PCAN-USB Hub

All-in-one USB adapter for
communication via CAN, RS-232, and USB

User Manual v2.1.2

PEAK
System

Products taken into account

Product Name	Model	Part Number
PCAN-USB Hub		IPEH-002004

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 "®".

© 2012 PEAK-System Technik GmbH

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 2.1.2 (2012-07-16)

Contents

1 Introduction

The PCAN-USB Hub provides multiple hardware interfaces through a USB connection. The device has connection facilities for one CAN bus, two serial RS-232 connections, and two additional USB devices. 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 Hub.

1.1 Properties at a Glance

⌐ High-speed USB 2.0 hub with

- CAN interface, D-Sub 9-pin connector (in accordance with CiA® 102)

- two RS-232 ports, D-Sub 9-pin connectors

- two High-speed USB 2.0 downstream ports

⌐ Passive (bus-powered) hub operation through the USB port of a PC enables power consumption of up to 100 mA per USB channel

⌐ Active (self-powered) hub operation through the optional external hub power supply (9 - 36 V) enables power consumption of up to 500 mA per USB channel

⌐ Guaranteed high transfer rates on all channels if a Full-speed device is connected, thanks to a hub controller with 4 transaction translators

⌐ Bit rates up to 1 Mbit/s

 ⌐ Time stamp resolution approx. 42 µs

 ⌐ Compliant with CAN specifications 2.0A and 2.0B

 ⌐ NXP PCA82C251 CAN transceiver

 ⌐ 5-Volt and external power supply at the CAN connector
   connectible by solder bridges, 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-USB Hub
with **Windows**. You can find CAN 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 at the computer (USB 2.0 recommended)

 ⌐ 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 <u>not</u> use a USB extension cable to connect the PCAN-
USB Hub 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 Hub in aluminum casing

⌐ Mating connector for voltage supply

⌐ 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 Hub under Windows and the connection of the hub to the computer. Drivers for the CAN interface as well as the RS-232 interfaces are installed.

Setup the driver for the CAN interface <u>before</u> connecting the PCAN-USB Hub to the computer for the first time.

▶ Do the following to install the driver for the CAN interface:

1. Make sure that you are logged in as user with administrator privileges (not needed for normal use of the PCAN-USB Hub 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 setup program.

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

.PEAK
System

📨 Do the following to connect the PCAN-USB Hub and carry out the initialization of the CAN driver and the installation of the drivers for the RS-232 interfaces:

Note: Do not use a USB extension cable to connect the PCAN-USB Hub 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 Hub to a USB port at the computer. 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.

3. Dialog boxes appear for the installation of the drivers for the RS-232 interfaces (devices "USB <-> Serial Cable" and "USB Serial Port"). Follow their instructions. Select the search for driver software on DVD during this procedure.

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

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

After the initialization process for the driver for the CAN interface is finished successfully the red LED at the CAN connector of the PCAN-USB Hub is illuminated.

The Device Manager of Windows contains the following new entries:

⌐ Ports (COM & LPT) > USB Serial Port (COMn[1]) and USB Serial Port (COMn[1])

⌐ CAN-USB-Hardware > PCAN-USB Device

⌐ Universal Serial Bus controllers > Generic USB Hub

⌐ Universal Serial Bus controllers > USB Serial Converter A

⌐ Universal Serial Bus controllers > USB Serial Converter A

⌐ Universal Serial Bus controllers > USB Composite Device

---

[1] The port numbers for the COM ports may vary. If a COM port is occupied, the next vacant port number is used. Changing the port number in the Device Manager: Ports (COM & LPT) > USB Serial Port (COMn) > Properties > Port Settings > Advanced

3 Connectors on the Adapter

3.1 Upstream Port (USB Cable)

The cable with the USB plug is used for connecting the PCAN-USB Hub to a computer.

When a High-speed USB connection (USB 2.0) is established, the LED at the upstream port is on. For a Full-speed USB connection (USB 1.1) the LED stays off.

The upstream port can be used for voltage supply of the PCAN-USB Hub (see the following section 3.2).

3.2 Power (Voltage Supply)

The voltage supply of the PCAN-USB Hub may either be done via the upstream port or with an external power supply at the power socket.

Property	For voltage supply via	
	upstream port	power socket
Supply voltage	5 V DC (USB)	9 - 36 V DC
Operating mode name	Bus-powered	Self-powered
Permissible current delivery USB port 1/2	100 mA	500 mA
Permissible total current consumption of hub (incl. additional USB devices at the hub)	500 mA	

If the permissible current delivery value is exceeded by connecting additional USB devices to the PCAN-USB Hub, Windows shows a respective warning and deactivates the related components.

Figure 1: Power socket at the rear of the PCAN-USB Hub
for the external voltage supply (self-powered operation)

The connection of an external power supply at the power socket is
done with the supplied mating connector for fastening cable
strands.

3.3 CAN

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
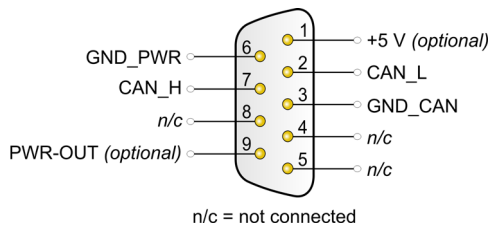specification CiA® 102.

Figure 2: Pin assignment High-speed CAN
(view onto connector of the PCAN-USB Hub)

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 3.3.1.

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).

3.3.1 Supplying External Devices via the CAN Connector

By setting solder bridges on the PCB of the PCAN-USB Hub (casing opened) a 5-Volt supply can be routed to pin 1 and the external voltage supply, if available, can be routed to pin 9 of the D-Sub CAN connector.

CAN D-Sub pin	Voltage	Max. current delivery
1	+5 V	100 mA
9	external supply voltage (9 - 36 V)	2 A

If the solder bridge for pin 9 is set, the state of this pin can be switched by software (on/off). At delivery pin 9 is on referred to the software part. On request we'll provide you with additional information and a Windows program for switching (contact information: see on page 2

▶ Proceed as follows to activate the 5-Volt supply and the external voltage supply at the CAN connector:

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

Remove the four lower corner screws from the aluminum casing of the PCAN-USB Hub and then the bottom cover.

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

The following figure shows the positions of the solder fields on the PCB of the PCAN-USB Hub; the tables below contain the possible settings.
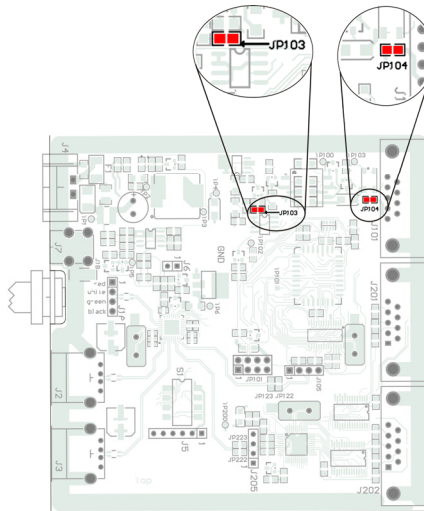
Figure 3: Positions of the solder fields JP103 and JP104
on the PCB of the PCAN-USB Hub

5-Volt supply →	None	Pin 1
JP104		

External supply →	None	Pin 9
JP103		

⚠ **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 Hub while it is de-energized (the hub 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).

3.4   RS-232

An RS-232 connection is done via a 9-pin D-Sub connector.
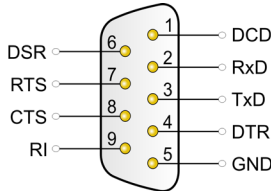
Figure 4: Pin assignment RS-232 A/B
(view onto connector of the PCAN-USB Hub)

3.5   USB Ports (Downstream)

Further USB devices can be connected to the USB ports 1 and 2.

Figure 5: USB ports at the back of the PCAN-USB Hub

When using the USB ports, we recommend the voltage supply of the PCAN-USB Hub via the power socket (self-powered operation). See also section 3.2 *Power (Voltage Supply)* on page 11.

Supply via	Operating mode	Current delivery USB port 1/2
Upstream port	Bus-powered	max. 100 mA
Power socket	Self-powered	max. 500 mA

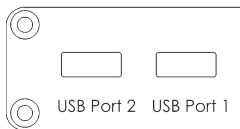# 3.6   Cabling

3.6.1   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 Hub does not have an internal termination. Use the adapter on a terminated CAN bus.

3.6.2   Example of a Connection
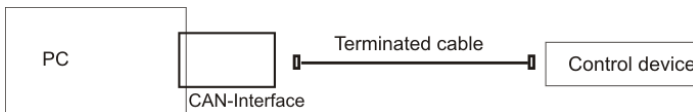
Figure 6: Simple CAN connection

In this example, the PCAN-USB Hub is connected with a control unit by a cable that is terminated at both ends.

3.6.3　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 LEDs

The PCAN-USB Hub has several status LEDs.
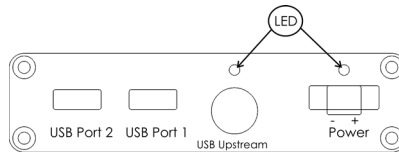
Figure 7: Arrangement of the LEDs on the back side,
USB upstream / power socket

Power

LED	Status	Meaning
Power	Green on	Supply via upstream port
	Red on	external voltage supply

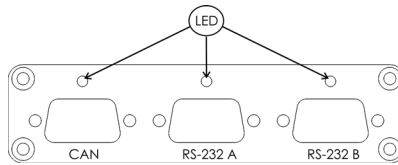| LED	Status	Meaning
USB upstream	Red on	High-speed USB connection (USB 2.0) with a computer
	OFF	Full-speed USB connection (USB 1.1) with a computer

Figure 8: Arrangement of the LEDs on the front side,
CAN / RS-232 A/B

LED	Status	Meaning
CAN	Red on	The CAN interface is initialized. There's a connection to a driver of the operating system
	Red slow blinking	A software application is connected to the CAN interface
	Red quick blinking	Data is transmitted via the connected CAN bus
RS-232 A/B	Green quick blinking	Transmission on TxD or RxD

4.2 Unplugging the Hub

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

4.3 Distinguishing Several PCAN-USB Hub

You can operate several PCAN-USB Hub 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. Fore more information see section 5.1.3 on page 25.

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.
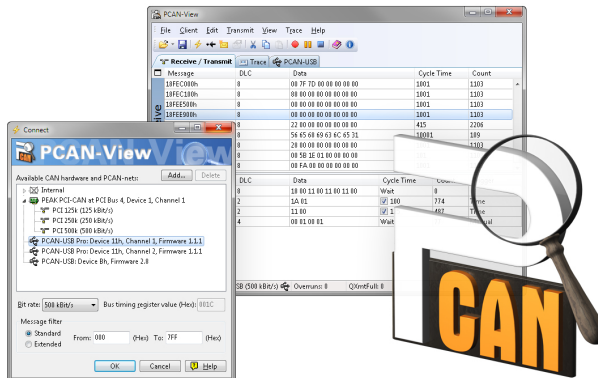

Figure 9: PCAN-View for Windows

▶ 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.
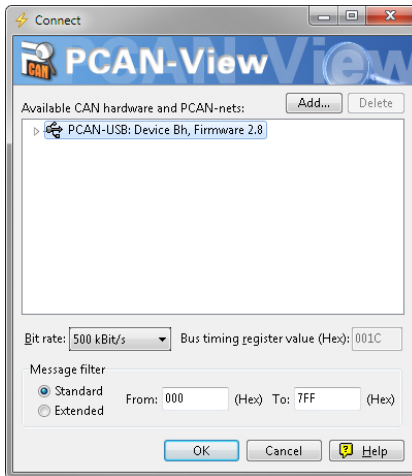
Figure 10: Selection of the CAN specific hardware and parameters

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 11).

5.1.1   Receive/Transmit Tab

Figure 11: 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.
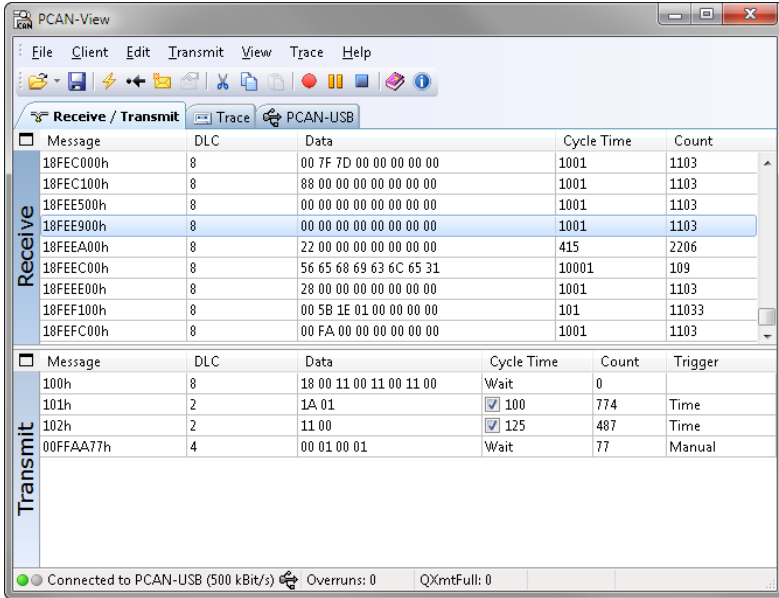
▶️ Do the following to transmit a CAN message with PCAN-View:

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

The dialog box **New Transmit Message** is shown.
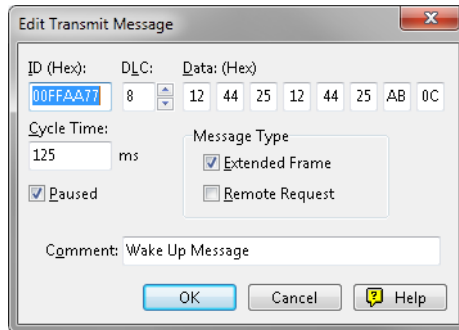
Figure 12: Dialog box New transmit message

7. Enter the ID and the data for the new CAN message.

8. 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.

9. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.

10. 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
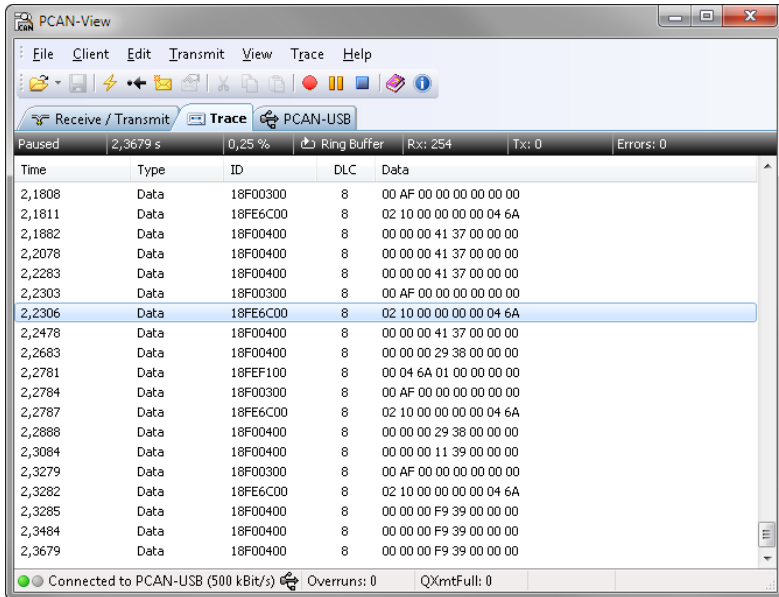
Figure 13: Trace tab

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
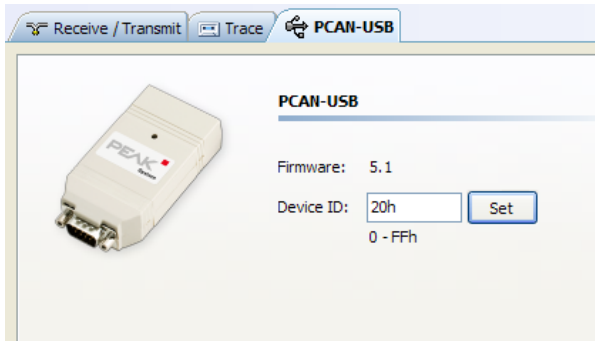
Figure 14: PCAN-USB tab

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 Hub adapters on a single computer.

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

5.1.4   Status Bar
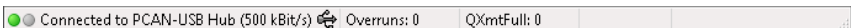
Figure 15: Display of the status bar

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
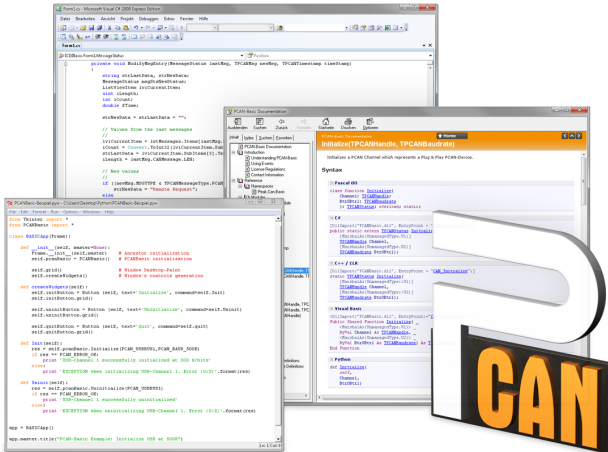
Figure 16: PCAN-Basic

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 µs (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
RS-232	2 x D-Sub (m), 9 pins
USB	2 x USB socket type A

USB	
Upstream port	USB 2.0 (compatible to USB 1.1)
Downstream ports	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
Supplying external devices	D-Sub Pin 1; 5 V, max 100 mA External power supply: D-Sub Pin 9; 9-36 V, max 2 A
Termination	none

RS-232	
Transfer rates	0.3 - 120 kbit/s
Signal levels	EIA-232E

Power Supply

Supply voltage	5 V DC via USB port (bus-powered operation) 9 - 36 V DC via Power socket (self-powered operation)
Power consumption	At 5 V via USB port: max. 300 mA At 12 V via Power socket: max. 150 mA (each time without connected USB devices)

Environment

Operating temperature	-40 - 85 °C (-40 - 185 °F)
Temperature for storage and transport	-40 - 105 °C (-40 - 221 °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	105 x 26 x 110 mm (without connection cable)
Cable length	ca. 1.5 m
Weight	300 g (with connection cable)

Appendix A CE Certificate

PCAN-USB Hub IPEH-002004 – EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the PCAN-USB Hub product
IPEH-002004

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   In accordance with the above mentioned EU directives,
Conformity   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

Signed this 4th day of October 2011
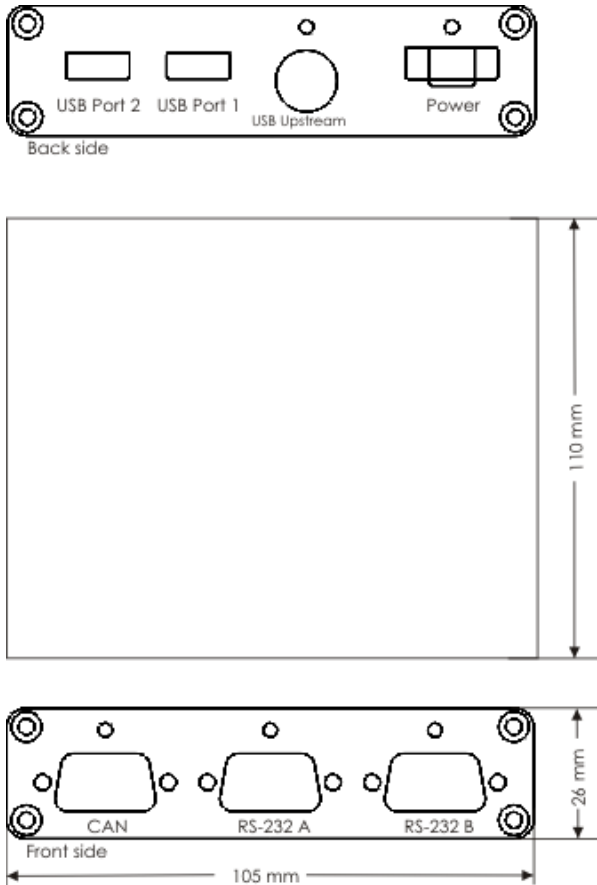
Appendix B Dimension Drawing

Figure 17: Back and front side with top view PCAN-USB Hub

The figure doesn't show the actual size of the product.

Appendix C Quick Reference

Software/Hardware Installation under Windows

Before connecting the PCAN-USB Hub to the computer set up the corresponding software package from the supplied DVD (with administrator privileges). Afterwards connect the PCAN-USB Hub to a USB port at your computer. The hub is recognized by Windows and the drivers are initialized. After the installation process for the CAN interface is finished successfully the red CAN LED on the hub is illuminated. The RS-232 interfaces are accessible as virtual COM ports.
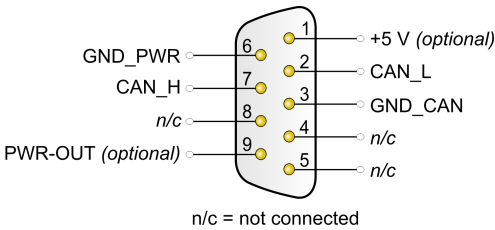
Getting Started under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the CAN interface of the PCAN-USB Hub. For initialization of the PCAN-USB Hub select the desired CAN interface and the CAN bit rate.

LED	Status	Meaning
Power	Green on	Supply via upstream port
	Red on	external voltage supply

LED	Status	Meaning
USB upstream	Red on	High-speed USB connection (USB 2.0) with a computer
	OFF	Full-speed USB connection (USB 1.1) with a computer

LED	Status	Meaning
CAN	Red on	The CAN interface is initialized. There's a connection to a driver of the operating system
	Red slow blinking	A software application is connected to the CAN interface
	Red quick blinking	Data is transmitted via the connected CAN bus
RS-232 A/B	Green quick blinking	Transmission on TxD or RxD

High-speed CAN

GND_PWR
CAN_H
n/c
PWR-OUT (optional)

6
7
8
9

1
2
3
4
5

+5 V (optional)
CAN_L
GND_CAN
n/c
n/c

n/c = not connected

RS-232

DSR
RTS
CTS
RI

6
7
8
9

1
2
3
4
5

DCD
RxD
TxD
DTR
GND