

# **ATTO ThunderLink® Thunderbolt™ Adapter Installation and Operation Manual**

## **ATTO ThunderLink FC 3322**

40-Gigabit Thunderbolt 3 to 32-Gigabit Fibre Channel Adapter

## **ATTO ThunderLink FC 3162**

40-Gigabit Thunderbolt 3 to 16-Gigabit Fibre Channel Adapter

## **ATTO ThunderLink NQ 3402**

40-Gigabit Thunderbolt 3 to 40-Gigabit Ethernet Adapter

## **ATTO ThunderLink SH 3128**

40-Gigabit Thunderbolt 3 to 12-Gigabit SAS/SATA Adapter

## **ATTO ThunderLink FC 2162**

20-Gigabit Thunderbolt 2 to 16-Gigabit Fibre Channel Adapter

## **ATTO ThunderLink FC 2082**

20-Gigabit Thunderbolt 2 to 8-Gigabit Fibre Channel Adapter

## **ATTO ThunderLink NS 3252**

25-Gigabit Thunderbolt 3 to 25-Gigabit Ethernet Adapter

## **ATTO ThunderLink NS 3102**

40-Gigabit Thunderbolt 3 to 10-Gigabit Ethernet Adapter

## **ATTO ThunderLink N3 3102**

40-Gigabit Thunderbolt 3 to 10-Gigabit Ethernet Adapter

## **ATTO ThunderLink NS 2102**

20-Gigabit Thunderbolt 2 to 10-Gigabit Ethernet Adapter

## **ATTO ThunderLink NT 2102**

20-Gigabit Thunderbolt 2 to 10-Gigabit Ethernet Adapter



**The Power Behind the Storage**

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# Table of Contents

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<b>1 ThunderLink Adapter Installation</b>	<b>3</b>
Verifying packaging contents	3
Installing Drivers	3
macOS®	3
Windows®	3
VMware® (ESXi™ 5.5 and later)	4
Thunderbolt 3	4
<b>2 ATTO ConfigTool</b>	<b>5</b>
Pre-Installation	5
Installation	5
Instructions for FULL or APPLICATION ONLY installation	5
Instructions for SYSTEM SERVICE ONLY installation	5
Using the ATTO ConfigTool	6
Navigating the ConfigTool	7
Host Discovery	7
Login to a Host	7
Select a Host	7
Select an Adapter	7
Select a Channel	7
Select an Adapter	8
About panel	8
Driver update	8
System Reboot	8
ThunderLink FC NVRAM Settings	10
ThunderLink SH NVRAM Settings	12
<b>3 Updating Hardware Flash</b>	<b>13</b>
Updating Flash	13
<b>Standards and Compliances</b>	<b>1</b>
Regulatory Notices	1
FCC Notices (US only)	1
Compliance with ICES-003	1
Compliance with EN Regulations	1
<b>Warranty Information</b>	<b>3</b>
Manufacturer limited warranty	3

# 1 ThunderLink Adapter Installation

This manual gives you information for installing and configuring your ThunderLink Adapter.

## Verifying packaging contents

- Note the serial number of your ThunderLink unit:
- AC adapter and power cord
- Getting Started Guide



Note **ThunderLink Fibre Channel Adapters ship with short-wave SFPs. Gen 6 technology necessitates that all optics must be a fully certified ATTO -branded SFP**



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



Note **ATTO Thunderbolt Adapters now feature a small slot on the right side of the Adapter. This is to allow for additional security via Kensington lock.**

## Installing the ThunderLink Adapter



**CAUTION** **For Windows PC: the Thunderbolt certified Adapter driver must be installed before plugging in the Adapter 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 Adapter (Fibre Channel, SAS/SATA or Ethernet) cable.
- Compatible storage (Fibre Channel, SAS/SATA or Ethernet).
2. Ensure that power to the storage Adapter is off.
3. Connect the AC adapter to the ThunderLink and the power cord to a power point.
4. Connect the storage to the ThunderLink via the storage Adapter cables.
5. Connect your ThunderLink to your laptop or other computing Adapter via Thunderbolt cable.
6. Power on the storage.

## Installing Drivers

### macOS®



Note **At this time users cannot see more than 256 LUNs in macOS**

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.atto.com](http://www.atto.com).
3. On the main menu, click **Support**, and choose **Downloads** under the **Technical Support** header.
4. Register or log in if previously registered.
5. Select Thunderbolt ThunderLink Adapters 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.

10. Select a download destination and run the self-extracting executable file.
11. Continue with the driver installation as described on the following pages for your Operating System.

### 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.atto.com](http://www.atto.com).
3. On the main menu, click **Support**, and choose **Downloads** under the **Technical Support** header.
4. Register or log in if previously registered.
5. Select Thunderbolt ThunderLink Adapters 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.
10. Select a download destination and run the self-extracting executable file.
11. Continue with the driver installation as described on the following pages for your Operating System.

## VMware® (ESXi™ 5.5 and later)

### Including driver in boot image



**Note** 2082 and 2162 only. Drivers do not feature Thunderbolt abilities such as hot-plug.

*Downloading drivers from the ATTO website*

VMware vSphere includes the ability to dynamically construct boot images for your ESXi servers using vCenter 5. This allows you to include ATTO drivers as part of a boot image, then using PXE boot, ISO image or CD you can start an ESXi host with that image. The end result is that your server(s) will boot and have ATTO drivers included without any additional steps. Consult the VMware vSphere documentation for more information on this feature.

## Thunderbolt 3

*Thunderbolt 3 extends the capabilities of Thunderbolt to 40Gb/s while utilizing USB-C connectors. Please note the following guidelines for best practice when using an ATTO Thunderbolt 3 Adapter.*

1. Thunderbolt cables used with ATTO Thunderbolt 3 Adapters must be Intel certified.
2. Active cables (1 and 2 meter) provide 40Gb/s connectivity.
3. For passive cabling options please note that varied lengths will dictate performance.
  - 0.8m – 40Gb/s Performance (40Gb/s cables are designated with a “3” marking)
  - 1m – 20Gb/s Performance
4. Thunderbolt 3 utilizes a USB-C connector and only platforms designated by the Intel Thunderbolt logo are compatible with ATTO Thunderbolt 3 adapters. Intel certified legacy adapters may be used to connect ATTO Thunderbolt 2 Adapters to the latest Thunderbolt 3 platforms. Apple’s bidirectional legacy adapter also has the ability to connect Thunderbolt 3 Adapters to previous versions of Thunderbolt hosts.
  - 2m – 20Gb/s Performance

### Adding ATTO Driver to existing ESXi Installation

1. Download the Driver Bundle, from the VMware or ATTO website, for the appropriate ATTO adapter. Unzip the contents of the bundle on your local workstation. Within the bundle you will find the Driver VIB file (.vib) for your ATTO Thunderbolt Adapter.
2. Use the Datastore Browser in the vSphere Client to upload the VIB file to your ESXi host.



**Note** *Alternatively, you can utilize programs like WinSCP (Windows) or SCP (Linux) to upload the file directly to your ESX host.*

3. Log in to the ESXi host on the Local Tech Support Console (ESXi), or through an SSH client.
4. Install the VIB using the following command on the ESXi host: `# esxcli software install -v file:///path/filename.vib`
5. Once the VIB is installed, reboot the ESXi host.

**\*Thunderbolt and the Thunderbolt logo are trademarks of Intel Corporation in the U.S. and/or other countries.**

## 2 ATTO ConfigTool

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The ATTO ConfigTool provides an effective mechanism to configure your ThunderLink Adapter. Features include:

- The names of ATTO Adapters installed in the host
- Information about the drivers and firmware controlling the Adapters, 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

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

To make the ATTO ConfigTool installer available:

- macOS - mount the .dmg file
- Windows - run the .exe file



Note **Please remember the location of the installer to run it in upcoming steps.**

### Installation

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The ATTO ConfigTool 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 Adapters 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
2. Run the ConfigTool\_4xx file
3. Select **FULL** or **APPLICATION ONLY** as desired
4. Follow the on-screen instructions

#### Instructions for SYSTEM SERVICE ONLY installation

1. Launch the ATTO ConfigTool system service Installer
  - macOS - 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

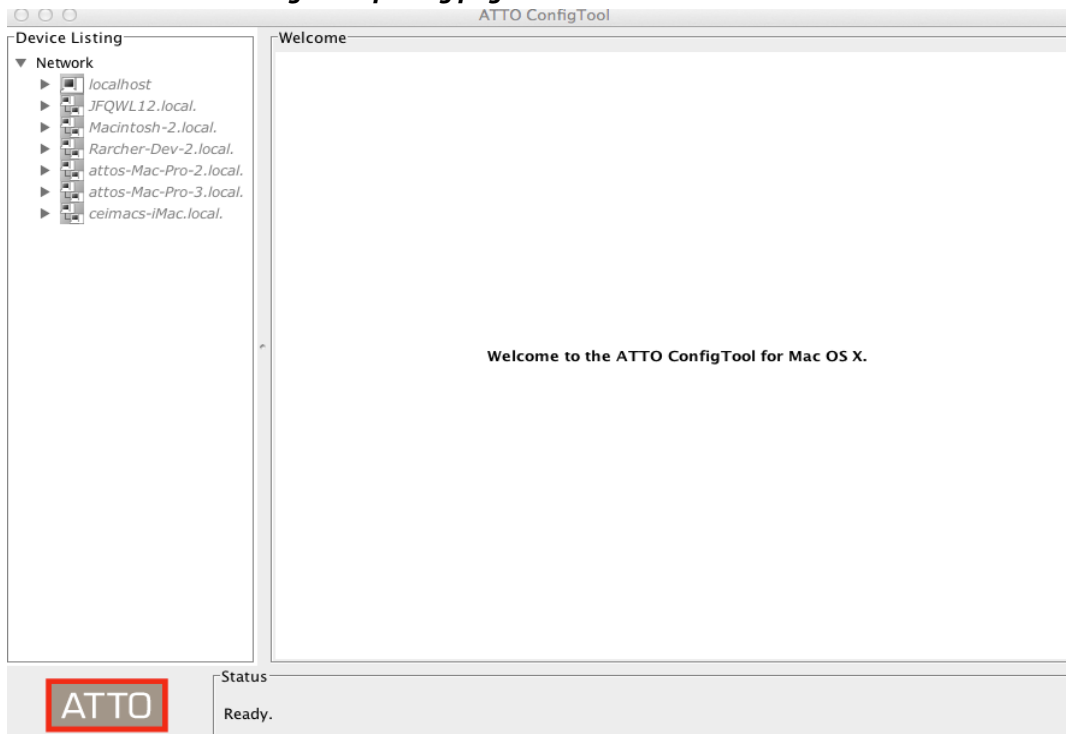
To use the ATTO ConfigTool, locate and double-click the application icon. The main page has three panes: **Adapter Listing**, **Configuration Options** and **Status**. The **Adapter Listing** window at the left of the display page lists local and remote hosts found on the network, as well as currently connected Adapters. You are required to login to manage

any host. Once you login, the **Adapter tree** will expand to reveal additional details on connected Adapters.

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

Tree node	Tabs displayed
Network	Host Tab
Host	Basic Info, Notifications, SNMP
Adapter	Basic Info, Flash, RAID, RAID CLI, Tasks
Channel	Basic Info, NVRAM
Adapters	Basic Info, Flash, SES

**Exhibit 1 The ATTO ConfigTool opening page**



# Navigating the ConfigTool

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## Host Discovery

The ATTO ConfigTool is able to discover hosts automatically, as well as manually. A host will be discovered and displayed in the **Adapter 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 **Adapter Listing**.

### Automatic Discovery

Hosts on the local subnet are automatically discovered and placed into the **Adapter 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 Adapter 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 macOS, 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 **Adapter Listing** p. The following tabs display in the **Configuration Options** pane:

- 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](#).
- The **Notification** tab allows you to set up notification of certain events in the ThunderLink Adapter.

## Select an Adapter

The following tabs display in the **Configuration Options** pane when you select a specific Adapter in the **Adapter Listing** pane .

- The **Basic Info** tab provides basic information about the Adapter currently highlighted in the Adapter listing. See [Exhibit 2](#).
- The **Flash** tab provides information about the current revision of flash loaded on the highlighted Adapter and allows you to update the flash. See [Exhibit 4](#).
- 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** pane when you select a specific channel in the **Adapter Listing** pane:

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



Note

**ATTO Adapters 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 Adapter to function incorrectly.**

## Select an Adapter

The following tabs display in the **Configuration Options** pane when you select a specific Adapter in the **Adapter Listing** pane:

- The **Basic Info** tab displays information about the selected Adapter.
- The **Flash** tab provides a tool to update the firmware of the selected Adapter. The flash tool is only available for Adapters that support flash update.

- The **SES** tab displays SES (SCSI Enclosure Services) status information, such as power supplies and fans, for SES Adapters.

## About window

The **About** window, 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.

## Driver update

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An Adapter 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 (macOS) file available for download 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 Adapter, the GUI will prompt to shutdown and install the Adapter.



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

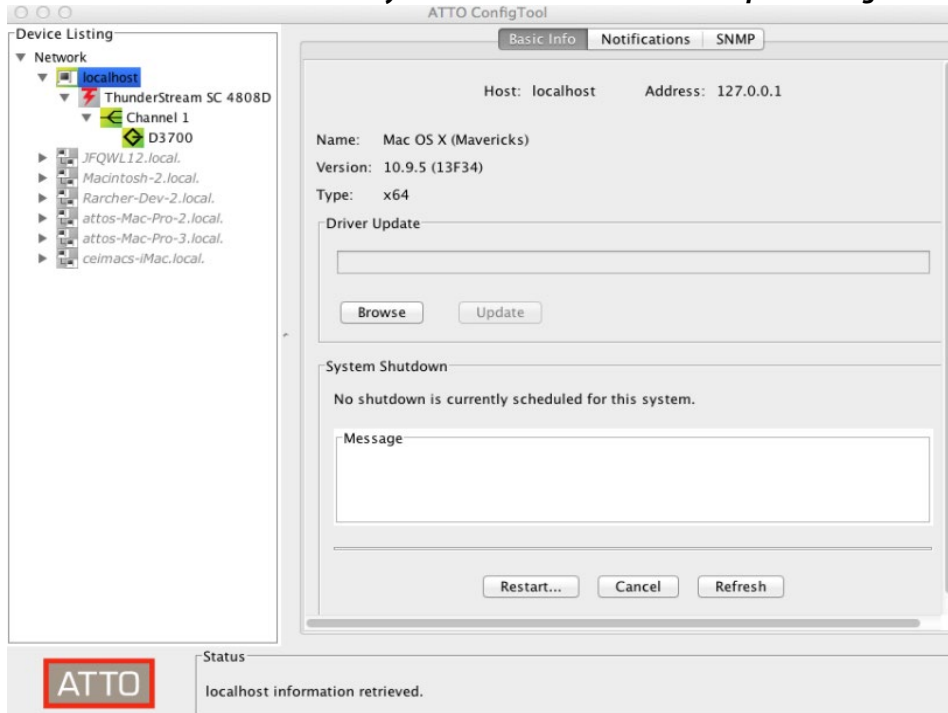
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A host can be rebooted using its **Basic info** tab. Select "Restart" and optionally provide a message. The host will reboot in one minute. The **Message** area will be updated to

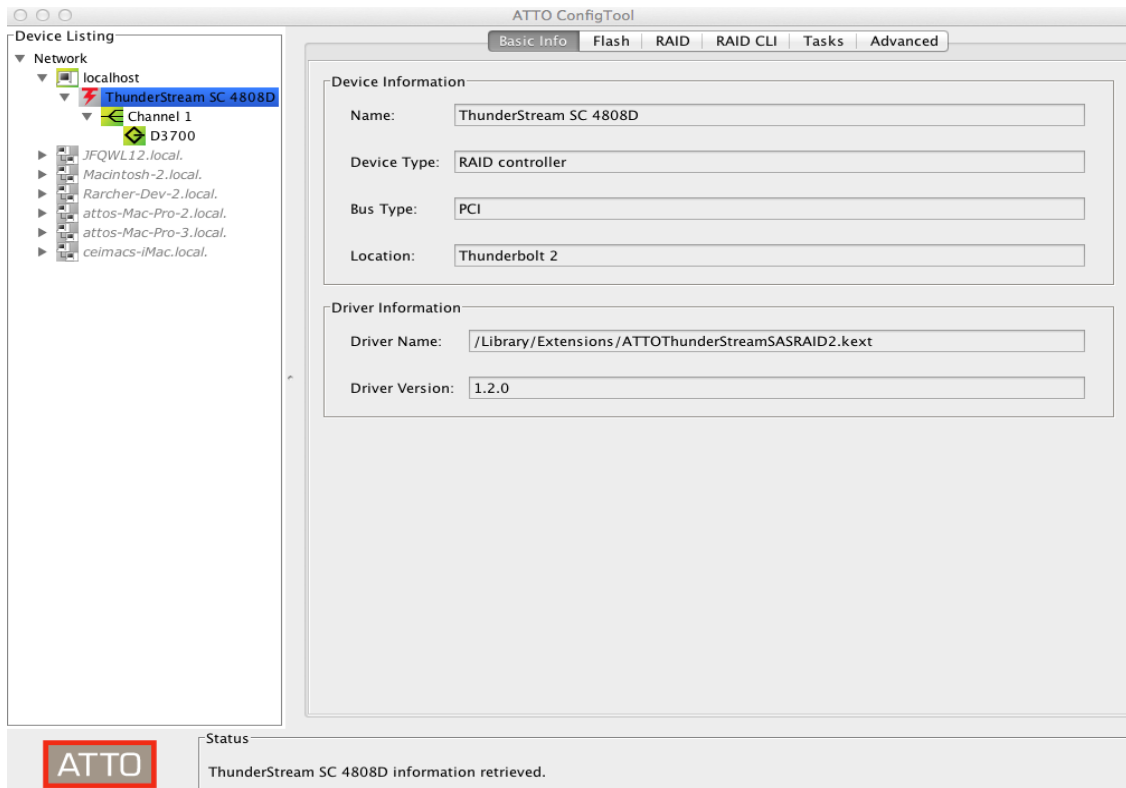
reflect the fact that the host has a scheduled reboot and display the time the reboot will occur.



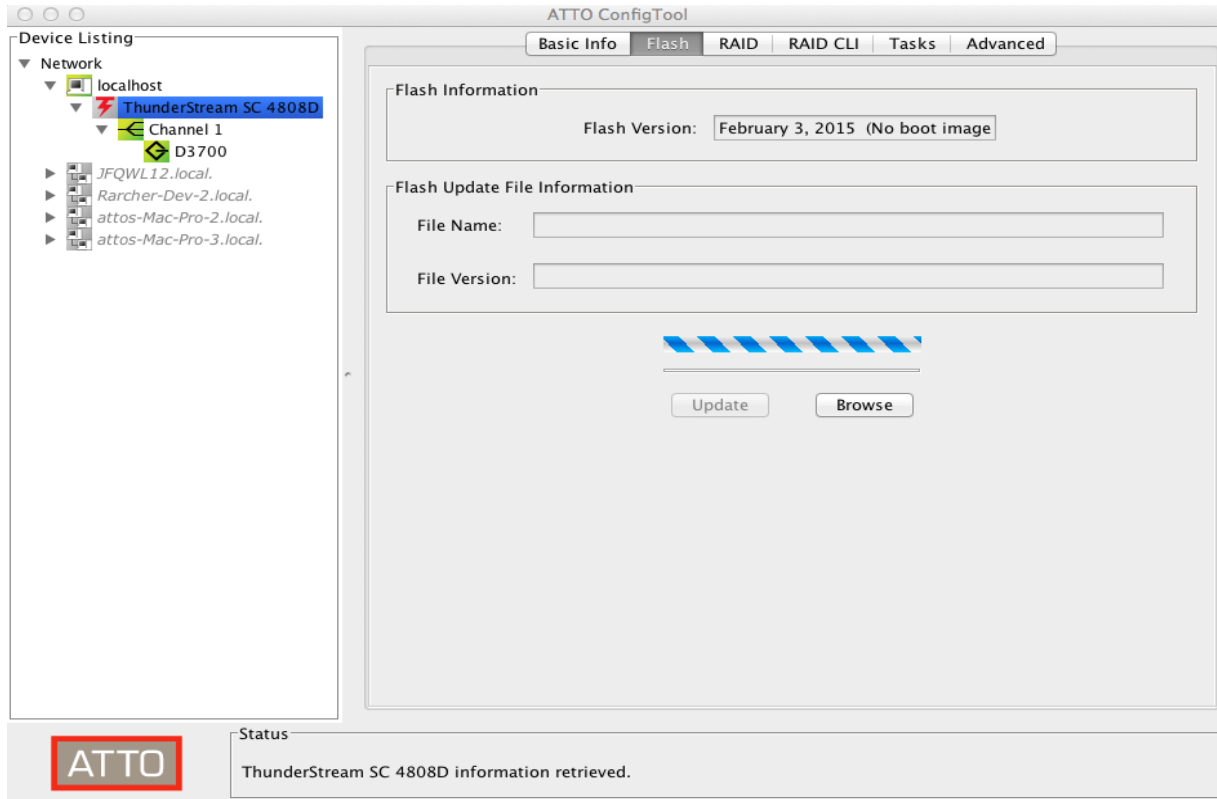
**Exhibit 2 The Basic Info tab when you choose a Host from the Adapter Listing.**



**Exhibit 3 The Basic Info tab when a Adapter is chosen from the Adapter Listing.**



#### Exhibit 4 The Flash tab.



## ThunderLink FC NVRAM Settings

The settings in the NVRAM tab vary depending upon the selected ThunderLink Fibre Channel Adapter and the operating system. Settings unsupported by that OS are not displayed.

ATTO Adapters 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 Adapter to function incorrectly.

**CAUTION** Back up system data when installing or changing hardware configurations.

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

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

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

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

### Node Name

The Node WWN assigned to this channel of the Adapter.

### Port Name

The Port WWN assigned to this channel of the adapter.

### Boot Driver

Choices: enabled, scan only, disabled

Default: disabled

If enabled and disk drives or a bootable CD are detected during the bus scan, the BIOS driver remains resident. If disabled, the BIOS starts, resets the Adapter chip and unloads the driver.

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

### \*Hard Address Enable Button

Choices: enabled, disabled

Default: disabled

When a Fibre Channel loop is initialized, each Adapter selects and configures itself to an available ID. **Hard Address Enable** permits the host to select the value entered in the **Hard Address** field.

#### \*Hard Address

Choices: None, 0-125

Default: 0

The value used as the FC-AL hard address. A value to represent the address if hard addressing is enabled.

#### Execution Throttle (8Gb, 16Gb or 32Gb)

Choices: 1- 255

Default: 255 (Disabled)

Specifies the maximum number of concurrent commands which can be achieved per port or per SCSI Target. Higher numbers or disabling the feature may increase performance, but some Adapters react poorly when flooded with too many commands at a time, ultimately decreasing performance. Note that the setting applies to the aggregate of all LUNs controlled by the SCSI Target.

#### Frame Size

Choices: 512, 1024, 2048

Default: 2048

Changes the size of the FC packet of information being sent. Typically, the initiator and target negotiates the desired frame size, starting with the largest value. The frame size should be set to the largest value for normal operation.

#### \*Connection Mode Options

Choices: AL, PTP, AL Preferred, PTP Preferred

Default: PTP Preferred

*Arbitrated Loop (AL): Connects to either an Arbitrated Loop or a Fabric Loop Port (FL Port) on a switch.*

*Point-to-Point (PTP): Connects to a direct Fabric connection, such as an F port on a switch or directly to another Adapter that is capable of running in PTP mode.*

*AL Preferred: Allows the card to determine what kind of connection to use, but tries to connect in Loop mode first, then Point-to-Point mode.*

*PTP Preferred: Allows the card to determine what kind of connection is to use, but tries to connect in Point-to-Point mode first, then Loop mode.*



Note

**Sometimes it is necessary to force a given connect mode because there is no industry standard for the topology detection**

**protocol and some Adapters may not connect when set to one of the automatic modes.**

#### Data Rate

Choices for 32 Gig: 8Gb/sec, 16Gb/sec, 32Gb/sec, Auto

Choices for 16 Gig: 4Gb/sec., 8Gb/sec., 16Gb/sec., Auto

Choices for 8 Gig: 4Gb/sec., 8Gb/sec., Auto

Default: Auto

Selects the Fibre Channel transmission rate. **Auto** indicates that the Adapter determines the rate based upon the Adapters connected.

**Note: 16 Gig, 32 Gig and Loop Only are incompatible choices and will not be allowed.**

#### Interrupt Coalesce

Choices: None, Low, Medium, High

Default: None

Specifies the time period a Adapter chip delays an interrupt. This allows the Adapter chip to queue up more than one interrupt before interrupting the CPU. When this methodology is chosen there is less overhead to service the interrupts. However, the coalescing time may delay the delivery of the completion for a single interrupt.

#### Port Down Retry Count

Choices: 0-255

Default: 8

The number of times the driver retries a command to a port which is currently logged out.

#### Link Down Timeout

Choices: 0-255

Default: 0

The number of seconds the driver waits for a link that is down to come up before reporting it to the operating system.

#### Spinup Delay

Choices: 0-255

Default: 0


Specifies number of seconds the driver waits for the first Adapter to be logged in and become ready.

**\* Only for TLFC 2082 and TLFC 2162**

# ThunderLink SH NVRAM Settings

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

 **CAUTION** *Back up system data when installing or changing hardware configurations.*

Use caution when making changes to NVRAM settings and only make changes to those with which you are familiar. Entering invalid or incorrect settings when using an NVRAM configuration utility such as the ATTO ConfigTool may cause your Adapter to function incorrectly. Once you have made the desired changes, click **Commit** to save the changes. Changes do not take effect until you reboot the system.

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

- **Defaults:** restores the Adapter to factory default settings. The **Commit** button must be clicked to save any changes.
- **Restore:** reverts to the NVRAM settings saved the last time the **Commit** button was used. Clicking **Commit** is not necessary when restoring.

## SAS Address

Read only

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

## Boot Driver

Choices: enabled, scan only, disabled

Default: enabled

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

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

## Heartbeat

Choices: enabled, disabled

Default: enabled

*When enabled, requires the firmware to respond to periodic activity. If the firmware does not respond, the system driver resets the firmware on the Adapter.*

## NCQ

Choices: enabled, disabled

Default: enabled

*When enabled, the Adapter driver sends multiple simultaneous commands to NCQ capable SATA disk drives.*

## Phy Speed (ExpressSAS only)

Choices: Auto, 12Gb/s, 6Gb/s, 3Gb/s, 1.5 Gb/s

Default: Auto

*Allows the user to manually adjust the speed of the PHY.*

## Device Wait Time

Choices: 1-255 seconds

Default: 3

*Specifies the number of seconds which the driver waits for Adapters to appear.*

## Device Wait Count

Choices: 1-255 Adapters

Default: 1

*Wait time and count apply to waiting for attached devices to be discovered.*

## Spinup Delay

Choices: 0-20 seconds

Default: 0

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

## 3 Updating Hardware Flash

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For Fibre Channel Thunderbolt products, your Adapter 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.atto.com](http://www.atto.com), to download the latest drivers and flash bundle.

### Updating Flash

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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 (ThunderLink Adapter specific) from the ATTO website.
  - a. Go to [www.atto.com](http://www.atto.com)
  - b. Click on **Support** and then click on **Downloads**.
  - c. Register or log in if previously registered.
  - d. Click on Thunderbolt ThunderLink Adapters in the left dialog.
  - e. Navigate to your ThunderLink Adapter 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, unzip the .zip/.dmg file based on Operating System.
3. Launch the **ConfigTool**.
4. Once you've extracted the firmware file to your desktop, open the ATTO ConfigTool network tree to **localhost** and then to the Adapter that you want to update.

5. On the right hand side, navigate to the **Flash** tab - see [Exhibit 8](#). Here, you will be able to compare the date on the new firmware to the date of the current firmware.
6. Browse to and open the file that you extracted to the desktop, then click **update**.
7. After you are sure that any attached storage is unmounted and disconnected, you can continue the update process.



Note **The status bar will give you information about the updates in bold red text.**

8. When the flash is complete, the ConfigTool application will request a system reboot.
9. Once the computer is restarted, open the ConfigTool again. Under the Adapter's flash tab, you'll see that the Adapter's firmware date has been updated to reflect the date of the file that you downloaded.



Note **Default settings are appropriate for most systems but you may change settings using the ATTO ConfigTool**



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

# 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 - FC 3162, FC 3322, FC 2082, FC 2162, NT 2102, NS 3252, NS 3102, N3 3102, SH 3128

Class A - NQ 3402

This equipment has been tested and found to comply with the limits for a Class B (Class A) digital Adapter, 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  indicates compliance of this ATTO Adapter to the EMC Directive and the Low Voltage Directive of the European Union.



ATTO ThunderLink Adapters comply with Directive 2011/65/EU, (EU) 2015/863 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. piezoelectric Adapters)

13 - Lead and cadmium in optical and filter glass



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

**Safety TLFC-2162/2082, TLNS-2102/3102:** TUV 72191148, CB IEC60950-1 (all national deviations)

**Safety TLNT-2102, TLNQ-3402, TLFC-3322/3162, TLSH-3128, TLNS-3252, TLN3-3102:** TUV 72203788, CB IEN62368-1 (all national deviations)

**Emissions/Immunity:** FCC Part 15, ICES-003, CE, AS/NZS CISPR 32, EN55032, EN55024, IEC61000-3-2, IEC61000-3-3, CISPR 24

# Warranty Information

## Manufacturer limited warranty

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