

PCAN-USB

USB to CAN Interface

User Manual v2.1.3



PEAK
System

Products taken into account

Product Name	Model	Part Number
PCAN-USB		IPEH-002021
PCAN-USB opto-decoupled	Galvanic isolation for CAN interface	IPEH-002022

The cover picture shows the product PCAN-USB opto-decoupled.

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1 Introduction

The PCAN-USB adapter provides one CAN channel at computers with USB ports. Device drivers and programming interfaces 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-USB adapter.

1.1 Properties at a Glance


- └ Adapter for USB connection (USB 1.1, compatible with USB 2.0)
- └ USB voltage supply
- └ Bit rates up to 1 Mbit/s
- └ Time stamp resolution approx. 42 μ s
- └ Compliant with 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® 102)
- └ NXP SJA1000 CAN controller, 16 MHz clock frequency
- └ NXP PCA82C251 CAN transceiver
- └ Galvanic isolation on the CAN connection up to 500 V (only PCAN-USB opto-decoupled)
- └ 5-Volts 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 PCAN-USB adapter 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 USB port (USB 1.1 or USB 2.0) at the computer or at a self-powered USB hub connected to the computer
- Operating system Windows 7/Vista/XP (32/64-bit) or Windows CE 6.x (x86 and ARMv4 processor support) or Linux (32/64-bit)

 **Note:** Do not use a USB extension cable to connect the PCAN-USB adapter to the computer. The use of an extension cable does not comply with the USB specification and can lead to malfunction of the adapter.

1.3 Scope of supply

- PCAN-USB in plastic casing
- Device drivers for Windows 7/Vista/XP (32/64-bit) and Linux (32/64-bit)
- Device driver for Windows CE 6.x (x86 and ARMv4 processor support)
- PCAN-View CAN monitor for Windows

- └ PCAN-Basic programming interface consisting of an interface DLL, examples, and header files for all common programming languages
- └ Manual in PDF format

2 Installing the Software and the Adapter

This chapter covers the software setup for the PCAN-USB adapter under Windows and the connection of the adapter to the computer.

Setup the driver before connecting the PCAN-USB adapter to the computer for the first time.


▶ Do the following to install the driver:

1. Make sure that you are logged in as user with administrator privileges (not needed for normal use of the PCAN-USB adapter later on).
2. Insert the supplied DVD into the appropriate drive of the computer. Usually a navigation program appears a few moments later. If not, start the file `Intro.exe` from the root directory of the DVD.
3. On the page **English > Drivers** activate the entry **PCAN-USB**.
4. Click on **Install now**. The setup program for the driver is executed.
5. Follow the instructions of the program.



Tip: If you don't want to install the CAN monitor PCAN-View for Windows onto the hard disk together with the driver, you have the option to start the program later directly from DVD without prior installation.

- ▶ Do the following to connect the PCAN-USB adapter to the computer and complete the initialization:

 **Note:** Do not use a USB extension cable to connect the PCAN-USB adapter to the computer. The use of an extension cable does not comply with the USB specification and can lead to malfunction of the adapter.

1. Connect the PCAN-USB adapter to a USB port of the computer or of a connected USB hub. The computer can remain powered on.

Windows notifies that new hardware has been detected.

2. Windows XP only: A Wizard dialog box appears. Follow its instructions. Deny the search for driver software at Windows Update and select the automatic software installation during this procedure.

All Windows operating systems: The drivers are found and installed by Windows.

3. Afterwards you can work as user with restricted rights again.

After the initialization process is finished successfully the red LED on the PCAN-USB adapter is illuminated.

3 Connecting the CAN Bus

3.1 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® 102.

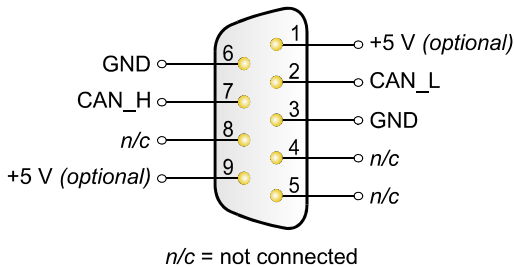


Figure 1: Pin assignment High-speed CAN
(view onto connector of the PCAN-USB adapter)

With the pins 1 and 9 devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector. At delivery these pins are not assigned. You can find a detailed description about the activation in the following section 3.2.



Tip: You can connect a CAN bus with a different transmission standard via a bus converter. PEAK-System offers different bus converter modules (e.g. PCAN-TJA1054 for a Low-speed CAN bus according to ISO 11898-3).

3.2 Supplying External Devices via the CAN Connector

On the PCAN-USB board (casing opened) a 5-Volt supply can optionally be routed to pin 1 and/or pin 9 of the D-Sub connector (PCAN-USB opto-decoupled: pin 1 only). Thus devices with low power consumption (e.g. external bus converters) can be directly supplied via the CAN connector.

When using this option the 5-Volt supply is connected to the power supply of the computer and is not fused separately. The opto-decoupled model of the adapter contains an interconnected DC/DC converter. Therefore the current output is limited to 50 mA.

▶ Proceed as follows to activate the 5-Volt supply:



Attention! Electrostatic discharge (ESD) can damage or destroy components on the PCAN-USB board. Take precautions to avoid ESD when handling the card.

In order to access the board open the casing of the PCAN-USB adapter by cautiously pushing in the latches on both sides, e.g. with a flat tip screwdriver.

Set the solder bridge(s) on the board of the PCAN-USB adapter according to the desired function. During this procedure take especially care not to produce unwanted short circuits on the board.

Figure 2 shows the positions of the solder fields JP3 on board of the PCAN-USB (IPEH-002021) and Figure 3 shows the positions of the solder field R11 on board of the PCAN-USB opto-decoupled (IPEH-002022). The tables below contain the possible settings.

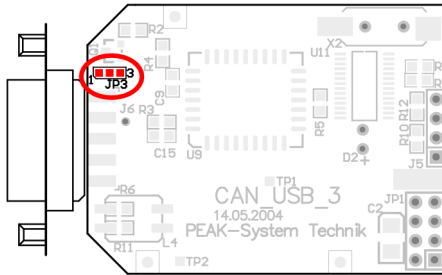


Figure 2: **PCAN-USB board (IPEH-002021)**, solder field JP3

5-Volt supply →	None	Pin 1	Pin 9	Pin 1 + Pin 9
PCAN-USB, solder field JP3				

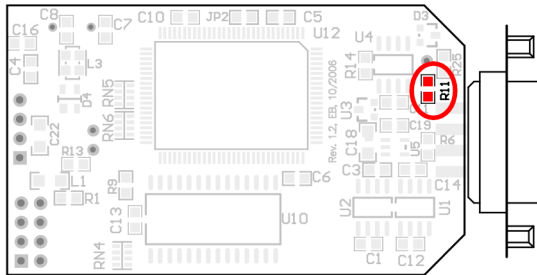


Figure 3: **Bottom side of the PCAN-USB opto-decoupled board (IPEH-002022)**, solder field R11

5-Volt supply →	None	Pin 1
PCAN-USB opto-decoupled, solder field R11		

For reassembly place the board overhead onto the top part of the casing. Ensure that the cable is lying with the strain relief in the cut-out of the casing, and that the LED is placed in the corresponding hole. Push the bottom part of the casing onto the top part (the latches click in).

⚠ Attention! Risk of short circuit! If the option described in this section is activated, you may only connect or disconnect CAN cables or peripheral systems (e.g. external bus converters) to or from the PCAN-USB adapter while it is de-energized (the adapter is not connected to the computer). Consider that some computers still supply the USB ports with power even when they are turned off (standby operation).

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

3.3.2 Example of a Connection

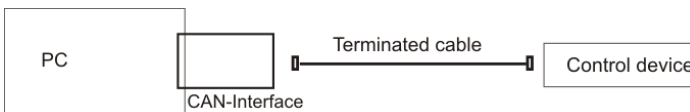


Figure 4: Simple CAN connection

In this example, the PCAN-USB adapter is connected with a control unit by a cable that is terminated 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-USB adapter has a red status LED which can be in one of the following conditions:

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

4.2 Unplugging the USB Connection

Under Windows the icon for removing hardware safely is not used with the PCAN-USB adapter. You can unplug the adapter from the computer without any preparation.

4.3 Distinguishing Several PCAN-USB Adapters

You can operate several PCAN-USB adapters on a single computer at the same time. The supplied program PCAN-View allows the assignment of device IDs in order to distinguish the adapters in a software environment. For more information see section 5.1.3 on page 21.

5 Using the software

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

5.1 CAN Monitor PCAN-View for windows

PCAN-View for Windows is a simple CAN monitor for viewing, transmitting, and logging CAN messages.

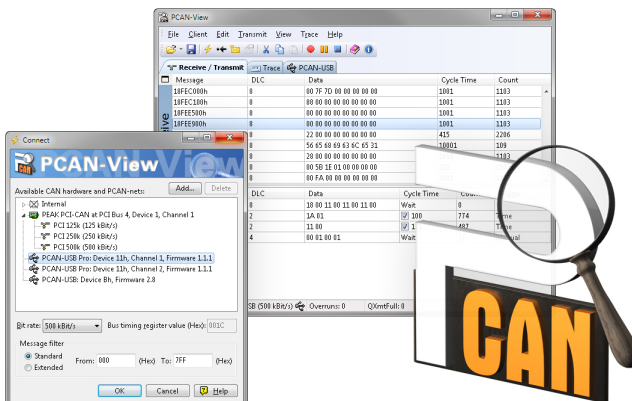


Figure 5: PCAN-View for Windows

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

1. If PCAN-View is already installed on the hard disk, open the Windows Start menu, go to **Programs > PCAN-Hardware**, and select the entry **PCAN-View**.

If you haven't installed PCAN-View together with the device driver, you can start the program directly from the supplied DVD. In the navigation program (Intro.exe) go to **English > Tools**, and under **PCAN-View for Windows** select the link **Start**.

The dialog box for selecting the CAN hardware and for setting the CAN parameters appears.

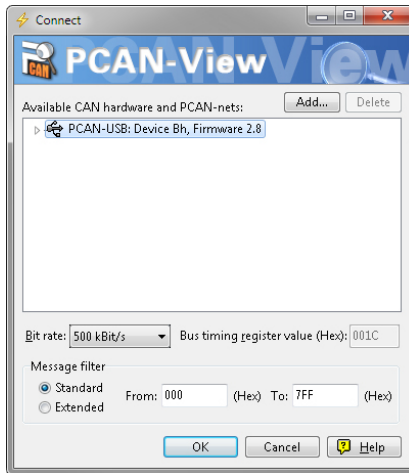
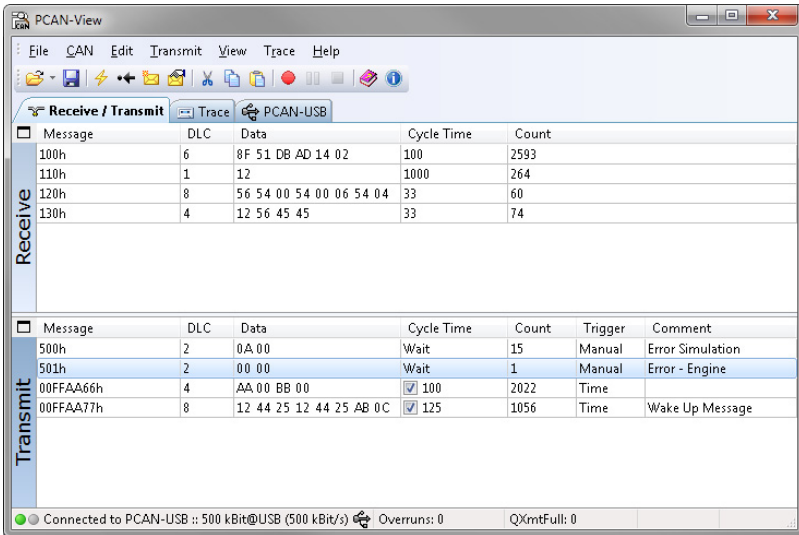


Figure 6: Selection of the CAN specific hardware and parameters

2. From the list **Available CAN hardware** select the CAN channel to be used.
3. Select the bit rate that is used by all nodes on the CAN bus from the dropdown list **Bit rate**.
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. Finally confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 7).

5.1.1 Receive/Transmit Tab



Message	DLC	Data	Cycle Time	Count
100h	6	8F 51 DB AD 14 02	100	2593
110h	1	12	1000	264
120h	8	56 54 00 54 00 06 54 04	33	60
130h	4	12 56 45 45	33	74


Message	DLC	Data	Cycle Time	Count	Trigger	Comment
500h	2	0A 00	Wait	15	Manual	Error Simulation
501h	2	00 00	Wait	1	Manual	Error - Engine
00FFAA66h	4	AA 00 BB 00	<input checked="" type="checkbox"/> 100	2022	Time	
00FFAA77h	8	12 44 25 12 44 25 AB 0C	<input checked="" type="checkbox"/> 125	1056	Time	Wake Up Message

Connected to PCAN-USB :: 500 kBit@USB (500 kBit/s) Overruns: 0 QXrmtFull: 0

Figure 7: 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. Representation of CAN data is in hexadecimal format.

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

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

The dialog box **New Transmit Message** is shown.

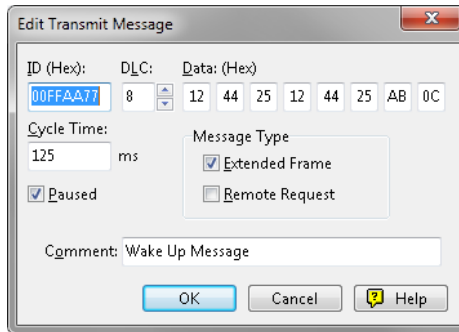


Figure 8: Dialog box New transmit message

2. Enter the ID and the data for the new CAN message.
3. The field **Cycle Time** indicates if the message shall be transmitted manually or periodically. If you want to transmit the message periodically, you must enter a value greater than 0. For a manual-only transmission enter 0.
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

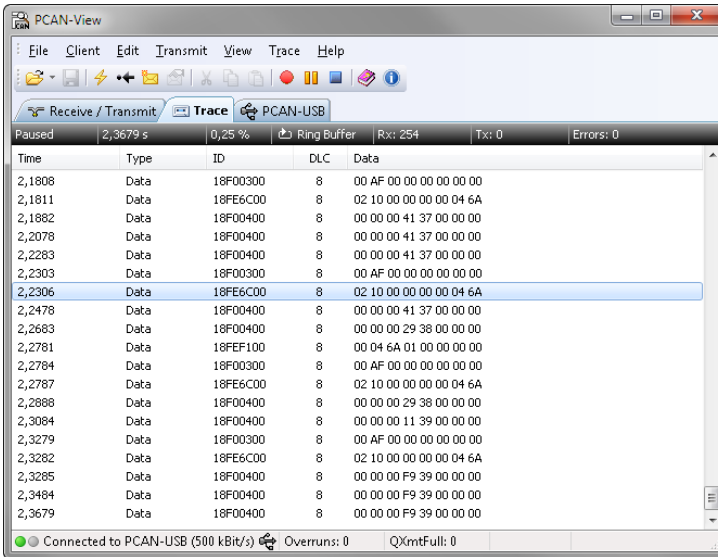


Figure 9: Trace tab

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

The tracer can be configured to run in linear or in ring buffer mode. In linear buffer mode the logging is stopped as soon as the buffer is filled completely. In ring buffer mode the oldest messages are overwritten by incoming ones.

5.1.3 PCAN-USB Tab

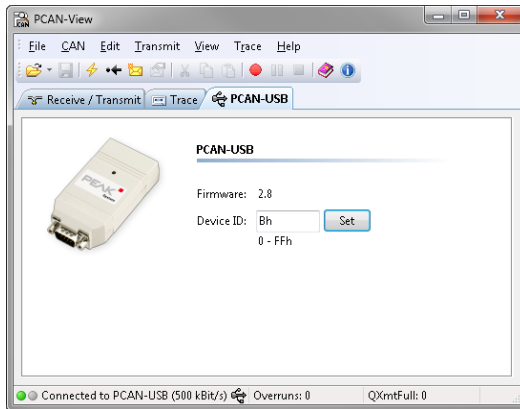


Figure 10: PCAN-USB tab

With the PCAN-USB tab you can assign a device ID to the adapter. Then it can be clearly identified during operation of several PCAN-USB adapters on a single computer.

Furthermore, the current firmware version of the connected adapter is displayed on the tab.

5.1.4 Status Bar

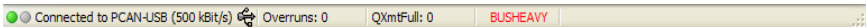


Figure 11: Display of the status bar

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 menu **Help** or the **F1** key.

5.2 Linking Own Programs with PCAN-Basic

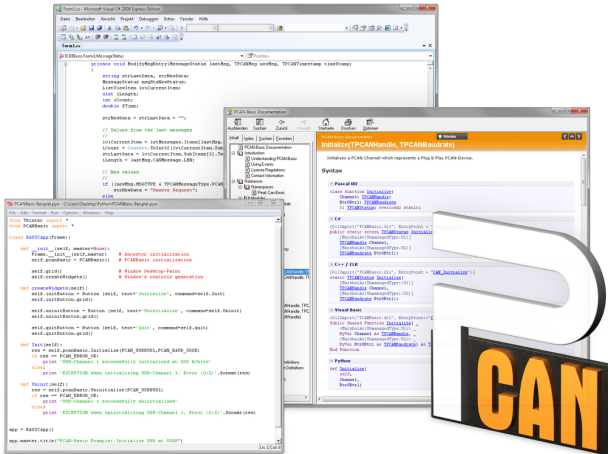


Figure 12: PCAN-Basic

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 interfaces by PEAK-System and can be used for the following operating systems:

- └ Windows 7/Vista/XP (32/64-bit)
- └ Windows CE 6.x (x86/ARMv4)

The API is designed for cross-platform use. Therefore software projects can easily ported between platforms with low efforts. PEAK-System has created examples for the following programming languages: C++, C#, C++/CLR, Visual Basic, Delphi, Python, and Java.

5.2.1 Features of PCAN-Basic

- └ Supports Windows 7/Vista/XP (32/64-bit) and Windows CE 6.x operating system
- └ Multiple PEAK-System applications and your own can be operated on a physical CAN channel at the same time
- └ Use of a single DLL for all supported hardware types
- └ Use of up to 8 channels for each hardware unit (depending on the PEAK CAN interface used)
- └ Simple switching between the 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)
- └ 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 systems
- └ Debugging information can be defined individually

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

Interaction

For receiving and transmitting CAN messages the functions `CAN_Read` and `CAN_Write` 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	USB plug type A
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 102

USB

Type	USB 1.1, compatible with USB 2.0
------	----------------------------------

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 (Philips) SJA1000
Transceiver	NXP (Philips) PCA82C251
Galvanic isolation	PCAN-USB: none PCAN-USB opto: up to 500 V
Supplying external devices	PCAN-USB: D-Sub pin 1/pin 9; 5 V, max. 100 mA PCAN-USB opto: D-Sub pin 1; 5 V, max. 50 mA Not assigned at delivery
Termination	none

Power supply

Supply voltage	+5 V DC (via USB port)
Power consumption	max. 200 mA

Continued on the next page

Environment	
Operating temperature	-40 - 85 °C (-40 - 185 °F)
Temperature for storage and transport	-40 - 100 °C (-40 - 212 °F)
Relative humidity	15 – 90 %, not condensing
EMC	EN 55024:2003-10 EN 55022:2008-05 EC directive 2004/108/EG
Ingress protection (IEC 60529)	IP20

Measures	
Size (w/o cable)	PCAN-USB: 75 x 43 x 22 mm PCAN-USB opto: 87 x 43 x 22 mm
Cable length	about 0.75 m
Weight (with cable)	PCAN-USB: 78 g PCAN-USB opto: 83 g

Appendix A CE Certificate

PCAN-USB IPEH-002021/22 - EC Declaration of Conformity
PEAK-System Technik GmbH



Notes on the CE Symbol

The following applies to the PCAN-USB products
IPEH-002021/22

EC Directive

This product fulfills the requirements of EC directive
2004/108/EG on "Electromagnetic Compatibility" and is
designed for the following fields of application as per the
CE marking:

Electromagnetic Immunity

DIN EN 55024, Publication date: 2003-10
Information technology equipment, immunity characteristics – Limits and methods of
measurement (IEC/CISPR 24:1997, modified + A1:2001 + A2:2003);
German version EN 55024:1998 + A1:2001 + A2:2003

Electromagnetic Emission

DIN EN 55022, Publication date: 2008-05
Information technology equipment – Radio disturbance characteristics – Limits and methods
of measurement (IEC/CISPR 22:2005, modified + A1:2005);
German version EN 55022:2006 + A1:2007

Declarations of Conformity

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 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 "V. Wilhelm".

Signed this 4th day of October 2011

Appendix B Dimension Drawings

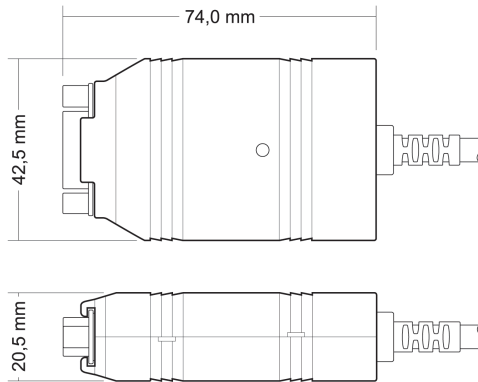


Figure 13: View PCAN-USB

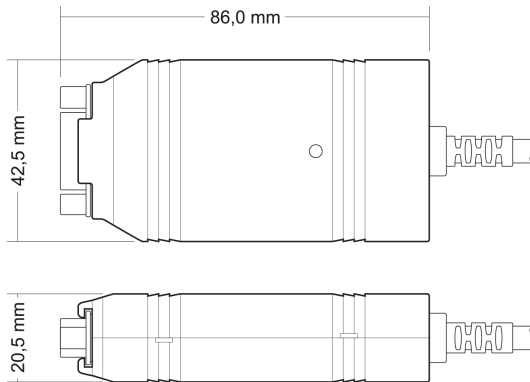


Figure 14: View PCAN-USB opto-decoupled

The figures don't show the actual size of the product.

Appendix C Quick Reference

Software/Hardware Installation under windows

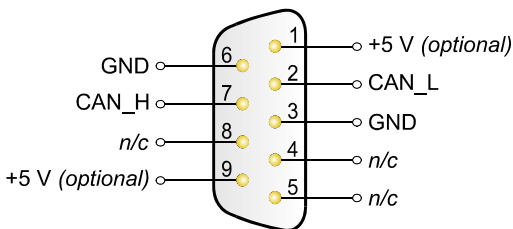
Before connecting the PCAN-USB adapter to the computer set up the corresponding software package from the supplied DVD (with administrator privileges). Afterwards connect the PCAN-USB adapter to a USB port at your computer. The adapter is recognized by Windows and the driver is initialized. After the installation process is finished successfully the red LED on the adapter is illuminated.

Getting Started under windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the PCAN-USB adapter. For initialization of the PCAN-USB adapter select the desired CAN interface 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 adapter.
Quick blinking	Data is transmitted via the connected CAN bus.

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



n/c = not connected