PCIe x16 Gen4 Host to Target Kit (61611)

Model: OSS-KIT-EXP-61611-xM

PCIe x16 Gen4 Host to Target Kit- Installation Manual

SKU: OSS-KIT-EXP-61611-XM

OSS
ONE STOP SYSTEMS

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Preface

Advisories

Five types of advisories are used throughout this manual to provide helpful information, or to alert you to the potential for hardware damage or personal injury.

NOTE
Used to amplify or explain a comment related to procedural steps or text.

IMPORTANT
Used to indicate an important piece of information or special “tip” to help you

CAUTION
Used to indicate and prevent the following procedure or step from causing damage to the equipment.

WARNING
Used to indicate and prevent the following step from causing injury.

DANGER or STOP
Used to indicate and prevent the following step from causing serious injury or significant data loss

Disclaimer: We have attempted to identify most situations that may pose a danger, warning, or caution condition in this manual. However, the company does not claim to have covered all situations that might require the use of a Caution, Warning, or Danger indicator.

Safety Instructions

Always use caution when servicing any electrical component. Before handling the expansion chassis, read the following instructions and safety guidelines to prevent damage to the product and to ensure your own personal safety. Refer to the "Advisories" section for advisory conventions used in this manual, including the distinction between Danger, Warning, Caution, Important, and Note.

- Always use caution when handling/operating the computer. Only qualified, experienced, authorized electronics personnel should access the interior of the computer and expansion chassis per UL and IEC 60950-1
- The power supplies produce high voltages and energy hazards, which can cause bodily harm.
- Use extreme caution when installing or removing components. Refer to the installation instructions in this manual for precautions and procedures. If you have any questions, please contact Technical Support.

WARNING

Never modify or remove the radio frequency interference shielding from your workstation or expansion unit. To do so may cause your installation to produce emissions that could interfere with other electronic equipment in the area of your system.

When Working Inside a Computer

1. Before taking covers off a computer, perform the following steps:
2. Turn off the computer and any peripheral devices.
3. Disconnect the computer and peripheral power cords from their AC outlets or inlets in order to prevent electric shock or system board damage.

In addition, take note of these safety guidelines when appropriate:

- To help avoid possible damage to systems boards, wait five seconds after turning off the computer before removing a component, removing a system board, or disconnecting a peripheral device from the computer.
- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs. If you are disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before connecting a cable, make sure both connectors are correctly oriented and aligned.

CAUTION

Do not attempt to service the system yourself except as explained in this manual. Follow installation instructions closely.

Protecting Against Electrostatic Discharge

Electrostatic Discharge (ESD) Warning
Electrostatic Discharge (ESD) is the enemy of semiconductor devices. You should always take precautions to eliminate any electrostatic charge from your body and clothing before touching any semiconductor device or card by using an electrostatic wrist strap and/or rubber mat.

Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedures to reduce the risk of damage to components. We strongly encourage you to follow proper ESD procedures, which can include wrist straps and smocks, when servicing equipment.

You can also take the following steps to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component's anti-static packaging material until you are ready to install the component in a computer. Just before unwrapping the anti-static packaging, be sure you are at an ESD workstation or are grounded.
- When transporting a sensitive component, first place it in an anti-static container or packaging.
- Handle all sensitive components at an ESD workstation. If possible, use anti-static floor pads and workbench pads.
- Handle components and boards with care. Do not touch the components or contacts on a board. Hold a board by its edges or by its metal mounting bracket.

1 Introduction

The PCIe x16 Gen 4 expansion kit connects a server to an OSS Expansion Backplane.
It is composed of a "Gen4 Mini-HD SFF-8644 PCIe cable (SKU# OSS-mSAS-CBL-x4-C-XM)" and two "PCIe x16 Gen 4 Cable Adapter (SKU: OSS-PCIe-HIB616-x16)".

The PCIe x16 Gen 4 host cable adapter plugs into a server and cables to a PCIe x16 Gen 4 switch-based target cable adapter. The expansion kit connects with up to (4) x4, 1 meter SFF-8644 PCIe Gen 4 compliant cables.

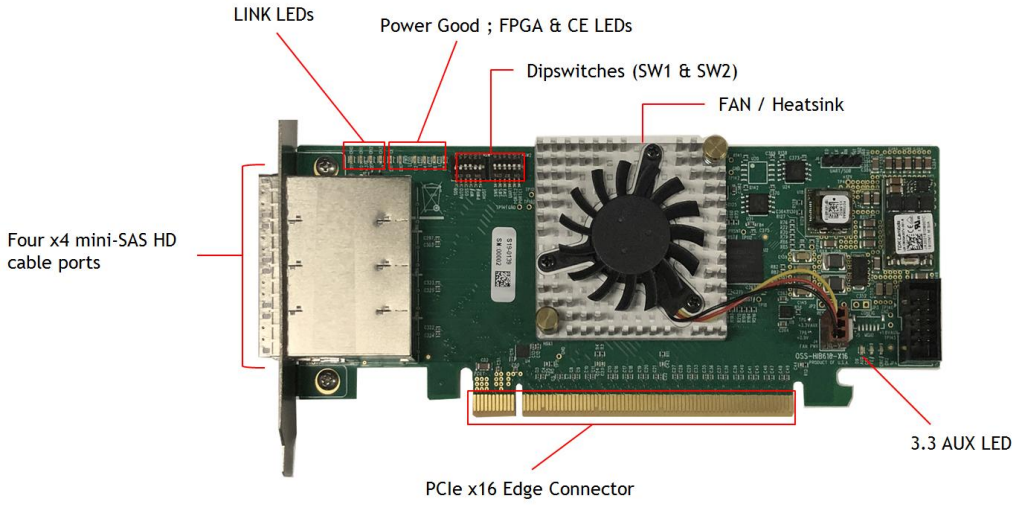
1.1 Specifications

Item	Description
Form Factor	PCIe 4.0 x16 half-height, half-length
Adapter Card Dimensions	6.6 x 2.65" (16.76 x 6.73 cm) at 0.063" (1.6mm) thickness
Bandwidth	256Gb/s
Connectors	• PCIe x16 card edge connector • Quad SFF-8644 connectors on the bracket • Compliant to PCI-SIG PCI Express External Cable Specification 3.0
Bracket	Standard and low profile brackets available
PCIe Switch	Broadcom PEX88032 • 16 GT/s /32-Lane PCI Express Gen 4 Switch • DMA Controller • SSC Isolation
Switch Latency	150ns
Cable Types	Supports the following cable types: • SFF-8644 PCIe CMI copper cables • Mini-SAS-HD copper cables
Cable Connection Modes	One x16 host connection via edge card to: • One x16 cable connection • Up to two x8 cable connections • Up to four x4 cable connections
Power	60W max • 1.5A @3.3V • 3A @12V • 250mA @ 3.3V aux
Operating Temperature	0˚C to +50˚C
Storage Temperature	-40˚C to 85˚C
Operating Humidity	10% to 90% relative humidity non-condensing
Storage Humidity	5% to 95% relative humidity non-condensing
Agency Compliance	Designed to meet the following agency standards: • FCC - Part 15 Class A, 47CFR; Canada ICES-003, issue 4, Class A; Japan: VCCI, Class A; CE Emissions 2004-108EC • UL/IEC 60950-1; Canada: CSA C22.2 No. 60950-1; Argentina: IEC60950-z; IEC 60950-1 (CB Certificate and CB Test Report) • CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, EN61000-3-3) • CISPR 22, CISPR 24, Class A: Australia/New Zealand AS/NZS CISPR 22, ClassA • RoHS 6 of 6 compliance (Directive 2011/95/EC)
Operating System	Supports the following OS Windows 7, 10, Windows Server 2012 R2 Linux Based OS

When ordering the Gen4 x16 PCIe HIB card and Gen4 SFF-8644 PCIe cable, use the following part numbers:

Part Numbers	Description
OSS-PCIe-HIB616-x16 (main part#)	**HIB616**-x16 Host Configuration with Full-height bracket
OSS-PCIe-HIB616-x16-Half	**HIB616**-x16 Host Configuration with Half-height bracket
OSS-PCIe-HIB616-x16-T	**HIB616**-x16 Target configuration with Full-height bracket
OSS-PCIe-HIB616-x16-T-Half	**HIB616**-x16 Target configuration with Half-height bracket
OSS-mSAS4-CBL-x4-C-XM	Mini HD SaS Cable
OSS-mSAS4-CBL-x4-C-1M	1 meter Gen4 Cable
OSS-mSAS4-CBL-x4-C-2M	2 meter Gen4 Cable
OSS-mSAS4-CBL-x4-C-3M	3 meter Gen4 Cable

1.2 Parts of HIB616-x16



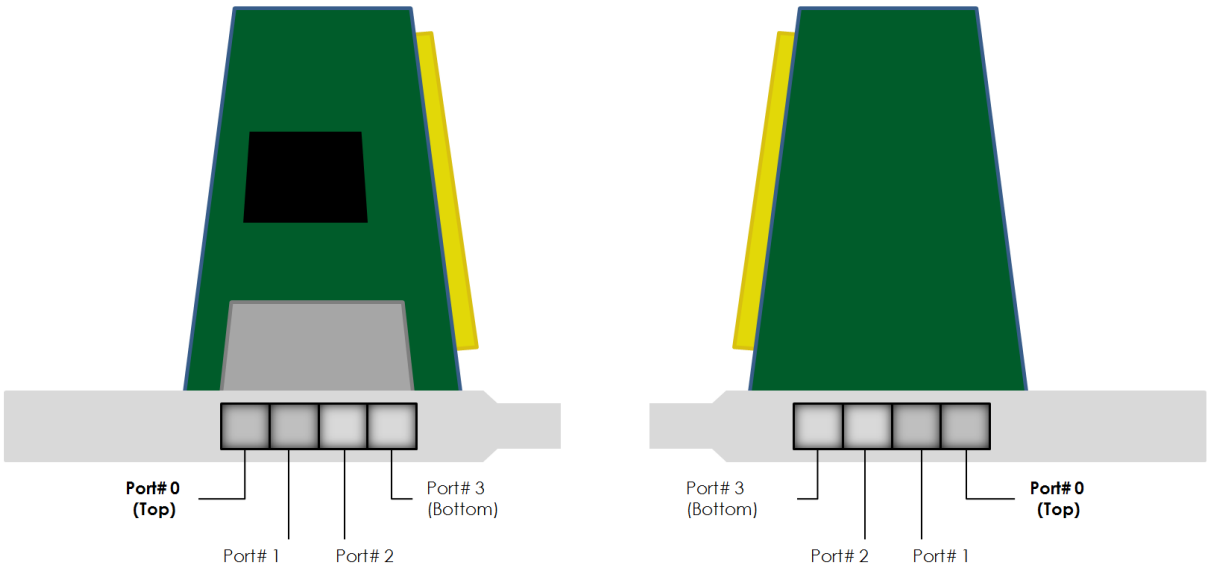
1.2.1 x4 cable Ports

There are four x4 cable ports available on the HIB card. It is very important to know where port#0 is when connecting a single x4 PCIe SFF-8644 cable. Port #0 is the connector nearest the Link LEDs. A single x4 SFF-8644 cable must be inserted into port#0 of the Target card all the time. For the Host card, you can plug in a single x4 cable to any port as long as the Host card switch is set to operate in a x4 mode.

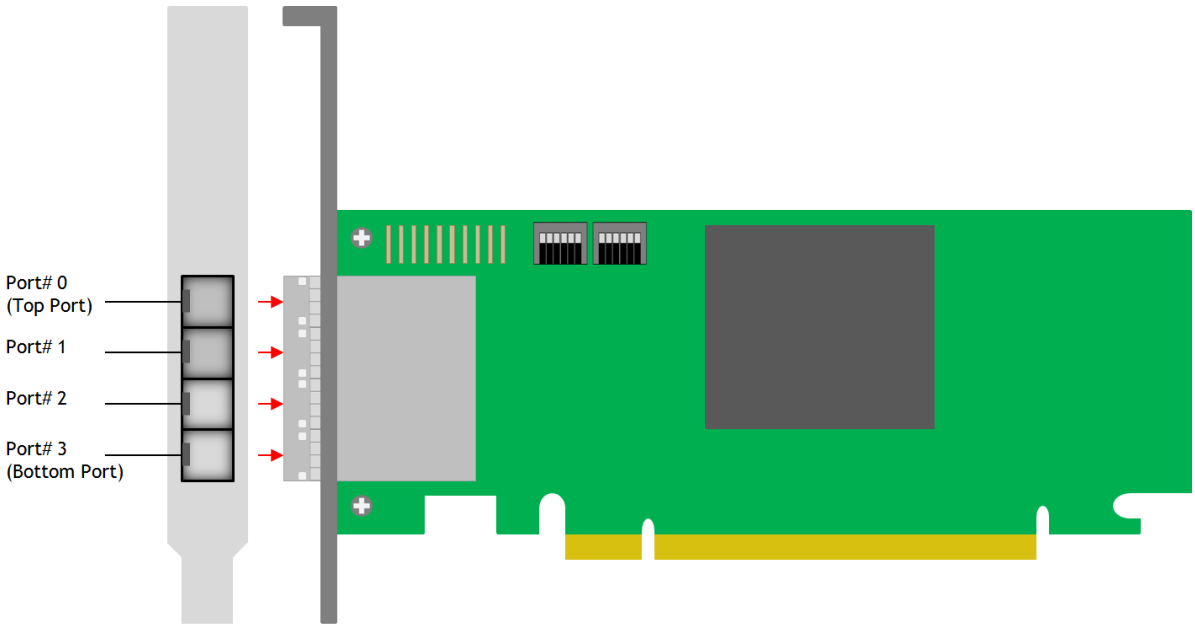
When using two x4 SFF-8644 cables, it must be connected to port#0 and port#1 of the Target card only. For the Host card, you can plug-in the two cables to port#0 and portt#1 **OR** port#2 and port#3.

Below are photos of the HIB cards in a different position when plugged into a PCIe slot. This will serve as a guide in determining where port#0 is located.

1.2.2 HIB card seated flat (horizontal position)

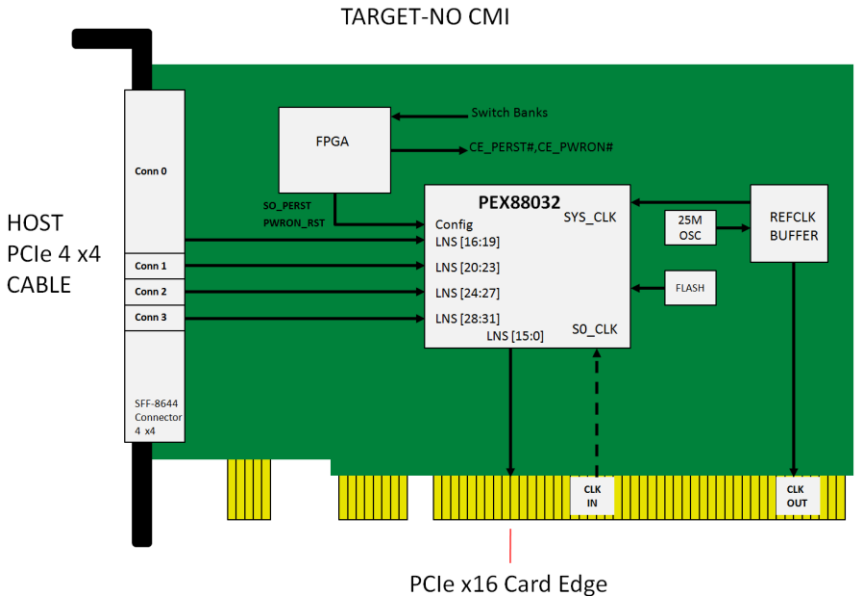


1.2.3 HIB card seated in a vertical position

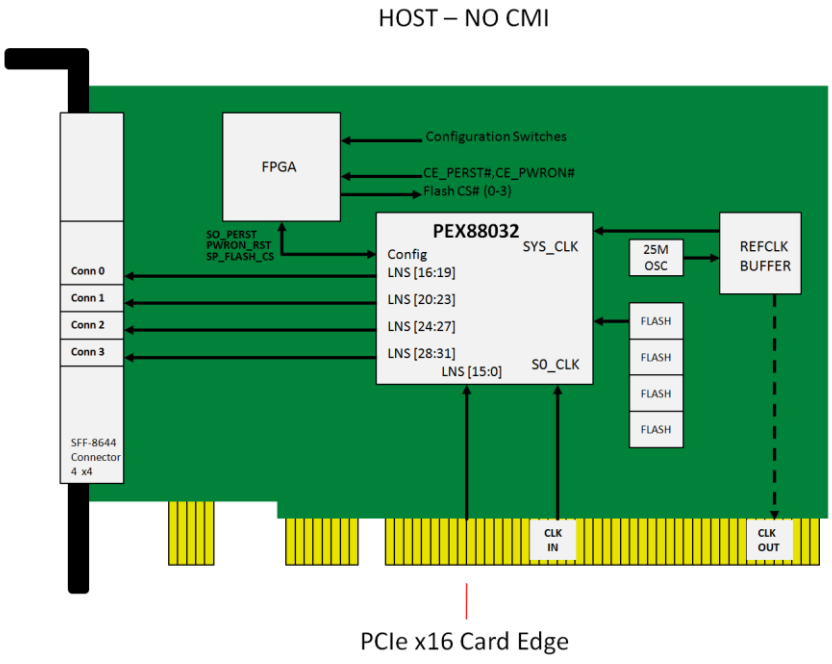


1.2.4 HIB Block Diagrams

Target Card

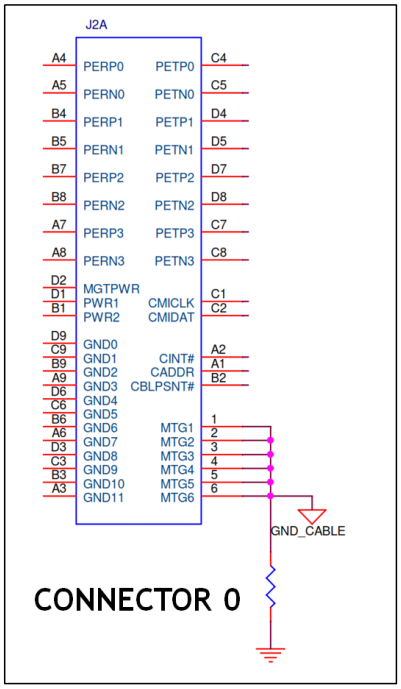


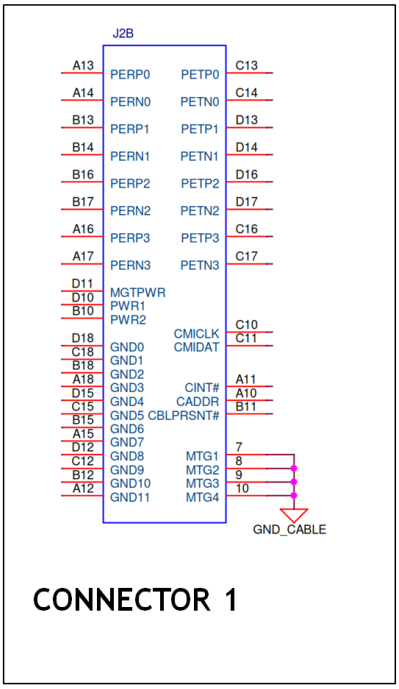
Host card



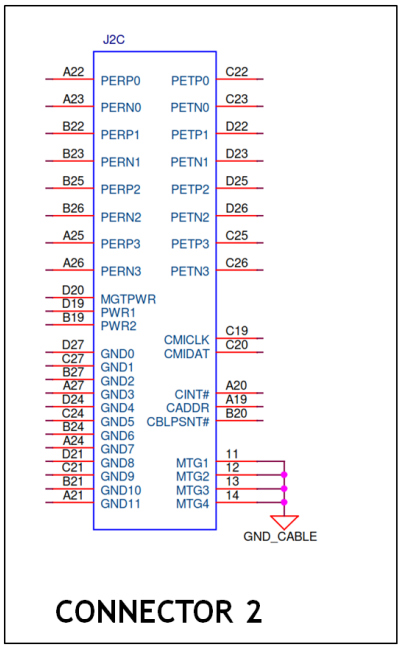
1.2.5 Pin out assignments of the SFF-8644 PCB Connectors

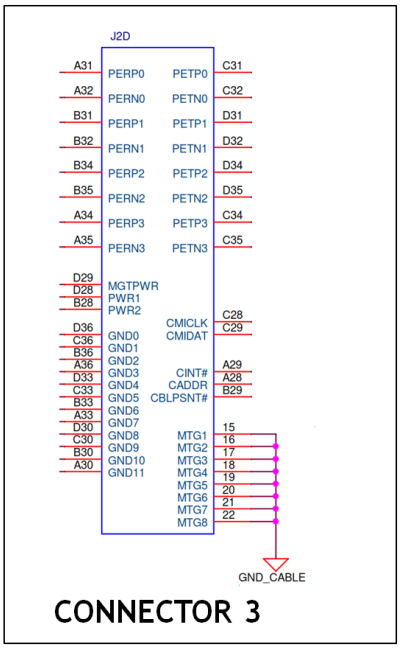
Connector 0 and 1





Connector 2 and 3





1.2.6 Signal Descriptions

PETpN/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 provisioning to the connector backshell is provided to allow for signal conditioning components within the cable assembly. A wire must not be provided within the cable. 345

MGTPWR: Power supplied to the connector backshell for cable management components that are needed while the link is not active. This needs to be active if the Subsystem has power. A wire must not be provided within the cable.

CBLPRSNT#: Cable present detect, an active-low signal pulled-down by the Free-Side when it is inserted into the Fixed-Side Connector. A wire must not be provided within the cable. 350

CADDR: This signal is used to configure the Upstream cable management device address. A wire must not be provided within the cable.

CINT#: This signal is asserted by the cable assembly to indicate a need for service via the Cable Management Interface controller. A wire must not be provided within the cable.

CMISDA: Management interface data line. Used for both initial link setup and sideband 355 messages when used with proper cables.

CMISCL: Management interface clock line. Used for both initial link setup and sideband messages when used with proper cables

CMICLK: same as CMISCL

CMIDAT: same as CMISDA

GND (Ground): Shield for differential pairs

1.3 Features

1.3.1 Host Interface Board

The HIB is provided with either a standard or low profile PCIe bracket type and has the following features:

- PCI Express interface that is compatible with the PCI Express Specification, revision 4.0.
- PCI Express 4.0 compliant x16 host and target interfaces.
- Compatibility with the PCIe Low Profile standards and PCIe 4.0 CEM standard.
- Operates at up to 256Gb/s at PCIe Gen4 speeds.
- No driver required.
- Uses mini-SAS HD or PCIe SFF-8644 cables.
- Simplified cabling with a point-to-point, serial architecture.
- Operates in Host and Target modes
- Support PCIe Bifurcation

1.4 SFF-8644 PCIe cable

Gen4 High speed signaling cable up to 3m in length. This passive copper cable mates to the SFF-8644 connectors on the HIB6xx family of OSS host interface boards and includes the CMI (cable management interface) and serialized EEPROMs in the cable backshell.

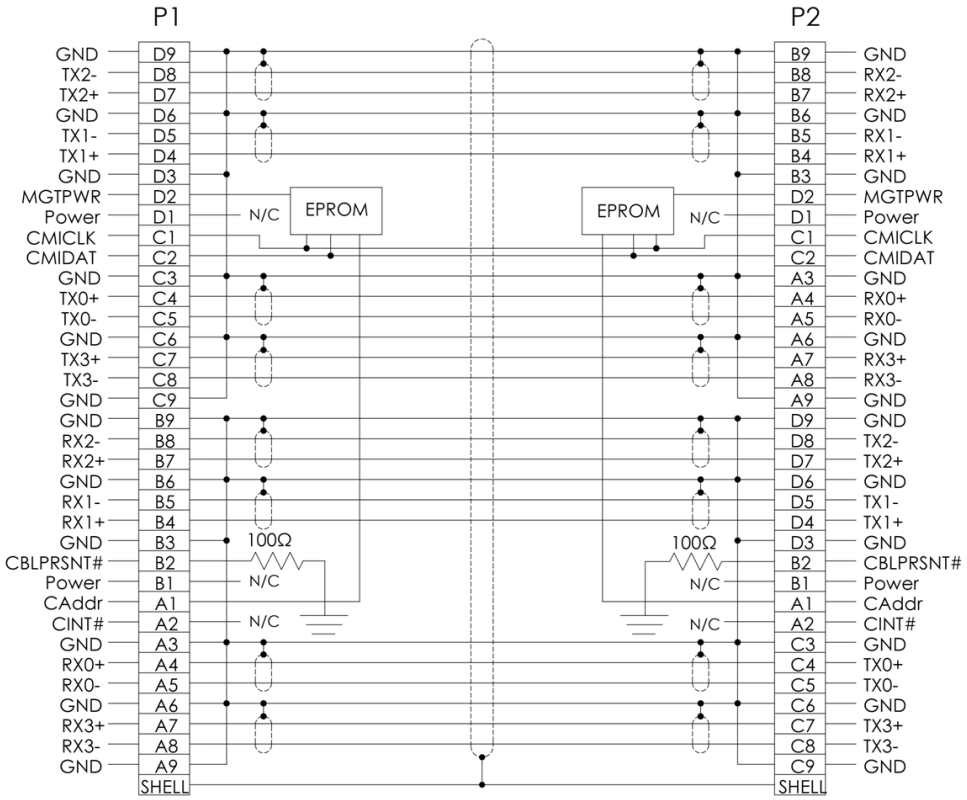
- x4, one cable
- x8, two cables
- x16, 4 cables

Allows transfers to and from the host up to 6GB/s

*Gen 4 cables are REQUIRED to support Gen 4 bandwidth and OSS Gen 4 products.

Specifications

Cable Lengths	1m, 2m, 3m
Cable Options	x4 (1 cable) x8 (2 cables) x16 (4 cables)
Wire Size AWG	28-30
Bend Radius	4.0" cable bend radius
Agency Compliance	CE, WEEE, RoHS2



2 Hardware Requirements

1. OSS-PCIe-HIB616-x16 card configured as a Host
2. OSS-PCIe-HIB616-x16 card configured as a Target
3. SFF-8644 Gen 4 PCIe x4 cable
    a. x16 Configuration: Four PCIe Gen4 cables
    b. X8 Configuration: Two PCIe Gen4 cables
    c. X4 Configuration: One PCIe Gen4 cable
4. Gen4 x16 PCIe slot (computer motherboard)
5. OSS Expansion Chassis / OSS Gen4 Backplane

2.1 OSS-PCIe-HIB616-x16 card

A pair of HIB616-x16 card, one is configured as a host card and the other is configured as a target card.

2.2 SFF-8644 Gen4 x4 Cable

This passive copper cable mates to the SFF-8644 connectors on the HIB6xx family of OSS host interface board.

- Tested and validated with 1m, 2m and 3m lengths
- Single or multiple cables can form larger PCIe links
    - x4 (1 cable)
    - x8 (2 cables)
    - X16 (4 cables)

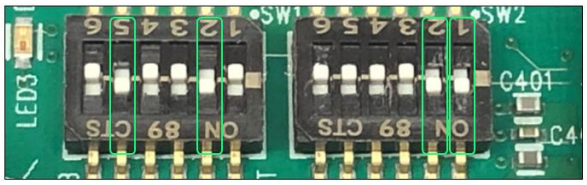
The cable that we qualified is the PCIe Gen 4 x4 (with GREEN tab), see photo below. The FPGA in the HIB616-x16 card does not support CMI operations.

2.3 Expansion Chassis / Gen4 Backplane

2.4 Host Card Mode Configuration

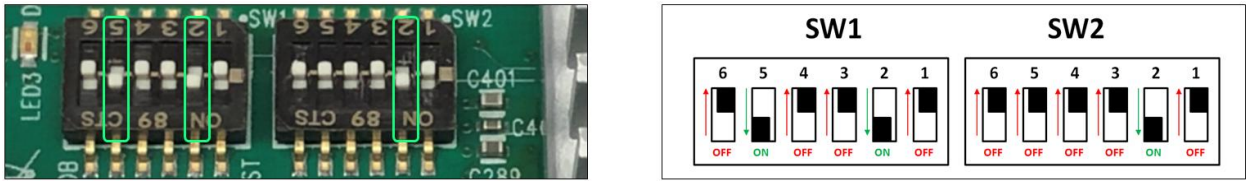
x16 Dip switch Settings:

- SW1 #2 = ON; #5 =ON.
- SW2 #1 = ON; #2 = ON



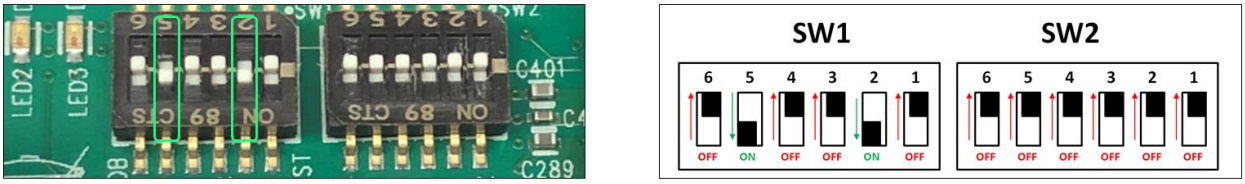
x8 Dip switch Settings:

- SW1 #2 = ON; #5 = ON
- SW2 #1 = OFF; #2 = ON or #2 = OFF and #1 = ON



x4 Dip switch Settings:

- SW1 #2 = ON; #5 = ON
- SW2 = All OFF

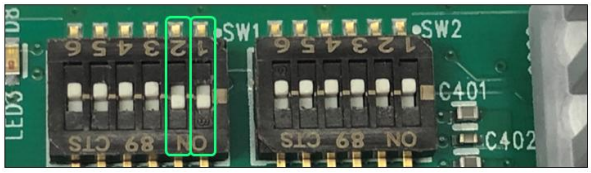


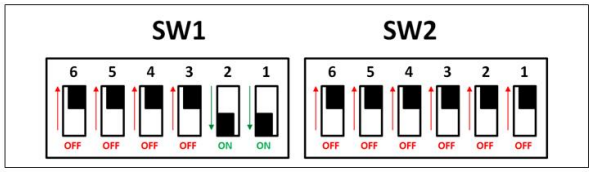
2.5 Target Card Mode Configuration

- SW1 #1 = ON; #2= ON
- SW2 = All OFF

2.5.1 Target mode switch settings - OSS-Backplane

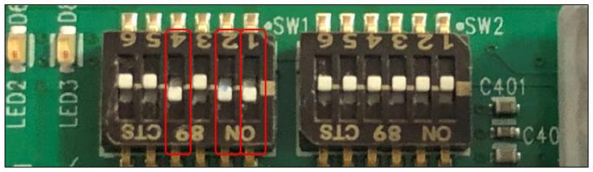
Use the switch settings below when using the OSS backplane.

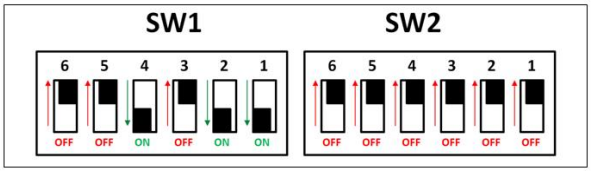




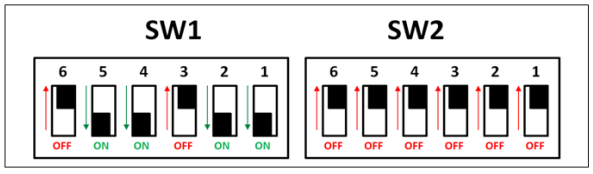
2.5.2 Target mode switch settings - Magma-Backplane

When using the legacy or Magma backplane, use the switch settings below for Target mode



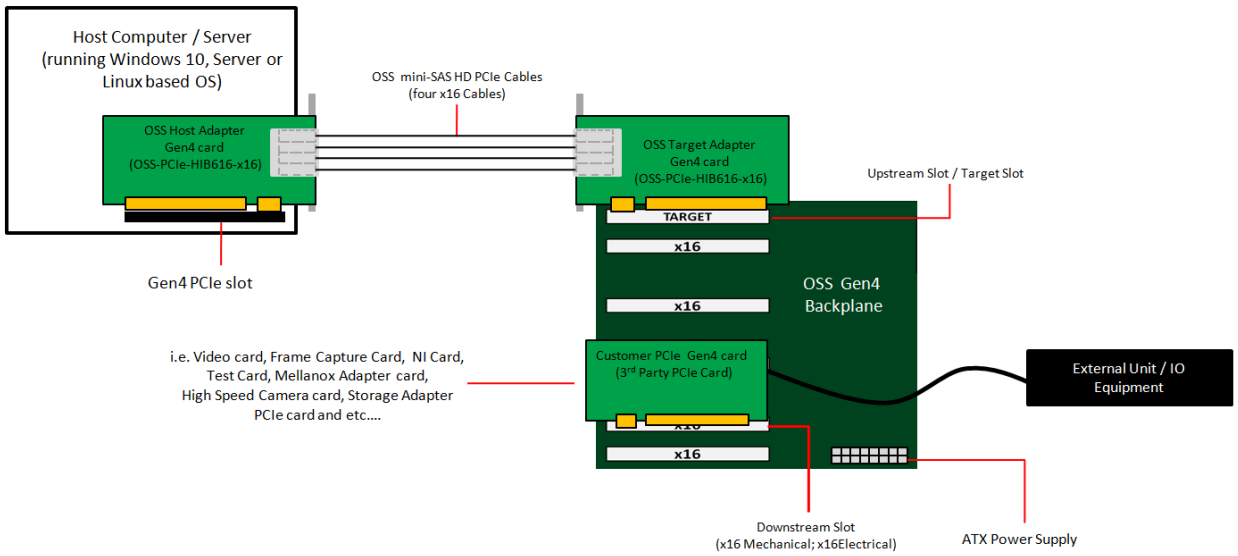


If Target card is not linking up, you can set SW1-5 to ON position, see photo below.



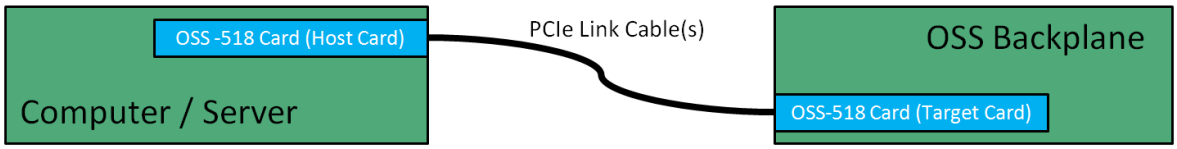
2.6 Configuration / Setup

The diagram or drawing below shows how to setup and use the hardware kit.



2.7 Supported Setup

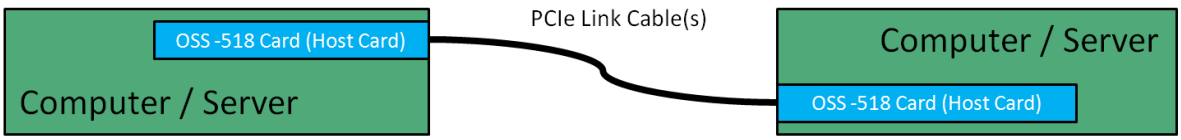
Using a set of OSS-PCIe-HIB616-x16 card (Target and Host cards), OSS Gen4 backplane and PCIe Gen4 cables.



2.8 Use Cases / Configurations

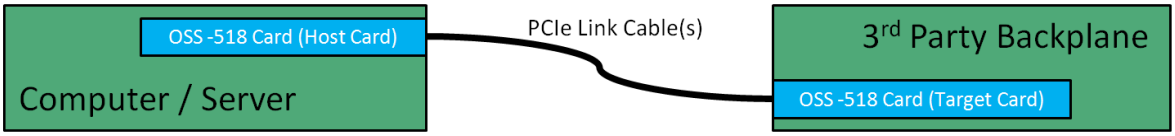
2.8.1 Host-to-Host

This configuration is **NOT** supported. The OSS-518 board (HIB616-x16 card) is not programmed for this option nor will it work from hardware standpoint.



2.8.2 Using 3rd Party Target Backplane

This configuration can be **supported** with appropriate switch confirmation. The OSS- 518 card typically outputs REFCLK on pins A6 and A7 which is not PCI standard. This can be changed by using the OSS switch (SW1-4). The OSS-518 outputs POWER_ON signal on a Reserved PCI pin. If customer expects remote turn ON, then they need to add that to their backplane, otherwise, they need to turn on the backplane power (not just AUX) before powering on host.



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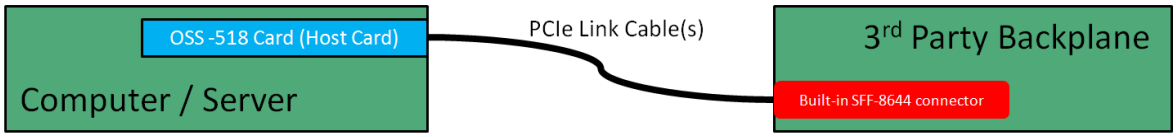
2.8.3 Connecting to 3rd Party backplane via on-board SFF-8644 connector

This should work as long as the 3rd party backplane creates its own REFCLK, Reset and is powered on first. If issue arises, we do not provide support on the 3rd party backplane.



Note: The customer or the end-user is solely responsible for troubleshooting their 3rd party backplane.

3 Installation Procedures

The following steps will guide you through the installation of your OSS HIB616-x16 card.

3.1 Tools Required for Installation

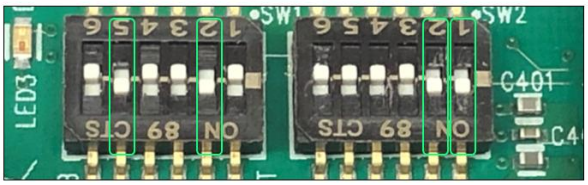
To complete the installation of the OSS product you will need a Phillips-head screwdriver and ESD wrist strap to prevent electrostatic discharge.

3.2 Configure Card to Host and Target modes

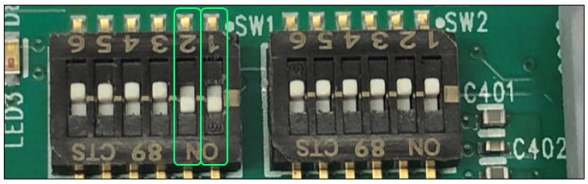
Set the switches on the card for the desired operating mode. See Host and Target cards configuration section for more details.

Photos below are Host and Target mode settings

Host Mode (x16)



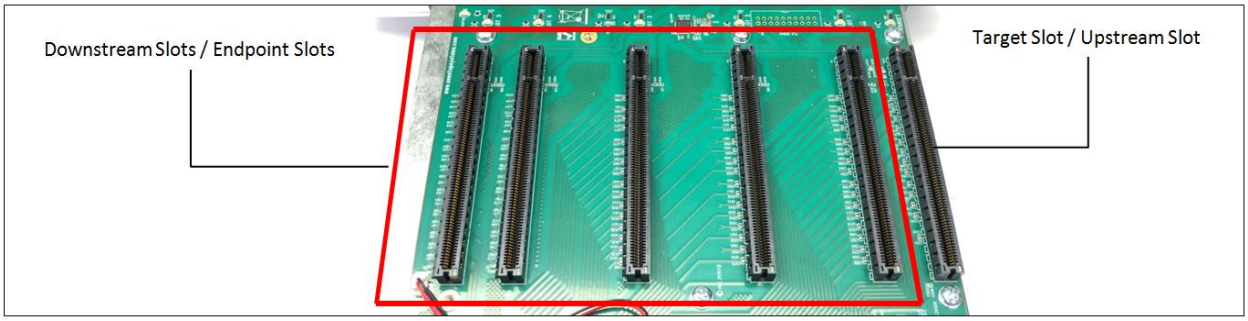
Target Mode



- The Host card is installed in the host computer.
- The Target card is installed in the expansion OSS backplane. The card is must be installed in a target slot.

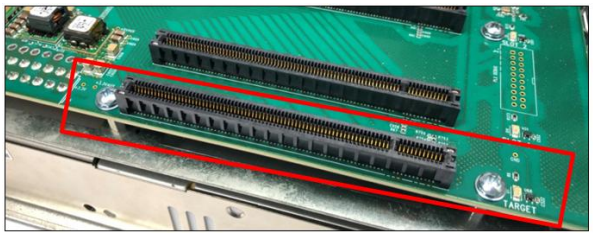
3.3 Install the Target card

In this example, a Gen4 backplane is used with this setup.



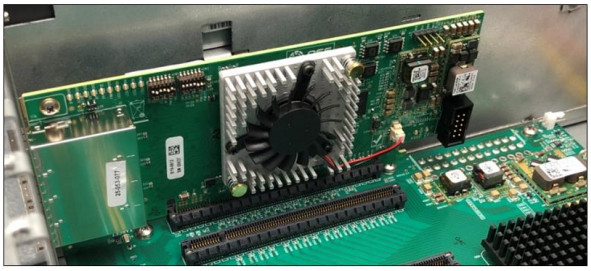
Do not plug in the Target card while the board or the unit is ON or has power. Disconnect the power first prior to installing the card.

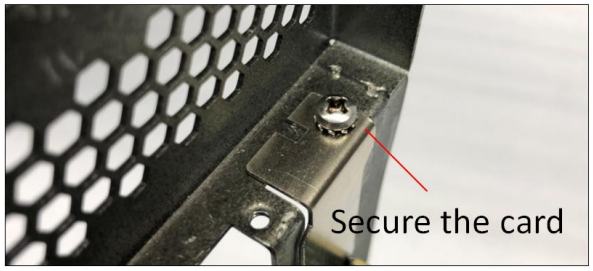
Install the Target card in the x16 PCIe upstream slot / target slot on the expansion board.



Note: Do not plug a Target-configured card in a downstream slot. The Target card will not function in a downstream slot and may cause damage.

Secure the card by screwing the card-bracket to the chassis.

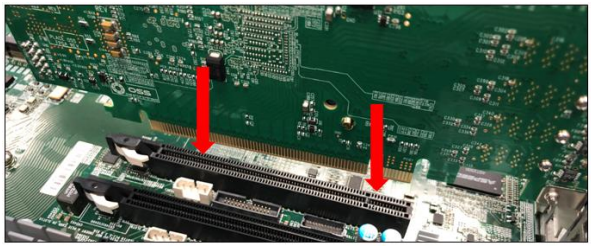


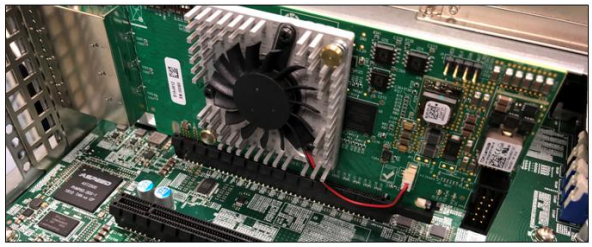


3.4 Install the Host card

Install a Host-configured card in a x16 Gen4 PCIe slot of a motherboard.

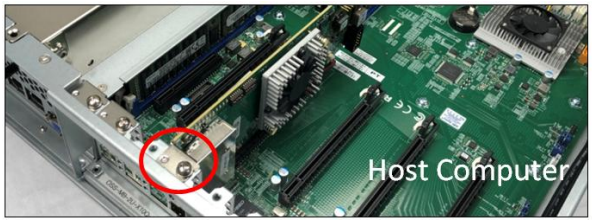
- Check the PCIe slot for any foreign debris as this can damage the card during installation.
- Align the host card PCIe connector on top of the PCIe slot and carefully push the card down until it is firmly seated.



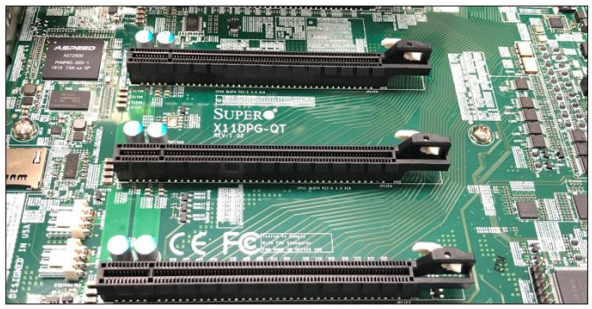


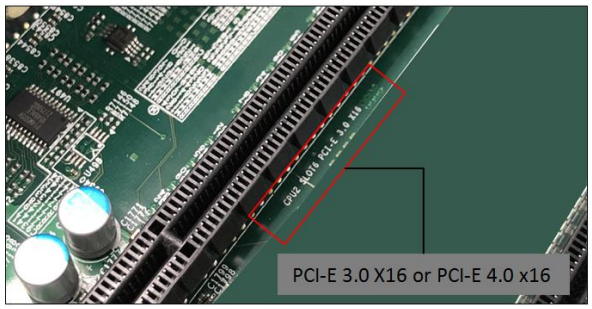
Do not plug in the Host card while the board or the unit is ON or has power. Disconnect the power first prior to installing the card.

Secure the card



The photos below are reference of a x16 PCIe slot connector. Below example is a photo of a PCI-E 3.0 x16 slot. The specification of the PCIe slot is printed on the board next to connector for easy identification.





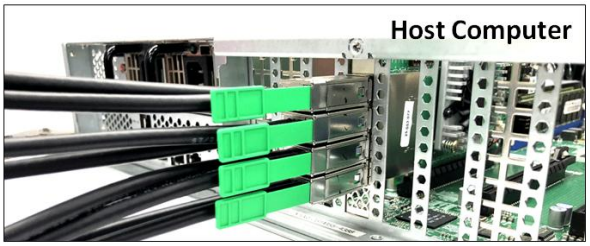
3.5 Connecting the Link Cables

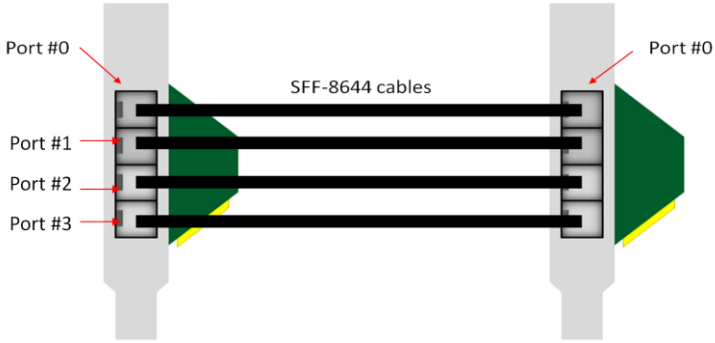
3.5.1 x16 configuration: FOUR cables

Note: Make sure the HIB616-x16 host card is set to x16 configuration, see the x16 switch setting section.

- Plug-in the 1st cable to Port#0 (Top port) on both Target and Host cards
- Plug-in the 2nd cable to Port#1 on both Target and Host cards
- Plug-in the 3rd cable to Port#2 on both Target and Host cards
- Plug-in the 4th cable to Port#3 (Bottom port) on both Target and Host cards

Note: It is easier to plug in the cables from bottom to top.





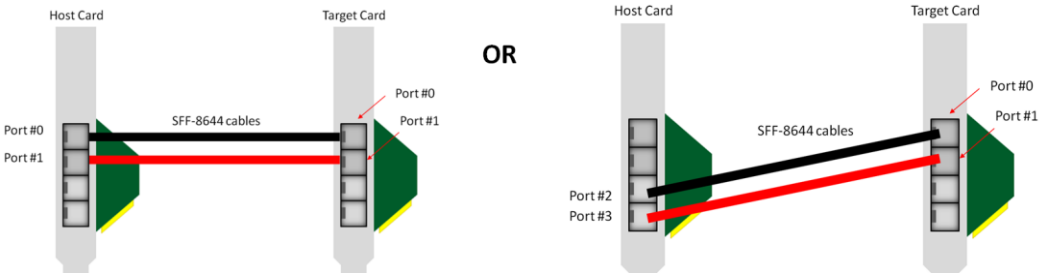
3.5.2 x8 configuration: TWO cables

Note: Make sure the HIB616-x16 host card is set to x8 configuration, see x8 switch setting section.

- Plug-in the 1st cable to Port#0 (Top port) on both Target and Host cards
- Plug-in the 2nd cable to Port#1 on both Target and Host cards.

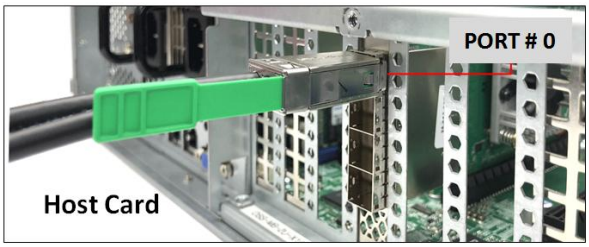
On the host card, you can move the two PCIe cables to the bottom ports. 1st Cable to PORT #2 and the 2nd cable to PORT #3

Note: The two cables on the TARGET card should not be removed from PORT #0 and PORT #1. See diagrams below as an example.



3.5.3 x4 Configuration: ONE cable

- Plug-in the single cable to Port#0 (Top port) on both Target and Host cards



You can move the x4 cable on the HOST card to another port. However, the other end of the cable stays connected to PORT#0 on the Target card.

Photo A1: Cable on the Target card isconnected to PORT #0. The other end of the cable is connected to PORT #1 on the Host card.

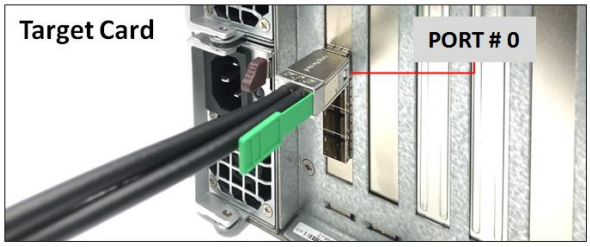
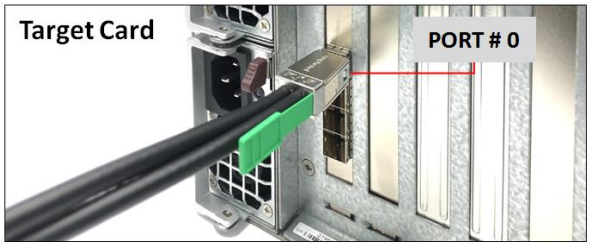


Photo B1: Cable on the Target card is connected to PORT #0. The other end of the cable is connected to PORT #2 on the Host card.



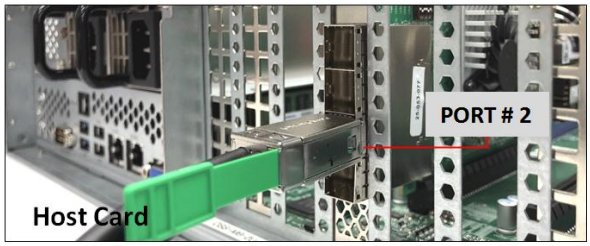
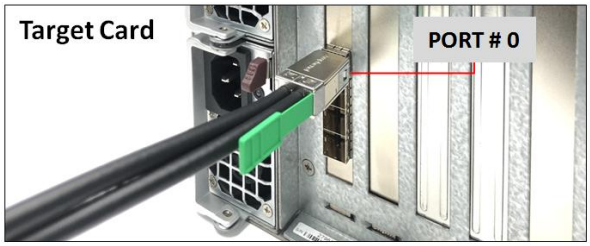
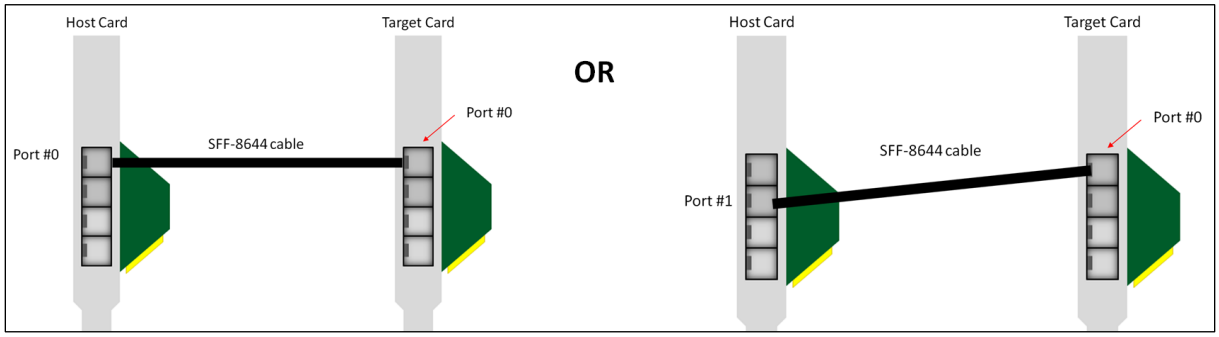
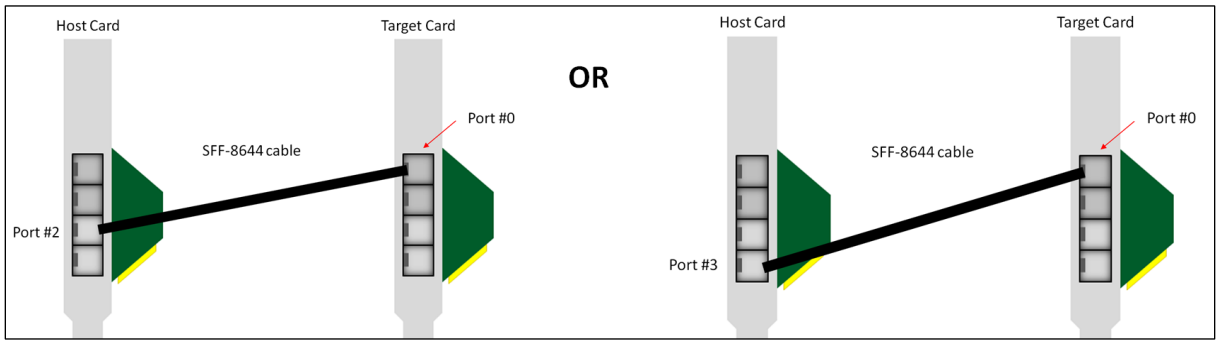


Photo C1: Cable on the Target card is connected PORT #0. The other end of the cable is connected to PORT #3 on the Host card.



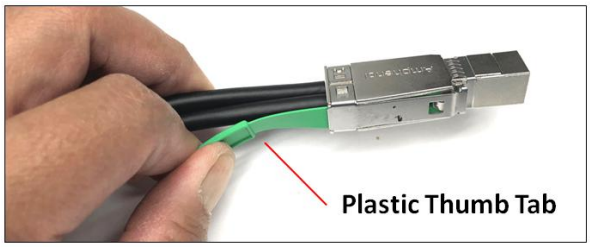
Diagrams below are different x4 cable configurations.

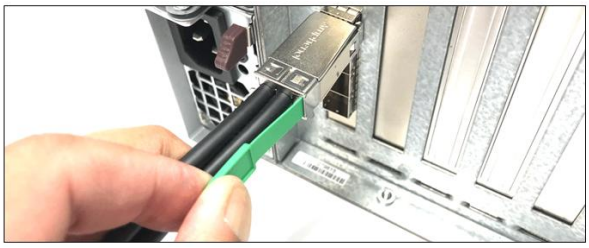




3.5.4 Disconnecting the cable

To disconnect the link cable, pull back the PLASTIC thumb tab to release metal pins while slowly pulling the cable out.



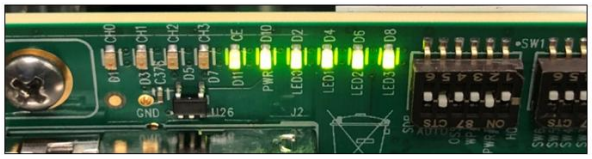


3.6 Turn ON the Expansion system / unit

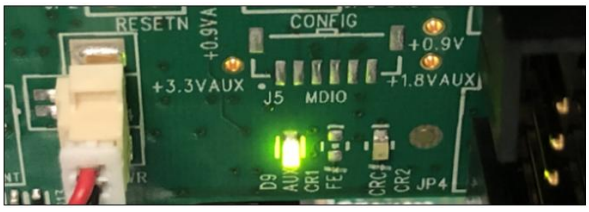
Flip the power supply switch to ON position. LED1, LED2, LED3, LED4 are always ON (solid green).

- CE (D11): will be ON, either solid green or blinking depending on the PCIe Gen on the expansion board.
- PWR (D1: will be blinking when FPGA program is running properly.
- AUX: Solid green

LED1, LED2, LED3, LED4, PWR and CE LEDS:



AUX LED



Stand-by Mode LED:

During "Stand-by Mode" (awaiting to power ON) you will only see four LEDs on the Host and Target cards. These are the LED1, LED2, LED3 and LED4.

3.7 Turn ON the Host computer

Power UP the host computer and boot all the way up. The LINK LEDs on the both Target and Host cards will illuminate. The LINK LED indicator will vary depending on the configuration you elected to use.

3.8 Verify LINK

After powering ON the host computer, the LINK LED on the host and target card should come ON.

x16 configuration (Four x4 Cables connected): The following LEDs on the Target card will be illuminated

- D10 - blinking green
- D11 (CE- Card Edge) – blinking green (Gen 3)– depends on speed of expansion chassis switch
- D1(CHO) - solid green
- D9 (AUX) – solid green
- LEDO,LED1,LED2,LED3 - all solid green

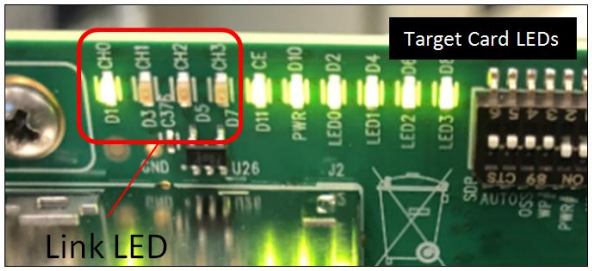
The following LEDs on the HOST Card will be illuminated

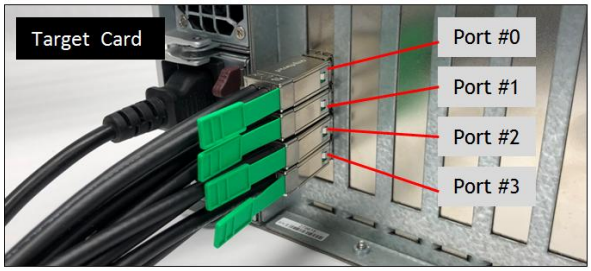
- D10 - blinking green
- D11 (CE- Card Edge) - solid green (Gen 4)– assuming connection to a Gen4 server
- D1(CHO) - solid green
- D9 (AUX) – solid green
- LED0,LED1,LED2,LED3 - SOLID GREEN

3.9 LED Indicators per Configuration

3.9.1 x16 Configuration LEDs

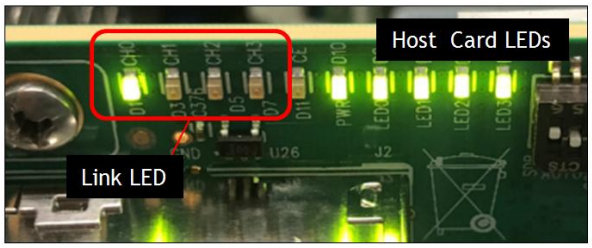
Target Card LED : Photo below is the link LED on the Target card (set to x16 with four cables attached).

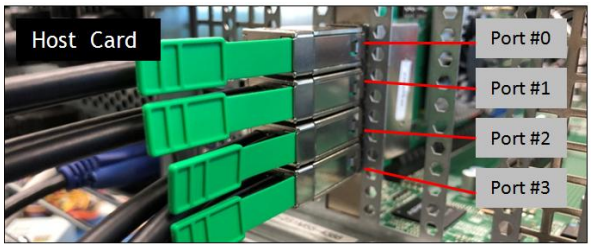




LED	Status	Description
CH0 (D1)	ON (Solid Green)	Link LED. There is a link between Host and Target cards
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good
CE(D11)	ON (Blinking Green)	Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane. Solid Green: Gen 4 on the expansion chassis switch
D10	ON (Blinking Green)	Power Good / FPGA Healthy
D9	ON (Solid Green)	AUX Power Good

Host Card LED : Photo below is the link led on the Host card (set to x16 with four cables attached).



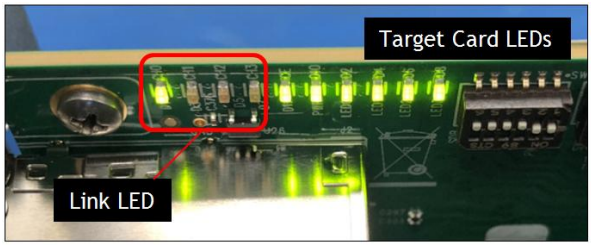


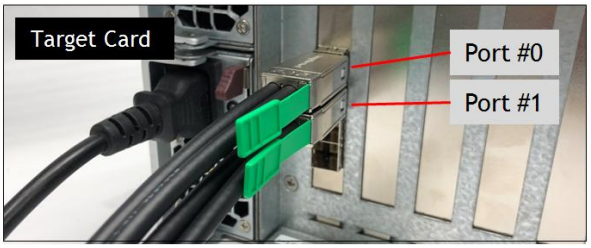
LED	Status	Description
CH0 (D1)	ON (Solid Green)	Link LED. There is a link between Host and Target cards
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good
CE(D11)	**ON (Solid Green)**	Solid Green: The CARD EDGE connector is communicating to Gen4 PCIe switch on the host computer motherboard. Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane
D10	ON (Blinking Green)	Power Good / FPGA Healthy
D9	ON (Solid Green)	AUX Power Good

- If there is no Link between Host and Target cards, LINK LED will be OFF on both cards.
- If the Host system is in the state of "standby mode" (waiting to be powered UP), LINK LED will be OFF on both cards.
    - Only LED0, LED1, LED2, LED3 are ON (solid green) on the Host card.

3.9.2 x8 Configuration LEDs (Two Cables)

Target Card LED : Photo below is the link LED on the Target card, which set to x8 with and two cables attached; 1st cable to PORT #0 AND 2ND cable to PORT #1





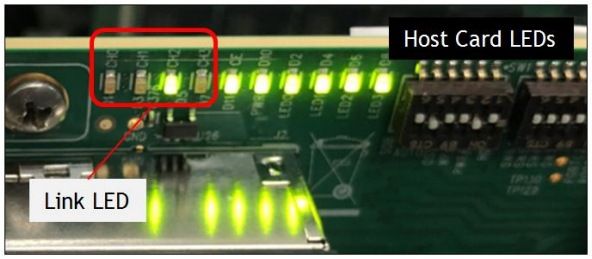
LED	Status	Description
CH0 (D1)	ON (Solid Green)	Link LED. There is a link between Host and Target cards
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good
CE(D11)	ON (Blinking Green)	Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane. Solid Green: Gen 4 on the expansion chassis switch
D10	ON (Blinking Green)	Power Good / FPGA Healthy
D9	ON (Solid Green)	AUX Power Good

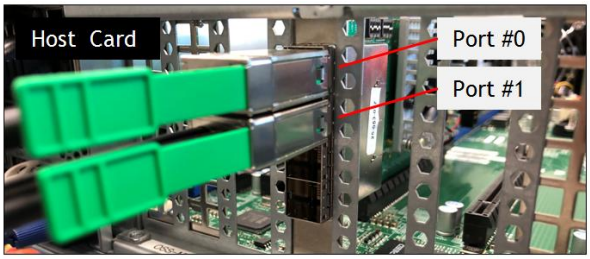
Host Card LED (When Expansion and Host systems are ON)

Photos below are the link LED on the host card, set to x8 and with two cables connected.

CH0 illuminates when connected to host port 2 and 3, CH2 illuminates when connected to ports 0 and 1. For target, always illuminates CH0

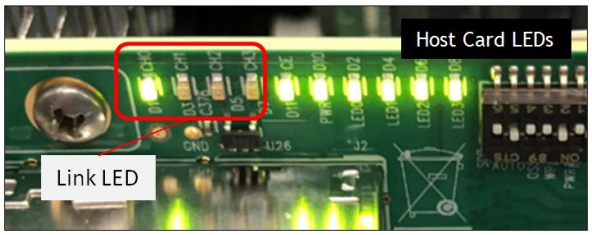
- 1st cable connected to PORT #0
- 2nd cable connected to PORT #1

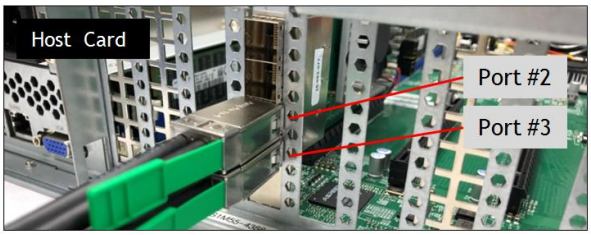




This is the link led on the Host card set to x8 with two cables attached on the bottom ports.

- 1st cable connected to PORT #2
- 2nd cable connected to PORT #3



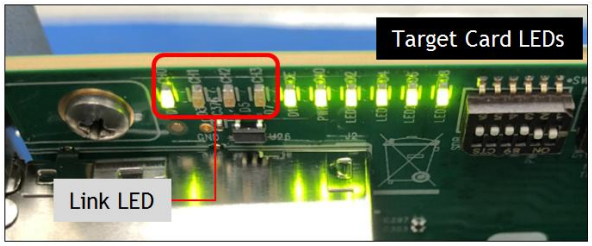


LED	Status	Description	
CH0 or CH2	ON (Solid Green)	There is a link between Host and Target cards. Either CHO or CH2 LED will be ON, depending where the two cables are connected on the ports of the HOST CARD.	
		CH2 (D3) Link LED	1st cable is connected to PORT#0 2nd cable is connected to PORT#1
		CH0 (D1) Link LED	1st cable is connected to BOTTOM PORT#3 2nd cable is connected to PORT#2
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good	
CE(D11)	**ON (Solid Green)**	Solid Green: Gen 4 on the expansion chassis switch Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane.	
D10	ON (Blinking Green)	Power Good / FPGA Healthy	
D9	ON (Solid Green)	AUX Power Good	

3.9.3 x4 Configuration LEDs (One Cable)

Target Card LED (When Expansion and Host systems are ON)

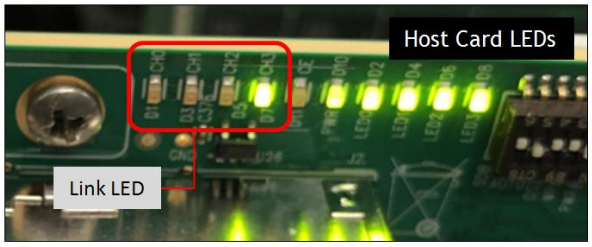
Photo below is the link LED on the Target card, set to x4 and with a single cable connected to PORT #0.



LED	Status	Description
CH0 (D1)	ON (Solid Green)	Link LED. There is a link between Host and Target cards
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good
CE(D11)	ON (Blinking Green)	Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane. Solid Green: Gen 4 on the expansion chassis switch
D10	ON (Blinking Green)	Power Good / FPGA Healthy
D9	ON (Solid Green)	AUX Power Good

Host Card LED (When Expansion and Host systems are ON)

The Photo below is the link LED on the Host card, set to x4 and with single cable connected to top PORT #0.



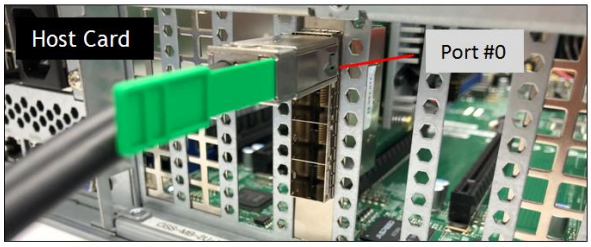
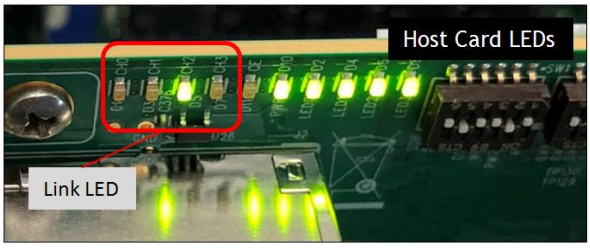


Photo below is the link LED on the Host card, set to x4 and with single cable connected to PORT #1.



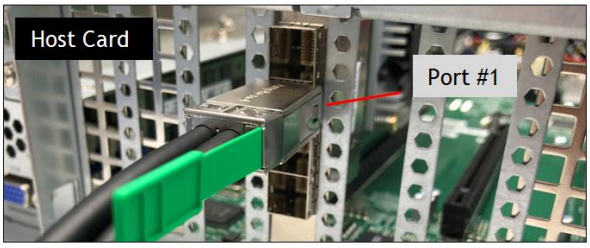
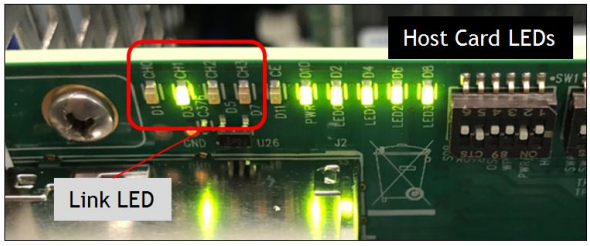


Photo below is the link LED on the Host card, set to x4 and with single cable connected to PORT #2.



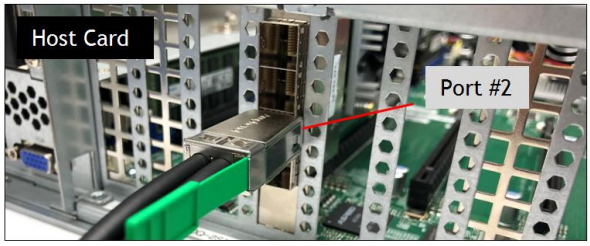
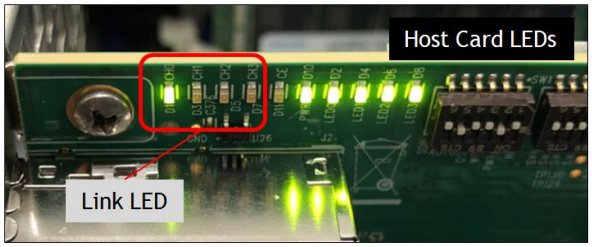
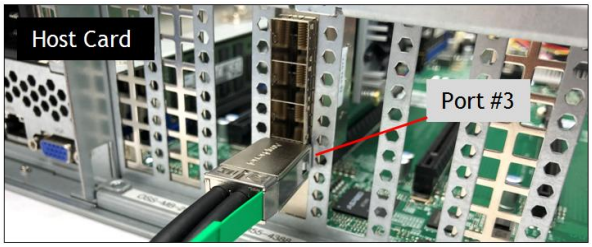


Photo below is the link LED on the Host card, set to x4 and with single cable connected to PORT #3.





LED	Status	Description	
CH0 or CH1 or CH2 or CH3	ON (Solid Green)	There is a link between Host and Target cards. Either CHO or CH1 or CH2 or CH3 LED will be ON, depending where the cable is connected on the port of the HOST CARD.	
		CH3 Link LED	Single x4 cable is connected to TOP PORT#0
		CH2 Link LED	Single x4 cable is connected to PORT#1
		CH1 Link LED	Single x4 cable is connected to PORT#2
		CHO Link LED	Single x4 cable is connected to Bottom PORT#3
LED0 (D2), LED1(D4), LED2(D6); LED3(D8)	ON (Solid Green)	Power Good	
CE(D11)	**ON (Solid Green)**	The CARD EDGE connector is communicating to Gen4 PCIe switch on the host computer motherboard. Blinking Green: The CARD EDGE connector is communicating to Gen3 PCIe switch on the expansion board / backplane.	
D10	ON (Blinking Green)	Power Good / FPGA Healthy	
D9	ON (Solid Green)	AUX Power Good	

DANGER or STOP

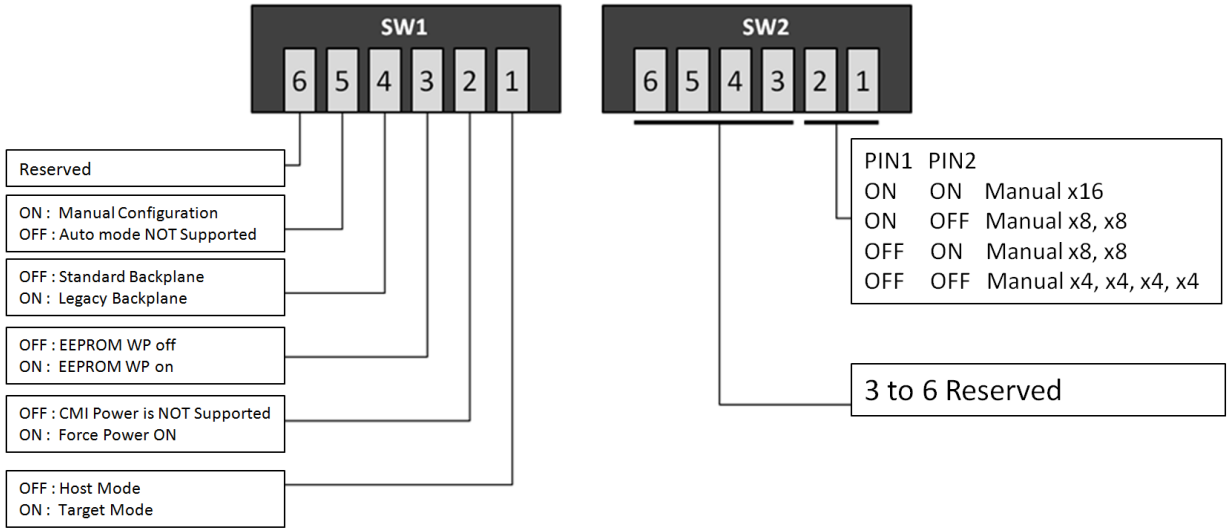
Do not remove or uninstall the Host and Target cards while the system is ON. Turn OFF the system first before uninstalling the cards.

4 Hardware & Technical Info

4.1 LED Definitions

LED	Descriptions	Status (Solid Green, OFF, Blinking)
D1 (CHO)	Cable Link LED	Solid Gen4, Blink 2Hz is Gen3, 1Hz is Gen2, 0.5Hz is Gen1
D3 (CH1)	Cable Link LED	Solid Gen4, Blink 2Hz is Gen3, 1Hz is Gen2, 0.5Hz is Gen1
D8 (CH2)	Cable Link LED	Solid Gen4, Blink 2Hz is Gen3, 1Hz is Gen2, 0.5Hz is Gen1
D7 (CH3)	Cable Link LED	Solid Gen4, Blink 2Hz is Gen3, 1Hz is Gen2, 0.5Hz is Gen1
D11 (CE)	Card Edge Link LED	Solid Gen4, Blink 2Hz is Gen3, 1Hz is Gen2, 0.5Hz is Gen1
D10	Power	Blinks when FPGA program running properly
LED0	Debug LED	Not defined, always on
LED1	Debug LED	Not defined, always on
LED2	Debug LED	Not defined, always on
LED3	Debug LED – would be used for CMI	Not defined, always on

4.2 Dipswitch Settings

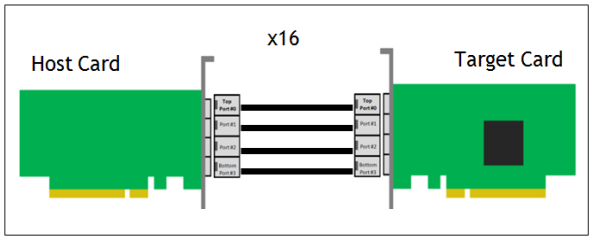


- SW1-5 must always be ON. Auto mode not supported
- SW2-3 to 6 is not used.
- Legacy backplane: Magma Gen3 backplane

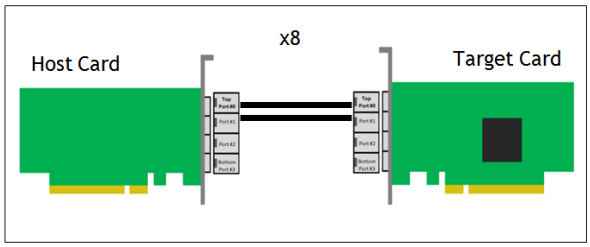
4.3 Standard & Bifurcated Configurations

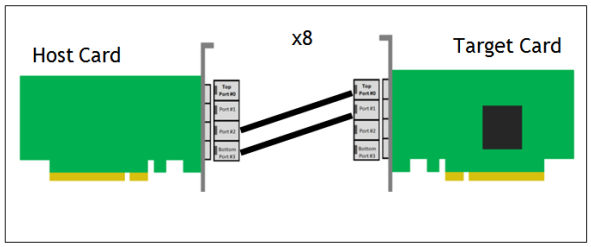
4.3.1 Standard Configurations

- x16: Using four Gen4 SFF-8644 cables

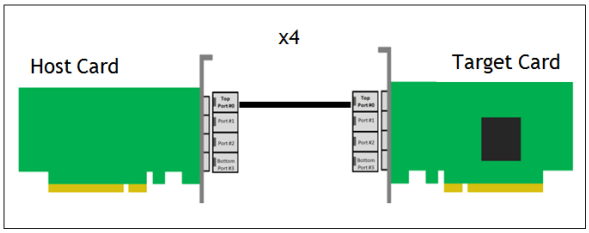


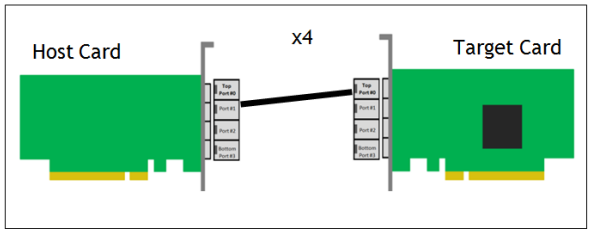
- x8: Using two Gen4 SFF-8644 cables

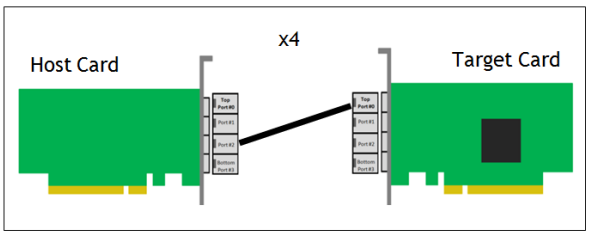


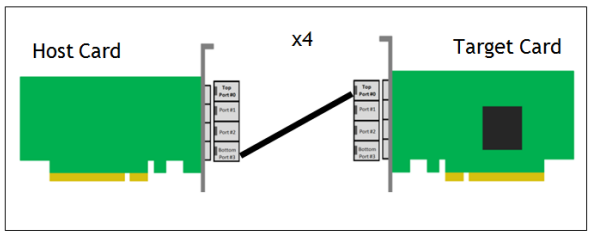


- x4: Using a single SFF-8644 cable



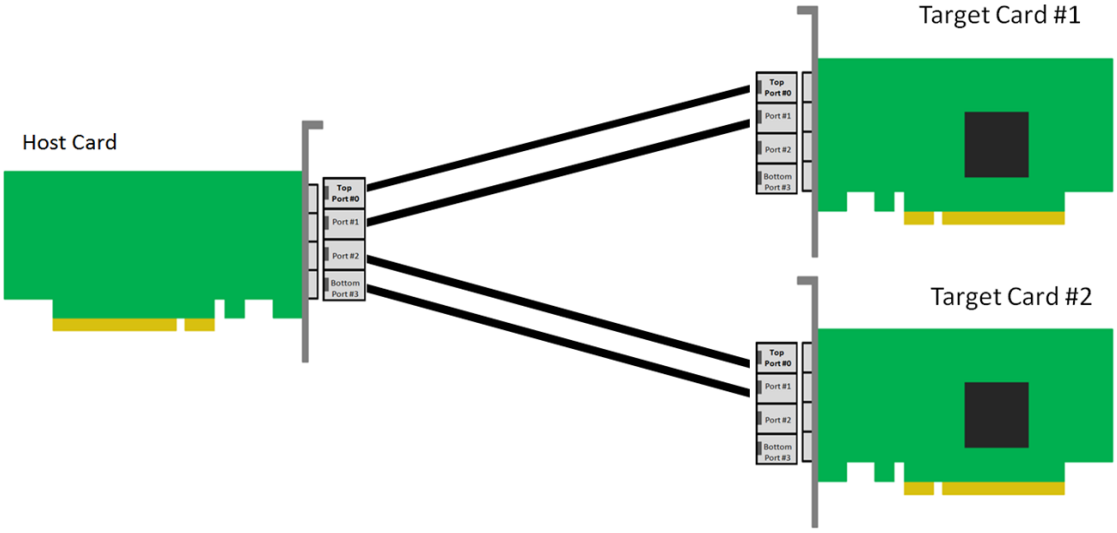




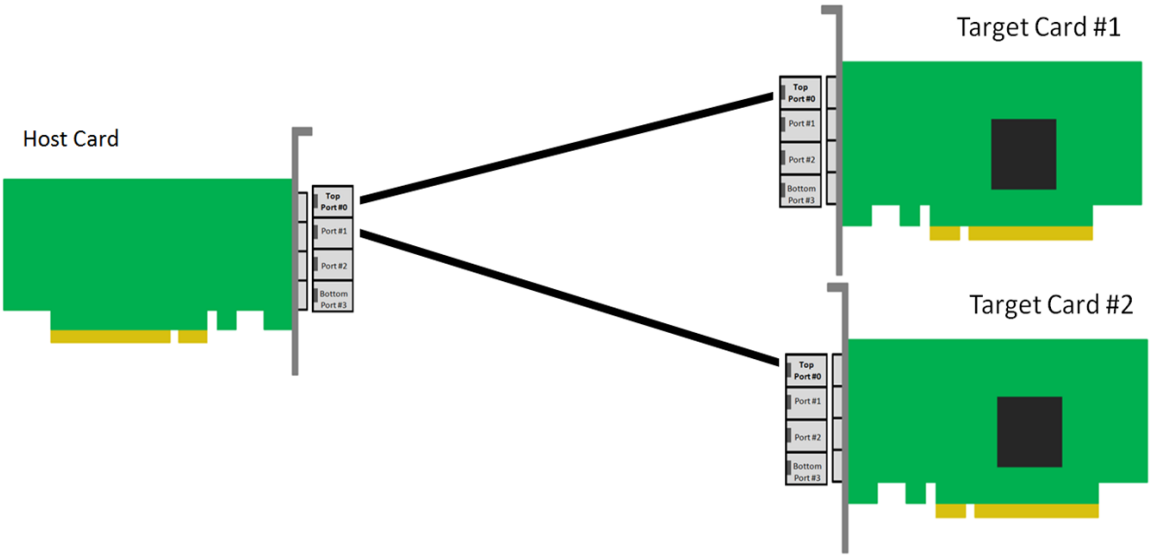


4.3.2 Bifurcated configurations

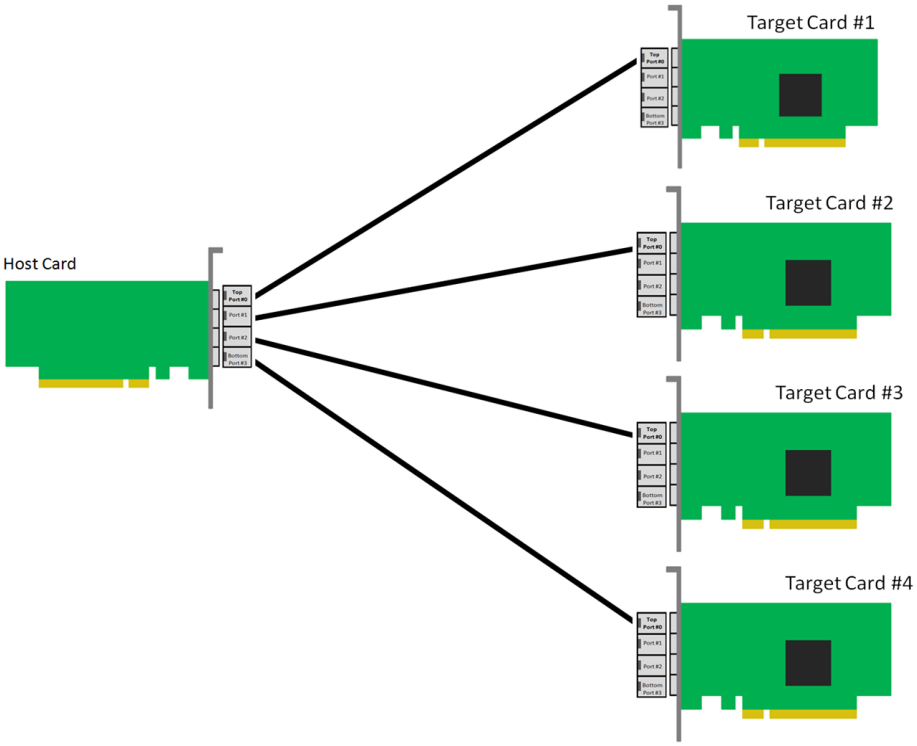
1. **x8, x8 Configuration: This is supported**



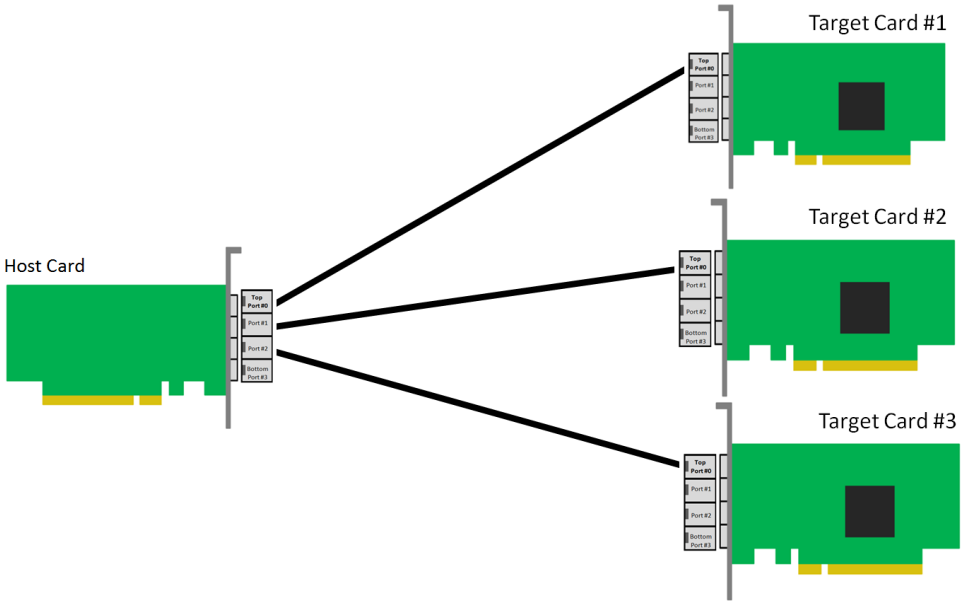
2. **x4, x4 Configuration: This is supported**



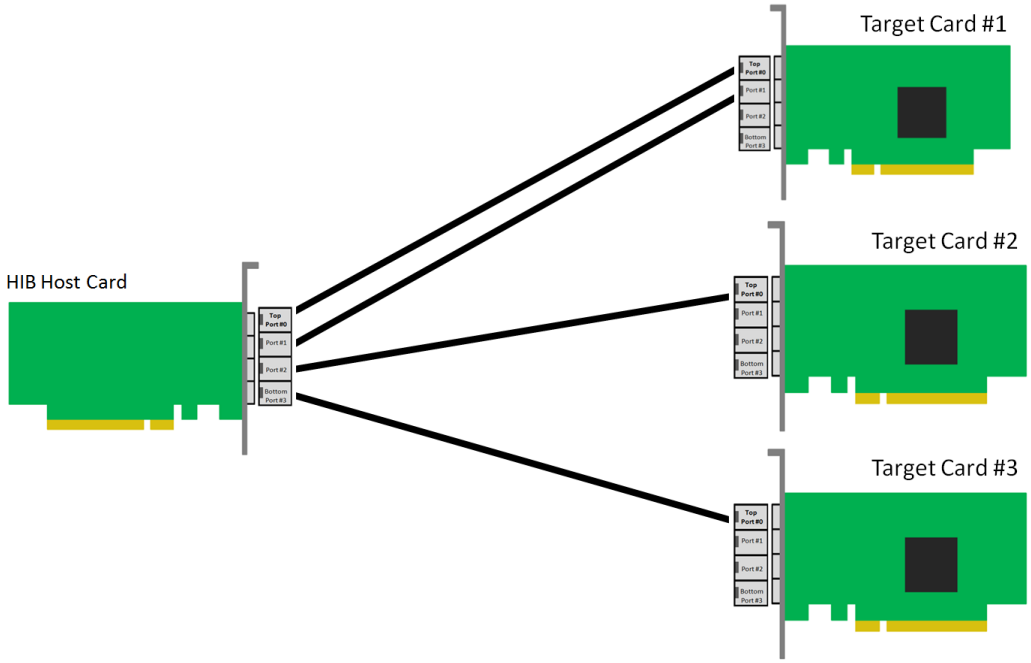
3. x4, x4, x4, x4 Configuration: This is supported



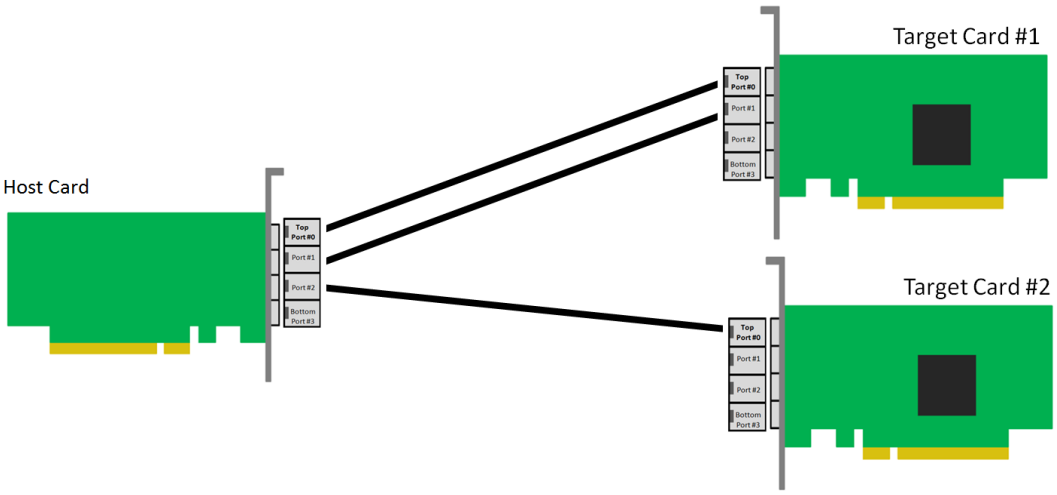
4. x4, x4, x4 Configuration: This is supported



5. **x8, x4, x4 Configuration: This is NOT supported. The firmware is not programmed in the board to support x8,x4,x4**



6. **X8, x4 Configuration: This is supported but it will just down train to x4**



5 Identify HIB Device

5.1 Linux OS

In Linux, you can check if the HIB card is detected by using the following commands on the terminal window.

- #lspci –tv | grep c010

The c010 is the Device number of the card. The output below gives you a tree-like structure of the PCI Device B/D/F numbers of b8:00.0 and bd:00.00 (B=Bus number. D=Device number. F=Function number). **The /B/D/F numbers will vary from system to system**.

```
root@oss1:~# lspci -tv | grep c010
 |          |                          |                                                                  \-1c.0-[b8]----00.0  LSI Logic / Symbios Logic Device c010
 |          |                          \-1c.0-[bd]----00.0  LSI Logic / Symbios Logic Device c010
root@oss1:~#
```

You can use the SDevice (Sub Device) of the card 00b2.

- #lspci –m | grep 'Device 00b2'

The output below gives you B/D/F numbers, the device Class, the Vendor name and Sub Vendor name.

```
root@oss1:~# lspci -m | grep 'Device 00b2'
b8:00.0 "Mass storage controller" "LSI Logic / Symbios Logic" "Device c010" -rb0 "LSI Logic / Symbios Logic" "Device 00b2"
bd:00.0 "Mass storage controller" "LSI Logic / Symbios Logic" "Device c010" -rb0 "LSI Logic / Symbios Logic" "Device 00b2"
root@oss1:~#
```

To check on the revision of the card, use the command below.

- #lspci –vmms ac:00.0
- See output below.

```
root@oss1:~# lspci -vmms ac:00.0
Slot:   ac:00.0
Class:  PCI bridge
Vendor: LSI Logic / Symbios Logic
Device: Device c010
Rev:    b0
NUMANode:       1
```

To check on the PCIe Gen speed and Link Width

- #lspci –nvvs b8:00.00 | grep 'LnkCap\|LnkSta'

```
root@oss1:~# lspci -nvvs ac:00.0 | grep 'LnkCap\|LnkSta'
                LnkCap: Port #224, Speed 16GT/s, Width x16, ASPM L0s L1, Exit Latency L0s <4us, L1 <32us
                LnkSta: Speed 16GT/s, Width x16, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
                LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-, EqualizationPhase1-
root@oss1:~#
```

To display more details or information

lspci –nvvs ac:00.00

```
root@oss1:~# lspci -s ac:00.0 -vvv
ac:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
        Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr+ Stepping- SERR+ FastB2B- DisINTx-
        Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
        Latency: 0, Cache Line Size: 32 bytes
        NUMA node: 1
        Bus: primary=ac, secondary=ad, subordinate=af, sec-latency=0
        I/O behind bridge: 0000f000-00000fff
        Memory behind bridge: fff00000-000fffff
        Prefetchable memory behind bridge: 00000000fff00000-00000000000fffff
        Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- <SERR- <PERR-
        BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
                PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREn-
        Capabilities: [40] Power Management version 3
                Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-,D3hot+,D3cold+)
                Status: D3 NoSoftRst+ PME-Enable+ DSel=0 DScale=0 PME-
        Capabilities: [68] Express (v2) Downstream Port (Slot-), MSI 00
                DevCap: MaxPayload 2048 bytes, PhantFunc 0
                        ExtTag- RBE+
                DevCtl: Report errors: Correctable- Non-Fatal- Fatal+ Unsupported-
                        RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
                        MaxPayload 256 bytes, MaxReadReq 128 bytes
                DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
                LnkCap: Port #224, Speed 16GT/s, Width x16, ASPM L0s L1, Exit Latency L0s <4us, L1 <32us
                        ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
                LnkCtl: ASPM Disabled; Disabled- CommClk-
                        ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
                LnkSta: Speed 16GT/s, Width x16, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
                DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF Via message ARIFwd-
                DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF Disabled ARIFwd-
                LnkCtl2: Target Link Speed: 16GT/s, EnterCompliance- SpeedDis-, Selectable De-emphasis: -6dB
                         Transmit Margin: Normal Operating Range, EnterModifiedCompliance- ComplianceSOS-
                         Compliance De-emphasis: -6dB
                LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-, EqualizationPhase1-
                         EqualizationPhase2-, EqualizationPhase3-, LinkEqualizationRequest-
        Capabilities: [a4] Subsystem: LSI Logic / Symbios Logic Device a032
        Capabilities: [100 v1] Device Serial Number 00-80-5e-10-43-32-36-50
        Capabilities: [fb4 v1] Advanced Error Reporting
                UESta:  DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF- MalfTLP- ECRC- UnsupReq- ACSViol-
                UEMsk:  DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF- MalfTLP- ECRC- UnsupReq+ ACSViol-
                UESvrt: DLP+ SDES+ TLP- FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+ MalfTLP+ ECRC- UnsupReq- ACSViol-
                CESta:  RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
                CEMsk:  RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
                AERCap: First Error Pointer: 1f, GenCap+ CGenEn- ChkCap+ ChkEn-
        Capabilities: [148 v1] Virtual Channel
                Caps:   LPEVC=0 RefClk=100ns PATEntryBits=1
                Arb:    Fixed- WRR32- WRR64- WRR128-
                Ctrl:   ArbSelect=Fixed
                Status: InProgress-
                VC0:    Caps:   PATOffset=00 MaxTimeSlots=1 RejSnoopTrans-
                        Arb:    Fixed+ WRR32- WRR64- WRR128- TWRR128- WRR256-
                        Ctrl:   Enable+ ID=0 ArbSelect=Fixed TC/VC=01
                        Status: NegoPending- InProgress-
        Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010 <?>
        Capabilities: [e00 v1] #12
        Capabilities: [f24 v1] Access Control Services
                ACSCap: SrcValid+ TransBlk+ ReqRedir+ CmpltRedir+ UpstreamFwd+ EgressCtrl+ DirectTrans+
                ACSCtl: SrcValid+ TransBlk- ReqRedir+ CmpltRedir+ UpstreamFwd+ EgressCtrl- DirectTrans-
        Kernel driver in use: pcieport

root@oss1:~#
```

You can check the Host and Target devices by using the command below.

#lspci –vvv | grep c010

The output below shows a link between Host card and the Target card.

```
root@oss1:~# lspci -vvv | grep c010
ab:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:0c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:1c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ad:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ae:10.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
af:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b0:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b0:0c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b0:1c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b1:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b2:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b4:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b5:14.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b5:15.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b8:00.0 Mass storage controller: LSI Logic / Symbios Logic Device c010 (rev b0)
b9:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ba:14.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ba:15.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
bd:00.0 Mass storage controller: LSI Logic / Symbios Logic Device c010 (rev b0)
root@oss1:~#
```

The output below shows only the Host is being detected. The Host card is not connected to the Target card.

```
root@oss1:~# lspci -vvv | grep c010
ab:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:0c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ac:1c.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ad:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
ae:10.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b0:00.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b1:14.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b1:15.0 PCI bridge: LSI Logic / Symbios Logic Device c010 (rev b0) (prog-if 00 [Normal decode])
b4:00.0 Mass storage controller: LSI Logic / Symbios Logic Device c010 (rev b0)
root@oss1:~#
```

To check or to identify whether the bus XX:XX.0 is the Upstream port and Downstream port, on the terminal window type **lspci –s ac:00.0 -vvv | grep 'Capabilities\|Port\|LnkSta\|LnkCap'** or lspci –nvvs –ac:00.00 | **grep 'Capabilities\|Port\|LnkSta\|LnkCap'**

```
root@oss1:~# lspci -nvvs ac:00.0 | grep 'Capabilities\|Port\|LnkSta\|LnkCap'
        Capabilities: [40] Power Management version 3
        Capabilities: [68] Express (v2) Downstream Port (Slot-), MSI 00
                LnkCap: Port #224, Speed 16GT/s, Width x16, ASPM L0s L1, Exit Latency L0s <4us, L1 <32us
                LnkSta: Speed 16GT/s, Width x16, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
                LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-, EqualizationPhase1-
        Capabilities: [a4] Subsystem: 1000:a032
        Capabilities: [100 v1] Device Serial Number 00-80-5e-10-43-32-36-50
        Capabilities: [fb4 v1] Advanced Error Reporting
        Capabilities: [148 v1] Virtual Channel
        Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010 <?>
        Capabilities: [e00 v1] #12
        Capabilities: [f24 v1] Access Control Services
root@oss1:~#
```

5.2 Windows 10 / Server

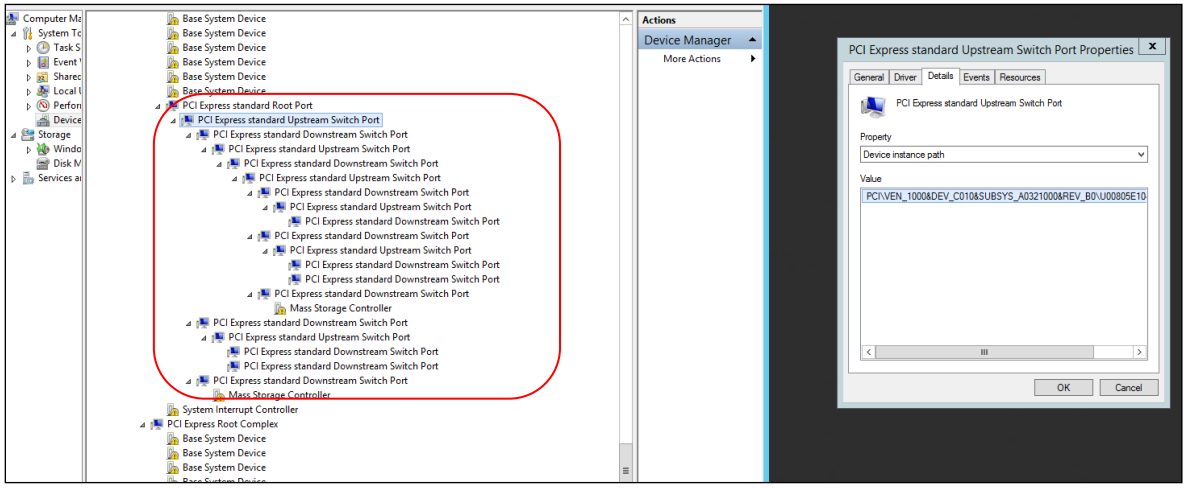
Verify hardware device in Windows Operating System. As your Windows computer starts up, you will see a small message box pop-up in the lower-right corner of the screen to alert you that Windows has found new hardware.

To verify a successful installation on Windows, find the '**My Computer**' icon and "right-click" on it. Then select '*Manage*' from the pop-up menu. Next, click on '*Device Manager*' in the leftmost Computer Management window. Finally, click on the *View Menu* and select *View Devices by Connection.*

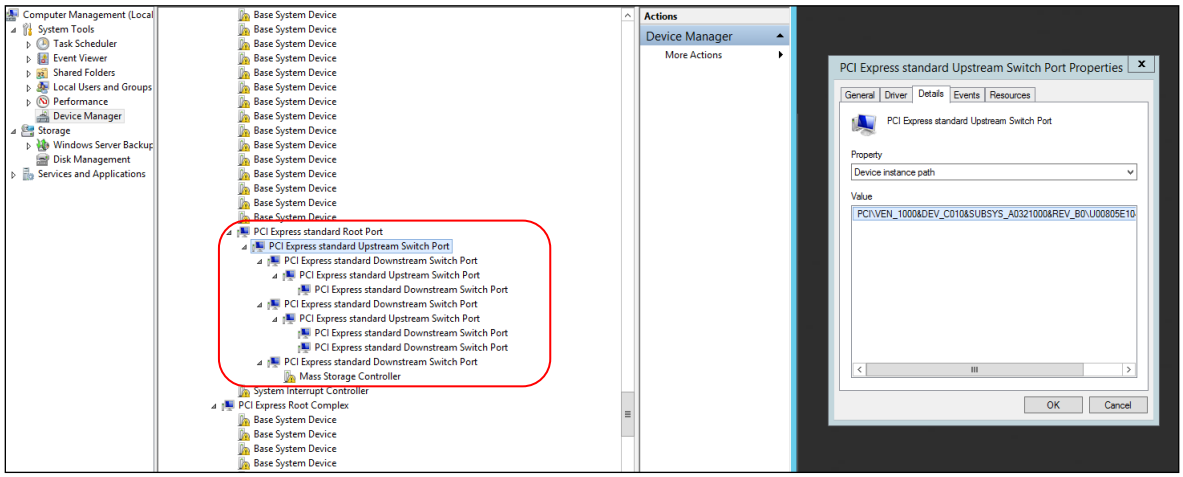
When everything is functioning correctly, your Windows Device Manager should look something like the screenshot below. You will see multiple PCI standard PCI-to PCI bridge or PCI Express standard Upstream Switch Ports and PCI Express standard Downstream Switch Ports.

These are the screenshots of Windows Device Manager running **Windows Server 2012 R2**

- The photo below is showing multiple layers of PCI Express standard Upstream Switch Port and PCI Express standard Downstream Switch Port.
- Displaying a link between Host and Target cards.

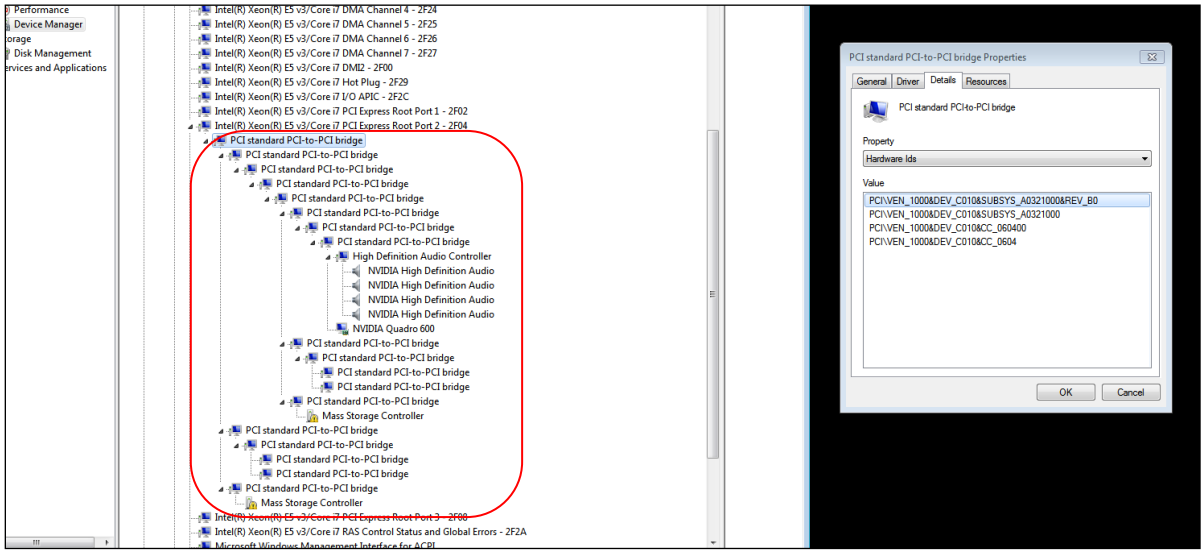


- Photo below is only showing a single Host device is detected.

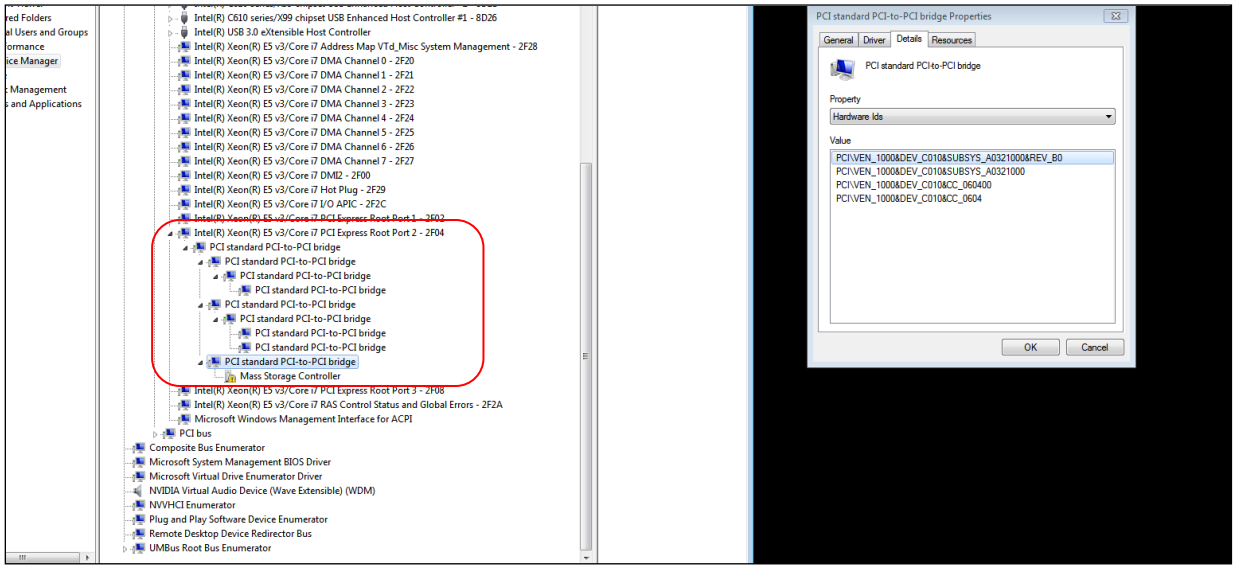


These are the screenshots of Windows Device Manager running **Windows 10.**

- Photo below is showing multiple layers of PCI standard PCI-to-PCI bridges.
- Displaying a link between Host and Target cards. Showing a PCIe device (i.e NVIDIA card) is recognized. The PCIe device is the 3rd party PCIe card installed into the downstream slot of an expansion backplane.



- The screenshot below depicts that only the Host card is detected.



6 Software Installation

No software or driver is required for the HIB616-x16 card.

7 Troubleshooting

7.1 Device is not detected or recognized

Make sure you have a known good set of HIB card (host and target cards), cables and backplane.

1. Check the Dip switch settings on each card. Make sure each card is properly configured.
2. Re-seat the host and target cards. Turn the power OFF before re-seating the HIB cards.
3. Re-seat the link cable(s). Ensure that the host system and expansion units are completely powered down when reseating the cables.
4. Unplug all power from the host computer and expansion unit, and reconnect it. Turn the expansion unit ON first before the host computer.
5. If you have replaced the link cables, OSS target and host cards and still experiencing the problem, try a different known-good computer.
6. Try another expansion unit or replace the backplane.
7. Send the OSS unit / hardware to OSS for evaluation / analysis and repair.

7.2 Broken OSS-518 Board

1. If you received a brand new DOA (Dead on Arrival) board, please contact OSS to RMA board and request for a replacement.
2. If you have an out of warranty board, please contact OSS Sales team and buy a new replacement board.
    - Standard warranty is 1 year, unless you have an SLA or extended warranty coverage.
3. If you purchased a second-hand / used board and it is broken, please contact OSS Sales team to buy a replacement.
    - Note: Purchasing a second-hand / used product is not covered under warranty.

7.3 Intermittent start up issue and PCIe cards are not getting recognized

If you are using a 4UValue chassis that has two backplanes and it is having issue starting up and the GPUs or PCIe cards are not detected, do the following steps:

1. Completely shut down the expansion unit and host server. Physically disconnecting the power cord from the expansion unit and computer.
2. Remove all the PCIe cards from the expansion unit
3. Disconnect the OSS link cables from the expansion unit and host computer
4. Reseat the OSS Target card and Host card
5. Reconnect all the OSS link cables to the Host and Target cards
6. Do not install any PCIe cards yet
7. Reconnect the power cord to the expansion unit and computer
8. Turn ON the computer and the expansion unit will automatically power ON

If the unit powers ON, do the next steps:

9. If the expansion chassis powers ON properly, that's good. Next is to shut it down
10. Turn OFF the computer and this should power down the 4UV chassis
11. Disconnect the power cord from the back of the 4UV chassis
12. Disconnect the power from the computer
13. Install one PCIe card on the backplane. If you have two backplanes, one PCIe card per backplane
14. Reconnect the power cord to the expansion unit and computer
15. Turn ON the computer, expansion chassis will automatically power ON
16. Boot the computer all the way up and check if the PCIe cards are detected.
17. Install the remaining PCIe cards. Repeat the same steps (from step 10 to 15)

7.4 Third Party Hardware and Software Support

OSS will assist customers in problem analysis to determine whether or not the technical issue is related to the third-party hardware or software. In order to isolate the issue, OSS reserves the right to request that the third-party hardware or software be removed.

If OSS identify that the OSS product is fully functional and the root cause or the problem is related to third-party hardware or software, customer / end-user will reach out to third-party vendor for assistance or will be responsible to further troubleshoot the issue.

7.5 There is no LINK between Host and Target

Troubleshooting:

- Make sure are using a compatible hardware as stated in the hardware requirement section. For more info on the hardware requirements go to Chapter 2.
- We strictly recommend to use an OSS Gen4 Host and Target cards, Gen4 OSS expansion backplane and SFF-8644 Gen 4 PCIe x4 cable.
- Ensure that the OSS Target and Host cards are configured to the desired mode.
- Read and follow the “Installation Procedures” on Chapter 3.

7.6 Does the OSS-518 board (Gen4 PCIe x16 Adapter card) support CMI Operation (Remote Power ON)?

The OSS-518 does not perform CMI with any SFF-8644 cable. The firmware on the OSS-518 board does not support it. So the OSS-518 board needs to be configured by setting the switch to FORCE Power ON (SW1#2=ON position) on both Target and Host.

8 How to Get More Help

You can visit the Technical Support FAQ pages on the Internet at https://www.onestopsystems.com/support

8.1 Contacting Technical Support

Our support department can be reached by phone at 1 (760) 745-9883. Support is available Monday through Friday, 8:00 AM to 5:00 PM PT. When contacting Technical Support make sure to include the following information:

1. Exact and correct serial #
2. Service Ticket or Case # (if you already submitted an online request)
3. Computer Type & Model: Operating System
4. Make & Model of PCI/PCIe cards: Application
5. Problem description

When submitting an online technical support request always provide a valid working e-mail address, phone number, shipping address and proper contact name. Check your e-mail for an automated response containing the case # and updates. You can also visit our web site at: https://www.onestopsystems.com/support for a quick response, use the Technical Support and RMA Request Form available in the Support Section of the website. Simply complete the form with all required information. Please make sure that your problem description is sufficiently detailed to help us understand your problem.

Shipping or Transporting of Expansion Unit with PCI / PCIe cards
Any PCIe cards in **should be removed** (or not to be installed) prior to shipment to avoid or prevent possible damage. Note: Expansion board and PCIe / PCI cards that arrive damaged in shipment will not be covered under warranty.

8.2 Returning Merchandise

If factory service is required, a Service Representative will give you a Return Merchandise Authorization (RMA) number. Put this number and your return address on the shipping label when you return the item(s) for service. Please note that One Stop Systems WILL NOT accept COD packages, so be sure to return the product freight and duties-paid. Ship the well-packaged product to the address below:

Attention:RMA # _____, One Stop Systems
2235 Enterprise Street, #110
Escondido, CA 92029
USA

It is not required, though highly recommended, that you keep the packaging from the original shipment of your product. However, if you return a product for warranty repair/ replacement or take advantage of the 30-day money back guarantee, you will need to package the product in a manner similar to the manner in which it was received from our plant. We cannot be responsible for any physical damage to the product or component pieces of the product (such as the host or expansion interfaces for the expansion chassis) that are damaged due to inadequate packing. Physical damage sustained in such a situation will be repaired at the owner's expense in accordance with Out of Warranty Procedures. Please, protect your investment, a bit more padding in a good box will go a long way to insuring the device is returned to use in the same condition you shipped it in. Please call for an RMA number first.

8.3 Third Party Hardware & Software Support Policy

OSS tests, certifies and bundles many popular third party hardware and software products with OSS hardware for ease of use and guaranteed operation. OSS encourages customer innovation by combining OSS products in new and interesting ways with third party and customer developed hardware and software. Unfortunately, with virtually infinite combinations of hardware and software, OSS cannot test and validate every possible configuration. OSS is committed to supporting its products and identifying if any technical issue may be related to third-party hardware or software. In order to isolate technical issues, OSS may request that the system be returned to the same configuration that shipped from the OSS factory and any non-OSS supplied third-party hardware or software be removed from the system during troubleshooting.

We test, certify and support many third party hardware and software products along with OSS hardware and are happy to integrate a fully supported system. Ask us about that service and we would be happy to help. If an OSS product is fully functional and a support issue is related to third-party hardware or software that did not ship from the OSS factory, the customer requesting support should reach out to the third-party vendor for assistance to fully troubleshoot the issue.

8.4 Online Support Resources

As a product user and customer, listed below are our Online Support Resources

https://www.onestopsystems.com/support provides Knowledgebase Articles such as troubleshooting methods, compatibility, FAQ, documentation, and product technical information.

If you need technical support, product assistance or have a technical inquiry we encourage you to submit it on-line using our Technical Support Form. If you need to send a unit for repair or diagnostic evaluation, fill out our RMA (Return Material Authorization) online request form.

- https://www.onestopsystems.com/support

2235 Enterprise Street, Suite#110, Escondido CA 92029

Toll-Free : +1(800)285-8900 US • Main: +1 (760) 745-9883 • Fax: +1 (760) 745-9824

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