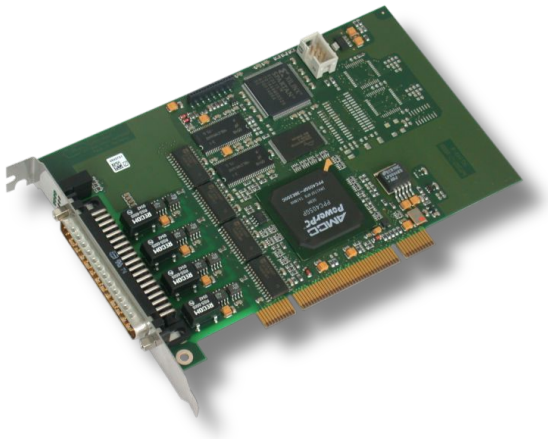
CAN-PCI/405-B4

PCI-CAN Interface



Hardware Manual

to Product C.2041.04

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N O T E

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Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Revision	Chapter	Changes versus previous version	Date
1.1	-	First released version	2008-10-27
1.2	-	Safety Instructions inserted	2014-06-25
	2.1	Safety informations inserted	
	4.4	'Electrical Isolation' entry revised	
	4.5	Chapter revised	
	5.1.1	Table revised and note about the wiring of the CAN-PCI/405-B4-1C4 inserted	
	8.	Declaration of Conformity updated	
	9.	Chapter 'Order Information' moved and revised	

Technical details are subject to change without further notice.

Safety Instructions

- When working with CAN-PCI/405-B4 follow the instructions below and read the manual carefully to protect yourself from injury and the CAN-PCI/405-B4 from damage.
- The device is a built-in component. It is essential to ensure that the device is mounted in a way that cannot lead to endangering or injury of persons or damage to objects.
- The device has to be securely installed in the control cabinet before commissioning.
- Protect the CAN-PCI/405-B4 from dust, moisture and steam.
- Protect the CAN-PCI/405-B4 from shocks and vibrations.
- The CAN-PCI/405-B4 may become warm during normal use. Always allow adequate ventilation around the CAN-PCI/405-B4 and use care when handling.
- Do not operate the CAN-PCI/405-B4 adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.
- Do not use damaged or defective cables to connect the CAN-PCI/405-B4 and follow the CAN wiring hints in chapter: "Correctly Wiring Electrically Isolated CAN Networks".
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and objects.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The CAN-PCI/405-B4 may only be driven by power supply current circuits, that are contact protected.
  A power supply, that provides a safety extra-low voltage (SELV or PELV) according to EN 60950-1, complies with this conditions.

Attention !
Electrostatic discharges may cause damage to electronic components.
To avoid this, please perform the steps described on page 7 *before* you touch the CAN-PCI/405-B4, in order to discharge the static electricity from your body.

Qualified Personal
This documentation is directed exclusively towards personal qualified in control and automation engineering.
The installation and commissioning of the product may only be carried out by qualified personal, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity
The CAN-PCI/405-B4 meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.

Intended Use
The intended use of the CAN-PCI/405-B4 is the operation as a PCI-CAN interface board.
The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The CAN-PCI/405-B4 is intended for installation in PCI-systems only.
- The operation of the CAN-PCI/405-B4 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CAN-PCI/405-B4 for medical purposes is prohibited.

Service Note
The CAN-PCI/405-B4 does not contain any parts that require maintenance by the user. The CAN-PCI/405-B4 does not require any manual configuration of the hardware.

Disposal
Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

Table of contents

1. Overview

1.1 Module Description

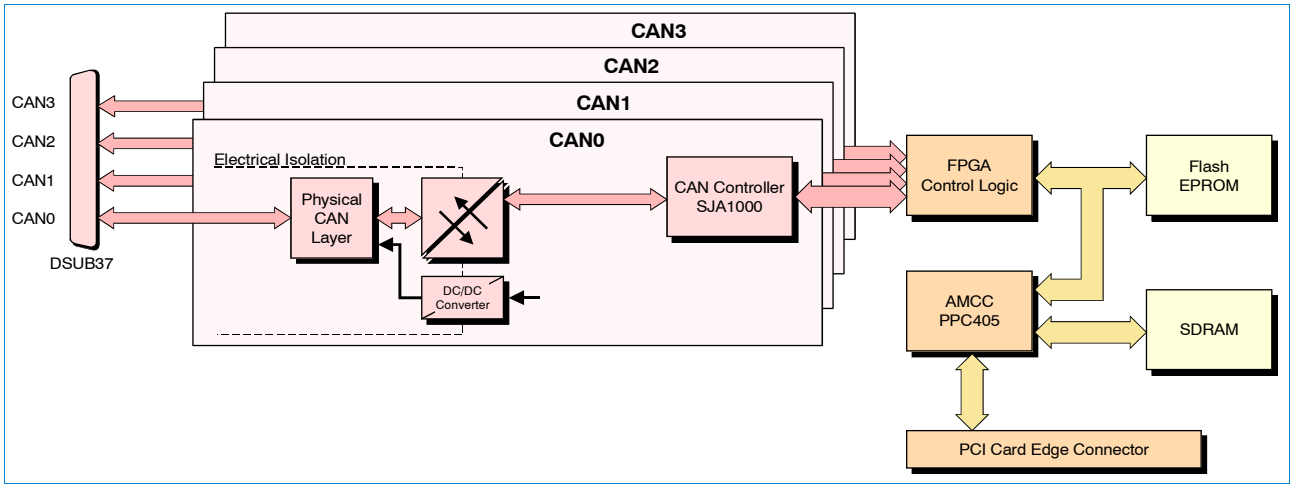


Figure 1: Block circuit diagram of the CAN-PCI/405-B4

The CAN-PCI/405-B4 is a PC board designed for the PCI bus. It supports four independent CAN interfaces. The four CAN interfaces can be connected via the 37-pole DSUB panel connector in the slot bracket.

The CAN-PCI/405-B4 provides four ISO 11898-compliant CAN interfaces based on SJA1000 CAN controllers. The CAN interfaces allow a data transfer rate of 1 Mbit/s.
The baud rate can be set by per software.
The interfaces are electrically isolated from the other potentials.

The CAN-PCI/405-B4 produces hardware-generated timestamps with a resolution of 1 µs for all CAN messages. A PowerPC™ 405GP cares for the local data management of the CAN-PCI/405-B4.

The CAN data are buffered in a local SDRAM. Security and consistency of data is guaranteed up to 1 Mbit/s.

2. Hardware Installation

2.1 Procedure

Read the safety instructions at the beginning of this document carefully, before you start with the hardware installation!

Danger!
Electric shock risk. Never carry out work while power supply voltage is switched on!

Attention !
Electrostatic discharges may cause damage to electronic components. To avoid this, please perform the following steps *before* you touch the module, in order to discharge the static electricity from your body:

→ Switch off the power of your PC, but leave it connected to the mains until you have discharged yourself.

→ Then touch the metal case of the PC to discharge the static electricity.

→ Furthermore, you must avoid contact between your clothes and the CAN-PCI/405-B4.

Procedure:

1. Switch off the PC and all connected peripheral devices (monitor, printer, etc.). Switch off the CAN devices of the net to which the CAN module is to be connected.
2. Discharge your body as described above.
3. Disconnect the power supply of the PC from the mains.
   If the computer does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).

   Danger!
   Never carry out work while power supply voltage is switched on!
4. Remove the PC cover.
   For further information on this see the manual of your PC.
   Unfasten the mounting screws at the back of the PC and remove the cover.
5. Select an open PCI slot and remove the slot cover of the PC. Unfasten the screw which fixes the slot cover and retain it for fixing the module afterwards.
   The CAN module can be inserted into every PCI slot. Be careful not to insert the board into an ISA slot, because this might damage the PC and the board!
6. Insert the CAN module into the selected PCI slot.
   Carefully push the board down until it snaps into place.
7. Attach the board.
   Secure the cover with the according screws at the back of the PC.

8. Replace the PC cover.
   Secure the cover with the according screws at the back of the PC.
9. Connect the CAN wire.
   Please note that the CAN bus has to be terminated at both ends! **esd** offers special T-connectors and terminator connectors. Additionally the CAN_GND signal has to be connected to earth at **exactly one** point. For easier wiring the termination connectors are equipped with an earth connector (4.8 mm fast-on, male).
   A CAN participant without an electrically isolated interface acts as an earth connection.

   The CAN-PCI/405-B4 is equipped with a 37-pole DSUB panel connector (male) in the slot bracket. Four CAN channels can be connected via the DSUB connector.
   As accessory the cable CAN-PCI/405-B4-1C4 (see order information) is available.
10. Reconnect the power supply of the PC.
11. Switch on the PC, the peripheral devices and the other CAN participants in any order.
12. End of hardware installation.

3. PCB View and LED Description

3.1 PCB View

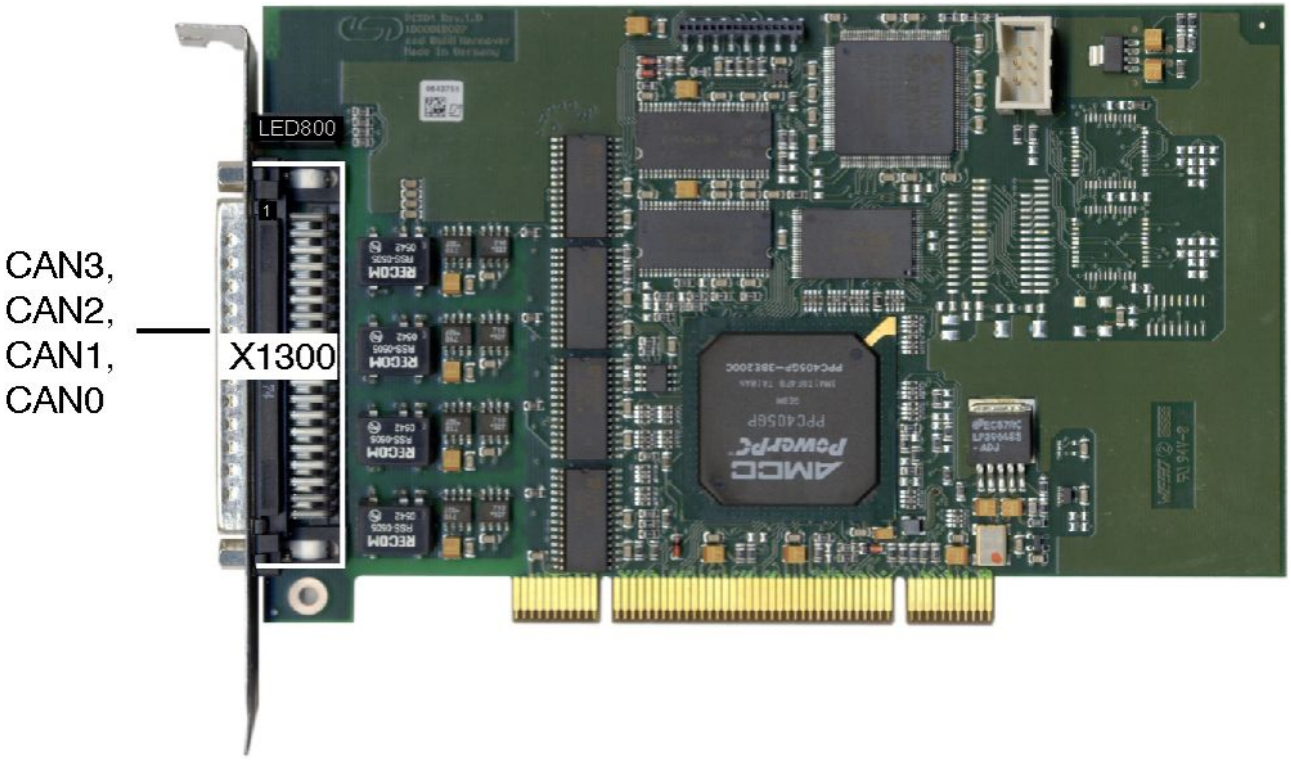


Figure 2: PCB top view of CAN-PCI/405-B4

See also page 14 for signal assignment of the CAN connector.

3.2 LEDs and DSUB37 Connector in the Slot Bracket

Four CAN nets can be connected to the CAN-PCI/405-B4 card via the 37-pole DSUB panel connector in the slot bracket.

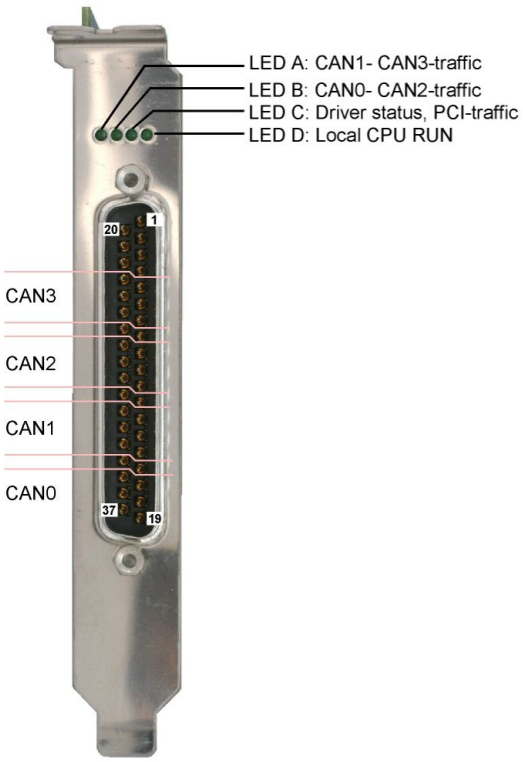


Figure 3: LEDs and connector position

LED	Function	Indication of the LED (LED on)
A	**CAN1-, CAN3-traffic**	CAN-frames are being received or transmitted on CAN1 and/or CAN3
B	**CAN0-, CAN2-traffic**	CAN-frames are being received or transmitted on CAN0 and/or CAN2
C	**Driver status/ PCI traffic**	LED off: No driver loaded LED on: Driver loaded LED flickering: Communication with CAN-board
D	**Local CPU RUN**	Local CPU is in RUN status (LED lights at every access to the SDRAM, therefore the LED can be blinking or permanently on in normal operation)

Table 1: Name and indication of the LEDs

4. Technical Data

4.1 General Technical Data

Power supply voltage	supplied by PCI bus, nominal voltage: 5 V ±5%, 3.3 V ±5%, typical current consumption for 4x CAN (max., at 20°C): 650 mA at 3,3 V and 250 mA at 5 V
Connectors	PCI bus - card edge (X100) CAN0-3 - DSUB9 panel connector /male (X1000)
Temperature range	0...50 °C ambient temperature
Humidity	max. 90%, non-condensing
Dimensions	164.64 mm x 106.68 mm (without slot cover panel and CAN connector)
Weight	approx. 130 g

Table 2: General data of the CAN-PCI/405-B4

4.2 Microprocessor and Memory

CPU	PowerPC 405GP, 200 MHz, 32 bit
Flash EPROM	2 MB Flash EPROM
SDRAM	32 MB SDRAM

Table 3: Microprocessor and memory

4.3 PCI Bus

Host bus	PCI according to PCI Local Bus Spec. 2.2
PCI data bus	32 bit
Controller	PPC405GP
Interrupt	interrupt signal A
Slot position	no restrictions for the slot position
Board dimension	PCI short card
Connector	PCI card edge connector

Table 4: PCI bus data

4.4 CAN Interface

Number of CAN interfaces	4x CAN via DSUB37 panel connector
CAN controller	SJA1000, acc. to ISO 11898-1 (CAN 2.0 A/B)
Physical Layer	Physical layer according to ISO 11898-2, transmission rate is programmable from 10 Kbit/s to 1 Mbit/s
Bus termination	terminating resistor has to be set externally, if required
Electrical isolation of the CAN interface against other units	both CAN interfaces are electrically isolated via optocouplers and DC/DC-converters against each other and against the PCIe bus potentials

Table 5: Data of the CAN interface

4.5 Software Support

Software drivers are available for Windows®, Linux® and real-time operating systems (see 'Order Information', page 28).
The CANopen software package is available for Windows, Linux, QNX® and RTX.
J1939 Stack is available as higher layer protocol for Windows, Linux and RTX.

For detailed information about the driver availability for your special operating system, please contact our sales team: sales@esd.eu

Additional free-of-charge esd CAN tools for Windows offer efficient setup and analysis of CAN applications and networks.

The software installation and the software drivers are described in the manual:

NTCAN-API: Application Developers Manual
NTCAN-API: Driver Installation Guide

esd-order No.: C.2001.21

5. Connector Assignments

5.1 CAN Interface at DSUB37 Connector

Device connector: 9-pin DSUB connector, male

Pin Position:

Pin Assignment:

Signal	Pin		Signal	Channel
n.c.	20	1	n.c.	
n.c.	21	2	n.c.	
n.c.	22	3	n.c.	
CAN_GND3	23	4	n.c.	
CAN3_H	24	5	CAN_GND3	CAN3
CAN3_L	25	6	CAN3_H	
n.c.	26	7	CAN3_L	
CAN_GND2	27	8	n.c.	
CAN2_H	28	9	CAN_GND2	CAN2
CAN2_L	29	10	CAN2_H	
n.c.	30	11	CAN2_L	
CAN_GND1	31	12	n.c.	
CAN1_H	32	13	CAN_GND1	CAN1
CAN1_L	33	14	CAN1_H	
n.c.	34	15	CAN1_L	
CAN_GND0	35	16	n.c.	
CAN0_H	36	17	CAN_GND0	CAN0
CAN0_L	37	18	CAN0_H	
		19	CAN0_L	

37-pole DSUB connector (male)

Signal Description:

CANx_L, CANx_H ... CAN signal lines of the CAN interfaces (x= 0 … 3)
CAN_GND ... reference potential of the local CAN physical layer (x= 0 … 3)
n.c. ... not connected

5.1.1 Adapter Cable CAN-PCI405-B4-1C4

The adapter cable CAN-PCI/405-B4-1C4 is designed for the connection to the 37-pole DSUB panel connector (male) of the CAN-PCI/405-B4. The signals of the four CAN interfaces are conducted to four DSUB9 plugs (male).

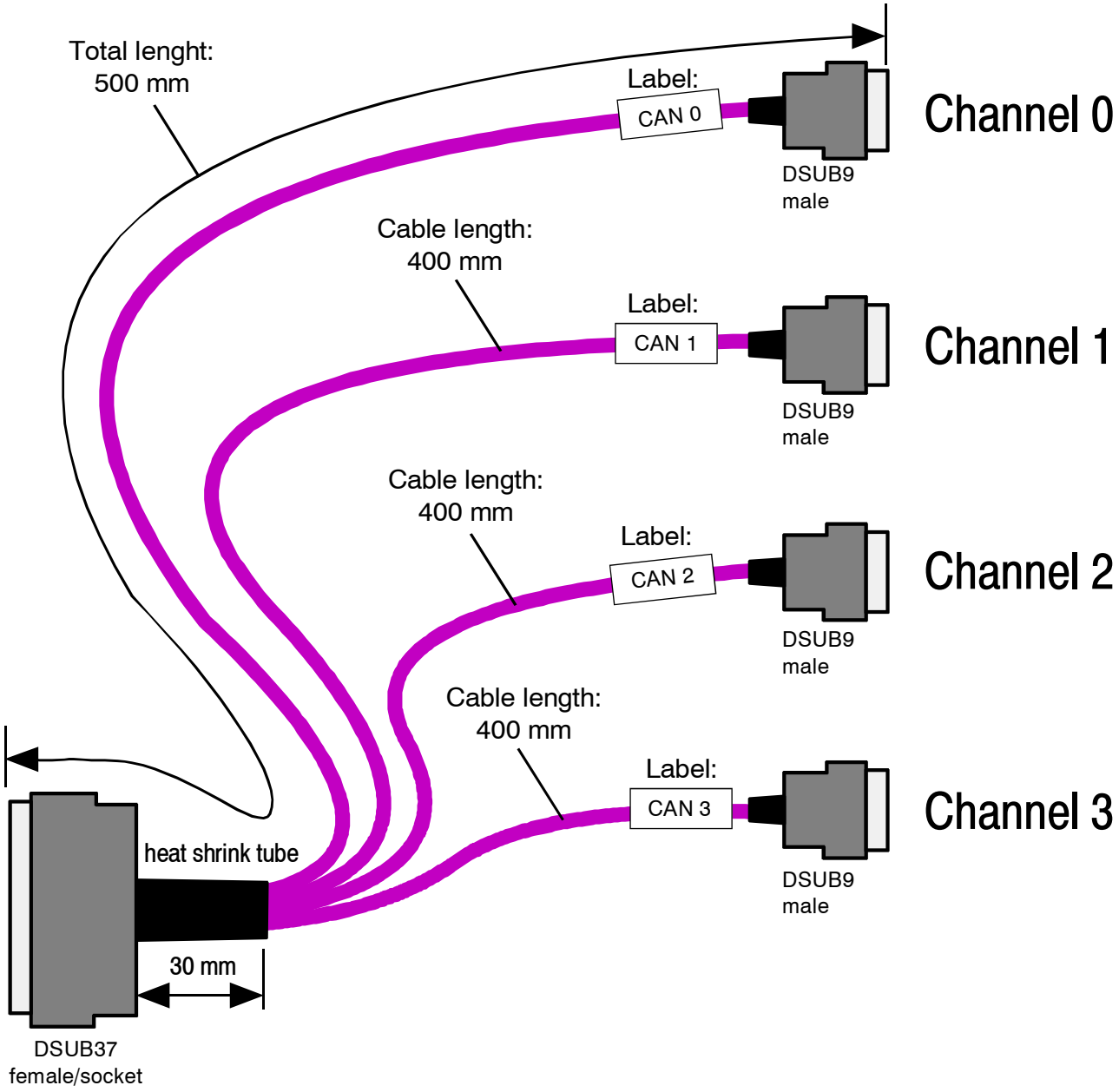


Figure 4: Adapter cable CAN-PCI/405-B4-1C4

Connector A		Cable		Connector B		Signal Name
Connector type	**Pin no.**	**Label**	**Color (internal)**	**Connector type**	**Pin no.**	
DSUB37 (female)	1	-	-	-		
	2					
	3					
	4					
	5	**CAN 3**	shield	**DSUB9** plug (male)	3 + Housing	CAN_GND3*
	6		brown		7	CAN3_H
	7		white		2	CAN3_L
	8	-		-		
	9	**CAN 2**	shield	**DSUB9** plug (male)	3 + Housing	CAN_GND2*
	10		brown		7	CAN2_H
	11		white		2	CAN2_L
	12	-		-		
	13	**CAN 1**	shield	**DSUB9** plug (male)	3 + Housing	CAN_GND1*
	14		brown		7	CAN1_H
	15		white		2	CAN1_L
	16	-		-		
	17	**CAN 0**	shield	**DSUB9** plug (male)	3 + Housing	CAN_GND0*
	18		brown		7	CAN0_H
	19		white		2	CAN0_L
	20	-	-	-	-	-
	: :					
	37					
	Housing not connected	-	-	-	-	-

*... CANx-GND are isolated from each other. They are not tied together by the adapter cable.

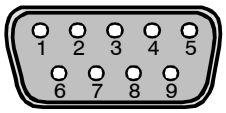
Table 6: Assignments of the cable connectors of CAN-PCI/405-B4-1C4

Note:
The CAN-GND signals of the cables of the 4-channel cable adapter "CAN-PCI/405-B4-1C4" are connected via the wire shield if the adapter is connected to the esd hardware. Thus the housings of the 9-pin DSUB connectors are connected to the respective CAN-GND, because no other potential is available on these connectors. There is no connection between the cable shield and the earth potential i.e. to the 37-pin DSUB connector housing.
Please note that in accordance with the wiring instructions the CAN-GND signal has to be connected to the earth potential at an appropriate position (see point 3 of the “General Rules” at the beginning of chapter 6.).

The assignment of the signals to the connector pins is the same for all CAN interfaces. All connectors are 9-pole DSUBs with male contacts.

Device connector: 9-pin DSUB connector, male

Pin Position:



Pin Assignment:

Signal	Pin		Signal
reserved	6	1	reserved
		2	CAN_L
CAN_H	7	3	CAN_GND
reserved	8	4	reserved
reserved	9	5	reserved

Signal Description:

CAN_L, CAN_H ... CAN signal lines

CAN_GND ... reference potential of the local CAN physical layer

reserved ... reserved for future applications, do not connect!

6. Correctly Wiring Electrically Isolated CAN Networks

For the CAN wiring all applicable rules and regulations (EC, DIN), e.g. regarding electromagnetic compatibility, security distances, cable cross-section or material, have to be met.

6.1 Light Industrial Environment (*Single* Twisted Pair Cable)

6.1.1 General Rules

Note:
esd grants the EC Conformity of the product, if the CAN wiring is carried out with at least single shielded **single** twisted pair cables that match the requirements of ISO 11898-2. Single shielded *double* twisted pair cable wiring as described in chapter 6.2. ensures the EC Conformity as well.

The following **general rules** for CAN wiring with single shielded *single* twisted pair cable must be followed:

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate wire cross-section (0.22 mm²) has to be used. The voltage drop over the wire has to be considered!
2	For light industrial environment use at least a two-wire CAN cable. Connect • the two twisted wires to the data signals (CAN_H, CAN_L) and • the cable shield to the reference potential (CAN_GND)!
3	The reference potential CAN_GND has to be connected to the functional earth (FE) at exactly **one** point.
4	A CAN net must not branch (exception: short cable stubs) and has to be terminated with the characteristic impedance of the line (generally 120 Ω ±10%) at both ends (between the signals CAN_L and CAN_H and **not** at GND)!
5	Keep cable stubs as short as possible (l < 0.3 m)!
6	Select a working combination of bit rate and cable length.
7	Keep away cables from disturbing sources. If this cannot be avoided, double shielded wires are recommended.

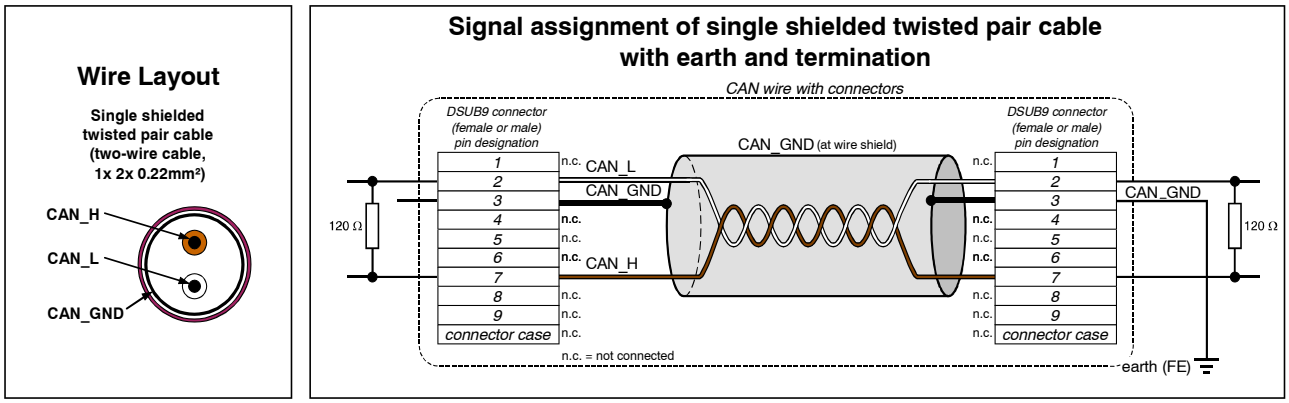


Figure 5: CAN wiring for light industrial environment

6.1.2 Cabling

- for devices which have only one CAN connector per net use T-connector and stub (shorter than 0.3 m) (available as accessory)

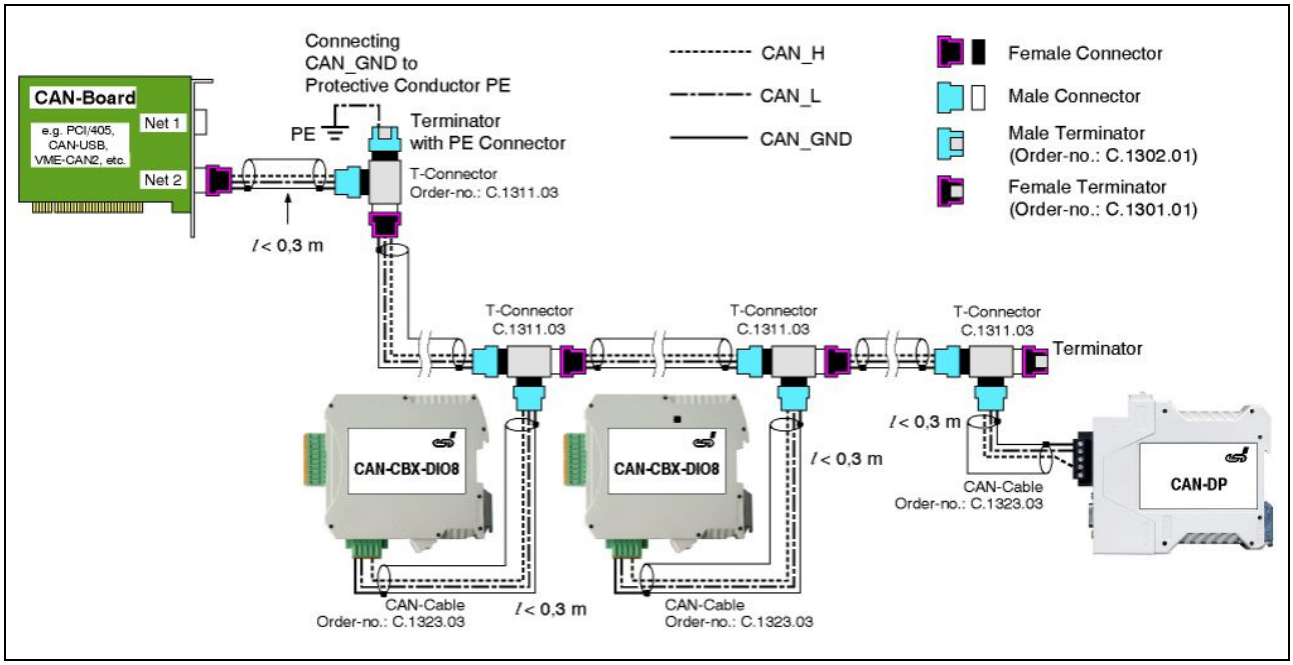


Figure 6: Example for proper wiring with single shielded single twisted pair wires

6.1.3 Termination

- If the used CAN interface is not equipped with an integrated CAN termination and it is at an end of the bus, use external termination plugs.
- 9-pin DSUB-termination connectors with male and female contacts and earth terminal are available as accessories

6.2 Heavy Industrial Environment (*Double* Twisted Pair Cable)

6.2.1 General Rules

The following **general rules** for the CAN wiring with single shielded *double* twisted pair cable must be followed:

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate wire cross-section (0.22 mm²) has to be used. The voltage drop over the wire has to be considered!
2	For heavy industrial environment use a four-wire CAN cable. Connect • two twisted wires to the data signals (CAN_H, CAN_L) and • the other two twisted wires to the reference potential (CAN_GND) and • the cable shield to functional earth (FE) at least at one point!
3	The reference potential CAN_GND has to be connected to the functional earth (FE) at exactly **one** point.
4	A CAN bus line must not branch (exception: short cable stubs) and has to be terminated with the characteristic impedance of the line (generally 120 Ω ±10%) at both ends (between the signals CAN_L and CAN_H and **not** at GND)!
5	Keep cable stubs as short as possible (l < 0.3 m)!
6	Select a working combination of bit rate and cable length.
7	Keep away CAN cables from disturbing sources. If this can not be avoided, double shielded cables are recommended.

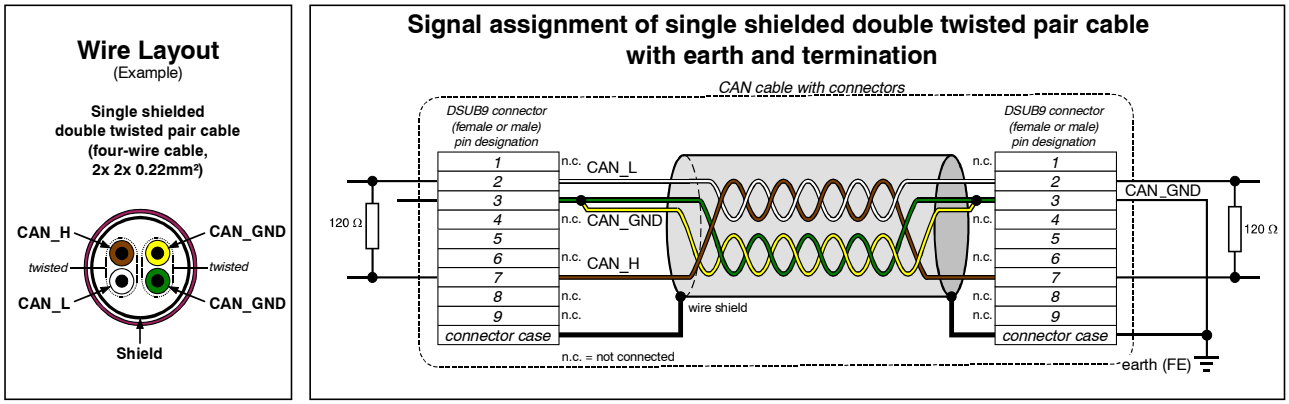


Figure 7: CAN wiring for heavy industrial environment

6.2.2 Device Cabling

- To connect CAN devices which are equipped with one CAN connector per net, use T-connectors and cable stubs (shorter than 0.3 m).

Attention:
If single shielded *double* twisted pair cables are used, realize the T-connections by means of connectors that support connection of two CAN cables at one connector where the cable's shield is looped through e.g. DSUB9 connector from ERNI (ERBIC CAN BUS MAX, order no.:154039).

The usage of esd's T-connector type C.1311.03 is not recommended for single shielded *double* twisted pair cables because the shield potential of the conductive DSUB housing is not looped through this T-connector type.

Furthermore, mixed use of single twisted and double twisted cables should be avoided!

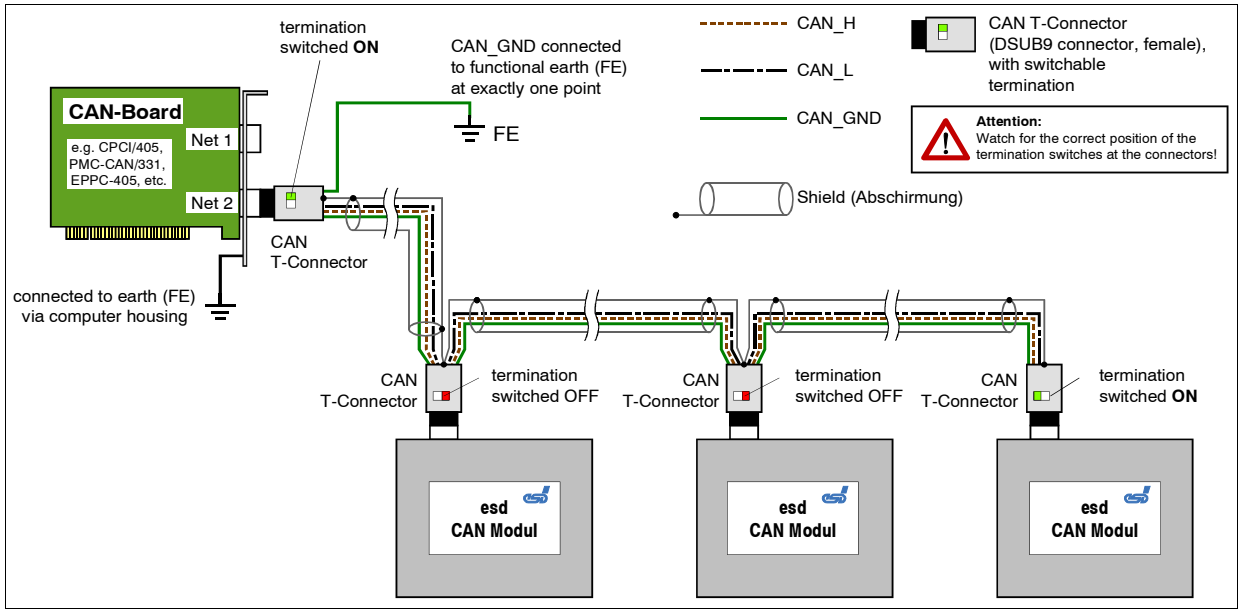


Figure 8: Example for proper wiring with single shielded double twisted pair cables

6.2.3 Termination

- If the used CAN interface is not equipped with an integrated CAN termination and it is at an end of the bus, use external termination plugs.

- A 9-pin DSUB-connector with integrated switchable termination resistor can be ordered e.g. from ERNI (ERBIC CAN BUS MAX, female contacts, order no.:154039).

6.3 Electrical Grounding

- For CAN devices with electrical isolation the CAN_GND must be connected between the CAN devices!
- CAN_GND has to be connected to the earth potential (FE) at **exactly one** point of the network!
- Each *CAN interface with electrical connection to earth potential* acts as an earthing point. For this reason do not connect more than one *CAN device with electrical connection to earth potential*!
- Earthing can e.g. be made at a connector/T-connector.

6.4 Bus Length

- Optical couplers are delaying the CAN signals. esd modules typically reach a wire length of 37 m at 1 Mbit/s within a closed net without impedance disturbances like e.g. cable stubs >> 0.3 m.

Bit rate [Kbits/s]	Typical values of reachable wire length **with esd interface** l_{max} [m]	**CiA recommendations** (07/95) for reachable wire lengths l_{min} [m]
1000	37	25
800	59	50
666.6̄	80	-
500	130	100
333.3̄	180	-
250	270	250
166	420	-
125	570	500
100	710	650
83,3̄	850	-
66.6̄	1000	-
50	1400	1000
33.3̄	2000	-
20	3600	2500
12.5	5400	-
10	7300	5000

Table 7: Recommended cable lengths at typical bit rates (with esd-CAN interfaces)

Note:
Please note the recommendations according to ISO 11898 for the selection of the cross section of the wire depending of the wire length.

6.5 Examples for CAN Cables

6.5.1 Cable for Light Industrial Environment Applications (Two-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (1x 2x 0.22) (UL/CSA approved) Part No.: 2170260 UNITRONIC ®-BUS-FD P CAN UL/CSA (1x 2x 0.25) (UL/CSA approved) Part No.: 2170272
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (1x 2x 0.22 mm²) Order No.: 93 022 016 (UL appr.) BUS-Schleppflex-PUR-C (1x 2x 0.25 mm²) Order No.: 94 025 016 (UL appr.)

6.5.2 Cable for Heavy Industrial Environment Applications (Four-Wire)

Manufacturer	Cable Type
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.com	e.g. UNITRONIC ®-BUS CAN UL/CSA (2x 2x 0.22) (UL/CSA approved) Part No.: 2170261 UNITRONIC ®-BUS-FD P CAN UL/CSA (2x 2x 0.25) (UL/CSA approved) Part No.: 2170273
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e. g. BUS-PVC-C (2x 2x 0.22 mm²) Order No.: 93 022 026 (UL appr.) BUS-Schleppflex-PUR-C (2x 2x 0.25 mm²) Order No.: 94 025 026 (UL appr.)

Note:
Configured CAN cables can be ordered from **esd**.

7. CAN Troubleshooting Guide

The CAN Troubleshooting Guide is a guide to find and eliminate the most frequent hardware-error causes in the wiring of CAN-networks.

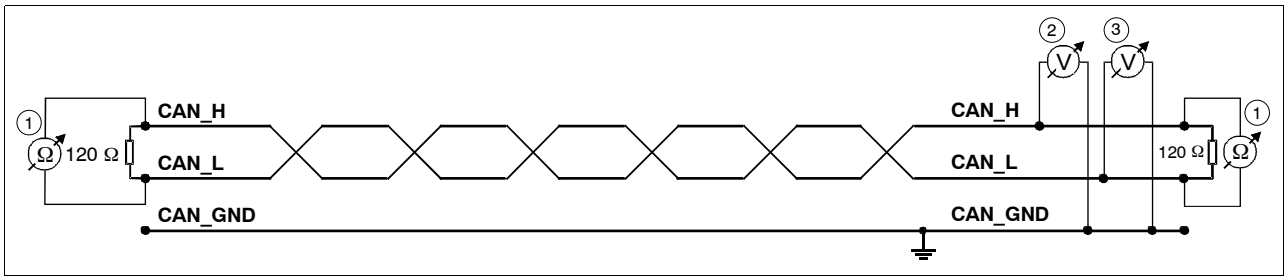


Figure 9: Simplified diagram of a CAN network

7.1 Termination

The termination is used to match impedance of a node to the impedance of the transmission line being used. When impedance is mismatched, the transmitted signal is not completely absorbed by the load and a portion is reflected back into the transmission line. If the source, transmission line and load impedance are equal these reflections are eliminated. This test measures the series resistance of the CAN data pair conductors and the attached terminating resistors.

To test it, please

1. Turn off all power supplies of the attached CAN nodes.
2. Measure the DC resistance between CAN_H and CAN_L at the ends of the network ① (see figure above) and at the centre of the network (if the network cable consists of more than one line section).

The measured value should be between 50 Ω and 70 Ω. The measured value should be nearly the same at each point of the network.

If the value is below 50 Ω, please make sure that:
- there is no short circuit between CAN_H and CAN_L wiring
- there are not more than two terminating resistors
- the nodes do not have faulty transceivers.

If the value is higher than 70 Ω, please make sure that:
- there are no open circuits in CAN_H or CAN_L wiring
- your bus system has two terminating resistors (one at each end) and that they are 120 Ω each.

7.2 Electrical Grounding

The CAN_GND of the CAN network has to be connected to the functional earth potential (FE) at only **one** point. This test will indicate if the CAN_GND is grounded in several places.
To test it, please

1. Disconnect the CAN_GND from the earth potential (FE).
2. Measure the DC resistance between CAN_GND and earth potential (see figure on the right).
3. Connect CAN_GND to earth potential.

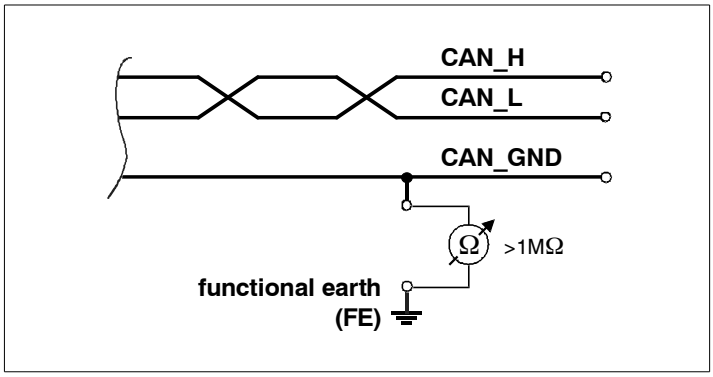


Figure 10: Simplified schematic diagram of ground test measurement

The resistance should be higher than 1 MΩ. If it is lower, please search for additional grounding of the CAN_GND wires.

7.3 Short Circuit in CAN Wiring

A CAN bus might possibly still be able to transmit data if there is a short circuit between CAN_GND and CAN_L, but the error rate will increase strongly. Make sure that there is no short circuit between CAN_GND and CAN_L!

7.4 CAN_H/CAN_L-Voltage

Each node contains a CAN transceiver that outputs differential signals. When the network communication is idle the CAN_H and CAN_L voltages are approximately 2.5 volts. Faulty transceivers can cause the idle voltages to vary and disrupt network communication.

To test for faulty transceivers, please

1. Turn on all supplies.
2. Stop all network communication.
3. Measure the DC voltage between CAN_H and GND ② (see figure above).
4. Measure the DC voltage between CAN_L and GND ③ (see figure above).

Normally the voltage should be between 2.0 V and 4.0 V.

If it is lower than 2.0 V or higher than 4.0 V, it is possible that one or more nodes have faulty transceivers. For a voltage lower than 2.0 V please check CAN_H and CAN_L conductors for continuity. For a voltage higher than 4.0 V, please check for excessive voltage.

To find the node with a faulty transceiver please test the CAN transceiver resistance (see below).

7.5 CAN Transceiver Resistance Test

CAN transceivers have one circuit that controls CAN_H and another circuit that controls CAN_L. Experience has shown that electrical damage to one or both of the circuits may increase the leakage current in these circuits.

To measure the current leakage through the CAN circuits, please use an resistance measuring device and:

1. Switch off the node and disconnect it from the network ④ (see figure below).

2. Measure the DC resistance between CAN_H and CAN_GND ⑤ (see figure below).

3. Measure the DC resistance between CAN_L and CAN_GND ⑥ (see figure below).

The measured resistance has to be about 500 kΩ for each signal. If it is much lower, the CAN transceiver it is probably faulty.
Another sign for a faulty transceiver is a very high deviation between the two measured input resistance (>> 200%).

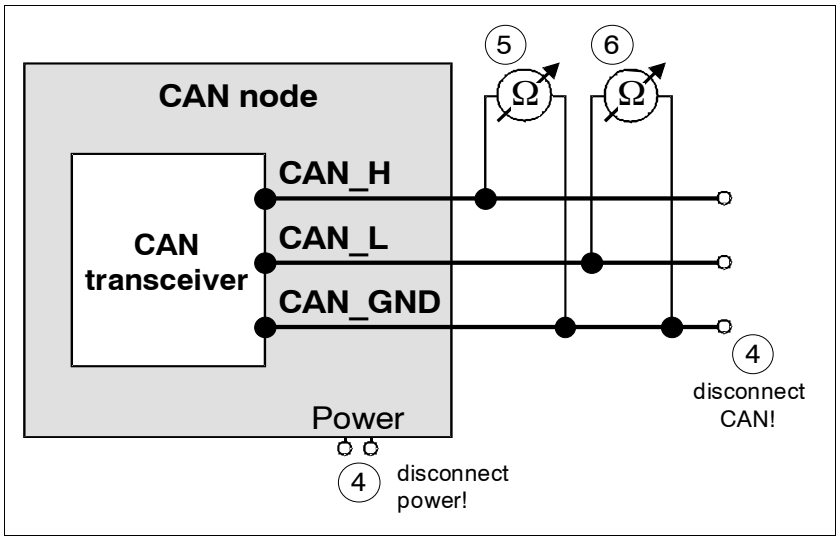


Figure 11: Measuring the internal resistance of CAN transceivers

8. Declaration of Conformity

EG-KONFORMITÄTSERKLÄRUNG
EC DECLARATION OF CONFORMITY

Adresse / *Address*
esd electronic system design gmbh
Vahrenwalder Str. 207
30165 Hannover
Germany

esd erklärt, dass das Produkt *esd declares, that the product*	Typ, Modell, Artikel-Nr. *Type, Model, Article No.*
CAN-PCI/405-B4 plus Adapter CAN-PCI/405-B4-1C4	**C.2041.04 plus C.2041.18**
die Anforderungen der Normen *fulfills the requirements of the standards*	**EN 61000-6-2:2005,** **EN 61000-6-3:2007+A1:2011**
gemäß folgendem Prüfbericht erfüllt. *according to test certificate.*	**H-K00-0330-09**
Das Produkt entspricht damit der EG-Richtlinie „EMV" *Therefore the product corresponds to the EC-Directive 'EMC'*	**2004/108/EG**
Das Produkt entspricht der EG-Richtlinie „RoHS" *The product corresponds to the EC-Directive 'RoHS'*	**2011/65/EU**

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
This declaration loses its validity if the product is not used or run according to the manufacturer's documentation or if non-compliant modifications are made.

Name / *Name* T. Bielert
Funktion / *Title* QM-Beauftragter / *Quality Management Representative*
Datum / *Date* Hannover, 2014-06-12

Rechtsgültige Unterschrift / *authorized signature*

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9. Order Information

Type	Properties	Order No.
CAN-PCI/405-B4	PPC405, 200 MHz, 32 MB SDRAM, 2 MB Flash, 4x CAN via DSUB37 (male) /1 Slot	C.2041.04
CAN layer 2 drivers for Windows and Linux are included in delivery.		
Accessories:		
CAN-PCI/405-B4-1C4	Cable DSUB37 (female) to 4x DSUB9 (male), to CAN-PCI/405-B4	C.2041.18
Software*		
CAN-DRV LCD QNX	CAN-driver object licence for QNX incl. CD-ROM	C.1101.32
CAN-DRV LCD RTX	CAN-driver object licence for RTX incl. CD-ROM	C.1101.35
CAN-DRV LCD OnTime RTOS	CAN-driver object licence for OnTimeRTOS incl. CD-ROM	C.1101.45
CANopen-LCD Windows/Linux	CANopen license for Linux and Windows incl. CD-ROM	C.1101.06
CANopen-LCD QNX	CANopen license QNX incl. CD-ROM	C.1101.17
CANopen-LCD RTX	CANopen license for RTX incl. CD-ROM	C.1101.16
J1939 Stack for Windows	J1939 Stack for esd-CAN-Hardware, includes Windows-XP object code, J1939 Simulation Tool, esd CAN Windows driver license	C.1130.10
J1939 Stack for Linux	J1939 Stack for esd-CAN-Hardware, includes Linux object code, esd CAN driver license for Linux	C.1130.11
J1939 Stack for RTX (Object)	J1939 Stack for esd CAN-Hardware - RTX object code - includes esd CAN driver licence for RTX	C.1130.12

* For detailed information about the driver availability of your special operating system, please contact our sales team.

Table 8: Order information

PDF Manuals
Manuals are available in English and usually in German as well. For availability of English manuals see table below.
Please download the manuals as PDF documents from our esd website www.esd.eu for free.

Manuals		Order No.
CAN-PCI/405-B4-ME	Hardware manual in English	C.2041.21
CAN-API-ME	NTCAN-API: Application Developers Manual NTCAN-API: Driver Installation Guide	C.2001.21
CANopen-ME	CANopen Manager/Slave Manual	C.2002.21
J1939 Software Manual	J1989 Software Manual in English	C.1130.21

Table 9: Available manuals

Printed Manuals
If you need a printout of the manual additionally, please contact our sales team: sales@esd.eu for a quotation. Printed manuals may be ordered for a fee.