

# » User Guide «

## **XMC401**

### **Dual SFP+ 10 Gigabit Ethernet XMC Module**

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## Revision History

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This product has been manufactured to satisfy environmental protection requirements where possible. Many of the components used (structural parts, printed circuit boards, connectors, batteries, etc.) are capable of being recycled.

Final disposition of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.



## Explanation of Symbols



### ***Caution, Electric Shock!***

This symbol and title warn of hazards due to electrical shocks (> 60V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

Please refer also to the section “High Voltage Safety Instructions” on the following page.



### ***Warning, ESD Sensitive Device!***

This symbol and title inform that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Please read also the section “Special Handling and Unpacking Instructions” on the following page.



### ***Warning!***

This symbol and title emphasize points which, if not fully understood and taken into consideration by the reader, may endanger your health and/or result in damage to your material.



### ***Note ...***

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.





## For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

### High Voltage Safety Instructions



#### **Warning!**

All operations on this device must be carried out by sufficiently skilled personnel only.



#### **Caution, Electric Shock!**

Before installing a not hot-swappable Kontron product into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks.

Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.

### Special Handling and Unpacking Instructions



#### **ESD Sensitive Device!**

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the board.



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## General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the device, which are not explicitly approved by Kontron and described in this manual or received from Kontron's Technical Support as a special handling instruction, will void your warranty.

This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board, please re-pack it as nearly as possible in the manner in which it was delivered.

Special care is necessary when handling or unpacking the product. Please consult the special handling and unpacking instruction on the previous page of this manual.



## Two Year Warranty

Kontron grants the original purchaser of Kontron's products a **TWO YEAR LIMITED HARDWARE WARRANTY** as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of Kontron are valid unless the consumer has the express written consent of Kontron.

Kontron warrants their own products, excluding software, to be free from manufacturing and material defects for a period of 24 consecutive months from the date of purchase. This warranty is not transferable nor extendible to cover any other users or long-term storage of the product. It does not cover products which have been modified, altered or repaired by any other party than Kontron or their authorized agents. Furthermore, any product which has been, or is suspected of being damaged as a result of negligence, improper use, incorrect handling, servicing or maintenance, or which has been damaged as a result of excessive current/voltage or temperature, or which has had its serial number(s), any other markings or parts thereof altered, defaced or removed will also be excluded from this warranty.

If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation (see our safety instructions).

Kontron provides for repair or replacement of any part, assembly or sub-assembly at their own discretion, or to refund the original cost of purchase, if appropriate. In the event of repair, refunding or replacement of any part, the ownership of the removed or replaced parts reverts to Kontron, and the remaining part of the original guarantee, or any new guarantee to cover the repaired or replaced items, will be transferred to cover the new or repaired items. Any extensions to the original guarantee are considered gestures of goodwill, and will be defined in the "Repair Report" issued by Kontron with the repaired or replaced item.

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*Chapter*

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**1**

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# Introduction

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# 1. Introduction

## 1.1 Board Overview

The XMC401 Dual SFP+ 10 Gigabit Ethernet module is an XMC mezzanine card designed for use with compliant carrier boards or CPU boards which support XMC modules with PCI Express 2.0 interconnection. The XMC401 incorporates a very flexible design which allows simple and easy integration of 10 Gigabit Ethernet functionality to any compliant system.

The XMC401 provides wire-speed, dual-port 10 Gigabit Ethernet throughput and is equipped with one dual-channel, 10 Gigabit Ethernet controller (Intel® 82599) and two SFP+ cages on the front panel for connection to SFP+ direct attach copper cables or SFP+ optical transceivers.

Carrier interfacing is provided by one XMC connector supporting PCI Express 2.0 (5 GT/s) with x8 lanes.

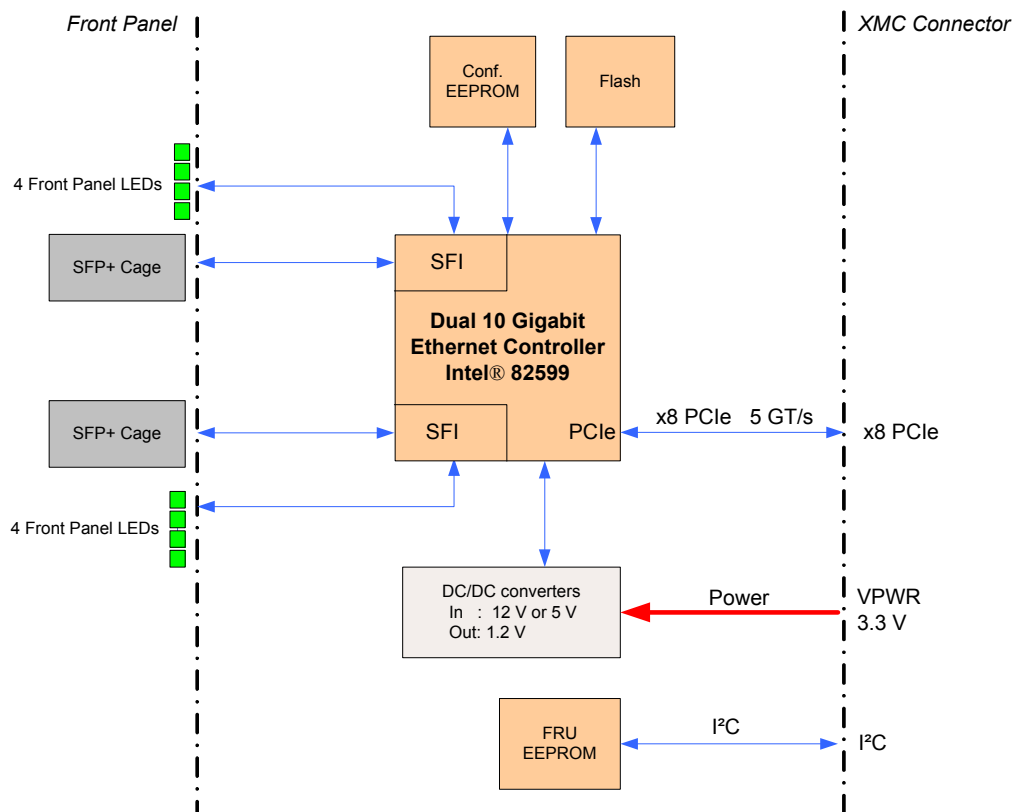
The XMC401 is supplied with two SFP+ cages as receptacles for direct attach copper cables or SFP+ optic transceivers. SFP+ direct attach copper cables or SFP+ optical transceivers are no part of this product.

## 1.2 Board Diagrams

The following diagrams provide additional information concerning board functionality and component layout.

### 1.2.1 Functional Block Diagram

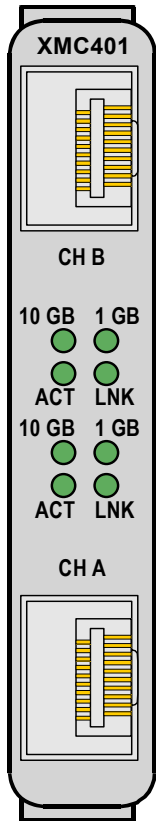
Figure 1-1: XMC401 Functional Block Diagram





### 1.2.2 Front Panel

Figure 1-2: XMC401 Front Panel



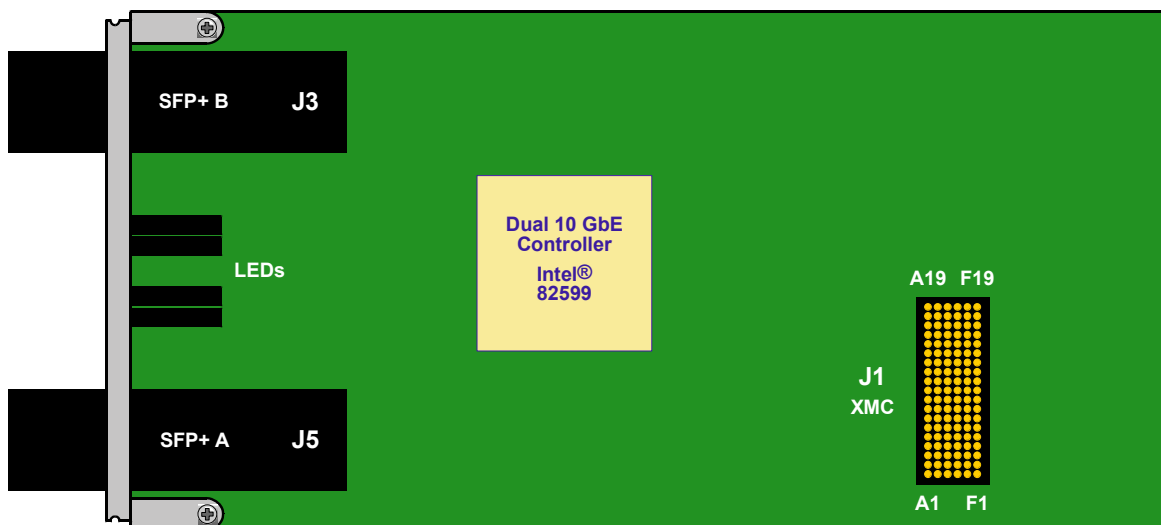
**LEGEND:**

**Ethernet Status LEDs:**

- ACT (green): Ethernet Activity
- LNK (green): Ethernet Link
- 10 GB (green): Ethernet Speed 10 Gigabit
- 1 GB (green): Ethernet Speed 1 Gigabit

### 1.2.3 Board Layout

Figure 1-3: XMC401 Board Layout (Top View)







### 1.3 Technical Specification

Table 1-1: XMC401 Main Specifications

XMC401		SPECIFICATIONS
Controller	Intel® 82599	Intel® 82599 10 Gigabit Ethernet controller with PCI Express 2.0 interface and two SFP+ ports
Memory	Configuration EEPROM	128 kbit EEPROM for Ethernet controller configuration
	Flash	8 Mbit of Flash memory for boot ROM
	FRU EEPROM	2 kbit EEPROM for storing IPMI serial EEPROM FRU data
Connectors	SFP+	Two front panel SFP+ cages for connection to SFP+ direct attach copper cables or SFP+ optical transceiver
	XMC	One onboard XMC connector supporting PCI Express 2.0 (5 GT/s) with x8 lanes for connection to a carrier board
LEDs	Ethernet Status LEDs	Four Ethernet Status LEDs per SFP+ port: <ul style="list-style-type: none"> <li>• ACT (green): Ethernet Activity</li> <li>• LNK (green): Ethernet Link</li> <li>• 10 GB (green): Ethernet Speed 10 Gigabit</li> <li>• 1 GB (green): Ethernet Speed 1 Gigabit</li> </ul>
Software	Operating Systems	There are various operating systems available for the XMC401. For information relating to the supported operating systems and the NetBoot feature, please refer to the Kontron web site or contact Kontron.
General	Mechanical	XMC-compliant form factor
	Power Consumption	See Chapter 5 for details.
	Temperature Range	Operational: 0°C to +55°C Storage: -55°C to +85°C
	Recommended Airflow	Volumetric Flow Rate: > 20 m³/h  Sufficient airflow must be provided to ensure optimal operation and long-term reliability of the XMC401. For further information, refer to the carrier's user guide.
	Climatic Humidity	93% RH at 40°C, non-condensing (acc. to IEC 60068-2-78)
	Dimensions	74 mm x 149 mm single-height XMC card
	Board Weight	90 grams

## 1.4 Standards

This product complies with the requirements of the following standards:

**Table 1-2: Standards**

TYPE	ASPECT	STANDARD	REMARKS
CE	Emission	EN55022 EN61000-6-3	
	Immission	EN55024 EN61000-6-2	
	Electrical Safety	EN60950-1	
Mechanical	Mechanical Dimensions	IEEE 1101.10	
Environmental	Vibration (Sinusoidal)	IEC60068-2-6	Test parameters: <ul style="list-style-type: none"> <li>• 10-300 (Hz) frequency range</li> <li>• 2 (g) acceleration</li> <li>• 1 (oct/min) sweep rate</li> <li>• 10 cycles/axis</li> <li>• 3 axis</li> </ul>
	Permanent Shock	IEC60068-2-29	Test parameters: <ul style="list-style-type: none"> <li>• 15 (g) acceleration</li> <li>• 11 (ms) pulse duration</li> <li>• 500 bumps per direction</li> <li>• 6 directions</li> <li>• 1 (s) recovery time</li> </ul>
	Single Shock	IEC60068-2-27	Test parameters: <ul style="list-style-type: none"> <li>• 30 (g) acceleration</li> <li>• 9 (ms) pulse duration</li> <li>• 3 shocks per direction</li> <li>• 6 directions</li> <li>• 5 (s) recovery time</li> </ul>
	Climatic Humidity	IEC60068-2-78	<b>see note below</b>
	WEEE	Directive 2002/96/EC	Waste electrical and electronic equipment
	RoHS	Directive 2002/95/EC	Restriction of the use of certain hazardous substances in electrical and electronic equipment



### Note ...

Kontron performs comprehensive environmental testing of its products in accordance with applicable standards.

Customers desiring to perform further environmental testing of Kontron products must contact Kontron for assistance prior to performing any such testing. This is necessary, as it is possible that environmental testing can be destructive when not performed in accordance with the applicable specifications.

In particular, for example, boards **without conformal coating** must not be exposed to a change of temperature exceeding 1K/minute, averaged over a period of not more than five minutes. Otherwise, condensation may cause irreversible damage, especially when the board is powered up again.

Kontron does not accept any responsibility for damage to products resulting from destructive environmental testing.



## 1.5 Related Publications

The following publications contain information relating to this product.

**Table 1-3: Related Publications**

PRODUCT	PUBLICATION
XMC	IEEE 1386-2001, IEEE Standard for a Common Mezzanine Card (CMC) Family ANSI/VITA 42.0-200x XMC Switched Mezzanine Card Auxiliary Standard ANSI/VITA 42.3-2006 XMC PCI Express Protocol Layer Standard
SFP+	SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module SFP+ Revision 4.1, 6th July 2009
All Kontron products	Product Safety and Implementation Guide, ID 1021-9142



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*Chapter* **2**

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# Functional Description

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## 2. Functional Description

### 2.1 10 Gigabit Ethernet Controller

The XMC401 provides one dual-channel 10 Gigabit Ethernet controller (Intel® 82599) optimized to deliver high performance with the lowest power consumption including independent transmit and receive queues as well as a PCI Express 2.0 (5 GT/s) interface that maximizes the use of bursts for efficient bus usage.

Some of the Intel® 82599 controller's main features are:

- PCI Express 2.0 (5 GT/s)
- MSI-X support, minimizes the overhead of interrupts
- Virtual Machine Device queues<sup>1</sup> (VMDq)
- Dual configurable FIFO buffers for each port; 160 kB Transmit (Tx) and 512 kB Receive (Rx)
- Support 15.5 kB (Jumbo Frames) in basic mode and 9.5 kB packets when DCB or Virtualization is enabled
- 10 Gigabit MAC Advanced Features Auto-Negotiation support as defined in IEEE 802.3ap clause 73
- iSCSI Boot and Acceleration

### 2.2 Memory

#### 2.2.1 Configuration EEPROM

The configuration EEPROM is a 128 kbit EEPROM for storing board control relevant information for the operation of the 10 Gigabit Ethernet controller.

#### 2.2.2 Flash

The XMC401 has 8 Mbit Flash memory for additional data storage. This memory is controlled by the 10 Gigabit Ethernet device but is accessible from a host CPU. As such this memory can be used for a variety of functionalities including the ability to boot a host CPU or System Master from LAN or configure iSCSI.

#### 2.2.3 FRU EEPROM

The FRU EEPROM is a 2 kbit EEPROM for storing IPMI Serial EEPROM FRU information.



## 2.3 Board Interfaces

### 2.3.1 SFP+ Interfaces

The XMC401 provides two 10 Gigabit Ethernet ports implemented via two SFP+ cages on the front panel with support for SFP+ direct attach copper cables or SFP+ optical transceivers. The SFP+ uplink ports are compliant with the SFF-8431 Specifications for Enhanced Small Form Factor Pluggable Module SFP+.

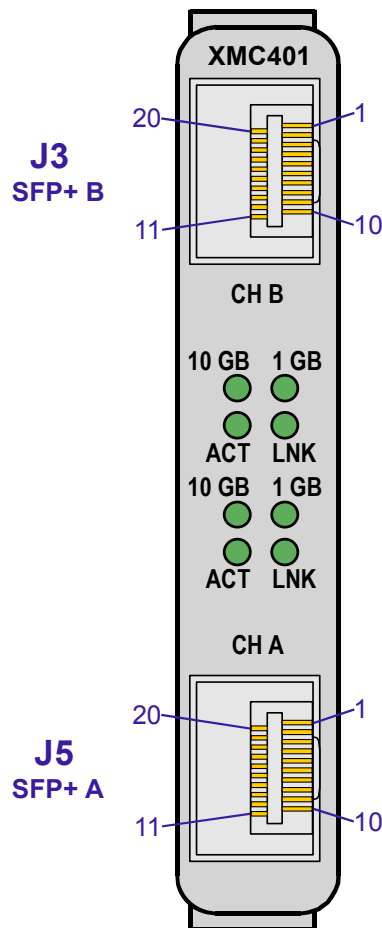


**Note ...**

If an SFP+ direct attach copper cable is connected to the XMC401, only the 10 Gigabit Ethernet speed is supported on the respective SFP+ cage.

Furthermore, eight LEDs are provided on the front panel to indicate the Ethernet status of the XMC401.

**Figure 2-1: SFP+ Cages J3 and J5**







**Table 2-1: SFP+ Cages J3 and J5 Pinout**

I/O	FUNCTION	SIGNAL	PIN		SIGNAL	FUNCTION	I/O
--	Transmitter Ground	VeeT	20	1	VeeT	Transmitter Ground	--
O	Transmitter Inverted Data Input	TD-	19	2	Tx_Fault	Transmitter Fault Indication	I
O	Transmitter Non-Inverted Data Input	TD+	18	3	Tx_Disable	Transmitter Disable	O
--	Transmitter Ground	VeeT	17	4	SDA	2-wire Serial Interface Data Line	I/O
--	Transmitter Power	VccT	16	5	SCL	2-wire Serial Interface Clock	O
--	Receiver Power	VccR	15	6	Mod_ABS	Module Absent	I/O
--	Receiver Ground	VeeR	14	7	RSO	Select between full or reduced receiver bandwidth	O
I	Receiver Non-Inverted Data Output	RD+	13	8	Rx_LOS	Receiver Loss of Signal	I
I	Receiver Inverted Data Output	RD-	12	9	RSI	Receiver Ground	--
--	Receiver Ground	VeeR	11	10	VeeR	Receiver Ground	--

The transfer rate of the SFP+ interfaces can be configured via the RSO signal (pin 7) and the RSI signal (pin 9) as indicated in the following table:

**Table 2-2: RSO and RSI Rate Select Configuration**

PARAMETER	STATE	CONDITIONS
RSO	Low	Rx signaling rate less than or equal to 4.25 GBd
	High	Rx signaling rate greater than 4.25 GBd
RSI	Low	Tx signaling rate less than or equal to 4.25 GBd
	High	Tx signaling rate greater than 4.25 GBd

**Table 2-3: Ethernet Status LEDs Function**

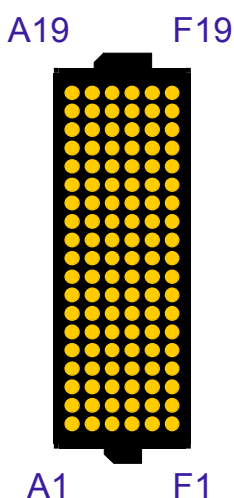
ETHERNET STATUS LED	COLOR	FUNCTION
ACT	green	ON = Ethernet activity to the SFP+ device OFF = No Ethernet activity to the SFP+ device
LNK	green	ON = Ethernet link to the SFP+ device OFF = No Ethernet link to the SFP+ device
10 GB	green	ON = 10 Gigabit Ethernet speed OFF = No Ethernet connection
1 GB	green	ON = 1 Gigabit Ethernet speed OFF = No Ethernet connection



## 2.3.2 XMC Interface

The XMC401 module is equipped with one onboard XMC connector, J1, for connection to the carrier board. The XMC connector provides the high-speed signals for a x8 PCI Express 2.0 (5 GT/s) interface.

**Figure 2-2: XMC Con. J1**      **Table 2-4: XMC Connector J1 Pinout**



PIN	ROW A	ROW B	ROW C	ROW D	ROW E	ROW F
1	PET0p0	PET0n0	3.3V	PET0p1	PET0n1	VPWR
2	GND	GND	NC (TRST#)	GND	GND	MRSTI#
3	PET0p2	PET0n2	3.3V	PET0p3	PET0n3	VPWR
4	GND	GND	NC (TCK)	GND	GND	NC (MRSTO#)
5	PET0p4	PET0n4	3.3V	PET0p5	PET0n5	VPWR
6	GND	GND	NC (TMS)	GND	GND	+12V
7	PET0p6	PET0n6	3.3V	PET0p7	PET0n7	VPWR
8	GND	GND	NC (TDI)	GND	GND	NC (-12V)
9	NC (RFU)	NC (RFU)	NC (RFU)	NC (RFU)	NC (RFU)	VPWR
10	GND	GND	TDO (NC)	GND	GND	GA0
11	PER0p0	PER0n0	NC (MBIST#)	PER0p1	PER0n1	VPWR
12	GND	GND	GA1	GND	GND	GND (MPRESENT#)
13	PER0p2	PER0n2	3.3V AUX	PER0p3	PER0n3	VPWR
14	GND	GND	GA2	GND	GND	MSDA
15	PER0p4	PER0n4	NC (RFU)	PER0p5	PER0n5	VPWR
16	GND	GND	MVMRO	GND	GND	MSCL
17	PER0p6	PER0n6	NC (RFU)	PER0p7	PER0n7	NC (RFU)
18	GND	GND	NC (RFU)	GND	GND	NC (RFU)
19	CLK+0	CLK-0	NC (RFU)	NC (WAKE#)	NC (ROOT0#)	NC (RFU)

**Legend:**

- PER0p/n[0..7]    Differential Receive  
These signals are used by the XMC401 to receive data from the carrier over the PCI Express interface.
- PET0p/n[0..7]    Differential Transmit  
These signals are used by the XMC401 to transmit data to the carrier over the PCI Express interface.
- CLK+/-0            Differential reference clock for Link 0 PCI Express interface
- VPWR                Power pins  
These signals carry either 12 V or 5 V power from the carrier to the XMC401.
- RFU                  Reserved for future use



*Chapter* **3**

# Installation



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## 3. Installation

The XMC401 has been designed for easy installation. However, the following standard precautions, installation procedures, and general information must be observed to ensure proper installation and to preclude damage to the board, other system components, or injury to personnel.

### 3.1 Hardware Installation

The product described in this manual can be installed in any available carrier acting as a PCI Express root complex and compliant with the XMC PCI Express Protocol Layer Standard (ANSI/VITA 42.3-2006).



#### **Note ...**

If the carrier operates as system controller, a BIOS update may be required to ensure proper operation of the XMC401. For further information, please contact Kontron.

#### 3.1.1 Safety Requirements

The board must be securely fastened to the carrier using appropriate retaining screws and stand-offs to ensure proper grounding and avoid loosening caused by vibration or shock.

In addition, the following safety precautions must be observed when installing or operating the XMC401. Kontron assumes no responsibility for any damage resulting from failure to comply with these requirements.



#### **Caution, Electric Shock Hazard!**

Ensure that the system main power is removed prior to installing or removing this board. Ensure that there are no other external voltages or signals being applied to this board or other boards within the system. Failure to comply with the above could endanger your life or health and may cause damage to this board or other system components including process-side signal conditioning equipment.



#### **ESD Equipment!**

This Kontron board contains electrostatically sensitive devices. Please observe the following precautions to avoid damage to your board:

- Discharge your clothing before touching the assembly. Tools must be discharged before use.
- Do not touch components, connector-pins or traces.
- If working at an anti-static workbench with professional discharging equipment, please do not omit to use it.



#### **Warning!**

The XMC401 has SFP+ cages with EMC shielding which can be damaged by improper handling during installation or removal. **DO NOT USE ANY FORCE** when (de-)mating the XMC401 bezel and the front panel. It can happen that the shielding tabs snag on the carrier board and get damaged if force is applied!



### 3.1.2 Installation Procedures

To install the board proceed as follows:

1. Ensure that the safety requirements indicated above are observed.



**Warning!**

Failure to comply with the instruction below may cause damage to the board or result in improper system operation.

2. Ensure that the SFP+ direct attach copper cables and SFP+ optical transceivers are properly configured for operation before installing.



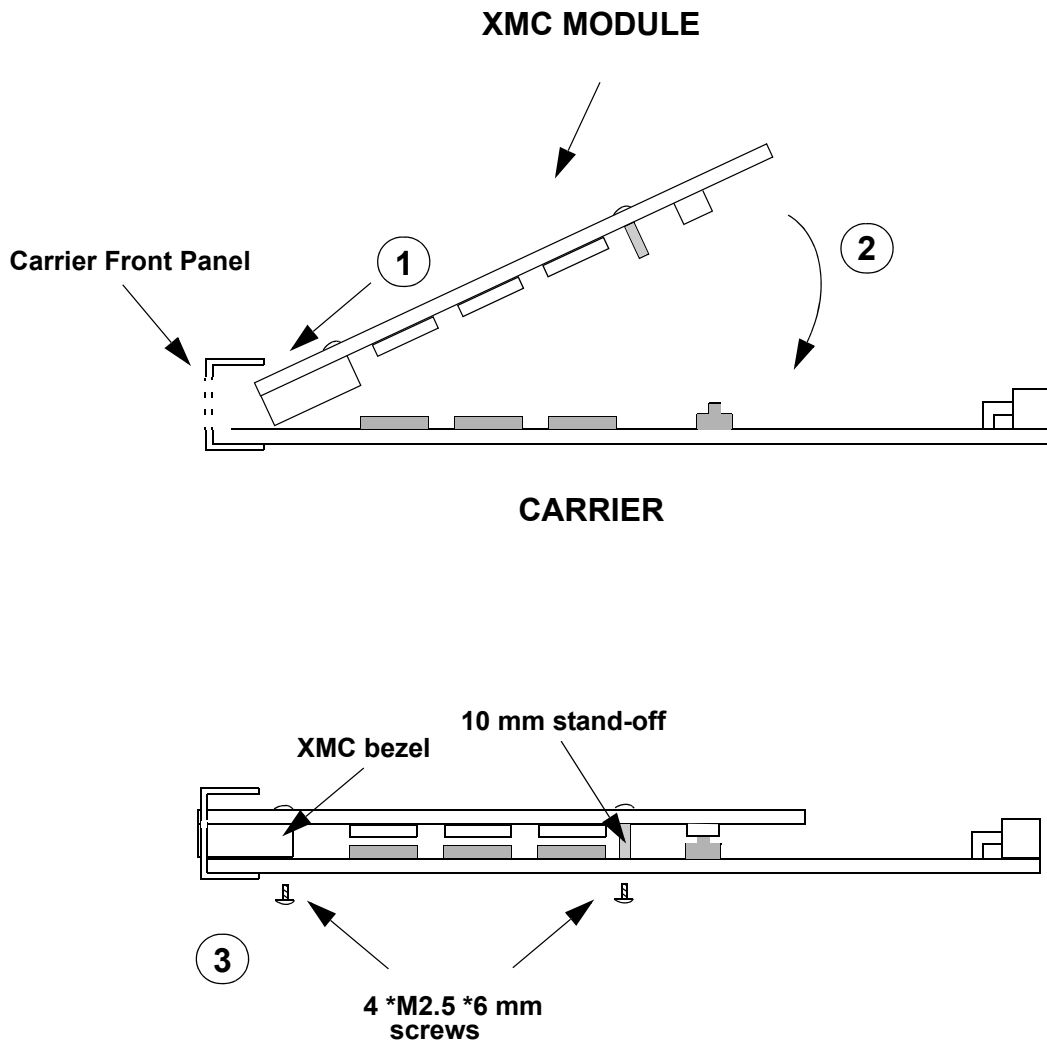
**Warning!**

Care must be taken when applying the procedures below to ensure that neither the XMC401 nor the carrier board is physically damaged by the application of these procedures.

3. To install the XMC401 perform the following referring to Figure 3-1 as required:
  1. Obtain carrier board and ensure that it satisfies application requirements and will allow for proper installation of the XMC401: e.g. connectors match, front panel cutout matches, holes for mounting screws are available and match, stand-offs can be properly installed, except for prescribed contact points no other contact between carrier and XMC401 after mating occurs, etc.
  2. Carefully insert the XMC401 into the front panel cutout of the carrier board ensuring that the EMC gasket is properly seated on the carrier's front panel.
  3. Ensuring that the XMC Connector J1 is properly aligned with the XMC connector of the carrier board, press the XMC401 and carrier board together so that their connectors are completely engaged.
  4. Install the four XMC401 retaining screws ensuring that the XMC401 is properly mated to the carrier board: e.g. XMC bezel flush with front panel, no misalignment of connectors, no contact between carrier and XMC401 except as prescribed, etc.
4. For installation of the carrier board with the XMC401 mounted in a system refer to the installation procedures for the carrier board.



Figure 3-1: XMC401 Installation / Removal Diagrams





### 3.1.3 Removal Procedures

To remove the XMC401 from the carrier board proceed as follows:

1. Ensure that the safety requirements indicated above are observed.



#### **Warning!**

Care must be taken when applying the procedures below to ensure that neither the XMC401 nor the carrier board is physically damaged by the application of these procedures.

2. If applicable, remove the carrier board from system using carrier board removal procedures.
3. To remove the XMC401 perform the following referring to Figure 3-1 as required:
  1. Obtain carrier board.
  2. Remove the four XMC401 retaining screws.
  3. Carefully disengage the XMC Connector J1 and the XMC connector on the carrier board so that no force or movement is applied to the XMC401 bezel.
  4. Ensure that the XMC401 bezel is not jammed or hung up on the carrier board. If necessary, partially disassemble the carrier board front panel to free the XMC401 bezel.
  5. Slide the XMC401 away from the front panel.
  6. Dispose of the XMC401 as required.
4. Dispose of the carrier board as required.

## 3.2 Installation/Removal of SFP+ Devices

The following precautions must be observed before installing or removing SFP+ devices to ensure proper installation/removal and preclude damage to the XMC401 or the SFP+ devices.



#### **Warning!**

The SFP+ cages provide EMC shielding which can be damaged by improper handling during installation or removal of SFP+ direct attach copper cables or SFP+ optical transceivers.

**DO NOT USE ANY FORCE** when installing or removing the SFP+ direct attach copper cables or the SFP+ optical transceivers.

Before removing the SFP+ device from the SFP+ cage, slightly lift the retaining clip on the SFP+ cage. Removing the SFP+ device without releasing the retention clip may result in damage to the SFP+ device or the XMC401.

For further information regarding the installation and removal of the SFP+ devices, refer to the manufacturer's instructions provided with the SFP+ device itself.

The following figures provide further information about the orientation of the SFP+ devices before installation and their connection to the XMC401.





Figure 3-2: SFP+ Optical Transceiver and SFP+ Direct Attach Copper Cable

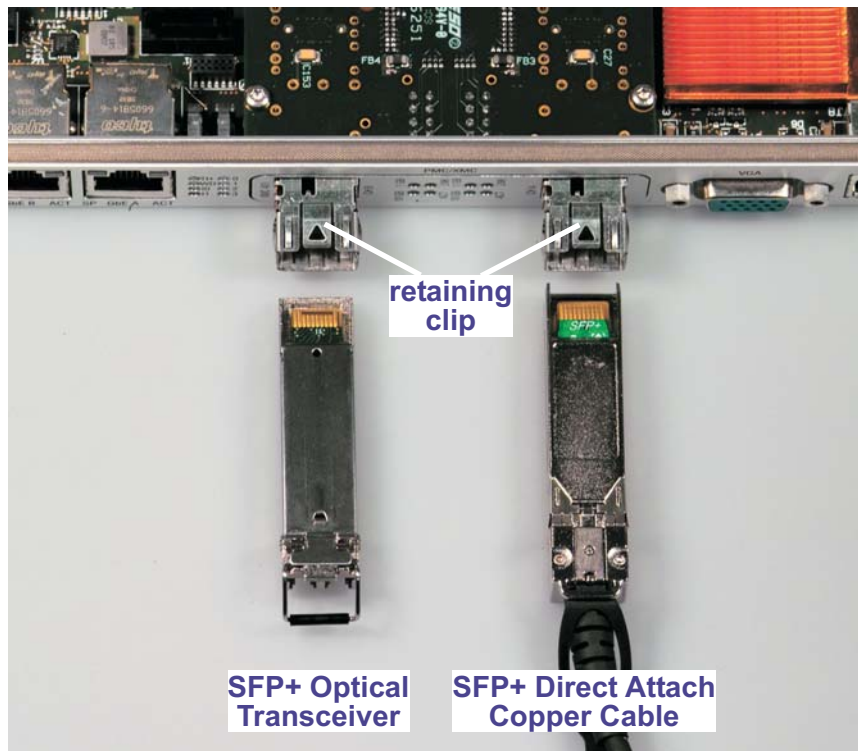
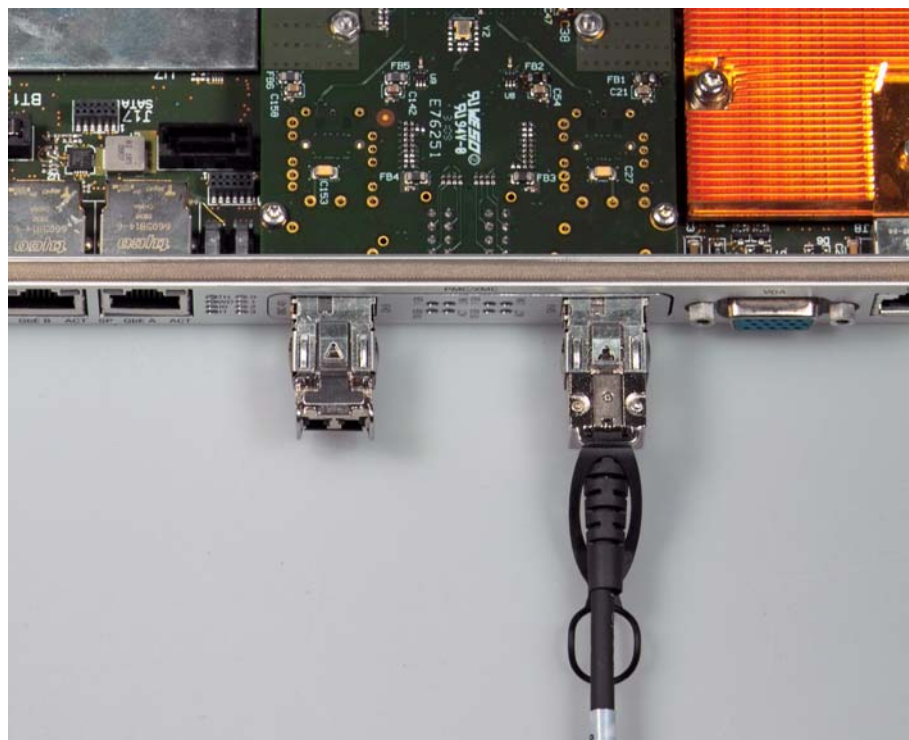


Figure 3-3: SFP+ Devices Connected to the XMC401





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*Chapter*

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**4**

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# Configuration

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## 4. Configuration

The XMC401 is designed for plug and play operation, and, as such, it does not have any user configurable board settings which are required for operation.

For application usage of onboard functionality refer to the appropriate software documentation.



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*Chapter*

**5**

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# Power Considerations

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## 5. Power Considerations

The considerations presented in the ensuing chapters must be taken into account by system integrators when specifying the XMC401 system environment.

### 5.1 Carrier Power Supply

Carrier power supplies for the XMC401 must be specified with enough reserve for the remaining system consumption. In order to guarantee a stable functionality of the system, it is recommended to provide more power than the system requires.

As the design of the XMC401 has been optimized for minimal power consumption, the carrier power supply unit must be stable even without minimum load.

#### 5.1.1 Start-Up Requirement

Carrier power supplies must comply with the following guidelines, in order to be used with the XMC401.

- Beginning at 10% of the nominal output voltage, the voltage must rise within  $> 0.1$  ms to  $< 20$  ms to the specified regulation range of the voltage. Typically:  $> 5$  ms to  $< 15$  ms.
- There must be a smooth and continuous ramp of each DC output voltage from 10% to 90% of the regulation band.
- The slope of the turn-on waveform shall be a positive, almost linear voltage increase and have a value from 0 V to nominal  $V_{out}$ .

#### 5.1.2 Power-Up Sequence

The VPWR (+5 or +12 V) output level must always be equal to or higher than the +3.3 VDC output during power-up and normal operation.

Both voltages must reach their minimum in-regulation level not later than 20 ms after the output power ramp start.

#### 5.1.3 Tolerance

The tolerance of the voltage lines is described in the XMC specification. The recommended measurement point for the voltage is the XMC connector on the carrier board.

The following table provides information regarding the required characteristics for each board input voltage.

**Table 5-1: Input Voltage Characteristics**

VOLTAGE	NOMINAL VALUE	OPERATING RANGE	REMARKS
VPWR	+5 V	+4.75 V to +5.2 V ( $\pm 5\%$ )	Main voltage
	+12 V	+11.4 V to +12.6 V ( $\pm 5\%$ )	Main voltage
+3.3 V	+3.3 V	+3 V to +3.6 V	Main voltage
+3.3 V AUX	+3.3 V	+3 V to +3.6 V	Not required
+12 V	+12 V	+11.4 V to +12.6 V ( $\pm 5\%$ )	Optional
-12 V	-12 V	-11.4 V to -12.6 V ( $\pm 5\%$ )	Not required
GND	Ground		



#### 5.1.4 Regulation

The carrier power supply shall be unconditionally stable under line, load, unload and transient load conditions including capacitive loads. The operation of the carrier power supply must be consistent even without the minimum load on all output lines.



##### **Warning!**

All of the input voltages must be functionally coupled to each other so that if one input voltage fails, all other input voltages must be regulated proportionately to the failed voltage. For example, if the VPWR begins to decrease, all other input voltages must decrease accordingly. This is required in order to preclude cross currents within the XMC401.

Failure to comply with above may result in damage to the board or improper system operation.



##### **Note ...**

If the main power input is switched off, the supply voltages will not go to 0V instantly. It will take a couple of seconds until the capacitors are discharged. If the voltage rises again before it has gone below a certain level, the circuits may enter a latch-up state where even a hard RESET will not help any more. The system must be switched off for at least 3 seconds before it may be switched on again. If problems still occur, turn off the main power for 30 seconds before turning it on again.



## 5.2 Power Consumption

The goal of this description is to provide a method to calculate the power consumption for the XMC401 module.

The power consumption table below lists the voltage and power specifications for the XMC401 module. The measurements were performed under Windows® 2003 Server at a temperature of 25°C.



### Note ...

The power consumption values indicated in the table below can vary depending on the ambient temperature or the system performance. This can result in deviations of the power consumption values of up to 10%.

The power consumption was measured using the following operating system and under the following testing conditions:

- XMC401 with Windows® 2003 Server  
These values represent the maximum power dissipation achieved during a 10 Gigabit Ethernet transfer test using two passive SFP+ direct attach copper cables.

**Table 5-2: Power Consumption: XMC401 with Windows® 2003 Server**

POWER	XMC401
12 V (if available)	0.25 W
VPWR (5 V)	4.0 W
3.3 V	0.4 W
Total	4.65 W



### Note ...

The power consumption of the XMC401 depends on the type of the SFP+ device attached. If an active SFP+ device is used, please refer to the manufacturer's specification for the respective device.



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