

# b maXX 6000

Addition to Instruction handbook b maXX 6000  
Integrated hardware-based safety function  
ISF ST0/SS1

**E**

5.23015.01

**Read the Instruction handbook  
before starting any work!**

Language: **English** (Translation)  
Document No. 5.23015.01  
Status 25-Sep-2025

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## DOCUMENT HISTORY

Version	State	Modification
5.23015.01	25-Aug-2025	Initial document



# 2

## GENERAL

### 2.1 Information on the instruction handbook

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This instruction handbook is a supplement to the instruction handbook for the b maXX 6000 device and provides important additional information on handling a **b maXX 6000 with integrated hardware-based safety function**.

The prerequisite for safe working is compliance with all the safety instructions and handling instructions in both instruction handbooks.

In addition, the local accident prevention regulations and general safety regulations applicable to the area of use of the device must be observed.

Before starting any work on the device, these operating instructions and the operating instructions for the b maXX 6000, in particular the chapter on safety instructions, must be read in full. Both instruction handbooks are part of the product and must be kept in the immediate vicinity of the device and accessible to personnel at all times.

Baumüller safety components and systems are developed, manufactured and tested in compliance with applicable safety standards. They may only be used under the specified ambient conditions and only in conjunction with authorized third-party devices.

The instruction handbook contains safety instructions, descriptions of the interfaces and information on the life cycle phases:

- Planning
- Installation/assembly
- Commissioning
- Validation
- Operation
- Modification/retrofitting
- Troubleshooting
- Maintenance/repair
- Demounting

### 2.2 Legend

#### Warning notices

Warning notices are marked by symbols in this instruction handbook. The notices are introduced by signal words which express the extent of the hazard.

Comply with the notices 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



#### **NOTE!**

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

## 2.3 Limitation of liability

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All statements and instructions in this instruction handbook 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 Copyright

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



### NOTE!

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.

## 2.5 Further applicable documents from other manufacturers

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Components from other manufacturers are built into the **b maXX 6000 with integrated hardware-based safety function**. 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.

## 2.6 Spare parts

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### 2.6 Spare parts

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#### **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

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

### 2.7 Disposal

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

### 2.8 Warranty and liability

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The warranty conditions can be found as a separate document in the sales documents. Operation of the devices described here is permitted in accordance with the methods/procedures/specifications specified. Anything else, e.g. the operation of devices in installation positions not described here, is not permitted and must be clarified with the factory in each individual case. If the devices are operated in any other way than described here, any warranty will be invalidated.

### 2.9 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.

### 2.10 List of related documentation

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#### **Instruction handbook**

	<b>Doc. No.</b>
Instruction handbook b maXX 6500	5.22004
Instruction handbook b maXX 6300	5.24007

#### **Parameter manual**

	<b>Doc. No.</b>
Parameter manual b maXX 5000/6000	5.09021

## 2.11 Certification

The **integrated hardware-based safety function** for b maXX 6000 has been developed in accordance with the standards specified below and certified by TÜV Rheinland.

EU Type Examination Certificate Number	01/205/5940.01/25
Test report No.	968/FSP 2587.01/25 from 30-Jul-2025
Notified Body:	0035

The declaration of conformity can be found in the instruction handbook b maXX 6000.

### Approvals, directives and standards

Safety engineering standards and directives	Area of application	Approvals
IEC 61508, Parts 1-7	Functional safety of safety-related electric, electronic and programmable electronic systems	up to SIL 3
DIN EN ISO 13849-1	Safety-related components of control units	up to performance level e

Additional standards	Area of application
DIN EN 61800-3	Adjustable speed electrical power drive systems - Part 3: EMC requirements
DIN EN 61800-5-1	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
DIN EN 61800-5-2	Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional
DIN EN 61131-2	Programmable controllers - Part 2: Equipment requirements and tests
DIN EN 60204	Electrical equipment of machines



# 3

## SAFETY

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 at the machine or installation on site. The observance of this is an important precondition for the safe and trouble-free operation

### 3.1 Contents of the instruction handbook

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All persons assigned to work on or with the device must have read and understood that instruction handbook before beginning work. 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

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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

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The **integrated hardware-based safety function for b maXX 6000** is exclusively designed and constructed for the intended purpose of use described here.

You are using the **integrated hardware-based safety function for b maXX 6000** according to the terms, as soon as you regard all notes and information in this instruction handbook.



### WARNING!

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

Any use of the **integrated hardware-based safety function for b maXX 6000** different from and/or exceeding beyond the scope of the intended use can lead to dangerous situations.

Therefore:

- Only use the **integrated hardware-based safety function** as intended.
- Follow all specifications of this instruction handbook.
- Ensure that exclusively qualified personnel work on or with this device.
- Take care in project planning to see that the **integrated hardware-based safety function** is always used within its specifications.
- Ensure that the power supply meets the required specifications.
- Only operate the **integrated hardware-based safety function** if it is in technically faultless condition.
- Only use the **integrated hardware-based safety function** with certificated components or in combination with components approved by Baumüller Nürnberg GmbH.

## 3.4 Operator responsibility

The **integrated hardware-based safety function for b maXX 6000** 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 instruction handbook, the safety, accident prevention and environmental protection regulations applicable to the area of application 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 in a risk analysis.  
The operator must implement these in the form of operation instruction for the total operation of the machine /application in dependence of the accordant risk assessment.
- This instruction handbook must be kept in the immediate vicinity of the **b maXX 6000** and be accessible to persons working on and with the device at all times.
- The statements of the instruction handbook are to be followed completely and absolutely!
- The **integrated hardware-based safety function for b maXX 6000** may only be operated in technically faultless condition and must be safe for operation.

## 3.5 IP code

The **b maXX 6000 with integrated hardware-based safety function** fulfills protection class **IP20** when installed.

### 3.6 Personnel training

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**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 instruction handbook:

- **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 instruction handbook 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 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

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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.

#### Electrical current



#### **DANGER!**

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

There is a live-threatening danger at contact with live parts. The damage of the insulation or of a single part can be live-threatening.

Therefore:

- Switch off the voltage supply immediately if there is a damage of the insulation.
- Only qualified personnel may work at the electrical installation.
- De-energize the machine for all work with reference to the discharge times (e.g. the controller DC-link) and protect against switching it on again.
- Observe the valid product safety standards when dealing with high-voltage equipment.

#### 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 Electric safety

The **integrated hardware-based safety function for b maXX 6000** 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.

This is achieved by installing the **b maXX 6000 with integrated hardware-based safety function** into a protected mounting location (at least IP 54, e.g. the mounting in a control cabinet).

Short-term conductivity from condensation is only permissible if the **b maXX 6000** is not in operation.



#### **WARNING!**

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

No conductive contaminants may appear during operating time.

Therefore:

- Before installing and commissioning the system, check if the contamination degree 2 is not exceeded (do this also by optical inspections, if it is necessary).

#### **Notice on power supply**



#### **WARNING!**

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

Only safety devices which have a safe disconnection to the 230 volt mains may be connected to the device.

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

### 3.10 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:

- Before starting to work, check the installed safety equipment. Make sure that the safety equipment is without damages and was not manipulated.

### 3.11 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 **b maXX 6000 with integrated hardware-based safety function** out of operation immediately:
  - Always immediately EMERGENCY-OFF at electrical hazards like short-circuits, smoke, fire, lightning.
  - At mechanical hazards, if necessary EMERGENCY-STOP until the machine stops. Additionally, EMERGENCY-OFF.
- Keep people out of the danger zone.
- Introduce first aid measures.
- Inform the supervisors at the site.
- Notify a doctor and/or fire department.
- Clear access routes for rescue vehicles.

### 3.12 Signs

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 **b maXX 6000** can become dirty or otherwise illegible.

Therefore:

- Keep all safety, warning and operation signs on the **b maXX 6000** 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 Safety-related parameters for an operation of 20 year

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In accordance with IEC 61508, safety means first of all, 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

The following table lists the safety-related parameters of the **integrated hardware-based safety function STO or SS1 for b maXX 6000** for an operation of 20 years with an average environmental temperature of 55°C.

Safety-related parameters of local I/O terminals and decentralized components can be found in the applicable documentation. The values relate exclusively to the components of the safety function.

#### Hardware type

**Double axis  
BM63XX** STO (F: 0080 0001) bzw. SS1 (F: 0080 2001):  
2 x safe input

- DIG\_IN\_1
- DIG\_IN\_2

**Single axis  
BM63XX /  
Mono axis  
BM65XX** STO (F: 0040 0001) bzw. SS1 (F: 0040 2001):  
1 x safe input

- DIG\_IN\_1

Refer to [▶Type code◀](#) from page 34.

## 4.1 Safety-related parameters for an operation of 20 year

Parameters in accordance with IEC 61508	
<b>PFH</b> (Probability of dangerous Failure per Hour)	$PFH = 4,5053 \cdot 10^{-11} /h$
<b>SFF</b> (Safe Failure Fraction)	SFF according SIL 3

Parameters in accordance with DIN EN ISO 13849-1	
<b>MTTF<sub>D</sub></b> (Mean Time To Failure dangerous)	$MTTF_D = 563,6 \text{ years}$
	<b>Classification</b> HIGH
<b>DC<sub>avg</sub></b> (Diagnostic Coverage)	$DC_{avg} = 99,54 \%$
	<b>Classification</b> HIGH

The **integrated hardware-based safety function STO for b maXX 6000** can be used in applications

as far as Cat 4 /PL e in accordance EN ISO 13849-1 and SIL3 in accordance EN 62061 / IEC 61508.

No proof test is necessary during the expected service life of the **b maXX 6000 with integrated hardware-based safety function** of up to 20 years.



### CAUTION!

If the user calculates his safety application for the specified values with 20 years, the **b maXX 6000 with integrated hardware-based safety function** must be decommissioned after 20 years. This is the maximum service life of the device. The **b maXX 6000 with integrated hardware-based safety function** must be decommissioned after this time. The **b maXX 6000 with integrated hardware-based safety function** must be properly disposed of. It is forbidden to perform a proof test.



### NOTICE!

The proper condition of the controller's fan must be checked before commissioning the **b maXX 6000 with integrated hardware-based safety function**. The maintenance and cleaning of the fan must be made at least once a year.

### 4.2 Response time

The response time of the **b maXX with safety function** until the IGBT power stage is activated is

maximum 1 ms + filter time of 2 ms.

In the SS1 version, the SS1 time must also be added.

### 4.3 Power connection values

External power supply +24 V	Power supply range $U_B = 24V -15\%/+20\%$ (SELV/PELV)
Connection cable to connector X9 <b>b maXX with safety function</b>	< 30 m

#### Input-side switching thresholds (SELV/PELV)

Voltage / Current	Switching threshold
U high max	30 V
U high min	11 V
U low max	5 V
U low min	-3 V
I high max	15 mA
I high min	2 mA
I low max	15 mA
I low min	Not defined

### 4.4 Requirements for the use of encoders



**WARNING!**

The following requirements must be complied with.

The encoder must be connected via a direct connection to the **b maXX 6000**, via which no external voltage can be introduced.

## 4.5 Operating conditions

### 4.5 Operating conditions

#### Climatic conditions

Operating conditions	0°C ... 55°C 95% relative humidity, no condensation
Storage conditions	-40°C ... 70°C 95% relative humidity, no condensation
Transport conditions	-40°C ... 70°C 95% relative humidity, no condensation
Installation altitude	max. 1000 meters with derating max. 4000 meters



#### WARNING!

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

#### Mechanical characteristics

Mounting position	Vertical (specified by controller installation position).
IP code	IP 20
Permitted degree of pollution	Degree of pollution 2

#### EMC characteristics

EMC resistance / emission	In accordance to DIN EN 61800-3 / DIN EN 61800-5-2
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## DESIGN AND OPERATION

This chapter describes the **integrated hardware-based safety function** and its operating elements and explains the type code of the b maXX 6000.

### 5.1 Safety instructions

---



#### **DANGER!**

Before deactivating safety functions, make sure that all persons have left the possible danger zone of the machine or system or that all persons present there have been informed of the planned deactivation of the safety functions and the subsequent movement.

Only then may the safety functions be deactivated and the drive or machine moved!



#### **WARNING!**

- The **integrated hardware-based safety function of the b maXX 6000** may only be operated with safety-compliant devices such as safe I/O terminals, emergency stop devices in accordance with DIN EN ISO 13850 and safety sensors in accordance with EN 61496.
- In the unlikely event of a total failure of an internal driver (IGBT) or a control element, the drive may be energized briefly (even in the STO state). The angular movement traveled in this case depends on the rotor position and the number of pole pairs of the motor. It is a maximum of  $180^\circ/\text{number of pole pairs}$ .



### **DANGER!**

#### **Danger from moving machine parts!**

If the inputs are supplied by a connected safety component (emergency stop device, safety light curtain), the driver stage is supplied immediately. Failure of the controller can lead to an unexpected start-up. Use the external safety components to ensure that an unexpected start-up is prevented during commissioning.

Therefore:

- Keep sufficient distance from moving machine parts / system parts or from the moving machine / system.

## 5.2 General

---

The **integrated hardware-based safety function for b maXX 6000** performs a safe pulse inhibit of the drive.

The time at which the pulse inhibit is executed depends on the version (STO or SS1) of the device.

On the output side, the **integrated hardware-based safety function** has two independent, safe pulse inhibits for two drive axes, which are triggered either by a safe input or by a safety-related fault.

The drive is in the STO state (see the description of the safe pulse inhibit interface in [►Safe pulse inhibit◄](#) on page 33).

It is not possible to parameterize or configure the **integrated hardware-based safety function STO/SS1**.

### 5.3 Functionality

The **integrated hardware-based safety function** supports the safe pulse inhibit of two independent drive axes.

The functional principle of the **integrated hardware-based safety function for the b maXX 6000** is shown in the following figure. The safety functions are connected or triggered via directly wired safety components

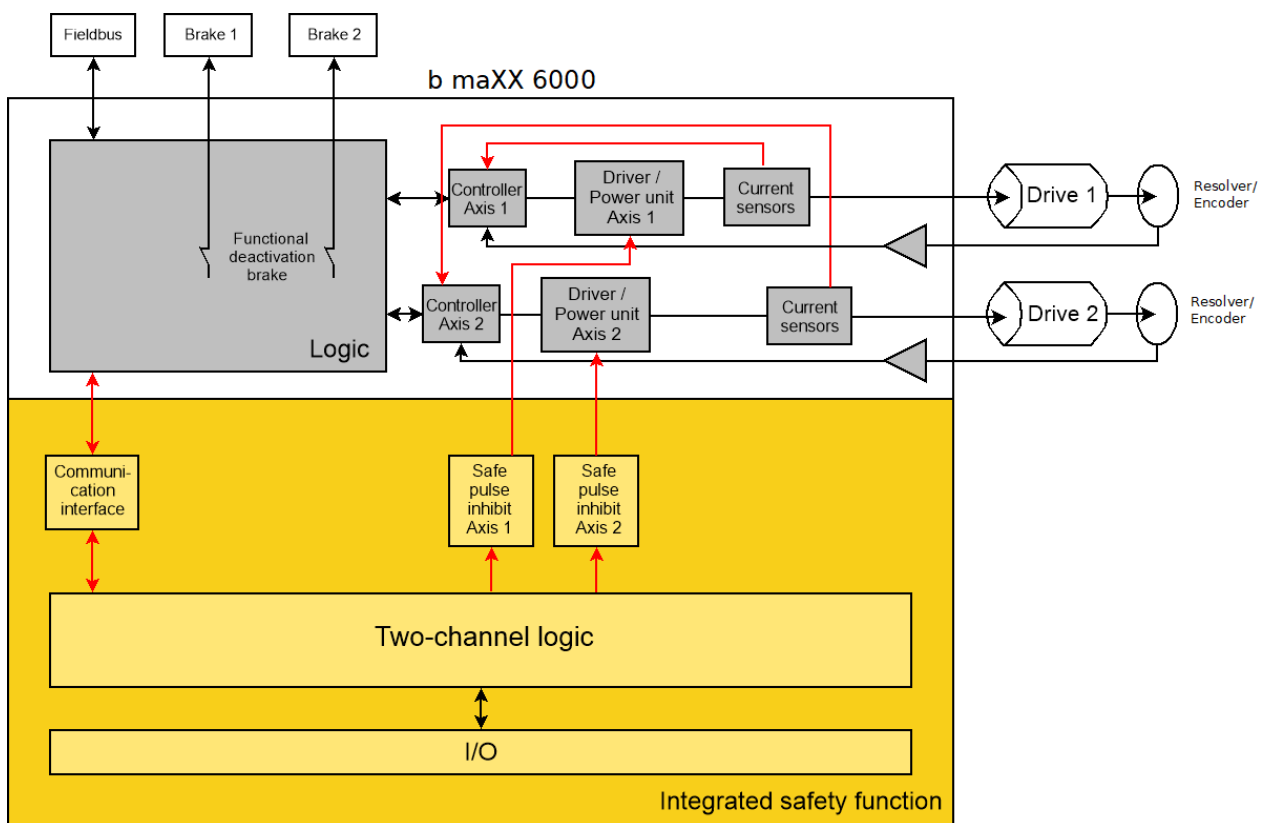


Figure 1: Principle of operation

If a requested safety function is triggered by cancellation of the digital input, the driver supply is switched off (necessary for the enabling of the power semiconductors of the output stage) via the interfaces of the safe pulse inhibit. In this case, the drive is in the STO state.



**WARNING!**

The safety instructions and risks relating to the STO safety function must be taken into account.

### 5.4 Safety functions

The **integrated hardware-based safety function for the b maXX 6000** is designed according EN 61800-5-2.

The type of safety function depends on the expansion stage, refer to [►Type code◄](#) on page 34.

The following table shows the possible safety functions that are available on the **integrated hardware-based safety function STO or SS1** via I/Os:

Function	Description
STO	Safe torque off
SS1	Safe stop 1, time controlled, fixed time 200 ms



#### WARNING!

- In the STO state, the drive is not disconnected from the power supply.
- The STO function is not sufficient as the sole safety function for drives that are subject to a permanent torque, such as suspended loads.
- The STO function is also executed when faults are detected and if the power supply fails. Depending on the application, this can result in safety restrictions. Additional measures must therefore be taken in this case, such as the installation of a suitable holding brake.



#### DANGER!

##### Danger from moving machine parts!

If the inputs are supplied by a connected safety component (emergency stop device, safety light curtain), the driver stage is supplied immediately. Failure of the controller can lead to an unexpected start-up. Use the external safety components to ensure that an unexpected start-up is prevented during commissioning.

Therefore:

- Keep sufficient distance from moving machine parts / system parts or from the moving machine / system.

### 5.4.1 STO - Safe torque off

The **safety function STO** is used to safely switch off the drive using the safe pulse inhibit.

In the event of a fault or on request, the **integrated hardware-based safety function** ensures that the voltage supply to the controller in the driver stage is safely switched off and the pulse inhibit is activated. This prevents the generation of a rotating field of the motor. The drive coasts to a stop uncontrolled.

The power supply is not disconnected from the motor during the switch-off function.

The STO state can be triggered by the following causes:

- By activating (low-active) the corresponding safe two-channel input (e.g. by actuating an emergency stop device)
- After the SS1 time has elapsed ([▶SS1 - Safe stop 1, time controlled◀](#) from page 30)
- Due to internal error

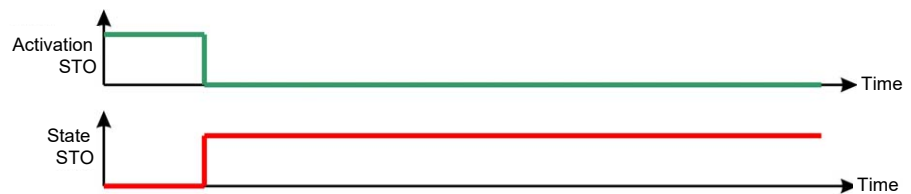


Figure 2: Safety function STO

### 5.4.2 SS1 - Safe stop 1, time controlled

The **safety function SS1** has a fixed SS1 delay time of  $t_{SS1} = 200$  ms.

Once the SS1 function has been activated, the drive is braked by the drive controller. Once the fixed SS1 time for the braking ramp has elapsed, the drive switches to the STO state (safe torque off). The braking ramp is not monitored.

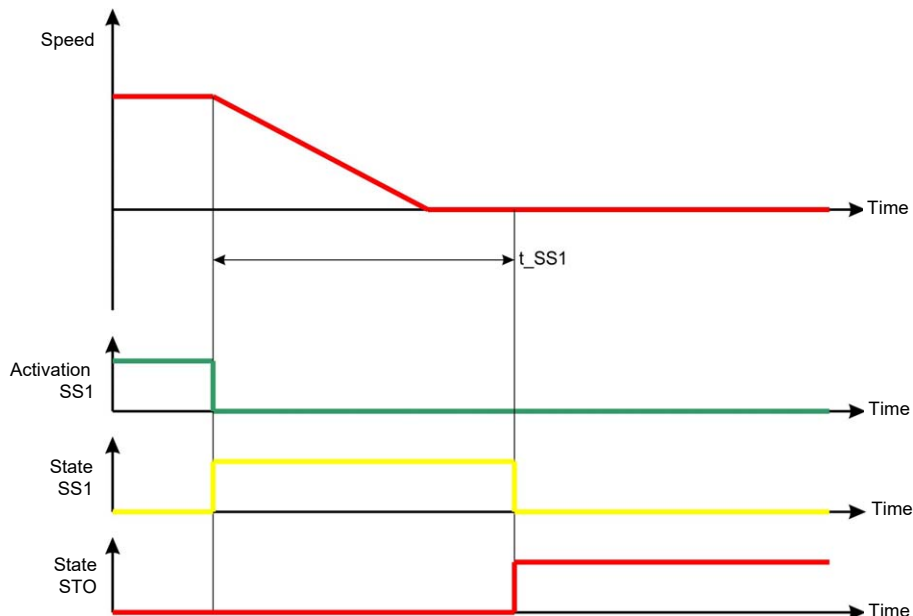


Figure 3: Safety function SS1-t



#### NOTE!

As soon as the function is activated, the SS1 time starts. If the function is deactivated before the SS1 time has elapsed, the SS1 time still runs until the end and the follow-up function is activated for a short time.

#### SS1 signaling to the controller

The activation start of the SS1 function is signaled to the controller. The controller recognizes this signal and starts to shut down the drive independently via a steep braking ramp. In certain cases, a higher-level controller can be dispensed with.

Immediate active braking until the drive comes to a standstill prevents the drive from coasting.

For an efficient solution, the braking ramp in the controller must be set so that the drive comes to a standstill before the SS1 time for braking ramp  $t_{SS1}$  (200 ms) has elapsed and STO is triggered. The settings required for this in the controller are described in the current parameter manual b maXX 6000 ("SS1 stop", "SS1 stop time" and error response).

The following settings must be made in the controller:

**Parameterization of the error reaction**

Error 1066 "SS1 stop forced by safety function SS1":

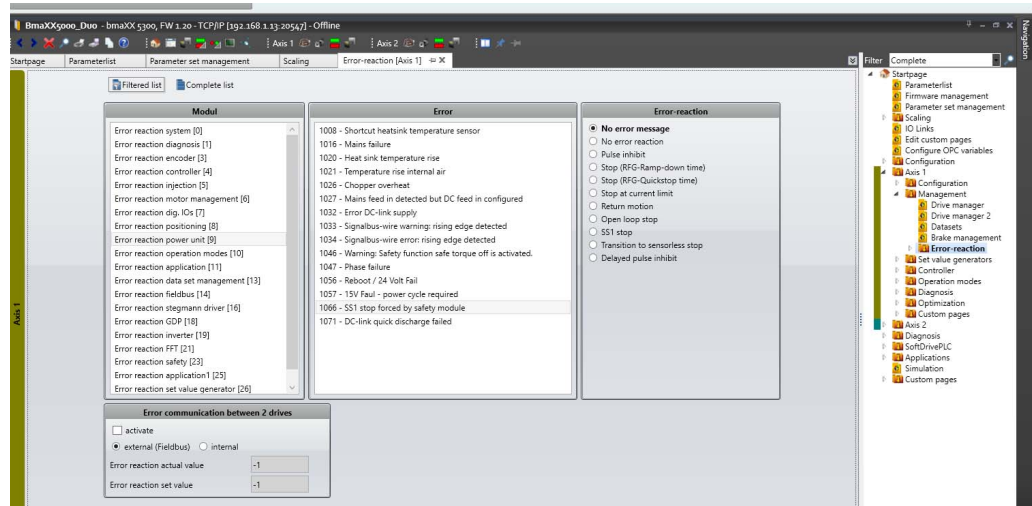


Figure 4: Parameterization of the error reaction

Besides the error reaction "SS1 stop" also another available error reaction can be parameterized (such as "Stop at the current limit"):

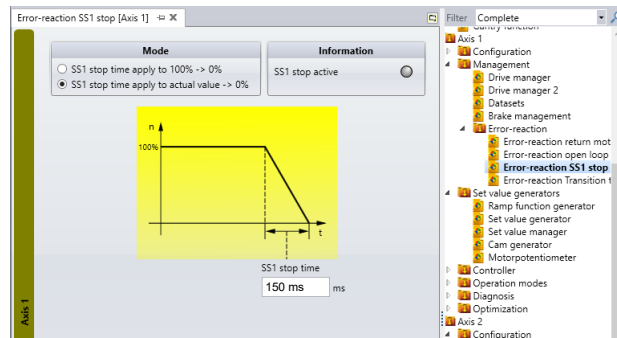


Figure 5: SS1 stop time (P110.21 in controller) in the "Error-reaction SS1 stop"

After the completion of the error reaction the drive changes to the error state and inhibits the pulses.

It must be considered that the SS1 stop time in the controller (in the example 150 ms) is lower than the SS1 time of the **integrated hardware-based safety function** (200 ms).

After the fixed delay time of the **integrated hardware-based safety function** (200 ms) expired, the drive changes in the STO state (safe torque off). The pulses are inhibited safely even if the drive was not braked down, yet.



**DANGER!**

After completion of the error reaction "SS1 stop" the drive switches into the error status and inhibits the pulses.

As the SS1 stop time of the controller should be lower than 200 ms, the **integrated hardware-based safety function** switches accordingly later into STO.

### 5.5 Survey of interfaces

The inputs are connected via the external connector of the **integrated hardware-based safety function**.

The following illustration shows the internal and external interfaces of the **integrated hardware-based safety function STO or SS1** via I/Os. The internal interfaces are connected to the controller electronics. They are used for safe access to the drive in the event of a request and for decoupling safety-relevant signals from the controller.

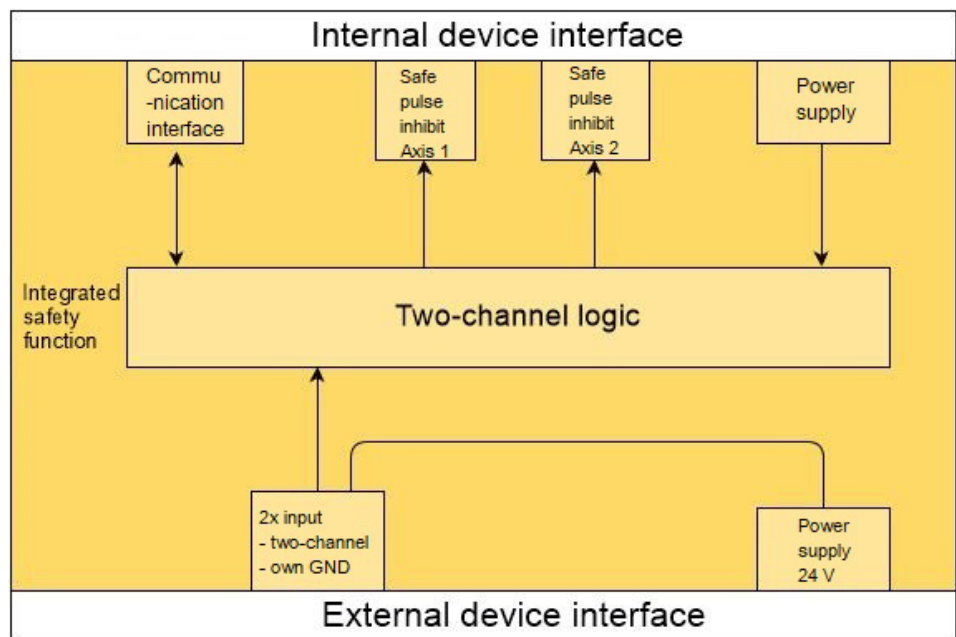


Figure 6: Interface of the integrated hardware-based safety function STO or SS1

#### 5.5.1 External interface



#### NOTE!

The physical inputs of the **integrated hardware-based safety function** are designed according to the closed-circuit current principle. In safety technology, this means that a lack of voltage at a safe input is always associated with the activation of the safety function linked to this input; the input is referred to as low active.

If, for example, the connection cable attached to the **integrated hardware-based safety function** is consciously or unconsciously removed by the operating personnel, or because it is torn off by a forklift truck moving over the cable, the **integrated hardware-based safety function** must trigger the linked safety function.

**Safe digital inputs** The **integrated hardware-based safety function** has 2 two-channel inputs with a separate ground connection (DIG\_IN\_1, DIG\_IN\_2).

- The DIG\_IN\_1 input is used for STO or SS1 of axis 1, depending on the expansion stage.
- The DIG\_IN\_2 input is used for STO or SS1 of axis 2 in a double-axis device, depending on the expansion stage.

The inputs are to be used in conjunction with output terminals, which must be connected in an electrically isolated manner.

#### Cross-circuit/short-circuit detection

- Detection of internal component faults and internal short circuits using diagnostic functions

#### Characteristics

- The inputs are low active.
- Potential isolation to the logic.
- Suitable for operating sensors with OSSD outputs in accordance with EN 61496. OSSD outputs have test pulses. The inputs of the **integrated hardware-based safety function** are monitored (filter time 2 ms) so that they are not triggered by these pulses.



#### NOTE!

The inputs comply with the specification type 3 according to EN 61131-2.

The technical data of the safe inputs are described in [▶Power connection values◀](#) on page 23.

### 5.5.2 Internal interface

**Safe pulse inhibit** By activating the safe pulse inhibit, the PWM control signal of the IGBTs is safely interrupted. This also interrupts the generation of a rotating field to control the motor. The drive is thus set to the STO state. The power supply is not disconnected from the motor during this switch-off function.



#### DANGER!

A short circuit between two non-adjacent control branches of the safe pulse inhibit within a short time interval can cause the drive to jerk in the STO state. The angle of rotation of this jerk depends on the angle of rotation of the drive, its number of poles and the transmission ratio of the gearbox used.

The response times for the safe pulse block are described in [▶Response time◀](#) on page 23.

## 5.6 Identification of the device

### 5.6 Identification of the device

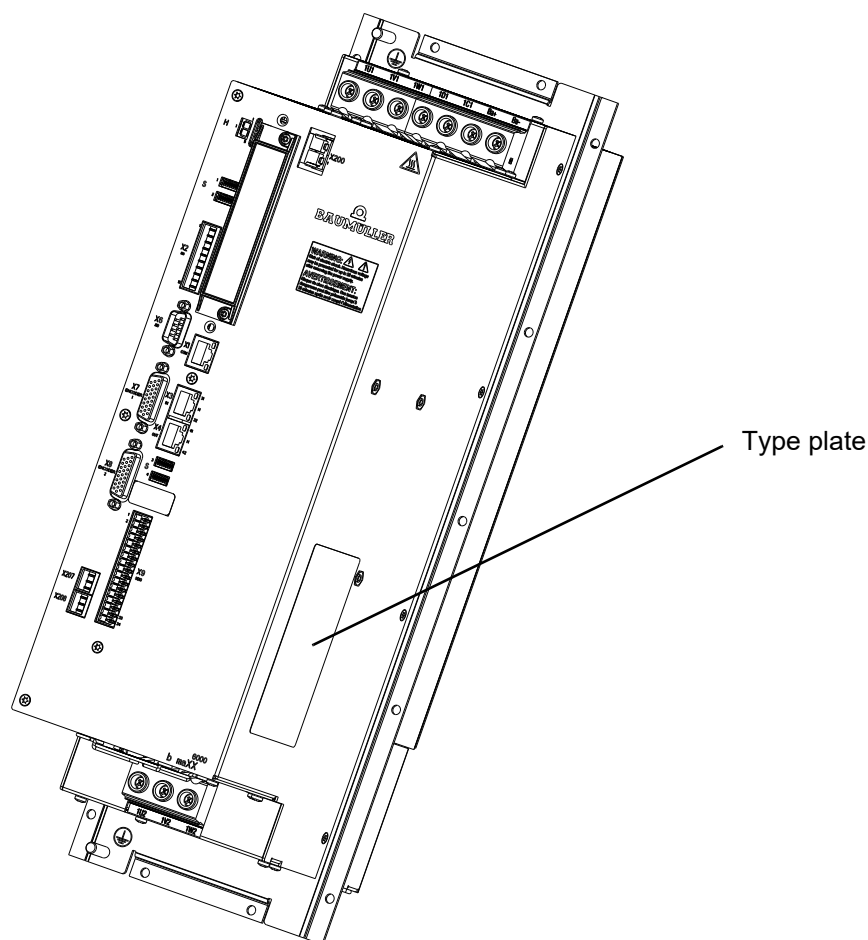


Figure 7: Location of the type plate

#### 5.6.1 Type code

Only the part of the b maXX 6000 type plate marked in red applies to the **integrated hardware-based safety function**.

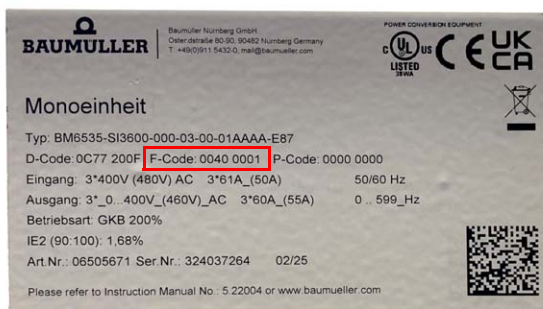


Figure 8: Type plate

The additional identification for the safety function under F: means in detail:

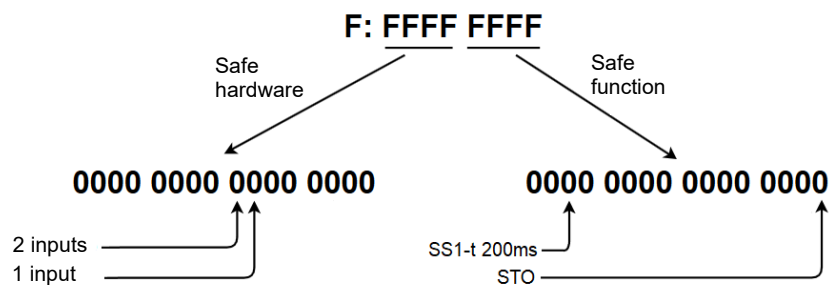


Figure 9: Type code safety function

## 5.6.2 Hardware / safety function variants

### STO via I/O

In this variant, only the STO safety function is available, which is activated via a safe digital input.

Parameterization is not possible.

Double-axis unit identifier: **F: 0080 0001**

- DIG\_IN\_1 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 1
- DIG\_IN\_2 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 2

Identifier single axis unit / mono unit: **F: 0040 2001**

- DIG\_IN\_1 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 1

For pin assignment, refer to [Pin assignment](#) on page 49.

### SS1 via I/O

In this variant, only the SS1-t safety function (with following function STO) is available, which is activated via a safe digital input.

The SS1 time is permanently set to 200 ms. Parameterization is not possible.

Double-axis unit identifier: **F: 0080 2001**

- DIG\_IN\_1 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 1
- DIG\_IN\_2 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 2

Identifier single axis unit / mono unit: **F: 0040 2001**

- DIG\_IN\_1 (sensor type: "Active sensor" 1), filter time: 2 ms) ⇒ STO axis 1

For pin assignment, refer to [Pin assignment](#) on page 49.

<sup>1)</sup> Sensor type: "Active sensor"

The input can be controlled with a sensor that generates an active output signal without test pulses. The lines are monitored when the input is deactivated.

If one channel of the two-channel input cannot be activated, e.g. due to a short circuit to 24 V, the safety function is activated by the second channel.

When the input is deactivated, however, it is recognized that only one channel was activated. The safety function remains active until both channels of the input have been activated.

## 5.6 Identification of the device

---

# PLANNING A SAFETY-ORIENTATED 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-orientated machines can lead to permanent injuries and death.

**CAUTION!**

The "Planning checklist" reproduced in the appendix must be used in the planning phase.

## 6.1 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.

**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.

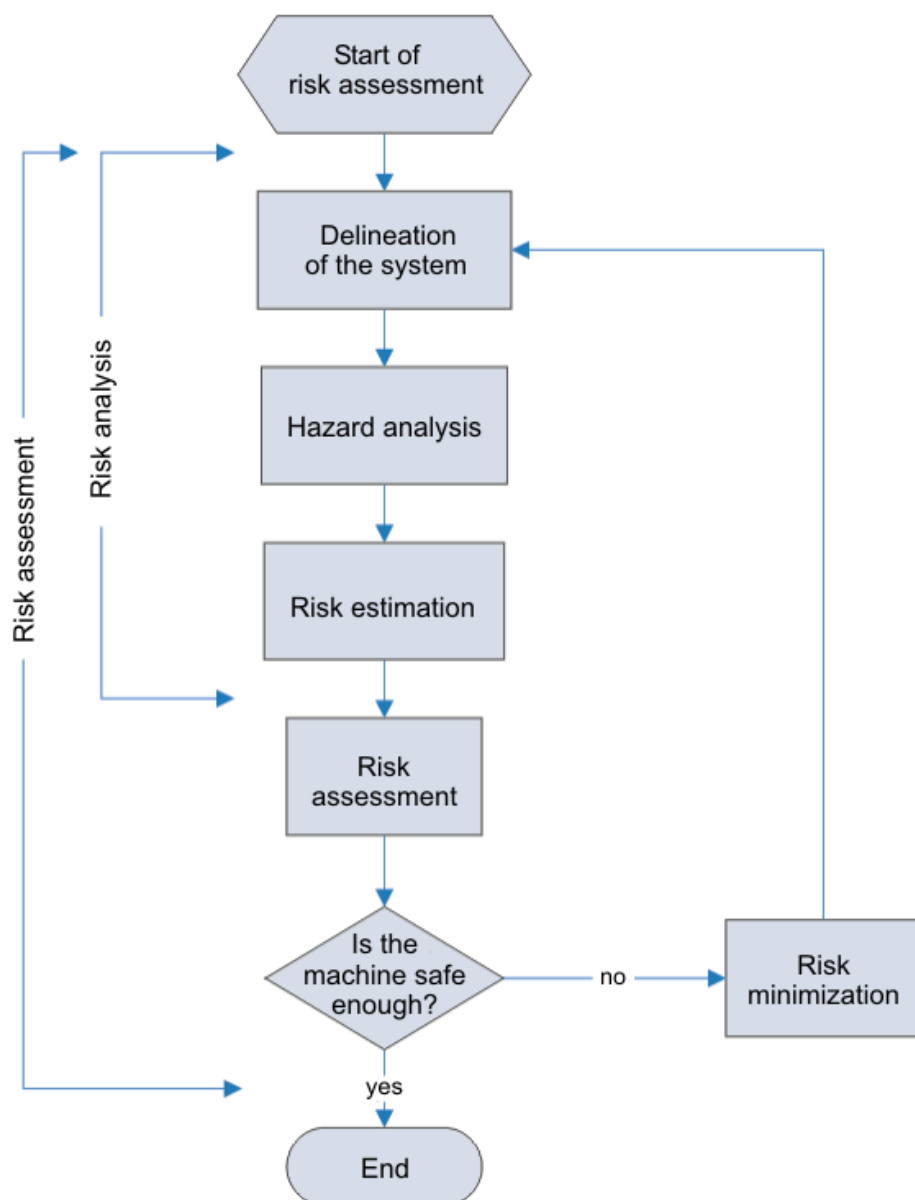


Figure 10: Risk assessment procedure in accordance with DIN EN ISO 12100-1 and EN ISO 14121

<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 according to EN 62061 and performance level according to EN ISO 13849-1) is carried out in the scope of risk assessment for the installation/machine in accordance with EN ISO 12100-1 and EN ISO 14121.

## 6.2 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 its wiring.



### CAUTION!

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

## 6.3 Course of the planning phase

The system is planned according to the requirements of the installation or the machine. The components, which are available for the automation of the available components are described in the Automation Catalog of the company Baumüller Nürnberg GmbH. Here information on concepts, PLCs, field buses, motion control, technology blocks, HMIs, IPCs and I/Os is available.

Before commissioning the safety function, it must be checked or ensured that the controller is adequately supplied by the connected power supply unit or that the connected safety components are adequately supplied.



## TRANSPORT AND PACKAGING

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

Please refer to the corresponding chapter in the instruction handbook for the b maXX 6000.

### Safety instructions



#### NOTICE!

##### Damage due to unauthorized transport!

Transport handled by untrained personnel can lead to a substantial amount of material damage.

Therefore:

- The unloading of the packages upon delivery as well as the in-house transport should only be done by trained personnel.
- Contact Baumüller Nürnberg GmbH sales office if necessary.



#### WARNING!

##### Danger of physical impact!

Secure devices against falling down.

Therefore:

- Take suitable measures, such as supports, hoists, straps, etc., to ensure that device cannot fall down.
- Use appropriate means of transport.



# INSTALLATION

The installation of the device can be found in the instruction handbook b maXX 6000.

The installation of the device is described in the instruction handbook for the b maXX 6000. The installation of the **integrated hardware-based safety function STO or SS1** is described below.

## 8.1 General safety instructions



### CAUTION!

Before installation, use the checklist printed in [►B.2 Installation checklist◄](#) on page 65.

- Ensure that the installation is carried out completely in accordance with the installation and wiring diagram.
- After installation, carry out a visual inspection and check all system components for visible damage.
- Check the system for wiring faults.
- Check the tightening torque and ensure that the electrical connection is not interrupted by insulation material.
- Check the tensile strength of the electrical clamp and screw connections.
- Ensure that the installation and cable routing is carried out in accordance with the applicable standards and guidelines.
- Ensure that the environmental characteristics of the system specified in [►Operating conditions◄](#) on page 24 are complied with.
- Make sure that the design of the system's IP code 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).

- ◉ Observe the information in chapter [►Safety◄](#) from page 13 and the safety instructions in the operating instructions for the b maXX 6000.

## 8.2 Requirements for the personnel carrying out the work

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### 8.2 Requirements for the personnel carrying out the work

---



**DANGER!**

**Danger to life due to electric current!**

The device and the environment in the switch cabinet can carry life-threatening voltages.

Therefore

- The described danger and warning notices must be observed.
- Ensure that only qualified personnel work on the appliance (refer to [▶Personnel training◀](#) on page 15).

### 8.3 Installation instructions

---

Please refer to the instruction handbook for the b maXX 6000 for the installation of the device.



**DANGER!**

**Danger to life due to electric current!**

The device and the environment in the switch cabinet can carry life-threatening voltages.

Therefore

- The described danger and warning notices must be observed.

## 8.4 Installation

When installing the **integrated hardware-based safety function for the b maXX 6000** with STO/SS1 functionality (refer to [►Type code◄](#) on page 34), please note the following.



### NOTE!

Installation 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, and the authorization to commission, ground and mark electrical power circuits and devices in accordance with the standards of the safety engineering.
- Occupational training or instruction, in accordance with the standards of work safety, for the care and use of appropriate safety equipment.



### WARNING!

#### **Danger due to faulty installation and initial commissioning!**

Installation and initial commissioning require qualified personnel with adequate experience. Faulty installation can lead to life-threatening situations or substantial material damage.

Therefore:

- Only allow installation and initial commissioning to be performed by employees of the manufacturer or by other qualified personnel.



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous during the electrical installation.
- Pay heed to areas on the device that could still be electrically energized after operation.

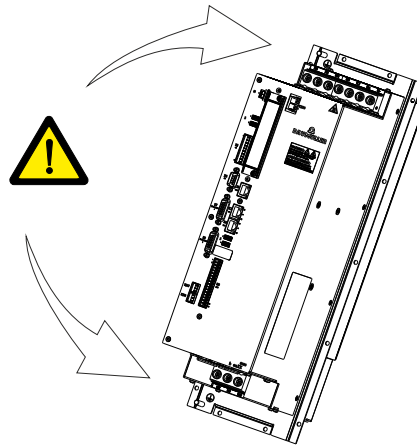


Figure 11: Hazard areas during electrical installation

### **Danger from residual energy**



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Stored electric charge.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

## 8.5 Demands on the electrical power supply



### CAUTION!

#### Danger due to electrical voltage!

The **integrated hardware-based safety function** or the **b maXX 6000** can be damaged / destroyed if the requirements for the electrical connection of the safety function are not met.

Therefore:

- Ensure that the connection values specified in the technical data are observed and that the connections are made in accordance with the specifications.

The standard EN 60204-1 (Electrical equipment of machines) must be observed for the installation and assembly of the cable connection.

Further notes:

- Ensure that the connection cables are laid in accordance with EMC requirements.
- Only use suitable cables with suitable cable diameters.
- Mark the cable connections to avoid confusion.
- Ensure that the connectors cannot fall off.

## 8.6 Requirements for the connection cables

The connecting cable must be selected in accordance with the EN 60204-1 standard.

The **b maXX 6000 with integrated hardware-based safety function** is supplied with a connector already fitted for connecting the conductors.

This connector must always be plugged in during operation, even if no conductors are connected.

Connectable conductors must comply with the following parameters:

Clamping range, rated connection:	min. 0,08 mm <sup>2</sup> max. 1 mm <sup>2</sup>
Conductor connection cross-section AWG:	min. AWG 28 max. AWG 18
solid/fine-stranded:	min. H05(07) V-U 0,2 mm <sup>2</sup> max. H05(07) V-U 1 mm <sup>2</sup>
with wire end ferrule according DIN 46 228/1:	min. 0,13 mm <sup>2</sup> max. 0,34 mm <sup>2</sup>
with wire end ferrule with collar according DIN 46 228/4:	min. 0,13 mm <sup>2</sup> max. 0,34 mm <sup>2</sup>

## 8.7 Electrical connection

Single axis BM63XX  
Mono unit BM65XX

Double axis BM63XX

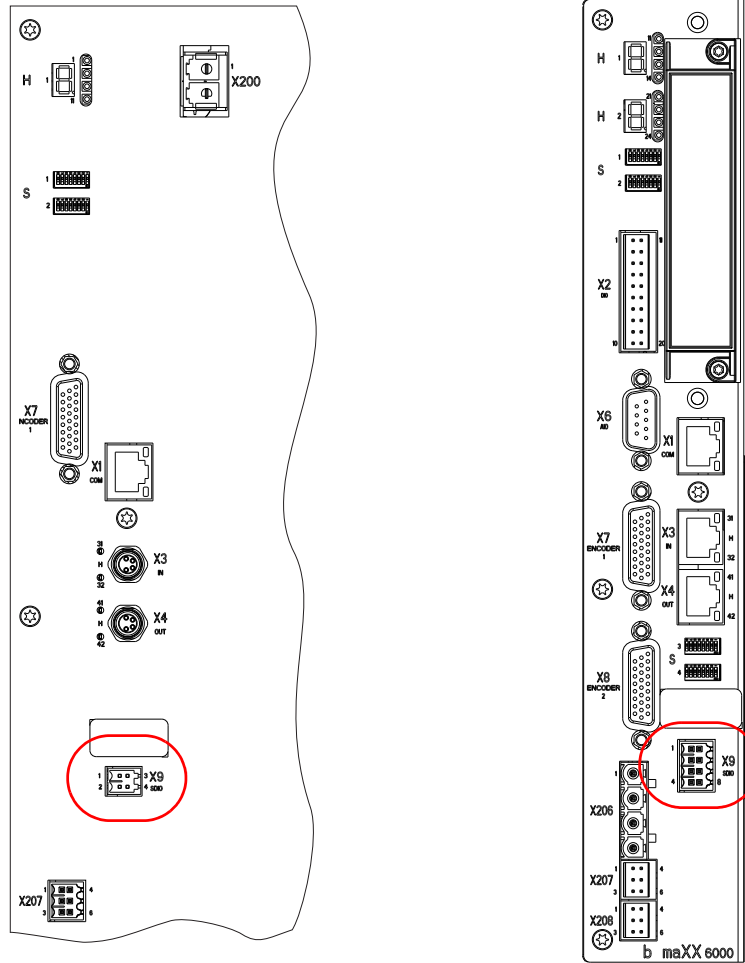


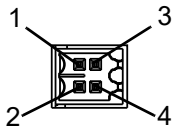
Figure 12: Electrical connection

### 8.7.1 Pin assignment

In the device type with hardware-based safety function STO or SS1 via I/Os (refer to [►Type code◄](#) on page 34), the pin assignment shown in the following figures is available.

#### X9 SDIO 4-pin Single axis BM63XX / Mono unit BM65XX

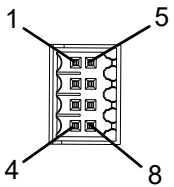
Pin assignment



Pin No.	Designation	Signal name
1	DIG_IN_1A	Input 1 A
2	GND_IN_1A	Ground input 1 A
3	DIG_IN_1B	Input 1 B
4	GND_IN_1B	Ground input 1 B

#### X9 SDIO 8-pin Double axis BM63XX

Pin assignment



Pin No.	Designation	Signal name
1	DIG_IN_1A	Input 1 A
2	GND_IN_1A	Ground input 1 A
3	DIG_IN_2A	Input 2 A
4	GND_IN_2A	Ground input 2 A
5	DIG_IN_1B	Input 1 B
6	GND_IN_1B	Ground input 1 B
7	DIG_IN_2B	Input 2 B
8	GND_IN_2B	Ground input 2 B

## 8.7.2 Examples of connecting the safety function

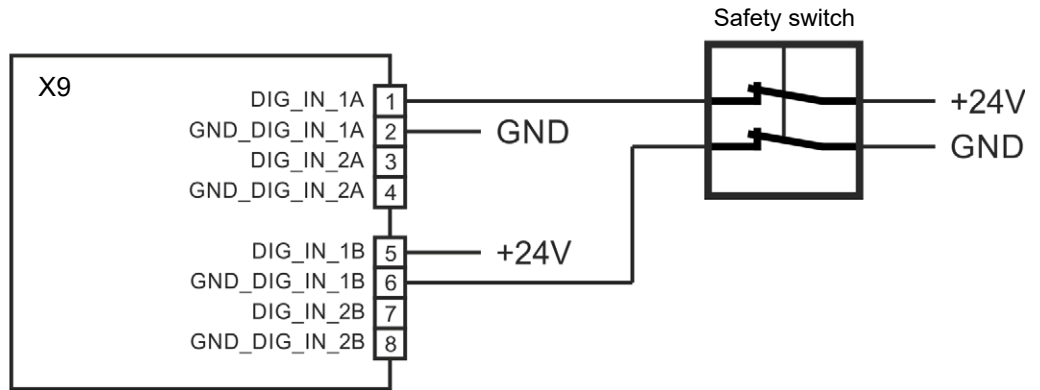


Figure 13: Example 1 of connecting the safety function

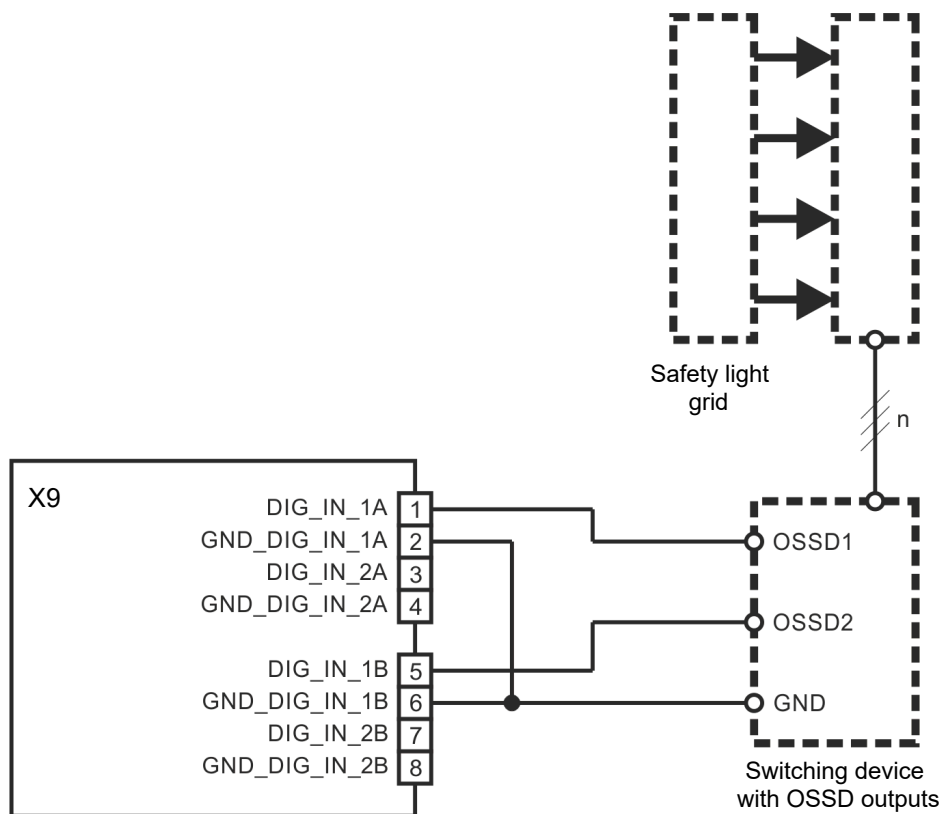


Figure 14: Example 1 of connecting the safety function

## COMMISSIONING

This chapter describes the commissioning procedure of the **integrated hardware-based safety function**. The procedure of commissioning ensures that the **b maXX 6000 with integrated hardware-based safety function** works properly.



### NOTE!

The procedure of a correct commissioning is the prerequisite for an error-free operation.

Before beginning the commissioning procedure, make sure that the following prerequisites have been fulfilled:

- The drive controller b maXX 6000 is installed correctly and ready for use.
- Integrated hardware-based safety function** is connected to the safety components (e.g. safe sensors).
- No individuals or parts are in the danger zone.



### NOTICE!

The commissioning of the **b maXX 6000 with integrated hardware-based safety function** is permitted only after the acclimation of the device.

The described climatic conditions in [▶Operating conditions◀](#) on page 24 must be observed.

Please take of [▶Troubleshooting and Error Correction◀](#) from page 55 for rectifying errors during the commissioning procedure.

### 9.1 General safety regulations



#### **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 Appendix [▶B.3 Commissioning and validation checklist◀](#) on page 66 must be used during commissioning.

- Maintain an adequate distance from moving machine parts/line parts or from the moving machine/line.
- Consider that the machine parts/line parts or machine/line can be set in motion via additional devices connected to the **b maXX 6000 with integrated hardware-based safety function**.
- 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 might react differently to what is inspected.
- If changes or expansions are conducted during the commissioning procedure, the effects on system reaction must be checked. To do this, it is necessary to execute the checklists for planning and installation procedure again.

- Follow the chapter [▶Safety◀](#) from page 13 and the safety instruction within the instruction handbook b maXX 6000.

### 9.2 Requirements on the personnel conducting the work

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



#### **Danger from mechanical action!**

The machine/line or parts of the machine or line can be started during the commissioning of the **b maXX 6000 with integrated hardware-based safety function**

Therefore:

- Maintain an adequate distance from moving machine parts/line parts or from the moving machine/line.
- The described danger- and warning notes in [▶Special dangers◀](#) from page 17 must be observed.

### 9.3 System validation

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

**WARNING!****Danger during commissioning!**

The control system 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◀](#) on page 66. 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 control system.

**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:

- Only connect the actuators and drives to the safe output terminals once no errors have been detected in the inspection of the logic circuit.
- 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 the reaction corresponds with the expected behavior.

### 9.4 Operation

---

Instructions on the operation of the system components, which is connected to the used controller, 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 **b maXX 6000 with integrated hardware-based safety function**.

Therefore:

Before expanding the system and removing individual system components and making changes in the wiring, the **b maXX 6000** must, as a rule, be disconnected from the power source and put into safe condition by technical trained personnel.

### 9.5 Modification and retrofitting

---

If the safety-critical system in which the **b maXX 6000 with integrated hardware-based safety function** is used is modified or retrofitted, the notes in the chapters [▶Planning a safety-orientated Control System◀](#) from page 37, [▶Installation◀](#) from page 43 and [▶Commissioning◀](#) from page 51 must be observed.

A risk assessment must be carried out again. The regulations for installation, commissioning and operation must be complied with. And the validation of the entire system must be carried out again.

# TROUBLESHOOTING AND ERROR CORRECTION

## 10.1 Requirements on the personnel conducting the work

---

Personnel working with the **b maXX 6000 with integrated hardware-based safety function** must be instructed in the safety regulations and the operation of the device and be familiar with the proper operation of the system. The reaction to error indications and statuses in particular requires special knowledge, which the operator must have.

## 10.2 Error diagnosis

---

**Fail-safe principle** The **integrated hardware-based safety function** is based on the fail-safe principle. This means that each error automatically causes the **integrated hardware-based safety function** to switch into the safe status STO (Safe Torque Off).

However, external errors, which are detected, cause a safe status STO. These errors can be caused by interferences of the FSoE-communication or from the diagnostic possibilities according to chapter [▶Detecting errors in the periphery◀](#) on page 56.

In the event of a fault, the error message “1013 - Switch-off by the safety technology” appears in the drive controller.

The parameters [P203.13](#) and [P203.14](#) of the controller are required for a general status diagnosis.

The lists of error states are given in chapter [▶Error messages◀](#) from page 56.



### WARNING!

Do not put a defective safety-oriented system back into operation as long as the cause of the error is unknown or an error has not been detected.

## 10.3 Detecting errors in the periphery

### 10.3 Detecting errors in the periphery

- The safe input and output have diagnostic functions in order to detect short circuits and crossfault on the input and output cables (refer to [▶External interface◀](#) on page 32).
- Electronic sensors must have an own error detection regarding short circuits on the output.

### 10.4 Error messages

Description of the operating states in controller parameter 203.11 (Status module) and their possible status and error states in parameter 203.12 (Status info module):

203.11	Description
0	Not active
1	-
2	Initial state
3	Parametrization
4	-
5	-
6	Error
7	Safety function

203.12	Description
0	-
-	-
4	Input configuration
0	Updating of safe parameter data
-	-
-	-
0	In the "Error" operation state, a corresponding error code can be read out via ProDrive in parameter 203.014 (refer to <a href="#">▶List of errors◀</a> on page 57)
-	-

## List of errors in operation state 6

Error No.	Description	Axis dependent	Acknowledgeable
0	No error		
42	Internal axis independent FPGA error	no	no
43	Internal axis dependent FPGA error	yes	no
103	Program flow: STO error	no	no
104	Temperature monitoring error	no	no
105	Error during test (write) of the input DIG_IN_1A	yes	no
106	Error during test (write) of the input DIG_IN_1B	yes	no
107	Error during test (write) of the input DIG_IN_2A	yes	no
108	Error during test (write) of the input DIG_IN_2B	yes	no
125	Error during test (read) of the input DIG_IN_1A	yes	no
126	Error during test (read) of the input DIG_IN_1B	yes	no
127	Error during test (read) of the input DIG_IN_2A	yes	no
128	Error during test (read) of the input DIG_IN_2B	yes	no

## 10.5 Repair

You cannot repair a defective **b maXX 6000 with integrated hardware-based safety function**.

Please contact Baumüller Nürnberg GmbH for a replacement.



## SHUTDOWN, STORAGE, DISPOSAL

Please refer to the corresponding chapter in the instruction handbook for the b maXX 6000.

### Safety instructions

- Refer to [▶Safety◀](#) from page 13 and the information in [▶Transport and Packaging◀](#) from page 41.

The shutdown of the device may only be carried out by for this qualified personnel.





## APPENDIX A - ABBREVIATIONS

AWG	American Wire Gauge
DC	Diagnostic coverage
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic sensitive device
HMI	Human-Machine-Interface
I/O	Input/Output
IEC	International Electro-technical Commission
IGBT	Insulated gate bipolar transistor
IP	IP code
IPC	Industrial PC
ISF	Integrated safety function for BM6000
ISO	International Organization for Standardization
MTTF <sub>d</sub>	Mean Time To Failure dangerous
OSSD	Output switch signal device
SELV	Safety extra low voltage
PELV	Protective extra low voltage
PFD	Probability of dangerous Failure on Demand
PFH	Probability of dangerous Failure per Hour
PL	Performance Level
PLC	Programmable logic controller
PWM	Pulse width modulation
SFF	Safe Failure Fraction
SIL	Safety integrity level
SS1	Safe stop 1
SS1-t	Safe stop 1 - time controlled
STO	Safe torque off





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	Was a risk assessment carried out and were the required SIL and performance levels in accordance with DIN EN ISO 13849-1 or IEC 62061, 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 and are the fault exclusions considered?			
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 (DIN EN ISO 13849-1) and safety category for this application?			
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)			

## B.1 Planning checklist

Serial No.	Requirement	Fulfilled		Remarks
		Yes	No	
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? If required, minimize contamination level by installation or encapsulation. Installation in IP54 according to EN 61800-5-2 D.2 and EN ISO 13849-2 D.5 is required.			
1.10	Has the maximum permissible reaction time of the safety functions been established by means of a risk analysis? (Reaction times of the <b>b maXX with integrated hardware-based safety function</b> refer to <a href="#">▶4.2 Response time◀</a> on page 23)			
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?			
1.14	Are all specified electrical values of the in- and output terminals observed?			

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?) Is it ensured, that the insulation of the cables is not damaged?			
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>integrated hardware-based safety function</b> ?			
3.3	Are encoders used exclusively which have been certified and/or released by Baumüller?			

Date	Name	Signature

### B.4 Modification and retrofitting check list

Serial No.	Requirement	Fulfilled		Remarks
		Yes	No	
4	Modification and retrofitting			
4.1	Is the modification/retrofitting of the system compatible? Are all requirements, which are listed in the check lists on planning, installation and commissioning/validation of this instruction handbook, 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



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# HOUSE OF AUTOMATION



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