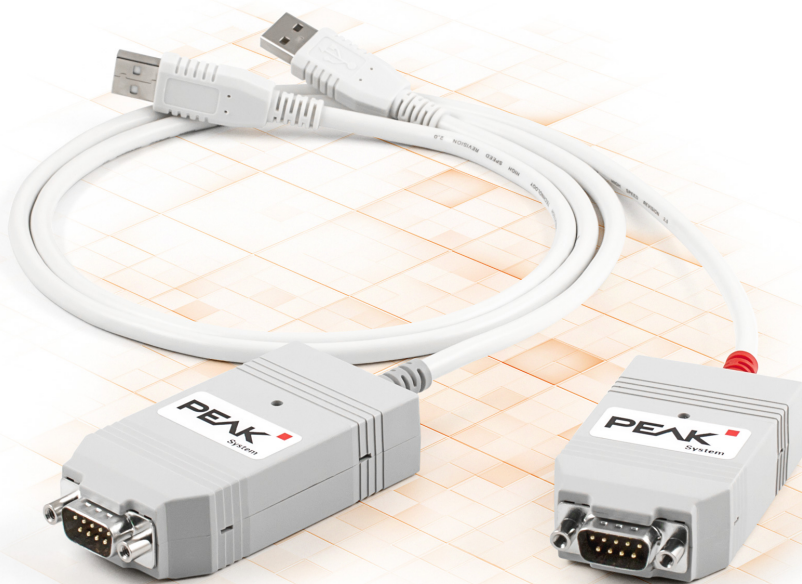


PCAN-USB

User Manual



Relevant Products

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

The cover picture shows both products, the PCAN-USB with the red and the PCAN-USB opto-decoupled with the grey cable strain relief.

Imprint

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Document version 3.2.0 (2024-06-10)

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1 Introduction

The PCAN-USB interface enables simple connection to CAN networks. Its compact plastic casing makes it suitable for mobile applications. The opto-decoupled version guarantees galvanic isolation of up to 500 Volts between the PC and the CAN side.

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 and support the standard CAN FD.

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



This manual describes the use of the CAN interface with **Windows**.
Device drivers and application information for **Linux**:
www.peak-system.com/quick/DL-Driver-E



At the end of this manual you can find a Quick Reference with brief information about the installation and operation of the PCAN-USB interface.

1.1 Properties at a Glance

- CAN interface for the USB connection
(Full-Speed mode, compatible with USB 1.1, USB 2.0, and USB 3.0)
- High-speed CAN connection (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
- Time stamp resolution 42 μ s
- NXP CAN controller SJA1000, 16 MHz clock frequency
- NXP CAN transceiver PCA82C251
- Galvanic isolation on the CAN connection up to 500 V (only for IPEH-002022)
- CAN termination can be activated through a solder jumper
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Voltage supply via USB
- Extended operating temperature range from -40 to +85 °C (-40 to +185 °F)

1.2 System Requirements

Computer with

- operating system Windows 11 (x64/ARM64), 10 (x64), or Linux
- a vacant USB port (USB 1.1, USB 2.0, or USB 3.0) or a vacant USB port at a self-powered USB hub

1.3 Scope of Supply

- PCAN-USB in plastic casing

Downloads

- Device drivers for Windows 11 (x64/ARM64), 10 (x64), and Linux
- 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 Settings

The following describes the settings for the power supply of external devices and the internal termination. If you do not need any of these settings, skip this chapter.

2.1 Voltage Supply of External Devices

Optionally, an external power supply can be connected via the D-Sub connector using solder bridges at pin 1 and/or pin 9 on the D-Sub connector. This allows external devices to be supplied with a voltage of 5 V DC, such as the PCAN-TJA1054 bus converter for Low-speed CAN. Pin 1 and pin 9 are not assigned at delivery. With the PCAN-USB opto-decoupled only pin 1 is available up to S/N 199999.

The opto-decoupled model of the CAN interface contains an interconnected DC/DC converter. Therefore, the current output is limited to 50 mA.

2.1.1 Activate Power Supply

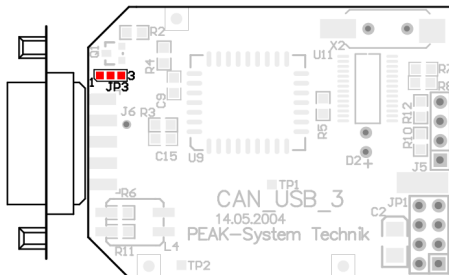


Risk of short circuit! Soldering on the CAN interface may only be performed by qualified electrical engineering personnel.

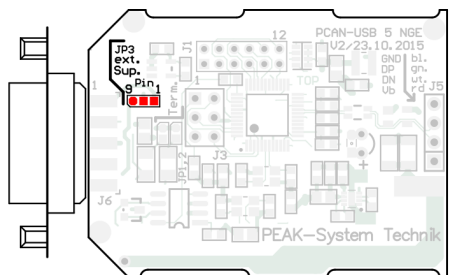


Attention! Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

1. Open the CAN interface casing. Push the latches on both sides cautiously with a slotted screwdriver.
2. Remove the circuit board.
3. Set the solder bridges according to the model of the PCAN-USB on the intended position on the circuit board (see below).
4. For assembly, place the circuit board on the upper half of the housing. The strain relief and the LED must be in the corresponding recesses.
5. Press the lower half of the housing onto the upper half of the housing until the latches engage.



PCAN-USB (IPEH-002021) to S/N 199999,
solder field JP3



PCAN-USB (IPEH-002021) from S/N 200000,
solder field JP3



Attention! The voltage supply for external devices 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).

2.2 Internal Termination

Only applicable from S/N 200000

The internal termination can be activated by solder jumpers on the circuit board to terminate one end of the CAN bus. At delivery the termination is not activated.



Tip: We recommend to do termination at the CAN cabling, for example with the terminating resistors PCAN-Term (IPEK-003002) or PCAN-MiniTerm (IPEK-003002-Mini). Thus, CAN nodes can be flexibly connected to the bus.

2.2.1 Activate Internal Termination

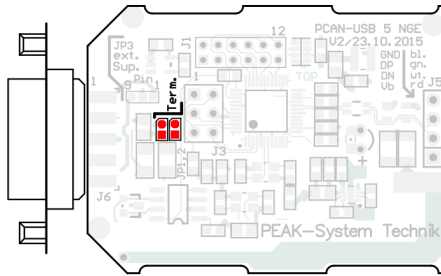


Risk of short circuit! Soldering on the CAN interface may only be performed by qualified electrical engineering personnel.

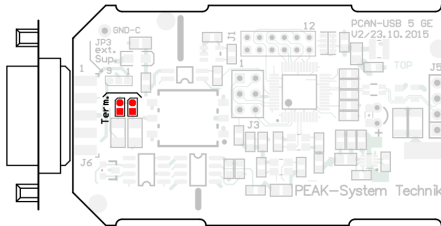


Attention! Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

1. Open the CAN interface casing. Push the latches on both sides cautiously with a slotted screwdriver.
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3. Set the solder bridges according to the model of the PCAN-USB on the intended position on the circuit board (see below).
4. For assembly, place the circuit board on the upper half of the housing. The strain relief and the LED must be in the corresponding recesses.
5. Press the lower half of the housing onto the upper half of the housing until the latches engage.



PCAN-USB (IPEH-002021) from S/N 200000,
solder fields for the CAN bus termination



PCAN-USB opto-decoupled (IPEH-002022) from S/N 200000,
solder fields for the CAN bus termination

PCAN-USB model	Termination High-speed CAN bus 120 Ω	
	Without (default)	Activated
IPEH-002021 from S/N 200000		
IPEH-002022 (opto-dec.) from S/N 200000		

3 Installation

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



Note: For installation under Linux, see Appendix E *Linux*.

Install the driver before you connect the CAN interface.

3.1 Install Device Driver Setup

1. Download the device driver setup from our website:
www.peak-system.com/quick/DL-Driver-E
2. Unpack the file `PEAK-System_Driver-Setup.zip`
3. Double-click the file `PeakOemDrv.exe`
The driver setup starts.
4. Follow the program instructions.

3.2 Connecting the CAN Interface



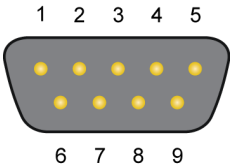
Attention! Do not use a USB extension cable to connect the CAN interface to the computer. Extension cables does not comply with the USB specification.

1. Connect the CAN interface to a USB port of the computer or of a connected USB hub. The computer can remain powered on.
Windows detects the new hardware and completes the driver installation.
2. Check the LED on the CAN interface. If the LED is on, then the driver was initialized successfully.

4 Connecting the CAN Bus

4.1 Connection over D-Sub Connector

After the CAN interface is connected, a CAN bus can be connected to the D-Sub connector. The pin assignment for CAN corresponds to the specification CiA® 106:

Pin	Assignment	D-Sub plug
1	CAN_V+ (optional)	
2	CAN_Low	
3	CAN_GND	
4	Not connected	
5	Not connected	
6	CAN_GND	
7	CAN_High	
8	Not connected	
9	CAN_V+ (optional)	

Low power devices can be supplied directly with 5 Volts over pin 1 and pin 9 of the CAN connector, for example bus converters. Pin 1 and/or pin 9 are not in use at the delivery state. For more information see section 2.1 *Voltage Supply of External Devices*.



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

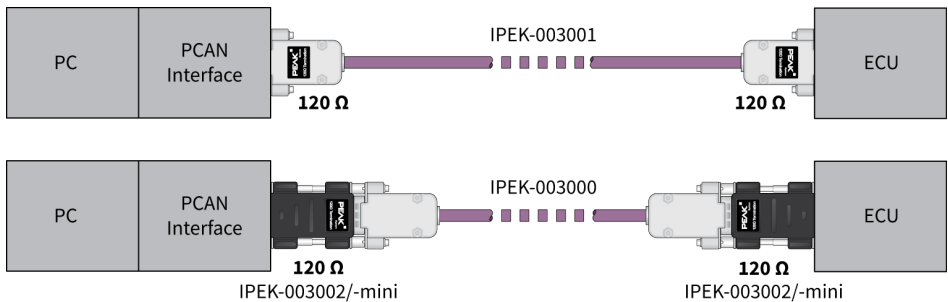
4.2 Cabling

4.2.1 Termination

The High-speed CAN bus (ISO 11898-2) must be terminated with $120\ \Omega$ on 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 interface to S/N 199999 does not have an internal termination. From S/N 200000 it has an optional internal termination with $120\ \Omega$. See the previous section 2.2 *Internal Termination* for information about activation.

4.2.2 Example of a Connection



This example shows a connection between the PCAN Interface and a control unit (ECU). The upper example shows a connection with a cable which is terminated with $120\ \Omega$ at both ends. At the lower example the connection is made with termination adapters.

4.2.3 Maximum Bus Length

The maximum bus length depends primarily on the bit rate:

Nominal bit rate	Buslength
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 km

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

4.3 Example Application under Windows

As an example application for accessing the CAN interface, run the CAN monitor PCAN-View from the Windows Start menu.

5 Operation

5.1 Status LED

The LED can be in the following states:

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

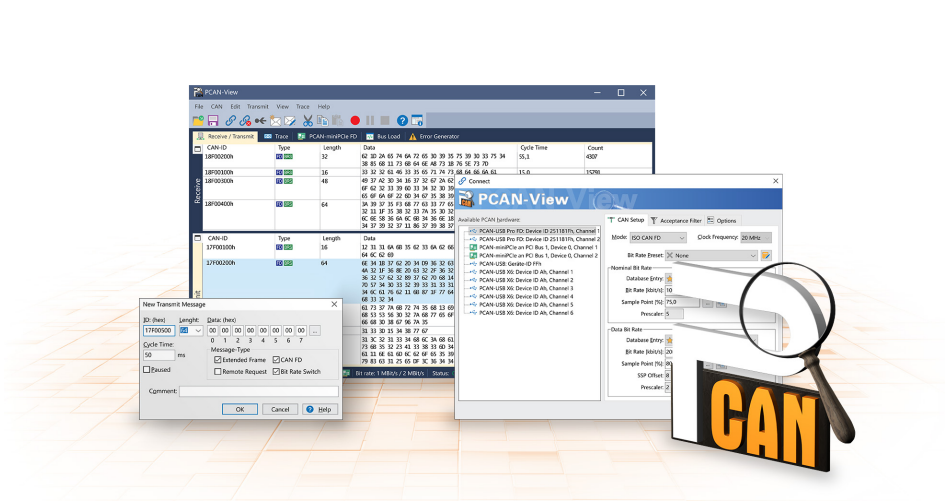
5.2 Unplugging the USB Connection

The PCAN-USB interface can be disconnected from the computer without further actions. In Windows, the interface is not listed under "Safely Remove Hardware".

5.3 Distinguishing several PCAN-USB Interfaces

You can operate several PCAN-USB interfaces on a single computer at the same time. The supplied program PCAN-View allows the assignment of device IDs in order to distinguish the CAN interfaces in a software environment.

6 CAN Monitor PCAN-View



The CAN monitor PCAN-View is a Windows software for viewing, sending, and recording CAN and CAN FD messages. The software is installed with the installation of the device driver package under Windows.

In the following the initialization of a CAN interface is described as an example.

Detailed information about using PCAN-View can be found in the program window under the menu item *Help*.

6.1 Initialize CAN interface

1. Open the program *PCAN-View* via the Windows Start menu.
- Depending on the CAN interface the *Connect* dialog is displayed with or without settings for CAN FD.

CAN

BTR 0	BTR 1	Sample Point	Tq	Nq	SJW
00h	05h	66 %	125 ns	8	1
00h	14h	75 %	125 ns	8	1
00h	23h	62 %	125 ns	8	1
00h	32h	50 %	125 ns	8	1
01h	01h	75 %	250 ns	4	1
01h	10h	50 %	250 ns	4	1
40h	14h	75 %	125 ns	8	2
40h	23h	62 %	125 ns	8	2

CAN FD

CAN interface

List entry in Available Hardware

USB Interface, 1-channel

see example above

USB Interface, 2-channel

PCAN-USB Pro FD: Device ID 251181Fh, Channel 1

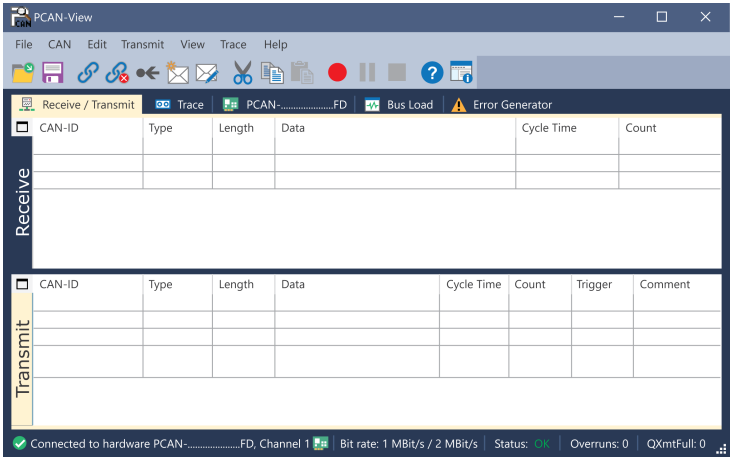
PCAN-USB Pro FD: Device ID 251181Fh, Channel 2

PCIe Interface, 2-channel

PCAN-PCI Express at PCI Bus 1, Device 0, Channel 1

PCAN-PCI Express at PCI Bus 1, Device 0, Channel 2

2. If there are several CAN interfaces, select the desired interface. For multiple channels, select the desired channel from the list.
3. Enter the *bit rate(s)* and other settings according to the connected CAN bus.
4. Confirm the entries with *OK*. The main window appears and displays the *Receive / Transmit* tab.

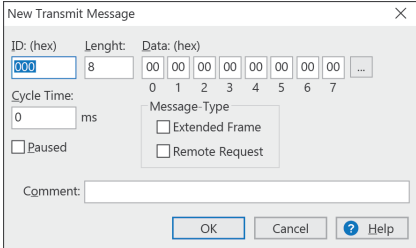
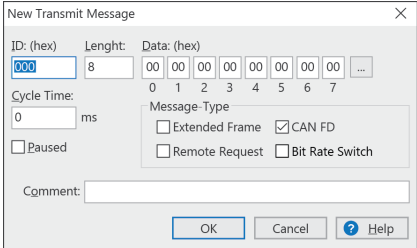


5. For initializing another channel or CAN interface, open another instance of *PCAN-View*.

6.2 Transmit CAN message

1. Select the menu command *Transmit / New Message*.

Depending on the CAN interface, the dialog box *New Transmit Message* is displayed with or without settings for CAN FD.

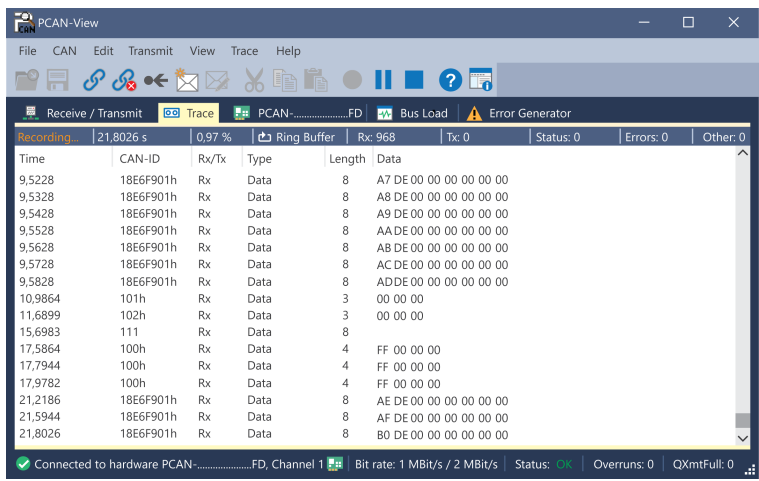
CAN	CAN FD
	

1. Enter the *ID*, *Length* and *Data* of the message. Other settings can be made according to the connected CAN bus.
2. Enter a value into the *Cycle Time* field to choose manually or periodically message transmission.
To transmit periodically enter a value greater than 0.
To transmit only manually enter the value 0.
3. Confirm the entries with *OK*.
The created transmit message appears on the *Receive / Transmit* tab.
4. To send the message manually, select the menu command *Transmit > Send* or press the **space** bar.
The manual transmission process is performed additionally for periodically transmitted CAN messages.

6.3 Additional Tabs

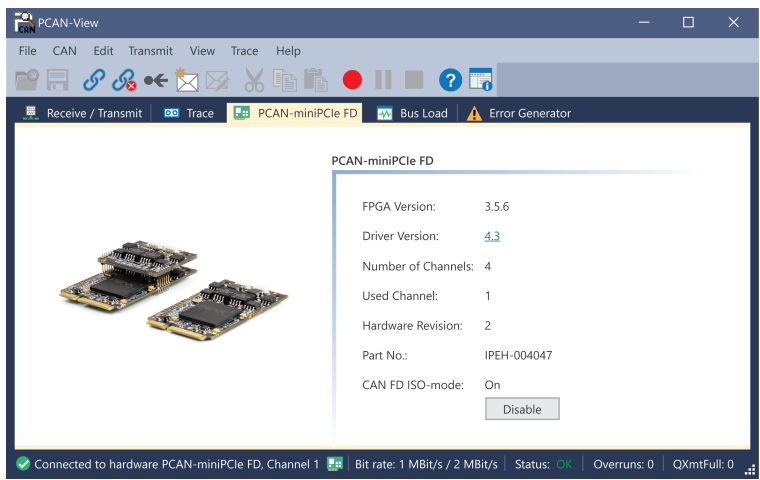
Depending on the CAN interface, additional tabs are available.

6.3.1 Trace Tab



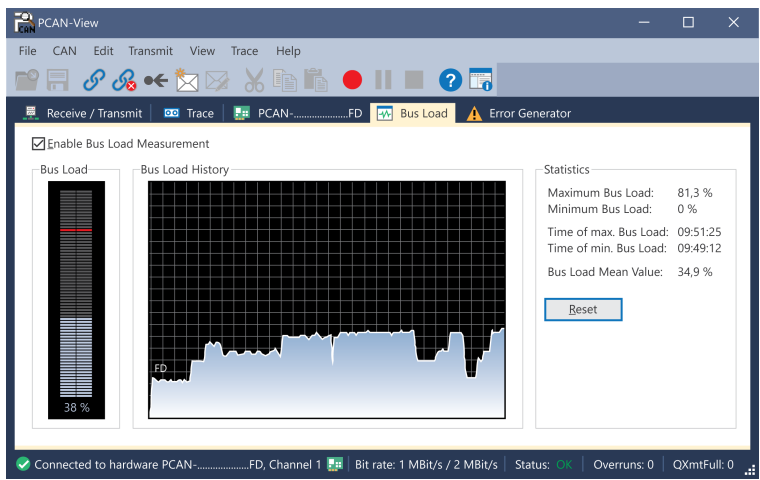
The tracer (data logger) records the communication of the CAN bus in linear or ring buffer mode. The trace data can be saved to a file.

6.3.2 CAN Interface Tab



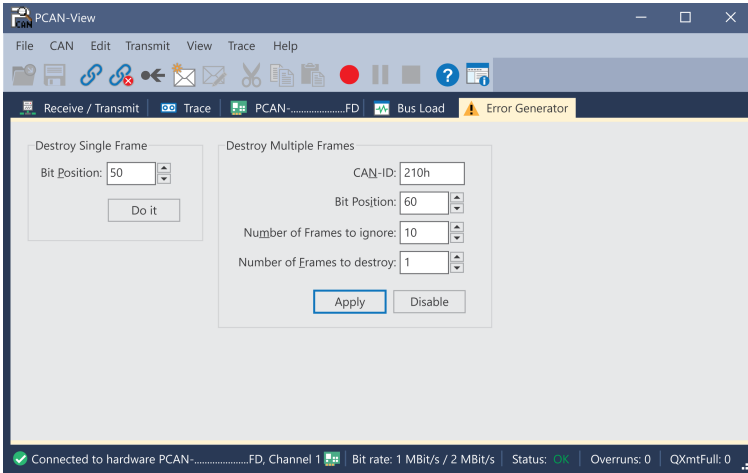
The *CAN interface* tab shows information about the hardware and the used Windows device driver. In this case exemplary for the PCAN-miniPCle FD. Depending on the CAN interface, a hardware ID can be determined to distinguish several interfaces of the same type.

6.3.3 Bus Load Tab



The *Bus Load* tab displays the current bus load, its time history and statistical information of the connected CAN channel.

6.3.4 Error Generator Tab



Via the *Error Generator* tab the communication on the CAN bus in test environments or during the development of CAN buses can be disturbed in a controlled way by 6 consecutive dominant bits. This is a violation of the CAN protocol on the CAN bus which must be recognized as an error by the connected CAN nodes.



Note: The Error Generator should only be used by experienced users and in the development environment. For further information, please contact our customer support: support@peak-system.com

You can destroy CAN frames with the error generator by one of two methods:

- once after activation
- repeatedly at specific intervals related to a CAN ID

Destroy Single CAN Frame

The *Destroy Single Frame* area refers to the next CAN frame that is recognized after activation.

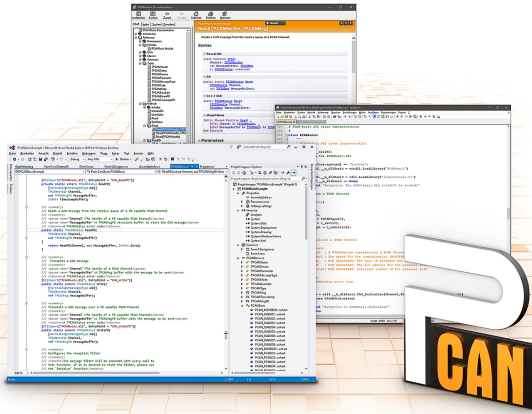
1. Enter the *Bit Position* where in the CAN frame the error is to be generated. The bit position must start after the identifier. The count includes the stuff bits.
2. Execute the destroy action with *Do it*.

The next received or transmitted CAN frame will be destroyed at the selected bit position.

Destroy Multiple CAN Frames

1. Enter the *CAN ID* of the CAN frame that is intended to be destroyed multiple times. The following specifications refer to this ID.
2. Enter the *Bit Position* where in the CAN frame the error is to be generated. The bit position must start after the identifier. The count includes the stuff bits.
3. If CAN messages are to be sent unharmed before being destroyed, specify the *Number of Frames to ignore*.
4. Determine the *Number of Frames to destroy*.
5. Confirm the entries with *Apply* to activate the error generator.
6. Stop destroying further CAN frames with *Disable*.

7 API PCAN-Basic



The intended use of PCAN-Basic requires compliance with the license rights. Read the license agreement for end users at:

<https://www.peak-system.com/quick/eula>

The programming interface (API) PCAN-Basic provides basic functions for the connection of own programs to the CAN and CAN FD Interfaces of PEAK-System. PCAN-Basic is the interface between the program and the device driver. In Windows operating systems this is a DLL (Dynamic Link Library) and in Linux operating systems an SO (Dynamic Shared Object). PCAN-Basic is designed to be cross-operating system compatible. Software projects can be ported between supported systems with little effort.

With the installation of the device driver package under Windows the DLL files of the API PCAN-Basic are placed in the system folder. Examples for all common programming languages as well as libraries and help files are available as a download package at: www.peak-system.com/quick/DL-Develop-E

For Linux, a download of the API is available under this link. For a use of PCAN-Basic another driver package with a chardev driver is needed, because an access under SocketCAN is not possible. The "Driver Package for Proprietary Purposes", the user manual, and further information about the implementation can be found at www.peak-system.com/linux.

7.1 Features of PCAN-Basic

- API for developing applications with CAN and CAN FD connections
- Support for CAN specifications 2.0 A/B and FD
- Application development for the platforms Windows 11 (x64/ARM64), 10 (x64), and Linux
- 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 type (depending on the PEAK CAN interface used)
- Simple switching between channels of a PEAK CAN interface
- Access to the CAN channels of a PCAN-Gateway via the new PCAN-LAN hardware type
- Driver-internal buffering of up to 32,768 CAN 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
- Support of CAN error frames
- Confirmation of physical transmission by CAN echo frames
- Extended system for debugging operations
- Multilingual debugging output
- Output language depends on operating system
- Debugging information can be defined individually
- Thread-safe API

7.2 Principle Description of the API

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

Initialization

A CAN 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 depending on the initialization mode. Additional settings can be made, such as 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.

8 Technical Specifications

Connectors	
Computer	USB plug type A
CAN	D-Sub (m), 9 pins, pin assignment according to CiA® 106
USB	to S/N 199999 USB 1.1, from S/N 200000 USB 2.0, Full-Speed mode (compatible with USB 1.1, USB 2.0, and USB 3.0)

CAN	
Protocols on OSI layer 2	CAN ISO 11898-1:2015, 2.0
Physical transmission, OSI layer 1	ISO 11898-2 (High-speed CAN)
CAN Bit rates	Nominal: 5 kbit/s to 1 Mbit/s
Controller	NXP SJA1000
Transceiver	NXP PCA82C251
Galvanic isolation	PCAN-USB: none PCAN-USB opto: up to 500 V
Supply for external devices via D-Sub pin 1 / pin 9	PCAN-USB: 5 V, max. 100 mA PCAN-USB opto ¹ : 5 V, max. 50 mA not activated at delivery
Internal termination	to S/N 199999 not available, from S/N 200000 via solder bridges, not activated at delivery
Time stamp resolution	42 µs

1 Pin 9 only from S/N 200000

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

Measures	
Size (w/o cable)	PCAN-USB: 75 x 43 x 22 mm PCAN-USB opto: 87 x 43 x 22 mm
Length (connection cable)	approx. 0.75 m
Weight (with cable)	PCAN-USB: 78 g PCAN-USB opto: 83 g

Environment

Operating temperature	-40 to +85 °C / -40 to +185 °F
Temperature for storage and transport	-40 to 100 °C / -40 to +212 °F
Relative humidity	15 to 90 %, not condensing
Ingress protection (IEC 60529)	IP20

Conformity

RoHS	EU Directive 2011/65/EU (RoHS 2) + 2015/863/EU DIN EN IEC 63000:2019-05
EMC	EU Directive 2014/30/EU DIN EN 55032:2022-08 DIN EN 55035:2018-04

Appendix A CE Certificate

EU Declaration of Conformity



This declaration applies to the following product:

Product name: **PCAN-USB**
Item number(s): **IPEH-002021, IPEH-002022**
Manufacturer: **PEAK-System Technik GmbH**
Leydheckerstraße 10
64293 Darmstadt
Germany



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) + 2015/863/EU (amended list of restricted substances)

DIN EN IEC 63000:2019-05

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);
German version of EN IEC 63000:2018

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 55032:2022-08

Electromagnetic compatibility of multimedia equipment - Emission requirements
(CISPR 32:2015);
German version of EN 55032:2015 + AC:2016 + A11:2020 + A1:2020

DIN EN 55035:2018-04

Electromagnetic compatibility of multimedia equipment - Immunity requirements
(CISPR 35:2016, modified);
German version of EN 55035:2017

Darmstadt, 7 June 2024

A handwritten signature in black ink, appearing to read "Uwe Wilhelm".

Uwe Wilhelm, Managing Director

Appendix B UKCA Certificate

UK Declaration of Conformity



This declaration applies to the following product:

Product name: **PCAN-USB**
Item number(s): **IPEH-002021, IPEH-002022**

Manufacturer:	UK authorized representative:
PEAK-System Technik GmbH	Control Technologies UK Ltd
Leydheckerstraße 10	Unit 1, Stoke Mill,
64293 Darmstadt	Mill Road, Sharnbrook,
Germany	Bedfordshire, MK44 1NN, UK



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

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

DIN EN IEC 63000:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);
German version of EN IEC 63000:2018

Electromagnetic Compatibility Regulations 2016

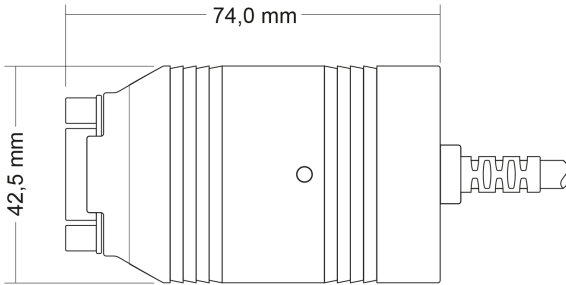
DIN EN 55032:2022-08
Electromagnetic compatibility of multimedia equipment - Emission requirements (CISPR 32:2015);
German version of EN 55032:2015 + AC:2016 + A11:2020 + A1:2020

DIN EN 55035:2018-04
Electromagnetic compatibility of multimedia equipment - Immunity requirements (CISPR 35:2016, modified);
German version of EN 55035:2017

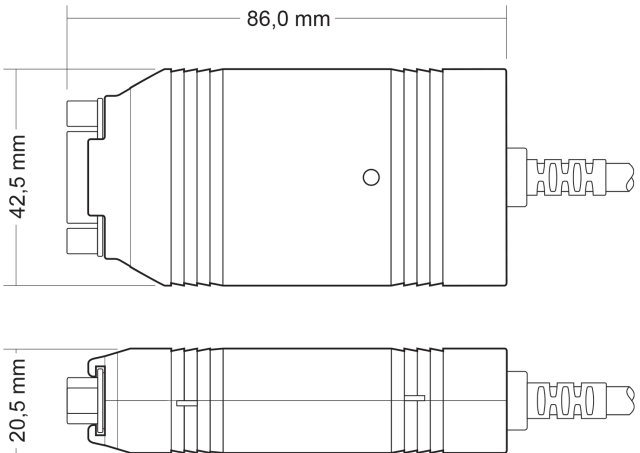
Darmstadt, 7 June 2024

Uwe Wilhelm, Managing Director

Appendix C Dimension Drawings



PCAN-USB



PCAN-USB opto-decoupled

Appendix D Quick Reference

Software/Hardware Installation under Windows

Download the device drivers installation package from our website www.peak-system.com/quick/DL-Driver-E. Install the driver before you install the CAN interface.

After driver installation connect the CAN interface to a USB port of the computer or of a connected USB hub. The new hardware is recognized by Windows and the driver is initialized. The LED on the interface then is lit.

Check the operational readiness. Open the Windows Start menu. Type *Peak Settings* and press **Enter**. The window *PEAK Settings* appears. The connected USB interface is displayed under *CAN Hardware*.

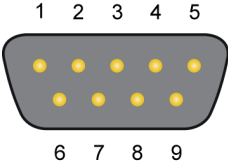
Getting Started under Windows

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

Status LED

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

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

Pin	Assignment	D-Sub plug
1	CAN_V+ (optional)	
2	CAN_Low	
3	CAN_GND	
4	Not connected	
5	Not connected	
6	CAN_GND	
7	CAN_High	
8	Not connected	
9	CAN_V+ (optional)	

Appendix E Linux

Depending on the Kernel version, device drivers for the CAN interfaces from PEAK-System are already included in the operating system. The PCAN interfaces are handled as network devices (SocketCAN, netdev). You can find the documentation for SocketCAN under:

<https://www.kernel.org/doc/Documentation/networking/can.txt>

The following command lists the available drivers:

```
grep PEAK_ /boot/config-`uname -r`
```

Whether the required driver for the PCAN interface is present and loaded can be checked with the following command:

```
lsmod | grep ^peak check
```

If the initialization was successful, the response line starts with `peak_usb`.

You can find a recent list of which PCAN interface is supported from which kernel version onwards on our Linux website.

If the required drivers are not listed, install the "Driver Package for Proprietary Purposes". The download and documentation for the driver can also be found on: www.peak-system.com/linux

This driver package is also needed to use the APIs based on the chardev driver, for example PCAN-Basic, libpcan, or libpcanfd.

Appendix F Disposal

The product must not be disposed of in household waste. Dispose of the product properly in accordance with local regulations.