

Operating Instructions | EN

# EL1918 and EL1918-2200

TwinSAFE Terminal with 8 digital fail-safe inputs





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# 1 Notes on the documentation

## 1.1 Disclaimer

Beckhoff products are subject to continuous further development. We reserve the right to revise the operating instructions at any time and without prior announcement. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in these operating instructions.

In these operating instructions we define all permissible use cases whose properties and operating conditions we can guarantee. The use cases we define are fully tested and certified. Use cases beyond this, which are not described in these operating instructions, require the approval of Beckhoff Automation GmbH & Co KG.

### 1.1.1 Trademarks

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### 1.1.2 Patents

The EtherCAT technology is protected by patent rights through the following registrations and patents with corresponding applications and registrations in various other countries:

- EP1590927
- EP1789857
- EP1456722
- EP2137893
- DE102015105702



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### 1.1.3 Limitation of liability

All components in this product as described in the operating instructions are delivered in a specific configuration of hardware and software, depending on the application regulations. Modifications and changes to the hardware and/or software configuration that go beyond the documented options are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

**The following is excluded from the liability:**

- Failure to observe these operating instructions
- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

### 1.1.4 Copyright

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## 1.2 Version numbers of the documentation

| Version | Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3.0.0   | <ul style="list-style-type: none"> <li>• Appendix extended with links to certificates and declarations of conformity</li> <li>• New chapters "Laser image" and "Notes on information security" added</li> <li>• In chapter "EL1918 and EL1918-2200" IEC 61511 added</li> <li>• Chapter "Intended use" revised and chapter "According to EN 81" added</li> <li>• Chapter "Target failure measures" revised and SFF value added</li> <li>• In chapter "Connecting" wire size width added</li> <li>• Document structure revised</li> <li>• Editorially revised</li> <li>• Chapter "System description" removed</li> <li>• Chapter renamed to "Version numbers of the documentation"</li> <li>• Machinery Directive changed to Machinery Regulation</li> </ul> |
| 2.2.1   | <ul style="list-style-type: none"> <li>• Chapter "Due diligence" expanded</li> <li>• Chapter "Service life" moved</li> <li>• Designation "Safety parameters" changed to "Target failure measures"</li> <li>• Corrections</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2.2.0   | <ul style="list-style-type: none"> <li>• Operating temperature extended in chapter "Technical data"</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2.1.0   | <ul style="list-style-type: none"> <li>• Chapter "Safety and instruction" revised</li> <li>• In chapter "Technical data" harmful gas test and footnote for corrosive environment added</li> <li>• Warning added to chapter "Mounting rail installation"</li> <li>• Chapter "Service life" revised</li> <li>• Certificate removed</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2.0.0   | <ul style="list-style-type: none"> <li>• Foreword changed to "Documentation notes" and "For your safety"</li> <li>• "Maintenance and cleaning" and "Decommissioning" adapted</li> <li>• Appendix adapted and extended</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1.3.1   | <ul style="list-style-type: none"> <li>• Corrections</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 1.3.0   | <ul style="list-style-type: none"> <li>• Firmware 02 added to chapter "Version history of the TwinSAFE product"</li> <li>• Added a link to certificate download page in chapter "Technical data"</li> <li>• Chapter "Firmware update of TwinSAFE products" removed</li> <li>• I/O component EL1918-2200 added as variant of EL1918</li> <li>• Chapter "Pin assignment" renamed</li> <li>• Chapter "Project design limits of the EL1918" moved</li> </ul>                                                                                                                                                                                                                                                                                                   |
| 1.2.0   | <ul style="list-style-type: none"> <li>• Project design limits added</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 1.1.0   | <ul style="list-style-type: none"> <li>• Restrictions on channel use amended</li> <li>• Note on commissioning added</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1.0.0   | <ul style="list-style-type: none"> <li>• Certificate added</li> <li>• Connection added</li> <li>• First released version</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 0.0.3   | <ul style="list-style-type: none"> <li>• System limits added</li> <li>• Description of <i>Module Fault Link active</i> parameter added.</li> <li>• Version history updated</li> <li>• References added</li> <li>• Description of local logic function added</li> <li>• Foreword updated</li> <li>• Safety instructions adapted to IEC 82079-1.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  |

| Version | Comment               |
|---------|-----------------------|
| 0.0.2   | • Update after review |
| 0.0.1   | • First draft         |

### Currentness

Check whether you are using the current and valid version of this document. The current version can be downloaded from the Beckhoff homepage at <http://www.beckhoff.com/twinsafe>. In case of doubt, contact Support and Service [► 12].

### Origin of the document

The original documentation is written in German. All other languages are derived from the German original.

### Product features

Only the product properties specified in the current operating instructions are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

## 1.3 Version history of the TwinSAFE product

This version history lists the software and hardware version numbers. A description of the changes compared to the previous version is also given.



#### Updated hardware and software

TwinSAFE products are subject to a cyclical revision. We reserve the right to revise and change the TwinSAFE products at any time and without prior notice.

**No** claims for changes to products already delivered can be asserted from these hardware and/or software changes.

| Software version | Hardware version | Modifications                                                                                                                                                                |
|------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 02 (V0108)       | 02               | Product maintenance                                                                                                                                                          |
| 02 (V0108)       | 01               | First release of EL1918-2200                                                                                                                                                 |
| 02 (V0108)       | 01               | <ul style="list-style-type: none"> <li>• New function blocks SBT and SLP</li> <li>• Prevention of unauthorized firmware downgrade</li> <li>• Updating the modules</li> </ul> |
| 01 (V0103)       | 00               | First release of the EL1918                                                                                                                                                  |

## 1.4 References

| No. | Version        | Description                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1] | /              | Not used.                                                                                                                                                                                                                                                                                                                                                                                                   |
| [2] | /              | Not used.                                                                                                                                                                                                                                                                                                                                                                                                   |
| [3] | 1.4.1 or newer | <b>Operating Manual for EL6910 TwinSAFE Logic Module</b><br>The document contains a description of the logic functions of the EL6910 and its programming.                                                                                                                                                                                                                                                   |
| [4] | 3.1.0 or newer | <b>Dokumentation TwinSAFE-Logic-FB</b><br>The document describes the safety-related function blocks that are available in the EL6910 and thus also in the TwinSAFE card and form the safety-related application.                                                                                                                                                                                            |
| [5] | 3.1.0 or newer | <b>TwinSAFE Application Guide</b><br>The application guide provides the user with examples for the calculation of safety-related parameters for safety functions according to the standards DIN EN ISO 13849-1 and EN 62061 or EN 61508:2010, as they are typically used on machines.                                                                                                                       |
| [6] | 2023/1230      | <b>Regulation (EU) 2023/1230 of the European Parliament and of the Council of 14 June 2023 on machinery and repealing Directive 2006/42/EC of the European Parliament and of the Council and Council Directive 73/361/EEC</b><br>This regulation, also known as the Machinery Regulation, defines requirements for placing machinery and machine-like components, such as safety components, on the market. |
| [7] | 2017           | <b>EN 61511-1:2017</b><br>The standard serves as a basic safety standard for functional safety in the process industry and is tailored to its safety-related systems.                                                                                                                                                                                                                                       |

## 1.5 Staff qualification

These operating instructions are intended exclusively for trained specialists in control technology and automation with the relevant knowledge.

The trained specialist personnel must ensure that the applications and use of the described product meet all safety requirements. This includes all applicable and valid laws, regulations, provisions and standards.

### Trained specialists

Trained specialists have extensive technical knowledge from studies, apprenticeships or technical training. Understanding of control technology and automation is available. Trained specialists can:

- Independently identify, avoid and eliminate sources of hazard.
- Apply relevant standards and directives.
- Implement specifications from accident prevention regulations.
- Evaluate, prepare and set up the workplaces.
- Evaluate, optimize and execute work independently.

## 1.6 Safety and instruction

Read the contents that refer to the activities you have to perform with the product. Always read the chapter [For your safety \[► 14\]](#) in the operating instructions.

Observe the warnings in the chapters so that you can handle and work with the product as intended and safely.

### Explanation of symbols

Various symbols are used for a clear arrangement:

- 1. The numbering indicates an action that should be taken.
- The bullet point indicates an enumeration.
- [...] The square brackets indicate cross-references to other text passages in the document.
- [1] The number in square brackets indicates the numbering of a referenced document.

The signal words used in the documentation are classified below.

### Signal words

#### Warning of personal injuries

|  <b>DANGER</b>    |
|----------------------------------------------------------------------------------------------------|
| Hazard with high risk of death or serious injury.                                                  |
|  <b>WARNING</b>  |
| Hazard with medium risk of death or serious injury.                                                |
|  <b>CAUTION</b> |
| There is a low-risk hazard that could result in medium or minor injury.                            |

#### Warning of damage to property or environment

| <b>NOTICE</b>                                                       |
|---------------------------------------------------------------------|
| <b>Notes</b><br>The environment, equipment, or data may be damaged. |

#### Information on handling the product



This information includes, for example:  
Recommendations for action, assistance or further information on the product.

## 1.7 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

### Download finder

Our [download finder](#) contains all the files that we offer you for downloading. You will find application reports, technical documentation, technical drawings, configuration files and much more.

The downloads are available in various formats.

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You will also find further documentation for Beckhoff components there.

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- and extensive training program for Beckhoff system components

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## 1.8 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

## 2 For your safety

Read this chapter containing general safety information. In addition, always observe the safety instructions and warnings in these operating instructions for your own safety, the safety of other persons and the safety of the product.

When working with control and automation products, many dangers can result from careless or incorrect use. Work particularly thoroughly, not under time pressure and responsibly towards other people.

### 2.1 Duty of care



#### Read entire documentation for TwinSAFE component

- TwinSAFE application manual
- EL6910 TwinSAFE logic terminal operating manual
- TwinSAFE Logic FB documentation manual

The operator must comply with all the requirements and notes specified in these operating instructions in order to fulfill his duty of care. This includes in particular that you

- comply with the provisions defined in the chapter [Limitation of liability](#) [► 6].
- only operate the TwinSAFE component when it is in perfect working order.
- provide the operating instructions in a legible condition and complete at the place of use of the TwinSAFE component.
- do not remove the safety markings attached to the TwinSAFE component and maintain their legibility.

The operator is also responsible for the safe operation of the system. This includes risk assessment. The following standards apply for risk assessment:

- EN ISO 12100:2010, Safety of machinery – General principles for design – Risk assessment and risk reduction
- ISO 13849-1, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

Beckhoff is not responsible for the safe operation of the system.

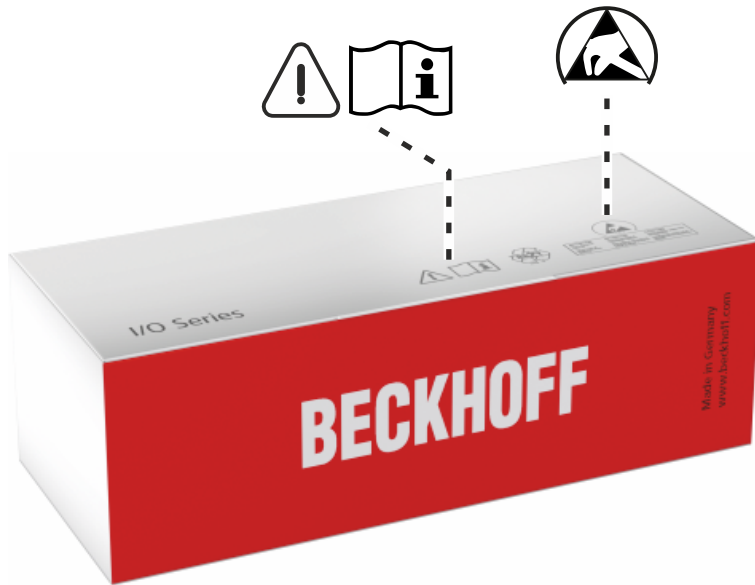


#### No disposal in domestic waste

Products marked with a crossed-out waste bin must not be disposed of with domestic waste. The device is considered waste electrical and electronic equipment when it is disposed of. Observe the national regulations for the disposal of waste electrical and electronic equipment.

## 2.2 Safety image signs

Beckhoff products feature safety pictograms, either on stickers or printed, which vary depending on the product. They serve to protect people and to prevent damage to the products. Safety pictograms may not be removed and must be legible for the user.



### **Read and observe the operating instructions**

Commissioning is only permitted if the operating instructions have been read and understood beforehand. This applies in particular to the safety instructions and the warnings.



### **Electrostatic sensitive components**

Work with and on the TwinSAFE component is only permitted at protected workplaces.

## 2.3 General safety instructions

This chapter contains safety instructions for handling the product. This product is a safety component as defined by the Machinery Directive. The product must be installed in a machine or system by the machine builder and is used to ensure the safety function. Safety components are not required for the functioning of a machine. However, a failure or malfunction of safety components will result in a hazard to personal safety. Read the documentation prepared by the machine builder.

### 2.3.1 Before operation

#### Use in machines according to the Machinery Regulation and EN 61511

Only use the TwinSAFE component in machines that comply with the Machinery Directive and the EN 61511 standard for the process industry. This will ensure safe operation.

Refer to the documents [6] and [7] under [References](#) [► 9].

#### Ensure traceability

Ensure the traceability of the TwinSAFE component via the serial number.

#### Use SELV/PELV power supply

Use a SELV/PELV power supply unit with an output-side voltage limit of  $U_{\max} = 36 \text{ V}_{\text{DC}}$  to supply the TwinSAFE component with  $24 \text{ V}_{\text{DC}}$ .

Failure to observe this will endanger the safety function of the product. Depending on the machine, death and danger to life, serious physical injury and damage to the machine may result.

#### Carry out commissioning test

Before commissioning, wiring faults to the sensors must be excluded. Before commissioning, carry out a commissioning test. After a successful commissioning test, you can use the TwinSAFE component for the intended safety-related task.

In case of wiring errors, the safety function of the product is at risk. Depending on the machine, death and danger to life, serious bodily injury and damage to the machine may result.

#### Use of permissible engineering tools and procedures

The TÜV SÜD certificate applies to these TwinSAFE components, the function blocks available in it, the documentation and the engineering tool. Engineering tools allowed are [TE9000 - TwinCAT 3 Safety Editor](#) and [TE9200 - TwinSAFE Loader](#). Use only the latest versions of the engineering tools. You will find this on the [Beckhoff website](#).

Procedures or engineering tools that deviate from this are not covered by the certificate. This is especially true for externally generated xml files for the TwinSAFE import.

## 2.3.2 During operation

### Interference due to emitted interference

Do not operate the following devices in the vicinity of the TwinSAFE component: for example, radio telephones, radios, transmitters or high-frequency systems.

TwinSAFE components comply with the requirements of the applicable electromagnetic compatibility standards with regard to interference emission and immunity. If you exceed the limits for emitted interference specified in the standards, the function of the TwinSAFE component may be impaired.

## 2.3.3 After operation

### De-energize and switch off components before working on them

Check all safety-relevant equipment for functionality before working on the TwinSAFE component. Secure the working environment. Secure the machine or plant against being inadvertently started up. Observe the chapter [Decommissioning](#) [► 64].

## 2.3.4 According to EN 81

### WARNING

#### Observe approval according to EN 81-20, EN 81-22 and EN 81-50

The design and installation of elevators must meet the requirements of EN 81-20, EN 81-22 and EN 81-50 for approval.

*Failure to do so may result in injury. Damage and malfunctions to the product may also result.*

### 2.3.4.1 Criteria

Observe the following criteria:

#### Use in machines according to EN 60204-1

Only use the TwinSAFE component in machines that are designed and installed in accordance with the requirements of the EN 60204-1 standard.

#### Use surge filter

Provide a surge filter against overvoltages for the supply voltage of the TwinSAFE component. This reduces the overvoltage category of the TwinSAFE component to overvoltage category II.

#### Select a safe temperature threshold

EN 81 requires that in the case of devices with internal temperature monitoring, a stop must be reached in the event of an overtemperature. In this case, passengers must be able to get off.

To ensure you can get off at a stop, take the following application measures.

- When the maximum permissible temperature of the respective TwinSAFE component is reached, the system switches off immediately. Read the internal terminal temperature of the TwinSAFE component. See chapter [Sample configuration for temperature measurement](#).
- Select a temperature threshold below the maximum temperature so that a stop can always be reached before the maximum temperature is reached. Information on the optimum terminal configuration can be found under [Arrangement instructions](#) [► 33] and [Sample configuration for temperature measurement](#).

#### Observe the error shutdown of the TwinSAFE component

Observe the necessary precautions when approaching a stop to get off. If the TwinSAFE component is operated outside the permissible temperature range, it changes to “Global Shutdown” state.

A global shutdown temporarily disables the TwinSAFE component. You can reset the error by switching off and on again. For further information, refer to the chapter [Diagnosis \[► 55\]](#).

**Observe lifetime**

Observe the lifetime of the TwinSAFE component. The lifetime is 20 years.

**Observe the safe state of the application**

The safe state of the application must be the de-energized state (quiescent current principle). The safe state of the TwinSAFE component is always the de-energized and switched off state.

**2.3.4.2 Environmental conditions**

Observe the following ambient conditions:

**For indoor use**

Use the TwinSAFE component indoors.

**Comply with ambient conditions**

Observe the ambient conditions and comply with the defined specifications. The ambient conditions can be found in the chapter .

**Secure TwinSAFE component against direct contact**

Secure the TwinSAFE component against direct contact.

**Use a suitable control cabinet**

Install the TwinSAFE component in a control cabinet with protection class IP54 in accordance with EN 60529. The requirement for pollution degree 3 is reduced to pollution degree 2 in accordance with EN 60664-1.

**Using the SELV/PELV power supply unit**

Supply the TwinSAFE component with a SELV/PELV power supply with a maximum voltage of  $U_{\max} \leq 36 \text{ V}_{\text{DC}}$ .

**Comply with ATEX conditions**

Comply with the operating conditions in hazardous areas (ATEX).

## 3 Product overview

### 3.1 EL1918 and EL1918-2200

The EL1918 is a digital input terminal for sensors with potential-free contacts for 24 V<sub>DC</sub>. The TwinSAFE Terminal has 8 fail-safe inputs.

With a two-channel connection, the EL1918 meets the requirements of IEC 61508:2010 SIL 3, EN ISO 13849-1:2023 (Cat 4, PL e) and IEC 61511 (SIL 3). See chapter [Safe input](#) [► 27].

The TwinSAFE terminal has the typical design of an EtherCAT HD Terminal.

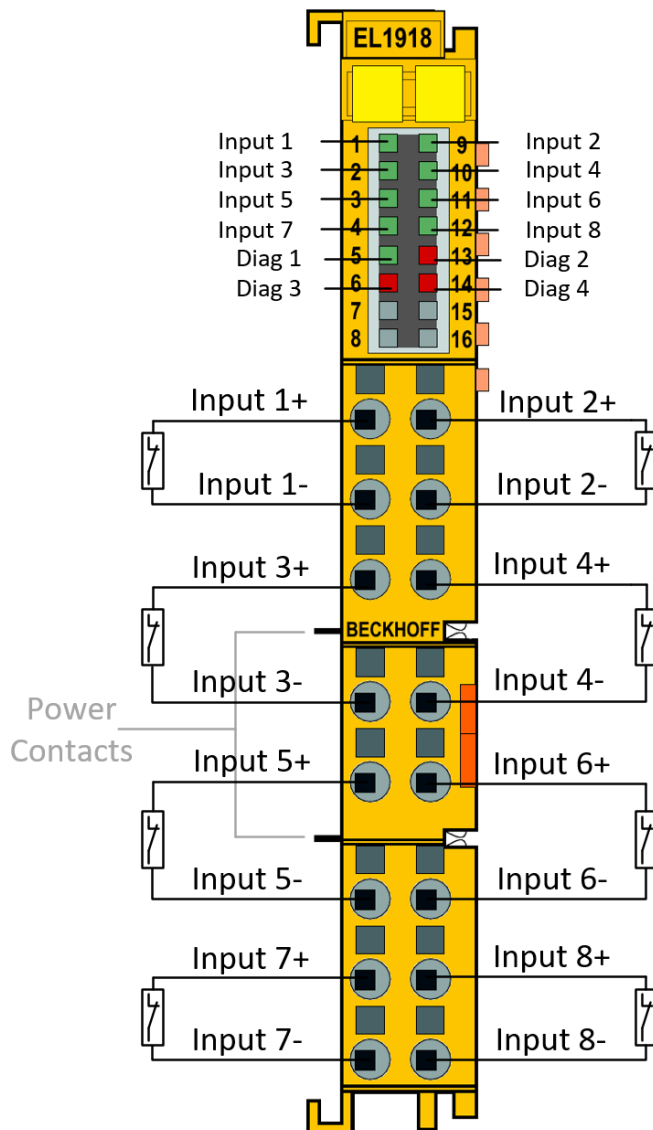


Fig. 1: EL1918 – TwinSAFE Terminal with 8 fail-safe inputs



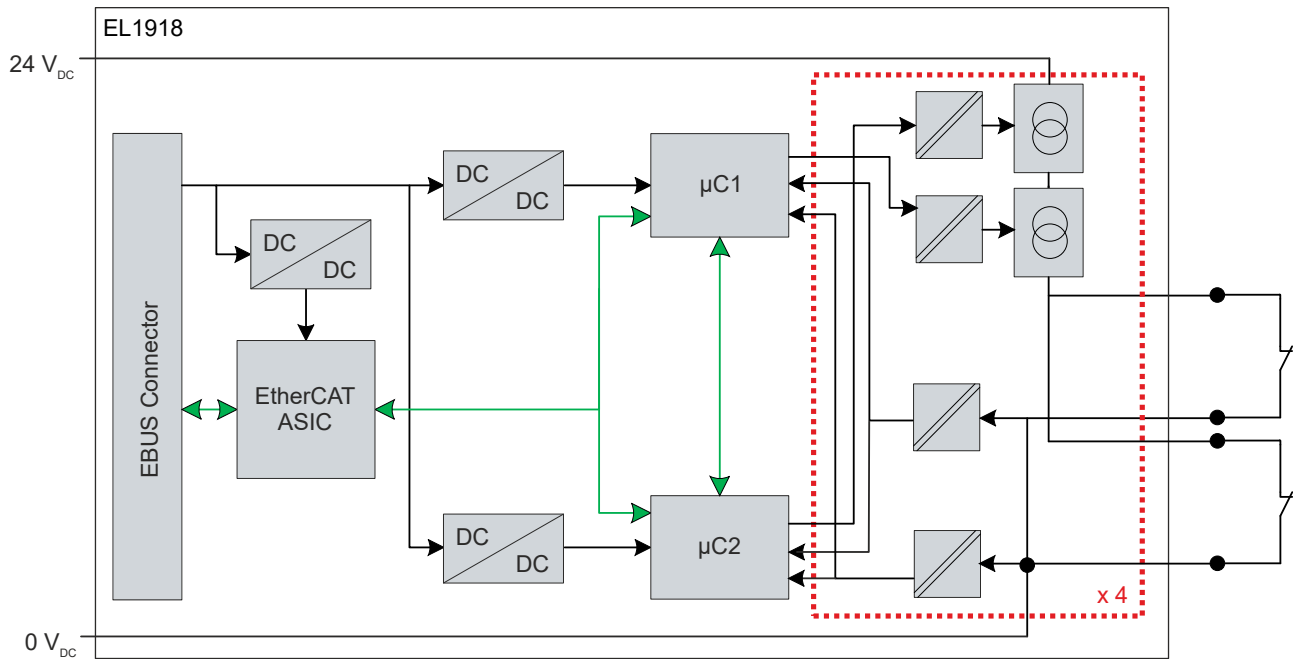
#### EL1918 variants

The EL1918 has an integrated safety control that can be used for user-specific applications directly on the component. The variant EL1918-2200 does not have this functionality and represents a pure I/O component.

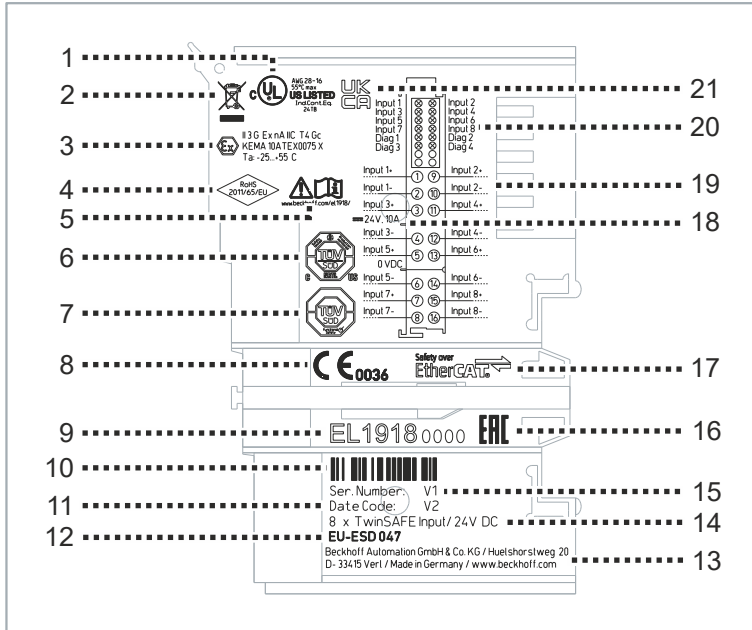
## 3.2 Block diagram

The block diagram describes the internal structure of the TwinSAFE component.

The EL1918 TwinSAFE Terminal has an internal two-channel design based on a 1oo2 structure.



### 3.3 Laser image



| Item number | Explanation                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------------------|
| 1           | UL mark of conformity                                                                                                        |
| 2           | Labeling of products that must not be disposed of with household waste in accordance with Directive 2012/19/EU               |
| 3           | EX conformity mark for ATEX with certificate number and temperature specification                                            |
| 4           | RoHS mark of conformity                                                                                                      |
| 5           | Product label "Read operating instructions", website                                                                         |
| 6           | TÜV-SÜD NRTL mark of conformity                                                                                              |
| 7           | TÜV-SÜD test mark for functional safety                                                                                      |
| 8           | CE mark of conformity                                                                                                        |
| 9           | Product designation                                                                                                          |
| 10          | Barcode for reading the serial number                                                                                        |
| 11          | Date Code<br>WW = calendar week of manufacture<br>YY = year of manufacture<br>SW = software version<br>HW = hardware version |
| 12          | Number of the EU type-examination certificate in accordance with Annex IV, paragraph A of Directive 2014/33/EU               |
| 13          | Address of the vendor, country of manufacture, website                                                                       |
| 14          | Product description                                                                                                          |
| 15          | Serial number                                                                                                                |
| 16          | EAC mark of conformity                                                                                                       |
| 17          | Safety over EtherCAT logo                                                                                                    |
| 18          | Supply                                                                                                                       |
| 19          | Illustration of the connector pin assignment                                                                                 |
| 20          | Description of the LEDs                                                                                                      |
| 21          | UKCA mark of conformity                                                                                                      |

### 3.4 Intended use

Operate the TwinSAFE component exclusively for the intended activities defined in this documentation, taking into account the prescribed values.

The functions allow the Beckhoff TwinSAFE components to be used in the field of machine safety and as safety devices for the process industry. The intended field of application for TwinSAFE components is safety functions on machines and process control technology in accordance with EN 61511 and the directly associated tasks in industrial automation.

TwinSAFE components are therefore only approved for applications with a defined "fail-safe state". This safe state is the de-energized. Fail-safety according to the relevant standards is required.

The TwinSAFE I/O components allow the connection of:

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

#### ● Test pulses



When selecting actuators please ensure that the test pulses of the TwinSAFE component do not lead to switching of the actuator or a diagnostic message of the TwinSAFE component.

The following TwinSAFE components were developed for these tasks:

- The EL1904 is an EtherCAT Terminal with 4 digital fail-safe inputs
- The EL2904 is an EtherCAT Terminal with 4 digital fail-safe outputs
- The EL6910 is an EtherCAT Terminal with integrated TwinSAFE logic

These TwinSAFE components are suitable for operation on the

- Beckhoff EKxxxx series Bus Couplers
- Beckhoff CXxxxx series Embedded PCs with E-bus connection

#### **WARNING**

##### **Improper use**

Any use which exceeds the permissible written values from the chapter [Technical data](#) [► 23] or which does not observe other specifications from these operating instructions or other documents of the overall documentation is considered to be not in accordance with the intended use and is therefore prohibited.

This applies in particular to the use cases defined by Beckhoff Automation, which have been fully tested and certified and whose properties and operating conditions can be guaranteed. Use cases beyond this are regarded as inappropriate and require the approval of Beckhoff Automation.

*Improper use will result in loss of safety and invalidation of certifications and approval.*

## 4 Technical data

### 4.1 Product data

The current certificates of all TwinSAFE products with the underlying standards and directives can be found at <https://www.beckhoff.com/en-en/support/download-finder/certificates-approvals/>.

| Electrical data of the EL1918 and EL1918-2200                                                    |                                                                                                                                    | Explanation                                                                                                |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Electrotechnical data                                                                            |                                                                                                                                    |                                                                                                            |
| • Supply voltage                                                                                 | 24 VDC (- 15 % / + 20 %) SELV/PELV with maximum 36 V <sub>DC</sub>                                                                 | According to IEC 61508-1:2010.                                                                             |
| • Output current of the clock outputs                                                            | typically 3 mA, max. 6.5 mA                                                                                                        |                                                                                                            |
| • Power loss of the terminal                                                                     | typically 1.6 W                                                                                                                    |                                                                                                            |
| • Insulation voltage                                                                             | Insulation tested with 500 V <sub>DC</sub>                                                                                         | Insulation voltage between the channels and the E-bus, under common operating conditions.                  |
| • Number of inputs                                                                               | 8                                                                                                                                  |                                                                                                            |
| • Current consumption of the module electronics at 24 V (without current consumption of sensors) | 8 channels occupied: typically 29.6 mA (@28.8 V <sub>DC</sub> )<br>0 channels occupied: typically 2.27 mA (@28.8 V <sub>DC</sub> ) |                                                                                                            |
| • Current consumption via E-bus                                                                  | 8 channels occupied: approx. 165 mA                                                                                                |                                                                                                            |
| • Cable length between sensor and terminal                                                       | unshielded max. 100 m (with 0.75 or 1 mm <sup>2</sup> )<br>shielded max. 100 m (with 0.75 or 1 mm <sup>2</sup> )                   |                                                                                                            |
| • Electrical isolation (between the channels)                                                    | No                                                                                                                                 |                                                                                                            |
| • Electrical isolation (between the channels and the E-bus)                                      | Yes                                                                                                                                |                                                                                                            |
| Signal voltage                                                                                   |                                                                                                                                    |                                                                                                            |
| • "0" inputs                                                                                     | -3 V to 5 V                                                                                                                        | According to DIN EN 61131-2:2008-04, type 3, see chapter <u>Characteristic curve of the inputs</u> [► 28]. |
| • "1" inputs                                                                                     | 11 V to 30 V                                                                                                                       |                                                                                                            |
| Mechanical data                                                                                  |                                                                                                                                    |                                                                                                            |
| • Weight                                                                                         | approx. 50 g                                                                                                                       |                                                                                                            |
| • Dimensions                                                                                     | 12 x 100 x 68 [in mm]                                                                                                              | Width x height x depth<br>See chapter <u>Dimensions</u> [► 27].                                            |
| • Status LEDs                                                                                    | Division and number:<br>12 LEDs<br>• 8 x input LEDs<br>• 4 diagnostic LEDs                                                         | See chapter <u>LEDs</u> [► 55].                                                                            |
| Software data of the EL1918 and EL1918-2200                                                      |                                                                                                                                    | Explanation                                                                                                |
| Reaction times                                                                                   |                                                                                                                                    |                                                                                                            |

| Software data of the EL1918 and EL1918-2200                      |                                                   | Explanation                                                               |
|------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------|
| • Response time in operation<br><i>read input/write to E-bus</i> | Typically 4 ms<br>maximum see fault reaction time |                                                                           |
| • Fault reaction time                                            | Adjustable<br>≤ watchdog time                     |                                                                           |
| <b>Process image</b>                                             |                                                   |                                                                           |
| • Input                                                          | 7 byte                                            | For more information, see the chapter Process image of the EL1918 [► 50]. |
| • Output                                                         | 6 byte                                            |                                                                           |

## 4.2 Target failure measures

### ● Calculation of the $MTTF_D$ value from the $PFH_D$ value



For calculation and estimation of the values described in the following table, refer to the following documentation:

- TwinSAFE Application Guide
- EN ISO 13849-1:2023; table K.1.

In terms of target failure measures, the FSoE communication is considered with 1 % of SIL 3 according to the protocol specification.

The TwinSAFE component is intended for use in safety-related applications. It meets the following standards:

- IEC 61508:2010 bis SIL3
- EN ISO 13849-1:2023 bis PL e, Kategorie 4
- IEC 61511 bis SIL3

| Ausfallgrenzwerte      |           | Erläuterung                                                                                |
|------------------------|-----------|--------------------------------------------------------------------------------------------|
| Lifetime               | 20 a      |                                                                                            |
| Proof-test-Intervall   | /         | Special proof tests are not required during the entire lifetime of the TwinSAFE component. |
| $PFH_D$                | 3,00 E-09 |                                                                                            |
| $PFD_{avg}$            | 4,90 E-05 |                                                                                            |
| $MTTF_D$               | High      |                                                                                            |
| DC                     | High      |                                                                                            |
| Performance level      | e         | According to EN ISO 13849-1:2023.                                                          |
| Category               | 4         | According to EN ISO 13849-1:2023.                                                          |
| SFF                    | > 99 %    |                                                                                            |
| HFT                    | 1         |                                                                                            |
| Classification element | Type B    | According to EN 61508-2:2010, chapter 7.4.4.1.2 und 7.4.4.1.3.                             |

## 4.3 Environmental conditions

Beckhoff products are designed for operation under certain environmental conditions, which vary according to the product. The following specifications must be observed for operation and environment in order to achieve the optimum service life of the products as well as to ensure product safety.

### WARNING

#### Do not use TwinSAFE components under the following operating conditions:

- under the influence of ionizing radiation (exceeding the natural background radiation)
- in corrosive environments<sup>1</sup>
- in an environment that leads to unacceptable contamination of the TwinSAFE component

<sup>1</sup> A corrosive environment exists when corrosion damage becomes apparent.

| Permissible requirements for the environment  |                                                                                                                                                                   | Explanation                                                                                                                                                                                                                      |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental conditions</b>               |                                                                                                                                                                   |                                                                                                                                                                                                                                  |
| • Class for climatic environmental conditions | 3K3                                                                                                                                                               | According to EN 60721-3-3:1995/A2:1997.<br><br>The deviation from 3K3 is only possible under optimum environmental conditions and also applies only to the technical data which are specified differently in this documentation. |
| • Harmful gas test                            | Test duration: 21 days<br>• Hydrogen sulfide: (50 ± 5) ppb<br>• Nitrogen dioxide: (1250 ± 20) ppb<br>• Chlorine: (10 ± 5) ppb<br>• Sulfur dioxide: (300 ± 20) ppb | According to DIN EN 60068-2-60:2016-06, method 4 with increased concentrations according to ANSI/ISA 71.04:2013 Level GX Group A.                                                                                                |
| • Device type                                 | Classified as open equipment                                                                                                                                      | According to DIN EN IEC 61010-2-201:2019-04.                                                                                                                                                                                     |
| • Pollution degree                            | 2                                                                                                                                                                 | According to EN 60664-1:2007.                                                                                                                                                                                                    |
| • Overvoltage category                        | II                                                                                                                                                                |                                                                                                                                                                                                                                  |
| • Protection class                            | III                                                                                                                                                               | By using a SELV/PELV power supply unit.                                                                                                                                                                                          |
| <b>Operating conditions</b>                   |                                                                                                                                                                   |                                                                                                                                                                                                                                  |
| • Fieldbus                                    | EtherCAT                                                                                                                                                          |                                                                                                                                                                                                                                  |
| • EMC requirements                            | Severity level conforms to SIL 3 Zone B                                                                                                                           | Conforms to EN 61326-3-1:2008, EN 61131-2:2007                                                                                                                                                                                   |
| • Vibration resistance                        | 5 Hz ≤ f < 58.1 Hz;<br>0.15 mm <sub>peak</sub><br>58.1 Hz ≤ f < 500 Hz;<br>20 m/s <sup>2</sup>                                                                    | Conforms to DIN EN 60068-2-6:2008-10.                                                                                                                                                                                            |
| • Shock resistance                            | 15 g with a pulse duration 11 ms in all three axes                                                                                                                | According to EN 60068-2-27:2010-02.                                                                                                                                                                                              |
| • Protection rating                           | IP20                                                                                                                                                              | According to EN 60529:1991 + A1:2000 + A2:2013.                                                                                                                                                                                  |
| • Permitted operating environment             | In a control cabinet or terminal box, with minimum protection rating IP54                                                                                         | According to EN 60529:1991 + A1:2000 + A2:2013.                                                                                                                                                                                  |
| • Correct installation position               | Mounted horizontally on a mounting rail                                                                                                                           | See chapter <a href="#">Installation position</a> [► 32].                                                                                                                                                                        |
| <b>Temperatures</b>                           |                                                                                                                                                                   |                                                                                                                                                                                                                                  |

| Permissible requirements for the environment                                                                                                                                                                                                                       |                     | Explanation                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------|
| Tested according to IEC 60068-2-1:2007, IEC 60068-2-2:2007 and IEC 60068-2-14:2009.<br><i>The measuring device has a tolerance range of <math>\pm 3\text{ °C}</math> for the minimum temperature and <math>\pm 2\text{ °C}</math> for the maximum temperature.</i> |                     |                                                                                                                        |
| • during operation                                                                                                                                                                                                                                                 | -30 °C to +55 °C    | For altitudes above 2000 m, the derating factors in the following table apply.                                         |
| • during transport and storage                                                                                                                                                                                                                                     | -40 °C to +70 °C    |                                                                                                                        |
| • internal switch-off temperature                                                                                                                                                                                                                                  | 110 °C              | If this value is exceeded, the TwinSAFE component switches to Global Shutdown.                                         |
| <b>Ambient air</b>                                                                                                                                                                                                                                                 |                     |                                                                                                                        |
| • Air humidity                                                                                                                                                                                                                                                     | 5% to 95%           | Non-condensing                                                                                                         |
| • Air pressure (operation/storage/transport)                                                                                                                                                                                                                       | 750 hPa to 1100 hPa | Corresponds to an altitude of approx. -690 m to 2450 m above sea level, assuming an international standard atmosphere. |

### Derating table for altitudes above 2000 m

The derating table (table 8) from the IEC 61131-2:2017 standard can be referred to for the use of the TwinSAFE components above the specified maximum altitude.

| Altitude in m                                                                                                                                                                 | Derating factor for the temperature <sup>1</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 0 to 2000 <sup>2</sup>                                                                                                                                                        | 1.0                                              |
| 3000                                                                                                                                                                          | 0.9                                              |
| 4000                                                                                                                                                                          | 0.8                                              |
| 5000                                                                                                                                                                          | 0.7                                              |
| Note: Linear interpolation is permissible between the altitudes                                                                                                               |                                                  |
| <sup>1)</sup> Ambient temperature of the device at an altitude of 2000 m                                                                                                      |                                                  |
| <sup>2)</sup> The air pressure and air density increase as the altitude decreases. Therefore the derating factor for 0 to 2000 m (1.0) is used for altitudes below sea level. |                                                  |

### Calculation example

The following example shows the calculation for a TwinSAFE component at an operating altitude of 4000 m.

- Permissible maximum ambient temperature up to 2000 m above sea level = 55 °C
- Permissible maximum ambient temperature up to 4000 m above sea level =  $55\text{ °C} \cdot 0.8 = 44\text{ °C}$

## 4.4 Dimensions

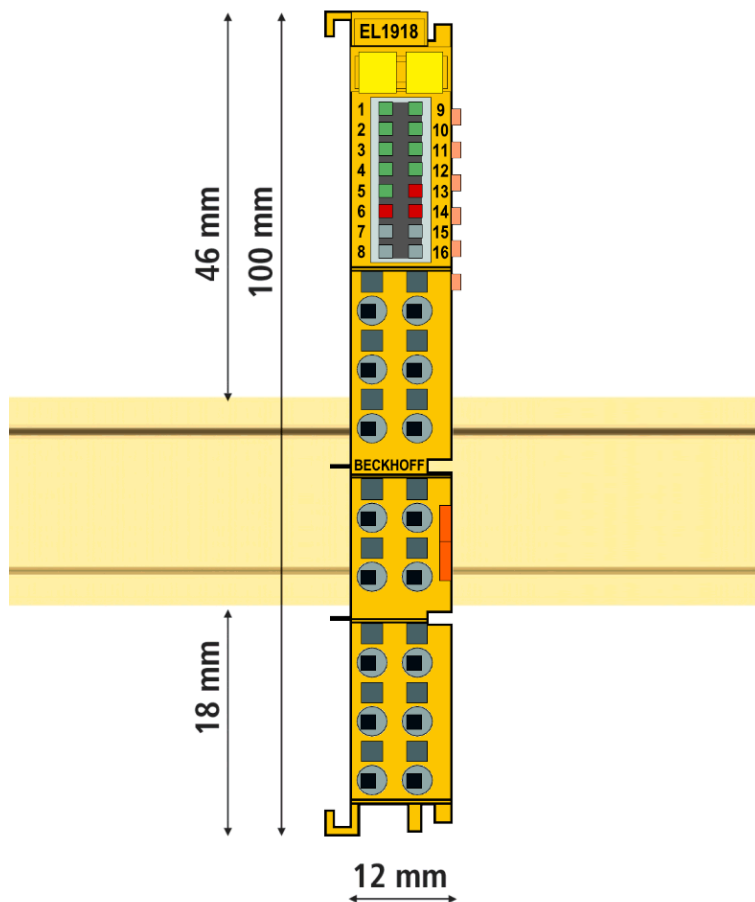


Fig. 2: EL1918 dimensions

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

Height: 100 mm

Depth: 68 mm

## 4.5 Safe input

The safe inputs and associated clock outputs are implemented as a single channel for each module. This has the advantage that any channels, e.g. for a two-channel safe sensor, can be combined and used. For error evaluation of these two channels, the *Module Fault Link active* parameter of the two modules involved must be set to TRUE. This is the default state of this parameter.

### **⚠ DANGER**

#### **Clocked signals inside a sheathed cable**

If clocked signals (clock outputs for the safe inputs) of different modules are used within a sheathed cable, a fault of one module, such as cross-circuit or external feed, must lead to the disconnection of all of these modules. This is achieved by setting the *Module Fault Link active* parameter for all modules involved. This parameter is set to TRUE by default.

### **⚠ DANGER**

#### **Safe inputs in Kat.4 / PL e**

If two safe input channels are to be used in a Category 4 structure, please ensure that you always combine an even and an odd channel number.

## 4.6 Characteristic curve of the inputs

The characteristic curve of the inputs is similar to type 3 according to EN 61131-2.

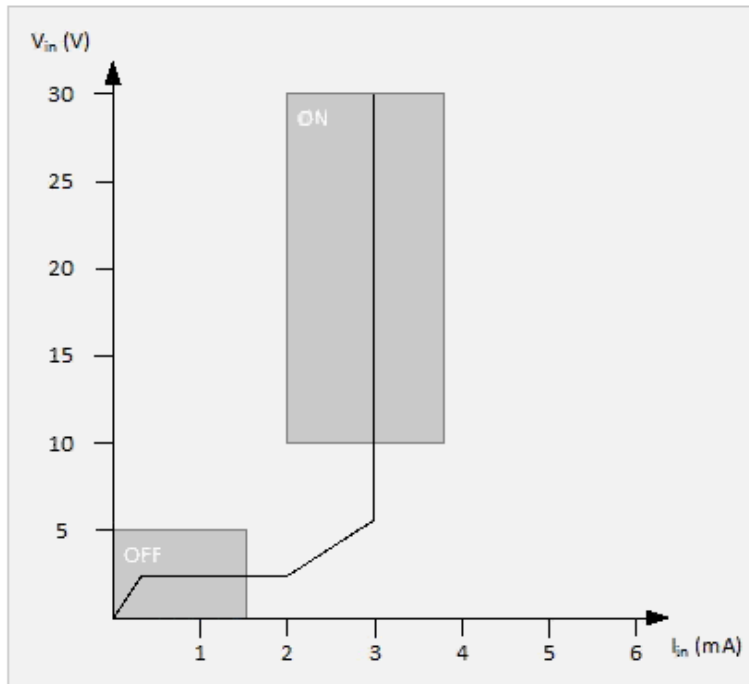


Fig. 3: Characteristic curve of the inputs

## 4.7 Lifetime

TwinSAFE components have a lifetime of 20 years, during which the target failure measures are guaranteed. For more information, see chapter [Target failure measures](#) [► 24].

The lifetime starts from the date of manufacture according to the Date Code.

### ⚠ WARNING

#### Replace TwinSAFE component after 20 years

After a lifetime of 20 years, the target failure measures are no longer guaranteed.

*Use beyond the lifetime may result in loss of safety.*

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

The TwinSAFE components bear a Date Code, which is composed as follows:

Date Code: CW YY SW HW

Legend:

CW: calendar week of manufacture

YY: year of manufacture

SW: software version

HW: hardware version

Example: Date Code 17 11 05 00

Calendar week: 17

Year: 2011

Software version: 05

Hardware version: 00

In addition, the TwinSAFE components bear a unique serial number.

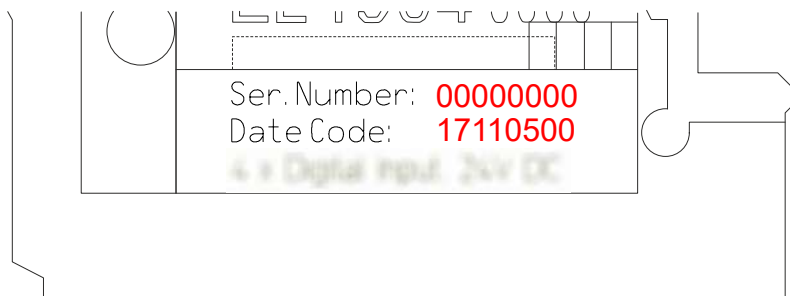


Fig. 4: Serial number and Date Code

## 5 Transport and storage

### WARNING

#### Observe the specified environmental conditions

Ensure that the digital TwinSAFE components are only transported and stored under the specified ambient conditions. The ambient conditions can be found in the chapter Environmental conditions.

*The TwinSAFE components can be damaged if they are transported or stored incorrectly.*

Ensure that the TwinSAFE component is not damaged during transportation and storage. Use the original manufacturer's packaging.

The TwinSAFE components can be stored for shorter or longer periods. Observe the conditions specified in chapter Environmental conditions.

#### Check the seal for damage

**i** Check the barcode sticker used to seal the outer packaging for damage. If the sticker is missing, opened or damaged, contact Beckhoff Support and Service.

## 6 Installation

### 6.1 Safety instructions

Before installing and commissioning the TwinSAFE components read the safety instructions in this documentation.

### 6.2 Mechanical installation

#### ⚠ WARNING

##### Only work in a de-energized state

The bus terminal system is under tension. Bring the bus terminal system into a safe, de-energized state before starting installation, disassembly or wiring of the TwinSAFE component.

*Failure to do so may result in injury from electric shock. Damage and malfunctions to the product may also result.*

#### ● Use a suitable control cabinet



For operation, the TwinSAFE component must be installed in a control cabinet or terminal box with IP54 protection rating according to IEC 60529 as a minimum.

#### 6.2.1 ESD protection

#### ⚠ WARNING

##### Prevent electrostatic charging

Comply with the following instructions.

*The devices contain electrostatically sensitive components which can be damaged by improper handling.*

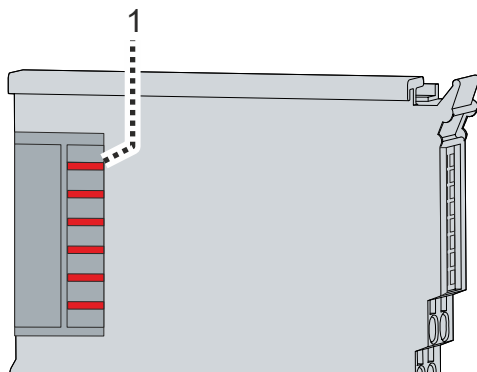


Fig. 5: Spring contacts

- They must be electrostatically discharged when handling the components.
- Avoid direct contact with the spring contacts on both sides [1]. See the figure.
- Avoid contact with highly insulating materials such as synthetic fibers or plastic films.
- When handling the components, ensure that the surroundings are well earthed. This includes the workplace, packaging and people.
- Terminate each bus station on the right-hand side with the end cap [EL9011](#) or [EL9012](#) to ensure the protection rating and ESD protection.

## 6.2.2 Installation position

### NOTICE

#### Maintain minimum distances

Observe the distances to neighboring devices and control cabinet walls shown in the figure. This ensures optimum convection cooling.

*If not observed, the TwinSAFE component may overheat. Shutdown of the TwinSAFE component and low availability are the result.*

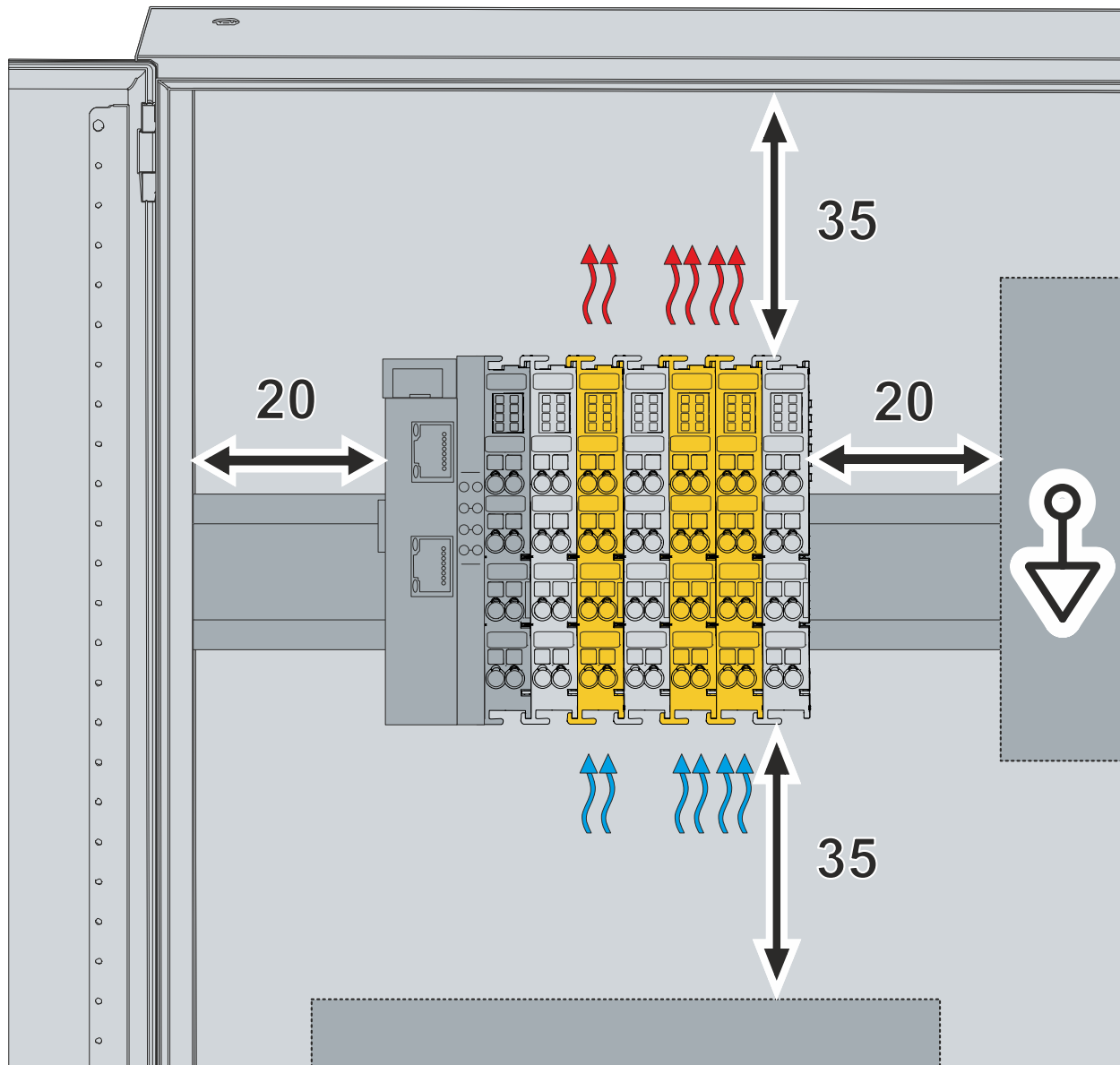


Fig. 6: Installation position

- All figures in millimeters

Mount the mounting rail horizontally for the prescribed installation position. The connection surfaces of the EL terminals or KL terminals must point to the front. This can be seen in the figure below.

The TwinSAFE components are ventilated from below, which enables optimum cooling of the electronics through convection. The direction indication “down” corresponds to the direction of positive acceleration of gravity.

### 6.2.3 Arrangement instructions

The more components are plugged behind the EK11xx EtherCAT Coupler or the EL9410 Power Supply Terminal, the higher the E-bus current that the power supply units must provide. With increasing current the waste heat from the power supply units also increases.

The following notes show thermally good and thermally bad arrangements of the TwinSAFE components.

Components with higher waste heat are marked with a red symbol . Components with lower waste heat are marked with a blue symbol .

#### 6.2.3.1 Thermally good

This arrangement is thermally well designed.

Between the EtherCAT Coupler, the power supply terminal and terminals with higher waste heat, there are terminals with lower current consumption and therefore lower waste heat.

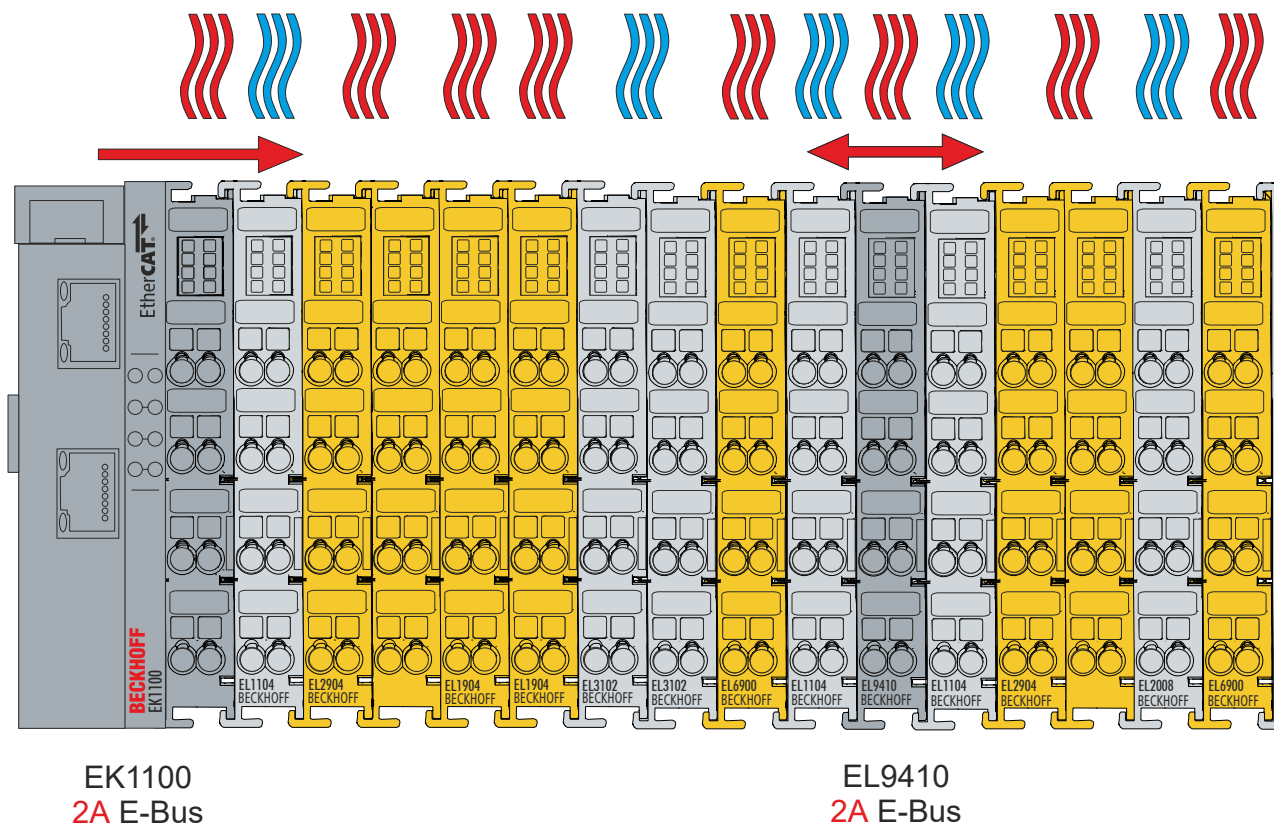


Fig. 7: Thermally good arrangement

### 6.2.3.2 Thermally poor

This arrangement is rather bad.

Terminals with a higher waste heat are located directly next to the EtherCAT Coupler or the power supply terminal with a high E-bus load.

The additional external heating of the TwinSAFE Terminals by the adjacent power supply units increases the internal terminal temperature. This can lead to the maximum permissible temperature being exceeded. The diagnostic message "Overtemperature" appears.

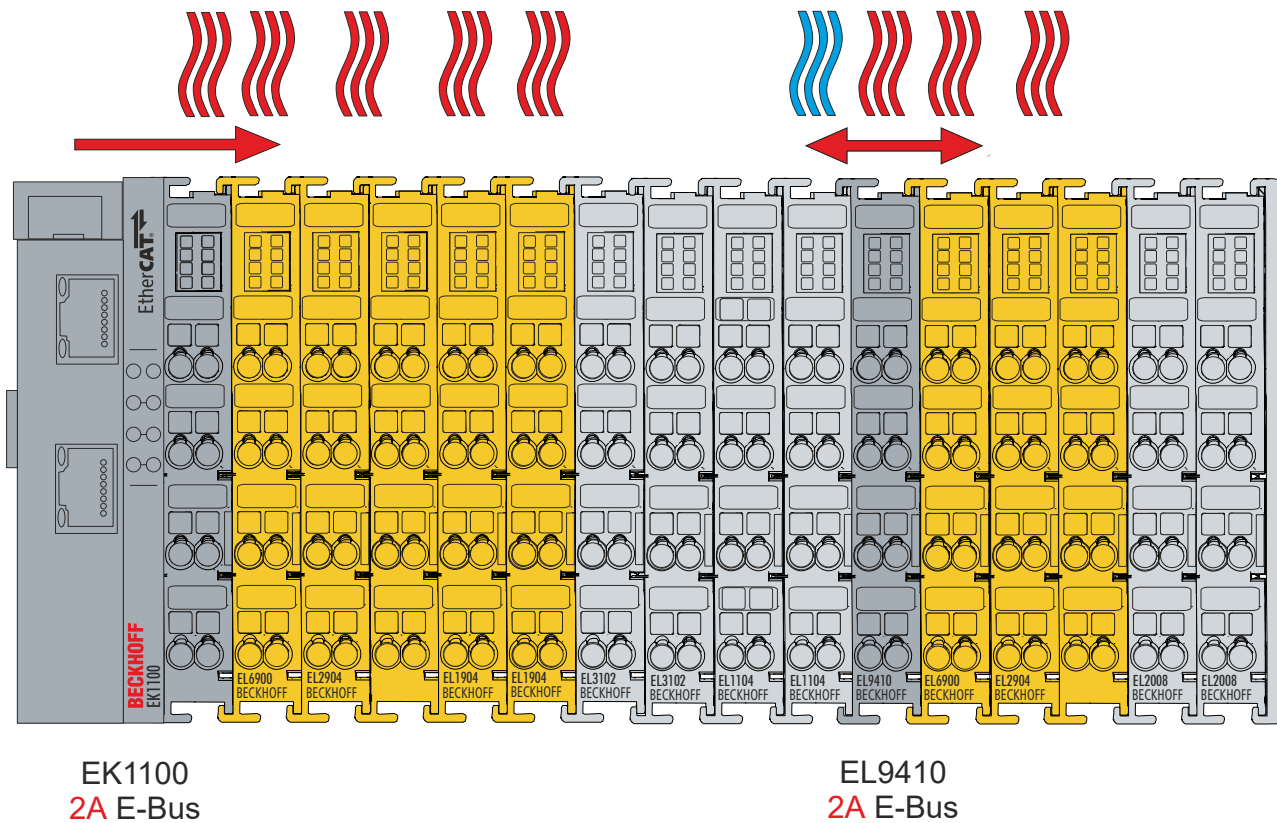


Fig. 8: Thermally poor arrangement

## 6.2.4 Temperature measurement

The temperature measurement consists of an EK1100 EtherCAT Coupler, to which EtherCAT Terminals are attached, based on the typical distribution of digital and analog signal types at a machine. On the EL6910 a safety project is active, which reads safe inputs and enables safe outputs during the measurement.

### NOTICE

#### External heat sources / radiant heat / impaired convection

The maximum permissible ambient temperature of 55°C was checked with the example configuration described above. Impaired convection, an unfavorable location near heat sources or an unfavorable configuration of the EtherCAT Terminals may result in overheating of the TwinSAFE components.

The key parameter is always the maximum permitted internally measured temperature of 110°C, above which the TwinSAFE components switch to safe state and report an error. The internal temperature can be read from the TwinSAFE components via CoE.

## 6.2.5 Mounting

### NOTICE

#### Material damage due to improper installation

Pressing on the LED strip can damage the TwinSAFE component and impair the function of the LEDs.

- Do not press on the LED strip when pushing the TwinSAFE component against the mounting rail. Instead, grasp the TwinSAFE component at the top and bottom edge or at the height of the orange tab to slide it onto the mounting rail.

#### **i** Ensure a functional component connection

Observe the assembly sequence described. First connect adjacent TwinSAFE components together using tongue and groove. Only slide the TwinSAFE component onto the mounting rail after it has been plugged together.

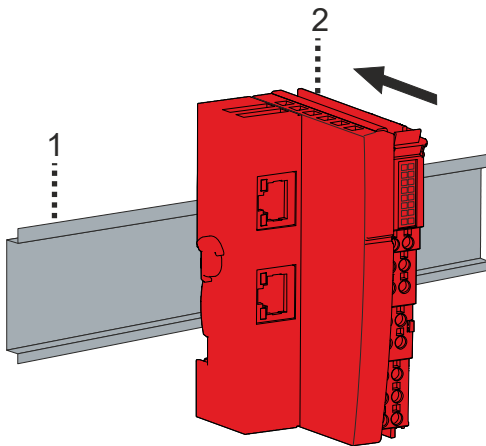
*If the tongue and groove do not interlock, a functional connection will not be established. When correctly assembled, no significant gap should be visible between the housings.*

#### Use suitable mounting rail fastening

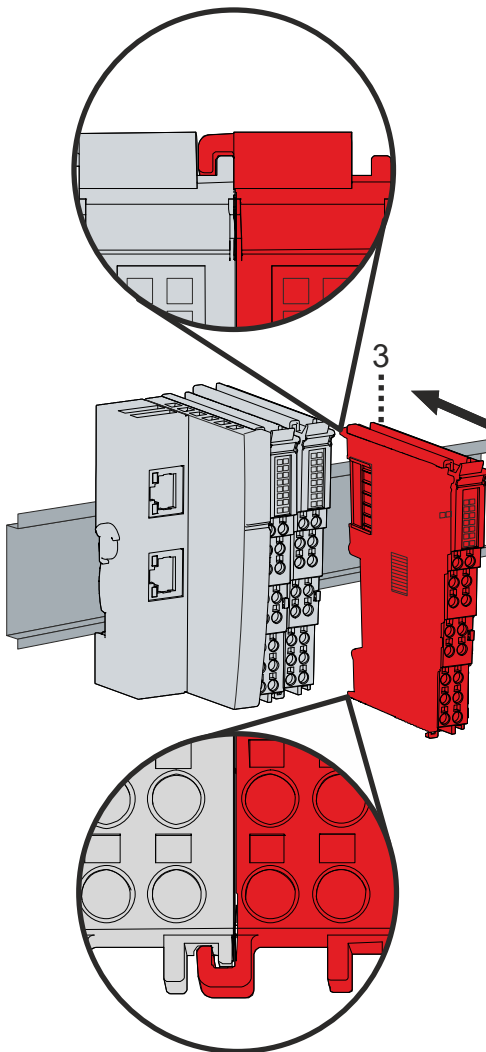
The locking mechanism of the TwinSAFE components protrudes into the profile of the mounting rail. When installing the components, make sure that the locking mechanism doesn't come into conflict with the fixing bolts of the mounting rail. For fastening mounting rails with a height of 7.5 mm under the TwinSAFE components, use flat fastening components such as countersunk head screws or blind rivets.

The TwinSAFE components are clamped onto standard 35 mm mounting rails by applying light pressure. The mounting rails are DIN rails in accordance with EN 60715.

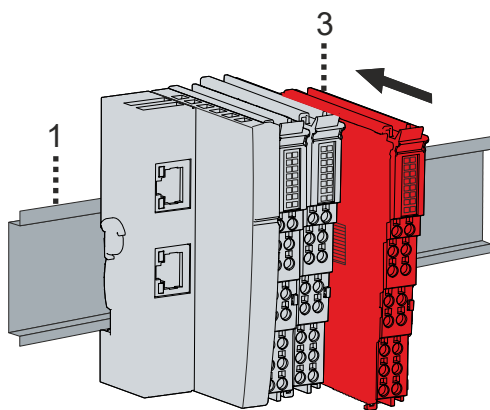
Install the TwinSAFE components as follows:



1. Plug the EtherCAT Coupler [2] onto the mounting rail [1]



2. Push the TwinSAFE Terminal [3] together with the adjacent component with tongue and groove



3. Push the TwinSAFE Terminal [3] against the mounting rail [1] until the locking mechanism audibly engages on the mounting rail

## 6.3 Electrical installation

### 6.3.1 Overvoltage protection

Provide a surge filter against overvoltage for the supply voltage of the bus terminal block and the TwinSAFE components if protection against overvoltage is required in your system.

### 6.3.2 Connection

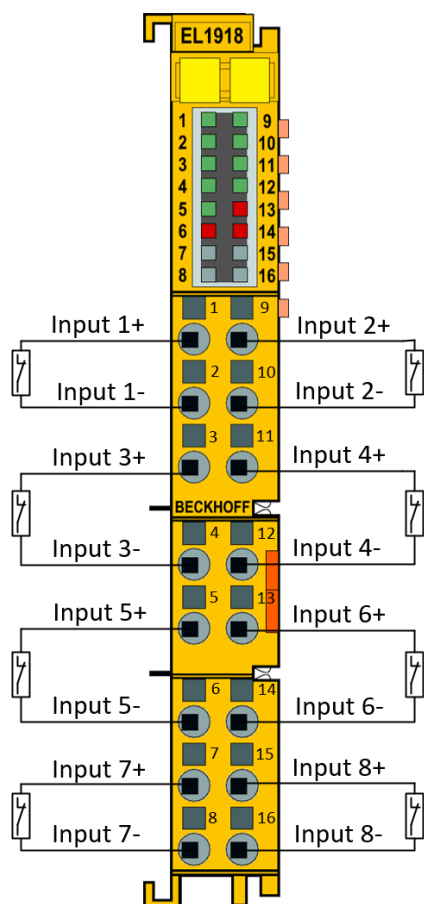


Fig. 9: EL1918 connection

| Terminal point | Input | Signal                  |
|----------------|-------|-------------------------|
| 1              | 1     | Input 1+ (clock output) |

| Terminal point | Input | Signal                  |
|----------------|-------|-------------------------|
| 2              |       | Input 1- (safe input)   |
| 3              | 3     | Input 3+ (clock output) |
| 4              |       | Input 3- (safe input)   |
| 5              | 5     | Input 5+ (clock output) |
| 6              |       | Input 5- (safe input)   |
| 7              | 7     | Input 7+ (clock output) |
| 8              |       | Input 7- (safe input)   |
| 9              | 2     | Input 2+ (clock output) |
| 10             |       | Input 2- (safe input)   |
| 11             | 4     | Input 4+ (clock output) |
| 12             |       | Input 4- (safe input)   |
| 13             | 6     | Input 6+ (clock output) |
| 14             |       | Input 6- (safe input)   |
| 15             | 8     | Input 8+ (clock output) |
| 16             |       | Input 8- (safe input)   |



### Configurable inputs

The inputs 1 to 8 can be occupied as you want with normally closed contacts or normally open contacts. The corresponding analysis is carried out in the safety PLC. The input labeled *Input x-* is used for connecting OSSD sensors (self-testing sensors).

## 6.3.3 Connecting



### Several conductors on one connection

If you want to connect several conductors to one connection, connect the conductors in an upstream wiring, for example with terminal blocks.

The permissible wire size width can be found in the following table.

|                                                     |                             |
|-----------------------------------------------------|-----------------------------|
| Wire size width (single core wires)                 | 0,08 to 2,5 mm <sup>2</sup> |
| Wire size width (fine-wire conductors)              | 0,08 to 2,5 mm <sup>2</sup> |
| Wire size width (conductors with a wire end sleeve) | 0,14 to 1,5 mm <sup>2</sup> |
| Wire stripping length                               | 8 to 9 mm                   |

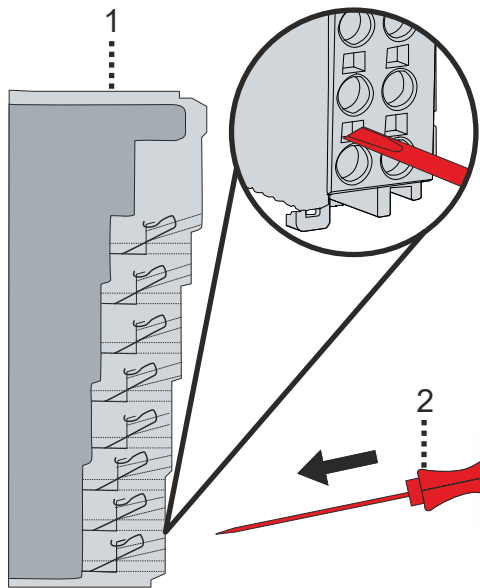
### 6.3.3.1 Conductor with ferrule

Solid and fine-stranded conductors with ferrules can be inserted directly into the terminal point without actuation. For all other ladder types, follow the instructions in the following chapter.

### 6.3.3.2 Other conductors

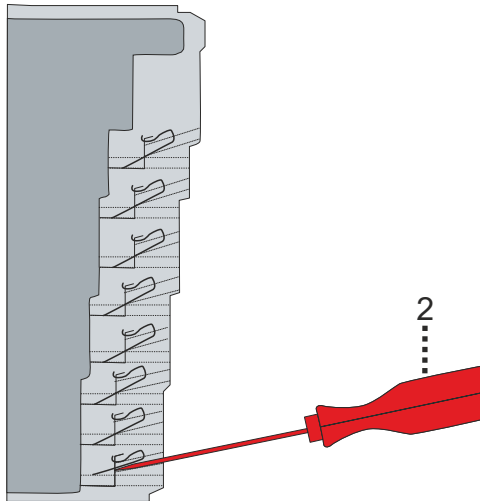
Up to 16 terminal points enable the connection of solid or fine-wire cables to the TwinSAFE component. The terminal points are spring-loaded.

Connect the conductors as follows:

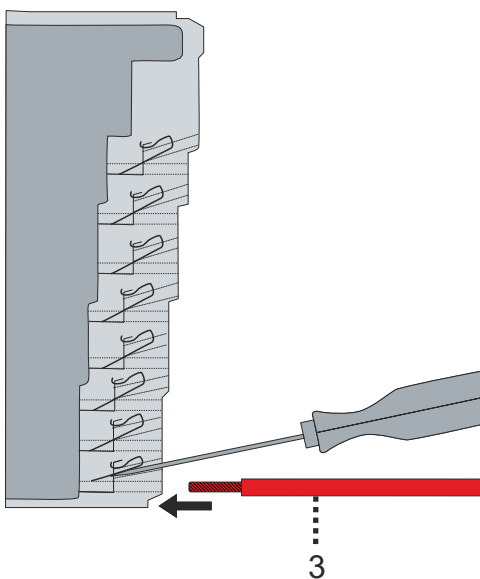


1. Push the screwdriver [2] straight into the square opening above the terminal point of the terminal [1] as far as it will go

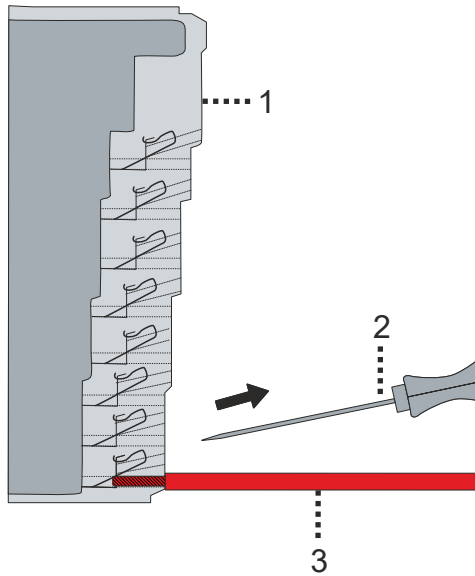
Do not turn, move back and forth or lever the screwdriver. The terminal point opens.



2. Keep screwdriver [2] pressed



3. Insert the wire [3] into the round terminal opening



4. Pull the screwdriver [2] out of the opening

The terminal [1] closes automatically when the pressure is released. The wire [3] is held securely and permanently.

The permissible conductor cross-section can be found in the technical data.

## 6.3.4 Connections

The electrical connections between the TwinSAFE components are realized automatically by plugging the components together.

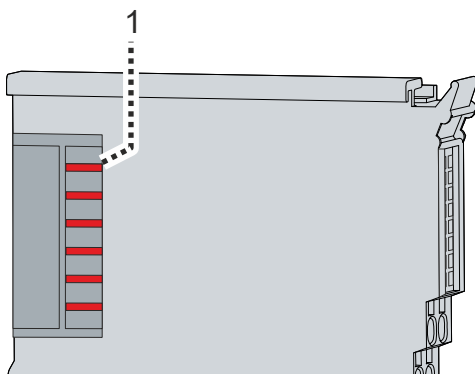
### 6.3.4.1 Spring contacts of the E-bus

#### NOTICE

##### Observe the E-bus current

Observe the maximum current that your EtherCAT Coupler can supply to the E-bus. Use the EL9410 Power Supply Terminal if the current consumption of your TwinSAFE Terminals exceeds the maximum current that your EtherCAT coupler can supply for the E-bus supply.

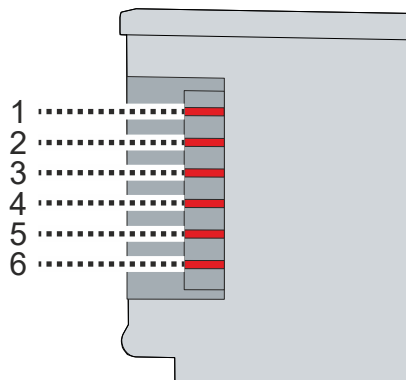
*Failure to do so may result in product damage.*



The 6 spring contacts [1] of the E-bus deal with the transfer of the data and the supply of the bus terminal electronics.

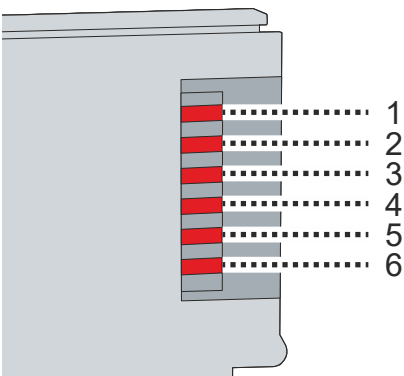
6.3.4.1.1 E-bus cables

Input side



| Key |                                          |
|-----|------------------------------------------|
| 1   | +5VDC supply voltage of the E-bus        |
| 2   | 0 VDC ground of the E-bus supply voltage |
| 3   | Receive line RX +                        |
| 4   | Receive line RX -                        |
| 5   | Transmission line TX +                   |
| 6   | Transmission line TX -                   |

Output side



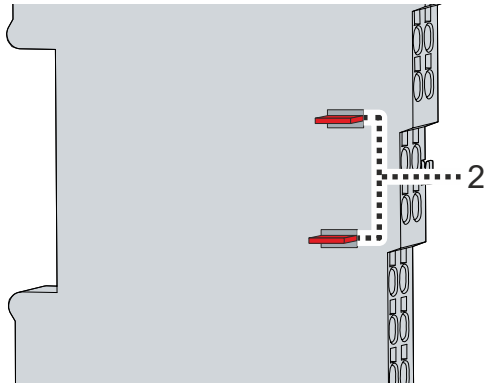
| Key |                                          |
|-----|------------------------------------------|
| 1   | +5VDC supply voltage of the E-bus        |
| 2   | 0 VDC ground of the E-bus supply voltage |
| 3   | Transmission line TX +                   |
| 4   | Transmission line TX -                   |
| 5   | Receive line RX +                        |
| 6   | Receive line RX -                        |

### 6.3.4.2 Power contacts

#### **i** Note the connection of the power contacts

During the design of a bus terminal block, note the contact assignments of the individual TwinSAFE components, as some components do not loop through the power contacts or do not loop them through completely. This can be the case with analog bus terminals or digital 4-channel bus terminals, for example.

Power feed terminals interrupt the power contacts and thus represent the start of a new supply rail. Possible Power Supply Terminals are the EL91xx and the EL92xx.



The power contacts [2] 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 EtherCAT Coupler.

### 6.3.5 Signal lines

#### NOTICE

##### Route the signal line separately

Route the signal line separately from potential sources of interference. Possible sources of interference are, for example, motor supply cables or power cables with 230 V<sub>AC</sub>. Keep the distance between the cables as large as possible.

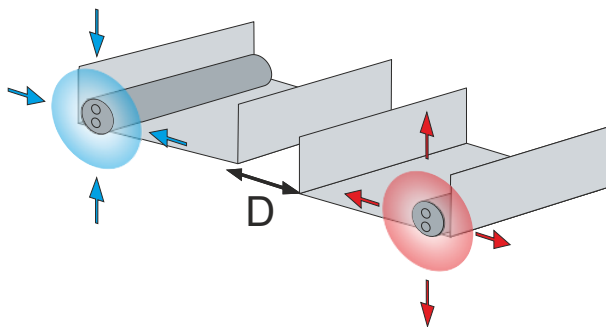
*Interference caused by cables routed in parallel can influence the signal form of the test pulses and thus cause diagnostic messages. Possible diagnostic messages are sensor errors or OpenLoad errors.*

Common signal routing with other clocked signals in a common cable also reduces the maximum expansion. The reason for this is that the signals may crosstalk over long cable lengths and diagnostic messages may appear.

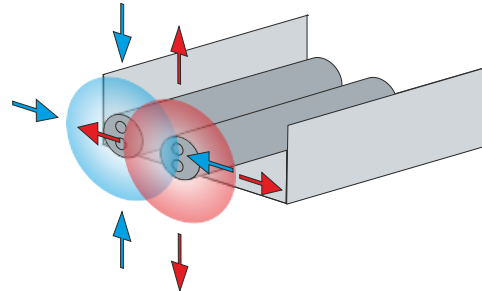
The following figures show correct and incorrect signal routing. Refer to the figure legend.

| Figure legend |                                     |
|---------------|-------------------------------------|
| D             | Distance between the cable channels |
| Blue arrows   | Signature lines                     |
| Red arrows    | Potential sources of interference   |

Correct



Incorrect



## 7 Operation

### 7.1 Environmental conditions

Ensure that the TwinSAFE components are only transported, stored and operated under the specified conditions according to the Technical Data.

#### **WARNING**

##### **Risk of injury!**

The TwinSAFE components must not be used under the following operating conditions.

- under the influence of ionizing radiation (that exceeds the level of the natural environmental radiation)
- in corrosive environments<sup>1</sup>
- in an environment that leads to unacceptable soiling of the TwinSAFE component

<sup>1</sup> A corrosive environment exists when corrosion damage becomes apparent.

#### **NOTICE**

##### **Electromagnetic compatibility**

The TwinSAFE components comply with the current standards on electromagnetic compatibility with regard to spurious radiation and immunity to interference in particular.

However, in cases where devices such as mobile phones, radio equipment, transmitters or high-frequency systems that exceed the interference emissions limits specified in the standards are operated near TwinSAFE components, the function of the TwinSAFE components may be impaired.

## 7.2 Configuration of the terminal in TwinCAT



### Identical configuration

The configuration of the terminal in TwinCAT is identical for the EL1918-2200 variant.

### ⚠ CAUTION

#### Do not change CoE objects!

Do not change any of the CoE objects in the TwinSAFE terminals. Any modifications (e.g. via TwinCAT) of the CoE objects will permanently set the terminals to the Fail-Stop state or lead to unexpected behavior of the terminals!

### 7.2.1 Inserting a Bus Coupler

See TwinCAT automation software documentation.

### 7.2.2 Inserting a Bus Terminal

See TwinCAT automation software documentation.

### 7.2.3 Adding an EL1918

An EL1918 is added in exactly the same way as any other Beckhoff EtherCAT Terminal. Open *TwinSAFE Terminals* item in the list and select the EL1918.

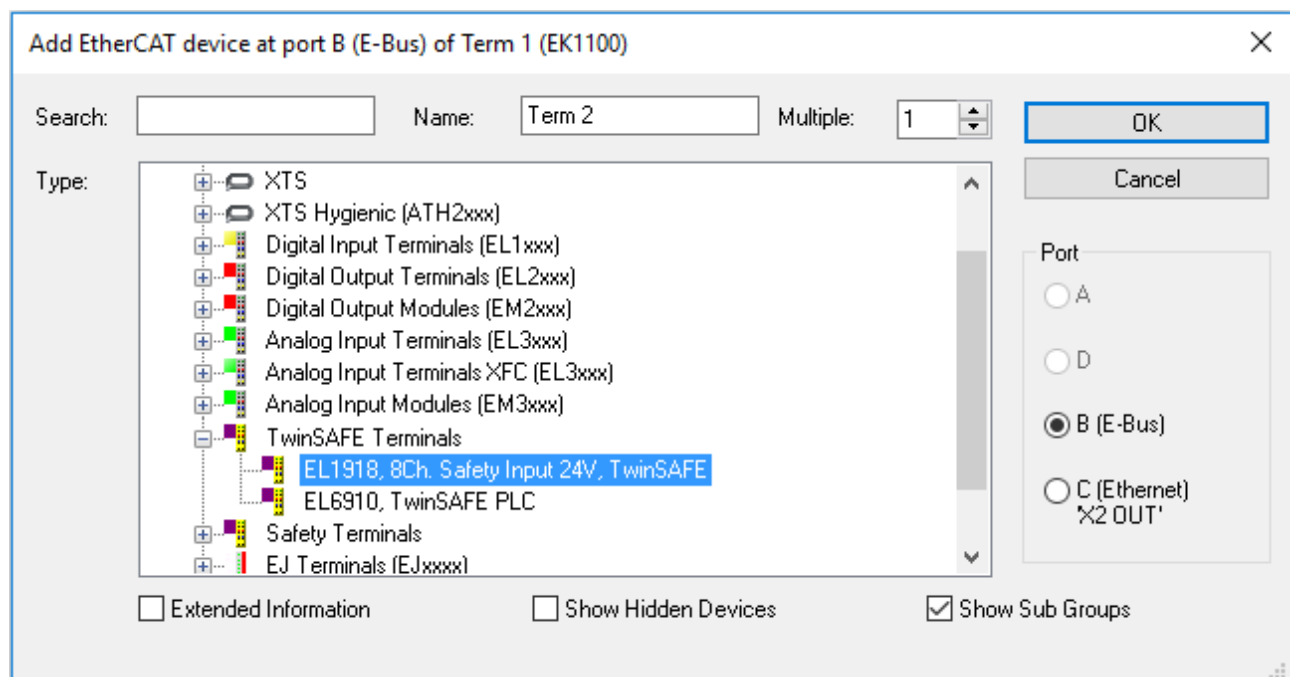


Fig. 10: Adding an EL1918

## 7.2.4 Address settings on TwinSAFE terminals with 1023 possible addresses

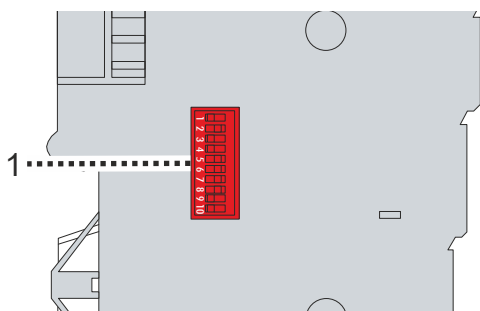


Fig. 11: Address settings on TwinSAFE terminals with 1023 possible addresses

You must set the TwinSAFE address using the 10-way DIP switch [1] on the left-hand side of a TwinSAFE terminal. TwinSAFE addresses from 1 to 1023 are available.

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

### ⚠ WARNING

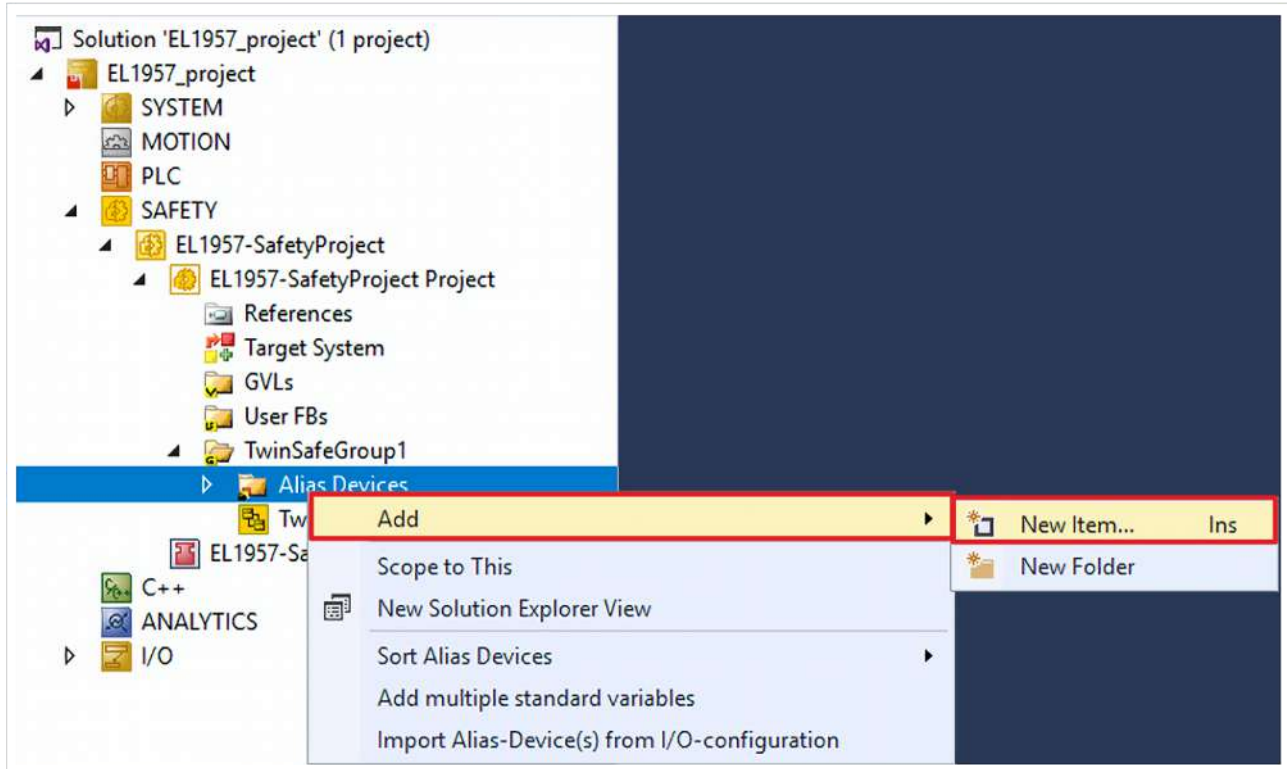
#### TwinSAFE address

Each TwinSAFE address may only be used once within a network / a configuration!  
The address 0 is not a valid TwinSAFE address!

## 7.2.5 Alias devices

The communication between the safety logic and the I/O level is realized via an alias level. At this alias level (sub-node *Alias Devices*) corresponding alias devices are created for all safe inputs and outputs, and also for standard signal types. For the safe inputs and outputs, this can be done automatically via the I/O configuration.

The connection- and device-specific parameters are set via the alias devices.



If the automatic import is started from the I/O configuration, a selection dialog opens, in which the individual terminals to be imported can be selected.

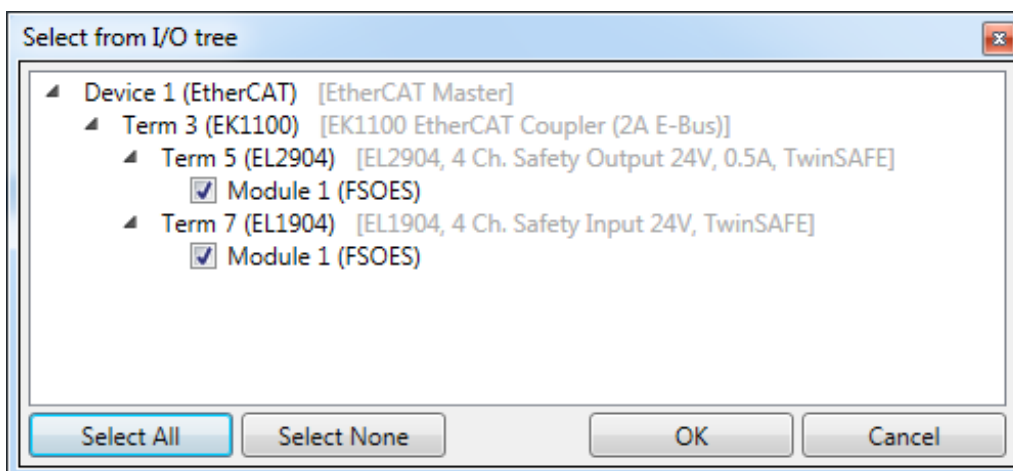


Fig. 12: Selection from the I/O tree

The alias devices are created in the safety project when the dialog is closed via OK.

Alternatively, the user can create the alias devices individually. To this end select *Add* and *New item* from the context menu, followed by the required device.

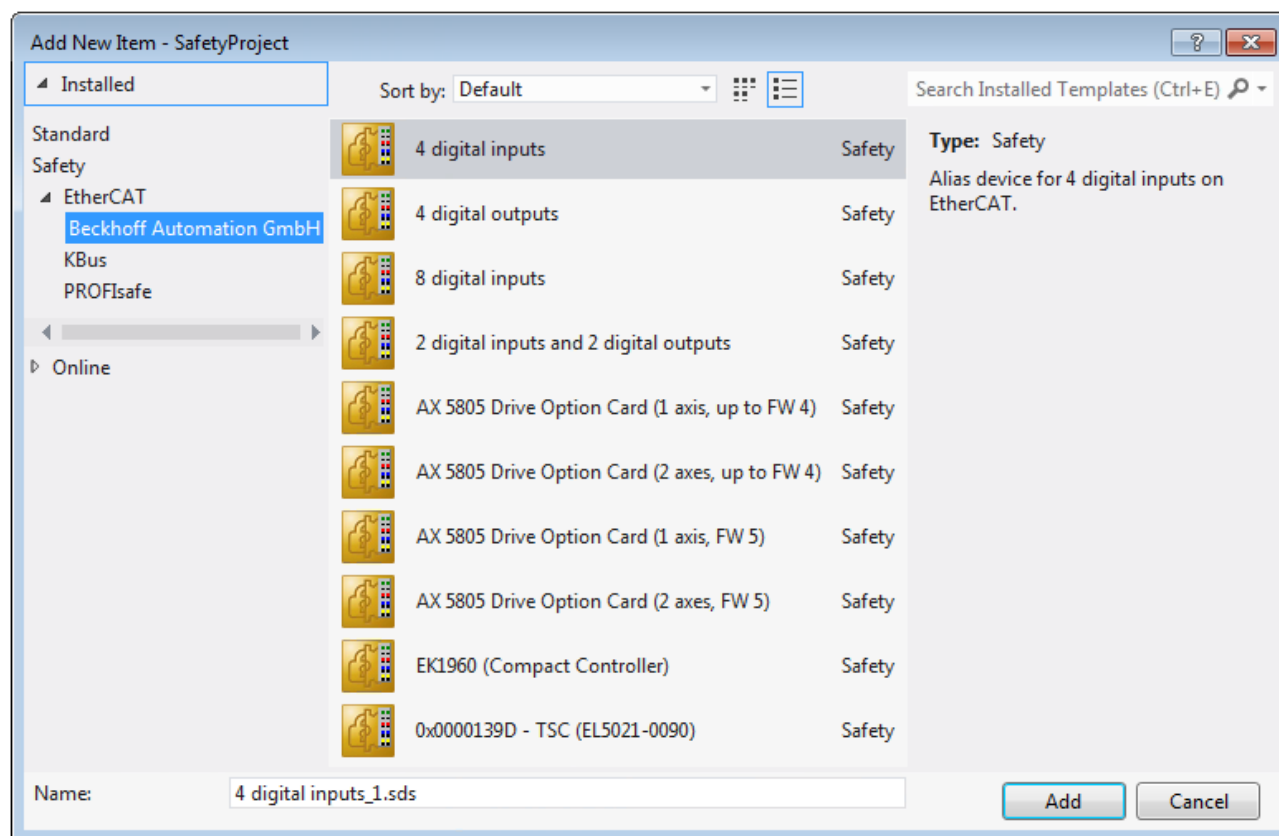


Fig. 13: Creating alias devices by the user

## 7.2.6 EL1918 parameters in TwinCAT

After creating the alias device, it can be parameterized according to the user specifications.

The FSoE address is set under the *Linking* tab, and the link to the physical device is created.

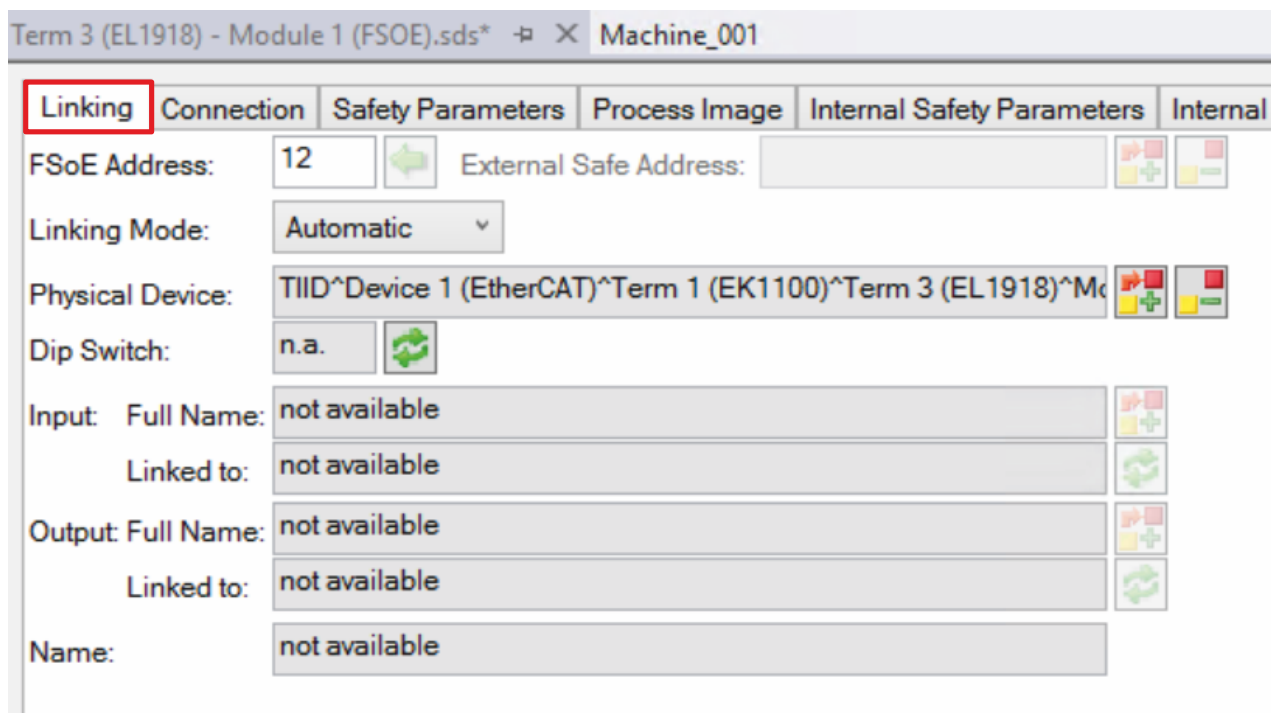


Fig. 14: Linking tab of the alias device

Under the *Connection* tab you can make further settings, e.g. the mapping of the info data or the behavior in case of a module error.

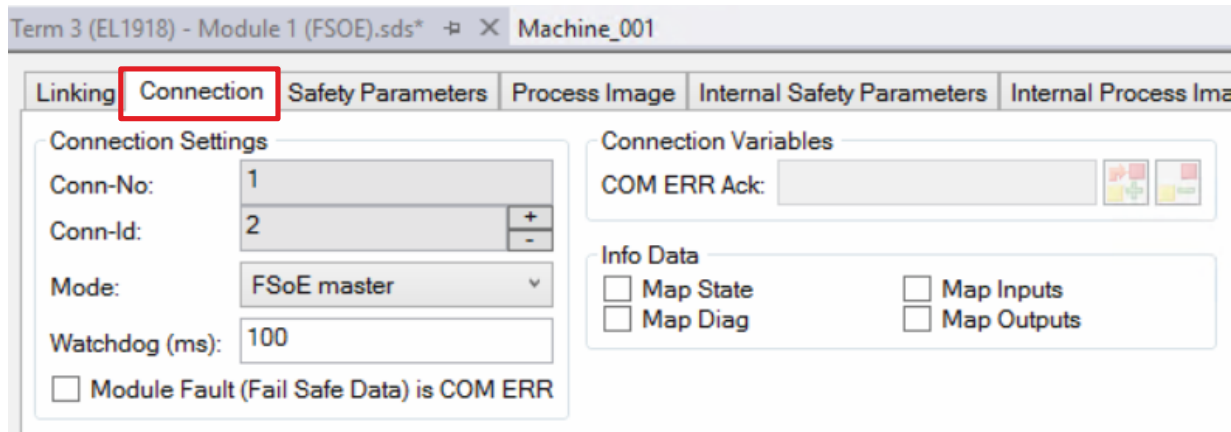


Fig. 15: Connection tab of the alias device

The *Safety Parameters* tab contains the parameters of the EL1918 to be set. The parameters are set separately for each input. Objects 0x8000 and 0x8001 are available for input 1. For all other inputs, the CoE index is increased by 10 hex each, so that objects 0x8070 and 0x8071 are available for input 8.

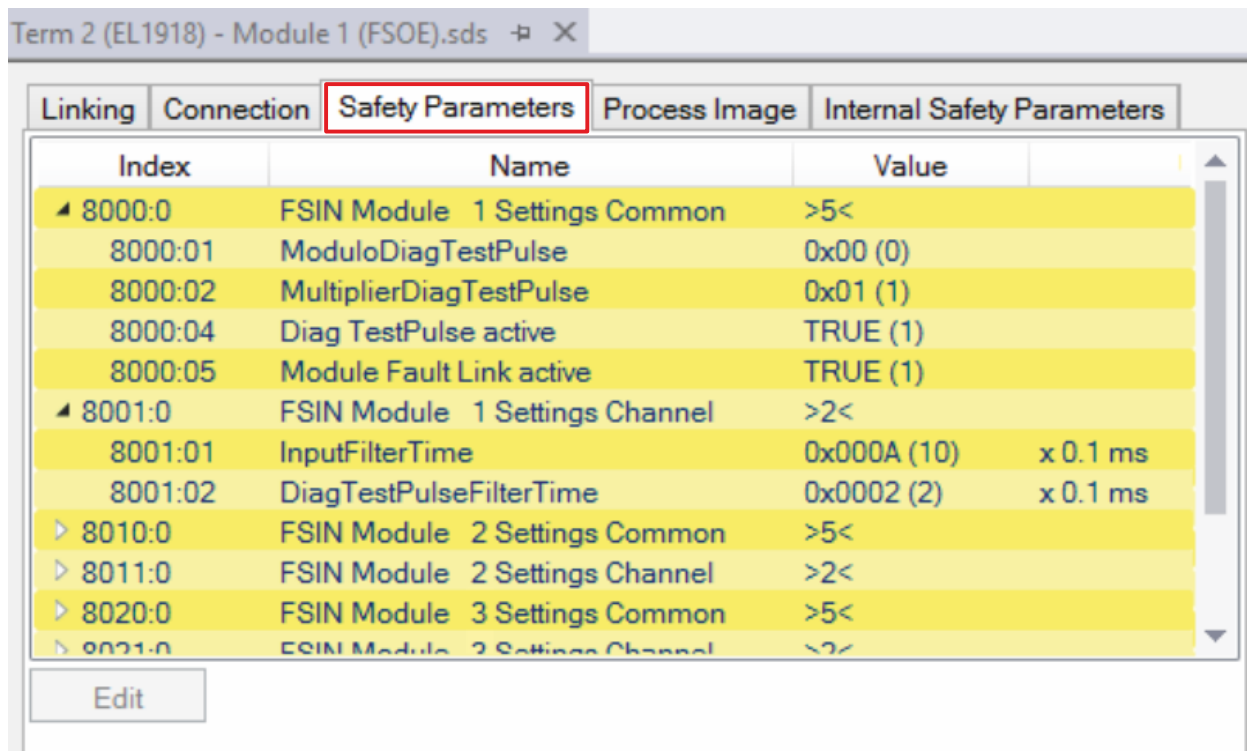


Fig. 16: EL1918 parameters

| Index   | Name                    | Default value/<br>unit | Description                                                                                                    |
|---------|-------------------------|------------------------|----------------------------------------------------------------------------------------------------------------|
| 80x0:01 | ModuloDiagTestPulse     | 0x00 / integer         | Modulo value for the frequency of generating a test pulse.<br>0 -> every time<br>1 -> every second time<br>... |
| 80x0:02 | MultiplierDiagTestPulse | 0x01 / integer         | Length of the test pulse in multiples of 400 µs                                                                |

| Index   | Name                     | Default value/<br>unit | Description                                                                                                                                                        |
|---------|--------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 80x0:04 | Diag TestPulse active    | TRUE / Boolean         | Activation of test pulses for the corresponding input module                                                                                                       |
| 80x0:05 | Module Fault Link active | TRUE / Boolean         | If a module error occurs in this module, a module error is also set for all other modules of this TwinSAFE component for which this parameter is also set to TRUE. |
| 80x1:01 | InputFilterTime          | 0x000A / 0.1 ms        | Input filter of the safe input. Following this time the internal input signal changes to the applied signal state.                                                 |
| 80x1:02 | DiagTestPulseFilterTime  | 0x0002 / 0.1 ms        | Input filter for the test pulse signal                                                                                                                             |

## 7.2.7 Process image of the EL1918

The process image of the EL1918 consists of 7 bytes process data in the input and 6 bytes process data in the output.

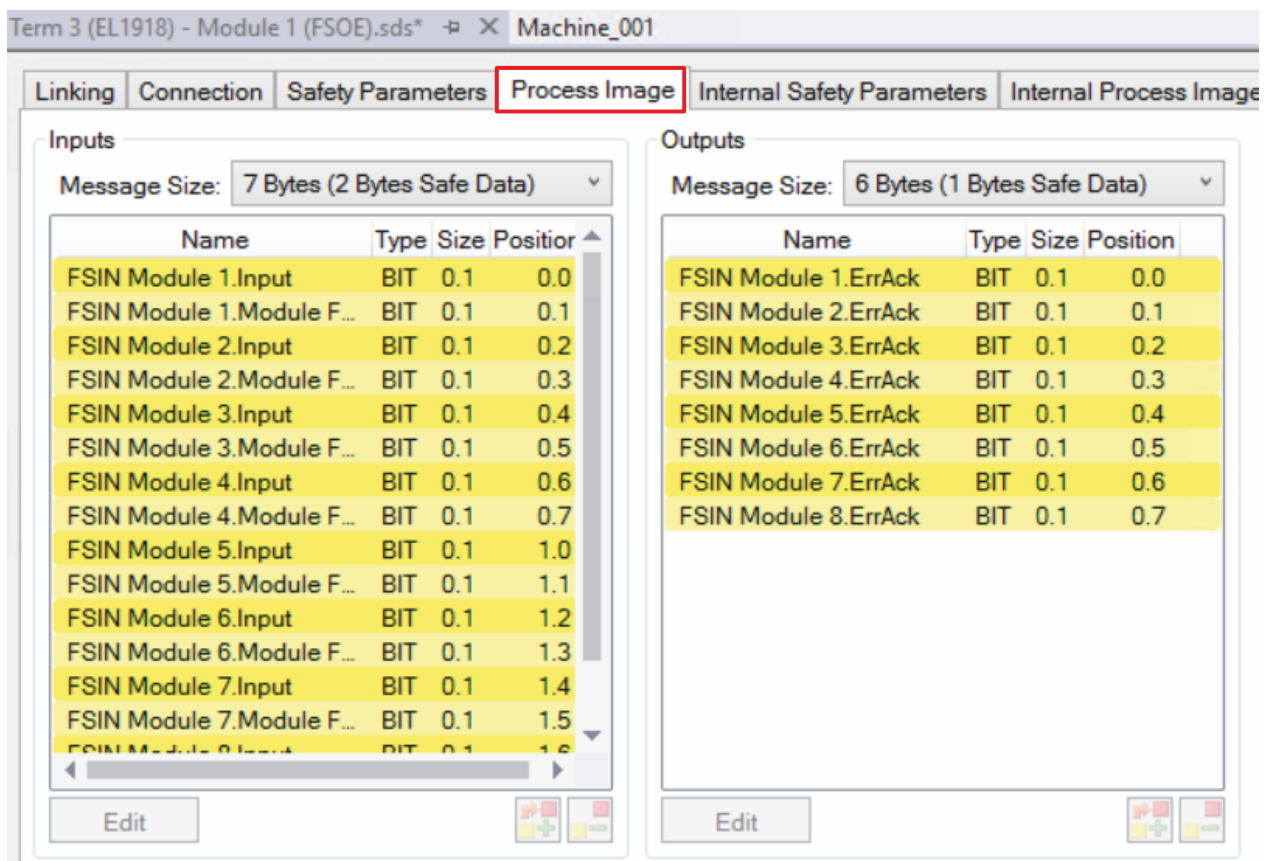


Fig. 17: Process image of the EL1918

The assignment of the individual signals in the safe data is listed in the following table.

| Name                      | Process image | Bit position | Description                          |
|---------------------------|---------------|--------------|--------------------------------------|
| FSIN Module1.Input        | IN            | 0.0          | Safe input 1                         |
| FSIN Module1.Module Fault | IN            | 0.1          | Module error information for input 1 |
| FSIN Module2.Input        | IN            | 0.2          | Safe input 2                         |
| FSIN Module2.Module Fault | IN            | 0.3          | Module error information for input 2 |
| FSIN Module3.Input        | IN            | 0.4          | Safe input 3                         |
| FSIN Module3.Module Fault | IN            | 0.5          | Module error information for input 3 |

| Name                      | Process image | Bit position | Description                          |
|---------------------------|---------------|--------------|--------------------------------------|
| FSIN Module4.Input        | IN            | 0.6          | Safe input 4                         |
| FSIN Module4.Module Fault | IN            | 0.7          | Module error information for input 4 |
| FSIN Module5.Input        | IN            | 1.0          | Safe input 5                         |
| FSIN Module5.Module Fault | IN            | 1.1          | Module error information for input 5 |
| FSIN Module6.Input        | IN            | 1.2          | Safe input 6                         |
| FSIN Module6.Module Fault | IN            | 1.3          | Module error information for input 6 |
| FSIN Module7.Input        | IN            | 1.4          | Safe input 7                         |
| FSIN Module7.Module Fault | IN            | 1.5          | Module error information for input 7 |
| FSIN Module8.Input        | IN            | 1.6          | Safe input 8                         |
| FSIN Module8.Module Fault | IN            | 1.7          | Module error information for input 8 |
| FSIN Module 1.ErrAck      | OUT           | 0.0          | Error acknowledge for safe input 1   |
| FSIN Module 2.ErrAck      | OUT           | 0.1          | Error acknowledge for safe input 2   |
| FSIN Module 3.ErrAck      | OUT           | 0.2          | Error acknowledge for safe input 3   |
| FSIN Module 4.ErrAck      | OUT           | 0.3          | Error acknowledge for safe input 4   |
| FSIN Module 5.ErrAck      | OUT           | 0.4          | Error acknowledge for safe input 5   |
| FSIN Module 6.ErrAck      | OUT           | 0.5          | Error acknowledge for safe input 6   |
| FSIN Module 7.ErrAck      | OUT           | 0.6          | Error acknowledge for safe input 7   |
| FSIN Module 8.ErrAck      | OUT           | 0.7          | Error acknowledge for safe input 8   |

## 7.2.8 EL1918: using the integrated TwinSAFE Logic functions

In addition to its standard function as a digital safe input terminal, the EL1918 TwinSAFE Terminal also supports the option of executing a local safety-related user program. To do this, select the EL1918 as the target system in the TwinCAT Safety Editor.

Information on creating a safety user program can be found in the documentation for the EL6910 (see References).

The default project, so that the EL1918 once again behaves as a safe input terminal, can be reactivated by deleting the safety-related user program from the TwinSAFE component. To do this, select the entry *Safe Logic, Mapping and Parameter Data* in the dialog for deleting the project. After switching the TwinSAFE component off and on, the default project is active again.

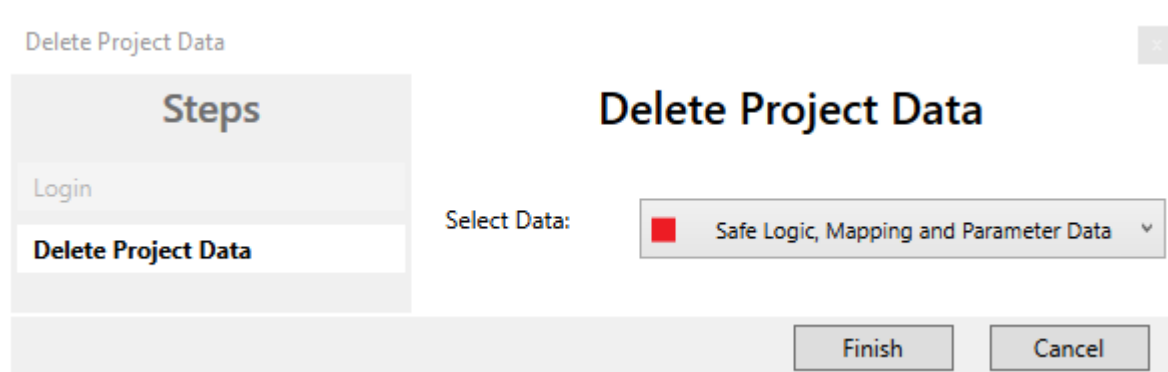


Fig. 18: Deleting the project data

### 7.2.8.1 Project design limits of EL1918



#### Project design limits

The maximum project design size for EL1918 is determined by the available memory. This is managed dynamically. The values specified in the following table are therefore only guide values and may differ from the actual values, depending on the safety project.

**NOTICE****Execution time of the logic function**

The execution time of the logic program - with identical logic program - will typically be longer compared to the EL6910, since the safe I/O signals must be processed additionally. This also has a corresponding effect on the processing of the I/O signals, since with increasing project size these can only be evaluated with a lower frequency.

|                                          |                                                                                                                                                                                                                                                                                            |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Process image size</b>                | max. 1486 byte per data direction<br>(maximum memory size 0x1E00 for 3 buffers, ie with the same size of input and output process data, a maximum size of 1280 bytes per data direction is possible. Only straight start addresses are possible, so fill bytes must be taken into account) |
| <b>TwinSAFE connections</b>              | 128 max.<br>(up to 255 CRCs in total; 1 CRC is required for a TwinSAFE connection with 1 or 2 byte safe data.)                                                                                                                                                                             |
| <b>Safe data per TwinSAFE connection</b> | maximum 126 byte (telegram length 255 byte)                                                                                                                                                                                                                                                |
| <b>TwinSAFE blocks</b>                   | maximum 512 (when using ESTOP function blocks with complete input and output mapping, other function blocks can lead to a smaller maximum number)                                                                                                                                          |
| <b>TwinSAFE groups</b>                   | 128 max.                                                                                                                                                                                                                                                                                   |
| <b>TwinSAFE user</b>                     | 40 max.                                                                                                                                                                                                                                                                                    |
| <b>Standard PLC inputs</b>               | dynamic (memory-dependent), max. 1484 byte                                                                                                                                                                                                                                                 |
| <b>Standard PLC outputs</b>              | dynamic (memory-dependent), max. 1484 byte                                                                                                                                                                                                                                                 |

**NOTICE****Project development**

TwinCAT 3.1 Build 4022.25 or newer is required to use the internal logic functions. If the EL1918 is used as TwinSAFE slave with the default project, at least an EL6910, EK1960 or newer logic component is required as TwinSAFE master.

## 7.3 TwinSAFE reaction times

### 7.3.1 Typical response time

The typical reaction time is the time that is required to transmit information from the sensor to the actuator, if the overall system is working without error in normal operation.

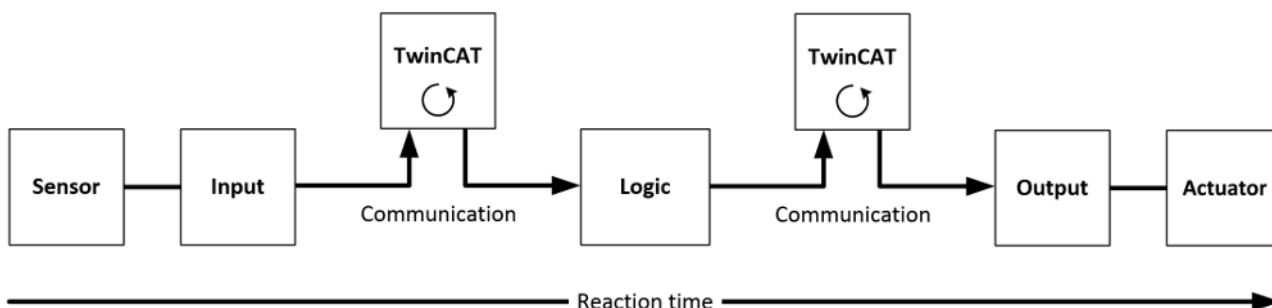


Fig. 19: Typical response time

| Definition | Description                                                                                                                      |
|------------|----------------------------------------------------------------------------------------------------------------------------------|
| RTSensor   | Response time of the sensor, until the signal is made available at the interface. Typically provided by the sensor manufacturer. |

| Definition | Description                                                                                                                                                                                                                                                                       |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RTInput    | Response time of the safe input, e.g. EL1904 or EP1908. This time can be found in the technical data. In the case of the EL1904 it is 4 ms.                                                                                                                                       |
| RTComm     | Response time of the communication. This is typically 3 times the EtherCAT cycle time, since a new Safety-over-EtherCAT telegram has to be generated before new data can be sent. These times depend directly on the higher-level standard controller (cycle time of the PLC/NC). |
| RTLogic    | Response time of the logic terminal. This is the cycle time of the logic terminal and typically ranges from 500 µs to 10 ms for the TwinSAFE logic terminal, depending on the size of the safety project. The actual cycle time can be read from the terminal.                    |
| RTOutput   | Response time of the output terminal. This is typically between 2 and 3 ms.                                                                                                                                                                                                       |
| RTActor    | Response time of the actuator. This information is typically provided by the actuator manufacturer                                                                                                                                                                                |
| WDComm     | Watchdog time of the communication                                                                                                                                                                                                                                                |

The typical response time is based on the following formula:

$$ReactionTime_{typ} = RT_{Sensor} + RT_{Input} + 3 * RT_{Comm} + RT_{Logic} + 3 * RT_{Comm} + RT_{Output} + RT_{Actuator}$$

with

$$ReactionTime_{typ} = 5\text{ ms} + 4\text{ ms} + 3 * 1\text{ ms} + 10\text{ ms} + 3 * 1\text{ ms} + 3\text{ ms} + 20\text{ ms} = 48\text{ ms}$$

### 7.3.2 Worst case response time

The worst-case response time is the maximum time required for switching off the actuator in the event of an error.

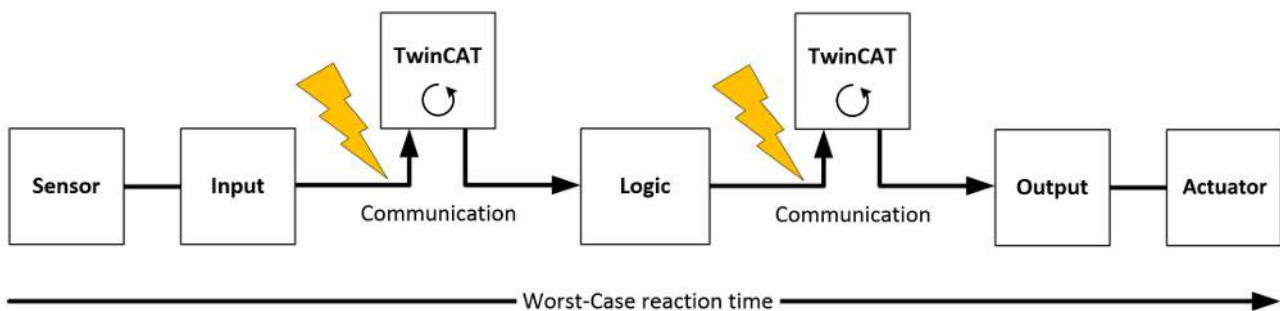


Fig. 20: Worst case response time

It is assumed that a signal change takes place at the sensor, and that this is passed to the input. A communication error occurs just at the moment when the signal is to be passed to the communication interface. This is detected by the logic once the watchdog time of the communication connection has elapsed. This information should then be passed on to the output, resulting in a further communication error. This fault is detected at the output once the watchdog time has elapsed, resulting in shutdown.

This results in the following formula for the worst-case response time:

$$ReactionTime_{max} = WD_{Comm} + WD_{Comm} + RT_{Actuator}$$

with

$$ReactionTime_{max} = 15\,ms + 15\,ms + 20\,ms = 50\,ms$$

## 8 Diagnosis

### 8.1 LEDs

This chapter describes the functions of LEDs. The LEDs are divided into status LEDs and diagnostic LEDs.

The following chapters contain a description of the individual LEDs.

#### 8.1.1 Status LEDs

This section contains information about the meaning of the different status LEDs.

The LEDs "Input1" to "Input8" differ only in the circuitry of inputs 1 to 8. They are therefore described in summary.

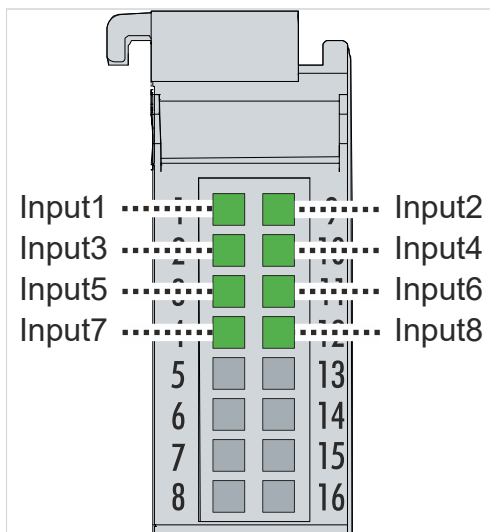


Fig. 21: Status LEDs

Status display for the respective input Input1 to Input8

#### LED on

Input set

#### LED off

Input not set

## 8.1.2 Diag LEDs

The diagnostic LEDs show different operating modes of the TwinSAFE component.

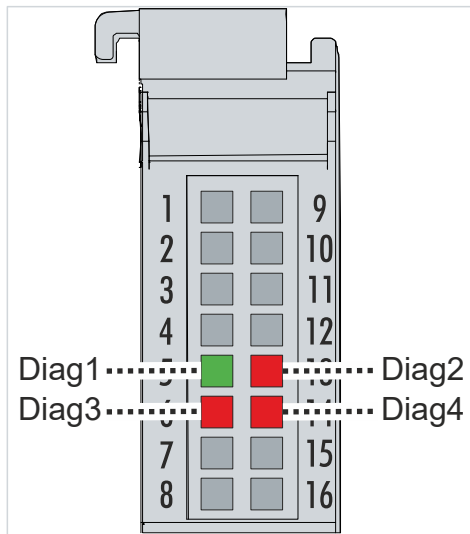


Fig. 22: Diag LEDs

| Diag1     | Diag2     | Diag3     | Diag4     | Description                                                                                                                                                                                                   |
|-----------|-----------|-----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| off       | off       | off       | off       | The device has no power supply.                                                                                                                                                                               |
| lights up | off       | -         | -         | The ambient conditions, operating voltage and internal tests are within the valid range.                                                                                                                      |
| lights up | flashes   | -         | -         | Internal tests are outside the valid range.<br>Diag2 outputs a logic error code.<br>For more information, see the chapter <a href="#">Logic error codes</a> [► 57].                                           |
| off       | flashes   | -         | -         | Ambient conditions or electrical parameters are outside the valid range.<br>Diag2 outputs an environment error code.<br>For more information, see the chapter <a href="#">Environment error codes</a> [► 57]. |
| lights up | lights up | lights up | off       | There is a global shutdown on $\mu$ C1.                                                                                                                                                                       |
| lights up | lights up | off       | lights up | There is a global shutdown on $\mu$ C2.                                                                                                                                                                       |
| lights up | off       | lights up | off       | There is a global fault on $\mu$ C1.                                                                                                                                                                          |
| lights up | off       | off       | lights up | There is a global fault on $\mu$ C2.                                                                                                                                                                          |
| lights up | flickers  | -         | -         | There is an error in a safe input or output module.                                                                                                                                                           |

### 8.1.3 Logic error codes

- The error codes refer to the LED Diag2.
- LED Diag1 is on.

| Flash code | Description                                                  |
|------------|--------------------------------------------------------------|
| 1          | Function block error in one of the TwinSAFE groups           |
| 2          | Communication error in one of the TwinSAFE groups            |
| 3          | Error combination: Function block and communication          |
| 4          | General error in one of the TwinSAFE groups                  |
| 5          | Error combination: General and function block                |
| 6          | Error combination: General and communication                 |
| 7          | Error combination: General, function block and communication |

### 8.1.4 Environment error codes

- The error codes refer to LED Diag2.
- LED Diag1 is off.

| Flash code | Description                                                               |
|------------|---------------------------------------------------------------------------|
| 1          | Maximum supply voltage $\mu$ C1 exceeded                                  |
| 2          | Minimum supply voltage $\mu$ C1 undershot                                 |
| 3          | Maximum supply voltage $\mu$ C2 exceeded                                  |
| 4          | Minimum supply voltage $\mu$ C2 undershot                                 |
| 5          | Maximum internal temperature exceeded                                     |
| 6          | Minimum internal temperature undershot                                    |
| 7          | Permissible temperature difference between $\mu$ C1 and $\mu$ C2 exceeded |
| 8          | Not used                                                                  |
| 9          | Not used                                                                  |
| 10         | General error                                                             |

### 8.1.5 Flash codes



#### LED flashes

Intervals:

400 ms ON

400 ms OFF

1 second pause between the flashing codes



#### LED flickers

Intervals:

50 ms ON

50 ms OFF

## 8.2 Diagnosis History

The diagnostic history of the TwinSAFE devices that support this function is implemented in accordance with the ETG guideline ETG.1020 Chapter 13 "Diagnosis Handling". The diagnostic messages are saved by the TwinSAFE device in a dedicated CoE object under 0x10F3 and can be read out by the application or by TwinCAT.

Both the control entries and the history itself can be found in the CoE object 0x10F3. The entry Newest Message (0x10F3:02) contains the subindex of 0x10F3, which contains the latest diagnostic message, e.g. 0x06 for diagnostic message 1.

### Index 10F3<sub>hex</sub> Diagnosis History

| Index (hex) | Name                        | Meaning                                                                                                                               | Data type | Flags | Default                    |
|-------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|----------------------------|
| 10F3:0      | Diagnosis History           |                                                                                                                                       |           |       |                            |
| 10F3:01     | Maximum Messages            | Maximum number of stored messages. A maximum of 64 messages can be stored. After that the respective oldest messages are overwritten. | UINT8     | RO    | 0x40 (64 <sub>dec</sub> )  |
| 10F3:02     | Newest Message              | Subindex of the latest message                                                                                                        | UINT8     | RO    | 0x00 (0 <sub>dec</sub> )   |
| 10F3:03     | Newest Acknowledged Message | Subindex of the last confirmed message                                                                                                | UINT8     | RW    | 0x00 (0 <sub>dec</sub> )   |
| 10F3:04     | New Messages Available      | Indicates that a new message is available                                                                                             | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )   |
| 10F3:05     | Flags                       | Set via the startup list. If set to 0x0001, the diagnostic messages are additionally sent by emergency to the EtherCAT master         | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> ) |
| 10F3:06     | Diagnosis Message 001       | Diagnostic message 1                                                                                                                  | BYTE[32]  | RO    | {0}                        |
| ...         | ...                         | ...                                                                                                                                   | ...       | ...   | ...                        |
| 10F3:45     | Diagnosis Message 064       | Diagnostic message 64                                                                                                                 | BYTE[32]  | RO    | {0}                        |

### Structure of the diagnostic messages

- DiagCode (4 bytes) – in this case always 0x 0000 E000
- Flags (2 bytes) - diagnosis type (info, warning or error), timestamp and number of parameters contained (see the following table)
- Text ID (2 bytes) – ID of the diagnostic message as a reference to the message text from the ESI/XML
- Timestamp (8 bytes) – local slave time in ns since switching on the TwinSAFE device
- dynamic parameters (16 bytes) – parameters that can be inserted in the message text (see following table)

### Flags in diagnostic messages

| Data type | Offset       | Description                                                                                                                                                                                                                  |
|-----------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UINT16    | Bits 0 to 3  | DiagType (value)                                                                                                                                                                                                             |
|           |              | 0      Info message                                                                                                                                                                                                          |
|           |              | 1      Warning message                                                                                                                                                                                                       |
|           |              | 2      Error message                                                                                                                                                                                                         |
|           |              | 3... 15 reserved                                                                                                                                                                                                             |
|           | Bit 4        | If the bit = 1, the timestamp contained in the message is the local timestamp of the TwinSAFE device. The age of the diagnostic message can be deduced by calculation with the current timestamp from the CoE object 0x10F8. |
|           | Bits 5 to 7  | reserved                                                                                                                                                                                                                     |
|           | Bits 8 to 15 | Number of parameters in this diagnostic message                                                                                                                                                                              |

### Dynamic parameters in the diagnostic messages

| Type              | Data type                          | Description                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags parameter 1 | UINT16                             | Describes the type of parameter 1<br><div> <div>Bits 12 to 15 = 0</div> <div> Bits 0 to 11 = data type of parameter 1<br/> 0x0001 - BOOLEAN<br/> 0x0002 - INT8<br/> 0x0003 - INT16<br/> 0x0004 - INT32<br/> 0x0005 - UINT8<br/> 0x0006 - UINT16<br/> 0x0007 - UINT32<br/> 0x0008 - REAL32<br/> 0x0011 - REAL64<br/> 0x0015 - INT64<br/> 0x001B - UINT64<br/> Text parameters and formats are specified in ETG.2000. </div> </div> |
| Parameter 1       | Data type in accordance with flags | Value of parameter 1                                                                                                                                                                                                                                                                                                                                                                                                              |
| Flags parameter 2 | UINT16                             | see Flags parameter 1                                                                                                                                                                                                                                                                                                                                                                                                             |
| Parameter 2       | Data type in accordance with flags | Value of parameter 2                                                                                                                                                                                                                                                                                                                                                                                                              |
| ...               |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                   |

The diagnostic messages are saved in text form in the ESI/XML file belonging to the TwinSAFE device. On the basis of the Text ID contained in the diagnostic message, the corresponding plain text message can be found in the respective languages. The parameters can be inserted in the appropriate positions. In the following example, %x is used for a hexadecimal representation of the parameters.

|            |                                                                                        |
|------------|----------------------------------------------------------------------------------------|
| 620 #x6032 | MessageText                                                                            |
| = Lcid     | 1031                                                                                   |
| Abc Text   | SAFEOUT:The Feedback of the active Channel Switch is wrong. Module:0x%x / Channel:0x%x |

Fig. 23: ESI/XML message text

Via the entry *New Messages Available* the user receives information that new messages are available. The messages can be read out via CompleteAccess (a CoE read command for the complete CoE object 0x10F3). The *New Messages Available* bit is reset after reading the messages.

The sending of emergency messages to the EtherCAT master is activated by adding the CoE object 0x10F3:05 to the startup list (Transition IP, value 0x0001). If new diagnostic messages arrive, they are entered in object 0x10F3 and additionally sent by emergency to the EtherCAT master.

| General    | EtherCAT  | Process Data | Slots      | Startup | CoE - Online | Diag History | Online |
|------------|-----------|--------------|------------|---------|--------------|--------------|--------|
|            |           |              |            |         |              |              |        |
| Transition | Protocol  | Index        | Data       | Comment |              |              |        |
| IP         | CoE       | 0x10F3:05    | 0x0001 (1) |         |              |              |        |
| Move Up    | Move Down | New...       | Delete...  | Edit... |              |              |        |

Fig. 24: Startup list

## 8.3 Diag History tab

All errors occurring within the TwinSAFE components are stored in their diag history. The diag history can be viewed by selecting the corresponding TwinSAFE component in the I/O tree structure and then selecting the *Diag History* tab. Use the *Update History* button to fetch the current data from the TwinSAFE component. Errors within the logic, the function blocks, the connections or the component itself are stored with a corresponding time stamp.

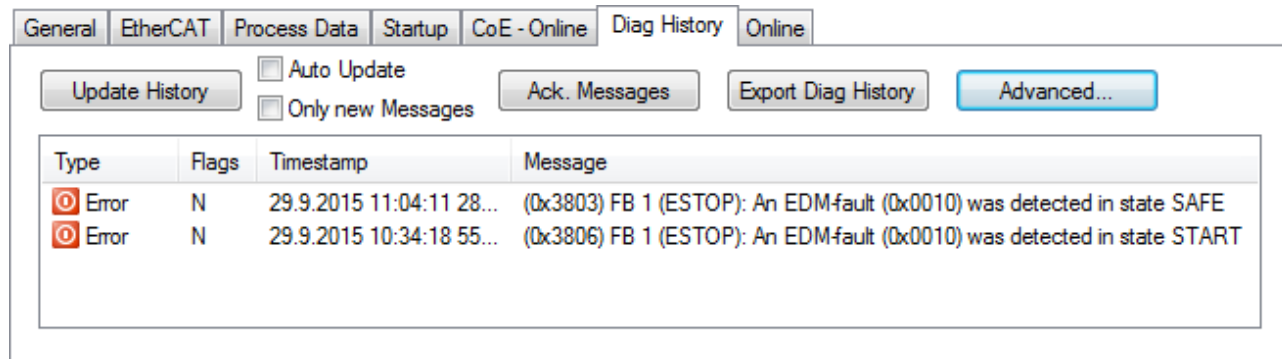


Fig. 25: Diag history

Use the *Advanced...* button to open the advanced settings. Here, the user can customize the behavior of the diag history.

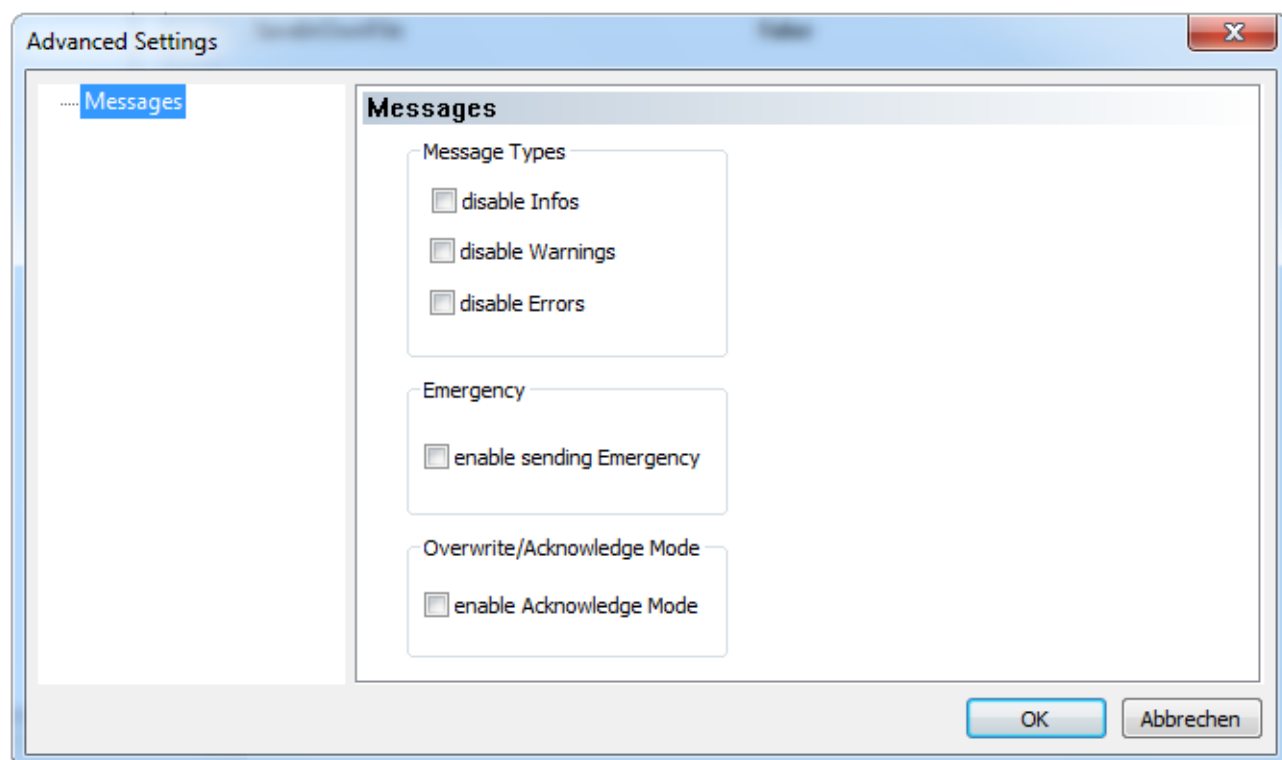


Fig. 26: Diag history – advanced settings

### Advanced Settings

| Setting       | Description                                                                                                                                                                                                                                                                                                                                                 |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Message Types | <ul style="list-style-type: none"> <li>• disable Info<br/>Messages with the <i>Info</i> status are not saved in the diag history</li> <li>• disable Warnings<br/>Messages with the <i>Warning</i> status are not saved in the diag history</li> <li>• disable Errors<br/>Messages with the <i>Error</i> status are not saved in the diag history</li> </ul> |

| Setting                      | Description                                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Emergency                    | In addition to saving the message in the diag history, an emergency object is also sent and displayed in the TwinCAT logger window. |
| Overwrite / Acknowledge Mode | This setting is currently not supported.                                                                                            |

## 9 Maintenance and cleaning



### Cleaning by the manufacturer only

Do not operate the TwinSAFE component if it is unacceptably dirty. Refer to the technical data for the protection class.

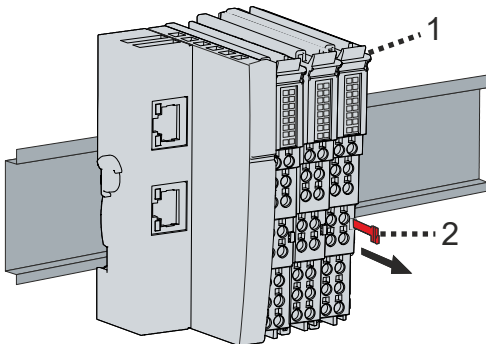
Send unacceptably dirty TwinSAFE component to the manufacturer for cleaning.

TwinSAFE components are basically maintenance-free.

### 9.1 Disassembly

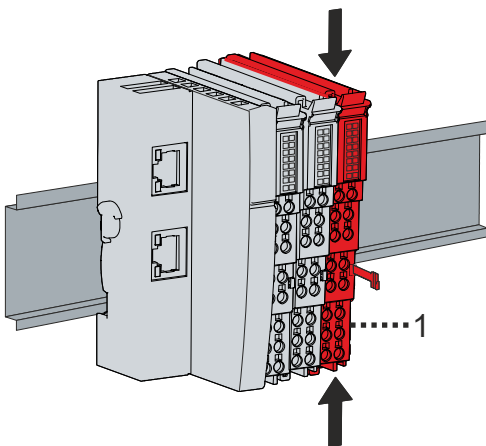
Each TwinSAFE component is secured by a lock on the mounting rail.

To remove the TwinSAFE component, release the lock as follows:

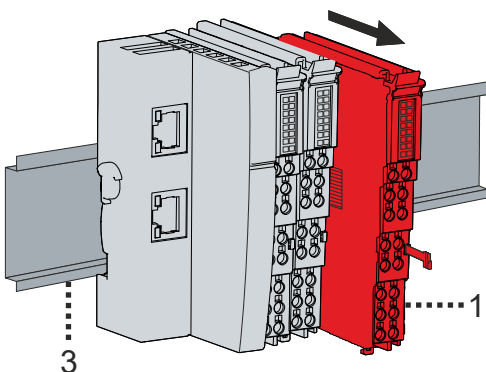


1. Pull the orange strap [2] approx. 1 cm out of the TwinSAFE component [1]

The mounting rail lock of the TwinSAFE component releases automatically.



2. Use your thumb and index finger to grip the unlocked TwinSAFE component [1] simultaneously at the top and bottom of the housing surfaces



3. Pull the TwinSAFE component [1] out of the bus terminal block from the mounting rail [3] with little effort

## 10 Decommissioning

### 10.1 Disposal

#### NOTICE

**Correct disposal**

Observe the applicable national laws and guidelines for disposal.

Incorrect disposal may result in environmental damage.

Remove the TwinSAFE component for disposal.

Depending on your application and the products used, make sure that the respective components are disposed of properly:

**Cast iron and metal**

Hand over cast iron and metal parts to scrap metal recycling.

**Cardboard, wood and polystyrene**

Dispose of packaging materials made of cardboard, wood or Styrofoam in accordance with regulations.

**Plastic and hard plastic**

You can recycle parts made of plastic and hard plastic via the waste management center or reuse them in accordance with the component regulations and markings.

**Oils and lubricants**

Dispose of oils and lubricants in separate containers. Hand over containers to the waste oil collection point.

**Batteries and accumulators**

Batteries and accumulators may also be marked with the crossed-out wheeled garbage can symbol. You must separate these components from waste. You are legally obliged to return used batteries and accumulators within the EU. Outside the validity of the EU Directive 2006/66/EC, observe the respective regulations.

#### 10.1.1 Returning to the vendor

In accordance with the WEEE-2012/19/EU directives, you can return used devices and accessories for professional disposal. The transport costs are borne by the sender.

Send the used devices with the note "For disposal" to:

Beckhoff Automation GmbH & Co. KG  
Gebäude „Service“  
Stahlstraße 31  
D-33415 Verl

In addition, you have the option to contact a local certified specialist company for the disposal of used electrical and electronic appliances. Dispose of the old components in accordance with the regulations applicable in your country.

# 11 Appendix

## 11.1 Volatility

If there are requirements concerning the volatility of products in your application, for example of the U.S. Department of Defense or similar authorities or security organizations, the following process applies:

The product has both volatile and non-volatile components. Volatile components lose their data immediately after removing power. Non-volatile components keep the data even after loss of power.

If there is customer specific data saved on the product, it cannot be ensured that this data might not be restored through for example forensic measures, even after the data is deleted through the provided tool chain. If this data is confidential, the scrapping of the product after usage is recommended to protect this data.

## 11.2 Focus of certificates

The most decisive document for certified components of the TwinSAFE department is the EC type examination certificate. The document contains both the test coverage and the regarded component and component family.

The current certificates of all TwinSAFE components with the underlying standards and directives can be found at <https://www.beckhoff.com/en-en/support/download-finder/certificates-approvals/>.

If the document refers only to the first four figures of a product (ELxxxx), the certificate is valid for all available variants of the component (ELxxxx-abcd). This is applicable for all components like EtherCAT Terminals, EtherCAT Boxes, EtherCAT plug-in modules and Bus Terminals.

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                   |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| CERTIFICADO ◆ CERTIFICADO ◆<br>СЕРТИФИКАТ ◆ |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                   |
|                                             | <h2>EC-Type Examination Certificate</h2> <p>No. M6A 062386 0055 Rev. 01</p>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                   |
|                                             | <b>Holder of Certificate:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Beckhoff Automation GmbH &amp; Co. KG</b><br>Hülshorstweg 20<br>33415 Verl<br>GERMANY          |
|                                             | <b>Product:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Safety components</b>                                                                          |
|                                             | <b>Model(s):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>EL1918</b>                                                                                     |
|                                             | <b>Parameters:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Supply voltage: 24VDC (-15%/+20%)<br>Ambient temperature: -25°C...+55°C<br>Protection class: IP20 |
|                                             | <p>This EC Type Examination Certificate is issued according to Article 12(3) b or 12(4) a of Council Directive 2006/42/EC relating to machinery. It confirms that the listed Annex-IV equipment complies with the principal protection requirements of the directive. It refers only to the sample submitted to TÜV SÜD Product Service GmbH for testing and certification. For details see: <a href="http://www.tuvsud.com/ps-cert">www.tuvsud.com/ps-cert</a></p> |                                                                                                   |
|                                             | <b>Test report no.:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             | BV99670C                                                                                          |

If you regard the example EL1918 in the picture, the certificate is valid for both the EL1918 and the available variant EL1918-2200.

## 11.3 Declarations of conformity and certificates

The EC Declaration of Conformity can be found under [EC Declaration of Conformity](#).

The UKCA Declaration of Conformity can be found at (website link to UKCA Declaration of Conformity).

Further certificates can be found under [EL1918 certificates](#).

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More Information:  
**[www.beckhoff.com/EL1918](http://www.beckhoff.com/EL1918)**

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