CPCI-CAN/331

CompactPCI-CAN-Interface

Hardware Installation
and
Technical Data

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Changes in the chapters
The changes in the user's manual listed below affect changes in the **hardware**, as well as changes in the **description** of the facts only.

Chapter	Changes versus previous version
3.2	CompactPCI bus connector coding inserted.
-	

Further technical changes are subject to change without notice.

N O T E

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1. Overview

1.1 Module Description

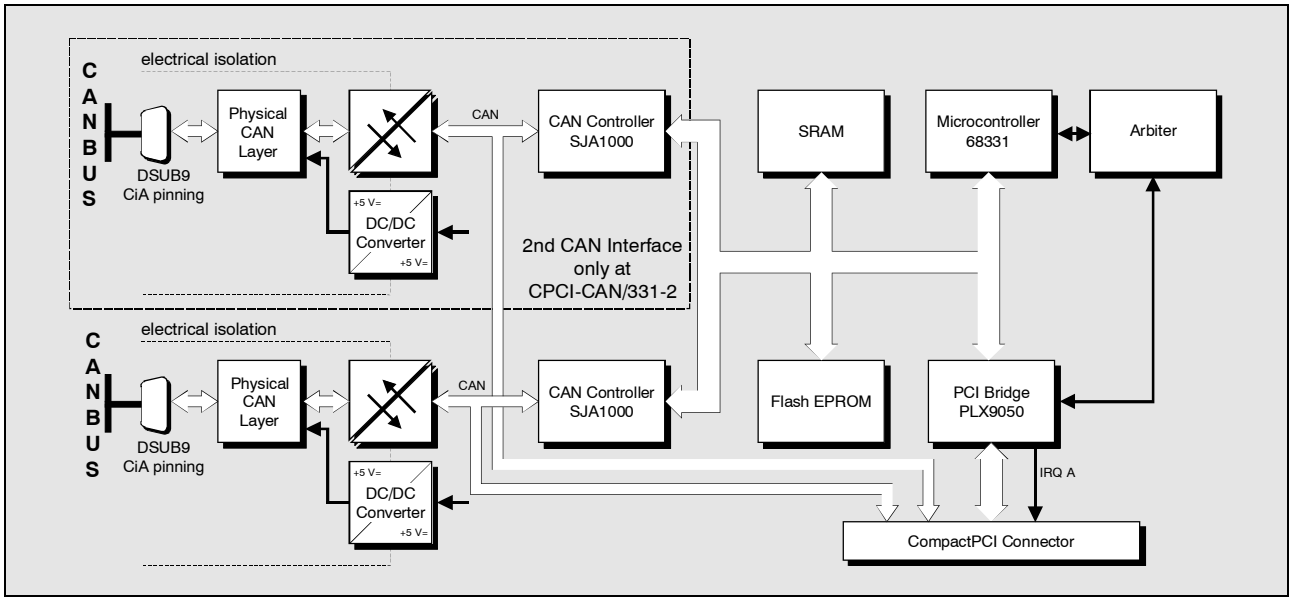


Fig. 1.1.1: Block-circuit diagram of the CPCI-CAN/331 module

The CPCI-CAN/331 module is a CAN-interface board for the CompactPCI bus. It uses a 68331-microcontroller, which cares for the local data management. The CAN data is buffered in a local SRAM. Data security and consistency are guaranteed up to 1 Mbit/s.

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

1.2 PCB View with Connectors

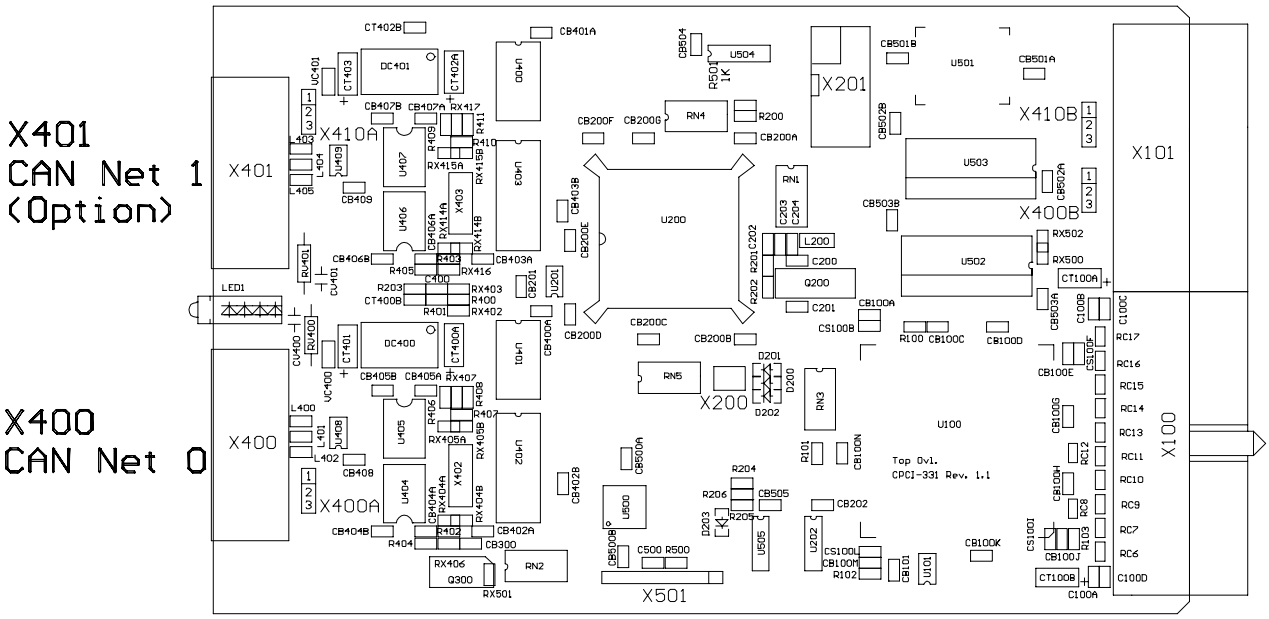
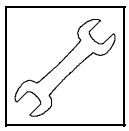


Fig. 1.2.1: Representation of the module (without a front panel)



2. Hardware Installation

Attention!
Electro-static discharges may cause damage to electronic components. In order to avoid this please make sure to follow the steps below *before* touching the CAN-module:

- Switch off the power supply of your computer, but leave it connected to mains.
- Now touch the metal case of the computer to discharge yourself.
- Even your clothes must not touch the CAN-module.

Installation:

1. Switch off your computer and all connected peripheral devices (monitor, printers, etc.). Switch off the CAN-devices of the network the CAN-module is to be connected to.
2. Discharge yourself as described above.
3. Disconnect the computer from mains.
4. Remove the computer cover.
5. Select an open 3HE-CompactPCI-bus position:
   In *a standard configuration* the CAN-module can be inserted into any 3HE-slot.

   Attention!
   - If the ISO11898-CAN-signals are assigned to the CompactPCI-I/O-connector X101 via the connectors X400A/B or X410A/B (see page 13), or
   - if the board has been reconfigured by changing the resistors so that the TTL-CAN-signals are connected to the CompactPCI-I/O-connector X101,
   - it must **not** be inserted into slots which are assigned with 64-bit PCI-signals!
6. Insert the CAN-module into the slot selected.
7. Attach the module by means of the front panel screw.
8. Replace the computer cover.

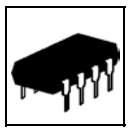
9. Connect the CAN-bus.
   Please note that the CAN-bus must be terminated at both ends. esd offers special T-connectors and terminator connectors. Additionally, the CAN-GND signal must be connected to earth at *exactly one* point in the CAN-network. Therefore, the CAN-terminator connectors have additionally an earth connection. A CAN-device whose CAN-interface is not electrically insulated acts as an earth connection like the CAN-GND.

   The first CAN-interface (CAN-network 0) is connected via the DSUB-connector (X400) and the second CAN-interface (CAN-network 1) is connected via the DSUB-connector (X401).

10. Connect the computer to mains again.

11. Switch on the computer, the peripheral devices and the other CAN-devices again.

12. End of hardware installation.
    For the software installation Windows-operating system installation programs are available which will be described in the software manual of the module.



3. Technical Data Summary

3.1 General Technical Data

Ambient temperature	0...50°C
Humidity	max. 90 %, non-condensing
Supply voltage	via CompactPCI-bus, nominal voltage: 5 V ±5%, current (typ.): for 1x CAN: 250 mA for 2x CAN: 350 mA
Connectors	X100 (132-pole male connector) - CompactPCI-board connector X101 (132-pole male connector) - CompactPCI-rear panel I/O X400 (DSUB9/male) - CAN-network 0 X401 (DSUB9/male) - optional CAN-network 1 X402 (8-pole pin strip) - opt. DeviceNet-interface network 0 X403 (8-pole pin strip) - opt. DeviceNet-interface network 1 X400A, X400B (3-pole male connector) - bridge signals from network 0 to X101 X410A, X410B (3-pole male connector) - bridge signals from network 1 to X101 The following connectors are only servicing: X200 (4-pole SMD female con.) - serial interface X201 (10-pole male con.) - BDM-interface X501 (5-pole pin strip) - ISP-programming
Dimensions	100 mm x 160 mm
Weight	< 250 g

Table 3.1.1: General module data

3.2 CompactPCI Bus

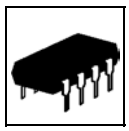
Host bus	PCI-bus in accordance with PCI Local Bus Specification 2.1
PCI-data / Adress bus	32 bit
Controller	PLX 9050
Interrupt	interrupt signal A
Board dimensions	in accordance with CompactPCI-Specification, Rev. 1.0
Connectors	
Connector coding	Type 2: brillant blue, 5 V signalling voltage only

Table 3.2.1: CompactPCI-bus data

3.3 CAN-Interface

Number	1, optionally 2 CAN-interfaces
CAN-controller	SJA1000
CAN-protocol	Basic-CAN 2.0A/B
Physical interface	physical layer in accordance with ISO 11898, transfer rate programmable from 10 kbit/s to 1 Mbit/s
Bus termination	has to be set externally
Electrical insulation of the CAN-interfaces from other units	the two possible CAN-interfaces are electrically insulated from each other and from the CompactPCI-bus potentials via optocouplers and DC/DC-converters
DeviceNet option	one adaptor board for each CAN-channel with Phoenix Combicon connectors (or equivalent), optocouplers and CAN-driver in accordance with DeviceNet-Specification 'DeviceNet Communication Model and Protocol, Rel. 2.0', DeviceNet connector is accessible via front panel

Table 3.3.1: Data of the CAN-Interfaces



3.4 Software Support

The product package contains software examples for DOS and Windows 3.11. Software drivers for Windows NT/XP/2000 and Windows 9x/ME are also available. The Windows-NT driver is realized in kernel mode and is multiprocessor conform. The Windows-95 driver is realized as VxD. The firmware can be loaded from the PC into the Flash-EPROM.

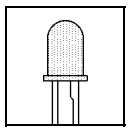
Software packages for CANopen or DeviceNet are available.

3.5 Order Information

Type	Description	Order No.
CAN-CPCI/331-1B	1xCAN 2.0A/B, ISO 11898	C.2027.02
CAN-CPCI/331-2B	2xCAN 2.0A/B, ISO 11898	C.2027.04
CAN-CPCI/331-2-T	2xCAN 2.0A/B, ISO 11898, extended temperature range	C.2027.06
CAN-CPCI/331-1D	1x DeviceNet	C.2027.07
CAN-CPCI/331-2D	2x DeviceNet	C.2027.08
Options:		
CAN-CPCI/331-95	Windows 95/98 VxD-Driver	C.2027.10
CAN-CPCI/331-NT	Windows NT Device-Driver	C.2027.11
CAN-CPCI/331-Co	CANopen Master/Slave-Obj.-Licence	C.2027.12
CAN-CPCI/331-DvN	DeviceNet-Object-Licence	C.2027.13
CAN-CPCI/331-Linux-Driver	Linux-Driver	C.2027.19
CAN-CPCI/331-FP6	6HE-Front panel	C.2027.30
CAN-CPCI/331-VxWorks	CAN-API-Object-Licence	C.2027.55
CAN-CPCI/331-LynxOS	LynxOS-Driver	C.2027.57
CAN-CPCI/331-ME	User manual in English [1*)] for C.2027.03 ... C.2027.08	C.2027.21
CAN-CPCI/331-ENG	Engineering manual in English [2*)] Contents: circuit diagrams, PCB top overlay drawing, data sheets of significant components	C.2027.25
CAN-API-ME	English manual for C.2027.10, C.2027.11 and C.2027.19 [1*)]	C.2001.21
CAL/CANopen-ME	English manual for C.2027.12 [1*)]	C.2002.21

1*) If module and manual are ordered together, the manual will be delivered free of charge.
2*) This manual is liable for costs, please contact our support.

Table 3.5.1: Order Information



4. LED-Displays

The module has four LEDs in the front panel. The green LED shows that the 5 V supply voltage are available. The other three LEDs can be controlled by the three ports of controller 68331. The firmware does not support them yet (03/98), however.

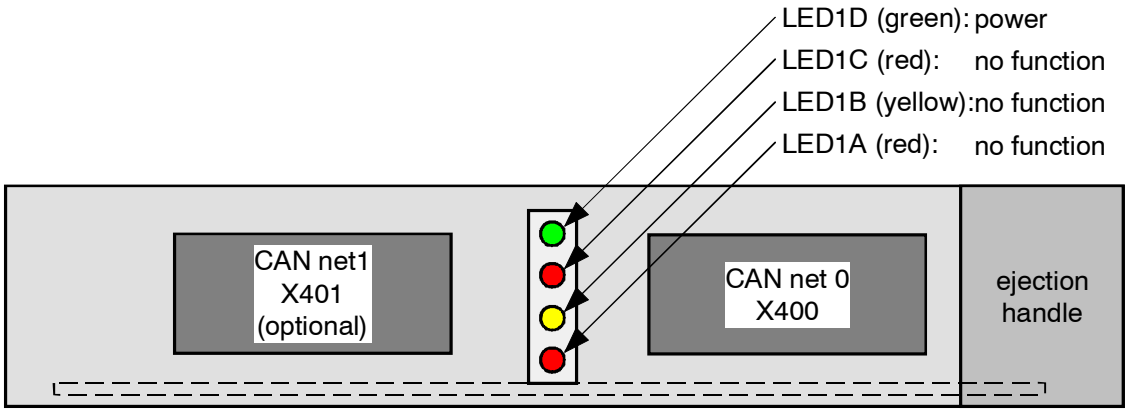


Fig. 4.1.1: Position and colours of the LEDs

LED	Colour	Name	Display function when	
			LED off	LED on
LED1D	green	power	no power supply	power supply is available
LED1C	red	-	not implemented	
LED1B	yellow	-	not implemented	
LED1A	red	-	not implemented	

Table 4.1.1: Display functions of the LEDs

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5. CAN-Signal Assignment of the CPCI-I/O-Connector X101

In standard design of the module only a few GND-signals are assigned to the CompactPCI-I/O connector X101. This design allows to use the board easily in slots whose rear-panel-I/O connectors on the CompactPCI backplane have been designed for 64-bit accesses. Every other configuration requires that the module is only used in slots which have been designed for I/O-signals, because otherwise the module or other components of the CompactPCI system might be destroyed!

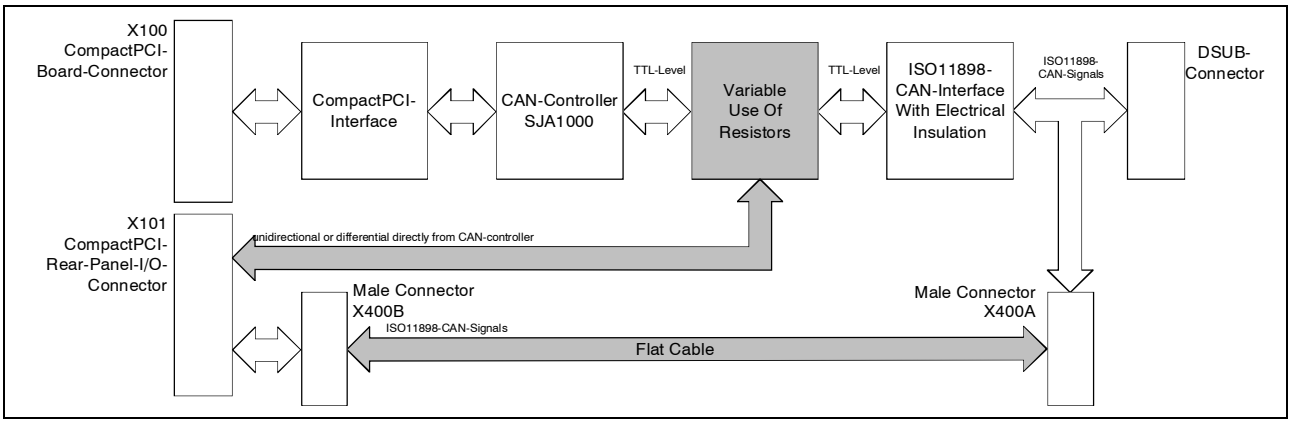


Fig. 5.1.1: Possible assignment of connector X101
(represented only in network 0)

Below the possible assignments of I/O-connector X101 will be described.

5.1 ISO11898-CAN-Layer to X101

In standard design of the module the CAN-signals of the two CAN-interfaces are only assigned to the DSUB-connectors. By means of the connectors X400A, X400B, X410A and X410B the signals can then be assigned to connector X101. This means that the signals are assigned to the DSUB-connectors and X101 at the same time!
If the ISO11898-CAN-signals are to be assigned to X101, the pins of connectors X4x0A and X4x0B (x=0, 1) have to be connected for each of both possible CAN channels.

CAN-network	Connections to connect ISO11898-signals to X101:
0	connect X400A to X400B
1	connect X410A to X410B

Table 5.1.1: Bridging ISO11898-CAN-signals to X101

5.2 TTL-CAN-Signals to X101

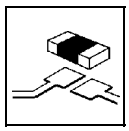
The assignment of the local CAN-interface and the CompactPCI-I/O connector X101 can also be changed by changing the resistors. Doing this, the CAN-signals can be connected *before* the ISO11898-interface and be assigned to X101. For this, available resistors have to be removed and new ones have to be equipped.
These changes are only to be made by experienced users by means of the circuit diagrams!

5.2.1 Comparison of Different Signal Assignments

Signal Assignment 1 (Standard):
In CPCI-CAN/331 standard the CAN-signals of the CAN-controllers are assigned to the local ISO11898 interface (DSUB9). X101 is only assigned with GND-signals.

Signal Assignment 2:
Alternatively the unidirectional CAN-signals of the controllers can be assigned to the CompactPCI-I/O connector X101. Assigning the signals to X101 and the DSUB-connectors at the same time is not permissible.

Signal Assignment 3:
Another alternative is to assign differential controller signals to connector X101. Doing this, the controller has to be especially configurated, because in standard configuration it uses the ports unidirectionally.



5.2.2 Changing the Signal Assignments

5.2.2.1 Signal Assignment 1: Unidirectional Signals to Local CAN-Interface

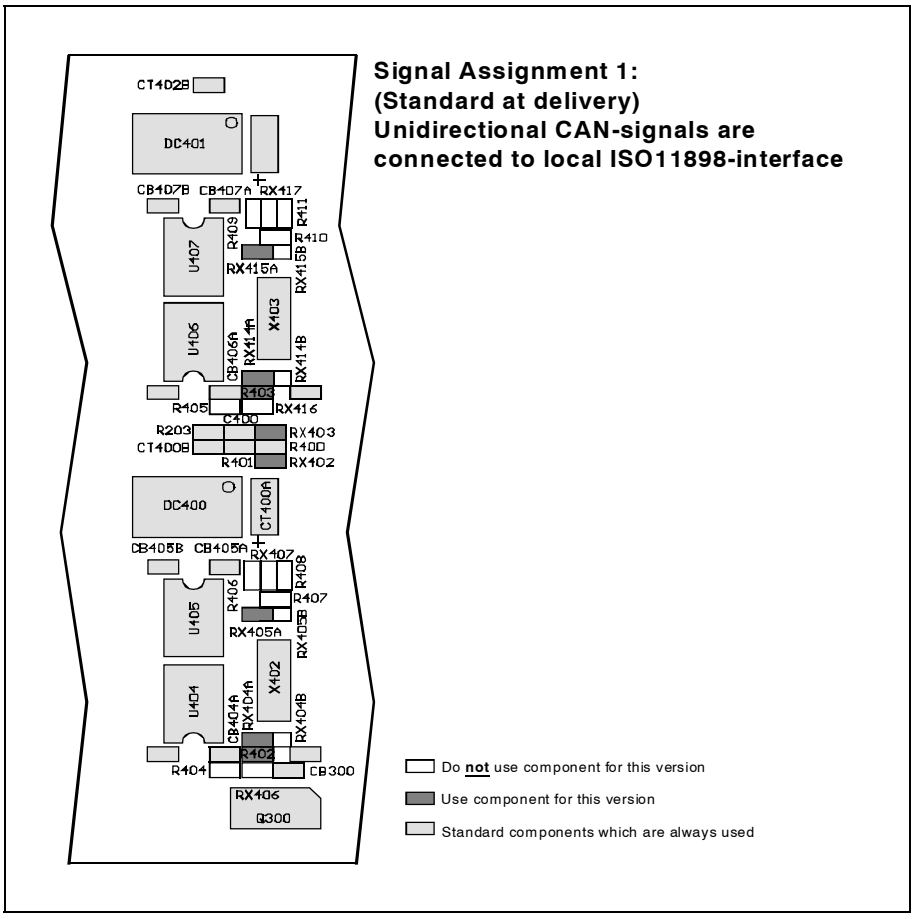


Fig. 5.2.1: Signal assignment 1

Resistor values:	
CAN-network 1	*CAN-network 0*
R403 = 10 kΩ RX403 = 0 Ω RX414A = 0 Ω RX415A = 0 Ω	R402 = 10 kΩ RX402 = 0 Ω RX404A = 0 Ω RX405A = 0 Ω

5.2.2.2 Signal Assignment 2: Unidirectional Signals to X101

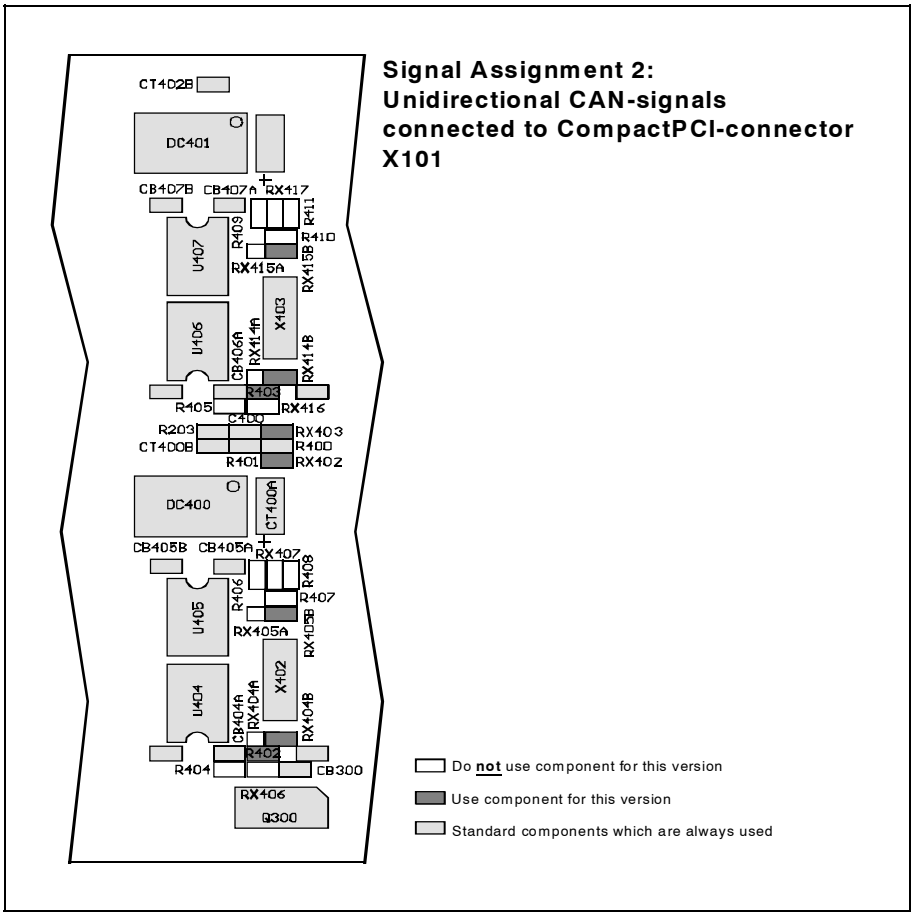


Fig. 5.2.2: Signal Assignment 2

Resistor values:	
CAN-network 1	*CAN-network 0*
R403 = 10 kΩ RX403 = 0 Ω RX414B = 0 Ω RX415B = 0 Ω	R402 = 10 kΩ RX402 = 0 Ω RX404B = 0 Ω RX405B = 0 Ω

5.2.2.3 Signal Assignment 3: Differential Signals to X101

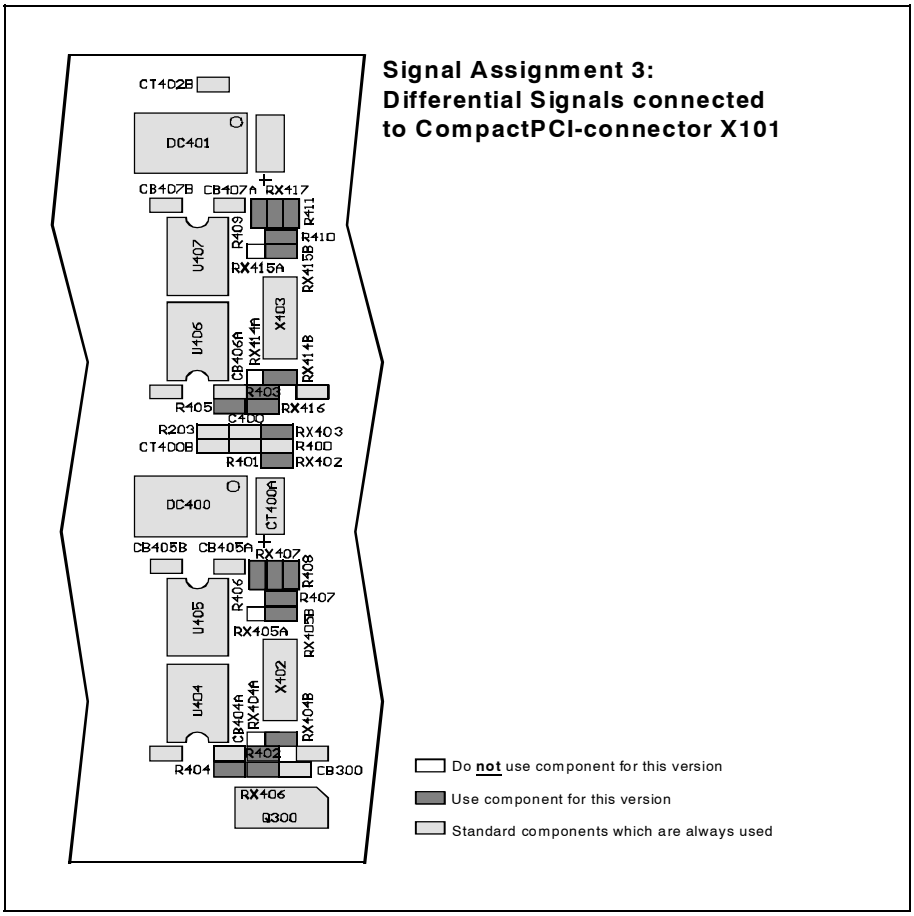


Fig. 5.2.3: Signal Assignment 3

Resistor values:	
CAN-network 1	*CAN-network 0*
RX403 = 0 Ω	RX402 = 0 Ω
R405 = 10 kΩ	R404 = 10 kΩ
R409 = 10 kΩ	R406 = 10 kΩ
R410 = 220 Ω	R407 = 220 Ω
R411 = 10 kΩ	R408 = 10 kΩ
RX414B = 0 Ω	RX404B = 0 Ω
RX415B = 0 Ω	RX405B = 0 Ω
RX416 = 0 Ω	RX406 = 0 Ω
RX417 = 0 Ω	RX407 = 0 Ω

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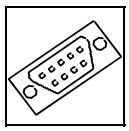


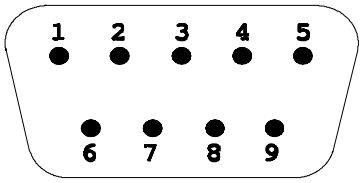
6. Connector Assignment

6.1 CAN-Bus Interfaces

6.1.1 CAN-Bus Interface at DSUB9 (X400, X401)

The signals are identically assigned to the connector of CAN-interface 1 (network 0: X400) and to the optional interface 2 (network 1: X401). The connectors are 9-pole male DSUB-connectors.

Pin Position:



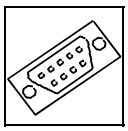
Pin Assignment:

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

9-pole DSUB-connector

Signal Description:

CAN_L, CAN_H...	CAN-signal lines
CAN_GND ...	reference potential of the local CAN-physical layer
shield ...	potential of the connector case
reserved ...	reserved for future applications



Connector Assignment

6.1.2 CAN-Bus Interface to CompactPCI-Bord Connector X101 (X400A, X400B, X410A, X410B)

The position of the connectors and the assignment of the pin numbers are shown above in the PCB (see page 4).

Assignment of connector **X400A** and **X400B** (net 0)

Signal	Pin	
	X400A	X400B
CAN_GND0	1	1
CAN_L0	2	2
CAN_H0	3	3

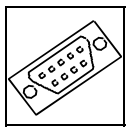
Assignment of connector **X410A** and **X410B** (net 1)

Signal	Pin	
	X410A	X410B
CAN_GND1	1	1
CAN_L1	2	2
CAN_H1	3	3

Signal Description:

CAN_H0, CAN_L0,
CAN_GND0... ISO11898-CAN-signal of CAN-net 0

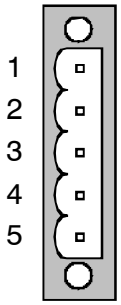
CAN_H1, CAN_L1,
CAN_GND1... ISO11898-CAN-signal of CAN-net 1



6.2 DeviceNet Option

If the module has a DeviceNet interface, the DSUB-connectors are not available.
5-pole Phoenix-Combicon connectors MSTB 2.5/-GF-5.08 (or equivalent) are used as connectors.

Pin Position:



Pin Assignments:

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

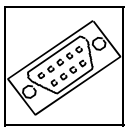
Signal Description:

V+... voltage supply for the CAN-interface (U_{VCC} = 24 V ± 4%)

V-... reference potential for V+ and CAN+/CAN-

CAN+, CAN-... CAN-signals

shield... shield
(connected to earth (front panel) via a highly resistive RC-combination (1MΩ, 10nF/500V))



6.3 Assignment of I/O-Connector X101

In standard design only the GND-signals are assigned to connector X101. Therefore, the following signal assignment only applies, if the configuration resistors are accordingly set, or if the connectors X400A/B or X410A/B are connected via a cable.

Pin	Signal						
	Row Z	Row A	Row B	Row C	Row D	Row E	Row F
1	-	-	R01*	R00*	T01*	T00*	GND
2	-	-	-	-	-	-	GND
3	-	-	-	-	-	-	GND
4	-	-	-	-	-	-	GND
5	-	-	-	-	-	-	GND
6	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-
8	-	-	-	-	-	CAN_H0	-
9	-	-	-	-	-	CAN_L0	-
10	-	-	-	-	-	CAN_GND0	-
11	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
13	-	-	-	-	-	CAN_H1	-
14	-	-	-	-	-	CAN_L1	-
15	-	-	-	-	-	CAN_GND1	-
16	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-
18	-	-	-	-	-	-	GND
19	-	-	-	-	-	-	GND
20	-	-	-	-	-	-	GND
21	-	-	-	-	-	-	GND
22	-	-	T10*	T11*	R10*	R11*	GND

Signal description:

T10*, R10*, T11*, R11* — CAN-signals which can be assigned to X101 (from CAN-controller network 0) by changing the resistors

T00*, R00*, T01*, R01* — CAN-signals which can be assigned to X101 (from CAN-controller network 1) by changing the resistors

CAN_H0, CAN_L0, CAN_GND0 — ISO11898-CAN-signals from CAN-network 0

CAN_H1, CAN_L1, CAN_GND1 — ISO11898-CAN-signals from CAN-network 1

7. Correctly Wiring Electrically Insulated CAN Networks

Generally all instructions applying for wiring regarding an electromagnetic compatible installation, wiring, cross sections of wires, material to be used, minimum distances, lightning protection, etc. have to be followed.

The following **general rules** for the CAN wiring must be followed:

1.	A CAN net must not branch (exception: short dead-end feeders) and has to be terminated by the wave impedance of the wire (generally 120 W ±10%) at both ends (between the signals CAN_L and CAN_H and **not** at GND)!
2.	A CAN data wire requires **two twisted** wires and a wire to conduct the reference potential (CAN_GND)! For this the shield of the wire should be used!
3.	The reference potential CAN_GND has to be connected to the earth potential (PE) at **one** point. Exactly **one** connection to earth has to be established!
4.	The bit rate has to be adapted to the wire length.
5.	Dead-end feeders have to kept as short as possible (l < 0.3 m)!
6.	When using double shielded wires the external shield has to be connected to the earth potential (PE) at **one** point. There must be not more than **one** connection to earth.
7.	A suitable type of wire (wave impedance ca. 120 Ω ±10%) has to be used and the voltage loss in the wire has to be considered!
8.	CAN wires should not be laid directly next to disturbing sources. If this cannot be avoided, double shielded wires are preferable.

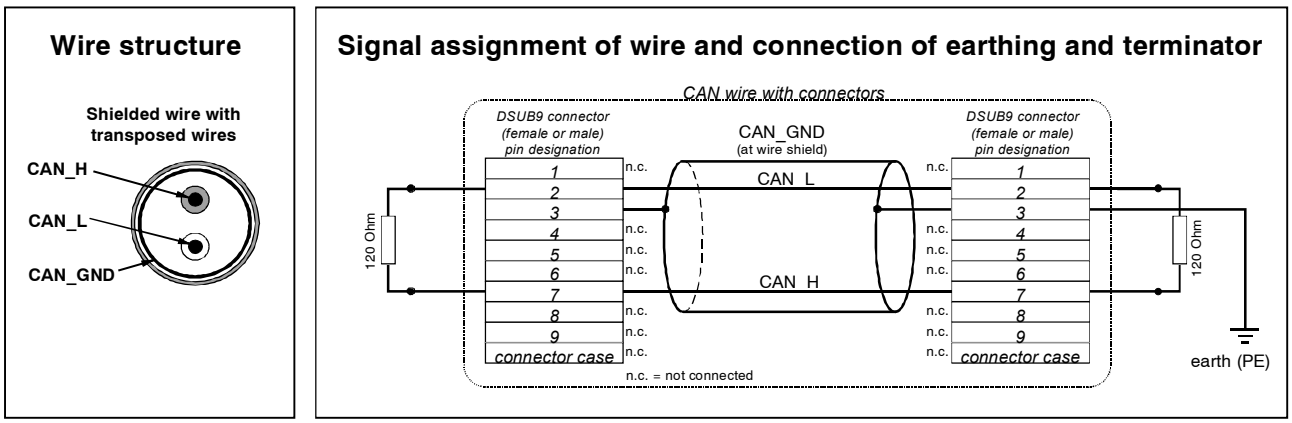


Figure: Structure and connection of wire

Cabling

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

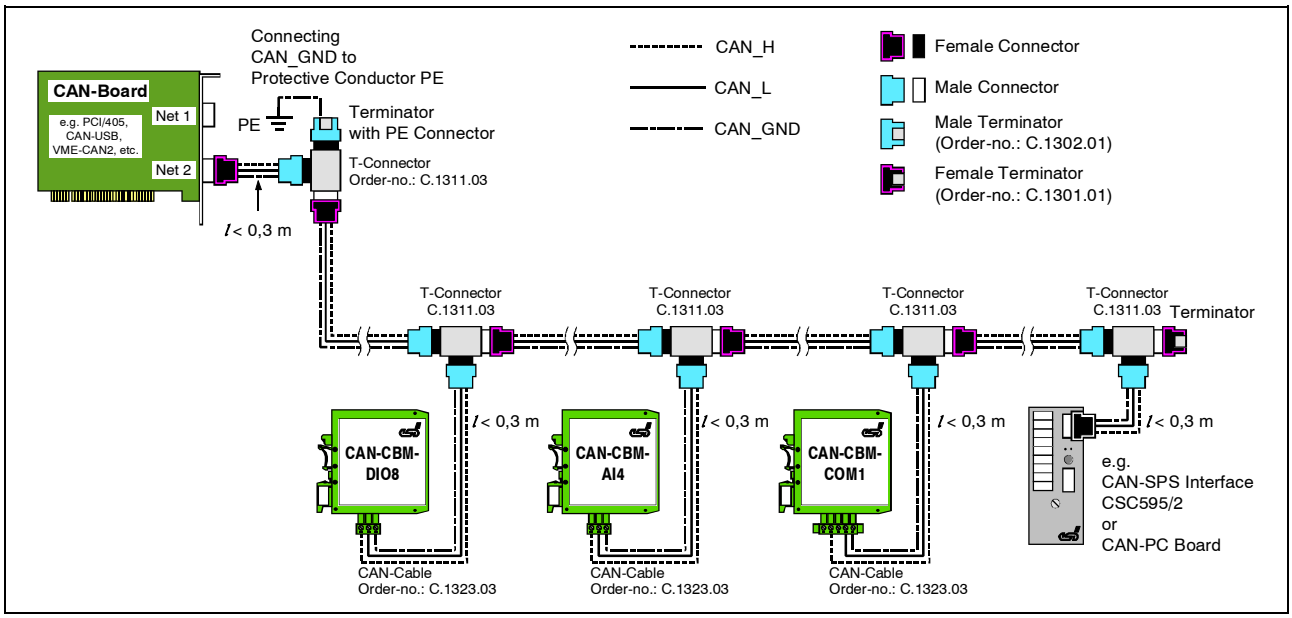


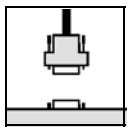
Figure: Example for correct wiring (when using single shielded wires)

Terminal Resistance

- use **external** terminator, because this CAN later be found again more easily!
- 9-pin DSUB-terminator with male and female contacts and earth terminal are available as accessories

Earthing

- CAN_GND has to be conducted in the CAN wire, because the individual esd modules are electrically isolated from each other!
- CAN_GND has to be connected to the earth potential (PE) at **exactly one** point in the net!
- each CAN user without electrically isolated interface works as an earthing, therefore: do not connect more than one user without potential separation!
- Earthing CAN e.g. be made at a connector

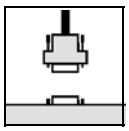


Wire Length

❍ Optical couplers are delaying the CAN signals. By using fast optical couplers and testing each board at 1 Mbit/s, however, esd CAN guarantee a reachable length of 37 m at 1 Mbit/s for most esd CAN modules within a closed net without impedance disturbances like e.g. longer dead-end feeders. (Exception: CAN-CBM-DIO8, -AI4 and AO4 (these modules work only up to 10 m with 1 Mbit/s))

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
666.6	80	-
500	130	100
333.3	180	-
250	270	250
166	420	-
125	570	500
100	710	650
66.6	1000	-
50	1400	1000
33.3	2000	-
20	3600	2500
12.5	5400	-
10	7300	5000

Table: Reachable wire lengths depending on the bit rate when using esd-CAN interfaces



Examples for CAN Wires

Manufacturer	Type of wire
U.I. LAPP GmbH Schulze-Delitzsch-Straße 25 70565 Stuttgart Germany www.lappkabel.de	e.g. UNITRONIC ®-BUS CAN UL/CSA (UL/CSA approved) UNITRONIC ®-BUS-FD P CAN UL/CSA (UL/CSA approved)
ConCab GmbH Äußerer Eichwald 74535 Mainhardt Germany www.concab.de	e.g. BUS-PVC-C (1 x 2 x 0,22 mm²) Order No.: 93 022 016 (UL appr.) BUS-Schleppflex-PUR-C (1 x 2 x 0,25 mm²) Order No.: 94 025 016 (UL appr.)
SAB Bröckskes GmbH&Co. KG Grefrather Straße 204-212b 41749 Viersen Germany www.sab-brockskes.de	e.g. SABIX® CB 620 (1 x 2 x 0,25 mm²) Order No.: 56202251 CB 627 (1 x 2 x 0,25 mm²) Order No.: 06272251 (UL appr.)

Note: Completely configured CAN wires can be ordered from **esd**.