The Drive & Control Company

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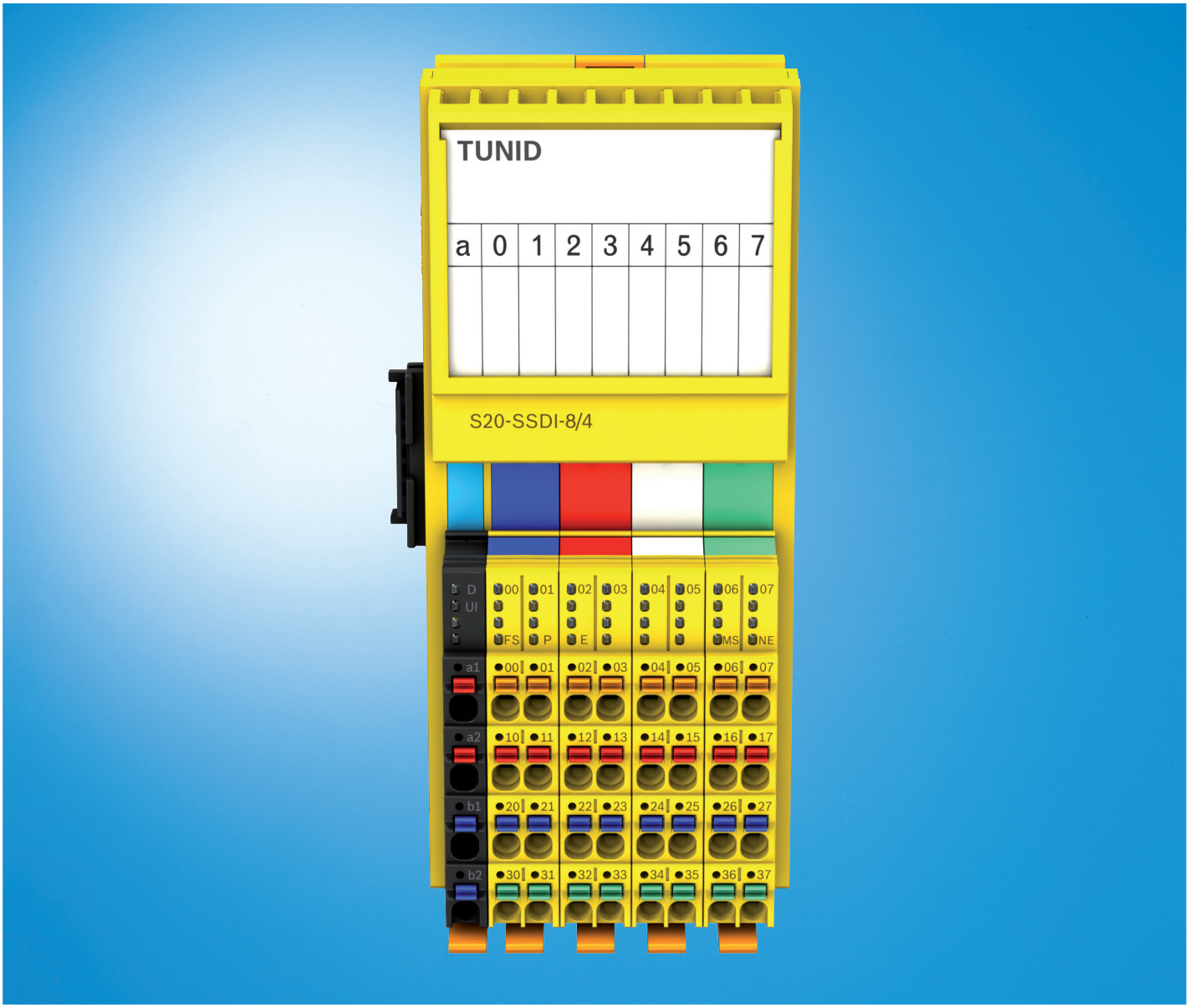
Bosch Group

IndraControl S20 Module

With Safe Digital Inputs S20-SSDI-8/4

Application Description
R911342480

Edition 01



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S20 Module
With Safe Digital Inputs S20-SSDI-8/4

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1 Using safety instructions

1.1 Structure of the safety instructions

The safety instructions are structured as follows:

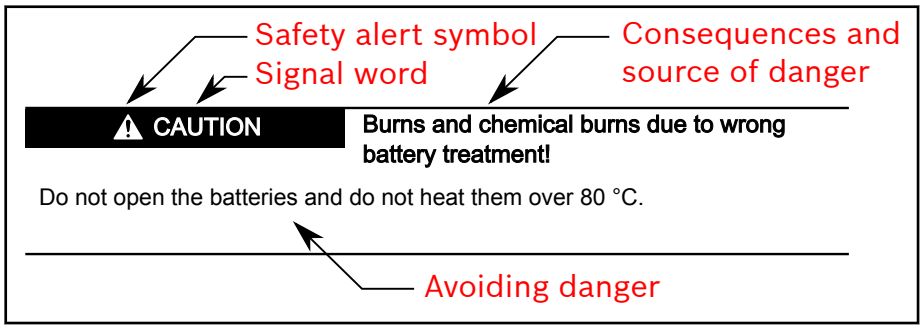


Fig. 1-1: Structure of the safety instructions

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

2 For your safety

2.1 General information

Target of the application description

The present information informs on the functioning, operating and connecting elements and the parameterization of the safety module S20-SSDI-8/4. This information allows to use the module S20-SSDI-8/4 in a CSos systems as per the given requirements.

Validity of the application description

This application description applies to the module S20-SSDI-8/4 in the version mentioned in the following as well as to the replacement by other device types for the same or higher versions.

- Module type: S20-SSDI-8/4
- HW/FW version: 00/1.01
- Part number: R911173191

Target group of the application description

The product use described in this application description is only intended for qualified electricians and staff trained by these qualified electricians that are familiar with the current standards and other guidelines of the electrical engineering and especially with the relevant safety concepts.

Bosch Rexroth is not liable for unintended handling and damages at Bosch Rexroth and third-party products by disregarding information given in this application description.

2.2 General safety instructions

⚠ WARNING **Fatal injuries caused by unintended module use**

Observe the safety instructions given in this chapter and the warnings in the manual.

Qualified staff

Qualified personnel in this manual are persons who by their training, experience, instruction and their knowledge of the relevant standards, regulations, accident prevention rules and working conditions have been authorized to perform the appropriate activities required and thereby are able to recognize and prevent potentially dangerous situations.

Additionally, knowledge on the following topics and products is required:

- Non-safety-related target system Sercos
- CIP Safety on Sercos (CSos)
- Components used
- IndraControl S20 product family
- Operation of software tools
- Safety regulations in the area of application

When using Csos systems, the following works have to be performed by qualified staff:

- Planning
- Configuring, parameterizing, programming
- Installing, commissioning, maintaining
- Maintaining, decommissioning

For your safety

Documentation

Observe all specifications in this manual and other applicable documents, refer to chapter 2.7 "Documentation" on page 9.

Personal and property protection

Personal and property protection can only be ensured if the module is used as intended, refer to chapter 2.6 "Intended use" on page 9.

Error detection

Depending on the wiring and the parameterization, the module detects errors in the safety-related installations.

Do not repair or make any changes!

Repairs or user-specific changes at the module are prohibited. The housing must not be opened. The module is protected against manipulations using protective labels. In case of unauthorized repair or opening of the housing, the protective label is damaged. The function of the safety module is not guaranteed anymore in this case.

In case of error, send the module to Bosch Rexroth or contact the Bosch Rexroth service immediately.

Interchanging or reversing polarity of the connections

Ensure that the connections are neither interchanged, polarity is not reversed nor manipulated. To better impede interchanging, plugs and slot markings are colored.

2.3 Electrical safety

⚠ WARNING **Loss of the safety function and presence of hazardous shock currents due to an incorrect installation**

- Observe the notes on electric safety
- Design the module used and perform their installation in the system according to the specific requirements
- Check the systems upgraded with Csos again

Direct and indirect touching

Ensure that all components connected to the system are protected against direct and indirect touching acc. to VDE 0100 part 410. If an error occurs, no hazardous parasitic voltages may occur (single-failure proof!)

Required actions:

- Use power supply units with protective separation (PELV)
- Decouple circuits, which are no PELV systems, via opto-couplers, relays and other components meeting the requirements of the safe separation

Power supply units for 24 V supply

Only use power supply units with protective separation and PELV voltage according to EN 50178/VDE 0160 (PELV). These power supply units exclude short circuits between the primary and the secondary side.

Ensure that the output voltage of the voltage supply does also not exceed 32 V in case of error.

Insulation measurement

Observe the dirt and overvoltages at runtime when selecting equipment.

The module is designed for overvoltage category II (acc. to DIN EN 60664-1). If overvoltages exceeding the values (defined in overvoltage category II) are expected in the system, take additional measures to limit the voltage.

2.4 Safety of machine or system

The machine or system vendor as well as the operator are reliable for the safety of machine or system and the application used in the machine or system.

Elaborate and implement a safety concept!

The use of the module requires a safety concept for your machine or system. These include the hazard and risk analysis and an inspection report (checklist) to validate the safety function, refer to chapter 2.5 "Guidelines and standards" on page 9 and chapter 15 "Checklists" on page 89.

The target safety integrity (SIL acc. to IEC 61508, SILCL acc. to EN 62061 or the performance level and category acc. to EN ISO 13849-1) results from the risk analysis. The determined safety integrity depends on how the module is to be wired and parameterized in the safety function.

Validating hardware and parameterization

Perform a safety validation in the complete system after each safety-relevant change.

Ensure the following points are observed using your test report:

- The safe modules are connected to the correct sensors and actuators
- The parameterization of the safe input and output channels is correct
- The linking of the variables to the safe sensors and actuators (single- or dual-channel) is correct

2.5 Guidelines and standards

The standards corresponding to the module are mentioned in the certificate of the registration authority and in the EC declaration of conformity (refer to www.boschrexroth.com/electrics).

2.6 Intended use

The module S20-SSDI-8/4 is intended to be exclusively used in a CSos system. The module can fulfill its tasks only if the specifications from this document are used.

Use this module only according to the specified technical data and ambient conditions, refer to chapter 12 "Technical data and ordering data" on page 75.

This module is intended to connect single- or dual-channel sensors used with safety engineering.

Example on module use:

- Single- or dual-channel E-STOP devices or protecting door devices
- Applications with enabling button
- Applications with two-hand circuits
- Applications with operation mode switches
- Downstream device for safety-related light barriers.
- Safety circuits acc. to EN 60204, part 1.

2.7 Documentation

Current documentation

Ensure that the current documentation is consulted. For changes and supplements of the present documentation, go to the internet **www.boschrexroth.com ▸ Products ▸ Electric Drives and Controls ▸ CAD and documentation ▸ Documentation**

CSos

When working with the Csos system and its components, these application descriptions and the other documents on the product information have to be available and observed. Observe the application descriptions of the following products:

- The safe control used

- Input and output modules of Csos
- CSos function blocks

Also note the relevant information on Sercos and CSos in the internet. Go to www.sercos.org and www.odva.org.

Related documents

Title	Part no./document type
Rexroth IndraControl S20: System and Installation	R911335988 Application Description
Rexroth IndraControl S20 Bus Coupler for Sercos	R911342782 Data sheet
Rexroth IndraControl S20 Error Messages	R911344826 Application Description

2.8 Abbreviations used

Abbreviation	Meaning	Standard	Example
SIL	Safety integrity level	IEC 61508	SIL 2, SIL 3
SILCL	SIL Claim Limit	EN 62061	SILCL 3
Cat.	Category	EN ISO 13849-1	Cat. 2, cat. 4
PL	Performance Level	EN ISO 13849-1	PL e, PL d

Tab. 2-1: Abbreviations of the safety requirements

Abbreviation	Meaning
PELV	Protective extra-low voltage acc. to EN 50178/VDE 0160
EUC	Equipment under control

Tab. 2-2: General abbreviations

Explanations on the terms and abbreviations used with Csos, refer to chapter 13 "CSos glossary" on page 83.

3 Product description

3.1 Brief module description

The module S20-SSDI-8/4 is a safe input module to be used in an IndraControl S20 station at any position in a Sercos I/O system. The module can only be used together with a safety control. The safe connection is established via the safe bus protocol CSos (CIP Safety on Sercos).

Set the TUNID (SNN and SDID) for the Csos device via a DIP switch.

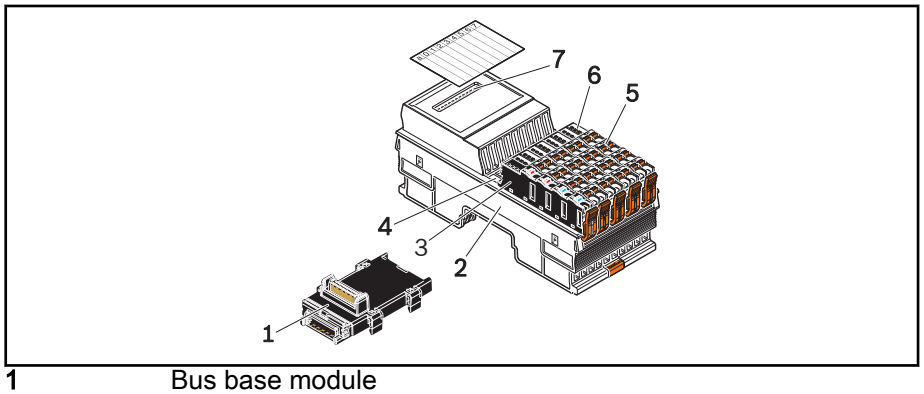
The module is provided with four safe digital inputs for the dual-channel assignment or eight digital inputs for the single-channel assignment.

The inputs can be parameterized user-specifically and allow the integration of sensors into the safe Csos system.

Depending on the operating conditions in the Csos system, safety categories with the following requirements can be met using the module:

- Up to SIL 3 acc. to IEC 61508
- Up to SILCL 3 acc. to EN 62061
- Up to cat. 4/PL e acc. to EN ISO 13849-1

3.2 Module structure



1	Bus base module
2	Electronics module
3	Plug to connect the supply voltage
4	Color code of the function
5	Peripheral connector
6	Diagnostic and status displays
7	DIP switch

Fig. 3-1: Module structure

For more information on the settings of the switches, refer to chapter 5.1.3 "Setting DIP switch" on page 25.

Product description

3.3 Housing dimensions

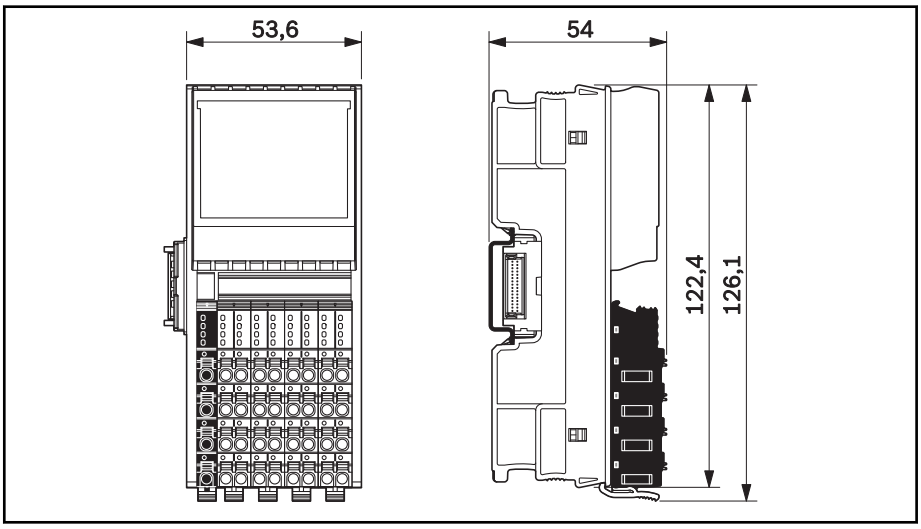


Fig. 3-2: Housing dimensions (specifications in mm)

3.4 Assigning terminal points

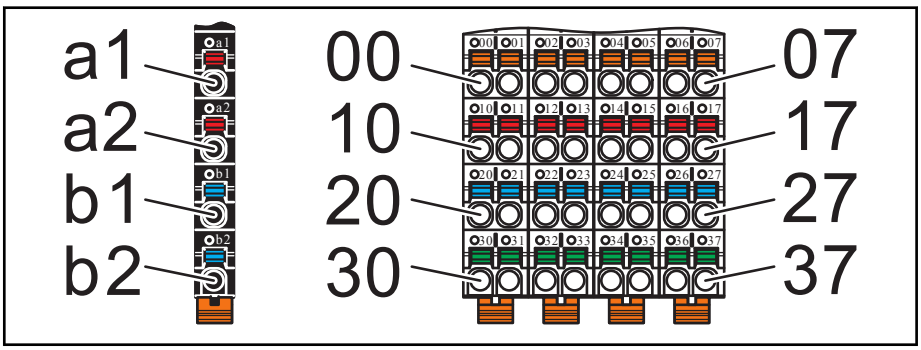


Fig. 3-3: Terminal point assignment

The IndraControl S20 plugs are delivered with the module. To connect them, they are identified and labeled in color.

Use exclusively the plugs delivered with the module.

The following applies to the tables:

- All inputs are safe digital inputs
- 0 V (GND): Common ground of the inputs and clocking outputs
- FE: Common functional earth
- T1: Clocking output 1
- T2: Clocking output 2

Terminal point	Color	Assignment	
a1, a2	Red	24 V DC (U_I)	UI: Supply of digital inputs (internally connected)
b1, b2	Blue	GND	Reference potential of the supply voltage (internally connected)

Tab. 3-1: Terminal point assignment; voltage connection

	Color	Plug 1		Plug 2		Plug 3		Plug 4	
		(Blue)		(Red)		(White)		(Green)	
Terminal point	Orange	00	01	02	03	04	05	06	07
Function		IN0_CH1	IN0_CH2	IN1_CH1	IN1_CH2	IN2_CH1	IN2_CH2	IN3_CH1	IN3_CH2
Terminal point	Red	10	11	12	13	14	15	16	17
Function		Clock T1	Clock T2	Clock T1	Clock T2	Clock T1	Clock T2	Clock T1	Clock T2
Terminal point	Blue	20	21	22	23	24	25	26	27
Function		GND	GND	GND	GND	GND	GND	GND	GND
Terminal point	Green	30	31	32	33	34	35	36	37
Function		FE							

Tab. 3-2: Terminal point assignment, I/O connection

⚠ WARNING **Loss of the safety function due to parasitic voltage**

Wire the sensors, which require a GND, to the assigned slot for 0 V (GND).

3.5 Safe digital inputs as well as the clocking outputs T1 and T2

3.5.1 Safe digital inputs

The module is provided with safe digital inputs that can be used as follows:

- For dual-channel assignment: Four dual-channel inputs
- For single-channel assignment: Eight single-channel inputs

For technical data of the safe inputs, refer to chapter 12.2.8 "Safe digital inputs" on page 78. The supply voltage for the inputs can be provided either externally or via the clocking outputs.

Parameterization

The safe digital inputs of the module can be parameterized in pairs. Thus, the inputs can be adjusted to different operating conditions and different safety integrities SIL, SILCL, cat., PL can be implemented.

The attainable safety integrity (SIL, SILCL, cat., PL) and error detection depends on the parameterization, the design of the sensor and the cable routing, refer to chapter 8 "Connection examples of the safe inputs" on page 37.

For information on the parameterization of the inputs, refer to chapter 6.2 "Parameterizing safe inputs" on page 31.

Diagnostics

It is diagnosed via the local diagnostic displays as well as via the diagnostic messages transferred to the control.

For information on the local diagnostic displays, refer to chapter 3.7 "Local diagnostic and status displays" on page 16.

For information on the diagnostic messages of the inputs, refer to chapter 10 "Errors: Message and recovery" on page 63.

⚠ WARNING **Loss of the safety function due to the use of diagnostic data for safety-relevant functions**

Do not use diagnostic data for safety-relevant functions or actions.

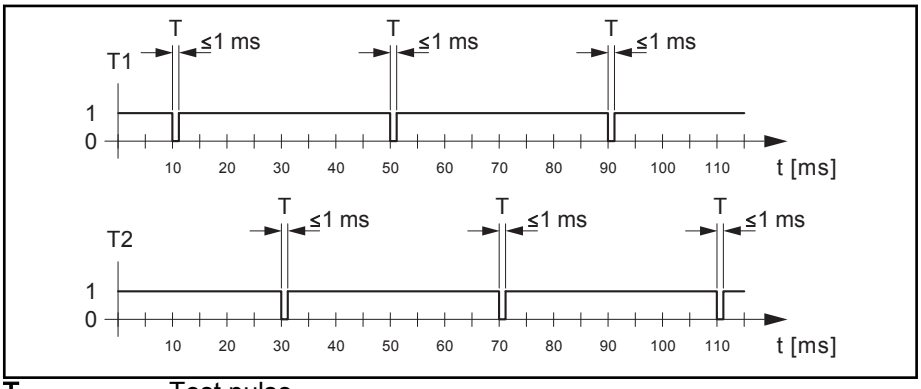
Software requirements on sensors/commanding devices

The functional safety has certain requirements on the execution of actuators/commanding devices. Use suitable sensors/commanding devices that, for example, are described in the common safety standards.

The module capability to detect errors depends on the parameterization. Adjust the parameterization of the modules to the respective sensor/commanding device, refer to chapter 6 "Parameterizing the module" on page 31.

3.5.2 Clocking outputs T1 and T2

The module is provided with two clocking outputs which are independent from each other. These clocking outputs provide the supply voltage for the safe inputs. Both clocking outputs provide a pulse pattern to detect a cross-fault in the external wiring of the inputs if the cross-fault monitoring was enabled for at least one input pair.



T Test pulse
Pulse width ≤ 1 ms
Period ≤ 40 ms

Fig. 3-4: Exemplary pulse pattern

The clocking outputs are also switched on and monitored if the module is in an unparameterized state. If a short circuit occurs at a clocking output in this state, the clocking output is disabled. This state is indicated by the local diagnostic LED.

For technical data of the clocking outputs, refer to chapter 12.2.9 "Clocking outputs" on page 79.

Behavior in case of error

In case of a short circuit against GND or overload of the clocking outputs, the clocking outputs are disabled. The error is simultaneously signaled at the error reporting LED "E" (error) and a diagnostic message is generated at the control. Acknowledge this error to commission the system again after eliminating the error, refer to chapter 10 "Errors: Message and recovery" on page 63.

As two clocking outputs are available for the eight inputs, interactions between the outputs are possible.

Diagnostics

⚠ WARNING **Loss of the safety function due to the use of diagnostic data for safety-relevant functions**

Do not use diagnostic data for safety-relevant functions or actions.

It is diagnosed via the local diagnostic display as well as via the diagnostic messages transferred to the control.

For information on the diagnostic messages of the clocking outputs, refer to tab. 10-12 "Parameterization errors (cannot be acknowledged)" on page 70.

Cross-fault monitoring

If all inputs are parameterized without cross-fault monitoring, a DC voltage without clocking pulses can be tapped at the clocking outputs. When at least one input pair was parameterized with the cross-fault monitoring, pulses are output at the clocking outputs T1 and T2.

For inputs parameterized with the cross-fault monitoring, the following applies:

- The inputs of channel 1 (INx_CH1) are assigned to the clocking output T1
- The inputs of channel 2 (INx_CH2) are assigned to the clocking output T2

Observe the error detection with regard to the clocking, refer to chapter 3.5.2 "Clocking outputs T1 and T2" on page 14.

3.6 Connecting options for sensors depending on the parameterization

Sensors meeting different safety requirements depending on the parameterization can be connected to the inputs.

The maximum attainable SIL/SILCL/Cat./PL is specified in the table. To meet the safety requirements:

- Observe the specifications in the connection examples, refer to chapter 8 "Connection examples of the safe inputs" on page 37
- Meet the requirements from the standards with regard to the external wiring and sensors to be used to attain a SIL/SILCL/cat./PL, refer to chapter 8.2 "Measures to meet a certain safety integrity" on page 38.

Product description

		Input							
Connection to the IndraControl S20 plugs		Single-channel sensor or redundant sensor			Dual-channel redundant commanding device/ sensor				
Input signal					Equivalent			Antivalent	
Cross-fault monitoring		With	Without		With	Without		With	Without
Connectable sensors: – With contacts		Yes	Yes	-	Yes	Yes	-	Yes	Yes
– With OSSD outputs		No	-	Yes	No	-	Yes	No	No
Attainable safety requirement	SIL	2	2	2	3	3	3	3	3
	SILCL	2	2	2	3	3	3	3	3
	Cat.	3①	2	2	4	3	4②	4	3
	PL	d	d	d	e	d	e	e	d
For connection examples, refer to the page		40	41	43	47	49	52	56	57

① Cat. 3 can only be attained with a redundant sensor
② Attainable category depends on the sensor set

3.7 Local diagnostic and status displays

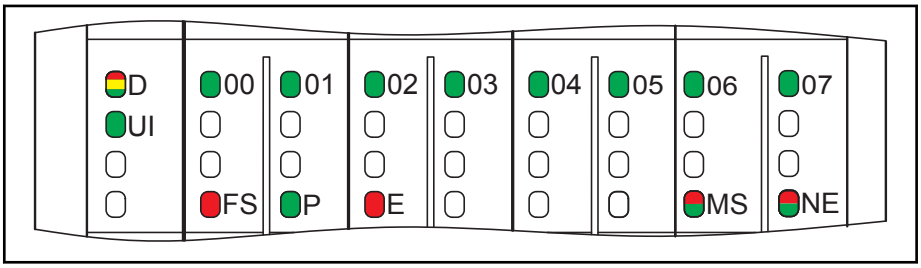


Fig. 3-5: Local diagnostic and status displays

LED	Color	State	Description
D		Diagnostics of the local bus communication	
	○	Off -- --	Device in (power) reset
	☀	Flashing red RD --	The device is ready, but not connected to the device located in front
	☀	Red on RD RD	The device is ready, but it lost the connection to the bus coupler
	☀	Yellow on YE YE	The device is ready, but it has not yet detected a valid cycle after power-on
	☀	Yellow flashing YE --	The device is not (yet) part of the current configuration
	☀	Green and yellow flashing alternately GN YE	The device is ready. Communication in the station is ok. Output data **cannot** be output and/or input data **cannot** be loaded. There is a malfunction in the periphery of the module (periphery error)
	☀	Green flashing GN --	The device is ready. Communication in the station is ok. Data is **in**valid. No valid data is provided by the control or the superimposed network. There is no malfunction on the module
	☀	Green on GN GN	Device is ready and communication in the station is ok. All data is valid. There is no malfunction
UI		Diagnostics of feeding digital inputs	
	☀	Green on GN GN	Feeding for digital inputs present and > approx. 17 V DC.
	☀	Green flashing GN --	No feeding for digital inputs present or < approx. 17 V DC.
FS	○	Diagnostics of the “Failure State”	
		Off -- --	The Safety application has valid CSos and device parameters (applies only if "UI" is lit at the same time).
	☀	Red on RD RD	Possible error causes: • Application is not ready on the module • Hardware error • TUNID (DIP switch) was changed at runtime The communication to a safe parent control is locked
	☀	Flashing red RD --	Module is not parameterized or parameterization was not applied

Product description

LED	Color	State	Description
P		Diagnostics of the safe communication protocol	
		Off -- --	No safe communication
		Green on GN GN	Safe communication running without malfunction
		Green flashing GN --	Safe communication is running. The control requests "Operator Acknowledgement"
E		Diagnostic error	
		Off -- --	No error
		Red on RD RD	Peripheral error
MS		CSos module status	
		Off -- --	
		Red/green flashing GN RD	Self test or configuration is active or required
		Green flashing GN --	Module is in "Stop" state. The safe state is transferred for each input ("0" in the process data image of the inputs)
		Green on GN GN	The module processes the inputs
		Flashing red RD --	Recoverable error. Recoverable errors are for example configuration errors of the Csos firmware
		Red on RD RD	Unrecoverable error. It is possible that the module has to be replaced

LED	Color	State	Description
NE		CSos safety network status	
		Off -- --	Module has no connection to the originator
		Green flashing GN --	The connection to the originator is established, but no I/O data is exchanged
		Green on GN GN	I/O data is exchanged with the originator
		Flashing red RD --	I/O connection to originator failed
		Red on RD RD	An error was detected in the connection that does not allow further processing.
		Red/green flashing GN RD	The module is ready to set a new TUNID via DIP switches. The new TUNID is applied upon the next voltage startup
00-07		Status per input 0-7	
		Off -- --	Input logic "0"
		Green on GN GN	Input logic "1"

Tab. 3-3: Overview on diagnostic LEDs

LEDS cannot display any safety-relevant states. They may only be used for diagnostic purposes. Do not derive safety-relevant states from the LEDs!

3.8 Safe state

3.8.1 Overview

The safe state for the module is the transfer of the value "0" in the image of the inputs at the safe control.

The safe state for input data is "0".

Passivation causes a change to the safe state, refer to "Passivation" on page 84.

The safe state can be assumed in the following cases:

1. Operating state
2. Error detection in the periphery
3. Device error
4. Parameterization error

5. Error detection in the safe communication

3.8.2 Operating state

In the operating state, the inputs can assume either state "1" or state "0". State "0" is the safe state.

3.8.3 Error detection in the periphery

Inputs

If an error is detected at an input, the safe state is entered at this input and "0" is displayed in the process data image of the input ("0" = safe state).

☞ **Operating time in incorrect state:**

If the module goes into an incorrect state, the user has to check, acknowledge and recover this error within the next 72 hours to avoid an increasing number of errors.

If the operating state is faulty, no module-internal tests run anymore and due to an increasing number of errors, it is possible, that the safe state is left.

Depending on the parameterization, the following errors can be detected at the inputs:

- Short circuit
- Cross-fault
- Overload or short circuit at the clocking outputs

The diagnostic message is transferred to the control, refer to chapter 10 "Errors: Message and recovery" on page 63. For information on which error occurs in which case, refer to chapter 8 "Connection examples of the safe inputs" on page 37.

3.8.4 Device errors

Device errors can close the safe communication.

Inputs

If a hardware error is detected at an input in the internal circuit, **all** inputs of the module go into the safe state. In the process data image of the inputs, "0" is shown ("0" = safe state).

The diagnostic message is transferred to the control, refer to chapter 10 "Errors: Message and recovery" on page 63.

Fatal errors

All fatal errors causing the loss or limitation of the safety function, cause that the complete module goes into the safe state. The LED "FS" is lit permanently at the module.

The following fatal errors cause the safe state:

- Fatal hardware error in the internal circuit
- User error
- Module overloading
- Module overheating
- Incorrect supply

The diagnostic message is transferred to the control, refer to chapter 10 "Errors: Message and recovery" on page 63.

⚠ WARNING **Subsequent faults can cause the loss of the safety function**

To avoid aftereffects, disconnect the module completely from the voltage supply and replace it if there is a device fault.

3.8.5 Parameterization errors

Parameterization errors are displayed in the following states:

- Incorrect parameterization

After parameterization errors, the module goes into the safe state. The LED "FS" flashes at the module.

If the parameterization is incorrect, a diagnostic message is transferred to the control, refer to chapter 10.2.5 "Parameterization errors" on page 70.

3.9 Programming and configuration data

Bosch Rexroth provides devices description files for control systems.

☞ Programming data and configuration data are bus- or network-specifically defined in the device description (SDDML, ...).

4 Integrating the local bus

4.1 General information

For the operation in an IndraControl S20 station, the module is integrated behind an IndraControl Sercos S20 bus coupler (S20-S3-BK+).

For detailed information on the setup of an IndraControl S20 station, refer to the application description of the IndraControl S20 system R911335988

⚠ WARNING **Loss of the safety function due to the use of unsuitable voltage supplies**

For the voltage supply at the bus coupler, use only voltage supplies acc. to EN 50178/VDE 0160 (PELV).

Ensure that the output voltage of the voltage supply for the bus coupler does also not exceed 30.2 V in case of error.

Observe the general safety instructions, refer to chapter 2.3 "Electrical safety" on page 8.

4.2 Supply voltage of the module logic

The voltage supply for the module logic is generated in the bus coupler and fed into the IndraControl S20 module via the bus base module.

For technical data of the supply voltage, refer to chapter 12.2.6 "Supply voltage U_{BUS} (logic)" on page 77.

The current currying capacity for the voltage supply U_{BUS} depends on the bus coupler used.

Observe the technical data and specifications in the bus coupler manual.

4.3 Supply voltage U_I

⚠ WARNING **Loss of the safety function due to the use of unsuitable voltage supplies**

Observe the general safety instructions, refer to chapter 2.3 "Electrical safety" on page 8.

The supply voltage U_I supplies the input circuits, the clocking outputs and the circuitry components of the periphery. For technical data of the supply voltage U_I, refer to chapter 12.2.7 "Supply voltage U_I (sensors, clocking outputs, periphery)" on page 78.

The maximum current carrying capacity via the U_I plug is 8 A.

⚠ CAUTION **A parallel reverse polarity protection is implemented into the module. This protection is only temporally limited.**

To avoid a module defect, proceed as follows:

- Due to the maximum current carrying capacity of 8 A, protect the voltage supply U_I externally with a fuse of 8 A (slow).
- Only use PELV power supply units with at least 4 times the nominal current required for triggering. Thus, triggering times of less than 300 ms can be ensured

The supply voltage U_I has to be fed via connection to the functional earth acc. to EN 60204-1.

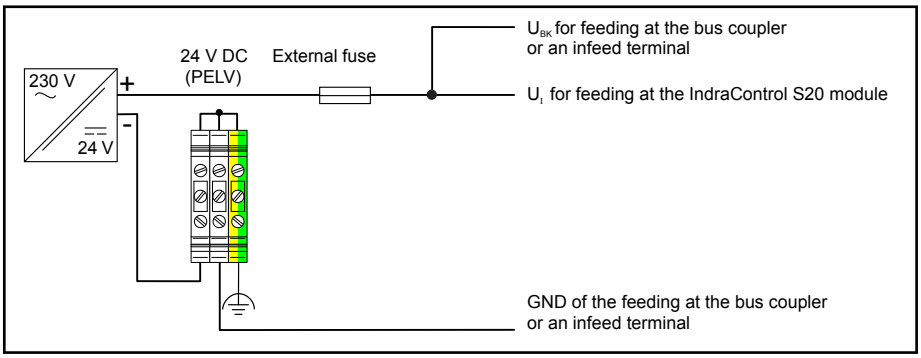


Fig. 4-1: Feeding U_I with connection to the functional earth acc. to EN 60204-1

Observe the information on the module behavior when an error occurs at the supply voltage U_I, refer to chapter 10.2.4 "Errors of the supply voltage" on page 70.

4.4 DC distribution network acc. to IEC 61326-3-1

⚠ WARNING **Module electronics destroyed due to overvoltage!**

Do no use a "DC distribution network".

A DC distribution network is a DC distribution net supplying a complete industrial warehouse with direct voltage. Any devices can be connected to it. A typical system or machine distribution is no DC distribution network. For devices intended for a typical system or machine distribution, the DC connections are considered and checked as I/O signals acc. to IEC 61326-3-1.

5 Mounting, demounting and electric installation

5.1 Mounting and demounting

5.1.1 Unpacking module

NOTICE **Module damage due to electrostatic discharge**

Comply with the required safety measures against electrostatic discharge (ESD) acc. to EN 61340-5-1 and IEC 61340-5-2 when handling the module.

Read the package insert and follow the instructions.

Only qualified staff is allowed to mount and demount the module.

5.1.2 Preparation and mounting

⚠ WARNING **Unintended machine startup due to installation works without to ensure that there is no voltage applied**

- Disconnect the complete IndraControl S20 station from the voltage and secure the system against restart before mounting or demounting the module
- Connect the voltage only after the system has been set up completely and ensure that there is no hazard originating from the station or the system. Observe the diagnostic displays and possible diagnostic messages

Install the module in a dust- and humidity-proof control cabinet or terminal box (IP 54 or higher) on a 35 mm mounting rail.

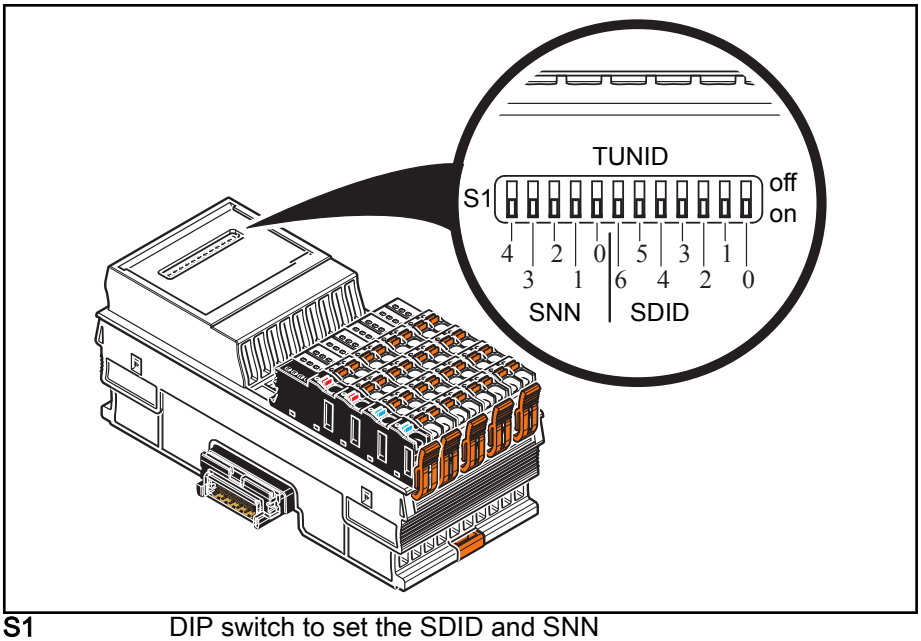
Protect the control cabinet or the terminal box against opening by unauthorized parties.

To connect the cables, use only IndraControl S20 plugs provided upon delivery.

5.1.3 Setting DIP switch

A DIP switch is located on the upper side of the module.

Mounting, demounting and electric installation



S1 DIP switch to set the SDID and SNN

Fig. 5-1: DIP switch

12-pin DIP switch: Address

Set the TUNID (SDID + SNN) for the CSos device.

The SDID addresses from 1 to 127 (1_{hex} to $7F_{hex}$) are permitted.

The SNN addresses from 1 to 31 (1_{hex} to $1F_{hex}$) are permitted.

The TUNID is shown as follows:

TUNID = SDID*1000000000000_{hex} + (600000000_{hex} + SNN)

SNN					**SDID**						
Address switch											
4	3	2	1	0	6	5	4	3	2	1	0
MSB SNN				LSB SNN	MSB SDID						LSB SDID
1_{hex} to $1F_{hex}$					1_{hex} to $7F_{hex}$						

MSB The"Most Significant Bit" (MSB) has the highest significance.
LSB The "Least Significant Bit" (LSB) has the lowest significance.

Tab. 5-1: Switch position at CSos

Example:

Calculating the TUNID using the DIP switch position

SDID: 23 = 17_{hex} ⇒ DIP switches 4, 2, 1 and 0 to "on"

SNN: 1 = 1_{hex} ⇒ DIP switch 0 to "on"

Resulting TUNID: $0000001700060000001_{hex}$

Setting address

1. Remove the labeling field.
2. Set the address.
3. Attach the labeling field again to the module.

The set address is only applied when applying the voltage supply (power-up). If the address is changed at runtime, the module responds with "FailureState".

Delete a possibly existing configuration on the module before mounting it. Delete by setting a new SNN or SDID at the DIP switches.

If the DIP switch position is changed, the module deletes its parameterization and responses like a new module.

If an invalid safety address - SNN=0 and/or SDID=0 is set, the module remains in the state "Wait for TUNID" after voltage start-up.

Parameters

The TUNID is mapped in the Sercos parameter S-0-1800.x.19. x describes the number of the module slot. The active TUNID can be checked by reading out the parameter S-0-1800.x.19.

5.1.4 Mounting and demounting modules

Mounting bus base module

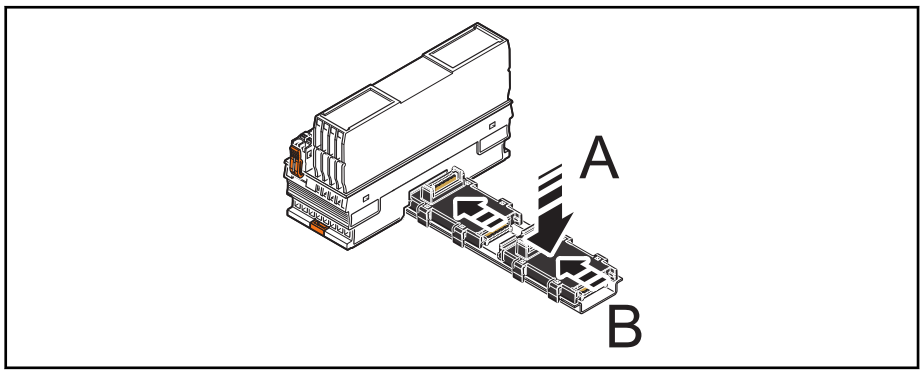


Fig. 5-2: Mounting bus base module

1. Set all bus base modules required for the station on the mounting rail (A).
2. Push the bus base modules into the connection of the bus coupler or the previous bus base module (B).

Snapping on and removing the electronics module

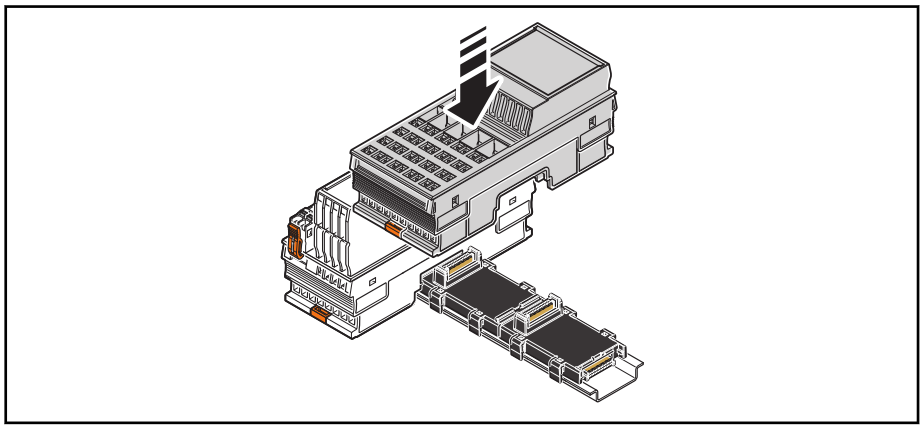


Fig. 5-3: Snapping on the module

1. Place the module vertically to the bus base module on the mounting rail until the is audibly engaged.

   Ensure that the device plug for the bus base connection is located above the respective socket on the bus base module.

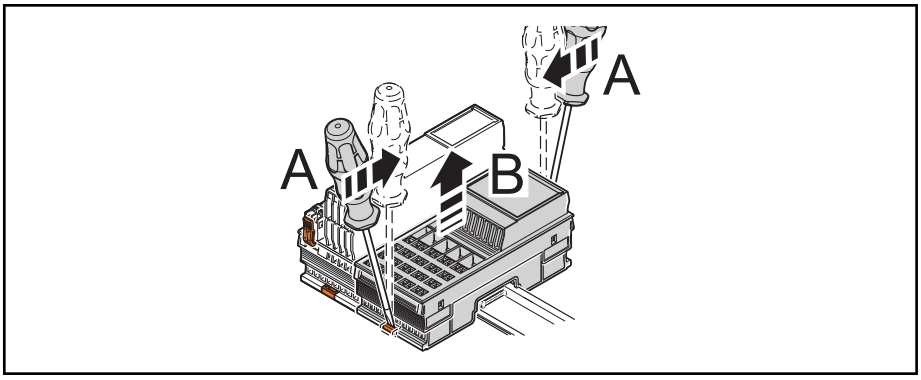


Fig. 5-4: Removing module

1. Before removing, remove all plugs of the module.
2. Use a suitable tool (e.g. slotted screwdriver) and put it first into the upper and then into the lower disengaging mechanism (base latch) of the module to disengage it (A).
3. Remove the module vertically to the mounting rail (B).

Attaching and removing plugs

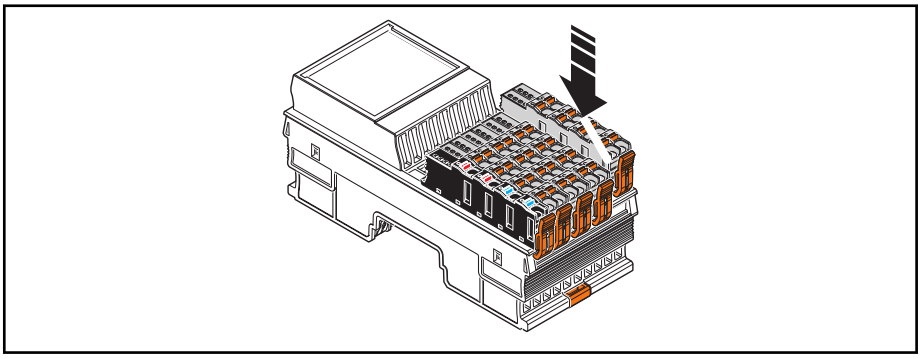


Fig. 5-5: Attaching plug

1. Set the plug vertically to its position. The plugs are color-coded, but not hardware-coded. Observe the colored markings of the plugs or slots. Assignment from left to right: blue, red, white, green.
2. Press the plug down until it is fix. Ensure that the locking clip engages.

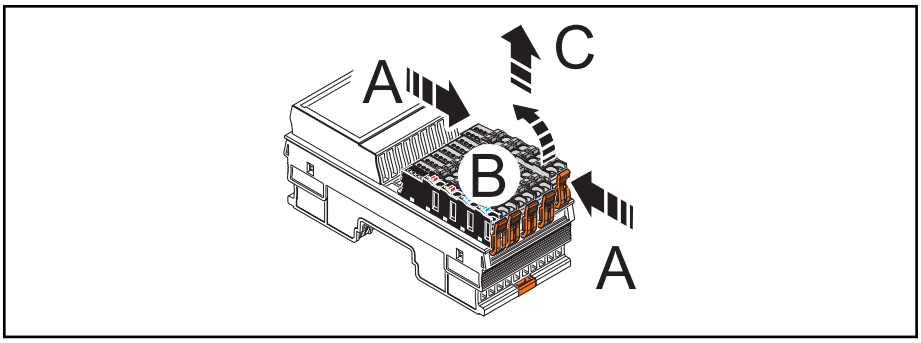


Fig. 5-6: Removing plug

1. Disengaging the locking clips (A).
2. Tilt the plug a bit up (B).
3. Remove the plug from the module (C).

5.2 Electric installation

5.2.1 General information

⚠ WARNING **Electric shock and unintended machine start-up due to installation works without to ensure that there is no voltage applied!**

- Disconnect the complete system from the voltage before performing installation works and secure the system against unintended voltage application
- Connect the voltage only after the setting is complete and ensure that there is no hazard originating from the station or the system. Observe the diagnostic displays and possible diagnostic messages

5.2.2 Electric installation of the IndraControl S20 station

For the electric installation of the IndraControl S20 station, proceed as follows:

- Connection to the parent bus system
- Connection of the supply voltages for the IndraControl S20 station

Perform the electric installation of the IndraControl S20 station as described in the following manuals:

- Application description of the IndraControl S20 system R911335988
- Sercos system manual for I/O devices R911333512

Observe the additional information in the documentation of the bus coupler.

5.2.3 Electric installation of the module

☞ Observe the general safety instructions, refer to chapter 2.3 "Electrical safety" on page 8.

⚠ WARNING **Loss of the safety function as well as material damage due to an incorrect installation**

- Take measures against exchanging or reversing the polarity of connections
- Impede manipulations at the connections

The voltage supply for the module electronics is fed in at the bus coupler. From there, the supply voltage of the module logic is provided via the bus base module. The supply voltage of the input circuits, clocking outputs and periphery is directly fed in at the module.

The sensors are connected via the IndraControl S20 plug.

Wire the connectors according to their application, refer to chapter 3.4 "Assigning terminal points" on page 12.

6 Parameterizing the module

6.1 Setting CSos and device parameters

The following tasks belong to the parameterization:

- Specify TUNID (SNN and SDID)
- Parameterize inputs
- Adjust the Safety configuration CRC (SCCRC)

☞ The projected communication address in the project of the control has to match the address set on the device.

The settings on the device are applied after a power-up.

TUNID

TUNID is a unique module ID in the Csos network topology. TUNID is specified in the configuration software.

Set the address previously specified in the configuration software via the DIP switch at the module, refer to chapter 5.1.3 "Setting DIP switch" on page 25.

Parameterizing inputs and clocking outputs

Parameterizing the safe inputs determines the module behavior and affects the attainable safety integrity.

Whenever adding voltage or upon reset, the control writes the parameterization created in the parameterization tool automatically to the module.

The following conditions have to be met:

- Supply voltage applied
- Local bus is in "RUN" state
- Communication between control and module is established

If the module is not parameterized, it is not ready. The LED "FS" flashes.

If the parameters are valid for all inputs and transferred without errors, the module is ready. Valid input data is only read in in this state. In each other state, the safe state is transferred for each input ("0" in the process data image of the inputs).

If an error was detected during the parameterization, the parameterization data is not applied. The flashing LED "FS" indicates that the parameterization is invalid.

The error is additionally reported to the control. In this case, check and correct the settings. For information on error messages and troubleshooting, refer to chapter 10 "Errors: Message and recovery" on page 63.

CSos and device parameters

Specify the parameterizable Csos parameters and device parameters. For an overview on the modules parameters and possible settings, refer to chapter 14 "CSos parameters and device parameters" on page 85.

6.2 Parameterizing safe inputs

The individual input pairs of a module can be parameterized differently. Thus, different safety integrities (SIL, SILCL, cat., PL) can be attained.

Dual-channel

The following specified assignment applies to the inputs in dual-channel operation:

- IN0_Ch1 to IN0_Ch2
- IN1_Ch1 to IN1_Ch2
- IN2_Ch1 to IN2_Ch2

- IN3_Ch1 to IN3_Ch2

The input information of both inputs are mapped on one bit. Unused bits are always set to "0".

Single-channel

In case of a single-channel assignment, the inputs can parameterized in a way that they operate independently from each other.

Parameterization

The safe inputs are parameterized in pairs per plug. For the parameterization options, refer to the following table:

Parameterization	Value range	Notes
Assignment	**Not assigned** Assigned, both single-channel Dual-channel equivalent Dual-channel antivalent	Parameterize the input pairs in pairs. For unassigned inputs, data is filled with "0". The inputs assigned to each other is specified in the dual-channel operation
Filter time (t_{Filter})	1.5 ms **3 ms** 5 ms 15 ms	The input signals are dejammed during the filter time. When selecting the filter time, ensure that the duration of the input signal is longer than the filter time. **Note:** The filter time affects the response time of the safety function
Symmetry	**Disabled** 100 ms 1 s 5 s	The parameterization is only active if the input is parameterized as dual channel. Also refer to "Symmetry and switch-on inhibit" on page 32
Switch-on inhibit in case of symmetry violation	**Disabled** Enabled	Disabled: If the symmetry is violated, only one diagnostic message is generated. Enabled: If the symmetry is violated, a diagnostic message is generated. The respective input is additionally set into the safe state
Cross-fault detection	No cross-fault monitoring **Cross-fault monitoring** INx_CH1 -> T1 INx_CH2 -> T2	If the cross-fault monitoring is switched on at an assigned input pair, the clocking outputs T1 and T2 are clocked. Otherwise, the clocking outputs are switched on without clocking

The default values are shown in **bold**

Tab. 6-1: Parameterization per input pair

Symmetry and switch-on inhibit

Use the symmetry monitoring to monitor the contact wear of the switches. The symmetry monitoring checks to what extent the (filtered) inputs belonging together simultaneously assume a different state. The symmetry is considered as violated if the inputs report non-matching states for a period longer than the value parameterized for the "symmetry". This applies to negative and positive edges.

Key for the following figures:

Representation	Meaning
S	Time set for the symmetry monitoring
Diag	Diagnostics
Q	Acknowledgement of the diagnostics message. After acknowledging the diagnostic message, the current state is read in

If the parameterization is antivalent, a negated signal is present at the mapped input IN0_Ch2.

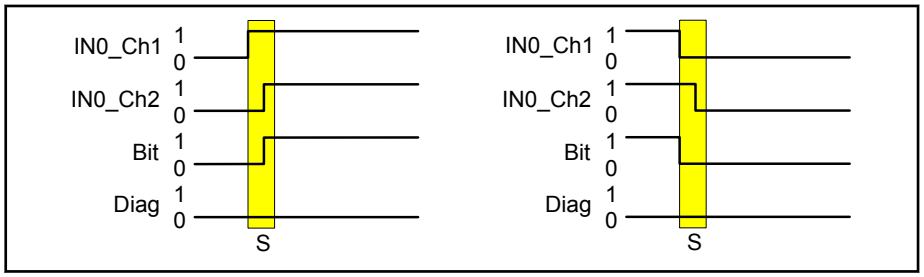


Fig. 6-1: Example of a signal change in the parameterized period for the symmetry monitoring

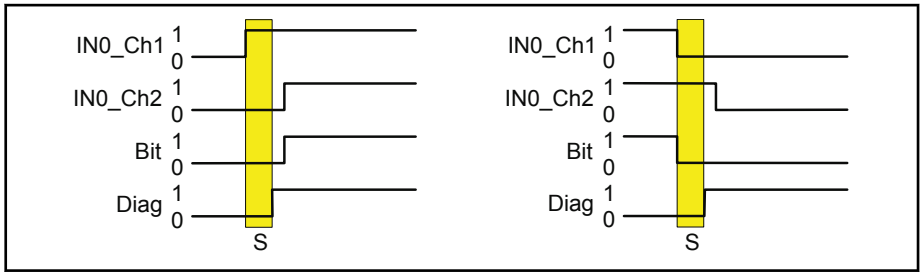


Fig. 6-2: Example of a signal change outside the parameterized period for the symmetry monitoring, switch-on inhibit disabled for symmetry violation

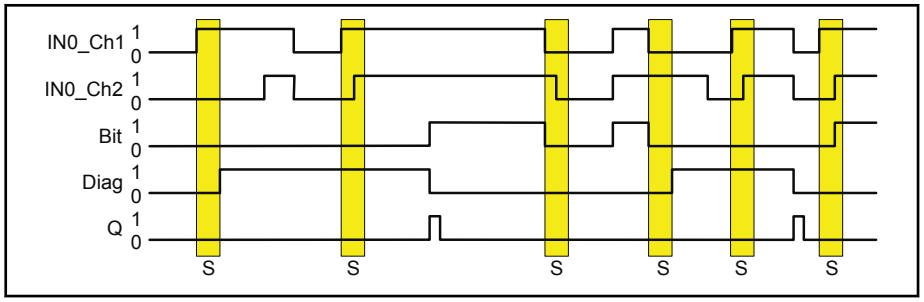


Fig. 6-3: Example of a signal change outside the parameterized period for the symmetry monitoring, switch-on inhibit enabled for symmetry violation

After acknowledging the diagnostic message, the state present at the input is immediately transferred to the control, refer to chapter 10.4 "Acknowledging an error at Csos" on page 71. If required, implement a startup inhibit in the application program after the error has been acknowledged.

The symmetry can also be violated by a cross-fault, refer to chapter 8 "Connection examples of the safe inputs" on page 37.

Parameterizing the module

Processing time of the input t_{IN} for a safety requirement

The processing time of the input t_{IN} for a safety requirement consists of the parameterized filter time t_{Filter} and the runtime of the firmware t_{FW}:

$t_{IN} = t_{Filter} + t_{FW}$

This includes:

t_{IN}	Processing time of the input
t_{Filter}	Parameterized filter time
t_{FW}	Firmware runtime: 2 ms

7 Duration of a safety requirement

The duration of a safety requirement has to be higher than the processing time of the respective input t_{IN}, refer to "Processing time of the input t_{IN} for a safety requirement" on page 34.

If the safety module identifies a safety requirement (safe "0") after the processing time of the input t_{IN} elapsed, the safety requirement is prolonged by the module until the safety requirement was transported to the safe control.

⚠ WARNING **Loss of the safety function due to the duration of the safety requirement that is too short**

- Observe the control response when processing the safe inputs
- Also observe the system-specific Csos behavior (e.g. watchdog time, processing time of the safe control) in addition to the processing time of the input t_{IN}

8 Connection examples of the safe inputs

8.1 Explanation on the examples

⚠ WARNING **Loss of the safety function due to incorrectly executed applications**

- Observe the information to attain the category, refer to chapter 8.2 "Measures to meet a certain safety integrity" on page 38
- To meet the specified PL, ensure that the sensor is provided with a corresponding diagnostic coverage and a corresponding MTTFd. For applications acc. to PL d, a high diagnostic coverage (> 99 %) is recommended. However, at least an average diagnostic coverage (90 % and 99 %) and an average MTTFd are required.

  For applications acc. to PL e, a high diagnostic coverage (> 99 %) and a high MTTFd are required
- Use sensors that can meet the required safety integrity.

☞ In these examples, also observe the standards IEC 61508, EN 62061 and EN ISO 13849-1 in addition to the actions mentioned in the table to meet the specified SIL/SILCL/Cat./PL.

☞ The notes given above apply to all the following connection examples.

Also observe the notes given in the individual connection examples.

If the settings match, the inputs of a module can meet different safety integrities (SIL, SILCL, cat., PL) at the same time.

The examples only describe how sensors can be electrically connected to the safe inputs.

For questions on your applications, please contact the service, refer to chapter 17 "Service and support" on page 99.

The following is specified for each example:

- **Key data**

  The table provides the important data for the example
- **Device diagnostics and module behavior in case of error**

  The diagnostic capability depends on the parameterization.

  If an error message is transferred to the control, the respective message is provided in the table. For information on the error code, the troubleshooting options and whether the error message has to be acknowledged, refer to chapter 10 "Errors: Message and recovery" on page 63.

  The diagnostic message "Symmetry volition" is only displayed if this diagnostic message was not disabled while parameterizing the respective input
- **Example parameterization**

  The table exemplarily shows all parameters for the specified assignment.

Connection examples of the safe inputs

Representation	Meaning
Bold	Mandatory setting
Normal	Exemplary setting. Depending on the application, another setting is possible.
-	Is not evaluated

Tab. 8-1: Key for the following tables

Faults (cross-faults. short circuits) that can be excluded if the installation is correct (e.g. protected cable routing, separated cable routing, double insulation, use of ferrules) are not considered in the table.

Only errors between inputs located on the same plug are observed. If the installation is correct, cross-faults against inputs and outputs of other plugs for example cannot occur.

8.2 Measures to meet a certain safety integrity

The attainable safety integrity (SIL, SILCL, category und performance level) is specified for each connection example.

SIL/SILCL

☞ Use the standard to determine the failure probability of your application acc. to IEC 61508 (SIL) or EN 62061 (SILCL).

Safety integrity	PFD[1)]	PFH[2)]
SIL 2/SILCL 2	1 % of 10^{-2}	1% of 10^{-6}
SIL 3/SILCL 3	1 % of 10^{-3}	1% of 10^{-7}

Tab. 8-2: PFD and PFH depending on SIL/SILCL

Performance Level

☞ Use the standard EN ISO 13849-1 to determine the Performance Level (PL)

Category

The categories are attained by applying the following measures:

Action	Cat. 2	Cat. 3	Cat. 4
Use proven and basic safety principles acc. to EN ISO 13849-2.	x	x	x
Use qualified sensors (refer to "Software requirements on sensors/commanding devices" on page 14)	x	x	x
Note that mechanical failure of the switching device can cause the loss of the safety function	x	x	x
Exclude non-opening of the contacts (e.g. by welding or mechanical failure if a switch is actuated (e.g. protection, redundancy, positive opening)	x	x	
Note that one single error can cause the loss of the safety function between the checks	x		

1) *"Probability of dangerous failure on demand"*

2) *"Probability of dangerous failure per hour"*

Action	Cat. 2	Cat. 3	Cat. 4
Ensure that the external wiring is regularly checked by the machine control upon machine startup. This check has to detect the loss of the safety function	x		
Consider errors with common cause		x	x
Note that all undetected errors can cause the loss of the safety function. Take measures allowing the exclusion of these errors (e.g. protected wiring of cables or double insulation). Observe the notes in the following tables		x	x
Ensure that one single error does not cause the loss of the safety function		x	
If single-channel sensors are not available for this category, use dual-channel sensors		x	
An accumulation of errors may not cause the loss of the safety function. The observation can be canceled after the third error if the probability that more errors occur is low			x

8.3 Single-channel assignment of the safe inputs

8.3.1 Notes

For the single-channel assignment of the safe inputs, the inputs run independently from each other. The assignment of each input signal to the clocking output cannot be freely selected.

Observe the following notes:

Cross-fault

Note that cross-faults to other inputs are only detected if the cross monitoring is enabled.

The error "cross-fault" causes the transfer of the safe state in the process data image of the respective inputs.

- Eliminate the error and acknowledge the message
- Observe the maximum error detection time of 64 ms

If a "1" signal is applied at the input and an error occurs, the error is detected at the latest after 64 ms. During this period, "1" can still be transferred in case of an error.

The error can cause an unexpected change in state from "0" to "1" during the error detection time (max. 64 ms).

- Ensure that the system does not accidentally start again after such changes in state
- Note that the processing time of the input t_{IN} can increase up to 64 ms is an error occurs.

To supply the voltage for the single-channel assignment, use the respective clocking output or the external voltage supply (external +24 V or OSSD).

State analysis

The module evaluates the input states and sends the result to the control.

The following values are transferred in the process data image of a safe input:

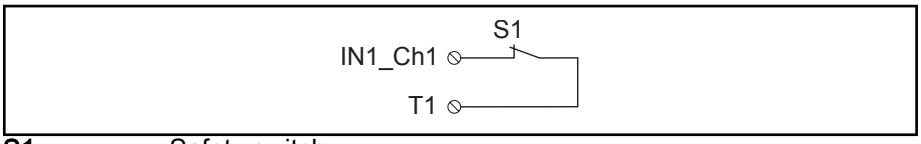
- "0" if a "0" signal is applied at the input or if an error was detected
- "1" if a "1" signal is applied at the input or if no error was detected

Connection examples of the safe inputs

8.3.2 Cross-fault monitoring enabled

If an input pair is parameterized as single-channel with cross-fault monitoring, the following assignment applies:

- INx_Ch1 is assigned to the clocking output T1
- INx_Ch2 is assigned to the clocking output T2



S1 Safety switch

Fig. 8-1: Single-channel assignment of inputs

Key data

Sensor	Single-channel
Sensor supply	Internal by clocking output T1 (clocked) or T2 (clocked)
Attainable SIL/ SILCL/Cat./PL	SIL 2/SILCL 2/Cat. 3/PL d

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	**No**	None	**Yes**	The error cannot be detected and causes a loss of the safety function
Non-closing of a contact	**No**	None	No	The error cannot be detected
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between clocking output and sensor or between sensor and input)	Yes	None	No	• Behavior in state "1" of the input: The error is detected as change in state from "0" to "1": A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart • Behavior in state "0" of the input: Note that when switching on the safety switch again, this error can cause a delayed transfer of state "1" in the process data image of the inputs
Cross-fault				
Input against input	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged. If the inputs are assigned to different clocking outputs, this error is identified as cross-fault after 64 ms
Input against assigned clocking output	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged

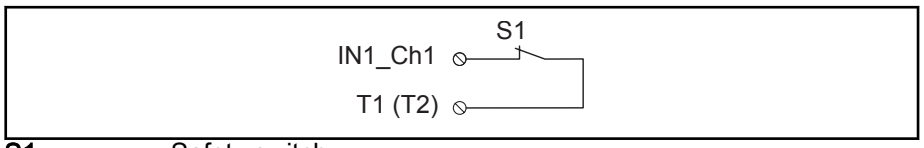
Error type	Identification	Diagnostics	Loss of the safety function	Notes
Input against unassigned clocking output	Yes	Cross-fault	No	Refer to "Cross-fault" on page 39
Clocking output against clocking output	Yes, if state is “1”	Cross-fault	No	The error is only detected in state "1" of the input
Short circuit				
Input against ground	Yes	None	No	Only in state "1" of the input, the error is detected change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart
Clocking output against ground	Yes	Short circuit	No	The affected clocking output is disabled

Tab. 8-3: Single-channel: Supply by T1 (clocked) or T2 (clocked)

Example parameterization

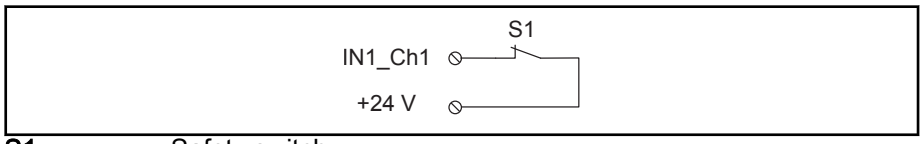
Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Both single-channel**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	Disabled	-
Switch-on inhibit in case of symmetry violation	Disabled	-
Cross-fault monitoring	Cross-fault monitoring	-

8.3.3 Cross-fault monitoring disabled, supplied by T1



S1 Safety switch
T1 Supply by T1

Fig. 8-2: Single-channel assignment of inputs, supplied by T1



S1 Safety switch
+24 V Supply by external 24 V

Fig. 8-3: Single-channel assignment of inputs, external supply

Connection examples of the safe inputs

Key data

Sensor	Single-channel switch
Sensor supply	• Internal by clocking output T1 or T2; cross-fault monitoring disabled • External (24 V)
Attainable SIL/ SILCL/Cat./PL	SIL 2/SILCL 2/Cat. 2/PL d

⚠ WARNING **Loss of the safety function due to cross-faults**

Exclude the cross-faults to attain the given PL.

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	**No**	None	**Yes**	The error cannot be detected and causes a loss of the safety function
Non-closing of a contact	**No**	None	No	The error cannot be detected
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between clocking output and sensor or between sensor and input)	Yes	None	No	• Behavior in state "1" of the input: The error is detected as change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart • Behavior in state "0" of the input: Note that when switching on the safety switch again, this error can cause a delayed transfer of state "1" in the process data image of the inputs
Cross-fault				
Input against input	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged
Input against clocking output	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged
Short circuit				
Input against external 24 V	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Input against ground	Yes, if state is "1"	None	No	Only in state "1" of the input, the error is detected change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart
Clocking output against external 24 V	No	None	No	The error cannot be detected, as the clocking was switched off
Clocking output against ground	Yes	Short circuit	No	The affected clocking output is disabled
External 24V against ground	Yes	None	No	Only in state "1" of the input, the error is detected change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart

Tab. 8-4: Single-channel without cross-fault monitoring, supplied by T1/T2, external supply or OSSD

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Both single-channel**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	Disabled	-
Switch-on inhibit in case of symmetry violation	Disabled	-
Cross-fault monitoring	No cross-fault monitoring	-

8.3.4 Supply by OSSD

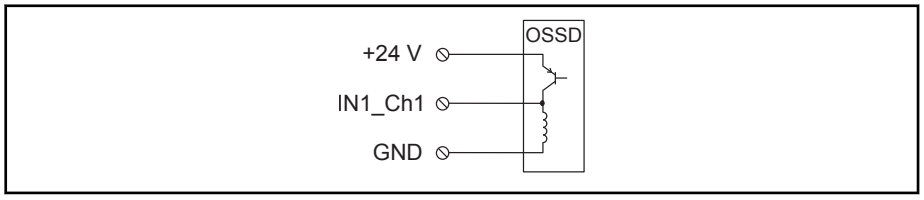


Fig. 8-4: Single-channel assignment of inputs, external supply (OSSD)

⚠ WARNING **Loss of the safety function due to parasitic voltage**

Directly connect the ground of the sensor at the terminal point "GND" of the module. Using an external ground is not permitted.

Connection examples of the safe inputs

Key data

Sensor	Single-channel OSSD output (with internal testing)
Sensor supply	External (OSSD sensor)
Attainable SIL/ SILCL/Cat./PL	SIL 2/SILCL 2/Cat. 2/PL d

⚠ WARNING **Loss of the safety function due to cross-faults**

Exclude the cross-faults to attain the given PL.

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
(Depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between sensor and input)	Yes	None	No	• Behavior in state "1" of the input: The error is detected as change in state from "0" to "1": A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart • Behavior in state "0" of the input: Note that when switching on the safety switch again, this error can cause a delayed transfer of state "1" in the process data image of the inputs
Input (Line break between sensor and GND)	No	None	No	The sensor has to detect the error. The sensor has to ensure that the safe state is entered when the error occurs
Cross-fault				
Input against input	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged
Input against clocking output	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged
Short circuit				
Input against external 24 V	**No**	None	**Yes**	The error cannot be detected and causes the loss of the safety function, as the safety switch is bridged
Input against ground	Yes, if state is "1"	None	No	Only in state "1" of the input, the error is detected change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart
Clocking output against external 24 V	**No**	None	No	The error cannot be detected, as the clocking was switched off

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Clocking output against ground	Yes	Short circuit	No	The affected clocking output is disabled
External 24V against ground	Yes	None	No	Only in state "1" of the input, the error is detected change in state from "1" to "0". A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart

Tab. 8-5: Single-channel without cross-fault monitoring, supplied by OSSD

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Both single-channel**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	Disabled	-
Switch-on inhibit in case of symmetry violation	Disabled	-
Cross-fault monitoring	No cross-fault monitoring	-

☞ Set the filter time of the input to a higher value than the width of the test pulse of the OSSD sensor.

The input has to be parameterized without cross-fault monitoring.

8.4 Dual-channel equivalent assignment of the safe inputs

8.4.1 General information

For the dual-channel assignment of the safe inputs, two adjacent inputs of the same plug are used. This assignment cannot be parameterized, refer to "Dual-channel" on page 31.

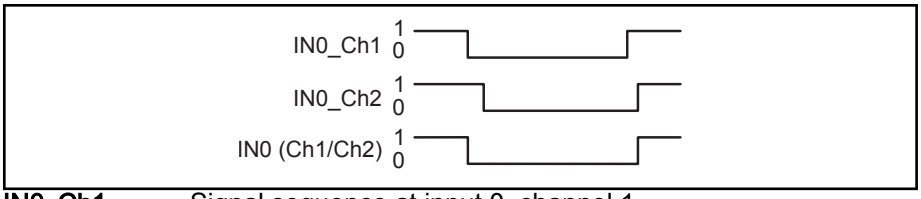
For the dual-channel equivalent assignment, the state only changes from "0" to "1" if both inputs change the state from "0" to "1". If the symmetry monitoring is set and the state does not change within the parameterized period at the inputs, a diagnostic message is generated.

If the signal state is "1", the input is active.

☞ Note that when switching on the safety switch again, a delayed change in state at one of the two inputs can cause a delayed transfer of state "1" in the process data image of the inputs.

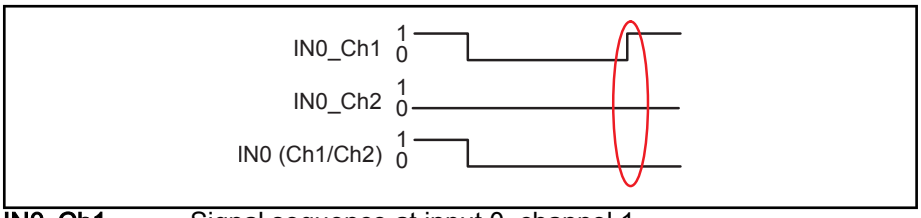
Connection examples of the safe inputs

Example on a correct and an incorrect signal change



IN0_Ch1 Signal sequence at input 0, channel 1
IN0_Ch2 Signal sequence at input 0, channel 2
IN0 (Ch1/Ch2) Safety-relevant signal for the dual-channel input 0, channel 1 and channel 2 at the control

Fig. 8-5: Correct signal change



IN0_Ch1 Signal sequence at input 0, channel 1
IN0_Ch2 Signal sequence at input 0, channel 2
IN0 (Ch1/Ch2) Safety-relevant signal for the dual-channel input 0, channel 1 and channel 2 at the control

Fig. 8-6: Error when changing the signal

In fig. 8-6 "Error when changing the signal" on page 46, the condition, that both signals had to be in state "0" before changing the state from "0" to "1", is not met. In this case, a diagnostic message is generated.

State analysis

The module evaluates the input states and sends the result to the control.

The following values are transferred in the process data image of the safe inputs:

- "0" if a "0" signal is applied at least at one of the two inputs or if an error was detected
- "1" if a "1" signal is applied at both inputs and if no error was detected and if the conditions to change the state are met as in fig. 8-5 "Correct signal change" on page 46.

8.4.2 Notes on errors

Observe the following notes on "cross-fault" and"symmetry violation":

Cross-fault

The error **cross-fault** causes the transfer of the safe state in the process data image of the respective inputs.

Eliminate the error and acknowledge the message.

Acknowledging the diagnostic message deletes the message and switches the input to active. The states are immediately detected at the input.

- Ensure in the application program that the system does not start accidentally again after acknowledging the diagnostic message
- Observe the maximum error detection time of 64 ms

For exceptions in the error detection time, refer to the following tables. If a "1" signal is applied at the input and an error occurs, the error is detected at the latest after 64 ms. During this period, "1" can still be transferred in case of an error.

The error can cause an unexpected change in state from "0" to "1" during the error detection time.

Ensure that the system does not start accidentally again after such changes in state.

Symmetry violation

- The diagnostic message "Symmetry violation" is only displayed if this diagnostic message was not disabled while parameterizing the respective input
- **Switch-on inhibit if the symmetry violation is disabled:**

  The message “Symmetry violation” does not cause the transfer of the safe state, refer to "Symmetry and switch-on inhibit" on page 32.

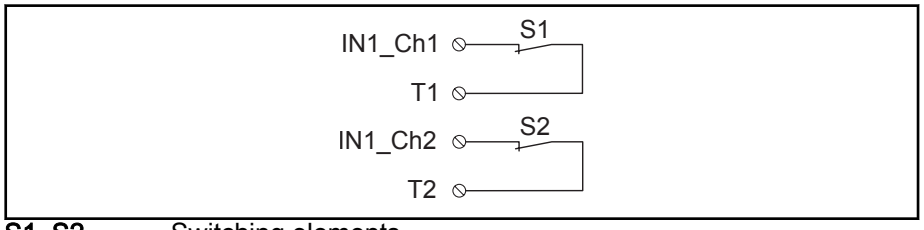
  The message has to be acknowledged. However, the current status of all inputs is always displayed in the process data image of the inputs
- **Switch-on inhibit if the symmetry violation is enabled:**

  The message “Symmetry violation” causes the transfer of the safe state, refer to "Symmetry and switch-on inhibit" on page 32

  The message has to be acknowledged. After acknowledgement, the current status of all inputs is displayed in the process data image of the inputs
- The message can be used for wear monitoring of the safety switch

8.4.3 Cross-fault monitoring enabled, supplied by T1 and T2

Possible assignment variants:



S1, S2 Switching elements
T1, T2 Supply by T1 **and** T2

Fig. 8-7: Dual-channel equivalent assignment of the inputs, supplied by T1 and T2 (both clocked)

Key data

Sensor	Dual-channel equivalent with cross-fault monitoring
Sensor supply	Internal by clocking output T1 **and** T2 (both clocked)
Attainable SIL/ SILCL/Cat./PL	SIL 3/SILCL 3/cat. 4/PL e

Observe the information to understand the change in state, refer to "Example on a correct and an incorrect signal change" on page 46

Device diagnostics and module behavior in case of error

Connection examples of the safe inputs

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	Yes	Symmetry violation①	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0":The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the corresponding inputs, as the incorrect input has not entered state "0"
Non-closing of a contact	Yes	Symmetry violation①	No	The error cannot be detected
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between clocking output and sensor or between sensor and input)	Yes	Symmetry violation①	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Cross-fault				
Input against input	Yes	Cross-fault	No	The error is detected in state "1"
Input against assigned clocking output	Yes	Symmetry violation①	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0":The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the inputs if the incorrect input has not yet entered into state "0"
Input against unassigned clocking output	Yes	Cross-fault	No	Refer to "Cross-fault" on page 46
Clocking output against clocking output	Yes	Cross-fault	No	The erros is detected at the inputs assigned to different clocking outputs
Short circuit				

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Input against ground	Yes	Symmetry violation①	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Clocking output against ground	Yes	Short circuit	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel. The error is also detected as short circuit of the clocking output. The affected clocking output is disabled

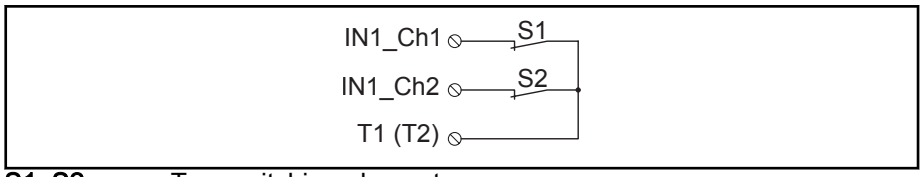
① Applies only if the symmetry monitoring is enabled

Tab. 8-6: Dual-channel equivalent with cross-fault monitoring, supplied by T1 and T2

Example parameterization

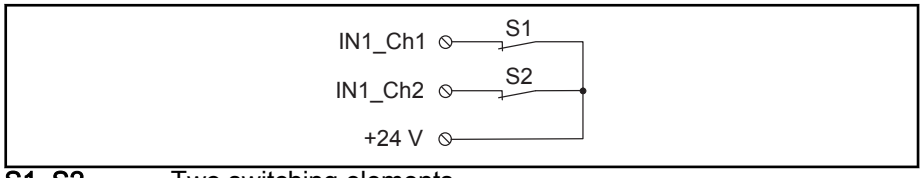
Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Dual-channel equivalent**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	100 ms	Application-dependent
Switch-on inhibit in case of symmetry violation	Enabled	Application-dependent
Cross-fault monitoring	Cross-fault monitoring	-

8.4.4 Cross-fault monitoring disabled, supplied by a clocking output or external supply



S1, S2 Two switching elements
T1 (T2) Supply by T1 **or** T2

Fig. 8-8: Dual-channel equivalent assignment of the inputs, supplied by T1 (or T2), cross-fault monitoring disabled



S1, S2 Two switching elements
+24 V External voltage supply

Fig. 8-9: Dual-channel equivalent assignment of the inputs, external supply, cross-fault monitoring disabled

Key data

Sensor	Dual-channel equivalent
Sensor supply	Internal by clocking output T1 (or T2) **or** external
Attainable SIL/ SILCL/Cat./PL	SIL 3/SILCL 3/Cat. 3/PL d

Connection examples of the safe inputs

Observe the information to understand the change in state, refer to "Example on a correct and an incorrect signal change" on page 46

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	Yes	Symmetry violation①	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0":The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the corresponding inputs, as the incorrect input has not entered state "0"
Non-closing of a contact	Yes	Symmetry violation①	No	The error cannot be detected
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Line break between clocking output or external supplier and sensor	Yes	None	No	Behavior in state "1" of the input: The error is detected as change in state from "0" to "1": A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart
Line break between sensor and input	Yes	Symmetry violation①	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Cross-fault				
Input against input	**No**	None	No	An accumulation of errors can cause the loss of the safety function
Input against clocking output	Yes	Symmetry violation①	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0": The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the corresponding inputs if the incorrect input has not entered state "0"

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Clocking output against clocking output	**No**	None	No	The error is not detected
Short circuit				
Input against external 24 V	Yes	Symmetry violation①	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0": The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the inputs, as the incorrect input was not set to "0" before
Input against ground	Yes	None	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Unclocked clocking output against external 24 V	**No**	None	No	The error is not detected
Clocking output against ground	Yes	Short circuit	No	The error is detected as change in state from "0" to "1": A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause a accidental system restart. The error is also detected as short circuit of the clocking output. The affected clocking output is disabled
External 24V against ground	Yes	None	No	The error is detected as change in state from "0" to "1": A unexpected change from "0" to "1" is possible. Ensure that such a change in state does not cause an accidental system restart

① Applies only if the symmetry monitoring is enabled

Tab. 8-7: Dual-channel equivalent, cross-fault monitoring disabled, supplied by a clocking output or external supply

☞ For all inputs parameterized without cross-fault monitoring, cross-faults and short circuits are not detected by the device diagnostics, but when the state of the input signals changes, as the state changes only in one channel.

⚠ WARNING **Loss of the safety function due to an increasing number of errors**

Test the safety function in reasonable intervals to detect errors early.

Connection examples of the safe inputs

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Dual-channel equivalent**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	100 ms	Application-dependent
Switch-on inhibit in case of symmetry violation	Disabled	Application-dependent
Cross-fault monitoring	**No cross-fault monitoring**	-

8.4.5 External supply (OSSD)

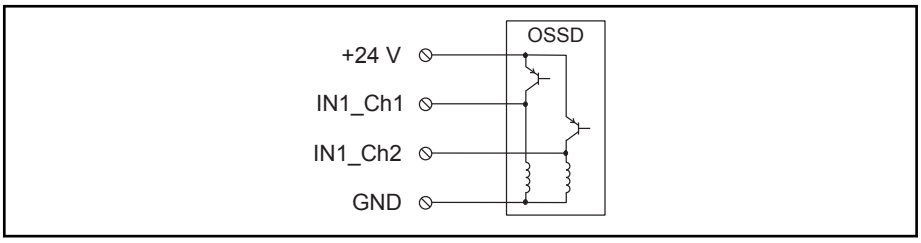


Fig. 8-10: Dual-channel equivalent assignment of the inputs, external supply (OSSD)

⚠ WARNING **Parasitic voltage can cause the loss of the safety function**

Directly connect the ground of the sensor at the terminal point GND of the safety module. Using an external ground is not permitted.

Key data

Sensor	Dual channel OSSD output (with internal testing)
Sensor supply	External (OSSD sensor)
Attainable SIL/ SILCL/Cat./PL	SIL 3/SILCL 3/cat. 4/PL e

☞ Observe the information to understand the change in state, refer to "Example on a correct and an incorrect signal change" on page 46

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Channel failure	Yes	Symmetry violation[1]	No	The error is detected when the state is changed, as the state changes only in one channel. • Changing state from "1" to "0": The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs • Changing state from "0" to "1": "0" is transferred in the process data image of the inputs, as the incorrect input was not set to "0" before
Depending on the sensor				Consider all errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break: sensor ⇔ input)	Yes	Symmetry violation[1]	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Input (Line break: sensor ⇔ GND)	No	None	No	The sensor has to detect the error. The sensor has to ensure that the safe state is entered when the error occurs
Cross-fault				
Input against input	**No**	None	**Yes**	The error has to be detected by the sensor. The sensor has to ensure that the safe state is entered when the error occurs
Input against clocking output	Yes	Symmetry violation[1]	No	The error is detected upon change in state if the clocking output is set to "1", as the state changes only in one channel
Short circuit				
Input against 24 V	Yes	Symmetry violation[1]	No	The error is detected when changing the state, as the state changes only in one channel
Input against ground	Yes	Symmetry violation[1]	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel

1 Applies only if the symmetry monitoring is enabled

Tab. 8-8: Dual-channel equivalent, external supply (OSSD)

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Dual-channel equivalent**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	100 ms	Application-dependent

Connection examples of the safe inputs

Parameterization	Parameterized as/value range	Notes
Switch-on inhibit in case of symmetry violation	Disabled	Application-dependent
Cross-fault monitoring	No cross-fault monitoring	-

☞ Set the filter time of the input to a higher value than the width of the test pulse of the OSSD sensor.

The input has to be parameterized without cross-fault monitoring.

8.5 Dual-channel antivalent assignment of the safe inputs

8.5.1 General information

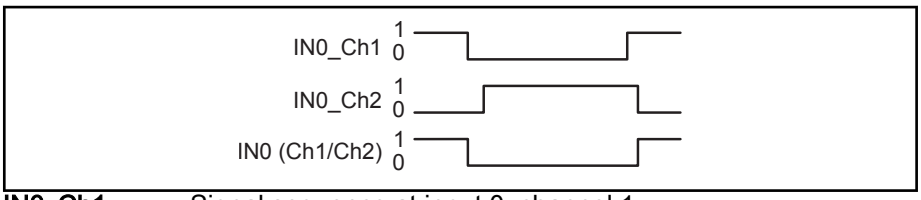
For the dual-channel assignment of the safe inputs, two adjacent inputs of the same plug are always used. This assignment cannot be parameterized, refer to chapter 6.2 "Parameterizing safe inputs" on page 31.

For the dual-channel antivalent assignment, the state changes only from "0" to "1" if the input INx_Ch1 changes its state from "0" to "1" and the input INx_Ch2 changes the state from "1" to "0". If the symmetry monitoring is set and the state does not change within the parameterized period at the inputs´, a diagnostic message is generated.

The state is active if the signal state at channel 1 is "1" and if the signal state at channel 2 is "0".

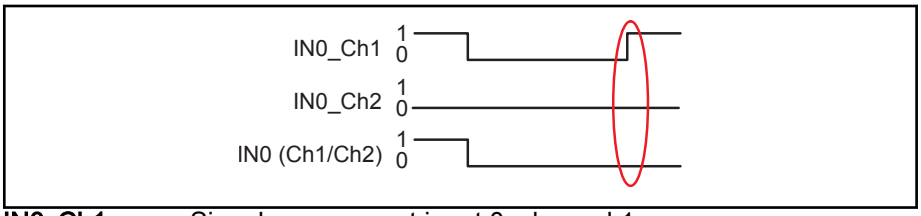
☞ Note that when switching on the safety switch again, a delayed change in state at one of the two inputs can cause a delayed transfer of state "1" in the process data image of the inputs.

Example on a correct and an incorrect signal change



IN0_Ch1 Signal sequence at input 0, channel 1
IN0_Ch2 Signal sequence at input 0, channel 2
IN0 (Ch1/Ch2) Safety-relevant signal for the dual-channel input 0, channel 1 and channel 2 at the control

Fig. 8-11: Correct signal change



IN0_Ch1 Signal sequence at input 0, channel 1
IN0_Ch2 Signal sequence at input 0, channel 2
IN0 (Ch1/Ch2) Safety-relevant signal for the dual-channel input 0, channel 1 and channel 2 at the control

Fig. 8-12: Error when changing the signal

In fig. 8-12 "Error when changing the signal" on page 54, the condition, that both signals had to be in opposite state before the signal change, is not met. In this case, a diagnostic message is generated.

State analysis

The module evaluates the input states and sends the result to the control.

The following values are transferred in the process data image of the safe inputs:

- "1" if a "1" signal is applied at channel 1 of the input and a "0" signal is applied at channel 2 of the input and if no error was detected and if the conditions to change the state are met as in fig. 8-11 "Correct signal change" on page 54.
- In all other cases, "0" is transferred

8.5.2 Notes on errors

Observe the following notes on cross-fault and symmetry violation:

Cross-fault

The error “cross-fault” causes the transfer of the safe state in the process data image of the respective inputs.

Eliminate the error and acknowledge the message.

Acknowledging the diagnostic message deletes the message and switches the input to active. The states are immediately detected at the input.

- Ensure in the application program that the system does not start accidentally again after acknowledging the diagnostic message
- Observe the maximum error detection time of 64 ms

For exceptions in the error detection time, refer to the following tables. If a "1" signal is applied at the input and an error occurs, the error is detected at the latest after 64 ms. During this period, "1" can still be transferred in case of an error.

The error can cause an unexpected change in state from "0" to "1" during the error detection time.

Ensure that the system does not start accidentally again after such changes in state.

Symmetry violation

- The diagnostic message "Symmetry volition" is only displayed if this diagnostic message was not disabled while parameterizing the respective input
- **Switch-on inhibit if the symmetry violation is disabled:**

  The message “Symmetry violation” does not cause the transfer of the safe state, refer to "Symmetry and switch-on inhibit" on page 32

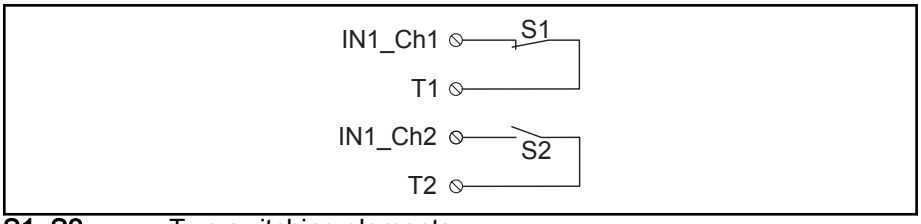
  The message has to be acknowledged. However, the current status of all inputs is always displayed in the process data image of the inputs.
- **Switch-on inhibit if the symmetry violation is enabled:**

  The message “Symmetry violation” causes the transfer of the safe state, refer to "Symmetry and switch-on inhibit" on page 32

  The message has to be acknowledged. After acknowledgement, the current status of all inputs is displayed in the process data image of the inputs.
- The message can be used for wear monitoring of the safety switch

Connection examples of the safe inputs

8.5.3 Cross-fault monitoring enabled, supplied by T1 and T2



S1, S2 Two switching elements

Fig. 8-13: Dual-channel antivalent assignment of the inputs, supplied by T1 and T2, cross-fault monitoring enabled

Key data

Sensor	Dual-channel antivalent
Sensor supply	Internal by clocking output T1 **and** T2 (cross-fault monitoring enabled)
Attainable SIL/ SILCL/Cat./PL	SIL 3/SILCL 3/cat. 4/PL e

☞ Observe the information to understand the change in state, refer to "Example on a correct and an incorrect signal change" on page 54

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel
Non-closing of a contact	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between clocking output and sensor or between sensor and input)	Yes	Symmetry violation①	No	The error is detected at the latest when the state is changed, as the state changes only in one channel
Cross-fault				
Input against input	Yes	Cross-fault	No	The error is detected if the other input is set to "1"
Input against assigned clocking output	Yes	Symmetry violation①	No	The error is detected when changing the state, as the state changes only in one channel
Input against unassigned clocking output	Yes	Cross-fault	No	Refer to "Cross-fault" on page 55

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Clocking output against clocking output	Yes	Cross-fault	No	The erros is detected at the inputs assigned to different clocking outputs
Short circuit				
Input against ground	Yes	None	No	The error is detected at the latest when the state is changed, as the state changes only in one channel
Clocking output against ground	Yes	Short circuit	No	The error is detected at the latest when changing the state, as the state changes only in one channel. The error is also detected as short circuit of the clocking output. The affected clocking output is disabled

① Applies only if the symmetry monitoring is enabled

Tab. 8-9: Dual-channel antivalent with cross-fault monitoring, supplied by T1 and T2

☞ An error in the input circuit INx_Ch2 can only be detected if the safety function was requested.

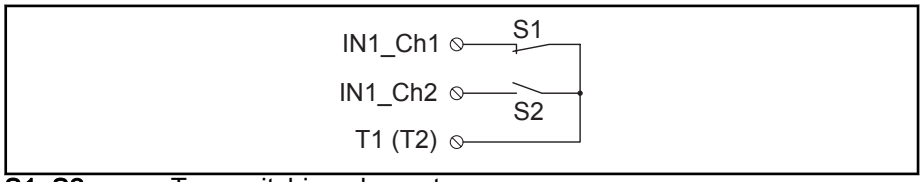
⚠ WARNING **Loss of the safety function due to an increasing number of errors**

Test the safety function in reasonable intervals to detect errors early.

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Dual-channel antivalent**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	Disabled	Application-dependent
Switch-on inhibit in case of symmetry violation	Disabled	Application-dependent
Cross-fault monitoring	Cross-fault monitoring	-

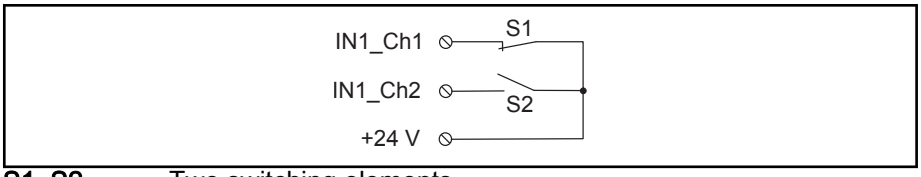
8.5.4 Cross-fault monitoring disabled, supplied by a clocking output or external supply



S1, S2 Two switching elements
T1 (T2) Supply by T1 **or** T2

Fig. 8-14: Dual-channel antivalent assignment of the inputs, supplied by T1 (or T2), cross-fault monitoring disabled

Connection examples of the safe inputs



S1, S2 Two switching elements
+24 V Supply by external 24 V

Fig. 8-15: Dual-channel antivalent assignment of the inputs, external supply

Key data

Sensor	Dual-channel antivalent
Sensor supply	Internal by clocking output T1 (or T2) **or** external
Attainable SIL/ SILCL/Cat./PL	SIL 3/SILCL 3/Cat. 3/PL d

☞ Observe the information to understand the change in state, refer to "Example on a correct and an incorrect signal change" on page 46

Device diagnostics and module behavior in case of error

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Error in sensor				
Non-opening of a contact	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel
Non-closing of a contact	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel
More errors (depending on the sensor)				Consider errors that can occur in the sensor
Error in wiring				
Interruption				
Input (Line break between clocking output and sensor or between sensor and input	Yes	Symmetry violation①	No	The error is detected at the latest when changing the state, as the state changes only in one channel
Cross-fault				
Input against input	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel
Input against clocking output	Yes	Symmetry violation①	No	The error is detected, as the state changes only in one channel. • Changing state from "1" to "0":The incorrect input remains on "1". "0" is transferred in the process data image of the respective inputs
Clocking output against clocking output	**No**	None	No	The error is not detected
Short circuit				

Error type	Identification	Diagnostics	Loss of the safety function	Notes
Input against external 24 V	Yes	Symmetry violation①	No	The error is detected at the latest when the state is changed, as the state changes only in one channel
Input against ground	Yes	Symmetry violation①	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel
Unclocked clocking output against external 24 V	No	None	No	The error is not detected
Clocking output against ground	Yes	Short circuit	No	The error is detected as change in state from "0" to "1": The error is also detected as short circuit of the clocking output. The affected clocking output is disabled
External 24V against ground	Yes	None	No	The error is detected in state "1" or when changing the state from "0" to "1", as the state changes only is one channel

① Applies only if the symmetry monitoring is enabled

Tab. 8-10: Dual-channel antivalent without cross-fault monitoring, supplied by a clocking output or external supply

⚠ WARNING **Loss of the safety function due to an increasing number of errors**

Test the safety function in reasonable intervals to detect errors early.

Example parameterization

Parameterization	Parameterized as/value range	Notes
Input xx channel 1/channel 2		
Assignment	**Dual-channel antivalent**	-
Filter time (t_{Filter})	3 ms	Application-dependent
Symmetry	100 ms	Application-dependent
Switch-on inhibit in case of symmetry violation	Enabled	Application-dependent
Cross-fault monitoring	No cross-fault monitoring	-

9 Commissioning and validation

9.1 Initial commissioning

Step	Relevant chapters and literature
Set the address	Refer to chapter 5.1.3 "Setting DIP switch" on page 25
Install the module in the IndraControl S20 station	Application description of the IndraControl S20 system R911335988
Connect the lines for the bus system and the supply voltages to the IndraControl S20 station	Application description of the IndraControl S20 system R911335988 or the documentation of the bus coupler (R911342782)
Wire the inputs as required according to the application	Refer to chapter 8 "Connection examples of the safe inputs" on page 37
Before applying the operating voltage: • Ensure that there are no wiring errors (e.g. cross-fault or short circuit) or grounding errors using a multimeter • Ensure that the functional earthing is connected	
Connect the required voltages to the IndraControl S20 module.	Application description of the IndraControl S20 system R911335988 or the documentation of the bus coupler (R911342782)
After applying the operating voltage: • If possible, measure the ripple of the voltages to ensure that there are no deviations. • Measure the input voltages at the module to ensure that the voltages are within the valid range • Check whether the module starts without errors using the LEDs on the module	
Check the mounting and installation	For checklists, refer to chapter 15.3 "Mounting and electric installation" on page 92
Make the required parameterizations	Refer to chapter 6 "Parameterizing the module" on page 31
Program the safety function	User manuals of the function blocks used
Perform a function test and the validation. Check whether the safety function responds as planned during programming and parameterization	For checklists, refer to chapter 15.5 "Validating" on page 94
Check whether the module started correctly and whether errors are displayed when adding the supply voltages using the diagnostic and status displays	For the procedure when an error is pending, refer to chapter 10 "Errors: Message and recovery" on page 63

Tab. 9-1: Commissioning steps

9.2 Recommissioning after module exchange

9.2.1 Replacing a module

⚠ WARNING **Unintended machine startup due to installation works without to ensure that there is no voltage applied**

- Disconnect the complete IndraControl S20 station from the voltage and protect the system against restart before mounting or demounting the module
- Connect the voltage only after the system has been set up completely and ensure that there is no hazard originating from the station or the system. Observe the diagnostic displays and possible diagnostic messages

When replacing a module, mount and demount as described in chapter 5 "Mounting, demounting and electric installation" on page 25 or in the application description for the IndraControl S20 system (R911335988)

- Mount the new module to the correct position in the station
- Observe the colored plug and slot labels when mounting the plugs

The new module has to fulfill the following conditions:

- Same device type
- Same or higher version

9.2.2 Recommissioning

After replacing the module, proceed as for the initial commissioning, refer to chapter 9.1 "Initial commissioning" on page 61.

The parameterization of the previous module remains and is applied to the new module upon system start.

Check the functionality of the new module.

9.3 Validating

Perform a safety validation after each safety-relevant change in the CSos system.

- Check the assignments of the sensor connections individually while validating your EUC
- Ensure that the following prerequisites are met:
  - The correct safe sensors are connected to the module
  - The module parameterization is correct
  - The linking of the variables used in the application program with the safe sensor is correct
- Perform a function test and an error simulation

Observe the information on the validation given in the checklist, refer to chapter 15.5 "Validating" on page 94.

10 Errors: Message and recovery

10.1 Reading out diagnostic messages

10.1.1 General information

Diagnosed errors are displayed with regard to the error type via local diagnostic displays and/or transferred as diagnostic messages to the control.

Sercos P-parameter

Diagnostic messages are read out via communication objects, also called PDI objects. Access these objects using the "Mapping procedure" via Sercos P-parameters described in the data sheet of the S20 bus coupler for Sercos.

Documentation

For information on the communication objects and general IndraControl S20 error messages, refer to the following documents:

- Data sheet "Rexroth IndraControl S20 Bus Coupler for Sercos"(R911342782)
- Application description "Rexroth IndraControl S20: System and Installation" (R911335988)
- Application description "Rexroth IndraControl S20 Error Messages" (R911344826)

Error code

The error code is specified for all diagnostic messages via the component "Code" of the DiagState object "0x0018", subindex "4". For a description of possible error codes, refer to chapter 10.2 "Error codes" on page 67.

Error location

For all diagnostic messages, the error location is displayed via the component "Channel/Group/Module" of the DiagState object "0x0018", subindex "3" or via the DiagStateChannelNo object "0x0033".

The error location reported via the component "Channel/Group/Module" corresponds to the terminal point at the input "00" to "07", refer to tab. 3-2 "Terminal point assignment, I/O connection" on page 13.

☞ Channel number "255 (0xFF)" means that the whole module is affected.

Terminal point	00	01	02	03	04	05	06	07
Input	IN0		IN1		IN2		IN3	
	IN0_CH1	IN0_CH2	IN1_CH1	IN1_CH2	IN2_CH1	IN2_CH2	IN3_CH1	IN3_CH2
Diagnostics "Channel"	0	1	2	3	4	5	6	7

Tab. 10-1: Assigning inputs for the diagnostic message

Example:

In case of a short circuit at the terminal point "05" of the input "IN2_CH", the value "0x05" is reported in the DiagState object "0x0018", subindex "3". The error location of the diagnostics is "Channel 5".

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

Tab. 10-2: Key for the following tables

Object type	Meaning
Var	Object with only one element (Simple variable)
Array	Object with multiple “Simple” variables of the same data type with the same length
Record	Object with multiple “Simple” variables of different data types or the same data type, but with different lengths

Tab. 10-3: Object types

Data type	Meaning
Visible string	Byte string with only printable ASCII characters. The byte string ends with 00hex (zero-terminated) and is thus 1 byte longer than the user data
Octet string	Byte string with any content
Unsigned 8	Unsigned value, only positive values 00_{hex} ... FF_{hex}
Unsigned 16	Unsigned value, only positive values 0000_{hex} ... $FFFF_{hex}$
Unsigned 32	Unsigned value, only positive values 0000 0000_{hex} ... FFFF $FFFF_{hex}$

Tab. 10-4: Data types

10.1.2 DiagState object 0x0018

The diagnostic object DiagState "0x0018" is structured as follows:

Index	Object name	Object type	Data type	A	L [byte]	Rights	Meaning
0x0018	DiagState	Record		6		R	Diagnostic state
.1	Lfd.Nr.	Var	Unsigned 16	1	2	R	Consecutive fault number since last reset or error memory reset
.2	Priority	Var	Unsigned 8	1	1	R	Priority of the message: 1: Highest priority, error cannot be acknowledged 2: Error can be acknowledged
.3	Channel/ Group/Module	Var	Unsigned 8	1	1	R	Channel, group or module where the malfunction occurred FF: Complete device
.4	Code	Var	Octet string	1	2	R	Malfunction code (refer to chapter 10.2 "Error codes" on page 67)

Index	Object name	Object type	Data type	A	L [byte]	Rights	Meaning
.5	MoreFollows	Var	Unsigned 8	1	1	R	Further information on the malfunction: 00 - Channel number can be read out via DiagStateChannelNo (refer to chapter 10.1.3 "DiagStateChannelNo object 0x0033" on page 65) 01 - Further information can be read out via the DiagStateLong object 02 - AddValue can be read out via DiagStateAddValue (refer to chapter 10.1.4 "DiagStateAddValue object 0x0034" on page 65) 04 - One group is affected 08 - One module is affected
.6	Text	Var	Visible string	1	Max. 50 +1	R	Plain text message; default: "Status OK"

Tab. 10-5: DiagState object

10.1.3 DiagStateChannelNo object 0x0033

If it is specified under MoreFollows in the DiagState object that a channel number is available, it can be determined via the DiagStateChannelNo object "0x0033".

Index	Object name	Object type	Data type	A	L [byte]	Rights	Meaning
0x0033	DiagState	Record		6		R	Diagnostic state
.1	Lfd.Nr.	Var	Unsigned 16	1	2	R	Consecutive fault number since last reset or error memory reset
.2	ChannelNo	Var	Unsigned 8	1	1	R	Affected channel

Tab. 10-6: DiagStateChannelNo object

10.1.4 DiagStateAddValue object 0x0034

If it is specified under MoreFollows in the DiagState object that an AddValue number is available, AddValue can be determined via the DiagStateAddValue object "0x0034".

Errors: Message and recovery

Index	Object name	Object type	Data type	A	L [byte]	Rights	Meaning
0x0033	DiagState	Record		6		R	Diagnostic state
.1	Lfd.Nr.	Var	Unsigned 16	1	2	R	Consecutive fault number since last reset or error memory reset
.2	AddValue	Var	Unsigned 32	1	4	R	Associated value to the fault code (parameterization error) (refer to chapter 10.2.5 "Parameterization errors" on page 70)

Tab. 10-7: DiagStateAddValue object

10.1.5 ResetDiag object 0x0019

Errors of priority 2 are acknowledged via the ResetDiag object "0x0019". To acknowledge and delete the latest pending error, "05hex" is written to the object. This module does not support all other values. The next pending error is subsequently output.

Write access to the ResetDiag object "0x0019" via the Sercos parameter "P-1-0025.x.0" with the value "0x05". "x" is the number of the module slot.

Index	Object name	Object type	Data type	A	L [byte]	Rights	Meaning
0x0019	ResetDiag	Record	Unsigned 8	1	1	W	Reset diagnostics; deletes the corresponding diagnostic memory and acknowledges the message

Tab. 10-8: ResetDiag object

10.1.6 Examples on reading out a diagnostic message

Example 1: **Reading out an error due to a cross-fault at channel 3 (priority 2) with a following acknowledgement**

Read-out DiagState object 0x0018

DiagState of slot 1:	
Lfd.Nr.:	1
Priority:	0x02 (2), warning active
Channel/Group/Module:	3
Code:	0x2141 (8513), cross-fault against another input or external voltage
MoreFollows:	02 DiagStateAddValue available
Text:	

Read-out DiagStateChannelNo object 0x0033

Lfd.Nr.:	1
ChannelNo:	0x03

After recovering the error cause, the error can be acknowledged.

Write "05hex" to the ResetDiag object "0x0019" (write access via the Sercos parameter "P-1-0025.x.0" with the value "0x05").

Example 2: **Reading out a parameterization error (priority 1)**

Read-out DiagState object 0x0018

DiagState of slot 1:	
Lfd.Nr.:	2
Priority:	0x01 (1), alarm active
Channel/Group/Module:	0
Code:	0x6320 (25376), parameter table invalid
MoreFollows:	02 DiagStateAddValue available
Text:	

Read-out DiagStateChannelNo object 0x0033

Lfd.Nr.:	2
ChannelNo:	0x0000

Read-out DiagStateAddValue object 0x0034

Lfd.Nr.:	2
ChannelNo:	0x0340

This error cannot be acknowledged, as it is an error of priority "1".

Check and correct the parameterization.

10.2 Error codes

10.2.1 General information

Contact Bosch Rexroth if the system outputs error codes not listed in the following documentations:

- In the following tables of this application description
- In the application description "Rexroth IndraControl S20: System and Installation" (R911335988)
- In the application description "Rexroth IndraControl S20 Error Messages" (R911344826)

Module exchange after error

When exchanging a module due to an error, observe the corresponding chapters, refer to chapter 5 "Mounting, demounting and electric installation" on page 25 and refer to chapter 9.2 "Recommissioning after module exchange" on page 62.

LED

The "LED" column in the following tables of this application description specifies which LED signals the error to the local error diagnostics.

Acknowledgement and restart

Always troubleshoot the cause first. If required, acknowledge the error. Whether an error has to be acknowledged and which special conditions apply to switch on an input or a module again, is given in the "Acknowledgement, remedy" column in the following tables of this application description.

⚠ WARNING **Hazardous state and undesired machine startup by acknowledging an error, as the safe output immediately returns to the operating state except for the specified exceptions**

- Before acknowledging an error, ensure that the acknowledgment does not cause a hazardous machine state
- When planning the machine or the system, ensure that the hazardous area is visible

⚠ WARNING **Unintended machine startup due to start or restart after adding voltages as well as the missing request of the safety function**

- Observe the following notes:
  - The module starts after the successful download of the configuration and parameter data set as well as after the successful processing of the internal check
  - A safety-relevant input is automatically set again to "1" if the trigger of the safety function is reset
- If an automatic restart is not intended, make the corresponding settings in the safety logic

10.2.2 Errors of the safe digital inputs

Errors of the safe digital inputs

Code	Error cause	LED	Description, effect	Acknowledgement, remedy
0x2140	Cross fault between two inputs	E "on"	A cross-fault to another input, an external voltage or an external clocking output was determined. The respective output is retained in the safe state	Read out channel number via the DiagStateChannelNo object 0x033. Check sensors, clocking outputs, plugs and cabling. This diagnostic message can be acknowledged. The acknowledgement deletes the message and enables the input and the assigned inputs. If the error remains pending, the message is output again
0x2141	Cross-fault between external voltage and one input			
0x2142	Cross-fault between the displayed input and the clocking output			
0x3183	Implausible signal change at the displayed input pair	E "on"	An implausible signal change was detected at an input pair in dual-channel mode	Read out the channel number via the DiagState- ChannelNo object 0x033. To reset the error state, both inputs have to go into the safe state. To map a "1" signal for the respective input pair, both inputs have to be set (note the negation for antivalent inputs). This diagnostic message can be acknowledged. The acknowledgement deletes the message.

Code	Error cause	LED	Description, effect	Acknowledgement, remedy
0x5010	Hardware error at the reference voltage source	E "on"	Due to the internal self test mechanism, a hardware error was detected at the reference voltage source of the inputs. All inputs are thus retained in the safe state	This diagnostic message can be acknowledged. The acknowledgement deletes the diagnostic message. It can only be restarted after an error-free power-up self test. If the power-up self test is not error-free, replace the module
	Hardware error at the displayed input	E "on"	A hardware error was detected at the displayed input due to internal tests. All inputs are thus retained in the safe state	Read out the channel number via the DiagState- ChannelNo object 0x033. This diagnostic message can be acknowledged. The acknowledgement deletes the message. It can only be restarted after an error-free power-up self test. If the power-up self test is not error-free, replace the module
0x8F01	Symmetry violation at the displayed input	E "on"	A violation of the parameterized symmetry was detected at an input pair in dual-channel mode. This error message is only intended to asses the contacts of the connected switches. If the switch-on inhibit is enabled for the symmetry violation, the inputs are blocked until the diagnostic message is acknowledged. Otherwise, the input information is still detected and send to the control	Read out the channel number via the DiagState- ChannelNo object 0x033. Check switch. This diagnostic message can be acknowledged. The acknowledgement deletes the message

Tab. 10-9: Errors of the safe digital inputs

10.2.3 Errors of the clocking outputs

Code	Error cause	LED	Description, effect	Acknowledgement, remedy
0x2345	Short-circuit or overload at the displayed clocking output	E "on"	A short-circuit or overload was detected at the displayed clocking output. Thus, the respective clocking output was disabled. The assigned inputs are set to "0"	Read out the channel number via the DiagState- ChannelNo object 0x033. Check plugs and cabling. This diagnostic message can be acknowledged. The acknowledgement deletes the message and enables the clocking output and the assigned inputs again

Tab. 10-10: Errors of the clocking outputs

The clocking outputs are also switched on and monitored in an unparameterized state. If a short circuit occurs at a clocking output in this state, the clocking output is disabled.

The exit the error, parameterize the module and acknowledge the error message.

Errors: Message and recovery

10.2.4 Errors of the supply voltage

Code	Error cause	LED	Description, effect	Acknowledgement, remedy
0x3411	Undervoltage U_l supply	UI "flashing"	Undervoltage was detected at the UI supply. A diagnostic message is generated if U_l < 17 V. All inputs of the module are retained in the safe state. The UI LED is permanently on gain, as soon as no undervoltage is detected	Check and correct the supply voltage. Check length and load of the supply lines. This diagnostic message can be acknowledged. The acknowledgement deletes the message and enables the inputs

Tab. 10-11: Supply voltage error

10.2.5 Parameterization errors

Parameterization errors cause diagnostic messages of priority "1" in the DiagState object. These errors cannot be acknowledged: The parameterization has to be checked and corrected.

To identify the type of parameterization error, go online with the software on the control and read out the error.

Code + AddValue	Error cause	LED	Description, effect	Solution
0x6320 + 0x034X	Symmetry monitoring was set and the input pairs are parameterized as single-channel	FS "flashing"	The module is retained in the safe state	Switch off symmetry monitoring or parameterize input pairs as dual-channel
0x6320 + 0x035X	Reswitch-on inhibit was parameterized and the input pairs are single-channel and/or the symmetry monitoring is not enabled			Disabling reswitch-on inhibit. Parameterize input pairs as dual-channel. Enable symmetry monitoring
0x6320 + 0x03F2	Calculated and received checksum of the parameter data does not match			Check checksum and send parameter data again to the module
0x6320 + 0x03FB	Device ID is incorrect or wrong module is used			Check that the correct module is used. If the error cannot be eliminated, contact Bosch Rexroth

Tab. 10-12: Parameterization errors (cannot be acknowledged)

10.2.6 General errors

Code	Error cause	LED	Description, effect	Acknowledgement, remedy
0x4210	Critical module temperature	E "On"	The module temperature reached a critical value. The switch-off is imminent. If the temperature increases more, the module goes into the safe state using the device firmware	Check the ambient conditions and switching frequency and modify them if required. This diagnostic message can be acknowledged. The acknowledgement deletes the diagnostic message
0xA012	Possible error causes: • Application is not ready on the module • Hardware error • TUNID (DIP switch) was changed at runtime	FS "On"	The communication to a safe parent control is locked. The module goes into the safe state	This diagnostic message cannot be acknowledged. Execute power-up. If the error message is output again, the module is defective and has to be replaced

Tab. 10-13: General errors

10.3 CSos errors

The following errors can occur additionally:

- For errors of the CSos system, refer to chapter 14.4 "CSos diagnostic messages" on page 87.
- Error of the Sercos bus. For information on these errors, refer to the documentation of the system used.

10.4 Acknowledging an error at Csos

- Eliminate the error cause
- Acknowledge the diagnostic message

Parameterization errors cannot be acknowledged. In this case, proceed as follows:

- Check the parameterization
- Adjust the parameterization
- Download a new data set

For information on how to proceed with the error acknowledgement, refer to the documentation of the control used and the chapter 10.1.5 "ResetDiag object 0x0019" on page 66.

Errors: Message and recovery

⚠ WARNING **Hazardous state and undesired machine startup by acknowledging an error, as the safe output immediately returns to the operating state except for the specified exceptions**

- Before acknowledging an error, ensure that the acknowledgment does not cause a hazardous machine state
- When planning the machine or the system, ensure that the hazardous area is visible

⚠ WARNING **Unintended machine startup due to start or restart after adding voltages as well as the missing request of the safety function**

- Observe the following notes:
  - The module starts after the successful download of the configuration and parameter data set as well as after the successful processing of the internal check
  - A safety-relevant input is automatically set again to "1" if the trigger of the safety function is reset
- If an automatic restart is not intended, make the corresponding settings in the safety logic

11 Maintaining, repairing, decommissioning and disposal

11.1 Maintenance

Module is maintenance-free.

Depending on the application and the connected periphery, the function of the peripherals and the security chain have to be checked regularly if necessary.

The service life of the module is 20 years. At a low demand rate, it is 25 years.

Retesting is currently not required.

Maintain the connected peripherals (e.g. light grids) as described in the vendor specifications.

11.2 Repair

Repairs or user-specific changes at the module are prohibited. The housing must not be opened. The module is protected against manipulations using protective labels. In case of unauthorized repair or opening of the housing, the protective label is damaged. The function of the safety module is not guaranteed anymore in this case.

In case of error, send the module to Bosch Rexroth or contact the Bosch Rexroth service immediately.

11.3 Decommissioning and disposal

Decommission as described by the machine or system vendor.

Ensure the following handling of used modules when decommissioning the Csos system or parts of the system:

Future of the module	Action
Modules are still used as intended	For requirements on storage and transport acc. to the technical data, refer to chapter 12.2 "Module data of the S20-SSDI-8/4" on page 75
Modules are not used anymore	Dispose modules according to the environmental standards. Ensure that the modules are not used again

12 Technical data and ordering data

12.1 CSos system data

CSos edition	2.8

Tab. 12-1: CSos system data

For the system data, refer to the documentation of the control used.

12.2 Module data of the S20-SSDI-8/4

12.2.1 General data

Size and weight	
Housing dimensions without bus base module with plug (width × height × depth)	53.6 mm × 126.1 mm × 54 mm
Weight (with plugs)	Approx. 220 g
Operation mode	
CSos	Extended data format with 12 bytes
Ambient temperature	
Operation	-35 to +60 °C (any installation location) –35 °C to +55 °C (acc. to CUL_{US})
Storage and transport	–40 °C to +85 °C
Air humidity	
Operation①	75 % on average, 85 % occasionally (no condensing)
Storage and transport②	75 % (no condensing)
Air pressure	
Operation	70 kPa to 108 kPa (up to 3,000 m above sea level)
Storage and transport	66 kPa to 108 kPa (up to 3,500 m above sea level)
Degree of protection	IP20; operation min. in installation space IP54
Housing material	Plastics PBT self-extinguishing (V0)
Clearance and creepage distances	Acc. to IEC 60664-1
Protection class	III (protective extra-low voltage) acc. to IEC61140, EN61140, VDE 0140-1
Gases jeopardizing functions acc. to DIN 40046-36, DIN 40046-37	Not resistant against gas jeopardizing the function [sulphur dioxide (SO2), hydrogen sulphide (H2S)].

Technical data and ordering data

Resistance of housing material against fungus	Resistant
Ambient compatibility	Not resistant against organic chlorine compounds
Connection data of the IndraControl S20 plug	
Connection type	Tension spring terminals
Conductor cross-section	Inflexible: 0.5 mm^2 to 1.5 mm^2 Flexible without sleeve: 0.25 mm^2 to 1.5 mm^2 Flexible with sleeve: 0.25 mm^2 to 1.5 mm^2 AWG 24-16

① In the range between -35 °C and +60 °C, take appropriate measures against increased humidity

② For a short period, slight condensation may appear on the outside of the housing

Tab. 12-2: General data

12.2.2 Mechanical requirements

Vibration acc. to IEC 60068-2-6	10 - 57 Hz: 0.35 mm with constant amplitude 57-150 Hz; 5g acceleration, constant amplitude
Shock acc. to IEC 60068-2-27	30g via 11 ms, criterion A

Tab. 12-3: Mechanical requirements

12.2.3 Safety characteristics acc. to EN 61508

Attainable SIL	SIL 2 (single-channel) SIL 3 (dual-channel) Depending on the parameterization and wiring, refer to chapter 3.6 "Connecting options for sensors depending on the parameterization" on page 15 and chapter 8 "Connection examples of the safe inputs" on page 37
Probability of a dangerous failure in case of request by safety function (PFD)	SIL 2: Up to 1 % of 10^{-2} (corresponds to 1 * 10^{-4}) SIL 3: Up to 1 % of 10^{-3} (corresponds to 1 * 10^{-5})
Probability of dangerous failure per hour for the complete module (PFH)	SIL 2: Up to 1 % of 10^{-6} (corresponds to 1 * 10^{-8}) SIL 3: Up to 1 % of 10^{-7} (corresponds to 1 * 10^{-9}) Depending on the parameterization, refer to tab. 8-2 "PFD and PFH depending on SIL/SILCL" on page 38
Hardware error tolerance (HFT) of the module	1
Permitted service life	20 years, at a low demand rate 25 years

Tab. 12-4: Safety characteristics acc. to EN 61508

12.2.4 Safety characteristics acc. to EN 62061

Attainable SIL claim limit	SILCL = SIL 2 (single-channel) SILCL = SIL 3 (dual-channel) Depending on the parameterization and wiring, refer to chapter 3.6 "Connecting options for sensors depending on the parameterization" on page 15 and chapter 8 "Connection examples of the safe inputs" on page 37
Safe Failure Fraction (SFF)	99 %
Probability of dangerous failure per hour for the complete module (PFH)	SIL 2: Up to 1 % of 10^{-6} (corresponds to 1 * 10^{-8}) SIL 3: Up to 1 % of 10^{-7} (corresponds to 1 * 10^{-9} Depending on the parameterization, refer to tab. 8-2 "PFD and PFH depending on SIL/SILCL" on page 38
Hardware error tolerance (HFT) of the module	1
Permitted service life	20 years, at a low demand rate 25 years Operation in incorrect state: 72 h

Tab. 12-5: Safety characteristics acc. to EN 62061

12.2.5 Safety characteristics acc. to EN ISO 13849-1

Attainable performance level	PL d (single-channel) PL e (dual-channel) Depending on the parameterization and wiring, refer to chapter 3.6 "Connecting options for sensors depending on the parameterization" on page 15 and chapter 8 "Connection examples of the safe inputs" on page 37
Diagnostic coverage (DC)	99 %
Mean time up to a dangerous failure (MTTFd)	100 years (irrespective of whether single-channel or dual-channel assignment)

Tab. 12-6: Safety characteristics acc. to EN ISO 13849-1

12.2.6 Supply voltage U_{BUS} (logic)

Logic voltage	5 V DC
Current consumption from U_{BUS}	Typ. 260 mA 310 mA max.

Tab. 12-7: Supply voltage U_{BUS} (logic)

The bus coupler or infeed terminal of the station supply the module with the logic voltage U_{BUS}.

For the technical data, refer to the data sheet of the bus coupler or the infeed terminal.

Technical data and ordering data

12.2.7 Supply voltage U_I (sensors, clocking outputs, periphery)

Nominal voltage	24 V DC acc. to EN 61131-2 and EN 60204
Ripple factor	3.6 V_{SS}
Valid voltage range	19.2 V DC to 30.2 V DC (incl. all tolerances and ripple)
Current consumption	Typ. 9 mA (All inputs set, supply from U_I at 30.2 V DC, without sensor supply via the clocking supplies T1 and T2)
Valid interruption period	1 ms (Output voltage of the clocking outputs can break down)
Overvoltage protection	Yes
Reverse voltage protection	Parallel, temporally limited reverse voltage protection
Undervoltage detection	At approx. 16.6 V
Diagnostic displays	Green LED UI, refer to chapter 3.7 "Local diagnostic and status displays" on page 16
External protection	Max. 8 A, slow

Tab. 12-8: Supply voltage U_I (sensors, clocking outputs, periphery)

⚠ WARNING **Loss of the safety functions due to the use of unsuitable voltage supplies**

Use voltage supplies acc. to EN 50178/VDE 0160 (PELV).

⚠ DANGER **A parallel reverse polarity protection is implemented into the module. This protection is only temporally limited.**

To avoid a module defect, proceed as follows:

- Due to the maximum current carrying capacity of 8 A, protect the voltage supply U_I externally with a fuse of 8 A (slow).
- Only use PELV power supply units with at least 4 times the nominal current required for triggering, as thus, only triggering times of less than 300 ms can be ensured

12.2.8 Safe digital inputs

Number	4 dual-channel or 8 single-channel
Input design	As per the requirements acc. to EN 61131-2 type 3
Supply	Via the clocking outputs T1 and T2 or external supply
Input current	Typ. approx. 4.2 mA at 24 V

Maximum current permissible for "0"	2 mA
Maximum current permissible for "1"	2.5 mA
Valid input voltage range	-3 V to +30.2 V
Voltage range for "0"	-3 V to +5 V
Voltage range for "1"	+11 V to +30 V
Maximum switching frequency	10 Hz
Filter time (t_{Filter})	1.5/3/5/15 ms (parameterizable), refer to chapter 6.2 "Parameterizing safe inputs" on page 31
Filter time accuracy	+0 ms, -0.5 ms
Processing time of the input	$t_{IN} = t_{Filter} + t_{FW}$ Refer to "Processing time of the input t_{IN} for a safety requirement" on page 34
Simultaneity	100%
Symmetry analysis	Yes, parameterizable, accuracy ±20 %
Derating	No
Permissible cable lengths	1000 m from the clocking output to the safe input (sum of the connected lines)
Status displays	One green LED per input, refer to chapter 3.7 "Local diagnostic and status displays" on page 16

Tab. 12-9: Safe digital inputs

12.2.9 Clocking outputs

Number	2
Supply	From U_I
Maximum switching current	0.4 A, short-circuit- and overload-protected
Saturation voltage	U_I -1 V
Simultaneity	100%
Derating	No
Permissible cable lengths	The sum of the connected lines may not exceed 1000 m per clocking output
Status displays	None
Diagnostic displays	E-LED to map the diagnostic state, refer to chapter 3.7 "Local diagnostic and status displays" on page 16

Tab. 12-10: Clocking outputs

12.2.10 Approvals

Approvals
For the current approvals, go to www.boschrexroth.com/electrics.

Technical data and ordering data

12.3 Compliance with EMC directive

Testing electromagnetic compatibility acc. to DIN EN 61000-6-2		
Electrostatic discharge (ESD)	EN 61000-4-2 (IEC 61000-4-2)	Criterion A 6 kV, contact discharge, 8 kV air discharge
Electromagnetic fields	EN 61000-4-3 (IEC 61000-4-3)	Criterion A, field strength 10 V/m
Fast transients (burst)	EN 61000-4-4 (IEC 61000-4-4)	Criterion A, test voltage 2 kV
Transient overvoltage (surge)	EN 61000-4-5 (IEC 61000-4-5)	Test level 2, criterion A DC supply lines: 1.0 kV/1.0 kV (symmetric/asymmetric) Signal lines: 1.0 kV/2.0 kV (symmetric/asymmetric)
Conducted disturbances	EN 61000-4-6 (IEC 61000-4-6)	Criterion A, test voltage10 V
Testing noise emission acc. to DIN EN 61000-6-3		
Emitted interference	EN 55022	Class B, residential area

Tab. 12-11: Compliance with EMC directive 2004/108/EC

12.4 Ordering information

12.4.1 Module

Description	Type	Part number
Rexroth IndraControl S20 Module with Safe Digital Inputs	S20-SSDI-8/4	R911173191

12.4.2 Documentation

Description	Part number
IndraControl S20 system	
Data sheet "Rexroth IndraControl S20 Bus Coupler for Sercos"	R911342782
Application description "Rexroth IndraControl S20: System and Installation"	R911335988
Application description "Rexroth IndraControl S20 Error Messages"	R911344826
Sercos	
Application description "Sercos System Manual for I/O Devices"	R911333512

Description	Part number
CSos	
Specification The CIP Networks Library Volume 5 CIP Safety, Edition 2.8, November 2013	See http://www.odva.org

Ensure that the current documentation is consulted. For the current documentations, go to the Bosch Rexroth internet: **www.boschrexroth.com ▸ Products ▸ Electric Drives and Controls ▸ CAD and documentation ▸ Documentation**.

13 CSos glossary

CIP Safety (Common Industrial Protocol Safety)
This safe protocol is used for the safe data transfer in the Sercos bus.

CRC
Cyclic Redundancy Check = CRC check value

The validity of the process data in the safety telegram is checked using a CRC check value. The assigned address books are checked and the safety-relevant parameters are also backed up. This value is part of the safety telegram.

CSos
"CSos" is the abbreviation for "CIP safety on sercos", which is the safe channel in Sercos.

Consumer
Device receiving safe data.

Diagnostic coverage (DC)
The effectiveness of the diagnostics is determined as ratio between the failure rate of the identified hazardous failures and the total failure rate of all hazardous failures.

Note 1: The diagnostic coverage can either apply to the complete system or to components of the safety-related systems. A diagnostics coverage could for example be available for sensors and/or the logic system and/or correcting elements.

Note 2: Following IEC 61508-4:2010, term 3.8.6.

Dynamization
The dynamization is intended to identify error states in the safety-relevant circuitries. It is automatically dynamized in the background without affecting the safety function or the default drive functions.

Expected Packet Interval (EPI)
Generation rate of cyclic messages.

Errors
State of a unit characterized by the inability to perform a requested function, excluding the inability during preventive maintenance or other planned actions or due to lack of external resources (IEC 60050-191:1990, 05-01).

Note 1: An error is often caused when the unit itself fails, but it can also be present without previous failure.

Note 2: In this part of the ISO 13849, "Error" means accidental error.

FMEA (Failure Mode and Effects Analysis)
FMEA is an analytic method of the preventive quality assurance. It is used to find potential vulnerabilities and to detect their relevance and evaluate them and to introduce measures for their avoidance or detection on time. The systematic analysis and recovery of vulnerabilities minimizes the risk, reduces the error costs and improves the reliability.

Format Type
CIP telegram format (base format, extended format).

Functional safety
Part of the overall safety relating to the EUC and EUC control system which depends on the correct functioning of the safety-related system E/E/PE system and other risk reducing measures (IEC 61508-4:2010, 3.1.12).

EUC: Installation, machine, apparatus or system used for manufacturing, material deformation, transportation, medical or other activities (IEC 61508-4:2010, 3.2.1).

EUC control system: System responding to the input signals of the process and/or an operator and generating output signals allowing the EUC to work as intended (IEC 61508-4:2010, 3.3.3).

Category
Classification of safety-related control parts with regard to their resistance to an error and their subsequent error response that can be reached due to the structural allocation of the parts, their error detection and/or their reliability (EN ISO 13849-1).

Mean time to failure (MTTFd)
Expectation value of the mean time up to the hazardous failure.

CSos glossary

	Note: Following IEC 62061:2005, term 3.2.34.
MTTF	Refer to "Mean time to failure (MTTFd)" on page 83.
Network Time Expectation (NTE)	Maximum transmission time between producer and consumer.
Passivation	If the safety module (F-periphery) detected an error, it switches the respective channel or all channels of the module to the safe state. The channels are passivated. The detected error is reported to the control. In case of a safe input module, substitute values "0" are provided for the safety program during passivation of the F-system instead of process values present at the safe inputs. In case of a safe output module, substitute values "0" are transferred to the safe outputs during passivation of the F-system instead of output values provided by the safety system.
Performance level (PL)	Discrete level specifying the ability of safety-related parts to perform a safety function under predictable conditions.
PFH (Probability of dangerous Failure)	Average probability of a dangerous failure in one hour (DIN EN 62061).
PL	Refer to "Performance level (PL)" on page 84.
Producer	Device sending safe data.
Remaining risk	The residual risk is the risk remaining after the protection measures were taken following ISO 12100:2011, 3.13.
Risk	Combination of probability when the damage occurs and the extend of the damage (ISO 12100:2011, 3.12).
Risk analysis	The risk analysis is the combination of the determination of the machine limits, the identification of the danger and the risk assessment (ISO 12100:2011, 3.15).
Risk assessment	Complete procedure covering a risk analysis and a risk evaluation (ISO 12100:2011, 3.17).
Risk evaluation	Evaluation based on the risk analysis whether the goals to minimize the risk were achieved (ISO 12100:2011, 3.16).
Safety measure	Measure for the intended risk reduction. Example 1: Implemented by the designer: Inherent design, technical protection measures, supplementing protection measures and user information. Example 2: Implemented by the user: By organization (safe working procedure, supervision, operating permit to perform works), provision and application of additional protective devices (personal protective equipment, training). Note: Following ISO 12100:2011, term 3.19.
SDID (Safety Device ID)	Safe device address in a network.
Safety integrity (SIL)	Discrete level (one of four possible levels) to specify the safety integrity of the safety functions assigned to the E/E/PE safety-related system. The safety integrity level 4 is the highest and 1 the lowest level (IEC 61508-4:2010, 3.5.8).
SNN (Safety Network Number)	Specifies the current physical network of the device.
Timeout	Waiting period before an error reaction is started.
TiMu (Timeout Multiplier)	Number of repetitions.
TUNID (Target Unique Network Identifier)	Unique network address of the safe communication partner.
UNID (Unique Network Identifier)	Unique network address.

14 CSos parameters and device parameters

14.1 Sercos parameters (CIP safety parameter objects)

Parameters	Data type	Length	Description
S-0-1800			**Safety Device**
S-0-1800.x.01	IDN	4	Application list
S-0-1800.x.02	IDN	4	List of validator objects
S-0-1800.x.04	DEC_OV	2	SV safety connection error counter
S-0-1800.x.10	DEC_OV	2	SSO device state
S-0-1800.x.15	HEX	10	SSO device configuration identifier
S-0-1800.x.17	HEX	10	SSO configuration UNID
S-0-1800.x.19	HEX	10	SSO Target UNID
S-0-1801			**Identity Object**
S-0-1801.x.01	DEC_OV	2	CIP vendor ID
S-0-1801.x.02	DEC_OV	2	CIP device type
S-0-1801.x.03	DEC_OV	2	CIP product code
S-0-1801.x.04	HEX	2	CIP revision
S-0-1801.x.05	HEX	2	CIP status
S-0-1801.x.06	HEX	4	CIP serial number
S-0-1801.x.07	ASCII	12	CIP product name
S-0-1810			**Safety Validator**
S-0-1810.x.01	DEC_OV	2	SV Max data age
S-0-1810.x.02	DEC_OV	2	State of the "safety validator"
S-0-1810.x.03	DEC_OV	2	SV error code
S-0-1810.x.04	DEC_OV	2	Safety validator type
S-0-1810.x.05	DEC_OV	2	SV time coordination message min. multiplier
S-0-1810.x.06	DEC_OV	2	SV maximum number of users
S-0-1810.x.07	DEC_OV	1	SV timeout multiplier
S-0-1810.x.09	DEC_OV	2	SV network time expectation multiplier
S-0-1820			**Safety Application**
S-0-1820.x.01	DEC_OV	4	CIP assembly instance number
S-0-1820.x.02	IDN	4	Safety validator instance
S-0-1820.x.03	BIN	2	Safety application type
S-0-1820.x.04	DEC_OV	2	Safety application data size

ASCII Character string, string
BIN Binary
DEC_OV Decimal without sign
HEX Hexadecimal

CSos parameters and device parameters

IDN Sercos parameter number

Tab. 14-1: Sercos parameters

14.2 CSos parameters (safe configuration)

CSos parameters are connection parameters within the safe configuration.

☞ The values formatted in **bold** in the table are specified by the system and cannot be changed manually.

CSos parameters	Default value	Description
Vendor ID	**287**	Vendor ID of Bosch Rexroth AG
Device Type	1027	Safety discrete I/O
Product Code	**32**	Specified by Bosch Rexroth AG
Major Revision	**01**	Major revision of the module
Minor Revision	**01**	Minor revision of the module
Connection name	**Input**	Name of the connection instance
Safety configuration CRC (SCCRC)	0x2F6035A	The CRC calculated in the safe parameterization is entered here. The default value results from the default parameterization
Safety Configuration Time Stamp (SCTS)	0x600000001	Specified value
Safety Network Number (SNN)	0x600000001	SNN set at the DIP switch + 0x600000000
Safety Device ID (SDID)	1	SDID set at the DIP switch
Format Type	2	Telegram format: 1 = base format 2 = extended format
Network Time Expectation (NTE)	40	This period (in ms) is monitored and guarantees that the process data is not older than the NTE
Timeout Multiplier	1	Number of telegrams that can be lost before a connection error is reported
Max. fault number	5	Number of incorrect packages per hour before a connection is closed
Timeout	1000	Period (in ms) that is waited for a connection to be established.
Device Info	SDDML-V3.0..	Name of the SDDML file used
Creator Info	Bosch Rexroth AG	Generator of SDDML file

Tab. 14-2: Overview on the CSos parameters of the module

14.3 Device parameters (safe parameterization)

The device parameters are individual module parameters within the safe parameterization, refer to chapter 6.2 "Parameterizing safe inputs" on page 31.

SCCRC The device parameters are crosschecked with a checksum, the Safety Configuration CRC (SCCRC).

14.4 CSos diagnostic messages

Error code		Error cause	Description	Solution
Dec	Hex			
6144	0x1800	Configuration is owned by another originator	The module was configured by another originator	Change SNN or SDID using DIP switches. The safe originator ID is deleted upon a new voltage startup
6145	0x1801	Output is owned by another originator	The module was configured by another originator	Change SNN or SDID using DIP switches. The safe originator ID is deleted upon a new voltage startup
6147	0x1803	Electronic Key mismatch: Product Code or Vendor ID	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6148	0x1804	Electronic Key mismatch: Device Type	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6149	0x1805	Electronic Key mismatch: Revision	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6150	0x1806	Output Connection Point not found	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6151	0x1807	App.Path: Configuration Class invalid	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6152	0x1808	App.Path: Configuration Assembly Instance invalid	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6153	0x1809	App.Path: Config. Assembly Instance does not exist	The configured device (SDDML file) does not match the physically installed module	Request new SDDML file or install the correct module
6154	0x180A	SCCRC mismatch in Type1 SafetyOpen	The SCCRC entered into the user interface under "Safe Configuration" does not match the SCCRC calculated in the "Safe Parameterization"	Copy SCCRC from the "Safe Parameterization" to the "Safe Configuration"
6155	0x180B	TUNID mismatch	The values of SNN and SDID entered at the DIP switch do not match the values entered under "Safe Configuration"	Compare the DIP switch position with the values entered under "Safe Configuration". Note that 0x600000000 is added to the SNN value
6156	0x180C	Data age of valid message greater than NTE	The exchanged data is older than NTE	Increase the NTE value under "Safe configuration"
6157	0x180D	Time coord. message not received in allowed time	The "time coordination message" was not received in the expected time	Increase the NTE value under "Safe configuration"

CSos parameters and device parameters

Error code		Error cause	Description	Solution
Dec	Hex			
6158	0x180E	Connection in use or Duplicate Forward_Open	It is either tried to reconfigure an existing connection or the "forward open" was sent twice	The configuration of the new connection is incomplete: Ensure that the SCCRC is provided with the same value in "Safe Configuration" and in "Safe Parameterization". Check whether the "Safety application" was compiled without errors. Log in to the standard application to automatically apply the required changes. "Duplicate Forward open": Increase the NTE value under "Safe configuration".
6160	0x1810	SafetyClose referenced an unknown connection	The module received a SafetyClose with incorrect connection parameters	Compare the DIP switch position with the values entered under "Safe Configuration". Note that 0x600000000 is added to the SNN value. Change SNN or SDID using DIP switches. The saved connection parameters are deleted upon a new voltage startup
6161	0x1811	Initialization not completed within time limit	Connection was not established	Restart the Safety application
6304	0x18A0	Operator made invalid settings on DIP switch	DIP switch position invalid. The DIP switch position may not be "0" for SNN and SDID	Set a value other than "0" for SNN and SDID. Change SNN or SDID using DIP switches. The DIP switch values are applied after a new voltage startup

Tab. 14-3: Parameter errors: CSos parameters

15 Checklists

15.1 General information

The checklists listed in this chapter support the following actions at the module S20-SSDI-8/4: Planning, mounting, electric installation, commissioning, parameterization as well as validation.

These checklists can be used for planning and or as a proof of performed working steps in the specified phases.

Archive the filled out checklists to use them as reference when performing recurring checks.

This checklist does not replace validation, initial commissioning as well a regular check by qualified staff.

The following excerpt shows a filled out list as example.

Checklist...			
Device type, equipment ID		S20-SSDI-8/4/S20-S3-BK+	
Version: HW/FW	00/1.01	**Date**	01/17/2014
Tester 1	John Doe	**Tester 2**	Jane Doe
Notes	System XXX was checked for hood manufacturing		

No.	**Request (mandatory)**	**Yes**	**Notes**
X	...	□	

No.	**Request (optional)**	**Yes**	**No**	**Notes**
Y	...	□	□	

Equipment ID Enter device type and/or equipment ID for the observed module.

Version: HW/FW Enter hardware and firmware version of the module, refer to chapter 3.2 "Module structure" on page 11.

Date Enter the date when this list was started.

Tester 1/2 Enter the name of the tester.

Notes Enter the note if required.

Request (mandatory) These requirements are mandatory for a safety application to complete the corresponding phase with the checklist.

Request (optional) These requirements are optional. Enter a note if any points are open (cannot be fulfilled).

15.2 Planning

Checklist to plan and use the module			
Device type, equipment ID			
Version: HW/FW		Date	
Editor		Tester	
Notes			

No.	Request (mandatory)	Yes	Notes
1	Was the current user manual used for planning?	□	Revision:
2	Is it permitted to connect these sensors to the module (acc. to the technical data and the parameterization options)?	□	
3	Was the power supply planned acc. to the specifications on the protective extra-low voltage as PELV?	□	
4	Is the external protection of the module planned (acc. to the specifications in the present manual on the supply voltage U_l)?	□	
5	Were actions planned against simple manipulation?	□	
6	Were actions planned against interchanging the plugs?	□	
7	Are the requirements on the sensors and on the cable routing observed acc. to the SIL/SIL CL/ cat./PL to be attained and is the implementation planned?	□	
8	Are the specifications on the parameterization determined for each channel?	□	
9	Is it ensured that a purposeful start of hazardous motions is only possible when the danger zone can be seen?	□	
10	Does the planned use match the intended use?	□	
11	Are the ambient conditions as well as the mechanical load met as specified in the technical data?	□	
12	Are check intervals determined and was the maximum service life considered?	□	

No.	Request (optional)	Yes	No	Notes
16	Were the specifications and electric installation specified (e.g. EPLAN) and provided to the executing bodies?	□	□	
17	Were the specifications for the commissioning specified and provided to the executing bodies?	□	□	

Checklist to plan and use the module		
	Date	Signature (editor)
	Date	Signature (tester)

15.3 Mounting and electric installation

Checklist for mounting and the electric installation of the module			
Device type, equipment ID			
Version: HW/FW		**Date**	
Editor		**Tester**	
Notes			

No.	Request (mandatory)	Yes	Notes
1	Was the mounting performed acc. to the specifications (specifications from the planning phase or acc. to the user manual)?	□	
2	Was the module installed and fastened correctly in the control cabinet PC (IP54)?	□	
3	Do the cross sections and the cable wiring correspond to the specifications?	□	
4	Does the connection technique correspond to the specifications made in the technical data in the corresponding user manual?	□	

No.	Request (optional)	Yes	No	Notes
5	Is the protocol or the address set correctly according to the specification?	□	□	
		Date		Signature (editor)
		Date		Signature (tester)

15.4 Commissioning and parameterization

Checklist to commission and parameterize the module			
Device type, equipment ID			
Version: HW/FW		Date	
Editor		Tester	
Notes			

No.	Request (mandatory)	Yes	Notes
1	Was the commissioning performed acc. to the specifications (specifications from the "planning" phase or acc. to the user manual)?	□	
2	Is a purposeful start of hazardous motions only possible during commissioning when the danger zone can be seen?	□	
3	Are all parameters parameterized for the inputs and is the NTE set correctly?	□	
4	Are the inputs - parameterized as dual-channel - parameterized in a way that they match each other?	□	
5	Is the assignment to the clocking outputs parameterized at the inputs?	□	
6	Was the switch-off delay for stop category 1 considered when calculating the total response time of the machine or system?	□	

No.	Request (optional)	Yes	No	Notes
7	Are the safety distances to be maintained measured acc. to the triggering and delay times (response times)?	□	□	

	Date	Signature (editor)
	Date	Signature (tester)

15.5 Validating

Checklist to commission and parameterize the module			
Device type, equipment ID			
Version: HW/FW		Date	
Editor		Tester	
Notes			

No.	Request (mandatory)	Yes	Notes
1	Are all requirements listed as mandatory in the "Planning" checklist met?	□	
2	Are all requirements listed as mandatory in the "Mounting and electric installation" checklist met?	□	
3	Are all requirements listed as mandatory in the "Commissioning and parameterization" checklist met?	□	
4	Does the parameterization of the safe inputs and clocking outputs correspond to the design of the actual connection of the commanding devices?	□	
5	Was the assignment between the sensors and the inputs and the variables of the safe application program checked (online status in the Safety program)?	□	
6	Was the function test to check all safety functions the module is involved in, performed?	□	
7	Were actions taken to attain a certain category?	□	
8	Do all wires correspond to the specifications?	□	
9	Does the power supply correspond to the specification on the protective extra-low voltage acc. to PELV?	□	
10	Is the external protection of the module implemented (acc. to the specifications in the present manual on the supply voltage U_I)?	□	
11	Were actions taken against simple manipulation?	□	
12	Are the requirements on the sensors and on the cable routing met acc. to the SIL/SIL CL/cat./PL to be attained?	□	
13	Are the specifications on the parameterization implemented in each channel?	□	
14	Was the checksum (SCCRC) from the safe parameterization applied to the safe configuration of the project and loaded to the control?	□	

Checklist to commission and parameterize the module			
15	Is it ensured that a purposeful start of hazardous motions is only possible when the danger zone can be seen?	□	
		Date	Signature (editor)
		Date	Signature (tester)

16 Disposal

16.1 General information

Dispose the products according to the respective valid national standard.

16.2 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
Electric Drives and Controls
Bürgermeister-Dr.-Nebel-Straße 2
D-97816 Lohr am Main, Germany

16.3 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.

16.4 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 people´s health when they are improper stored 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.

17 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)

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Notes

The Drive & Control Company

Rexroth
Bosch Group

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