PCAN-Repeater

2-Channel CAN Repeater with galvanic isolation

User Manual V1.0.3

PEAK System

Products taken into account

Product Name	Model	Part Number
PCAN-Repeater	Industry	IPEH-004038

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Document version 1.0.3 (2011-10-10)

Contents

1 Introduction

With the PCAN-Repeater a galvanic isolated connection can be established between two High-speed CAN busses (ISO 11898-2) with the same bit rates. The maximum isolation voltage is 5 kV. The CAN traffic is transmitted 1:1 to the other bus. The device is designed for use in industrial plants.

1.1 Properties at a Glance

- Two High-speed CAN channels (ISO 11898-2)
- Galvanic isolation up to 5 kV according to IEC60601-1, between the CAN channels and between CAN and power supply
- Bit rates up to 1 Mbit/s
- CAN bus load and CAN error indication with LEDs for standard bit rates from 20 kbit/s up to 1 Mbit/s
- Termination for each CAN channel can be activated separately
- Listen-only mode optionally switchable for CAN channel 1 or CAN channel 2
- Plastic casing (width: 22,5 mm) for mounting to a top hat rail (DIN-EN 60715 TH35)
- Extended operating temperature range -40 - 85 °C (-40 - 185 °F)

1.2 Prerequisites for Operation

- Voltage supply source in the range of 8 to 30 V DC

1.3 Scope of Supply

- PCAN-Repeater in a top hat rail casing
- 3 mating connectors for power supply and CAN connectors
- Manual in PDF format

2 Connectors

2.1 CAN1 / CAN2

The CAN connectors are located on the upper side of the casing.

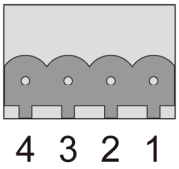


Figure 1: Pin assignment CAN

Pin	Meaning
1	CAN-High
2	CAN-Low
3	CAN-GND
4	CAN-Shield[1]

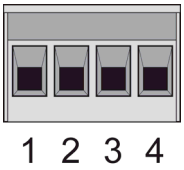
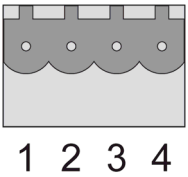


Figure 2: Mating connector CAN

[1]Capacitive connection (5 kV) to supply shield (top hat rail potential)

2.2 Power Supply

The connection for the power supply is located on the lower side of the casing.



Pin	Meaning
1	GND
2	not connected
3	Vbat (8 - 30 V DC)
4	Shield (top hat rail potential)

Figure 3: Pin assignment Power

Figure 4: Mating connection Power

3 Operation

3.1 Operation with Bus Load and Error Display

Do the following to install the PCAN-Repeater into your CAN network:

1. Mount the PCAN-Repeater at the appropriate position on the top hat rail by placing it at the top of the rail and snapping it to the bottom.
2. Connect each of the two CAN ports with the corresponding CAN network. Note that the two CAN busses must have the same bit rates.
3. Connect the PCAN-Repeater to a suitable power supply (8 - 30 V DC).
4. The PCAN-Repeater now forwards the CAN messages 1 to 1.

3.1.1 Signal Delay

The PCAN-Repeater has a transit time delay of 115 ns. This corresponds to a cable length of 23 m. Therefore, you should consider the dependence of the maximum length of a CAN bus on the bit rate at the installation of the repeater. The following table shows the maximum possible CAN bus length at different bit rates:

Bit rate	Bus length	Bus length with Repeater
1 Mbit/s	40 m	17 m
500 kbit/s	110 m	87 m
250 kbit/s	240 m	217 m
125 kbit/s	500 m	477 m
50 kbit/s	1,3 km	For small bit rates, the delay of the repeater can be neglected
20 kbit/s	3,3 km	
10 kbit/s	6,6 km	
5 kbit/s	13,0 km	

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

Note: The PCAN-Repeater cannot be used to extend CAN busses.

3.1.2 Busload- and Error Display

For the bus load and error display the use of standard bit rates is provided. As soon as the adapter is successfully put into operation in a network, the adapter runs automatic bit rate detection. As long as no bit rate is detected and for the duration of the detection the traffic LED is on, colored orange. After a successful detection the bus load and errors are displayed with the traffic and error LEDs. Details can be found in the following chapter.

For the following bit rates, the bus load and error display are supported:

20 kbit/s, 33.3 kbit/s, 47.6 kbit/s, 50 kbit/s, 83.3 kbit/s, 95.2 kbit/s, 100 kbit/s, 125 kbit/s, 200 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1 Mbit/s

3.2 Status LEDs

The PCAN-Repeater has three status LEDs that represent the following conditions:

Upper LED	Status	Meaning
Error	Red flashing	Communication error (error frames)

Middle LED	Status	Meaning
Traffic	Orange on	Bit rate detection is performed or no standard bit rate is detected
	OFF	No CAN communication
	Green slow blinking (2 Hz)	Bus load > 0 - 19 %
	Green quick blinking (4 Hz)	Bus load 20 - 49 %
	Orange slow blinking (2 Hz)	Bus load 50 - 79 %
	Orange quick blinking (4 Hz)	Bus load 80 - 100 %

Lower LED	Status	Meaning
Power	Green on	Power supply is on

Note: The display of the error and traffic LEDs refers always to the CAN bus that is connected to CAN channel 1 (only relevant for the listen-only mode).

3.3 CAN Termination

The termination for each CAN channel can be separately activated by a switch on the board. At delivery of the repeater the termination is switched on.

The High-speed CAN busses connected to the device must be correctly terminated, otherwise disturbances could be the consequence. If a connected CAN bus is completely terminated,

deactivate the termination on the repeater. If a CAN bus is not completely terminated, activate the internal termination for the appropriate channel. Note that a CAN bus always must be terminated with 120 Ohms at both ends.

Proceed as follows to switch the termination on or off:

Important note: Before opening the adapter unplug the power supply.

In order to access the board open the casing of the PCAN-Repeater, by pushing the latch at the top behind the CAN connectors and at the bottom behind the power connector slightly in, e.g. with a flat tip screwdriver. Now you can pull out the front part of the casing with the board.

Figure 5 shows the positions of the respective switches of the PCAN-Repeater on the board.

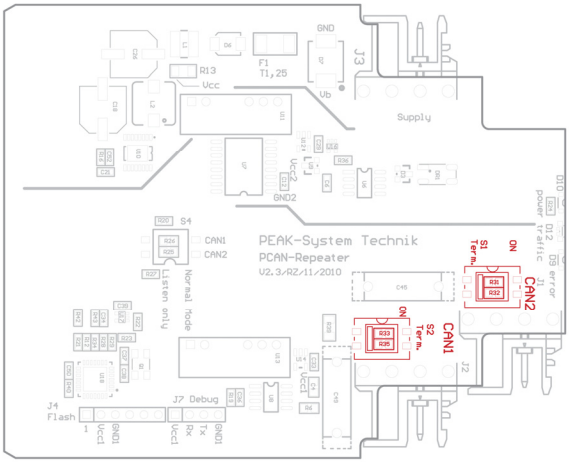


Figure 5: Termination per CAN channel

Change the termination settings for the CAN channels with the switches on the board. The affiliations and settings are labeled on the board.

3.4 Listen-only Mode

The listen-only mode is optionally switched on for the CAN channel 1 or the CAN channel 2. If the listen-only mode for CAN-channel 1 is activated the participants on this bus can receive the messages from CAN channel 2, but no data (and also no Acknowledge) is transferred from CAN channel 1 to CAN channel 2. At delivery of the PCAN-Repeater the listen-only mode is switched off.

Note: The listen-only mode should be enabled only for one CAN channel. If both CAN channels are running in listen-only mode the complete repeater function is disabled.

Proceed as follows to switch the listen-only mode on or off:

Important note: Before opening the adapter unplug the power supply.

In order to access the board open the casing of the PCAN-Repeater, by pushing the latch at the top behind the CAN connectors and at the bottom behind the power connector slightly in, e.g. with a flat tip screwdriver. Now you can pull out the front part of the casing with the board.

Figure 6 shows the positions of the respective switches of the PCAN-Repeater on the board.

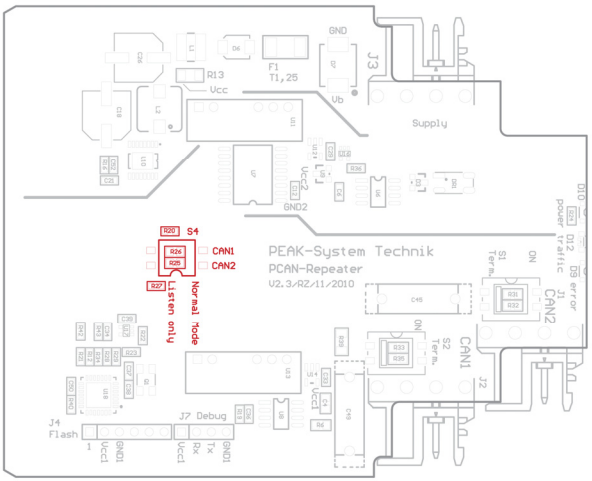


Figure 6: Listen-only mode per CAN channel

To turn on the listen-only mode for the CAN channels, switch **S4** to **Listen only** for each CAN channel. The settings of the switch are labeled on the board.

3.5 Application Examples

3.5.1 Decoupling of two Bus Segments

The PCAN-Repeater is used to establish a galvanic isolation between two bus segments. If a connected CAN bus is completely terminated, deactivate the termination on the repeater. If a CAN bus is not completely terminated, activate the internal termination for the appropriate channel. Note that a CAN bus always must be terminated with 120 Ohms at both ends.

With the switchable listen-only mode, the direction of message forwarding can be set up as required. With a suitable bit rate (see chapter 3.1.2) the bus load and errors will be displayed with the traffic and error LEDs.

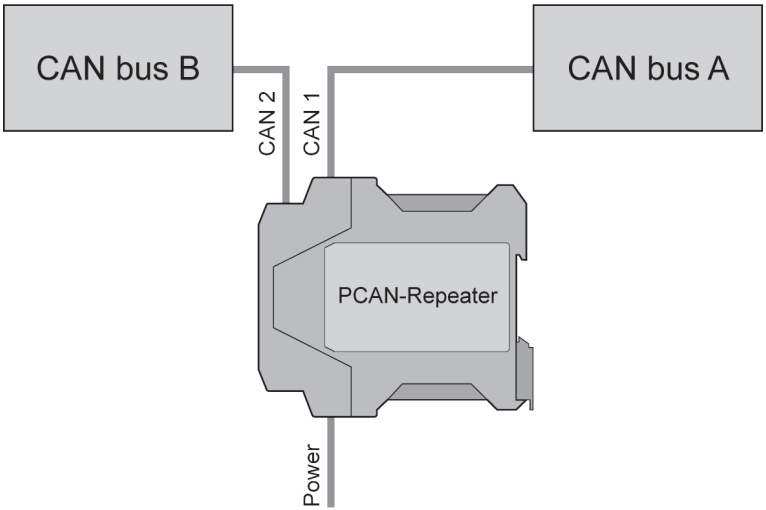


Figure 7: Decoupling of two CAN busses

CAN 1	Status
Termination	**On**, at a not terminated CAN bus **Off**, at a completely terminated CAN bus
Listen-only mode	Optional On or Off

CAN 2	Status
Termination	**On**, at a not terminated CAN bus **Off**, at a completely terminated CAN bus
Listen-only mode	Optional On or Off

3.5.2 Implementation of a Stub Line

The PCAN-Repeater is used to establish a physical coupling of two or more segments of a CAN network. With a tap on a CAN bus a long stub line can be implemented with several participants.

If the CAN bus B is not completely terminated, activate the internal termination for CAN channel 1. Note that a CAN bus always must be terminated with 120 Ohms at both ends. As this tap on the CAN bus A is not a cable end, deactivate the termination on CAN channel 2.

With the switchable listen-only mode, the direction of message forwarding can be set up as required. With a suitable bit rate (see chapter 3.1.2) the bus load and error will be displayed with the traffic and error LEDs.

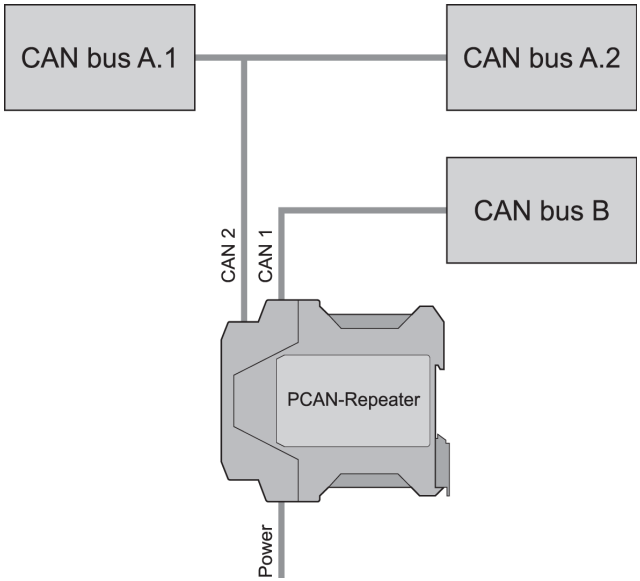


Figure 8: Implementation of a stub line

CAN 1	Status
Termination	**On**, at a not terminated CAN bus **Off**, at a completely terminated CAN bus
Listen-only mode	Optional On or Off

CAN 2	Status
Termination	**Off**, a termination may only be done on the cable ends of a CAN bus
Listen-only mode	Optional On or Off

3.5.3 Use as a Passive Observer

A CAN bus can be terminated and observed by the PCAN-Repeater.

Use the CAN channel 1. Note that the termination of the open CAN channel (CAN 2) is activated.

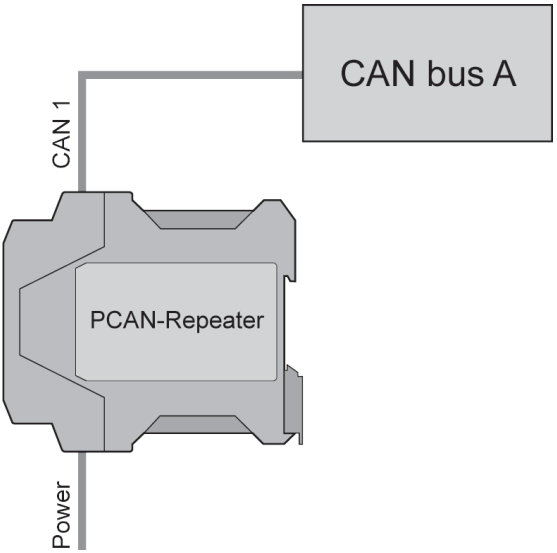


Figure 9: Use as a passive Observer

CAN 1	Status
Termination	**On**, at a not terminated CAN bus **Off**, at a completely terminated CAN bus
Listen-only mode	**Off**

CAN 2	Status
Termination	**On**
Listen-only mode	**Off**

4 Technical Specifications PCAN-Repeater

Connectors	
CAN	2 x Phoenix connector 4-pin
Power	Phoenix connector 4-pin

CAN	
Specification	ISO 11898-2 High-speed CAN (up to 1 Mbit/s) 2.0A (standard format) and 2.0B (extended format)
Transceiver	NXP PCA82C251
Galvanic isolation	Up to 5 kV, between the CAN channels and between CAN and power supply
Termination	120 Ohm, switchable for each CAN channel, at delivery activated
Listen-only mode	Switchable for CAN channel 1 or 2
Transmit time delay	115 ns (equals 23 m cable length)

Power supply	
Supply voltage	8 - 30 V DC
Power consumption	70 mA at 9 V 30 mA at 24 V

Measures	
Size	22,5 x 99 x 114,5 mm (W x H x D) See also dimension drawing Appendix B on page 21
Weight	96 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	EN 61326-1:2006-10 EC directive 2004/108/EG Extended interference resistance: IEC61000-4-6 (10 V eff.) IEC61000-4-3 (20 V/m)
Security	IEC 60601-1
Ingress protection (IEC 60529)	IP20

Appendix A CE-Certificate

PCAN-Repeater IPEH-004038 – EC Declaration of Conformity
PEAK-System Technik GmbH

Notes on the CE Symbol CE

The following applies to the PCAN-Repeater product IPEH-004038

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/Emission
DIN EN 61326-1; publication date: 2008-06
Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements (IEC 61326-1:2005);

German version EN 61326-1:2006

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:

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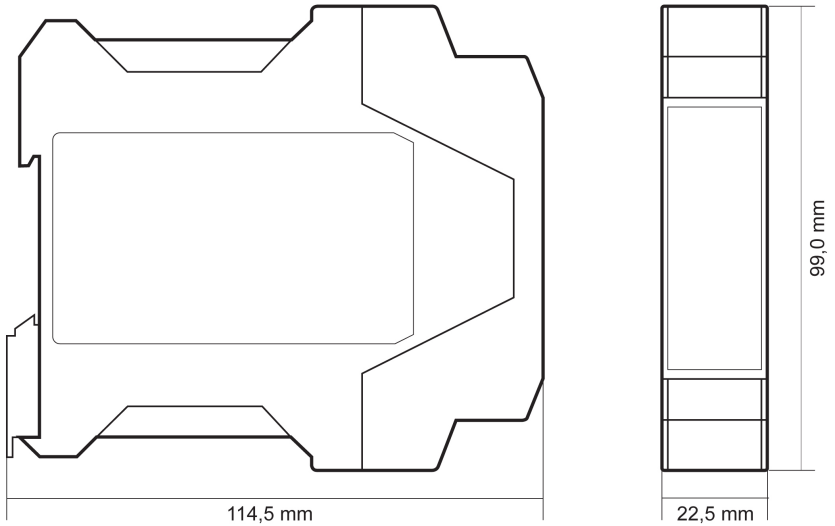
Signed this 21th day of August 2010

Appendix B Dimension Drawing



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