CAN-CBX-DIO8-J1939

Digital I/O module as J1939 ECU

Manual

to Product C.3010.05

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N O T E

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Document History

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

Rev.	Chapter	Changes versus previous version	Date
1.0	-	First English manual of CAN-CBX-DIO8-J1939	2015-03-25

Technical details are subject to change without further notice.

Safety Instructions

- When working with CAN-CBX-DIO8-J1939 follow the instructions below and read the manual carefully to protect yourself from injury and the CAN-CBX-DIO8-J1939 from damage.
- Do not open the housing of the CAN-CBX-DIO8-J1939.
- The permitted operating position is specified as shown (Figure: 8). Other operating positions are not allowed.
- Never let liquids get inside the CAN-CBX-DIO8-J1939. Otherwise, electric shocks or short circuits may result.
- Protect the CAN-CBX-DIO8-J1939 from dust, moisture and steam.
- Protect the CAN-CBX-DIO8-J1939 from shocks and vibrations.
- The CAN-CBX-DIO8-J1939 may become warm during normal use. Always allow adequate ventilation around the CAN-CBX-DIO8-J1939 and use care when handling.
- Do not operate the CAN-CBX-DIO8-J1939 adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.
- Do not use damaged or defective cables to connect the CAN-CBX-DIO8-J1939.
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and domestic animals and property.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The CAN-CBX-DIO8-J1939 may only be driven by power supply current circuits, that are contact protected.
  A power supply, that provides a safety extra-low voltage (SELV or PELV) according to EN 60950-1, complies with this conditions.

Qualified Personal
This documentation is directed exclusively towards personal qualified in control and automation engineering. The installation and commissioning of the product may only be carried out by qualified personal, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

Conformity
The CAN-CBX-DIO8-J1939 is an industrial product and meets the demands of the EU regulations and EMC standards printed in the conformity declaration at the end of this manual.

Warning: In a residential, commercial or light industrial environment the CAN-CBX-DIO8-J1939 may cause radio interferences in which case the user may be required to take adequate measures.

Intended Use
The intended use of the CAN-CBX-DIO8-J1939 is the operation as digital I/O module as J1939 ECU as part of the J1939-Starter-Kit USB/2 for Windows (esd order No.: C.1130.09).
The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The CAN-CBX-DIO8-J1939 is intended for indoor use only.
- The operation of the CAN-CBX-DIO8-J1939 in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the CAN-CBX-DIO8-J1939 for medical purposes is prohibited.

Service Note
The CAN-CBX-DIO8-J1939 does not contain any parts that require maintenance by the user. The CAN-CBX-DIO8-J1939 does not require any manual configuration of the hardware. Unauthorized intervention in the device voids warranty claims.

Disposal
Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

Table of contents

Typographical Conventions

Throughout this design specification the following typographical conventions are used to distinguish technical terms.

Convention	Example
File and path names	**/dev/null** or **<stdio.h>**
Function names	***open()***
Programming constants	NULL
Programming data types	uint32_t
Variable names	*Count*

The following indicators are used to highlight noticeable descriptions.

Attention:
Warnings or cautions to tell you about operations which might have unwanted side effects.

Note:
Notes to point out something important or useful.

Number Representation

All numbers in this document are base 10 unless designated otherwise.
For hexadecimal numbers '$_h$' is appended. For example, 42 is represented as $2A_h$ in hexadecimal format.

Abbreviations

API	Application Programming Interface
CAN	Controller Area Network
CPU	Central Processing Unit
CiA	CAN in Automation
HW	Hardware
I/O	Input/Output
LSB	Least Significant Bit
MSB	Most Significant Bit
n.a.	not applicable
OS	Operating System
SDK	Software Development Kit

1. Overview

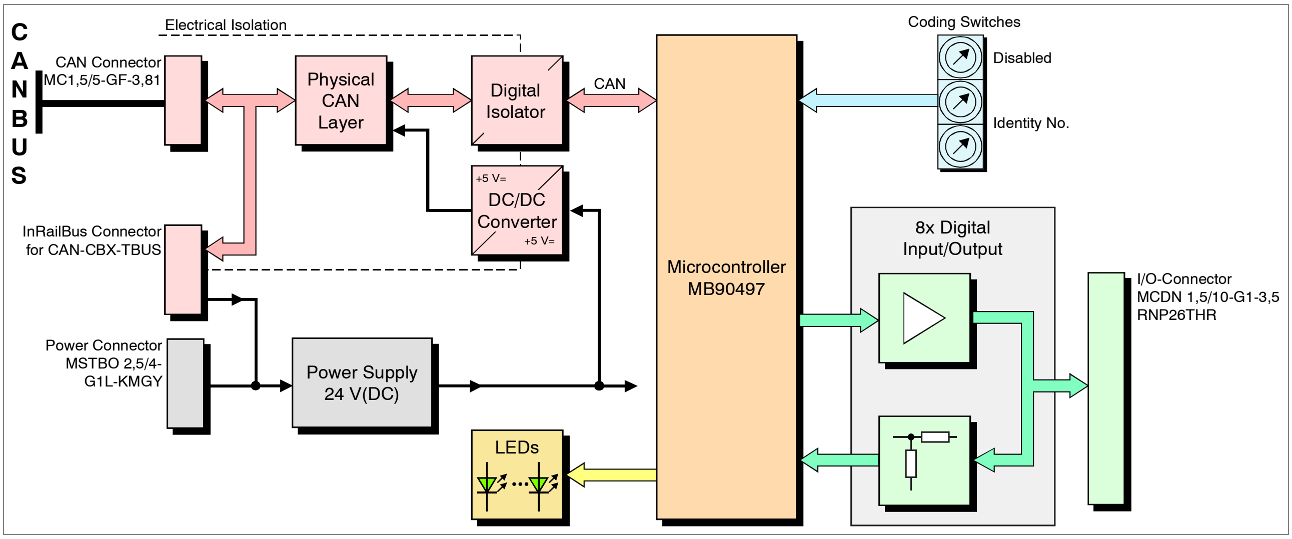


Figure 1: Block circuit diagram

The CAN-CBX-DIO8-J1939 comes with eight digital input and output channels. Six of these digital IOs are outputs, two are inputs.

The module operates with a MB90F497 microcontroller which buffers CAN data into a local SRAM. The firmware is contained in the flash. Parameters are stored in a serial EEPROM.

The CAN-CBX-DIO8-J1939 features the possibility to connect the power supply and the CAN bus signals via the InRailBus connector (TBUS-connector) integrated in the mounting rail. Individual modules can then be removed without interrupting the bus signals.

The ISO 11898-compliant CAN interface of the CAN-CBX-DIO8-J1939 allows a data transfer rate of 250 Kbit/s.
The CAN interface is electrically isolated by a dual digital isolator and a DC/DC converter.

The identity number can be configured via coding switches.

1.1 CAN-CBX-DIO8-J1939 as Part of J1939 Starter Kit

The CAN-CBX-DIO8-J1939 (order No.:C.3010.05) is delivered in the scope of delivery of the J1939-Starter-Kit USB/2 for Windows (esd order No.: C.1130.09).

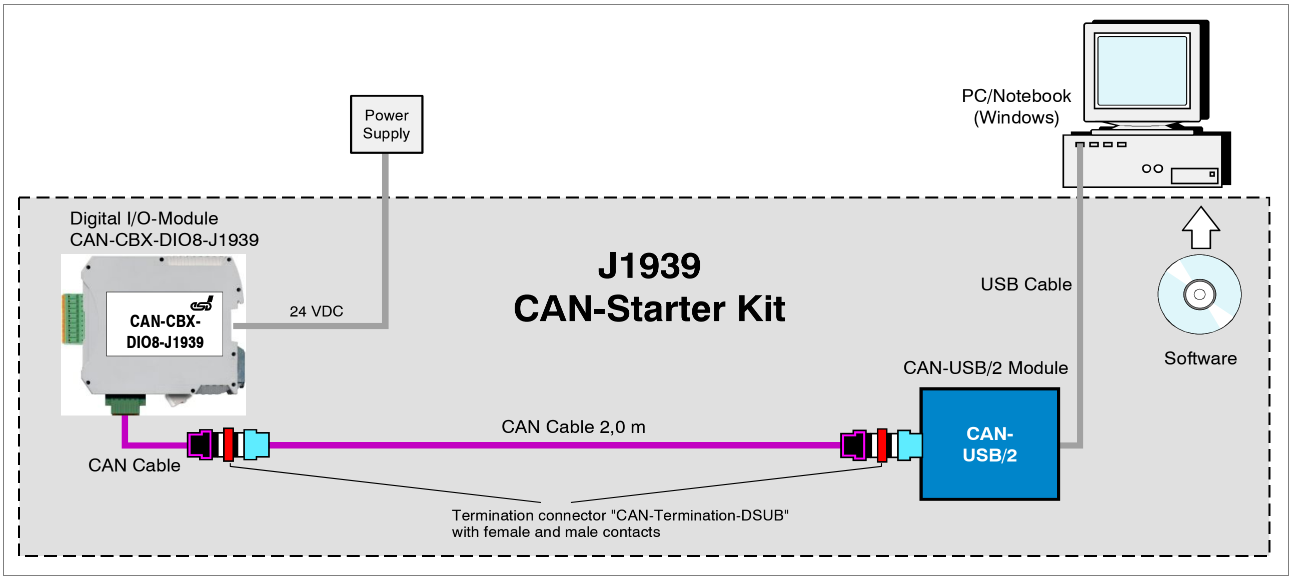


Figure 2: CAN-CBX-DIO8-J1939 as part of J1939 Starter Kit USB/2 for Windows

1.2 Connecting Diagram

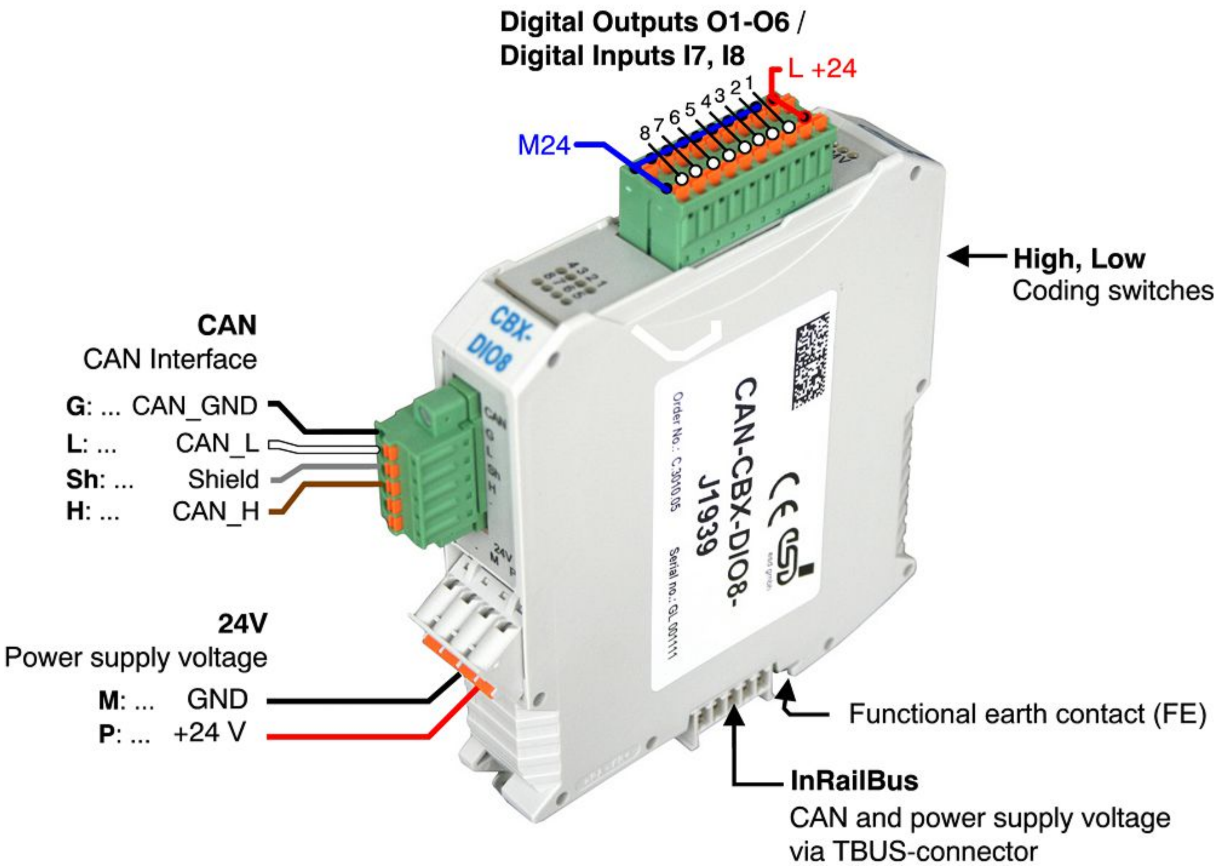


Figure 3: Connecting diagram of CAN-CBX-DIO8-J1939

Note:
See also page 23 for signal assignment of the connectors.
Please refer to page 30 for information on conductor connection and conductor cross section.

2. LEDs

2.1 Position of the LEDS

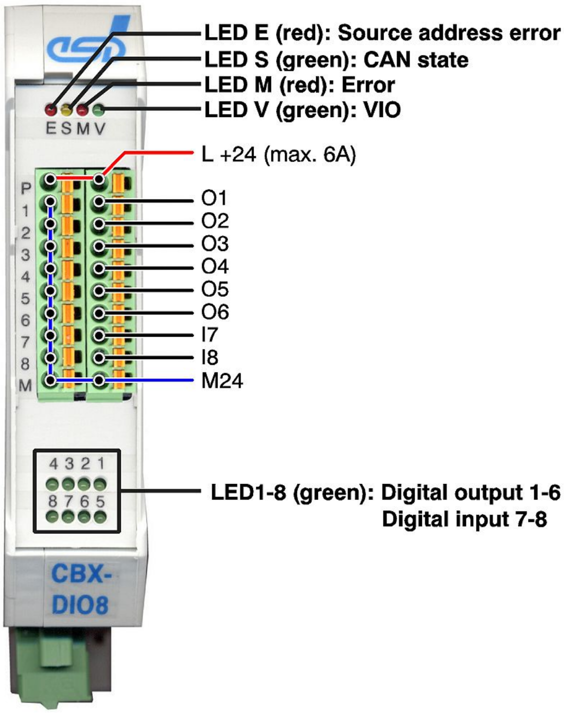


Figure 4: Connectors and LEDs

The CAN-CBX-DIO8-J1939 module is equipped with 4 status LEDs and 8 LEDs for the input and output channels.

2.2 LED Indication

The indicator states of the individual LEDs are described in the following chapters. In principle the following indicator states are distinguished:

Indicator state	Description	Sequence (each character corresponds to 100 ms)
ON	LED constantly on	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
OFF	LED constantly off	....
FLICKER	LED flickering with a frequency of approx. 5 Hz	I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.I.
BLINK	LED blinking with a frequency of approx. 1 Hz	IIIII.....IIIII.....IIIII.....IIIII.....
FLASH1	LED 200 ms on, 1000 ms off	II..........II..........II..........II..
FLASH2	LED 200 ms on, LED 200 ms off, 200 ms on, 1000 ms off	II..II..........II..II..........II..II..
FLASH3	LED 2x (200 ms on, 200 ms off) + 1x (200 ms on 1000 ms off)	II..II..II..........II..II..II..........

Table 1: Description of indicator states

2.2.1 Source Address Error LED

LED	Colour	Function	Indicator State	Description	Name in schematic diagram*1
E	red	Source Address Error	OFF	No error	LED200A
			FLICKER	No source address can be claimed (The preferred address is 164, then addresses [128...160] are automatically tried)	

*1... The schematic diagram is not part of this manual.

Table 2: Description of Source Address Error LEDs

2.2.2 CAN State LED

LED	Colour	Function	Indicator State	Description	Name in schematic diagram*1
S	green	CAN State	ON	CAN state OK	LED200B
			BLINK	Warning level reached	
			FLICKER	CAN state passive	
			OFF	Bus off	

*1... The schematic diagram is not part of this manual.

Table 3: Description of the CAN state LED

2.2.3 Error LED

LED	Colour	Function	Indicator State	Description	Name in schematic diagram*1
M	red	Error	OFF	Unused, LED is always off	LED200C

*1... The schematic diagram is not part of this manual.

Table 4: Description of the Error LED

2.2.4 VIO LED

The V LED indicates the “Auxiliary IO Status”. See chapter “Software“, page 15 for further information about the inputs.

LED	Colour	Function	Indicator State	Description: State of the Inputs I8	Description: State of the Inputs I7	Name in schematic diagram*1
V	green	VIO	OFF	0	0	LED200D
			FLASH 1	0	1	
			FLASH 2	1	0	
			FLASH 3	1	1	

*1... The schematic diagram is not part of this manual.

Table 5: Description of the VIO LED

2.2.5 LEDs 1 - 8

The LEDs 1 - 8 show the status of the digital outputs O1 - O6 and of the digital inputs I7 and I8. (Bit/byte counting starts at 1 here)

LED	Channel	Indicator function = I/O channel state	Name in schematic diagram*1
1	O1	O1 is mapped to bit1 of byte1 of PGN 65280	LED400D
2	O2	O2 is mapped to bit1 of byte2 of PGN 65280	LED400C
3	O3	O3 is mapped to bit1 of byte3 of PGN 65280	LED400B
4	O4	O4 is mapped to bit1 of byte9 of PGN 65281	LED400A
5	O5	O5 is mapped to bit1 of byte17 of PGN 65281	LED410D
6	O6	O6 is mapped to bit8 of byte24 of PGN 65281	LED410C
7	I7	I7 is mapped to bit7 of byte1 of PGN65241 (SPN 701, "Auxiliary I/O #01")	LED410B
8	I8	I8 is mapped to bit5 of byte1 of PGN65241 (SPN 702, "Auxiliary I/O #02")	LED410A

*1... The schematic diagram is not part of this manual.

LED x	Status of channel
off	input voltage of the channel x is 'off'
on	input voltage of the channel x is active (the corresponding bit of the PGN is set)

x .. 1 - 8

2.3 Coding Switches

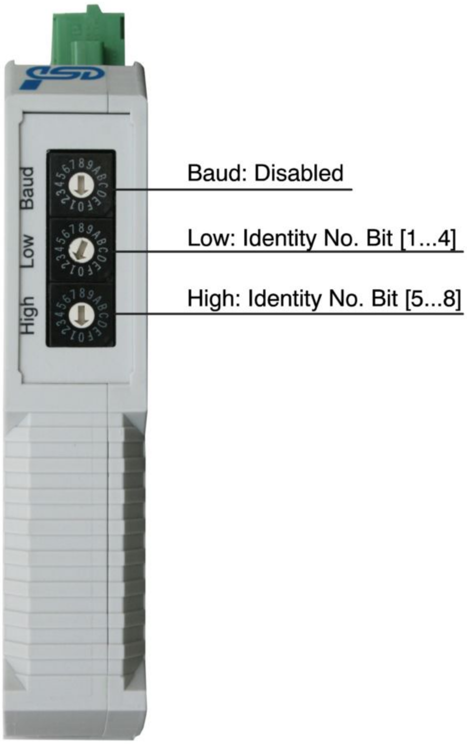


Figure 5: Position of the coding switches

Note:
At the moment the module is switched 'on', the state of the coding switches is determined. Changes of the settings therefore have to be made before switching on the module, because changes of the settings are not determined during operation.

2.3.1 Setting the Identity Number

The identity No. of the CAN-CBX-DIO8-J1939 module can be set decimal from 1 to 127 or hexadecimal from 01_h to $7F_h$. All other values are reserved.

The four higher-order bits (higher-order nibble) can be set with coding switch HIGH, the four lower-order bits can be set with coding switch LOW.

LOW: Identity No. Bit [1...4]
HIGH: Identity No. Bit [5...8]
(Bit [8] is reserved and can not be used in the CAN-CBX-DIO8-J1939)

3. Software

The CAN-CBX-DIO8-J1939 (esd order No.: C.3010.05) uses the same hardware as the CANopen® module CAN-CBX-DIO8 (esd order No.: C.3010.02), but with a modified firmware. So the device acts as J1939 ECU instead.

Its IOs are used as follows:

IOs [1..6]: Outputs (O1 … O6)
IOs [7..8]: Inputs (I7, I8)

(Bit/Byte counting starts at 1 here)

Outputs:
Updated when the devices sees PGN 65280/65281 (Manufacturer Specific PGNs):
O1 is mapped to bit1 of byte1 of PGN 65280
O2 is mapped to bit1 of byte2 of PGN 65280
O3 is mapped to bit1 of byte3 of PGN 65280
O4 is mapped to bit1 of byte9 of PGN 65281
O5 is mapped to bit1 of byte17 of PGN 65281
O6 is mapped to bit8 of byte24 of PGN 65281

Inputs:
Value is broadcast every second in PGN 65241 ("Auxiliary IO Status"):
I7 is mapped to bit7 of byte1 (SPN 701, "Auxiliary I/O #01")
I8 is mapped to bit5 of byte1 (SPN 702, "Auxiliary I/O #02")

The LED "V" shows the states of I7 and I8, see chapter "VIO LED" page 12.

4. Hardware Installation

To put the CAN-CBX-DIO8-J1939 into operation, please follow the installation notes.

Step	Procedure	see page
	Read the safety instructions at the beginning of this document carefully, before you start with the hardware installation!	4
	Please note the chapter "Installation of the Module Using InRailBus-Connector"!	17
1.	Install the CAN-CBX-DIO8-J1939 module as component of the J1939-Starter-Kit USB/2 for Windows and connect the interfaces (power supply voltage, CAN, digital inputs, digital outputs).	9, 10
2.	Please note that the CAN bus has to be terminated at both ends! **esd** offers special T-connectors and termination connectors. Additionally the CAN_GND signal has to be connected to earth at **exactly one** point in the CAN network. A CAN participant with a CAN interface which is not electrically isolated corresponds to the grounding of the CAN-GND.	-
3.	If multiple CAN-CBX-DIO8-J1939 are used in the same CAN, please ensure that each J1939 device has a unique name! If necessary, change the identity number via the coding switches.	14
4.	Apply the 24 V-power supply voltage of the CAN-CBX-DIO8-J1939.	-

4.1 Installation of the Module Using InRailBus-Connector

If the CAN bus signals and the power supply voltage shall be fed via the InRailBus, please proceed as follows:

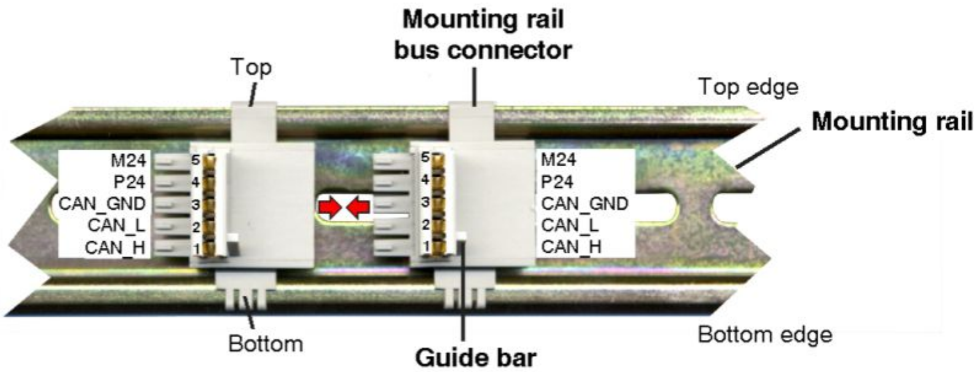


Figure 6: Mounting rail with bus connector

1. Position the InRailBus connector on the mounting rail and snap it onto the mounting rail using slight pressure. Plug the bus connectors together to contact the communication and power signals (in parallel with one). The bus connectors can be plugged together before or after mounting the CAN-CBX modules.
2. Place the CAN-CBX module with the DIN rail guideway on the top edge of the mounting rail.

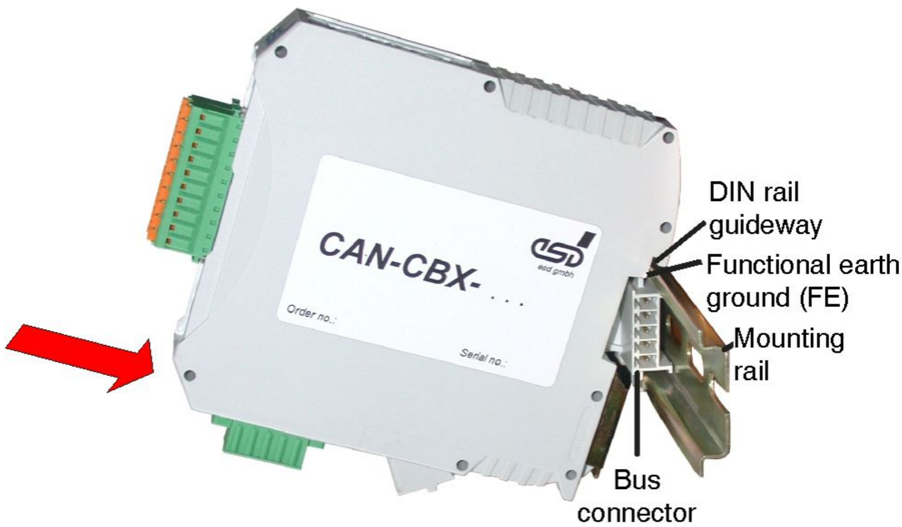


Figure 7: Mounting CAN-CBX modules

3. Swivel the CAN-CBX module onto the mounting rail in pressing the module downwards according to the arrow as shown in figure 7. The housing is mechanically guided by the DIN rail bus connector.

4. When mounting the CAN-CBX module the metal foot catch snaps on the bottom edge of the mounting rail. Now the module is mounted on the mounting rail and connected to the InRailBus via the bus connector. Connect the bus connectors and the InRailBus, if not already done.

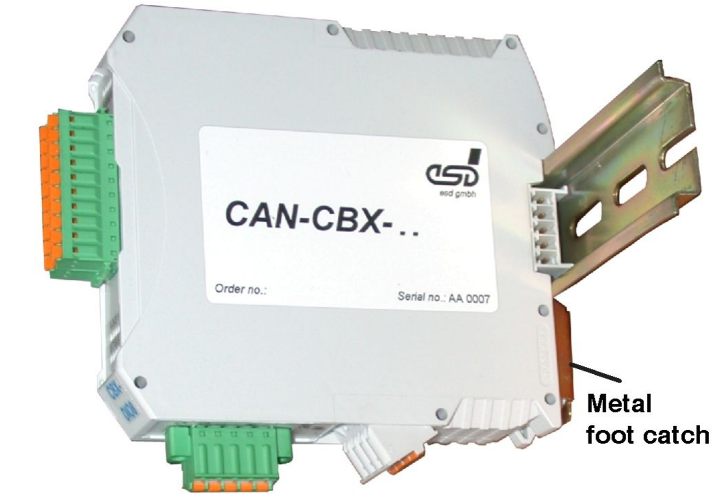


Figure 8: Mounted CAN-CBX module

4.1.1 Connecting Power Supply and CAN Signals to CBX-InRailBus

To connect the power supply and the CAN-signals via the InRailBus, a terminal plug is needed. The terminal plug is not included in delivery and must be ordered separately (order no.: C.3000.02, see order information).

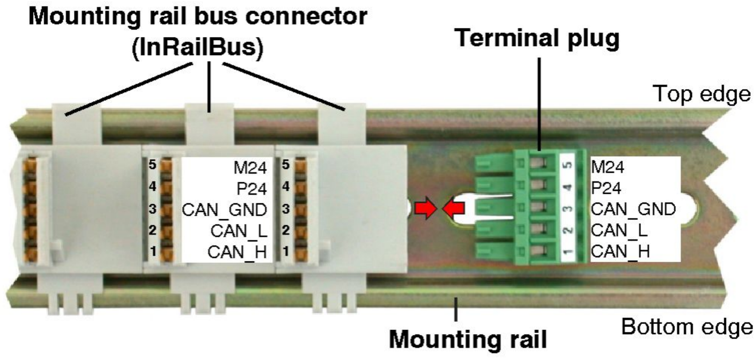


Figure 9: Mounting rail with InRailBus and terminal plug

Plug the terminal plug into the socket on the right of the mounting-rail bus connector of the InRailBus, as described in Figure 8. Then connect the CAN interface and the power supply voltage via the terminal plug.

4.1.2 Connection of the Power Supply Voltage

Attention:
Please note the safety instructions containing the requirements on power supply current circuits (see page 4)!

Attention:
The connections for the 24 V power supply are internally connected and must not be supplied by two independent power sources at the same time!

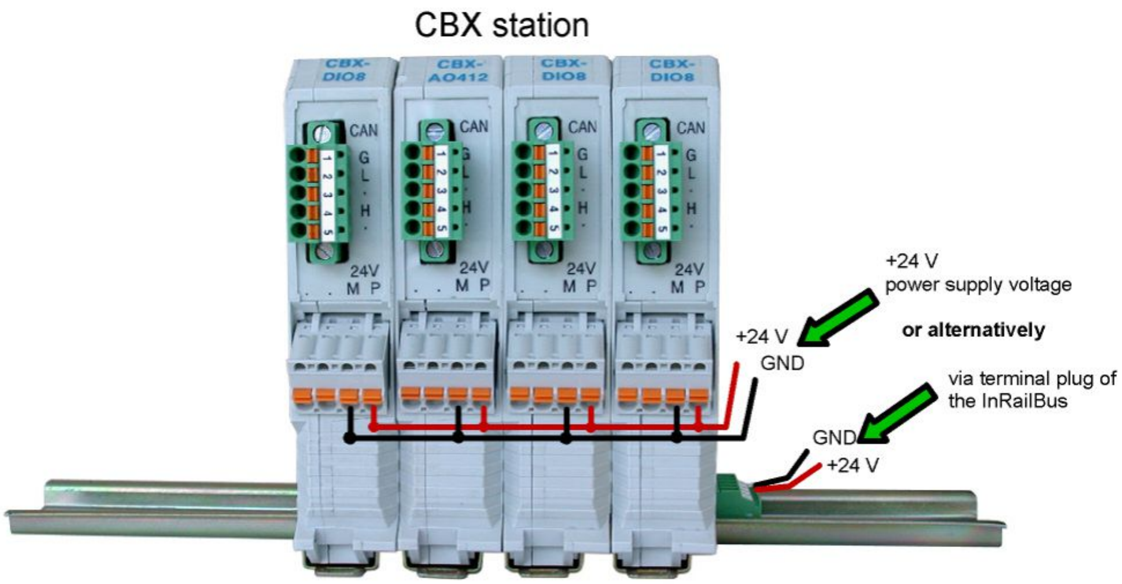


Figure 10: Connecting the power supply voltage to the CAN-CBX station

Earthing of the Mounting Rail

Note:
The module is connected with the mounting rail via its functional earth contact.
This improves the stability against electromagnetic disturbances.
Thus the mounting rail shall be connected to an appropriate functional earth contact in the environment or in the installation.
Please note, that the impedance of the connection has to be kept low.
The functional earth contact of the module does not ensure electrical safety.

4.1.3 Connection of CAN

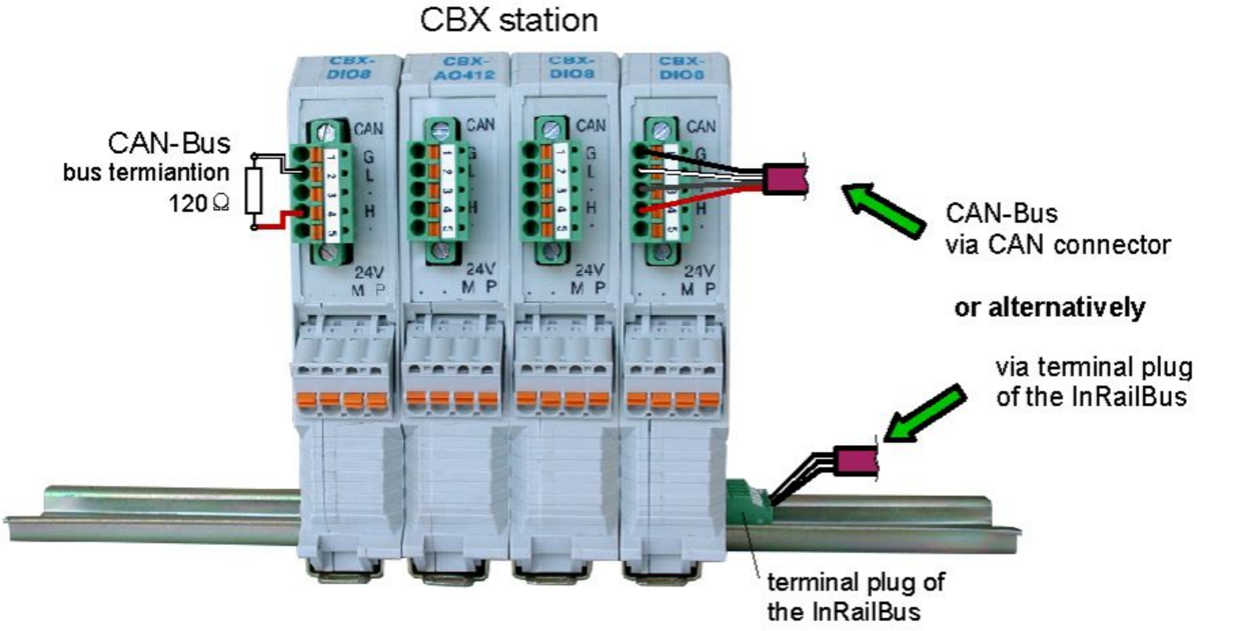


Figure 11: Connecting the CAN signals to the CAN-CBX station

Generally the CAN signals can be fed via the CAN connector of the first CAN-CBX module of the CBX station. The signals are then connected through the CAN-CBX station via the InRailBus. To loop through the CAN signals the CAN bus connector of the last CAN-CBX module of the CAN-CBX station has to be used. The CAN connectors of the CAN-CBX modules which are not at the ends of the CAN-CBX station must not be connected to the CAN bus, because this would cause incorrect branching.
A bus termination must be connected to the CAN connector of the CAN-CBX module at the end of the CBX-InRailBus (see Figure 11), if the CAN bus ends there.

4.2 Remove the CAN-CBX Module from InRailBus

If the CAN-CBX module is connected to the InRailBus please proceed as follows:

Release the module from the mounting rail in moving the foot catch (see Figure 8) downwards (e.g. with a screwdriver). Now the module is detached from the bottom edge of the mounting rail and can be removed.

Note:
It is possible to remove individual devices from the CBX station without interrupting the InRailBus connection, because the contact chain will not be disrupted.

5. Technical Data

5.1 General Technical Data

Power supply voltage	nominal voltage: 24 V/DC input voltage range: 18...30 V/DC current consumption (24 V, 20℃): typ.: 30 mA, (without VIO) max.: 40 mA
Connectors	24V (4-pin PCB plug connector with spring-cage connection, X100) - 24 V-power supply voltage 1-8,P,M (20-pin PCB plug connector, X400) - digital input/output CAN (5-pin Mini-COMBICON connector, X600) - CAN interface InRailBus (5-pin ME-MAX-TBUS connector, Phoenix Contact X101) - CAN interface and power supply voltage via InRailBus Only for test- and programming purposes (internal): X200 (6-pin socket connector)
Temperature range	-20...+70 °C ambient temperature
Humidity	max. 90%, non-condensing
Protection class	IP20
Pollution degree	maximum permissible according to DIN EN 61131-2: Pollution Degree 2
Housing	plastic housing for carrier rail mounting NS35/7,5 DIN EN 60715
Dimensions	width: 22.5 mm, height: 99 mm, depth: 114.5 mm (without connectors)
Weight	approx. 180 g (CAN-CBX-DIO8-J1939 incl. CAN cable)

Table 6: General data of the module

5.2 CPU Unit

CPU	16 bit µC MB90F497
RAM	2 Kbyte integrated
Flash	64 Kbyte integrated
EEPROM	1 Kbyte via I²C

Table 7: Microprocessor and Memory

5.3 CAN Interface

Number of CAN interfaces	1 x CAN
Connection	5-pin PCB plug connector with spring-cage connection or via InRailBus-connector (CAN-CBX-TBUS)
CAN controller	MB90F497, according to ISO11898-1 (only 11-bit CAN identifier are supported by software)
Electrical isolation of CAN interfaces from other units	via dual digital isolator and DC/DC converters
Physical layer CAN	physical layer according to ISO 11898-2, transfer rate programmable from 10 Kbit/s up to 1 Mbit/s
Bus termination	has to be set externally if required

Table 8: Data of the CAN interface

5.4 Digital In-/ Outputs

Number	6 output channels, 2 input channels, over voltage protection (max. 30 V)
Digital output circuit	
Design	high side switch
Nominal voltage	24 V
Nominal load current	up to 1 A per output (at 50°C ambient temperature, all channels switched)
Digital input circuit	
Nominal voltage	24 V
Protective circuit	20-pin PCB plug connector
Input switching threshold	U_{IN_Off} = 0...8 V, U_{IN_On} = ≥ 12 V, U_{IN_Max} = 30 V

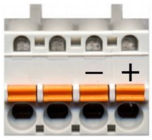
Table 9: Data of the digital in/outputs

6. Connector Assignments

6.1 24 V-Power Supply Voltage

Device connector: Phoenix Contact MSTBO 2,5/4-G1L-KMGY
Line connector: Phoenix Contact FKCT 2,5/4-ST KMGY, 5.0 mm pitch,
spring cage connection,
Phoenix Contact order No.: 19 21 90 0 (included in the scope of delivery)
For conductor connection and conductor cross section see page 30.

Pin Position:



1 2 3 4

Pin Assignment:

Device housing label	24V			
	.	.	M	P
Connector label	(none)	(none)	-	+

Pin	1	2	3	4
Signal	P24 (+ 24 V)	M24 (GND)	M24 (GND)	P24 (+ 24 V)

Please refer to the connecting diagram page 10.

Note:
The pins 1 and 4 are connected internally.
The pins 2 and 3 are connected internally.

Signal Description:

P24... power supply voltage +24 V ± 10 %
M24... reference potential

6.2 CAN

6.2.1 CAN Interface

The physical layer is designed according to ISO 11898-2. The CAN bus signals are electrically isolated from the other signals via digital isolator and DC/DC-converter.

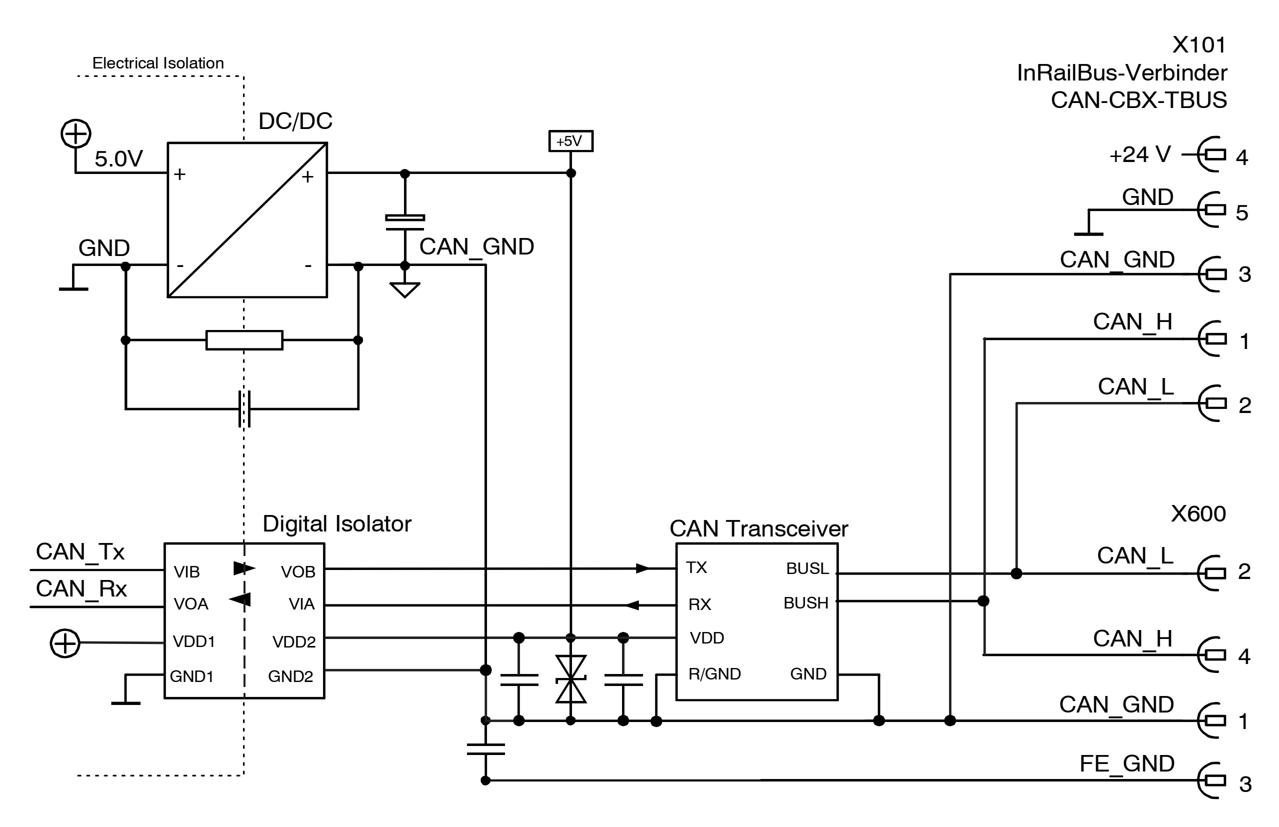


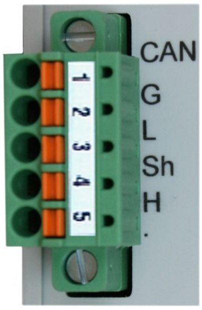
Figure 12: CAN interface

The CAN interface can be connected via the CAN connector or optionally via the InRailBus. Use the mounting-rail bus connector of the CBX-InRailBus (CAN-CBX-TBUS), see order information (page 118).

6.2.2 CAN

Device connector : Phoenix Contact MC 1,5/5-GF-3,81
Line connector: Phoenix Contact FK-MCP 1,5/5-STF-3,81, spring-cage connection
Phoenix Contact Order No.: 1851261 (included in delivery)
For conductor connection and conductor cross section see page 30.

Pin Position:
(device connector view)



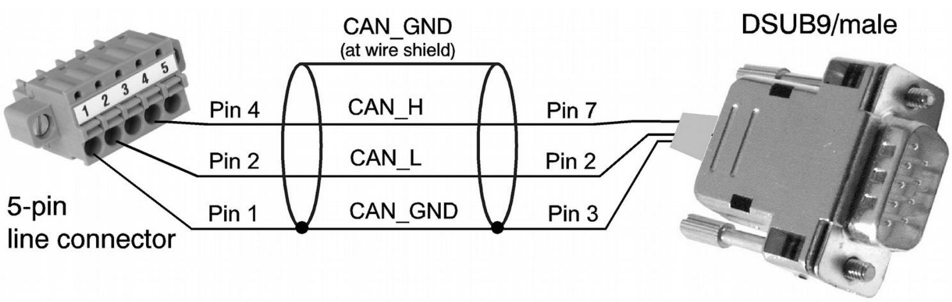
Pin Assignment:

Imprint	Signal	Pin
G	CAN_GND	1
L	CAN_L	2
Sh	Shield	3
H	CAN_H	4
•	-	5

Signal description:

CAN_L, CAN_H ... CAN signals
CAN_GND ... reference potential of the local CAN physical layer
Shield ... pin for line shield connection (using hat rail mounting direct contact to the mounting rail potential)
- ... not connected

Adapter cable from 5-pin line connector (here Phoenix Contact FK-MCP1,5/5-STF_3,81 with spring-cage-connection) to 9-pin DSUB, see chapter 6.2.2.1"Adapter Cable CAN-Cable-B" for further information:



The assignment of the 9-pin DSUB-connector and the line connector is designed according to CiA® 303 part 1.

6.2.2.1 Adapter Cable CAN-Cable-B

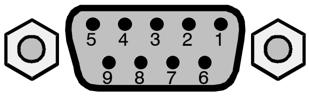
The adapter cable CAN-Cable-B 0.3m (order No.: C.1323.04) is included in delivery.
The signals of the CAN interface are conducted to a DSUB9 plug, female.

Cable connectors: - Phoenix Contact FK-MCP 1,5/5-STF-3,81 as described on page 25
- 9-pin DSUB connector, female

Figure 13: CAN-Cable-B

CAN via DSUB9 female connector plug

Pin Position:



Pin Assignment:

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

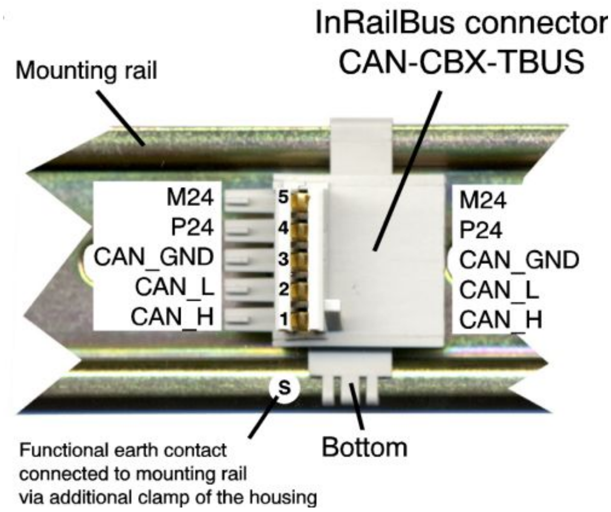
Signal Description:
CAN_L, CAN_H ... CAN signal lines
CAN_GND ... reference potential of the local CAN physical layer
reserved ... reserved for future applications, do not connect!

Note:
The CAN-GND signal of the cable "CAN-Cable-B" is connected via the wire shield if the cable is connected to the esd hardware. Thus the housings of the 9-pin DSUB connector is connected to CAN-GND, because no other potential is available on this connector. There is no connection between the cable shield and the earth potential i.e. to the DSUB9 connector housing.
Please note that in accordance with the wiring instructions the CAN-GND signal has to be connected to the earth potential at an appropriate position .

6.3 CAN and Power Supply via InRailBus Connector X101

Connector type: Mounting-rail bus connector of the CBX-InRailBus
Phoenix Contact ME 22,5 TBUS 1,5/5-ST-3,81 KMGY

Connector View:



Pin Assignment:

Pin	Signal
5	M24 (GND)
4	P24 (+24 V)
3	CAN_GND
2	CAN_L
1	CAN_H
S	FE (PE_GND)

Signal Description:

CAN_L,
CAN_H ... CAN signals
CAN_GND ... reference potential of the local CAN-Physical layers
P24... power supply voltage +24 V ±10 %
M24... reference potential
FE... functional earth contact (EMC) (connected to mounting rail potential)

6.4 Digital In/Outputs X400

6.4.1 Digital Inputs

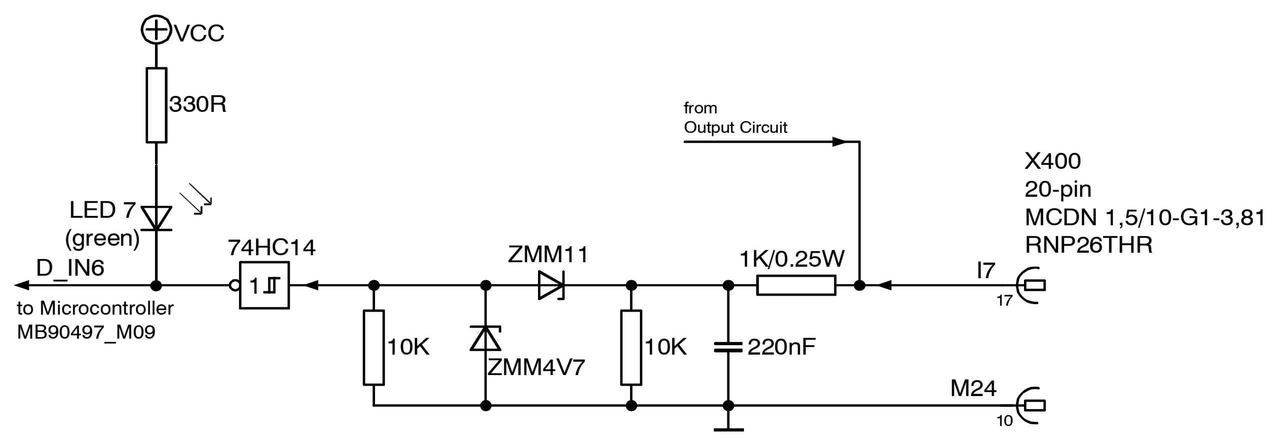


Figure 14: Digital input circuit (Example: I7)

6.4.2 Digital Outputs

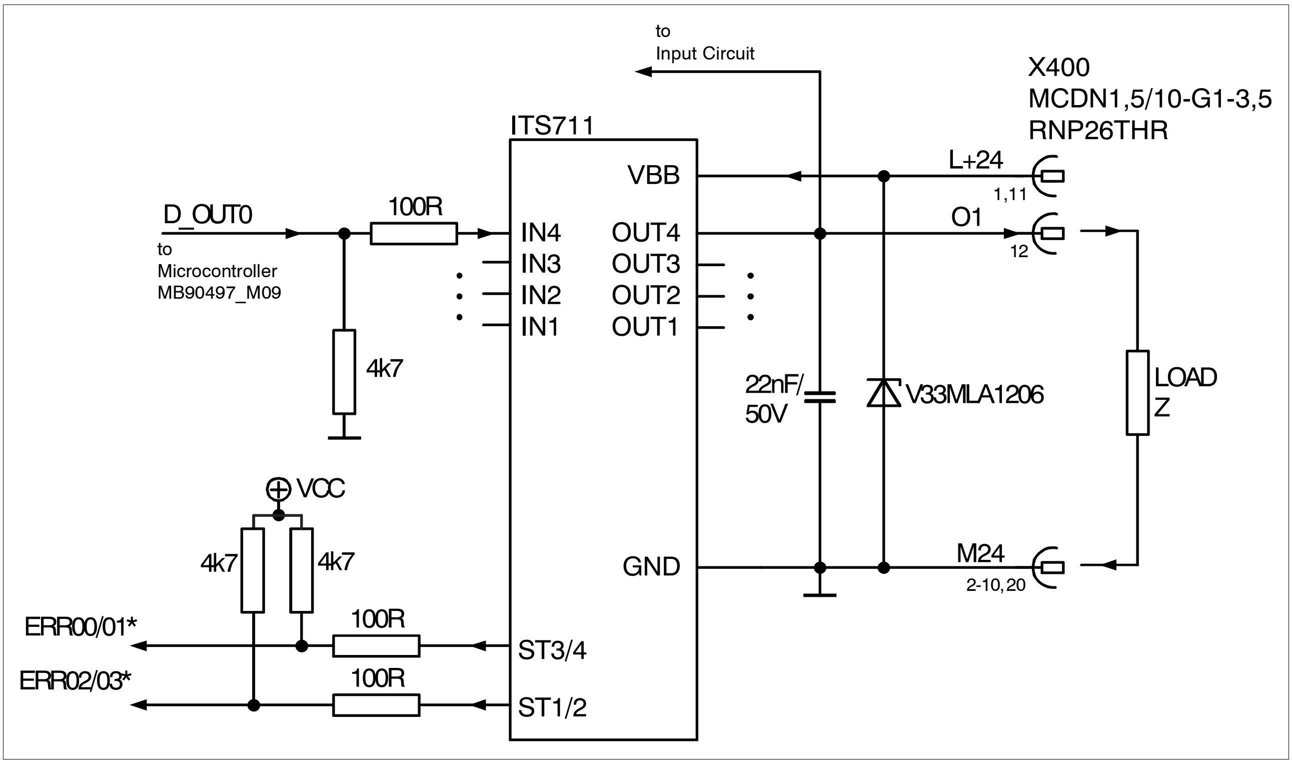
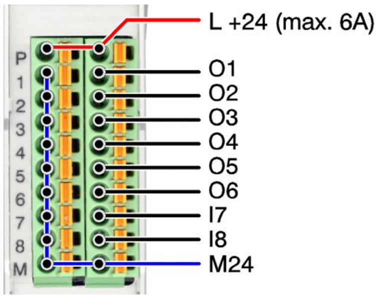


Figure 15: Digital output circuit (Example O1)

6.4.3 Connector Assignment

Device connector : Phoenix Contact MCDN 1,5/10-G1-3,5 RNP26THR
Line connector: Phoenix Contact, 2x FMC 1,5/10-ST-3,5, spring-cage connection
Phoenix Contact Order No.:1952348 (included in delivery)
For conductor connection and conductor cross section see page 30.

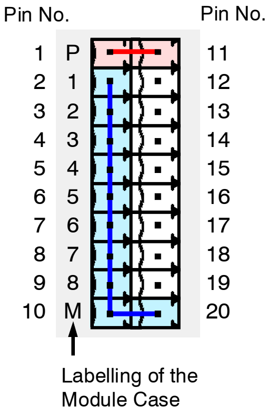
Connector top view:



Pin Assignment:

Signal	Pin
L + 24 V	1
M24	2
	3
	4
	5
	6
	7
	8
	9
	0

Pin Position:



Pin Assignment:

Pin	Signal
11	L + 24 V
12	O1
13	O2
14	O3
15	O4
16	O5
17	O6
18	I7
19	I8
20	M24

Signal Description:
L +24 V... supply voltage of the digital inputs and outputs
M24... reference potential
Ox... signal line of the digital output *x* (*x* = 1 - 6)
Iy... signal lines of the digital input *y* (*y* = 7 - 8)

Attention:
The maximum current load of the connector pins is 6A/pin. If all 8 outputs are to be operated with the maximum admissible load, the supply voltage has to be connected to pins 1 and 11. These pins are connected to each other on the PCB.

Note:
To ensure EU Conformity a cable with a maximum wire length of 30 m has to be used for the digital inputs and digital outputs.

6.5 Conductor Connection/Conductor Cross Sections

The following table contains an extract of the technical data of the line connectors.

Characteristics	**Connector Type**		
	Power Supply Voltage 24 V	CAN-Connector	Digital Inputs and Outputs
Connector type plug component (Range of articles)	FKCT 2,5/..-ST KMGY [1]	FK-MCP 1,5/5-STF-3,81 [2]	FMC 1,5/10-ST-3,5 [3]
Connection method	spring-cage connection	spring-cage connection	spring-cage connection
Stripping length	10 mm	9 mm	10mm
Conductor cross section solid min.	0.2 mm²	0.14 mm²	0.2 mm²
Conductor cross section solid max.	2.5 mm²	1.5 mm²	1.5 mm²
Conductor cross section stranded min.	0.2 mm²	0.14 mm²	0.2 mm²
Conductor cross section stranded max.	2.5 mm²	1.5 mm²	1.5 mm²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²	0.25 mm²	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm²	1.5 mm²	1.5 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²	0.25 mm²	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm²	0.5 mm²	0.75 mm²
Conductor cross section AWG/kcmil min.	24	26	24
Conductor cross section AWG/kcmil max	12	16	16
2 conductors, solid	not allowed	not allowed	not allowed
2 conductors, stranded	not allowed	not allowed	not allowed
2 conductors, stranded, ferrules without plastic sleeve	not allowed	not allowed	not allowed
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²	not allowed	not allowed
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.0 mm²	not allowed	not allowed
Minimum AWG according to UL/cUL	26	28	24
Maximum AWG according to UL/cUL	12	16	16

7. References

[1] Phoenix Contact GmbH & Co. KG, Blomberg.
Technical data is taken from the Phoenix Contact website:
https://www.phoenixcontact.com/online/portal/de;
PCB plug connector - FKCT-2,5/4-ST KMGY - 1921900, downloaded 2015-02-10

[2] Phoenix Contact GmbH & Co. KG, Blomberg.,
Technical data is taken from the Phoenix Contact website:
https://www.phoenixcontact.com/online/portal/de;
PCB plug connector - FK-MCP 1,5/ ...-STF-3,81 - 1851261, downloaded 2015-02-10

[3] Phoenix Contact GmbH & Co. KG, Blomberg.
Technical data is taken from the Phoenix Contact website:
https://www.phoenixcontact.com/online/portal/de;
PCB plug connector - FMC 1,5/10-ST-3,5 - 1952348, downloaded 2015-02-10

8. Declaration of Conformity

EU-KONFORMITÄTSERKLÄRUNG
EU DECLARATION OF CONFORMITY

Adresse *Address* **esd electronic system design gmbh**
Vahrenwalder Str. 207
30165 Hannover
Germany

esd erklärt, dass das Produkt *esd declares, that the product*	Typ, Modell, Artikel-Nr. *Type, Model, Article No.*
CAN-CBX-DIO8 **CAN-CBX-DIO8-J1939**	**C.3010.02** **C.3010.05**
die Anforderungen der Normen *fulfills the requirements of the standards*	**EN 61000-6-2:2005,** **EN 61000-6-4:2007+A1:2011**
gemäß folgendem Prüfbericht erfüllt. *according to test certificate.*	**H-K01-0247-07**
Das Produkt entspricht damit der EU-Richtlinie „EMV" *Therefore the product corresponds to the EU Directive 'EMC'*	**2014/30/EU**
Das Produkt entspricht der EU-Richtlinie „RoHS" *The product corresponds to the EU Directive 'RoHS'*	**2011/65/EU**

Diese Erklärung verliert ihre Gültigkeit, wenn das Produkt nicht den Herstellerunterlagen entsprechend eingesetzt und betrieben wird, oder das Produkt abweichend modifiziert wird.
This declaration loses its validity if the product is not used or run according to the manufacturer's documentation or if non-compliant modifications are made.

Name / *Name*	T. Ramm
Funktion / *Title*	CE-Koordinator / *CE Coordinator*
Datum / *Date*	Hannover, 2015-01-21

Thorsten Ramm

Rechtsgültige Unterschrift / *authorized signature*

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9. Order Information

Type	Properties	Order No.
CAN-CBX-DIO8-J1939	CAN-CBX-DIO8-J1939 - I/O Module with J1939 ECU functionality for J1939 Starter Kit - Outputs (1-6) updated when receiving PGN 65280/65281 - Inputs (7-8) broadcast every second by PGN 65241 ("Auxiliary IO Status") - inclusive DSUB9 CAN cable, 0,3m	C.3010.05
Accessories		
 **CAN-CBX-TBUS**	Mounting-rail bus connector of the CBX-InRailBus for CAN-CBX modules	C.3000.01
 **CAN-CBX-TBUS-Connector**	Terminal plug of the CBX-InRailBus for the connection of the +24V power supply voltage and the CAN interface, Female type	C.3000.02
 **CAN-CBX-TBUS-Connection adapter**	Terminal plug of the CBX-InRailBus for the connection of the +24V power supply voltage and the CAN-Interface, Male type	C.3000.03

For detailed information about the driver availability of your special operating system, please contact our sales team.

Table 10: Order information

PDF Manuals
For availability of English manuals see table below.
Please download the manuals as PDF documents from our esd website www.esd.eu for free.

Manuals		Order No.
CAN-CBX-DIO8-J1939-ME	Manual in English	C.3010.23

Table 11: Available manuals

Printed Manuals
If you need a printout of the manual additionally, please contact our sales team: sales@esd.eu for a quotation. Printed manuals may be ordered for a fee.