Adnacom Inc.

200 - 5050 Kingsway

Burnaby, BC V5H 4H2, Canada

https://adnacom.com/

Adnacom S18 64 GT/s
PCIe Gen 3 Fiber-Optic Extension System

User's Guide

Revision 1.0

Contents

1 Terminology 4
2 System Description 6
2.1 Overview 6
2.2 Transceivers and Cables 8
2.2.1 Transceiver and Cable Types 8
2.2.2 Cable Length 8
2.2.3 Transceiver and Cable Qualification 8
3 H18A PCIe Adapter 9
3.1 H18A Overview 9
3.2 H18A Drawing 9
3.3 H18A DIP Switches in Host Mode (S2.8 = OFF) 10
3.4 H18A DIP Switches in Target Mode (S2.8 = ON) 11
3.5 H18A LEDs 13
3.6 H18A Connectors 14
4 R10 PCIe x8 Backplane 15
4.1 R10 Drawing 15
4.2 R10 Buttons 16
4.3 R10 LEDs 16
4.4 R10 Connectors 16
4.5 R10 Reference Schematic 17
5 System Installation 18
5.1 Preparing the Computer 18
5.2 Configuring Host and Target Adapters 18
5.3 Installing the H18A Host Adapter 18
5.4 Selecting a Power Supply for the R10 Backplane 19
5.5 Installing the R10 Backplane and H18A Target Adapter 19
5.6 Installing the User's PCIe Card in the R10 Backplane 19
5.7 Installing QSFP Transceivers and Connecting Fiber-Optic Cables 20
6 System Operation 21
6.1 Power-On Sequence 21
6.2 Manual Power-On/Off Sequence (Power Modes 1 and 2) 21
6.3 Automatic Power-On/Off Sequence (Power Mode 3) 21
7 System Functionality Verification 22
8 Installing the R10 in an ATX Chassis 25
9 Designing a Custom R10 Backplane 26
10 Using the R10 with a Custom Power Supply 27
10.1 Custom Power Supply Requirements 27
10.2 Power Cable 28

11 Monitor Utility 29
11.1 Overview 29
11.2 Monitoring Parameters 29
11.3 Firmware Update 32
11.4 Application Programming Interface (API) 34
12 Ethernet Web Interface 35
12.1 Overview 35
12.2 IP Configuration 35
12.2.1 User-Defined IP Configuration (S1.7 = OFF, S1.8 = ON) 36
12.3 Accessing the Web Interface 36
13 Troubleshooting 37
13.1 Overview 37
13.2 System Context Diagram 37
13.3 Troubleshooting Algorithm 37
13.3.1 Identify the Problem 37
13.3.2 Review the Operating and Installation Instructions 38
13.3.3 Verify the Computer and Add-in Card 38
13.3.4 Verify the H18A Host Adapter 38
13.3.5 Verify the QSFP Cables on the Host Side 38
13.3.6 Verify the H18A Target Adapter and R10 Backplane 38
13.3.7 Verify the Add-in Card 39
13.4 Operating and Performance Problems 39
13.5 Cable Problems 39
13.6 Two-Cable Link Problems 40
13.7 R10 Automatic Power-On/Off Problems 40
13.8 Customer Support 40
14 Product Design Disclaimer 41
15 Customer Support 42
16 Warranty 43

1 Terminology

The common terms used in this guide are listed in Table 1.1.

Table 1.1. Common Terms

Term	Description
Add-in card	A card that plugs into a connector and is mounted in a chassis
AOC	Active optical cable
ATX	ATX is a system board form factor. Refer to the ATX Specification.
xN	A link with N lanes
DAC	Direct attach cable
Downstream	The ports on a switch other than the upstream port are downstream ports.
EMI	Electromagnetic interference
ESD	Electrostatic discharge
Gb/s	Gigabits per second
GT/s	Gigatransfers per second
Gen 1	PCIe 2.5 GT/s
Gen 2	PCIe 5 GT/s, backward compatible with Gen 1
Gen 3	PCIe 8 GT/s, backward compatible with Gen 1 and Gen 2
H18A	The Adnacom-H18A is a PCIe cable adapter that can operate as either the host or target adapter. The operating mode is selected by the S2.8 DIP switch.
Host adapter	An H18A installed in the host computer, with S2.8 = OFF
Lane	A lane consists of two differential signal pairs: one pair for transmission and one pair for reception. An xN link is composed of N lanes.
Link	A link consists of two ports and their interconnecting lanes. It provides a dual-simplex communications path between two components.
microATX	microATX is a system board form factor. Refer to the microATX Specification.
NC	Not connected
OS	Operating system
PCIe	Interconnect standard for PCI Express cards
PCIe switch	A device that connects two or more ports and routes PCIe packets between them
Port	A logical interface between a component and a PCI Express link

Term	Description
QSFP	Quad small form-factor pluggable transceiver
R10	Adnacom-R10 backplane
RMA	Return merchandise authorization
Root complex	A device that connects the processor and memory subsystem to PCI Express switches and devices
S18	Adnacom-S18 system
Target adapter	An H18A installed in the R10 backplane, with S2.8 = ON
Upstream	The port on a switch that is topologically closest to the root complex is the upstream port.

2 System Description

2.1 Overview

The S18 is a multi-lane PCI Express Gen 3 extension system. It consists of an H18A host adapter installed in the host computer, an H18A target adapter installed in the R10 backplane, a PCIe add-in card installed in the R10 backplane, and one or two cables connecting the host and target adapters, as shown in Figure 2.1 and Figure 2.2. The H18A host adapter can also connect to two H18A or H14 target adapters, using one cable per target adapter, as shown in Figure 2.3. For this configuration, the host H18A must be configured with two x4 ports (S1.1 = ON, S1.2 = OFF). Either or both ports can connect to a target adapter.

Figure 2.1. S18 with Two Cables

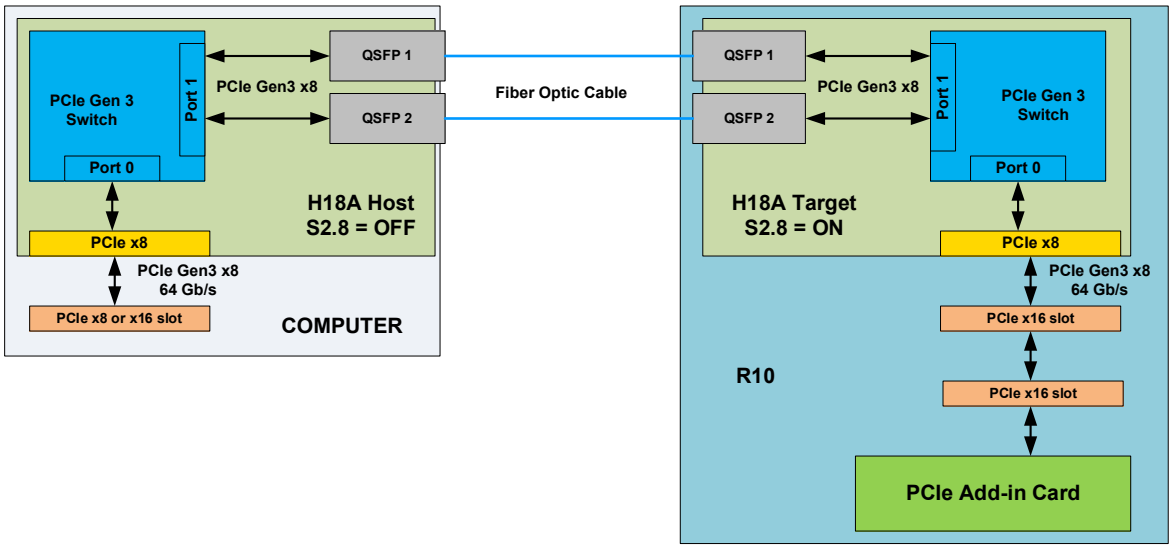


Figure 2.2. S18 with One Cable

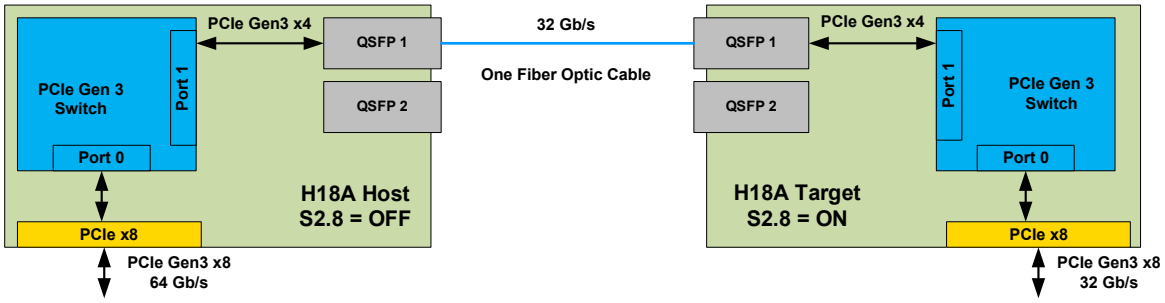
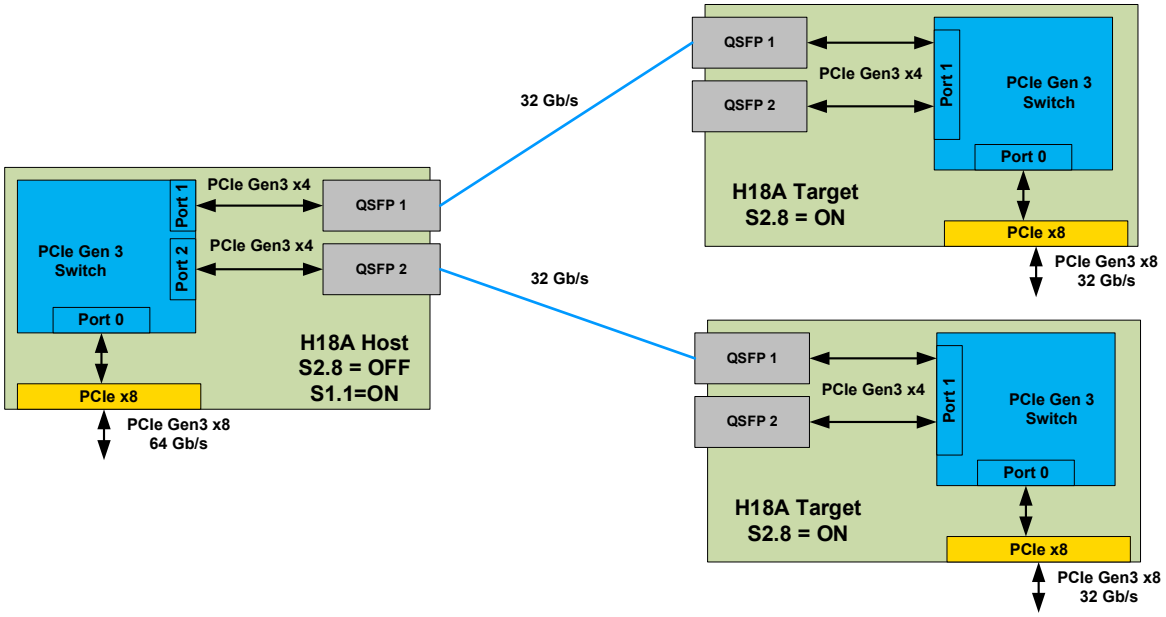


Figure 2.3. H18A with Two Target Adapters



2.2 Transceivers and Cables

2.2.1 Transceiver and Cable Types

The S18 is compatible with various transceivers and cables, including:

- QSFP transceivers connected by a fiber-optic cable. Transceivers are available with LC and MPO/MTP connectors and support single-mode and multimode cables. In QSFP transceivers with an LC connector, four PCIe lanes are optically multiplexed onto a single duplex fiber link.
- QSFP active optical cable (AOC)
- QSFP direct attach cable (DAC)
- Fiber-optic rotary joint (FORJ)

2.2.2 Cable Length

The typical maximum lengths for LC-LC cables are shown in Table 2.1.

Table 2.1. LC-LC Cable Maximum Length

Cable Type	Typical Maximum Length
Multimode OM3 50/125 µm	250 m
Multimode OM4 50/125 µm	350 m
Single-mode OS1 9/125 µm	500 m
Single-mode OS2 9/125 µm	500 m

For AOC and DAC assemblies, refer to the maximum length specified by the cable manufacturer.

Cable length affects data transfer performance. For detailed benchmark test results, refer to the S18 product page at https://adnacom.com/s18/.

2.2.3 Transceiver and Cable Qualification

Not all optical transceivers and AOCs are guaranteed to work reliably with the PCIe interface. Adnacom provides qualified transceivers and cables as part of the supplied systems. We recommend purchasing the S18 with Adnacom transceivers for initial testing and evaluation. Customers can qualify other transceivers and cables. However, manufacturers often update optical components without changing the part numbers, so customers must maintain appropriate revision control with the manufacturer.

Transceivers should consume less than 1.5 W to keep their temperatures within the recommended operating range. If transceiver power consumption exceeds 1.5 W, install heat sinks on the QSFP cages and ensure adequate airflow. The transceiver case temperature and its maximum and minimum limits can be checked using the monitor utility described in Section 11.

3 H18A PCIe Adapter

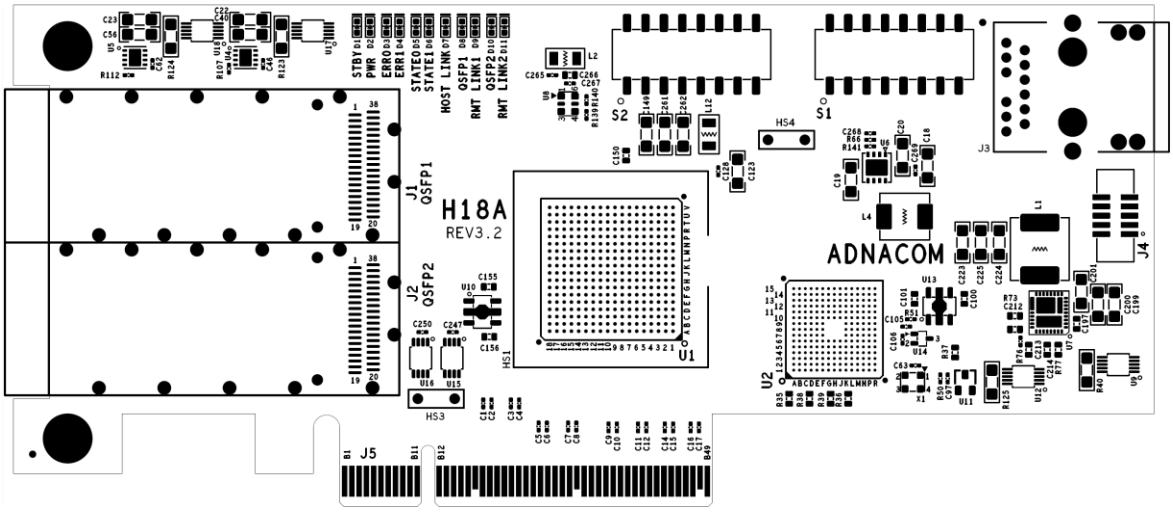
3.1 H18A Overview

The H18A is a PCIe Gen 3 cable adapter with two QSFP connectors. The board can function as either the host or target adapter, with the operating mode selected by the S2.8 DIP switch described in Table 3.2 (host mode) and Table 3.4 (target mode). The host H18A is installed in the computer, and the target H18A is installed in the ADNACOM ADAPTER CARD slot on the R10 backplane.

3.2 H18A Drawing

The H18A board layout is shown in Figure 3.1.

Figure 3.1. H18A Drawing



3.3 H18A DIP Switches in Host Mode (S2.8 = OFF)

Table 3.1. H18A S1 DIP Switch in Host Mode

<table>
<tr><th>Switch</th><th>Description</th><th>Default</th></tr>
<tr><td>1:2</td><td>Cable Interface Configuration
<table>
<tr><th>S1.1</th><th>S1.2</th><th>Configuration</th></tr>
<tr><td>OFF</td><td>OFF</td><td>One x8 port</td></tr>
<tr><td>ON</td><td>OFF</td><td>Two x4 ports</td></tr>
<tr><td>OFF</td><td>ON</td><td>Four x2 ports (two ports per QSFP connector)</td></tr>
<tr><td>ON</td><td>ON</td><td>Reserved</td></tr>
</table>
Notes:
1. The configuration with two x4 ports is used when the H18A connects to two H18A or H14 target adapters, with one cable connected to each target adapter.
2. The configuration with four x2 ports is not used in the S18.</td><td>OFF
OFF</td></tr>
<tr><td>3</td><td>Gen 2 Cable Interface
OFF – Gen 3
ON – Gen 2 (limits the cable interface speed to 5 GT/s)
Note: S2.1 must be set to OFF.</td><td>OFF</td></tr>
<tr><td>4</td><td>Optical Reset
OFF – Disabled
ON – Enabled. The lasers are turned off during a computer reset.
Note: The S18 does not support optical reset.</td><td>OFF</td></tr>
<tr><td>5</td><td>Hot-Plug Capability
OFF – The Hot-Plug Surprise and Hot-Plug Capable bits are not set.
ON – The Hot-Plug Surprise and Hot-Plug Capable bits are set.</td><td>OFF</td></tr>
<tr><td>6</td><td>Wake Enable
OFF – Wake is disabled.
ON – Wake is enabled.</td><td>OFF</td></tr>
<tr><td>7:8</td><td>IP Configuration
<table>
<tr><th>S1.7</th><th>S1.8</th><th>Configuration</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Static IP address 192.168.100.101</td></tr>
<tr><td>OFF</td><td>ON</td><td>User-defined IP configuration. Refer to Section 12.</td></tr>
<tr><td>ON</td><td>OFF</td><td>Static IP address 192.168.100.103</td></tr>
<tr><td>ON</td><td>ON</td><td>Static IP address 192.168.100.105</td></tr>
</table></td><td>OFF
OFF</td></tr>
</table>

Table 3.2. H18A S2 DIP Switch in Host Mode

Switch	Description	Default
1	**Gen 1 Cable Interface** OFF – Speed is defined by the S1.3 DIP switch setting. ON – Gen 1 (limits the cable interface speed to 2.5 GT/s)	OFF
2	Reserved. Set to OFF.	OFF
3	**Cable Port Link-Width Downtraining Disable** OFF – Downtraining is enabled. ON – Downtraining is disabled. **Note:** Disabling downtraining may improve link training for some transceivers. Contact Adnacom for recommended settings.	OFF
4	Reserved. Set to OFF.	OFF
5	Reserved. Set to OFF.	OFF
6	Reserved. Set to OFF.	OFF
7	Reserved. Set to OFF.	OFF
8	**Mode** OFF – Host	OFF

3.4 H18A DIP Switches in Target Mode (S2.8 = ON)

Table 3.3. H18A S1 DIP Switch in Target Mode

Switch	Description	Default
1	Reserved. Set to OFF.	OFF
2	Reserved. Set to OFF.	OFF
3	Reserved. Set to OFF.	OFF
4	Reserved. Set to OFF.	OFF
5	**Hot-Plug Capability** OFF – The Hot-Plug Surprise and Hot-Plug Capable bits are not set. ON – The Hot-Plug Surprise and Hot-Plug Capable bits are set.	OFF
6	Reserved. Set to OFF.	OFF

<table>
<tr><th>Switch</th><th>Description</th><th>Default</th></tr>
<tr><td>7:8</td><td>IP Configuration
<table>
<tr><th>S1.7</th><th>S1.8</th><th>Configuration</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Static IP address 192.168.100.101</td></tr>
<tr><td>OFF</td><td>ON</td><td>User-defined IP configuration. Refer to Section 12.</td></tr>
<tr><td>ON</td><td>OFF</td><td>Static IP address 192.168.100.103</td></tr>
<tr><td>ON</td><td>ON</td><td>Static IP address 192.168.100.105</td></tr>
</table></td><td>OFF
OFF</td></tr>
</table>

Table 3.4. H18A S2 DIP Switch in Target Mode

<table>
<tr><th>Switch</th><th>Description</th><th>Default</th></tr>
<tr><td>1</td><td>Reserved. Set to OFF.</td><td>OFF</td></tr>
<tr><td>2</td><td>Reserved. Set to OFF.</td><td>OFF</td></tr>
<tr><td>3:4</td><td>Power Control
<table>
<tr><th>S2.3</th><th>S2.4</th><th>Description</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Power is turned on and off using the power button SW2 on the R10.</td></tr>
<tr><td>ON</td><td>OFF</td><td>Power is always on.</td></tr>
<tr><td>OFF</td><td>ON</td><td>Power is turned on and off automatically with the computer.</td></tr>
<tr><td>ON</td><td>ON</td><td>Reserved</td></tr>
</table></td><td>OFF
OFF</td></tr>
<tr><td>5</td><td>Reserved. Set to OFF.</td><td>OFF</td></tr>
<tr><td>6</td><td>Reserved. Set to OFF.</td><td>OFF</td></tr>
<tr><td>7</td><td>Reserved. Set to OFF.</td><td>OFF</td></tr>
<tr><td>8</td><td>Mode
ON – Target</td><td>ON</td></tr>
</table>

3.5 H18A LEDs

Table 3.5. H18A LEDs

LED	Color	Description
D1	Red	**Standby Status:** ON – Standby mode OFF – The computer power supply is on, or the +3.3Vaux supply is off. **In target mode:** Blinking – The slot's 12 V or 3.3 V supply is below the levels defined in the ATX Power Supply Specification, or the backplane PWR_OK signal is asserted low.
D2	Green	**Computer Power Status:** ON – The computer power supply is on. OFF – The computer power supply is off.
D3, D4	Red	**Error Status:** Reserved
D5, D6	Green	**Status:** Reserved
D7	Blue	**Host Link Status:** The status is described in Table 3.6.
D8	Green	**QSFP 1 Status:** The status is described in Table 3.7.
D9	Blue	**Remote Link 1 Status:** Port 1 link status is described in Table 3.6.
D10	Green	**QSFP 2 Status:** The status is described in Table 3.7.
D11	Blue	**Remote Link 2 Status:** Port 2 link status is described in Table 3.6. In the configuration with one x8 port, the status is the same as the Remote Link 1 status when QSFP 2 is connected to the remote device.

Table 3.6. PCIe Link Status

PCIe Link LED	Description
OFF	The link is down.
Blinking, 0.5 s on, 0.5 s off (1 Hz)	The link is up at 2.5 GT/s.
Blinking, 0.25 s on, 0.25 s off (2 Hz)	The link is up at 5.0 GT/s.
ON	The link is up at 8.0 GT/s.

Table 3.7. QSFP Status

QSFP LED	Description
OFF	The QSFP is not powered.
Blinking, 0.25 s on, 0.25 s off (2 Hz)	The received optical power is below the worst-case receiver sensitivity.
ON	The transmitter and receiver are on.

3.6 H18A Connectors

The H18A connectors are described in Table 3.8.

Table 3.8. H18A Connectors

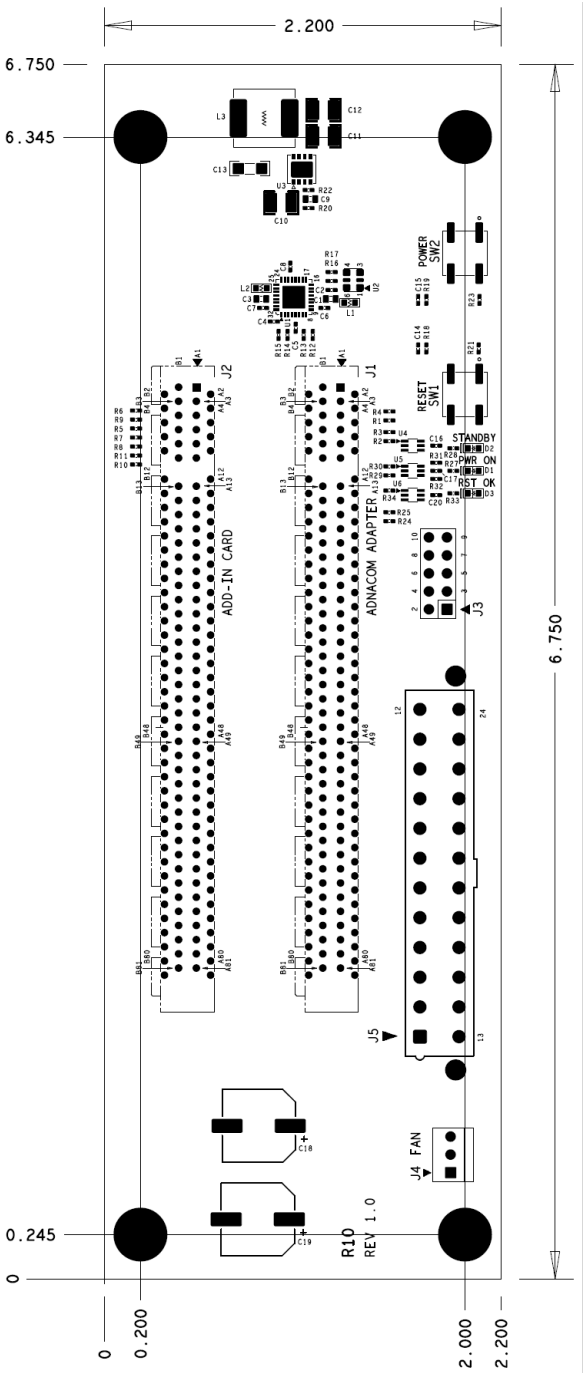
Designator	Description
J1	QSFP 1 connector
J2	QSFP 2 connector
J3	Ethernet connector
J4	Test connector (factory use only)

4 R10 PCIe x8 Backplane

4.1 R10 Drawing

The R10 board layout is shown in Figure 4.1.

Figure 4.1. R10 Drawing



4.2 R10 Buttons

The R10 buttons are described in Table 4.1.

Table 4.1. R10 Buttons

Designator	Description
SW1	Reset button
SW2	Power button

4.3 R10 LEDs

The R10 LEDs are described in Table 4.2.

Table 4.2. R10 LEDs

Designator	Color	Description
D1	Green	**Power:** The R10 is powered.
D2	Red	**Standby:** The R10 is in standby mode.
D3	Red	**Reset:** ON – Reset is asserted. OFF – Reset is deasserted.

4.4 R10 Connectors

The R10 connectors are listed in Table 4.3. The pinouts of the J3 front panel header, J4 fan connector, and J5 power connector are shown in Table 4.4, Table 4.5, and Table 4.6, respectively.

Table 4.3. R10 Connectors

Designator	Description
J1	ADNACOM ADAPTER CARD – PCI Express x16 slot for the target H18A
J2	ADD-IN CARD – PCI Express x16 slot for the user's PCIe card
J3	Front panel header
J4	Fan connector
J5	Power connector (ATX24)

Table 4.4. J3 Front Panel Header

Pin	Signal Name
1	Power ON LED (+)
3	Power ON LED (–)
2	Standby LED (+)
4	Standby LED (–)
5	GND
6	GND
7	Power ON/OFF Switch
9	Power ON/OFF Switch
8	Reset Switch
10	Reset Switch

Table 4.5. J4 Fan Connector

Pin	Signal Name
1	GND
2	+12 V
3	Not connected

Table 4.6. J5 Power Connector

Pin	Signal Name	Pin	Signal Name
1	+3.3VDC	13	+3.3VDC
2	+3.3VDC	14	Not connected
3	GND	15	GND
4	Not connected	16	PS_ON#
5	GND	17	GND
6	Not connected	18	GND
7	GND	19	GND
8	PWR_OK	20	Not connected
9	+5VSB	21	Not connected
10	+12VDC	22	Not connected
11	+12VDC	23	Not connected
12	+3.3VDC	24	GND

4.5 R10 Reference Schematic

The R10 schematic can be downloaded from the S18 product page at https://adnacom.com/s18/.

5 System Installation

5.1 Preparing the Computer

- We strongly recommend updating your computer's BIOS and OS. Download the latest BIOS update and installation instructions from the computer or motherboard manufacturer's website.
- The H18A does not support overclocking. Ensure that the PCI Express clock frequency in the BIOS is set to the default value or to 100 MHz.
- The optical transceivers do not support PCI Express link power management. Therefore, all PCIe power management features must be disabled in the BIOS and OS. Step-by-step instructions for Windows and Linux can be downloaded from the S18 product page at https://adnacom.com/s18/. For other operating systems, please refer to the OS documentation or contact the OS vendor for assistance.

5.2 Configuring Host and Target Adapters

- Configure one of the H18A adapters as the host adapter by setting S2.8 = OFF.
- Configure the other H18A adapter as the target adapter by setting S2.8 = ON.
- On the host adapter, set S1.1 = OFF and S1.2 = OFF for one x8 port, or set S1.1 = ON and S1.2 = OFF for two x4 ports.
- Set the cable interface speed on the host adapter. To limit the speed to Gen 2, set S1.3 = ON and S2.1 = OFF. To limit the speed to Gen 1, set S2.1 = ON.
- Set up the power control mode on the target H18A as shown in Table 5.1.

Table 5.1. Target H18A Power Control Modes

Mode	Target H18A S2 Switch	Description
1	S2.3 = OFF, S2.4 = OFF	Power is turned on and off using the momentary button SW2 on the R10 or an external momentary switch connected to pins 7 and 9 of the R10 J3 header.
2	S2.3 = ON, S2.4 = OFF	The power supply and the R10 are always on. This mode should be used with a custom power supply.
3	S2.3 = OFF, S2.4 = ON	Power is turned on and off automatically when the computer is turned on and off.

5.3 Installing the H18A Host Adapter

- Power off the host computer and unplug its power cord.
- Remove the computer's cover.
- Insert the H18A adapter into any x8 or x16 slot on the motherboard. Fit the low-profile bracket first if the chassis requires it.
- Secure the adapter to the computer chassis using the retaining screw.

- Ensure sufficient airflow to keep the PCIe switch and transceiver temperatures below their maximum limits. The temperatures can be verified with the monitor utility described in Section 11.
- Connect the power cord and verify that the red standby LED D1 is on when the computer is off. If the standby LED is off, it indicates that there is no +3.3Vaux voltage at the PCIe slot. Check the BIOS settings to enable this voltage or restore the default BIOS settings. After restoring BIOS defaults, reapply the PCIe settings described in Section 5.1 before operating the system.

5.4 Selecting a Power Supply for the R10 Backplane

The R10 backplane is designed to be powered by a standard computer power supply. **Use a power supply with a minimum load requirement of 0 A for all rails to ensure proper operation. Verify this parameter in the power supply datasheet.** Power supplies that meet the ATX Version 3 Multi Rail Desktop Platform Power Supply specification usually have no minimum load requirements. Many standard computer power supplies require a minimum load to maintain a stable output voltage and may not turn on unless an additional load is present. If the installed add-in card does not draw enough current for stable operation, it may be necessary to connect a chassis fan or a load resistor to the 12 V and 3.3 V rails to meet the minimum current requirements specified in the power supply datasheet.

5.5 Installing the R10 Backplane and H18A Target Adapter

- Power off the R10 and disconnect the R10 power supply from its power source before installing or removing cards.
- The R10 can be installed in any microATX or ATX case, as shown in Section 8.
- Install the target H18A in the J1 slot labeled ADNACOM ADAPTER CARD on the R10.
- Connect the main power supply cable (20- or 24-pin connector) to the R10 J5 connector.
- If required, connect a chassis fan to the J4 connector.

5.6 Installing the User's PCIe Card in the R10 Backplane

- Power off the R10 and disconnect the R10 power supply from its power source before installing or removing cards.
- Follow the recommendations and procedures provided by the card manufacturer for installation in standard computer slots.
- Install the user's card in the J2 slot labeled ADD-IN CARD on the R10.

5.7 Installing QSFP Transceivers and Connecting Fiber-Optic Cables

The H18A supports AOCs, DACs, and optical transceivers.

Transceivers must be connected using cables intended for use with those transceivers. Single-mode transceivers must be connected using single-mode OS1 or OS2 cables. Multimode transceivers must be connected using multimode OM3 or OM4 cables. OM1 and OM2 cables are not recommended.

When using QSFP transceivers and optical cables, clean the transceiver and cable connectors with the appropriate tools before installation. Cleaning tool options include Fluke Networks P/N: QUICKCLEAN-1.25-1P, US Conec IBC P/N: 9393, NTT-AT P/N: ATC-NE-R2, or equivalent tools.

The valid cable connections for the S18 are shown in Table 5.2.

Table 5.2. Valid Cable Connections

Cables per Link	Valid Connection	Cable Link
2	**The host cable port is configured as one x8 port.** Host QSFP 1 to target QSFP 1 Host QSFP 2 to target QSFP 2 Both cables must be the same type and length.	x8, 64 GT/s
1	**The host cable port is configured as one x8 port.** • Connect host QSFP 1 to target QSFP 1. • Unplug unused transceivers and cables from the QSFP 2 connectors on both the host and target adapters to prevent link training failure.	x4, 32 GT/s
	The host cable port is configured as two x4 ports. • Connect host QSFP 1 or host QSFP 2 to target QSFP 1. • Unused transceivers and cables may remain connected.	

6 System Operation

6.1 Power-On Sequence

After completing all installation steps, reconnect power to the computer and the R10 power supply. For correct operation, the R10, target adapter, and add-in card must be powered and ready before the computer begins PCIe bus enumeration. In Power Modes 1 and 2, power on the R10 before powering on the computer. In Power Mode 3, the R10 powers on automatically with the computer and must become ready before enumeration begins. If the target adapter or add-in card is not detected, verify the power-on timing and restart the computer.

If the computer does not support PCIe hot-plug functionality, disconnecting a fiber-optic cable or cycling the R10 power while the system is running requires a computer restart.

6.2 Manual Power-On/Off Sequence (Power Modes 1 and 2)

Power-On Sequence

- Power on the R10.
- Power on the computer.

Power-Off Sequence

- Power off the computer.
- Power off the R10.

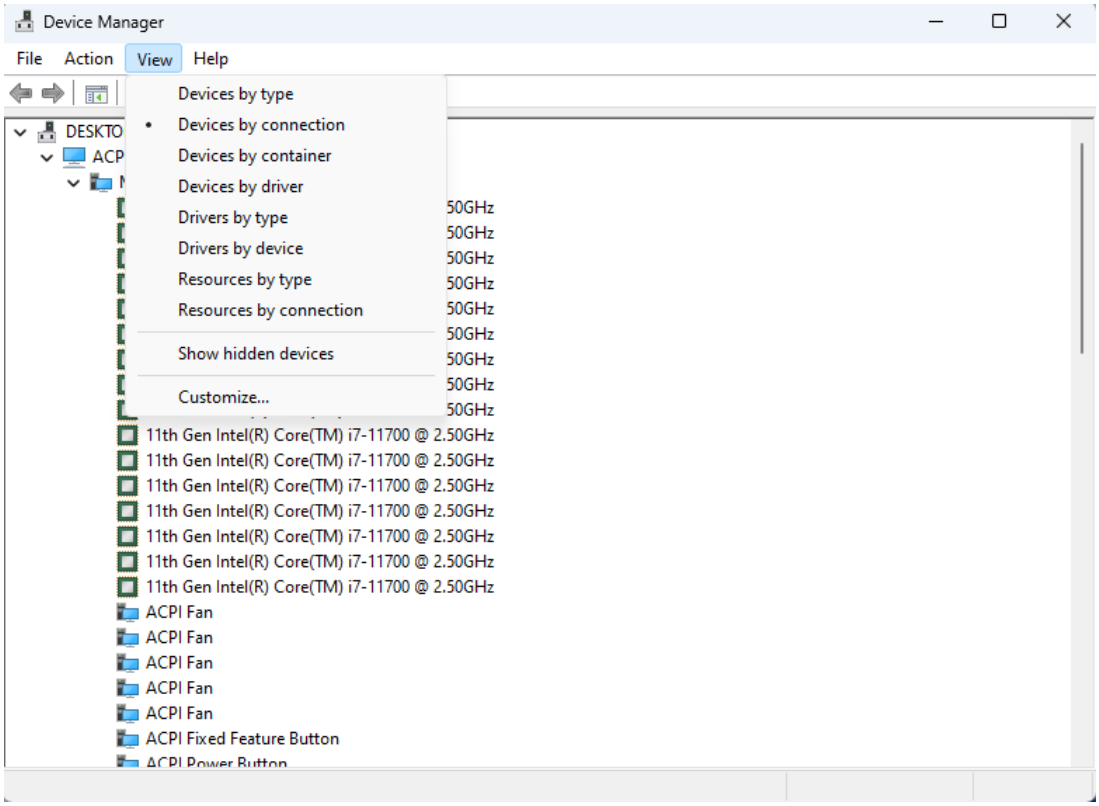
6.3 Automatic Power-On/Off Sequence (Power Mode 3)

In Mode 3, the R10 turns on and off automatically when the computer is turned on or off. This mode can be used only with a standard computer power supply or with a power supply that provides a standby voltage and a control signal for the +3.3 V and +12 V rails.

7 System Functionality Verification

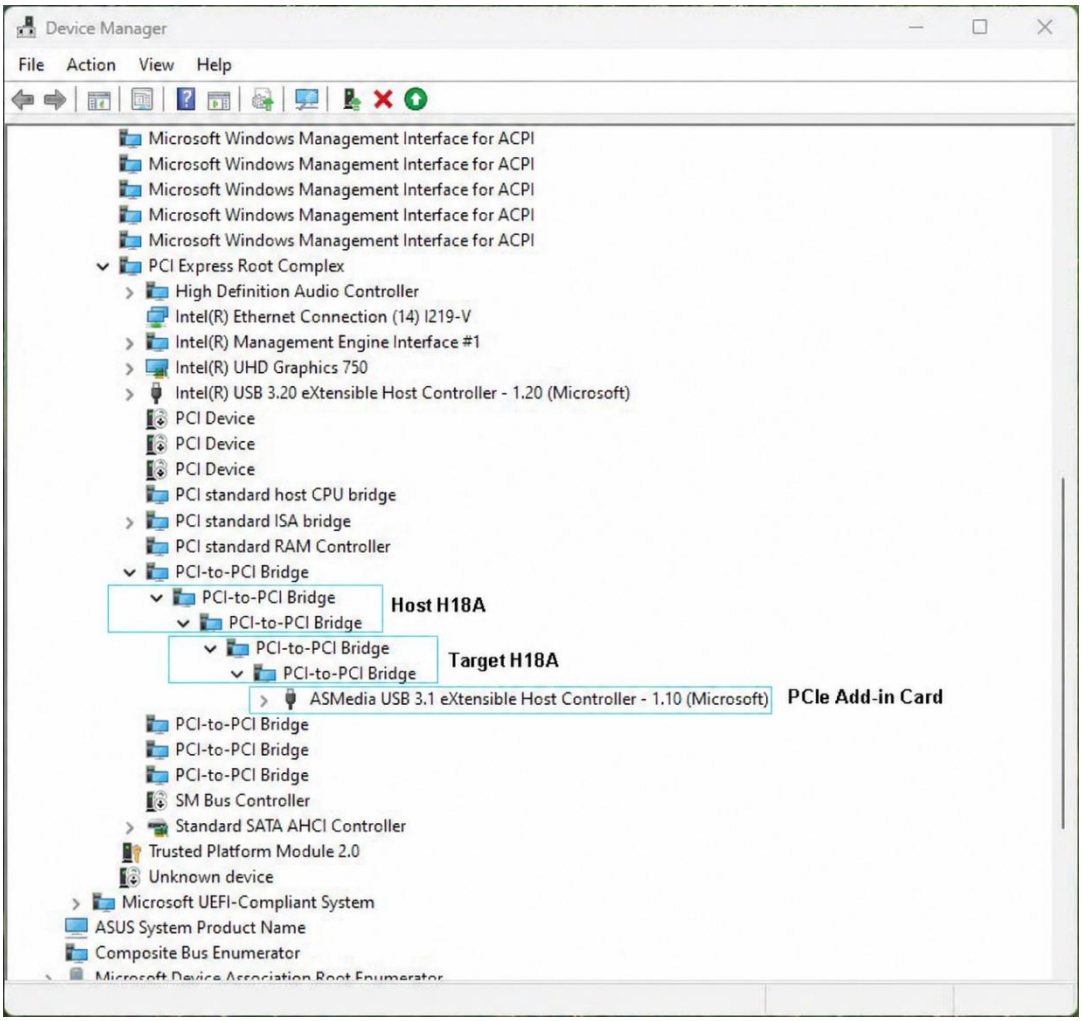
To verify a successful installation on Windows, use **Device Manager**. In **Device Manager,** click the View menu and select "**Devices by connection**." The Device Manager window is shown in Figure 7.1.

Figure 7.1. Device Manager



Expand the ACPI entry. Then, under PCI Bus, find the entries containing "**PCI Express Root**" or "**PCI standard PCI-to-PCI bridge**." Under one of these entries, you should see multiple PCI-to-PCI bridges and your add-in card, as shown in Figure 7.2.

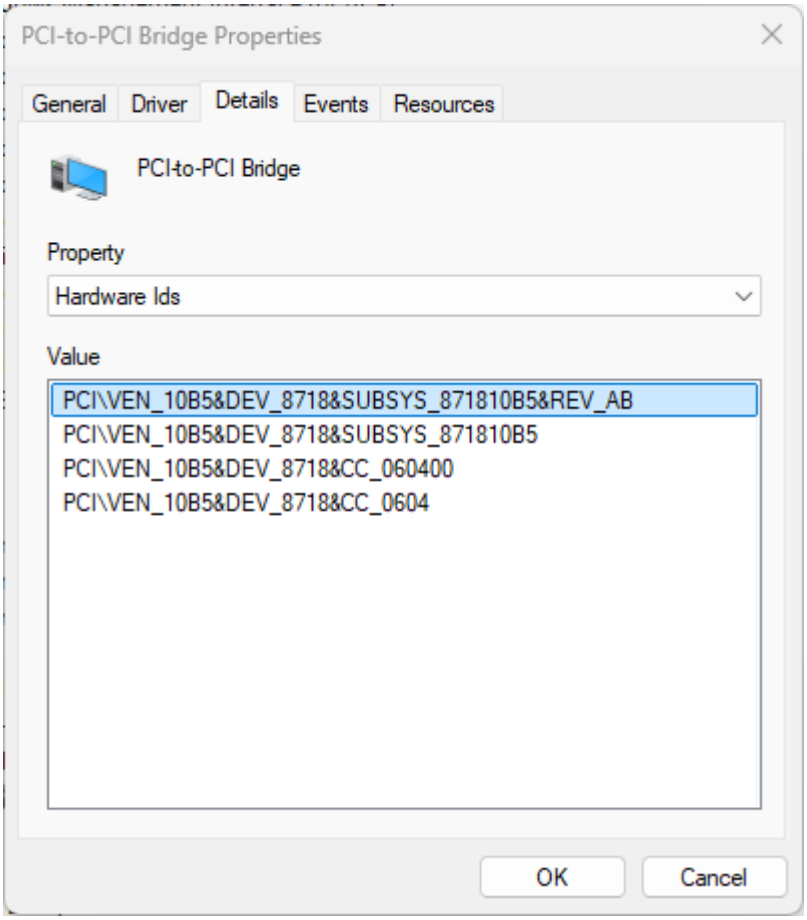
Figure 7.2. S18 System View in Device Manager



Right-click the "**PCI standard PCI-to-PCI bridge**" entry you want to view, then click **Properties.** On the **Details** tab, select Hardware Ids in the Property list to verify the vendor ID and device ID of the selected device.

The H18A PCI-to-PCI bridges report **Vendor ID = 10B5** and **Device ID = 8718,** as shown in Figure 7.3.

Figure 7.3. H18A Hardware IDs



If the installation was unsuccessful, refer to Section 13 (Troubleshooting).

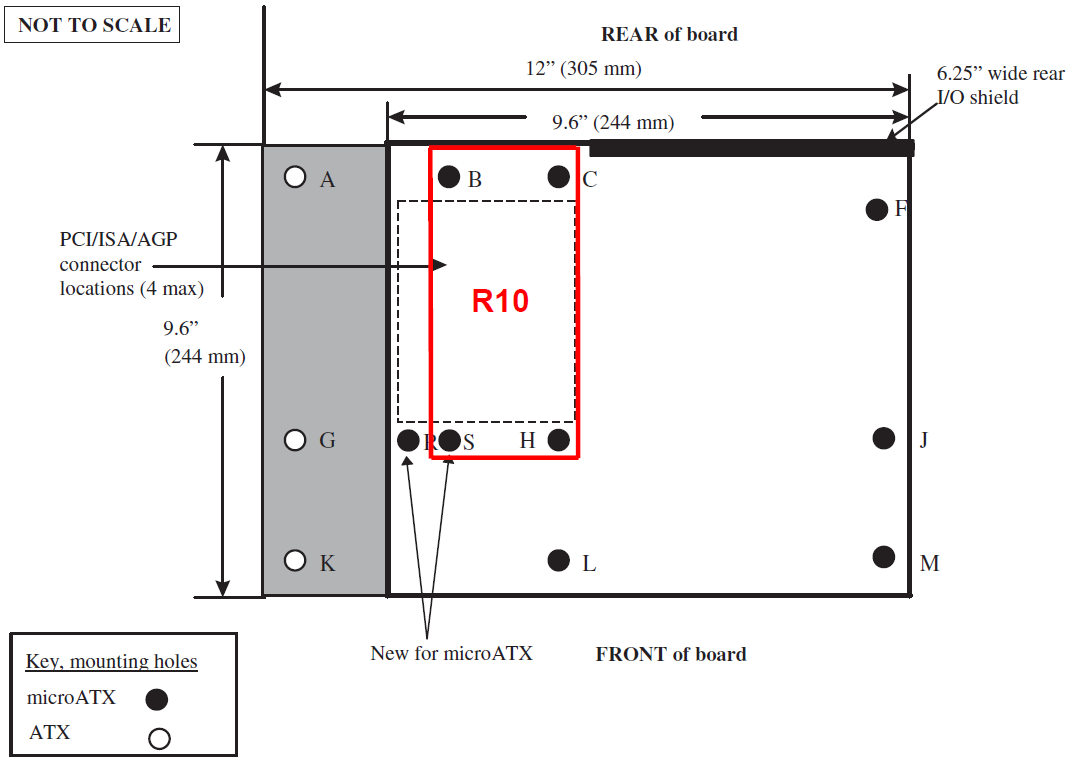
8 Installing the R10 in an ATX Chassis

The R10 can be mounted in any microATX or ATX case using mounting holes B, C, S, and H, as shown in Figure 8.1.

Figure 8.1. R10 Mounting Holes

microATX Motherboard Interface Specification
Version 1.2

To avoid damage to traces on microATX and ATX motherboards, chassis standoffs in any locations not specified for microATX and ATX should be removable or not be implemented at all.



Form factor	Mounting hole locations	Notes
microATX	B, C, F, H, J, L, M, R, S	Holes R and S are added for microATX form factor. Hole B was defined in Full AT format
ATX	A, C, F, G, H, J, K, L, M	Hole F must be implemented in all ATX 2.1-compliant chassis assemblies. It was optional in the ATX 1.1 specification.

Figure 2: microATX and ATX Form-factor Mounting Holes

Notes: In Figure 2, Figure 3, and Figure 8, the board is shown oriented with the rear of the board toward the top.
The shaded portion to the left above indicates the greater width of the ATX form factor.
For details about mounting holes and board sizes, see the mechanical drawing in this specification.

9 Designing a Custom R10 Backplane

If the R10 does not suit your application, the following options are available:

1. Users can design their own backplane using the R10 reference schematic, available for download from the S18 product page at https://adnacom.com/s18/. The Adnacom engineering team can provide design assistance if needed.
2. Adnacom can design, prototype, and manufacture a backplane to meet the customer's requirements.

10 Using the R10 with a Custom Power Supply

10.1 Custom Power Supply Requirements

Although the R10 is designed to operate with a standard computer power supply, some applications may require a custom power supply. The custom power supply must meet the requirements listed in Table 10.1, Table 10.2, and Table 10.3.

The +5VSB input can also be powered from a +12 V supply.

There is no specific requirement for sequencing the power supply outputs. They may turn on and off in any order.

Table 10.1. DC Output Voltage Regulation

Output	Range	Min	Nom	Max	Unit
+3.3V	±5%	+3.14	+3.30	+3.47	V
+12V	±5%	+11.40	+12.00	+12.60	V
+5VSB	±5%	+4.75	+5.00 – +12.00	+12.60	V

Table 10.2. DC Output Noise/Ripple

Output	Maximum Ripple and Noise (mVp-p)
+3.3V	50
+12V	120
+5VSB	50

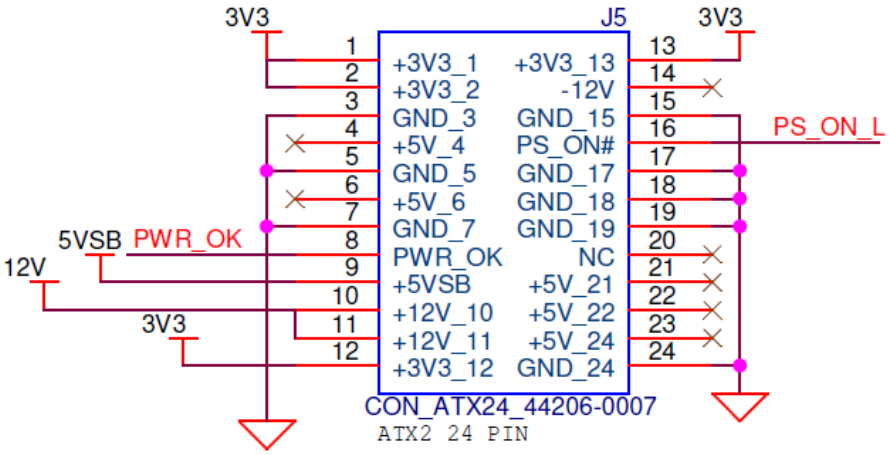
Table 10.3. Current Requirements

Output	Nominal Current (A)
+3.3V	Add-in card requirements
+12V	0.5 A plus the requirements of the add-in card and transceivers
+5VSB	0.5 A at 5 V plus add-in card requirements

10.2 Power Cable

The R10 power connector is Molex part number 44206-0007. A mating 24-pin housing and pre-crimped wires can be purchased from Digi-Key. The R10 main power schematic is shown in Figure 10.1.

Figure 10.1. R10 Main Power Schematic

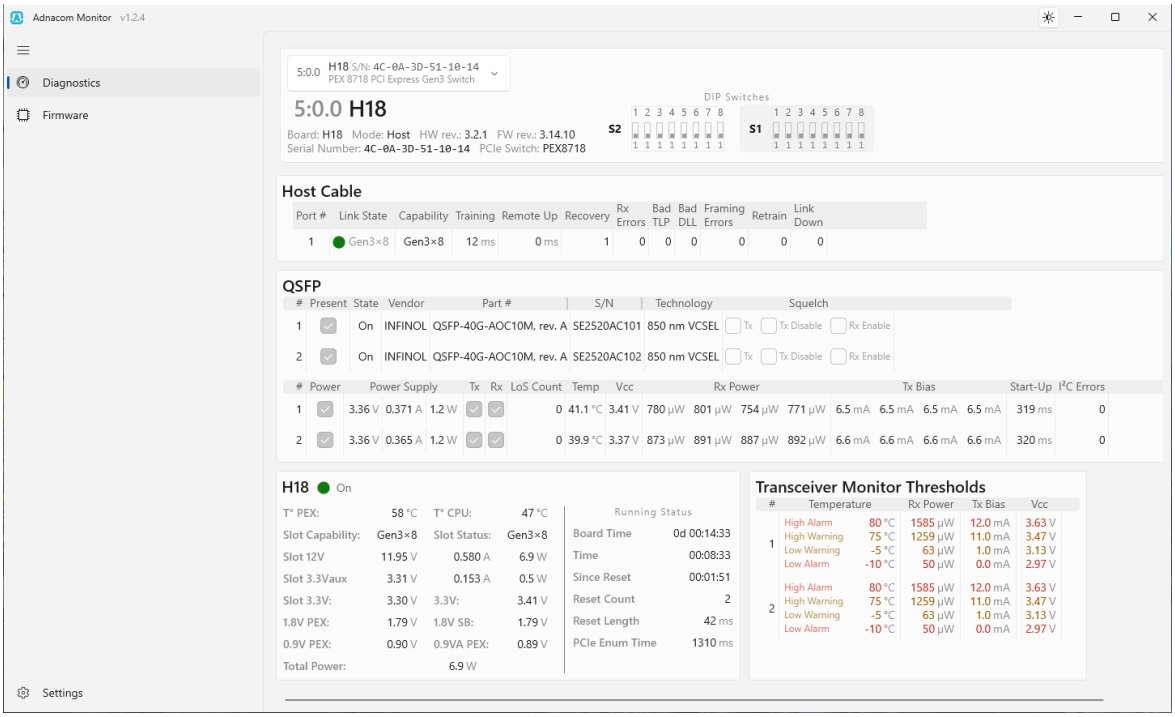


11 Monitor Utility

11.1 Overview

The Adnacom Monitor utility provides real-time board status, diagnostic information for troubleshooting, and firmware update capabilities. The utility is available for Windows and Linux and can be downloaded from the S18 product page at https://adnacom.com/s18/. The Windows version of the utility is shown in Figure 11.1.

Figure 11.1. Windows Monitor Utility



11.2 Monitoring Parameters

Table 11.1. Board Information

Field	Description
HW REV	Assembly revision
FW REV	Firmware revision
Serial Number	Serial number
PCIe Switch	PEX8718 – PCIe switch part number

Table 11.2. DIP Switch

Field	Description
DIP Switches	S1 and S2 DIP switch status

Table 11.3. QSFP Configuration

Field	Description
QSFP	QSFP number
Present	Presence status
Vendor	QSFP vendor name
Part Number	QSFP part number
Serial Number	QSFP serial number
Technology	QSFP technology as defined in the QSFP specification
Squelch	Supported squelch functionality

Table 11.4. Cable Interface

Field	Description
Port	PCIe switch port number
Capability	Maximum speed and width supported by the cable interface
Link	Link speed and width status
Training	Time from reset deassertion to link establishment
Remote	Remote device status (valid only for optical cables)
Remote Up	This value is the time from reset deassertion until the remote device is ON. The remote device must be turned on before PCIe enumeration begins; otherwise, it will not be visible to the computer.
Recovery	The recovery state counter is used to evaluate link quality. It should remain unchanged during operation. A slow increase is acceptable.
Rx Error	The receiver error counter is used to evaluate link quality. It should remain unchanged during operation. A slow increase is acceptable.
Bad TLP	The bad TLP (transaction layer packet) counter is used to evaluate link quality. It should remain unchanged during operation. A slow increase is acceptable.
Bad DLL	The bad DLLP (data link layer packet) counter is used to evaluate link quality. It should remain unchanged during operation. A slow increase is acceptable.
Framing Error	The framing error counter is used to evaluate link quality. It should remain unchanged during operation. A slow increase is acceptable.
Retrain	This counter indicates the number of times the H18A has tried to retrain the link to the maximum width and speed. The link must be trained before PCIe enumeration starts.

Field	Description
Link Down	The link-down counter indicates the number of times the link has gone down since the last restart. To resume operation after the link goes down, restart the computer or use PCIe hot-plug functionality if it is supported by the computer.

Table 11.5. Computer Interface

Field	Description
Port	PCIe switch port number
Capability	Maximum speed and width supported by the edge connector
Link	Link speed and width status

Table 11.6. Running Status

Field	Description
Power	Power supply status
Time	Time since computer power-up
Since Reset	Time since the last reset
Reset Count	Number of resets since computer power-up
Reset Length	Length of the last reset pulse
PCIe Enum Time	This value is the time from the last reset to the start of PCIe switch enumeration. It must be longer than the time required to turn on the remote device.

Table 11.7. H18A Status

Field	Description
Time	Elapsed time since +3.3Vaux power was applied to the H18A
State	H18A state
T PEX	PCIe switch junction temperature (maximum operating junction temperature: 110 °C)
T CPU	Supervisory CPU junction temperature (maximum operating junction temperature: 125 °C)
Slot 3.3V	Voltage
Slot 12V	Voltage, current, and power
Slot 3.3Vaux	Voltage, current, and power
3.3V	H18A 3.3 V power supply voltage
1.8VSB	H18A CPU 1.8 V power supply voltage

Field	Description
PEX 1.8V	H18A PCIe switch 1.8 V power supply voltage
PEX 0.9V	H18A PCIe switch digital 0.9 V power supply voltage
PEX 0.9VA	H18A PCIe switch analog 0.9 V power supply voltage

Table 11.8. QSFP Status

Field	Description
QSFP	QSFP number
Power Supply	Voltage, current, and power
State	QSFP state
Tx	Transmitter status
Rx	Receiver status
LoS Counter	Loss-of-signal counter since the last reset
Temp	Internal QSFP temperature
Vcc	Internal QSFP voltage
Icc	QSFP current
Rx1-Rx4	Received optical power, channels 1–4
Tx1-Tx4	Transmitter bias current, channels 1–4
Start-Up	QSFP initialization time
I2C Error	Number of I2C errors since the last reset

Table 11.9. QSFP Thresholds

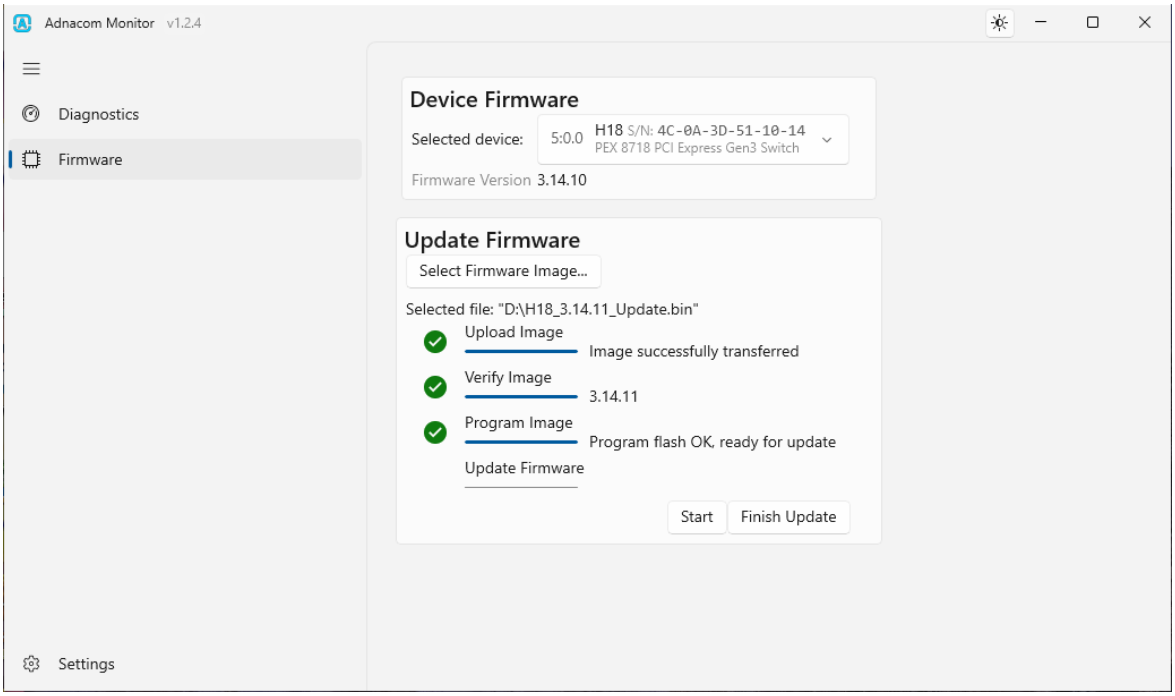
Field	Description
Temperature	Alarm and warning thresholds
Rx Power	Alarm and warning thresholds
Tx Current	Alarm and warning thresholds
Vcc	Alarm and warning thresholds

11.3 Firmware Update

The firmware update page of the monitor utility is shown in Figure 11.2. To update the H18A firmware, perform the following steps:

1. Open the Adnacom Monitor utility and select Firmware in the navigation pane.
2. In the Selected device list, select the H18A to be updated.
3. Click the Select Firmware Image button and select the firmware file.
4. Click the Start button to upload and program the new firmware.
5. Click the Finish Update button to switch to the new firmware.
6. Restart the computer.

Figure 11.2. Firmware Update



11.4 Application Programming Interface (API)

In addition to the Adnacom Monitor utility, an application programming interface (API) is available for customers who want to read the monitoring parameters described in Section 11.2 directly from their own applications. The API is available for Windows and Linux. It provides programmatic access to the same board information, link status, running status, H18A status, and QSFP status and threshold data that the Monitor utility displays. Customers can use this data to integrate S18 system monitoring into their own software, logging, or alerting tools.

The API software and documentation are available on GitHub at https://github.com/adnacom/. For assistance with the API, contact Adnacom customer support (see Section 15).

12 Ethernet Web Interface

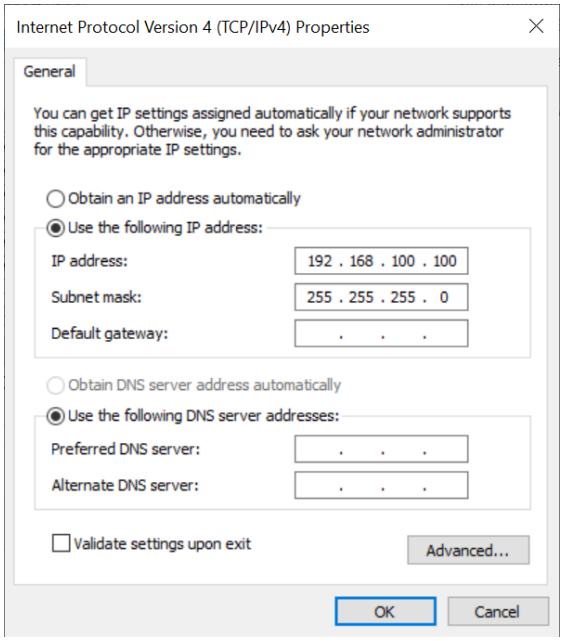
12.1 Overview

Each H18A has an Ethernet connector (J3) that provides a browser-based interface to the same board status and diagnostic information described in Section 11.2.

The web interface is useful when the adapter cannot be reached from the host computer—for example, when the cable link has not trained and the target H18A is not visible to the host software. Both the host and target adapters can be connected to the network simultaneously using different IP addresses.

The IP addresses can be preset static addresses, user-configured static addresses, or addresses assigned by a DHCP server. The computer network adapter configuration for the default IP address is shown in Figure 12.1.

Figure 12.1. Computer Network Adapter Configuration



12.2 IP Configuration

The IP configuration is selected by the S1.7 and S1.8 DIP switches described in Table 3.1 (host mode) and Table 3.3 (target mode). The available IP configurations are listed in Table 12.1.

Table 12.1. H18A IP Configuration

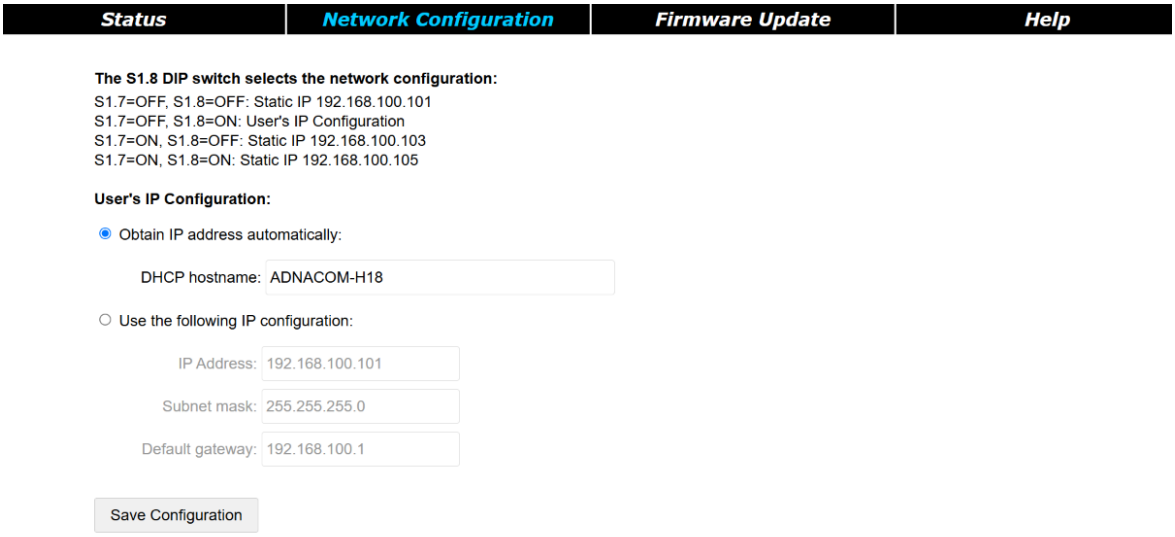
S1.7	S1.8	Description
OFF	OFF	Static IP address 192.168.100.101
OFF	ON	User-defined IP configuration
ON	OFF	Static IP address 192.168.100.103
ON	ON	Static IP address 192.168.100.105

Note: When both H18A adapters are connected to the same network, each adapter must be set to a different IP address.

12.2.1 User-Defined IP Configuration (S1.7 = OFF, S1.8 = ON)

The user-defined configuration is selected by setting S1.7 = OFF and S1.8 = ON and configuring the IP settings on the Network Configuration page shown in Figure 12.2. The user-defined IP address can be static or assigned by a DHCP server. When the DHCP server assigns an IP address, the web interface is accessed using the H18A DHCP hostname, for example, http://ADNACOM-H18/. The hostname is not case-sensitive.

Figure 12.2. IP Address Configuration



12.3 Accessing the Web Interface

- Connect the H18A J3 connector to a network or directly to a computer using an Ethernet cable.
- Ensure that the computer's network adapter is on the same subnet as the H18A.
- Open a web browser and enter the H18A IP address.
- The Status page presents the parameters described in Section 11.2.

13 Troubleshooting

13.1 Overview

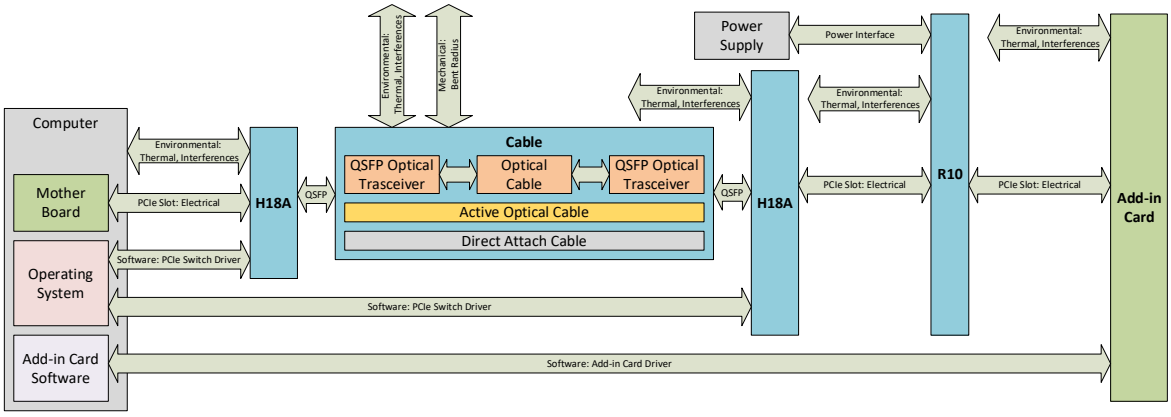
The goal of troubleshooting is to find and fix a problem that prevents the system from functioning as intended. The following principles are recommended for effective troubleshooting:

1. Clearly identify the problem: What exactly is not working?
2. Establish a theory of probable cause: Assess which component or recent change might be responsible for the malfunction.
3. Test the theory: Replace the component that may be causing the problem or change its state, ensuring that only one variable is changed at a time.
4. Verify system functionality. If the problem has been resolved, continue to step 5. Otherwise, revert any changes made in step 3 and return to step 2.
5. Document all findings, actions taken, and outcomes throughout the process.

13.2 System Context Diagram

The S18 PCIe extension includes the following components: a computer, a host H18A, one or two cables, a target H18A, an R10, a power supply, and a PCIe add-in card installed in the R10 slot. These elements are interconnected through interfaces, as depicted in Figure 13.1. The diagram identifies the relevant components and interfaces to analyze, modify, and evaluate during troubleshooting.

Figure 13.1. S18 System Context Diagram



13.3 Troubleshooting Algorithm

13.3.1 Identify the Problem

Describe the problem in detail and analyze the system components and interfaces to identify the component or interface most likely to be causing it. If the problem is confirmed and is most likely caused by the S18, continue to the next section. Otherwise, consult the documentation for the other components and contact their manufacturers for technical support.

13.3.2 Review the Operating and Installation Instructions

The installation and operation instructions are provided in Sections 5 and 0, respectively. If the system is installed correctly and the problem persists, remove the host H18A from the computer and reinstall the system step by step, as described in the following sections.

13.3.3 Verify the Computer and Add-in Card

After removing the H18A from the computer, install the add-in card directly in the computer and confirm that both the computer and the add-in card function properly.

13.3.4 Verify the H18A Host Adapter

Install the host H18A in the computer without connecting the QSFP cables. Confirm that the red standby LED D1 is on when the computer is off. If the standby LED remains off, this indicates that there is no +3.3Vaux voltage at the PCIe slot. Review the BIOS settings to ensure this voltage is enabled. If the voltage cannot be enabled, restore the BIOS default settings. After restoring BIOS defaults, reapply the PCIe settings described in Section 5.1 before operating the system. For Dell computers, enable +3.3Vaux by navigating to BIOS Settings → Power Management → Deep Sleep Control and setting it to Disabled.

Power on the computer and verify that the H18A is recognized by the system software, as detailed in Section 7.

Install the monitor utility described in Section 11 and confirm that it can read the H18A status.

If the H18A is not detected, refer to the status LEDs described in Section 3.5. Try installing it in a different slot or computer. If it appears to be an H18A failure, proceed to Section 15 to contact our support team.

If no issue with the host H18A is identified, power down the computer and proceed to the next section.

13.3.5 Verify the QSFP Cables on the Host Side

Attach the cables to the host H18A QSFP connectors. Power on the computer and verify that the H18A is visible to the computer software. Use the monitor utility to verify that the H18A detects each cable and displays the cable parameters correctly. The H18A reads the cable configuration and status via an I2C interface. No I2C errors should be detected, and the QSFP state should be ON for every installed transceiver.

If a problem with a cable is identified, try a different cable or transceiver. The transceivers supplied by Adnacom are specifically qualified for use with Adnacom products and are expected to cause no issues.

If no problem with the cables is identified, turn off the computer and proceed to the next section.

13.3.6 Verify the H18A Target Adapter and R10 Backplane

Select manual power-on/off mode by setting S2.3 = OFF and S2.4 = OFF on the H18A target adapter. Attach the cables to the H18A target adapter. Power on the R10 backplane using the SW2 power button.

Ensure that the D1 standby LED on the target H18A adapter is off. If the LED is blinking, it indicates that the 12 V or 3.3 V voltage is below the levels defined in the ATX Power Supply Specification, or the PWR_OK signal on pin 8 of the R10 J5 connector is asserted low. Review Section 5.4 which describes the requirements for the R10 power supply.

Restart or power on the computer. Open the monitor utility to confirm that the host and target H18A adapters are detected by the system. Ensure there are no I2C errors and that the QSFP state shows ON. Confirm that the negotiated cable link width and speed match the expected width and speed for the selected cable configuration. The cable interface status table displays PCIe link error counters, which should remain unchanged during operation. If these counters increment slowly (once every few seconds), performance is not affected, but this may indicate that the cable quality needs verification. Check the main power supply and internal power supply voltages. The receiver's optical power and transmitter current must be between the low and high warning thresholds shown by the utility. If the measured values are outside the normal operating range, it indicates a problem with the transceivers or cable. If a problem is identified, try a different cable or transceiver.

If no problem is identified, turn off the computer and the R10 and proceed to the next section.

13.3.7 Verify the Add-in Card

Power off the R10 and disconnect the R10 power supply from its power source before installing or removing cards. Install the PCIe add-in card in the J2 slot labeled ADD-IN CARD on the R10. Power on the R10 and check that the D7 LED on the target H18A indicates that the link between the H18A and the PCIe add-in card is up. Use the Ethernet web interface described in Section 12 to verify that the link is operating at the expected speed and width. The LED status is described in Table 3.6. If the PCIe link is established, power on the computer and ensure it boots properly, detects the add-in card in software, and reports no driver issues. If the card driver is not correctly installed, reinstall the driver and restart the computer.

If there is no link between the target H18A and the PCIe add-in card, reinstall both cards and check the H18A and R10 status LEDs. Use a multimeter to measure the voltages at the R10 power connector and confirm that they are within ±5% of the nominal values.

13.4 Operating and Performance Problems

Use the monitor utility to identify issues with the PCIe link, cable, power supply, and environmental conditions. The link error counters indicate a problem with the cable or transceivers. The reset and link-down counters may indicate a problem with the power supply.

13.5 Cable Problems

If QSFP transceivers and optical cables are used, clean the transceiver and cable connectors with the appropriate tools as described in Section 5.7.

If the cable PCIe link is established, use the monitor utility to identify problems with the QSFP transceivers and cable, as described in Section 13.3.6.

If the received optical power is low on any channel, ensure that the cable type matches the transceiver type. Single-mode transceivers must be connected using single-mode OS1 or OS2 cables. Multimode transceivers must be connected using multimode OM3 or OM4 cables. OM1 and OM2 multimode cables are not recommended.

The duplex LC-LC cable connectors must be connected A-to-B to maintain proper fiber polarity in a duplex channel, ensuring that the transmitter (Tx) at one end is connected to the receiver (Rx) at the other. A-to-B polarity is the most widely used configuration for duplex LC-LC cables, as defined in the TIA-568 standard.

If the PCIe link is not established, check the QSFP status LEDs on the H18A described in Table 3.5. If a QSFP LED is blinking or off and the connectors have been cleaned, replace the cable and transceivers one part at a time.

13.6 Two-Cable Link Problems

The following conditions are specific to the configuration with one x8 port:

- **Mismatched cables.** Both cables must be of the same type and length. A difference in propagation delay between the two cables can prevent the x8 link from training.
- **Crossed cables.** QSFP 1 on the host adapter must be connected to QSFP 1 on the target adapter, and QSFP 2 to QSFP 2. Verify the connections against Table 5.2.
- **Unused transceiver or AOC installed.** When only one cable is used, a transceiver or AOC left in QSFP 2 of either adapter may prevent link training. Remove unused transceivers and cables from QSFP 2 on both the host and target adapters.
- **The link trains to x4 with two cables connected.** Check the QSFP 2 status LED (D10) on both adapters and the QSFP 2 received optical power in the monitor utility. Swap cable 1 and cable 2 to determine whether the fault follows the cable or stays with the QSFP connector.

13.7 R10 Automatic Power-On/Off Problems

The R10 must be on and configured when the computer software starts PCIe bus enumeration; otherwise, the target H18A and PCIe add-in card will not be visible to the computer software. The monitor utility provides timing measurements that can help identify the problem. The maximum turn-on time for a standard ATX power supply is approximately 500 ms. If required, increase the BIOS boot (POST) delay so that the R10 is ready before PCIe enumeration starts.

13.8 Customer Support

If the problem persists, please refer to Section 15 for instructions on contacting Adnacom technical support.

14 Product Design Disclaimer

Adnacom products are designed according to the PCI Express specifications outlined in their respective datasheets and should work with all PCI Express-compliant add-in cards and drivers. Our support team can assist with issues directly related to our products; however, we may not be able to help with troubleshooting third-party add-in cards or drivers. For any issues involving third-party hardware, please contact the manufacturer of that hardware directly. For further assistance regarding Adnacom products, please refer to Section 15 to contact our support team.

15 Customer Support

Contact Adnacom Customer Support either by using the contact form on our website at https://adnacom.com or by emailing support@adnacom.com. Please have the following details ready; they help our support team diagnose and resolve your issue quickly.

Category	Details
Contact Information	Contact name Company name
Product Information	Product part numbers Product serial numbers
System Information	Computer model Operating system Installed PCIe cards Number and type of cables and transceivers LED status on all boards
Problem Description	A detailed description of the problem Screenshots of the monitor utility or Status web page

All information you provide will be used solely for troubleshooting and resolving your support request and will be handled in accordance with our privacy policy.

16 Warranty

All Adnacom components are warranted for one year from the date of shipment against defects in materials and workmanship. During the warranty period, Adnacom will, at its discretion and at no cost to the customer, repair or replace any component determined to be defective. This warranty covers both parts and labor. Warranty claims require proof of purchase.

To begin the return process for a warranty claim, customers must obtain a Return Merchandise Authorization (RMA) number. To do so, please contact Adnacom Customer Support using either the contact form on our website at https://adnacom.com or by emailing support@adnacom.com. Once your RMA request is approved, you will receive the RMA number along with the correct shipping address for your return. Be sure to clearly mark the RMA number on the outside of the package. Items must be returned in the original packaging or equivalent.

This warranty excludes coverage for defects resulting from failure to follow the User's Guide, product modifications, misuse, abuse, negligent handling, power failures or surges, fire, flood, accidents, third-party actions, or other events beyond reasonable control. Except as stated above, Adnacom provides no other warranties, express or implied.

The customer's right to recover damages due to Adnacom's fault or negligence is strictly limited to the amount paid for the product. Adnacom shall not be liable for loss of data, profits, product usage, or any incidental or consequential damages, even if advised of the possibility of such damages.