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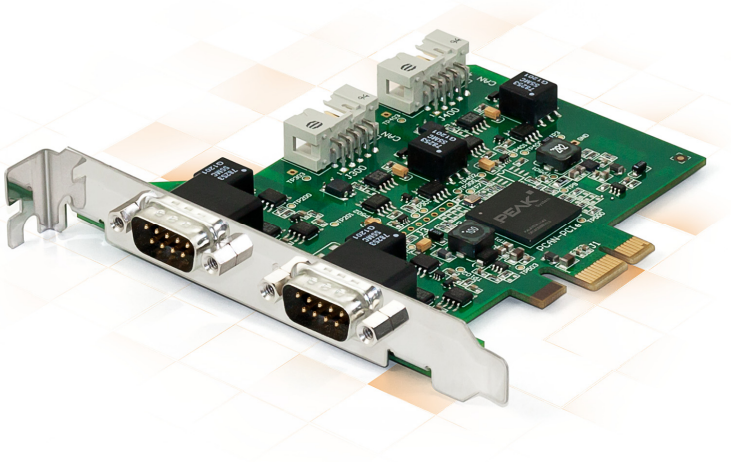
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Find the *PEAK System PCAN-PCIe Single Channel* at our website: *Click HERE*

PCAN-PCI Express

CAN Interface for PCI Express

User Manual



Document version 3.6.0 (2019-03-20)

PEAK System

Relevant products

Product name	Model	Part number	Ser. no.
PCAN-PCI Express Single Channel galv. isolated	One CAN channel	IPEH-003026	starting at 01000
PCAN-PCI Express Dual Channel galv. Isolated	Two CAN channels	IPEH-003027	
PCAN-PCI Express Four Channel galv. isolated	Four CAN channels	IPEH-003040	

The cover picture shows the product PCAN-PCI Express Four Channel galvanic isolated. Other product versions have an identical form factor but vary in equipment.

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PEAK-System Technik GmbH
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29

www.peak-system.com
info@peak-system.com

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1 Introduction

The PCAN-PCI Express card enables the connection of a PC with PCI Express slots to CAN networks. There is galvanic isolation of up to 500 Volts between the computer and CAN sides. There are versions with one, two and four channels.

The monitor software PCAN-View and the programming interface PCAN-Basic for the development of applications with CAN connection are included in the scope of supply.

Device drivers exist for different operating systems, so programs can easily access a connected CAN bus.



Tip: At the end of this manual (Appendix C) you can find a Quick Reference with brief information about the installation and operation of the PCAN-PCI Express card.

1.1 Properties at a Glance

- PC plug-in card (PCIe x1) for PCI Express slots
- 1, 2 or 4 High-speed CAN channels (ISO 11898-2)
- Bit rates from 5 kbit/s up to 1 Mbit/s
- Compliant CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- CAN bus connection via D-Sub, 9-pin (in accordance with CiA® 303-1)
- FPGA implementation of the CAN controller (SJA1000 compatible)
- NXP PCA82C251 CAN transceiver

- Galvanic isolation on the CAN connection up to 500 V, separate for each CAN channel
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

Note: This manual describes the use of the PCAN-PCI Express card with **Windows**. You can find device drivers for **Linux** and the corresponding application information on the provided DVD in the directory branch `Develop` and on our website under www.peak-system.com/linux.

1.2 System Requirements

- A vacant PCI Express slot in the computer
- Operating system Windows 10, 8.1, 7 (32/64-bit) or Linux (32/64-bit)

1.3 Scope of Supply

- PCAN-PCI Express card
- Slot bracket with D-Sub connectors for the CAN bus (only four-channel version)
- Device drivers for Windows 10, 8.1, 7 and Linux (32/64-bit)
- CAN monitor PCAN-View for Windows
- Programming interface PCAN-Basic for developing applications with CAN connection

- Programming interfaces for standardized protocols from the automotive sector
- Manual in PDF format

2 Installing the Software and the Card

This chapter covers the software setup for the PCAN-PCI Express card in Windows and the installation of the card in the computer.

Install the driver before you install the card.

- Do the following to install the driver:

  1. Start `Intro.exe` from the root directory of the DVD.

     The navigation program starts.
  2. Select in the main menu **Drivers** and click on **Install now**.
  3. Confirm the message of the User Account Control related "Installer database of PEAK Drivers".

     The driver setup starts.
  4. Follow the program instructions.

- Do the following to install the card:



Attention! Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

  1. Four-channel version only: Connect the 10-pin connector of CAN ports 3 and 4 with a cable from the slot bracket.
  2. Shut down the computer.
  3. Disconnect the computer's power supply.
  4. Open the computer case.

5. Four-channel version only: The additional slot bracket with connectors used by the four-channel version needs a further place.
6. Insert the PCI Express card into an available PCI Express slot.
7. Close the computer case.
8. Reconnect the computer power supply.
9. Turn on the computer and start Windows.

Windows detects the new hardware and completes the driver installation.

Do the following to check the operational readiness:

1. Open the Windows Start menu.
2. Type `peakcpl` and press Enter.

The information window for PEAK hardware appears. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

3 Connecting the CAN Bus

3.1 Connection over D-Sub connector

A High-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The pin assignment for CAN corresponds to the specification CiA® 303-1.

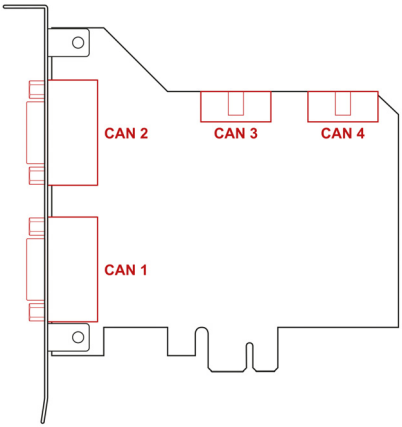


Figure 1: Position of the sockets for the CAN connection, CAN 3 (upper left position), CAN 4 (upper right position)

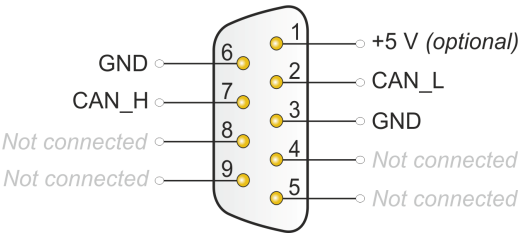


Figure 2: Pin assignment of High-speed CAN connection (view onto a male connector on the PCAN-PCI Express card)

Low power devices (e.g. bus converters) can be supplied directly with 5 volts over pin 1 of the CAN connector. Pin 1 is not in use at the delivery state. For more information see the next section 3.2.

Tip: Connect a CAN bus with a different transmission standard via a bus converter. PEAK-System offers different bus converter modules like the PCAN-TJA1054 for a Low-speed CAN bus according to ISO 11898-3.

The pin assignment between the D-Sub port and the 10-pin connector on the PCAN-PCI Express Four Channel card for channel 3 and 4 is as follows:

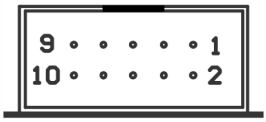


Figure 3: Numbering at the 10-pin connector

Pin	Assignment	Assignment D-Sub
1	+5 V (optional)	1
2	GND	6
3	CAN_L	2
4	CAN_H	7
5	GND	3
6	not connected	8
7	not connected	4
8	not connected	9
9	not connected	5
10	not connected	

3.1.1 Slot Bracket with D-Sub Connectors



Figure 4: Dual channel slot bracket

Four-channel version only: To connect a CAN bus to the PCAN-PCI Express card, use the supplied slot bracket. After you have connected the cables from the slot bracket with the 10-pin sockets of CAN port 3 and 4, you can connect the CAN buses with the D-Sub sockets.

3.2 Voltage Supply of External Devices

External devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector (independently for each connector on the dual or four-channel version). With a solder bridge per CAN channel on the PCAN-PCI Express board, a 5-Volt supply can optionally be routed to pin 1 of the D-Sub connector. The current output is limited to 50 mA.

➧ Do the following to activate the voltage supply:

Risk of short circuit! Solder with great care to avoid unwanted short circuits on the card.

Attention! Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

Set the solder bridges corresponding to the desired settings.

Figure 5 shows the solder field positions on the card. The table below contains the possible settings.

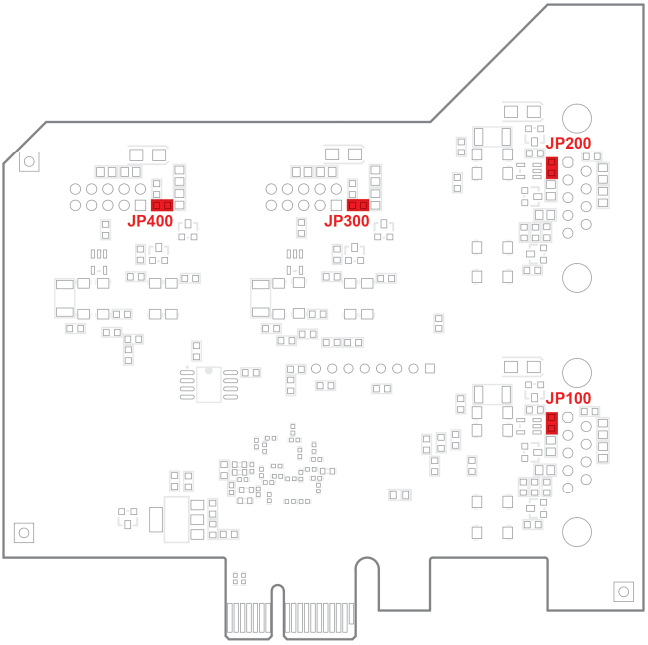


Figure 5: Position of the solder fields on the board's bottom side for a 5-Volt supply at the CAN connection

D-Sub connector	Solder field	5-Volt supply	
		Without (Standard)	With (Pin 1)
CAN 1	JP100		
CAN 2	JP200		
CAN 3	JP300		
CAN 4	JP400		

Risk of short circuit! The 5-Volt supply is not protected separately. Therefore, turn off the computer before you connect and disconnect CAN cables or peripheral systems.

3.3 Cabling

3.3.1 Termination

The High-speed CAN bus (ISO 11898-2) must be terminated with 120 ohms at both ends. The termination prevents interfering signal reflections and ensures the proper operation of the transceiver of the connected CAN nodes (CAN interface, control device).

The PCAN-PCI Express card does not have an internal termination. Use the card on a terminated CAN bus.

3.3.2 Example of a Connection

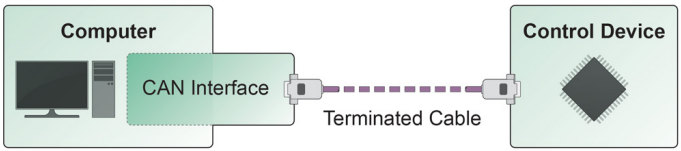


Figure 6: Simple CAN connection

In this example, the PCAN-PCI Express card is connected with a control unit by a cable that is terminated with 120 ohms at both ends.

3.3.3 Maximum Bus Length

High-speed CAN networks may have bit rates of up to 1 Mbit/s. The maximum bus length depends primarily on the bit rate.

The following table shows the maximum possible CAN bus length at different bit rates:

Bit rate	Bus length
1 Mbit/s	40 m
500 kbit/s	110 m
250 kbit/s	240 m
125 kbit/s	500 m
50 kbit/s	1.3 km
20 kbit/s	3.3 km
10 kbit/s	6.6 km
5 kbit/s	13.0 km

The listed values have been calculated on the basis of an idealized system and can differ from reality.

4 Software and API

This chapter covers the provided software PCAN-View and the programming interface PCAN-Basic.

4.1 Monitor Software PCAN-View

PCAN-View is simple Windows software for viewing, transmitting, and logging CAN and CAN FD messages.

Note: This chapter describes the use of PCAN-View with a CAN adapter.

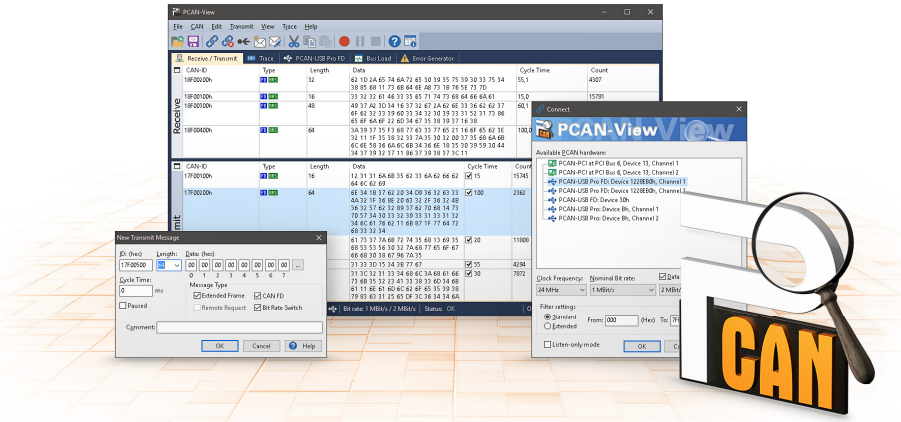


Figure 7: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

1. Open the Windows Start menu and select **PCAN-View**.

   The **Connect** dialog box appears.

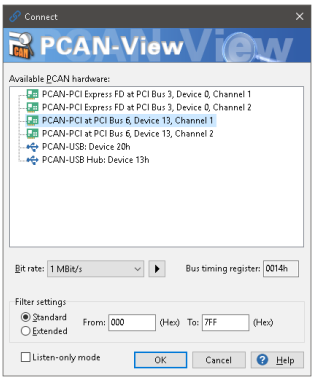


Figure 8: Selection of the hardware and parameters

2. Select an interface from the list.
3. From the drop-down list, select the **Bit rate** that is used by all nodes on the CAN bus.

Tip: You can create custom bit rates by using the button (▸).

4. Under **Filter settings** you can limit the range of CAN IDs to be received, either for standard frames (11-bit IDs) or for extended frames (29-bit IDs).
5. Activate the **Listen-only mode** if you do not actively participate in the CAN traffic and just want to observe. This also avoids an unintended disruption of an unknown CAN environment (e.g. due to different bit rates).
6. Confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 9).

4.1.1 Receive/Transmit Tab

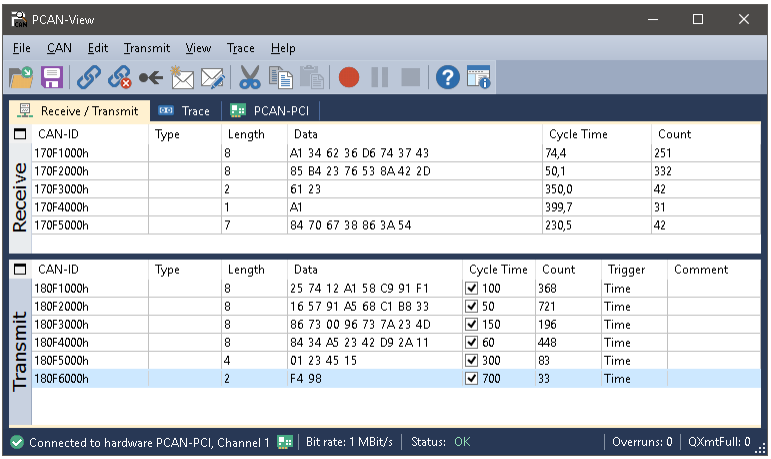


Figure 9: Receive/Transmit Tab

The **Receive/Transmit** tab is the main element of PCAN-View. It contains two lists, one for received messages and one for the transmit messages. The CAN data format is hexadecimal by default.

Do the following to transmit a CAN message with PCAN-View:

1. Select the menu command **Transmit** > **New Message** (alternatively or Ins).

   The **New Transmit Message** dialog box appears.

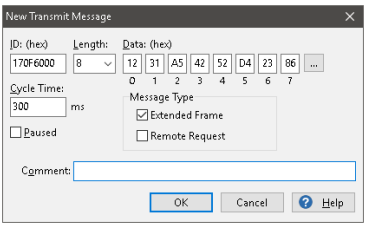


Figure 10: Dialog box new transmit message

2. Enter the **ID**, the data **Length,** and the CAN message **Data**.

Note: With the program version 4 of PCAN-View, the DLC field was renamed to **Length**. Latter reflects the actual data length.

3. Enter a value into the **Cycle Time** field to choose manually or periodically message transmission. Enter a value greater than 0 to transmit periodically. Enter the value 0 to transmit only manually.
4. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.
5. Trigger selected transmit messages manually with the menu command **Transmit** > **Send** (alternatively Space bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.

Tip: Under the menu command **File > Save,** you can save the current transmit messages into a transmit list. Saved transmit lists are available for reuse.

4.1.2 Trace Tab

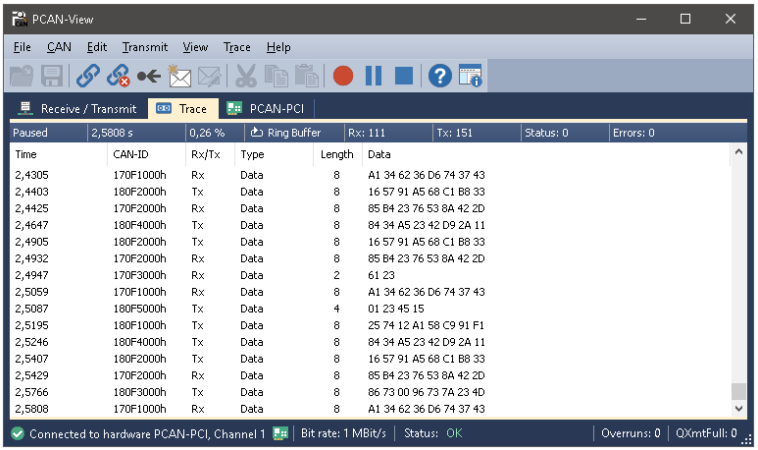


Figure 11: Trace Tab

On the **Trace** tab, the data tracer (data logger) of PCAN-View is used for logging the communication on a CAN bus. During this process the messages are cached in the working memory of the PC. Afterwards they can be saved to a file.

The Tracer runs either in linear or in ring buffer mode. The linear buffer mode stops the Tracer as soon as the buffer is full. The ring buffer mode overwrites the oldest messages by new ones as soon as the buffer is full.

4.1.3 PCAN-PCI Express Tab

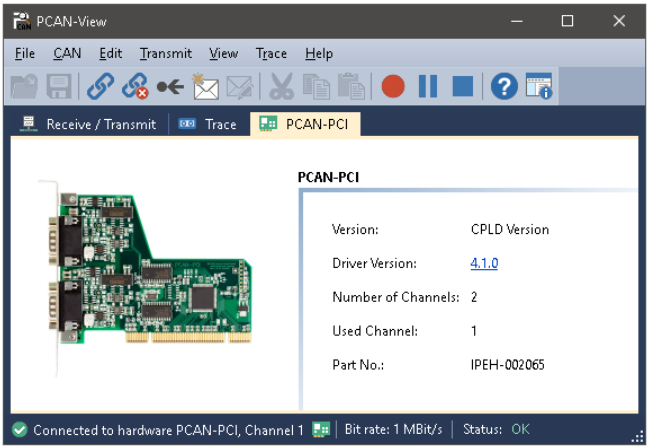


Figure 12: PCAN-PCI tab (example)

The **PCAN-PCI Express** tab contains some detailed information about the hardware and driver.

4.1.4 Status Bar



Figure 13: Display of the Status Bar

The status bar shows information about the current CAN connection, about error counters (Overruns, QXmtFull) and shows error messages.

You can find further information about the use of PCAN-View in the help which you can invoke in the program via the **Help** menu or with the F1 key.

4.2 Linking Own Programs with PCAN-Basic



Figure 14: PCAN-Basic

On the provided DVD, you can find files of the programming interface PCAN-Basic in the directory branch `Develop`. This API provides basic functions for linking own programs to CAN- and CAN FD interfaces by PEAK-System and can be used for the following operating systems:

- Windows 10, 8.1, 7 (32/64-bit)
- Windows CE 6.x (x86/ARMv4)
- Linux (32/64-bit)

The API is designed for cross-platform use. Therefore software projects can easily ported between platforms with low efforts. For all common programming languages examples are available.

Beginning with version 4, PCAN-Basic supports the new CAN FD standard (CAN with Flexible Data Rate) which is primarily characterized by higher bandwidth for data transfer.

4.2.1 Features of PCAN-Basic

- API for developing applications with CAN and CAN FD connection
- Access to the CAN channels of a PCAN-Gateway via the new PCAN-LAN device type
- Supports the operating systems Windows 10, 8.1, 7 (32/64-bit), Windows CE 6.x, and Linux (32/64-bit)
- Multiple PEAK-System applications and your own can be operated on a physical channel at the same time
- Use of a single DLL for all supported hardware types
- Use of up to 16 channels for each hardware unit (depending on the PEAK CAN interface used)
- Simple switching between channels of a PEAK CAN interface
- Driver-internal buffer for 32,768 messages per CAN channel
- Precision of time stamps on received messages up to 1 µs (depending on the PEAK CAN interface used)
- Supports PEAK-System's trace formats version 1.1 and 2.0 (for CAN FD applications)
- Access to specific hardware parameters, such as listen-only mode
- Notification of the application through Windows events when a message is received

- Extended system for debugging operations
- Multilingual debugging output
- Output language depends on operating system
- Debugging information can be defined individually
- Thread-safe API



Tip: An overview of the API functions is located in the header files. You can find detailed information about the PCAN-Basic API on the provided DVD in the text and help files (file name extensions `.txt` and `.chm`).

4.2.2 Principle Description of the API

The PCAN-Basic API is the interface between the user application and device driver. In Windows operating systems this is a DLL (Dynamic Link Library).

The sequence of accessing the CAN interface is divided into three phases:

1. Initialization
2. Interaction
3. Completion

Initialization

A channel must be initialized before using it. This is done by the simple call of the function `CAN_Initialize` for CAN and `CAN_InitializeFD` for CAN FD. Depending on the type of the CAN hardware, up to 16 CAN channels can be opened at the same time. After a successful initialization the CAN channel is ready. No further configuration steps are required.

Interaction

For receiving and transmitting messages the functions `CAN_Read` and `CAN_Write` as well as `CAN_ReadFD` and `CAN_WriteFD` are available. Additional settings can be made, e.g. setting up message filters to confine to specific CAN IDs or setting the CAN controller to listen-only mode.

When receiving CAN messages, events are used for an automatic notification of an application (client). This offers the following advantages:

- The application no longer needs to check for received messages periodically (no polling).
- The response time at reception is reduced.

Completion

To end the communication the function `CAN_Uninitialize` is called in order to release the reserved resources for the CAN channel, among others. In addition the CAN channel is marked as "Free" and is available to other applications.

4.2.3 Notes about the License

Device drivers, the interface DLL, and further files needed for linking are property of the PEAK-System Technik GmbH and may be used only in connection with a hardware component purchased from PEAK-System or one of its partners. If a CAN hardware component of third-party suppliers should be compatible to one of PEAK-System, then you are not allowed to use or to pass on the driver software of PEAK-System.

If a third-party supplier develops software based on the PCAN-Basic and problems occur during the use of this software, consult the software provider.

5 Technical Specifications

Connectors	
Computer	PCI Express x1 (1 Lane), Specification 1.1
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 303-1

CAN	
Specification	ISO 11898-2, High-speed CAN 2.0A (standard format) and 2.0B (extended format)
Bit rates	5 kbit/s - 1 Mbit/s
Controller	FPGA implementation (SJA1000 compatible)
Transceiver	NXP PCA82C251
Galvanic isolation	up to 500 V, separate for each CAN channel
Supplying external devices	D-Sub pin 1; 5 V, max. 50 mA not assigned at delivery
Internal Termination	none

Measures	
Size	PCB: 121 x 114 mm (H x W) See also dimension drawing in Appendix B on page 30
Weight	PCAN-PCI Express Single Channel: 55 g PCAN-PCI Express Dual Channel: 66 g PCAN-PCI Express Four Channel: 73 g

Power supply			
Current consumption		at 3.3-V pin	at 12-V pin
	Product version		
	Single Channel:	265 mA	max. 50 mA
	Dual Channel:	265 mA	max. 80 mA
	Four Channel:	300 mA	max. 150 mA

Environment	
Operating temperature	-40 - +85 °C
Temperature for storage and transport	-40 - +125 °C
Relative humidity	15 - 90 %, not condensing

Conformity	
EMV	Directive 2014/30/EU DIN EN 55024:2016-05 DIN EN 55032:2016-02
RoHS 2	Directive 2011/65/EU DIN EN 50581 VDE 0042-12:2013-02

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name: PCAN-PCI Express

Item number(s): IPEH-003026/27, serial numbers starting at 01000
IPEH-003040

Manufacturer: PEAK-System Technik GmbH
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

CE We declare under our sole responsibility that the mentioned product is in conformity with the following directives and the affiliated harmonized standards:

EU Directive 2011/65/EU (RoHS 2)

DIN EN 50581 VDE 0042-12:2013-02
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances;
German version EN 50581:2012

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 55024:2016-05
Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010 + Cor.:2011 + A1:2015);
German version EN 55024:2010 + A1:2015

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

Darmstadt, 22 February 2019

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawing

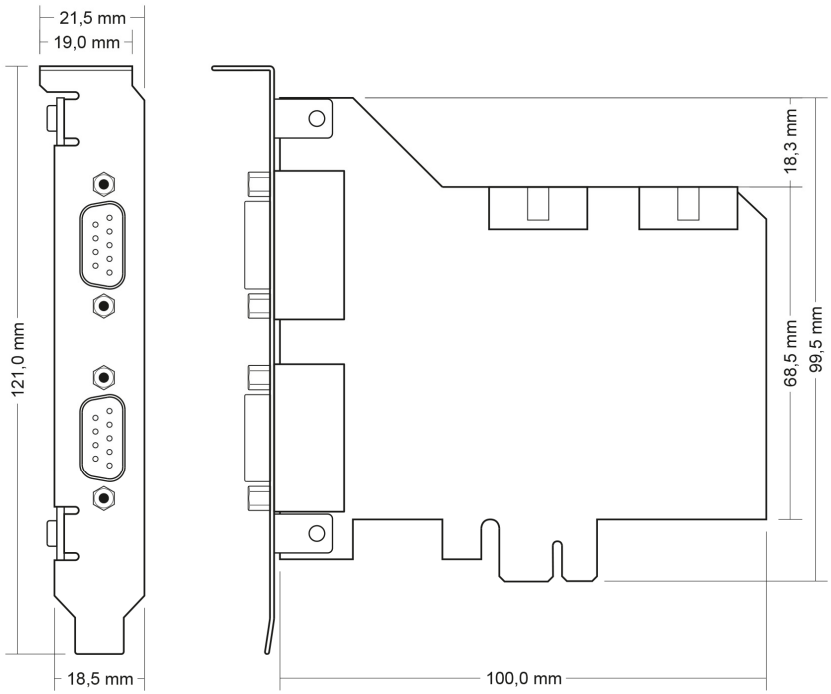


Figure 15: Dimension drawing PCAN-PCI Express

The figure does not show the actual size of the product.

Appendix C Quick Reference

Software/Hardware Installation under Windows

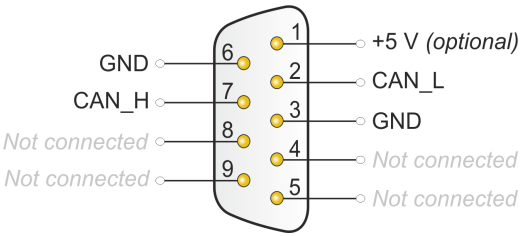
Install the driver from the supplied DVD, before you insert the plug-in card. Turn off the computer and insert the PCAN-PCI Express into an available PCI Express slot.

The new hardware is detected at the next Windows start and the driver is initialized. Check the operational readiness. Open the Windows Start menu. Type `peakcpl` and press Enter.
An information window for PEAK Hardware opens. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

Getting Started under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the card. For initialization of the PCI Express card select the desired CAN channel and CAN bit rate.

High-speed CAN connector (D-Sub, 9 pins)



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