



CPCI-USB-5

CompactPCI®-USB 2.0 Interface with 6 USB Ports



Hardware Manual

to Products I.2326.01



NOTE

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Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Rev.	Chapter	Changes versus previous version	Date
1.0	-	First English version	2010-06-02
1.1	-	Safety Instructions and notes on page 4 revised and inserted	2014-08-12
	3	Item 4: Note to chapter Hardware Installation inserted.	
	5.	New chapter "Firmware supported Commands"	
	5.1	Chapter "Command LED" moved to chapter 5.1.1, chapter 5.1.2 new	
	5.2	New chapter "Set Power Switches"	
	5.3	Chapter "Monitoring of the Local Power Supply Voltage" moved and example added	
	6.4	Note to usage of CompactFlash media inserted	
	8	New chapter "Software Licenses" inserted	
	9	Declaration of Conformity inserted	
	10	Chapter "Order Information" moved and revised	
1.2	-	CPCI-USB-5-CF/SD option deleted	2015-06-02
	1.	Description of the CPCI-USB-5-CF/SD option deleted in figure and text	
	2.	Picture new, Note inserted	
	3.	Description of CPCI-USB-5-CF/SD deleted	
	4.1.2	Description of LED 8 changed	
	6.1	Description of CPCI-USB-5-CF/SD card connectors deleted	
	-	Chapters "CompactFlash Interface" and "Secure Digital Interface" deleted	
	10.	Order Information revised	

Technical details are subject to change without further notice.



Safety Instructions

- When working with CPCI-USB-5 follow the instructions below and read the manual carefully to protect yourself from injury and the CPCI-USB-5 from damage.
- The device is a built-in component. It is essential to ensure that the device is mounted in a way that cannot lead to endangering or injury of persons or damage to objects.
- The device has to be securely installed in the control cabinet before commissioning.
- Protect the CPCI-USB-5 from dust, moisture and steam.
- Protect the CPCI-USB-5 from shocks and vibrations.
- The CPCI-USB-5 may become warm during normal use. Always allow adequate ventilation around the CPCI-USB-5 and use care when handling.
- Do not operate the CPCI-USB-5 adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.
- Do not use damaged or defective cables to connect the CPCI-USB-5 and follow the CAN wiring hints in chapter: "Correctly Wiring Electrically Isolated CAN Networks".
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and domestic animals and property.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The CPCI-USB-5 may only be driven by power supply current circuits, that are contact protected.
A power supply, that provides a safety extra-low voltage (SELV or PELV) according to EN 60950-1, complies with this conditions.



Attention !

Electrostatic discharges may cause damage to electronic components.

To avoid this, please perform the steps described on page 9 *before* you touch the CPCI-USB-5, in order to discharge the static electricity from your body.

Qualified Personal

This documentation is directed exclusively towards personal qualified in control and automation engineering.

The installation and commissioning of the product may only be carried out by qualified personal, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity

The CPCI-USB-5 is an industrial product and meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.

Warning: In a residential, commercial or light industrial environment the CPCI-USB-5 may cause radio interferences in which case the user may be required to take adequate measures.

Intended Use

The intended use of the CPCI-USB-5 is the operation as CompactPCI module in a CompactPCI system.

The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The CPCI-USB-5 is intended for installation in a CompactPCI system only.
- The operation of the CPCI-USB-5 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CPCI-USB-5 for medical purposes is prohibited.

Service Note

The CPCI-USB-5 does not contain any parts that require maintenance by the user. The CPCI-USB-5 does not require any manual configuration of the hardware.

Disposal

Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

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Typographical Conventions

Throughout this design specification the following typographical conventions are used to distinguish technical terms.

Convention	Example
File and path names	<code>/dev/null</code> or <code><stdio.h></code>
Function names	<i>open()</i>
Programming constants	<code>NULL</code>
Programming data types	<code>uint32_t</code>
Variable names	<i>Count</i>

The following indicators are used to highlight noticeable descriptions.



Attention:

Warnings or cautions to tell you about operations which might have unwanted side effects.



Note:

Notes to point out something important or useful.

Number Representation

All numbers in this document are base 10 unless designated otherwise. Hexadecimal numbers have a prefix of 0x, and binary numbers have a prefix of 0b. For example, 42 is represented as 0x2A in hexadecimal and 0b101010 in binary.

1. Overview

1.1 Module Description

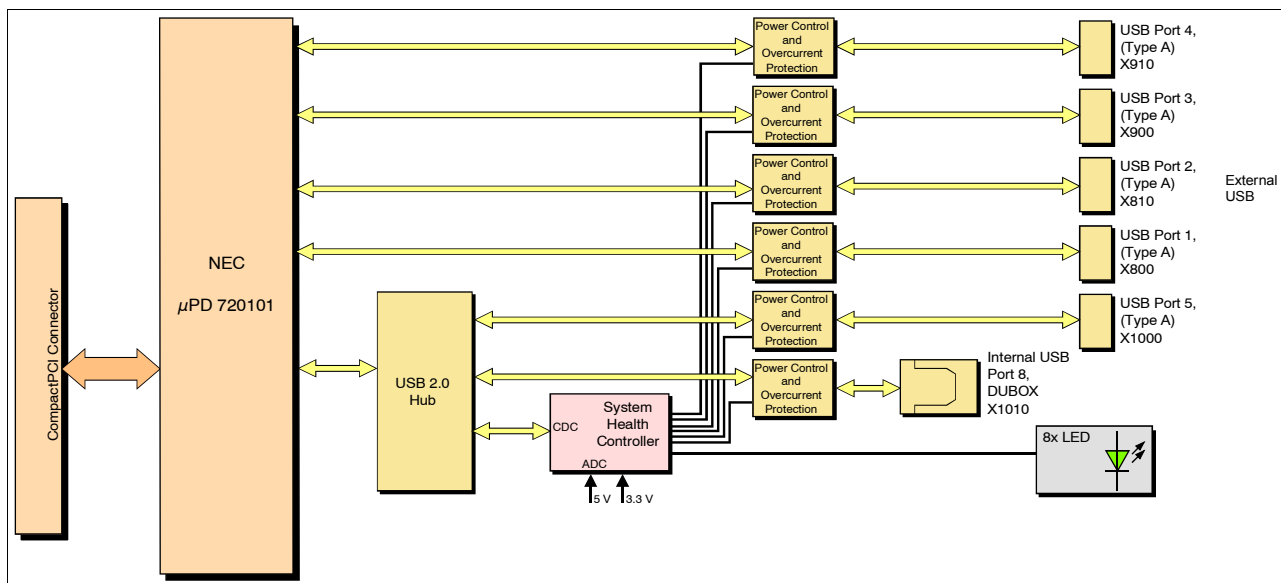


Figure 1: Block-circuit diagram of the CPCI-USB-5

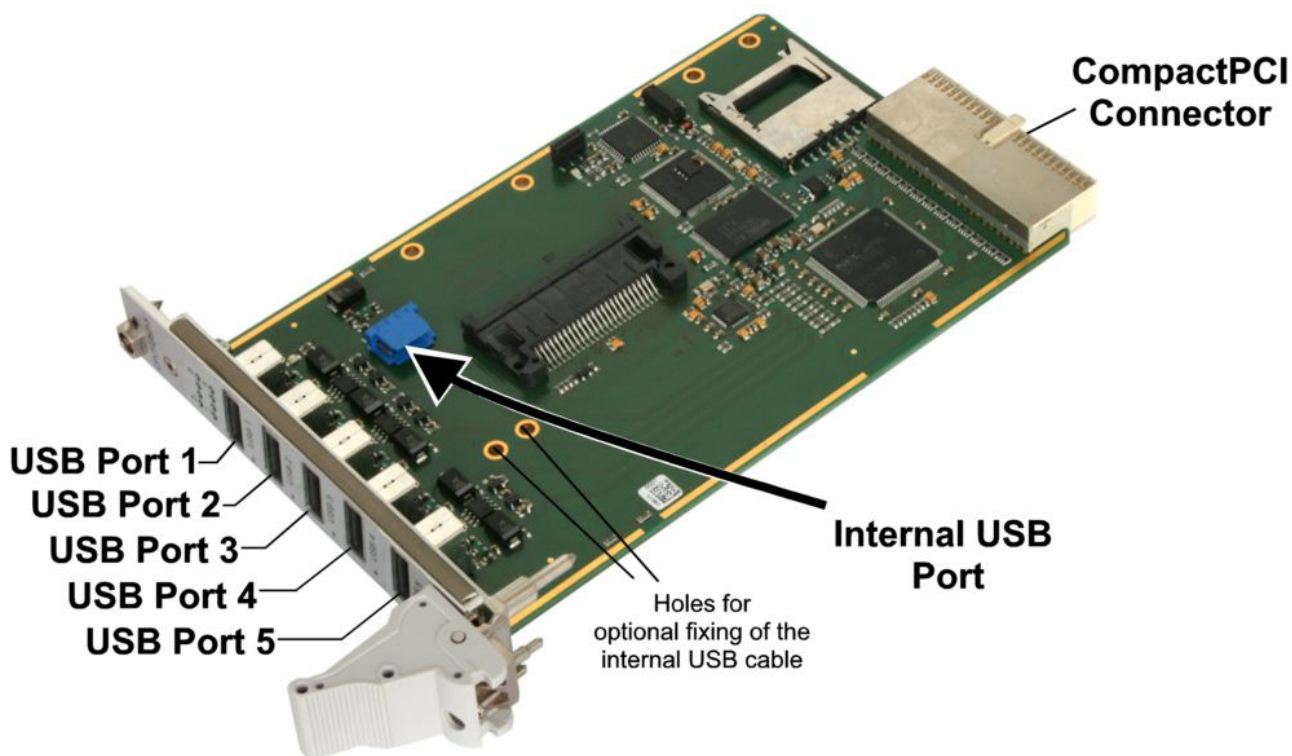
The CPCI-USB-5 is a CompactPCI® board in 3U format. It is equipped with a NEC μPD720101, a USB 2.0 host controller that supports 5 Hi-Speed USB 2.0 interfaces. One of them is multiplied by an on-board HUB.

The 5 external USB 2.0 interfaces are accessible via USB connectors (type A, female) in the front panel. The internal USB 2.0 interface is accessible via a 5-pin DUBOX connector located on the board. Power control and overcurrent protection are ensured for all 6 USB interfaces.

The CDC-device reduces the starting current by sequentially powering up the USB ports.

The CPCI-USB-5 runs with standard USB-Serial system-drivers of the common operating systems.

2. PCB View with Position of the Connectors



Note:

The CompactFlash card slot and the SD memory card slot are not equipped on the standard CPCI-USB-5.

3. Hardware Installation



Read the safety instructions at the beginning of this document carefully, before you start with the hardware installation!



Danger!

Electric shock risk. Never carry out work while power supply voltage is switched on!



Attention !

Electrostatic discharges may cause damage to electronic components. To avoid this, please perform the following steps *before* you touch the CPCI-USB-5, in order to discharge the static electricity from your body:

- Switch off the power of your computer, but leave it connected to the mains until you have discharged yourself (if applicable).
- Please touch the metal case of the computer now to discharge yourself.
- Furthermore, you should prevent your clothes from touching the computer, because your clothes might be electrostatically charged as well.

Procedure:

1. Switch off your computer and all connected peripheral devices (monitor, printer, etc.).
2. Discharge your body as described above.
3. Disconnect the computer from the mains.
If the computer does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).



Danger!

Never carry out work while power supply voltage is switched on!

4. Connect the internal USB line (USB port 8) via the 5-pin DUBOX connector (X1010) to the internal USB port (see figure 1).
The board comes with two 3.2 mm holes for optional fixing the internal USB-cable for strain relief, e.g. by means of cable ties.
5. Insert the CPCI-USB-5 into a free CompactPCI Slot in your PC.
6. Fix the CPCI-USB-5 with the screws on the front panel.
7. Connect the external USB lines (USB1-USB5) to the USB connectors in the front panel (see Figure 1). The external USB lines are 'hot-pluggable' and can be connected or disconnected later.
8. Connect the computer to mains again (mains connector or safety fuse).
9. Switch on the computer and the peripheral devices.
10. End of hardware installation.
11. Set the interface properties in your operating system. For further information refer to the documentation of the operating system.

4. LEDs

4.1 Front Panel with Connector and LED Description

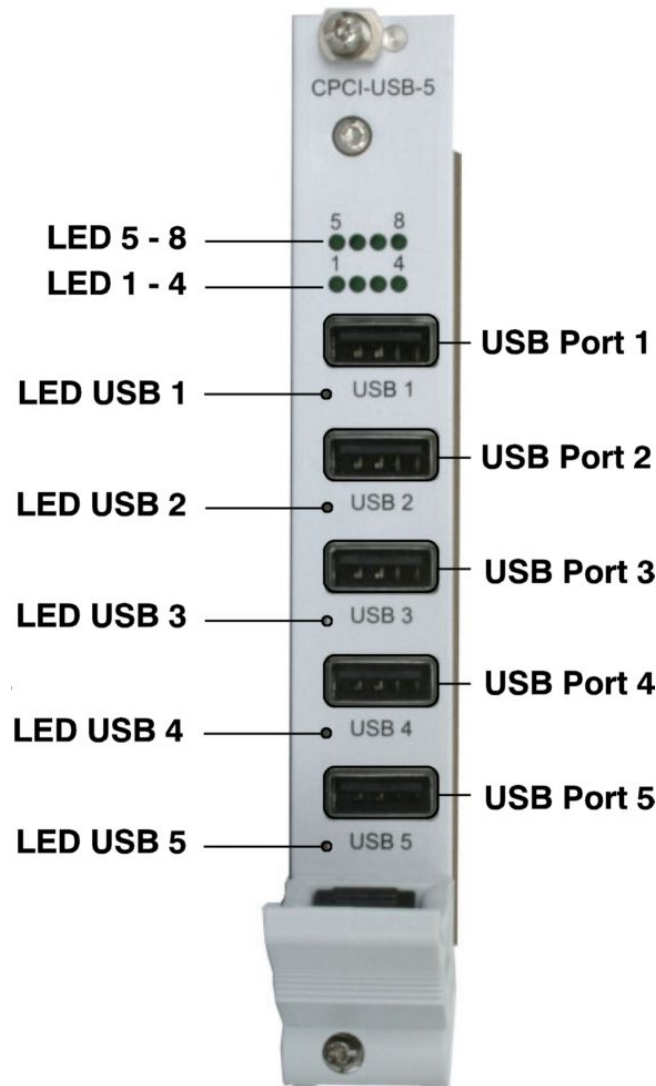


Figure 3: Front panel CPCI-USB-5

4.1.1 LEDs USB1-USB5

Name/ Labelling	Description	LED- Description in Schematics Diagram
USB 1	When powering up the system the LEDs are sequentially turned on corresponding to sequentially powering up the USB ports. After powering up the system these LEDs are permanently on.	LED1000
USB 2		LED800
USB 3		LED810
USB 4		LED900
USB 5		LED910

4.1.2 LEDs 1-8

Name/ Labelling	Colour	Description	LED-Description in Schematics Diagram
1	green	user-specific (see chapter 5.1)	LED660A
2	green		LED660B
3	green		LED660C
4	green		LED660D
5	green		LED661A
6	green		LED661B
7	green		LED661C
8	green	reserved	LED661D

5. Firmware supported Commands

5.1 User-Specific LEDs (LED1-7)

The LEDs 1-7 can be addressed via standard USB-serial-system drivers of the common operating systems as a virtual serial interface.

A string, containing the command and the desired LED-status as parameter, has to be send to the corresponding serial interface.

5.1.1 Command *LED*

The call contains the command *LED* and the binary value of the LED-status as 2 hexadecimal nibbles.

Call: “*LED parameter*”

LEDxx with *xx* = hexadecimal value of the LED-status (0x00 ... 0x7F)

Parameter-Description:

Assignment of the LEDs to the parameter bits:								
Bit	7	6	5	4	3	2	1	0
LED	not used	LED7	LED6	LED5	LED4	LED3	LED2	LED1

LED-Status:	LED-Status	Binary value
	LED on	1
	LED off	0

Example:

Call	Meaning
<i>LED01</i>	LED 1 is on
<i>LED03</i>	LED 1 and LED 2 are on
<i>LED05</i>	LED 1 and LED 3 are on
<i>LED07</i>	LED 1, LED 2 and LED 3 are on
:	:
<i>LED55</i>	LED 1, LED 3, LED5 and LED 7 are on
:	:
<i>LED7F</i>	all LEDs (1-7) are on

5.1.2 Command **BLINK**

This call contains the command **BLINK**, the specification of the LED (x) and the binary value of the blinking sequence as 4 hexadecimal nibbles (yyyy).

Call: “**BLINK** parameter”

BLINKxyyyy with x = value 0..6 and yyyy = hexadecimal value of blinking sequence (0x0000 ... 0xFFFF)

Parameter description x:

Assignment of the LEDs to the parameter bit BLINKx :								
Bit	7	6	5	4	3	2	1	0
LED	not used	LED 7	LED 6	LED 5	LED 4	LED 3	LED 2	LED 1

LED Status:	LED-Status	Binary value
	LED on	1
	LED off	0

Parameter description yyyy:

yyyy this hexadecimal value (0x0000..0xFFFF) defines the blinking sequence for LED x (x = 0- 7)
Each bit describes the status of the LED for 1/8s (125 ms), beginning with bit 0. After bit 15 (= after 2 s) is reached, the sequence will start again with bit 0.

Example:

Example:

CALL <i>BLINKxyyyy</i>	Darstellung yyyy																Meaning		
	hex	binary																	
<i>BLINK00E31</i>	0x0E31	0000111000110001(b)																LED 1 (x = 0) blinking with the following sequence: 125 ms on (1), 375 ms off (000), 250 ms on (11), 375 ms off (000), 375 ms on (111), 500 ms off (0000) starts again from the beginning	
		Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		0
		Value	0	0	0	0	1	1	1	0	0	0	1	1	0	0	0		1
		Status	off			on			off			on		off			on		
		← ← ← ← ←																	
<i>BLINK65555</i>	0x5555	0101010101010101(b)																LED 7 (x = 6) blinking with the following sequence: 125 ms on (1), 125 ms off (0), and so on	
		Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		0
		Value	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0		1
		Status	off	on	off	on	off	on	off	on	off	on	off	on	off	on	off		on
		← ← ← ← ←																	
<i>BLINK5AAAA</i>	0xAAAA	1010101010101010(b)																LED 6 (x = 5) blinking with the following sequence: 125 ms off (0), 125 ms on (1), and so on	
		Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1		0
		Value	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1		0
		Status	on	off	on	off	on	off	on	off	on	off	on	off	on	off	on		off
		← ← ← ← ←																	

5.2 Set Power Switches

The power switches USB1 to USB5 and USB8 (via connector X1010) can be set with this command.

When switching on for the first time (from *PWR00* to another status), the switching will be delayed for 2 s. When switching on several power-switches at the same time there is always a delay of 500 ms before the next power-switch will be powered up.

Call: "PWR parameter"

PWRxx with xx = hexadecimal value 0x00 ... 0x3F

Parameter Description:

Assignment of the power-switches to the parameter bit PWR:								
Bit	7	6	5	4	3	2	1	0
USB	not used	not used	USB8	USB5	USB4	USB3	USB2	USB1

Power-switch status:

PWR-Switch Status	Binary value
PWR on	1
PWR off	0

Example:

Command	Meaning
<i>PWR00</i>	No power-switch set
<i>PWR03</i>	Power-switch USB1 and USB2 are set
<i>PWR3F</i>	all power-switches are set (USB1 ... USB5 and USB8)

5.3 Monitoring of the Local Power Supply Voltage

The local power supply voltage is monitored by the system health controller.

The ADC values measured can be read via standard USB-serial system drivers of the common operating systems. The system health controller is addressed as a virtual serial interface.

To request the current values of the 5 V- and 3.3 V-power supply voltage the command *ADC* has to be send to the corresponding serial interface.

Call: 'ADC'

Output: By the health controller currently measured actual values of the local 5 V- and 3.3 V-power supply voltage with an accuracy of 2 decimal digits.

Example : "ADC: 5.077 3.352"

6. Summary of Technical Data

6.1 General Technical Data

Temperature range	0...50°C ambient temperature
Humidity	90% non-condensing
	via CompactPCI Bus: nominal voltage: 3.3 V (5 V tolerant) current consumption: maximum at 3.3 V: 25 mA maximum at 5 V: 125 mA
Connectors	USB1 - external USB 2.0 interface (X800, USB-socket type A) USB2 - external USB 2.0 interface (X810, USB-socket type A) USB3 - external USB 2.0 interface (X900, USB-socket type A) USB4 - external USB 2.0 interface (X910, USB-socket type A) USB5 - external USB 2.0 interface (X1000, USB-socket type A) USB8 - internal USB 2.0 interface (X1010, 5-pin DUBOX connector, male, (fci connect 76382-305LF)) CPCI - CompactPCI board connector (X100, 132-pin male connector) Only for test- and programming purposes: X601 - (6-pin SMD socket terminal strip)
Dimensions	100 mm x 160 mm
Weight	approx. 145 g

6.2 USB-Interface

Number	5x external USB, 1x internal USB
USB interface	USB 2.0, Hi-Speed, bit rate up to 480 Mbit/s
Host controller	NEC μ PD720101
Connector	external USB (USB1-USB5): USB socket type A internal USB (USB8): 5-pin DUBOX connector, male (X1010), (fci connect 76382-305LF) Mates with Dubox CTW Housings and Contacts, Series 76347, 65239, 65240. see www.fciconnect.com for details

6.3 CompactPCI Bus

Host bus	PCI-Bus according to PCI Local Bus Specification 2.2
PCI-data/address bus	32 Bit, 33 MHz
Controller	NEC μ PD720101
Board dimension	according to CompactPCI-Specification, Rev. 2.2
Connector	
Connector coding	Universal-Board, not keyed (3.3 V or 5 V signalling voltage)

6.4 System Health Controller

Type	Atmel AVR® 8-bit microcontroller
Functionality	<ul style="list-style-type: none"> - controls LEDs - measures current values of the local 3.3 V- and 5 V-power supply voltage - monitoring the status of the USB interfaces - sequentially powering up the USB ports

6.5 Software Support

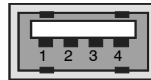
The CPCI-USB-5 runs with the standard USB-serial system drivers of common operating systems.

7. Connector Assignment

7.1 External USB (USB 1 - USB 5)

Device connector: USB connector type A

Pin Position:



Pin Assignment:

Pin	Signal
1	V_{BUS}
2	D-
3	D+
4	GND

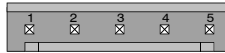
Signal Description:

V_{BUS} ...	+5 V power supply voltage
D+, D-...	USB signal lines Data+, Data-
GND...	Reference potential

7.2 Internal USB

Device connector: 5-pin DUBOX connector, male (fci connect 76382-305LF)
Line connector: Dubox CTW Housings and Contacts, Series 76347, 65239, 65240,
see www.fciconnect.com for details

Pin Position:



Pin Assignment:

Pin	Signal
1	V_{BUS}
2	D+
3	D-
4	GND
5	Shield (shielding)

Signal Description:

V_{BUS} ... +5 V power supply voltage
D+, D-... USB signal lines Data+, Data-
GND... Reference potential

8. Software Licenses

The firmware (from Rev. 2.0) uses components from LUFA library, from Dean Camera,
<http://www.fourwalledcubicle.com>

```
LUFA Library
    Copyright (C) Dean Camera, 2014.

    dean [at] fourwalledcubicle [dot] com
        www.lufa-lib.org
```

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9. Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG EU DECLARATION OF CONFORMITY



Adresse **esd electronic system design gmbh**
Address **Vahrenwalder Str. 207**
30165 Hannover
Germany

esd erklärt, dass das Produkt
esd declares, that the product
CPCI-USB-5

Typ, Modell, Artikel-Nr.
Type, Model, Article No.
I.2326.01

die Anforderungen der Normen
fulfills the requirements of the standards

EN 61000-6-2:2005,
EN 61000-6-4:2007+A1:2011

gemäß folgendem Prüfbericht erfüllt.
according to test certificate.

H-K00-0359-09,
H-Z01-0359-13

Das Produkt entspricht damit der EU-Richtlinie „EMV“
Therefore the product corresponds to the EU Directive 'EMC'

2014/30/EU

Das Produkt entspricht der EU-Richtlinie „RoHS“
The product corresponds to the EU Directive 'RoHS'

2011/65/EU

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
This declaration loses its validity if the product is not used or run according to the manufacturer's documentation or if non-compliant modifications are made.

Name / Name **T. Ramm**
Funktion / Title **CE-Koordinator / CE Coordinator**
Datum / Date **Hannover, 2014-07-18**

Rechtsgültige Unterschrift / *authorized signature*

10. Order Information

Type	Properties	Order No.
CPCI-USB-5	CPCI USB 2.0 interface with 5x USB 2.0 via front panel, 1x USB 2.0 via on-board connector	I.2326.01

Table 1: Order information

PDF Manuals

Manuals are available in English and usually in German as well. For availability of English manuals see table below.

Please download the manuals as PDF documents from our esd website www.esd.eu for free.

Manuals		Order No.
CPCI-USB-5-ME	Hardware manual in English	I.2326.21

Table 2: Available manuals

Printed Manuals

If you need a printout of the manual additionally, please contact our sales team: sales@esd.eu for a quotation. Printed manuals may be ordered for a fee.