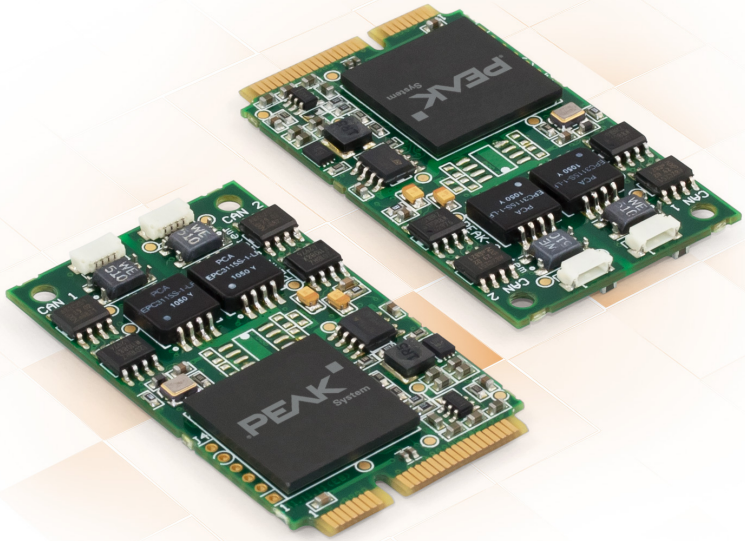
PCAN-miniPCIe

User Manual



Relevant Products

Product name	Model	Part number
PCAN-miniPCIe Single Channel	One CAN channel, galvanic isolation for CAN connection	IPEH-003048
PCAN-miniPCIe Double Channel	Two CAN channels, galvanic isolation for CAN connection	IPEH-003049

The cover picture shows the product PCAN-miniPCIe Double Channel. The Single Channel model has an identical form factor like the Double Channel model but varies in equipment.

Imprint

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Contents

1 Introduction

The CAN interface PCAN-miniPCIe for an PCI Express Mini slot is available as a version with one or two channels. With its small format, the CAN interface is ideal for embedded PCs, single board computers (SBC) and compact embedded applications. Depending on the version, one or two CAN type fieldbuses can be connected. Galvanic isolation up to 300 volts for each CAN channel protects against the transmission of electrical interference peaks between the CAN channels and the computer.

The monitor software PCAN-View and the programming interface PCAN-Basic for the development of applications with CAN connection are included in the scope of supply.

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

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 CAN interface.

1.1 Properties at a Glance

- CAN interface for the PCI Express Mini slot with PCIe lane
- 1 or 2 High-speed CAN channels (ISO 11898-2)
- CAN bus connection via connection cable and D-Sub, 9-pin (in accordance with CiA® 303-1)
- CAN nominal bit rates from 5 kbit/s up to 1 Mbit/s
- Complies with CAN spezification ISO 11898-1 for CAN

- FPGA implementation of the CAN FD controller (SJA1000 compatible)
- NXP PCA82C251 CAN transceiver
- Galvanic isolation up to 300 V per CAN connection
- Extended operating temperature range from -40 to +85 °C (-40 to +185 °F)

1.2 System Requirements

Computer with:

- Operating system Windows® 11 (64 bit), 10 (32/64 bit) or Linux (32/64-bit)
- PCI Express Mini slot with PCIe lane

1.3 Scope of Supply

- CAN interface PCAN-miniPCIe
- Connection cable including D-Sub plug for each channel, 20 cm

Downloads

- Device drivers for Windows® 11 (64 bit), 10 (32/64 bit) and Linux (32/64-bit)
- CAN monitor PCAN-View for Windows
- Programming interface PCAN-Basic for developing applications with CAN connection
- Programming interfaces for standardized protocols from the automotive sector

2 Installation

This chapter covers the software setup for the CAN interface PCAN-miniPCIe in Windows and the installation of the CAN interface in the computer.

Note: For installation on Linux, see Appendix D *Linux*.

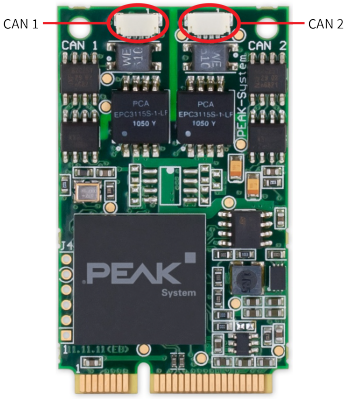
Install the driver before you install the CAN interface.

2.1 Install Device Driver Setup

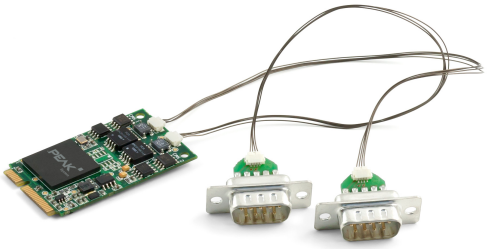
1. Download the device driver setup from our website:
   www.peak-system.com/quick/DL-Driver-E
2. Unpack the file `PEAK-System_Driver-Setup.zip`
3. Double-click the file `PeakOemDrv.exe`
   The driver setup starts.
4. Follow the program instructions.

2.2 Connect the CAN interface

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



CAN ports Double Channel.



Double Channel with connection cables.

1. Shut down the computer.
2. Disconnect the computer's power supply.
3. Open the computer case.
4. Insert the CAN interface into an empty PCI Express Mini slot.
5. For each CAN channel, mount a D-Sub connector of the connection cable in a suitable recess of the computer housing.
6. For each CAN channel interconnect the SUR socket connector of the connection cable and the SUR header on the CAN interface.
7. Close the computer case.
8. Reconnect the computer power supply.
9. Turn on the computer and start Windows.
   Windows detects the new hardware and completes the driver installation.

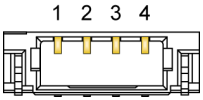
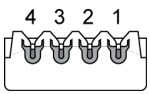
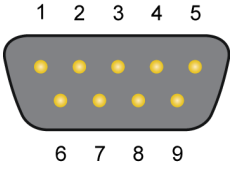
2.3 Check Operational Readiness

1. Open the Windows Start menu.
2. Type `Peak Settings` and press Enter.
   The window *PEAK Settings* appears.
3. Select *CAN Hardware*.
   The connected CAN interface is displayed.

3 Connecting the CAN Bus

3.1 Connection over D-Sub Connector

After the connection cable has been connected to the CAN interface a CAN bus can be connected to the D-Sub connector. The pin assignment of the D-Sub connector corresponds to the specification CiA® 303-1:

CAN interface	Connection cable		
SUR header **Type: SM04B-SURS-TF**	**SUR socket** **Type: 04SUR-32S**	**D-Sub plug, 9-pin**	
			
			Assignment
2	2	3, 6	CAN_GND
3	3	7	CAN_High
4	4	2	CAN_Low
1	1	1, 4, 5, 8, 9	None

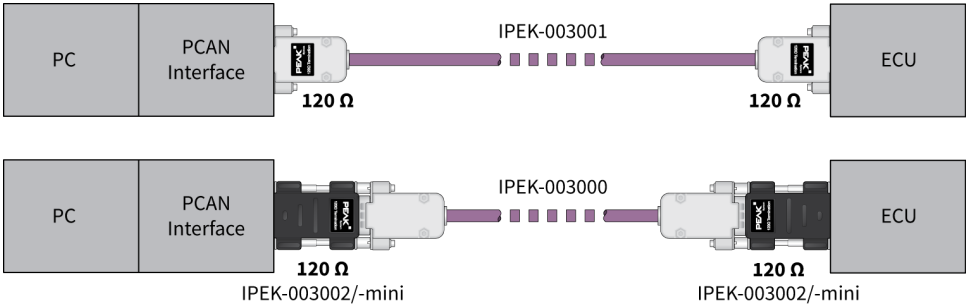
3.2 Cabling

3.2.1 Termination

The High-speed CAN bus (ISO 11898-2) must be terminated with 120 Ω 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 CAN interface PCAN-miniPCIe does not have an internal termination. Use the CAN interface on a terminated CAN bus.

3.2.2 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 Ω at both ends. At the lower example the connection is made with termination adapters.

3.2.3 Maximum Bus Length

The maximum bus length depends primarily on the bit rate:

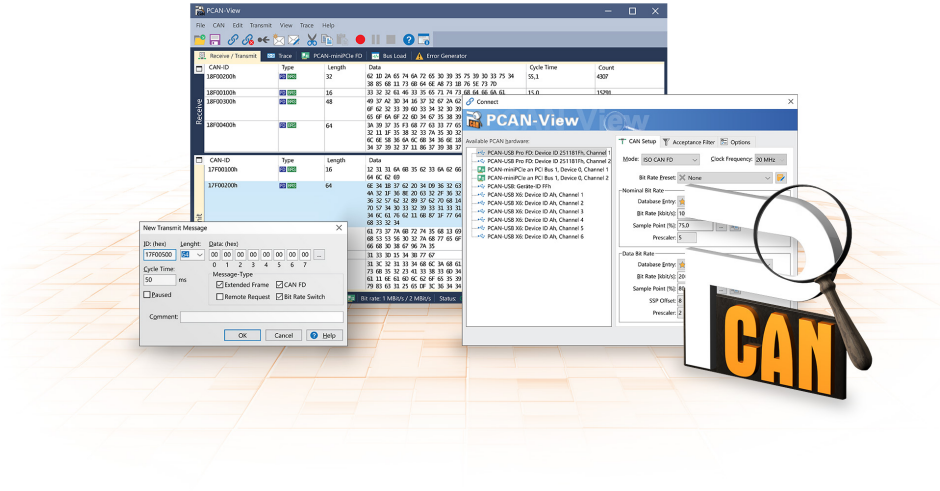
Nominal bit rate	Buslength
1 Mbit/s	40 m
500 kbit/s	110 m
250 kbit/s	240 m
125 kbit/s	500 m
50 kbit/s	1.3 km
20 kbit/s	3.3 km
10 kbit/s	6.6 km
5 kbit/s	13 km

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

3.3 Example Application under Windows

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

4 CAN Monitor PCAN-View



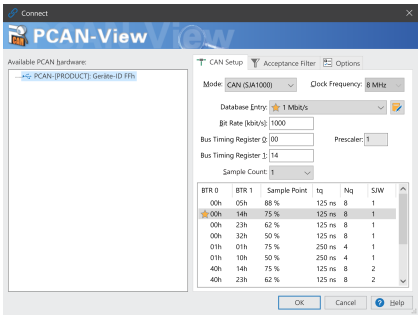
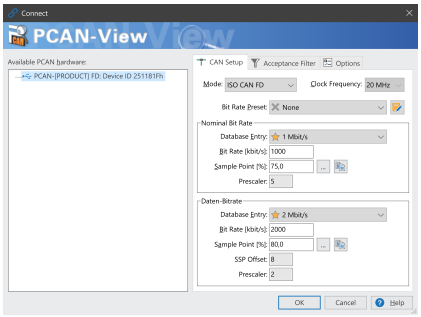
The CAN monitor PCAN-View is a Windows software for viewing, sending, and recording CAN and CAN FD messages. The software is installed with the installation of the device driver package under Windows.

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*.

4.1 CAN interface initialize

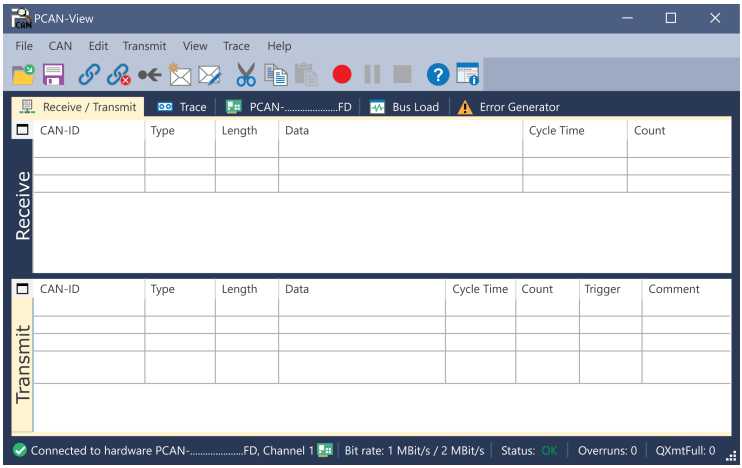
1. Open the program *PCAN-View* via the Windows Start menu.
   Depending on the CAN interface the *Connect* dialog is displayed with or without settings for CAN FD.

CAN	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.

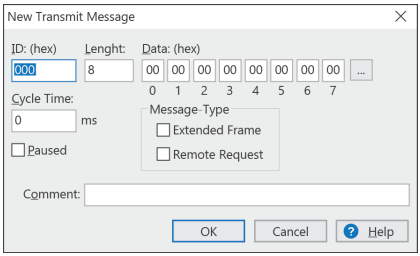
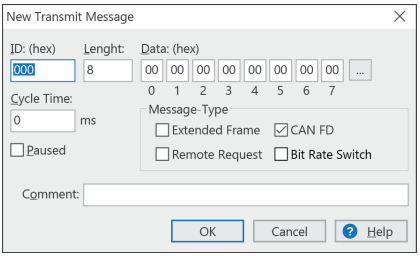
4. Confirm the entries with *OK*. The main window appears and displays the *Receive / Transmit* tab.



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

4.2 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.

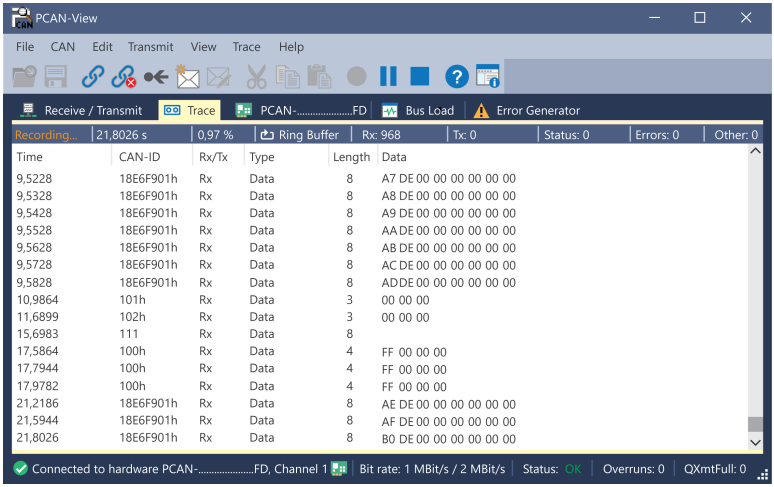
CAN	CAN FD
	

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.
   Enter a value greater than 0 to transmit periodically.
   Enter the value 0 to transmit only manually.
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.

4.3 Additional Tabs

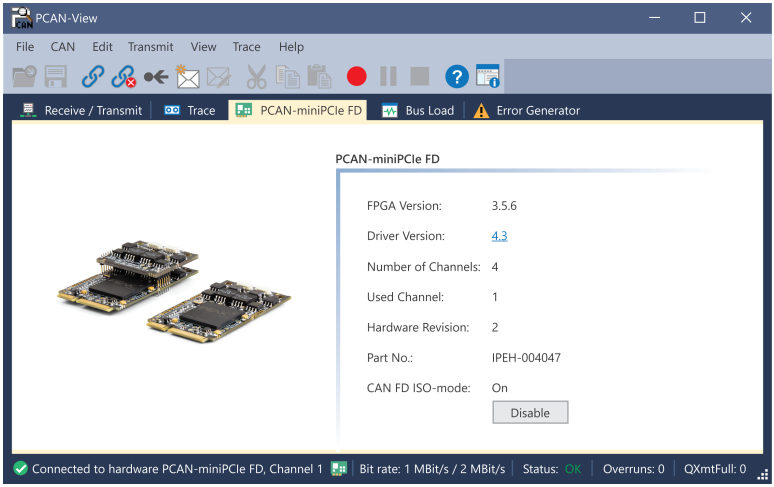
Depending on the CAN interface, additional tabs are available.

4.3.1 Trace Tab



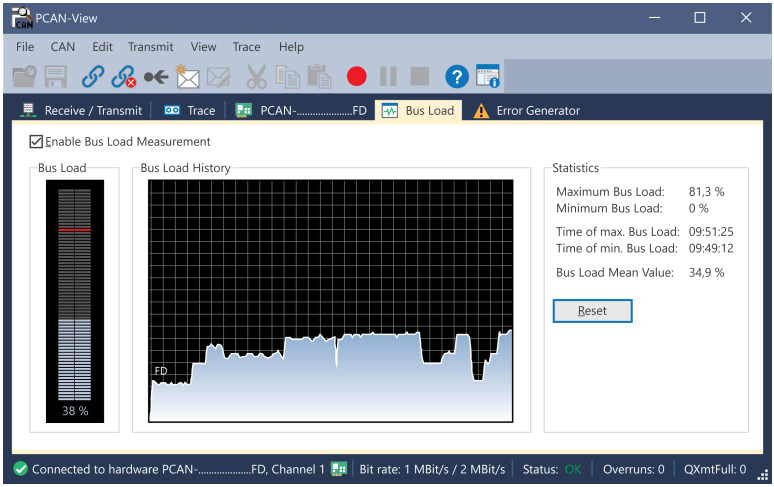
The tracer (data logger) records the communication of the CAN bus in linear or ring buffer mode. The trace data can be saved to a file.

4.3.2 CAN interface Tab



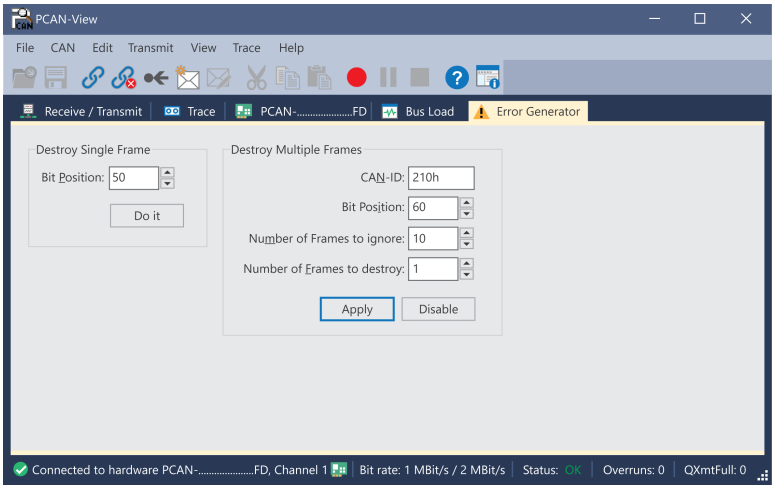
The *CAN interface* tab shows information about the hardware and the used Windows device driver. In this case exemplary for the PCAN-miniPCIe FD. Depending on the CAN interface, a hardware ID can be determined to distinguish several interfaces of the same type. For interfaces with CAN FD a transmission according to "ISO" or "Non-ISO" can be set as default of the hardware.

4.3.3 Bus Load Tab



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

4.3.4 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

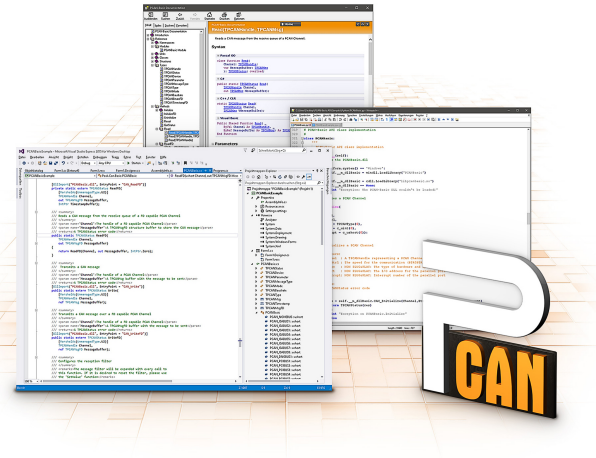
The *Destroy Single Frame* area refers to the next CAN frame that is recognized by the plug-in card after activation.

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*.

5 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 interface 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 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 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

5.1 Features of PCAN-Basic

- Thread-safe API for developing applications with CAN and CAN FD connections
- Supports CAN specifications ISO 11898-1 for CAN and CAN FD
- Supports the operating systems:
  - Windows® 11 (64 bit), 10 (32/64 bit)
  - Linux (32/64-bit)
- Multiple PEAK-System applications and your own can be operated on a physical channel at the same time
- Single DLL (Win) / SO (Linux) for all supported hardware types
- Use of up to 16 channels for each hardware type
- Simple switching between channels
- Access to the CAN channels of a PCAN-Gateway via the PCAN-LAN device type
- Driver-internal buffering under Windows of up to 32,768 CAN 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 v1.1 for CAN and v2.0 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 systems
- Debugging information can be defined individually

5.2 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. Per CAN interface type the API allows the simultaneous use of up to 16 CAN channels. 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.

For the receiving CAN messages, events can be configured for 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.

6 Technical Data

Connections		
	Connection side	**Connection type**
CAN connection cable	CAN bus CAN interface	D-Sub (m), 9-pin 04SUR-32S (www.jst-mfg.com)
CAN socket on CAN interface	Type: SM04B-SURS-TF	
Computer	PCI Express Mini slot, 52-pin; electromechanical specifications 1.1 and 1.2; uses PCIe lane	

CAN (FD)	
Protocols on OSI layer 2	CAN according to ISO 11898-1
Physical transmission, OSI layer 1	ISO 11898-2 (High-speed CAN)
Transceiver	NXP PCA82C251
CAN bit rates	5 kbit/s to 1 Mbit/s
Controller	FPGA implementation (SJA1000 compatible)
Time stamp resolution	1 µs
Galvanic isolation	up to 300 V, separate for each CAN connector
Interne Terminierung	none

Power supply		
Max. current consumption at 1.5 V pin	Single Channel Double Channel	180 mA 180 mA
Max. current consumption at 3.3 V pin	Single Channel Double Channel	230 mA 330 mA

Measures		
Size (W x L x H)	Single Channel Double Channel	30 x 51 x 4 mm 30 x 51 x 4 mm
Length connection cable	20 cm	
Weight	Single Channel Double Channel Connection cable Screw for D-Sub connector	7 g 7 g 7 g (each) 1 (each)

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

Conformity	
RoHS	Directive 2011/65/EU (RoHS 2) + 2015/863/EU DIN EN IEC 63000:2019-05;VDE 0042-12:2019-05
EMV	Directive 2014/30/EU EN 55024:2016-05;VDE 0878-24:2016-05 EN 55032:2016-02;VDE 0878-32:2016-02

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name: **PCAN-miniPCIe**

Item number(s): **IPEH-003048/49**

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

DIN EN IEC 63000:2019-05;VDE 0042-12:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016); German version EN 63000:2018

EU Directive 2014/30/EU (Electromagnetic Compatibility)

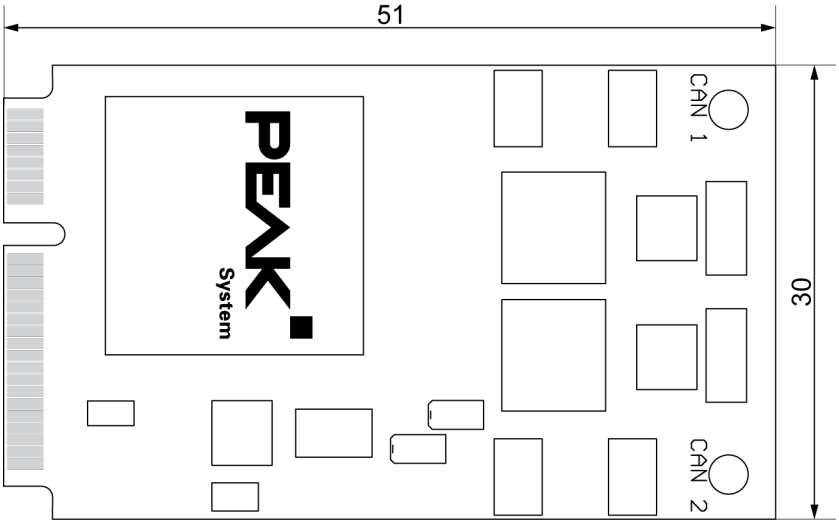
DIN EN 55024:2016-05;VDE 0878-24:2016-05
Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010 + Cor.:2011 + A1:2015); German version EN 55024:2010 + A1:2015

DIN EN 55032:2016-02;VDE 0878-32:2016-02
Electromagnetic compatibility of multimedia equipment - Emission Requirements (CISPR 32:2015); German version EN 55032:2015

Darmstadt, 7 September 2021

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawings



Dimensions in mm of PCAN-miniPCIe Single Channel and Double Channel.

Appendix C 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.

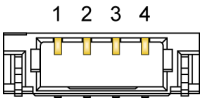
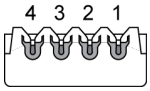
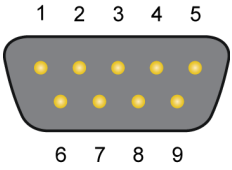
Turn off the computer and insert the PCAN-miniPCIe into an available PCI Express Mini slot (using PCIe lane).

The new hardware is detected at the next Windows start and the driver is initialized. Check the operational readiness. Open the Windows Start menu. Type `Peak Settings` and press Enter. The window *PEAK settings* appears. The connected CAN 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.

Pin assignment

CAN interface	Connection cable		
SUR header **Type: SM04B-SURS-TF**	**SUR socket** **Type: 04SUR-32S**	**D-Sub plug, 9-pin**	
			**Assignment**
2	2	3, 6	CAN_GND
3	3	7	CAN_High
4	4	2	CAN_Low
1	1	1, 4, 5, 8, 9	None

Appendix D Linux

Depending on the Kernel version, device drivers for the CAN interfaces from PEAK-System are already included in the operating system. The CAN interfaces are treated as network devices (SocketCAN, netdev). You can find the documentation for SocketCAN under: https://www.kernel.org/doc/Documentation/networking/can.txt

The command `grep PEAK_ /boot/config-`uname -r`` lists the available drivers. The following table shows the PCAN-Interfaces and from which kernel version they are supported.

PCAN-Interface			Kernel version
PCAN-PCI	PCAN-PCI Express	PCAN-miniPCI	≥ 3.2
PCAN-PC/104-Plus	PCAN-PCI/104-Express		
PCAN-USB	PCAN-USB Pro	PCAN-ExpressCard	≥ 3.4
PCAN-PCI Express	PCAN-miniPCIe		
PCAN-PCI/104-Express			≥ 3.7
PCAN-USB FD	PCAN-USB Pro FD		≥ 4.0
PCAN-Chip USB			≥ 4.11
PCAN-PCI Express FD			≥ 4.12
PCAN-PCI/104-Express FD	PCAN-miniPCIe FD	PCAN-Chip PCIe FD	≥ 4.12
PCAN-M.2			
PCAN-Chip PCIe			≥ 4.3
PCAN-USB X6			≥ 4.9

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` or `peak_pci`.

If the required drivers are not listed, install the "Driver Package for Proprietary Purposes". The download, the user manual for the driver, and the corresponding "Implementation Details" can be found under: 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.