

# PCAN-LWL

Optical Coupler for  
CAN Data Transmission

## User Manual



Document version 2.0.3 (2013-07-24)

**PEAK**  
System

## Products taken into account

Product Name	Model	Part number
PCAN-LWL		IPEH-002026

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# 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-LWL modules.

For use in explosion-proof areas or for EMC measurements, two PCAN-LWL modules can be used to replace a stretch of CAN network with optical waveguides (OWG, German: LWL) 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 indication for transceiver status
- └ High-speed CAN: AMIS 30660 transceiver, max. 500 kbit/s, switchable 120 Ohm bus termination
- └ Low-speed CAN: TJA1055 transceiver, max. 125 kbit/s, switchable 510 Ohm/5.6 kOhm bus termination, bus error indication
- └ Fiber optic duplex line, 62.5/125  $\mu$ m, ST connectors
- └ Aluminum casing
- └ CAN bus connection via D-Sub, 9-pin (in accordance with CiA® 102)
- └ Supply voltage from 6.5 to 30 V
- └ Supply via D-Sub 9-pin, or DC socket (jumper)
- └ Operating temperature range from 0 to 70 °C (32 to 185 °F)



**Note:** You can find additional information about the properties and the behavior of the Low-speed CAN transceiver TJA1055 in the corresponding data sheet which you can download, for example, from the NXP website: [www.nxp.com](http://www.nxp.com)

## 1.2 Prerequisites for Operation

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

## 1.3 Scope of supply

- └ 2 pieces CAN to optical waveguide converter including AC adaptors
- └ Choice of 5 or 10 m FO cable, 62.5/125  $\mu\text{m}$ , duplex line, ST connectors, other lengths available on request
- └ Manual in PDF format

## 2 Connectors

### 2.1 CAN

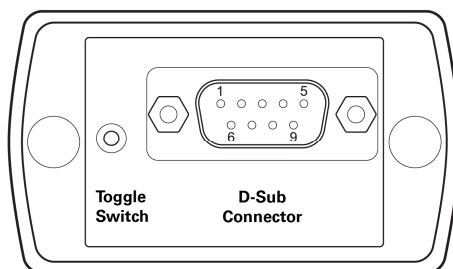


Figure 1: Casing side with toggle switch and D-Sub connector for CAN

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

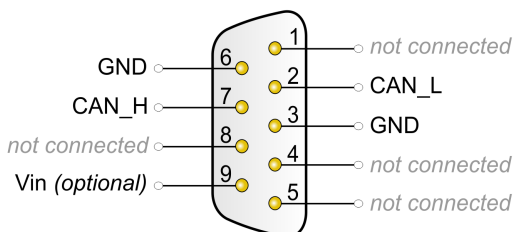


Figure 2: Pin assignment D-Sub connector

Pin 9 can be used for power supply of a PCAN-LWL module. See section 3.2 *Choice of the Input for the Power Supply* on page 11 for further information.

## 2.2 optical waveguides (OWG)

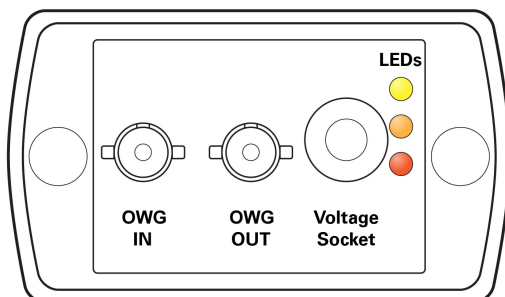


Figure 3: Casing side with OWG connectors, voltage socket, and LEDs

A PCAN-LWL module has two standardized ST connectors for the optical waveguides. The connections are separately in charge of sending and receiving light signals.

Both optical waveguides of the duplex line are marked with colors at each connector. For both modules, connect the OWG output of one module with the OWG input of the other.

Optical wave guide (marker)	Connector at 1 <sup>st</sup> PCAN-LWL module	Connector at 2 <sup>nd</sup> PCAN-LWL module
Red	OWG IN	OWG OUT
Black	OWG OUT	OWG IN

## 2.3 voltage supply

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

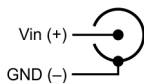


Figure 4: Assignment voltage input socket

See section 3.2 *Choice of the Input for the Power Supply* on page 11 for further information.



## 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 the PCAN-LWL module, you can do the following jumper settings affecting the basic operation:

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



**Tip:** At delivery, the PCAN-LWL set is configured to be used in a High-speed CAN bus system and to be supplied via the voltage input sockets on the housing sides of the PCAN-LWL modules. If you use this common configuration, a change of the settings as described in this chapter is not needed.

For doing jumper settings, the circuit board must be taken out of the casing.

➡ To do so, do the following:

1. If extant, remove the protecting caps from the OWG connectors (right housing side).
2. Remove the two screws on the left housing side (the one with the D-Sub connector).
3. 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 Choice Between High-speed and Low-speed CAN Transceiver

The PCAN-LWL set can be integrated into a High-speed CAN bus as well as into a Low-speed CAN bus. The corresponding CAN transceiver and mode must be selected by a jumper block on the circuit boards of the PCAN-LWL modules.

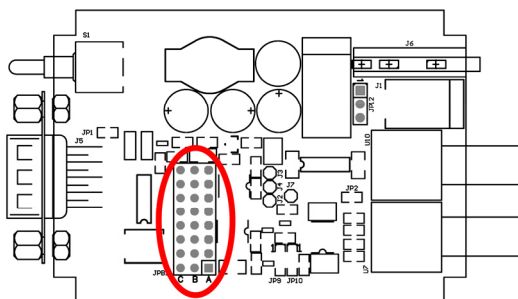


Figure 5: Position jumper block JPB1

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

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 the PCAN-LWL module is operating, the set CAN mode is indicated by the corresponding LED on the casing.



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

## 3.2 Choice of the Input for the Power Supply

A PCAN-LWL module can be supplied either by an external voltage source (e.g. the supplied AC adaptor) via the corresponding input socket or via pin 9 of the D-Sub 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.

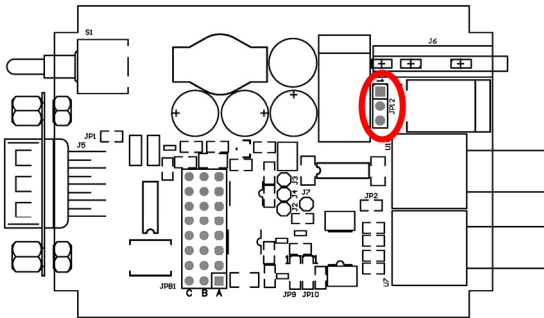




Figure 6: Position jumper JP12

Voltage supply via...	Jumper JP12	Comment
D-Sub connector, pin 9	1-2 	When having increased EMC requirements, use a shielded cable for the supply and for CAN.
Supply socket	2-3 	Default setting at delivery. This input is to be preferred for EMC applications (additional built-in filter).

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



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




## 3.3 CAN Termination

### 3.3.1 High-speed CAN Bus Termination

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

In the PCAN-LWL module, the High-speed CAN bus is terminated with 120  $\Omega$  between CAN\_L and CAN\_H. This termination can be switched on or off by using the turn switch that is accessible via the whole on the top side of the module casing. To do so, use a small flat tip screwdriver.

The positions of the switch are defined as follows:

- └ OFF:  (up)
- └ ON:  or  (left or right)

### 3.3.2 Low-speed CAN Bus Termination

Every node on a Low-speed CAN bus (ISO 11898-3) has a terminating resistor. For optimum system conditions, the whole network should be terminated with 100  $\Omega$  (parallel connection of all terminating resistors). A single node is terminated with 500  $\Omega$  up to 6 k $\Omega$ .

To simplify the adaptation of the PCAN-LWL module to existing networks, you can switch between the terminating resistors 510  $\Omega$  (up) and 5,6 k $\Omega$  (down) with a toggle switch at the casing.

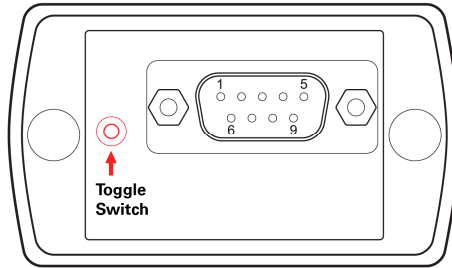


Figure 7: Toggle switch at the casing side with D-Sub connector

For smaller networks or for testing single components, set the switch to 510  $\Omega$ . For monitoring or configuring existing networks (already optimally terminated), set the switch to 5,6 k $\Omega$  in order to minimize an influence on the total termination.



**Note:** When the High-speed CAN transceiver is activated, the switch for the Low-speed CAN terminating resistor has no effect.

## 4 operation

### 4.1 CAN Bit Rate

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

### 4.2 Transit Delay

For the PCAN-LWL set (2 x PCAN-LWL + 5 m OWG stretch), a transit delay arises by the conversion of electric signals to light signals in the two PCAN-LWL modules:

Operation mode	Transit delay	Corresponding cable length
High-speed CAN	250 ns	50 m
Low-speed CAN	1.5 $\mu$ s	300 m

Because the travel time of light signals in optical waveguides approximately equals the travel time of electric signals in copper (about 5 ns/m), the length of the duplex optical waveguide can be taken into account 1:1 for the length of the CAN bus. Thus, there isn't an additional transit delay at this point.

When installing the PCAN-LWL set, consider the dependence of the maximum length of a CAN bus on the used bit rate. The following tables show the maximum CAN bus length at different bit rates.

Bit rate High-speed CAN	Max. bus length without PCAN-LWL	Max. bus length with PCAN-LWL set (2 x PCAN-LWL + 5 m OWG stretch)
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	Using these bit rates, the transit delay can be disregarded.
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 PCAN-LWL set (2 x PCAN-LWL + 5 m OWG stretch)
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	Using these bit rates, the transit delay can be disregarded.
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 LEDs

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

### 4.3.1 Red LED “Low-Speed Error”

The red LED indicates the error output of the Low-speed CAN transceiver. This output is active for the 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 TJA1055 CAN transceiver by NXP for further details ([www.nxp.com](http://www.nxp.com)).



**Note:** When operating the PCAN-LWL module in High-speed CAN mode, the red LED doesn't have a function.



## 5 Technical specifications

### CAN

High-speed CAN	D-Sub male connector, 9-pin, assignment according to specification CiA® 102 Transceiver: AMIS 30660 Bit rate: max. 500 kbit/s Bus termination: switchable 120 Ω
Low-speed CAN	D-Sub male connector, 9-pin, assignment according to specification CiA® 102 Transceiver: TJA1055 Bit rate: max. 125 kbit/s Bus termination: switchable 510 Ω/5.6 kΩ
Transit delay 2 x PCAN-LWL + 5 m OWG stretch	High-speed CAN: about 250 ns Low-speed CAN: about 1.5 µs
Optical waveguide	Fiber optic duplex line with ST connector

### Power supply

Supply voltage	6.5 - 30 V DC
Current 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 55024:2011-09 EN 55022:2011-12 EC directive 2004/108/EG
Ingress protection (IEC 60529)	IP20

### Measures

Size	60 x 35 x 80 mm (W x H x D) See also dimension drawing Appendix C on page 20
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: 2011-09  
Information technology equipment, immunity characteristics – Limits and methods of  
measurement (IEC/CISPR 24:1997, modified + A1:2001 + A2:2003);  
German version EN 55024:2010

### Electromagnetic Emission

DIN EN 55022, Publication date: 2011-12  
Information technology equipment – Radio disturbance characteristics – Limits and methods  
of measurement (IEC/CISPR 22:2005, modified + A1:2005);  
German version EN 55022:2010

### 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

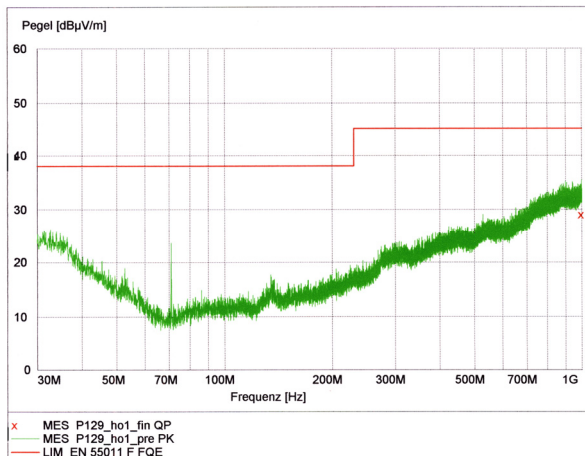
Phone: +49 (0)6151 8173-20  
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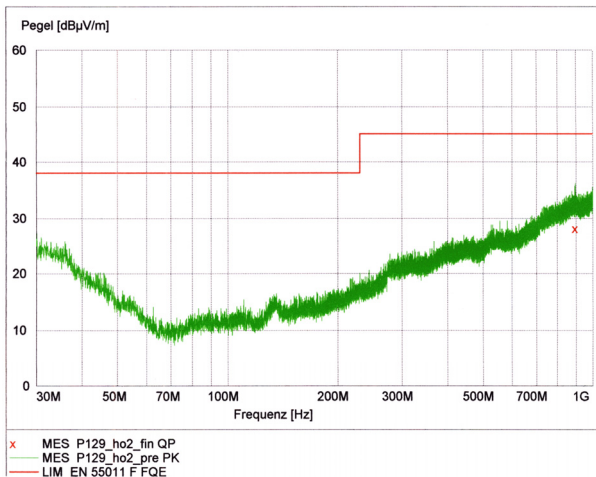
Signed this 6<sup>th</sup> day of February 2013

## Appendix B Emission Diagrams

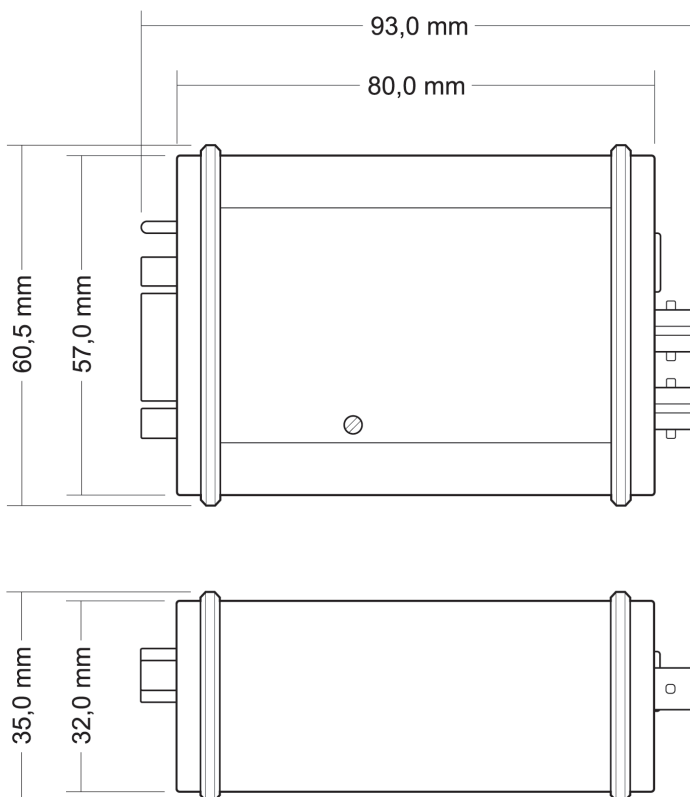
Without test device:



With PCAN-LWL:



## Appendix C Dimension Drawing






The figure does not show the original size.

## Appendix D Quick Reference

### Basic Settings on PCAN-LWL Circuit Board

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

### CAN Termination

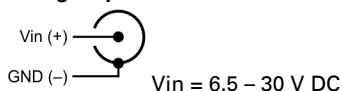
CAN mode	Terminating resistor
High-speed CAN	120 $\Omega$ between CAN_L and CAN_H OFF:  , ON:  or 
Low-speed CAN	510 $\Omega$ /5.6 k $\Omega$ , toggle switch at the casing

### Status LEDs

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

### Connectors

#### Voltage input socket:



#### OWG:



#### CAN:

