PCAN-ExpressCard

CAN Interface for the ExpressCard Slot

User Manual

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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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Contents

1 Introduction

The PCAN-ExpressCard provides a connection between a CAN bus and a laptop or desktop PC with an ExpressCard slot. The card is available in single and dual-channel versions. There are also galvanically separated versions which guarantee galvanic separation up to a maximum of 300 Volts between the PC and CAN sides. 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

- 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 from 5 kbit/s up to 1 Mbit/s

- CAN bus connection via D-Sub, 9-pin (in accordance to CiA® 102)

- NXP SJA1000 CAN controller, 16 MHz clock frequency

- NXP PCA82C251 CAN transceiver

- 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-Volt supply to the CAN connection, e.g. for external bus converter

— Operating temperature range from 0 to 70 °C (32 to 158 °F)

> **Note**: This manual describes the use of the PCAN-ExpressCard 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   Prerequisites for Operation

— ExpressCard slot in the computer, type ExpressCard/54

— Operating system Windows 8.1, 7, Vista (32/64-bit) or Linux (32/64-bit)

1.3   Scope of Supply

— PCAN-ExpressCard CAN interface

— Device drivers for Windows 8.1, 7, Vista (32/64-bit) and Linux (32/64-bit)

— PCAN-View CAN monitor for Windows 8.1, 7, Vista (32/64-bit)

— 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 <u>before</u> connecting the PCAN-ExpressCard for the first time.

▶ Do the following to install the driver:

1. 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.

2. In the main menu, select **Drivers**, and then click on **Install now**.

3. Confirm the message of the User Account Control regarding the "Installer Database of PEAK Drivers".

   The setup program for the driver is started.

4. Follow the instructions of the program.

➡ 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. The drivers are found and installed by Windows automatically.

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.
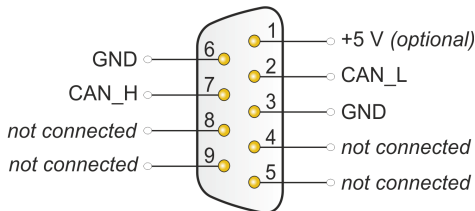

Figure 1: Pin assignment High-speed CAN

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 19.

> ⚠️ **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.
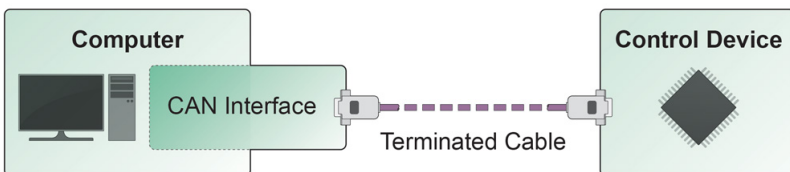
3.3.2 Example of a Connection

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 Software and API

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

5.1 Monitor Software PCAN-View

PCAN-View is simple Windows software for viewing, transmitting, and logging CAN- and CAN FD messages.

ℹ️ **Note:** This chapter describes the use of PCAN-View with a CAN adapter.
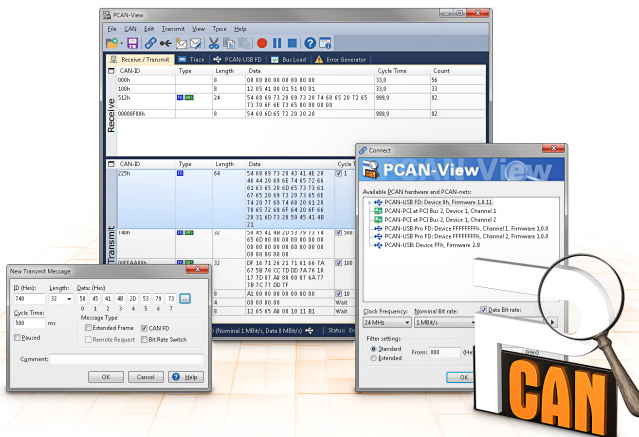

Figure 3: PCAN-View for Windows

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

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

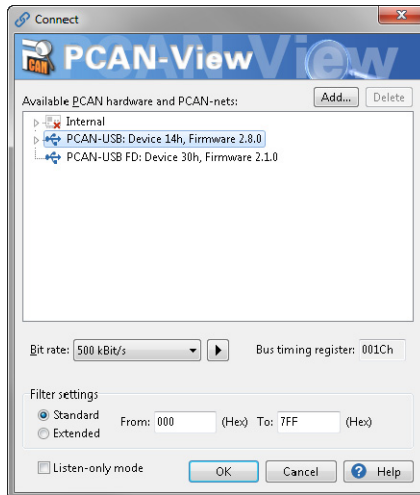   The dialog box for selecting the hardware and for setting the parameters appears.

Figure 4: Selection of the specific hardware and parameters

2. From the list **Available PCAN hardware,** select the desired interface to be used.

3. Select the bit rate that is used by all nodes on the CAN bus from the drop-down list **Bit rate**. Use the button to the right of the drop-down list to create User-defined bit rates.

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. Finally, confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 5).
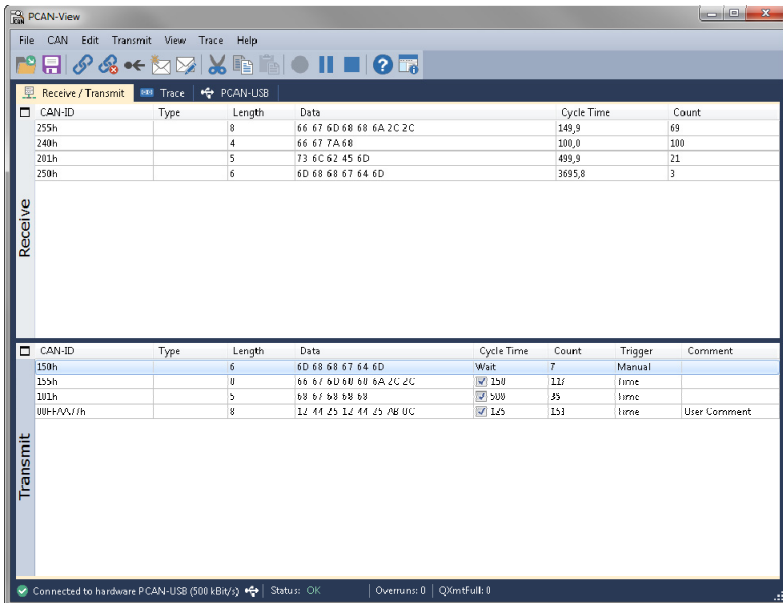
5.1.1 Receive/Transmit Tab

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).

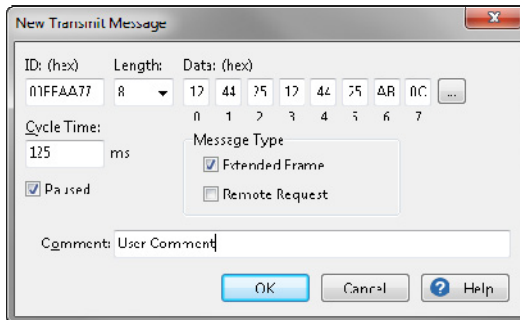   The dialog box **New Transmit Message** is shown.

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.
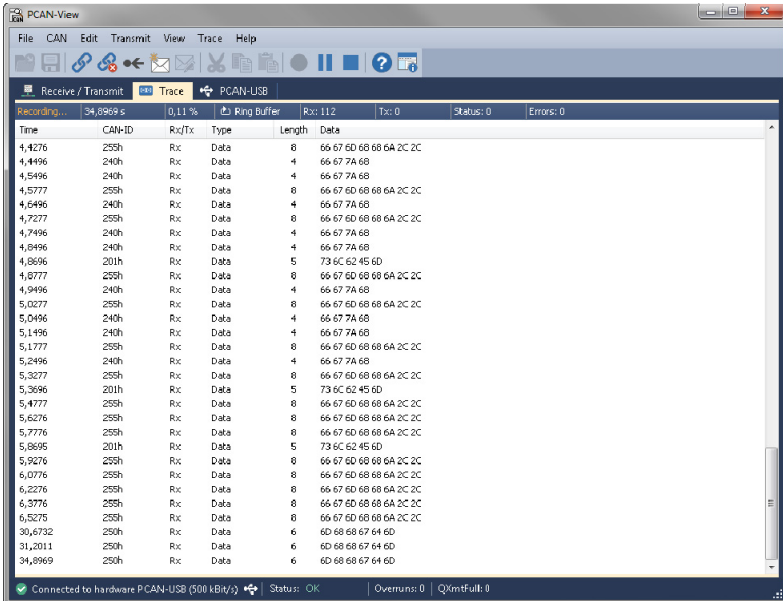
5.1.2   Trace Tab

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.
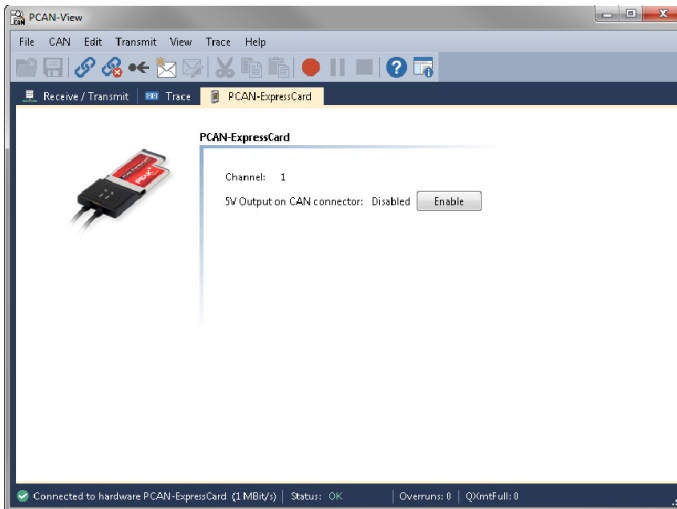
5.1.3 PCAN–ExpressCard Tab

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.

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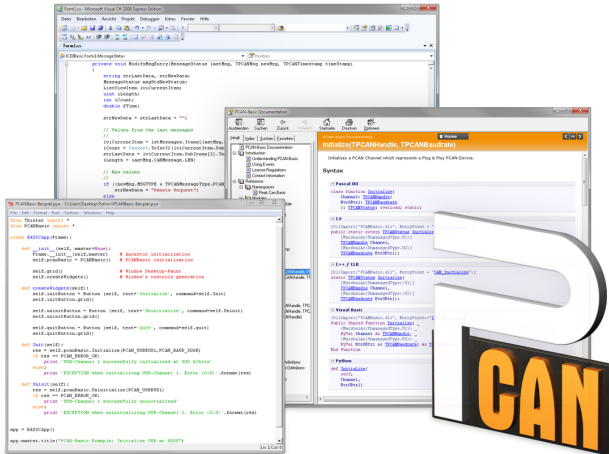## 5.2   Linking Own Programs with PCAN-Basic

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- and CAN FD interfaces by PEAK-System and can be used for the following operating systems:

- Windows 8.1, 7, Vista (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 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.

5.2.1 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 8.1, 7, Vista (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 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)

— 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

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 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 for communication with the CAN hardware and the CAN bus. 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.

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

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 SJA1000
Transceiver	NXP 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.)		on 1.5-V pin	on 3.3-V pin
	Product model		
	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 28
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 55024:2011-09 EN 55022:2011-12 EC directive 2004/108/EG
Ingress protection (IEC 60529)	IP30

Appendix A CE Certificate
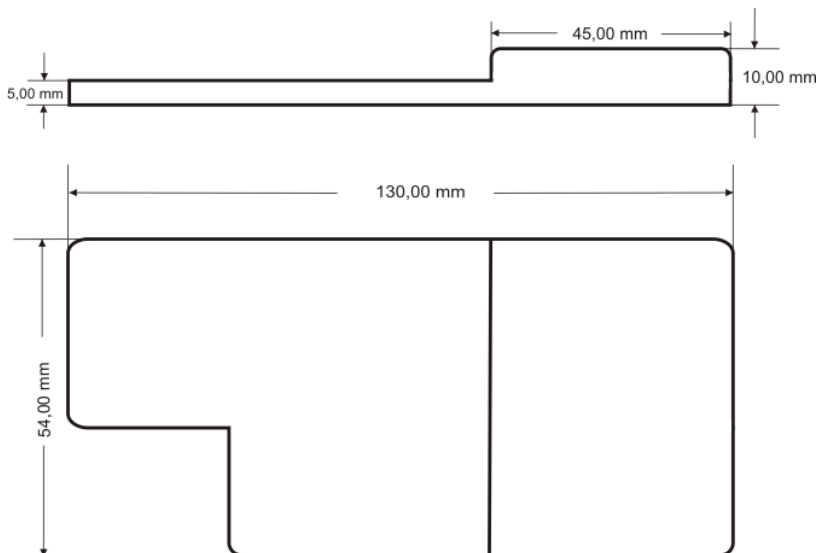
Appendix B Dimension Drawing

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)