Dolphin PCI Express MXS924 Switch

MXS924 24 ports PCI Express 4.0 Switch Users Guide

Version 1.2e

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DISCLAIMER

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Terms and Acronyms

Important terms and acronyms used in this manual

AOC   Active Optical Cable. Special PCIe fiber cable assembly with SFF-8644 connectors.

CMI   Cable Management Interface. The 2-wire management interface for communication between subsystems connected by a PCIe 3.0 cable. Details can be found in the PCI-SIG External Cabling Specification 3.0. The CMI functionality is optional with the MXS924 switch.

BMC Controller Board Management Controller (Microcontroller) on the MXS924 used to manage and implement the CMI communications and switch management functions. CMI communication require PCIe 3.0 / 4.0 cables.

eXpressWare Dolphin's software stack for PCIe clustering and IO. www.dolphinics.com/software for more information.

Lane   One PCI Express Lane contains a differential pair for transmission and a differential pair for reception.

Link   A collection of PCI Express Lanes providing the communication path between an Upstream and Downstream Port. The MXS924 support links of x4, x8 or x16 width by utilizing lanes from 1,2 or 4 ports.

MiniSAS-HD Standard MiniSAS-HD cable with SFF-8644 connectors.

PCIe 3.0 cable PCIe 3.0 cable with SFF-8644 connectors. Complaint to the new PCI-SIG External Cabling Specification 3.0. Support for CMI.

PCIe 4.0 cable PCIe 4.0 cable with SFF-8644 connectors. Complaint to the new PCI-SIG External Cabling Specification 4.0. (draft) Support for CMI.

Chassis Ports The MXS924 has 24 x4 Gen3 SFF-8644 ports, named P1, P2, P3 …, P24. The port numbers are printed on the chassis panel below the connectors.

Fabric Port MXS924 ports configured to be used as a link to another MXS924 switch. For standard dual NTB switch configurations, Chassis ports P1, P2, P3 and P4 are normally the fabric ports.

Upstream Port Used in Transparent configurations, chassis ports P1, P2, P3 and P4 are normally the upstream port used to connect to the host. All other ports are normally downstream ports – used as x4, x8 or x16 links depending on the transparent configuration enabled.

Overview

This document describes the Dolphin MXS924 PCI Express 4.0 switch used in combination with other Dolphin PCI Express products. Dolphin is currently providing the following compliant PCI Express products:

- MXH930 PCI Express Gen4 x16 NTB SFF-8644 cable adapter card
- MXH932 PCI Express Gen4 x16 Transparent Host and Target SFF-8644 cable adapter card
- MXP908 PXIe Peripheral Gen4 x8 NTB SFF-8644 cable adapter card
- MXP909 PXIe Peripheral Gen4 x8 Transparent Host SFF-8644 cable adapter card
- PXH820 PCI Express Gen3 x8 NTB XMC SFF-8644 cable adapter card
- PXH822 PCI Express Gen3 x8 Transparent Host and Target XMC SFF-8644 cable adapter card
- PXH830PCI Express Gen3 x16 NTB SFF-8644 cable adapter card
- PXH832PCI Express Gen3 x16 Transparent Host and Target SFF-8644 cable adapter card
- MXH830 PCI Express Gen3 x16 NTB SFF-8644 cable adapter card
- MXH832 PCI Express Gen3 x16 Transparent Host and Target SFF-8644 cable adapter card
- MXH833 PCI Express Gen3 x16 Transparent Target SFF-8644 cable adapter card

The MXS924 switch can be used to create a PCIe fabric or PCIe expansion using the above products or to any product compliant to the PCI-SIG External Cabling Specification 3.0 (for connecting Gen 3.0 equipment or 4.0 (for connecting Gen 4.0 equipment).

Please reference the MXS924 Management Firmware Release note for details and currently supported features.

Software support

All Dolphin PXH and MXH PCI Express NTB adapter cards support the complete eXpressWare suite of Dolphin PCI Express Software including Dolphin SuperSockets™, optimized TCP/IP drivers, SmartIO and SISCI Embedded software.

Dolphin SuperSockets is a Berkeley Sockets compliant library that provides a socket latency below 1 microsecond, and close to the wire speed streaming bandwidth for networked applications. SuperSockets™ is currently available on Linux and Windows. It is a 100% transparent plug-and-play solution for commercial and embedded applications.

Dolphin's optimized TCP/IP driver enables PCI Express to be used as a traditional 10G Ethernet / 40G Ethernet replacement such as for NFS sharing and legacy networking that does not need the low latency provided by SuperSockets. The TCP/IP driver supports gateway functionality.

The SISCI software provides a well-defined, easy to use shared memory / reflective memory programming API for PCI Express over cable.

The SmartIO software enables dynamic sharing of and access to PCIe devices through a PCIe fabric.

More information about eXpressWare at http://www.dolphinics.com/software.

Please consult the Dolphin eXpressWare Installation and Reference manual and eXpressWare release note for details and limitations.

Revision history

Hardware revisions

The following table gives a general overview of the hardware capabilities.

Switch revision	Capabilities
MXS924-AB	• Initial product version
MXS924-BB	• Manufacturing improvements, no functional changes vs rev AB.

Management Firmware Version

The MXS924 is managed by built in processor and contains nonvolatile storage for processor code, Web GUI and PCIe configuration data. This software / firmware is released as a bundle, please consult the MXH924 Management Firmware Release note for details.

PCI Express 4.0 Switch – MXS924

The MXS924 is a 24 port PCI Express 4.0 switch available from Dolphin providing an easy to use, multi-functional solution.

MXS924 high level specification

- PCI Express Gen1 2.5 GT/s / Gen2 5.0 GT/s / Gen3 8.0 GT/s / Gen4 16 GT/s per lane signaling – 4 lanes – up to 64 GT/s total signaling per port.
- Compliant with PCI Express Gen1, Gen2, Gen3 and Gen4 computers and IO systems, auto detection. Each port operates independently at Gen1, Gen2, Gen3 or Gen4 speeds
- Lane width auto-training to connected cable width (x16, x8, x4, x2, x1)
- 19-Inch 1U rack mountable chassis.
- Physical dimensions 440mm x 357mm x 45mm (17" x 14" x 1.75") (WxDxH).
- Supports NTB connections to other hosts and transparent connections to IO systems as a transparent P2P device
- Based on Microsemi PFX Gen4 Switchtec chipset
- PCI Express Base Specification Rev 4.0
- PCI Express External Cabling Specification, Rev. 3.0 / 4.0
- Twenty-four PCI Express Gen4 x4 SFF-8644 Cable connection
  - Durability max total 250 mating cycles
- Support for hot plugging of the PCI Express cable (NTB mode, SISCI and SuperSockets)
- Built in management processor for monitoring and firmware upgrade and management
  - RJ45 Ethernet (1Gb/100Mb Ethernet) connector (optional use)
  - USB port for firmware upgrade
  - SD-card boot medium
- Operational status and alert LEDs
- No PCI Express power domain isolation
- 4 Redundant fans
- Operating systems supported:
  - NTB mode: Linux, Windows, RTX and VxWorks.
  - Transparent mode: All (No drivers required)
- Power supply input 100 - 240VAC 50/60 Hz – 2.8A
- Power Consumption: Max 80 Watt (including active optical transceivers)
- Operating temperature 0°C to 40°C, Relative Humidity 5% - 95% non-condensing
- Storage temperature -25°C to 70°C, Relative Humidity 10% - 90% non-condensing
- Weight: 4.6 Kilo (10 lbs.)
- RoHS compliant
- Safety Test compliance
  - IEC 62368-1:2014
- EMC test compliance
  - EN 55032:2012
  - EN 55024:2010
  - EN 61000-3-2:2014
  - EN 61000-3-3:2013
- FCC & CE Mark

NTB Configuration examples

The MXS924 switch can be used as a standalone PCI Express switch, or several switches can be cascaded to build larger PCIe expansion systems or PCIe fabrics. It can be combined with compliant PCIe cards available from Dolphin or compliant customer designs. Some examples can be found below. Please consult the chapter Configuring the MXS924 switch on page 17 for more details.

NOTE: Please consult the eXpressWare Release Note for information on supported topologies and configurations for each software release.

NOTE: Please note that the Dolphin eXpressWare currently does not support mixing MXHxxx and PXHxxx cards in a single cluster.

6 node PCIe 4.0 x16 NTB Cluster

Each node has a Dolphin Express MXH930, MXH830, PXH830 or PXH820 adapter. Up to six systems can be connected to the Dolphin MXS924 switch using the default firmware configuration. All nodes connect directly to the switch using up to four x4 cables (x16 link). This is the switch default configuration.
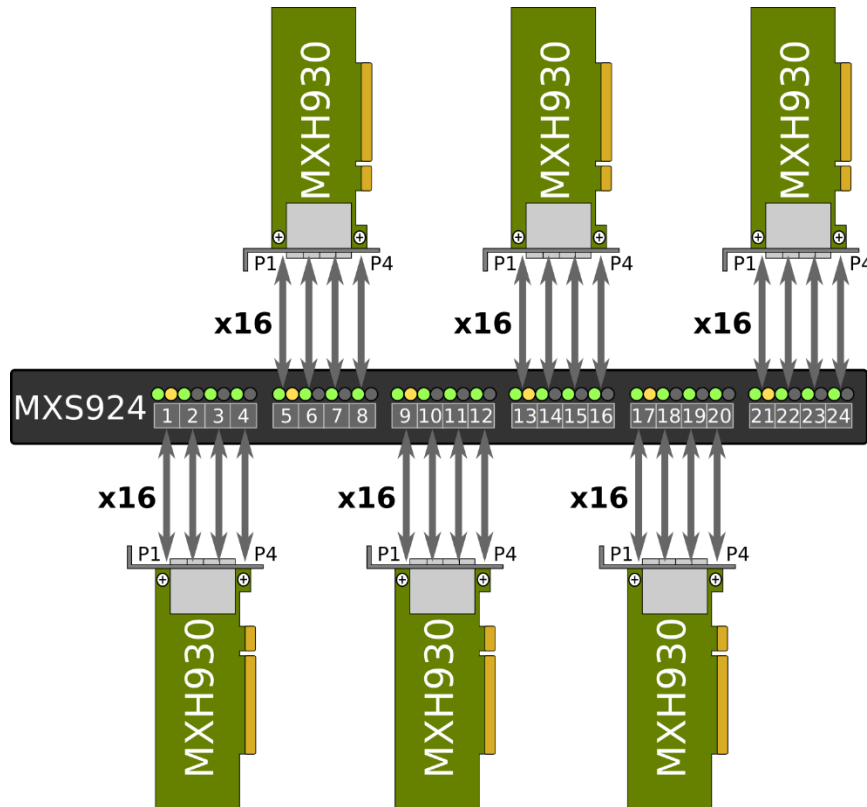
Figure 1: 6 Node PCIe x16 Cluster

12 node PCIe 4.0 x8 NTB Cluster

Each node has a Dolphin Express MXH930, MXH830, PXH830 or PXH820 adapter. Up to twelve systems can be connected to the Dolphin MXS924 switch. All nodes connect directly to the switch using up to two x4 cables (x8
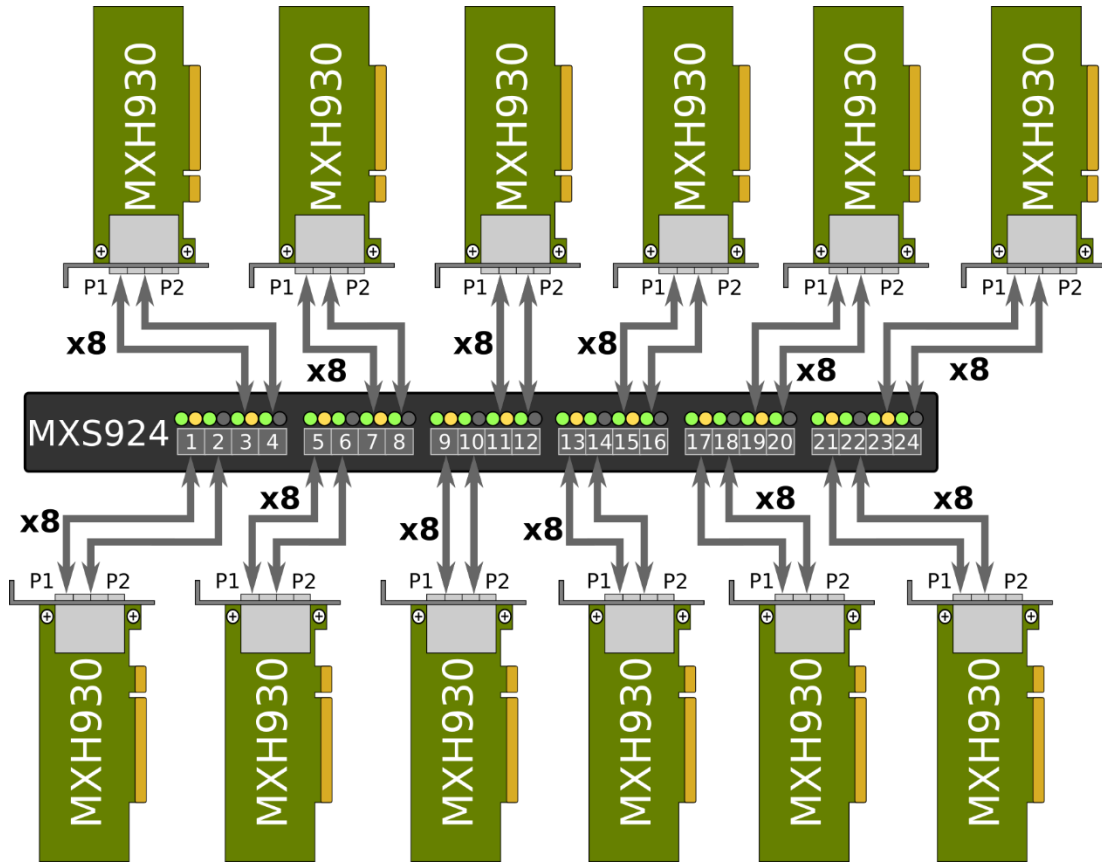
Figure 2: 12 Node PCIe x8 Cluster

24 node PCIe 4.0 x4 NTB Cluster

Each node has a Dolphin Express MXH930, MXH914, MXH830, PXH830 or PXH820 adapter. Up to twenty-four systems can be connected to the Dolphin MXS924 switch. All nodes connect directly to the switch using a single x4 cables (x4 link).

Larger NTB Cluster configurations

The MXS924 can be used to create clusters up to 60 nodes. Please contact Dolphin for details and availability.

Transparent PCIe IO expansion – Multiple expansion chassis connected to one server

The MXS924 can be used for regular Transparent PCIe IO expansion. A MXH932 adapter card in host transparent mode is connected to the switch upstream port (port P1, P2, P3 and P4 for a full x16). The MXH932 Transparent target adapters or other compliant transparent devices are connected to the other downstream ports. Figure 3: Transparent PCIe IO Expansion below shows tree expansion chassis and one JBOF connected to a single host using two MXS924 switches. The IO devices can be connected using x16, x8 or x4 links depending on the required scale out and performance requirements.
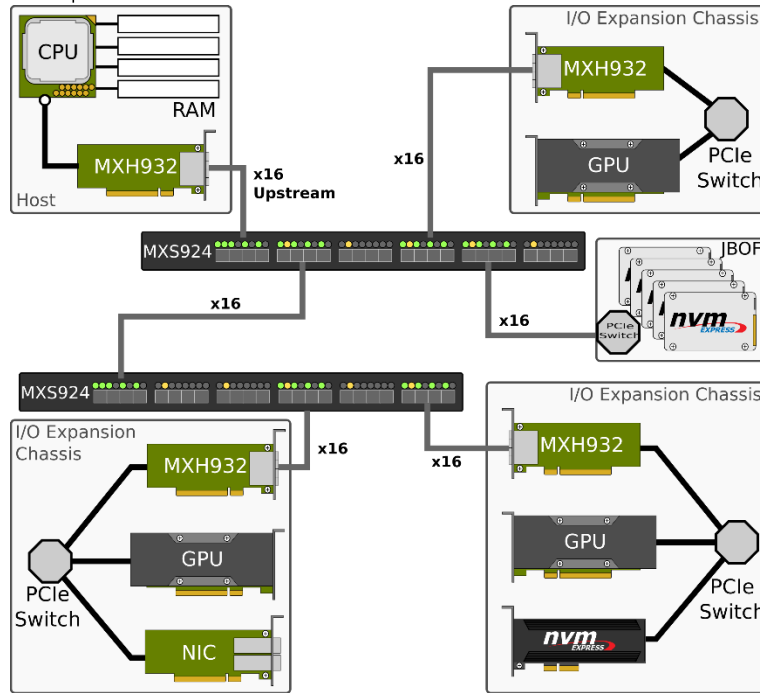
Figure 3: Transparent PCIe IO Expansion Example

Please note that the MXS924 Switch shipping default is NTB x16. To enable the switch to be used for standard transparent

IO Expansion, please log into the Web GUI and select the desired Transparent configuration. Please consult the chapter "Configuring the MXS924 switch" on page 17 for more details.

The supported configurations are found in Table 1 : Supported Transparent Configurations on page 11.

No special device driver is required for the transparent adapter card or the MXS924 switch.

Any device in the PCI Express IO system will operate using its standard device driver.

NOTE: Please note that large scale PCIe IO expansion may be limited by your BIOS. Please consult your system vendor before buying the system.

Supported Transparent Configurations

Management version 1.6.0 supports the configurations found in Table 1 : Supported Transparent Configurations below. Please note that the Host uplink always is x16.

Table 1 : Supported Transparent Configurations

Configuration Name	PCIe Configurations	Chassis ports
Transparent x16	One x16 upstream port	P1-P4
	Five x16 downstream ports	P5-P8 / P9-P12 / P13-P16 / P17-P20 / P21-24
Transparent x8	One x16 upstream port	P1-P4
	Ten x8 downstream ports	P5-P6 / P7-P8 / P9-P10 / P11-P12 / P13-P14 / P15-P16 / P17-P18 / P19-P20 / P21-P22 / P23-24
Transparent x4	One x16 upstream port	P1-P4
	Twenty x4 downstream ports	P5 / P6 / P7 / P8 / P9 / P10 / P11 / P12 / P13 / P14 / P15 / P16 / P17 / P18 / P19 / P20 / P21 / P22 / P23 / P24

The switch supports automatic PCIe down training to a lower speed and narrower link on each individual link.

If you would like to mix PCIe x4, x8 and x16 links, you need to configure the switch for the widest use case and connect a reduced number of cables for devices that only need x8 or x4 connectivity.

Support for custom configuration files is available to OEMs. Please contact Dolphin for more information.

Cables

The MXS924 switch supports SFF-8644 cables. The maximum cable distance will depend on the actual cable quality, the device at the other end of the cable, and the cable link speed (Gen1, Gen2, Gen3 or Gen4). Cables compliant to the PCI-SIG External Cabling Specification 4.0 (PCIe 4.0 cables) are recommended for transparent use.

Speed and medium, card	Max cable length
PCIe 4.0: MXH930, MXH932	Copper: 2 meters Fiber: 100 meters
PCIe 3.0: PXH830, PXH832	Copper: 2 meters (longer being qualified) Fiber: 100 meters

Management processor

The actual configuration of the switch is controlled by the onboard firmware loaded from onboard FLASH memory and will be enabled immediately after power is applied to the switch. The built-in management processor has no active role in normal operations except for firmware updates, switch configuration and monitoring.

Use cases summary and settings

The table below gives an overview of the default configuration settings and limitations.

Use Case	Description	Cable Hot Plug	Power Sequence Requirements	Software/ Driver
Transparent	Transparent – Dolphin adapter card connects to downstream PCIe devices or PCIe expansion systems through the MXS924 switch	Not supported by legacy device drivers	IO system and MXS924 must power on before PC	No driver required for host card or MXS924 switch. Legacy drivers for IO Devices
NTB	NTB configuration. All connected hosts have Dolphin adapter card	Fully supported	No limitations	Dolphin SISCI, SuperSockets, TCP/IP, SmartIO

Table 3: Switch use cases

LEDs

The switch has several LEDs on the connector side to signal various operating modes and status.

MXS924 Switch Status LEDs

The MXS924 has two LEDs next to the RJ45 Ethernet connector.

Marking	Description
PWR	Dark: Power off or failure. Green: Power on.
ST	Dark: Normal Blinking: Firmware upgrade in progress

Table 2 MXS924 Switch status LED overview

Port and Link status LEDs

The switch has 24 x4 PCI Express ports organized in six quad port blocks. Depending on the software configuration of the switch each x4 port can be combined with its neighboring ports to form either a x8 or a x16 port within the same quad port block

Each of the 24 PCI Express ports has two bi-color LEDs status visible through the cabinet. The LEDs are located just above the connector for each port. The Link status LED provides information on the current PCIe link status. The Port status LED provides information on the configuration. The table below provides a summary of the LED behavior. Refer to the sections below for more information on each LED.

Mark	Function	Dark	Yellow	Green
L	Link status	Cable not connected	Cable connected locally	PCIe Link up and running
S	Port status		Port starts here	Indicates upstream port capabilities

Table 2: Link LED overview

Port status LEDs

The port status LED is used to indicate port width and if it's upstream or downstream.

Each port status LED lit denotes the start of a port. The other ports part of this aggregated port will be dark.

If the switch is configured as a 24 * x4 switch every port status LED will light up:

If the switch is configured as 12 * x8 every second port status LED will be on:

| L 1 S | L 2 S | L 3 S | L 4 S | L 5 S | L 6 S | L 7 S | L 8 S | L 9 S | L10S | L11S | L12S | L13S | L14S | L15S | L16S | L17S | L18S | L19S | L20S | L21S | L22S | L23S | L24S |

And if it's configured as 6 * x16 every fourth status LED will be on:

| L 1 S | L 2 S | L 3 S | L 4 S | L 5 S | L 6 S | L 7 S | L 8 S | L 9 S | L10S | L11S | L12S | L13S | L14S | L15S | L16S | L17S | L18S | L19S | L20S | L21S | L22S | L23S | L24S |

It is also possible to have more complex configurations. Let's say 2 * x16 + 8 * x8:

| L 1 S | L 2 S | L 3 S | L 4 S | L 5 S | L 6 S | L 7 S | L 8 S | L 9 S | L10S | L11S | L12S | L13S | L14S | L15S | L16S | L17S | L18S | L19S | L20S | L21S | L22S | L23S | L24S |

In the examples above the port status LED color is orange which denotes that it is a NTB port or a downstream transparent port. If the LED is green, it indicates that the port is a transparent upstream port.

When the cables are connected, and you have a valid link the port status LED will in both cases turn yellow.

Link status LEDs
Each port has also a separate link status LED. It reflects the cable and link status:

- it will remain dark if no valid cable has been detected in the port
- it will light up orange if the cable is inserted and ok, but there is no valid link established.
- it will be green if the cable is ok, and the link is valid.

USB Port
The switch has a USB port for firmware updates. Do not try to utilize the USB port unless instructed by Dolphin support.

SD Card Port
The switch is delivered with a SD Card. Do not remove the SD-Card unless instructed by Dolphin support. A missing SD-Card will prevent you from utilizing the management processor services but will not affect the basic PCIe switching capabilities.

Installation

Safety instructions

Always use caution when working with computers, IO Devices and electrical components.

High *voltages are present inside the MXS924 cabinet that may cause severe harm to your body if opened. Never open the switch cabinet, no user serviceable parts are available inside the cabinet. Opening the cabinet will void your warranty.*

Static electricity from your clothes or work environment can damage your PCI Express adapter card or your PC. Always wear a grounded antistatic wrist strap while opening the PC and when Dolphin PCI Express adapter is removed from the anti-static bag. The MXS924 switch requires no special anti-static protection and should be handled in line with other electronic equipment.

Special National notes:

Norway: "Apparatet må tilkoples jordet stikkontakt"

Sweden: "Apparaten skall anslutas till jordat uttag"

Finland: "Laite on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan"

Installing the Switch in a rack

The MXS924 shipping box includes rack mount ears that can be used to fix the MXS924 into a 19-inch standard rack. The rack mount ears can be mounted on the front or rear of the switch depending on user requirements.

Airflow

The MXS924 contains 4 independent fans creating an airflow through the switch to cool internals. The airflow is in through the front panel and out through the cable connector side.

Switch desktop use

Rubber feet are included and should be applied beneath the switch to avoid scratches in desktop use.

Ethernet

The MXS924 switch supports Ethernet management and monitoring. Please connect an Ethernet cable from the switch RJ45 plug to a 1Gb/100Mb Ethernet network. The switch supports both static and DHCP configurations. The switch defaults to static IP address, the MAC address is available next to the Ethernet port.

NOTE: The MXS924 management Ethernet interface is configured with an 192.168.1.210 IP-address with a 255.255.255.0 netmask and allows for HTTP/HTTPS web access. The default username and password can be found in the "Getting started document" included with each switch package.

Installing and removing PCIe cables

The MXS924 supports approved PCI Express x4 SFF-8644 or PCIe 3.0 / PCIe 4.0 cables. Installing and removing cables should be done with both upstream and downstream device powered off. The Dolphin SuperSockets, TCP/IP drivers and SISCI fully supports hot plugging (*Note: installation and removal of cables while the system is running*). Standard PCI Express cables are not designed for a high number of installation and removals; the gold applied to the connector head may wear out and cause loss of communication. Please contact your Dolphin representative if you intend to continuously connect and disconnect the PCI Express cables.

1, 2, or 4 cables can be used to create a x4, x8 or x16 connection to other compliant devices. If more than one cable is used to create a wide link, the first cable must be connected to a width aligned port number.

Connecting a cable

Please carefully install the PCI Express cable connector into the connector housing on the adapter card or MXS924 Switch box. Computer cables should always use strain relief to protect the connected equipment from excessive force via the cable. This is especially important for cables between racks.

Disconnecting a cable

Carefully pull the thumb tab in the direction of the cable to release the cable from the connector house and eject the cable.

MXS924 operating modes

The Dolphin PCI Express MXS924 switch has two main operational modes: *Transparent* and *Non-Transparent Bridge* (NTB) mode. The switch operating mode is controlled by the MXS924 switch management software. The shipping default configuration is support for 6 ports x16 NTB mode. Please consult the chapter Configuring the MXS924 switch on page 17 for more details.

Transparent mode port usage

In standard transparent mode, Ports P1, P2, P3 and P4 are always configured as a x16 upstream port. Port P1 should always be used. If you want to create a x8 link, you should use port 1 & 2. To create a x16 link, you shold use port P1, P2, P3 and P4. All other ports are configured as downstream ports. Separate configuration settings exists for creating 10 x8 or 20 x4 transparent downstream ports.

NTB mode port usage

Any port can be used in any order for all NTB configurations. If more than one cable is used to create a wide link, the first cable must be connected to a width aligned port number. Separate configuration settings exists and must be enabled for twelve x8 mode or 24 x4 mode. The six x16 mode is the shipping default.

Dolphins eXpressWare software and adapter cards will auto detect ports and automatically connect at the highest speed possible. Customers writing their own low-level drivers need to contact Dolphin for further technical information.

Cascading switches

The MXS924 supports cascading multiple switches into larger PCI Express networks. Please consult the Management Firmware release note and eXpressWare release note for supported configurations and limitations.
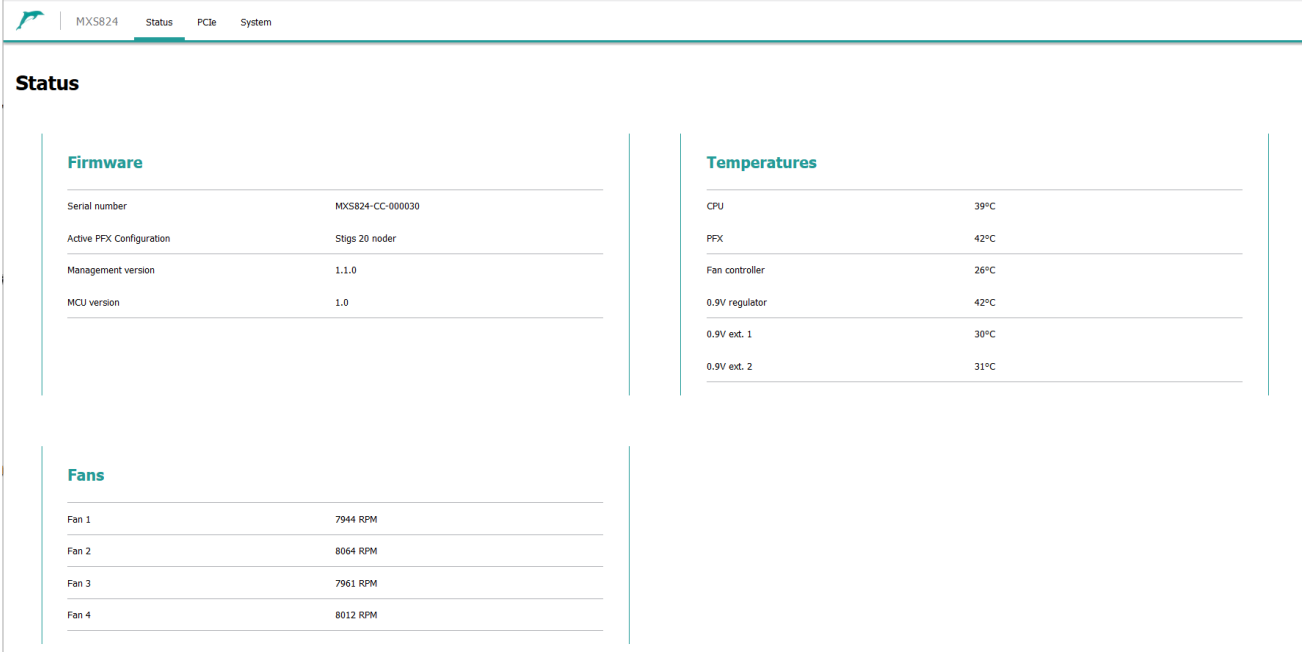
Configuring the MXS924 switch

The MXS924 shipping default configuration is NTB six nodes x16. You need to follow the description below to enable other NTB configurations or PCIe transparent IO configurations.

The MXS924 comes with a Web GUI for monitoring temperature, fan speed, port monitoring and switch configuration management. This documentation covers the 1.6.0 version of the Management firmware.

The GUI currently consist of three sections, all easily accessible by the top menu or by scrolling down the page.

Status section

The status section provides real-time data from the firmware, fans and temperature sensors. Please note that there are 4 fans connected to the switch. The four should be close to 8000 RPM when the switch operates at normal room temperatures.

New switches are delivered with the standard NTB 6 port x16 link width configuration active unless you have a specialized order with a different configuration pre-programmed. The switch' active configuration is shown under «Firmware» below the «Status» section of the Web GUI as highlighted in the picture above.

PCIe Configuration section

The PCIe Configuration section enables the user to change the active configuration, upload new Dolphin provided configurations, erase uploaded configurations and to perform a reset of the PFX switch.

Unless otherwise specified, the switch is delivered with a standard set of configurations for NTB and Transparent operation. The available selections will appear in the menu.

Change configuration

This section allows you to change the active configuration of the PCIe switch. The section works like a filter for the available configurations.

Start by selecting a «Group» (Standard, Custom, …), then «Type» (NTB, Transparent, Uploaded, …), and eventually the configuration. You can then press [Change configuration] where you will be met with a warning message; « Changing the config will reset the PCIe switch, halting all traffic, and should not be done in a production environment. You must NOT turn off the switch or leave this page during the burn operation. Are you sure you want to continue?». Pressing [OK] initiates an erase, write and verification step, all with individual progress bars.

Upload configuration

Additional configurations and special customizations may be provided by Dolphin.

Upload Configuration

Upload a new configuration. This will be added to the «Custom» configuration group. Select a file first and we'll try to guess the following fields.

File*   [Browse...] No file selected.

Type

Topology

Name*

Version

Ports

Speed

Width

Description

[Upload]

Press the [Browse] button to locate the binary on your disk and press the [Upload] button to perform the upload. You will be provided with the new file name on successful upload, which will afterwards be present under the «Custom» group and «Uploaded» type in the «Change» field set.

Uploading and applying configurations not provided or approved by Dolphin may break your hardware and will void your warranty.

Delete configuration group
The «Delete» field set enable the user to clean up the list of uploaded configurations by deleting the entire «Custom» group if present. This will only erase the available configurations on the switch and will not affect the PCIe switch and its active configuration.

Reset switch
Press the «Reset Switch» to initiate a hardware reset of the PCIe switch chip. You will be prompted for confirmation.

Firmware section

The Firmware section is currently reserved for firmware upgrades containing only an «Upgrade» fieldset. Dolphin's MXS924 switch is pre-configured during manufacturing and a firmware upgrade is normally not required for default operations. Please contact Dolphin support before trying to upgrade any firmware. Warranty is void if unauthorized firmware upgrades are attempted.

Software installation, PXH830, PXH820

No special software is required for the switch, but Dolphin Express PXH adapters need to install eXpressWare 5.20.0 or newer software releases to enable seamless integration with the MXS924 switch. More information on installing Dolphins SuperSockets, SISCI or TCP/IP driver software can be found at https://www.dolphinics.com/px

Software installation, MXH930, MXH830

No special software is required for the switch, but Dolphin Express MXH adapters need to install eXpressWare 5.20.0 or newer software releases to enable seamless integration with the MXS924 switch. More information on installing Dolphins SuperSockets, SISCI or TCP/IP driver software can be found at https://www.dolphinics.com/mx

Support

More information about the product, support and software download can be found at http://www.dolphinics.com.

For general support questions, please contact Dolphin via the Jira Service Management portal: https://www.dolphinics.com/csp.

Compliance

EMC compliance

The Dolphin PCI Express MXS924 has been tested to comply with the following relevant test standards
for PCI Express equipment, Telecommunication, and Industry equipment:

- EN 55032:2015 + A11:2020
- EN 55035:2017
- EN 61000-3-2:2014
- EN 61000-3-3:2013
- CISPR 32:2012 First Edition
- CISPR 35:2012 Edition 1.0 (CISPR/I/412/CDV)
- 47 CFR Part 15. Subpart B (Clause 15.107 and 15.109) in conjunction with
  ANSI C63.4:2014

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

FCC Class A

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

Safety compliance

The MXS924 PCI Express switch has been tested to comply with the following safety standards:

- EN 62368-1:2014 + A11:2017

A CB test certificate is available upon request.

RoHS compliance

The Dolphin MXS924 is RoHS compliant. A compliance certificate issued by the Manufacturer is
available upon request.

Flammability standard

The Dolphin MXS924 PWB is UL94V-0 compliant. The board has the 94V-0 mark in its silk screen.

WEEE Notice

The MXS924 switch is labelled in accordance with European Directive 2002/96/EC concerning waste
electrical and electronic equipment (WEEE). The Directive determines the framework for the return
and recycling of used appliances as applicable throughout the European Union. This label is applied to
products to indicate that the product is not to be thrown away but returned to your local approved WEEE waste
collector.

Limited warranty

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

Warranty Period

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

Coverage

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

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

Service Procedure

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

Limitations

TO THE FULLEST EXTENT PERMITTED BY LAW, DOLPHIN WILL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOST PROFITS, LOST DATA, OR LOSS OF USE) ARISING OUT OF ANY USE OF DOLPHIN PRODUCTS, SOFTWARE OR SERVICE PROVIDED. DOLPHINS MAXIMUM LIABILITY WILL NOT EXCEED THE TOTAL AMOUNT PAID FOR THE PRODUCT BY PURCHASER.