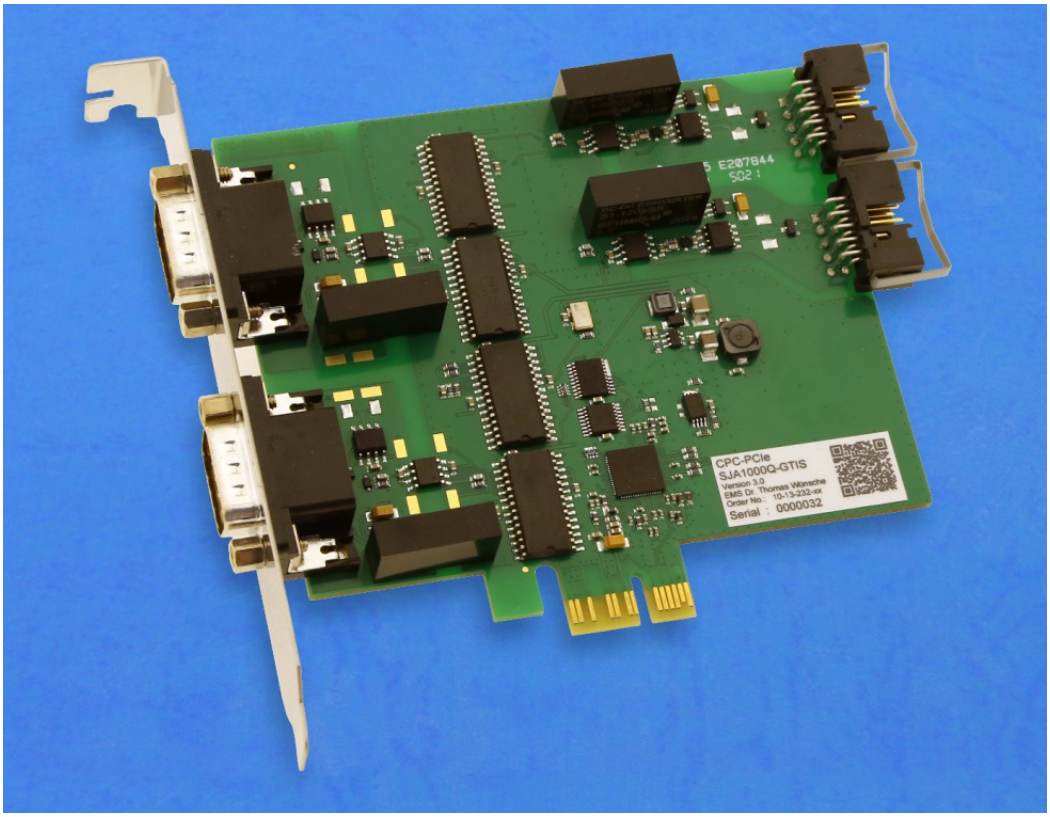

CAN-PC Interface

CPC-PCIe
CPC-PCIe low profile

User manual

EMS
Thomas Wünsche

User manual CPC-PCIe V3, also 'low profile' version

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If you discover a security vulnerability in one of our products, please report it to **security@ems-wuensche.com**. Thank you for your support.

Our products are continously improved. Due to this fact specifications may be changed at any time and without announcement.

FCC: **This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

WARNING: **CPC-PCIe hardware and software may not be used in applications where damage to life, health or private property may result from failures in or caused by these components.**

Content

1 Overview 1

1.1 Attributes 1
1.2 General Description 1
1.3 Ordering Information 2

2 Programming Interface 3

3 Electrical Characteristics 4

3.1 Absolute Limiting Values 4
3.2 Nominal Values 4

4 Operating Instructions 5

4.1 Pin Configuration of CAN Connector 5
4.2 Configuration 5
4.3 Installation 6
4.4 SocketCAN 8
4.5 Dimensions CPC-PCIe 9
4.6 Dimensions CPC-PCIe low profile 9

5 Appendix 10

5.1 Instruction for Disposal 10
5.2 FCC Statement 10
5.3 CE Conformity 11

1 Overview

1.1 Attributes

- CAN Interfaces for industrial applications
- Compact size for PCIe x1 slots
- CiA DS 102 and ISO 11898 compatible physical layer
- Equipped with up to four CAN controller NXP SJA1000
- Extended ESD-protection of the CAN controller
- Galvanic decoupling between PC and CAN bus (optional)
- Galvanic decoupling between individual CAN channels (optional)
- low profile version for single and dual channel cards available
- Easy programming based on direct mapping of CAN controller registers into PC memory area
- Linux socketCAN is supported

1.2 General Description

CPC-PCIe is a PCI Express plug-in card for the CAN bus. Designed for industrial series applications CPC-PCIe has a robust and cost efficient layout. CPC-PCIe supports up to four CAN controller of type NXP SJA1000.

CPC-PCIe maps the CAN controller into the PC address space and thus allows access to CAN messages with low latency. Existing software for the supported CAN controller can easily be adapted. With CPC-PCIe the CAN communication may be handled either in interrupt controlled or in polled mode.

CPC-PCIe can optionally be delivered with galvanic decoupling of the CAN bus. The dual and four channel version has the additional option of galvanic decoupling between the CAN channels.

For applications with restricted space conditions low profile versions are available for the single and dual channel card.

1.3 Ordering Information

10-13-200-xx	**CPC-PCIe/SJA1000S** CAN plug-in board with one CAN controller NXP SJA1000
10-13-201-xx	**CPC-PCIe/SJA1000S-GTIS** CAN plug-in board with one CAN controller NXP SJA1000, galvanic decoupling
10-13-210-xx	**CPC-PCIe/SJA1000D** CAN plug-in board with two CAN controllers NXP SJA1000
10-13-211-xx	**CPC-PCIe/SJA1000D-GTID** CAN plug-in board with two CAN controllers NXP SJA1000, galvanic decoupling
10-13-212-xx	**CPC-PCIe/SJA1000D-GTI2S** CAN plug-in board with two CAN controllers NXP SJA1000, individual galvanic decoupling
10-13-230-xx	**CPC-PCIe/SJA1000Q** CAN plug-in board with four CAN controllers NXP SJA1000
10-13-232-xx	**CPC-PCIe/SJA1000Q-GTIS** CAN plug-in board with four CAN controllers NXP SJA1000, individual galvanic decoupling
10-13-240-xx	**CPC-PCIe/SJA1000S low profile** CAN plug-in board with one CAN controller NXP SJA1000
10-13-241-xx	**CPC-PCIe/SJA1000S-GTIS low profile** CAN plug-in board with one CAN controller NXP SJA1000, galvanic decoupling
10-13-244-xx	**CPC-PCIe/SJA1000D-GTI2S low profile** CAN plug-in board with two CAN controllers NXP SJA1000, individual galvanic decoupling

Note: xx denotes language of delivery:

10 German
20 English

2 Programming Interface

CPC-PCIe is mapped into the PC memory space with a base address assigned by the PC BIOS. The availability of the CAN controller(s) into the memory area makes the CAN communication direct and provides a low latency time. The card is identified by the following parameters:

Vendor ID	: 0x125B
Device ID	: 0x9110
Subvendor ID	: 0xA000
Subsystem ID	: 0x4010

CPC-PCIe is automatically enumerated by the operating system at boot time. As drivers are provided for Windows and Linux there is normally no need to directly access the card.

In case this is needed please contact **EMS Dr. Thomas Wünsche** for more detailed information about the programming interface of CPC-PCIe.

3 Electrical Characteristics

3.1 Absolute Limiting Values

Any (also temporary) stress in excess of the limiting values may cause permanent damage on CPC-PCIe and connected devices.

Parameter	Min.	Max.	Unit
Storage temperature	-20	80	°C
Operating temperature*	0	60	°C
Voltage on the bus connections	-30	30	V
Current across ground connection	-	1	A

* Extended temperature range on demand

3.2 Nominal Values

Parameter	Min.	Typ.	Max.	Unit
Power supply on +3 V Pins of the PCIe expansion slot	3,1	3,3	3,5	V
Power supply on +12 V Pins of the PCIe expansion slot	11	12	13	V
Voltage on bus pins*	-30	-	30	V
Isolation voltage of galvanic decoupling between host and CAN potential	-	1000	-	V
CAN controller clock frequency	-	16	-	MHz

* This potential is measured against the ground potential of the related CAN transceiver

4 Operating Instructions

4.1 Pin configuration of CAN connector

The CAN interface connector (D-Sub9 male) schema complies to CiA Standard DS 102. The pin usage is detailed in the following table:

Pin	Name	Description
1	-	Reserved by CiA, not connected
2	CAN_L	CAN low bus line
3	GND	CAN Ground
4	-	Reserved by CiA, not connected
5	-	Reserved by CiA, not connected
6	-	Reserved by CiA, not connected
7	CAN_H	CAN high bus line
8	-	Reserved by CiA, not connected
9	-	Reserved by CiA, not connected

4.2 Configuration

CPC-PCIe is a Plug and Play interface and therefore does not need a configuration. The base address of the interface within the PC memory and the interrupt used is assigned by the PC BIOS.

4.3 Installation

- CPC-PCIe may be installed in an empty expansion slot on the motherboard of your IBM compatible computer. To avoid damage please pay attention to the following hints:
- **WARNING:** Computer devices and components are sensitive against static discharge. For this reason keep CPC-PCIe in the antistatic cover until installing. Just before removing CPC-PCIe from the protection cover touch the metal case of your computer.
- Avoid damage by achieving equal potential between all devices on the CAN before plugging the connection.
- To the rear side connector of CPC-PCIe only CAN networks with a connector and electrical character complying with CiA DS-102 may be attached.
- PC and CAN bus are not galvanic decoupled in the standard version of CPC-PCIe. Use in systems with diverging ground potential of PC and CAN bus is not permitted in this case.
- The four channel type of cards have their CAN connectors on a separate slot panel. Connection to the PCB is made by a ribbon cable to their respective connectors on the PCB.
- The second channel of the low profile type is also connected by a ribbon cable on a separate low profile slot panel.
- Besides the instructions mentioned in this manual carefully observe the instructions in your computer's user manual.
- If you are not sure about the installation please contact EMS Dr. Thomas Wünsche.
- CPC-PCIe and CPC-PCIe low profile need a driver to operate on Windows operating systems. This driver is part of the ´CPC Series Runtime Kit for MS Windows Environment´, which is provided as download (digital service) free of charge. A data medium (e.g. CD) will be sent on request.

Execute the following steps for installation:

- Disconnect your computer from the power line.
- Open the case of your computer and remove the cover of the expansion slot rear panel.
- Insert CPC-PCIe carefully into the PCIe slot. Therefore take the card at its top corners and shift it down into the slot equally. Push onto the upper side of CPC-PCIe to achieve correct seat in the slot.

  If the card can not be inserted without problems, please don't use extensive force. Remove the card and retry.
- Fix the mounting screw and close the PC housing. Connect the required cables.

4.4 Socket CAN

With a recent Linux kernel the socketCAN driver for the CPC-PCIe (ems_pci.ko) is already included. It supports the following interface versions:

CPC-PCI	all variants, also low profile variants
CPC-PCIe	all variants, also low profile variants
CPC-104P	all variants

After installation of CPC-PCIe the driver will be loaded automatically. This can be verified by entering the "dmesg" command on a console. It should output the following lines (example for a two channel CPC-PCIe):

```
ems_pci 0000:03:00.0: enabling device (0000 -> 0002)
ems_pci 0000:03:00.0: Channel #1 at 0x00000000d3e59998, irq 18
ems_pci 0000:03:00.0: Channel #2 at 0x00000000b9526421, irq 18
```

Before the interface can be used in an application it must be configured using the "ip" command:

First the baud rate is set to i.e. 125kBaud:

```
ip link set can0 type can bitrate 125000
```

Then the interface is set up:

```
ip link set up can0
```

Now received CAN messages can be shown with the following command:

```
candump can0
```

Useful links:

An introduction is given here:

en.wikipedia.org/wiki/SocketCAN

The can-utils can be found here:

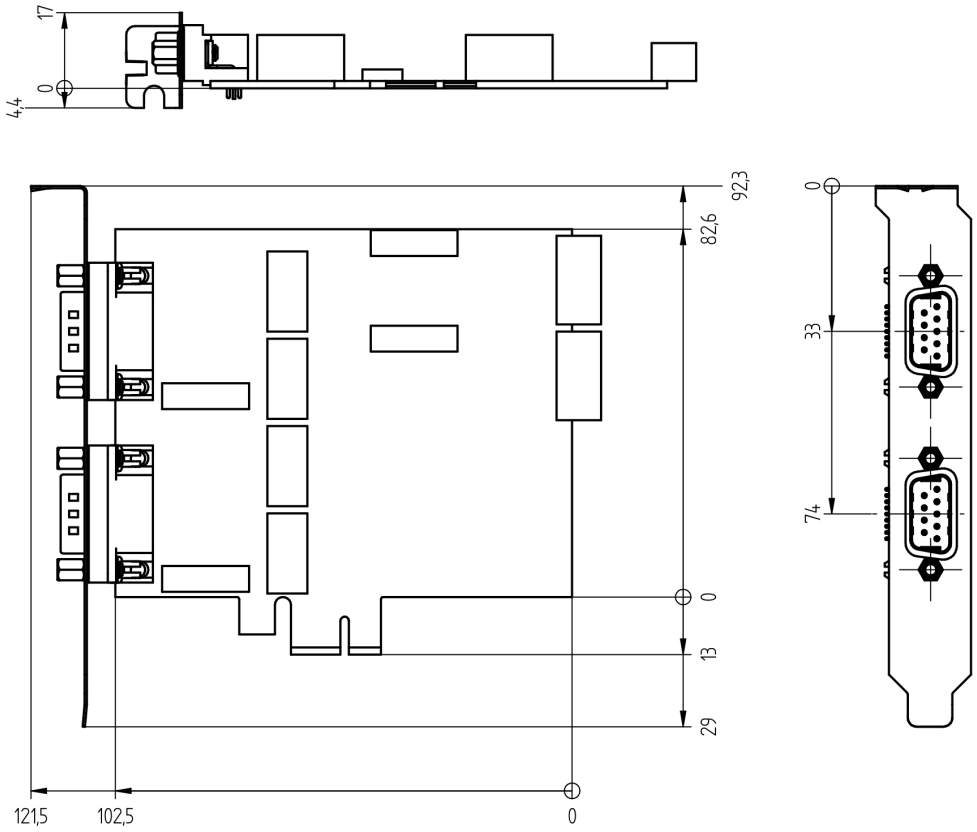
www.github.com/linux-can/can-utils/

Also a good introduction is in the kernel documentation:

/usr/src/linux/Documentation/networking/can.txt

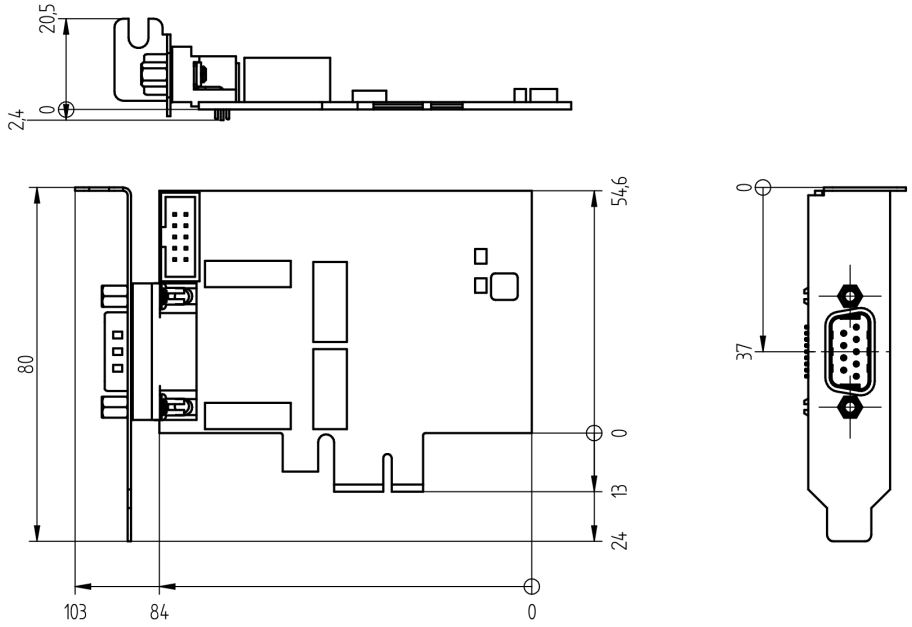
4.5 Dimensions CPC-PCIe

Four channel version



4.6 Dimensions CPC-PCIe low profile

Two channel version



5 Appendix

5.1 Instruction for Disposal

Electronic Equipment Act (WEEE)

EMS is selling its products exclusively to commercial customers. This is the reason why all devices are designed for commercial use and have to be disposed appropriately. In accordance to § 10 para. 2 clause 3 Electronic Equipment Act (WEEE) the disposal of EMS products is regulated the following way.

The equipment must not be disposed at the public collection points. In accordance with the applicable law the disposal has to be done by the customer for own account. The same applies to products, which have been sold to third parties, if those parties do not take care of a disposal in accordance to the applicable law. As an alternative the products can be returned to EMS free of charge.

5.2 FCC Statement

CPC-PCIe has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Testing for 'CPC-PCIe low profile' is pending.

5.3 CE Conformity

Declaration of Conformity

CE

The manufacturer

EMS Dr. Thomas Wünsche e.K.
Sonnenhang 3
85304 Ilmmünster

hereby declares, that the following products:

Name	Article Number	Serial
CPC-PCIe/SJA1000S	10-13-200-xx	>0000011
CPC-PCIe/SJA1000S-GTI	10-13-201-xx	>0000011
CPC-PCIe/SJA1000D	10-13-210-xx	>0000011
CPC-PCIe/SJA1000D-GTID	10-13-211-xx	>0000011
CPC-PCIe/SJA1000D-GTI2S	10-13-212-xx	>0000011
CPC-PCIe/SJA1000Q	10-13-230-xx	>0000011
CPC-PCIe/SJA1000Q-GTIS	10-13-232-xx	>0000011
CPC-PCIe/SJA1000S low profile	10-13-240-xx	>0000011
CPC-PCIe/SJA1000S-GTIS low profile	10-13-241-xx	>0000012
CPC-PCIe/SJA1000D-GTI2S low profile	10-13-244-xx	>0000011

meet the requirements of the following standards:

Electromagnetic Immunity

EN 55035:2018-04; VDE 0878-35:2018-04 – Electromagnetic compatibility of multimedia equipment – Immunity requirements (CISPR 35:2016, modified); German version EN 55035:2017

Electromagnetic Emission
EN 55032:2016-02; VDE 0878-32:2016-02 – Electromagnetic compatibility of multimedia equipment – Emission Requirements (CISPR 32:2015); German version EN 55032:2015

and therefore conform with the EU requirements on:

Electromagnetic compatibility (2014/30/EG)

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities.

RoHS 3

The RoHS 3 (EU 2015/863) commits manufacturers of „Electrical and Electronic Equipment" (EEE) to secure compliance with the RoHS Directive before placing a CE mark.

Based on technical documentation and to the best of our knowledge, we hereby confirm that the above mentioned products do not contain any of the restricted substances according to Article 4 of the RoHS Directive in excess of the maximum concentration values tolerated by weight in any of their homogeneous materials.

Ilmmünster, 29.06.2022

Dr. Thomas Wünsche

EMS Thomas Wünsche