CAN-CBM-SIO1
CAN-CBM-SIO4
CAN - RS-232, RS-422, RS-485 or TTY-Interface

CAN-CBM-PLC/331-1
Automation Computer with CAN-Interface

Hardware Manual

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
-	Description of CAN-CBM-SIO4 module and CAN-CBM-PLC/331-1 module inserted
-	-

Technical details are subject to change without notice.

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1. Overview

1.1 Description of the Module

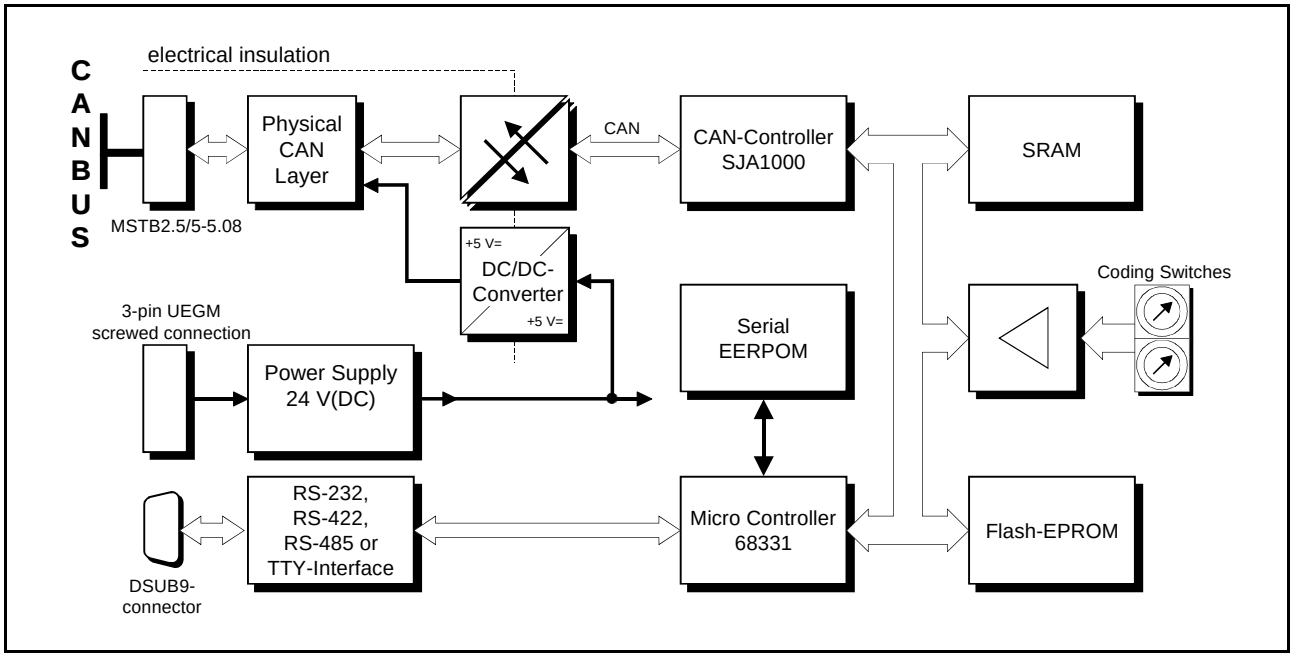


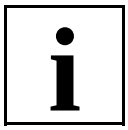
Fig. 1.1: Block-circuit diagram of the CAN-CBM modules

The CAN-CBM-SIO1 and CAN-CBM-PLC/331-1 modules offer the linking of one serial interface with the CAN-net. The CAN-CBM-PLC/331-1 module is configured as SPS controller with the software tool CoDeSys.
The CAN-CBM-SIO4 module is equipped with five serial interfaces. The physical interface of the serial interfaces can be configured like the CAN-CBM-SIO1 module via piggybacks.

The described CAN-CBM modules use a 68331 micro controller, which buffers the CAN-data into a local SRAM. Data security and consistency are guaranteed up to 1 Mbit/s in the CAN-network. The firmware - optional protocols also- is held in the flash.

The ISO 11898-compatible CAN-interface allows a maximum data-transmission rate of 1 Mbit/s. The CAN-interface is electrically insulated by means of optocouplers and DC/DC-converters**.**
The interface is connected via a 5-pin connector with screwed contacts in Combicon style. The module is optionally available with a DeviceNet interface.

The parameters of the serial interface can be configured via CAN - the maximum bit rate is 500 kbit/s. The parameters and the CAN settings are stored into an EEPROM.



Overview

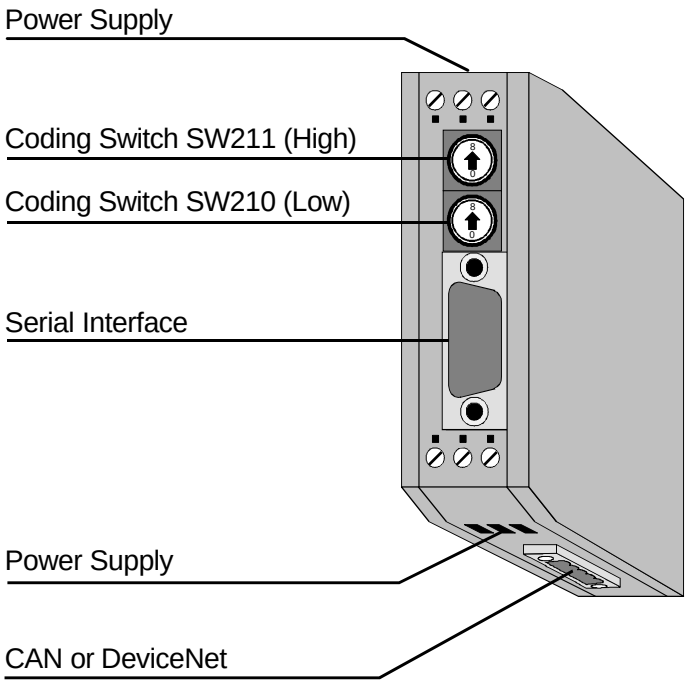
For CAN-CBM-SIO1 and CAN-CBM-SIO4 common protocols like 3964 R, Modbus or also FreePort to the connection of a S7-200 are optionally available. Custom-designed protocols can be made on request or developed with the help of GNU-C surroundings.

By use of the RS-232-interface as modem connection a remote maintenance of the CAN net can be done in remote operation. In addition to RS-232 you can also choose between RS-422, RS-485 or also TTY-20 mA as a physical interface. It is connected via a DSUB9-connector. Beyond that the CAN-CBM-SIO4 is connected via four additional RJ45-sockets.

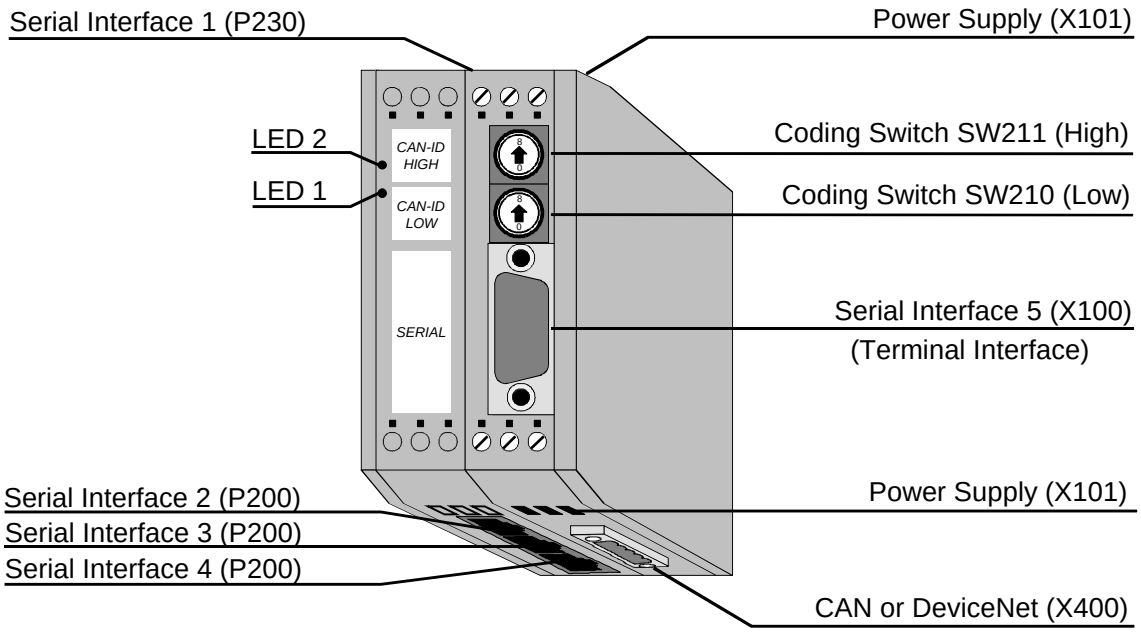
On request the layer-7-protocols CANopen and DeviceNet are supported.

1.2 Front View with Connectors and Coding Switches

1.2.1 CAN-CBM-SIO1 and CAN-CBM-PLC/331-1



1.2.2 CAN-CBM-SIO4



1.3 Summary of Technical Data

1.3.1 General Technical Data

Power supply	nominal voltage: 24 V/DC ±10%, current (at 20°C): max. 70 mA (+20 mA in TTY-operation)
Connectors	X100 (DSUB9, male) - CAN-CBM-SIO1 serial interface 1 CAN-CBM-SIO4 serial interface 5 CAN-CBM-PLC/331-1 serial interface 1 X101 (6-pin screwed connector UEGM) - 24 V-voltage supply X400 (Combicon style, 5-pin MSTB2.5/5-5.08) - CAN or DeviceNet CAN-CBM-SIO4 only: P200 (RJ45-socket) - serial interface 1 P230 (RJ45-socket) - serial interface 2, 3, 4
Temperature range	0...50 /C ambient temperature
Humidity	max. 90%, non-condensing
Case dimensions (B x H x T)	width: 25 mm (CAN-CBM-SIO1, CAN-CBM-PLC/331-1), 40 mm (CAN-CBM-SIO4), height: 85 mm, depth: 83 mm (including hat-rail holder and connector projection DSUB9, without CAN/DeviceNet connector)
Weight	CAN-CBM-SIO1, CAN-CBM-PLC/331-1: ca. 150 g

Table 1.3.1: General data

1.3.2 Micro Controller Unit

Micro controller	68331
Memory	SRAM: 128 k x 16 Bit Flash-EPROM: 128 k x 8 Bit EEPROM: serial I²C-EEPROM
Debug interface	for service and programming

Table 1.3.2: Micro controller unit

1.3.3 CAN/DeviceNet Interface

Number of CAN-interfaces	1 x CAN option: 1 x DeviceNet
CAN-controller	SJA1000, CAN 2.0A/B
Electrical insulation of CAN-interface from other units	via optocouplers and DC/DC-converter
Physical layer CAN	Physical layer in accordance with ISO 11898, transmission rate programmable from 10 kbit/s to 1 Mbit/s
Physical layer DeviceNet (option)	Physical layer in accordance with DeviceNet specification Rev. 2.0, bit rate: 125 kbit/s, 250 kbit/s, 500 kbit/s

Table 1.3.3: Data of CAN-interface

1.3.4 Serial Interface

	Interface at DSUB9 connector	Interface at RJ45 socket (only for CAN-CBM-SIO4)
Channel-assignment for CAN-CBM-SIO1	Channel 1	-
Channel-assignment for CAN-CBM-PLC/331-1	Channel 1	-
Channel-assignment for CAN-CBM-SIO4	Channel 5	Channel 1, 2, 3, 4
Controller	68331	82C684
Interface	standard: RS-232 options: RS-422, RS-485, TTY active / passive	
Connection	9-pin DSUB connector	8-pin RJ45-socket

Table 1.3.4: Data of serial interfaces

1.4 Software Support

The complete EPROM-resident communication firmware for operating the CAN-CBM modules is contained in the product package.

1.4.1 CAN-CBM-SIO1 / CAN-CBM-SIO4

In standard mode without protocol the unit transmits a CAN-frame on the CAN-identifier set before, when receiving 8 ASCII characters - or after receiving a configurable end mark (such as CR, LF or EOT) and after a settable time out expired after no characters had been received anymore.

1.4.2 CAN-CBM-PLC/331-1

The CAN-CBM-PLC/331-1-Module can be configurated with $CoDeSys_{RTOS-UH}$. This is a programming system running under Windows for application control (IEC1131-3) with a run time system under RTOS-UH. The configuration of the CAN-CBM-PLC/331-1 module is described in chapter 5.
The CoDeSys software comes with an online help and a handbook, describing the programming system. Further information on the higher protocol layers can be taken from the CAL/CANopen documentation ‘CiA-Draft Standard 301’.

1.5 Order Information

1.5.1 CAN-CBM-SIO1 / CAN-CBM-SIO4

Type	Features	Order No.
CAN-CBM-SIO	1 x CAN 2.0A/B with RS-232	C.2840.03
CAN-CBM-SIO4	1 x CAN 2.0A/B with (4+1) x RS-232	C.2843.03
Instead of RS-232 with: (please state clearly in order)	RS-422 adaptor RS-485 adaptor TTY-20mA passive TTY-20mA active	X.1930.02 X.1930.04 X.1930.06 X.1930.08
CAN-CBM-SIO	Freeport Protocol	C.2840.42
CAN-CBM-SIO-DvN	DeviceNet Slave	C.2840.13
CAN-CBM-SIO-DvN-M	DeviceNet Master (Scanner)	C.2840.19
CAN-CBM-SIO-Co	CANopen (Slave)	C.2840.18
-	Connection cable 8-pin RJ48 to 8-pin RJ48 Length: 2 m	C.2401.30
-	Adaptor 8-pin RJ45 to 25-pin DSUB/male, Pin arrangement without tools independently configurable	C.2401.34
-	Adaptor 8-pin RJ45 to 25-pin DSUB/female, Pin arrangement without tools independently configurable	C.2401.36
-	Adaptor 8-pin RJ45 to 9-pin DSUB/female, Pin arrangement without tools independently configurable	C.2401.38
-	Adaptor 8-pin RJ45 to 9-pin DSUB/male, Pin arrangement without tools independently configurable	C.2401.40
CAN-CBM-SIO-ME	English manual for C.2840.02 1*)	C.2840.21

1*) If ordered together with the module, the manual is included in the product package.

Table 1.5.1: Order information CAN-CBM-SIO1 and CAN-CBM-SIO4

1.5.2 CAN-CBM-PLC/331-1

Type	Features	Order No.
CAN-CBM-PLC/331-1	1 x CAN 2.0A/B at RS-232	C.2845.03
Instead of RS-232 with: (Please state clearly in order)	RS-422 adaptor RS-485 adaptor TTY-20mA passive TTY-20mA active	X.1930.02 X.1930.04 X.1930.06 X.1930.08
$CoDeSys_{RTOS-UH}$	IEC1131-3 PLC-developing system with 5 program languages; for RTOS-UH; PC-Host	P.4071.02
CAN-CBM-PLC/331-MD	Additional user manual in English [1*)]	C.2845.20

1*) If ordered together with the module, the manual is included in the product package.

Table 1.5.2: Order information for CAN-CBM-PLC/331-1

2. CAN-Identifier

The CAN-CBM-SIO4 module is equipped with one Rx- and one Tx-identifier for each of the five channels. The CAN-CBM-SIO1-module is equipped with one identifier-pair, for the only serial channel.

Module	Physical channel	Receive CAN-Data	Transceiver CAN-data
CAN-CBM-SIO1	Terminal interface on DSUB9 Channel 1	RxID1	TxID1
CAN-CBM-SIO4	Channel 1	RxID1	TxID1
	Channel 2	RxID2	TxID2
	Channel 3	RxID3	TxID3
	Channel 4	RxID4	TxID4
	Terminal interface on DSUB9 Channel 5	RxID5	TxID5
CAN-CBM-PLC/331-1	CAN-Identifier must be set by CoDeSys. The CAN-CBM-PLC/331-1 doesn't use the coding switches for any setting.		

Attention: The Rx-Identifier **RxID5** and the Tx-identifier **TxID5** are assigned to terminal-interface (on DSUB9) on CAN-CBM-SIO4 module. On CAN-CBM-SIO1 module with only a single serial interface the Rx-Identifier **RxID1** and the Tx-Identifier **TxID1** are assigned to terminal interface.

Table 2.1: Allocation of serial channels to the identifier of the module

The identifiers are calculated in the default configuration of a base value, which is set by the coding switches, and a fixed offset.

CAN-Identifier

CAN-CBM-SIO4		CAN-CBM-SIO1	
Identifier	**Offset (HEX)**	**Identifier**	**Offset (HEX)**
TxID1	0	TxID1	0
TxID2	1		
TxID3	2		
TxID4	3		
TxID5	4		
RxID1	5	RxID1	1
RxID2	6		
RxID3	7		
RxID4	8		
RxID5	9		

Table 2.2: Offset of the identifier in default setting

Calculation of the base value and the identifier:

base value = 10 x coding switch value
identifier = base value + offset (HEX)

Example:

The coding switches are set to ‘1’. So the setting of the coding switch is $11 and the base value is:

$A x $11 = $AA

The identifier values then arise as follows:

$AA + offset (HEX) = identifier

CAN-CBM-SIO4	
Identifier	**Value (HEX)**
TxID1	AA
TxID2	AB
TxID3	AC
TxID4	AD
TxID5	AE
RxID1	AF
RxID2	B0
RxID3	B1
RxID4	B2
RxID5	B3

CAN-CBM-SIO1	
Identifier	**Value (HEX)**
TxID1	AA
RxID1	AB

Table 2.3: Example for identifier settings

3. Unit Description

3.1 CAN/DeviceNet Unit

3.1.1 Interface Circuit

The CAN-CBM modules are available with a CAN-interface in accordance with ISO11898 or alternatively with a DeviceNet interface. The same connector is used for both interfaces. The connector assignment is different, however. The following figures represent the two interfaces.

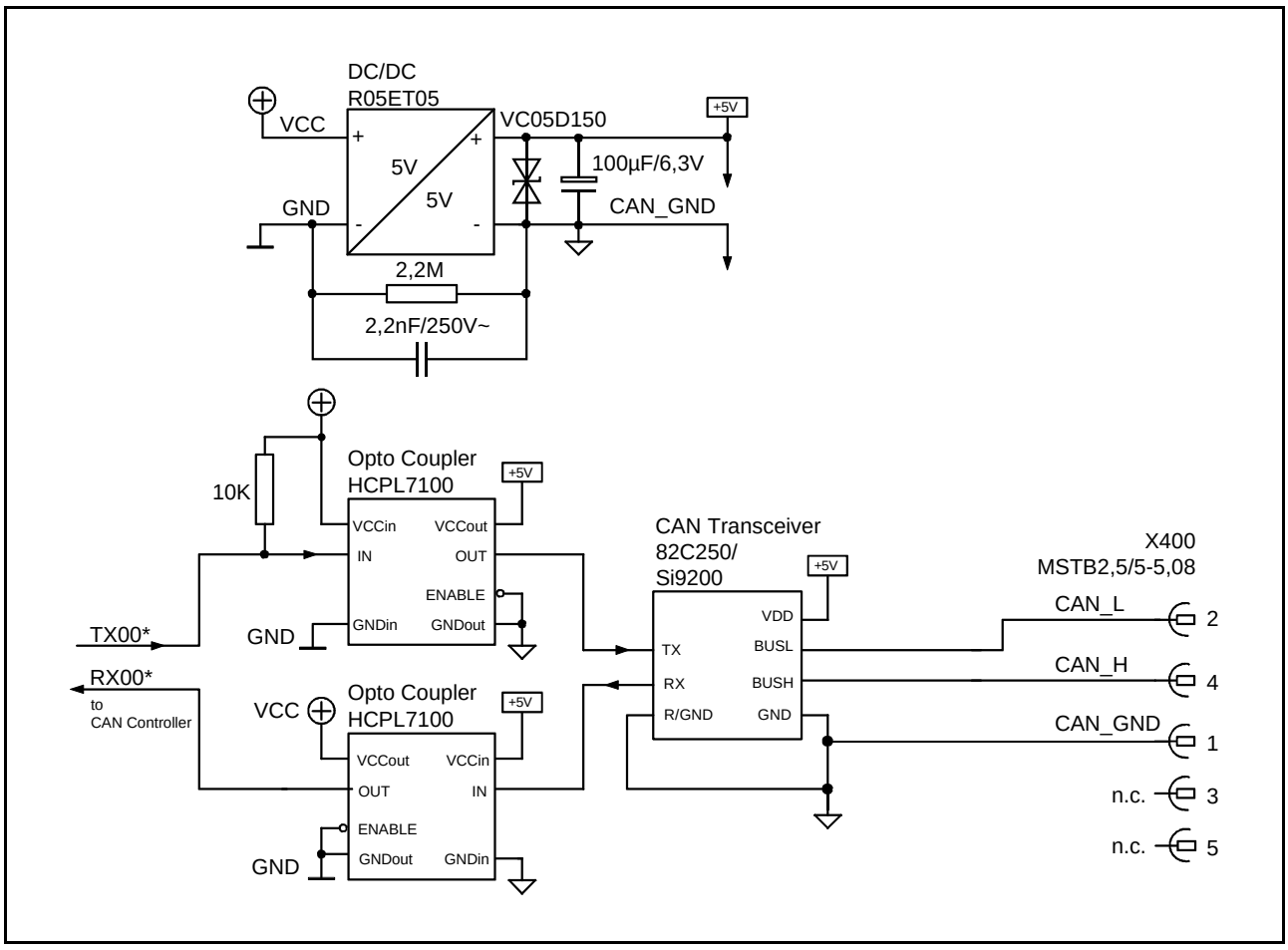


Fig. 3.1.1: Circuit of CAN-interface

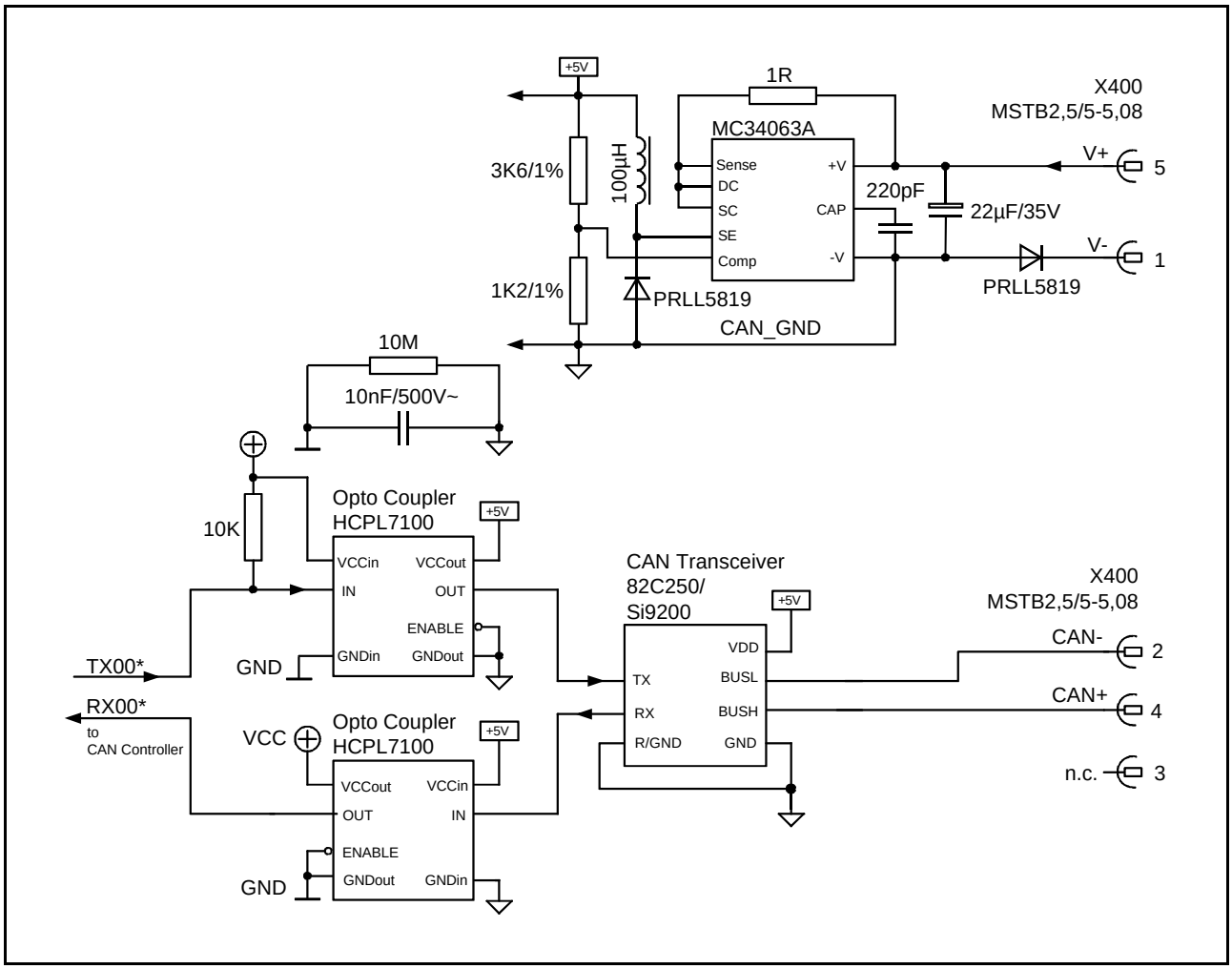
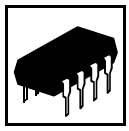


Fig. 3.1.2: Circuit of DeviceNet interface



3.2 Serial Interface X100 (9-pin DSUB/ Male)

3.2.1 Configuration

The physical interface of the serial 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, for the other interfaces piggy backs are used.

The serial interface is controlled by the 68331 controller and by QUART 82C684 . The bit rate of the interface can be parameterized.

The controller QUART 82C684 supports bit rates of up to 230 kbit/s. If the 4 interfaces are run at the same time only 38,4 kbit can be attained.

The controller integrated in the 68331 supports bit rates of up to 500 kbit/s in this application.

Bit rates of over 38.4 kbit/s can only be achieved by means of RS-422 and RS-485 interfaces. With the RS-232 drivers used a maximum of 38.4 kbit/s is possible.

Unit	maximum bit rate
Controller: -68331 -Quart 82C684	 500 kbit/s 230 kbit/s (38,4 kbit/s)
RS-422 interface	500 kbit/s
RS-485 interface	500 kbit/s
RS-232 interface	38.4 kbit/s
TTY-interface	38.4 kbit/s

Table 3.2.1: Attainable bit rates for the different physical interfaces

The following bit rates can be set by means of the software. The values in the second column represent the actual bit rates which result from the 68331 controller-internal conversion.

Bit rate (reference value) [bit/s]	Bit rate (actual value) [bit/s]
500,000 (only 68331)	500,000
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 3.2.3: Settable bit rates

3.2.2 Connection of the Various Serial Interfaces at DSUB9 Connector

Below the wiring of the serial interfaces is represented for channel 1 (CAN-CBM-SIO1 and CAN-CBM-PLC/331-1) and channel 5 (CAN-CBM-SIO4). The figures help to explain the short terms used in for the signals in the appendix (Connector Assignment). Furthermore the circuit diagrams of the various available piggybacks can be found in the appendix (Circuit Diagrams).
The signal terms are specified exemplary for the connection of the CAN-CBM modules as transmitter (Terminal DTE).

3.2.2.1 The RS-232 Interface

The signals CTS, DSR and DCD aren't evaluated by the CAN-CBM modules.

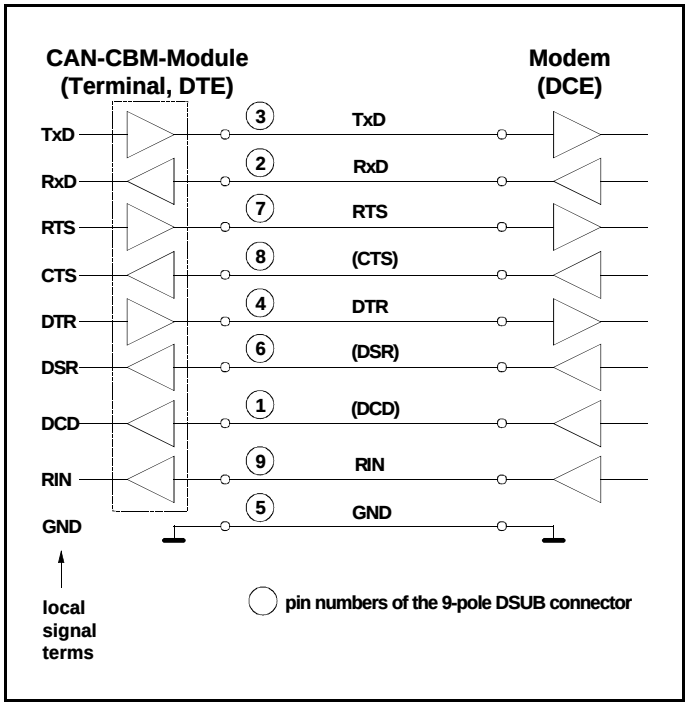


Fig. 3.2.3: Connection diagram for RS-232 operation

3.2.2.2 RS-422 Interface

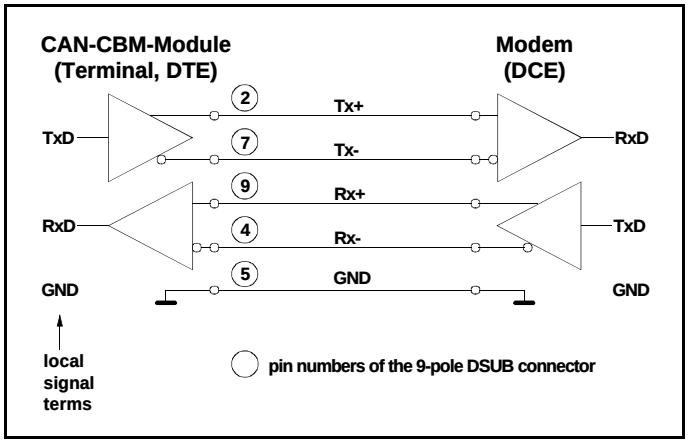


Fig. 3.2.4: Connection diagram for RS-422 operation

3.2.2.3 RS-485 Interface

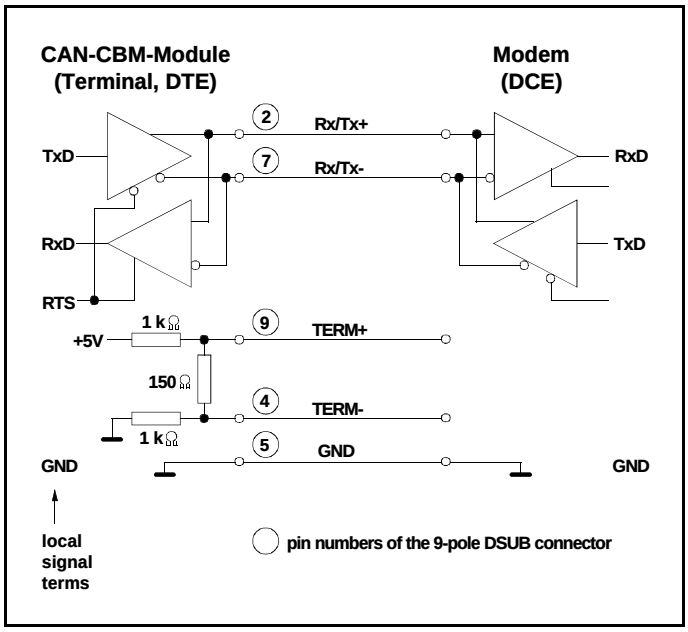


Fig. 3.2.5: Connection diagram for RS-485 operation

In order to activate the terminating-impedance network on the piggyback, you have to connect pins 9 and 2 and pins 4 and 7, e.g. in the DSUB-connector.

3.2.2.4 TTY(20 mA)-Interface

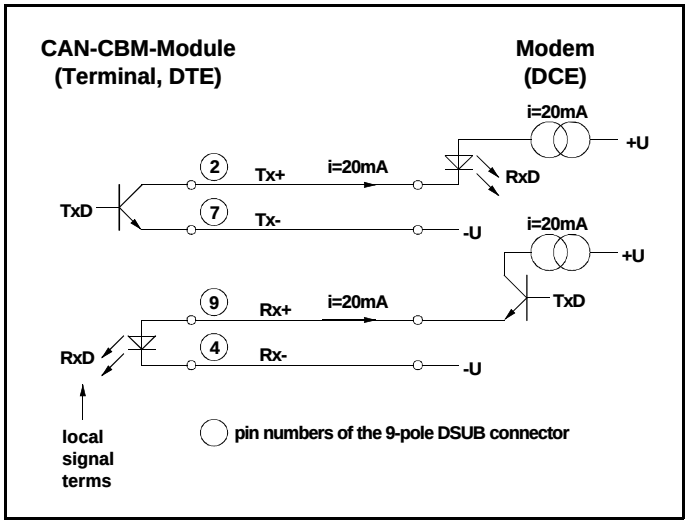


Fig. 3.2.6: Connection diagram for TTY-operation (passive)

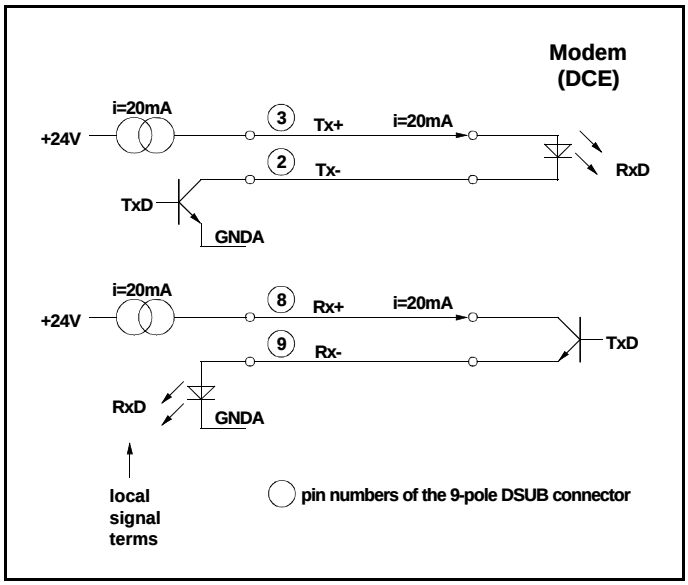


Fig. 3.2.7: Connection diagram for TTY-operation (active)

3.2.3 Connection of the Various Serial Interfaces on RJ45-Sockets

Below the wiring of the serial interfaces of CAN-CBM-SIO4 in relation to the data direction is shown. The figures should explain the short terms used in for the signals in the chapter *Connector Assignment*. Furthermore the circuit diagrams of the various available piggybacks can be found in the chapter *Circuit Diagrams*.

As example for the connection cable the adapter cable RJ48-DSUB9/female has been shown here which is layed out for the RS-232 modem operation (data communication equipment).

The conduction marked by RTS can be programmed as RTS- or DTR-signal in the Controller 82C684. The module-software programs the signal as RTS-input. The RTS wiring can be connected to the DTR pin, if the terminal needs a DTR signal as answer.

3.2.3.1 RS-232-Interface

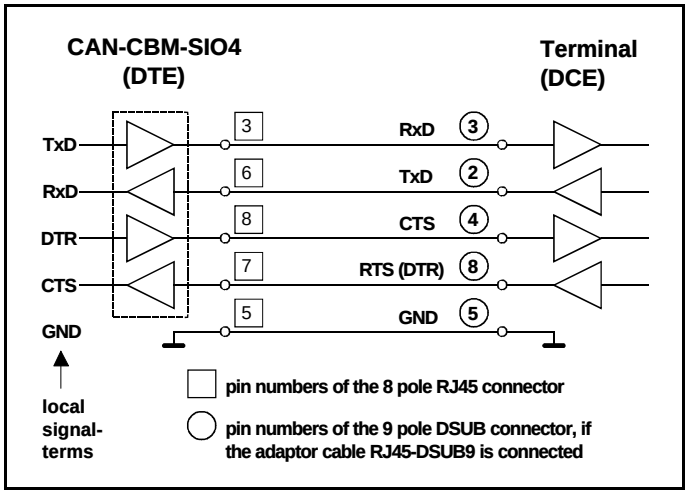


Fig. 3.2.8: Connection-diagram for RS-232 operation

3.2.3.2 RS-422-Interface

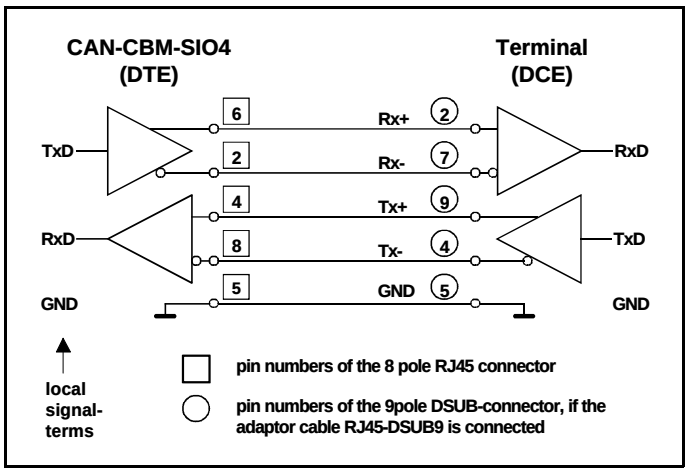


Fig. 3.2.9: Connection diagram for RS-422 operation

3.2.3.3 RS-485 Interface

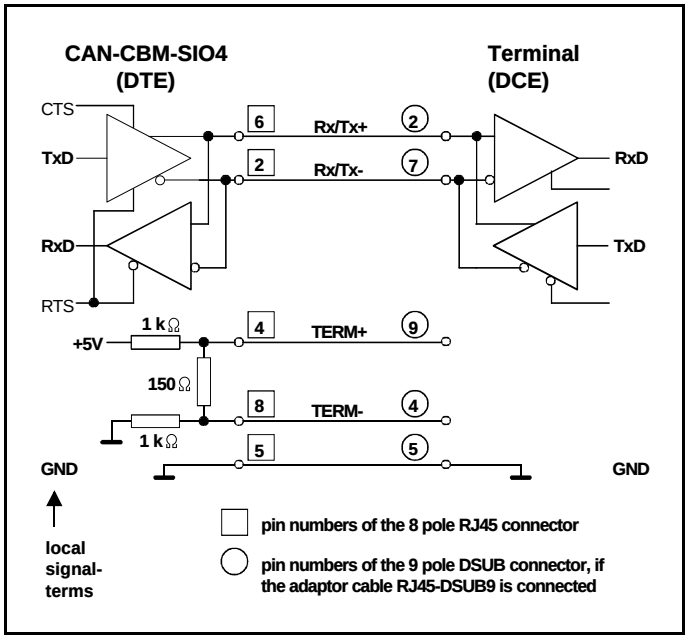


Fig. 3.2.10: Connection diagram for RS-485 operation

Pin 4 and 8 of the RJ45 socket lead in RS-485 operation to a termination resistor, on the piggyback. To activate the termination, the signal Rx/Tx+ has to be connected to TERM+ and the signal Rx/Tx- to TERM-.

3.2.3.4 TTY(20 mA) Interface

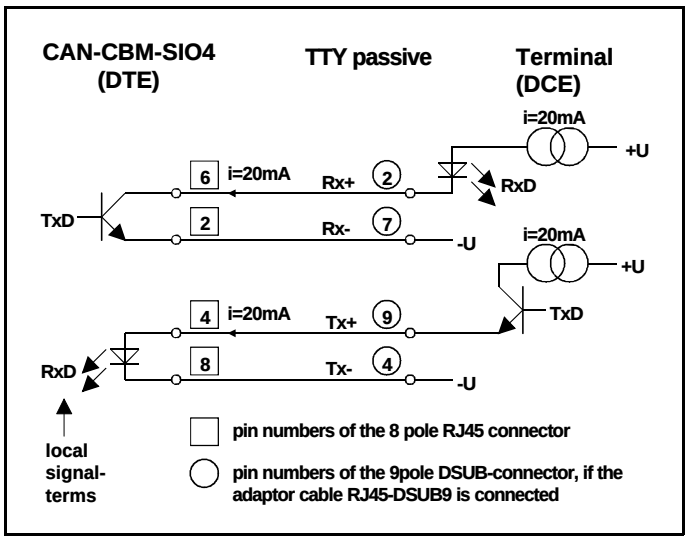


Fig. 3.2.11: Connection diagram for TTY operation (passive)

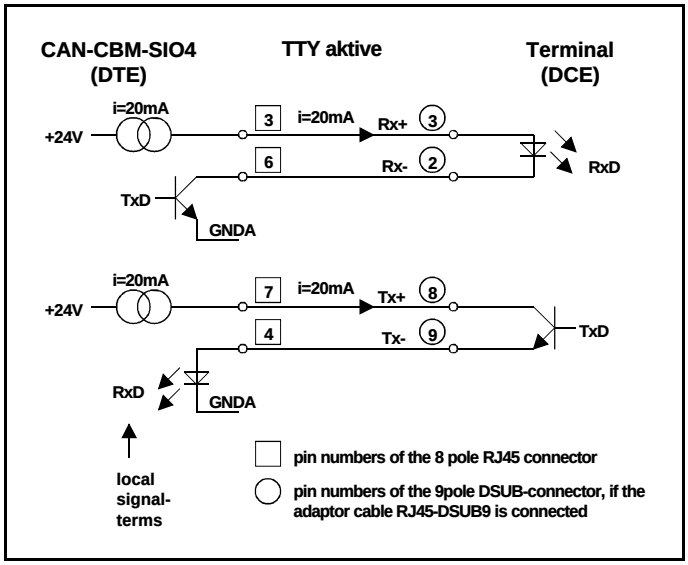
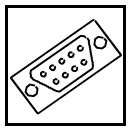


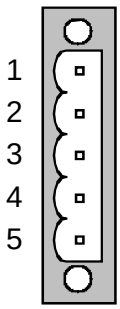
Fig. 3.2.12: Connection diagram for TTY operation (active)



4. Connector Assignments

4.1 CAN (X400, 5 pole Combicon Style)

Pin Position:



Pin Assignment:

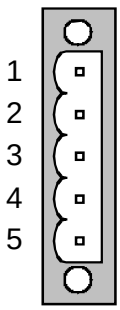
Pin	Signal
1	CAN_GND
2	CAN_L
3	n.c.
4	CAN_H
5	n.c.

Signal Terms:

CAN_L, CAN_H...	CAN-signal lines
CAN_GND ...	reference potential of the local CAN-physical layer
n.c...	not connected

4.2 DeviceNet (X400, 5 pole Combicon Style)

Pin Position:

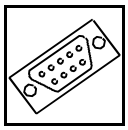


Pin Assignment:

Pin	Signal
1	V-
2	CAN-
3	n.c.
4	CAN+
5	V+

Signal Terms:

V+...	Voltage supply feed (U_{VCC} = 24 V ± 4%)
V-...	reference potential of V+ and CAN+/CAN-
CAN+, CAN-...	CAN-signal lines
n.c. ...	not connected



Connector Assignment

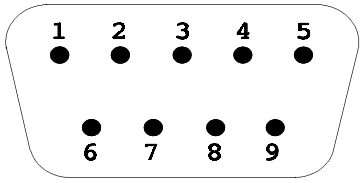
4.3 Assignment of the Serial Interface on DSUB9

Notes to the connection of the serial interfaces can also be taken from the chapter *'Connection of the Various Serial Interfaces at DSUB9 Connector'*. You find the directions of the signals (Rx<->Tx) in the connection diagrams.

4.3.1 RS-232 Interface (X100, 9-pin DSUB / Male)

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

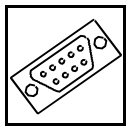
Pin Position:



Pin Assignment:

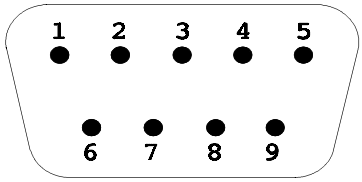
Signal		Pin		Signal	
			1	(DCD)	(input)
(DSR)	(input)	6	2	RxD	(input)
RTS	(output)	7	3	TxD	(output)
(CTS)	(input)	8	4	DTR	(output)
RIN	(input)	9	5	GND	

9-pin DSUB-connector



4.3.2 RS-422 Interface (X100, 9-pin DSUB / Male)

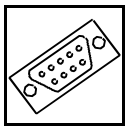
Pin Position:



Pin Assignment:

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

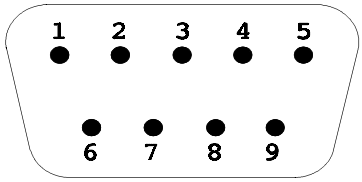
9-pin DSUB-connector



Connector Assignment

4.3.3 RS-485 Interface (X100, 9-pin DSUB / Male)

Pin Position:

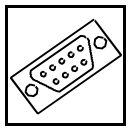


Pin Assignment:

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

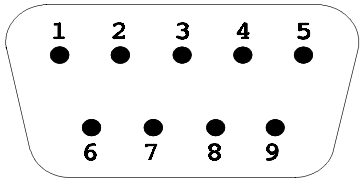
9-pin DSUB-connector

The signals Term+ and Term- are connected to a terminating-impedance network on the board. In order to activate the connection, Term+ has to be connected to the Rx/Tx+ signal and Term- to the Rx/Tx- signal.



4.3.4 TTY-passive-Interface (X100, 9-pin DSUB / Male)

Pin Position:

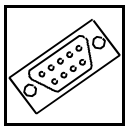


Pin Assignment:

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

9-pin DSUB-connector

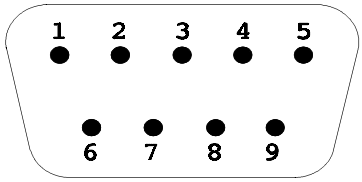
( ) The signals specified in brackets are assigned, but are not required for operating this physical interface.



Connector Assignment

4.3.5 TTY-Active Interface (X100, 9-pin DSUB / Male)

Pin Position:

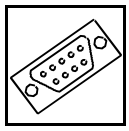


Pin Assignment:

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

9-pin DSUB-connector

( ) The signals specified in brackets are assigned, but they are not required for operating this physical interface.



4.4 Connector Pin Assignment of the Serial Interface of RJ45 Socket

Only CAN-CBM-SIO4 is mounted with this interface!

Notes to the connection of the serial interfaces can also be taken from the chapter ‘Connection of the Various Serial Interfaces at DSUB9 Connector’. You find the directions of the signals (Rx<->Tx) in the connection diagram.

4.4.1 Serial Interface 2...4 (P200/P230, 8-pin RJ45 Socket)

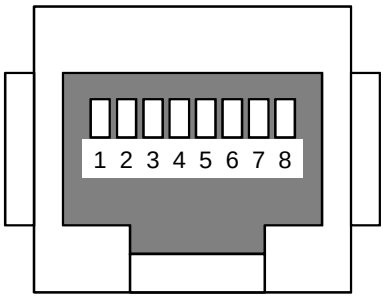
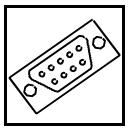


Fig. 4.4.1: Pin assignment of RJ45 socket



Connector Assignment

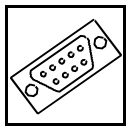
4.4.2 Pin Assignment of the 8 Pin RJ45 Sockets (P200/230)

The signal names used in the table below correspond to the physical data directions seen from the CAN-CBM-SIO4, i.e., the TxD signal is an output and has to be connected to the RxD line of the other device.

Connector Pin RJ45	**Signal arrangement**				
	RS-232	**RS-422**	**RS-485**	**TTY-passive**	**TTY-aktive**
1	-	-	-	-	-
2	-	Tx-	Rx/Tx-	Tx-	[GNDA]
3	TxD Data Output	-	-	[I1+]	Tx+
4	-	Rx+	TERM+ *1)	Rx+	Rx-
5	GND	GND	GND	GND	GND
6	RxD Data Input	Tx+	Rx/Tx+	Tx+	Tx-
7	CTS Handshake Input	GND	GND	[I2+]	Rx+
8	RTS Handshake Output	Rx-	TERM- *1)	Rx-	[GNDA]

*1) The pins 4 and 8 of the sockets (P200/P230) lead to a terminal resistance which is on the piggyback. To activate the terminal resistance the signal TERM+ has to be connected to Rx/Tx+ and the signal TERM- has to be connected to the signal Rx/Tx-.

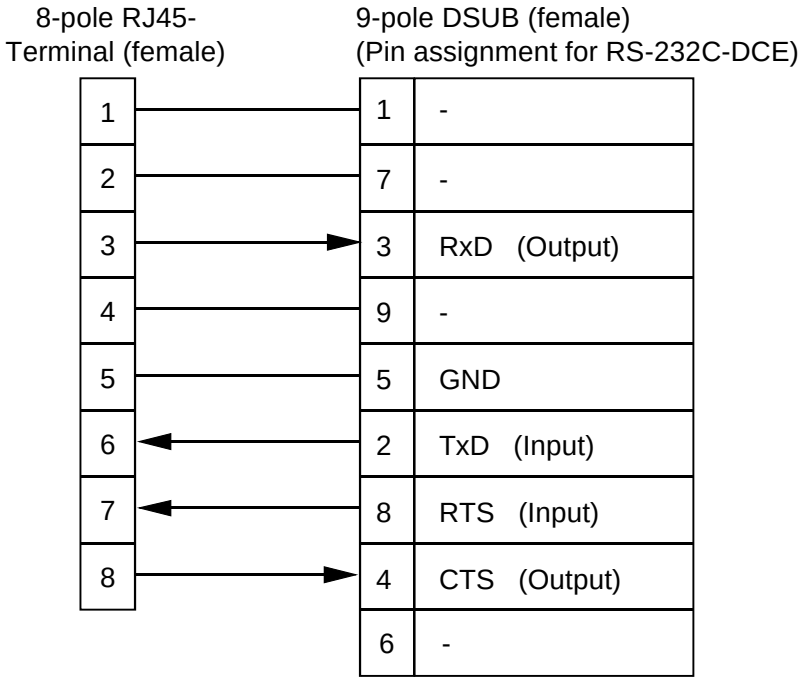
[ ] The signals shown in brackets are arranged but are not necessary for the operation of the interface.

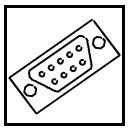


4.4.3 Pin Assignment of the Adaptor Cable RJ45-DSUB9/Female

The adaptors RJ45-DSUB9/male (order no. C.2401.40) and RJ45-DSUB9/female (order no. C.2401.38) can once be configured indepently without tools. The connection between adaptor and CAN-CBM-SIO4 occurs by the connection cable RJ45-RJ45 (order no. C.2401.30).

The adaptor cable (order no. C.2401.30) is layed out for the operation of the CAN-CBM-SIO4 as data communication equipment (receiver, modem). The arrangement for the RS-232 interface reveals itself as follows:





Connector Assignment

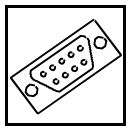
Following table shows the signal arrangement in case the adaptor RJ45-DSUB9/socket is used for the connection of the other interfaces (Signal arrangement seen from Terminal/DCE):

When connecting the TTY lines, following has to be noticed:
The descriptions (out) and (in) show only the direction of the data transmission and *not* the direction of the current. For the connection of the TTY signals the circuit layer in chapter *'Connection of the Various Serial Interfaces at DSUB9 Connector'* will be helpful.

RJ45 socket	DSUB9 socket	Signal arrangement			
		RS-422	**RS-485**	**TTY-passiv**	**TTY-aktiv**
1	1	-	-	-	-
6	2	Rx+ (out)	Rx/Tx+	Rx+ (out)	Rx- (out)
3	3	-	-	[I1+]	Rx+ (out)
8	4	Tx- (in)	TERM- *1)	Tx- (in)	[GNDA]
5	5	GND	GND	GND	GND
-	6	-	-	-	-
2	7	Rx- (out)	Rx/Tx-	Rx- (out)	[GNDA]
7	8	GND	GND	[I2+]	Tx+ (in)
4	9	Tx+ (in)	TERM+ *1)	Tx+ (in)	Tx- (in)

*1) The pins 4 and 8 of the sockets (P200/P230) lead to a terminal resistance which is on the piggyback. To activate the terminal resistance the signal TERM+ has to be connected to Rx/Tx+ and the signal TERM- has to be connected to the signal Rx/Tx-.

[ ] The signals shown in brackets are arranged but are not necessary for the operation of the interface.



4.4.4 Connection of the Adaptor RJ45-DSUB25 Socket

The adaptors RJ45-DSUB25/male (order no. C.2401.34) and RJ45-DSUB25/female (order no. C.2401.36) can once be configured independently without tools. The connection between adaptor and CAN-CBM-SIO4 occurs by the connection cable RJ45-RJ45 (order no. C.2401.30).

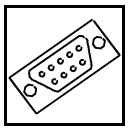
The following table shows the connector Pin Assignment, if the CAN-CBM-SIO4 should work as modem (data communication equipment) in RS-232 operation, i.e. as receiver.
The Pin Assignment of the other serial interfaces (RS-422, RS-485, TTY) results from this.

When connecting the TTY lines, following has to be noticed:
The descriptions (out) and (in) show only the direction of the data transmission and *not* the direction of the current. For the connection of the TTY signals the circuit layer in chapter *'Connection of the Various Serial Interfaces at DSUB9 Connector'* will be helpful.

Connector Pin		**Signal arrangment**				
RJ45 socket	**DSUB25 socket**	**RS-232**	**RS-422**	**RS-485**	**TTY-passive**	**TTY-active**
1	1	-	-	-	-	-
2	14	-	Rx- (out)	Rx/Tx-	Rx- (out)	[GNDA]
3	3	RxD Data Output	-	-	[I1+]	Rx+ (out)
4	16	-	Tx+ (in)	TERM+ *1)	Tx+ (in)	Tx- (in)
5	7	GND	GND	GND	GND	GND
6	2	TxD Data Input	Rx+ (out)	Rx/Tx+	Rx+ (out)	Rx- (out)
7	4	RTS Handshake Input	GND	GND	[I2+]	Tx+ (in)
8	5	CTS Handshake Output	Tx- (in)	TERM- *1)	Tx- (in)	[GNDA]

*1) The pins 4 and 8 of the sockets (P200/P230) lead to a terminal resistance which is on the piggyback. To activate the terminal resistance the signal TERM+ has to be connected to Rx/Tx+ and the signal TERM- has to be connected to the signal Rx/Tx-.

[ ] The signals shown in brackets are arranged but are not necessary for the operation of the interface.



Connector Assignment

The following table shows the connector Pin Assignment of the25 pole DSUB/male, if the CAN-CBM-SIO4 should work as terminal in RS-232 operation, i.e. as transmitter.
The Pin Assignment of the other serial interfaces (RS-422, RS-485, TTY) results from this.

Attention: This pin assignment is *not compatible* to the pin assignment of the serial interfaces of the previous table. It is *only* for the RS-232-signals compatible (DTE-DCE-connection).

Connector Pin		**Signal arrangement**				
RJ45 socket	**DSUB25 socket**	**RS-232**	**RS-422**	**RS-485**	**TTY-passive**	**TTY-active**
1	1	-	-	-	-	-
2	14	-	Tx- (out)	Rx/Tx-	Tx- (out)	[GNDA]
3	2	TxD Data Output	-	-	[I1+]	Tx+ (out)
4	16	-	Rx+ (in)	TERM+ *1)	Rx+ (in)	Rx- (in)
5	7	GND	GND	GND	GND	GND
6	3	RxD Data Input	Tx+ (out)	Rx/Tx+	Tx+ (out)	Tx- (out)
7	5	CTS Handshake Input	GND	GND	[I2+]	Rx+ (in)
8	4	RTS *2) Handshake Output	Rx- (in)	TERM- *1)	Rx- (in)	[GNDA]

*1) The pins 4 and 8 of the sockets (P200/P230) lead to a terminal resistance which is on the piggyback. To activate the terminal resistance the signal TERM+ has to be connected to Rx/Tx+ and the signal TERM- has to be connected to the signal Rx/Tx-.

[ ] The signals shown in brackets are arranged but are not necessary for the operation of the interface.

*2)... An DTR signal is needed by some modems (Data from CBM-SIO4 -> terminal). If this is the case, the DTR signal can be created by bridgeing the RTS signal in the connector on the DTR pin. With a 25-pin DSUB-connector pin 4 has to be bridged to pin 20 in this case.

4.5 Voltage Feed (X101, UEGM)

The voltage is fed by means of the UEGM-screwed connectors integrated in the case. They can be used for cables with a cross section of up to 2.5 mm².

The assignment of the connectors is the same at both sides of the case. The connectors can be used alternatively. The contact in the middle is designed for +24V and the two outer contacts are designed for GND.

Attention: It is **not** permissible to feed through the 24V supply voltage, i.e. using one side as a 24V input and the other side as a 24V output to supply other devices !

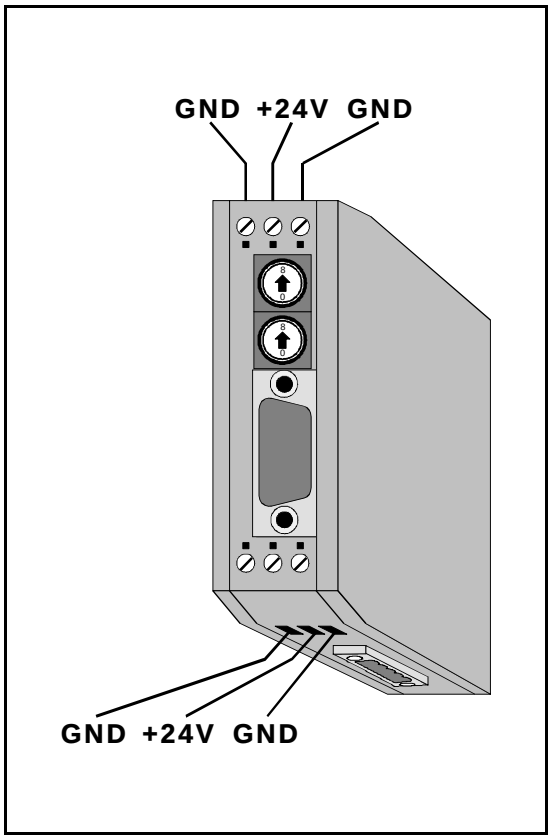


Fig. 4.5.1: Voltage feed CAN-CBM-SIO1-module and CAN-CBM-PLC/331-1-module

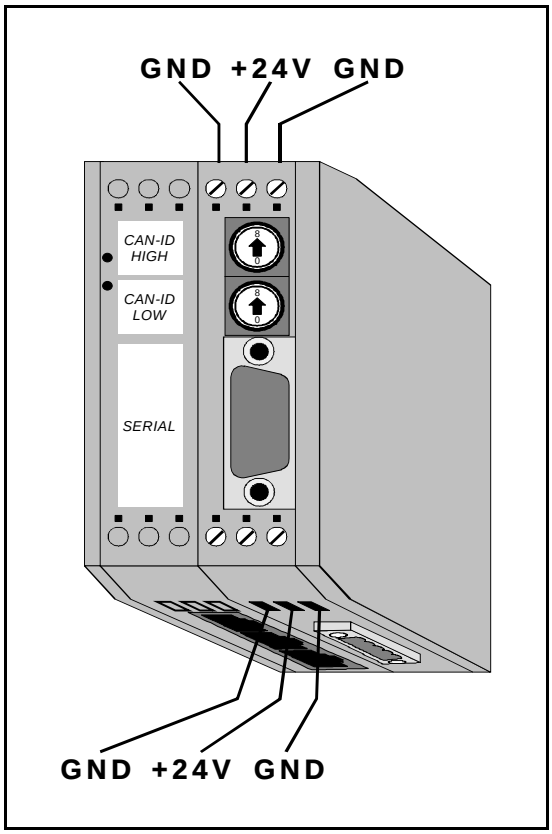


Fig. 4.5.2: Voltage feed CAN-CBM-SIO4-module

5. Configuration of the CAN-CBM-PLC/331-1/-2 Module

This chapter describes how to configure the CAN-CBM-PLC/331-1/-2 module and take it into operation by means of the CoDeSys programming environment.
The CoDeSys software is shipped with an online help which describes the various possibilities of CoDeSys.
Further information about CANopen can be found in the CANopen CiA Draft Standard 301 specification.

In order to configure the CAN-CBM-PLC/331-1/2 module you have to follow the steps below:

1. Import the various Files:

Install the Target Support Package by means of the installation program ***Install Target.exe***. Check, whether the EDS files of the desired modules are available in the subdirectory: %CoDeSys%\Targets\ESD\ESD_CAN-Module\ of the library directory. Import the desired EDS files, if required.

2. Start the CoDeSys Development Environment.

3. Configuration: Select ***New*** in the ***File*** menu. The dialog box ***Target Settings***, as shown in the figure below, appears.

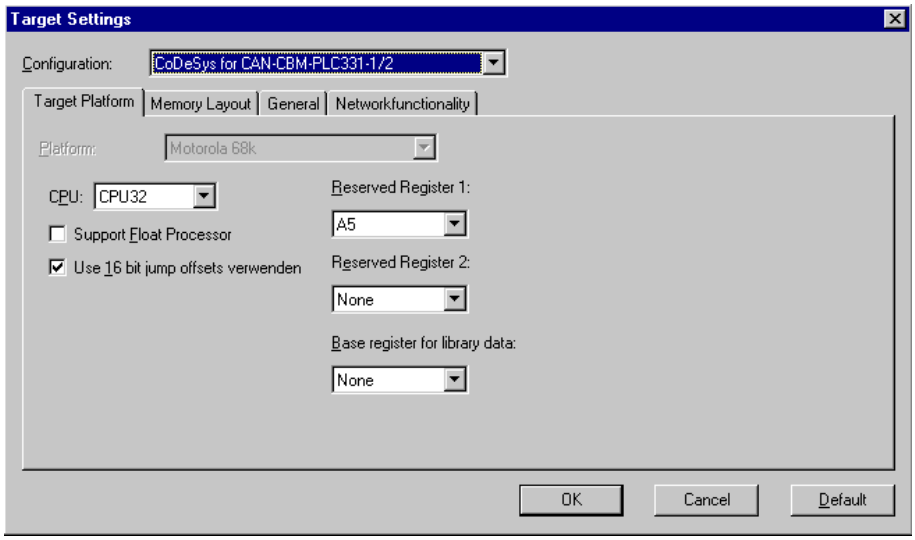


Fig.1: Settings of the target platform

The ***Configuration*** has to be set to 'CoDeSys for CAN-CBM-PLC/331-1/2'. By selecting this target the platform-specific basis configuration is loaded.

Set ***CPU*** to'CPU32'. Acknowledge by ***OK***.

Check the path names of the Compilation Files and Libraries.
Select ***Options*** in the menu ***Project***, and further ***Directories***. Check the path of the ***Libraries*** (e.g.:C:\codesys\library) and of the ***Compilation Files*** (e.g.:C:\CoDeSys)

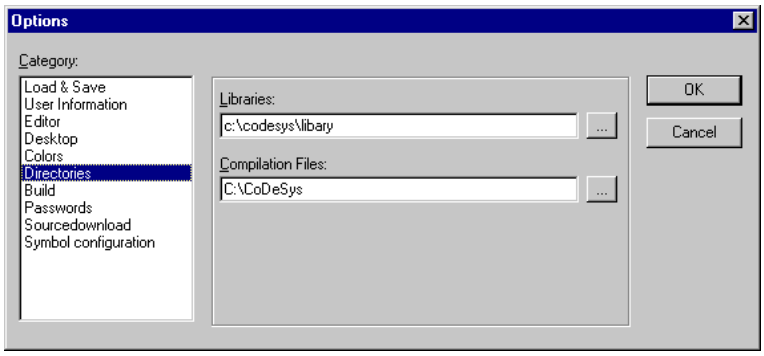


Fig.2: Check libraries and compilation files

4. New POU: When you acknowledge your selection in ***Target Platform*** with ***OK***, the dialog box ***New POU*** opens:

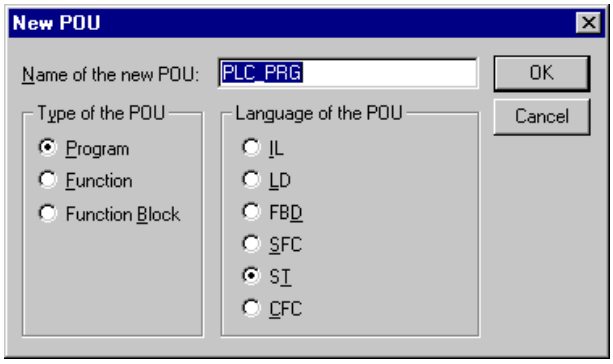


Fig.3: Dialog box ***New POU***

The PLC_PRG unit has been specially predefined and is automatically installed for every new project. It must not be deleted or renamed (does not apply for the use of task configuration). You can find further information on this in the CoDeSys online help.

Acknowledge the settings without further changes by ***OK***.

5. Selecting the CAN Master:

Change to ***Resources*** register 
(register, lower left screen corner).
Select menu point ***PLC Configuration***.

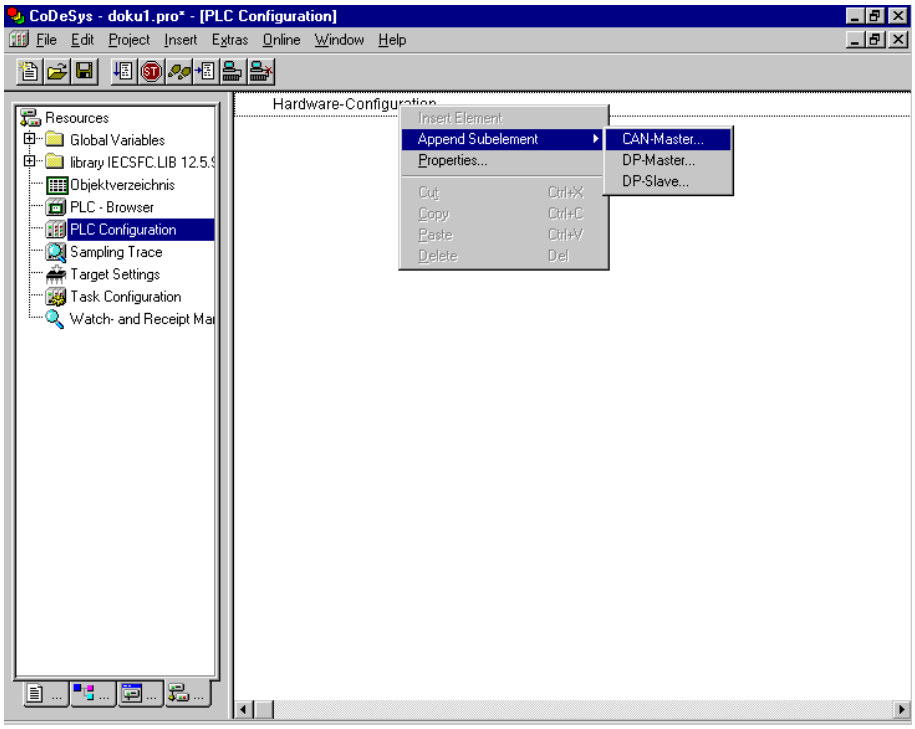


Fig.4: Select CAN-master

The ***PLC Configuration*** field appears on screen. Click the field ***Hardware-Configuration*** with the right mouse key and select the menu point ***Append Subelement*** and then ***CAN-Master***.

6. Select CAN Properties:

In the dialog box which then appears you can now specify the desired CAN properties:

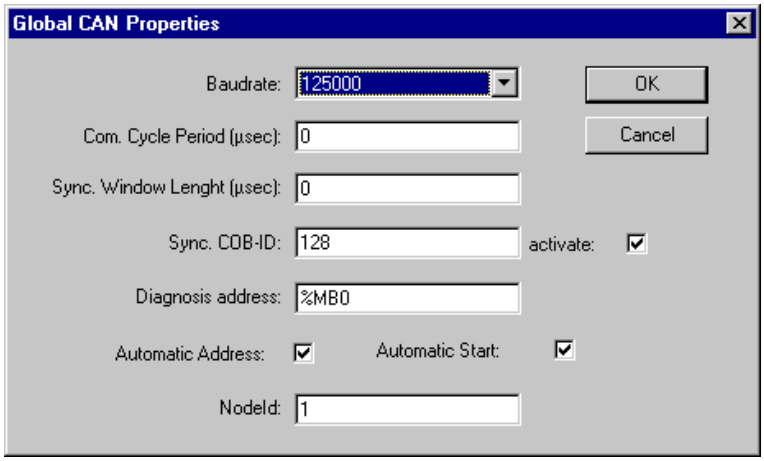


Fig.5: Set global CAN properties

The settings of the parameters listed depend on the respective application. Further information can be found in the CoDeSys online help.

***Baudrate*:** Specify the baud rate desired for transmission (here 125 kbaud).

***Com. Cycle Period*:** Cycle period for Sync. telegram, i.e. the period between the transmission of two SYNC telegrams by the SYNC master.
The ***Com. Cycle Period*** depends on slaves, bus speed and internal data processing rate.

Attention: ***Com.Cycle Period*** must be larger than ***Sync. Window Length*** to make sure that all SYNC consuming devices have received the synchronous PDOs (Process Data Objects). See also Fig.6.

Sync.Windows Length*:** Shows the time which passes from the transmission of a SYNC until all synchronous PDOs have been transmitted. Since it is smaller than the ***Com.Cycle Period the transmission of all requested data is guaranteed before a new SYNC telegram can be started. See Fig.6.

Attention! If the fields ***Com. Cycle Period*** and ***Sync.Windows Length*** have been assigned with '0', no SYNC telegrams will be transmitted.

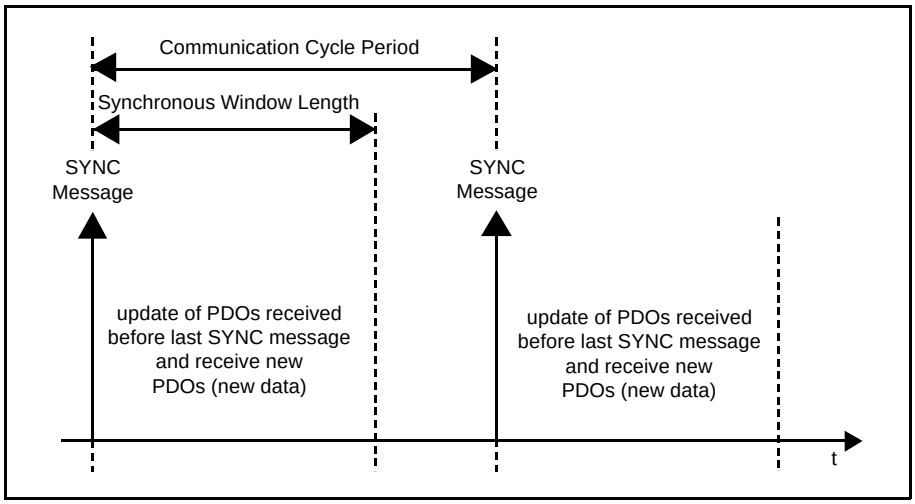


Fig.6: Bus synchronisation

***Sync. COB-ID*:** Identifier under which SYNC telegrams are transmitted and received.

***Diagnose Address*:** Here you have to specify a pointer under which the diagnose data is stored.

***Node ID*:** Identifier of the CAN-CBM-PLC/331-1/2 (between 1 and 127, decimal specification).

If you acknowledge your selection with ***OK***, the CAN-master in the ***PLC Configuration*** field is included into the configuration scheme under hardware configuration (see Fig. 7 'Append subelements').

Further information and details can be found in the CANopen specification 'CANopen CiA Draft Standard 301' chap. 9.3.1.

7. Append Subelement:

After the master has been configured the remaining CAN network is assembled and configured. In order to include further elements you have to click on the included CAN-master with the right mouse key to get to a selection of modules via menu point ***Append Subelements***.

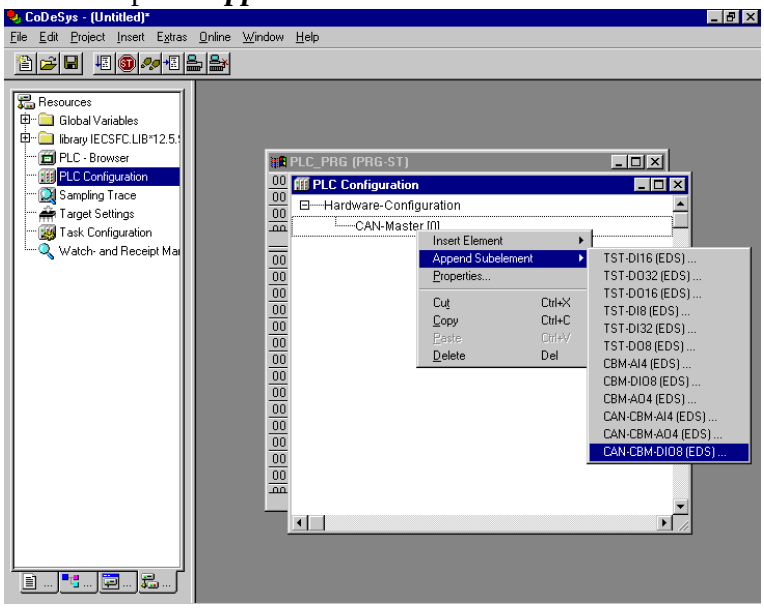


Fig.7: Append subelements

If you click the desired module (here CBM-DIO8) with the left mouse key, a dialog box (see Fig. 8) will open in which you can specify the desired properties of the device selected.

If no entry or EDS file is available for the device, you can substitute the unavailable EDS file by a TST file. TST files are EDS files configured for simple applications. The ending of the test file name (TST files) explains the respective function of the file:

TST-*xxyyzz*

trunk of name:	TST-	
following letter:	*xx*...	D,A (Digital, Analog)
following letters:	*yy*...	I,O, IO (Input, Output, In/Output)
following numbers:	*zz*...	length of the transmitted data in bits, e.g.:8, 16, 32 or 64

Example:

TST-DI8 (EDS)	digital input, 8 bits
TST-DO32 (EDS)	digital output, 32 bits

8. Basis Parameters:

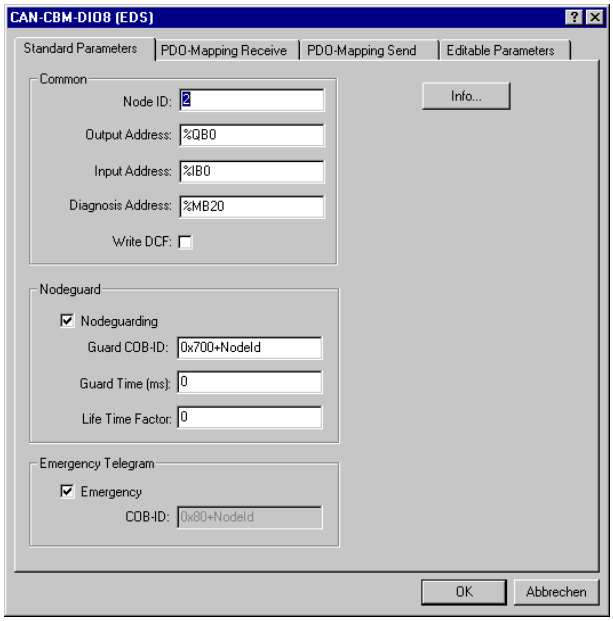


Fig.8: Set basis parameters of subelements

Specify the following parameters according to your application.
Please refer to the chapter 'Basis Parameters of a CAN Module' of the CoDeSys online help for more details about the parameters.

Node ID: Identifier of CAN-slave

Input Address: Address under which the module is accessed by the application program.

Diagnose Address: Address under which the diagnose data is stored.

Write DCF: Creating a DCF file after an EDS file has been included, if activated.

All process data in the CAN network are read or written via input and output address range of the CAN-CBM-PLC/331-1/2 module. (Via, e.g.: %IB4 ... input byte 4, %QB6 ... output byte 6).
CAN-specific data such as: identifier, RTR...are not used in the application program itself.

If the options ***Nodeguarding*** and ***Emergency Telegram*** are desired to monitor the device, activate them. Further details, also about the menu points ***PDO Mapping Receive***, ***PDO Mapping Send*** and ***Editable Parameters*** can be found in the CoDeSys online help.

Acknowledge your selection with ***OK***

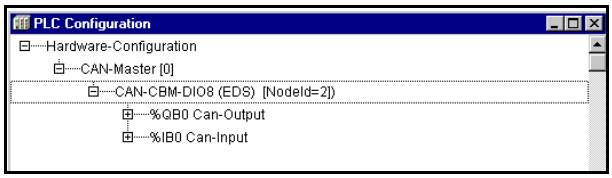


Fig.9: PLC configuration

The selected module (here CAN-CBM-DIO8) now appears in the window ***PLC Configuration*** in the configuration scheme as subelement. By clicking the preceding plus sign with the left mouse key you get more information about the respective element, such as input and output address.

9. Add further Modules:

In order to add further modules you have to repeat the steps described under 7. and 8.

Example: The module CBM-AO4 (EDS) is selected as further module as described under **7. Append Subelements**.

The dialog box properties ***CAN-CBM-AO4*** opens:

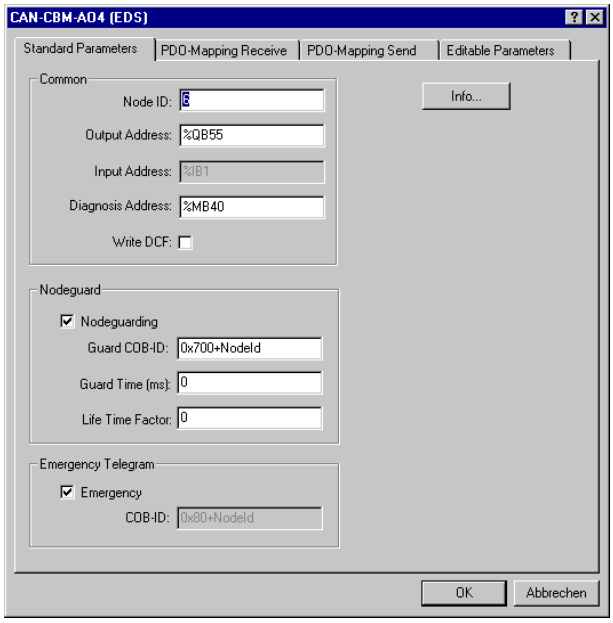


Fig.10: Example CAN-CBM-AO4

The identifier of the desired module has got the node ID = 6,
the output address: %QB55 (the output byte 55),
the diagnose address: %MB40 (the byte at the address of the pointer 40),
the guard COB-ID results from 0x700+Node ID (here 6)

The following window will open, when you acknowledge with OK:

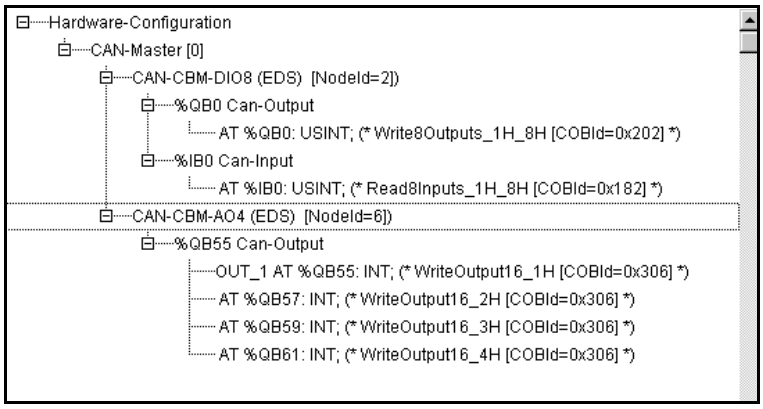


Fig.11: Configuration example

The module CAN-CBM-AO4 with node ID = 6 has now been added. By clicking the plus sign you can get further information about the configuration. The output address of the first channel is: %QB55
The following function description appears for each channel of the selected module:

Function description	*name* AT*%address*:data type;(*comment*)
Example	OUT_1 AT%QB55:INT;(*WriteOutput16_1H [COBId0x306]*)

name: If another output module is added before the CAN-CBM-AO4 module, the output address is automatically increased according to the number of outputs of the added module. In order to prevent a change for all programs in which this address appears, a name can be assigned to the global variable. By clicking AT a small input window appears. Here you can enter a name for the global variable, which is on address 55, here. This name can now be used for all programming.

AT%*address*: selected output address, %QB55

Data type: here of integer type

(*Comment*): WriteOutput16_1H: Output 16 bits on channel 1(1H), under the COB-ID = 0x306 the process data is transmitted in the CAN network.

6. 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 Ω ±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.

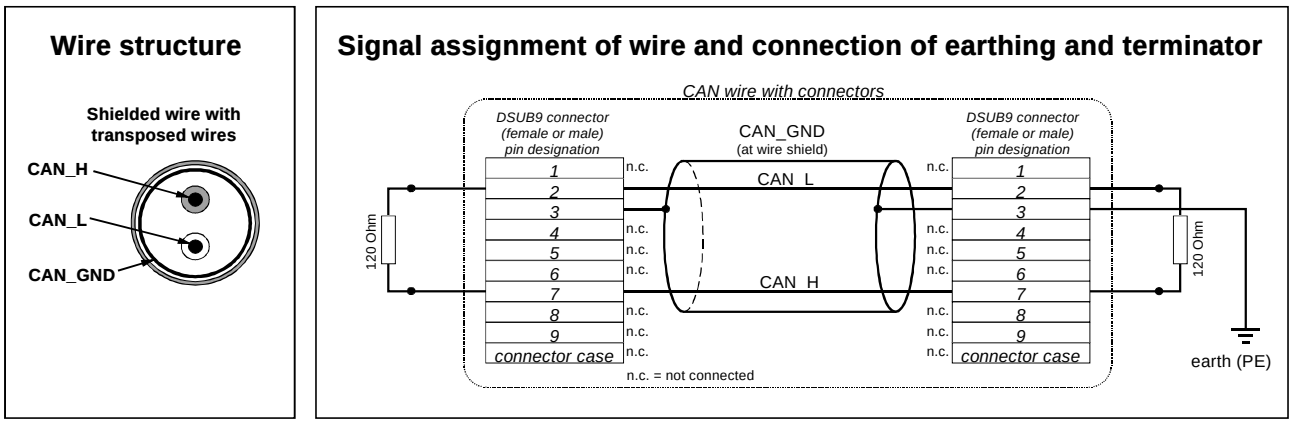


Figure: Structure and connection of wire

Cabling

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

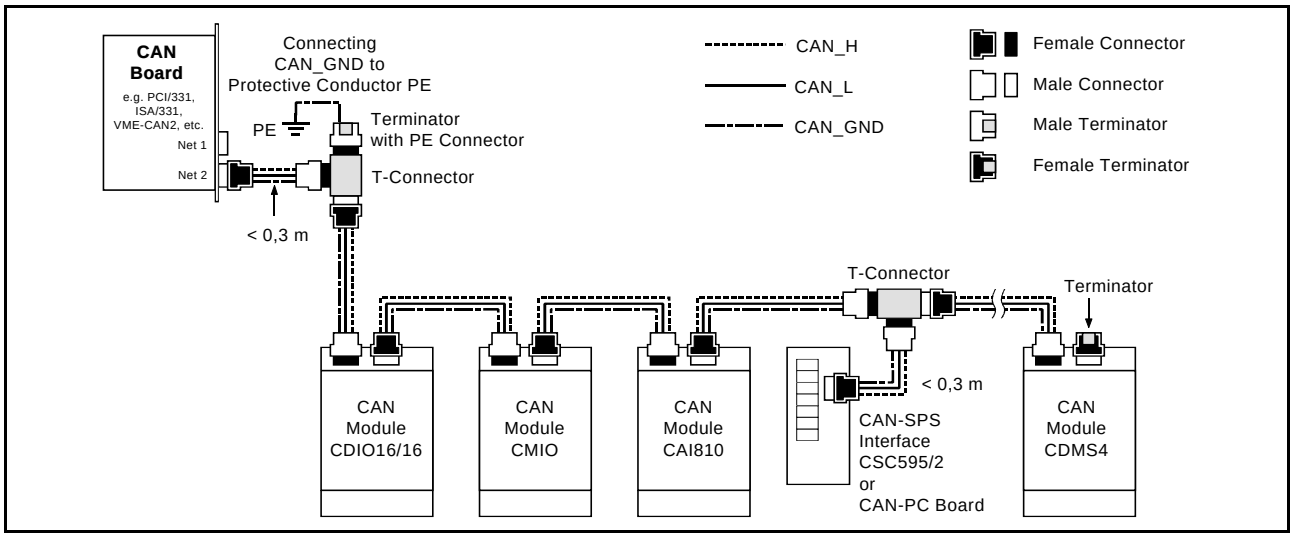


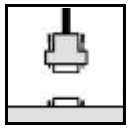
Figure: Example for correct wiring (when using single shielded wires)

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 insulated 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 insulated 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: CANbloc-Mini-DIO8, -AI4 and AO4 (these modules work only up to 10 m with 1 Mbit/s))

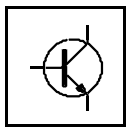
Bit rate [kbit/s]	Typical values of reachable wire length **with esd interface** l_{max} [m]	**CiA recommendations** (07/95) for reachable wire lengths l_{min} [m]
1000	37	25
800	59	50
666.6	80	-
500	130	100
333.3	180	-
250	270	250
166	420	-
125	570	500
100	710	650
66.6	1000	-
50	1400	1000
33.3	2000	-
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
U.I. LAPP GmbH & Co. KG Schulze-Delitzsch-Straße 25 70565 Stuttgart	UNITRONIC ®-BUS LD, UNITRONIC ®-BUS FD P LD
metrofunk KABEL-UNION GmbH Postfach 410109 12111 Berlin	LiYCY 2 x 0,38 mm², LiYCY 2 x 0,5 mm², LiYCY 2 x 0,75 mm², LiYCY 2 x 1,0 mm², 1P x AWG 22 C, 1P x AWG 20 C

Manufacturer	Type of wire
Alcatel Kabelmetal Kabelkamp 20 30179 Hannover	DUE 4401, DUE 4001, DUE 4402
ConCab Kabel GmbH Äußerer Eichwald 74535 Mainhardt	1 x 2 x 0,22 mm² Best-Nr. 93022016 (UL approved)



7. Circuit Diagrams