

# **Manual**

## **Serial PCI Express Cards**



<b>Models</b>	13031 13431 13631
<b>Version</b>	1.0

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Current PC designs are favoring PCI Express over the established PCI bus system. There are still PC motherboards which provide slots for both systems, but for cost and performance reasons future designs will likely be equipped with PCI Express slots only.

W&T has in response developed a family of serial PCI Express interface cards in addition to the existing standard PCI solutions; these new additions will be described on the following pages along with their technical data and connection examples.

While PCIe solutions offer the advantage of easy installation and automatic allocation of PC resources, their drawback is that support of the cards is no longer assured by the operating system itself, but rather must be provided by driver software.

Current information on the new developments as well as the newest driver releases can be found in the Internet at <http://www.wut.de> or in the e-mail updates provided to members of the W&T Interface Club. Subscriptions to the Interface Club can requested from the W&T homepage.

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## Basics and general characteristics

### PCI Express

PCI Express is not a traditional PC bus system in which all plug-in cards are in parallel with the majority of bus lines. PCI Express is rather a star type wiring technique using a point-to-point connection between the PC and plug-in card to allow significantly greater transmission speeds than a bus solution with parallel wired slots would be able to process.

Data transmission to the plug-in cards in PCI Express is serial using differential wire pairs, so-called „lanes“, which run at a speed of 2.5 or 5 GB/s. For cards with high data throughput (graphics and network cards, hard drive controllers), multiple lanes are routed to a slot, whereas cards with less complexity get by easily with one lane.

The PCI Express standard enables solutions in which one (x1), four (x4), eight (x8) or 16 (x16) lanes are routed to a slot, with the connectors differing in the mechanical configuration, pin configuration and load capacity of the supply voltage.

The mechanical coding of cards and connectors ensures however that short cards can be easily used in long slots.

### Mechanical details

All the serial PCI Express cards described here are short plug-in cards of standard size (length of circuit board: 105 mm, height: 93 mm) with an „x1“ PCI Express connector.

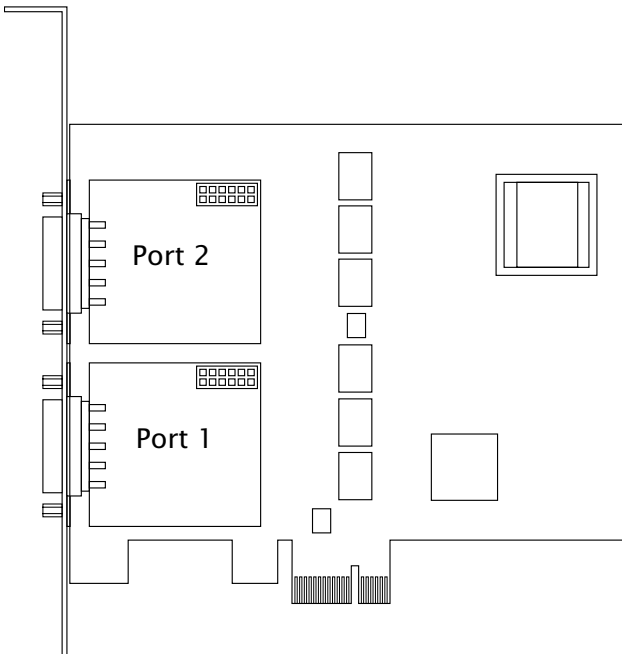
If you do not have an available x1 slot, the cards can also be used in a long „x4“, „x8“ or „x16“ slot.

**Function of W&T PCI Express cards**

All the W&T PCI Express interface cards described in this manual add two additional serial interfaces to the PC.

The integrated galvanic isolation of the interfaces from the PC and the ability to equip the serial ports on the card with various interface types makes these cards ideal in meeting the needs of industrial automation.

The arrangement of the serial ports on the card can be seen in the following diagram:



### Galvanic isolation and ESD protection

The serial ports on all W&T PCI interface cards are galvanically isolated from each other and from the PC with an isolation voltage of at least 1kV DC.

Galvanic isolation of the signals is implemented using fast opto-couplers; driver and receiver chips are powered by a galvanically isolated DC/DC converter.

The signal lines for the serial ports are protected against static discharge for a voltage of up to 15kV per IEC 801-2, Level 4.

**Important:** Please note when planning the installation that although the signal lines including signal ground do not have a galvanic connection to the PC, the shield for the interface connectors does make a direct connection to the chassis ground of the PC due to the metal slot bracket.



To prevent equalizing currents through the shield, the latter should – depending on the application – be connected either on one end only or capacitively coupled only.

**Driver and software installation**

All the serial PCI Express interface cards are accessible under the various operating systems only using special drivers.

The driver software and detailed information about installation and configuration of them under the various operating systems is found on the enclosed W&T Product CD.

The drivers are subject to continuous improvement both with respect to their technical features and the number and type of supported operating systems.

For this reason W&T makes the current drivers and software installation manuals available on the data sheet pages for the PCI cards in the Internet under <http://www.wut.de>.



## PCI Express base board for Interface-Modules, #13031

### Function

The serial W&T PCI Express base board 13011 together with W&T interface modules provides two independent serial interfaces with galvanic isolation of 1kV DC. Integration of the interface-specific components on the cards in the form of interchangeable interface modules provides for an optional mixed configuration of the cards with different interface types. This means for example you can easily implement an RS232 interface for connecting a local peripheral device and an RS485 interface for connecting a controller on a single card.

### Wiring configuration

The serial TTL interface on the base board is implemented as a 12-pin PCB connector. The connector pin assignments are shown in the following table:

pin#	signal	function
1	5V	power supply
2	RI	input
3	RxD	input
4	TxD	output
5	n.c.	n.c.
6	CTS	input
7	DTR	output
8	DSR	input
9	RTS	output
10	DCD	input
11	12V	power supply
12	GND	signal ground

Pin 1 of the connector is indicated by a rectangular soldering pad.

**Technical Data**

PCI standard:	PCI Express 1.1, x1 connector
Serial ports:	Two galvanically isolated ports with 5V CMOS level
UART:	Oxford OXPCle954 with 128 Byte FIFO
Base addresses:	automatic configuration
Interrupts:	automatic configuration
Baud rate:	50 Baud .. 3 MBaud
Data format:	any
Signals:	RxD, TxD, RTS, CTS, DSR, DTR, DCD, RI
Serial connections:	2x 12-pin. 2mm PCB plug
Galvanic isolation:	min. 1kV DC isolation voltage
Supply voltage:	3,3V, typ. 200mA, 12V, current consumption depending on current draw of the modules used
Ambient temperature:	Storage: -40..+70°C, Operating: 0..+70°C
Relative humidity:	0..95% RH (non-condensing)
Note:	The card can be configured with modules of various interface types
Dimensions:	105 x 93 mm
Weight:	approx. 110 g
Scope of delivery:	PCI Express base board Driver CD

**PCI Express card 2x 20mA, #13431****Function**

The W&T PCI Express card 13431 provides two mutually independent serial 20mA interfaces with 1kV of galvanic isolation for PCI Express systems.

**Wiring configuration**

The 20mA connections on the PCI Express card are implemented as DB9 plugs. The connector pin assignments are shown in the following table:

pin#	function
1	Data Out 20 mA
2	Data Out +
3	Data Out -
4	Data Out GND
5	Halfduplex control
6	Data In 20 mA
7	Data In +
8	Data In -
9	Data In GND

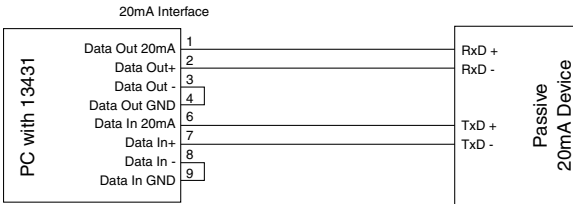
**Applications**

A ground level on Pin 5 of the SUB-D connector places the 20mA interface in half-duplex mode in which there is echo suppression of the sent signals.

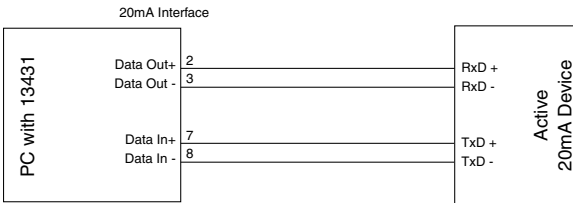
The PCI Express card can be used as either an active or passive 20mA component. In active mode the card provides the loop current for the respective 20mA loop, whereas in passive mode the connected device itself must provide the loop current.

The mode can be set independently for both loops using the external wiring of the card. Examples for wiring the PC card in active/passive mode are shown in the following drawings:

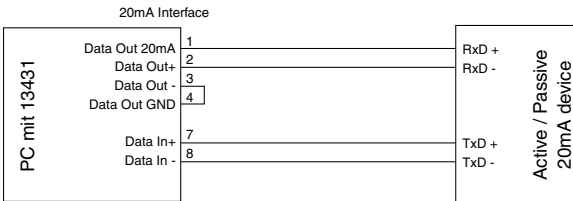
**Active Tx and active Rx current loop application**



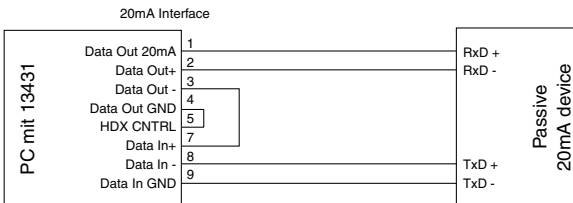
**Passive Tx and passive Rx current loop application**



**Active Tx and passive Rx current loop application**



**PCIe card active, halfduplex mode application**



**Technical Data**

PCI standard:	PCI Express 1.1, x1 connector
Serial ports:	Two galvanically isolated 20mA ports
Operating modes:	Active and passive Full- and half-duplex
UART:	Oxford OXPCIe954 with 128 Byte FIFO
Base addresses:	automatic configuration
Interrupts:	automatic configuration
Baud rate:	50 Baud .. 57.600 Baud
Data format:	any
Signals:	RxD+, RxD-, TxD+, TxD-
Maximum permissible voltage drop in the current loop:	8 V
Serial connections:	2x 9-pin. SUB-D plug
Galvanic isolation:	min. 1kV DC isolation voltage
Supply voltage:	3,3V, typ. 200mA, 12V, typ. 200mA
Ambient temperature:	Storage: -40..+70°C, Operating: 0..+70°C
Relative humidity:	0..95% RH (non-condensing)
Dimensions:	105 x 93 mm
Weight:	approx. 110 g
Scope of delivery:	PCI Express card 2x 20mA Driver CD



**PCI Express Card 2x RS232/RS422/RS485, #13631**

**Function**

The W&T PCI Express Card 13631 provides two mutually independent, switchable RS232/RS422/RS485 interfaces with 1 kV of galvanic isolation for PCI Express systems.

**Wiring configuration**

The serial connections on the PC Express card are configured as DB9 plugs. The pin configuration can be seen in the following table:

RS232 mode

pin#	signal	function
1	DCD	input
2	RxD	input
3	TxD	output
4	DTR	output
5	GND	GND
6	DSR	input
7	RTS	output
8	CTS	input
9	RI	input

RS422/RS485 mode

pin#	signal	function
1	TXD A	output
2	RxD A	input
3	DTR A	output
4	CTS A	input
5	GND	GND
6	TXD B	output
7	RxD B	input
8	DTR B	output
9	CTS B	input

**Operating modes**

The combined RS232/RS422/485 interface of the PCI Express card can be set to various operating modes using the DIL switches located near the serial port. These modes are described below:

**RS232 mode**

This mode provides one data channel each (RxD and TxD) in both directions, as well as six handshake channels (RTS, CTS, DSR, DCD, DTR and RI).

**RS422 mode**

The PCI Express card supports one data and one handshake channel each (selectable DTR or RTS handshake output) in each direction. The RS422 sender and receiver chips are always active.

**RS485 mode**

In all RS485 modes there is always one data channel available in each direction. The operating modes differ only in how the RS485 driver and receiver chips are controlled.

**RS485 4-wire bus master**

In this mode the Master uses a pair of wires to send requests to the slaves, which in turn use an additional common wire pair to send their replies to the master. In this mode, in which the master can always send and is always listening for the slaves, the RS485 drivers and receivers always remain active.

**RS485 4-wire mode / RS485 2-wire mode with echo, handshake control**

One data channel is available in each direction. The RS485 driver chip is turned on with RTS or DTR = „ON“, whereas RTS or DTR = „OFF“ places the driver in high-impedance state. The receiver channel is always active in this mode.

**RS485 2-wire mode with no echo, handshake control**

One data channel in each direction is available. The RS485 line driver is turned on with RTS or DTR = „ON“, whereas RTS or DTR = „OFF“ puts the driver in high-impedance state. The receiver channel is deactivated when the driver is turned on, and turned on when the driver is at high-impedance.



**RS485 4-wire mode / RS485 2-wire mode with echo, automatic control**

One data channel is available in each direction. The RS485 line driver is automatically activated whenever data is output and returned to high-impedance state at the end of data output. The receiver channel is always active in this mode.

**RS485 2-wire mode without echo, automatic control**

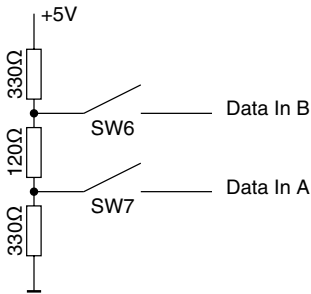
One data channel is available in each direction. The RS485 line driver is automatically activated whenever data is output and returned to high-impedance state at the end of data output. The receiver channel is deactivated when the driver is turned on, and turned on when the driver is at high-impedance.

The DIL mode switch settings can be seen in the following table:

Operating mode	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
RS232	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
RS422, RS485, 4-wire bus master DTR handshake	OFF	OFF	OFF	ON	OFF	*	*	OFF
RS422, RS485, 4-wire bus master RTS handshake	OFF	OFF	OFF	OFF	ON	*	*	OFF
RS485, 4-wire / 2-wire with echo DTR control	OFF	OFF	ON	ON	OFF	*	*	OFF
RS485, 2-wire without echo DTR control	ON	OFF	ON	ON	OFF	*	*	OFF
RS485, 4-wire / 2-wire with echo RTS control	OFF	OFF	ON	OFF	ON	*	*	OFF
RS485, 2-Draht without echo RTS control	ON	OFF	ON	OFF	ON	*	*	OFF
RS485, 4-wire / 2-wire with echo automatic control	OFF	ON	OFF	ON	OFF	*	*	OFF
RS485, 2-wire without echo automatic control	ON	ON	OFF	ON	OFF	*	*	OFF

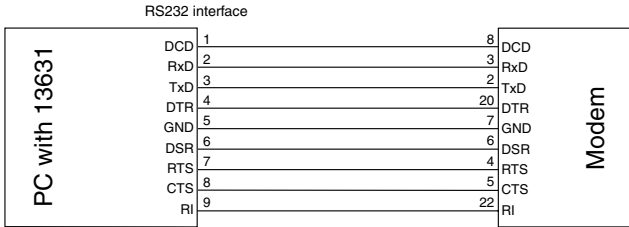
## Termination

All RS485 modes require terminating the bus system with a termination network which ensures a defined rest state in the high-impedance phases of bus operation. The connection between the bus system and a termination network can be made on the cPCI card by closing DIL switches 6 and 7:

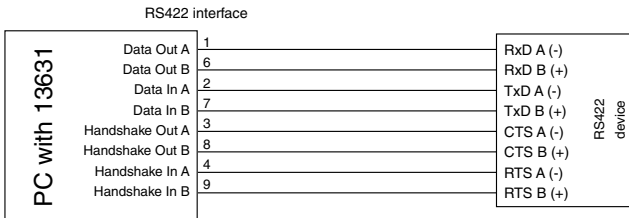


Applications

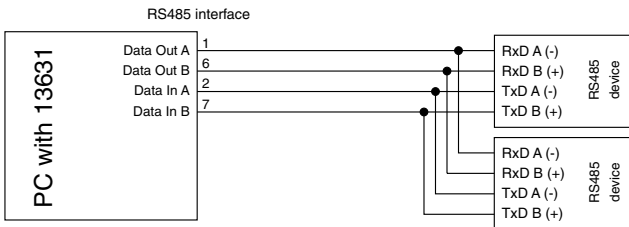
RS232 application with hardware handshake



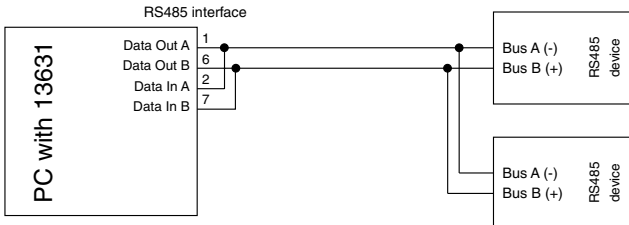
RS422 application with hardware handshake



RS485 4-wire bus master application



RS485 2-wire application



**Technical Data**

PCI standard:	PCI Express 1.1, x1 connector
Serial ports:	Two galvanically isolated RS232/RS422/RS485 ports
Operating modes:	RS232, RS422 RS485 2/4 wire mode with automatic control RS485 2/4 wire mode with handshake control
Switchover delay:	approx. 10µs from send to receive for RS485 automatic control (can be factory changed on request)
UART:	Oxford OXPcIe954 with 128 Byte FIFO
Base addresses:	automatic configuration
Interrupts:	automatic configuration
Baud rate:	RS232 mode: 50 Baud..1 MBaud RS422/RS485 mode: 50 Baud..3 MBaud
Data format:	any
Signals:	RS232 mode: RxD, TxD, RTS, CTS, DSR, DTR, DCD, RI RS422/RS485 mode: RxD A/B, TxD A/B, CTS A/B, DTR A/B
Serial connections:	2x 9-pin. SUB-D plug
Galvanic isolation:	min. 1kV DC isolation voltage
Supply voltage:	3,3V, typ. 200mA, 12V, typ. 100mA
Ambient temperature:	Storage: -40..+70°C, Operating: 0..+70°C
Relative humidity:	0..95% RH (non-condensing)
Dimensions:	105 x 93 mm
Weight:	approx. 110 g
Scope of delivery:	PCI Express card 2x RS232/RS422/RS485 Driver CD