CAN-PCI/331

PCI-CAN-Interface

DN-PCI/331

PCI-DeviceNet-Interface

Hardware Manual

to Product C.2020.xx
and C.2017.xx

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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
1.6	6.	Wiring hints updated.	2014-12-18
1.5	-	Manual application limited to DeviceNet hardware versions from “DEV331 rev. 1.1” (see print at PCB top layer corner) on only.	2014-01-27
1.5	1.3	Figure “Top layer view of the DN-PCI/331-2” inserted.	2014-01-27
1.5	4	Chapter “LED description” inserted.	2014-01-27
1.4	3.3	Reference voltage of electrical isolation of CAN-PCI/331 inserted.	2013-12-27
1.4	4.2	Shield not connected at DN-PCI/331 with order no. C.2017.06 and C.2017.07	2013-12-27
1.4	8.	Update of order information.	2013-12-27
1.3	-	Added new trademarks	2012-04-13
1.3	-	New safety instructions	2012-03-01
1.3	1.2	New picture of the top layer	2012-03-01
1.3	2	Update chapter “Hardware Installation”	2012-03-01
1.3	5	Update chapter “Correctly Wiring Electrically Isolated CAN Networks”	2012-03-01
1.3	6	Added new chapter “CAN Troubleshooting Guide”	2012-03-01
1.3	8	Update chapter “Order Information”	2012-03-01

Technical details are subject to change without further notice.

Safety Instructions

- When working with CAN-PCI/331 follow the instructions below and read the manual carefully to protect yourself from injury and the CAN-PCI/331 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/331 from dust, moisture and steam.
- Protect the CAN-PCI/331 from shocks and vibrations.
- The CAN-PCI/331 may become warm during normal use. Always allow adequate ventilation around the CAN-PCI/331 and use care when handling.
- Do not operate the CAN-PCI/331 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/331 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/331 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 9 *before* you touch the CAN-PCI/331, 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/331 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 for the use in industrial environment.

Intended Use

The intended use of the CAN-PCI/331 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/331 is intended for installation in PCI systems only.
- The operation of the CAN-PCI/331 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CAN-PCI/331 for medical purposes is prohibited.

Service Note

The CAN-PCI/331 does not contain any parts that require maintenance by the user. The CAN-PCI/331 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

This manual describes the hardware of the CAN-PCI/331 and the DN-PCI/331 because both devices are based on a comparable design.

1.1 Description of the CAN-PCI/331

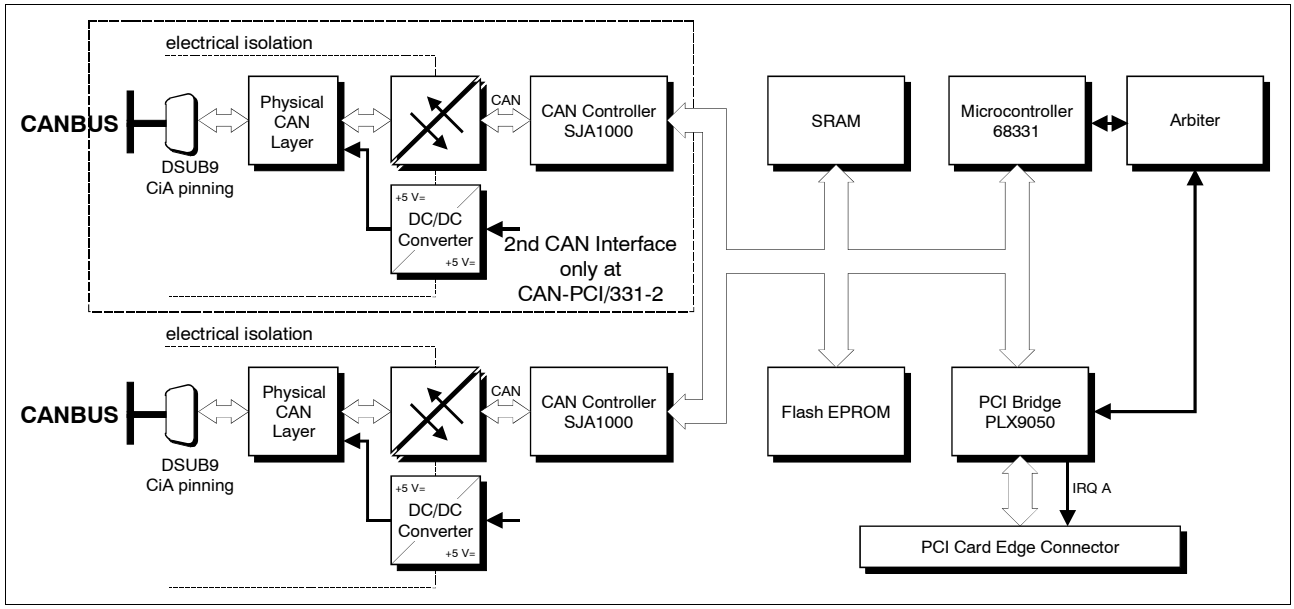


Figure 1: Block circuit diagram of CAN-PCI/331

The CAN-PCI/331 is an intelligent PC card for PCI-bus systems. It is equipped with a MC68331 microcontroller, that controls the CAN data locally. The microcontroller buffers the CAN data in a local SRAM. Data security and consistency are guarantated up to 1 Mbit/s.

The ISO 11898 compliant CAN-interfaces allow a data transfer rate of 1 Mbit/s. Among many other features the bit rate can be set by software. The CAN interface is electrically isolated from the other potentials by optocouplers and DC/DC-converters.

1.2 Description of the DN-PCI/331

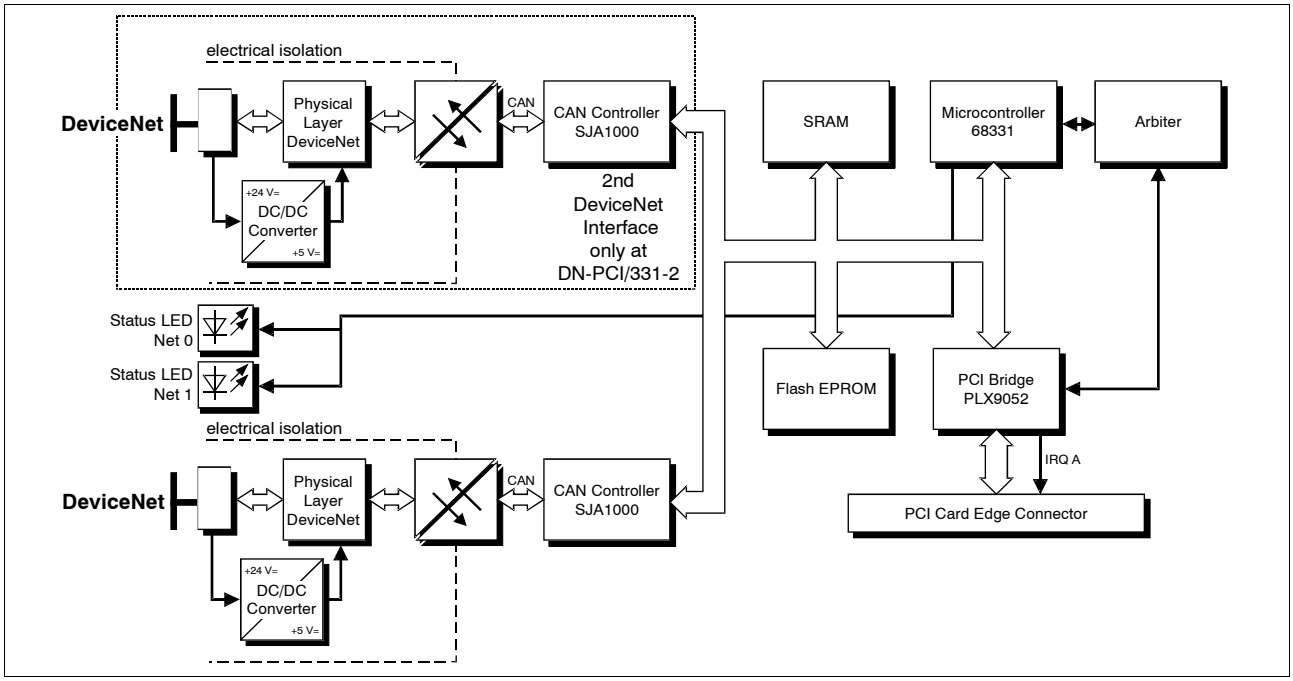


Figure 2: Block circuit diagram of DN-PCI/331

The DeviceNet interface of the DN-PCI/331 meets the requirements of the DeviceNet specification 2.0.

1.3 PCB View with Connectors

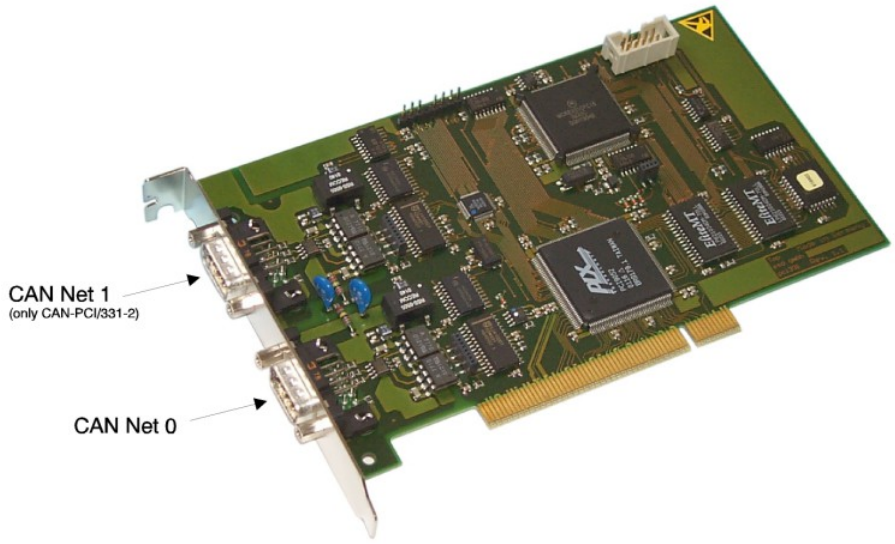


Figure 3: Top layer view of the CAN-PCI/331-2 module with 2x CAN

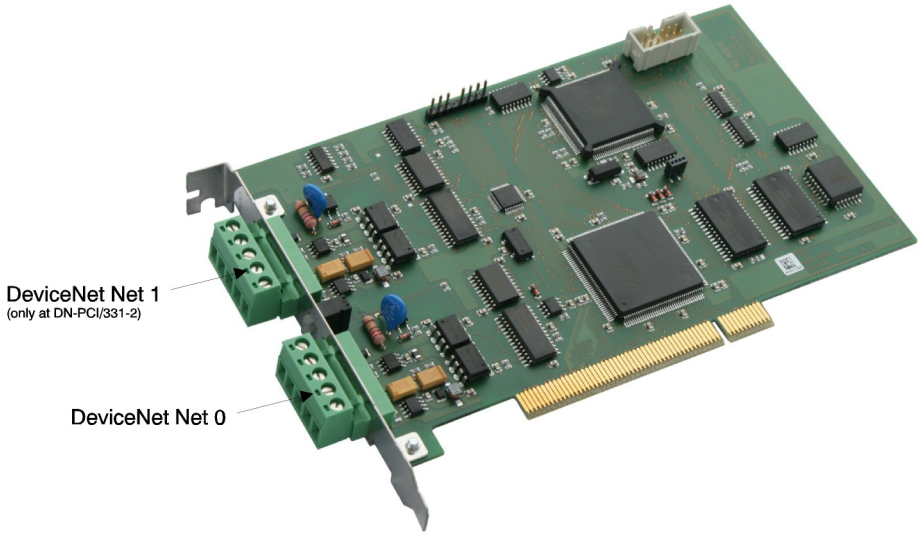


Figure 4: Top layer view of the DN-PCI/331-2 module with 2x DeviceNet

2. Hardware Installation

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 discharge the static electricity from your body by touching the metal case of the PCI *before* you touch the CAN-PCI/331.

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!
   Don't work on your computer with opened housing and power supply switched on!
4. Open the case.
5. Select a free 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.
6. Insert the 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 network cable.

   CAN-PCI/331: Please note the wiring hints in chapter Fehler: Referenz nicht gefunden.
   The first CAN interface (CAN net 0) has to be connected via the lower DSUB connector (X401) and the second CAN interface (CAN net 1) has to be connected via the upper DSUB connector (X400).
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.

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% — 0.55 A (1x CAN); 0.7 A (2x CAN)
Connectors	X100 (Card Edge) - PCI-Bus X400 (DSUB9/male) - optional CAN-Net 1 X401 (DSUB9/male) - CAN-Net 0 The following connectors are only used for programming or test purposes: X201 (10-pin socket connector) - BDM-interface X501 (5-pin plug connector) - ISP-programming
Dimensions	174.57 mm x 106.68 mm
Weight	< 200 g

Table 1: General technical data of the module

3.2 PCI-Bus

Host-Bus	PCI bus according to PCI Local Bus Specification 2.1
PCI bus width	32 bit
Controller	PLX 9050
Interrupt	interrupt signal A
Slot position	no restrictions for the position of the CAN-PCI/331 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/DeviceNet Interface

Number of CAN interfaces	1, optional 2 CAN interfaces	
CAN controller	SJA1000 (11 bit CAN-ID)	
CAN protocol	1x CAN 2.0A according to ISO 11898-1	
	Order-no:	Description:
	C.2020.02 and C.2020.04	CAN 2.0A (11 bit CAN-ID)
	C.2020.03 and C.2020.05	CAN 2.0A/B (11/29 bit CAN-ID)
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	
Electrical separation of CAN interfaces from other units and from each other	separation by means of optocouplers and DC/DC-converters CAN-PCI/331: voltage over CAN isolation (CAN to slot bracket/EARTH; CAN to host/system ground; CAN to CAN): 1kV DC @ 1s (I < 1 mA)	
DeviceNet	**Only at DN-PCI/331:** Onboard interface 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 fieldbus 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 see chapter “9. Order Information” at page 24 or contact our sales team: sales@esd.eu.

4. LED Description (DN-PCI/331 only)

The DN-PCI/331 is equipped with one combined module/network status LED for each channel:

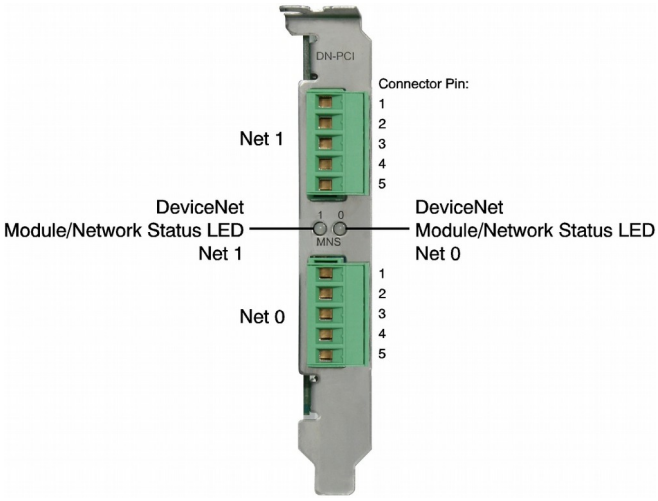


Figure 5: LED position at the DN-PCI/331-2

LED Display	Status	Description
slowly flashing green/red/off	Not Configured	DeviceNet network interface has not been configured
off	Not On-line, Not Powered	- DN-PCI/331 has not completed the Dup_MAC_ID test yet - DN-PCI/331 may not be powered
green	Device Operational AND On-line, Connected	DN-PCI/331 is operating in normal condition and is on-line with connections in the established state
flashing green	Device Operational AND On-line, Not Connected	- DN-PCI/331 is operating in normal condition and is on-line with no connections in the established state - DN-PCI/331 has passed Dup_MAC_ID test, is on-line but has no established connections to other nodes, i.e. the internal slave of the DN-PCI/331 is not owned by a master/scanner.
flashing red	Minor Fault and/or Connection Time-Out	Recoverable fault and/or one or more I/O-connections are in the Timed-Out state
red	Critical Fault or Critical Link Failure	DN-PCI/331 has an unrecoverable fault; may need replacing. Failed communication device. DN-PCI/331 has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC_ID or Bus-off)
flashing red/green	Communication Faulted and Received an Identify Comm Fault Request- Long Protocol	A specific Communication Faulted device. DN-PCI/331 has detected a network access error and is in the Communication faulted state. DN-PCI/331 has subsequently received and accepted an Identify Communication Faulted Request- Long Protocol message (not yet implemented)

Table 4: DeviceNet module/network status LED description

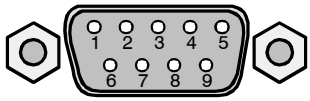
5. Connector Assignments

5.1 CAN (CAN-PCI/331 only)

The signal assignments of CAN-net 0 (X400) and of the optional CAN-net 1 (X401) 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!

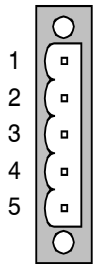
5.2 DeviceNet Interface (DN-PCI/331 only)

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

The power supply of the CAN 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 (internally not connected)

6. Correct Wiring of 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 space to physical limits
- Trouble-free maintenance at future network modifications or at 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

Note:
esd only grants the compliance with directive 2004/108/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 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** 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.

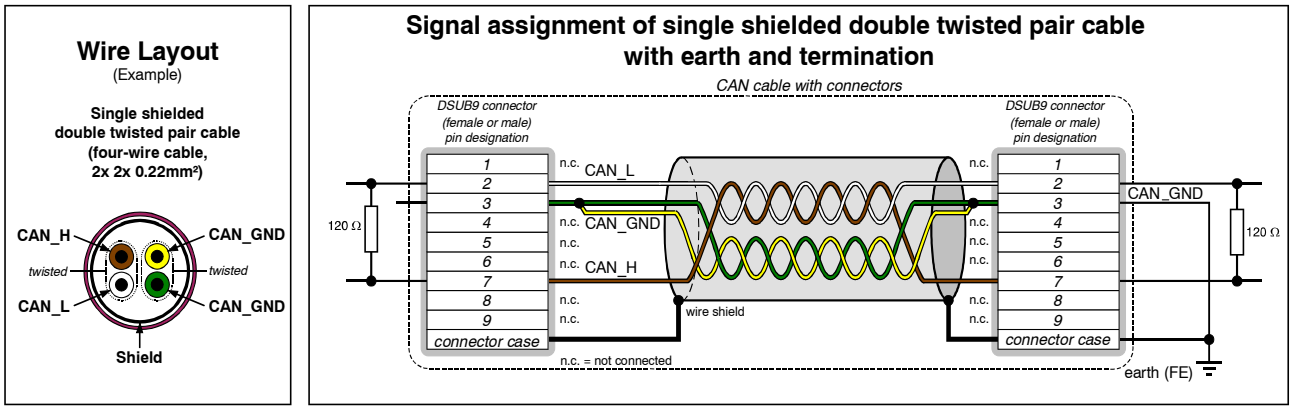


Figure 6: CAN wiring for heavy industrial environment

6.2.2 Device Cabling

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.

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

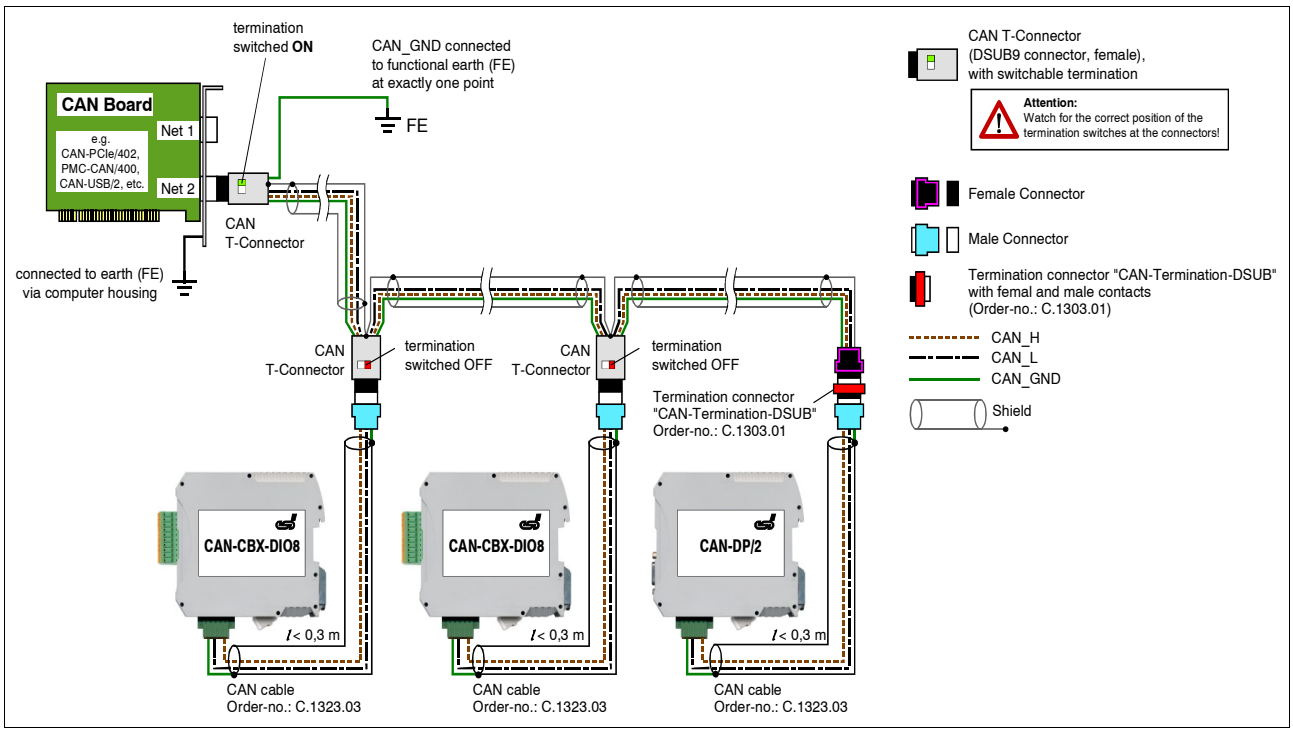


Figure 7: Example of proper wiring with single shielded double twisted pair cables

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

Note:
esd only grants the compliance with directive 2004/108/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 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 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.

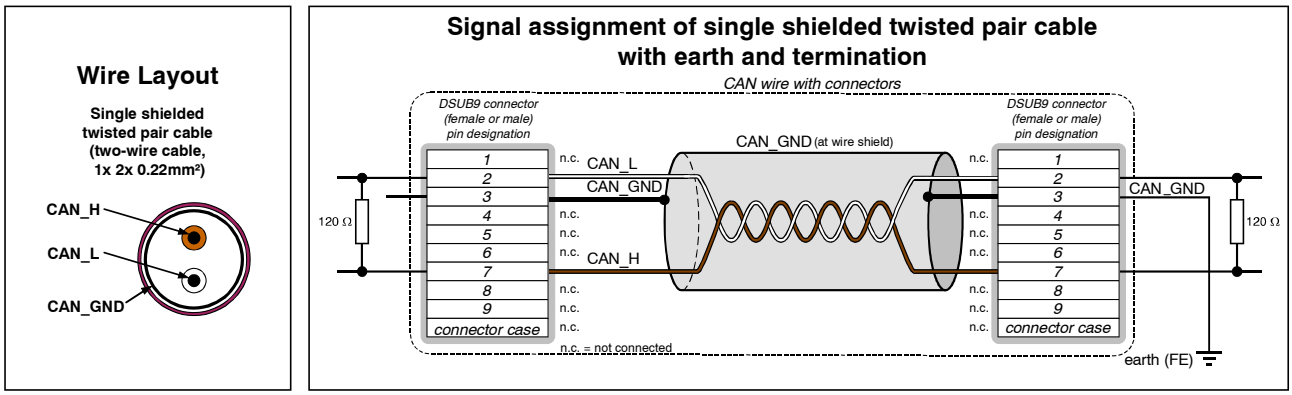


Figure 8: CAN wiring for light industrial environment

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.

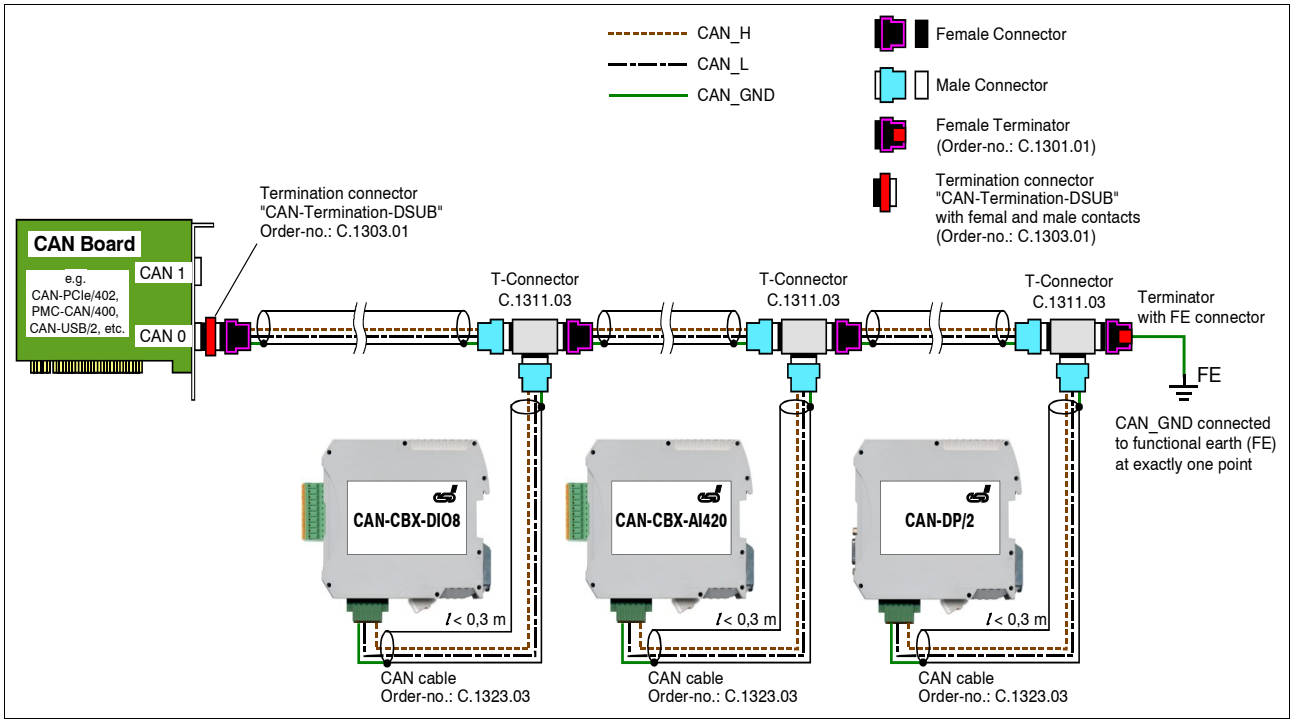


Figure 9: Example for proper wiring with single shielded single twisted pair wires

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 an 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.

Note:
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 configured 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.)

Note:
Configured CAN cables with standard or customized 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.

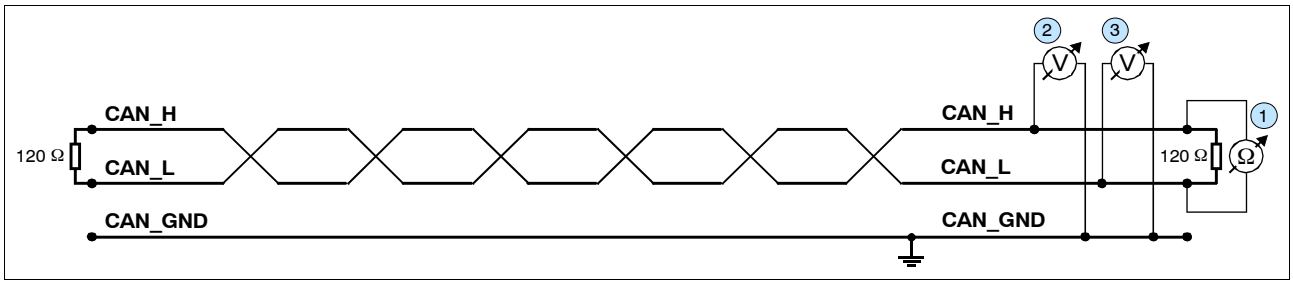


Figure 10: Simplified diagram of a CAN network

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 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. Reconnect CAN_GND to earth potential.

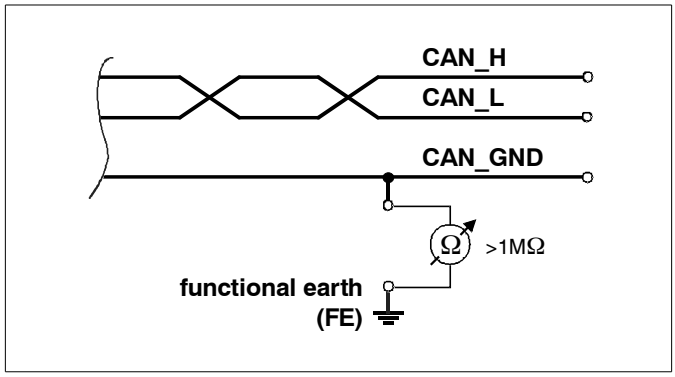


Figure 11: Simplified schematic diagram of ground test measurement

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 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 indication for a faulty transceiver is a very high deviation between the two measured input resistances (>> 200 %).

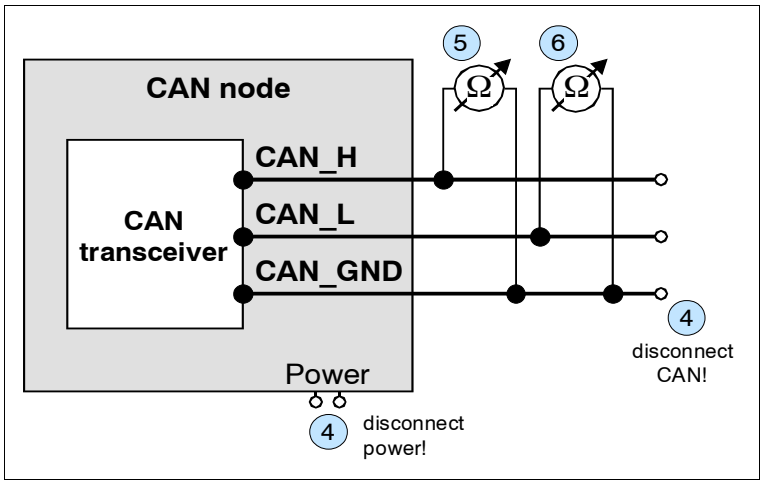


Figure 12: Measuring the internal resistance of CAN transceivers

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

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.*
Produktname	**CAN-PCI/331-1**	**C.2020.02**
Produktname	**CAN-PCI/331-1 29-Bit**	**C.2020.03**
Produktname	**CAN-PCI/331-2**	**C.2020.04**
Produktname	**CAN-PCI/331-2 29-Bit**	**C.2020.05**

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 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. Ramm
Funktion / *Title*	CE-Koordinator / *CE Coordinator*
Datum / *Date*	Hannover, 2012-04-25

Thorsten Ramm

Rechtsgültige Unterschrift / *authorized signature*

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9. Order Information

Type	Properties	Order No.
CAN-PCI/331-1 1xCAN	1x CAN 2.0A (11 bit CAN-ID), ISO 11898 *	C.2020.02
CAN-PCI/331-1 1xCAN 29bit	1x CAN 2.0A/B (29 bit CAN-ID), ISO 11898 *	C.2020.03
CAN-PCI/331-2 2xCAN	2x CAN 2.0A (11 bit CAN-ID), ISO 11898 *	C.2020.04
CAN-PCI/331-2 2xCAN 29bit	2x CAN 2.0A/B (29 bit CAN-ID), ISO 11898 *	C.2020.05
CAN-PCI/331-2 1xLowSpeed + 1xHighSpeed	1x CAN low-speed, ISO 11519-2, 1x CAN high-speed, ISO 11898	C.2020.40
DN-PCI/331-1 1xDeviceNet	1x DeviceNet interface	C.2017.06
DN-PCI/331-2 2xDeviceNet	2x DeviceNet interface	C.2017.07
	* includes CAN layer 2 software driver on CD-ROM for Windows and Linux	
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 VxWorks	CAN-driver object licence for VxWorks incl. CD-ROM	C.1101.55
CAN-DRV-LCD OnTime-RTOS-32	CAN-driver object licence for OnTime-RTOS-32 incl. CD-ROM	C.1101.45
DN-PCI/331-Windows	Windows device driver	C.2017.10
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
CANopen-LCD VxWorks	CANopen license for VxWorks incl. CD-ROM	C.1101.18
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	J1939 Stack for esd-CAN hardware, includes RTX object code, esd CAN driver license for RTX	C.1130.12
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/331-MD	Hardware manual for CAN-PCI/331 and DN-PCI/331 in German	C.2020.20
CAN-PCI/331-ME	Hardware manual for CAN-PCI/331 and DN-PCI/331 in English	C.2020.21
CAN-API-ME	NTCAN, Part 1: Structure, Function and C/C++ API, Application Developers Manual (English) NTCAN, Part 2: Installation, Configuration and Firmware Update, Installation Guide (English)	C.2001.21
DN-API-ME	DeviceNet-API-manual in English	C.2006.21
J1939-ME	J1939 software manual in English	C.1130.21
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.