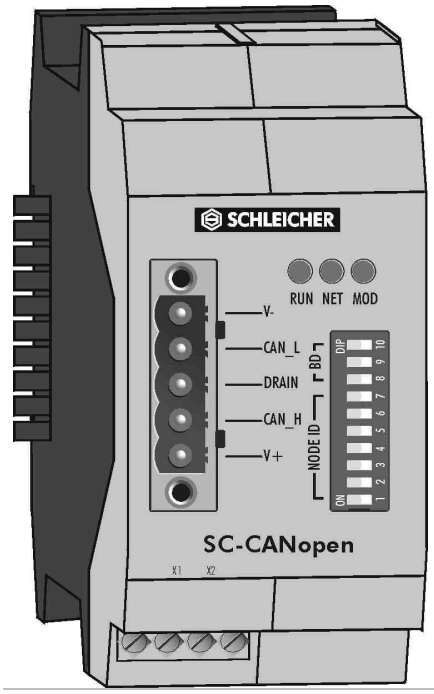
SAFETY CENTER Bus Coupler Module — SC-CANopen-A

PI 0117-0502 E



EN 954-1	Safety Category	4

Bus coupler module for the modular Safety Center (SC) safety control unit for emergency-off, safety door applications and selenoid-operated switch monitoring.

- diagnostics through CANopen fieldbus
- baud rate up to 1000 kBaud
- 27 bytes SC system information
- 2 outputs for remote start of the SC system

Equipment Description

The SC-CANopen bus coupler module is mounted in a 45 mm wide rack designed for 35 mm standard rails according to EN 50022. The device is equipped with a plug-in screw-type terminal block.
Power is supplied through the internal SC bus.

Features

- Not a safety-related bus coupler.
- Operation with one Master.
- SC-CANopen can be shut down during bus operation. The operation of other Slaves can be continued.
- Slave addresses (NODE Ids) can be entered from 1 – 127.
- Each bus coupler module has a device-specific identification number.
- Transfers max. 27 bytes SC System information.
- 2 outputs (short-circuit-proof) for Safety Center control (remote start).

Functional Description

The SC-CANopen bus coupler module provides the user with 27 bytes (depending on configuration and number of SCI) SC system information from the Safety Center. This information can be transferred through the CANopen to other bus subscribers (e.g., PLC). The system information includes input levels for all SC modules, error messages and status information.

Proper Use / Intended Purpose

The SC-CANopen is the bus for the CANopen fieldbus in the modular Safety Center control unit.
The Safety Center is used to monitor signal transmitters, e.g., emergency-off momentary contact switches, position switches, etc., that are used as safety devices on machinery for the protection of people, material and equipment.
To achieve the protection function, safe outputs are switched on or off depending on the state of the signal transmitter. These safe outputs are turned off to avoid hazardous situations around the machinery. The control can be used for applications with stop categories 0 and 1 according to EN 60204-1.
A Safety Center consists of one basic module type SCB for a supply voltage of 24 VDC, at least one (maximum 4) input module(s) type SCI, and one bus coupler module (if necessary).
A connector is integrated into the housing to provide the connection between modules.

Assembly

Place the SC-CANopen on the standard rail and lock it in. The standard rail must be connected with protection earth (PE) conductor. Connect the basic module and the input modules with the SC-CANopen. It is very important that a solid connection is ensured in the finished installation (e.g., using rail stop elements).
Then the SC-CANopen must be connected to the fieldbus and the basic module (if applicable).
The Safety Center must be installed in a control cabinet with a protection type of at least IP54.

Disassembly

See Safety Instructions!
Remove the wires by pulling out the plug-in terminal and the fieldbus cable.
Push apart the modules on the standard rail until the module connector is accessible. Release the standard rail lock at the bottom of the device and remove the module.

Note

The safety category according to EN 954-1 depends on external wiring, the selected command source, and the local layout at the machinery.

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Configuring CANopen

Pre-defined connection set

When you start up RPDO1 and TPDO1 are available with the following default IDs:
RPDO1 = 200h + Node ID
TPDO1 = 180h + Node ID
The other T/RPDOs do not have a default ID. They will be assigned automatically by a configurator when the devices are configured.
The TPDOs for the digital inputs will be sent when the input signals have changed (change of status, asynchronous depending on device profile).

Node guarding

Node guarding allows the network administrator to detect a failed slave. To detect a failed slave the master sends messages to the guarding ID (100Eh) of the slave in periodic cycles. The slave replies with a guarding message which also includes a toggle bit.

Life guarding

While node guarding is used by network administrators to detect a failed slave, the slave uses guarding telegrams to detect a failed master. This monitoring function of the slave is called life guarding.

To detect a broken cable the node and life guarding functions must be activated.

To activate life guarding the master must describe the Guard Time (100Ch) and the Life Time Factor (100Dh) objects. If the monitoring time resulting from
*Life Time = Life Time Factor * Guard Time [ms]*
expires before the slave receives a guarding telegram, the module activates the green NET led flashing.
If one of the above mentioned objects is 0, no life guarding and thus no cable break detection is carried out.

System Bytes and PDO Default Mapping

Modul	SC Configuration				System Bytes / PDO / SDO Mapping					
	1	2	3	4	In	TPDO*	SDO	Out	RPDO	SDO
SCB	x	x	x	x	BAD	TPDO1	6000,1	PBOUT	RPDO1	6200,1
					BKD		6000,2			
					BSD		6000,3			
SCI (Add. 0)	x	x	x	x	EED0_A	TPDO3	6000,4			
					EED0_B		6000,5			
					EFD0_A		6000,6			
					EFD0_B		6000,7			
					EKD0_A		6000,8			
					EKD0_B		6000,9			
SCI (Add. 1)		x	x	x	EED1_A	TPDO4	6000,10			
					EED1_B		6000,11			
					EFD1_A		6000,12			
					EFD1_B		6000,13			
					EKD1_A		6000,14			
					EKD1_B		6000,15			
SCI (Add. 2)			x	x	EED2_A	TPDO5	6000,16			
					EED2_B		6000,17			
					EFD2_A		6000,18			
					EFD2_B		6000,19			
					EKD2_A		6000,20			
					EKD2_B		6000,21			
SCI (Add. 3)				x	EED3_A	TPDO6	6000,22			
					EED3_B		6000,23			
					EFD3_A		6000,24			
					EFD3_B		6000,25			
					EKD3_A		6000,26			
					EKD3_B		6000,27			

* TPDO2 reserved

The SCI modules must be installed with an ascending address sequence (0 - 1 - 2 - 3).

Output Data

One byte digital output data is transmitted. Only inputs (SA4 resp. SB4) of the SCB (SC basic module) can be connected to this outputs. All other loads are not permitted. Mind: A H/L-signal to the SA4 resp. SB4 starts the SCB.

byte structure **PBOUT**

bit	7	6	5	4	3	2	1	0
	x	x	x	x	x	x	0	0

bit 0 ⇒ output X1
bit 1 ⇒ output X2
bit 2 to bit 6 ⇒ not used

Input Data

Max 27 byte input data are transmitted.

byte structure **BAD**

bit	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0

bit 0-3 ⇒ error Input Module address 0-3
bit 4 ⇒ error Basic Module
bit 5 ⇒ error feedback circuit
bit 6 ⇒ 0 = enable current paths of group A open
1 = enable current paths of group A closed
bit 7 ⇒ 0 = enable current paths of group B open
1 = enable current paths of group B closed

byte structure **BKD**

bit	7	6	5	4	3	2	1	0	
	0	0	1	0	0	0	0	0	20h ⇒ 0 s
	0	0	0	1	0	0	0	0	10h ⇒ 0.5 s or 5 s
	0	0	0	0	1	0	0	0	08h ⇒ 1.0 s or 10 s
	0	0	0	0	0	1	0	0	04h ⇒ 1.5 s or 15 s
	0	0	0	0	0	0	1	0	02h ⇒ 2.0 s or 20 s
	0	0	0	0	0	0	0	1	01h ⇒ 3.0 s or 30 s

byte structure **BSD**

bit	7	6	5	4	3	2	1	0
	0	0	0	0	0	0	0	0

bit 0 ⇒ level to terminal SA4 of the SCB
bit 1 ⇒ operation 1: AB 0: A/B
bit 2 ⇒ level to terminal YA2 of the SCB
bit 3 ⇒ level to terminal YA3 of the SCB
bit 4 ⇒ level to terminal SB4 of the SCB
bit 5 ⇒ enter button 1: inactive 0: active
bit 6 ⇒ level to terminal YB2 of the SCB
bit 7 ⇒ level to terminal YB3 of the SCB

byte structure **EED**

input	8	7	6	5	4	3	2	1	
	0	0	0	0	0	0	0	0	⇒ 8

0 ⇒ L level
1 ⇒ H level

byte structure **EFD**

input pairs	8+7		6+5		4+3		2+1		
	0	0	0	0	0	0	0	0	⇒ 4

00 ⇒ no error
01 ⇒ synchronous timeout
10 ⇒ sequence error
11 ⇒ bridge-fault (in case of bridge-fault all data pairs are set to 11)

byte structure **EKD**

bit	7	6	5	4	3	2	1	0	
	0	0	1	0	0	0	0	0	20h ⇒ switch position 1
	0	0	0	1	0	0	0	0	10h ⇒ switch position 2
	0	0	0	0	1	0	0	0	08h ⇒ switch position 3
	0	0	0	0	0	1	0	0	04h ⇒ switch position 4
	0	0	0	0	0	0	1	0	02h ⇒ switch position 5
	0	0	0	0	0	0	0	1	01h ⇒ switch position 6

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LED Indicators

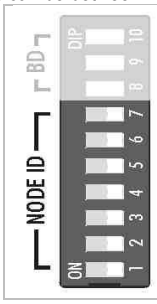
LED	Color	Status	Meaning
RUN	Green	ON	The bus coupler processor is running.
NET (network status)	Green	ON	CANopen status: Operational (PDO + SDO Data Exchange)
		Flashing	CANopen status: Pre-Operational (SDO Data Exchange)
	Red	ON	CAN status: Bus OFF, CAN bus cannot be accessed without any errors. Possible causes for errors: No 24V supply to bus connector. Incorrect baud rate selected. Cables in network are incorrectly wired. Another CAN controller in the network has a hardware error
		Flashing	Node guarding has failed (NMT master no longer monitors the slave)
MOD (module status)	Green	ON	CANopen ready
		Flashing	After cable break

Examples of error states

MOD Green / NET Red	No field bus cable connected or no 24V on bus connector.
MOD Green / NET Flashing Green	CANopen ready, 24V on bus connector but no other CAN controller available or the NMT master does not give the operational instruction.

DIP Switch NODE ID

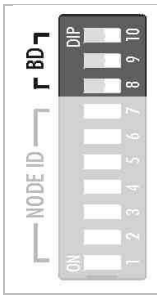
The node number (NODE ID) is set using DIP switches 1 to 7. The node number is set using a binary value. DIP1 is the lowest bit (2^0) and DIP7 is the highest bit (2^6). Node numbers can be between 1 and 127. Example of node numbers 1, 5 and 127



NODE ID	DIP1	DIP2	DIP3	DIP4	DIP5	DIP6	DIP7
1	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF	OFF
...							
127	ON	ON	ON	ON	ON	ON	ON

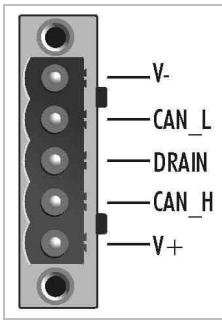
DIP Switch BD (BAUD)

The baud rate is set using DIP switches 8 to 10.



Baud rate in kBaud	DIP8	DIP9	DIP10
125	OFF	OFF	OFF
125	ON	OFF	OFF
125	OFF	ON	OFF
125	ON	ON	OFF
250	OFF	OFF	ON
500	ON	OFF	ON
800	OFF	ON	ON
1000	ON	ON	ON

Pin-Assignment BUS Interface



1	V-	Ground / 0V
2	CAN_L	CAN Low
3	DRAIN	Shield connection optional
4	CAN_H	CAN High
5	V+	Power supply Rated value +24V DC (+18V to +30V)

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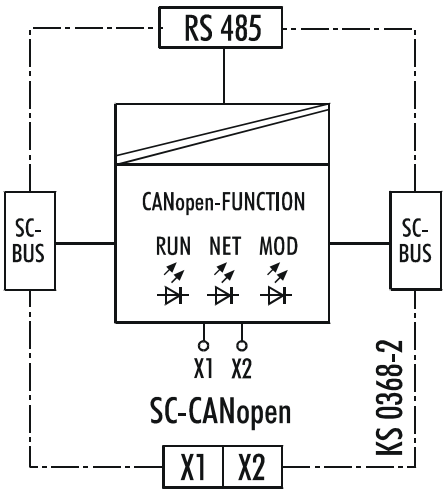
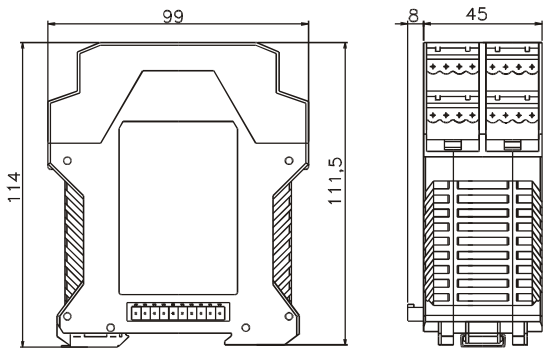
Specifications

Supply Circuit	
rated voltage U_N, DC	24 VDC (through SC-Bus)
residual ripple	2.4 Vpp
rated power	3.5 W
operating range, U_{bmin}, U_{bmax}	0.85 to 1.1 U_N
Electrical Safety	
air and leakage paths	DIN VDE 0110 –1: 1997-04
over-voltage category	III
contamination level	2 internal, 3 external
rated voltage	24 V
housing / terminals protection type (DIN EN 60529: 2000-09)	IP 40/ IP 20
DC isolation supply circuit / interface	yes
Output Circuits X1, X2	
semiconductor	short-circuit-proof
rated output voltage	24 VDC
rated current	10 mA
Interfaces	
interface level	RS 485
connection technology	CANopen (Open Style Connector, 5 srew terminals)
Climatic Conditions	
ambient operating temperature	-25 to +50 °C
storage temperature	-25 to +70 °C
relative humidity	30 to 95 % non-condensing
climatic application class (DIN 40040)	H V F
Dimensions	
weight	0.18 kg
size HxWxD	99 x 53 x 117
Removable Terminals X1, X2	
1-wire or fine wire	1 x 0.14 mm² to 2.5 mm² 2 x 0.14 mm² to 0.75 mm²
fine wire with wire-end sleeve acc. to DIN 46228	1 x 0.25 mm² to 2.5 mm² 2 x 0.25 mm² to 0.5 mm²
max. torque	0.5 to 0.6 Nm
for UL and CSA approbations	Use only copper wire AWG 18-16
max. torque	5.25 lbs-in

Connection Diagram



Dimensional Diagram S9-3 device type -A



Subject to changes

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