

PCAN-Repeater DR

CAN Repeater for the Decoupling of Bus Segments

User Manual



Document version 1.3.1 (2017-02-10)

PEAK
System

Relevant products

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

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1 Introduction

The PCAN-Repeater DR creates a connection between two High-speed CAN busses with galvanic isolation of up to 5 kV (DC). Both CAN channels are decoupled from each other and from the power supply. All message traffic including error frames is forwarded 1:1 between both channels, if necessary, in one direction only. The PCAN-Repeater DR behaves passively and is transparent from the perspective of the CAN bus. LEDs display the current bus status. With its DIN rail casing and extended temperature range support, this module is suitable for use in an industrial environments.

Due to the CAN protocol, the maximum length of a CAN bus depends on the bit rate. Therefore, a bus cannot be extended with the PCAN-Repeater DR. The physical total length of the CAN bus is reduced with each built-in PCAN-Repeater DR according to its signal delay.

1.1 Properties at a Glance

- Two High-speed CAN channels (ISO 11898-2)
- Bit rates up to 1 Mbit/s
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- NXP PCA82C251 CAN transceiver
- Connections for CAN and power supply via 4-pin screw terminal block (Phoenix)
- LEDs display CAN bus load and CAN errors
- Each CAN channel can be selectively terminated

- └ Galvanic isolation up to 5 kV (DC) according to IEC 60601-1, between both CAN channels and between CAN and power supply
- └ Listen-only mode optionally switchable for CAN channel 1 or CAN channel 2
- └ Plastic casing (width: 22,5 mm) for mounting on a DIN rail (DIN EN 60715 TH35)
- └ Voltage supply from 8 to 30 V
- └ Extended operating temperature range -40 to 85 °C (-40 to 185 °F)

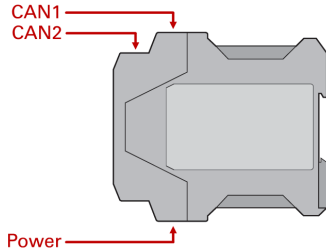
1.2 Prerequisites for Operation

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

1.3 Scope of supply

- └ PCAN-Repeater DR in DIN rail plastic casing
- └ 3 mating connectors (Phoenix, Type: MSTB 2,5/4-ST BK) for power supply and CAN connections
- └ Manual in PDF format

2 Connectors



2.1 CAN1/CAN2

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

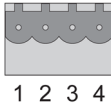


Figure 1: CAN socket

Pin	Assignment
1	CAN-High
2	CAN-Low
3	CAN-GND
4	CAN-Shield ¹

2.2 Power Supply

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

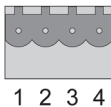


Figure 2: Power socket

Pin	Assignment
1	GND
2	not connected
3	Vbat (8 - 30 V DC)
4	Shield (DIN rail potential)

¹ Capacitive connection (5 kV) to supply shield (DIN rail potential)

3 Operation

3.1 Putting Into Operation

- ▶ Do the following to install the PCAN-Repeater DR into your CAN network:
1. Mount the PCAN-Repeater DR at the appropriate position on the DIN rail by placing it at the DIN 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 DR to a suitable power supply (8 - 30 V DC).

The PCAN-Repeater DR now forwards the CAN messages 1 to 1.

3.1.1 Signal Delay

The PCAN-Repeater DR 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: Due to the CAN protocol, the maximum length of a CAN bus depends on the bit rate. Therefore, a bus cannot be extended with the PCAN-Repeater DR. The physical total length of the CAN bus is reduced with each built-in PCAN-Repeater DR according to its signal delay.

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.

The bus load and error display are supported for the following bit rates:

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 DR 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 the termination is switched on. A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise disturbances may arise.

- ▶ If a connected CAN bus is terminated, deactivate the termination on the Repeater. If a CAN bus is not terminated correctly, activate the internal termination for the appropriate channel. Proceed as follows to switch the termination on or off:

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

1. Open the plastic casing by slightly pushing the latches at the top behind the CAN connectors and at the bottom behind the power connector, e.g. with a flat tip screwdriver.
2. Now you can pull out the front part of the casing with the board.

Figure 3 shows the positions of the respective switches of the PCAN-Repeater DR on the board.

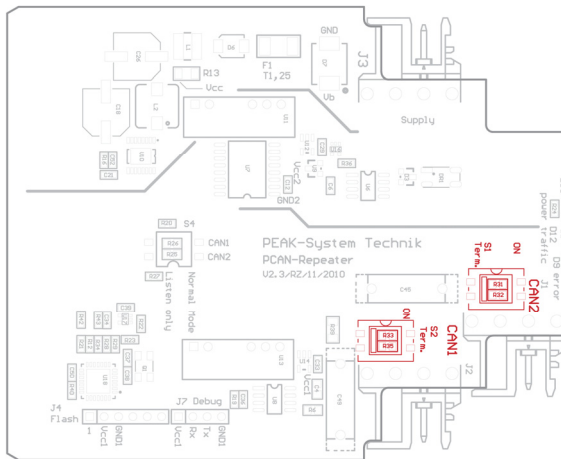



Figure 3: Termination per CAN channel


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


For the assembly of the PCAN-Repeater DR slide the board including the front part back into the plastic casing and press the casing together (the latches click in).

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 DR 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 DR 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.

1. Open the casing by slightly pushing the latches at the top behind the CAN connectors and at the bottom behind the power connector, e.g. with a flat tip screwdriver.
2. Now you can pull out the front part of the casing with the board.

Figure 4 shows the positions of the respective switches of the PCAN-Repeater DR on the board.

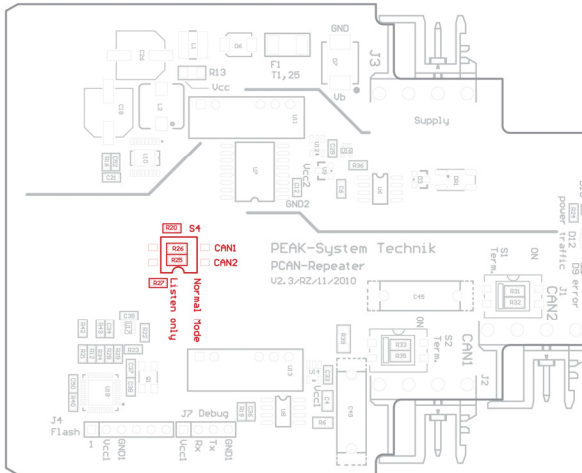


Figure 4: Listen-only mode per CAN channel

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.

For the assembly of the PCAN-Repeater DR slide the board including the front part back into the plastic casing and press the casing together (the latches click in).

3.5 Application Examples

This section describes two application examples for the PCAN-Repeater DR:

- └ Decoupling of two Bus Segments (below)
- └ Implementation of a Stub Line (on page 14)



Note: The PCAN-Repeater DR cannot be used to extend the length of a CAN bus in order to exceed the maximum length.

3.5.1 Decoupling of Two Bus Segments

The PCAN-Repeater DR 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 section 3.1.2 on page 8) the bus load and errors will be displayed with the traffic and error LEDs.

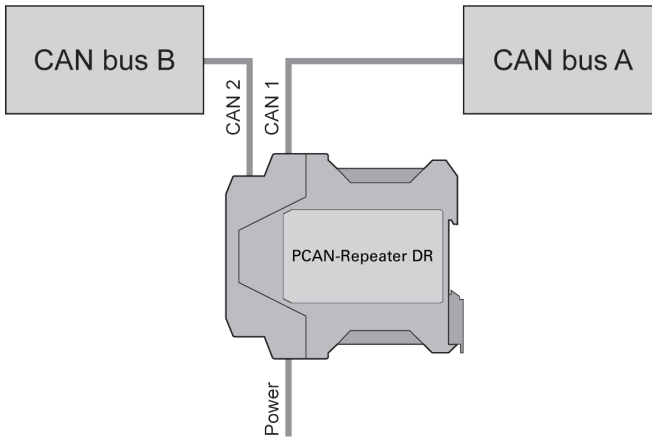


Figure 5: Decoupling of two CAN busses

CAN 1	Status	CAN 2	Status
Termination	On , at a not terminated CAN bus Off , at a completely terminated CAN bus	Termination	On , at a not terminated CAN bus Off , at a completely terminated CAN bus
Listen-only mode	Optional On or Off	Listen-only mode	Optional On or Off

3.5.2 Implementation of a Stub Line

The PCAN-Repeater DR 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

section 3.1.2 on page 8) the bus load and error will be displayed with the traffic and error LEDs.

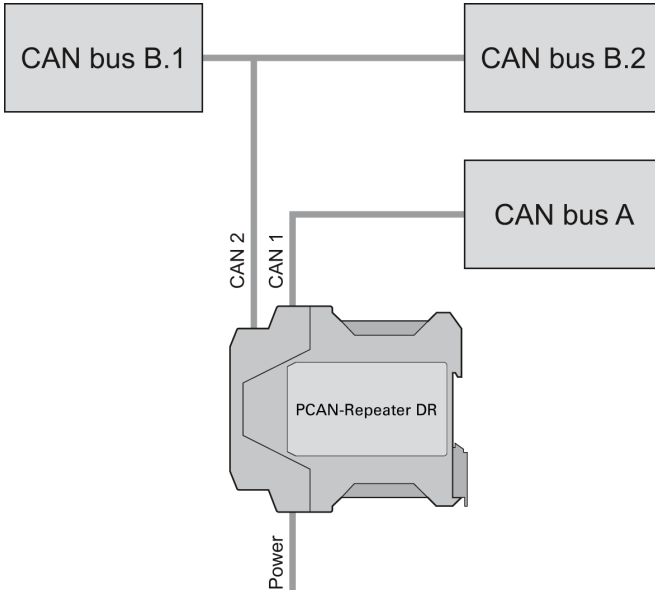


Figure 6: Implementation of a stub line

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

4 Technical specifications

Connectors

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

CAN

Specification	ISO 11898-2; High-speed CAN 2.0A (standard format) and 2.0B (extended format)
Bit rates	5 kbit/s - 1 Mbit/s
Transceiver	NXP PCA82C251
Galvanic isolation	Up to 5 kV DC or 3.5 kV AC, between both 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 in Appendix B on page 19
Weight	96 g

² Phoenix connector, type MSTB 2,5/4-ST BK, order no. 1756298,
www.phoenixcontact.com

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	Directive 2014/30/EU EN 61326-1:2013-07 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 DR IPEH-004038 – EC Declaration of Conformity
PEAK-System Technik GmbH



Notes on the CE Symbol

The following applies to the "PCAN-Repeater DR" product with the item number(s) IPEH-004038.

EU Directive This product fulfills the requirements of EU EMC Directive 2014/30/EU (Electromagnetic Compatibility) and is designed for the following fields of application as for the CE marking:

Electromagnetic Immunity/Emission
DIN EN 61326-1, publication date 2013-07
Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements (IEC 61326-1:2012);
German version EN 61326-1:2013

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

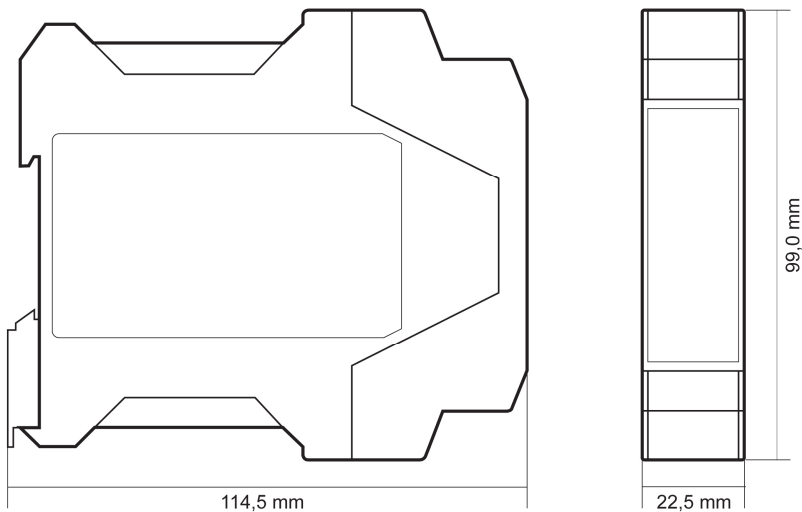
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A handwritten signature in black ink, appearing to read "Uwe W. Sch..."

Signed this 23th day of January 2017

Appendix B Dimension Drawing



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