

# Instruction handbook

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**be in motion**

**be in motion**



**BM5-SSL**

**Safe STO Logic**



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## DOCUMENT HISTORY

Revision level	Edition	Modifications
01	04-May-2018	Initial document
02	9-Jul-2018	CE certification updated





## GENERAL

### 2.1 Information on the Instruction handbook

---

This operation manual provides important information for the use of the device. Respect of the safety guidelines and instructions in this operation manual are prerequisites for the safe work.

Furthermore, the local accident prevention legislation and general safety regulations applying to the device's field of application must also be complied with.

Read the operation manual completely, in particular the chapter on safety instructions, before beginning any work on the device. The operation manual is a component of the product and must be kept accessible in the immediate vicinity of the device at all times.

Knowledge of the regulations and proper technical implementation of the safety instructions in this manual by qualified personnel are prerequisites for the safe installation, commissioning and safety during the operation and maintenance of the Baumüller **BM5-SSL**. Unqualified interference with the devices during shutdown or use of the safety functions or failure to comply with the instructions of this manual can lead to serious personal injury, property damage or environmental harm, for which Baumüller assumes no liability.

Baumüller safety components and systems are developed, manufactured and tested in compliance with the applicable safety standards. They may only be used under the specified environmental conditions and only in connection with approved external devices.

The operation manual contains safety instructions, descriptions of the interfaces and information on the phases of the product's life cycle:

- Planning
- Installation/Assembly
- Commissioning
- Validation
- Operation
- Modification/Retrofitting
- Maintenance/Repair
- Disassembly

### 2.2 Symbol explanation

#### Warning notes

Warning notes are marked by symbols in this operation manual. The notices are introduced by signal words which express the extent of the hazard.

Comply with the notes under all circumstances and act with caution in order to avoid accidents, personal injury and property damage.



#### **DANGER!**

....notifies of an imminent dangerous situation which will lead to death or serious injuries if not avoided.



#### **WARNING!**

....notifies of a potentially dangerous situation which can lead to death or serious injuries if not avoided.



#### **CAUTION!**

....notifies of a potentially dangerous situation which can lead to minor or slight injuries if not avoided.



#### **NOTICE!**

....notifies of a potentially dangerous situation which can lead to property damage if not avoided.

#### Recommendations



#### **NOTICE!**

....draws attention to useful tips and recommendations as well as information for efficient and trouble-free operation.

## 2.3 Limitation of liability

All statements and instructions in this operation manual have been compiled in compliance with the applicable standards and legislation while taking the current level of technology and our long-term experience and findings into account.

The manufacturer assumes no liability for damages resulting from:

- failure to observe the operation manual
- application for purposes other than those intended
- use by untrained personnel

The actual scope of materials delivered can vary from the explanations and illustrations described here in the event of custom designs, the use of additional ordering options or due to the most recent changes in technology.

The user assumes the responsibility of conducting maintenance and commissioning in accordance with the safety regulations of the applicable standards and all other relevant national or regional legislation relating to conductor dimensioning and protection, grounding, circuit breakers, overvoltage protection, etc.

The person who conducted the assembly or installation shall be accountable for damages occurring during assembly or connection.

## 2.4 Preliminary information



### CAUTION!

The following shall apply if the document you are reading is designated as preliminary information:

This version pertains to preliminary technical information which the user of the described devices and functions should receive ahead of time, in order to be able to adjust to potential changes and/or functional expansions.

This information is to be seen as preliminary, since it has not yet been subjected to the Baumüller internal review process. In particular, this information is still subject to changes, meaning that this preliminary information cannot be construed as legally binding. Baumüller assumes no liability for damages resulting from this potentially incorrect or incomplete version.

Should you detect or suspect content-related and/or serious formal errors in this preliminary information, please contact the contact person at Baumüller assigned to you and inform us of your findings and comments, so that they can be taken into account and potentially incorporated during the transition from the preliminary information to the final (reviewed by Baumüller) information.

### 2.5 Copyright

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Treat the operation manual as confidential. It is intended exclusively for those working with the device. It is not permissible to transfer the operation manual to third parties without the written approval of the manufacturer.



#### **NOTICE!**

The content-related statements, texts, diagrams, images and other illustrations are copyright protected and subject to industrial property rights. Any improper use is liable to prosecution.

### 2.6 Further applicable documents from other manufacturers

---

Components from other manufacturers are built into the device. Hazard evaluations for these bought-in parts have been conducted by the applicable manufacturers. The conformity of the designs with the applicable European and national legislation has been declared by the respective component manufacturers.

### 2.7 Spare parts

---



#### **WARNING!**

Improper or defective spare parts can lead to damage, malfunctions or total failure as well as jeopardize safety.

#### **Therefore:**

- Only use original spare parts from the manufacturer

Supply spare parts from authorized dealers or directly at the manufacturer.

### 2.8 Disposal

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If no return or disposal agreement has been made, dismantled components can be taken for recycling after proper disassembly.

See also [►Disposal instructions◄](#) on page 66.

## 2.9 Warranty and liability

---

All the information in this operation manual is non-binding customer information; it is subject to ongoing further development and is updated on a continuous basis by the permanent change management system of Baumüller Nürnberg GmbH.

Claims of warranty or liability towards Baumüller Nürnberg GmbH are rejected, in particular if one or more of the reasons listed in chapter [►Intended use◄](#) on page 18 has/have been the cause of the damage/s.

The operation of the devices described here in accordance with the specified methods/procedures/requirements is permissible. Everything else, even the operation of devices in installation positions not depicted here, for instance, is not permissible and must be clarified with the factor on a case-by-case basis. The warranty will be rendered null and void if the devices are operated differently than described here.

## 2.10 Customer service

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Our customer service is available for technical support.

Information on the competent contact person can be found at any time via telephone, fax, E-mail or over the Internet.

## 2.11 Terms used

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A list of the abbreviations used can be found in [►Appendix A - Abbreviations◄](#) from page 67.

## 2.12 Certification

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The device **Safe STO logic** from Baumüller Nürnberg GmbH has been developed in accordance with the standards specified in [►Approvals, directives and standards◄](#) on page 14 and certified by TÜV Rheinland Industrie GmbH.

### 2.12.1 Approvals, directives and standards

Safety engineering standards and directives	Area of application	Approvals
EN 61508, part 1-7:2010	Functional safety of safety-related electric, electronic and programmable electronic systems	Up to SIL 2
EN ISO 13849-1:2015	Safety-related components of control units	Up to Performance Level d
IEC 62061:2005, AC:2015	Functional safety of safety-related electric, electronic and programmable electronic systems	
EN 61800-5-2:2017	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional	
IEC 60204-1:2016 (in extracts)	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	

Additional standards	Area of application
EN 61800-3:2004, A1:2012	Adjustable speed electrical power drive systems - Part 3: EMC requirements
EN 61800-5-1:2007, A1:2017	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy

## SAFETY NOTES

This chapter provides an overview of all important safety aspects for the optimum protection of the personnel as well as for safe and trouble-free operation.

### 3.1 Contents of the instruction handbook

---

All persons assigned to work on or with the device must have read and understood that operation manual before beginning work with the device. This also applies if the person concerned has already worked with such a device or a similar device or has been trained by the manufacturer.

### 3.2 Alterations and rebuilding of the device

---

In order to avoid hazards and ensure optimum performance, neither alterations, additions nor rebuilding work may be conducted on the device unless explicitly authorized by the manufacturer.

### 3.3 Intended use

Das **BM5-SSL** ist ausschließlich für den hier beschriebenen bestimmungsgemäßen Verwendungszweck konzipiert und konstruiert.

Sie verwenden das Gerät dann bestimmungsgemäß, wenn Sie alle Hinweise und Informationen dieser Betriebsanleitung beachten.



#### **WARNING!**

##### **Danger due to use other than intended!**

Any use of the device different from and/or exceeding beyond the scope of the intended use can lead to dangerous situations.

Therefore:

- Only use the **BM5-SSL** as intended.
- Follow all specifications of this operation manual.
- Ensure that exclusively qualified personnel work on or with the **BM5-SSL**.
- Take care in project planning to see that the **BM5-SSL** is always used within its specifications.
- Ensure that the power supply meets the required specifications.
- Only operate the **BM5-SSL** if it is in technically faultless condition.
- Only use the **BM5-SSL** in combination with components approved by Baumüller Nürnberg GmbH.

### 3.4 Operator responsibility

The **BM5-SSL** is implemented in an industrial zone. The operator of the device is thus subject to the legal work safety obligations.

In addition to the work safety instructions in this operation manual, the safety, accident prevention and environmental protection regulations applicable to the area of application of this device must also be complied with. In doing so, the following applies in particular:

- The operator must inform himself of the applicable work safety regulations and additionally ascertain hazards arise through the special work conditions at the place of use of the device in a risk assessment. The operator must implement this in the form of operation instructions for the operation of the device.
- This operation manual must be kept in the immediate vicinity of the device and be accessible to persons working on and with the device at all times.
- The statements of the operation manual are to be followed completely and absolutely!
- The device may only be operated in technically faultless condition and must be safe for operation.



### 3.5 Protective equipment

The **BM5-SSL** complies with IP20.

### 3.6 Personnel training

**WARNING!****Risk of injury if operated by insufficiently qualified persons!**

Improper handling can lead to severe personal injury and property damage.

Therefore:

- Only allow certain activities to be conducted by persons specified in the respective chapters of this instruction handbook.

The following qualifications for various areas of operation are specified in the operation manual:

- **Operating personnel**

The drive system may only be operated by persons who have been trained, instructed and authorized to do so.

Troubleshooting, repairs, cleaning, maintenance and exchange may only be conducted by trained or instructed personnel. These persons must be familiar with the operation manual and act according to it.

Commissioning and instruction may only be conducted by qualified personnel.

- **Qualified personnel**

Electrical engineers and specialist electricians of the customer or a third party who are authorized by Baumüller Nürnberg GmbH, trained and certified in the installation and commissioning of Baumüller drive systems and commissioning, grounding and designating electrical systems and devices in accordance with the safety engineering standards.

Qualified personnel is educated or trained in the maintenance and use of suitable safety equipment in accordance with the respective local safety engineering standards.

### 3.7 Personnel protective equipment

---

Wearing the appropriate personal protective equipment when working is required in order to minimize hazards to the health.

- Always wear the respective protective equipment required for the respective task when working.
- Observe signs on personal safety in the work area!



#### **Protective work clothes**

consists of close-fitting workwear of low tear strength, without loose sleeves or projecting parts. Intended mainly to protect the wearer from moving machine parts.

Do not wear any rings and necklaces.



#### **Protective helmet**

for protection from falling and flying parts.



#### **Safety shoes**

for protection from heavy falling objects.



#### **Safety gloves**

to protect hands from friction, abrasions, puncture, prick wounds or deeper injuries as well as from contact with hot objects.

#### **To be worn during special work**



#### **Protective glasses**

to protect the eyes from flying parts and spraying liquids.

### 3.8 Special dangers

The residual risks arising as a result of the hazard analysis will be specified in the following section.

Observe the safety instructions described here and the warning notices in the following chapters in order to reduce health hazards and avoid dangerous situations.

#### Moving parts

**WARNING!****Danger of injury due to moving parts!**

Rotating and/or linear moving parts can cause severe injuries.

Therefore:

- Do not interfere with moving parts during operation.
- Do not open covers during operation.
- The mechanical residual energy depends on the application. Powered parts will also keep rotating/moving for a certain time after the power supply has been shut off. Make sure to provide suitable safety equipment.

### 3.9 Fire fighting

**DANGER!****Live-threatening danger from electrical current!**

Electric shock can occur if a conductive fire extinguishing medium is used.

Therefore:

- Use the following fire extinguishing medium:



ABC-Pulver / CO<sub>2</sub><Default Font>

### 3.10 Electric safety

The **BM5-SSL** is designed for contamination level 2 in accordance with DIN EN 61800-5-1. This means that only non-conductive contamination may appear during operating time. Short-term conductivity from condensation is only permissible if the **BM5-SSL** is not in operation.



#### **WARNING!**

##### **Risk of injury from conductive contaminants!**

No conductive contaminants may appear during operating time.

Therefore:

- Before installing the system, check that contamination degree 2 is not exceeded, and ensure so by additional measures, if necessary.

#### 3.10.1 Notice on power supply



#### **WARNING!**

##### **Risk of injury from electric current!**

Only devices which have a safe disconnection to the 230 volt power supply may be connected to the **BM5-SSL**.

The power supply unit for generating the 24 Volt supply must meet the requirements for PELV in accordance with EN 60204-1.

### 3.11 Safety equipment



#### **WARNING!**

##### **Live-threatening danger from inoperable safety equipment!**

Safety equipment provides a maximum of safety during operation. Even if the safety equipment may make work processes more complicated, they may not be put out of operation under any circumstances. Safety is only ensured if the safety equipment is intact.

Therefore:

- Check to make sure that the safety equipment is functional and installed properly before beginning work.

### 3.12 Conduct in the event of danger and accidents

**Preventive measures**

- Always be prepared for accidents or fire!
- Keep first aid equipment (first-aid box, blankets, etc.) and fire extinguishers on hand!
- Instruct personnel in accident reporting, first aid and rescue equipment.

**In case of emergency: Act properly**

- Put the device out of operation immediately with the EMERGENCY STOP.
- Introduce first aid measures.
- Keep people out of the danger zone.
- Inform the supervisors at the site.
- Notify a doctor and/or fire department.
- Clear access routes for rescue vehicles.

### 3.13 Signs and labels

The following symbols and notification signs are found in the work area. They relate to their immediate installation environment.

**WARNING!****Injury hazard due to illegible symbols!**

In the course of time, stickers and symbols on the device can become dirty or otherwise illegible.

Therefore:

- Keep all safety, warning and operation signs on the device in easily legible condition at all times.

**Electric current**

Only qualified personnel may work in work spaces with this marking.

Unauthorized persons may not touch work equipment bearing this marking.



## TECHNICAL DATA

### 4.1 Dimensions

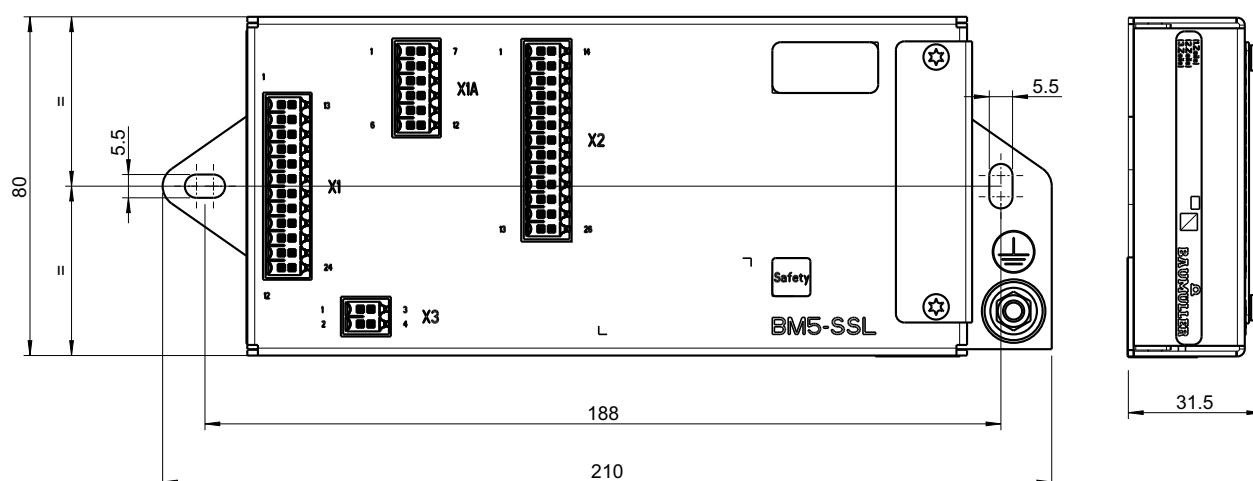


Figure 1: Dimension

## 4.2 Operational conditions

### 4.2 Operational conditions

#### 4.2.1 Environmental condition

Transport temperature range	- 25 °C to + 70 °C
Transport climate class (K) EN 60721-3-2	2 K 3
Storage temperature range	- 25 °C to + 55 °C
Storage climate class EN 60721-3-1	1 K 4
Operational temperature range	min. 5 °C to max. 55 °C
Operational climate class EN 60721-3-3	3 K 3
Installation altitude	up to 4000 m
Humidity (operating) EN 60721-3-3	Relative humidity: 5% to 85% non-condensed, and absolute humidity: 1 g/m <sup>3</sup> to 25 g/m <sup>3</sup>
Ionizing and non-ionized radiation	< measurable range
Vibration, shock and continuous shock EN 61800-5-1, chapter 5.2.6.4 vibration test	Max. 0.5 g when operating
Degree of contamination EN 61800-5-1, table 6, tab. 2	2



#### **WARNING!**

The operating conditions specified in the table above may not be exceeded at any time.



#### **NOTICE!**

Normally only a non-conductive dirt buildup occurs. Any conductive dirt buildup, whether short-term or permanent, is prohibited and could lead to destruction of the device. The customer is responsible for destruction resulting from dirt buildup of conductive materials or matter.

#### 4.2.2 EMC characteristics

EMC resistance / emission	In accordance with EN 61800-5-2/DIN EN 61800-3
---------------------------	--

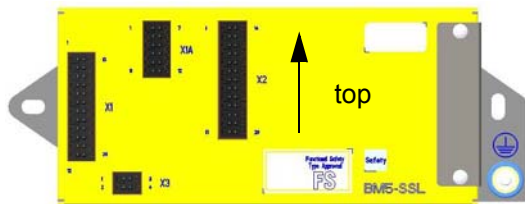


### 4.3 Requirements for control voltage / 24 V power supply

Only 24 V power supply units which comply with the SELV/PELV standards of EN 50178. are permitted for control voltage.

Control voltage	+24 V -15 % / +20 %
-----------------	---------------------

#### 4.3.1 Mechanical characteristics

Dimensions	Housing: 170 mm x 80 mm x 27 mm Housing with mounting plate: 210 mm x 80 mm x 27 mm
Weight	ca. 460 g
Mounting orientation	
IP code	IP20

### 4.4 Functional safety

This chapter describes parameters in relation to functional safety. First of all, in accordance with IEC 61508, safety means that a system is free of unwarranted risks. Functional safety is the part of the overall safety, which ensures that a safety system's response to its input conditions is free of errors. Internal safety-related device errors must be detected and brought into a safe condition in the process.

#### 4.4.1 Safety-related characteristics

The following table lists the safety-related characteristics of the **Safe STO logic** for an operation of 20 years. Safety-related parameters of local I/O terminals and decentralized components can be found in the applicable documentation.



#### CAUTION!

If the user calculates his safety application with 20 years for the specified values, the **BM5-SSL** will have to be decommissioned and sent back to the manufacturer within not more than 20 years. The user cannot perform a proof test.

## 4.4 Functional safety

The values are valid at the desired environmental conditions, see [►Environmental condition](#) on page 24.

**PFH** Probability of dangerous Failure per Hour

**HFT** Hardware Fault Tolerance

Characteristics according IEC 61508	
Safety Integrity Level'	SIL2, high demand mode
PFH	$< 1 \times 10^{-8}$
HFT	1

**MTTF<sub>D</sub>** Mean Time To Failure

**DC<sub>avg</sub>** Diagnostic Coverage

Characteristics according DIN EN ISO 13849-1	
Performance level	PLd, category 3
MTTF <sub>D</sub>	high
DC <sub>avg</sub>	medium



### WARNING!

Demands on the function test of the safety function to comply with the safety integrity level **SIL2** respectively the performance level **PLD, category 3**:

At least once a year the safety function has to be activated and deactivated again.

At least once a year the voltage at the STO outputs in state STO must be measured, it must be lower than 5 V.

No proof test is necessary during the expected life service of 20 years.

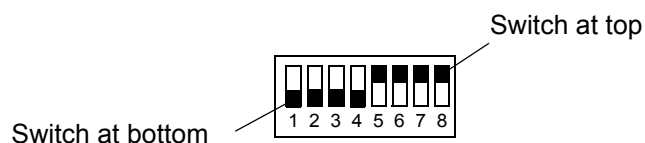
#### 4.4.2 Reaction time STO

The reaction time is maximum 3 ms from changing the input state to  $U_L$  (see ► [Safety inputs](#) on page 50) to the output state STO (at SS1 time = 0 ms)

#### 4.4.3 SS1 time

The SS1 time is set via dip switch.

The setting is only allowed in de-energized state.



SS1 time	Sx
0 ms (=STO)	
200 ms	
300 ms	
400 ms	
500 ms	
600 ms	
800 ms	
1000 ms	

**Tolerance SS1**      The tolerance of the SS1 time is  $\pm 1$  ms.

### BM5-SSL-000-000

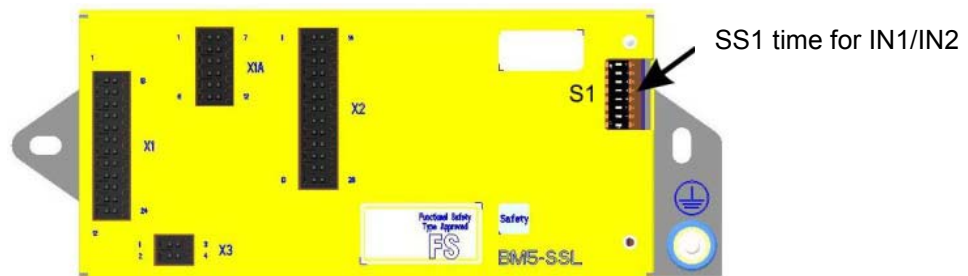


Abbildung 2: SS1 time: BM5-SSL-000-000

#### 4.4.4 Reaction time SS1

The reaction time from the change of the input states to  $U_L$  (see [▶ Safety inputs](#) on page 50) until the output state STO (at SS1 time  $> 0$  ms) is:

Max reaction time SS1 = SS1 time + tolerance of SS1 time + reaction time STO.

- SS1 time, see [▶ SS1 time](#) on page 27.
- Tolerance of SS1 time, see [▶ Tolerance SS1](#) on page 28.
- Reaction time STO, see [▶ Reaction time STO](#) on page 27.

# PACKAGING AND TRANSPORT

Before transport, we package every Baumüller device in such a manner that damaging occurring during transport is very unlikely.

## 5.1 Transport

---

**BM5-SSL** are packaged at the factory according to the order.

- Avoid heavy shaking and concussions during the transport.
- Avoid static discharges on the electronic components of the **BM5-SSL**.
- Only remove the **BM5-SSL** from the protective packaging immediately before assembly.

## 5.2 Unpacking

---

Upon receiving the still-packaged **BM5-SSL**:

- Check to see if any transport damages can be found!

If so:

- Immediately file a complaint to the supplier. Confirm the complaint in writing and immediately contact the representative of Baumüller Nürnberg GmbH who is assigned to assist you.



### CAUTION!

#### Danger due to electrostatic discharge!

The **BM5-SSL** (specifically its electronic components) can be damaged or totally destroyed if exposed to electrostatic discharges by being touched by hand.

Therefore:

- Follow the rules and instructions on handling components sensitive to electrostatic discharge when handling the **BM5-SSL**.

## 5.3 Disposing of the packaging

---

If no damage from transport can be found:

- Open the packaging of the device.
- Check the items included in the delivery against the bill of delivery.

The items included in the delivery are:

- **BM5-SSL**
- This operation manual including certificate of conformity on DVD
- If any transport damages can be found or any items are missing from the delivery, file a complaint to the Baumüller representative assigned to you.

## 5.3 Disposing of the packaging

---

The packaging consists of cardboard and plastic.

- Follow local regulations on disposal if you dispose of the packaging.

## 5.4 To be observed during transport

---

The **BM5-SSL** has been packaged at the factory for the initial transport. If you subsequently need to ship the **BM5-SSL** again, please observe the following:

- Use the original packaging
- or
- use suitable packaging for the components groups which are sensitive to electrostatic discharge.

Make sure that the transport conditions, see [►Operational conditions◄](#) on page 24, are consistently fulfilled throughout the entire transport process.

## DESIGN AND OPERATION

### 6.1 System

The **BM5-SSL** provides for all connected axes a simultaneous response to three different safety relevant events. In this case the STO inputs of the axes are activated by the **BM5-SSL** simultaneously. The function evaluation of the safety relevant event is provided by three functional outputs of the **BM5-SSL**.

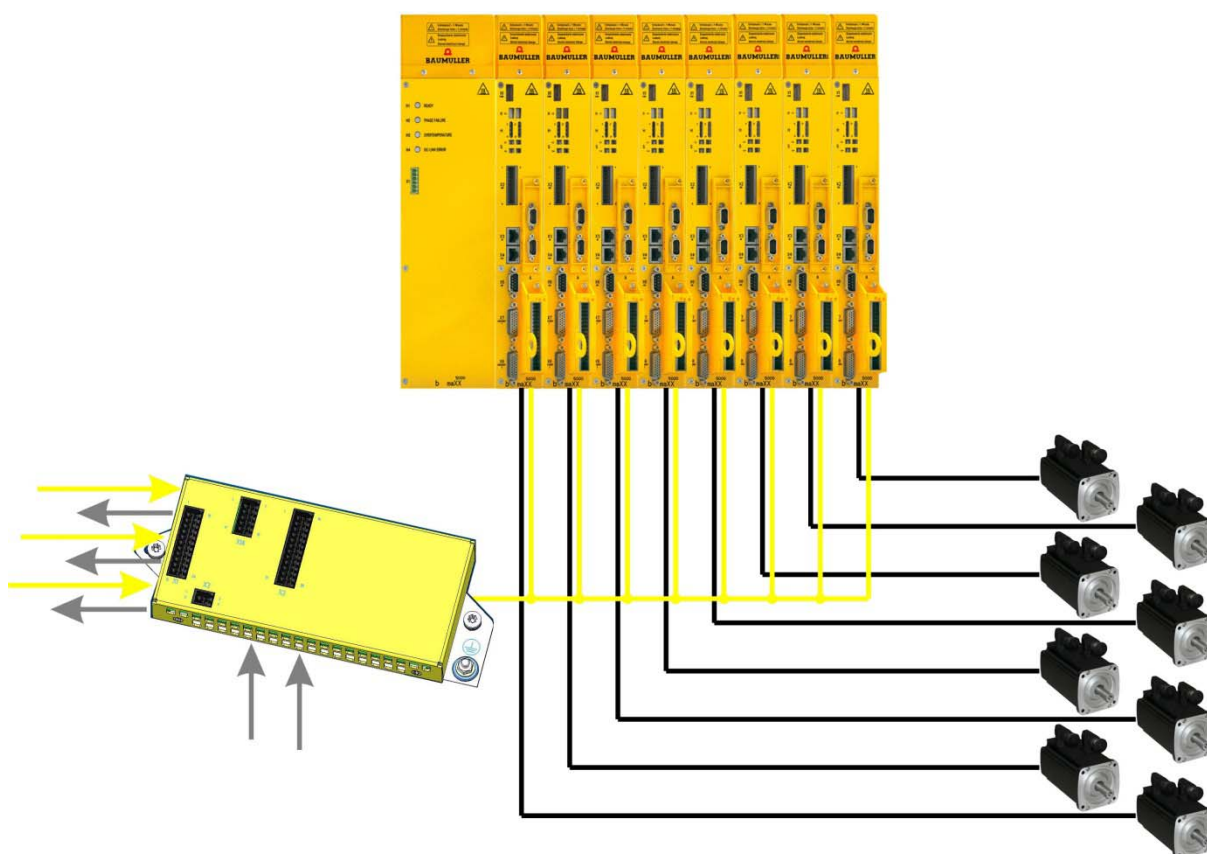


Figure 3: System

### 6.2 Internal logic

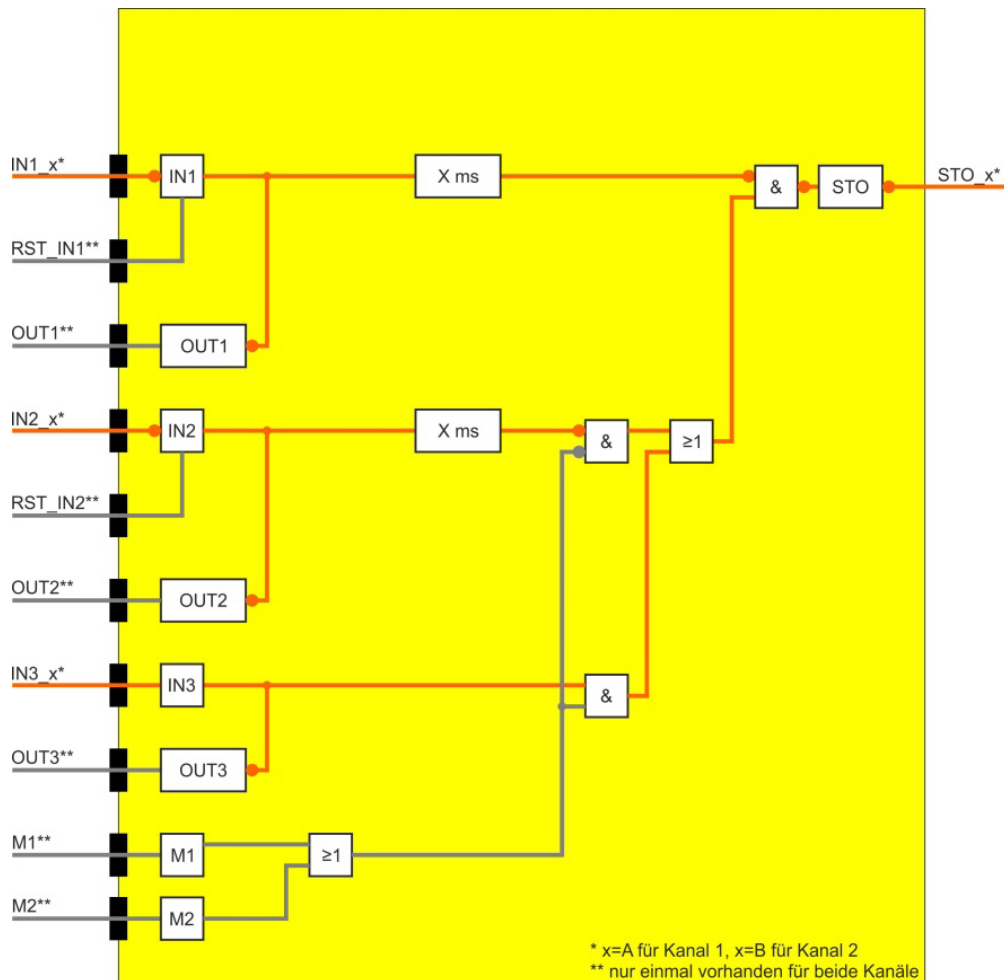


Figure 4: Internal logic (per channel)

#### 6.2.1 Inputs

The safety input IN1 reacts independent of the operation mode. The low level of IN1 always enables the safety function. This corresponds with the safety function STO in case the SS1 time is set to 0 ms. This corresponds with the safety function SS1 in case the SS1 time is set to >0 ms. The corresponding output OUT1 reacts immediately to the input. For instance, it can be used at a set SS1 time >0 ms from the master control to initiate a functional stop of the connected axes before the STO function is enabled after the SS1 time has elapsed.

The safety input IN2 reacts dependent on the mode. The low level of IN2 enables the safety function only if the operation mode inputs M1 and M2 are low too. This corresponds with the safety function STO in case the SS1 time is set to 0 ms. This corresponds with the safety function SS1 in case the SS1 time is set to >0 ms. The corresponding output OUT2 reacts immediately to the input. For instance, it can be used at a set SS1 time >0 ms from the master control to initiate a functional stop of the connected axes before the STO function is enabled after the SS1 time has elapsed.



The safety input IN3 reacts dependent on the mode. The low level of IN3 enables the safety function only if one or both operation mode inputs M1 and M2 are high. With this input the safety function STO is possible only. The corresponding output OUT3 can be used at the master control for evaluation.

All safety inputs are equipped with two channels. The safety function is activated as soon as one of the both channels A or B is low. The safety state STO can be left only if both channels have been in low state simultaneously. In addition when using the inputs IN1 and IN2 a falling edge on the corresponding reset input is necessary.

In case the SS1 time is set >0ms at inputs IN1 and IN2, this time elapsed after activating the safety function independent of the further state of the inputs and results in the state STO. Acknowledgment or termination of the request during the SS1 time is not possible.

If the inputs IN1 and IN2 respectively IN3 are high after applying the power supply, no acknowledgment via the reset inputs are necessary. The device leaves the state STO immediately after successful run-up.

## 6.2.2 Outputs

There is one output driver state for STO\_A and one for STO\_B. This outputs are available 8-times each on X1 and X1A to provide an one to one wiring to the connected axes.

Channel 1 is a p switch, i. e. the switch is in the positive part of the output STO\_A, the corresponding GND\_STO\_A is connected with GND of the power supply.

Channel 2 is a n switch, i. e. the switch is in the negative part of the output STO\_B, the corresponding STO\_B is connected with +24 V of the power supply.

The current of each output is limited to 265 mA. The maximum possible number of inputs that can be connected depends on its input current and input capacity. Not later than 1 ms after the state change of an output the corresponding output voltage must be available, otherwise the device recognizes an error and changed to error state.

$$C = \frac{T_{max}}{U_{max}} \cdot I_{max} = \frac{0.001 \text{ s}}{30 \text{ V}} \cdot 0.265 \text{ A} = 8.8 \text{ } \mu\text{F}$$

with  $U_{max} = 30 \text{ V}$   
 $T_{max} = 1 \text{ ms}$   
 $I_{max} = 265 \text{ mA}$

The **BM5-SSL** is able to manage up to 8 axes (STO from MAR or SAF-001-001).

## 6.2 Internal logic

### 6.2.3 State matrix

Nr.	IN1_A	IN1_B	RST_IN1	IN2_A	IN2_B	RST_IN2	IN3_A	IN3_B	M1 M2	OUT 1	OUT 2	OUT 3	STO_A	STO_B
1	1	1	x	1	1	x	x	x	0	1	1	x	1	1
2	↓	x	x	1	1	x	x	x	0	0	1	x	0 after X* ms	x
3	x	↓	x	1	1	x	x	x	0	0	1	x	x	0 after X* ms
4	1	1	x	↓	x	x	x	x	0	1	0	x	0 after X* ms	x
5	1	1	x	x	↓	x	x	x	0	1	0	x	x	0 after X* ms
6	0	0	1	1	1	x	x	x	0	0	1	x	0	0
7	1	1	↓	1	1	x	x	x	0	1	1	x	1	1
8	1	1	x	x	x	x	1	1	1	1	x	1	1	1
9	1	1	x	x	x	x	↓	x	1	1	x	0	0	x
10	1	1	x	x	x	x	x	↓	1	1	x	0	x	0
11	1	1	x	x	x	x	0	0	1	1	x	0	0	0
12	1	1	x	x	x	x	1	1	1	1	x	1	1	1

\* SS1 time + reaction time

x: not relevant or no change

No. 1 is the start state for No. 2,3,4 and 5

No. 6 is the start state for No. 7

No. 8 is the start state for No. 9 and 10

No. 11 is the start state for No. 12

### 6.3 Identification of the device - Type code

The type plate shows the type code of the device. It is attached at the left side of the **BM5-SSL**.

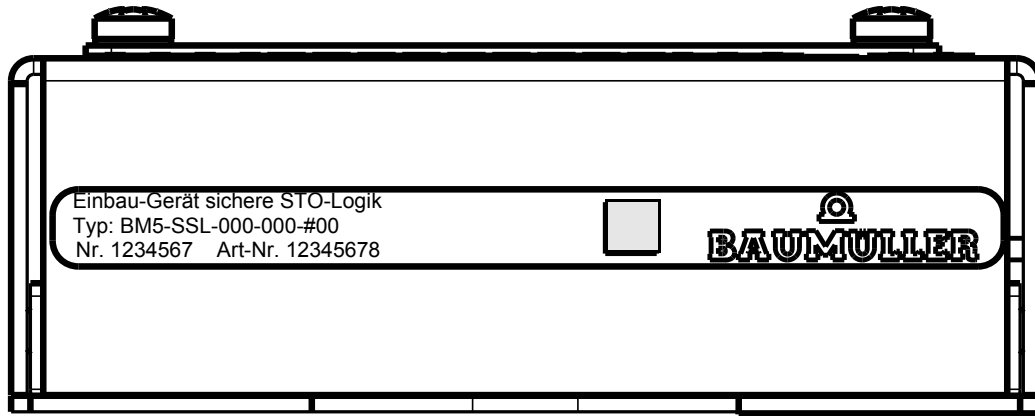


Figure 5: Type plate example

<u>BM5</u> - SSL - XXX - XXX - #XX	<b>b maXX 5000</b> component
BM5 - SSL - XXX - XXX - #XX	Safe STO logic
BM5 - SSL - XXX - XXX - #XX	000: Version with one DIP switch, without LED
BM5 - SSL - XXX - XXX - #XX	000: Only one SS1 time for both inputs IN1 and IN2
BM5 - SSL - XXX - XXX - #XX	Safety level
	#00: The device is designed for safety function „STO/SS1“.



# PLANNING OF A SAFETY-ORIENTED CONTROL SYSTEM

The entire process of defining the safety system is carried out in the planning phase. In addition to risk assessment, the planning contains the detailed definition of all system components, the definition of the system parameters and the detailed installation and wiring of the components.

**DANGER!**

Conducting the planning thoroughly aids in avoiding failures. Failures in safety-oriented machines can lead to permanent injuries and death.

**CAUTION!**

The „Planning checklist“ reproduced in the appendix is to be used in the planning phase.

## 7.1 Risk assessment

The risk assessment establishes which dangers a machine can present and which plant parts will have to be equipped with safety technology devices. The residual risk is reduced to a justifiable level by means of safety technology measures.

## 7.1 Risk assessment



### CAUTION!

As machine manufacturer, the applicable machine guidelines obligate you to conduct a risk assessment in order to establish the dangers associated with the machine and reduce the residual risk to a justifiable minimum.



### CAUTION!

It is absolutely necessary to conduct the risk assessment during the planning phase and before conducting retrofitting work.

The risk assessment should be conducted according to the procedure described in the following.

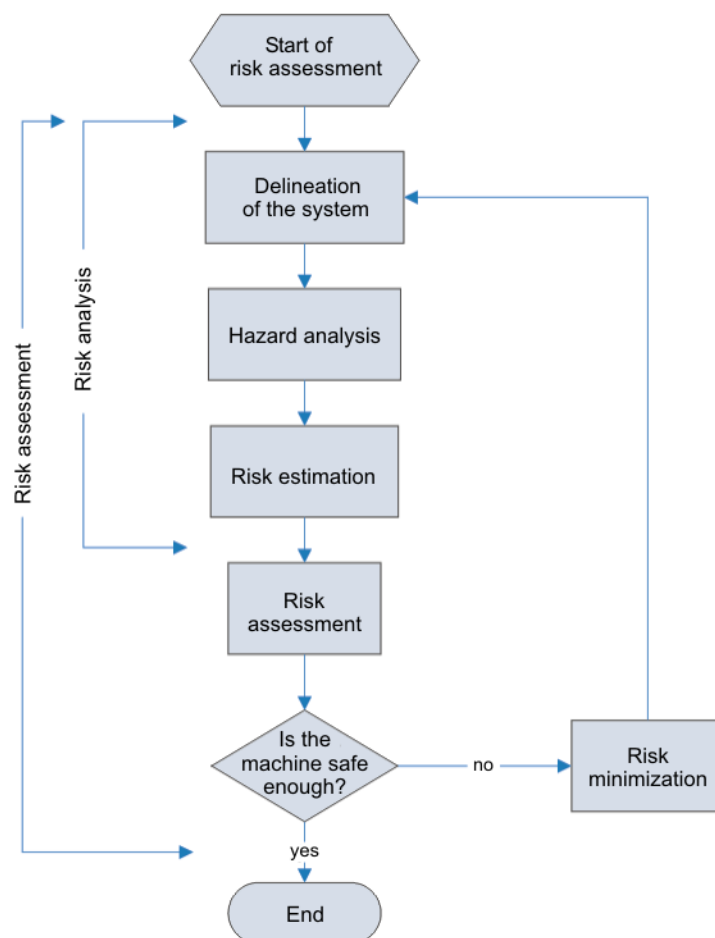


Abbildung 6: Risk assessment procedure in accordance with DIN EN ISO 12100-1 and EN ISO 14121

<b>Delineation of the system:</b>	Determination of the limits of the system's boundaries and the intended use
<b>Hazard analysis:</b>	Identification of hazards and the related hazardous situations
<b>Risk estimation:</b>	Estimation of the risks for each hazard identified
<b>Risk assessment:</b>	Assessment of the risks and establishment of risk reduction measures

The determination of the required safety class (SIL, performance level) is carried out in the scope of risk assessment. The course of action for the determination of the Performance Level is described in DIN EN ISO 13849-1. Annex A of IEC 62061 contains an informative part for the determination of the required SIL.

## 7.2 Installation and wiring plan

An installation and wiring plan for the entire safety system is to be developed in the planning phase. It contains all system components and their wiring.



### CAUTION!

The applicable standards and guidelines on laying electrical lines are to be observed when developing the wiring plan.

## 7.3 Course of the planning phase

The system is planned according to the respective requirements of the plant or the machine. The components available for the automation of the available components are described in the Automation catalog of the company Baumüller Nürnberg GmbH. There, you can find information on concepts, PLCs, fieldbuses, motion control, technology blocks, HMIs, IPCs and I/Os.





# MOUNTING AND INSTALLATION

This chapter describes the mechanical mounting and the electrical installation.

The mounting and installation process consists of the following steps:

- 1 Mount the **BM5-SSL**.
- 2 Connect the **BM5-SSL** with e. g. b maXX 5800 and safety components (for example, emergency stop device, electromechanical safety component, ...).
- 3 Check the assembly and installation by means of the „Installation checklist“ listed in Appendix [►B.2◄](#) on page 71.

## 8.1 General safety regulations



### CAUTION!

The „Installation checklist“ shown in Appendix [►B.2◄](#) on page 71 should be used during the assembly and installation phase.

- Make sure that the installation process is carried out entirely in accordance with the installation and wiring plan.
- Conduct a visual inspection and check all system components for visible damage.
- Check the system for wiring errors.
- Inspect the tightening torque and make sure that the electrical connection is not interrupted by insulation material.
- Inspect the tensile-load capacity of the electrical terminal and screw connections.
- Make sure that the installation and cable routing are carried out in accordance with applicable standards and guidelines.
- Make sure that the system's environmental properties specified in [►Environmental condition◄](#) on page 24 are not exceeded.
- Make sure that the design of the system's type of protection is sufficient.
- Make sure that the safety system is not damaged by moving parts or work in the area surrounding the installed safety components.
- Make sure that the system components do not come into contact with aggressive substances (such as acids, bases, transmission oil).

- Follow the information in the chapter [►Safety Notes◄](#) from page 15.

### 8.2 Mounting

Mounting steps:

- 1 Prepare mounting  
(for drilling holes see [►Dimensions◄](#) from page 23)
- 2 Mounting  
(for fixing see [►Mounting instruction◄](#) on page 43)



#### NOTE!

The PE connection must be wired with min. 1.5 mm<sup>2</sup> cross-section when connecting with the PE (e. g. with the mounting plate of the switching cabinet) in case the mounting is done with mounting adapter for top hat rail mounting (see [►Accessories◄](#) on page 61).



#### NOTE!

Mounting shall only be performed by employees of the manufacturer or by other qualified personnel.

Qualified personnel are persons who – on account of their occupational training, experience, instruction and knowledge of relevant standards and stipulations, accident prevention regulations and operating conditions – are authorized by the persons responsible for the safety of the facilities to perform the respective activities that are necessary, while at the same time recognizing and preventing any potential risks. The qualifications necessary for working with the device are, for example:

- Occupational training or instruction in accordance with the standards of safety engineering for the care and use of appropriate safety equipment.



#### NOTICE!

##### **Danger due to electrostatic discharge.**

The connecting terminals of the device are partially at risk due from ESD.

Therefore:

Please heed the respective notes.

## 8.2.1 Prepare mounting

Based on the planning documents and the drilling patterns (see [►Dimensions◄](#) on page 23) the positions of the attachment drill holes can be determined.



### NOTICE!

#### Property damage due to conductive contamination.

Therefore:

- When performing installation work of any kind, it must be ensured that no foreign material (e.g. drill shavings, copper strands, etc.) gets into the device as a result.
  - If possible, the drilling of the holes should be done before mounting the device and the configuring of the cables should take place outside of the control cabinet. If this is not possible, the device must be appropriately covered.
- Remove this covering again prior to start!



### CAUTION!

#### Eye injury due to flung particles.

Metal particles are flung when making the drill holes and the cutout sections.

Therefore:



Wear protective eye wear!

- Preparing drill holes.



### NOTE!

Consider the minimum clearances for cooling (on top/on bottom 100 mm) when making the drill holes.

## 8.2.2 Mounting instruction

Mounting procedure:

- 1 Keep suitable fastening components readily available.
- 2 Mount the device

### 8.3 Installation

This chapter describes the electrical installation.

Prior to installation, ensure that the technical prerequisites have been fulfilled:

- 1 Check the requirements for the electrical cables and the provision of corresponding cables.
- 2 Check the properties of the connections and the specified configuration of the respective cables.
- 3 Connect the protective conductor on the PE connection.

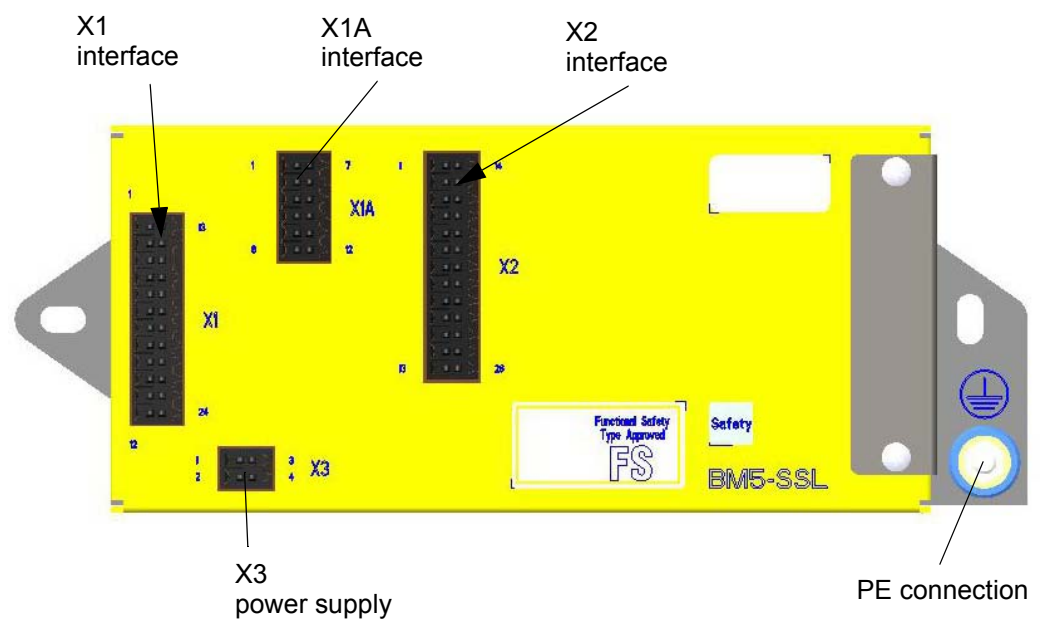
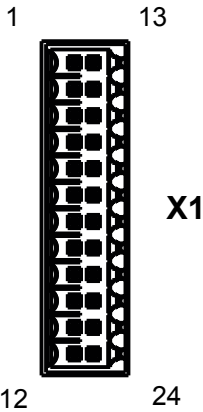


Figure 7: Connections

8.3.1 Pin assignment

8.3.1.1 Connection X1



GND_STO_A axis 1	1	13	STO_A axis 1
GND_STO_B axis 1	2	14	STO_B axis 1
GND_STO_A axis 2	3	15	STO_A axis 2
GND_STO_B axis 2	4	16	STO_B axis 2
GND_STO_A axis 3	5	17	STO_A axis 3
GND_STO_B axis 3	6	18	STO_B axis 3
GND_STO_A axis 4	7	19	STO_A axis 4
GND_STO_B axis 4	8	20	STO_B axis 4
GND_STO_A axis 5	9	21	STO_A axis 5
GND_STO_B axis 5	10	22	STO_B axis 5
GND_STO_A axis 6	11	23	STO_A axis 6
GND_STO_B axis 6	12	24	STO_B axis 6

Pin	Assignment	Description
1	GND_STO_A (for axis 1)	GND for STO output A
2	GND_STO_B (for axis 1)	GND for STO output B
3	GND_STO_A (for axis 2)	GND for STO output A
4	GND_STO_B (for axis 2)	GND for STO output B
5	GND_STO_A (for axis 3)	GND for STO output A
6	GND_STO_B (for axis 3)	GND for STO output B
7	GND_STO_A (for axis 4)	GND for STO output A
8	GND_STO_B (for axis 4)	GND for STO output B
9	GND_STO_A (for axis 5)	GND for STO output A
10	GND_STO_B (for axis 5)	GND for STO output B
11	GND_STO_A (for axis 6)	GND for STO output A
12	GND_STO_B (for axis 6)	GND for STO output B
13	STO_A (for axis 1)	STO output A
14	STO_B (for axis 1)	STO output B
15	STO_A (for axis 2)	STO output A
16	STO_B (for axis 2)	STO output B
17	STO_A (for axis 3)	STO output A
18	STO_B (for axis 3)	STO output B
19	STO_A (for axis 4)	STO output A
20	STO_B (for axis 4)	STO output B
21	STO_A (for axis 5)	STO output A
22	STO_B (for axis 5)	STO output B
23	STO_A (for axis 6)	STO output A
24	STO_B (for axis 6)	STO output B

### STO\_A output:

First channel of the safe STO logic.

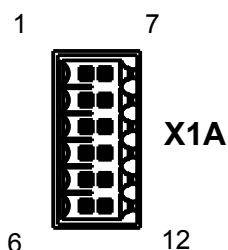
Technical data see [►Safety outputs◄](#) on page 51.

### STO\_B output:

Second channel of the safe STO logic.

Technical data see [►Safety outputs◄](#) on page 51.

## 8.3.1.2 Connection X1A



GND_STO_A axis 7	1	7	STO_A axis 7
GND_STO_B axis 7	2	8	STO_B axis 7
(= X1A:9)	3	9	(= X1A:3)
GND_STO_A axis 8	4	10	STO_A axis 8
GND_STO_B axis 8	5	11	STO_B axis 8
(= X1A:12)	6	12	(= X1A:6)

Pin	Assignment	Description
1	GND_STO_A (for axis 7)	GND for STO output A
2	GND_STO_B (for axis 7)	GND for STO output B
3	(= X1A:9)	Internal connected with pin 9
4	GND_STO_A (for axis 8)	GND for STO output A
5	GND_STO_B (for axis 8)	GND for STO output B
6	(= X1A:12)	Internal connected with pin 12
7	STO_A (for axis 7)	STO output A
8	STO_B (for axis 7)	STO output B
9	(= X1A:3)	Internal connected with pin 3
10	STO_A (for axis 8)	STO output A
11	STO_B (for axis 8)	STO output B
12	(= X1A:6)	Internal connected with pin 6

### STO\_A output:

First channel of the safe STO logic..

Technical data see [►Safety outputs◄](#) on page 51.

### STO\_B output:

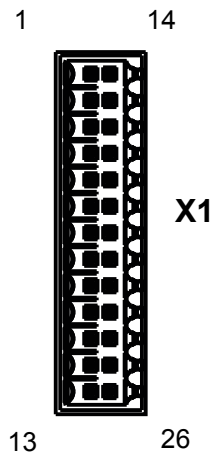
Second channel of the safe STO logic..

Technical data see [►Safety outputs◄](#) on page 51.

### 8.3.1.3 Connection X2

#### BM5-SSL000-000

See also ► [Identification of the device - Type code](#)◄ on page 35.



GND_IN1_A Internal connected with GND (= X3:1/2)	1	14	IN1_A
GND_IN1_B	2	15	IN1_B Internal connected with 24 V (= X3:3/4)
GND_RST_IN1 Internal connected with GND (= X3:1/2)	3	16	RST_IN1
GND_IN2_A Internal connected with GND (= X3:1/2)	4	17	IN2_A
GND_IN2_B	5	18	IN2_B Internal connected with 24 V (= X3:3/4)
GND_RST_IN2 Internal connected with GND (= X3:1/2)	6	19	RST_IN2
GND_IN3_A Internal connected with GND (= X3:1/2)	7	20	IN3_A
GND_IN3_B	8	21	IN3_B Internal connected with 24 V (= X3:3/4)
GND for GND_INx_A	9	22	24V for INx_A
GND for GND_INx_B	10	23	24V for INx_B
M1	11	24	OUT1
M2	12	25	OUT2
GND_M1_M2 Internal connected with GND (= X3:1/2)	13	26	OUT3



Pin	Assignment	Description
1	GND_IN1_A	GND for safety input 1 A, internal connected with X3:1/2
2	GND_IN1_B	GND for safety input 1 B
3	GND_RST_IN1	GND for reset input for safety input 1, internal connected with X3:1/2
4	GND_IN2_A	GND for safety input 2 A, internal connected with X3:1/2
5	GND_IN2_B	GND for safety input 2 B
6	GND_RST_IN2	GND for reset input for safety input 2, internal connected with X3:1/2
7	GND_IN3_A	GND for safety input 3 A, internal connected with X3:1/2
8	GND_IN3_B	GND for safety input 3 B
9	GND for GND_INx_A	GND for GND_INx_A, internal connected with X3:1/2
10	GND for GND_INx_B	GND for GND_INx_B, internal connected with X3:1/2
11	M1	Input 1 operation mode / Modus
12	M2	Input 2 operation mode / Modus
13	GND_M1_M2	GND for operation mode inputs, internal connected with X3:1/2
14	IN1_A	Safety input 1 A
15	IN1_B	Safety input 1 B, internal connected with X3:3/4
16	RST_IN1	reset input for safety input 1
17	IN2_A	Safety input 2 A
18	IN2_B	Safety input 2 B, internal connected with X3:3/4
19	RST_IN2	reset input for safety input 2
20	IN3_A	Safety input 3 A
21	IN3_B	Safety input 3 B, internal connected with X3:3/4
22	24V for INx_A	24V for INx_A, internal connected with X3:3/4
23	24V for INx_B	24V for INx_B, internal connected with X3:3/4
24	OUT1	Output 1, displays state of safety input 1
25	OUT2	Output 2, displays state of safety input 2
26	OUT3	Output 3, displays state of safety input 3

x = 1, 2, 3

## Safety input INx\_A:

First channel of safety inputs INx.

Technical data see [►Safety inputs◄](#) on page 50.

## Safety input INx\_B:

Second channel of safety inputs INx.

Technical data see [►Safety inputs◄](#) on page 50.

## Reset input RST\_INx:

Reset for safety input INx.

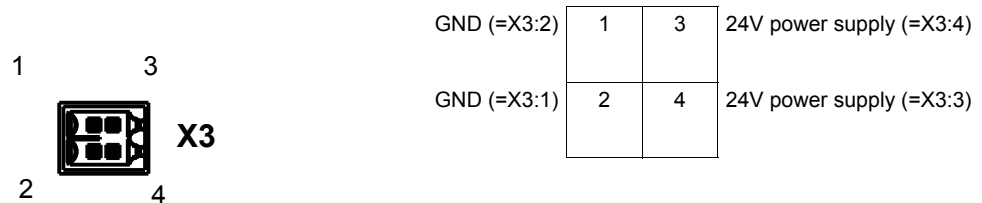
Technical data see [►Safety inputs◄](#) on page 50.

## Output OUTx:

Functional output for instantaneous display of the safety inputs INx.

Technical data see [►Functional outputs◄](#) on page 51.

### 8.3.1.4 Connection X3



Pin	Assignment	Description
1	GND (=X3:2)	GND power supply
2	GND (=X3:1)	
3	24V power supply (=X3:4)	+24V DC power supply
4	24V power supply (=X3:3)	

#### Power supply:

Power supply for electronics of **BM5-SSL**.

Technical data see [►Requirements for control voltage / 24 V power supply◄](#) on page 25.

### 8.3.1.5 Safety inputs

All inputs are type 3 according IEC61131.

The input levels are defined as follows at a power supply of 24 V<sub>DC</sub>:

$U_{Hmax} = 30 \text{ V}$	$I_{Hmax} = 15 \text{ mA}$
$U_{Hmin} = 11 \text{ V}$	$I_{Hmin} = 2 \text{ mA}$
$U_{Lmax} = 5 \text{ V}$	$I_{Lmin} = \text{not defined}$
$U_{Lmin} = -3 \text{ V}$	$I_{Lmax} = 15 \text{ mA}$

The maximum cable length is 30 m.

The safety inputs are designed for operation with sensors with OSSD outputs. The maximum test pulse length is 1 ms, the interval between the pulses must be 100 ms or longer.

Both inputs (INx\_A and INx\_B together) are necessary for the safety function and must be actuated separately. If both inputs are actuated together with a single cable, the fault exclusion according EN 61800-5-2 Annex D must be justified.

## 8.3.1.6 Safety outputs

Nominal output voltage: 24 V

Max. output current per channel: 265 mA

Both outputs STO\_A and STO\_B are necessary for the safety function together.

The maximum cable length is 30 m.

## 8.3.1.7 Functional outputs

Nominal output voltage: 24 V

Max. output current per channel: 500 mA

The maximum cable length is 30 m.

## 8.3.2 PE connection

Max. connector cross-section	Connection system	Torque
10 mm <sup>2</sup> copper cables	Cable lug for M5	min. 2.2 Nm max. 3.0 Nm



### NOTE!

According to DIN EN 61800-5-1, the following PE connection is required:

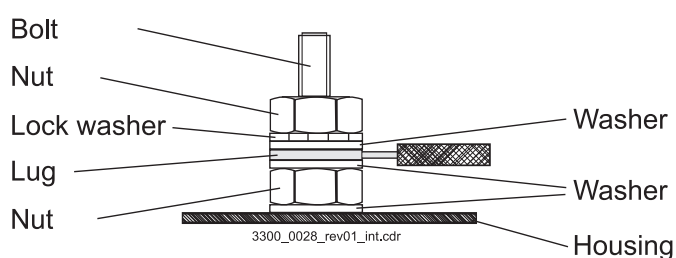


Figure 8: Structure of PE-connection

- Also, without the cable, the screw must be firmly tightened and must have a correct, electrical contact to the cabinet.
- There is **one** line lug between two washers and the pressing nut is protected against loosening by one spring washer.
- The lug must have a large-surfaced contact, which means, that it should be close to the screw.
- The structure must ensure a permanent safe contact.

### 8.3.3 Connection options

The inputs must be connected according the following connection diagrams.

#### BM5-SSL000-000

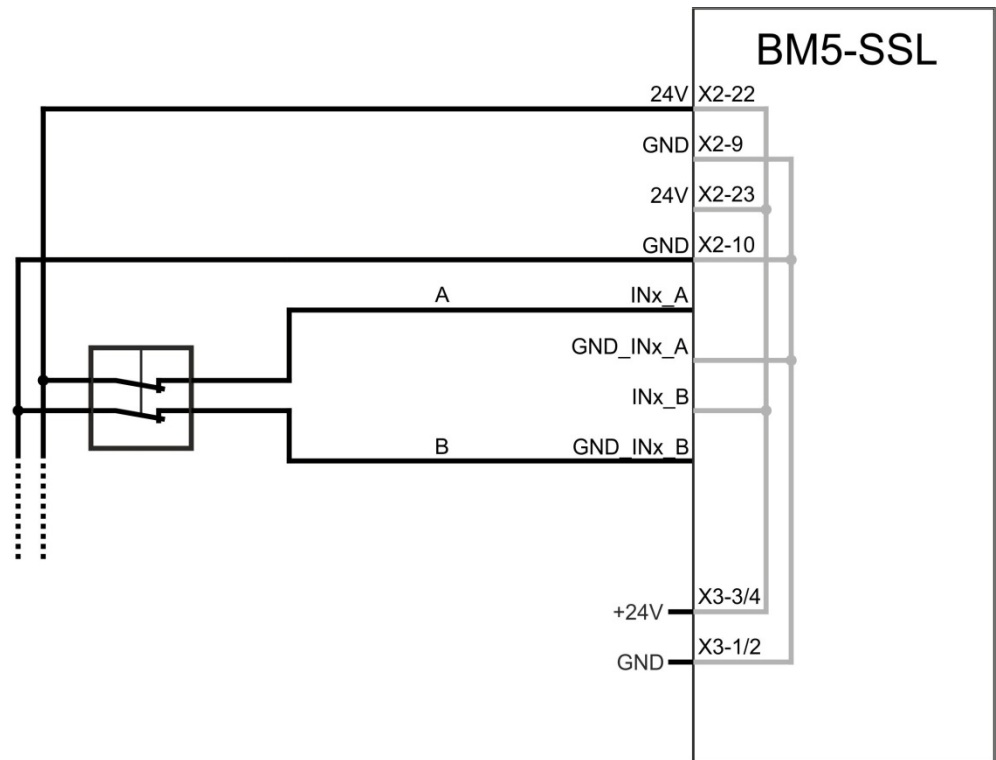


Figure 9: BM5-SSL-000-000: Potential free contact, p and n switching

Short circuit	Reaction
Cable A $\Leftrightarrow$ Cable B	Safety function of <b>BM5-SSL</b> is activated.
Cable A $\Leftrightarrow$ +24V	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.
Cable A $\Leftrightarrow$ GND	Safety function of <b>BM5-SSL</b> is activated.
Cable B $\Leftrightarrow$ +24V	Safety function of <b>BM5-SSL</b> is activated.
Cable B $\Leftrightarrow$ GND	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.

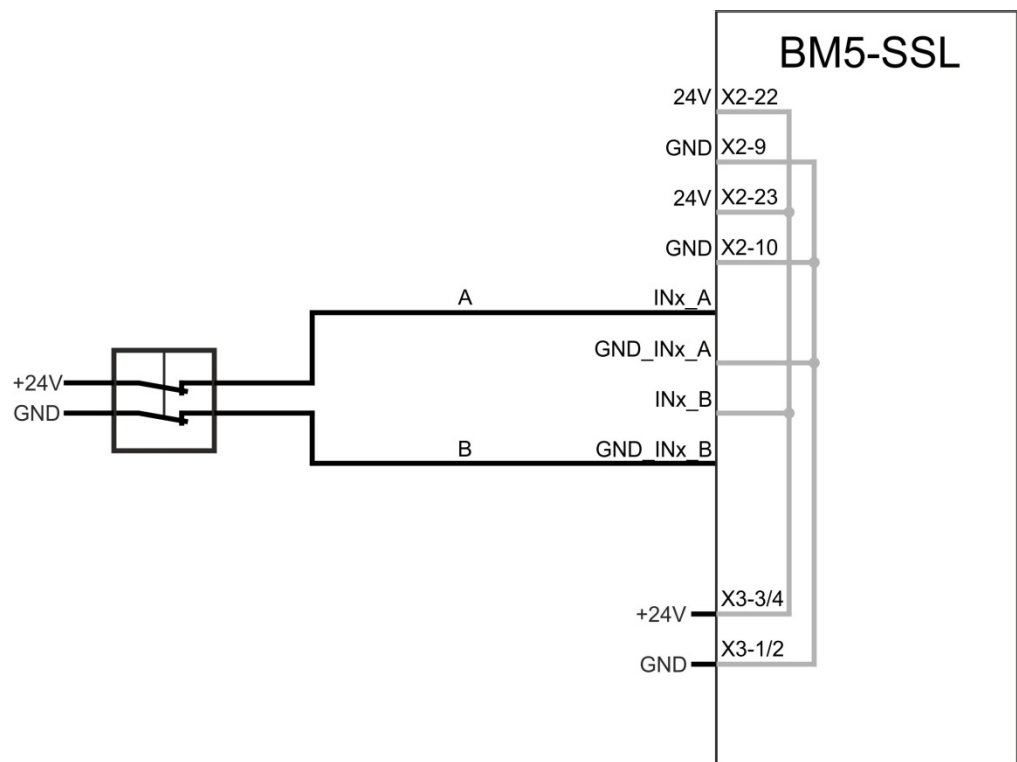


Figure 10: BM5-SSL-000-000: Potential free contact, p and n switching

Short circuit	Reaction
Cable A ⇔ Cable B	Safety function of <b>BM5-SSL</b> is activated.
Cable A ⇔ +24V	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.
Cable A ⇔ GND	Safety function of <b>BM5-SSL</b> is activated.
Cable B ⇔ +24V	Safety function of <b>BM5-SSL</b> is activated.
Cable B ⇔ GND	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.

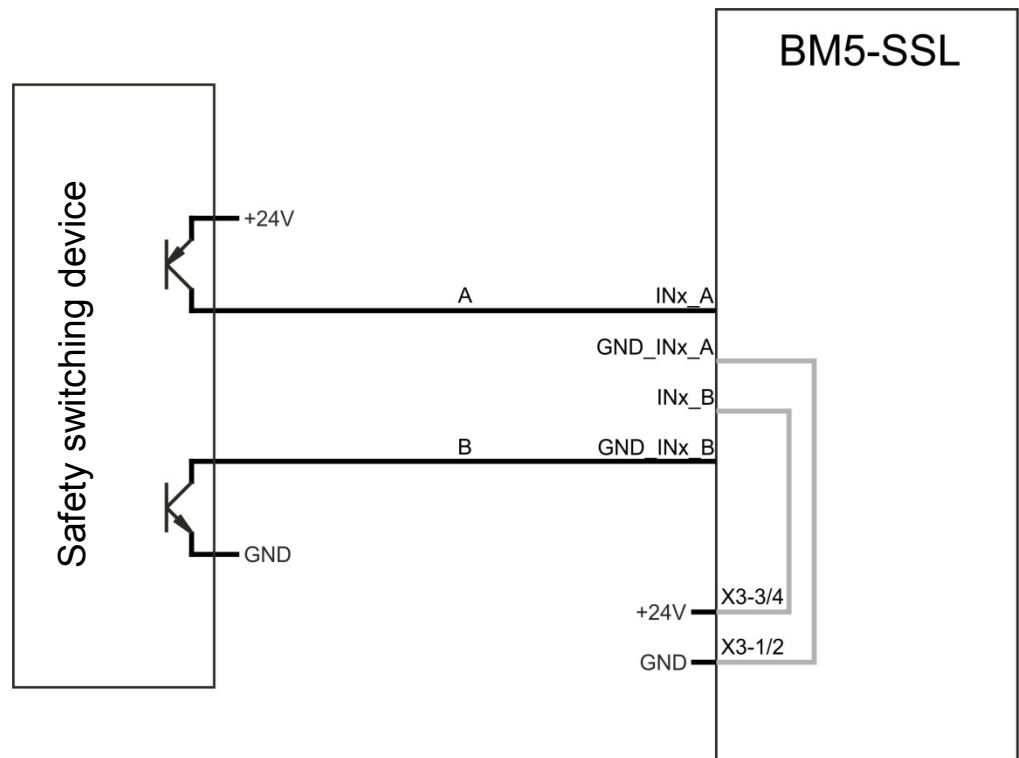


Figure 11: BM5-SSL-000-000: Safety switching device, p and n switching

Short circuit	Reaction
Cable A $\Leftrightarrow$ Cable B	Safety function of <b>BM5-SSL</b> is activated.
Cable A $\Leftrightarrow$ +24V	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.
Cable A $\Leftrightarrow$ GND	Safety function of <b>BM5-SSL</b> is activated.
Cable B $\Leftrightarrow$ +24V	Safety function of <b>BM5-SSL</b> is activated.
Cable B $\Leftrightarrow$ GND	Safety function is actuated by one channel only, <b>BM5-SSL</b> remains in state STO.

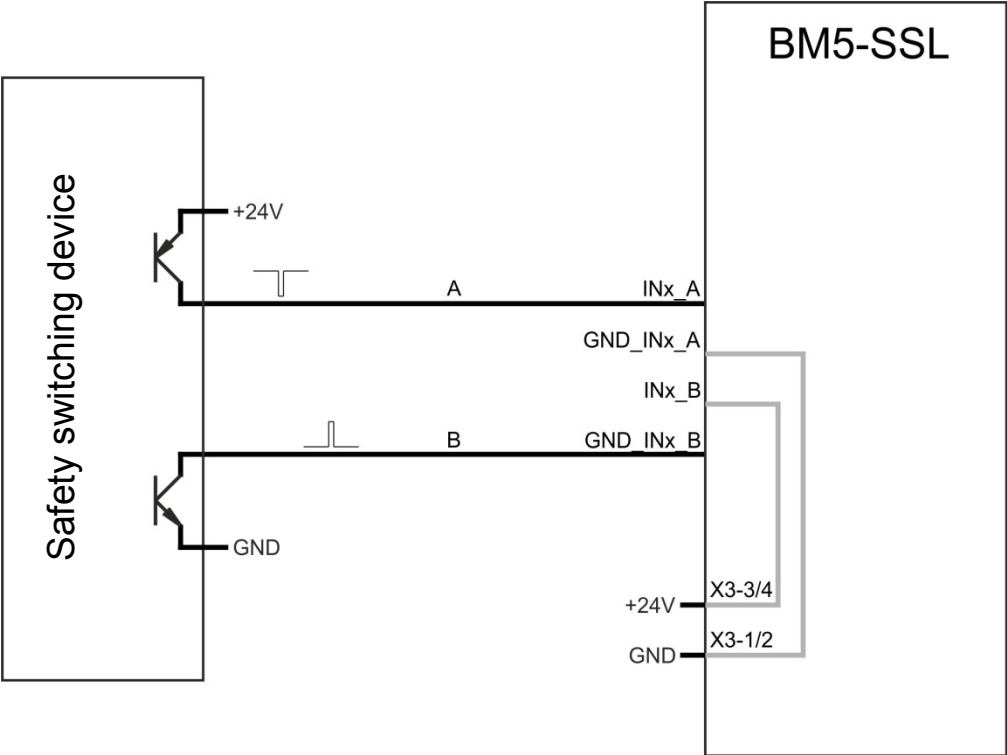


Figure 12: BM5-SSL-000-000: Safety switching device, OSSD, p and n switching

Short circuit	Reaction
Cable A ⇔ Cable B	Safety function of <b>BM5-SSL</b> is activated.
Cable A ⇔ +24V	Short circuit is recognized by the controlling safety switching device. The save switching device activates the safety function of the <b>BM5-SSL</b> via the second channel.
Cable A ⇔ GND	Safety function of <b>BM5-SSL</b> is activated.
Cable B ⇔ +24V	Safety function of <b>BM5-SSL</b> is activated.
Cable B ⇔ GND	Short circuit is recognized by the controlling safety switching device. The save switching device activates the safety function of the <b>BM5-SSL</b> via the second channel.

### 8.3.4 Connection option outputs

#### STO output

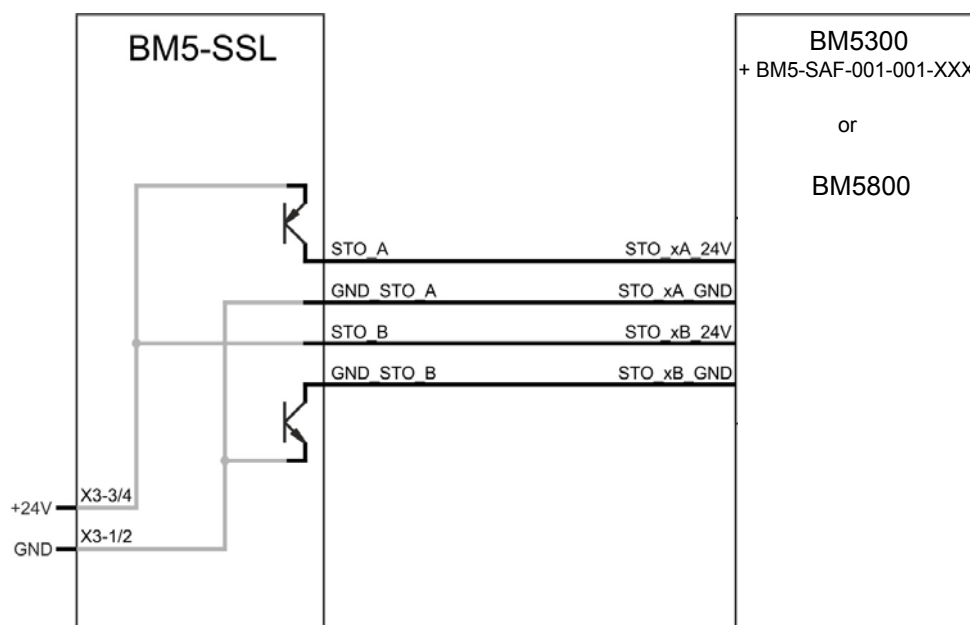


Figure 13: Connection option STO output 1

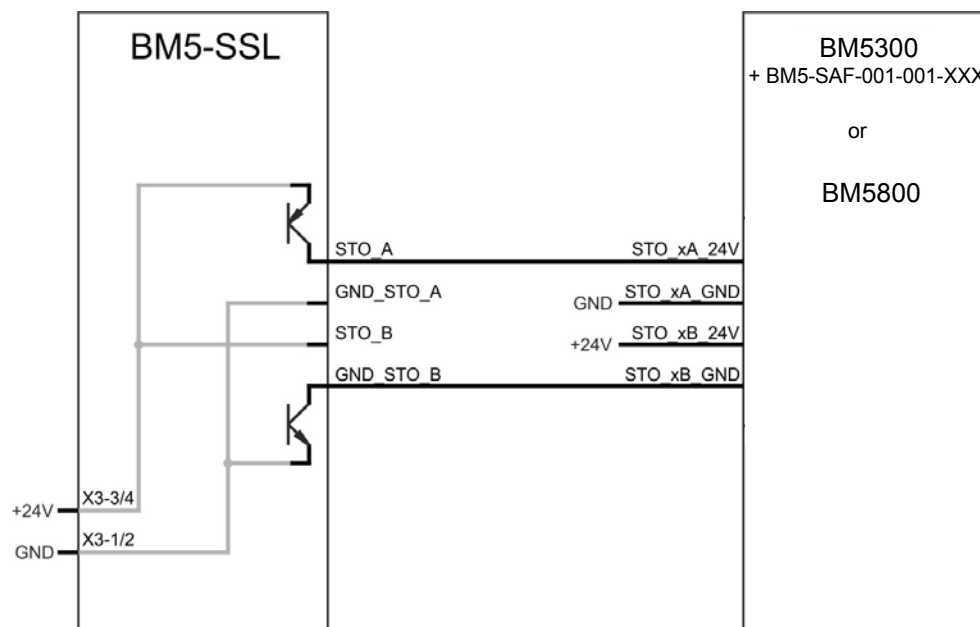


Figure 14: Connection option STO output 2



# COMMISSIONING AND OPERATION

This chapter describes the commissioning of the **BM5-SSL**.



## NOTICE!

The commissioning of the **BM5-SSL** is only allowed after the acclimation of the device.

## 9.1 General safety regulations

- Follow the chapter [►Safety Notes◄](#) from page 15.



## DANGER!

### Danger of injury due to moving parts!

Machine parts/line parts or the entire machine/line can move during commissioning. The „Planning checklist“ reproduced in the appendix [►Commissioning and validation checklist◄](#) from page 72.

Therefore:

- Maintain an adequate distance from moving machine parts/line parts or from the moving machine/line.
- Note that the machine parts/line parts or machine/line can be set in motion via additional axes connected to the **BM5-SSL**.
- Activate the safety devices in any case prior to switching on the system.
- Make sure that the system is commissioned exclusively by qualified personnel.
- Make sure that there are no people in the danger zone during the initial commissioning. Always anticipate that a machine, system or safety device may not behave as it is intended to.
- If changes or expansions are conducted during the commissioning process, the effects on the behavior of the system will have to be inspected. To do this, it will be necessary to process the checklists for the planning and installation phase again.

### 9.2 Requirements on the personnel

---

The commissioning work may only be conducted by professionally trained personnel, in particular personnel which understands the safety regulations and can follow them.

### 9.3 Procedure of commissioning

---

- Remove the cover of the dip switch for setting SS1 time
- Set SS1 time  
see [▶SS1 time◀](#) on page 27.
- Mount the cover of the dip switch
- Wiring of the inputs, outputs and of the power supply,  
see [▶Installation◀](#) from page 44.
- Connect the power supply
- Verification of the set SS1 time by measurement

### 9.4 Operation

---

Instructions on the operation of the system components connected to the axis units used can be found in the corresponding operation manuals and application manuals for these components.



#### **DANGER!**

It is not permitted to make any changes to the system configuration during the operation of the **BM5-SSL**.

Therefore:

- Before expanding the system and removing individual system components and making changes in the wiring, the **BM5-SSL** must as a rule be disconnected from the power source and put into safe condition by technical trained personnel.

## SYSTEM VALIDATION

All safety functions as well as the trouble-free functioning of the installed system must be tested with the initial operation. The testing of the system must be documented.



### WARNING!

#### Danger during commissioning!

The **BM5-SSL** may only be put into operation after being tested successfully by a technical expert.

Therefore:

- Conduct a complete function test. In doing so, check the correct allocation of the connected safety components.
- A checklist for the commissioning and validation of the system is reproduced in Appendix [►B.3 Commissioning and validation checklist◄](#) from page 72. Conduct the validation of the system in accordance with this checklist and document the procedure accordingly.
- Make sure that operating personnel has been instructed in the handling of the **BM5-SSL**.

### 10.1 Function test

---

The function test is a major part of the validation of the entire system. The function test is used to determine the trouble-free allocation of the network safety components and the programmed logic of the system.

Depending on the complexity of the logic circuit of the respective project, it is recommended to conduct the function tests in steps.

The following course of action is recommended when conducting the function tests:

- 1** Only connect the actuators and drives to the safe output terminals once no errors have been detected in the inspection of the logic circuit.
- 2** Conduct a complete function test with all sensors (initiators), switches, actuators and drives.

To conduct the function tests, trigger all safety functions sequentially and document the system's reaction. Check whether their action corresponds with the expected behavior.

## ACCESSORIES AND SPARE PARTS

Accessories/spare parts for devices **BM5-SSL** are listed in this chapter. Product management is happy to handle any queries and suggestions on accessory parts.

### 11.1 Accessories

#### 11.1.1 Connectors BM5-SSL

- No accessories kit
- Proposal for connectors that can be used

**BM5-SSL** is delivered without female connectors.

Connector	Used in BM5-SSL	Suitable connector-example *
	Weidmüller male connector	Weidmüller female connector
X1	S2L 3.50/24/180G 3.5SN BK 17290400000	B2CF 3.50/24/180 SN BK BX 1277570000
X1A	S2L 3.50/12/180G 3.5SN BK 1728980000	B2CF 3.50/12/180 SN BK BX 1277510000
X2	S2L-SMT 3.50/26/180G 3.5SN BK 1794630000	B2CF 3.50/26/180 SN BK BX 1277580000
X1	S2L-SMT 3.50/04/180G 3.5SN BK 1924530000	B2CF 3.50/04/180 SN BK BX 1277460000

### 11.1.2 Mounting adapter for top hat rail mounting

---

- No accessories kit
- Proposal

**BM5-SSL** is delivered without mounting adapter.

Manufacturer	Designation	Type	Order No.
Weidmüller	Electronics housing, mounting adapter	MTA 45 MF	1251310000

# MAINTENANCE AND REPAIR

## 12.1 Maintenance

---

If you are complying with the mandatory environmental conditions, see [►Operational conditions◄](#) from page 24, then the **BM5-SSL** is maintenance-free. If you detect or suspect a defect in the **BM5-SSL**, contact Baumüller Nürnberg GmbH.



### CAUTION!

Take organizational measures to make sure that the interval for the repeat testing of all system components (proof test interval, see [►Safety-related characteristics◄](#) from page 25) is complied with.

## 12.2 Repair

---

You cannot repair a defective **BM5-SSL**. Please contact Baumüller Nürnberg GmbH for a replacement.



### CAUTION!

Defective **BM5-SSL** may only be repaired by the manufacturer.





# DEMOUNTING, STORAGE AND DISPOSAL

This chapter describes how to demount the **BM5-SSL**, store it and dispose it.

## 13.1 Safety regulations

- Follow the chapter ► [Safety Notes](#) ◀ from page 15.



### WARNING!

#### Danger of injury due to uncontrollable behavior of the machine/line.

The behavior of the machine/line can change as a result of removing the **BM5-SSL** with the power source connected.

Therefore:

- Make sure that the power to all electrical connections is shut off and secured to prevent from being turned back on.
- Using suitable measuring equipment, check to make sure that none of the connections are carrying live current before beginning work on the electrical connections.
- Only disassemble the connections and remove the connection once you are completely certain that the **BM5-SSL** is not under power.

## 13.2 Requirements on the personnel

The personnel you assign to carry out the disassembly must have the knowledge and training necessary to perform this work properly. The personnel should be selected so that it will be able to understand and use the safety instructions attached to the device and its components as well as the connections.

### 13.3 Demounting

---

The personnel carrying out the disassembly must meet the requirements above.

Carry out the disassembly process in the following order:

- 1 Make sure that the power has been disconnected and cannot be turned back on accidentally.
- 2 Disassemble the **BM5-SSL** in the reverse order of the assembly (see chapter [►Assembly and installation◄](#) from page 69 onward).
- 3 Document the disassembly (or exchange) of the **BM5-SSLs**.

### 13.4 Storage condition

---

Store the **BM5-SSL** in a suitable package under the storage conditions specified in the [►Operational conditions◄](#) from page 24.

### 13.5 Recommissioning

---

If you want to put the **BM5-SSL** back into operation, observe the specifications under „Storage conditions“.

### 13.6 Disposal instructions

---

<b>Prerequisites</b>	<b>BM5-SSL</b> has already been disassembled properly.
<b>Sheet steel</b>	Parts of the <b>BM5-SSL</b> are made of galvanized or coated sheet steel. Sheet steel must be put into the cycle of potential recyclables for ferrous metals.
<b>Electronic scrap</b>	Electronic scrap (circuit boards), which cannot be disassembled further must be disposed of as special waste. Observe the applicable regulations in doing so.

### 13.7 Recycling collection center/offices

---

Make sure that the disposal is carried out in compliance with your company's disposal guidelines as well as those of the competent recycling collection centers and offices. In the event of uncertainty, contact the industrial inspectorate responsible for your company or the environmental agency.



## APPENDIX A - ABBREVIATIONS

<b>DC</b>	Diagnostic Coverage
<b>EMC</b>	Electromagnetic compatibility
<b>EN</b>	European standard
<b>ESD</b>	Electrostatic sensitive device
<b>EXT, ext</b>	External
<b>I/O</b>	Input/Output
<b>ISO</b>	International Organization for Standardization
<b>LED</b>	Light-emitting diode
<b>MTTF<sub>d</sub></b>	Mean Time To Failure
<b>PFD</b>	Probability of Failure on Demand (mean residual error probability of a dangerous error on demand)
<b>PFH</b>	Probability of Failure per Hour
<b>SIL</b>	Safety Integrity Level
<b>SFF</b>	Safe Failure Fraction (fraction of failures which lead to safe status)
<b>STO</b>	Safe Torque Off



## APPENDIX B - CHECKLISTS

The use of checklists serves documentation purposes and guides in the implementation of a safety system. The checklists reproduced in this chapter serve to prevent errors and must be processed carefully for every project. It is also required to make copies of the printed checklists.

No claim is made that the checklists are complete. There may be additional requirements depending on the specific plant.

### B.1 Planning checklist

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
1	Planning			
1.1	Has a risk assessment been carried out and have the required SIL and performance levels in accordance with DIN EN ISO 13849-1 or IEC 62061 been determined?			
1.2	Are power supplies according to PELV specifications being used exclusively?			
1.3	Is the line routing carried out in accordance with the applicable standards and guidelines?			
1.4	Is the electrical supply for the local I/O terminals and field bus components properly dimensioned?			
1.5	Do all safety-oriented system components meet the requirements of the established SIL (IEC 61508), performance levels and safety category (DIN EN ISO 13849-1)?			

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
1.6	Does the wiring of the safety components meet the requirements of the previously determined safety classification? (Example: Dual-channel wiring of an emergency stop for SIL 2 application)			
1.7	Do the components meet the environmental conditions prevailing in the application?			
1.8	Does the system fulfill the required type of protection?			
1.9	Is degree of pollution 2 complied with?			
1.10	Has the maximum permissible reaction time of the safety functions been established by means of a risk analysis?			
1.11	Is the maximum permissible reaction time reached? Has computational evidence been provided?			
1.12	Is the system protected from mechanical overloading?			
1.13	Is the system protected from corrosive substances?			

Date	Name	Signature

**B.2 Installation checklist**

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
2	Installation			
2.1	Has it been ensured that there are no short circuits from the wiring of the input and output terminals?			
2.2	Has it been ensured that the safety switch devices have not been bypassed as a result of wiring errors?			
2.3	Has a wiring inspection in accordance with the installation plan been conducted?			
2.4	Are all connection plugs labeled according to their allocation?			
2.5	Are the connection terminals loaded with the specified clamping torque?			
2.6	Has it been ensured that the insulation of the lines is not causing any faulty contacts?			
2.7	Has the reliability of all terminal connections been tested through mechanical tensile loading?			
2.8	Has a visual inspection of the installed components been conducted?			
2.10	Do the components meet the environmental conditions prevailing in the application?			
2.11	Does the system fulfill the required type of protection?			
2.12	Is degree of pollution 2 complied with?			
2.13	Is the system protected from corrosive substances?			

Date	Name	Signature

## B.3 Commissioning and validation checklist

### B.3 Commissioning and validation checklist

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
3	Commissioning			
3.1	Has a complete function test been conducted and documented?			
3.2	Has the operating personnel been instructed in the handling of the <b>BM5-SSL</b> ?			

Date	Name	Signature

### B.4 Modification and retrofitting checklist

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
4	Modification and retrofitting			
4.1	Is the modification/retrofitting of the system compatible? Do all of the checklist's requirements on the planning, installation and commissioning/validating continue to be fulfilled?			
4.2	Are the calculated reaction times still complied with after the modification/retrofitting? Proof is required!			
4.3	Has a complete function test been conducted and documented?			

Date	Name	Signature





## **APPENDIX C - DECLARATION OF CONFORMITY**

**EU - Declaration of Conformity****Doc.-No.****5.18008.01****Date:****26.06.2018****according to Machinery Directive 2006/42/EC**

The Manufacturer:

Baumüller Nürnberg GmbH  
 Ostendstrasse 80-90  
 90482 Nuremberg, Germany

declares, that the product:

Designation:

b maXX Safe STO logic

Type:

BM5-SSL-000-000-#00

BM5-SSL-001-001-#00

Manufactured since::

06/2018

is developed, designed and manufactured in accordance with the Machinery Directive 2006/42/EC.  
 This product complies with the requirements of the EMC Directive 2014/30/EU.

Applied harmonized standards:

Standard	Title
EN 62061:2005 + AC:2015	Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2015	Safety of machinery - Safety-related parts of control systems Part 1: General principles for design
EN 61800-5-1:2017	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 61800-5-2:2017	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
IEC 60204-1:2016 (in extracts)	Safety of machinery - Electrical equipment of machines Part 1: General requirements
IEC 61800-3:2004 + A1:2012	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC 61508, part 1-7:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems

Authorized person to compile the technical files:

Name: Thomas Peetz, Baumüller Nürnberg GmbH, dept. CAP

Address: Ostendstrasse 80-90, 90482 Nuremberg, Germany

Notified body executed the EC type-examination procedures according to Machinery Directive 2006/42/EC

Name: TÜV Rheinland Industrie Service GmbH

Address: Am Grauen Stein, 51105 Köln, Germany

Identification number 0035

Registration numbers: 01/205/5363.01/18

Attention should be paid to the safety instructions in the manual.

This product is to be used in machinery and must not put into operation until the machinery, into which it is incorporated, has been declared to be in conformity with the Machinery Directive 2006/42/EC.

Nuremberg / 26.06.2018

Location / Date

Subject to change of this declaration of EC conformity without notice. Actual valid edition on request.



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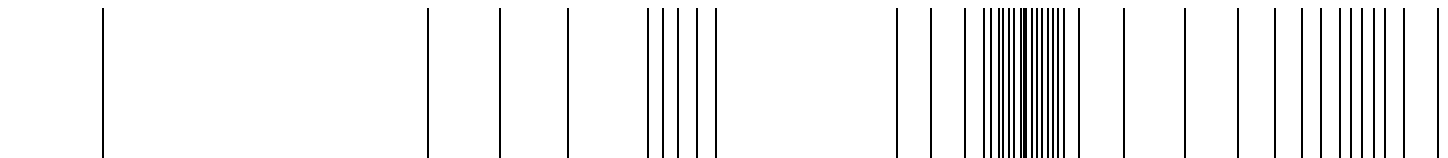


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**be in motion**



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