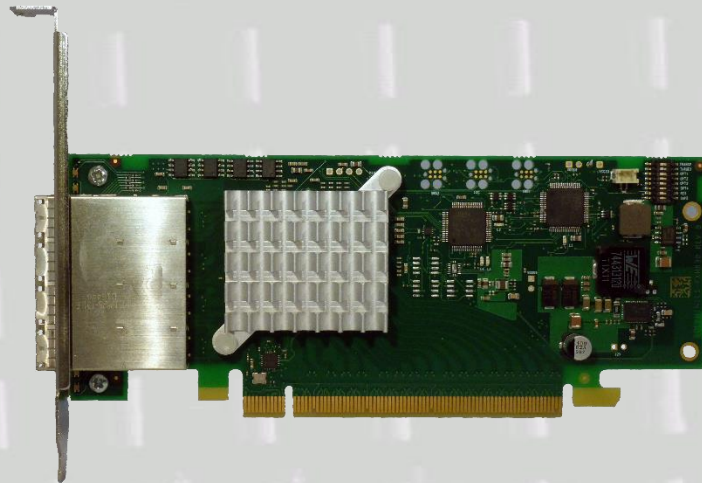




Dolphin PCI Express PXH830 Adapter



PXH830 NTB Adapter Users Guide
Version 1.17

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DISCLAIMER

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The new PCI Express External Cabling specification 3.0 is as of today not completed and ratified by the PCI SIG. The PXH830 is designed to be compliant to the new specification, but Dolphin cannot guarantee the card will be compliant to the final 1.0 specification.

LIFE SUPPORT POLICY

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.
CMI	Cable Management Interface. The 2-wire management interface for communication between subsystems connected by a PCIe 3.0 cable. Details can be found in the PCI-SIG External Cabling Specification 3.0. The CMI functionality is optional with the PXH830 card.
CMI Controller	Microcontroller on the PXH830 used to manage and implement the CMI communications.
eXpressWare	Dolphin's software stack for PCIe clustering and IO. www.dolphinics.com for more information.
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.
MiniSAS-HD	Standard MiniSAS-HD cable with SFF-8644 connectors.
PCIe 3.0 cable	PCIe 3.0 cable with SFF-8644 connectors. Compliant to the new PCI-SIG External Cabling Specification 3.0. Support for CMI.
Port	The PXH830 has four x4 ports, named P1, P2, P3, P4. The physical ports are identified by text on the PCIe brackets. The PCIe chip only supports 2 concurrent NTB connections.

PXH830 High Level Specification

The PXH830 is a PCI Express Gen3 x8 NTB adapter card available from Dolphin providing an easy-to-use, multi-functional PCI Express networking solution.

The PXH830 supports PCIe Gen1, Gen2 and Gen3 speeds and x1, x2, 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 External Cabling Specification Rev 3.0, version 0.7
- 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.
- The PXH830 supports NTB connections to two or three other nodes.
- Quad SFF-8644 cable connector
 - Durability max total 250 mating cycles
- Cable port configurations
 - One x16 NTB port
 - Two x8 NTB ports
- Broadcom / Avago / PLX PEX8733 PCI Express Gen3 chipset.
- 132 nanosecond cut-through latency port to port.
- Support for MiniSAS-HD copper cables up to 9 meters (between PXH830 cards).
- Support for PCI Express 3.0 copper cables with CMI.
- Support for active optical fibers up to 100 meters.
- Low profile, Half length - PCI Express Electromechanical Specification, Rev 2.0.
- Dimensions 167.8mm x 68.9 mm
- Comes with both low profile and standard profile PCI Express bracket.
- 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.
- No PCI Express power domain isolation.
- Power consumption:
 - 12 Volt: Max 14 Watt, typical 10 Watts without AOC attached.
 - +3.3 Volt: Max 3.3 Watt
 - +3.3 Volt AUX: Max 1 Watt
- Port power supply (per cable port): 3.3 Volt +/- 5%, 0.6 A
- 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
- Operating Temperature: 0°C - 50°C (32°F - 122°F), Air Flow: ~0 LFM
- Relative Humidity: 5% - 95% (non- condensing)
- Regulatory
 - CE
 - Compliant to EN-55022 (2010), EN 55024 (2010), EN 61000-6-2 (2005), Class A.
 - RoHS
 - FCC Class A.
 - WEEE

Packaging

The PXH830 includes the following components.

- PXH830 Adapter Board with a full height PCIe bracket mounted
- Low profile bracket
- 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 PXH830. 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 for the Host computer?
- What type and length of cables will be used?
- How to ensure proper operational conditions, temperature and air-flow.

PCIe Slot Determination

The PXH830 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 a 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.

PXH830 NTB Configuration

The PXH830 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 link x16 operations. Alternative configuration settings are two x8 links, or long cable tuning.

Operating Environment

To maximize life time 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 PXH830 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
Operating Temperature: 0°C - 50°C (32°F - 122°F), Air Flow: ~0 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 Ports and Connections

The PXH830 is designed to support both long and short cables and comes with two types of PCIe link tuning parameters. The default configuration supports cables between 0.5 and 3 meters or fiber cables (AOC). To use cables longer than 3 meters, please use DIP-Switch OPT2 to enable the long cable tuning.

Cable ports

The PXH832 has a quad SFF-8644 connector. Each port implements 4 PCIe lanes. The ports are numbered as shown in Figure 1 PCIe bracket below.

The PXH830 cable connector is compliant to the SFF-8644 industry specification and supports x4/x8 Mini-SAS HD cables or x4/x8 PCI Express 3.0 cables (PCIe 3.0 cable) compliant to the PCIe External Cabling Specification 3.0. Four x4 or two x8 cables are needed for full PCIe x16 connectivity. Currently, the PXH830 card does not benefit from the new PCIe 3.0 cable, a future firmware release may add support for optional, advanced PCIe networking management if PCIe 3.0 cables are installed.

Active Optical Cables (AOC)

The PXH830 card is compliant with active fiber optic cables up to 100 meters. No special configuration is required.

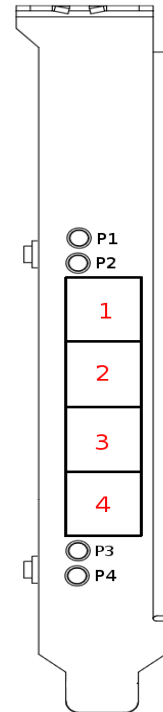


Figure 1 PCIe bracket

Installation

Step 1 - Unpack board

The PXH830 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 PXH830 is removed from the anti-static bag.



Unpack the PXH830 from the anti-static bag using proper anti-static procedures.

Step 2 - Change PCIe Bracket if necessary

The PXH830 package includes a standard and low profile PCI Express bracket. By default, the standard height bracket is installed on the board. If you need to replace the mounted bracket with a low profile bracket, carefully unscrew the two mounting screws to remove the full height bracket. Save the two mounting screws and replace the bracket with the low profile bracket. Use the two mounting screws to install the low profile bracket. The screws should be carefully tightened, but be careful not to over-tighten. Make sure you are properly grounded to avoid static discharges that may destroy the adapter card before performing this procedure.

Step 3 - Configure the Board for Proper Operation

Set the DIP switch settings for the required NTB use case.




Configuration PXH830	DIP switch view
1 x16 port (Shipping Default)	
2 x8 ports OPT1 set	
Long cable tuning OPT2 set	

Table 1: PXH830 SW1 configuration settings. OPT 1 and OPT2 can be combined.

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 PXH830. Please follow your computer's or expansion chassis manual on how to install a PCI Express card.



The PXH830 Adapter card can be installed into any PCI Express x16 slot. The PXH830 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 PXH830 is an x16 card, so maximum performance will only be attained if the slot provides full electrical x16 signaling.

The PXH830 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 can be done while the systems are running. Hot plugging / removing cables are fully supported.

Connecting Cables

Please carefully install the cable connector into the connector housing on the PXH830 adapter card. To install the cable, match the cable house with the connector on the PXH830 adapter card. Use even pressure to insert the connector until it is secure. Adhere to ESD guidelines when installing the cables to ensure you don't damage the board. Computer 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. Note that for wider than x4 connections, the same cable-ports (ie port 1 through 4) should be used on both hosts to ensure that the cards properly link up as x8 or x16.

The PXH830 supports both copper and active optical cables (AOC). Specifications can be found in Table 1. The max distance may change if connecting to other PCIe products.

Cable	Speed	Distance
Copper MiniSAS-HD	Gen3	9 meters
Copper MiniSAS-HD	Gen1	12 meters
Copper PCIe 3.0 cable	Gen3	TBD
Fiber optic (AOC)	Gen3	100 meters

Table 1: Cable Specifications

Disconnecting Cables

Please carefully pull the release tab to release the cable from the locking latches and gently pull the cable out of the connector guides.

Step 6 – Installing the Dolphin eXpressWare Software

The PXH830 adapter card is compliant with Dolphin's eXpressWare software package for the PX product line. Please visit

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

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 PXH830 requires Dolphin software version DIS 5.4.0 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 7 - Verify Installation & LEDs

The PXH830 comes with 4 bi-color LEDs which show the corresponding cable port status according to Table 2: LED below. Please note that the eXpressWare software must be installed and configured properly to ensure the LEDs are lit correctly.

The LEDs are visible through cut-outs in the PCIe bracket on each side of the cable connector block.

LED color	Function
Off	No cable installed
Yellow	Cable installed, no link
Green	Cable installed, link gen 3
Green blinking	Cable installed, link gen 1/2

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 PXH830 has one bank of 8 DIP switches. The default factory setting for the PXH830 is NTB mode, short cable, and single (up to x16) link connection.

The PXH830 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 show the bank of DIP switches for the PXH830. It is used to configure the adapter card. Please leave all undocumented DIP switches in the default position. The table below lists all options and DIP switch settings for the card

Figure 2: DIP Switch

DIP no.	Name	Description	ON	OFF	Default
1	TRANSP	Leave in default position	Not used	NTB mode, Normal operation	OFF
2	TARGET	Leave in default position	Not used	Normal operation	OFF
3	OPT1	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	OPT2	Enable long-cable configuration	Support cables of 4-9m length	Supports cables of 0.4-3m length or fiber optic cables	OFF
5	OPT3	TBD	TBD	Normal operation	OFF
6	OPT4	CMI Disable	Will disable the CMI interface.	CMI will be used if a PCIe 3.0 cable is detected	OFF
7	RES	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.

Use Cases Summary and Settings

The PXH830 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 PXH830 installed.	OPT2 on if long cables All other off
B	Three node NTB configuration. All systems have a PXH830 installed	OPT1 on to enable two x8 links OPT2 on if long cables All other off
C	Multi node with MXS824 switch	All DIP Switches off

Table 3: Use Case DIP switch settings

Use Case A - 2 Node Configuration – NTB Mode

Each node has a PXH830 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 5.4.0 and newer. Both PXH830 adapter cards operate in NTB mode. The DIP-Switch is set to all off, except if a long cable is used.

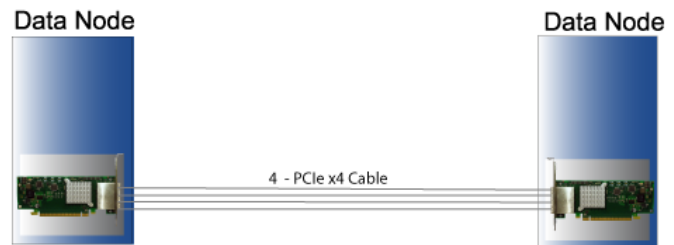
Connecting the cables for 2 Node Configurations, x16 link

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 #x to Port #x

Port, Host A	Port, Host B
P1	P1
P2	P2
P3	P3
P4	P4



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 select one of the alternatives below.

Table 5: Alternative x8 cabling, select alternative 1, 2, 3 or 4.

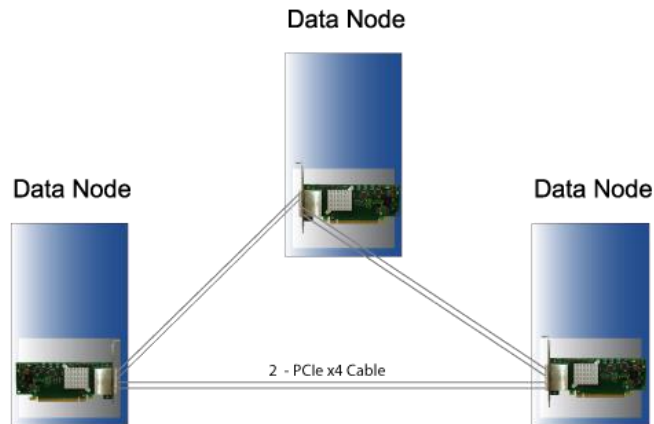
Alternatives	Host A	Host B
1	P1	P1
	P2	P2
2	P1	P3
	P2	P4
3	P3	P1
	P4	P2
4	P3	P3
	P4	P4

Connecting the cables for 2 Node Configurations, x4 link

To establish an x4 link when in dual port mode, please connect any port to any port on the other card.

Use Case B - 3 Node Configuration – NTB Mode

Each node has a PXH830 adapter and a direct x4 or x8 cable connection is used between all systems. This configuration is fully supported by all Dolphin software, from version DIS 5.4.1 and newer. All PXH830 adapter cards operate in NTB mode. The DIP-Switch OPT1 is ON to enable dual port mode.

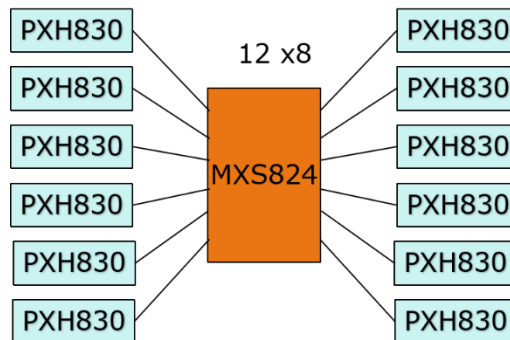


Connecting the cables for 3 Node Configurations, x8 link

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 P1 + P2 to P1 + P2 or P3 + P4

Use Case C - Multi node with MXS824 switch – NTB Mode

Each node has a PXH830 adapter and a direct x4, x8 or x16 cable connection to the MXS824 switch. This configuration is fully supported by all Dolphin software, from version DIS 5.7.0 and newer. All PXH830 adapter cards operate in NTB mode. All DIP-Switches are off. The drawing below shows a 12-node cluster.



Please consult the MXS824 Users Guide for information how to configure the MXS824 switch for x4, x8 or x16 links and how to build larger configurations.

Firmware Upgrade

The PXH830 design uses a microcontroller to implement the PCIe CMI protocol and other 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. Please contact Dolphin for more information.

Identifying the Card

The card has a label-sticker with the serial number in the format 'PXH830-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. PXH830-CC-012345).

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

First, identify the devices for the Dolphin Host card:

```
#lspci

0a:00.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca)
0a:00.1 System peripheral: PLX Technology, Inc. Device 87d0 (rev ca)
0a:00.2 System peripheral: PLX Technology, Inc. Device 87d0 (rev ca)
0b:08.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca)
0c:00.0 Bridge: PLX Technology, Inc. PEX 8732 32-lane, 8-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
```

Then

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

```
[root@metty ~]# lspci -s a:0.0 -v
0a:00.0 PCI bridge: PLX Technology, Inc. Device 8733 (rev ca) (prog-if 00 [Normal decode])
    Flags: bus master, fast devsel, latency 0, IRQ 37, NUMA node 0
    Memory at f4900000 (32-bit, non-prefetchable) [size=256K]
    Bus: primary=0a, secondary=0b, subordinate=0c, sec-latency=0
    Memory behind bridge: f0000000-f48fffff
    Prefetchable memory behind bridge: 0000000040000000-000000007ffffff
    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 0830
    Capabilities: [100] Device Serial Number 00-00-42-43-00-00-00-67
    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: pciport
```

This shows the card as revision 0x4243 (hexadecimal values of the 'CC' letters in the ASCII table), with the production number 0x00000067 (0000103 in decimal).

Support

More information about the product, support and software download can be found at <http://www.dolphinics.com/px.html>. Please email pci-support@dolphinics.com if you have any questions.

Technical Information

PCIe Cable Signals

The external PCI Express cable connector (SFF-8644) and cabling support the following signals:

- PEPn/PETnN: PCI Express Transmitter pairs, labeled where N is the Lane number (starting with 0); “p” is the true signal while “n” is the complement signal.
- PERpN/PERnN: PCI Express Receiver pairs, labeled where N is the Lane number (starting with 0); “p” is the true signal while “n” is the complement signal.
- PWR: Power to support AOC and signal conditioning components within the cable assembly.
- MGTPWR: Power supplied to the connector for cable management components that are needed while the link is not active. This needs to be active if the subsystem has power.
- CBLPRSNT#: Cable present detect, an active-low signal pulled-down by the cable when it is inserted into the PXH830 connector.
- CADDR: Signal used to configure the upstream cable management device address.
- CINT#: Signal asserted by the cable assembly to indicate a need for service via the CMI controller.
- CMISDA: Management interface data line. Used for both initial link setup and sideband messages when used with CMI compliant cables.
- CMISCL: Management interface clock line. Used for both initial link setup and sideband messages when used with CMI compliant cables.

External PCIe x4 Cable Connector Pin-Out

	Column								
Row	9	8	7	6	5	4	3	2	1
D	GND	PETn2	PETp2	GND	PETn1	PETp1	GND	MGTPWR	PWR
C	GND	PETn3	PETp3	GND	PETn0	PETp0	GND	CMISDA	CMISCL
B	GND	PERn2	PERp2	GND	PERn1	PERp1	GND	CBLPRSNT#	PWR
A	GND	PERn3	PERp3	GND	PERn0	PERp0	GND	CINT#	CADDR

Table 6; External PCIe x4 cable Pin-Out

Compliance and Regulatory Testing

EMC Compliance

The Dolphin PCI Express PXH830 adapter has been 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
- EN 61000-6-2 (2005)



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 PXH830 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.



Limited Warranty

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

Warranty Period

Dolphin warrants the product for one (1) year from the date of purchase. Extended warranties are available.

Coverage

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

- Damages 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 which results from accident, abuse, misuse, neglected improper handling or improper installation; moisture, corrosive environments, high voltage surges, shipping or abnormal working conditions.
- Damages which results from violating the specified operating or storage temperatures and airflow.
- Damages 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 that have had the product serial number tampered with or removed.
- Damage to the product caused by products not supplied by Dolphin.

Service Procedure

If 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, email returnrequests@dolphinics.com to obtain a valid RMA number and instructions.

Products returned to Dolphin without a proper RMA number will not be serviced under this warranty.

Hardware Revision history

The PXH830 Adapter card has been undergoing some changes since it was introduced. The following table gives a general overview of the hardware capabilities and changes. Please contact Dolphin if you have any questions.

Adapter revision	Capabilities / Changes
PXH830-Bx	<ul style="list-style-type: none">• Initial shipping version.
PXH830-Cx	<ul style="list-style-type: none">• No changes for NTB operation, ref PXH832 Uses Guide
PXH830-CF	<ul style="list-style-type: none">• Fixed current limiting issue with x16 configurations and some Fiber Optic cables• New bracket port numbering to match MXH824 Switch port numbering• Current shipping version