Connect-IB™ Single and Dual QSFP+ Port PCI Express Gen3 x8 Adapter Card User Manual

P/N:

MCB191A-FCAT, MCB192A-FCAT

Rev 1.2

www.mellanox.com

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Revision History

This document was printed on June 2, 2014.

Table 1 - Revision History Table

Date	Rev	Comments/Changes
June 2013	1.2	• Added Section 3.4, “Bracket Installation,” on page 15
December 2013	1.1	• Made restructuring changes to the UM • Added Chapter 4,“Driver Installation” on page 19 • Added Chapter 5,“Firmware” on page 34 • Added Chapter 6,“Troubleshooting” on page 36
January 2013	1.0	First Release

About this Manual

This *User Manual* describes Mellanox Technologies Connect-IB™ Single and Dual QSFP+ port PCI Express 8 lanes (x8) adapter cards. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and relevant documentation.

Intended Audience

This manual is intended for the installer and user of these cards and assumes basic familiarity with InfiniBand® network and architecture specifications.

Related Documentation

Table 2 - Documents List

Mellanox Firmware Tools (MFT) User Manual Document no. 2204UG	User Manual describing the set of MFT firmware management tools for a single node. See http://www.mellanox.com => Support => Download Firmware Tools
Mellanox OFED for Linux User Manual Document no. 2877	User Manual describing OFED features, performance, InfiniBand diagnostic, tools content and configuration.See http://www.mellanox.com => Products => Software => Linux SW/Drivers => Mellanox OpenFabrics Enterprise Distribution for Linux (MLNX_OFED)
IBTA Specification Release 1.2.1	InfiniBand Architecture Specification
PCI Express 3.0 Specifications	Industry Standard PCI Express 3.0 Base and Card Electromechanical Specifications

Document Conventions

When discussing memory sizes, MB and MBytes are used in this document to mean size in Mega Bytes. The use of Mb or Mbits (small b) indicates size in mega bits. IB is used in this document to mean InfiniBand. In this document PCIe is used to mean PCI Express.

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Customers who purchased Mellanox products directly from Mellanox are invited to contact us through the following methods.

- URL: http://www.mellanox.com => Support
- E-mail: support@mellanox.com
- Tel: +1.408.916.0055

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http://www.mellanox.com => Support

or use the following link to go directly to the Mellanox Support Download Assistant page,

http://www.mellanox.com/supportdownloader/.

1 Introduction

This is the User Guide for Mellanox Technologies Connect-IB 56Gb/S InfiniBand adapter cards. Connect-IB provide the highest performing and most scalable interconnect solution for PCI Express Gen2 and Gen3 servers used in High-Performance Computing, Enterprise Data Centers, and Storage environments. Parallel processing, transactional services, clustered data bases, and high-performance storage applications will achieve significant performance improvements resulting in reduced completion time and lower cost per operation.

This chapter covers the following topics:

1.1 Product Overview

The following tables provide the ordering part number, port speed, number of ports, and PCI Express speed. Each adapter comes with two bracket heights - short and tall.

Table 3 - Single and Dual-port Connect-IB Adapter Cards

Ordering Part Number (OPN)	MCB191A-FCAT- single-port card MCB192A-FCAT- dual-port card
Data Transmission Rate	InfiniBand: FDR (56 Gb/s)
Network Connector Types	single or dual-port QSFP+
PCI Express (PCIe) SerDes Speed	PCIe 3.0 x8 8GT/s
RoHS	R6
Adapter IC Part Number	MT27608A0-FCCR-FI
Device ID (decimal)	4114 for Physical Function 4113 for Virtual Function

1.2 Features and Benefits

Table 4 - Features and Benefits

Features:	
InfiniBand Architecture Specification v1.2.1 compliant	VPI-enabled adapters facilitate any standard networking, clustering, storage, and management protocol to seamlessly operate over any converged network with the same software infrastructure.
PCI Express 3.0 (1.1 and 2.0 compatible)	Uses PCIe Gen 3.0 (1.1 and 2.0 compatible) through an x8 edge connector up to 8GT/s
InfiniBand FDR	A pre-standard InfiniBand data rate, where each lane of a 4X port runs a bit rate of 14.0625Gb/s with a 64b/66b encoding, resulting in an effective bandwidth of 54.54Gb/s.
Memory	PCI Express - stores and accesses InfiniBand and/or Ethernet fabric connection information and packet data SPI - includes one 32Mb SPI Flash device (Winbond W25Q32BVSSIG) EEPROM - accessible through the I^2C-compatible interface. The EEPROM capacity is 4Kb.
Greater than 100Gb/s over InfiniBand	
Greater than 130M messages/sec	
1us MPI ping latency	
CPU offload of transport operations	
Application offload	
GPU communication acceleration	
End-to-end internal data protection	
End-to-end QoS and congestion control	
Hardware-based I/O virtualization	
RoHS-R6 compliant	
Benefits:	
World-class cluster, network, and storage performance	
Guaranteed bandwidth and low-latency services	
I/O consolidation	
Virtualization acceleration	
Power efficient	
Scales to tens-of-thousands of nodes	

1.3 Operating Systems and Distributions

- (RHEL), and other Linux distributions
- Microsoft Windows Server 2008/CCS 2003, HPC Server 2008
- VMware ESX 5.1
- OpenFabrics Enterprise Distribution (OFED)

1.4 Connectivity

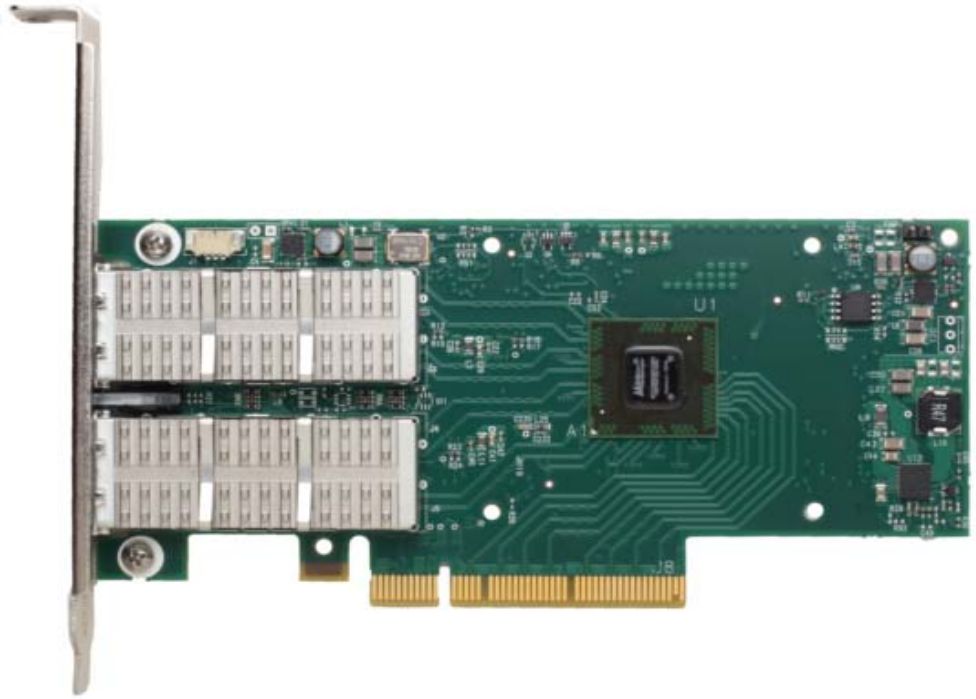
- Interoperable with InfiniBand switches
- Passive copper cable with ESD protection
- Powered connectors for optical and active cable support

2 Interfaces

Each adapter card includes the following interfaces:

- "InfiniBand Interface"
- "PCI Express Interface"
- "LED Assignment"
- "I2C-compatible Interface"

Figure 1: MCB192A-FCAT Card



The adapter cards include special circuits to protect from ESD shocks to the card/server when plugging copper cables.

2.1 InfiniBand Interface

The network ports of the Connect-IB adapter cards are compliant with the *InfiniBand Architecture Specification, Release 1.2.1*. InfiniBand traffic is transmitted through the cards' QSFP+ connectors.

2.2 PCI Express Interface

The Connect-IB adapter cards support PCI Express 3.0 (1.1 and 2.0 compatible) through x8 edge connector. The device can be either a master initiating the PCI Express bus operations or a slave responding to PCI bus operations. The following lists the PCIe interface features:

- PCI Express 2.0 or 3.0 compliant
- Auto-negotiates to x8, x4, or x1

- Support for MSI-X mechanisms

2.3 LED Assignment

There are two I/O LEDs per port in dual-port designs and one bicolor LED located on the I/O panel. See Section 7.3, “LED Operation,” on page 39 for different LED functions.

2.4 I²C-compatible Interface

A three-pin header on the adapter cards is provided as the I²C-compatible interface. See Figure 4, “Mechanical Drawing of the Dual-port MCB192A-FCAT Adapter Card,” on page 40 for the location on the board.

3 Hardware Installation

3.1 System Requirements

3.1.1 Hardware

A system with a PCI Express x8 slot is required for installing the card.

3.1.2 Operating Systems/Distributions

Please refer to Section 1.3, “Operating Systems and Distributions,” on page 12.

3.1.3 Software Stacks

Mellanox OpenFabric software package - MLNX_OFED for Linux. See Chapter 4, “Driver Installation”.

3.2 Safety Precautions

The adapter is being installed in a system that operates with voltages that can be lethal. Before opening the case of the system, observe the following precautions to avoid injury and prevent damage to system components.

1. Remove any metallic objects from your hands and wrists.
2. Make sure to use only insulated tools.
3. Verify that the system is powered off and is unplugged.
4. It is strongly recommended to use an ESD strap or other antistatic devices.

3.3 Pre-installation Checklist

1. Verify that your system meets the hardware and software requirements stated above.
2. Shut down your system if active.
3. After shutting down the system, turn off power and unplug the cord.
4. Remove the card from its package. Please note that the card must be placed on an antistatic surface.
5. Check the card for visible signs of damage. Do not attempt to install the card if damaged.

3.4 Bracket Installation

The card is usually shipped with a tall bracket installed. If this form factor is suitable for your requirements, you can skip the remainder of this section and move to Section 3.5, “Card Installation Instructions,” on page 17. If you need to replace it with the short bracket that is included in the shipping box, please follow the instructions in this section.

Note: Due to risk of damaging the EMI gasket, it is not recommended to replace the bracket more than three times.

To replace the bracket you will need the following parts:

- The new bracket of the proper height
- The 2 screws saved from the removal of the bracket
- The 2 fiber washers saved from the removal of the bracket

3.4.1 Removing the Existing Bracket

1. Remove the two screws holding the bracket in place. The bracket comes loose from the card.

Be careful not to put stress on the LEDs.

2. Save the two screws and the two fiber washers.

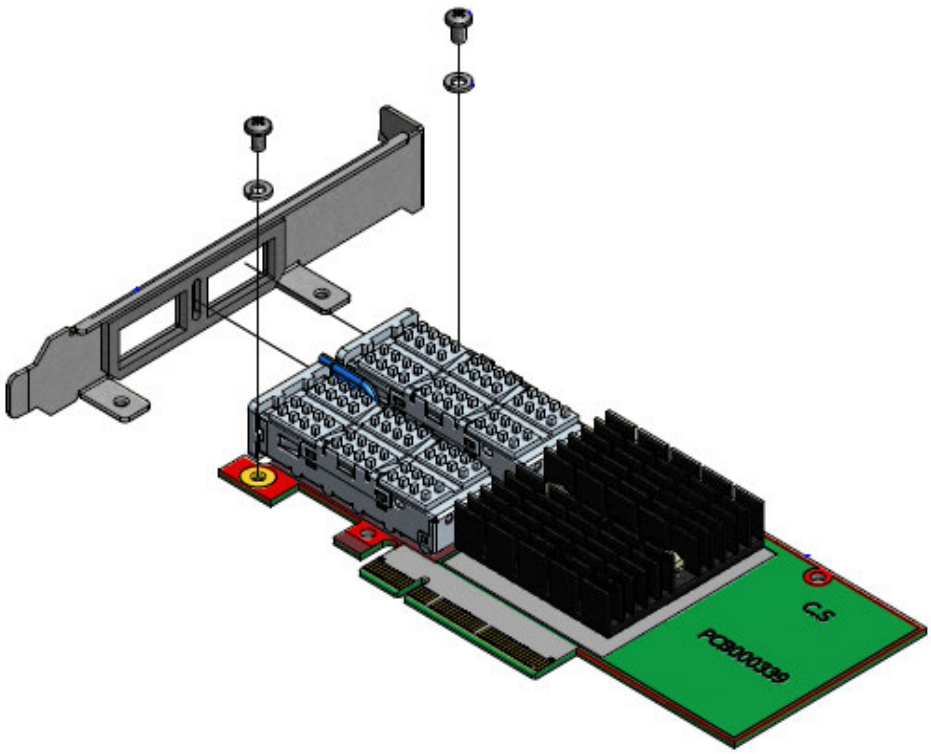
3.4.2 Installing the New Bracket

1. Place the bracket onto the card until the screw holes line up. See Figure 2..

Do not force the bracket onto the card. You may have to gently push the LEDs using a small screwdriver to align the LEDs with the holes in the bracket.

2. Screw on the bracket using the screws and washers saved from the bracket removal procedure above.

Figure 2: Place the Bracket on the Card (Example)



3.5 Card Installation Instructions

1. Before installing the card, make sure that the system is off and the power cord is not connected to the server. Please follow proper electrical grounding procedures.
2. Open the system case.
3. Place the adapter in an available PCI Express slot.

A lesser width adapter can be seated into a greater width slot (x4 in a x8), but a greater width adapter cannot be seated into a lesser width slot (x8 in a x4). Align the adapter connector edge with the PCI Express connector slot.

4. Applying even pressure at both corners of the card, insert the adapter card into the slot until it is firmly seated. When the adapter is properly seated, the adapter port connectors are aligned with the slot opening, and the adapter faceplate is visible against the system chassis.

Do not use excessive force when seating the card, as this may damage the system or the adapter.

5. Secure the adapter with the adapter clip or screw.
6. Close the system case.

3.6 Cables and Modules

To obtain the list of supported cables for your adapter, please refer to “Mellanox Products Approved Cable Lists” at:

www.mellanox.com/related-docs/user_manuals/Mellanox_approved_cables.pdf.

3.6.1 Cable Installation

1. All cables can be inserted or removed with the unit powered on.
2. To insert a cable, press the connector into the port receptacle until the connector is firmly seated.
   a. Support the weight of the cable before connecting the cable to the adapter card. Do this by using a cable holder or tying the cable to the rack.
   b. Determine the correct orientation of the connector to the card before inserting the connector. Do not try and insert the connector upside down. This may damage the adapter card.
   c. Insert the connector into the adapter card. Be careful to insert the connector straight into the cage. Do not apply any torque, up or down, to the connector cage in the adapter card.
   d. Make sure that the connector locks in place.

3. After inserting a cable into a port, the Yellow LED indicator will light when the physical connection is established (that is, when the unit is powered on and a cable is plugged into the port with the other end of the connector plugged into a functioning port).
4. After plugging in a cable, lock the connector using the latching mechanism particular to the cable vendor. When a logical connection is made the Green LED will come on. When data is being transferred the green led will blink.

When installing cables make sure that the latches engage.

Always install and remove cables by pushing or pulling the cable and connector in a straight line with the card.

5. Care should be taken as not to impede the air exhaust flow through the ventilation holes. Cable lengths which allow for routing horizontally around to the side of the chassis before bending upward or downward in the rack should be used
6. To remove a cable, disengage the locks and slowly pull the connector away from the port receptacle. Both LED indicators will turn off when the cable is unseated.
   a. Pull on the latch release mechanism thereby unlatching the connector and pull the connector out of the cage.
   b. Do not apply torque to the connector when removing it from the adapter card.
   c. Remove any cable supports that were used to support the cable's weight.

Cables, especially long copper cables, can weigh a substantial amount. Make sure that the weight of the cable is supported on its own and is not hanging from the adapter card.

3.7 Identify the Card in Your System

3.7.1 On Linux

Get the device location on the PCI bus by running lspci and locating lines with the string "Mellanox Technologies":

```
> lspci |grep -i Mellanox
02:00.0 InfiniBand: Mellanox Technologies MT27600 [Connect-IB]
```

4 Driver Installation

4.1 Linux

For Linux, download and install the latest OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox web site at: http://www.mellanox.com => Products => Software => InfiniBand/VPI Drivers => Linux SW/Drivers => Download. This chapter describes how to install and test the Mellanox OFED for Linux package on a single host machine with Mellanox Connect-IB adapter hardware installed.

4.1.1 Hardware and Software Requirements

Table 5 - Software and Hardware Requirements

Requirements	Description
Platforms	For the list of supported architecture platforms, please refer to the Mellanox OFED Release Notes file.
Required Disk Space for Installation	1GB
Device ID	For the latest list of device IDs, please visit http://pci-ids.ucw.cz/read/PC/15b3.
Operating System	Linux operating system. For the list of supported operating system distributions and kernels, please refer to Mellanox OFED Release Notes file.
Installer Privileges	The installation requires administrator privileges on the target machine.

4.1.2 Downloading Mellanox OFED

Step 1. Verify that the system has a Mellanox HCA installed by ensuring that you can see Connect-IB entries in the display.

The following example shows a system with an installed Mellanox HCA:

```
host1# lspci -v | grep Mellanox
02:00.0 InfiniBand: Mellanox Technologies MT27600 [Connect-IB]
```

Step 2. Download the ISO image to your host.

The image's name has the format `MLNX_OFED_LINUX-<ver>-<OS label><CPU arch>.iso`. You can download it from http://www.mellanox.com => Products => Software => InfiniBand/VPI Drivers.

Step 3. Use the md5sum utility to confirm the file integrity of your ISO image. Run the following command and compare the result to the value provided on the download page.

```
host1# md5sumMLNX_OFED_LINUX-<ver>-<OS label>.iso
```

4.1.3 Installing Mellanox OFED

Mellanox OFED includes an installation script called `mlnxofedinstall` which performs the following:

- Discovers the currently installed kernel
- Uninstalls any software stacks that are part of the standard operating system distribution or another vendor's commercial stack
- Installs the MLNX_OFED_LINUX binary RPMs (if they are available for the current kernel)
- Identifies the currently installed InfiniBand and Ethernet network adapters and automatically[1] upgrades the firmware

4.1.3.1 Pre-installation Notes

- The installation script removes all previously installed Mellanox OFED packages and re-installs from scratch. You will be prompted to acknowledge the deletion of the old packages.

Pre-existing configuration files will be saved with the extension ".conf.rpmsave".

- If you need to install Mellanox OFED on an entire (homogeneous) cluster, a common strategy is to mount the ISO image on one of the cluster nodes and then copy it to a shared file system such as NFS. To install on all the cluster nodes, use cluster-aware tools (such as pdsh).
- If your kernel version does not match with any of the offered pre-built RPMs, you can add your kernel version by using the "`mlnx_add_kernel_support.sh`" script located under the docs/ directory.

  Usage:

```
mlnx_add_kernel_support.sh -m|--mlnx_ofed <path to MLNX_OFED
>directory> [--make-iso|--make-tgz]
>
>[--make-iso]                    Create MLNX_OFED ISO image.
>[--make-tgz]                    Create MLNX_OFED tarball. (Default)
>[-t|--tmpdir <local work dir>]
> [--kmp]
[-k | --kernel] <kernel version>
[-s | --kernel-sources] <path to the kernel sources> [-v|--verbose]
[-n|--name]
[-y|--yes]
```

Example

The following command will create a MLNX_OFED_LINUX ISO image for RedHat 6.3 under the /tmp directory.

```
  # ./MLNX_OFED_LINUX-2.0-3.0.1-rhel6.3-x86_64/mlnx_add_kernel_support.sh -m <path>/
MLNX_OFED_LINUX-2.0-3.0.1-rhel6.3-x86_64 --make-tgz
  Note: This program will create MLNX_OFED_LINUX TGZ for rhel6.3 under /tmp directory.
```

1. The firmware will not be updated if you run the install script with the '--without-fw-update' option.

```
All Mellanox, OEM, OFED, or Distribution IB packages will be removed.
Do you want to continue?[y/N]:y
See log file /tmp/mlnx_ofed_iso.1380.log
Building OFED RPMs. Please wait...
Removing OFED RPMs...
Created /tmp/MLNX_OFED_LINUX-2.0-3.0.1-rhel6.3-x86_64.tgz
Install newly created MLNX_OFED package:
# cd /tmp
# tar xzf MLNX_OFED_LINUX-2.0-3.0.1-rhel6.3-x86_64.tgz
# ./MLNX_OFED_LINUX-2.0-3.0.1-rhel6.3-x86_64/mlnxofedinstall
```

4.1.3.2 Installation Script

The usage of the installation script is described below. You will use it during the installation procedure described in Section 4.1.3.4, “Installation Procedure,” on page 22.

Usage

```
./mnt/mlnxofedinstall [OPTIONS]
```

Options

-c|-- config <packages config_file>	Example of the configuration file can be found under docs
-n|--net <network config file>	Example of the network configuration file can be found under docs
-k|--kernel-version <kernel version>	Use provided kernel version instead of 'uname -r'
-p|--print-available	Print available packages for the current platform and create a corresponding ofed.conf file. The installation script exits after creating ofed.conf.
--without-32bit	Skip 32-bit libraries installation
--without-depcheck	Skip Distro's libraries check
--without-fw-update	Skip firmware update
-fw-update-only	Update firmware. Skip driver installation
--force-fw-update	Force firmware update
--force	Force installation (without querying the user)
--all|--hpc|--basic|--msm	Install all, hpc, basic or Mellanox Subnet manager packages correspondingly
--vma|--vma-vpi	Install packages required by VMA to support VPI
--vma-ib	Install packages required by VMA to work over InfiniBand
--with-vma	Set configuration for VMA use (to be used with any installation parameter).
--guest	Install packages required by guest os
--hypervisor	Install packages required by hypervisor os
-v|-vv|-vvv	Set verbosity level
--umad-dev-rw	Grant non root users read/write permission for umad devices instead of default
-enable-affinity	Run mlnx_affinity script upon boot
--disable-affinity	Disable mlnx_affinity script (Default)

```
--enable-sriov                  Burn SR-IOV enabled firmware
--add-kernel-support            Add kernel support (Run mlnx_add_kernel_support.sh)
--skip-distro-check             Do not check MLNX_OFED vs Distro matching
--total-vfs <0-63>              Maximum number of Virtual Functions in SR-IOV mode
                                (Default: 16). Implies '--enable-sriov'
--hugepages-overcommit          Set 80% of MAX_MEMORY as overcommit for a huge page
                                allocation. Per priority bit mask (uint). Default 0
-q                              Set quiet - no messages will be printed
--with-fabric-collector         Install fabric-collector package.
```

4.1.3.3 mlnxofedinstall Return Codes

Table 6 lists the `mlnxofedinstall` script return codes and their meanings.

Table 6 - mlnxofedinstall Return Codes

Return Code	Meaning
0	The Installation ended successfully
1	The installation failed
2	No firmware was found for the adapter device
22	Invalid parameter
28	Not enough free space
171	Not applicable to this system configuration. This can occur when the required hardware is not present on the system.
172	Prerequisites are not met. For example, missing the required software installed or the hardware is not configured correctly.
173	Failed to start the `mst` driver

4.1.3.4 Installation Procedure

Step 1. Login to the installation machine as root.

Step 2. Mount the ISO image on your machine

```
host1# mount -o ro,loop MLNX_OFED_LINUX-<ver>-<OS label>-<CPU arch>.iso /mnt
```

Step 3. Run the installation script.

```
./mlnxofedinstall
This program will install the MLNX_OFED_LINUX package on your machine.
Note that all other Mellanox, OEM, OFED, or Distribution IB packages will be removed.
Do you want to continue?[y/N]:y

Uninstalling the previous version of MLNX_OFED_LINUX
[root@swl014 MLNX_OFED_LINUX-2.0-2.0.0-rhel6.3-x86_64]#
[root@swl014 MLNX_OFED_LINUX-2.0-2.0.mo0-rhel6.3-x86_64]# ./mlnxofedinstall
```

```
This program will install the MLNX_OFED_LINUX package on your machine.
Note that all other Mellanox, OEM, OFED, or Distribution IB packages will be removed.
Do you want to continue?[y/N]:y

Uninstalling the previous version of MLNX_OFED_LINUX

Starting MLNX_OFED_LINUX-2.0-2.0.0 installation ...
Installing mlnx-ofa_kernel RPM
Preparing...                ##################################################
mlnx-ofa_kernel             ##################################################
Installing mlnx-ofa_kernel-kmp-default 2.1 RPM
Preparing...                ##################################################
mlnx-ofa_kernel-kmp-default ##################################################
Installing mlnx-ofa_kernel-kmp-trace 2.1 RPM
Preparing...                ##################################################
mlnx-ofa_kernel-kmp-trace   ##################################################
Installing mlnx-ofa_kernel-kmp-xen 2.1 RPM
Preparing...                ##################################################
mlnx-ofa_kernel-kmp-xen     ##################################################
Installing mlnx-ofa_kernel-devel RPM
Preparing...                ##################################################
mlnx-ofa_kernel-devel       ##################################################
Installing kernel-mft-mlnx-kmp-default any RPM
Preparing...                ##################################################
kernel-mft-mlnx-kmp-default ##################################################
Installing kernel-mft-mlnx-kmp-trace any RPM
Preparing...                ##################################################
kernel-mft-mlnx-kmp-trace   ##################################################
Installing kernel-mft-mlnx-kmp-xen any RPM
Preparing...                ##################################################
kernel-mft-mlnx-kmp-xen     ##################################################
Installing knem-mlnx RPM
Preparing...                ##################################################
knem-mlnx                   ##################################################
Installing knem-mlnx-kmp-default 1.1.90mlnx2 RPM
Preparing...                ##################################################
knem-mlnx-kmp-default       ##################################################
Installing knem-mlnx-kmp-trace 1.1.90mlnx2 RPM
Preparing...                ##################################################
knem-mlnx-kmp-trace         ##################################################
Installing knem-mlnx-kmp-xen 1.1.90mlnx2 RPM
Preparing...                ##################################################
knem-mlnx-kmp-xen           ##################################################
Installing ummunotify-mlnx RPM
Preparing...                ##################################################
ummunotify-mlnx             ##################################################
Installing ummunotify-mlnx-kmp-default 1.0 RPM
Preparing...                ##################################################
ummunotify-mlnx-kmp-default ##################################################
```

```
Installing mpi-selector RPM
Preparing...                ##################################################
mpi-selector                ##################################################
Installing user level RPMs:
Preparing...                ##################################################
ofed-scripts                ##################################################
Preparing...                ##################################################
libibverbs                  ##################################################
Preparing...                ##################################################
libibverbs                  ##################################################
Preparing...                ##################################################
libibverbs-devel            ##################################################
Preparing...                ##################################################
libibverbs-devel            ##################################################
Preparing...                ##################################################
libibverbs-devel-static     ##################################################
Preparing...                ##################################################
libibverbs-devel-static     ##################################################
Preparing...                ##################################################
libibverbs-utils            ##################################################
Preparing...                ##################################################
libmlx4                     ##################################################
Preparing...                ##################################################
libmlx4                     ##################################################
Preparing...                ##################################################
libmlx4-devel               ##################################################
Preparing...                ##################################################
libmlx4-devel               ##################################################
Preparing...                ##################################################
libmlx5                     ##################################################
Preparing...                ##################################################
libmlx5                     ##################################################
Preparing...                ##################################################
libmlx5-devel               ##################################################
Preparing...                ##################################################
libmlx5-devel               ##################################################
Preparing...                ##################################################
libcxgb3                    ##################################################
Preparing...                ##################################################
libcxgb3                    ##################################################
Preparing...                ##################################################
libcxgb3-devel              ##################################################
Preparing...                ##################################################
libcxgb3-devel              ##################################################
Preparing...                ##################################################
libcxgb4                    ##################################################
Preparing...                ##################################################
libcxgb4                    ##################################################
Preparing...                ##################################################
```

```
libcxgb4-devel          ##################################################
Preparing...            ##################################################
libcxgb4-devel          ##################################################
Preparing...            ##################################################
libnes                  ##################################################
Preparing...            ##################################################
libnes                  ##################################################
Preparing...            ##################################################
libnes-devel-static     ##################################################
Preparing...            ##################################################
libnes-devel-static     ##################################################
Preparing...            ##################################################
libipathverbs           ##################################################
Preparing...            ##################################################
libipathverbs           ##################################################
Preparing...            ##################################################
libipathverbs-devel     ##################################################
Preparing...            ##################################################
libipathverbs-devel     ##################################################
Preparing...            ##################################################
libibcm                 ##################################################
Preparing...            ##################################################
libibcm                 ##################################################
Preparing...            ##################################################
libibcm-devel           ##################################################
Preparing...            ##################################################
libibcm-devel           ##################################################
Preparing...            ##################################################
libibumad               ##################################################
Preparing...            ##################################################
libibumad               ##################################################
Preparing...            ##################################################
libibumad-devel         ##################################################
Preparing...            ##################################################
libibumad-devel         ##################################################
Preparing...            ##################################################
libibumad-static        ##################################################
Preparing...            ##################################################
libibumad-static        ##################################################
Preparing...            ##################################################
libibmad                ##################################################
Preparing...            ##################################################
libibmad                ##################################################
Preparing...            ##################################################
libibmad-devel          ##################################################
Preparing...            ##################################################
libibmad-devel          ##################################################
Preparing...            ##################################################
libibmad-static         ##################################################
```

```
Preparing...                ##################################################
libibmad-static             ##################################################
Preparing...                ##################################################
ibsim                       ##################################################
Preparing...                ##################################################
ibacm                       ##################################################
Preparing...                ##################################################
librdmacm                   ##################################################
Preparing...                ##################################################
librdmacm                   ##################################################
Preparing...                ##################################################
librdmacm-utils             ##################################################
Preparing...                ##################################################
librdmacm-devel             ##################################################
Preparing...                ##################################################
librdmacm-devel             ##################################################
Preparing...                ##################################################
opensm-libs                 ##################################################
Preparing...                ##################################################
opensm-libs                 ##################################################
Preparing...                ##################################################
opensm                      ##################################################
opensmd                    0:off  1:off  2:off  3:off  4:off  5:off  6:off
Preparing...                ##################################################
opensm-devel                ##################################################
Preparing...                ##################################################
opensm-devel                ##################################################
Preparing...                ##################################################
opensm-static               ##################################################
Preparing...                ##################################################
opensm-static               ##################################################
Preparing...                ##################################################
infiniband-diags            ##################################################
Preparing...                ##################################################
fca                         ##################################################
INFO: updating ...

IMPORTANT NOTE:
===============

- The FCA Manager and FCA MPI Runtime library are installed in /opt/mellanox/fca directory.
- The FCA Manager will not be started automatically.
- To start FCA Manager now, type:
    /etc/init.d/fca_managerd start

- There should be single process of FCA Manager running per fabric.

- To start FCA Manager automatically after boot, type:
    /etc/init.d/fca_managerd install_service
```

```
- Check /opt/mellanox/fca/share/doc/fca/README.txt for quick start instructions.

Preparing...                ##################################################
dapl                        ##################################################
Preparing...                ##################################################
dapl                        ##################################################
Preparing...                ##################################################
dapl-devel                  ##################################################
Preparing...                ##################################################
dapl-devel                  ##################################################
Preparing...                ##################################################
dapl-devel-static           ##################################################
Preparing...                ##################################################
dapl-devel-static           ##################################################
Preparing...                ##################################################
dapl-utils                  ##################################################
Preparing...                ##################################################
perftest                    ##################################################
Preparing...                ##################################################
mstflint                    ##################################################
Preparing...                ##################################################
mft                         ##################################################
Preparing...                ##################################################
srptools                    ##################################################
srpd                       0:off  1:off  2:on   3:on   4:off  5:on   6:off
Preparing...                ##################################################
rds-tools                   ##################################################
Preparing...                ##################################################
rds-devel                   ##################################################
Preparing...                ##################################################
ibutils2                    ##################################################
Preparing...                ##################################################
ibutils                     ##################################################
Preparing...                ##################################################
cc_mgr                      ##################################################
Preparing...                ##################################################
dump_pr                     ##################################################
Preparing...                ##################################################
ar_mgr                      ##################################################
Preparing...                ##################################################
ibdump                      ##################################################
Preparing...                ##################################################
infiniband-diags-compat     ##################################################
Preparing...                ##################################################
qperf                       ##################################################
Preparing...                ##################################################
mxm                         ##################################################
Preparing...                ##################################################
```

```
  openmpi                  ##################################################
  Preparing...             ##################################################
  openmpi                  ##################################################
  Preparing...             ##################################################
  bupc                     ##################################################
  Preparing...             ##################################################
  infinipath-psm           ##################################################
  Preparing...             ##################################################
  infinipath-psm-devel     ##################################################
  Preparing...             ##################################################
  mvapich2                 ##################################################
  Preparing...             ##################################################
  openshmem                ##################################################
  Preparing...             ##################################################
  hcoll                    ##################################################
  Preparing...             ##################################################
  libibprof                ##################################################
  Preparing...             ##################################################
  libvma                   ##################################################
  - Changing max locked memory to unlimited (in /etc/security/limits.conf)
    Please log out from the shell and login again in order to update this change
    Read more about this topic in the VMA's User Manual

  - VMA README.txt is installed at: /usr/share/doc/packages/libvma-6.5.3-0/README.txt
  - Please refer to VMA journal for the latest changes: /usr/share/doc/packages/libvma-6.5.3-0/
journal.txt
  Preparing...             ##################################################
  mlnxofed-docs            ##################################################
  Preparing...             ##################################################
  mpitests_mvapich2__1_9   ##################################################
  Preparing...             ##################################################
  mpitests_openmpi__1_6_5  ##################################################
  Preparing...             ##################################################
  mpitests_openmpi__1_7_4  ##################################################
  Device (0a:00.0):
          0a:00.0 InfiniBand: Mellanox Technologies Device 1011
          Link Width is not 8x
          PCI Link Speed: 2.5Gb/s


  Installation finished successfully.

  The firmware version on /dev/mst/mt4113_pciconf0 - 10.10.1000 is up to date.
  Note: To force firmware update use '--force-fw-update' flag.
```

In case your machine has the latest firmware, no firmware update will occur and the installation script will print at the end of installation a message similar to the following:

```
...
The firmware version on /dev/mst/mt26448_pci_cr0 - 2.9.1000 is up
to date.
Note: To force firmware update use '--force-fw-update' flag.
The firmware version on /dev/mst/mt4099_pci_cr0 - 2.11.500 is up
to date.
Note: To force firmware update use '--force-fw-update' flag.
```

In case your machine has an unsupported network adapter device, no firmware update will occur and the error message below will be printed. Please contact your hardware vendor for help on firmware updates.

Error message:

```
-I- Querying device ...
-E- Can't auto detect fw configuration file: ...
```

Step 4. In case the installation script performed firmware updates to your network adapter hardware, it will ask you to reboot your machine.

Step 5. The script adds the following lines to `/etc/security/limits.conf` for the userspace components such as MPI:

```
* soft memlock unlimited
* hard memlock unlimited
```

These settings unlimit the amount of memory that can be pinned by a user space application. If desired, tune the value unlimited to a specific amount of RAM.

Step 6. For your machine to be part of the InfiniBand/VPI fabric, a Subnet Manager must be running on one of the fabric nodes. At this point, Mellanox OFED for Linux has already installed the OpenSM Subnet Manager on your machine. For details on starting OpenSM, refer to the OFED User Manual. See Table 2, “Documents List,” on page 8.

Step 7. (InfiniBand only) Run the `hca_self_test.ofed` utility to verify whether or not the InfiniBand link is up. The utility also checks for and displays additional information such as

- HCA firmware version
- Kernel architecture
- Driver version
- Number of active HCA ports along with their states
- Node GUID

Note: For more details on `hca_self_test.ofed`, see the file `hca_self_test.readme` under `docs/`.

```
 Number of CAs Detected ................. 1
 PCI Device Check ....................... PASS
 Kernel Arch ............................ x86_64
 Host Driver Version .................... MLNX_OFED_LINUX-2.1-0.0.4.20131125.1547 (OFED-2.1-
0.0.4-20131125-1547): 3.0.13-0.27-default
 Host Driver RPM Check .................. PASS
 Firmware on CA #0 HCA .................. v10.10.1000
 Firmware Check on CA #0 (HCA) .......... PASS
 Host Driver Initialization ............. PASS
 Number of CA Ports Active .............. 0
 Port State of Port #1 on CA #0 (HCA)..... INIT (InfiniBand)
 Port State of Port #2 on CA #0 (HCA)..... INIT (InfiniBand)
 Error Counter Check on CA #0 (HCA)...... PASS
 Kernel Syslog Check .................... PASS
 Node GUID on CA #0 (HCA) ............... 00:02:c9:03:00:1a:00:40
 ----------------- DONE ---------------------
```

After the installer completes, information about the Mellanox OFED installation such as prefix, kernel version, and installation parameters can be retrieved by running the command `/etc/infiniband/info`.

4.1.4 Installation Results

Software

- The OFED and MFT packages are installed under the /usr directory.
- The kernel modules are installed under:
  - InfiniBand subsystem:

    ```
    /lib/modules/`uname -r`/updates/kernel/drivers/infiniband/
    ```

  - mlx4_core driver:

    ```
    /lib/modules/<kernel_version>/extra/mlnx-ofa_kernel/drivers/net/ethernet/mellanox/mlx4/
    mlx4_core.ko
    ```

  - mlx4_ib driver:

    ```
    /lib/modules/<kernel_version>/extra/mlnx-ofa_kernel/drivers/infiniband/hw/mlx4/mlx4_ib.ko
    ```

  - mlx5_core driver:

    ```
    /lib/modules/<kernel_version>/extra/mlnx-ofa_kernel/drivers/net/ethernet/mellanox/mlx5/core/
    mlx5_core.ko
    ```

  - mlx5_ib driver:

    ```
    /lib/modules/<kernel_version>/extra/mlnx-ofa_kernel/drivers/infiniband/hw/mlx5/mlx5_ib.ko
    ```

  - IPoIB:

    ```
    /lib/modules/`uname -r`/updates/kernel/drivers/infiniband/ulp/ipoib/ib_ipoib.ko
    ```

  - iSER:

    ```
    /lib/modules/`uname -r`/updates/kernel/drivers/infiniband/ulp/iser/ib_iser.ko
    ```

- eIPoIB:

```
/lib/modules/`uname -r`/updates/kernel/drivers/net/eipoib/eth_ipoib.ko
```

- SRP

```
/lib/modules/`uname -r`/updates/kernel/drivers/infiniband/ulp/srp/ib_srp.ko
```

- RDS:

```
/lib/modules/`uname -r`/updates/kernel/net/rds/rds.ko
/lib/modules/`uname -r`/updates/kernel/net/rds/rds_rdma.ko
/lib/modules/`uname -r`/updates/kernel/net/rds/rds_tcp.ko
```

Kernel's modules location may vary depending on the kernel's configuration.
For example: /lib/modules/`uname -r`/extra/kernel/drivers/net/ethernet/mellanox/mlx4/mlx4_core

- The package kernel-ib-devel include files are placed under `/usr/src/ofa_kernel/include/`. These include files should be used when building kernel modules that use the stack. (Note that the include files, if needed, are "backported" to your kernel.)
- The raw package (un-backported) source files are placed under `/usr/src/ofa_kernel-<ver>`
- The script `openibd` is installed under `/etc/init.d/`. This script can be used to load and unload the software stack.
- The directory `/etc/infiniband` is created with the files `info` and `openib.conf and connectx.conf`. The `info` script can be used to retrieve Mellanox OFED installation information. The `openib.conf` file contains the list of modules that are loaded when the `openibd` script is used. The `connectx.conf` file saves the ConnectX adapter card's ports configuration to Ethernet and/or InfiniBand. This file is used at driver start/restart (`/etc/init.d/openibd start`)
- The file `90-ib.rules` is installed under `/etc/udev/rules.d/`
- If OpenSM is installed, the daemon `opensmd` is installed under `/etc/init.d/` and `opensm.conf` is installed under `/etc`.
- If IPoIB configuration files are included, `ifcfg-ib<n>` files will be installed under:
  - `/etc/sysconfig/network-scripts/` on a RedHat machine
- The installation process unlimits the amount of memory that can be pinned by a user space application. See Step 5.
- Man pages will be installed under `/usr/share/man/`

Firmware

- The firmware of existing network adapter devices will be updated if the following two conditions are fulfilled:

  1. You run the installation script in default mode; that is, *without* the option '--without-fw-update'.

2. The firmware version of the adapter device is older than the firmware version included with the Mellanox OFED ISO image.

If an adapter's Flash was originially programmed with an Expansion ROM image, the automatic firmware update will also burn an Expansion ROM image.

- In case your machine has an unsupported network adapter device, no firmware update will occur and the error message below will be printed. Please contact your hardware vendor for help on firmware updates.

  Error message:

```
-I- Querying device ...
-E- Can't auto detect fw configuration file: ...
```

4.1.5 Post-installation Notes

- Most of the Mellanox OFED components can be configured or reconfigured after the installation by modifying the relevant configuration files. See the relevant chapters in this manual for details.
- The list of the modules that will be loaded automatically upon boot can be found in the `/etc/infiniband/openib.conf` file.

4.1.6 Updating Firmware After Installation

In case you ran the `mlnxofedinstall` script with the '`--without-fw-update`' option and now you wish to (manually) update firmware on your adapter card(s), you need to perform the following steps:

If you need to burn an Expansion ROM image, please refer to OFED User Manual. See Table 2, "Documents List," on page 8

The following steps are also appropriate in case you wish to burn newer firmware that you have downloaded from Mellanox Technologies' Web site (=> Support => Firmware Download).

Step 1. Start `mst`.

```
host1# mst start
```

Step 2. Identify your target InfiniBand device for firmware update.

1. Get the list of InfiniBand device names on your machine.

```
host1# mst status
MST modules:
------------
    MST PCI module loaded
    MST PCI configuration module loaded
    MST Calibre (I2C) module is not loaded
```

```
 MST devices:
 ------------
 /dev/mst/mt25418_pciconf0        - PCI configuration cycles access.
                                    bus:dev.fn=02:00.0 addr.reg=88
                                    data.reg=92
                                    Chip revision is: A0
 /dev/mst/mt25418_pci_cr0         - PCI direct access.
                                    bus:dev.fn=02:00.0 bar=0xdef00000
                                    size=0x100000
                                    Chip revision is: A0
 /dev/mst/mt25418_pci_msix0       - PCI direct access.
                                    bus:dev.fn=02:00.0 bar=0xdeefe000
                                    size=0x2000
 /dev/mst/mt25418_pci_uar0        - PCI direct access.
                                    bus:dev.fn=02:00.0 bar=0xdc800000
                                    size=0x800000
```

2. Your InfiniBand device is the one with the postfix "_pci_cr0". In the example listed above, this will be `/dev/mst/mt25418_pci_cr0`. does not apply

Step 3. Burn firmware.

1. Burning a firmware binary image using `mstflint` (that is already installed on your machine). Please refer to `MSTFLINT_README.txt` under `docs/`.
2. Burning a firmware image from a .mlx file using the `mlxburn` utility (that is already installed on your machine).

The following command burns firmware onto the ConnectX device with the device name obtained in the example of Step 2.

```
 host1$ mlxburn -dev /dev/mst/mt25418_pci_cr0 -fw /mnt/firmware/fw-25408/fw-25408-ryyel.mlx
 ls /mnt/firmware/fw-4113/10_10_1000/
 BUILD_ID              fw-ConnectIB.mlx      MCB191A-FCA_A1.ini    MCB193A-FBA_A1.ini    MCB194A-
FCA_A1.ini    syndrome_list.log
 exp_rom/              fw_strings.db         MCB192A-FCA_A1.ini    MCB193A-FCA_A1.ini
mlnx_ofed_latest.txt
 reg-l-vrt-212:/tmp # mlxburn -dev /dev/mst/mt4113_pciconf0 -fw /mnt/firmware/fw-4113/10_10_1000/
fw-ConnectIB.mlx
 -I- Querying device ...
 -I- Using auto detected configuration file: /mnt/firmware/fw-4113/10_10_1000/MCB192A-FCA_A1.ini
(PSID = MT_1240110019)
 -I- Generating image ...

     Current FW version on flash:  10.10.1000
     New FW version:               10.10.1000

     Note: The new FW version is not newer than the current FW version on flash.

  Do you want to continue ? (y/n) [n] : y

 Burning FS3 FW image without signatures  - OK
 Restoring signature                      - OK
 -I- Image burn completed successfully.
```

5 Firmware

5.1 Updating Adapter Card Firmware

Each card is shipped with the latest version of qualified firmware at the time of manufacturing. Firmware is updated occasionally, and the most recent firmware can be obtained from: http://www.mellanox.com => Support => Download Firmware. Check that the firmware on your card is the latest found on the Mellanox site, if not update to the latest version found on the Mellanox web site.

Firmware can be updated on the stand alone single card using the **flint** tool of the *Mellanox Firmware Tools (MFT)* package. This package is available for download, along with its user manual, from the Mellanox Firmware Tools page. See http://www.mellanox.com => Support => Download Firmware Tools.

A firmware binaries table lists a binary file per adapter card. The file name of each such binary is composed by combining the firmware name, the firmware release version, and the card part number. Please contact Mellanox System Support if you cannot find the firmware binary for your adapter card.

The following steps describe how to retrieve the PSID (firmware identification) and programmed firmware version of your adapter card. They also describe how to update the card with the latest firmware version available.

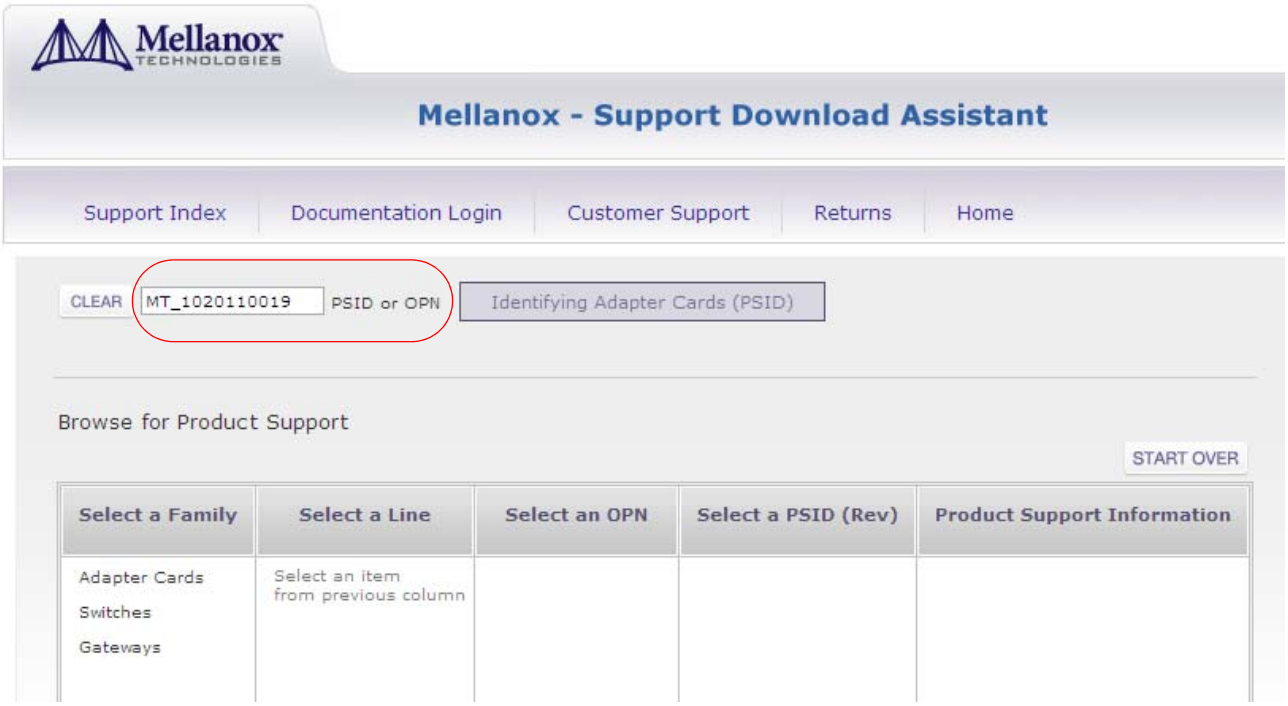
Note: The following steps are an example and do not correspond to this device.

1. Retrieve the PSID and firmware version:
   a. Install the MFT package. The package is available at www.mellanox.com => Products => Software => InfiniBand/VPI Drivers => Firmware Tools. Make sure to download the package corresponding to your computer's operating system.
   b. Enter: mst start.
   c. Get the Mellanox *mst device name* using the command "mst status"
   d. Get the PSID (firmware identification) and programmed firmware version using the command.

```
  > flint -d /dev/mst/mt4099_pci_cr0  q
  Image type:      ConnectX
  FW Version:     2.9.4000
  Device ID:         4099
  Chip Revision:  0
  Description:    Node                Port1                Port2
Sys image
  GUIDs:              000002c900000200 000002c900000201 000002c900000202
000002c900000203
  MACs:
000002c90200        000002c90201
  Board ID:          (MT_1020110019)
  VSD:
  PSID:                 MT_1020110019
```

2. Compare the programmed firmware version with the latest available.
   a. Go to Mellanox's web site: http://www.mellanox.com/supportdownloader. See Figure 3.
   b. Enter your card PSID to display the latest firmware.

Figure 3: Support Download Assistant



3. If a newer firmware version exists for your adapter card, update the firmware as follows:
   a. Download the firmware image zip file from the Download Center (see Step 2a above).
   b. Unzip the firmware image.
   c. Burn the firmware image.(Please note that the following are examples). Enter:

```
> flint -d /dev/mst/mt4099_pci_cr0 -i <binary image> burn
```

   a. Reboot the computer.
   b. Enter: mst start.
   c. Verify that the card firmware was updated successfully.

```
> flint -d /dev/mst/mt4099_pci_cr0  q
Image type:      ConnectX
FW Version:     2.9.4100
Device ID:         4099
...
```

6 Troubleshooting

6.1 General

Server unable to find the adapter	• Ensure that the adapter is placed correctly • Make sure the adapter slot and the adapter are compatible • Install the adapter in a different PCI Express slot • Use the drivers that came with the adapter or download the latest • Make sure your motherboard has the latest BIOS • Try to reboot the server
The adapter no longer works	• Reseat the adapter in its slot or a different slot, if necessary • Try using another cable • Reinstall the drivers for the network driver files may be damaged or deleted • Reboot the server
Adapters stopped working after installing another adapter	• Try removing and re-installing all adapters • Check that cables are connected properly • Make sure your motherboard has the latest BIOS
Link indicator light is off	• Ensure that adapter driver/s is loaded • Try another port on the switch • Make sure the cable is securely attached • Check your are using the proper cables that do not exceed the recommended lengths • Verify that your switch and adapter port are compatible
Link light is on, but with no communication established	• Check that the latest driver is loaded • Check that both the adapter and its link are set to the same speed and duplex settings

6.2 Linux

Environment Information	cat/etc/issue uname –a cat/proc/cupinfo | grep ‘model name’ | uniq ofed_info | head -1 ifconfig –a ethtool <interface> ethtool –i <interface_of_Mellanox_port_num> ibdev2netdev
Card Detection	lspci | grep –i Mellanox
Mellanox Firmware Tool (MFT)	Download and install MFT: http://www.mellanox.com/content/pages.php?pg=management_tools&menu_section=34 Refer to the User Manual for installation instructions. Once installed, run: mst start mst status flint –d <mst_device> q
Ports Information	ibstat lbv_devinfo
Firmware Version Upgrade	To download the latest firmware version refer to http://www.mellanox.com/supportdownloader
Collect Log File	/var/log/messages dmesg > system.log**F**

7 Specifications

7.1 MCB191A-FCAT Specifications

Table 7 - MCB191A-FCAT Specifications Table

Physical	**Size:** 2.71in. x5.6 in. (68.9mm x 142.25 mm)
	Connector: QSFP+ InfiniBand (Copper and optical)
Protocol Support	**InfiniBand:** IBTA v1.2.1 Auto-Negotiation: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane), FDR (14.0625Gb/s per lane) port
	Data Rate: Up to 56Gb/s FDR– InfiniBand
	PCI Express Gen3: SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible)
Power and Environmental	**Voltage:** 12V, 3.3V
	Typ Power: Passive Cables 9.68W
	Max Power: Passive Cables 10.67W
	Temperature: 0°C to 55°C
	Air Flow: 300LFM[a]
Regulatory	**Safety:** IEC/EN 60950-1:2006 ETSI EN 300 019-2-2 IEC 60068-2- 64, 29, 32
	RoHS: RoHS-R6

a. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

7.2 MCB192A-FCAT Specifications

Table 8 - MCB192A-FCAT Specifications Table

Physical	**Size:** 2.71in. x5.6 in. (68.90mm x 142.25 mm)
	Connector: QSFP+ InfiniBand (Copper and optical)

Table 8 - MCB192A-FCAT Specifications Table

Protocol Support	**InfiniBand:** IBTA v1.2.1 Auto-Negotiation: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (10.3125Gb/s per lane), FDR (14.0625Gb/s per lane) port
	Data Rate: Up to 56Gb/s FDR– InfiniBand
	PCI Express Gen3: SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible)
Power and Environmental	**Voltage:** 12V, 3.3V
	Typ Power: Passive Cables 10.73W
	Max Power: Passive Cables 12.32W
	Temperature: 0°C to 55°C
	Air Flow: 300LFM[a]
Regulatory	**Safety:** IEC/EN 60950-1:2006 ETSI EN 300 019-2-2 IEC 60068-2- 64, 29, 32
	RoHS: RoHS-R6

a. Air flow is measured ~1” from the heat sink between the heat sink and the cooling air inlet.

7.3 LED Operation

There are two I/O LEDs per port in dual-port designs and one bicolor LED in single-port designs, green and yellow, located on the I/O panel. See Table 9 for different LED functions.

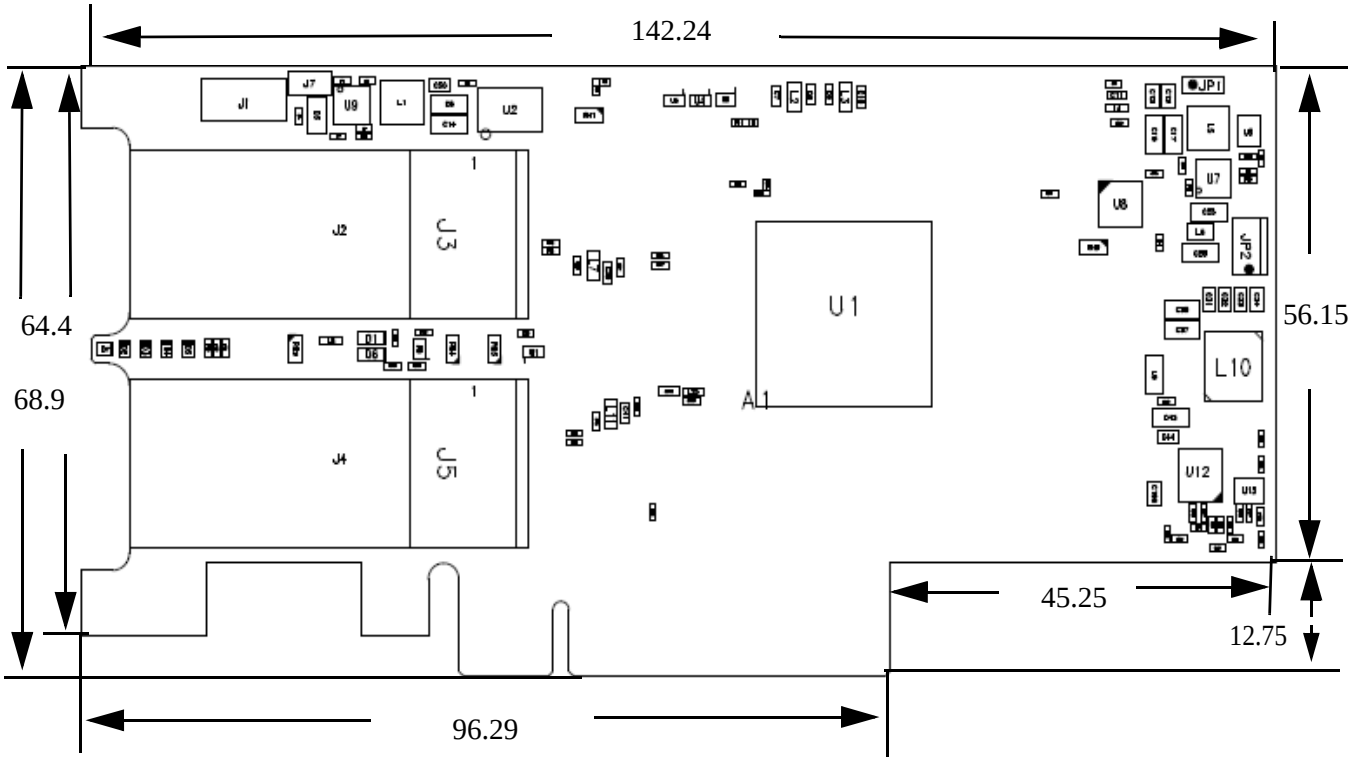
Table 9 - LED Assignment

LED	Function
Yellow - Physical link	• Constant on indicates a good physical link • Blinking indicates a problem with the physical link • If neither LED is lit, then the physical link has not been established • When logical link is established, yellow LED turns off
Green - Logical (data activity) link	• A constant green indicates a valid logical (data activity) link without data transfer. • A blinking green indicates a valid logical link with data transfer • If only the yellow LED is lit and the green LED is off, then the logical link has not been established

7.4 Board Mechanical Drawing and Dimensions

All dimensions are in millimeters.
All the mechanical tolerances are +/- 0.1mm

Figure 4: Mechanical Drawing of the Dual-port MCB192A-FCAT Adapter Card



7.5 Bracket Mechanical Drawings

Figure 5: Dual-port Bracket

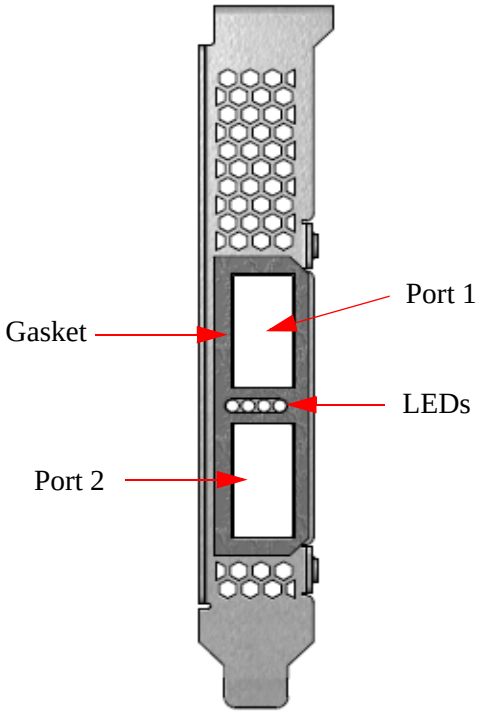
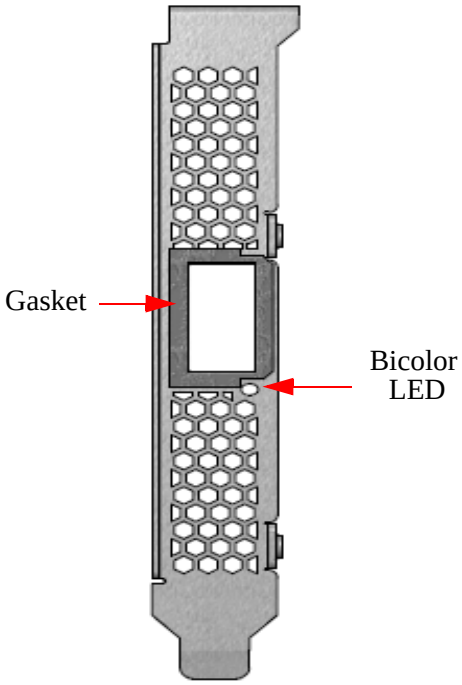


Figure 6: Single-port Bracket



Appendix A: Interface Connectors Pinout

A.1 QSFP+ Connector Pinout

Figure 7: Connector and Cage Views

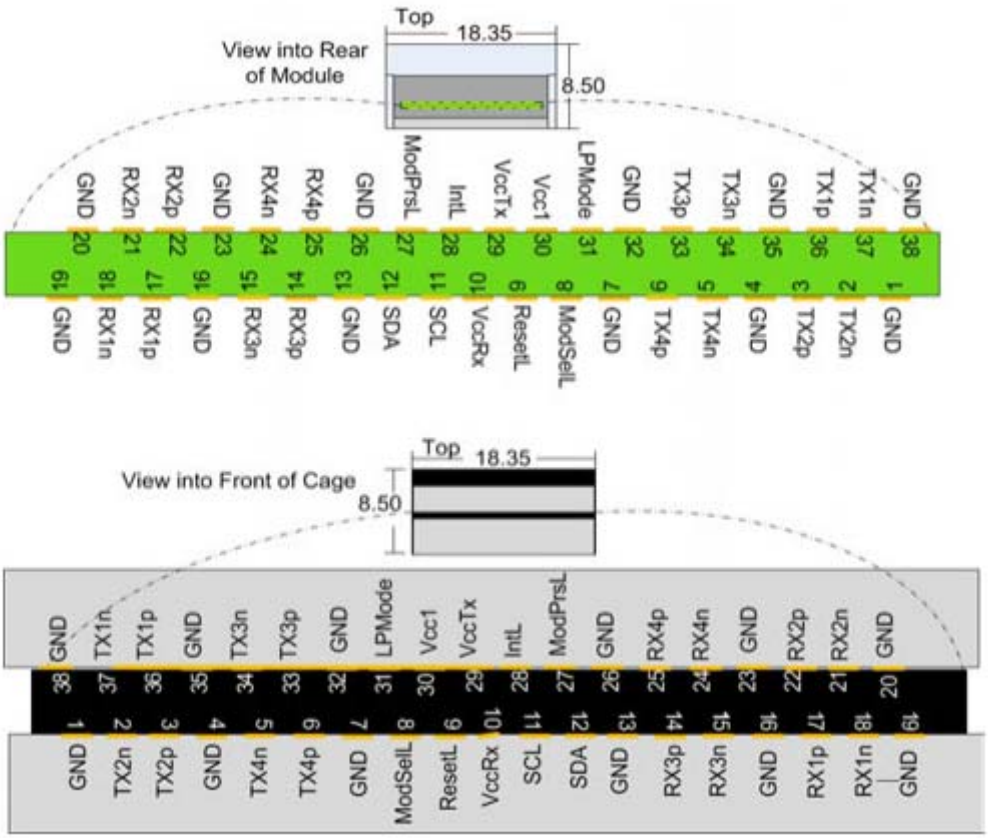


Table 10 - Connector Pin Number and Name to Signal Name Map

Connector Pin Number	Connector Pin Name	Port A Signal Name
1	GND	GND
2	TXN_2	Tx2n
3	TXP_2	Tx2p
4	GND	GND
5	TXN_4	Tx4n
6	TXP_4	Tx4p
7	GND	GND
8	ModSelL_Port0	ModSelL
9	ResetL_Port0	ResetL

Table 10 - Connector Pin Number and Name to Signal Name Map

Connector Pin Number	Connector Pin Name	Port A Signal Name
10		VccRx
11	SCL	SCL
12	SDA	SDA
13	GND	GND
14	RXP_3	Rx3p
15	RXN_3	Rx3n
16	GND	GND
17	RXP_1	Rx1p
18	RXN_1	Rx1n
19	GND	GND
20	GND	GND
21	RXN_2	Rx2n
22	RXP_2	Rx2p
23	GND	GND
24	RXN_4	Rx4n
25	RXP_4	Rx4p
26	GND	GND
27	ModPrsl_Port0	Mod PrsL
28	IntL	IntL
29		VccTx
30		Vcc1
31	LPMode_Port0	LPMode
32	GND	GND
33	TXP_3	Tx3p
34	TXN_3	Tx3n
35	GND	GND
36	TXP_1	Tx1p
37	TXN_1	Tx1n
38	GND	GND

A.2 PCI Express x8 Connector Pinout

The adapter cards use a standard PCI Express x8 edge connector and the PCI Express x8standard pinout according to the PCI Express 3.0 specification.

A.3 I²C-compatible Connector Pinout

Figure 8: Compatible Connector Plug and Pinout

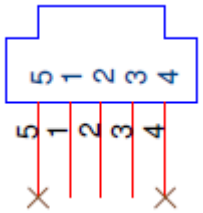
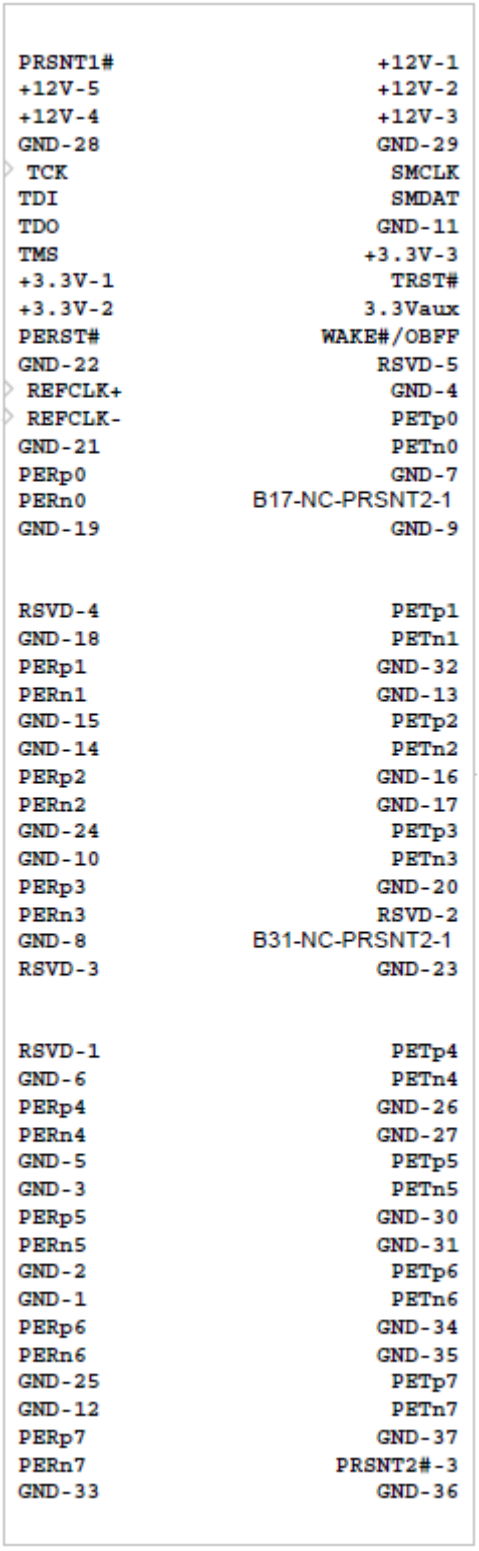


Table 11 - I2C-compatible Connector

Connector Pin Number	Signal Name
1	SDA
2	SCL
3	GND
4	NC
5	NC

Figure 9: PCIe Connector Pinout



PRSNT1#	+12V-1
+12V-5	+12V-2
+12V-4	+12V-3
GND-28	GND-29
TCK	SMCLK
TDI	SMDAT
TDO	GND-11
TMS	+3.3V-3
+3.3V-1	TRST#
+3.3V-2	3.3Vaux
PERST#	WAKE#/OBFF
GND-22	RSVD-5
REFCLK+	GND-4
REFCLK-	PETp0
GND-21	PETn0
PERp0	GND-7
PERn0	B17-NC-PRSNT2-1
GND-19	GND-9
RSVD-4	PETp1
GND-18	PETn1
PERp1	GND-32
PERn1	GND-13
GND-15	PETp2
GND-14	PETn2
PERp2	GND-16
PERn2	GND-17
GND-24	PETp3
GND-10	PETn3
PERp3	GND-20
PERn3	RSVD-2
GND-8	B31-NC-PRSNT2-1
RSVD-3	GND-23
RSVD-1	PETp4
GND-6	PETn4
PERp4	GND-26
PERn4	GND-27
GND-5	PETp5
GND-3	PETn5
PERp5	GND-30
PERn5	GND-31
GND-2	PETp6
GND-1	PETn6
PERp6	GND-34
PERn6	GND-35
GND-25	PETp7
GND-12	PETn7
PERp7	GND-37
PERn7	PRSNT2#-3
GND-33	GND-36

Appendix B: Finding the GUID and Serial Number on the Adapter Card

Each Mellanox adapter card has a label on the print side that shows the card serial number and the card GUID for the InfiniBand protocol.

Figure 10: Board Labels

Port 1 uses the GUID described on the label. To obtain the GUID for Port 2, add 1 to that of Port 1.

Appendix C: Safety Warnings

Below is a list of safety warnings in English. For safety warnings in other languages, please refer to the appendices in this user manual.

1. **Installation Instructions**

Read all installation instructions before connecting the equipment to the power source.

2. **Over-temperature**

This equipment should not be operated in an area with an ambient temperature exceeding the maximum recommended: 55°C (131°F).
To guarantee proper air flow, allow at least 8cm (3 inches) of clearance around the ventilation openings.

3. **During Lightning - Electrical Hazard**

During periods of lightning activity, do not work on the equipment or connect or disconnect cables.

4. **Copper Cable Connecting/Disconnecting**

Some copper cables are heavy and not flexible, as such they should be carefully attached to or detached from the connectors. Refer to the cable manufacturer for special warnings and instructions.

5. **Equipment Installation**

This equipment should be installed, replaced, or serviced only by trained and qualified personnel.

6. **Equipment Disposal**

Disposal of this equipment should be in accordance to all national laws and regulations.

7. **Local and National Electrical Codes**

This equipment should be installed in compliance with local and national electrical codes.

8. Hazardous Radiation Exposure

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

CLASS 1 LASER PRODUCT and reference to the most recent laser standards: IEC 60 825-1:1993 + A1:1997 + A2:2001 and EN 60825-1:1994+A1:1996+ A2:200

Appendix D: Avertissements de sécurité d'installation (Warnings in French)

1. Instructions d'installation

Lisez toutes les instructions d'installation avant de brancher le matériel à la source d'alimentation électrique.

2. Température excessive

Ce matériel ne doit pas fonctionner dans une zone avec une température ambiante dépassant le maximum recommandé de 55°C (131°F). Un flux d'air de 200LFM à cette température ambiante maximale est nécessaire. En outre, pour garantir un bon écoulement de l'air, laissez au moins 8 cm (3 pouces) d'espace libre autour des ouvertures de ventilation.

3. Orages – dangers électriques

Pendant un orage, il ne faut pas utiliser le matériel et il ne faut pas brancher ou débrancher les câbles.

4. Branchement/débranchement des câbles en cuivre

Les câbles en cuivre sont lourds et ne sont pas flexibles, il faut donc faire très attention en les branchant et en les débranchant des connecteurs. Consultez le fabricant des câbles pour connaître les mises en garde et les instructions spéciales.

5. Installation du matériel

Ce matériel ne doit être installé, remplacé ou entretenu que par du personnel formé et qualifié.

6. Elimination du matériel

L'élimination de ce matériel doit s'effectuer dans le respect de toutes les législations et réglementations nationales en vigueur.

7. Codes électriques locaux et nationaux

Ce matériel doit être installé dans le respect des codes électriques locaux et nationaux.

8. Exposition au rayonnement grave

Mise en garde – l'utilisation de commandes ou de réglages ou l'exécution de procédures autres que ce qui est spécifié dans les présentes peut engendrer une exposition au rayonnement grave.

PRODUIT LASER DE CLASSE 1 » et références aux normes laser les plus récentes CEI 60 825-1:1993 + A1:1997 + A2:2001 et NE 60825-1:1994+A1:1996+ A2:2001

Appendix E: Sicherheitshinweise (Warnings in German)

1. Installationsanleitungen

Lesen Sie alle Installationsanleitungen, bevor Sie das Gerät an die Stromversorgung anschließen.

2. Übertemperatur

Dieses Gerät sollte nicht in einem Bereich mit einer Umgebungstemperatur über der maximal empfohlenen Temperatur von 55°C (131°F) betrieben werden. Es ist ein Luftstrom von 200 LFM bei maximaler Umgebungstemperatur erforderlich. Außerdem sollten mindestens 8 cm (3 in.) Freiraum um die Belüftungsöffnungen sein, um einen einwandfreien Luftstrom zu gewährleisten.

3. Bei Gewitter - Elektrische Gefahr

Arbeiten Sie während eines Gewitters und Blitzschlag nicht am Gerät, schließen Sie keine Kabel an oder ab.

4. Anschließen/Trennen von -Kupferkabel

Kupferkabel sind schwer und nicht flexible. Deshalb müssen sie vorsichtig an die Anschlüsse angebracht bzw. davon getrennt werden. Lesen Sie die speziellen Warnungen und Anleitungen des Kabelherstellers.

5. Geräteinstallation

Diese Gerät sollte nur von geschultem und qualifiziertem Personal installiert, ausgetauscht oder gewartet werden.

6. Geräteentsorgung

Die Entsorgung dieses Geräts sollte unter Beachtung aller nationalen Gesetze Bestimmungen erfolgen.

7. Regionale und nationale elektrische Bestimmungen t

Dieses Gerät sollte unter Beachtung der regionalen und nationalen elektrischen Bestimmungen installiert werden.

This equipment should be installed in compliance with local and national electrical codes.

8. Strahlenkontak

Achtung – Nutzung von Steuerungen oder Einstellungen oder Ausführung von Prozeduren, die hier nicht spezifiziert sind, kann zu gefährlichem Strahlenkontakt führen..

Klasse 1 Laserprodukt und Referenzen zu den aktuellsten Lasterstandards : ICE 60 825-1:1993 + A1:1997 + A2:2001 und EN 60825-1:1994+A1:1996+ A2:2001

Appendix F: Advertencias de seguridad para la instalación (Warnings in Spanish)

1. Instrucciones de instalación

Antes de conectar el equipo a la fuente de alimentación, leer todas las instrucciones de instalación.

2. Sobrecalentamiento

No se debe utilizar el equipo en un área con una temperatura ambiente superior a la máxima recomendada: 55°C(131°F). Además, para garantizar una circulación de aire adecuada, se debe dejar como mínimo un espacio de 8 cm (3 pulgadas) alrededor de las aberturas de ventilación.

3. Cuando hay rayos: peligro de descarga eléctrica

No utilizar el equipo ni conectar o desconectar cables durante períodos de actividad de rayos.

4. Conexión y desconexión del cable Copper

Dado que los cables de cobre son pesados y no son flexibles, su conexión a los conectores y su desconexión se deben efectuar con mucho cuidado. Para ver advertencias o instrucciones especiales, consultar al fabricante del cable.

5. Instalación de equipos

La instalación, el reemplazo y el mantenimiento de este equipo estarán a cargo únicamente de personal capacitado y competente.

6. Eliminación de equipos

La eliminación definitiva de este equipo se debe efectuar conforme a todas las leyes y reglamentaciones nacionales.

7. Códigos eléctricos locales y nacionales

Este equipo se debe instalar conforme a los códigos eléctricos locales y nacionales.

8. Exposición a niveles de radiación peligrosos

Precaución: el uso de controles o ajustes o la realización de procedimientos distintos de los que aquí se especifican podrían causar exposición a niveles de radiación peligrosos.

PRODUCTO LÁSER DE CLASE 1 y referencia a las normas de láser más recientes: IEC 60825-1:2007/03 y EN 60825-1:2007