User Manual

SCS® Smart Control Systems – SCS200 intelligent power distribution

1 Table of contents

2 General information

2.1 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.

2.2 Qualified personnel

This user manual must exclusively be used by qualified personnel, who are able – based on their training and experience – to realise 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.

2.3 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. The right to make changes without notice is reserved. Error and omissions excepted.

2.4 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.

3 Introduction

3.1 SCS200 intelligent power distribution

More intelligent and complex systems as well as 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. It is an intelligent power distribution system, allowing decentralised control and monitoring of loads via the CAN bus. The design features a pcb-based power distribution in a compact IP66/ IP67 enclosure.

SCS200 modules are plug-and-play solutions that allow you to reduce wiring time and save space. Comprehensive diagnostic capabilities (integral load protection, load current and voltage measurement, output status) and the integrated CAN connection of the SCS200 allow predictive maintenance and the implementation of load management.

The SCS200 was especially designed for the use in agricultural machinery, construction machinery, specialty vehicles, buses and trucks. Major applications are the decentralised power distribution of higher loads downstream the ECU.

Besides power distribution, the SCS200 provides more transparency on the load side by feeding back the current and voltage values. The integral electronic load protection provides additional safety. The analog inputs of the SCS200 are ideally suited to CAN connection of sensors installed in the proximity of the device.

The SCS200 is SAEJ1939-compatible. The module allows uncomplicated and quick system extensions or complete vehicle or machinery modernisation.

Fig. 1 shows how the SCS200 can be integrated in the on-board electrical system.

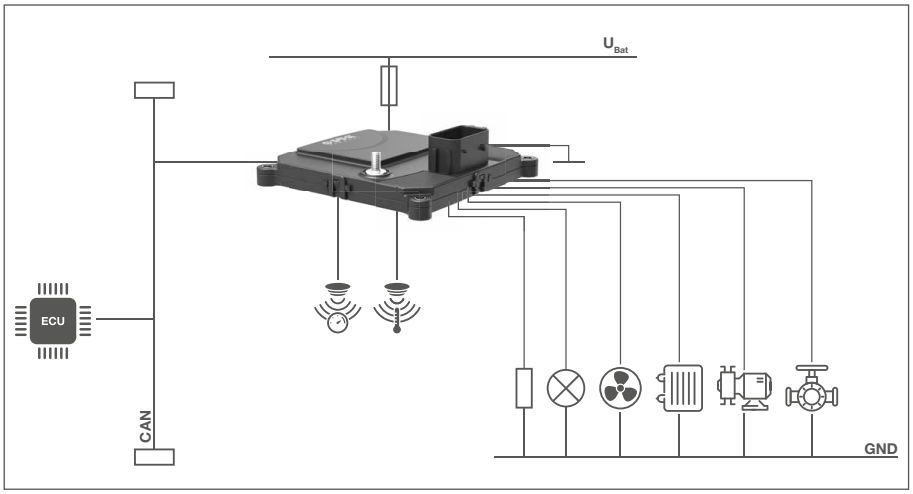


fig. 1: SCS200 installed in a vehicle

4 Hardware options

There are two main versions of the SCS200 which superficially can be distinguished by the version of switching elements installed.The two versions are the semi-conductor version and the relay version, which are described in more detail in the following.

All versions of the SCS200 are pin-compatible and have the same housing footprint to allow ease of replacement.

4.1 Semi-conductor version SCS200-SC…

The semi-conductor version SCS200-SC... of the SCS200 intelligent power distribution system switches loads via HSD power semi-conductors. The module receives its commands via the CAN bus. Internal current measurement allows an electronic load protection in addition to the signal of the present load current via 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 of the six analog inputs of the device can be read via CAN messages. A wake pin allows waking the module via the hardware from the sleep mode. The fully electronic version in an IP66 / IP67 enclosure is available for 12 VDC both with 8 or 12 load outputs.

4.1.1 Dimensions SCS200-SC…

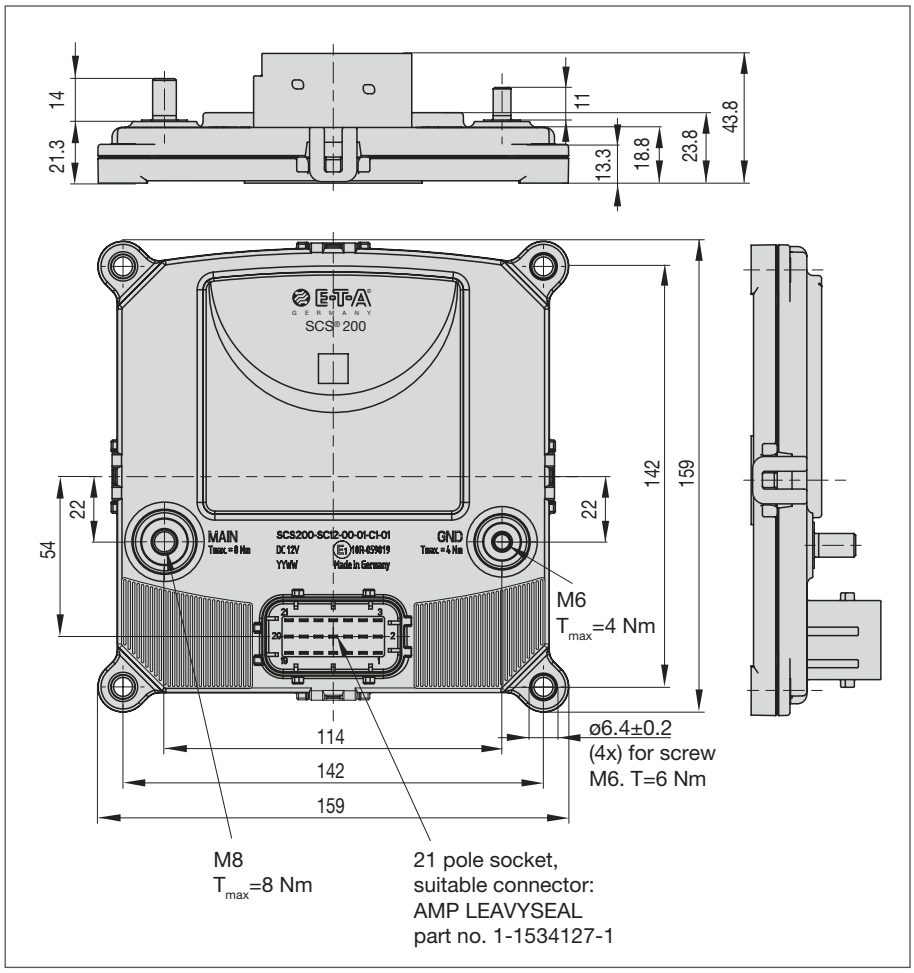


fig. 2: Dimensions SCS200-SC…

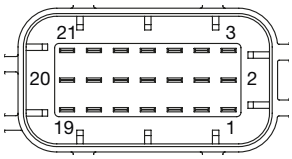
4.1.2 Pin assignment SCS200-SC08-...

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

Ampacity of outputs:
4 x 30 A
4 x 10 A

Main terminals
U_{Bat}: M8 screw terminal (marking: MAIN)
GND: M6 screw terminal (marking: GND

21-pole connector
Mating plug: Tyco AMP
LEAVYSEAL 1-1534127-1



Pin	Name	Description
1	n.c.	not connected
2	LOAD_8	10 A load
3	LOAD_4	30 A load
4	n.c.	not connected
5	IN_A_1	Analogue input 1
6	LOAD_7	10 A load
7	n.c.	not connected
8	IN_A_3	Analogue input 3
9	LOAD_3	30 A load
10	n.c.	not connected
11	IN_A_4	Analogue input 4
12	LOAD_6	10 A load
13	IN_A_2	Analogue input 2
14	IN_A_5	Analogue input 5
15	LOAD_2	30 A load
16	IN_A_6	Analogue input 6
17	WAKE_SIGNAL_IN	CAN wake up input
18	LOAD_5	10 A load
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	LOAD_1	30 A load

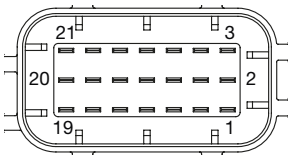
4.1.3 Pin assignment SCS200- SC12-...

The following table shows the pin assignment of the fully electronic SCS200 version with 12 load outputs.

Ampacity of outputs:
4 x 30 A
8 x 10 A

Main terminals
U_{Bat}: M8 screw terminal (marking: MAIN)
GND: M6 screw terminal (marking: GND

21-pole connector
Mating plug: Tyco AMP
LEAVYSEAL 1-1534127-1



Pin	Name	Description
1	LOAD_9	10 A load
2	LOAD_8	10 A load
3	LOAD_4	30 A load
4	LOAD_10	10 A load
5	IN_A_1	Analogue input 1
6	LOAD_7	10 A load
7	LOAD_11	10 A load
8	IN_A_3	Analogue input 3
9	LOAD_3	30 A load
10	LOAD_12	10 A load
11	IN_A_4	Analogue input 4
12	LOAD_6	10 A load
13	IN_A_2	Analogue input 2
14	IN_A_5	Analogue input 5
15	LOAD_2	30 A load
16	IN_A_6/GND_CAN	Analogue input 6
17	WAKE_SIGNAL_IN	CAN wake up input
18	LOAD_5	10 A load
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	LOAD_1	30 A load

The SCS200 has a reverse polarity protection:
- main terminals U_{Bat} to GND: reverse polarity non-conductive
- load outputs to GND: reverse polarity conductive

4.2 Relay version SCS200-RC…

The relay verson SCS200-RC... of the SCS200 intelligent power distribution system switches connected loads via electro-mechanical or solid state relays in ISO Micro enclosure. Each relay has an upstream back-up fuse. The module receives its switch commands via the CAN bus.

The relay version SCS200-RC... has a removeable 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. Upon request, the SCS200 relay version is also available in a populated version.

As with the SCS200 semi-conductor version, an internal current measurement also enables electronic load protection of the relay version. 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 fuses are merely back-up elements, ensuring physical isolation in a worst case scenario. Ideally, these fuses never trip as the electronic load protection will always respond before.

The relay version also provides a signal of the present load current via CAN bus.
The voltage values of the six analog inputs of the device can also be read via CAN messages.

A wake pin allows waking the module via the hardware from the sleep mode.
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 Recommended relays and fuses for SCS200-RC…

We recommend to use the following or similar fuses for insertion in the SCS200 relay version:
30 A channels: 40 A fuse by ESKA/MTA (p/n 340.035)
10 A channels: 15 A fuse by ESKA/MTA (p/n 340.029)

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

U_N = 12 V: channel 1-4: ESR10-NC2A4HB-00-D1-30A by E-T-A
channel 5-8: ESR10-NC2A4HB-00-D1-10A by E-T-A

U_N = 24 V: channel 1-4: V23074-A2002-A403 by TE connectivity
channel 5-8: ESR10-NC2A4HB-00-D2-10A by 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.

4.2.2 Dimensions SCS200- RC08-

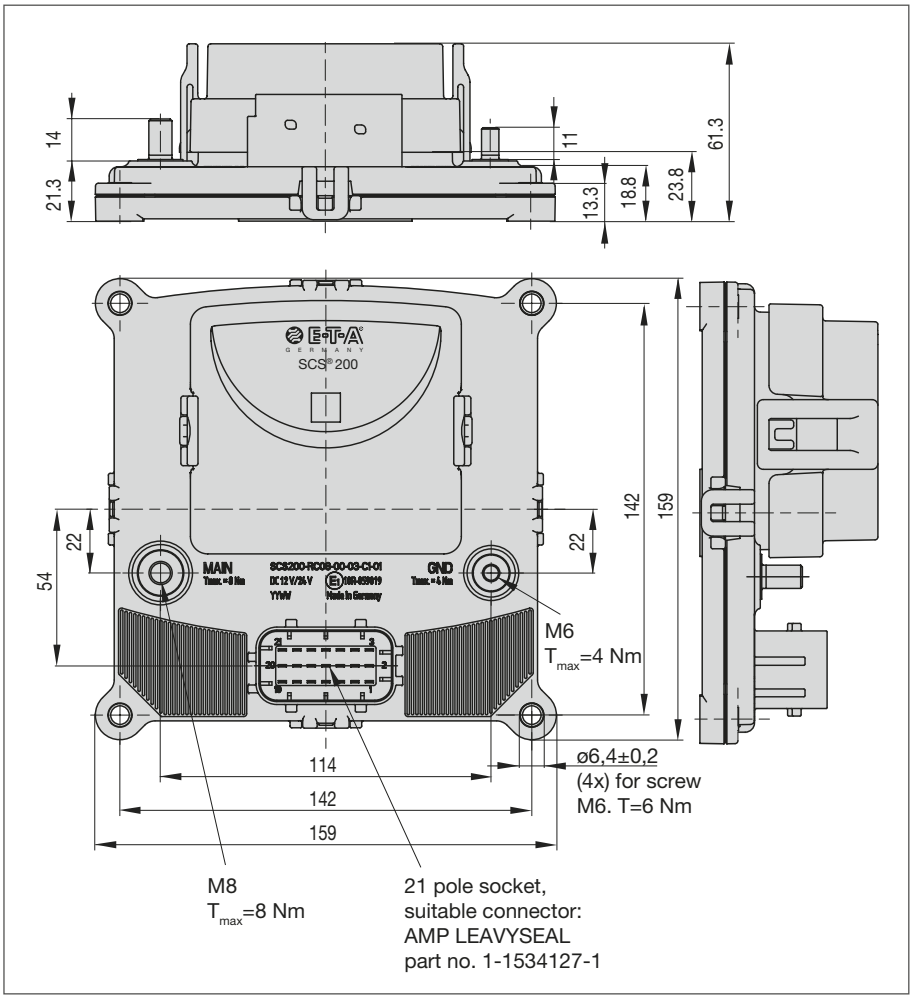


fig. 3: Dimensions SCS200- RC08-...

4.2.3 Pin assignment SCS200-RC08-...

The following table shows the pin assignment of the fully electronic SCS200 Relay version with 8 load outputs.

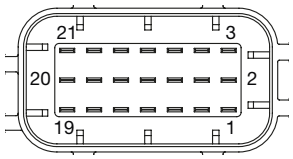
Ampacity of outputs:
4 x 30 A
4 x 10 A

Main terminals

U_{Bat}: M8 screw terminal (marking: MAIN)
GND: M6 screw terminal (marking: GND

21-pole connector

Mating plug: Tyco AMP
LEAVYSEAL 1-1534127-1



Pin	Name	Description
1	n.c.	not connected
2	LOAD_8	10 A load
3	LOAD_4	30 A load
4	n.c.	not connected
5	IN_A_1	Analogue input 1
6	LOAD_7	10 A load
7	n.c.	not connected
8	IN_A_3	Analogue input 3
9	LOAD_3	30 A load
10	n.c.	not connected
11	IN_A_4	Analogue input 4
12	LOAD_6	10 A load
13	IN_A_2	Analogue input 2
14	IN_A_5	Analogue input 5
15	LOAD_2	30 A load
16	IN_A_6	Analogue input 6
17	WAKE_SIGNAL_IN	CAN wake up input
18	LOAD_5	10 A load
19	CAN_H_OUT	CAN high
20	CAN_L_OUT	CAN low
21	LOAD_1	30 A load

The SCS200 has the following polarity protection:

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

4.2.4 Relay assignment SCS200-RC08-...

Fig. 4 shows the pin assignment of the SCS200 relay version with 8 load outputs.

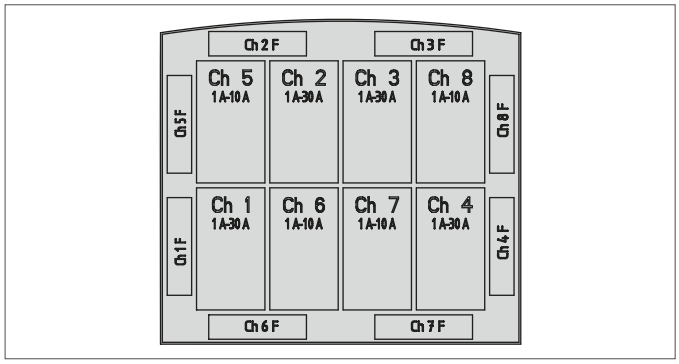


fig. 4: Relay assignment SCS200-RC08-...

4.2.5 Visual LED indication SCS200-RC...

The relay version has status LEDs on the pcb, beneath the cover. These LEDs indicate the status of the CAN bus. The following conditions are visually indicated:

- red: Bus error, communication interrupted
- green: CAN live, communication faultless

The green LED is automatically deactivated in the sleep mode.

The green LED can be deactivated if required via a CAN message in order to save energy.

4.3 Analog inputs

Independently of the product version, the SCS200 provides 6 analog inputs or sensor inputs.
The module reads the voltage applied to the inputs and sends it as a CAN message to other bus devices. Sensor, that are installed in the proximity of the module, can easily be connected to the CAN bus via analog inputs. Cable lengths can thus be reduced and so can ECU inputs.
The analog inputs of the SCS200 cover a voltage range of 0 - 10 VDC.
Higher voltages, e.g. Ubat,$_{Bat,}$ can nevertheless be applied to the inputs, but are read out with less accuracy.
Accuracy: up to 5 V: ± 125 mV
up to 10 V: ± 200 mV
The analog inputs of the SCS200 are internally protected against overvoltage.

The voltage values at the analog 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 analog inputs. This kind of data processing must be done by a superordinate control unit.

5 Mounting

Please ensure sufficient space for the mating plugs of the load terminals (fig. 5). For the relay version, this must also be observed for removing the cover.

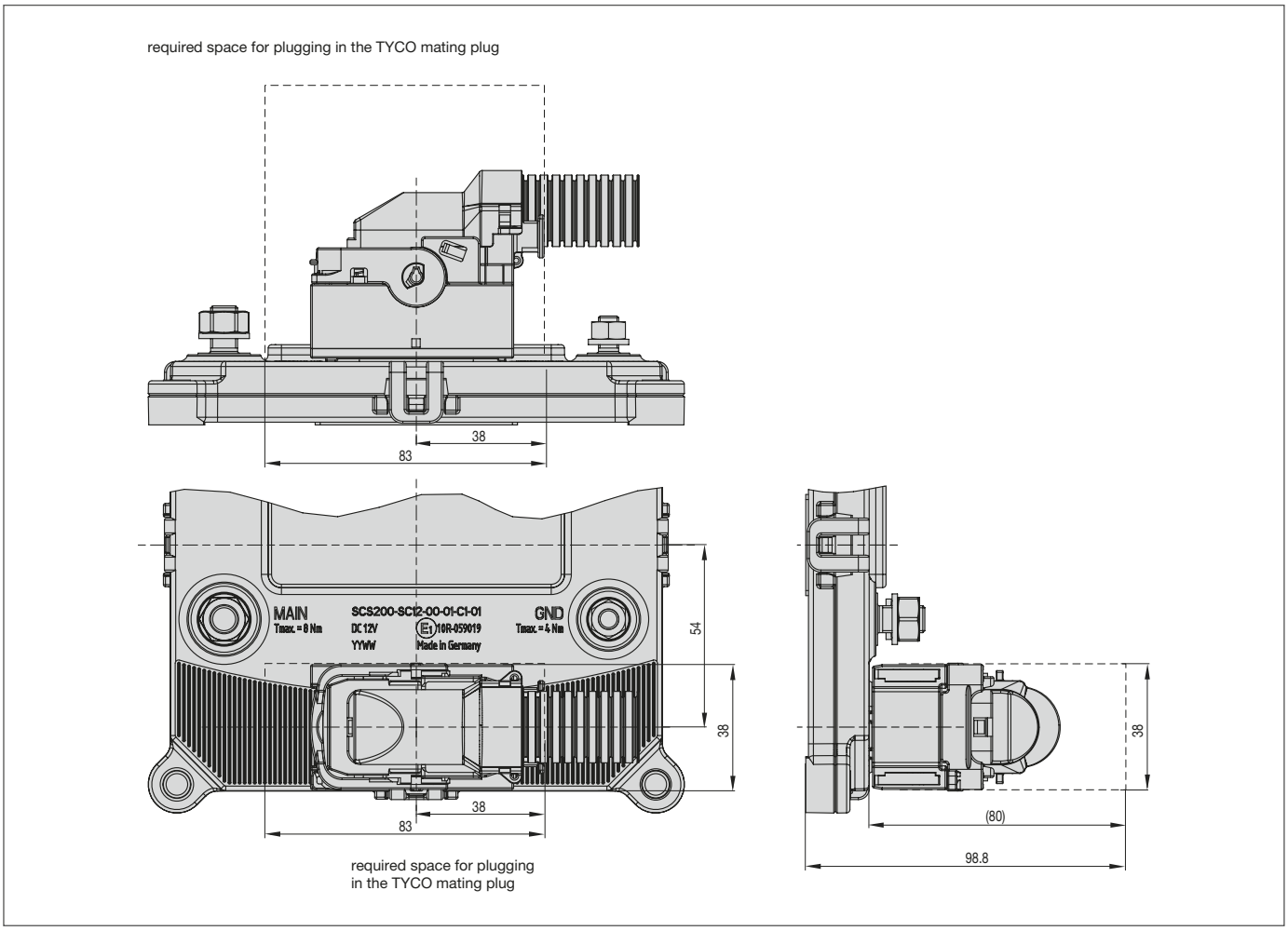


fig. 5: Required space for plugging in the Tyco mating plug

The device must be firmly mounted before connection of cables. Please use M6 mounting screws (tightening torque max. 6 Nm). The mounting hardware is not included in the scope of delivery.

M8 and M6 hexnuts and washers for the MAIN and GND terminals are included in the delivery.

All connecting cables have to be fixed min. 7 cm from the axis of the screw terminal with suitable means. An excessive mechanical strain must be avoided.

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

5.1 Cable cross sections

Cross section of main terminal: ≥ 50 mm²

Cross section of load terminal:

30 A channels:	AWG12 or 4 mm²
10 A channels:	AWG12 or ≥ 2.5 mm²

The cross section needs to be adjusted to the actual current and the operating temperature conditions. The temperature behaviour of the device improves with larger cross sections.

6 Software and diagnostic functions

The SCS200 is a CAN-controlled power distribution board providing comprehensive diagnostic functions as well current and voltage monitoring. The product is a slave module which is controlled by a superordinate control unit or ECU via the CAN bus. The SCS200 receives commands for switching the load outputs as CAN frames and, in the event of a change or upon request, provides diagnostic data and measuring values. Logical links between the analog inputs and the load outputs are not implemented in the device itself, but are taken over by the superordinate control unit.

6.1 Field bus connection

The SCS200 supports the CAN 2.0B standard and is SAE J1939 compatible. It can therefore be used without further adjustment or the use of gateways with other standard components in a J1939 network. By assigning an unambiguous ID or node address to the SCS200, it is possible to operate more than one module on the same bus.
The example in fig. 6 shows the structure of a CAN network with SCS200.

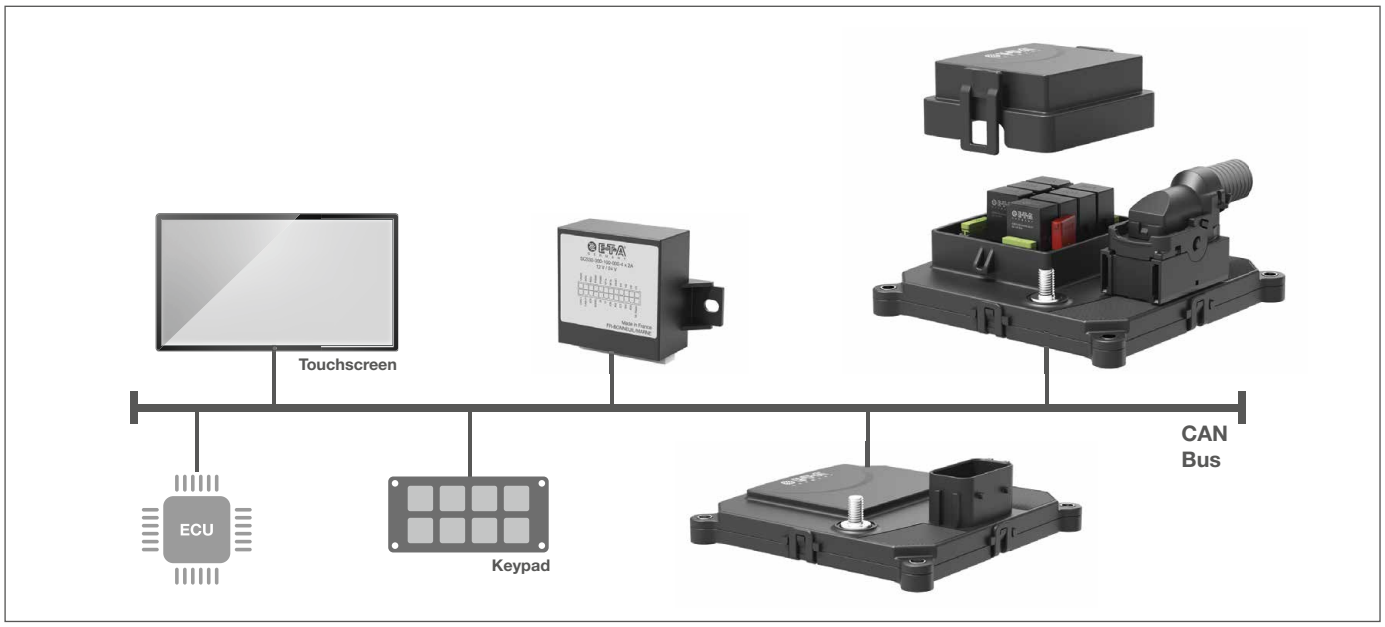


fig. 6: Structure of a CAN network with two SCS200s

Configuration of the SCS200 is possible without a special programming environment or pertinent software. Adjustments can be implemented via pre-defined CAN frames which are sent ot the device via the bus. The configuration or initialisation of the module can therefore also be adopted directly by a superordinate control unit or ECU during vehicle production. In addition, a connection to a PC can be set up via a CAN-to-bus adapter. A customary programme for CAN monitoring allows receipt of messages from the module and addressing the SCS200.

The SCS200 has an internal bootloader. Should an update of the SCS200 firmware become necessary, it can be installed on site.

6.2 Integral electronic load protection

Both the fully electronic SCS200-SC... versions and the SCS200-R08... 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 also the affected load output. After remedy of the failure, the channels can be reset via a corresponding CAN message (see 7.4.3.1.1).

6.2.1 Configuration of the current rating per channel

In order to adjust the electronic load protection of the SCS200 to the actual current 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:

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

The SCS200 is supplied in a standard configuration where the current ratings of all channels are set to the maximum value (30A or 10A respectively).

6.2.2 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 a standard and cannot be deactivated.

trip current 1: 1.3 times I_N
trip delay 1: 200 ms (default)

Trip 2 (fast disconnection):

Disconnection of the load output in question in the event of high overcurrent or short circuit This disconnection can be deactivated in the software by sending a corresponding CAN message to module (also see 7.4.1.4). By deactivating the fast disconnection trip 2, nuisance tripping when switching loads with higher inrush currents can be avoided.

trip current 2:

Channel 1 – Channel 4	Current rating (A)	5	7.5	10	15	20	25	30
	trip current 2 (A)	15	22.5	30	45	60 (SCS200-SC...) 52 (SCS200-RC...)	60 (SCS200-SC...) 52 (SCS200-RC...)	60 (SCS200-SC...) 52 (SCS200-RC...)
Channel 5 – Channel 12	Current rating (A)	1	2	3	4	5	7.5	10
	trip current 2 (A)	3	6	9	12	15	22.5 (SCS200-SC...) 21 (SCS200-RC...)	22.5 (SCS200-SC...) 21 (SCS200-RC...)

trip delay 2: 25 ms (default)

6.2.3 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 with the following current values:

SCS200-SC12-…: disconnection at a total current of > 150 A
SCS200-SC08-…: disconnection at a total current of > 120 A
SCS200-RC08-…: disconnection at a total current of > 120 A

Loads are also disconnected in the event of too high supply voltage or too high voltage applied to channel.

SCS200-SC…: U_N > 17 V
SCS200-RC…: U_N > 33 V (complete disconnection of the module at U_N > 34 V)

6.3 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.

6.3.1 Current measurement

The SCS200 measures the current per load output as well as the total current of the module and provides these values via CAN bus. Loads can be monitored precisely at any point in time and possibly required action can be taken regarding load management and predictive maintenance.

Measuring accuracy of load current per channel:	channels 1 – 4	(I_N = 5 A – 30 A):	± 0.5 A
	channels 5 – 12	(I_N = 1 A – 10 A):	± 0.5 A

Measuring accuracy total current: ± 3 A

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

SCS200-SC…:	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-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

Measuring accuracy cannot be guaranteed for the entire life span of the device.

6.3.2 Voltage measurement

The SCS200 provides current measuring values regarding supply voltage and voltage applied to the load outputs via CAN bus. These values can also be evaluated for implementation of the load management.

Measuring accuracy voltage measurement at U_N: ± 3 %

Measuring accuracy cannot be guaranteed for the entire life span of the device.

6.3.3 Output status and troubleshooting

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

Switching status per channel:

- ON
- OFF

Load status and troubleshooting per channel:

- normal
- overcurrent (trip characteristics see 6.2.2)
- overvoltage
- disconnection due to high total current
- open load / low current consumption

6.3.3.1 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 100 ms.

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

SCS200-SC…:	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-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

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

6.4 ON and OFF delay

The SCS200 offers the option to define an ON delay or OFF delay for each channel. This function is recommendable for realisation of overtravel or debouncing.

The ON or OFF delay can be adjusted between 0.5 s and 2.7 hrs (also see 7.4.1.3).

Accuracy: ± 10 ms

6.5 Sleep mode

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

The sleep command is received via the CAN bus. Via a broadcast message (proprietary B), all SCS200 modules on the bus can simultaneously be put into the sleep mode. However, it is also possible selectively have individual SCS200 modules fall asleep (also see 7.4.3.3).

Closed circuit current input in the sleep mode:

SCS200-SC…: < 0.5 mA

SCS200-RC…: < 1.2 mA at 12 V (typically 1 mA)
< 2.4 mA at 24 V (typically 2.2 mA)

There are various ways to wake the device up again:

- 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: Via wake-up input - for wake up of the module connect pin 17 to ground.

7 CAN communication

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

7.1 Physical layer

For a reliable communication, the CAN physical layer should be built up to the specifications of ISO 11898-2 or SAE J1939-1x. Wiring should only be at each end of the bus as a twisted pair with terminating resistors in a »daisy chain« arrangement (fig. 7).

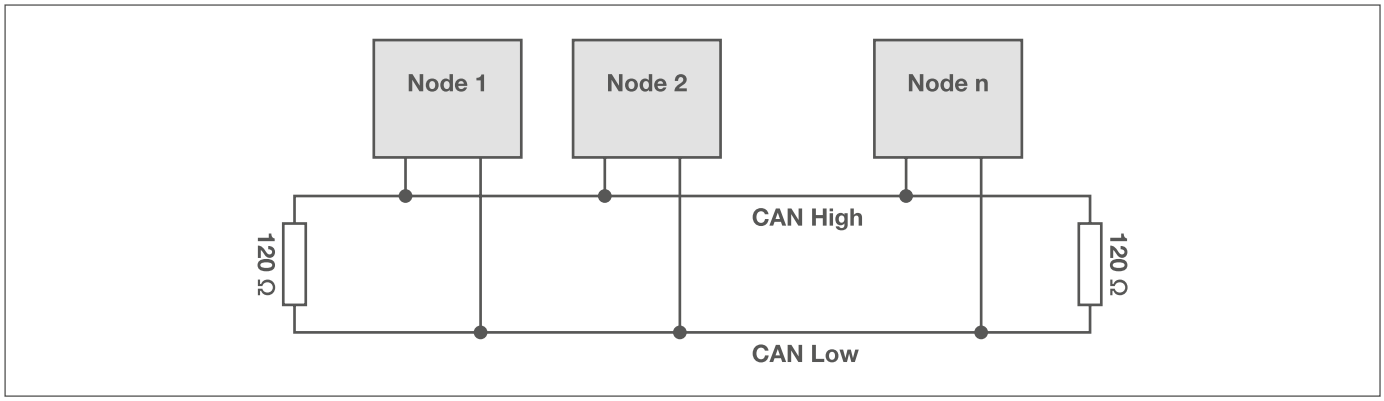


fig. 7: CAN network

The SCS200 has an integral CAN terminationi as a standard set-up. This could also be the case with devices made by other manufacturers. Please make sure to always provide sufficient CAN termination.
Upon request, the SCS200 is also available without integral CAN termination (see ordering information in the SCS200 data sheet).

The SCS200 supports a bit rate of 250 kbps.

7.2 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 Least Significant Byte (LSB).

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

b32	b31	b30	b29	b28	b27	b26	b25	b24	b23	b22	b21	b20	b19	b18	b17	b16	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1
MSb																															LSb

Transmission Order

MSb							Byte 1							LSb	MSb							Byte 2							LSb	MSb							Byte 3							LSb	MSb							Byte 4							LSb
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
							LSb																	MSb							

fig. 8: Transmission sequence of several data bytes (not alphanumerically) to J1939-71

7.3 SAE J1939

For the communication with the SCS200 we reverto to both J1939 Proprietary A messages and J1939 Proprietary B messages. These are listed in detail under 7.4.

7.3.1 Address claiming

The SCS200 is assigned an unambiguous 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 J1939-81 to independently claim an unambiguous 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

xx SCS200 node address

PGN 60928 – Message for Adress Claimed

Transmission Rate:	as requested
Data Length:	8 bytes
Data Page:	0
PDU format	238
PDU Specific:	255 (global address)
Default Priority:	6
Parameter Group Number:	60928 (00EE00h)

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.

7.3.2 Manufacturer ID

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

7.4 Overview of CAN messages

7.4.1 Initialisation/configuration

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

The following values can be configured:

- CAN node address of the SCS200
- current rating per load output
- ON delay per load output
- OFF delay per load output
- deactivation of fast disconnection trip 2
- reset to default configuration

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.
To save the settings, it is necessary to reset the device after sending the respective message.

PGN 61184 – 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
Parameter Group Number:	61184 (EF00h)

CAN-ID 0x18EFxxyy

xx Node address SCS200
yy: optional source address of sender

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 and manufacturer ID	Manufacturer ID	property to be config-ured	channel	new value	new value	not used	not used
Unit	–	–	–	–	–	–	–	–

7.4.1.1 Change of SCS200 node address

CAN data

Byte	Bit	Description	Vvalue
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	Bit	Description	Value
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

7.4.1.2 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

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

7.4.1.3 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 according to the following scheme:

basic delay (s) X multiplier (0 – 10) = delay periods (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

7.4.1.4 Deactivation of fast disconnection trip 2

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 (trip 2 active, default) 0x01 (trip 2 deactivated)
Byte 6		not used	0x00
Byte 7		not used	0x00
Byte 8		not used	0x00

7.4.1.5 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

In order to return to the default setting, a waiting period of at least 3 seconds is required after sending the corresponding CAN message, followed by the reset of the module.

The SCS200 is delivered with the default configuration. The following values are pre-set:

Default configuration SCS200

- CAN node address: 0xA0
- Rated current per channel: max. rated current
  channels 1 – 4: 30 A
  channels 5 – 12: 10 A
- ON/OFF delay per channel: 0 s
- fast disconnection: active

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. For this purpose please use the CAN message described in 7.4.1.1.

7.4.1.6 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 7.5 A current rating 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

7.4.2 Save and query the configuration

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.
The configuration of the module can be done once during the production process and is preserved over the entire operation or until the next change by means of 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 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	

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			

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

PGN 61184 – 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
Parameter Group Number: 61184 (EF00h)

CAN-ID: 0x18EFxxyy

xx node address SCS200
yy: optional source address of sender

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID and 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 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 – 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
Parameter Group Number: 65296 (FF10h)

CAN-ID: 0x18FF10xx

xx Node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Contents EEPROM address 0x60	Contents EEPROM address 0x61	Contents EEPROM address 0x62	Contents EEPROM address 0x63	Contents EEPROM address 0x64	Contents EEPROM address 0x65	Contents EEPROM address 0x66	Contents EEPROM address 0x67
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bit 8	Contents EEPROM address 0x60	status fast disconnection channel 1
	bits 7 – 5		basic ON delay channel 1
	bits 4 – 1		multiplier ON delay channel 1
Byte 2	bit 8	Contents EEPROM address 0x61	not used
	bits 7 – 5		basic ON OFF delay channel 1
	bits 4 –1		multiplier OFF delay channel 1
Byte 3	bit 8	Contents EEPROM address 0x62	status fast disconnection channel 2
	bits 7 – 5		basic ON delay channel 2
	bits 4 – 1		multiplier ON delay channel 2
Byte 4	bit 8	Contents EEPROM address 0x63	not used
	bits 7 – 5		basic ON OFF delay channel 2
	bits 4 – 1		multiplier OFF delay channel 2
Byte 5	bit 8	Contents EEPROM address 0x64	status fast disconnection channel 3
	bits 7 – 5		basic ON delay channel 3
	bits 4 – 1		multiplier ON delay channel 3
Byte 6	bit 8	Contents EEPROM address 0x65	not used
	bits 7 – 5		basic ON OFF delay channel 3
	bits 4 – 1		multiplier OFF delay channel 3
Byte 7	bit 8	Contents EEPROM address 0x66	status fast disconnection channel 4
	bits 7 – 5		basic ON delay channel 4
	bits 4 – 1		multiplier ON delay channel 4
Byte 8	bit 8	Contents EEPROM address 0x67	not used
	bits 7 – 5		basic ON OFF delay channel 4
	bits 4 – 1		multiplier OFF delay channel 4

PGN 65297 – 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
Parameter Group Number:	65297 (FF11h)

CAN-ID: 0x18FF11xx

xx node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Contents EEPROM address 0x68	Contents EEPROM address 0x69	Contents EEPROM address 0x6A	Contents EEPROM address 0x6B	Contents EEPROM address 0x6C	Contents EEPROM address 0x6D	Contents EEPROM address 0x6E	Contents EEPROM address 0x6F
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bit 8	Contents EEPROM address 0x68	status fast disconnection channel 5
	bits 7 – 5		basic ON delay channel 5
	bits 4 – 1		multiplier ON delay channel 5
Byte 2	bit 8	Contents EEPROM address 0x69	not used
	bits 7 – 5		basic ON OFF delay channel 5
	bits 4 – 1		multiplier OFF delay channel 5
Byte 3	bit 8	Contents EEPROM address 0x6A	status fast disconnection channel 6
	bits 7 – 5		basic ON delay channel 6
	bits 4 – 1		multiplier ON delay channel 6
Byte 4	bit 8	Contents EEPROM address 0x6B	not used
	bits 7 – 5		basic ON OFF delay channel 6
	bits 4 – 1		multiplier OFF delay channel 6
Byte 5	bit 8	Contents EEPROM address 0x6C	status fast disconnection channel 7
	bits 7 – 5		basic ON delay channel 7
	bits 4 – 1		multiplier ON delay channel 7
Byte 6	bit 8	Contents EEPROM address 0x6D	not used
	bits 7 – 5		basic ON OFF delay channel 7
	bits 4 – 1		multiplier OFF delay channel 7

Byte	Bit	Description	Value
Byte 7	bit 8	Contents EEPROM address 0x6E	status fast disconnection channel 8
	bits 7 – 5		basic ON delay channel 8
	bits 4 – 1		multiplier ON delay channel 8
Byte 8	bit 8	Contents EEPROM address 0x6F	not used
	bits 7 – 5		basic ON OFF delay channel 8
	bits 4 – 1		multiplier OFF delay channel 8

PGN 65298 – 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
Parameter Group Number: 65298 (FF12h)

CAN-ID: 0x18FF12xx

xx Node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Contents EEPROM address 0x70	Contents EEPROM address 0x71	Contents EEPROM address 0x72	Contents EEPROM address 0x73	Contents EEPROM address 0x74	Contents EEPROM address 0x75	Contents EEPROM address 0x76	Contents EEPROM address 0x77
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bit 8	Contents EEPROM address 0x70	status fast disconnection channel 9
	bits 7 – 5		basic ON delay channel 9
	bits 4 – 1		multiplier ON delay channel 9
Byte 2	bit 8	Contents EEPROM address 0x71	not used
	bits 7 – 5		basic ON OFF delay channel 9
	bits 4 – 1		multiplier OFF delay channel 9
Byte 3	bit 8	Contents EEPROM address 0x72	status fast disconnection channel 10
	bits 7 – 5		basic ON delay channel 10
	bits 4 – 1		multiplier ON delay channel 10
Byte 4	bit 8	Contents EEPROM address 0x73	not used
	bits 7 – 5		basic ON OFF delay channel 10
	bits 4 – 1		multiplier OFF delay channel 10

Byte	Bit	Description	Value
Byte 5	bit 8	Contents EEPROM address 0x74	status fast disconnection channel 11
	bits 7 – 5		basic ON delay channel 11
	bits 4 – 1		multiplier ON delay channel 11
Byte 6	bit 8	Contents EEPROM address 0x75	not used
	bits 7 – 5		basic ON OFF delay channel 11
	bits 4 – 1		multiplier OFF delay channel 11
Byte 7	bit 8	Contents EEPROM address 0x76	status fast disconnection channel 12
	bits 7 – 5		basic ON delay channel 12
	bits 4 – 1		multiplier ON delay channel 12
Byte 8	bit 8	Contents EEPROM address 0x77	not used
	bits 7 – 5		basic ON OFF delay channel 12
	bits 4 – 1		multiplier OFF delay channel 12

PGN 65299 – 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
Parameter Group Number: 65299 (FF13h)

CAN-ID: 0x18FF13xx

xx Node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Contents EEPROM address 0x78	Contents EEPROM address 0x79	Contents EEPROM address 0x7A	Contents EEPROM address 0x7B	Contents EEPROM address 0x7C	Contents EEPROM address 0x7D	Contents EEPROM address 0x7E	Contents EEPROM address 0x7F
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	Contents EEPROM address 0x78	current ratings channel 1
	bits 4 – 1		current ratings channel 2
Byte 2	bits 8 – 5	Contents EEPROM address 0x79	current ratings channel 3
	bits 4 – 1		current ratings channel 4
Byte 3	bits 8 – 5	Contents EEPROM address 0x7A	current ratings channel 5
	bits 4 – 1		current ratings channel 6

Byte	Bit	Description	Value
Byte 4	bits 8 – 5	Contents EEPROM address 0x7B	current ratings channel 7
	bits 4 – 1		current ratings channel 8
Byte 5	bits 8 – 5	Contents EEPROM address 0x7C	current ratings channel 9
	bits 4 – 1		current ratings channel 10
Byte 6	bits 8 – 5	Contents EEPROM address 0x7D	current ratings channel 11
	bits 4 – 1		current ratings channel 12
Byte 7		Contents EEPROM address 0x7E	checksum
Byte 8		Contents EEPROM address 0x7F	CFG

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

7.4.3 SCS200 Receipt 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.

7.4.3.1 Switch commands and queries per channel

PGN 61184 – 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
Parameter Group Number: 61184 (EF00h)

CAN-ID 0x18EFxxyy

xx Node address SCS200
yy: optional source address of sender

Overview set-up CAN data

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

7.4.3.1.1 Switch load outputs

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID Switch output	0x0
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3	bits 8 – 5	switch channel 1	0x0…0x2
	bits 4 – 1	switch channel 2	0x0…0x2
Byte 4	bits 8 – 5	switch channel 3	0x0…0x2
	bits 4 – 1	switch channel 4	0x0…0x2
Byte 5	bits 8 – 5	switch channel 5	0x0…0x2
	bits 4 – 1	switch channel 6	0x0…0x2
Byte 6	bits 8 – 5	switch channel 7	0x0…0x2
	bits 4 – 1	switch channel 8	0x0…0x2
Byte 7	bits 8 – 5	switch channel 9	0x0…0x2
	bits 4 – 1	switch channel 10	0x0…0x2
Byte 8	bits 8 – 5	switch channel 11	0x0…0x2
	bits 4 – 1	switch channel 12	0x0…0x2

Coding the current rating within the CAN message

0x0 no change
0x1 switch on channel
0x2 switch off channel

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

7.4.3.1.2 Query current and voltage measuring values per channel

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID query measuring values	0x1
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3	bits 8 – 5	query current & voltage channel 1	0x0…0x1
	bits 4 – 1	query current & voltage channel 2	0x0…0x1
Byte 4	bits 8 – 5	query current & voltage channel 3	0x0…0x1
	bits 4 – 1	query current & voltage channel 4	0x0…0x1

Byte	Bit	Description	Value
Byte 5	bits 8 – 5	query current & voltage channel 5	0x0…0x1
	bits 4 – 1	query current & voltage channel 6	0x0…0x1
Byte 6	bits 8 – 5	query current & voltage channel 7	0x0…0x1
	bits 4 – 1	query current & voltage channel 8	0x0…0x1
Byte 7	bits 8 – 5	query current & voltage channel 9	0x0…0x1
	bits 4 – 1	query current & voltage channel 10	0x0…0x1
Byte 8	bits 8 – 5	query current & voltage channel 11	0x0…0x1
	bits 4 – 1	query current & voltage channel 12	0x0…0x1

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

7.4.3.2 Queries of load conditions and diagnosis

PGN 61184 – 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
Parameter Group Number: 61184 (EF00h)

CAN-ID 0x18EFxxyy

xx Node address SCS200
yy: optional source address of sender

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID and manufacturer ID	Manufacturer ID	requirement	not used	not used	not used	not used	not used
Unit	–	–	–	–	–	–	–	–

7.4.3.2.1 Query analog inputs

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID General measuring value query	0x2
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3		query voltage values of analog inputs	0x01
Byte 4		not used	0x00
Byte 5		not used	0x00
Byte 6		not used	0x00

Byte	Bit	Description	Value
Byte 7		not used	0x00
Byte 8		not used	0x00

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

7.4.3.2.2 Query total current, U_{Bat} and module temperature

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID General measuring value query	0x2
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3		query total current, U_{Bat} 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 particular request with Proprietary B messages (PGN 65285, also see 7.4.4.1).

7.4.3.2.3 Query status conditions and diagnostic data

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID status 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 particular request with Proprietary B messages (PGNs 65294 and 65295, also see 7.4.4.5 and 7.4.4.6).

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

7.4.3.3 Activate sleep mode

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

PGN 61184 – 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
Parameter Group Number: 61184 (EF00h)

CAN-ID 0x18EFxxyy

xx Node address SCS200

yy: optional source address of sender

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID and 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 and diagnosis	0x3
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3		Activate 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 – 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
Parameter Group Number: 65281 (FF01h)

CAN-ID 0x18FF01yy

yy: optional source address of sender

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID and manufacturer ID	Manufacturer ID	requirement	not used	not used	not used	not used	broadcast
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID status and diagnosis	0x3
	bits 4 – 1	manufacturer ID part 1	0x3
Byte 2		manufacturer ID part 2	0xD8
Byte 3		Activate 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

7.4.3.4 Deactivate SCS200-RC… status LED

PGN 61184 – 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
Parameter Group Number: 61184 (EF00h)

CAN-ID 0x18EFxxyy

xx node address SCS200
yy: optional source address of sender

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Message ID and manufacturer ID	Manufacturer ID	requirement	Condition	not used	not used	not used	not used
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	message ID status 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

7.4.4 SCS200 broadcast information (CAN Tx)

In the event of changes of the measured values and as a response to commands and queries, the SCS200 sends of Proprietary B CAN messages.

On start-up, the module first responds with the 'Message for Address Claimed' message defined in SAE J1939 as a start-up message, as already described in 7.3.1.

All other CAN frames sent by the SCS200 are described in the following.

7.4.4.1 Total current, U_{Bat} and module temperature

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

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

PGN 65285 – 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
Parameter Group Number: 65285 (FF05h)

CAN-ID 0x18FF05xx

xx Node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	not used		Total current		Supply voltage		Module temperature	
Unit	–		10 mA		10 mV		0.01 °C)	

CAN data

Byte	Bit	Description	Value
Byte 1		not used	0x00
Byte 2		not used	0x00
Byte 3		Total current	LSB total current
Byte 4			MSB total current
Byte 5		Supply voltage	LSB supply voltage
Byte 6			MSB supply voltage
Byte 7		Module temperature (internal temperature sensor on pcb)	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

7.4.4.2 Voltage values at analog inputs

The measured voltage levels are sent by the SCS200 within two different CAN messages list in the following:
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 65286 – 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
Parameter Group Number:	65286 (FF06h)

CAN-ID 0x18FF06xx

xx Node address SCS200

Overview set-up CAN data

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

CAN data

Byte	Bit	Description	Value
Byte 1		Analog input 1	LSB analog input 1
Byte 2			MSB analog input 1

Byte	Bit	Description	Value
Byte 3		Analog input 2	LSB analog input 2
Byte 4			MSB analog input 2
Byte 5		Analog input 3	LSB analog input 3
Byte 6			MSB analog input 3
Byte 7		Analog input 4	LSB analog input 4
Byte 8			MSB analog input 4

PGN 65287 – 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
Parameter Group Number: 65287 (FF07h)

CAN-ID 0x18FF07xx

xx Node address SCS200

Overview set-up CAN data

	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Contents	Analog input 5		Analog input 6		not used	not used	not used	not used
Unit	10 mV		10 mV		–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1		Analog input 5	LSB analog input 1
Byte 2			MSB analog input 1
Byte 3		Analog input 6	LSB analog input 2
Byte 4			MSB analog input 2
Byte 5		not used	0x00
Byte 6		not used	0x00
Byte 7		not used	0x00
Byte 8		not used	0x00

7.4.4.3 Voltage values per channel

The measured voltage levels are sent by the SCS200 within three different CAN messages as listed in the following:
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 – 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
Parameter Group Number: 65288 (FF08h)

CAN-ID 0x18FF08xx

xx Node address SCS200

Overview set-up CAN data

	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 load 1	LSB voltage load 1
Byte 2			MSB voltage load 1
Byte 3		voltage at load 2	LSB voltage load 2
Byte 4			MSB voltage load 2
Byte 5		voltage at load 3	LSB voltage load 3
Byte 6			MSB voltage load 3
Byte 7		voltage at load 4	LSB voltage load 4
Byte 8			MSB voltage load 4

PGN 65290 – 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
Parameter Group Number: 65290 (FF0Ah)

CAN-ID 0x18FF0Axx

xx Node address SCS200

Overview set-up CAN data

	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 load 5	LSB voltage load 5
Byte 2			MSB voltage load 5
Byte 3		voltage at load 6	LSB voltage load 6
Byte 4			MSB voltage load 6
Byte 5		voltage at load 7	LSB voltage load 7
Byte 6			MSB voltage load 7
Byte 7		voltage at load 8	LSB voltage load 8
Byte 8			MSB voltage load 8

PGN 65292 – 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
Parameter Group Number: 65292 (FF0Ch)

CAN-ID 0x18FF0Cxx

xx Node address SCS200

Overview set-up CAN data

	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 load 9	LSB voltage load 9
Byte 2			MSB voltage load 9
Byte 3		voltage at load 10	LSB voltage load 10
Byte 4			MSB voltage load 10
Byte 5		voltage at load 11	LSB voltage load 11
Byte 6			MSB voltage load 11
Byte 7		voltage at load 12	LSB voltage load 12
Byte 8			MSB voltage load 12

If no loads are connected to the channels of the SCS200, the outputs are “floating” or without 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.

7.4.4.4 Load current per channel

The measured load currents and are sent by the SCS200 within three different CAN messages as listed in the following:
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 – 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
Parameter Group Number: 65289 (FF09h)

CAN-ID 0x18FF09xx

xx Node address SCS200

Overview set-up CAN data

	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		Current consumption load 1	LSB current load 1
Byte 2			MSB current load 1
Byte 3		Current consumption load 2	LSB current load 2
Byte 4			MSB current load 2
Byte 5		Current consumption load 3	LSB current load 3
Byte 6			MSB current load 3
Byte 7		Current consumption load 4	LSB current load 4
Byte 8			MSB current load 4

PGN 65291 – 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
Parameter Group Number: 65291 (FF0Bh)

CAN-ID 0x18FF0Bxx

xx Node address SCS200

Overview set-up CAN data

	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		Current consumption load 5	LSB current load 5
Byte 2			MSB current load 5
Byte 3		Current consumption load 6	LSB current load 6
Byte 4			MSB current load 6
Byte 5		Current consumption load 7	LSB current load 7
Byte 6			MSB current load 7
Byte 7		Current consumption load 8	LSB current load 8
Byte 8			MSB current load 8

PGN 65293 – 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
Parameter Group Number: 65293 (FF0Dh)

CAN-ID 0x18FF0Dxx

xx Node address SCS200

Overview set-up CAN data

	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		Current consumption load 9	LSB current load 9
Byte 2			MSB current load 9
Byte 3		Current consumption load 10	LSB current load 10
Byte 4			MSB current load 10
Byte 5		Current consumption load 11	LSB current load 11
Byte 6			MSB current load 11
Byte 7		Current consumption load 12	LSB current load 12
Byte 8			MSB current load 12

7.4.4.5 Load status and troubleshooting

Status and error messages are sent by the SCS200 within the CAN message mentioned below.
If a failure occurs, the diagnostic message will be sent off cyclically every 100 ms. The message will also be transmitted as a response to the corresponding transmission request.

PGN 65294 – 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
Parameter Group Number: 65294 (FF0Eh)

CAN-ID 0x18FF0Exx

xx Node address SCS200

Overview set-up CAN data

	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	Overvoltage	Overload (total)
Unit	–	–	–	–	–	–	–	–

CAN data

Byte	Bit	Description	Value
Byte 1	bits 8 – 5	status / error diagnosis channel 1	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 2	0x0…0x2
Byte 2	bits 8 – 5	status / error diagnosis channel 3	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 4	0x0…0x2
Byte 3	bits 8 – 5	status / error diagnosis channel 5	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 6	0x0…0x2
Byte 4	bits 8 – 5	status / error diagnosis channel 7	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 8	0x0…0x2
Byte 5	bits 8 – 5	status / error diagnosis channel 9	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 10	0x0…0x2
Byte 6	bits 8 – 5	status / error diagnosis channel 11	0x0…0x2
	bits 4 – 1	status / error diagnosis channel 12	0x0…0x2
Byte 7		error: Overvoltage	0x00 status normal 0x01 overvoltage
Byte 8		error: Overcurrent (total current)	0x00 status normal 0x01 overcurrent (total current)

Coding the error diagnosis within the CAN message

0x0 status normal
0x1 overcurrent
0x2 open load

Example

Overload 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

7.4.4.6 Switching status of load outputs

The switching status of the output channels are sent by the SCS200 within the CAN message mentioned below.

The message will be transmitted as a response to the corresponding transmission request.

PGN 65295 – 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
Parameter Group Number: 65295 (FF0Fh)

CAN-ID 0x18FF0Fxx

xx Node address SCS200

Overview set-up CAN data

	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	Bit	Description	Value
Byte 7		not used	0x00
Byte 8		not used	0x00

Coding the current rating within the CAN message

0x0 channel OFF

0x1 channel ON

8 Tests and technical data

8.1 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	4.2	DC supply voltage
ISO 16750-2	4.3	Overvoltage
ISO 16750-2	4.4	Superimposed AC voltage
ISO 16750-2	4.5	Slow decrease or increase of supply voltage
ISO 16750-2	4.6.1	Momentary drop in supply voltage
ISO 16750-2	4.6.2	Reset behaviour at voltage drop
ISO 16750-2	4.6.3	Starting pulses
ISO 16750-2	4.6.4	Load dump
ISO 16750-2	4.7	Reversed voltage
ISO 16750-2	4.8	Ground reference and supply offset
ISO 16750-2	4.9.1	single line interruption
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 load circuits
ISO 16750-3	4.1.2.7	Vibration -
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

Name	Chapter/section	Comments
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.

High vibration values may lead to a deterioration of the internal resistance values in the sockets over the entire life span. 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.

8.2 Derating of ampacity

8.2.1 SCS200-SC12-…

Fig. 9 shows the derating of the max. total current of 12-channel semi-conductor version over the ambient temperature.

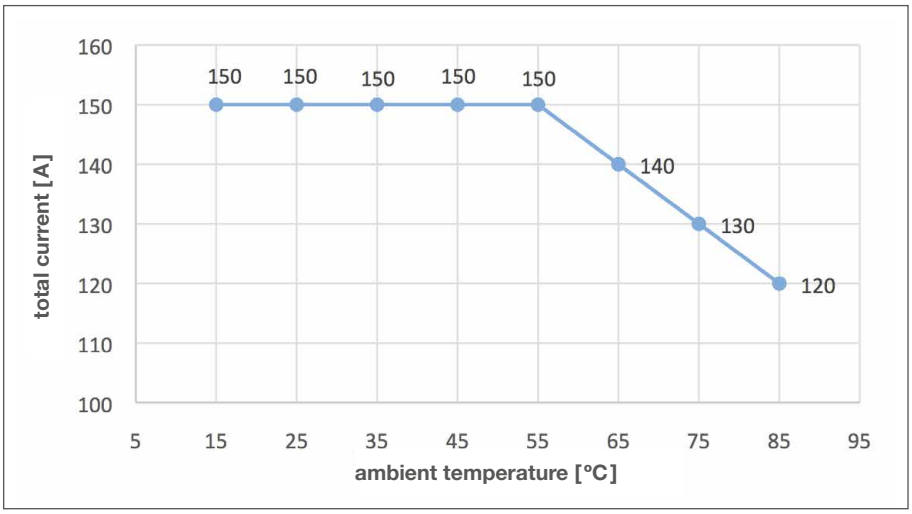


fig. 9: Derating of max. total current (SCS200-SC12-...)

Fig. 10 shows the derating of the ampacity per load output at max. total current over the ambient temperature.
The ampacity of the single channels can be increased by a reduced total current.

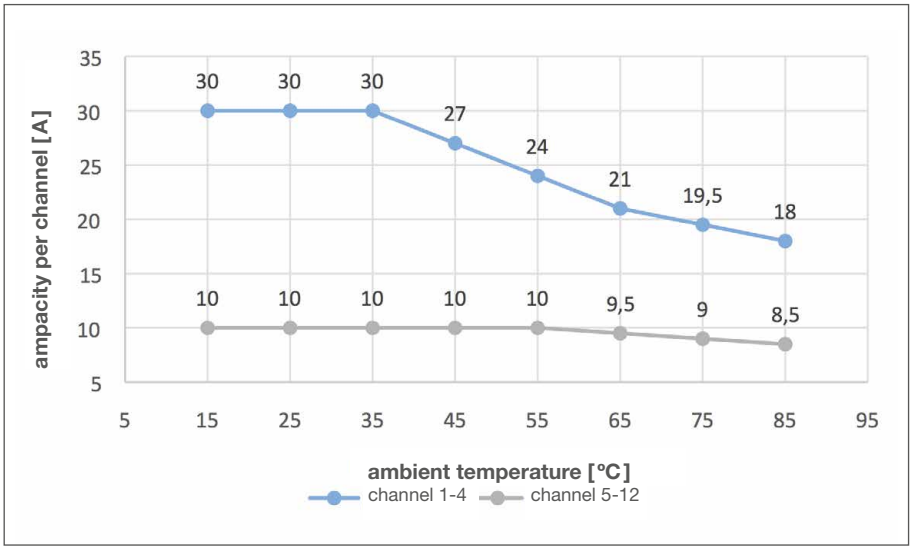


fig. 10: Derating of the ampacity per channel, at max. total current (SCS200-SC12-…)

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

8.2.2 SCS200-RC08-…

Derating was determined with the following population:

Fuses
30 A channels: 40 A fuse by ESKA/MTA (p/n 340.035)
10 A channels: 15 A fuse by ESKA/MTA (p/n 340.029)

Relays 12 VDC:
30 A channels: ESR10-NC2A4HB-00-D1-30A by E-T-A
10 A channels: ESR10-NC2A4HB-00-D1-10A by E-T-A

Relays 24 VDC:
30 A channels: V23074-A2002-A403 by TE connectivity
10 A channels: channel 5-8: ESR10-NC2A4HB-00-D2-10A by E-T-A

Fig. 11 shows the derating of the max. total current of the relay version over the ambient temperature.

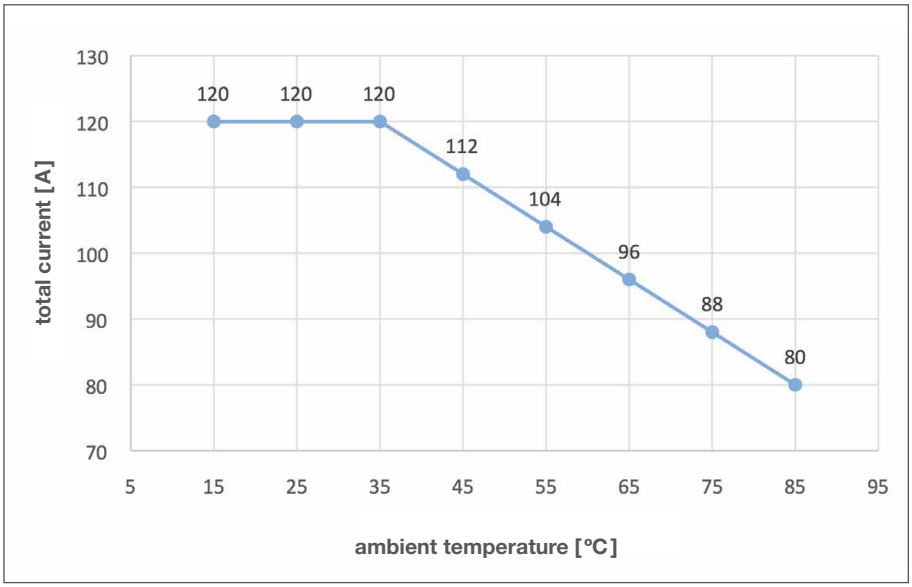


fig. 11: Derating of max. total current (SCS200- RC08-...)

Fig. 12 shows the derating of the ampacity per load output at max. total current for 12 VDC. The ampacity of the single channels can be increased by a reduced total current.

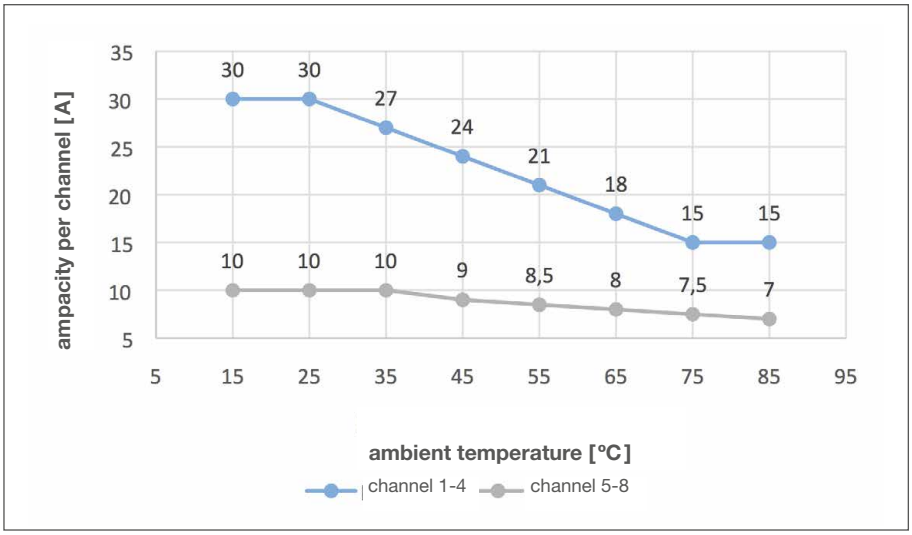


fig. 12: Derating of the ampacity per channel, at max. total current (SCS200- RC08-..., 12 VDC)

Fig. 13 shows the derating of the ampacity per load output **at max. total current** for 12 VDC. The ampacity of the single channels can be increased by a reduced total current.

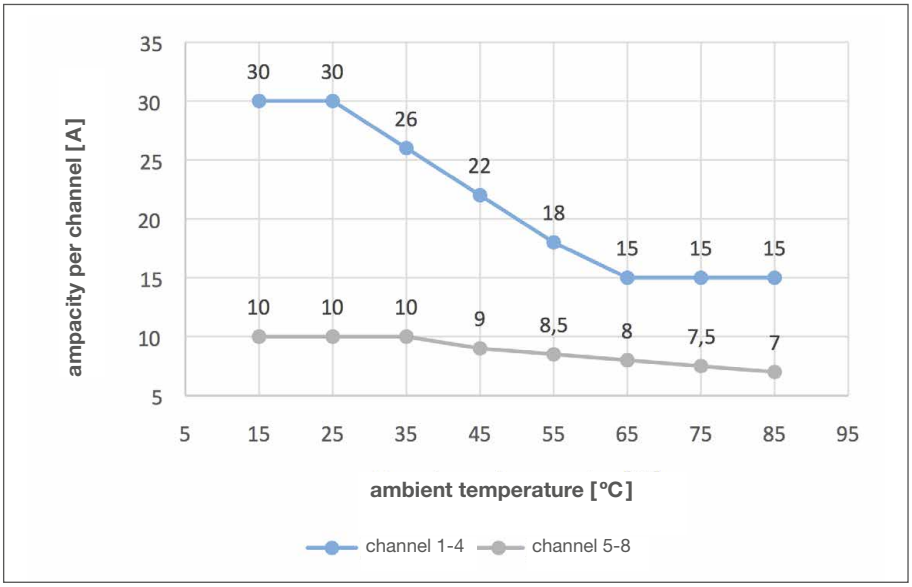


fig. 13: Derating of the ampacity per channel, at max. total current (SCS200- RC08-..., 24 VDC)

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

9 List of abbreviations

AWG	American Wire Gauge
CAN	Controller Area Network
ECU	Electronic Control Unit
EEPROM	Electrically Erasable Programmable Read-Only Memory
ESR	Elektronisches Standard Relais
HSD	High Side Driver
ID	Identificator
IP	International Protection
ISO	International Organization for Standardization
LED	Light Emitting Diode
LSB	Least Significant Byte
MSB	Most Significant Byte
PC	Personal Computer
PDU	Power Distribution Unit
PGN	Parameter Group Number
SAE	Society of Automotive Engineers
SCS	Smart Control Systems
USB	Universal Serial Bus

Notes

https://www.e-t-a.de/qr1042/

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ENGINEERING TECHNOLOGY

E-T-A Elektrotechnische Apparate GmbH
Industriestraße 2-8 · 90518 Altdorf GERMANY
Phone +49 9187 10-0 · Fax +49 9187 10-397
E-mail: info@e-t-a.de · www.e-t-a.de