Documentation

KL28xx

HD Bus Terminals, digital output 24 V DC

Version: 1.0.0
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BECKHOFF

1 Product overview: digital output terminals

KL2808 [▶ 8] (8 digital outputs; 24 V DC, 0.5 A)
KL2828 [▶ 11] (8 digital outputs; 24 V DC, 2 A)

KL2809 [▶ 14] (16 digital outputs; 24 V DC, 0.5 A)
KL2819 [▶ 20] (16 digital outputs; 24 V DC, 0.5 A, with diagnostics)

KL2872 [▶ 17] (16 digital outputs; 24 V DC, 0.5 A; ribbon cable connection)
KL2872 - 0010 [▶ 17] (16 digital outputs; 24 V DC, 0.5 A; ribbon cable connection, negative switching)

KL2889 [▶ 14] (16 digital outputs; 24 V DC, 0.5 A, switching to negative potential)

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2 Foreword

2.1 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.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

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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2.2 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.

Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

 **DANGER**	**Serious risk of injury!** Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.
 **WARNING**	**Risk of injury!** Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.
 **CAUTION**	**Personal injuries!** Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.
 **Attention**	**Damage to the environment or devices** Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.
 **Note**	**Tip or pointer** This symbol indicates information that contributes to better understanding.

2.3 Documentation Issue Status

Version	Comment
1.0.0	• First published

Hardware versions

The hardware versions (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 - firmware version
HH - hardware version

Example with ser. no.: 40 15 1A 00:

40 - week of production 40
15 - year of production 2015
1A - firmware version 1A
00 - hardware version 00

2.4 Non-reactive Bus Terminals

Note

Use of non-reactive Bus Terminals in safety applications

If a Bus Terminal is described as non-reactive, this means that the downstream terminal behaves passively in a safety application (e.g. in the case of the all-pole switch-off of a potential group).
In this case the terminals do not represent an active part of the safety controller and do not affect the Safety Integrity Level (SIL) or Performance Level (PL) attained in the safety application.
For details, please refer to chapter 2.17f in the TwinSAFE application manual.

Attention

Pay attention to the hardware version

Please pay attention to the information about the hardware version and non-reactivity of the respective Bus Terminal in the chapters "Technical Data" or "Firmware Compatibility"!
Only terminals with the appropriate hardware version may be used without the attained SIL/PL being affected!

3 KL2808 - Introduction and technical data

3.1 Introduction and pin assignment

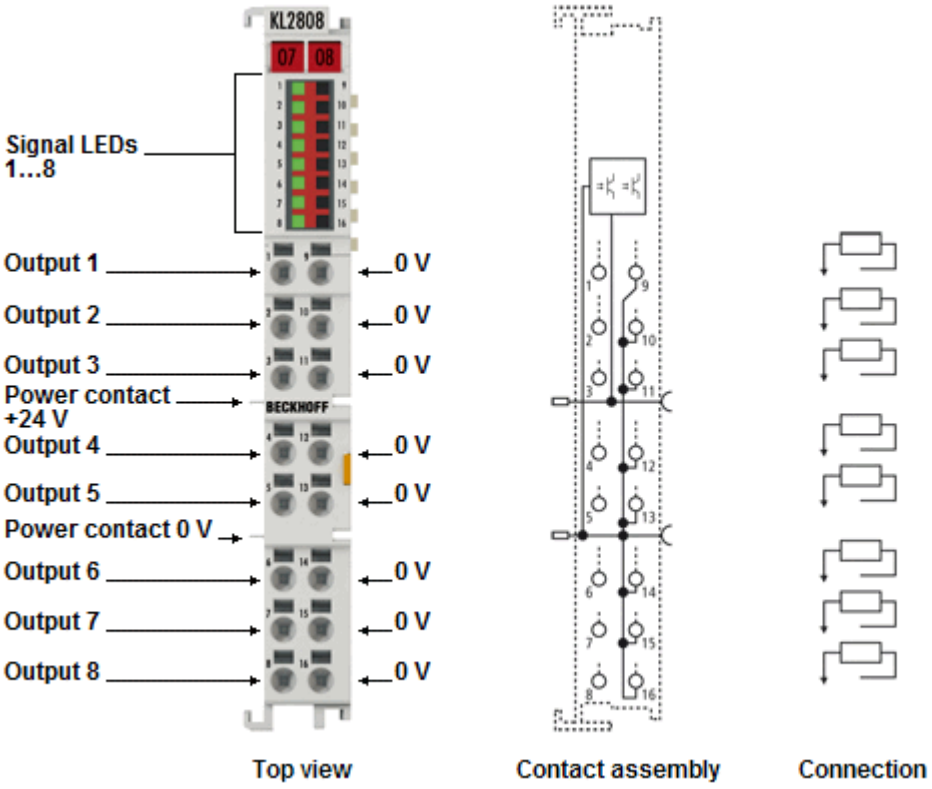

Fig. 1: KL2808

HD Bus Terminal, 8-channel digital output 24 V DC, 0.5 A

The KL2808 digital output terminal connects the binary control signals from the automation device on to the actuators at the process level with electrical isolation. The KL2808 is protected against polarity reversal and processes load currents with outputs protected against overload and short-circuit. The Bus Terminal contains eight channels, consisting of a signal output and 0 V DC. The signal states are displayed by LEDs. The power contacts are looped through.

The outputs are fed via the 24 V power contact in the KL2808. The conductors can be connected without tools in the case of solid wires using a direct plug-in technique.

The HD Bus Terminals (High Density) with increased packing density feature 16 connection points in the housing of a 12 mm terminal block.

KL2808 - LEDs

LED	Color	Meaning	
OUTPUT 1- 8	green	off	No output signal
		on	24 V_{DC} output signal at the respective output

KL2808 – pin assignment

Terminal point		Description
Name	No.	
Output 1	1	Output 1
Output 2	2	Output 2
Output 3	3	Output 3
Output 4	4	Output 4
Output 5	5	Output 5
Output 6	6	Output 6
Output 7	7	Output 7
Output 8	8	Output 8
0 V	9	0 V (internally connected to terminal point 10, 11, 12, 13, 14, 15, 16 and negative power contact)
0 V	10	0 V (internally connected to terminal point 9, 11, 12, 13, 14, 15, 16 and negative power contact)
0 V	11	0 V (internally connected to terminal point 9, 10, 12, 13, 14, 15, 16 and negative power contact)
0 V	12	0 V (internally connected to terminal point 9, 10, 11, 13, 14, 15, 16 and negative power contact)
0 V	13	0 V (internally connected to terminal point 9, 10, 11, 12, 14, 15, 16 and negative power contact)
0 V	14	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 15, 16 and negative power contact)
0 V	15	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 14, 16 and negative power contact)
0 V	16	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 14, 15 and negative power contact)

3.2 Technical data

Technical data	KL2808
Connection technology	2-wire
Number of Outputs	8
Rated load voltage	24 V DC (-15 %/+20 %)
Current consumpt. K-bus	typ. 20 mA
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit-proof) per channel
Short circuit current	< 2 A
Breaking energy	< 150 mJ/channel
Reverse voltage protection	yes
Current consumption power contacts	typ. 15 mA + load
Electrical isolation	500 V (K-bus/field potential)
Bit width in the process image	8 output bits
Configuration	no address or configuration setting
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Weight	approx. 65 g
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715
Permissible ambient temperature range during operation	0°C ... +55°C
Permissible ambient temperature range during storage	-25°C ... +85°C
Permissible relative humidity	95 %, no condensation
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
Installation pos.	variable, see section "Installation positions" [▶ 29] of chapter "Mounting and wiring" [▶ 23]
Protect. class	IP20
Approvals	CE, ATEX [▶ 31], cULus, GL

4 KL2828 - Introduction and technical data

4.1 Introduction and pin assignment

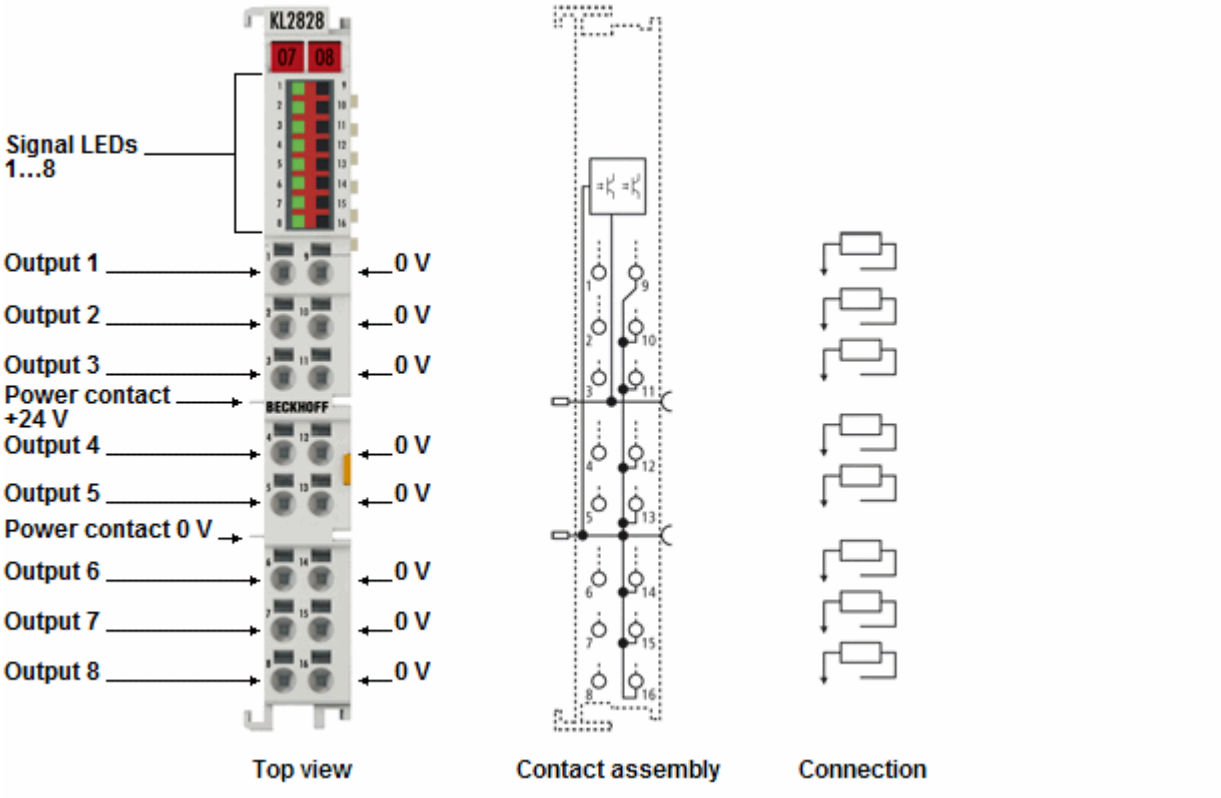

Fig. 2: KL2828

HD Bus Terminal, 8-channel digital output 24 V DC, 2 A

The 8-channel KL2828 digital output terminal connects the binary control signals from the electrically isolated automation device on to the actuators at the process level. The KL2828 is protected against polarity reversal and processes load currents with outputs protected against overload and short-circuit. The HD Bus Terminal contains eight 2 A channels, consisting of signal output and 0 V, whose signal state are indicated by light emitting diodes. The power contacts are looped through. In the KL2828 the outputs are fed via the 24 V power contact. The conductors can be connected without tools in the case of single-wire conductors using a direct plug-in technique. The maximum total output current of the terminal is 10 A.

KL2828 - LEDs

LED	Color	Meaning	
OUTPUT 1- 8	green	off	No output signal
		on	24 V_{DC} output signal at the respective output

KL2828 - pin assignment

Terminal point		Description
Name	No.	
Output 1	1	Output 1
Output 2	2	Output 2
Output 3	3	Output 3
Output 4	4	Output 4
Output 5	5	Output 5
Output 6	6	Output 6
Output 7	7	Output 7
Output 8	8	Output 8
0 V	9	0 V (internally connected to terminal point 10, 11, 12, 13, 14, 15, 16 and negative power contact)
0 V	10	0 V (internally connected to terminal point 9, 11, 12, 13, 14, 15, 16 and negative power contact)
0 V	11	0 V (internally connected to terminal point 9, 10, 12, 13, 14, 15, 16 and negative power contact)
0 V	12	0 V (internally connected to terminal point 9, 10, 11, 13, 14, 15, 16 and negative power contact)
0 V	13	0 V (internally connected to terminal point 9, 10, 11, 12, 14, 15, 16 and negative power contact)
0 V	14	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 15, 16 and negative power contact)
0 V	15	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 14, 16 and negative power contact)
0 V	16	0 V (internally connected to terminal point 9, 10, 11, 12, 13, 14, 15 and negative power contact)

4.2 Technical data

Technical data	KL2828
Connection technology	2 wire
Number of outputs	8
Rated load voltage	24 V_{DC} (-15% / +20%)
Current consumption K-bus	typ. 18 mA
Load type	ohmic, inductive, capacitive
Max. output current	2 A per channel (∑ 10 A)
Short circuit current	< 40 A typ.
Breaking energy	< 1.2 J/channel
Reverse voltage protection	yes
Current consumption of power contacts	typ. 15 mA + load
Electrical isolation	500 V (K-bus/field potential)
Bit width in process image	8 output bits
Configuration	no address or configuration settings required
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (connected width: 12 mm)
Weight	approx. 70 g
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715
Permissible ambient temperature range during operation	0…+55 °C
Permissible ambient temperature range during storage	-25 °C ... +85 °C
Permissible relative humidity	95%, no condensation
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
Installation position	Vertical (also see section "Installation positions" [▶ 29] of chapter "Mounting and wiring" [▶ 23])
Protection class	IP 20
Approvals	CE, cULus

5 KL2809, KL2889 - Introduction and technical data

5.1 Introduction and pin assignment

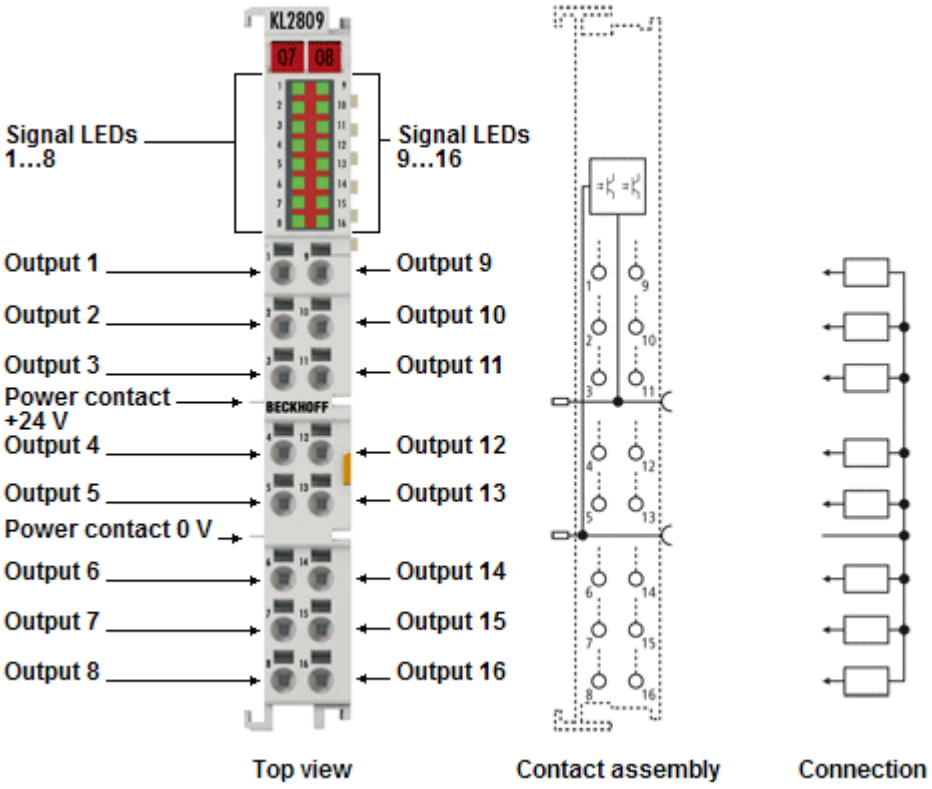

Fig. 3: KL2809

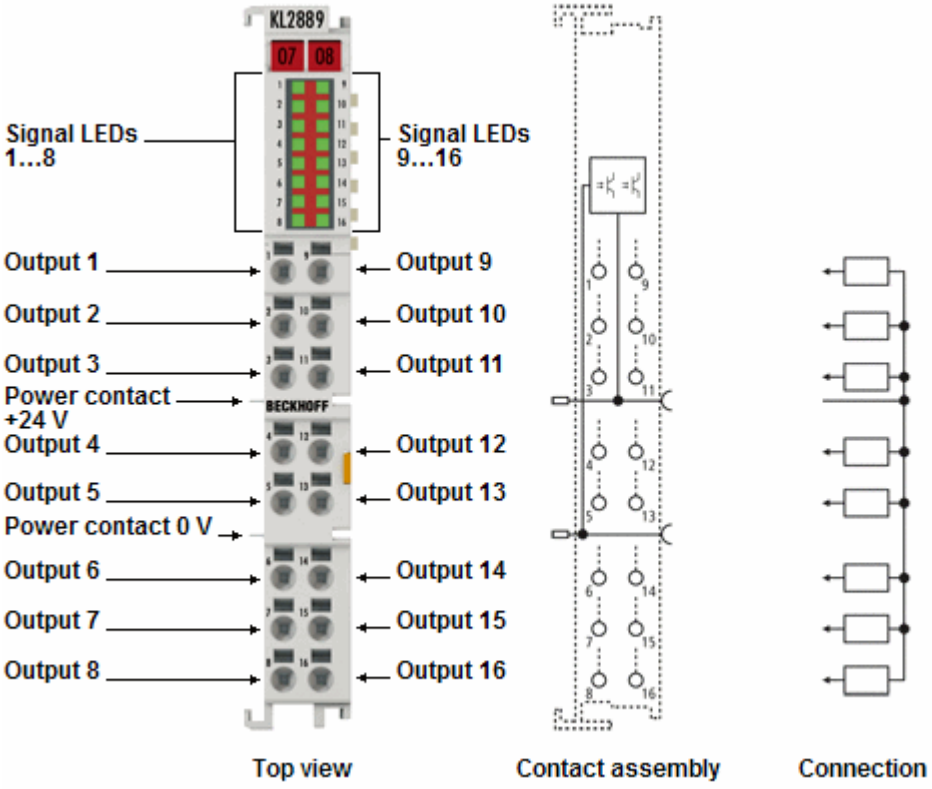

Fig. 4: KL2889

HD Bus Terminals, 16-channel digital output 24 V DC, 0.5 A

The KL2809 digital output terminal connects the binary control signals from the automation device on to the actuators at the process level with electrical isolation. The KL2809 is protected against polarity reversal and processes load currents with outputs protected against overload and short-circuit. The Bus Terminal contains 16 channels, whose signal states are displayed by LEDs. The connection technology is particularly suitable for single-ended inputs. All components have to use the same reference point as the KL2809 or KL2889. The power contacts are looped through.

The outputs of the KL2809 are fed via the 24 V power contact and the outputs of the KL2889 via the 0 V power contact. The conductors can be connected without tools in the case of solid wires using a direct plug-in technique.

The HD Bus Terminals (High Density) with increased packing density feature 16 connection points in the housing of a 12 mm terminal block. They are particularly suitable for space-saving use in control cabinets.

KL2809, KL2889 – LEDs

LED	Color	Meaning	
OUTPUT 1- 16	green	off	No output signal
		on	- Output signal 24 V_{DC} (KL2809) - Output signal 0 V (KL2889)

KL2809, KL2889 – pin assignment

Terminal point		Description
Name	No.	
Output 1	1	Output 1
Output 2	2	Output 2
Output 3	3	Output 3
Output 4	4	Output 4
Output 5	5	Output 5
Output 6	6	Output 6
Output 7	7	Output 7
Output 8	8	Output 8
Output 9	9	Output 9
Output 10	10	Output 10
Output 11	11	Output 11
Output 12	12	Output 12
Output 13	13	Output 13
Output 14	14	Output 14
Output 15	15	Output 15
Output 16	16	Output 16

5.2 Technical data

Technical data	KL2809	KL2889
Connection technology	1-wire	
Number of Outputs	16	
Rated load voltage	24 V DC (-15 %/+20 %)	
Current consumpt. K-bus	typ. 35 mA	typ. 45 mA
Load type	ohmic, inductive, lamp load	
Max. output current	0.5 A (short-circuit-proof) per channel	
Short circuit current	< 2 A	< 7 A
Breaking energy	< 150 mJ/channel	< 100 mJ/channel
Reverse voltage protection	yes	
Current consumption power contacts	typ. 35 mA + load	
Electrical isolation	500 V (K-bus/field potential)	
Bit width in the process image	16 output bits	
Configuration	no address or configuration setting	
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)	
Weight	approx. 70 g	
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715	
Permissible ambient temperature range during operation	0°C ... +55°C	
Permissible ambient temperature range during storage	-25°C ... +85°C	
Permissible relative humidity	95 %, no condensation	
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	
Installation pos.	variable, see section "Installation positions" [▶ 29] of chapter "Mounting and wiring" [▶ 23]	
Protect. class	IP20	
Approvals	CE, ATEX [▶ 31], cULus, GL	

6 KL2872, KL2872-0010 - Introduction and technical data

6.1 Introduction and pin assignment

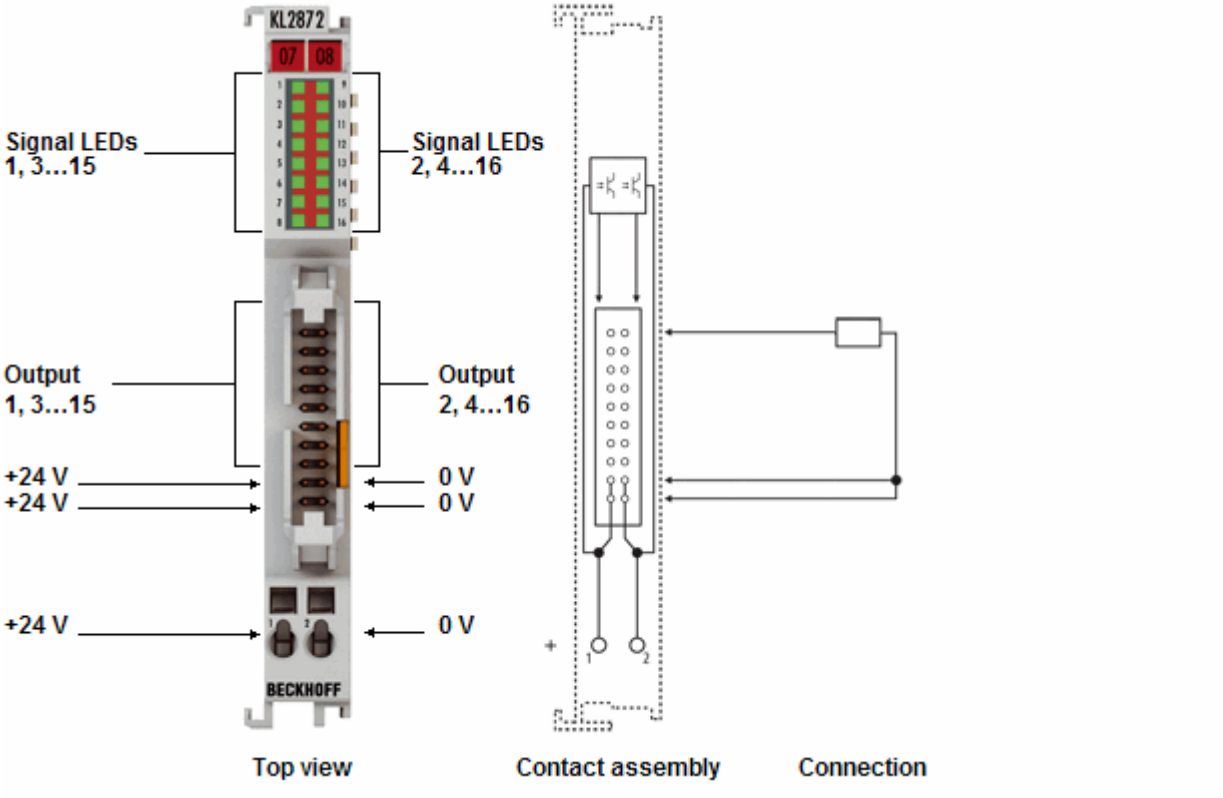

Fig. 5: KL2872

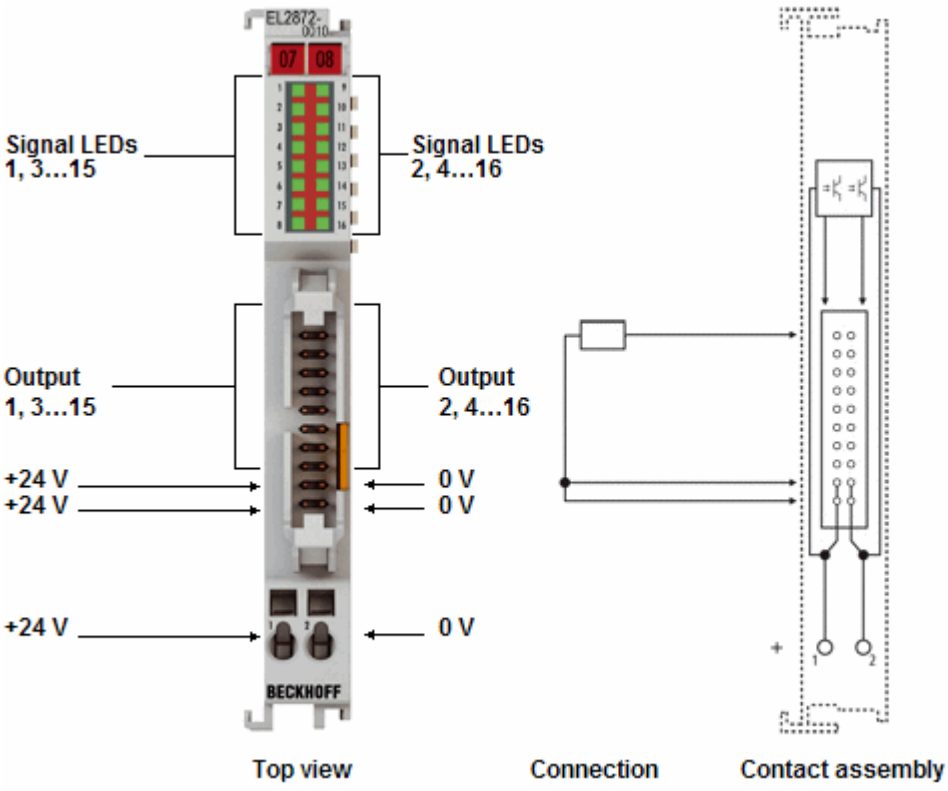

Fig. 6: KL2872-0010

Bus Terminals, 16-channel digital output 24 V DC, 0.5 A, flat-ribbon cable connection

The KL2872-00x0 digital output terminals offers a very compact design with its 16 channels. It is thus ideally suited for multi-pin connector valve terminals. A 20-pin connector enables the secure connection of plug connectors using insulation displacement contact, as is usual for ribbon cables and special round cables. This significantly simplifies the wiring of many channels. State-of-the-art output drivers guarantee minimum power dissipation. 16 LEDs display the logical signal states of the outputs.

KL2872, KL2872-0010 – LEDs

LED	Color	Meaning	
OUTPUT 1- 16	green	off	No output signal
		on	- 24 V_{DC} output signal at the respective output (KL2872-0000) - 0 V output signal at the respective output (KL2872-0010)

KL2872, KL2872-0010 – pin assignment

Terminal point		Description
Name	No.	
+24 V	1	+ 24 V DC
0 V	2	0 V

Contact pin strip

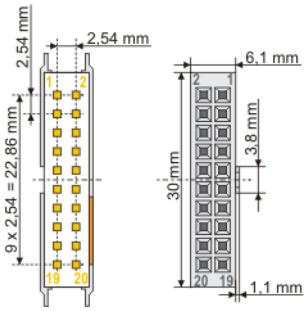

Fig. 7: *Dimensions of the 20-pin contact strip of the terminal and the matching spring contact strip; for connections see* Contact assignment

6.2 Technical data

Technical data	KL2872	KL2872-0010
Connection technology	flat-ribbon cable	
Number of Outputs	16	
Rated load voltage	24 V DC (-15 %/+20 %)	
Current consumpt. K-bus	typ. 5 mA	
Load type	ohmic, inductive, lamp load	
Max. output current	0.5 A (short-circuit-proof) per channel	
Short circuit current	< 2 A	
Breaking energy	< 150 mJ/channel	
Reverse voltage protection	yes	
Current consumption power contacts	typ. 60 mA from the supply (no power contacts)	
Electrical isolation	500 V (K-bus/field potential)	
Reference potential	Ground (switching to +24 V potential)	+24 V (switching to ground potential)
Bit width in the process image	16 output bits	
Configuration	no address or configuration setting	
Special features	ideal for multi-pin connector valve terminals	
Conductor connection	20-pin contact strip [▶ 19]	
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)	
Weight	approx. 55 g	
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715	
Permissible ambient temperature range during operation	0°C ... +55°C	
Permissible ambient temperature range during storage	-25°C ... +85°C	
Permissible relative humidity	95 %, no condensation	
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	
Installation pos.	variable	
Protect. class	IP20	
Approvals	CE, ATEX [▶ 31], cULus	

7 KL2819 - Introduction and technical data

7.1 Introduction and pin assignment

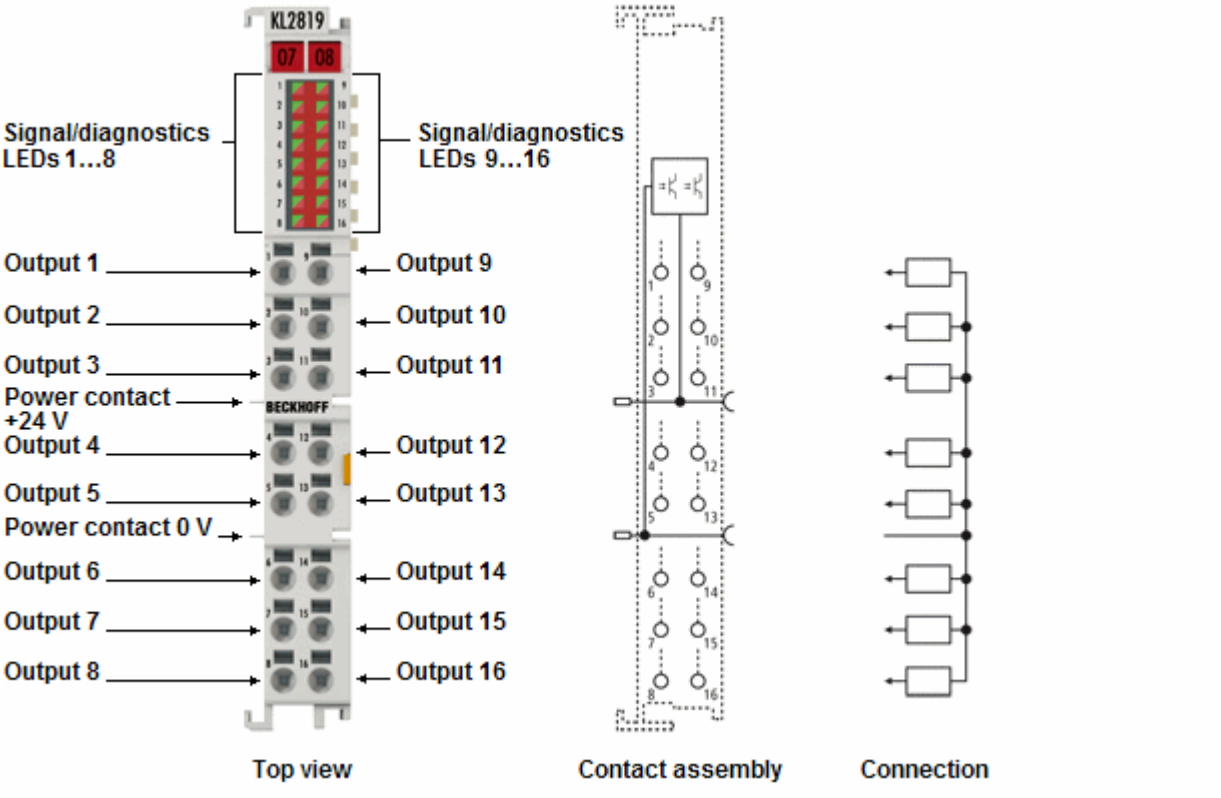

Fig. 8: KL2819

HD Bus Terminal, 16-channel digital output 24 V DC, 0.5 A, with diagnostics

The KL2819 Bus Terminal has 16 digital output channels for the switching of 24 V loads up to 0.5 A. The integrated diagnostics can be evaluated by the controller and indicated by the LEDs. Overtemperature and the lack of a voltage supply to the terminal are supplied as diagnostic information. Moreover, each of the channels can signal e.g. a short circuit. The switching state and any error of the output are indicated by the LED. Maintenance of the application is simplified by the diagnostic function. The power contacts are connected through; reference ground of the outputs is the 0 V power contact. The outputs are electrically isolated from the fieldbus side.

KL2819 – LEDs

LED	Color	Meaning	
OUTPUT 1- 16	green	off	No output signal
		on	Output signal 24 V
DIAGNOSE 1- 16	red	on	ERROR: Overcurrent / Overtemperature

KL2819 – pin assignment

Terminal point		Description
Name	No.	
Output 1	1	Output 1
Output 2	2	Output 2
Output 3	3	Output 3
Output 4	4	Output 4
Output 5	5	Output 5
Output 6	6	Output 6
Output 7	7	Output 7
Output 8	8	Output 8
Output 9	9	Output 9
Output 10	10	Output 10
Output 11	11	Output 11
Output 12	12	Output 12
Output 13	13	Output 13
Output 14	14	Output 14
Output 15	15	Output 15
Output 16	16	Output 16

7.2 Technical data

Technical data	KL2819
Connection technology	1-wire
Number of Outputs	16
Rated load voltage	24 V DC (-15 %/+20 %)
Current consumpt. K-bus	typ. 30 mA
Load type	ohmic, inductive, lamp load
Max. output current	0.5 A (short-circuit-proof) per channel
Short circuit current	< typ. 1.1 A
Breaking energy	< 300 mJ/channel
Reverse voltage protection	yes
Current consumption power contacts	typ. 50 mA + load
Electrical isolation	500 V (K-bus/field potential)
Output stage	push (high-side switch)
Bit width in the process image	16 bit output and diagnostics (2 x 8-Bit-control/status optional)
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Weight	approx. 70 g
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715
Permissible ambient temperature range during operation	0°C ... +55°C
Permissible ambient temperature range during storage	-25°C ... +85°C
Permissible relative humidity	95 %, no condensation
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
Installation pos.	Variable, see section "Installation positions" [▶ 29] of chapter "Mounting and wiring" [▶ 23]
Protect. class	IP20
Approvals	CE

7.3 Continuing documentation

A detailed description can be found within the documentation of KL2819 Bus Terminal:
http://www.beckhoff.de/english/download/busterm.htm

8 Mounting and wiring

8.1 Installation on mounting rails

WARNING	**Risk of electric shock and damage of device!** Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

Assembly

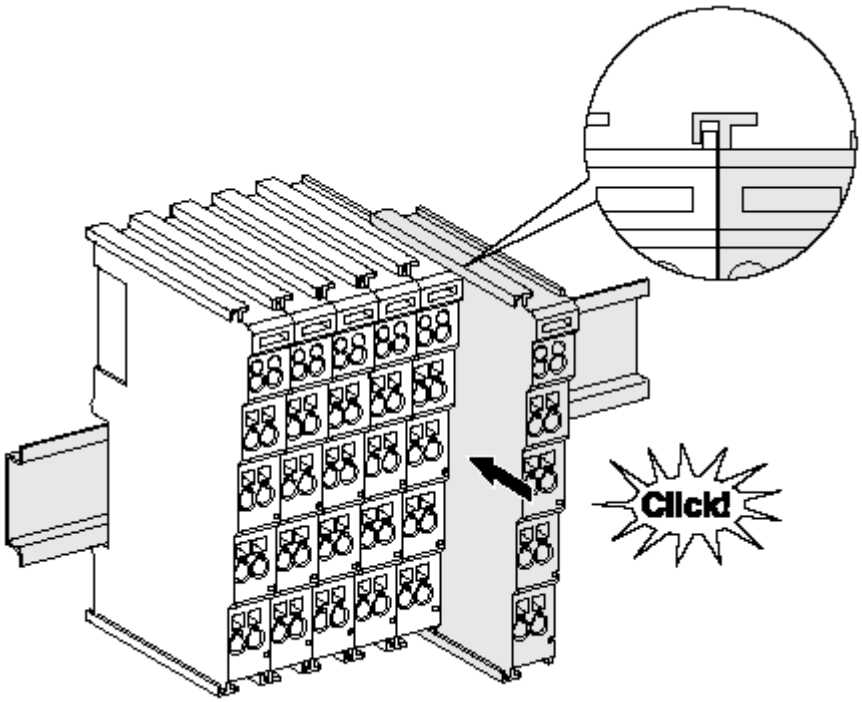

Fig. 9: Attaching on mounting rail

The Bus Coupler and Bus Terminals are attached to commercially available 35 mm mounting rails (DIN rails 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. Join the components with tongue and groove and push the terminals against the mounting rail, until the lock clicks onto the mounting rail.
   If the Terminals are clipped onto the mounting rail first and then pushed together without tongue and groove, the connection will not be operational! When correctly assembled, no significant gap should be visible between the housings.

Note	**Fixing of mounting rails** The locking mechanism of the terminals and couplers extends to the profile of the mounting rail. At the installation, the locking mechanism of the components must not come into conflict with the fixing bolts of the mounting rail. To mount the mounting rails with a height of 7.5 mm under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

Disassembly

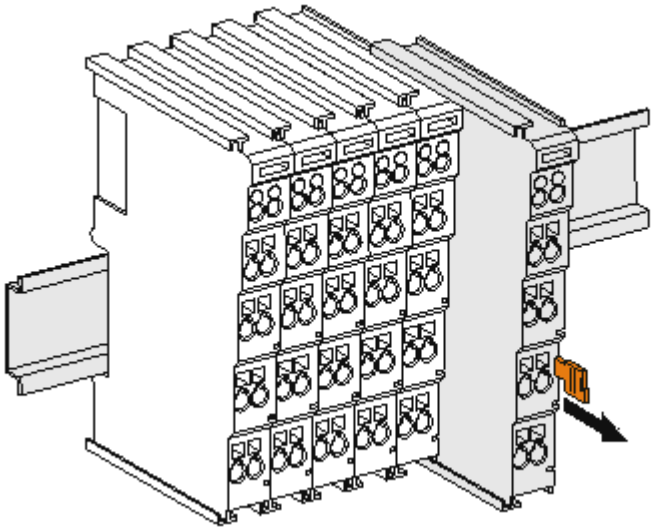

Fig. 10: Disassembling of terminal

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

1. Pull the terminal by its orange-colored lugs approximately 1 cm away from the mounting rail. In doing so for this terminal the mounting rail lock is released automatically and you can pull the terminal out of the bus terminal block easily without excessive force.
2. Grasp the released terminal with thumb and index finger simultaneous at the upper and lower grooved housing surfaces and pull the terminal out of the bus terminal block.

Connections within a bus terminal block

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

- The six spring contacts of the K-Bus/E-Bus deal with the transfer of the data 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 terminals on the Bus Coupler (up to 24 V) or for higher voltages via power feed terminals.

Note	**Power Contacts** During the design of a bus terminal block, the pin assignment of the individual Bus Terminals must be taken account of, since some types (e.g. analog Bus Terminals or digital 4-channel Bus Terminals) do not or not fully loop through the power contacts. Power Feed Terminals (KL91xx, KL92xx or EL91xx, EL92xx) interrupt the power contacts and thus represent the start of a new supply rail.

PE power contact

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

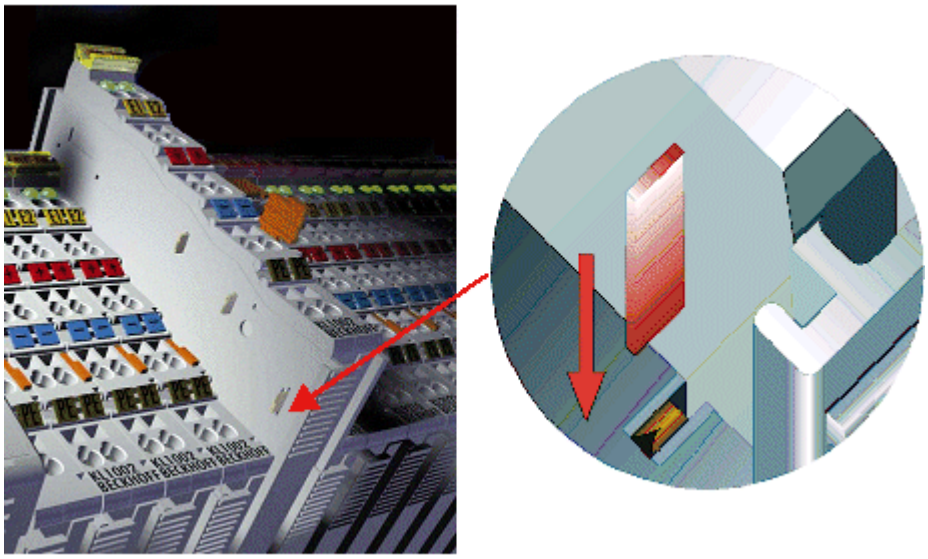

Fig. 11: *Power contact on left side*

Attention	**Possible damage of the device** Note that, for reasons of electromagnetic compatibility, the PE contacts are capacitatively coupled to the mounting rail. This may lead to incorrect results during insulation testing or to damage on the terminal (e.g. disruptive discharge to the PE line during insulation testing of a consumer with a nominal voltage of 230 V). For insulation testing, disconnect the PE supply line at the Bus Coupler or the Power Feed Terminal! In order to decouple further feed points for testing, these Power Feed Terminals can be released and pulled at least 10 mm from the group of terminals.
WARNING	**Risk of electric shock!** The PE power contact must not be used for other potentials!

8.2 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

For terminals with enhanced mechanical load capacity, the following additional installation instructions 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 with) or 32 terminals (24 mm mounting with)
- 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.

8.3 Connection system

 WARNING	**Risk of electric shock and damage of device!** Bring the bus terminal system into a safe, powered down state before starting installation, disassembly or wiring of the Bus Terminals!

Overview

The Bus Terminal system offers different connection options for optimum adaptation to the respective application:

- The terminals of KLxxxx and ELxxxx series with standard wiring include electronics and connection level in a single enclosure.
- The terminals of KSxxxx and ESxxxx 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

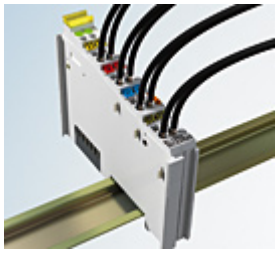

Fig. 12: Standard wiring

The terminals of KLxxxx and ELxxxx series have been tried and tested for years.
They feature integrated screwless spring force technology for fast and simple assembly.

Pluggable wiring

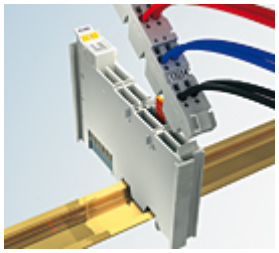

Fig. 13: Pluggable wiring

The terminals of KSxxxx and ESxxxx series feature a pluggable connection level.
The assembly and wiring procedure for the KS series is the same as for the KLxxxx and ELxxxx series.
The KS/ES series terminals enable 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 mm^2 and 2.5 mm^2 can continue to be used with the proven spring force technology.

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

High Density Terminals (HD Terminals)

Fig. 14: *High Density Terminals*

The Bus Terminals from these series with 16 connection 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.

Note	**Wiring HD Terminals** The High Density (HD) Terminals of the KLx8xx and ELx8xx series doesn't support steady wiring.

Ultrasonically "bonded" (ultrasonically welded) conductors

Note	**Ultrasonically “bonded" conductors** It is also possible to connect the Standard and High Density Terminals with ultrasonically "bonded" (ultrasonically welded) conductors. In this case, please note the tables concerning the wire-size width [▶ 28] below!

Wiring

Terminals for standard wiring ELxxxx / KLxxxx and terminals for steady wiring ESxxxx / KSxxxx

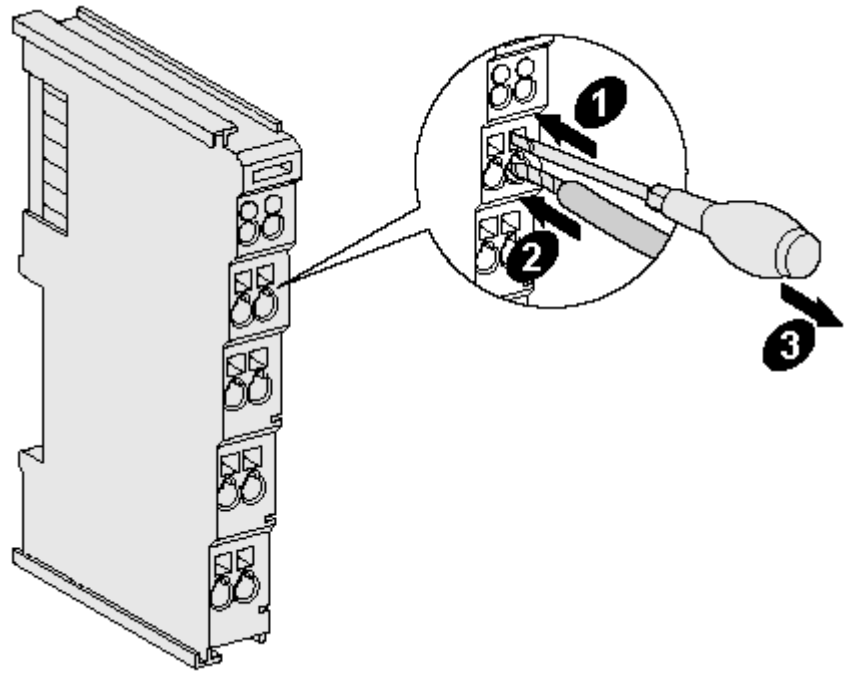

Fig. 15: Mounting a cable on a terminal connection

Up to eight connections enable the connection of solid or finely stranded cables to the Bus Terminals. The terminals are implemented in spring force technology. Connect the cables as follows:

1. Open a spring-loaded terminal by slightly pushing with a screwdriver or a rod into the square opening above the terminal.
2. The wire can now be inserted into the round terminal opening without any force.
3. The terminal closes automatically when the pressure is released, holding the wire securely and permanently.

Terminal housing	ELxxxx, KLxxxx	ESxxxx, KSxxxx
Wire size width	0.08 ... 2,5 mm²	0.08 ... 2.5 mm²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals ELx8xx, KLx8xx (HD)

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 contact 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 (conductors with a wire end sleeve)	0.14... 0.75 mm²
Wire size width (single core wires)	0.08 ... 1.5 mm²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm²
Wire size width (ultrasonically “bonded" conductors)	only 1.5 mm² (see notice [▶ 27]!)
Wire stripping length	8 ... 9 mm

Shielding

Note	**Shielding** Analog sensors and actors should always be connected with shielded, twisted paired wires.

8.4 Installation positions

Attention	**Constraints regarding installation position and operating temperature range** Please refer to the technical data for a terminal to ascertain whether any restrictions regarding the installation position and/or the operating temperature range have been specified. When installing high power dissipation terminals ensure that an adequate spacing is maintained between other components above and below the terminal in order to guarantee adequate ventilation!

Optimum installation position (standard)

The optimum installation position requires the mounting rail to be installed horizontally and the connection surfaces of the EL/KL terminals to face forward (see Fig. *"Recommended distances for standard installation position"*). The terminals are ventilated from below, which enables optimum cooling of the electronics through convection. "From below" is relative to the acceleration of gravity.

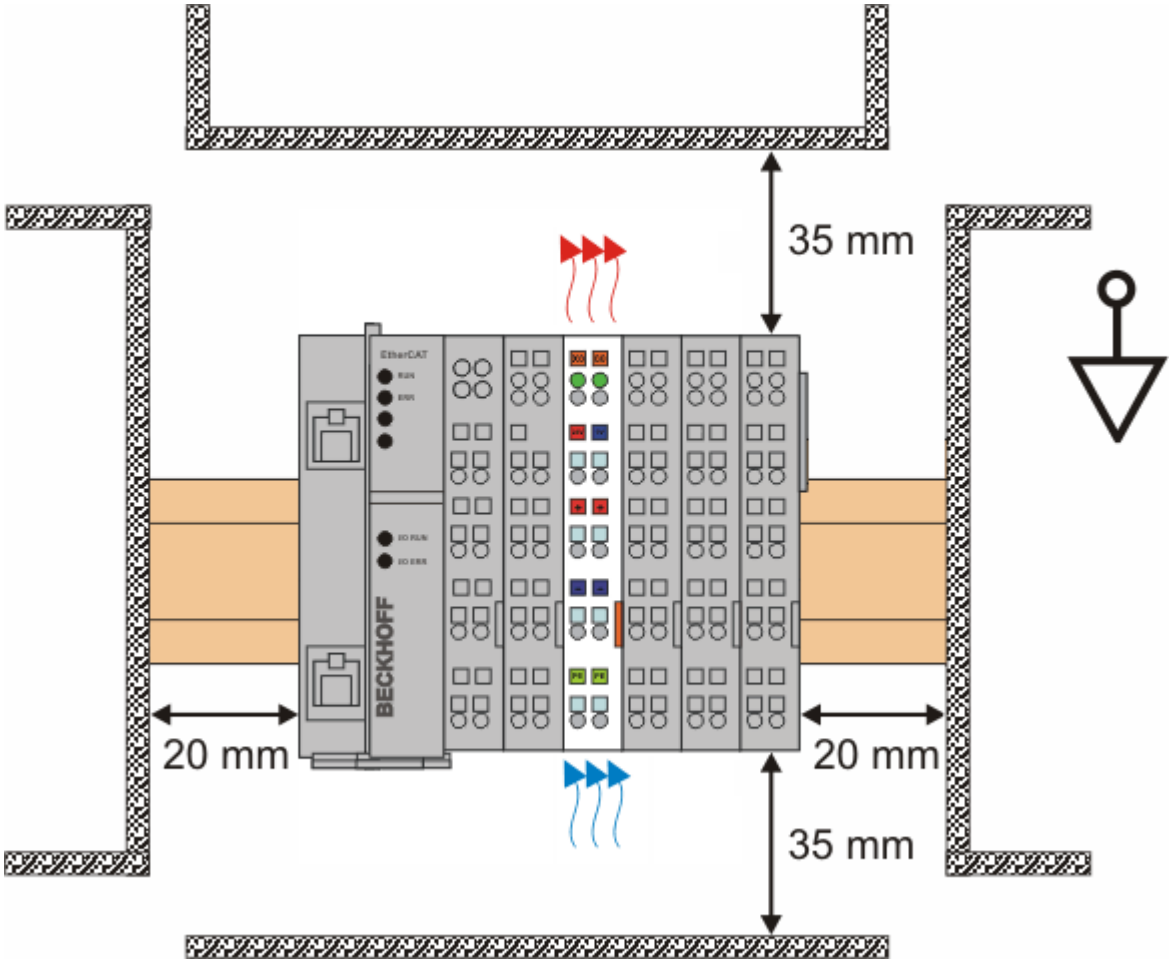

Fig. 16: *Recommended distances for standard installation position*

Compliance with the distances shown in Fig. *"Recommended distances for standard installation position"* is recommended.

Other installation positions

All other installation positions are characterized by different spatial arrangement of the mounting rail - see Fig *“Other installation positions”.*

The minimum distances to ambient specified above also apply to these installation positions.

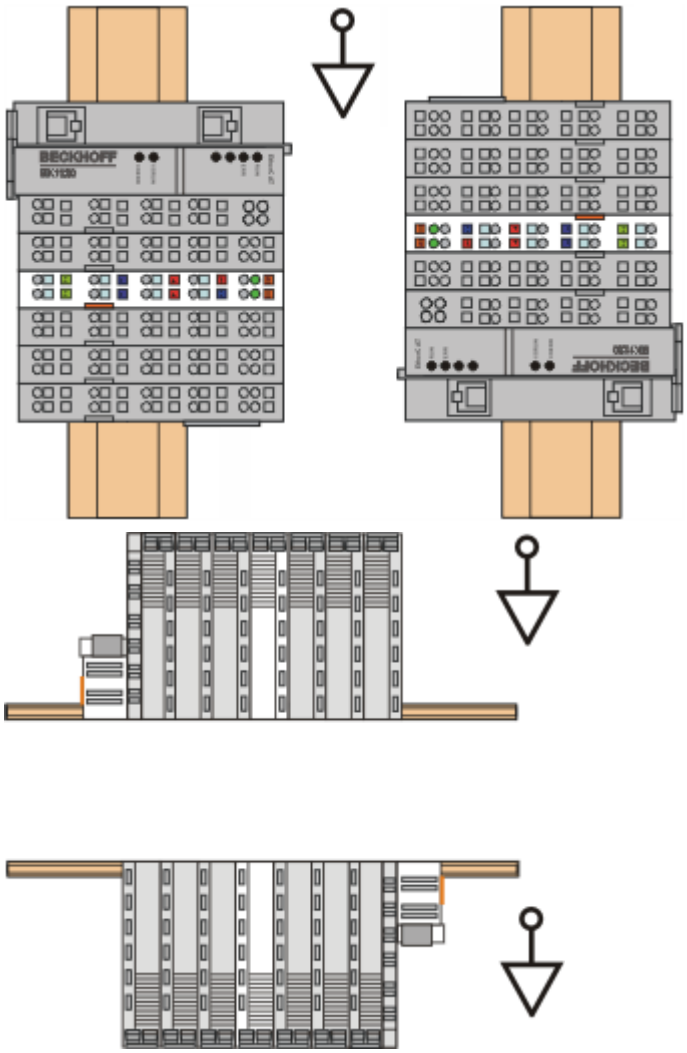

Fig. 17: *Other installation positions*

8.5 ATEX - Special conditions

WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components in potentially explosive areas (directive 94/9/EU)!

- The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60529! The environmental conditions during use are thereby to be taken into account!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of 0 to 55°C for the use of Beckhoff fieldbus components in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The fuses of the KL92xx/EL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

The fundamental health and safety requirements are fulfilled by compliance with the following standards:

- EN 60079-0: 2006
- EN 60079-15: 2005

Marking

The Beckhoff fieldbus components certified for potentially explosive areas bear one of the following markings:

II 3 G Ex nA II T4 KEMA 10ATEX0075 X Ta: 0 - 55°C

or

II 3 G Ex nA nC IIC T4 KEMA 10ATEX0075 X Ta: 0 - 55°C

8.6 ATEX Documentation

 **Note**	**Notes about operation of the Beckhoff terminal systems in potentially explosive areas (ATEX)** Pay also attention to the continuative documentation Notes about operation of the Beckhoff terminal systems in potentially explosive areas (ATEX) that is available in the download area of the Beckhoff homepage http:\\www.beckhoff.com!

9 Appendix

9.1 Support and Service

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

Beckhoff's branch offices and representatives

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

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages:
http://www.beckhoff.com

You will also find further documentation for Beckhoff components there.

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Beckhoff Support

Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

- support
- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

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Beckhoff Service

The Beckhoff Service Center supports you in all matters of after-sales service:

- on-site service
- repair service
- spare parts service
- hotline service

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List of illustrations