

Documentation

KL6301-0000

EIB/KNX Bus Terminal

Version: 3.0.0
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BECKHOFF

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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.

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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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, DE102004044764, DE102007017835 with corresponding applications or registrations in various other countries.

The TwinCAT Technology is covered, including but not limited to the following patent applications and patents: EP0851348, US6167425 with corresponding applications or registrations in various other countries.



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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.

Description of instructions

In this documentation the following instructions are used.
These instructions must be read carefully and followed without fail!

DANGER

Serious risk of injury!

Failure to follow this safety instruction directly endangers the life and health of persons.

WARNING

Risk of injury!

Failure to follow this safety instruction endangers the life and health of persons.

CAUTION

Personal injuries!

Failure to follow this safety instruction can lead to injuries to persons.

NOTE

Damage to environment/equipment or data loss

Failure to follow this instruction can lead to environmental damage, equipment damage or data loss.



Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Documentation issue status

Version	Comment
3.0.0	<ul style="list-style-type: none"> • Migration • Connection technology updated • Connection corrected
2.3.0	<ul style="list-style-type: none"> • Programming description moved to the Beckhoff Information System [▶ 22] • TwinCAT library TcEIB (formerly TcKL6301) updated to version 5.2.0 • ATEX notes added
2.2.0	<ul style="list-style-type: none"> • Integrated TwinCAT library TcKL6301 updated to version 3.0.6
2.1.0	<ul style="list-style-type: none"> • Description of the link with the TwinCAT System Manager added
2.0.0	<ul style="list-style-type: none"> • Changes to the firmware version B1 (8 filters now possible) and TwinCAT library TcKL6301, version V3.000.000 <p>Note: The TwinCAT library TcKL6301, version V3.000.000 (or higher) can also be used with firmware version B0. In that case, however, only the 4 filters with 64 entries each are possible.</p>
1.2.0	<ul style="list-style-type: none"> • Mounting description expanded
1.1.0	<ul style="list-style-type: none"> • New output variable in receive function block (V2.005.000)
1.0.0	<ul style="list-style-type: none"> • First release

Hardware and firmware versions

Documentation Version	KL6301-0000	
	Firmware	Hardware
3.0.0	B2	02
2.3.0	B2	01
2.2.0	B1	01
2.1.0	B1	00
2.0.0	B1	00
1.2.0	B0	00
1.1.0	B0	00
1.0.0	B0	00

The hardware and firmware version (delivery state) can be found in the serial number printed at 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

FF - firmware version

HH - hardware version

Example with ser. no.: 35 05 B0 00:

35 - week of production 35

05 - year of production 2005

B0 - firmware version B0

00 - hardware version 00

2 Product overview

2.1 Introduction

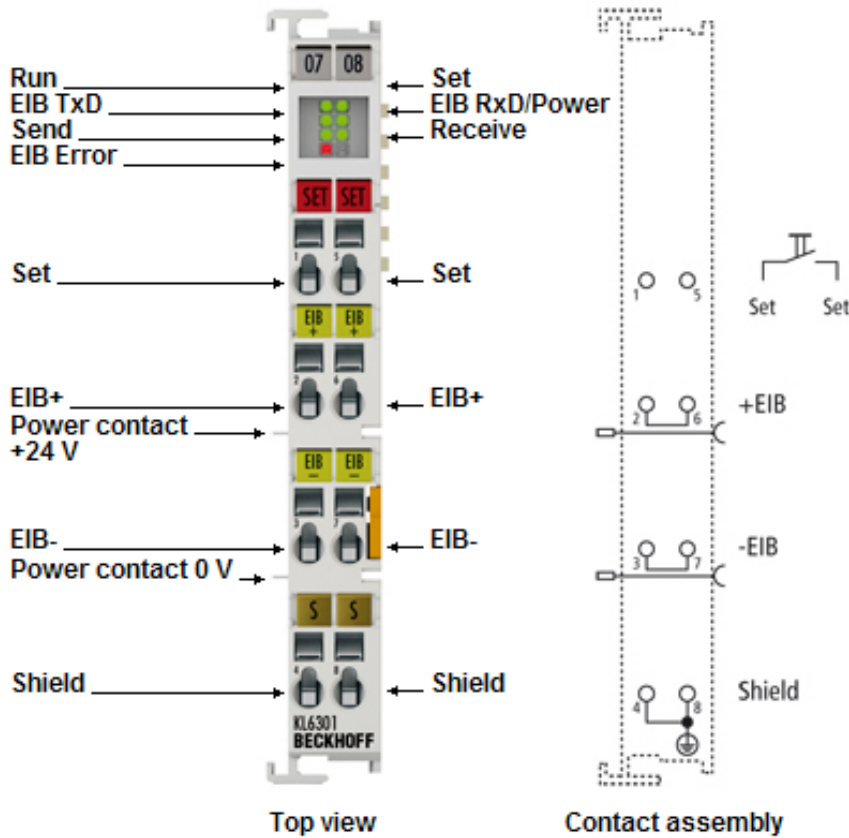


Fig. 1: KL6301

The EIB Bus Terminal KL6301 connects the EIB/KNX bus system to the Beckhoff Bus Terminal system. The KL6301 offers the possibility to exchange any data with EIB/KNX devices. The ETS software is not required for configuring the KL6301. It is configured and parameterized via TwinCAT function blocks (IEC61131-3).

Software required for use of the KL6301:

1. An ETS tool for linking the data and commissioning the other EIB/KNX devices
2. TwinCAT PLC and an appropriate library to communicate with the KL6301 from the application.

● TwinCAT library for EIB/KNX: TcKL6301



TwinCAT supports the KL6301 with its own library for EIB/KNX, the [TcEIB](#) [► 22].

If the KL6301 is to be used with an external controller, a Bus Terminal controller (BC or BX) is required on which the EIB library can run. Operation of the KL6301 on a PC or CX without TwinCAT PLC is not supported!

2.2 Diagnostic LEDs

The LEDs indicate the operating state of the KL6301.

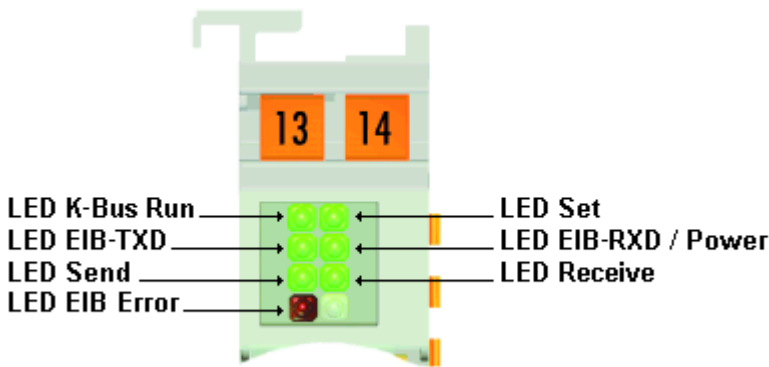


Fig. 2: KL6301 - Diagnostic LEDs

LED displays

LED	Color	Chan-nel	State and significance		
			on	off	flashes
K-Bus Run	green	1	Lit, either weakly or strongly: K-bus communication OK	No K-Bus communication	K-Bus communication
Set	green		No significance	-	-
EIB-TXD	green		Goes out briefly when an EIB telegram is sent	-	-
EIB-RXD / POWER	green		Goes out briefly when an EIB telegram is received	No EIB power supply unit is connected	-
SEND	green		Toggles for each EIB telegram sent	-	-
RECEIVE	green		Toggles for each received EIB telegram	-	-
EIB ERROR	red		Comes on in the event of an error. Goes out once the error was read.	-	-

2.3 Technical data

Technical data	KL6301-0000
Number of outputs	1
Transmission standard	Twisted Pair (TP)
Data transfer rate	9.6 kbyte
Electrical isolation	500 V (K-Bus/EIB)
Power supply for the electronics	via the K-bus and through the power contacts EIB electronics via an external EIB power supply unit
Current consumption via K-bus	typically 55 mA
Bit width in process image	Output: 24 bytes data, input: 24 bytes data
Weight	approx. 85 g
Dimensions (W x H x D)	approx. 12 mm x 100 mm x 70 mm
Mounting [▶ 11]	on 35 mm mounting rail conforms 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 air humidity	95 %, no condensation
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 see also installation instructions ▶ 18 for enhanced mechanical load capacity
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Mounting position	variable
Approval	CE, cULus, ATEX

3 Mounting and wiring

3.1 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

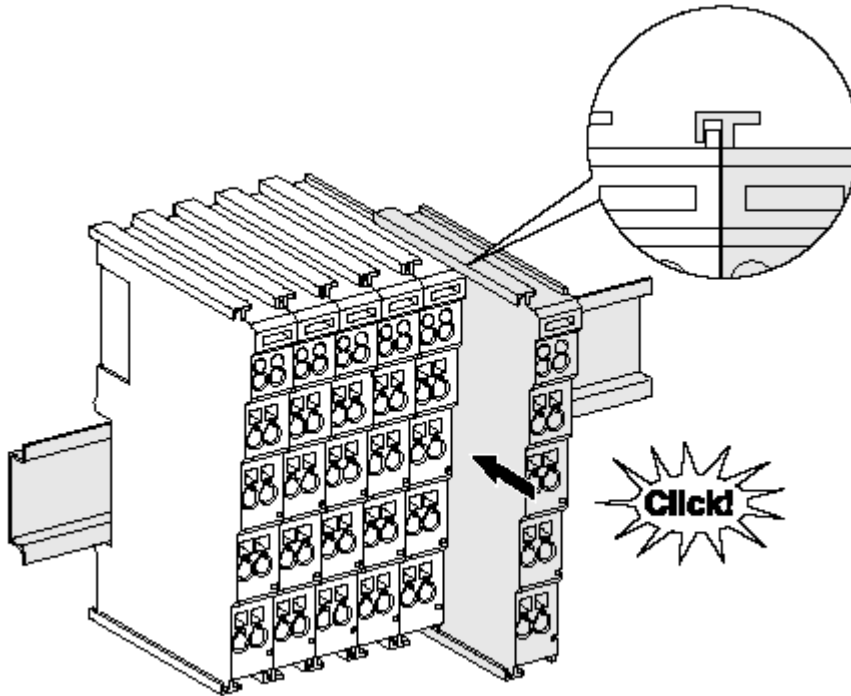


Fig. 3: Attaching on mounting rail

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.

● Fixing of mounting rails

i 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

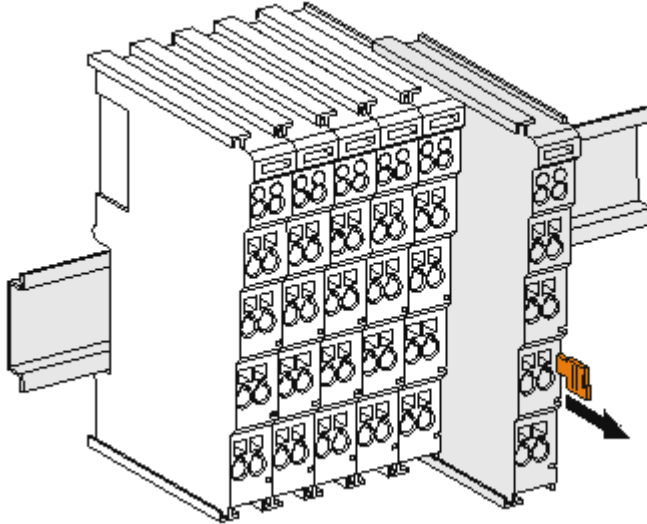


Fig. 4: Disassembling of terminal

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.

● Power Contacts

i 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.

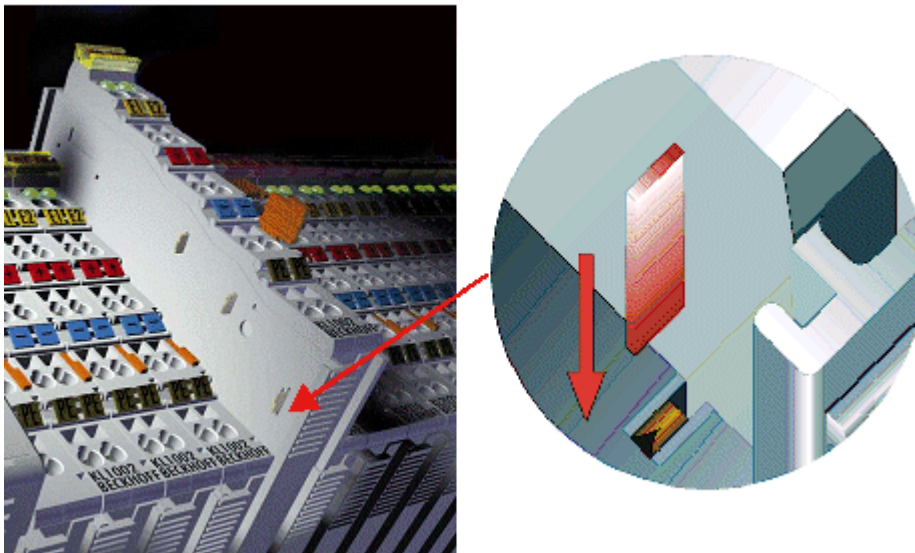


Fig. 5: Power contact on left side

NOTE

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!

3.2 Connection

3.2.1 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 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. 6: Standard wiring

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

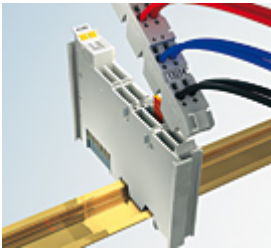
Pluggable wiring (ESxxxx / KSxxxx)

Fig. 7: 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. 8: High Density Terminals

The Bus Terminals from these series with 16 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.

i **Wiring HD Terminals**

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

Ultrasonically "bonded" (ultrasonically welded) conductors

i **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 below!

3.2.2 Wiring

⚠ 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!

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

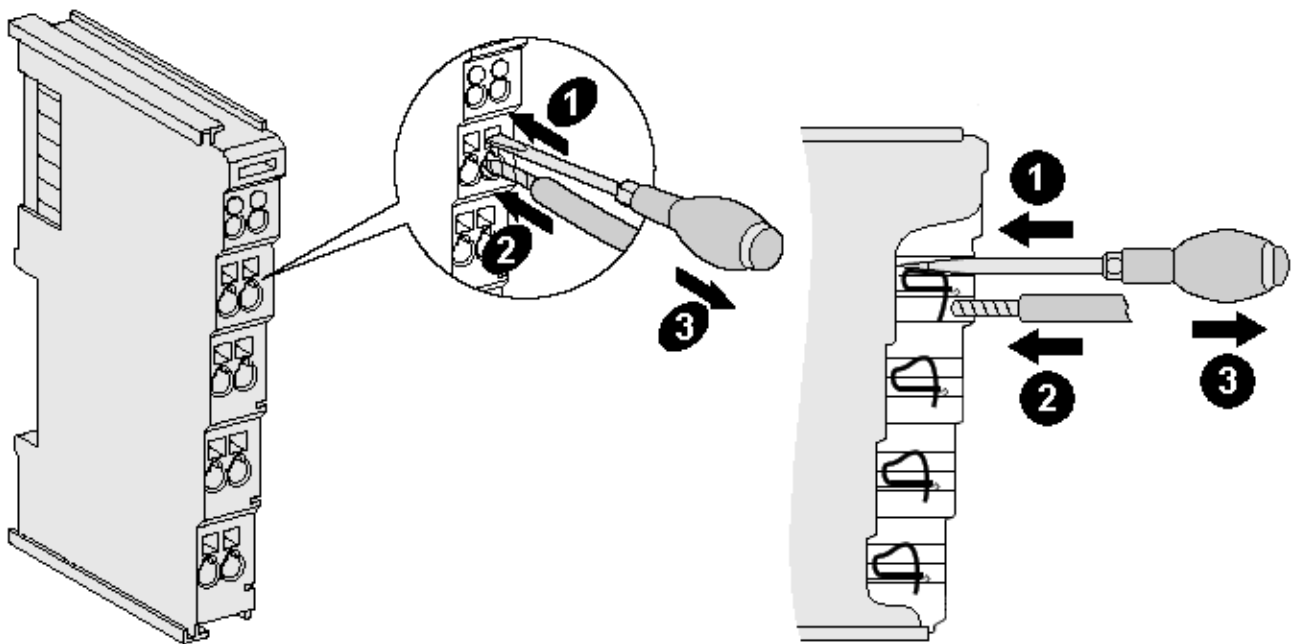


Fig. 9: Connecting a cable on a terminal point

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:

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. The terminal point closes automatically when the pressure is released, holding the wire securely and permanently.

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 \[► 14\]](#)) with 16 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 "bonded" conductors)	only 1.5 mm ²
Wire stripping length	8 ... 9 mm

3.3 Connection

⚠ WARNING

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

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

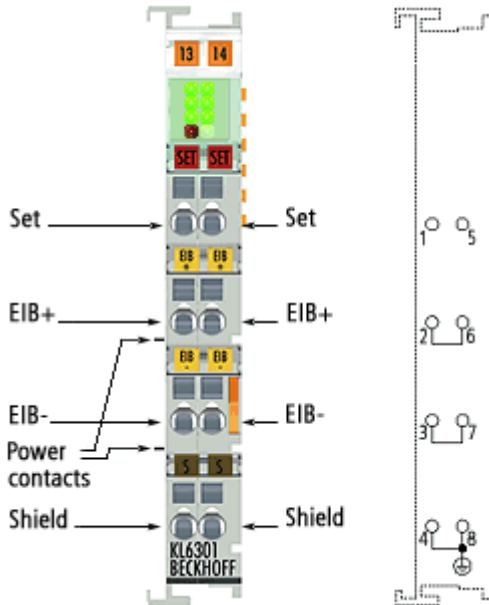


Fig. 10: KL6301 - connection

Terminal point	No.	Connection for
Set	1	reserved
EIB +	2	EIB plus (red), internally connected with terminal point 6
EIB -	3	EIB minus (grey), internally connected with terminal point 7
Shield	4	Shield, internally connected with terminal point 8
Set	5	reserved
EIB +	6	EIB plus (red), internally connected with terminal point 2
EIB -	7	EIB minus (grey), internally connected with terminal point 3
Shield	8	Shield, internally connected with terminal point 4

● Set terminal points

i The terminal points for Set have no function and must not be used!

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

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.

3.5 ATEX - Special conditions (standard temperature range)

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components with standard temperature range 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 standard temperature range 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 60079-0:2012+A11:2013
- EN 60079-15:2010

Marking

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



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

or



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

3.6 ATEX Documentation



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>!

4 EIB

4.1 Function of the KL6301

Operation of the EIB Bus Terminal requires function blocks that are available for downloading from within this documentation.

From firmware version B1 and library version V3.000.000 there are three different modes that can be activated in the KL6301 function block.

Mode 0: 4 filters, each with 64 group entries (compatible with firmware B0)

Mode 1: 8 filters, each with 32 group entries

Mode 100: Monitor function (all group address telegrams can be received, the KL6301 sends no ACK). Sending is disabled in this mode.

● **Mode 1 and 100**



Modes 1 and 100 can only be used with the basic function blocks from the TcKL6301 library.

Sending

The KL6301 sends data individually. This means that a Data variable sent to the KL6301 is sent to the EIB network individually. Subsequent EIB data can only be transferred to the KL6301 after a successful transfer. Two types of EIB telegrams can be sent:

- WRITE_GROUP for writing data to other EIB devices
- READ_GROUP_REQ for requesting data from other EIB devices

Receiving

The KL6301 has a maximum of 8 filter addresses. These filters filter the EIB group addresses. Only EIB telegrams entered in the filter are visible in the process image and are acknowledged.

A filter may contain up to 64 group addresses. With 4 filters multiplied with 64 entries a total of 256 group addresses are available. With 8 filters multiplied with 32 entries a total of 256 group addresses are available. The system is configured via a function block. The group addresses are loaded and are immediately active when the Bus Terminal is initialized.

At least one filter has to be parameterized. The type of data is irrelevant for the filter setting.

Monitor function

No filters must be set if mode 100 is enabled. The filters EIB_GROUP_FILTER are simply left empty and not written.

5 Programming

5.1 TwinCAT libraries

Software documentation in the Beckhoff Information System:

TwinCAT 2: [TwinCAT 2 PLC Lib: EIB](#)

TwinCAT 3: [TwinCAT 3 PLC Lib: Tc2 EIB](#)

6 Appendix

6.1 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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e-mail:	service@beckhoff.com

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