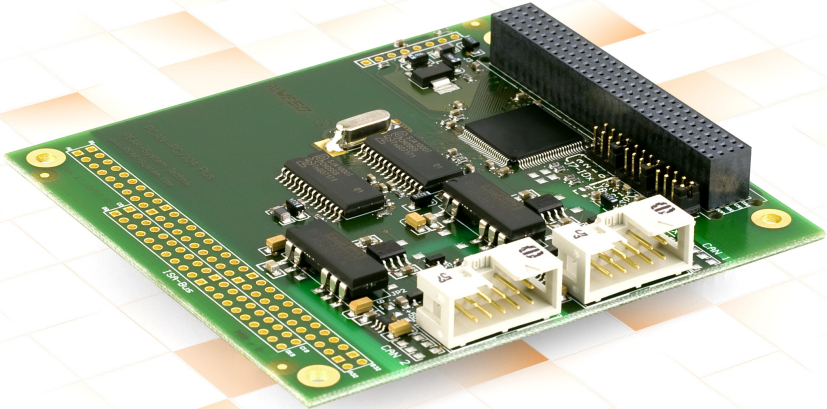


PCAN-PC/104-Plus

User Manual



Relevant Products

Product name	Model	Part number
PCAN-PC/104-Plus Single Channel	One CAN channel	IPEH-002094
PCAN-PC/104-Plus Dual Channel	Two CAN channels	IPEH-002095
PCAN-PC/104-Plus Single Channel opto-decoupled	One CAN channel, galvanic isolation for CAN connection	IPEH-002096
PCAN-PC/104-Plus Dual Channel opto-decoupled	Two CAN channels, galvanic isolation for CAN connection	IPEH-002097

The cover picture shows the product PCAN-PC/104-Plus Dual Channel opto-decoupled. Other product versions have an identical form factor but vary in equipment.

Imprint

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1 Introduction

The PCAN-PC/104-Plus card enables the connection of one or two CAN networks to a PC/104-Plus system. Up to four cards can be operated, with each piggy-backing off the next. The CAN bus is connected using a 9-pin D-sub plug on the slot bracket supplied.

The card is available as a single or dual-channel version. The opto-decoupled versions also guarantee galvanic isolation of up to 500 Volts between the PC and the CAN sides.

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



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

- Form factor PC/104
- Use of the 120-pin connection for the PCI bus
- Up to four cards can be used in one system
- 1 or 2 High-speed CAN channels (ISO 11898-2)
- Bit rates from 5 kbit/s up to 1 Mbit/s
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Connection to CAN bus through D-Sub slot brackets, 9-pin (in accordance with CiA® 106)
- NXP SJA1000 CAN controller, 16 MHz clock frequency
- NXP PCA82C251 CAN transceiver
- 5-Volt supply to the CAN connection can be connected through a solder jumper, e.g. for external bus converter
- Galvanic isolation on the CAN connection up to 500 V, separate for each CAN channel (only for IPEH-002096 and IPEH-002097)
- Extended operating temperature range from -40 to +85 °C (-40 to +185 °F)
- Optional available: PC/104-ISA stack-through connector

1.2 System Requirements

PC/104-Plus stack with

- PCI-Bus (according to the specification PC/104-Plus)
- Operating system Windows 11 (x64), 10 (x64) or Linux

1.3 Scope of Supply

- PCAN-PC/104-Plus card
- Slot bracket with D-Sub connectors for the CAN bus

Downloads

- Device drivers for Windows 11 (x64), 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 Configuration

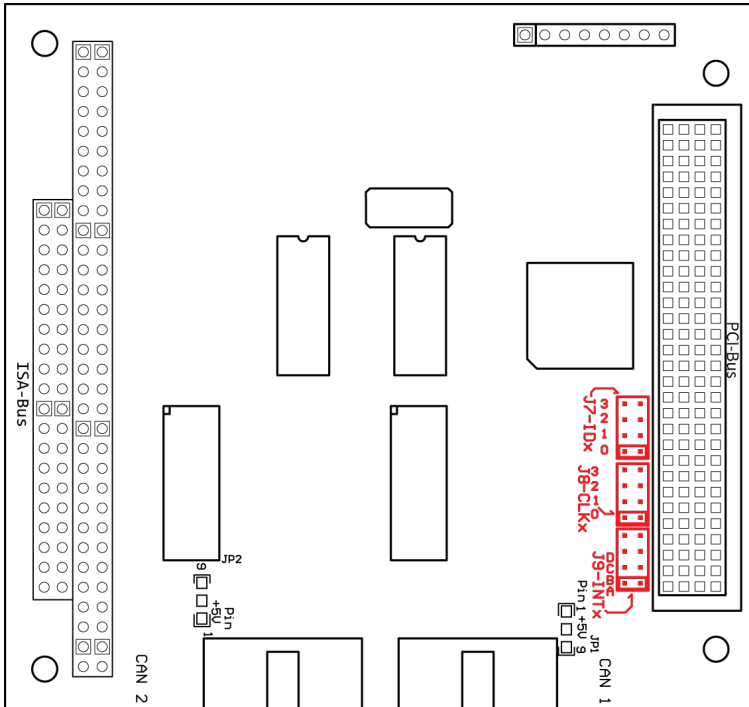
Before installing the CAN interface into a PC/104 stack, you must configure it using jumpers on the PCB.



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

2.1 Position in the PC/104 Stack

The CAN interface must be adjusted to a specific position in the PC/104 stack by setting the appropriate jumpers. The position number results from the distance to the host.



		Position in the PC/104 stack			
Jumper	Signal	1	2	3	4
J7	ID Select	0	1	2	3
J8	Clock Select	0	1	2	3
J9	Interrupt Select	A	B	C	D

2.2 Voltage Supply of External Devices



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).

Optionally, an external voltage supply can be connected separately for each CAN channel via 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, for example bus converters (PCAN-TJA1054 for Low-Speed-CAN). Pin 1 and pin 9 are not connected at delivery.

The current output is limited to

- 100 mA without galvanic isolation.
- 50 mA with galvanic isolation.

The lower current output of the versions with galvanic isolation is due to an intermediate DC/DC converter.

2.2.1 Activate voltage supply

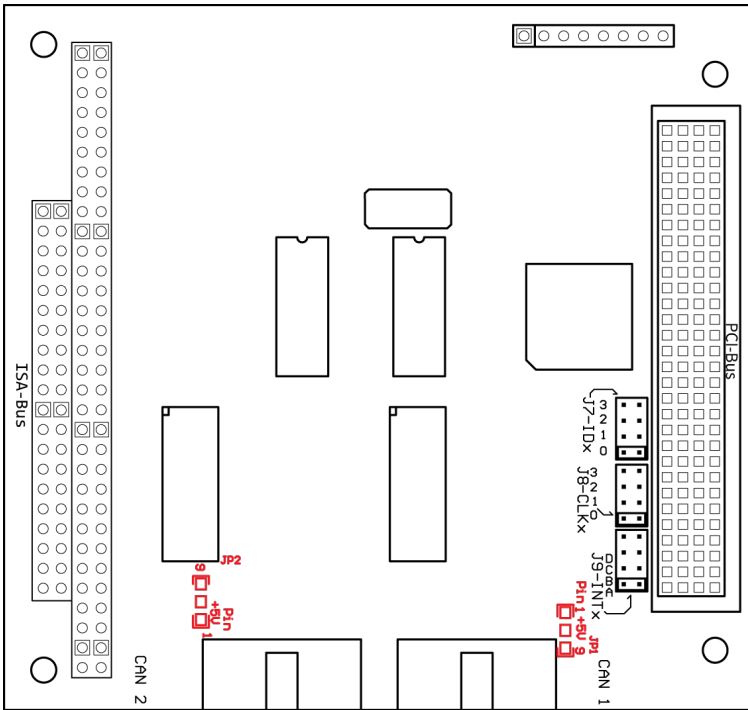


Risk of short circuit! Soldering on the CAN interface may only be performed by qualified electrical engineering personnel.



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

Set the solder bridge(s) on the card according to the desired settings.



5-Volt supply					
D-Sub connector	Solder field	Without (Standard)	Pin 1	Pin 9	Pin 1 and pin 9
CAN 1	JP1				
CAN 2	JP2				

2.3 Notes for the ISA Bus Stack-through Connection

If you want to use additional modules in the PC/104 stack being connected via the ISA bus, the connections J1 and J2 must be equipped with stack-through connectors. On request you get a respective version of the CAN interface.

Taking the host as point of view, PC/104 modules with ISA bus must be plugged onto the stack behind any module with PCI bus. The signals of the ISA bus are connected through and not used by the CAN interface PCAN-PC/104-Plus.

3 Installation

This chapter covers the software setup for the CAN interface PCAN-PC/104-Plus under Windows and the installation of the CAN interface into the PC/104 stack.

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

Install the driver before you install the CAN interface.

3.1 Install Device Driver Setup

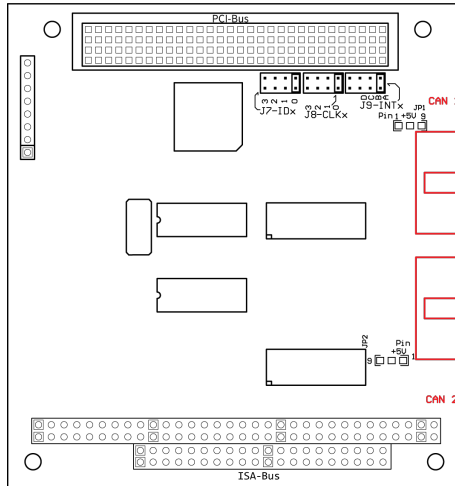
1. Download the device driver setup from our website:
www.peak-system.com/quick/DL-Driver-E
2. Unpack the file `PEAK-System_Driver-Setup.zip`
3. Double-click the file `PeakOemDrv.exe`
The driver setup starts.
4. Follow the program instructions.

3.2 Install CAN interface

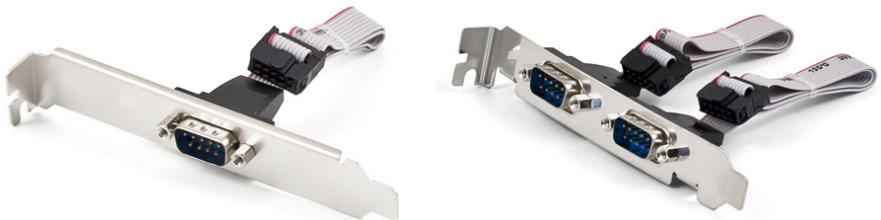


Attention! Electrostatic discharge (ESD) can damage or destroy components on the card. Take precautions to avoid ESD.

1. Connect one cable per CAN connection from the slot bracket to a 10-pin socket on the CAN interface.



2. Shut down the computer.
3. Disconnect the computer's power supply.
4. Insert the CAN interface into the PC/104 stack at the position configured before (Position 1 to 4).
5. Install the slot bracket.



6. Reconnect the computer power supply.
7. Turn on the computer and start Windows.

Windows detects the new hardware and completes the driver installation.

3.3 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.

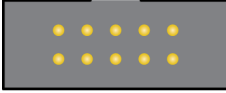



Under Windows the CAN interface PCAN-PC/104-Plus is run as a PCI card.

4 Connecting the CAN Bus

4.1 Connection over D-Sub Connector

After the slot bracket 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® 106:

10-pin connector on CAN interface	D-Sub plug on slot bracket, 9-pin	Assignment
9 7 5 3 1	1 2 3 4 5	
		
10 8 6 4 2	6 7 8 9	
1	1	+5 V (optional)
2	6	GND
3	2	CAN_Low
4	7	CAN_High
5	3	GND
8	9	+5 V (optional)
6, 7, 9, 10	4, 5, 8	None

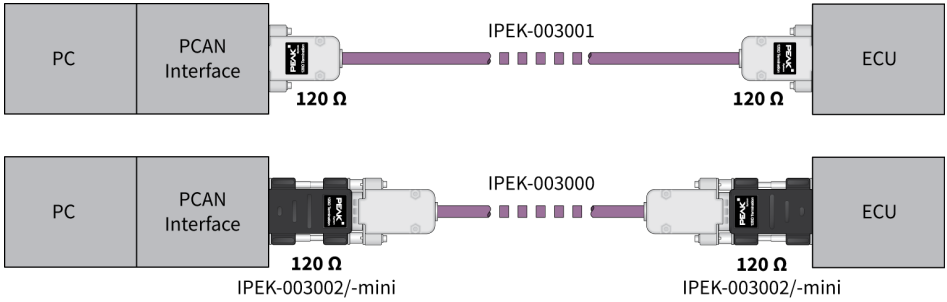
4.2 Cabling

4.2.1 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-PC/104-Plus does not have an internal termination. Use the CAN interface on a terminated CAN bus.

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

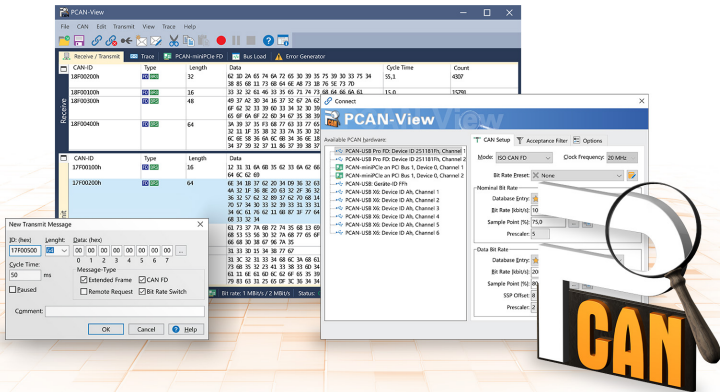
4.2.3 Maximum Bus Length

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.

5 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.

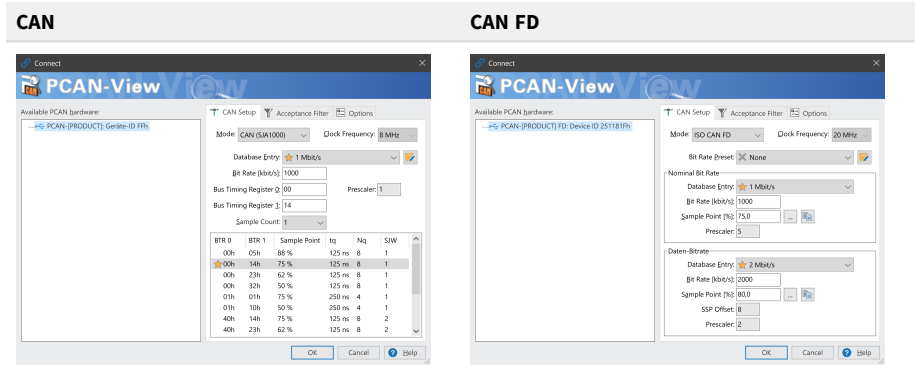
In the following the initialization of a CAN interface is described as an example.

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

5.1 Initialize CAN interface

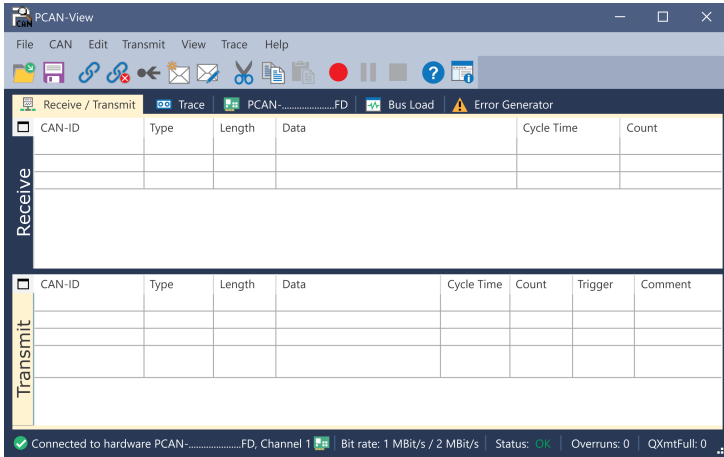
1. Open the program *PCAN-View* via the Windows Start menu.

Depending on the CAN interface the *Connect* dialog is displayed with or without settings for CAN FD.



CAN interface	List entry in Available Hardware
USB Interface, 1-channel	see example above
USB Interface, 2-channel	<ul style="list-style-type: none"> PCAN-USB Pro FD: Device ID 251181Fh, Channel 1 PCAN-USB Pro FD: Device ID 251181Fh, Channel 2
PCIe Interface, 2-channel	<ul style="list-style-type: none"> PCAN-PCI Express at PCI Bus 1, Device 0, Channel 1 PCAN-PCI Express at PCI Bus 1, Device 0, Channel 2

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

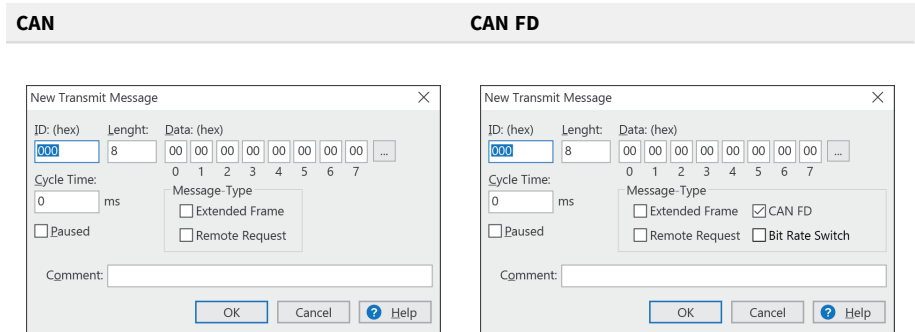


- For initializing another channel or CAN interface, open another instance of *PCAN-View*.

5.2 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.



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.

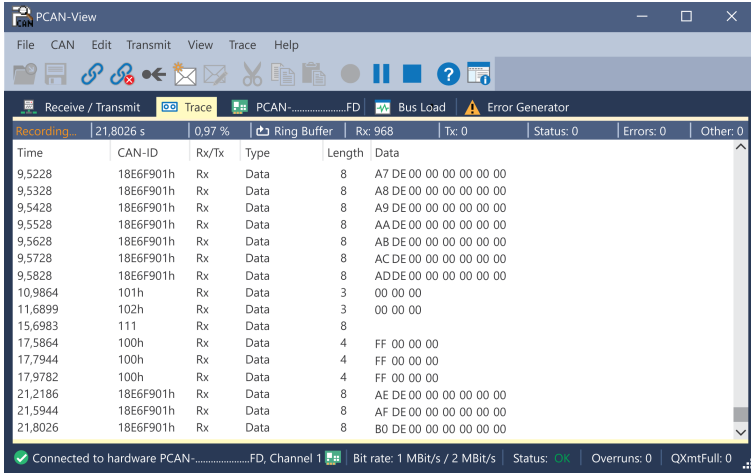
4. To send the message manually, select the menu command *Transmit > Send* or press the **space** bar.

The manual transmission process is performed additionally for periodically transmitted CAN messages.

5.3 Additional Tabs

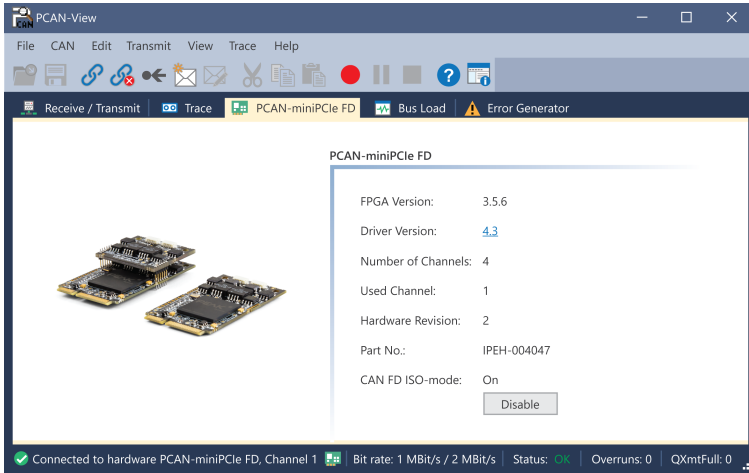
Depending on the CAN interface, additional tabs are available.

5.3.1 Trace Tab



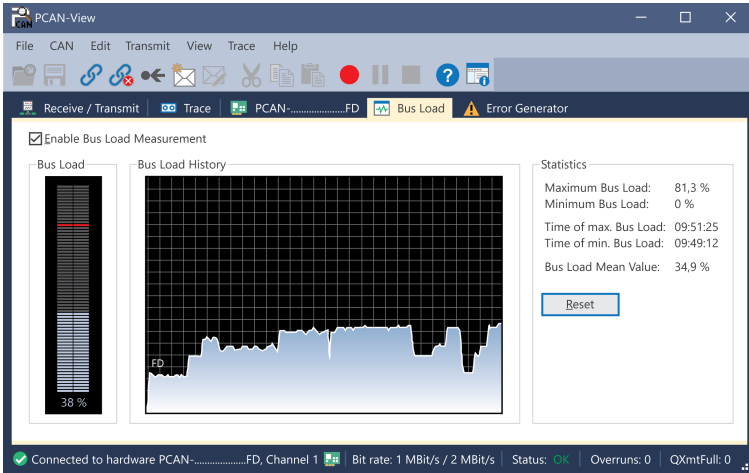
The tracer (data logger) records the communication of the CAN bus in linear or ring buffer mode. The trace data can be saved to a file.

5.3.2 CAN Interface Tab



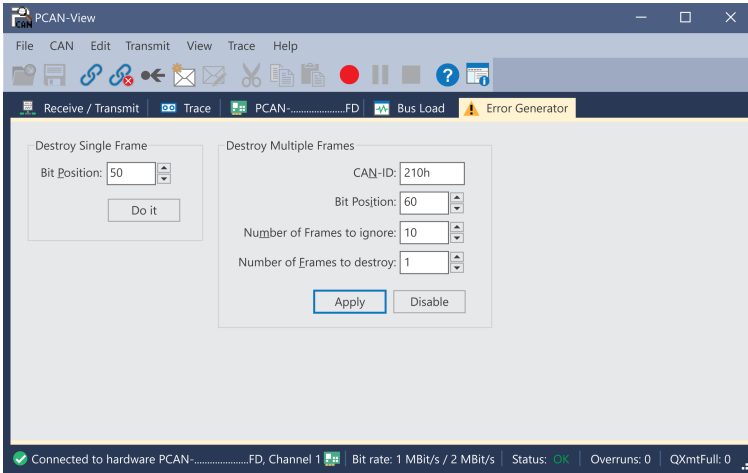
The *CAN interface* tab shows information about the hardware and the used Windows device driver. In this case exemplary for the PCAN-miniPCle FD. Depending on the CAN interface, a hardware ID can be determined to distinguish several interfaces of the same type.

5.3.3 Bus Load Tab



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

5.3.4 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.

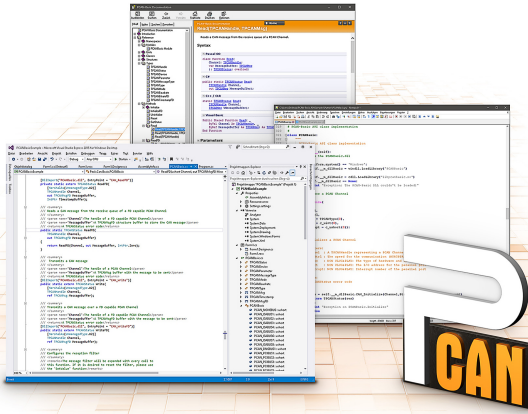
1. Enter the *Bit Position* where in the CAN frame the error is to be generated. The bit position must start after the identifier. The count includes the stuff bits.
2. Execute the destroy action with *Do it*.

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*.

6 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.

6.1 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

6.2 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.

7 Technical Data

Connections

	Connection side	Connection type
CAN slot bracket	CAN-bus	D-Sub (m), 9-pin, pin assignment according to CiA® 106
	Stack card	10-pin connector
PC/104-Plus	PCI bus (PC/104-Plus Version 2), 120-pin strip, for 5-Volt systems ISA bus: optionally equipped stack-through connectors for the ISA signals	

CAN

Protocols on OSI layer 2	CAN according to ISO 11898-1		
Physical transmission	ISO 11898-2 (High-speed CAN)		
Transceiver	NXP PCA82C251		
CAN bit rates	5 kbit/s to 1 Mbit/s		
Controller	NXP SJA1000		
Time stamp resolution	1 µs		
Galvanic isolation	Single Channel		without
	Dual Channel		without
	Single Channel	opto-decoupled	up to 500 V, separate for each CAN connector
	Dual Channel	opto-decoupled	up to 500 V, separate for each CAN connector
Power supply external devices at D-Sub pin 1 and/or pin 9 (not assigned at delivery)	Single Channel		5 V, max. 100 mA
	Dual Channel		5 V, max. 100 mA
	Single Channel	opto-decoupled	5 V, max. 50 mA
	Dual Channel	opto-decoupled	5 V, max. 50 mA
Internal Termination	none		

Power supply

Supply voltage	4.75 to 5.25 V DC		
Max. current consumption without power supply for external devices	Single Channel		150 mA
	Dual Channel		280 mA
	Single Channel	opto-decoupled	260 mA
	Dual Channel	opto-decoupled	490 mA

Measures

Size (W x L x H)	about 90 x 96 x 15 mm; (stacking height; component height max. 11 mm)		
Weight	Single Channel		46 g
	Dual Channel		50 g
	Single Channel	opto-decoupled	47 g
	Dual Channel	opto-decoupled	53 g
	Slot bracket	Single Channel	25 g
	Slot bracket	Dual Channel	40 g

Environment

Operating temperature	-40 to +85 °C (-40 to +185 °F)
Temperature for storage and transport	-40 to +125 °C (-40 to +257 °F)
Relative humidity	15 to 90 %, not condensing

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-PC/104-Plus**
Item number(s): **IPEH-002094, IPEH-002095, IPEH-002096, IPEH-002097**
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-PC/104-Plus**
Item number(s): **IPEH-002094, IPEH-002095, IPEH-002096, IPEH-002097**

Manufacturer:
PEAK-System Technik GmbH
Leydheckerstraße 10
64293 Darmstadt
Germany

UK authorized representative:
Control Technologies UK Ltd
Unit 1, Stoke Mill,
Mill Road, Sharnbrook,
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

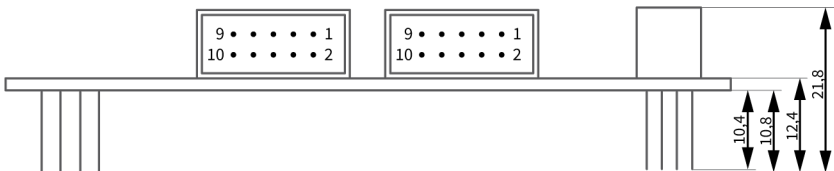
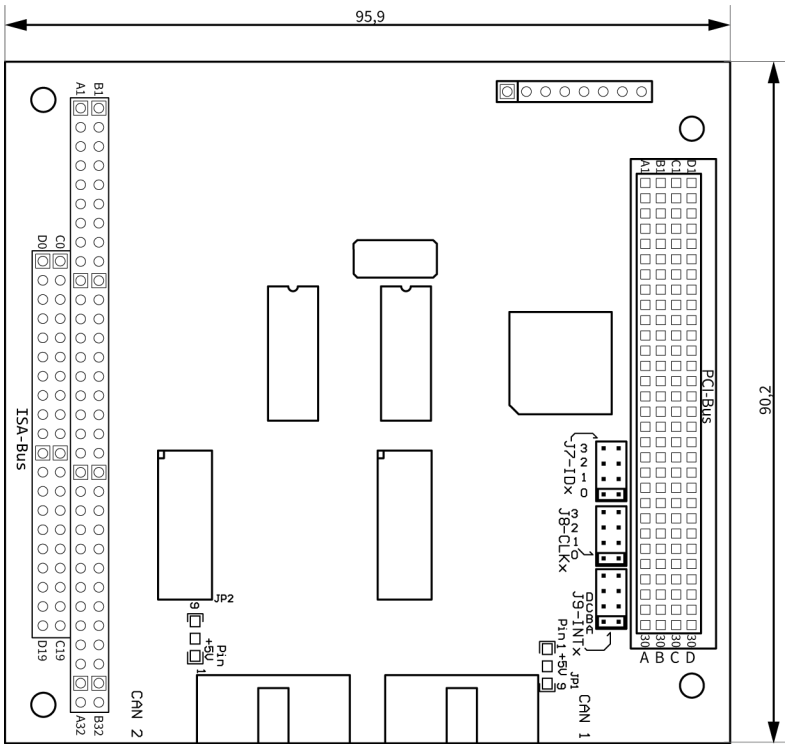
DIN EN 55035:2018-04

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



Dimensions in mm of PCAN-PC/104-Plus Single Channel and Dual Channel.

Appendix D Quick Reference

Position of the card in the PC/104 stack

Jumper	Signal	Position in the PC/104 stack			
		1	2	3	4
J7	ID Select	0	1	2	3
J8	Clock Select	0	1	2	3
J9	Interrupt Select	A	B	C	D

Software/Hardware Installation under Windows

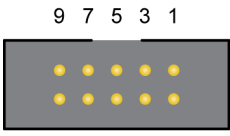
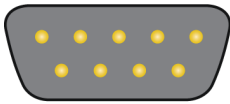
Download the device drivers installation package from our website www.peak-system.com/quick/DL-Driver-E. Install the driver before you install the CAN interface.

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 . 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

10-pin connector on CAN interface	D-Sub plug on slot bracket, 9-pin	Assignment
		
1	1	+5 V (optional)
2	6	GND
3	2	CAN_Low
4	7	CAN_High
5	3	GND
8	9	+5 V (optional)
6, 7, 9, 10	4, 5, 8	None

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_pci`.

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.