PCAN-LWL

System for Optical Transmission of CAN Data

User Manual

PEAK System

Products taken into account

Product Name	Model	Item Number
PCAN-LWL		IPEH 002026

Last Updates

January 20, 2005

- Taking the switchable HS-CAN termination into account
- Note about the HS-CAN transceiver

July 19, 2005

- Technical specifications: Added information about OWG cable
- Minor corrections

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Contents

1 Introduction

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

PCAN-LWL allows you to substitute any CAN bus segment by an optical waveguide (OWG). An optical fiber duplex line with ST connector is used as OWG. A conversion is possible from/to High-speed CAN (HS-CAN) or Low-speed CAN (LS-CAN).

Fields of application are EMC measurements of CAN modules, CAN bus segments with electromagnetic spurious irradiations, and lines through explosion-proof areas.

1.1 Properties of the PCAN-LWL at a Glance

- Use in HS-CAN (up to 500 kBit/s) and LS-CAN
- Internal terminating resistors, for LS-CAN switching between two resistor values possible, for HS-CAN termination resistor can be switched on or off
- LEDs for indicating the used CAN transceiver (HS or LS) and for errors on the LS-CAN
- Conversion with a PCAN-LWL module at each the beginning and the end of the OWG segment
- Transmission with duplex HCS OWG (62.5/125 µm)
- Easy to handle ST bayonet connection for OWG
- External power supply with 6.5 to 30 V DC via socket for separate voltage input or via CAN connector

1.2 System Requirements

The following prerequisites must be given, so that PCAN-LWL can be used properly:

- HS-CAN (up to 500 kBit/s) or LS-CAN
- 9-pin Sub-D socket for connection to the PCAN-LWL modules (pin assignment according to CiA recommendation DS102-1)
- Power supply with AC adaptor or via CAN bus

Note: Because of conversion delays the use of PCAN-LWL reduces the maximum length of a CAN bus. See according section 3.1 on page 9.

1.3 Scope of Supply

The scope of supply normally consists of the following parts:

- PCAN-LWL-Modules
- 5 m (about 6 yards) duplex OWG
- 2 AC adaptors
- Manual in printed form

2 Basic Settings

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

- Choice between HS-CAN and LS-CAN transceiver
- Choice of the input for the power supply

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

For a change of the settings the circuit board must be taken from the case. To do this, please proceed as follows:

1. Remove the two screws on the front side with the CAN 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 a reversed order.

2.1 Choice Between HS-CAN and LS-CAN Transceiver

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

Tip: It is possible to connect one PCAN-LWL module with a HS-CAN while the other PCAN-LWL module is connected to a LS-CAN (conversion HS-CAN/LS-CAN). You should make sure (like in any other case) that the transfer rates are the same in both CANs.

Jumper block JPB1	Choice of transceiver for...	Remark
B-A	HS-CAN	Default setting at delivery
C-B	LS-CAN	

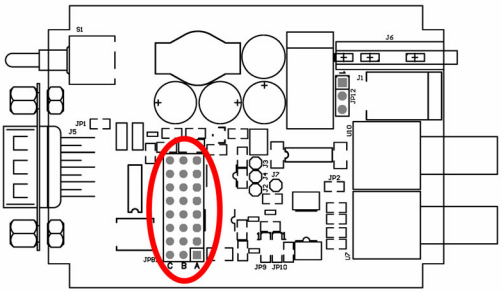


Figure 1: Position jumper block JPB1

Note: When setting the jumper block, please 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.

2.2 Choice of the Input for the Power Supply

A PCAN-LWL module can be powered by an external voltage source (e.g. with the supplied AC adaptor or the battery pack PCAN-Batt) 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.

Jumper JP12	Power supply via...	Remark
1-2	CAN connector, pin 9	Should not be used at strong electromagnetic interference.
2-3	Input socket for power supply at front side of module	Default setting at delivery

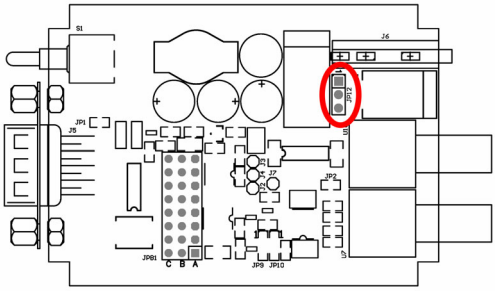


Figure 2: Position jumper JP12

The unused power supply input (according to the setting) is electrically isolated from the actual power supply of the PCAN-LWL module.

3 Operation

The system consisting of a PCAN-LWL module, the OWG, and another PCAN-LWL module replaces a section of the existing electrical CAN bus between two nodes.

Please go through the following sections for information about the start-up.

3.1 Reduction of the Maximum Length of the CAN Bus

A delay arises by the conversion of electric signals to light signals in the two PCAN-LWL modules. The consequence is a reduction of the maximum length of the CAN bus. This should be considered at the conception of the application.

CAN mode	Signal delay by conversion	Resulting reduction of the max. CAN bus length
HS-CAN	250 ns (typical)	about 50 m (55 yards)
CAN	1.5 µs (typical)	about 300 m (330 yards)

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 can be taken into account 1:1 for the length of the CAN bus.

3.2 Connections

3.2.1 OWG

For each transmission and reception a PCAN-LWL module has a connector. These are designed as standardized ST plug connectors.

Figure 3: Front side of case
with OWG connectors

Connect the OWG output of one PCAN-LWL module with the input of the other one and vice versa (see table below). Both OWGs of the duplex line are marked with colors at each connector, where a color is assigned to one OWG each.

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

3.2.2 CAN

For connection or the electric CAN bus (HS-CAN as well as LS-CAN) a 9-pin Sub-D plug is used at the front side of the case. The assignment is as follows:

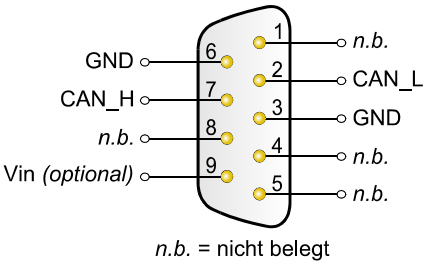


Figure 4: Pin assignment CAN connector

For details about the power supply via Vin of the CAN connector see the following section 3.2.3.

Bus Termination HS-CAN

The HS-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 whole on the top side of the module case. To do so, use a small flat tip screwdriver. The positions of the switch are defined as follows:

- ON:  or 
- OFF: 

Note: When the LS-CAN transceiver is selected (jumper block JPB1 on the PCB set to according position), the turn switch cannot be accessed via the hole in the module case. (See also section 2.1 *Choice Between HS-CAN and LS-CAN Transceiver*.)

Bus Termination LS-CAN

Every node in a LS-CAN has a terminating resistor. For optimum system conditions the whole CAN should be terminated with 100 Ω (parallel connection of all terminating resistors). A single node should be terminated with 500 Ω up to 6 kΩ.

To simplify the adaptation of the PCAN-LWL to existing CANs you can switch between the terminating resistors 510 Ω and 5.6 kΩ with a toggle switch at the case.

For smaller CANs or for testing a single component the slide switch should be set to 510 Ω. For monitoring or configuration of existing CANs, that are already optimized regarding termination, the slide switch should be set to 5.6 kΩ to minimize an influence on the total termination.

Note: When the HS-CAN transceiver is activated, the toggle switch for the LS-CAN terminating resistor doesn't have any influence.

3.2.3 Power Supply

A PCAN-LWL module needs a DC voltage of 6.5 to 30 V. The path for the voltage input is determined as described in the section about the basic settings (see section 2.2).

- Voltage input socket:
  It is located at the front side of the case together with the LWL connectors. Here you can connect the delivered DC adaptor. Further more a use of other DC power supplies is possible, e.g. the storage battery pack PCAN-Batt.

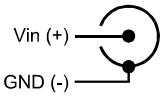


Figure 5: Assignment voltage input socket

- CAN connector, pin 9:
  The power supply is coming via this separate line on the CAN bus. The voltage source is located on another node connected to the CAN bus.

Attention! Switch off the power supply at the CAN bus 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 Status Information by LEDs

The case of the PCAN-LWL module has three LEDs (red, orange, yellow) on the front side with the OWG connectors. They indicate different CAN operating states.

3.3.1 Red LED "Lowspeed Error"

The red LED indicates the state of the error output of the LS-CAN transceiver. This output is active for the following error conditions on the LS-CAN side:

- 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 und VCC
- Short circuit between CAN_H and CAN_L

Please see the data sheet for the LS-CAN-Transceiver Philips TJA1054 for further details.

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

3.3.2 Orange LED "Lowspeed TJA1054"

When in the PCAN-LWL module the LS-CAN transceiver is activated for transmission, during existing power supply this LED is lit permanently.

3.3.3 Yellow LED "Highspeed 82C251"

When in the PCAN-LWL module the HS-CAN transceiver is activated for transmission, during existing power supply this LED is lit permanently.

Technical note: Instead of the HS-CAN transceiver Philips 82C251, as shown on the case printing, the PCAN-LWL contains the HS-CAN transceiver AMIS 30660. The latter ensures a better immunity to electrical noise while providing the same functionality. Please note that the minimum transmission rate for HS-CAN lies at 15 kBit/s due to specifications of this transceiver.

4 Questions (FAQ)/Trouble Shooting

Questions/Problem	Answer
Why doesn't the PCAN-LWL module work (none of the LEDs is lit) although a **power supply** is connected and switched on?	Make sure that on the circuit board of the PCAN-LWL module the correct power supply input is set with the jumper JP12. See according section 2.2 *Choice of the Input for the Power Supply* on page 8.
Why hasn't an automatic switch for the **power supply input** been planned during the design phase?	The consequence would have been a higher minimum input voltage.
During operation I have **disconnected** an **OWG** for a short time by mistake. After re-establishing the OWG connection there are still errors indicated for the CAN bus.	One or more CAN nodes weren't able to synchronize after the interruption and therefore generate error messages. Reset the respective CAN node software to its normal state.
After connecting the PCAN-LWL module to the **HS-CAN** bus the **communication** is not working anymore.	On the PCAN-LWL circuit board check, if the jumper block JPB1 is set correctly on position B-A and if all pins of row B are connected to those on row A. See according section 2.1 *Choice Between HS-CAN and LS-CAN Transceiver* on page 6.

5 Technical Specifications

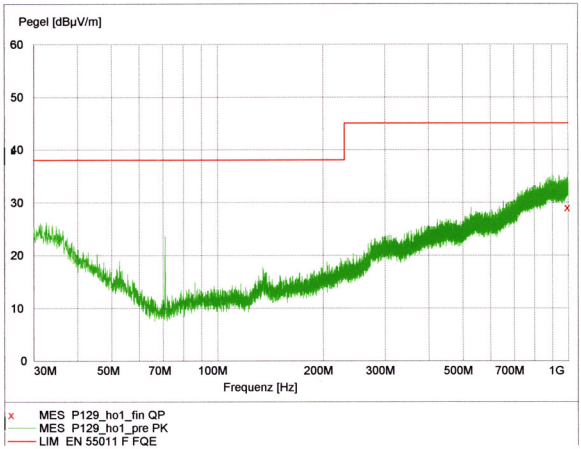
Supply voltage:	6.5 – 30 V DC
Current consumption:	typical 40 mA, max. 50 mA (at 9 V)
Operating temperature:	PCAN-LWL module: 0 – 70 °C (32 – 158 °F) OWG cable: -20 – +60 °C (-4 – +140 °F)
Case dimensions:	60 x 35 x 80 mm (2 3/8 x 1 3/8 x 3 1/8 inches) (without connectors and switch)
Transfer rates:	LS-CAN: 40 – 125 kBit/s HS-CAN: 15 – 500 kBit/s
CAN transceiver:	LS-CAN: Philips TJA1054 HS-CAN: AMIS 30660
Signal delay: (2 PCAN-LWL modules, 5 m OWG)	LS-CAN: about 1.5 µs HS-CAN: about 250 ns
Optical wave guide:	Optical fiber duplex line with ST connector
EMC – noise immunity:	EN 61000-6-1 EN 61000-4-2: 8 kV contact discharge method EN 61000-4-3: 20 V/m EN 61000-4-4: 4 kV EN 61000-4-6: 10 V
EMC – emission:	EN 55022, EN 55011

Design and specifications are subject to change without notice.

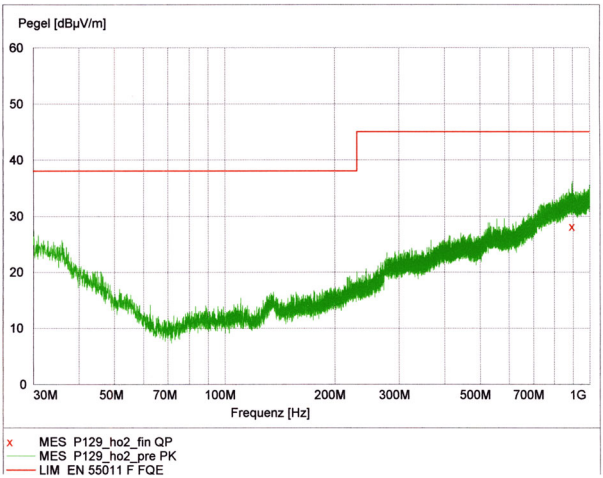
Appendix A Certificates

A.1 EMC – Emission (EN 55011)

Without test device:



With PCAN-LWL:



Appendix B Quick Reference

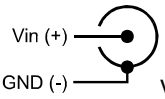
Basic Settings on PCAN-LWL Circuit Board

Jumper block JPB1	CAN mode
B-A (preset)	HS-CAN
C-B	LS-CAN

Jumper JP12	Power supply via...
1-2	CAN connector, pin 9
2-3 (preset)	Voltage input socket

Connectors

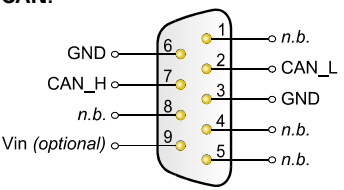
Voltage input socket:



Vin = 6.5 – 30 V DC

OWG:

CAN:



n.b. = nicht belegt

Termination

CAN mode	Terminating resistor
HS-CAN	120 Ω between CAN_L and CAN_H ON:  or  , OFF: 
LS-CAN	510 Ω / 5.6 kΩ, switchable (toggle switch at the case)

LEDs

Red	LS-CAN errors
Orange	LS-CAN mode is set
Green	HS-CAN mode is set