

Documentation | EN

KL2432 and KL2434

Bus terminals, digital outputs, 24 V DC, 2 A

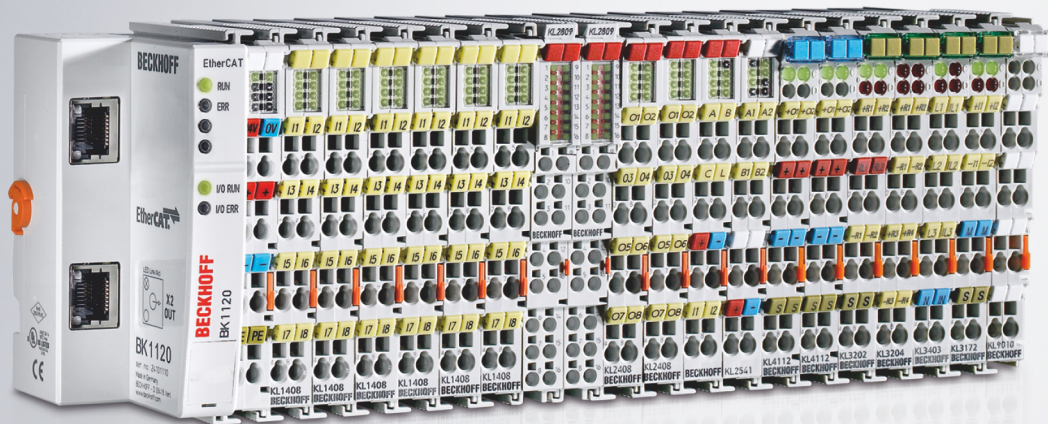


Table of contents

1 Foreword	5
1.1 Notes on the documentation	5
1.2 Safety instructions	6
1.3 Documentation issue status	7
1.4 Suggestions or proposals for documentation	7
2 Product overview	8
2.1 KL2432 - Introduction	8
2.1.1 KL2432 - Technical data	9
2.1.2 KL2432 - Connection and LEDs	10
2.2 KL2434 - Introduction	11
2.2.1 KL2434 - Technical data	12
2.2.2 KL2434 - Connection and LEDs	13
2.3 Interference-free Bus Terminals	14
3 Mounting and wiring	19
3.1 Instructions for ESD protection	19
3.2 Mounting rail installation	20
3.3 Disposal	22
3.4 Installation instructions for enhanced mechanical load capacity	23
3.5 Connection	23
3.5.1 Connection system	23
3.5.2 Wiring	26
3.5.3 Shielding	27
4 Commissioning	28
4.1 Switching loads	28
4.1.1 Overload protection	28
4.1.2 Switching of inductive loads	29
5 Appendix	30
5.1 Beckhoff Identification Code (BIC)	30
5.2 Support and Service	32

1 Foreword

1.1 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.

Trademarks

Beckhoff®, ATRO®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, MX-System®, Safety over EtherCAT®, TC/BSD®, TwinCAT®, TwinCAT/BSD®, TwinSAFE®, XFC®, XPlanar® and XTS® are registered trademarks of and licensed by Beckhoff Automation GmbH.

Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.



EtherCAT® and EtherCAT P® are registered trademarks and patented technologies, licensed by Beckhoff Automation GmbH, Germany.

Copyright

© Beckhoff Automation GmbH & Co. KG, Germany.

The reproduction, distribution and utilization of this document as well as the communication of its contents to others without express authorization are prohibited.

Offenders will be held liable for the payment of damages. All rights reserved in the event of the grant of a patent, utility model or design.

Third-party brands

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

1.2 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.

1.3 Documentation issue status

Version	Comment
1.0.0	• First release
0.2	• Product images updated • Technical data updated • Chapter <i>Interference-free bus terminals</i> added • Chapter <i>Switching loads</i> added
0.1	• First draft

Firmware and hardware versions

Documenta- tion Version	KL2432/KS2432		KL2434/KS2434	
	Firmware	Hardware	Firmware	Hardware
1.0.0	-	00	-	00
0.2	-	00	-	00
0.1	-	00	-	00

The K-bus firmware and hardware version (delivery state) can be taken from the serial number printed on the side of the terminal

Syntax of the serial number

Structure of the serial number: WW YY FF HH

WW - week of production (calendar week)

YY - year of production

FF - K-bus firmware version

HH - hardware version

Example with serial number 49 05 1B 03:

49 - week of production 49

05 - year of production 2005

1B - firmware version 1B

03 - hardware version 03

1.4 Suggestions or proposals for documentation

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

2 Product overview

2.1 KL2432 - Introduction

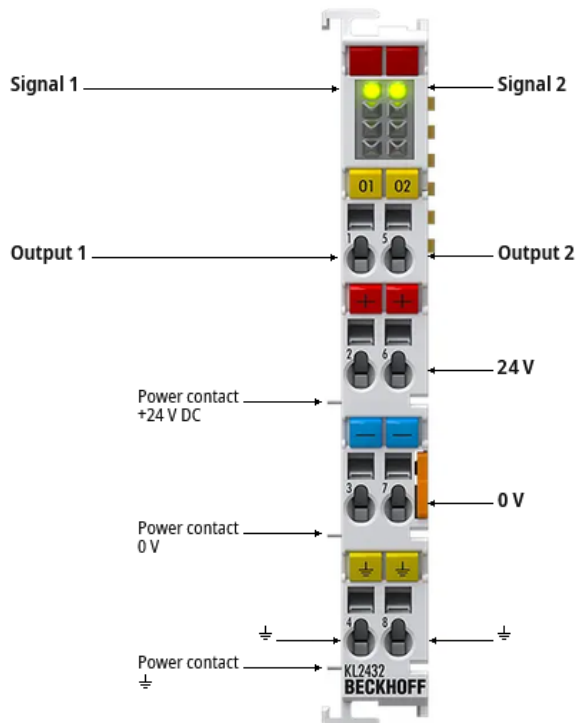


Fig. 1: KL2432 - Bus terminal, 2-channel digital output, 24 V DC, 2 A

The KL2432 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 bus terminal has two channels, whose signal state is displayed by light emitting diodes.

Special properties:

- connection of different load types possible (resistive, inductive, lamp load)
- max. output current of 2 A per channel
- short-circuit proof outputs and reverse polarity protection

2.1.1 KL2432 - Technical data

Technical data	KL2432
Connection technology	4-wire
Number of outputs	2
Rated voltage	24 V _{DC} (-15% / +20%)
Load type	resistive, inductive, lamp load
Max. output current	2.0 A (short-circuit proof) per channel
Typical short-circuit current	< 12 A
Max. switch-off energy (ind.)	< 1.3 J / channel
Reverse polarity protection	yes
Electrical isolation	500 V (K-bus / field voltage)
Current consumption via power contacts	typ. 15 mA + load
K-bus current consumption	typ. 6 mA
Bit width in process image	2 outputs
Configuration	no address or configuration settings required
Weight	approx. 55 g
Permissible ambient temperature during operation	-25°C... +60°C
Permissible ambient temperature during storage	-40°C... +85°C
Permissible relative humidity	95%, no condensation
Enhanced mechanical load capacity	yes, see also Installation instructions [► 23] for enhanced mechanical load capacity
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection rating / installation position	IP20 / any
Pluggable wiring level	for all KSxxxx terminals
Markings / approvals*	CE

*) Real applicable approvals/markings see type plate on the side (product marking).

Housing data	KL-12-8-pin	KS-12-8-pin
Design	compact terminal housing with signal LEDs	
Material	polycarbonate	
Installation [► 20]	on 35 mm mounting rail, according to EN 60715 with lock	
Stackable by	double slot and key connection	
Labeling (optional)	BZxxxx series contact labels	
Wiring	solid wire conductors (e), stranded wire conductors (f) and ferrule (a): spring actuation by screwdriver	
Connection cross-section	e*: 0.08...2.5 mm ² f*: 0.08...2.5 mm ² a*: 0.14...1.5 mm ²	0.08...1.5 mm ² 0.08...1.5 mm ² 0.14...1.5 mm ²
Connection cross-section AWG	e*: AWG28...14 f*: AWG28...14 a*: AWG26...16	AWG28...16 AWG28...16 AWG26...16
Stripping length	8...9 mm	
Power contacts current load	I _{max} : 10 A	
Dimensions (W x H x D)	15 mm x 100 mm x 68 mm (width aligned 12 mm)	

*) e: solid wire; f: stranded wire; a: with ferrule

2.1.2 KL2432 - Connection and LEDs

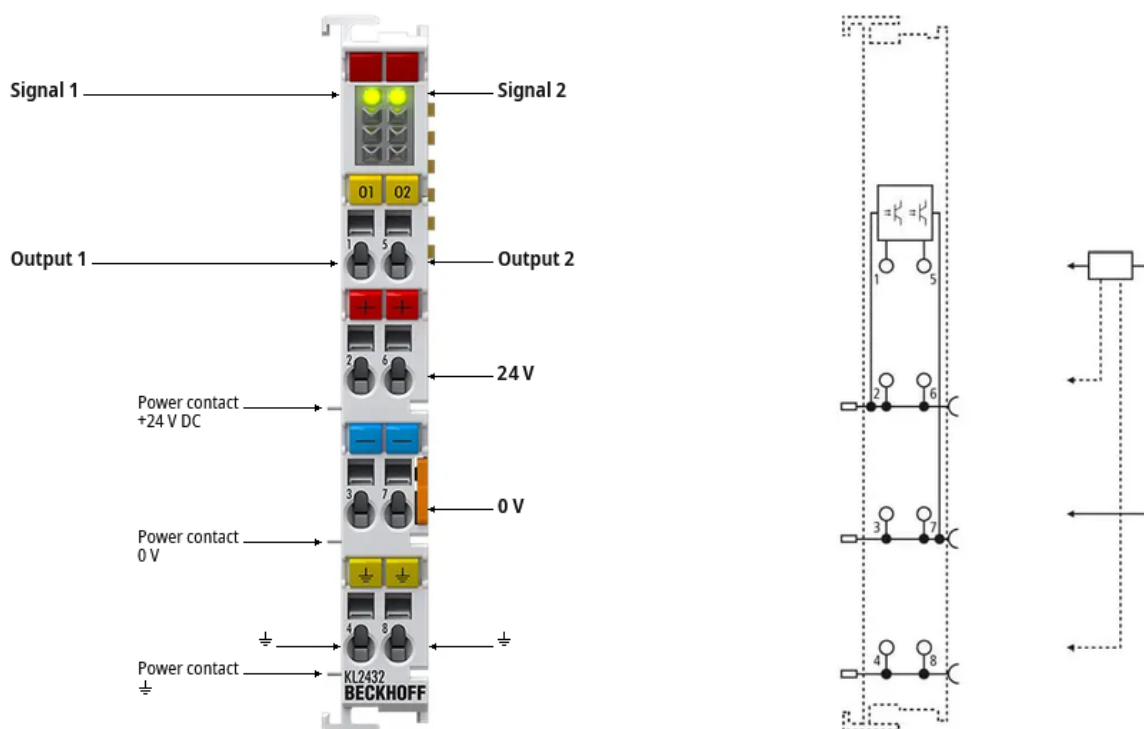


Fig. 2: KL2432 - Connection and LEDs

KL2432 - Connection

Terminal point		Description
Name	No.	
Output 1	1	Output 1
+24 V	2	+24 V (internally connected to terminal point 6 and positive power contact)
0 V	3	Ground for output 1 (internally connected to terminal point 7 and negative power contact)
⊥	4	⊥ (internally connected to terminal point 8 and power contact ⊥)
Output 2	5	Output 2
+24 V	6	+24 V (internally connected to terminal point 2 and positive power contact)
0 V	7	Ground for output 2 (internally connected to terminal point 3 and negative power contact)
⊥	8	⊥ (internally connected to terminal point 4 and power contact ⊥)

KL2432 - LEDs

LED	Color	Meaning	
Signal LED 1...2	green	off	Channel 1: signal voltage "0"
		on	Channel 1: signal voltage "1"

2.2 KL2434 - Introduction

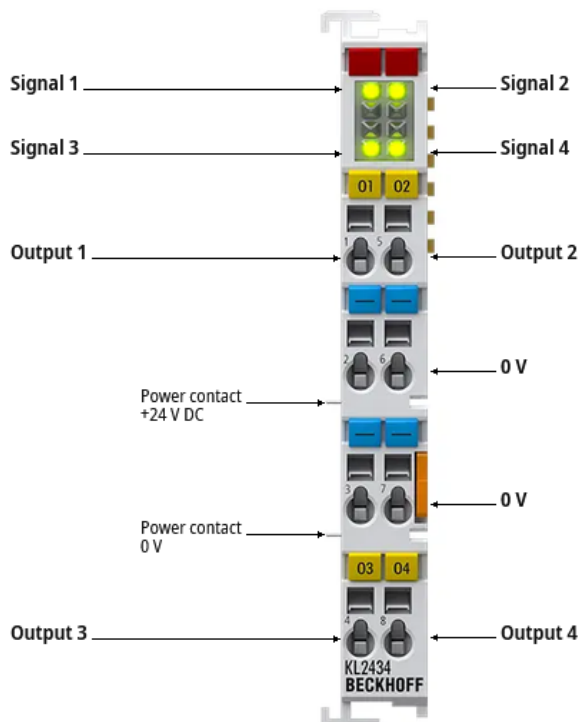


Fig. 3: KL2434 - Bus terminal, 4-channel digital output, 24 V DC, 2 A

The KL2434 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 bus terminal has four channels, whose signal state is displayed by light emitting diodes. Direct connection of four 2-wire actuators is possible because the terminal has four ground connection points.

Special properties:

- connection of different load types possible (resistive, inductive, lamp load)
- max. output current of 2 A per channel
- short-circuit proof outputs and reverse polarity protection

2.2.1 KL2434 - Technical data

Technical data	KL2434
Connection technology	2-wire
Number of outputs	4
Rated voltage	24 V _{DC} (-15% / +20%)
Load type	resistive, inductive, lamp load
Max. output current	2.0 A (short-circuit proof) per channel
Typical short-circuit current	< 12 A
Max. switch-off energy (ind.)	< 1.3 J / channel
Reverse polarity protection	yes
Electrical isolation	500 V (K-bus / field voltage)
Current consumption via power contacts	typ. 20 mA + load
K-bus current consumption	typ. 11 mA
Bit width in process image	4 outputs
Configuration	no address or configuration settings required
Weight	approx. 70 g
Permissible ambient temperature during operation	-25°C... +60°C
Permissible ambient temperature during storage	-40°C... +85°C
Permissible relative humidity	95%, no condensation
Enhanced mechanical load capacity	yes, see also Installation instructions [► 23] for enhanced mechanical load capacity
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection rating / installation position	IP20 / any
Pluggable wiring level	for all KSxxxx terminals
Markings / approvals*	CE

*) Real applicable approvals/markings see type plate on the side (product marking).

Housing data	KL-12-8-pin	KS-12-8-pin
Design	compact terminal housing with signal LEDs	
Material	polycarbonate	
Installation [► 20]	on 35 mm mounting rail, according to EN 60715 with lock	
Stackable by	double slot and key connection	
Labeling (optional)	BZxxxx series contact labels	
Wiring	solid wire conductors (e), stranded wire conductors (f) and ferrule (a): spring actuation by screwdriver	
Connection cross-section	e*: 0.08...2.5 mm ² f*: 0.08...2.5 mm ² a*: 0.14...1.5 mm ²	0.08...1.5 mm ² 0.08...1.5 mm ² 0.14...1.5 mm ²
Connection cross-section AWG	e*: AWG28...14 f*: AWG28...14 a*: AWG26...16	AWG28...16 AWG28...16 AWG26...16
Stripping length	8...9 mm	
Power contacts current load	I _{max} : 10 A	
Dimensions (W x H x D)	15 mm x 100 mm x 68 mm (width aligned 12 mm)	

*) e: solid wire; f: stranded wire; a: with ferrule

2.2.2 KL2434 - Connection and LEDs

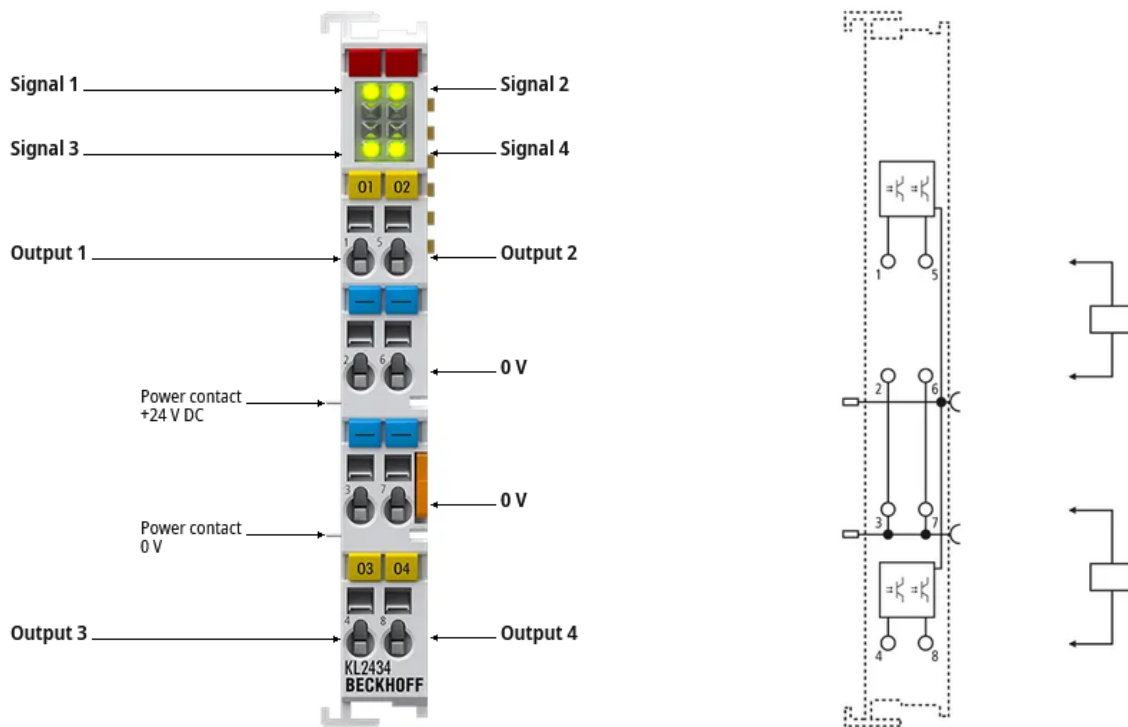


Fig. 4: KL2434 - Connection and LEDs

KL2434 - Connection

Terminal point		Description
Name	No.	
Output 1	1	Output 1
0 V	2	Ground for output 1 (internally connected to terminal points 3, 6, 7, and negative power contact)
0 V	3	Ground for output 3 (internally connected to terminal points 2, 6, 7, and negative power contact)
Output 3	4	Output 3
Output 2	5	Output 2
0 V	6	Ground for output 2 (internally connected to terminal points 2, 3, 7, and negative power contact)
0 V	7	Ground for output 4 (internally connected to terminal points 2, 3, 6, and negative power contact)
Output 4	8	Output 4

KL2434 - LEDs

LED	Color	Meaning	
Signal LEDs 1...4	green	off	Signal voltage "0"
		on	Signal voltage "1"

2.3 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
KL2134	09
KL2408	05
KL2424	05
KL2432	00
KL2434	00
KL2809	02
KL9110	07

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.

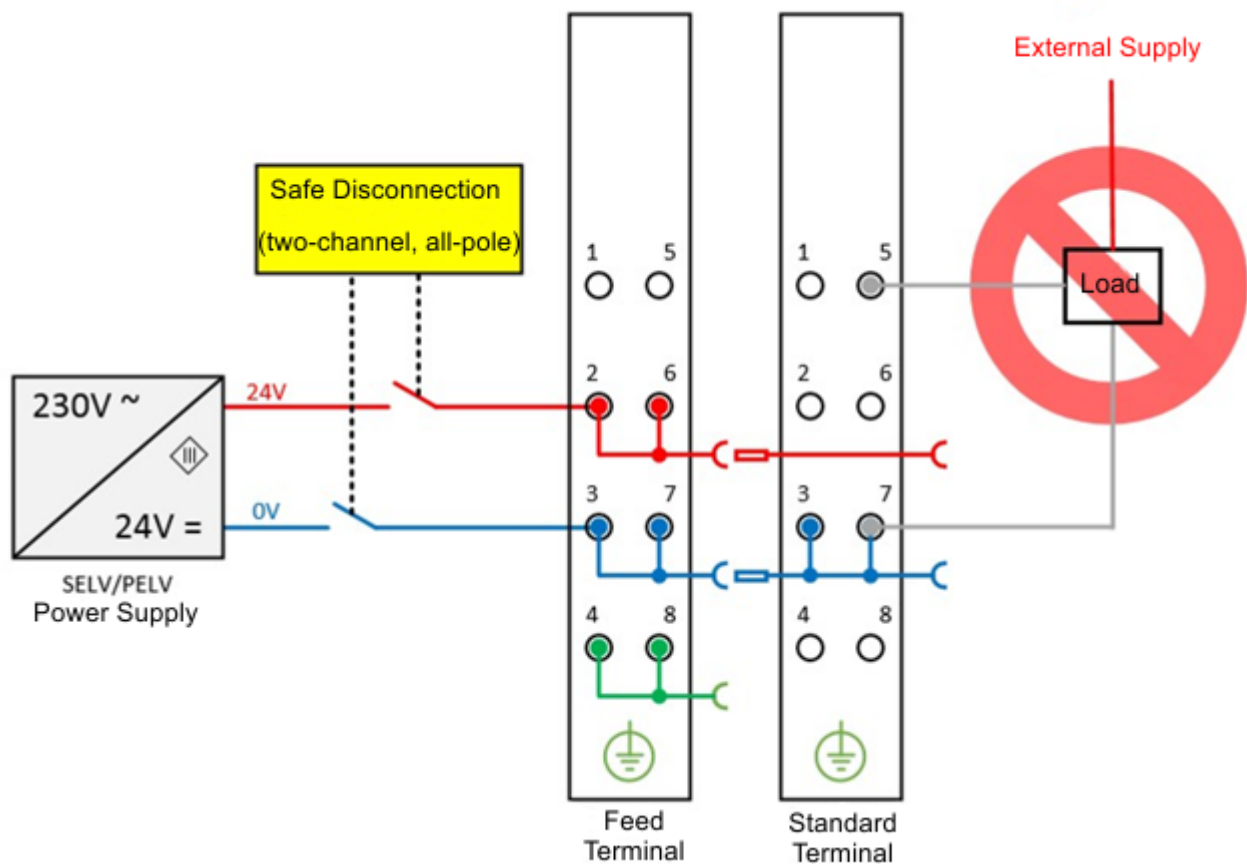


Fig. 5: Negative example – active load

- **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.

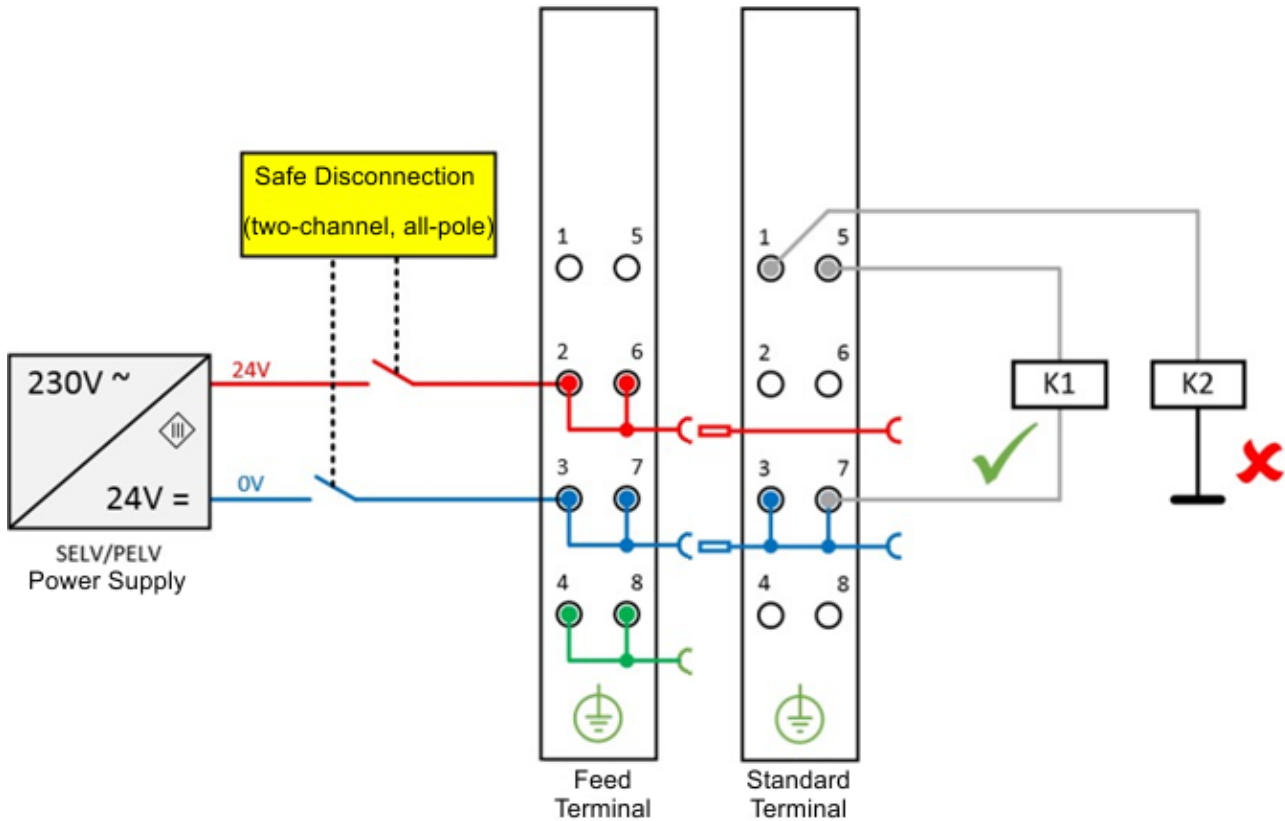


Fig. 6: Ground connection of the load: correct (K1) and incorrect (K2)

- 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.

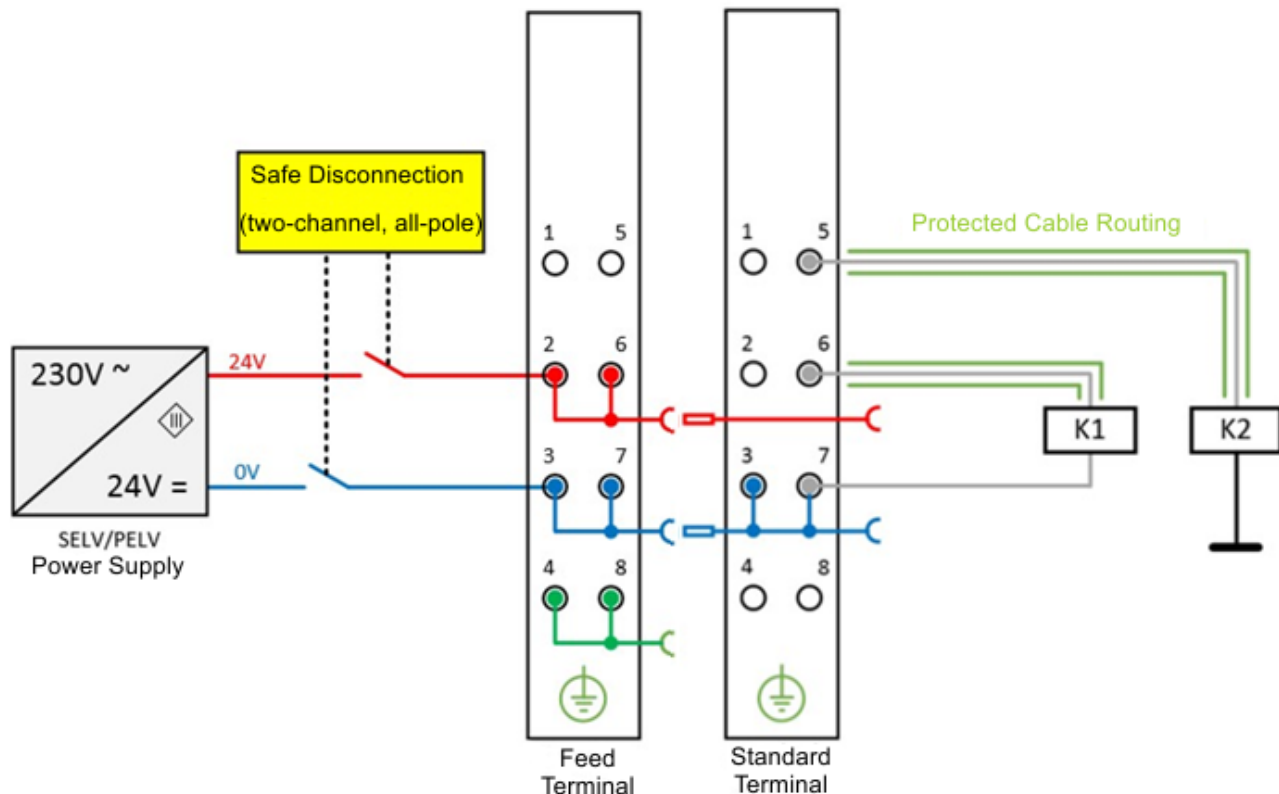


Fig. 7: Excluding a short-circuit fault by protecting cables

- **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!

3 Mounting and wiring

3.1 Instructions for ESD protection

NOTICE

Destruction of the devices by electrostatic discharge possible!

The devices contain components at risk from electrostatic discharge caused by improper handling.

- Please ensure you are electrostatically discharged and avoid touching the spring contacts (see fig.) of the device directly.
- Avoid contact with highly insulating materials (synthetic fibers, plastic film etc.).
- Surroundings (working place, packaging and personnel) should be grounded probably, when handling with the devices.
- Each assembly must be terminated at the right hand end with a KL9010 bus end terminal, to ensure the protection class and ESD protection.

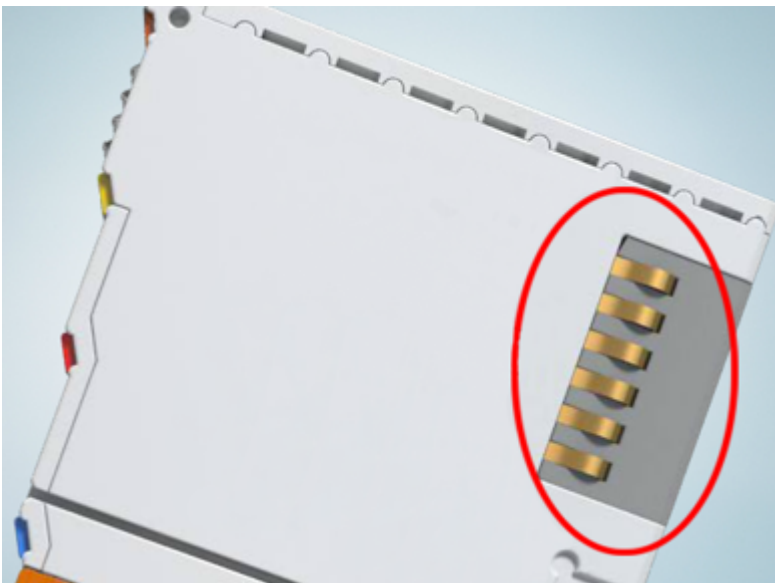


Fig. 8: Spring contacts of the Beckhoff I/O components

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

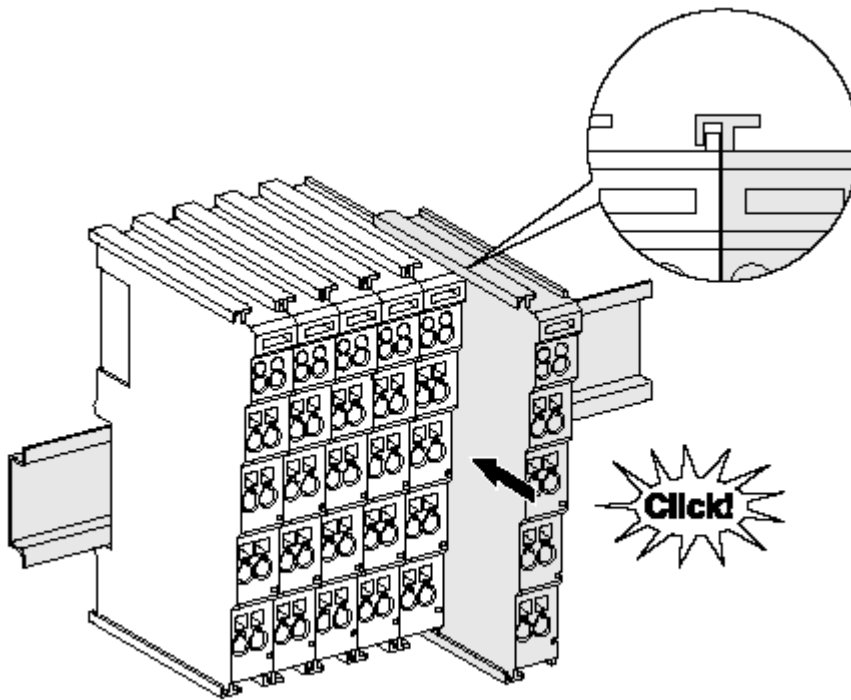


Fig. 9: Installation on the mounting rail

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.

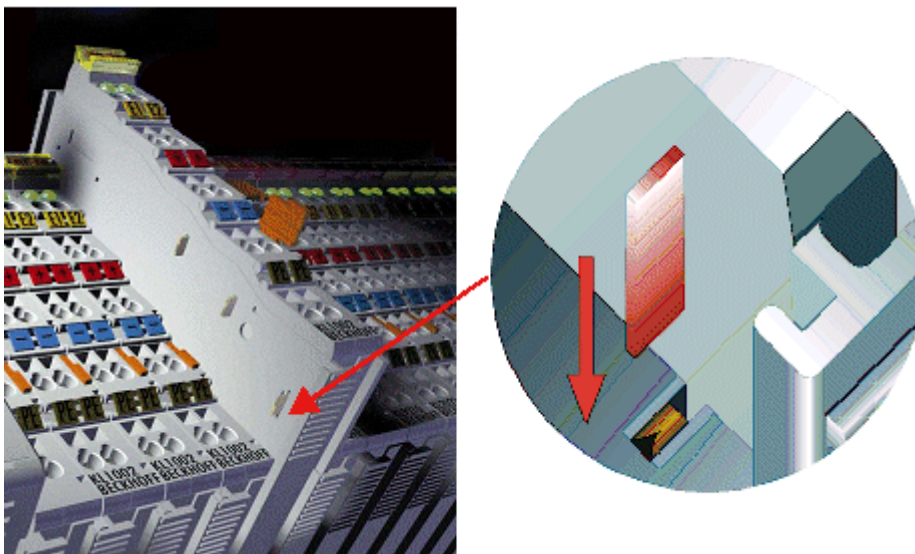


Fig. 10: Power contact on the left

⚠ 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

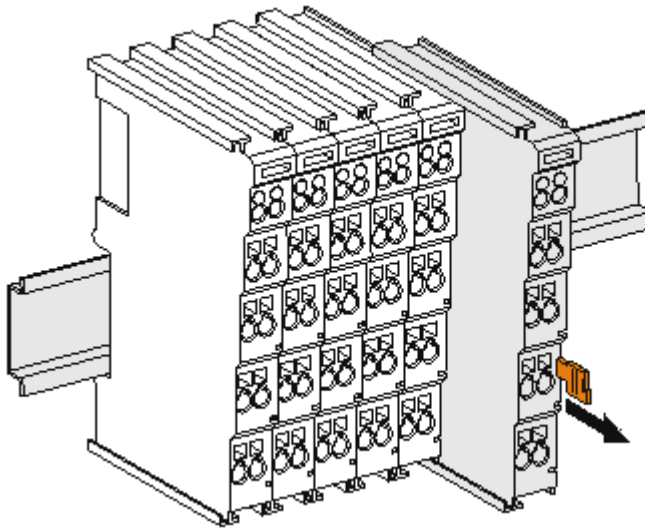


Fig. 11: Removal from mounting rail

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 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.

3.4 Installation instructions for enhanced mechanical load capacity

⚠ WARNING

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

Bring the Bus Terminal system into a safe, de-energized state before starting mounting, disassembly or wiring of the Bus Terminals!

Additional checks

The terminals have undergone the following additional tests:

Verification	Explanation
Vibration	10 frequency runs in 3 axes
	6 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	25 g, 6 ms

Additional installation instructions and notes

For terminals with enhanced mechanical load capacity, the following additional installation instructions and notes apply:

- The enhanced mechanical load capacity is valid for all permissible installation positions.
- Use a mounting rail according to EN 60715 TH35-15.
- Fix the terminal segment on both sides of the mounting rail with a mechanical fixture, e.g. an earth terminal or reinforced end clamp.
- The maximum total extension of the terminal segment (without coupler) is:
64 terminals (12 mm mounting width) or 32 terminals (24 mm mounting width)
- Avoid deformation, twisting, crushing and bending of the mounting rail during edging and installation of the rail.
- The mounting points of the mounting rail must be set at 5 cm intervals.
- Use countersunk head screws to fasten the mounting rail.
- The free length between the strain relief and the wire connection should be kept as short as possible. A distance of approx. 10 cm should be maintained to the cable duct.

3.5 Connection

3.5.1 Connection system

⚠ 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!

Overview

The bus terminal system offers different connection options for optimum adaptation to the respective application:

- The terminals of ELxxxx and KLxxxx series with standard wiring include electronics and connection level in a single enclosure.
- The terminals of ESxxxx and KSxxxx series feature a pluggable connection level and enable steady wiring while replacing.

- The High Density Terminals (HD Terminals) include electronics and connection level in a single enclosure and have advanced packaging density.

Standard wiring (ELxxxx / KLxxxx)

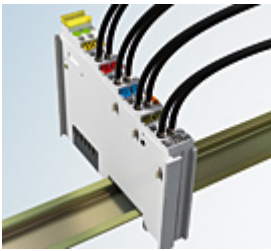


Fig. 12: Standard wiring

The terminals of the ELxxxx and KLxxxx series integrate screwless spring-cage technology for quick and easy wiring.

Pluggable wiring (ESxxxx / KSxxxx)



Fig. 13: Pluggable wiring

The terminals of ESxxxx and KSxxxx series feature a pluggable connection level. The assembly and wiring procedure is the same as for the ELxxxx and KLxxxx series. The pluggable connection level enables the complete wiring to be removed as a plug connector from the top of the housing for servicing. The lower section can be removed from the terminal block by pulling the unlocking tab. Insert the new component and plug in the connector with the wiring. This reduces the installation time and eliminates the risk of wires being mixed up.

The familiar dimensions of the terminal only had to be changed slightly. The new connector adds about 3 mm. The maximum height of the terminal remains unchanged.

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

Conductor cross sections between 0.08 mm² and 2.5 mm² can continue to be used with the proven spring force technology.

The overview and nomenclature of the product names for ESxxxx and KSxxxx series has been retained as known from ELxxxx and KLxxxx series.

High Density Terminals (HD Terminals)



Fig. 14: High Density Terminals

The terminals from these series with 16/32 terminal points are distinguished by a particularly compact design, as the packaging density is twice as large as that of the standard 12 mm bus terminals. Massive conductors and conductors with a wire end sleeve can be inserted directly into the spring loaded terminal point without tools.

● **Wiring HD Terminals**

i The High Density Terminals of the ELx8xx and KLx8xx series doesn't support pluggable wiring.

Ultrasonically compacted (ultrasonically welded) strands

● **Ultrasonically compacted (ultrasonically welded) strands**

i Ultrasonically compacted (ultrasonically welded) strands can also be connected to the standard and high-density terminals. In this case, please note the tables concerning the wire-size width [► 27]!

3.5.2 Wiring

⚠ 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!

Terminals for standard wiring ELxxxx/KLxxxx and for pluggable wiring ESxxxx/KSxxxx

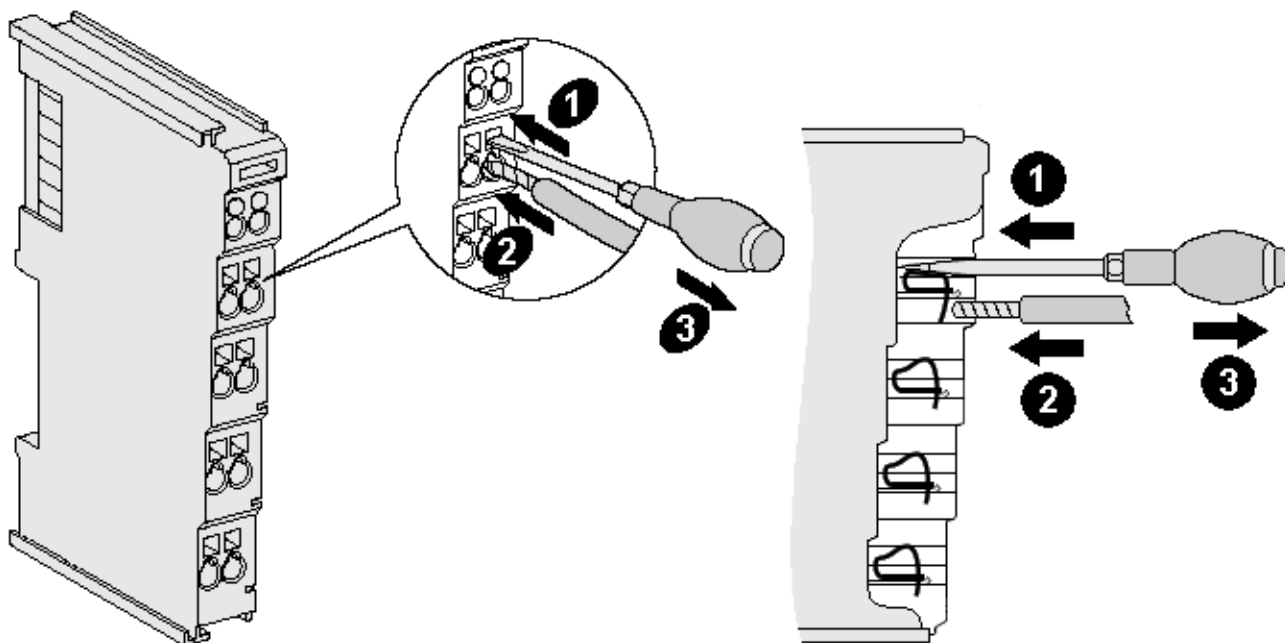


Fig. 15: Connecting a cable on a terminal point

Up to eight terminal points enable the connection of solid or finely stranded cables to the bus terminal. The terminal points are implemented in spring force technology. Connect the cables as follows (see fig. "Connecting a cable on a terminal point"):

1. Open a terminal point by pushing a screwdriver straight against the stop into the square opening above the terminal point. Do not turn the screwdriver or move it alternately (don't toggle).
2. The wire can now be inserted into the round terminal opening without any force.
3. When the screwdriver is removed, the terminal point closes automatically and holds the wire securely and permanently in place

See the following table for the suitable wire size width:

Terminal housing	ELxxxx, KLxxxx	ESxxxx, KSxxxx
Wire size width (single core wires)	0.08 ... 2.5 mm ²	0.08 ... 2.5 mm ²
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm ²	0.08 ... 2.5 mm ²
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm ²	0.14 ... 1.5 mm ²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals ([HD Terminals](#) [[▶ 24](#)]) with 16/32 terminal points

The conductors of the HD Terminals are connected without tools for single-wire conductors using the direct plug-in technique, i.e. after stripping the wire is simply plugged into the terminal point. The cables are released, as usual, using the contact release with the aid of a screwdriver. See the following table for the suitable wire size width.

Terminal housing	High Density Housing
Wire size width (single core wires)	0.08 ... 1.5 mm ²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm ²
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm ²
Wire size width (ultrasonically compacted [ultrasonically welded] strands)	only 1.5 mm ² (see notice [▶ 25])
Wire stripping length	8 ... 9 mm

3.5.3 Shielding**Shielding**

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

4 Commissioning

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").

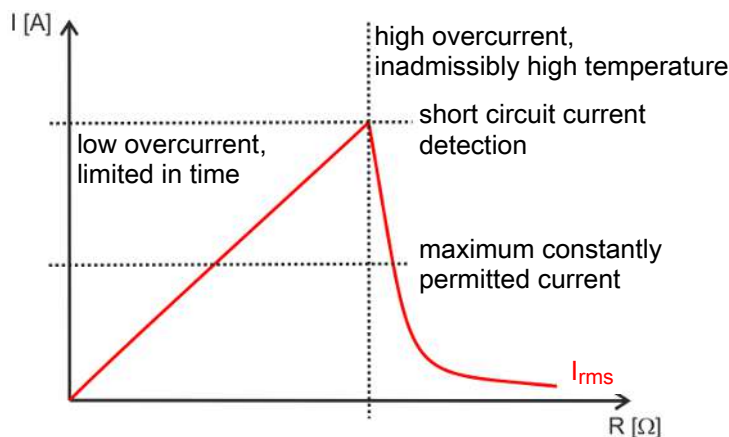


Fig. 16: Overload current limit

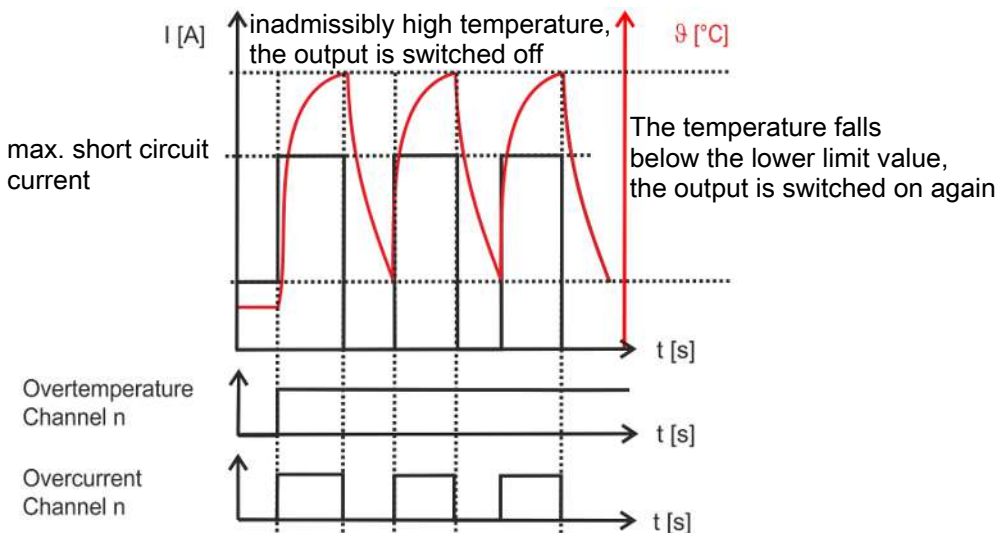


Fig. 17: Schematic illustration of the thermal switch-off in the event of overload

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

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.

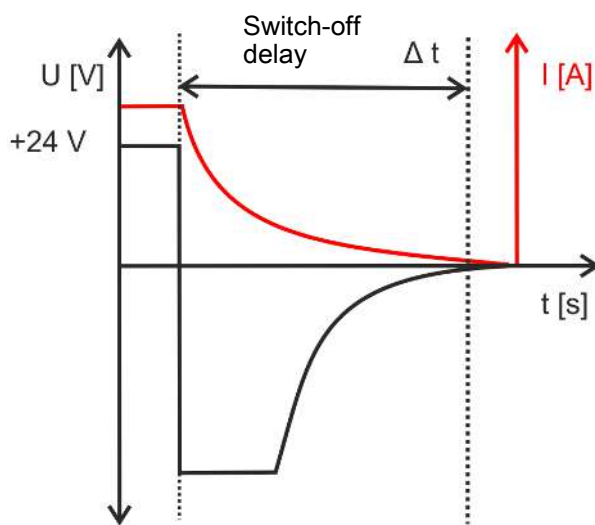


Fig. 18: Switching off inductive loads

5 Appendix

5.1 Beckhoff Identification Code (BIC)

The Beckhoff Identification Code (BIC) is increasingly being applied to Beckhoff products to uniquely identify them. The BIC is represented as a Data Matrix code (DMC, code schema ECC200); its content is based on ANSI standard MH10.8.2-2016.

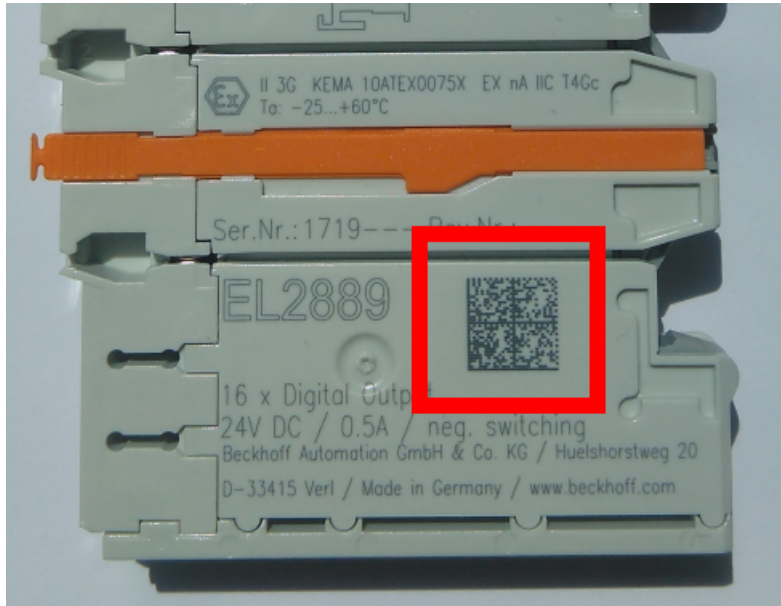


Fig. 19: BIC as a Data Matrix code (DMC, ECC200 code scheme)

The BIC is being introduced gradually across all product groups. Depending on the product, it can be found in the following locations:

- on the packaging unit
- directly on the product (if space suffices)
- on the packaging unit and the product

The BIC is machine-readable and contains information that can be used for handling and product management by the customer.

Each item of information is clearly identifiable with the data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length stated by the following table. If the items of information are shorter, spaces are added.

The following information may be present; items 1 through 4 are always included, while the others depend on the product family's requirements:

Item no.	Type of information	Explanation	Data identifier	Number of characters including the data identifier	Example
1	Beckhoff order number	Beckhoff order number	1P	8	1P 072222
2	Beckhoff Traceability Number (BTN)	Unique serial number, see note below	SBTN	12	SBTN k4p562d7
3	Article description	Beckhoff article description, e.g. EL1008	1K	32	1KEL 1809
4	Quantity	Quantity in packaging unit, e.g. 1, 10, etc.	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P 401503180016
6	ID/serial number	Optional: Previous serial number system, e.g., for safety products or calibrated terminals	51S	12	51S 678294
7	Variant	Optional: Product variant number on the basis of standard products	30P	12	30P F971, 2*K183
...					

Beckhoff uses additional types of information and data identifiers for internal processes.

Structure of the BIC

Example of composite information consisting of items 1 through 4 and the example value mentioned above in item 6. The data identifiers are highlighted in bold:

1P072222**SBTN**k4p562d7**1KEL**1809 **Q1** **51S**678294

The same number as a DMC:



Fig. 20: Example DMC **1P**072222**SBTN**k4p562d7**1KEL**1809 **Q1** **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, item no. 2). The BTN is a unique 8-character serial number that will replace all other serial number systems at Beckhoff in the future (e.g. batch designations on IO components, previous serial number circle for safety products, etc.). The BTN is also being introduced gradually, so it may not yet be coded in the BIC.

NOTICE

This information has been carefully prepared. However, the method described is constantly being refined. We reserve the right to revise and change procedures and documentation at any time and without notice. No claims for modification may be made on the basis of the data, diagrams, and descriptions in this documentation.

5.2 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.

Beckhoff subsidiaries and representative offices

Please contact your Beckhoff subsidiary or your representative office for local support and service for Beckhoff products. You can find the addresses of Beckhoff subsidiaries and representative offices at: www.beckhoff.com/worldwide.

For Beckhoff products and technologies, we offer [Training programs](#), [tutorials](#), and [webinars](#).

Beckhoff Support

Beckhoff Support provides assistance with technical questions regarding the use, planning, programming, and commissioning of Beckhoff products.

☎ Hotline: +49 5246 963-157
✉ Email: support@beckhoff.com, [Support form](#)
Web page: www.beckhoff.com/support

Beckhoff Service

Our service specialists are here to assist you with any questions you may have regarding after-sales service processes, such as replacement parts, repairs, etc.

☎ Hotline: +49 5246 963-460
✉ Email: service@beckhoff.com, [Service form](#)
Web page: www.beckhoff.com/service

Download finder

The [Download finder](#) serves as a central source for downloadable documents and files related to Beckhoff products, such as application reports, technical documentation, drawings, and configuration files.

Beckhoff Information System

The [Beckhoff Information System](#) is the central online documentation resource for Beckhoff products and contains documentation on products and automation topics, as well as sample code.

Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl, Germany

☎ Phone: +49 5246 963-0
✉ Email: info@beckhoff.com
Web page: www.beckhoff.com

Trademark statements

Beckhoff®, ATRO®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, MX-System®, Safety over EtherCAT®, TC/BSD®, TwinCAT®, TwinCAT/BSD®, TwinSAFE®, XFC®, XPlanar® and XTS® are registered and licensed trademarks of Beckhoff Automation GmbH.

More Information:
www.beckhoff.com/KL2xxx

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com

