The Drive & Control Company

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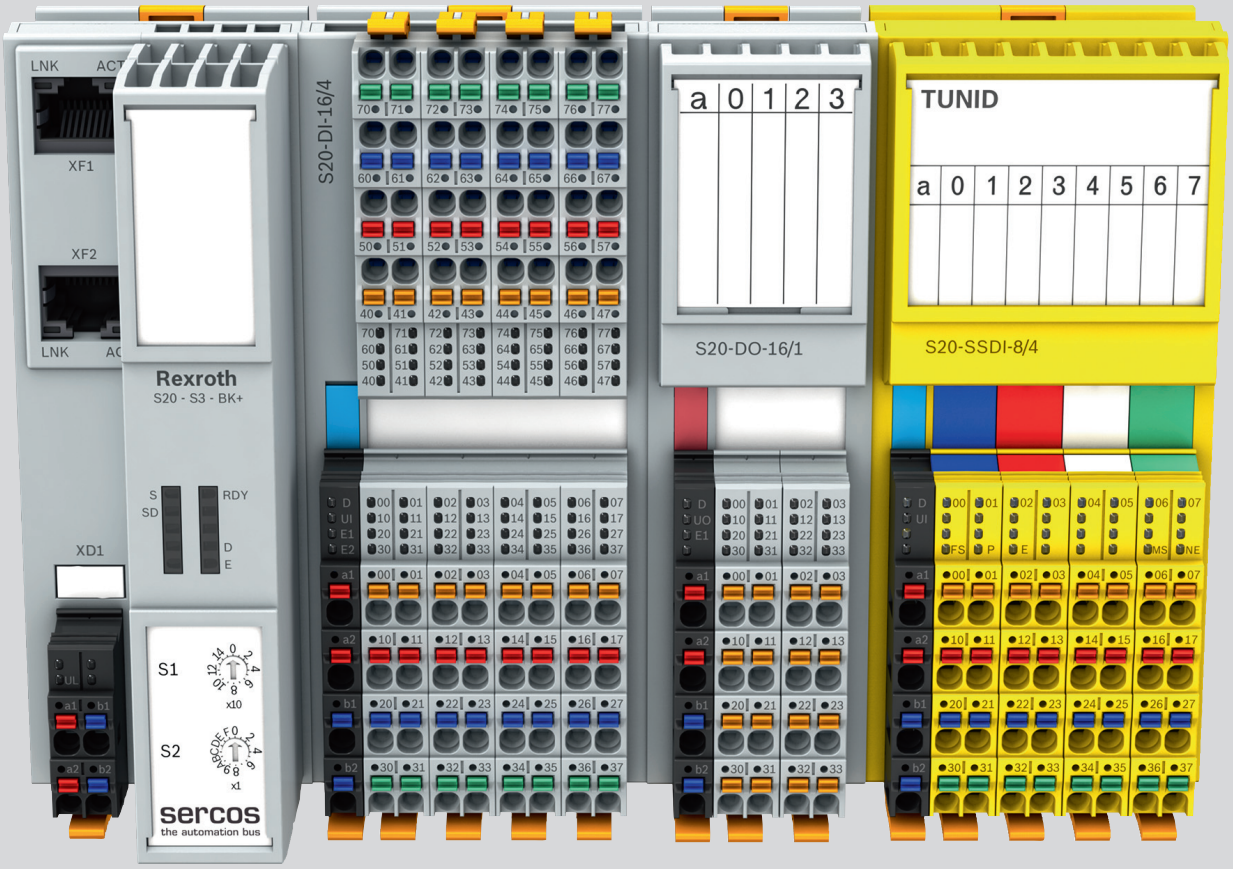
S20
System and Installation

Application Description
R911335988

Edition 03



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01	2014-02	First edition
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1 Use of the safety instructions

1.1 Structure of the safety instructions

The safety instructions are structured as follows:

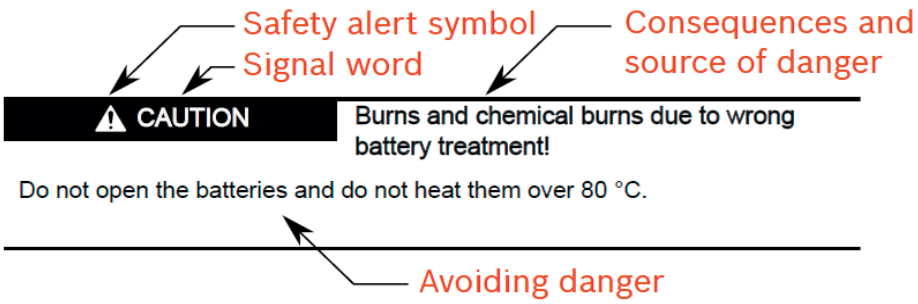


Abb. 1-1 Structure of the safety instructions

1.2 Explaining signal words and safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6-2006).

The signal word is used to draw attention to the safety instruction and also provides information on the severity of the hazard.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words danger, warning and caution is used to alert the reader to personal injury hazards.

⚠ DANGER:

In case of non-compliance with this safety instruction, death or serious injury **will** occur.

⚠ WARNING:

In case of non-compliance with this safety instruction, death or serious injury **can** occur.

⚠ CAUTION:

In case of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTE

In case of non-compliance with this safety instruction, material damage can occur.

Use of the safety instructions

1.3 Symbols used

Hints are represented as follows:

This is an information.

Tips are represented as follows:

This is a tip for the user.

1.4 Signal graphic explanation on the device

Prior to the installation and commissioning of the device, refer to the device documentation.

2 Documentation landscape of S20

2.1 Available documents

The documentation for the S20 product group is modular, providing you with the optimum information to meet your requirements.

In the following table, the term “module” is used for the controller, bus coupler, and I/O module.

Document	Contents
System: information on the S20 system	
Application description “S20: system and installation” (this document)	DOK-CONTRL-S20*SYS*INS-AP03-EN-P, material number R911335988 This document is the generic system manual for S20. It describes the system and everything about S20 module mounting and wiring regardless of a higher-level network.
Application description “S20: error messages”	DOK-CONTRL-S20*DIAG*ER-AP..-EN-P, material number R911344826 The document lists all error messages for the system and provides remedial measures.
Module: basic information on a specific module	
Packing slips	A packing slip is provided with the module upon delivery. It contains key information for the electrical installation of a module or group of modules. This includes, for example: • Short description • Safety notes • Mounting/removal • Terminal point assignment
Application description for safety modules and controllers	The application description contains the complete information needed for use for each safety module and controller. This includes at least: • Description • Mounting/removal and power supply • Startup • Technical data and ordering data
Module-specific data sheets	The data sheet for each module contains the complete information needed for use. This includes at least: • Function description • Accessories • Technical data • Pin assignment/terminal point assignment • Local diagnostics and status indicators • Connection examples
Additional: information on a specific module	
Additional application descriptions	The additional documents either describe: • A bus coupler connected to a network or • A specific module Each document only describes the relevant module-specific and/or bus-specific special features. Being a generic document, the “DOK-CONTRL-S20*SYS*INS-AP03-EN-P” application description also applies.

Fig. 2-1 S20 documentation

Documentation landscape of S20

2.2 Documentation on the Internet

The documentation is available at
www.boschrexroth.com/electrics. Here, you will find information on each product.

2.3 Purpose of this document

This document informs you about the S20 system. It describes the system and everything about S20 module mounting and wiring regardless of a higher-level network.

3 The S20 product group

3.1 S20 – the block-based modular I/O system

S20 is a modular I/O system for the control cabinet. Open to all Ethernet-based communication protocols and available in various designs, S20 offers maximum flexibility.

Your advantages

- Increased machine output with particularly fast and synchronous signal acquisition
- Particularly robust mechanical design as well as shock and vibration resistance withstand even the most adverse conditions and increase system availability
- Installation time is reduced by fast wiring and easy handling
- The S20 I/O system is part of the COMPLETE line system
- Can be used with Bosch Rexroth controllers or in all common networks with a corresponding bus coupler
- Implement safety applications with PROFIsafe

The S20 product group

3.2 Design of an S20 station

An S20 station consists of individual modules that are snapped onto a grounded DIN rail.
A controller or a bus coupler forms the head of the station. I/O modules are mounted next to it.
Bus base modules are used for connecting the individual S20 modules to one another and to the station head. The bus base modules are snapped onto the DIN rail side by side and thus form the S20 local bus.

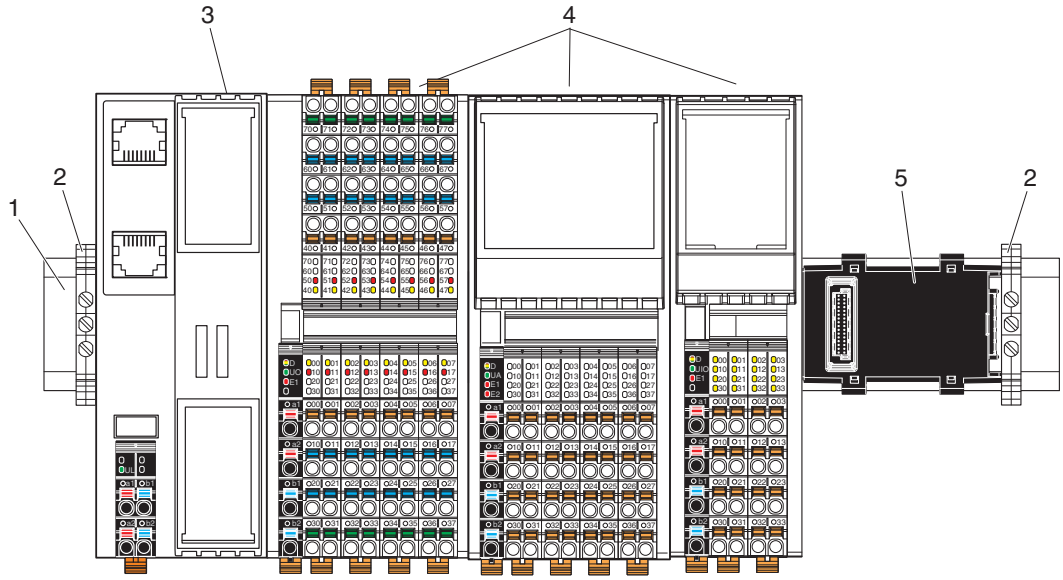


Fig. 3-1 Example of an S20 station

1 DIN rail
2 End brackets (for securing the station, see “End bracket” on page 41)
3 Bus head (bus coupler or controller)
4 S20 input or output modules
5 Bus base module

For detailed information about the function, properties, wiring, and parameterization, please refer to the module-specific documentation.

3.3 Product description

S20 modules with various functions are available within the S20 product group.

The S20 module consists of an electronics module, one or several connectors and a bus base module.

The electronics module can be changed without having to remove a wire from the connector.

The bus base modules are snapped onto the DIN rail side by side and thus form the S20 local bus that connects the modules to one another.

The S20 local bus is subsequently referred to as the local bus.

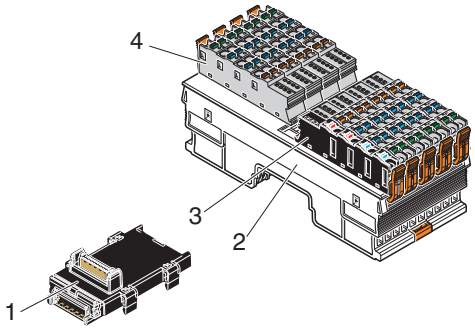


Fig. 3-2 Components of an S20 I/O module

Key:

1 Bus base module
2 Electronics module
3 Connector for connecting the supply voltage
4 I/O connector

Versions Modules are available for the following automation tasks:

- Controller
- Bus couplers to integrate the S20 station into various networks (PROFINET, Sercos, PROFIBUS, etc.).
- Input and output modules for digital and analog signals
- Modules for temperature measurement
- Module for open and closed-loop control, and position detection
- Modules for communication
- ...

This product range is growing continuously.

The S20 product group

Voltage ranges

S20 modules are available for the protective extra-low voltage (PELV) and the low voltage range. You can use low-voltage and extra-low voltage modules directly next to each other within an S20 station.

Voltage range	Product groups	Nominal voltage used	Permissible voltage range	Examples
Protective extra-low voltage	Low-level signal modules	24 V DC	19,2 V DC ... 30 V DC	S20-DI-16/4
Low voltage	Low-voltage modules	220 V DC 230 V AC	-300 V DC ... 300 V DC 24 V AC ... 230 V AC (50 Hz ... 60 Hz)	S20-DOR-4/2-220-AC

Fig. 3-3 Voltage ranges for S20

The instructions given in this application description and in the module-specific documentation must be followed during installation and startup.
Particularly observe:
Chapter “Safety notes for mounting and removal” on page 37.

Mounting location

The S20 modules meet IP20 degree of protection and can be used in closed control cabinets or control boxes (junction boxes) with IP54 degree of protection according to EN 60529 or higher.

The compact design means that the S20 modules can be installed in standard terminal boxes. Please observe the mounting distances when selecting the housing, see Chapter “Mounting distances” on page 52.

Mounting

Each S20 module consists of a bus base module and an electronics module. Snap the bus base modules tool-free onto the grounded DIN rail and arrange the modules side by side. The local bus is created automatically when the bus base modules are installed next to one another.

Then, snap the electronics modules onto the DIN rail over the bus base modules.

See Chapter “Mounting and removing modules” on page 37.

Removal

Only a standard tool is necessary for removing the electronics module (e.g., a bladed screwdriver with a blade width of 2.5 mm).

See Chapter “Mounting and removing modules” on page 37.

Bus connection (network)

The S20 station is integrated in the network using a controller or bus coupler.

S20 local bus

There is an interface to the S20 local bus on the bottom of the modules. Bus base modules are used to carry the communications voltage and the bus signals from the controller or from the bus coupler through the S20 station. The bus base module is supplied as standard with each module.

The maximum number of S20 modules within a station is 63. The actual number of modules within an S20 station may be limited by the supplied communications current, the current consumption of the connected modules, and the system limits of the controller or bus coupler. See Chapter “Maximum number of modules” on page 42.

Connectors

The S20 modules have connectors for connecting the power supply and the I/O. The connectors have spring-cage terminal blocks. Suitable wires can be connected with Push-in technology (see Chapter “Conductor cross-sections, and stripping and insertion lengths” on page 54).

Connecting the supply voltage

The communications power for the S20 station is supplied at the controller or bus coupler. The voltage for the module's I/O is supplied separately to each I/O module (see Chapter "Connecting the power supplies" on page 60).

I/O connection

Sensors and actuators are connected using connectors (see Chapter "Connecting sensors and actuators" on page 64).

Depending on the module, the sensor/actuator cables are connected in one direction (at the bottom) or in two directions (at the top and at the bottom).

FE connection

At the bottom of each module there is at least one FE spring (metal contact) creating a functional ground connection when the module is snapped onto a grounded DIN rail.

Programming interface, service interface

On the controllers and bus couplers, there is a USB interface that can be used as a programming interface or service interface. In addition to providing the network interface, it enables communication with the controller or bus coupler from a PC.

Web-based management

By means of web-based management integrated into the controller and some bus couplers, you have the option to display static and dynamic information of the controller using a standard browser. The status and diagnostic functions can be displayed on a graphical user interface by means of read access via a device network connection.
In addition, you can configure specific controller/bus coupler properties via web-based management.

Diagnostics

The S20 system provides comprehensive diagnostics:

- Remote diagnostics
- Process diagnostics (e.g., cycle time monitoring)
- Communication diagnostics
- Module diagnostics (status of the S20 module)
- I/O diagnostics (status of sensors/actuators)

For the diagnostic options of a specific module, please refer to the module-specific data sheets.

Reset button

The reset button provided on the controllers and bus couplers can only be operated with a pointed object (e.g., a pen) and is therefore protected against accidental activation.

If the reset button is actuated during operation, the controller or bus coupler is restarted.

Using the reset button, the controller or bus coupler can also be reset to the default settings.

For more detailed information on the reset button, please refer to the module-specific documentation.

Configuration memory (controller)

The controllers have an integrated configuration memory. Alternatively, it is possible to use a pluggable configuration memory in the form of an SD card or USB stick.

For more detailed information on the configuration memory, please refer to the application description of the controller used.

3.4 Approvals

For the latest approvals, please visit www.boschrexroth.com/electrics.

Observe any notes and restrictions on the approvals in the module-specific packing slip or in the module-specific documentation.

4 S20 modules at a glance

4.1 S20 item designation

The item designation helps you to identify the function of a module.

	Product group	System	Function	Number of inputs or outputs	Conductor connection	Function extension
Examples:	S20	PN	BK			
	S20		DI	16	/1	HS
	S20		DI	16	/4	
	S20		AI	4		I
	S20		AI	4		UTH
	S20		DO	64	/1	
	S20		PSDO	8	/3	
	S20		DOR	4	/2	220-AC
	S20		DIDO	8	/1	

Product group	S20	S20
System	PN	PROFINET
	S3	Sercos
	PB	PROFIBUS DP
	EC	EtherCAT®
	ETH	Ethernet (Modbus/TCP)
	EIP	EtherNet/IP™
Function	BK, BK+	Bus coupler
	DI	Digital input
	DO	Digital output
	DOR	Relay output
	SSDI	Safe digital input
	SSDO	Safe digital output
	P(SDI, SDO)	PROFIsafe
	PSDI	Safe digital input
	PSDO	Safe digital output
	AI	Analog input
	AO	Analog output
	CNT	Counter
	INC	Incremental encoder input
	SSI	SSI interface for absolute encoders
	RS-UNI	Communication module for serial data transmission via RS-232 or RS-485/422

Fig. 4-1 Structure of the item designations

S20 modules at a glance

Function	PWR	Feed-in
	PM	Power measurement
	IOL	IO-Link
	SGI	Strain gauge acquisition
	PWM	Pulse width modulation
	DALI	DALI master
	KNX	KNX master
Number of inputs or outputs	1 ... 64	1 ... 64 channels
Connection technology (for digital modules only)	/4	4-conductor technology
	/3	3-conductor technology
	/2	2-conductor technology
	/1	1-conductor technology
Function extension	HS	High speed
	RTD	Analog input for the connection of resistance temperature detectors
	UTH	Analog input for the connection of thermocouple sensors
	I	Current
	U	Voltage
	2A	2 A outputs
	AC	Low voltage range AC (nominal voltage 230 V AC)
	220-AC	Low voltage range AC and DC (nominal voltage 230 V AC, 220 V DC)
	OVS	Oversampling
	T	Amplifier for valves
	EF	Extended functions

Fig. 4-1 Structure of the item designations [...]

The standard modules are supplied with the bus base module and S20 connectors. The connectors are mounted to the electronics module, and the bus base module is supplied as a separate part.
Bus base modules are also available as replacement items.
Please refer to the module-specific page at www.boschrexroth.com/electrics and click on the “Order details” tab to see whether a module-specific connector set is available as a replacement item.

4.2 Controllers

4.2.1 XM21, XM22

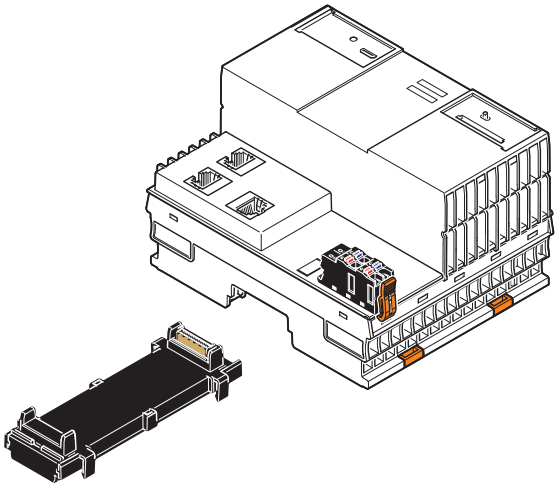


Fig. 4-2 Example: XM21

The XM21 and XM22 embedded controllers are available for various PLC and motion applications. Local connection of the S20 I/O modules enables flexible controller extension for high-performance process connectivity. Distributed I/Os, drives and other system peripherals are connected via Sercos as standard.

The controller can also be flexibly used at high temperature ranges. A specially certified version of the XM22 controller is also suitable for use in marine and offshore applications.
For more information, please refer to the XM21/22 DOK-CONTRL-IC*XM2*****-IT04-EN-P operating instructions, material number R911340667.

Optional extension modules increase the integration possibilities. These modules are installed next to each other on the left side of the controllers. The service-friendly design easily reduces installation and startup costs.
For more information, please refer to the DOK-CONTRL-XFE**EXTMOD-IT..-EN-P operating instructions, material number R911345570.

S20 modules at a glance

4.2.2 XM42

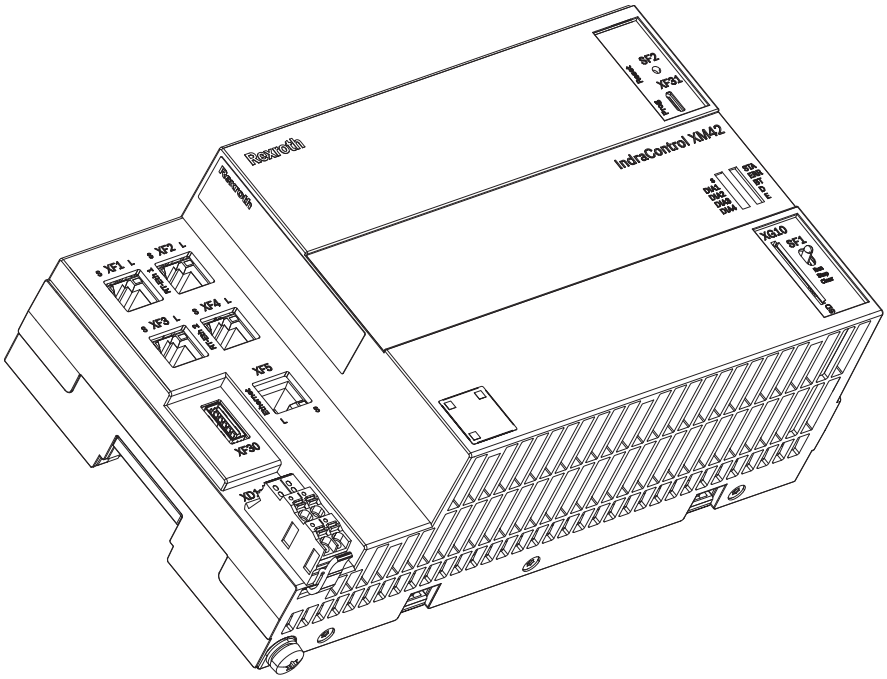


Fig. 4-3 XM42

The XM42 high-performance controller from Bosch Rexroth is a functional all-rounder for various PLC, motion and CNC applications. Local connection of the modules of the S20 IP20 I/O system enables flexible controller extension for high-performance process connectivity. Additional on-board interfaces further extend the options for integration. For more information, please refer to the XM42 DOK-CONTRL-XM4X*CTRL**-IT03-EN-P operating instructions, material number R911345567.

Optional extension modules increase the integration possibilities. These modules are installed next to each other on the left side of the controllers. The service-friendly design easily reduces installation and startup costs.
For more information, please refer to the DOK-CONTRL-XFE**EXTMOD-IT..-EN-P operating instructions, material number R911345570.

4.3 Bus coupler

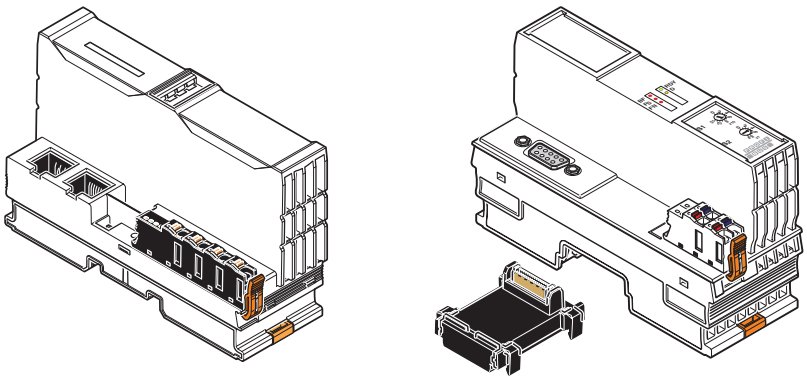


Fig. 4-4 Example: S20-PN-BK (AT housing) and S20-PB-BK (NE housing)

As the head of an S20 station, the bus coupler with a network and an S20 local bus connection represents the link between your network and the S20 station.

Bus system/network	Bus coupler	Housing
PROFINET	S20-PN-BK+	NE
Sercos	S20-S3-BK+	NE
PROFIBUS DP	S20-PB-BK	NE
EtherNet/IP™	S20-EIP-BK	NE
Ethernet (Modbus/TCP)	S20-ETH-BK	NE
EtherCAT®	S20-EC-BK	NE
PROFINET	S20-PN-BK	AT
Sercos	S20-S3-BK	AT

Fig. 4-5 Supported bus systems/networks

S20 modules at a glance

4.4 Input and output modules

4.4.1 Overview

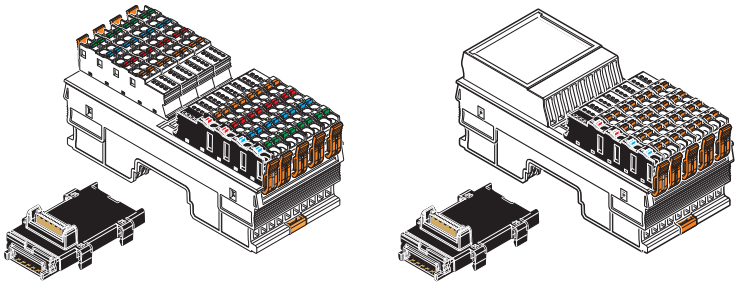


Fig. 4-6 Example: S20-DI-16/4 and S20-AO-8

Modules are available with various functions. These include, for example, the modules listed below. The text in brackets indicates the function according to the item designation.

- Digital input and output modules (DI, DO, DOR)
- Analog input and output modules (AI, AO, SGI)
- Digital input and output modules for the low voltage range (220-AC, AC)
- Temperature recording modules (RTD, UTH)
- Module for open- and closed-loop control, and position detection (CNT/INC, SSI)
- Module for communication (RS-UNI, DALI, KNX, IOL)
- Function module for energy measurement (PM)
- Function module for oversampling digital inputs and outputs (OVS)
- PMW amplifier function module for controlled proportional and switching valves with four output stages (PWM-4-T)
- Safety modules with safe digital inputs and outputs (PSDI, PSDO, SSDI, SSDO, see Chapter “Safety modules with safe digital inputs or outputs” on page 21)
- Power module for communications power U_{Bus} (see Chapter “Power module for the communications power U_{Bus}” on page 21)
- ...

4.4.2 Safety modules with safe digital inputs or outputs

The safety modules are to be used in an S20 station at any point in a safe system (e.g., PROFIsafe).

Depending on the version, the modules either have safe digital inputs or outputs. They can be parameterized according to the specific application and enable the integration of sensors and actuators in the safe system.

For more detailed information on these modules, please refer to the module-specific user documentation.

4.5 Power module for the communications power U_{Bus}

If the maximum load of the controller or bus coupler for the S20 local bus supply (communications power U_{Bus}) is reached, you can use this power module to provide this voltage again.

4.6 Master

Masters are used to integrate lower-level systems in the S20 station.

Example:

S20-DALI-2-PWR	The 2-channel DALI master enables communication with two DALI networks including their bus power supply.

5 Housing versions, design, and dimensions

5.1 Housing versions

Various housing versions are available in the S20 portfolio; they are shown in Fig. 5-1.

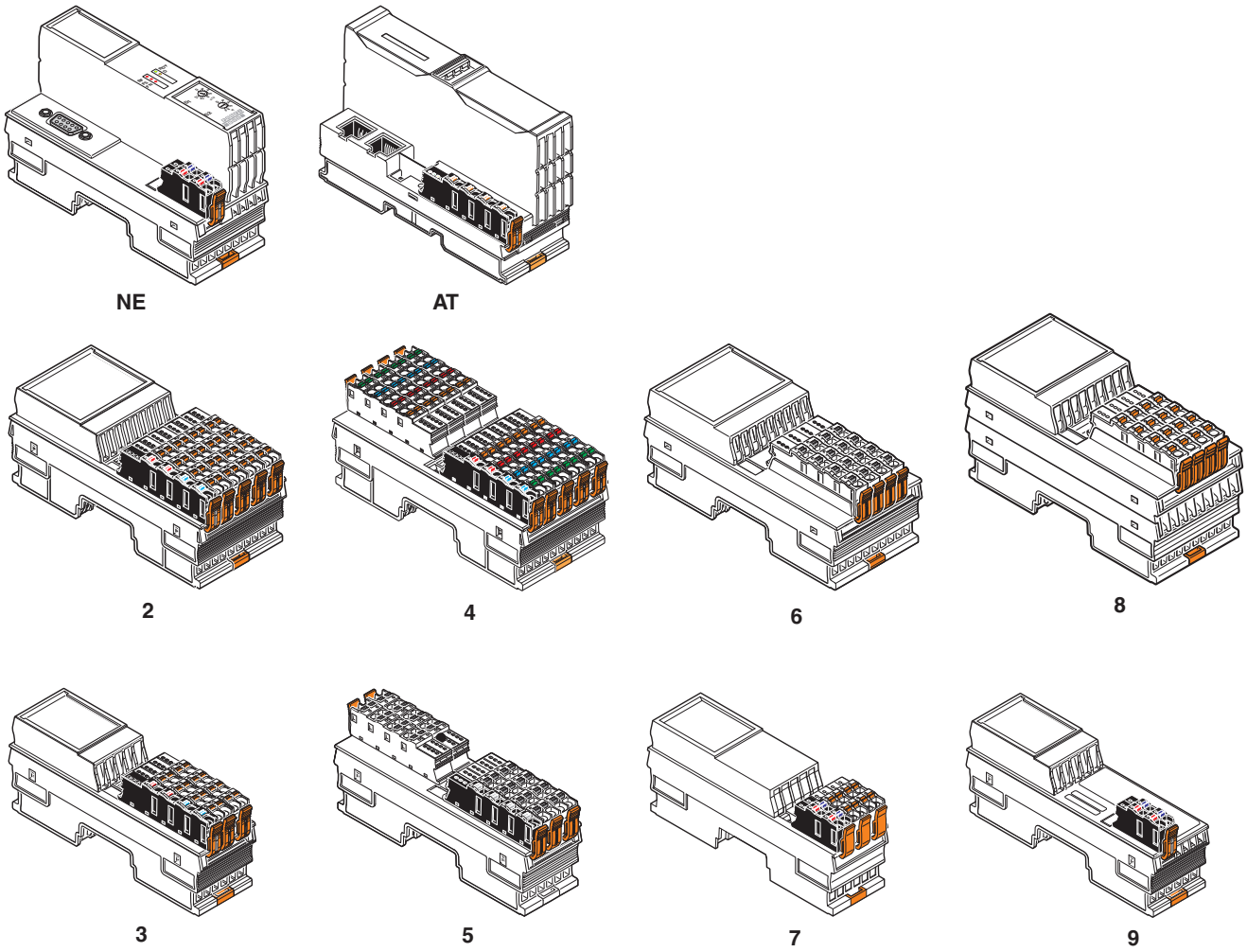


Fig. 5-1 Housing versions

Housing type	Special feature	Example	Design	Dimensions
NE	S20-xx-BK bus coupler Separate bus base module	S20-PB-BK, S20-PN-BK+, S20-S3-BK+	Fig. 5-3 on page 24	Fig. 5-5 on page 26
AT	Bus coupler Integrated bus base	S20-PN-BK, S20-S3-BK		Fig. 5-6 on page 26
2	Wide housing, 1 terminal field	S20-AI-8 S20-DI-32/1		Fig. 5-7 on page 27
4	Wide housing, 2 terminal fields	S20-DI-16/4 S20-DO-16/3	Fig. 5-4 on page 25	Fig. 5-8 on page 27
6	Wide housing, 1 terminal field, **l**ow **v**oltage, 4 connectors	S20-DOR-4/2-220-AC		Fig. 5-13 on page 29
8	Wide, high housing, 1 terminal field, power measurement	S20-PM-EF		Fig. 5-14 on page 29
3	Narrow housing, 1 terminal field, long connector	S20-AI-4-UTH S20-RS-UNI		Fig. 5-9 on page 28
5	Narrow housing, 2 terminal fields	S20-DI-32/1-S		Fig. 5-10 on page 28
7	Narrow housing, 1 terminal field, short connector	S20-SSI-AO-1/1		Fig. 5-11 on page 28
9	Narrow housing, 1 terminal field, universal	S20-PWR		Fig. 5-12 on page 28

Fig. 5-2 Housing versions

Housing versions, design, and dimensions

5.2 Basic design of S20 modules

5.2.1 Bus coupler

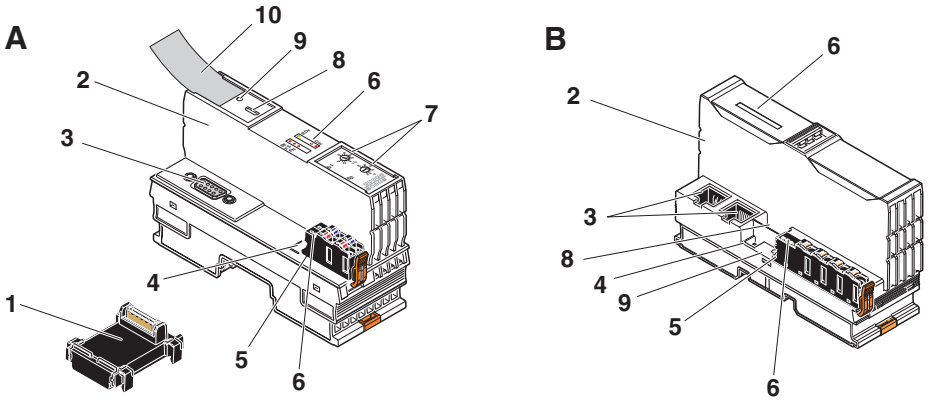


Fig. 5-3 Design of a bus coupler

A	NE housing	e.g., S20-PB-BK
B	AT housing	S20-PN-BK, S20-S3-BK

1 Bus base module
The bus base is integrated in the module for the S20-PN-BK and S20-S3-BK bus couplers (AT housing).
For all other bus couplers (NE housing), a separate bus base module is included in the scope of supply.

2 Electronics module

3 Bus connection (here: Ethernet connections, PROFIBUS connection)

4 Function identification

5 Connector for connecting the communications voltage U_L

6 Diagnostics and status indicators (here: LEDs)

7 Rotary coding switch

8 Service interface

9 Reset button

10 Insert label

On the bottom of the module, there are two FE springs for connecting functional ground via the grounded DIN rail. These are not shown in Fig. 5-3. They are illustrated in Fig. 9-1 on page 71.

5.2.2 I/O module (electronics module)

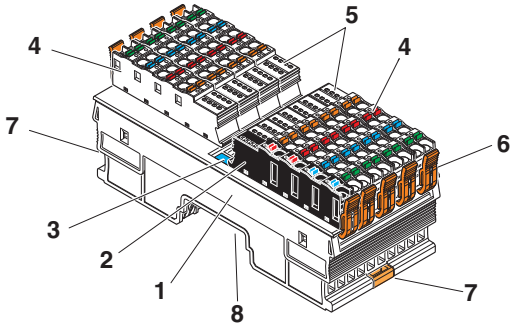


Fig. 5-4 Design of an I/O module (example: S20-DI-16/4)

1 Electronics module
2 Connector for connecting the I/O supply voltage (U_I, U_O, U_{IO} or U_A)
3 Function identification
4 Connectors for connecting the I/O
5 Diagnostics and status indicators
6 Locking latches of the I/O connectors
7 Base latch for latching to the DIN rail (2 x)
8 Device plug for connecting to the local bus via the bus base module (at the bottom, not illustrated)

On the underside of the module, there is at least one FE spring for connecting the functional ground via the grounded DIN rail. This is not shown in Fig. 5-4. It is illustrated in Fig. 9-1 on page 71.

Housing versions, design, and dimensions

5.3 S20 module dimensions

All dimensions are in mm.

5.3.1 Bus coupler

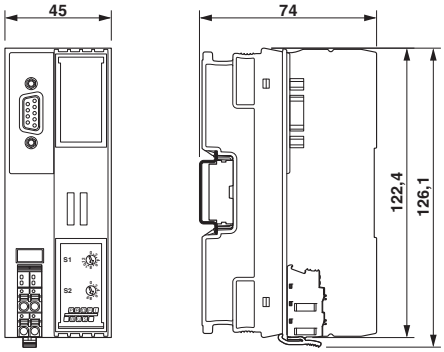


Fig. 5-5 *Nominal dimensions of the bus coupler housing with separate bus base (NE type, e.g., S20-PB-BK, S20-PN-BK+)*

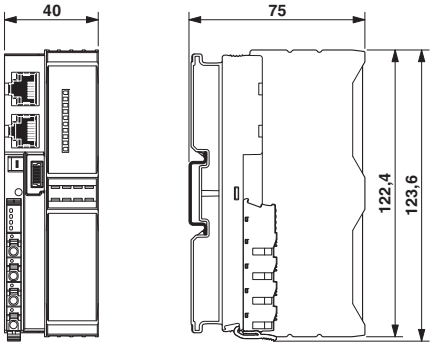


Fig. 5-6 *Nominal dimensions of the bus coupler housing with integrated bus base (AT type, e.g., S20-PN-BK)*

5.3.2 I/O modules for the 24 V area

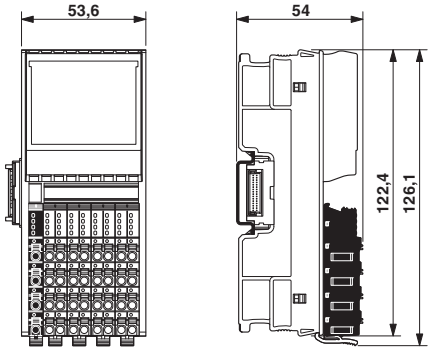


Fig. 5-7 *Nominal dimensions of the module housing with one terminal field (type 2; e.g., S20-AI-8, S20-DI-32/1)*

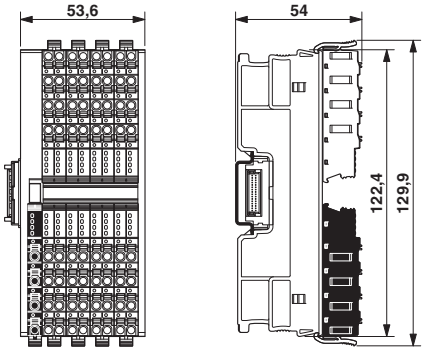


Fig. 5-8 *Nominal dimensions of the module housing with two terminal fields (type 4; e.g., S20-DI-16/4, S20-DO-16/3)*

Housing versions, design, and dimensions

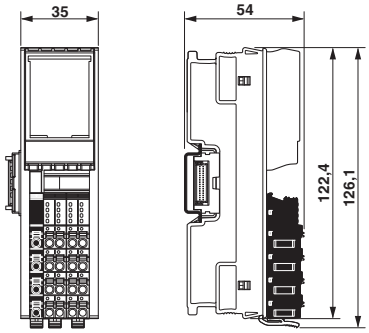


Fig. 5-9 *Nominal dimensions of the module housing with one terminal field (type 3; e.g., S20-DI-16/1-HS, S20-AI-4-UTH, S20-RS-UNI)*

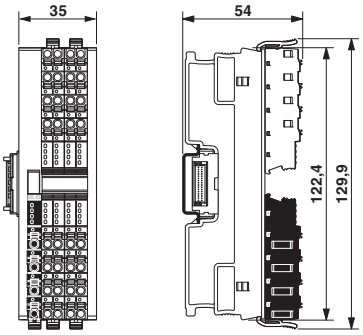


Fig. 5-10 *Nominal dimensions of module housing with two terminal fields (type 5)*

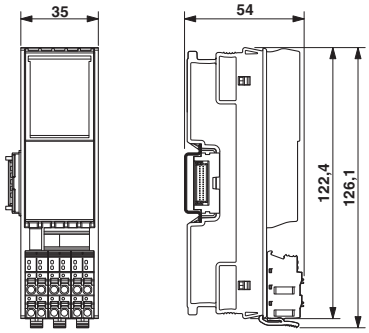


Fig. 5-11 *Nominal dimensions of the module housing with one terminal field and short connectors (type 7; e.g., S20-SSI-AO-1/1)*

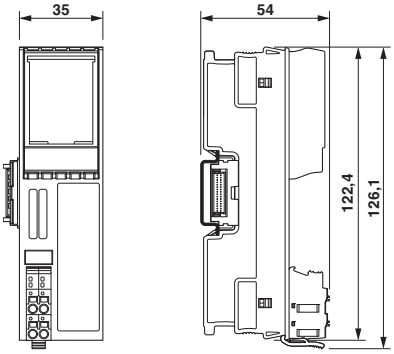


Fig. 5-12 *Nominal dimensions of the module housing with one terminal field and short connectors (type 9; e.g., S20-PWR)*

5.3.3 I/O modules for the low voltage range

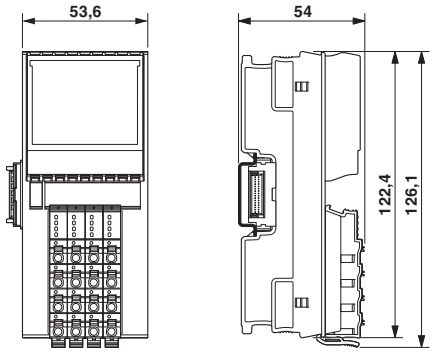


Fig. 5-13 *Nominal dimensions of the module housing for the low voltage range with one terminal field and four connectors (type 6; e.g., S20-DOR-4/2-220-AC)*

5.3.4 Power measurement module

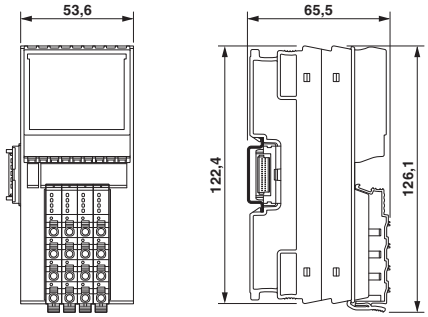


Fig. 5-14 *Nominal dimensions of the module housing for power measurement with one terminal field (type 8, S20-PM-EF)*

Housing versions, design, and dimensions

5.4 Bus base modules

Bus base modules connect the modules to each other.

Bus base modules carry the communications voltage and the bus signals from the bus coupler or controller through the S20 station (local bus).

A bus base module is supplied as standard with each controller, bus coupler and S20 module. This does not include the bus couplers in the AT housing in which the bus base is integrated.

NOTE **Malfunction**

Ensure you insert the bus base module belonging to the relevant module.
Bus base modules with different overall widths and functions are available (e.g., red bus base module for the power module).

Versions

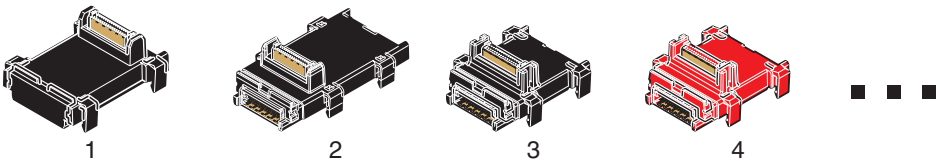


Fig. 5-15 Bus base modules

No.	Type	Item number	For use with
1	S20-BS-BK	R911173392	Bus coupler, NE housing
2	S20-BS	R911172540	Module housing, type 2, 4, 6, 8
3	S20-BS-S	R911173203	Module housing, type 3, 5, 7, 9
4	S20-BS-PWR	R911173865	Power module
...	Others		See device-specific documentation

Fig. 5-16 Bus base modules

Basic structure

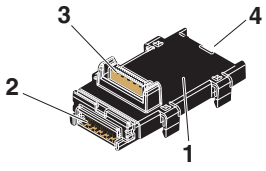


Fig. 5-17 Design of a bus base module

1 Bus base module
2 Connection to the bus coupler or the previous bus base module (connector)
3 Connection of the local bus to an I/O electronics module (female connector)
4 Connection for the following bus base module (female connector)

5.5 S20 connector

The S20 connectors accept cables up to 1.5 mm^2 and a stripping length of 8 mm. Detailed information on the conductor cross sections and stripping lengths can be found in Chapter “Conductor cross-sections, and stripping and insertion lengths” on page 54.

5.5.1 Versions and dimensions

Various S20 connector versions are available.

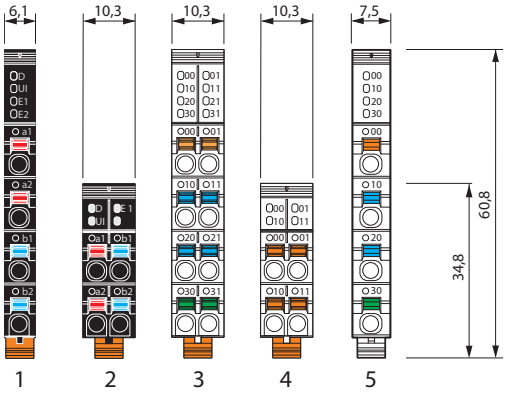


Fig. 5-18 Connectors: versions and dimensions

No.	Color	Use	Examples of use
24 V range			
1	Black RAL 9005	Feeding the supply voltages	S20-PN-BK, S20-S3-BK S20-DI-..., S20-DO-... S20-AI-..., S20-AO-... S20-CNT-INC-2/2
2			XM2x S20-xx-BK(+) S20-SSI-AO-1/1
3	Light gray RAL 7035	I/O connection (protective extra-low voltage)	S20-DI-..., S20-DO-... S20-AI-..., S20-AO-... S20-CNT-INC-2/2
	Zinc yellow RAL 1018	I/O connection (safety modules, protective extra-low voltage)	S20-PSDI-8/4 S20-PSDO-8/3
4	Light gray RAL 7035	I/O connection (protective extra-low voltage)	S20-SSI-AO-1/1
230 V range			
5	Light gray RAL 7035	I/O connection (low voltage)	S20-DOR-4/2-220-AC

Fig. 5-19 Connectors: versions and dimensions

Housing versions, design, and dimensions

5.5.2 Basic structure

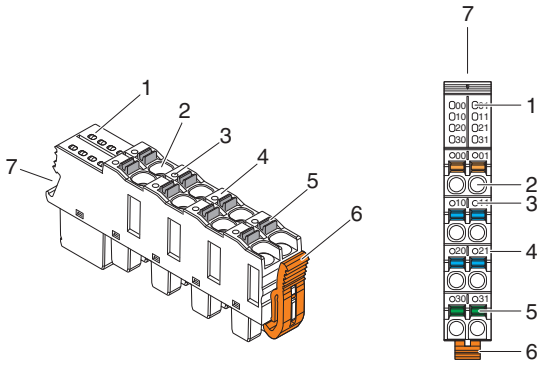


Fig. 5-20 Basic design of an S20 connector

1 Local diagnostic and status indicators
2 Terminal point
3 Touch connection
4 Terminal point marking
5 Spring lever
The color of the spring lever corresponds to the function (see Chapter “Color and marking” on page 33)
6 Locking latch
7 Space for connector marking

5.6 Color and marking

Housing

The following housing colors are currently used for the electronics modules:

Color	Similar RAL color	Use
Light gray	RAL 7035	Standard modules
Zinc yellow	RAL 1018	Safety modules

Fig. 5-21 Housing colors of electronics modules

Connectors

All connectors for the voltage supply are completely black (RAL 9005).

The bottom parts of the connectors for the I/O connection are black (RAL 9005). The upper parts match the color of the housing, i.e., light gray A or zinc yellow.

Function identification

The module functions are color coded (1 in Fig. 5-22).

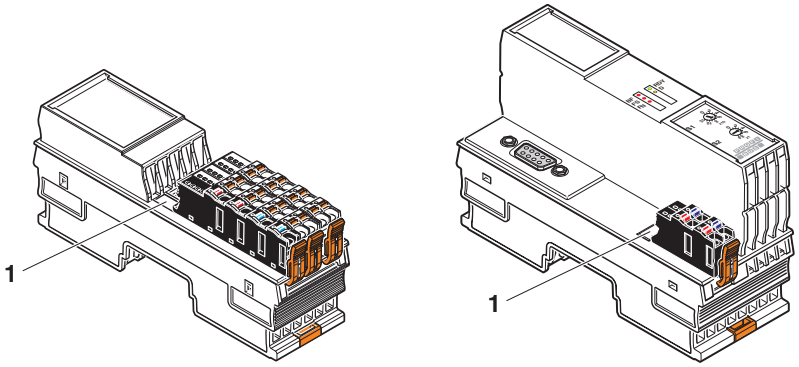


Fig. 5-22 Color coding of the module function

The following colors indicate the function:

Color	Similar RAL color	Function of the module
Light blue	RAL 5012	Digital input
Flame red	RAL 3000	Digital output
Signal violet	RAL 4008	Digital input and output
Pale green	RAL 6021	Analog input, temperature measurement
Zinc yellow	RAL 1018	Analog output
Pastel orange	RAL 2003	Function: open- and closed-loop control, communication, position detection
Pure white	RAL 9010	Bus coupler, controller, boost

Fig. 5-23 Color coding of the module function

Housing versions, design, and dimensions

Connections Apart from the S20 connectors, all connections are consecutively numbered, e.g., X1, X2 for Ethernet connections.

Operating elements Operating elements are marked according to their function, e.g., rotary coding switches with S1 and S2 including the switch positions.

Display elements Diagnostic and status indicators are marked with the function, e.g., D, E, UI, 00, 01, ... (1 in Fig. 5-24).

Terminal points The terminal points are consecutively numbered, e.g., a1, b1, 00, 01, ... (2 in Fig. 5-24).

The associated colored spring lever indicates the function (signal, potential) (3 in Fig. 5-24).

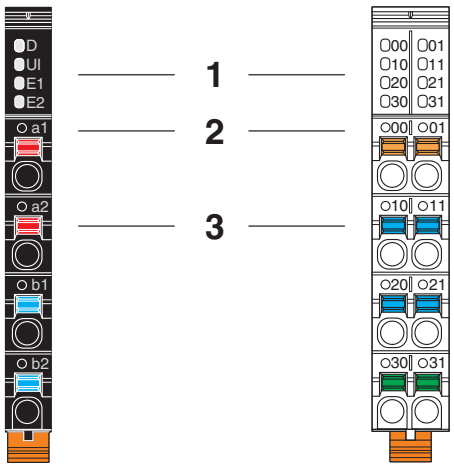


Fig. 5-24 Marking of the terminal points and the LEDs on the connectors

Color	Function of the terminal points	
	Low-level signal	**Low voltage**
Orange	Signal	Signal
Red	24 V DC	230 V AC, 220 V DC, relay main contact
Blue	GND	N (neutral conductor)
Green	FE (functional ground)	PE (protective conductor)

Fig. 5-25 Color coding of terminal point function

For the marking and function identification of a module, please refer to the module-specific data sheet.

Additional marking options

In addition to the standard marking options detailed above, you can also custom-mark the module using a zack marker strip or an insert label.

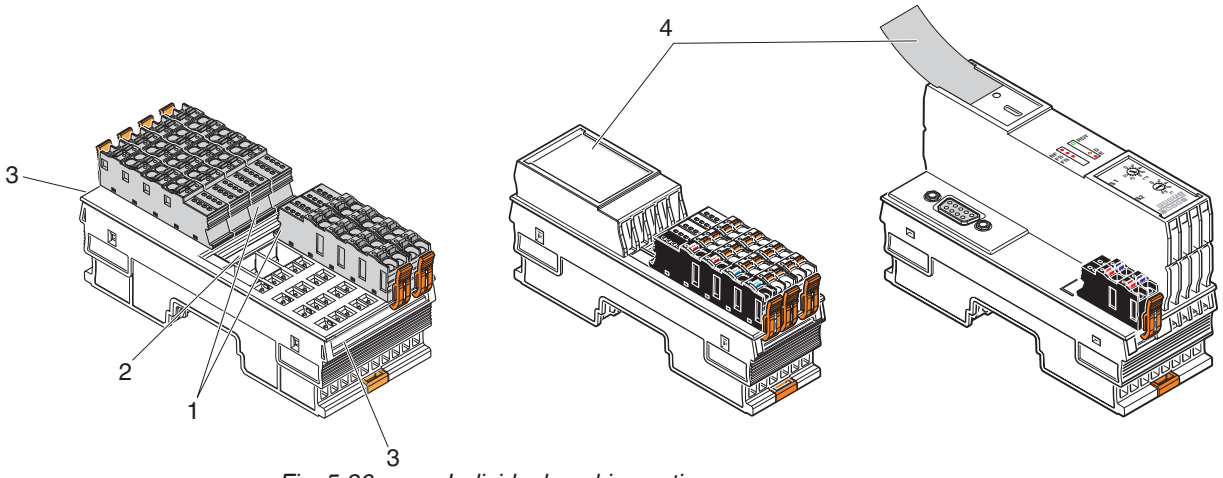


Fig. 5-26 Individual marking options

1 Space for connector marking
2 Space for module marking
3 Space for slot marking
4 Insert label

Ordering data can be found in Chapter “Ordering data” on page 95.

Slot and connector marking

Each slot on the module and the associated connector can be marked individually to ensure clear assignment between the slot and the connector (1 and 3 in Fig. 5-26).

6 Transport, storage, and unpacking

6.1 Transport

NOTE **Electrostatic discharge**

Electrostatic discharge can damage or destroy components. When handling the display, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

S20 modules are delivered in a folded box packaging.

- Please observe the notes on the packaging.

Suitable transport packaging

- Only transport the device in its original packaging or in packaging suitable for transport.

Technical data and environmental conditions

- During transport, observe the specifications regarding humidity and temperature range.
  See Chapter “Technical data” on page 90.

6.2 Storage

Suitable storage location

The storage location must be:

- Dry
- Protected from unauthorized access
- Protected from harmful environmental influences such as UV light

Technical data and environmental conditions

- During storage, observe the specifications regarding the temperature range, air pressure, and humidity.
  See Chapter “Technical data” on page 90.

6.3 Unpacking

Observing the packing slip

- Read the complete packing slip carefully before unpacking the device.
- Retain the packing slip.

Checking the delivery

- Check the delivery for damage and completeness.
- Submit claims for any transport damage immediately.

Scope of supply of standard modules

- S20 module with inserted connectors
- Associated bus base module

7 Mounting and removing modules

7.1 Safety notes for mounting and removal

7.1.1 General safety notes

NOTE **Electrostatic discharge**

The modules contain components that can be damaged or destroyed by electrostatic discharge. When handling the modules, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

NOTE **Electrical damage due to inadequate external protection**

Fuse does not trip in the event of an error

Provide external fuses for the 24 V area of each module. If you use a fuse, the power supply unit must be capable of supplying four times the nominal current of the fuse. This ensures that the fuse trips reliably in the event of a fault.

NOTE **Disregarding this warning may result in damage of the contacts or malfunction**

Before working on a module, disconnect the module from the I/O devices and power.

For a bus coupler or controller, this means:

- Disconnect the feed-in of communications voltage UL at the bus coupler or controller.

For an I/O module, this means:

- Disconnect the connected I/O devices from power.
- Disconnect the I/O supply voltage at the relevant module.

The communications voltage that is fed in at the bus coupler or the controller is still available.

Mounting and removing modules

NOTE **Damage to the contacts when tilting**

Tilting the modules can damage the contacts.

- **Place the modules vertically onto the DIN rail.**
- **Remove the modules vertically from the DIN rail.**

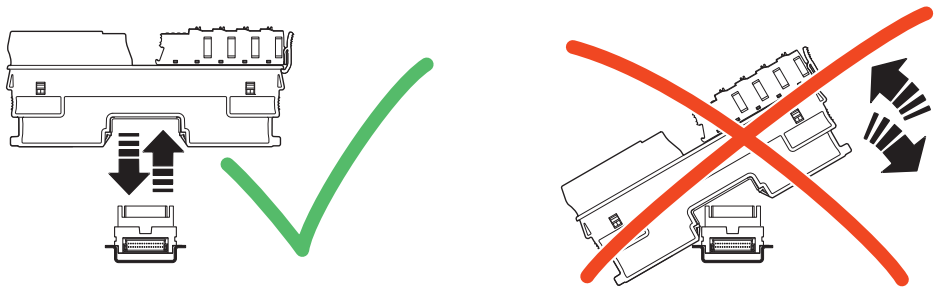


Fig. 7-1 Placing/removing the module vertically

When using modules in the low voltage area, please also observe Chapter “Additional safety notes for the low voltage area” on page 39. Additionally observe the information in the module-specific data sheets.

7.1.2 Additional safety notes for the low voltage area

Installing the system

Install the system according to the requirements of EN 50178.

Only qualified personnel may work on S20 modules in the low voltage range.

In terms of this document, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

⚠ WARNING **Dangerous contact voltage**

Please be aware of dangerous contact voltage when working on circuits that do not meet protective extra-low voltage requirements.

- The S20 modules for the low voltage range may only be mounted and removed when power is disconnected.
- When working on the modules and wiring, always switch off the supply voltage and ensure it cannot be switched on again.
- The S20 modules for the low voltage range must only be operated in a closed control cabinet.

Failure to observe these instructions can lead to damage to health or even life-threatening injury.

⚠ WARNING **Dangerous contact voltage in the event of ground faults**

- The S20 modules for the low voltage range must only be operated on grounded networks.

Additionally observe the information in the module-specific data sheets.

Mounting and removing modules

7.2 Basic information about mounting

Mounting location

The S20 modules meet the requirements of IP20 degree of protection. They can therefore be used in closed control cabinets or in control boxes (junction boxes) with IP54 degree of protection in accordance with EN 60529 or higher.

The compact design means that the S20 modules can be installed in standard junction boxes. Please observe the mounting distances when selecting the housing, see Chapter “Mounting distances” on page 52.

IP20 degree of protection

Insert the connectors onto the electronics modules in order to achieve IP20 degree of protection.

DIN rail

All S20 modules are mounted on grounded 35 mm standard DIN rails. The preferred installed height of the DIN rail is 7.5 mm (corresponds to TH 35-7.5 in accordance with EN 60715).

The recommended DIN rails from Phoenix Contact or recommended mounting straps from Lütze can be found in Chapter “Ordering data” on page 95.

Mount the modules **vertically** onto the DIN rail. As the module does not need to be tilted, easy installation and removal is ensured even in confined spaces.

The distance between the DIN rail fasteners must not exceed 200 mm. This distance is necessary for the stability of the rail when mounting and removing modules.

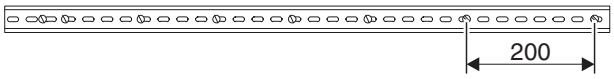


Fig. 7-2 Fixing the DIN rail (in mm)

NOTE

Electrical damage from the fixing elements
Danger of malfunction

If the fixing elements (screw, rivet, etc.) are too high, the bus base modules are not correctly snapped onto the DIN rail.

For fixing the DIN rail, only use elements with a maximum installation height of 3 mm.

Mounting position

Wall mounting on a horizontal DIN rail on the wall is the preferred mounting position (Fig. 7-3, Fig. A). This mounting position provides optimum air flow for the modules.

Other mounting positions are possible. However, temperature derating may be required. Observe the ambient temperatures provided in the module-specific documentation.

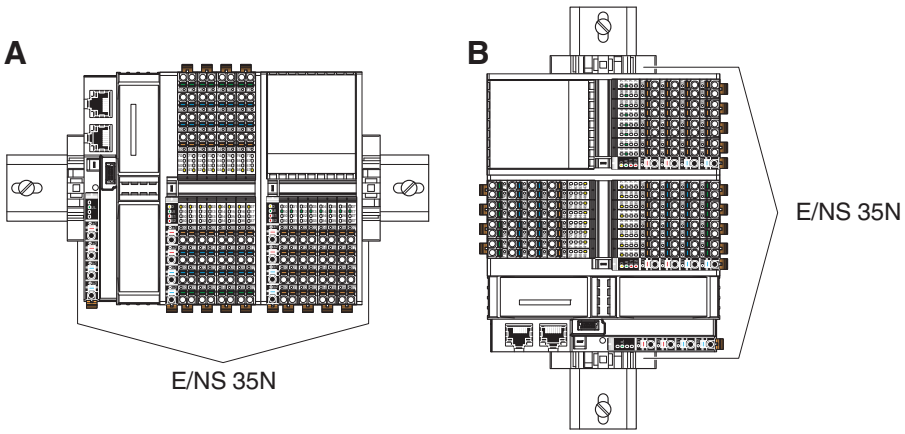


Fig. 7-3 Mounting positions for an S20 station

The module-specific documentation specifies whether any other mounting position than the preferred mounting position is not permitted.

End bracket

Mount end brackets on both sides of the S20 station (see also Fig. 7-3). The end brackets ensure that the S20 station is correctly mounted. They secure the station on both sides and keep it from moving from side to side on the DIN rail.

Always attach the left end bracket of the station when beginning to mount the station. This ensures the following:

- It prevents the station from slipping on the DIN rail.
- The space for the end bracket is secured.
- There is a counter pressure for the insertion force that occurs when the bus base modules are installed next to the bus coupler.
- For bus couplers in the AT housing: if the bus coupler needs to be replaced, you have enough space to separate the bus coupler from the bus base modules.

Mounting position	Ambient conditions	End bracket
Horizontal; Fig. 7-3, Fig. A	Normal	E/NS 35N
	High shock and vibration load	
Other; Fig. 7-3, Fig. B	Normal	
	High shock and vibration load	

Fig. 7-4 Recommended end brackets

Mounting and removing modules

Tools

No tools are required for mounting the modules.

A standard tool, e.g., a bladed screwdriver with a blade width of 2.5 mm, is necessary for removing the electronics modules and using the spring levers.

Order of the modules

The modules on the DIN rail can be put in any order behind the bus coupler. To ensure functionality, mount the modules side by side, without a gap.

If you are using modules with shield connection, installing them next to each other is recommended in order to make optimum use of the busbar for shield connection.

Maximum number of modules

The maximum number of S20 modules within a station is 63.

The actual number of modules within an S20 station may be limited by the following factors:

- Supplied communications current
- Current consumption of the connected modules
- System limits of the bus coupler

Power supply/ current consumption

The bus coupler, controller or the power module for the communications power provide the power supply for the local bus. In the module-specific documentation, this current value is specified as “Power supply at U_{Bus}”.

The total current consumption of all S20 modules arranged in the station must not exceed this maximum current. The communications current consumption values are specified for each module in the module-specific data sheet as “Current consumption from U_{BUS}”.

The following information is stored in the device description files (e.g., gsdml file):

- Current supplied by the bus coupler, controller or power module
- Maximum current consumption of the modules that can be connected

You can use these maximum currents in the engineering tool for configuration in order to prevent an overload of the communications power.

NOTE **Electronics may be damaged if overloaded**

Observe the current consumption of each device when configuring an S20 station. It is specified in every module-specific data sheet and may vary. As such, the permissible number of devices that can be connected therefore depends on the station structure.

Install a power module for the communications power if the maximum current consumption at U_{Bus} is reached. Create another station as an alternative.

System limits of the bus coupler

For information regarding the system limits of the bus coupler or controller used, please refer to the module-specific documentation. The system limits include:

Network	Bus coupler	System limits
Sercos	S20-S3-BK+	Amount of process data
PROFINET	S20-PN-BK+	Amount of process data
PROFIBUS	S20-PB-BK	Amount of process data
		Amount of parameter data
		Amount of configuration data

Fig. 7-5 System limit examples

The amount of process data and the amount of parameter and configuration data for PROFIBUS are documented in the module-specific data sheet for each I/O module.

If the system limits of the bus coupler or controller are reached, create a new station.

Example structure of an S20 station

See Chapter “Example of an S20 station” on page 10.

7.3 Mounting modules

Please refer to Chapter “Safety notes for mounting and removal” on page 37.

Note that bus couplers in the AT housing with the integrated bus base are mounted differently than in the NE housing with a separate bus base module.

No tools are required for mounting the S20 modules.

- First, mount the end bracket onto the grounded DIN rail.

7.3.1 Bus base modules, controllers, and bus couplers in the NE housing

Mounting the bus base modules

- First, install the bus base module for the controller or bus coupler onto the DIN rail.
- Install all other bus base modules required for the station onto the DIN rail (Fig. 7-6, A).

NOTE **Malfunction**

Ensure you insert the bus base module belonging to the relevant module.
Bus base modules with different overall widths and functions are available.

- Push each subsequent bus base module into the connection of the previous bus base module (Fig. 7-6, B).

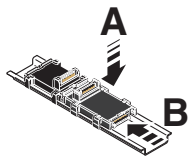


Fig. 7-6 Connecting bus base modules to each other

It is not possible to snap another bus base module to the previous bus base module if there is already an electronics module on it. In this case, first remove the last electronics module before snapping on more bus base modules.

Snapping on the controller or bus coupler

- Place the controller or bus coupler **vertically** onto the first bus base module and onto the DIN rail until the bus coupler or controller snaps into place with a click.
  Make sure that the device plug for the bus base connection is positioned above the corresponding female connector on the bus base module.

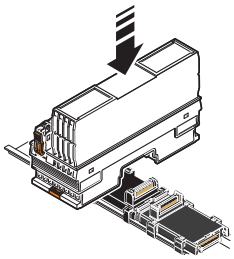


Fig. 7-7 Snapping the bus coupler on

Connecting the network

Connect the network according to the specifications given in the module-specific documentation.

7.3.2 Bus coupler in the AT housing (S20-PN-BK and S20-S3-BK)

Snapping the bus coupler on

Note that you need at least 5 mm of space to slide an S20-PN-BK or S20-S3-BK bus coupler to the left if you want to remove it (e.g., for replacement).

- Place the bus coupler **vertically** on the DIN rail until it snaps into place with a click (Fig. 7-8).

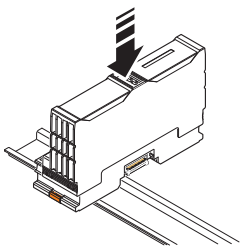


Fig. 7-8 Snapping the bus coupler on

Mounting the bus base modules

- Place all bus base modules required for the station on the DIN rail (Fig. 7-9, A). Observe the proper orientation of the bus base modules. When mounting on horizontal DIN rails on the wall, the logo must be readable and the laser-engraved arrow should point towards the bus coupler.
- Push the bus base modules into the connection of the bus coupler or the previous bus base module (Fig. 7-9, B).

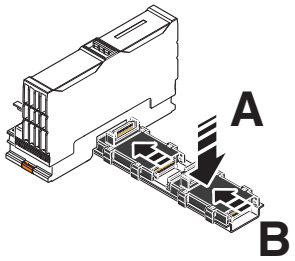


Fig. 7-9 Connecting bus base modules with each other and with the bus coupler

It is not possible to snap a bus base module onto the previous bus base module if there is already an electronics module on it. In this case, first remove the last electronics module before snapping on more bus base modules.

Connecting the network

Connect the network according to the specifications given in the module-specific documentation.

7.3.3 I/O modules

- Place the necessary I/O modules **vertically** onto the corresponding bus base modules and onto the DIN rail until they snap into place with a click.
  Pay attention to the correct position.
  Make sure that the device plugs for the bus base connection are positioned above the corresponding female connectors on the bus base module.

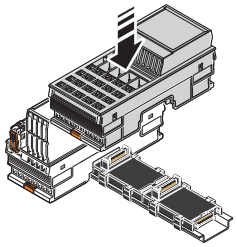


Fig. 7-10 Inserting I/O modules

If you are using analog modules, mount the necessary shield connection elements.

For connecting the shield, Bosch Rexroth recommends the S20-SHIELD-SET S20 shield connection set in combination with S20-SHIELD-NLS, S20-SHIELD-SK5 and S20-SHIELD-SK14 (see Chapter “Connecting the shield using the S20 shield connection set” on page 73).

When using the S20-SHIELD-SET, mount the elements in the following order:

1. Bus base module
2. Shield bus holder
3. Electronics module

See Chapter “Connecting the shield using the S20 shield connection set” on page 73.

7.4 Removing the modules

Please refer to Chapter “Safety notes for mounting and removal” on page 37.

A standard tool, e.g., a bladed screwdriver with a blade width of 2.5 mm is necessary for removing modules.

7.4.1 Removing connectors or cables

Removing the network connector

- Remove the network connector (if present) according to the specifications in the module-specific documentation.

Supply connector, I/O connector

- Prior to module removal, remove the connectors or cables, if present, from the module.
  - If no cables are inserted, the connectors do not need to be removed.
  - If cables are inserted, either remove the connectors from the module or the cables from the connectors.
    The cables should only be removed from the connector if you wish to change the wiring or no longer wish to use the connector.

Removing the cables

See Chapter “Removing cables from the terminal point” on page 59.

Removing the S20 connectors

See Chapter “Bus coupler in the AT housing (S20-PN-BK and S20-S3-BK)” on page 50.

7.4.2 Controllers, bus couplers in the NE housing, and I/O modules

The controller, bus coupler, and each I/O module can be removed individually from the station.

- Insert a suitable tool (e.g., bladed screwdriver) in the upper **and** lower snap-in mechanism (base latches) of the module one after the other and unlock it (Fig. 7-11, Fig. 7-12, A). The base latches are locked in place in the open position.
- Remove the electronics module **perpendicular** to the DIN rail (Fig. 7-11, Fig. 7-12, B). The base latches return to the idle position again.

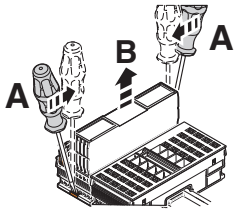


Fig. 7-11 Removing the bus coupler

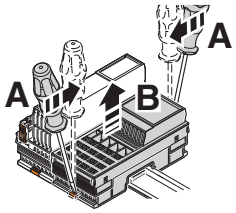


Fig. 7-12 Removing an I/O module

The bus base module remains on the DIN rail.

Bus base module

Please proceed as follows if, after having removed modules, you want to remove bus base modules from the DIN rail as well:

- If a module is located on the neighboring bus base module to the left, remove it.

If the bus base module is in the end position:

- Remove the bus base module from the connection of the previous bus base module by sliding it approximately 5 mm to the right (A).
- Insert a suitable tool (e.g., bladed screwdriver) into the latches on one side (B, B1, B2) one after the other.
- Swivel the bus base module upwards and remove it (C).

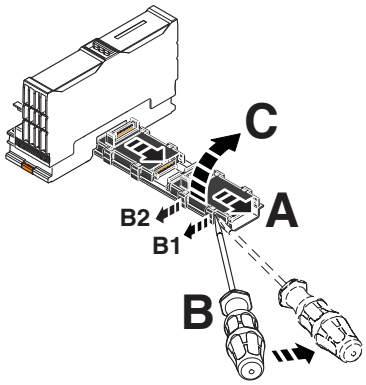


Fig. 7-13 Removing the bus base module

If the bus base module to be removed is inside the station:

- If possible, push the following bus base modules and any fitted modules approximately 15 mm to the right.
  In doing so, disconnect the bus base module you want to remove from the connection of the next bus base module.
- If it is not possible to slide the next bus base modules and modules, remove the modules. Starting at the end of the station, remove the bus base modules.
- Disconnect the bus base module to be removed from the connection to the previous bus base module by sliding it about 5 mm to the right (A).
- Insert a suitable tool (e.g., bladed screwdriver) into the latches on one side (B, B1, B2) one after the other.
- Swivel the bus base module upwards and remove it (C).
- Push the rest of the station back to the left until the bus base modules touch each other again.

7.4.3 Bus coupler in the AT housing (S20-PN-BK and S20-S3-BK)

NOTE **Module can be damaged when removed forcibly**
Risk of damage to components

The bus coupler can only be removed from the station after the bus coupler has been slid to the left and thereby disconnected from the subsequent module.

NOTE **Damage to the FE contacts**

Pushing the bus coupler on the DIN rail can result in damage to the FE contacts. Check the contacts following removal of the bus coupler.

- Remove the left end bracket.
- Disconnect the bus coupler from the subsequent bus base module by sliding it approximately 5 mm to the left (A). It must be completely removed from the neighboring bus base module.
- Insert a suitable tool (e.g., bladed screwdriver) first in the upper **and** then in the lower snap-on mechanism (base latches) of the bus coupler and release it (B). The base latches are locked in place in the open position.

You can swap steps A and B. In this case, make sure to align the bus coupler properly to avoid damage of the bus contacts.

- Remove the bus coupler **perpendicular** to the DIN rail (C). The base latches return to the idle position again.

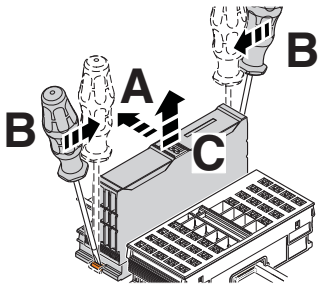


Fig. 7-14 Removing the bus coupler

7.5 Removing or inserting a connector

7.5.1 Removing a connector

- Release the locking latch (A). Tilt the connector slightly upward (B). Remove the connector from the module (C).

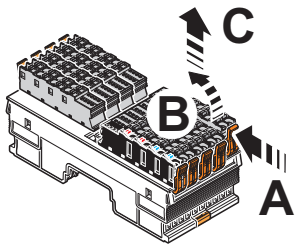


Fig. 7-15 Removing a connector

7.5.2 Inserting a connector

- Insert the connector vertically in its position. Press firmly on the connector. Ensure that the latching engages with a click.

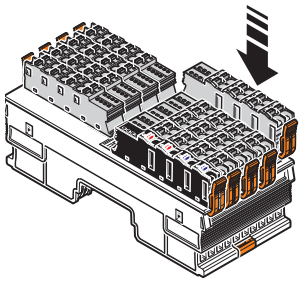


Fig. 7-16 Snapping a connector on

7.6 Replacing a module

- To replace a module, proceed as described in Chapters “Removing the modules” on page 47 and “Mounting modules” on page 43.
- Once replaced, restore all the necessary connections.

When replacing a controller

Observe any notes for replacement in the module-specific documentation.

7.7 Mounting distances

The space required for cable routing depends on the number of cables to be installed. Leave this space free at the bottom and/or at the top.

For the recommended distances of the upper and lower cable ducts or the cable routing to the modules, please refer to Fig. 7-17 and Fig. 7-18.

In addition to the specified dimensions, provide adequate space for mounting and removal of the male connectors and cables.

7.7.1 Bus coupler

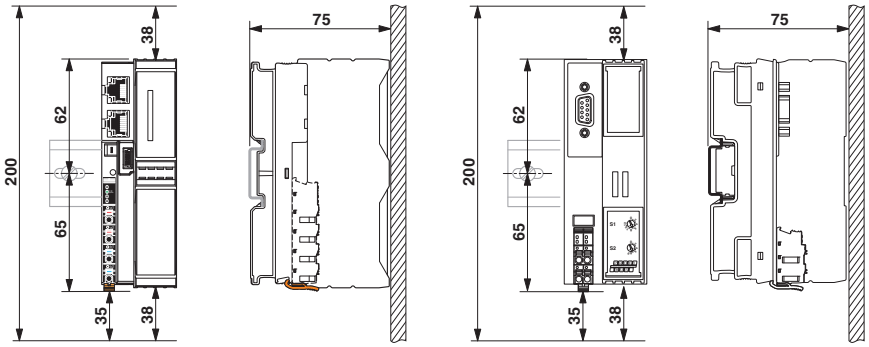


Fig. 7-17 Mounting distances: bus coupler (dimensions rounded)

7.7.2 I/O modules

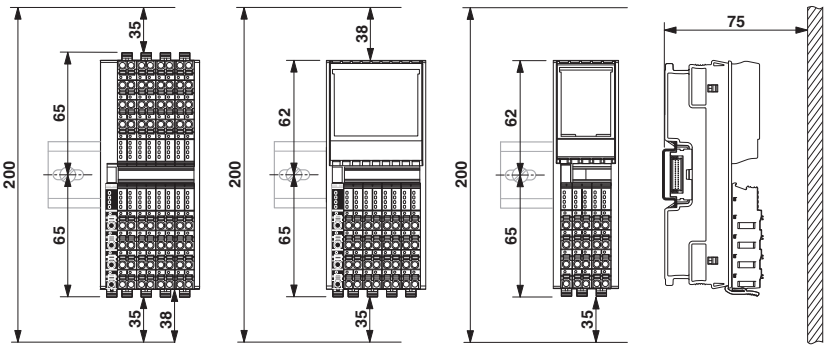


Fig. 7-18 Mounting distances: I/O modules (dimensions rounded):

If the distances are smaller, the minimum bending radius of the cables, easy handling during installation, and a clear structure cannot be guaranteed.

Housing type	Housing height	Distance between DIN rail and housing cover	Remark
2, 4, 3, 5	54 mm	75 mm	See Fig. 7-18
8	65.5 mm	87 mm	

Fig. 7-19 I/O module mounting clearances

8 Connecting or removing cables

8.1 Connections and cables in the S20 system

NOTE **Damage to contacts**

There is risk of damage to the terminal points if they are mechanically overstrained.

- Implement strain relief for the connected cables.

All electrical connections can be plugged in.

The network cables on the controller or bus coupler are connected via D-SUB or RJ45 connectors depending on the network.

The cables for the I/O devices and supply voltages are connected via S20 connectors.

Each terminal point is designed for a maximum current of 8 A. This applies to the periphery of the I/O modules (I/O connectors) as well as to the communications power, sensor supply, and actuator supply (power connectors).

Applications with UL approval:

- Only use copper conductors.
- The current might be reduced. Observe any specifications in the module-specific packing slip, data sheet, and the rating on the modules.

When using S20 modules, you can use shielded and unshielded, rigid and flexible conductors, with or without ferrules.

Please observe the following when wiring:

- Twist stranded cable ends.
- Make sure to install the conductor in the middle of the wiring space, especially with small cross-sections.

If using ferrules, use those which correspond to the specifications in Chapter “Conductor cross-sections, and stripping and insertion lengths” on page 54.
Make sure the ferrules are properly crimped.

8.2 Conductor cross-sections, and stripping and insertion lengths

For electrical and/or thermal reasons, it may not be possible to use the minimum conductor cross-sections specified here for certain modules. Therefore, always observe the information in the module-specific documentation.

Conductor cross sections

Conductor	Cross section
Rigid	0.5 mm^2 .... 1.5 mm^2
Flexible with ferrule without insulating collar (A ...) • In accordance with DIN 46228-1, sleeve length: 10 mm	0.25 mm^2 .... 1.5 mm^2
Flexible with ferrule with insulating collar (AI ...) • In accordance with DIN 46228-4, sleeve length: 8 mm • In accordance with DIN 46228-1, sleeve length: 10 mm	0.25 mm^2 .... 1.0 mm^2 0.25 mm^2 .... 1.5 mm^2

Fig. 8-1 Permissible conductor cross-sections for Push-in connection technology (tool-free conductor insertion)

Flexible cables without ferrules are only suitable for Push-in connection technology **when using the spring lever**.

Conductor	Cross section
Rigid	0.2 mm^2 .... 1.5 mm^2
Flexible without ferrule	0.2 mm^2 .... 1.5 mm^2
Flexible with ferrule without insulating collar (A ...)	0.25 mm^2 .... 1.5 mm^2
Flexible with ferrule with insulating collar (AI ...)	0.25 mm^2 .... 1.5 mm^2

Fig. 8-2 Permissible conductor cross-sections when using the spring lever for inserting the conductor

Conductor	Cross section
AWG	24 ... 16

Fig. 8-3 Permissible AWG conductor cross-sections

Stripping and insertion lengths

NOTE **Malfunction when the conductor is not securely fixed**

To ensure secure fixing and correct function:

Make sure that the stripping length of a conductor without a ferrule, or the insertion length of a conductor with a ferrule corresponds to the specifications.

The crimping form must be trapezoidal. The relevant tools can be found in the Phoenix Contact product range.

For crimping, we recommend pliers for trapezoidal crimp: CRIMPFOX 6, CRIMPFOX DUO 10 or CRIMPFOX 10T-F.

According to the current state, these crimping pliers meet the general conditions regarding the S20 wiring space (in accordance with internal cylindrical gauge DIN EN 60947-1 (DIN VDE 0660-100)-A1).

Conductor without ferrule: stripping length: 8 mm

Conductor with ferrule: insertion length 8 mm or 10 mm

Ferrules: see Chapter “Ordering data” on page 95.

TWIN ferrules

NOTE **Malfunction when using wrong ferrule**

TWIN ferrules are not permitted in the S20 system.

8.3 Terminal point, associated spring lever, and associated touch connection

When using the screwdriver, pay attention to the position of the spring lever to the assigned terminal point.

When testing the signal with a measuring probe, pay attention to the position of the touch connection to the assigned terminal point.

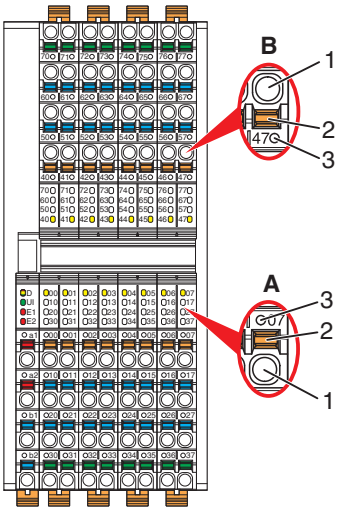


Fig. 8-4 Terminal point with associated spring lever, and associated touch connection

A	Cable outlet at the bottom:	Spring lever and touch connection **above** the terminal point
B	Cable outlet at the top:	Spring lever and touch connection **below** the terminal point (B)
1	Terminal point	
2	Spring lever	
3	Touch connection	

8.4 Connecting unshielded cables

Wire the connectors according to your application.

For the terminal point assignment, please refer to the corresponding module-specific documentation.

When wiring, proceed as follows:

- Strip 8 mm off the cable.

Tool-free (Push-in)

Suitable for:

- Conductor cross-sections from 0.5 mm^2
- Rigid cables
- Flexible cables with ferrules
- Insert the cable into the terminal point. The wire is clamped automatically.

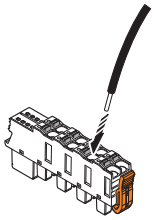


Fig. 8-5 Connecting a rigid unshielded cable

With tools

Suitable for:

- Flexible cables
- Rigid cables
- Flexible cables with ferrules
- Open the spring by pressing the spring lever with the screwdriver (Fig. 8-6, A).
  Use a bladed screwdriver with a blade width of 2.5 mm, for example.
- Insert the cable in the terminal point (B).
- Remove the screwdriver to secure the cable.

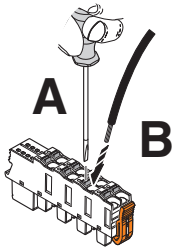


Fig. 8-6 Connecting a flexible cable

Connecting or removing cables

Inserting a connector

- Insert the connector vertically in its position. Press firmly on the connector. Make sure that the locking latch snaps in.

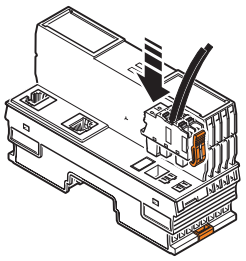


Fig. 8-7 Inserting a connector

8.5 Connecting shielded cables

Please also observe the information in Chapter “Shielding concept” on page 72 for shielding.

Connect the shield upstream of the module.

When connecting the cables, proceed as follows:

Stripping the cables, connecting the shield

- Strip approximately 20 mm off the outer sheath of the cable at the required distance from the end of the cable (a in Fig. 8-8).
  The necessary distance a depends on the distance to the busbar.
- Strip 8 mm off the wires.

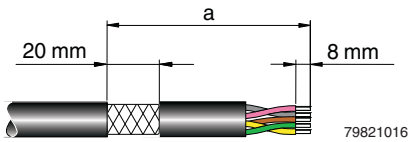


Fig. 8-8 Connecting the shielded cable

- If present, remove the protective foil.
- Lay the cable with the braided shield under a shield clamp. Tighten it using a screw.
  Malfunctions will then be led to the support brackets via a busbar. The support brackets are connected to the grounded DIN rail.
  Ordering data can be found in Chapter “Ordering data” on page 95.

Make sure the shielding is as close as possible to the signal terminal points.
When using twisted pair conductors, keep the conductor twisted until just before the terminal point.

NOTE

The busbar is only for shielding the modules, not for the strain relief of the connected cables.

Wiring connectors

- Connect the cables to the connector. To do this, proceed as described in Chapter “Connecting unshielded cables” on page 57.

8.6 Removing cables from the terminal point

- To remove a cable from the terminal point, press on the spring lever using a suitable tool (e.g., bladed screwdriver with a blade width of 2.5 mm). This opens the leg spring connection of the relevant terminal point (Fig. 8-9, A).
- Remove the conductor (Fig. 8-9, B).

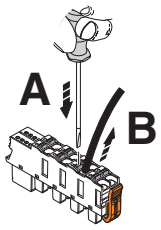


Fig. 8-9 Removing the cable

8.7 Connecting the power supplies

8.7.1 S20 system supply

When using an S20 station, you must provide the following supply voltages:

- Supply voltage for the bus coupler or the controller (U_L)
- Supply voltage for sensors and actuators

Unshielded cables are usually sufficient for connecting the power supplies. Connect them as shown in Chapter “Connecting unshielded cables” on page 57.

For the connector pin assignment of the supply voltage connections, please refer to the module-specific documentation.

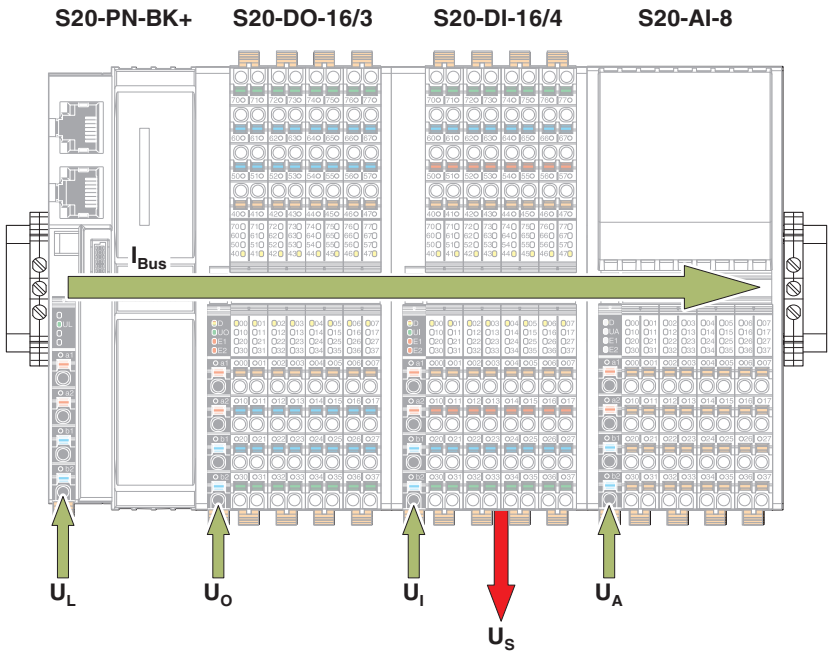


Fig. 8-10 Supply voltages in the S20 system

Key:

U_L	(U_{Logic})	Feed-in of the communications voltage
U_{Bus}	(U_{Bus})	Power supply for the S20 local bus (generated from U_L)
U_I	(U_{Input})	Feed-in for digital input modules Sensor supply/encoder supply (S20-CNT-INC-2/2) Encoder supply/analog supply (S20-SSI-AO-1/1)
U_S	(U_{Sensor})	Sensor supply (generated from U_I)
U_O	(U_{Output})	Supply for digital output modules
U_{IO}	($U_{Input/Output}$)	Supply for digital input and output modules
U_A	(U_{Analog})	Supply for analog modules
I_{Bus}	(I_{Bus})	Power supply for the local bus

For information regarding which supply voltage is used for a module, please refer to the module-specific documentation.

8.7.2 Power supply requirements

Choose a power supply unit that is suitable for the currents in your application. The selection depends on the bus configuration and the resulting maximum currents.

⚠ WARNING: Loss of electrical safety when using unsuitable power supplies / hazardous shock currents

The S20 low-level signal controllers, bus couplers, and modules are designed exclusively for protective extra-low voltage (PELV) operation according to EN 60204-1. Only protective extra-low voltage in accordance with the defined standard may be used for supply purposes.

- Only use power supply units that ensure safe isolation in accordance with EN 61010-2-201. They prevent short circuits between the primary and secondary circuits.

⚠ WARNING: Dangerous contact voltage in the event of ground faults

- The S20 modules for the low voltage area must only be operated in grounded networks.

IEC 61131-2 requires power failure protection of 10 ms. To meet this requirement, use only power supply units (230 V AC/24 V DC, 400 V AC/24 V DC) that support mains buffering for at least 10 ms.

Observe the information in the module-specific documentation.

8.7.3 Supply at the controller or bus coupler

Communications voltage (U_L) is supplied at the controller or bus coupler. It supplies the module electronics (logic) of the controller or bus coupler. Additionally, it generates the communications voltage for the local bus (U_{Bus}), which supplies the connected modules with communications current.

If the communications voltage U_L is switched off, the local bus will shut down.

8.7.4 Supply at the power module

If the maximum load of the bus coupler for the S20 local bus supply (communications power U_{Bus}) is reached, you can use a power module to provide this voltage again.

To this end, apply a 24 V DC voltage (U_L) to the module from which U_{Bus} is generated.

NOTE **Malfunction**

The power module only boosts the U_{Bus} voltage when it is snapped onto the associated red bus base module and when the U_{Bus} voltage is available in the bus segment upstream of the power module.

Connecting or removing cables

8.7.5 Supply at the I/O modules

The inputs and outputs, as well as the sensors, are supplied directly at each module.

The input and output power supply ($U_I/U_O/U_{IO}/U_A$) should be installed and fused independent of the communications voltage (U_L). In this way, the local bus can be operated even if some I/O devices are switched off. This also prevents unnecessary interference couplings between I/O and logic.

The use of separate power supply units for U_L and $U_I/U_O/U_{IO}/U_A$ may be necessary in environments with a lot of interference.

8.7.6 Jumpers in power connectors, potential forwarding, and fusing

Terminal points a1 and a2, as well as b1 and b2 are jumpered in the power connector. You can therefore use one of the terminal points for feed-in and the second terminal point for forwarding a potential respectively.

NOTE **Module damaged when overloaded**

Please note that the maximum current carrying capacity of a terminal point of 8 A must not be exceeded.

Protect the supply accordingly.

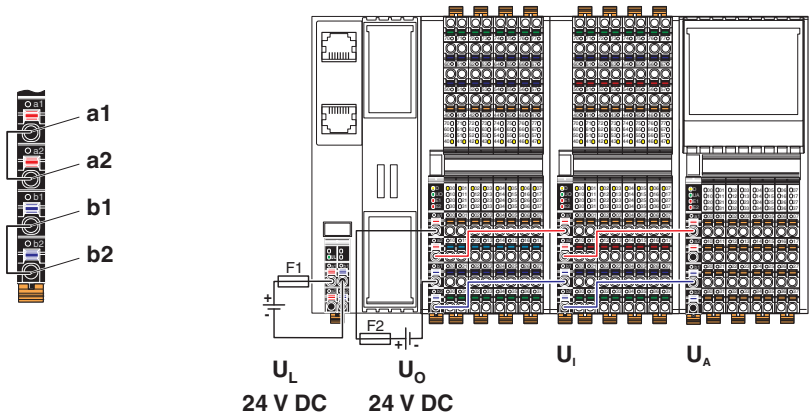


Fig. 8-11 Jumpering in the power connector and example of potential forwarding

F1, F2 Protecting the supply voltage using suitable fuses (see module-specific documentation)

Considering the current carrying capacity of the terminal points, the potential forwarding shown in Fig. 8-11 must not be used when the digital output module is fully loaded (e.g., S20-DO-16/3 current consumption at U_O is 8 A, maximum).

8.7.7 Parallel supply

If the maximum current consumption is greater than 8 A for a module but you wish to fully load the module, the supply voltage can be supplied in parallel. The module can now be loaded with 16 A, maximum.

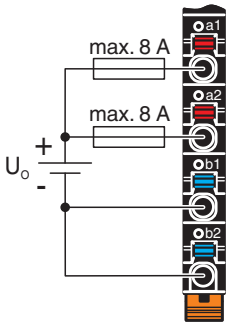


Fig. 8-12 Parallel supply of the supply voltage

8.8 Connecting the network

Your network cable is connected to a controller or bus coupler.

Connect the network according to the module-specific documentation.

8.9 Connecting sensors and actuators

Sensors and actuators are connected using the I/O module connectors.

Connect the unshielded cables as described in Chapter “Connecting unshielded cables” on page 57.

Connect the shielded cables as described in Chapter “Connecting shielded cables” on page 58.

8.9.1 Connection technology for sensors and actuators

The I/O modules of the S20 product group normally permit connection of sensors and actuators in 1, 2, 3 or 4-conductor technology.

The relevant module-specific data sheets indicate which connection technology is possible for the individual modules.

8.9.2 Connections used for low-level signal digital I/O modules

For the actual terminal point assignment, please refer to the corresponding module-specific data sheet. It also provides a connection example.

Connection	Representation in the figure	1-conductor	2-conductor	3-conductor	4-conductor
Sensor signal IN	IN	X	X	X	X
Sensor supply U_S	U_S (+24 V)	–	X	X	X
Ground GND	GND	–	–	X	X
Grounding/FE shielding	FE (⏚)	–	–	–	X

Fig. 8-13 Overview of the connections used for low-level signal digital input modules

X Used
– Not used

Connection	Representation in the figure	1-conductor	2-conductor	3-conductor
Actuator signal OUT	OUT	X	X	X
Actuator supply U_O	U_O (+24 V)	–	–	–
Ground GND	GND	–	X	X
Grounding/FE shielding	FE (⏚)	–	–	X

Fig. 8-14 Overview of the connections used for low-level signal digital output modules

X Used
– Not used

8.9.3 Connecting digital sensors and actuators using different connection technologies

1-conductor technology

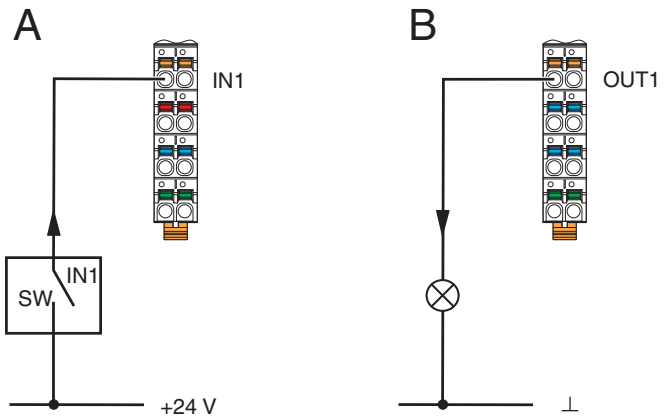


Fig. 8-15 1-conductor connection for digital modules

Sensor

Fig. 8-15, Fig. A, shows the connection of a 1-conductor sensor.

- The SW switch provides the input signal.
- The sensor signal is routed to the IN1 terminal point.
- The sensor is supplied with a 24 V voltage.

NOTE **Malfunction**

To ensure the correct function, supply the sensors and U_I from a power supply with a common GND as the reference potential.

Actuator

Fig. 8-15, Fig. B, shows the connection of a 1-wire actuator.

- The actuator is supplied with voltage by output OUT1.
- The load is switched directly via the output.

NOTE **Malfunction**

To ensure the correct function, make sure that GND of the actuators and GND of the supply voltage U_O, which supplies the actuators, have the same potential.

Connecting or removing cables

2-conductor technology

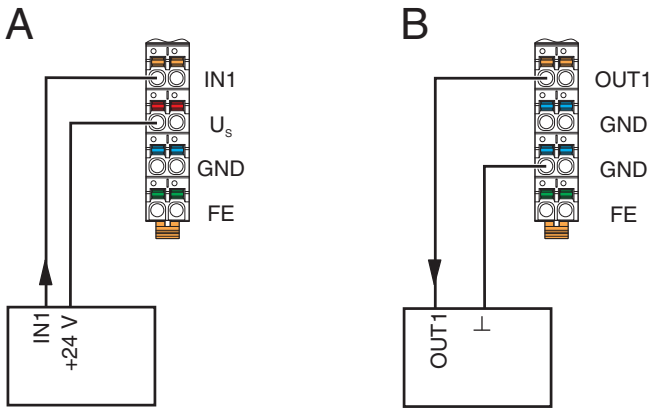


Fig. 8-16 2-conductor connection for digital modules

Sensor Fig. 8-16, Fig. A, shows the connection of a 2-conductor sensor.

- The sensor signal is routed to the IN1 terminal point.
- The sensor is supplied by voltage U_S.

Actuator Fig. 8-16, Fig. B, shows the connection of an actuator.

- The actuator is supplied with voltage by output OUT1.
- The load is switched directly via the output.

3-conductor technology

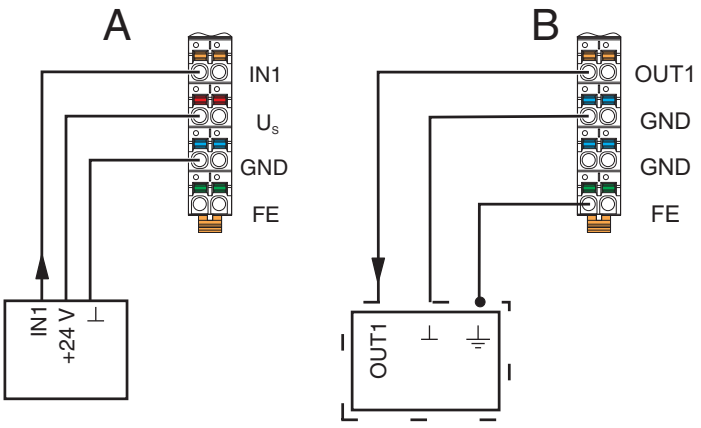


Fig. 8-17 3-conductor connection for digital modules

Sensor Fig. 8-17, Fig. A, shows the connection of a 3-conductor sensor.

- The sensor signal is routed to the IN1 terminal point.
- The sensor is supplied with power via terminal points U_S and GND.

Actuator Fig. 8-17,Fig. B, shows the connection of a shielded actuator.

- The actuator is supplied by output OUT1.
- The load is switched directly via the output.
- The actuator is grounded via the FE terminal point.

4-conductor technology

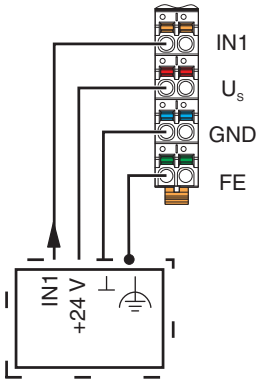


Fig. 8-18 4-conductor connection for digital modules

Sensor Fig. 8-18 shows the connection of a shielded 4-conductor sensor.

- The sensor signal is routed to the IN1 terminal point.
- The sensor is supplied with power via terminal points U_S and GND.
- The sensor is grounded via the FE terminal point.

Connecting or removing cables

8.9.4 Redundant signals

If you are using I/O modules redundantly, connect the modules as shown in Fig. 8-19.

In the example, the two modules are located in two S20 stations.

8.9.4.1 Redundant digital inputs

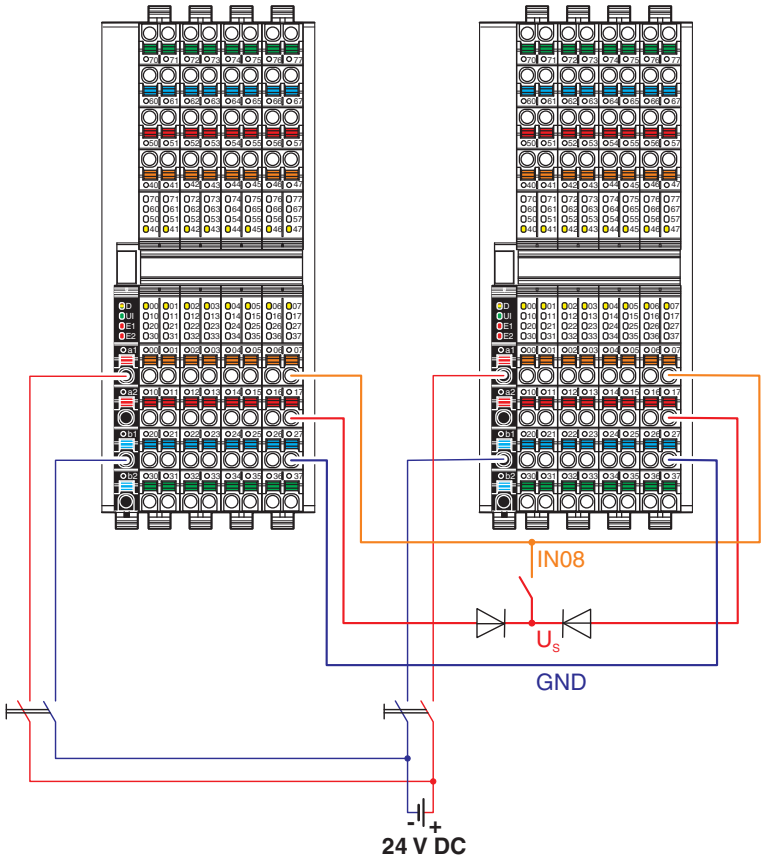


Fig. 8-19 Example: connection for redundant use of digital inputs

IN08	Digital input 8
U_S	Sensor supply
GND	Reference potential

⚠ CAUTION: Malfunction

To avoid malfunction, make sure that the GND connection shown in Fig. 8-19 is established as the reference potential to the redundant signal inputs.

Make sure that, in the event of a short circuit of the sensor supply, the effects are limited by providing decoupling (longitudinal diode).

8.9.4.2 Redundant digital outputs

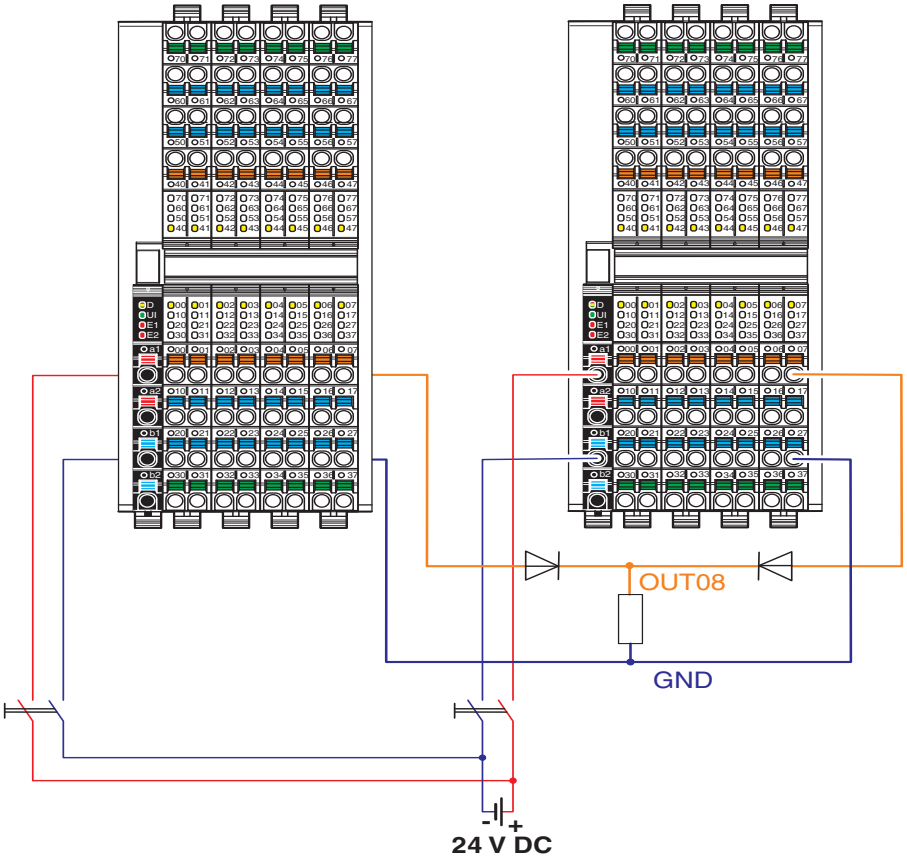


Fig. 8-20 Example: connection for redundant use of digital outputs

OUT08	Digital output 8
U_O	Supply of digital outputs
GND	Reference potential

⚠ CAUTION: Malfunction

To avoid malfunction, make sure that the GND connection shown in Fig. 8-20 is established as the reference potential to the redundant signal inputs.

Make sure that, in the event of a short circuit of the sensor supply, the effects are limited by providing decoupling (longitudinal diode).

9 Grounding and shielding

9.1 Grounding concept

Within an S20 station, a distinction is made between functional ground (FE) and protective ground (PE).

Protective grounding (PE)

Protective grounding protects people and machines against hazardous voltages. To avoid these dangers, as far as possible, correct grounding, taking the local conditions into account, is vital.

Functional grounding (FE)

Functional ground is only used to discharge interference. It does not provide shock protection for people.

Functional grounding is used to improve immunity. All devices must be grounded so that any possible interference from connectors for data transmission is shielded and discharged to ground.

9.1.1 Protective ground (PE)

Protective ground is a low-impedance current path that minimizes the risk to the user in the event of an error. This includes a high voltage and/or high current error between an electrical circuit and ground.

According to the electrical design, the S20 low voltage modules correspond to protection class II devices and therefore do not require grounding. However, IP20 protection is not sufficient for protection class II. This means that the modules only become real protection class II devices when used with a control cabinet or an installation box.

9.1.2 Functional ground (FE)

Functional ground is a low-impedance current path between circuits and ground. This current path is not intended as a protective measure but rather for the improvement of immunity, for example.

Functional ground is used in the 24 V DC area (protective extra-low voltage).

To ensure reliable functional grounding of the station, please observe the following:

1 The S20 modules (controller, bus coupler, I/O modules) have at least one FE spring (metal clip, 1 in Fig. 9-1) at the bottom. This spring establishes an electrical connection to the grounded DIN rail when the module is mounted. When using grounding terminal blocks to connect the DIN rail to protective ground, the modules are then grounded when snapped onto the DIN rail.

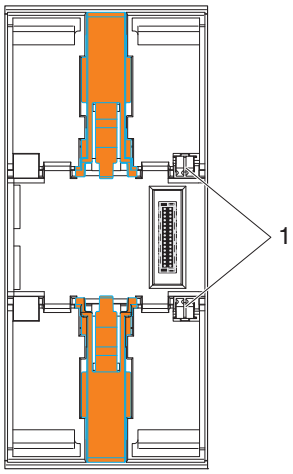


Fig. 9-1 FE spring (1)

2 When using modules for surge protection (TRABTECH), connect their functional ground directly with the grounded DIN rail.
Do not connect the functional ground of the modules for surge protection to an S20 module (e.g., to an FE contact of an S20 connector).
This ensures that interference is discharged before it enters the S20 module. Only this ensures good electromagnetic compatibility.

9.2 Shielding concept

Shielding is used to reduce the effects of interference on the system.

9.2.1 Shielding with S20

In the S20 system, the following shielded cables are used:

- Network cables
- Connecting cables
  - On modules for analog signals (analog input, analog output, temperature measurement)
  - On function modules and acquisition modules

Observe the following points when shielding:

- Connect the shield to a module before the signal connection.
- Ensure a large surface connection of the shield.
- Make sure there is good contact between the shield and shield bus (synonyms: neutral busbar, busbar).
- Do not damage or squeeze the conductors.
- When connecting the shielding, observe the specifications for wiring.
- Make sure the shield is as close as possible to the signal terminal point.

9.2.2 Shielding when connecting analog sensors and actuators

- Always connect analog sensors and actuators with shielded, twisted pair cables.
- Connect the shielding via a shield bus. (see Fig. 9-9)

When connecting the cables, observe the information in the module-specific data sheet.

- As a rule, shielding must only be connected directly to the FE potential on one side. This is to prevent any occurrence of equipotential bonding currents via the shielding (see Fig. 9-9 and Fig. 9-10).
- If necessary, integrate the shielding concept for analog I/O cables in the system concept. For example, it is advisable to use a central FE shield connection at the control cabinet entry (see Fig. 9-10).

For connecting the shield, Bosch Rexroth recommends the S20 shield connection set S20-SHIELD-SET.

9.2.3 Connecting the shield using the S20 shield connection set

The shield connection set consists of two shield bus holders and two SK 5 shield-connection clamps. This shield connection set can be used to connect cable shields in an S20 station in the vicinity of the modules.

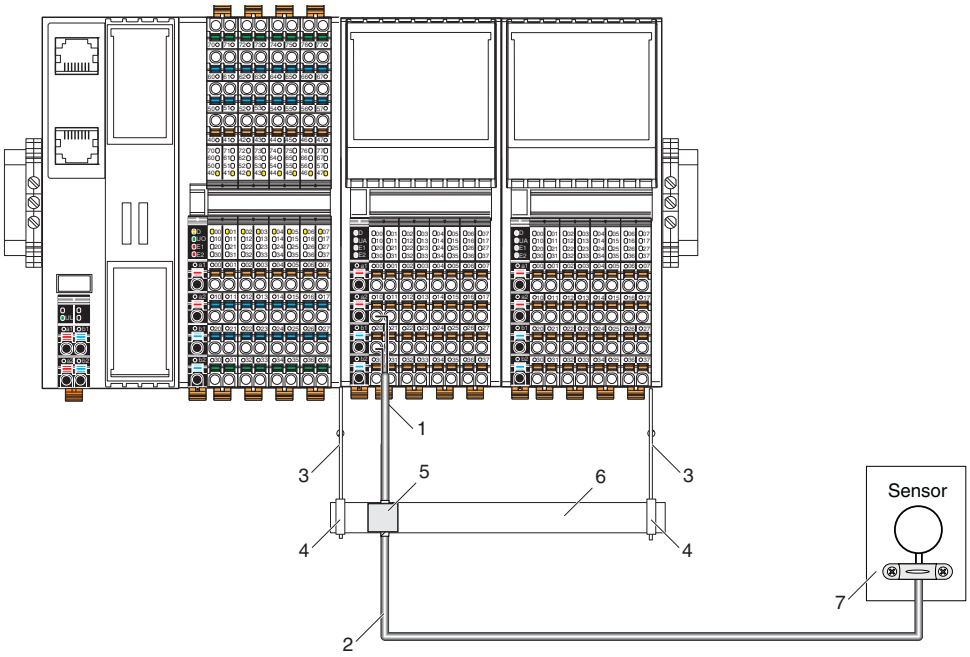


Fig. 9-2 Connecting the shield using S20 SHIELD SET

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Shield bus holder

4 SK 5 shield-connection clamps (2 pcs., included in the S20-SHIELD-SET) for securing the busbar (accessory) on the shield bus holder

5 Shield-connection clamp for connecting the shield to the busbar (S20-SHIELD-SK..., see Chapter “Ordering data for accessories” on page 95)
Connect the shield directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the busbar.

6 Busbar (S20-SHIELD-NLS..., see Chapter “Ordering data for accessories” on page 95)

7 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

S20 shield connection set

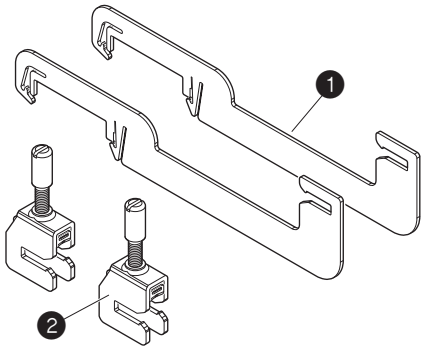


Fig. 9-3 Set components

1 Shield bus holders (2 pcs.)

2 SK 5 shield-connection clamps for securing the busbar on the shield bus holder (2 pcs.)

Contact is made with the shield on the busbar using shield clamps (both are available as accessories). Select the shield clamp based on the conductor cross-section and type (... SK5 or ... SK14), see Chapter “Material for shield connection” on page 95.

Mounting

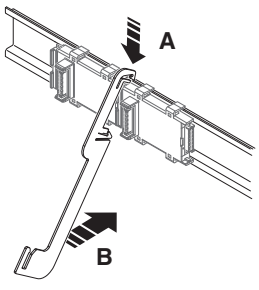
Mount the shield bus holders after mounting the bus base modules and before mounting the electronics modules.

Polished surfaces indicate the positions of the shield bus holders on the bus base modules.

The maximum distance between two adjacent shield bus holders should not exceed 215 mm (e.g., four modules with four connectors next to each other).

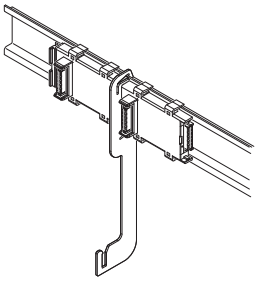
If the busbar is secured using more than two shield bus holders, distribute the holders equally over the width of the busbar.

If using a shield bus holder at the end of an S20 station, mount the shield bus holder after the last module. In this case, it is not positioned above a bus base module. Secure the shield bus holder using an end bracket (accessory).

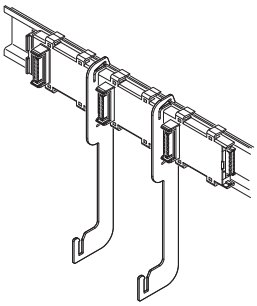


- Hook the shield bus holder onto the DIN rail.

Fig. 9-4 Hooking the shield bus holder on

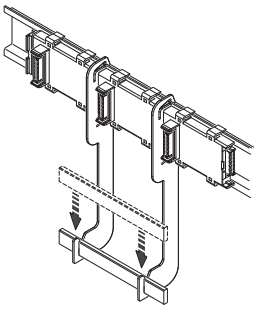


- Snap the shield bus holder onto the DIN rail.

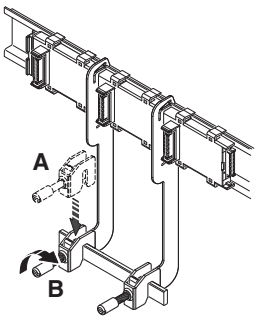


- Then snap on the second shield bus holder.

Fig. 9-5 Snapping on the shield bus holders

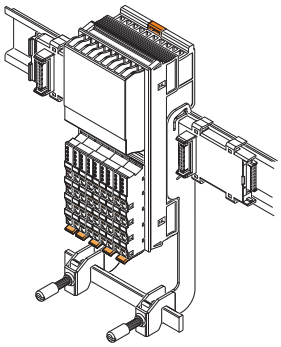


- Push the busbar into the shield bus holders.



- Secure the busbar using the SK 5 shield-connection clamps included in the scope of supply.

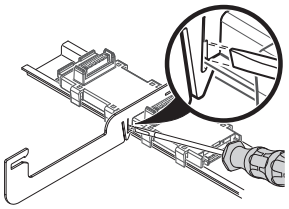
Fig. 9-6 Mounting the busbar



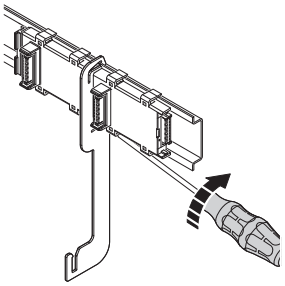
- Mount the electronics modules.

Fig. 9-7 Mounting the electronics modules

Removal For removal, use a screwdriver with a blade width of 4 mm.



- First, remove the adjacent electronics modules (to the right and left of each shield bus holder).
- Insert the screwdriver in the release slot.



- Turn the screwdriver to release the locking clip from the DIN rail.
- Remove the shield bus holder.

Fig. 9-8 Removing the shield connection

The locking clip may become deformed following contact with the screwdriver. In this case, bend it back into shape prior to reassembly.

9.2.4 Connecting the shielding to a busbar

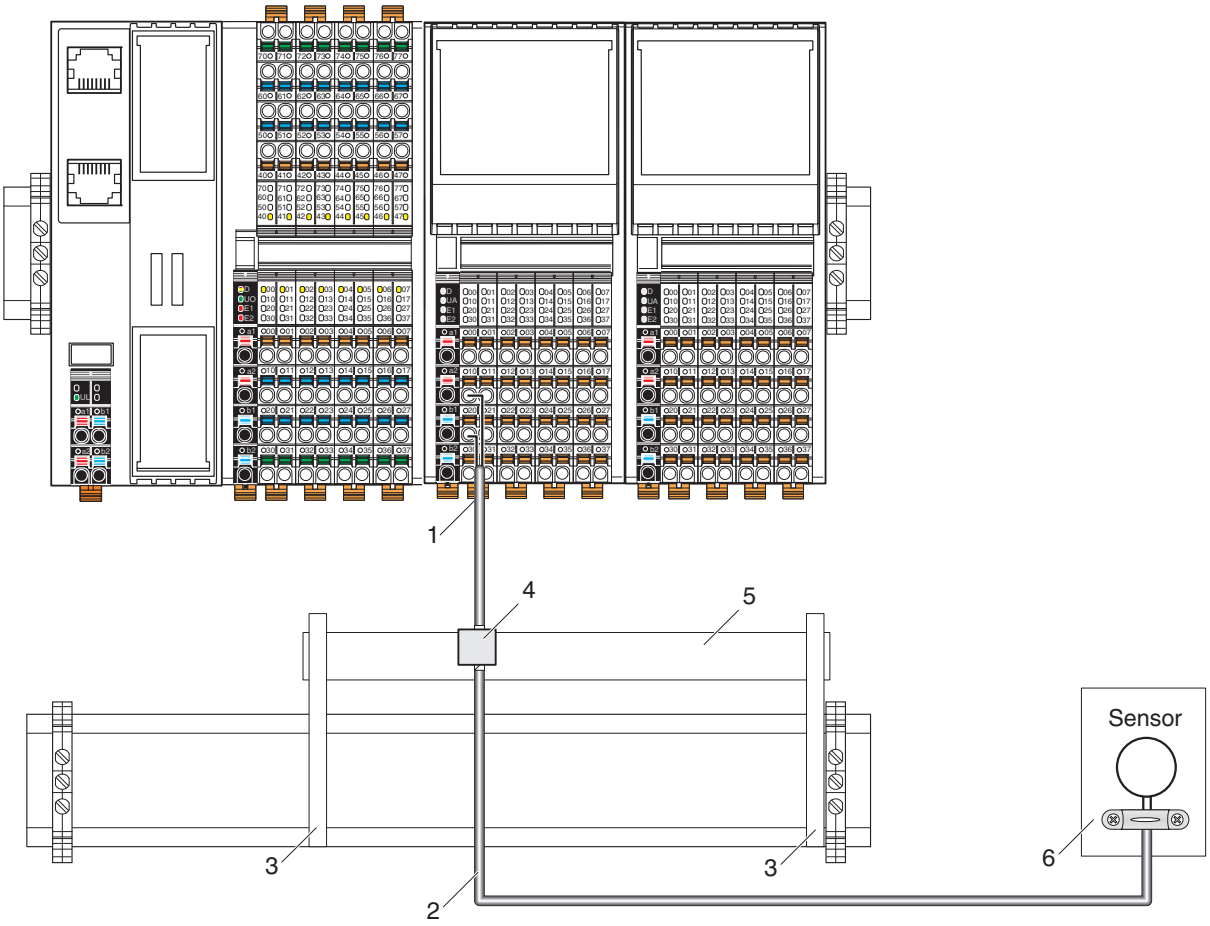


Fig. 9-9 Connecting the shielding to a busbar

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Support bracket

4 Shield-connection clamp for connecting the shield to the busbar (S20-SHIELD-SK..., see Chapter “Ordering data for accessories” on page 95)
Connect the shield directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the busbar.

5 Busbar

6 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

9.2.5 Integrating analog shielding in a concept with central equipotential bonding at the control cabinet entry

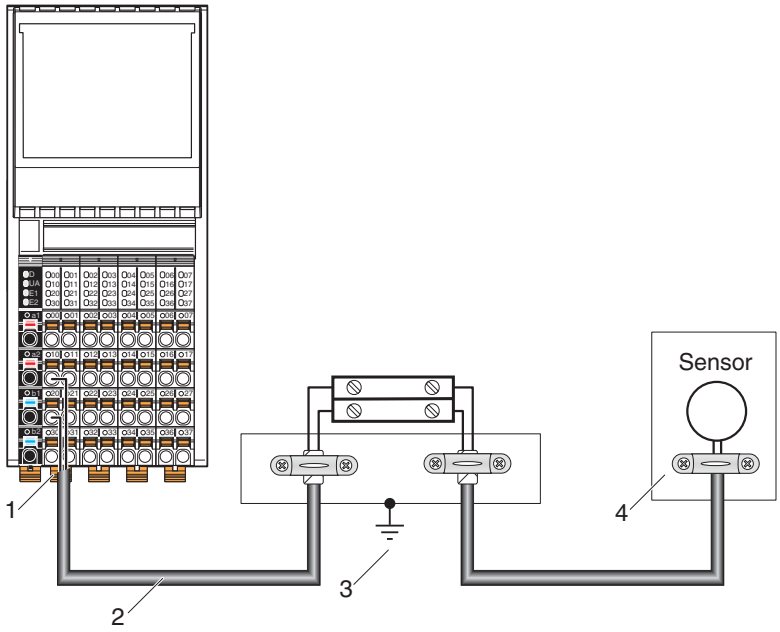


Fig. 9-10 Integration of analog shielding in a concept with central equipotential bonding at the control cabinet entry

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Connect the strain relief directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the marshalling level.

4 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

NOTE **Functions may be impaired**

Observe the following when integrating the shielding of analog I/O cables in an equipotential bonding concept:

Direct connection to the FE potential must only be made at one point (e.g., at the central grounding point of the marshalling level).

10 Diagnostics and status indicators

All S20 modules are provided with diagnostic and status indicators for quick local error diagnostics. They enable the clear localization of system errors (bus errors) or I/O errors.

Diagnostics The diagnostic indicators (red, yellow, or green) provide information on the state of the module. In the event of an error, they provide information about the type and location of the error. A module is functioning correctly if all of its green LEDs are on.

Status The status indicators (yellow) indicate the status of the associated input or output and of the connected I/O device.

Extended diagnostics Some modules have extended diagnostics. Short circuit or overload of the sensor supply, for example, can be detected and reported. If a short circuit occurs at an output, some output modules can diagnose each channel individually. Information regarding the supply voltage is also reported. Information about I/O errors is sent to the controller with precise details of the error type and is displayed using status indicators.

The diagnostics indicators D, UA, E1, E2 show the current status. This status is not saved. This means, for example, that an wire break or overrange is indicated via the LEDs. If the respective error has been removed and no other error has occurred, the LEDs indicate the error-free state again.
The error is not saved on the module.
For some modules, however, the DiagState object (0018_{hex}) is used to report some specific errors to the controller.

On the S20 connectors, all possible positions for diagnostic and status indicators have light guides.
Since not every position has its own LED on the printed circuit board, there are some light guides without any function.
Examples:
A20-AI-8: The light guides 00 ... 07, 10 ... 17, 20 ... 27, and 30 ... 37 **do not have** any function.
S20-DI-32/1: The light guides 00 ... 07, 10 ... 17, 20 ... 27, and 30 ... 37 **have** a function.

For information regarding the diagnostic and status indicators on each module and their meaning, please refer to the module-specific documentation.

Diagnostics and status indicators

10.1 Indicators on bus couplers

Bus couplers have power supply indicators, as well as network and module indicators.

Indicators for the power supply are located on the power connector. The other indicators are located on the module.

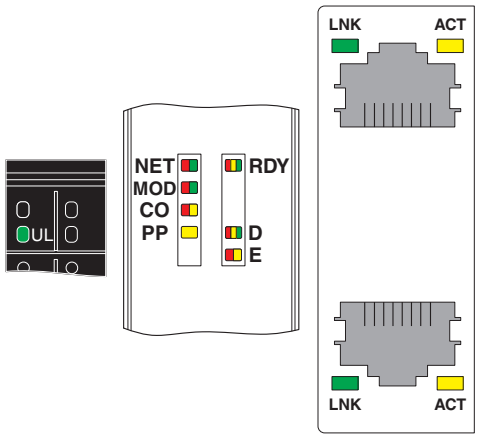


Fig. 10-1 Indicators on bus couplers (example: S20-EIP-BK)

All bus couplers have the following indicators:

Designation	Color	Meaning	State	Description
U_L	Green	U_{Logik}	ON	Communications voltage supply present.
			OFF	Communications voltage supply not present.
RDY	Green/ yellow/ red	Ready	Green ON	Device is ready to operate.
			Flashing green/yellow	Communications power undervoltage or overvoltage
				Overtemperature
			Yellow ON	Firmware/bus coupler is booting.
			Flashing yellow	Firmware update is being performed.
			Flashing yellow/red	Firmware update has failed.
			Flashing red	Faulty firmware
			Red ON	Rotary coding switches are set to an invalid/reserved position.
			OFF	Device is not ready for operation.

Fig. 10-2 LEDs on bus couplers

Designation	Color	Meaning	State	Description
D	Red/ yellow/ green	Diagnostics for local bus communication		
		Run	Green ON	The station is ready for operation, communication within the station is OK. All data is valid. A malfunction has not occurred.
		Active	Flashing green	The station is ready for operation, communication within the station is OK. The data is **not** valid. The controller or higher-level network is not providing valid data. There is no malfunction in the module.
			Flashing red/green	A residual system is operated, at least one device of the configuration cannot be reached.
		Ready	Yellow ON	The station is ready to operate. No data is being exchanged.
			Flashing yellow	Access via USB (service)
			Flashing yellow/red	Local bus error during active I/O check
			Flashing red	Local bus error during startup
				Possible causes: • Configuration cannot be generated, information is missing from a device. • Chip version of a device is <V1.1. • Desired configuration and actual configuration differ. • No local bus device connected. • The maximum number of local bus devices is exceeded.
			Red ON	The station is ready for operation but has lost connection to at least one device.
				Possible causes: • Communication error • Local bus device has been removed or a configured device is missing. • Reset at a local bus device • Serious device error at a local bus device (local bus device can no longer be accessed)
		Power down	OFF	Device is in (power) reset or in energy-saving mode.
E	Yellow/red	Error	Yellow ON	I/O warning at a local bus device.
			Red ON	I/O error at a local bus device.
			OFF	No I/O messages present.

Fig. 10-2 LEDs on bus couplers

Further diagnostic and/or status indicators may also be available.

For information regarding the diagnostic and status indicators on the bus coupler and their meaning, please refer to the bus coupler documentation.

Diagnostics and status indicators

10.2 Indicators on I/O modules

The LEDs of the I/O modules are located on the connectors.

10.2.1 LEDs on the power connectors

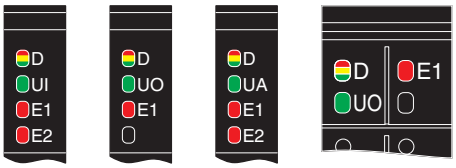


Fig. 10-3 LEDs on the power connectors (examples)

Designation	Color	Meaning	State	Description
D	Red/ yellow/ green	Diagnostics for local bus communication		
		Run	Green ON	The device is ready for operation, communication within the station is OK. All data is valid. A malfunction has not occurred. • The connection to the controller is present.
		Active	Flashing green	The device is ready for operation, communication within the station is OK. The data is **not** valid. The controller or higher-level network is not providing valid data. There is no malfunction in the module.
		Device application not active	Flashing green/yellow	The device is ready for operation, communication within the station is OK. Output data **cannot** be output and/or input data **cannot** be read. There is a malfunction on the I/O side of the module. • The controller is providing valid process data.
		Ready	Yellow ON	The device is ready to operate, but has still not detected a valid cycle after power up. • There has been no communication since the last power up.
		Connected	Flashing yellow	The device is not (yet) part of the active configuration.
		Reset	Red ON	The device is ready for operation, but has lost the connection to the bus head.
		Not connected	Flashing red	The device is ready for operation, but there is no connection to the previous device.
		Power down	OFF	Device is in (power) reset. • The supply voltage is not present. • Energy-saving mode is active.
U_x	Green	U_x	ON	I/O supply is present.
			OFF	I/O supply is not present.
E1	Red/yellow	Device error or warning Indicates messages that apply to the entire device.		
			Red ON	Error (priority 1)
			Yellow ON	Warning (priority 2)
E2	Red/yellow	I/O error, channel error or channel warning (group message) Indicates messages that only apply to a single channel.		
			Red ON	Error (priority 1)
			Yellow ON	Warning (priority 2)

Fig. 10-4 LEDs on the power connectors

Voltages U_x:

U_I	(U_{Input})	Supply for digital input modules; sensor/encoder supply
U_O	(U_{Output})	Feed-in for digital output modules
U_{IO}	($U_{Input/Output}$)	Supply for digital input and output modules
U_A	(U_{Analog})	Supply for analog modules

For information regarding the diagnostic and status indicators on each module and their meaning, please refer to the module-specific documentation.

10.2.2 LEDs on the I/O connectors

The LEDs on the I/O connectors are numbered according to the terminal points. All LED locations are numbered even when they are not used.
Exception: For modules with safe inputs and outputs (see the module-specific documentation).

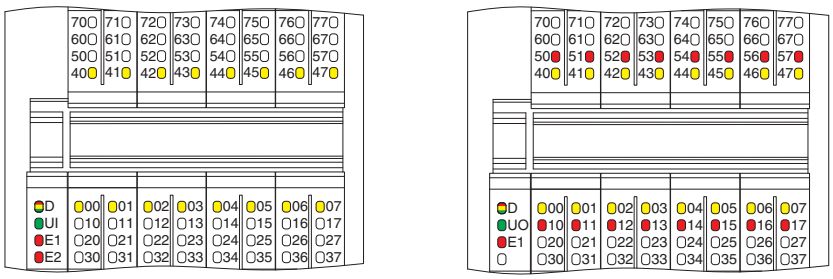


Fig. 10-5 LEDs on the I/O connectors (e.g., S20-DI-16/4, S20-DO-16/3)

Designation	Color	Meaning	State	Description
xx	**Yellow**	Status of the input or output	ON	Corresponding input or output set.
			OFF	Corresponding input or output not set.
yy	**Red**	Diagnostics of the output	ON	Error at the output.
			OFF	No error at the output.

Fig. 10-6 LEDs on the I/O connectors

xx	Channel identification
yy	Channel identification

Fig. 10-6 lists commonly used LEDs. More LEDs may also be found on the modules.
The available LEDs of a module and their meanings can be found in the module-specific documentation.

10.3 Reporting diagnostics via PDI

The malfunctions indicated by the local diagnostics and status indicators are also mapped in PDI object 0018_{hex} (DiagState).

Detailed information can be found in Chapter “Objects for diagnostics” on page 100 and in the module-specific data sheet.

11 Process, parameter, and diagnostic data

The S20 local bus is used for the transmission of process data and parameter data.

11.1 Process data

S20 devices have at least one byte of process data. If less than eight bits are used, they occupy the least significant bits of the byte.

Significance of the data corresponds to the Motorola format (Big Endian).

The significance of the data bytes declines as the number goes up.

For the process data assignment and the assignment of the process data to the terminal points of a module, please refer to the module-specific data sheet.

11.2 Parameter and diagnostic data (PDI channel)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel (PDI = Parameters, Diagnostics, and Information).

The PDI channel is used in addition to the process data channel in the S20 system for the demand-oriented, acyclic transmission of parameter and diagnostic data as well as other information. Each S20 I/O module has this acyclic channel for exchanging acyclic data.

Via the PDI channel, you can use read and write services to access the communication objects created in the S20 I/O module. These objects can be used, for example, to set measuring ranges, to specify the substitute value behavior of outputs in the event of a bus error, or to read I/O diagnostic details.

Process, parameter, and diagnostic data

11.3 Saving of parameters

Every S20 module has parameters. They can be read, written, or read and written. The parameters that can be written are saved every time a change is made.

Some parameters are defined as startup parameters in the device description file of each module.

Startup parameters (flash)

Startup parameters are stored retentively (in a non-volatile way, permanently) in the flash memory.

Startup parameters include the application object parameters, e.g., substitute value, filter time etc. As soon as valid parameters are specified for these objects, they are stored retentively on the module.

Due to the storage technology used, parameters that are stored retentively can only be written for a specific number of times (100,000 up to 1,000,000 times, typically). They are not suitable for being changed cyclically.

NOTE **Damage to the flash memory during cyclic write access**

The flash memory is only designed for a limited number of write access operations. Make therefore sure that write access operations are not performed too often and, in particular, not cyclically.

Observe this behavior when programming function blocks.

Other parameters (RAM)

Other parameters are stored temporarily (in a volatile way) in the RAM.

12 IndraWorks software support

IndraWorks - universal framework for all engineering tasks

The IndraWorks engineering framework provides you with all the tools required for starting up your drives and controllers in a unified way.

Project management including the data management for device configurations, visualizations, and the PLC program enables both the transparent representation and data consistency.

Based on CODESYS V3, IndraWorks includes all editors according to the 3rd edition of the IEC 61131-3 for comfortable programming of your PLC application.

Intuitive wizards and a comprehensive online help gradually guide you through all engineering steps from device configuration via the generic application template up to the parameterization of technology functions.

Using the IndraWorks offline parameterization, you can set the configuration of all planned devices and use all parameters in the PLC application, without the need for connection to the real system.

A comprehensive range of tools for startup and service activities (e.g., multi-channel oscilloscope, logic analyzer and debugging functions of the PLC logic) offer various status messages and system diagnostics at the touch of a button.

NOTE

Please be aware that the software is only meant to **support** you. The project engineer is responsible for the correctness of the configuration.

For more information on the software, visit:
http://www.boschrexroth.com/de/de/produkte/engineering/open-core-engineering/die-features-von-open-core-engineering/software-tools/software-tools-3

13 Device replacement, device defects, and repairs

13.1 Devicereplacement

S20 modules can be replaced, if necessary.

If you want to replace a S20 module, proceed as follows:

- Observe the safety notes in Chapter 7.1, “Safety notes for mounting and removal”.
- If necessary, disconnect the wiring as shown in Chapter 8.6, “Removing cables from the terminal point”.
- Replace the S20 module in your application with a new S20 module.
  See Chapter 7.6, “Replacing a module”.
- If necessary, connect the supply and the I/O devices.
  See Chapter 8, “Connecting or removing cables”.

Observe the device type and version

The new module must meet the following requirements:

- Same device type
- Same or later version

13.2 Device defects and repairs

Do not open the housing

Repairs may only be carried out by Bosch Rexroth. Do not open the housing. If the housing is opened, the function of the device can no longer be ensured.

Defective devices

- Please contact Bosch Rexroth.

14 Maintenance, decommissioning, and disposal

14.1 Maintenance

S20 modules are maintenance-free.

14.2 Decommissioning and disposal

Carry out decommissioning according to the requirements of the machine or system manufacturer.

When decommissioning, ensure the following for the S20 modules used:

The device continues to be used as intended:

- Observe the storage and transport requirements.
  See Chapter “Transport, storage, and unpacking” on page 36.

The device is not used anymore:

Device disposal

- Do not dispose of the device with household waste; it should instead be disposed of in accordance with the currently applicable national regulations.

Packaging disposal

- Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, tubular bags, etc.) with household waste in accordance with the currently applicable national regulations.

15 Technical data and ordering data

Observe additional documentation.

For the system data of your network, please refer to the corresponding documentation.
If you are using S20 in a system with other product groups, also observe the technical data for these product groups. Please refer to the associated documentation for this technical data.
For safety applications, please refer to the documentation of the safety modules used.
When using a controller, please refer to the associated documentation.

The following values are standard values for the preferred mounting position (wall mounting on horizontal DIN rail).
For different values, please refer to the module-specific documentation.

The technical data does not claim to be complete. Technical modifications reserved.

15.1 Technical data

System data	
Number of devices supported in an S20 station	63 devices, maximum

Each S20 module is a device.

Maximum current consumption of the S20 modules	See module-specific data sheet

When configuring an S20 station, observe the communications power supply through the bus coupler, the controller or the power module, as well as the current consumption of each device. This data may vary depending on the module and is given in the module-specific documentation. Create a new station or install a power module for the communications power if the maximum current consumption at UBus is reached.
In addition, the maximum number of devices may be limited by the controller/bus coupler system data. Observe the information in the module-specific documentation.
See also Chapter “Maximum number of modules” on page 42.

General data (standard values; for deviations see module-specific documentation)	
Ambient temperature	
Ambient temperature (operation)	-25 °C ... +60 °C
Ambient temperature (storage/transport)	-40°C ... +85°C
Temperature change	5 K/min (non-condensing permitted)
Permissible humidity (operation/storage/transport)	5% ... 95% (non-condensing)
Permissible air pressure (operation/storage/transport)	70 kPa ... 106 kPa (up to 3000 m above mean sea level)
Degree of protection	IP20

General data (standard values; for deviations see module-specific documentation) [...]	
Protection class	Low-level signal: III, IEC 61140, EN 61140, VDE 0140-1 Low voltage, mounted in an adequate housing with at least IP54 degree of protection: II, IEC 61140, EN 61140, VDE 0140-1
Air clearances and creepage distances	Low-level signal: according to EN 60664-1 Low voltage: according to EN 61010-2-201
Housing material	Plastic, self-extinguishing (V0)
Pollution degree	Low-level signal: 2, IEC 60664-1, EN 60664-1 Low voltage: 2, IEC 61010-2-201, EN 61010-2-201
Overvoltage category	Low-level signal: II, IEC 60664-1, EN 60664-1 Low voltage: III, IEC 61010-2-201, EN 61010-2-201

Do not use the device in atmospheres that contain corrosive gas.

Mechanical tests (standard values; for deviations see module-specific documentation)	
Vibration resistance in accordance with EN 60068-2-6/ IEC 60068-2-6	5g
Shock test in accordance with EN 60068-2-27/ IEC 60068-2-27	30g
Bump endurance test in accordance with EN 60068-2-27/ IEC 60068-2-27	10g

Technical data and ordering data

Conformance with EMC Directive 2004/108/EC (for deviations and detailed values see module-specific documentation)	
Immunity test in accordance with EN 61000-6-2	
Electrostatic discharge (ESD), EN 61000-4-2/IEC 61000-4-2	Criterion B
Electromagnetic fields, EN 61000-4-3/IEC 61000-4-3	Criterion A
Fast transients (burst), EN 61000-4-4/IEC 61000-4-4	Criterion B
Transient overvoltage (surge), EN 61000-4-5/EN 61000-4-5	Criterion B
Conducted interference, EN 61000-4-6/IEC 61000-4-6	Criterion A
Noise emission test in accordance with EN 61000-6-3	Class B

Low-voltage modules: developed according to IEC 61850-3 (for deviations and detailed values, see module-specific documentation)	
Electrostatic discharge (ESD), EN 61000-4-2/IEC 61000-4-2	Criterion A
Electromagnetic fields, EN 61000-4-3/IEC 61000-4-3	Criterion A
Fast transients (burst), EN 61000-4-4/IEC 61000-4-4	Criterion A
Transient overvoltage (surge), EN 61000-4-5/IEC 61000-4-5	Criterion A
Conducted interference, EN 61000-4-6/IEC 61000-4-6	Criterion A
Immunity against magnetic fields, EN 61000-4-8/ IEC 61000-4-8	300 A/m continuous, 1000 A/m for 1 s
Immunity to damped oscillatory magnetic fields, EN 61000-4-10/IEC 61000-4-10	100 A/m
Immunity to conducted common mode disturbances, EN 61000-4-16/IEC 61000-4-16	30 V continuous, 300 V for 1 s
Attenuated oscillating waves, EN 61000-4-18/IEC 61000-4-18	1 kV symmetrical, 2.5 kV asymmetrical
Noise emission test in accordance with EN 61000-6-3	Class B

Interface for S20 local bus	
Connection method	Bus base module
Transmission speed	100 Mbps

24 V supply (U_L, U_I, U_O, U_{IO}, U_A)	
Nominal voltage	24 V DC
Ripple	±5 %
Maximum permissible voltage range	19.2 V DC ... 30.0 V DC (including all tolerances, ripple included)
Connection	S20 connector

The local bus supply (communications power) U_{Bus} is generated from communications voltage U_L (24 V).

S20 local bus supply (supplies the bus logic of the connected modules)	
Remark	The U_L communications power is supplied on the bus coupler, controller, or power module for the communications power. The communications power U_{Bus} is generated from this communications power U_L and distributed over the bus base modules. These two voltages are not electrically isolated. The current through the local bus I_{Bus} is short-circuit-proof.
Connection	Bus base modules
Communications voltage (U_{Bus})	5 V DC
Maximum load current in the local bus (I_{Bus})	See documentation for controller, bus coupler or power module

Voltage dips and interruptions of the I/O supply	
Degree of severity PS1	Interrupt time < 1 ms
Time interval between voltage dips	< 1 s
Behavior	Criterion A A supply voltage dip of <1 ms has no effect.
Degree of severity PS2	Interrupt time < 10 ms
Time interval between voltage dips	< 1 s
Behavior	Criterion C Bus disconnection, all system outputs are reset.

IEC 61131-2 requires power failure protection of 10 ms. To meet this requirement, use only power supply units (230 V AC/24 V DC, 4000 V AC/24 V DC) that support mains buffering for at least 10 ms.

Technical data and ordering data

S20 connector/connection method/cable cross-sections

For electrical and/or thermal reasons, it may not be possible to use the minimum conductor cross-sections specified here for certain modules. Therefore, always observe the information in the module-specific documentation.

Labeling	S20 connector
Connection method	Push-in connection
Maximum load capacity of the contacts	8 A
Conductor cross-section (typical)	0.2 mm^2 ... 1.5 mm^2; AWG 24 ... 16 See Chapter “Conductor cross-sections, and stripping and insertion lengths” on page 54
Stripping lengths	8 mm or 10 mm; See Chapter “Conductor cross-sections, and stripping and insertion lengths” on page 54

Electrically isolated areas

See module-specific documentation

Test voltages (standard values for the 24 V area; for deviations and low-voltage area see module-specific documentation)

For information about the test voltages between the network and other potential areas, please refer to the documentation for the bus coupler.

Isolating distance	Test voltage
Logic / I/O supply	500 V AC, 50 Hz, 1 min.
Logic / functional ground	500 V AC, 50 Hz, 1 min.
I/O supply / functional ground	500 V AC, 50 Hz, 1 min.

Approvals

For the latest approvals, please visit www.boschrexroth.com/electrics.

15.2 Ordering data

The complete product catalog is available in electronic form at www.boschrexroth.com/electrics.

Ordering data for the S20 modules and corresponding connectors

For the ordering data for the S20 module and corresponding connectors, please refer to the corresponding data sheet.

Ordering data for accessories

Description	Type	MNR	Pcs./Pkt.
Mounting material			
End bracket set (containing 2 E/NS 35N end brackets)	SUP-M01-ENDHALTER	R911170685	1
Material for shield connection			
Please observe the available space when selecting the shield clamps.			
Shield connection set (contains 2 busbar holders and 2 SK 5 shield clamps)	S20-SHIELD-SET	R911173030	1
Shield clamp for connecting the shield on busbars; to be secured using screw			
5 mm diameter	S20-SHIELD-SK5	R911173282	10
14 mm diameter	S20-SHIELD-SK14	R911173286	10
Busbar, 10 mm x 3 mm, 1 m long	S20-SHIELD-NLS	R911173283	1

Ordering data for documentation

The module-specific documentation can be downloaded at www.boschrexroth.com/electrics.
Make sure you always use the latest documentation.

16 Technical appendix: Communication objects (PDI objects)

Communication objects are stored on each module. You can access these objects with read, write or read and write services via the PDI channel.

In most cases, the objects are accessed automatically, e.g., when writing the start parameterization during startup of the bus coupler or the controller.

The objects created in a module are:

- General standard objects (index 0001_{hex} to $003D_{hex}$)
  For more detailed information on these objects, please refer to Chapter “General standard objects” on page 97.
- Manufacturer-specific application objects (index 0080_{hex} to $5FFF_{hex}$, $FF8F-_{hex}$)
  These objects have device-specific variables.
  For more detailed information on these objects, please refer to the module documentation.

Object type	Meaning
	Object with only one element (simple variable)
	Object with several simple variables of the same data type with the same length
	Object with several simple variables of different data types or of the same data type with different lengths

Fig. 16-1 Object types

Data type		Meaning
Visible string		Byte string with printable ASCII characters only The byte string finishes with 00_{hex} (null-terminated) or is filled up with 00_{hex} to reach the total length.
		In the following tables and the module-specific data sheets, only the pure user data is provided in the “Content” column. Null termination and filling up a visible string with 00hex is not shown.
Bit string		Bit strings always have a length of n x 8 bits, where n ∈ N (n element of the natural numbers).
Octet string		Byte string with any contents
	UINT8	Value without sign, only positive values 00_{hex} ... FF_{hex}
	UINT16	Value without sign, only positive values 0000_{hex} ... $FFFF_{hex}$
	UINT32	Value without sign, only positive values 0000 0000_{hex} ... FFFF $FFFF_{hex}$

Fig. 16-2 Data types

The following applies for the tables below:

Abbreviation	Meaning
A	Number of elements
L [bytes]	Length of the element in bytes
R	Read
W	Write

Fig. 16-3 Key for the following tables

16.1 General standard objects

The standard objects include:

- Objects for identification (device rating plate)
- Objects for device diagnostics
- Objects for process data management
- Objects for device management
- Objects with object descriptions
- Objects for modular devices and subsystems

Certain objects are optional, which means that not every object is implemented on every module. Information on which object is supported by a particular module is available in the module-specific data sheet.

16.1.1 Objects for identification

These objects describe the manufacturer, the device, and device application and form the device rating plate.

The bold entries in Fig. 16-4 are identical for all S20 modules from Bosch Rexroth. All other entries may vary depending on the individual module.

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	Content/example
Manufacturer							
0001	VendorName	Visible string	1	32	R	Manufacturer name	**Bosch Rexroth AG**
0002	VendorID	Visible string	1	7	R	Manufacturer ID	**006034**
0003	VendorText	Visible string	1	58	R	Manufacturer text	**Components and systems for industrial automation**
0012	VendorURL	Visible string	1	58	R	Manufacturer URL	**http://www.boschrexroth.com**
Module - general							
0004	DeviceFamily	Visible string	1	58	R	Device range	... (e.g., I/O analog IN)
0006	Product Family	Visible string	1	32	R	Product family	**S20**
000E	CommProfile	Visible string	1	5	R	Communication profile	633
000F	DeviceProfile	Visible string	1	5	R	Device profile	0010
0011	ProfileVersion	Record	2		R	Profile version	
.1	BuildDate	Visible string	1	11	R	Version date	2018-04-19
.2	Version	Visible string	1	19	R	Version ID	Basic profile V3.0
0017	Language	Record	2	6; max. 50	R/W	Language	**en-us; English**

Fig. 16-4 Objects for identification (device rating plate) in accordance with basic profile V3.0

General standard objects

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	Content/example
Module - specific (for a specific module)							
0005	Capabilities	Array of octet strings	N	N * 8	R	Device properties	... (e.g., Nothing) See Fig. 16-5
0007	ProductName	Visible string	1	32	R	Product name	... (e.g., S20-AI-4-I)
0008	SerialNo	Visible string	1	22	R	Serial number	xxxxxxxxxx (e.g., 12345123456)
0009	ProductText	Visible string	1	58	R	Product text	... (e.g., 4 analog input channels)
000A	OrderNumber	Visible string	1	32	R	Item number	xxxxxxxxxx (e.g., R911173340)
000B	Hardware Version	Record	2		R	Hardware version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., AA1)
000C	FirmwareVer-sion	Record	2		R	Firmware version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., --, 1.10)
000D	PChVersion	Record	2		R	Parameter channel version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., 2016-12-01, PDI V1.10)
0037	DeviceType	Octet string	1	8	R	Device type	xx xx xx xx xx xx xx xx_{hex} (e.g., 00 20 00 08 00 00 00 $A6_{hex}$)
003A	VersionCount	Array of UINT16	4	8	R	Version count; unique consecutive numbering for the version of the corresponding component	E.g., 0009 0002 0001 0117
.1	ProfileVersion	UINT16	1	2	R	0009 for basic profile V3.0	xx xx_{hex} (z. B. 0009)
.2	PChVersion	UINT16	1	2		PDI version	xx xx_{hex} (z. B. 0002)
.3	Hardware Version	UINT16	1	2		Hardware version e.g., HW 01	xx xx_{hex} (z. B. 0001)
.4	Firmware Version	UINT16	1	2		Firmware version e.g., FW 1.17	xx xx_{hex} (z. B. 0117)
Use of the device							
0014	Location	Visible string	1	58	R/W	Installation location	... (e.g., Please fill in ...); Can be filled in by the user.
0015	Equipment Ident	Visible string	1	58	R/W	Equipment ID	... (e.g., Please fill in ...); Can be filled in by the user.
0016	ApplDevice Addr	UINT16	1	2	R/W	Application-specific device address	... (e.g., Please fill in ...); Can be filled in by the user.

Fig. 16-4 Objects for identification (device rating plate) in accordance with basic profile V3.0 [...]

Properties (0005_{hex}: Capabilities)

This object indicates the properties and functions the device has in addition to the basic functions. At the moment, the following properties exist:

Contents	Meaning
Nothing	No additional functions
Safety0	The slave supports secure data communication. This takes place in both directions.
Energy0	The slave supports energy management.
SubMA_0	The slave is a subbus master. There is at least one additional subsystem below this slave.
FwUpdt0	The slave supports the firmware update. Currently, only the Bosch Rexroth Service can perform a firmware update.
SyncI_0	The slave supports synchronization of the inputs.
SyncO_0	The slave supports synchronization of the outputs.

Fig. 16-5 Properties

General standard objects

16.1.2 Objects for diagnostics

These objects describe the diagnostic state of the device and any connected I/O devices, as well as options for resetting diagnostics.

For the specific content of these objects, please refer to the module-specific data sheet.

16.1.2.1 Diagnostic state (0018_{hex}: DiagState)

Read all information via subindex 00 to receive all information on an error number.

Index [hex]	Object name	Data type	Length in bytes	Meaning		
0018	DiagState	Record		Diagnostic state	Complete diagnostic information	
.1	Lfd.Nr.	UINT16	2	Error number	0 ... 65535_{dez}	Unique, consecutive error number since the last power up or reset of the diagnostic counter
.2	Priority	UINT8	1	Priority	Priority of the message. 1: highest priority. See Fig. 16-9 on page 103.	
					00_{hex}	No malfunction
					01_{hex}	Error
					02_{hex}	Warning
					03_{hex}	Information
					81_{hex}	Error eliminated
					82_{hex}	Warning eliminated
					83_{hex}	Information removed
.3	Channel/ Group/ Module	UINT8	1	Channel/ Group/ Module	Channel, group or module where the malfunction occurred. Additional information available under “Additional information”.	
					00_{hex}	No malfunction
					xx_{hex}	Channel xx, group xx or module xx
					FF_{hex}	Entire device
.4	Code	Octet string	2	Error code		
.5	MoreFollows	Bit string 8	1	Additional information	Further information about the malfunction	
					00_{hex}	Subindex 3 refers to a channel number.
					04_{hex}	Subindex 3 refers to a group number.
					08_{hex}	Subindex 3 refers to a module number.
					Other	Not used at present.
.6	Text	Visible string	max. 51	Text	Plain text message. Default: Status OK	

Fig. 16-6 Objects for diagnostics: diagnostic state (read) in accordance with basic profile V2.x

Index [hex]	Object name	Data type	Length in bytes	Meaning		
0018	DiagState		23 + max. 100	Diagnostic state	Current diagnostic state of the device in short form	
.01	Lfd.Nr.	UINT16	2	Consecu-tive number	0 ... 65535_{dez}	Unique, consecutive error number since the last power up or reset of the diagnostic counter
.02	Priority	UINT8	1	Priority	Priority of the malfunction. 1: highest priority. See Fig. 16-9 on page 103.	
					00_{hex}	No malfunction
					01_{hex}	Error
					02_{hex}	Warning
					03_{hex}	Information
					81_{hex}	Error eliminated
					82_{hex}	Warning eliminated
					83_{hex}	Information removed
.03	Channel	UINT8	1	Kanal	Channel on which the malfunction occurred.	
					00_{hex}	No malfunction
					xx_{hex}	Channel xx
					FF_{hex}	Entire device
.04	Code	Octet string	2	Error code		
.05	MoreFollows	Bit string 8	1	Additional information	Information for interpreting the following data (see Fig. 16-8)	
.06	Reserved	Octet string	2	Reserved	(= 0000_{hex})	
.07	SubModNo	UINT8	1	Submodule number	If the device is a modular device, the corresponding submodule is specified here. If the device is not a modular device, “0” is entered here.	
.08	Function Group	Octet string	8	Function group	Short designation of the function of the group reporting diagnostics. For example: DI (0x44, 0x49, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00) RTD (0x52, 0x54, 0x44, 0x00, 0x00, 0x00, 0x00, 0x00) AI, AO, DO, IOL, CNT, INC, RS485, PSDI, PSDO, SC The manufacturer-specific designation (e.g., “Relay OUT”) is specified in the diagnostic text (0x0018.11).	

Fig. 16-7 Objects for diagnostics: diagnostic state (read) in accordance with basic profile V3.x

General standard objects

Index [hex]	Object name	Data type	Length in bytes	Meaning	
.09	AddValue	Octet string	4	Additional information	“Additional value” for the current diagnostic state of the device.
.0A	TextLength	UINT8	1	Text length	Length of the following diagnostic text in bytes.
.0B	Text	Visible string	max. 100	Diagnostic text	Device-specific explanation of the malfunction that occurred. Information includes: • Error type • Function group and channel • Terminal point • Option for action for the user Default: “Status OK” The string is terminated with 00_{hex}.

Fig. 16-7 Objects for diagnostics: diagnostic state (read) in accordance with basic profile V3.x [...]

Byte/bit	Value	Meaning
Byte	00_{hex}	No additional information
Bit 0	1	There is additional information about this error. You can read it via object $E800_{hex}$ “DiagStateLong” (if implemented).
Bits 1 ... 3	0	Reserved
Bit 4	1	There are additional simultaneously occurring diagnostic events. You can read them via object $E806_{hex}$ “ComplDiagState” (if implemented).
Bits 5 ... 6	0	Reserved
Bit 7	1	Indication that this is an extended version of object 0018_{hex} (compared to version V2.x).

Fig. 16-8 Index 5: additional information

Priority		Message type	Example	Remark
01_{hex}	High	Error (malfunction, alarm)	Supply voltage faulty Parameter table invalid	A malfunction has occurred that requires a response. For example, a malfunction leads to an action in the drive, but does not necessarily to a system stop with immediate effect.
02_{hex}	Medium	Warning	Limit value not reached or exceeded	Risk of an error. A warning does not lead to an action in the device.
03_{hex}	Low	Information (message, notification)	General operating message: 10000 operating hours have elapsed.	General operating message: 10000 operating hours have elapsed.

Fig. 16-9 Classification of the error messages

Diagnostic object 0018_{hex} is implemented with a storage depth of 1.
This means that:
- A higher priority message overwrites a lower priority message.
- Lower priority messages are not reported if a higher priority message is already present.

16.1.2.2 Acknowledge diagnostic messages (0019_{hex}: ResetDiag)

Index [hex]	Object name	Data type	A	L [bytes]	Meaning
0019	ResetDiag	UINT8	1	1	Acknowledge diagnostic messages Deletes the corresponding diagnostic memory and acknowledges the message

Fig. 16-10 Objects for diagnostics: acknowledge diagnostic messages (write)

Value (hex)	Meaning
00	Permit all diagnostic messages
02	Delete and acknowledge all diagnostic messages that are still pending
05	Delete and acknowledge the last (pending) diagnostic message Used with safety devices as follows: If an error is no longer present when this value (05_{hex}) is written, any “passivated” output is only now enabled again and also can only now be set again.
06	Delete and acknowledge all diagnostic messages and do not permit new diagnostic messages

Fig. 16-11 Value range

General standard objects

16.1.3 Objects for process data management

The contents for objects implemented on a device are listed in the module-specific documentation.

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning
0024	ResetCode	Array of UINT16	N	N * 2	R/W	Substitute value behavior during bus reset (PDOUT)
0025	PDIN	OctetString	1	Process data length	R	Input process data
0026	PDOUT	OctetString	1	Process data length	R	Output process data
002F	PDOUT_Subst	OctetString	1	Process data length	R/W	Substitute value for output process data If acceptance of substitute value has been parameterized in 0024_{hex}.
0030	PF_Code	Array of UINT16	N	N * 2	R/W	Substitute value behavior during I/O error (PDIN)
0031	PDIN_Subst	OctetString	1	Process data length	R/W	Substitute value for input process data If acceptance of substitute value has been parameterized in 0030_{hex}.

Objects for process data management

16.1.4 Objects for device management

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	
0029	ParamSet WriteControl	UINT8	1	1	R/W	Block parameterization control, see “Block parameterization” on page 106	
						01	Initiate block parameterization
						00	Terminate block parameterization
						Other	Reserved
002A	Conflict Dictionary	Array of records (N * 6 elements)	N	N * 8	R	Conflict dictionary. Result of block parameterization n = 1 ... N, N = number of dependent parameters, see “Conflict dictionary” on page 107	
.01	ConfGrNo_n	UINT8	1	1	R	Conflict group number of the nth dependent parameter	
.02	Subslot_n	UINT8	1	1	R	Subslot of the nth dependent parameter	
.03	Index_n	UINT16	1	2	R	Index of the nth dependent parameter	
.04	Subindex_n	UINT8	1	1	R	Subindex of the nth dependent parameter	
.05	Element_n	UINT8	1	1	R	Element in the record of the nth dependent parameter	
.06	AddCode_n	UINT16	1	2	R	Additional information on the nth dependent parameter	
002B	ParamSet	UINT16	1	2	R/W	Select parameter record	
002D	ResetParam	UINT8	1	1	R/W	Reset parameterization	
						00	No action
						01	Reset application parameters to default values (application objects and selected standard objects)
						Other	Reserved
002E	ParamHash	UINT32	1	4	R	Hash value, see “Hash value” on page 107	
0040	ListOfObj ToRestore	Array of records	N	N * 3	R	List of objects to be restored List of objects to be read and backed up from this device in order to restore the parameterization for the substitute device in the event of a device being replaced.	
0048	PChMaxResp Time	UINT16	1	2	R	Maximum permissible PDI response time in ms Default: $01F4_{hex}$ (500 ms)	

Fig. 16-12 Objects for device management (write)

General standard objects

16.1.4.1 Block parameterization

Block parameterization serves to enable the joint transfer of interdependent parameters. If you attempt to parameterize interdependent parameters individually, this may result in the error message “Dependency of other parameter not taken into consideration”. Block parameterization should be used in this case.

The plausibility check for the parameterization data is disabled during block parameterization, the data is only stored temporarily. However, the data length and subindex are checked.

The plausibility check is only performed when block parameterization is terminated with data item 00_{hex}.

If the check was completed with no errors, the temporarily stored parameterization data is applied and stored in the flash memory.

If errors were detected in the temporarily stored parameterization data, the service is acknowledged negatively with 08, 00, 0040_{hex}.

The exact cause of the error can be read in object $002A_{hex}$.

Not all startup objects have to be written.

The following actions are carried out when the parameter contents are modified:

Write control changes from 00_{hex} to 01_{hex}:
initiation of block parameterization

- Block parameterization is initiated
- Conflict dictionary is reset

Write control changes from 01_{hex} to 00_{hex}:
termination of block parameterization

- Block parameterization is terminated
- Individual parameterization is active
- Parameterization is checked for compatibility

  Parameters are compatible:
  - The parameter contents are accepted.
  - Write access to the write control parameter is acknowledged positively.

  Parameters are not compatible:
  - The old contents of all the parameters required for block parameterization remain in effect.
  - The conflict dictionary is updated.
  - Write access to the write control parameter is acknowledged negatively.

Error code in the event of negative acknowledgment:

Code (hex)	Additional Code (hex)	Meaning	Remedy
0801	0040	Dependent values were not taken into consideration.	Check the parameterization.

In the event of an error, the conflict dictionary contains the indices and additional code for the parameters involved in the conflict.

The block parameterization is permanently stored in the device description files for the module. This means that whenever the module is parameterized using a tool, the block parameterization is automatically initiated at the start of parameterization and terminated at the end of parameterization.

To use block parameterization without tools, proceed in the following sequence:

- Initiate block parameterization by writing value 01_{hex} to object 0029_{hex}.
- Write the startup parameters that you want to change to the corresponding objects.
- Terminate block parameterization by writing value 00_{hex} to object 0029_{hex}.

16.1.4.2 Conflict dictionary

The conflict dictionary contains the indices and error messages (additional code) for the parameters involved in the conflict.

Block parameterization

With block parameterization, all conflicts within the “parameter block” are listed.

If you receive a negative response after block parameterization has been completed, plausibility of the parameters has been violated. In this case, the module does not save the parameterized values.

Check and correct the parameterization.

Individual parameterization

With individual parameterization, the contents of the conflict dictionary refer to the “last” write access.

Check and correct the parameterization.

16.1.4.3 Hash value

The hash value is a unique value that is generated for a specific device and ensures the integrity of the parameter data. The data of the startup objects is verified using this hash value. The value only changes if an object relevant for startup has been changed. The value is therefore suitable for comparing the parameterization.

General standard objects

16.1.5 Objects for object descriptions

These objects are only applicable to tools.

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning
0038	ObjDescrReq	Record	2	3	R/W	Object description request
0039	ObjDescr	Record	16	max. 58	R	Object description

Fig. 16-13 Object descriptions

16.1.6 Objects for energy management

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning
003D	WakeUpTime	UINT16	1	2	R	Startup time, time (in ms) until the system is ready to operate after the supply voltage has been switched on Default: $01F4_{hex}$: < 500 ms

Fig. 16-14 Objects for energy management

16.1.7 Objects for modular devices

The contents for objects implemented on a device are listed in the module-specific documentation.

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning
0035	SubBusInfo	Record	1	16	R	Subbus information
0036	ActSubBusStructure	Array of records	N	N * 8	R	Actual subbus configuration
0041	RefSubBusStructure	Array of records	N	N * 8	R/W	Desired subbus configuration
0042	ModuleStatus	Array of bytes	N	N * 1	R	Module status
0043	SubBusBehaviour	Record	1	3	R/W	Subbus behavior
0044	SubBusControl	UINT8	1	1	R/W	Subbus control
0047	AddInfo	Record	1	16	R	Additional information
00F0	PackedPrm	Record	1	max. 63	R/W	All startup parameters consecutively; only relevant for PROFIBUS
C000 ... C07F	ProjBasProf					Projection of basic profile onto the subbus modules

Fig. 16-15 Objects for modular devices

16.2 Manufacturer-specific application objects

Manufacturer-specific application objects are module-specific and are documented in the module-specific documentation.

These objects are used, for example, to implement parameterization of individual channels for analog modules or parameterization of filter times for digital input modules.

16.3 Value ranges

Make sure to observe the permissible value ranges during module parameterization.
If invalid values are specified for an object, these are not saved and an error message is generated.

17 Technical appendix: altitude, times, synchronization, substitute value behavior, and power-on behavior

17.1 Use of S20 modules at altitudes above 3000 meters

This chapter applies to modules of the S20 product group that are operated with a DC voltage of <60 V DC.

⚠ WARNING **Dangerous contact voltage. Loss of safety function.**

This chapter does **not** apply to the following modules or applications:

- Modules that are not operated with PELV (protective extra-low voltage) (e.g., 120 V or 230 V)
- Modules with safety functions (e.g., PROFIsafe)
- Use of a safe signal path

In these cases, consider the individual module or application separately.

The S20 modules are approved for use up to an elevation of 3000 m above mean sea level, see “Technical data” on page 90.

The maximum permissible ambient temperature decreases at altitudes above this level. Therefore, keep temperature derating in mind when using the modules at altitudes above 3000 m up to 5000 m.

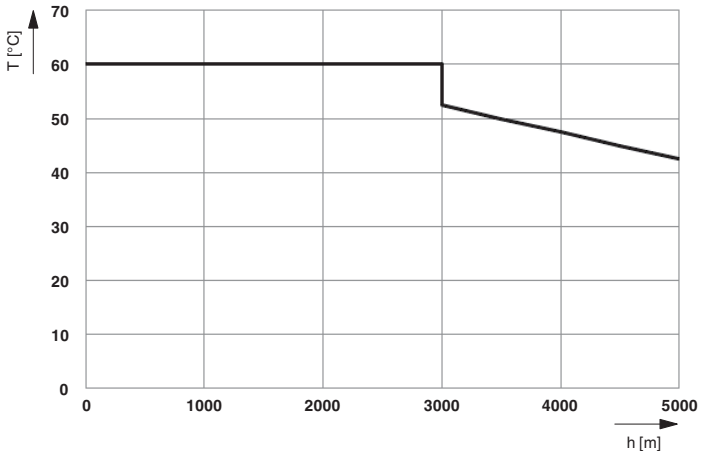


Fig. 17-16 Derating of the permissible ambient temperature depending on the altitude

Key:

T [°C]	Maximum ambient temperature (operation) in °C
h [m]	Altitude in m

17.2 Transmission speed

Within an S20 station, communication takes place via a fast, cyclic and time-equidistant local bus. The typical cycle time is less than 50 µs.

17.3 Typical cycle time on the local bus

The typical cycle time on the local bus is calculated according to the formula:

$$t = 2\ \mu s + n * 1\ \mu s$$

Where:

t	Typical cycle time on the local bus
n	Number of modules attached to the bus coupler

The typical cycle time for a station of five modules is:

$$t = 2\ \mu s + n * 1\ \mu s$$

$$t = 2\ \mu s + 5 * 1\ \mu s$$

$$t = 7\ \mu s$$

17.4 Response times for an S20 system

In general, the response time for an I/O system is the time from reading in the input, processing in the controller, to setting the output. This includes the times shown in Fig. 17-17. They are explained in Fig. 17-19 with example times.

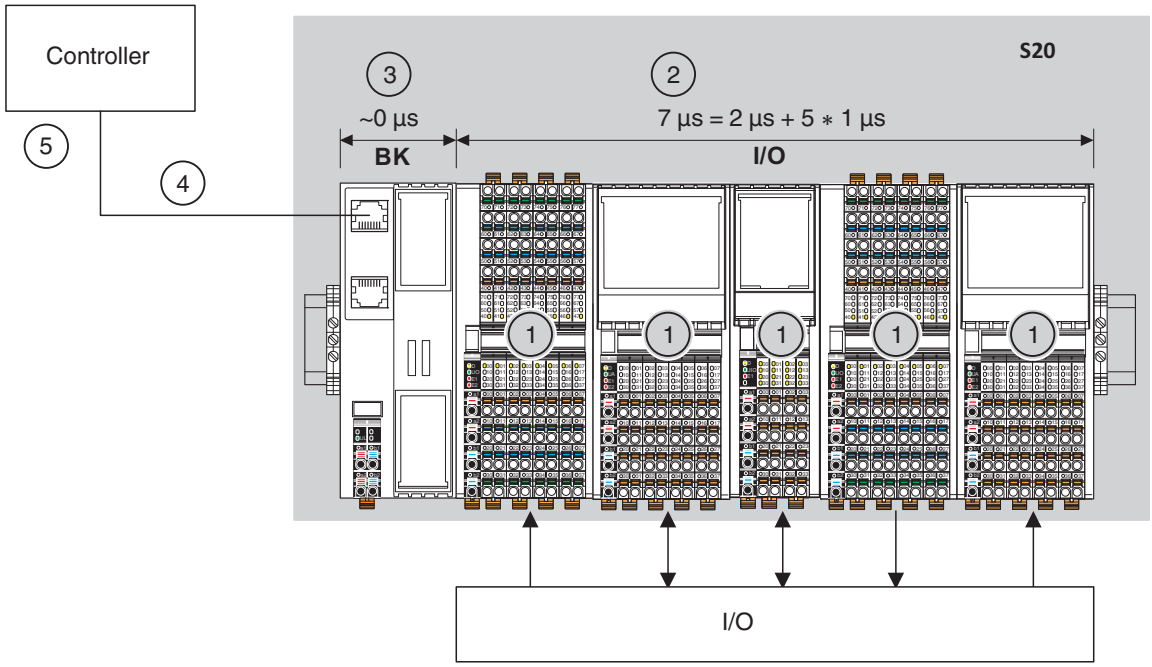


Fig. 17-17 Response time of an overall system

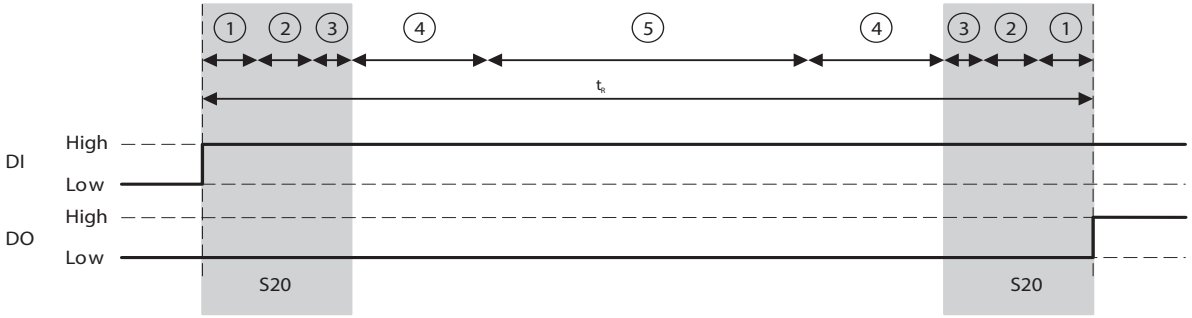


Fig. 17-18 Response time t_R starting with reading in an input (DI) and ending with setting an output (DO)

When determining the response time of the overall system, S20 (no. 1 ... 3) represents the smallest proportion by far. Therefore, it can normally be ignored. See example values in Fig. 17-19.

Typical processing times for an S20 system:

No. in Fig. 17-17	Meaning	Example
1	Processing time in the S20 I/O modules (depending on the I/O application)	For example <5 µs (S20-DI-16/1) Approx. 150 µs (S20-DI32/1) Approx. 160 µs (S20-AI-4-I, 12 kHz filter, without mean-value generation) Approx. 33 ms (S20-AI-4-I, 30 Hz filter, without mean-value generation)
2	Cycle time of the local bus	Here: 7 µs (see Appendix 17.3 “Typical cycle time on the local bus“)
3	Time for copying the data between the local bus and higher-level network in the S20 bus coupler	~ 0 µs
4	Update time (cycle time) of the higher-level network	Depending on the higher-level network, e.g., PROFINET with 2 ms
5	Processing time (cycle time) of the controller	4 ms, for example
	You also have to consider the processing time of the connected sensors and actuators (I/Os).	<100 µs, for example

Fig. 17-19 Typical processing times in an S20 system

The response time of the overall system depends on the selected S20 I/O modules.

When using I/O modules with a very low processing time (e.g., digital modules), the response time of the overall system (no. 1 … 3) represents the smallest proportion by far and can therefore be ignored.

However, in time-critical applications with very short application/processing times in the controller, take the processing time in the modules into account as well.

Rule of thumb for applications:
Application/bus cycle time > 2 x module processing time (Nyquist-Shannon sampling theorem)

Response times for an S20 system

Term	**Used with, for example**	**Meaning**
Processing time		The processing time of an I/O module depends on the device type and can include, for example: • Conversion time • Input filter time • Process data update time
• Conversion time (A/D conversion time, D/A conversion time)	AI, AO	Time the analog-to-digital converter or digital-to-analog converter requires to convert the signal
• Input filter time (filter time)	DI	Minimizing the effects of contact bouncing
	RTD	Increasing the accuracy of the measurement results
• Process data update time (process data update, update time)	DI, DO AI, AO	Time in which the I/O module cyclically updates the process data. Updating of the values in the process data depends on the conversion time or filter time.

Fig. 17-20 Terms used

Conversion time, input filter time, and process data update time
If the time is relevant for a module, you will find this is information in the module-specific data sheet.

Example: S20-AI-4-I with 4-sample mean-value generation

Information from the DOK-CONTRLS20*AI*4*I*-DA02-EN-P data sheet:

Analog inputs	
Number of inputs	4
...	...
A/D conversion time	31.25 µs
...	...
Process data update	160 µs
Input filter	30 Hz, 12 kHz and mean-value generation (can be parameterized)
...	...

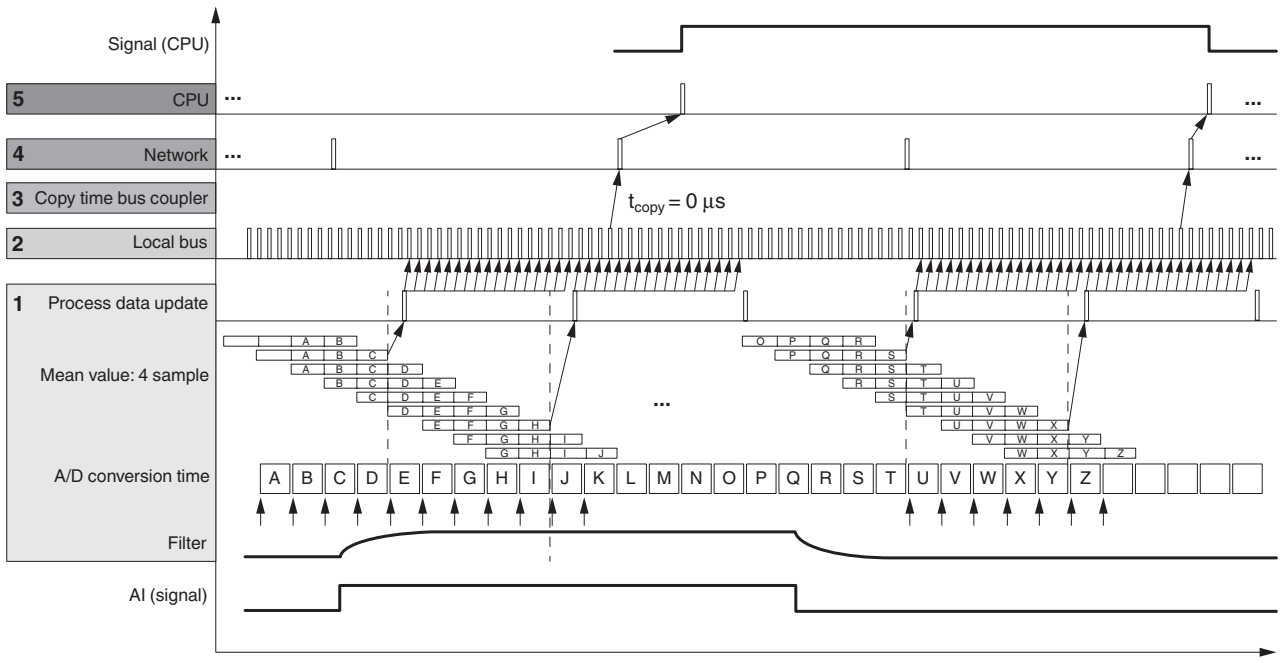


Fig. 17-21 Transmission of the data from an analog input to the controller

Response times for an S20 system

Transmission of the data from an analog input to the controller	Designation in Fig. 17-21		Meaning	Information in the data sheet for S20-AI-4-I
		Signal (CPU)	Mapping of the signal in the controller	
	5	CPU	Transfer of the process data item into the controller process image In the next controller cycle, the current process data item will then be transferred into the controller process image. In the example, this is the mean value of EFGH and the mean value of UVWX.	
	4	Network	Transfer of the current process data item into the network The mean value of ABC will not be transferred because the mean value of EFGH is already available in the network at the time of the data transfer.	
	3	Copy time bus coupler	Copy time in the bus coupler is negligible The bus coupler makes the value available to the network.	0 µs
	2	Local bus	Local bus The local bus transfers the provided value into the process data.	
	1	Process data update	Process data update: During the process data update by the firmware, the last mapped mean value is accepted and made available to the local bus. This value will be made available to the local bus until the next process data update.	160 µs
		Mean-value: 4-sample	4-sample mean value Mean-value generation from the last four values. Mean-value generation can usually be parameterized. 4-sample mean-value generation was selected for the example.	Can be parameterized: 16-sample (default) No mean value 4-sample 32-sample
		A/D conversion time	Conversion time of the analog-to-digital converter Conversion of the analog input value to the digital value.	31.25 µs
		Filter	Filter of the AI signal, shown qualitatively here	Can be parameterized: 30 Hz (default) 12 kHz
		AI (signal)	Signal at the analog input under consideration	

Fig. 17-22 Key for Fig. 17-21

17.5 Synchronization

If you want to use the synchronization function, make sure that the following requirements are met simultaneously:

- The bus coupler or controller supports the function.
- There is at least one module in the S20 station that supports local bus synchronization.

Only the S20 modules that support local bus synchronization can be operated in a synchronous manner. All the other S20 modules of the station work in an asynchronous manner.

17.5.1 Synchronization in general

Some S20 modules offer a synchronization option.

To use this property, synchronization must be consistently supported from the clock master in the higher-level network to the I/O modules.

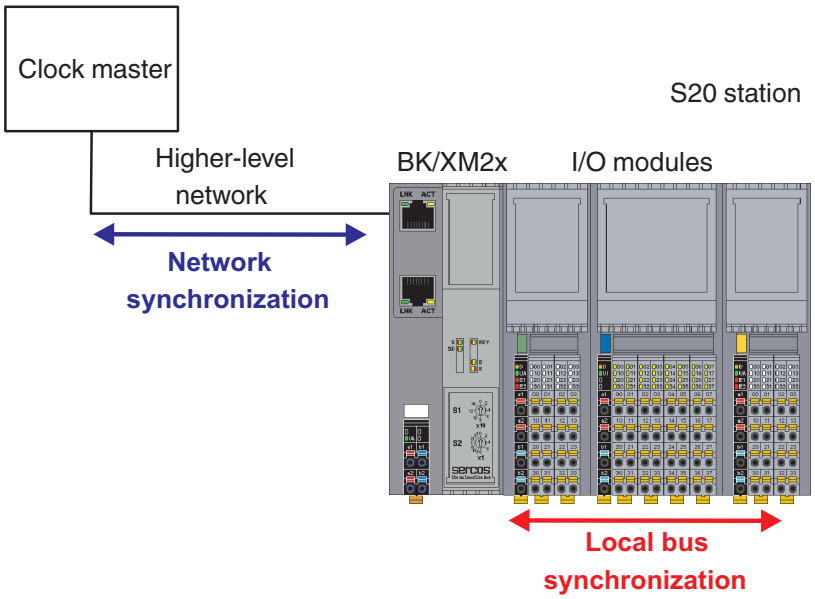


Fig. 17-23 Network and local bus synchronization

Clock master In the overall system, the clock master is the unit which determines the synchronization times and time points and sends out a synchronization clock signal. Generally this is the network controller.

Higher-level network The higher-level network is the communication system which links the controller and the head of the S20 station. This network must support synchronization.

The head of an S20 station can be a bus coupler or a controller from the XM2x or XM42 series. Currently, only some bus couplers support synchronization.

Synchronization

Bus coupler The bus coupler is the link between the higher-level network and the S20 station. It must support synchronization in accordance with the definition of the higher-level network and transfers the synchronization parameters and signals to the S20 station.

Examples of bus couplers which support the synchronization mechanisms for a network

Network	Bus coupler	Synchronization mechanism of the network	Remark
EtherCAT®	S20-EC-BK	SM-synchronous	Asynchronous
		DC-synchronous	The bus cycle of the local bus is synchronized with the EtherCAT® cycle. The implemented distributed clock unit is used for the time synchronization of processes.
Sercos	S20-S3-BK+	Asynchronous	Asynchronous
		Clock-synchronous	Cyclical master-slave communication with one of the cycle times to be selected during initialization.

Fig. 17-24 Synchronization mechanisms of the bus couplers

Exemplary illustration of the synchronization mechanisms

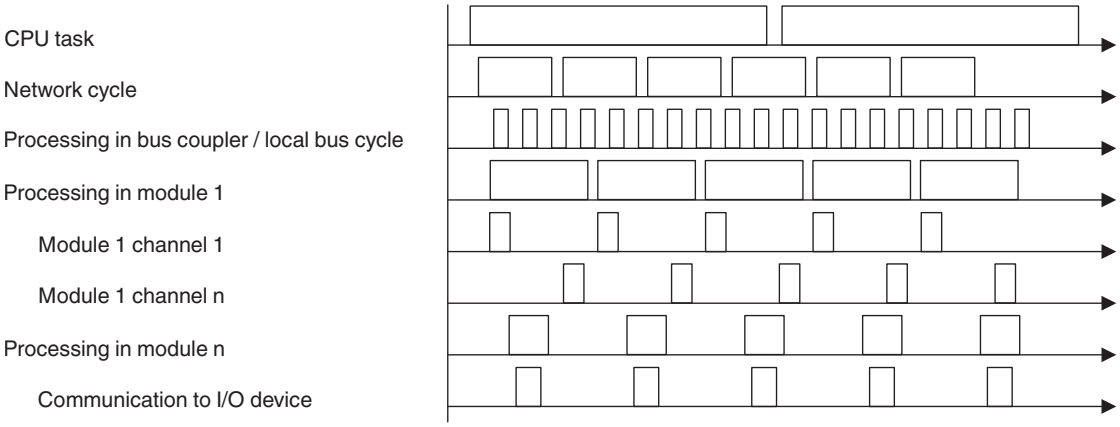


Fig. 17-25 Asynchronous

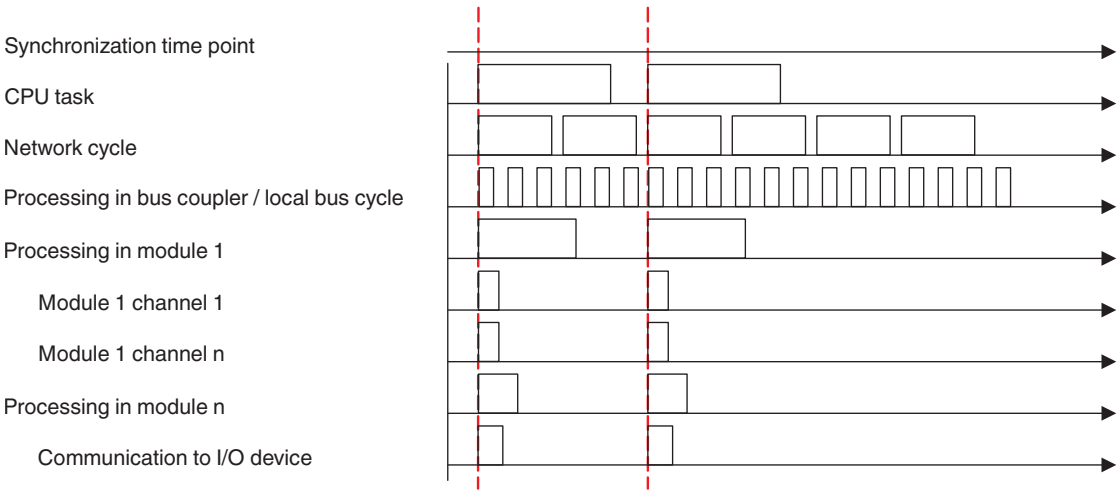


Fig. 17-26 Synchronous

I/O modules

Not all I/O modules support local bus synchronization.
In the case of modules which support local bus synchronization, the SyncI_0 (synchronization of inputs) property or SyncO_0 (synchronization of outputs) property is specified in the “Capabilities” object 0005_{hex}.

In the case of an I/O module which works asynchronously, its input or output signals are read or output at a time determined by the higher-level network. The data is consistent, i.e., all data for a module is processed at the same time.

In order for the clock master in the higher-level network to calculate the exact point in time for an input or output, the module provides the bus coupler or controller with various information. This includes, for example, the minimum possible repeat time, signal processing length, and required run-up for transfer of the data. These values are either permanently set in the module or are dynamically determined based on the parameterization.

The bus coupler or controller reads the values and makes them available to the clock master. The synchronization time determined by the clock master can be different for each module and is set by the bus coupler or the controller in each module that can be synchronized.

In this way, synchronism requirements of a few nanoseconds within a station can be achieved. The precision of the overall system is essentially determined by the higher-level network capabilities and its clock master.

Modules which do not support synchronous processing do not affect a synchronous system. They do not accept or transfer the values at a specific time, instead they do this as fast as possible.

17.5.2 Synchronization options

Modules can either support synchronization or not. When a module can be synchronized, you can use the function or deactivate it, depending on the application.

Module property	Use	Remark
Cannot be synchronized	Asynchronous	
Can be synchronized	Asynchronous	If synchronization is not required for your application or is not useful, then deactivate synchronous mode.
	Synchronous	The modules are to be synchronized. Select the modules in a suitable manner. Parameterize them accordingly. See Chapter 17.5.3, “Conditions for local bus synchronization”.

Fig. 17-27 Synchronization options

17.5.3 Conditions for local bus synchronization

To make good use of this function, the following conditions must be met:

1. The higher-level controller must support synchronization mechanisms for the network.
2. The bus coupler must support synchronization mechanisms for the network.
3. At least one module on the local bus must support local bus synchronization.

17.6 Substitute value behavior and power-on behavior

Substitute values for S20

The term substitute value is used for the behavior when switching on the power supply as well as for the behavior when valid process data is missing.

Power-on behavior

The power-on behavior defines the module behavior after switching on the power supply.

An S20 module has this behavior until it receives valid process data.

Substitute value behavior (failsafe behavior)

The substitute value behavior defines the module behavior when valid process data is missing.

Once a module has exchanged valid process data for the first time after switching on the power supply, the substitute value behavior is activated.

If valid process data is missing (e.g., in the event the connection is aborted), the module changes to the substitute value behavior.

Typically, the substitute value behavior is parameterized using the engineering tool or object 0024_{hex} “Substitute value behavior when process data is missing”. The following values are possible:

Code (hex)	Behavior	Example: S20-AO-4
0000	Output of zero values	Output of zero values (0 V/0 mA/4 mA) at the output
0001	Output of final values	Output of final values (10 V/5 V/20 mA) at the output
0002	Hold last value	Hold last value
0003	Substitute value	Acceptance of substitute values of the “Substitute OUT process data” object ($002F_{hex}$)

Fig. 17-28 Possible settings for the substitute value behavior

To determine whether, and if yes, which substitute value behavior can be parameterized for a module, please refer to the module-specific data sheet.

Substitute value behavior and power-on behavior

Overview regarding the behavior of analog output modules from the S20 portfolio with an environment not being ready for operation

	Substitute value behavior	Behavior upon local bus failure	Behavior upon U_A failure
With an environment not being ready for operation due to ...	**E.g., PLC stop, fieldbus interruption**	**E.g., U_{Bus} failure, local bus interruption**	**I/O supply failure at the module**
Description	**Controllable module state, as the higher-level system (bus coupler, controller, ...) is able to provide a substitute value via the local bus.**	**It is no longer possible to influence the module outputs, as a higher-level system has been disconnected. The module behaves according to the hardware structure of its output circuit used.**	**The output drivers are no longer supplied due to a supply voltage failure at the module (U_A).**
S20-AO-8 R911172538	As set in the “user-defined parameters”	Last value is held	Outputs at 0 V/0 mA
S20-SSI-AO-1/1 R911172544	As set in the “user-defined parameters”	Last value is held	Outputs at 0 V/0 mA
S20-AIAO-2 R911173743	As set in the “user-defined parameters”	Last value is held	Outputs at 0 V/0 mA
S20-AI6-AO2-SSI2 R911173120	As set in the “user-defined parameters”	Outputs at 0 V/0 mA	Outputs at 0 V/0 mA
S20-AO-4 R911173248	As set in the “user-defined parameters”	Outputs at 0 V/0 mA	Outputs at 0 V/0 mA

Fig. 17-29 Behavior of analog output modules with an environment not being ready for operation

The analog outputs of the **S20-AO-8**, **S20-SSI-AO-1/1** and **S20-AIAO-2** modules hold their last values in the event of a local bus failure. Specific applications are, for example, ventilation flaps or cooling pumps, which should hold their previous settings in the event of a fault. If 0 V/0 mA are required at the input of the I/O connected to the module (e.g., for hydraulic axes), the signal needs to be interrupted by a relay.

The **S20-AO-4** and **S20-AI6-AO2-SSI2** modules reset their analog outputs to 0 V/0 mA in the event of a local bus failure.

The S20-AO-8, S20-SSI-AO-1/1, and S20-AIAO-2 modules hold the last value of the analog output(s) if the local bus fails. This is appropriately documented in the data sheets.

The S20-AO-4 and S20-AI6-AO2-SSI2 modules reset their outputs to 0 V/0 mA in the event of a local bus failure. This behavior is also documented accordingly.

18 Disposal

18.1 General information

Dispose the products according to the respective valid national standard.

18.2 Return

For disposal, our products can be returned free of charge. However, the products must be free of remains like oil and grease or other impurities.

Furthermore, the products returned for disposal must not contain any undue foreign substances or components.

Send the products free of charge to the following address:

Bosch Rexroth AG
Bgm.-Dr.-Nebel-Straße 2
97816 Lohr a.Main
Germany

18.3 Packaging

The packaging material consists of cardboard, plastics, wood or styrofoam. Packaging material can be recycled anywhere.

For ecological reasons, please do not return empty packages.

18.4 Batteries and accumulators

Batteries and accumulators can be labelled with this symbol.

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

The end user within the EU is legally obligated to return used batteries. Outside the validity of the EU Directive 2006/66/EC keep the stipulated directives.

Used batteries can contain hazardous substances, which can harm the environment or the health of the individual when they are stored incorrectly or disposed of.

After use, the batteries or accumulators contained in Rexroth products have to be disposed of according to the country-specific collection system.

Disposal

19 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries.
You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone:	**+49 9352 40 5060**
Fax:	**+49 9352 18 4941**
E-mail:	service.svc@boschrexroth.de
Internet:	http://www.boschrexroth.com

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

Service and support

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Notes

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