

PCAN-ExpressCard

CAN Interface for the
ExpressCard Slot

User Manual



Document version 2.4.1 (2017-02-08)

PEAK
System

Relevant products

Product name	Model	Part number
PCAN-ExpressCard Single Channel	One CAN channel	IPEH-003000
PCAN-ExpressCard Dual Channel	Two CAN channels	IPEH-003001
PCAN-ExpressCard Single Channel galvanically decoupled	One CAN channel, galvanic isolation for CAN connection	IPEH-003002
PCAN-ExpressCard Dual Channel galvanically decoupled	Two CAN channels, galvanic isolation for CAN connections	IPEH-003003

The cover picture shows the product PCAN-ExpressCard Dual Channel. Other product models have an identical form factor but vary in the number of CAN connectors according to the model.

CANopen® and CiA® are registered community trade marks of CAN in Automation e.V.

All other product names mentioned in this document may be the trademarks or registered trademarks of their respective companies. They are not explicitly marked by "™" and "®".

Copyright © 2017 PEAK-System Technik GmbH

Duplication (copying, printing, or other forms) and the electronic distribution of this document is only allowed with explicit permission of PEAK-System Technik GmbH. PEAK-System Technik GmbH reserves the right to change technical data without prior announcement. The general business conditions and the regulations of the license agreement apply. All rights are reserved.

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

Document version 2.4.1 (2017-02-08)

Contents

1	Introduction	5
1.1	Properties at a Glance	5
1.2	Prerequisites for Operation	6
1.3	Scope of Supply	6
2	Installing the Software and the Card	7
3	Connecting the CAN Bus	8
3.1	Connection over D-Sub Connector	8
3.2	Voltage Supply of External Devices	8
3.3	Cabling	9
3.3.1	Termination	9
3.3.2	Example of a Connection	9
3.3.3	Maximum Bus Length	10
4	Operation	11
4.1	Status LED	11
4.2	Removing the Adapter	11
5	Software and API	12
5.1	Monitor Software PCAN-View	12
5.1.1	Receive/Transmit Tab	14
5.1.2	Trace Tab	16
5.1.3	PCAN-ExpressCard Tab	17
5.1.4	Status Bar	18
5.2	Linking Own Programs with PCAN-Basic	19
5.2.1	Features of PCAN-Basic	20
5.2.2	Principle Description of the API	21
5.2.3	Notes about the License	22
6	Technical Specifications	23

Appendix A	CE Certificate	25
Appendix B	Dimension Drawing	26
Appendix C	Quick Reference	27

1 Introduction

The PCAN-ExpressCard provides a connection between a CAN bus and a laptop or desktop PC with an ExpressCard slot. The card is available in single and dual-channel versions. There are also galvanically separated versions which guarantee galvanic separation up to a maximum of 300 Volts between the PC and CAN sides.

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 you can find a Quick Reference (on page 27) with brief information about the installation and operation of the PCAN-ExpressCard.

1.1 Properties at a Glance

- └ Card for ExpressCard slot
- └ Form factor ExpressCard/54
- └ 1 or 2 High-speed CAN channels (ISO 11898-2)
- └ Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- └ Bit rates from 5 kbit/s up to 1 Mbit/s
- └ CAN bus connection via D-Sub, 9-pin (in accordance to CiA® 303-1)
- └ NXP SJA1000 CAN controller, 16 MHz clock frequency

- └ NXP PCA82C251 CAN transceiver
- └ Software option to switch a 5-Volt supply to the CAN connection, e.g. for external bus converter
- └ Galvanic isolation on the CAN connection up to 300 V (only galvanically decoupled models), separate for each CAN channel
- └ Operating temperature range from 0 to 70 °C (32 to 158 °F)



Note: This manual describes the use of the PCAN-ExpressCard 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 Prerequisites for Operation

- └ ExpressCard slot in the computer, type ExpressCard/54
- └ Operating system Windows 10, 8.1, 7 (32/64-bit) or Linux (32/64-bit)

1.3 Scope of Supply

- └ PCAN-ExpressCard CAN interface
- └ Device drivers for Windows 10, 8.1, 7 (32/64-bit) 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-ExpressCard under Windows and the installation in the computer.

Install the driver before you install the adapter.

▶ 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 adapter:

1. Insert the PCAN-ExpressCard into an ExpressCard slot of your computer. The computer can remain powered on.
Windows notifies that new hardware has been detected. The drivers are found and installed by Windows automatically.
2. Check the LED on the adapter. If the LED (one for each CAN channel) is red, then the driver was initialized successfully.

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 corresponds to the specification CiA® 303-1.

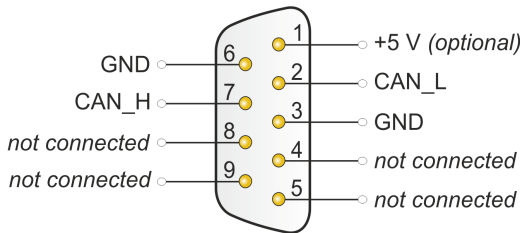


Figure 1: Pin assignment High-speed CAN

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 (for the Dual Channel model simultaneously with both CAN connectors). With the provided Windows software PCAN-View, the 5-Volt supply can be activated onto pin 1 of the D-Sub CAN connector.

The galvanically decoupled models of the card have an interconnected DC/DC converter. Therefore, the current output is limited to 50 mA.

You find further information about the use of this option in PCAN-View in section 5.1.3 on page 17.

3.3 Cabling

3.3.1 Termination

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN interface, control device) will not work.

The PCAN-ExpressCard does not have an internal termination. Use the adapter on a terminated CAN bus.

3.3.2 Example of a Connection

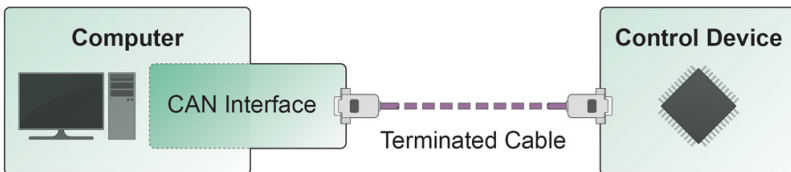


Figure 2: Simple CAN connection

This example shows a connection between the PCAN-ExpressCard and a control unit. The connection cable 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 operation

4.1 Status LED

The PCAN-ExpressCard has a status LED for each existing CAN channel which may be in one of the following conditions:

Status LED	Meaning
On	There's a connection to a driver of the operating system.
Slow blinking	A software application is connected to the CAN channel.
Quick blinking	Data is transmitted via the connected CAN bus.

4.2 Removing the Adapter

Under Windows the icon for removing hardware safely is not used with the PCAN-ExpressCard. You may remove the card from the computer without any preparation under Windows.

5 software and API

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

5.1 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.

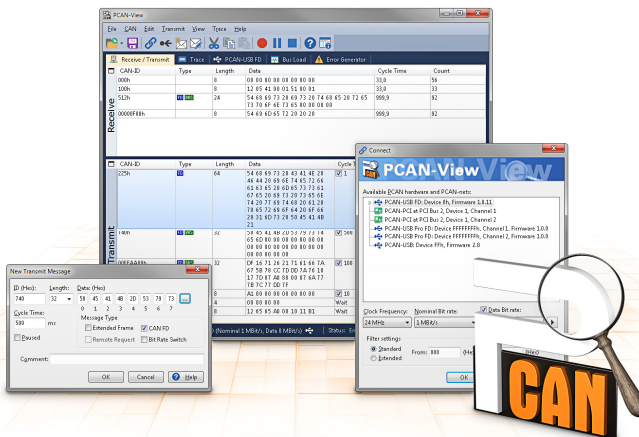


Figure 3: PCAN-View for Windows

▶ Do the following to start and initialize PCAN-View:

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

The **Connect** dialog box appears.

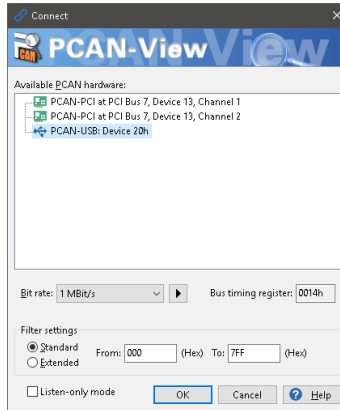


Figure 4: Selection of the specific hardware and parameters

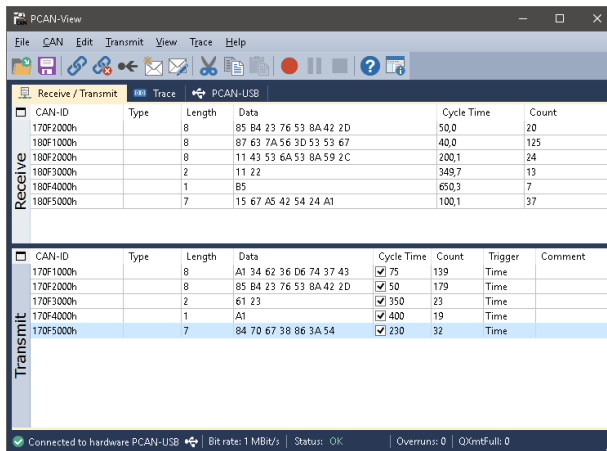
2. Select an interface from the list.
3. From the dropdown list, select the **Bit rate** that is used by all nodes on the CAN bus.



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 5).

5.1.1 Receive/Transmit Tab




CAN-ID	Type	Length	Data	Cycle Time	Count
170F2000h		8	85 B4 23 76 53 8A 42 2D	50,0	20
180F1000h		8	87 63 7A 56 3D 53 53 67	40,0	125
180F2000h		8	11 43 53 6A 53 8A 59 2C	200,1	24
180F3000h		2	11 22	349,7	13
180F4000h		1	B5	650,3	7
180F5000h		7	15 67 A5 42 54 24 A1	100,1	37

CAN-ID	Type	Length	Data	Cycle Time	Count	Trigger	Comment
170F1000h		8	A1 34 62 36 D6 74 37 43	<input checked="" type="checkbox"/> 75	139	Time	
170F2000h		8	85 B4 23 76 53 8A 42 2D	<input checked="" type="checkbox"/> 50	179	Time	
170F3000h		2	61 23	<input checked="" type="checkbox"/> 350	23	Time	
180F4000h		1	A1	<input checked="" type="checkbox"/> 400	19	Time	
170F5000h		7	84 70 67 38 86 3A 54	<input checked="" type="checkbox"/> 230	32	Time	

Figure 5: 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.

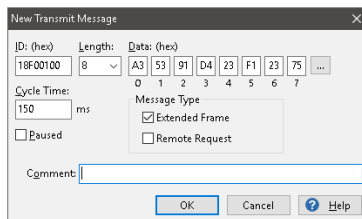


Figure 6: Dialog box new transmit message

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. You 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: Using the menu command **File > Save** the current transmit messages can be saved to a list and loaded for reuse later on.

5.1.2 Trace Tab

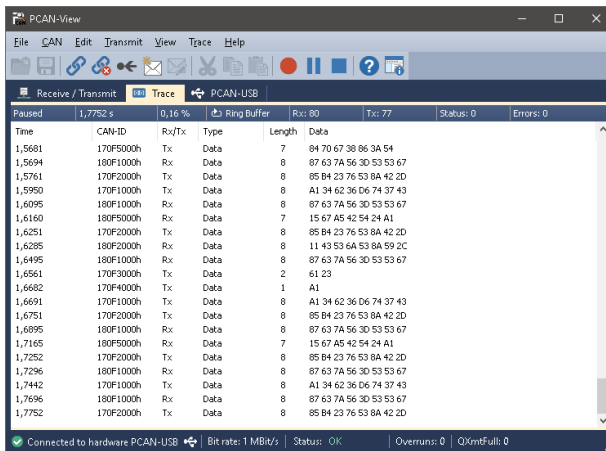


Figure 7: Trace tab

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.

5.1.3 PCAN-ExpressCard Tab

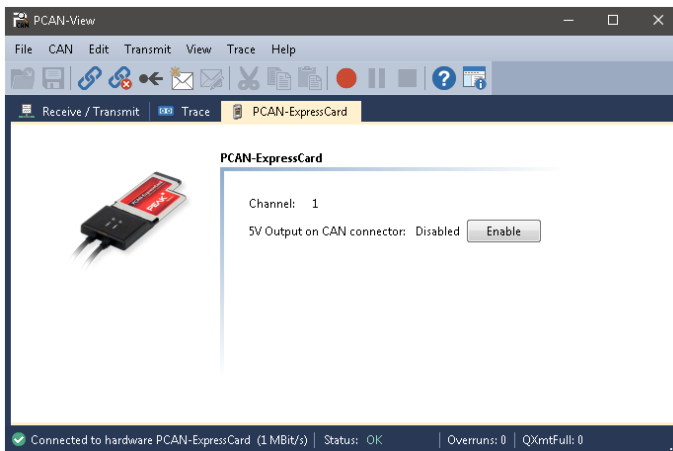


Figure 8: PCAN-ExpressCard tab

On the **PCAN-ExpressCard** tab, the 5-Volt supply on pin 1 of the D-Sub CAN connector is enabled or disabled. For the Dual Channel model the setting is valid for both CAN connectors simultaneously. You find information about technical details in section 3.2 on page 8.

▶ Do the following to activate the voltage supply:

Press the button **Enable** / **Disable** to change the settings.



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.

Consider that some computers still supply the USB ports with power even when they are turned off (standby operation).

5.1.4 Status Bar



Figure 9: Example 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.

5.2 Linking Own Programs with PCAN-Basic

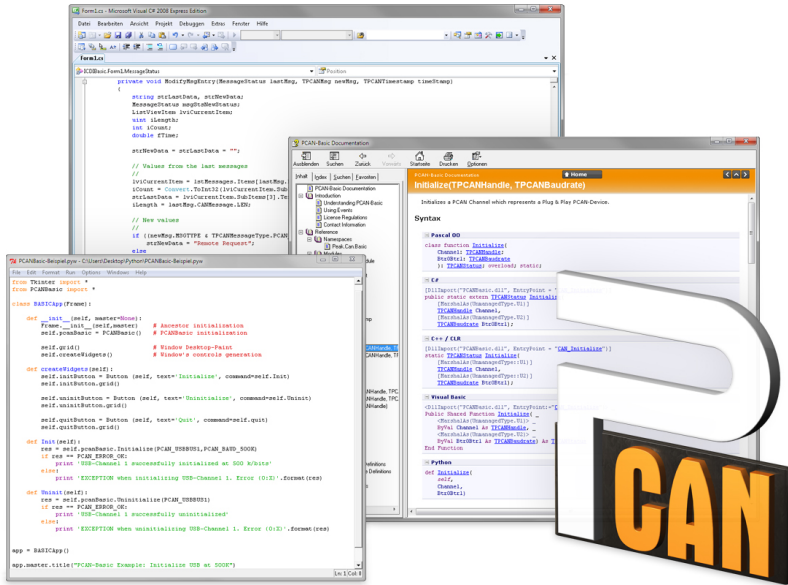


Figure 10: PCAN-Basic

On the provided DVD, you can find files of the PCAN-Basic programming interface 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 be 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.

5.2.1 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 μ s (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



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`).

5.2.2 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.

5.2.3 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.

6 Technical specifications

Connectors

Computer	ExpressCard slot, type ExpressCard/54
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	NXP SJA1000
Transceiver	NXP PCA82C251
Galvanic isolation	PCAN-ExpressCard: none PCAN-ExpressCard opto: Galvanic isolation up to 300 V (separate for each CAN channel)
Supplying external devices	PCAN-ExpressCard: D-Sub pin 1; 5 V, max. 100 mA PCAN-ExpressCard opto: D-Sub pin 1; 5 V, max. 50 mA Switched off at delivery
Internal termination	none

Power supply

Current consumption (max.)		
	on 1.5-V pin	on 3.3-V pin
Product model		
Single Channel:	142 mA	245 mA
Dual Channel:	142 mA	296 mA
Single Channel opto:	142 mA	273 mA
Dual Channel opto:	142 mA	335 mA

Measures

Size (without cables)	130 x 54 x 10 mm (L x W x D) See also dimension drawing in Appendix B on page 26
Weight	Product model Single Channel: 60 g Dual Channel: 80 g Single Channel opto: 60 g Dual Channel opto: 80 g

Environment

Operating temperature	0 - 70 °C (32 - 158 °F)
Temperature for storage and transport	-30 - 100 °C (-22 - 212 °F)
Relative humidity	15 - 90 %, not condensing
EMC	Directive 2014/30/EU DIN EN 55024:2016-05 DIN EN 55022:2011-12
Ingress protection (IEC 60529)	IP30

Appendix A CE Certificate

PCAN-ExpressCard IPEH-003000/01/02/03 – EC Declaration of Conformity
PEAK-System Technik GmbH



Notes on the CE Symbol

The following applies to the "PCAN-ExpressCard" product with the item number(s) IPEH-003000/01/02/03.

EU Directive This product fulfills the requirements of EU EMC Directive 2014/30/EU (Electromagnetic Compatibility) and is designed for the following fields of application as for the CE marking:

Electromagnetic Immunity

DIN EN 55024, publication date 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

Electromagnetic Emission

DIN EN 55022, publication date 2011-12
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22:2008, modified);
German version EN 55022:2010

Declarations of Conformity In accordance with the above mentioned EU Directive, the EU declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

PEAK-System Technik GmbH

Mr. Wilhelm
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29
E mail: info@peak-system.com

A handwritten signature in black ink, appearing to read "Uwe W. H.", is written over a horizontal line.

Signed this 23rd day of January 2017

Appendix B Dimension Drawing

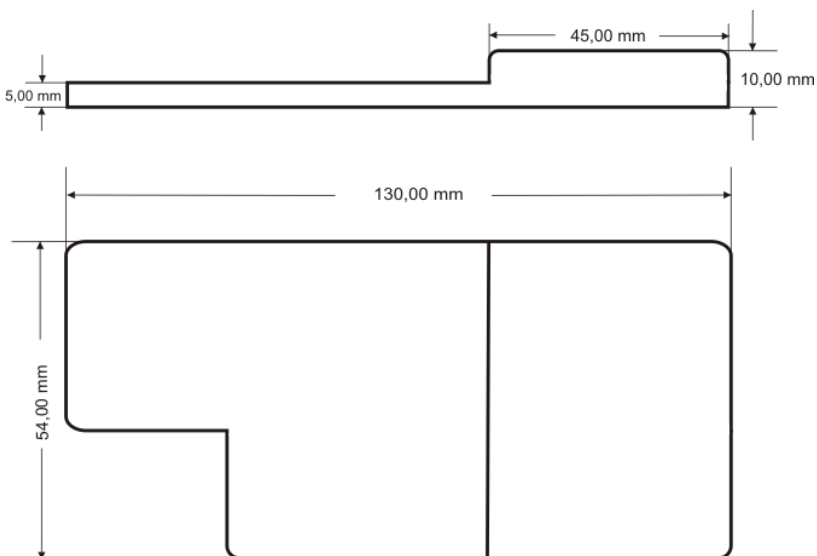


Figure 11: Side view and top view of the PCAN-ExpressCard

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 PCAN-ExpressCard into a vacant ExpressCard slot. The card is recognized by Windows and the driver is initialized. The LED (one for each CAN channel) must light red.

Getting started under windows

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

Status LED	Meaning
On	There's a connection to a driver of the operating system.
Slow blinking	A software application is connected to the CAN channel.
Quick blinking	Data is transmitted via the connected CAN bus.

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

