



**ATTO ThunderStream
Thunderbolt™ to SAS/SATA RAID
Troubleshooting Guide**

OVERVIEW

This document describes troubleshooting techniques that can be used to identify and resolve issues associated with the ATTO ThunderStream.

Before continuing with this guide, verify that the latest host adapter driver and flash bundle are installed for your operating system. If you are experiencing an interoperability or protocol issue, chances are that other users have already reported the same thing. ATTO releases driver and flash bundle updates numerous times a year and there is a good chance your issue has already been resolved. The latest drivers can be obtained from the “Driver Download” section of the ATTO web site.

Also verify that you are using the latest versions of third party applications and storage devices. In addition to the steps listed below, we highly recommend you explore the following additional technical resources:

- Read the information posted in the support section of the ATTO web site [www.attotech.com/support]. The known issues and workarounds are listed.
- The known issues section of the Product Release Notes document may also be helpful in identifying a potential issue. Product Release Notes can be obtained in the “Driver Download” section of the ATTO web site.
- The “Installation and Operations Manual” explains proper techniques and tips used for installation, operation, and configuration of the ThunderStream. The “Utilities Manual” explains how to configure and tune your ThunderStream for optimal performance in given configurations. It also explains how the ATTO “ConfigTool” management GUI can be used to monitor operation of the ThunderStream and the connections to your storage targets. Both of these manuals can be found in the support section of the ATTO web site.

ATTO spends a great deal of time testing third party applications and products. This testing ensures that each supported configuration performs as indicated and operates successfully. Interoperability matrices are available in the support section of the ATTO web site. While these are not all inclusive, the listed products are a good baseline for assuring that they have been tested and should work in your system. Storage and system providers’ web sites are the best sources for detailed configuration information including hardware and firmware/drivers/software for each component supported.

The ATTO ConfigTool is a great utility that can be used to monitor the connections between your ThunderStream and your storage. It will list and provide details on each connected device the host adapter sees. It will also allow you to configure the ThunderStream for specific modes of operation. However, changing these settings can have adverse effects. ATTO recommends you leave the settings at their default values unless instructed to change them by an ATTO Technical Support representative or you have advanced knowledge of the Thunderbolt™ or SAS protocols.

TROUBLESHOOTING TECHNIQUES

There are a few categories that failures can be placed in:

- **Hardware:** A component completely or intermittently fails.
- **Interoperability:** One or more devices in the system interpret the protocol specification different than the others resulting in undesirable behavior.
- **Design:** There is an error in the implementation of the software or firmware that prevents or limits functionality.
- **User Error:** The system is unable to achieve expected behavior due to improper installation or configuration or the desired behavior is simply not achievable due to unrealistic expectations.

Troubleshooting steps need to be taken to isolate hardware failures and user errors, which can easily be remedied by replacing a piece of hardware or changing something, from interoperability or design errors which could require code changes and take considerable time to resolve.

Some of the problems common with most installations include:

- 1) My operating system hangs, does not boot, crashes, or does not see the ATTO ThunderStream.
- 2) My ATTO ThunderStream cannot detect the SAS/SATA drives.
- 3) My operating system does not see the RAID group(s).
- 4) My RAID group is degraded.
- 5) My ATTO ThunderStream is not working with my LTO tape drive/library.

Unfortunately, these common problems can be caused by myriad of common installation mistakes/problems or combination of several problems.

Some of the following techniques may seem simplistic or overly obvious, but these are the ones that are commonly overlooked and can take several hours of frustration to locate. It is important to try only one technique at a time. While changing multiple variables may seem to be a time saver, it usually complicates the troubleshooting process. The goal is to observe the issue and systematically isolate it to identify the least common factors that cause it to occur. If the problem goes away, there is no sure way of knowing what actually resolved it. If the problem does re-occur, you may have actually fixed it with one change, but another change may have caused a similar symptom.

OBSERVATIONS

Take a step back and think about what is being observed. Ask the following questions:

- Has the configuration been working and all of a sudden now fails? If you can absolutely assure that nothing has changed, the issue is most likely due to a hardware failure. However, there are some very subtle changes that could have been made (maybe by a colleague) that could affect overall system behavior. What has changed? Has the switch or storage firmware been upgraded? Has something been

added or taken away? Even something as seemingly innocuous as an upgrade to disk drive firmware in a RAID storage system can have unexpected effects.

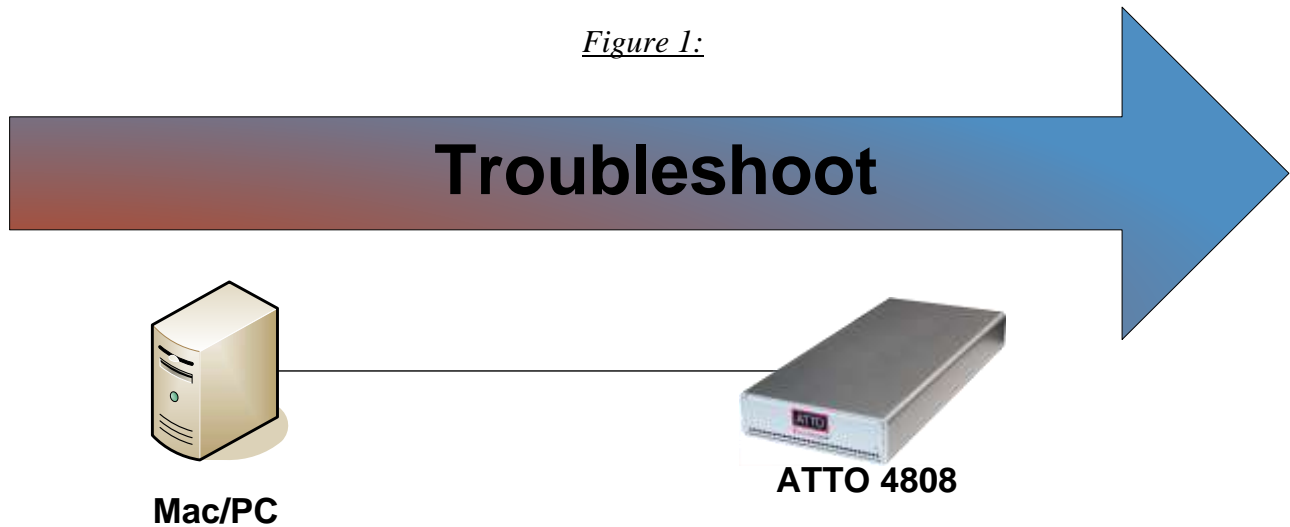
- What is the observed behavior compared to the expected behavior? When reporting an issue to ATTO, try to observe and report the overall “high level” problem as well as the details. For example, an overall problem may be that drives disappear during heavy I/O. The details would include if the ThunderStream reported or logged an error when this occurred. Providing enough detail is important towards achieving a quick resolution.
- Is the problem repeatable? If yes, can it be repeated on a non-production test system? Collecting information such as system error logs is often needed. Since production systems are not generally set up to collect this information in normal operation, it is important to be able to configure the system to collect data and recreate the problem on a non-production test system.
- What do the status LEDs indicate? Check the ThunderStream LEDs to determine the status. Refer to the appropriate product manuals to gain an understanding of what the LEDs indicate, but they are usually a good source of information towards identifying root cause.

PROBLEM ISOLATION

Once the problem is observed, attempt to determine where the problem originates. Begin by eliminating problem sources at a high level. Is it the computer or the storage? If the storage can be eliminated, only the computer and its components need to be examined.

Problem #1: My operating system hangs, does not boot, crashes, or does not see the ATTO ThunderStream.

Figure 1:



With this problem, you will want to troubleshoot with Mac/PC first. Troubleshooting should start with:

Mac/PC:

- 1) Try reseating the Thunderbolt™ cable to the Mac/PC. The ThunderStream can take up to 30 seconds to become ready. On some earlier iMacs with Thunderbolt™ connections, you can accidentally plug the cable in upside down. Verify that you plug the cable in correctly.
- 2) Try plugging the Thunderbolt™ cable into another Thunderbolt™ port on Mac/PC if available.
- 3) Try using a different Thunderbolt™ cable.
- 4) Verify that your Mac/PC has the latest system updates (BIOS, EFI, Firmware & OS).
- 5) Remove any other Thunderbolt™ devices from the system and see if the ThunderStream is found.
 - a. If this works, you could have a bad cable.
 - b. Alternatively, if the ThunderStream was not the first in the chain, the device ahead of it may be the cause of the issue.
- 6) Make sure you have the latest driver for the ThunderStream installed.

ATTO ThunderStream:

- 1) Try reseating the Thunderbolt™ cable to the ThunderStream. The ThunderStream can take up to 30 seconds to become ready.
- 2) Try plugging the Thunderbolt™ cable into the other Thunderbolt™ port on the ThunderStream.
- 3) Try using a different Thunderbolt™ cable.
- 4) Verify that the ThunderStream power supply is plugged into the unit properly.
- 5) Try disconnecting all SAS devices from the ThunderStream and see if the ThunderStream will boot.
 - a. If the Mac /PC now sees the ATTO ThunderStream or no longer freezes, try replacing the SAS cables.
 - i. Cable length limits for a direct connection between a ThunderStream and a SATA drive is limited to 1 meter. Connection to a SAS expander or a SAS drive is limited to 6 meters. Longer cable lengths will cause problems. Any internal cabling must be

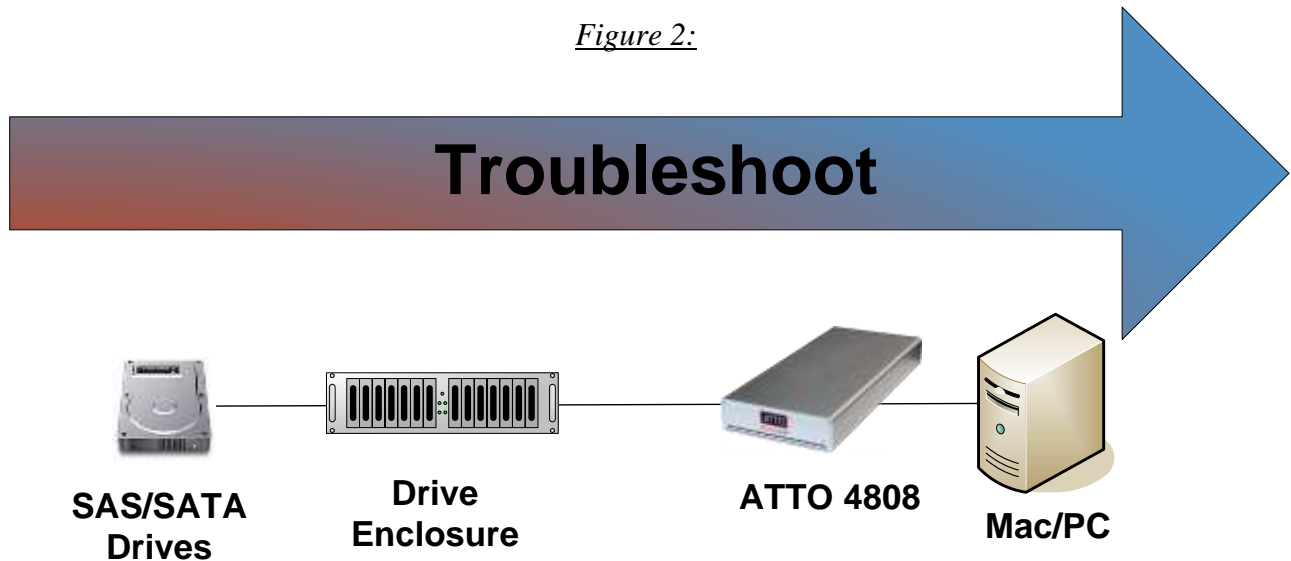
included when considering total cable length. If possible try to shorten cabling as much as possible. There may be SAS/SATA cabling internal to the SAS/SATA device as well that would need to be checked.

- b. If the Mac /PC now see the ATTO ThunderStream or no longer freezes, verify that the ThunderStream is using the latest firmware.
- 6) Windows users only: Some older ATTO ThunderStream may lack a certain bit set that tells the Windows host that the device is certified for Windows. Some PC manufacturers choose to ignore this bit and some do not. Check with your PC manufacturer for a possible work-around for this problem.

If you are still experiencing problems, see Appendix A to collect diagnostic logs and then contact ATTO Tech Support.

Problem #2: My ATTO ThunderStream cannot find the SAS/SATA drives.

When troubleshooting this kind of problem, the best approach is to troubleshoot the inside-out method. See Figure 2.



Begin with the device(s) connected to the ThunderStream first and work your way out to the host.

Hint: Take notice as to which drive or drives are not detected.

- Is it one drive?
- Is it a few drives, but they all seem to be associated with a specific cable, ThunderStream port, or part of the drive enclosure?

SAS/SATA Drives:

- 1) **Check the SAS/SATA device power:** Verify the devices are powering up.
- 2) **Drive Lights:** Watch the drive lights before, during, and after startup. Many drives have term power lights that should be on before startup and turn off when system boots.
- 3) **Reseat the drive:** Verify that the drive is properly seated in the drive slot.
- 4) **Drive connector:** Verify that the drive connector is not damaged.
- 5) **Manufacturer troubleshooting.** Check with the manufacturer of the SAS/SATA drive for further troubleshooting methods.

If the SAS/SATA drives appear to be working order, move on to the Drive Enclosure.

Drive Enclosure:

- 1) **Check cable integrity:** Cables are the number one cause of problem in any SAS/SATA system. Cables that work on one SAS/SATA system does not necessarily mean they will work on all SAS/SATA systems. There are many low cost, but low quality cables that will not work well with the high speed signaling of the ATTO ThunderStream. Check the cables for solid connections. Try swapping the

cables with known good ones. Verify the length of the cable is appropriate for the signal type and speed. Cables that are too long may result in intermittent drive issues.

- 2) **Power:** Make sure that the enclosure has the necessary power cabling and connections. Also a cause for drives not appearing can be insufficient or dirty power conditions. If the enclosure is connected to a UPS, try connecting it directly to the outlets instead. Also if the enclosure is sharing the circuit with many other devices, try placing the enclosure on its own circuit.
- 3) **Drive connectors:** Verify the drive connectors in the enclosure are not damaged.
- 4) **External SAS Connectors:** Make sure the SAS connectors on the enclosure are in good condition. Also many enclosures will designate certain SAS ports as host ports and others as expansion ports. Make sure the ATTO ThunderStream is plugged into the port designated as a host connection.
- 5) **SAS Connector LEDs:** Many enclosures will have an LED on the SAS connection to indicate if the links are up or not. If the LED does not light up, this may indicate a bad SAS cable.
- 6) **Enclosure Services:** Many enclosures will report fan speed, enclosure temperature, power levels, etc using an SES processor. If the enclosure supports these functions, you can check on them in the ATTO *Config Tool* or using the *atraidcli* CLI program.

ATTO ThunderStream:

- 1) First see if the SAS ports are up and running. A down link may be a bad cable. There are two ways of determining if this is the issue:
 - a. In the RAID CLI tab of the ATTO *ConfigTool* (or *atraidcli* CLI program), type ‘SASPortList’. Look at the Link column.

```
sasportlist
10
; Connector PHY Link Speed SAS Address
;=====
```

Device	B	1	Up	6Gb	50010860005aa700
Device	B	2	Up	6Gb	50010860005aa700
Device	B	3	Up	6Gb	50010860005aa700
Device	B	4	Up	6Gb	50010860005aa700
Device	A	1	Down	6Gb	50010860005aa701
Device	A	2	Down	6Gb	50010860005aa701
Device	A	3	Down	6Gb	50010860005aa701
Device	A	4	Down	6Gb	50010860005aa701

- b. Use the command line tool, *atsasphy* to look at the Negotiated Rate. A down link will have a negotiated rate of unknown.

```
#####
Channel 1: ATTO ThunderStream
#####
```

PHY 0 Information

```
-----
PHY State:           Enabled
Port ID:             2
```

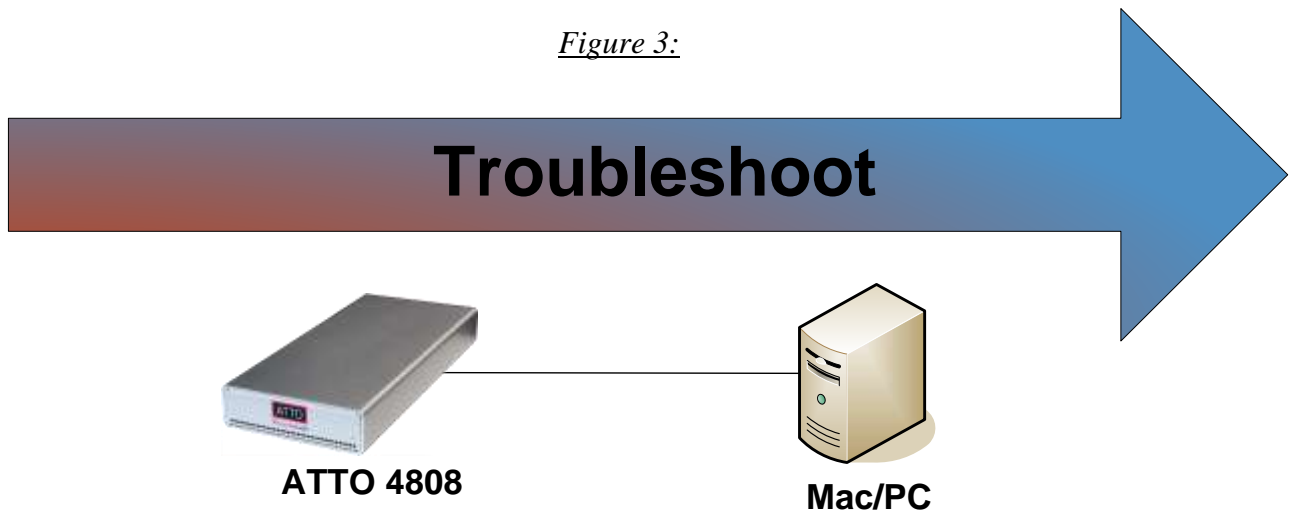

Negotiated Rate:	Unknown
Minimum Rate:	1.5 Gb/s
Maximum Rate:	6 Gb/s
Invalid Dword Count:	0
Disparity Error Count:	0
Loss Of Dword Sync Count:	0
PHY Reset Error Count:	0

- 2) **Try reseating the cables into the ATTO ThunderStream.**
- 3) **Perform a SAS/SATA bus scan:** Use either the RAID tab refresh option in the ATTO *ConfigTool* or type ‘**blockdevscan**’ in the RAID CLI tab.
 - a. If no devices appear re-check SAS/SATA cables.
 - b. If garbage info appears, the problem is most likely a bad SAS/SATA cable.
 - c. Cable length limits for a direct connection between a ThunderStream and a SATA drive is limited to 1 meter. Connection to a SAS expander or a SAS drive is limited to 6 meters. Longer cable lengths will cause problems. Any internal cabling must be included when considering total cable length. If possible try to shorten cabling as much as possible. There may be SAS/SATA cabling internal to the SAS/SATA device as well that would need to be checked.
 - d. If the SAS/SATA port hangs during scan, the problem is most likely SAS/SATA cabling.
 - e. If all devices appear, repeat the rescan several times and verify the devices can be still be seen. If devices disappear and/or disappear and comeback, the problem is most likely a SAS/SATA cable.
- 4) **Old SAS/SATA devices:** Some older SAS/SATA devices may improperly negotiate SAS/SATA speeds. Try changing the device’s operational speed via a jumper on the device. See device vendor manual for more details.
- 5) **Swap ATTO ThunderStream connector:** Try swapping the cables around and see if the problem moves to the new connection. If it does, then the problem is most likely a cable problem. If it does not, you could have a bad SAS connector on the ThunderStream.
- 6) **ThunderStream firmware:** Verify that you are using the latest firmware. When updating the firmware, be sure also to update to the latest OS driver. Refer to the ThunderStream manual for details on finding the firmware revision.
- 7) **RGWaittimeout:** This value designates how long the ThunderStream will wait before scanning for drives. If the drives are not ready when the scan occurs, they will not be detected. Some drives may need additional time to become ready. Also, if many drives are installed in an enclosure, more time may be needed. Use the RAID CLI tab within the ATTO *Config Tool* or use the *atraidcli* CLI program to increase this value. Type ‘**help rgwaittimeout**’ for proper syntax. However, increasing it beyond 60 seconds is not advisable.

If you are still experiencing problems, see Appendix A to collect diagnostic logs and then contact ATTO Tech Support.

Problem #3: My operating system does not see the RAID group(s).

Figure 3:



First, go through the procedure for Problem#2 because the number one reason for a RAID group not appearing in the operating system is because one or more drives are not detected.

ATTO ThunderStream:

- 1) First try re-mapping the RAID groups. Launch and log into the ATTO *Config Tool*. Go to the RAID tab. On the RAID Management menu, select **automap**.
 - a. You can also remap using the command line program via **atraidcli -x "automap"**
- 2) Check the RAID group status in the RAID tab of the ATTO *Config Tool*.
 - a. If the status reports OFFLINE and INITIALIZING, the RAID group is still initializing. You will need to wait until the initialization is complete before you can use the RAID group.
 - b. If the status is OFFLINE (and not INITIALIZING), the RAID group has failed. Please contact ATTO Tech Support.
- 3) Does the RAID group show up in the ATTO *Config Tool* device tree (device tree is the left pane)? If it does, then the operating system should see it.
- 4) Sometimes the members in the RAID group are not all ready by the time the RAID gives up scanning for drives. You can alter this behavior under the NVRAM settings of **Device Wait Timeout** and **Device Wait Count**. The Device Wait Timeout is how long the ThunderStream will wait while scanning for devices in a RAID group. The Device Wait Count is the minimum number of partitions, pass-through devices, and expanders to find. Once this minimum number is found, the Device Wait Timeout is prematurely ended.

Mac/PC

- 1) Make sure you have the latest OS updates installed on your system.
- 2) On some operating systems, you can force the operating systems to rescan for new devices. See your operating system documentation for instructions on how to rescan for new disks or hardware.

- 3) Some older operating systems (Windows XP) have drive size limitations. This limitation can be partially overcome by creating the RAID group using 4k sector size instead of the standard 512 bytes sector size. See documentation on how to create a RAID group using 4k sector size.

If you are still experiencing problems, see Appendix A to collect the diagnostic logs and then contact ATTO Tech Support.

Problem #4: My RAID group is degraded.

Occasionally a drive error may occur which will cause a RAID group to become DEGRADED. This section will cover identification and replacement of the bad disk. When a drive experiences an error requiring its replacement, an alert (audible or visual) is created on the Mac/PC or an email is sent to all the addresses set up for notification.

Note: The ATTO ThunderStream is unable to turn on fault lights on the individual drives in enclosures that do not support SES. In enclosures that do not support SES, the ThunderStream can blink the Activity LEDs of the working drives to determine the bad drives.

To identify a faulted drive:

- Open the ATTO **Config Tool**.
- Click on the RAID tab.
- The RAID Group status will be displayed in the bottom pane.
- Double click the RAID group in the bottom pane. This will open a RAID Group tab in the bottom pane.
- A RAID group can go degraded in three ways:
 1. A Faulted drive: If the drive has a status of Faulted, that means an unrecoverable media error has occurred. If the enclosure supports SES or SGPIO, the **Config Tool** will automatically light up the FAULT LED on the bad drive.
 2. A Degraded drive: If the drive failed to respond to a write command, or went away and came back during a write, the drive will be marked as Degraded since it does not have up-to-date data on it. If the enclosure supports SES or SGPIO, the **Config Tool** can locate the drive. Click on the degraded drive. Then under RAID Management, select locate.
 3. Unavailable drive: This drive can no longer be found or is completely unresponsive. If the enclosure supports SES or SGPIO, the **Config Tool** can locate the drive. Click on the unavailable drive. Then under RAID Management, select locate.
- If the enclosure does not support SES or SGPIO, identify the bad drive by doing the following:
 - If the RAID is already rebuilding, wait until it completes. RAID Group status will appear in the bottom pane on the RAID tab.
 - Once completed or if you did not start the rebuild, stop all IO to the RAID group.
 - Select all of the good drives in the top window pane.
 - Go to the RAID Management menu item, select Locate -> Drives.
 - All of the good drives will blink the Activity LEDs. The bad drive should have no IO going to it.

Once you have identified and replaced the bad drive, you need to rebuild the RAID group if a hot spare was not specified.

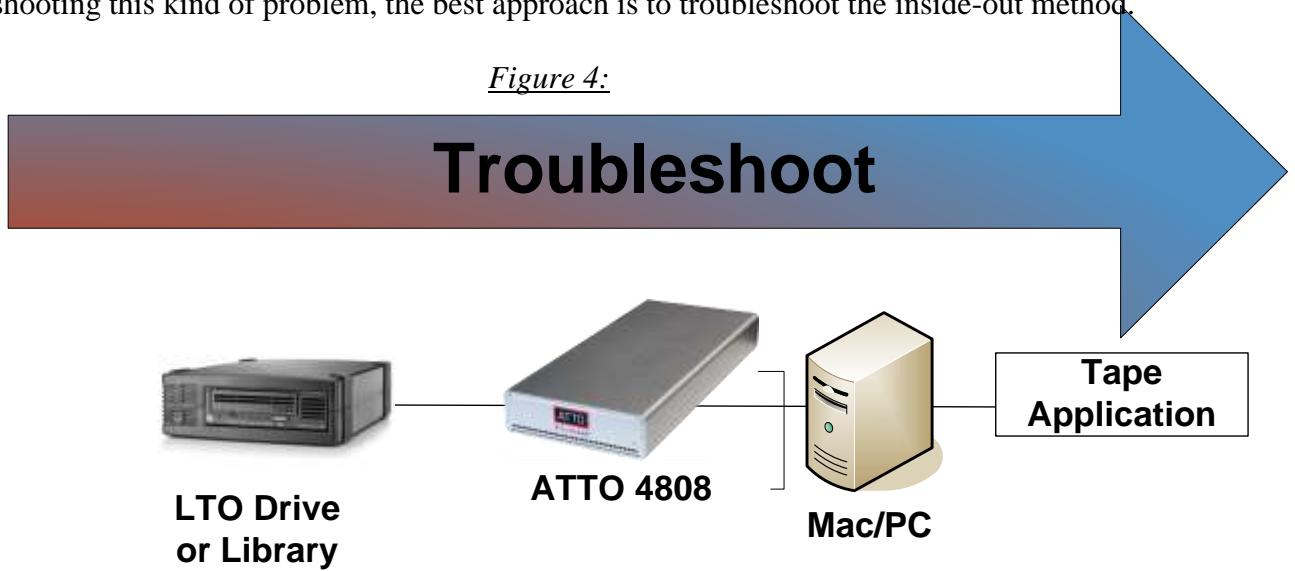
- Launch the ATTO **Config Tool** and go to the RAID tab.
- Click the RAID Group that is **Degraded**.
- Go to Raid Management and select **Rebuild**
- The **Config Tool** will automatically open a tab for the Group.

- The user will be prompted to drag a free drive on top of the member being replaced.
- The *Config Tool* will bring up a pop-up window verifying the action.

Problem #5: My ATTO ThunderStream is not working with my LTO tape drive/library.

When troubleshooting this kind of problem, the best approach is to troubleshoot the inside-out method.

Figure 4:



LTO Drive or Library:

- 1) **Check cable integrity:** Cables are the number one cause of problem in any SAS/SATA system. Cables that work on one SAS/SATA system does not necessarily mean they will work on all SAS/SATA systems. There are many low cost, but low quality cables that will not work well with the high speed signaling of the ATTO ThunderStream. Check the cables for solid connections. Try swapping the cables
- 2) **External SAS Connectors:** Make sure the SAS connectors on the enclosure are in good condition.
- 3) Verify that you are using the latest firmware and driver for your tape device.
- 4) If the tape drive is part of the tape library, try reseating the tape drive (if possible).
- 5) If available, run self-diagnostic on the tape drive or library and verify that it is in working order.
- 6) Check the tape drive vendor’s website for further troubleshooting steps.

ATTO ThunderStream:

- 1) First see if the SAS ports are up and running. A down link may be a bad cable. There are two ways of determining if this is the issue:
 - a. In the RAID CLI tab of the ATTO *ConfigTool* (or *atraidcli* CLI program), type ‘SASPortList’. Look at the Link column.

```
sasportlist
10
; Connector PHY Link Speed SAS Address
;=====
Device B 1 Up 6Gb 50010860005aa700
Device B 2 Up 6Gb 50010860005aa700
Device B 3 Up 6Gb 50010860005aa700
Device B 4 Up 6Gb 50010860005aa700
Device A 1 Down 6Gb 50010860005aa701
```

```

Device    A    2    Down  6Gb  50010860005aa701
Device    A    3    Down  6Gb  50010860005aa701
Device    A    4    Down  6Gb  50010860005aa701

```

- b. Use the command line tool, **atsasphy**. Look at the Negotiated Rate. A down link will have a negotiated rate of unknown.

```

#####
Channel 1: ATTO ThunderStream
#####

```

PHY 0 Information

```

-----
PHY State:           Enabled
Port ID:             2
Negotiated Rate:     Unknown
Minimum Rate:        1.5 Gb/s
Maximum Rate:        6 Gb/s
Invalid Dword Count: 0
Disparity Error Count: 0
Loss Of Dword Sync Count: 0
PHY Reset Error Count: 0

```

- 2) Trying reseating cables into the ATTO ThunderStream.
- 3) Cable Length limits. Direct connection to a SAS drive limits the cable length to 6 meters. Longer cable lengths will cause problems.
- 4) Try using the other ATTO ThunderStream connector: Try swapping the cables around and see if the problem moves to the new connection. If it does, then the problem is most likely a cable problem. If it does not, you could have a bad SAS connector on the ThunderStream.
- 5) ThunderStream firmware: Verify that you are using the latest firmware. When updating the firmware, be sure also to update to the latest OS driver. Refer to ThunderStream manual for details on finding the firmware revision.

Mac/PC:

- 1) Try reseating the Thunderbolt™ cable to the Mac/PC. The ThunderStream can take up to 30 seconds to become ready. On some earlier iMacs with Thunderbolt™ connections, you can accidentally plug the cable upside down. Verify that you plug the cable in correctly.
- 2) Try plugging the Thunderbolt™ cable into another Thunderbolt™ port on Mac/PC if available.
- 3) Try using a different Thunderbolt™ cable.
- 4) Verify that your Mac/PC has the latest system updates (BIOS, EFI, Firmware & OS).
- 5) Remove any other Thunderbolt™ devices from the system and see if the ThunderStream is found.
 - a. If this works, you could have a bad cable.
 - b. Alternatively, if the ThunderStream was not the first in the chain, the device ahead of it may be the cause of the issue.
- 6) Make sure you have the latest driver for the ThunderStream installed.

Tape Application:

- 1) Verify that you are using the latest tape drivers for the software that you are using.
 - a. Window users: Many tape applications require you to use the application's tape drivers and not the built-in or native Windows drivers. Please confer with your application documentation for further details.
 - b. OS X users: OS X does not have native tape drivers and thus you need some kind of tape application in order to use your tape devices.
- 2) Verify that you are using the latest application software/updates
 - a. LTFS users: Do not mix different vendors' LTFS solution as it may cause interoperability issues.
 - b. LTFS also requires various drivers and application software pieces. Confer with your vendor and verify that you are using the recommended revisions.

If you are still experiencing problems, see Appendix A to collect the diagnostic logs and then contact ATTO Tech Support.

Appendix A Contacting Support:

When you run into a situation where you cannot resolve an issue, please collect as much as possible of the following information before contacting ATTO Tech Support.

Note: It is recommended that *Event Logging* only be active for troubleshooting purposes as performance will be affected. When in this mode of operation, all flags should be enabled.

For Windows users:

To enable the advanced *Event Logging* feature of the ATTO ExpressSAS ThunderStream in a Windows environment, please do the following:

- a) Click “Start” and “Run”.
- b) Type “regedit” to start the registry editor.
- c) Follow the tree structure to :
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\tssas2r\Parameters\Device
- d) Change the parameter **EventLogMask** to FFFFF7FF
- e) Reboot the PC and reproduce the issue.

Windows and OS X Users:

After the issue occurs:

- 1) Launch the *ATTO Config Tool*.
- 2) Log into the *ATTO Config Tool* using an account administrative rights
- 3) Click on the Help menu item and select **Run Diagnostics**.
 - a. If you are running a headless server, please contact ATTO Tech Support for a command line data collection script.
- 4) Try noting the local time that the problem occurred.
- 5) Have this file ready for Support.

If troubleshooting a problem where Mac/PC is freezing, crashing, or the ThunderStream is not seen, try and get the system back to a known good state. This may require you removing the ATTO ThunderStream. Once back to a known good state, run steps 1 to 5 above to collect the logs.

CONTACT INFORMATION

You may receive customer service, sales information, and technical support by phone or by email and web site contact form.

ATTO Technology, Inc.
155 CrossPoint Parkway
Amherst, New York 14068
Phone: (716) 691-1999
Fax: (716) 691-9353
www.attotech.com

Sales Support: sls@attotech.com
Technical Support: techsupp@attotech.com