

Documentation | EN

ED288x

EtherCAT Terminals, digital output, 24 V DC, 0.5 A, ground switching, push-in

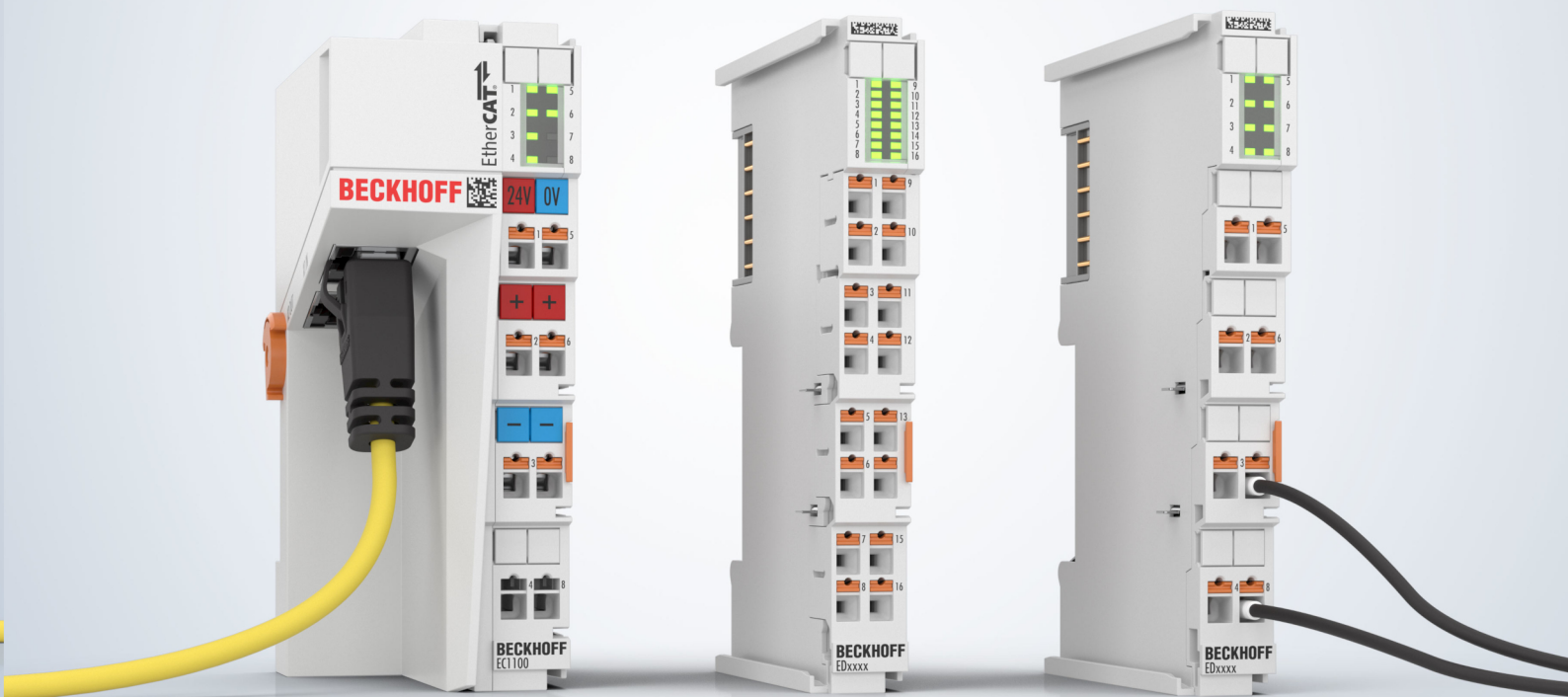


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1 Foreword

1.1 Product overview

This documentation covers the following products:

[ED2887](#) [► 15] EtherCAT Terminal, 32-channel digital output, 24 V DC, 0.5 A, ground switching, push-in

[ED2889](#) [► 19] EtherCAT Terminal, 16-channel digital output, 24 V DC, 0.5 A, ground switching, push-in

Use the tabular product overview or the product finder to find the right product for your application (<https://www.beckhoff.com/IO>).

1.2 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.

The qualified personnel is obliged to always use the currently valid documentation.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation 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 this documentation.

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1.3 Guide through documentation

NOTICE



Further components of documentation

This documentation describes device-specific content. It is part of the modular documentation concept for Beckhoff I/O components. For the use and safe operation of the devices described in this documentation, additional cross-product descriptions are required, which can be found in the following table.

Title	Description
EtherCAT System Documentation (PDF)	• System overview • EtherCAT basics • Cable redundancy • Hot Connect • EtherCAT devices configuration
Application guide TwinSAFE (PDF)	Examples for the calculation of safety parameters for safety functions
Infrastructure for EtherCAT/Ethernet (PDF)	Technical recommendations and notes for design, implementation and testing
Software Declarations I/O (PDF)	Open source software declarations for Beckhoff I/O components

The documentations can be viewed at and downloaded from the Beckhoff website (www.beckhoff.com) via:

- the “Documentation and Download” area of the respective product page,
- the [Download finder](#),
- the [Beckhoff Information System](#).

If you have any suggestions or proposals for our documentation, please send us an e-mail stating the documentation title and version number to: documentation@beckhoff.com

1.4 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!

Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

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

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.

1.5 Interference-free bus terminals

i Implementing interference-free bus or EtherCAT Terminals in safety applications

When a bus terminal or EtherCAT Terminal is described as interference-free, this means that the downstream terminal will be passive in a safety application (e.g., during all-pole disconnection of a potential group).

In this context, the terminals do not constitute an active part of the safety controller and do not influence the safety integrity level (SIL) or performance level (PL) achieved in the safety application.

Please refer to the [TwinSAFE Application Manual](#), chapter “All-pole disconnection of a potential group with downstream interference-free standard terminals (Category 4, PL e)” and subsequent sections.

NOTICE

Note the hardware version

Please refer to the “Technical data” and “Firmware compatibility” sections for information on the hardware version and interference-free nature of the respective bus terminal!

Only terminals with the correct hardware version may be used – otherwise the achieved SIL/PL may be affected!

The terminals regarded as interference-free at the point that this document was drafted are listed in the following tables along with their respective hardware versions.

Bus terminals

Terminal name	From hardware version
KL2408	05
KL2809	02
KL2134	09
KL2424	05
KL9110	07

ED Terminals

Terminal name	From hardware version
ED2008	00
ED2032	00
ED2034	00
ED2807	00
ED2809	00
ED2828	00
ED2838	00
ED2887	00
ED2889	00
ED9100	00
ED9110	00
ED9184	00
ED9410	00

EL Terminals

Terminal name	From hardware version
EL2004	15
EL2008	07
EL2014	00
EL2022	09
EL2024	06
EL2034	06
EL2042	06
EL2044	01
EL2068	00
EL2212	00
EL2258	00
EL2407	00
EL2409	00
EL2489	00
EL2809	01
EL2819	00
EL2828	00
EL2838	00
EL2869	00
EL2872	01
EL2878-0005	00
EL9110	13
EL9184	00
EL9185	00
EL9186	00
EL9187	00
EL9410	16

ELX Terminals

Terminal name	From hardware version
ELX1052	00
ELX1054	00
ELX1058	00
ELX2002	00
ELX2008	00
ELX2792	00
ELX3152	00
ELX3158	00
ELX3181	00
ELX3184	00
ELX3202	00
ELX3204	00
ELX3252	00
ELX3312	00
ELX3314	00
ELX3351	00
ELX4154	01
ELX4181	00
ELX5151	00
ELX6233	00
ELX9560	03

External wiring

The following requirements are to be ensured *by the system manufacturer* and must be incorporated into the user documentation.

- **IP54 protection rating**
The terminals must be installed in IP54 control cabinets to assure the required IP54 protection rating.
- **Power supply**
The standard terminals must be supplied with 24 V by an SELV/PELV power supply unit with an output voltage limit of $U_{\max} = 60 \text{ V}$ in the event of a fault.
- **Prevention of feedback**
Feedback can be prevented through different measures. These are described below. In addition to mandatory requirements, there are also optional requirements – only one of these must be selected.
 - **Do not switch loads with a separate power supply**
Loads that have their own power supply may not be switched by standard terminals, since in this case feedback via the load cannot be ruled out.

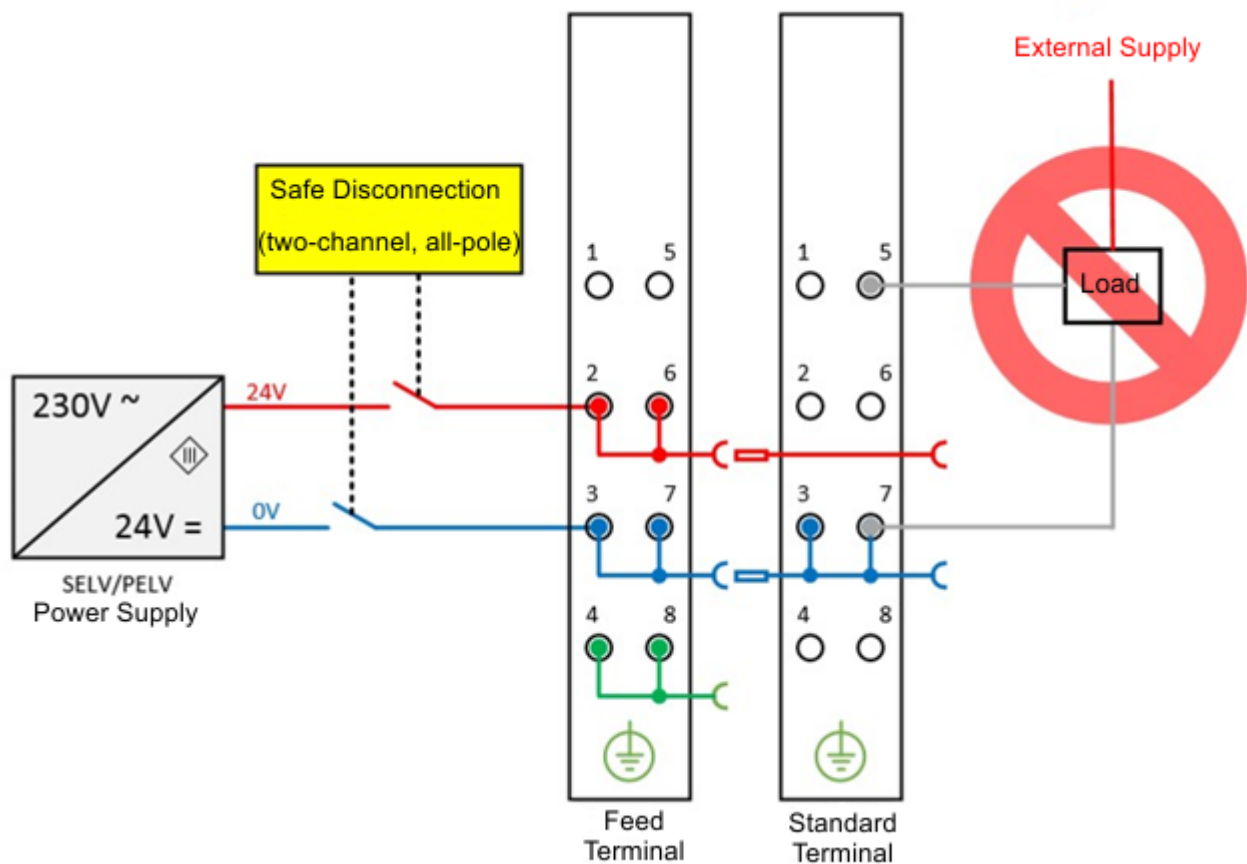


Fig. 1: Negative example – active load

- **A negative example** here could be activating an STO input for a variable frequency drive. **Exceptions** to the general requirement are only permitted if the manufacturer of the connected load guarantees that feedback to the control input cannot occur. This can be achieved, for example, through compliance with load-specific standards.

- **Option 1: Ground return and all-pole disconnection**

The ground connection for the connected load must be fed back to the safely switched ground.

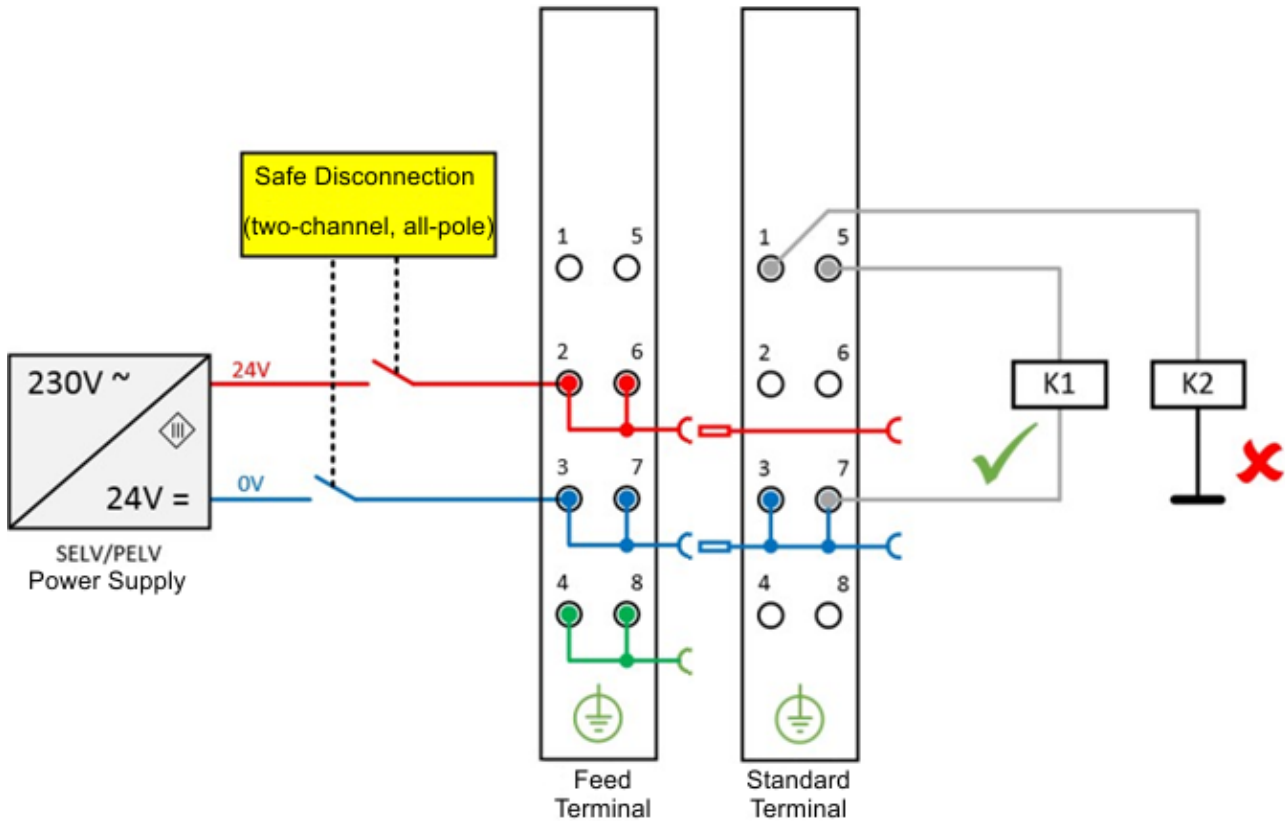


Fig. 2: Ground connection of the load: correct (K1) and incorrect (K2)

- If either
 - a) the load's ground is not connected back to the terminal, or
 - b) the ground is not safely switched but permanently connected

, it is necessary to rule out faults related to short circuits with external potential in order to achieve Cat. 4 PLe in accordance with DIN EN ISO 13849-1:2007 or SIL 3 in accordance with IEC 61508:2010 (see the overview in the chapter "Effect of the options on the safety level").

- **Option 2: Excluding cable short-circuiting faults**

If option 1 is not feasible, the ground return and all-pole disconnection can be dispensed with if the danger of feedback due to a cable short-circuit can be excluded by other measures. These measures, which can be implemented as alternatives, are described in the following sections.

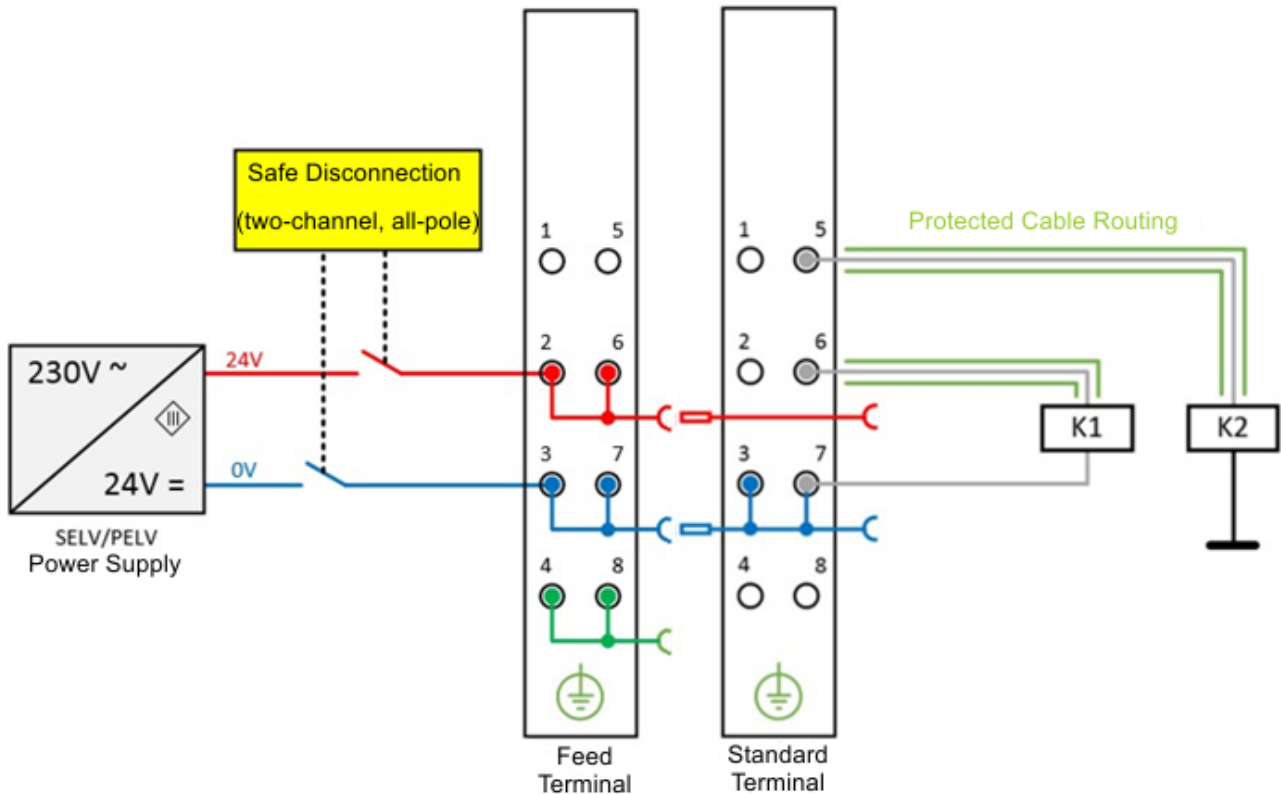


Fig. 3: Excluding a short-circuit fault by protecting cables

- **a) Option 1: Load connection using separate sheathed cables**

The non-safely switched potential for the standard terminal may not be grouped inside the same sheathed cable as other potential-conducting lines. (*Fault exclusion, see DIN EN ISO 13849-2:2013, Table D.4*)

- **b) Option 2: Wiring is kept internal within the control cabinet**

All loads connected to the non-safe standard terminals must be located in the same control cabinet as the terminals. The cables are routed entirely inside the control cabinet. (*Fault exclusion, see DIN EN ISO 13849-2:2013, Table D.4*)

- **c) Option 3: Dedicated earth connection per conductor**

All conductors connected to the non-safe standard terminals are protected by their own earth connection. (*Fault exclusion, see DIN EN ISO 13849-2:2013, Table D.4*)

- **d) Option 4: Wiring permanently (fixed) installed and protected against external damage**

All conductors connected to the non-safe standard terminals are permanently fixed in place and protected against external damage, for example, by a cable channel or conduit.

- **The options' effect on the safety level**

In principle, standard terminals in safely switched potential groups are not an active part of the safety controller. This means that **the safety level attained is solely defined by the higher-level safety controller**: the standard terminals are not included in the calculation! However, the wiring of the standard terminals can lead to limitations on the maximum safety level that can be achieved. There are different maximum achievable safety levels which are dependent on the selected solution option (see Option 1 and Option 2) for preventing feedback and the applicable safety standard, and these are summarized in the following table:

Summary of safety levels

Feedback prevention measures	DIN EN ISO 13849-1	IEC 61508	EN 62061
Cable short-circuit fault exclusion	max. Cat. 4	max. SIL3	max. SIL2*
Ground return and all-pole disconnection	PL e		max. SIL3

⚠ WARNING**Please follow the instructions for operating interference-free terminals!**

- All terminals in a potential group must be interference-free!
- Make sure that, even in the event of a fault, no power can be fed back through external wiring!

2 Product description

2.1 ED2887



EtherCAT Terminal, 32-channel digital output, 24 V DC, 0.5 A, ground switching, push-in

The ED2887 digital output terminal connects the binary 24 V DC control signals from the automation device on to the actuators at the process level with electrical isolation.

The EtherCAT Terminal has 32 channels that indicate their signal state via light emitting diodes (status LEDs).

The power contacts are looped through internally. In the ED2887 the outputs are supplied via the 0 V DC power contact. The connection technology is optimized for single-ended signals (common reference point). To ensure error-free operation, all connected components must use the same reference as the ED2887 Terminal.

Special features:

- suitable for controlling different types of loads:
 - resistive loads (e. g. resistors)
 - inductive loads (e. g. relays, contactors, valves)
 - capacitive loads
- max. output current of 0.5 A per channel (Σ 10 A)
- ground switching
- short-circuit proof outputs: protection against overload or short circuit
- reverse polarity protection in the event of incorrect polarity of the supply voltage

The ED-series EtherCAT Terminals have push-in connection technology which makes wiring easy and tool-free.

2.1.1 Technical data

General	ED2887
Number of channels Total	32
Internal communication protocol	EtherCAT
Digital output	ED2887
Standard digital Ground switching	
Number of channels	32
Load type	resistive, inductive, capacitive
Connection technology	1-wire
Signal range Nominal	24 V DC
Signal range Technical	20.4...28.8 V DC
Output current	max. 0.5 A per channel
Output current Σ	max. 10 A
Short-circuit proof	yes
Output stage	pull
Switching times T_{ON}	typ. 100 μ s
Switching times T_{OFF}	typ. 300 μ s
Reverse polarity protection	yes
Switching-off energy Inductive	< 100 mJ per channel
XFC	ED2887
Distributed clocks	no
Timestamp	no
Oversampling	no
Supply and electrical isolation	ED2887
Electronics Supply voltage	via E-bus, via power contacts
E-bus Current consumption	typ. 65 mA
Power contacts Input voltage	24 V DC (-15%/+20%)
Power contacts Current carrying capacity	max. 10 A
Power contacts Current consumption	typ. 50 mA + load
Power contacts Output voltage	corresponds to Power contacts Input voltage
Electrical isolation Channel/channel	no
Electrical isolation Channel/bus	functional, 707 V DC (type test)
Environmental conditions	ED2887
Operating temperature	-25...+60°C
Storage temperature	-40...+85°C
Relative humidity	95%, no condensation
Installation position	variable
Standards and approvals	ED2887
Vibration resistance	conforms to EN 60068-2-6
Shock resistance	conforms to EN 60068-2-27
EMC immunity	conforms to EN 61000-6-2
EMC emission	conforms to EN 61000-6-4
Markings*)	CE
Approvals*)	—
*) Real applicable approvals/markings, see name plate on the side (product labeling)	

Housing data	ED-24-2x16pin
Weight	approx. 100 g
Protection rating	IP20
Material	polycarbonate
Dimensions Width (single)	27 mm
Dimensions Width (stacked)	24 mm
Dimensions Height	100 mm
Dimensions Depth	65 mm
Installation Terminal/back wall	DIN rail, 35 mm (EN 60715)
Installation Terminal/terminal	double slot and key connection
Pluggable wiring level	no
Connection mechanism	push-in
Connection cross-section Solid wire	0.08...1.5 mm ²
Connection cross-section Stranded wire	0.25...1.5 mm ²
Connection cross-section With ferrule	0.14...0.75 mm ²
Connection cross-section AWG Solid wire	AWG28...16
Connection cross-section AWG Stranded wire	AWG22...16
Connection cross-section AWG With ferrule	AWG26...19
Stripping length	8...9 mm
Power contact "+" (left)	yes
Power contact "+" (right)	yes
Power contact "-" (left)	yes
Power contact "-" (right)	yes
Power contact "≡" (left)	no
Power contact "≡" (right)	no
Insertion lock for power contact "≡"	yes

2.1.2 Connection and LEDs

⚠ WARNING

Risk of injury through electric shock and damage to the device!
Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

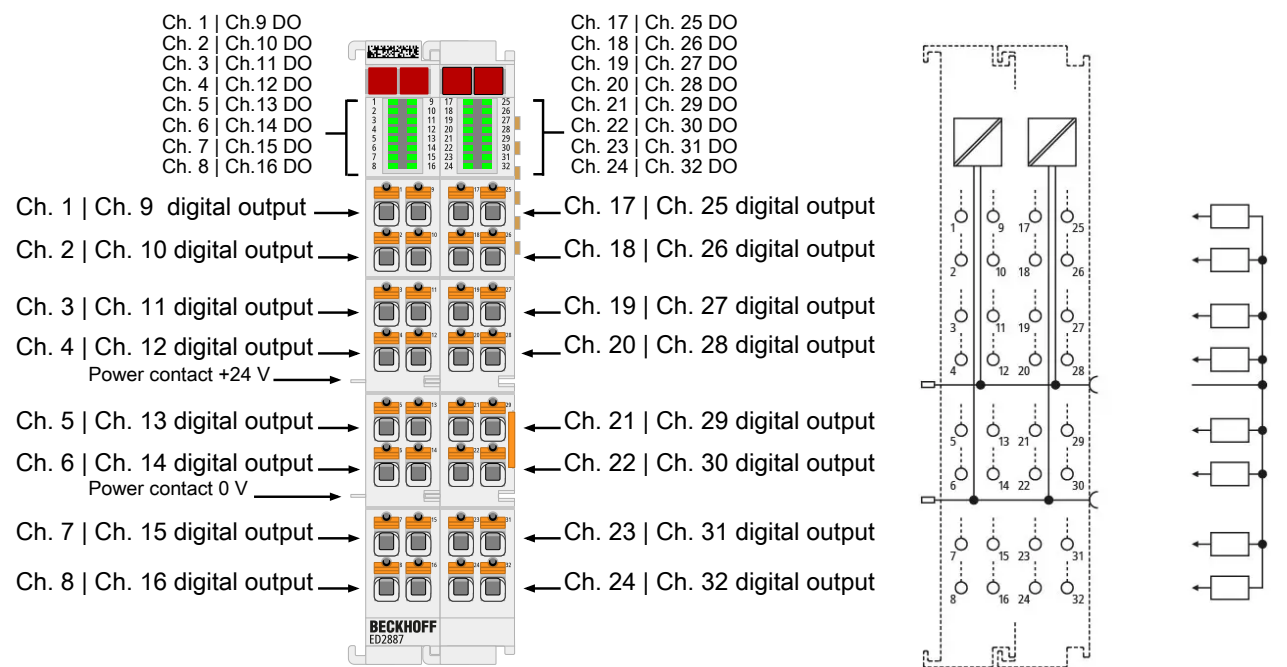


Fig. 4: ED2887

Connection

Terminal point		Description
Abbreviation	No.	
Ch 1	1	Output 1
...	...	...
Ch 32	32	Output 32

i

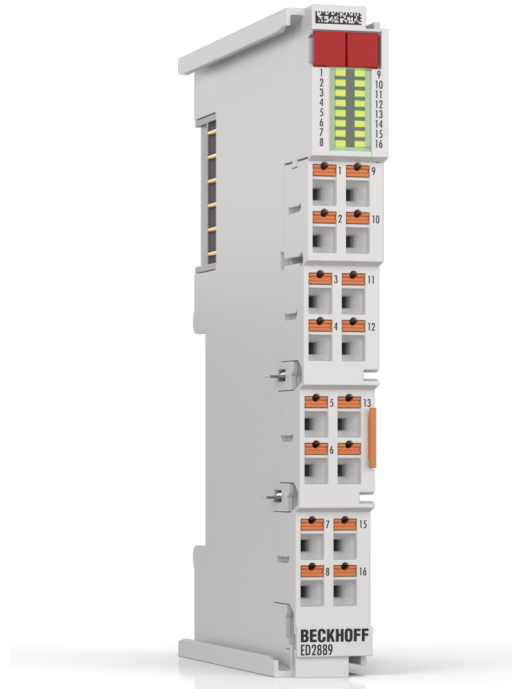
Common reference point required for all connected components
The connection technology is optimized for single-ended signals (common reference point).

- To ensure error-free operation, all connected components must use the same reference point as the terminal.

LEDs

Name	No.	Color	Meaning	
Output status Ch1 ...32	1...32	green	off	no output signal
			on	0 V DC output signal at the respective output

2.2 ED2889



EtherCAT Terminal, 16-channel digital output, 24 V DC, 0.5 A, ground switching, push-in

The ED2889 digital output terminal connects the binary 24 V DC control signals from the automation device on to the actuators at the process level with electrical isolation.

The EtherCAT Terminal has 16 channels that indicate their signal state via light emitting diodes (status LEDs).

The power contacts are looped through internally. In the ED2889 the outputs are supplied via the 0 V DC power contact. The connection technology is optimized for single-ended signals (common reference point). To ensure error-free operation, all connected components must use the same reference as the ED2889 Terminal.

Special features:

- suitable for controlling different types of loads:
 - resistive loads (e. g. resistors)
 - inductive loads (e. g. relays, contactors, valves)
 - capacitive loads
- max. output current of 0.5 A per channel
- ground switching
- short-circuit proof outputs: protection against overload or short circuit
- reverse polarity protection in the event of incorrect polarity of the supply voltage

The ED-series EtherCAT Terminals have push-in connection technology which makes wiring easy and tool-free.

2.2.1 Technical data

General	ED2889
Number of channels Total	16
Internal communication protocol	EtherCAT
Digital output	ED2889
Standard digital Ground switching	
Number of channels	16
Load type	resistive, inductive, capacitive
Connection technology	1-wire
Signal range Nominal	24 V DC
Signal range Technical	20.4...28.8 V DC
Output current	max. 0.5 A per channel
Short-circuit proof	yes
Output stage	pull
Switching times T _{ON}	typ. 100 µs
Switching times T _{OFF}	typ. 300 µs
Reverse polarity protection	yes
Switching-off energy Inductive	< 100 mJ per channel
XFC	ED2889
Distributed clocks	no
Timestamp	no
Oversampling	no
Supply and electrical isolation	ED2889
Electronics Supply voltage	via E-bus, via power contacts
E-bus Current consumption	typ. 100 mA
Power contacts Input voltage	24 V DC (-15%/+20%)
Power contacts Current carrying capacity	max. 10 A
Power contacts Current consumption	typ. 20 mA + load
Power contacts Output voltage	corresponds to Power contacts Input voltage
Electrical isolation Channel/channel	no
Electrical isolation Channel/bus	functional, 707 V DC (type test)
Environmental conditions	ED2889
Operating temperature	-25...+60°C
Storage temperature	-40...+85°C
Relative humidity	95%, no condensation
Installation position	variable
Standards and approvals	ED2889
Vibration resistance	conforms to EN 60068-2-6
Shock resistance	conforms to EN 60068-2-27
EMC immunity	conforms to EN 61000-6-2
EMC emission	conforms to EN 61000-6-4
Markings*)	CE
Approvals*)	-
*) Real applicable approvals/markings, see name plate on the side (product labeling)	

Housing data	ED-12-16pin
Weight	approx. 60 g
Protection rating	IP20
Material	polycarbonate
Dimensions Width (single)	15 mm
Dimensions Width (stacked)	12 mm
Dimensions Height	100 mm
Dimensions Depth	65 mm
Installation Terminal/back wall	DIN rail, 35 mm (EN 60715)
Installation Terminal/terminal	double slot and key connection
Pluggable wiring level	no
Connection mechanism	push-in
Connection cross-section Solid wire	0.08...1.5 mm ²
Connection cross-section Stranded wire	0.25...1.5 mm ²
Connection cross-section With ferrule	0.14...0.75 mm ²
Connection cross-section AWG Solid wire	AWG28...16
Connection cross-section AWG Stranded wire	AWG22...16
Connection cross-section AWG With ferrule	AWG26...19
Stripping length	8...9 mm
Power contact "+" (left)	yes
Power contact "+" (right)	yes
Power contact "-" (left)	yes
Power contact "-" (right)	yes
Power contact "≡" (left)	no
Power contact "≡" (right)	no
Insertion lock for power contact "≡"	yes

2.2.2 Connection and LEDs

⚠ WARNING

Risk of injury through electric shock and damage to the device!
Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

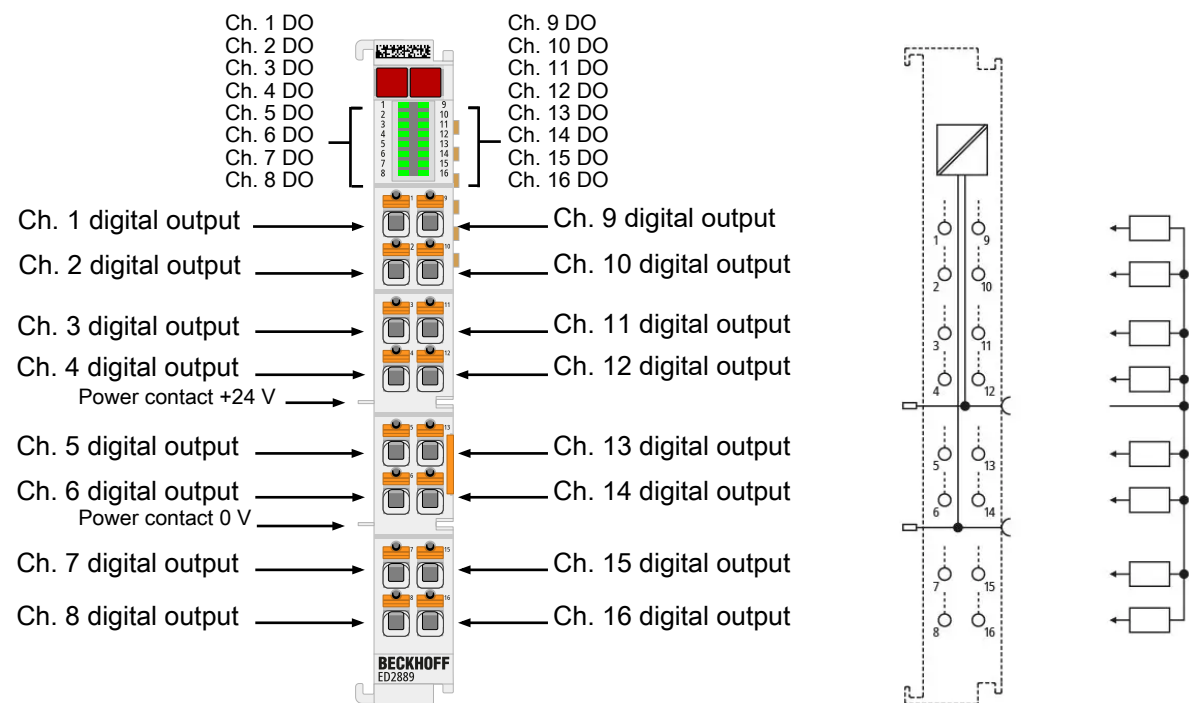


Fig. 5: ED2889

Connection

Terminal point		Description
Abbreviation	No.	
Ch 1	1	Output 1
...	...	...
Ch 16	16	Output 16

i Common reference point required for all connected components

The connection technology is optimized for single-ended signals (common reference point).

- To ensure error-free operation, all connected components must use the same reference point as the terminal.

LEDs

Name	No.	Color	Meaning	
Output status Ch1 ...16	1...16	green	off	no output signal
			on	0 V DC output signal at the respective output

3 Mounting and wiring

3.1 Notes on ESD protection

NOTICE

Devices can be destroyed by electrostatic charging!

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

- When handling the components, take care to avoid electrostatic discharge; also, prevent direct contact with the spring-loaded contacts (see illustration).
- Contact with highly insulating materials (synthetic fibers, plastic films, etc.) should be avoided when simultaneously handling components.
- When handling the components, ensure proper earthing of the environment (workplace, packaging, and persons).
- Each bus station must be terminated with the [EL9011](#) or [EL9012](#) end cap on its right side to guarantee the protection rating and ESD protection.

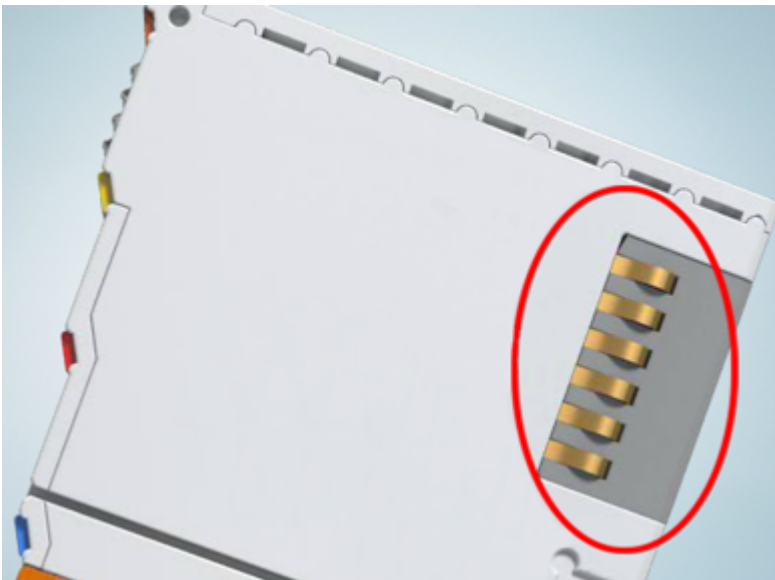


Fig. 6: Spring contacts of Beckhoff I/O components

3.2 Mounting rail installation

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

The bus terminal system is designed for installation in a control cabinet or junction box.

Installation

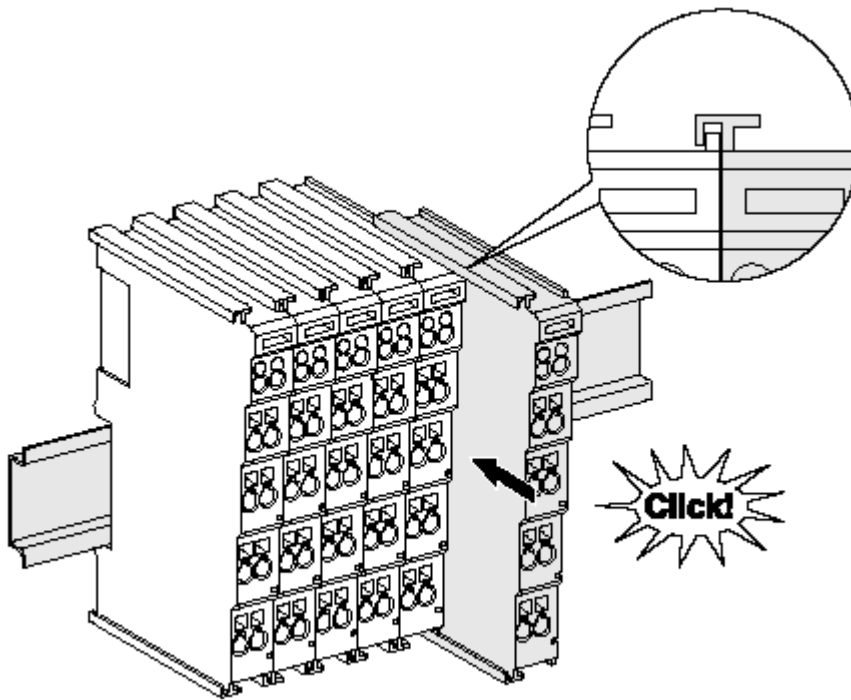


Fig. 7: Installation on the mounting rail

The bus couplers and bus terminals are attached to commercially available 35 mm mounting rails (DIN rail according to EN 60715) by applying slight pressure:

1. First attach the fieldbus coupler to the mounting rail.
2. The bus terminals are now attached on the right-hand side of the fieldbus coupler. To do this, connect the components with the slot and key and push the terminals against the mounting rail until the latch audibly engages on the mounting rail.

If you snap the terminals onto the mounting rail first and then push them next to each other without the slot and key engaging, no functional connection will be established! When correctly assembled, no significant gap should be visible between the housing units.

● Fastening the mounting rails

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

NOTICE

Earth the mounting rail!

Make sure the mounting rail is properly earthed.

Connections within a bus terminal block

The electric connections between the bus coupler and the bus terminals are made automatically by joining the components:

- The six spring-loaded contacts of the E-bus/K-bus deal with the data transfer and the supply of the bus terminal electronics.
- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminal points on the bus coupler (up to 24 V) or via power supply terminals for higher voltages.

i Power contacts

When configuring a bus terminal block, note the contact assignments of the individual bus terminals, as some types

- do not loop through the power contacts or do not loop them through completely (e. g. analog bus terminals or digital 4-channel bus terminals),
- the power contacts are disconnected, thus marking the start of a new supply rail (power supply terminals).

Power contact $\perp$

The power contact marked $\perp$ (ground connection in accordance with IEC 60417-5017) can be used as a ground. For safety reasons this contact mates first when plugging together, and can ground short-circuit currents of up to 125 A.

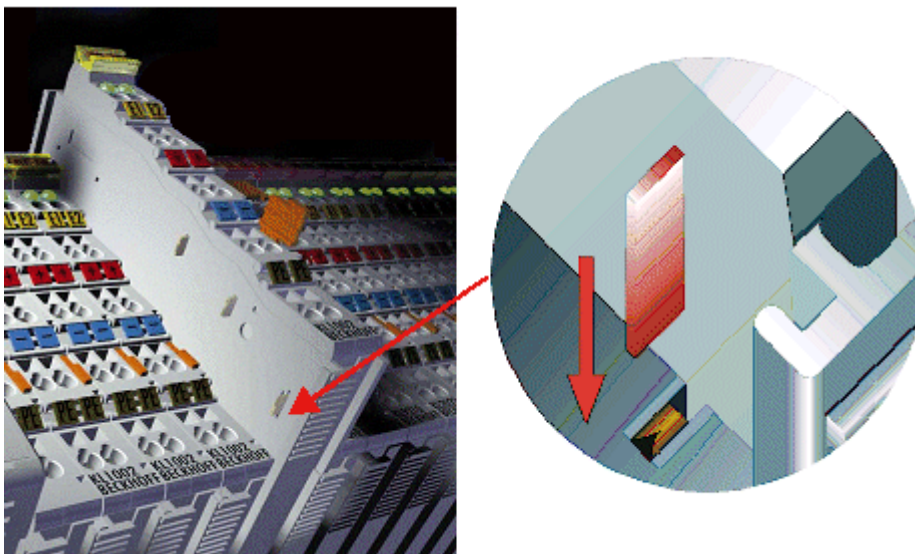


Fig. 8: Power contact on the left

⚠ WARNING

Risk of injury from electric shock!

The power contact marked $\perp$ may not be used for other potentials!

NOTICE

Risk of damage to the device

Note that, for electromagnetic compatibility, the earth contacts are capacitatively coupled to the mounting rail. This may lead to incorrect results during insulation testing or to damage to the terminal (e.g. disruptive discharge to the earth line during insulation testing of a consumer with a rated voltage of 230 V). For insulation testing, disconnect the earth supply line at the bus coupler or the power supply terminal! In order to decouple further supply points for testing, these power supply terminals can be released and pulled at least 10 mm from the group of terminals.

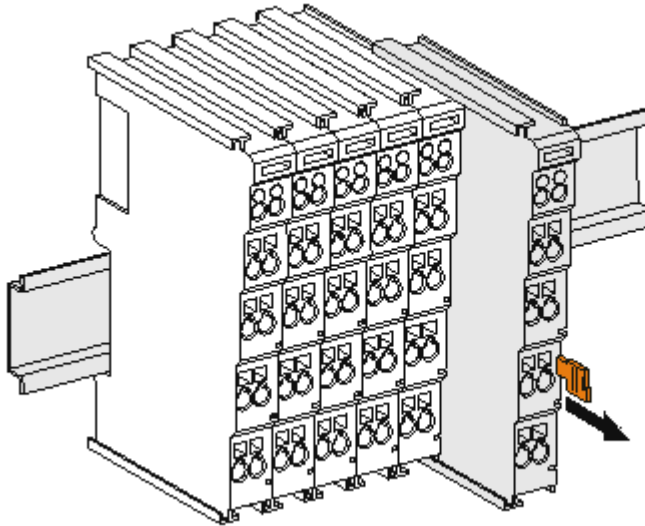
Disassembly

Fig. 9: Removal from mounting rail

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

1. Pull down the terminal at its orange-colored straps from the mounting rail by approx. 1 cm. The rail locking of this terminal is automatically released, and you can now pull the terminal out of the bus terminal block with little effort.
2. To do this, grasp the unlocked terminal simultaneously at the top and bottom of the housing surfaces with your thumb and index finger and pull it out of the bus terminal block.

3.3 Positioning of passive terminals



Note on the placement of passive terminals in the bus terminal block

EtherCAT Terminals that do not take part in active data exchange within the bus terminal block are referred to as passive terminals. These terminals can be recognized because they do not consume power from the E-bus. To ensure optimal data exchange, no more than two passive terminals may be connected directly to each other!

Examples of the placement of passive terminals (highlighted in light color)

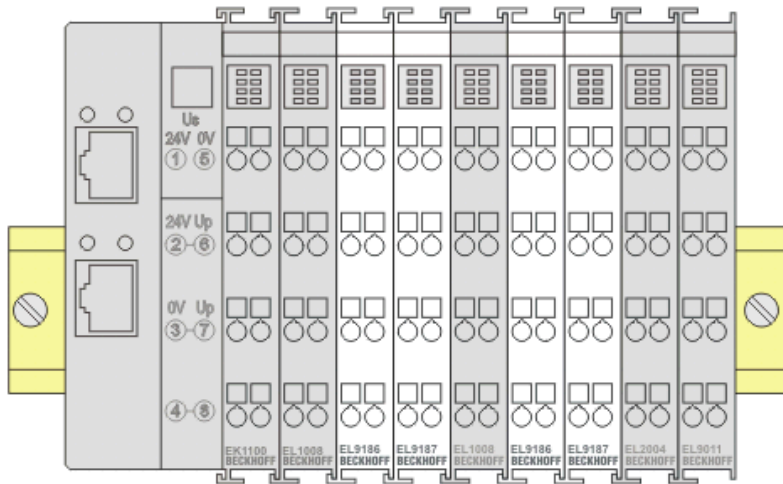


Fig. 10: Proper positioning

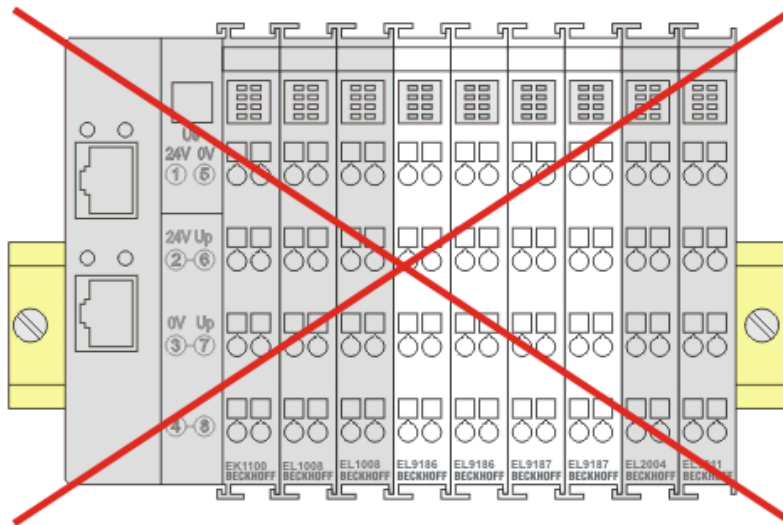


Fig. 11: Incorrect positioning

3.4 Installation positions

NOTICE

Constraints regarding installation position and operating temperature range

- Please refer to the technical data of the device to ascertain whether any restrictions regarding the installation position and/or the operating temperature range have been specified.
- When installing devices with increased heat dissipation, ensure that there is sufficient space above and below the devices during operation to guarantee adequate ventilation!

The installation positions and their names for mounting devices on mounting rails are specified below. The illustration of the devices in the following figures is an example.

The following applies to all installation positions: the reference direction “down” (see arrow) is the direction of the earth's gravitational force.

Horizontal installation (standard installation)

The mounting rail is mounted horizontally on a vertical mounting plate.
The connection level of the devices points to the front.

The devices are ventilated from below, which enables optimum cooling of the electronics through convection. This is therefore also the recommended installation position.

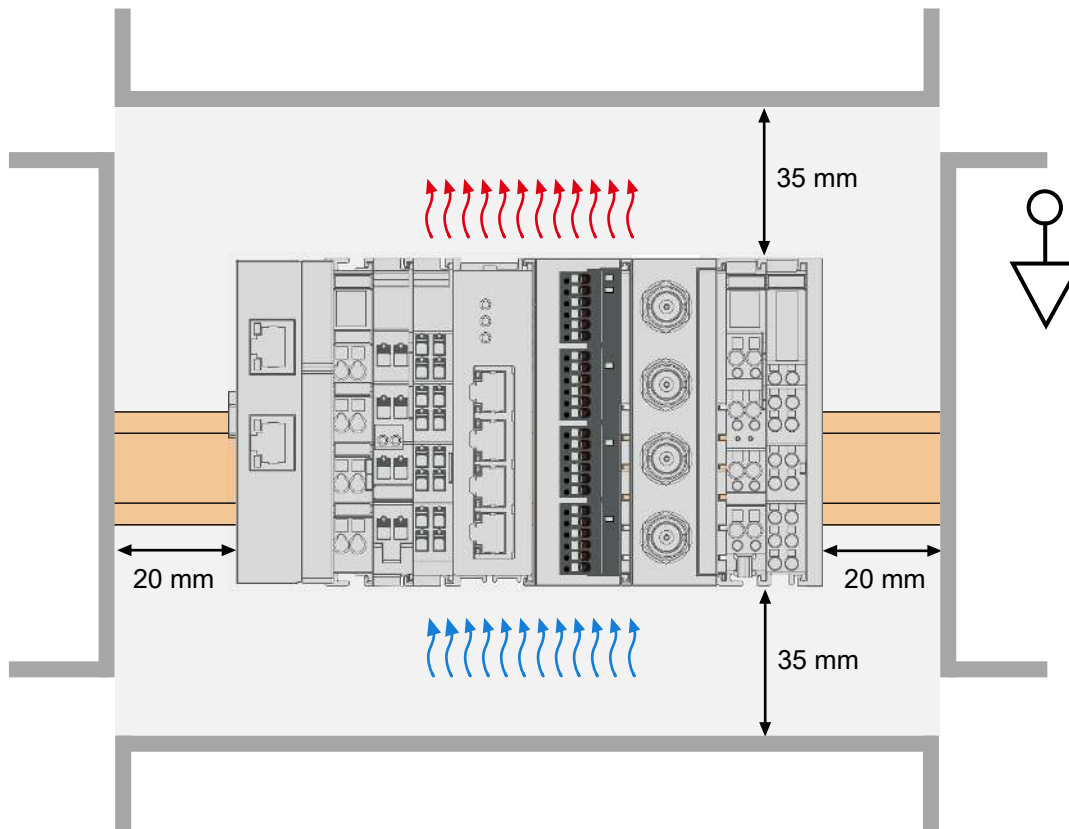


Fig. 12: Recommended minimum distances for standard installation position

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure “Recommended minimum distances for standard installation position” is strongly recommended in all installation positions.

Vertical installation

The mounting rail is mounted vertically on a vertical mounting plate.
The connection level of the devices faces the front.
The devices can be arranged as follows:

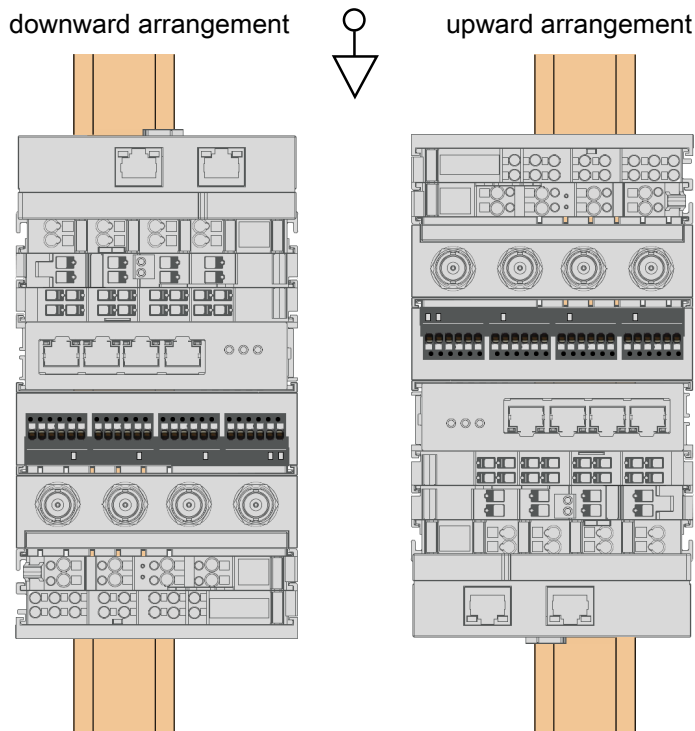


Fig. 13: Installation position: Vertical, downward arrangement (left)/upward arrangement (right)

Flat installation

The mounting rail is mounted on a horizontal mounting plate.
The connection level of the devices points upwards.

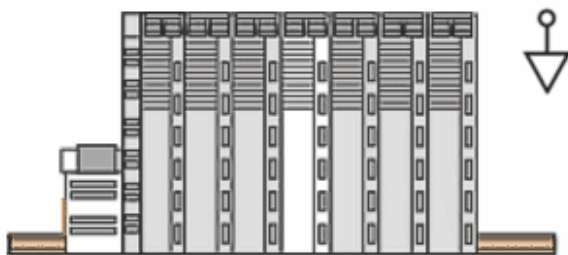


Fig. 14: Flat installation

NOTICE

Danger of sliding off the mounting rail

Particularly in the “vertical” installation position, but also in other installation positions under corresponding mechanical load, the terminal segment may move on the mounting rail. These can lead to undesirable malfunctions.

- If this risk exists, secure the terminal segment with appropriate locking devices, e.g. by clamping it to the mounting rail.

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure “Recommended minimum distances for standard installation position” is strongly recommended in all installation positions.

Installation positions with **ZB8610** fan cartridge

If the cooling should or must be increased for the intended application, the ZB8610 fan cartridge can be mounted on the underside of the device. In the horizontal installation position, the devices are ventilated from bottom to top by the fan cartridge. This optimum cooling is further enhanced by convection ventilation (see following figure).

The fan cartridge can be used in any installation position.

Further information on operation with and without a fan can be found in the technical data for the device (e.g. derating, information on installation positions, etc.).

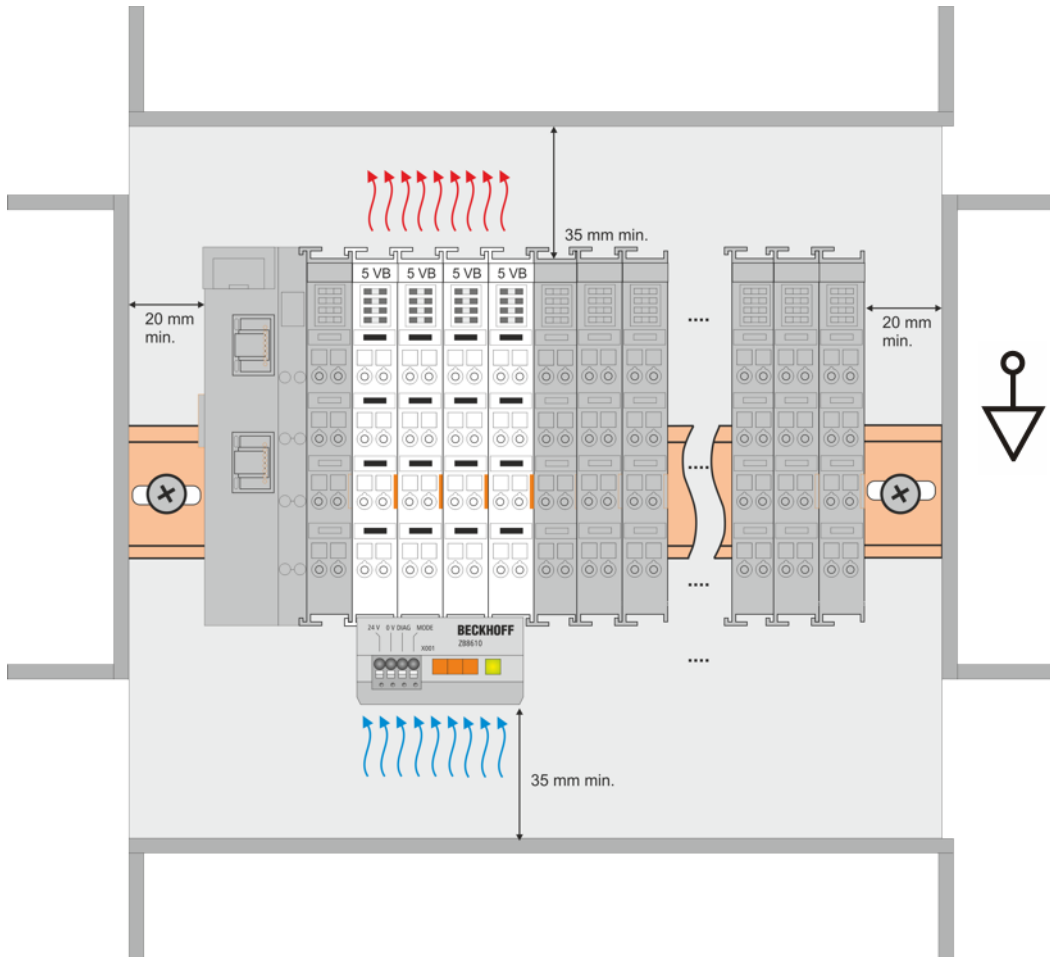


Fig. 15: Recommended minimum distances for operation with fan, using horizontal installation position as an example

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances as shown in the figure “Recommended minimum distances for operation with fan” is strongly recommended.

3.5 Push-in connection technology (EC/ED/EFxxxx)

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

In the case of EC/ED/EFxxxx-series Terminals with push-in connection technology, solid conductors fitted with wire end ferrules can be plugged in directly without tools (see “Wiring [▶ 32]” section).

● Ultrasonically compacted wires

i Ultrasonically compacted (ultrasonically welded) wires can also be connected.

- Please note the information on the connection cross-section in the table housing data in the chapter Technical data of the relevant device!



Fig. 16: Tool-free push-in connection; housing types ED-12-8pin, ED-12-16pin, and EF-12-8pin

The following connection options are available for optimum adaptation to the application:

- The EC/EDxxxx-series Terminals contain electronics and the connection level in one housing unit.
- The EFxxxx-series Terminals have a pluggable connection level. For servicing, the pluggable connection level allows the entire wiring to be removed from the top of the housing as a single plug. This reduces the installation time and eliminates the risk of wires being mixed up. The plug is only slightly protruding (for dimensions, see Technical data -> Housing data of the corresponding product). Installation and wiring are carried out as for the EDxxxx-series Terminals. Proceed as follows when replacing:
 - Press the unlocking hub and pull the lower part out of the terminal block.
 - Push in the replacement component and plug the connector with the upright wiring back in.

● Strain relief of the cable

i A tab for strain relief of the cable simplifies assembly in many applications and prevents entangling of the individual connection wires when the connector is pulled.

Overview of housing designs

EC/EDxxxx housing designs, contain the electronics and connection level in one housing	EFxxxx housing designs with pluggable wiring level	Description
EC-40-8pin	-	8 connection points on 40 mm
ED-12-8pin	EF-12-8pin	8 connection points on 12 mm
ED-24-2x8pin	EF-24-2x8pin	16 connection points on 24 mm
ED-12-16pin	-	16 connection points on 12 mm
ED-24-2x16pin	-	32 connection points on 24 mm

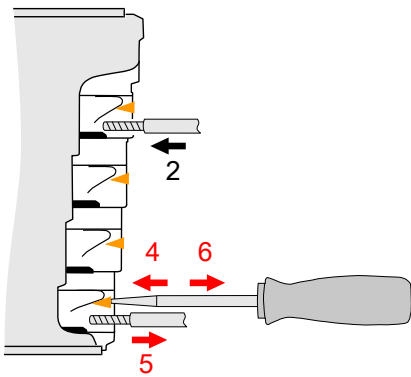
3.5.1 EC/ED/EFxxxx wiring with push-in connection technology

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

1.) Tool-free connection for solid conductors and conductors with ferrules



2.) Connection by push-button actuation for stranded wire conductors and **loosening the conductor (with tools)**

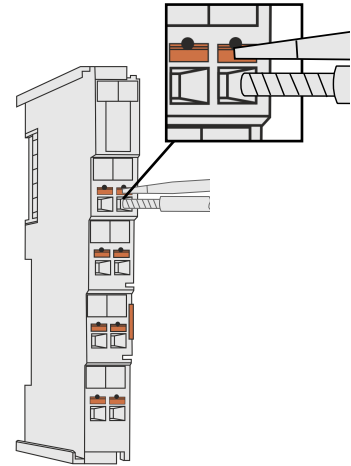
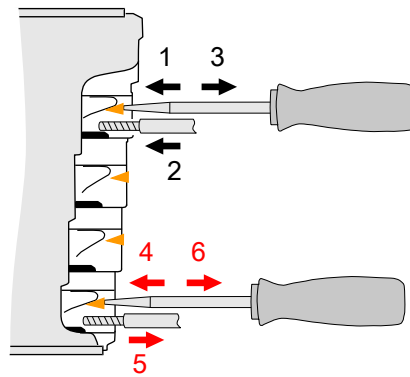


Fig. 17: Connecting and disconnecting the conductors

1. Connecting solid conductors and conductors with ferrules (Fig. top left, step 2)

These can be connected using a direct plug-in technique, without tools.

- Insert the conductor into the terminal point after stripping the insulation (2)

2. Connect stranded cables (Fig. top right, steps 1–3)

These must be connected via the push-button.

- Use a screwdriver to press the push-button to open the contact point (1).
- Then insert the conductor (2).
- Release the push-button by pulling back the screwdriver to close the terminal point (3).

Disconnect cables (Fig. above steps 4–6)

The release is performed using the push-button for all conductor types.

- Use a screwdriver to press the push-button to unlock the contact (4).
- Then pull out the conductor (5).
- Release the push-button by pulling back the screwdriver to close the terminal point (6).

NOTICE



Observe the permissible connection cross-sections and stripping lengths

The permissible conductor cross-section and stripping length depend on the type of housing, please refer to the housing data in the "Technical data" chapter for the device in question.

3.5.2 Shielding



Shielding

Encoders, analog sensors, and actuators should always be connected with shielded, pair-wise twisted cables.

3.6 Note on power supply

WARNING

Power supply from SELV / PELV power supply unit!

SELV / PELV circuits (safety extra-low voltage / protective extra-low voltage) according to IEC 61010-2-201 must be used to supply this device.

Notes:

- SELV / PELV circuits may give rise to further requirements from standards such as IEC 60204-1 et al, for example with regard to cable spacing and insulation.
- A SELV supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor, a PELV supply also requires a safe connection to the protective conductor.

3.7 Disposal



Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

4 Commissioning

NOTICE



Further information

For information on commissioning with TwinCAT and EtherCAT basics, please refer to the [“EtherCAT system manual”](#).

⚠ CAUTION

Watchdog settings

Changes to the watchdog settings can lead to unwanted system behavior or damage to devices.

- Observe the information in the chapter [“Notes on watchdog settings”](#) in the EtherCAT system documentation before making any changes to the watchdog settings!

4.1 Switching loads

4.1.1 Overload protection

● Technical data



Please refer to the information on load type, maximum output current, and maximum short-circuit current in the technical data section of the relevant documentation.

When switching on lamp loads, high starting currents occur that are limited by the output circuit of the terminals (see Figure “Overload current limit”).

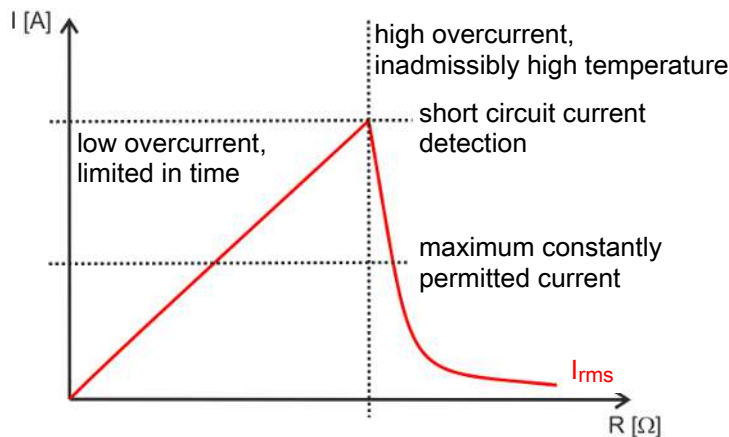


Fig. 18: Overload current limit

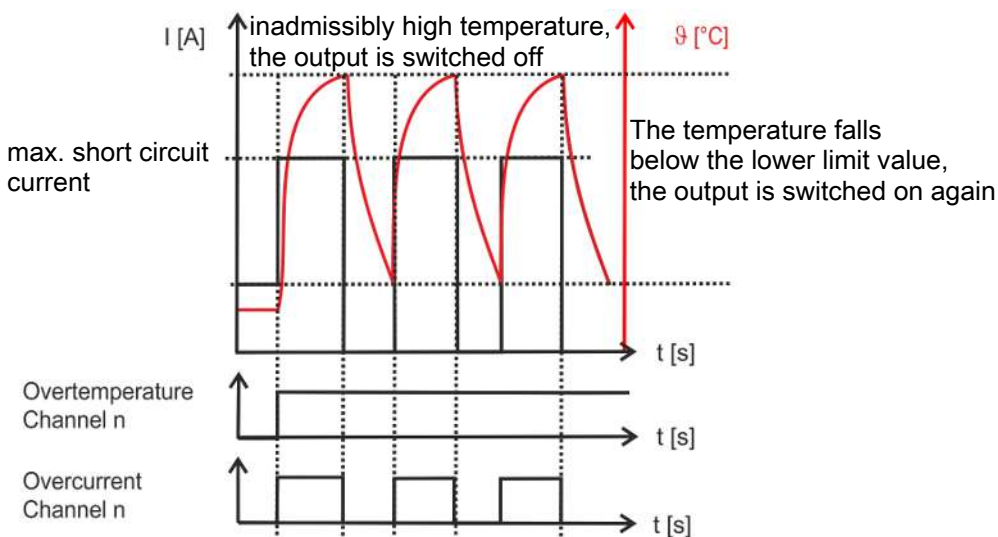


Fig. 19: Schematic illustration of the thermal switch-off in the event of overload

In the event of long-term overload and/or short-circuit, the output is protected by the thermal switch-off of the channel. The output circuit of the terminal limits the current. The terminal maintains this current until significant auto-heating of the channel occurs. When the upper temperature limit is exceeded, the terminal switches the channel off. The channel is switched on again after it has cooled down to below the lower temperature limit. The output signal is clocked until the output is switched off by the controller or the short-circuit is eliminated (see Figure “Schematic illustration of the thermal switch-off in case of overload”). The clock frequency depends on the ambient temperature and the load of the other terminal channels.

Short circuit or prolonged overload on one channel leads to an increase in the device temperature. If several channels are overloaded, this leads to a rapid increase in the device temperature. The overloaded channels are switched off when the upper limit for the device temperature is exceeded. The channels are only switched on again if the temperature falls below the lower limit values for both the device and the channel. The non-overloaded channels continue operating properly.

4.1.2 Switching of inductive loads

When switching off inductive loads, high induction voltages result from interrupting the current too quickly. These are limited by an integrated free-wheeling diode (see Technical data for switching-off energy). Since the current only reduces slowly, a delayed switch-off can occur in many control applications. For example, a valve remains open for several milliseconds. The switch-off times correspond, for instance, to the switch-on time of the coil.

● Protection against high induction voltages

i

To prevent voltage spikes when switching off inductive loads, we recommend installing appropriate protective circuits (e.g., using a free-wheeling diode, RC circuit, or varistor) directly on the actuator.

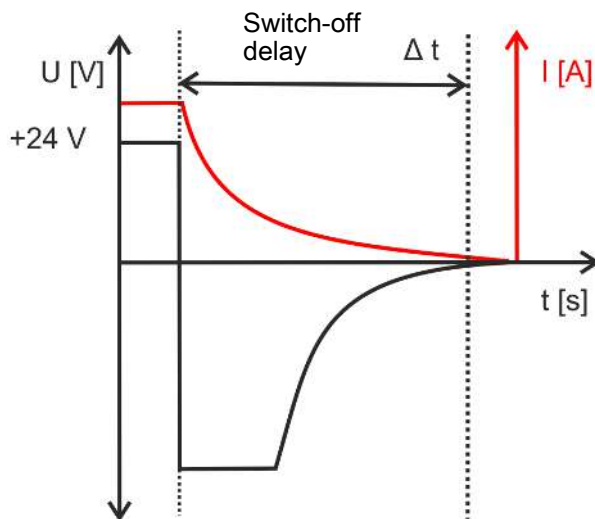


Fig. 20: Switching off inductive loads

5 Appendix

5.1 Firmware compatibility

Beckhoff EtherCAT devices are delivered with the latest available firmware version. Firmware and hardware must be compatible; not every combination ensures compatibility. The overview below shows the hardware versions on which a firmware can be operated.

Note

- The newest possible firmware for the respective hardware should be implemented
- Beckhoff is not under any obligation to provide customers with free firmware updates for delivered products.

NOTICE

Risk of damage to the device!

Observe the notes on the firmware update in the EtherCAT System Manual in chapter "[Firmware Update](#)". If a device is set to BOOTSTRAP mode for firmware update, it may not check whether the new firmware is suitable during download.

This may result in damage to the device! Therefore, always make sure that the firmware is suitable for the hardware version!

ED2887

Hardware (HW)	Firmware (FW)	Revision no.	Release date
01*	02*	ED2887-0000-0016	2025/11

ED2889

Hardware (HW)	Firmware (FW)	Revision no.	Release date
01*	00*	ED2889-0000-0016	2025/11

*) This is the current compatible firmware/hardware version at the time of the preparing this documentation. Check on the Beckhoff website whether more up-to-date [documentation](#) is available.

5.2 Documentation issue status

Version	Comment
1.1.0	• Update chapter "Notes on the documentation" • Update chapter "Support and service" • Update structure
1.0.0	• First release
0.1	• Preliminary documentation for ED288x

5.3 Support and Service

Beckhoff Support and Service provides assistance with questions regarding Beckhoff products and system solutions, as well as with their planning, commissioning, and operation.

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