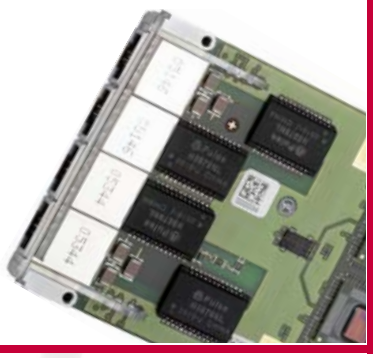
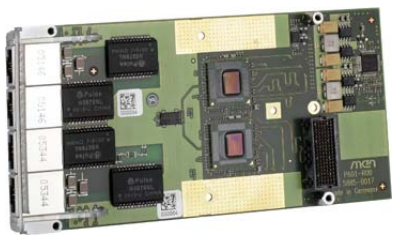
User Manual

P601 – Quad Redundant Gigabit Ethernet XMC





Configuration example

P601 – Quad Redundant Gigabit Ethernet XMC

The P601 is a Gigabit Ethernet XMC mezzanine card suitable for any XMC compliant single-board computer or host carrier board in any type of bus system, i.e. CPCI, VME or on any type of stand-alone SBC. Compared to PMC, the XMC standard defines a different board-to-board connector for support of PCI Express®.

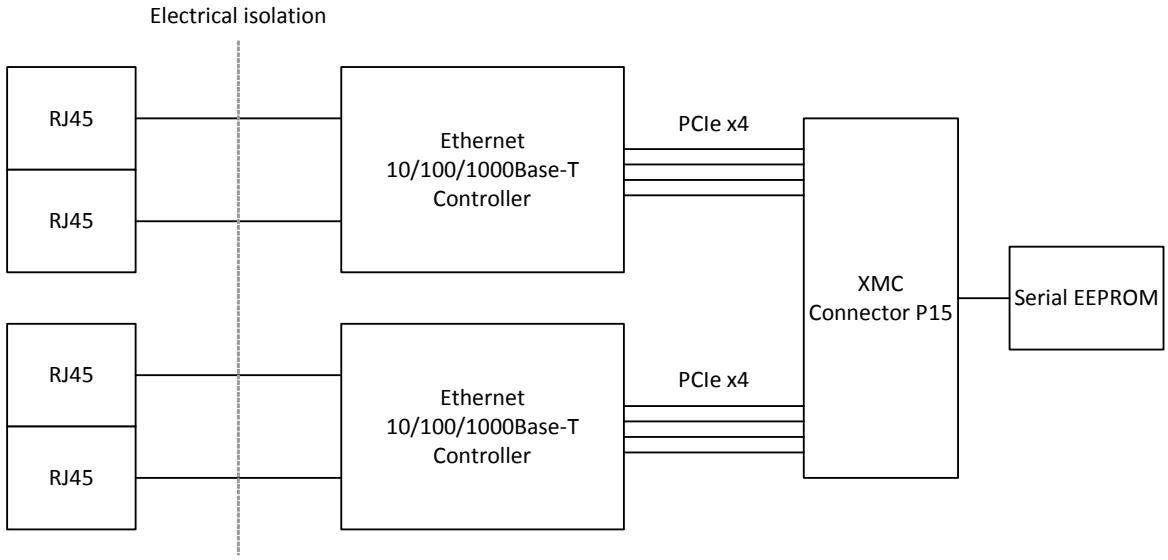
The four Ethernet channels on the P601 are provided by two Ethernet controllers with two lines each and supported by two PCIe® links with four lanes each. With a specific set-up the two lines inside each Ethernet controller can be used as a redundant channel pair. In this mode one line is monitored by the other line and the controller recognizes when an error occurs.

The mezzanine module P601 is typically suited as an extension for Windows® and Linux based systems with a heavy demand for multiple and ultra-fast communication requirements. As such it is used in high-bandwidth multi-channel communication applications in networked appliances such as base stations, routers, switches, gateways, residential gateway controllers, etc. Main target markets comprise telecom, medical engineering and transportation.

For use in rugged environments the P601 is delivered with a passive heat sink and is prepared for conformal coating.

Equipped with Intel® components that come exclusively from the Intel® Embedded Line, the P601 has a guaranteed minimum standard availability of 5 years.

Diagram


Electrical isolation
RJ45
RJ45
Ethernet
10/100/1000Base-T
Controller
PCIe x4
XMC
Connector P15
Serial EEPROM
RJ45
RJ45
Ethernet
10/100/1000Base-T
Controller
PCIe x4

Technical Data

Ethernet

- Four 10/100/1000Base-T Ethernet channels at front panel
- RJ45 connectors at front panel
- Two independent dual-port Ethernet controllers
  - Fully integrated Gigabit Ethernet Media Access Controllers (MAC) and physical layer ports (PHY)
  - 48 kB per port on-chip packet buffer
  - Full duplex and half duplex operation
- Ethernet controllers are connected by two PCIe® links with four lanes each
- Two LEDs per channel to signal LAN Link, Activity status and connection speed (10/100/1000Base-T)

XMC Characteristics

- XMC connector P15 assembled

Peripheral Connections

- Via front panel on four RJ45 connectors

PCI Express®

- Two links with four lanes each to connect local 1000Base-T Ethernet controllers (1 GB/s per channel in each direction)
- Both links on XMC connector P15

Electrical Specifications

- Isolation voltage: 1.5 kV DC electrical isolation between isolated side and digital side
- Supply voltage/power consumption:
  - +5 V or +12 V (-5%/+5%), 1.4 A typ. (+5 V), 600 mA typ. (+12 V)
  - +3.3 V (-5%/+5%), 100 mA typ.

Mechanical Specifications

- Dimensions: conforming to XMC standard VITA 42.0-200x
- Weight: 104 g (with heat sink)

Environmental Specifications

- Temperature range (operation):
  - 0..+55°C
  - Industrial temperature range on request
  - Airflow: min. 10m³/h
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to + 3000 m

- Shock: 15 g/11 ms
- Bump: 10 g/16 ms
- Vibration (sinusoidal): 2 g/10..150 Hz
- Conformal coating on request

MTBF

- 920 841h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

Software Support

- Drivers from Intel® for Windows® and Linux

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First edition	2006-04-12
E2	Pin assignment of XMC connector corrected	2008-04-09
E3	Corrected Chapter 3.1 Power Supply on page 17	2012-03-02
E4	Corrected order of Ethernet ports	2013-07-17

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This sign marks important notes or warnings concerning the use of voltages which can lead to serious damage to your health and also cause damage or destruction of the component.

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ# /IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

WEEE Application

The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

In other words: Since MEN does not deliver ready-made products to end users, the WEEE directive is not applicable for MEN. Users are nevertheless recommended to properly recycle all electronic boards which have passed their life cycle.

Nevertheless, MEN is registered as a manufacturer in Germany. The registration number can be provided on request.

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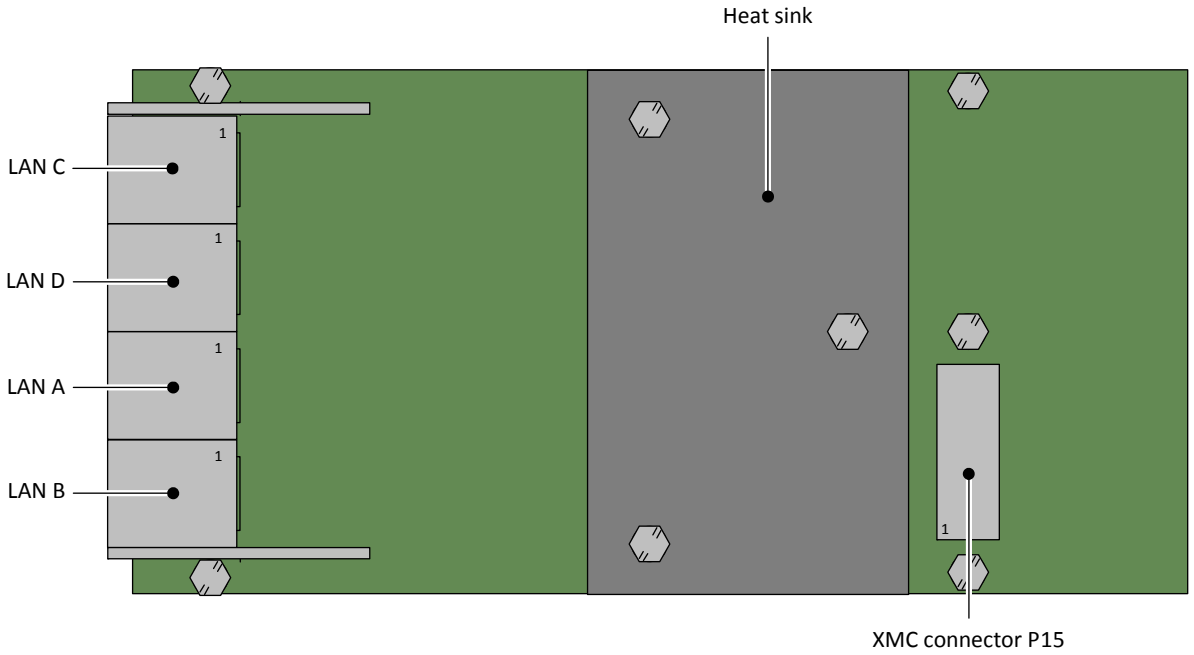
Tables

1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Figure 1. *Map of the board — top view*



1.2 Integrating the Board into a System

You can use the following "check list" to install the XMC on a carrier board for the first time and to test proper functioning of the board.

- ☑ Power-down the system and remove the XMC carrier board.
- ☑ Install the XMC in a suitable slot of the carrier board as described in the carrier board's user manual.
- ☑ Insert the carrier board into the system again.
- ☑ Power-up the system.
- ☑ If there is a system crash or other abnormal behavior at start-up, check if the XMC is plugged properly.
- ☑ You can now install driver software for the P601.

1.3 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.

You can find any driver software available for download on MEN's website.

2 Connecting the XMC

2.1 Peripheral Interfaces

You can connect peripherals via the four RJ45 Ethernet front connectors.

There are two status LEDs for each channel at the front panel which signal LAN link, activity status and connection speed. They are assigned to the four connectors in the following way.

Table 1. *Status LEDs of 8-pin RJ45 Ethernet 10/100/1000Base-T connectors (LAN_A..LAN_D)*

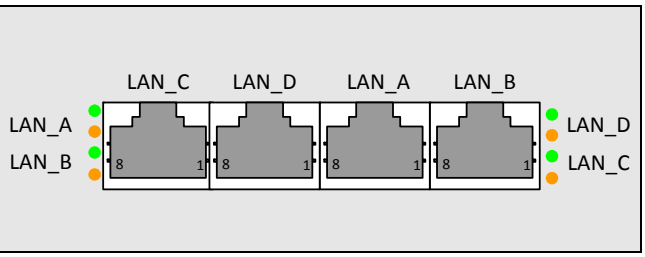
Green LED: On: Link 100 Mbits/s Off: Link with 10 Mbits/s or 1000 Mbits/s	
Orange LED: Blinks whenever there is transmit or receive activity	

Table 2. *Pin assignment of 8-pin RJ45 Ethernet 10/100/1000Base-T connectors (LAN_A..LAN_D)*

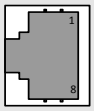
		1000Base-T	10/100Base-T
	1	BI_DA+	TX+
	2	BI_DA-	TX-
	3	BI_DB+	RX+
	4	BI_DC+	-
	5	BI_DC-	-
	6	BI_DB-	RX-
	7	BI_DD+	-
	8	BI_DD-	-

Table 3. *Signal mnemonics of Ethernet 10/100/1000Base-T connectors*

Signal	Direction	Function
BI_Dx+/-	in/out	Differential pairs of data lines for 1000Base-T
RX+/-	in	Differential pair of receive data lines for 10/100Base-T
TX+/-	out	Differential pair of transmit data lines for 10/100Base-T

Connector types:

- Modular 8/8-pin mounting jack according to FCC68
- Mating connector:
  Modular 8/8-pin plug according to FCC68

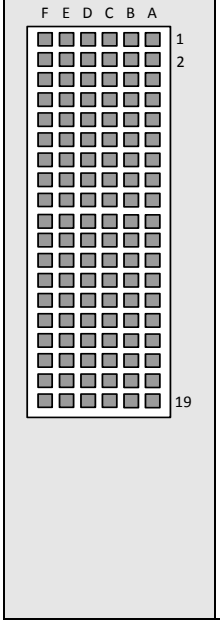
2.2 Host PCI Interface

The P601 supports two PCI Express links with four lanes each on XMC connector P15.

Note: This pin assignment is not compliant to the XMC standard VITA 42.3-200x. The standard only supports one link with up to eight lanes per XMC connector.

In the following you find the pin assignment of the 114-pin XMC plug connector P15:

Table 4. *Pin Assignment of 114-pin XMC Connector P15*



	F	E	D	C	B	A
1	VPWR	PET0n1	PET0p1	+3.3V	PET0n0	PET0p0
2	MRSTI#	GND	GND	-	GND	GND
3	VPWR	PET0n3	PET0p3	+3.3V	PET0n2	PET0p2
4	MRSTO#	GND	GND	TCK	GND	GND
5	VPWR	PET1n1	PET1p3	+3.3V	PET1n0	PET1p0
6	-	GND	GND	TMS	GND	GND
7	VPWR	PET1n3	PET1p3	+3.3V	PET1n2	PET1p2
8	-	GND	GND	TDI	GND	GND
9	VPWR	-	-	-	-	-
10	GA0	GND	GND	TDO	GND	GND
11	VPWR	PER0n1	PER0p1	-	PER0n0	PER0p0
12	MPRESENT#	GND	GND	GA1	GND	GND
13	VPWR	PER0n3	PER0p3	-	PER0n2	PER0p2
14	MSDA	GND	GND	GA2	GND	GND
15	VPWR	PER1n1	PER1p1	-	PER1n0	PER1p0
16	MSCL	GND	GND	MVMRO	GND	GND
17	-	PER1n3	PER1p3	-	PER1n2	PER1p2
18	-	GND	GND	-	GND	GND
19	-	-	WAKE0#	-	REFCLK-0	REFCLK+0

Connector:

- 114-pin XMC plug connector, e. g. SAMTEC :ASP105885-01
- Mating connector:
  114-pin XMC receptacle connector

Table 5. *Signal mnemonics of 114-pin XMC connector*

	Signal	Direction	Function
Power	VPWR	in	Variable power pins, +5V or 12V supply voltage
	+3.3V	in	+3.3V supply voltage
	GND	-	Ground
PCI Express Link 0	PER0p/n[0..3]	in	PCI Express link 0, differential receive, lanes 0..3
	PET0p/n[0..3]	out	PCI Express link 0, differential transmit, lanes 0..3
	REFCLK+/-0	in	Differential reference clock
	WAKE#	in	Reactivation of power rails and reference clocks
PCI Express Link 1	PER1p/n[0..3]	in	PCI Express link 1, differential receive, lanes 0..3
	PET1p/n[0..3]	out	PCI Express link 1, differential transmit, lanes 0..3
Other	GA[0..2]	in	I2C channel select
	MSCL	in	IPMI I2C serial clock
	MPRESENT#	out	Module present
	MRSTI#	in	XMC reset in
	MRSTO#	out	XMC reset out
	MSDA	in/out	IPMI I2C serial data
	MVMRO	in	XMC write prohibit

3 Functional Description

3.1 Power Supply

The P601 is supplied via the carrier board. There are two supply voltages needed: 3.3 V and VPWR. VPWR must be 5 V or 12 V.

The input currents at the P15 XMC connector are 1.4 A (± 10%) with VPWR at 5 V or 0.6 A (± 10%) with VPWR at 12 V. 100 mA (± 10%) are consumed at 3.3 V.

A wide range switching power supply generates the Ethernet controller supply voltages. These voltages have a value of 1.8 V with a current of 2.2 A (± 10%) and 1.1 V with a current of 2.2 A (± 10%).

3.2 Ethernet Interfaces

The P601 is equipped with two dual port gigabit Ethernet controllers and with a PCI Express interface according to the XMC standard.

3.2.1 Ethernet Controller

The P601 is equipped with the Intel 82571EB Ethernet Controller. It is a single, compact component with two fully integrated Gigabit Ethernet Media Access Controllers (MAC) and physical layer ports (PHY). The device uses the PCI Express architecture.

The Intel 82571EB provides a standard IEEE 802.3 Ethernet interface for 1000Base-T, 100Base-TX, and 10Base-T applications (802.3, 802.3u and 802.3ab).

The Gigabit Ethernet Controller with PCI Express architecture is designed for high performance and low memory latency. The device is optimized to connect to a system using four PCI express lanes (x4 PCI Express interface). Alternatively the controller can use one PCI Express lane.

Wide internal data paths eliminate performance bottlenecks by efficiently handling large address and data words.

A large 48 kB per port on-chip packet buffer maintains superior performance. In addition, using hardware acceleration, the controller offloads tasks from the host, such as TCP/UDP/IP checksum calculations and TCP segmentation.

The controller can be used in redundancy mode for high availability, reliability and safety.

In addition it provides a Serializer-Deserializer (SerDes) for optical fiber and backplane applications as well as SMB and FML management ports for support of a Board Management Controller (BMC).

3.2.2 Thermal Considerations

The P601 Ethernet controllers are equipped with an extra heat sink which is fastened on the top side with three screws.

Note: MEN gives no warranty on functionality and reliability of the P601 if you use any other heat sink than that supplied by MEN. Please contact either MEN directly or your local MEN sales office!

4 Appendix

4.1 Literature and Web Resources

- P601 data sheet with up-to-date information and documentation:
  www.men.de

4.1.1 XMC

- XMC PCI Express Protocol Layer Standard
  VITA 42.3-2006; June 2006
  VMEbus International Trade Association
  www.vita.com
- Standard for VITA 42.0 XMC
  VITA 42.0-2008; December 2008
  VMEbus International Trade Association
  www.vita.com

4.1.2 PCI Express

- PCI Special Interest Group
  www.pcisig.com

4.2 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the P601. You can find information on the article number, the board revision and the serial number on two labels attached to the board.

- **Article number:** Gives the board's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the hardware revision of the board.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 2. *Labels giving the board's article number, revision and serial number*