



ATTO Technology, Inc.

**ATTO ThunderLink
Thunderbolt™ to SAS/SATA
Troubleshooting Guide**

OVERVIEW

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

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 ThunderLink. The “Utilities Manual” explains how to configure and tune your ThunderLink for optimal performance in given configurations. It also explains how the ATTO “ConfigTool” management GUI can be used to monitor operation of the ThunderLink 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 ThunderLink 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 ThunderLink 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 ThunderLink.
- 2) My ATTO ThunderLink cannot find the SAS/SATA drives.
- 3) My ATTO ThunderLink 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.

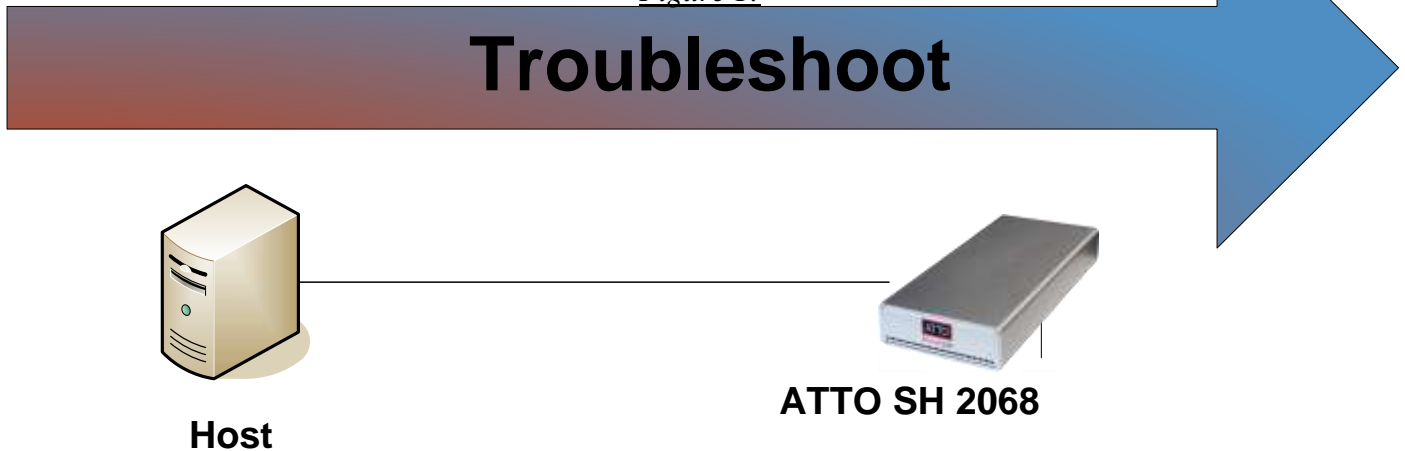
- What is the observed behavior compared to the expected behavior? When reporting an issue to ATTO, try to observe and report the overall “high level” problem as well as the details. For example, an overall problem may be that drives disappear during heavy I/O. The details would include if the ThunderLink 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 ThunderLink 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 server or the storage? If the storage can be eliminated, only the server and its components need to be examined.

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

Figure 1:



With this problem, you will want to troubleshoot with host computer first. Troubleshooting should start with:

Host:

- 1) Try reseating the Thunderbolt™ cable to the host. The ThunderLink 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 host if available.
- 3) Try using a different Thunderbolt™ cable.
- 4) Verify that your host has the latest system updates (BIOS, EFI, firmware & OS).
- 5) Remove any other Thunderbolt™ devices from the system and see if the ThunderLink is found.
 - a. If this works, you could have a bad cable.
 - b. Alternatively, if the ThunderLink 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 ThunderLink installed.

ATTO ThunderLink:

- 1) Try reseating the Thunderbolt™ cable to the ThunderLink. The ThunderLink can take up to 30 seconds to become ready.
- 2) Try plugging the Thunderbolt™ cable into the other Thunderbolt™ port on the ThunderLink.
- 3) Try using a different Thunderbolt™ cable.
- 4) Verify that the ThunderLink power supply is plugged into the unit properly. Verify the power LED is illuminated.
- 5) Try disconnecting all SAS/SATA devices from the ThunderLink and see if it will boot.
 - a. If the host now see the ATTO ThunderLink or no longer freezes, try replacing the SAS cables.
 - i. Cable length limits for a direct connection between a ThunderLink 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.

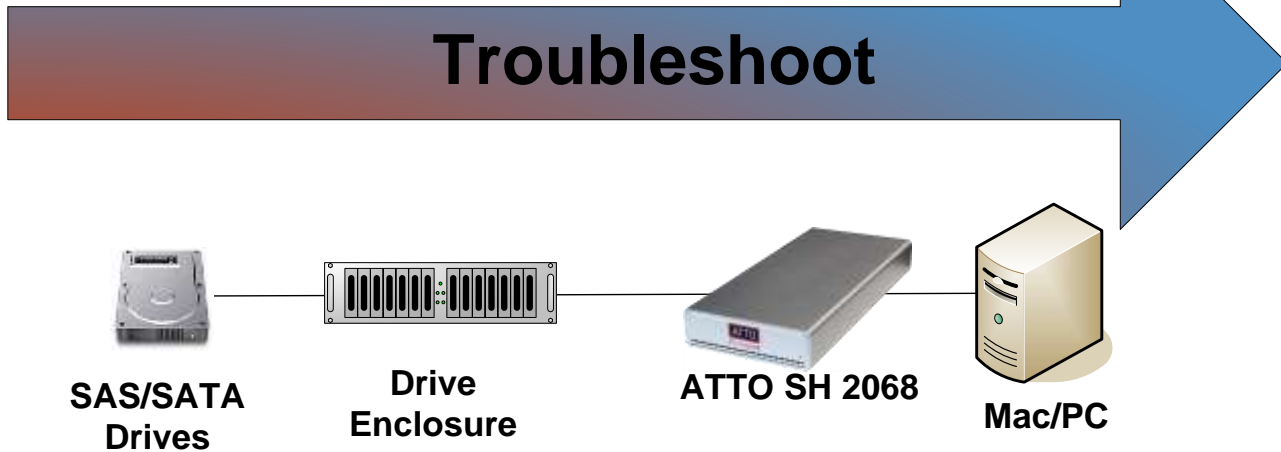
- b. If the host still does not see the ATTO ThunderLink or freezes, verify that the ThunderLink is using the latest firmware and driver.
- 6) Windows users only: Some older ATTO ThunderLink may lack a certain bit set that tells the Windows host that the device is certified for Windows. Some PC manufacturers 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 ThunderLink cannot find the SAS/SATA drives.

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

Figure 2:



You begin with the device(s) connected to the ThunderLink 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, ThunderLink 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 manufacturer of SAS/SATA device(s) for further troubleshooting methods.

If 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 device may not work with all SAS/SATA devices. There are many low cost, but low quality cables that will not work well with the high speed signaling of the ATTO ThunderLink. 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 ThunderLink 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 ThunderLink:

- 1) First see if the SAS ports are up and running. A down link may be the result of a bad cable. 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 ThunderLink  
#####  
  
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 cables into the ATTO ThunderLink.** Cable length limits for a direct connection between a ThunderLink 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.
- 3) **Old SAS/SATA devices:** Some old 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.
- 4) **Swap ATTO ThunderLink 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 ThunderLink.

- 5) **ThunderLink 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 ThunderLink manual for details on finding the firmware revision.
- 6) Sometimes not all of the SAS/SATA devices have become ready by the time the ThunderLink scans 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. You can modify how targets are scanned using the **Device Wait Timeout** and **Device Wait Count** within the NVRAM. The **Device Wait Timeout** is how long the ThunderLink will wait while scanning for devices. The **Device Wait Count** is the minimum number of devices to be found. Once this minimum number is found, the Device Wait Timeout is prematurely ended.

Mac/PC:

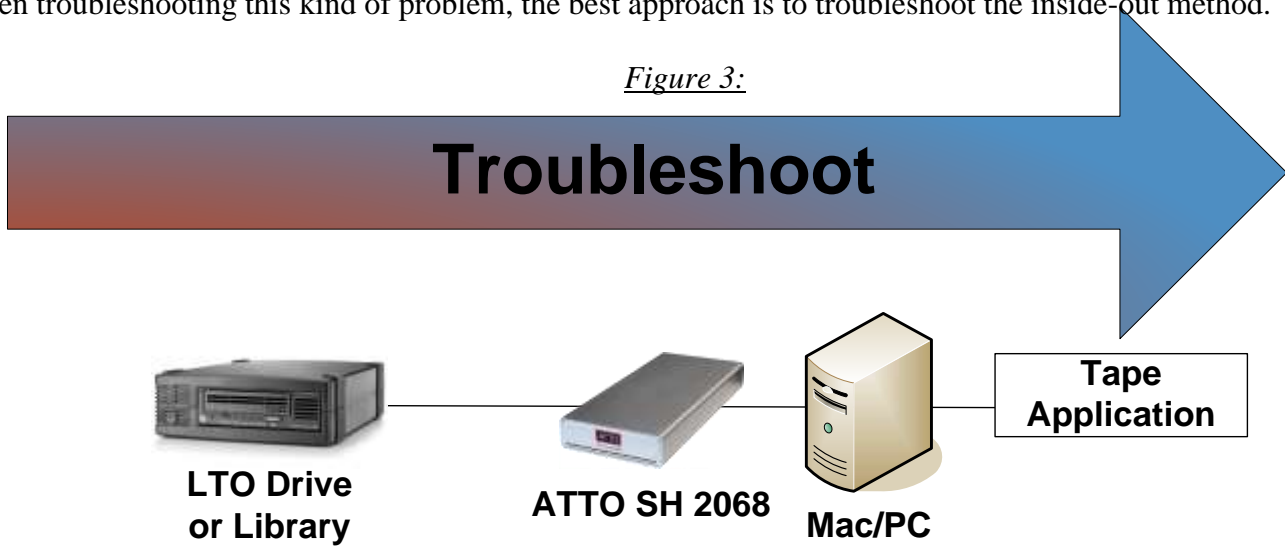
- 1) Try reseating the Thunderbolt™ cable to the Mac/PC. The ThunderLink can take up to 30 seconds to become ready. On some earlier iMacs with Thunderbolt™ connections, you can accidentally plug the cable upside down. Verify that you plug the cable in correctly.
- 2) Try plugging the Thunderbolt™ cable 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 ThunderLink device is found.
 - a. If this works, you could have a bad cable.
 - b. Alternatively, if the ThunderLink device 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 ThunderLink installed.

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

Problem #3: My ATTO ThunderLink 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 3:



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 ThunderLink. 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 ThunderLink:

- 1) First see if the SAS ports are up and running. A down link may be a bad cable.
 - a. Use the command line tool, *atsasphy*. Look at the Negotiated Rate. A down link will have a negotiated rate of unknown.

```
#####  
Channel 1: ATTO ThunderLink  
#####
```

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 ThunderLink.
- 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 ThunderLink 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 ThunderLink.
- 5) ThunderLink 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 ThunderLink manual for details on finding the firmware revision.

Mac/PC:

- 1) Try reseating the Thunderbolt™ cable to the Mac/PC. The ThunderLink 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 ThunderLink is found.
 - a. If this works, you could have a bad cable.
 - b. Alternatively, if the ThunderLink 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 ThunderLink 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 ThunderLink 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\tlsash\Parameters\Device
- d) Change the parameter **EventLogMask** to FFFFF7FF
- e) Reboot the PC and reproduce the issue.

Windows, OS X, and Linux 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 ThunderLink is not seen, try and get the system back to a known good state. This may require you removing the ATTO ThunderLink. 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.

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