BECKHOFF New Automation Technology

Operating Instructions | EN

EJ19xx and EJ29xx

TwinSAFE EJ Modules with digital fail-safe inputs and outputs

2025-08-29 | Version: 2.1.0

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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 documentation at any time and without notice. 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 this documentation.

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

1.1.1 Trademarks

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1.1.2 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

1.1.3 Copyright

1.1.4 Third-party trademarks

Trademarks of third parties may be used in this documentation. You can find the trademark notices here: https://www.beckhoff.com/trademarks.

1.2 Version numbers of the documentation

Version	Comment
2.1.0	• Version histories corrected • Editorially revised • Chapter "Service life" moved and figure revised • Designation “Safety parameters” changed to “Target failure measures” • Chapter “Notes on information security” added • Certificate removed in the appendix and links to certificates and declarations of conformity added • Notes on connection added • Chapter “Intended use” extended
2.0.0	• Foreword changed to “Documentation notes” and “For your safety” • Chapter "Service life" moved • Chapter "Maintenance and cleaning" and "Decommissioning" adapted • Appendix adapted and extended
1.4.0	• Added a link to certificate download page in chapter "General technical data" • Version histories added • Updated software versions added • The chapters "Inserting an EJ module" revised • "Beckhoff Support and Service" updated
1.3.0	• Maximum permissible operating temperature changed • Warning added to chapter "General technical data" • New layout
1.2.0	• Description temperature measurement updated
1.1.0	• Description of the test pulses of the outputs updated
1.0.0	• Certificate added • Technical data updated • Description *Digital input* updated
0.0.2	• LED description adapted
0.0.1	• First preliminary version

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 [▶ 9].

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 References

No.	Version	Title / description
[1]	1.3.0 or newer	**Design Guide for EJ backplane for TwinSAFE modules** The Design Guide contains specifications for the development of an EJ backplane when TwinSAFE EJ modules are to be used.
[2]	4.7 or newer	**EJxxxx | EtherCAT plug-in modules - design guide** The design guide contains general specifications for the development of an EJ backplane.
[3]	1.4.1 or newer	**Operating instructions for EL6910 TwinSAFE Logic module** The document contains a description of the Logic functions of the EL6910, and thus also of the TwinSAFE component, and their programming.
[4]	3.1.0 or newer	**Documentation for TwinSAFE Logic FB** The document describes the safety function blocks that are available in the EL6910, and thus also in the TwinSAFE component, and form the safety application.
[5]	1.8.0 or newer	**TwinSAFE Application Guide** The Application Guide provides the user with examples for the calculation of failure limits for safety functions according to the standards DIN EN ISO 13849-1 and EN 62061 or EN 61508:2010, such as are typically used on machines.
[6]	2006/42/EC	**Directive 2006/42/EC of the European Parliament and of the Council of 17. May 2006 on machinery and amending Directive 95/16-7/EC (revised) of 29 June 2006** This directive, also known as the Machinery Directive, defines requirements for the placing on the market of machines and machine-like components, such as safety components.

1.4 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.

1.5 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 [▶ 11] 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

⚠ DANGER

Hazard with high risk of death or serious injury.

⚠ WARNING

Hazard with medium risk of death or serious injury.

⚠ CAUTION

There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE

Notes

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.

1.6 Support and Service

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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.

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Please contact your Beckhoff branch office or representative for local support and service on Beckhoff products!

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1.7 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 [▶ 5].
- 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:

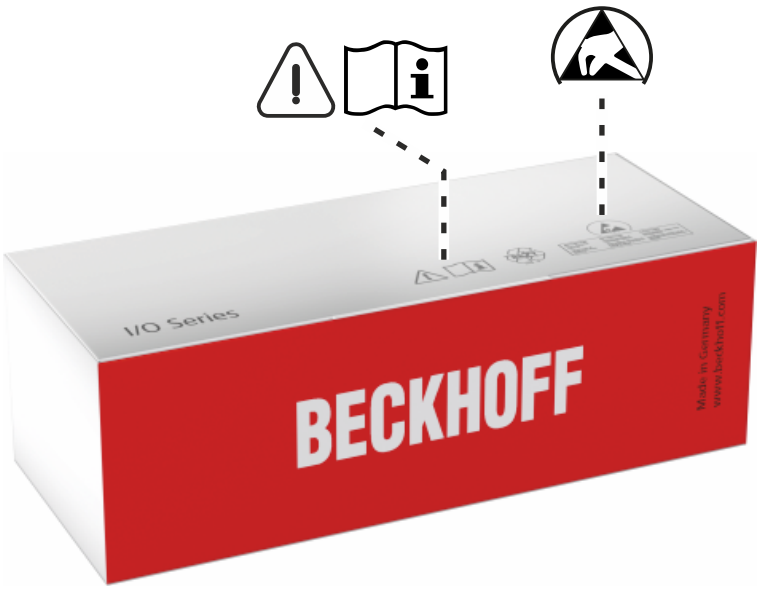
- EN ISO 12100:2010, Safety of machinery – General principles for design – Risk assessment and risk reduction
- ISO 13849-1, Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

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

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 [▶ 7].

Ensure traceability

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

Using the SELV/PELV power supply unit

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

Use a SELV/PELV power supply unit with an output voltage limitation of U_{max} = 60 V_{DC} to supply the TwinSAFE component with 48 V_{DC}.

Failure to do so may jeopardize the safety function of the product. Depending on the machine, death and danger to life, serious bodily 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.

Overvoltage protection

If protection against overvoltage is necessary in your plant, provide a surge filter for the voltage supply to the EJ distribution board and the TwinSAFE EJ modules.

This surge filter can be implemented on the EJ distribution board or as an external filter function block and is intended to limit transients above 36 V.

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 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.

2.3.3 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 [▶ 45].

3 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 EJ modules are intended for operation on an EJ distribution board.

⚠ WARNING

Improper use

Any use which exceeds the permissible written values from the chapter General technical data 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.

CE approval

The CE mark refers to the named EtherCAT plug-in module.
When installing the EtherCAT plug-in module to create a ready-to-use end product (PCB in combination with a housing), the manufacturer of the end product must verify the compliance with the guidelines and the CE certification of the entire system
For the operation of the EtherCAT plug-in modules, installation in a housing is required.

4 EtherCAT plug-in module system (EJ)

Similar to the EtherCAT Terminal system, a module segment consists of a bus coupler and any desired I/O modules. In contrast to the EtherCAT Terminals, however, the EtherCAT plug-in modules have no spring-loaded contacts, since the wiring level is outsourced: communication, signal distribution and the supply of power to the modules takes place via plug connectors on the rear side of the modules and the conductive tracks of the signal distribution board.

The EtherCAT plug-in modules and the plug level for sensors and actuators can be placed flexibly on the signal distribution board. Signal distribution boards can be user-developed or provided as custom solutions by Beckhoff Automation GmbH & Co. KG.

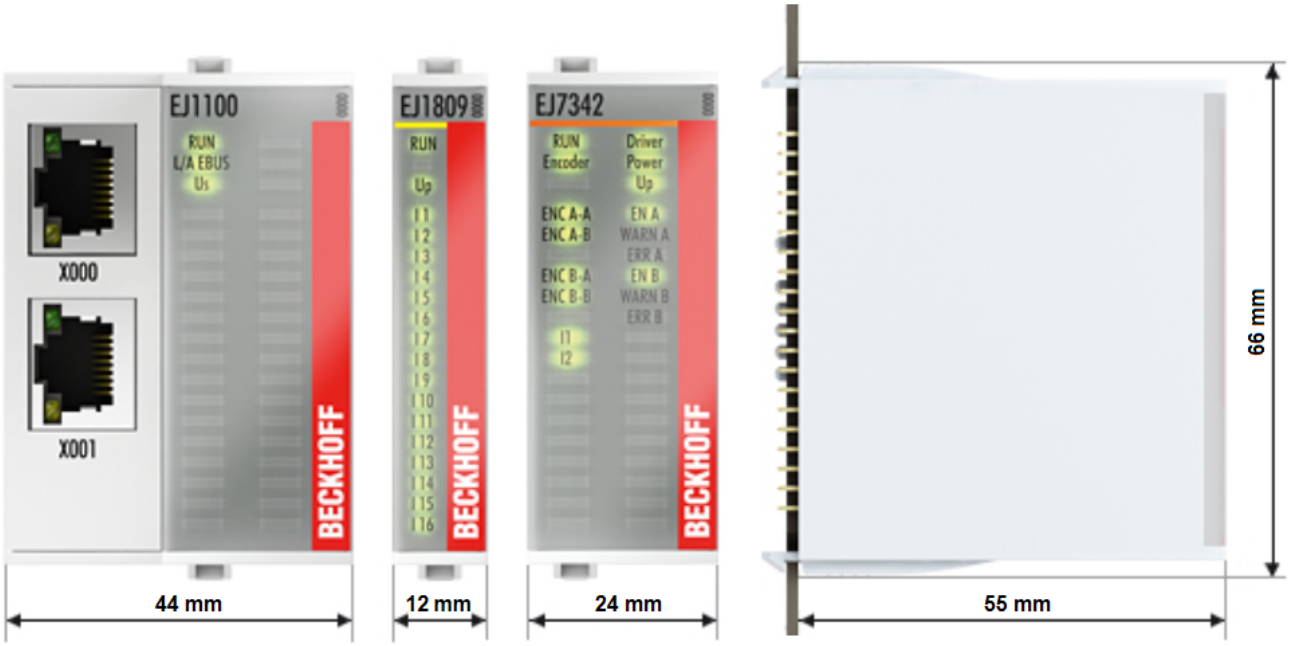


Fig. 1: EtherCAT plug-in module system (EJ)

5 General technical data

5.1 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/.

⚠ WARNING

Keep a distance from the maximum values

The EJ modules are integrated into an overall system by the user. Due to complexity and variability, exact technical limits for environmental conditions are not universally applicable. In addition, many influencing factors exist that cannot be fully derived in this documentation.

Therefore, keep as large a distance as possible from the maximum values.

Non-observance can endanger safety.

Hardware data		Explanation
• Product property	EJx9xx	
Electrotechnical data		
• Supply voltage	24 V_{DC} (- 15 % / + 20 %) SELV/PELV with maximum 36 V_{DC}	According to IEC 61508-1:2010.
• Output current of the clock outputs	typically 8 mA to max. 11 mA	
• Output current of the outputs	max. 500 mA	
Signal voltage		
• "0" inputs	-3 V to 5 V	According to IEC 61131-2:2007, type 3, see chapter Characteristic curve of the inputs.
• "1" inputs	11 V to 30 V	
Reading back the outputs (diagnostic thresholds)		
• Signal voltage "1"	> 5.61 V	
• Signal voltage "0"	< 1.68 V	
Actuators		
• Actuators	• inductive • ohmic • capacitive	When selecting actuators, please ensure that the test pulses do not lead to actuator switching.
• Actuator switching frequency (inductive load)	max. 2.5 mH at 100 Hz max. 1 H at 1 Hz	These are example working points. The user must evaluate the actuators used in relation to energy.
Cable length		
• unshielded	max. 100 m	With a cross-section of 0.75 mm² or 1 mm².
• shielded	max. 100 m	

Software data		Explanation
Reaction times		
• Reaction time in operation *read input/write to E-bus*	4 ms maximum see fault reaction time	
• Fault reaction time	Adjustable ≤ watchdog time	
• Watchdog time	min. 2 ms, max. 60000 ms	

Software data		Explanation
• Cycle time	approx. 500 µs or according to project size (if a user-specific project is used)	
Process image		
• Input	Dynamic in accordance with the configuration.	
• Output	Dynamic in accordance with the configuration.	

Specific technical data

The specific technical data for the respective product together with the safety parameters can be found in the respective product-specific sub-chapter.

5.2 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[1]
- in an environment that leads to unacceptable contamination of the TwinSAFE component

[1] *A corrosive environment exists when corrosion damage becomes apparent.*

Permissible requirements for the environment		Explanation
Environmental conditions		
• Class for climatic environmental conditions	3K3	According to EN 60721-3-3:1995/ A2:1997. 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.
• Pollution degree	2	According to EN 60664-1:2007.
Operating conditions		
• EMC requirements	Conforms to EN 61000-6-2 / EN 61000-6-4.	
• Vibration resistance	Conforms to EN 60068-2-6 / EN 60068-2-27.	
• Shock resistance	Conforms to EN 60068-2-6 / EN 60068-2-27. 15 g with pulse duration 11 ms in all three axes	
• Protection rating	IP20	
• 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	horizontal	See chapter Installation position and minimum distances [▶ 24].
Temperatures		
• during operation	-25 °C to +45 °C	
• during transport and storage	-40 °C to +70 °C	
Ambient air		
• Air humidity	5% to 95%	Non-condensing.
• Air pressure	750 hPa to 1100 hPa	Corresponds to an altitude of approx. -690 m to 2450 m above sea level, assuming an international standard atmosphere.

5.2.1 EJ backplane

⚠ CAUTION

EJ backplane

Make sure that the TwinSAFE EJ modules are used only on an EJ backplane that has been developed and manufactured in accordance with the *Design Guide for EJ backplanes for TwinSAFE modules* (see References).

Pin-out and coding of the TwinSAFE EJ modules

The pin-out and description of the coding via the coding pins of the TwinSAFE EJ modules are listed in the document *Design Guide for EJ backplanes for TwinSAFE Modules* (see References).

5.3 Dimensions

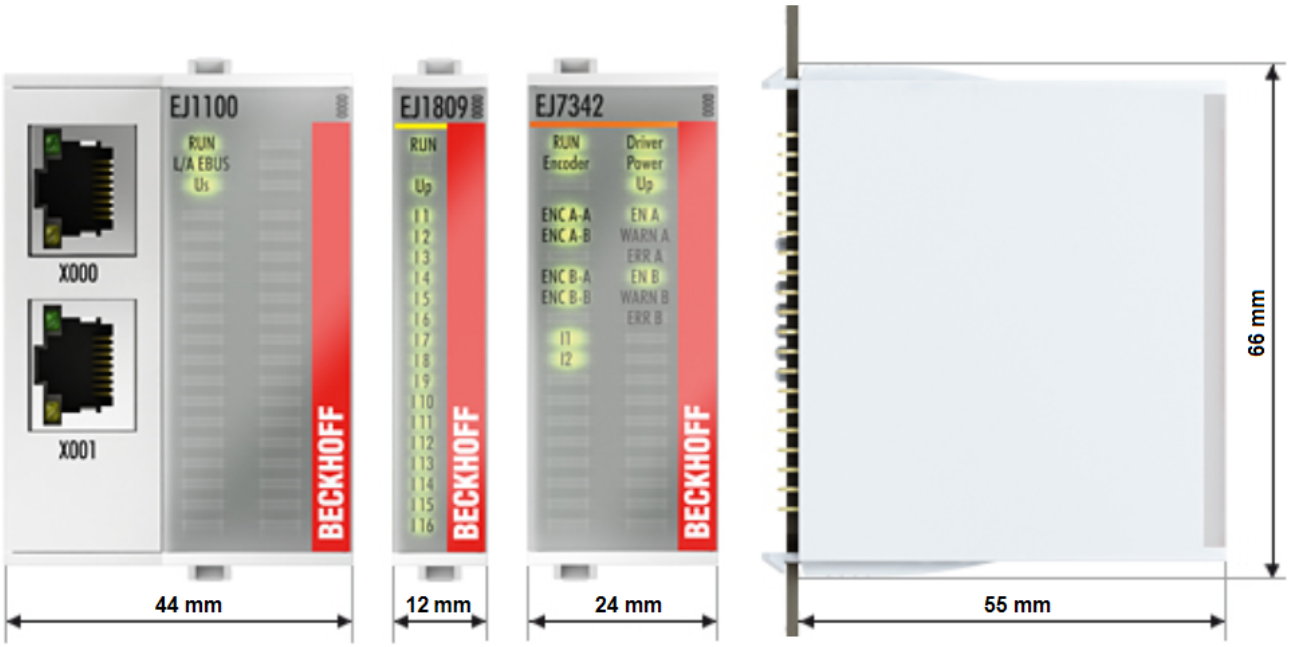


Fig. 2: EJxxxx - dimensions (short modules)

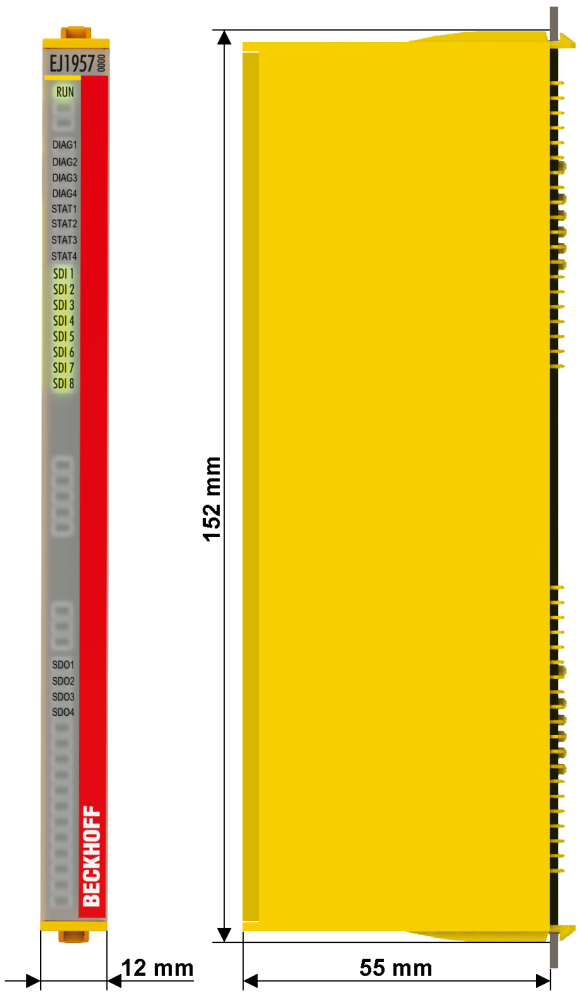


Fig. 3: EJxxxx - dimensions (long modules)

Dimension table

Product	Width	Height	Depth (above signal distribution board)
Single module EJ6910	12 mm	66 mm	55 mm
Double module EJ1914, EJ2914	24 mm	66 mm	55 mm
Single module (long) EJ1918, EJ1957, EJ2918	12 mm	152 mm	55 mm

5.4 Lifetime

⚠ 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:	Example: Date Code 17 11 05 00
CW: calendar week of manufacture	Calendar week: 17
YY: year of manufacture	Year: 2011
SW: software version	Software version: 05
HW: hardware version	Hardware version: 00

In addition the TwinSAFE components bear a unique serial number.

Fig. 4: Unique serial number of a TwinSAFE EJ module

6 General operation / function

6.1 Installation

6.1.1 Safety instructions

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

6.1.2 Transport / storage

Use the original packaging in which the components were delivered for transporting and storing the TwinSAFE components.

⚠ CAUTION

Note the specified environmental conditions

Please ensure that the digital TwinSAFE components are only transported and stored under the specified environmental conditions (see technical data).

6.1.3 Mechanical installation

⚠ WARNING

Risk of injury!

Bring the bus system into a safe, de-energized state before starting installation, disassembly or wiring of the devices!

6.1.3.1 Control cabinet / terminal box

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

6.1.3.2 Installation position and minimum distances

For the prescribed installation position the backplane is mounted horizontally (EJ connector vertical), and the connection surfaces of the EJ modules face forward (see figure below). The EJ modules 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.

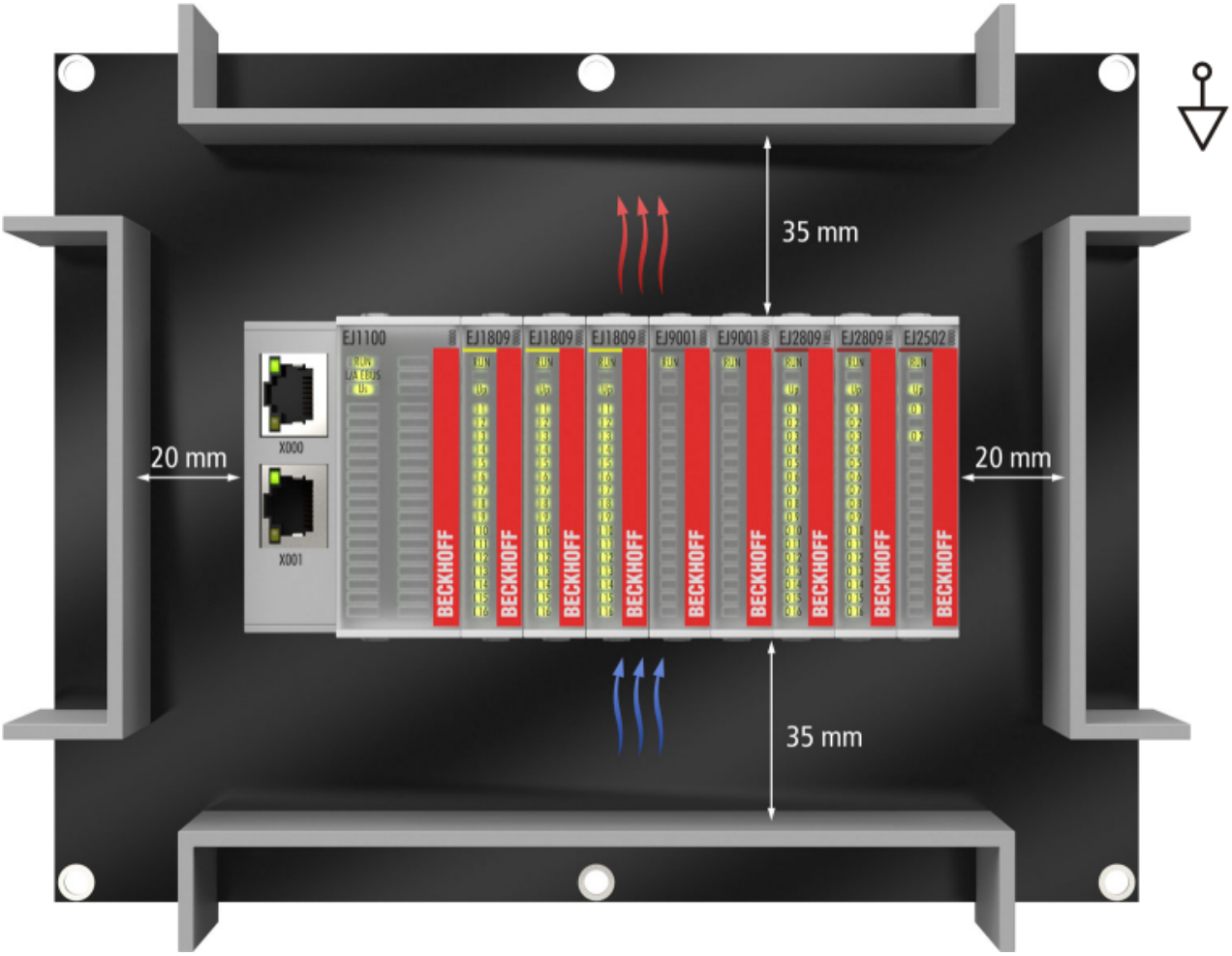


Fig. 5: Installation position and minimum distances

In order to ensure optimum convection cooling, the distances to neighboring devices and to control cabinet walls must not be smaller than those shown in the diagram.

6.1.3.3 Temperature measurement

The temperature measurement consists of an EJ1100 EtherCAT coupler, to which EJ modules are attached, based on the typical distribution of digital and analog signal types at a machine. On the EJ6910 a safety project is active, which reads safe inputs and enables safe outputs during the measurement.

External heat sources / radiant heat / impaired convection

The maximum permissible ambient temperature of 45 °C was checked with the example configuration described above. Impaired convection; an unfavorable location near heat sources or an unfavorable configuration of the EtherCAT EJ modules may result in overheating of the modules.

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.

6.1.4 Electrical installation

⚠ WARNING

Risk of injury!

Bring the bus system into a safe, de-energized state before starting installation, disassembly or wiring of the devices!

6.1.4.1 Connections between EJ modules

The electrical connections between the EJ Bus Coupler and EJ modules are realized automatically by plugging the components into the EJ backplane.

Note the maximum E-bus current!

Observe the maximum current that your EJ Bus Coupler can supply to the E-bus! Use the EJ9400 power supply module if the current consumption of your modules exceeds the maximum current your EJ Bus Coupler can provide.

6.1.4.2 Overvoltage protection

If protection against overvoltage is necessary in your plant, provide a surge filter for the voltage supply to the Bus Terminal blocks and the TwinSAFE EJ modules.

6.2 Digital input

6.2.1 Parameterization

Two indices are provided under the safety parameters for the parameterization of the inputs. These are the general settings for the test pulse outputs and the channel-specific settings for the input filter. In the TwinSAFE EJ modules an input module consists of two channels.

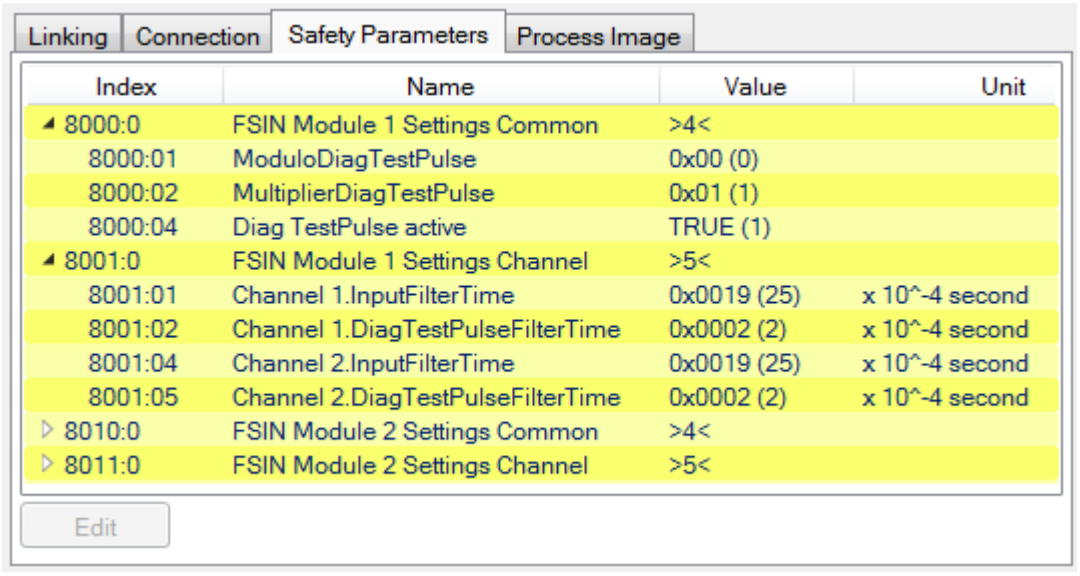


Fig. 6: Digital input - safety parameters

Index	Name	Default value / unit	Description
80x0:01	ModuloDiagTestPulse	0x00 / integer	Modulo value for the frequency of the generation of a test pulse. 0 -> every time 1 -> every second time ...

Index	Name	Default value / unit	Description
80x0:02	MultiplierDiagTestPulse	0x01 / integer	Length of the test pulse in multiples of 2 ms
80x0:04	Diag TestPulse active	TRUE / Boolean	Activation of test pulses for the corresponding input module
80x1:01	Channel 1.InputFilterTime	0x0019 / 0.1 ms	Input filter of safe input 1. Following this time the internal input signal changes to the applied signal state.
80x1:02	Channel 1.DiagTestPulseFilterTime	0x0002 / 0.1 ms	Input filter for the test pulse signal
80x1:04	Channel 2.InputFilterTime	0x0019 / 0.1 ms	Input filter of safe input 2. Following this time the internal input signal changes to the applied signal state.
80x1:05	Channel 2.DiagTestPulseFilterTime	0x0002 / 0.1 ms	Input filter for the test pulse signal

The index is incremented by 0x10 for each input module in accordance with the number of inputs.

6.3 Digital output

NOTICE

protected wiring

If the wiring of the outputs or the connected actuators leaves the control cabinet, the user must ensure that the wiring is protected.

⚠ WARNING

Active loads

The use of active loads (with their own power supply) is not permissible unless the manufacturer of the load ensures the non-reactivity of the power supply to the control signal.

⚠ DANGER

Clocked signals inside a sheathed cable

If clocked signals from different output modules are used inside a single sheathed cable, then a module error such as a cross-circuit or external power supply must lead to the switch-off of all of these modules. This switch-off must be executed by the user program.

6.3.1 Parameterization

The outputs are parameterized via the *Safety Parameters* tab of the alias devices. A TwinSAFE EJ output module consists of four channels.

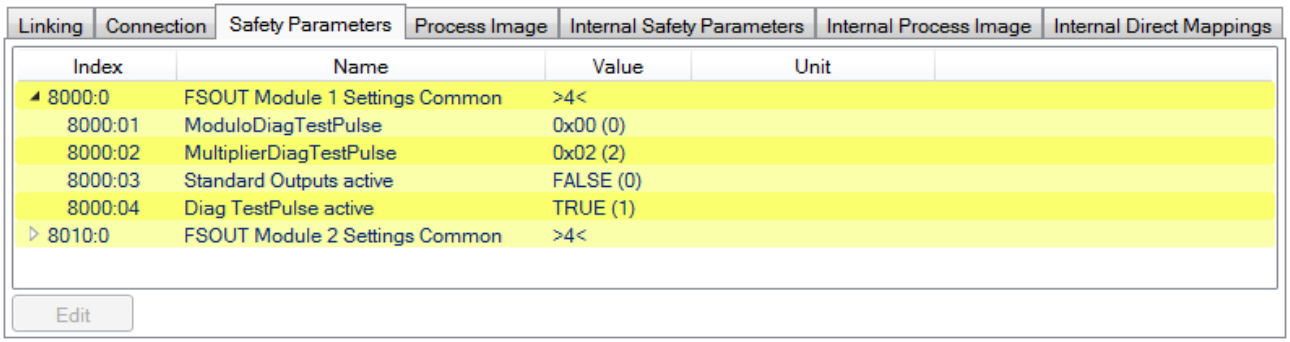


Fig. 7: Digital output –safety parameters

Index	Name	Default value / unit	Description
80x0:01	ModuloDiagTestPulse	0x00 / integer	Modulo value for the frequency of the generation of a test pulse. 0 -> every time 1 -> every second time ...
80x0:02	MultiplierDiagTestPulse	0x02 / integer	Length of the test pulse in multiples of 400 µs
80x0:03	Standard outputs active	FALSE / Boolean	Activation of the logical AND operator of the safe and standard outputs of the module
80x0:04	Diag TestPulse active	TRUE / Boolean	Activation of test pulses for the corresponding output module

The index is incremented by 0x10 for each output module in accordance with the number of outputs.

Testpulse length of the output signals

The setting via the parameter MultiplierDiagTestPulse controls the test pulses of the individual channels. In addition, the second internal switch off path is also tested. This leads to a prolongation of the length of the test pulses by approx. 700µs.

Together with the setting MultiplierDiagTestPulse = 2 results in a minimum test pulse length of 1.5 ms.

The parameter MultiplierDiagTestPulse can not be reduced to 1 since a reliable readback of the test pulse at the output is not possible.

Testpulse length of the output

The minimum useful setting of MultiplierDiagTestPulse = 2 results in a total test pulse length of approx. 1.5 ms.

6.3.2 Actuators

The outputs have a maximum permissible output current of 0.5 A. This must not be exceeded. The simultaneity factor of the outputs of an EJ module is 100%.

Inductive, resistive and capacitive loads are supported.

6.4 Status LEDs

The status LEDs of the TwinSAFE EJ modules are labeled STAT1 to STAT4.

STAT1	STAT2	STAT3	STAT4	Meaning
Off	Off	Off	lit	No TwinSAFE project available on the component
Off	Off	lit	lit	TwinSAFE project loaded, but not yet in RUN state
lit	Off	lit	lit	TwinSAFE project loaded and in RUN state. Customization is active for at least one TwinSAFE group
lit	lit	lit	lit	TwinSAFE project loaded and in RUN state. Customization is NOT active

6.5 Diagnostic LEDs

The diagnostic LEDs of the TwinSAFE EJ modules are labeled DIAG1 to DIAG4.

6.5.1 Flashing codes

LED	lit	flashes	flickers	off
DIAG1 (green)	Environment variables, operating voltage and internal tests are in the valid range • If DIAG2 flashes, a logic error code applies	-		Environment variables, operating voltage and internal tests are outside the valid range • If DIAG2 flashes, an environment error code applies
DIAG2 (red)	Together with DIAG3 and 4: Global shutdown[1)] has occurred (see diag history of the TwinSAFE components).	Logic or environment error code according to Diag1 and tables below is output	Error of the safe input or output module	Together with DIAG3 and 4: Global fault[1)] has occurred (see diag history of the TwinSAFE components).
DIAG3 (red)	Global fault or global shutdown on µC1[1)]	-		No global fault or global shutdown on µC1[1)]
DIAG4 (red)	Global fault or global shutdown on µC2[1)]	-		No global fault or global shutdown on µC2[1)]

1. A global fault permanently disables the TwinSAFE component, so that it has to be replaced. A global shutdown temporarily disables the TwinSAFE component. The error can be reset by switching off and back on again.

Logic error codes of LED DIAG2 (if LED DIAG1 is lit)

Flashing 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

Environment error codes of LED DIAG2 (if LED DIAG1 is off)

Flashing Code	Description
1	Maximum supply voltage µC1 exceeded
2	Supply voltage µC1 below minimum value
3	Maximum supply voltage µC2 exceeded
4	Supply voltage µC2 below minimum value
5	Maximum internal temperature exceeded
6	Internal temperature below minimum value
7	Valid temperature difference between µC1 and µC2 exceeded
8	not used
9	not used
10	General error

6.5.2 Flash code display

LED	Display	Description
flashing		400 ms ON / 400 ms OFF 1 second pause between the flash codes
flickering		50 ms ON / 50 ms OFF

7 EJ1914

7.1 Overview

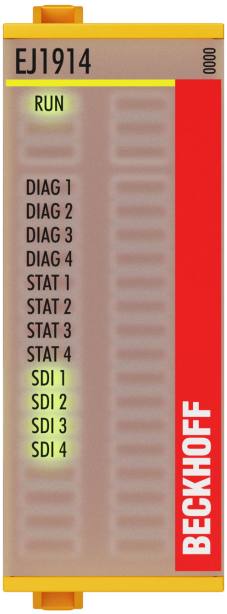


Fig. 8: EJ1914 - TwinSAFE module with 4 fail-safe inputs

The EJ1914 Safety EtherCAT plug-in module is a digital input module for sensors with potential-free contacts for 24 V_{DC}. The plug-in module has 4 fail-safe inputs and 4 clock outputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 PL e.

The EJ module is parameterized via 2 input modules.

7.1.1 Version history

This version history lists the software and hardware version numbers. You will also find a description of the changes to previous versions contained in each case. See the table below for more information.

Software version	Hardware version	Modifications
01 (0104)	00	• I/O port register settings changed
01 (0102)	00	First release of the EJ1914

7.2 Inserting the EJ module

An EJ module is inserted in exactly the same way as any other Beckhoff EtherCAT module. In the list, open *Safety Terminals* and select the EJ module.

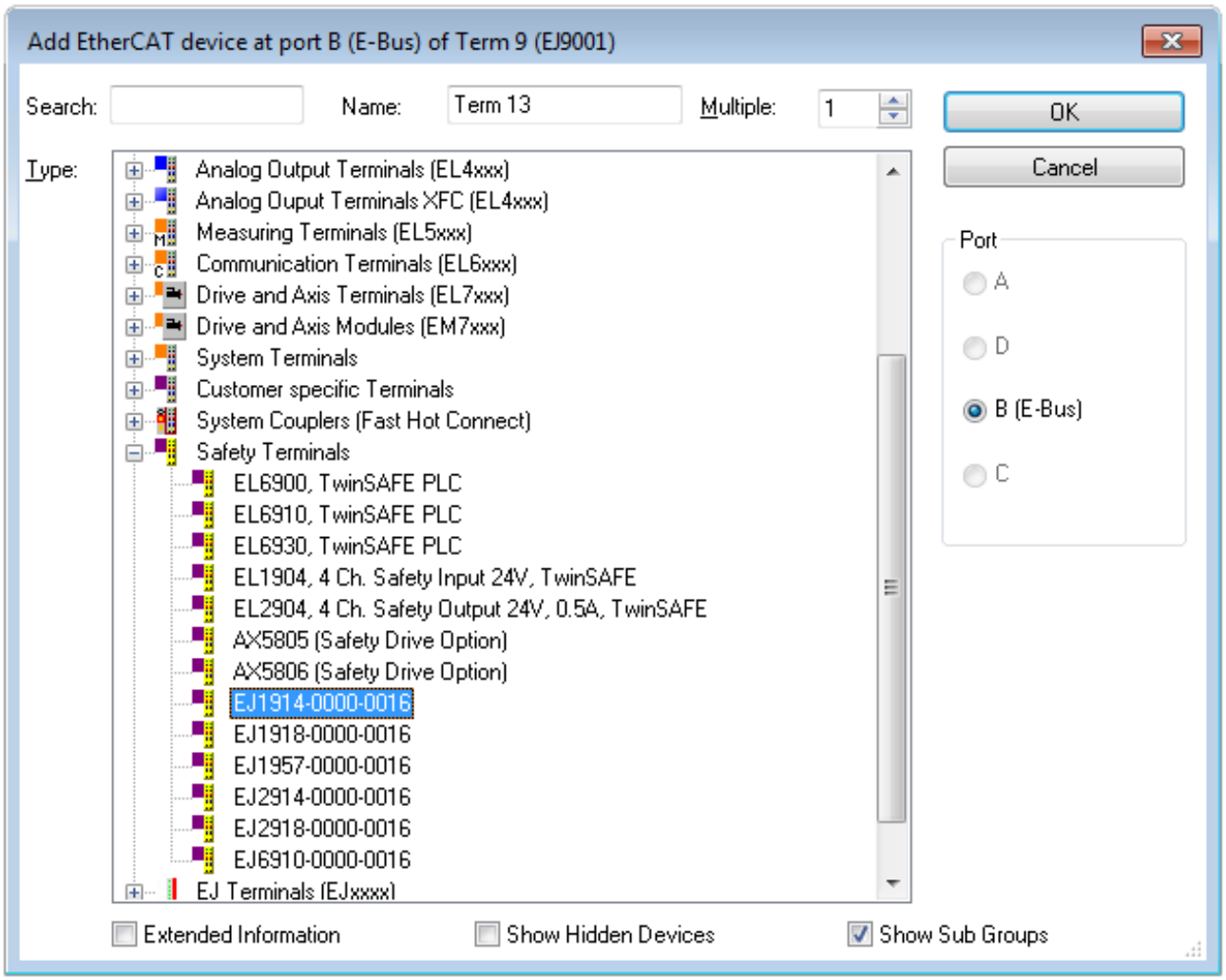


Fig. 9: Adding the EJ module

7.3 Specific product data

The EJ1914 Safety EtherCAT plug-in module is a digital input module for sensors for 24 V_{DC}. The EJ plug-in module has 4 fail-safe inputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 Category 4 / PL e.

Product property	EJ1914
Number of inputs	4
Number of clock outputs	4
Number of outputs	-
Status display	4 (one green LED per input)
Diagnostic display	4 (1 green, 3 red LEDs)
Current consumption of the module electronics at 24 V (without current consumption of sensors)	4 channels occupied: typically 15 mA 0 channels occupied: typically 2 mA
Current consumption via E-bus	4 channels occupied: approx. 260 mA
Weight	approx. 45 g

7.3.1 Connection

The pin assignment can be found in document [1] at References [▶ 7].

7.4 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.

EJ1914 target failure measures		Explanation
Lifetime	20 a	
Proof test interval	/	Special proof tests during the entire service life of the TwinSAFE component are not required.
PFH_D	3.21E-09	
%SIL 3 of PFH_D	3.2 %	
PFD_{avg}	2.20E-04	
%SIL 3 of PFD_{avg}	5.1%	
$MTTF_D$	2406 a	
DC	98.3%	
SIL	3	According to IEC 61508:2010.
Performance Level	e	According to EN ISO 13849-1:2023.
Category	4	According to EN ISO 13849-1:2023.
HFT	1	
Element classification	Type B	According to EN 61508-2:2010 Chapter 7.4.4.1.2 and 7.4.4.1.3.

8 EJ1918

8.1 Overview

Fig. 10: EJ1918 - TwinSAFE module with 8 digital fail-safe inputs

The EJ1918 Safety EtherCAT plug-in module is a digital input module for sensors with potential-free contacts for 24 V_{DC}. The plug-in module has 8 fail-safe inputs and 8 clock outputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 PL e.

The EJ module is parameterized via 4 input modules.

8.1.1 Version history

This version history lists the software and hardware version numbers. You will also find a description of the changes to previous versions contained in each case. See the following table.

Software version	Hardware version	Modifications
01 (0104)	00	• I/O port register settings changed
01 (0102)	00	First release of the EJ module

8.2 Inserting the EJ module

An EJ module is inserted in exactly the same way as any other Beckhoff EtherCAT module. In the list, open *Safety Terminals* and select the EJ module.

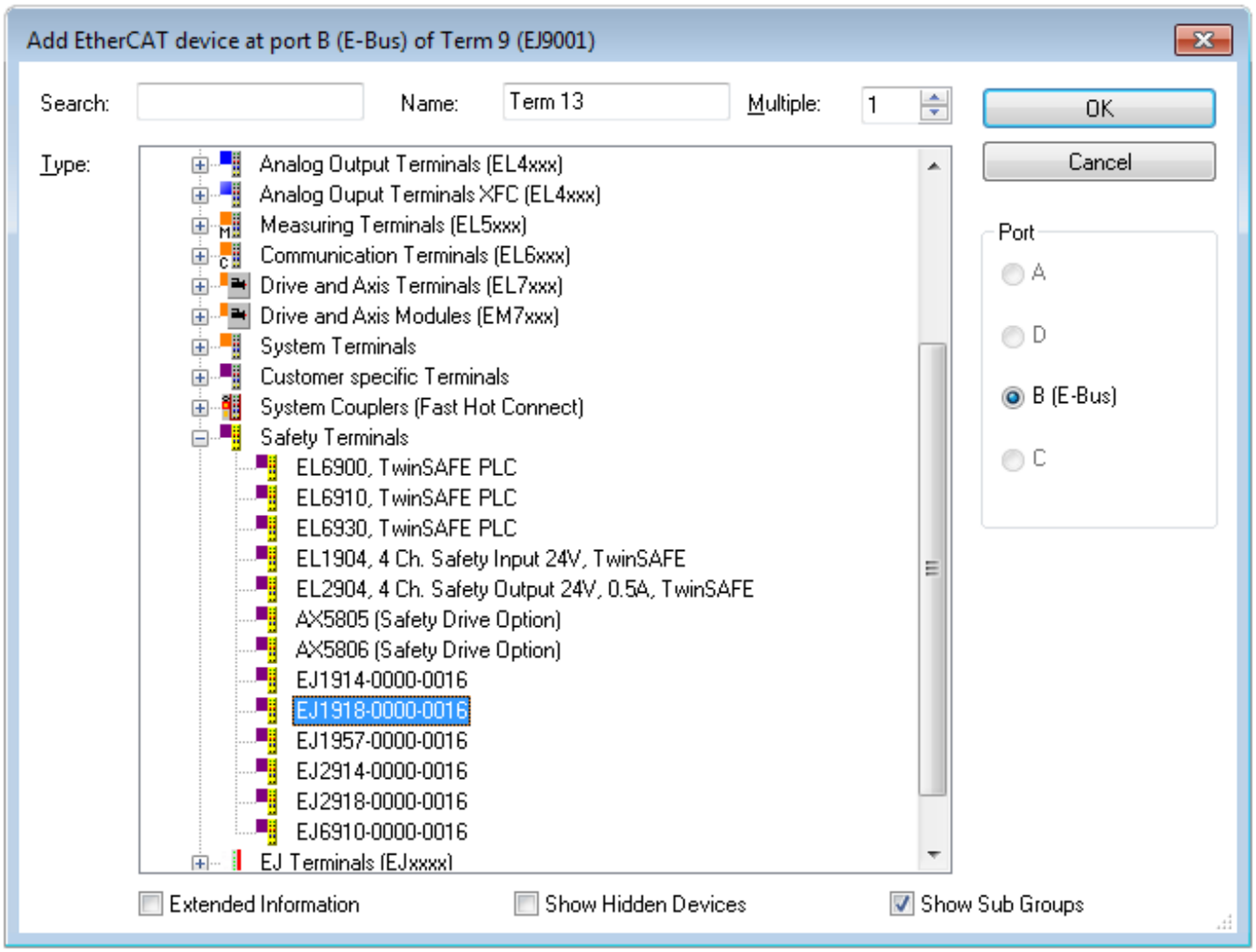


Fig. 11: Adding the EJ module

8.3 Specific product data

Product property	EJ1918
Number of inputs	8
Number of clock outputs	8
Number of outputs	-
Status display	8 (one green LED per input)
Diagnostic display	4 (1 green, 3 red LEDs)
Current consumption of the module electronics at 24 V (without current consumption of sensors)	8 channels occupied: typically 26 mA 0 channels occupied: typically 3 mA
Current consumption via E-bus	8 channels occupied: approx. 290 mA
Weight	approx. 60 g

8.3.1 Connection

The pin assignment can be found in document [1] at References [▶ 7].

8.4 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.

EJ1918 target failure measures		Explanation
Lifetime	20	
Proof test interval	not required 1)	Special proof tests during the entire service life of the TwinSAFE component are not required.
PFH_D	3.21E-09	
%SIL 3 of PFH_D	3.2%	
PFD_{avg}	4.95E-05	
%SIL 3 of PFD_{avg}	5.0%	
$MTTF_D$	2406 a	
DC	98.3%	
SIL	3	According to IEC 61508:2010.
Performance Level	e	According to EN ISO 13849-1:2023.
Category	4	According to EN ISO 13849-1:2023.
HFT	1	
Element classification	Type B	According to EN 61508-2:2010 Chapter 7.4.4.1.2 and 7.4.4.1.3.

9 EJ1957

9.1 Overview

Fig. 12: EJ1957 – TwinSAFE module with 8 digital fail-safe inputs and 4 digital fail-safe outputs

The EJ1957 TwinSAFE module is a digital input and output terminal for sensors with potential-free contacts for 24 V_{DC}. The plug-in module has 8 fail-safe inputs with 8 clock outputs and 4 fail-safe outputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 PL e.

The EJ module is parameterized via four input modules and one output module.

9.1.1 Version history

This version history lists the software and hardware version numbers. You will also find a description of the changes to previous versions contained in each case. See the following table.

Software version	Hardware version	Modifications
01 (0104)	00	• I/O port register settings changed
01 (0102)	00	First release of the EJ module

9.2 Inserting the EJ module

An EJ module is inserted in exactly the same way as any other Beckhoff EtherCAT module. In the list, open *Safety Terminals* and select the EJ module.

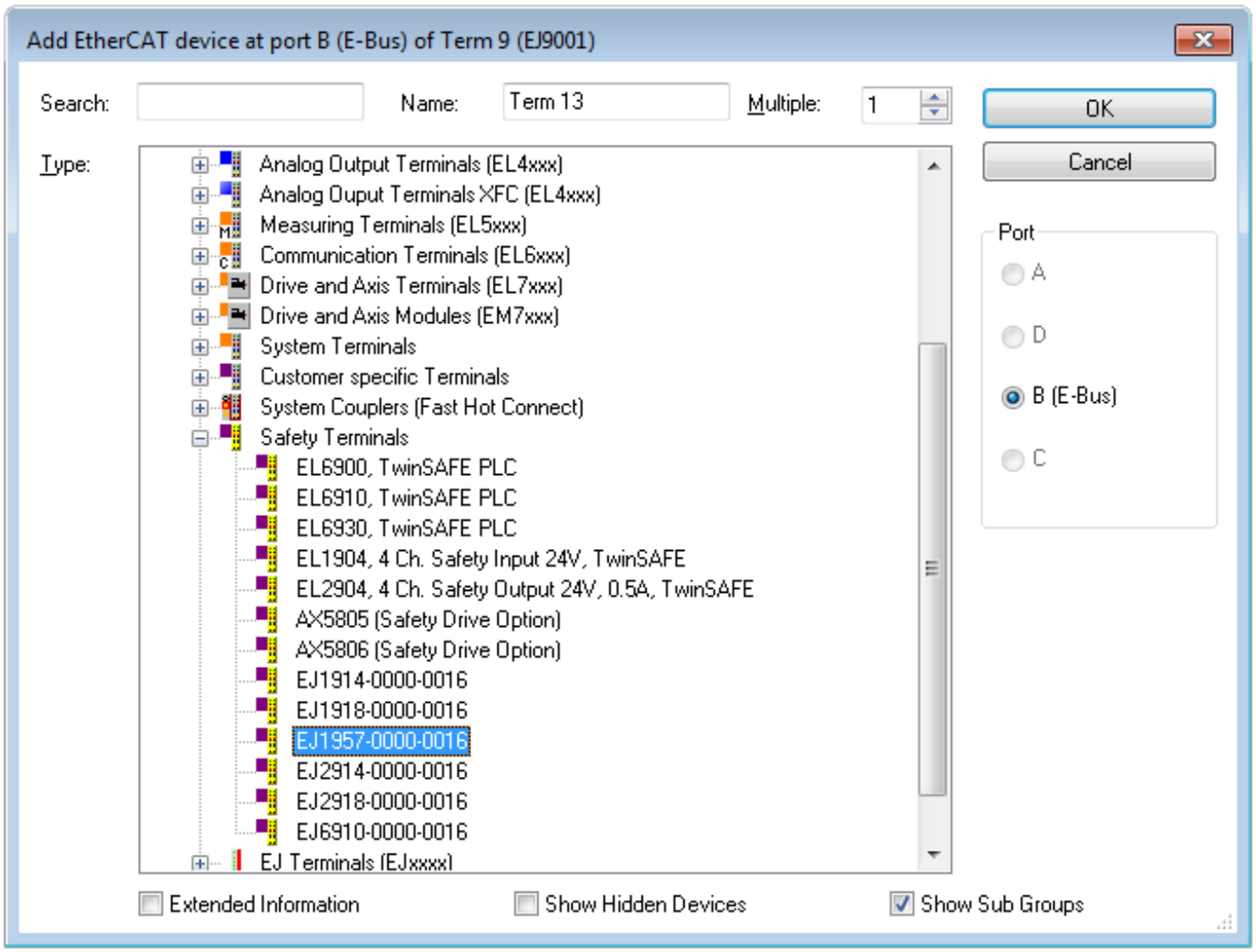


Fig. 13: Adding the EJ module

9.3 Specific product data

Product property	EJ1957
Number of inputs	8
Number of clock outputs	8
Number of outputs	4
Status display	12 (one green LED per input/output)
Diagnostic display	4 (1 green, 3 red LEDs)
Current consumption of the module electronics from 24 V (without current consumption of sensors and actuators)	12 channels occupied: typically 46 mA 0 channels occupied: typically 3 mA
Current consumption via E-bus	12 channels occupied: approx. 330 mA
Weight	approx. 64 g

9.3.1 Connection

The pin assignment can be found in document [1] at References [▶ 7].

9.4 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.

EJ1957 target failure measures		Explanation
Lifetime	20	
Proof test interval	not required	Special proof tests during the entire service life of the TwinSAFE component are not required.
PFH_D	4.43E-09	
%SIL 3 of PFH_D	4.4%	
PFD_{avg}	5.0E-05	
%SIL 3 of PFD_{avg}	5.0%	
$MTTF_D$	1731 a	
DC	98.4%	
SIL	3	According to IEC 61508:2010.
Performance Level	e	According to EN ISO 13849-1:2023.
Category	4	According to EN ISO 13849-1:2023.
HFT	1	
Element classification	Type B	According to EN 61508-2:2010 Chapter 7.4.4.1.2 and 7.4.4.1.3.

10 EJ2914

10.1 Overview

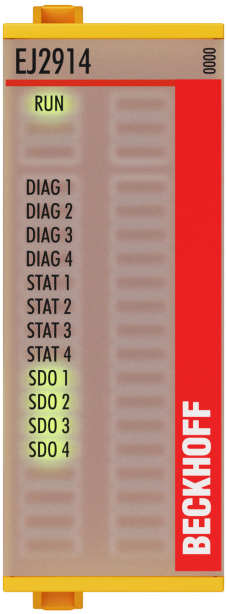


Fig. 14: EJ2914 - TwinSAFE module with 4 digital fail-safe outputs

The EJ2914 TwinSAFE module is a digital output module for actuators with 24 V_{DC}. The plug-in module has 4 fail-safe outputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 PL e.

The EJ module is parameterized via one output module.

10.1.1 Version history

This version history lists the software and hardware version numbers. You will also find a description of the changes to previous versions contained in each case. See the following table.

Software version	Hardware version	Modifications
01 (0104)	00	• I/O port register settings changed
01 (0102)	00	First release of the EJ2914

10.2 Inserting the EJ module

An EJ module is inserted in exactly the same way as any other Beckhoff EtherCAT module. In the list, open *Safety Terminals* and select the EJ module.

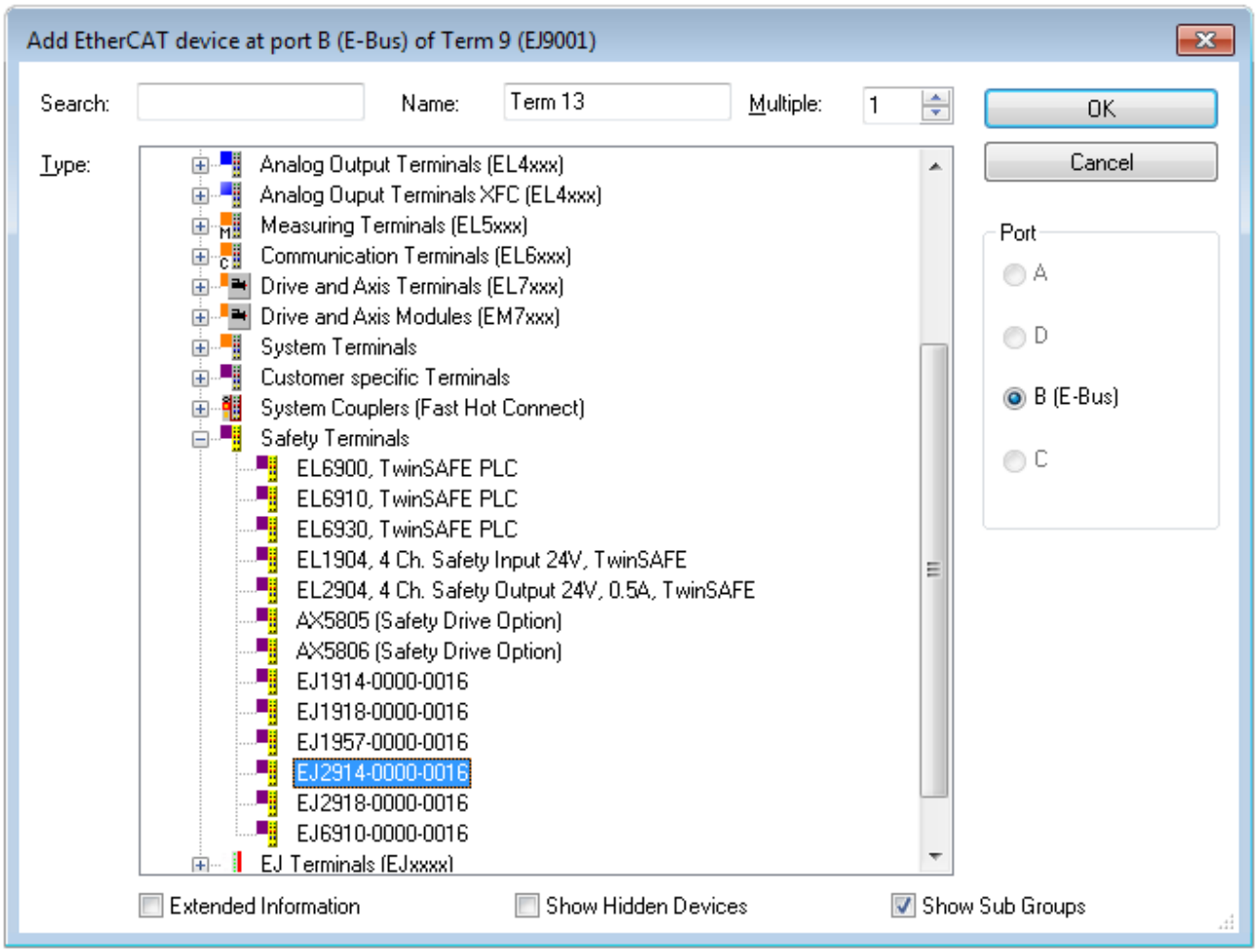


Fig. 15: Adding the EJ module

10.3 Specific product data

Product property	EJ2914
Number of inputs	-
Number of clock outputs	-
Number of outputs	4
Status display	4 (one green LED per output)
Diagnostic display	4 (1 green, 3 red LEDs)
Current consumption of the module electronics from 24 V (without current consumption of actuators)	0 channels occupied: typically 1 mA 4 channels occupied: typically 22 mA
Current consumption via E-bus	4 channels occupied: approx. 260 mA
Weight	approx. 47 g

10.3.1 Connection

The pin assignment can be found in document [1] at References [▶ 7].

10.4 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.

EJ2914 target failure measures		Explanation
Lifetime	20	
Proof test interval	not required	Special proof tests during the entire service life of the TwinSAFE component are not required.
PFH_D	3.03E-09	
%SIL 3 of PFH_D	3.0%	
PFD_{avg}	2.6E-05	
%SIL 3 of PFD_{avg}	2.6%	
$MTTF_D$	1994 a	
DC	98.1%	
SIL	3	According to IEC 61508:2010.
Performance Level	e	According to EN ISO 13849-1:2023.
Category	4	According to EN ISO 13849-1:2023.
HFT	1	
Element classification	Type B	According to EN 61508-2:2010 Chapter 7.4.4.1.2 and 7.4.4.1.3.

11 EJ2918

11.1 Overview

Fig. 16: EJ2918 - TwinSAFE module with 8 digital fail-safe outputs

The EJ2918 TwinSAFE module is a digital output module for actuators with 24 V_{DC}. The plug-in module has 8 fail-safe outputs and meets the requirements of IEC 61508:2010 SIL 3 and EN ISO 13849-1:2023 PL e.

The EJ module is parameterized via two output modules.

11.1.1 Version history

This version history lists the software and hardware version numbers. You will also find a description of the changes to previous versions contained in each case. See the following table.

Software version	Hardware version	Modifications
02 (0105)	00	• I/O port register settings changed
02 (0103)	00	First release of the EJ2918

11.2 Inserting the EJ module

An EJ module is inserted in exactly the same way as any other Beckhoff EtherCAT module. In the list, open *Safety Terminals* and select the EJ module.

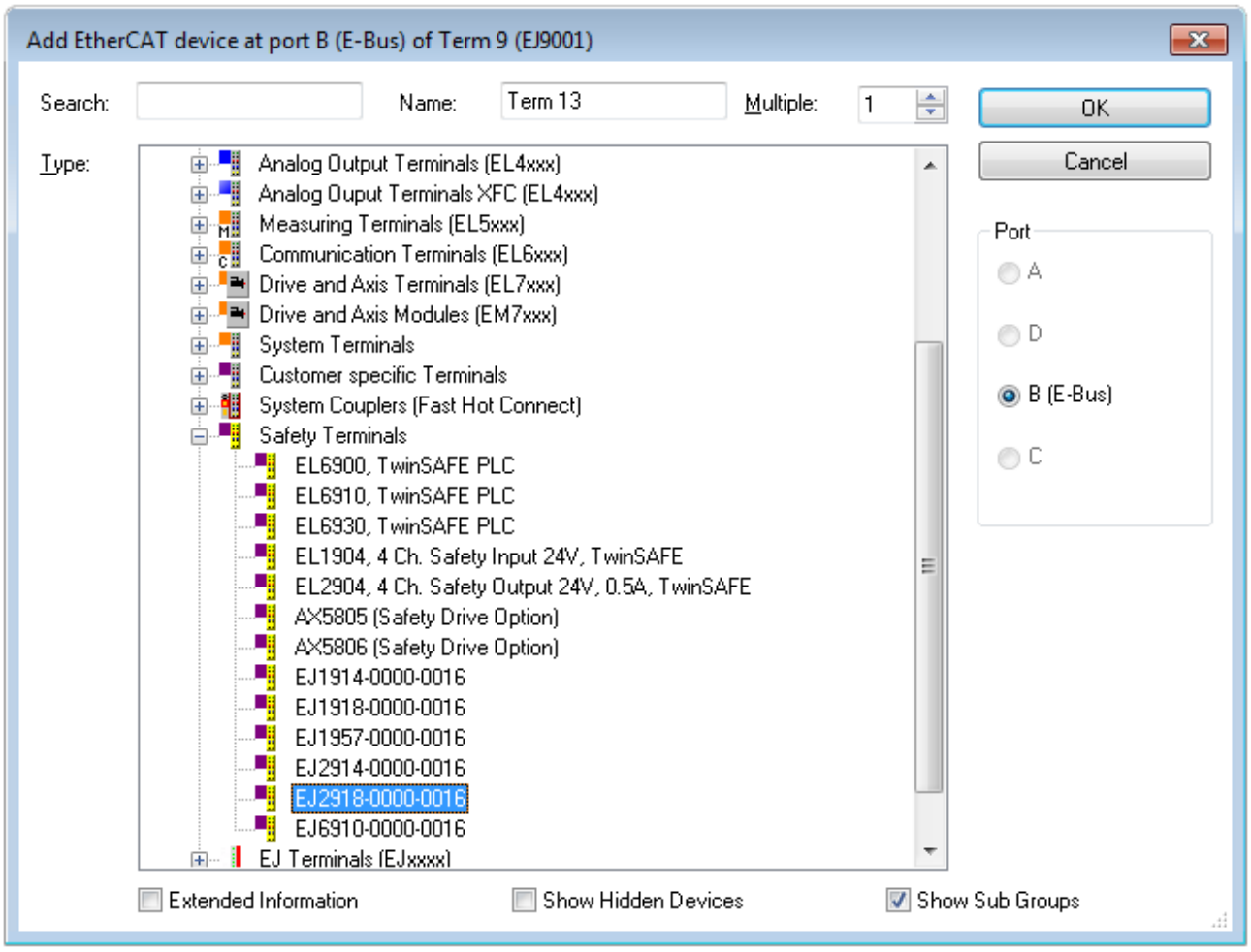


Fig. 17: Adding the EJ module

11.3 Specific product data

Product property	EJ2918
Number of inputs	-
Number of clock outputs	-
Number of outputs	8
Status display	8 (one green LED per output)
Diagnostic display	4 (1 green, 3 red LEDs)
Current consumption of the module electronics from 24 V (without current consumption of actuators)	8 channels occupied: typically 42 mA 0 channels occupied: typically 1 mA
Current consumption via E-bus	8 channels occupied: approx. 310 mA
Weight	approx. 62 g

11.3.1 Connection

The pin assignment can be found in document [1] at References [▶ 7].

11.4 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.

EJ2918 target failure measures		Explanation
Lifetime	20	
Proof test interval	not required	Special proof tests during the entire service life of the TwinSAFE component are not required.
PFH_D	3.03E-09	
%SIL 3 of PFH_D	3.0%	
PFD_{avg}	2.6E-05	
%SIL 3 of PFD_{avg}	2.6%	
$MTTF_D$	1994 a	
DC	98.1%	
SIL	3	According to IEC 61508:2010.
Performance Level	e	According to EN ISO 13849-1:2023.
Category	4	According to EN ISO 13849-1:2023.
HFT	1	
Element classification	Type B	According to EN 61508-2:2010 Chapter 7.4.4.1.2 and 7.4.4.1.3.

12 Maintenance and cleaning

Unacceptable contamination

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

TwinSAFE components are basically maintenance-free.

13 Decommissioning

13.1 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.

13.1.1 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.

14 Appendix

14.1 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.

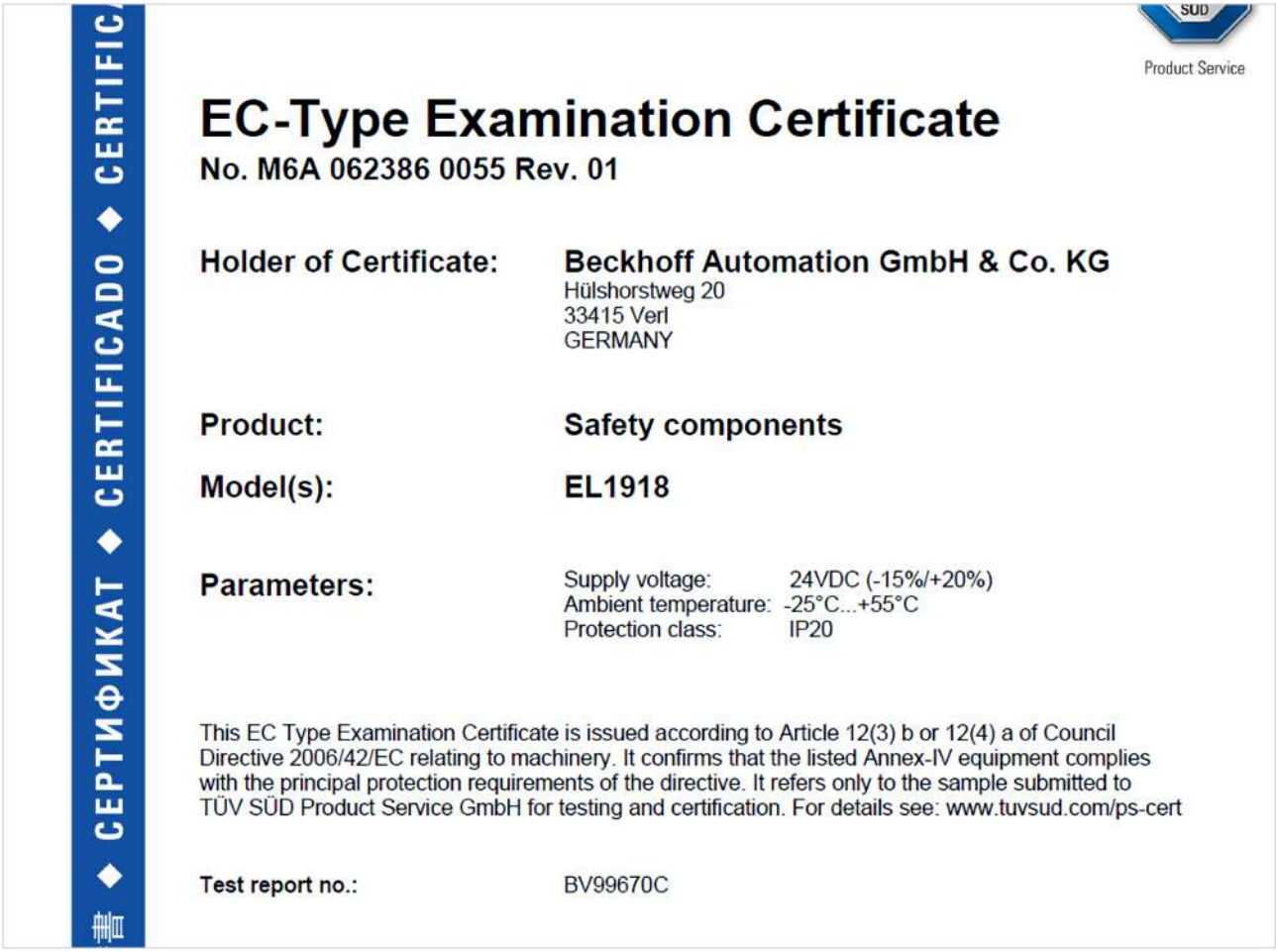
If there is customer specific data saved on the product, it cannot be ensured that this data might not be restored through for example forensic measures, even after the data is deleted through the provided tool chain. If this data is confidential, the scrapping of the product after usage is recommended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

14.2 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.

14.3 Declarations of conformity and certificates

The EC Declaration of Conformity can be found at 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 EJx9xx certificates.

List of figures

Trademark statements

More Information:
www.beckhoff.com/EJx9xx

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