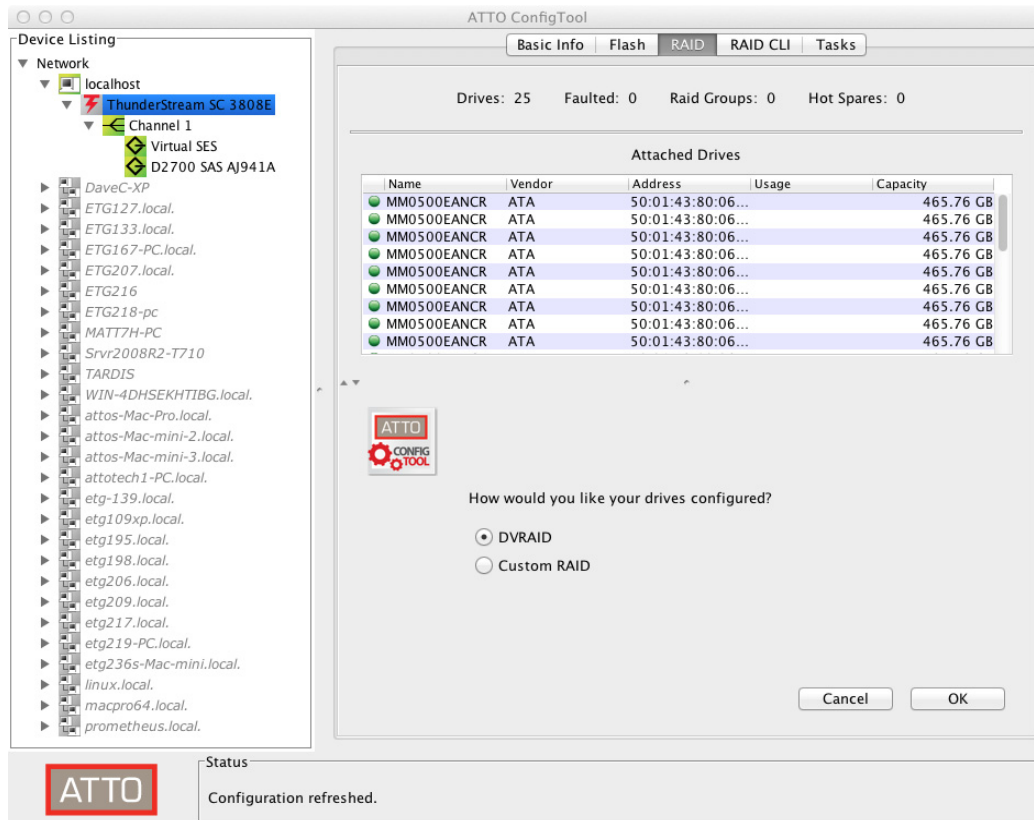
The following section applies to the ThunderStream SC 3808 only.

Use the ATTO ConfigTool to set up RAID groups on your ThunderStream SC storage controller in one of the following RAID levels:

- JBOD, RAID Level 0,1,4,5,6,10 & DVRAID™

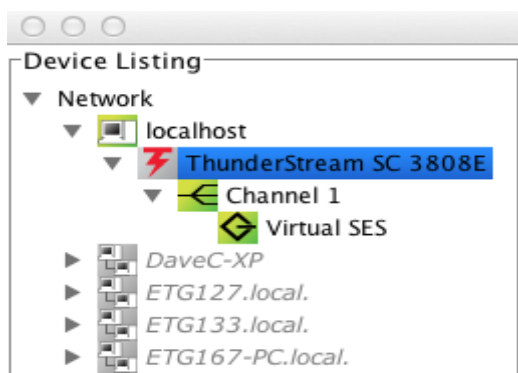
Each RAID group may be divided into one or more partitions; each partition appears to the host operating system as a virtual disk.

Exhibit 2.1-0 ConfigTool RAID page.

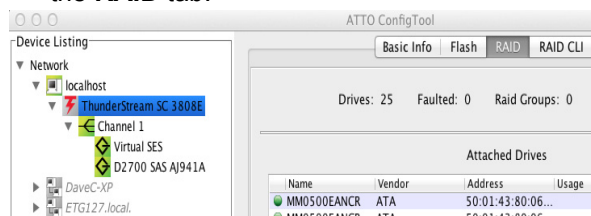


Preliminary Steps

- 1 Launch the **ConfigTool**
- 2 The **Welcome** screen appears.
- 3 From the left-hand panel **Device Listing**, expand all the elements of the selected hosts in the Network tree.
- 4 Click on **ThunderStream SC 3808**.



- 5 A set of tabs appear in the right panel. Click on the **RAID** tab.



- 6 The application scans for drives.
A list of drives appears. Devices are displayed in the top panel and RAID groups and Hot Spares are displayed in the bottom panel.
- 7 Select either **Setup DVRAID** (continue with [Setting up DVRAID](#) on page 10) or **Custom RAID setup** (continue with [Customizing a RAID setup](#) on page 11).
 - a. If the RAID wizard does not start automatically, select the **RAID Management** menu item at the top of the screen, then select the **Create RAID Group** from the menu presented.

Setting up DVRAID

DVRAID (Digital Video RAID) provides parity redundancy for your data. Optimized for performance for the high data transfer rates required in digital video environments, DVRAID is ATTO Technology proprietary technology which supports the editing of uncompressed 10-bit High Definition (HD) video and multiple streams of real-time, uncompressed Standard

Definition (SD) video. The DVRAID wizard automatically sets up DVRAID using all storage attached to the ThunderStream SC storage controller based on the number of available drives. See [Exhibit 2.1-1](#). DVRAID setup cannot be used if any other RAID groups are present.

Exhibit 2.1-1 The DVRAID wizard automatically sets up the number of RAID groups based on the number of available drives. Each RAID group uses one drive as a parity drive.

Available drives	RAID groups created	Drives in each group
6	1	6
7	1	7
8	1	8
12	2	6
14	2	7
16	2	8
24	4	6

If you do not have 6, 7, 8, 12, 14, 16 or 24 drives, you cannot use the DVRAID wizard.

If you do not want all storage set up in DVRAID or you do not have the correct number of drives, use [Customizing a RAID setup](#).

- 1 After following [Preliminary Steps](#) on page 10, select the **DVRAID** radio button in the ConfigTool RAID wizard.

- 2 Click on **OK**.
- 3 The ThunderStream storage controller firmware automatically uses all unassigned disks to create a DVRAID configuration.
- 4 Follow the on screen instructions.
- 5 Once created, the DVRAID will begin initializing. When complete, the group will be ready for use.

Customizing a RAID setup

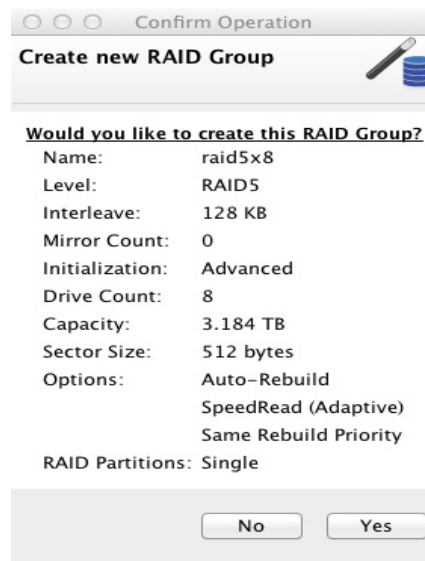
- 1 After following [Preliminary Steps](#) on page 10, select the **Custom RAID** radio button. See [Exhibit 2.1-0](#) on page 9.
- 2 Select the options to configure the new RAID group (see [Exhibit 2.1-2](#) on page 12):
 - **RAID Group Name:** Assign a name to the RAID group. The name must be unique and no more than 14 characters.
 - **RAID Group Level:** Select a RAID group level from the drop-down box.
 - **RAID Group Interleave:** Select an interleave value. The default value is 128KB.
 - **RAID Group Mirror Count:** Select a mirror count, a copy of the original data stored on a separate disk, for RAID groups that have mirrors.
 - **Initialize:** Select the initialization method for the RAID group. The default is **Advanced**. **Advanced** initialization is recommended for new drives because the procedure erases and verifies the drive media. The RAID group is unavailable until initialization is complete.
Express initialization performs RAID group setup in the background and the RAID group is immediately available for use.

- 3 Click **Next**.
- 4 Select the disk devices in the top panel and drag them into the device area in the bottom panel. See [Exhibit 2.1-3](#) on page 12.
- 5 If you want the RAID group to be presented as one virtual disk (partition) with the default RAID group properties, click **Finish**.
If you want to change other parameters from default values, click **Next** and select the desired property.

- **SpeedRead, Auto-Rebuild and Rebuild Priority:** refer to [Change RAID group properties](#) on page 13 for specific information on these parameters.
 - **Sector Size:** 512 bytes (default) or 4096 bytes.
- 6 If you want more than one virtual disk (partition) click **Next** and select one of the following:
 - **leave as one partition**
 - **partition by count**
 - **partition by size**

When you have made all your selections, click **Finish**.

- 7 A confirmation dialogue box asks you to confirm the configuration you have chosen. Click **Yes**.



- 8 The RAID group configuration you have chosen is initialized and completed. The time it takes to initialize the RAID configuration you have chosen depends on the RAID level selected, the capacity of the drives and the initialization method selected.

Exhibit 2.1-2 Selecting the options to configure the new RAID group.

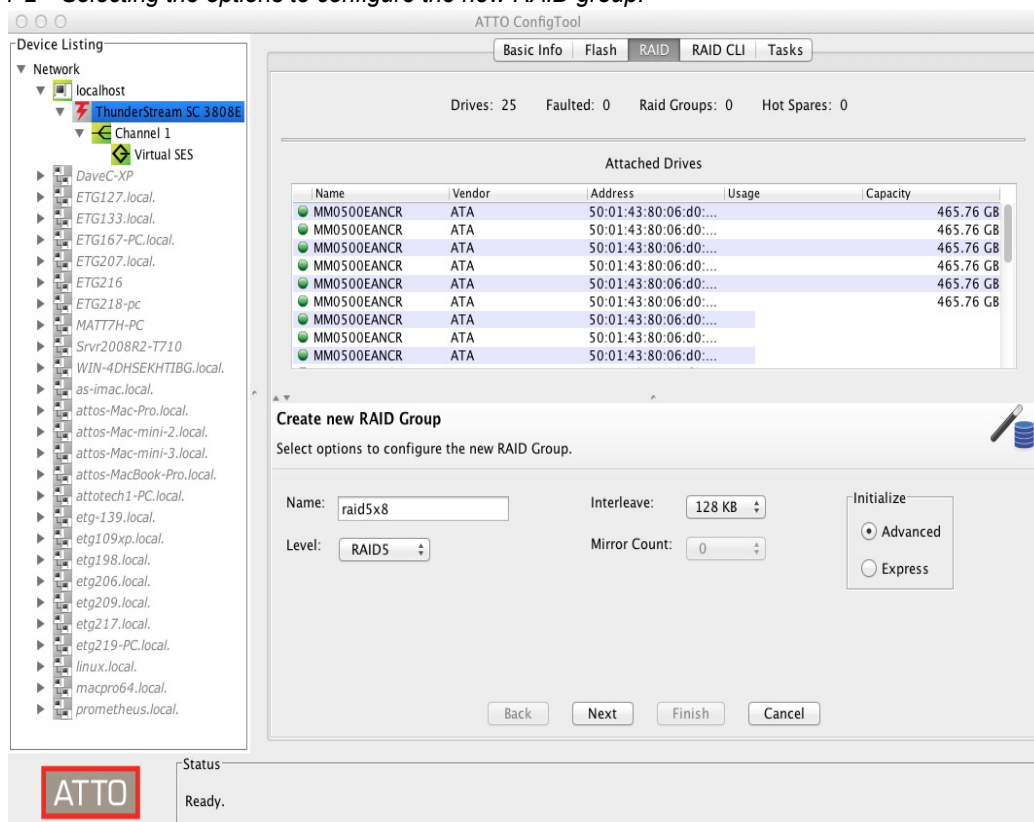
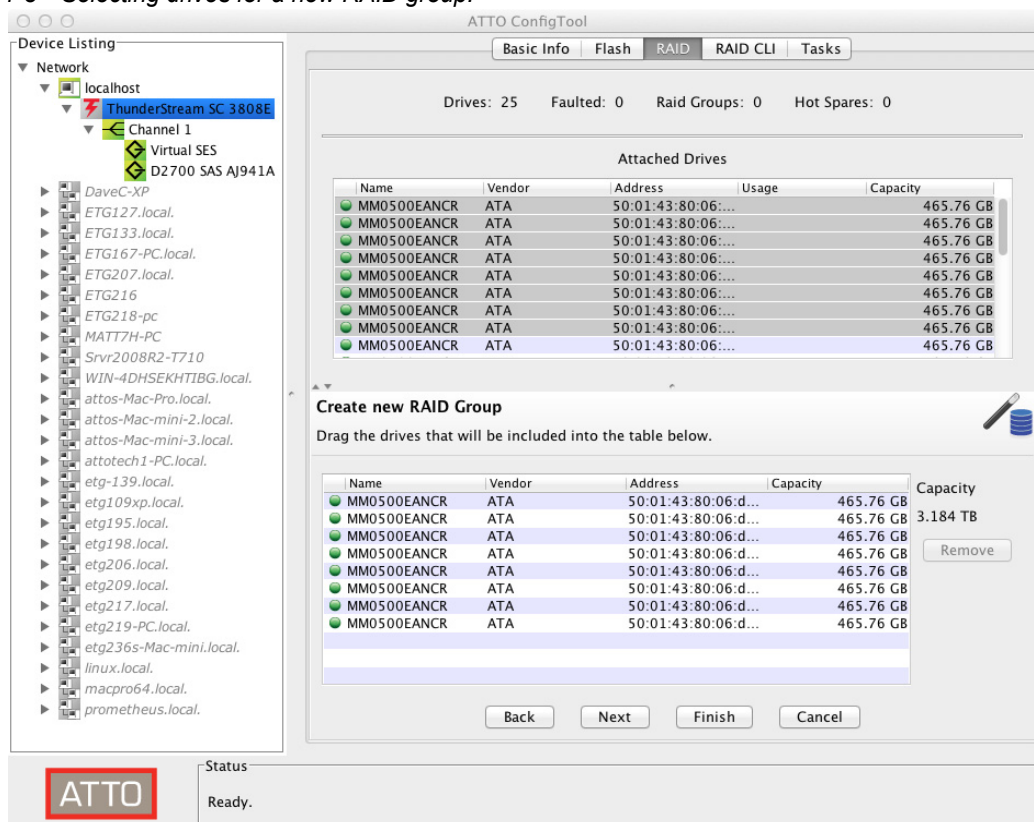


Exhibit 2.1-3 Selecting drives for a new RAID group.



Creating a Hot Spare Pool

- 1 After following the [Preliminary Steps](#) on page 10, find the **Hot Spare** tab in the bottom panel within the **RAID** tab.
- 2 Select the **Hot Spare** tab to show existing members of the Hot Spare Pool.
- 3 To add drives to the Hot Spare Pool, select unallocated drives from the top panel and drag them to the Hot Spare Pool.
To remove a drive from the Hot Spare Pool, select the drive, click on it and click on **Delete Hot Spares**.

Modifying RAID Groups

The ATTO ConfigTool interface may be used to replace a failed drive, add capacity to a RAID group, or change a RAID configuration from the current configuration to a new configuration.



CAUTION

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

Expand capacity

Click on **Expand Capacity** in the **RAID Management** menu and follow the on-screen instructions. Depending on the RAID configuration, you may need to add more than one device.



CAUTION

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

Delete a RAID group

To delete a RAID group using the ATTO ConfigTool, click on **Delete Group** in the **RAID Management** menu and follow the on-screen instructions.



CAUTION

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

Change RAID group properties

A RAID group has properties that are specific to the RAID group. The value of each property remains with the RAID group when it is moved from one computer to another. Some of the properties can only be specified during RAID group creation whereas others may be changed at any time during the life of the RAID group.

- 1 Select a RAID group in the **Groups** panel.
- 2 Click on **Properties** in the **RAID Management** menu.
- 3 View or change the current properties.

- **SpeedRead** specifies the cache policy to be used during read operations. Once a read command is given, the SAS/SATA RAID storage controller retrieves the next set of sequential data from the RAID group and caches it in internal memory. If you select **Never**, read caching is never performed. If you select **Always**, read caching is always performed. If you select **Adaptive**, the default, SpeedRead is enabled or disabled depending on the sequential patterns detected in I/O requests.

- **Auto-Rebuild** controls the replacement of a faulted drive with any available unallocated drive. When you click on the **Auto-Rebuild** check box and the **Accept** button, Auto-Rebuild is enabled. If a drive becomes faulted, the SAS/SATA RAID storage controller replaces the drive with an unallocated drive.
- **Rebuild Priority** specifies the ratio of rebuild I/O activity to host I/O activity. A rebuild priority of **Same** (default value) indicates that rebuild I/O and host I/O are treated equally. A rebuild priority of low

indicates that host I/O is given a higher priority than rebuild I/O. A rebuild priority of **High** indicates that rebuild I/O is given a higher priority than host I/O.

- **Prefetch** specifies the number of stripes that are read when SpeedRead is enabled or adaptive. The valid values for Prefetch are 0, 1, 2, 3, 4, 5 and 6, and the default value is 0. This property can only be changed after the RAID group is created. To access this property, select the RAID group and view its properties.

4 Click **Accept**.

Setup RAID Notification

The ATTO ConfigTool provides a mechanism to issue a notification when a RAID event occurs in ThunderStream SC storage controllers.

RAID events are divided into three categories:

- **Critical events** indicate a serious problem has occurred and the administrator of the RAID group should perform corrective action.
- **Warning events** are less serious but still warrant notification.
- **Information alerts** provide additional useful information about warnings or critical events.

The **Notifications** tab provides numerous drop-down boxes that allow for the selection of the types of RAID events to receive for a notification. There are four options available in these drop-down boxes:


- **Critical:** Only RAID events of a Critical level are reported for the notification.
- **Warning:** Only RAID events of Warning and Critical level are reported for the notification.
- **All:** All RAID events (Information, Warning, Critical) are reported for the notification.
- **None:** No RAID events are reported for the notification. This level is particularly useful if a notification feature is not desired.



The notifications are specified at the host system level and apply to all ATTO ThunderStream SC storage controllers installed in the host system.

Basic alerts

The **Basic Alerts** section of the **Notifications** tab provides the controls to select the levels of RAID events for Audible and Visual notifications, as well as the level of RAID events to output to the system event log.

Audible Alerts utilize the system speaker and/or the hardware buzzer to produce the notification. There is an icon  in the system tray (or system status area) that is used to turn off the alarm. The user must right-click on the icon and then select **Mute Audible Alert** from the menu. This will stop the alarm.

Visual Alert utilize pop-up message boxes to display the contents of a RAID event. The pop-up may be closed using the pop-ups button.

Logging

The ATTO ConfigTool Service outputs RAID events and other useful informational messages to the system event log. The level of RAID events inserted into the system event log may be controlled by the System Log drop-down box in the Basic Alerts section of the Notifications tab. See [Exhibit 2.1-4](#)

Logs are collected with the one-button diagnostics menu item. This can be useful when contacting ATTO Technical Support. Choose **Help, Run Diagnostics**, then choose a place to save the file output. It may take several minutes to gather the log. See [Exhibit 2.1-5](#)

Exhibit 2.1-4 The **Basic Alerts** controls of the **Notifications** tab in the ATTO ConfigTool.

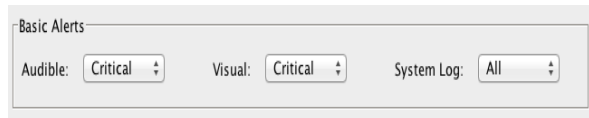
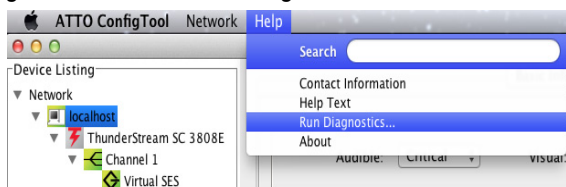


Exhibit 2.1-5 Run Diagnostics generates an extensive log to aide in troubleshooting.



Email

The ATTO ConfigTool Service periodically sends email notifications to the designated email address(es) that have been input under the Notification Addresses: field(s). There are three text fields under which email addresses can be specified, and more than one email address may be specified in each text field, as long as they are separated by a comma. Each email address text field can be configured to receive a specific level of RAID events via the drop-down box displayed next to each email address text field.

The ATTO ConfigTool Service can be configured to use a TLS/SSL email server (eg. Gmail™, Yahoo®, etc.) as well as the port to use when connecting to the email server. The ATTO ConfigTool Service's connection to the email server may be configured using the following controls:

- **Server Address:** SMTP email server to use when sending an email (eg. smtp.example.com)
- **Sender Address:** specifies the text that will show in the "From" field in the sent email.
- **Username:** specifies the username or login ID that is required when logging into the email server to send an email
- **Password:** specifies the password for the account identified by the Username.
- **Enable SSL:** Check this if using SSL protocol for email.
- **Port:** specifies the port number to which the ATTO ConfigTool Service attempts to connect to the email server. Valid values are 1-65535.



Note

Contact your email provider for the appropriate Port number. Using any other number will result in an email notification failure.

Email notifications are sent at 15-minute intervals. If a Critical RAID event is detected, an email notification will be sent after a 10-second delay. This delay allows the ATTO ConfigTool Service to gather supporting RAID events that may be useful in identifying why the Critical RAID event occurred.

Exhibit 2.1-6 The **Notifications** tab in the ATTO ConfigTool.

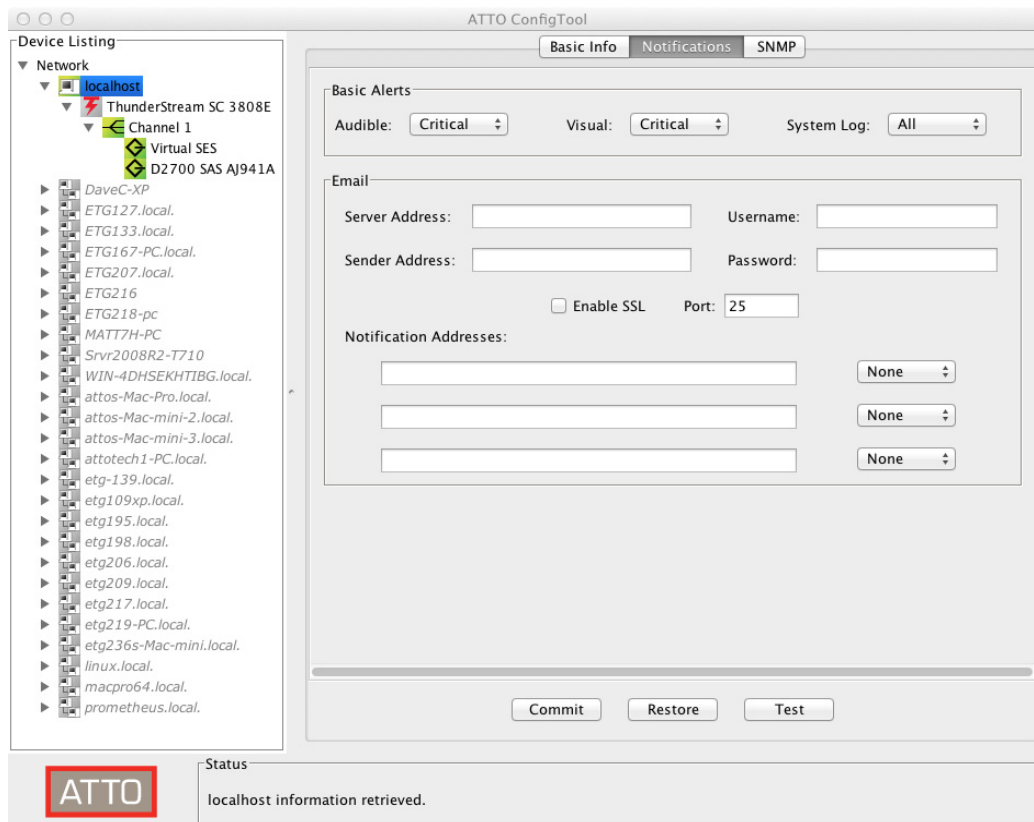
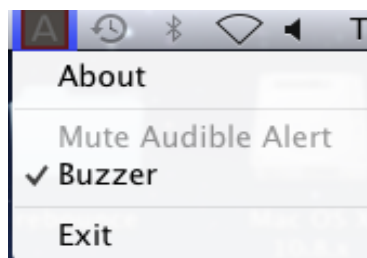


Exhibit 2.1-7 Mute Audible Alert



Using SCSI Enclosure Services (SES)

SAS/SATA drive enclosures may provide a SCSI Enclosure Processor which indicates enclosure health status, drive identification and drive fault identification.

The ATTO ConfigTool recognizes drive enclosures that provide SCSI Enclosure Services (SES). You may use SES to identify individual drives, all the drives in the same enclosure, all the drives in a single RAID

group, or faulted drives. You may also select drives and monitor the status of the enclosure.

To use SES, open the ATTO ConfigTool and follow one of the procedures below.

Identifying Drives

Drive Identification lights LEDs showing the drives you have selected using the ATTO ConfigTool. Most drive enclosures blink an LED next to the drive in the enclosure.

- 1 Select one or more drives individually or in enclosures or drives in RAID groups:
 - Select individual drives in the **Attached Drives** panel.
 - Select one or more RAID groups in the **Groups** panel.
 - Select one or more drives in the **Attached Drives** panel, right click on one of the selected drives and select **Enclosure**.
- 2 Right-click on one of the selected drives or RAID groups.
- 3 Select **Locate**.



Note

If a RAID 1 or RAID 10 group was selected, the locate operation provides the capability to select a specific mirror of the group.

The status icon next to the selected drives blinks and the enclosure performs its specific identification method until you stop it.

- 4 To stop the drive identification, right-click on one of the selected drives or RAID groups.
- 5 De-select **Locate**.

Identify Faulted Drives



Note

Fault identification only works when the enclosure supports SES.

Drive Fault Identification is performed automatically by the ThunderStream SC storage controller when a drive is determined to be bad.

The fault identification continues until the drive is replaced or the RAID group is deleted.

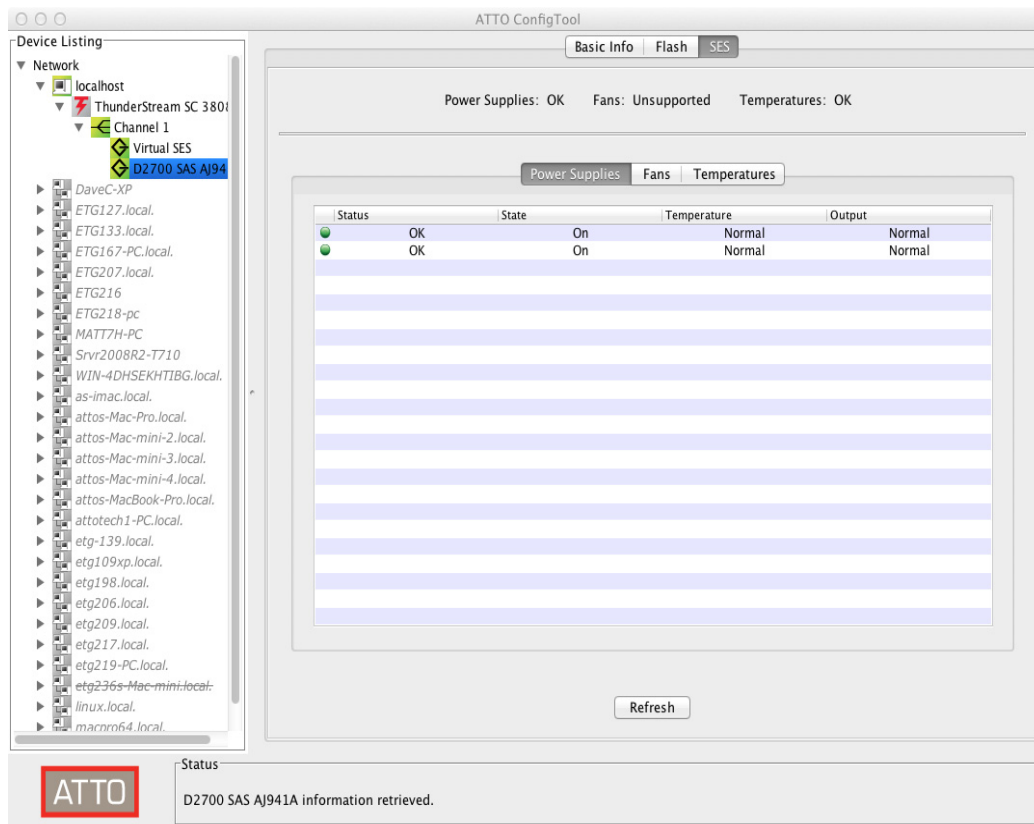
Monitoring Health

The ATTO ThunderStream SC storage controller performs **Enclosure Health Monitoring** automatically when an SES device is present. The storage controller monitors the status of the enclosure's power supplies, fans and temperatures. If the status of any of these sub-systems indicates a failure, the storage controller reports the problem.

The ConfigTool shows the status of selected SES devices and reports the specific health of each sub-system.

- 1 Select the SES device from the **Device Listing** tree in the ConfigTool.
- 2 Select the **SES** tab at the top of the right panel.
- 3 View the overall status of each component across the top of the right panel. (See [Exhibit 2.1-8.](#))
- 4 Select a specific sub-system (power supply, fans and temperatures) and view the status of the reporting sub-system.

*Exhibit 2.1-8 The **SES** tab.*



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

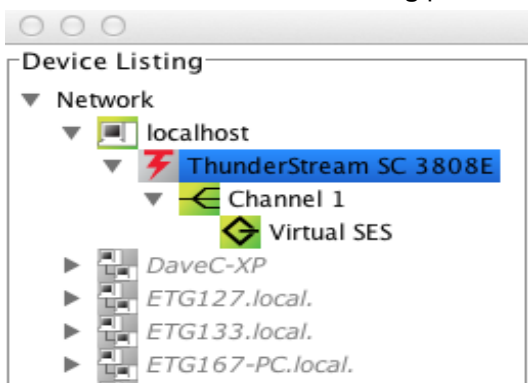
Self-Monitoring, Analysis and Reporting Technology, or S.M.A.R.T., is a system built into SATA drives to detect and report on various indicators of drive health.

The S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) monitoring feature monitors and reports the status of SATA drives using certain parameters recorded by the drives. Notifications are sent when the values exceed certain pre-determined values.

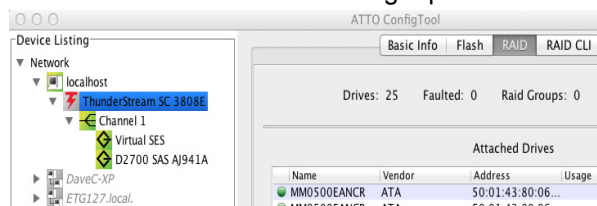
Enabling or Disabling S.M.A.R.T. Monitoring

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.

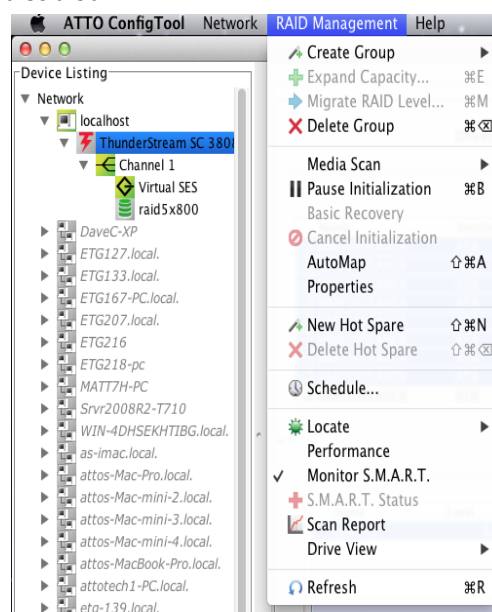
- 1 Select the **ThunderStream SC** storage controller from the **Device Listing** panel.



- 2 Select the **RAID** tab in the right panel.



- 3 Select the **RAID Management** menu item at the top of the screen.
- 4 Select the **Monitor S.M.A.R.T.** menu item to change the monitoring status. The **Monitor S.M.A.R.T.** menu item under the **RAID Management** menu has a check mark when monitoring is enabled and no mark when it is disabled.



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

The ATTO ConfigTool 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. See [Exhibit 2.1-9](#) on page 20.

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 record of S.M.A.R.T. status, an arrow notes which way the change went, either higher or lower.

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.

- 1 Select a single drive in the **Attached Drives** panel.
- 2 Right-click on the selected drive.
- 3 Select **S.M.A.R.T. Status** in the sub-menu.
- 4 The **S.M.A.R.T. Status** box displays.
 - 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 displays.



Note

If you click on the **Refresh** button when monitoring is disabled, a pop-up box displays. You can enable monitoring from the pop-up box to complete the refresh request.

Exhibit 2.1-9 S.M.A.R.T. status for a selected drive

○ ○ ○ MK2002TSKB (50:01:08:60:00:55:c8:ef) S.M.A.R.T. Status

Status: OK

ID	Attribute	Threshold	Worst	Current	Raw
01	Raw Read Error...	50	100	100	000000000000
02	Throughput Per...	50	100	100	000000000000
03	Spin Up Time	1	100	100	000000002DEE
04	Start/Stop Count	0	100	100	00000000001D
05	Reallocated Sec...	50	100	100	000000000000
07	Seek Error Rate	50	100	100	000000000000
08	Seek Time Perf...	50	100	100	000000000000
09	Power on Hours...	0	100	100	00000000008D
0A	Spin Retry Count	30	100	100	000000000000
0C	Power Cycle Co...	0	100	100	000000000018
BF	G-Sense Error...	0	100	100	000000000000
C0	Power-off Retr...	0	100	100	000000000011
C1	Load/Unload C...	0	100	100	00000000002D
C2	Temperature	0	100	100	002E00170018
C4	Reallocation Ev...	0	100	100	000000000000

Monitoring: Enabled

Aug 14, 2012 10:31:28 AM

← 1 of 1 →

Refresh



RAID Media Scan Feature

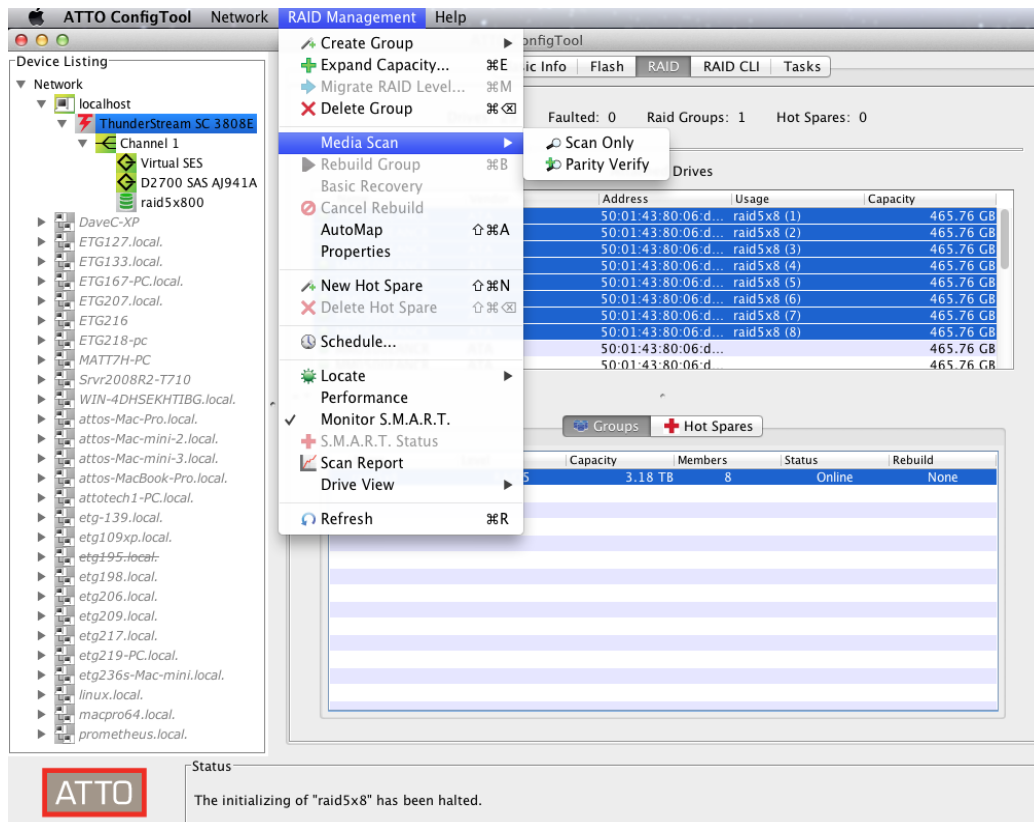
The Media Scan feature scans disk drives for media errors and parity errors. All media errors are counted and fixed. All parity errors are reported in the event log. The two options are described below:

Media Scan - Media Scan works with parity RAID group members, Hot Spare drives and unallocated drives. Media Scan reads the selected drives and, if a Media Error is found, Media Scan re-writes the disk with the media error.

Media Scan with Parity Verify - is a variation of Media Scan that is available for on-line parity RAID groups only. Parity Verification is performed on each RAID group stripe that has no detected media errors. The parity of the stripe is recalculated and compared to the original parity for the stripe. If there is a mismatch, an error is generated and recorded in the Event Log and System Log files.

Starting a Media Scan

- 1 Select the **ThunderStream SC** storage controller from the **Device Listing** panel.
- 2 Select the **RAID** tab in the right panel.
- 3 Select the RAID group, Hot Spare drive(s) or unallocated drive(s) which will have a Media Scan. One RAID group can be selected or multiple Hot Spare and unallocated drives can be selected.
- 4 Select the **RAID Management** menu item at the top of the screen.
- 5 Select the **Media Scan** menu item.
- 6 Select the  **Scan Only** or  **Parity Verify** from the sub-menu.
- 7 The Media Scan starts as soon as the sub-menu item is selected.



Media Scan Status

The Media Scan starts as soon as the menu item is selected. The **Attached Drives** panel displays a rotating icon next to each drive being scanned. The **RAID Group** panel displays the type of scan being performed and a status for percent complete.

The screenshot displays the ATTO ConfigTool interface. On the left is the 'Device Listing' pane, showing a network tree with 'localhost' expanded to 'Channel 1', which contains 'Virtual SES' and 'D2700 SAS AJ941A' (raid5x800). Below this is a list of various local devices. The main window has tabs for 'Basic Info', 'Flash', 'RAID', 'RAID CLI', and 'Tasks'. The 'RAID' tab is active, showing 'Drives: 25', 'Faulted: 0', 'Raid Groups: 1', and 'Hot Spares: 0'. Below this is the 'Attached Drives' table:


Name	Vendor	Address	Usage	Capacity
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (1)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (2)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (3)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (4)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (5)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (6)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (7)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500FANC	ATA	50:01:43:80:06:d...		465.76 GB

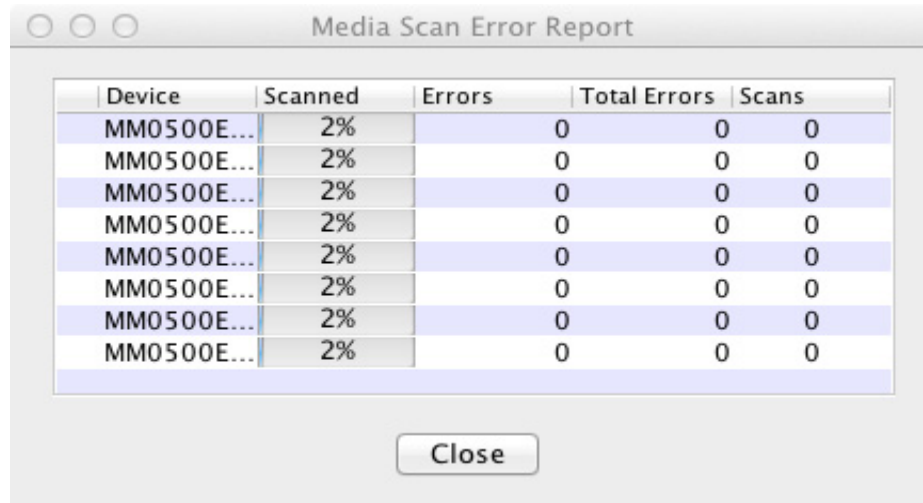
Below the 'Attached Drives' table is the 'Groups' panel, which shows a table with the following data:

Name	Level	Capacity	Members	Status	Rebuild
raid5x8	RAID5	3.18 TB	8	Online	Media Scanning...

At the bottom of the window is the 'Status' bar, which includes the ATTO logo and the message: 'The media scanning of "raid5x8" has been started.'

Viewing the Scan Report

- 1 Select the **ThunderStream SC** storage controller from the **Device Listing** panel.
- 2 Select the **RAID** tab in the right panel.
- 3 Select the RAID group, Hot Spare drive(s) or unallocated drive(s) whose scan report should be displayed. One RAID group can be selected or multiple Hot Spare and unallocated drives can be selected.
- 4 Select the **RAID Management** menu item at the top of the screen.
- 5 Select the  **Scan Report** from the menu.
- 6 A **Media Scan Error Report** message box appears with the scan results. If a scan is currently in process the **Scanned** column indicates the percent complete for the operation.



The image shows a 'Media Scan Error Report' dialog box. It contains a table with the following data:

Device	Scanned	Errors	Total Errors	Scans
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0
MM0500E...	2%	0	0	0

Below the table is a 'Close' button.

Replacing a faulted drive

If a drive in a RAID group fails, the RAID group's status becomes degraded. To return to optimal functionality, replace the faulted drive using one of the following mechanisms.



Note

All of these mechanisms start a RAID group rebuild after the drive is replaced. A RAID group rebuild may take several hours to complete. The RAID group is accessible during rebuild; however, performance may be impacted, depending on the Rebuild Priority assigned.

A degraded RAID group will automatically rebuild if:

- 1 A hot spare is available
- 2 Auto-rebuild is enabled and a blank hard drive is available

Manually replace a drive

You may replace a drive and rebuild a RAID group manually.

- 1 After following the [Preliminary Steps](#) on page 10, double-click on the degraded RAID group in the bottom panel.
- 2 A RAID group members tab displays in the bottom panel. Select an unallocated drive from the drive inventory and drag it over the degraded drive in the members tab.
If the selected drive is appropriate, the faulted drive is replaced.

Drive Replacement on a Failure Condition

Replacing RAID Group Member Drives as Soon as They Fail

With parity and redundancy RAID levels, the RAID Group can withstand the loss of one member, and the data is still valid and accessible. In this case, the RAID Group goes into DEGRADED mode and uses parity or redundancy to generate the data. Although the RAID Group is fully operational, the RAID Group is at risk because if any other drive fails, data integrity is called into question.

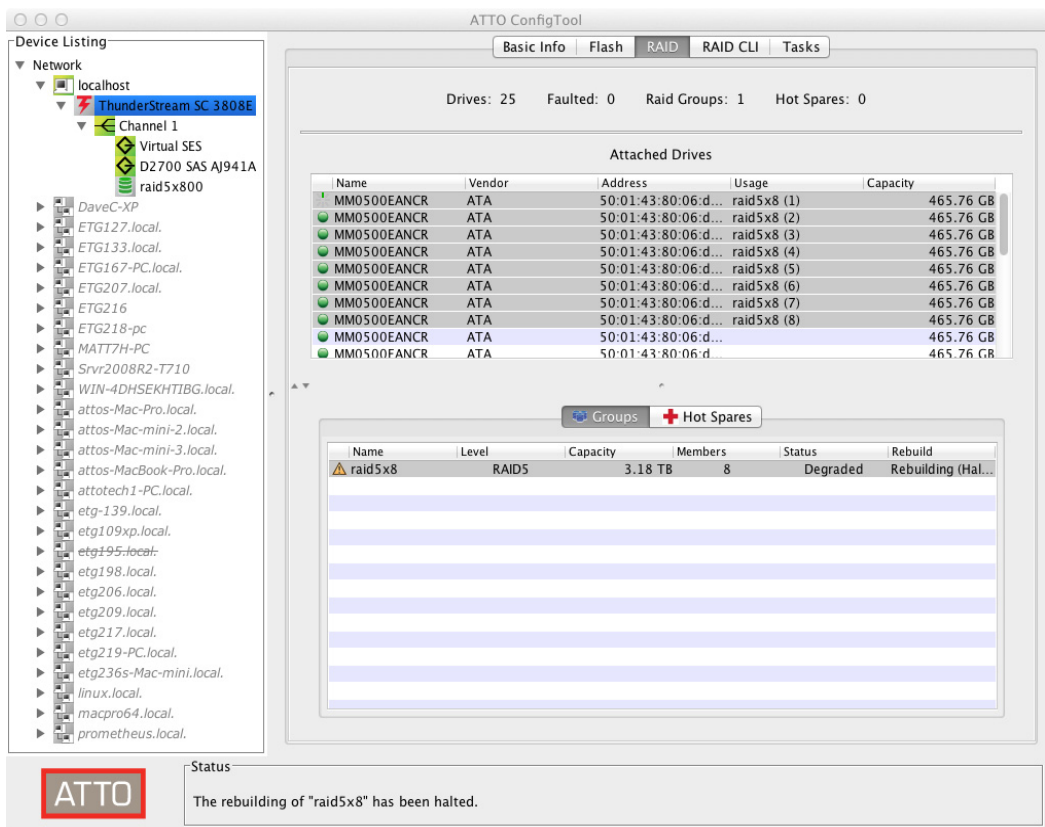
A Warning about Drive Replacement

A very common reason that an array goes from DEGRADED mode to OFFLINE mode is when the wrong drive is replaced. By pulling out a perfectly good drive, a double-drive fault occurs and there are insufficient drives to generate data. The following procedure is very important when you are considering removing a failed drive, to ensure the correct drive is pulled.

Identifying Failed Drives

If a failed drive is in an enclosure that supports SES (SCSI Enclosure Services), the drive's Fault LED should be blinking. In that case, it is clear which drive should be replaced.

Exhibit 2.1-10 RAID Display of Degraded Group



ATTO ConfigTool

Basic Info Flash RAID RAID CLI Tasks

Drives: 25 Faulted: 0 Raid Groups: 1 Hot Spares: 0

Name	Vendor	Address	Usage	Capacity
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (1)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (2)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (3)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (4)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (5)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (6)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (7)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB

Groups + Hot Spares

Name	Level	Capacity	Members	Status	Rebuild
raid5x8	RAID5	3.18 TB	8	Degraded	Rebuilding (Hal...

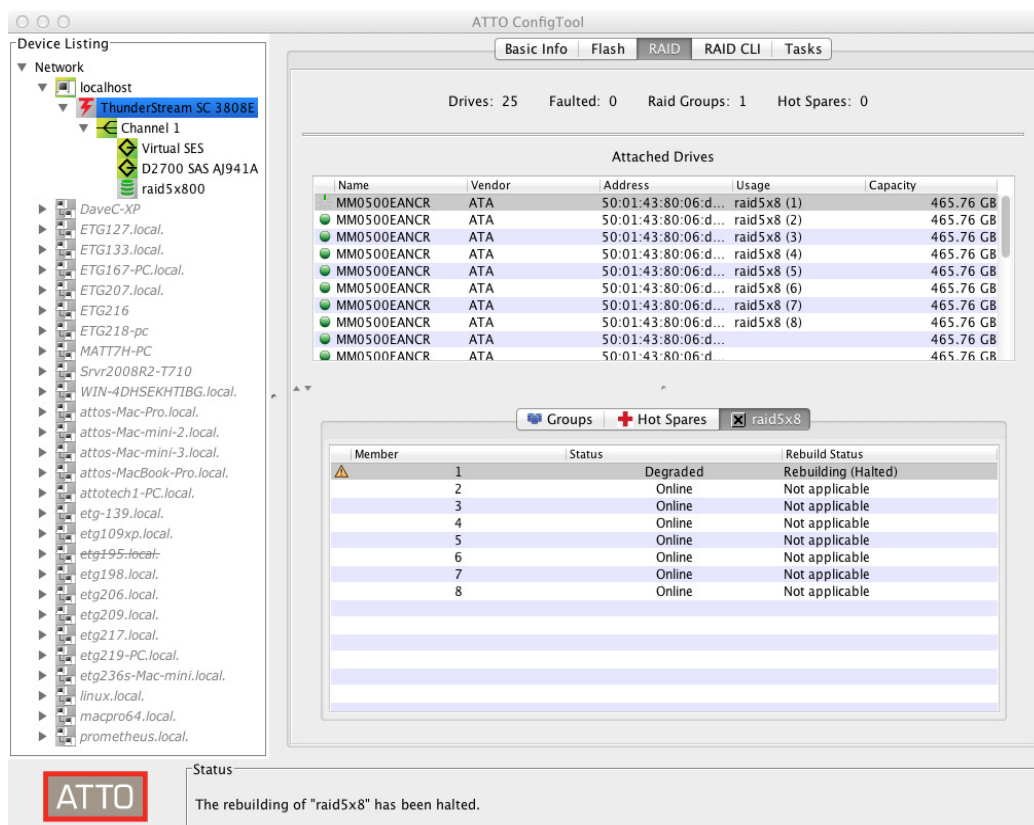
ATTO

Status

The rebuilding of "raid5x8" has been halted.

By double-clicking the RAID Group line, each RAID Member and its status is displayed. In [Exhibit 2.1-11](#), below, RAID Member 1 indicates DEGRADED. If the drive is in an enclosure that supports SES (SCSI Enclosure Services), the drive's Fault LED should be blinking.

Exhibit 2.1-11 Member List for Degraded RAID Group



ATTO ConfigTool

Basic Info | Flash | RAID | RAID CLI | Tasks

Drives: 25 Faulted: 0 Raid Groups: 1 Hot Spares: 0

Attached Drives

Name	Vendor	Address	Usage	Capacity
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (1)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (2)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (3)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (4)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (5)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (6)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (7)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB
MM0500EANC	ATA	50:01:43:80:06:d...	raid5x8 (8)	465.76 GB

Groups | Hot Spares | **raid5x8**

Member	Status	Rebuild Status
1	Degraded	Rebuilding (Halted)
2	Online	Not applicable
3	Online	Not applicable
4	Online	Not applicable
5	Online	Not applicable
6	Online	Not applicable
7	Online	Not applicable
8	Online	Not applicable

ATTO

Status

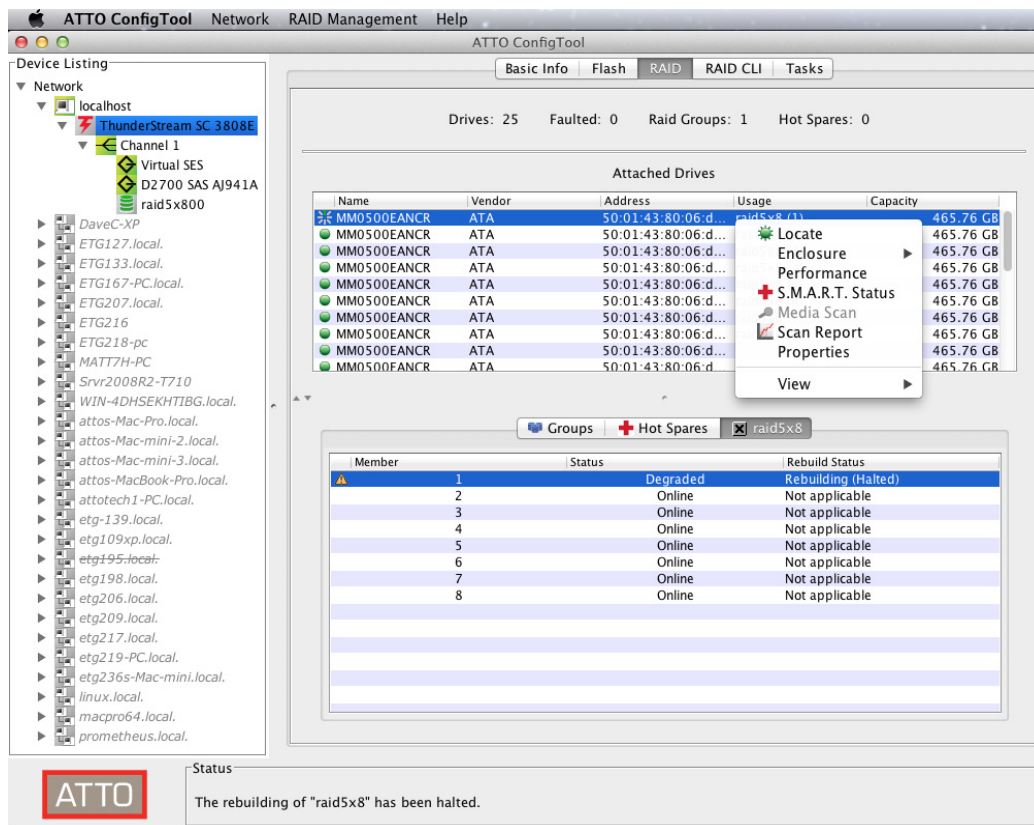
The rebuilding of "raid5x8" has been halted.

The member drive can be physically identified, in its enclosure, by right-clicking in the Attached Drives list and selecting Locate (See [Exhibit 2.1-12](#) below). The drive's Identify LED (or activity LED, in a non-SES enclosure) should blink.

If fault LED is not on or enclosure does not support SES, do the following:

- 1 Stop all I/O to the RAID
- 2 Highlight each drive in the RAID group except the faulted one.
- 3 Click RAID Management and then locate.
- 4 All drives, except for the faulted, will have blinking LEDs

Exhibit 2.1-12 Identify a Drive Using Locate



Recovering an Offline RAID Group

Recovery from Replacement of Wrong Drive

Exhibit 2.1-13 RAID 5 Group with 4 Operational Drives

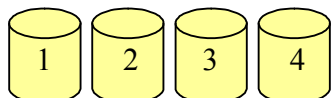


Exhibit 2.1-14 A Drive Fails; RAID Group goes DEGRADED

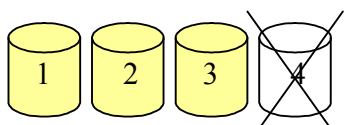
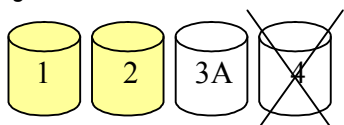


Exhibit 2.1-15 Drive 3 is replaced instead of drive 4! RAID Group goes OFFLINE



When a drive fails, but the wrong drive is replaced, a rebuild will not initiate and the RAID Group will be taken off line. The user should follow the procedure described earlier in this section to identify the failed drive, and ensure the correct drive is replaced.

The situation described above can be corrected. Replace the erroneously replaced drive (3A) with the original drive 3 in the above example; then identify and replace the failed drive (4); and then start a rebuild.

Recovery Mode

Sometimes, despite careful operation and maintenance, drives will coincidentally fail in such a way that the RAID Group integrity is compromised. After a RAID Group has been marked OFFLINE because of problems with member drives, there is a way to possibly recover some of the data. The following guidelines and commands can help recover data from an OFFLINE RAID Group. The following descriptions refer to RAID 5 specifically, but the principles extend to other RAID types.

Recovery from Failed Rebuild

Fault During Rebuild - Recover by Forcing Rebuild to Continue



Note

The diagrams which follow illustrate a scenario where a failed drive is removed and replaced. The error recovery procedure is also valid if there is a Hot Spare, or if there is an unallocated drive and Auto Rebuild is enabled.

Exhibit 2.1-16 RAID 5 Group with 4 Operational Drives

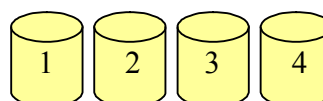


Exhibit 2.1-17 A Drive Fails; RAID Group goes DEGRADED

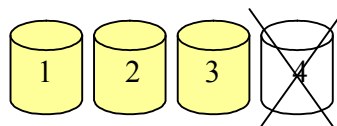


Exhibit 2.1-18 Drive is Removed and Replaced

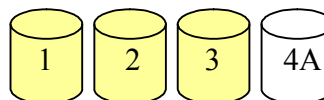
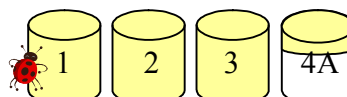
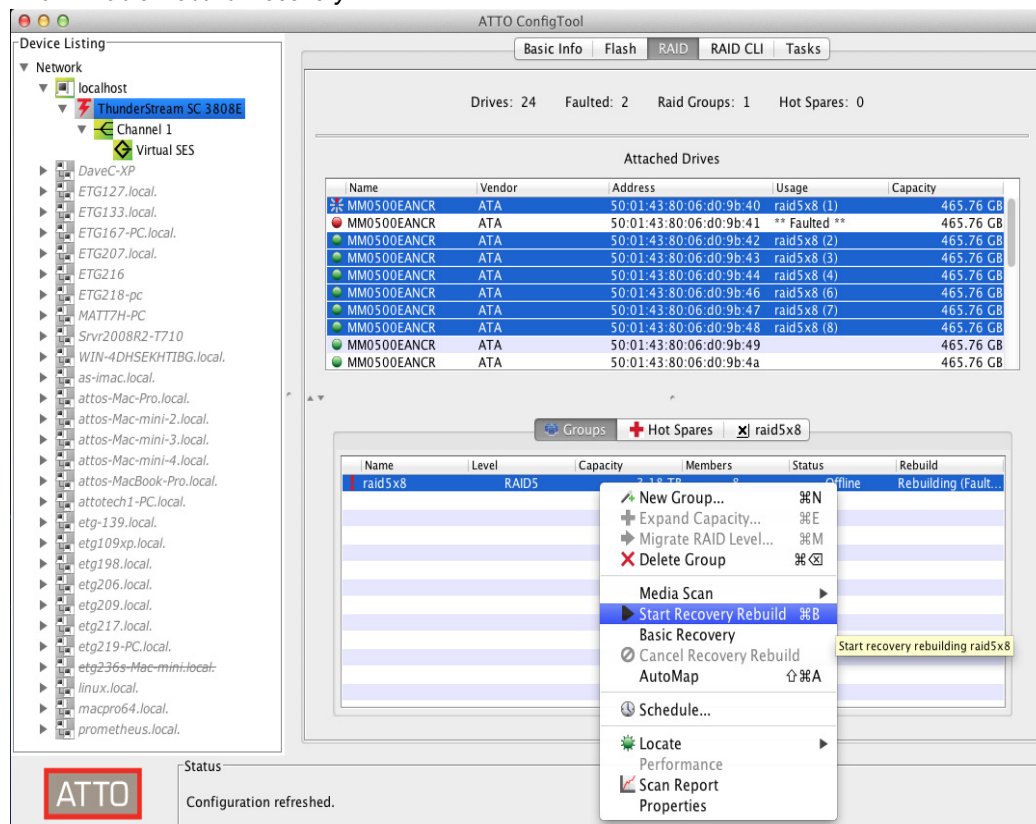


Exhibit 2.1-19 Media Error During Rebuild; Rebuild Halts, RAID Group goes OFFLINE



Use the ATTO ConfigTool to force the RAID Group to continue the rebuild. First, display the RAID Group information as shown in [Exhibit 2.1-10](#). Then right-click on the Offline RAID Group that has the Rebuild status **Rebuilding (Faulted)**. Select the option Start Recovery Rebuild as shown below in [Exhibit 2.1-20](#).

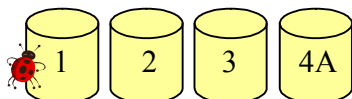
Exhibit 2.1-20 Enable Rebuild Recovery



The RAID Group status will change from **Offline** to **Degraded**. The Rebuild status will change from **Rebuilding (Faulted)** to **Recovery Rebuilding (n%)**, where n% is the completion percentage of the rebuild process.

At the end of the Rebuild Recovery, barring major problems, the RAID Group will be put back online. However, at the location corresponding to the Media Error, the data may be invalid! Anytime a RAID Group goes OFFLINE, data integrity **has been compromised**. It is imperative that data consistency checks and file system repair tools are used to validate the data before trying to use it.

Exhibit 2.1-21 Recover Rebuild; Rebuild Completes; RAID Group goes ONLINE



Note

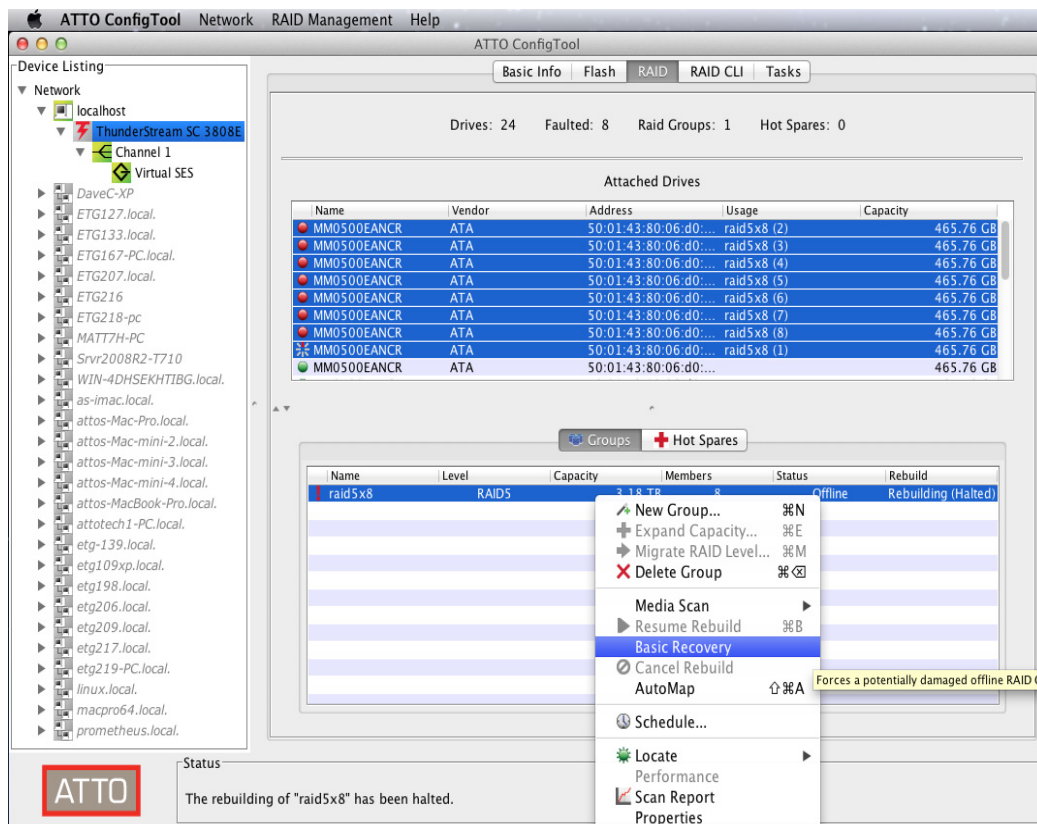
If the rebuild cannot continue to the end because of unrecoverable errors on multiple drives, use the Extreme recovery mode, described below, to try to recover data.

Basic Recovery Mode

CLI commands or the GUI can be used to put the drives into basic recovery mode. This allows you to read data to a backup location, replace all failed or marginal drives, and then restore the data to the new drives. However, at the location corresponding to the Media Error, the data may be invalid! Anytime a RAID Group goes OFFLINE, data integrity **has been compromised**. It is imperative that data consistency checks and file system repair tools are used to validate the data.

To enter recovery mode from the ATTO ConfigTool, select the Offline RAID Group and right-click to get the menu options. Select the option Basic Rebuild as shown below.

Exhibit 2.1-22 Enable Basic Recovery Mode



The RAID Group status will change from **Offline** to **Recovery (Basic)**. Once you enter Recovery Mode, use a host application to read the data (whatever you can) off of the drives and back it up to another location. The RAID Group will stay in recovery mode. If you use the CLI command `RGRecover Disable` to disable this mode, the RAID Group will return to the OFFLINE state. There is no mechanism to put this RAID Group back online.

Once you have the data backed up, use only good drives to create a new RAID Group, and then restore the data to the new RAID Group.

Extreme Recovery Mode

When a critical number of drives fail, or if a Rebuild Recovery operation fails, the Extreme Recovery Mode may be an option. This will only work if one or both of the failed drives are still operational at some level, there are spare slots, and the data is not too far out of date. When this is the case, re-insert one or both drives into the array and enter Extreme Recovery mode. The original failed drives will only be accessed if there is an error on the other (non-failed) RAID Group drives. Follow the procedure outlined in section, [Basic Recovery Mode](#) on page 28.

3.0 Updating Hardware Flash

Your Desklink Device is shipped with the latest flash and drivers but these may need to be updated as new versions become available. Visit the ATTO website, www.attotech.com, to download the latest drivers and flash bundle.

Updating Flash

Hardware flash memory may need to be updated as new versions become available.

- 1 Download and install the most recent version of the **ConfigTool** from the ATTO website.
- 2 Download the proper flash bundle (Desklink Device specific) from the ATTO website.
 - a. Go to www.attotech.com
 - b. Click on **downloads**.
 - c. Register or log in if previously registered.
 - d. Click on **Thunderbolt Desklink Devices** in the left dialog.
 - e. Navigate to your Desklink Device model in the right dialog and click on it.
 - f. Scroll down to and click the desired flash bundle depending on the operating system.
 - g. A download window appears. Choose **Save**.
 - h. After the download has completed, process the downloaded file:
 - On OS X, mount the **.dmg** file.
 - On Windows, run the **.exe** file.

- 3 Launch the **ConfigTool**.



Note

Default settings are appropriate for most systems but you may change settings using the ATTO ConfigTool on the Installation CD.

Please refer to the ATTO Utilities Installation and Operation Manual or contact an ATTO Technical Support Technician.

Appendix A Standards and Compliances

The equipment described in this manual generates and uses radio frequency energy. If this equipment is not used in strict accordance with the manufacturer's instruction, it can and may cause interference with radio and television reception.

Regulatory Notices

FCC Notices (US only)

Class B - SC 3808, FC 2162, NT 2102, NS 1101, NT 1102, FC 1082, SH 1068

Class A - NS 2102

This equipment has been tested and found to comply with the limits for a Class B (Class A) digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

Compliance with ICES-003

This Class B digital apparatus complies with Canadian ICES-003.

*Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada

Compliance with EN Regulations

Marking by the symbol **CE** indicates compliance of this ATTO device to the EMC Directive and the Low Voltage Directive of the European Union.



ATTO Desklinc Devices comply with Directive 2011/65/EU on the Restriction of the Use of Hazardous Substances in Electrical and Electronic Equipment (RoHS) and take the following exemptions:

- 5 - Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.
- 7a - Lead in high melting temperature type solders (i.e. lead based alloys containing 85% by weight or more lead).
- 7c-I - Lead in electronic ceramic parts (e.g. piezoelectronic devices)
- 13 - Lead and cadmium in optical and filter glass

UL60950-1/CSA C22.2 No. 60950-1



The product has been certified and bears the Mark, as applicable, of the EMC and Product Safety authorities as indicated below:

Safety: TUV 72140946, CB IEC60950-1 (all national deviations)

Emissions/Immunity: FCC Part 15, ICES-003, CE, AS/NZS CISPR 22, EN55022, EN55024, IEC61000-3-2, IEC61000-3-3, CISPR 24

Appendix B Warranty Information

Manufacturer limited warranty

ATTO Technology, Inc. ("ATTO") warrants to the original purchaser of this product ("Product") that the Product is free from defects in material and workmanship for the term described for this specific Product on ATTO's website (www.attotech.com). ATTO's liability shall be limited to replacing or repairing any defective product at ATTO's option. There is no charge for parts or labor if ATTO determines that this product is defective.

PRODUCTS WHICH HAVE BEEN SUBJECT TO ABUSE, MISUSE, ALTERATION, NEGLECT, OR THOSE PRODUCTS THAT HAVE BEEN SERVICED, REPAIRED OR INSTALLED BY UNAUTHORIZED PERSONNEL WILL NOT BE COVERED UNDER THIS WARRANTY. DAMAGE RESULTING FROM INCORRECT CONNECTION OR AN INAPPROPRIATE APPLICATION OF THIS PRODUCT SHALL NOT BE THE RESPONSIBILITY OF ATTO. LIABILITY UNDER THIS LIMITED WARRANTY IS LIMITED TO ATTO PRODUCT(S). DAMAGE TO OTHER EQUIPMENT CONNECTED TO ATTO PRODUCT(S) IS THE CUSTOMER'S RESPONSIBILITY. THIS LIMITED WARRANTY IS MADE IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. ATTO DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT IMPLIED WARRANTIES CANNOT BE EXCLUDED, SUCH IMPLIED WARRANTIES ARE LIMITED IN DURATION TO THE EXPRESS WARRANTY PERIOD APPLICABLE TO THE PRODUCT. BECAUSE SOME STATES OR JURISDICTIONS DO NOT ALLOW LIMITATIONS ON THE DURATION OF IMPLIED WARRANTIES, THE ABOVE MAY NOT BE APPLICABLE. ATTO'S RESPONSIBILITY TO REPAIR OR REPLACE A DEFECTIVE PRODUCT IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY.

ATTO IS NOT RESPONSIBLE FOR DAMAGE TO OR LOSS OF ANY DATA, PROGRAMS OR ANY MEDIA. THE PRODUCTS ARE NOT INTENDED FOR USE IN: (I) MEDICAL DEVICES OR THE MEDICAL FIELD; OR (II) USE IN RUGGED APPLICATIONS.

ATTO IS NOT LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, IRRESPECTIVE OF WHETHER ATTO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NO ATTO DEALER, AGENT OR EMPLOYEE IS AUTHORIZED TO MAKE ANY MODIFICATION, EXTENSION OR ADDITION TO THIS WARRANTY.

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