PCAN-LIN

RS-232 to LIN/CAN Interface

User Manual v2.0.2

PEAK System

Products taken into account

Product Name	Model	Item Number
PCAN-LIN	High-speed CAN (HS-CAN)	IPEH-002025
PCAN-LIN	Low-speed CAN (LS-CAN)	IPEH-002028
PCAN-LIN	High-speed CAN, opto-decoupled (opto)	IPEH-002029

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Contents

1 Introduction

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

With the PCAN-LIN module data is exchanged between participants of LIN, CAN, and serial communication. With the configuration program for Windows several modes can be set. As LIN master the module can request data and forward the received LIN data to the CAN bus and/or to the serial interface.

This user manual discusses the use of the PCAN-LIN hardware. The software supplied on CD is described in the corresponding help. Information about the protocol for the communication via the serial interface can be found in the separate document "PCAN-LIN – Protocol Definitions".

1.1 Properties at a Glance

- Transmission/reception of LIN 1.x/2.x frames
- Default bit rate for LIN is 19,200 bit/s, for CAN 500 kbit/s
- Operation as Slave or Master/Slave in a LIN network
- Universal gateway (or router, if filter functions are used):
  - from RS-232 to LIN (and vice versa)
  - from RS-232 to CAN (limited bandwidth)
  - from LIN to CAN (as LIN master also vice versa)
- Initiation of single LIN frames from CAN or RS-232 possible while LIN schedule table is inactive
- Processing a definable LIN ID list (schedule table with limited number of entries)

- Modular configuration with Windows software via serial interface
- Transceiver for High-speed CAN (ISO 11898-2) or Low-speed CAN (ISO 11898-3), depending on model
- Galvanically separated RS-232 interface (only opto-decoupled model IPEH-002029)

1.2 System Requirements

- Voltage supply:
  - Modules up to ser. no. 999: 8 - 18 V DC
  - Modules from ser. no. 1000: 9 - 30 V DC
- For the serial connection to the computer: serial extension cable D-Sub 9-pin, RS-232 connector on the computer
- For the supplied configuration software: Windows 7/Vista/XP

1.3 Scope of Supply

- PCAN-LIN module
- CD-ROM with documentation (PDF) and Windows software
- On request: cable set for LIN, CAN, and voltage supply

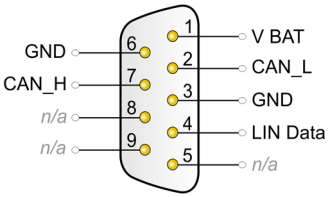
2 Connectors

The PCAN-LIN module has two 9-pin D-Sub connectors:

- Male: LIN, CAN, and voltage supply
- Female: RS-232

2.1 D-Sub Male Connector for LIN, CAN, and Voltage Supply

The field busses and the voltage supply (e.g. a car battery) are connected together via the D-Sub male connector on the PCAN-LIN module.



n/a = not assigned

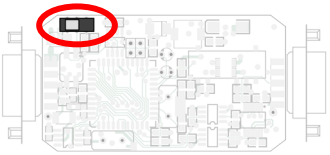
V BAT (up to ser. no. 999): 8 - 18 V DC
V BAT (from ser. no. 1000): 9 - 30 V DC

2.1.1 CAN Termination

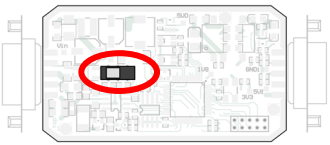
PCAN-LIN model	Termination	Comment
High-speed CAN (opto)	none	
Low-speed CAN	5.66 kΩ (default) / 560 Ω	Change between resistance values with switch on the circuit board; low resistance setting only necessary if few CAN nodes are connected to the Low-speed CAN bus.

- Do the following to change the resistance value of the **Low-speed CAN** termination:

1. Open the plastic casing of the PCAN-LIN module by cautiously pushing in the two latches on both sides, e.g. with a flat tip screwdriver.
2. On the PCAN-LIN circuit board there is a switch for the Low-speed CAN termination.



PCAN-LIN modules up to ser. no. 999



PCAN-LIN modules from ser. no. 1000

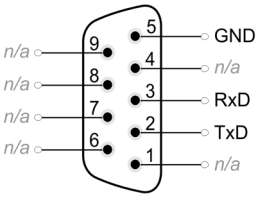
Set the switch according to the desired resistance value. Setting possibilities:

5.66 kΩ (default)	560 Ω
 (left)	 (right)

2.2 D-Sub Female Connector for RS-232

Via the serial interface (RS-232 specification) the PCAN-LIN module is linked to a computer or another monitoring or control unit. A computer can be connected to the PCAN-LIN module via a normal serial extension cable with 9-pin D-Sub connectors (no null modem cable).

For the serial communication only the two data lines and the ground connection are needed; handshake lines are not used.



n/a = not assigned

The RS-232 connection of the **opto-decoupled PCAN-LIN model** is galvanically separated from the other electronic circuits in the module. The maximum separation voltage is 1 kV.

3 Software Installation

The scope of supply contains the PCAN-LIN Configuration Tool for Windows.

To start the setup procedure of the software do the following:

1. Please make sure that you are logged in as user with administrator privileges.
2. Insert the supplied CD-ROM into a drive of the computer. The navigation program for the CD-ROM starts automatically after a short moment. If not, start the program `Intro.exe` from the root directory of the CD manually.
3. In the category **Tools** of the navigation program you'll find the entry **PCAN-LIN Configuration Tool**. Klick on **Install** in order to start the setup program.
4. Follow the instructions of the setup program.

After the software setup you can access the PCAN-LIN Configuration Tool via Windows' Start menu. You can find further information about the use of the PCAN-LIN Configuration Tool in the help which you can invoke in the program.

4 Operation

As soon as a supply voltage is applied via the D-Sub male connector (see section 2.1 on page 7), the PCAN-LIN module is ready for use. This is indicated by a short blink of both LEDs (Status LED: green, Transmission/Error LED: green and red).

4.1 Module Configuration

The PCAN-LIN module does not have any hardware switches. It is solely configured via the serial RS-232 interface. To do so, either the supplied Windows software PCAN-LIN Configuration Tool or self-developed software can be used.

Configurations for **basic use cases** are presented and explained in chapter 5 starting on page 13.

In a separate document, information about the **protocol definitions** related to the RS-232 interface can be found.

4.2 LEDs

The top of the PCAN-LIN module has two LEDs in the middle. These status indicators are mainly related to the LIN interface during operation and have following meanings:

Status (green)

If a LIN frame timeout occurs, e.g. because of an “slave not responding error”, the LED is toggled (on/off).

Transmission/Error (two-color)

For the duration of the transmission of a LIN frame the LED is lit green.

If an error occurs during the transmission (checksum error / transmitted data byte does not correlate to the received one at LIN Request Frames) the LED shortly flashes red.

Further possibilities for a red LED flash are:

- CAN bus error (item IPEH-002028 with Low-speed CAN transceiver only)
- The receive and transmit error counter has exceeded a limit

5 Configuration Examples

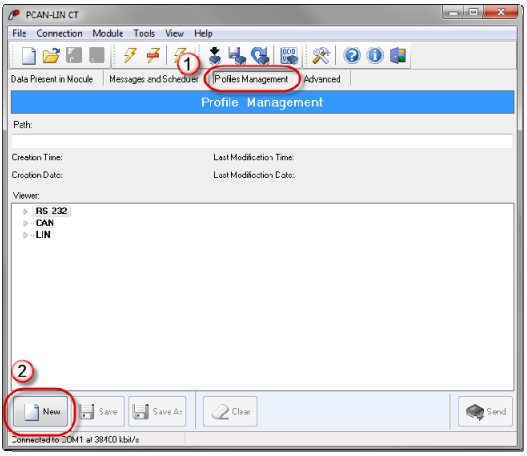
The chapter covers configuration examples for basic use cases.

LIN mode	Use case	See
Master	Gateway LIN - CAN	5.1 on page 15
	Master with Schedule Table	5.2 on page 17
	Gateway LIN - RS-232	5.3 on page 19
Slave	Gateway LIN - CAN (LIN Monitor)	5.4 on page 20
	LIN Slave	5.5 on page 22
No LIN	Gateway CAN - RS-232	5.6 on page 24

A configuration is created with the supplied Windows program PCAN-LIN Configuration Tool (version 3) and afterwards sent to the PCAN-LIN module via the RS-232 interface.

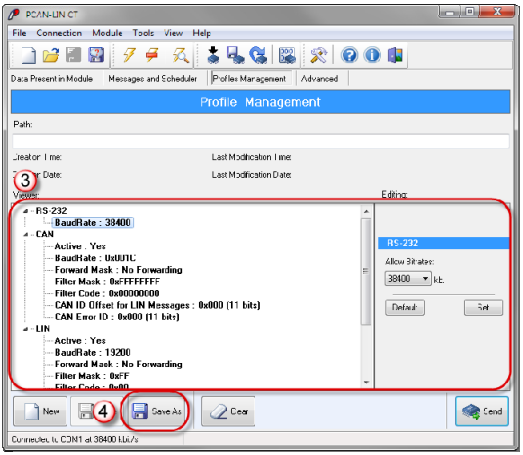
➡ Do the following to create a new profile:

1. In the Configuration Tool, select the **Profiles Management** tab.



2. Click the **New** button in the lower window area.

The parameters of the PCAN-LIN function units shown in the list are now provided with default values.



3. The configuration examples in the following manual sections contain tables with parameters for the corresponding profile. In the Configuration Tool, select a parameter in the tree view on the left and change its value on the right, according to the declaration in the table. Use the **Set** button during this procedure.
4. When finished the modifications, you can save the profile (**Save as** button).

Do the following to send the configuration to the PCAN-LIN module:

1. Establish the communication to the connected PCAN-LIN module (menu command **Connection** > **Connect**).
2. On the Profiles Management tab, click on the **Send** button on the lower right.
3. Confirm the questions. In this context, the configuration is permanently saved in the module and the module is reset in order to activate the new configuration.

5.1 Gateway LIN - CAN

Properties

- LIN master
- Monitoring of the LIN bus via CAN
- CAN frames initiate the transmission of LIN frames
- Transmission of a data frame on the LIN bus by transmitting a CAN data frame
- Request of a data frame on the LIN bus by transmitting a CAN remote frame

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	Bitrate		
CAN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	LIN	
		LIN & RS-232	RS-232 for diagnostic purposes
	Filter Mask	0xFFFFFFFF	All CAN frames are received
	Filter Code	0x00000000	
	CAN ID Offset	0x000 (11 bits)	
	CAN Error ID	*CAN ID*	For transmission of error and status messages. Is activated via LIN > Forward Mask > CAN Error.

Interface	Parameter	Setting	Comment
LIN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	CAN / CAN & RS-232	RS-232 for diagnostic purposes
	Filter Mask	0xFF	All LIN frames are received
	Filter Code	0x00	
	Master Status	Inactive	Schedule table not processed
	LIN Bus Termination	Master	
	Scheduler Entries		Not relevant (see Master Status)
	Slave ID + Data Configuration	Disabled	
	Frame Configuration	*Application-specific*	
	CAN ID for Slave Activation	Disabled	

Bold = needed modification compared to the default setting

5.2 Master with Schedule Table

Properties

- LIN master
- Schedule table is processed autonomously
- Optional: forwarding of LIN data to CAN/RS-232
- Optional: module itself transmits additional data, dynamical update of the data via CAN/RS-232

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	Bitrate		
CAN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	No Forwarding	
	Filter Mask	0xFFFFFFFF	All CAN frames are received
	Filter Code	0x00000000	
	CAN ID Offset	0x000 (11 bits)	
	CAN Error ID	*CAN ID*	For transmission of error and status messages. Is activated via LIN > Forward Mask > CAN Error.

Interface	Parameter	Setting	Comment
LIN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	none	
	Filter Mask	0xFF	All LIN frames are received
	Filter Code	0x00	
	Master Status	Active	Schedule table is processed automatically after module start
		Inactive	Processing of schedule table must be started manually
	LIN Bus Termination	Master	
	Scheduler Entries	*Application-specific*	
	Slave ID + Data Configuration	Disabled	
	Frame Configuration	*Application-specific*	
	CAN ID for Slave Activation	Disabled	

Bold = needed modification compared to the default setting

5.3 Gateway LIN - RS-232

Properties

- LIN master
- Controlling of LIN bus via RS-232
- Data is transmitted to LIN slaves or requested from them via RS-232 command

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	**Bitrate**	*Application-specific*	
CAN	**Activation**	No	
LIN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	RS-232	
	Filter Mask	0xFF	All LIN frames are received
	Filter Code	0x00	
	Master Status	Inactive	Schedule table not processed
	LIN Bus Termination	Master	
	Scheduler Entries		Not relevant (see Master Status)
	Slave ID + Data Configuration	Disabled	
	Frame Configuration	*Application-specific*	
	CAN ID for Slave Activation	Disabled	

Bold = needed modification compared to the default setting

5.4 Gateway LIN - CAN (LIN Monitor)

Properties

- Only listener on the LIN bus
- No sending of LIN data
- Forwarding of LIN data to CAN/RS-232

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	**Bitrate**	*Application-specific*	
CAN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	No Forwarding	
		RS-232	For diagnostic purposes
	Filter Mask		Not relevant
	Filter Code		
	CAN ID Offset	0x000 (11 bits)	
	CAN Error ID	*CAN ID*	For transmission of error and status messages. Is activated via LIN > Forward Mask > CAN Error.

Interface	Parameter	Setting	Comment
LIN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	CAN	RS-232 also possible
	Filter Mask	0xFF	All LIN frames are received
	Filter Code	0x00	
	Master Status	Inactive	Schedule table not processed
	LIN Bus Termination	Slave	
	Scheduler Entries		Not relevant (see Master Status)
	Slave ID + Data Configuration	Disabled	
	Frame Configuration	*Application-specific*	
	CAN ID for Slave Activation	Disabled	

Bold = needed modification compared to the default setting

5.5 LIN Slave

Properties

- Response to LIN header from an outside master
- Reception of LIN frames, forwarding of the frames to CAN/RS-232 possible
- Update of LIN data via the CAN ID

  `<CAN ID Offset> + <LIN ID> + 0x40`

- Update of LIN data via RS-232

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	Bitrate	*Application-specific*	
CAN	**Activation**	No	
		Yes	If LIN data shall be updated via CAN
	Bitrate	*Application-specific*	
	Forward Mask	No Forwarding	
		RS-232	For diagnostic purposes
	Filter Mask	0xFFFFFFFF	All CAN frames are received
	Filter Code	0x00000000	
	CAN ID Offset	0x000 (11 bits)	Update of LIN data with CAN IDs 0x40-0x7F
	CAN Error ID	*CAN ID*	For transmission of error and status messages. Is activated via LIN > Forward Mask > CAN Error.

Interface	Parameter	Setting	Comment
LIN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	No Forwarding	
		CAN / CAN & RS-232 / RS-232	Alternative settings for monitoring purposes
	Filter Mask	0xFF	All LIN frames are received
	Filter Code	0x00	
	Master Status	Inactive	Schedule table not processed
	LIN Bus Termination	Slave	
	Scheduler Entries		Not relevant (see Master Status)
	Slave ID + Data Configuration	Disabled	
	Frame Configuration	*Application-specific*	
	CAN ID for Slave Activation	Disabled	
		CAN ID (not related to CAN ID Offset)	Modifies the LIN slave mask dynamically during runtime (on/off, reaction to LIN requests)

Bold = needed modification compared to the default setting

5.6 Gateway CAN - RS-232

Properties

- Simple gateway in order to forward CAN data to RS-232 and vice versa
- No LIN functionality

Profile in the Configuration Tool

Interface	Parameter	Setting	Comment
RS-232	Bitrate	*Application-specific*	
CAN	Activation	Yes	
	Bitrate	*Application-specific*	
	Forward Mask	RS-232	
	Filter Mask	0xFFFFFFFF	All CAN frames are received
	Filter Code	0x00000000	
	CAN ID Offset	0x000 (11 bits)	
	CAN Error ID	0x000 (11 bits)	
LIN	**Activation**	No	

Bold = needed modification compared to the default setting

6 Firmware Update

You can use the program Flash Magic to upload a new firmware to the PCAN-LIN module.

Prerequisites:

- You need a hex file containing the new firmware.
- The software Flash Magic which transfers the new firmware to the PCAN-LIN module must be installed on your computer.

You can obtain new firmware on request from PEAK-System Technik (contact: see on page 2); the installation file for Flash Magic is on the provided CD in the `Tools` branch.

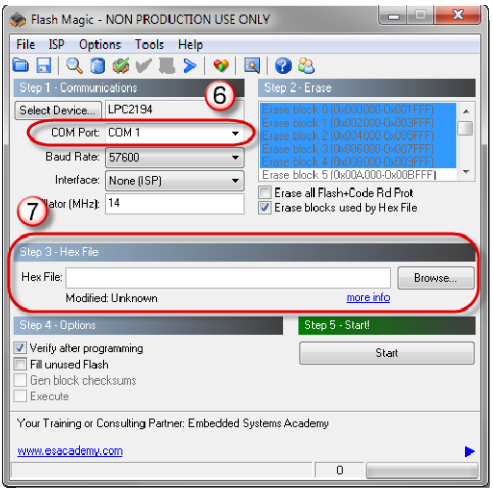
Do the following to update the firmware:

1. Start the PCAN-LIN Configuration Tool.
2. Establish the communication to the connected PCAN-LIN module (menu command **Connection** > **Connect**).
3. Select the menu command **Module** > **Programming mode** and confirm the question.

   Both LEDs on the PCAN-LIN module are lit green.
4. Start the program Flash Magic.
5. Depending on the serial number of the used PCAN-LIN modules, matching presets must be selected for the programming process. Select the menu command **File** > **Open Settings** and then one of the two settings files that are included on the provided CD in the directory `Tools\PCAN-LIN`:

Ser. no. PCAN-LIN	Microcontroller	Settings file
up to 999	XA-G49	`PCAN-LIN_XA.fms`
from 1000	LPC2194	`PCAN-LIN_LPC.fms`

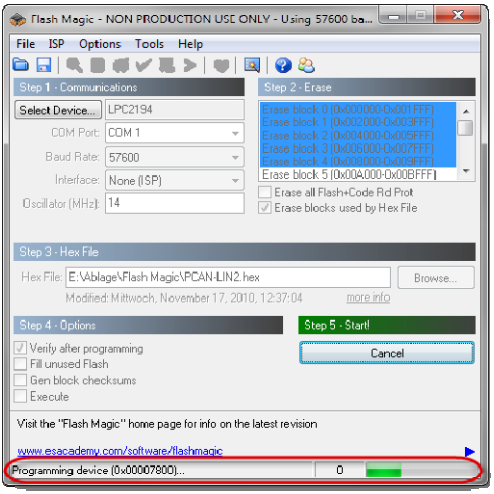
6. If the serial connection to the PCAN-LIN module isn't established via COM1, select another COM port in area **Step 1**.



7. In area **Step 3** choose the hex file with the new firmware by clicking the **Browse** button.

8. Click on the button **Start**.

   The process status of the programming sequence is shown in the status bar. The steps Erasing, Programming, and Verifying are performed.



9. When the update procedure has ended successfully (message “Finished”), quit the program Flash Magic and restart the PCAN-LIN module by interrupting the supply voltage for a moment.

7 Technical Specifications

Power supply		
Supply voltage	R2*: 8 - 18 V DC R3*: 9 - 30 V DC	
Current consumption	PCAN-LIN HS-CAN: PCAN-LIN LS-CAN: PCAN-LIN HS-CAN opto:	max. 130 mA max. 130 mA max. 140 mA

Serial interface	
Standard	RS-232
Bit rates	R2*: max. 38,400 bit/s R3*: max. 115,200 bit/s
Galvanic isolation	between RS-232 and LIN/CAN, max. 1 kV (only PCAN-LIN HS-CAN opto)

LIN	
Standard	ISO 15765-2, LIN 1.x and LIN 2.0
Transceiver	R2*: TLE6259 R3*: MAX13020
Bit rates	max. 20,000 bit/s
Termination	1 kΩ, switchable via configuration

CAN		
	PCAN-LIN HS-CAN (opto)	**PCAN-LIN LS-CAN**
Standard	ISO 11898-2	ISO 11898-3
	CAN 2.0A/B (standard/extended format)	
Controller	R2*: SJA1000 R3*: integrated in the microcontroller	
Transceiver	R2*: PCA82C251 R3*: MAX3057	R2*: TJA1054 R3*: TJA1055
Bit rates	max. 1 Mbit/s	max. 125 kbit/s
Termination	none	5.66 kΩ (default) / 560 Ω

* R2 = modules with ser. no. up to 999, R3 = modules with ser. no. from 1000

Measures	
Size	91 x 42 x 20 mm (L x W x H) See also dimension drawing in Appendix B on page 32
Weight	PCAN-LIN HS-CAN: 47 g PCAN-LIN LS-CAN: 48 g PCAN-LIN HS-CAN opto: 50 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
EMC directives	DIN EN 55024:2003-10 DIN EN 55022:2008-05 EC directive 2004/108/EG

Appendix A CE Certificates

PCAN-LIN IPEH-002025/28/29, ser. no. 1 - 999 – EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the PCAN-LIN products
IPEH-002025/28/29, ser. no. 1 - 999

EC Directive

This product fulfills the requirements of EC directive 2004/108/EG on "Electromagnetic Compatibility" and is designed for the following fields of application as per the CE marking:

Electromagnetic Immunity
DIN EN 55024, Publication date: 2003-10
Information technology equipment – Immunity characteristics – Limits and methods of measurement (IEC/CISPR 24:1997, modified + A1:2001 + A2:2002);
German version EN 55024:1998 + A1:2001 + A2:2003

Electromagnetic Emission
DIN EN 55022, Publication date: 2008-05
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (IEC/CISPR 22:2005, modified + A1:2005);
German version EN 55022:2006 + A1:2007

Declarations of Conformity

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

PEAK-System Technik GmbH
Mr. Wilhelm
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29
E-mail: info@peak-system.com

Signed this 7th day of December 2010

PCAN-LIN IPEH-002025/28/29, ser. no. from 1000 – EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the PCAN-LIN products
IPEH-002025/28/29, ser. no. from 1000

EC Directive

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DIN EN 55024, Publication date: 2003-10
Information technology equipment – Immunity characteristics – Limits and methods of measurement (IEC/CISPR 24:1997, modified + A1:2001 + A2:2002);
German version EN 55024:1998 + A1:2001 + A2:2003

Electromagnetic Emission
DIN EN 55022, Publication date: 2008-05
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (IEC/CISPR 22:2005, modified + A1:2005);
German version EN 55022:2006 + A1:2007

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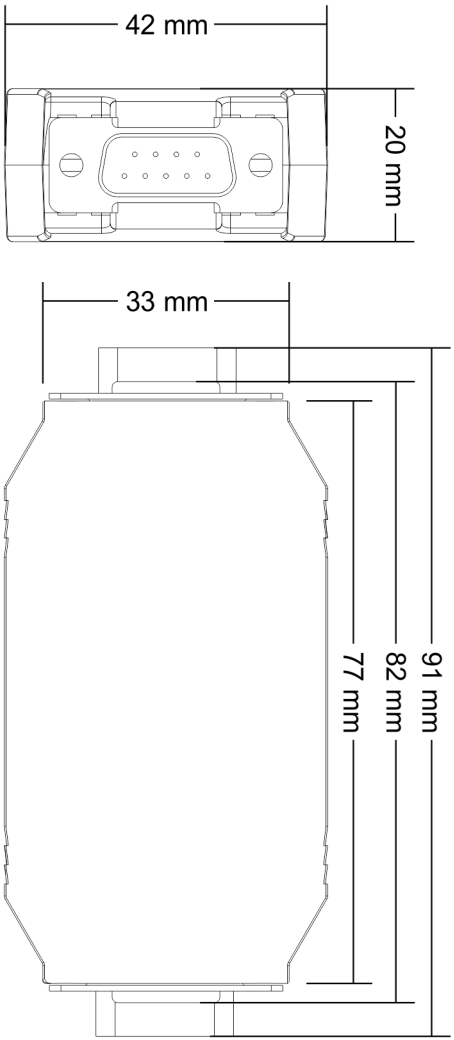
Fax: +49 (0)6151 8173-29
E-mail: info@peak-system.com

Signed this 7th day of December 2010

Appendix B Dimension Drawing



Appendix C Changes of Hardware/Software

This section covers the most important changes of the hardware and the software related to former versions.

C.1 PCAN-LIN Module

Property	Modules up to ser. no. 999	Modules from ser. no. 1000
Supply voltage	8 - 18 V DC	9 - 30 V DC
Microcontroller (relevant for firmware update)	XA-G49	LPC2194
LIN slave/master mode (in Configuration Tool: LIN Bus Termination)	LIN termination is switched; during transmission of a LIN header the master mode is automatically used, independent from the setting	LIN termination is switched; master mode is explicitly switched on or off

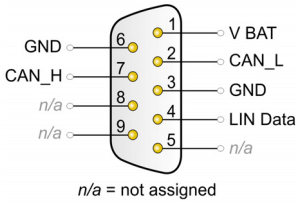
C.2 PCAN-LIN Configuration Tool

Property	Version 1	Version 3
Entries on the **Profiles Management** tab in the branch **LIN**	Number of Retries	Dropped
	Bit Recognition Status	No possibility for changing anymore; always active
	Slave Mask	Integrated into table under Frame Configuration
	Slave ID + Data Configuration: only a single ID	Entries possible for all IDs under Frame Configuration

Appendix D Quick Reference

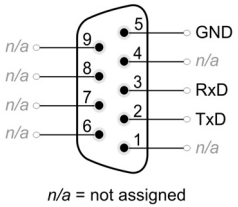
Connectors

D-Sub Male Connector for LIN, CAN, and Voltage Supply



V BAT (up to ser. no. 999): 8 - 18 V DC
V BAT (from ser. no. 1000): 9 - 30 V DC

D-Sub Female Connector for RS-232



Operation

When applying the supply voltage, the operational readiness of the PCAN-LIN module is indicated by flashes of both LEDs (Status LED: green, Transmission/Error LED: green and red).

Configuration Software (Windows)

For installation, from the navigation program of the supplied CD (`Intro.exe`) and the sub menu **Tools**, start the setup program for the **PCAN-LIN Configuration Tool**.