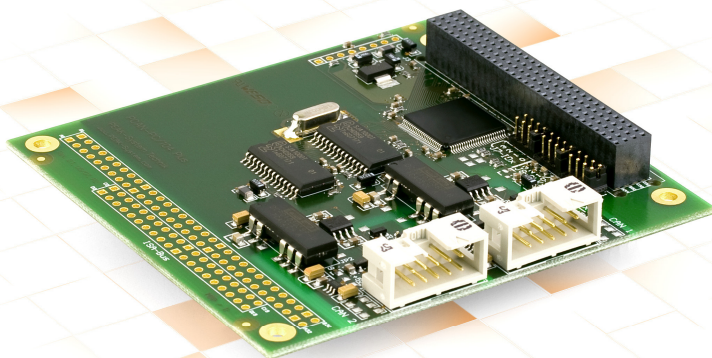


# PCAN-PC/104-Plus

CAN Interface for PC/104-Plus

## User Manual



Document version 2.5.0 (2019-03-06)

**PEAK**  
System

## 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 connections	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.

On request you can get the product versions with stack-through connectors for the ISA bus.

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# Contents

<b>1</b>	<b>Introduction</b>	<b>5</b>
1.1	Properties at a Glance	5
1.2	System Requirements	6
1.3	Scope of Supply	7
<b>2</b>	<b>Configuring and Installing the Card and the Software</b>	<b>8</b>
2.1	Configuring the Card	8
2.1.1	Setting the Position in the PC/104 Stack	8
2.2	Installing the Software and the Card	10
2.3	Notes for the ISA Bus Stack-through Connection	12
<b>3</b>	<b>Connecting the CAN Bus</b>	<b>13</b>
3.1	Connection over D-Sub connector	13
3.1.1	Slot Bracket with D-Sub Connectors	15
3.2	Voltage Supply of External Devices	16
3.3	Cabling	18
3.3.1	Termination	18
3.3.2	Example of a Connection	18
3.3.3	Maximum Bus Length	19
<b>4</b>	<b>Software and API</b>	<b>20</b>
4.1	Monitor Software PCAN-View	20
4.1.1	Receive/Transmit Tab	22
4.1.2	Trace Tab	24
4.1.3	PCAN-PC/104-Plus Tab	25
4.1.4	Status Bar	25
4.2	Linking Own Programs with PCAN-Basic	26
4.2.1	Features of PCAN-Basic	27
4.2.2	Principle Description of the API	28
4.2.3	Notes about the License	29

<b>5 Technical Specifications</b>	<b>30</b>
<b>Appendix A CE Certificate</b>	<b>32</b>
<b>Appendix B Dimension Drawing</b>	<b>33</b>
<b>Appendix C Quick Reference</b>	<b>34</b>

# 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 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.



**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-PC/104-Plus card.

## 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 bracket, 9-pin (in accordance with CiA<sup>®</sup> 303-1)
- └ 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 converters
- └ Galvanic isolation on the CAN connection up to 500 V (only opto-decoupled versions), separate for each CAN channel
- └ Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)
- └ Optionally available: PCI/104-ISA stack-through connector



**Note:** This manual describes the use of the PCAN-PC/104-Plus card with **Windows**. You can find device 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](http://www.peak-system.com/linux).

## 1.2 System Requirements

- └ PC/104 stack with PCI-Bus (according to the specification PC/104-Plus)
- └ 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)

## 1.3 Scope of Supply

- └ PCAN-PC/104-Plus card
- └ Slot bracket with D-Sub connectors for the CAN bus
- └ 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 Configuring and Installing the Card and the Software

This chapter covers the configuration and the software setup for the PCAN-PC/104-Plus card under Windows and the installation of the card in the PC/104 stack.



**Note:** Under Windows the PCAN-PC/104-Plus card is run as a PCI card.

### 2.1 Configuring the Card

Before installing the PCAN-PC/104-Plus card into a PC/104 stack, you may have to configure it using jumpers on the PCB.



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

#### 2.1.1 Setting the Position in the PC/104 Stack

For communication with the host the PCAN-PC/104-Plus card uses the PCI interface where specific relations between the lengths of the signal lines must be met. Different line lengths result from different positions of a PC/104-Plus card in a PC/104 stack.

Therefore, the PCAN-PC/104-Plus card must be adjusted to a specific position in the stack by setting the appropriate jumpers. The spatial distance to the host results in the index for the assignment of the jumpers.



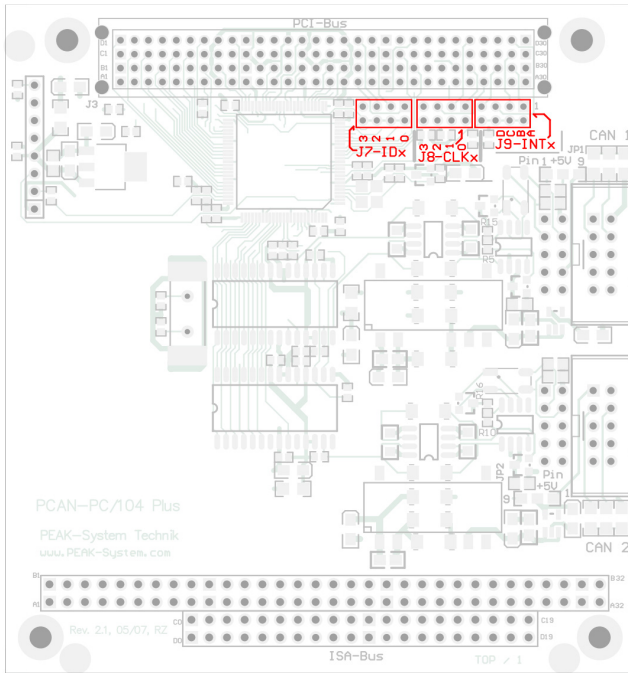


Figure 1: Position of the jumpers J7, J8, J9 on the PCAN-PC/104-Plus card

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

## 2.2 Installing the Software and the Card


This chapter covers the software setup for the PCAN-PC/104-Plus and the installation of the card in the PC/104 stack.

Install the driver before you install the card.

▶ 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 install card into the PC/104 stack:

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

1. Plug a cable from the slot bracket to a 10-pin socket for each CAN connection.

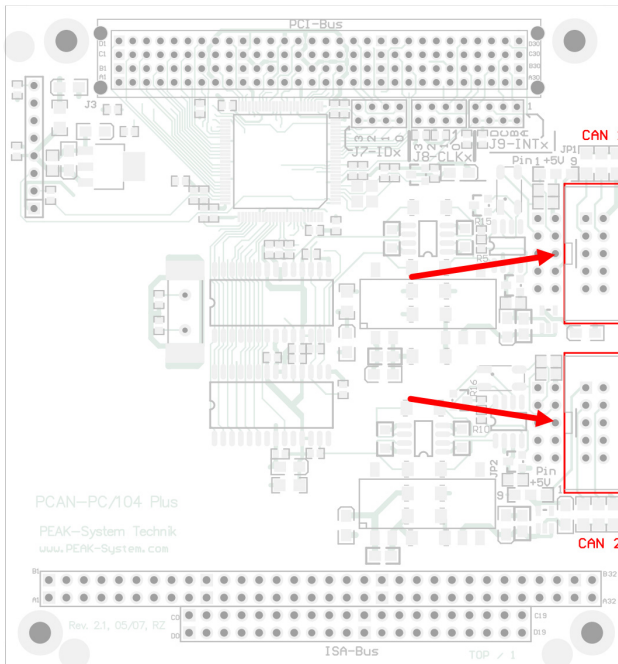


Figure 2: Position of the sockets for the CAN connection,  
J4 for CAN channel 1 (upper position),  
J5 for CAN channel 2 (lower position, Dual Channel versions only)

2. Shut down the computer.
3. Disconnect the computer's power supply.

4. Insert the card into the PC/104 stack at the position configured before (1 to 4).
5. Reconnect the power supply of the computer.
6. Turn on the computer and start Windows.

Windows detects the new hardware and completes the driver installation.

▶ Do the following to check the operational readiness:

1. Open the Windows Start menu.
2. Type `peakcp1` and press .

The information window for PEAK hardware appears. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

## 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 PCAN-PC/104-Plus card.

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 PCAN-PC/104-Plus card.

## 3 Connecting the CAN Bus

### 3.1 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.

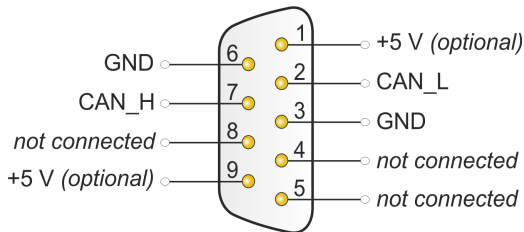


Figure 3: Pin assignment High-speed CAN bus  
(view onto a D-Sub connector of the slot bracket)

Low power devices (e.g. bus converters) can be supplied directly with 5 volts over pin 1 and/or pin 9 of the CAN connector. Pin 1 and/or pin 9 are not in use at the delivery state. For more information see the next section 3.2 on page 16.

The pin assignment between a 10-pin socket on the PCAN-PC/104-Plus card and a D-Sub male connector is as follows:

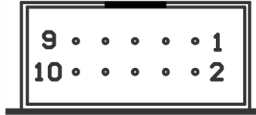


Figure 4: Numbering at the 10-pin socket

Pin	Assignment	Assignment D-Sub
1	+5 V (optional)	1
2	GND	6
3	CAN_L	2
4	CAN_H	7
5	GND	3
6	not connected	8
7	not connected	4
8	+5 V (optional)	9
9	not connected	5
10	not connected	



**Tip:** 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).

### 3.1.1 Slot Bracket with D-Sub Connectors



Figure 5: Single channel slot bracket



Figure 6: Dual channel slot bracket

To connect a CAN bus to the PCAN-PC/104-Plus card, use the supplied slot brackets. After you have connected the cables from the slot bracket with the 10-pin sockets, you can connect the CAN busses with the D-Sub sockets.

## 3.2 Voltage Supply of External Devices

External devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector (independently for each connector on the Dual Channel versions). With a solder bridge per CAN channel on the PCAN-PC/104-Plus board, a 5-Volt supply can optionally be routed to pin 1 and/or pin 9 of the D-Sub connector. The current output is limited to 100 mA.

The opto-decoupled versions of the card contain an interconnected DC/DC converter. Therefore, the current output is limited to 50 mA.

▶ 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.

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

Figure 7 shows the solder field positions on the card. The table below contains the possible settings.



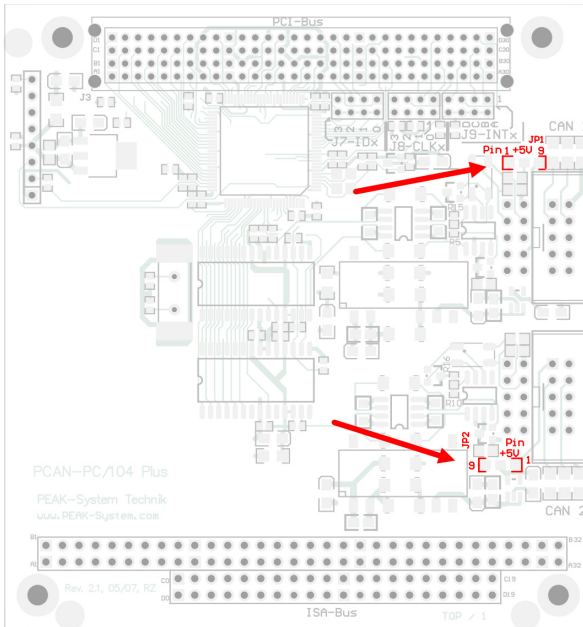


Figure 7: Positions of the solder fields on the PCAN-PC/104-Plus card for a 5-Volt supply (JP1 upper position, JP2 lower position)

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

**Note:** The pin labels for the CAN connector are related to the 9-pin D-Sub connector being connected via a cable to a socket on the card.

**Risk of short circuit!** The 5-Volt supply is not protected separately. Therefore, turn off the computer before you connect and disconnect CAN cables or peripheral systems.

## 3.3 Cabling

### 3.3.1 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-PC/104-Plus card does not have an internal termination. Use the card on a terminated CAN bus.

### 3.3.2 Example of a Connection

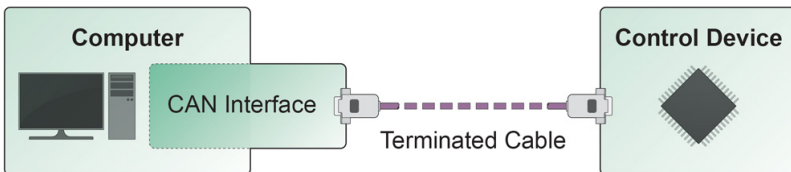


Figure 8: Simple CAN connection

This example shows a connection between the PCAN-PC/104-Plus card and a control unit. The connection cable is terminated with 120 ohms at both ends.

### 3.3.3 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 Software and API

This chapter covers the provided software PCAN-View and the programming interface PCAN-Basic.

### 4.1 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.

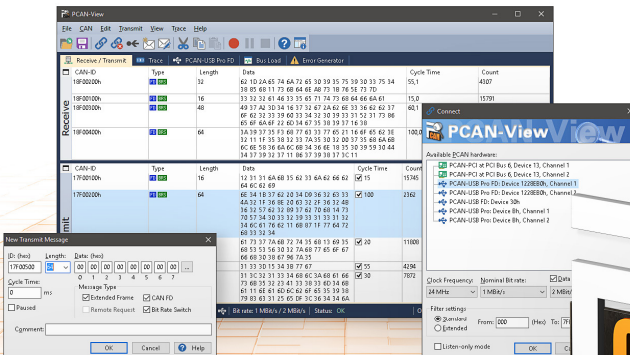


Figure 9: PCAN-View for Windows

▶ Do the following to start and initialize PCAN-View:

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

The **Connect** dialog box appears.

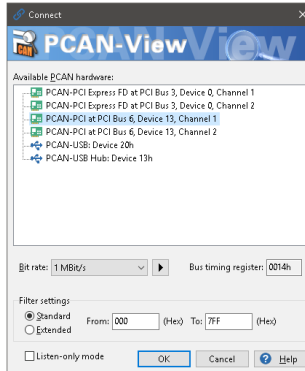


Figure 10: Selection of the hardware and parameters

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 an 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).

### 4.1.1 Receive/Transmit Tab

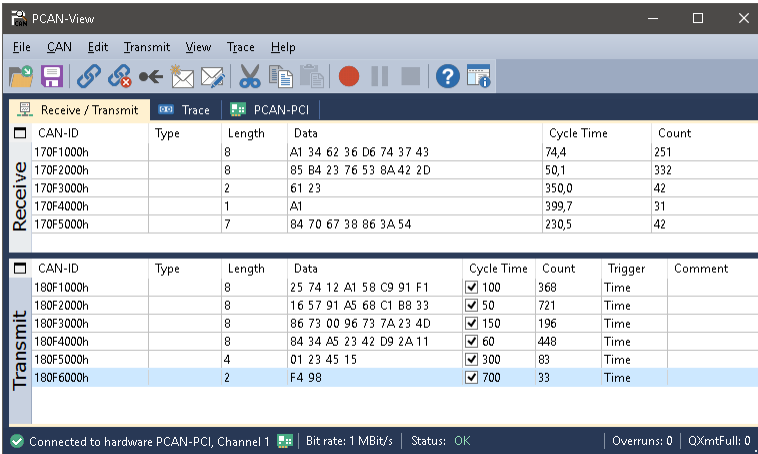


Figure 11: Receive/Transmit Tab

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.

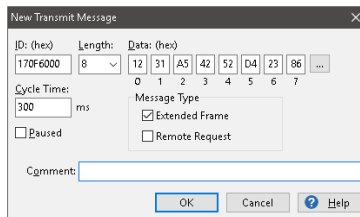



Figure 12: Dialog box new transmit message

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. Trigger selected transmit messages manually with the menu command **Transmit > Send** (alternatively  bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.



**Tip:** Under the menu command **File > Save**, you can save the current transmit messages into a transmit list. Saved transmit lists are available for reuse.

## 4.1.2 Trace Tab

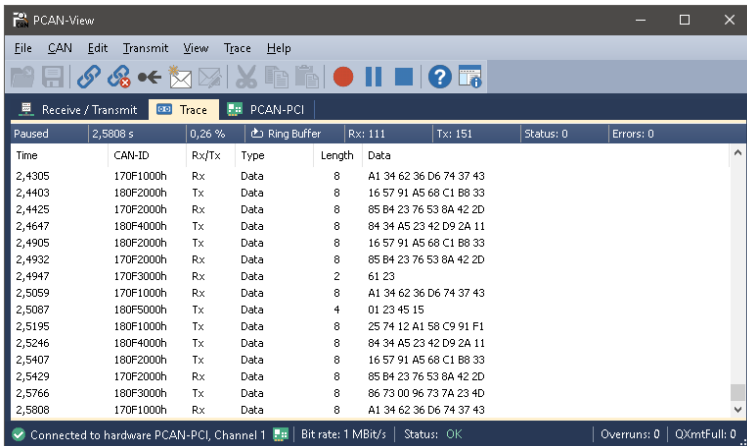


Figure 13: Trace Tab

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.



### 4.1.3 PCAN-PC/104-Plus Tab

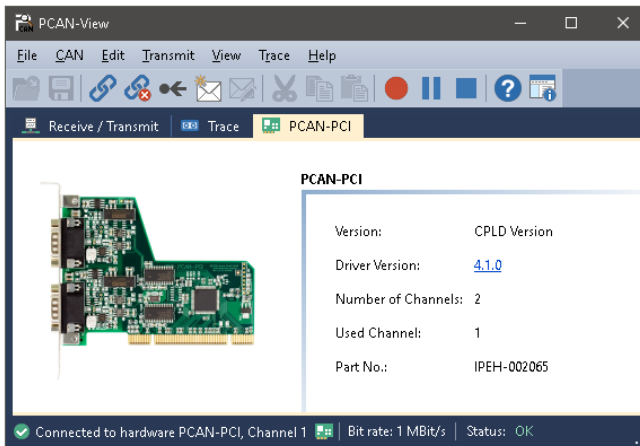


Figure 14: PCAN-PCI tab (example)

The **PCAN-PC/104-Plus** tab contains some detailed information about the hardware and driver.

### 4.1.4 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.

## 4.2 Linking Own Programs with PCAN-Basic

OH

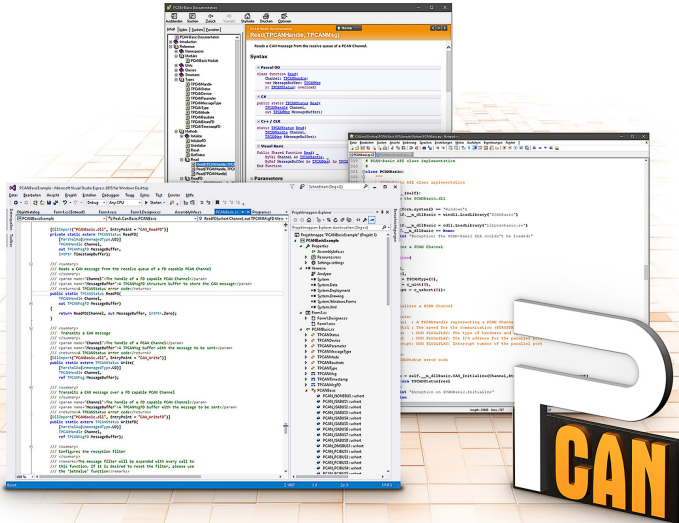


Figure 16: PCAN-Basic

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 be 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.

#### 4.2.1 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 the operating systems Windows 10, 8.1, 7 (32/64-bit), Windows CE 6.x, and Linux (32/64-bit)
- └ 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  $\mu$ 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

- └ 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`).

### 4.2.2 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.

### **4.2.3 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.

## 5 Technical specifications

### Connectors

PC/104-Plus	PCI bus (PC/104-Plus Version 2), 120-pin strip, for 3.3-Volt and 5-Volt systems ISA bus: optionally equipped stack-through connectors for the ISA signals
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 303-1

### 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
Galvanic isolation	PCAN-PC/104-Plus: none PCAN-PC/104-Plus opto: up to 500 V, separate for each CAN channel
Supplying external devices	PCAN-PC/104-Plus: D-Sub pin1 / 9; 5 V, max. 100mA PCAN-PC/104-Plus opto: D-Sub pin1 / 9; 5 V, max. 50mA Not assigned at delivery
Internal Termination	none

### Supply

Supply voltage	4.75 - 5.25 V DC
Current consumption	PCAN-PC/104-Plus Single Channel: max. 150 mA PCAN-PC/104-Plus Dual Channel: max. 280 mA PCAN-PC/104-Plus Single Channel opto: max. 260 mA PCAN-PC/104-Plus Dual Channel opto: max. 490 mA

### Measures

Dimension	about 90 x 96 x 15 mm; (stacking height; component height max. 11 mm) See also dimension drawing in Appendix B on page 33								
Weight	<table border="0"> <tr> <td>PCAN-PC/104-Plus Single Channel:</td> <td>46 g</td> </tr> <tr> <td>PCAN-PC/104-Plus Dual Channel:</td> <td>50 g</td> </tr> <tr> <td>PCAN-PC/104-Plus Single Channel opto:</td> <td>47 g</td> </tr> <tr> <td>PCAN-PC/104-Plus Dual Channel opto:</td> <td>53 g</td> </tr> </table>	PCAN-PC/104-Plus Single Channel:	46 g	PCAN-PC/104-Plus Dual Channel:	50 g	PCAN-PC/104-Plus Single Channel opto:	47 g	PCAN-PC/104-Plus Dual Channel opto:	53 g
PCAN-PC/104-Plus Single Channel:	46 g								
PCAN-PC/104-Plus Dual Channel:	50 g								
PCAN-PC/104-Plus Single Channel opto:	47 g								
PCAN-PC/104-Plus Dual Channel opto:	53 g								

### Environment

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

### 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-PC/104-Plus  
Item number(s): IPEH-002094/95/96/97  
Manufacturer: PEAK-System Technik GmbH  
Otto-Roehm-Strasse 69  
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)**

**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

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

Uwe Wilhelm, Managing Director



# Appendix B Dimension Drawing

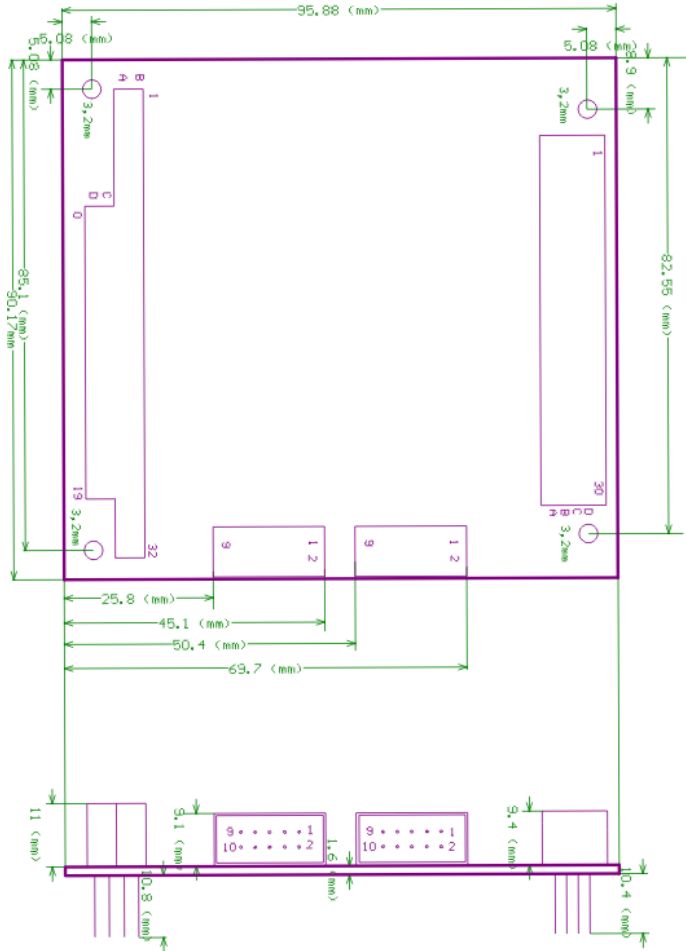


Figure 17: Dimension drawing PCAN-PC/104-Plus.

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

## Appendix C 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

Install the driver from the supplied DVD, before you insert the plug-in card in the PC/104 stack.

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 `peakcp1` and press **Enter**.

An information window for PEAK Hardware opens. The plug-in card must be displayed in the table on the **CAN Hardware** tab.

### Getting started under windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the PCAN-PC/104-Plus card. For initialization of the card select the CAN connection and the CAN bit rate.

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

