



ATTO Technology, Inc.

ATTO ExpressSAS
SAS/SATA Host Adapter
Troubleshooting Guide

OVERVIEW

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

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 host adapters. The “Utilities Manual” explains how to configure and tune your host adapter for optimal performance in given configurations. It also explains how the ATTO “ConfigTool” management GUI can be used to monitor operation of the host adapter 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 host adapter 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 host adapter 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 SAS protocol.

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 SAS/SATA installations include:

- 1) My operating system hangs, does not boot, crashes, or does not see the ATTO ExpressSAS SAS HBA.
- 2) BIOS/EFI issues
- 3) My ATTO ExpressSAS SAS HBA cannot find the SAS/SATA drives.
- 4) My ATTO ExpressSAS SAS HBA is not working with my LTOx 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 host adapter 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 adapter 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.

Record your observations. When an error is encountered, please insure you have an answer to each of the following questions when reporting it as an issue to ATTO Technical Support. This will expedite the ability to find a resolution tremendously.

QUESTION	ANSWER
1. Computer Model:	
2. Operating System and Kernel Version:	
3. PCI slot # and type:	
4. ATTO Driver version:	
5. ATTO Flash Bundle version:	
6. ATTO Configuration Tool version:	
7. Include the manufacturer, model number and firmware level for the switch:	
8. List the application(s) and version(s) that were running when the failure occurred.	
9. Did it ever work? Is this a new error that just started happening, or is this an error that has been existed since the first use?	
10. Does the error occur when you try it with a second host adapter (if possible)? For example, swap out one host adapter for another and see if error still occurs.	
11. Does the error occur when you try it with a different SFP (if possible)? For example, swap out one SFP for another and see if error still occurs.	

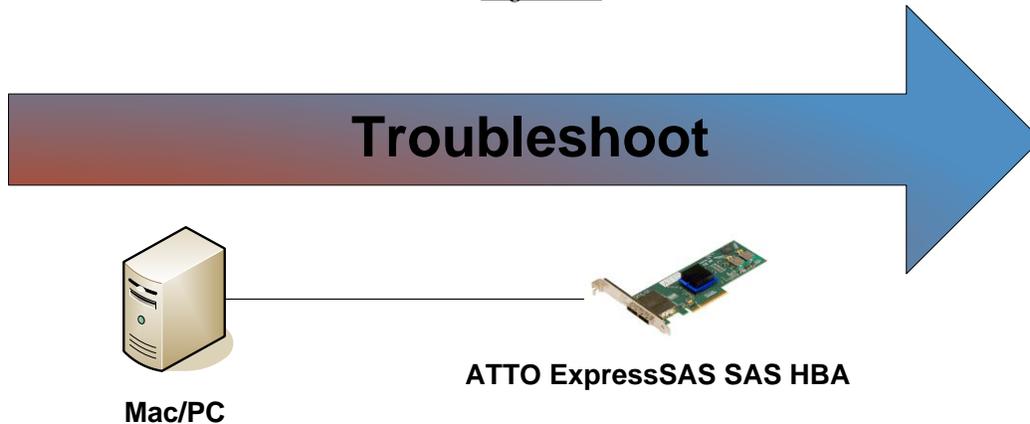
12. Is the adapter in default mode? Are there settings that have been adjusted that may be causing the problem? Do settings need to be adjusted to allow the device to function properly?	
13. Can the error be reproduced easily? How often does it fail? Does the error occur sporadically/randomly, or can it be reproduced every time?	

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 SAS HBA.

Figure 1:



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

Host:

- 1) Try reseating the ExpressSAS SAS HBA in the PCIe slot
- 2) Try plugging the ExpressSAS SAS HBA into another PCIe slot if available.
- 3) Verify that your host computer has the latest system updates (BIOS, EFI, firmware, OS, etc).
- 4) Remove any other non-vital PCIe controller cards from the system and see if the HBA is detected.

ATTO ExpressSAS SAS HBA:

- 1) Verify that the Host Adapter has the latest firmware installed.
 - a. If you cannot check this through normal means like the *ATTO Config Tool* or *CLI tools*, contact ATTO Tech Support for a bootable ISO to flash the adapter.
- 2) Try setting the Boot NVRAM option to disabled.
 - a. If you cannot change this through normal means like the *ATTO Config Tool* or *CLI tools*, contact ATTO Tech Support for a bootable ISO that will remove the boot option from the flash.
- 3) Try disconnecting all SAS/SATA devices from the HBA and see the system boots.
 - a. If the host now sees the ATTO ExpressSAS SAS HBA or no longer freezes, try replacing the SAS cables.
 - b. Cable length limits for a direct connection between a RAID Adapter 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.
- 4) If the system is hanging during the BIOS or EFI post, or if the hang is when accessing the BIOS/EFI setup utility, please refer to Problem #2 – BIOS/EFI troubleshooting.

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

Problem #2: Troubleshooting BIOS/EFI issues:

This section describes troubleshooting techniques that can be used to identify and resolve BIOS/EFI issues associated with the ATTO ExpressSAS SAS HBA. Some of these techniques may seem simplistic or overly obvious, but these are the ones that are commonly overlooked and can take several hours of frustration to find. It is important to only try one technique at a time. While changing multiple variables may seem to be a time saver, it usually complicates the troubleshooting process.

1) The computer will not boot past its Power-On Self Test when the controller is installed.

- The controller may be improperly seated. Power down the computer and reseat the controller.
- Try putting the controller in a different PCIe slot.
- Disconnect any SAS/SATA devices from the controller and reboot the computer. If this resolves the issue, investigate the SAS/SATA cables or SAS/SATA target devices as described in section 3 below.
- If the computer still does not boot, try installing the controller in a different computer. If the controller works in the new computer, report this as a possible interoperability issue between the controller and the computer. If the problem follows the controller, replace it with a new adapter.
- Verify that the latest version of the computer BIOS is installed. *Use caution when updating the computer's BIOS. A mistake could leave the system in an unusable state.*

2) The ExpressSAS RAID R6xx controller does not appear during the system BIOS scan.

Note: The ATTO Technology banner should appear shortly after booting the computer.

```
*****  
*           ATTO ExpressSAS™ Version 3.30           *  
*           Copyright © 2007 ATTO Technology, Inc.   *  
*****
```

```
*** Press [Ctrl] [Z] for Setup Utility ***  
Channel 1 ExpressSAS H680 FW Version 3.30
```

- The controller may be improperly seated. Power down the computer and reseat the controller.
- Try putting the controller in a different PCI slot.
- Verify that the latest version of the computer BIOS is installed. Use caution when updating the computer's BIOS. A mistake could leave the system in an unusable state.
- Remove any non-vital PCI controllers from the system to determine if there is a PCI bus conflict.
- Disconnect any SAS/SATA devices from the controller and reboot the computer. If this resolves the issue, investigate the SAS/SATA cable or SAS/SATA target devices as described in the section below.
- If the computer still does not boot, try installing the controller in a different computer. If the controller works in the new computer, try updating the flash on the controller as described in the "Installation and Operations" manual. Then try it again in the original computer.

- If it still fails, report this as a possible interoperability issue between the controller and the computer.
 - If the problem follows the controller, replace it with a new adapter.
- 3) **The computer freezes when the ATTO Banner is displayed during the system BIOS scan or when BIOS/EFI Config Utility is launched.**
- Disconnect all devices from the SAS controller and reboot the system.

If the system still freezes:

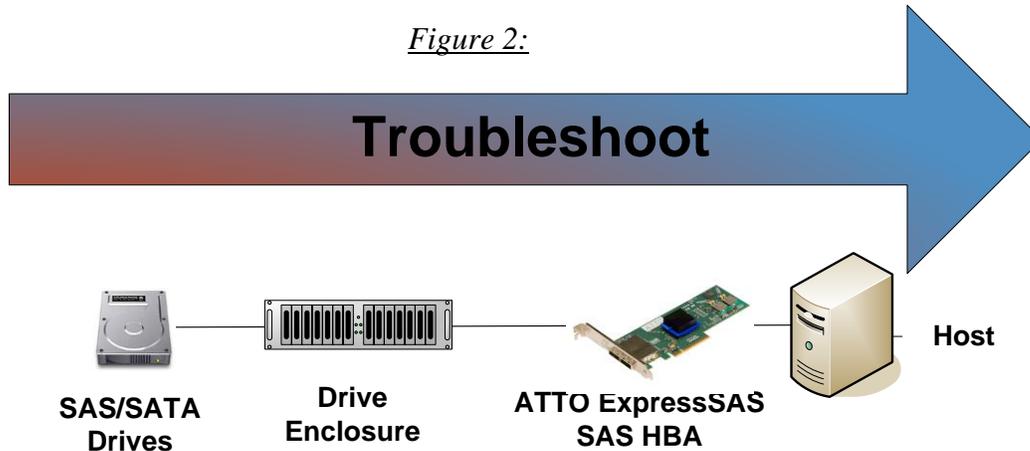
- Remove any non-vital PCI controllers from the system to determine if there is a PCI bus conflict.
- Remove the SAS HBA and test it in a different computer (not the same model). If the controller works properly, enter the ATTO ExpressSAS Utility during the system BIOS scan by hitting Control-Z when prompted. Enter the controller configuration menu and disable the BIOS. There may be a BIOS conflict between the ATTO controller and the original computer. Place the controller back into the original machine and reboot.
 - If this resolves the issue, report this as a BIOS conflict. Note that you can continue to operate. Disabling the BIOS will only prevent the computer from booting from an external drive connected to the controller.
 - If the computer still hangs, replace the controller with a new one.

If the system no longer freezes after disconnecting the SAS/SATA devices:

- Check the SAS/SATA devices. Check for fault lights on the drives.
- Check cable integrity. Check the cables for solid connections. Make sure they are snapped in. Inspect cable ends for bent pins.
- Try attaching SAS/SATA devices one at a time with different cables, adding drives and cables until the problem occurs. This will help pinpoint the device or cable causing the problem.
- Watch the LED indicators on the SAS/SATA devices before, during, and after startup. Drive lights should also flash at startup as the SAS/SATA bus is scanned. This may give a clue as to the root cause of the issue.

Problem #3: My ATTO ExpressSAS SAS HBA cannot detect 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 ExpressSAS SAS HBA and work your way out:
SAS/SATA Drives - Drive Enclosure - ATTO ExpressSAS SAS HBA - 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, Host Adapter 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 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 Host Adapter. 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 ExpressSAS SAS HBA is plugged into ones designated as host.
- 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.

ATTO ExpressSAS SAS HBA:

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

```
#####  
Channel 1: ATTO ExpressSAS SAS HBA  
#####  
  
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 ExpressSAS SAS HBA.
- 3) **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 Host Adapter. 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.
- 4) **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.

- 5) **Swap ATTO ExpressSAS SAS HBA 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 ExpressSAS SAS HBA.
- 6) **ExpressSAS SAS HBA firmware:** Verify that you are using the latest firmware. When updating the firmware, be sure also to update to the latest OS driver. Refer ThunderStream manual for details on finding the firmware revision.
- 7) Sometimes SAS/SATA devices are not all spun up and ready by the time the ExpressSAS SAS HBA 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 ExpressSAS SAS HBA 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.

Host:

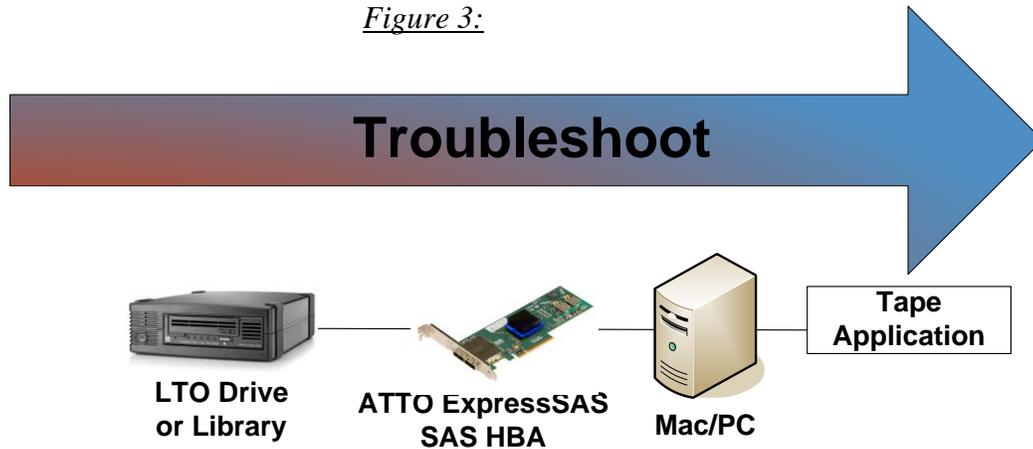
- 1) Try reseating the ExpressSAS SAS HBA in the PCIe slot
- 2) Try plugging the ExpressSAS SAS HBA into another PCIe slot if available.
- 3) Verify that your host has the latest system updates (BIOS, EFI, firmware, OS, etc).
- 4) Remove any other PCIe card from the system and see if the HBA is found.

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

Problem #4: My ATTO ExpressSAS SAS HBA 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, see Figure 3.

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. Check the cables for solid connections.
- 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 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 vendor’s website for further troubleshooting steps.

ATTO ExpressSAS SAS HBA:

- 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 ExpressSAS SAS HBA
#####

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 ExpressSAS SAS HBA.

- 3) **Cable Length limits:** 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. Swap ATTO ExpressSAS SAS HBA 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 ExpressSAS SAS HBA. Also be aware that there are many low cost, but low quality cables that will not work well with the high speed signaling of the ATTO adapter.
- 4) **ExpressSAS Flash Bundle:** Verify that you are using the latest firmware. When updating the firmware, be sure also to update to the latest OS driver. Refer to ExpressSAS SAS HBA manual for details on finding the firmware revision.

Computer:

- 1) Try reseating the ExpressSAS SAS HBA in the PCIe slot
- 2) Try plugging the ExpressSAS SAS HBA into another PCIe slot if available.
- 3) Verify that your computer has the latest system updates (BIOS, EFI, firmware, OS, etc).
- 4) Remove any other PCIe card from the system and see if the HBA is found.
 - a. If this works, you could have a bad PCIe slot.

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.

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* be active only 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 SAS HBA 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:
 - a. For ATTO ExpressSAS H12xx (ATTO 12 Gig SAS HBA Line)
 \HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\esas4hba\Parameters
 - b. For ATTO ExpressSAS H6F0-GT
 \HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\esas3hba\Parameters
 - c. For ATTO ExpressSAS H6xx PCIe 2.0 cards
 \HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\esas2hba\Parameters
- d) Change the parameter **EventLogMask** to FFFFFFFF
- e) Reboot the PC and reproduce the issue.

For Linux users:

To enable the advanced *Event Logging* features of the ATTO ExpressSAS SAS HBA in a Linux environment, please do the following:

- a) Open a terminal window
- b) Type ‘sudo rmmmod attocfg’
- c) The next step is based on the family of host adapter in the system.
 - a. For ATTO ExpressSAS H12xx (ATTO 12 Gig SAS HBA Line)
 - i. Type ‘sudo rmmmod esas4hba’
 - ii. Type ‘sudo modprobe esas4hba options event_log_mask=0xFFFFFFFF’
 - b. For ATTO ExpressSAS H6F0-GT
 - i. Type ‘sudo rmmmod esas3hba’
 - ii. Type ‘sudo modprobe esas3hba options event_log_mask=0xFFFFFFFF’
 - c. For ATTO ExpressSAS H6xx PCIe 2.0 cards
 - i. Type ‘sudo rmmmod esas2hba’
 - ii. Type ‘sudo modprobe esas2hba options event_log_mask=0xFFFFFFFF’

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 host is freezing, crashing, or the SAS HBA is not seen, try and get the system back to a known good state. This may require you removing the ATTO SAS HBA. 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 Monday through Friday, 8:00 am to 6:00 pm Eastern Standard Time, or by email and web site contact form.

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