ATTO FastFrame™ Network Interface Card Installation and Operation Manual

FastFrame NQ41

40Gb Single Port PCIe 3.0 Network Interface Card

FastFrame NQ42

40Gb Dual Port PCIe 3.0 Network Interface Card

FastFrame NS12

10GbE Dual Port PCIe 2.0 Network Interface Adapter

FastFrame NS11

10GbE Single Port PCIe 2.0 Network Interface Adapter

FastFrame NT12

10GBASE-T Dual Port PCIe 2.0 Network Interface Adapter

FastFrame NT11

10GBASE-T Single Port PCIe 2.0 Network Interface Adapter

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The Power Behind the Storage

Table of Contents

1 ATTO FastFrame Ethernet Features & Overview

FastFrame Ethernet NICs provide flexible and scalable LAN connectivity.

Built on industry-leading Intel® silicon for universal usability, ATTO FastFrame NICs lead in high performance I/O connectivity for macOS environments while offering broad support for Windows and Linux server and workstation operating systems. They provide reliable, inexpensive, fast network access to block storage via iSCSI, with lossless Ethernet (CEE) and Data Center Bridging (DCB) for improved iSCSI quality of service. ATTO FastFrame NICs comprise a full range of products for flexible design—single, dual, and quad-port configurations, as well as support for Direct Attach Copper.

ATTO FastFrame NICs operate with existing structured shielded or unshielded twisted pair copper cabling familiar to network professionals.

Strong reseller & OEM programs plus exceptional support provided by ATTO make the FastFrame line of NICs the choice for system builders seeking a lasting footprint in storage-intensive and data center markets.

Extensively tested and optimized by ATTO for high-performance in Media & Entertainment applications, as well as applications with similar profiles such as medical imaging, and oil & gas 10GbE cards, ports & cabling are backwards compatible to Gig-E for staged upgrades or future-proofing—and you can run 10GBASE-T NICs with Cat6a cabling that's already in place

30% lower power rating means lower energy costs, lower data center maintenance fees, and less heat to dissipate.

Getting Started

In general, to install the ATTO Network Interface Adapter, you must:

1. Ensure you have the equipment and software you need for the installation:

    * FastFrame NIC
    * A computer with an available expansion slot

    Note **Install your FastFrame NIC into a PCIe 2.0 or PCIe 3.0 (NQ41 and NQ42) x8 expansion slot for best performance**

    * Cables

    http://www.atto.com/products/cable-finder/

2. Install drivers for your operating system. Refer to **Driver Installation**.
3. Install the FastFrame Adapter. Refer to **Hardware Installation**.

4. Attach your NIC to a switch or server using an ATTO recommended cables and QSFPs:

Optical (NQ41, NQ42)

* CBL_-0130-001 (1m)
* CBL_-0128-003 (3m)
* CBL_-0310-005 (5m)
* CBL_-0310-020 (20m)
* QSFP-0040-R00 40Gb/s, QSFP, MPO 850nm, up to 30m

Optical (NS12, NS11)

* CBL-LCLC-R03 (3 Meter)
* CBL-LCLC-R10 (10 Meter)

10GBASE-T (NT12, NT11)

* CAT6a

FastFrame NQ42 Adapter

The ATTO comprehensive line of FastFrame 40-Gigabit Ethernet products includes dual port models to provide added connectivity for users in a wide variety of applications and enhancing support for additional streams of video in media and entertainment applications, and provides the high-quality and high-performance experience ATTO customers are accustomed to.

The FastFrame NQ42 QSFP+ NIC is best suited for users interested in utilizing qualified, high-quality pluggable optical QSFP+ transceivers providing connectivity distances of up to 30m. As a bonus, ATTO FastFrame models which support optical QSFP+ transceivers come with QSFP+s

Technical specifications

- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 40Gb/s throughput per port
- High-performance x8 PCIe 3.0 bus

Ethernet features

- Data rate per port: 40Gb/s, 10Gb/s
- Jumbo frame support up to 9,000 bytes
- Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO)

Host bus specifications

- PCI Express 3.0 (1.1 and 2.0 compatible) through a x8 edge connector
- PCIe Base 3.0 compliant
- 2.5, 5.0, or 8.0GT/s link rate x8
- Auto-negotiates to x8, x4, x2, x1
- Support for MSI/MSI-X mechanisms

Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55º C (32 to 131º F)
- Storage temperature: -40 to 70º C (-40 to 158º F)
- Relative humidity: 90%
- Power draw 7.69 W
- RoHS compliant

External connectivity

- Easy to install full height connection bracket
- External LEDs indicate link and activity
- Two pluggable optical QSFP+ modules included

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux®

FastFrame NQ41 Adapter

Technical specifications

- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 40Gb/s throughput per port
- High-performance x8 PCIe 3.0 bus

Ethernet features

- Data rate per port: 40Gb/s, 10Gb/s
- Jumbo frame support up to 9,000 bytes
- Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO)

Host bus specifications

- PCI Express 3.0 (1.1 and 2.0 compatible) through an x8 edge connector
- PCIe Base 3.0 complaint
- 2.5, 5.0, or 8.0GT/s link rate x8
- Auto-negotiates to x8, x4, x2, x1
- Support for MIS/MSI-X mechanisms

Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55º C (32 to 131º F)
- Storage temperature: -40 to 70º C (-40 to 158º F)
- Relative humidity: 90%
- Power draw 7.69 W
- RoHS compliant

External connectivity

- Easy to install full height connection bracket;
- External LEDs indicate link and activity
- One pluggable optical QSFP+ modules included

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux®

FastFrame NS12 Adapter

Technical specifications

- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 10Gb/s throughput per port
- High-performance x8 PCIe 2.0 bus

Ethernet features

- Data rate per port: 10Gb/s, 1Gb/s
- Jumbo frame support up to 9,000 bytes
- Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO, TSO, and RSC)

Host bus specifications

- x8 mechanical and x8 electrical PCI Express interconnect
- Conforms to PCI Express Base Spec 2.0
- Conforms to PCI Express CEM Spec 2.0
- PCI Hot Plug spec 1.0
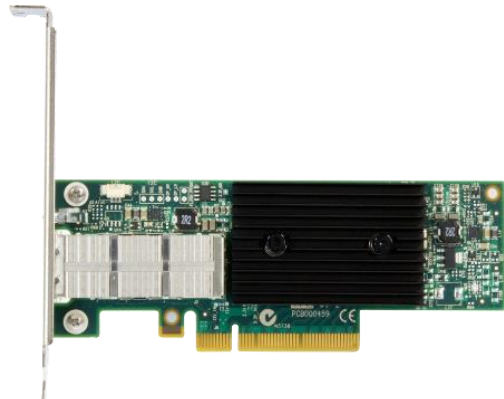
Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55 ºC (32 to 131 ºF)
- Storage temperature: -40 to 70 ºC (-40 to 158 ºF)
- Relative humidity: 10 to 90% non-condensing
- 5.9 W (typical)
- 100 lf/m (minimum) airflow recommended
- RoHS compliant

External connectivity

- Easy to install full height connection bracket; low-profile bracket included in finished goods packaging
- External LEDs for on-line and speed status for each port
- Two pluggable optical LC SFP+ modules

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux®
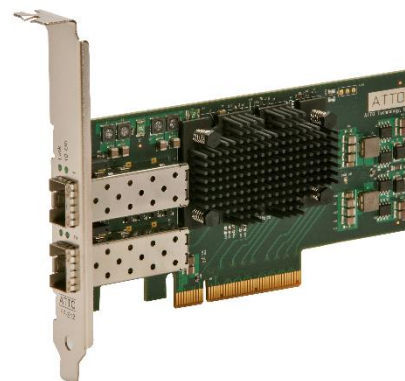
FastFrame NS11 Adapter

Technical specifications

- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based
- Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 10Gb/s throughput per port
- High-performance x8 PCIe 2.0 bus

Ethernet features

- Data rate per port: 10Gb/s, 1Gb/s
- Jumbo frame support up to 9,000 bytes
- TSO, RSC, Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO)
- Descriptor ring and queue management optimizations

Host bus specifications

- x8 mechanical and x8 electrical PCI Express interconnect
- Conforms to PCI Express Base Spec 2.0
- Conforms to PCI Express CEM Spec 2.0
- PCHI Hot Plug spec 1.0

## Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55 ºC (32 to 131 ºF)
- Storage temperature: -40 to 70 ºC (-40 to 158 ºF)
- Relative humidity: 10 to 90% non-condensing
- 4.7 W (typical)
- 100 lf/m (minimum) airflow recommended
- RoHS compliant

External connectivity

- Easy to install full height connection bracket; low-profile bracket included in finished goods packaging
- External LEDs for on-line and speed status for each port
- Pluggable optical LC SFP+ module included

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux

FastFrame NT12 Adapter

Technical specifications

- Intel X540 10GBASE-T Ethernet Controller
- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based
- Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 10Gb/s throughput per port
- High-performance x8 PCIe 2.0 bus

Ethernet features

- Data rate per port: 10Gb/s, 1Gb/s, 100Mb/s
- Jumbo frame support up to 9,000 bytes
- TSO, RSC, Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO)
- Descriptor ring and queue management optimizations

Host bus specifications

- x8 mechanical and x8 electrical PCI Express 2.0 interconnect
- Backward compatible with PCI Express 1.1
- Supports PCI Express Base Spec 2.0
- Supports PCI Express CEM Spec 2.0

Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55 ºC (32 to 131 ºF)
- Storage temperature: -40 to 70 ºC (-40 to 158 ºF)
- Relative humidity: 10 to 90% non-condensing
- 13.6W (typical)
- 200 lf/m (minimum) airflow recommended
- RoHS compliant

External connectivity

- Easy to install full height connection bracket; low-profile bracket included in finished goods packaging
- External LEDs for link speed and activity for each port
- Compatible with CAT-7, CAT-6a, and CAT-6 Ethernet cables for 10GBASE-T connections and CAT-5e for 1000BASE-T and 100BASE-TX connections

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux
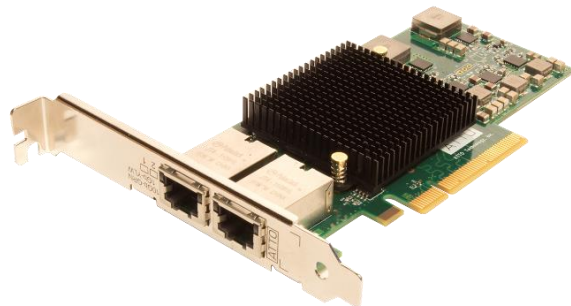
FastFrame NT11 Adapter

Technical specifications

- Simultaneously supports multiple networking and storage protocols: TCP/IP, iSCSI
- Supports Data Center Bridging; Priority-based Flow Control (PFC), Enhanced Transmission Selection (ETS) and DCB Exchange (DCBX) protocol
- Up to 40Gb/s throughput per port
- High-performance x8 PCIe 3.0 bus

Ethernet features

- Data rate per port: 40Gb/s, 10Gb/s
- Jumbo frame support up to 9,000 bytes
- Tx/Rx IP, TCP & UDP checksum offloading (IPv4, IPv6) capabilities, Transmission control protocol (TCP), User datagram protocol (UDP), Internet protocol (IP)
- Large send offloads (LSO)

Host bus specifications

- PCI Express 3.0 (1.1 and 2.0 compatible) through an x8 edge connector
- PCIe Base 3.0 complaint
- 2.5, 5.0, or 8.0GT/s link rate x8
- Auto-negotiates to x8, x4, x2, x2
- Support for MIS/MSI-X mechanisms

Environmental & physical specifications

- Length: 5.6 inches
- Height: 2.71 inches
- Operating temperature: 0 to 55º C (32 to 131º F)
- Storage temperature: -40 to 70º C (-40 to 158º F)
- Relative humidity: 90%
- Power draw 7.69 W
- RoHS compliant

External connectivity

- Easy to install full height connection bracket;
- External LEDs indicate link and activity
- One pluggable optical QSFP+ modules included

Software specifications

- Microsoft® Windows Server®
- Microsoft Windows®
- macOS®
- Linux®
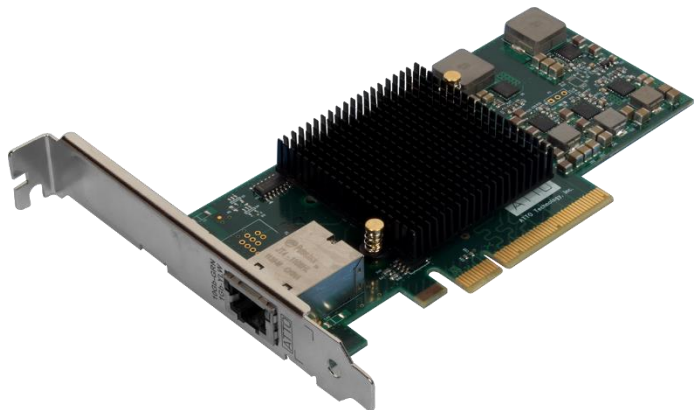
Selection guide: FastFrame adapters

Product Features	FFRM-NQ41	FFRM-NQ42	FFRM-NS12	FFRM-NS11	FFRM-NT12	FFRM-NT11
Ports	1	2	2	1	2	1
Maximum Transfer Rate (Full Duplex)	10GB/s	20GB/s	5GB/s	2.5GB/s	5GB/s	2.5GB/s
Bus type	PCIe 3.0	PCIe 3.0	PCIe 2.0	PCIe 2.0	PCIe 2.0	PCIe 2.0
Bus characteristics	8 lane	8 lane	8 lane	8 lane	8 lane	8 lane
Optical/Copper interface	QSFP+ SR	QSFP+ SR	SFP+LC	SFP+ LC	RJ45	RJ45
Maximum cable length	See Chart Below	See Chart Below	See Chart Below	See Chart Below	See Chart Below	See Chart Below
Low profile form factor	✓	✓	✓	✓	✓	✓
Advanced Data Streaming (ADS™) Technology	✓	✓	✓	✓	✓	✓
Windows® driver support	✓	✓	✓	✓	✓	✓
macOS® driver support	✓	✓	✓	✓	✓	✓
Linux® driver support	✓	✓	✓	✓	✓	✓

Cable length varies by interface and cable type.

Interface	Cable type	Max Distance
40Gb	Passive Copper	5m
40Gb	Active Fibre	30m
10GBASE-SR	62.5/125 µm multi-mode fiber (OM1)	26m
100BASE-SX	62.5/125 µm multi-mode fiber (OM1)	55m
10GBASE-SR	50/125 µm MMF (OM2)	82m
10GBASE-SR	Laser optimized 50/125 µm MMF (OM3)	300m
10GBASE-T	CAT-7	100m
10GBASE-T	CAT-6a	100m
10GBASE-T	CAT-6	55m
1000BASE-T	CAT-5e	100m
100BASE-TX	CAT-5e	100m

2 Driver Installation

Before installing your FastFrame adapter, you must configure your system to recognize it by installing drivers for your operating system.

Note *If you already have one or more FastFrame adapters installed and you are installing additional adapter(s), you do not need to perform any of these procedures unless you are updating a previously installed driver. We strongly recommend downloading the latest drivers, available at http://www.atto.com/downloads.php*

Windows

Note *Windows may utilize a new User Account Control Feature. Because of this there may be additional confirmations that will need to be performed to properly install the driver. These confirmations normally consist of a dialog where the user has to give Windows permission to perform an action. If you do not have the correct privileges during this, you will be prompted for an actual user name and password. You may need to contact your system administrator if you do not have this information.*

1. Power on your system and log in as the administrator or a user with proper administrative privileges.
2. Go to https://www.attotech.com
3. Click on downloads
4. Register or log in if previously registered.
5. Click on Ethernet Adapters in the left dialog.
6. Navigate to your HBA model/family in the right dialog and click on it.
7. Scroll down to and click the desired driver depending on the operating system.
8. A download window appears. Choose Save File.
9. Double-click the downloaded file to extract and launch the driver setup program.
10. Follow the on-screen instructions to complete the driver installation.
11. Follow the on-screen instructions to complete the driver installation

Linux

Note *These steps assume a basic knowledge of Linux terminal commands. You must also have the correct kernel header files for the appropriate kernel already installed.*

1. Power on your system and log in as the administrator or a user with proper administrative privileges.
2. Go to https://www.atto.com/
3. Click on downloads
4. Register or log in if previously registered.
5. Click on Ethernet Adapters in the left dialog.
6. Navigate to your HBA model/family in the right dialog and click on it.
7. Scroll down to and click the desired driver depending on the operating system.
8. A download window appears. Choose Save File.
9. After the download has completed, open the FastFrame volume on the desktop.
10. Open the Linux folder.
11. Open the Drivers folder.
12. Copy the .tgz file to a temporary folder.
13. Open a terminal window and change the location of the copied tgz.
14. Extract the file using the command tar -xfz <filename.tgz>.
15. Change to the directory created above then run the installer script ./install.sh.

FreeBSD

These steps assume a basic knowledge of FreeBSD terminal commands. You must also have the correct kernal source files for the appropriate kernel already installed.These steps also assume the user has a GUI and internet browser installed, or an external machine which can download the driver and transfer it to the appropriate machine running a supported version of FreeBSD.

1. Power on your system and log in as the administrator or a user with proper administrative privileges.
2. Go to https://www.atto.com/
3. Click on downloads
4. Register or log in if previously registered.
5. Click on Ethernet Adapters in the left dialog.
6. Navigate to your HBA model/family in the right dialog and click on it.
7. Scroll down to and click the desired driver depending on the operating system.
8. A download window appears. Choose Save File.
9. After the download has completed, open the FastFrame volume on the desktop.
10. Open the FreeBSD folder.
11. Open the Drivers folder.
12. Copy the .tgz file to a temporary folder.
13. Open a terminal window and change the location of the copied tgz.
14. Extract the file using the command tar -xfz <filename.tgz>.
15. Change to the directory created above then run the installer script ./install.sh.

macOS

1. Power on your system and log in as the administrator or a user with proper administrative privileges
2. Go to https://www.atto.com/
3. Click on downloads.
4. Register or log in if previously registered.
5. Click on Ethernet Adapters in the left dialog. 6 Navigate to your HBA model/family in the right dialog and click on it.
6. Scroll down to and click the desired driver depending on the operating system.
7. A download window appears. Choose Save File.
8. Launch the installer package.
9. Follow the on-screen instructions.

3 Hardware Installation

Install the ATTO FastFrame Adapter and attach your devices to it using the instructions below

⚠️ CAUTION **Back up your system data before changing or installing any hardware.**

System requirements

The FastFrame Ethernet Adapter package contains the following:

- FastFrame Network Interface Adapter
- QSFP+ Modules (NQ adapters only)
- SFP+ Modules (NS adapters only)

📝 Note **If any of these items are missing, contact your ATTO authorized sales representative.**

To install and use the FastFrame Ethernet Adapter you will need:

- A computer with an available PCI Express expansion slot

📝 Note **Install your FastFrame NIC into a PCIe 2.0 or PCIe 3.0 (NQ41 and NQ42) x8 expansion slot for best performance**

- The complete FastFrame Ethernet Adapter package

MAC address

FastFrame NICs are configured with a unique MAC address designated by the Institute of Electrical and Electronic Engineers. This address, stored in flash memory, allows the system to recognize the FastFrame NIC as a unique part of your configuration. The address is clearly marked on the back of the adapter.

The MAC address assigned to an adapter is assigned to the 1st port of the adapter. If the adapter has more than one port then the MAC address is incremented by and assigned to the 2nd port.

For example, for the NQ4Xseries, the assignment will be as follows:

MAC address	
MAC address + 1	
MAC address + 2	
MAC address + 3	

Installation

⚠️ CAUTION **FastFrame NICs contain components that are sensitive to electrostatic discharge (ESD). ESD can cause damage to the FastFrame host adapter. Please follow standard methods to avoid ESD.**

For bracket installation, please see the bracket installation guide included in your NIC product package.

1. Install the latest drivers. Refer to **Driver Installation**.
2. Power down the computer and unplug the computer from all power sources.
3. Open the case.
4. Remove the cover bracket from the PCI Express slot (v1.1a or later).
5. Install the FastFrame NIC host adapter in any open PCI Express expansion slot. If you have questions about how to install an expansion card in your system, consult your computer's documentation.

📝 Note **The FastFrame adapters fit into x8 or x16 mechanical PCI Express slots.**

6. Repeat step 4 through 5 for each adapter you want to install.
7. Close the case on the computer and power it up.

Bracket Details

Exhibit 1 FFRM-NQ42 Dual-Port Bracket
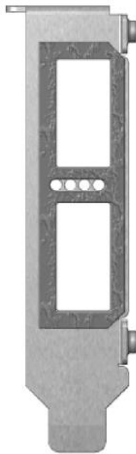
Exhibit 2 FFRM-NQ41 Single-Port Bracket

Exhibit 3 FFRM-NS12 Full & Low Profile Bracket

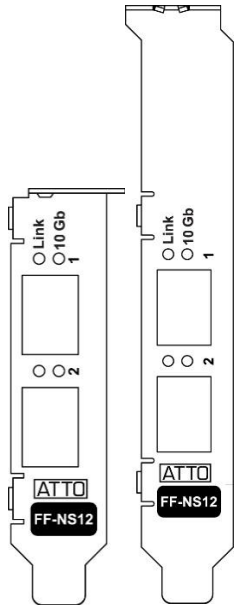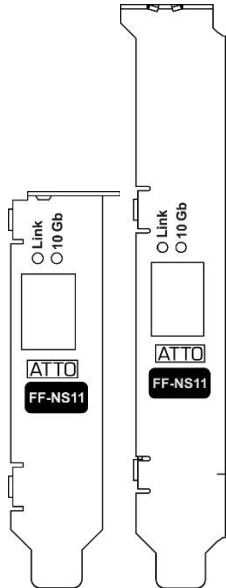*Exhibit 4 FFRM-NS11 Full & Low Profile Bracket*

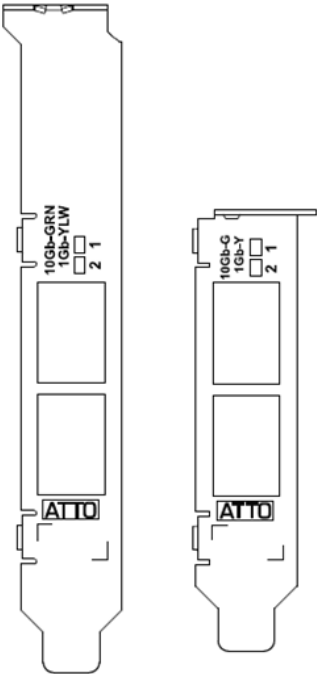**Exhibit 5 FFRM-NT12 Full & Low Profile Bracket**
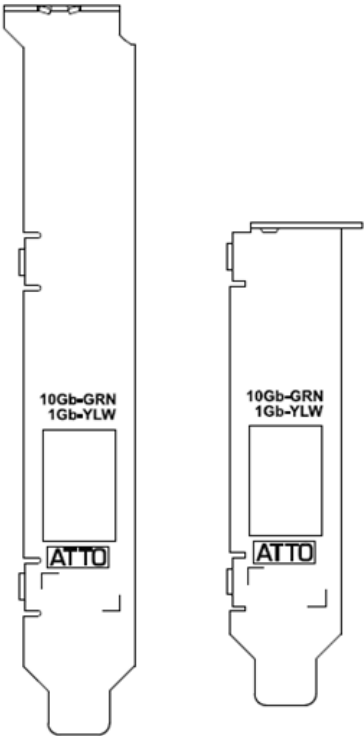
Exhibit 6 FFRM-NT11 Full & Low Profile Bracket
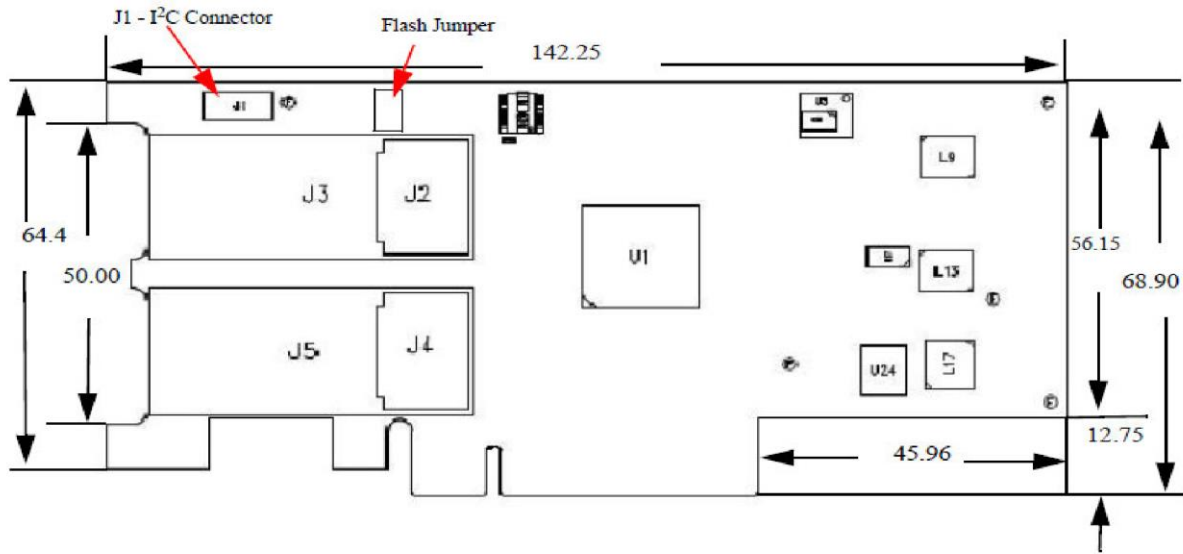
Board Details

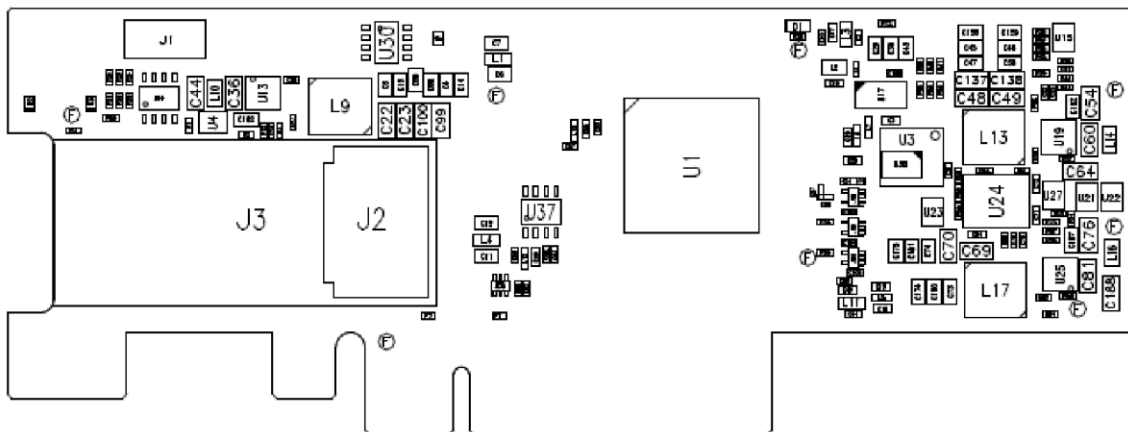*Exhibit 7 FFRM-NQ42 board*
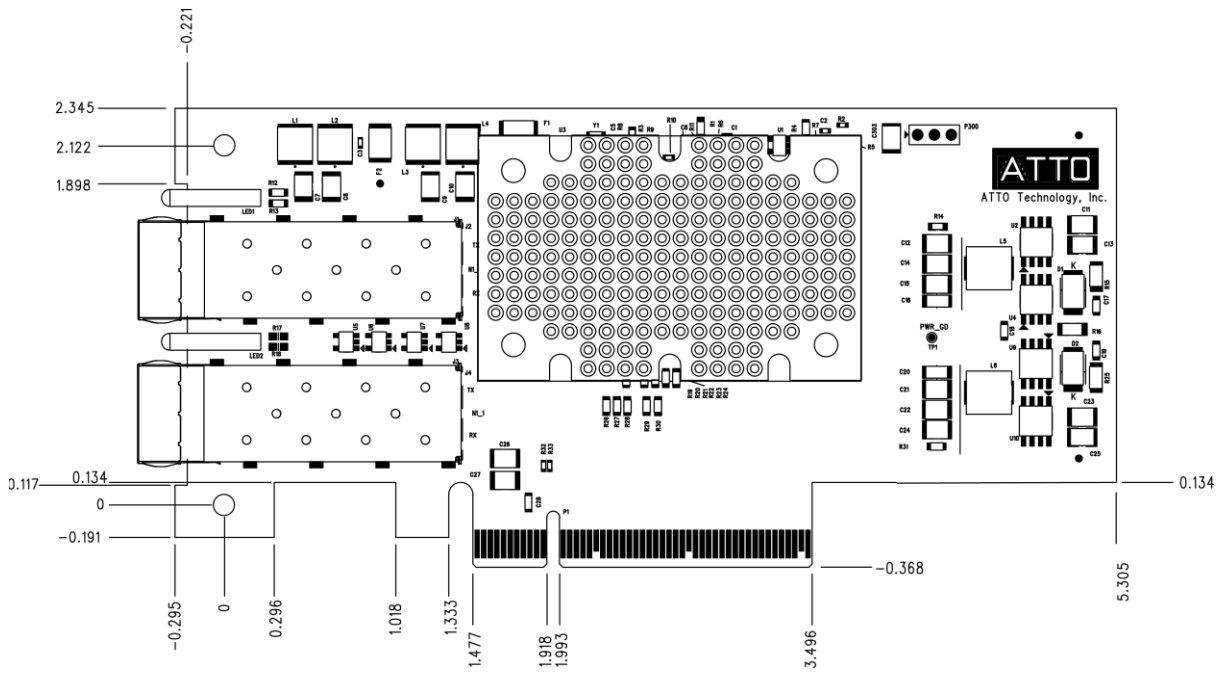

Exhibit 8 FFRM-NQ41 board

Exhibit 9 FFRM-NS12 board
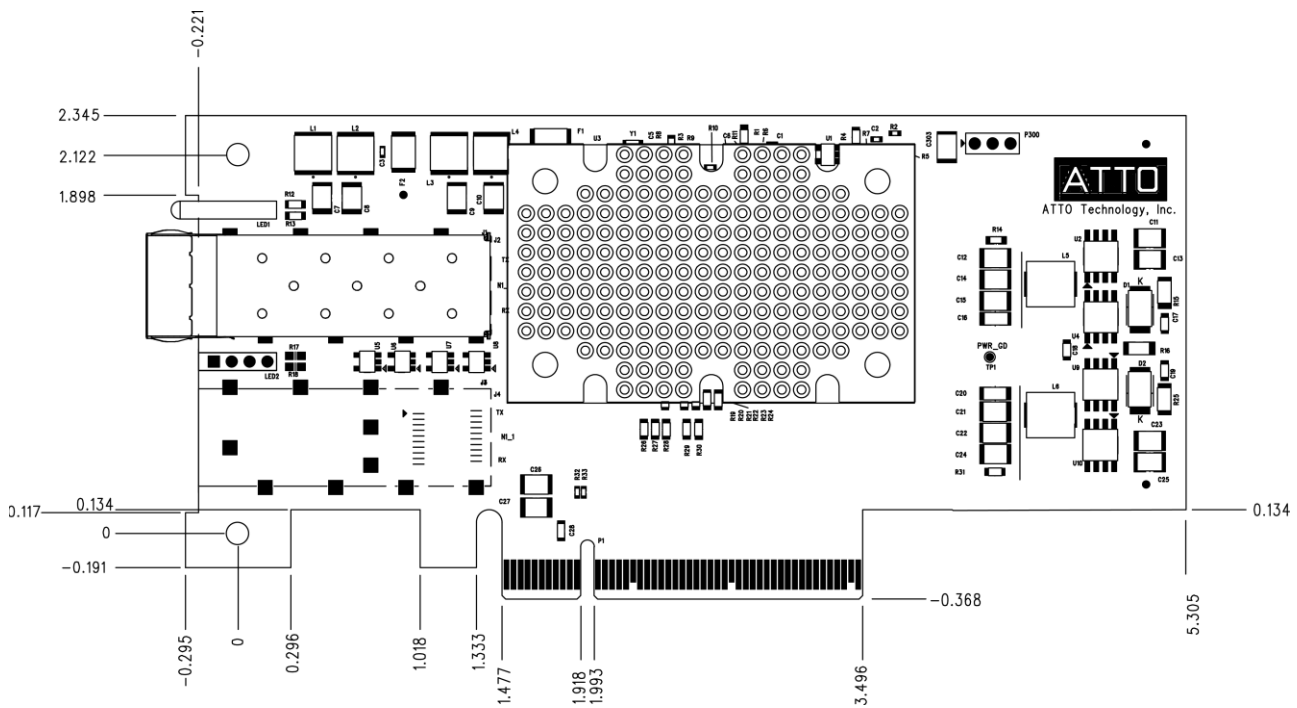

Exhibit 10 FFRM-NS11 board
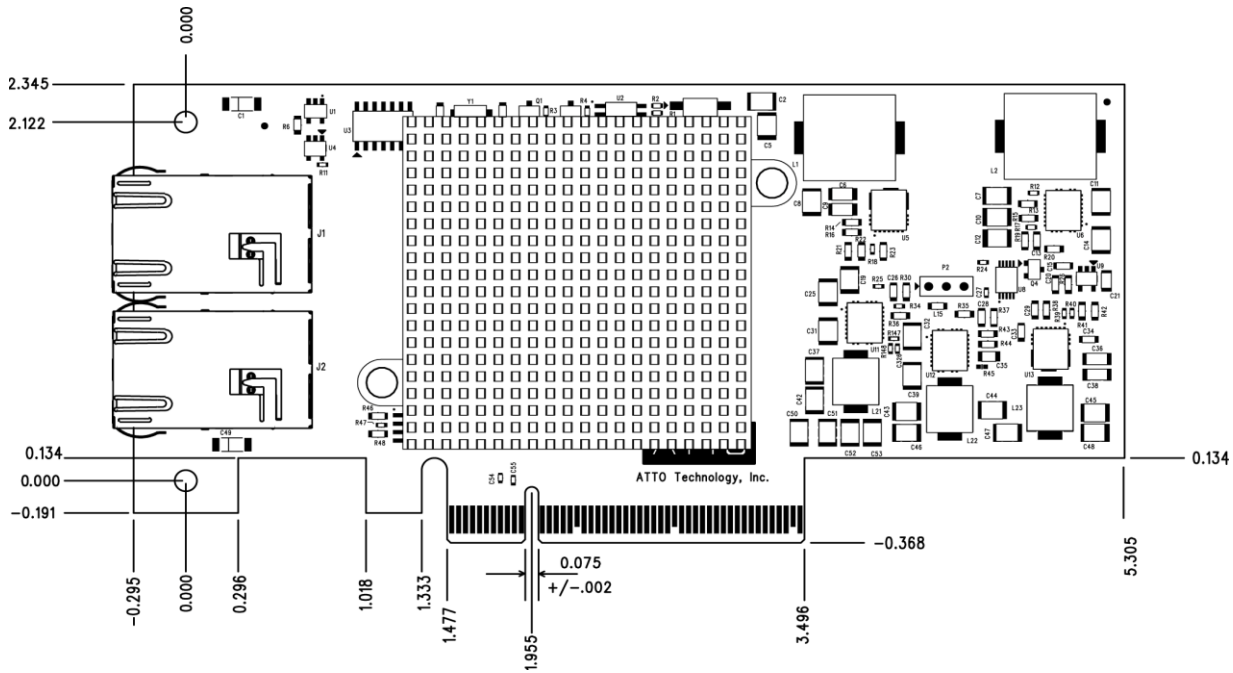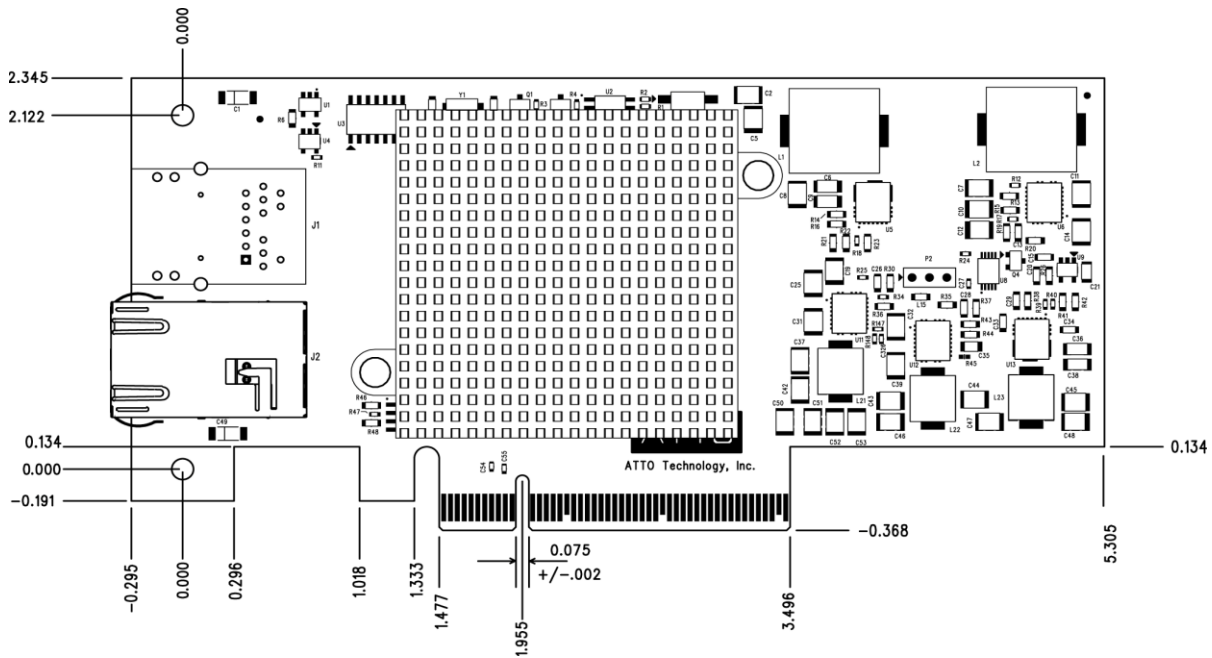
Exhibit 11 FFRM-NT12 board

ATTO Technology, Inc.

Exhibit 12 FFRM-NT11 board

ATTO Technology, Inc.

4 Troubleshooting

This chapter contains solutions for the most common problems you might encounter. If you need additional assistance, please refer to the ATTO Technology website, www.atto.com, or contact an authorized ATTO Technology representative.

General suggestions

- Check each cable connection on every device.
- Verify all cables are in proper working condition. Loose or broken cables are often the cause of errors or problems.

- Check that connected devices are plugged into an AC outlet and are turned on before you add power to your computer.

Windows

- If working properly the NIC should appear in the Device Manager.
- If the FastFrame NIC does not appear under the Network Adapters:

1. Remove power from the PC.
2. Open the case.
3. Check that the FastFrame NIC adapter is properly seated in the PCI slot.
4. Replace the case and apply power.

- If the adapter has been identified but there is an exclamation point (!) on the listing:

1. Right click on the listing and select Uninstall.
2. Reload the driver (see **Driver Installation**).
3. Reboot the system and repeat the installation process.

Note *If problems persist, contact your authorized ATTO Technology representative.*

Linux

1. Verify the FastFrame driver is loaded with the lsmod command. If lsmod does not show the driver, refer to the installation instructions to install and load the driver in **Driver Installation**.
2. Check the system log with the command dmesg. The FastFrame driver creates status messages during

initialization. Make sure that all installed cards are properly detected and initialized.

Note *Advanced users only. Modify the driver makefile to enable debugging information. Upon loading, the FastFrame driver displays detailed debugging information which may help troubleshoot the problem.*

macOS

1. Open the ATTO ConfigTool by downloading it from the ATTO website. Refer to the ATTO Utilities Installation and Operations Manual for additional information.
2. If the adapter does not appear in the System Profiler, make sure the card is seated properly in the PCIe slot.

   a. Shut down and remove power from the Mac.
   b. Remove the side of the case.
   c. Check the PCIe slot
   d. Replace the side of the case.
   e. Apply power

Note *If the Fastframe adapter is properly seated and devices are still not accessible check the cable to verify the link light is illuminated. If not contact an authorized ATTO representative.*

3. Verify the driver is loaded.

   a. Click on the adapter name in the Device Listing to view the Basic Info screen.
   b. If the Driver Information section indicates Unknown: driver not loaded, reinstall the driver. Refer to **Driver Installation.**
   c. If reinstalling the driver does not fix the problem, contact an authorized ATTO representative.

4. Reset the NVRAM for all channels to defaults and reboot. If the problem persists, contact an authorized ATTO representative.

Note *When calling ATTO Technical Support please have a printout of the IOreg listing, Apple System Profiler, Serial number of the adapter, and what driver and firmware that is currently loaded in your Apple computer.*

Appendix A Glossary

Some terms used in the Fibre Channel industry are defined below. More information is available through the ATTO Technology website (www.atto.com), the Fibre Channel Industry Association (www.fibrechannel.com), Cern (www.cern.ch), the Storage Area Networking Industry Association ((www.snia.org), the Fibre Channel Consortium (www.iol.unh.edu/consortiums, click on FC) and the Ethernet Alliance (http://www.ethernetalliance.org/).

Term	Definition
ANSI	American National Standards Institute
BER	Bit Error Rate: a measure of transmission accuracy; the ratio of bits received in error to bits sent
bit	Smallest unit of data a computer can process: a single binary digit with a value of either 0 or 1
bus	A collection of unbroken signal lines used to transmit information from one part of a computer system to another; taps on the lines connect devices to the bus
byte	An ordered set of 8 bits
channel	A point-to-point link which transports data from one point to another
CPU	Central Processing Unit: the portion of the computer that actually performs computations
CRC	Cyclic Redundancy Check: an error-correcting code which calculates a numeric value for received and transmitted data; if no error has occurred during transmission, the CRC for both received and transmitted data should be the same
device driver	A program that allows a microprocessor to direct the operation of a peripheral device
DMA	Direct Memory Access: a way to move data from a storage device directly to RAM without using the CPU's resources
DMA bus master	Allows a peripheral to control the flow of data to and from system memory by block as opposed to allowing the processor to control the data by bytes (PIO or programmed I/O)
fabric	A Fibre Channel switch of two or more Fibre Channel switches interconnected to physically transmit data between any two N Ports on the switch or switches
FC	Fibre Channel
FCF	Fibre Channel Forwarder
FCoE	Fibre Channel over Ethernet
frame	An indivisible unit for transfer of information in Fibre Channel
frame header	The first field in the frame containing the address and other control information about the frame
full-duplex	A communication protocol which allows transmission in both directions at the same time

half duplex	A communication protocol which allows transmission in both directions, but only one direction at a time
host	A processor, usually a CPU and memory, which communicates with devices over an interface
initiator device	A component which originates a command
LED	Light-emitting diode: a type of diode that emits light when current passes through it; visible LEDs are used as indicator lights on all sorts of electronic devices
LUN	Logical Unit Number: an identifier for a logical unit (0-7)
MAC	Media Access Controller
MAC Address	A unique address assigned to an ethernet device
multi-mode fiber	An optical fiber which can carry several beams of light at once
N_port	A port attached to a node used with point to point or fabric configurations
originator	An initiating device; a component which originates a command
parity checking	A method which verifies the accuracy of data transmitted over the SCSI bus by adding one bit in the transfer to make the sum of all the bits either odd or even (for odd or even parity); an error message occurs if the sum is not correct
PCI	Peripheral Component Interconnect. Allows peripherals to be connected directly to computer memory, bypassing the slower ISA and EISA busses
point-to-point	A topology where two ports communicate
port	An access point in a device: see N_port, NL_port, etc.
port address	Also port number; the address, assigned by the PCI bus, through which commands are sent to a host adapter board
port number	See port address
receiver	The ultimate destination of data transmission; a terminal device
scatter/gather	A device driver feature which allows the host adapter to modify a transfer data pointer so that a single host adapter can access many segments of memory, minimizing interrupts and transfer overhead
SAS	Serial Attached SCSI: a serial SCSI bus technlogy anod point to point architecture for connecting host bus adapters to storage devices
SATA	Serial AT Attachment: a serial ATA bus technology and point to point architecture for connecting host bus adapters to storage devices

scatter/gather	A device driver feature which allows the host adapter to modify a transfer data pointer so that a single host adapter can access many segments of memory, minimizing interrupts and transfer overhead
SCSI	Small Computer Systems Interface: a processor-independent standard for system-level interface between a computer and intelligent devices including hard disks, floppy disks, CD-ROM, printers, scanners, etc.
single-mode fiber	An optical fiber with a small core which supports one wavelength (ray of light); the core radius is nearly equal to the wavelength of the source
SNMP	Simple Network Management Protocol: a standard for monitoring network-attached devices
topology	Logical layout of the parts of a computer system or network and their interconnections
transceiver	A transmitter/receiver module
transfer rate	The rate at which bytes or bits are transferred, as in megabytes or gigabits per second

Appendix B Standards and Compliances

FCC standards: radio and television interference

This equipment has been tested and found to comply with the limits for a Class B digital device (NQ41 and NQ42 are Class A), 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 instruction manual, may cause interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause 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

Canadian standards

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.

European standards

Declaration of Conformity

This following statement applies to the FastFrame CNA host adapter.

This device has been tested in the basic operating configuration and found to be compliant with the following European Union standards: Application of Council Directive: 2004/108/EC Standard(s) to which conformity is declared: EN55024:1998 +A1:2001 +A2:2003; EN55022:2006 +A1:2007 CLASS B.

This Declaration will only be valid when this product is used in conjunction with other CE approved devices and when the entire system is tested to the applicable CE standards and found to be compliant

Japanese standards

この装置は、クラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。　　　VCCI－B

Voluntary Control Council for Interference by Information Technology Equipment (VCCI, Japan)

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

Compliances

ATTO FastFrame cards comply with Directive 2011/65/EU on the Restriction of the Use of Hazardous Substances in Electrical and Electronic Equipment (RoHS). Contact your ATTO representative regarding RoHS compliant products.

The FastFrame family of adapters take the following RoHS exemptions:

7(a) - Lead in high melting temperature type solders (i.e. lead based alloys containing 85% by weight or more lead).

7(c)-I - Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, (e.g. piezoelectronic devices, or in a glass or ceramic matrix compound).

13(a) - Lead in white glasses used for optical applications.

15 - Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages.

Appendix C Safety, Warranty

All ATTO host adapter products have been tested to meet applicable safety standards when operated in proper electrical and thermal environments.

Safety

Please review the specifications for your specific host adapter before installing and operating it in any computer system to ensure compatibility.

Installation

Before installing an ATTO host adapter product into your computer system, unplug the computer from its electrical power source and allow adequate time for electrical discharge and the internal components to cool down before removing the computer system cover. This will decrease the risk of personal injury from electrical shock or touching the hot surface of an electrical component. Once an ATTO host adapter is installed in a computer system, the computer cover must be reinstalled properly before turning the computer system back on.

Operation

ATTO host adapters require adequate cooling to function properly. If you have any questions as to the airflow provided by your computer system, please refer to your computer system manual or contact your computer system manufacturer.

To facilitate proper air circulation, ATTO host adapters should never be operated in a computer system without the cover installed or with an inoperable fan as this may cause safety or thermal problems which could damage the ATTO host adapter and void the warranty.

ATTO Technology, Inc. Limited Warranty

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

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

ATTO IS NOT RESPONSIBLE FOR DAMAGE TO OR LOSS OF ANY DATA, PROGRAMS OR ANY MEDIA. THE PRODUCTS ARE NOT INTENDED FOR USE IN: (I) MEDICAL DEVICES OR THE MEDICAL FIELD; OR (II) USE IN RUGGED APPLICATIONS.ATTO IS NOT LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, IRRESPECTIVE OF WHETHER ATTO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NO ATTO DEALER, AGENT OR EMPLOYEE IS AUTHORIZED TO MAKE ANY MODIFICATION, EXTENSION OR ADDITION TO THIS WARRANTY. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.