

PCAN-LWL

Optical Coupler for CAN-Data
Transmission

User Manual v2.0.0



Products taken into account

Product Name	Model	Part number
PCAN-LWL		IPEH-002026

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Document version 2.0.0 (2011-11-18)

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1 Introduction




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

For use in explosion-proof areas or for EMC measurements, the PCAN-LWL can be used to replace a stretch of CAN network with a fibre-optic line at any point. There are the options of conversion to High-speed CAN or Low-speed CAN. The modules are supplied with power externally.

1.1 Properties at a Glance

- LED display for transceiver status
- High-speed CAN: AMIS 30660 transceiver, max. 500 kbit/s, switchable 120 Ohm bus termination
- Low-speed CAN: TJA1054 transceiver, max. 125 kbit/s, switchable 510 Ohm / 5.6 kOhm bus termination, bus error display
- Fibre-optic duplex line, 62.5/125 μm , ST connectors
- Aluminum casing
- CAN bus connection via D-Sub, 9-pin (in accordance with CiA® 102)
- Supply voltage range from 6.5 to 30 V
- Supply via D-Sub 9 pin, or DC connector
- Operating temperature range from 0 to 70 °C (32 to 158 °F)

 **Note:** You can find additional information about the properties and the behavior of the LS-CAN transceiver TJA1054 in the corresponding data sheet, which you can download, e.g. from the NXP website: www.nxp.com

1.2 System Requirements

- High-speed CAN bus (ISO 11898-2, max. 500 kbit/s) or Low-speed CAN bus (ISO 11898-3, max. 125 kbit/s)
- 9-pin D-Sub socket for connection to the PCAN-LWL modules (pin assignment according to specification CiA® 102)
- Power supply with AC adaptor or via CAN bus

1.3 Scope of supply

- 2 CAN to optical waveguide converters including power supply units
- A choice of 5 or 10 m FO cable, 62.5 / 125 μm , duplex line, ST connector, other lengths available on request
- Manual in PDF format

2 Connections

2.1 CAN

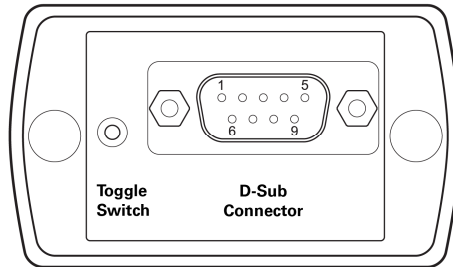


Figure 1: Side of the case with toggle switch and CAN connector

A CAN bus (High-speed CAN as well as Low-speed CAN) is used to the 9-pin D-Sub connector on the left side of the case. The pin assignment for CAN corresponds to the specification CiA[®] 102.

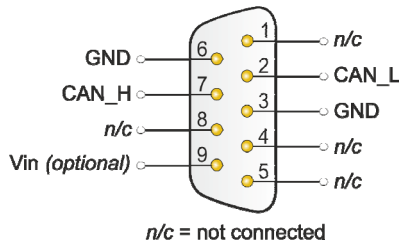


Figure 2: Pin assignment CAN connector

Pin 9 can be used to power the PCAN-LWL. In section 3.2 *Selecting the Power Supply* on page 11, you can find detailed information about the supply of the PCAN-LWL.

2.2 OWG

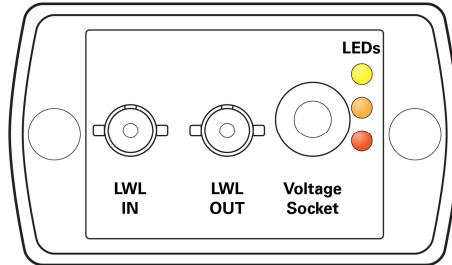


Figure 3: Side of the case with OWG connectors, voltage socket and LEDs

A PCAN-LWL module has two standardized ST connectors for the OWG connectors. The connectors are each responsible for transmission and reception of light signals.

Both OWGs of the duplex line are marked with colors at each connector (red/black), where a color is assigned to one OWG each. Connect each OWG output of one module with the OWG input of the other.

Optical wave guide (marker)	Connect at 1. PCAN-LWL module	Connect at 2. PCAN-LWL module
Red	LWL IN	LWL OUT
Black	LWL OUT	LWL IN

2.3 Power supply

A PCAN-LWL module needs a DC voltage of 6.5 to 30 V. On the voltage input socket you can connect the supplied AC adapter.

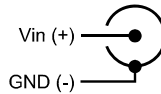


Figure 4: Assignment voltage input socket

In section 3.2 *Selecting the Power Supply* on page 11, you can find detailed information about the supply of the PCAN-LWL.

3 Configuration

At the PCAN-LWL housing the termination for a Low-speed CAN bus can be adjusted by a toggle switch and the termination for a High-speed CAN bus can be adjusted by a rotary switch.

On the circuit board of a PCAN-LWL you can do the following settings affecting the basic operation:

- Choice between High-speed and Low-speed CAN transceiver
- Choice of the input for the power supply



Tip: At shipment PCAN-LWL is pre-configured for use in a High-speed CAN bus and for the power supply via the separate voltage input socket. If you use this common configuration, a change of the basic settings as described in this chapter is not needed.

For the jumper settings on the circuit board this must be removed from the case.

➡ To do this, proceed as follows:

1. Remove the two screws from the left side of the case (side with the D-Sub connector).
2. Pull the circuit board with the lid out of the case.

After changing the settings (see the following subsections) the assembly is done in the reversed order.

3.1 selecting High-speed or Low-speed CAN transceiver

The PCAN-LWL system can be integrated in a High-speed CAN bus as well as in a Low-speed CAN bus. The corresponding CAN transceiver or mode must be selected by a jumper block on the respective circuit board of the PCAN-LWL.

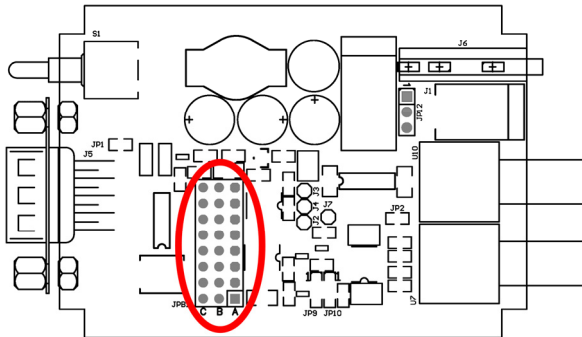


Figure 5: Position jumper block JPB1

Jumper block JPB1	Choice of transceiver	Meaning
B-A	High-speed CAN	Default setting at delivery
C-B	Low-speed CAN	

When setting the jumper block, make sure that the turn switch always is located on the side of the labels for the pin rows „C B A“.

While PCAN-LWL is operating, the set CAN mode is indicated by the corresponding LED at the case.

Note: It is also possible to use different transceivers with the two connected PCAN-LWL modules (conversion High-speed CAN/Low-speed CAN). You should make sure (like in any other case) that the transfer rates are the same in both CAN busses.

3.2 selecting the Power Supply Input

A PCAN-LWL module can be powered by an external voltage source (e.g. with the supplied AC adapter) via the corresponding input socket or via pin 9 of the CAN connector (in each case 6.5 – 30 V DC). The power supply input to be used must be set with the jumper JP12 on the circuit board of the PCAN-LWL module.

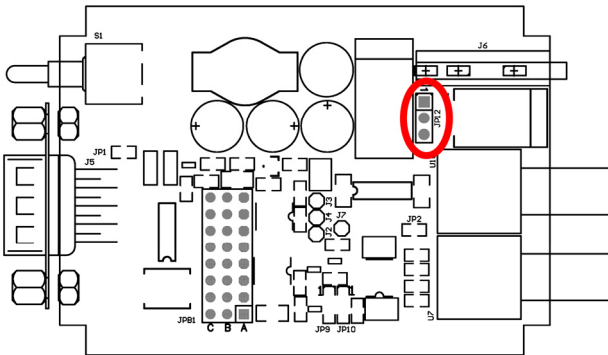




Figure 6: Position jumper JP12

Jumper JP12	Power supply via...	Meaning
1-2 	CAN connector, pin 9	At increased EMC requirements use a shielded cable for the supply and for CAN.
2-3 	Input socket for power supply	Default setting at delivery. Prefer this Input for EMC applications (additional integrated filter).

The unused power supply input according to the setting is electrically isolated from the actual used power supply.



⚠ Attention! Switch the power supply at the CAN bus off before connecting or removing the CAN plug at the PCAN-LWL module. Otherwise electronic parts may be destroyed, even on other nodes attached to the CAN bus.

3.3 CAN Termination

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN interface, control device) will not work.

3.3.1 Termination at High-speed CAN Bus

The High-speed CAN bus is terminated inside the PCAN-LWL module between CAN_L and CAN_H with 120 Ω . This termination can be switched on or off by using the turn switch that is accessible via the hole on the top side of the case. To do so, use a small flat tip screwdriver. The positions of the switch are defined as follows:

└ ON:  or 

└ OFF: 

3.3.2 Termination at Low-speed CAN Bus

Every node in a Low-speed CAN bus (ISO 11898-3) has a termination resistor. For optimum system conditions the whole CAN bus should be terminated with 100 Ω (parallel connection of all termination resistors). A single node should be terminated with 500 Ω up to 6 k Ω .

To simplify the adaptation of the PCAN-LWL to existing CAN busses you can switch between the termination resistors 510 Ω (Position of toggle switch up) and 5.6 k Ω (Position of toggle switch down).

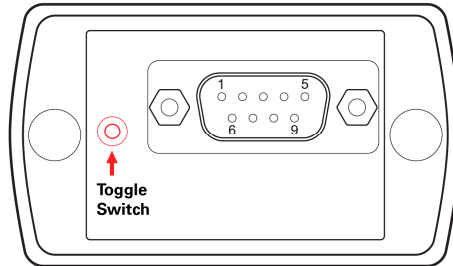


Figure 7: Toggle switch on the side of the case with D-Sub connector

For smaller CAN busses or for testing a single component the toggle switch should be set to $510\ \Omega$. For monitoring or configuration of existing CAN busses, that are already optimized regarding termination, the toggle switch should be set to $5.6\ \text{k}\Omega$ to minimize an influence on the total termination.

Note: When the High-speed CAN transceiver is activated, the toggle switch for the Low-speed CAN termination resistor doesn't have any influence.

4 Operation

4.1 CAN Bit Rate

When operating the PCAN-LWL modules it must be ensured that the bit rate is identical on the connected CAN busses. No conversion or automatic adaptation of the bite rate is done in the PCAN-LWL modules.

4.2 Signal Delay

Through the implementation of electric signals to light signals in the two PCAN-LWL modules, a signal delay of approx. 250 ns for the OWG set (2x PCAN-LWL + 5 m OWG) arises in High-speed CAN operation. This corresponds to a cable length of 50 m. In Low-speed CAN operation the two PCAN-LWL modules have a signal delay of approx. 1.5 μ s. This corresponds to a cable length of 300 m. Therefore, you should consider the dependence of the maximum length of a CAN bus on the bit rate. The following tables show the maximum possible CAN bus length at different bit rates.

Since the travel time of light signals in OWGs approximately equals the travel time of electric signals in copper (about 5 ns/m), the length of the duplex OWG is be taken into account 1:1 for the length of the CAN bus.

Bit rate High-speed CAN	Max. Bus length without PCAN-LWL	Max. Bus length with OWG set (2x PCAN-LWL + 5 m OWG)
500 kbit/s	110 m	60 m
250 kbit/s	240 m	190 m
125 kbit/s	500 m	450 m
50 kbit/s	1,3 km	For small bit rates the delay of the PCAN-LWL module can be neglected.
20 kbit/s	3,3 km	
10 kbit/s	6,6 km	
5 kbit/s	13,0 km	

Bit rate Low-speed CAN	Max. Bus length without PCAN-LWL	Max. Bus length with OWG set (2x PCAN-LWL + 5 m OWG)
125 kbit/s	500 m	200 m
50 kbit/s	1,3 km	1 km
20 kbit/s	3,3 km	3 km
10 kbit/s	6,6 km	For small bit rates the delay of the PCAN-LWL module can be neglected.
5 kbit/s	13,0 km	

The listed values have been calculated on the basis of an idealized system and can differ from reality.

4.3 Status LED

LED	Meaning
Yellow on	High-speed CAN connection
Orange on	Low-speed CAN connection
Red on	Error, Error condition on the Low-speed CAN

4.3.1 Red LED Low-speed „Error“

The red LED indicates the state of the error output of the Low-speed CAN transceiver. This output is active at following errors:

- └ Interrupt on CAN_H
- └ Interrupt on CAN_L
- └ Short circuit between CAN_H and GND
- └ Short circuit between CAN_H and VCC
- └ Short circuit between CAN_L and GND
- └ Short circuit between CAN_L and VCC
- └ Short circuit between CAN_H and CAN_L

Please see the data sheet for the CAN transceiver TJA1054 for more details.



Note: The red LED does not have any function at operation of PCAN-LWL in High-speed CAN mode.

5 Technical specification

CAN	
High-speed CAN	D-Sub plug, 9 pins, in accordance with CiA® 102 Transceiver: AMIS 30660 Bit rate: max. 500 kbit/s Bus termination: switchable 120 Ω
Low-speed CAN	D-Sub plug, 9 pins; in accordance with CiA® 102 Transceiver: TJA1054 Bit rate: max. 125 kbit/s Bus termination: switchable 510 Ω / 5,6 kΩ
Signal delay through 2x PCAN-LWL + 5 m OWG	High-speed CAN: approx. 250 ns Low-speed CAN: approx. 1,5 μs
Optical wave guide	Optical fibre duplex line with ST connector
Power supply	
Supply voltage	6,5 - 30 V
Power consumption	max. 50 mA (at 9 V)
Environment	
Operating temperature	0 - 70 °C (32 - 158 °F)
Temperature for storage and transport	-40 - 100 °C (-40 – 212 °F)
Relative humidity	15 - 90 %, not condensing
EMC	EN 55024:2003-10 EN 55022:2008-05 EC directive 2004/108/EG
Ingress protection (DIN EN 60529)	IP20
Measures	
Size	60 x 35 x 80 mm (B x H x T) See also dimension drawings Appendix B on page 19
Weight	138 g

Appendix A CE-Certificate

PCAN-LWL IPEH-002026 – EC Declaration of Conformity
PEAK-System Technik GmbH



Notes on the CE Symbol

The following applies to the PCAN-LWL products
IPEH-002026

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 + A2:2003);
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

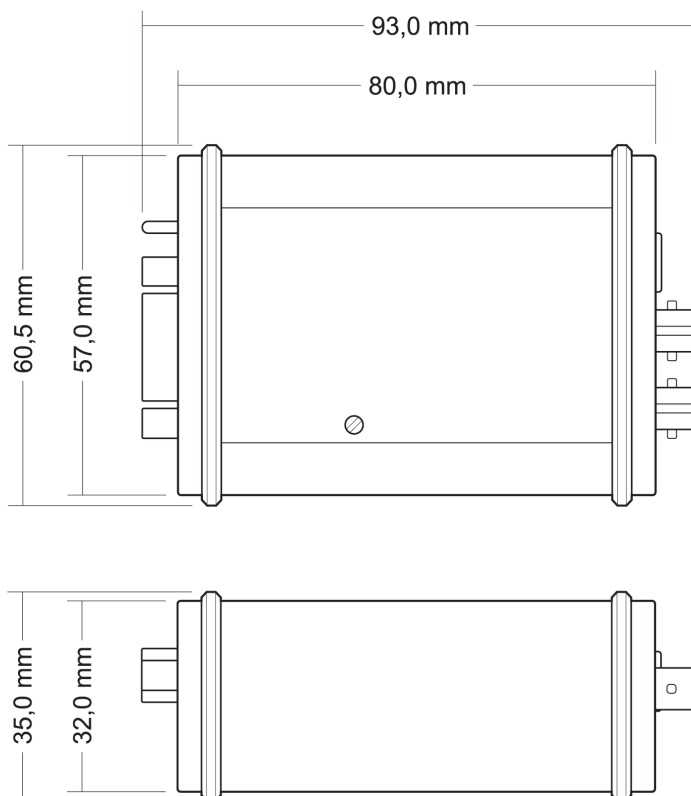
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A handwritten signature in black ink, appearing to read "Uwe W. A.", written in a cursive style.

Signed this 4th day of October 2011

Appendix B Dimension Drawing







This figure doesn't show the actual size of the product.

Appendix C Quick Reference

Basic Settings on PCAN-LWL Circuit Board

Jumper block JPB1	Choice of transceiver	Meaning
B-A	High-speed CAN	Default setting at delivery
C-B	Low-speed CAN	

Termination

CAN mode	Terminating resistor
High-speed CAN	120 Ω between CAN_L and CAN_H  ON:  or  , OFF: 
Low-speed CAN	510 Ω / 5,6 k Ω , switchable (toggle switch at the case)

Status LED

LED	Meaning
Yellow on	High-speed CAN connection
Orange on	Low-speed CAN connection
Red on	Error, Error condition on the Low-speed CAN

Connectors

