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PCAN-USB Hub

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

User Manual



Document version 2.6.0 (2019-05-28)

PEAK System

Relevant products

Product name	Model	Part number
PCAN-USB Hub		IPEH-002004

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1 Introduction

The PCAN-USB Hub provides multiple hardware interfaces through a USB connection. It offers the user one CAN, two RS-232, and two further USB interfaces. Its robust aluminum casing makes the PCAN-USB Hub suitable for mobile applications.

The package is also supplied with the CAN monitor PCAN-View for Windows and the programming interface PCAN-Basic.

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-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® 303-1)
  - 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
- CAN bit rates from 5 kbit/s 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, compatible with USB 1.1 and USB 3.0)
- Operating system Windows 10, 8.1, 7 (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 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 10, 8.1, 7 and Linux (32/64-bit)
- Device driver for Windows CE 6.x
  (x86 and ARMv4 processor support)
- 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 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.

Install the driver before you connect the USB hub to the computer.

Do the following to install the driver:

1. Start `Intro.exe` from the supplied 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 to "Installer database of PEAK Drivers".

   The driver setup starts.

4. Follow the program instructions.

Do the following to connect the adapter:

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 USB hub to a USB port of the computer or of an other connected USB hub. The computer can remain powered on.

   Windows detects the new hardware and completes the driver installation.

Note: If you have no internet connection, install the serial driver for the device via the product DVD: `Drivers/PCAN-USB Hub Serial Drivers/Windows/CMD v2.xx.xx WHQL Certified.exe`.

2. Check the LED on the adapter. If the LEDs are red, then the driver was initialized successfully.

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 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.

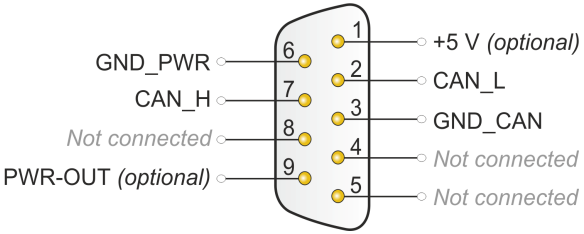


Figure 2: Pin assignment High-speed CAN
(view onto connector of the PCAN-USB Hub)

Low power devices (e.g. bus converters) can be supplied directly with 5 volts over pin 1 and pin 9 of the CAN connector. Pin 1 and pin 9 is not in use at the delivery state. For more information see the next 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 Voltage Supply of External Devices

External devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector. With a solder bridge for the one CAN channel on the PCAN-USB Hub board (casing opened), a 5-Volt supply can optionally 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 on or off by software. 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).

➥ 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.

1. Remove the four lower corner screws from the aluminum casing and then the bottom cover.
2. Set the solder bridge(s) on the card according to the desired settings.

   Figure 3 shows the positions of the solder fields on the PCB of the PCAN-USB Hub; the tables below contain the possible settings.

3. Put the bottom cover on the aluminum casing and screw the four lower corner screws.

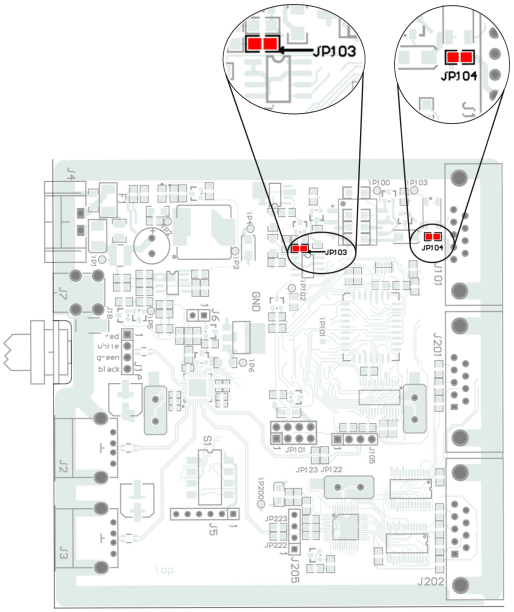


Figure 3: Positions of the solder fields JP103 and JP104 on the PCB of the PCAN-USB Hub

D-Sub connector	Solder field	5-Volt supply		External voltage supply (9 - 36 V)	
		Without (standard)	Pin 1	Without (standard)	Pin 9
CAN 1	JP104				
CAN 1	JP103				

Risk of short circuit! The voltage 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).

3.4 RS-232

An RS-232 connection is done via a 9-pin D-Sub connector.

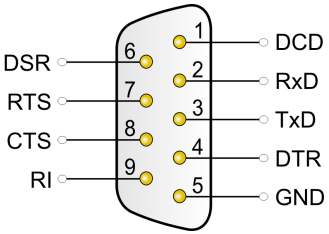


Figure 4: Pin assignment RS-232 A/B
(view onto connector of the PCAN-USB Hub)

3.5 USB Ports (Downstream)

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

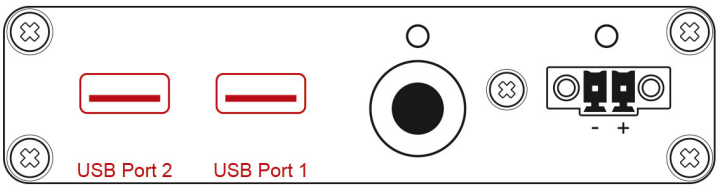


Figure 5: USB ports at the back of the PCAN-USB Hub

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 10.

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 with 120 ohms at both ends. The termination prevents interfering signal reflections and ensures the proper operation of the transceivers of the connected CAN nodes (CAN interfaces, control devices).

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

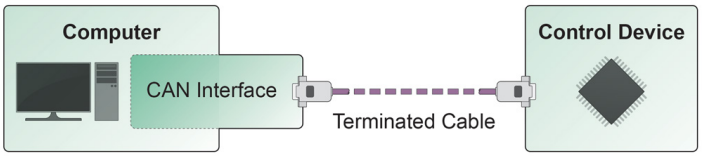


Figure 6: Simple CAN connection

This example shows a connection between the PCAN-USB Hub and a control unit. The connection cable is terminated with 120 ohms 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.

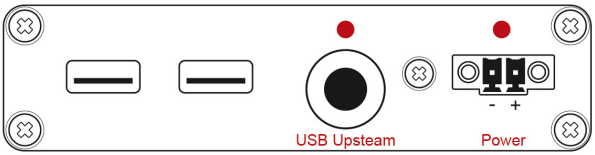


Figure 7: Arrangement of the LEDs on the back side,
USB upstream / power socket

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

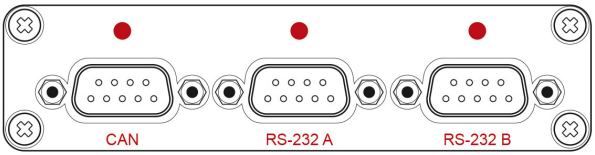


Figure 8: Arrangement of the LEDs on the front side,
CAN / RS-232 A/B

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 24.

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.

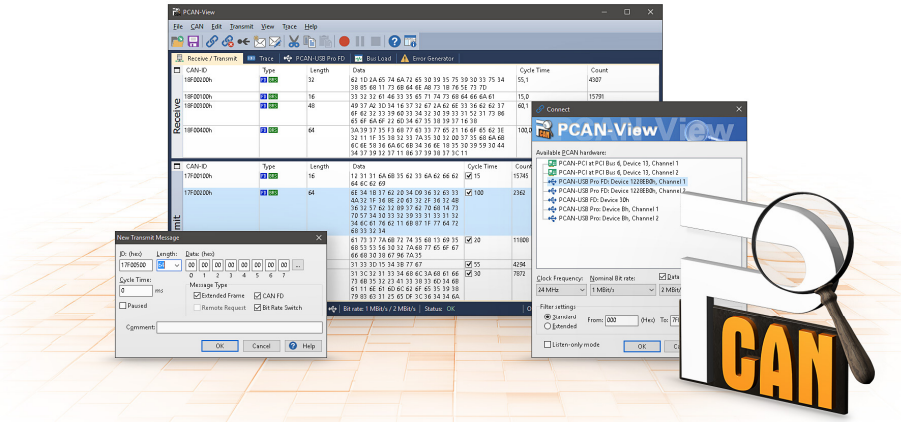


Figure 9: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

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

   The **Connect** dialog box appears.

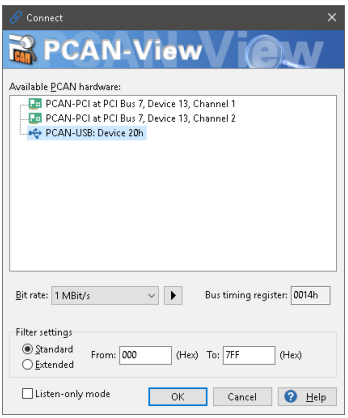


Figure 10: Selection of the specific hardware and parameters

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 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 11).

5.1.1 Receive/Transmit Tab

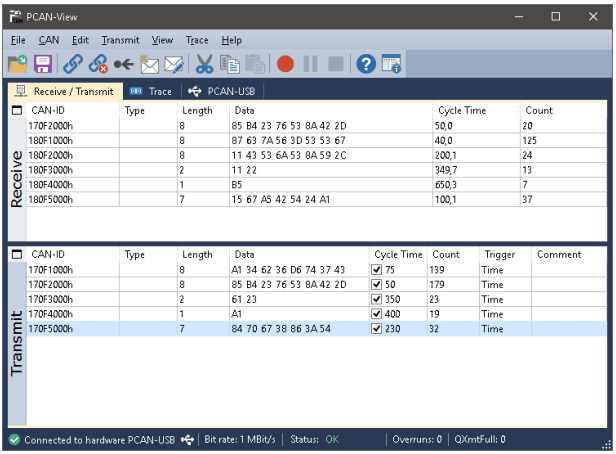


Figure 11: Receive/Transmit tab

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. 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.

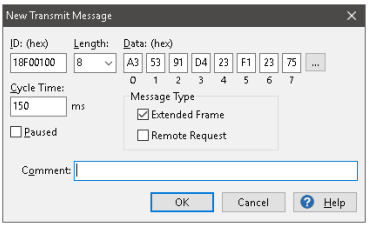


Figure 12: Dialog box New transmit message

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

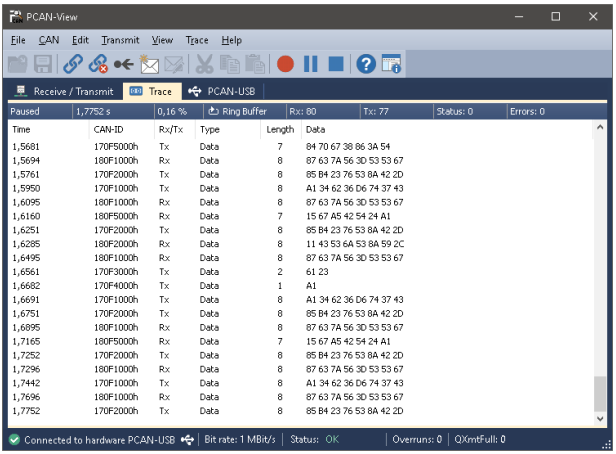


Figure 13: Trace tab

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-USB Tab

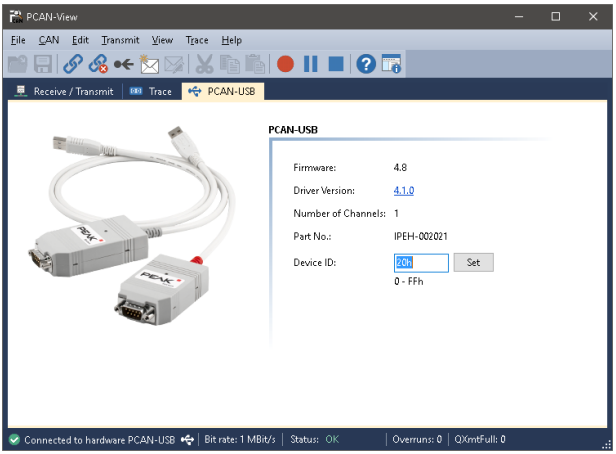


Figure 14: PCAN-USB tab

The **PCAN-USB** tab contains some detailed information about the hardware and driver. In addition, you can assign a **Device ID** to the adapter. Thus, it can be uniquely identified while operating several PCAN-USB Hub adapters on a computer at the same time.

To identify a PCAN-USB Hub adapter, you first go to the dialog box for selecting the hardware of PCAN-View (Figure 10 on page 20). In the list **Available PCAN hardware and PCAN-nets**, you can perform a right-click on every USB adapter and execute the command **Identify**. Thereby the LED of the corresponding adapter flashes shortly.

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 **Help** menu or with 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 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 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 Windows 10, 8.1, 7 (32/64-bit), Windows CE 6.x, and Linux (32/64-bit) operating system
- 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 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)
- 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 systems
- 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	USB plug type A
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 303-1
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 SJA1000
Transceiver	NXP 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
Internal 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
Ingress protection (IEC 60529)	IP20

Measures	
Size	105 x 26 x 104 mm (without connection cable)
Cable length	ca. 1.5 m
Weight	300 g (with connection cable)

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-USB Hub

Item number(s): IPEH-002004

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

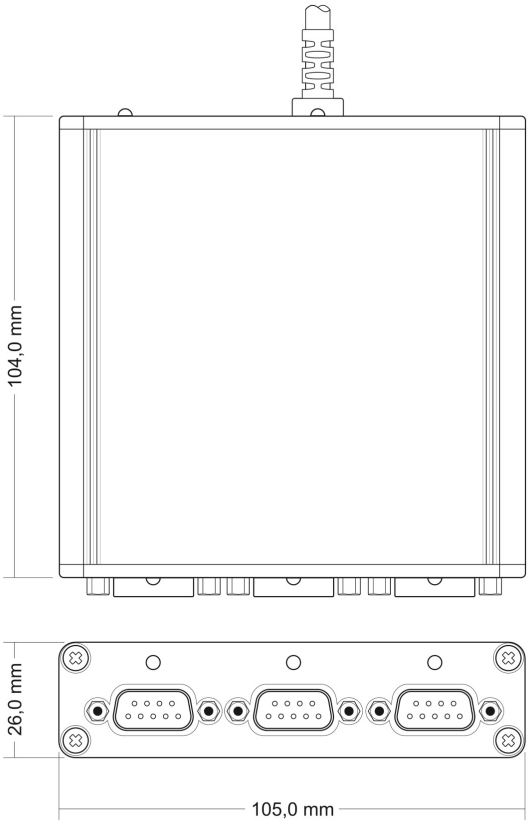
DIN EN 55032:2016-02
Electromagnetic compatibility of multimedia equipment - Emission Requirements (CISPR 32:2015);
German version EN 55032:2015

Darmstadt, 22 February 2019



Uwe Wilhelm, Managing Director

Appendix B Dimension Drawing



The figure doesn't 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 connect the USB-Hub with the computer. The new hardware is detected at the next Windows start and the driver is initialized.

Note: If you have no internet connection, install the serial driver for the device via the product DVD: `Drivers/PCAN-USB Hub Serial Drivers/Windows/CMD v2.xx.xx WHQL Certified.exe`.

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

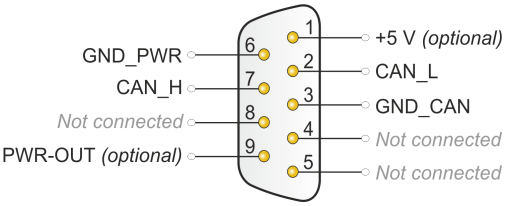
Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the CAN interface of the PCAN-USB Hub. For initialization of the PCAN-USB Hub select the desired CAN interface and the CAN bit rate.

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

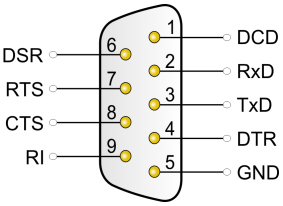
LED	Status	Meaning
USB upstream	Red on	High-speed USB connection (USB 2.0) with a computer
	OFF	Full-speed USB connection (USB 1.1) with a computer

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



RS-232



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