PCAN-ExpressCard

ExpressCard to CAN Interface

User Manual v2.1.2

PEAK System

Products taken into account

Product Name	Model	Part Number
PCAN-ExpressCard Single Channel	One CAN channel	IPEH-003000
PCAN-ExpressCard Dual Channel	Two CAN channels	IPEH-003001
PCAN-ExpressCard Single Channel galvanically decoupled	One CAN channel, galvanic isolation for CAN connection	IPEH-003002
PCAN-ExpressCard Dual Channel galvanically decoupled	Two CAN channels, galvanic isolation for CAN connections	IPEH-003003

The cover picture shows the product PCAN-ExpressCard Dual Channel. Other product models have an identical form factor but vary in the number of CAN connectors according to the model.

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1 Introduction

The PCAN-ExpressCard provides one or two CAN channels for notebooks and computers with ExpressCard slots. Device drivers and programming interfaces 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-ExpressCard.

1.1 Properties at a Glance

- Expansion card for ExpressCard slot
- Form factor ExpressCard/54
- 1 or 2 High-speed CAN channels (ISO 11898-2)
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Bit rates up to 1 Mbit/s
- Connection to CAN bus via D-Sub 9-pin (according to CiA® 102)
- NXP CAN controller SJA1000, 16 MHz clock frequency
- NXP CAN transceiver PCA82C251
- Galvanic isolation on the CAN connection up to 300 V (only galvanically decoupled models), separate for each CAN channel
- Software option to switch a 5-Volts supply to the CAN connection, e.g. for external bus converter
- Operating temperature range from 0 to 70 °C (32 to 158 °F)

1.2 Prerequisites for Operation

- ExpressCard slot in the computer, type ExpressCard/54
- Operating system Windows 7/Vista/XP (32/64-bit) or Linux (32/64-bit)

1.3 Scope of Supply

- PCAN-ExpressCard CAN interface
- Device drivers for Windows 7/Vista/XP (32/64-bit) and Linux (32/64-bit)
- PCAN-View CAN monitor for Windows
- PCAN-Basic programming interface consisting of an interface DLL, examples, and header files for all common programming languages
- Manual in PDF format

2 Installing the Software and the Card

This chapter covers the software setup for the PCAN-ExpressCard under Windows and the installation in the computer.

Setup the driver before connecting the PCAN-ExpressCard for the first time.

- Do the following to install the driver:

  1. Make sure that you are logged in as user with administrator privileges (not needed for normal use of the PCAN-ExpressCard later on).
  2. Insert the supplied DVD into the appropriate drive of the computer. Usually a navigation program appears a few moments later. If not, start the file `Intro.exe` from the root directory of the DVD.
  3. On the page **English** > **Drivers** activate the entry **PCAN-PCI**.
  4. Click on **Install now**. The setup program for the driver is executed.
  5. Follow the instructions of the program.

Tip: If you do not want to install the CAN monitor PCAN-View for Windows onto the hard disk together with the driver, you have the option to start the program later directly from DVD without prior installation.

- Do the following to connect the PCAN-ExpressCard to the computer and complete the initialization:

  1. Insert the PCAN-ExpressCard into an ExpressCard slot of your computer. The computer can remain powered on.

Windows notifies that new hardware has been detected.

2. Windows XP only: A Wizard dialog box appears. Follow its instructions. Deny the search for driver software at Windows Update and select the automatic software installation during this procedure.

   All Windows operating systems: The drivers are found and installed by Windows automatically.

3. Afterwards you can work as user with restricted rights again.

After the initialization process for the driver for the CAN interface is finished successfully an LED is on for each CAN connection of the PCAN-ExpressCard.

Furthermore, you can find the entry “PCAN-ExpressCard” in the branch “CAN-Hardware” of the Windows Device Manager.

3 Connecting the CAN Bus

3.1 D-Sub Connector

A High-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The pin assignment corresponds to the specification CiA® 102.

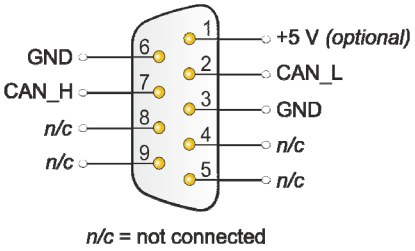

Figure 1: Pin assignment High-speed CAN

3.2 Supplying External Devices via the CAN Connector

Optionally a 5-Volt supply can be switched with the provided Windows software PCAN-View onto pin 1 of a D-Sub CAN connector (for the Dual Channel model simultaneously for both CAN connectors). Thus devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector.

When using this option the 5-Volt supply is directly connected to the power supply of the computer and is not fused separately. The galvanically decoupled models of the card have an interconnected DC/DC converter. Therefore the current output is limited to 50 mA.

You find further information about the use of this option in PCAN-View in section 5.1.3 on page 18.

Attention! Risk of short circuit! If the option described in this section is activated, you may only connect or disconnect CAN cables or peripheral systems (e.g. bus converters) to or from the PCAN-ExpressCard while it is de-energized (the card is not connected to the computer). Consider that some computers still supply the ExpressCard slot with power even when they are turned off (standby operation).

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 device) will not work.

The PCAN-ExpressCard does not have an internal termination. Use the adapter on a terminated CAN bus.

3.3.2 Example of a Connection

Figure 2: Simple CAN connection

In this example, the PCAN-ExpressCard is connected with a control unit by a cable that is terminated 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 Operation

4.1 Status LED

The PCAN-ExpressCard has a status LED for each existing CAN channel which may be in one of the following conditions:

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

4.2 Removing the Adapter

Under Windows the icon for removing hardware safely is not used with the PCAN-ExpressCard. You may remove the card from the computer without any preparation under Windows.

5 Using the Software

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

5.1 CAN Monitor PCAN-View for Windows

PCAN-View for Windows is a simple CAN monitor for viewing, transmitting, and logging CAN messages.

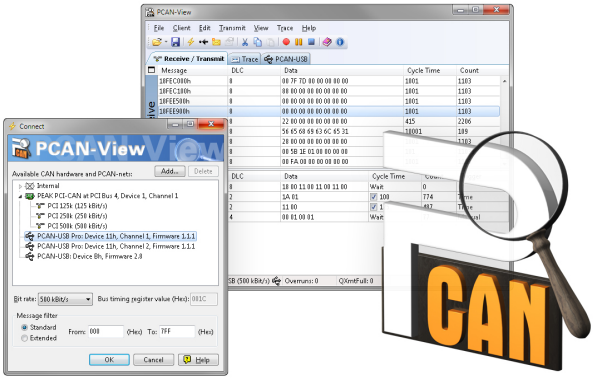

Figure 3: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

1. If PCAN-View is already installed on the hard disk, open the Windows Start menu, go to **Programs** > **PCAN-Hardware**, and select the entry **PCAN-View**.

If you haven't installed PCAN-View together with the device driver, you can start the program directly from the supplied DVD. In the navigation program (`Intro.exe`) go to **English** > **Tools**, and under **PCAN-View for Windows** select the link **Start**.

The dialog box for selecting the CAN hardware and for setting the CAN parameters appears.

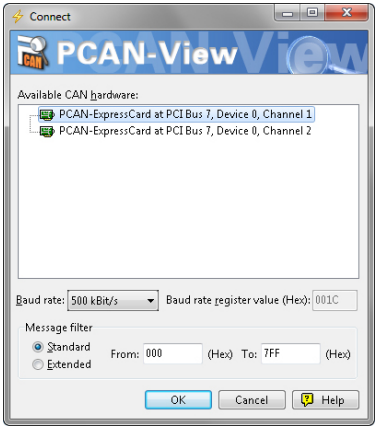

Figure 4: Selection of the CAN specific hardware and parameters

2. From the list **Available CAN hardware** select the CAN channel to be used.
3. From the dropdown list **Bit rate** select the one that is used by all nodes on the CAN bus.
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. Finally confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 5).

5.1.1 Receive/Transmit Tab

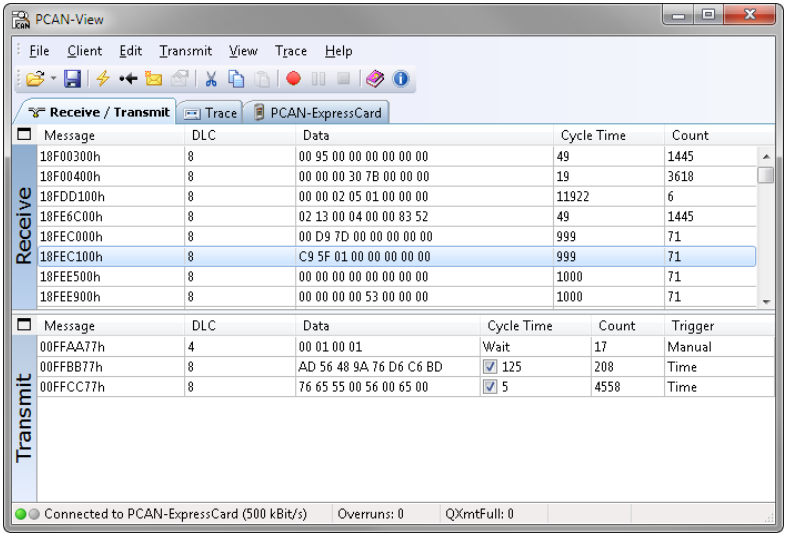

Figure 5: Receive/Transmit tab

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. Representation of CAN data is in hexadecimal format.

- Do the following to transmit a CAN message with PCAN-View:

1. Select the menu command **Transmit** > **New Message** (alternatively or Ins).

   The dialog box **New Transmit Message** is shown.

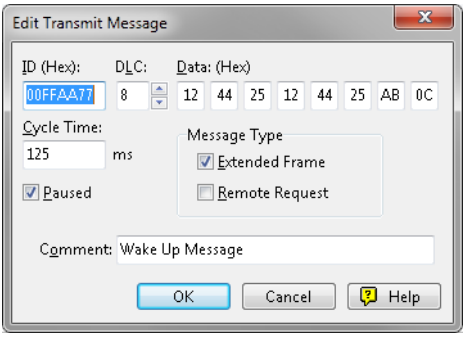

Figure 6: Dialog box New transmit message

2. Enter the ID and the data for the new CAN message.
3. The field **Cycle Time** indicates if the message shall be transmitted manually or periodically. If you want to transmit the message periodically, you must enter a value greater than 0. For a manual-only transmission enter 0.
4. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.
5. You trigger selected transmit messages manually with the menu command **Transmit** > **Send** (alternatively Space bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.

Tip: Using the menu command **File** > **Save** the current transmit messages can be saved to a list and loaded for reuse later on.

5.1.2 Trace Tab

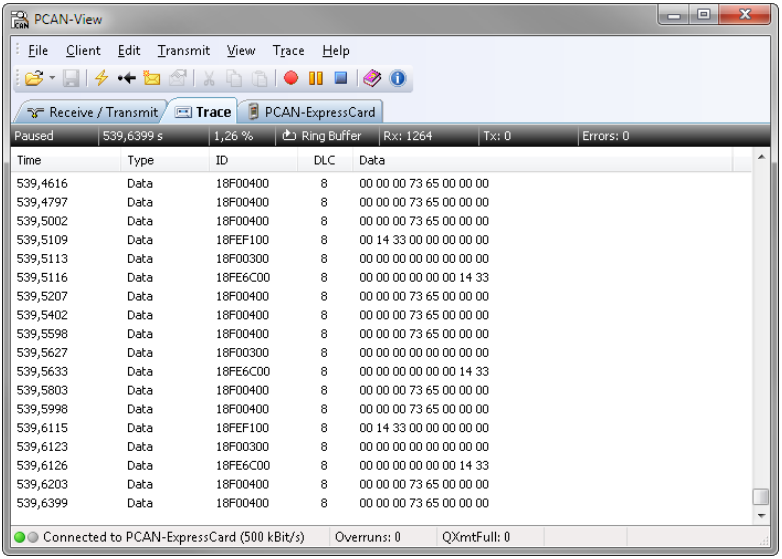

Figure 7: Trace tab

On the Trace tab the data tracer of PCAN-View is used for logging the communication on a CAN bus. During this process the CAN messages are cached in the working memory of the PC. Afterwards they can be saved to a file.

The tracer can be configured to run in linear or in ring buffer mode. In linear buffer mode the logging is stopped as soon as the buffer is filled completely. In ring buffer mode the oldest messages are overwritten by incoming ones.

5.1.3 PCAN-ExpressCard Tab

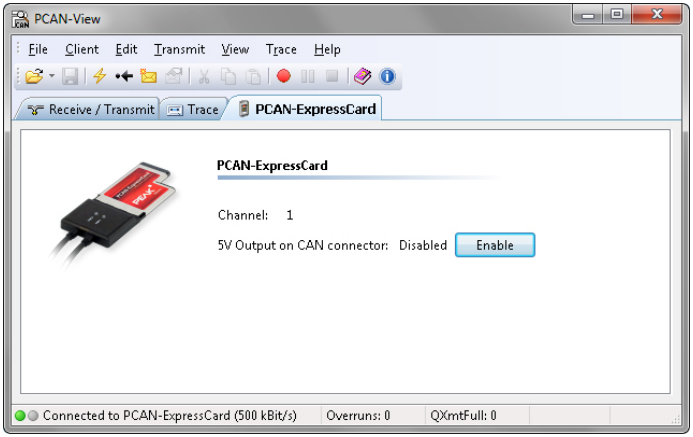

Figure 8: PCAN-ExpressCard tab

On the PCAN-ExpressCard tab the 5-Volts supply on pin 1 of the D-Sub CAN connector is enabled or disabled. For the Dual Channel model the setting is valid for both CAN connectors simultaneously. You find information about technical details in section 3.2 on page 9.

To toggle the setting press the button **Enable** / **Disable**.

Attention! Risk of short circuit! If the option described in this section is activated, you may only connect or disconnect CAN cables or peripheral systems (e.g. bus converters) to or from the PCAN-ExpressCard while it is de-energized (the card is not connected to the computer). Consider that some computers still supply the ExpressCard slot with power even when they are turned off (standby operation).

5.1.4 Status Bar

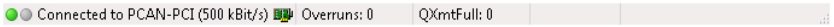

Figure 9: Example of the status bar

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.

5.2 Linking Own Programs with PCAN-Basic

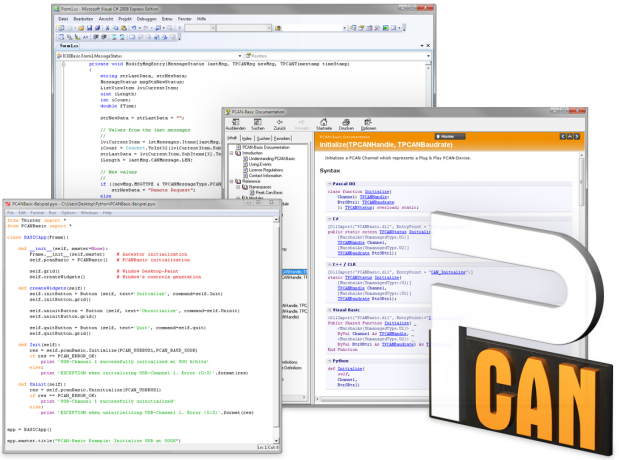

Figure 10: PCAN-Basic

On the provided DVD you can find files of the programming interface PCAN-Basic in the directory branch `Develop`. This API provides basic functions for linking own programs to CAN interfaces by PEAK-System and can be used for the following operating systems:

- Windows 7/Vista/XP (32/64-bit)
- Windows CE 6.x (x86/ARMv4)

The API is designed for cross-platform use. Therefore software projects can easily ported between platforms with low efforts. PEAK-System has created examples for the following programming languages: C++, C#, C++/CLR, Visual Basic, Delphi, Python, and Java.

5.2.1 Features of PCAN-Basic

- Supports Windows 7/Vista/XP (32/64-bit) and Windows CE 6.x operating system
- Multiple PEAK-System applications and your own can be operated on a physical CAN channel at the same time
- Use of a single DLL for all supported hardware types
- Use of up to 8 channels for each hardware unit (depending on the PEAK CAN interface used)
- Simple switching between 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 µs (depending on the PEAK CAN interface used)
- 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

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`).

5.2.2 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 CAN channel must be initialized before using it. This is done by the simple call of the function `CAN_Initialize`. Depending on the type of the CAN hardware, up to eight CAN channels can be opened at the same time. After a successful initialization the CAN channel is ready for communication with the CAN hardware and the CAN bus. No further configuration steps are required.

Interaction

For receiving and transmitting CAN messages the functions `CAN_Read` and `CAN_Write` 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.

5.2.3 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.

6 Technical Specifications PCAN-ExpressCard

Connectors	
Computer	ExpressCard slot, type ExpressCard/54
CAN	D-Sub (m), 9 pins Pin assignment according to specification CiA® 102

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 (Philips) SJA1000
Transceiver	NXP (Philips) PCA82C251
Galvanic isolation	PCAN-ExpressCard: none PCAN-ExpressCard opto: Galvanic isolation up to 300 V (separate for each CAN channel)
Supplying external devices	PCAN-ExpressCard: D-Sub pin 1; 5 V, max. 100 mA PCAN-ExpressCard opto: D-Sub pin 1; 5 V, max. 50 mA Switched off at delivery
Termination	none

Power supply			
Current consumption (max.)	Product model	on 1.5-V pin	on 3.3-V pin
	Single Channel:	142 mA	245 mA
	Dual Channel:	142 mA	296 mA
	Single Channel opto:	142 mA	273 mA
	Dual Channel opto:	142 mA	335 mA

Measures	
Size (without cables)	130 x 54 x 10 mm (L x W x D) See also dimension drawing in Appendix B on page 27
Weight	Product model Single Channel: 60 g Dual Channel: 80 g Single Channel opto: 60 g Dual Channel opto: 80 g

Environment	
Operating temperature	0 - +70 °C (32 - 158 °F)
Temperature for storage and transport	-30 - +100 °C (-22 - +212 °F)
Relative humidity	15 - 90 %, not condensing
EMC	EN 55024:2003-10 EN 55022:2007-04 EC directive 2004/108/EG
Ingress protection (IEC 60529)	IP30

Appendix A CE Certificate

PCAN-ExpressCard IPEH-003000/01/02/03 - EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the PCAN-ExpressCard products IPEH-003000/01/02/03

EC Directive

This product fulfills the requirements of EC directive 2004/108/EG on "Electromagnetic Compatibility" and is designed for the following fields of application as per the CE marking:

Electromagnetic Immunity
DIN EN 55024, Publication date: 2003-10
Information technology equipment, immunity characteristics – Limits and methods of measurement (IEC/CISPR 24:1997, modified + A1:2001 + A2:2003);
German version EN 55024:1998 + A1:2001 + A2:2003

Electromagnetic Emission
DIN EN 55022, Publication date: 2008-05
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (IEC/CISPR 22:2005, modified + A1:2005);
German version EN 55022:2006 + A1:2007

Declarations of Conformity

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

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Germany

Phone: +49 (0)6151 8173-20
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E-mail: info@peak-system.com

Signed this 4th day of October 2011

Appendix B Dimension Drawing

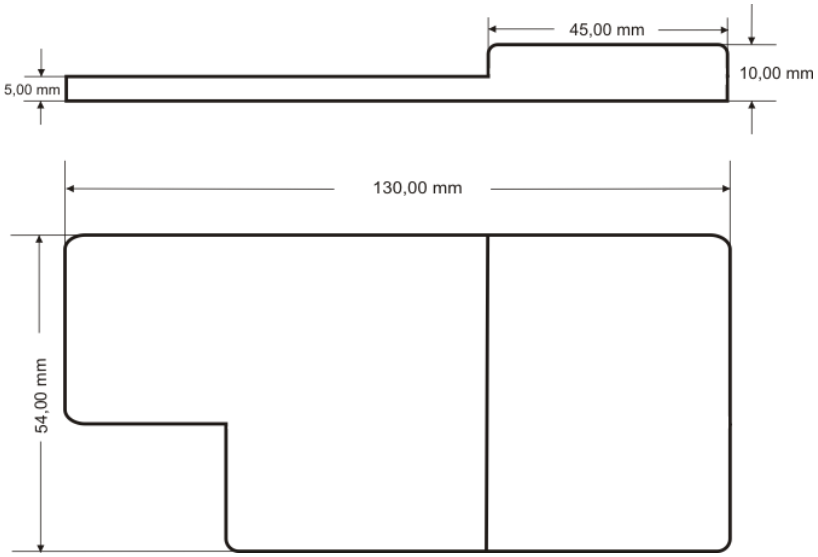


Figure 11: Side view and top view of the PCAN-ExpressCard

The figure does not show the actual size of the product.

Appendix C Quick Reference

Software/Hardware Installation under Windows

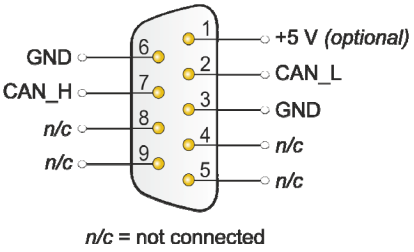
Before connecting the PCAN-ExpressCard to the computer set up the corresponding software package from the supplied DVD (with administrator privileges). Afterwards insert the card into a ExpressCard slot of the computer. The card is recognized by Windows and the driver is initialized. After the installation process is finished successfully, an LED is on for each CAN channel of the card.

Getting Started under Windows

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

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

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



n/c = not connected