

CAN-CBM-REL4

CAN Module with 4 Relay Outputs

Hardware Manual

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Changes in the chapters

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

Chapter	Changes versus previous version
2.3	Change of LED signals
3.2	Changes concerning manual configuration
4.1	Description of pin assignment changed

Technical details are subject to change without further notice.

NOTE

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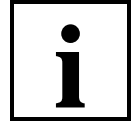
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Contents

1. Overview	3
1.1 Description of the CAN-CBM-REL4 Module	3
2. Case View and LED Description	5
2.1 Case	5
2.2 Front View with LED and Connector Description	6
2.3 LED Displays	7
2.3.1 Module Status LEDs	7
3. Configuration via Rotary Switches	9
3.1 Position of Rotary Switches	10
3.2 Manual Configuration via Coding Switches	11
3.2.1 Store Default Configuration in EEPROM	11
3.2.2 Manual Configuration	12
3.2.3 Setting the Module Number	14
4. Connector Assignment	15
4.1 Connecting the CAN Bus	15
4.2 Connecting the Relays	16
5. Summary of Technical Data	17
5.1 General Technical Data	17
5.2 Micro Controller Units	18
5.3 Software Support	18
5.4 Order Information	19
6. Correctly Wiring Electrically Isolated CAN Networks	21

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1. Overview

1.1 Description of the CAN-CBM-REL4 Module

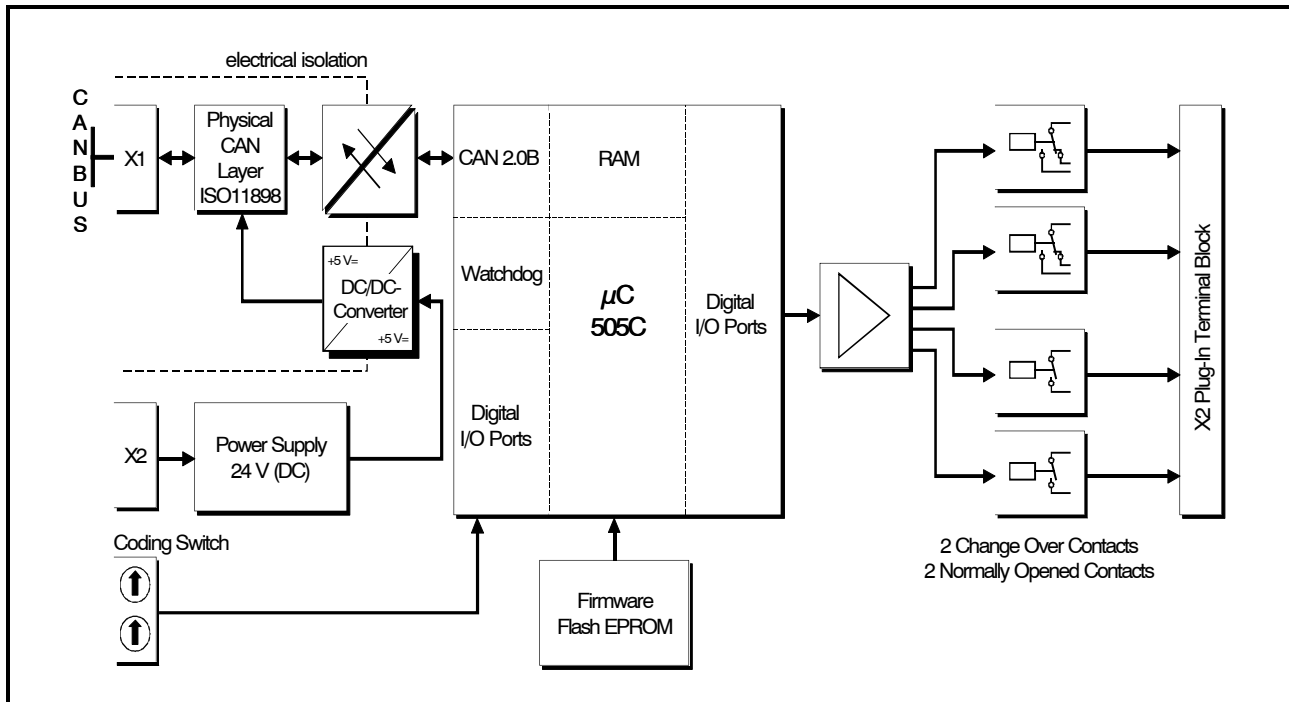


Fig.1.1: Block circuit diagram of the CAN-CBM-REL4 module

The CAN-CBM-REL4 module offers four monostable relay outputs. Two of these are normally open contacts and two are change over contacts.

The channels are designed for nominal voltages of up to 220 VDC or 250 VAC. The maximum permissible switching current is 2 A per channel. The maximum switching power is 62.5 VA.

The maximum switching frequency of each relay is 20 switching cycles per minute.

The individual channels are electrically insulated and therefore various voltages can be applied to the CAN-CBM-REL4 module simultaneously.

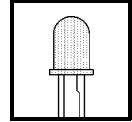
The CAN-CBM-REL4 module operates with a local micro controller of C505C type, which has an integrated CAN controller.

By means of two HEX rotary switches connected to the micro controller the CAN-CBM-REL4 module can be configured manually. Baud rate or module number, for example, can be set via the rotary switches.

The ISO 11898-compatible CAN interface allows a maximum data transfer rate of 1 Mbit/s.

The CAN interface is electrically isolated from other voltage potentials by optocouplers and DC/DC converters. It is connected via a Combicon style connector.

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2. Case View and LED Description

2.1 Case

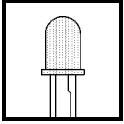
The board is installed in a polyamide case (UEGM–MSTB) by the manufacturer Phoenix Contact. The front has a 12-pin COMBICON connector (MSTBT 2.5/12-ST-5.08) to which the power supply and in- and outputs of the relays can be connected.

Four yellow, one red and one green LED show the current module status.

The two HEX rotary switches for manual configuration are on the upper case side.

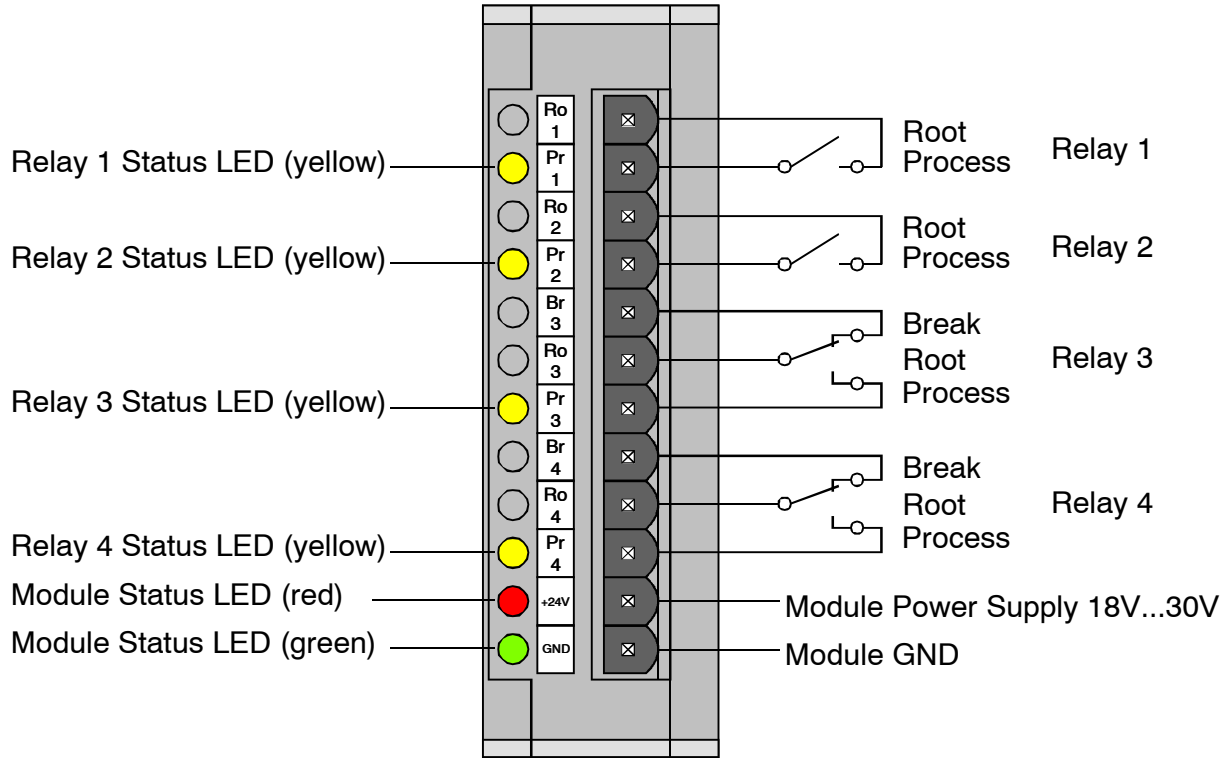
The CAN connection, a 5-pin COMBICON connector (MSTBT2.5/5-5.08), is at the lower case side.

The case can be locked onto carrier rails according to EN 50 022 (hat rail) by means of clips at the back of the case.



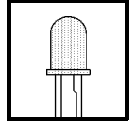
LED Displays

2.2 Front View with LED and Connector Description



Designation:

Ro...	Root	(COM - common)
Pr...	Process	(N.O. - normally opened)
Br...	Break	(N.C. - normally closed)



2.3 LED Displays

The module has four yellow, one red and one green LED (see page 6).

2.3.1 Module Status LEDs

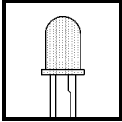
The red and the green LED signal the CANopen ERROR and the CANopen RUN status. The different shining conditions can be taken from the lower tables.

Name	Colour	LED
LED1	red	Error
LED2	green	Run

Table 2.3.1: Names of red and green LED

Shining condition of the green CANopen RUN LED	RUN Status of the CAN module	Description
single flash (200 ms on, 1 s off)	STOPPED	-
blinking (200 ms on, 200 ms off)	PRE-OPERATIONAL	-
LED on	OPERATIONAL	-

Table 2.3.2: Display of the green LED

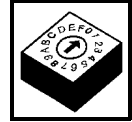


LED Displays

Shining condition of the red CANopen Error LED	Status of CAN module	Description
LED off	no error	- module is in working condition
single flash (200 ms on, 1 s off)	warning limit reached	- at least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
double flash (each 200 ms on, 200 ms off, 1 s pause)	NMT Error	- a 'Guard Event' or a 'Heartbeat Error' has occurred
triple flash (each 200 ms on, 200 ms off, 1 s pause)	Sync Error	- the Sync message has not been received within the configured communication cycle period time out (see object 1006 _h)
LED flashes 4x in succession * (each 200 ms on, 200 ms off, 1 s pause)	I ² C Error	- check sum error in I ² C-EEPROM
LED flashes 5x in succession * (each 200 ms on, 200 ms off, 1 s pause)	no valid Node-ID	- configured module number (Node-ID) is not permitted
LED flashes 6x in succession * (je 200 ms on, 200 ms off, 1 s pause)	no valid Baud rate	- configured CAN bit rate is not permitted

* these errors occurs only during configuration via coding switches

Table 2.3.3: Display of red LED



3. Configuration via Rotary Switches

Depending on the setting of the two rotary switches LOW (SW110) and HIGH (SW111), the CAN-CBM-REL4 module starts with different configuration:

Default configuration	00h :	Default configuration is stored in EEPROM
Manual configuration	FFh:	Parameters are selected and configured via the rotary switches, configuration is stored in EEPROM

When the configuration has been finished, the module number is set via both rotary switches:

Setting the module number	01-7Fh:	CAN-CBM-REL4 module is started with the configuration presently stored in the EEPROM. The module number corresponds to the current position of the rotary switches when the module is switched on and is not to be changed during operation. The module is shipped with the module no. set to 01h.
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Note: If switching the module OFF and ON, you have to wait a few seconds between switching ON and switching OFF, because the capacitors of the local power control must be discharged!



3.1 Position of Rotary Switches

The rotary switches for the manual configuration and the setting of the module number are on the upper side of the case.

Coding switch SW 110 (Low)

Coding switch SW 111 (High)

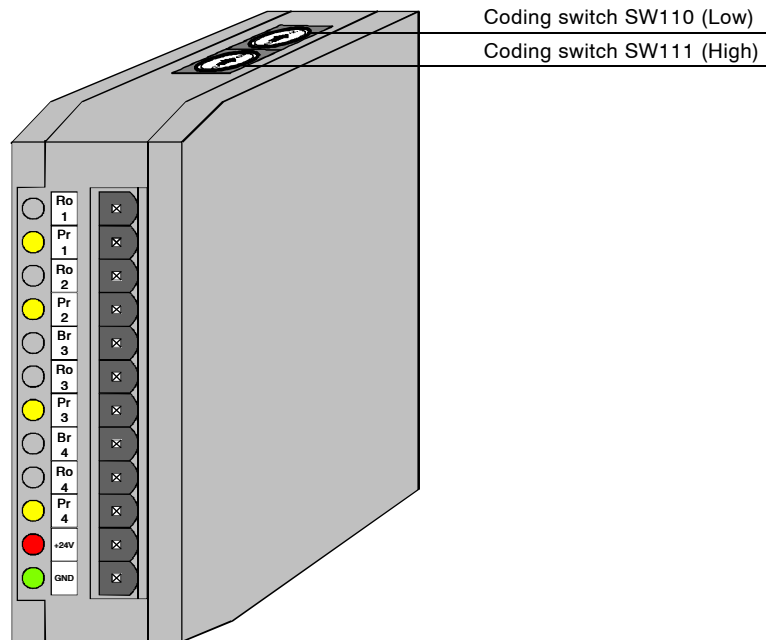
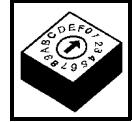


Fig. 3.1: Case view



3.2 Manual Configuration via Coding Switches

3.2.1 Store Default Configuration in EEPROM

In default configuration the CAN-CBM-REL4 module is pre-configured with certain values, such as a fixed baud rate at the moment (later options are possible). The default configuration is stored in the EEPROM.

Procedure:

1. In order to load the default configuration the two rotary switches are set to 00h before voltage is applied.
2. When voltage is applied to the CAN-CBM-REL4 module, the red and the green LED start flashing with a frequency of about 10 Hz (flickering/ CANopen). After about 10 s both LEDs switch off and the default configuration has been stored in the EEPROM.

Note: If only the green LED switches off after 10 seconds and the red LED flashes 4x in succession (see page 8), an error during the storing procedure in the EEPROM is indicated. This error is serious. Please contact the service.

Parameter of the default configuration:

Parameter	CANopen Object [Hex]	Value in the Default Configuration
CAN bit rate	-	125 kbit/s
COB-ID SYNC message	1005	80 _h
Guard-Time	100C	0
Life Time Factor	100D	0
Producer Heartbeat Time	1017	0
Configuration Date	1020	0
Configuration Time	1020	0
Change Polarity Output 8-Bit	6202	0
Error Mode Output 8-Bit	6206	FF _h
Error Value Output 8-Bit	6207	0
Filter Mask Output 8-Bit	6208	FF _h

Table 3.2.1: Values in the default configuration
(see software manual of the module)



3.2.2 Manual Configuration

Procedure:

1. For manual configuration both rotary switches are set to FFh before power is supplied.
2. When power is supplied, the red LED flashes quickly (ca. 10 Hz, flickering) and the green LED is on constantly.
3. By means of both rotary switches the CAN-CBM-REL4 module can now be configured. Rotary switch HIGH selects the desired parameter and rotary switch LOW sets the parameter.

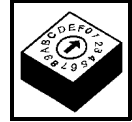
Switch HIGH (kind of parameter)	Switch LOW (parameter)	Description
0_h	$0_h \dots 7_h$	setting the baud rate
$1_h \dots E_h$	-	not defined
F_h	F_h	leave specification cycle

Table 3.2.2: Permitted settings of the rotary switches for manual configuration

Switch LOW	Bit rate in kbit/s
0	1000
1	500
2	250
3	125
4	100
5	50
6	20
7	10
8	800

Table 3.2.3: Selection of the CAN bit rate via coding switch LOW

As soon as one of the rotary switches is changed, you can start to set the parameters. The green LED flashes more slowly now (frequency about 2,5 Hz).



4. After about 10 s the setting of the parameter has to be finished. If the setting is successful, the green LED is on constantly again, the red LED remains flashing.
5. The setting of the following parameter or another setting can be started by changing the rotary switch again.

If the parameter has not been set within the 10 seconds, and if the rotary switches are still changed after these 10 seconds, both LEDs are constantly shining. After 10 seconds the configuration can be repeated.

6. The configuration mode can be left by setting the value FFh.
Both LEDs switch off when the configuration has successfully been stored in the EEPROM.

Note: If an error occurred during the storing procedure in the EEPROM, only the green LED switches off while the red LED flashes 4x in succession (see page 7). This is a serious fault. Please contact the service.



3.2.3 Setting the Module Number

When the configuration has been successful, the module number (Node-ID) has to be set by means of the rotary switches before the module is switched on, i.e. before power is supplied.

The module number can be set to values between 1 and 127 (01h to 7Fh).

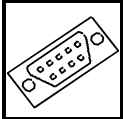
The CAN-CBM-REL4 module wakes up in the CANopen-defined status *pre-operational* and reports this by transmitting the boot-up protocol on the CAN bus.

If the CAN-CBM-REL4 module was started with a module number outside of the permissible range, the red LED flashes 4x in succession (see page 8). The green LED is off.

As long as the module number is not within the defined range, the CAN-CBM-REL4 module does not get into the *pre-operational* status.

In order to correct the module number you have to disconnect the module from the power supply, set the new module number and connect the power supply again. Then the CAN-CBM-REL4 module wakes up *pre-operational* and the green LED flashes constantly.

The module is shipped with the module number (Node-ID) set to 01_h.



4. Connector Assignment

4.1 Connecting the CAN Bus

The CAN connection is on the lower side of the case. 5-pole COMBICON connectors (male) MSTB2.5/5-5.08 by Phoenix are used as connectors. Pins 3 and 5 are not connected.

The following pin assignment is valid for all CAN-CBM-REL4 modules which have a serial number starting with a letter code $\geq \mathbf{AB}_{xxx}$.

Pin	Signal
5	n.c.
4	CAN_H
3	n.c.
2	CAN_L
1	CAN_GND

Table 4.1: Pin Assignment of the Combicon socket of the module

Signal Description:

CAN_L, CAN_H ... CAN signals
 CAN_GND... reference potential of the CAN physical layers

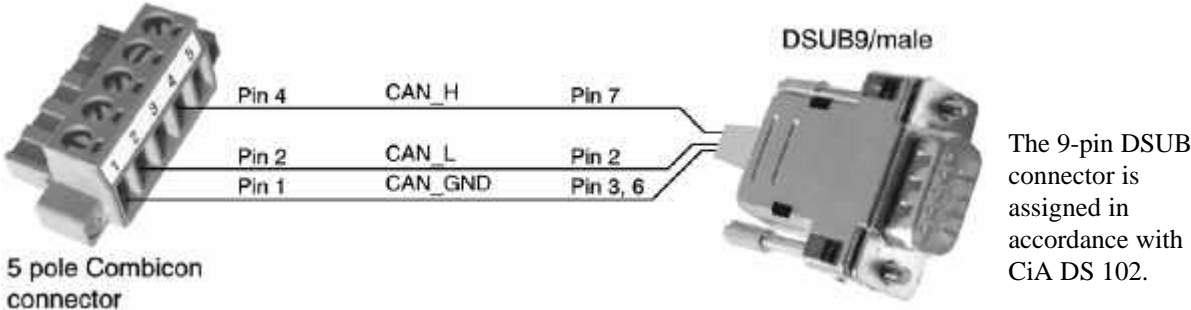
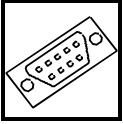


Fig 4.1: Adapter cable 5-pole Combicon to 9-pole DSUB



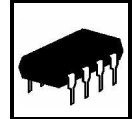
Connector Assignment

4.2 Connecting the Relays

The front of the case has a 12-pin COMBICON connector (MSTBT 2.5/12-ST-5.08) for power supply and in- and outputs of the relays.

Pin No.	Signal	
12	root	Relay 1
11	process	
10	root	Relay 2
9	process	
8	breaker	Relay 3
7	root	
6	process	
5	breaker	Relay 4
4	root	
3	process	
2	+ 24 V	
1	GND	

Table 4.2: Connecting the Relays

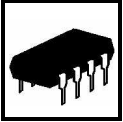


5. Summary of Technical Data

5.1 General Technical Data

Ambient temperature	0...+50 °C, -40...+85 °C optional
Humidity	max. 90%, non-condensing
Power supply	nominal voltage: 24 V, permissible voltage range: 18 V...30 V (Order no. C.2833.01) 10 V...30 V (Order no. C.2833.03)
Connectors	U200 (12-pin COMBICON connector) - supply voltage, relay in- and outputs X200 (5-pin COMBICON connector)- CAN connection
Dimensions	25 mm x 79 mm x 91 mm (+10 mm for I/O-terminal), for installation on carrier rails NS35/7.5 according to DIN EN 50022
Weight	ca. 95 g

Table 5.1: General data of the CAN-CAN-CBM-REL4 module



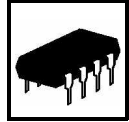
5.2 Micro Controller Units

Micro controller	C505C, 8 MHz
Flash-EEPROM	storing the firmware, available memory capacity 64 kbyte
I ² C-EEPROM	storing the parameters, 512 bytes
CAN interface	physical layer according to ISO 11898, electrical insulation
Transfer rate	programmable between 20 kbit/s to 1Mbit/s via rotary switches
CAN identifiers	configurable via rotary switches
LED display	1 green status LED, 1 red error LED, 4 yellow LEDs for relay position display

Table 5.2: Technical data of the micro controller units

5.3 Software Support

The CAN-CBM-REL4 module operates with CANopen according to CiA-DS401. Please refer to the software manual for CANopen functions.

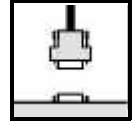


5.4 Order Information

Type	Features	Order No.
CAN-CBM-REL4	2 monostable change over contacts, 2 monostable normally open contacts, V _{cc} = 18 V... 30 V ambient temperature 0...50 °C	C.2833.01
CAN-CBM-REL4 -40/+85 °C	2 monostable change over contacts, 2 monostable normally open contacts, V _{cc} = 18 V... 30 V ambient temperature -40...+85 °C	C.2833.02
CAN-CBM-REL4 12V	2 monostable change over contacts, 2 monostable normally open contacts, V _{cc} = 10 V... 30 V ambient temperature 0...50 °C	C.2833.03
CAN-CBM-REL4-ME *)	English manual	C.2833.21

*) if you order product and manual together, the manual is included in the price.

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6. Correctly Wiring Electrically Isolated 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 $120 \Omega \pm 10\%$) 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 ($l < 0.3 \text{ m}$)!
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. $120 \Omega \pm 10\%$) 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.

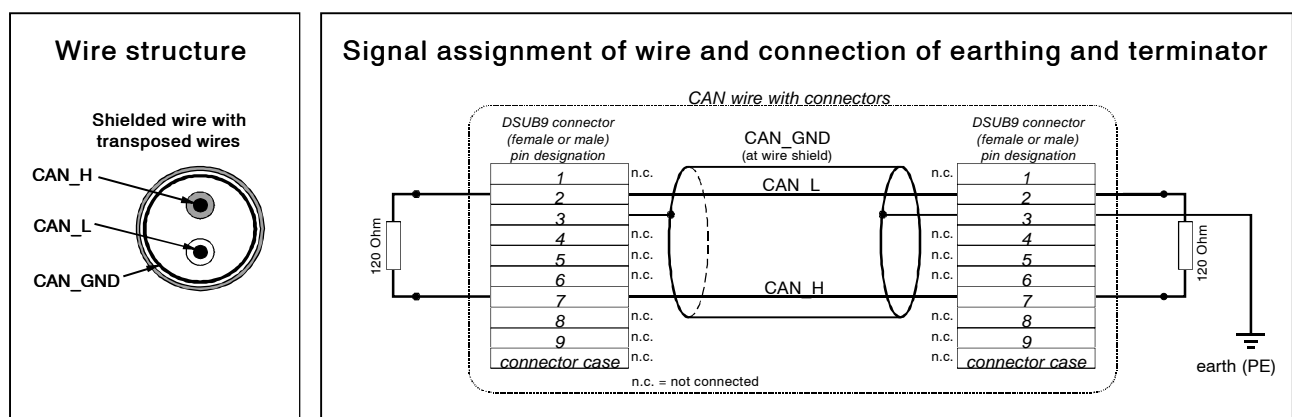
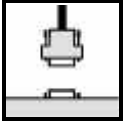


Figure: Structure and connection of wire



Wiring

Cabling

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

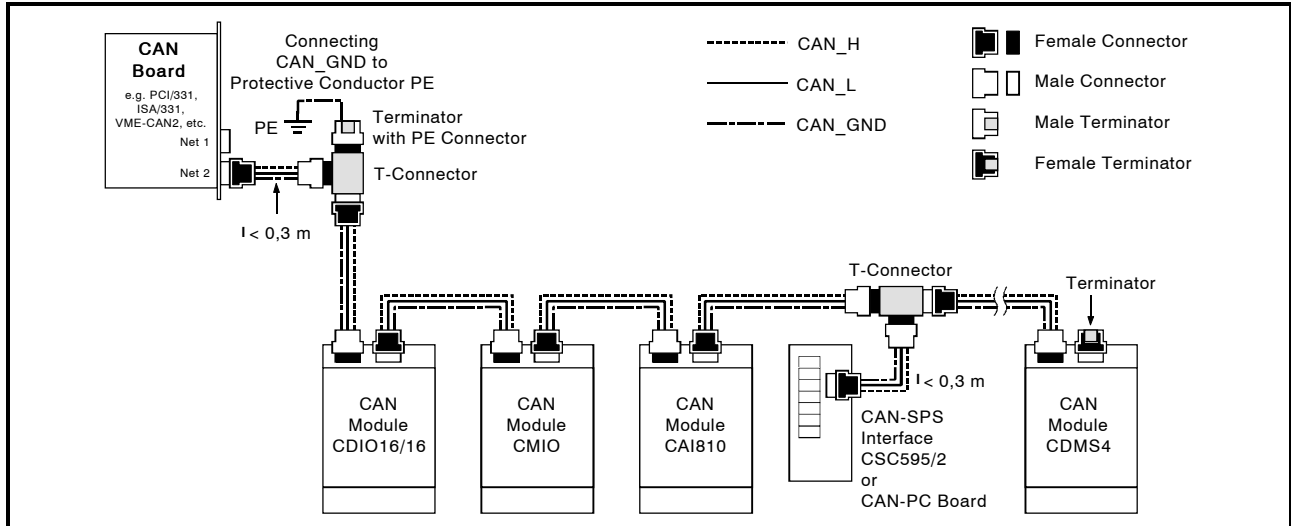


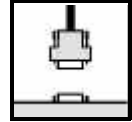
Figure: Example for correct wiring (when using single shielded wires)

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 Suitable Types of Wire

Manufacturer	Type of wire	Manufacturer	Type of wire
U.I. LAPP GmbH & Co. KG Schulze-Delitzsch-Straße 25 70565 Stuttgart	UNITRONIC @-BUS LD, UNITRONIC @-BUS FD P LD	Alcatel Kabelmetal Kabelkamp 20 30179 Hannover	DUE 4401, DUE 4001, DUE 4402
metrofunk KABEL-UNION GmbH Postfach 410109 12111 Berlin	LiYCY 2 x 0,38 mm ² , LiYCY 2 x 0,5 mm ² , LiYCY 2 x 0,75 mm ² , LiYCY 2 x 1,0 mm ² , 1P x AWG 22 C, 1P x AWG 20 C	ConCab Kabel GmbH Äußerer Eichwald 74535 Mainhardt	1 x 2 x 0,22 mm ² Order no.: 93022016 (UL approved)