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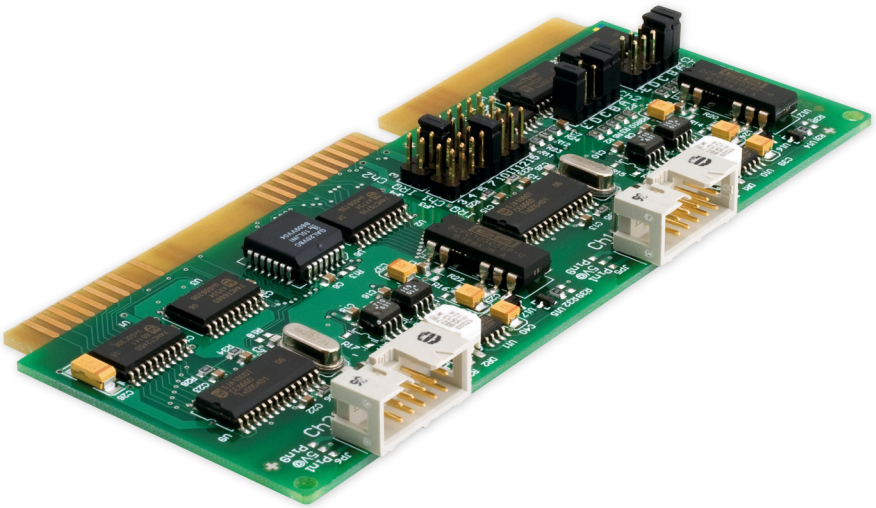
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Find the *PEAK System PCAN-ISA Single Channel Opto-Decoupled* at our website: *Click HERE*

PCAN-ISA

CAN Interface for ISA

User Manual



Document version 2.1.0 (2019-03-21)

PEAK System

Relevant products

Product name	Model	Item number
PCAN-ISA Single Channel	One CAN channel	IPEH-002074
PCAN-ISA Dual Channel	Two CAN channels	IPEH-002075
PCAN-ISA Single Channel opto-decoupled	One CAN channel, galvanic isolation for CAN connection	IPEH-002076
PCAN-ISA Dual Channel opto-decoupled	Two CAN channels, galvanic isolation for CAN connections	IPEH-002077

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

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Contents

1 Introduction 5
1.1 Properties at a Glance 5
1.2 System Requirements 6
1.3 Scope of Supply 7

2 Configuration and Installation 8
2.1 Configuring the Card 8
2.1.1 Position of the Jumper Fields 8
2.1.2 I/O Address Range 9
2.1.3 Interrupt 10
2.2 Installing the Software 11
2.3 Installing the Hardware 12
2.4 Modifying the Computer's BIOS Settings 13
2.4.1 Indicating Used Interrupts 13
2.4.2 Deactivating the APIC Mode 14

3 Connecting a CAN Bus 16
3.1 Connection over D-Sub connector 16
3.2 Voltage Supply for External Devices 17
3.3 Cabling 19
3.3.1 Termination 19
3.3.2 Example of a Connection 19
3.3.3 Maximum Bus Length 20

4 Software and API 21
4.1 Monitor Software PCAN-View 21
4.1.1 Receive/Transmit Tab 24
4.1.2 Trace Tab 26
4.1.3 PCAN-ISA 27
4.1.4 Status Bar 27

4.2 Linking Own Programs with PCAN-Basic 28
4.2.1 Features of PCAN-Basic 29
4.2.2 Principle Description of the API 30
4.2.3 Notes about the License 31

5 Frequently Asked Questions (FAQ) 32

6 Technical Specifications 33

Appendix A CE Certificate 35

Appendix B Quick Reference 36

1 Introduction

The PCAN-ISA card enables simple, cost-effective connection of computer systems with ISA slots to CAN networks. Multiple PCAN-ISA cards can easily be operated using interrupt sharing.

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.

Note: This manual refers to different versions of the PCAN-ISA card. Differences at use and at the technical specifications are mentioned accordingly in this manual.

Tip: At the end of this manual (Appendix B) you can find a **Quick Reference** with brief information about the installation and operation of the PCAN-ISA card.

1.1 Properties at a Glance

- PC plug-in card for 16-bit ISA slots
- Multiple cards can be operated in parallel in a single PC (interrupt sharing)
- 13 port and 8 interrupt addresses are available for configuration using jumpers

- 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® 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 converter
- 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)

Note: This manual describes the use of the PCAN-ISA card with Windows. You can find device drivers for Linux and the corresponding information on PEAK-System's website under www.peak-system.com/linux.

1.2 System Requirements

- An empty ISA slot (16 bit) in the computer
- Operating system Windows 10, 8.1, 7 (32-bit) or Windows CE 6.x (x86 and ARMv4 processor support) or Linux (32/64-bit)

1.3 Scope of Supply

- Plug-in card PCAN-ISA
- Slot bracket with D-Sub connectors for the CAN bus
- Device drivers for Windows 10, 8.1, 7 (32-bit) and Linux (32/64-bit)
- Device driver for Windows CE 6.x (x86 and ARMv4 processor support)
- CAN monitor PCAN-View for Windows
- CAN monitor PCAN-View for DOS
- Programming interface PCAN-Basic for developing applications with CAN connection
- Programming interfaces for standardized protocols from the automotive sector
- Manual in PDF format

2 Configuration and Installation

2.1 Configuring the Card

Before you install the PCAN-ISA card into the computer you may need to configure it. For each CAN channel an interrupt (IRQ) and an I/O address range is set for operation in the computer.

At delivery the PCAN-ISA card has the following default settings:

CAN channel	IRQ	I/O address range	Remark
1	10	300h – 31Fh	
2	5	320h – 33Fh	Only on the Dual Channel version

Tip: If the given resources are not firmly occupied by other devices, you can skip the configuration and directly continue with the following manual section 2.2.

For a configuration differing from the default settings you need to set jumpers on the PCAN-ISA PCB according to the following explanations.

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

2.1.1 Position of the Jumper Fields

The single-channel version of the PCAN-ISA card has two jumper fields, one for the setting of the I/O address range and one for the setting of the interrupt (Figure 1). Accordingly the Dual Channel version has the doubled layout (Figure 2).

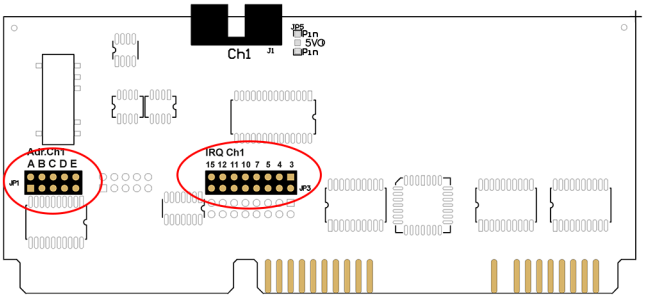


Figure 1: PCAN-ISA Single Channel – Position of the jumper fields for setting the I/O address range (JP1, left marker) and the interrupt (JP3, right marker)

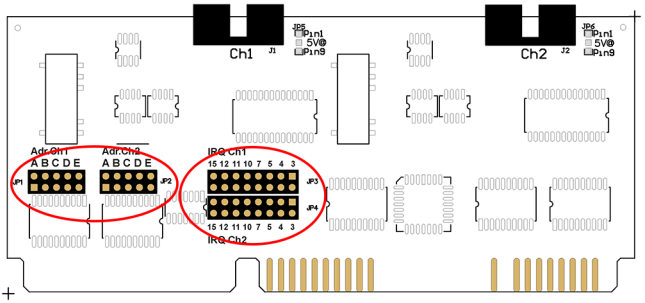


Figure 2: PCAN-ISA Dual Channel – Position of the jumper fields for setting the I/O address ranges (JP1, JP2, left marker) and the interrupts (JP3, JP4, right marker)

2.1.2 I/O Address Range

Each CAN channel must be assigned to an unique I/O address range in the computer. An address space from 200h up to 39Fh (h = hexadecimal) is available. The PCAN-ISA card uses 32 addresses beginning from the configured base address. The configuration is done on jumper field JP1 for CAN channel 1 and jumper field JP2 for CAN channel 2 (latter only with the Dual Channel version).

The following table shows the possible settings. The X stands for a set jumper. The default settings at delivery for CAN channels 1 and 2 are highlighted.

Jumper field JP1/JP2					I/O address range
A	B	C	D	E	
X					200h – 21Fh
X				X	220h – 23Fh
X			X		240h – 25Fh
X			X	X	260h – 27Fh
X		X			280h – 29Fh
X		X		X	2A0h – 2BFh
X		X	X		2C0h – 2DFh
X		X	X	X	2E0h – 2FFh
X	X				300h – 31Fh
X	X			X	320h – 33Fh
X	X		X		340h – 35Fh
X	X		X	X	360h – 37Fh
X	X	X			380h – 39Fh

2.1.3 Interrupt

An interrupt (IRQ) must be assigned to each CAN channel. The PCAN-ISA card supports the interrupts 3, 4, 5, 7, 10, 11, 12, and 15. The default setting at delivery for CAN channel 1 is interrupt 10, for CAN channel 2 interrupt 5.

It is possible to share the same interrupt between two existing CAN channels. Therefore you can configure the same interrupt, when using two PCAN-ISA cards in the same computer.



Tip: We suggest to configure different interrupts as long as resources allow it and use interrupt sharing only, if this is not the case.

2.2 Installing the Software

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 until the **Costum Setup** is displayed.

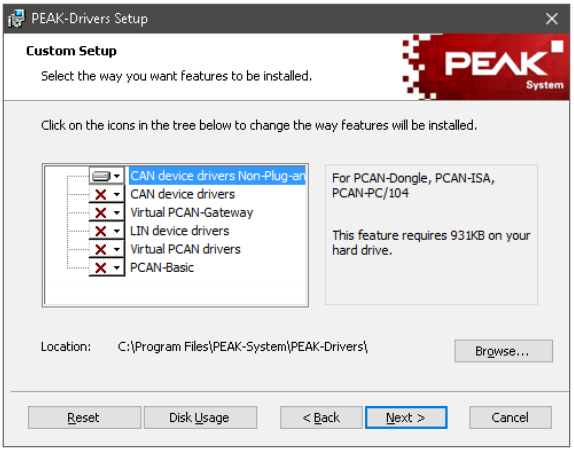


Figure 3: Driver selection in the PEAK-Drivers Setup

5. Deselect the **CAN device drivers** and select **CAN device drivers Non-Plug-and-Play** (see Figure 3).

Node: The **CAN device drivers Non-Plug-and-Play** is only available under 32-bit Windows. PCAN-ISA does not work under 64-bit Windows.

6. Follow the further instructions.

2.3 Installing the Hardware

Do the following to install the PCAN-ISA card into the computer:

1. Turn off the computer.
2. Open the computer case and plug the PCAN-ISA card into an empty slot on the computer's motherboard.
3. In the computer replace a slot bracket with the supplied slot bracket containing the D-Sub connector(s) for the CAN bus, if applicable.
4. For each CAN channel connect the flat cable to the corresponding connector on the card.

   You can look up the pin assignment of the 10-pin CAN connectors on the card in section 3.1.
5. Close the computer's casing.

Note: Before switching on the computer, please follow the procedure for modifying the computer's BIOS settings described in the following section.

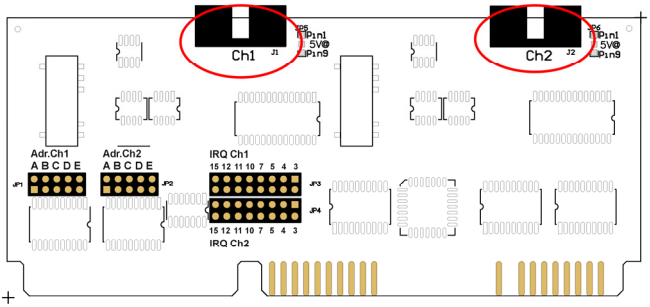


Figure 4: Connectors for the cable(s) to the slot bracket (here: PCAN-ISA Dual Channel, the Single Channel version only has the left connector Ch1)

2.4 Modifying the Computer's BIOS Settings

To ensure a flawless operation of the PCAN-ISA card it is necessary that you adjust settings in the BIOS setup of the computer:

- Indicate used interrupts
- Deactivate the APIC mode

Note: Due to a diversity of existing BIOS setup versions for computers we cannot give detailed instructions here. Instead we indicate common setting names.

In order to know how to start the computer's BIOS setup please consult the corresponding documentation. Usually you can enter the BIOS setup by pressing the Del or F2 key shortly after switching on the computer.

2.4.1 Indicating Used Interrupts

By indicating the interrupts that are set on the PCAN-ISA card, you avoid that the corresponding resources are automatically assigned to other devices and that this results in conflicts.

In the BIOS setup itself you can often find the settings for the interrupts under a menu item containing the text **PnP**. For the interrupt(s) used by PCAN-ISA change the setting to **Reserved** or **Legacy ISA**.

2.4.2 Deactivating the APIC Mode

Note: Do not mix up APIC with ACPI.

The APIC mode is a certain type of interrupt management in a computer.

If the APIC mode is active in your computer, you must deactivate it so that the PCAN-ISA card can work properly with interrupts.

- Do the following to determine in Windows if the APIC mode is active:

  1. Open the Windows **Device Manager**.
  2. Select the menu entry **View** > **Resources by type**.
  3. Open the branch of **Interrupt request (IRQ)**.

     If entries with interrupt numbers greater than 15 are listed, the APIC mode is active and you must deactivate it.

- Do the following to deactivate the APIC mode:

Attention! When you deactivate the APIC mode in the BIOS setup, it may happen that you must reinstall Windows afterwards, because it cannot start anymore due to the low-level setting.

1. Restart the computer and switch to the BIOS setup.
2. Search for the APIC setting and deactivate it.
3. Save the changes in the BIOS and quit the BIOS setup.

4. If Windows doesn't start properly, reinstall it or perform a repair installation.

3 Connecting a 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 corresponds to the specification CiA® 303-1.

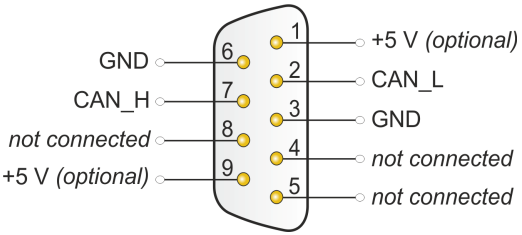


Figure 5: Pin assignment High-Speed-CAN
(view onto connector of the slot bracket)

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.

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).

The pin assignment between the D-Sub port and the 10-pin connector on the PCAN-ISA card is as follows:

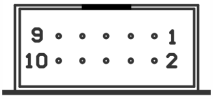


Figure 6: Numbering at the 10-pin connector

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	

3.2 Voltage Supply for External Devices

External devices with low power consumption (e.g. bus converters) can be directly supplied via the CAN connector (independently for each CAN connector on the Dual Channel version). With a solder bridge on the PCAN-ISA card, a 5-Volt supply can optionally be routed to pin 1 and/or pin 9 of the D-Sub connector.

The opto-decoupled versions of the PCAN-ISA card contain an interconnected DC/DC converter. Therefore, the current output is limited to about 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 positions on the card; the table below contains the possible settings.

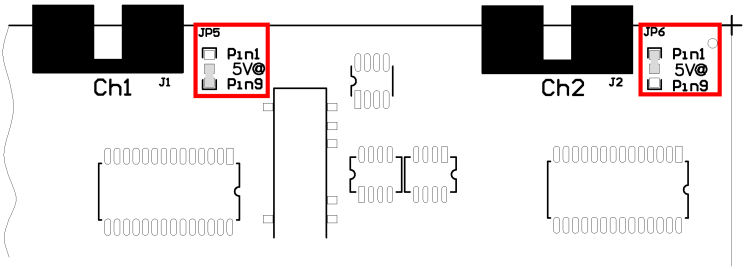


Figure 7: Position of the solder bridge fields for the 5-Volt supply

D-Sub connectors	Solder fields	5-Volt supply			
		Without (standard)	Pin 1	Pin 9	Pin 1 and 9
CAN 1	JP5				
CAN 2	JP6				

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

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

3.3.2 Example of a Connection

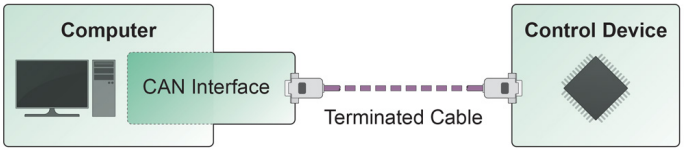


Figure 8: Simple CAN connection

This example shows a connection between the PCAN-ISA adapter 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 have bit rates up to 1 Mbit/s. The maximum bus length primarily depends on the bit rate.

The following table shows different maximum possible CAN bus length with 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.

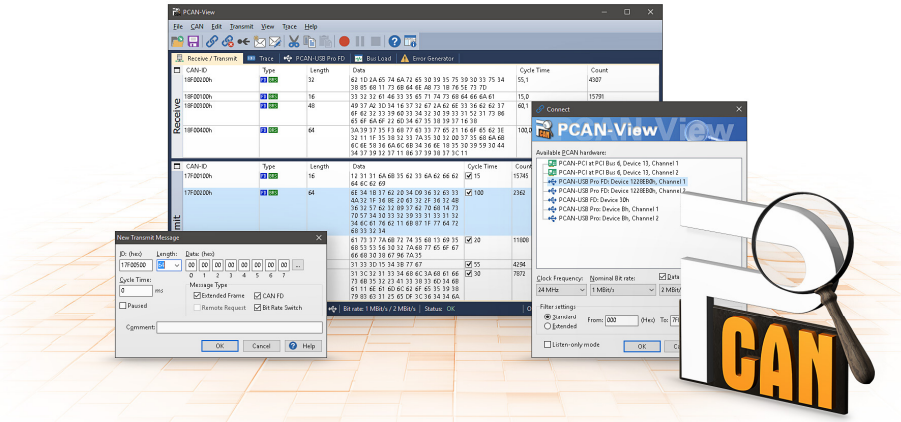


Figure 9: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

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

   The **Connect** dialog box appears.

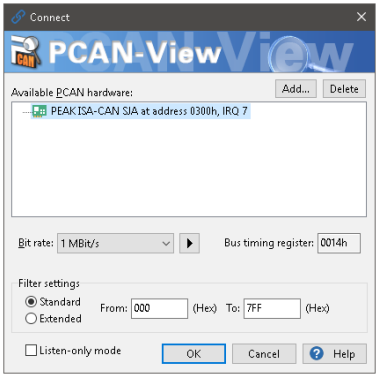


Figure 10: Selection of the hardware and parameters

2. Select an interface from the list and continue with step 7.
3. If no entry is in the list, press the button **Add**.

   The dialog box **Add CAN hardware** appears.

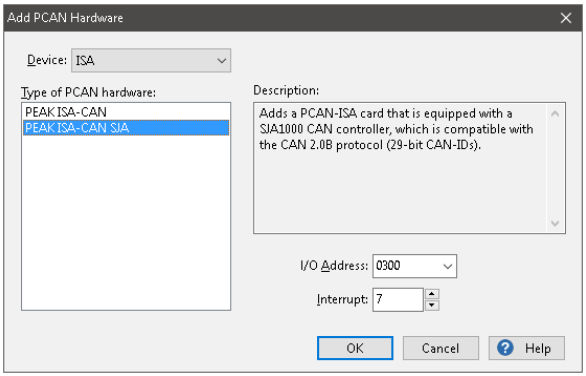


Figure 11: Selection of a hardware type

4. Select **PEAK ISA-CAN SJA**.
5. Enter the port address and the interrupt of the used parallel interface established before (see section 2).
6. Confirm your input with **OK**.
7. 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 (▸).

8. 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).
9. 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).
10. Confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 12).

4.1.1 Receive/Transmit Tab

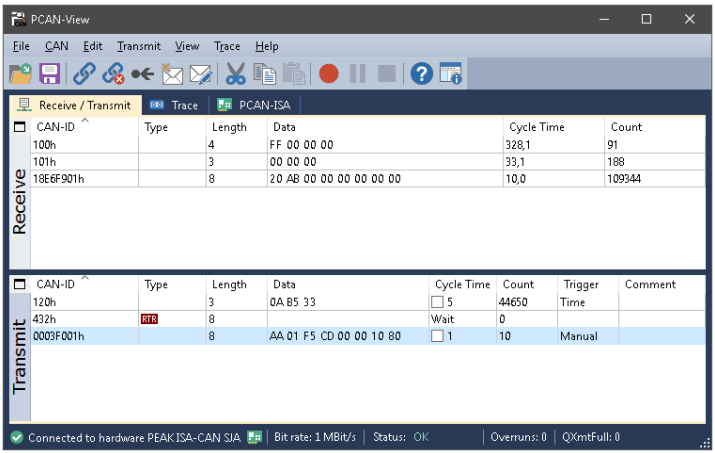


Figure 12: Receive/Transmit Tab

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.

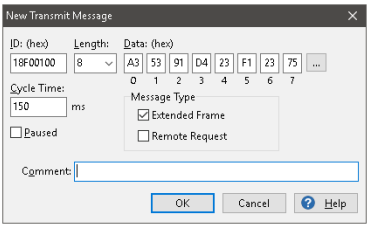


Figure 13: Dialog box new transmit message

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 Space 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

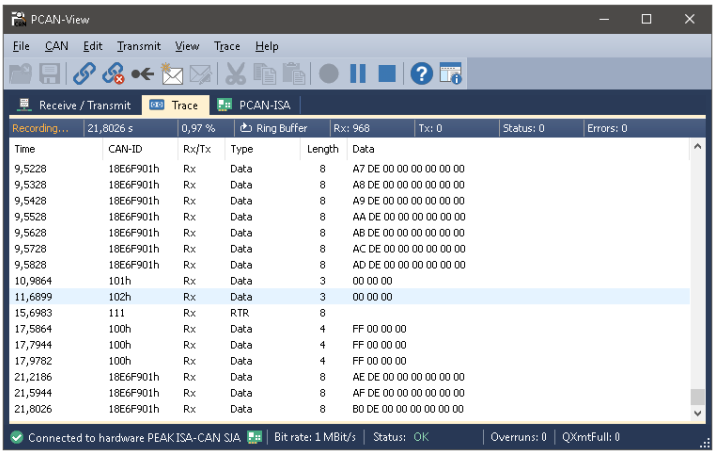


Figure 14: Trace Tab

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-ISA

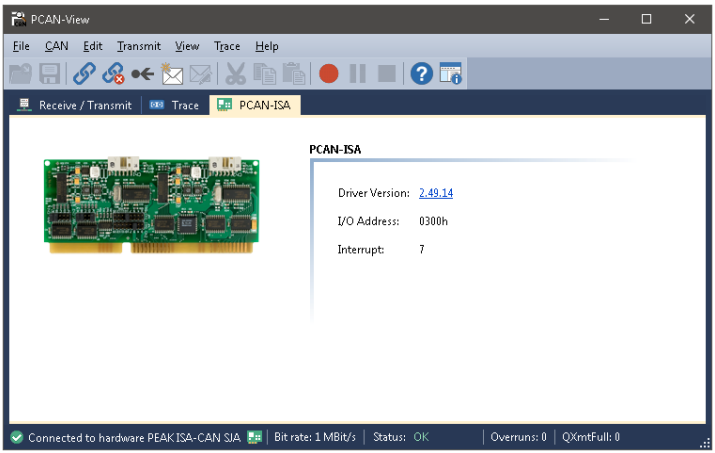


Figure 15: PCAN-ISA tab

The **PCAN-ISA** tab contains some detailed information about the hardware and driver.

4.1.4 Status Bar



Figure 16: 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



Figure 17: 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 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 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 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 Frequently Asked Questions (FAQ)

Question	Answer
Can I use **several PCAN-ISA cards** in the same computer?	Yes. When there's a lack of resources it is possible to share the same interrupt between CAN channels. However, consider that an unique I/O address range is assigned to each CAN channel.

6 Technical Specifications

Connectors	
Computer	ISA bus with 8 MHz clock rate, 16 bit bus width
CAN	D-Sub (m), 9 pins Pin assignment according to 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 Philips PCA82C251
Galvanic isolation	up to 500 V (for each CAN connector) (only for opto-dec. cards)
Supplying external devices	PCAN-ISA: D-Sub pin 1/9; 5 V, max. 100mA PCAN-ISA opto: D-Sub pin 1/9; 5 V, max. 50mA via solder bridge(s), disabled at delivery

Supply		
Current consumption	PCAN-ISA Single Channel:	max. 150 mA
	PCAN-ISA Dual Channel:	max. 170 mA
	PCAN-ISA Single Channel opto-dec.:	max. 210 mA
	PCAN-ISA Dual Channel opto-dec.:	max. 270 mA

Measures		
Size	143 x 66 x 13 mm (5 5/8 x 2 5/8 x 1/2 inches)	
Weight	PCAN-ISA Single Channel:	39 g
	PCAN-ISA Dual Channel:	45 g
	PCAN-ISA Single Channel opto-dec.:	41 g
	PCAN-ISA Dual Channel opto-dec.:	48 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-ISA

Item number(s): IPEH-002074/75/76/77

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

CE 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



Uwe Wilhelm, Managing Director

Appendix B Quick Reference

Default setting at delivery

CAN channel	IRQ	I/O address range	Remark
1	10	300h – 31Fh	
2	5	320h – 33Fh	Only on the Dual Channel version

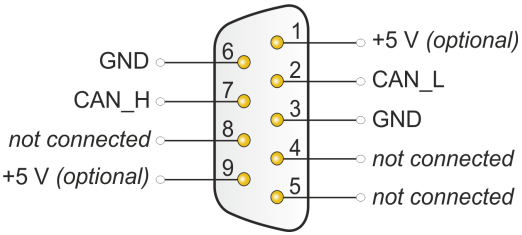
Hardware Installation / Configuring the Computer

Install the driver from the supplied DVD. Turn off the computer. Insert the card into a free ISA slot (16 bit). After switching on the computer, enter the BIOS setup. In the PnP table mark the interrupts used by the PCAN-ISA card as reserved.

Software setup and startup under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the PCAN-ISA card. Indicate the needed parameters for initialization of the PCAN-ISA card (I/O base address, interrupt) and select the desired CAN channel, when using the Dual Channel version.

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



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