BECKHOFF New Automation Technology

Operating Manual | EN

EK1914

TwinSAFE Bus Coupler with 2 fail-safe inputs and 2 fail-safe outputs

2023-03-01 | Version: 2.0.0

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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

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH.

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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

1.2 Version numbers

Version	Comment
2.0.0	• Migration • Editorially revised • In chapter Technical data link to download page of certificates added • Appendix adapted and expanded
1.3.1	• Technical data permissible air pressure extended
1.3.0	• Note on the extended temperature range added to the technical data
1.2.0	• Reliability document updated • Safety parameters updated • Foreword revised
1.1.2	• Reliabililty document added • Chapter reaction times added
1.1.1	• Certificate updated
1.1.0	• Version numbers added • Company address changed • Description DateCode added • HFT and classification element added
1.0.1	• Certificate added
1.0.0	• First released version

Currentness

Please 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.de/twinsafe. In case of doubt, please contact Technical Support (see Beckhoff Support and Service [▶ 10]).

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 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.

1.4 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 in the operating instructions.

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

1.4.1 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.

1.4.1.1 Pictograms

In order to make it easier for you to find text passages, pictograms and signal words are used in warning notices:

⚠ DANGER

Failure to observe will result in serious or fatal injuries.

⚠ WARNING

Failure to observe may result in serious or fatal injuries.

⚠ CAUTION

Failure to observe may result in minor or moderate injuries.

NOTE

Notes

Notes are used for important information on the product. The possible consequences of failure to observe these include:

- Malfunctions of the product
- Damage to the product
- Damage to the environment

Information

This sign indicates information, tips and notes for dealing with the product or the software.

1.5 Beckhoff Support and Service

Support

Beckhoff Support offers technical advice on the use of individual Beckhoff products and system planning. The employees support you in the programming and commissioning of sophisticated automation systems.

Hotline:	+49 5246/963-157
E-mail:	support@beckhoff.com
Web:	www.beckhoff.com/support

Training

Training in Germany takes place in our training center at the Beckhoff headquarters in Verl, at subsidiaries or, by arrangement, at the customer's premises.

Hotline:	+49 5246/963-5000
E-mail:	training@beckhoff.com
Web:	www.beckhoff.com/training

Service

The Beckhoff Service Center supports you with after-sales services such as on-site service, repair service or spare parts service.

Hotline:	+49 5246/963-460
E-mail:	service@beckhoff.com
Web:	www.beckhoff.com/service

Download area

In the download area you can obtain product information, software updates, the TwinCAT automation software, documentation and much more.

Web:	www.beckhoff.com/download

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2 For your safety

2.1 Safety instructions

2.1.1 Before operation

Ensure traceability

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

Use in machines according to the Machinery Directive

Only use the TwinSAFE component in machines that comply with the Machinery Directive. This is how you ensure safe operation.

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 SELV/PELV power supply

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

2.1.2 In 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.

2.1.3 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 [▶ 56].

3 The Beckhoff EtherCAT Terminal system

The Beckhoff EtherCAT Terminal system is used for decentralized connection of sensors and actuators to a controller. The components of the Beckhoff EtherCAT Terminal system are mainly used in industrial automation and building management systems. As a minimum, a bus station consists of an EtherCAT Coupler and connected EtherCAT Terminals. The EtherCAT Coupler forms the communication interface to the higher-level controller, while the EtherCAT Terminals form the interface to the sensors and actuators. The whole bus station is clipped onto a 35 mm DIN mounting rail (EN 60715). The mechanical link of the bus station is established with a slot and key system on EtherCAT Couplers and EtherCAT Terminals.

The sensors and actuators are connected with the terminals via the screwless (spring-loaded) connection system.

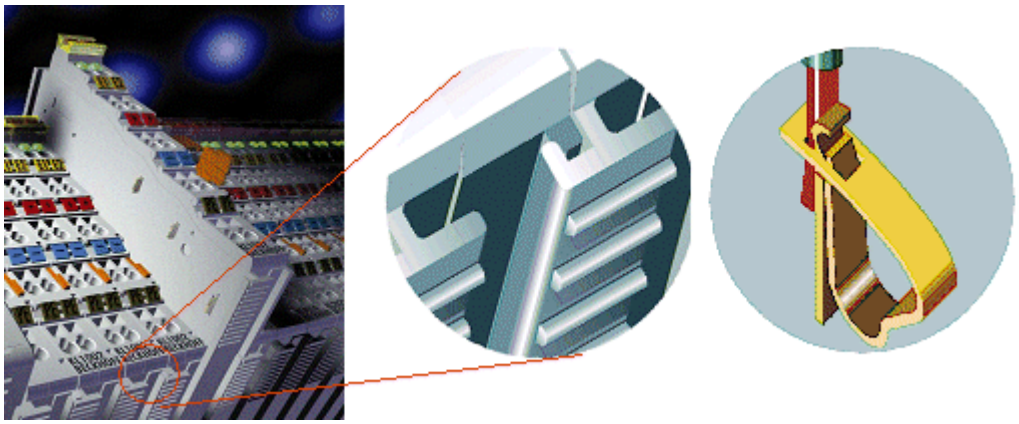


Fig. 1: Slot and key system and screwless (spring-loaded) connection system

3.1 EtherCAT Bus Coupler

Mechanical data	Bus Coupler
Material	polycarbonate, polyamide (PA6.6).
Dimensions (W x H x D)	44 mm x 100 mm x 68 mm
Mounting	on 35 mm mounting rail (EN 60715) with locking
Attachable by	double slot and key connection

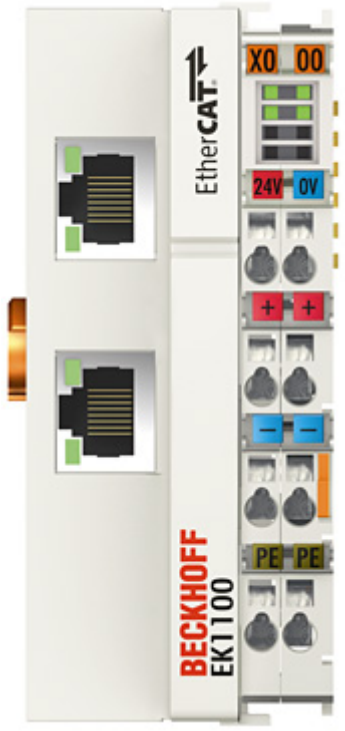


Fig. 2: Bus Coupler (EtherCAT)

Connection technology	Bus Coupler
Wiring	Spring-loaded system
Connection cross-section	0.08 mm² ... 2.5 mm², stranded wire, solid wire
Fieldbus connection	EtherCAT
Power contacts	3 spring contacts
Current load	10 A
Nominal voltage	24 V_{DC}

3.2 EtherCAT Terminals

Mechanical data	Bus Terminal
Material	polycarbonate, polyamide (PA6.6).
Dimensions (W x H x D)	12 mm x 100 mm x 68 mm or 24 mm x 100 mm x 68 mm
Mounting	on 35 mm mounting rail (EN 60715) with locking
Attachable by	double slot and key connection

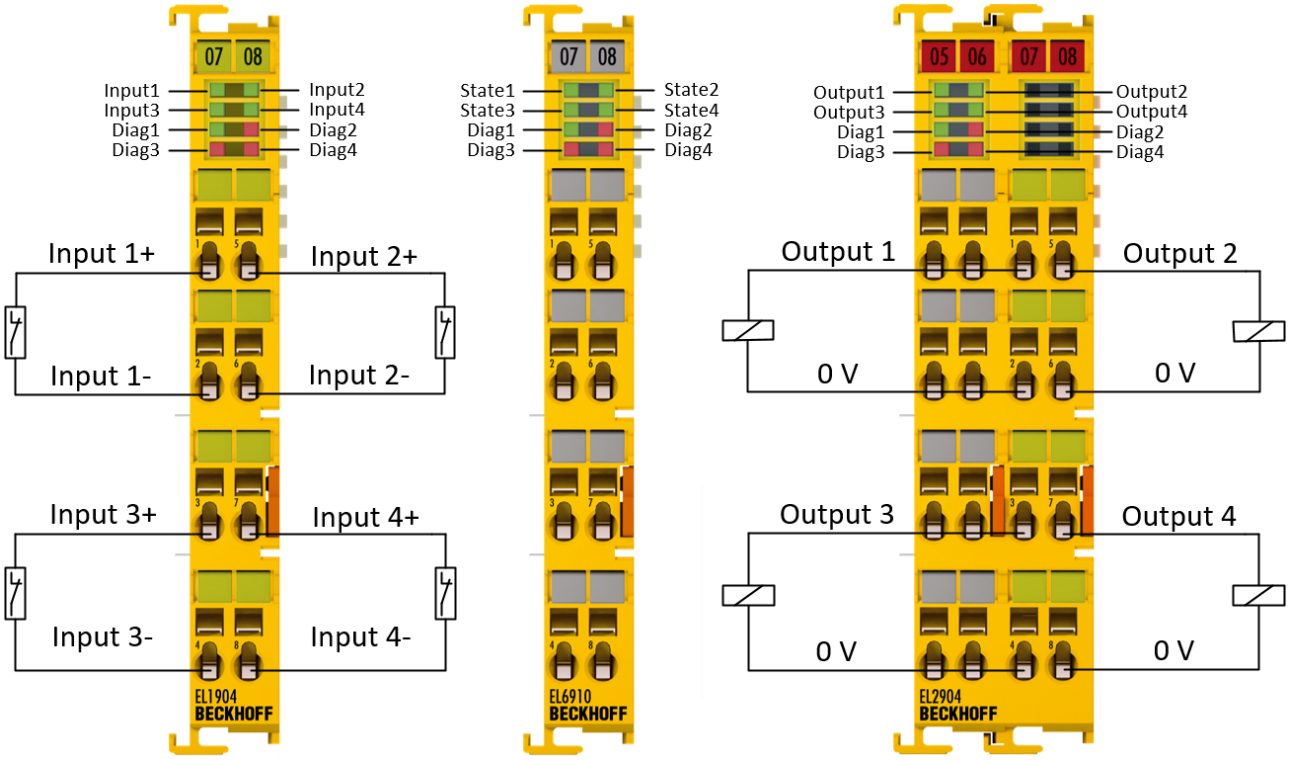


Fig. 3: Overview of EtherCAT Terminals

Connection technology	Bus Terminal
Wiring	Spring-loaded system
Connection cross-section	typically 0.08 mm² – 2.5 mm², stranded wire, solid wire
Communication	E-bus
Power contacts	Up to 3 blade/spring contacts
Current load	10 A
Nominal voltage	Depending on terminal type (typically 24 V_{DC})

3.3 E-bus

The E-bus is the data path within a terminal strip. The E-bus is led through from the Bus Coupler through all the terminals via six contacts on the terminals' side walls.

3.4 Power contacts

The operating voltage is passed on to following terminals via three power contacts. Terminal strip can be split into galvanically isolated groups by means of potential supply terminals as required. The supply terminals play no part in the control of the terminals, and can be inserted at any locations within the terminal strip.

4 System description TwinSAFE

4.1 Extension of the Beckhoff I/O system with safety functions

The TwinSAFE products from Beckhoff enable convenient expansion of the Beckhoff I/O system with safety components, and integration of all the cabling for the safety circuit within the existing fieldbus cable. Safe signals can be mixed with standard signals as required. The transfer of safety-related TwinSAFE telegrams is handled by the standard controller. Maintenance is simplified significantly thanks to faster diagnosis and simple replacement of components.

The following basic functionalities are included in the TwinSAFE components:
digital inputs (e.g. EL19xx, EP1908), digital outputs (e.g. EL29xx), drive components (e.g. AX5805) and logic units (e.g. EL6900, EL6910). For a large number of applications, the complete safety sensor and actuator technology can be wired on these components. The required logical link of the inputs and the outputs is handled by the EL69xx. In addition to Boolean operations, the EL6910 now also enables analog operations.

4.2 Safety concept

TwinSAFE: Safety and I/O technology in one system

- Extension of the familiar Beckhoff I/O system with TwinSAFE components
- Safe and non-safe components can be combined as required
- Logical link of the I/Os in the EL69xx TwinSAFE logic terminal
- Suitable for applications up to SIL 3 according to EN 61508:2010 and Cat 4, PL e according to DIN EN ISO 13849-1:2008
- Safety-relevant networking of machines via bus systems
- In the event of an error, all TwinSAFE components always switch to the wattless and therefore safe state
- No safety requirements for the higher-level standard TwinCAT system

Safety over EtherCAT protocol (FSoE)

- Transfer of safety-relevant data via any media (“genuine black channel”)
- TwinSAFE communication via fieldbus systems such as EtherCAT, Lightbus, PROFIBUS, PROFINET or Ethernet
- IEC 61508:2010 SIL 3 compliant
- FSoE is IEC standard (IEC 61784-3-12) and ETG standard (ETG.5100)

Fail-safe principle (fail stop)

The basic rule for a safety system such as TwinSAFE is that failure of a part, a system component or the overall system must never lead to a dangerous condition. The safe state is always the switched off and wattless state.

⚠ CAUTION

Safe state

For all TwinSAFE components the safe state is always the switched-off, wattless state.

5 Product description

5.1 General description

EK1914 - TwinSAFE Bus Coupler with two fail-safe inputs and two fail-safe outputs

The EK1914 is an EtherCAT Bus Coupler with 4 standard inputs, 4 standard outputs, and 2 fail-safe inputs and 2 fail-safe outputs.

The EK1914 fulfils the requirements of DIN EN ISO 13849-1:2008 (Cat 4, PL e).

The TwinSAFE Bus Coupler has the usual design of an EtherCAT coupler.

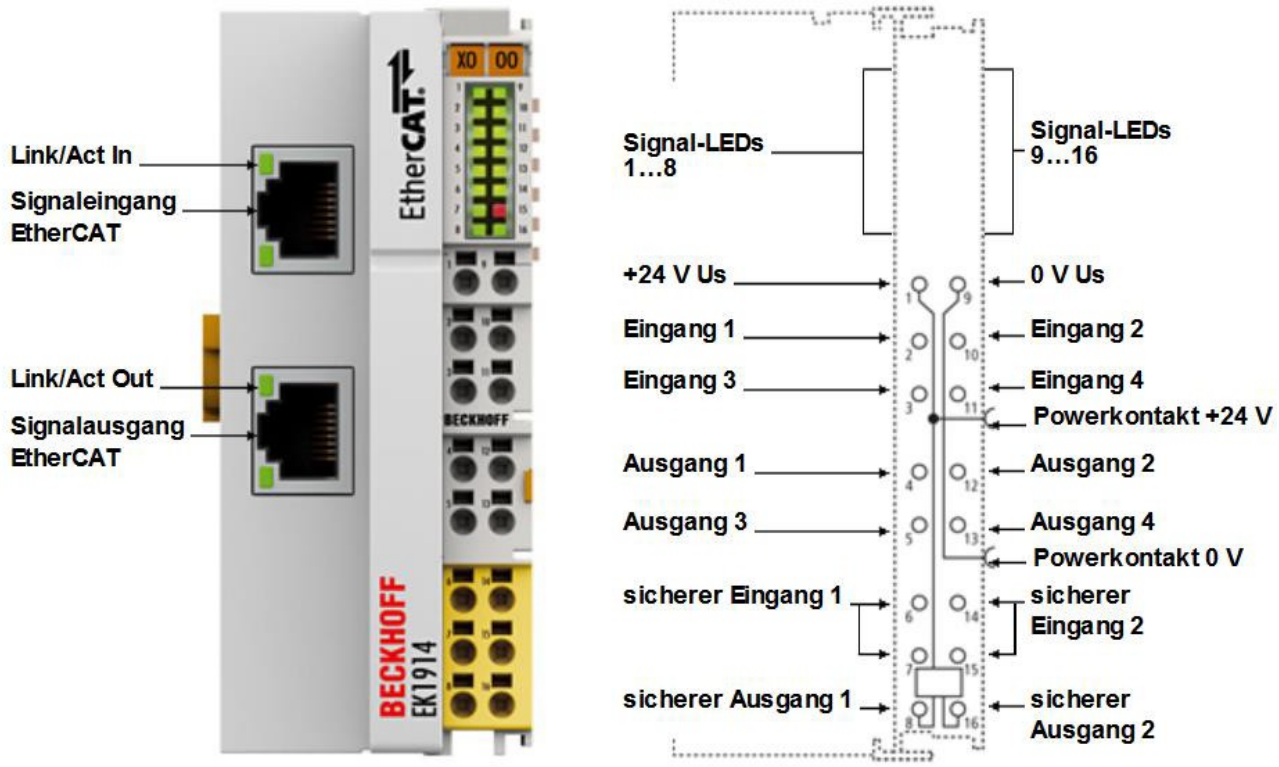


Fig. 4: EK1914 overview

5.2 Intended use

⚠ WARNING

Caution - Risk of injury!

The TwinSAFE compact controller may only be used for the purposes described below!

The EK1914 TwinSAFE Bus Coupler expands the application area of the Beckhoff Bus Terminal system by functions that enable it to be used in the field of machine safety as well. The TwinSAFE Bus Coupler is designed for machine safety functions and directly associated industrial automation tasks. They are therefore only approved for applications with a defined fail-safe state. This safe state is the wattless state. Fail-safety according to the relevant standards is required.

The TwinSAFE Bus Coupler permits the connection of

- 24 VDC sensors such as
  emergency off push-button switches, rope pull switches, position switches, two-hand switches, safety switching mats, light curtains, light barriers, laser scanner, etc.
- 24 VDC actuators such as
  contactors, protective door switches with tumbler, signal lamps, servo drives, etc.

NOTE

Test pulses

When selecting actuators, please ensure that the EK1914 test pulses do not lead to actuator switching or a diagnostic message from the EK1914.

This module is suitable for operation in an EtherCAT network and can be extended by EtherCAT Terminals of the type ELxxxx.

⚠ CAUTION

Follow the machinery directive

The TwinSAFE Bus Coupler may only be used in machines in accordance with the machinery directive.

⚠ CAUTION

Ensure traceability

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

5.3 Technical 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/.

Data		Comment
• Task within the EtherCAT system	Coupling of EtherCAT Terminals (ELxxxx) to 100BASE-TX EtherCAT networks	
• Protocol / Baud rate	EtherCAT Device Protocol / 100 MBaud	
• Cable length between two Bus Couplers	max. 100 m	100BASE-TX
• Transmission medium	at least Ethernet CAT-5 cable	
• Bus connection	2 x RJ45	
• Supply voltage for the EK1914 (PELV)	24 V_{DC} (–15% / +20%)	
• Number of standard inputs	4	
• Number of standard outputs	4	
• Number of safe inputs	2	
• Number of safe outputs	2	
• Status display	16 LEDs	
• Reaction time	typical: 4 ms, max.: see error reaction time	Read input/write to E-bus
• Error reaction time	≤ watchdog time	
• Signal voltage “0”, standard inputs	-3 V - 5 V	EN 61131-2, type 1/3
• Signal voltage “1”, standard inputs	11 V - 30 V	EN 61131-2, type 3
• Input filter of standard inputs	500 µs	
• Input current of standard inputs	typical 3 mA	EN 61131-2, type 3
• Output current per standard output	max. 0,5A	
• Output current of the clock outputs	typical 10 mA, max. 15 mA	
• Output current per safe output	max. 500 mA, min. 20 mA	
• Actuators	When selecting actuators please ensure that the test pulses from the safe outputs do not lead to actuator switching	
• Cable length between sensor/ actuator and Bus Coupler — unshielded	max. 100 m (at 0,75 or 1 mm²)	
• Cable length between sensor/ actuator and Bus Coupler — shielded	max. 100 m (at 0,75 or 1 mm²)	
• Input process image	8 byte	
• Output process image	8 byte	
• E-bus power supply (5 V)	max. 500 mA	In case of higher current consumption, use additional EL9410 power feed terminals.
• Power contacts (PELV)	max. 24V_{DC}, max. 4A	

Data		Comment
• Current consumption	typical 72 mA	Excluding current consumption of the sensors/actuators and further terminals on the E-bus.
• Power loss of the Bus Coupler	typical 1,8 W	Without connected sensors/actuators
• Electrical isolation channels	No	Between the channels
• Electrical isolation E-bus	No	Between the channels and the E-bus
• Electrical isolation EtherCAT	Yes	Between the EtherCAT connections and the channels/E-bus
• Insulation voltage	Insulation tested with 500 V_{DC}	Between the EtherCAT connections and the channels/E-bus, under common operating conditions
• Dimensions (W x H x D)	approx. 44 mm x 100 mm x 68 mm	For further information see Dimensions [▶ 23].
• Weight	approx. 123 g	

5.4 Safety parameters

Safety parameters		Comment
Lifetime	20 a	
Prooftest-Intervall	/	Special proof tests during the entire service life of the TwinSAFE Bus Coupler are not required.
PFH_D	2,64E-09	
%SIL3	2,64%	
PFD	3,92E-05	
%SIL3	3,92%	
$MTTF_D$	High	
DC	High	
SFF	>99 %	
Performance Level	e	
Category	4	
HFT	1	
Element classification	Typ B	According to EN 61508-2:2010 chapter 7.4.4.1.2 and 7.4.4.1.3.

The TwinSAFE Bus Coupler can be used for safety-related applications within the meaning of EN ISO 13849-1 up to PL e (Cat4).

To calculate or estimate the MTTFd value out of the PFHD value please refer to the Application Guide TwinSAFE or to the ISO 13849-1:2015 table K.1.

5.5 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 (which exceeds the level of natural ambient radiation)
- in a corrosive environment
- in an environment that leads to inadmissible contamination of the TwinSAFE component.

Permissible requirements for the environment		Explanation
Umweltbedingungen		
• Permissible ambient temperature (operation) up to HW05	0°C to +55°C	
• Permissible ambient temperature (operation) from HW06	-25°C to +55°C	
• Permissible ambient temperature (transport/storage)	-25°C to +70°C	
• Permissible air humidity	5% to 95%, non-condensing	
• Permissible air pressure (operation/ storage/transport)	750 hPa to 1100 hPa	This corresponds to a height of approx. -690 m to 2450 m over sea level assuming an international standard atmosphere.
• Climate category	3K3	According to EN 60721-3-3:1995/ A2:1997. The deviation from 3K3 is possible only with optimal environmental conditions and also applies only to the technical data which are specified differently in this documentation.
• Pollution degree	2	comply with the chapter Maintenance and cleaning [▶ 55].
• EMC immunity/emission	According to EN 61000-6-2 / EN 61000-6-4	
• Vibration/shock resistance	According to EN 60068-2-6 / EN 60068-2-27	
• Shocks	15 g with pulse duration 11 ms in all three axes	
• Protection class	IP20	
• Permitted operating environment	In the control cabinet or terminal box, with minimum protection class IP54 according to IEC 60529	
• Correct installation position	See chapter Installation position and minimum distances [▶ 26].	

5.6 Dimensions

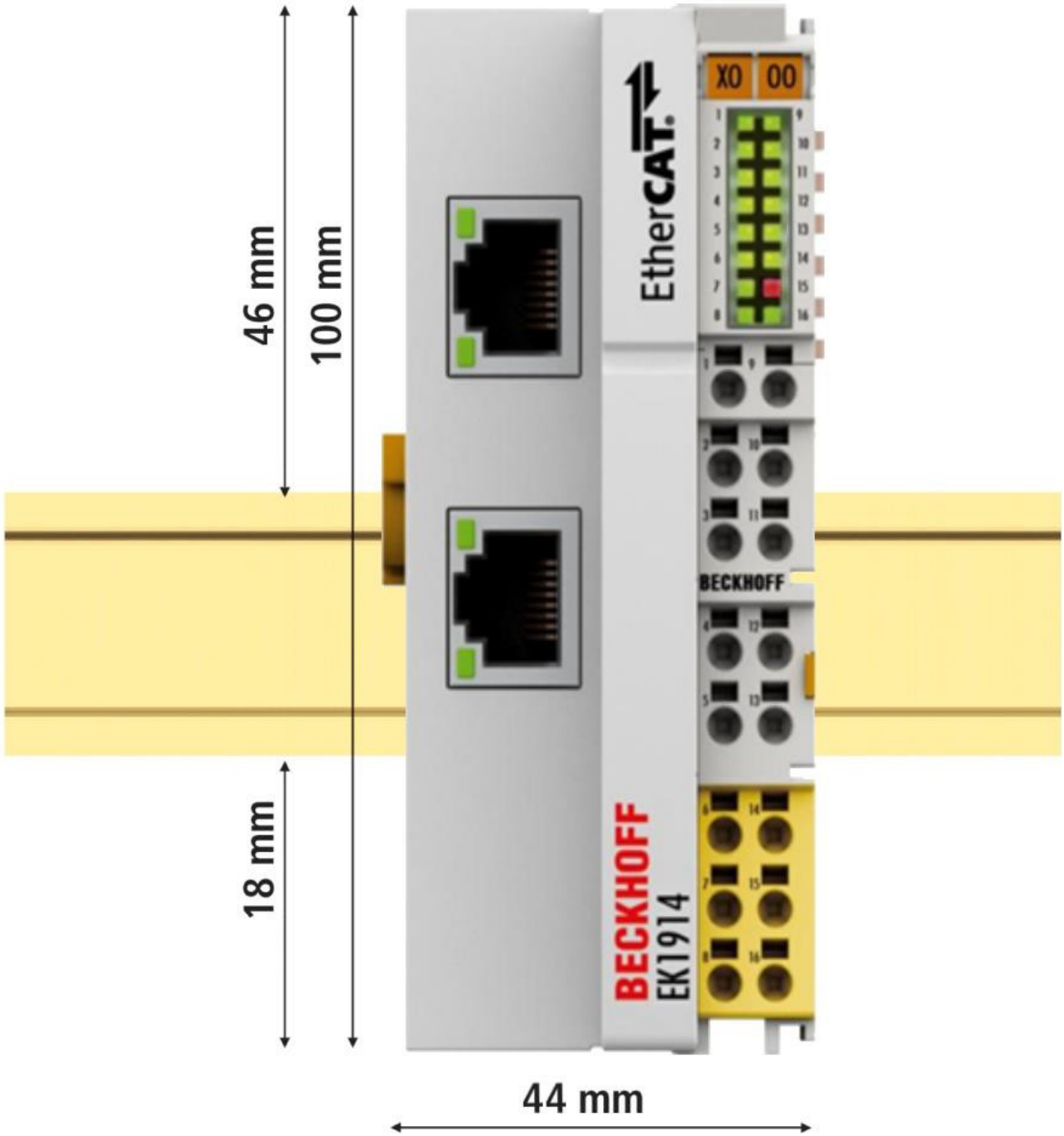


Fig. 5: Dimensions

Width: 44 mm

Height: 100 mm

Depth: 68 mm

6 Transport and storage

⚠ WARNING

Observe specified environmental conditions

Ensure that the digital TwinSAFE components are only transported and stored under the specified environment conditions. The environmental conditions can be found in chapter Environmental conditions [▶ 22].

Incorrect transport or storage can damage the TwinSAFE components.

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

You have the option of storing the TwinSAFE component for a short or longer period. Observe the conditions from chapter Environmental conditions [▶ 22].

Checking the seal for damage

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 [▶ 10].

7 Installation

7.1 Safety instructions

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

7.2 Transport / storage

For transport and storage of the TwinSAFE components, use the original packaging in which the components were delivered.

⚠ CAUTION

Note 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 technical data.

Incorrect transport or storage can damage the TwinSAFE components. Never use damaged TwinSAFE components. Dispose of the affected product.

7.3 Mechanical installation

⚠ WARNING

Only work on TwinSAFE components when they are de-energized

The Bus Terminal system is live. Set the Bus Terminal system to a safe, de-energized state before you start mounting, dismounting or wiring the TwinSAFE components.

If you work on the TwinSAFE components while the Bus Terminal system is live, you may be injured by electric shock. In addition, the device may be damaged.

7.3.1 Control cabinet / terminal box

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

7.3.2 Installation position and minimum distances

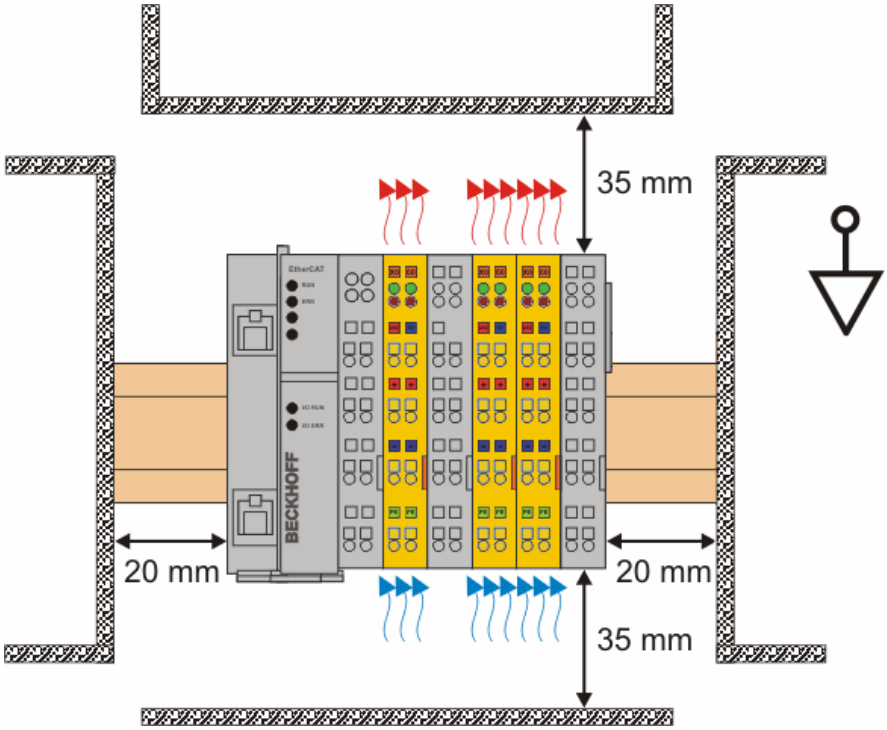


Fig. 6: Installation position and minimum distances

Mount the mounting rail horizontally for the specified installation position. The connection surfaces of the EL terminals or KL terminals must face forwards. This can be seen from the illustration.

The components are ventilated from bottom to top, which enables optimum cooling of the electronics by convection ventilation. The direction specification "down" corresponds to the direction of the positive acceleration due to gravity.

NOTE

Observe minimum distances

Maintain the distances to neighboring devices and control cabinet walls specified in the figure. This is the only way to ensure optimum convection cooling.

If sufficient convection cooling is not ensured, the devices may overheat and be damaged.

7.3.3 Installation on mounting rails

⚠ WARNING

Only work on TwinSAFE components when they are de-energized

The Bus Terminal system is live. Set the Bus Terminal system to a safe, de-energized state before you start mounting, dismounting or wiring the TwinSAFE components.

If you work on the TwinSAFE components while the Bus Terminal system is live, you may be injured by electric shock. In addition, the device may be damaged.

Assembly

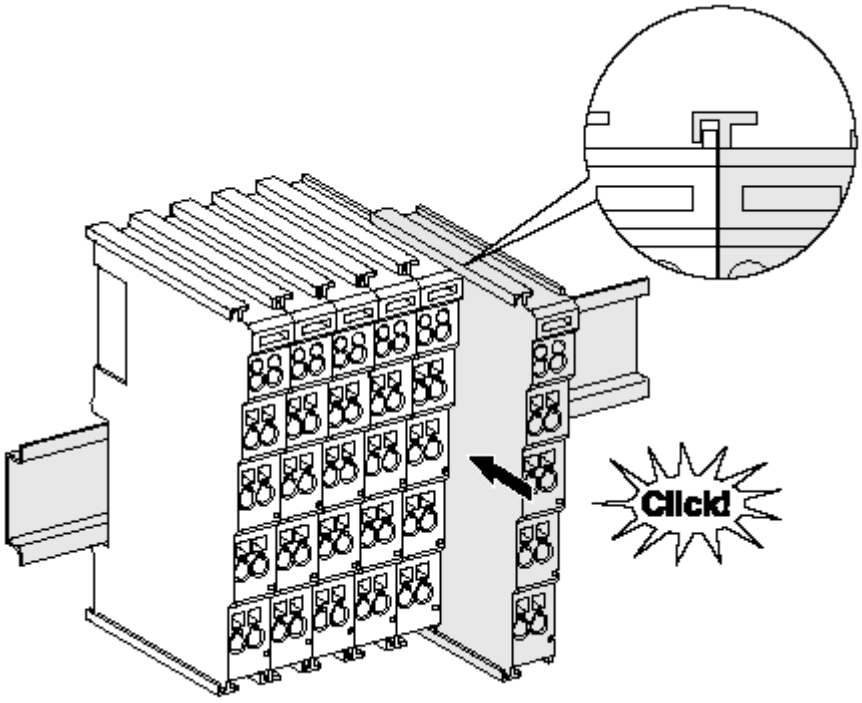


Fig. 7: Installation on the mounting rail

The EtherCAT Couplers and TwinSAFE Terminals are snapped onto standard 35 mm mounting rails by applying slight pressure. The mounting rails are top-hat rails according to EN 60715. Mount the components in the following sequence:

1. Plug the EtherCAT coupler onto the mounting rail.
2. Plug the TwinSAFE terminals together with tongue and groove.
3. ush the TwinSAFE terminals against the mounting rail until the latch audibly engages on the mounting rail.

Ensure functional component connection

Adhere to the described assembly sequence. First plug the TwinSAFE terminals together with tongue and groove. Only push the TwinSAFE terminals onto the mounting rail after they have been plugged together.

If you first snap the TwinSAFE terminals onto the mounting rail and then push them next to each other without the tongue and groove interlocking, no functional connection will be established. When correctly mounted, no significant gap should be visible between the housings.

Use suitable mounting rail fastening

The locking mechanism of the TwinSAFE terminals and the EtherCAT Coupler extends into the profile of the mounting rail. When mounting the components, ensure that the locking mechanism does not come into conflict with the mounting screws of the mounting rail. Use flat mounting connections such as countersunk screws or blind rivets to fasten mounting rails with a height of 7.5 mm under the terminals and couplers.

Disassembly

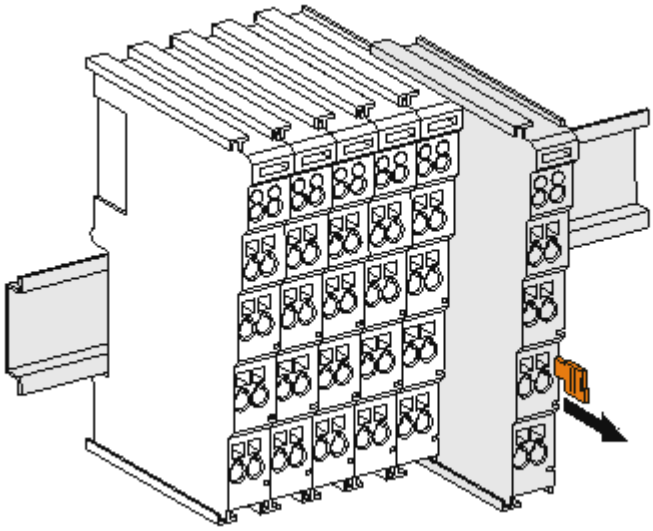


Fig. 8: Removal from mounting rail

Each TwinSAFE terminal is secured on the mounting rail by a latch. For disassembly, the locking of the TwinSAFE terminals must be released as follows:

4. Pull the TwinSAFE terminal down approx. 1 cm from the mounting rail by the orange-colored tab. The mounting rail lock of the TwinSAFE terminal is released automatically.
5. Grip the unlocked TwinSAFE terminal simultaneously at the top and bottom of the housing surfaces with thumb and index finger.
6. Pull the TwinSAFE terminal out of the Bus Terminal block with little force.

7.4 Electrical installation

7.4.1 Connections within a Bus Terminal block

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

Spring contacts (E-bus)

The 6 spring contacts of the E-bus take over the transmission of the data and the supply of the bus terminal electronics.

NOTE

Observe E-bus current

Observe the maximum current that your EtherCAT coupler can supply for E-bus supply! 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 E-bus supply.

Power contacts

The power contacts transmit 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.

Observe contact assignments of the power contacts

When configuring a Bus Terminal block, note the contact assignments of the individual TwinSAFE terminals, since some types do not loop through the power contacts, or not completely. This may be the case, for example, with analog Bus Terminals or digital 4-channel Bus Terminals.

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.

PE power contact

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

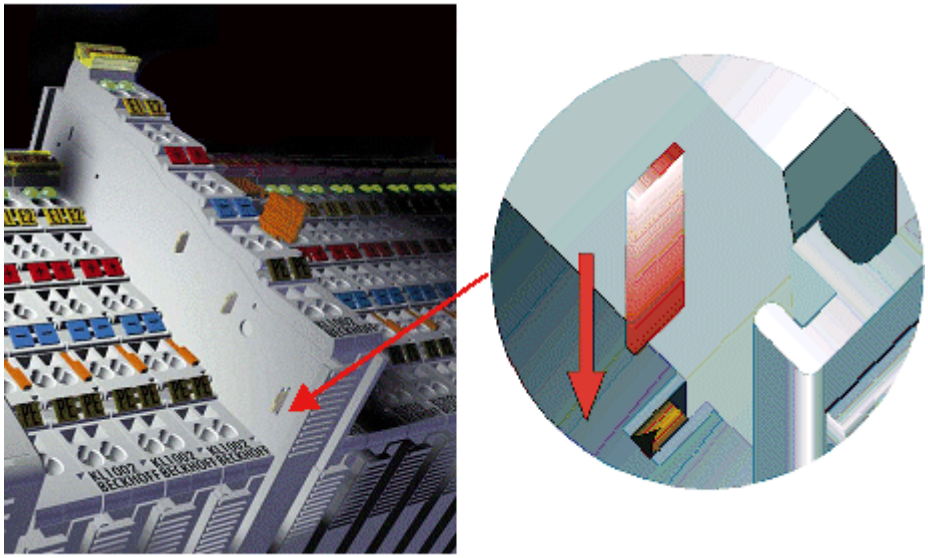


Fig. 9: PE power contact

⚠ DANGER

Serious risk of injury

Never use the PE power contact for other potentials.

⚠ CAUTION

Disconnect PE supply line for insulation test

For insulation testing disconnect the PE feed line at the EtherCAT coupler or the power terminal. In order to decouple further supply points for the test, you can unlock these supply terminals and pull them at least 10 mm out of the interconnection of the other terminals.

Note that for EMC reasons the PE contacts are capacitively connected to the mounting rail. This can lead to incorrect results during insulation testing and also to damage to the TwinSAFE component.

7.4.2 Overvoltage protection

Provide a surge filter against overvoltage for the supply voltage of the Bus Terminal block and the TwinSAFE components, if protection against overvoltages is required in your system.

7.4.3 HD housing wiring

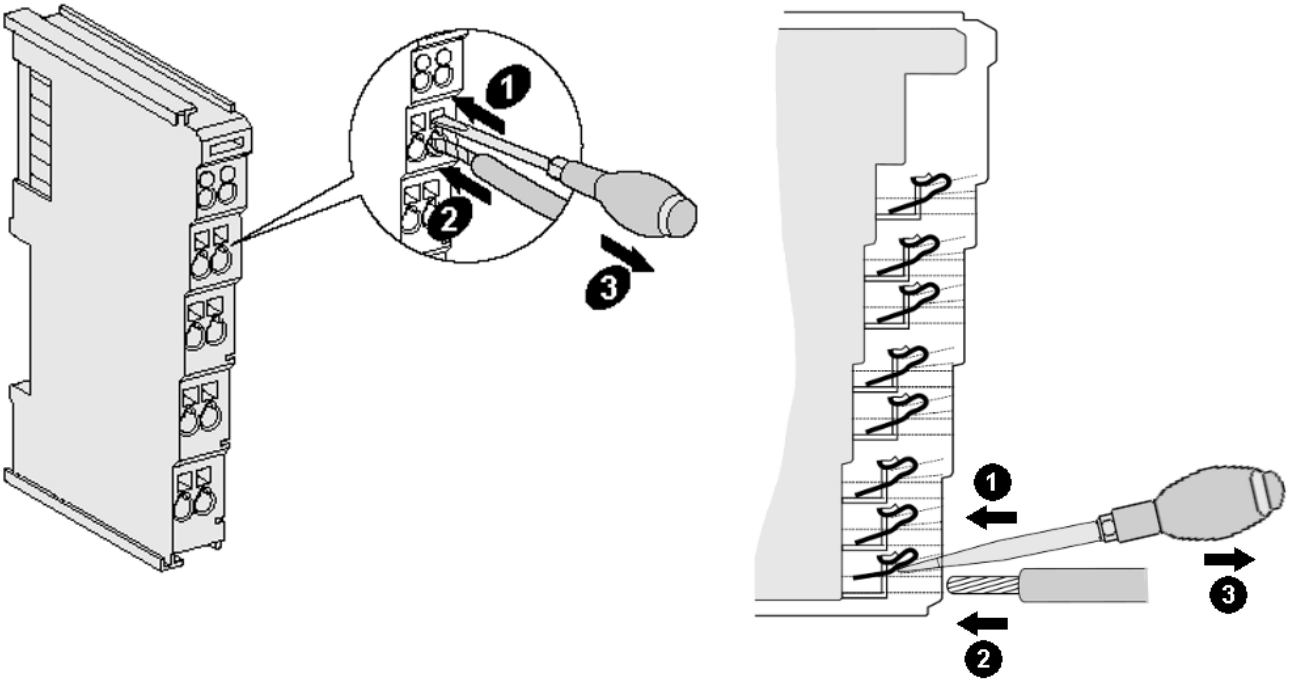


Fig. 10: Connection of a cable to a terminal point

Up to 16 terminal points enable the connection of solid or finely stranded wires to the EtherCAT Terminal. The terminal points are spring-loaded.

Several conductors at one connection

If it is necessary to connect several conductors to one connection, pre-connect them with terminal blocks, for example.

Solid and stranded wire conductors with ferrules can be inserted directly into the terminal point. This eliminates steps 1 and 3 in the above illustration. For all other conductor types, the terminal point must be opened with a screwdriver to establish the connection.

Connect the cables as follows:

1. Open a terminal point by pushing a screwdriver straight into the square opening above the terminal point as far as it will go. Do not turn or move the screwdriver back and forth (do not lever)
2. The wire can now be inserted into the round terminal opening without any force.
3. The terminal closes automatically when the pressure is released, holding the wire safely and permanently.

7.4.4 High Density terminals

Fig. 11: HD terminals

The ELx8xx / KLx8xx series Bus Terminals, like the EK1914 with 16 connection points, are characterized by a particularly compact design, since the packing density on 12 mm is twice that of standard Bus Terminals. Solid conductors equipped with a wire end ferrule can be plugged directly into the spring terminal point without tools.

Ultrasonic strand-compressed conductors

Ultrasonic stranded (ultrasonically welded) conductors can also be connected to the standard and high-density (HD) terminals.

Please refer to the following table for the conductor cross-section.

7.4.5 Wire cross sections (HD)

With the HD Terminals or Bus Couplers the wires are connected without tools in the case of solid wires using the direct plug-in technique, for example the wire is simply inserted into the contact point after stripping the insulation. The cables are released, as in the case of the standard terminals, using the contact release with the aid of a screwdriver. The permissible conductor cross-sections can be taken from the following table.

Terminal housing	EK1914
Wire cross-section (core wire with wire end sleeve)	0,14 - 0,75 mm^2
Wire cross-section (solid)	0,08 - 1,5 mm^2
Wire cross-section (fine-wire)	0,25 - 1,5 mm^2
Wire cross-section (Ultrasonically "bonded")	1,5 mm^2 only
Strip length	8 - 9 mm

7.4.6 Pin assignment

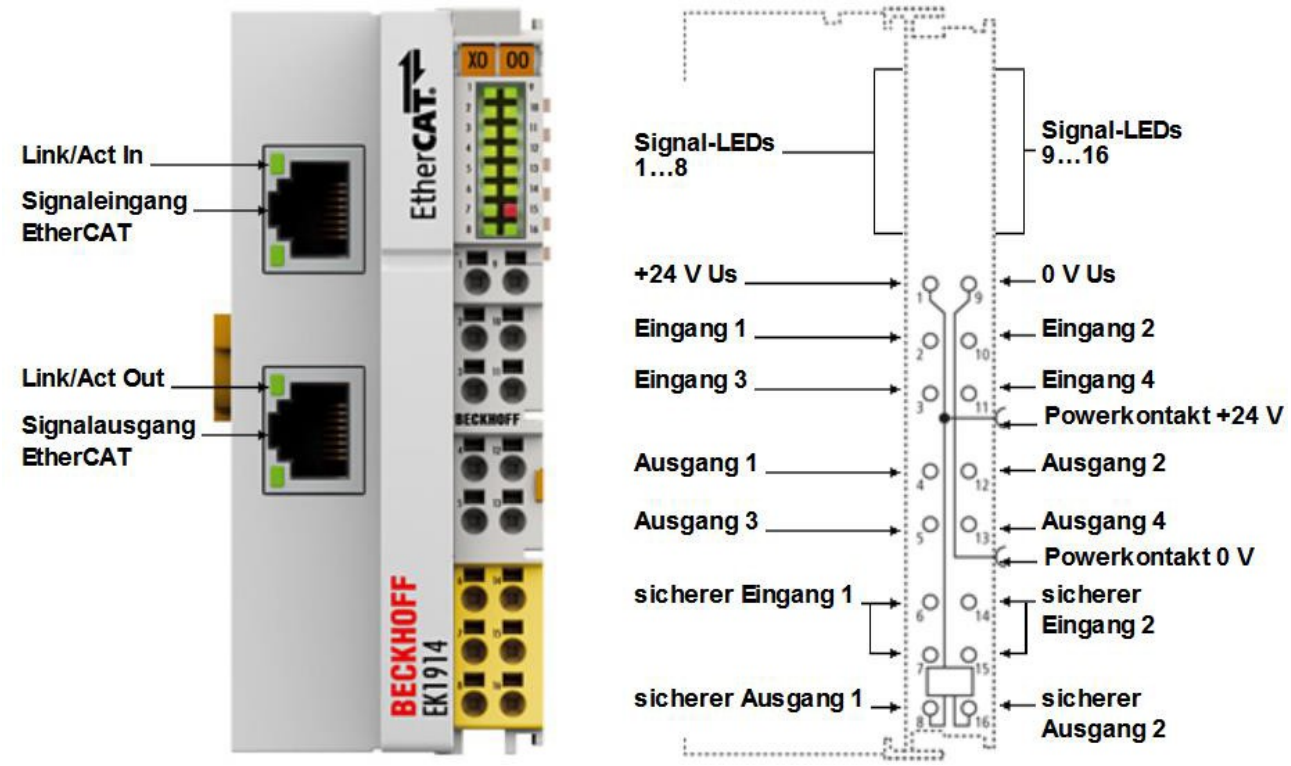


Fig. 12: Pin assignment of the EK1914

Terminalpoint	Signal	Description
1	+24V	Supply Voltage Us
2	In1	Standard input 1
3	In3	Standard input 3
4	Out 1	Standard output 1
5	Out 3	Standard output 3
6	Safe In1	Clock output safe input 1
7		Safe input 1
8	Safe Out 1	Safe output 1
9	0V	Supply Voltage Us
10	In2	Standard input 2
11	In4	Standard input 4
12	Out 2	Standard output 2
13	Out 4	Standard output 4
14	Safe In2	Clock output safe input 2
15		Safe input 2
16	Safe Out 2	Safe output 2

Configurable safe inputs

The safe inputs 1 and 2 can be optionally assigned with normally closed contacts or normally open contacts. The corresponding evaluation takes place in the safety PLC.

NOTE

Test pulses of the safe outputs

When selecting the actuators, ensure that the test pulses of the EK1914 do not lead to switching of the actuator or a diagnostic message of the EK1914.

7.4.6.1 Permitted cable length - inputs

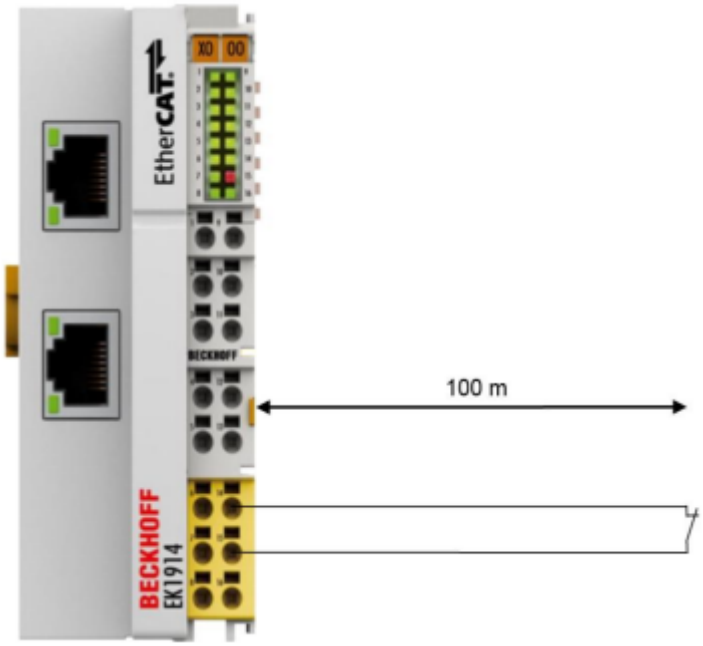


Fig. 13: Cable length input

When connecting a single switching contact via its own continuous cabling (or via a non-metallic sheathed cable), the maximum permitted cable length is 100 m.

NOTE

Route the signal cable separately

Route signal cable separately from potential sources of interference. Possible sources of interference are, for example, motor supply cables or power cables with 230 V_{AC}. Keep the distance between the cables as large as possible.

Interference from cables routed in parallel can influence the signal shape of the test pulses and thus cause diagnostic messages. Possible diagnostic messages are, for example, sensor errors.

The following illustrations show correct and incorrect signal routing. Observe the illustration legend.

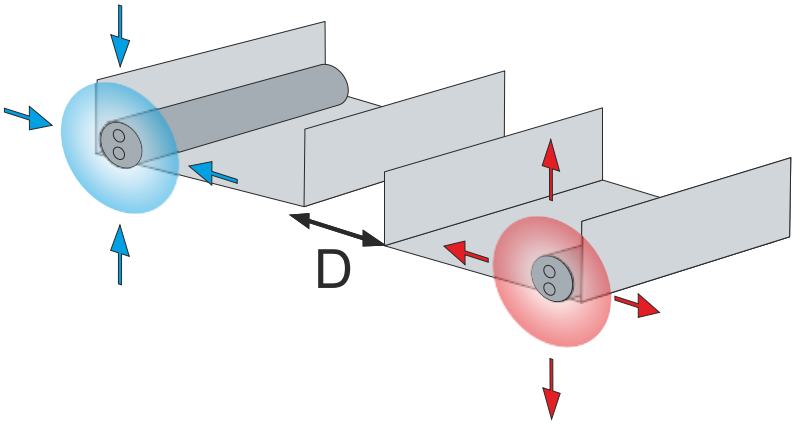


Fig. 14: Route signal lines correctly

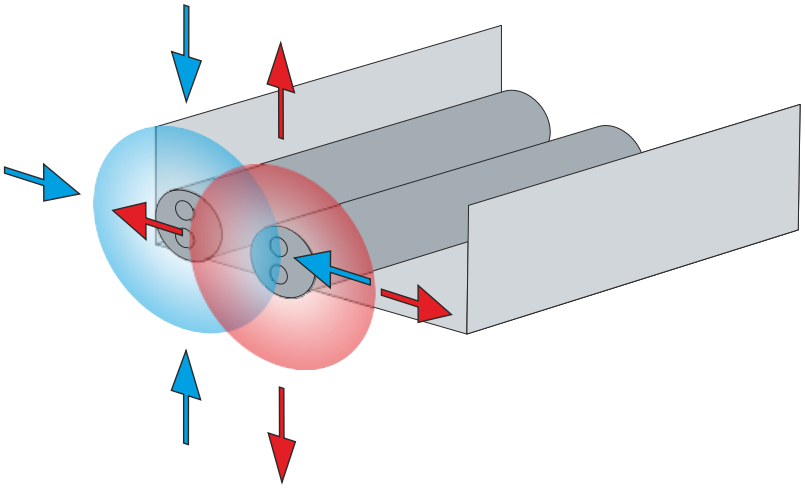


Fig. 15: Route signal lines incorrectly

Illustration legend	
D	Distance between cable ducts
Blue arrows	Signature lines
Red arrows	Potential sources of interference

A common signal routing with other clocked signals in a bus also reduces the maximum extension. The reason for this is that crosstalk of the signals may occur on a long line length and diagnostic messages appear. If the connection via a bus line is unavoidable, the test pulses can be switched off (Sensor test parameter). However, this then leads to a reduction in the diagnostic coverage when calculating the performance level.
The use of contact points, connectors or additional switching contacts in the cabling also reduces the maximum expansion.

The typical length of a test pulse (switching from 24 V to 0 V and back to 24 V) is approximately 380 µs and occurs about 400 times per second.
In the step mat mode (parameter: "Short cut is no module fault"), test pulses with a typical length of 750 µs are generated in addition to the typical test pulse lengths of 380 µs.

7.4.6.2 Permitted cable length - outputs

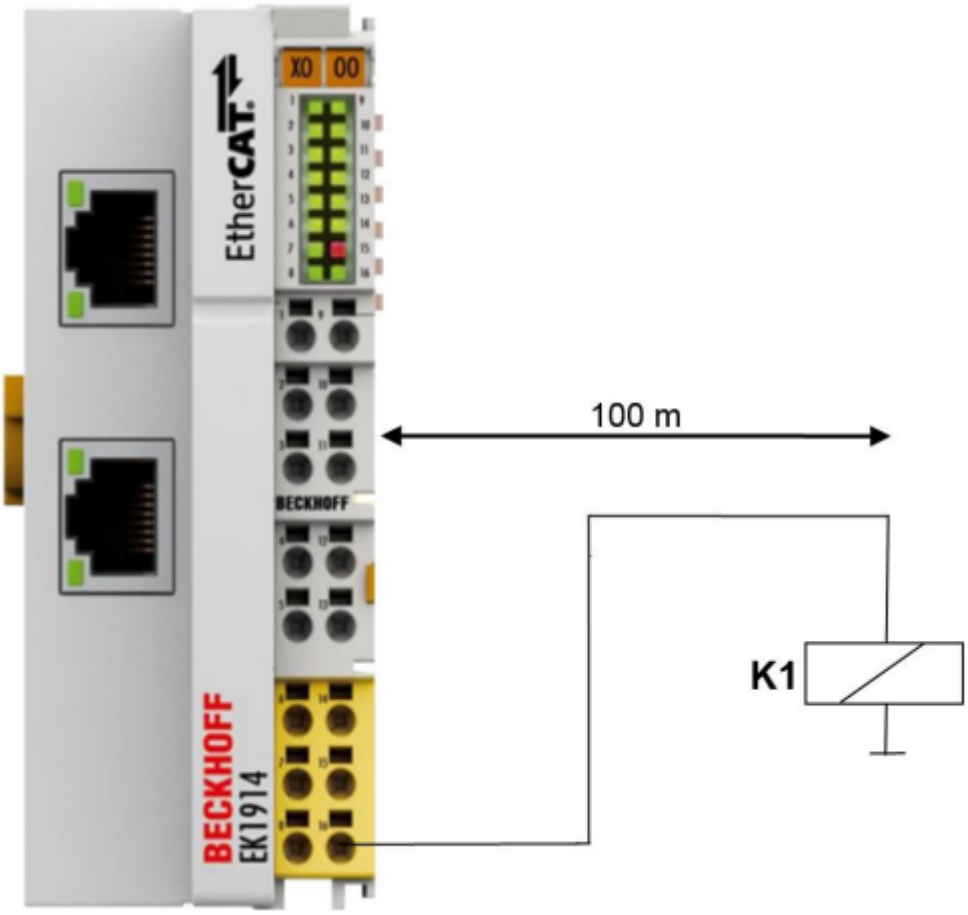


Fig. 16: Cable length output

When connecting a single actuator via its own continuous cabling (or via a sheathed cable), the maximum permitted cable length is 100 m.

NOTE

Route the signal cable separately

Route signal cable separately from potential sources of interference. Possible sources of interference are, for example, motor supply cables or power cables with 230 V_{AC}. Keep the distance between the cables as large as possible.

Interference from cables routed in parallel can influence the signal shape of the test pulses and thus cause diagnostic messages. Possible diagnostic messages are, for example, sensor errors.

The following illustrations show correct and incorrect signal routing. Observe the illustration legend.

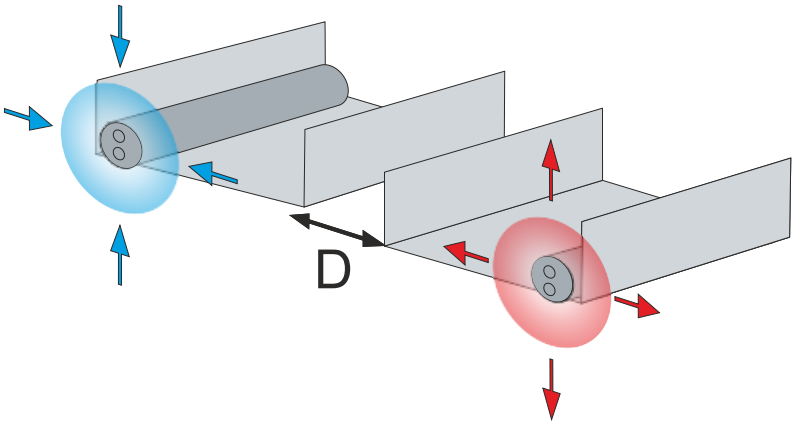


Fig. 17: Route signal lines correctly

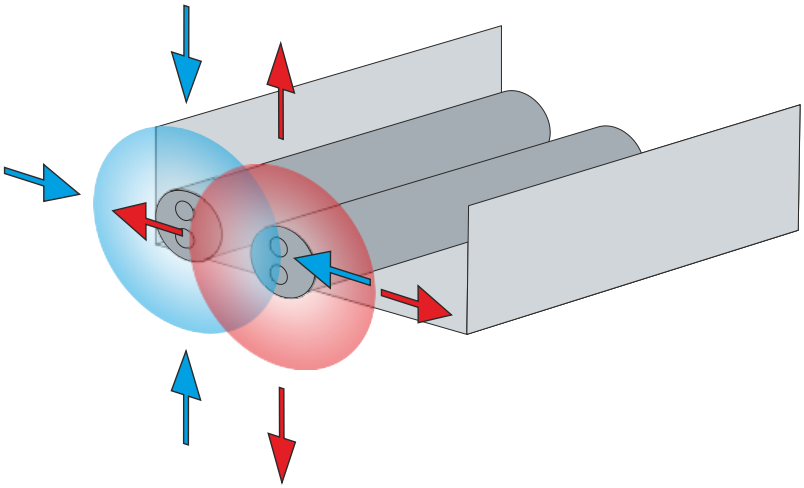


Fig. 18: Route signal lines incorrectly

Illustration legend	
D	Distance between cable ducts
Blue arrows	Signature lines
Red arrows	Potential sources of interference

The common routing of signals together with other clocked signals in a common cable also reduces the maximum propagation since crosstalk of the signals can occur over long cable lengths and cause diagnostic messages. If connection via a common cable cannot be avoided, the test pulses can be switched off (parameter: “Testing of outputs active”). However, this then leads to a reduction in the degree of diagnostic cover when calculating the performance level.
The use of contact points or plug connectors in the cabling similarly reduces the maximum expansion.

The typical length of a test pulse (switching from 24 V to 0 V and back to 24 V) is 300 µs to 800 µs but can also be longer in individual cases. Testing usually takes place 3 to 6 times per second.

Test pulses for the outputs

The following diagram shows a typical test pulse curve for the two outputs of an EK1914. The parameter *Testing of outputs active* is enabled.

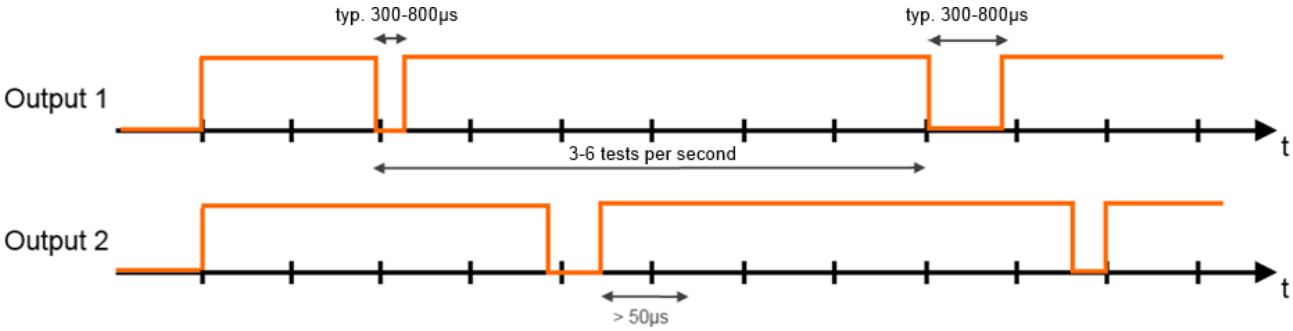


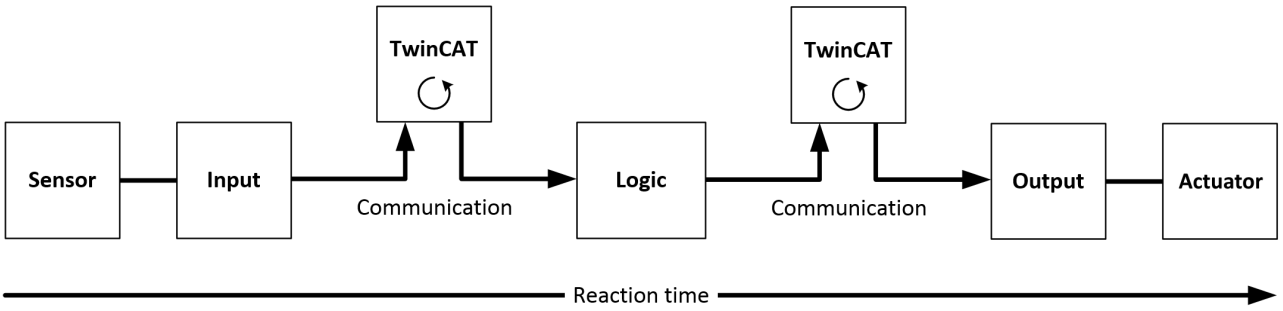
Fig. 19: Test pulses

7.5 TwinSAFE reaction times

The TwinSAFE terminals form a modular safety system that exchanges safety-oriented data via the Safety-over-EtherCAT protocol. This chapter is intended to help you determine the system's reaction time from the change of signal at the sensor to the reaction at the actuator.

7.5.1 Typical reaction 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.



Definition	Description
RTSensor	Reaction time of the sensor until the signal is provided at the interface. Typically supplied by the sensor manufacturer.
RTInput	Reaction time of the safe input, such as EL1904 or EP1908. This time can be found in the technical data. In the case of the EL1904 it is 4 ms.
RTComm	Reaction time of the communication This is typically 3x the EtherCAT cycle time, because new data can only be sent in a new Safety-over-EtherCAT telegram. These times depend directly on the higher-level standard controller (cycle time of the PLC/NC).
RTLogic	Reaction 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 EL6900, depending on the size of the safety project. The actual cycle time can be read from the terminal.
RTOutput	Reaction time of the output terminal. This typically lies within the range of 2 to 3 ms.
RTActor	Reaction time of the actuator. This information is typically supplied by the actuator manufacturer
WDComm	Watchdog time of the communication

The following formula results for the typical reaction time:

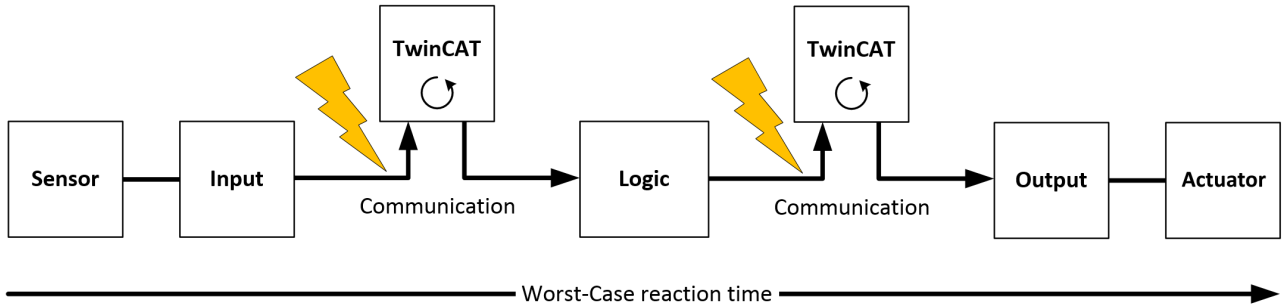
$$ReactionTime_{typ} = RT_{Sensor} + RT_{Input} + 3 * RT_{Comm} + RT_{Logic} + 3 * RT_{Comm} + RT_{Output} + RT_{Actuator}$$

Example for reaction time calculation:

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

7.5.2 Worst-case reaction time

The worst-case reaction time is the maximum time required to switch off the actuator in the case of an error.



This assumes that a signal change occurs at the sensor and is transmitted to the input. A communication error occurs at precisely the moment when the signal is to be transferred to the communication interface. This is detected by the logic following the watchdog time of the communication link.

This information should then be transferred to the output, but a further communication error occurs here. This error is detected at the output following a safety watchdog time out and leads to a switch-off.

This results in the following equation for the worst-case reaction time:

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

Example for the calculation of the worst-case reaction time:

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

7.6 Tested devices

The following list contains devices that were tested together with the EK1914 TwinSAFE Bus Coupler. The results only apply for the current device hardware version at the time of testing. The tests were carried out in a laboratory environment. Modifications of these products cannot be considered here. If you are unsure, test the hardware together with the TwinSAFE Bus Coupler.

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

Sensors

Manufacturer	Type	Comment
SICK	C4000	Safety light curtain
SICK	S3000	Safety light scanner
Wenglor	SG2-14ISO45C1	Safety light grids
Leuze	lumiflex ROBUST 42/43/44	Safety light barriers
Schmersal	BNS250-11ZG	Safety switch
ifm	GM701S	Inductive safety sensor
Keyence	SL-V (with PNP cable set)	Safety light curtain

Actuators

Manufacturer	Type	Comment
Beckhoff	AX5801	TwinSAFE Drive option card: safe restart lock
Siemens	SIRIUS Serie S00 3RT1016-1BB42	Contactor

NOTE

Recommended protective circuits

For actuators, we recommend R/C or diode protective circuits. Varistor protective circuits should not be used.

8 Configuration of the EK1914 in TwinCAT

⚠ CAUTION

Do not change register values

Do not make any changes to the CoE objects of the TwinSAFE bus coupler. Changes (e.g. via the SystemManager) to the CoE objects set the coupler permanently to the Fail-Stop state.

8.1 Inserting a Beckhoff TwinSAFE Bus Coupler

An EK1914 is inserted in the same way as any other Beckhoff Bus Coupler. In the list, open Safety Terminals and select the EK1914.

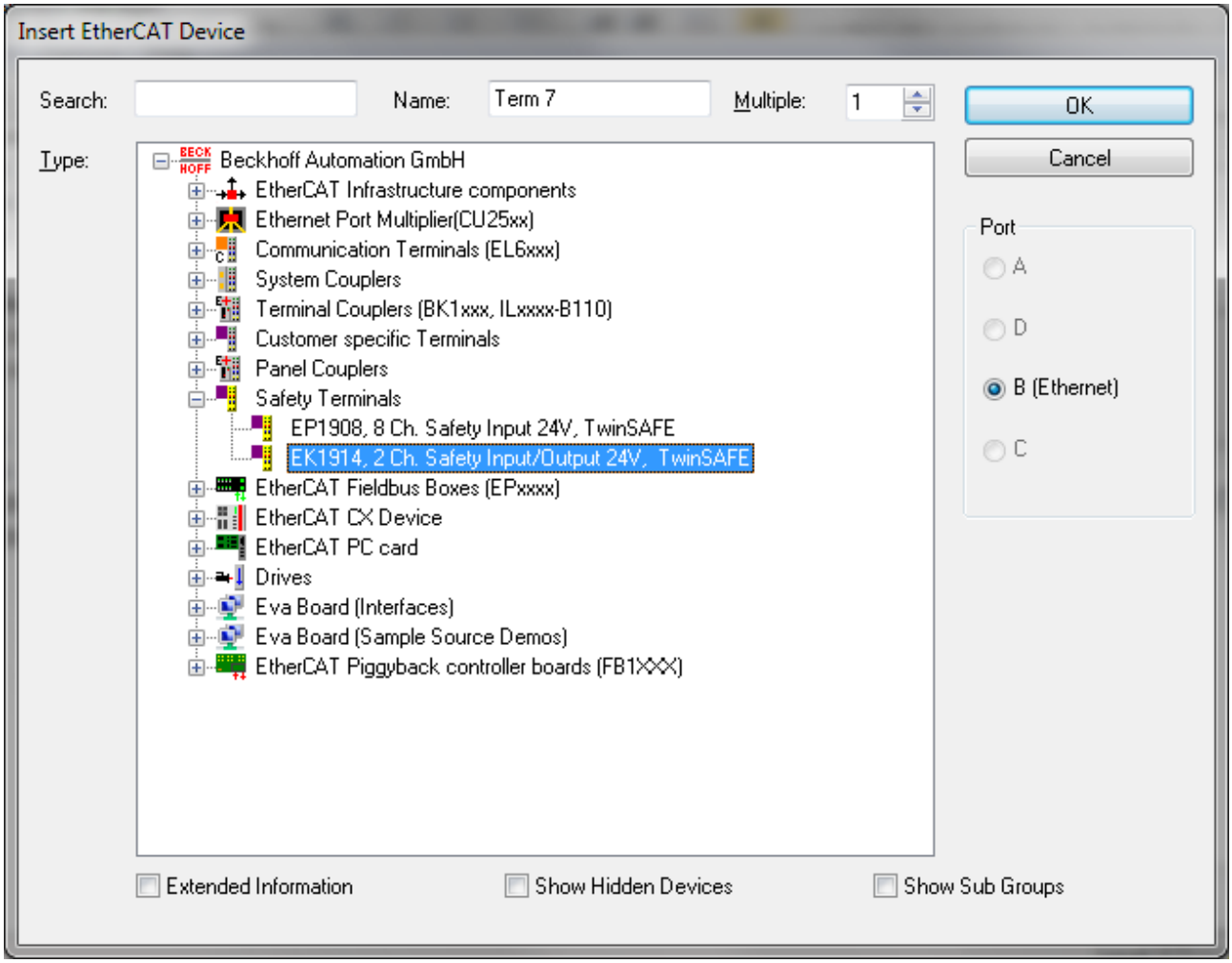


Fig. 20: Insert bus coupler

8.2 Address settings on the EK1914 TwinSAFE Bus Coupler

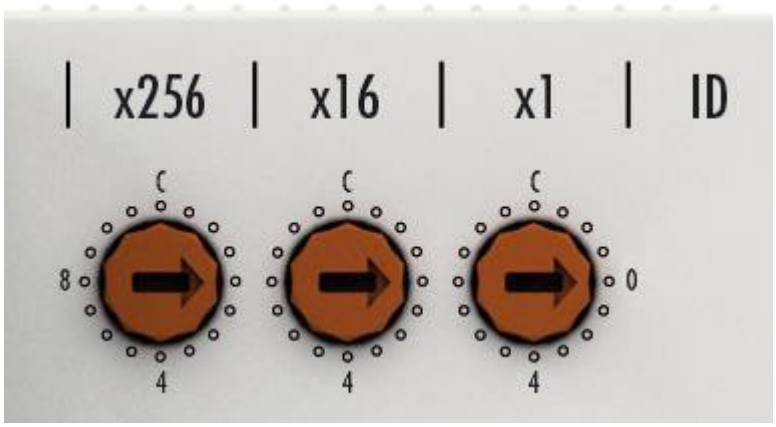


Fig. 21: Address switches

The TwinSAFE address of the coupler must be set using the three rotary switches on the side of the EK1914 TwinSAFE Bus Coupler. TwinSAFE addresses between 1 and 4095 are available.

Rotary switch			Address
1 (left)	**2 (center)**	**3 (right)**	
0	0	1	**1**
0	0	2	**2**
0	0	3	**3**
…	…	…	**…**
0	0	F	**15**
0	1	0	**16**
0	1	1	**17**
…	…	…	**…**
0	F	F	**255**
1	0	0	**256**
1	0	1	**257**
…	…	…	**…**
F	F	F	**4095**

⚠ WARNING

Unique TwinSAFE address

Each set TwinSAFE address may only occur once within a network! Address 0 is not a valid address.

8.3 Entering a TwinSAFE address and parameters in the System Manager

The TwinSAFE address set using the DIP switch must also be set on the Safe Parameter tab (FSoE Address entry) underneath the EK1914. The parameters for the safe inputs and outputs can also be set here.

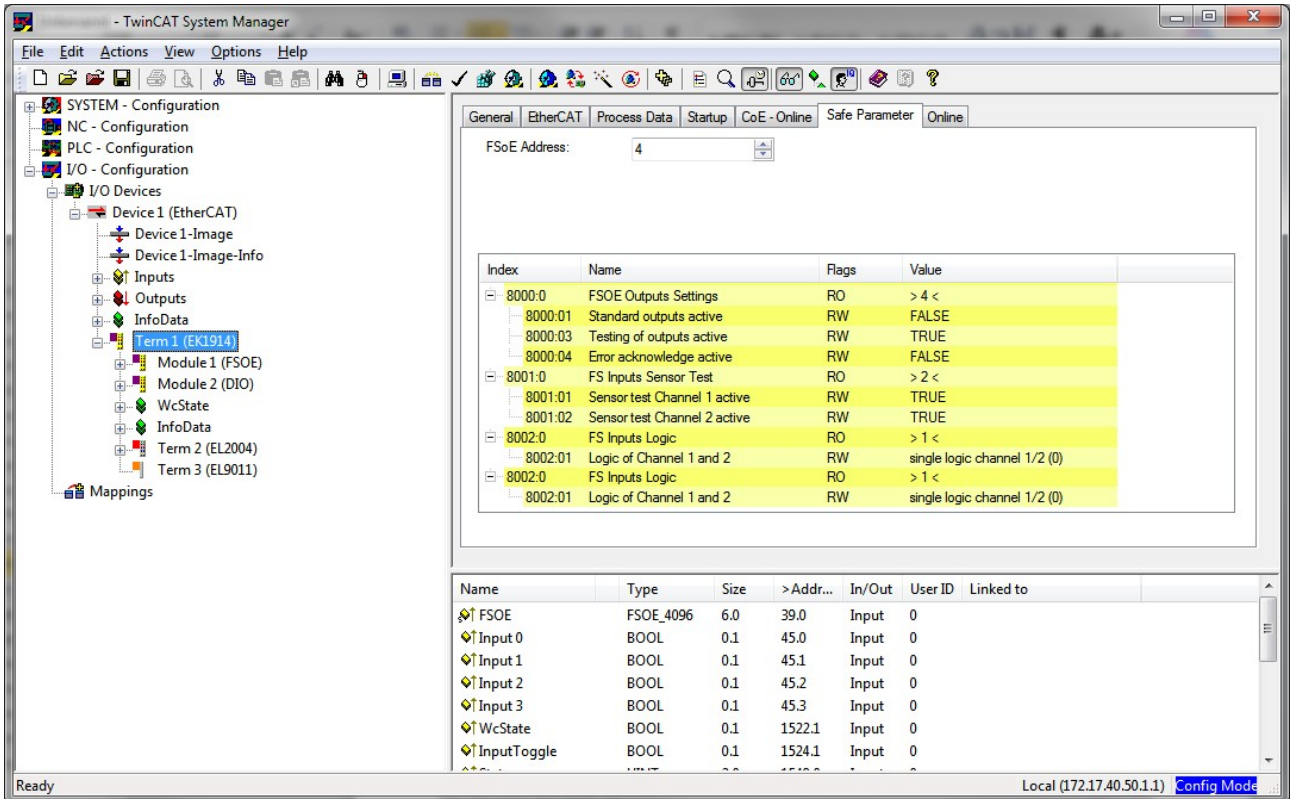


Fig. 22: Parameters of the EK1914

The parameter settings of the EK1914 can also be set under the respective TwinSAFE connection on the Connection and Safe Parameter tabs.

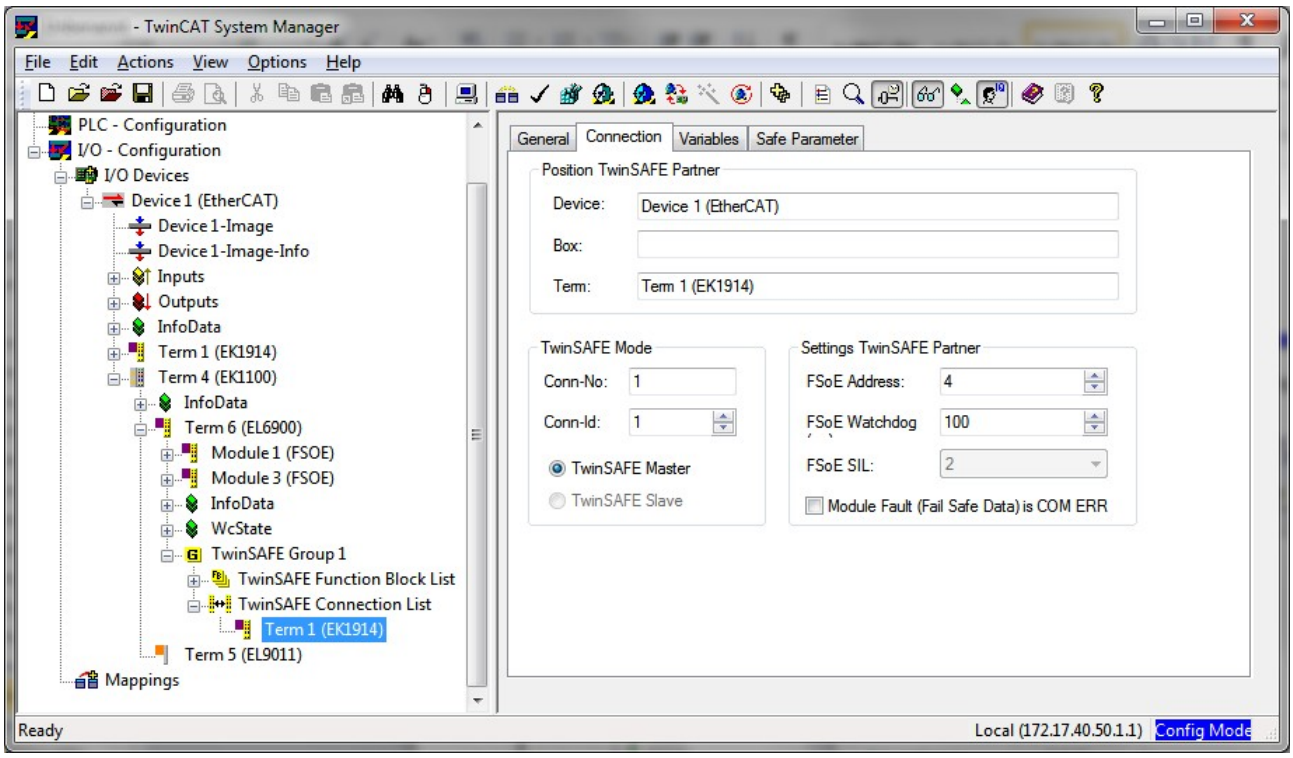


Fig. 23: Connection settings

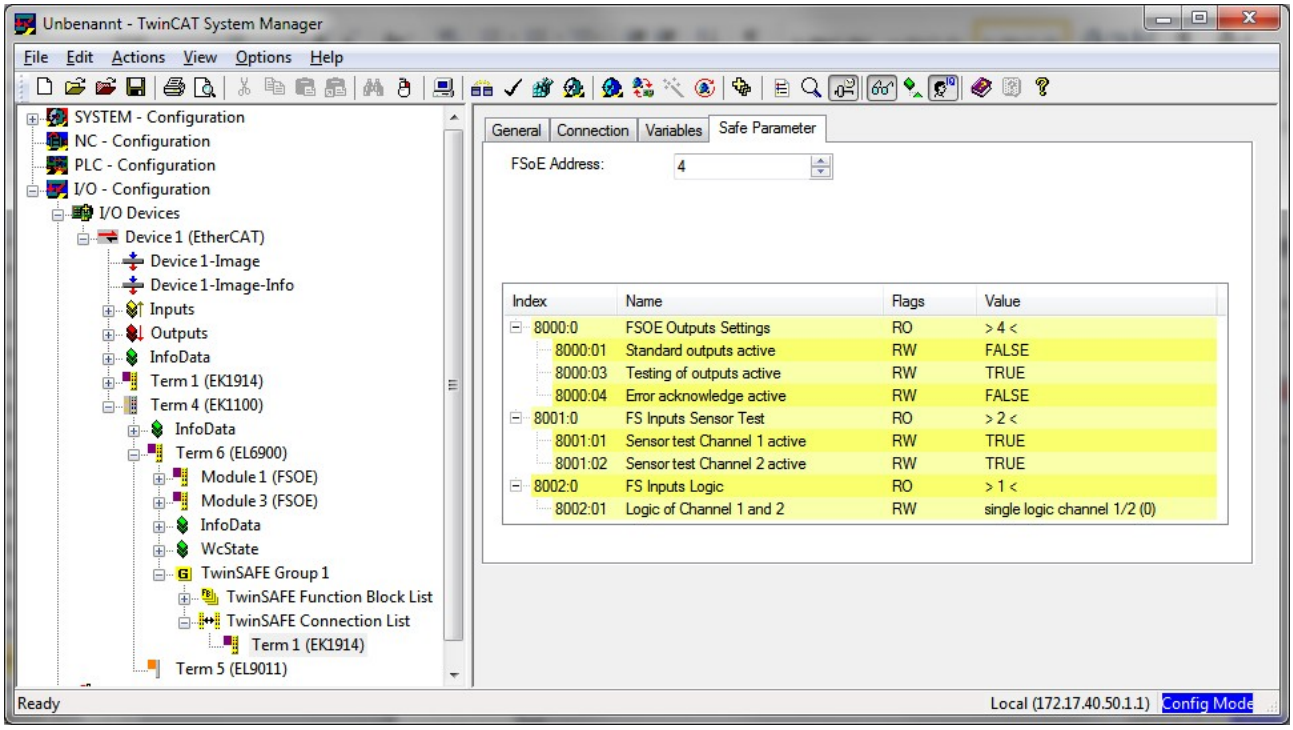


Fig. 24: Parameter settings

Parameter overview

PrmName	Bedeutung	Werte
FSoE_Address	DIP switch address	1 to 4095
Standard outputs active	In addition the safe output can be switched off from the standard PLC. The safe output is linked with the standard logic signal AND.	true / false

PrmName	Bedeutung	Werte
Testing of outputs active	Test pulses for the outputs are activated	true / false
Error acknowledge active	True: Bus Coupler errors lead to a reset of the TwinSAFE connection (error code 14 (0x0E)). This error code is shown in the diagnostic data for the connection until the user acknowledges it via ErrAck in the TwinSAFE group. False (Default): Bus Coupler errors can only be reset by switching the power supply off and back on again.	true / false
Sensortest Kanal 1 aktiv	The clock signal of the “Clock output safe input 1” connection is tested at the “Safe input 1” connection.	true / false
Sensortest Kanal 2 aktiv	The clock signal of the “Clock output safe input 2” connection is tested at the “Safe input 2” connection.	true / false
Logik Kanal 1 und 2	Logic of channels 1 and 2	• single logic • asynchronous repetition OSSD (sensor test must be switched off) • any pulse repetition OSSD (sensor test must be switched off) • Short cut is no module fault
Store Code	This parameter is required for the TwinSAFE Restore Mode.	-
Project CRC	This parameter is required for the TwinSAFE Restore Mode.	-
Identity	These parameters are used internally only.	-
Detected Modules	These parameters are used internally only.	-

8.3.1 Configuration of the EK1914 for light barriers, light grids, light curtains, etc.

The EK1914 also supports direct connection of contact-free protective devices with two self-testing outputs such as light barriers, light grids, light curtains, laser scanners, etc.

⚠ CAUTION

Sensors with self-testing outputs

Only sensors with self-testing outputs whose sensor self-test does not exceed the duration of 350 µs may be connected to the EK1914 (see figure)!

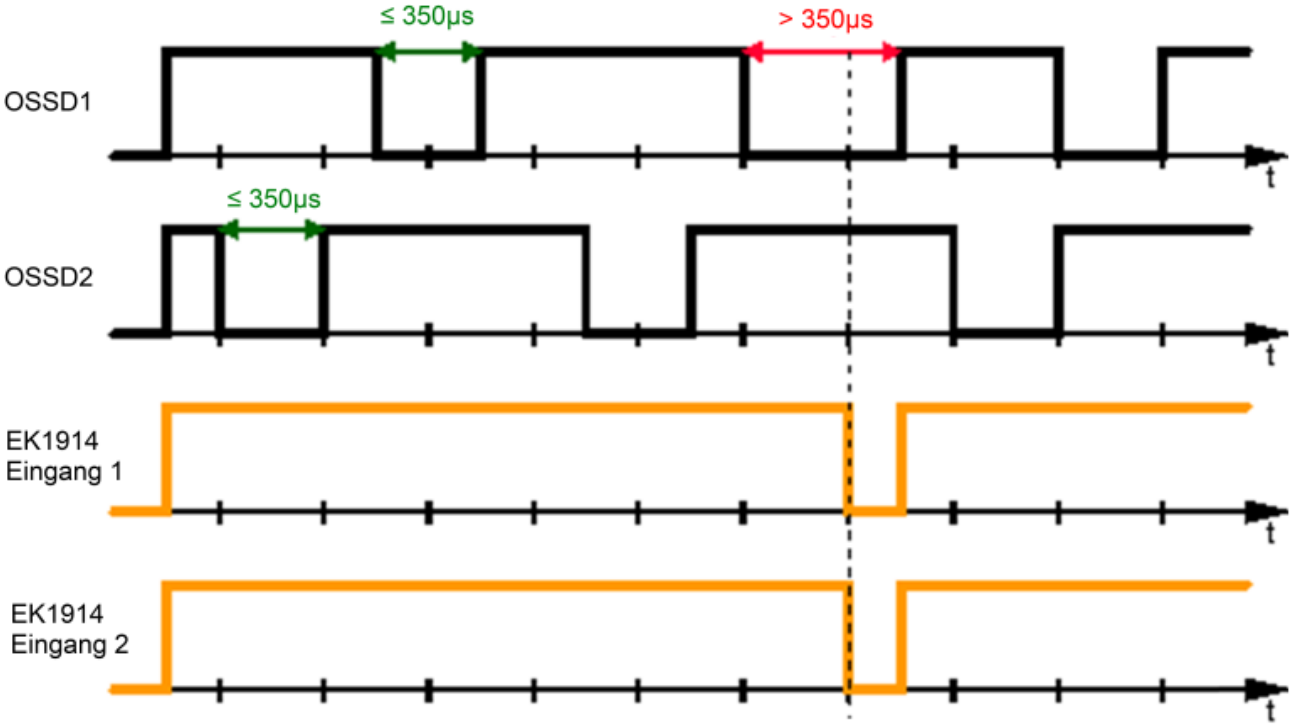


Fig. 25: Clock outputs

Parameter

To connect these sensors please set the following parameters for the EK1914 in the TwinCAT System Manager:

- Connect the two sensor signals to channels 1 and 2 and activate the entry *asynchronous repetition OSSD* or *any pulse repetition* for both the inputs used under the parameter *Logic for channel 1 and 2*. The difference between these settings is that with *any pulse repetition* simultaneous tests of the OSSD signals up to 350 µs are allowed.
- Switch the sensor test of the EK1914 to *false* for both the inputs used

8.3.2 Configuration of the EK1914 for safety switching mats

The EK1914 also supports the direct connection of safety switching mats.

Parameter

To connect these safety mats please set the following parameters for the EK1914 in the TwinCAT System Manager:

- Connect the two sensor signals to channels 1 and 2 and activate the entry *short cut channel x/y is no module fault* for both the inputs used under the parameter *Logic for channel 1 and 2*.
- Switch the sensor test of the EK1914 to true for both the inputs used

9 Diagnosis

9.1 Diagnosis LEDs

The LEDs Diag 1 (LED 7) and Diag 2 (LED 15) display diagnostic information for the EK1914.

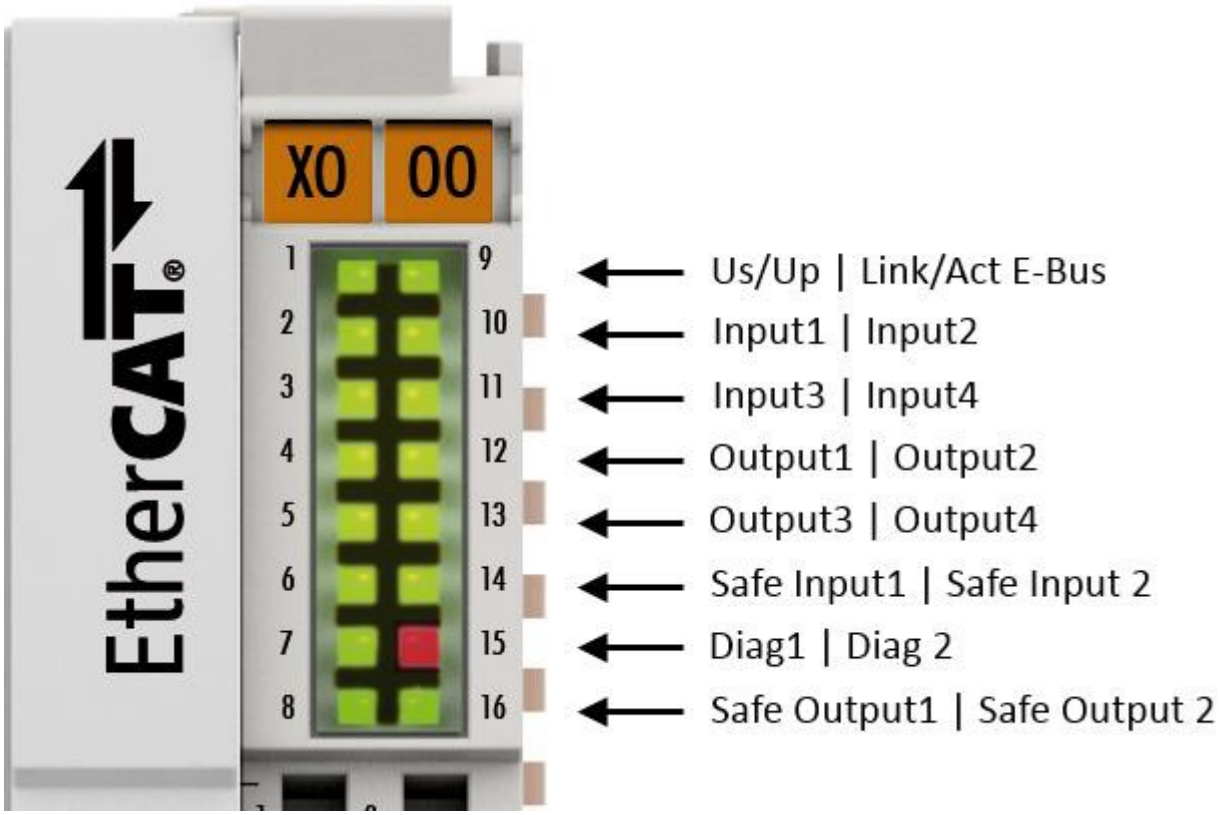


Fig. 26: Diagnosis LEDs

9.1.1 Diag1 (green)

The Diag 1 LED indicates the state of the TwinSAFE interface. The LED is set as soon as the FSoE State Reset is quit and TwinSAFE communication is thus started

9.1.2 Diag2 (red)

Diag2 lights up

The Diag 2 LED lights up red when the bus coupler has detected an external power supply or a cross-circuit. If the error has been eliminated, the LED goes out.

A more detailed error cause is set in diagnostic CoE object 0x800E.

Diag2 flashes

In case of an error, the Diag 2 LED displays a blink code that describes the error in more detail. The blink codes are structured as follows:

Flashing sequence	Meaning
Rapid flickering	Start of flashing code
First slow sequence	Error code 1
Second slow sequence	Error code 2
Third slow sequence	Error code 3
Fourth slow sequence	Error code 4

Fig. 27: Start Error code 1 Error code 2

The errors indicated by the following flashing codes are reversible. After rectification of the error cause, the Bus Coupler can be put back into operation with a restart.

Flashing code	Meaning	Remedy
2-1-1-1	The temperature has exceeded the maximum permissible temperature (µC1)	Ensure observance of the permissible ambient 3 temperature.
3-1-1-1	The temperature has exceeded the maximum permissible temperature (µC2)	
4-1-1-1	The temperature has fallen below the minimum permissible temperature (µC1)	
5-1-1-1	The temperature has fallen below the minimum permissible temperature (µC2)	

If another flashing code is displayed, there is an internal coupler error that has stopped the Bus Coupler. In this case the Bus Coupler must be checked by Automation GmbH & Co. KG.

NOTE

Note flashing codes; return the Bus Coupler

Note the flashing code displayed and include this information with the Bus Coupler when you return it.

9.2 Diagnosis objects

The CoE objects $800E_{hex}$ display further diagnostic information.

⚠ CAUTION

Do not change CoE objects

Do not make any modifications to the CoE objects of the TwinSAFE Bus Coupler! Any modifications (e.g. using the TwinCAT system manager) of the CoE objects would permanently set the Bus Coupler to the Fail-Stop state.

Index $800E_{hex}$: diagnostic objects - safe inputs

Index	Name	Meaning			Flags	Default
800E:0	Diag	The following sub-indices contain detailed diagnostic information.			RO	
800E:0A	Sensor test error	Bit	Error during the sensor test		RO	
		0	1_{bin}	Error at input 1		0_{bin}
		1	1_{bin}	Error at input 2		0_{bin}
800E:0B	Error during two-channel evaluation	Bit	Error during the contiguous evaluation of two channels, i.e. the two channels contradict each other.		RO	
		0	1_{bin}	Error in the first input pair		0_{bin}
800E:0C	Error in the safety mat operating mode: input pair not identical	Bits	Error in the input pair		RO	
		1, 0	11_{bin}	Error in the first input pair		00_{bin}
800E:0D	Error in the safety mat operating mode: external supply	Bit	Error in the test pulses in the safety mat operating mode; i.e. the Bus Coupler has detected an external supply.		RO	
		0	1_{bin}	Error at input 1		0_{bin}
		1	1_{bin}	Error at input 2		0_{bin}

Index $800E_{hex}$: diagnostic objects - safe outputs

Index	Name	Meaning		Flags	Default
800E:0E	Diagnose µC1	Value	Description	RO	
		5	Cross-circuit output 1 and output 2		0
		6	Cross-circuit output 1 and output 2		0
		10	Overvoltage		0
		11	Undervoltage		0
		21... 27	Error when testing the field voltage switches		0
		30... 33	Start-up of the output circuit failed		0
		101	External supply 0 V output 1, detected with set output		0
		102	External supply 24 V output 1		0
		103	External supply 0 V output 2, detected with set output		0
		104	External supply 24 V output r		0
800E:0F	Diagnose µC2	Value	Description	RO	
		201	External supply 0 V output 1, detected with set output		0
		202	External supply 24 V output 1		0

Index	Name	Meaning		Flags	Default
		203	External supply 0 V output 2, detected with set output		0
		204	External supply 24 V output 2		0

NOTE

Differing diagnostic messages possible

Due to the variable order or execution of the test series, diagnostic messages differing from those given in the table above are possible.

9.3 Possible causes of diagnostic messages

Diagnosis	Possible cause	Remedial actions
Diag 2 LED 800E:0E / 800E:0F set to: 5.6 or greater than 100	If parameter *Testing of outputs active* is switched on:	
	Faulty test pulses. Cause: external supply or cross-circuit.	Eliminate cross-circuit or external supply.
	Faulty test pulses. Cause: parallel routed cables with high capacitive coupling and dynamized signals, possibly also in common cables	Isolate lines and lay in separate non-metallic sheathed cable. Create a distance between the non-metallic sheathed cables.
	Cause: current exceeds the limit of 500 mA.	Select actuator accordingly. Current < 500 mA
	Irrespective of whether the parameter *Testing of outputs active* is switched on:	
	The output voltage lies below the permissible voltage range (24 V -15%/+20%). A possible cause is a short-circuit at the output or e.g. a voltage drop at the instant of switching.	Eliminate short-circuit. Design power supply accordingly. Check supply lines for voltage drop.
	EMC faults	Take suitable EMC measures
	Internal defect	Exchange Bus Coupler
Diag 2 LED 800E:0E / 800E:0F set to: 11	Voltage on the power contacts too low.	Increase Bus Coupler supply voltage and reset error display by power-on reset of the Bus Coupler
	EMC faults	Take suitable EMC measures
	Internal defect	Exchange Bus Coupler
Diag 2 LED 800E:0E / 800E:0F set to: 10	Field potential too high. Voltage on the power contacts too high.	Decrease Bus Coupler supply voltage and reset error display by power-on reset of the Bus Coupler
	Field potential too high. Voltage on the power contacts too high.	Use an R/C or diode-based protective circuit on the actuators
	EMC faults	Take suitable EMC measures
	Internal defect	Exchange Bus Coupler

10 Service life

The TwinSAFE Bus Couplers are designed for a service life of 20 years. Due to the high diagnostic coverage within the lifecycle no special proof tests are required.

The TwinSAFE Bus Couplers bear a date code, which is composed as follows:
Date Code: CW YY SW HW

Legend:	Example: Date Code 27 14 01 00
CW: Calendar week of manufacture	Calendar week: 27
YY: Year of manufacture	Year: 2014
SW: Software version	Software version: 01
HW: Hardware version	Hardware version: 00

In addition the TwinSAFE Bus Couplers bear a unique serial number.

Fig. 28: Date Code of EK1914

11 Maintenance and cleaning

Cleaning by the manufacturer only

Do not operate the TwinSAFE component if it is impermissibly dirty according to protection class IP20. Send impermissibly dirty TwinSAFE components to the manufacturer for cleaning.

TwinSAFE components are basically maintenance-free.

12 Decommissioning

12.1 Disposal

NOTE

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.

12.1.1 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.

13 Appendix

13.1 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.

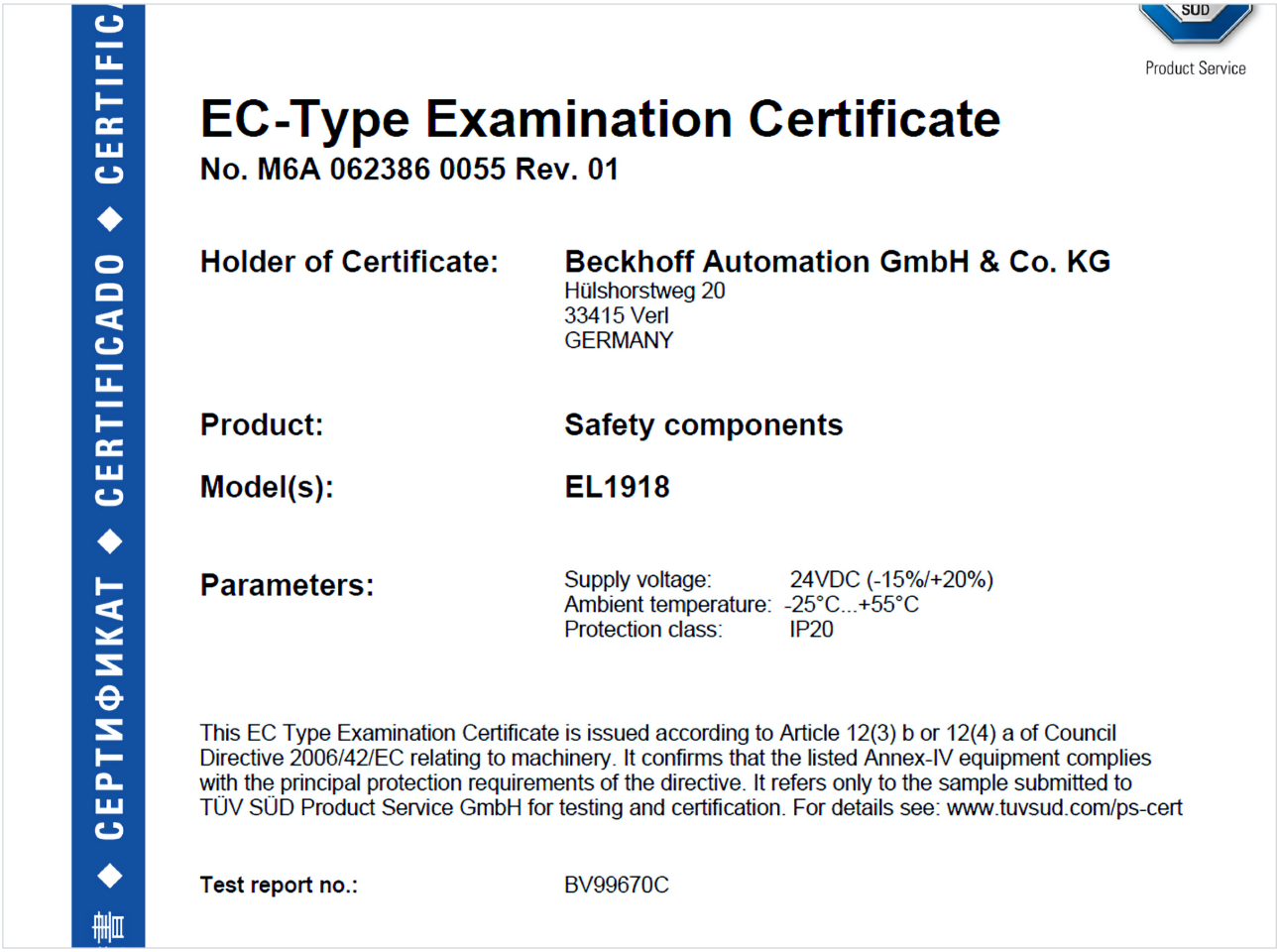
If there is customer specific data saved on the product, it cannot be ensured that this data might not be restored through for example forensic measures, even after the data is deleted through the provided tool chain. If this data is confidential, the scrapping of the product after usage is recommended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

13.2 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.



СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFIC

Product Service

EC-Type Examination Certificate

No. M6A 062386 0055 Rev. 01

Holder of Certificate: **Beckhoff Automation GmbH & Co. KG**
Hülshorstweg 20
33415 Verl
GERMANY

Product: **Safety components**

Model(s): **EL1918**

Parameters:
Supply voltage: 24VDC (-15%/+20%)
Ambient temperature: -25°C...+55°C
Protection class: IP20

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: www.tuvsud.com/ps-cert

Test report no.: BV99670C

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

13.3 Certificate

BECKHOFF New Automation Technology

Originalerklärung
Original declaration

EG-Konformitätserklärung

EC Declaration of Conformity

Nummer: 2017040EK1914-1, Datum: 31.07.2017
Number, Date

Hersteller *Manufacturer*	**Beckhoff Automation GmbH & Co. KG** Hülshorstweg 20, 33415 Verl, Germany
erklärt, dass das Produkt *declares that the product*	**TwinSAFE EK1914** TwinSAFE-Buskoppler mit zwei fehlersicheren Eingängen und zwei fehlersicheren Ausgängen *TwinSAFE Bus Coupler with two fail-safe inputs and two fail-safe outputs*

Sicherheitsbauteil nach EG-Richtlinie 2006/42/EG, Anhang IV
safety component according to EC directive 2006/42/EC, annex IV

den einschlägigen Bestimmungen der Maschinenrichtlinie 2006/42/EG entspricht.
complies with the relevant requirements of the machinery directive 2006/42/EC.

Angewandte Normen
Applied Standards

EN 62061:2005+A1:2013	**Sicherheit von Maschinen – Funktionale Sicherheit sicherheitsbezogener elektrischer, elektronischer und programmierbarer elektronischer Steuerungssysteme** *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN61131-2:2007	**Speicherprogrammierbare Steuerungen - Teil 2: Betriebsmittelanforderungen und Prüfungen** *Industrial-process control systems - Instruments with analogue inputs and two- or multi-state outputs - Part 2: Guidance for inspection and routine testing*
EN 50581:2012	**Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe** *Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances*
EN ISO 13849-1:2015	**Sicherheit von Maschinen – Sicherheitsbezogene Teile von Steuerungen** *Safety of machinery – Safety-related parts of control systems*
EN 61000-6-2:2011	**Elektromagnetische Verträglichkeit (EMV) – Störfestigkeit für Industriebereiche** *Electromagnetic compatibility (EMC) – Immunity for industrial environments*
EN 61000-6-4:2011	**Elektromagnetische Verträglichkeit (EMV) - Störaussendung für Industriebereiche** *Electromagnetic compatibility (EMC) - Emission standard for industrial environments*

Die Übereinstimmung eines Baumusters des bezeichneten Produkts mit der EG-Richtline wurde bescheinigt von
The accordance of a production sample of the designated product with the EC directive is certified by

Benannte Stelle *Notified body*	**TÜV SÜD Product Service GmbH** Ridlerstraße 65, 80339 München, Germany
EG-Baumusterprüfbescheinigung *EC-type examination certificate*	**M6A 17 07 62386 040, 28.07.2017**

Verantwortlich für die Zusammenstellung der technischen Unterlagen
Responsible for the compilation of technical documentation

Bevollmächtigter *Authorised person*	**Beckhoff Automation GmbH & Co. KG** Hülshorstweg 20, 33415 Verl, Germany

Verl, 31.07.2017

Dipl.-Phys. Hans Beckhoff

Geschäftsführer Beckhoff Automation GmbH & Co. KG
CEO Beckhoff Automation GmbH & Co. KG

Fig. 29: EK1914 EC Declaration of Conformity

List of figures

More Information:
www.beckhoff.com/EK1914

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