PCAN-Router Pro FD

6-Channel CAN FD Router with I/O and Data Logger

User Manual

Document version 1.3.0 (2020-06-29)

PEAK System

Relevant products

Product name	Model	Part number
PCAN-Router Pro FD		IPEH-002220

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 1.3.0 (2020-06-29)

Contents

1 Introduction

With six channels, the PCAN-Router Pro FD links the data traffic of modern CAN FD and classic CAN buses. Pluggable CAN transceiver modules allow flexible adaptation of each CAN channel to the respective requirements. In addition, the router is equipped with an analog input and four digital I/Os.

The CAN messages can be recorded on the internal memory or on an inserted memory card and later read out via the USB connection. With the PCAN-Router Pro FD the data flow of test benches and production plants can be managed, monitored, and controlled. The conversion from CAN to CAN FD or vice versa enables the integration of new CAN FD applications into existing CAN 2.0 networks.

The behavior of the PCAN-Router Pro FD can be programmed freely for specific applications. The firmware is created using the included development package with GNU compiler for C and C++ and is then transferred to the module via CAN. Various programming examples, such as message forwarding or recording, facilitate the implementation of own solutions.

1.1 Properties at a Glance

- 6 High-speed CAN channels (ISO 11898-2)
  - Complies with CAN specifications 2.0 A/B and FD
  - CAN FD support for ISO and Non-ISO standards
  - CAN FD bit rates for the data field (64 bytes max.) from 40 kbit/s up to 12 Mbit/s
  - CAN bit rates from 40 kbit/s up to 1 Mbit/s
  - NXP CAN transceiver TJA1043 with Wake-up

  - Alternative pluggable transceiver modules on request (details on page 14)

- CAN connections are D-Sub, 9-pin
- CAN termination switchable, separately for each CAN channel
- Wake-up function using separate input, CAN bus, or real-time clock
- 2 digital I/Os, each usable as digital input or output with High-side switch
- 2 digital I/Os, each usable as digital input or output with Low-side switch
- 1 analog input (0 - 33 V)
- Recording of CAN data and error frames
- Internal memory: 16 GByte pSLC eMMC
- SD card slot for additional memory
- USB connection for accessing the data memory (e.g. recorded log data)
- Conversion of logging data to various output formats using the Windows software PEAK-Converter
- Battery-buffered real-time clock (RTC), can also be used for wake-up
- Beeper
- Status LEDs for CAN channels, memory cards, and power supply
- Microcontroller STM32F765NIH6 (based on Arm® Cortex® M7)
- 32 MByte SDRAM in addition to microcontroller RAM
- Aluminum casing with flange

- 8 - 32 V power supply, protection against overvoltage and reverse polarity
- Slot for a backup battery for defined switch-off behavior (e.g. for log data saving)
- Optional on request:
  Ethernet interface via RJ-45 socket or BroadR-Reach® interface via D-Sub connector
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

1.2 Operation Requirements

- The transfer of the firmware via CAN requires a PEAK CAN interface

1.3 Scope of Supply

- PCAN-Router Pro FD in aluminum casing including mating connectors for I/O and power
- USB connector cable
- Windows development package with GCC ARM Embedded, flash program, and programming examples
- Conversion software PEAK-Converter for Windows 10, 8.1, 7 (32/64-bit)
- Manual in PDF format

2 Connectors

This chapter describes the connections on the front panel of the PCAN-Router Pro FD.

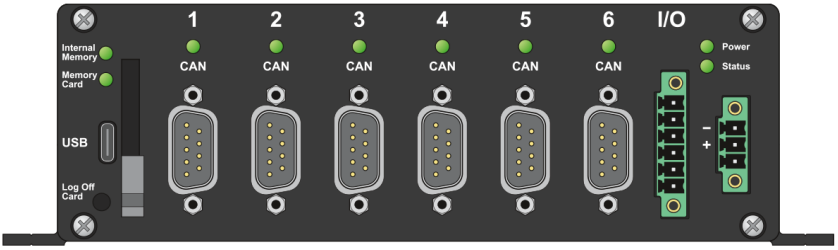


Figure 1: Pin assignment on the front panel of the PCAN-Router Pro FD

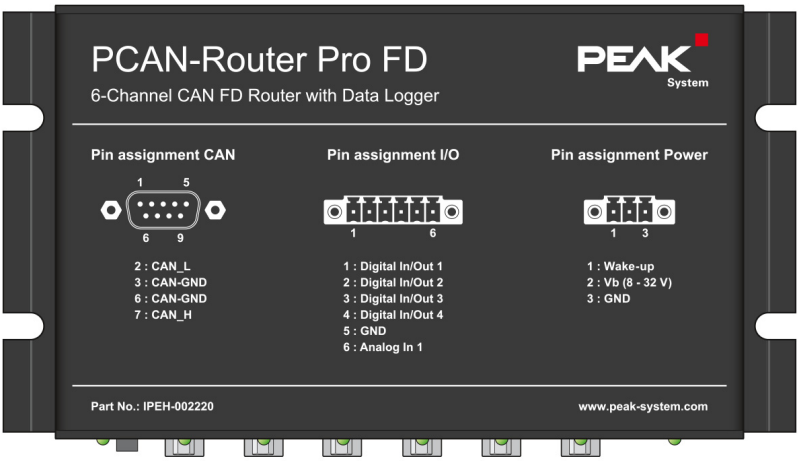


Figure 2: Description of the pin assignments on the top of the housing

2.1 Power Supply

For the operation of the PCAN-Router Pro FD a voltage source with nominal 12 V DC is required, 8 to 32 V are possible. The input is electronically protected with reverse polarity and overvoltage protection.

Note: The scope of delivery does not include a power supply unit for the power supply of the device. The device is not supplied via the USB connection to the PC.

The connection is made via the mating connector supplied (3-pole, type: Phoenix Contact MC1,5/2-STF-3,81) to which you can screw cable strands. The polarity is as follows:

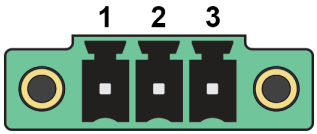


Figure 3: Power connector

Pin	Function	Description
1	Wake-up	3 to 32 V DC required for wake-up signal
2	V_b (8-32V)	Power supply with 8 to 32 V DC
3	GND	Ground

Pin 1 is only necessary for transceivers without wake-up function (see section 4.1) to switch on the device.

2.2 CAN over D-Sub Connectors

A high-speed CAN bus (ISO 11898-2) is connected to the 9-pin D Sub connector. The CAN assignment corresponds to the CiA® 303-1 specification.

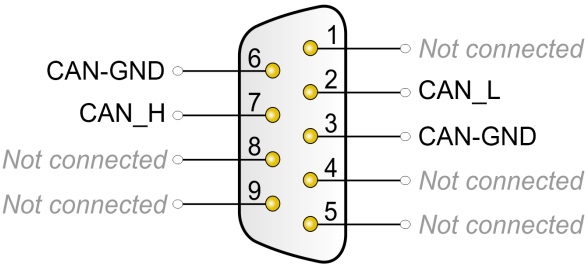


Figure 4: Pin assignment High-speed CAN

2.3 Inputs and Outputs (I/O)

The I/O connector has 4 digital inputs and outputs and one analog input. The connection is made via the supplied mating connector (6-pin, type: Phoenix Contact MC1.5/2-STF-3.81), to which you can screw cable strands.

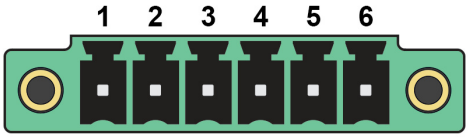


Figure 5: I/O connector

Pin	Name	Function
1	Digital In/Out 1	Digital input and output 1 (High-side)
2	Digital In/Out 2	Digital input and output 2 (High-side)
3	Digital In/Out 3	Digital input and output 3 (Low-side)

Pin	Name	Function
4	Digital In/Out 4	Digital input and output 4 (Low-side)
5	GND	Ground
6	Analog In 1	Analog input 1

2.4 Status LEDs

When a power supply is applied, the power LED lights up green. All other LEDs can be programmed with a custom firmware. More details can be found in the supplied programming examples.

2.5 USB Connection

The internal memory and the external memory card of the PCAN-Router Pro FD can be accessed via a USB connection with a PC. The operating system on the PC integrates the memory card into the file management, for example as a mass storage device under Windows.

Note: Access to the USB connection via the CPU is not possible.

2.6 SD Card Slot and Internal Memory

The PCAN-Router Pro FD is equipped with an internal memory card. Optionally, an additional SD card can be inserted into the SD card slot.

Both memory cards must be formatted with the file system FAT 32 which allows a maximum memory size of 2 TByte. However, 32 GByte is the maximum memory size supported by Windows at FAT 32. For working with larger SD cards, additional tools are required.

The internal memory and the external memory card of the PCAN-Router Pro FD can be accessed via a USB connection with a PC.

2.7 Log Off Card Button

The function of the Log Off Card button can be programmed with a custom firmware.

3 Operation

3.1 Ensuring Power Supply

The PCAN-Router Pro FD must be supplied as standard with a nominal 12 V (8 to 32 V possible) DC voltage via the power connection.

Note: If you install a backup battery (see section 4.4) and it is charged, the device can also be operated without a power supply (e.g. in the event of a power failure).

3.2 Starting the PCAN-Router Pro FD

The PCAN-Router Pro FD is automatically switched on when the supply voltage is applied (power LED lights up). By default, six transceiver modules with wake-up function are installed.

If other transceiver modules without wake-up function are installed on request, an external wake-up signal via pin 1 of the power connector from 3 to 32 Volt is required (see section 4.1 on page 14).

4 Hardware Modifications

You can make various hardware adjustments on the board of the PCAN-Router Pro FD:

- Using an alternative CAN Transceiver module (section 4.1)
- Adapting the termination for a CAN bus (section 4.2)
- Changing the button cell for the real-time clock (section 4.3)

4.1 Alternative Transceiver Module

An alternative CAN transceiver module can be used for each of the six CAN connections. The **PCAN-Transceiver TJA1043** is preinstalled by default. The following alternative modules are supported:

Order Number	Name	Transmission Standard	Bit Rate	Wake-up	Galvanic Isolation
IPEH-001001	PCAN-Transceiver TJA1041	High-Speed-CAN ISO 11898-2	40 kbit/s to 1 Mbit/s	yes	no
IPEH-001002	PCAN-Transceiver PCA82C251	High-Speed-CAN ISO 11898-2	0 kbit/s to 1 Mbit/s	no	no
IPEH-001004	PCAN-Transceiver TH8056	Single-Wire-CAN SAE J2411	1.3 kbit/s to 40 or 100 kbit/s	yes	no
IPEH-001005	PCAN-Transceiver TJA1055	Low-Speed-CAN ISO 11898-3	20 kbit/s to 125 kbit/s	yes	no
IPEH-001006	PCAN-Transceiver TJA1044	High-Speed-CAN ISO 11898-2	25 kbit/s to 12 Mbit/s[1]	no	no
IPEH-001007	PCAN-Transceiver TJA1044-ISO	High-Speed-CAN ISO 11898-2	25 kbit/s to 12 Mbit/s[1]	no	yes
IPEH-001008 Default	**PCAN-Transceiver TJA1043**	**High-Speed-CAN ISO 11898-2**	**40 kbit/s to 12 Mbit/s[1]**	**yes**	**no**

[1] According to the CAN transceiver data sheet only CAN FD bit rates up to 5 Mbit/s are guaranteed with the specified timing.

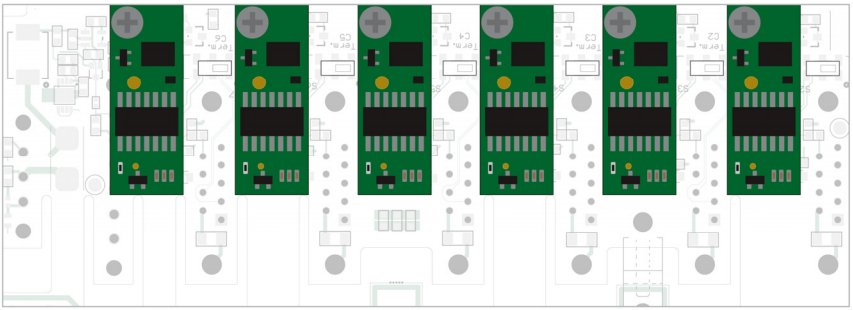


Figure 6: Positions of the transceiver modules for the six CAN FD channels

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

Do the following to change a transceiver module:

1. Disconnect the device from the power supply.
2. Remove the two upper screws on the front and back of the housing.
3. **BroadR-Reach® interface only:**
   Remove the mounting screws of the D-Sub connector on the back of the housing.
4. Pull out the housing cover.
5. **Only with backup battery installed:**
   Remove the backup battery.
6. Remove the screw on the board from the transceiver module to be replaced.
7. Remove the module from the front panel slot.
8. Plug the new transceiver module into the slot.
9. Fasten the module again with the screw.
10. **Only with backup battery installed:**
    Reinstall the backup battery and secure it with a cable tie.

11. Insert the housing cover.
12. **BroadR-Reach® interface only:**
    Fasten again the screws of the D-Sub connector at the rear of the housing.
13. Fasten the four screws to the front and rear of the housing.

When the PCAN-Router Pro FD is restarted, it automatically detects the type of CAN transceiver module used and sets the transmission standard (see table above) for the CAN channel accordingly.

Note: If one or more transceiver modules without wake-up function are installed in an adapted configuration, an external wake-up signal via pin 1 of the power connector is required. Only then will the device or the respective transceiver be powered on.

4.2 Setting the Termination for a CAN Bus

Depending on the CAN transceiver module used, you can use the **switch blocks** to set a CAN bus termination for the respective CAN 1 to CAN 6 (**C1** to **C6**) connection. On delivery, the switch blocks are set to **off**.

Tip: We recommend adding termination at the CAN cabling, for example with termination adapters (e.g. PCAN-Term). Thus, CAN nodes can be flexibly connected to the bus.

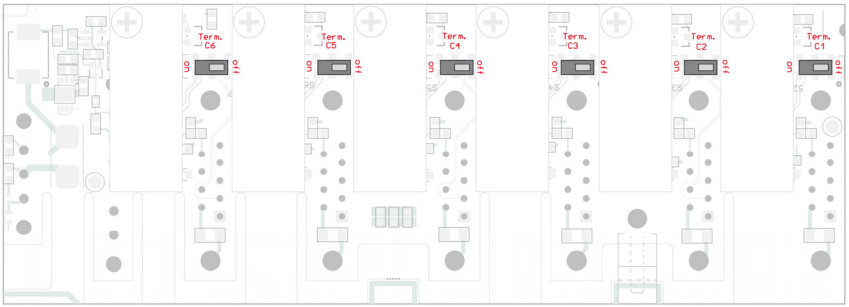


Figure 7: Positions of the switch blocks for CAN termination on the front board

Type of Transceiver	Termination at Switch Position	
	Off	**On**
High-speed-CAN (ISO 11898-2) Transceiver installed by default.	none	120 Ω between CAN_L and CAN_H
Low-speed-CAN (ISO 11898-3) Transceiver only on request.	4.7 kΩ for CAN_L and CAN_H	1.1 kΩ for CAN_L and CAN_H
Single-Wire-CAN (SAE J2411) Transceiver only on request.	9.1 kΩ for CAN_SW	2.1 kΩ for CAN_SW

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

Do the following to activate the CAN termination:

1. Disconnect the device from the power supply.
2. Remove the two upper screws on the front and back of the housing.
3. Pull out the housing cover.
4. Use a slotted screwdriver and set the switch of the desired CAN channel from **off** to **on**.
5. Insert the housing cover.
6. Fasten the four screws to the front and back of the housing.

4.3 Changing the Button Cell for the Real-Time Clock (RTC)

The real-time clock (RTC) installed in the PCAN-Router Pro FD is supplied by a button cell of the IEC type CR1620 (3 V) as long as the device is switched off (without power supply).

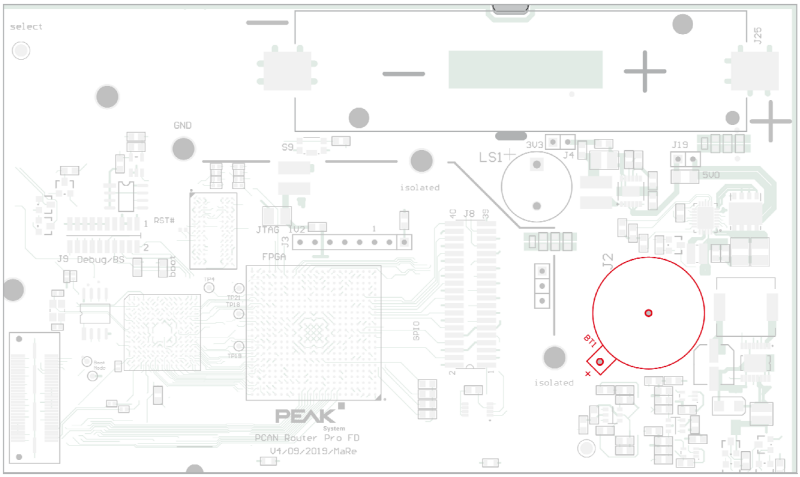


Figure 8: Position of the button cell for the real-time clock on the main board

A new button cell lasts several years. If the internal clock indicates an unexpected time, remove the button cell, and measure its voltage. The nominal voltage is 3.0 volts. If the measured voltage is lower than 2.5 volts, replace the button cell.

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

Do the following to replace the button cell:

1. Disconnect the device from the power supply.
2. Remove the two upper screws on the front and back of the housing.

3. Pull out the housing cover.
4. **Only with backup battery installed**:
   Remove the backup battery before replacing the button cell.
5. Carefully remove the button cell from the holder.
6. Insert the new button cell.
7. **Only with backup battery installed**:
   Replace the backup battery.
8. Insert the housing cover.
9. Fasten the four screws to the front and back of the housing.

4.4 Installing Backup Battery

On the board of the PCAN-Router Pro FD a backup battery in the form factor 18650 can be inserted, which must be protected against short circuit, overcharging, and deep discharge (Protection PCB). Thus, operation can be ensured during a power failure (power LED off).

The recharging of the backup battery must be programmed. A code example (C/C++) of this can be found in the supplied development package.

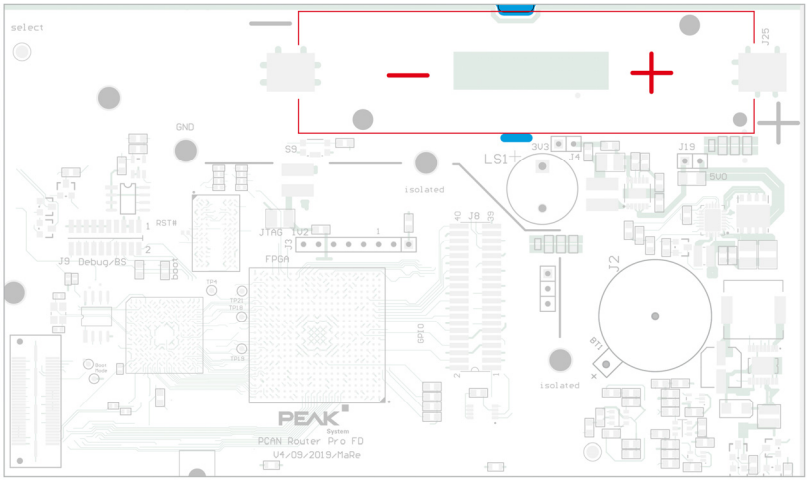


Figure 9: Position of the backup battery on the board

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

Do the following to install the backup battery:

1. Disconnect the device from the power supply.
2. Remove the eight screws at the front and back of the housing.
3. **Only with optional BroadR-Reach® interface:**
   Remove the two fastening screws of the D-Sub connector on the rear of the housing.
4. Remove the back panel and housing cover.
5. Pull the board out of the housing in the direction of the front side.
6. Insert the backup battery with integrated protection (form factor 18650) according to the polarity.
7. Fasten the battery with a cable tie in the recesses provided.

8. Push the board back into the first rail of the housing.
9. Replace the housing cover and the back panel.
10. **Only with optional BroadR-Reach® interface**:
    Fasten the two screws of the D-Sub connector to the rear of the housing.
11. Reinsert all eight housing screws.

Important note: Only use batteries with integrated PCB protection to avoid short circuit, overcharging, and deep discharge! We recommend using a lithium-ion battery such as the Soshine 18650 3600 mAh 3.7 V or comparable models.

5 Creating Own Firmware

With the help of the development package, you can program your own application-specific firmware for PEAK-System programmable hardware products.

Download of the development package:

URL: www.peak-system.com/quick/DLP-Router-Pro-FD

System Requirements:

- PC with Windows® 10 (32-/64-bit)
- CAN interface of the PCAN series to upload the firmware to your hardware via CAN

Content of the package:

- `Build Tools\`
  Tools for automating the build process
- `Compiler\`
  Compilers for the supported programmable products
- `Hardware\`
  Contains sub directories of the supported hardware which include several firmware examples. Use the examples for starting your own firmware development.
- `PEAK-Flash\`
  Windows tool for uploading the firmware to your hardware via CAN. Copy the directory to your PC and start the software without further installation.
- `LiesMich.txt` and `ReadMe.txt`
- `SetPath_for_VSCode.vbs`
  VBScript to modify the example directories for the Visual Studio Code IDE.

Do the following to create your own firmware:

1. Create a folder on your local PC. We recommend using a local drive.
2. Copy the complete unzipped `PEAK-DevPack` directories into your folder, incl. all subs.

   No installation is required at all.
3. Run the script `SetPath_for_VSCode.vbs`. This script will modify the example directories for the Visual Studio Code IDE (https://code.visualstudio.com/).

   After that every example directory has a folder called `.vscode` containing the needed files with your local path information.
4. Now you can start Visual Studio Code which is available for free from Microsoft.
5. Select the folder of your project and open it.

   For example: `d:\PEAK-DevPack\Hardware\PCAN-Router Pro FD\Examples\01_ROUTING`
6. You can edit the C code and call `make clean`, `make all`, or compile single file via the menu **Terminal > Run Task**.
7. Create your firmware with `Make All`.

   The firmware is the `*.bin` in the sub directory `out` of your project folder.

6 Firmware Upload

The firmware upload is done via a CAN bus with the supplied Windows program PEAK-Flash.

6.1 System Requirements

In order to upload a new firmware to the PCAN-Router Pro FD, the following requirements must be met:

- CAN interface of the PCAN series for the computer (e.g. PCAN-USB FD)
- CAN cabling between the CAN interface and the PCAN-Router Pro FD with correct termination (120 at each end of the CAN bus)
- Operating system Windows 10, 8.1, or 7 (32/64-bit)

6.2 Preparing the Hardware

For an upload of new firmware via CAN, the CAN bootloader must be activated in the PCAN-Router Pro FD. The bootloader is started using the ID rotary switch on the back of the casing.

▶ Do the following to prepare the hardware:

Figure 10: Rotary switch for setting the ID on the back of the housing

1. Turn the **ID** rotary switch on the back of the housing to position **F**. Use a slotted screwdriver, for example.

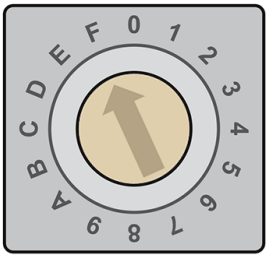


Figure 11: Turn the rotary switch on the rear of the housing to **F**.

2. Restart the device by interrupting the power supply for the change of the rotary switch to take effect.
3. Connect the CAN interface of your computer to a CAN connector on the PCAN-Router Pro FD.

Note: The firmware upload is possible with each of the 6 CAN channels.

6.3 Firmware Transfer

Do the following to transfer a new firmware with PEAK-Flash

1. The software PEAK-Flash is included in the development package, which can be downloaded via the following link: www.peak-system.com/quick/DLP-Router-Pro-FD
2. Open the zip file and extract it to your local storage medium.
3. Run the `PEAK-Flash.exe`

   The program opens.

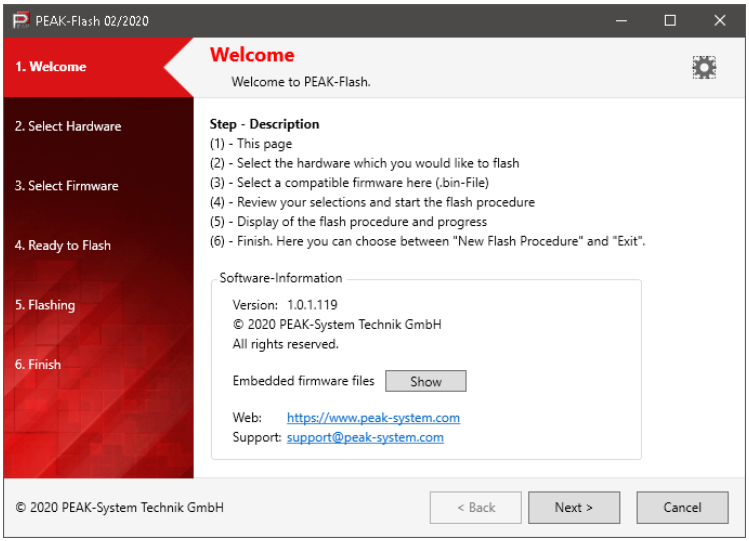


Figure 12: Main window of PEAK-Flash

4. Click the **Next** button.
5. Click on the **Modules connected to the CAN bus** radio button.
6. In the **Channels of connected CAN hardware** drop-down menu, select a CAN interface connected to the computer (e.g. PCAN-USB FD).
7. In the **Bit rate** drop-down menu, select the nominal bit rate available on the CAN bus.

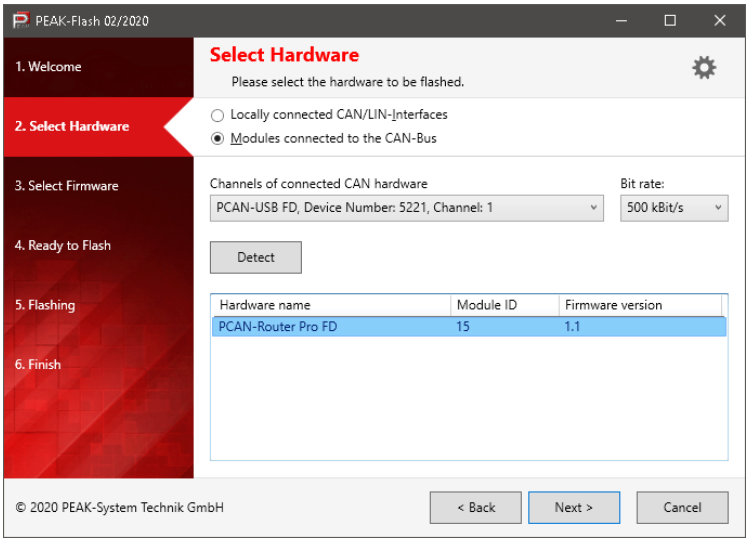


Figure 13: Hardware selection

8. Click on **Detect**.

   In the list, the **PCAN-Router Pro FD** appears together with the **Module ID** and **Firmware version**. If not, check whether a proper connection to the CAN bus with the appropriate nominal bit rate exists.

9. Click **Next**.

10. Select the **Firmware File** radio button and click **Select**.

11. Select the corresponding file (`*.bin`).

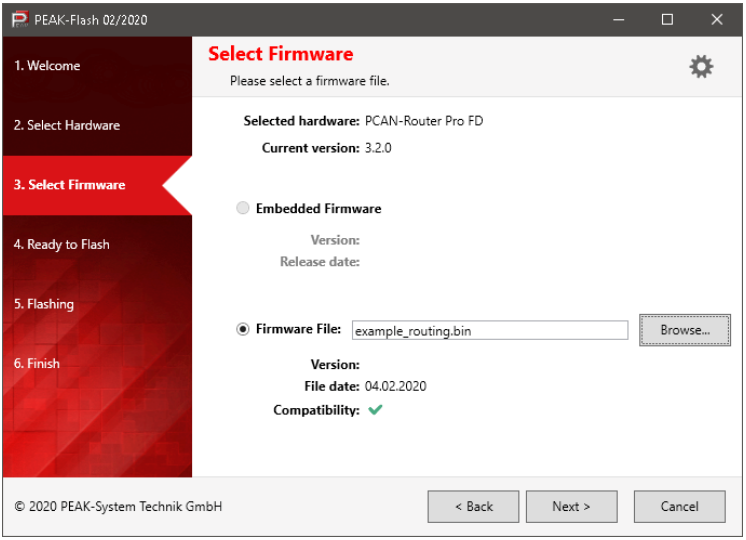


Figure 14: PCAN-Router Pro FD as **Hardware Profile**

12. Click **Next**.

    The **Ready to Flash** dialog appears.

13. Click **Start** to transfer the new firmware to the PCAN-Router Pro FD.

    The **Flashing** dialog appears.

14. After the process is complete, click **Next**.

15. You can exit the program.

16. Turn the rotary switch on the PCAN-Router Pro FD back to the previously set module ID.

17. Restart the device by interrupting the power supply for the change of the rotary switch to take effect.

You can now use the PCAN-Router Pro FD with the new firmware.

7 Configurable Data Logging

In addition to the programming examples, the PCAN-Router Pro FD is delivered with a ready-to-use firmware for tracing CAN data.

The CAN messages can be recorded on the internal eMMC memory or on an inserted SD card which are both accessible via the USB connector. A text file is used to configure the six CAN channels and data logging features.

Features

- Separate configuration of the 6 CAN channels
  - Setting the CAN specification to 2.0 A/B, CAN FD ISO, or CAN FD Non-ISO
  - Setting the nominal and data bit rates
  - Enabling or disabling the Listen-Only mode
- Recording of data frames, error frames, or data and error frames
- Setting of the trace mode and maximum file size
- Setting of the storage medium for saving the trace files
- Configuration of events for starting and stopping the recording
  - Powering the device
  - By pressing the Log Off Card button
  - By receiving a specific CAN message
- Configuration of timeout events for stopping the recording or shutting-down the device
  - Data traffic has stopped
  - Power loss on terminal 15

- Main power loss

- Defining beep patterns for tracing start, end, and error events
- Defining the LED blinking pattern

Note: When using the firmware for data logging, the other programmable features of the PCAN-Router Pro FD are not available.

7.1 Installation

Important note for devices with a serial number up to 150: The development package contains various upgrades in the directory `\Hardware\PCAN-Router Pro FD\Upgrades\`. Carry out their installation once according to the enclosed instructions to enable the full functionality of your device.

Do the following to upload the data logging firmware:

1. The firmware is included in the development package, which can be downloaded via the following link: www.peak-system.com/quick/DLP-Router-Pro-FD
2. Open the zip file and extract it to your local storage medium.
3. The firmware file (`*.bin`) is in the directory `\Hardware\PCAN-Router Pro FD\Datalogger\`.
4. Proceed with the firmware upload as described in chapter 6 Firmware Upload on page 24.
5. After a successful upload, proceed with the configuration described in the next chapter.

7.2 Configuration

The firmware comes with a file named `config.txt` which can be found in the same directory as the firmware. All settings of the CAN channels and logging features are configured with this file.

Note: If you update the data logging firmware to a new version, please make sure to use the new configuration file as well.

Editing the file can be done with any common text editor but some rules must be considered:

- The configuration file is parsed line by line
- Comments are started with `//` and can have up to 190 characters. Comments are ignored when the file is parsed
- The header of the configuration file must not be edited. Especially the firmware version number must not be changed, since the following configuration features are only processed, if the correct firmware version is indicated
- A configuration is started with a keyword followed by `=` and the corresponding options or parameters
- If a keyword is not written correctly or is not supported at all, the line is ignored
- If parameters are not specified, default values are used, if available
- In case of an error, parsing is stopped and the Status LED is blinking red quickly

After editing, the file can be uploaded to a memory card via USB. After the USB was disconnected safely, the device can be restarted by interrupting the power supply. Data logging is then executed with the uploaded configuration.

Note: If config.txt files were uploaded to both memory cards, configuration of the internal eMMC memory card is used.

7.2.1 Nominal and Data Bit Rates

In this section, the nominal and data bit rates for all 6 CAN channels are configured separately by setting the register values. The number at the end of the keyword indicates the CAN channel.

```
CAN_BITRATE_CAN1= f_clock=80000000, nom_brp=1,
nom_tseg1=63, nom_tseg2=16, nom_sjw=16, data_brp=1,
data_tseg1=15, data_tseg2=4, data_sjw=4
```

When configuring bit rates all register values should be specified. A default value is used if a single register value is not set. This can lead to unintended bit rate settings.

Parameter	Value Range	Description
f_clock	80000000 60000000 40000000 30000000 24000000 20000000	The clock frequency indicated in Hz.
nom_brp	1 to 1024	Bit Rate Prescaler of the nominal bit rate.
nom_tseg1	1 to 256	Time Segment 1 of the nominal bit rate.
nom_tseg2	1 to 128	Time Segment 2 of the nominal bit rate.
nom_sjw	1 to 128	Synchronization Jump Width of the nominal bit rate.
data_brp	1 to 1024	Bit Rate Prescaler of the data bit rate.
data_tseg1	1 to 32	Time Segment 1 of the data bit rate.
data_tseg2	1 to 16	Time Segment 2 of the data bit rate.
data_sjw	1 to 16	Synchronization Jump Width of the data bit rate.

Tip: This parameter string can be created easily with the Bit Rate Calculation Tool which can be downloaded for free from our website www.peak-system.com.

7.2.2 CAN Specification and Options

In this section, the used CAN specification and additional options are configured separately for each channel. The number at the end of the keyword indicates the CAN channel.

```
CAN_OPTIONS_CAN1= canfdnoniso listenonly
```

By default, the CAN specification is set to CAN FD ISO. To change the CAN specification one of the following values can be set.

CAN Specification	Description
canfdnoniso	Configures the channel to use CAN FD Non-ISO.
force20ab	Configures the channel to use CAN 2.0 A/B only. A specified data bit rate is ignored.

The following options can be added. When setting multiple options per channel, the values are separated with a space or comma.

Option	Description
listenonly	If the CAN channel should act as a pure observer, not affecting the data traffic, Listen-Only mode can be added as an option.
pflash7E7	This option enables a firmware update via PEAK-Flash without turning the rotary switch on the rear of the housing to F. In this case the new firmware is transferred to the device using CAN messages with the ID 7E7.

7.2.3 Trace Options

In this section, options for tracing are configured separately for each channel. The number at the end of the keyword indicates the CAN channel.

```
TRC_OPTIONS_CAN1= dataframes
```

The options specify the frames to be recorded. If no option is set, nothing is recorded. When setting multiple options per channel, the values are separated with a space or comma.

Option	Description
dataframes	CAN data frames are traced.
errorframes	CAN error frames are traced.

7.2.4 Maximum File Size

The data of all 6 CAN channels are saved in the same file. With this keyword, the maximum file size is defined in Mbyte. The default value is 256. A new file is only created if the maximum file size is reached. If tracing is stopped and restarted, the data is stored in the same file.

```
TRC_FILE_MAX_SZ_MB=256
```

Tip: Using the software PEAK-Converter, trace files can be converted into other formats and single channels can be extracted. The PEAK-Converter can be downloaded for free from our website www.peak-system.com.

7.2.5 Trace Mode

In this section, the trace mode is configured. This covers handling of existing files when a new recording is started and the behavior if the memory's maximum capacity is reached.

```
TRC_MODE=2
```

Value	Mode	Description
0	linear-replace	▪ When a new recording is started, existing trace files are deleted. ▪ When the memory's maximum capacity is reached, recording is stopped.
1	linear-append	▪ When a new recording is started, existing trace files are kept. ▪ When the memory's maximum capacity is reached, recording is stopped.
2	circular-append	▪ When a new recording is started, existing trace files are kept. ▪ When the memory's maximum capacity is reached, the oldest file is deleted and a new file with an incremented file index is created. ▪ This value is the default setting.

Important note: If the device is configured to start tracing on power-up, all files are deleted when using **trace mode 0**, even if the device is powered for accessing the files via USB.

7.2.6 Memory Card

This setting specifies which memory card is used for tracing.

```
TRC_DRIVE=EMMC
```

Option	Description
SDC	The optional insertable SD card is used for tracing.
EMMC	The internal eMMC memory card is used for tracing. This value is the default setting.

7.2.7 Handling of the USB Connection

This setting specifies how an existing USB connection is handled when tracing is started.

```
TRC_KICK_USBC=YES
```

Option	Description
YES	The USB host is disconnected when tracing is started. In that case a running USB data transfer would be canceled. This value is the default setting.
NO	The USB host is not disconnected. Tracing can only be started if the USB cable was disconnected before.

Note: For reading the configuration file, USB is disconnected on power-up independent of this configuration.

7.2.8 Trace Start on Power-Up

This setting specifies whether tracing is started when the device is powered-up or not.

```
TRC_STATE=START
```

Option	Description
START	Tracing is started at power-up. This value is the default setting.
STOP	Tracing is started by pressing the Log Off Card button or by transmitting a specific CAN message.

7.2.9 Timeouts

With these settings timeouts are specified in milliseconds.

No CAN traffic

`TRC_STOP_TRAFFIC_TO` specifies a timeout for no CAN traffic. If no CAN message was received for this duration, tracing is stopped.

```
TRC_STOP_TRAFFIC_TO=0
```

Terminal 15 Loss

`TRC_STOP_T15_TO` specifies a timeout for terminal 15 loss. If power at the pin 1 of the power connector was lost for this duration, tracing is stopped.

```
TRC_STOP_T15_TO=0
```

Main Power Loss

`TRC_STOP_MAINPOW_TO` specifies a timeout for main power loss. If the main power was lost for this duration, tracing is stopped. This function requires an installed backup battery.

```
TRC_STOP_MAINPOW_TO=!5000
```

Value Range	Description
0	Timeout is disabled. This value is the default setting.
1 to 4000000000	Tracing is stopped after this duration.
!1 to !4000000000	By adding **!** the device is shut down after the specified duration.

7.2.10 Beep Patterns

With these settings beep patterns for the events trace start, stop, and error are specified. The general structure of a beep pattern configuration is as follows:

```
KEYWORD=Repetition Tick-Duration Pattern
```

Parameter	Description
Repetition	A number from 1 to 4000000000 indicates how often the pattern is repeated. If 0 is indicated, the pattern is repeated endlessly.
Tick-Duration	This value defines the duration of a single tick in milliseconds with a maximum of 4000000000.
Pattern	A beep pattern is built with up to 64 x or _ characters. x = The beeper is on for the duration of one tick. _ = The beeper is off for the duration of one tick.

Important note: A pattern should end with _ since the last value is kept. If the pattern ends with x, the device would not stop beeping until the next pattern starts. With the configuration `KEYWORD=1 50 _` the device can be muted for the event.

`TRC_START_BEEP` defines a beep pattern for the event trace start.

```
TRC_START_BEEP=1 50 xx__xx_____xxxx_
```

`TRC_START_BEEP` defines a beep pattern for the event trace stop.

```
TRC_START_BEEP=1 50 xx__xx_____xxxx_
```

`TRC_ERROR_BEEP` defines a beep pattern for the event trace error which occurs if the file system of the memory card is not valid.

```
TRC_ERROR_BEEP=1 80 x__x__x__xxx__xxx__xxx__x__x__x
```

7.2.11 LED Blinking Patterns

The memory card LEDs are blinking if tracing is started and the cards are accessed. The CAN LEDs are blinking if CAN traffic occurs.

With the following setting the blinking pattern can be configured.

```
TRC_LED_BLINK=Tick-Duration Pattern
```

Parameter	Description
Tick-Duration	This value defines the duration of a single tick in milliseconds with a maximum of 4000000000.
Pattern	A blinking pattern is built with up to 64 x or _ characters. x = The LED is on for the duration of one tick. _ = The LED is off for the duration of one tick. The pattern should start with some off characters since the LEDs are switched on by default. The last character is kept.

7.2.12 Remote Control via CAN

Tracing can be started and stopped by transmitting a specific CAN message to any of the six CAN channels.

This setting specifies the CAN ID of the message which is used for remote controlling. The first data byte of the transmitted CAN message determines if tracing is started or stopped.

```
TRC_REMOTE_CANID=12345678
```

Parameter	Value Range
CAN ID	Extended 29-bit CAN ID is indicated in hexadecimal format with a value larger than 7FF.
First Data Byte	1 = Tracing is started. 2 = Tracing is stopped.

Note: The indicated CAN ID must not be used on any connected CAN bus. By default, this feature is commented out to prevent unintended behavior.

7.3 Operation

7.3.1 LEDs

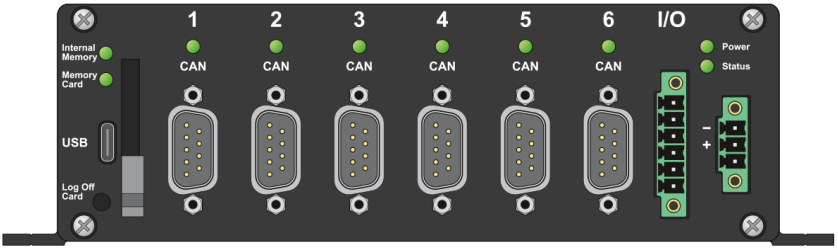


Figure 15: Status, CAN channel, and memory card LEDs on the front panel of the PCAN-Router Pro FD

Status LED	Status	Description
Green blinking	Normal operation	
Red quick blinking	Configuration error	The configuration file is not valid. Parsing was stopped.

Memory Card LEDs	Status	Description
Green	Tracing is stopped	Tracing is stopped. The memory cards can be accessed via USB.
Red blinking	Tracing is started	Tracing is started. The LEDs are blinking due to memory card access.

CAN Channel LEDs	Status	Description
Green blinking	Tracing is disabled	Tracing is disabled for this channel. The LED is blinking due CAN traffic.
Orange blinking	Tracing is enabled	Tracing is enabled for this channel. The LED is blinking due CAN traffic.

The blinking pattern of the memory card and CAN channel LEDs can be configured (see chapter 7.2.11 page 38).

7.3.2 Control with the Log Off Card Button

The Log Off Card button is used to start and stop logging and safely disconnect and reconnect the internal and external memory cards.

If the button is pressed while logging, logging is stopped and all interactions with the memory cards are canceled. Then it is possible to access the memory cards via the USB connection or to remove the SD card from the slot.

If the button is pressed again, the memory cards are reconnected and logging is restarted. If this is done while the memory card is accessed via USB, the USB connection is canceled or kept depending on the configuration (see chapter 7.2.7 page 35).

7.3.3 Handling Trace Files

The messages of all configured CAN channels are saved to a binary coded trace file named `Trace_###.btrc`. The 3-digit file index `###` is incremented when a new file is created.

A new file is only created if the maximum file size is reached. If tracing was stopped and then restarted, saving is continued in the same file which was used before.

Beside the `*.btrc` trace files, a `*.next` file is stored on the memory card. This file contains information about the current tracing process and how to proceed if continued. If trace files are removed from the memory card, this `*.next` file must be removed too.

Tip: Using the software PEAK-Converter, trace files can be converted into other formats and single channels can be extracted. The PEAK-Converter can be downloaded for free from our website www.peak-system.com.

Memory Card Capacity and Logging Duration

The amount of data generated during a recording is determined by the bit rates used, the bus load, and the length of the CAN messages.

Example: All 6 CAN channels are operated with a nominal bit rate of 500 kByte/s and a data bit rate of 2 MByte/s. The incoming message traffic generates 50 % bus load.

With a 32 GByte memory card the data traffic of all 6 CAN channels can be recorded for at least 11 hours.

8 Technical Specifications

Connectors	
CAN	6 x D-Sub (m), 9 pins Assignment according to specification CiA® 303-1
USB	USB port type C Superspeed USB 3.0 Upstream
Inputs/outputs	Phoenix mating connector MC1.5/2-STF-3.81, 6-pin; 2 x digital input or output with high-side switch 2 x digital input or output with low-side switch 1 x analog input (0 - 33 V)
Power	Phoenix mating connector MC1.5/2-STF-3.81, 3-pole; overvoltage and reverse polarity protection
Ethernet or D-Sub (optional)	RJ-45 or BroadR-Reach® interface available on request only; self-created firmware required

CAN	
protocols	CAN FD ISO 11898-1:2015, CAN FD non-ISO, CAN 2.0 A/B
Physical transmission	ISO 11898-2 (High-speed CAN)
CAN bit rates	40 kbit/s - 1 Mbit/s
CAN FD bit rates	40 kbit/s - 12 Mbit/s[2]
Controller	FPGA implementation
Time stamp resolution	1 µs
Wake-up duration	20 ms
Standard transceiver	NXP TJA1043
Other Transceivers	on request
Internal termination	via internal switches, not activated at delivery
CAN-ID reserved for configuration transmission	7E7h

[2] According to the CAN transceiver data sheet only CAN FD bit rates up to 5 Mbit/s are guaranteed with the specified timing.

Analog Inputs	
Count	1
Connectors	Analog In 1
Resolution A/D converter	12 bit
Input voltage maximum	+ 32 V
Input impedance	222 kΩ
Measuring range	0 – 33.3 V
Measurement resolution (per LSB)	8 mV
Measurement accuracy	± 0.3 % ± 6 LSB
Low pass	8 Hz

Digital Inputs	
Count	4
Connectors	Digital In/Out 1 to 4
Input voltage maximum	0 to +32 V
Input current	<1 mA
Input impedance	133 kΩ
Input circuitry	Pull-down: 100 kΩ to ground
Switching threshold Low => High	> 2.7 V
Switching threshold High => Low	< 1.4 V
Low pass	50 Hz

Digital Outputs	High-side	Low-side
Count	2	2
Connectors	Digital In/Out 1 bis 2	Digital In/Out 3 bis 4
Type	High-side / N-FET	Low-side / N-FET
Driver chip	ISP452HUMA1	AUIPS2052GTR
Output current nominal	0.7 A	0.9 A
Drop-out voltage with Inom	650 mV	max. 470 mV
Drop-out voltage at 200mA	420 mV	max. 100 mV
Drop-out voltage at 500mA	560 mV	max. 420 mV

Digital Outputs	High-side	Low-side
Maximum output current (current limitation)	0,7 A minimal 1.5 A typically 2.4 A maximum	1.2 A minimal 1.8 A typically 3 A maximum
Protection	Overcurrent (0.7 - 2.4 A) and temperature protection (150°C)	Overcurrent (1.2 - 3 A) and temperature protection (165°C)
Maximum voltage	max. 32 V on load	

Power Supply	
Supply voltage	12 V DC, 8 to 30 V DC possible
Current consumption	Idle: 400 mA Maximum: 1 A
Current consumption Sleep mode	12 V, 25°C: 230 µA Maximum: 350 µA
Wake-up voltage	3 to 32 V DC at pin 1 of the power connector
Wake-up duration	20 ms
Auxiliary voltage RTC	Button cell CR1620 3.0 V
Slot for backup battery[3]	18650 form factor

Microcontroller	
Type	STM32F765NIH6 (based on Arm® Cortex® M7)
Clock frequency	200 MHz
Memory	32 MByte SDRAM
Firmware upload	via CAN (PCAN interface required)

Data Logging	
Internal memory	16 GByte pSLC eMMC
External memory (optional)	SD card
Maximum memory size	32 GByte (see chapter 2.6 page 11 for details)
File system	FAT 32
Maximum size of a recording	4 GByte

[3] Only use batteries with integrated PCB protection to avoid short circuit, overcharging, and deep discharge! We recommend using a lithium-ion battery such as the Soshine 18650 3600 mAh 3.7 V or comparable models.

Data Logging	
Initialization duration of the data logger firmware	50 ms (wake-up duration not included)
Recording format	Proprietary binary format (*.btrc), Conversion options with the supplied Windows program: - PCAN-Trace (*.trc) - Vector trace (*.asc) - comma separated values (*.csv)

Environment[4]	
Operating temperature	-40 - 85 °C (-40 - 185 °F)
Temperature for storage and transport	-40 - 100 °C (-40 - 212 °F)
Relative Humidity	15 - 90 %, non-condensing
Protection class (IEC 60529)	IP20

Measures	
Size	190 x 104 x 55 mm (see also Dimension Drawing on page 50)
Weight (without battery and optional interface)	696 g
Weight with optional interface (without battery)	720 g

Conformity	
EMV	Directive 2014/30/EU DIN EN 61326-1:2013-07
RoHS 2	Directive 2011/65/EU DIN EN 50581 VDE 0042-12:2013-02

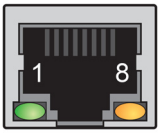
[4] The operating temperature as well as the temperature for storage and transport can be limited by installing a backup battery.

Appendix A Optional Interfaces

On request, the PCAN-Router Pro FD can be equipped with an Ethernet interface via an RJ-45 socket or with a BroadR-Reach® interface via a D-Sub connector.

Ethernet interface via RJ-45 Socket

Figure 16: Ethernet interface via RJ-45 socket on the back of the housing (only on request)



Pin	Signal
1	Tx+
2	Tx-
3	Rx+
4	-
5	-
6	Rx-
7	-
8	-
9	-

BroadR-Reach® Interface via D-Sub Connector

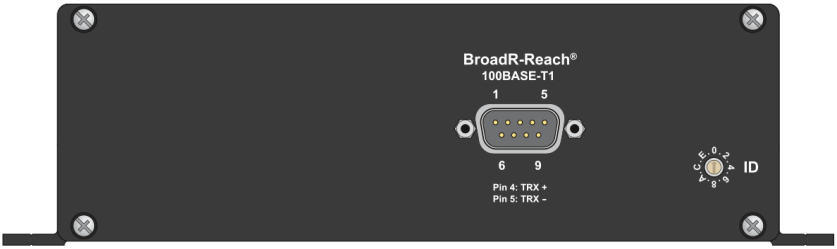
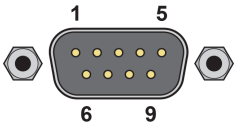


Figure 17: BroadR-Reach® interface via D-Sub connector on the back of the housing (only on request)



Pin	Signal
1	-
2	-
3	-
4	TRX+
5	TRX-
6	-
7	-
8	-
9	-

Appendix B CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name: PCAN-Router Pro FD

Item number(s): IPEH-002220

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 61326-1:2013-07
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2012);
German version EN 61326-1:2013

Darmstadt, 11 September 2019

Uwe Wilhelm, Managing Director

Appendix C Dimension Drawing

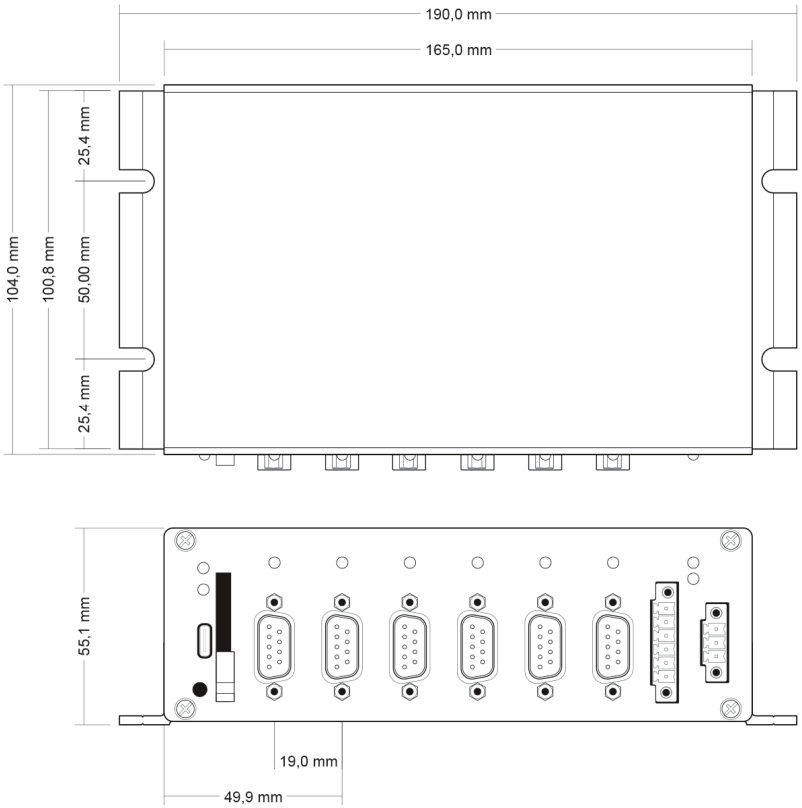


Figure 18: Dimension drawing PCAN-Router Pro FD

The figures do not correspond to the original size.

Appendix D Disposal Information (Battery)

The device and the battery it contains must not be disposed of with household waste. Remove the battery from the device for proper separate disposal.

The PCAN-Router Pro FD contains the following battery:

- 1 x button cell CR1620 3.0 V

Important Note: If you have installed a backup battery (form factor 18650), do not forget to dispose it properly.