CAN - CSC595/2

CAN - PLC Interface Module
for
S5-90U, S5-95U and S5-100U

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
-	First English version.
-	

Technical details are subject to change without notice.

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1. Overview

1.1 Module Description

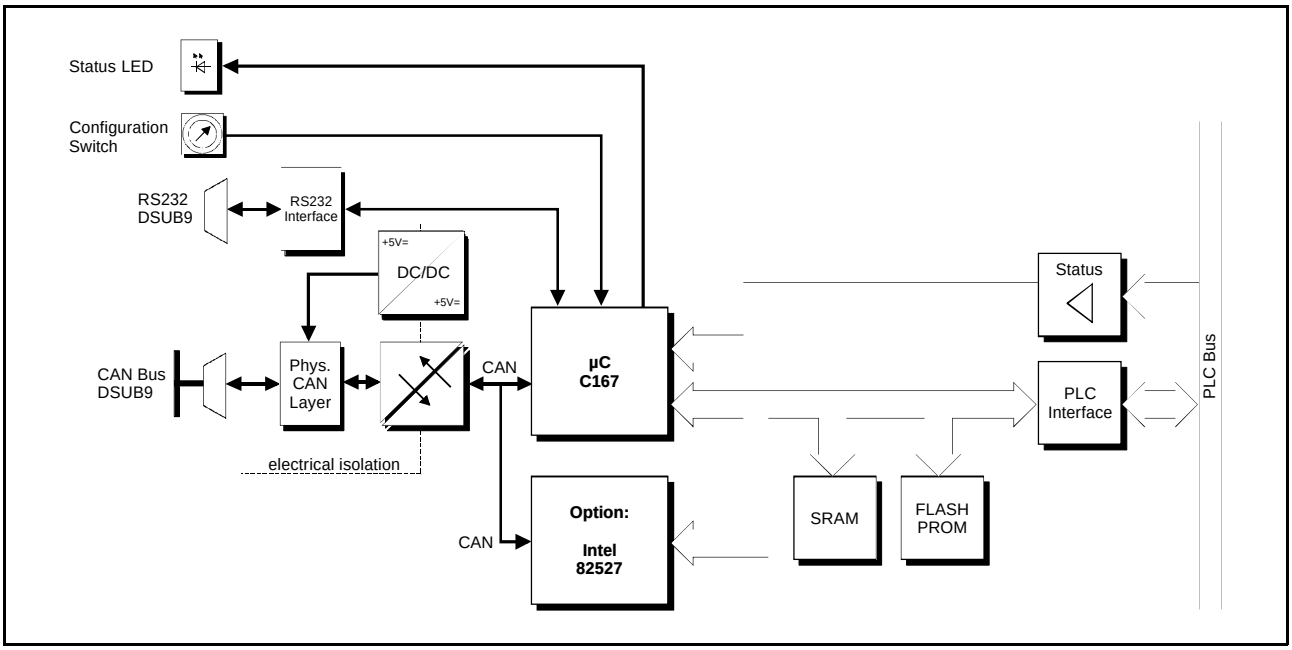


Fig. 1.1.1: Block-circuit diagram of the CSC595/2

By means of the communication processor CAN-CSC595/2 SIEMENS PLCs of S5-90U, S5-95U or S5-100U and esd-CAN-I/O modules or other CAN participants can be directly linked.

The module guarantees complete transparency of process data to the PLC programmer. No further function or data components are required so that PLC programs can be run as usual.

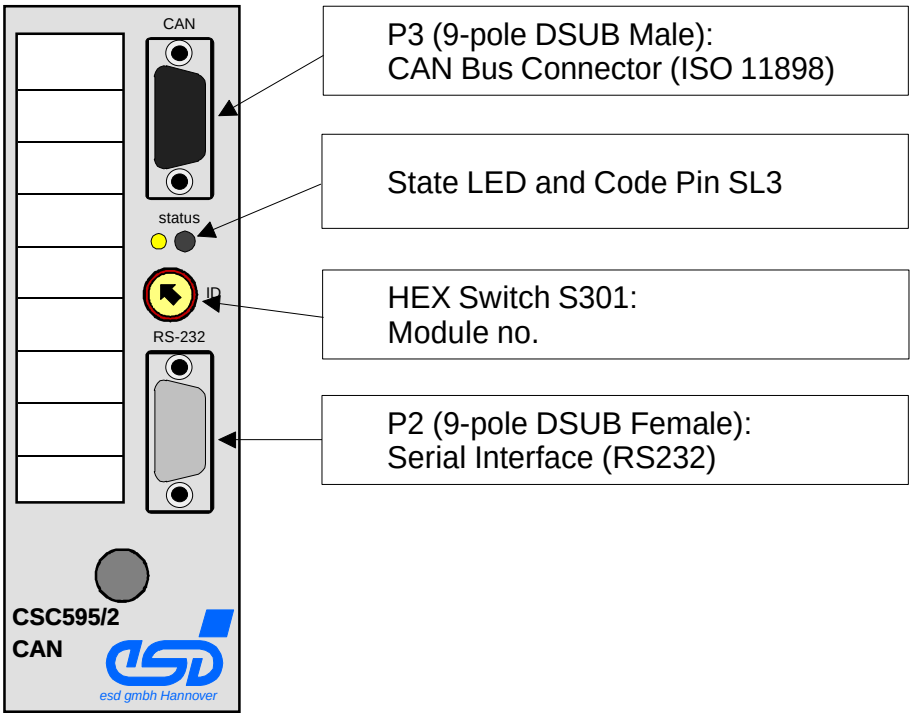
The CAN-CSC595/2 uses the high performance microcontroller C167C with integrated CAN-controller and guarantees a bit rate of 1 Mbit/s without data loss even when the C167C is running as a high-level-protocol master.

The physical CAN-layer corresponds to ISO 11898. Like all CAN-identifiers, the bit rate can be set via the local RS-232 interface by means of the software.

This and other modules can be configured via the RS-232 interface. An automatic configuration of other modules (after cold start) is also possible. The settings are stored into the local EEPROM.

The module is shipped in a plastic case which is compatible to SIEMENS S5 devices.

1.2 Front-Panel View With LEDs- and Connectors



1.3 Summary of Technical Data

1.3.1 General Technical Data

RS-232 interface	RS-232C interface at 9-pin female DSUB as input and configuration interface and for loading new S-records for software updates of the FLASH EPROM
Temperature range	0...50EC ambient temperature
Humidity	max. 90%, non-condensing
Power supply CAN-module	fed via PLC bus, nominal voltage 9V ±10%, current (typical, at 20EC): ca. 200 mA (without CAN-controller 82527)
Connectors	P301 - PLC connection P2 (DSUB9/female) - RS-232 interface P3 (DSUB9/male) - CAN bus interface
Case	Siemens PLC-module case, compatible to SIMATIC S5 bus module
Weight	ca. 250 g

Table 1.3.1: General data of the CSC595/2

1.3.2 CAN-Interfaces of the CSC595/2

Number of CAN-interfaces	one interface at connector P3
Controller components	C167 and 82527(option)
Use of the optional second controller	reception and evaluation of RTR frames
CAN-identifiers	programmable via CAN- or RS232 interface
esd-module No.	can be set via coding switch in front panel or programmed via CAN- or RS-232 interface
I²C-EEPROM	for storing the parameters
Physical layer	physical layer in accordance with ISO 11898, transmission rate programmable from 10 kbit/s to 1 Mbit/s
Electrical insulation of the CAN-interfaces from other units	insulation via optical couplers and DC/DC-converters in accordance with German VDE regulation 0110b §8, isolation group C and installation into cubicle): 300 V(DC), 250 V(AC)

Table 1.3.2: CAN-interfaces of the CSC595/2

1.3.3 PLC Unit

PLC link	compatible PLC units: SIEMENS S5-90U SIEMENS S5-95U SIEMENS S5-100U SIEMENS S5-102U SIEMENS S5-103U SIEMENS ET-100
Monitoring mode	monitoring the PLC bus: transmission of all PLC data to the CAN bus

Table 1.3.3: PLC unit

1.4 Software Support

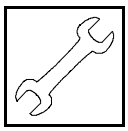
The complete EPROM-resident CAN-communication firmware for operating the CSC595/2 module is contained in the product package. The software will be explained in the second part of the manual.

1.5 Order Information

Type	Features	Order No.
CAN-CSC595-2	interface CAN/Siemens S5-SPS product package: device with CAN-controller C167 (82527 not mounted) with plastic case, coding pin for bootstrap loader, software and hardware manual	C.2902.02
CAN-CSC595/2-SDS	option: SDS master firmware	C.2902.50
CAN-CSC595/2-CoS	option: CANopen slave firmware	C.2902.52
CAN-CSC595/2-CoM	option: CANopen master firmware	C.2902.54
CAN-CSC595/2-MD	German manual 1*)	C.2902.20
CAN-CSC595/2-ME	English manual 1*)	C.2902.21

1*) If ordered together with the module, the manual is free of charge.

Table 1.5.1: Order information



2. Installation Notes

2.1 Installing the CSC595/2 Module into a SIMATIC-Automation Device

Please read the instructions in the SIMATIC-S5 manual carefully before taking the SIMATIC-S5 automation device into operation! The following steps relate only to the installation of the CSC595/2 module.

Way of procedure:

1. Switch off (disconnect) the power supply of the SIMATIC central extension devices and of the signal feeder and signal receiver.

2. Select a free stack in the central device, plug CSC595/2 to board carrier of the SIMATIC and fix by means of the recess screw accessible in the front panel.

3. Connect CAN-interface.
   The CAN-interface is connected via the 9-pin DSUB-connector in the front panel. Notes on wiring the CAN-network can be taken from the chapter 'Correctly Wiring Electrically Insulated Networks' at the end of this manual.

4. Connect terminal to RS232-interface.
   You can either use a normal terminal (such as WYSE, FALCO) or a PC or Laptop with a terminal program. The connection will be described separately in the following chapter 'Connecting a terminal'.

5. Switch on central device, switch on the other CAN bus participants, switch on terminal (the sequence is arbitrarily)

6. If the driver software is already in the local Flash EPROM (default status when module is shipped), the status LED of controller C167 (next to the coding connector) has to flash: green for 500 ms and red for 100 ms. Doing this, the LED signalizes that the module status is OK and that the module is operating by using the default parameters.

7. Now the CSC595/2 module can be configured via a terminal. During the configuration various parameters (such as bit rate, identifiers) can be changed. All configuration parameters can be stored into the local EEPROM. The changed and stored parameters will only become active after a RESET.

The configuration of the module will be described in the software manual. The you will also find a complete list of default parameters with which the module is operating after being shipped.

2.2 Connecting a Terminal

The terminal is required to configure the CSC595/2 module. You can either use a normal terminal or a PC with a terminal program. If users want to install new software updates themselves, a PC is absolutely necessary.

The setting parameters of the interface (bit rate, etc.) Will be described in the chapter ‘Specification of the serial Interface’, starting on page 21.

2.2.1 Terminal

During wiring the terminal should be switched off. The terminal is connected via the 9-pin female DSUB connector (P2) in the front panel. The signal assignment has been chosen in a way that a terminal can be directly connected without a null modem.

2.2.2 PC or Laptop with Terminal Program

During wiring the PC or Laptop should be switch off.

The port to which the module is connected during operation (configuration) depends on the terminal program that is used. Normally, various ports are supported.

When connecting to a 9-pin mouse port a *null modem* has to be connected to the supply. If the PC or Laptop is connected to a 25-pin DSUB-connector a null modem is not required. The signal assignment of suitable connection lines will be listed in the appendix.

esd also offers manufactured connection cables with 9-pin connectors for which no null modem is required.

3. Component Print, Jumpers and Coding Switches

3.1 Component Print

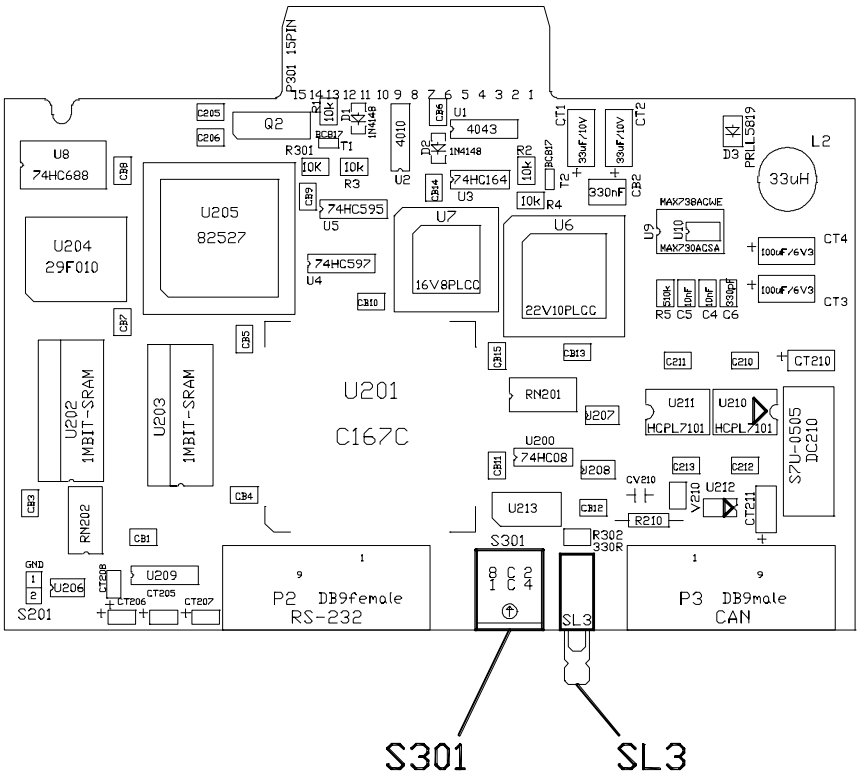


Fig. 3.1.1: Position of configuration elements on the component layer of the PCB

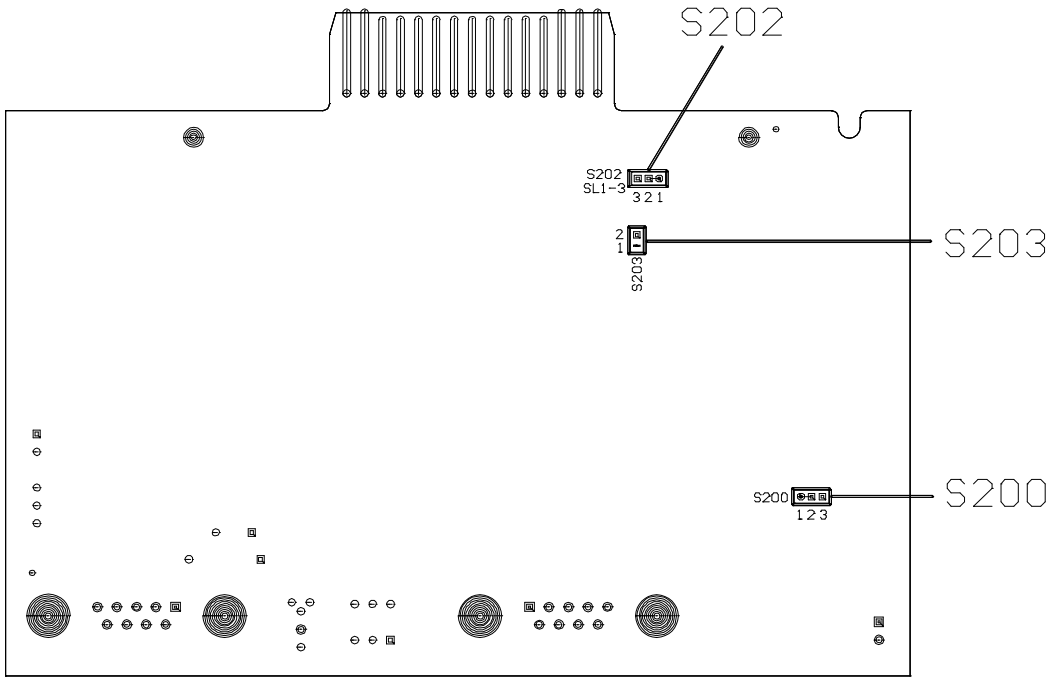


Fig. 3.1.2: Position of solder bridges on the bottom layer of the PCB

3.2 Default Setting of Bridges and Coding Switches

The respective default setting of bridges, coding switches and of the plug contact at the time the board is shipped, will be listed in the following figures.

Please refer to figure 3.1.1 for the position of the components on the top layer of the PCB. In the following descriptions the components will be described as seen by the user with the board in a position where the CAN bus connectors are pointing to the left.

The position of the solder bridges can be taken from figure 3.1.2. In the following descriptions the solder bridges will be described as seen by the user with the board in a position where the CAN bus connectors are pointing to the right (bottom layer view).

Summary of default settings when the module is shipped:

Solder bridge	Function	Setting
S200	memory capacity of SRAMs	256 kByte (2 x 128 kByte)
S202	operation of 82527 with 10 MHz or 20 MHz	82527 is pulsed with 20 MHz
S203	Tx-signal of the 82527 to CAN interface	board without 82527: solder bridge open board with 82527: bridge closed, i.e. Tx-signal is connected to the CAN bus interface

Note: Solder bridge S200 will not be described again below, because the position of the bridge depends from the SMD-memory components (SRAMs) used. The SMD memories used are mounted at the factory and cannot be changed afterwards. Therefore the user must not change the position of solder bridge S 200!

Plug contact/ coding switch	Function	Setting
Plug contact SL3	activate bootstrap loader	not set, i.e. bootstrap loader is inactive
Coding switch S301	module No.	the module No. has always to be adjusted to an available CAN network by the user, therefore, there is no defined default setting

Table 3.2.1: Default setting of bridges and coding switches

3.3 Description of Bridges and Coding Switches

3.3.1 Operation of the 82527 with 10 MHz or 20 MHz (S202)

By means of this solder bridge the pulse frequency of the 82527 controller can be set to 10 MHz or 20 MHz. When the module is shipped, the bridge is set to 20 MHz.

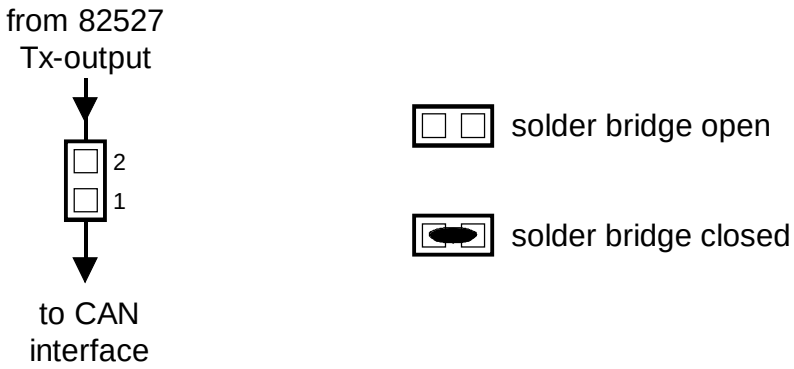
The position of this solder bridge is not to be changed by the user.

Example above: Setting of solder bridge for 20 MHz operation of controller 82527

3.3.2 Connection of Tx-signal of CAN controller 82527 to CAN interface (S203)

By means of this solder bridge the Tx-signal of the CAN controller 82527 is connected to the CAN interface. The solder bridge is open, if the controller is not equipped.

The position of this solder bridge is not to be changed by the user.



Example above: CAN controller 82527 not equipped

3.3.3 Activating the Bootstrap Loader (SL3)

In order to be able to download a software update via the serial interface into the local memory, the bootstrap loader has to be enabled. It has been locked to prevent the local program code from being overwritten accidentally.

In order to enable the bootstrap loader the coding pin, which is included in the product package, has to be plugged into the socket SL3. The pin closes an internal contact and by doing so enables the bootstrap loader. Now the loading procedure can be started via the operation software.

The coding pin makes a correct contact, when it is inserted as far as possible.

3.3.4 Setting the Module No. via Coding Switch S301

The module No. with which the CSC595/2 module is selected via the CAN bus when operating by means of the default parameters, consists of 8 bits. The module No. is required for the firmware to identify the module.

By means of the four pin coding switch S301 in the front panel bits 0 to 3 of the CAN-module No. are set. Bits 4 to 7 of the module No. have been fixed to ‘0'.

The assignment of coding switch position to module No. is therefore as follows:

Coding switch position	Module-No. bit [HEX]
0 (*)	00 (*)
1	01
2	02
:	:
E	0E
F	0F

Table 3.3.4: Assignment of coding switch position to module No.

(*) If the coding switch is set to ‘00' and a RESET is triggered (via Power Down), the module keeps on operating by means of the default parameters after being switched on again. All previously changed parameters are lost, even if they had been stored into the local I²C-EEPROM.

When the module is operating via the default parameters, the module No. which has been set at the coding switch is active. The complete 8-bit module No. can be freely programmed via the firmware. The programmed module No. replaces the module No. set via the coding switch immediately.

Programming the module No. will be described in the software manual of this module.

Attention: It is not possible to set and save new parameters of the module, while the coding switch is set to ‘0’! This happens because, after a reset, that is necessary after the programming of the module the new parameters will be overwriten by the default parameters.

The setting of the coding switch at the moment the module is shipped has bot been determined, because the user has to synchronize it with other module numbers in the CAN-network.

4. Description of the Units

4.1 PLC-Bus Interface

The CSC595/2 module has a PLC-interface which has been designed for the connection to Siemens SIMATIC-S5 units. The interface is controlled by programmable logical components. The transmit and receive data is buffered into SRAM memories. The following figure represents the structure of the interface control.

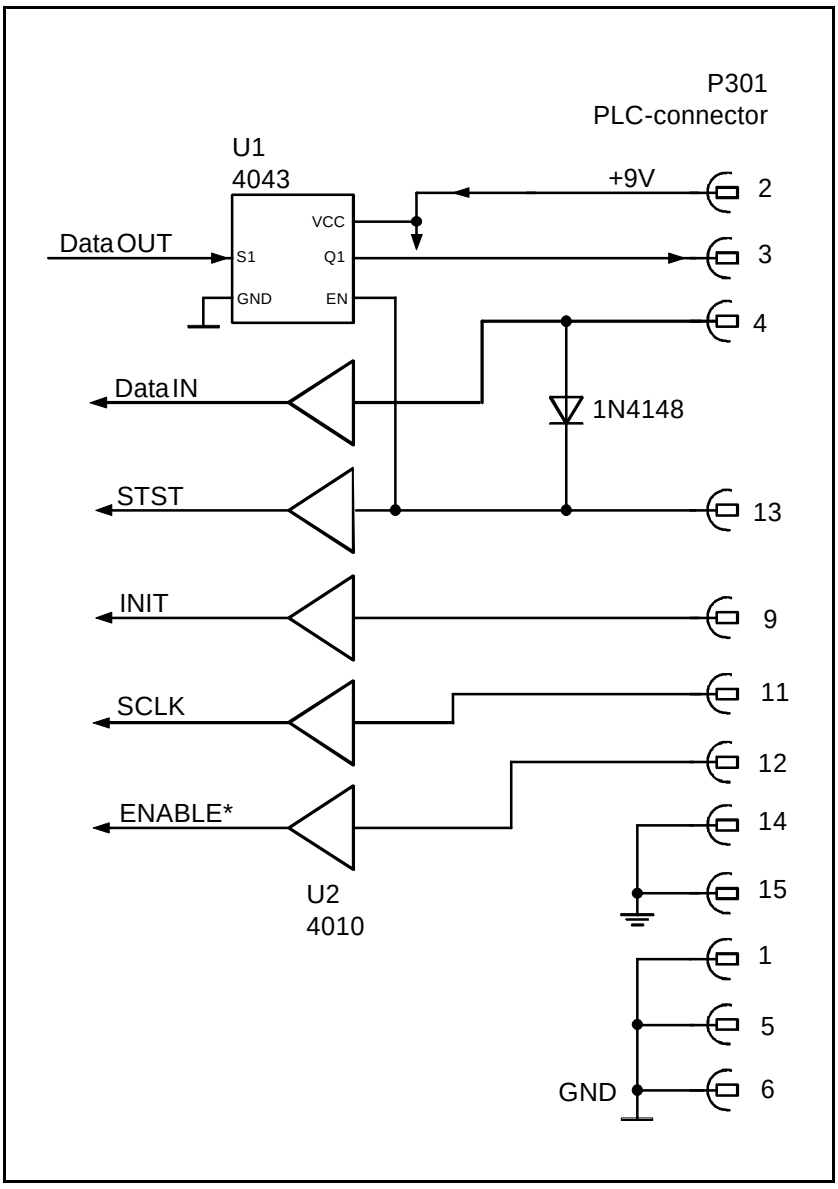


Fig. 4.2.1: Block-circuit diagram of the PLC-interface control

4.2 CAN Bus Interface

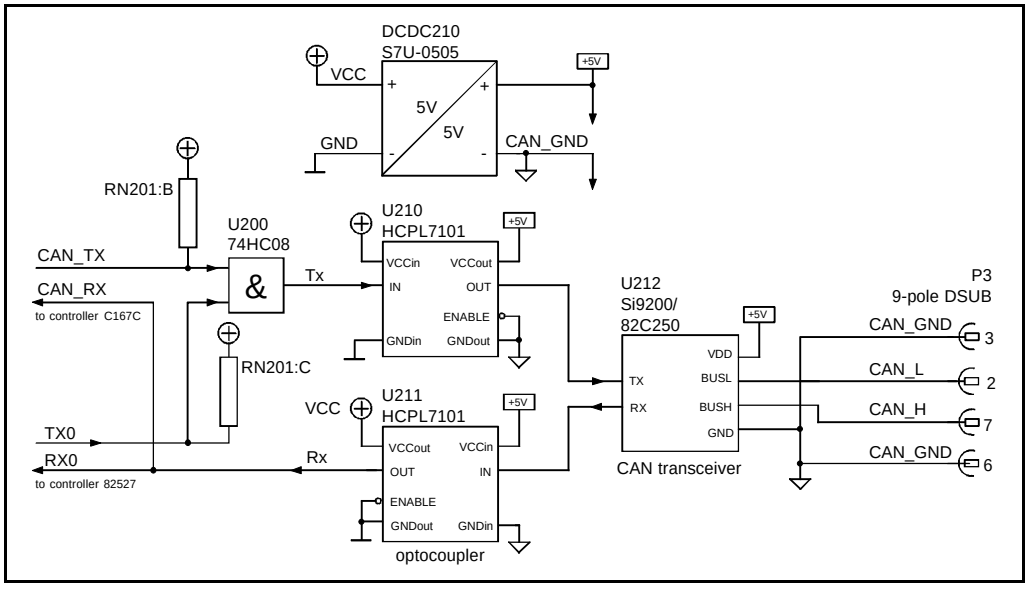
4.2.1 Bit Rate

The transmission speed of the CAN-interface can be varied between 10 kbit/s and 1.0 Mbit/s. The bit rate is set by means of the local software. Further information on this can be taken from the software manual of this module.

4.2.2 Transmit and Receive Circuit of the CAN-Interface (Physical Layer)

The C167C is used as a CAN-controller. The physical interface of the CAN bus is in accordance with the ISO 11898 norm. The Si9200 or the 82C250 are used as CAN bus transceivers in the module. The CAN-interface is supplied with power from the local +5V supply voltage by a DC/DC-converter. The signals to the CAN bus are electrically insulated by optical couplers.

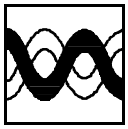
Notes on the wiring of the CAN-network:
The reference potential of the CAN bus (CAN_GND) has to be connected to the earth potential at exactly *one* point in the CAN-network.



+5V, VCC, GND, CANGND...	local supply voltages
CAN_TX, CAN_RX...	signals of CAN-controller C167C (U201)
TX0, RX0...	signals of the optional CAN-controller 82527 (U205)
CAN_L, CAN_H...	CAN bus signal lines

Fig. 4.3.1: Functional circuit diagram of the CAN bus interface when using the interface components Si9200 or 82C250

The connector assignment can be taken from the appendix.



4.3 Specification of the Serial Interface

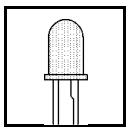
The RS-232 interface is specified as follows:

Parameters	Settings
baud rate	19200 baud
data bits	8 bits/character
stop bits	1 stop bit
parity bit	no parity
handshake	no handshake (or, if this cannot be set: XON/XOFF)

Table 4.4.1: Parameters of the serial interface

The PC or terminal connected has to be set to the values specified above.

The connector assignment of the interface at P2 can be taken from the appendix.

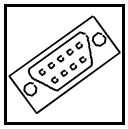


4.4 LED Display

The status LED is next to the bootstrap plug.

LED status	Meaning of the LED status		
	module is in RESET status	module is in bootstrap mode	module is in 'normal' operation
constantly green	-	-	General status of the nodule is OK
LED flashes: short green, short red (approx. 100 ms green, 100 ms red)	-	-	EEPROM error
LED flashes: short green, short red (approx. 200 ms green, 200 ms red)	-	Displaying the bootstrap mode	-
LED flashes: long green, short red (approx. 500 ms green, 100 ms red)	-	-	Default status (module is operating via default parameters)
LED flashes: short green, short red, short off (330 ms green, 330 ms red, 330 ms off)	-	-	Module has been configured as a CANopen master, but the CANopen network has not yet started
LED off	Module is in RESET	-	-

-... This combination of operating status of the module and LED status does not exist.



5. Appendix

5.1 Connector Assignments

5.1.1 PLC-Bus Connector P301

Pin	Signal
1	GND
2	+9V
3	Data OUT
4	Data IN
5	GND
6	GND
7	-
8	-
9	INIT
10	-
11	SCLK
12	ENABLE*
13	STST-Bus
14	PE
15	PE

+9V, GND..... voltage supply

Data IN,
Data OUT..... data lines

STST-Bus..... start/stop signal of control unit

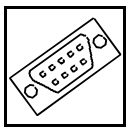
INIT..... signal for initialisation sequence

SCLK..... synchronous shift pulse

ENABLE*..... enable input for bus

PE..... protection earth connection

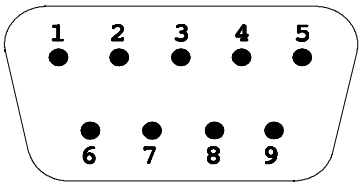
'-'..... not connected



Connector Assignment

5.1.2 Connector of CAN Bus Interface P3 (9-pin DSUB Male)

Pin Position:



Pin Assignment:

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

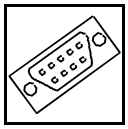
9-pin male DSUB connector

Signal Description:

CAN_L, CAN_H ... CAN-signal lines

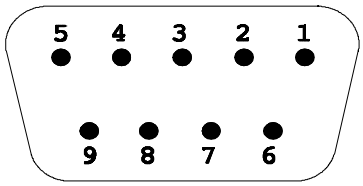
CAN_GND ... reference potential of the local CAN-physical layer

reserved ... pins which are reserved for future applications



5.1.3 Serial Interface RS-232 at P2 (9-pin DSUB Female)

Pin Position:



Pin Assignment:

Signal	Pin		Signal
-	1	6	-
RxD	2	7	-
TxD	3	8	-
DTR	4	9	-
GND	5		

9-pin female DSUB connector

Signal Description:

TxD ... signal line: data output of the CSC595/2

RxD ... signal lines: data input of the CSC595/2

DTR ... handshake signal (output)

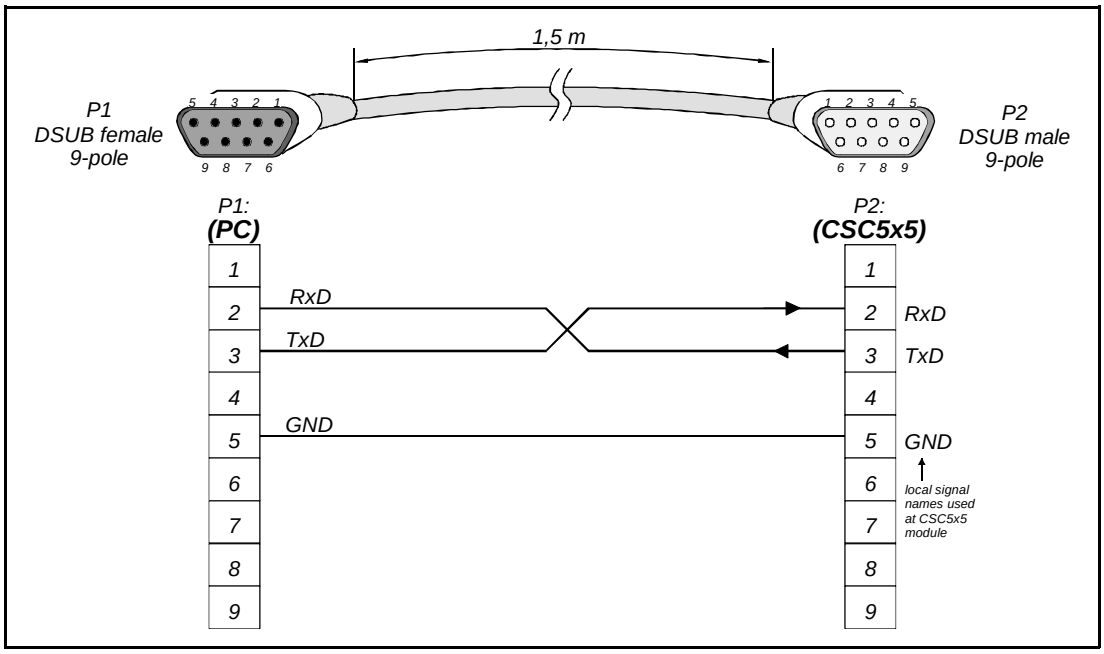
GND ... reference potential

'-' ... not connected

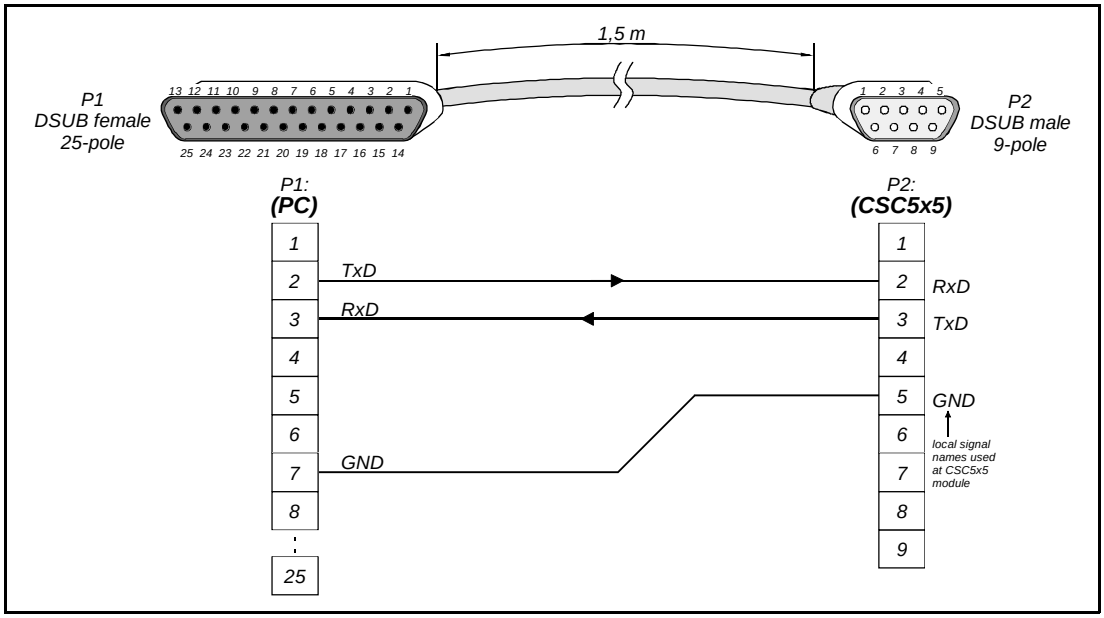
5.1.4 Connection Lines for CSC595/2 to PC (RS-232 Interface)

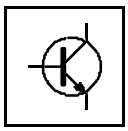
The following two figures show the required assignment for two RS-232 connection lines between PC and CSC595/2.

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



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





5.2 Circuit Diagrams

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 S ±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 S ±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.

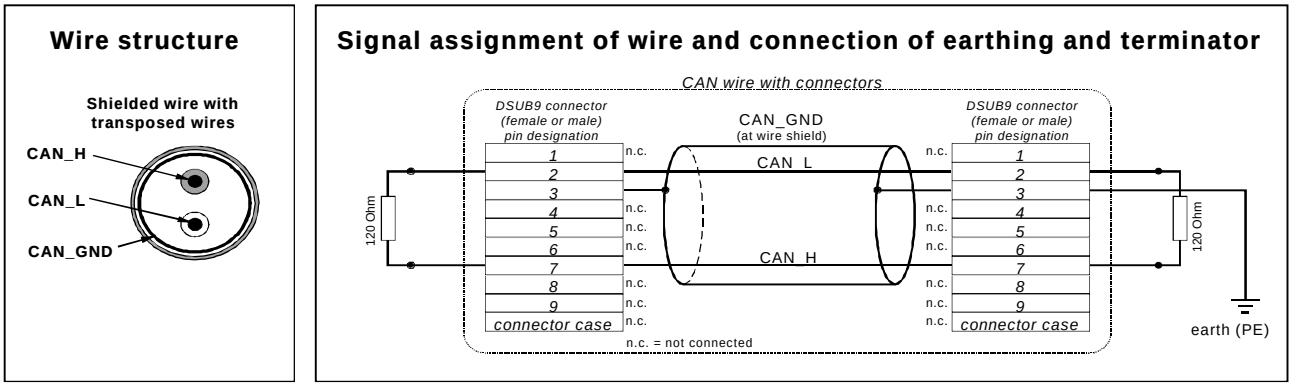
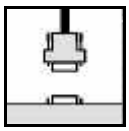


Fig.: Structure and connection of wire



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)

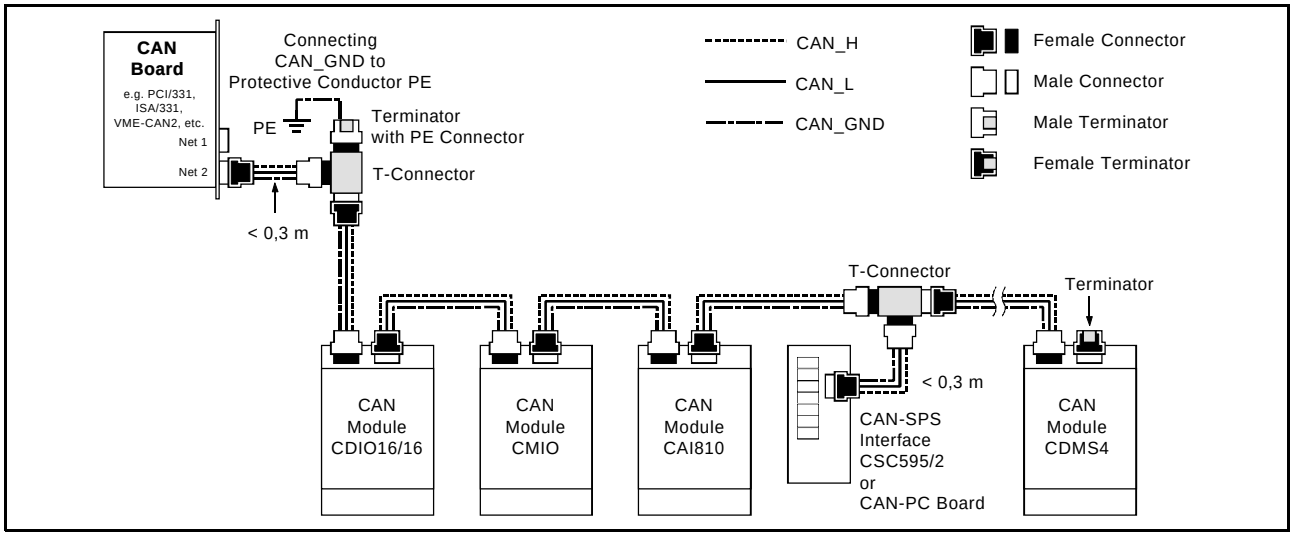


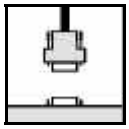
Fig.: Example for correct wiring (when using single shielded wires)

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

- Optocouplers are delaying the CAN signals. By using fast optocouplers 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 and -AI4, this 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 / Germany	UNITRONIC ®-BUS LD, UNITRONIC ®-BUS FD P LD
metrofunk KABEL-UNION GmbH Postfach 410109 12111 Berlin / Germany	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
Alcatel Kabelmetal Kabelkamp 20 30179 Hannover / Germany	DUE 4401, DUE 4001, DUE 4402