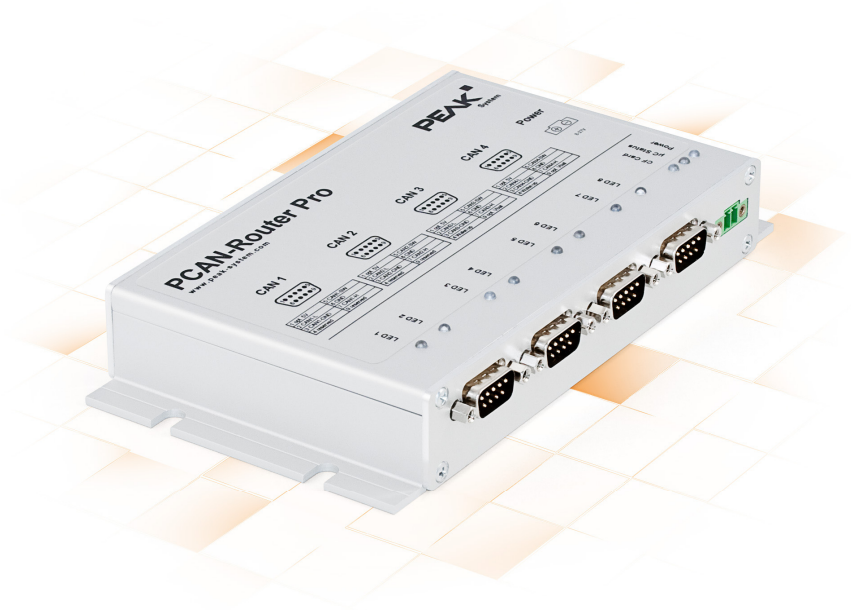
PCAN-Router Pro

4-Channel CAN Router with Data Logger

User Manual



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PEAK System

Relevant Products

Product Name	Part Number	Model	Firmware Version
PCAN-Router Pro	IPEH-002212	from SN 100	from 1.15.x

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Contents

1 Introduction

The PCAN-Router Pro allows joining the data traffic from four High-speed CAN buses. The behavior of the router is configured via the CAN bus with the provided Windows program PPCAN-Editor 2. As well as pure forwarding, the CAN data can be processed, manipulated, and for example, filtered in a number of different ways. There are a variety of function blocks and other settings available to the user for configuration setup. Furthermore, there is a virtual fifth CAN channel which is used for recording all data traffic to a CompactFlash card.

As an alternative to the standard firmware which the PCAN-Router Pro is equipped with at delivery, custom firmware based on the ARM microcontroller NXP LPC2294 can be created and implemented. 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 facilitate the implementation of own solutions.

CAN transceiver modules in the PCAN-Router Pro allow a flexible adaptation of each CAN channel to the requirements. For example, Low-speed and Single-wire CAN transceivers are also available on request.

The **documentation** for the PCAN-Router Pro has multiple parts:

- PCAN-Router Pro - User Manual (this document):
  Explains hardware adjustments, the operation of the device, and the hardware-specific settings in the PPCAN-Editor 2 (Appendix E on page 62).
- PPCAN-Editor 2 - Documentation (program help):
  The help of the configuration program PPCAN-Editor 2 for Windows, accessible via the **Help** menu or via F1.

- PPCAN-Editor 2 Tutorial - Learning by doing based on many examples, which you can find in the PCAN-Router Pro package in the directory Tutorial.

- PPCAN-Editor 2 - References (PDF file):
  Explains the function blocks and the mathematical functions that are implemented in PPCAN-enabled devices (like the PCAN-Router Pro).

1.1 Properties at a Glance

- 4 High-speed CAN channels (ISO 11898-2)
  - Complies with CAN specifications 2.0 A/B
  - CAN bit rates from 40 kbit/s up to 1 Mbit/s
  - NXP TJA1041 CAN transceiver with wake-up
  - Alternative pluggable transceiver modules on request
- 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
- CompactFlash card slot
- Battery-buffered real-time clock (RTC), can also be used for wake-up
- Beeper
- Status LEDs for CAN channels, CompactFlash card, microcontroller, and power supply
- NXP microcontroller LPC2294
- Aluminum casing with flange. DIN rail fixing option available on request

- 8 - 27 V power supply, protection against overvoltage and reverse polarity
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

Properties of the standard firmware:

- Detailed configuration with the software PPCAN-Editor 2 for Windows
- Various function blocks for data processing and manipulation
- Configurable beeper
- Configurable CAN channel status LEDs
- Recording of CAN data and error frames to a CompactFlash card
- Conversion of logging data to various output formats using the Windows software PEAK-Converter

1.2 Operation Requirements

- Voltage supply 8 – 27 V DC (e.g. car battery)
- For configuring via CAN (standard firmware):
  - Computer with CAN interface of the PCAN series (e.g. PCAN-USB)
  - CAN cabling with correct termination
  - Windows 11, 10 (32/64-bit) for the configuration program
- For converting logged CAN data:
  - Computer with card reader for CompactFlash cards
  - Windows 11, 10 (32/64-bit) for the conversion program

- Sufficient space for data on the hard disk (up to 5 times of the initial file size from the CompactFlash card, e.g. 1 GByte + 4 GByte)

1.3 Scope of Supply

- PCAN-Router Pro in aluminum casing
- Industrial CompactFlash card (min. 1 GByte)
- Mating connector for power supply[1]

Downloads:

- Configuration software PPCAN-Editor 2 for Windows
- Conversion software PEAK-Converter for Windows
- Windows development package with GCC ARM Embedded, flash program, and programming
- Library with programming examples

[1] 2-pole, pitch 3.81 mm, Phoenix Contact MC1.5/2-STF-3,81

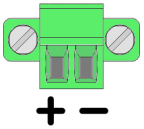
2 Connectors

2.1 Power Supply

The operation of the PCAN-Router Pro requires a voltage source with a nominal 12 V direct current voltage, 8 to 27 V are possible. The input is electronically 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.

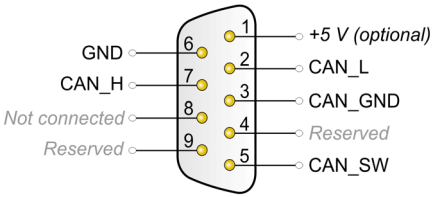
The connection is done with the supplied **mating connector** (Phoenix Contact MC1.5/2-STF-3.81) for fastening cable strands. The polarity is as follows:



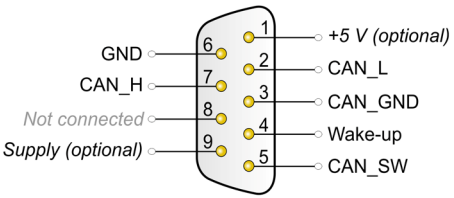
Note: After applying the supply voltage, the PCAN-Router Pro needs a wake-up signal in order to start operation. See section 5.1 on page 28.

2.2 CAN 1 to CAN 4, D-Sub 9-pin

A CAN bus is connected to a 9-pin D-Sub port.



Pin assignment of the ports **CAN 1** and **CAN 2**



Pin assignment of the ports **CAN 3** and **CAN 4**

The assignment of the CAN pins relies upon the used CAN transceiver module:

Transceiver Module	Transmission Standard	Special Function	Used CAN Lines
PCAN-Transceiver TJA1041 (default)	High-speed CAN ISO 11898-2	Wake-up via CAN	CAN_L, CAN_H
PCAN-Transceiver PCA82C251	High-speed CAN ISO 11898-2	none	CAN_L, CAN_H
PCAN-Transceiver MAX3057-ISO	High-speed CAN ISO 11898-2	Galvanic isolation of the CAN connection up to 300 V	CAN_L, CAN_H
PCAN-Transceiver TH8056	Single-wire CAN SAE J2411	Wake-up via CAN	CAN_SW
PCAN-Transceiver TJA1055	Low-speed CAN ISO 11898-3	Wake-up via CAN	CAN_L, CAN_H

The D-Sub connectors have pins with additional functions:

Connectors	Pin	Function
CAN 1, CAN 2, CAN 3, CAN 4	1	5-Volt supply for external devices (to be activated on the circuit board)
CAN 3, CAN 4	4	Input for external wake-up signal
CAN 3, CAN 4	9	Supply of the router via a D-Sub connector (to be activated on the circuit board)

Note: The additional functions at the D-Sub connectors are not galvanically isolated. When using the transceiver module PCAN-Transceiver MAX3057-ISO, galvanic isolation is only provided for those pins that are assigned to CAN communication at the corresponding D-Sub connector (2: CAN_L, 7: CAN_H, 3: CAN_GND).

2.3 CompactFlash Card

To log the CAN data traffic (trace) you can use CompactFlash cards (CF cards) with a maximum capacity of 2 GByte.

The CF slot is located on the rear of the PCAN-Router Pro. The CF card is properly inserted if it flushes with the rear panel.

Note: When you want to insert or eject a CompactFlash card, the PCAN-Router Pro must be turned off (no power supply or power-down mode, Power LED off). Else the card is not detected or data gets lost.

About the use of a CF card see chapter 6 *Logging CAN Traffic onto a CompactFlash Card* on page 38.

3 Hardware Adjustments

You can adjust some hardware settings on the circuit board of the PCAN-Router Pro:

- Using an alternative CAN transceiver module
  (see chapter 3.1 on page 13)
- Adjusting the termination for a CAN bus
  (see chapter 3.2 on page 16)
- Setting the Router ID for the configuration
  (see chapter 3.3 on page 18)
- Enabling the 5-Volt supply for external devices
  (see chapter 3.4 on page 20)
- Enabling the supply of the router via a D-Sub connector
  (see chapter 3.5 on page 22)
- Replacing the button cell for the real-time clock (RTC)
  (see chapter 3.6 on page 24)

3.1 Alternative CAN Transceiver Modules

An alternative CAN transceiver module can be used for each of the four CAN connections. The **PCAN-Transceiver TJA1041** is preinstalled by default. The following alternative modules are supported:

Order number	Name	Transmission standard	Bit rate	Wake-up	Galvanic isolation
IPEH-001001 Default	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-001003	PCAN-Transceiver MAX3057-ISO	High-Speed-CAN ISO 11898-2	5 kbit/s to 1 Mbit/s	no	yes
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

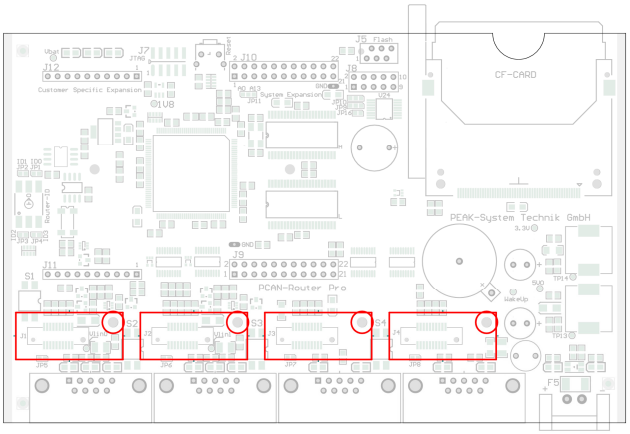
Do the following to replace a transceiver module:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect the power supply.
2. Unscrew the four screws at the upper corners of the housing on the front and back.
3. Remove the housing cover.
4. Unscrew the two screws at the lower corners of the front cover.
5. Pull out with the front panel the board from the bottom side of the housing to the front.

6. Remove the retaining screw from the transceiver module to be replaced.

   Pay attention to the spacer and the nut, which may come loose.



Positions of the transceiver modules for the four CAN channels (CAN 1 on the left)

7. Pull off the transceiver module upwards from the main board.
8. Plug the alternative transceiver module onto the socket.

   Make sure that the hole in the transceiver module is aligned to the corresponding hole in the main board.
9. Secure the transceiver module with the screw, the spacer, and the nut.
10. Put the cover back on the housing by paying attention to the LED light guides.
11. Screw the four screws at the upper corners of the housing on the front and back side.

12. Screw the two screws at the lower corners of the front cover.
13. Restart the device by connecting power supply again.

After the restart, the PCAN-Router Pro automatically detects the type of the inserted CAN transceiver module and adjusts the according **default bit rate** for the CAN channel (see table above). The bit rate can be changed by a configuration.

Note: After applying the supply voltage, the PCAN-Router Pro needs a wake-up signal in order to start operation. See section 5.1 on page 28.

3.2 Termination of the CAN Buses

Depending on the used CAN transceiver module you can activate or change the CAN bus termination for each CAN connection CAN 1 to CAN 4 with **switch blocks S1 to S4**. Switches 1 and 2 on a switch block always must have the same position. By default, internal termination is not activated.

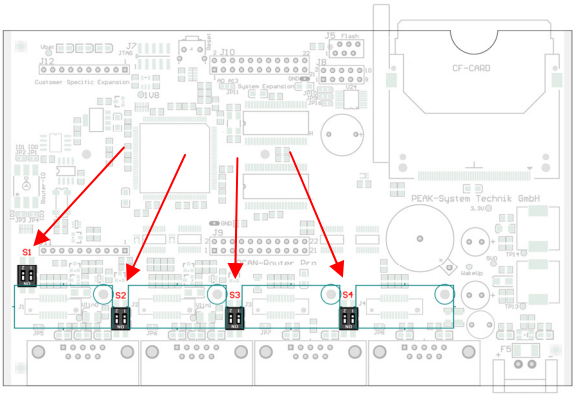
Tip: We recommend adding termination at the CAN cabling, for example with termination adapters (e.g. PCAN-Term). Thus, CAN nodes can be flexibly connected to the bus.

Do the following to activate the termination:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect the power supply.
2. Unscrew the four screws at the upper corners of the housing on the front and back.
3. Remove the housing cover.
4. Unscrew the two screws at the lower corners of the front cover.
5. Pull out with the front panel the board from the bottom side of the housing to the front.
6. Apply the desired termination using switch blocks **S1** to **S4** (CAN 1 to CAN 4).

   Make sure that both DIP switches (1/2) on the switch block are in the same position.



Positions of the switch blocks for CAN termination;
ON switch position is marked on the switch blocks

Type of Transceiver	Termination at Switch Position[2]	
	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

7. Put the cover back on the housing by paying attention to the LED light guides.
8. Screw the four screws at the upper corners of the housing on the front and back side.
9. Screw the two screws at the lower corners of the front cover.
10. Restart the device by connecting power supply again.
    After the restart, the internal termination for the respective CAN channel is active.

[2] Both switches of a switch block

3.3 Setting the Router ID for other Configurations

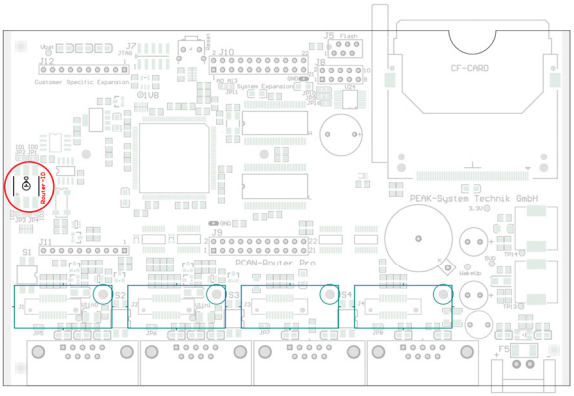
The board of the PCAN-Router Pro has a rotary switch with 16 settings to determine the Router ID (0 - F hex = 0 - 15). When the device is started with the standard firmware, that configuration is loaded from the internal memory whose number matches the specified Router ID. In addition, the Router ID gives a unique identification during the PPCAN communication (configuration transfer). For the transmission of CAN messages during normal operation this Router ID is not relevant.

Note: The rotary switch setting **F** is reserved for an upload of new firmware.

Do the following to change the Router ID:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect the power supply.
2. Unscrew the four screws at the upper corners of the housing on the front and back.
3. Remove the housing cover.
4. Find the rotary switch on the board with the help of the following figure:



5. Turn the **ID** rotary switch on the board to your desired position. Use a slotted screwdriver, for example.
6. Put the cover back onto the casing by taking care of LED light guides.
7. Screw the four screws at the upper corners of the housing on the front and back side.
8. Restart the device by connecting power supply again.

   After the restart, the changed Router ID will be active.

During operation with a configuration the LED **µC Status** blinks green every second. If a configuration for the set Router ID does not exist, the LED blinks twice as fast.

3.4 Voltage Supply of External Devices

A 5-Volt supply can optionally be routed to pin 1 of a D-Sub connector (independently for each connector) by setting solder jumpers on the circuit board of the PCAN-Router Pro. Thus, devices with low power consumption (e.g. bus converters) can be directly supplied via the D-Sub connector. The current output is limited to 100 mA for each connector.

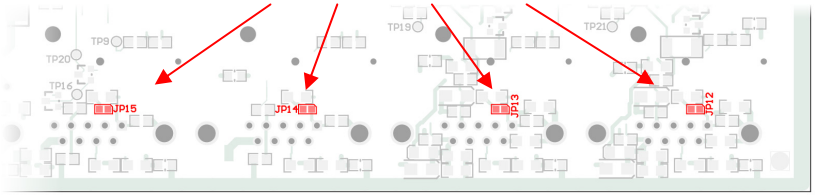
Attention! Risk of short circuit! If the option described in this section is activated, you may only connect or disconnect CAN cables or peripheral systems (e.g. bus converters) to or from the PCAN-Router Pro while it is turned off.

Do the following to activate the 5-Volt supply:

Danger of short circuit! Take great care when soldering to avoid short circuits.

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect the power supply.
2. Unscrew the four screws at the upper corners of the housing on the front and back.
3. Remove the housing cover.
4. Unscrew the two screws at the lower corners of the front cover.
5. Pull out with the front panel the board from the bottom side of the housing to the front.
6. Solder the solder bridge(s) on the board using the following figure and table:



Connection	Solder Field	Default	Activated
CAN 1, Pin 1	JP12		
CAN 2, Pin 1	JP13		
CAN 3, Pin 1	JP14		
CAN 4, Pin 1	JP15		

7. Put the cover back onto the casing by taking care of LED light guides.
8. Screw the four screws at the upper corners of the housing on the front and back side.
9. Screw the two screws at the lower corners of the front cover.
10. Restart the device by connecting power supply again.

    After restarting, the 5-Volt supply via the D-Sub connector is active.

3.5 Power Supply via D-Sub Connector

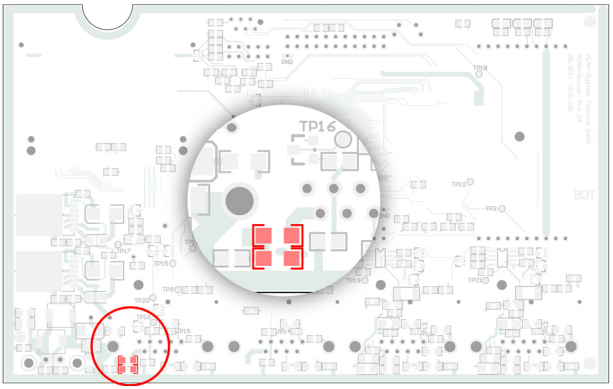
As an alternative to the power connector intended for supplying the PCAN-Router Pro, it can be supplied via pin 9 of the D-Sub connector **CAN 3** or **CAN 4** with 8 to 27 V DC. On the circuit board of the PCAN-Router Pro, a connection to the desired D-Sub connector must be established with a solder bridge. Pin 6 (GND) is used as negative for the supply.

➥ Do the following to enable the supply via a D-Sub connector:

Danger of short circuit! Take great care when soldering to avoid short circuits.

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect the power supply.
2. Unscrew the four screws along the top edges of the housing on the front and back of the device.
3. Remove the housing cover.
4. Unscrew the two screws at the lower corners of the front cover.
5. Together with the front panel, pull out the circuit board into front direction from the casing's lower part.
6. Solder the solder bridge(s) on the board using the following figure and table:



Position of the solder fields on the bottom side of the circuit board for the supply of the router via the D-Sub connector

Connection	No Function	Supply is Possible
CAN 3, Pin 9		
CAN 4, Pin 9		

7. Put the cover back onto the casing by taking care of LED light guides.
8. Screw the four screws at the upper corners of the housing on the front and back side.
9. Screw the two screws at the lower corners of the front cover.
10. Restart the device by connecting power supply again.

    After restarting, the device can be supplied with power via pin 9 at the D-Sub connector CAN 3 or CAN 4.

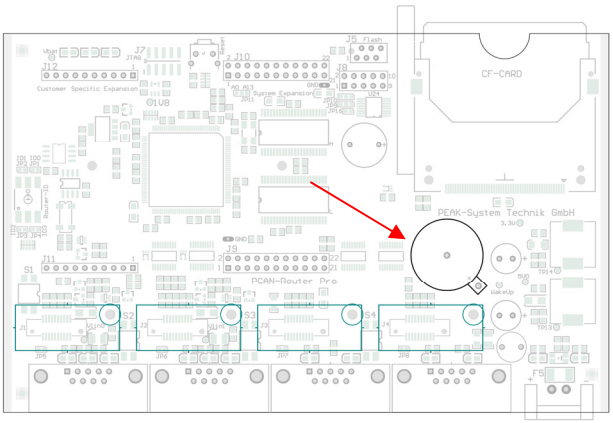
3.6 Replacing the Button Cell for the Real-time Clock (RTC)

The real-time clock (RTC) integrated in the PCAN-Router Pro is supplied by a button cell of the IEC type CR1620 (3 V), as long as the device is turned off (without voltage supply or in power-down mode).

➡ Do the following to replace the button cell:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Disconnect power supply.
2. Unscrew the four screws along the top edges of the housing on the front and back of the device.
3. Remove the housing cover.
4. Carefully remove the button cell from the holder.



5. Insert the new button cell.

6. Put the cover back onto the casing by taking care of LED light guides.
7. Screw the four screws at the upper corners of the housing on the front and back.
8. Restart the device by connecting power supply again.

A new button cell lasts several years. If the internal clock indicates an unexpected time, take out the button cell and measure its voltage. This should be around the nominal 3.0 Volts. If the measured voltage is lower than 2.5 Volts, you should replace the button cell with a fresh one.

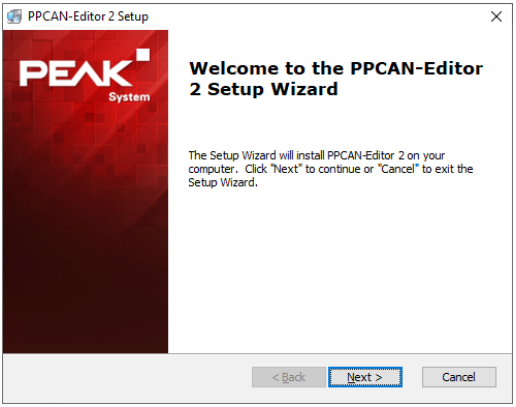
Find more details about recalling and setting the time in sections 5.3 *Shipping Configuration* on page 30 and 5.4 *Setting the Real-Time Clock* on page 33.

4 Installing Configuration Software

Create configurations for the operation with the standard firmware using the software PPCAN-Editor 2 for Windows. This chapter covers the installation procedure for the program. Please find information about the creation of a configuration in the program help or in the tutorial of the PPCAN-Editor 2.

Do the following to install the PPCAN-Editor 2:

1. Download the PPCAN-Editor 2 software:
   `www.peak-system.com/quick/DL-Software-E`
2. Start the setup program (`PPCAN-Editor-2-Setup.exe`).



3. Follow the instructions of the setup program and install the PPCAN-Editor 2.

You can then start the PPCAN-Editor 2, create a configuration, and send it to the PCAN-Router Pro. You can get corresponding information in the help or in the tutorial for the PPCAN-Editor 2.

Note: The PPCAN-Editor 2 uses the **CAN ID 7E7h** for communication with the PCAN-Router Pro. Using the standard firmware, it is defined for each CAN channel that the PCAN-Router Pro is reacting to incoming configuration messages. Therefore, do not use CAN ID 7E7h otherwise, or switch this behavior on or off for the single CAN channels (I/O function *70h Special Out > Configuration ID 07e7h Enable*).

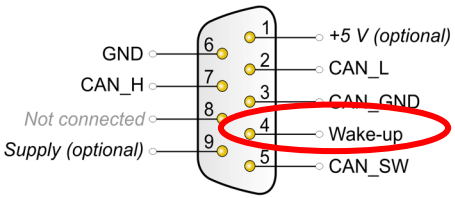
5 Operation

5.1 Turning On the PCAN-Router Pro (Wake-Up)

After applying a supply voltage, the PCAN-Router Pro does a reset and is turned off (power-down mode, Power LED off). To start operation, the PCAN-Router Pro needs a wake-up signal. The following subsections show the options.

5.1.1 Wake-Up by High Level

On each of the ports CAN 3 and CAN 4, a High level (at least 4.5 V) can be applied to pin 4 to switch on the PCAN-Router Pro.



Wake-up pin 4 at ports CAN 3 and CAN 4

Possible external wake-up signals are the supply voltage for the PCAN-Router Pro or terminal 15 “Ignition” in a motor vehicle.

If at least one CAN transceiver module with wake-up function is present in the PCAN-Router Pro (default), the assignment of a wake-up pin can be omitted, because the device starts automatically after applying the supply voltage. Power-down times must then not be shorter than 30 s to ensure a reliable restart.

5.1.2 Wake-up via CAN

This function is only available if a CAN transceiver module with wake-up function is present for the used CAN channel. For all CAN channels, this is the case with standard equipment.

Transceiver module	Transmission standard	Wake-up function
PCAN-Transceiver TJA1041 Transceiver installed by default.	High-speed CAN ISO 11898-2	yes
PCAN-Transceiver PCA82C251	High-speed CAN ISO 11898-2	no
PCAN-Transceiver MAX3057-ISO	High-speed CAN ISO 11898-2	no
PCAN-Transceiver TH8056	Single-wire CAN SAE J2411	yes
PCAN-Transceiver TJA1055	Low-speed CAN ISO 11898-3	yes

When on a CAN channel a message is received, the PCAN-Router Pro turns on. This CAN message and all further ones coming in within the wake-up period of 165 ms are not processed by the PCAN-Router Pro.

5.1.3 Wake-Up by Real-Time Clock (RTC)

Applies to the standard firmware.

The PCAN-Router Pro is turned on at the alarm time set previously.

The alarm time is set with a CAN message. To do so, the I/O function *70h (Special Out) > RTC Set Alarm* must be assigned to a CAN variable in the used configuration.

5.2 Default Bit Rates of the CAN Channels

In order to ensure the communication with the PCAN-Router Pro, default bit rates are preset for CAN channels according to the used CAN transceiver module.

Transceiver module	Transmission standard	Default bit rate
PCAN-Transceiver TJA1041 Transceiver installed by default.	High-speed CAN ISO 11898-2	500 kbit/s
PCAN-Transceiver PCA82C251	High-speed CAN ISO 11898-2	500 kbit/s
PCAN-Transceiver MAX3057-ISO	High-speed CAN ISO 11898-2	500 kbit/s
PCAN-Transceiver TH8056	Single-wire CAN SAE J2411	33.3 kbit/s
PCAN-Transceiver TJA1055	Low-speed CAN ISO 11898-3	125 kbit/s

The default bit rate is enabled if the current configuration in the PCAN-Router Pro does not provide another bit rate. In a configuration the bit rate can be set independently for each CAN channel. This is done with the I/O function *70h (Special Out) > CAN Bitrate*.

Tip: If the communication with the PCAN-Router Pro is prevented because you do not know the bit rates used by a configuration, you can set the Router ID to a position without configuration (see section 3.3 on page 18). Then the default bit rate is enabled.

5.3 Shipping Configuration

- Applies to the standard firmware.

The PCAN-Router Pro contains an example configuration at delivery. You can change its elements (e.g. the CAN IDs) or use them as basis for own configurations.

To edit the shipping configuration in the PPCAN-Editor 2 use the file on the PCAN-Router Pro package:
`Configurations\ShippingConfig\ShippingConfig.ppproj`.

The PCAN-Router Pro package can be downloaded from the product page under Downloads or from the following page:
`www.peak-system.com/quick/DL-Packages-E`

This configuration has following properties:

- All incoming messages from the four CAN channels are written to an inserted CompactFlash card.
- No forwarding is done between the four CAN channels.
- The LEDs for the CAN ports blink during CAN traffic; LEDs 1, 3, 5, and 7 (green) for incoming, LEDs 2, 4, 6, and 8 (red) for outgoing CAN messages.
- Via CAN channel 1 status CAN messages are provided for request (RTR) containing information related to the logging function and the CompactFlash card (see following tables).
- Optionally: The battery buffered real-time clock (RTC) can be set and recalled via CAN channel 1 (see section 5.4 *Setting the Real-Time Clock* on page 33).

5.3.1 Structure of the Status Messages

Applies to the standard firmware.

CAN Property	Message GetTraceStatus_R
ID	7F0h
Data length	4 bytes
Transmit cycle time	none (0 ms)
RTR	yes
Format	Intel (Little Endian)
Data	See following table

Position (byte:bit)	Length (bits)	Name of Data Variable	Description
0:0	1	NoCardPresent	No CF card inserted in the PCAN-Router Pro For a correct recognition of a CF card, it must be inserted into or ejected from the PCAN-Router Pro at turned off state.
0:1	1	PartitionError	CF card does not contain a partition or more than one
0:2	1	FAT16Error	CF card isn't formatted with the file system FAT16
0:3	1	RootError	Root directory cannot be found
0:4	1	RootDirError	Root directory cannot be opened
0:5	1	FileNotFound	File `trace.btr` does not exist
0:6	1	FileOpenError	File `trace.btr` cannot be opened
0:7	1	FileSeekError	Start of file `trace.btr` cannot be found
1:0	1	FileStartError	First sector of file `trace.btr` cannot be determined
1:1	1	EndOfFileError	Trace file is completely filled with CAN messages (linear record mode)
1:2	1	RunAllocationError	Maximum number of records is reached

CAN Property	Message GetTraceInfo_R
ID	7F1h
Data length	8 bytes
Transmit cycle time	none (0 ms)
RTR	yes
Format	Intel (Little Endian)
Data	See following table

Position (byte:bit)	Length (bits)	Name of Data Variable	Description
0:0	32	CFTraceFileMsgFree	Number of CAN messages still fitting into the trace file
4:0	32	CFTraceQueueOverruns	Number of CAN message not being processed by the CF card queue due to overload

5.4 Setting the Real-Time Clock

Applies to the standard firmware.

The PCAN-Router Pro comprises a battery-buffered real-time clock (RTC). The clock is accessed with the I/O functions *70h (Special Out) > RTC* and *F0h (Special In) > RTC*.

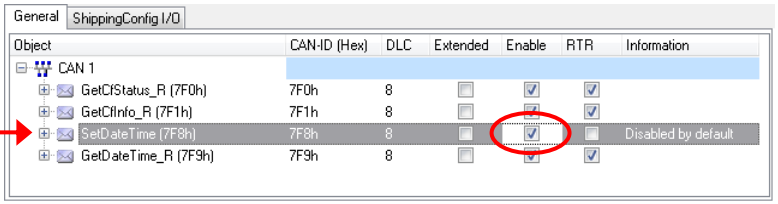
The shipping configuration for the PCAN-Router Pro contains an entry you can enable in order to set the time with a CAN message. By default, this entry is disabled to avoid accidental adjustment of the time via CAN.

The following gives instructions about:

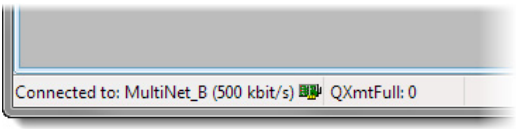
- Adjustment of the shipping configuration and the transfer to the PCAN-Router Pro
- Transmission of a CAN message with the Windows program PCAN-View in order to set the time.

Do the following to adjust the shipping configuration and to transfer this to the PCAN-Router Pro:

1. Start the PPCAN-Editor 2.
2. Via **File > Open** or , open `ShippingConfig.ppproj`. You find the file in PCAN-Router Pro package under `Configurations\ShippingConfig\`.
3. In the **CAN Objects** window on the **General** tab, select the symbol entry **CAN 1 > SetDateTime (7F8h)**.



4. Enable the symbol entry by checking the corresponding field **Enable**.
5. Make sure that a CAN connection exists between the computer and the PCAN-Router Pro, and, furthermore, that the PPCAN-Editor 2 has access to this connection.



PPCAN-Editor 2: Display of a connection in the status bar on the bottom.

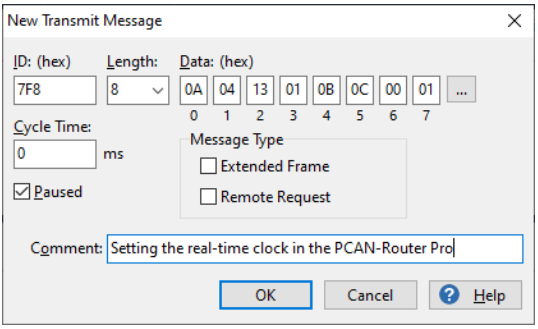
6. With **Transmit > Send Configuration** or send the altered configuration to the PCAN-Router Pro.

Do the following to set the time with PCAN-View and the shipping configuration for the PCAN-Router Pro:

1. Under Windows start the program PCAN-View.
2. Establish a connection to the CAN bus that is connected with the CAN channel 1.
3. On the **Transmit** panel, insert the CAN message 7F8h with 8 data bytes for data, time, and the RTC update bit (see example below).

   Make sure that the values are hexadecimal values. Because the message must only be received once by the PCAN-Router Pro, no cyclic transmission is set.

   Example for Monday, 2010-04-19, 11:13:00:



Data bytes (hexadecimal):
year month day weekday hour minute second RTC update bit

4. Transmit this message once manually, e.g. by pressing the space bar.

   Date and time of the real-time clock in the PCAN-Router Pro are now set to the information contained in the data bytes.

Tip: You can recall the current date and time with another CAN message having the ID 7F9h and being transmitted as remote request frame (data bytes: see table below).

Data structures of the CAN messages for the real-time clock (shipping configuration):

Function	CAN ID	Data Bytes	Remarks
Setting RTC	7F8h	`YY MM DD WW hh mm ss 01`	Last byte = RTC update bit
Reading RTC	7F9h (RTR)	`YY MM DD W0 cc ss mm hh`	Weekday on upper 4 bits

Y = year (2-digit), M = month, D = day, W = weekday (1 = Monday),
h = hour, m = minute, s = second, c = hundredth

5.5 Status LEDs

Applies to the standard firmware except for the “Power” LED.

LED	Status	Meaning
Power	Off	If a supply voltage is applied, the PCAN-Router Pro is in power-down mode and must be turned on by a wake-up signal. See section 5.1 on page 28.
	Green static	A supply voltage exists and the PCAN-Router Pro is turned on.
µC Status	Green slow blinking (1 Hz)	Normal operation with the configuration which is allocated to the currently specified Router ID.
	Green quick blinking (2 Hz)	No or no valid configuration is available for the currently specified Router ID. Changing the Router ID: section 3.3 on page 18 Transferring a configuration to the PCAN-Router Pro: see program help of the PPCAN-Editor 2
	Green quick blinking with short light phase (2 Hz)	Configuration transfer to/from the PCAN-Router Pro via CAN (ID 7E7h)
	Red	Reset Due to the shortness of the reset signal, this status is barely viewable.
CF Card	Orange blinking	Write access onto the CompactFlash card
LED 1 LED 3 LED 5 LED 7	Configurable (green)	Freely configurable, access via I/O functions *00h (Dout Level) > LED CAN*
LED 2 LED 4 LED 6 LED 8	Configurable (red)	

5.6 Power-down Mode

In power-down mode, the voltage supply is turned off for a majority of the electronic components in the PCAN-Router Pro and the current consumption is reduced to 470 µA at 12 V. The Power LED is off.

In order to set the PCAN-Router Pro from turned on state to the power-down mode, you need to deactivate the selfhold function. This is done by transmitting a CAN message that is processed by the PCAN-Router Pro and that sets the I/O function *70h (Special Out) > Selfhold* to 0 (deactivated).

If the PCAN-Router Pro is in power-down mode, a wake-up signal is needed so that the device turns on again (see section 5.1 on page 28).

6 Logging CAN Traffic onto a CompactFlash Card

Note: To optimize performance and reduce memory card accesses, the PCAN-Router Pro saves incoming messages in blocks. This means that the available storage space cannot be used optimally. The size of the memory blocks is configurable. For more information please contact our support: support@peak-system.com

6.1 Preparing a CompactFlash Card

To log CAN traffic with the PCAN-Router Pro the contents of a CompactFlash card (CF card) must be prepared in a certain way.

What you need:

- a Computer with card reader for CF cards
- a CF card with a maximum of 2 GByte capacity (enclosed: 1-GByte card, already prepared)

Do the following to prepare a CF card:

Important note: When you want to insert or eject a CompactFlash card, the PCAN-Router Pro must be turned off (no power supply or power-down mode, Power LED off). Else the card is not detected or data gets lost.

Attention: Already existing data on the CF card will be lost when following the described procedure.

1. Insert the card into the card reader of the computer.

2. With the appropriate program of the operating system format the card using the **file system FAT16**.
3. Create a file `trace.btr` in the root directory of the CF card, which contains empty bytes (00h).

   The file size must be a multiple of 512 bytes.

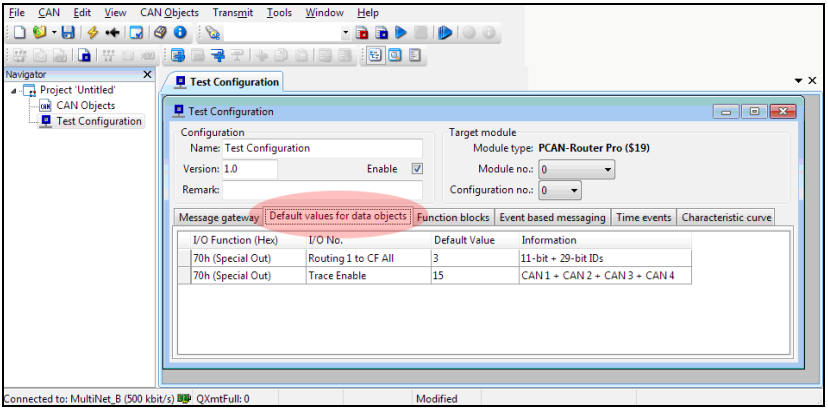
Tip: You will find various trace files (`trace.btr`) in different sizes in the download package. Decompress the respective ZIP archive directly to the root directory of the CF card. The download package can be downloaded here: `www.peak-system.com/quick/DL-Packages-E`

4. Log off the CF card from the operation system (e.g. under Windows with the Eject command) and remove the card from the card reader of the computer.
5. Insert the CF card into the slot on the rear of the PCAN-Router Pro.

   The CF card is properly inserted if it flushes with the rear panel.

6.2 Preparing a Configuration for Recording

In the configuration program PPCAN-Editor 2 the recording of the CAN traffic is set up in the module-specific configuration ( ) on the **Default values for data objects** tab.



The entries for the recording
are created in the module-specific configuration.

Create the following entries (see also figure):

Field	Selection/Input	Explanation
I/O Function	70h (Special Out)	Special functions of the PCAN-Router Pro
I/O No	Routing 1 to CF All	Forward all CAN messages from CAN channel 1 to the CF card. Alternatively, you can select the CAN channels 2, 3, or 4, or create additional entries for these CAN channels.
Default Value	3	2-bit value; CAN frames with 11-bit and/or 29-bit ID are forwarded to the CF card (here: both ID types) Bit 0 (1 dec.) = 11-bit ID Bit 1 (2 dec.) = 29-bit ID

Field	Selection/Input	Explanation
I/O Function	70h (Special Out)	Special functions of the PCAN-Router Pro
I/O No	Trace Enable	The logging function must be enabled for the desired CAN channels.
Default Value	15	4-bit value: a set bit enables the logging function for the corresponding CAN channel (here: all four CAN channels). Bit 0 (1 dec.) = CAN 1 Bit 1 (2 dec.) = CAN 2 Bit 2 (4 dec.) = CAN 3 Bit 3 (8 dec.) = CAN 4

Further logging possibilities with the I/O function *70h (Special Out)*:

- *Routing 1 to CF Explicit*: Only CAN messages with the given 11-bit ID
- *Routing 1 to CF Excluding*: All CAN messages with 11-bit ID excluding those with the given 11-bit ID

Tip: This setting and further ones for the PCAN-Router Pro are explained in Appendix E *Router Resources* on page 62.

6.3 Using the Recorded CAN Traffic

The recorded CAN traffic on the CompactFlash card (CF card) is binary-coded in the `trace.btr` file. For further use you must convert the data in an appropriate format.

Possible conversion targets:

Target Format	File Ending	Explanation/Usage
PCAN-Trace	`.trc`	Text-based trace format by PEAK-System; viewing of the data in the PCAN-Explorer or playback of the CAN messages with the PCAN-Trace program.
Vector ASC Trace	`.asc`	Text-based trace format by the Vector company that also can be used by some third-party programs.
Character Separated Values (CSV)	`.csv`	Common, text-based format for import into a spreadsheet (semicolon as separator).

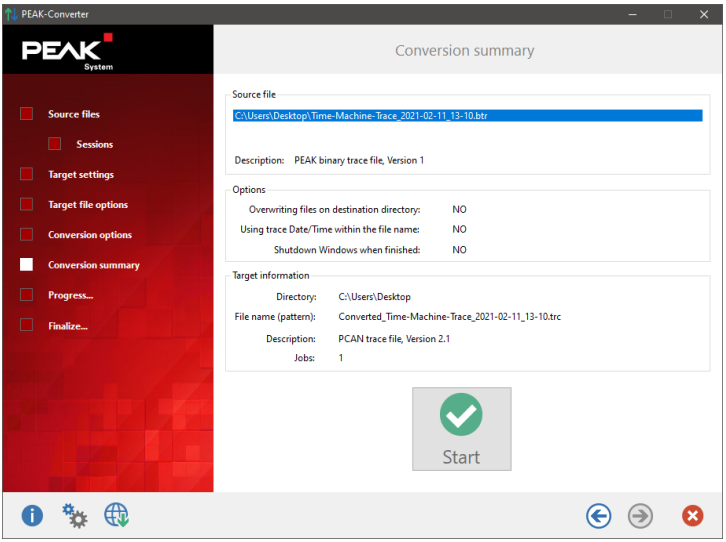
Do the following to get the trace data:

1. Eject the CF card from the PCAN-Router Pro and insert it into the card reader of the computer.
2. Copy the PEAK-Converter to your local hard disk. You can find the software in the PCAN-Router Pro package under `Tools` or on our website.

   Link to the PCAN-Router Pro Package:
   `www.peak-system.com/quick/DL-Packages-E`

   Link to the software website:
   `www.peak-system.com/quick/DL-Software-E`
3. Start the converter program `PEAK-Converter.exe`.
4. Select the file `trace.btr` from the CF card at step **Source files**.
5. Make the settings for the conversion in the following steps. Do not save the target file on the CF card.

6. Start the conversion.



7 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-DevPack

System Requirements:

- PC with Windows 11, 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\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.

7.1 Library

The development of applications for the PCAN-Router Pro is supported by the library `libPCAN-Router-ProGNU*ys.a` (`*` stands for version number), a binary file. You can access all resources of the PCAN-Router Pro by means of this library. Die library is documented in the header files (`*.h`) which are located in the `inc` subdirectory of each example directory.

8 Firmware Upload

The microcontroller in the PCAN-Router Pro is equipped with new firmware via CAN and the Windows program PEAK-Flash. For this, the bootloader must be activated in the PCAN-Router Pro. There are two possibilities to start the bootloader:

- **Only with standard firmware on the device**:
  PEAK-Flash can enable the bootloader, if you use the standard firmware on the device. For more information, see chapter 8.3 *Firmware Transfer* on page 50.
- The rotary switch on the circuit board can enable the bootloader. For this, see chapter 8.2 *Prepare Hardware* on page 48 and then chapter 8.3 *Firmware Transfer* on page 50.

Note: After an update of the standard firmware, the **µC Status** LED blinks with increased frequency (2 Hz) indicating that no configuration is available. Re-transfer your configuration(s) to the PCAN-Router Pro with the PPCAN-Editor 2.

8.1 System Requirements

The following prerequisites must be given, so that the PCAN-Router Pro can be updated with new firmware:

- CAN interface of the PCAN series for the computer (e.g. PCAN-USB)
- CAN cabling between the CAN interface and the PCAN-Router Pro with proper termination (120 Ω on each end of the CAN bus)
- Operating system Windows 11, 10 (32/64-bit)

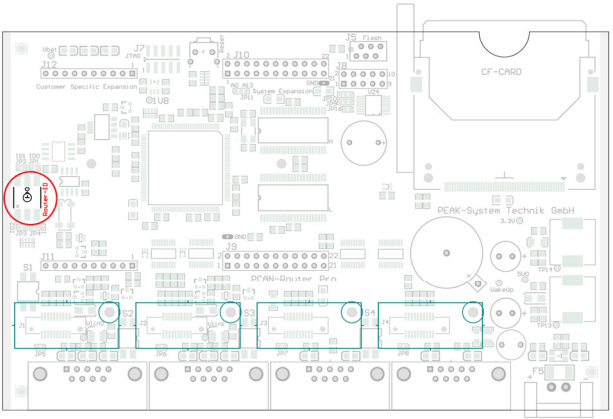
8.2 Prepare Hardware

For a firmware upload via CAN, the CAN bootloader must be activated in the PCAN-Router Pro via the rotary switch on the board. When using the standard firmware, you can continue directly with chapter 8.3 on page 50.

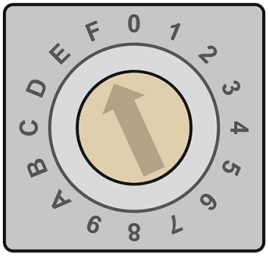
Do the following to set the rotary switch:

Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board of the PCAN-Router Pro. Take precautions to avoid ESD when handling the circuit board.

1. Unscrew the four screws at the upper corners of the housing on the front and back.
2. Remove the housing cover.
3. Find the rotary switch on the board with the help of the following figure:



4. Turn the **ID** rotary switch on the board to position **F**. Use a slotted screwdriver, for example.



5. Restart the device by interrupting the power supply.

   The change of the rotary switch takes effect.

   The **µC Status** LED stays off. The LEDs of the CAN connectors CAN 1 to CAN 4 are blinking.

6. Continue with chapter 8.3 *Firmware Transfer* on page 50.

7. Turn the rotary switch on the board back to the previously set module ID.

8. Put the cover back onto the casing by taking care of LED light guides.

9. Screw the four screws at the upper corners of the housing on the front and back.

10. Restart the device by connecting power supply again.

8.3 Firmware Transfer

The firmware is uploaded via a CAN bus using the supplied Windows program PEAK-Flash. The firmware upload is only possible with **CAN channel 1**.

Important Note: When uploading a new firmware, all existing configurations on the PCAN-Router Pro are erased. Therefore, make sure that the configurations are saved on your computer in order to transfer them with the PPCAN-Editor 2 to the PCAN-Router Pro after the firmware update.

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

1. Connect the device to the power supply.

   The power LED lights green.

2. Connect the CAN interface of your computer to the **CAN 1** connector on the PCAN-Router Pro. Make sure that the CAN cabling is terminated correctly (2 x 120 Ω).

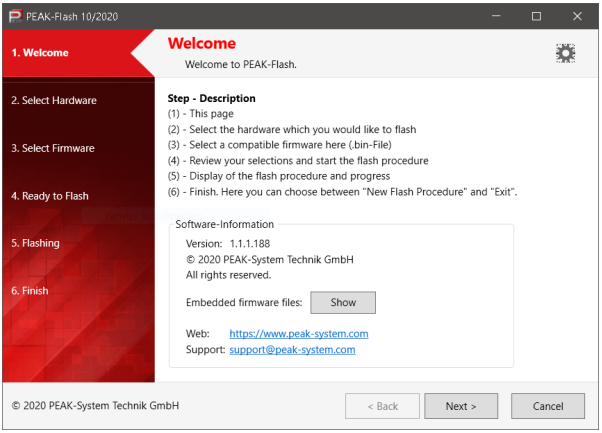
   Firmware upload is only possible with the CAN 1 connector. This must be connected to the PC alone.

3. Download the software PEAK-Flash, which is included in the development package:
   `www.peak-system.com/quick/DLP-DevPack`

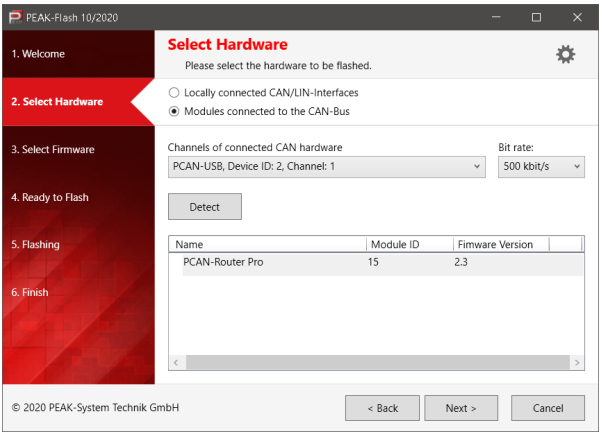
4. Open the zip file and extract it to your local storage medium.

5. Run the `PEAK-Flash.exe`.

   The program opens.



6. Click the **Next** button.
7. Click on the **Modules connected to the CAN bus** radio button.
8. In the **Channels of connected CAN hardware** drop-down menu, select a CAN interface connected to the computer (e.g. PCAN-USB).
9. Make sure that the nominal bit rate of **500 kbit/s** is selected in the **Bit rate** drop-down menu.



10. Click on **Detect**.

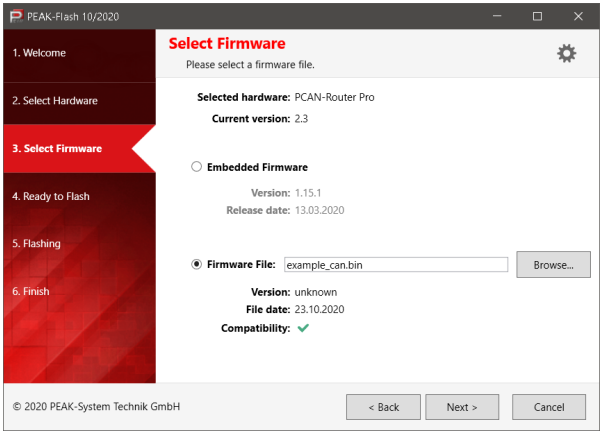
    In the list, the **PCAN-Router Pro** appears together with the **Module ID** and **Firmware version**. If not, check whether a proper connection to the CAN bus with the appropriate nominal bit rate exists.

11. Click **Next**.

12. Select the **Embedded Firmware** or the **Firmware File** radio button.

    Embedded Firmware is for updating the standard firmware of the device.

    Firmware File is for selecting a firmware file (`*.bin`).



13. Click **Next**.

    The **Ready to Flash** dialog appears.

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

    The **Flashing** dialog appears.

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

16. You can exit the program.

17. **Only for firmware update via rotary switch:**
    Continue with step 6 in chapter 8.2 on page 48.
18. Restart the device by shortly interrupting the power supply.

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

9 Technical Specifications

Connectors	
Power	1 x Phoenix mating connector, 2-pole, pitch 3.81 mm (Phoenix Contact MC1.5/2-STF-3.81 – 1827703)
CAN	4 x D-Sub (m), 9 pins Pin assignment according to specification CiA® 303-1

Power Supply	
Operating voltage	12 V DC, 8 - 27 V possible
Current consumption	Idle: 65 mA at 12 V Maximum: 130 mA at 8 V 95 mA at 12 V 70 mA at 27 V Power-down: 470 µA
Protection	±1 kV surge protection - 40 V reverse polarity protection ±4 kV ESD protection
Wake-up voltage	2 V to 7.5 V DC at pin 4 of D-Sub connector 3 and 4
Wake-up duration	165 ms
RTC backup supply	Button cell CR1620 3.0 V
Power saving modes	Power-down mode with 470 µA

CAN		
Protocols on OSI layer 2	CAN 2.0 A/B	
Physical transmission	ISO 11898-2 (High-speed CAN)	
Transceiver	PCAN-Transceiver TJA1041	(IPEH-001001)
Other transceivers on request	PCAN-Transceiver PCA82C251 PCAN-Transceiver MAX3057-ISO PCAN-Transceiver TH8056 PCAN-Transceiver TJA1055	(IPEH-001002) (IPEH-001003) (IPEH-001004) (IPEH-001005)
CAN bit rates	Nominal: 40 kbit/s - 1 Mbit/s	
Controller	Internal CAN controllers (NXP LPC2294)	
Supported clock frequencies	56 MHz	

CAN		
Supported bit timing values		Nominal
	Prescaler (BRP)	0 - 1023
	Time Segment 1 (TSEG1)	0 - 15
	Time Segment 2 (TSEG2)	0 - 8
	Synch. Jump Width (SJW)	0 - 3
Galvanic isolation	Only with transceiver PCA82C251 on request	
Supplying external devices	D-Sub pin 1; 5 V, max. 100 mA Not connected at delivery	
Internal termination (depending on the transceiver module for a CAN channel)	Activation via switch on the board	

CAN	OFF	ON
High-speed	none	120 Ω
Low-speed	4.7 kΩ	1.1 kΩ
Single-wire	9.1 kΩ	2.1 kΩ

CAN ID reserved for configuration transfer	7E7h
Listen-only mode	Programmable; not activated at delivery
Time stamp resolution	1 µs

Microcontroller und EEPROM	
CPU	NXP LPC2294
Clock frequency	56 MHz
Voltages	Core: 1.8 V; I/O: 3.3 V
RAM	16 kByte (internal) 1 MByte (external)
MCU Flash	256 kByte (240 kByte usable for custom firmware)
Firmware upload	via CAN (PCAN interface required)
EEPROM size	128 kByte

Mass Storage	
Type	CompactFlash card
Memory size	max. 2 GByte
File system	FAT16

Data Logging	
Internal memory	none
External memory	CompactFlash card
Storage requirement	512 bytes per 25 CAN messages (independent of the message lengths)
Maximum memory size	2 GByte
Maximum size of a recording	2 GByte
Recording format	Proprietary binary format (`*.btr`) Conversion options with the supplied Windows program: - PCAN-Trace (`*.trc`) - Vector trace (`*.asc`) - comma separated values (`*.csv`)

Measures	
Dimensions	190 x 29 x 104 mm (W x H x D) See also dimension drawing
Weight	570 g

Environment	
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 %, not condensing
Ingress protection (IEC 60529)	IP20

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;VDE 0042-12:2019-05
EMC	EU Directive 2014/30/EU DIN EN 61326-1:2013-07;VDE 0843-20-1:2013-07

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name: **PCAN-Router Pro**

Item number(s): **IPEH-002212**

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

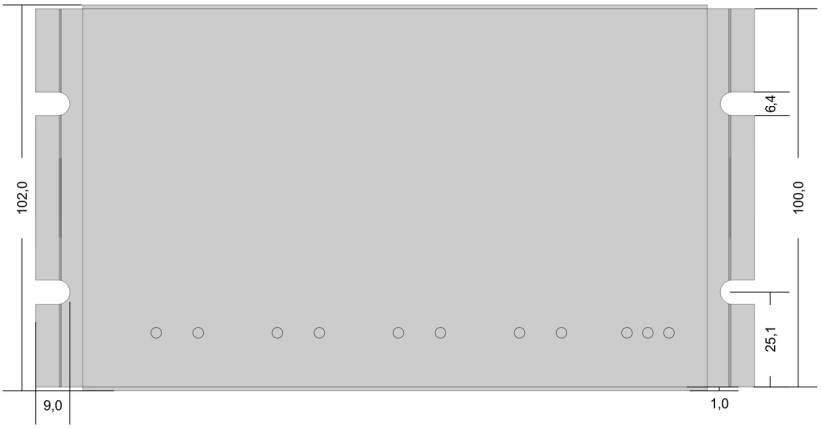
EU Directive 2014/30/EU (Electromagnetic Compatibility)

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

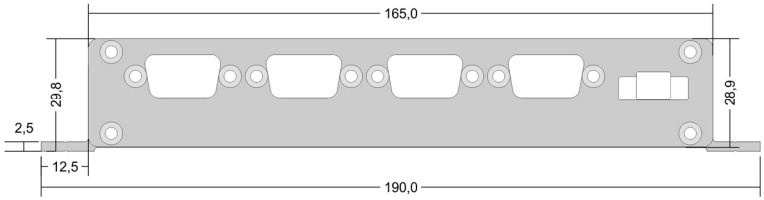
Darmstadt, 23 October 2020

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawing



Top view (measures in mm)



Front view (measures in mm)

The figures do not show the original size.

Appendix C Contents of a CompactFlash Card

Applies to the standard firmware.

Contents of a CompactFlash card being prepared for data logging:

- File system FAT16 (often just called FAT)
- File `trace.btr` in the root directory (file name extension `.btr` = binary trace)
- File size: a multiple of 512 bytes (min. 1024 bytes), not fragmented
- File contents: empty bytes (00h)

The size and the time stamp of the file `trace.btr` are not altered by the PCAN-Router Pro at data logging.

Capacity of CAN messages of the file `trace.btr`:

$$\text{CAN messages} = \left(\frac{Bytes_{trace.btr}}{512} - 1 \right) \cdot 25 \quad \text{(theoretical value)}$$

Important Note: To optimize performance and reduce memory card accesses, the PCAN-Router Pro saves incoming messages in blocks. This means that the available storage space cannot be used optimally. The size of the memory blocks is configurable. For more information please contact our support: `support@peak-system.com`

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 contains the following battery:

- 1 x button cell CR1620 3.0 V

Appendix E Router Resources

The table lists all the logical resources of the PCAN-Router Pro with standard firmware, arranged by I/O functions (column “I/O Function”) and the respective I/O numbers (column “I/O Number”).

I/O Function	I/O Number	Number of Bits	Value Range	Function
DOut Level (00h)	LED CAN x	1		CAN status LEDs 1 - 8 (= 1a - 4b)
Special Out (70h)	Selfhold	1	0: Off, 1: On	When turned on (wake-up), automatically set to 1. To switch off the module set to 0.
	CAN x Mode	3	0 - 5	Operation mode CAN transceiver x 0: Normal (all transceivers) 1: WakeUp (AU5790) 2: PowerDown (AU7590, PCA82C251, TJA1041, TJA1055) 3: ListenOnly (PCA82C251, TJA1041, TJA1055) 4: HighSpeed (AU5790) 5: Standby (PCA82C251, TJA1041, TJA1055)
	Beeper Pattern	32	Value from bit pattern (see right)	Tonal rhythm for beeper, resulting from a bit pattern (makes a 32-bit value): `tttttttt tttttttt tttttttt 00clllll` `t`: Sequence of 24 segments each 100 ms, where the beeper makes a sound (bit set) `c`: 0 = play sequence once, 1 = play sequence continuously `l`: Number of sequence segments `t` that are played (0 - 24)
	Routing x to y All	2	0 - 3	Forwarding of all CAN messages from CAN channel x to CAN channel y Bit 1 set: CAN messages with 11-bit ID (standard frame) Bit 2 set: CAN messages with 29-bit ID (extended frame)
	Routing x to y Explicit	11	11-bit CAN ID	Forwarding of CAN messages with the given 11-bit CAN ID
	Routing x to y Excluding	11	11-bit CAN ID	Forwarding of all CAN messages with 11-bit CAN ID except the specified 11-bit CAN ID
	Routing x to CF All	2	0 - 3	Forwarding all CAN messages from CAN channel x to the CF card. Prerequisite: I/O function *Special Out (70h) > Trace Enable* Bit 1 set: CAN messages with 11-bit ID (standard frame) Bit 2 set: CAN messages with 29-bit ID (extended frame)
	Routing x to CF Explicit	11	11-bit CAN ID	Forwarding of CAN messages with the given 11-bit CAN ID to CF card Prerequisite: I/O function *Special Out (70h) > Trace Enable*
	Routing x to CF Excluding	11	11-bit CAN ID	Forwarding of all CAN messages with 11-bit CAN ID except the specified 11-bit CAN ID to CF card Prerequisite: I/O function *Special Out (70h) > Trace Enable*
	Trace Enable	5	Value from bit pattern (see right)	Enable logging function for one or more CAN channels Prerequisite for the execution of I/O function *Special Out (70h) > Routing x to CF [All/Explicit/Excluding]* Each of the five bits represents a CAN channel (Example: CAN 3 and CAN 4 = 01100b = 12). The fifth, virtual CAN channel can create transmit messages that are included in the trace.

I/O Function	I/O Number	Number of Bits	Value Range	Function
	Trace Disable	5	Value from bit pattern (see right)	Disable logging function for one or more CAN channels Each of the five bits represents a CAN channel (Example: CAN 1 and CAN 3 = 00101b = 5). The fifth, virtual CAN channel can create transmit messages.
	Trace Clear	2	1, 2	Erases trace sessions on the CF card: 1 = Erases the contents of the current session and restarts the logging in this session. 2 = Erases all sessions and restarts the logging in a new first session.
	Trace Buffer Type	2	1, 2	Determines the mode for logging: 1 = linear: The logging stops when the trace file is full (default). 2 = circular: When the trace file is full, the logging restarts at the beginning.
	Configuration ID 7E7h Enable	4	Value from bit pattern (see right)	Determines for each CAN channel if it can receive configuration messages via the CAN ID 7E7h (on for all channels by default). At least one CAN channel must be selected for reception. Each of the four bits represents a CAN channel (Example: CAN 2 and CAN 4 = 1010b = 10). If 0 is indicated, 15 (all four CAN channels) is used automatically.
	RTC Set Year		0 - 99	Declarations for date and time to set the battery-buffered real-time clock Note: All declarations must be transmitted to the router. Initialization with the I/O function *Special Out (70 h) > RTC Write*
	RTC Set Month		1 - 12	
	RTC Set Day of Month		1 - 31	
	RTC Set Day of Week		1 = Mo ... 7 = Su	
	RTC Set Hour		0 - 23	
	RTC Set Minute		0 - 59	
	RTC Set Second		0 - 59	
	RTC Write	1	1	Initializes the real-time clock (RTC) with declarations from the I/O function *Special Out (70h) > RTC Set*
	RTC Set Alarm	32	Value from bit pattern (see right)	Sets the alarm time for turning on the PCAN-Router Pro when it is in power-down mode Bit pattern: `--MMMMMM MMDDDDDh hhhhmmmm mmssssss` `M` = month, `D` = day of month, `h` = hour, `m` = minute, `s` = second
	Logging Error Frames Enable	4	Value from bit pattern (see right)	Determines for each CAN channel if occurring error frames are recorded with the enabled logging function. Each of the four bits represents a CAN channel (Example: CAN 2 and CAN 3 = 0110b = 6).
	CAN x Bitrate Raw	32	Composition of different values (see right)	Sets the CAN bit rate for CAN channel x by the according register bytes for the CAN controller: 0x00YX00BB with BB = bit rate prescaler (BRP), X = Tseg1, Y = Tseg2; clock = 56 MHz; real value = register value + 1 Example for 800 kbit/s: 0x00290004 Register values: BB = 4, Tseg1 = 9, Tseg2 = 2 Real values: BBr = 5, Tseg1r = 10, Tseg2r = 3 Segment length (BBr / clock): 5 / 56 MHz = 89.286 ns Segment count (Sync + Tseg1r + Tseg2r): 1 + 10 + 3 = 14 Bit length (segment length * segment count): 89.286 ns * 14 = 1.25 µs, equivalent to 800 kbit/s
	CAN Bitrate: xy		0 - 3 (CAN channel 1 - 4)	Sets a CAN bit rate xy for the given CAN channel

I/O Function	I/O Number	Number of Bits	Value Range	Function
	None			No function Can be used as place-holder if the corresponding input or output has no function.
Const (CCh)	(Diverse values)			Diverse constants Read only; can be used as input constants
Positive Const (CDh)	0 to 255			Positive constants Read only; can be used as input constants
Negative Const (CEh)	0 to -255			Negative constants Read only; can be used as input constants
Special In (F0h)	Conf Ver Main	8	0 - 255	Main version number of the configuration Can be specified in the PPCAN-Editor 2 during the module-specific settings
	Conf Ver Sub	8	0 - 255	Secondary version number of the configuration
	FW Ver Main	3	0 - 7	Main version number of the firmware For information purposes
	FW Ver Sub	5	0 - 31	Secondary version number of the firmware
	FW Build	8	0 - 255	Build version number of the firmware
	Module ID	4	0 - 15	Router ID Position of the corresponding rotary switch on the board of the PCAN-Router Pro (see section 3.3 on page 18)
	Tx Msg Count CAN x	32		Number of transmitted CAN messages on CAN channel x
	Rx Msg Count CAN x	32		Number of received CAN messages on CAN channel x
	RTC Time	32	Value from bit pattern (see right)	Read current time from the real-time clock Bit pattern: `hhhhhhhh mmmmmmmm ssssssss cccccccc` `h` = hours, `m` = minutes, `s` = seconds, `c` = hundreds
	RTC Date	32	Value from bit pattern (see right)	Read current date from the real-time clock Bit pattern: `WWWW---- DDDDDDDD MMMMMMMM YYYYYYYY` `W` = day of week, `D` = day of month, `M` = month, `Y` = year
	RTC Alarm	32	Value from bit pattern (see right)	Read set alarm time from the real-time clock Bit pattern: `--MMMMMM MMDDDDDh hhhhmmmm mmssssss` `M` = month, `D` = day of month, `h` = hour, `m` = minute, `s` = second
	Main Cycle Counter	32	0 - 65535	Gives the average duration for a computation cycle of the firmware (since the last polling)
	Main Cycle Time Max [ms]	16		Gives the maximum duration for a computation cycle of the firmware
	Main Cycle Time Avg [µs]	16		Mean duration based on 1000 calculation cycles
	Rx Traffic Indicator CAN x	1	0, 1	Indicates the reception of CAN messages (monoflop 100 ms)
	Rx Error Counter CAN x	8	0 - 255	Counter of the CAN controller for reception errors
	Tx Error Counter CAN x	8		Counter of the CAN controller for transmission errors

I/O Function	I/O Number	Number of Bits	Value Range	Function
	Bus Error Counter CAN x	32	0 - 2^{32}-1	Counter of the CAN controller for bus errors
	Rx Queue Overrun CAN x	32		Counter for overrun of the reception queue
	Error Warning CAN x	32		Counter of the CAN controller for warning errors
	Error Passive CAN x	32		Counter of the CAN controller for passive errors
	Data Overrun CAN x	32		Counter of the CAN controller for data overrun errors
	Tx Traffic Indicator CAN x	1	0, 1	Indicates the transmission of CAN messages (monoflop 100 ms)
	Trace Status	16	Value from bit pattern (see right)	Status of logging to CompactFlash card Bit meaning: 0: No CF card inserted in the PCAN-Router Pro For a card detection a reset (power cycle) is required. 1: CF card does not contain a partition or more than one 2: CF card isn't formatted with the file system FAT16 3: Root directory cannot be found 4: Root directory cannot be opened 5: File `trace.btr` does not exist 6: File `trace.btr` cannot be opened 7: File pointer cannot be set to the start of the file 8: First sector of file `trace.btr` cannot be determined 9: Trace file is completely filled with CAN messages (linear record mode) 10: Maximum number of records is reached 11 - 15: (Not used)
	Trace File Msg Free	32	0 - 2^{32}-1	Number of CAN messages still fitting into the trace file
	Trace Queue Overruns	32		Number of CAN message not being processed by the CF card queue due to overload
	None			No function Can be used as place-holder if the corresponding input or output has no function.
32-bit Variable (FFh)	0 to 255	32	0 - 2^{32}-1 or -2^{31} - +2^{31}-1	256 disposable 32-bit variables; interpretation as Signed or Unsigned depending on context