OPERATING MANUAL

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SCS200

E-T-A®

ENGINEERING TECHNOLOGY

CONTENT

CONTENT

1. GENERAL INFORMATION

1.1 Safety instructions

This manual points out possible danger for your personal safety and gives instruction how to avoid property damage. The following safety symbols are used to draw the reader's attention to the safety instructions included in this manual.

Danger
There is a threat to life or health unless the following safety measures are observed.

Warning
Danger to man, machinery, materials or the environment unless the following safety measures are observed.

Caution
Danger of damaging the product or machinery and materials unless the following safety measures are observed.

Note
Information is provided to allow a better understanding.

For general safety instructions please see the overview included in the shipment.

1.2 Qualified personnel

This user manual must exclusively be used by qualified personnel. These are persons who – based on their training and experience – are able to detect arising problems when handling the product and to avoid related hazards. These persons have to ensure that the use of the product described here meets the safety requirements as well as the requirements of the presently valid directives, standards and laws.

1.3 Use

The product is part of a continuous enhancement process. Therefore, there might be deviations between the product in hand and this documentation. These deviations will be remedied by a regular review and resulting corrections in future editions. If the documentation contains technical or spelling errors, we reserve the right to make corrections without prior notice.

1.4 Delivery state

The product is supplied with a defined hardware and software configuration. Any changes in excess of the documented options are not permitted and lead to liability exclusion.

2. INTRODUCTION

2.1 SCS200 intelligent power distribution

Intelligent and complex systems and the electrification of loads currently play a decisive role in the development of on-board electrical systems.

The SCS200 is the right answer to these requirements. The intelligent power distribution system enables decentralized control and monitoring of loads via the CAN bus. It is based on board-based power distribution in a compact IP66/IP67 enclosure.

SCS200 modules are plug & play solutions which help reduce wiring time and space requirements. Its comprehensive diagnosis capability (integral load protection, output current and voltage measuring, output status) and its integral CAN connection enable predictive maintenance and implemented load management.

The SCS200 has been specially developed for use in agricultural machinery, construction machinery, special vehicles, buses and trucks. It enables decentralized ECU control of high current devices that exceed the ECU's own power capabilities.

In addition to power distribution, the SCS200 provides greater transparency on the output side by providing feedback on actual current and voltage values. The integrated electronic load protection guarantees additional safety. The analogue inputs of the SCS200 are ideal for making nearby sensor readings accessible to all nodes on the CAN bus.

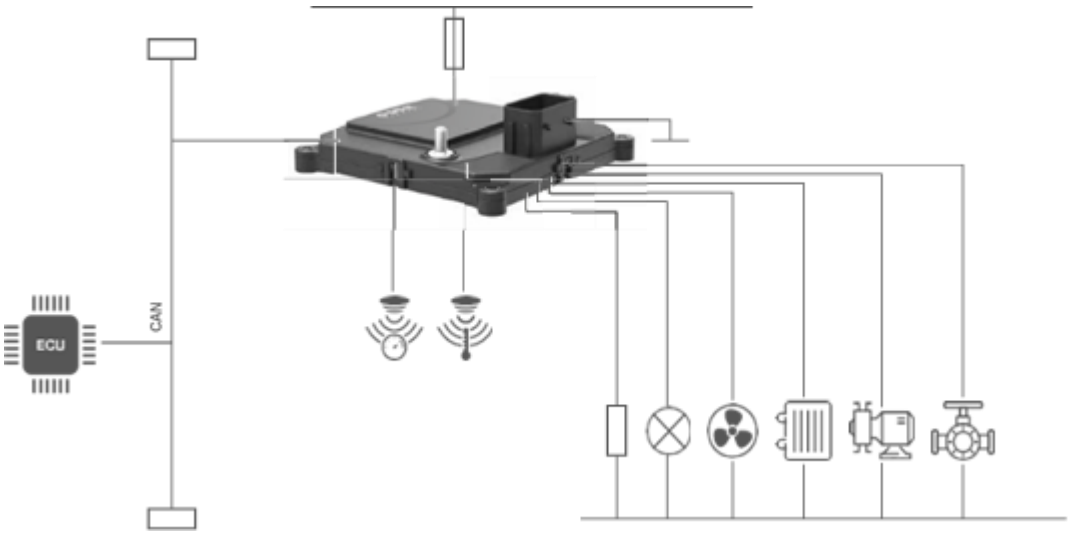


Figure 1 Example of the SCS200 in a vehicle

The SCS200 is available in both SAEJ1939 and CANopen compatible versions. The module allows uncomplicated and quick system extensions or complete vehicle or machinery modernization. Figure 1 shows an example of how the SCS200 can be integrated in the on-board electrical system.

3. MOUNTING METHOD AND CONNECTION

3.1 General information

Please ensure sufficient space for the mating plugs of the output terminals (Figure 2) for the relay version, this must also be observed for removing the cover.

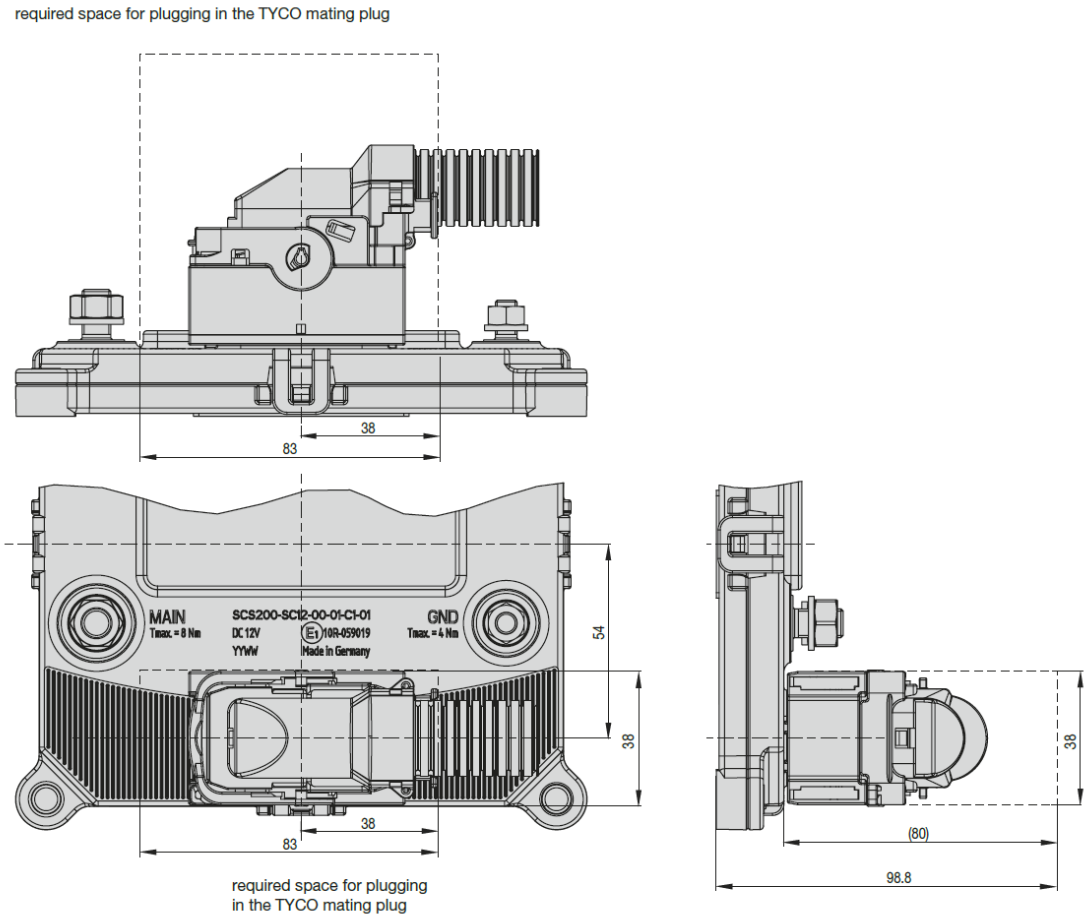


Figure 2: Required space for plugging in the Tyco mating plug

3.2 Mounting the module

The device must be firmly mounted before connecting the cables. For this purpose, the module has four screw eyes with a grid dimension of 142 mm. This allows the module to be mounted on the mounting surface in four positions,

each rotated by 90°. Please take this into account when laying your cables. Please use M6 fastening screws for installation (tightening torque max. 6 Nm). The mounting material is not included in the scope of delivery.

In addition, the semiconductor versions can be mounted in any position, while the relay version must not be mounted with the cover facing downwards to prevent the components from loosening.

3.3 Cable connection main supply

Main connections
UBat: M8 screw terminal (marking: MAIN)
GND: M6 screw terminal (marking: GND)

M8 and M6 hexagon nuts and corresponding washers for the MAIN and GND terminals are supplied with the SCS200.

All connection cables must be firmly fixed with suitable means within 7 cm from the axis of the stud connection. Any excessive mechanical strain must be avoided.

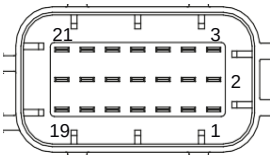
Please provide additional upstream protection against overload in the supply line (battery +) according to the max. current. In the event of overload, the machine may be damaged.

3.4 Cable connection load outputs

All versions of the SCS200 use the following connectior.

21-pin connector

Mating plug: Tyco AMP
LEAVYSEAL 1-1534127-1



The corresponding pin assignment can be found in Chapter 4.

The following cable cross-sections are recommended in accordance with DIN EN 60947-1:

	SCS200-RC…	SCS200-SC… 12V	SCS200-SC… 24V	SCS200-SC… 48V
Cross section of main terminal:	≥ 50 mm² ≥ AWG1	≥ 50 mm² ≥ AWG0	≥ 50 mm² ≥ AWG1	≥ 35 mm² ≥ AWG3
30 A channels	≥ 4 mm² ≥ AWG12	≥ 4 mm² ≥ AWG12		
25 A channels			≥ 4 mm² ≥ AWG12	
15 A channels				≥ 2.5 mm² ≥ AWG12
10 A channels	≥ 1.5 mm² ≥ AWG15	≥ 1.5 mm² ≥ AWG15	≥ 1.5 mm² ≥ AWG15	≥ 1.5 mm² ≥ AWG15

Table 1: Cable connection load outputs

The cross section must be adjusted to the actual current, the cable length and the operating temperature conditions. The temperature behavior of the device improves with larger cross sections.

When using inductive loads, it is mandatory to use an appropriately rated flyback diode for this load to prevent the module from severe damage.

4. HARDWARE OPTIONS

The SCS200 is available in two main variants, which differ primarily in the design of the switching elements. These are the semiconductor version and the relay version, which are described in more detail below. Furthermore, each main variant is available in different versions for different voltage ratings.

All versions of the SCS200 feature the same housing footprint to allow ease of replacement. Only the pin assignment may differ slightly between the versions. See the following pages of this chapter for more information.

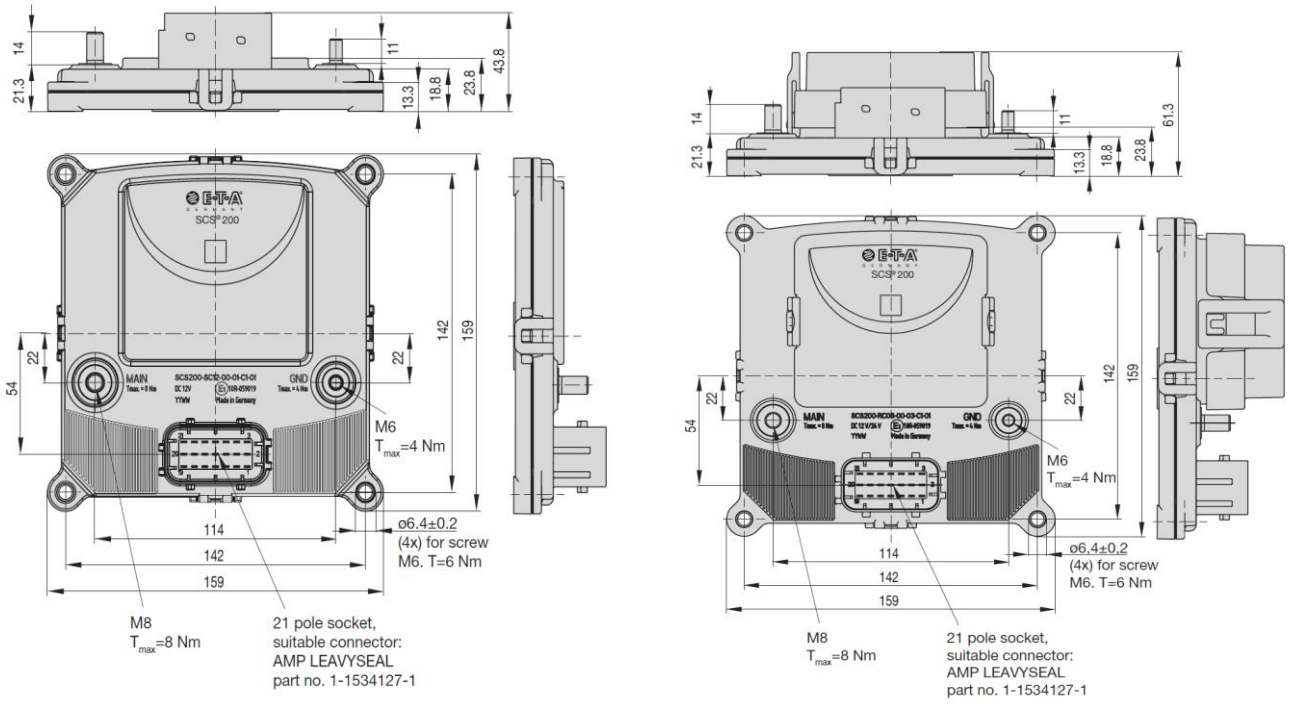


Figure 3: Dimensions SCS200-SC… (left) and SCS200-RC...(right)

4.1 Semiconductor version SCS200-SC…

The semiconductor version SCS200-SC... of the SCS200 intelligent power distribution system switches outputs via HSD power semiconductors. The module receives its switch commands via the CAN bus. In the event of an overload, the channel will be switched OFF automatically. Via a CAN message, the channel can be switched ON again remotely.

The voltage values at the six analogue inputs of the device can be read in via CAN messages. A wake pin can be used to wake the module from sleep mode via the hardware. The fully electronic version is available for 12 VDC both with 8 or 12 load outputs. For 24 VDC and 48VDC versions always have 12 load outputs.

4.1.1 Pin assignment SCS200-SC08… 12V

Pin	Name	Description
1	n.c.	not connected
2	OUT_8	10 A
3	OUT_4	30 A
4	n.c.	not connected
5	IN_A_1	Analogue input 1 / PMA 1
6	OUT_7	10 A
7	n.c.	not connected
8	IN_A_3	Analogue input 3 / PMA 3
9	OUT_3	30 A
10	n.c	not connected
11	IN_A_4	Analogue input 4

Pin	Name	Description
12	OUT_6	10 A
13	IN_A_2	Analogue input 2 / PMA 2
14	IN_A_5	Analogue input 5
15	OUT_2	30 A
16	IN_A_6	Analogue input 6
17	WAKE_SIGNAL_IN	CAN wake up input
18	OUT_5	10 A
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	OUT_1	30 A

Table 2: Pin assignment SCS200-SC08...

4.1.2 Pin assignment SCS200-SC12... 12V

Pin	Name	Description
1	OUT_9	10 A
2	OUT _8	10 A
3	OUT _4	30 A
4	OUT _10	10 A
5	IN_A_1	Analogue input 1 / PMA 1
6	OUT _7	10 A
7	OUT _11	10 A
8	IN_A_3	Analogue input 3 / PMA 3
9	OUT _3	30 A
10	OUT _12	10 A
11	IN_A_4	Analogue input 4

Pin	Name	Description
12	OUT _6	10 A
13	IN_A_2	Analogue input 2 / PMA 2
14	IN_A_5	Analogue input 5
15	OUT _2	30 A
16	IN_A_6	Analogue input 6
17	WAKE_SIGNAL_IN	Wake up input
18	OUT _5	10 A
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	OUT _1	30 A

Table 3: Pin assignment SCS200-SC12... 12V

4.1.3 Pin assignment SCS200-SC12… 24V

Pin	Name	Description
1	OUT _9	10 A
2	OUT _8	10 A
3	OUT _3	10 A [1]
4	OUT _10	10 A
5	IN_A_1	Analogue input 1 / PMA 1
6	OUT _7	10 A
7	OUT _11	10 A
8	IN_A_3	Analogue input 3 / PMA 3
9	OUT _6	10 A
10	OUT _12	10 A
11	IN_A_4	Analogue input 4

Pin	Name	Description
12	OUT _4	10 A
13	IN_A_2	Analogue input 2 / PMA 2
14	IN_A_5	Analogue input 5
15	OUT _2	15 A / 15A
16	U-Control	Logic Supply
17	WAKE_SIGNAL_IN	Wake up input
18	OUT _5	10 A
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	OUT _1	25A

Table 4: Pin assignment SCS200-SC12... 24V

4.1.4 Pin assignment SCS200-SC12… 48V

Pin	Name	Description
1	OUT _9	10 A
2	OUT _8	10 A
3	OUT _3	15A
4	OUT _10	10 A
5	IN_A_1	Analogue input 1 / PMA 1
6	OUT _7	10 A
7	OUT _11	10 A
8	IN_A_3	Analogue input 3 / PMA 3
9	OUT _6	10 A
10	OUT _12	10 A
11	IN_A_4	Analogue input 4

Pin	Name	Description
12	OUT _4	10 A
13	IN_A_2	Analogue input 2 / PMA 2
14	IN_A_5	Analogue input 5
15	OUT _2	15A
16	U-Control	Logic Supply
17	WAKE_SIGNAL_IN	Wake up input
18	OUT _5	10 A
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	OUT _1	15A

Table 5: Pin assignment SCS200-SC12... 48V

The SCS200 has the following protection against reverse polarity:

- Main terminals U_{Bat} to GND: reverse polarity non-conductive
- Load outputs to GND: reverse polarity conductive

[1] Reducing the total current to 100 A allows the use of load output 3 with 25 A.

4.1.5 Inductive loads

The SCS200 has the ability to switch the following inductive loads.

SCS200-SC… 24V: L/R ≤ 2ms
SCS200-SC… 48V: L/R ≤ 1ms

For all other inductive loads, it is mandatory to use an appropriately rated flyback diode for this load to prevent the module from severe damage.

4.2 Relay version SCS200-RC…

The SCS200-RC... relay version of the SCS200 intelligent power distribution system switches connected loads via electromechanical or semiconductor relays in ISO Micro design. Each relay also has an upstream fuse. The module receives its switch commands via the CAN bus.

The relay version SCS200-RC... has a removable cover to allow access to the relay and fuse blocks. The product is supplied unpopulated and can be populated by the customers, depending on the application. In addition, E-T-A offers suitable relays and fuses as accessories. As with the SCS200 semiconductor version, an internal current measurement also enables electronic load protection within the relay version. In the event of an overload, the channel will be switched OFF automatically. Via a CAN message, the error can be reset, and the channel can be switched ON again remotely. The fuses only serve as back-up elements that ensure galvanic isolation in the worst-case scenario. The relay version provides a signal of the present load current via CAN bus.

The current load current is reported via the CAN bus for the relay version.

The voltage values at the device's six analogue inputs can be read in via CAN messages.

A wake pin can be used to wake the module from sleep mode via the hardware.

The SCS200 version with relay and fuse blocks in an IP66/67 enclosure is a12/24 VDC device and available with 8 load outputs.

4.2.1 Pin assignment SCS200-RC08… 12V / 24V

The following table shows the pin assignment of the SCS200 relay version with 8 load outputs.

Pin	Name	Description
1	n.c.	not connected
2	OUT _8	10 A
3	OUT _4	30 A
4	n.c.	not connected
5	IN_A_1	Analogue input 1 / PMA 1
6	OUT _7	10 A
7	n.c.	not connected
8	IN_A_3	Analogue input 3 / PMA 3
9	OUT _3	30 A
10	n.c	not connected
11	IN_A_4	Analogue input 4

Pin	Name	Description
12	OUT _6	10 A
13	IN_A_2	Analogue input 2 / PMA 2
14	IN_A_5	Analogue input 5
15	OUT _2	30 A
16	IN_A_6	Analogue input 6
17	WAKE_SIGNAL_IN	CAN wake up input
18	OUT _5	10 A
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	OUT _1	30 A

Table 6: Pin assignment SCS200-RC...

The SCS200 has the following protection against reverse polarity:

- Main terminals U_{Bat} to GND: reverse polarity non-conductive
- Load outputs to GND: depending on relays fitted

4.2.2 Recommended relays and fuses for SCS200-RC…

We recommend using the following or similar fuses for insertion in the SCS200 relay version:

30 A channels: 40 A fuse from ESKA/MTA (art. no.: 340.035)
10 A channels: 15 A fuse from ESKA/MTA (art. no.: 340.029)

We recommend using the following or similar relays for insertion in the SCS200 relay version:

U_{Bat} = 12 V: Channels 1-4: ESR10-NC2A4HB-00-D1-30A from E-T-A
Channel 5-8: ESR10-NC2A4HB-00-D1-10A from E-T-A

U_{bat} = 24 V: Channel 1-4: V23074-A2002-A403 from TE connectivity
Channel 5-8: ESR10-NC2A4HB-00-D2-10A from E-T-A

Please observe performance limits described in the data sheet when using the relays. Operation in excess of these values is not allowed. There is a risk of damaging the relays and resulting burns when touching.

When mounting the relays, the max. allowed number of plug-in operations of the terminals must not be exceeded. The number of plug-in cycles is limited to five cycles.

A simultaneous population of the relay version with 12V and 24V relays is not allowed and may cause damages to the relay and resulting burns when touching.

4.2.3 Relay assignment SCS200-RC08-…

Figure 4 shows the component assignment of the SCS200 relay version with 8 load outputs.

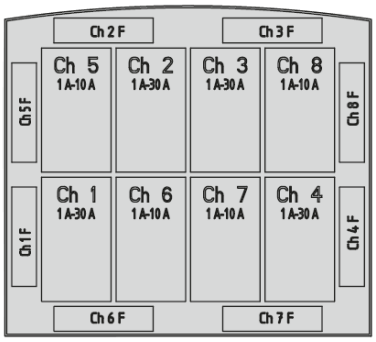


Figure 4: SCS200-RC... relay assignment

4.2.4 Status LEDs SCS200-RC-…

The relay version has status LEDs on the circuit board, below the cover. These LEDs indicate the status of the CAN bus. The following statuses are visualised:

- Red: Bus error, communication is faulty
- Green: CAN Life, communication is running without errors

In sleep mode, the green status LED is automatically deactivated.

If required, the green status LED of the module can be deactivated via a CAN message to save additional energy.

4.3 Analogue inputs

The SCS200 provides up to 6 analogue inputs or sensor inputs. The specific number depends on the version of the SCS200 and if some of the inputs are used for PMA. For details, please refer to the pin assignment on previous pages.

The voltage applied to the inputs is read by the module and sent to other bus participants as a CAN message. For example, sensors that are installed near the module can be easily connected to the CAN bus via the analogue inputs. This allows cable lengths to be reduced and inputs on the ECU to be saved.

The analogue inputs of the SCS200 record a voltage range of 0 - 10 VDC.

Accuracy:	up to 5 V:	± 125 mV
	up to 10 V:	± 200 mV

Above 10 V the accuracy decreases. The analogue inputs of the SCS200 are internally protected against overvoltage.

The voltage values at the analogue inputs of the SCS200 are read by the module and sent within a CAN message. The module does however not process the data, e.g. switch the load outputs depending on the analogue inputs. This kind of data processing must be done by a superordinate control unit.

5. SOFTWARE AND DIAGNOSTIC FUNCTIONS

The SCS200 is a CAN-controlled power distribution board providing comprehensive diagnostic functions as well as current and voltage monitoring.

This product is a client module that is controlled by a superordinate control unit or ECU via the CAN bus. The SCS200 receives commands for switching the load outputs in the form of CAN frames and provides diagnostic data and measured values in the event of a change or on request. Logical links between the analogue inputs and the load outputs are not implemented in the device itself but are taken over by the superordinate control unit.

The SCS200 has an internal bootloader. If an update of the SCS200 firmware is necessary, please get in touch your E-T-A contact person.

5.1 Field bus connection

The SCS200 supports the CAN 2.0 standard and is available either as an SAE J1939 or CANopen compatible version. The product can therefore be used with other standard components in a J1939 or CANopen network without customisation or the use of gateways. By assigning an unambiguous ID or node address to the SCS200, it is possible to operate more than one module on the same bus. Figure 6 shows an example of the structure of a CAN network with SCS200 modules.

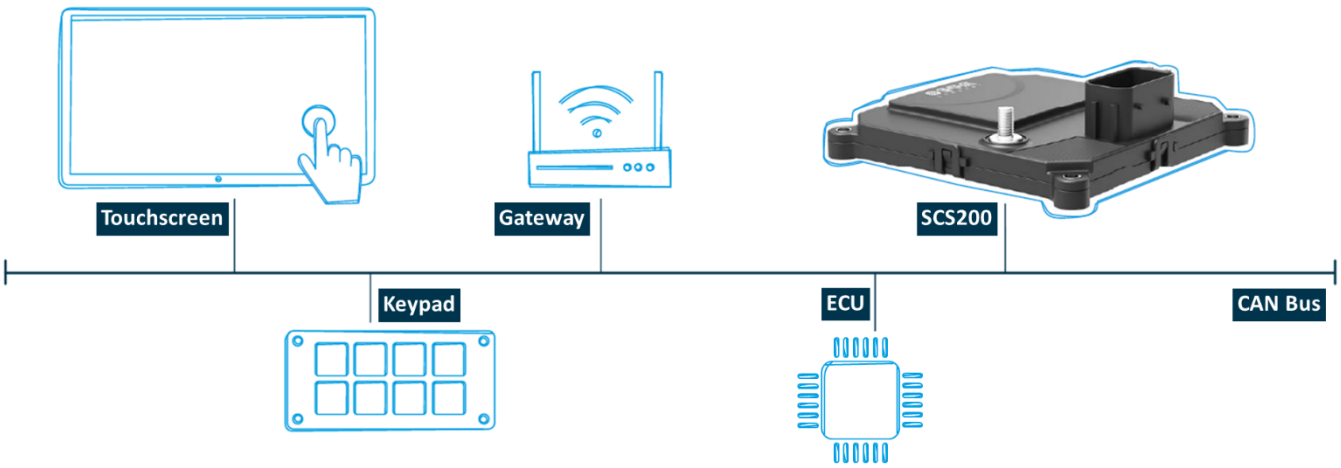


Figure 5: Example of a CAN network with an SCS200

The SCS200 can be configured without a special programming environment or associated software. Settings can be made using predefined CAN frames that are sent to the device via the bus. The configuration or initialisation of the module can therefore also be carried out directly by a superordinate control unit or ECU during vehicle production. A connection to a PC can also be established via a CAN-to-USB adapter. Messages from the module can be easily received and the SCS200 can be addressed using a standard CAN monitoring program.

5.2 Integral electronic load protection

Both the fully electronic SCS200-SC... versions and the SCS200-RC... relay versions have an electronic load protection.

It comprises the disconnection of the individual load outputs in the event of overcurrent or short circuit in a single channel as well as disconnection of all load outputs in the event of excess total current or overvoltage. The SCS200 signals the error condition via CAN message and the affected load output. Once the error has been rectified, the channels can be switched ON again via a corresponding CAN message (see 6.3.2.1.1 for J1939 and 6.5.3.2 for CANopen).

5.2.1 Configuration of the current rating per channel

In order to adjust the electronic load protection of the SCS200 to the actual power consumption of the connected loads, the current rating can be configured for each channel of the module. This is done via a dedicated CAN message.

The following current ratings can be configured per channel:

SCS200-SC… 12V SCS200-RC…							
Channel 1 – channel 4 (A)	5	7.5	10	15	20	25	30
Channel 5 – channel 12 (A)	1	2	3	4	5	7.5	10

SCS200-SC… 24V							
Channel 1 – channel 3 (A)	3	5	7.5	10	15	20	25
Channel 4 – channel 12 (A)	1	2	3	4	5	7.5	10

SCS200-SC… 48V								
Channel 1 – channel 3 (A)	1	2	3	4	5	7.5	10	15
Channel 4 – channel 12 (A)	1	2	3	4	5	7.5	10	-

The SCS200 is supplied in a standard configuration where the current ratings of all channels are set to the maximum value.

5.2.2 Overload disconnection per channel (Trip 1 and Trip 2)

Trip 1 (standard disconnection):

Disconnection of the load output in question in the event of an overload. This disconnection is implemented as standard and cannot be deactivated.

Trip current 1: 1.3 x I_N
Trip delay 1: 200 ms

Trip 2 (fast disconnection):

Disconnection of the respective load output in the event of a high overcurrent or short circuit. This disconnection can be deactivated on the software side by sending a corresponding CAN message to the module (6.3.1.6 and 6.5.2.2). By deactivating the trip 2 fast disconnection, premature tripping can be avoided when switching loads with higher inrush peaks.

Trip current 2:

SCS200-RC…								
Channel 1 – 4	Current rating (A)	5	7.5	10	15	20	25	30
	Trip current 2 (A)	15	22.5	30	45	52	52	52
Channel 5 – 8	Current rating (A)	1	2	3	4	5	7.5	10
	Trip current 2 (A)	3	6	9	12	15	21	21

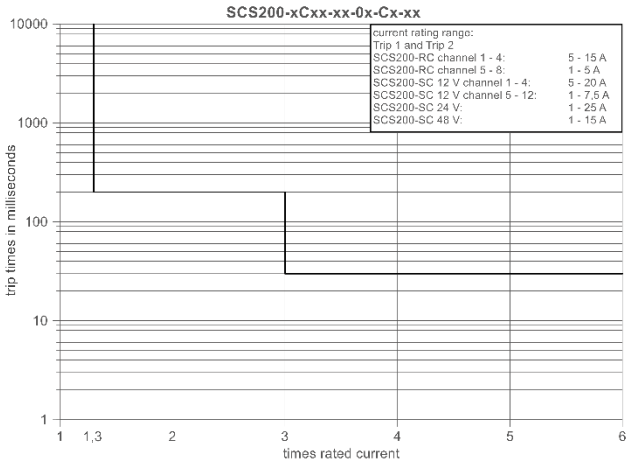
SCS200-SC… 12V								
Channel 1 – 4	Current rating (A)	5	7.5	10	15	20	25	30
	Trip current 2 (A)	15	22.5	30	45	60	60	60
Channel 5 – 12	Current rating (A)	1	2	3	4	5	7.5	10
	Trip current 2 (A)	3	6	9	12	15	22.5	22.5

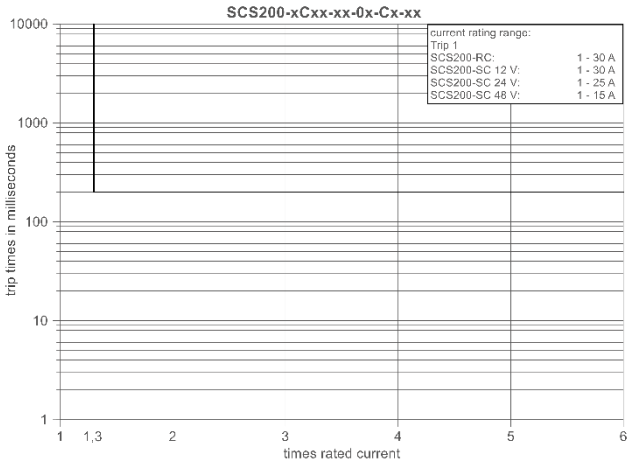
SCS200-SC… 24V								
Channel 1 – 3	Current rating (A)	3	5	7.5	10	15	20	25
	Trip current 2 (A)	9	15	22.5	30	45	60	75
Channel 4 – 12	Current rating (A)	1	2	3	4	5	7.5	10
	Trip current 2 (A)	3	6	9	12	15	22.5	30

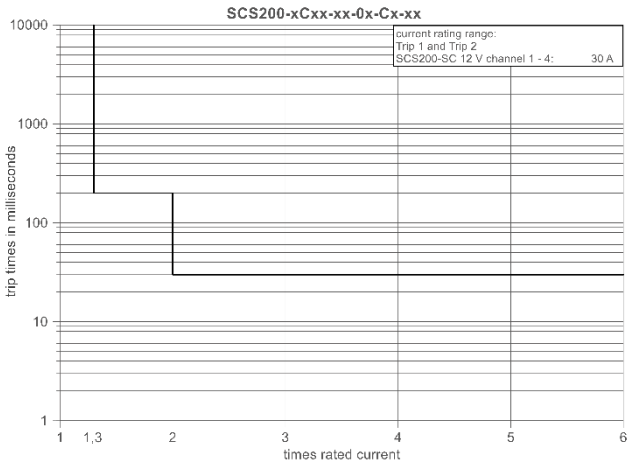
SCS200-SC… 48V									
Channel 1 – 3	Current rating (A)	1	2	3	4	5	7.5	10	15
	Trip current 2 (A)	3	6	9	12	15	22.5	30	45
Channel 4 – 12	Current rating (A)	1	2	3	4	5	7.5	10	
	Trip current 2 (A)	3	6	9	12	15	22.5	30	

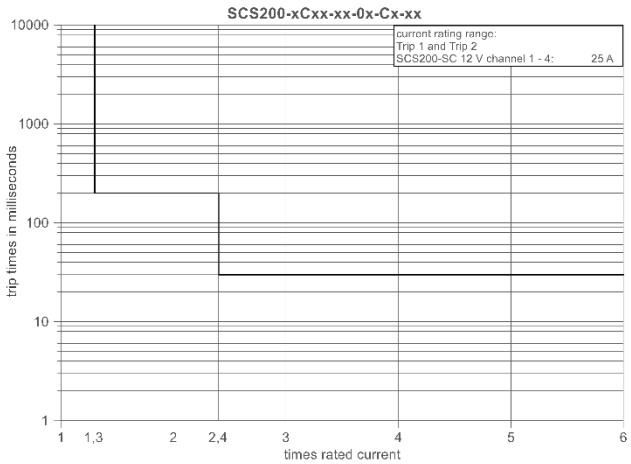
Trip delay 2: 30ms

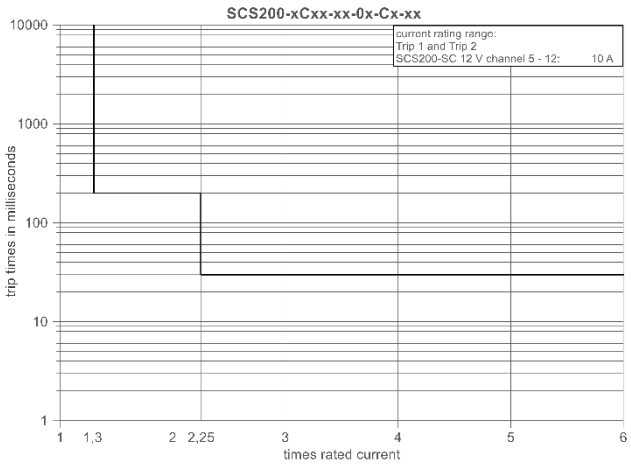
Trip curves

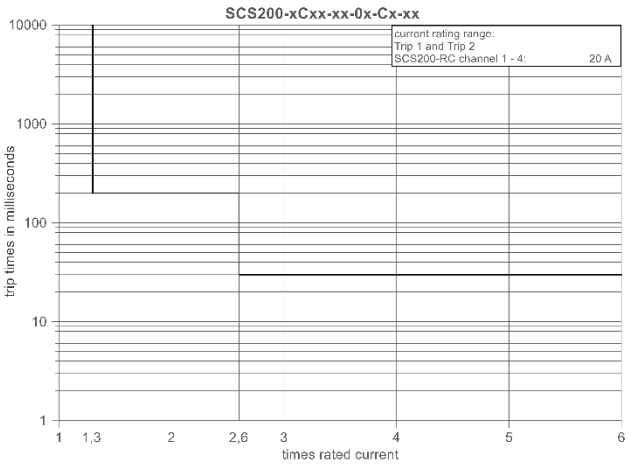


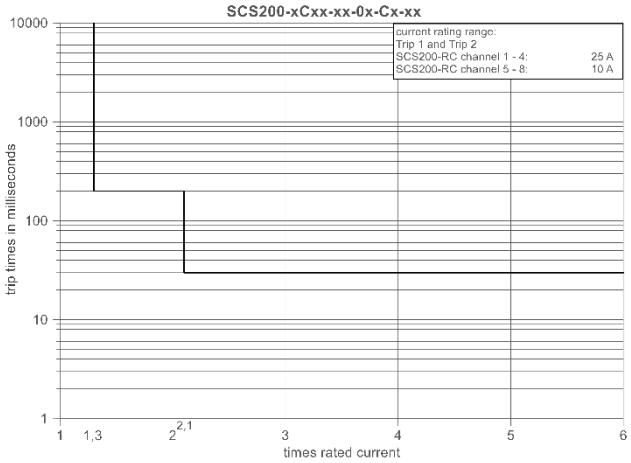


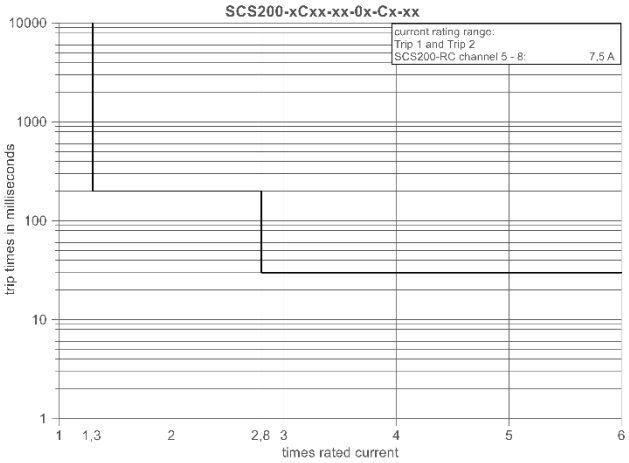












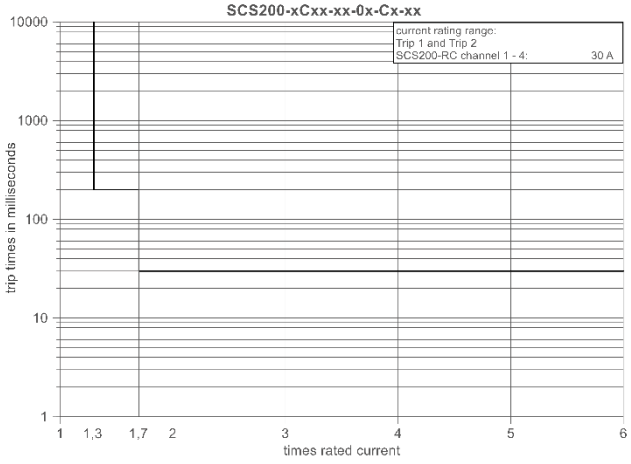


Figure 6: Overview of trip curves

Semiconductor self-protection

The SCS200 uses intelligent semiconductors with integrated self-protection. Due to that it my happen in some cases, the SCS200 detects an open load instead of an overcurrent. This can happen with very high short-circuit currents, as the used semiconductors have an integrated self-protection. Depending on the level of the short-circuit current, the switch-off by the self-protection may be faster than the regular overcurrent detection, in which case the µC detects an open load accordingly, as it still assumes the switching state ON.

The SCS200 was designed and tested for the following short circuit resistances:

SCS200-RC…:	depending on equipped relay
SCS200-SC… 12V:	30A Channel: > 100A @ 16V
	10A Channel: > 60A @ 16V
SCS200-SC… 24V:	25A Channel: > 100A @ 32V
	10A Channel: > 60A @ 32V
SCS200-SC… 48V:	15A Channel: > 90A @ 52V
	10A Channel: > 60A @ 52V

5.2.3 Overload disconnection total current and U_{Bat}

In the event of excess total current across the module, the load outputs of SCS200 are disconnected. This is the case for the following currents.

- SCS200-RC08...: Disconnection at total current > 120 A
- SCS200-SC08... 12V: Disconnection at total current > 120 A
- SCS200-SC12… 12V: Disconnection at total current > 150 A
- SCS200-SC12... 24V: Disconnection at total current > 120 A
- SCS200-SC12... 48V: Disconnection at total current > 90 A

The SCS200 will still be able to communicate if the outputs are disconnected because of excess total current.

The loads are also disconnected if the supply voltage is too low, too high or the voltage on the channel is too high.

- SCS200-RC...: 7 V > U_{Bat} > 33 V (complete disconnection of the module at U_{Bat} > ~34 V)
- SCS200-SC… 12V: 7 V > U_{Bat} > 17 V
- SCS200-SC… 24V: 7 V > U_{Bat} > 33 V
  8.5 V > $U_{Control}$ > 33 V
- SCS200-SC… 48V: 7 V > U_{Bat} >55 V
  8.5 V > $U_{Control}$ > 33 V

Either overload or over-/undervoltage disconnection delay is 200ms. The corresponding CAN message (see 6.3.3.7) is sent accordingly.

The SCS200 will still be able to communicate if the voltage is lower than the thresholds mentioned above. If the voltage is decreased further the SCS200 will lose the ability to communicate. The threshold depends on tolerances as well as environment and age.

The SCS200 will still be able to communicate if the voltage is higher than the thresholds mentioned above. If the voltage is increased further the SCS200 may be damaged.

5.3 Diagnostic information

The SCS200 provides comprehensive diagnostic functions via the CAN bus. These are described in detail in the following. An addition to current and voltage measurements, the temperature of the SCS200 module is determined and made available to the user.

5.3.1 Current measurement

The SCS200 measures the current per load output as well as the current total current of the module and provides these values via the CAN bus. This allows loads to be monitored precisely at any time and any necessary measures for load management and predictive maintenance to be derived.

- Measuring accuracy load current per channel: ± 0.5 A
- Measuring accuracy total current: ± 3 A

Reliable and precise measurement is ensured for the following current ratings:

- SCS200-RC…: Channels 1 - 4 (I_N = 5 A - 30 A): Load currents > 4.5 A
  Channels 5 - 8 (I_N = 1 A - 10 A): Load currents > 1.5 A
- SCS200-SC12… 12V: Channels 1 - 4 (I_N = 5 A - 30 A): Load currents > 6 A
  Channels 5 - 12 (I_N = 1 A - 10 A): Load currents > 1.5 A
- SCS200-SC12… 24V: Channels 1 - 3 (I_N = 3 A - 25 A): Load currents > 3 A
  Channels 4 - 12 (I_N = 1 A - 10 A): Load currents > 1.5 A
- SCS200-SC12… 48V: Channels 1 - 3 (I_N = 1 A - 15 A): Load currents > 1.8 A
  Channels 4 - 12 (I_N = 1 A - 10 A): Load currents > 0.9 A

The measurement accuracy cannot be guaranteed over the entire life cycle of the device.

5.3.2 Voltage measuring

The SCS200 provides current measured values for the supply voltage and the voltage applied to the load outputs via the CAN bus. These values can also be analysed to implement load management.

Measuring accuracy of voltage measurement @ U_{Bat}: ± 3 %

The measurement accuracy cannot be guaranteed over the entire life cycle of the device.

5.3.3 Output status and error diagnosis

The SCS200 provides feedback in the form of CAN frames about the switching status of the channels and about the status or errors on the load itself.

Switching status per channel:	• ON • OFF
Load status and error diagnosis per channel:	• Normal • Overcurrent • Open load / low power consumption
Error diagnosis on module level:	• Under-/Overvoltage • Disconnection due to excessive total current

5.3.3.1 Open load

If a channel is switched ON, but no or only very low load current flows, the SCS200 detects this condition as open load. A corresponding CAN message is sent OFF cyclically every 500 ms.

The open load message is sent from the following current ratings:

- SCS200-RC...: Channels 1 - 4 (I_N = 5 A - 30 A): Load currents < 4 A
  Channels 5 - 8 (I_N = 1 A - 10 A): Load currents < 1.5 A
- SCS200-SC12… 12V: Channels 1 - 4 (I_N = 5 A - 30 A): Load currents < 4 A
  Channels 5 - 12 (I_N = 1 A - 10 A): Load currents < 0.5 A
- SCS200-SC12… 24V: Channels 1 - 3 (I_N = 3 A - 25 A): Load currents < 1 A
  Channels 4 - 12 (I_N = 1 A - 10 A): Load currents < 0.8 A
- SCS200-SC12… 48V: Channels 1 - 3 (I_N = 1 A - 15 A): Load currents < 1 A
  Channels 4 - 12 (I_N = 1 A - 10 A): Load currents < 0.8 A

Unlike with an overload message, the load output in question is not automatically disconnected in the event of an “open load”. There will only be a signal in the form of a CAN message.

5.4 Physical module addressing (PMA)

The address of the CAN node can be changed in two ways. The option to do this via CAN message is explained in chapter 6.3.1.1. In addition to this method, a physical address assignment is possible for the SCS200. In this case, the analog inputs 1-3 of the module are used as standard to define the node address of the SCS200. This enables address assignment when installing the device depending on its installation location, without service personnel having to initialize the module on the software side via the CAN bus, for example. So-called teach-in processes by the ECU are also possible without any complications.

To use physical module addressing (PMA), the module inputs should be wired according to a specific scheme. Inputs 1-3 must be permanently connected to a potential > 5 V (high) or ground potential (low) to generate a combination of high and low valued inputs, which is used to define an address offset. In this case, one input codes one bit.

The offset defined in this way is added to the so-called base ID of the module to determine the final node address of the SCS200. This base ID is also used as the node address if inputs 1-3 are not wired. In a system in which PMA is used, it is advisable not to use the default node address (i.e. offset=0) as a valid node address by default to make modules recognizable that were not addressed via inputs 1-3 and therefore report with default node address.

If desired, the base ID of the SCS200 can be changed via a CAN message. The offset set via module inputs 1-3 is then added to the newly defined base ID.

In applications in which more than seven SCS200 modules are used, the additional modules must be assigned a different base ID than the original seven modules.

IN 1	IN 2	IN 3	SCS200 Node Address
0	0	0	Base-ID + 0
1	0	0	Base-ID + 1
0	1	0	Base-ID + 2
1	1	0	Base-ID + 3
0	0	1	Base-ID + 4
1	0	1	Base-ID + 5
0	1	1	Base-ID + 6
1	1	1	Base-ID + 7

Table 7: PMA input

0 = low (<5V)
1 = high (>5V)

PMA is enabled by default.

If PMA is used, analog inputs 1-3 are not available as standard analog inputs. The voltage values are not sent via a CAN message; the inputs are only used to assign the address offset.

Analog inputs 4-6 are still available as analog inputs by default.

If PMA is active, the potential at inputs 1-3 is checked each time the module is started

Physical module addressing can be deactivated at any time via a CAN configuration message. If PMA is deactivated, inputs 1-3 are used as standard analog inputs again and the voltage level at the inputs is sent via a CAN diagnostic message. In this case, the CAN node address of the SCS200 can only be changed CAN-based (the base ID set via CAN is used as the node address of the module).

The J1939 version of the SCS200 supports address claiming in accordance with SAE J1939 as an underlying safety feature, even if PMA is active. This guarantees that each module on the bus has a unique node address and remains addressable even in the event of unforeseen addressing errors.

After changing the base ID / node address or changing other configuration settings of the SCS200 via the respective CAN message, the module must be rebooted. This can be done either via a hardware reset or via a specific CAN frame (see also associated CAN messages).

5.5 ON and OFF delay

The SCS200 offers the option to define an ON delay or OFF delay for each channel. This function can be used for the realisation of overruns or debouncing.

An ON and OFF delay between 0.5 s and 2.7 h can be set (see also 6.3.1.4 and 6.3.1.13)

Accuracy: ± 10 ms

5.6 Paralleling of outputs

If more loads with a higher rated current are required than there are outputs available, two of the 10A outputs can be connected in parallel. This must be done via CAN message as well as in the wiring harness. A parallel connection of channels is possible for the following outputs.

SCS200-RC…:	Channels 5 – 8
SCS200-SC… 12 V:	Channels 5 – 12
SCS200-SC… 24 V:	Channels 4 – 12
SCS200-SC… 48 V:	Channels 4 – 12

If two outputs are connected in parallel, they are switched simultaneously when a switching command is received for the numerically smaller channel. Switching commands for the numerically larger channel have no effect.

For example, if channels 5 and 6 are connected in parallel, both react to switching commands for channel 5 and ignore switching commands for channel 6.

The rated current for the group is the sum of the two configured currents. For example, if channel 5 is configured with 10A and channel 6 with 7.5A, this results in a rated current of 17.5A.

Also, for trip 2 the sum of both outputs is used. To deactivate trip 2 for the parallel connection it has to be deactivated for the numerically smaller output.

Switch ON and switch OFF delays of the numerically smaller channel are taken over for the pair. Changes for switch ON/OFF delays after the two channels are paired can be done with the specific CAN message für the numerically smaller channel.

The open load detection is still active for both paired channels. If it isn´t needed it has to be deactivated for both channels.

If an output is connected in parallel with another output that was previously connected in parallel with a third output, the first, older link is removed.

For example, channels 5 and 6 are again connected in parallel as above. If a CAN command is now sent that links channels 5 and 7 together, channel 6 can be used individually again.

5.7 CAN bitrate

The SCS200 supports a bus transmission rate of 50 kbit/s, 100 kbit/s, 125 kbit/s, 250 kbit/s (default), 500 kbit/s and 1 Mbit/s. For configuration see 6.3.1.8 or 6.5.2.2.

5.8 CAN fail-safe

If CAN communication is disrupted or interrupted, the SCS200 can no longer receive and process switching commands. In this case, in the standard configuration, each channel remains in the last switching state. The overcurrent monitoring remains active, of course, and in the event of an overcurrent event the corresponding channel will continue to be switched off.

In some applications, however, it may be useful to define predefined switching states in the event of a communication failure, for example so that a load is always ON or always OFF if there is no communication. This can be done either uniformly for all channels or individually for each channel.

This is not a Functional-Safety feature!
Please be aware, that permanently switched-on loads may cause damage or injuries!

To use the configuration of the CFS (CAN fail-safe), several items have to be configured in a row.

Figure 7: CFS configuration sequence

Detailed information about these steps can be found in 6.3.1.9 for J1939 and 6.5.2.2 for CANopen.

5.9 Default configuration and factory reset

During configuration process or if the module is used in a different setup than before it might be easier to restore either the default configuration or do a factory reset than changing every previously made configuration back.

The SCS200 is delivered with the default configuration. The following parameters are reset with restoring default configuration:

- Current ratings per channel: see 6.3.1.3 or 6.5.2.2
- ON and OFF delay per channel: 0 s
- Fast disconnection (Trip 2): active
- Open load message: active

In addition to resetting the configuration, the SCS200 offers the option of resetting to factory settings. This reset also resets all other configurations.

- Node address: see 6.2.2 or 6.4.2
- CAN Bitrate: 250 kbit/s
- PMA status: active
- Current ratings per channel: see 6.3.1.3 or 6.5.2.2
- ON and OFF delay per channel: 0 s
- Fast disconnection (Trip 2): active
- Open load message: active
- Paralleling of outputs: none
- CFS configuration: none

5.10 Sleep mode

In order to reduce power consumption of SCS200, the module can be put into sleep mode.

5.10.1 Sleep Mode SCS200-RC… / SCS200-SC… 12V

The SCS200 can be set to sleep mode by sending a CAN message. If there are multiple SCS200 on the same CAN it´s possible to set single ones to sleep mode by using the specific node ID. Further it´s possible to send all of them to sleep with a broadcast message. Both are explained in 6.3.2.7.

The following methods can be used to wake up the device.

- Via CAN: In the event of CAN activity – CAN messages not directly addressed to the SCS200 are suitable for waking the device up. Any activity on the bus will wake up the module.
- Via hardware: Using wake-up input - to wake up the module, connect pin 17 to GND or U_{bat}. The SCS200 is waking on the change of potential.

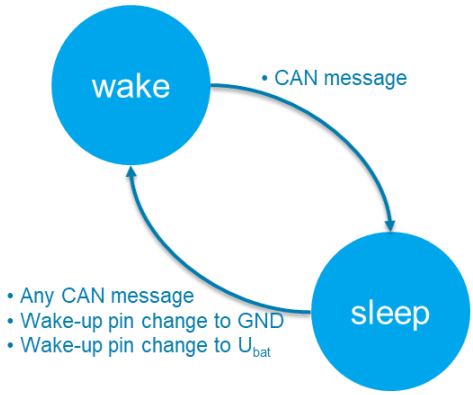


Figure 8: Wake and sleep state transitions SCS200-RC... / SCS200-SC... 12V

Quiescent current in sleep mode:

SCS200-SC… 12V:	< 0.5 mA
SCS200-RC…:	< 1.2 mA @ 12 V (typ. 1 mA)
	< 2.4 mA @ 24 V (typ. 2.2 mA)

5.10.2 Sleep Mode SCS200-SC… 24V / 48V

There are two different types of sleep mode for this versions of the SCS200. To set the module to soft sleep mode the wake-up input has to be set to GND.

The following methods can be used to wake up the device from soft sleep mode.

- Via CAN: In the event of CAN activity – CAN messages not directly addressed to the SCS200 are suitable for waking the device up. Any activity on the bus will wake up the module.
- Via hardware: Using wake-up input - to wake up the module, connect pin 17 to U_{bat}.

If the SCS200 wakes by CAN while the wake-up input is still set to GND the SCS200 will directly go to soft sleep again.

The SCS200 can also be set to deep sleep mode by sending a CAN message. If there are multiple SCS200 on the same CAN it´s possible to set single ones to deep sleep mode by using the specific node ID. Further it´s possible to send all of them to deep sleep with a broadcast message. Both are explained in 6.3.2.7.

The following methods can be used to wake up the device.

- Via CAN: In the event of CAN activity – CAN messages not directly addressed to the SCS200 are suitable for waking the device up. Any activity on the bus will wake up the module.
- Via hardware: Using wake-up input - to wake up the module, connect pin 17 to GND or U_{bat}. The SCS200 is waking on the change of potential.

If the SCS200 wakes from deep sleep by putting and keeping the wake-up input to GND it will wake only for a short time and then go to soft sleep.

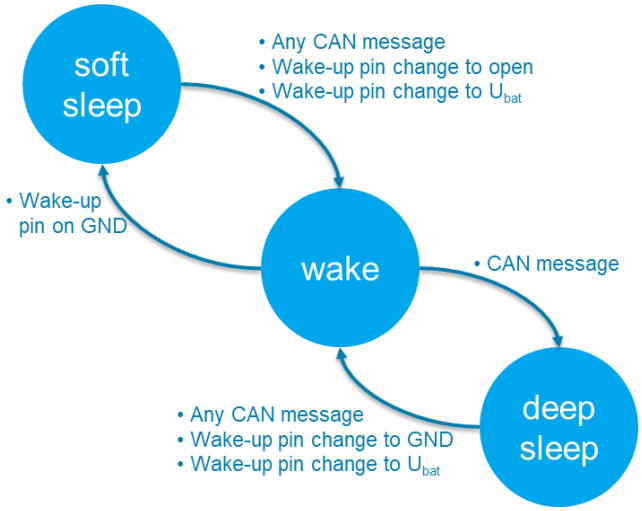


Figure 9: Wake and sleep state transitions SCS200-SC... 24V / 48V

Quiescent current in sleep mode:

SCS200-SC… 24/48V: < 0.5mA (deep sleep mode)
< 1.0mA (soft sleep mode)

6. CAN COMMUNICATION

The CAN communication of the SCS200 is based on the CAN 2.0 specification and supports the SAE J1939 standard as well as CANopen. The product can be integrated into a corresponding CAN system with other standard components.

6.1 Physical layer

For reliable communication, the CAN physical layer should be set up in accordance with the specifications of ISO 11898-2.

Wiring should only be at each end of the bus, which is a twisted pair, have a terminating resistor of 120Ω (Figure 10 CAN network).

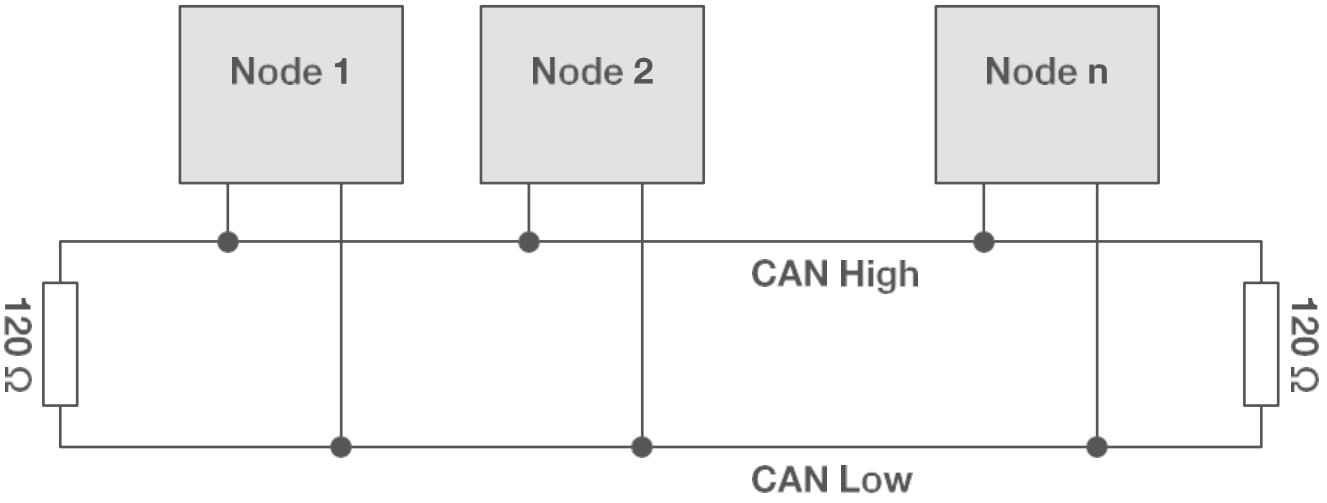


Figure 10 CAN network

The SCS200 does not have an integrated CAN termination as standard! Always ensure that there is sufficient CAN termination.

6.2 SAE J1939

Both J1939 Proprietary A and J1939 Proprietary B messages are used for communication with the SCS200. These are listed in detail under 6.3.

6.2.1 Data format

The SCS200 sends information, including diagnostic and measuring data, which are longer than one byte. These data are sent first within the CAN message according to SAE J1939-71 with the least significant byte (LSB).

The following tables are showing the transmission sequence of several data bytes (not alphanumerically) according to J1939-71.

PGN position notation		
Start position	Length	
1 – 4	4 bytes	(ex. PGN 65199, SPN 1039)
01 – 04	4 bytes	(ex. PGN 65211, SPN 994)

Data definition																															
b3	b3	b3	b2	b2	b2	b2	b2	b2	b2	b2	b2	b2	b1	b1	b1	b1	b1	b1	b1	b1	b1	b1	b9	b8	b7	b6	b5	b4	b3	b2	b1
MSB																															LSB

Transmission order																															
Byte 1								Byte 2								Byte 3								Byte 4							
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
b8	b7	b6	b5	b4	b3	b2	b1	b16	b15	b14	b13	b12	b11	b10	b9	b24	b23	b22	b21	b20	b19	b18	b17	b32	b31	b30	b29	b28	b27	b26	b25
MSB							LSB	MSB							LSB	MSB							LSB	MSB							LSB

6.2.2 Address claiming

The SCS200 is assigned a unique node address. Upon delivery, this SCS200 ID is set to 0xA0 by default. The node address of the module can manually be changed per CAN message. Additionally, the SCS200 supports address claiming as per fail-81 to independently claim a unique source address on the bus.

The following standard commands are applied:

CAN-ID	PGN	CAN data	Meaning
0x18EAFFxx	59904	0x00 0xEE 0x00	Request Message for Address Claimed (PGN 60928)
0x18EEFFxx	60928	Name of controller application (to J1939-81, see below)	Address claimed / cannot claim

Table 8: SCS200 node address

PGN 60928 (00EE00h) – Message for Address Claimed

Transmission rate:	as requested
Data length:	8 bytes
Data page:	0
PDU format:	238
PDU specific:	255 (global address)
Default priority:	6

Name of controller application

Byte 1	Bits 8-1:	Least significant byte of Identity Number
Byte 2	Bits 8-1:	Second byte of Identity Number
Byte 3	Bits 8-6:	Least significant 3 bits of Manufacturer Code
	Bits 5-1:	Most significant 5 bits of Identity Number
Byte 4	Bits 8-1:	Most significant 8 bits of Manufacturer Code
Byte 5	Bits 8-4:	Function Instance
	Bits 3-1:	ECU Instance
Byte 6	Bits 8-1:	Function
Byte 7	Bits 8-2:	Vehicle System
	Bit 1:	Reserved
Byte 8	Bit 8:	Arbitrary Address Capable
	Bits 7-5:	Industry Group
	Bits 4-1:	Vehicle System Instance

The last byte of the CAN 2.0B-ID of the address claimed message sent by the SCS200 upon module start holds information on the node address of the SCS200.

6.2.3 Manufacturer ID

E-T-A Elektrotechnische Apparate GmbH was assigned the following SAE J1939 Manufacturer ID: 984 (decimal) or 0x3D8.

6.3 Overview of J1939 CAN messages

6.3.1 Initialization/configuration

Some software settings of the SCS200 can be changed and queried by the user via corresponding CAN messages.

The following values can be configured:

- CAN node address of the SCS200
- PMA
- Current rating per load output
- ON delay per load output
- OFF delay per load output
- Paralleling of outputs
- Deactivation of fast disconnection trip 2
- Deactivation of open load diagnostic
- CAN bitrate
- Safe state configuration
- Reset to default configuration
- Reset to factory settings

Adjustment of these values is via CAN messages. The superordinate control unit or ECU can directly send these CAN frames. The SCS200 can therefore be called a plug-and-play module. However, the SCS200 can also be addressed via the PC using standard CAN monitoring software.

The following CAN message (Proprietary A) must be used to configure the SCS200.

PGN 61184 (EF00h) – Proprietary A

Transmission rate:	N/A (only Rx)
Data length:	8 bytes
Data page:	0
PDU format:	239
PDU specific:	Destination address (SCS200 node address)
Default Priority:	6

Overview of CAN data structure for module configuration

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID & manufacturer ID	Manufacturer ID	Property to be configured	Channel	New value	New value	Not used	Not used
Unit	-	-	-	-	-	-	-	-

Table 9: J1939 CAN data structure for module configuration

CAN-ID 0x18Efxxyy
xx: Node address SCS200
yy: Any source address of sender

6.3.1.1 Change of SCS200 node address

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Change SCS200 node address	0x03
Byte 4		New node address	0x01…0xFD
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The change will only take effect after a manual reboot according 0.

6.3.1.2 Activate / deactivate PMA

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Change PMA mode	0x06
Byte 4		Activate / Deactivate PMA	0x00…0x01
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of PMA status
0x00 PMA active (default)
0x01 PMA inactive

After sending this CAN message, the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

6.3.1.3 Adjustment of current rating per channel

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Change current rating	0x02
Byte 4		Output channel	0x01…0x0C
Byte 5		Rated current	0x00…0x07
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding the current rating within the CAN message

SCS200-SC08… / SCS200-SC12… 12V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-4 (A)	30 (default)	5	7.5	10	15	20	25	30
I_N channel 5-12 (A)	10 (default)	1	2	3	4	5	7.5	10

SCS200-SC12… 24V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-3 (A)	25 (default)	3	5	7.5	10	15	20	25
I_N channel 4-12 (A)	10 (default)	1	2	3	4	5	7.5	10

SCS200-SC12… 48V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-3 (A)	15 (default)	1	2	3	4	5	7.5	10
I_N channel 4-12 (A)	10 (default)	1	2	3	4	5	7.5	10

The change will only take effect after a manual reboot according 0.

6.3.1.4 Adjustment of delay periods per channel

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Change delay period	0x01
Byte 4		Output channel	0x01…0x0C
Byte 5	Bits 8-5	Basic ON delay (s)	0x0…0x7
	Bits 4-1	Multiplier ON delay	0x0…0xA
Byte 6	Bits 8-5	Basic OFF delay (s)	0x0…0x7
	Bits 4-1	Multiplier OFF delay	0x0…0xA
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The delay period to be adjusted per channel is calculated using the following scheme

$$\boldsymbol{Basic\ delay}\ [s]\ \cdot\ \boldsymbol{multiplier}\ (\mathbf{0}-\mathbf{10}) = \boldsymbol{delay\ period}\ [s]$$

Coding the basic delay within the CAN message

Value	0x0	0x1	0x2	0x3	0x4	0x5	0x6	0x7
ON delay / OFF delay (s)	0.5	1	5	10	50	100	500	1000

The change will only take effect after a manual reboot according 0.

6.3.1.5 Paralleling of Outputs

For more information about the reason and the conditions of paralleling outputs see 5.6.

To connect two outputs in parallel, the following CAN message needs to be sent.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Paralleling of outputs	0x07
Byte 4		1st Output	0x04…0x0C
Byte 5		2nd Output	0x04…0x0C
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

After sending this CAN message, the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

To reset the parallel connection of outputs the following CAN messages need to be sent.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Remove all parallel connections	0x0B
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

After sending this CAN message, the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

6.3.1.6 Activate / deactivate fast disconnection trip 2

Trip 2 can be activated (default) or deactivated for every single output.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Setting of fast disconnection	0x05
Byte 4		Output channel	0x01…0x0C
Byte 5		Activate / deactivate fast disconnection	0x00…0x01
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of trip 2 activation
0x00 Trip 2 active (default)
0x01 Trip 2 inactive

The change will only take effect after a manual reboot according 0.

6.3.1.7 Activate / deactivate open load message

The open load message can be activated (default) and deactivated for every single output.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Openload diagnostic message	0x09
Byte 4		Output channel	0x01…0x0C
Byte 5		Activate / deactivate open load message	0x00…0x01
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of open load message activation
0x00 open load message active (default)
0x01 open load message inactive

The change will only take effect after a manual reboot according 0.

6.3.1.8 Change CAN Bitrate

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Change Bitrate	0x08
Byte 4		Bitrate	0x00…0x08
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of Bitrate

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x08
Bitrate (kbit/s)	250 (default)	250	50	100	125	250	500	1000

After sending this CAN message, the SCS200 will reboot. The SCS200 will reboot with the new bitrate. Therefore, the SCS200 may not respond in your current environment.
Do not switch OFF the SCS200 during this reboot phase!

6.3.1.9 CAN fail-safe configuration

6.3.1.9.1 Set heartbeat mode

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Configure CAN fail-safe	0x0D
Byte 4		Setting heartbeat mode	0x0E
Byte 5		Select heartbeat mode	0x00…0x02
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of heartbeat mode

0x00 no heartbeat mode
0x01 n/a
0x02 Heartbeat server mode

6.3.1.9.2 Configuration for all channels, or definition that all channels are configured individually.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Configure CAN fail-safe	0x0D
Byte 4		Setting all channels	0x0D
Byte 5		Select state	0x00…0x03
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of state
0x00 No change (default)
0x01 ON (only with heartbeat mode)
0x02 OFF (only with heartbeat mode)
0x03 Individual safe states for all channels

If all channels have been configured uniformly, the next step can be skipped, and you can continue directly with setting the heartbeat time.

6.3.1.9.3 Set channels individually

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Configure CAN fail-safe	0x0D
Byte 4		Output channel	0x01…0x0C
Byte 5		Select state	0x00…0x02
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of state

0x00 No change (default)
0x01 ON (only with heartbeat mode)
0x02 OFF (only with heartbeat mode)

6.3.1.9.4 Set heartbeat time

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Configure CAN fail-safe	0x0D
Byte 4		Setting heartbeat time	0x0F
Byte 5		Select time [s]	0x01…0x0F
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of time
0x01 1s
0x02 2s
…
0x0F 15s (default)

The configuration will only take effect after a manual reboot according 0.

6.3.1.10 Manual reboot

Some configurations only take effect after a manual reboot has been carried out. This can be done by a power on reset or by the following CAN message.

This reboot can be performed after several different configuration messages have been sent. There is no need to do it after every single configuration message.

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Reset	0x8
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Perform reboot	0x01
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Check byte	0x38

6.3.1.11 Default configuration

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Reset to default configuration	0x04
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

After sending this CAN message, the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

If the CAN node address of the module was changed, it will not be automatically reset to 0xA0 even when returning to the default settings. This must be done manually by CAN message.

6.3.1.12 Factory Reset

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Configuration	0x6
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Factory reset	0x0A
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

After sending this CAN message, the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

6.3.1.13 Sample configuration

How to adjust an OFF delay of 15 s on channel 3 of the SCS200. Node-ID SCS200: 0xA0

Source address of sender: 0x64

CAN-ID	CAN data
0x18EFA064	0x63 0xD8 0x01 0x03 0x00 0x23 0x00 0x00

How to adjust a current rating of 7.5 A on channel 10 of the SCS200. Node-ID SCS200: 0xA0

Source address of sender: 0x64

CAN-ID	CAN data
0x18EFA064	0x63 0xD8 0x02 0x0A 0x06 0x00 0x00 0x00

6.3.2 SCS200 queries and receive messages (CAN Rx)

Switch commands or queries sent to the SCS200 are Proprietary A messages. The following CAN frames can be received and processed by the SCS200.

If there are more SCS200 on the same bus it´s possible to send a query to all nodes in once by using the general broadcast destination address (0xFF) instead of the specific node address. This can also be used for cyclical queries.

This is not recommended for use in switching command messages.

Processing time of switching commands

The processing of a switching command can exceed 100ms, depending on the bus load and other system conditions.

PGN 61184 (EF00h) – Proprietary A

Transmission rate:	N/A (only Rx)
Data length:	8 bytes
Data page:	0
PDU format:	239
PDU specific:	Destination address (SCS200 node address)
Default Priority:	6

CAN-ID 0x18Efxxyy
xx: Node address SCS200
yy: Any source address of sender

6.3.2.1 Switch commands and queries per channel

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID & manufacturer ID	Manufacturer ID	Channels 1 & 2	Channels 3 & 4	Channels 5 & 6	Channels 7 & 8	Channels 9 & 10	Channels 11 & 12
Unit	-	-	-	-	-	-	-	-

6.3.2.1.1 Switching load outputs

CAN data

Byte	Bit	Description	Value
Byte 1	Bit 8-5	Message identifier: Switch output	0x0
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3	Bit 8-5	Switch channel 1	0x0…0x7
	Bits 4-1	Switch channel 2	0x0…0x7
Byte 4	Bit 8-5	Switch channel 3	0x0…0x7
	Bits 4-1	Switch channel 4	0x0…0x7
Byte 5	Bit 8-5	Switch channel 5	0x0…0x7
	Bits 4-1	Switch channel 6	0x0…0x7
Byte 6	Bit 8-5	Switch channel 7	0x0…0x7
	Bits 4-1	Switch channel 8	0x0…0x7
Byte 7	Bit 8-5	Switch channel 9	0x0…0x7
	Bits 4-1	Switch channel 10	0x0…0x7
Byte 8	Bit 8-5	Switch channel 11	0x0…0x7
	Bits 4-1	Switch channel 12	0x0…0x7

Coding the output switching status within the CAN message

0x0 No change
0x1 Switch ON channel
0x2 Switch OFF channel
0x7 Switch OFF channel immediately (without programmed delay)

Example

Switch ON channels 5 and 7.
Node-ID SCS200: 0xA0
Source address of sender: 0x64

CAN-ID	CAN data
0x18EFA064	0x03 0xD8 0x00 0x00 0x10 0x10 0x00 0x00

Frequent switching of outputs

Switching an output too frequently leads to excessive heat buildup in the electronics and to a derating of its ampacity. Do not switch at a rate faster than 1Hz.

6.3.2.1.2 Querying current and voltage measuring values per channel

CAN-data

Byte	Bit	Description	Value
Byte 1	Bit 8-5	Message ID: Query measured values	0x0
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3	Bit 8-5	Channel 1	0x0…0x1
	Bits 4-1	Channel 2	0x0…0x1
Byte 4	Bit 8-5	Channel 3	0x0…0x1
	Bits 4-1	Channel 4	0x0…0x1
Byte 5	Bit 8-5	Channel 5	0x0…0x1
	Bits 4-1	Channel 6	0x0…0x1
Byte 6	Bit 8-5	Channel 7	0x0…0x1
	Bits 4-1	Channel 8	0x0…0x1
Byte 7	Bit 8-5	Channel 9	0x0…0x1
	Bits 4-1	Channel 10	0x0…0x1
Byte 8	Bit 8-5	Channel 11	0x0…0x1
	Bits 4-1	Channel 12	0x0…0x1

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65288 to 65293, see also 7.4.4.3 and 7.4.4.4).

6.3.2.2 Queries of load conditions and diagnosis

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Con-tents	Message ID & manufacturer ID	Manufacturer ID	Require-ment	Not used	Not used	Not used	Not used	Not used
Unit	-	-	-	-	-	-	-	-

6.3.2.2.1 Querying analogue inputs

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Gen. query of measured values	0x2
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query voltage values of analogue inputs	0x01
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65286 and 65287, see also 7.4.4.2).

6.3.2.2.2 Querying total current, U_{Bat} and module temperature

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Gen. query of measured values	0x2
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query total current, UBat and module temperature	0x02
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with a Proprietary B message (PGN 65285, see also 6.3.3.1).

6.3.2.2.3 Querying status conditions, diagnostic data and reset diagnostic bits

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query status condition and diagnostic data	0x03…0x05
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding the diagnostic query within the CAN message

0x03 Query load status and error diagnosis
0x04 Reset error diagnosis bits
0x05 Query switching status of channels

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65294 and 65295, see also 6.3.3.7 and 6.3.3.8).

If an error was detected by the module, the diagnosis bits must be reset or acknowledged by sending the corresponding CAN message after remedy of the failure.

Example

Query switching status of channels.
Node-ID SCS200: 0xA0
Source address of sender: 0x64

CAN-ID	CAN data
0x18EFA064	0x33 0xD8 0x05 0x00 0x00 0x00 0x00 0x00

6.3.2.3 Query PMA status

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query PMA status	0x08
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65287, see also 6.3.3.4).

6.3.2.4 Query SW version

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query SW version	0x09
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65306, see also 6.3.3.10).

If an update of the SCS200 firmware is necessary, please get in touch with your E-T-A contact person.

6.3.2.5 Query parallel connections

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query parallel connection status	0x0A
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65307, see also 6.3.3.11).

6.3.2.6 Query CAN fail-safe configuration

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query CAN fail-safe configuration	0x0C
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the respective request with Proprietary B messages (PGNs 65310, see also 6.3.3.12).

6.3.2.7 Querying the complete configuration

The current configuration of the SCS200 can be queried via a Proprietary A message.

PGN 61184 (EF00h) – Proprietary A

Transmission Rate: N/A (only Rx)
Data length: 8 bytes
Data page: 0
PDU format: 239
PDU specific: Destination address (SCS200 node address)
Default priority: 6

CAN-ID: 0x18Efxxyy
xx: Node address SCS200
yy: Any source address of sender

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID & manufacturer ID	Manufacturer ID	Requirement	Not used	Not used	Not used	Not used	Not used
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Query configuration data	0x02
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

The SCS200 responds to the requirement of a configuration query with the following four Proprietary B messages which reflect the configuration values stored in the EEPROM.

PGN 65296, PGN 65297, PGN 65298, PGN 65299 (see 6.3.3.9).

6.3.2.8 Activating sleep mode

In order to put a single SCS200 module into sleep mode, the following CAN message must be used.

PGN 61184 (EF00h) – Proprietary A

Transmission rate:	N/A (only Rx)
Data length:	8 bytes
Data page:	0
PDU format:	239
PDU specific:	Destination address (SCS200 node address)
Default Priority:	6

CAN-ID 0x18Efxxyy
xx: Node address SCS200
yy: Any source address of sender

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Con-tents	Message ID & manufacturer ID	Manufacturer ID	Require-ment	Not used	Not used	Not used	Not used	Not used
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Activating sleep mode	0x01
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

In order to put all SCS200 modules on the bus simultaneously into sleep mode, the following Proprietary B broadcast message must be used.

PGN 65281 (FF01h) – Proprietary B

Transmission rate:	N/A (only Rx)
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	Destination address (SCS200 node address)
Default Priority:	6

CAN-ID 0x18FF01yy
yy: Any source address of sender

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Con-tents	Message ID & manufacturer ID	Manufacturer ID	Require-ment	Not used	Not used	Not used	Not used	Broad-cast
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Activating sleep mode	0x01
Byte 4		Not used	0x00
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Broadcast	0x33

Deactivate SCS200-RC… status LED

PGN 61184 (EF00h) – Proprietary A

Transmission rate:	N/A (only Rx)
Data length:	8 bytes
Data page:	0
PDU format:	239
PDU specific:	Destination address (SCS200 node address)
Default Priority:	6

CAN-ID 0x18Efxxyy
xx: Node address SCS200
yy: Any source address of sender

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Con-tents	Message ID & manufacturer ID	Manufacturer ID	Require-ment	Status	Not used	Not used	Not used	Not used
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Message ID: Status condition and diagnosis	0x3
	Bits 4-1	Manufacturer ID part 1	0x3
Byte 2		Manufacturer ID part 2	0xD8
Byte 3		Switch green LED	0x06
Byte 4		Switch command	0x00 green LED OFF 0x01 green LED ON
Byte 5		Not used	0x00
Byte 6		Not used	0x00
Byte 7		Not used	0x00
Byte 8		Not used	0x00

6.3.3 SCS200 transmission information (CAN Tx)

The SCS200 Proprietary B sends CAN messages when the measured values change and in response to commands and queries.

Voltage values have to change more than 0.5V to trigger a CAN message. Current values have to change more than 0.5A to trigger a CAN message, except total current, this has to change more than 3A to trigger a CAN message.

When starting, the module first reports with the "Message for Address Claimed" message defined in SAE J1939 as a start-up message, as already described in 6.2.2

All other CAN frames sent by the SCS200 are described below.

6.3.3.1 EEPROM mapping

The current configuration of the SCS200 is saved in the EEPROM of the module. Thus, all settings persist even after disconnection from the supply voltage or ON/OFF operation of the device.

This means that the module can be configured once during the production process and remains in place throughout operation or until the next change via CAN messages.

EEPROM mapping

Starting address	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte A	Byte B	Byte C	Byte D	Byte E	Byte F
0x60	Adjustment channel 1		Adjustment channel 2		Adjustment channel 3		Adjustment channel 4		Adjustment channel 5		Adjustment channel 6		Adjustment channel 7		Adjustment channel 8	
0x70	Adjustment channel 9		Adjustment channel 10		Adjustment channel 11		Adjustment channel 12		I_N channel 1 & 2	I_N channel 3 & 4	I_N channel 5 & 6	I_N channel 7 & 8	I_N channel 9 & 10	I_N channel 11 & 12	CHKSM & CFG	

Saving the settings per channel (example channel 1)

	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Byte 0x60	Trip 2	Basic ON delay			Multiplier ON delay			
Byte 0x61		Basic OFF delay			Multiplier OFF delay			
Byte 0x78	I_N channel 1				I_N channel 2			

6.3.3.2 Total current, U_{Bat} and module temperature (PGN 65285)

The measured values are sent by the SCS200 within the CAN message listed below.

The message is sent as a response to the corresponding transmission request and upon change of the values.

PGN 65285 (FF05h) – Proprietary B

Transmission rate:	as requested by the user or in the event of value change, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	5
Default Priority:	6

CAN-ID 0x18FF05xx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents								
SCS200-RC… SCS200-SC… 12V	**Node ID**	**Not used**	**Total current**			**U_{Bat}**	**1st internal temperature sensor**	
SCS200-SC… 24V SCS200-SC… 48V	**U_{Bat}**		**Total current**			**$U_{Control}$**	**1st internal temperature sensor**	
Unit	**10 mV**		**10 mA**			**10 mV**	**0.01 °C**	

CAN data

Byte	Bit	Description	Value
Byte 1		Not used / Supply voltage	LSB supply voltage
Byte 2			MSB supply voltage
Byte 3		Total current	LSB total current
Byte 4			MSB total current
Byte 5		Supply voltage / Voltage of logic circuit	LSB supply voltage
Byte 6			MSB supply voltage
Byte 7		1st internal temperature sensor	LSB module temperature
Byte 8			MSB module temperature

Example

I_{tot} = 80 A (0x1F40)

U_{Bat} = 12 VDC (0x04B0)

T_{Module} = 26 °C (0x0A28)

Node-ID SCS200: 0xA0

CAN-ID	CAN data
0x18FF05A0	0x00 0x00 0x40 0x1F 0xB0 0x04 0x28 0x0A

As the temperature measurement is not calibrated there might be a small offset between measured module temperature and real temperature.

6.3.3.3 Voltage values at analogue inputs (PGN 65286)

The measured voltage levels are sent by the SCS200 within two different CAN messages, which are listed below.

PGN 65286 (FF06h) – Proprietary B

Transmission rate:	as requested by the user or in the event of value change, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	6
Default Priority:	6

CAN-ID 0x18FF06xx
xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	**Analogue input 1**		**Analogue input 2**		**Analogue input 3**		**Analogue input 4**	
Unit	**10 mV**		**10 mV**		**10 mV**		**10 mV**	

CAN data

Byte	Bit	Description	Value
Byte 1		**Voltage value analogue input 1**	**LSB analogue input 1**
Byte 2			**MSB analogue input 1**
Byte 3		**Voltage value analogue input 2**	**LSB analogue input 2**
Byte 4			**MSB analogue input 2**
Byte 5		**Voltage value analogue input 3**	**LSB analogue input 3**
Byte 6			**MSB analogue input 3**
Byte 7		**Voltage value analogue input 4**	**LSB analogue input 4**
Byte 8			**MSB analogue input 4**

6.3.3.4 Voltage values at analogue inputs, 2nd temperature, voltage at wake up pin, PMA status (PGN 65287)

PGN 65287 (FF07h) – Proprietary B

Transmission rate: as requested by the user or in the event of value change, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 7
Default Priority: 6

CAN-ID 0x18FF07xx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents								
SCS200-RC… SCS200-SC… 12V	**Analogue input 5**		**Analogue input 6**		**Not used**		**Not used**	**PMA status**
SCS200-SC… 24V SCS200-SC… 48V	**Analogue input 5**		**2nd internal temperature sensor**		**Voltage at wake-up pin**		**Not used**	**PMA status**
Unit	**10 mV**		**10 mV / 0.01°C**		**10 mV**		**-**	**-**

CAN data

Byte	Bit	Description	Value
Byte 1		**Voltage value analogue input 5**	**LSB analogue input**
Byte 2			**MSB analogue input**
Byte 3		**Voltage value analogue input 6 / 2nd module temperature sensor**	**LSB**
Byte 4			**MSB**
Byte 5		**Not used / Voltage at wake-up pin**	**LSB**
Byte 6			**MSB**
Byte 7		**Not used**	**0x00**
Byte 8		**PMA status**	**0x00…0x01**

Coding of PMA status

0x00 PMA active (default)
0x01 PMA inactive

As the temperature measurement is not calibrated there might be a small offset between measured module temperature and real temperature.

6.3.3.5 Voltage values per channel (PGN 65288, PGN 65290, PGN 65292)

The measured voltage levels are sent by the SCS200 within three different CAN messages, which are listed below.

The messages are sent as a response to the corresponding transmission request and upon change of the corresponding voltage value. Low voltage levels are screened out to avoid unnecessary load of the bus.

PGN 65288 (FF08h) – Proprietary B

Transmission rate:	as requested by the user or in the event of value change, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	8
Default Priority:	6

CAN-ID 0x18FF08xx
xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	**Channel 1**		**Channel 2**		**Channel 3**		**Channel 4**	
Unit	**10 mV**		**10 mV**		**10 mV**		**10 mV**	

CAN data

Byte	Bit	Description	Value
Byte 1		Voltage at out 1	LSB voltage out 1
Byte 2			MSB voltage out 1
Byte 3		Voltage at out 2	LSB voltage out 2
Byte 4			MSB voltage out 2
Byte 5		Voltage at out 3	LSB voltage out 3
Byte 6			MSB voltage out 3
Byte 7		Voltage at out 4	LSB voltage out 4
Byte 8			MSB voltage out 4

PGN 65290 (FF0Ah) – Proprietary B

Transmission rate: as requested by the user or in the event of value change, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 10
Default Priority: 6

CAN-ID 0x18FF0Axx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Channel 5		Channel 6		Channel 7		Channel 8	
Unit	10 mV		10 mV		10 mV		10 mV	

CAN data

Byte	Bit	Description	Value
Byte 1		Voltage at out 5	LSB voltage out 5
Byte 2			MSB voltage out 5
Byte 3		Voltage at out 6	LSB voltage out 6
Byte 4			MSB voltage out 6
Byte 5		Voltage at out 7	LSB voltage out 7
Byte 6			MSB voltage out 7
Byte 7		Voltage at out 8	LSB voltage out 8
Byte 8			MSB voltage out 8

PGN 65292 (FF0Ch) – Proprietary B

Transmission rate: as requested by the user or in the event of value change, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 12
Default Priority: 6

CAN-ID 0x18FF0Cxx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Channel 9		Channel 10		Channel 11		Channel 12	
Unit	10 mV		10 mV		10 mV		10 mV	

CAN data

Byte	Bit	Description	Value
Byte 1		Voltage at out 9	LSB voltage out 9
Byte 2			MSB voltage out 9
Byte 3		Voltage at out 10	LSB voltage out 10
Byte 4			MSB voltage out 10
Byte 5		Voltage at out 11	LSB voltage out 11
Byte 6			MSB voltage out 11
Byte 7		Voltage at out 12	LSB voltage out 12
Byte 8			MSB voltage out 12

If no loads are connected to the channels of the SCS200, the outputs are "floating" or without a defined potential. Upon query of the values, a low voltage value will therefore be shown at the output although the corresponding channel is not switched ON. If a load is connected to the output and therefore a defined potential is available, this behaviour will not occur.

6.3.3.6 Load current per channel (PGN 65289, PGN 65291, PGN 65293)

The measured load currents are sent by the SCS200 within three different CAN messages, which are listed below.

The messages are sent as a response to the corresponding transmission request and upon change of the corresponding voltage value. Low voltage levels are screened out to avoid unnecessary load of the bus.

PGN 65289 (FF09h) – Proprietary B

Transmission rate:	as requested by the user or in the event of value change, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	9
Default Priority:	6

CAN-ID 0x18FF09xx
xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	**Channel 1**		**Channel 2**		**Channel 3**		**Channel 4**	
Unit	**10 mA**		**10 mA**		**10 mA**		**10 mA**	

CAN data

Byte	Bit	Description	Value
Byte 1		**Power consumption out 1**	**LSB current out 1**
Byte 2			**MSB current out 1**
Byte 3		**Power consumption out 2**	**LSB current out 2**
Byte 4			**MSB current out 2**
Byte 5		**Power consumption out 3**	**LSB current out 3**
Byte 6			**MSB current out 3**
Byte 7		**Power consumption out 4**	**LSB current out 4**
Byte 8			**MSB current out 4**

PGN 65291 (FF0Bh) – Proprietary B

Transmission rate: as requested by the user or in the event of value change, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 11
Default Priority: 6

CAN-ID 0x18FF0Bxx
xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Channel 5		Channel 6		Channel 7		Channel 8	
Unit	10 mA		10 mA		10 mA		10 mA	

CAN data

Byte	Bit	Description	Value
Byte 1		Power consumption out 5	LSB current out 5
Byte 2			MSB current out 5
Byte 3		Power consumption out 6	LSB current out 6
Byte 4			MSB current out 6
Byte 5		Power consumption out 7	LSB current out 7
Byte 6			MSB current out 7
Byte 7		Power consumption out 8	LSB current out 8
Byte 8			MSB current out 8

PGN 65293 (FF0Dh) – Proprietary B

Transmission rate: as requested by the user or in the event of value change, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 13
Default priority: 6

CAN-ID 0x18FF0Dxx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Channel 9		Channel 10		Channel 11		Channel 12	
Unit	10 mA		10 mA		10 mA		10 mA	

CAN data

Byte	Bit	Description	Value
Byte 1		Power consumption out 9	LSB current out 9
Byte 2			MSB current out 9
Byte 3		Power consumption out 10	LSB current out 10
Byte 4			MSB current out 10
Byte 5		Power consumption out 11	LSB current out 11
Byte 6			MSB current out 11
Byte 7		Power consumption out 12	LSB current out 12
Byte 8			MSB current out 12

6.3.3.7 Load status and error diagnosis (PGN 65294)

Status and error messages are sent by the SCS200 within the CAN message listed below.

If a failure occurs, the diagnostic message will be sent cyclically every 100 ms. The message will also be transmitted as a response to the corresponding transmission request.

PGN 65294 (FF0Eh) – Proprietary B

Transmission rate: as requested by the user or cyclically in the event of an error (100 ms)
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 14
Default Priority: 6

CAN-ID 0x18FF0Exx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents								
SCS200-RC… **SCS200-SC… 12V**	Channels 1 & 2	Channels 3 & 4	Channels 5 & 6	Channels 7 & 8	Channels 9 & 10	Channels 11 & 12	U_{Bat}	Overload (total)
SCS200-SC… 24V **SCS200-SC… 48V**							U_{Bat} and $U_{Control}$	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Status / error diagnosis channel 1	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 2	0x0…0x4
Byte 2	Bits 8-5	Status / error diagnosis channel 3	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 4	0x0…0x4
Byte 3	Bits 8-5	Status / error diagnosis channel 5	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 6	0x0…0x4
Byte 4	Bits 8-5	Status / error diagnosis channel 7	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 8	0x0…0x4
Byte 5	Bits 8-5	Status / error diagnosis channel 9	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 10	0x0…0x4
Byte 6	Bits 8-5	Status / error diagnosis channel 11	0x0…0x4
	Bits 4-1	Status / error diagnosis channel 12	0x0…0x4
Byte 7	Bits 8-5	SCS200-RC…/SCS200-SC… 12V: Status / error diagnosis U_{Bat} SCS200-SC… 24V/48V: Status / error diagnosis $U_{Control}$	0x00…0x4
	Bits 4-1	Status / error diagnosis U_{Bat}	0x00…0x4
Byte 8	Bits 8-1	Status / error diagnosis overcurrent (total current)	0x00…0x01

Coding of error diagnosis of output channels (Bytes 1-6)

0x0 Status normal
0x1 Trip 1 (standard overload disconnection)
0x2 Open load
0x3 n/a
0x4 Trip 2 (fast overload disconnection)

Coding of error diagnosis in Byte 7

SCS200-RC… / SCS200-SC… 12V: Error diagnosis U_{Bat}:
0x00 Status normal
0x01 Undervoltage
0x10 Overvoltage

SCS200-SC… 24V / 48V:
Bits 8-5: Error diagnosis $U_{Control}$
0x0 Status normal
0x1 Undervoltage
0x2 n/a
0x3 n/a
0x4 Overvoltage

Bits 4-1: Error diagnosis U_{Bat}:
0x0 Status normal
0x1 Undervoltage
0x2 n/a
0x3 n/a
0x4 Overvoltage

Coding of error diagnosis of total current

0x00 Status normal
0x01 Overcurrent

Example

Trip1 at channel 2 and open load at channel 5
Node-ID SCS200: 0xA0

Can-ID	CAN data
0x18FF0EA0	0x01 0x00 0x20 0x00 0x00 0x00 0x00 0x00

6.3.3.8 Switching status of load outputs (PGN 65295)

The switching status of the output channels are sent by the SCS200 within the CAN message listed below. The message will be transmitted as a response to the corresponding transmission request.

PGN 65295 (FF0Fh) – Proprietary B

Transmission rate:	as requested by the user, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	15
Default Priority:	6

CAN-ID 0x18FF0Fxx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	**Channels 1 & 2**	**Channels 3 & 4**	**Channels 5 & 6**	**Channels 7 & 8**	**Channels 9 & 10**	**Channels 11 & 12**	**Not used**	**Not used**
Unit	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	Switching status channel 1	0x0…0x1
	Bits 4-1	Switching status channel 2	0x0…0x1
Byte 2	Bits 8-5	Switching status channel 3	0x0…0x1
	Bits 4-1	Switching status channel 4	0x0…0x1
Byte 3	Bits 8-5	Switching status channel 5	0x0…0x1
	Bits 4-1	Switching status channel 6	0x0…0x1
Byte 4	Bits 8-5	Switching status channel 7	0x0…0x1
	Bits 4-1	Switching status channel 8	0x0…0x1
Byte 5	Bits 8-5	Switching status channel 9	0x0…0x1
	Bits 4-1	Switching status channel 10	0x0…0x1
Byte 6	Bits 8-5	Switching status channel 11	0x0…0x1
	Bits 4-1	Switching status channel 12	0x0…0x1
Byte 7		Not used	0x00
Byte 8		Not used	0x00

Coding of output switching status of output channels

0x0 Channel OFF
0x1 Channel ON

6.3.3.9 EEPROM Content (PGN 65296, PGN 65297, PGN 65298, PGN 65299)

The SCS200 sends the EEPROM content after querying the configuration data (see 6.3.2.7). The content is split into the following 4 messages.

PGN 65296 (FF10h) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 16
Default Priority: 6

CAN-ID 0x18FF10xx
xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Settings Output 1		Settings Output 2		Settings Output 3		Settings Output 4	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	**Bit 8**	Status Trip 2 activation output 1	0x0…0x1
	Bits 7-5	Basic ON delay output 1	0x0…0x7
	Bits 4-1	Multiplier ON delay output 1	0x0…0xA
Byte 2	**Bit 8**	Open load setting output 1	0x0…0x1
	Bits 7-5	Basic OFF delay output 1	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 1	0x0…0xA
Byte 3	**Bit 8**	Status Trip 2 activation output 2	0x0…0x1
	Bits 7-5	Basic ON delay output 2	0x0…0x7
	Bits 4-1	Multiplier ON delay output 2	0x0…0xA
Byte 4	**Bit 8**	Open load setting output 2	0x0…0x1
	Bits 7-5	Basic OFF delay output 2	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 2	0x0…0xA
Byte 5	**Bit 8**	Status Trip 2 activation output 3	0x0…0x1
	Bits 7-5	Basic ON delay output 3	0x0…0x7
	Bits 4-1	Multiplier ON delay output 3	0x0…0xA
Byte 6	**Bit 8**	Open load setting output 3	0x0…0x1
	Bits 7-5	Basic OFF delay output 3	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 3	0x0…0xA
Byte 7	**Bit 8**	Status Trip 2 activation output 4	0x0…0x1
	Bits 7-5	Basic ON delay output 4	0x0…0x7
	Bits 4-1	Multiplier ON delay output 4	0x0…0xA
Byte 8	**Bit 8**	Open load setting output 4	0x0…0x1
	Bits 7-5	Basic OFF delay output 4	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 4	0x0…0xA

The coding of the different contents can be seen in the specific configuration section of 6.3.1.

PGN 65297 (FF11h) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 17
Default Priority: 6

CAN-ID 0x18FF11xx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Settings Output5		Settings Output 6		Settings Output7		Settings Output 8	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bit 8	Status Trip 2 activation output 5	0x0…0x1
	Bits 7-5	Basic ON delay output 5	0x0…0x7
	Bits 4-1	Multiplier ON delay output 5	0x0…0xA
Byte 2	Bit 8	Open load setting output 5	0x0…0x1
	Bits 7-5	Basic OFF delay output 5	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 5	0x0…0xA
Byte 3	Bit 8	Status Trip 2 activation output 6	0x0…0x1
	Bits 7-5	Basic ON delay output 6	0x0…0x7
	Bits 4-1	Multiplier ON delay output 6	0x0…0xA
Byte 4	Bit 8	Open load setting output 6	0x0…0x1
	Bits 7-5	Basic OFF delay output 6	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 6	0x0…0xA
Byte 5	Bit 8	Status Trip 2 activation output 7	0x0…0x1
	Bits 7-5	Basic ON delay output 7	0x0…0x7
	Bits 4-1	Multiplier ON delay output 7	0x0…0xA
Byte 6	Bit 8	Open load setting output 7	0x0…0x1
	Bits 7-5	Basic OFF delay output 7	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 7	0x0…0xA
Byte 7	Bit 8	Status Trip 2 activation output 8	0x0…0x1
	Bits 7-5	Basic ON delay output 8	0x0…0x7
	Bits 4-1	Multiplier ON delay output 8	0x0…0xA
Byte 8	Bit 8	Open load setting output 8	0x0…0x1
	Bits 7-5	Basic OFF delay output 8	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 8	0x0…0xA

The coding of the different contents can be seen in the specific configuration section of 6.3.1.

PGN 65296 (FF12h) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 18
Default Priority: 6

CAN-ID 0x18FF12xx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Settings Output 9		Settings Output 10		Settings Output 11		Settings Output 12	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bit 8	Status Trip 2 activation output 9	0x0…0x1
	Bits 7-5	Basic ON delay output 9	0x0…0x7
	Bits 4-1	Multiplier ON delay output 9	0x0…0xA
Byte 2	Bit 8	Open load setting output 9	0x0…0x1
	Bits 7-5	Basic OFF delay output 9	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 9	0x0…0xA
Byte 3	Bit 8	Status Trip 2 activation output 10	0x0…0x1
	Bits 7-5	Basic ON delay output 10	0x0…0x7
	Bits 4-1	Multiplier ON delay output 10	0x0…0xA
Byte 4	Bit 8	Open load setting output 10	0x0…0x1
	Bits 7-5	Basic OFF delay output 10	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 10	0x0…0xA
Byte 5	Bit 8	Status Trip 2 activation output 11	0x0…0x1
	Bits 7-5	Basic ON delay output 11	0x0…0x7
	Bits 4-1	Multiplier ON delay output 11	0x0…0xA
Byte 6	Bit 8	Open load setting output 11	0x0…0x1
	Bits 7-5	Basic OFF delay output 11	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 11	0x0…0xA
Byte 7	Bit 8	Status Trip 2 activation output 12	0x0…0x1
	Bits 7-5	Basic ON delay output 12	0x0…0x7
	Bits 4-1	Multiplier ON delay output 12	0x0…0xA
Byte 8	Bit 8	Open load setting output 12	0x0…0x1
	Bits 7-5	Basic OFF delay output 12	0x0…0x7
	Bits 4-1	Multiplier OFF delay output 12	0x0…0xA

The coding of the different contents can be seen in the specific configuration section of 6.3.1.

PGN 65299 (FF13h) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 19
Default Priority: 6

CAN-ID 0x18FF13xx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	I_N Channels 1 & 2	I_N Channels 3 & 4	I_N Channels 5 & 6	I_N Channels 7 & 8	I_N Channels 9 & 10	I_N Channels 11 & 12	CHKSM	CFG
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	I_N channel 1	0x0…0x7
	Bits 4-1	I_N channel 2	0x0…0x7
Byte 2	Bits 8-5	I_N channel 3	0x0…0x7
	Bits 4-1	I_N channel 4	0x0…0x7
Byte 3	Bits 8-5	I_N channel 5	0x0…0x7
	Bits 4-1	I_N channel 6	0x0…0x7
Byte 4	Bits 8-5	I_N channel 7	0x0…0x7
	Bits 4-1	I_N channel 8	0x0…0x7
Byte 5	Bits 8-5	I_N channel 9	0x0…0x7
	Bits 4-1	I_N channel 10	0x0…0x7
Byte 6	Bits 8-5	I_N channel 11	0x0…0x7
	Bits 4-1	I_N channel 12	0x0…0x7
Byte 7		CHKSM CFG	-
Byte 8			

The coding of I_N can be seen in 6.3.1.3.

Example

For channel 3 of the SCS200, an OFF delay of 15 s and a current rating of 25 A was configured. Node-ID SCS200: 0xA0

CAN-ID	CAN data
0x18FF10A0	0x00 0x00 0x00 0x00 0x00 0x23 0x00 0x00
0x18FF11A0	0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x18FF12A0	0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00
0x18FF13A0	0x00 0x60 0x00 0x00 0x00 0x00 0x00 0x00

6.3.3.10 Software version (PGN 65306)

If the SW version is queried the SCS200 replies with the following message.

PGN 65306 (FF1Ah) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 26
Default Priority: 6

CAN-ID 0x18FF1Axx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Not used	Not used	Not used	Not used	Not used	Not used	SW version	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-1	Not used	-
Byte 2	Bits 8-1	Not used	-
Byte 3	Bits 8-1	Not used	-
Byte 4	Bits 8-1	Not used	-
Byte 5	Bits 8-1	Not used	-
Byte 6	Bits 8-1	Not used	-
Byte 7	Bits 8-5	SW minor version	0x0…0xF
	Bits 4-1	SW patch version	0x0…0xF
Byte 8	Bits 8-1	SW major version	0x00…0xFF

Example

Byte 7: 0x10
Byte 8: 0x02

Corresponds to Version 2.1.0

If an update of the SCS200 firmware is necessary, please get in touch with your E-T-A contact person.

6.3.3.11 Parallel connection status (PGN 65307)

If the parallel connections are queried the SCS200 replies with the following message.

PGN 65307 (FF1Bh) – Proprietary B

Transmission rate:	as requested by the user, max. 100 ms
Data length:	8 bytes
Data page:	0
PDU format:	255
PDU specific:	27
Default Priority:	6

CAN-ID 0x18FF1Bxx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Not used	Connec-tion of Channel 4	Connec-tion of Channels 5 & 6	Connec-tion of Channels 7 & 8	Connec-tion of Channels 9 & 10	Connec-tion of Channels 11 & 12	Not used	
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	**Bits 8-1**	**Not used**	**-**
Byte 2	**Bits 8-5**	**Not used**	**-**
	Bits 4-1	**Connection of channel 4**	**0x0…0xC**
Byte 3	**Bits 8-5**	**Connection of channel 5**	**0x0…0xC**
	Bits 4-1	**Connection of channel 6**	**0x0…0xC**
Byte 4	**Bits 8-5**	**Connection of channel 7**	**0x0…0xC**
	Bits 4-1	**Connection of channel 8**	**0x0…0xC**
Byte 5	**Bits 8-5**	**Connection of channel 9**	**0x0…0xC**
	Bits 4-1	**Connection of channel 10**	**0x0…0xC**
Byte 6	**Bits 8-5**	**Connection of channel 11**	**0x0…0xC**
	Bits 4-1	**Connection of channel 12**	**0x0…0xC**
Byte 7		**Not used**	**-**
Byte 8			

Coding of connections:

0x0 No parallel connection
0x4 Parallel connection with channel 4
0x5 Parallel connection with channel 5
…
0xC Parallel connection with channel 12

6.3.3.12 CAN fail-safe information (PGN 65310)

If the CFS configuration is queried the SCS200 replies with the following message.

PGN 65310 (FF1Eh) – Proprietary B

Transmission rate: as requested by the user, max. 100 ms
Data length: 8 bytes
Data page: 0
PDU format: 255
PDU specific: 30
Default Priority: 6

CAN-ID 0x18FF1Exx

xx: node address of the SCS200

Overview of CAN data structure

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	CFS state channels 1 & 2	CFS state channels 3 & 4	CFS state channels 5 & 6	CFS state channels 7 & 8	CFS state channels 9 & 10	CFS state channels 11 & 12	Heartbeat & Chan-nel mode	Heartbeat time
Unit	-	-	-	-	-	-	-	-

CAN data

Byte	Bit	Description	Value
Byte 1	Bits 8-5	CFS state channel 1	0x0…0x2
	Bits 4-1	CFS state channel 2	0x0…0x2
Byte 2	Bits 8-5	CFS state channel 3	0x0…0x2
	Bits 4-1	CFS state channel 4	0x0…0x2
Byte 3	Bits 8-5	CFS state channel 5	0x0…0x2
	Bits 4-1	CFS state channel 6	0x0…0x2
Byte 4	Bits 8-5	CFS state channel 7	0x0…0x2
	Bits 4-1	CFS state channel 8	0x0…0x2
Byte 5	Bits 8-5	CFS state channel 9	0x0…0x2
	Bits 4-1	CFS state channel 10	0x0…0x2
Byte 6	Bits 8-5	CFS state channel 11	0x0…0x2
	Bits 4-1	CFS state channel 12	0x0…0x2
Byte 7	Bits 8-5	Heartbeat mode	0x0…0x2
	Bits 4-1	CFS channel mode	0x0…0x3
Byte 8	Bits 8-5	Heartbeat time	0x1…0xF
	Bits 4-1	Not used	-

The codings can be seen in 6.3.1.9.

6.4 CANopen

The SCS200 complies with CiA® 301. More information can be found on https://www.can-cia.org/.

6.4.1 EDS file

The EDS file for the SCS200 can be found on our Website ask your E-T-A contact person.

Please ensure that the downloaded EDS file fits to the firmware version of the used SCS200.

If an update of the SCS200 firmware is necessary, please get in touch with your E-T-A contact person.

6.4.2 Node ID

The SCS200 is assigned a unique node address. Upon delivery, this SCS200 ID is set to 0x01 by default. The node address of the module can manually be changed per CAN message or by using PMA. See 5.4 for more information regarding PMA.

If more than one SCS200 is used on the same CAN bus at least one of the node IDs must be changed.

6.4.3 Vendor ID

E-T-A Elektrotechnische Apparate GmbH was assigned the following CANopen Vendor ID: 0x501.

6.5 Overview of CANopen objects

CANopen defines a general structure of the object dictionary. Table 10 shows an overview of this structure.

Index	Object
0x0000	Not used
0x0001 … 0x001F	Static data types
0x0020 … 0x003F	Complex data types
0x0040 … 0x005F	Manufacturer-specific complex data types
0x0060 … 0x025F	Device profile specific data types
0x0260 … 0x03FF	Reserved
0x0400 … 0x0FFF	Reserved
0x1000 … 0x1FFF	Communication profile area
0x2000 … 0x5FFF	Manufacturer-specific profile area
0x6000 … 0x67FF	Standardized profile area 1st logical device
0x6800 … 0x6FFF	Standardized profile area 2nd logical device
0x7000 … 0x77FF	Standardized profile area 3rd logical device
0x7800 … 0x7FFF	Standardized profile area 4th logical device
0x8000 … 0x87FF	Standardized profile area 5th logical device
0x8800 … 0x8FFF	Standardized profile area 6th logical device
0x9000 … 0x97FF	Standardized profile area 7th logical device
0x9800 … 0x9FFF	Standardized profile area 8th logical device
0xA000 … 0xAFFF	Standardized network variable area
0xB000 … 0xBFFF	Standardized system variable area
0xC000 … 0xFFFF	Reserved

Table 10: CANopen object dictionary structure

The object dictionary contains a maximum of 65.536 objects that shall be addressed through a 16-bit index and up to 256 sub-indices per object, which shall be addressed through an 8-bit sub-index. The static data types at indices from 0001h to 001Fh shall contain type definitions for standard data types like BOOLEAN, INTEGER, UNSIGNED, floating point, string, etc. Complex data types at indices from 0020h to 003Fh shall be pre-defined structures that are composed of standard data types and are common to all CANopen devices. Manufacturer-specific complex data types at indices from 0040h to 005Fh shall be structures composed of standard data types but are specific to a particular CANopen device. Device profiles may define additional data types specific to their device type. The static data types and the complex data types defined by the device profile shall be listed at indices from 0060h to 025Fh. A CANopen device may optionally provide the structure of the supported complex data types (indices from 0020h to 005Fh and from 0060h to 025Fh) at read access to the corresponding index. Sub-index 0 then shall provide the highest sub-index supported at this index, and the following sub-indices shall contain the data type encoded as UNSIGNED16 according to Table 44. The communication profile area at indices from 1000h to 1FFFh shall contain

the communication specific parameters. These objects are common to all CANopen devices. The standardized profile area at indices from 6000h to 9FFFh shall contain all data objects common to a class of CANopen devices that may be read or written via the network. The device profiles may use objects from 6000h to 9FFFh to describe parameters and functionality. The object dictionary concept caters for optional features, which means a manufacturer may not provide certain extended functionality on his CANopen devices but if he wishes to do so he shall do it in a pre-defined fashion. Space is left in the object dictionary at indices from 2000h to 5FFFh for truly manufacturer-specific functionality. The network variables at indices from A000h to AFFFh shall contain input variables and output variables, which are part of a programmable CANopen device. The definition of these network variables does not fall into the scope of this document and are part of future profiles and frameworks. The system variables at indices from B000h to BFFFh shall contain input variables and output variables, which are part of an underlying CANopen network in a hierarchical sense. The definition of these system variables does not fall into the scope of this document and are part of future profiles and frameworks.

Index and sub-index usage

A 16-bit index is used to address all objects within the object dictionary. In case of a simple variable the index references the value of this variable directly. In case of records and arrays however, the index addresses the whole data structure. To allow individual elements of structures of data to be accessed via the network a sub-index is defined. For single object dictionary objects such as an UNSIGNED8, BOOLEAN, INTEGER32 etc. the value for the sub-index is always 00h. For complex object dictionary objects such as arrays or records with multiple data fields the sub-index references fields within a data-structure pointed to by the main index. The fields accessed by the sub-index may be of differing data types.

6.5.1 Objects 0x1000 … 0x1FFF - Communication profile area

6.5.1.1 Object 0x1000 - 0x100A

Index	Object Description	Sub index	Data Type	Description	Default Value
0x1000	Device type	0x00	unsigned32	Device type	0x00070191
0x1001	Error Register	0x00	Unsigned8	Error information	0x00
0x1005	COB-ID SYNC	0x00	Unsigned32	COB-ID SYNC message	0x00000080
0x1008	Manufacturer Device Name	0x00	VISIBLE_STRING	Name of Device	SCS200_CANopen
0x1009	Manufacturer Hardware Version	0x00	VISIBLE_STRING	Hardware Version	2.00
0x100A	Manufacturer Software Version	0x00	VISIBLE_STRING	Software Version	1.xx

6.5.1.2 Object 0x1010 - Store parameters

Sub index (Byte 4)	Data Type	Access	Description	Default Value
0x00	unsigned32	const	highest sub-index supported	0x01
0x01	unsigned32	R/W	save communication related parameters (Index from 0x1000 to 0x1FFF)	0x00000001

In order to avoid storage of parameters by mistake, storage shall be only executed when a specific signature is written to the sub-index 0x01. The signature that shall be written is "save":

Signature	LSB			MSB
ISO8859 character	s	a	v	e
Hex	0x73	0x61	0x76	0x65

6.5.1.3 Object 0x1011: Restore default parameters

Sub index (Byte 4)	Data Type	Access	Description	Default Value
0x00	unsigned32	const	highest sub-index supported	0x01
0x01	unsigned32	R/W	save communication related parameters (Index from 0x1000 to 0x1FFF)	0x00000001

In order to avoid storage of parameters by mistake, storage shall be only executed when a specific signature is written to the sub-index 0x01. The signature that shall be written is "load":

Signature	LSB			MSB
ISO8859 character	l	o	a	d
hex	0x6C	0x6F	0x61	0x64

6.5.1.4 Object 0x1017: Producer heartbeat time

Sub index (Byte 4)	Data Type	Access	Description	Default Value
0x00	Unsigned16	R/W	The value shall be given in multiples of 1 ms. The value 0 shall disable the producer heartbeat.	0x0000

6.5.1.5 Object 0x1018: Identity object

Sub index (Byte 4)	Data Type	Access	Description	Default Value
0x00	Unsigned8	const	highest sub-index supported	0x04
0x01	unsigned32	RO	Vendor ID	0x00000501
0x02	Unsigned32	RO	Product Code	See table below
0x03	Unsigned32	RO	Revision number	0x00000100
0x03	Unsigned32	RO	Serial number	-

Product code	Version
0x01	SCS200-SC… 12V
0x02	SCS200-SC… 24V
0x03	SCS200-RC
0x04	SCS200-SC… 48V

6.5.1.6 Object 0x1400 to 0x1401: RPDO communication parameter

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1400	1st Receive PDO Communication	0x00	Unsigned8	RO	highest sub-index supported	0x02
		0x01	Unsigned32	R/W	COB-ID	0x40000200 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0xFF
0x1401	2nd Receive PDO Communication	0x00	Unsigned8	RO	highest sub-index supported	0x02
		0x01	Unsigned32	R/W	COB-ID	0x40000300 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0xFF

6.5.1.7 Object 0x1600 to 0x1601: RPDO mapping parameter

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1600	1st Receive PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x06
		0x01	Unsigned32	RO	Mapping 1	0x62000108
		0x02	Unsigned32	RO	Mapping 2	0x62000208
		0x03	Unsigned32	RO	Mapping 3	0x62000308
		0x04	Unsigned32	RO	Mapping 4	0x62000408
		0x05	Unsigned32	RO	Mapping 5	0x62000508
		0x06	Unsigned32	RO	Mapping 6	0x62000608
0x1601	2nd Receive PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x06
		0x01	Unsigned32	RO	Mapping 1	0x20021608
		0x02	Unsigned32	RO	Mapping 2	0x20021708
		0x03	Unsigned32	RO	Mapping 3	0x20020D08
		0x04	Unsigned32	RO	Mapping 4	0x20020E08

6.5.1.8 Object 0x1800 to 0x1809: TPDO communication parameter

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1800	1st Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000180 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1801	2nd Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000280 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1802	3rd Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000380 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1803	4th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000480 + Node ID
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1804	5th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000495
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1805	6th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000496
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1806	7th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000497
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1807	8th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000498
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1808	9th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x40000499
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00
0x1809	10th Transmit PDO Communication Parameter	0x00	Unsigned8	RO	highest sub-index supported	0x05
		0x01	Unsigned32	R/W	COB-ID	0x4000049A
		0x02	Unsigned8	R/W	Transmission Type	0x01
		0x03	Unsigned16	R/W	Inhibit Time	0x00
		0x05	Unsigned16	R/W	Event Timer	0x00

6.5.1.9 Object 0x1A00 to 0x1A09: TPDO mapping parameter

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1A00	1st Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x08
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x60000108
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x60000208
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x60000308
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x60000408
		0x05	Unsigned32	RO	PDO Mapping Entry 5	0x60000508
		0x06	Unsigned32	RO	PDO Mapping Entry 6	0x60000608
		0x07	Unsigned32	RO	PDO Mapping Entry 7	0x60000708
		0x08	Unsigned32	RO	PDO Mapping Entry 8	0x60000808
0x1A01	2nd Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64010110
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64010210
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64010310
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64010410
0x1A02	3rd Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64010510
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64010610
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64010710
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64010810
0x1A03	4th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64010910
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64010A10
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64010B10
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64010C10
0x1A04	5th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64010D10
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64010E10
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64010F10
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64011010

Index	Object Description	Sub index	Data Type	Access	Description	Default Value
0x1A05	6th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64011110
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64011210
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64011310
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64011410
0x1A06	7th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64011510
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64011610
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64011710
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64011810
0x1A07	8th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64011910
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64011A10
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64011B10
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64011C10
0x1A08	9th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x04
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x64011D10
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x64011E10
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x64011F10
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x64012010
0x1A09	10th Transmit PDO Mapping	0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x08
		0x01	Unsigned32	RO	PDO Mapping Entry 1	0x60000908
		0x02	Unsigned32	RO	PDO Mapping Entry 2	0x60000A08
		0x03	Unsigned32	RO	PDO Mapping Entry 3	0x60000B08
		0x04	Unsigned32	RO	PDO Mapping Entry 4	0x60000C08
		0x05	Unsigned32	RO	PDO Mapping Entry 5	0x60000D08
		0x06	Unsigned32	RO	PDO Mapping Entry 6	0x60000E08
		0x07	Unsigned32	RO	PDO Mapping Entry 7	0x60000F08
		0x08	Unsigned32	RO	PDO Mapping Entry 8	0x60001008

6.5.2 Objects 0x2000 … 0x5FFF - Manufacturer-specific profile area

6.5.2.1 Object 0x2001 – Config read

Parameter	Value
Object type	Variable
Data type	Unsigned32
Access type	wo
Default value	
PDO mapping	False

Description	Sub index (Byte 4)	Comment
Diagnosis output 1…12	0x01…0x0C	
Output states	0x0D	
Output CAN states	0x0E	
Diagnosis all outputs	0x0F	
Trip 2 configuration	0x10	
Config output 1…12	0x11…0x1C	
PMA configuration	0x1D	
Parallel connection	0x1E	SCS200-RC…: Outputs 5-12 SCS200-SC… 12V: Outputs 5-12 SCS200-SC… 24V/48V: Outputs 4-11
	0x1F	SCS200-SC… 24V/48V: Output 12
Open load configuration		Only SCS200-RC… and SCS200-SC… 12V
CFS configuration	0x20	
Heartbeat time	0x21	
Open load configuration	0x22	Only SCS200-SC… 24V and 48V

6.5.2.1.1 Content of Sub-indexes 0x01 … 0x0C – Output diagnosis

Data Byte 5	Data Byte 6	Data Byte 7	Data Byte 8
0x00 – Output OFF 0x01 – Output ON	0x01 – Trip 1 0x02 – Open load 0x04 – Trip 2	n/a	n/a

6.5.2.1.2 Content of Sub-indexes 0x0D and 0x0E – Output state

Data Byte 6				Data Byte 7				Data Byte 8			
Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits
8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1
OUT9	OUT 10	OUT 11	OUT 12	OUT 5	OUT 6	OUT 7	OUT 8	OUT 1	OUT 2	OUT 3	OUT 4
0b00 – OFF											
0b01 – ON											

6.5.2.1.3 Content of Sub-index 0x0F – Diagnosis all outputs

SCS200-RC… and SCS200-SC… 12V

Data Byte 5	**Bits 8 – 7**	U_{Bat}	0b0001 – Undervoltage 0b0100 – Overvoltage
	Bits 6 – 5		
	Bits 4 – 3	Total Current	0x01 – Overcurrent
	Bits 2 – 1		
Data Byte 6	**Bits 8 – 7**	OUT 9	0b00 – OK 0b01 – Trip 1 0b10 – open load 0b11 – Trip 2
	Bits 6 – 5	OUT 10	
	Bits 4 – 3	OUT 11	
	Bits 2 – 1	OUT 12	
Data Byte 7	**Bits 8 – 7**	OUT 5	
	Bits 6 – 5	OUT 6	
	Bits 4 – 3	OUT 7	
	Bits 2 – 1	OUT 8	
Data Byte 8	**Bits 8 – 7**	OUT 1	
	Bits 6 – 5	OUT 2	
	Bits 4 – 3	OUT 3	
	Bits 2 – 1	OUT 4	

SCS200-SC… 24V/48V

Data Byte 5	**Bits 8 – 7**	$U_{Control}$	0b01 – Undervoltage 0b10 – Overvoltage
	Bits 6 – 5	U_{Bat}	
	Bits 4 – 3	Total Current	0x01 – Overcurrent
	Bits 2 – 1		
Data Byte 6	**Bits 8 – 7**	OUT 9	0b00 – OK 0b01 – Trip 1 0b10 – open load 0b11 – Trip 2
	Bits 6 – 5	OUT 10	
	Bits 4 – 3	OUT 11	
	Bits 2 – 1	OUT 12	
Data Byte 7	**Bits 8 – 7**	OUT 5	
	Bits 6 – 5	OUT 6	
	Bits 4 – 3	OUT 7	
	Bits 2 – 1	OUT 8	
Data Byte 8	**Bits 8 – 7**	OUT 1	
	Bits 6 – 5	OUT 2	
	Bits 4 – 3	OUT 3	
	Bits 2 – 1	OUT 4	

6.5.2.1.4 Content of Sub-index 0x10 – Trip 2 configuration

Data Byte 6				**Data Byte 7**				**Data Byte 8**			
Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits
8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1
OUT9	OUT 10	OUT 11	OUT 12	OUT 5	OUT 6	OUT 7	OUT 8	OUT 1	OUT 2	OUT 3	OUT 4
0b00 – active											
0b01 – inactive											

6.5.2.1.5 Content of Sub-indexes 0x11…0x1C – Output Configuration

Data Byte 5		Parallel connection	0x04 – with output 4 0x05 – with output 5 … 0x0C – with output 12
Data Byte 6		Current rating	See 0
Data Byte 7	**Bits 8 – 5**	Delay OFF	
	Bits 4 – 1	Multiplier OFF	
Data Byte 8	**Bits 8 – 5**	Delay ON	
	Bits 4 – 1	Multiplier ON	

6.5.2.1.6 Content of Sub-index 0x1D – PMA configuration

Data Byte 5	Data Byte 6	Data Byte 7	Data Byte 8
0x00 – active 0x01 – inactive	n/a	n/a	n/a

6.5.2.1.7 Content of Sub-indexes 0x1E and 0x1F – Parallel connection

SCS200-RC… and SCS200-SC… 12V 0x1E

Data Byte 5	**Bits 8 – 5**	OUT11	0x5 – parallel with output 5 0x6 – parallel with output 6 … 0xC – parallel with output 12
	Bits 4 – 1	OUT 12	
Data Byte 6	**Bits 8 – 5**	OUT 9	
	Bits 4 – 1	OUT 10	
Data Byte 7	**Bits 8 – 5**	OUT 7	
	Bits 4 – 1	OUT 8	
Data Byte 8	**Bits 8 – 5**	OUT 5	
	Bits 4 – 1	OUT 6	

SCS200-SC… 24V/48V 0x1E

Data Byte 5	**Bits 8 – 5**	OUT10	0x4 – parallel with output 4 0x5 – parallel with output 5 … 0xC – parallel with output 12
	Bits 4 – 1	OUT 11	
Data Byte 6	**Bits 8 – 5**	OUT 8	
	Bits 4 – 1	OUT 9	
Data Byte 7	**Bits 8 – 5**	OUT 6	
	Bits 4 – 1	OUT 7	
Data Byte 8	**Bits 8 – 5**	OUT 4	
	Bits 4 – 1	OUT 5	

SCS200-SC… 24V/48V 0x1F

Data Byte 5	**Bits 8 – 5**		0x4 – parallel with output 4 0x5 – parallel with output 5 … 0xC – parallel with output 12
	Bits 4 – 1	OUT 12	
Data Byte 6	**Bits 8 – 5**		
	Bits 4 – 1		
Data Byte 7	**Bits 8 – 5**		
	Bits 4 – 1		
Data Byte 8	**Bits 8 – 5**		
	Bits 4 – 1		

6.5.2.1.8 Content of Sub-indexes 0x1F and 0x22 – Open load message configuration

Data Byte 6				**Data Byte 7**				**Data Byte 8**			
Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits	Bits
8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1	8 - 7	6 - 5	4 - 3	2 - 1
OUT9	OUT 10	OUT 11	OUT 12	OUT 5	OUT 6	OUT 7	OUT 8	OUT 1	OUT 2	OUT 3	OUT 4
0b00 – active											
0b01 – inactive											

6.5.2.1.9 Content of Sub-index 0x20 – CFS configuration

Data Byte 5	**Bits 8 – 7**	Heartbeat mode	0x0 – No heartbeat 0x2 – Heartbeat server mode
	Bits 6 – 5		
	Bits 4 – 3	Fail states all outputs	0x00 – No change 0x01 – ON 0x02 – OFF 0x03 – all outputs individually
	Bits 2 – 1		
Data Byte 6	**Bits 8 – 7**	OUT 9	0b00 – No change 0x01 – ON 0b10 – OFF
	Bits 6 – 5	OUT 10	
	Bits 4 – 3	OUT 11	
	Bits 2 – 1	OUT 12	
Data Byte 7	**Bits 8 – 7**	OUT 5	
	Bits 6 – 5	OUT 6	
	Bits 4 – 3	OUT 7	
	Bits 2 – 1	OUT 8	
Data Byte 8	**Bits 8 – 7**	OUT 1	
	Bits 6 – 5	OUT 2	
	Bits 4 – 3	OUT 3	
	Bits 2 – 1	OUT 4	

6.5.2.1.10 Content of Sub-index 0x21 – Heartbeat time configuration

Data Byte 6	Data Byte 7	Data Byte 8
	Heartbeat time [ms]	
	Example: Default (15s)	
	0x98	0x3A

6.5.2.2 Object 0x2002 – Config write

Parameter	Value
Object type	Variable
Data type	Unsigned32
Access type	wo
Default value	
PDO mapping	False

One object is used with different sub-indexes using several multiplexers to configure and control the SCS200 module.

Description	Sub index (Byte 4)	Data Byte 5	Data Byte 6		Data Byte 7	
			Bits 8-5	Bits 4-1	Bits 8-5	Bits 4-1
Config output 1…12	0x01 … 0x0C	0x01 – Delay	0x0…0x7 – Delay ON	0x0…0xA – Multiplier ON	0x0…0x7 – Delay OFF	0x0…0xA – Multiplier OFF
		0x02 – Nominal current	0x00…0x07 – coding below		-	-
		0x05 – Trip 2	0x00 – active (default) 0x01 – inactive		-	-
		0x06 – Parallel connection	0x04…0x0C – Parallel with output 4…12		-	-
		0x09 – Open load message deactivation	0x00 – active (default) 0x01 – inactive		-	-
Reset diagnosis	0x0D	-	-	-	-	-
Sleep mode	0x0E	-	-	-	-	-
PMA mode	0x0F	0x00 – PMA active (default) 0x01 – PMA inactive	-	-	-	-
Reset	0x10	0x00 – default config 0x0A – factory reset	-	-	-	-
Remove parallel connections	0x11	-	-	-	-	-
Manual reboot	0x12	-	-	-	-	-

Description	Sub index (Byte 4)	Data Byte 5	Data Byte 6		Data Byte 7	
			Bits 8-5	Bits 4-1	Bits 8-5	Bits 4-1
CFS configuration	0x13	0x00 – default	-	-	-	-
		0x01…0x0C – Write fail state output 1…12	0x00 – No change 0x01 – ON 0x02 – OFF		-	-
		0x0D – Write fail state for all outputs	0x00 – No change 0x01 – ON 0x02 – OFF 0x03 – all outputs individually			
		0x0E – Heartbeat mode	0x00 – No heartbeat 0x01 – n/a 0x02 – heartbeat server mode			
		0x0F – Heartbeat time	0x01 – 1s 0x02 – 2s … 0x0F – 15s (default)			
Node ID change	0x14	0x01…0x7F – New ID				
Change bitrate	0x15	0x00 – default (250 kbit/s) 0x02 – 50 kbit/s 0x03 – 100 kbit/s 0x04 – 125 kbit/s 0x05 – 250 kbit/s 0x06 – 500 kbit/s 0x08 – 1000 kbit/s				

Coding the current rating within the CAN message

SCS200-SC08… / SCS200-SC12… 12V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-4 (A)	30 (default)	5	7.5	10	15	20	25	30
I_N channel 5-12 (A)	10 (default)	1	2	3	4	5	7.5	10

SCS200-SC12… 24V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-3 (A)	25 (default)	3	5	7.5	10	15	20	25
I_N channel 4-12 (A)	10 (default)	1	2	3	4	5	7.5	10

SCS200-SC12… 48V:

Value	0x00	0x01	0x02	0x03	0x04	0x05	0x06	0x07
I_N channel 1-3 (A)	15 (default)	1	2	3	4	5	7.5	10
I_N channel 4-12 (A)	10 (default)	1	2	3	4	5	7.5	10

The delay period to be adjusted per channel is calculated using the following scheme

$$\boldsymbol{Basic\ delay}\ [s]\ \cdot\ \boldsymbol{multiplier}\ (\mathbf{0}-\mathbf{10}) = \boldsymbol{delay\ period}\ [s]$$

Coding of delay ON/OFF

Value	0x0	0x1	0x2	0x3	0x4	0x5	0x6	0x7
ON delay / OFF delay (s)	0.5	1	5	10	50	100	500	1000

The use of sub-indexes 0x01…0x0C, 0x13, 0x14 will only take effect after a manual reboot by sub-index 0x12.

After use of sub-indexes 0x0F, 0x10, 0x11, 0x15 the SCS200 performs a reboot. Please note that it can take up to 400ms before the module can receive new CAN messages.
Do not switch OFF the SCS200 during this reboot phase!

Example

How to adjust an OFF delay of 15 s on channel 3 of the SCS200. Node-ID SCS200: 0x1

COB-ID	Object	Write	Sub-Ind.	Byte 5	Byte 6	Byte 7	Byte 8
0x601	0x2002	0x22	0x03	0x01	0x00	0x23	0x00

How to adjust a current rating of 7.5 A on channel 10 of the SCS200. Node-ID SCS200: 0x1

COB-ID	Object	Write	Sub-Ind.	Byte 5	Byte 6	Byte 7	Byte 8
0x601	0x2002	0x22	0x0A	0x02	0x06	0x00	0x00

6.5.3 Objects 0x6000 … 0x67FF - Standardized profile area 1st logical device

6.5.3.1 Object 0x6000 - Diagnostic and State of Loads

Sub index	Data Type	Access	Bit	Description	Value
0x00	Unsigned8	RO	Bit 8-1	Number of mapped application objects in PDO	0x10
0x01	Unsigned8	RO	Bit 8-5	Diagnostic of Load 1	0b0000 – OK 0bxxx1 – Trip 1 error 0bxx1x – Open load 0bx1xx – Trip 2 error
			Bit 4-1	Diagnostic of Load 2	
0x02	Unsigned8	RO	Bit 8-5	Diagnostic of Load 3	
			Bit 4-1	Diagnostic of Load 4	
0x03	Unsigned8	RO	Bit 8-5	Diagnostic of Load 5	
			Bit 4-1	Diagnostic of Load 6	
0x04	Unsigned8	RO	Bit 8-5	Diagnostic of Load 7	
			Bit 4-1	Diagnostic of Load 8	
0x05	Unsigned8	RO	Bit 8-5	Diagnostic of Load 9	
			Bit 4-1	Diagnostic of Load 10	
0x06	Unsigned8	RO	Bit 8-5	Diagnostic of Load 11	
			Bit 4-1	Diagnostic of Load 12	
0x07	Unsigned8	RO	Bit 8-1	Diagnostic of Voltages	See note in next page
0x08	Unsigned8	RO	Bit 8-1	Diagnostic of total current	0x00 - OK 0x01 - Overcurrent
0x09	Unsigned8	RO	Bit 8-5	State of Load 1	0b0000 – Off 0b0001 – On
			Bit 4-1	State of Load 2	
0x0A	Unsigned8	RO	Bit 8-5	State of Load 3	
			Bit 4-1	State of Load 4	
0x0B	Unsigned8	RO	Bit 8-5	State of Load 5	
			Bit 4-1	State of Load 6	
0x0C	Unsigned8	RO	Bit 8-5	State of Load 7	
			Bit 4-1	State of Load 8	
0x0D	Unsigned8	RO	Bit 8-5	State of Load 9	
			Bit 4-1	State of Load 10	
0x0E	Unsigned8	RO	Bit 8-5	State of Load 11	
			Bit 4-1	State of Load 12	
0x0F	Unsigned8	RO	Bit 8-1	Reserve	
0x10	Unsigned8	RO	Bit 8-1	Reserve	

Sub Index 0x07 - Diagnostic of Voltages

Version	Data Byte	Value
12V/Relay	0xPQ	0x00 - OK 0x01 – Undervoltage from U_{Bat} 0x10 – Overvoltage from U_{Bat}
24V/48V		- 0xP: 0x0 - OK 0x1 - Undervoltage from $U_{Control}$ 0x4 - Overvoltage from $U_{Control}$ - 0xQ: 0x0 - OK 0x1 - Undervoltage from U_{Bat} 0x4 - Overvoltage from U_{Bat}

6.5.3.2 Object 0x6200 - Switching Loads

Sub index	Data Type	Access	Bit	Description	Value
0x00	Unsigned8	RO	Bit 8-1	Number of mapped application objects in PDO	0x06
0x01	Unsigned8	R/W	Bit 8-5	Switch Load 1	0x0 No change 0x1 Switch ON channel 0x2 Switch OFF channel 0x7 Switch OFF channel immediately (without programmed delay)
			Bit 4-1	Switch Load 2	
0x02	Unsigned8	R/W	Bit 8-5	Switch Load 3	
			Bit 4-1	Switch Load 4	
0x03	Unsigned8	R/W	Bit 8-5	Switch Load 5	
			Bit 4-1	Switch Load 6	
0x04	Unsigned8	R/W	Bit 8-5	Switch Load 7	
			Bit 4-1	Switch Load 8	
0x05	Unsigned8	R/W	Bit 8-5	Switch Load 9	
			Bit 4-1	Switch Load 10	
0x06	Unsigned8	R/W	Bit 8-5	Switch Load 11	
			Bit 4-1	Switch Load 12	

Example: Switch ON channel 5 with node ID 0x01

CAN-ID	CAN data
0x601	0x2F 0x00 0x62 0x03 0x10 0x00 0x00 0x00

6.5.3.3 Object 0x6401 - Read Analog Input

Sub index	Data Type	Access	Description	Unit
0x00	Unsigned8	RO	Number of mapped application objects in PDO	0x20 (default value)
0x01	Unsigned16	RO	**24V/48V Version**: Control Voltage ($U_{Control}$) **12V/Relay Version**: Supply Voltage (U_{Bat})	10 mV
0x02	Unsigned16	RO	Total Current	10 mA
0x03	Unsigned16	RO	**24V/48V Version**: Load Voltage (U_{Bat}) **12V/Relay Version**: Analog Input 6	10 mV
0x04	Unsigned16	RO	Analog Input 1	10 mV
0x05	Unsigned16	RO	Analog Input 2	10 mV
0x06	Unsigned16	RO	Analog Input 3	10 mV
0x07	Unsigned16	RO	Analog Input 4	10 mV
0x08	Unsigned16	RO	Analog Input 5	10 mV
0x09	Unsigned16	RO	Voltage Load 1	10 mV
0x0A	Unsigned16	RO	Voltage Load 2	10 mV
0x0B	Unsigned16	RO	Voltage Load 3	10 mV
0x0C	Unsigned16	RO	Voltage Load 4	10 mV
0x0D	Unsigned16	RO	Current Load 1	10 mA
0x0E	Unsigned16	RO	Current Load 2	10 mA
0x0F	Unsigned16	RO	Current Load 3	10 mA
0x10	Unsigned16	RO	Current Load 4	10 mA
0x11	Unsigned16	RO	Voltage Load 5	10 mV
0x12	Unsigned16	RO	Voltage Load 6	10 mV
0x13	Unsigned16	RO	Voltage Load 7	10 mV
0x14	Unsigned16	RO	Voltage Load 8	10 mV
0x15	Unsigned16	RO	Current Load 5	10 mA
0x16	Unsigned16	RO	Current Load 6	10 mA
0x17	Unsigned16	RO	Current Load 7	10 mA
0x18	Unsigned16	RO	Current Load 8	10 mA
0x19	Unsigned16	RO	Voltage Load 9	10 mV
0x1A	Unsigned16	RO	Voltage Load 10	10 mV
0x1B	Unsigned16	RO	Voltage Load 11	10 mV
0x1C	Unsigned16	RO	Voltage Load 12	10 mV
0x1D	Unsigned16	RO	Current Load 9	10 mA
0x1E	Unsigned16	RO	Current Load 10	10 mA
0x1F	Unsigned16	RO	Current Load 11	10 mA
0x20	Unsigned16	RO	Current Load 12	10 mA

7. TESTS AND TECHNICAL DATA

7.1 Environmental testing and approvals

The following approval test was carried out for all SCS200 versions

Name	Chapter / section	Comments
E1	Directive R-10, regulatory status 5	KBA, approval mark E1*10R05/01*9019*00

The following tests were carried out for all SCS200 versions

Name	Chapter / section	Comments
ISO 16750-2	4.9.2	Multiple line interruption
ISO 16750-2	4.10.2	Short circuit in signal circuits
ISO 16750-2	4.10.3	Short circuit in load circuits
ISO 16750-3	4.1.2.7	Vibration - sprung masses Test VII
ISO 16750-3	4.2.2	Mechanical shock
ISO 16750-3	4.3	Free fall
ISO 16750-4	5.1.1.1	Storage at -40 °C
ISO 16750-4	5.1.1.2	Operation at -40 °C
ISO 16750-4	5.1.2.1	Storage at +90 °C
ISO 16750-4	5.1.2.2	Operation at +90 °C
ISO 16750-4	5.2	Temperature step test
ISO 16750-4	5.3.1	Temperature cycle test
ISO 16750-4	5.3.2	Rapid change of temperature
ISO 16750-4	5.6.2.2	Damp heat cyclic test
ISO 16750-4	5.7	Damp heat, steady-state test
ISO 16750-4	5.10	Dust test (covered by IP testing)
ISO 16750-5	4	Chemical loads

After a free fall, all relays and fuses of the SCS200-RC... version must be pushed in again into the socket. The impact may have loosened the tight fit of the components.

If the SCS200-RC... variant is subjected to heavy loads due to vibrations, the contact resistances in the sockets may deteriorate over the course of its typical life. This can be remedied by removing and re-inserting the components.

The following chemical loads were tested:

- Diesel AA
- Motor oil BA
- Hydraulic fluid BD
- Battery acid CA
- Urea CD
- Vehicle cleaner DB
- Acetone DG
- Cleaning agent containing ammonium DJ
- Spirit DK
- Transpiration
- Cosmetic products EC
- Soft drinks containing caffeine and sugar ED
- Cream, coffee whitener EF

Exposure to battery acid may cause external damage to the housing (illegible product marking), but this will not affect the functionality of the SCS200. However, it is recommended to replace the device in this case.

To prevent damage, after exposure to chemical loads, these must be immediately removed from the device.

7.2 Derating of ampacity

7.2.1 SCS200-SC12… 12V

Figure 11 shows the derating of the maximum total current of the 12-channel semiconductor version over the ambient temperature with a voltage rating of 12V.

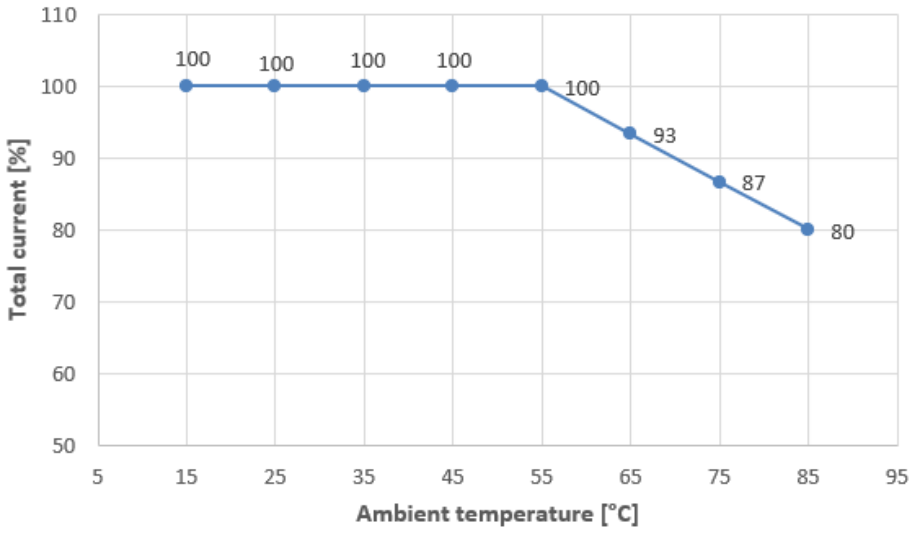


Figure 11: Derating of the maximum total current (SCS200-SC... 12V)

Figure 12 shows the derating of the ampacity per load output at max. total current over the ambient temperature.

The ampacity of the individual channels can be increased by reducing the total current.

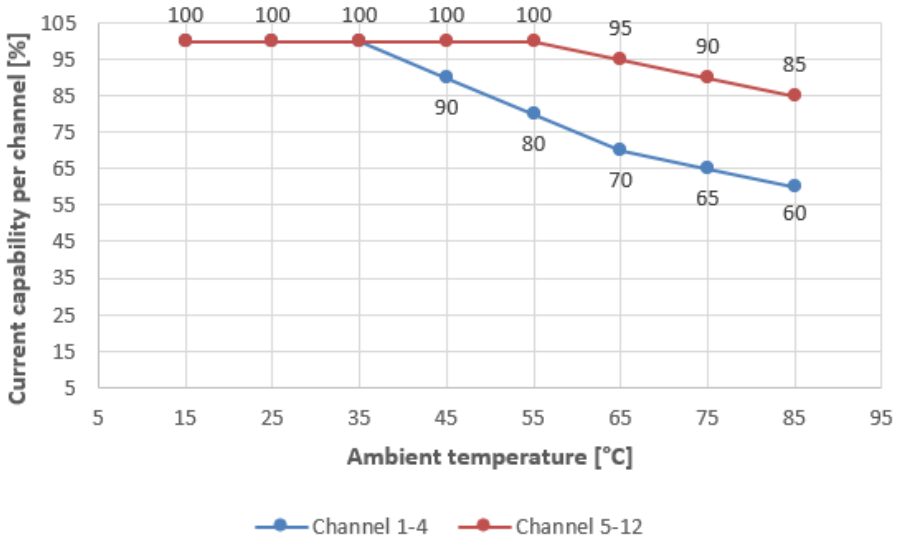


Figure 12: Derating of the ampacity per channel at maximum total current (SCS200-SC… 12V)

Cable cross-sections must be adjusted to the actual current and the operating temperature conditions. The temperature behavior of the device improves with larger cross sections.

7.2.2 SCS200-SC12… 24V

Figure 13 shows the derating of the maximum total current of the 12-channel semiconductor version over the ambient temperature with a voltage rating of 24V.

Figure 14 shows the derating of the ampacity per load output at max. total current over the ambient temperature.

The ampacity of the individual channels can be increased by reducing the total current.

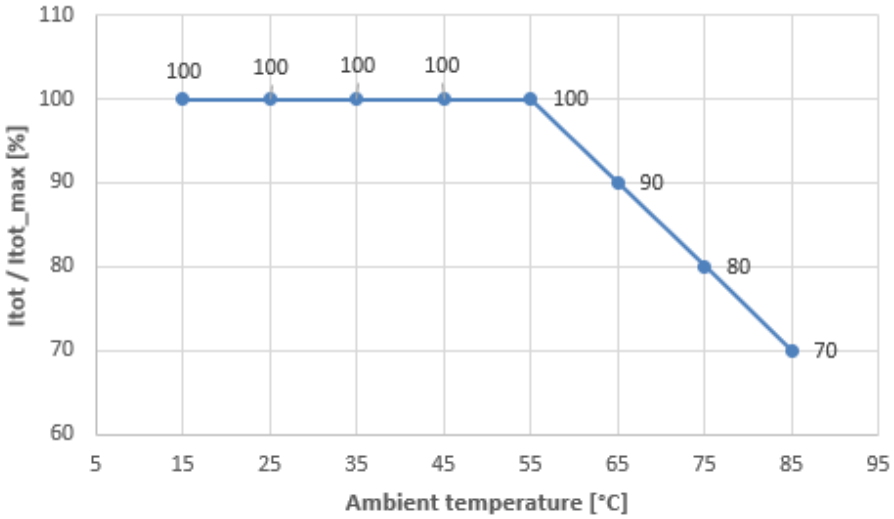


Figure 13: Derating of the maximum total current (SCS200-SC… 24V)

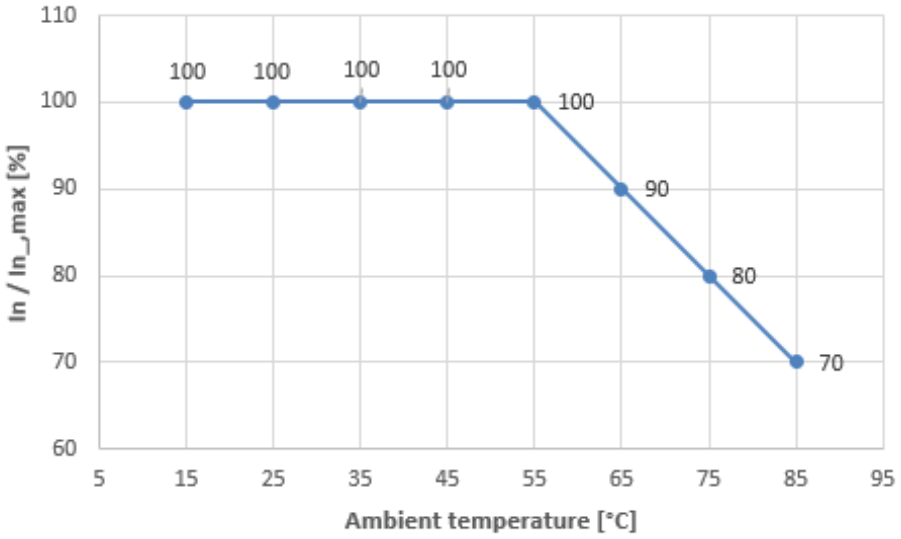


Figure 14: Derating of the ampacity per channel at maximum total current (SCS200-SC… 24V)

Cable cross-sections must be adjusted to the actual current and the operating temperature conditions. The temperature behavior of the device improves with larger cross sections.

7.2.3 SCS200-SC12… 48V

Figure 15 shows the derating of the maximum total current of the 12-channel semiconductor version over the ambient temperature with a voltage rating of 48V.

Figure 16 shows the derating of the ampacity per load output at max. total current over the ambient temperature.

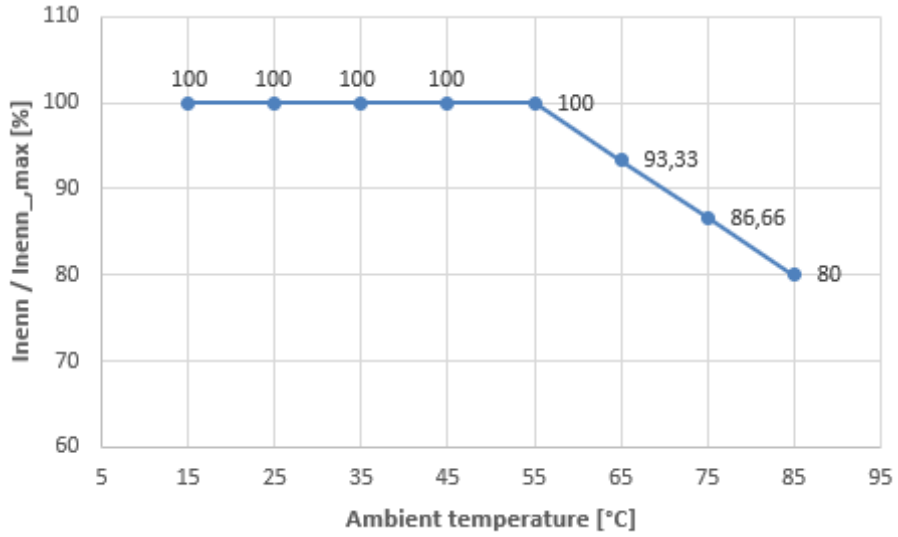


Figure 15: Derating of the maximum total current (SCS200-SC… 48V)

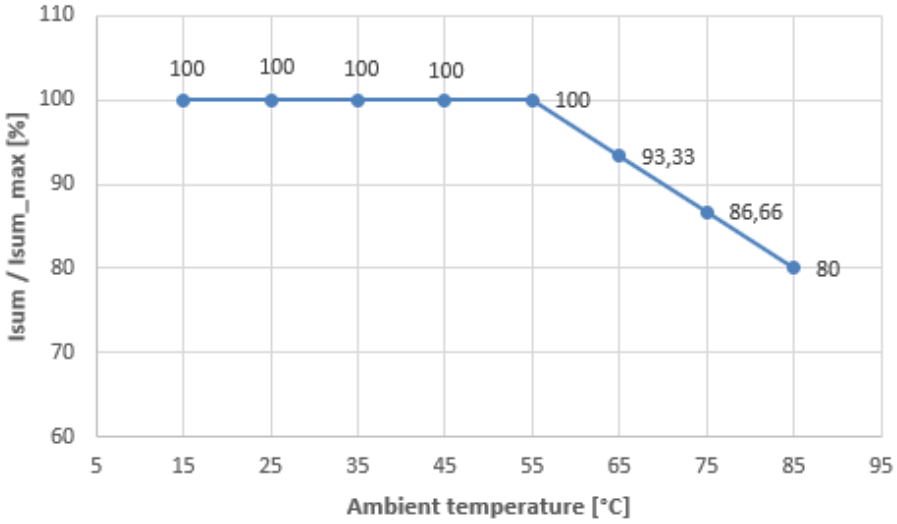


Figure 16: Derating of the ampacity per channel at maximum total current (SCS200-SC… 48V)

The ampacity of the individual channels can be increased by reducing the total current.

Cable cross-sections must be adjusted to the actual current and the operating temperature conditions. The temperature behavior of the device improves with larger cross sections.

7.2.4 SCS200-RC-…

Derating was determined with the following population.

Fuses:

30 A channels: 40 A fuse from ESKA/MTA (art. no.: 340.035)

10 A channels: 15 A fuse from ESKA/MTA (art. no.: 340.029)

Relays 12 VDC:

30 A channels: ESR10-NC2A4HB-00-D1-30A from E-T-A

10 A-channels: ESR10-NC2A4HB-00-D1-10A from E-T-A

Relays 24 VDC:

30 A channels: V23074-A2002-A403 from TE connectivity

10 A channels: Channel 5-8: ESR10-NC2A4HB-00-D2-10A from E-T-A

Figure 17 shows the derating of the maximum total current of the relay version over the ambient temperature.

Figure 18 shows the derating of the ampacity per load output, at max. total current, for 12 VDC.

The ampacity of the individual channels can be increased by reducing the total current.

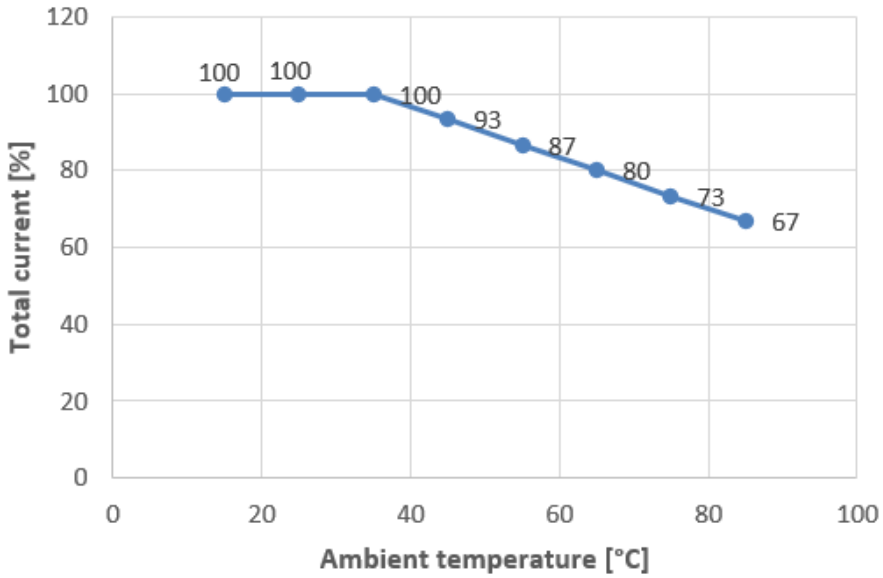


Figure 17: Derating of the maximum total current (SCS200-RC...)

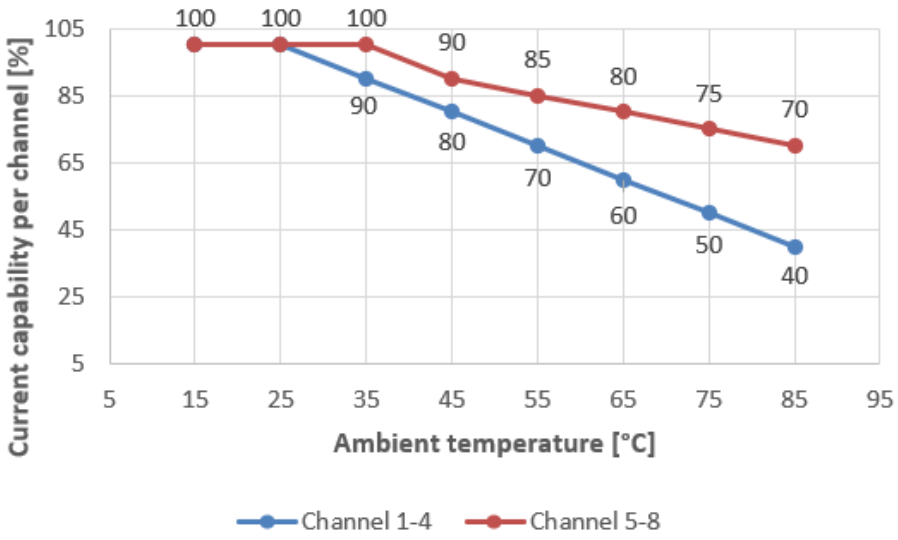


Figure 18: Derating of the ampacity per channel at maximum total current (SCS200-RC..., 12 VDC)

Figure 19 shows the derating of the ampacity per load output, **at max. total current**, for 24 VDC.

The ampacity of the individual channels can be increased by reducing the total current.

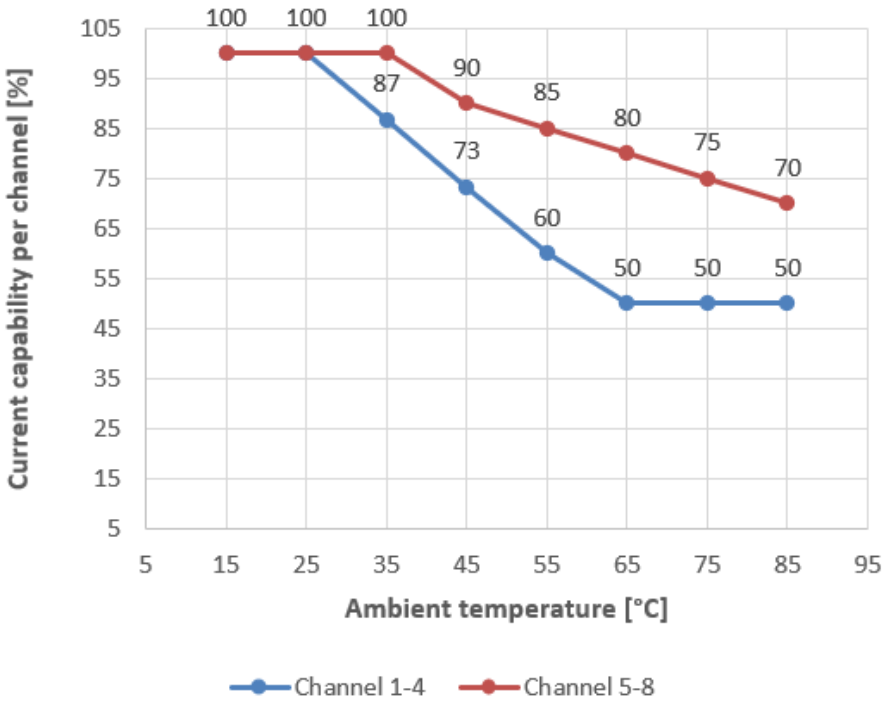


Figure 19: Derating of the ampacity per channel at maximum total current (SCS200-RC..., 24 VDC)

Cable cross-sections must be adjusted to the actual current and the operating temperature conditions. The temperature behavior of the device improves with larger cross sections.

8. LISTS

8.1 List of abbreviations

AWG	American Wire Gauge
CAN	Controller Area Network
CFS	CAN fail-safe
ECU	Electronic Control Unit
EDS	Electronic Data Sheet
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESR	Electronic Standard Relay
GND	Ground
HSD	High Side Driver
ID	Identificator
IP	International Protection
ISO	International Organization for Standardization LED Light Emitting Diode
LED	Light Emitting Diode
LSB	Least Significant Byte
MSB	Most Significant Byte
PC	Personal Computer
PDO	Process Data Object
PDU	Power Distribution Unit
PGN	Parameter Group Number
PMA	Physical module addressing
SAE	Society of Automotive Engineers
SCS	Smart Control Systems
SW	Software
TPDO	Transmit Process Data Object
USB	Universal Serial Bus
VDC	Volts of Direct Current

8.2 List of figures

8.3 List of tables

9. NOTES

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