CAN-PCI/266

Passive 66-MHz PCI-CAN Interface

Hardware Manual

to Product C.2036.02, C.2036.04

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N O T E

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This manual contains important information and instructions on safe and efficient handling of the CAN-PCI/266. Carefully read this manual before commencing any work and follow the instructions.
The manual is a product component, please retain it for future use.

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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
1.4	-	Editorial revision	2012-02-08
	-	'Safety Instructions' inserted	
	1.2	Jumper description deleted	
	1.2.1	Chapter: 'Jumper' deleted	
	2.	Chapter revised, Jumper description removed	
	3.3	Description of bus termination changed	
	3.4	Chapter: 'Software Support' revised	
	6.	Current version of the chapter inserted	
	9.	Chapter: 'Order Information' moved and revised	
1.5	-	Safety Information revised	2015-11-23
	2.	“Hardware Installation” safety messages revised	
	5.	CAN wiring hints for double twisted pair cables	
	8.	EU-Declaration of Conformity new	
	9.	Order information revised	

Technical details are subject to change without further notice.

Safety Instructions

- When working with CAN-PCI/266 follow the instructions below and read the manual carefully to protect yourself from injury and the CAN-PCI/266 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/266 from dust, moisture and steam.
- Protect the CAN-PCI/266 from shocks and vibrations.
- The CAN-PCI/266 may become warm during normal use. Always allow adequate ventilation around the CAN-PCI/266 and use care when handling.
- Do not operate the CAN-PCI/266 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/266 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 domestic animals and property.
- 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/266 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.

DANGER
Hazardous Voltage - **Risk of electric shock** due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the CAN-PCI/266 is to be integrated.
→ Disconnect all hazardous voltages (mains voltage) before opening the system.
→ Ensure the absence of voltage before starting any electrical work

ATTENTION
Electrostatic discharges may cause damage to electronic components.
To avoid this, please perform the steps described on page 8 *before* you touch the CAN-PCI/266, 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/266 is an industrial product and 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/266 is the operation as a PCI CAN interface.
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/266 is intended for installation in PCI systems only.
- The operation of the CAN-PCI/266 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CAN-PCI/266 for medical purposes is prohibited.

Service Note
The CAN-PCI/266 does not contain any parts that require maintenance by the user. The CAN-PCI/266 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.

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1. Overview

1.1 Description of the Module

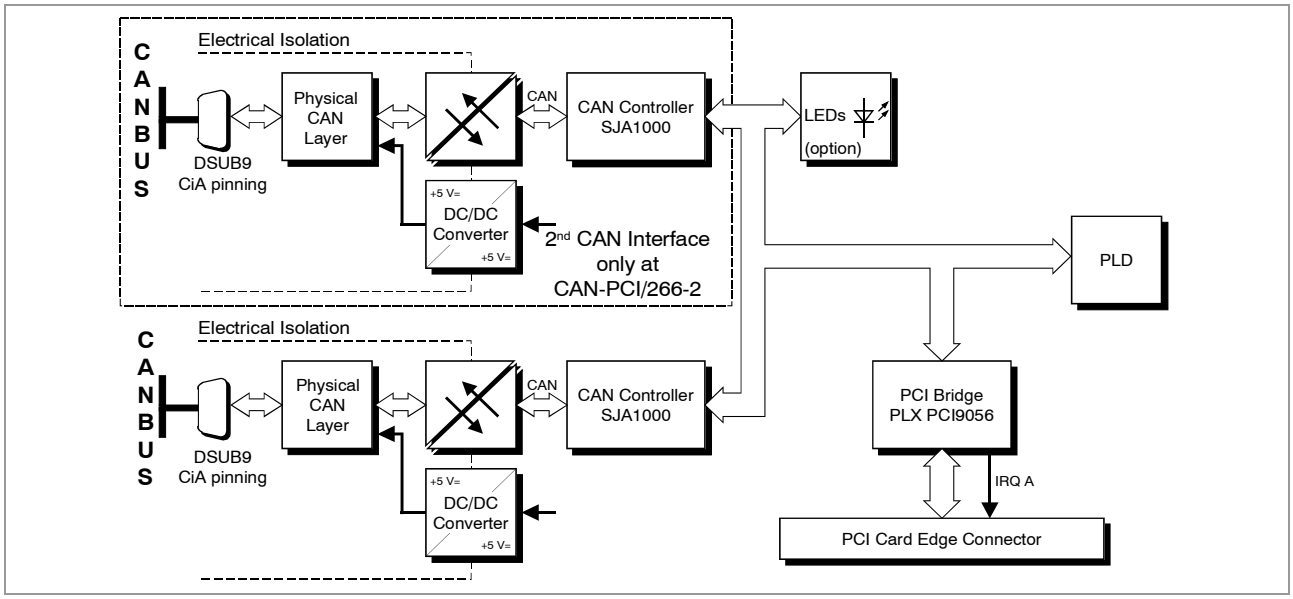


Figure 1: Block circuit diagram of CAN-PCI/266

The CAN-PCI/266 is a passive PCI-bus board for 66 MHz PCI-bus systems with one or optional two CAN-interfaces. The CAN-PCI/266 works with a bus width of 32 bits. The module can also be used in 33 MHz PCI-bus systems at a bus speed of 33 MHz.

The ISO 11898 compliant CAN-interfaces allow a data transfer rate of 1 Mbit/s. Among many other features the bit rate can be parametrised by software.
The CAN interface is electrically isolated from the other potentials by optocouplers and DC/DC-converters.
Optional the board can be delivered with DeviceNet interface or Single-Wire interface.

The CAN-PCI-266-2 (with two CAN-interfaces) is equipped with four LEDs in the front panel.

1.2 PCB View with Connectors

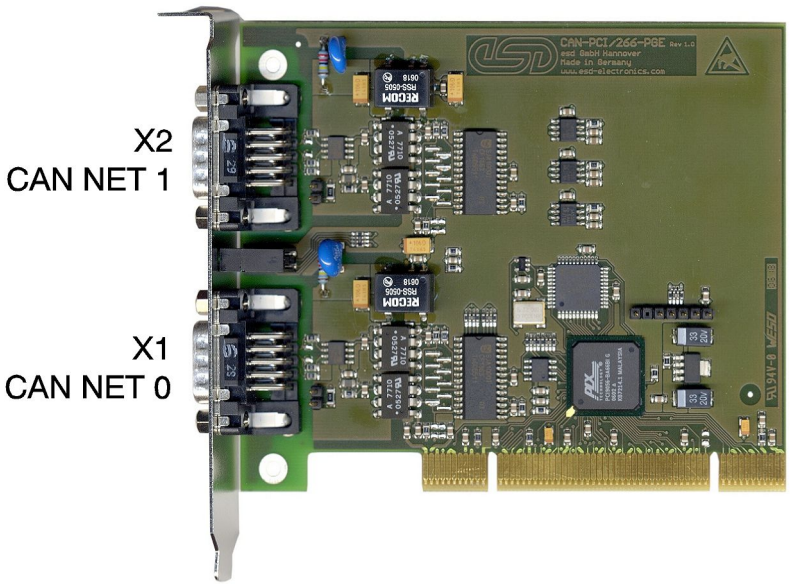


Figure 2: Top layer view of the module with 2x CAN

See also page 13 for signal assignment of the CAN connectors.

2. Hardware Installation

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

DANGER
Hazardous Voltage - Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the CAN-PCI/266 is to be integrated. Never carry out work while power supply voltage is switched on!

ATTENTION
Electrostatic discharges may cause damage to electronic components.
To avoid this, discharge the static electricity from your body by touching the metal case of the PCI system *before* you touch the CAN-PCI/266.
Furthermore, you should prevent your clothes from touching the CAN-PCI/266, because your clothes might be electrostatically charged as well.

Procedure:

1. Switch off your computer and all connected peripheral devices (monitor, printer, etc.). Switch off the connected CAN devices.
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
   Hazardous Voltage - Risk of electric shock due to unintentional contact with uninsulated live parts with high voltages inside of the system into which the CAN-PCI/266 is to be integrated.
   → Disconnect all hazardous voltages (mains voltage) before opening the system.
   → Ensure the absence of voltage before starting any electrical work
4. Open the case.
5. Select an open PCI slot and remove the slot cover at the back 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 can damage the PC and the board!
6. Insert the CAN-PCI/266 board into the selected PCI slot. Carefully push the board down until it snaps into place.
7. Attach the board.
   Use the screw you removed from the slot cover in step 5.
8. Close the computer case again.
9. Connect the CAN wire.
   Please note that the CAN bus has to be terminated at both ends!
   Use the special T- connectors and terminator connectors offered by esd. 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 first CAN interface (CAN net 0) has to be connected via the lower DSUB connector (X1) and the second CAN interface (CAN net 1) has to be connected via the upper DSUB connector (X2).

10. Connect the computer to mains again (mains connector or safety fuse).
11. Switch on the computer and the peripheral devices.
12. End of hardware installation.

    Continue with the software installation as described in the manual ‘CAN-API, Installation Guide’.

3. Technical Data

3.1 General Technical Data

Ambient temperature	0...50°C
Humidity	90 %, non-condensing
Supply voltage	via PCI-bus, Nominal voltage / current (typ., at 20°C): 5 V ±5% / 0.16 A (2x CAN) **and** 3.3 V ±5% / 0.17 A
Plug- and socket connectors	X1 (DSUB9/male) - CAN Net 0 X2 (DSUB9/male) - optional CAN Net 1 X100 (card edge) - PCI-bus
Dimensions	99.1 mm x 120 mm (board only)
Weight	100 g (2 x CAN)

Table 1: General technical data of the module

3.2 PCI-Bus

Host bus	PCI bus according to PCI Local Bus Specification 2.2
PCI bus width	32 bit
PCI bus clock rate	66 MHz / 3.3 V signalling level or 33 MHz / 3.3 V or 5.0 V signalling level
Controller	PLX PCI9056
Interrupt	Interrupt Signal A
Slot position	no restrictions for the position of the CAN-PCI/266 on the PCI bus, PCI bridges are tolerated
Board dimensions	compatible with all 'short' PCI-card slots
Connector	PCI-card edge connector

Table 2: PCI bus data

3.3 CAN Interface

Number of CAN interfaces	1, optional 2 CAN interfaces
CAN controller	SJA1000
CAN protocol	basic CAN 2.0A/2.0B
Physical Layer	physical layer according to ISO 11898, transmission rate is programmable from 10 kbit/s to 1 Mbit/s
Bus termination	terminating resistor has to be set externally
Electrical separation of CAN interfaces from other units and from each other	separation by means of optocouplers and DC/DC-converters
DeviceNet-Option	adapter board with DeviceNet connector in Phoenix Combicon style, optocouplers and CAN driver according to DeviceNet specification 'DeviceNet Communication Model and Protocol, Rel. 2.0'

Table 3: Data of the CAN interface

3.4 Software Support

Software drivers are available for Windows and Linux. Drivers for other operating systems are available as well. For detailed information about the driver availability of your special operating system, please contact our sales team: sales@esd.eu

The CAN layer 2 (CAN-API) software installation and the software drivers are described in the manual:

“NTCAN-API Part 1: Structure, Function and C/C++ API” Application Developers Manual and
“NTCAN-API Part 2: Installation, Configuration and Firmware Update” Installation Guide
esd-order No.: C.2001.21

4. Front Panel View with LED-Display

The CAN-PCI-266 is equipped with four green LEDs in the front panel.

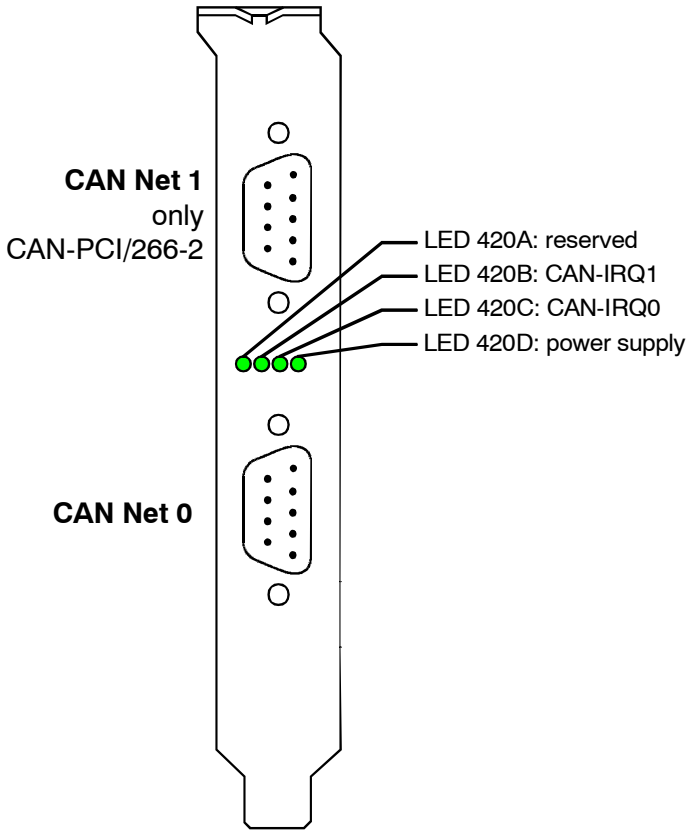


Figure 3: Front panel view

LED	Colour	Name	Display function (LED on)
D420A	green	**ADU-CS**	reserved
D420B	green	**CAN-IRQ1**	interrupt of CAN net 1 active - CAN frames are received or transmitted
D420C	green	**CAN-IRQ0**	interrupt of CAN net 0 active - CAN frames are received or transmitted
D420D	green	**-**	5 V- power supply on

Table 4: LEDs

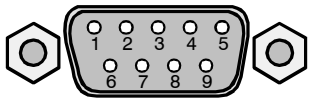
5. Connector Assignments

5.1 CAN

The signal assignments of CAN-net 0 (X1) and of the optional CAN-net 1 (X2) are identical.

Device connector: 9-pin DSUB connector, male

Pin Position:



Pin Assignment:

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

Signal Description:

CAN_L, CAN_H ...	CAN signal lines
CAN_GND ...	reference potential of the local CAN physical layer
(CAN_GND)...	optional reference potential of the local CAN physical layer
Shield ...	shielding (connected with the case of the 9-pin DSUB connector)
reserved ...	reserved for future applications, do not connect!

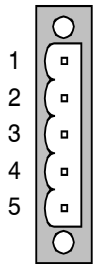
5.2 Option: DeviceNet-Interface

The DeviceNet interface is designed according to specification 'DeviceNet Communication Model and Protocol, Rel. 2.0' .

The power supply of the CAN-bus driver has to be supported from external and the connection is done via pluggable clamps of Phoenix MSTB 2,5/-GF-5,08 type (or equivalent).

Pin Position:

(device connector view)



Pin Assignment:

Pin	Signal
1	V-
2	CAN-
3	Shield
4	CAN+
5	V+

Signal Description:

V+...	power supply (U_{VCC} = 24 V ± 4%)
V-...	reference potential to V+ and to CAN+/CAN-
CAN+, CAN-...	CAN-signals
Shield...	Shielding (via high resistance RC combination connected to earth (shield panel))

6. Correctly Wiring Electrically Isolated CAN Networks

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

6.1 Standards concerning CAN Wiring

The flexibility in CAN network design is one of the key strengths of the various extensions and additional standards like e.g. CANopen, ARINC825, DeviceNet and NMEA2000 that have been built on the original ISO 11898-2 CAN standard. In using this flexibility comes the responsibility of good network design and balancing these tradeoffs.

Many CAN organizations and standards have scaled the use of CAN for applications outside the original ISO 11898. They have made system level tradeoffs for data rate, cable length, and parasitic loading of the bus.

However for CAN network design margin must be given for signal loss across the complete system and cabling, parasitic loadings, network imbalances, ground offsets against earth potential and signal integrity. **Therefore the practical maximum number of nodes, bus length and stub length are typically much lower.**

esd has concentrated her recommendations concerning CAN wiring on the specifications of the ISO 11898-2. Thus this wiring hints forgoes to describe the special features of the derived standards CANopen, ARINC825, DeviceNet and NMEA2000.

The consistent compliance to ISO 11898-2 offers significant advantages:

- Durable operation due to well proven design specifications
- Minimizing potential failures due to sufficient margin to physical limits
- Trouble-free maintenance during future network modifications or during fault diagnostics due to lack of exceptions

Of course reliable networks can be designed according the specifications of CANopen, ARINC825, DeviceNet and NMEA2000, **however it must be observed that it is strictly not recommended to mix the wiring guidelines of the various specifications!**

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

6.2.1 General Rules

NOTICE
esd only grants the compliance with directive 2014/30/EU, if the CAN wiring is carried out with single shielded **double twisted** pair cables that match the requirements of ISO 11898-2.

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

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate conductor 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** to CAN_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.

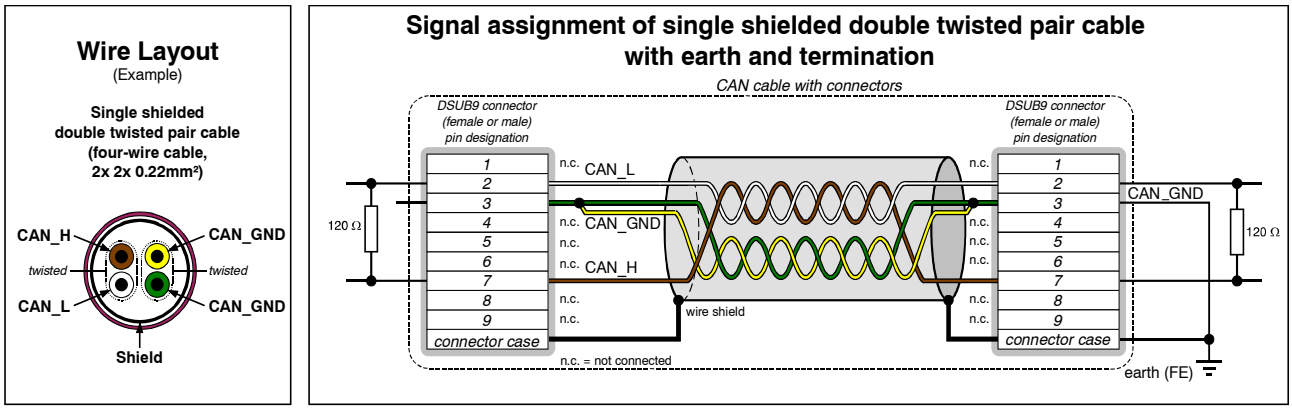


Figure 4: CAN wiring for heavy industrial environment

6.2.2 Device Cabling

NOTICE
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.

If a mixed application of single twisted and double twisted cables is unavoidable, take care that the CAN_GND line is not interrupted!

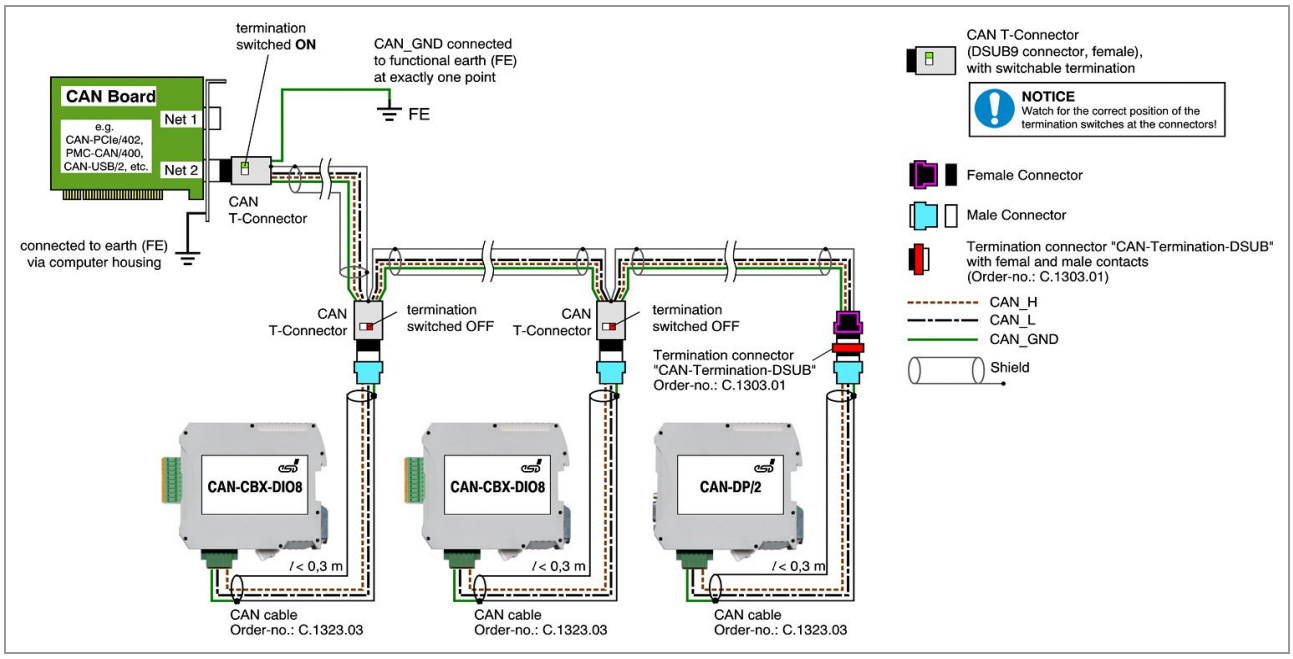


Figure 5: Example of proper wiring with single shielded double twisted pair cables

6.2.3 Termination

- A termination resistor has to be connected at both ends of the CAN bus.
  If an integrated CAN termination resistor which is equipped at the CAN interface at the end of the bus is connected, this one has to be used for termination instead of an external CAN termination plug.

- 9-pin DSUB-termination connectors with integrated termination resistor and male and female contacts (gender changer) are available from esd (order no. C.1303.01).

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

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

6.3.1 General Rules

NOTICE
esd only grants the compliance with directive 2014/30/EU, if the CAN wiring is carried out with single shielded **double twisted** pair cables that match the requirements of ISO 11898-2. See previous chapter: 'Heavy Industrial Environment (Double Twisted Pair Cable)'.

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

1	A cable type with a wave impedance of about 120 Ω ±10% with an adequate conductor 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 CAN_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.

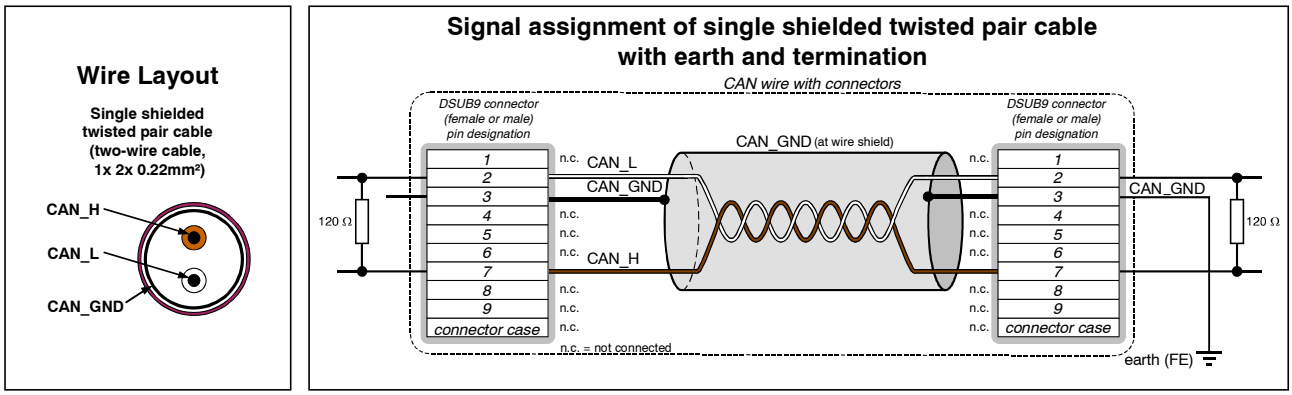


Figure 6: CAN wiring for light industrial environment

6.3.2 Cabling

- To connect CAN devices with just one CAN connector per net use a short stub (< 0.3 m) and a T-connector (available as accessory). If this devices are located at the end of the CAN network, the CAN terminator “CAN-Termination-DSUB9” can be used.

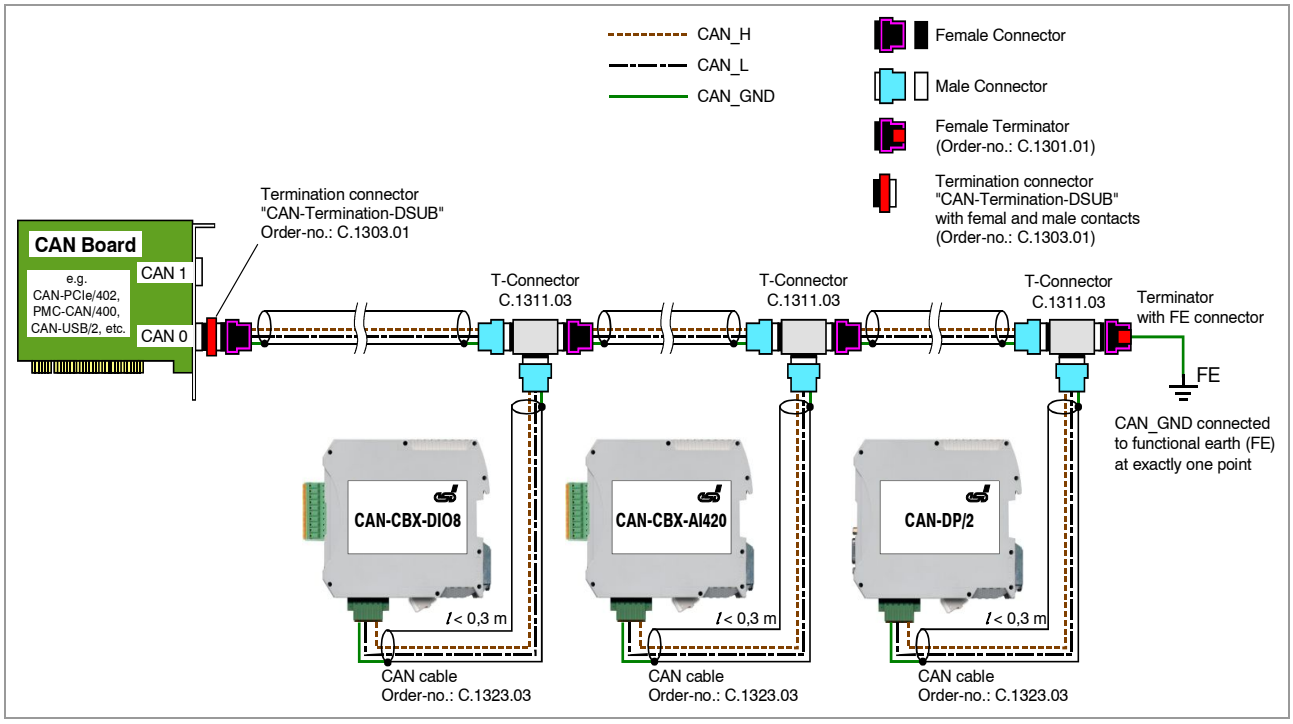


Figure 7: Example for proper wiring with single shielded single twisted pair wires

6.3.3 Termination

- A termination resistor has to be connected at both ends of the CAN bus.
  If an integrated CAN termination resistor which is equipped at the CAN interface at the end of the bus is connected, this one has to be used for termination instead of an external CAN termination plug.

- 9-pin DSUB-termination connectors with integrated termination resistor and male and female contacts (gender changer) are available from esd (order no. C.1303.01).

- DSUB termination connectors with male contacts (order no. C.1302.01) or female contacts (order no. C.1301.01) and additional functional earth contact are available, if CAN termination and grounding of CAN_GND is required.

6.4 Electrical Grounding

- For CAN devices with electrical isolation the CAN_GND must be connected between the CAN devices.
- CAN_GND should 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 a grounding point. For this reason it is recommended not to connect more than one *CAN device with electrical connection to earth potential.*
- Grounding can be made e.g. at a termination connector (e.g. order no. C.1302.01 or C.1301.01).

6.5 Bus Length

Bit rate [Kbit/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.$\overline{6}$	80	-
500	130	100
333.$\overline{3}$	180	-
250	270	250
166	420	-
125	570	500
100	710	650
83,$\overline{3}$	850	-
66.$\overline{6}$	1000	-
50	1400	1000
33.$\overline{3}$	2000	-
20	3600	2500
12.5	5400	-
10	7300	5000

Table 5: Recommended cable lengths at typical bit rates (with esd-CAN interfaces)

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

NOTICE
Please note the recommendations of ISO 11898 regarding to the configuration of the cable cross-section in dependance of the cable length.

6.6 Examples for CAN Cables

esd recommends the following two-wire and four-wire cable types for CAN network design. These cable types are used by esd for ready-made CAN cables, too.

6.6.1 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.)

6.6.2 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.)

INFORMATION
Ready-made CAN cables with standard or custom length 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.

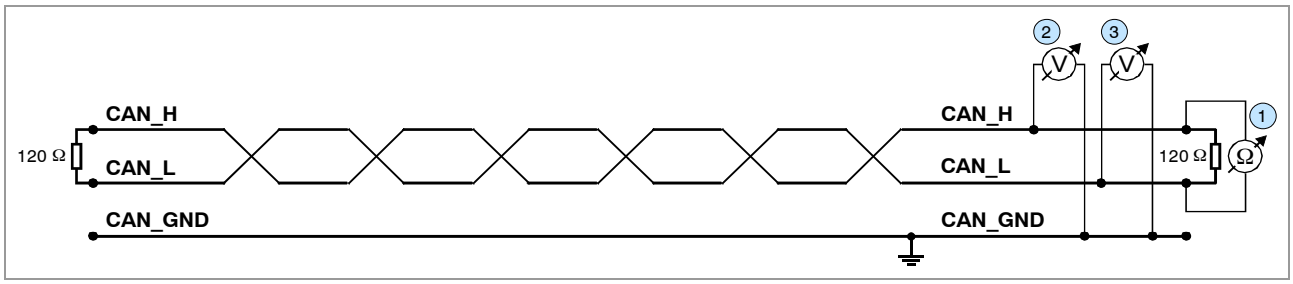


Figure 8: Simplified diagram of a CAN network

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 avoided. 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 one end of the network ① (see figure above).

The measured value should be between 50 Ω and 70 Ω.

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 connected
- 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 should be connected to the functional earth potential (FE) at only **one** point. This test will check 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. Reconnect CAN_GND to earth potential.

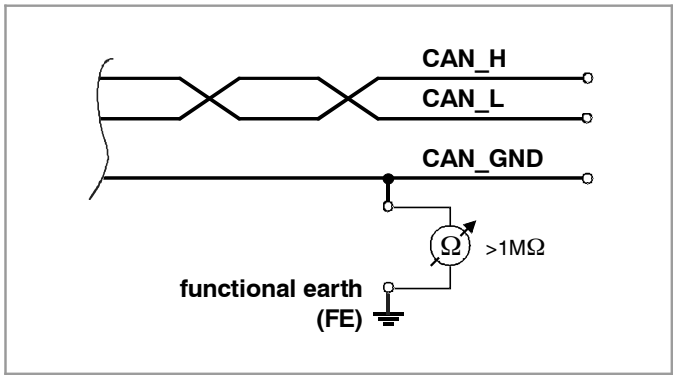


Figure 9: Simplified schematic diagram of ground test measurement

The measured 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 generally 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 V measured to CAN_GND. 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 CAN_GND (2) (see figure at previous page).
4. Measure the DC voltage between CAN_L and CAN_GND (3) (see figure at previous page).

Normally the voltage should be between 2.0 V and 3.0 V.

If it is lower than 2.0 V or higher than 3.0 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.

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

7.5 CAN Transceiver Resistance Test

CAN transceivers have circuits that control CAN_H and CAN_L. Experience has shown that electrical damage of the circuits may increase the leakage current in these circuits.

To measure the current leakage through the CAN circuits, please use a 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 indication for a faulty transceiver is a very high deviation between the two measured input resistances (>> 200 %).

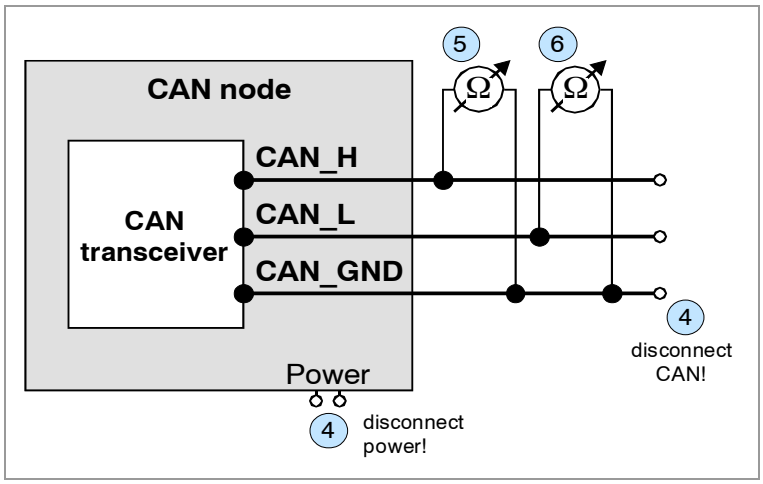


Figure 10: Measuring the internal resistance of CAN transceivers

7.6 Support by esd

If you have executed the fault diagnostic steps of this troubleshooting guide and you even can not find a solution for your problem our support department will be able to assist.
Please contact our support via email at **support@esd.eu** or by phone **+40-511-37298-130**.

8. Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG
EU 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/266-1 **CAN-PCI/266-2**	**C.2036.02** **C.2036.04**
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-K00-0470-12**
Das Produkt entspricht damit der EU-Richtlinie „EMV" *Therefore the product conforms to the EU Directive 'EMC'*	**2014/30/EU**
Das Produkt entspricht der EU-Richtlinie „RoHS" *The product conforms to the EU 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. Ramm
Funktion / *Title*	CE-Koordinator / *CE Coordinator*
Datum / *Date*	Hannover, 2015-10-20

Rechtsgültige Unterschrift / *authorized signature*

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9. Order Information

Type	Properties	Order No.
CAN-PCI/266-1	1x CAN 2.0A/B, ISO11898	C.2036.02
CAN-PCI/266-2	2x CAN ISO 11898	C.2036.04
CAN layer2 drivers for Linux and Windows are included in delivery		
Software Drivers*		
CAN-DRV LCD QNX	object licence for QNX incl. CD-ROM	C.1101.32
CAN-DRV LCD VxWorks	object licence for VxWorks incl. CD-ROM	C.1101.55
CAN-DRV LCD RTX	object licence for RTX incl. CD-ROM	C.1101.35
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 VxWorks	CANopen license for VxWorks incl. CD-ROM	C.1101.18
CANopen-LCD RTX	CANopen license for RTX incl. CD-ROM	C.1101.16

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

Table 6: 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/266-ME	Hardware manual in English	C.2036.21
CAN-API-ME	NTCAN API manual 1/2: Application Developers Manual NTCAN API manual 2/2: Driver Installation Guide	C.2001.21
CANopen-ME	CANopen manuals in English	C.2002.21

Table 7: 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.