

# Operating Instructions

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**be in motion**    **be in motion**



**b maXX<sup>®</sup> Systems**

**Safety I/O Terminals**

**SI4000 / SO4000**

<b>E</b>	5.08009.05
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**Read the Operating Instructions before beginning**

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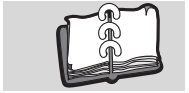
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# 1

## PREFACE

### 1.1 Information on the Operation Manual

---

This Operation Manual provides important information on handling the device. Compliance with all safety instructions operation instructions specified is a prerequisite for work safety.

Furthermore, it is also necessary to comply with the local accident prevention legislation and general safety regulations applying to the device's field of application.

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 to personnel in the immediate vicinity of the device at all times.

### 1.2 Legend

---

#### Warning notices

Warning notices are indicated by symbols in this Operation Manual. 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.



#### **NOTE!**

...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.



### 1.3 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 may vary from the explanations and illustrations described here in cases involving custom designs or the use of additional ordering options, or as a result of 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.

### 1.4 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 considered 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 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. The obligations specified in the following section under “Obligations” do not apply to preliminary information.

### 1.5 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.

b maXX<sup>®</sup> is a registered trademark of Baumüller Nürnberg GmbH

### 1.6 Further applicable documents

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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.

### 1.7 Replacement parts

---

**WARNING!**

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

**Therefore:**

- Only use original replacement parts from the manufacturer

Procure replacement parts from authorized dealers or directly from the manufacturer.  
See also [▶Appendix B - Accessories◀](#) from page 65 onward.

### 1.8 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 ◀](#) on page 62.

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## 1.9 Warranty conditions

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The warranty conditions can be found as a separate document in the sales documentation.

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.

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## 1.10 Customer service

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Our customer service is available for technical support.

Information on the contact person responsible can be found at any time via telephone, fax, E-mail or over the internet ([www.baumueller.de](http://www.baumueller.de)).

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## 1.11 Terms used

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The terms "SI4000" (for input terminal) or "SO4000" (for output terminal) are also used for the product "**Safety I/O Terminals.**"

A list of the abbreviations used can be found in [▶Appendix A - Abbreviations◀](#) from page 63 onward.

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## 1.12 Certification

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The safety I/O Terminals are a component part of a system composed of b maXX safe PLC, power supply and other system modules.

The safety I/O Terminals have been developed in accordance with the standards specified in [▶Chapter 1.12.1◀](#) and certified by TÜV Süd.

SI4000:

Approval no. Z10 15 03 75013 001

Test report: BV82168T

SO4000:

Approval no. Z10 15 03 75013 003

Test report: BV82168T

### 1.12.1 Approvals, directives and standards

Safety engineering standards and directives	Area of application	Approvals
EN 61508, Parts 1-3	Functional safety of security-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 (category 4)
Additional standards	Area of application	
2006/42/EC	machinery directive	
DIN EN 81-1		to the extent to which they may be applicable
EN 13243		to the extent to which they may be applicable
DIN EN 61000-6-2		
DIN EN 61000-6-4		

# 2

## USE OF THIS HANDBOOK

This safety handbook contains information on the intended use of the Baumüller safety I/O terminals.

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

Baumüller control devices 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:

- Installation/Assembly
- Commissioning
- Operation
- Troubleshooting
- Maintenance/repair
- Disassembly



## SAFETY

This section 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 Operation Manual

---

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 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 Appropriate use

---

**WARNING!****Caution - Risk of injury**

Safety terminals may only be used for the purposes described below!

The safety terminals expand the application range of Baumüller bus terminals with functions that enable them to be used for machine safety applications. The safety terminals are designed for machine safety functions and directly associated industrial automation tasks. They are therefore only approved for applications with a defined fail-safe state. This safe state is the wattless state. Fail-safety according to the relevant standards is required.

## 3.3 Appropriate use

The safety terminals enable connection of:

- 24 V<sub>DC</sub> sensors (SI4000) such as emergency stop push buttons, pull cord switches, position switches, two-hand switches, safety mats, light curtains, light barriers, laser scanners etc.
- 24 V<sub>DC</sub> actuators (SO4000) such as contactors, protection door switches with tumbler, signal lamps, servo drives etc.



### NOTICE!

#### Test pulses

When selecting actuators please ensure that the SO4000 test pulses do not lead to actuator switching or diagnostic message from the SO4000. The test pulses of the SO4000 terminal outputs are not configurable and cannot be switched off.

The following modules were developed for these tasks:

- The SI4000 terminal is an input module with digital inputs.
- The SO4000 terminal is an output module with digital outputs.

These modules are suitable for operation with

- Baumüller b maXX safe PLC
- Baumüller ECK000 series bus coupler

Your use of the device is considered to be compliant with its intended use if you have read all instructions and information in this Operation Manual.



### WARNING!

#### Follow the machinery directive

The safety terminals may only be used in machines according to the Machinery Directive.



### WARNING!

#### Ensure traceability

The buyer has to ensure the traceability of the device via the serial number.



**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 device as intended.
- Follow all specifications of this Operation Manual.
- Ensure that exclusively qualified personnel work on or with this device.
- Take care in project planning to see that the device is always used within its specifications.
- The device and/or mounting rail is mounted on a wall which is sufficiently sturdy.
- Ensure that the power supply meets the required specifications.
- Only operate the device if it is in technically faultless condition.
- Only use the device in combination with components approved by Baumüller Nürnberg GmbH.

### 3.4 Operator responsibility

The device 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

Protection category	
SI4000	IP 20
SO4000	IP 20

All SI4000 and SO4000 devices with the couple stations (b maXX safe PLC or bus coupler) must be built into a suitable electrical cabinet in order to comply with the protective categories (IP54) required in EN 60529.

## 3.6 Personnel training

---



### **DANGER!**

#### **Life-threatening danger through electric current!**

Immediate life-threatening danger is present if contact with live parts is made.

Therefore:

- Operate the device in an electrical cabinet which provides protection from direct contact with the devices and meets at least the protective categories (IP54) of EN 60529.

## 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 Operation Manual.

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 Anlagen-Systemtechnik GmbH & Co. KG, 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

denotes tight-fitting work clothing with low tear resistance, tight sleeves and no protruding parts. It primarily serves in protecting from...

Do not wear any rings and necklaces.



#### Protective helmet

for protection from falling and flying parts.



#### Safety shoes

for protection from heavy falling parts.



#### Safety gloves

to protect the hands from friction, abrasions, 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.

#### Electric current



#### **DANGER!**

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

Immediate life-threatening danger is present if contact with live parts is made. Damage to the insulation or individual component can be life-threatening.

Therefore:

- Shut down immediately if the insulation on the power supply is damaged.
- Only allow the work to be conducted on the electrical system by qualified personnel.
- Turn the current off when conducting any work on the electrical system and secure it before turning it back on.

#### Dangers from residual energy



#### **DANGER!**

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

After the device has been disconnected from the mains, live parts such as line connectors may only be touched once the capacitors in the device have been discharged.

Therefore:

- Take the capacitors' discharge time into account and do not touch live parts beforehand.
- Follow commensurate instructions on the device.
- If you have connected additional capacitors to the intermediate circuit, it can also take considerably longer for the intermediate circuit to discharge. In such case, you will have to establish the necessary waiting period yourself or measure whether the device has been de-energized.

## Moving parts



### **WARNING!**

#### **Risk of energy from 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 Firefighting



### **DANGER!**

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

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

Therefore:

- Use the following fire extinguishing medium:



ABC powder/CO<sub>2</sub>

### 3.10 Electric safety

The safety control is designed for contamination level 2 in accordance with EN 50178. This means that only non-conductive contamination may appear during operating time. Short-term conductivity from condensation is only permissible if the control 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 mains may be connected to the control.

The power supply for generation the 24-volt supply must meet the requirements for PELV in accordance with EN 50178.

### 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

---

- Preventative measures**
- Always be prepared for accidents or fire!
  - Keep first aid equipment (first aid kits, blankets, etc.) and fire extinguishers readily available.
  - 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 Signage

The following symbols and notification signs are found in the work area. They relate to the immediate environment in which they are placed.



#### **WARNING!**

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

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.



#### **DANGER!**

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

Discharge time > 1 minute

Saved electric charge.

Therefore:

- Keep the discharge time of the capacitors in mind and do not touch live parts beforehand.
- Follow the commensurate instructions on the device.
- If you have connected additional capacitors to the intermediate circuit, it can also take considerably longer for the intermediate circuit to discharge. In such case, you will have to establish the necessary waiting period yourself or measure whether the device has been de-energized.



# 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.

### 4.1 Safety-related parameters

The safety-related parameters of the safety I/O Terminals will be described in the following. Safety-related parameters of b maXX safe PLC and decentral components can be found in the applicable documentation. The values specified here relate exclusively to the safety I/O Terminals.

Parameters in accordance with IEC 61508	Meaning
PFH = $2.30 \cdot 10^{-9}$ /h for SI4000 PFH = $1.73 \cdot 10^{-9}$ /h for SO4000	Probability of Failure per Hour
PFD <sub>avg</sub> = $1.81 \cdot 10^{-4}$ for SI4000 PFD <sub>avg</sub> = $1.42 \cdot 10^{-4}$ for SO4000	Probability of Failure on Demand = mean residual error probability of a dangerous error on demand
Lifetime [a] = 20 years	
Safety Integrity Level = SIL 3	
Classification element *) type A	
HFT 1	Hardware Failure Tolerance

\*) Classification according to IEC 61508-2:2010 (see chapter 7.4.4.1.2 and 7.4.4.1.3 in IEC 61508-2)

Parameters in accordance with DIN EN ISO 13849	Meaning
MTTF <sub>d</sub> > 100 years	Mean Time To Failure
DC > 99% (high)	Diagnostic Coverage
Performance level = e	
Category = 4	

The interval for the repeat test (proof test interval) is set for 20 years. The repeat test serves to detect failures which could not be detected by the diagnostic coverage during the operating time. It is necessary to detect all dangerous failures so that the repeat test will be fully effective and “like new” condition can be established for the system.



### CAUTION!

To ensure the safety-related parameters specified above, the safety control will have to be decommissioned and sent back to the manufacturer within not more than 20 years.

## 4.2 Lifetime

The safety terminal are designed for a service life of 20 years.

Due to the high diagnostic coverage within the lifecycle no special proof tests are required.

The terminals have a date code which corresponds to the following glossary:

Date code: WW YY SW HW

WW	calendar week of production
YY	year of production
SW	software version (hex)
HW	hardware version (hex)

Example: Date code:	17 11 05 00
calendar week of production	17
year of production	2011
software version	05
hardware version	00

Additionally the terminals have a unique serial number.

**NOTICE!****Declaration of the version**

All changes both of the hardware and of the firmware lead to a change of the version. All changes which impact security-relevant properties of the terminals are denoted in this manual.

### 4.3 Using of the terminals with b maXX safe PLC

The tests of the b maXX safe PLC are carried out with the following terminal versions.

Test	Version input terminal SI4000	Version output terminal SO4000
Module test FSoE	1701	1404
Module test Motion Control	1701	1404
Environmental test	1701	1404
EMC test	1701	1404
System test	1701	1405 / 1406

The results only apply for the current terminal hardware version at the time of testing. The tests were carried out in a laboratory environment.



# DESCRIPTION OF THE SAFETY I/O TERMINALS

This chapter describes the safety I/O Terminals and the type code applied to the module.

## 5.1 General description

---

### 5.1.1 SI4000 4-channel safety digital input terminal

---

The SI4000 is a digital input terminal for sensors with floating contacts for 24 V<sub>DC</sub>. The bus terminal has 4 fail-safe inputs.

With two-channel connection, the SI4000 meets the requirements of IEC 61508:2010 SIL3, DIN EN ISO 13849-1:2008 (Cat 4, PL e) and UL 508.

The bus terminal has the standard design of a Baumüller Bus Terminal.

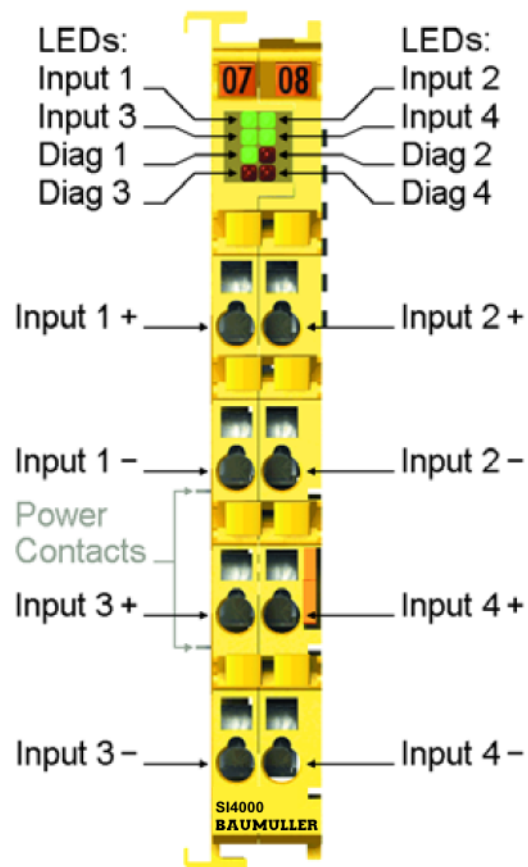


Figure 1: SI4000 safety input terminal

### 5.1.2 SO4000 4-channel safety digital output terminal

The SO4000 is a safe output terminal with digital outputs for connecting actuators (contactors, relays, etc.) with a maximum current 0.5 A (24 V<sub>DC</sub>). The bus terminal has 4 fail-safe outputs.

The SO4000 meets the requirements of IEC 61508:2010 SIL3, DIN EN ISO 13849-1:2008 (Cat 4, PL e) and UL 508.

The bus terminal has the standard design of a Baumüller Bus Terminal.

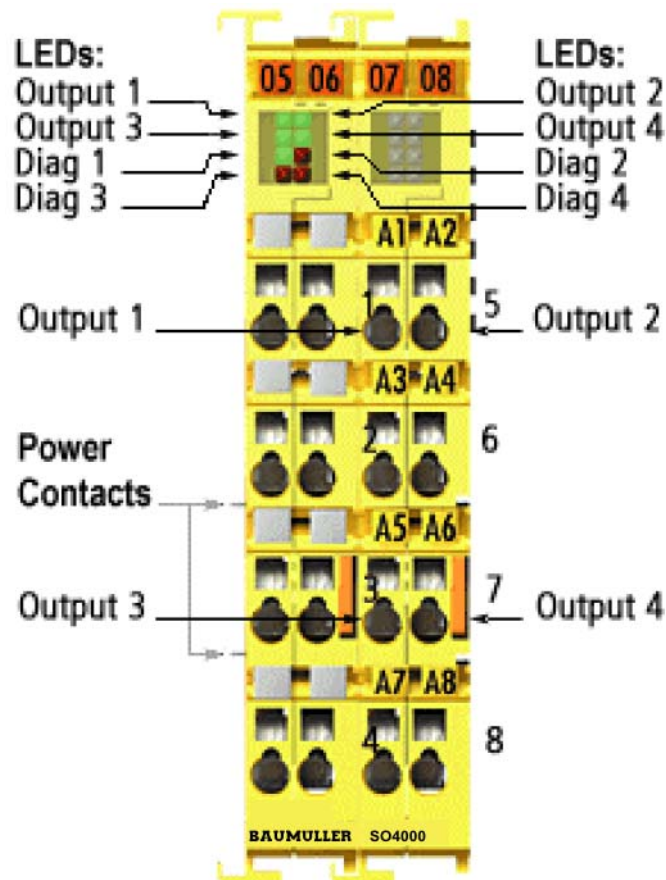


Figure 2: SO4000 safety output terminal

## 5.2 Appropriate use



### DANGER!

The safety I/O terminals may only be used for the purposes described in [▶Appropriate use ◀](#) from page 15 onward.

## 5.3 Technical data

See [▶Appendix D - Technical Data◀](#) from page 71 onward.

## 5.4 Dimensions

### 5.4 Dimensions

#### 5.4.1 SI4000

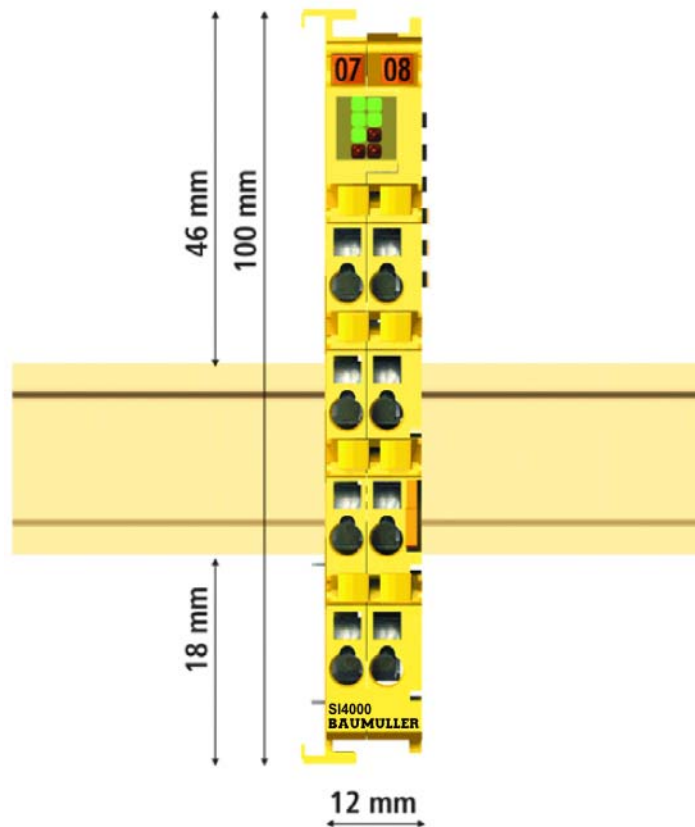


Figure 3: Dimensions of SI4000

Width: 12 mm (side-by-side installation)

Height: 100 mm

Depth: 68 mm



## 5.4.2 SO4000

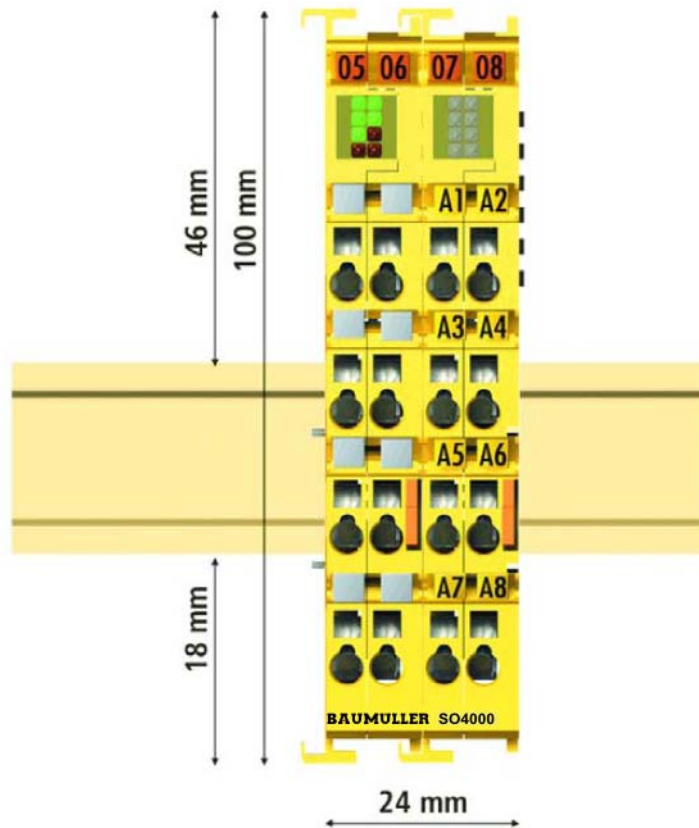


Figure 4: Dimensions of SO4000

Width:	24 mm (side-by-side installation)
Height	100 mm
Depth	68 mm



# ASSEMBLY AND INSTALLATION

## 6.1 Safety instructions

---

Before installing and commissioning the safety I/O terminals please read the chapter [▶Safety ◀](#) from page 15 onward.



### CAUTION!

The "Installation checklist" reproduced in Appendix [▶C.1◀](#) on page 67 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 Appendix [▶D.3.1◀](#) on page 74 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).

## 6.2 Transport and storage

---

Use the original packaging for transporting or storing the digital safety I/O terminals.

## 6.3 Installation of Bus Terminals on C mounting rails

---



### **CAUTION!**

#### **Note the specified environmental conditions**

Please ensure that the digital safety I/O terminals are only transported and stored under the specified environmental conditions (see [►Appendix D - Technical Data◄](#) from page 71 onward).

## 6.3 Installation of Bus Terminals on C mounting rails

---



### **DANGER!**

#### **Danger from electricity**

Set the bus system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

### 6.3.1 Control cabinet

---

The safety I/O terminals must be installed in a control cabinet or terminal box with IP54 protection class according to IEC 60529 as a minimum.

### 6.3.2 Mounting rail installation

---

The Bus Coupler and Bus Terminals are attached to commercially available 35 mm C mounting rails (according to EN 50022) by applying slight pressure:

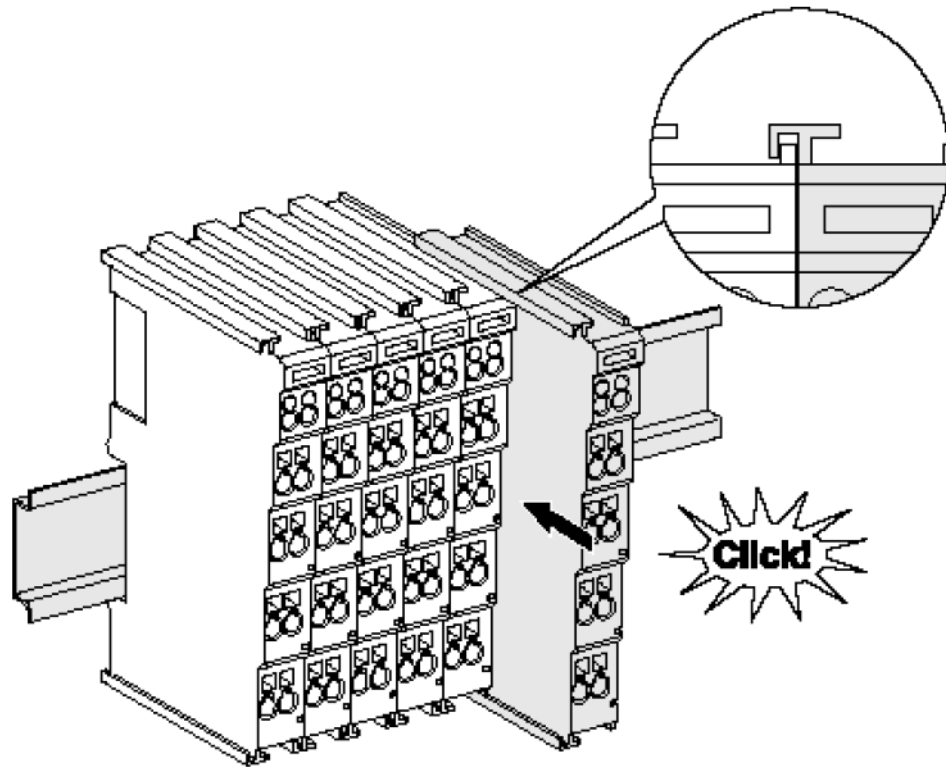


Figure 5: Assembly of the terminals

- 1 First attach the Fieldbus Coupler to the mounting rail.
- 2 The Bus Terminals are now attached on the right-hand side of the Fieldbus Coupler. Join the components with slot and key and push the terminals against the mounting rail, until the lock clicks onto the mounting rail.  
If the Terminals are clipped onto the mounting rail first and then pushed together without slot and key, the connection will not be operational! When correctly assembled, no significant gap should be visible between the housings.

During the installation of the Bus Terminals, the locking mechanism of the terminals must not come into conflict with the fixing bolts of the mounting rail.

## 6.4 Electrical installation

### 6.4.1 Connections within a bus terminal block

The electric connections between the Bus Coupler and the Bus Terminals are automatically realised by joining the components:

- The six spring contacts of the I/O-Bus deal with the transfer of the data and the supply of the Bus Terminal electronics.



### NOTICE!

#### Note the maximum I/O bus current!

Observe the maximum current that your Bus Coupler can supply to the I/O bus!

- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminals on the Bus Coupler.



### NOTICE!

#### Note the pin assignment of the power contacts!

During the design of a bus terminal block, the pin assignment of the individual Bus Terminals must be taken account of, since some types (e.g. analog Bus Terminals or digital 4-channel Bus Terminals) do not or not fully loop through the power contacts.

Power Feed Terminals (ES0000) interrupt the power contacts and thus represent the start of a new supply rail.

### PE power contact

The power contact labeled PE can be used as a protective earth. For safety reasons this contact mates first when plugging together, and can ground short-circuit currents of up to 125 A.



### CAUTION!

#### Danger from damage of the terminal

Note that, for reasons of electromagnetic compatibility, the PE contacts are capacitatively coupled to the mounting rail. This may lead to incorrect results during insulation testing or to damage on the terminal (e.g. disruptive discharge to the PE line during insulation testing of a consumer with a nominal voltage of 230 V).

Therefore:

- For insulation testing, disconnect the PE supply line at the Bus Coupler or the Power Feed Terminal! In order to decouple further feed points for testing, these Power Feed Terminals can be released and pulled at least 10 mm from the group of terminals.



### DANGER!

#### Serious risk of injury!

The PE power contact must not be used for other potentials!

6.4.2 Wiring

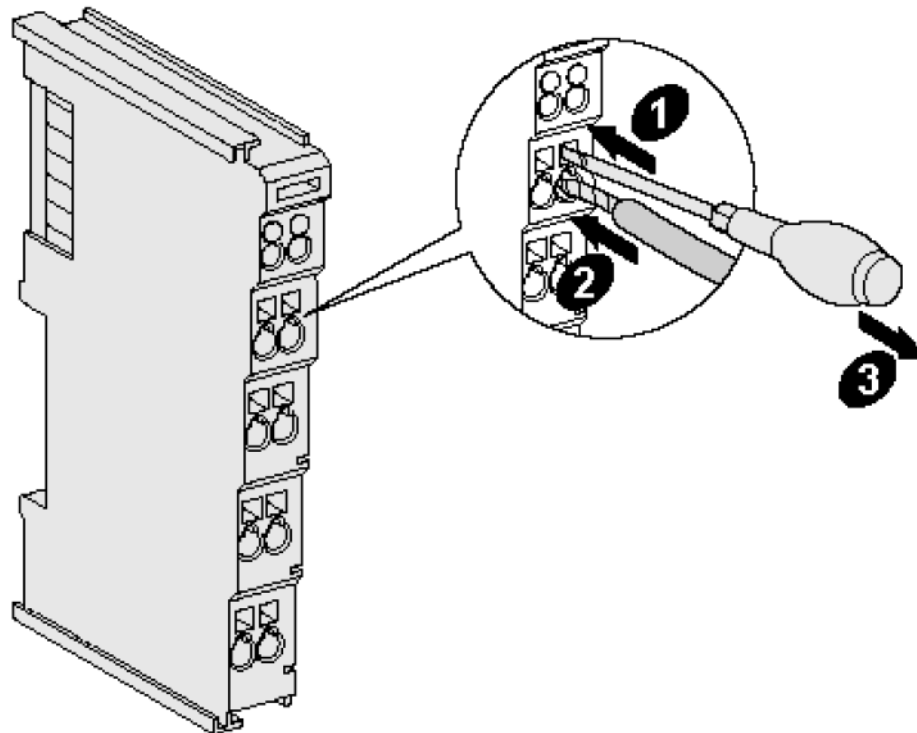


Figure 6: Wiring

Up to eight connections enable the connection of solid or finely stranded cables to the Bus Terminals. The terminals are implemented in spring force technology. Connect the cables as follows:

- 1 Open a spring-loaded terminal by slightly pushing with a screwdriver or a rod into the square opening above the terminal.
- 2 The wire can now be inserted into the round terminal opening without any force.
- 3 The terminal closes automatically when the pressure is released, holding the wire securely and permanently.

<b>Wire cross-section</b>	0.08 bis 2.5 mm <sup>2</sup>
<b>Strip length</b>	8 mm

6.5 Power supply

The supply connections  $V_k$  for the module electronics (I/O bus) and supply connections for the field devices (power contacts) of a terminal block are galvanically separated from each other and can be supplied via separate 24 V<sub>DC</sub> voltage sources. If no electrical isolation is required between I/O bus and field devices, the module electronics and the field devices can be supplied from a single voltage source.

## 6.5 Power supply



### NOTICE!

For the trouble-free operation of an I/O bus extension system, the ground connection of the I/O bus power supplies ( $V_k$  0 V) of all terminal blocks must be connected with each other via a low-impedance connection (see Figure). This also includes the ground connection of the I/O bus power supply of the higher-level Fieldbus Coupler!

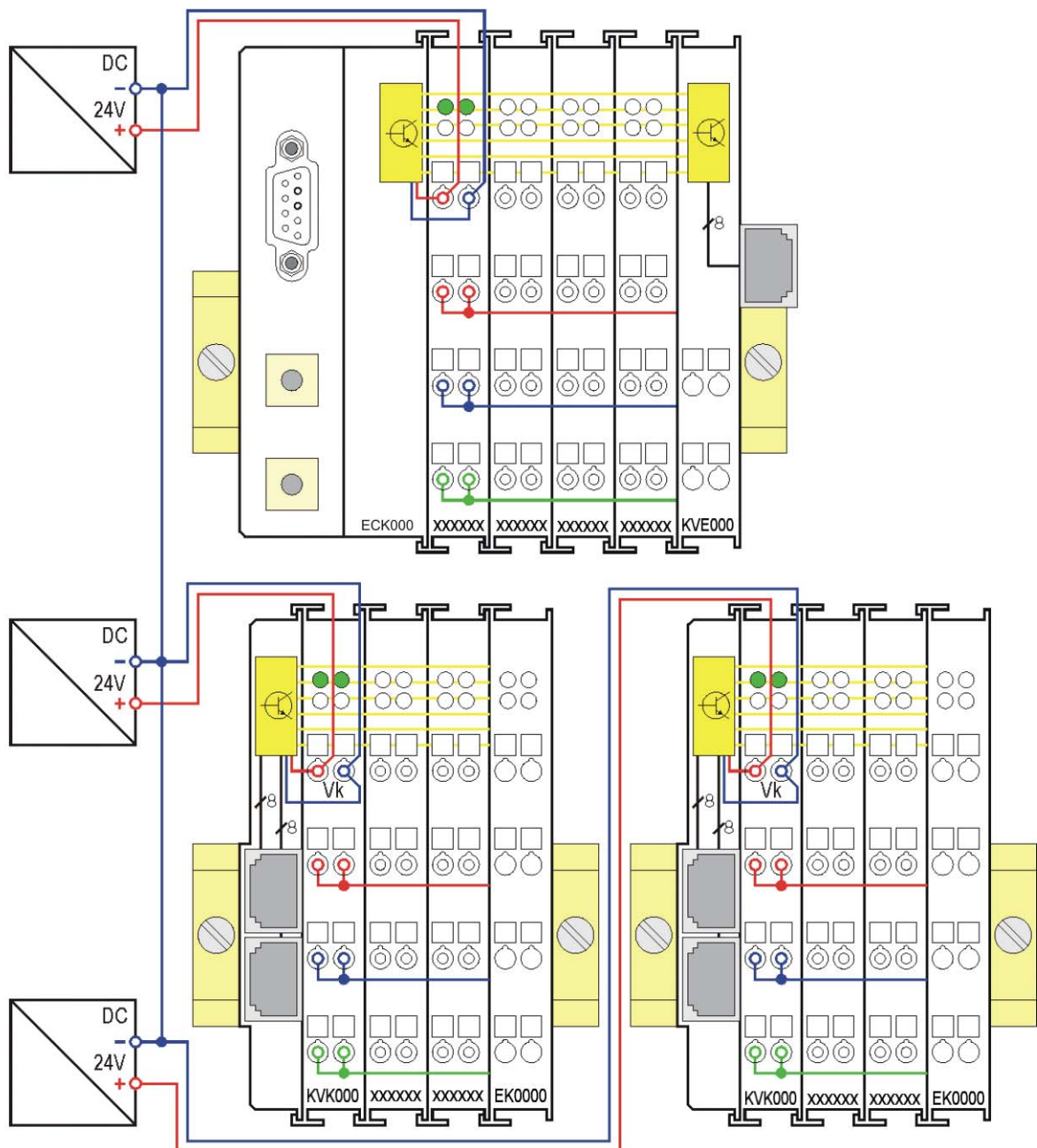


Figure 7: Power supply of the terminal blocks



## COMMISSIONING

Please ensure that the safety I/O terminals are only transported, stored and operated under the specified conditions (see [►Appendix D - Technical Data◄](#) from page 71 onward).



### CAUTION!

The [►Commissioning and validation checklist ◄](#) on page 69 reproduced in the Appendix should be used during the commissioning phase.

Therefore:

- 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.
- Never leave the system unsupervised during commissioning with manually set variables in debug mode (forcing). The important safety functions may not be active in this form of operation. Make sure that no one enters the danger zone.
- 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.



### DANGER!

#### Risk of injury!

The safety I/O terminals must **not** be used under the following operating conditions:

- under the influence of ionising radiation
- in corrosive environments
- in an environment that leads to unacceptable soiling of the bus terminal

### 7.1 Installation

---

#### 7.1.1 Safety instructions

---

Before installing and commissioning the safety I/O terminals please read the chapter [►Safety◄](#) from page 15 onward.

#### 7.1.2 Transport and storage

---

Use the original packaging for transporting or storing the digital safety I/O terminals.



#### **CAUTION!**

##### **Note the specified environmental conditions**

Please ensure that the digital safety I/O terminals are only transported and stored under the specified environmental conditions (see [►Appendix D - Technical Data◄](#) from page 71 onward).

#### 7.1.3 Mechanical installation

---



#### **DANGER!**

##### **Danger from electricity**

Set the bus system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

##### 7.1.3.1 Control cabinet

---

The safety I/O terminals must be installed in a control cabinet or terminal box with IP54 protection class according to IEC 60529 as a minimum.

##### 7.1.3.2 Installation of Bus Terminals on C mounting rails

---

See [►Mounting rail installation◄](#) from page 36 onward.

#### 7.1.4 Electrical installation

---

See [►Electrical installation◄](#) from page 37 onward.

7.1.5 SI4000 pin assignment

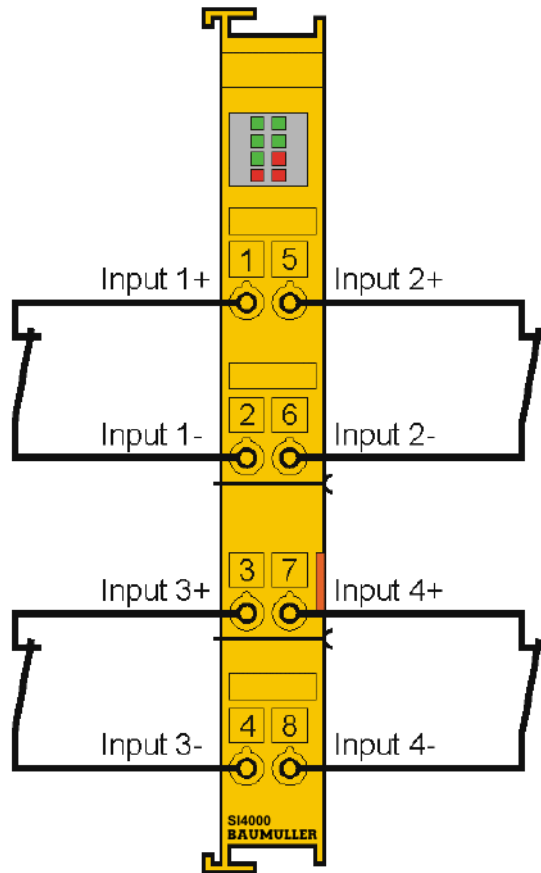


Figure 8: SI4000

Clamping point	Input	Signal
1	1	Input 1+
2		Input 1-
3	3	Input 3+
4		Input 3-
5	2	Input 2+
6		Input 2-
7	4	Input 4+
8		Input 4-



### NOTICE!

#### Configurable inputs

The inputs 1 to 4 can be occupied as you want with N/C or N/O contacts. The corresponding analysis is carried out in the b maXX safe PLC.

### 7.1.5.1 Tested devices

The following list contains devices that were tested together with the SI4000 terminal. The results only apply for the current device hardware version at the time of testing. The tests were carried out in a laboratory environment. Modifications of these products cannot be considered here. If you are unsure please test the hardware together with the safety terminal.

Manufacturer	Type	Comment
SICK	C4000	Safety light curtain
Wenglor	SG2-141S045C1	Safety light grids
Leuze	lumiflex ROBUST 42/43/44	Safety light barriers
Schmersal	BNS250-11ZG	Safety switch
ifm	GM701S	Inductive safety sensor

The tests were carried out as function tests only. The information provided in the respective manufacturer documentation remains valid.

7.1.6 SO4000 pin assignment

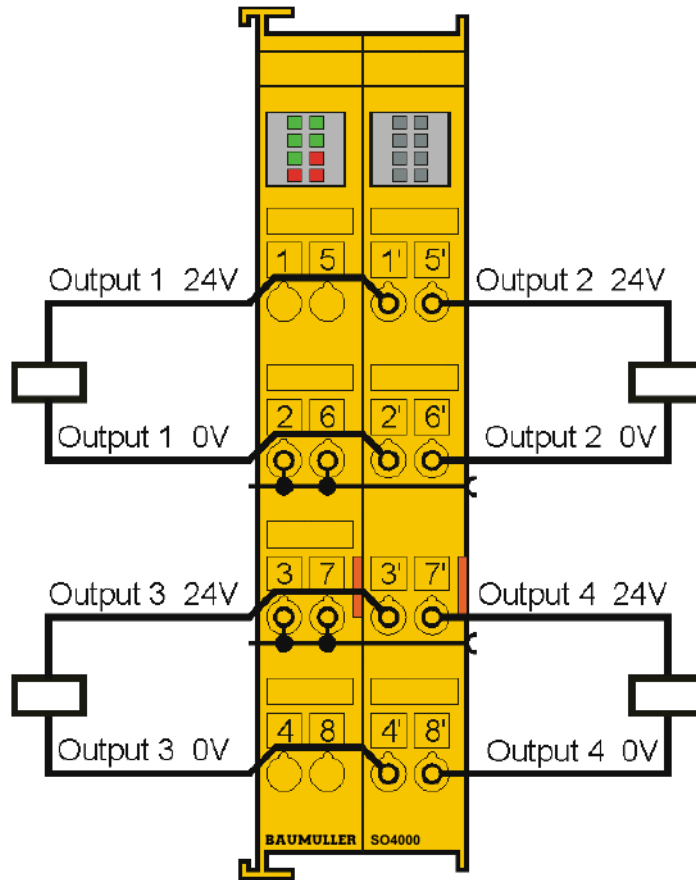


Figure 9: SO4000

Clamping point	Input	Signal
1		not used, no function
2		positive power contact
3		negative power contact
4		not used, no function
5		not used, no function
6		positive power contact
7		negative power contact
8		not used, no function
1'	1	Output 1+
2'		Output 1-
3'	3	Output 3+
4'		Output 3-

Clamping point	Input	Signal
5'	2	Output 2+
6'		Output 2-
7'	4	Output 4+
8'		Output 4-



### NOTICE!

#### Test pulses

When selecting actuators please ensure that the SO4000 test pulses do not lead to actuator switching or diagnostic message from the SO4000.

The test pulses of the SO4000 terminal outputs are not configurable and cannot be switched off.

### 7.1.6.1 Tested devices

The following list contains devices that were tested together with the SO4000 terminal. The results only apply for the current device hardware version at the time of testing. The tests were carried out in a laboratory environment. Modifications of these products cannot be considered here. If you are unsure please test the hardware together with the safety terminal.

Manufacturer	Type	Comment
Beckhoff	AX5801	TwinSAFE Drive option card: safe restart lock
Beckhoff	AX2000 AS option	Safe restart lock
Beckhoff	KL2964	Three-channel contact extension with feedback
Siemens	SIRIUS series S00 3RT1016-1BB42	Contactors
Telemecanique	LP1K09	Contactors
Dold	LG5929.54/100	Extension module with floating contacts

The tests were carried out as function tests only. The information provided in the respective manufacturer documentation remains valid.



### NOTICE!

#### Recommended protective circuits

We recommend R/C or diode-based protective circuits for these devices. Varistor-based protective circuits should not be used.

### 7.1.7 Address settings on the safety terminals

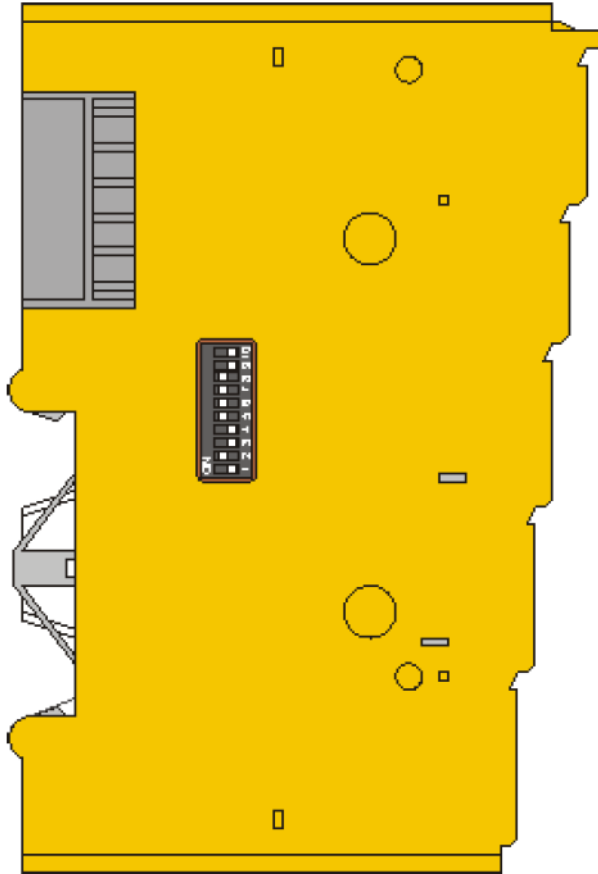


Figure 10: Address setting

The address of the terminal is set via the 10-way Dip switch on the left-hand side of the safety terminal. Addresses between 1 and 1023 are available.

Dip switch										Address
1	2	3	4	5	6	7	8	9	10	
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	0
<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1
OFF	<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
<b>ON</b>	<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
OFF	OFF	<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	4
<b>ON</b>	OFF	<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	5
OFF	<b>ON</b>	<b>ON</b>	OFF	OFF	OFF	OFF	OFF	OFF	OFF	6

Dip switch										Address
1	2	3	4	5	6	7	8	9	10	
ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	7
...	...	...	...	...	...	...	...	...	...	...
ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	1023



### WARNING!

#### Unique safety address

Each address may only be used once within a network!

### 7.1.8 Parameterization

#### 7.1.8.1 SI4000 parameter overview

PrmName	Meaning	Values
S_Address	Dip switch address	1 to 1023
Channel 1	Activation of channel 1	active/not active
Channel 2	Activation of channel 2	active/not active
Channel 3	Activation of channel 3	active/not active
Channel 4	Activation of channel 4	active/not active
Sensor test channel 1	The clock signal for connection Input1+ is checked at connection Input1-	active/not active
Sensor test channel 2	The clock signal for connection Input2+ is checked at connection Input2-	active/not active
Sensor test channel 3	The clock signal for connection Input3+ is checked at connection Input3-	active/not active
Sensor test channel 4	The clock signal for connection Input4+ is checked at connection Input4-	active/not active
Channel 1 and 2	For two-channel evaluation, inputs 1 and 2 must have the same signal states	single-channel evaluation/two-channel evaluation



PrmName	Meaning	Values
Channel 3 and 4	For two-channel evaluation, inputs 3 and 4 must have the same signal states	single-channel evaluation/two-channel evaluation
Ambivalence channel 1 and 2	If active, inputs 1 and 2 must have different signal states	not active/active
Ambivalence channel 3 and 4	If active, inputs 3 and 4 must have different signal states	not active/active

### 7.1.8.2 SI4000 configuration for light barriers, light grids, light curtains etc.

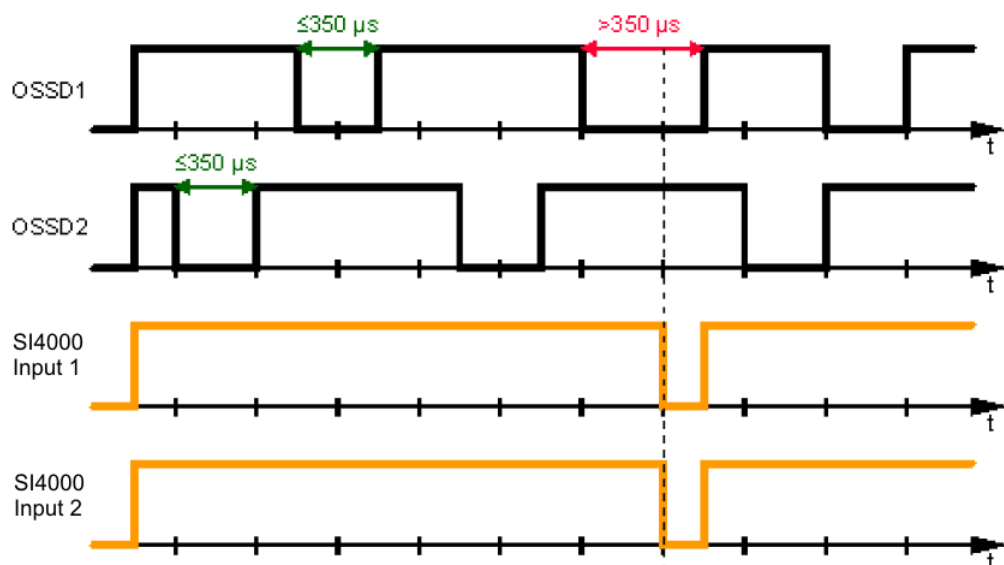
The SI4000 also supports direct connection of contact-free protective equipment with two self-testing outputs such as light barriers, light grids, light curtains, laser scanner etc.



#### CAUTION!

#### Sensors with self-testing outputs

Only sensors with self-testing outputs and a maximum sensor self-test duration of 350  $\mu$ s may be connected to the SI4000.



#### Parameter

To connect these sensors please set the following parameters for the SI4000 in ProMaster:

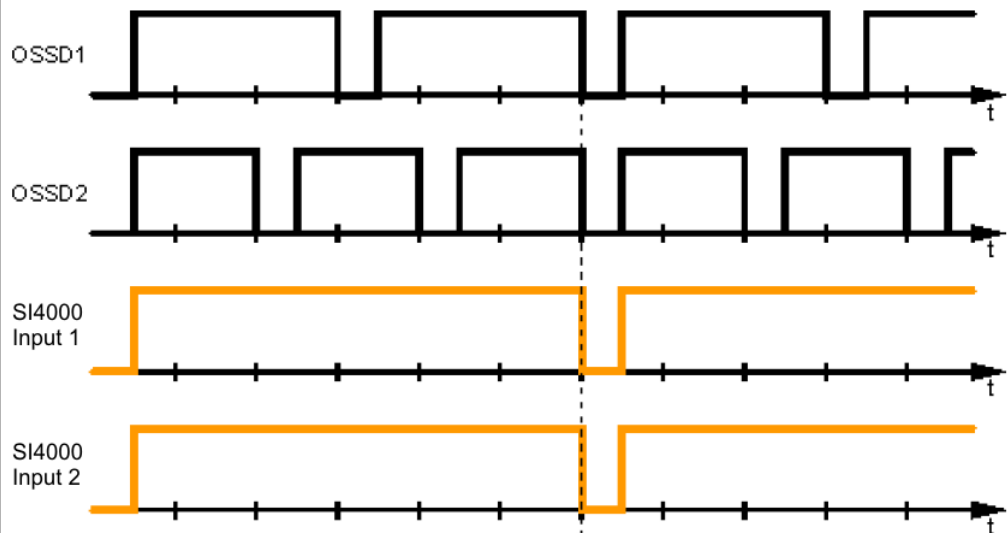
- Connect the two sensor signals either to channels 1 and 2 or channels 3 and 4 and activate the two-channel evaluation for the two inputs used.
- Set the SI4000 sensor test for the two inputs used to **not active**.



### CAUTION!

#### No simultaneous sensor self-test with two-channel evaluation

The sensor self-test must not set the two channels for two-channel evaluation to LOW simultaneously.



### 7.1.8.3 SO4000 parameter overview

PrmName	Meaning	Values
S_Address	Dip switch address	1 to 1023
Channel 1	Activation of channel 1	active/not active
Channel 2	Activation of channel 2	active/not active
Channel 3	Activation of channel 3	active/not active
Channel 4	Activation of channel 4	active/not active

## 7.1.8.4 Configuration of the safety SI4000 Parameter in ProSafety

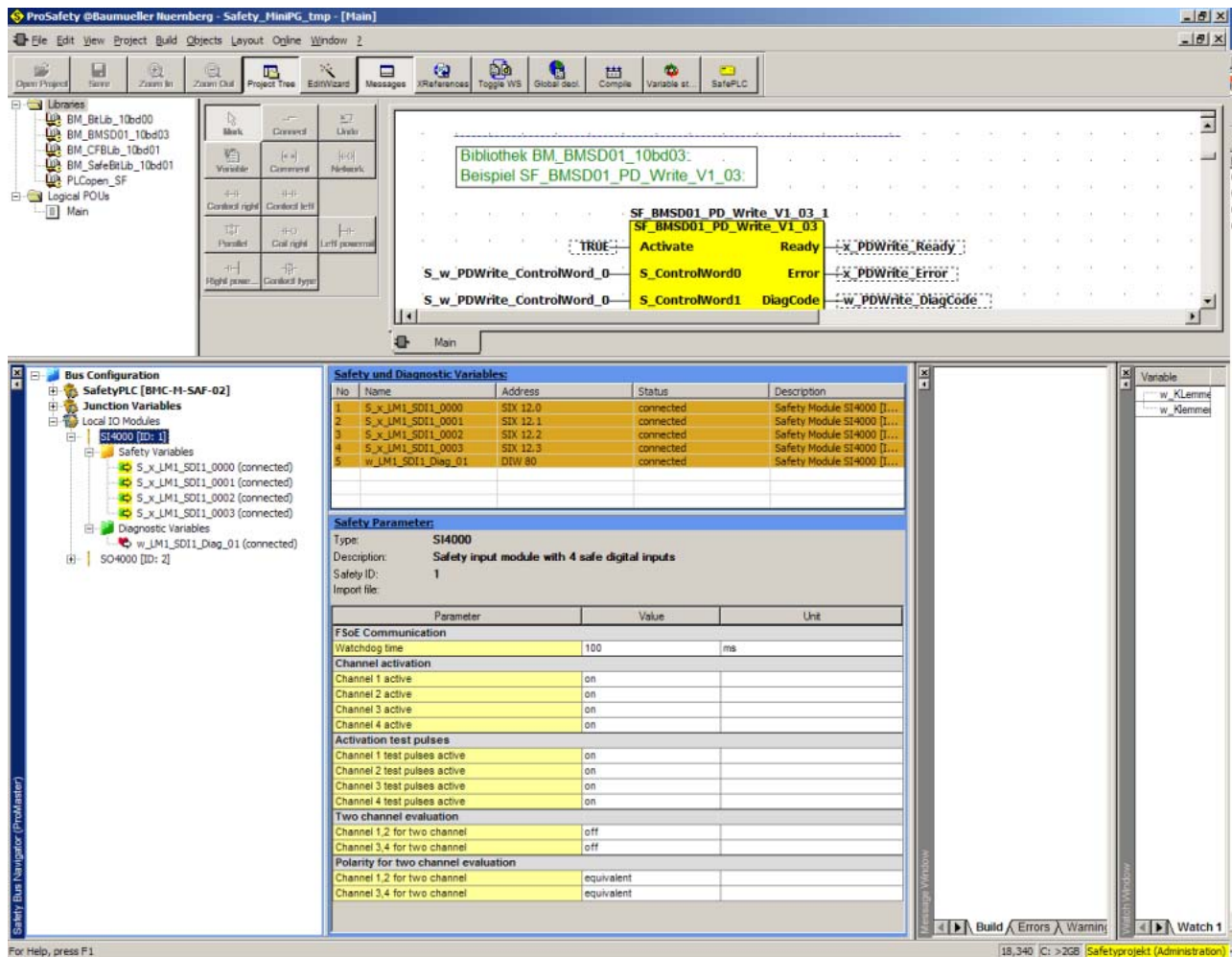


Figure 11: ProSafety

- Switch to „Bus Configuration“ with the mouse and mark the „Local I/O module / SI4000“.

=> The field „Safety parameter“ will be opened.

Here you can configure the SI4000 specific safety parameter such as „Watchdog time“, „Activation test pulse“, and so on.

## 7.1.8.5 Configuration of the safety SO4000 Parameter in ProSafety

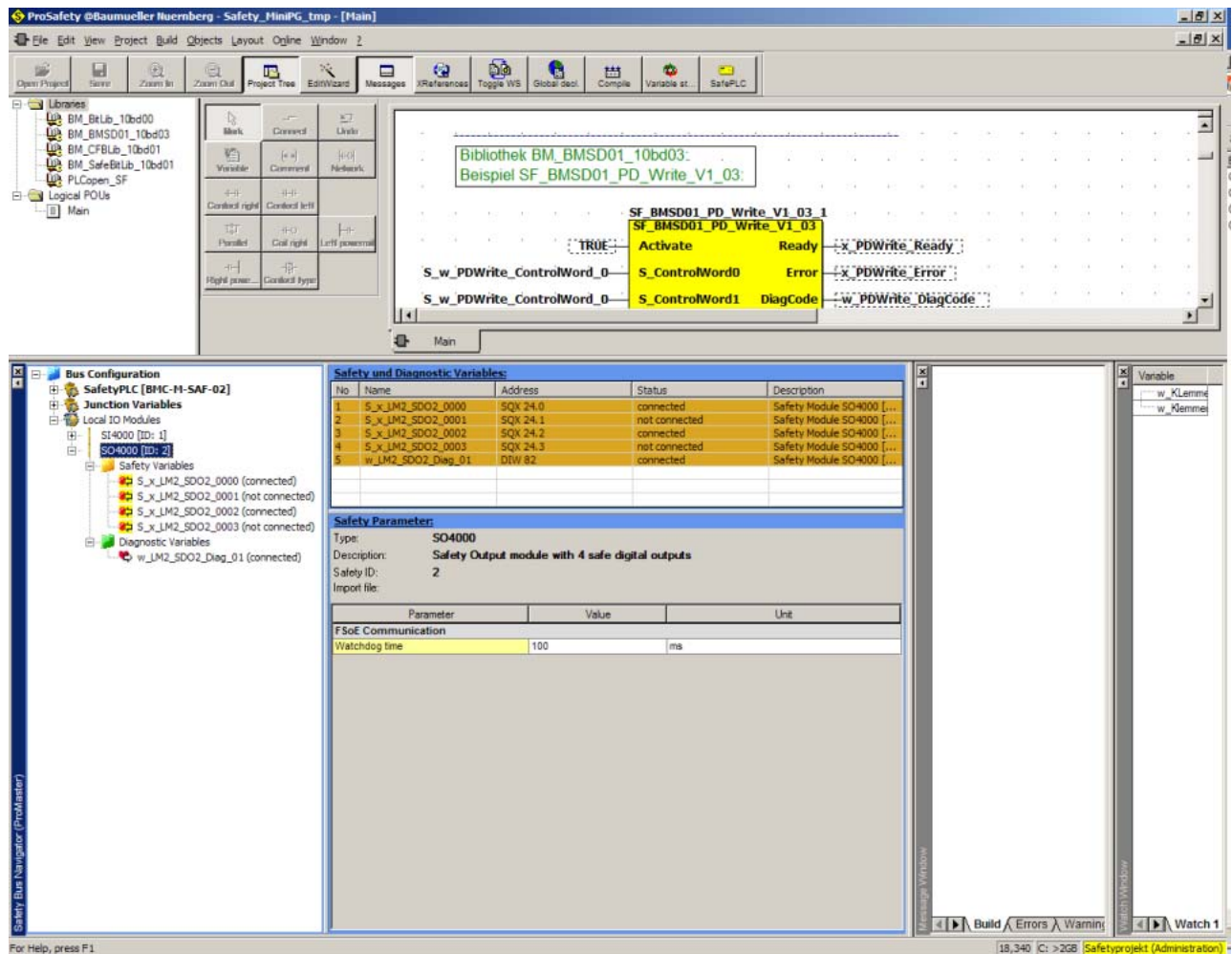


Figure 12: ProSafety

- Switch to „Bus Configuration“ with the mouse and mark the „Local I/O module / SO4000“.
  - => The field „Safety parameter“ will be opened.
- Here you can configure the SO4000 specific safety parameter „Watchdog time“.

### 7.1.8.6 Meaning of the SI4000 and SO4000 diagnostic variables

Variable	Value / Bit	Meaning
w_LM*_SDx_Diag_01	Bit 0	0: Configuration data of the safety device is invalid 1: Configuration data of the safety device is valid
	Bit 1	0: Safety communication has not yet started running to the safety device 1: Safety communication has started running to the safety device (display saved)
	Bit 2	0: An error has not occurred 1: An error related to the safety device has occurred (saved display)
	Bit 3	0: An error has not occurred 1: An error related to the safety device has occurred (current display)
	Bit 4	0: Safe parameter download to the safety device not active 1: Safe parameter download to the safety device active
	Bit 5	0: Safety communication in another status 1: Safety communication running to the safety device in "FailSafeData" status
	Bit 6	0: Safety communication in another status 1: Safety communication is running to the safety device in "ProcessData" status (normal operation status)
	Bit 7	0: No error reported by safety device 1: Safety device is reporting an error (FailSafe-Data)
	Bit 8 – 15	Reserved

x stands for I with the input module and for O with the output module

### 7.2 Diagnostic

#### 7.2.1 Diagnostic LEDs SI4000

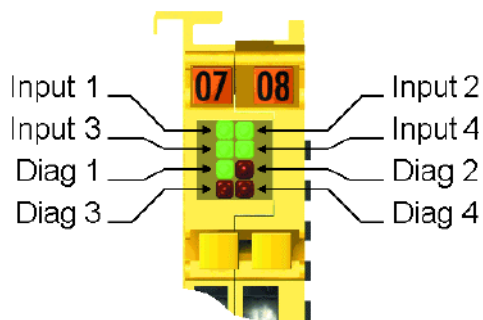


Figure 13: Diagnostic LEDs SI4000

##### 7.2.1.1 Diag 1 (green)

The Diag 1 LED indicates the state of the FSoE interface.

Flashing Code	Meaning
LED illuminated continuously	normal operation: FSoE communication OK
rapid flickering, alternating with 1 flash pulse	Error in S parameter (Fail <u>s</u> afe parameter)
rapid flickering, alternating with 2 flash pulses	Error in I parameter (I <u>n</u> dividual parameter)
rapid flickering, alternating with 3 flash pulses	Waiting for S and I parameter
rapid flickering, alternating with 4 flash pulses	S- and I-parameter correct: Waiting for first host message
rapid flickering, alternating with 5 flash pulses	Watchdog error
rapid flickering, alternating with 6 flash pulses	CRC error
rapid flickering, alternating with 7 flash pulses	Sequence number error
rapid flickering, alternating with 8 flash pulses	Intermediate state in a sensor

##### 7.2.1.2 Diag 2 (red)

The Diag 2 LED illuminates red if the terminal detects an external supply or cross-circuit. Once the error has been rectified the LED goes out.

### 7.2.1.3 Diag 3 (red) and Diag 4 (red)

The Diag 3 and Diag 4 LEDs indicate internal terminal errors.



#### NOTICE!

#### Returning the terminal

These errors lead to shutdown of the terminal. The terminal must be checked by Baumüller Anlagen-Systemtechnik GmbH & Co. KG.

Diag 3 LED (red)	Diag 4 LED (red)	Source of error
Lit	flashes (see below for flashing codes)	μC1
Lit	off	μC2

In the event of a fault the Diag 4 LED indicates the type of error through flashing codes. The flashing codes are structured as follows:

Flashing sequence	Meaning
Rapid flickering	Start of flashing code
First slow sequence	Error code
Second slow sequence	Error code argument

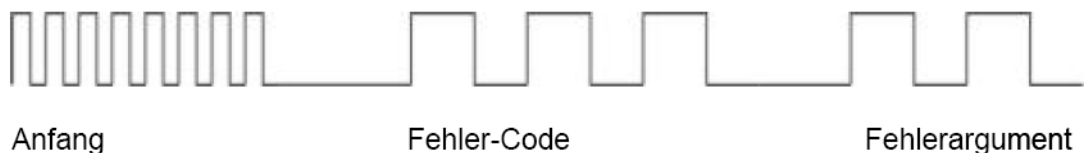


Figure 14: Blinking sequence

Count the number of flash pulses after the rapid flickering sequence

- during the first slow sequence in order to ascertain the error code
- during the second slow sequence in order to ascertain the error argument

The flashing code is repeated after the second slow sequence, followed by rapid flickering.

### 7.2.2 Diagnostic LEDs SO4000

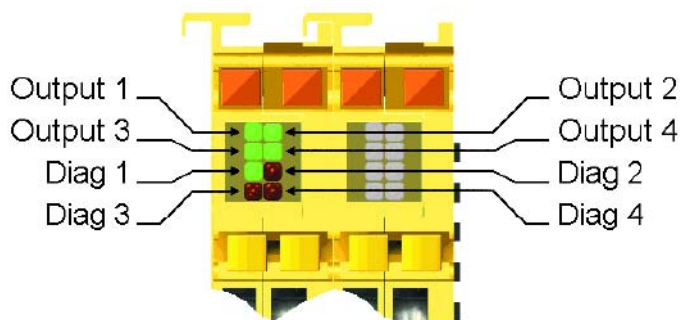


Figure 15: LEDs SO4000

#### 7.2.2.1 Diag 1 (green)

The Diag 1 LED indicates the state of the FSoE interface.

Flashing Code	Meaning
LED illuminated continuously	normal operation: FSoE communication OK
rapid flickering, alternating with 1 flash pulse	Communication error: The connection is not in „Run“ State
rapid flickering, alternating with 3 flash pulses	Communication error: The connection is not in „Run“ State

#### 7.2.2.2 Diag 2 (red)

The Diag 2 LED indicates the state of the digital outputs.

Flashing Code	Meaning
rapid flickering, alternating with 1 flash pulse	Output 1: Open load or current below minimum value of 20 mA or current above maximum value of 500 mA
rapid flickering, alternating with 2 flash pulses	Output 2: Open load or current below minimum value of 20 mA or current above maximum value of 500 mA
rapid flickering, alternating with 3 flash pulses	Output 3: Open load or current below minimum value of 20 mA or current above maximum value of 500 mA
rapid flickering, alternating with 4 flash pulses	Output 4: Open load or current below minimum value of 20 mA or current above maximum value of 500 mA
rapid flickering, alternating with 5 flash pulses	field potential too low



Flashing Code	Meaning
rapid flickering, alternating with 6 flash pulses	field potential too high
rapid flickering, alternating with 7 flash pulses	terminal temperature too low
rapid flickering, alternating with 8 flash pulses	terminal temperature too high
rapid flickering, alternating with 9 flash pulses	Temperature difference error
rapid flickering, alternating with 10 flash pulses	error in output circuit through Open Load, external supply or cross-circuit

These errors can only be reset by switching the power supply for the safety terminal off and back again.

### 7.2.2.3 Diag 3 (red) and Diag 4 (red)

See [▶Diag 3 \(red\) and Diag 4 \(red\)◀](#) from page 55 onward.

## 7.3 Troubleshooting

- Check wiring, check 24 V supply
- SO4000: Pay attention to minimum current of 20 mA
- The SAF module for the b maXX 5000, which is directly controlled via SO4000 must cope with this ("Separate Grounds" of the type: BM5-O-SAF-002-001-xxx-#01 or BM5-O-SAF-003-001-xxx-#01 and the adapter for the safety-I/O-terminal).
- FSoE communication problems:
  - Checking the address setting on the safety terminals (may be assigned once only)
  - Check if EtherCAT bus is running synchronously
    - The setting of the cycle time in the ring must be the same all over
    - The user must activate the bus synchronization in all b maXX 5000 controllers (there is no automatic setting, as the EtherCAT slave is permanently integrated in the controller. The device is delivered as single device without a configured bus connection)
    - Check grounding at the machine
    - Regard EtherCAT cabling sequence by starting from the EtherCat master (for example, if b maXX 5000 controllers are integrated):  
Cable of EtherCAT master → Connection at (input) terminal "X3" (of the b maXX 5000), of (output) terminal "X4" → go to the next EtherCAT slave
  - Incorrect mapping of the FSoE participants in the configuration software
  - Mapped participants are missing at the EtherCAT bus

### 7.4 Maintenance

---

The digital safety input terminal SI4000 and the digital safety output terminal SO4000 are maintenance free!



**WARNING!**

**Observe the specified environmental conditions!**

Please ensure that the safety terminals are only stored and operated under the specified conditions (see [►Appendix D - Technical Data◀](#) from page 71 onward).

If the terminal is operated outside the permitted temperature range it will switch to global fault state.

#### 7.4.1 Cleaning

---

Protect the safety terminal from unacceptable soiling during operation and storage!

If the safety terminals were subjected to unacceptable soiling they may no longer be operated!



**WARNING!**

**Have soiled terminals checked!**

Cleaning of the safety terminal by the user is not permitted!

Please send soiled terminals to the manufacturer for inspection and cleaning!

#### 7.4.2 Service life

---

The safety terminals are designed for a service life of 20 years.

Due to the high diagnostic coverage within the lifecycle no special proof tests are required.

## SYSTEM VALIDATION

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



### WARNING!

#### Danger during commissioning!

The control system may only be put into commission 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 [▶C.2 Commissioning and validation checklist◀](#) on page 69. 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.

### 8.1 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.

Use the project documentation printed out by ProSafety to conduct the function test. The instructions on handling the project documentation can be found in the programming handbook.

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 Separate all actuators and drives from the output terminals electrically.
- 2 Test the logic circuit by forcing variables in the ProSafety safe programming interface (see chapter "FORCING AND OVERWRITING" in the ▶Application Manual b maXX safe PLC◀). Check whether the behavior of the logic corresponds with the expected function. Also check whether the evaluation of multi-channel safety components is conducted in a multi-channel manner.
- 3 Only connect the actuators and drives to the safe output terminals once no errors have been detected in the inspection of the logic circuit.
- 4 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.

The function test must lead to the following results:

- the logical allocation of all system components is **correct**
- the allocation of all system components is **complete**

## DISMANTLING, STORAGE

In this chapter, we will describe how you decommission the terminals store it. Observe the information in chapter [►Safety◄](#) from page 15 onward.

### 9.1 Safety regulations

---

Bring the bus system into a safe, powered down state before starting disassembly of the Terminals! Only specially trained personnel are allowed to dismantle the terminals. The safety regulations for commissioning apply analogously to dismantling.

### 9.2 Requirements of the personnel carrying out work

---

The personnel that carries out dismantling must have the necessary knowledge and have been trained appropriately to carry out this work. Choose these persons such that they understand and can apply the safety instructions printed on the unit and parts of it and on the connections.

### 9.3 Decommissioning

---

**DANGER!****Serious risk of injury!**

Set the bus system into a safe, de-energized state before starting disassembly of the bus terminals!

### 9.4 Disassembly

---

Each terminal is secured by a lock on the mounting rail, which must be released for disassembly:

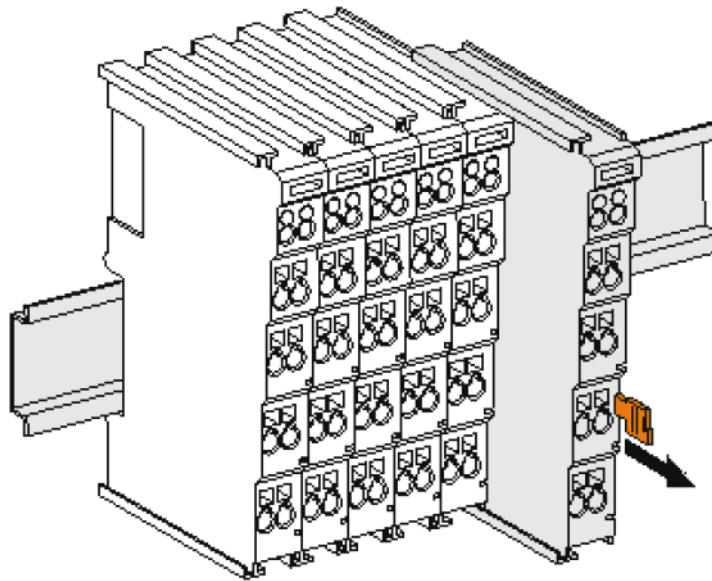


Figure 16:

- 1 Carefully pull the orange-colored lug approximately 1 cm out of the disassembled terminal, until it protrudes loosely. The lock with the mounting rail is now released for this terminal, and the terminal can be pulled from the mounting rail without excessive force.
- 2 Grasp the released terminal with thumb and index finger simultaneous at the upper and lower grooved housing surfaces and pull the terminal away from the mounting rail.

## 9.5 Storage conditions

---

Store the terminals in suitable packaging according to the storage conditions in [►Appendix D - Technical Data◄](#) from page 71 onward.

## 9.6 Recommissioning

---

If you want to recommission the terminals, observe the information in "Storage Conditions" in [►Appendix D - Technical Data◄](#) from page 71 onward.

Then, carry out [►Assembly and Installation◄](#) from page 35 onward again.

## 9.7 Disposal

---

In order to dispose of the device, it must be removed and fully dismantled.

- Housing components (polycarbonate, polyamide (PA6.6)) are suitable for plastic recycling.
- Metal parts can be sent for metal recycling.
- Electronic parts such as disk drives and circuit boards must be disposed of in accordance with national electronics scrap regulations.



## APPENDIX A - ABBREVIATIONS

<b>CPU</b>	Central Processing Unit
<b>DC</b>	Diagnostic Coverage
<b>Diag</b>	Diagnostic LED
<b>DIN</b>	Deutsches Institut für Normung e.V.
<b>EMC</b>	Electromagnetic compatibility
<b>EN</b>	European standard
<b>FSoE</b>	Safety protocol „Safety over Ether-CAT“
<b>HFT</b>	Hardware Failure Tolerance
<b>I/O</b>	Input/Output
<b>I/O bus</b>	Bus between b maXX safe PLC and the modules right of the PLC and/or power supply
<b>LED</b>	Light-emitting diode
<b>MTTF<sub>d</sub></b>	Mean Time To Failure
<b>PFD</b>	Probability of Failure on Demand
<b>PFH</b>	Probability of Failure per Hour
<b>PLC</b>	Process loop control, stored Program Control, SPS
<b>RAM</b>	Random Access Memory
<b>ROM</b>	Read Only Memory
<b>SFF</b>	Safe Failure Fraction (Fraction of failures which lead to safe status)
<b>SIL</b>	Safety Integrity Level
<b>SW</b>	Software







## APPENDIX B - ACCESSORIES

This appendix lists all accessory items which are available from Baumüller Nürnberg GmbH for the safety I/O terminals.

If you have enquiries or suggestions on the accessory items, the Baumüller product management will be glad to assist you.

### B.1 List of all accessory items

---

At the moment there are no accessories available for the I/O terminals.





## APPENDIX C - CHECKLISTS

The use of checklists serves documentation purposes and guides in the implementation of a safety system. The checklists reproduced in Appendix C - Checklists 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.

### C.1 Installation checklist

---

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
1	Installation			
1.1	Has it been ensured that there are no short circuits from the wiring of the input and output terminals?			
1.2	Has it been ensured that the safety switch devices have not been bypassed as a result of wiring errors?			
1.3	Has a wiring inspection in accordance with the installation plan been conducted			
1.4	Are all connection plugs labelled according to their allocation?			
1.5	Are the connection terminals loaded with the specified clamping torque?			
1.6	Has it been ensured that the insulation of the lines is not causing any faulty contacts?			
1.7	Has the reliability of all terminal connections been tested through mechanical tensile loading?			

## C.1 Installation checklist

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
1.8	Has a visual inspection of the installed components been conducted?			
1.9	Have the required installation spacings to other components been complied with?			
1.10	Do the components meet the environmental conditions prevailing in the application?			
1.11	Does the system fulfil the required type of protection?			
1.12	Is degree of pollution 2 complied with?			
1.13	Is the system protected against corrosive substances?			

Date	Name	Signature

## C.2 Commissioning and validation checklist

Serial no.	Requirement	Fulfilled		Remarks
		Yes	No	
2	Commissioning			
2.1	Has it been ensured that all safe communication participants of a system have a unique safe device address? This also applies to participants belonging to different safety controls, if the controls are connected to one another via gateways (such as ethernet).			
2.2	Has a complete function test been conducted and documented?			
2.3	Has the operating personnel been instructed in the handling of the control system?			

Date	Name	Signature





## APPENDIX D - TECHNICAL DATA

In this appendix, you will find the technical data for Baumüller Nürnberg GmbH's Safety I/O terminals.

### D.1 Connection technology

---

<b>Connection technology</b>	
Wiring	Cage Clamp® spring-loaded system
Connection cross-section	0.08 mm <sup>2</sup> ... 2.5 mm <sup>2</sup> , AWG 28-14, stranded wire, solid wire
Field bus connection	depending on fieldbus
Power contacts	up to 3 blade/spring contacts
Current load	10 A
Nominal voltage	depends on bus terminal type

### D.2 Connection values

---

<b>Product name</b>	<b>SI4000</b>
Number of inputs	4
Number of outputs	0
Status display	4 (one green LED per output)
Response time (read input / write to I/O bus)	typical: 4 ms maximum: see fault response time
Fault response time	< watch dog time (adjustable from 5 ms to 100 ms)
Cable length between sensor and terminal (unscreened line)	max. 100 m (at 0.75 mm <sup>2</sup> or 1 mm <sup>2</sup> )
Cable length between sensor and terminal (screened line)	max. 100 m (at 0.75 mm <sup>2</sup> or 1 mm <sup>2</sup> )

## D.2 Connection values

<b>Product name</b>	<b>SI4000</b>
Input process image	6 bytes
Output process image	6 bytes
SI4000 supply voltage	24 V <sub>DC</sub> (-15% / +20%)
Current consumption of the modular electronics at 24 V (without current consumption of sensors)	4 channel occupied: typically 12 mA 0 channel occupied: typically 1 mA
Current consumption from I/O-bus	4 channel occupied: typically 47 mA 0 channel occupied: typically 33 mA
Power dissipation of the terminal	typically 540 mW
Electrical isolation (between the channels)	no
Electrical isolation (between the channels and the I/O bus)	yes
Insulation voltage (between the channels and the I/O bus, under common operating conditions)	isolation checked with 500 V <sub>DC</sub>
Permissible contamination level	Contamination level 2 (see chapter <a href="#">►Cleaning◄</a> on page 58)
Unacceptable operating conditions	Safety terminals must not used under the following operating conditions: <ul style="list-style-type: none"> <li>• under the influence of ionising radiation</li> <li>• in corrosive environments</li> <li>• in an environment that leads to unacceptable soiling of the bus terminal</li> </ul>
Shocks	15 g with pulse duration 11 ms in all three axes
Protection class	IP20
Permitted operating environment	control cabinet or terminal box with minimum protection class IP54 according to IEC 60529
Permissible installation position	any
Approvals	CE

<b>Product name</b>	<b>SO4000</b>
Number of inputs	0
Number of outputs	4
Status display	4 (one green LED per output)
Output current per channel	max. 500 mA, min. 20 mA per channel
Cable length between sensor and terminal (unscreened line)	max. 100 m
Fault response time	< watch dog time



<b>Product name</b>	<b>SO4000</b>
Cable length between sensor and terminal (screened line)	max. 100 m
Wire cross section	min. 0.75 mm <sup>2</sup>
Input process image	6 bytes
Output process image	6 bytes
SO4000 supply voltage	24 V <sub>DC</sub> (-15% / +20%)
Current consumption from I/O-bus	max. 250 mA
Power dissipation of the terminal	typically 2 W
Electrical isolation (between the channels)	no
Electrical isolation (between the channels and the I/O bus)	yes
Insulation voltage (between the channels and the I/O bus, under common operating conditions)	insulation checked with 500 V <sub>DC</sub>
Permissible contamination level	Contamination level 2 (see chapter <a href="#">▶Cleaning</a> ◀ on page 58)
Unacceptable operating conditions	Safety terminals must not used under the following operating conditions: <ul style="list-style-type: none"> <li>• under the influence of ionising radiation</li> <li>• in corrosive environments</li> <li>• in an environment that leads to unacceptable soiling of the bus terminal</li> </ul>
Vibration/shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
Shocks	15 g with pulse duration 11 ms in all three axes
Protection class	IP20
Permitted operating environment	control cabinet or terminal box with minimum protection class IP54 according to IEC 60529
Permissible installation position	horizontal
Approvals	CE



**WARNING!**

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

## D.3 Operating conditions

### D.3 Operating conditions

#### D.3.1 Climatic properties

Product	SI4000
Permissible ambient temperature (operation)	0°C ... +55°C
Permissible ambient temperature (transport and storage)	-25°C ... +70°C
Permissible relative air humidity	95 %, non-condensing
Climate class according to EN 60721-3-3	3K3
Permissible air pressure (operation, storage, transport)	750 hPa to 1100 hPa

Product	SO4000
Permissible ambient temperature (operation)	0°C ... +55°C
Permissible ambient temperature (transport and storage)	-25°C ... +70°C
Permissible relative air humidity	95 %, non-condensing
Climate class according to EN 60721-3-3	3K3
Permissible air pressure (operation, storage, transport)	750 hPa to 1100 hPa

#### D.3.2 Mechanical properties

Product	SI4000
Material	polycarbonate, polyamide (PA 6.6)
Dimensions (W x H x D)	12 mm x 100 mm x 68 mm
Mounting	on 35 mm mounting rail (conforms to EN 50022) with lock
Attachable by	double slot and key connection
Weight	approx. 50 g

<b>Product</b>	<b>SO4000</b>
Material	polycarbonate, polyamide (PA 6.6)
Dimensions (W x H x D)	24 mm x 100 mm x 68 mm
Mounting	on 35 mm mounting rail (conforms to EN 50022) with lock
Attachable by	double slot and key connection
Weight	approx. 100 g

**D.3.3 EMC properties**

<b>Product</b>	<b>SI4000 and SO4000</b>
EMC resistance burst	conforms to EN 61000-6-2
ESD emission	conforms to EN 61000-6-4





# APPENDIX E - DECLARATION OF CONFORMITY

In this section we provide general information about EC directives, the CE symbol and the Declaration of Conformity.

## E.1 What is an EC directive?

---

EC directives specify requirements. The directives are written by the relevant bodies within the EU (which used to be called the EC, and the EEC before that, hence the now illogical term EC directive), and are implemented by all the member countries of the EU in national law. In this way the EC directives guarantee free trade within the EU.

An EC directive only contains essential minimum requirements. You will find detailed requirements in standards, to which references are made in the directive.

## E.2 What the CE symbol indicates

---

*a) The CE marking symbolizes conformity to all the obligations incumbent on manufacturers for the product by virtue of the Community directives providing for its affixing.*

...

*b) The CE marking affixed to industrial products symbolizes the fact that the natural or legal person having affixed or been responsible for the affixing of the said marking has verified that the product conforms to all the Community total harmonization provisions which apply to it and has been the subject of the appropriate conformity evaluation procedures.*

...

*Council Decision 93/465/EEC, Annex I B. a) + c)*

We affix the CE mark to the equipment and to the operating instructions as soon as we have established that we have satisfied the requirements of the relevant directives.

I/O terminals supplied by the Baumüller Nürnberg GmbH are not concerned of the Low Voltage Directive, because their operating voltage is less than 60 V DC or less than 75 V AC. Therefore a declaration of conformity to 2006/95/EC (Low Voltage Directive) cannot be issued.

## Definition of the term Declaration of Conformity

---

The electrical safety and function of the I/O terminals will be checked with the harmonized standard EN 61508, part 1-3.

With specified application of this Baumüller equipment in your machinery, you can act on the assumption that the equipment satisfies the requirements of 2006/42/EG (machinery directive).

Therefore the equipment is developed and constructed in such a way, that the requirements of the harmonized standard EN 60204-1 can be met by the electrical installation.

I/O terminals supplied by the Baumüller Nürnberg GmbH satisfy the requirements of 2014/30/EU (EMC Directive) by satisfying the requirements of the harmonized standard EN 61000-6-2 and EN 61000-6-4.

To enable you to market your machine within the EU, you must be in possession of the following:

- Conformity mark (CE mark)
- Declaration(s) of Conformity regarding the directive(s) relevant to the machine

### E.3 Definition of the term Declaration of Conformity

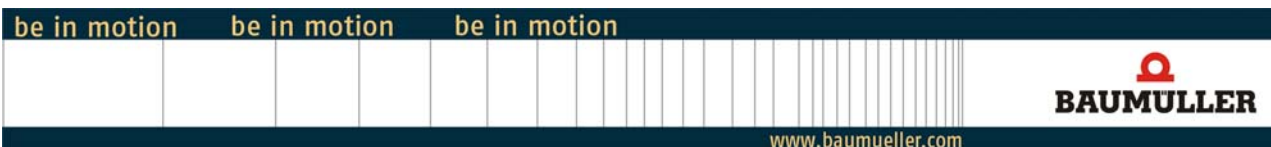
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A Declaration of Conformity as defined by this operating instruction is a declaration that the electrical equipment brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

### E.4 Declaration of Conformity

---



## Declaration of EC conformity

**Doc.-No.:** 5.10067.01

**Date:** 2015-03-04

## according to machinery directive 2006/42/EC

We the manufacturer: Baumüller Nürnberg GmbH  
Ostendstraße 80-90  
90482 Nürnberg, GERMANY

declare that our product

Name: Safety I/O Terminals  
Type: SI4000, SO4000  
Date of manufacture: 2015-03-04

was developed, constructed and manufactured according to the machinery directive 2006/42/EC.

Applied harmonized standards:

Standard	Title
EN 61508-1:2010	Functional safety of security-related electric, electronic and programmable electronic systems - Part 1: General requirements
EN 61508-2:2010	Functional safety of security-related electric, electronic and programmable electronic systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
EN 61508-3:2010	Functional safety of security-related electric, electronic and programmable electronic systems - Part 3: Software requirements
EN ISO 13849-1:2008	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
DIN EN 81-1:2000 (to the extent to which they may be applicable)	Safety rules for the construction and installation of lifts - Part 1: Electric lifts
EN 13243:2004 (to the extent to which they may be applicable)	Safety requirements for cableway installations designed to carry persons - Electrical equipment other than for drive systems
DIN EN 61000-6-2:2006	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
DIN EN 61000-6-4:2007	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

Authorized person for preserving relevant technical documents:

Name: Engelbert Meier, Baumüller Nürnberg GmbH  
Address: Ostendstraße 80-90, 90482 Nürnberg, Germany

Notified body which has provided the EC type-Examination Certificate in accordance with the machinery directive mentioned above:

Name: TÜV Süd Product Service GmbH  
Address: Ridlerstr. 65, 80339 München / Germany  
Notified body number: 0123  
Registration number: Z10 15 03 75013 001 (SI4000) and Z10 15 03 75013 003 (SO4000)

The safety instructions in the manual must be observed. This product is designed for integration in a machine. The commissioning is not allowed until the entire machine, in which this product is integrated, is complying with the directives mentioned above.

Nürnberg / 2015-03-04  
Location / Date

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







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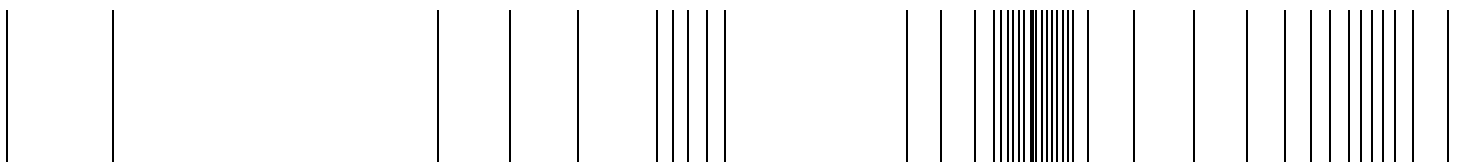
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**be in motion**



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