CPCI-CAN/400-4

4 CAN Interfaces with ARINC825, optional IRIG-B and optional PXI-Interface

Hardware Manual

to Product C.2033.01, C.2033.04

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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
1.0	-	First English version	2011-08-01
1.1	-	Safety instructions revised	2013-04-19
	1.	Block circuit diagram new	
	5.1	Values of current consumption corrected, P1, P2 renamed to J1, J2, pin number corrected	
	10.	Order information revised	
1.2	-	Safety instructions revised	2015-11-11
	3.	Step 8. - Note about CAN termination inserted	
	5.1	Absolute maximum power and description of additional front panel added	
	5.5	OnTime RTOS-32 and J1939 protocol libraries added	
	9.	Declaration of Conformity updated	
	10.	Order Information revised	

Technical details are subject to change without further notice.

Safety Instructions

- When working with CPCI-CAN/400-4 follow the instructions below and read the manual carefully to protect yourself from injury and the CPCI-CAN/400-4 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 CPCI-CAN/400-4 from dust, moisture and steam.
- Protect the CPCI-CAN/400-4 from shocks and vibrations.
- The CPCI-CAN/400-4 may become warm during normal use. Always allow adequate ventilation around the CPCI-CAN/400-4 and use care when handling.
- Do not operate the CPCI-CAN/400-4 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 CPCI-CAN/400-4 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 CPCI-CAN/400-4 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 8 *before* you touch the CPCI-CAN/400-4, 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 CPCI-CAN/400-4 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 CPCI-CAN/400-4 is the operation as CompactPCI-CAN interface in a CompactPCI system.
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 CPCI-CAN/400-4 is intended for installation in a CompactPCI system only.
- The operation of the CPCI-CAN/400-4 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CPCI-CAN/400-4 for medical purposes is prohibited.

Service Note
The CPCI-CAN/400-4 does not contain any parts that require maintenance by the user. The CPCI-CAN/400-4 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

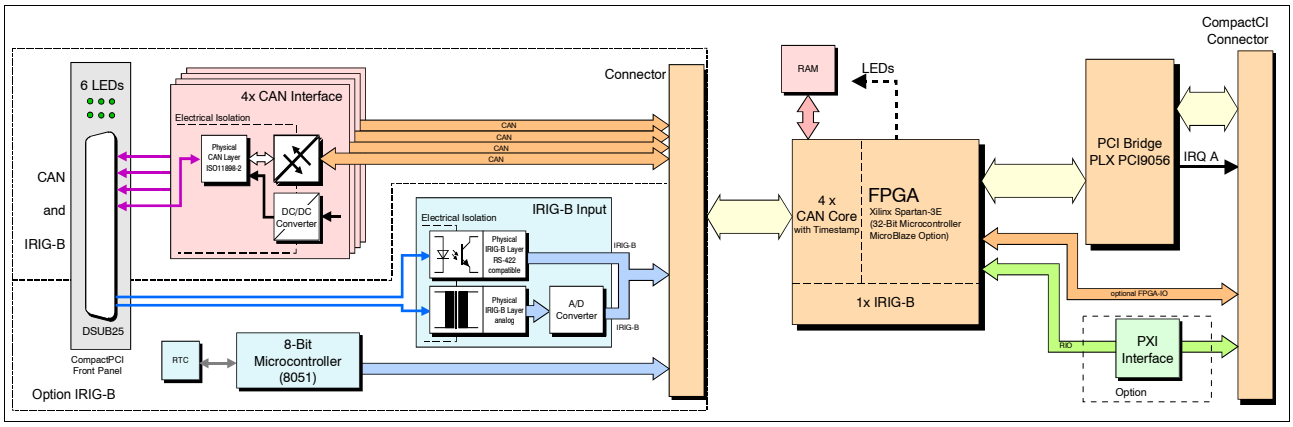


Figure 1: Block circuit diagram

The CPCI-CAN/400-4 is a CompactPCI® board in 3U format, that features four electrically isolated high-speed CAN interfaces according to ISO 11898-2. CAN is driven by the esd Advanced CAN Core (esdACC) CAN controller implemented in the Xilinx® Spartan® 3e FPGA.
The CPCI-CAN/400-4 provides high resolution hardware timestamps.

The CPCI-CAN/400-4 optionally features an IRIG-B interface that offers inputs for analog or RS-422 IRIG-B coded signals. Both are electrically isolated. IRIG-B evaluation is controlled by an additional microcontroller. IRIG-B is used directly for CAN timestamping.

All I/Os are connected to a 25-pin DSUB connector in the front panel.

The CPCI-CAN-400-4 optionally features a PXI interface.
The signals TRG 0-7, CLK 10 and STAR are controlled via the FPGA. The signals LBL/LBR1-12 are looped through.
The PXI interface is available on request.

2. PCB View with Connectors

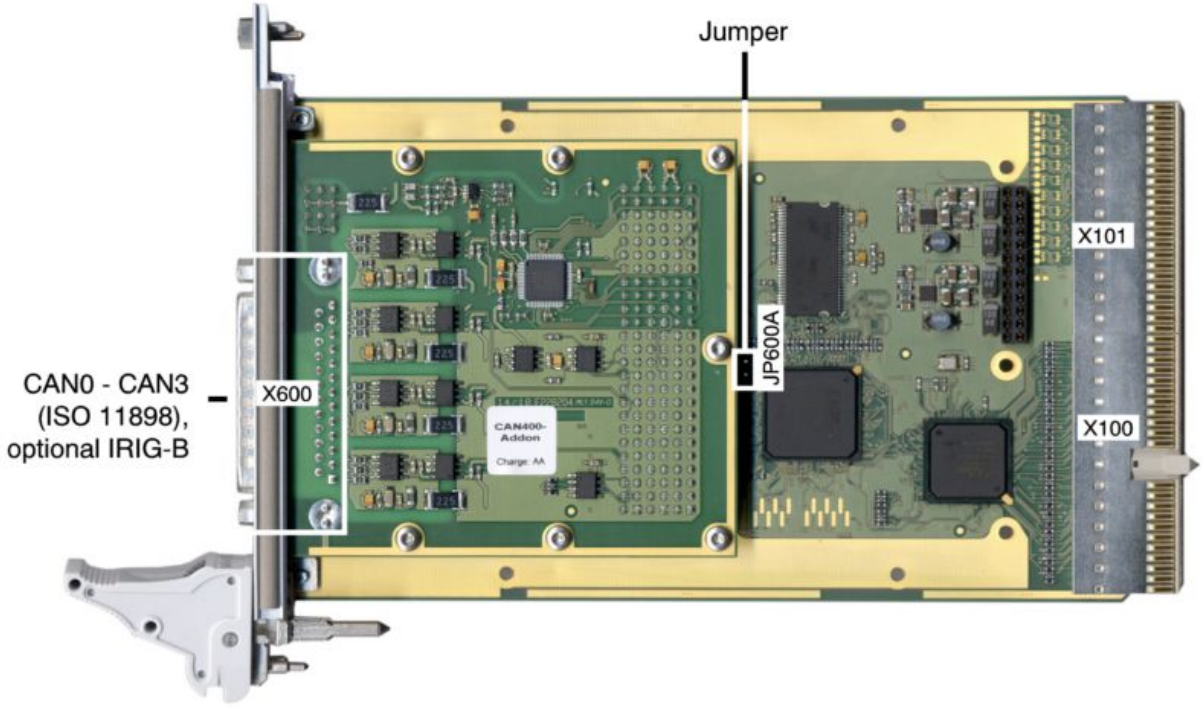


Figure 2: PCB top view

Attention:
The jumper (JP600A) has to be left in delivery status!
Otherwise the software driver can not be started.

See also page 15 for signal assignment of the CAN connector.

3. 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 perform the following steps *before* you touch the CPCI-CAN/400-4, in order to discharge the static electricity from your body:

- Switch off the power of your computer, but leave it connected to the mains until you have discharged yourself (if applicable).
- Please touch the metal case of the computer now to discharge yourself.
- Furthermore, you should prevent your clothes from touching the computer, because your clothes might be electrostatically charged as well.

Procedure:

1. Switch off your computer and all connected peripheral devices (monitor, printer, etc.).
2. Discharge your body as described above.
3. Disconnect the computer 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. Open the case.
5. Insert the CPCI-CAN/400-4 board into a free CompactPCI slot in your computer.
6. Close the computer case again.
7. Fix the CPCI-CAN/400-4 board with the screws on the front panel.
8. Connect the CAN interfaces via the DSUB25 connector in the front panel of the CPCI-CAN/400-4 (see page 7).
   Please note that the CAN bus has to be terminated at both ends! esd offers special T-connectors and termination connectors. Additionally the CAN_GND signal has to be connected to earth at exactly one point in the CAN network.
   A CAN participant with a CAN interface which is not electrically isolated corresponds to the grounding of the CAN-GND.

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

4. LEDs

4.1 Position of the LEDS

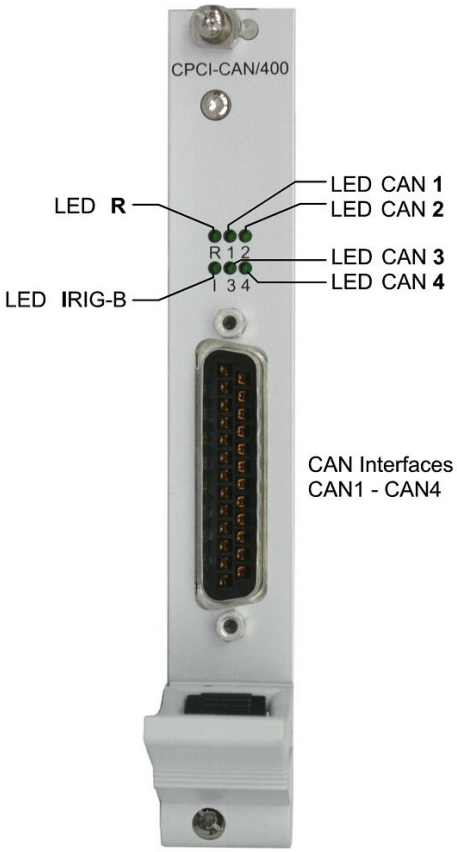


Figure 3: Connectors and LEDs

4.2 LED Indication

LED	Colour	Function	Indicator State	Description	LED name in schematic diagram
R	green	Power	off	CPCI-CAN/400-4 not ready, FPGA not loaded	LED301A
			on	CPCI-CAN/400-4 is ready for operation, FPGA is loaded	
I	green	IRIG-B	off	-	LED300A
			flickering	no IRIG-B signal	
			blinking	CPCI-CAN/400-4 synchronises with IRIG-B	
			on	IRIG-B time synchronised	

Table 1: Description of LEDs R and I

LED	Colour	Function	Indicator State	Description	LED name in schematic diagram
1	green	CAN1 Traffic	off	no CAN traffic on CAN 1	LED301B
			blinking	CAN traffic on CAN 2	
2	green	CAN2 Traffic	off	no CAN traffic on CAN 2	LED301C
			blinking	CAN traffic on CAN 2	
3	green	CAN3 Traffic	off	no CAN traffic on CAN 3	LED300B
			blinking	CAN traffic on CAN 3	
4	green	CAN4 Traffic	off	no CAN traffic on CAN 4	LED300C
			blinking	CAN traffic on CAN 4	

Table 2: Description of CAN LEDs

5. Technical Data

5.1 General Technical Data

Power supply voltage	via CompactPCI bus: nominal voltage: 3.3 V (5V tolerant), typical current consumption (incl. CAN traffic): at 5 V: 265 mA at 3.3V: 175 mA (FPGA not booted) 265 mA (FPGA booted) Absolute maximum power at 3.3V ($I_{max.3.3V}$ = 1A): $P_{max:3.3}$ = 3.3W
Connectors	CAN0 ... CAN3 (X600, 25-pin DSUB) - CAN Interfaces CAN0-CAN3, optional IRIG-B J1 CompactPCI board connector (X100, 110-pin male connector) J2 CompactPCI board connector (X101, 110-pin male connector) Only for test- and programming purposes: X303 reserved for future use
Temperature range	0...50 °C ambient temperature
Humidity	max. 90%, non-condensing
Dimensions	PCB only: 100 mm x 160 mm
Weight	235 g

Table 3: General data of the module

5.2 Microprocessor and Memory

BlockRAM (FPGA)	72 KB
DRAM	64 MB

Table 4: Microprocessor and Memory

5.3 CAN Interface

Number of CAN interfaces	4
CAN controller	esdACC in FPGA Spartan® 3e, acc. to ISO 11898-1 (CAN 2.0 A/B)
CAN protocol	according to ISO 11898-1
Physical Layer	High-speed CAN interface according to ISO 11898-2, bit rate up to 1 Mbit/s
Electrical isolation	via digital isolator and DC/DC converter, 500 V (effective) between CAN potential and module-system-potential with pollution degree 1
Bus termination	terminating resistor has to be set externally, if required
Connector	DSUB25 (male)

Table 5: Data of the CAN interface

5.4 CompactPCI Bus

Host bus	PCI-Bus according to PCI Local Bus Specification 2.2
PCI-data/address bus	32 Bit, 33/66 MHz
Microprocessor	optional 32-bit µC in FPGA (MicroBlaze)
Board dimension	according to CompactPCI-Specification, Rev. 2.2
Connector	
Connector coding	Universal-Board, not keyed (3.3 V or 5 V signalling voltage)

Table 6: Data of the CompactPCI bus

5.5 IRIG-B Interface (Option)

Number	1x analog and 1x RS-422 compatible (via front panel, both electrically isolated), 1x RS-422 compatible (at J2 only)
Controller	8051 microcontroller
Connector	DSUB25

Table 7: Data of the serial interface

5.6 Software Support

CAN layer 2 (CAN-API) software drivers are available for Windows®, VxWorks®[1], QNX®, RTX[1] Linux®[1] and On Time RTOS-32[1] . Drivers for other operating systems are available on request.

Multiple higher layer protocols are available.
The CANopen® software package is available for Windows, VxWorks, Linux, QNX and RTX.
ARINC 825 as another higher layer protocol is available as an option for Windows, VxWorks, QNX, Linux and RTX.
J1939 protocol libraries are available for Windows, others on request.

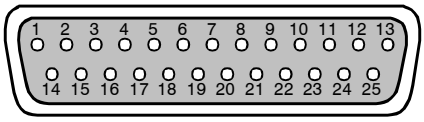
[1] For detailed information about the driver availability of your special operating system please contact our sales team.

6. Connector Assignments

6.1 CAN

Device connector: 25-pin DSUB connector, male

Pin Position:



Pin Assignment:

Signal	Pin		Signal
CAN_0_H	14	1	CAN 0 L
reserved	15	2	CAN_0_GND
CAN_1_L	16	3	reserved
CAN_1_GND	17	4	CAN_1_H
reserved	18	5	reserved
CAN_2_H	19	6	CAN_2_L
reserved	20	7	CAN_2_GND
CAN_3_L	21	8	reserved
CAN_3_GND	22	9	CAN_3_H
reserved	23	10	reserved
IRIG-B_Rx+ (optional)	24	11	reserved
IRIG_B_A+ (optional)	25	12	IRIG-B_Rx- (optional)
		13	IRIG-B_A- (optional)

Shield	S

Signal Description:

CAN_Y_L, CAN_Y_H ...	CAN signal lines of CAN interface Y (Y = 0, 1, 2, 3)
CAN_Y_GND ...	reference potential of the local CAN physical layer Y (Y = 0, 1, 2, 3)
Shield ...	shielding (connected with the case of the 25-pin DSUB connector)
reserved ...	reserved for future applications, do not connect!
IRIG-B_Rx+, IRIG-B_Rx-...	optional IRIG-B signal lines
IRIG-B_A+, IRIG-B_A- ...	optional IRIG-B signal lines

7. 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.

7.1 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!**

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

7.2.1 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.

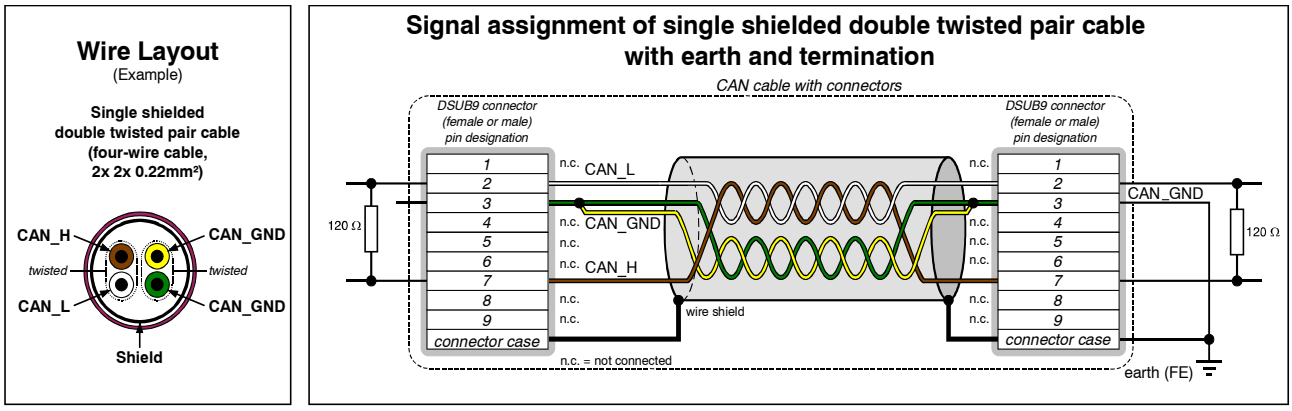


Figure 4: CAN wiring for heavy industrial environment

7.2.2 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!

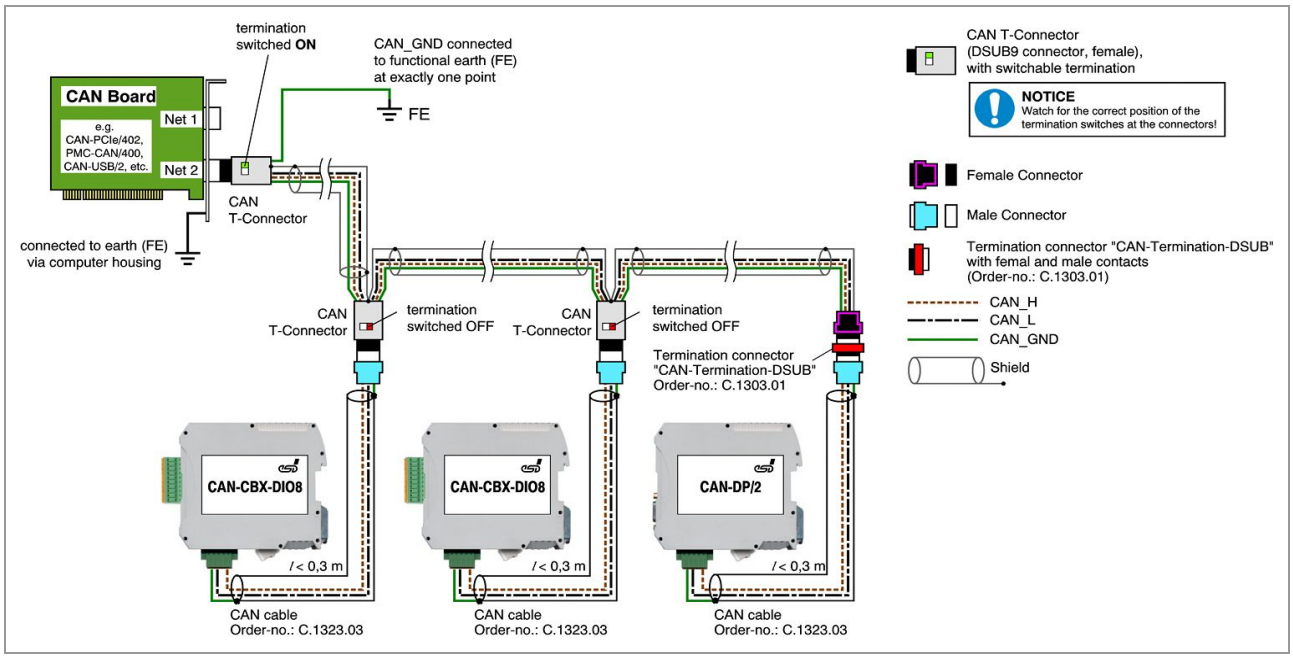


Figure 5: Example of proper wiring with single shielded double twisted pair cables

7.2.3 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).

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

7.3.1 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.

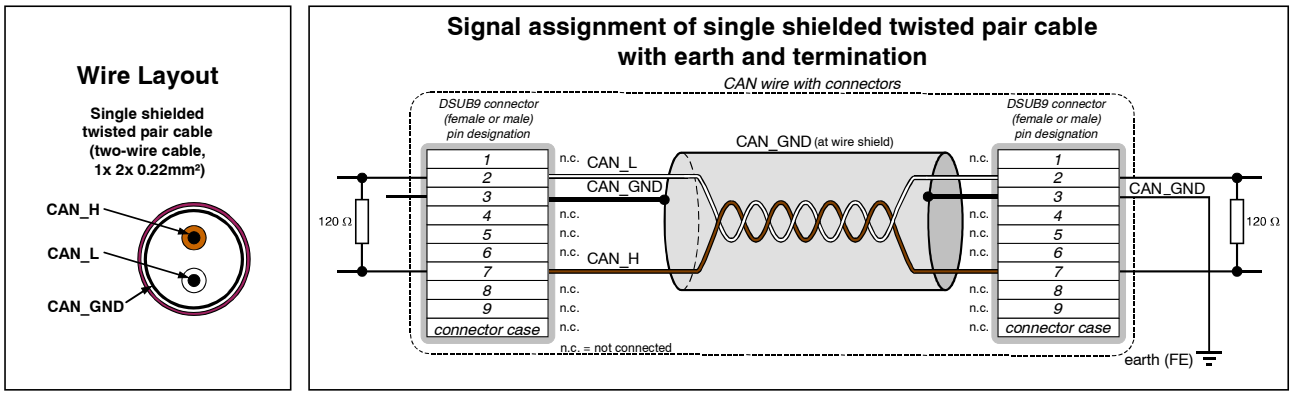


Figure 6: CAN wiring for light industrial environment

7.3.2 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.

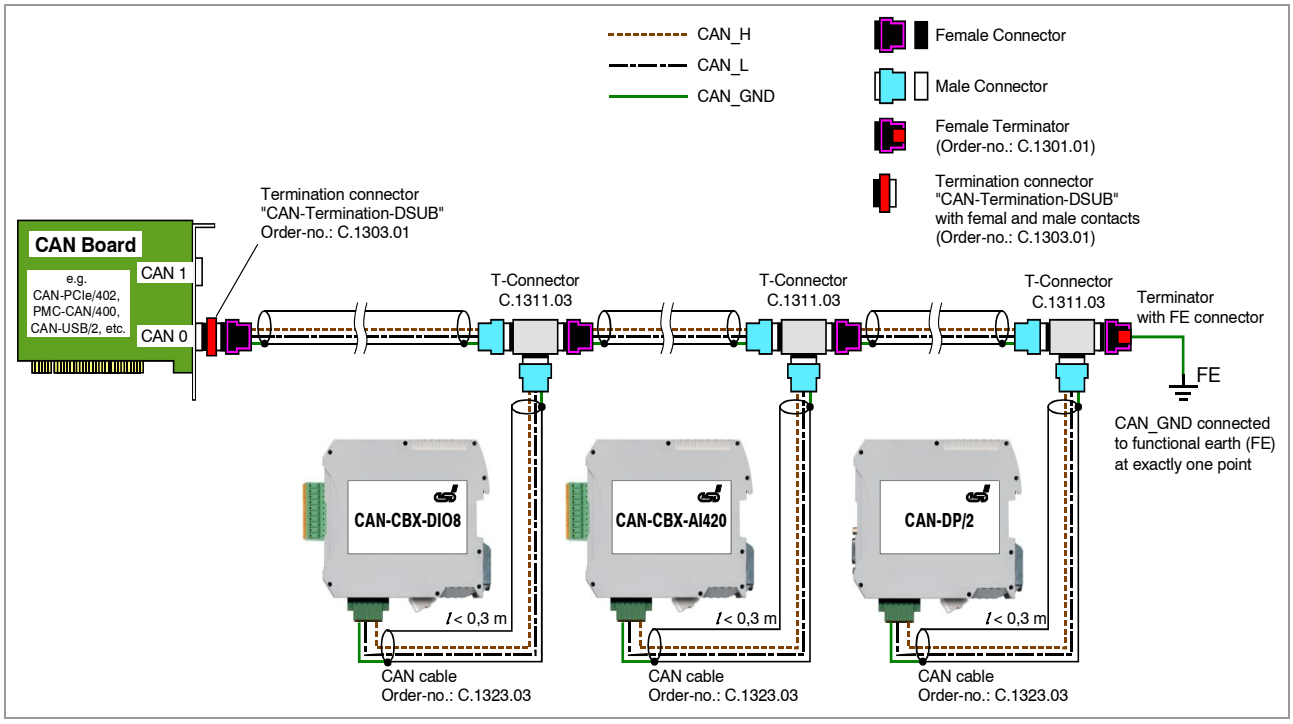


Figure 7: Example for proper wiring with single shielded single twisted pair wires

7.3.3 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.

7.4 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).

7.5 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 8: 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.

7.6 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.

7.6.1 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.)

7.6.2 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**.

8. 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.

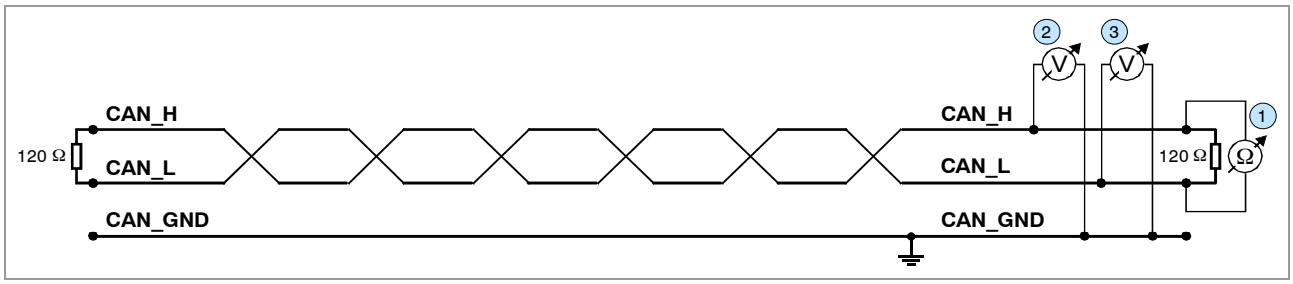


Figure 8: Simplified diagram of a CAN network

8.1 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.

8.2 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.

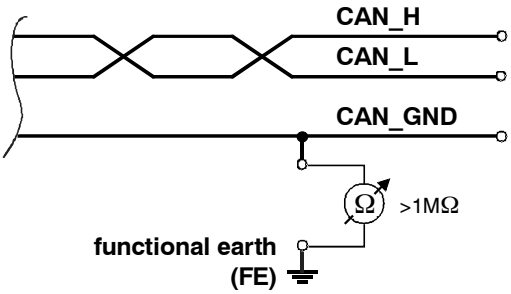


Figure 9: Simplified schematic diagram of ground test measurement

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

8.3 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!

8.4 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.

8.5 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 %).

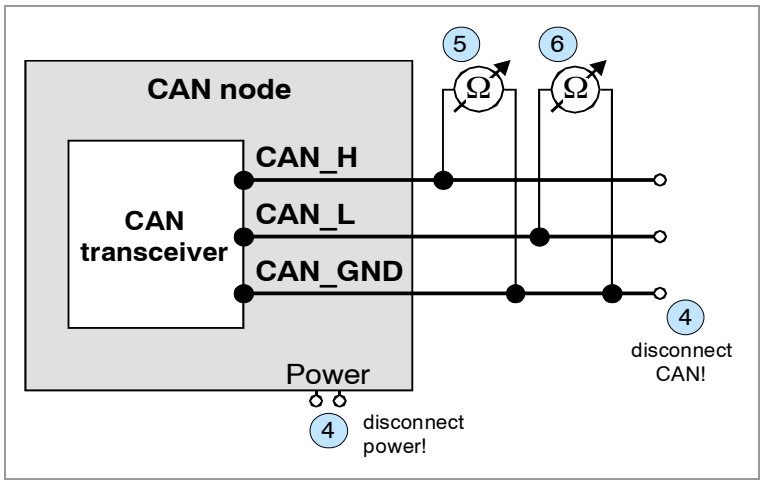


Figure 10: Measuring the internal resistance of CAN transceivers

8.6 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**.

9. 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.*
CPCI-CAN/400-4	**C.2033.04**
CPCI-CAN/400-4 IRIG-B	**C.2033.01**
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-K00-0401-10**
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, 2015-02-16

Thorsten Ramm
Rechtsgültige Unterschrift / *authorized signature*

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10. Order Information

Type	Properties	Order No.
CPCI-CAN/400-4	CPCI-CAN/400-4 active CompactPCI CAN interface board, 1 x DSUB-25 with 4 x CAN	C.2033.04
CAN layer 2 drivers for Windows and Linux are included in delivery.		
Software		
Additional CAN layer 2 object licenses including CD-ROM[1]: CAN-DRV-LCD QNX CAN-DRV-LCD VxWorks CAN-DRV-LCD RTX CAN-DRV-LCD OnTime-RTOS-32		 C.1101.32 C.1101.55 C.1101.35 C.1101.45
Higher Layer protocols including CD-ROM[1]: CANopen-LCD Windows/Linux CANopen-LCD QNX CANopen-LCD VxWorks CANopen-LCD RTX J1939stack for Windows J1939 stack for Linux ARINC825-LCD Windows / Linux ARINC825-LCD QNX ARINC825-LCD VxWorks ARINC825-LCD RTX		 C.1101.06 C.1101.17 C.1101.18 C.1101.16 C.1130.10 C.1130.11 C.1140.06 C.1140.17 C.1140.18 C.1140.16
[1] For detailed information about the driver availability for your special operating system, please contact our sales team.		

Table 9: Order information

PDF Manuals
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.
CPCI-CAN/400-4-ME	Manual in English	C.2033.21
NTCAN-API-ME	NTCAN-API: Application Developers Manual NTCAN-API: Driver Installation Guide	C.2001.21
CANopen Manager/Slave Manual	CANopen API Manual	C.2002.21

Table 10: 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.