

PCAN-PC/104-Plus Quad

Four-Channel CAN Interface for
PC/104-Plus

User Manual



Document version 1.4.0 (2019-03-07)

PEAK
System

Relevant products

Product name	Model	Part number
PCAN-PC/104-Plus Quad	Four CAN channels	IPEH-002099

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

PCAN® is a registered trademark of PEAK-System Technik GmbH. CANopen® and CiA® are registered community trade marks of CAN in Automation e.v.

All other product names mentioned in this manual may be the trademarks or registered trademarks of their respective companies. They are not explicitly marked by "™" and "®".

Copyright © 2019 PEAK-System Technik GmbH

Duplication (copying, printing, or other forms) and the electronic distribution of this document is only allowed with explicit permission of PEAK-System Technik GmbH. PEAK-System Technik GmbH reserves the right to change technical data without prior announcement. The general business conditions and the regulations of the license agreement apply. All rights are reserved.

PEAK-System Technik GmbH
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29

www.peak-system.com
info@peak-system.com

Document version 1.4.0 (2019-03-07)

Contents

1	Introduction	5
1.1	Properties at a Glance	5
1.2	System Requirements	6
1.3	Scope of Supply	7
2	Configuring and Installing the Card and the Software	8
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
3	Connecting the CAN Bus	13
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
4	Software and API	20
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 Quad 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

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

1 Introduction

The PCAN-PC/104-Plus Quad card enables the connection of four 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 brackets supplied. There is galvanic isolation of up to 500 Volts between the computer and 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 Quad 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
- 4 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® 303-1)

- └─ FPGA implementation of the CAN controller (SJA1000 compatible)
- └─ 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
- └─ 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 Quad 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.

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 Linux (32/64-bit)

1.3 Scope of Supply

- └ PCAN-PC/104-Plus Quad card
- └ Two Slot brackets with D-Sub connectors for the CAN bus
- └ Device drivers for Windows 10, 8.1, 7 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
- └ Manual in PDF format

2 Configuring and Installing the Card and the Software

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



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

2.1 Configuring the Card

Before installing the PCAN-PC/104-Plus Quad card 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.

2.1.1 Setting the Position in the PC/104 Stack

The PCAN-PC/104-Plus Quad card must be adjusted to a specific position in the stack by setting the appropriate jumpers. The position number results from the distance to the host.

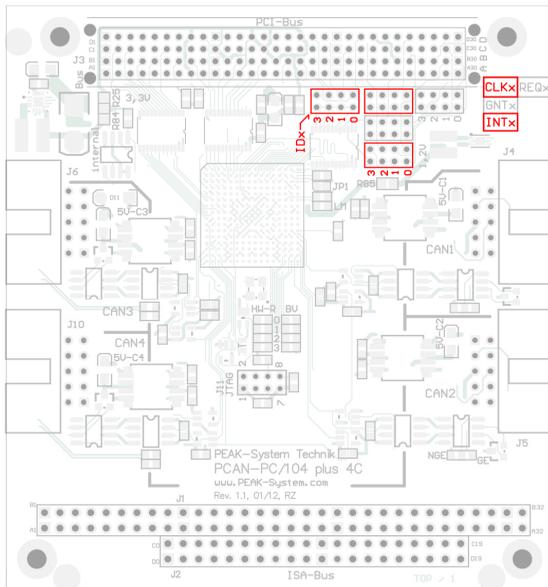


Figure 1: Jumper fields IDx, CLKx, and INTx on the PCAN-PC/104-Plus Quad card

Jumper	Signal	Position in the PC/104 stack in relation to the host			
		1	2	3	4
IDx	ID Select	0	1	2	3
CLKx	Clock Select	0	1	2	3
INTx	Interrupt Select	0	1	2	3

Because the PCI bus master operation is not used by the card, the jumper fields REQx and GNTx remain empty.

2.2 Installing the Software and the Card

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.

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 `peakcpl` 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 Quad 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 Quad 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.

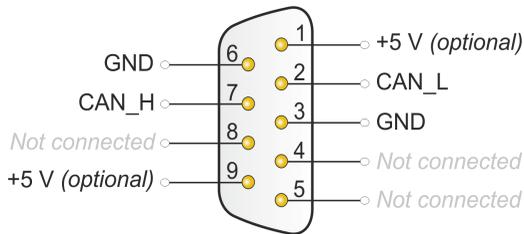


Figure 3: Pin assignment High-speed CAN bus
(view onto a D-Sub connector of the slot bracket)

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.

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

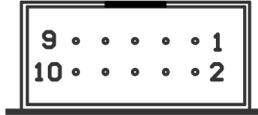


Figure 4: Numbering at the 10-pin socket

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: You can connect a CAN bus with a different transmission standard via a bus converter. PEAK-System offers different bus converter modules (e.g. PCAN-TJA1054 for a Low-speed CAN bus according to ISO 11898-3).

3.1.1 Slot Bracket with D-Sub Connectors



Figure 5: Dual channel slot bracket

To connect a CAN bus to the PCAN-PC/104-Plus Quad 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). 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.

By using interconnected DC/DC converter the current output is limited to 100 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 6 shows the solder field positions on the card. The table below contains the possible settings.



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.

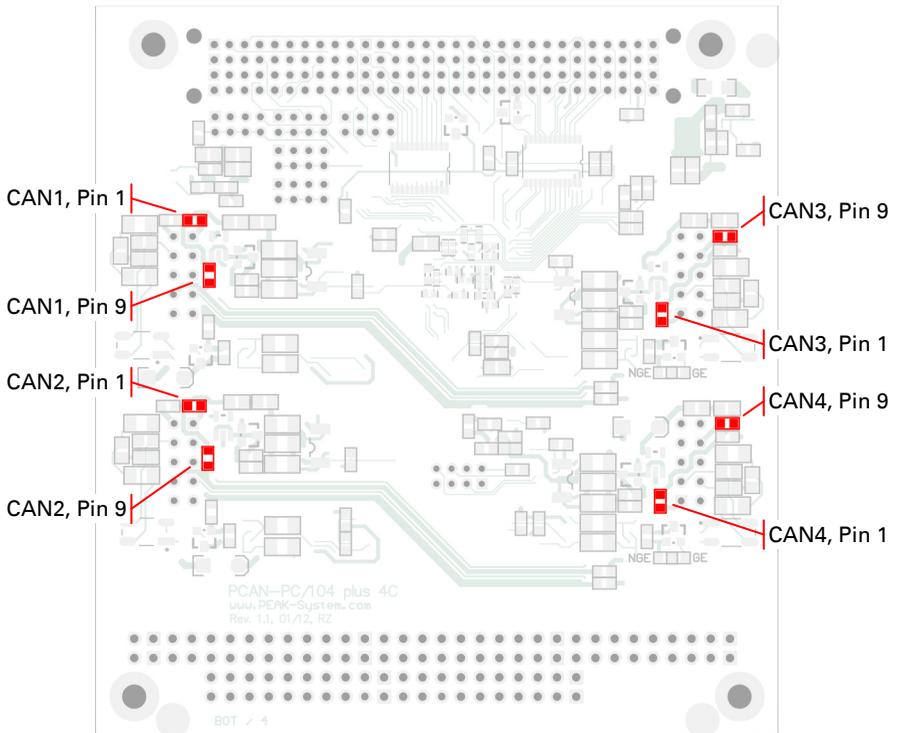


Figure 6: Positions of the solder fields on the board's bottom side for a 5-Volt supply at the CAN connection (D-Sub)

D-Sub connector	5-Volt supply		
	Without (Standard)	Pin 1	Pin 9
CAN 1			
CAN 2			
CAN 3			
CAN 4			

3.3 Cabling

3.3.1 Termination

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN-interface, control unit) will not work.

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

3.3.2 Example of a Connection

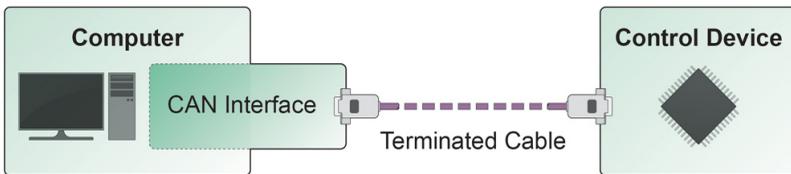


Figure 7: Simple CAN connection

In this example, the PCAN-PC/104-Plus Quad card is connected with a control unit by a cable that 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.

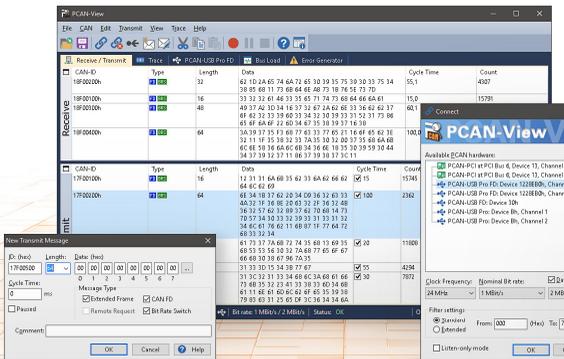


Figure 8: PCAN-View for Windows

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

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

The **Connect** dialog box appears.

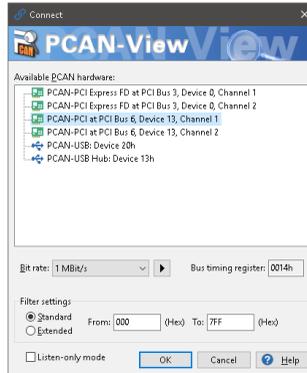


Figure 9: Selection of the hardware and parameters

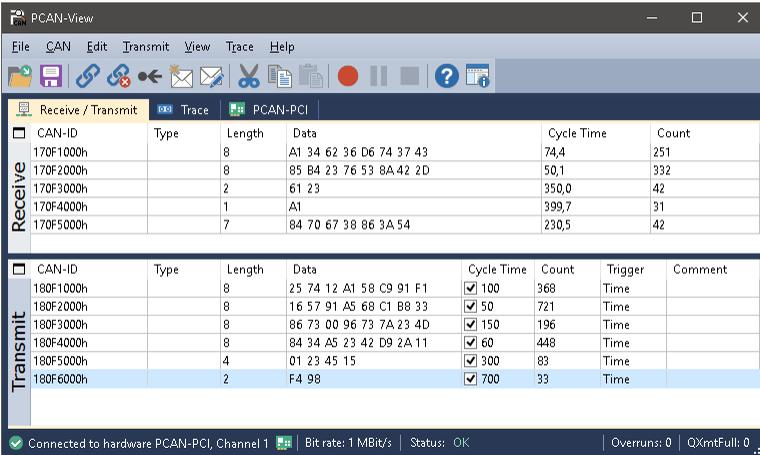
2. Select an interface from the list.
3. From the drop-down list, select the **Bit rate** that is used by all nodes on the CAN bus.



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 10).

4.1.1 Receive/Transmit Tab



Receive		Type	Length	Data	Cycle Time	Count
170F1000h			8	A1 34 62 36 D6 74 37 43	74,4	251
170F2000h			8	85 B4 23 76 53 8A 42 2D	50,1	332
170F3000h			2	61 23	350,0	42
170F4000h			1	A1	399,7	31
170F5000h			7	84 70 67 38 86 3A 54	230,5	42

Transmit		Type	Length	Data	Cycle Time	Count	Trigger	Comment
180F1000h			8	25 74 12 A1 58 C9 91 F1	<input checked="" type="checkbox"/> 100	368	Time	
180F2000h			8	16 57 91 A5 68 C1 B8 33	<input checked="" type="checkbox"/> 50	721	Time	
180F3000h			8	86 73 00 96 73 7A 23 4D	<input checked="" type="checkbox"/> 150	196	Time	
180F4000h			8	84 34 A5 23 42 D9 2A 11	<input checked="" type="checkbox"/> 60	448	Time	
180F5000h			4	01 23 45 15	<input checked="" type="checkbox"/> 300	83	Time	
180F6000h			2	F4 98	<input checked="" type="checkbox"/> 700	33	Time	

Figure 10: 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.

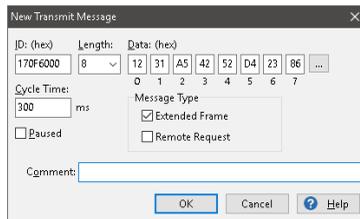


Figure 11: Dialog box new transmit message

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

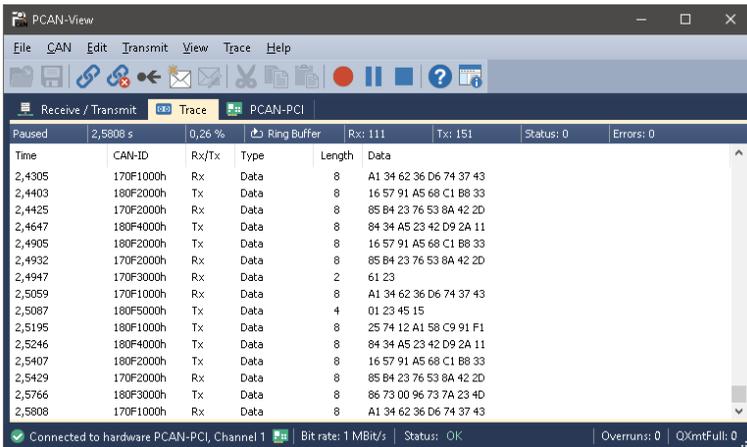


Figure 12: Trace tab

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 Quad Tab

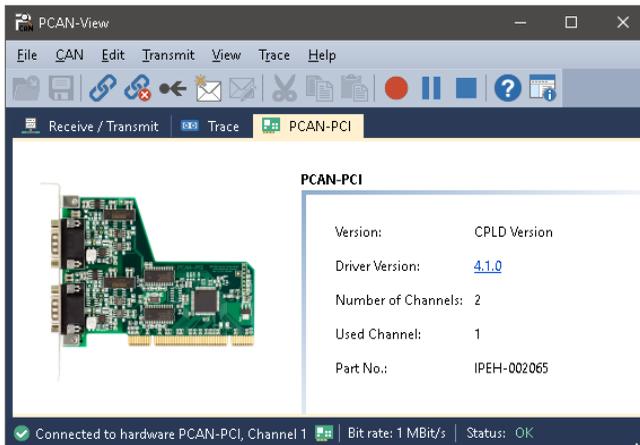


Figure 13: PCAN-PCI tab (example)

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

4.1.4 Status Bar



Figure 14: Example for 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

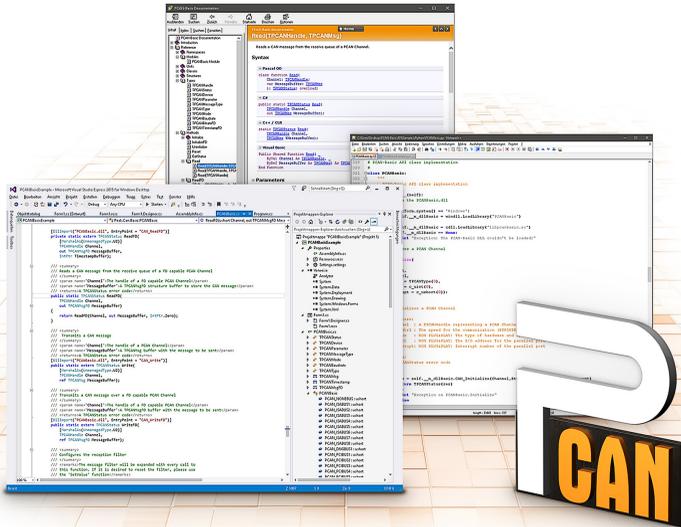


Figure 15: PCAN-Basic

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 channels of a PEAK CAN interface
- └ Driver-internal buffering of 32,768 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
- └ Extended system for debugging operations
- └ Multilingual debugging output

- Output language depends on operating system
- 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 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	FPGA implementation (SJA1000 compatible)
Transceiver	NXP PCA82C251
Galvanic isolation	Up to 500 V, separate for each CAN channel
Supplying external devices	D-Sub pin1 / 9; 5 V, max. 100mA Not assigned at delivery
Internal Termination	None

Supply

Supply voltage	5 V DC
Current consumption	max. 300 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	56 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 Quad
Item number(s): IPEH-002099
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

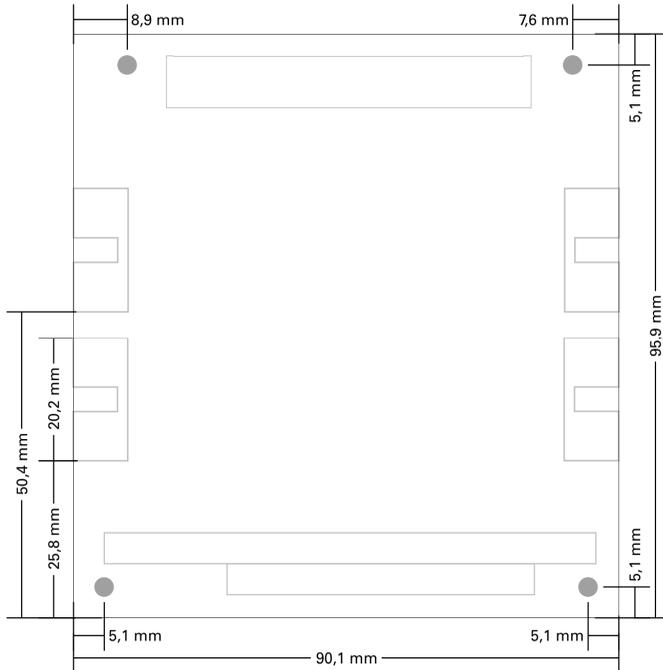


Figure 16: Dimension drawing PCAN-PC/104-Plus Quad.

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

Appendix C Quick Reference

Card Configuration

Jumper	Signal	Position in the PC/104 stack in relation to the host			
		1	2	3	4
IDx	ID Select	0	1	2	3
CLKx	Clock Select	0	1	2	3
INTx	Interrupt Select	0	1	2	3

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 `peakcpl` 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 Quad card. For initialization of the card select the CAN connection and the CAN bit rate.

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

