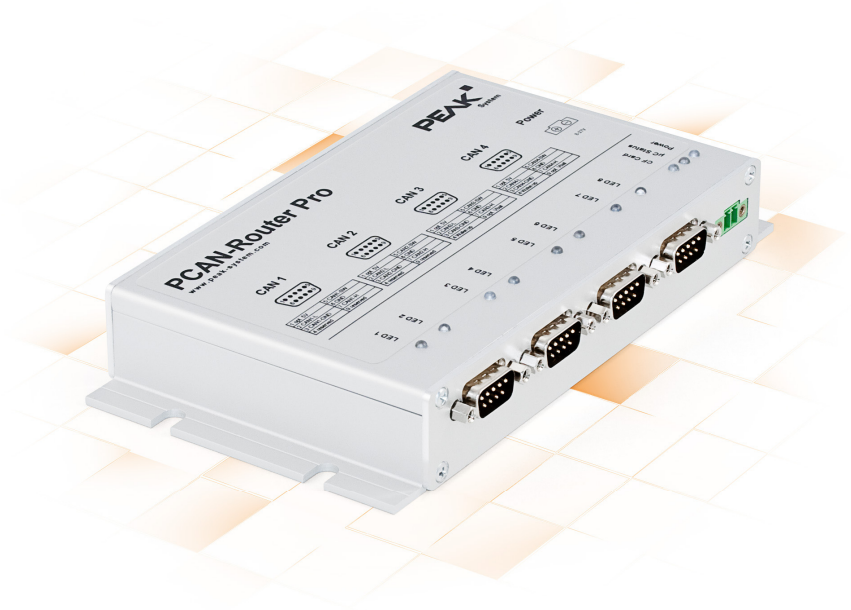
PCAN-Router Pro

4-Channel CAN Router with Data Logger

User Manual



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PEAK System

Relevant products

Product Name	Part number	Model
PCAN-Router Pro	IPEH-002212	Firmware version 1.4.x

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Contents

1 Introduction

The PCAN-Router Pro links the data traffic from up to four High-speed CAN buses. The behavior of the router is configured via the CAN bus with the provided Windows program PPCAN-Editor. 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 scope of supply includes a library and the Yagarto GNU ARM toolchain (contains the GNU Compiler Collection GCC for C and C++).

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 (Appendix E on page 56).
- PPCAN-Editor - Documentation (program help):
  The help of the configuration program PPCAN-Editor for Windows, accessible via the **Help** menu or via F1.

- PPCAN-Editor - 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 via pluggable transceiver modules (Wake-up capability); alternatively, Low-speed, Single-wire, and opto-decoupled High-speed modules, as well as High-speed modules without wake-up function available
- Wake-up via a separate input or the CAN bus
- Complies with CAN specifications 2.0 A/B
- CAN connection D-Sub, 9-pin
- CAN termination switchable, separately for each CAN channel
- Slot for CompactFlash card
- 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 LPC2294 microcontroller
- Aluminum casing with flange; DIN rail fixing option available on request
- Voltage supply from 8 to 27 V, protection against overvoltage and reverse polarity
- Extended operating temperature range from -40 to +85 °C (-40 to +185 °F)

Properties of the standard firmware:

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

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 10, 8.1, or 7 (32/64-bit) for the configuration program
- For converting logged CAN data:
  - Computer with card reader for CompactFlash cards
  - Windows 10, 8.1, or 7 (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

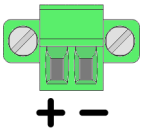
- PCAN-Router Pro in an aluminum casing
- Mating connector for power supply
- Configuration software PPCAN-Editor 2 for Windows
- Conversion software PEAK-Converter for Windows
- Industrial CompactFlash card (min. 1 GByte)
- Windows development software
  (Yagarto GNU ARM toolchain, flash program)
- Library with programming examples
- Manual in PDF format

2 Connectors

2.1 Power (Voltage 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.

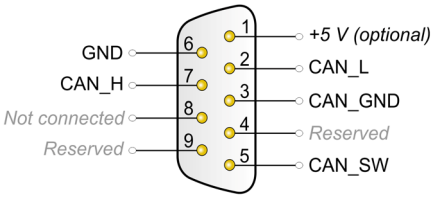
The connection is done with the supplied **mating connector** (Phoenix Contact MC1,5/2-STF-3,81) for fastening cable strands. The polarity is as follows:



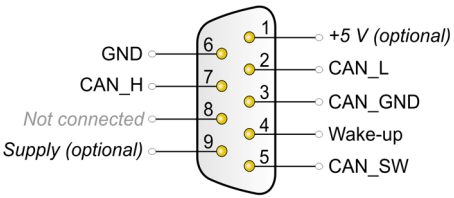
Note: After applying the supply voltage, the PCAN-Router Pro needs a wake-up signal in order to start operation. Having customized equipment, if there is no CAN transceiver module with wake-up function, the PCAN-Router Pro must be switched on with an external wake-up signal (see section 5.7.3 on page 32).

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:

Module name	Transmission standard	Special function	Used CAN lines
CAN-HS	High-speed CAN ISO 11898-2		CAN_L, CAN_H
HSGE2	High-speed CAN ISO 11898-2	Galvanic isolation up to 300 V for the CAN interface	CAN_L, CAN_H
CAN-HS-1041 (standard)	High-speed CAN ISO 11898-2	Wake-up via CAN	CAN_L, CAN_H
CAN-LS	Low-speed CAN ISO 11898-3	Wake-up via CAN	CAN_L, CAN_H
CAN-LS-SW	Single-wire CAN SAE J2411	Wake-up via CAN	CAN_SW

The D-Sub connectors have pins with additional functions:

Connectors	Pin	Function	See section...
CAN 1, CAN 2, CAN 3, CAN 4	1	5-Volt supply for external devices (to be activated on the circuit board)	3.4 on page 17
CAN 3, CAN 4	4	Input for external wake-up signal	5.7.3 on page 32
CAN 3, CAN 4	9	Supply of the router via a D-Sub connector (to be activated on the circuit board)	3.5 on page 18

Note: The additional functions at the D-Sub connectors are not galvanically isolated. When using the transceiver module HSGE2, 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 34.

3 Hardware Adjustments

You can adjust some hardware settings on the circuit board of the PCAN-Router Pro (corresponding section in brackets):

- Using an alternative CAN transceiver module (3.1 on page 13)
- Adjusting the termination for a CAN bus (3.2 on page 15)
- Setting the Router ID for the configuration (3.3 on page 16)
- Enabling the 5-Volt supply for external devices (3.4 on page 17)
- Enabling the supply of the router via a D-Sub connector (3.5 on page 18)
- Replacing the button cell for the real-time clock (RTC) (3.6 on page 20)

Do the following to **remove the circuit board from the casing** of the PCAN-Router Pro in order to access the possibilities for adjustments on the board:

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. Along the top edge of the casing remove two screws on each the front and the rear of the PCAN-Router Pro.
2. Take off the upper casing part.
3. On the front of the PCAN-Router Pro, remove the lower two screws.
4. Together with the front panel, pull out the circuit board into front direction from the casing's lower part.

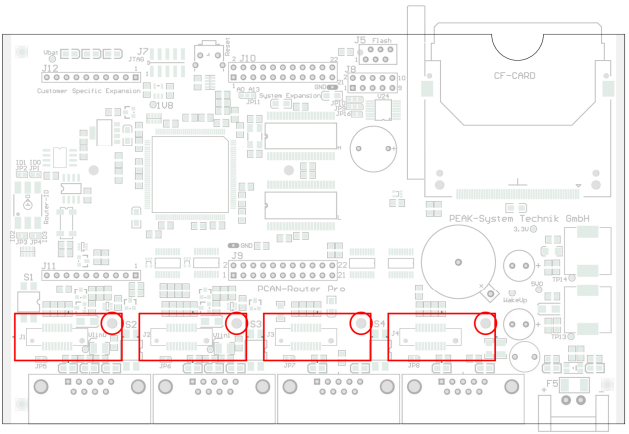
The subsequent **assembly** is done in reverse order. Take care about the light guides on the casing top.

3.1 Using an Alternative CAN Transceiver Module

For each of the four CAN connections an alternative CAN transceiver module can be inserted.

Following modules are available:

Module name	Transmission standard	Special function	Used CAN lines	Default bit rate
CAN-HS	High-speed CAN ISO 11898-2		CAN_L, CAN_H	500 kbit/s
HSGE2	High-speed CAN ISO 11898-2	Galvanic isolation up to 300 V for the CAN interface	CAN_L, CAN_H	500 kbit/s
CAN-HS-1041 (standard)	High-speed CAN ISO 11898-2	Wake-up	CAN_L, CAN_H	500 kbit/s
CAN-LS	Low-speed CAN ISO 11898-3	Wake-up	CAN_L, CAN_H	125 kbit/s
CAN-LS-SW	Single-wire CAN SAE J2411	Wake-up	CAN_SW	33.3 kbit/s



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

Do the following to replace a transceiver module:

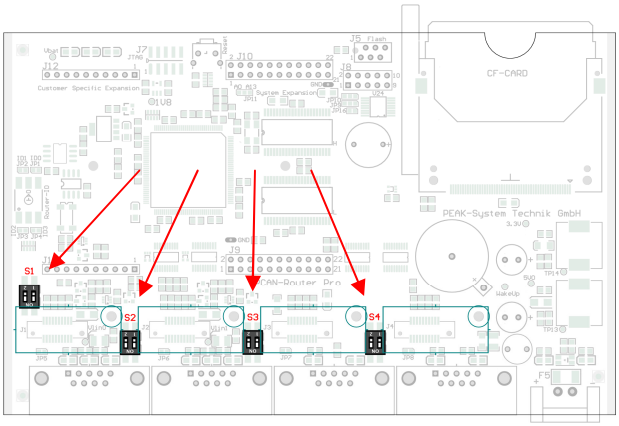
1. Remove the retaining screw from the transceiver module to be replaced. Take care of the spacer and the nut that are possibly get loose.
2. Pull off the transceiver module upwards from the main board.
3. Plug the alternative transceiver module onto the socket. Make sure that the hole in the transceiver module is aligned to the corresponding hole in the main board.
4. Secure the transceiver module with the screw, the spacer, and the nut.

At 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: Having customized equipment, if there is no CAN transceiver module with wake-up function, the PCAN-Router Pro must be switched on with an external wake-up signal (see section 5.7.3 on page 32).

3.2 Adjusting the Termination for a CAN Bus

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, the switches are set to off (opposite to position “ON” on a switch block).



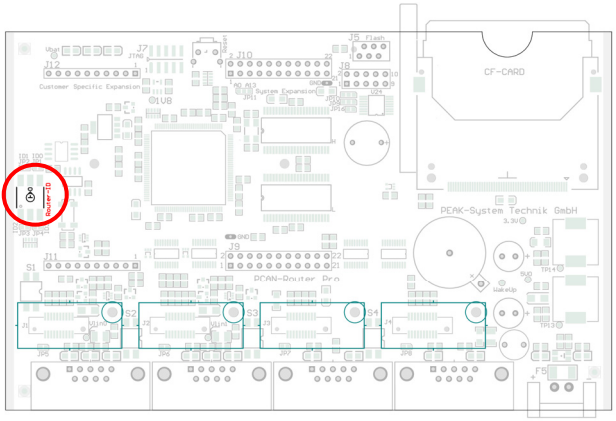
Positions of the switch blocks for CAN termination;
ON switch position is labeled on the switch blocks

Type of transceiver	Termination at switch position*	
	Off	ON
High-speed CAN (ISO 11898-2)	none	120 Ω between CAN_L and CAN_H
Low-speed CAN (ISO 11898-3)	4.7 kΩ for CAN_L and CAN_H	1.1 kΩ for CAN_L and CAN_H
Single-wire CAN (SAE J2411)	9.1 kΩ for CAN_SW	2.1 kΩ for CAN_SW

* Both switches of a switch block

3.3 Setting the Router ID for the Configuration

The board of the PCAN-Router Pro has a rotary switch with 16 settings to determine the Router ID (0 - F hex = 0 - 15).



Position of the rotary switch for the Router ID

When the PCAN-Router Pro 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 the PCAN-Router Pro 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 (start of the bootloader) on the PCAN-Router Pro with a serial number of 100 and above.

This is how you change the Router ID of a PCAN-Router Pro:

1. Change the position of the rotary switch with a small slot screwdriver.

2. Restart the PCAN-Router Pro by briefly cutting off the power supply.

   After the restart the changed Router ID will be active. Before the restart changes made at the rotary switch will have no influence on operation.

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.

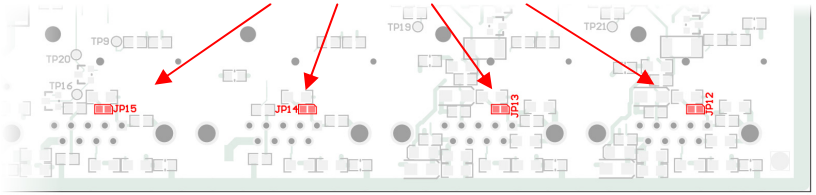
3.4 Enabling the 5-Volt Supply for External Devices

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.

➡ Proceed as follows to activate the 5-Volt supply:

Set the solder jumper(s) on the circuit board of the PCAN-Router Pro according to the desired function. During this procedure take especially care not to produce unwanted short circuits on the board.

The following figure shows the positions of the solder fields on the circuit board. The table below contains the possible settings.



Position of the solder fields on the bottom side of the circuit board
for the 5-Volt supply at the D-Sub connector
(JP12 on the right, JP15 on the left)

Connection	Solder field	No function	+5 V 100 mA
CAN 1, Pin 1	JP12		
CAN 2, Pin 1	JP13		
CAN 3, Pin 1	JP14		
CAN 4, Pin 1	JP15		

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.

3.5 Enabling the Supply of the Router via a D-Sub Connector

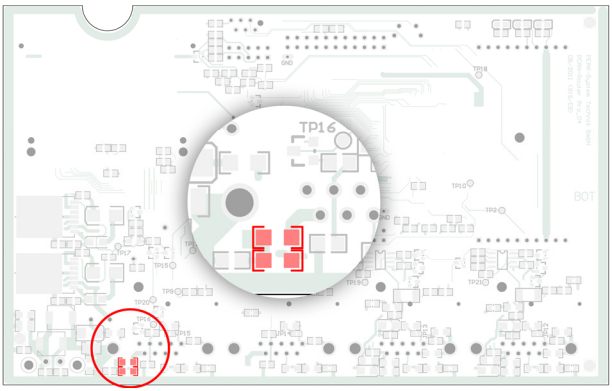
As an alternative to the “Power” connector intended for supplying the PCAN-Router Pro, it can be supplied via pin 9 of the D-Sub connector CAN 3 or CAN 4 with 8 to 27 V DC. On the circuit board of the PCAN-Router Pro, a connection to the desired D-Sub connector must be established with a solder bridge.

Pin 6 “GND” is used as negative for the supply.

Proceed as follows to enable the supply via a D-Sub connector:

Set the solder jumper on the circuit board of the PCAN-Router Pro according to the desired function. During this procedure take especially care not to produce unwanted short circuits on the board.

The following figure shows the positions of the solder fields on the circuit board. The table below contains the possible settings using solder bridges.

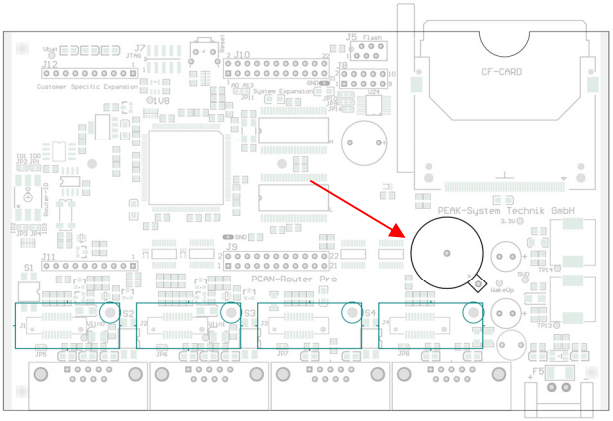


Position of the solder fields on the bottom side of the circuit board for the supply of the router via the D-Sub connector

Connection	No function	Supply is possible
CAN 3, Pin 9		
CAN 4, Pin 9		

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).



Position of the button cell for the real-time clock

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.

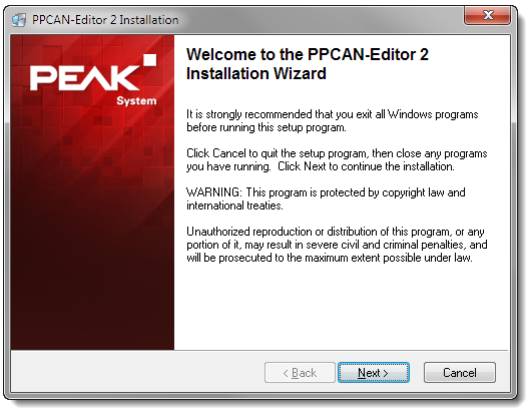
Find more details about recalling and setting the time in sections 5.3 *Shipping Configuration* on page 24 and 5.4 *Setting the Real-Time Clock* on page 27.

4 Installing Software

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

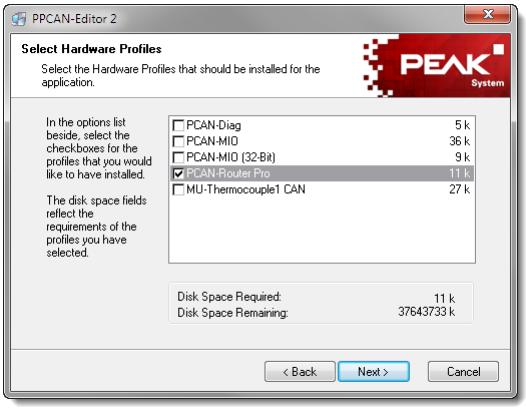
This is how to install the PPCAN-Editor:

1. On the supplied DVD, change to the following directory:
   `\Tools\PCAN-Router Pro\Tools\PPCAN-Edit`
2. Start the setup program
   `PPCAN-Editor2-Setup.exe`.



Startup screen of the installation program for the PPCAN-Editor

3. Follow the instructions of the setup program until you come to the step **Select Hardware Profiles**. At this point select at least the entry “PCAN-Router Pro” so that the PCAN-Router Pro will be supported by the PPCAN-Editor.



Choice of the hardware profile for the PCAN-Router Pro

4. Follow the remaining instructions of the setup program.

You can then launch the PPCAN-Editor, create a configuration, and send it to the PCAN-Router Pro. Find relevant information in the help of the PPCAN-Editor.

Note: The PPCAN-Editor 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

After applying a supply voltage, the PCAN-Router Pro does a reset and is turned off (power-down mode, Power LED off). For turning on the PCAN-Router Pro needs a wake-up signal.

The standard equipment of the PCAN-Router Pro provides High-speed CAN transceiver modules with wake-up function that automatically initialize a wake-up when a supply voltage is applied. Therefore, the PCAN-Router Pro immediately turns on by itself (Power LED on).

CAN transceiver module	Transmission standard	Wake-up function
CAN-HS	High-speed CAN ISO 11898-2	no
HSGE2	High-speed CAN ISO 11898-2	no
CAN-HS-1041 (standard)	**High-speed CAN ISO 11898-2**	**yes**
CAN-LS	Low-speed CAN ISO 11898-3	**yes**
CAN-LS-SW	Single-wire CAN SAE J2411	**yes**

Note: Having customized equipment, if there is no CAN transceiver module with wake-up function, the PCAN-Router Pro must be switched on with an external wake-up signal (see section 5.7.3 on page 32).

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.

Module name	Transmission standard	Default bit rate
CAN-HS	High-speed CAN ISO 11898-2	500 kbit/s
HSGE2	High-speed CAN ISO 11898-2	500 kbit/s
CAN-HS-1041 (standard equipment)	High-speed CAN ISO 11898-2	500 kbit/s
CAN-LS	Low-speed CAN ISO 11898-3	125 kbit/s
CAN-LS-SW	Single-wire CAN SAE J2411	33.3 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 16). 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.

For editing the shipping configuration in the PPCAN-Editor it is contained on the provided DVD as file `ShippingConfig.ppproj`.

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 27).

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

Position (byte:bit)	Length (bits)	Name of data variable	Description
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.

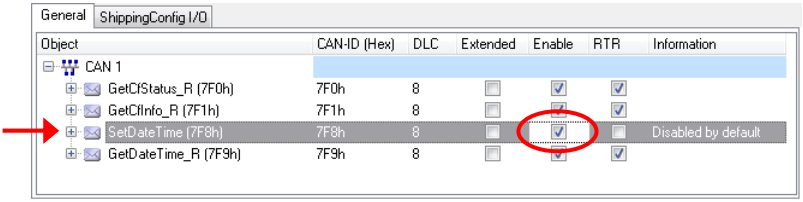
The following gives instructions about

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

PCAN-View is supplied with a CAN interface of the PCAN series (e.g. PCAN-USB).

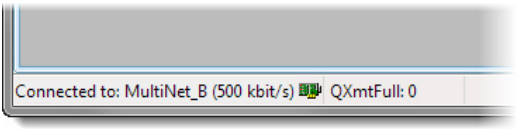
Do the following to adjust the shipping configuration and to transfer this to the PCAN-Router Pro:

1. Under Windows start the PPCAN-Editor.
2. Via **File > Open** or  , open the file `ShippingConfig.ppproj` residing in the following directory on the supplied DVD:
   `\Tools\PCAN-Router Pro\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 has access to this connection.



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

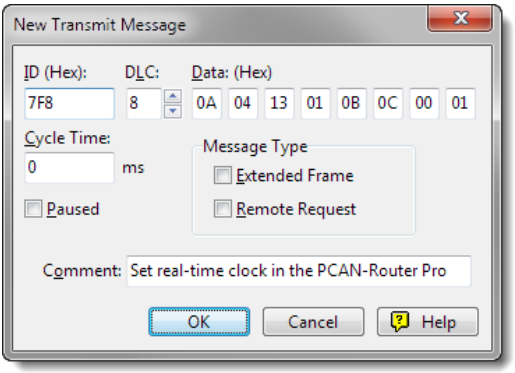
6. With **Transmit > Send Configuration** or send the altered configuration to the PCAN-Router Pro.

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 and establish a connection to the CAN bus that is connected with the PCAN-Router Pro, CAN channel 1.

2. On the **Transmit** panel insert the CAN message 7F8h with 8 data bytes for data, time, and the RTC update bit (see example below). Note that these are hexadecimal values. Since the message must only received once by the PCAN-Router Pro, a cyclic transmission isn't set.

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



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

3. 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	State	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 following section 5.7.
	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 16 Transferring a configuration to the PCAN-Router Pro: see program help of the PPCAN-Editor
	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 router turns on again (see the following section).

5.7 Wake-up

If the PCAN-Router Pro is in power-down mode (supply voltage is applied, Power LED off), a wake-up signal is needed for turning on. The following subsections show the options.

5.7.1 Wake-Up with Supply Voltage

If the PCAN-Router Pro contains at least one CAN transceiver module with wake-up function (this is the case with standard equipment), the Router is switched on automatically as soon as the supply voltage is applied.

If none of the CAN transceiver modules has the wake-up function, an external wake-up signal must be used (see section 5.7.3 on page 32).

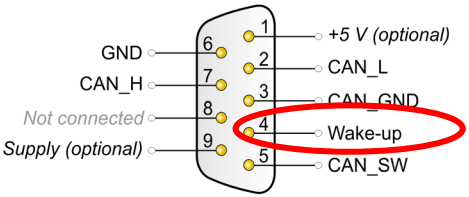
5.7.2 Wake-up via CAN

Note: 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.

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.

5.7.3 Wake-Up Externally 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

An external wake-up signal is required if none of the CAN transceiver modules in the PCAN-Router Pro has a wake-up function.

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

5.7.4 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.

6 Logging CAN Traffic onto a CompactFlash Card

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)

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

Do the following to prepare a CF card:

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 FAT** (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.

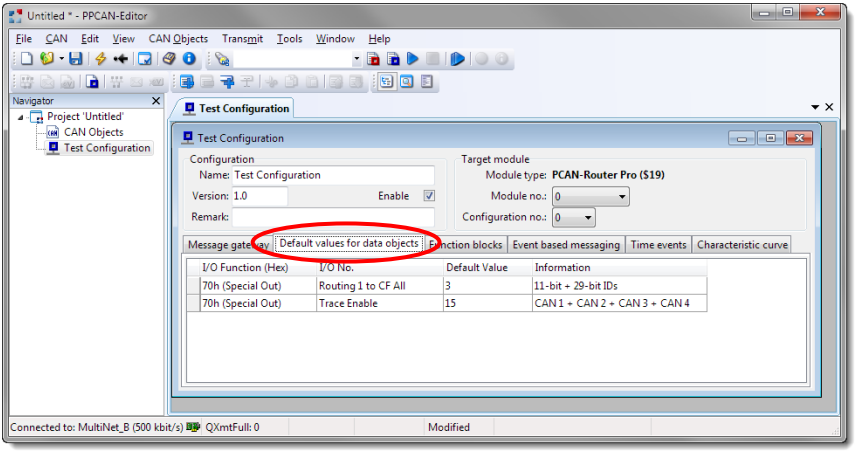
   For a start the file `trace.btr` is available in different sizes on the provided DVD. Decompress the respective ZIP archive directly to the root directory of the CF card.
4. Log off the CF card from the operation system (e.g. under Windows with the Eject command) and remove the card from the card reader of the computer. Then, 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.

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.

6.2 Preparing a Configuration for Recording

In the configuration program PPCAN-Editor 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

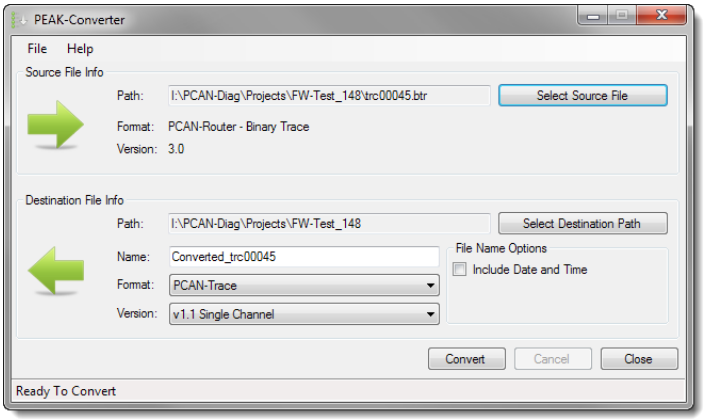
Further logging possibilities with the I/O function *70h (Special Out)*:

- *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 56.

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. To do so, the Windows program PEAK-Converter is available on the provided DVD.



User interface of the PEAK-Converter

Possible conversion targets:

Target format	File name extension	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).

For further use of the trace data proceed as follows:

1. Eject the CF card from the PCAN-Router Pro and insert it into the card reader of the computer.
2. From the provided DVD, start the converter program `PEAK-Converter.exe` located in the directory `Tools/PCAN-Router Pro/Tools/PEAK-Converter`.
3. As source select the file `trace.btr` from the CF card.
4. Specify a destination file and select the desired target format (see above). Do not save the destination file to the CF card.

7 Creating Custom Firmware

Besides the standard firmware, the PCAN-Router Pro (from serial number 100) can be operated with a custom firmware. This is based on the NXP LPC2294 microcontroller with ARM core. The functions of the PCAN-Router Pro are accessed via a software library.

Installation packages for the Yagarto GNU ARM toolchain for Windows and several code examples are on the provided DVD. You find the files in the following directory branch:

`/Develop/Microcontroller hardware/PCAN-Router Pro/`

7.1 Installing the GNU ARM Toolchain

To compile the code examples and the custom firmware code under Windows, install Yagarto on your computer. Yagarto is a collection of tools to develop applications for ARM processors and microcontrollers on Windows platforms. The collection includes the GNU GCC compiler for C and C++, Make, and further tools. Further information about Yagarto: www.yagarto.de

System requirement: Windows 10, 8.1, or 7 (32-/64-bit)

Do the following to install Yagarto:

1. From the directory branch on the provided DVD mentioned above, change to the `Compiler` subdirectory.

   The directory contains the two installation programs `yagarto-*.exe` and `yagarto-tools-*.exe`.

2. Execute the first installation program and follow its instructions.

If you don't want to use the default destination folder, make sure that your customized path doesn't contain any spaces. Otherwise compile operations will not work later.

3. Afterwards, execute the second installation program and follow its instructions.

In the system environment, the installation programs create search paths for the executable files. These new search paths are effective only for programs and command prompts that are started afterwards.

7.2 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. The library is documented in the header files (`*.h`). The files are located in each example directory.

7.3 Firmware Examples

On the DVD, the `Example` subdirectory contains source code for several firmware examples that you can use and test directly and that you can reuse for custom firmware.

Note: For the standard firmware of the PCAN-Router Pro, source code is not available.

7.3.1 Compiling a Firmware Example

Do the following to compile a firmware example under Windows:

1. From the provided DVD, copy the subdirectory of the desired example from the `Example` directory to the local hard disk.
2. Open a **command prompt** by using the Windows Start menu. Alternatively you can press the key combination ⊞ + R and enter `cmd.exe` as program to be executed.
3. At the command prompt, change to the previously copied directory.
4. Execute the following command in order to clean-up the target directories (i.e. `.out`) from files that have been generated earlier:

   ```
   make clean
   ```

5. Execute the following command to compile the firmware example:

   ```
   make all
   ```

   If the compiler has finished without errors (“Errors: none”), you can find the firmware file with the extension `.bin` in the subdirectory `.out`. This file is then used for firmware upload to the PCAN-Router Pro.

8 Firmware Upload

You can transfer (upload) a new version of the standard firmware as well as custom firmware to the PCAN-Router Pro. The upload of firmware to the PCAN-Router Pro is done via a CAN bus with the provided Windows program PCAN-Flash.

➡ Go through the following sections for a firmware upload.

Note: When updating the standard 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 to the PCAN-Router Pro after the firmware update.

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 10, 8.1, or 7 (32-/64-bit)
- For custom firmware:
  PCAN-Router Pro from serial number 100

8.2 Preparing Hardware and Software

For an upload of new firmware via CAN, the CAN bootloader must be activated in the PCAN-Router Pro. This is done with the Router ID rotary switch on the circuit board. This requires that the casing of the router is opened.

If the PCAN-Router Pro is currently operated with a **standard firmware**, you can alternatively activate the CAN bootloader by software just before the flash process. In this case it is not necessary to open the casing.

In the following instruction, steps that are only needed for one of these two activation types are marked as follows:

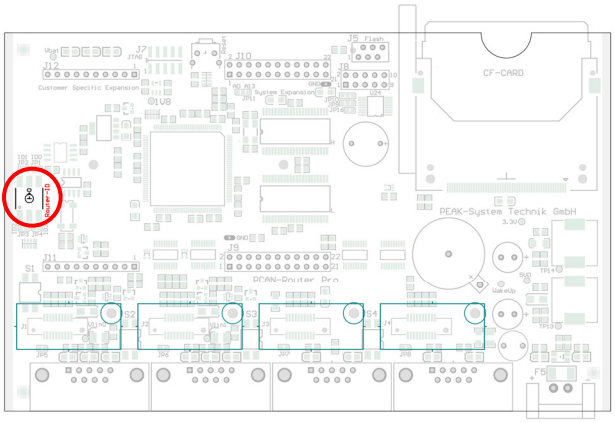
- BL-HW: activate bootloader by hardware
- BL-SW: activate bootloader by software

Furthermore, as part of the preparations a CAN connection must be established and software must be copied from the provided DVD.

Perform the following steps for preparation of the hardware:

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. Turn the PCAN-Router Pro off by disconnecting it from the power supply.
2. BL-HW: Along the top edge of the casing remove two screws on each the front and the rear of the PCAN-Router Pro. Afterwards take off the upper casing part.



Position of the rotary switch on the circuit board of the PCAN-Router Pro

3. BL-HW: Make a note of the current setting of the rotary switch “Router ID” and then turn it to “F”.

4. Connect CAN connector CAN 1 of the PCAN-Router Pro with a CAN interface connected to the computer. Pay attention to the proper termination of the CAN cabling (2 x 120 Ω).

   Uploading firmware via another CAN connector on the PCAN-Router Pro is not possible.

Perform the following steps for preparation of the software:

1. On the supplied DVD, change to the following directory: `/Develop/Microcontroller hardware/PCAN-Router Pro/`

2. Copy the subdirectory `PcanFlash` to the local hard disk.

   The contained Windows software that copies the Firmware via CAN (`PcanFlash.exe`) can only be started from a data carrier that is writable.

3. If you are updating the standard firmware, make sure beforehand that you've saved the current configuration(s)

on your computer in order to transfer them to the PCAN-Router Pro after the firmware update.

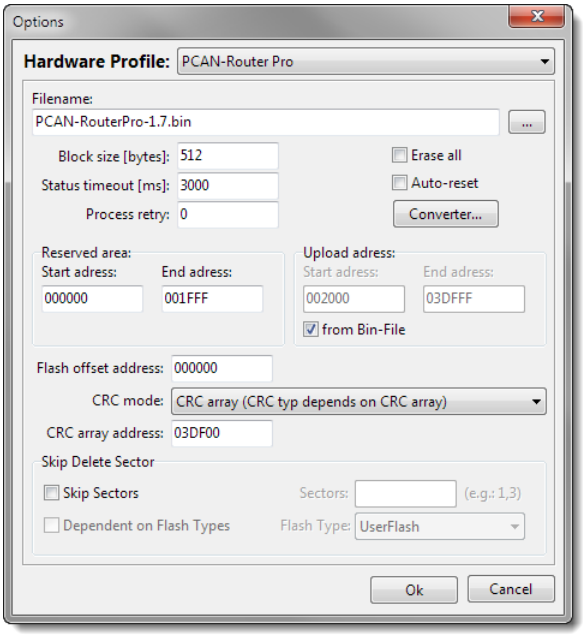
8.3 Sending the Firmware

The process of uploading new firmware to the PCAN-Router Pro is as follows:

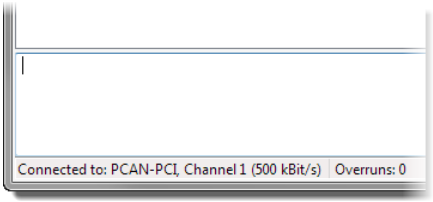
1. Turn on the PCAN-Router Pro by applying a supply voltage.

   BL-HW: The “µC Status” LED stays off, the LEDs of the CAN connectors CAN 1 to CAN 4 are blinking.

2. Run the program `PcanFlash.exe` under Windows from the local hard drive.
3. Click on the (Options) button in order to call up the dialog box.
4. From the **Hardware Profile** dropdown list, select the **PCAN-Router Pro** entry.

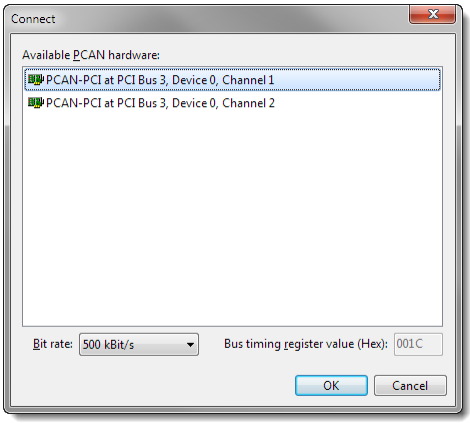


5. Click on the ... button next to the **File name** field in order to select the desired firmware file (`*.bin`) to be uploaded.
6. Click on the **OK** button.
7. Make sure that the PCAN-Flash program is connected with 500 kbit/s to the available CAN interface at the computer.



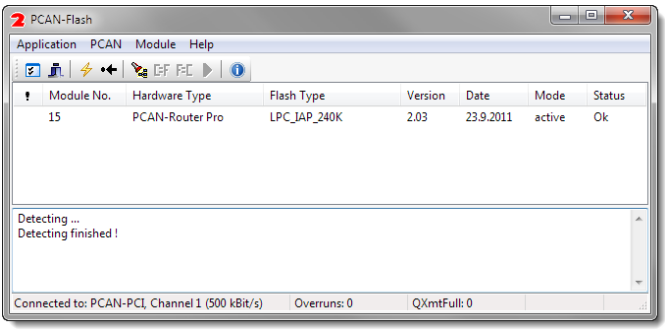
PCAN-Flash: Display of a connection in the status bar on the bottom.

If not, click the (Connect) button in order to change the selection in the according dialog box.



8. Click the (Detect) button in order to detect the PCAN-Router Pro connected to the CAN bus.

   An entry for the PCAN-Router Pro appears in the main window.



9. Select the entry for the PCAN-Router Pro.

10. BL-SW: Click the (Activate module) button.

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

11. Click the (Program) button in order to start uploading the new firmware to the PCAN-Router Pro.

    Observe the status indication at the bottom of the window. The process was successful if the last message to appear is “Flashing of module(s) finished!”.

12. BL-SW: Click the (Reset module) button.

    The “µC Status” is blinking.

13. BL-HW: Disconnect the power supply from the PCAN-Router Pro.

14. BL-HW: Turn the “Router ID” rotary switch back to the previously noted setting.

15. BL-HW: Put the cover back onto the casing (taking care of LED light guides) and fasten it with the four screws.

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

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.

9 Technical Specifications

Power supply	
Supply voltage	12 V DC, 8 - 27 V possible
Mating connector type	Phoenix Contact MC1,5/2-STF-3,81
Current consumption (at 12 V)	Idling: 65 mA Maximum (4 channels to CF): 95 mA Power-down mode: 470 µA
Wake-up time	165 ms
Auxiliary supply RTC	Button cell CR1620 3.0 V

Microcontroller	
Type	NXP LPC2294
Clock	56 MHz
Memory (internal)	Flash: 256 KByte (240 KByte usable for custom firmware) RAM: 16 KByte
External memory	RAM: 1 MByte
Firmware upload	via CAN (CAN interface of the PCAN series required for the PC)

CAN	
Standard transceiver	High-speed CAN ISO 11898-2 with wake-up function (TJA1041)
Other transceivers (on request)	High-speed CAN ISO 11898-2 (PCA82C251) without or with galvanic isolation Low-speed CAN ISO 11898-3 (TJA1055) with wake-up function Single-wire CAN SAE J2411 (TH8056) with wake-up function
Wake-up time	165 ms

CAN	
Termination	Setup with switches 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 * Determined by the transceiver module used for each CAN channel
CAN ID reserved for configuration transfer	7E7h

Data logging	
Medium	CompactFlash card, max. 2 GByte
Maximum size of a trace	2 GByte
Storage requirement	512 bytes per 25 CAN messages (independent of the message lengths)
Recording format	Proprietary binary format (`*.btr`), conversion options with the provided Windows program: - PCAN-Trace (`*.trc`) - Vector Trace (`*.asc`) - comma-separated values (`*.csv`)

Measures	
Size (casing)	190 x 29 x 104 mm (W x H x D) See also dimension drawing in Appendix B on page 53
Weight	570 g

Environment	
Operating temperature	-40 - +85 °C (-40 - +185 °F)
Temperature for storage and transport	-40 - +100 °C (-40 - +212 °F)
Relative humidity	15 - 90 %, not condensing
Ingress protection (IEC 60529)	IP20

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

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)

DIN EN 50581 VDE 0042-12:2013-02
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances;
German version EN 50581:2012

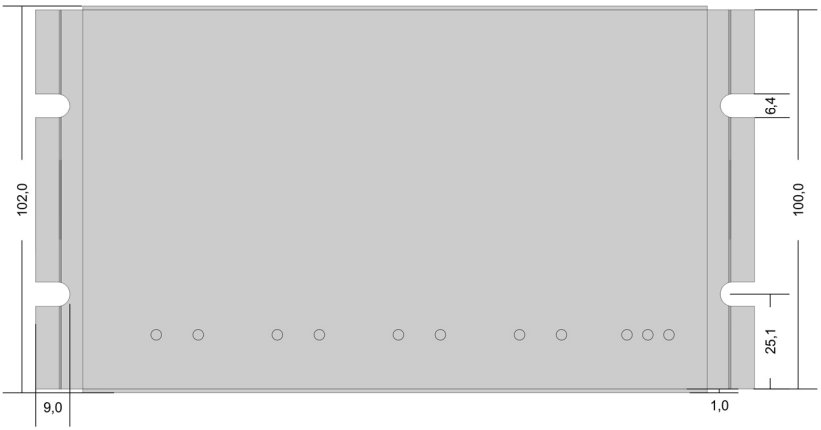
EU Directive 2014/30/EU (Electromagnetic Compatibility)

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

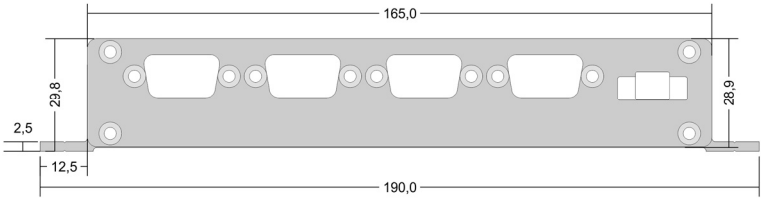
Darmstadt, 22 February 2019

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`:

$$\text{CAN-Nachrichten} = \left(\frac{\text{Bytes}_{\text{trace.btr}}}{512} - 1 \right) \cdot 25$$

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 = bitrate 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 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 16)
	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