20G229-00 E2 • 2017-01-23

G229

Serial I/O Expansion Board

3U CompactPCI Serial

User Manual

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About this Document

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

It describes the design, functions and connection of the product. The manual does not include detailed information on individual components (data sheets etc.).

G229 product page with up-to-date information and downloads:
www.men.de/products/g229/

History

Issue	Comments	Date
E1	First issue	2016-07-22
E2	Added UART port numbers and chapters Chapter 2.4 Using the G229 under Windows on page 16, Chapter 2.5 Using the G229 under Linux on page 21	2017-01-23

Conventions

Indicates important information or warnings concerning situations which could result in personal injury, or damage or destruction of the component.

Indicates important information concerning electrostatic discharge which could result in damage or destruction of the component.

Indicates important information or warnings concerning proper functionality of the product described in this document.

The globe icon indicates a hyperlink that links directly to the Internet. When no globe icon is present, the hyperlink links to specific information within this document.

Italics	Folder, file and function names are printed in *italics*.
Mono	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 text.
IRQ# /IRQ	Signal names followed by a hashtag "#" or preceded by a forward 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 "from the board or component".

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the PCB 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.
- Only store the product in its original ESD-protected packaging. Retain the original packaging in case you need to return the product to MEN for repair.

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Since July 1, 2006 all MEN standard products comply with RoHS legislation.

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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1 Product Overview

1.1 Product Description

The MEN G229 is an I/O expansion board for CompactPCI Serial for adding often required functions to a CPU board on a single slot. It can be used, e.g., as a main boot device for a server CPU.

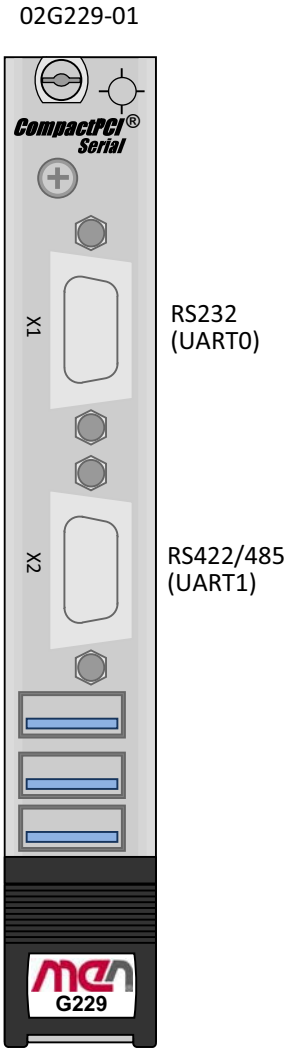
The board is designed and tested for the railway and industrial market. It provides 3 USB 3.0 ports and isolated RS232 and RS422/485 interfaces, for either service or continuous operation in a railway or industrial environment.

For data storage or as a boot medium a m.2 slot supporting NVMe is provided on the board. It provides a fast boot time as it is connected via a PCI Express x1 link.

The G229 is a low-power solution for the extended temperature range.

1.2 External Interfaces

Figure 1. Front interfaces



1.3 Board Layout

Figure 2. Board layout – top view

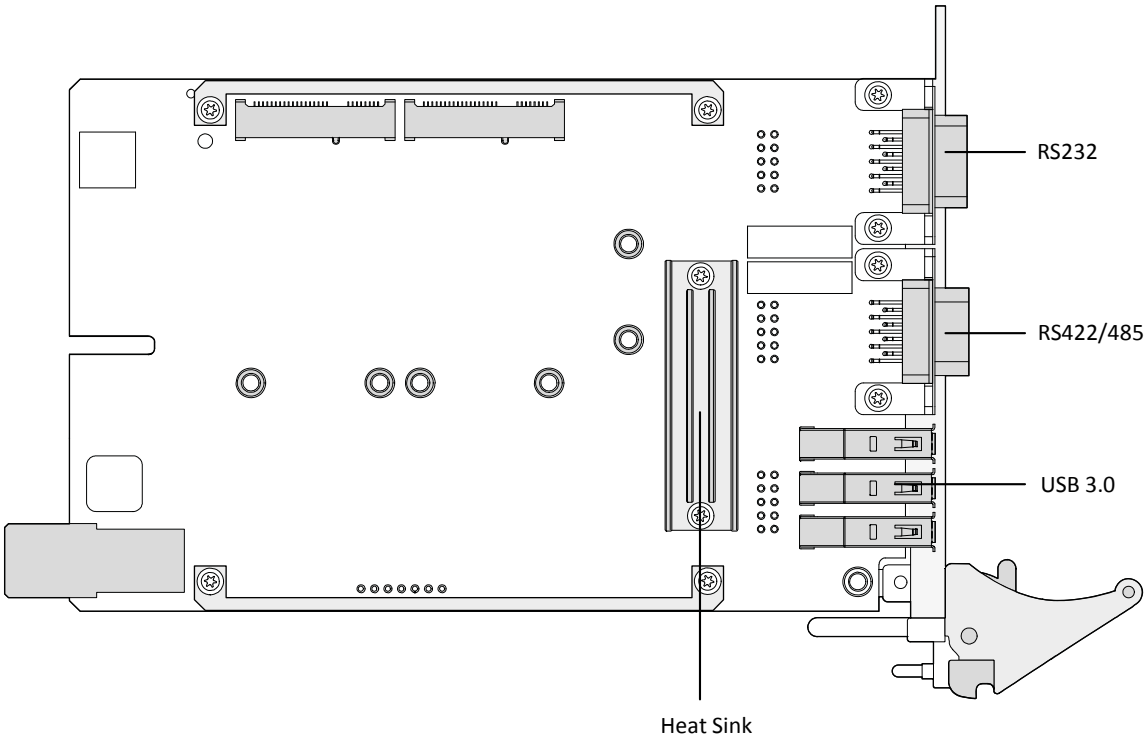
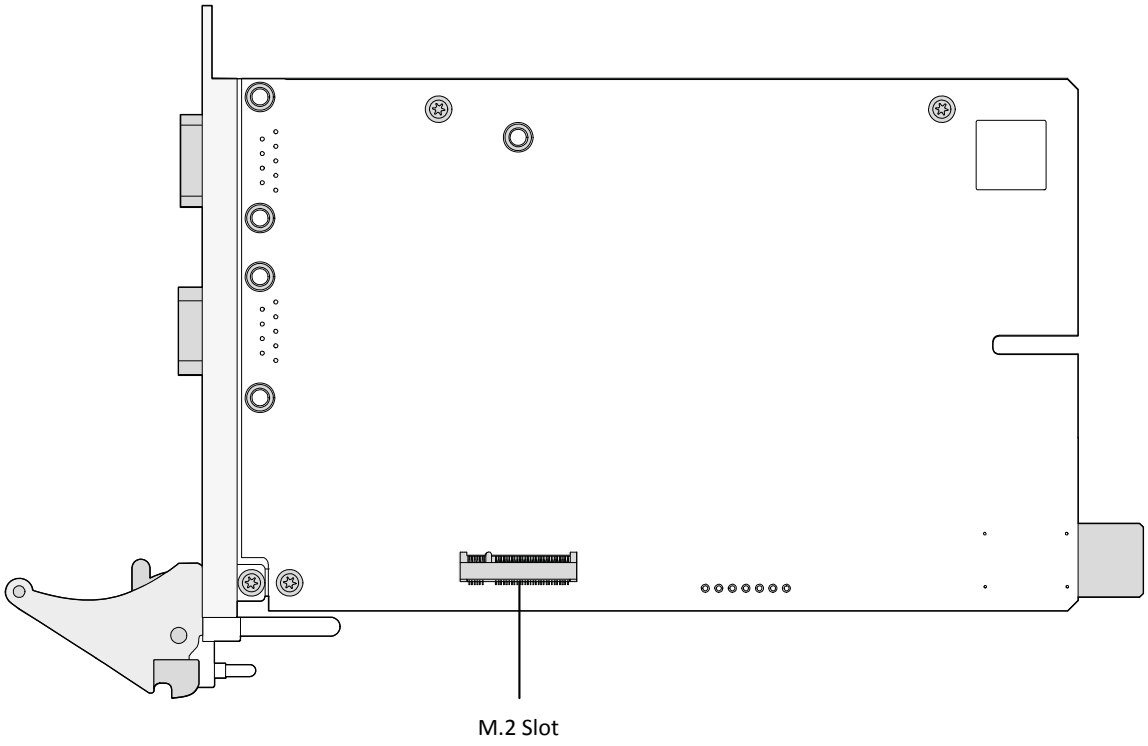
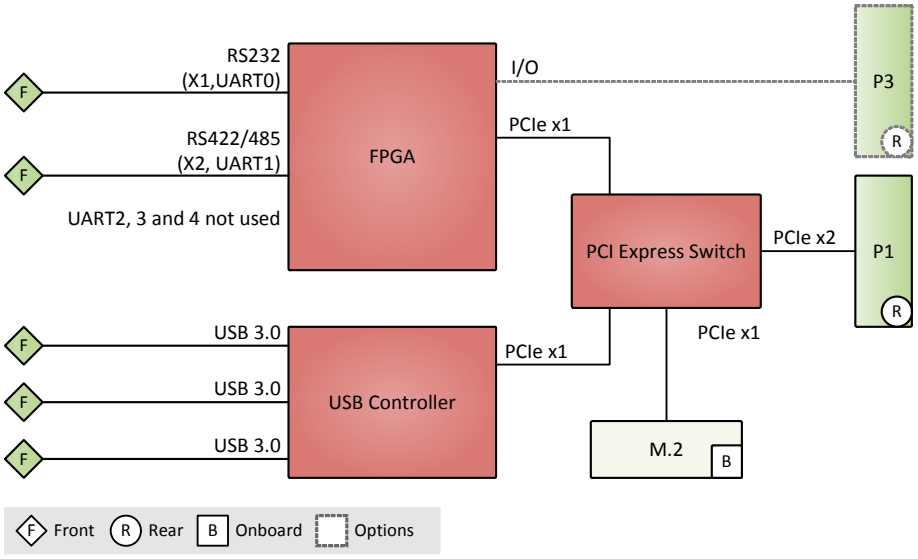


Figure 3. Board layout – bottom view



1.4 Block Diagram

Figure 4. Block diagram



1.5 Technical Data

Front Interfaces

- USB
  - Three Series A connectors, USB 3.0
- RS232
  - D-Sub connector at front panel
  - Handshake lines: RTS, CTS
- RS422/485
  - D-Sub connector at front panel
  - Full duplex

Mass Storage

- m.2 slot for NVMe

Backplane Standard

- Compliance with CompactPCI Serial PICMG CPCI-S.0 Specification
- Peripheral slot
- Host interface:
  - One PCI Express x2 link, PCIe 2.x

Electrical Specifications

- Supply voltage
  - +12 V (-5%/+5%)
- Power consumption
  - 4.91 A max.
  - 2.79 A typ.

Mechanical Specifications

- Dimensions
  - 3U, 4 HP
  - Only slim guide rails can be used in Heitec housings (included in delivery)
- Weight
  - 178 g (model 02G229-01)

Environmental Specifications

- Temperature range (operation)
  - -40°C to +70°C (screened)
  - Airflow: min. 1.5 m/s
- Temperature range (storage): -40°C to +85°C
- Cooling concept
  - Air-cooled
  - Conduction-cooled in MEN CCA frame
- Humidity: EN 60068-2-30, EN 50155
- Altitude: -300 m to +3000 m
- Shock: EN 50155
- Vibration: EN 50155

- Conformal coating

Reliability

- MTBF: 630 662 h @ 40°C according to IEC/TR 62380 (RDF 2000)

Safety

- Electrical Safety
  - EN 62368-1 (former EN 60950-1)
  - EN 50153
- Flammability
  - UL 94V-0

EMC

- EMC Radiated Emission: EN 55022, EN 50121-3-2 class B
- EMC Conducted Emission: EN 55022, EN 50121-3-2 class B
- EMC Immunity: EN 55024, EN 50121-3-2

Software Support

- Windows
- Linux

See the MEN website for supported operating system versions and drivers:
www.men.de/products/g229/#downl

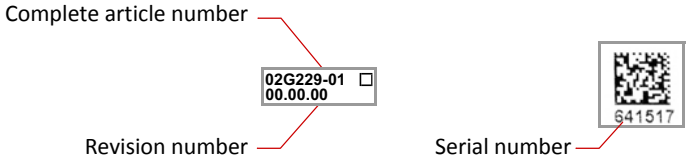
1.6 Product Identification

MEN user documentation may describe several different models and/or design revisions of the G229. You can find information on the article number, the design revision and the serial number on two labels affixed to the board.

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

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

Figure 5. Product labels



2 Getting Started

2.1 Configuring the Hardware

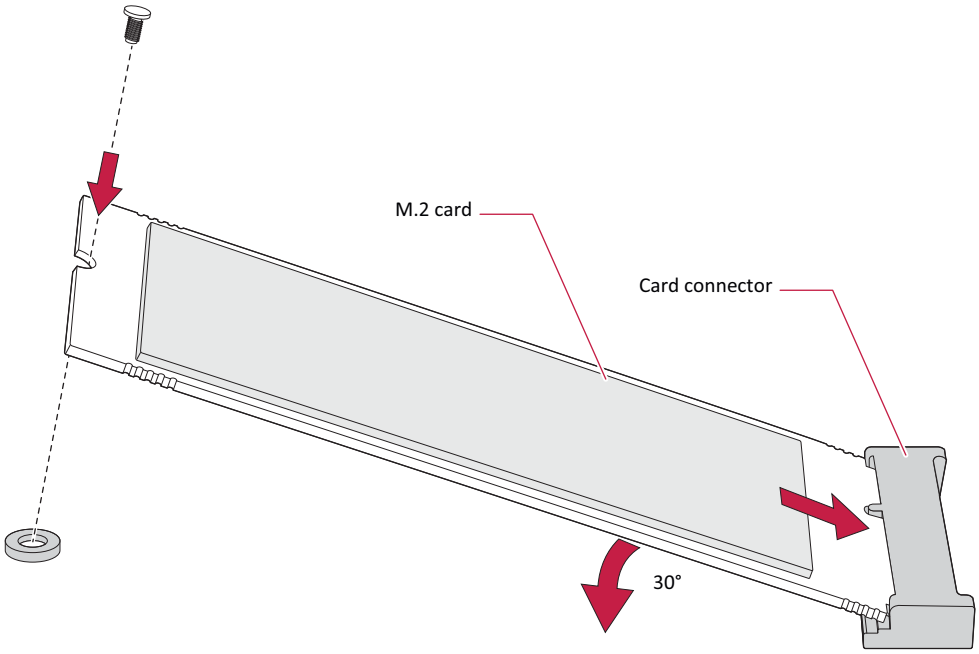
Check your hardware requirements before installing the board in a system. Modifications are difficult or impossible to do when the board is integrated in a system.

MEN offers suitable accessory articles for G229.
See the MEN website for ordering information:
www.men.de/products/g229/#ord

2.1.1 Installing an M.2 Solid State Drive

To install an M.2 solid state drive, the following steps are necessary.

- Power down your system and remove the G229 from the system.
- Put the board on a flat surface.
- Align the SSD properly at a 30° angle to the M.2 connector on the G229.



- Firmly push the M.2 SSD down while plugging it in the M.2 connector on the G229.
- Fasten the SSD to the board from the top side using a M3x4 screw.

2.2 Connecting and Starting

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

» Power down the system.

» Insert the G229 into a peripheral slot of your CompactPCI system, making sure that the backplane connectors are properly aligned.

Note: The peripheral slots of every CompactPCI Serial system are marked by a circle with a plus sign behind it on the backplane and/or at the front panel.

» Power up the system.

2.3 Installing Driver Software

For a detailed description on how to install driver software, please refer to the respective documentation of the software package to be installed.

See the MEN website for all available software:
www.men.de/products/g229/#downl

2.3.1 MDIS System Package

The G229 is supported by the MDIS framework.

MDIS stands for MEN Driver Interface System and is a framework for device drivers for almost any kind of I/O hardware. It greatly simplifies system configuration, also in combination with specialized board BSPs.

See the MEN website for more information on MDIS.

2.4 Using the G229 under Windows

This chapter describes how to use Windows software together with the G229. A detailed step-by-step description is given where needed.

2.4.1 Configuring the UART Interfaces

MEN's driver installation package (Installset) for Windows (13F215-77) allows easy configuration through the Device Manager.

To do this, open the *Properties* page of each G229 UART device via the Windows Device Manager and select the *Port Interface* tab.

See the MEN website for the Windows Installset and user manual:
www.men.de/software/13f215-77/

See the block diagram and the front panel drawing in Chapter 1 Product Overview to find out the interface names and numbers.

2.5 Using the G229 under Linux

This chapter describes how to use Linux software together with the G229. A detailed step-by-step description is given where needed.

2.5.1 Configuring the UART Interfaces

MEN provides a Linux driver that allows to configure the interface mode and baud rate.It is included in the 13MD05-90 MDIS5 system package for Linux.

See the MEN website for the MDIS system package:
www.men.de/software/13md05-90/

The *baud_base* parameter must be set to 1843200. Use the following command:

```
# modprobe men_lx_z25 baud_base=1843200
```

MEN's Linux driver supports the following values for the *mode* parameter:

se	single ended (RS232)
df_fdx	differential, full duplex (RS422)
df_hdxe	differential, half duplex, with echo (RS485)
df_hdx	differential, half duplex, no echo (RS485)

Note: You can check using *dmesg* whether all */dev/ttySx* interfaces are present.

Most Linux kernels only support 4 UARTs by default. If you need more than 4 UARTs, add parameter *8250.nr_uarts=16* to your kernel boot line in the bootloader or adjust kernel parameter *CONFIG_NR_8250_UARTS* and recompile the kernel.

See the block diagram and the front panel drawing in Chapter 1 Product Overview to find out the interface names and numbers.

3 Functional Description

3.1 Power Supply

The G229 is supplied via the backplane.

3.2 Mass Storage

3.2.1 M.2 Card Slot

The G229 is shipped without a m.2 drive installed. The slot is ready-to-use.

Supported features:

- M-coding
- 22 mm module width
- 42 mm, 60 mm or 80 mm module length.

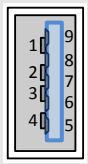
3.3 USB

3.3.1 Front Connection

Table 1. Connector types – USB 3.0

Connector	Type
On G229	9-pin USB 3.0 Standard-A receptacle according to Universal Serial Bus Specification
Mating	9-pin USB 3.0 Standard-A plug according to Universal Serial Bus Specification

Table 2. Pin assignment – USB 3.0



1	+5V	9	StdA_SSTX+
2	D-	8	StdA_SSTX-
3	D+	7	GND
4	GND	6	StdA_SSRX+
		5	StdA_SSRX-

Table 3. Signal mnemonics – USB 3.0

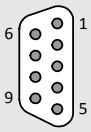
Signal	Direction	Function
+5V	out	+5 V power supply
GND	-	Digital ground
D+, D-	in/out	USB 2.0 differential pair
StdA_SSTX+, StdA_SSTX-	out	SuperSpeed transmitter differential pair
StdA_SSRX+, StdA_SSRX-	in	SuperSpeed receiver differential pair

3.4 RS232

Table 4. Connector types – 9-pin D-Sub plug

Connector	Type
On G229	9-pin D-Sub plug according to DIN41652/MIL-C-24308, with thread bolt UNC4-40
Mating	9-pin D-Sub receptacle according to DIN41652/MIL-C-24308, available for ribbon cable (insulation piercing connection), hand-soldering connection or crimp connection

Table 5. Pin assignment – RS232 (9-pin D-Sub)



1	-	6	-
2	RXD	7	RTS#
3	TXD	8	CTS#
4	-	9	-
5	GND		

Table 6. Signal mnemonics – RS232

Signal	Direction	Function
GND	-	Ground
CTS#	in	Clear to send
RTS#	out	Request to send
RXD	in	Receive data
TXD	out	Transmit data

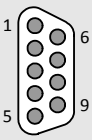
3.5 RS422/485

Table 7. Connector types – 9-pin D-Sub receptacle

Connector	Type
On G229	9-pin D-Sub receptacle according to DIN41652/MIL-C-24308, with thread bolt UNC4-40
Mating	9-pin D-Sub plug according to DIN41652/MIL-C-24308, available for ribbon cable (insulation piercing connection), hand-soldering connection or crimp connection

3.5.1 Full-Duplex Interface

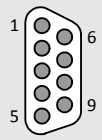
Table 8. Pin assignment – RS422/485 full duplex (9-pin D-Sub)



1	-	6	I-VCC
2	-	7	-
3	TX+	8	TX-
4	RX+	9	RX-
5	I-GND		

3.5.2 Half-Duplex Interface

Table 9. Pin assignment – RS422/485 half duplex (9-pin D-Sub)



1	-	6	I-VCC
2	-	7	-
3	RX/TX+	8	RX/TX-
4	-	9	-
5	I-GND		

Table 10. Signal mnemonics – RS422/485

Signal	Direction	Description
I-GND	-	Isolated reference potential
I-VCC	out	Isolated power supply
RX+/-	in	Receive data
TX+/-	out	Transmit data

3.6 CompactPCI Serial

Refer to the CompactPCI Serial standard PICMG CPCI-S.0 for detailed information regarding the rear I/O connectors.

- CompactPCI Serial Specification PICMG CPCI-S.0 Revision 2.0: 2015; PCI Industrial Computers Manufacturers Group (PICMG) www.picmg.org
- Introduction to CompactPCI Serial on Wikipedia: en.wikipedia.org/wiki/CompactPCI_Serial

4 Hardware/Software Interface

This chapter is intended for software developers or board integrators who need deeper knowledge of the implementation details of the G229 interfaces and its internal connections.

4.1 PCI Configuration

The G229 has the following IDs on the PCI bus:

- PCI Device ID: `0x4D45`
- PCI Vendor ID: `0x1A88`
- Subsystem Device ID: `0x5A91`
- Subsystem Vendor ID: `0x00D1`