CAN-CBM-DP

Profibus-DP / CAN-Gateway

DN-CBM-DP

Profibus-DP / DeviceNet-Gateway

Hardware Manual

to Product C.2844.03/.05 and C.2846.02

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N O T E

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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
1.1	Description of PROFIBUS-DP data range inserted.
1.2	Description of PROFIBUS-DP data range inserted.

Technical details are subject to change without notice.

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Contents **Page**

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1. Overview

This manual describes the hardware of the CAN-interface CAN-CBM-DP- and the hardware of the DeviceNet-interface DN-CBM-DP-module together. Differences are noted.

1.1 Module Description CAN-CBM-DP

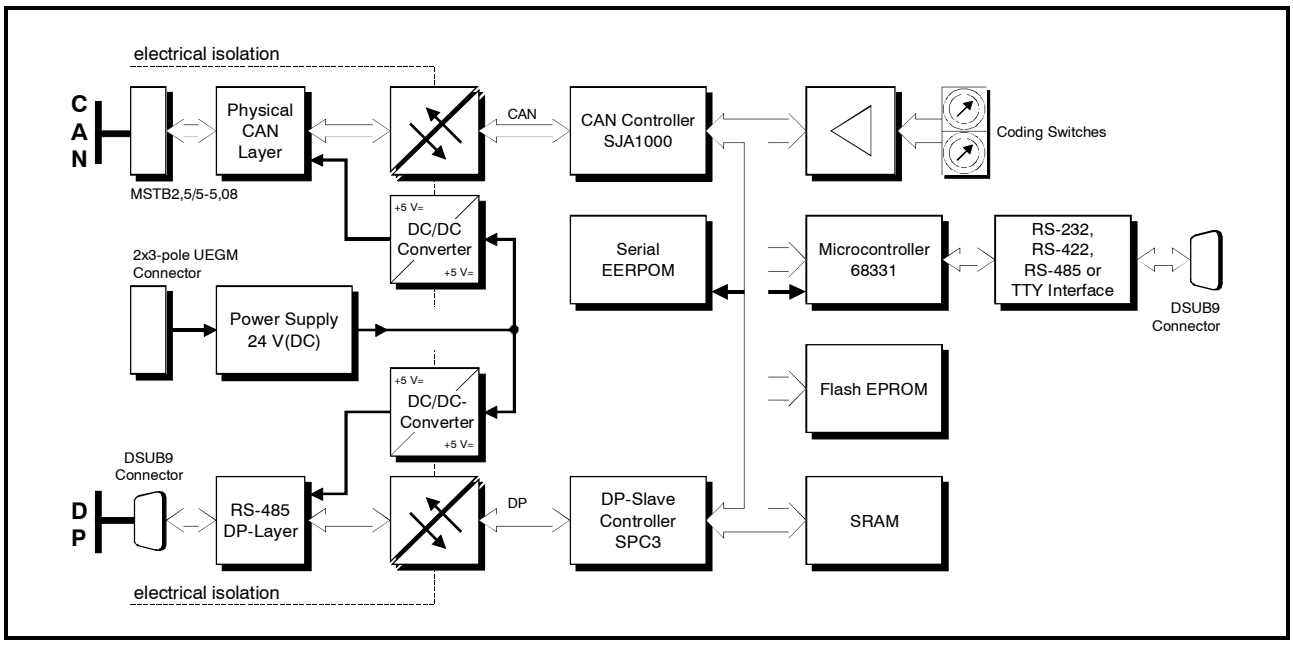

Fig. 1.1.1: Block-circuit diagram of the CAN-CBM-DP module

By means of the module CAN-CBM-DP any Profibus-DP master can be connected to a CAN network. The DP/CAN gateway acts like a slave I/O component on the DP-bus, with a total of up to 300 bytes input and output data. Maximum 244 bytes of the total of 300 bytes can be used as input data (with 56 byte output data) or maximum 244 bytes can be used as output data (with 56 bytes input data).

With the CAN gateway you can connect CAN modules with CANopen or layer 2 implementation to e.g. a SIMATIC-S7. There are no limitations on CANopen PDO's and SDO's by the gateway and the complete DeviceNet scanner functionality is supported. The number of CAN participants is not limited by the module, too.

The module operates internally with a 68331 micro controller, which buffers the CAN and Profibus DP data into the local SRAM. The firmware and configuration data are kept in the Flash EEPROM. Parameters are stored by means of a serial EEPROM.

The ISO 11898-compliant CAN interface allows a maximum data-transfer rate of 1 Mbit/s. The Profibus-DP slave interface automatically recognizes all usual bit rates up to 12 Mbit/s. The DP interface as well as the CAN interface are electronically insulated by optocouplers and DC/DC converters. The CAN is connected by means of a 5-pin screw/plug connector in Combicon design.

Overview

According to standard, the DP interface is equipped with a 9-pin female DSUB connector.
The module has a serial interface (default: RS-232) for servicing and configuration. It is connected by means of a male DSUB9.

The data mapping of the CAN-I/O data of the DP slave is done by the Profibus Configuration tool, e.g. PLC SIMATIC MANAGER. Additionally a configuration software is available under Windows 95/98 or Windows NT.
CANopen is supported as Layer-7 protocol on CAN.

1.2 Module Description DN-CBM-DP

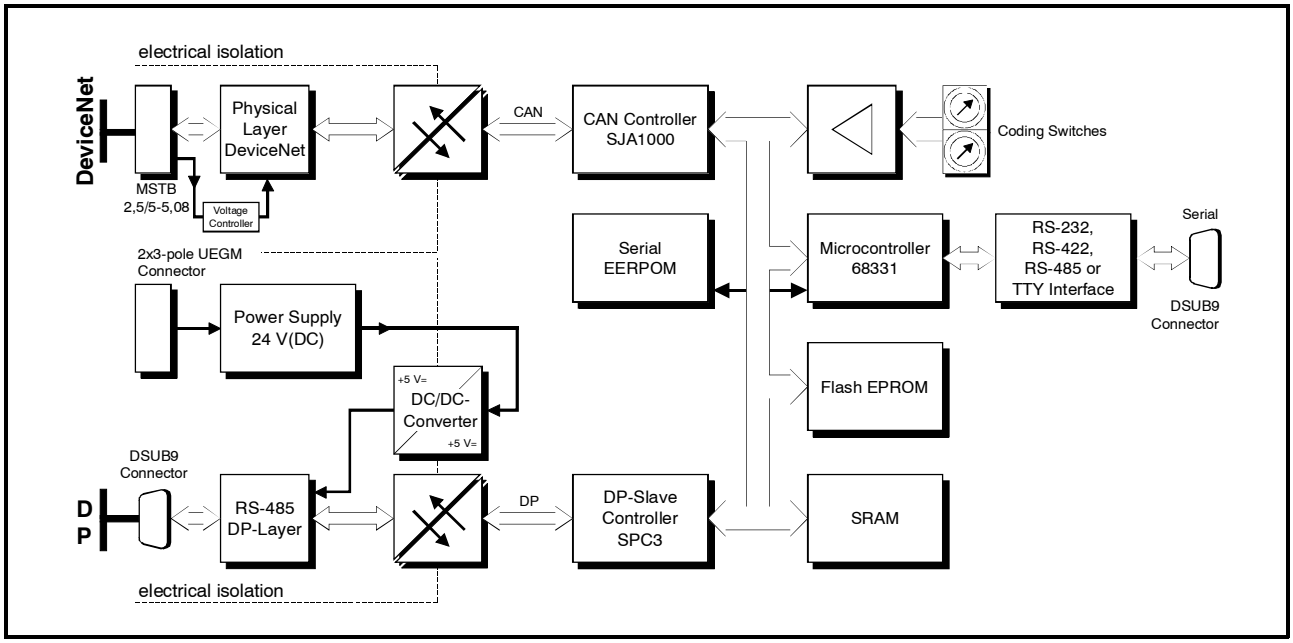

Fig. 1.2.1: Block-circuit diagram of the DN-CBM-DP module

The module DN-CBM-DP can link any Profibus-DP master to DeviceNet. The DN-CBM-DP gateway acts like a slave I/O component on the DP-bus, with a total of up to 312 bytes input and output data. Maximum 244 bytes of the total of 312 bytes can be used as input data (with 68 byte output data) or maximum 244 bytes can be used as output data (with 68 bytes input data).

The module operates internally with a 68331 micro controller, which buffers the DN and Profibus DP data into the local SRAM. The firmware and configuration data are kept in the Flash EEPROM. Parameters are stored by means of a serial EEPROM.

The DeviceNet interface is designed according to the DeviceNet Specification Rev.2.0. All DeviceNet bit rates are supported. The Profibus-DP slave interface automatically recognizes all usual bit rates up to 12 Mbit/s. The DP interface as well as the DeviceNet interface are electronically insulated by optocouplers and DC/DC converters. The DeviceNet is connected by means of a 5-pin screw/plug connector in Combicon design. According to standard, the DP interface is equipped with a 9-pin female DSUB connector.
The module has a serial interface (default: RS-232) for servicing and configuration. It is connected by means of a male DSUB9.

For mapping the I/O data of the DP slave a configuration software is available under Windows 95/98 or Windows NT.
DeviceNet is supported as Layer-7 protocols.

1.3 Front View with Connectors and Coding Switches

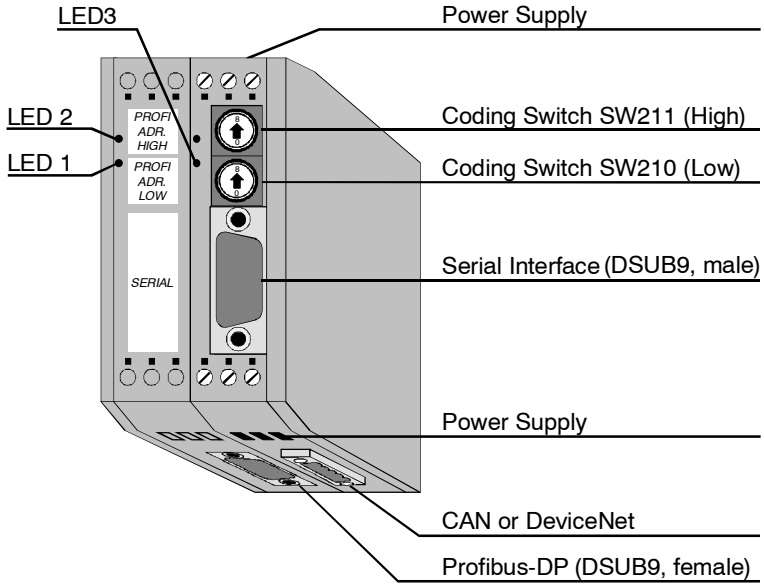

Fig. 1.2.1: Position of connectors and control elements

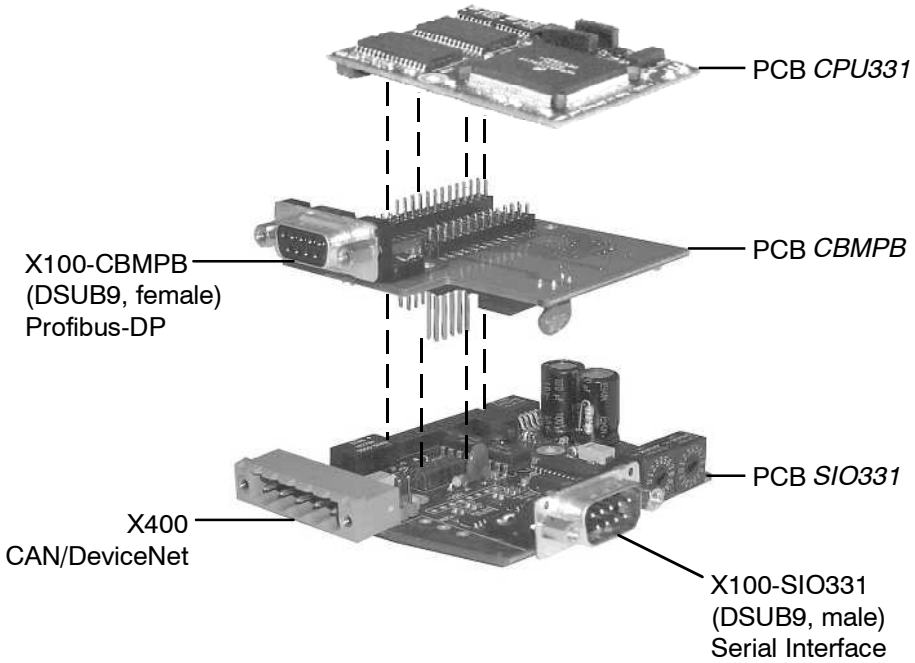

Fig. 1.3.2: Internal module structure with PCB designations and connector names (Figure without connector for supply voltage)

1.4 Summary of Technical Data

1.4.1 General Technical Data

Supply voltage	Nominal voltage 24 V/DC ±10%, Current (at 20°C): max. 125 mA (+20 mA in TTY operation of serial interface)
Connectors	X100-SIO331 (DSUB9, male) - serial interface X100-CBMPB (DSUB9, female) - Profibus-DP-interface X101 (6-pin screw connector UEGM) - 24V-voltage supply X400 (Combicon design, 5-pin MSTB2.5/5-5.08) - CAN or DeviceNet
Temperature range	0...50 ˚C ambient temperature
Humidity	max. 90%, non-condensing
Case dimensions (W x H x D)	Width: 40 mm, height 85 mm, depth: 83 mm (including hat rail mounting and jutted out connectors DSUB9, without CAN/DeviceNet connectors)
Weight	approx. 200 g

Table 1.4.1: General data of the CAN-CBM-DP and DN-CBM-DP

1.4.2 Microcontroller Circuit

Microcontroller	68331
Memory	SRAM: 128 k x 16 Bit (optional 512 k x 16 Bit) Flash-EPROM: 128 k x 8 Bit EEPROM: serial I²C-EEPROM (1024 k x 8 Bit)
Debug interface	for service and programming

Table 1.4.2: Microcontroller circuit

1.4.3 CAN/DeviceNet Interface

Number of interfaces	CAN-CBM-DP: 1 x CAN DN-CBM-DP: 1 x DeviceNet
Connection	5-pin Combicon design MSTB2.5/5-5.08
CAN controller	SJA1000, CAN 2.0A/B
Electrical insulation of CAN interface from other circuits	via optocouplers and DC/DC converters (CAN-CBM-DP)
Physical Layer CAN (CAN-CBM-DP)	Physical Layer according to ISO 11898, transmission rate programmable from 10 kbit/s to 1 Mbit/s
Physical Layer DeviceNet (DN-CBM-DP)	Physical Layer according to DeviceNet specification Rev. 2.0, bit rate: 125 kbit/s, 250 kbit/s, 500 kbit/s

Table 1.4.3: Data of CAN/DeviceNet interface

1.4.4 Profibus-DP Interface

Number of Profibus-DP interfaces	1x Profibus-DP
Connection	9-pin DSUB female
DP controller	Siemens Profibus Controller SPC3, DP-Slave
Electrical insulation of Profibus-DP from other circuits	via optocouplers and DC/DC converters
Physical Layer	RS-485

Table 1.4.4: Data of Profibus-DP interface

1.4.5 Serial Interface

Controller	68331
Interface	Standard: RS-232 Options: RS-422, RS-485, TTY active/passive
Connection	9-pin DSUB male

Table 1.4.5: Data of serial interface

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1.5 Order Information

Type	Properties	Order No.
CAN-CBM-DP	DP-CAN-Gateway, CAN-layer 2, CAN 2.0A-firmware for 11 bit CAN identifier, RS-232 interface, GSD-file	C.2844.03
CAN-CBM-DP-2.0B	DP-CAN-Gateway, CAN-layer 2, CAN 2.0A/B-firmware for 11 and 29 bit CAN identifier, RS-232 interface, GSD-file	C.2844.05
DN-CBM-DP	DP-DeviceNet-Gateway, Firmware for 11 bit CAN identifier, RS-232 interface	C.2846.02
Instead of RS-232 supplemented by: (to be specified in order)	RS-422 adapter RS-485 adapter TTY-20mA passive TTY-20mA active	V.1930.02 V.1930.04 V.1930.06 V.1930.08
CAN-CBM-DP-ME	English manual [1*)] for C.2844.03/05 incl. configuration software (includes hardware and software manual)	C.2844.21
DN-CBM-DP-ME	English manual [1*)] for C.2846.02 incl. configuration software (includes hardware and software manual)	C.2846.21
CAN-CBM-DP-ENG	English engineering manual [2*)] for C.2844.03/05 and C.2846.02 Content: circuit diagrams, PCB top overlay drawing, data sheets of significant components	C.2844.25

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

Table 1.5.1: Order information

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2. Circuit Description

2.1 CAN/DeviceNet Circuit

2.1.1 Interface Circuit

The CAN-CBM-DP module is equipped with an ISO 11898-compliant CAN interface, the DN-CBM-DP with a DeviceNet interface. The same connector in Combicon design is used for the two types, the assignment of the connector, however, differs. The following figures show both interfaces.

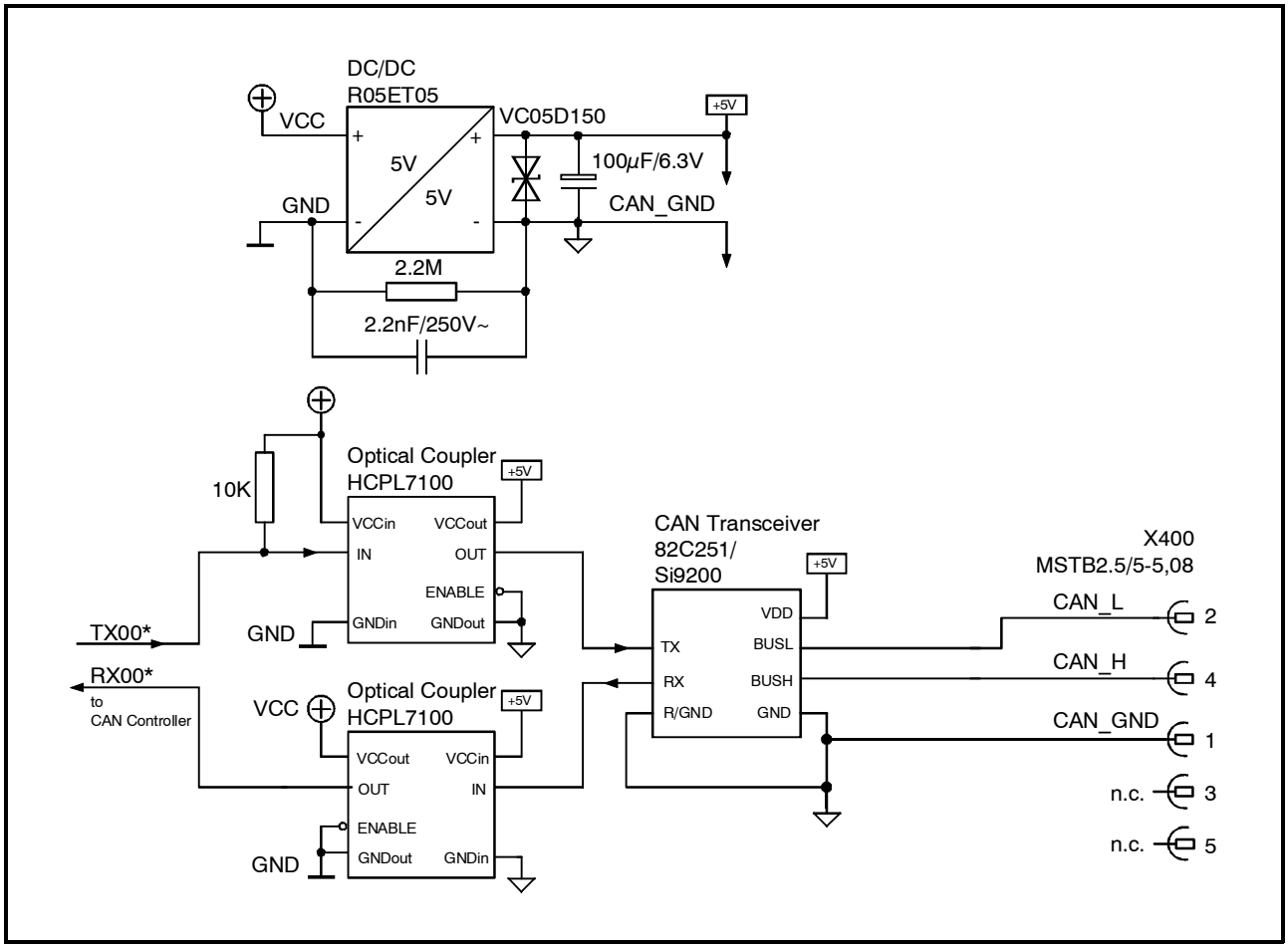


Fig. 2.1.1: Circuit of CAN interface CAN-CBM-DP

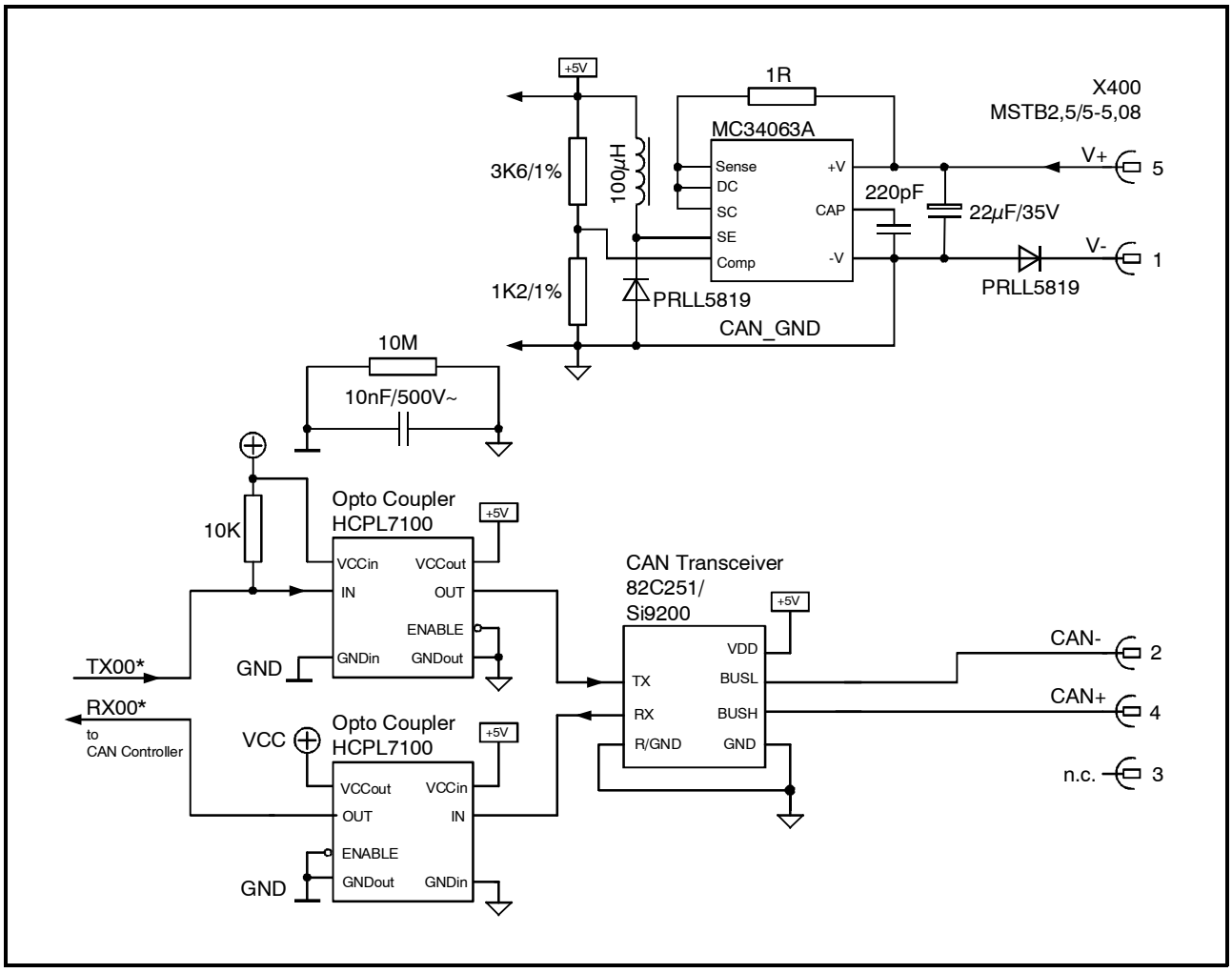


Fig. 2.1.2: Circuit of DeviceNet interface DN-CBM-DP

2.2 Profibus-DP Circuit

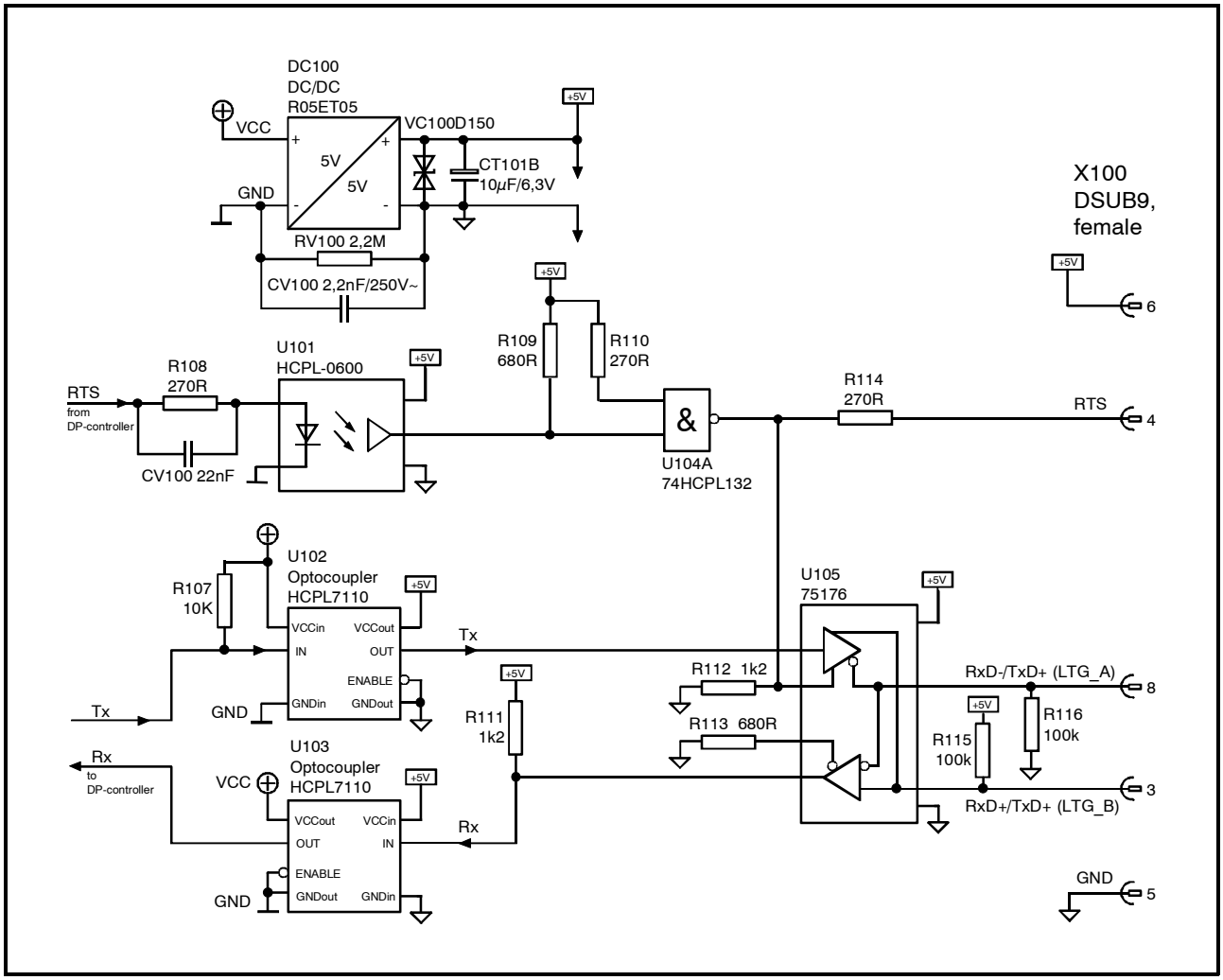


Fig. 2.2.1: Circuit of Profibus-DP interface

Note: The terminating resistors of the Profibus-DB networks have to be connected externally (see EN 50 170)!

2.3 Serial Interface

2.3.1 Configuration

The physical interface of the serial configuration interface can be configured as an RS-232, RS-422, RS-485, TTY-active or TTY-passive interface. For RS-232 operation an RS-232A driver component is used and for the other interfaces piggy-backs are used.

The serial interface is controlled by the 68331. The bit rate of the interface can be set by parameters. For each interface type (RS-232, RS-422, RS-485, TTY) a bit rate of up to 38,4 kbit/s is supported.

The following bit rates can be set by means of the software. The values in the second column shown the actual bit rates, which result from the controller-internal conversion.

Bit rate (set value) [bit/s]	Bit rate (actual value) [bit/s]
38,400	38,462
19,200	19,231
9,600	9,615
4,800	4,808
2,400	2,404
1,200	1,199
600	600.2
300	299.9

Table 2.3.1: Adjustable bit rates

2.3.2 Connection of Various Serial Interfaces

Below the wiring of the serial interfaces is shown. The figures are used to explain the terms for the signals used in the appendix. In the appendix you can also find the circuit diagrams of the various available piggy-backs.
The signal terms are exemplary for the connection of the CBM-DP as transmitter (terminal DTE).

2.3.2.1 The RS-232 Interface

The input signals CTS, DSR and DCD are not evaluated by the CAN-CBM-DP and DN-CBM-DP!

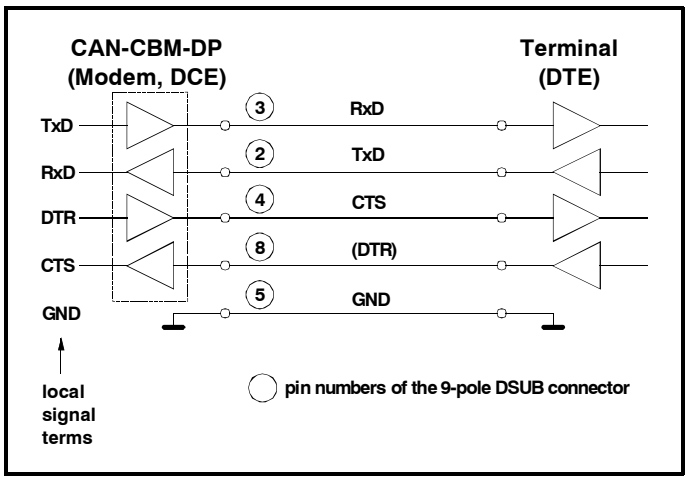


Fig. 2.3.1: Connection diagram for RS-232 operation

2.3.2.2 The RS-422 Interface

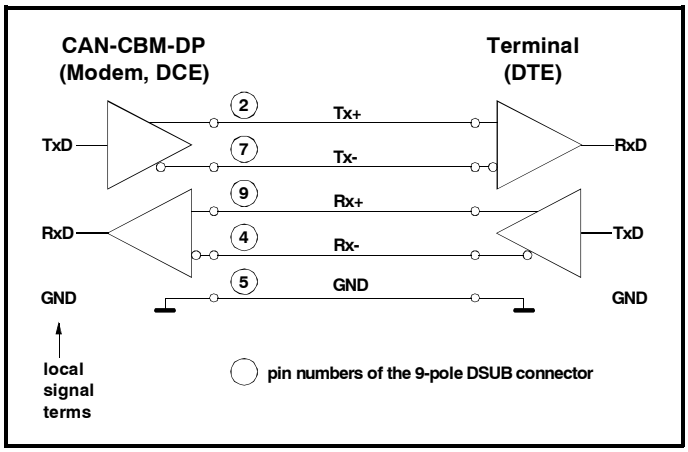


Fig. 2.3.2: Connection diagram for RS-422 operation

2.3.2.3 The RS-485 Interface

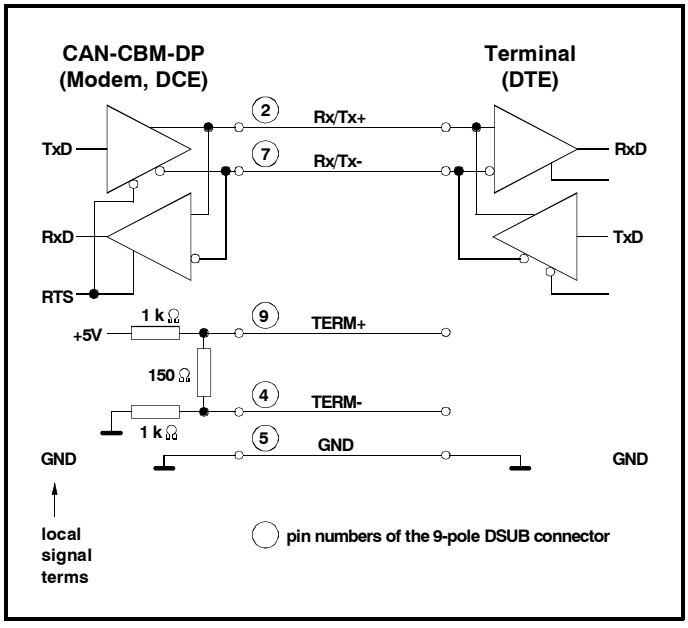


Fig. 2.3.3: Connection diagram for RS-485 operation

In order to activate the terminating resistor network on the piggy-back, you have to connect pins 9 and 2 and pins 4 and 7 in the DSUB9 connector, for example.

2.3.2.4 The TTY(20 mA) Interface

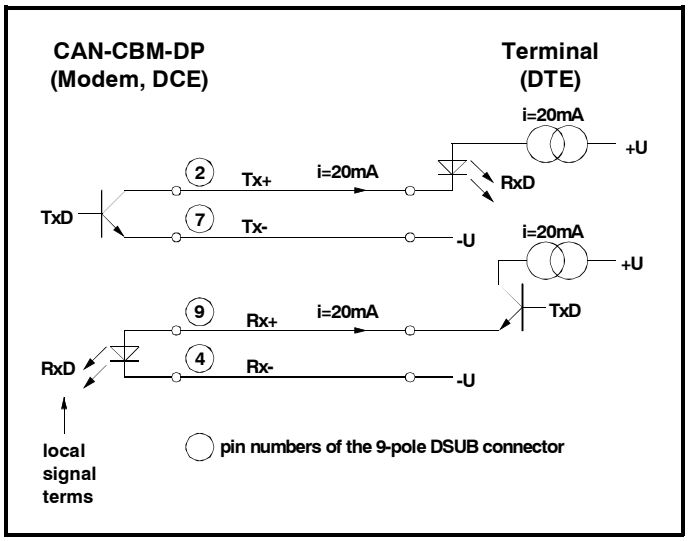


Fig. 2.3.4: Connection diagram for TTY operation (passive)

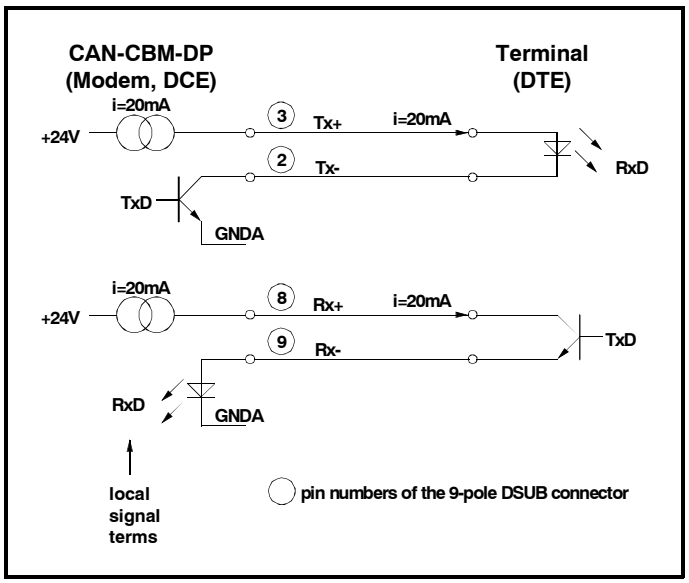


Fig. 2.3.5: Connection diagram for TTY operation (active)

2.4 Function of Coding Switches

The coding switches are used to set the PROFIBUS address. On power-on the PROFIBUS address is read from the coding switches. The settings have to be changed before switching on, because changes have no effect during operation.

The CAN-CBM-DP/DN-CBM-DP is operated as a slave station whose addresses can be set in the range *decimally* from 3 to 124 or *hexadecimally* from $03 to $C7. If an address smaller than 3 is set, address 3 is valid. If an address larger than 124 (decimal) or C7 (HEX) is set, address 124 is valid.

The upper coding switch (SW211) is used to set the MSBs, the lower coding switch (SW210) is used to set the LSBs.

The CAN identifiers (CAN-CBM-DP) are set by means of a PROFIBUS-DP configuration tool (e.g. SIMATIC manager). Information about this can be found in the 'CAN-CBM-DP Software Manual'.

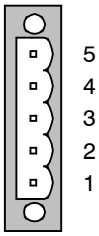
The MACID for the operation of the DN-CBM-DP module is set by the configuration received from the PLC via PROFIBUS-DP, too.

3. Appendix

3.1 Connector Assignments

3.1.1 CAN-CBM-DP: CAN-Bus (X400, 5-pin Combicon Style)

Pin Assignment of the Combicon socket of the module

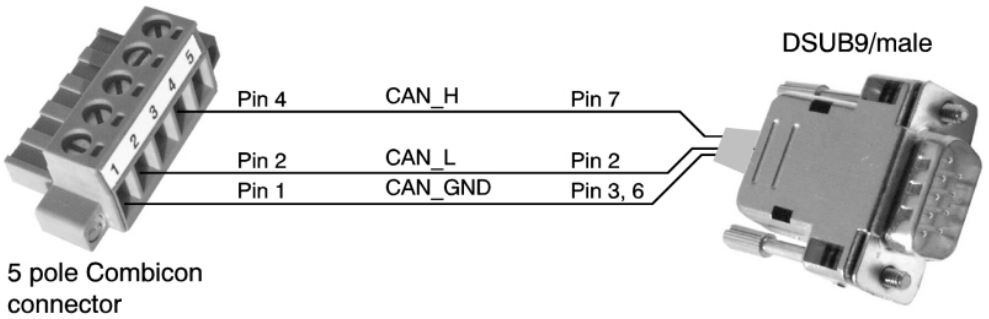


Pin	Signal
5	n.c.
4	CAN_H
3	Shield
2	CAN_L
1	CAN_GND

Signal Terms:

CAN_L, CAN_H ...	CAN signals
CAN_GND...	reference potential of the CAN physical layers
Shield...	connection of shield line (Shield signal is not connected locally on the CAN-CBM-DP)

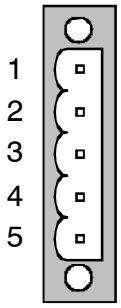
Pin assignment of an adapter cable 5-pole Combicon to 9-pole DSUB:



The 9-pin DSUB connector is assigned in accordance with CiA DS 102.

3.1.2 DN-CBM-DP: DeviceNet (X400, 5-pin Combicon Style)

Pin Position:



Pin Assignment:

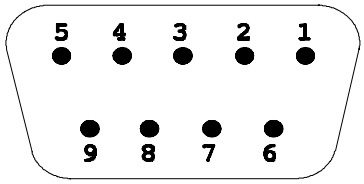
Pin	Signal
1	V-
2	CAN-
3	Shield
4	CAN+
5	V+

Signal terms:

V+...	Voltage supply feed (U_{VCC} = 24 V ± 4%)
V-...	Reference potential to V+ and CAN+/CAN-
CAN+, CAN-...	CAN-signal lines
Shield...	connection of shield line (Shield signal is not connected locally on the DN-CBM-DP)

3.1.3 Profibus-DP Interface (X100-CBMPB, 9-pin DSUB female)

Pin Position:



Pin Assignment:

Signal	Pin		Signal
n.c.	1	6	+5 V (output)
n.c.	2	7	n.c.
RxD+/TxD+ (I/O)	3	8	RxD-/TxD- (I/O)
RTS (output)	4	9	n.c.
GND	5		

9-pin DSUB female

Signal Terms:

RxD+/TxD+... receive and transmission data
RxD-/TxD-

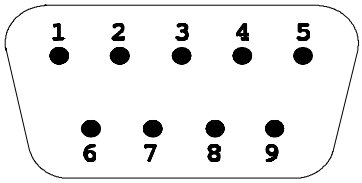
RTS... control signal for repeater (‘Request To Send’)

+5 V... voltage supply for external terminating resistor networks (max. 50 mA)

GND... reference potential

3.1.4 RS-232 Interface (X100-SIO331, 9-pin DSUB male)

Pin Position:



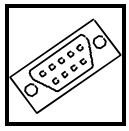
Pin Assignment:

Signal		Pin		Signal	
(DSR)	(input)	6	1	(DCD)	(input)
RTS	(output)	7	2	RxD	(input)
(CTS)	(input)	8	3	TxD	(output)
RIN	(input)	9	4	DTR	(output)
			5	GND	

9-pin DSUB male

The signal name is indicated looked by the CAN-CBM-module.

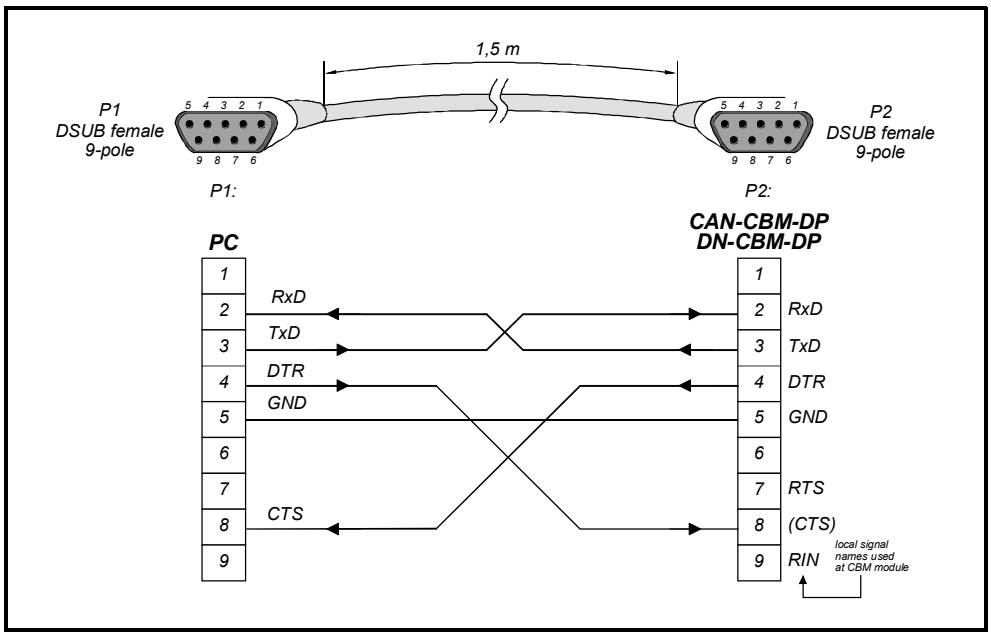
The input signals CTS, DSR and DCD are not evaluated by the CAN-CBM-DP / DN-CBM-DP!



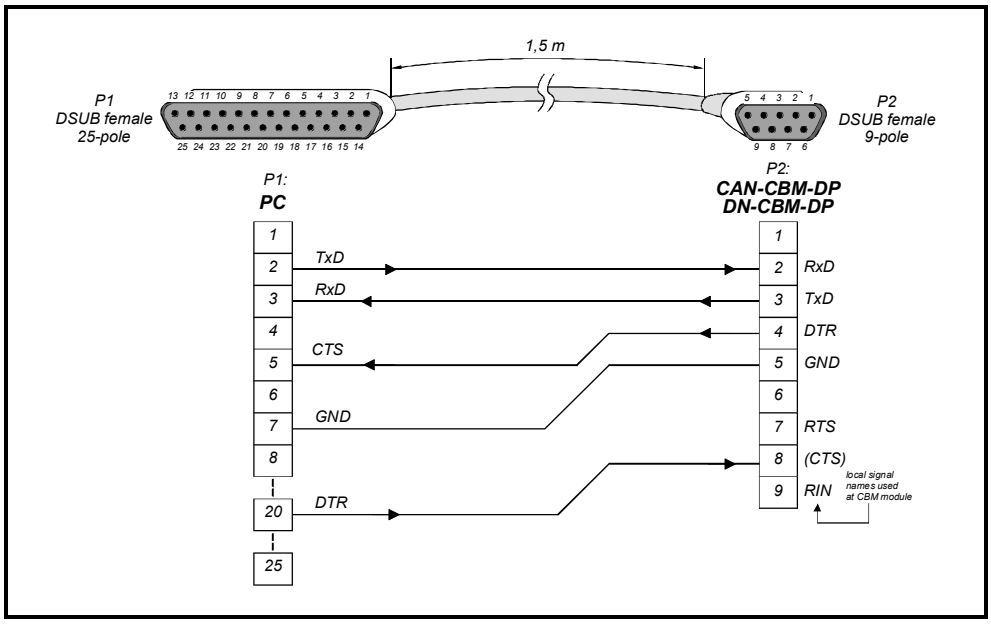
3.1.5 Connection Lines for the RS-232 Interface to a PC

The following two figures show the required assignment for RS-232 connection lines between PC and CAN-CBM-DP/DN-CBM-DP.

Adapter cable 9-pin DSUB female to 9-pin DSUB female

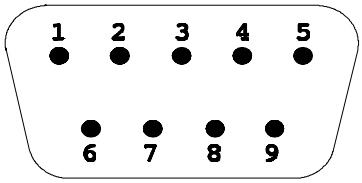


Adapter cable 25-pin DSUB female to 9-pin DSUB female



3.1.6 RS-422 Interface (X100-SIO331, 9-pin DSUB male)

Pin Position:



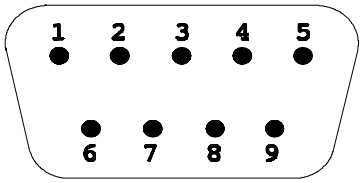
Pin Assignment:

Signal	Pin		Signal
-	6	1	-
Tx- (output)	7	2	Tx+ (output)
-	8	3	-
Rx+ (input)	9	4	Rx- (input)
		5	GND

9-pin DSUB male

3.1.7 RS-485 Interface (X100-SIO331, 9-pin DSUB male)

Pin Position:



Pin Assignment:

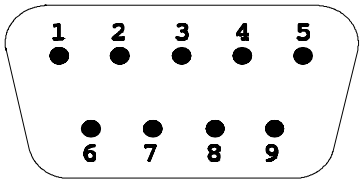
Signal	Pin		Signal
-	6	1	-
		2	Rx/Tx+
Rx/Tx-	7	3	-
-	8	4	Term- (for Rx/Tx-) *1)
Term+ (for Rx/Tx+) *1)	9	5	GND

9-pin DSUB male

*1)... The signals Term+ and Term- are connected to a terminating resistor network on the PCB. In order to activate the connection, Term+ has to be connected to the Rx/Tx+ signal and Term- with the Rx/Tx- signal.

3.1.8 TTY-passive Interface (X100-SIO331, 9-pin DSUB male)

Pin Position:



Pin Assignment:

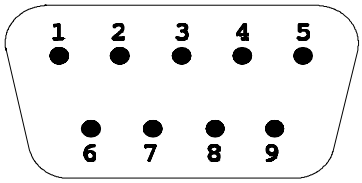
Signal	Pin		Signal
-	6	1	-
		2	Tx+ (transmitter)
Tx- (transmitter)	7	3	I1+ *1)
I2+ *1)	8	4	Rx- (receiver)
Rx+ (receiver)	9	5	GND

9-pin DSUB male

*1)... Signals I2+ and I1+ are assigned, but are not required for operating this physical interface.

3.1.9 TTY-active Interface (X100-SIO331, 9-pin DSUB male)

Pin Position:



Pin Assignment:

Signal	Pin		Signal
-	6	1	-
GNDA *1)	7	2	Tx- (transmitter)
Rx+ (receiver)	8	3	Tx+ (transmitter)
Rx- (receiver)	9	4	GNDA *1)
		5	GND

9-pin DSUB male

*1)... The GNDA signals have been assigned but are not required for operating this physical interface.

3.1.10 Voltage Supply (X101, UEGM)

Voltage is supplied by means of the screw connector UEGM, integrated in the case. It can be connected to lines with a cross-section of up to 2.5 mm².

Assignment of the screw connectors is the same on both sides of the case. They can be used alternatively. The middle contact is for +24 V and the two outer contacts are for GND.

Note: It is **not permissible** to feed-through the supply voltage, i.e. To use one side as 24 V input and the other side as 24 V output in order to supply other devices!

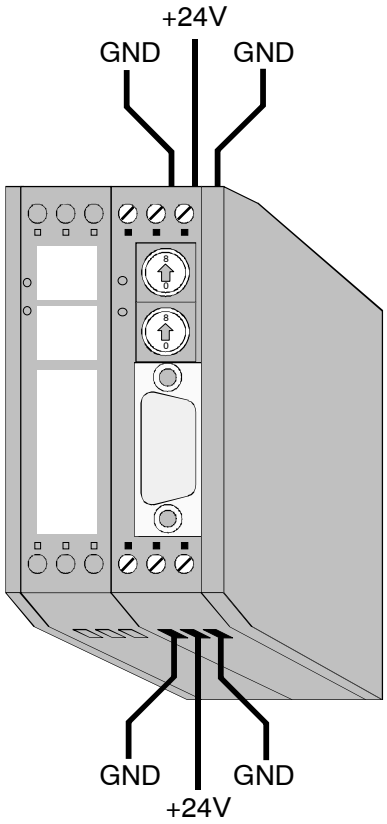


Fig 3.1.1: Voltage supply

4. 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 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.

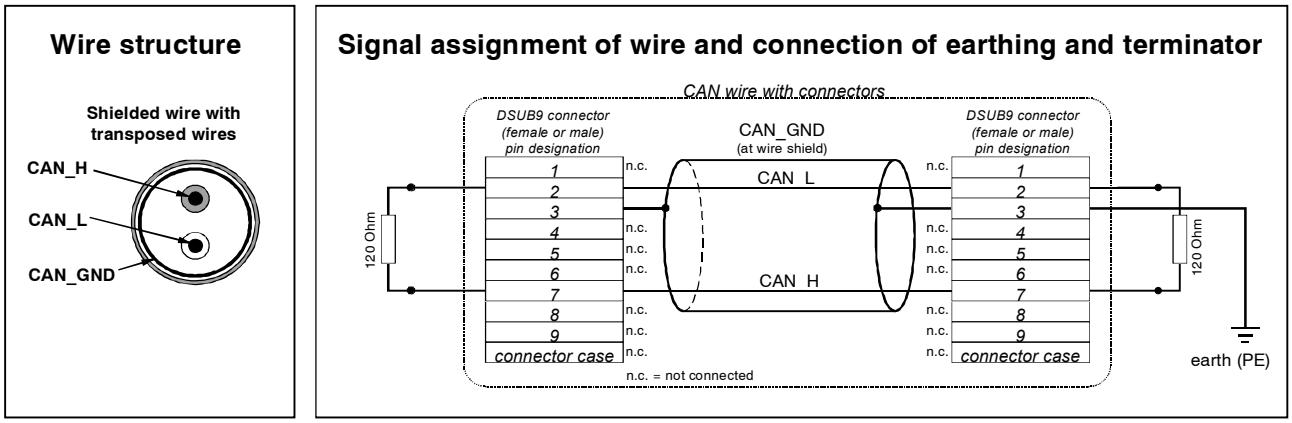


Figure: Structure and connection of wire

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)

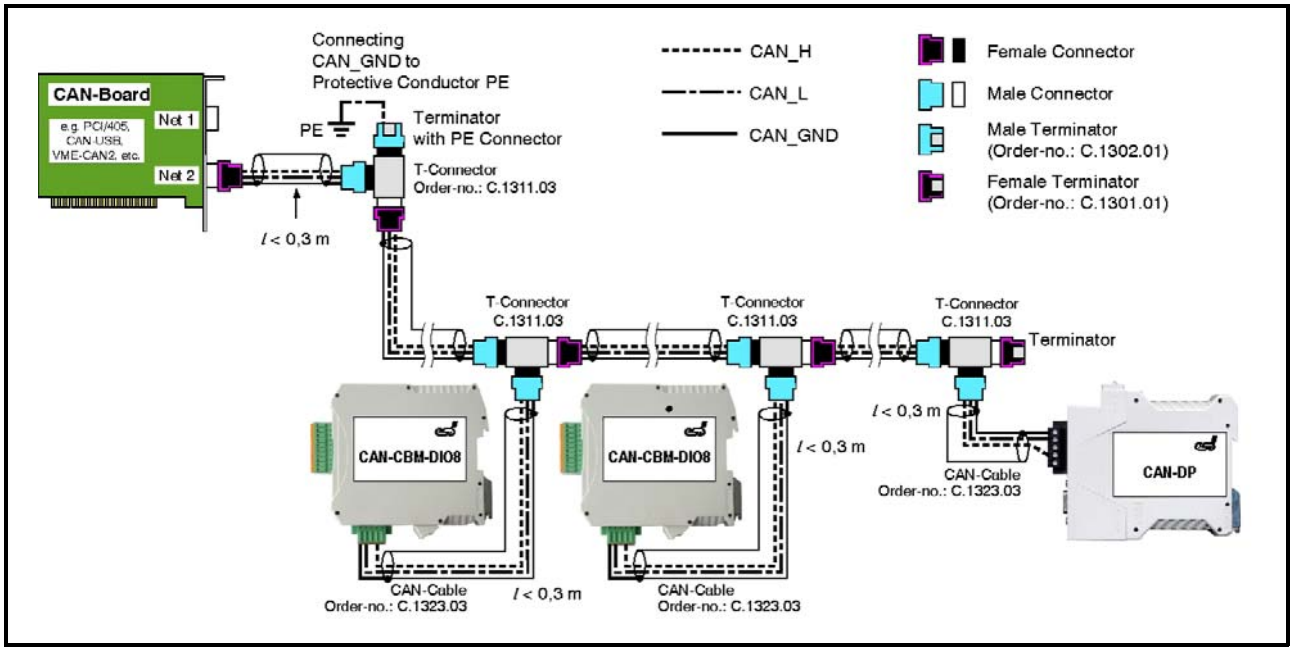


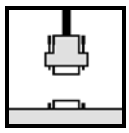
Figure: Example for correct wiring (when using single shielded wires)

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, esd modules typically reach a wire length of 37 m at 1 Mbit/s within a closed net without impedance disturbances like e.g. longer dead-end feeders.

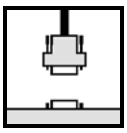
Bit rate [Kbit/s]	Typical values of reachable wire length **with esd interface** l_{max} [m]	**CiA recommendations** (07/95) for reachable wire lengths l_{min} [m]
1000	37	25
800	59	50
666.6	80	-
500	130	100
333.3	180	-
250	270	250
166	420	-
125	570	500
100	710	650
66.6	1000	-
50	1400	1000
33.3	2000	-
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**.



5. CAN-Bus Troubleshooting Guide

The CAN-Bus Troubleshooting Guide is a guide to find and eliminate the most frequent hardware-error causes in the wiring of CAN-networks.

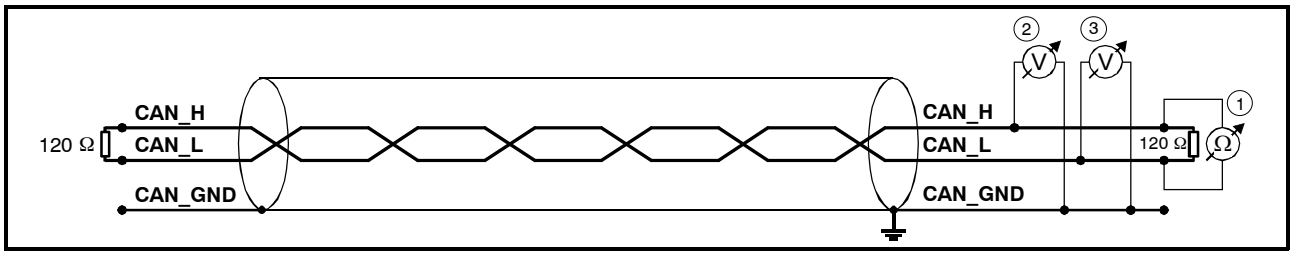


Figure: Simplified diagram of a CAN network

5.1 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 eliminated. 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 the middle and ends of the network (1) (see figure above).

The measured value should be between 50 and 70 Ω. The measured value should be nearly the same at each point of the network.

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
- 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.

5.2 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 volts. 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 GND (2) (see figure above).
4. Measure the DC voltage between CAN_L and GND (3) (see figure above).

   Normally the voltage should be between 2.0 V and 4.0 V.
   If it is lower than 2.0 V or higher than 4.0 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. For a voltage higher than 4.0 V, please check for excessive voltage.

To find the node with a faulty transceiver please test the CAN transceiver resistance (see next page).

5.3 Ground

The shield of the CAN network has to be grounded at only one location. This test will indicate if the shielding is grounded in several places. To test it, please

1. Disconnect the shield wire (Shield) from the ground.
2. Measure the DC resistance between Shield and ground (see picture on the right hand).
3. Connect Shield wire to ground.

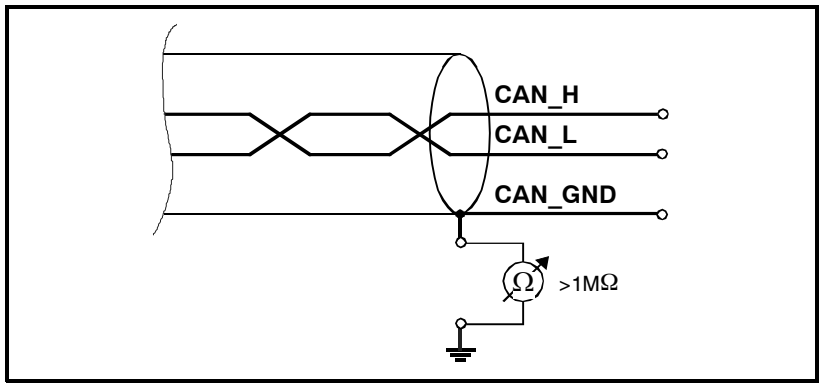


Fig.: Simplified schematic diagram of ground test measurement

The resistance should be higher than 1 M Ω. If it is lower, please search for additional grounding of the shield wires.

5.4 CAN Transceiver Resistance Test

CAN transceivers have one circuit that controls CAN_H and another circuit that controls CAN_L. Experience has shown that electrical damage to one or both 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. Disconnect the node from the network. Leave the node unpowered (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).

Normally the resistance should be between 1 M Ω and 4 M Ω or higher. If it is lower than this range, the CAN transceiver is probably faulty.

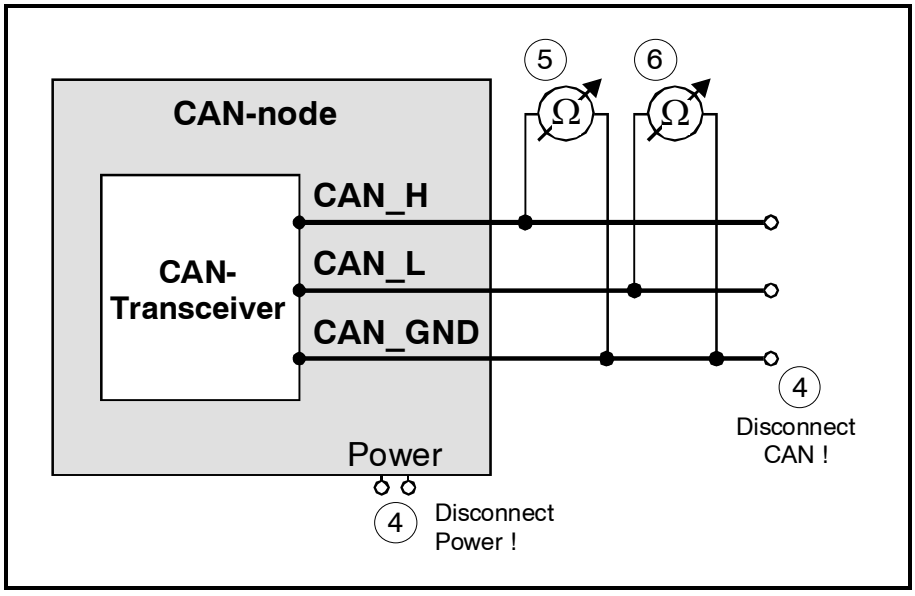


Figure: Simplified diagram of a CAN node