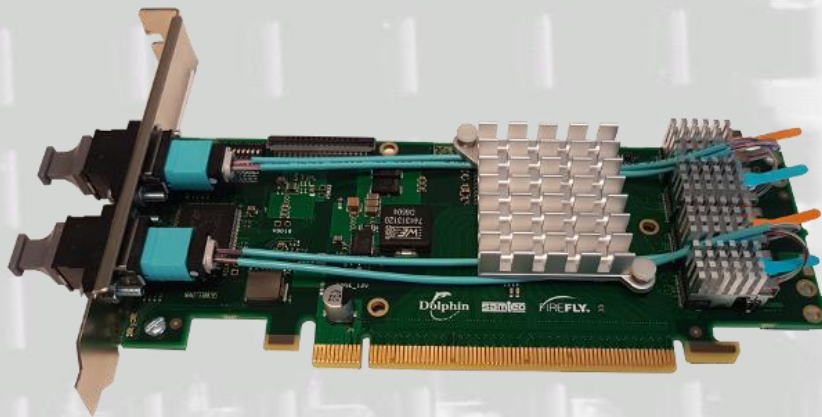




PCI Express PXH840 Adapter



PXH840 NTB PCIe Adapter users guide
Version 1.2

Date: 30th November 2023

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DISCLAIMER

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DOLPHIN INTERCONNECT SOLUTIONS' PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES.

ENVIRONMENTAL POLICY

Dolphin is minimizing the amount of printed documentation and software CDs in its shipments; please download additional documentation and software from www.dolphinics.com.

Terms and acronyms

Important terms and acronyms used in this manual

AOC	Active Optical Cable. PCIe fiber cable assembly.
eXpressWare	Dolphin's software stack for PCIe clustering and IO. www.dolphinics.com for more information.
FireFly	Optical fiber solution for PCIe over cable from Samtec Inc
Lane	One PCI Express Lane contains a differential pair for transmission and a differential pair for reception.
Link	A collection of one or more PCI Express Lanes providing the communication path between an Upstream and Downstream Port.
Port	The PXH840 has two MPO (MTP) connectors providing up four PCIe x4 ports, named L0, L1, L2 and L3. The physical ports are identified by text on the PCIe brackets. The PCIe chip only supports 2 NTB ports.

PXH840 high level specification

The PXH840 is a PCI Express Gen3 x16 adapter card supporting NTB operations. The card comes with firmware and a license to use the eXpressWare PCIe networking software from Dolphin Interconnect Solutions.

Product variants

The card can be ordered with different FireFly optical engines mounted depending on your use case and requirements:

SKU / Model	#FireFly	Config
PXH840	2 x8	NTB x16 / NTB 2 x8
PXH841	1 x8	NTB x8
PXH843	2 x4	NTB x8 / NTB 2 x4
PXH844	1 x4	NTB x4

The PXH840 supports PCIe Gen1, Gen2 and Gen3 speeds and x4, x8 and x16 link-widths. The card will operate at the highest common speed shared between the slot and the card (Gen3) and the widest common link-width (x16).

- PCI Express Base Specification, Rev. 3.0.
- PCI Express CEM Specification, Rev. 3.0.
- PCI Express Gen3 8.0 GT/s per lane signaling – 128 GT/s total signaling.
- PCI Express Gen3 x16 edge connector. The card installs in any PCI Express slot that has a physical x16 connector. The slot may have any electrical width x1 – x16.
- Compliant with PCI Express Gen1 through Gen3 computers and IO systems, auto detection.
- MPO cable connector
- The PXH840 in NTB mode supports to two or three other nodes.
- NTB Cable port configurations, up to
 - One x16
 - Two x8
- Broadcom / Avago / PLX PEX8733 PCI Express Gen3 chipset.
- 132 nanosecond cut-through latency port to port.
- Support for active optical fibers up to 100 meters.
- Low profile, Half-length form factor - Dimensions 167.8mm x 68.9 mm.
- Weight 140 Grams with 4 FireFly, heatsink and full-height bracket mounted.
- Comes with standard profile PCI Express bracket. Low profile bracket option available, please contact Dolphin for more information.
- Host clock isolation. Automatic support for host running CFC or SSC mode.
- VAUX powered board management controllers for flexible configuration and cable management.
- EEPROM recovery option.
- PCI Express power domain isolation.
- Power consumption:
 - 12 Volt: Max 18 Watt, typical 14 Watt with 4 FireFlies attached.
 - 3.3 Volt: Not connected
 - 3.3 VAUX: Max 1 Watt Port power (per cable port): 3.3 Volt +/- 5%, 0.6 A
- Operational Environment
 - Operating Temperature: 0°C - 55°C (32°F - 131°F), Air Flow: 150 LFM
 - Relative Humidity: 5% - 95% (non- condensing)
- Regulatory
 - CE
 - Compliant to EN-55022 (2010), EN 55024 (2010), Class A.
 - RoHS
 - FCC Class A.
 - WEEE
- Safety Standards
 - UL 62368-1 and CAN/CSA C22.2 No. 62368-1-14

MTBF by Temperature and Environment

The MTBF (in hours) for the PXH840 can be found in the table below. The numbers are calculated using the Telcordia SR-332 issue 2 (2006) standard.

Ambient Temp [°C]	Environment		
	Ground fixed, controlled	Ground fixed, uncontrolled	Ground mobile
0	2.502.014	1.251.007	417.002
5	1.997.375	998.688	332.896
10	1.594.418	797.209	265.736
15	1.274.114	637.057	212.352
20	1.020.169	510.084	170.028
25	819.034	409.517	136.506
30	659.679	329.839	109.946
35	533.255	266.628	88.876
40	432.743	216.372	72.124
45	352.611	176.306	58.769
50	288.522	144.261	48.087
55	237.081	118.540	39.513

Table 1: MTBF vs. Temperature and Environment

Packaging

The PXH840 includes the following components.

- PXH840 Adapter Board with a full height PCIe bracket mounted
- Anti-static bag
- Getting started guide with serial number for quick download of Dolphins eXpressWare PCIe software.

Pre-Installation Questions

Certain steps should be taken prior to installing the PXH840. You should determine the following configuration requirements.

- Which PCIe slot and system will the card be installed in?
- What is the speed and link width of the slot that the card will be installed in?
- What is the operating environment in which the card will be installed?
- What width and length of cables will be used?
- Proper operational conditions, temperature, airflow.

PCIe Slot determination

The PXH840 supports PCIe Gen1, Gen2 and Gen3 speeds and x1, x2, x4, x8 and x16 link-widths. The slot width and speed will affect the performance of the card. The card can be physically installed in an x4, x8 or x16 connector. The card will auto configure to the slot speed and width.

- Install the board in a slot connecting directly to the CPU for optimal shared memory performance.
- Install the board behind a PCIe switch in the IO system for optimal PCIe peer to peer performance (e.g. between GPUs, FPGAs)

TIP: After installing the eXpressWare software, run the “sisci_benchmarks” benchmark suite to verify the expected performance. Please contact Dolphin support if you need assistance to reach the expected performance.

PXH840 Configuration

The PXH840 has a DIP switch bank to control the main configuration of the card. The DIP switch labeled SW1 can be found close to the upper edge of the board. The default DIP switch setting is single NTB link x16 operations. Alternative NTB configuration settings is two x8 links.

Operating environment

To maximize lifetime for the product and maintain the warranty, please honor the specified operating temperature, and make sure the specified air flow is present. Special care should be considered when PXH840 is used in office type cabinets in combination with other high energy consuming PCIe devices, e.g. not active cooled GPUs:

Operating Temperature: 0°C - 55°C (32°F - 131°F), Air Flow: 150 LFM

Operating Temperature with AOC: 0°C - 45°C (32°F - 113°F), Air Flow: 150 LFM

Relative Humidity: 5% - 95% (non- condensing)

TIP: After installing the Dolphin eXpressWare software, you can use the tool `dis_diag` to determine the actual board temperatures.

Cable Connections

The PXH840 is designed for Samtec FireFly optical engines. The card supports any length up to 100 meters without any special PCIe tuning.

Transparent operation.

The PXH840 variants are designed for NTB operation. The PXH842 is a PCI Express Gen3 x16 Transparent Host and Target card for PCIe IO expansion applications. Please consult the PXH842 users guide for details.

Installation

Step 1 - Unpack board

The PXH840 card is shipped in an anti-static bag to prevent static electricity damage. The card should only be removed from the bag after ensuring that anti-static precautions are taken. Static electricity from your clothes or work environment can damage your PCI Express adapter card or your PC. Always wear a grounded anti-static wrist strap while opening the PC and when the PXH840 is removed from the anti-static bag.



Step 3 - Configure the board for proper operation

The PXH840 board support several NTB use-cases and must be configured using the DIP Switch to meet your specific use case.

NTB Configuration settings

DIP switch settings for the NTB use cases, two node x16 or three node x8. These settings must be applied to all cards in the PCIe network.

NTB Configuration PXH840	DIP switch view
1 x16 NTB port (Shipping Default)	A row of eight DIP switches, all in the 'up' position.
2 x8 NTB ports OPT3 set	A row of eight DIP switches, with the third switch from the left in the 'down' position and all others in the 'up' position.

Table 1: PXH840 SW1 NTB configuration settings.

Step 4 - Install the Adapter Card

Before installing the adapter card, make sure you are properly grounded to avoid static discharges that may destroy your computer or the adapter card. Ensure you are properly grounded before opening your computer or the anti-static bag containing the PXH840. Please follow your computer's or expansion chassis' manual on how to install a PCI Express card.



The PXH840 Adapter card can be installed into any PCI Express x16 slot. The PXH840 supports PCI Express Gen1, Gen2 and Gen3 signaling. NOTE: A Gen3 slot is recommended as it typically doubles the performance compared to a Gen2 slot. The PXH840 is an x16 card, so maximum performance will only be attained if the slot provides full electrical x16 signaling.

The PXH840 supports hosts using either spread spectrum or constant frequency clocking. The card implements clock isolation.

Step 5 - Installing and Removing Cables

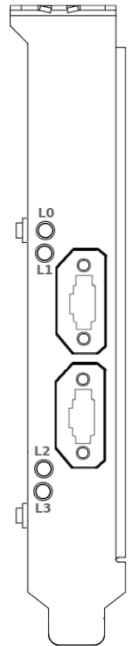
Installing and removing cables in NTB mode can be done while the systems are running. Hot plugging / removing cables are fully supported. The fiber optic cable(s) are connected to the MPO connector(s) found on the PCIe bracket. The bracket will have one or two, single or dual MPO connectors depending on the board configuration.

Connecting Cables

Please carefully install the fiber patch cable connector into the connector housing on the PXH840 adapter card. To install the cable, remove the protective cover on both the cable and the card, match the cable house keying with the MPO connector on the PXH840 adapter card and use light pressure to insert the connector until it is latched. Cables should always use strain relief to protect the connected equipment from excessive force on the cable. This is especially important for cables between racks. Please always save the protective covers for future use if the cable is disconnected from the card.

Disconnecting Cables

Please carefully pull the release tab to release the cable from the locking. Always replace the protective cover on both the card and the cable after disconnecting the cable.



Step 6 – Installing the Dolphin eXpressWare software

The PXH840 adapter card in NTB mode is compliant with Dolphin's eXpressWare software package for the PX product line. Please visit

<http://www.dolphinics.com/px>

to register and download the latest documentation and software. It is recommended to follow the quick installation guide found on the web page above to install the software for your operating system.

TIP: Dolphin provides software and documentation for several product families; **please remember to select the PX product family before downloading.** The PXH840 requires Dolphin software version DIS 5.5.0 or higher to operate. The software download requires a password to log in. **The password will automatically be emailed to you if you follow the instructions found on the getting started document bundled with the adapter card.** If you fail to provide the correct serial number found on the getting started document, your request will be managed manually.

Step 5 - Verify Installation

The PXH840 comes with a set of LEDs to verify proper configuration. Table 2: LED below is a chart of the LEDs and their corresponding meaning.

The card has four bi-color Link-LEDs visible through the PCI Express front bracket.

LED color	Function
Off	No cable installed
Yellow	Cable installed, no link
Green	Link up, PCIe Gen 3 speed
Green blinking	Link up, PCIe Gen 1 or 2 speed

Table 2: LED behavior

Please install the Dolphin eXpressWare software and run the included verification tests as suggested by the software installation procedure and documentation.

Operation and Maintenance

Configuration and DIP Switches

The PXH840 has one bank of 8 DIP switches. The default factory setting for the PXH840 is NTB mode, short cable, and single (up to x16) link connection.

The PXH840 has DIP switches for setting special modes or operations. Please carefully read the documentation before modifying any DIP switch settings. Please pay close attention to ON and OFF positions written on the DIP switch.

DIP Switch Bank – Configuration

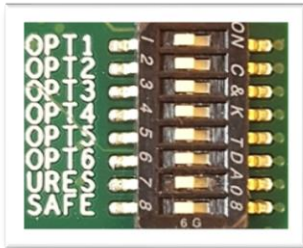


Figure 1: DIP Switch shows the DIP switch for the PXH840. It is used to configure the adapter card. Please leave all undocumented DIP switches in the default position. The table below shows all the various DIP switch settings for the PXH840.

Figure 1: DIP Switch

DIP no.	Name	Description	ON	OFF	Default
1	OPT1	Reserved for future use. Must be off.	TBD	NTB mode	OFF
2	OPT2	Reserved for future use. Must be off.	TBD	Normal operation	OFF
3	OPT3	Enable dual x8 link configuration	Dual x8 link on cable ports 1-2 and 3-4	Single x16 link, cable ports 1-4	OFF
4	OPT4	Reserved for future use. Must be off.	TBD	Normal operation	OFF
5	OPT5	Reserved for future use. Must be off.	TBD	Normal operation	OFF
6	OPT6	TBD	TBD	Normal operation	OFF
7	UTRES	Holds the management processors in reset	Board management is held in reset	Normal operation	OFF
8	SAFE	Enables the card to boot if the EEPROM has been corrupted	Safe EEPROM	Normal operation	OFF

Note: Some DIP switch configuration options may be changed in the future versions. Please always consult the latest user guide for details.

NTB Use Cases Summary and Settings

The PXH840 card may be used in the following use cases as summarized in Table 3: Use Case DIP switch settings below.

Use case	Description	DIP switch setting
A	Two node NTB configuration. Both systems have PXH840 installed.	OPT2 on if long cables All other off
B	Three node NTB configuration. All systems have a PXH840 installed	OPT1 on to enable two x8 links OPT2 on if long cables All other off

Table 3: Use Case DIP switch settings

Use Case A - 2 Node Configuration – NTB Mode

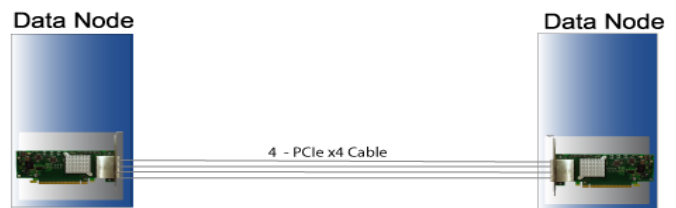
Each node has a PXH840 adapter and a direct x4, x8 or x16 cable connection to the other system. This configuration is fully supported by all Dolphin software, from version DIS 5.5.0 and newer. Both PXH840 adapter cards operate in NTB mode. The DIP-Switch is set to all off.

Connecting the cables for 2 Node Configurations, x16 link

To establish an x16 link, a given port number should be connected to the same port number on the other card.

Table 4: Required x16 cabling. Always connect a cable from Port L# to Port L#

Port, Host A	Port, Host B
L0+L1	L0+L1
L2+L3	L2+L3



A failure connecting any of the cables will cause the link to re-train to x8 or x4.

Connecting the cables for 2 Node Configurations, x8 link

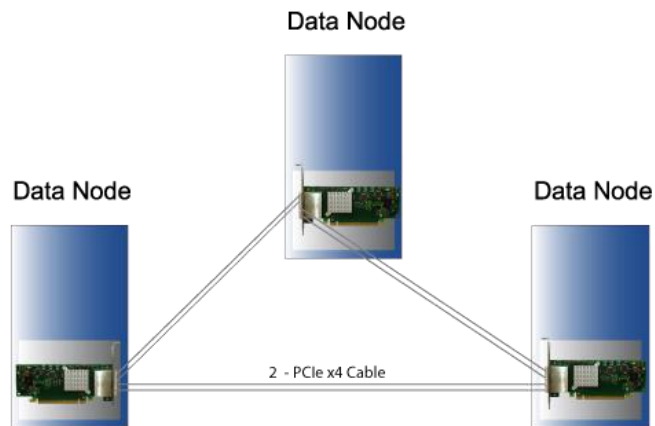
To establish an x8 link, please connect a cable from port L0+L1 to port L0+L1 on the other card.

Connecting the cables for 2 Node Configurations, x4 link

To establish an x4 link when in dual port mode, please connect port L0 to port L0.

Use Case B - 3 Node Configuration – NTB Mode

Each node has a PXH840 adapter and a direct x4 or x8 cable connection is used between all systems. All PXH840 adapter cards operate in NTB mode. The DIP-Switch OPT3 is ON to enable dual port x8 mode.



Connecting the cables for 3 Node Configurations, x8 link

Connect the cables between two nodes as described above, connecting two nodes x8. Connect the third node to the two other cards using similar rules. Always connect L0 + L1 to L0 + L1 or L2 + L3

Transparent Use Cases

The PXH840 is designed for NTB operations. The PXH842 should be used for Transparent use cases. Please reference the PXH842 Users Guide for more information.

Firmware upgrade

The PXH840 design uses a microcontroller to implement configuration, management, and maintenance functions. Dolphin may from time to time publish updated firmware for the microcontroller or EEPROM data for the card. Please note that standard PLX firmware tools cannot be used to upgrade the firmware. More information can be found in the PXH840 Firmware Release Note.

Identifying the Card

The card has a label-sticker with the serial number in the format 'PXH840-YY-ZZZZZZ', where YY denotes the card revision (e.g. CC) and ZZZZZZ denotes the serialized production number (e.g. 012345) – this whole string makes up the serial number of the card (i.e. PXH840-CC-012345).

You can also get this information using `lspci` in Linux:

First, identify the devices for the Dolphin Host card:

```
# lspci | grep "Device 8733"
01:00.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca)
02:08.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca)
```

Then run `lspci`, and identify the card. It will show up as something like

```
# lspci -s 1:0.0 -v
01:00.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca) (prog-if 00 [Normal decode])
Flags: bus master, fast devsel, latency 0, IRQ 25
Memory at f7d00000 (32-bit, non-prefetchable) [size=256K]
Bus: primary=01, secondary=02, subordinate=03, sec-latency=0
Capabilities: [40] Power Management version 3
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Capabilities: [68] Express Upstream Port, MSI 00
Capabilities: [a4] Subsystem: Dolphin Interconnect Solutions AS Device 0832
Capabilities: [100] Device Serial Number 00-00-43-43-00-00-0a
Capabilities: [fb4] Advanced Error Reporting
Capabilities: [138] Power Budgeting <?>
Capabilities: [10c] #19
Capabilities: [148] Virtual Channel
Capabilities: [e00] #12
Capabilities: [b00] Latency Tolerance Reporting
Capabilities: [b70] Vendor Specific Information: ID=0001 Rev=0 Len=010
Kernel driver in use: pcieport
Kernel modules: shpchp
```

Second,
do

```
# lspci -s 1:0.0 -v | grep -E "Subsystem|Serial"
Capabilities: [a4] Subsystem: Dolphin Interconnect Solutions AS Device 0832
Capabilities: [100] Device Serial Number 00-00-43-43-00-00-0a
```

This shows the card as revision 0x4243 (hexadecimal values of the 'CC' letters in the ASCII table), with the production number 0x0000000A (0000010 in decimal).

Support

More information about the product, support and software download can be found at <http://www.dolphinics.com/px>.
For general support questions, please contact Dolphin via the Jira Service Management portal:
<https://www.dolphinics.com/csp>.

Technical Information

Please reference the FireFly PCUO manual available from Samtec for more information.

Compliance and Regulatory Testing

EMC Compliance

The Dolphin PCI Express PXH840 adapter is tested to the following relevant test standards for PCI Express cards, telecommunication and industry equipment installed in a standard PC:

EN 55022 (2010), Class B
EN 55024 (2010), Class A



This does not ensure that it will comply with these standards in any random PC. It is the responsibility of the integrator to ensure that their products are compliant with all regulations where their product will be used.

RoHS Compliance

The Dolphin PXH840 is RoHS compliant. A Compliance certificate issued by the manufacturer is available upon request.



FCC Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.



Laser Eye Safety

The PXH84x series is classified as a Class 1 laser.



Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Caution – Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Limited Warranty

Dolphin Interconnect Solutions warrants this product to be free from manufacturing defects under the following terms:

Warranty Period

The warranty applies for one (1) year from the date of purchase. Extended warranty is available.

Coverage

To the extent permitted by applicable law, this warranty does not apply to:

- Damage caused by operator error or non-compliance with instructions available for the product.
- Use or attempt to use or program firmware not approved by Dolphin.
- Damage due to accidents, abuse, misuse, improper handling or installation, moisture, corrosive environments, high voltage surges, shipping, or abnormal working conditions.
- Damage caused by acts of nature, e.g. floods, storms, fire, or earthquakes.
- Damage caused by any power source out of range or not provided with the product.
- Normal wear and tear.
- Attempts to repair, modify, open, or upgrade the product by personnel or agents not authorized by Dolphin.
- Products for which the serial number label has been tampered with or removed.
- Damage to the product caused by products not supplied by Dolphin.

Service Procedure

In the event that the product proves defective during the Warranty Period, you should contact the seller that supplied you with the product, or if you purchased it directly from Dolphin, visit <https://www.dolphinics.com/csp> to obtain a valid RMA number and instructions. Products returned to Dolphin without a proper RMA number will not be serviced under this warranty.