PCAN-Router Pro FD

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

User Manual

Document version 1.6.1 (2022-07-05)

Relevant Products

Product Name	Model	Part Number
PCAN-Router Pro FD	Standard model	IPEH-002220
PCAN-Router Pro FD	Standard model with Ethernet interface	IPEH-002222

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Contents

1 Introduction 6
1.1 Properties at a Glance 6
1.2 Operation Requirements 8
1.3 Scope of Supply 8

2 Connectors and Operating Elements 9
2.1 Power Supply 10
2.2 CAN Connection 10
2.3 Inputs and Outputs (I/O) 11
2.4 USB Connection 12
2.5 SD Card Slot and Internal Memory 12
2.6 Log Off Card Button 12
2.7 ID Rotary Switch 13
2.8 Status LEDs 13
2.9 Ethernet Connection 14

3 Device Start-up 15
3.1 Ensuring Power Supply 15
3.2 Starting the Device 15

4 Hardware Modifications 16
4.1 Alternative Transceiver Module 16
4.2 Setting the Termination for a CAN Bus 18
4.3 Changing the Button Cell for the Real-Time Clock (RTC) 19
4.4 Installing Backup Battery 21

5 Creating Own Firmware 23

6 Firmware Upload 25

6.1 System Requirements 25
6.2 Preparing the Hardware 25
6.3 Firmware Transfer 28

7 Configurable Data Logging 31
7.1 Installation 32
7.2 Configuration 33
7.2.1 Nominal and Data Bit Rates 34
7.2.2 CAN Specification and Options 35
7.2.3 Trace Options 36
7.2.4 Maximum File Size 36
7.2.5 Trace Mode 37
7.2.6 Memory Card 37
7.2.7 Handling of the USB Connection 38
7.2.8 Trace Start on Power-Up 38
7.2.9 Timeouts 39
7.2.10 Beep Patterns 40
7.2.11 LED Blinking Patterns 41
7.2.12 Remote Control via CAN 41
7.2.13 RTC Setting via CAN 42
7.3 Configuration of the Ethernet Connection 43
7.3.1 IP Address 44
7.3.2 Subnet Mask 45
7.3.3 Gateway Address 45
7.3.4 Output the IP address via CAN 46
7.3.5 FTP Access 47
7.3.6 FTP Connection Timeout 48
7.4 Operation 49
7.4.1 LEDs 49
7.4.2 Control with the Log Off Card Button 50
7.4.3 Handling Trace Files 50
7.4.4 Memory Card Capacity and Logging Duration 51
7.4.5 FTP Data Transfer 51
7.4.6 WebSocket Remote Control 53

8 Technical Specifications 59

Appendix A CE Certificate 64

Appendix B Dimension Drawing 65

Appendix C Disposal Information (Battery) 66

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.

On delivery, the PCAN-Router Pro FD is equipped with a firmware for the configurable recording of CAN and CAN FD data traffic.

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 16)

- 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 to 32 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)
- Ethernet interface via RJ-45 socket, max. 100 Mbit/s (IPEH-002222 only)
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

1.2 Operation Requirements

- Power supply in the range of 8 to 32 V DC
- 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
- IPEH-002222: RJ-45 network patch cord (2 m)

Downloads:

- Windows development package with GCC Arm Embedded, flash program, and programming examples
- Conversion software PEAK-Converter for Windows
- Manual in PDF format

2 Connectors and Operating Elements

This chapter describes the connectors on the front and rear panel of the PCAN-Router Pro FD.

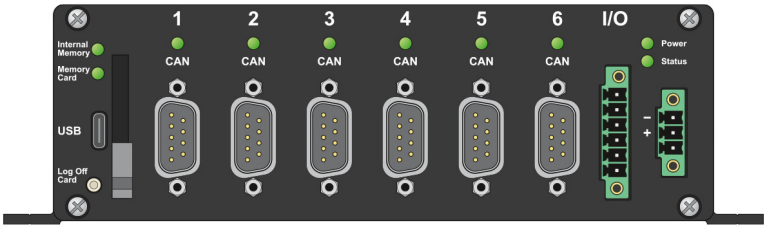

Figure 1: Connectors on the front panel
of the PCAN-Router Pro FD

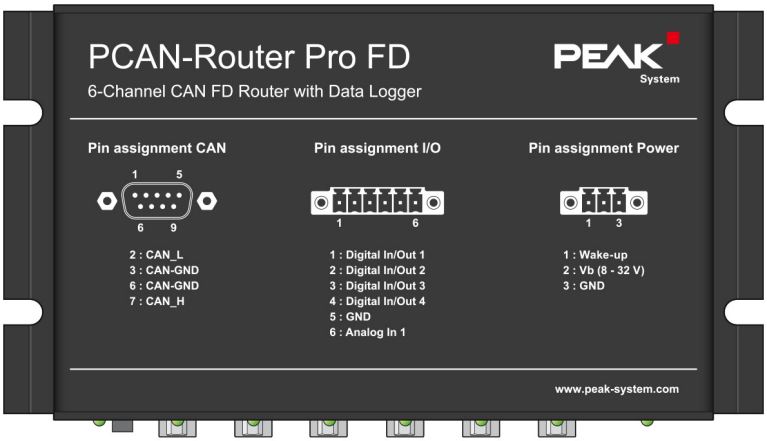

Figure 2: Description of the pin assignments
on the top of the housing

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 protected against reverse polarity and overvoltage.

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 MC1,5/3-STF-3,81) to which you can screw cable strands.

Figure 3: Power connector

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

More information about start-up (especially Wake-up):
chapter 3 *Device Start-up* on page 15

2.2 CAN Connection

A high-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The CAN assignment corresponds to the CiA® 106 specification.

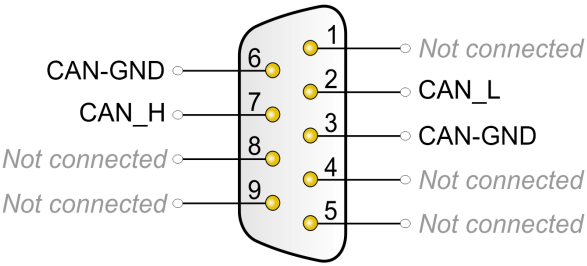

Figure 4: Pin assignment High-speed CAN

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 MC1,5/6-STF-3,81), to which you can screw cable strands.

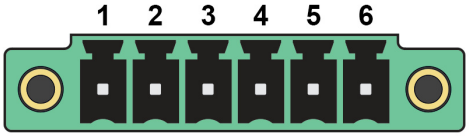

Figure 5: I/O connector

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

2.4 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.

2.5 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.

2.6 Log Off Card Button

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

Independent of the installed firmware, the CAN bootloader for uploading a firmware can be activated with this button. The corresponding procedure is documented in chapter 6.2 on page 25.

2.7 ID Rotary Switch

On the back of the PCAN-Router Pro FD housing is a rotary switch for selecting an ID from 0 to F. The selected value can be read out with a custom firmware.

Figure 6: Back side of standard product version (IPEH-002220)

Independent of the installed firmware, the CAN bootloader for uploading a firmware can be activated with the rotary switch position F. The corresponding procedure is documented in chapter 6.2 on page 25.

2.8 Status LEDs

Power LED	Device status	Remark
Off	No supply voltage applied or Supply voltage applied and device in sleep mode	Wake-up signal required to start the device, see 3 *Device Start-up* on page 15
On (green)	Supply voltage applied **and** device started via wake-up	

The status of **all other LEDs** is determined by the used firmware. More details can be found in the provided programming examples.

At delivery, the PCAN-Router Pro FD is programmed with the data logger firmware. Its LED blinking patterns are described in section 7.4.1 on page 49.

2.9 Ethernet Connection

Optionally, the PCAN-Router Pro FD is available with an Ethernet interface (IPEH-002222). The connection is established via an RJ-45 socket on the back of the housing, the maximum transfer rate is 100 Mbit/s.

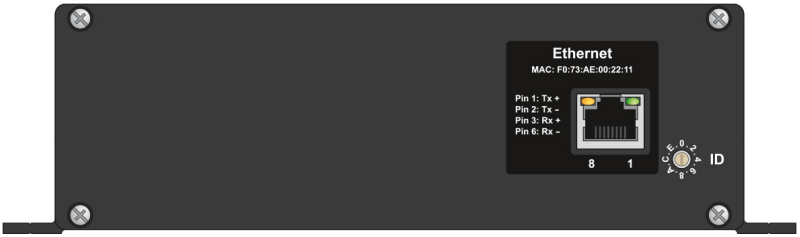

Figure 7: Back side of product version with Ethernet interface (IPEH-002222)

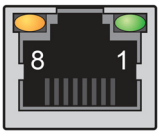

Figure 8: RJ-45 socket

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

3 Device Start-up

3.1 Ensuring Power Supply

The PCAN-Router Pro FD must be supplied with nominally 12 V DC via the Power connector (8 to 32 V possible).

If you have installed a backup battery and it is charged, the device can temporarily be operated without external power supply (e.g. in case of a power failure). See section 4.4 on page 21 on the subject of backup battery.

3.2 Starting the Device

By default, the PCAN-Router Pro FD is equipped with transceivers that have a wake-up function. Thus, the device starts as soon as a supply voltage is applied to Pin 2. The Power LED is on.

In the following cases it is necessary to use the wake-up input at the Power connector (Pin 1):

- The device has customized equipment without wake-up-capable CAN transceivers (see also section 4.1 *Alternative Transceiver Module* on page 16).
- The device is to be woken up again from the sleep mode that has occurred in the meantime.
- The firmware or its settings specify that the device is only switched on as long as a voltage is applied to the wake-up input (e.g. via terminal 15 of a motor vehicle).

4 Hardware Modifications

You can do various hardware modifications 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	5 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**	**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.

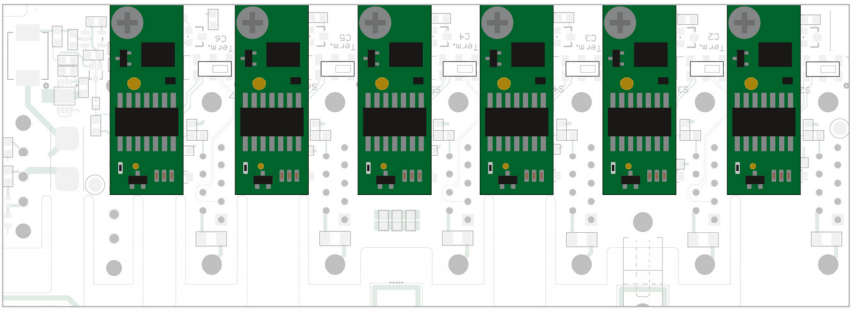

Figure 9: Positions of the transceiver modules for the six CAN FD channels

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 rear of the housing.
3. Pull the housing cover upwards.
4. **Only with backup battery installed:**
   Remove the backup battery.
5. Remove the screw on the board from the transceiver module to be replaced.
6. Remove the module from slot of the front panel.
7. Plug the new transceiver module into the slot.
8. Fasten the module with the screw.
9. **Only with backup battery installed:**
   Reinstall the backup battery and secure it with a cable tie.
10. Put the housing cover back in place.
11. Fasten the four screws to the front and rear of the housing.

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

4.2 Setting the Termination for a CAN Bus

Depending on the CAN transceiver modules used, you can use the **switch blocks** on the front panel to set a CAN bus termination for CAN 1 to CAN 6 (**C1** to **C6**). 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.

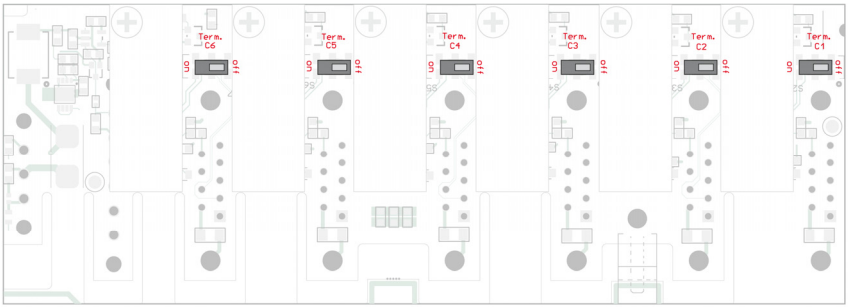

Figure 10: Positions of the switch blocks for CAN termination on the front board

Type of Transceiver and Transmission Standard	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 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 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 rear of the housing.
3. Pull the housing cover upwards.
4. Use a slotted screwdriver and set the switch of the desired CAN channel from **off** to **on**.
5. Put the housing cover back in place.
6. Fasten the four screws to the front and rear 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).

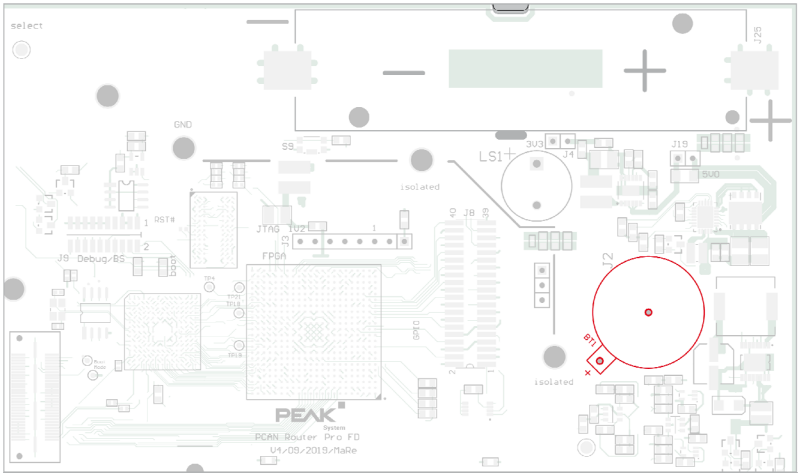

Figure 11: Position of the button cell for the real-time clock on the main board

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 rear of the housing.
3. Pull the housing cover upwards.
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. Put the housing cover back in place.
9. Fasten the four screws to the front and rear 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.

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

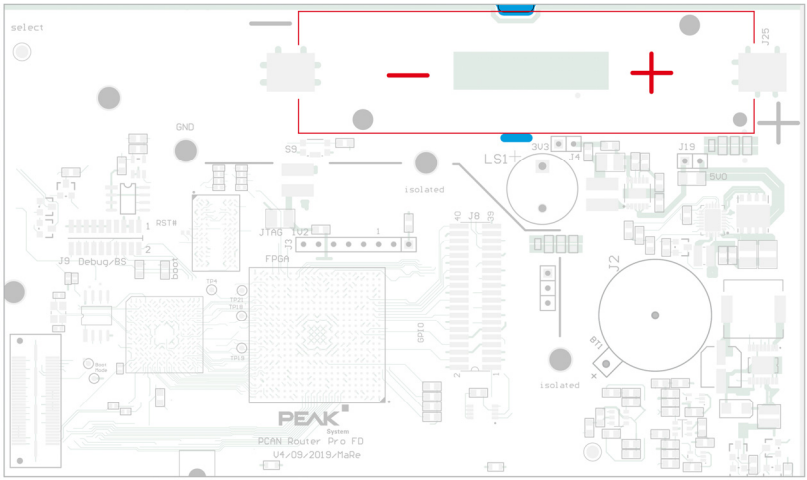

Figure 12: Position of the backup battery on the board

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.

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 rear of the housing.
3. Remove the back panel and housing cover.
4. Pull the board out of the housing in the direction of the front side.
5. Insert the backup battery with integrated protection (form factor 18650) according to the polarity.
6. Fasten the battery with a cable tie in the recesses provided.
7. Push the board back into the first rail of the housing.
8. Put the housing cover and back panel back in place.
9. Fasten all screws to the front and rear of the housing.

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:

Download link: www.peak-system.com/quick/DLP-DevPack

System Requirements:

- PC with Windows 11 (64-bit), 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 software 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`
  Short documentation how to work with the development package in German and English.

`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 PC. We recommend using a local drive.
2. Unzip the development package `PEAK-DevPack.zip` completely into your folder. 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. After this every example directory has a folder called `.vscode` containing the needed files with your local path information.
4. Start Visual Studio Code. The IDE is available free of charge from Microsoft: `https://code.visualstudio.com`.
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` file 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 software 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 Ω at each end of the CAN bus)
- Operating system Windows 11 (64-bit), 10 (32/64-bit)

6.2 Preparing the Hardware

For uploading a new firmware via CAN, the CAN bootloader must be activated. With the PCAN-Router Pro FD there are two possibilities to do this. The bootloader can be activated either with the **Log Off Card** button on the front of the housing or with the rotary switch on the back.

- Do the following to start the bootloader with the **Log Off Card** button:

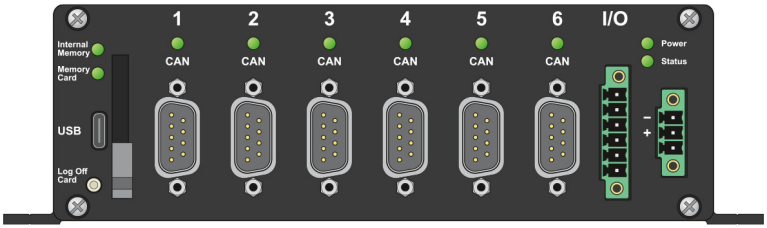

Figure 13: **Log Off Card** button on the bottom left of the front

1. Disconnect the power supply.
2. Press and hold the **Log Off Card** button and restore the power supply.
3. Keep the button pressed for about 5 seconds.

   The bootloader is activated. The CAN, status, and memory card LEDs are flashing orange alternately.
4. 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. The selected CAN channel must be connected alone to the PC.

Do the following to start the bootloader with the rotary switch:

Figure 14: ID rotary switch on the back

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

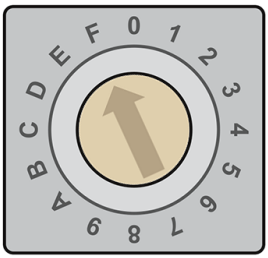

Figure 15: Turn the rotary switch on the back of the housing to **F**.

2. Restart the device by interrupting the power supply. The change of the rotary switch to takes effect.

   The bootloader is activated. The CAN, status, and memory card LEDs are flashing orange alternately.

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. The selected CAN channel must be connected alone to the PC.

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-DevPack
2. Open the zip file and extract it to your local storage medium.
3. Run the `PEAK-Flash.exe`.

   The program opens.

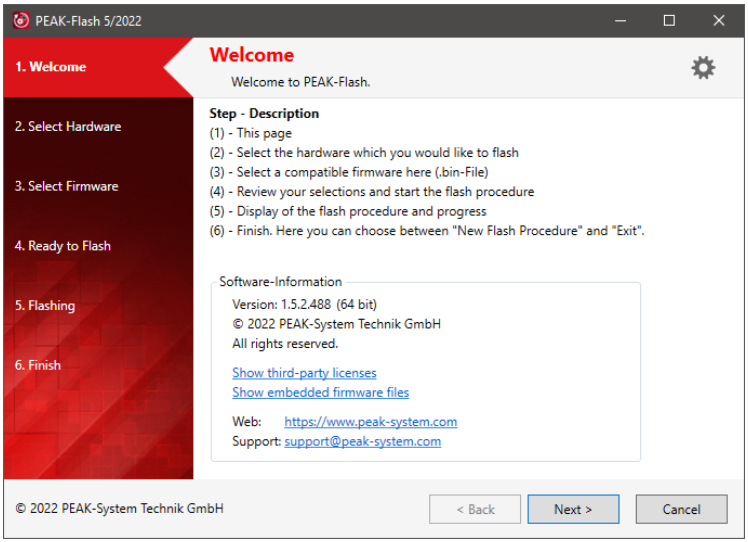

Figure 16: Main window of PEAK-Flash

4. Click the **Next** button.
5. Click on the **Modules connected to the CAN bus** radio button.
6. From the **Channels of connected CAN hardware** drop-down menu, select a CAN interface connected to the computer (e.g. PCAN-USB FD).
7. If the bootloader is activated, all CAN channels are configured with a nominal bit rate of 500 kbit/s. Click on **Change** and set a bit rate of 500 kbit/s in **Mode CAN**.

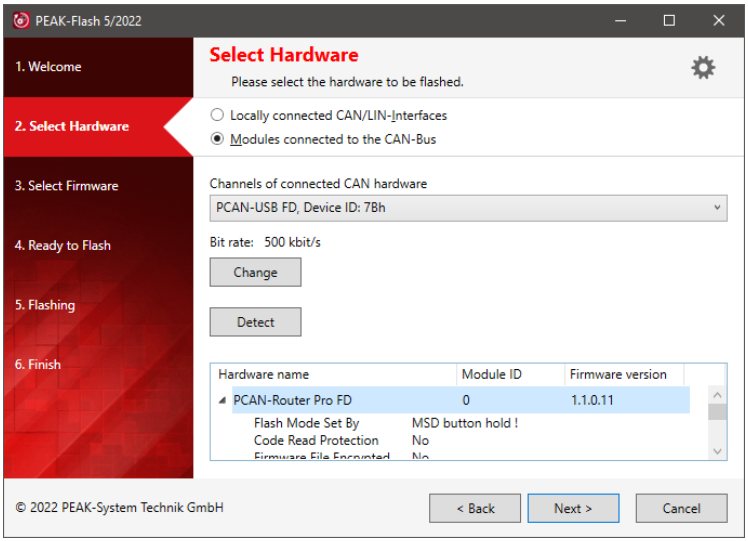

Figure 17: Hardware selection

8. Click on **Detect**.

   In the list, the PCAN-Router Pro FD appears together with its Module ID and Firmware version. With the triangle on the left of the name you can reveal details about your hardware.
9. Click **Next**.

10. Select the **Firmware File** radio button and click **Browse**.
11. Select the corresponding file (`*.bin`).

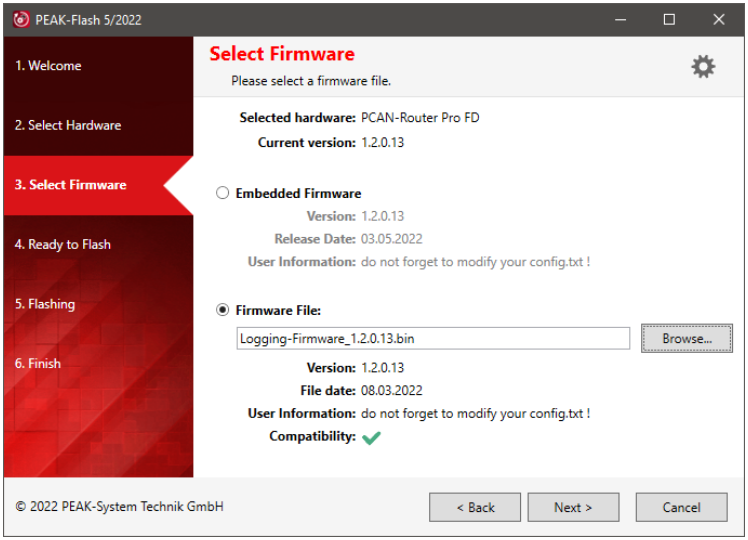

Figure 18: Selection of the firmware file (`*.bin`)

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** and exit the software.
15. If you have activated the bootloader with the rotary switch, turn it back to the previously set module ID.
16. Restart the device by interrupting the power supply.

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 wake-up terminal (pin 1 of the power connector)
- Main power loss

- Defining beep patterns for tracing start, end, and error events
- Defining the LED blinking pattern
- Only when used with Ethernet interface (IPEH-002222):
  - FTP access for downloading trace files and uploading the configuration file
  - WebSocket connection for remote controlling via Ethernet with message transfer in JSON format (example website included in the development package)

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-DevPack
2. Open the zip file and extract it to your local storage medium.

3. The firmware file (`*.bin`) is in the following directory:
   `\Hardware\PCAN-Router Pro FD\Datalogger\`
4. Proceed with the firmware upload as described in chapter 6 *Firmware Upload* on page 25.
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
- Lines can have up to 190 characters
- Comments are started with `//` and are ignored while parsing
- 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.

Parameter	Value Range	Description
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/quick/DL-Software-E.

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.

Option	Description
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 is 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/quick/DL-Software-E.

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	▪ If a new recording is started, existing trace files are deleted. ▪ If the memory's maximum capacity is reached, recording is stopped.
1	linear-append	▪ If a new recording is started, existing trace files are kept. ▪ If the memory's maximum capacity is reached, recording is stopped.
2	circular-append	▪ If a new recording is started, existing trace files are kept. ▪ If 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.

Option	Description
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
```

Power Loss on Wake-up terminal

TRC_STOP_T15_TO specifies a timeout for power loss on the wake-up terminal (Pin 1 of the Power connector). If power 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.

Value Range	Description
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_STOP_BEEP` defines a beep pattern for the event trace stop.

```
TRC_STOP_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 specified in hexadecimal format with a value larger than 7FF.
First Data Byte	1 = Tracing is started. 2 = Tracing is stopped.

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

7.2.13 RTC Setting via CAN

The internal RTC can be set via CAN. This setting specifies the ID of the CAN message used for this purpose.

```
RTC_CNTL_CANID=2FFFFFF
```

The RTC is set to a user specific time according to the UTC time format. This is done by sending two CAN messages with the same CAN ID. The first includes the date. The second includes the time and an offset for the time difference to UTC which can be positive or negative.

Parameter	Value Range
CAN ID	CAN ID in hexadecimal format. The CAN frame type Standard 11-bit or Extended 29-bit does not matter.
DLC / Count	Length of the data field of the CAN message: 7 or more.

The data bytes are interpreted as BCD code. Therefore, the usually hexadecimal data can be set as readable decimal values.

Data bytes for setting the date:

Byte	Value Range	Description
0	01	Specifies the CAN message to set the date.
1, 2	2020 ... 2099	Year
3	01 ... 12	Month
4	01 ... 31	Day

Example for 24th July 2022: `01 20 22 07 24 00 00`

Data bytes for setting the time:

Byte	Value Range	Description
0	02	Specifies the CAN message to set the time and offset.
1	00 ... 23	Hours
2	00 ... 59	Minutes
3	00 ... 59	Seconds
4	0 = + not 0 = -	Time zone offset positive (set to 0) or negative (set to another value).
5	00 ... 23	Offset hours
6	00 ... 59	Offset minutes

Example for 08:45 Berlin time +1 hour: `02 08 45 00 00 01 00`

Note: The specified CAN ID is checked on all CAN channels. If the logger is active, the CAN ID is ignored.

7.3 Configuration of the Ethernet Connection

Since version 1.1.0.11 the data logger firmware supports the PCAN-Router Pro FD with Ethernet interface (IPEH-002222). For the

configuration of the interface and its usage the `config.txt` has been extended. The additional settings are described in the following subchapters.

Note: When using a regular PCAN-Router Pro FD without Ethernet, the additional settings are ignored.

7.3.1 IP Address

This setting controls the activation of the Ethernet interface and the assignment of the IP address. When assigning addresses in an IP network, the IP address can be assigned automatically by a DHCP server or manually.

```
ETH_IP=DHCP
```

Option	Description
	No value. Disables the Ethernet interface.
DHCP	Activates the Ethernet interface. The IP address, subnet mask, and gateway IP address are assigned automatically via DHCP (Dynamic Host Configuration Protocol).
xxx.xxx.xxx.xxx	Activates the Ethernet interface. The IP address is set manually to the specified value. Example: 192.168.1.128 **Note:** For the connection to an IP network, it is also necessary to specify a subnet mask.

When specifying the IP address manually, note that it is an IPv4 address. It consists of 4 numbers between 0 and 255. Certain address ranges are reserved.

- The first number must be less than 224, since addresses starting from this value are reserved for Multicast messages
- Depending on the Subnet mask, the highest device address is reserved for broadcast messages. For the Subnet mask

255.255.255.0 and the network address 192.168.1.xxx, the reserved address would be: 192.168.1.255

- Depending on the Subnet mask, the lowest device address is reserved for messages that are addressed to the entire network. For the Subnet mask 255.255.255.0 and the network address 192.168.1.xxx, the reserved address would be: 192.168.1.0

7.3.2 Subnet Mask

This setting is used to set the Subnet mask. It must be specified if the IP address was set manually.

```
ETH_MASK=255.255.255.0
```

The Subnet mask indicates which part of the IP address represents the network, and which part represents the device. This subdivision is achieved by filling in the (binary) Subnet mask from left to right with the number “1”. The resulting values for the individual fields are: 0, 128, 192, 224, 240, 248, 252, 254, and 255.

While entering values from left to right, as soon as a value smaller than “255” is entered, a “0” must follow. For example, 255.255.128.0 is valid, while 255.128.255.0 is false.

7.3.3 Gateway Address

This setting is used to set the IP address (IPv4) of the gateway that manages the IP network. It must be specified if the IP address was set manually.

```
ETH_GW=192.168.1.1
```

The same guidelines apply for setting the gateway address as for the IP address, see chapter 7.3.1 on page 44.

7.3.4 Output the IP address via CAN

If DHCP is used for specifying the IP address, the dynamically assigned address can hardly be predicted.

With the following setting it is possible to define a CAN message transmitting the IP address on data byte 0 to 3. The message is transmitted once on CAN channel 1 after the device is powered.

```
ETH_CAN=12345ABC
```

Option	Description
	No value. The feature is disabled.
0 to 1FFFFFFF	The CAN message is defined with an Extended 29-bit CAN ID in hexadecimal format.

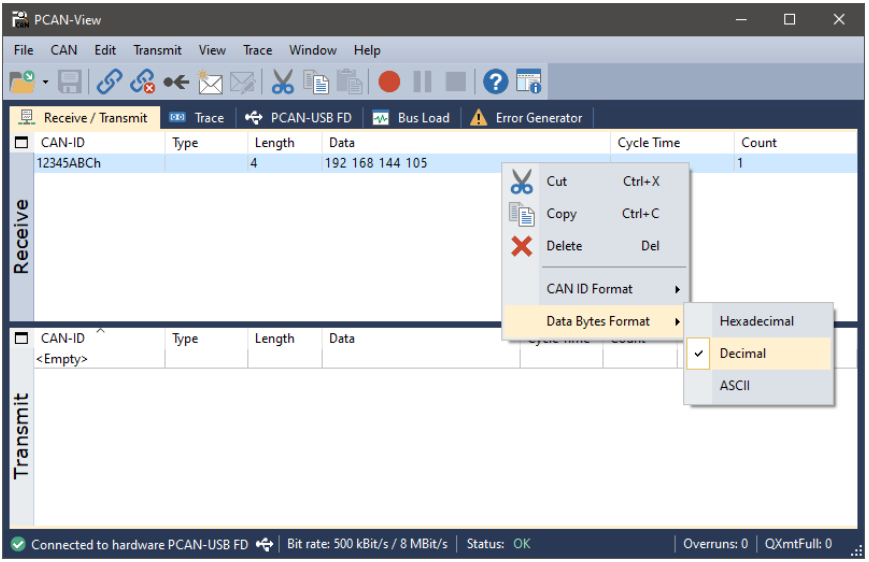

Figure 19: PCAN-View Receive / Transmit window
with decimal data indication

The CAN message and its data can be displayed using a PEAK CAN interface and the free Windows software PCAN-View. After connecting to the CAN bus, the software lists all CAN messages and provides an option to show the data bytes in decimal format.

7.3.5 FTP Access

With this setting the access to the memory cards via FTP (File Transfer Protocol) is enabled or disabled.

```
FTP_ACCESS=YES
```

Parameter	Description
YES	FTP access is enabled.
NO	FTP access is disabled.

The data transfer with FTP is described in detail in chapter 7.4.5 on page 51.

7.3.6 FTP Connection Timeout

With this setting a timeout for the FTP connection is specified in seconds. If the FTP connection is idle for the set time, the connection is closed automatically. The connection timeout does not take effect during an ongoing data transmission.

```
FTP_CONN_TO=60
```

Option	Description
	No value. The FTP connection timeout is disabled.
Time in seconds	The FTP connection timeout is enabled.

7.4 Operation

7.4.1 LEDs

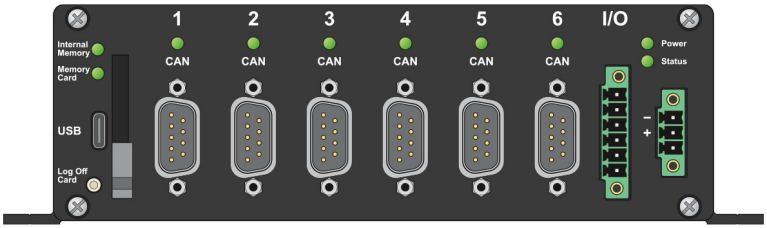

Figure 20: Status, CAN channel, and memory card LEDs on the front panel of the PCAN-Router Pro FD

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 41).

7.4.2 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 38).

7.4.3 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/quick/DL-Software-E.

7.4.4 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.

7.4.5 FTP Data Transfer

Since version 1.1.0.11 the data logger firmware supports the PCAN-Router Pro FD with Ethernet interface (IPEH-002222). The firmware includes a basic FTP server implementation for transferring data via Ethernet. This can be used to download trace files from the memory cards or to upload a new configuration file.

Do the following to etablish a FTP connection:

1. Meet the following requirements:
   - Data logger configuration file with valid IP settings and FTP_ACCESS set to YES.
   - PCAN-Router Pro FD is powered and connected to the IP network via Ethernet.
   - Tracing is stopped.
   - Your FTP software is limited to a single FTP connection.
   - There are no other FTP connections from other computers.
2. Start your software for connecting via FTP.

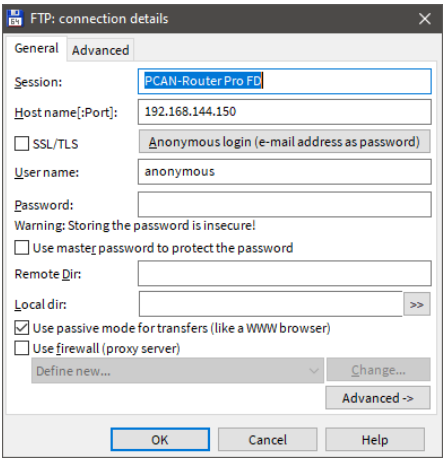

Figure 21: FTP connection details with example IP address

3. Enter the IP address of your PCAN-Router Pro FD.
4. Keep the port input free since the standard FTP port is used.
5. Enter “anonymous” as username.
6. Keep password free.
7. Establish the FTP connection.

If a connection timeout is configured and the FTP connection is idle for the set time, the connection is closed automatically. The connection timeout does not take effect during an ongoing data transmission.

Note: If a new configuration file with changed IP settings is uploaded, the FTP connection may require an update according to the new settings.

7.4.6 WebSocket Remote Control

Since version 1.1.0.11 the data logger firmware supports the PCAN-Router Pro FD with Ethernet interface (IPEH-002222). The firmware includes a WebSocket server implementation for remote controlling the PCAN-Router Pro FD via Ethernet.

The WebSocket protocol provides a persistent, asynchronous communication between a client and a server. In contrast to HTTP the communication is bidirectional. A WebSocket server can send data with and without the request of the client.

In order to establish a WebSocket connection with the PCAN-Router Pro FD, a software with WebSocket support is required. WebSocket APIs are available for all common programming languages. In addition, WebSocket support can be added to modern browsers using plug-ins. For example, the WebSocket Client for Chrome by Albert Beade is an easy tool for getting started.

For connection, the IP address of the WebSocket server is called with `ws://`. Adding the port number is not required, since the standard port 80 is used.

```
Example: ws://192.168.144.150
```

After connecting, several commands requests can be transmitted from client to PCAN-Router Pro FD. The request as well as the response messages are in JSON format.

WebSocket can optionally differentiate whether different protocols are transmitted. For remote controlling the PCAN-Router Pro FD, a protocol with the name "json-signals" was defined. With this, it is possible to implemented further protocols in the future.

Command List

All following commands require an established WebSocket connection.

In case of an error, a response with `cmd-err` and a corresponding error message is returned.

Error:	`{"cmd-err": "command not evaluated"}`

System Information

This command returns system information like the part number, details about the installed firmware and bootloader, the FPGA revision, the MAC address, the hardware version, and the set date and time.

Request:	`{"sys-cmd-get": "sys-infos"}`

Response:	`{"part-no" : "IPEH-002222",`
	`"fw-type" : "can-data-logger",`
	`"fw-version" : "1.2.0.13",`
	`"bl-version" : "2.0.11",`
	`"fpga-version" : "10",`
	`"pcb-version" : "5",`
	`"mac-addr" : "F0-73-AE-00-70-00",`
	`"datetime" : "2021-06-15 13:40:00-0100"}`

The displayed line breaks are not part of the response string.

Hardware Reboot

This command initiates a reboot after the indicated time in milliseconds. The command is not executed if the tracer is running.

After a successful reboot, the RTC and config.txt are read in. Modifications of the configuration file take effect.

Request:	`{"sys-cmd-exec": "hw-reboot", "time": "4000"}`
Response:	`{"cmd-info": "reboot in 4000 ms"}`
Errors:	`{"cmd-err": "reboot aborted, tracer running"}`

Note: It is not recommended to reboot during an FTP data transmission.

Set RTC Time

This command is used to set the internal RTC to a user specific time according to the UTC time format. The value includes date, time, and an offset for the time difference to UTC which can be positive or negative. The structure is:

```
YYYY-DD-MM HH:MM:SS+HHMM
```

Request:	`{"sys-cmd-set": "time-utc",` `"datetime": "2021-06-15 13:40:00+0100"}`
Response:	`{"cmd-ack":` `"datetime set to 2021-06-15 13:40:00+0100"}`

Errors:	`{"cmd-err": "year before 2020"}`
	`{"cmd-err": "bad month"}`
	`{"cmd-err": "bad day of month"}`
	`{"cmd-err": "bad hour"}`
	`{"cmd-err": "bad minutes"}`
	`{"cmd-err": "bad seconds"}`
	`{"cmd-err": "bad zone value"}`

Tracer Commands

There are 4 commands for interacting with the trace function. It is possible to start, stop, or pause the tracer and to request the status.

Start the tracer:

Request:	`{"trc-cmd-exec": "start"}`
Response:	`{"trc-status": "recording"}`
Errors:	`{"cmd-err": "tracer not started, maybe still recording"}`

Stop the tracer:

Request:	`{"trc-cmd-exec": "stop"}`
Response:	`{"trc-status": "stopped"}`
Errors:	`{"cmd-err": "tracer not stopped, maybe still stopped"}`

Pause the tracer:

Request:	`{"trc-cmd-exec": "pause"}`
Response:	`{"trc-status": "paused"}`
Errors:	`{"cmd-err": "tracer not paused, maybe stopped"}`

Request the tracer status:

Request:	`{"trc-cmd-get": "status"}`

Response:	`{"trc-status": "recording"}`
	`{"trc-status": "stopped"}`
	`{"trc-status": "paused"}`

WebSocket Example Website

The data logger firmware comes with a website that provides a JavaScript implementation for a WebSocket connection and the transmission of some command requests.

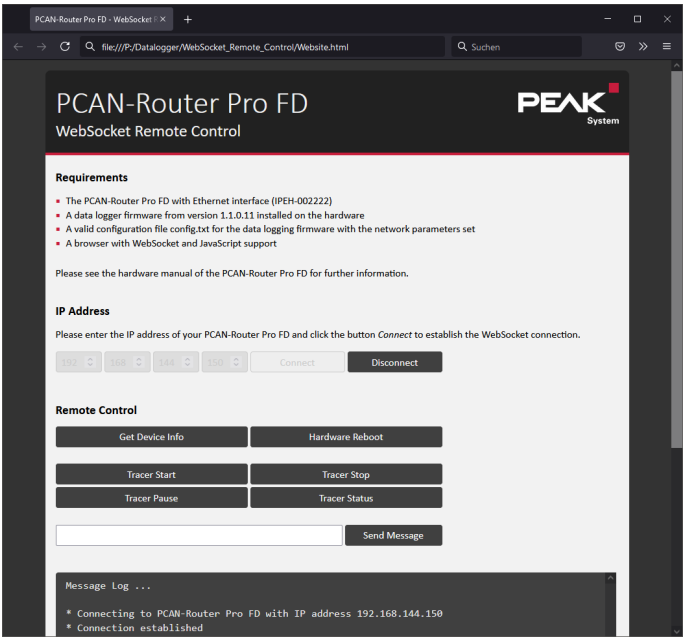

Figure 22: WebSocket Remote Control example website

Do the following to use the WebSocket example:

1. Make sure that the PCAN-Router Pro FD is connected to your IP network and has a valid IP address.
2. Open `website.html` with a common browser from the directory `\Hardware\PCAN-Router Pro FD\Datalogger\WebSocket_Remote_Control`.

3. Enter the IP address of your PCAN-Router Pro FD which you have set in the `config.txt` or has been assigned via DHCP.
4. Click on “Connect”.

   The connection is established, the control elements are enabled and a message is added to the message log.
5. You can now use the control elements to transmit command requests.
6. Use “Disconnect” to close the connection.

As long as the PCAN-Router Pro FD is running, the connection is active. The connection is closed automatically if the device is disconnected or switched off. This can be used to monitor the “alive” status of the PCAN-Router Pro FD.

Note: The website cannot be opened from the PCAN-Router Pro FD via Ethernet. No HTTP server functionality is implemented within the data logger firmware.

8 Technical Specifications

Connectors	
CAN	6 x D-Sub (m), 9 pins, assignment according to specification CiA® 106
USB	USB port type C, Superspeed USB 3.0 Upstream
Inputs/outputs	Phoenix mating connector MC1,5/6-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 to 32 V)
Power	Phoenix mating connector MC1,5/3-STF-3,81, 3-pole; overvoltage and reverse polarity protection
Ethernet (IPEH-002222 only)	RJ-45, max. 100 Mbit/s

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 to 1 Mbit/s
CAN FD bit rates	40 kbit/s to 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	+ 38 V
Input impedance	222 kΩ
Measuring range	0 to 33.3 V
Measurement resolution (per LSB)	8.13 mV
Measurement accuracy	± 1.2 % ± 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 to High	> 2.7 V
Switching threshold High to 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 200 mA	420 mV	max. 100 mV
Drop-out voltage at 500 mA	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
Overcurrent protection	0.7 to 2.4 A	1.2 to 3 A
Temperature protection	150 °C (302 °F)	165 °C (329 °F)
Maximum voltage	-	max. 32 V on load

Power Supply				
Supply voltage	12 V DC, 8 to 32 V DC possible			
Current consumption Standard version IPEH-002220	Sleep mode: 12 V, 25°C: 230 µA Sleep mode maximum: 350 µA			
	At voltage	Idle	Maximum	With battery charging
	8 V	270 mA	290 mA	1050 mA
	12 V	190 mA	230 mA	670 mA
	24 V	120 mA	150 mA	370 mA
	30 V	110 mA	130 mA	320 mA
Current consumption with Ethernet interface IPEH-002222	At voltage	Idle	Maximum	With battery charging
	8 V	360 mA	420 mA	1180 mA
	12 V	250 mA	290 mA	730 mA
	24 V	150 mA	170 mA	400 mA
	30 V	130 mA	150 mA	350 mA
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			

[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.

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 2.5 page 12 for details)
File system	FAT 32
Maximum size of a recording	4 GByte
Initialization duration of the data logger firmware	50 ms (wake-up duration not included)
Recording format	Proprietary binary format (*.btrc), conversion options with Windows software PEAK-Converter: - PCAN-Trace (*.trc) - Vector trace (*.asc) - comma-separated values (*.csv)

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

Measures	
Size	190 x 104 x 55 mm (see also Dimension Drawing on page 65)
Weight (without battery)	IPEH-002220: 700 g IPEH-002222: 710 g (with Ethernet interface)

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

Conformity	
RoHS	EU Directive 2011/65/EU (RoHS 2) EU Directive 2015/863/EU (amended list of restricted substances) DIN EN IEC 63000:2019-05
EMC	EU Directive 2014/30/EU DIN EN 61326-1:2013-07

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name: **PCAN-Router Pro FD**

Item number(s): **IPEH-002220/002222**

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) + 2015/863/EU (amended list of restricted substances)

DIN EN IEC 63000:2019-05;VDE 0042-12:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016); German version EN IEC 63000:2018

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 61326-1:2013-07;VDE 0843-20-1:2013-07
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, 4 June 2021

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawing

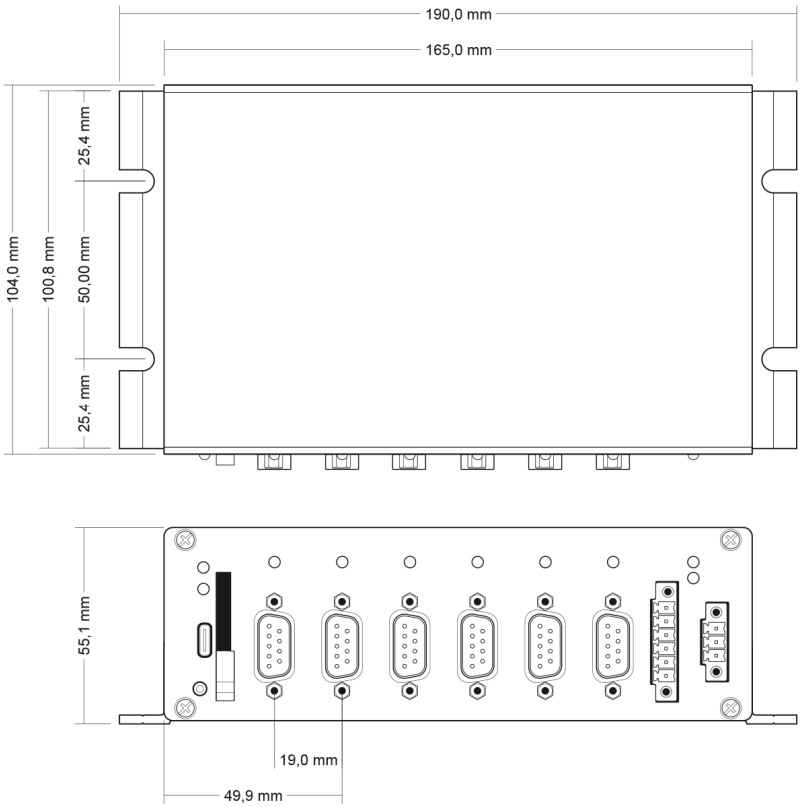

Figure 23: Dimension drawing PCAN-Router Pro FD

The figures do not correspond to the original size.

Appendix C 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.