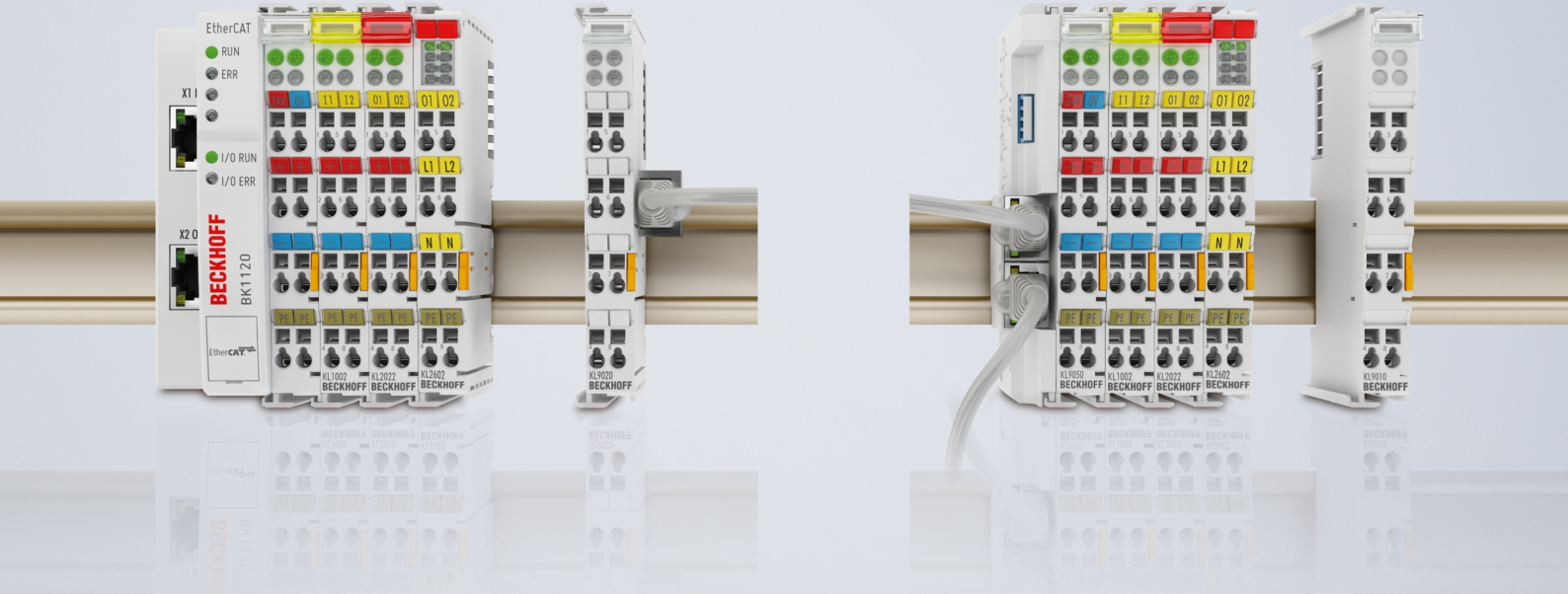
BECKHOFF New Automation Technology

Documentation | EN

KL9020, KL9050

K-Bus Extension



2022-08-17 | Version: 2.2.0

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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.

Trademarks

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 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
2.2.0	• Chapter “Technical data” updated • Document structure updated • Chapter “Disposal” added • New title page • Revision status updated
2.1.0	• Update chapter “Instructions for ESD protection” • Chapter Beckhoff Identification Code (BIC)” added • Update Firmware and hardware versions
2.0.0	• Migration • Update Technical data • Chapter *Instructions for ESD protection* added • Update chapter *Connection* added • Chapters *ATEX - special conditions (standard temperature range)* and *ATEX documentation* added • Firmware and hardware versions updated • Structure update
1.2.0	• Description of the structure of a K-bus extension expanded • Mounting description expanded
1.1.1	• Foreword and appendix updated • Product overview for KL9050 updated
1.1	• Ordering information updated • Description of the diagnostic LEDs corrected
1.0	First release

Firmware and hardware versions

Documentation Version	KL9020		KL9050	
	Firmware	Hardware	Firmware	Hardware
2.2.0	03	15	01	08
2.1.0	03	13	01	07
2.0.0	03	12	01	06
1.2.0	03	08	01	03
1.1.1	03	07	01	02
1.1	01	02	01	01
1.0	01	02	01	01

The firmware and hardware versions (delivery state) can be found in the serial number printed on the side of the terminal.

Syntax of the serial number

Structure of the serial number: KK YY FF HH

KK - week of production (CW, calendar week)
YY - year of production
FF - firmware version
HH - hardware version

Example with serial number 35 05 03 07:

35 - week of production 35
05 - year of production 2005
03 - firmware version 03
07 - hardware version 07

2 Product Overview

2.1 Functional description

System expansion

Based on a bus terminal block consisting of a Bus Coupler and a maximum of 64 Bus Terminals, using the K-bus Extension Terminals KL9020 and KL9050 your system can be expanded by up to 31 terminal blocks. The expansion terminal blocks can be equipped with a maximum of 64 Bus Terminals each. The maximum permissible configuration consists of 255 Bus Terminals and 1020 I/Os. The K-bus Extension Terminals KL9020 and KL9050 enable a distance of 5 m max. between two terminal blocks and therefore an overall system length of 155 m.

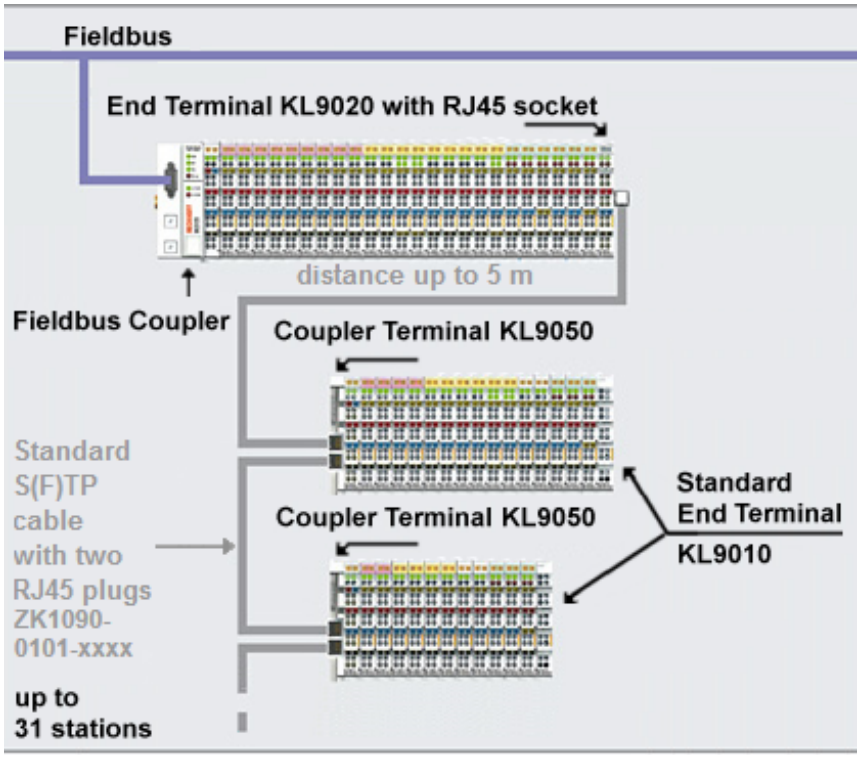

Fig. 1: KL9020 and KL9050 in the Beckhoff Bus Terminal system

The K-bus Extension Terminals KL9020 and KL9050 integrate seamlessly into the Beckhoff Bus Terminal system in terms of their appearance and functionality. The transparent terminal lugs used for labelling indicate their function as system terminals.

KL9020

The End Terminal with RJ45 socket (KL9020 [▶ 9]) is plugged into the end of the bus terminal block instead of a standard End Terminal (KL9010) and enables the connection of the K-bus extension cable. The electronics of the KL9020 are supplied via the K-bus from the Fieldbus Coupler.

KL9050

In the expansion terminal blocks, the Coupler Terminal KL9050 [▶ 10] replaces the Fieldbus Coupler and takes over its function. It is mounted on the mounting rail [▶ 15] at the start of the extension station and connected to the preceding Bus Terminal block via an RJ45 socket with the designation IN by means of a K-bus extension cable with a maximum length of 5 m. Connect the K-bus extension cable

- of the first expansion terminal block to the End Terminal with RJ45 socket (KL9020) of the terminal block with the Fieldbus Coupler.

- of all other expansion terminal blocks with the RJ45 socket (identified with OUT) of the Coupler Terminal (KL9050) of the preceding expansion terminal block.

The power contacts and the corresponding connection points of the Coupler Terminal are electrically isolated from the K-bus.

K-bus extension cable

The data is transmitted between the terminal blocks via eight-core Ethernet cables with RJ45 plugs. Beckhoff offers pre-assembled cables in different lengths, which can be customized with commercially available Ethernet tools.

The K-bus Extension Terminals should also work with cables from other manufacturers. However, Beckhoff recommends the use of Beckhoff Ethernet cables [▶ 28], which are tested for the specified functionality.

2.2 KL9020 - End Terminal with RJ45 socket

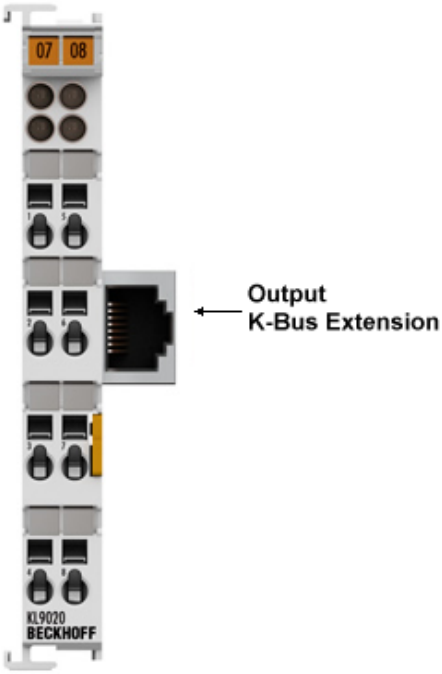

Fig. 2: KL9020 - End Terminal with RJ45 socket

Interface	Function
K-Bus extension output	RJ45 socket for the continuing K-bus extension

2.3 KL9050 - Coupler Terminal

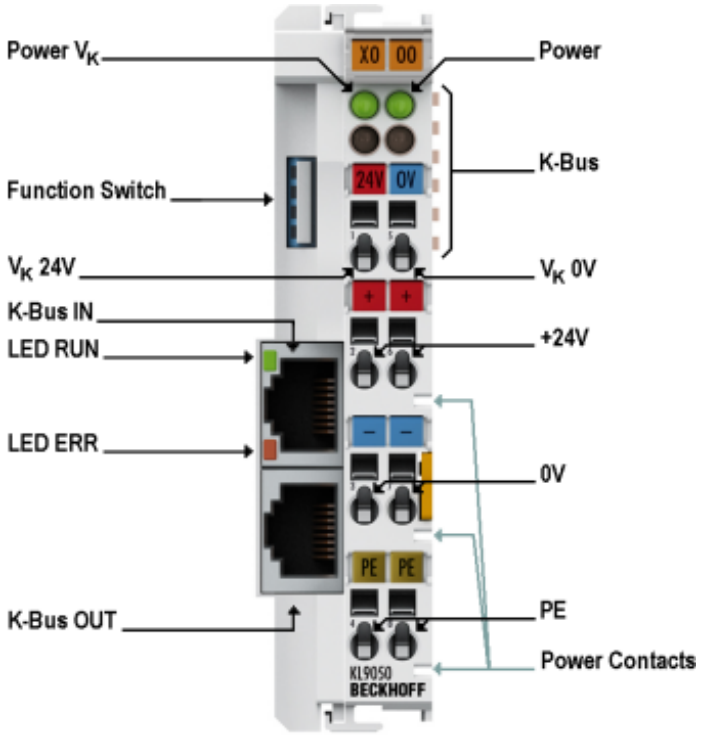

Fig. 3: KL9050 - Coupler Terminal

LED	No.	Function
Power V_k, green	A	LED indicates whether the supply voltage for the electronics of the Coupler Terminal is switched on.
Power, green	C	LED indicates whether the supply voltage for the I/O terminals of the terminal block is switched on. The power supply of the terminals is via the power contacts.
RUN (K-Bus IN), green	-	LED indicates that data is being transmitted on the K-bus.
ERR (K-Bus IN), red	-	LED indicating a fault on the K-Bus.

Terminal point	No.	Function
V_k 24 V	1	Input of the +24 V supply voltage for the Coupler Terminal electronics
+24 V	2	Input of the +24 V supply voltage for the power contacts (internally connected to terminal point 6)
0 V	3	Input of the 0 V supply voltage for the power contacts (internally connected to terminal point 7)
PE	4	PE connection (internally connected to terminal point 8)
V_k 0 V	5	Input of the 0 V supply voltage for the Coupler Terminal electronics
+24 V	6	Input of the +24 V supply voltage for the power contacts (internally connected to terminal point 2)
0 V	7	Input of the 0 V supply voltage for the power contacts (internally connected to terminal point 3)
PE	8	PE connection (internally connected to terminal point 4)

Interface	Function
K-bus In	RJ45 socket for the incoming K-bus extension
K-bus OUT	RJ45 socket for the continuing K-bus extension
K-bus	Internal K-bus of the Bus Terminal block
Power Contacts	Internal power contacts of a bus terminal block
Function Switch [▶ 14]	Switch for the termination resistor of the Coupler Terminal

2.4 Technical Data

Technical Data	General
Number of Bus Terminals per Fieldbus Coupler	with BKxx20 or BKxx50 fieldbus coupler: max. 255 with Fieldbus Couplers BKxx00 or BKxx10: max. 64
Number of bytes per Fieldbus Coupler	limited by Fieldbus Coupler and Fieldbus Limit (see documentation for the Fieldbus Coupler being used)
Increase in runtime due to K-bus extension	negligible (see runtime calculation in the documentation for the Fieldbus Coupler used)
Length of cable between 2 terminal blocks	max. 5 m
Total length of cable	max. 155 m (31 x 5 m) from KL9020 to the last KL9050
Topology	Bus structure

Technical Data	KL9020 [▶ 9] End Terminal with RJ45 socket for K-Bus extension
Fieldbus	independent
Number of KL9020 per Fieldbus Coupler	1
Configuration	automatic
Current consumption from the K-bus	typically 70 mA
Dielectric strength	500 V (shielding, base plate / K-bus)
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
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Weight	approx. 45 g
Dimensions (W x H x D)	approx. 26 mm x 100 mm x 70 mm
Mounting [▶ 13]	on 35 mm mounting rail conforms to EN 60715
Installation position / protection class	Variable / IP20
Approvals/Markings*	CE, UKCA, UL, EAC, GL, ATEX [▶ 23]

Technical Data	KL9050 [▶ 10] K-Bus Extension Coupler Terminal
Number of Bus Terminals per KL9050	max. 64
Number of KL9050 per Fieldbus Coupler	max. 31
Configuration	via switch Function switch [▶ 14]
Supply voltage	24 V_{DC} (-15%/+20%)
Current consumption (via Terminals V_k 24V, V_k 0V)	maximum 200 mA Calculation: 70 mA + (K-bus current of the terminal block) / 4
Starting current	2.5 x nominal current
K-bus power supply (for Bus Terminals)	maximum 400 mA
Power contacts voltage	maximum 30 V_{DC}
Power contact current load	10 A max. (short-circuit 125 A)
Dielectric strength	500 V (power contact/supply voltage/fieldbus)
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
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Weight	approx. 75 g
Dimensions (W x H x D)	approx. 24.5 mm x 100 mm x 70 mm
Mounting [▶ 13]	on 35 mm mounting rail conforms to EN 60715
Installation position / protection class	Variable / IP20
Approvals/Markings*	CE, UKCA, UL, EAC, GL, ATEX [▶ 23]

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

Ex marking

Standard	Marking
ATEX	II 3 G Ex nA IIC T4 Gc

3 Mounting and wiring

3.1 Instructions for ESD protection

NOTE

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 contacts of the device directly.
- Avoid contact with highly insulating materials (synthetic fibers, plastic film etc.).
- Surroundings (working place, packaging and personnel) should by 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.

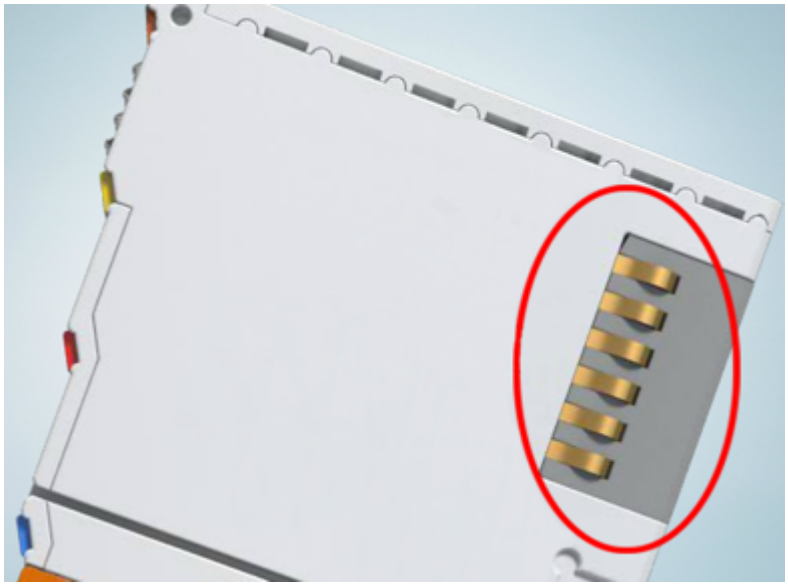

Fig. 4: Spring contacts of the Beckhoff I/O components

3.2 Structure of a K-bus extension

⚠ 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!

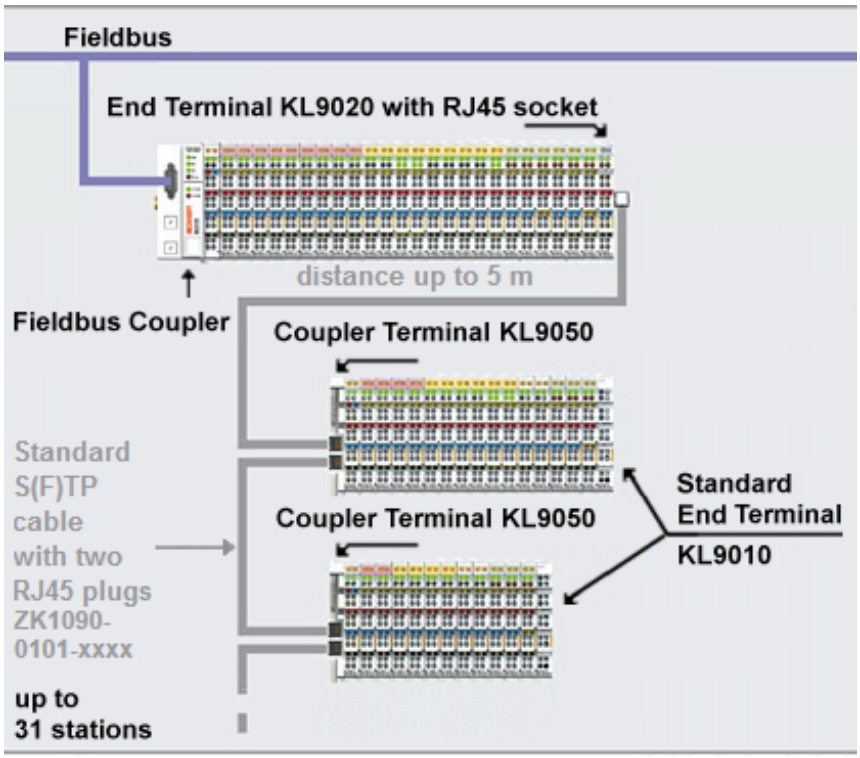

Fig. 5: KL9020 and KL9050 in the Beckhoff Bus Terminal system

Mounting

When mounting, observe the information in the chapter entitled Mounting rail installation [▶ 15].

1. Ensure that the system is powered down and in a safe state.
2. Install the first bus terminal block, consisting of the fieldbus coupler and the desired Bus Terminals, on a mounting rail.
   Instead of a standard End Terminal (KL9010), install an End Terminal with RJ45 socket (KL9020) as the last terminal at the end of the first Bus Terminal block.
3. Install the first expansion terminal block, consisting of a Coupler Terminal (KL9050) and the desired Bus Terminals, on a mounting rail [▶ 11].
   Install a standard End Terminal (KL9010) as the last terminal at the end of the first expansion terminal block.
4. Connect one RJ45 plug of an Ethernet cable into the RJ45 socket of the KL9020 of the first bus terminal block until it clicks into place.
   Connect the other RJ45 plug of the Ethernet cable into the RJ45 socket (labelled *IN*) of the expansion terminal block Coupler Terminal (KL9050) until it clicks into place.
5. Install the next expansion terminal block, consisting of a Coupler Terminal (KL9050) and the desired Bus Terminals, on a mounting rail [▶ 11].
   Install a standard End Terminal (KL9010) as the last terminal at the end of this expansion terminal block.
6. Connect one RJ45 plug of an Ethernet cable into the RJ45 socket (labelled *OUT*) of the KL9020 of the previous expansion terminal block until it clicks into place.
   Connect the other RJ45 plug of the Ethernet cable into the RJ45 socket (labelled *IN*) of the KL9050 of the added expansion terminal block until it clicks into place.

7. Repeat steps 5 and 6 in order to connect further expansion terminal blocks. A maximum of 31 expansion terminal blocks can be connected.
8. Set the Function Switch [▶ 14] on all Coupler Terminals (KL9050) correctly.

Function Switch

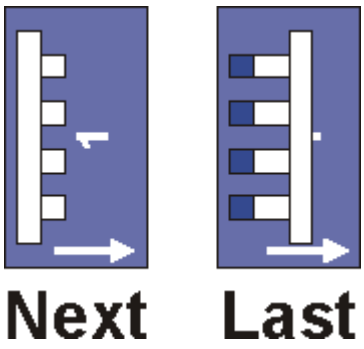

Fig. 6: KL9050 - Function Switch

- **Switch position Next:**
  The *Function Switch* of all Coupler Terminals (KL9050) to which a continuing Ethernet cable is connected must be set to position *Next*!
- **Switch position Last:**
  Activate the terminating resistor at the last expansion terminal block of your K-bus extension system by switching the *Function Switch* on the last Coupler Terminal (KL9050) to the *Last* position.

⚠ CAUTION

Danger to persons, the environment and equipment

✓ Correct setting of the *Function Switches* of all Coupler Terminals (KL9050) within a K-bus extension system must be ensured!

✓ Correct setting of the *Function Switches* must also be ensured if Coupler Terminals (KL9050) are replaced!

✓ Please note that all extension terminal blocks connected after a Coupler Terminal (KL9050), whose *Function Switch* is set to the *Last* position, are not included correctly in the process image! This means:

a) The inputs of these terminals are not visible in the process image!

b) The outputs of these terminals are not controlled by the process image!

⇨ The *Function Switch* may be set to the *Last* position only at the last Coupler Terminal (KL9050) of the K-bus extension system!

Notes on the topology

Notes on the connection of the KL9020 and KL9050 terminals

The end terminal with RJ45 socket (KL9020) may only be used at the end of Bus Terminal blocks that are opened by a fieldbus coupler! All extension terminal blocks must be terminated by a KL9010 standard end terminal!

At least one terminal with process image must be connected to each KL9050 Coupler Terminal! The operation of an extension terminal block with only one KL9010 (with no inputs or outputs) is not permissible

Disassembly

When mounting, observe the information in the chapter entitled Mounting rail installation [▶ 15].

1. Ensure that the system is powered down and in a safe state.
2. Press the plastic lock of the RJ45 plug and pull it from the socket.

3. Carefully pull the orange-colored lug approximately 1 cm out of the terminal to be disassembled, until it protrudes loosely. The lock with the C mounting rail is now released for this terminal, and the terminal can be pulled from the mounting rail without excessive force.
4. Grasp the released terminal with thumb and index finger simultaneous at the upper and lower grooved housing surfaces and pull the terminal away from the mounting rail.

3.3 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

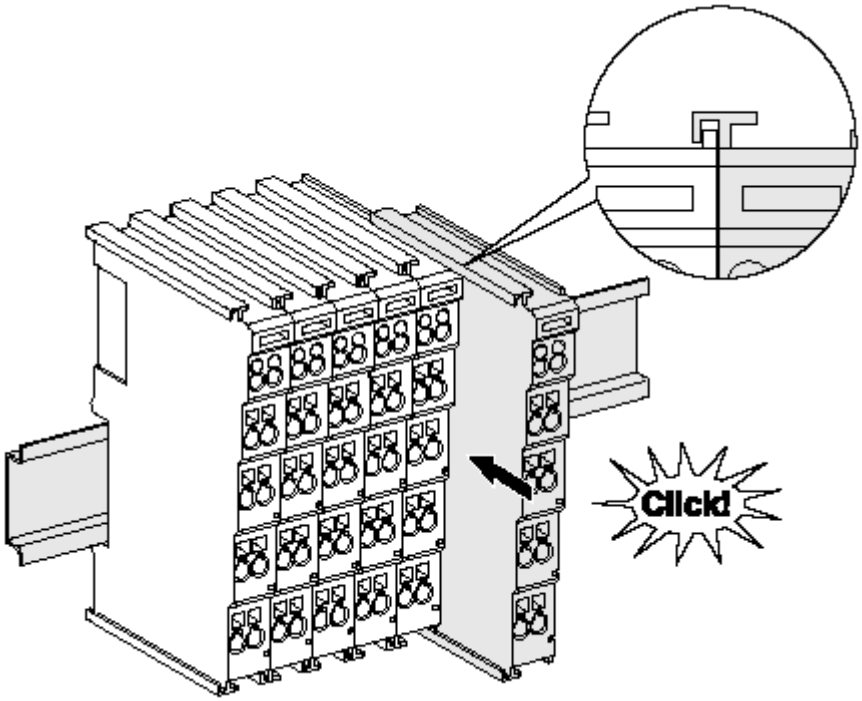

Fig. 7: Attaching on mounting rail

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

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

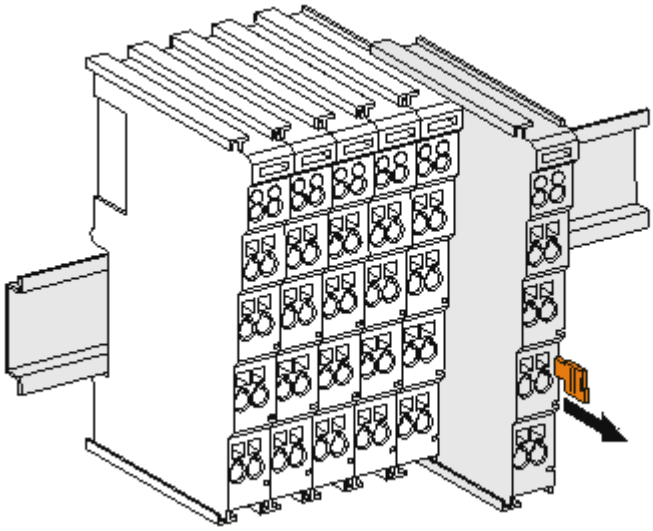

Fig. 8: Disassembling of terminal

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

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.

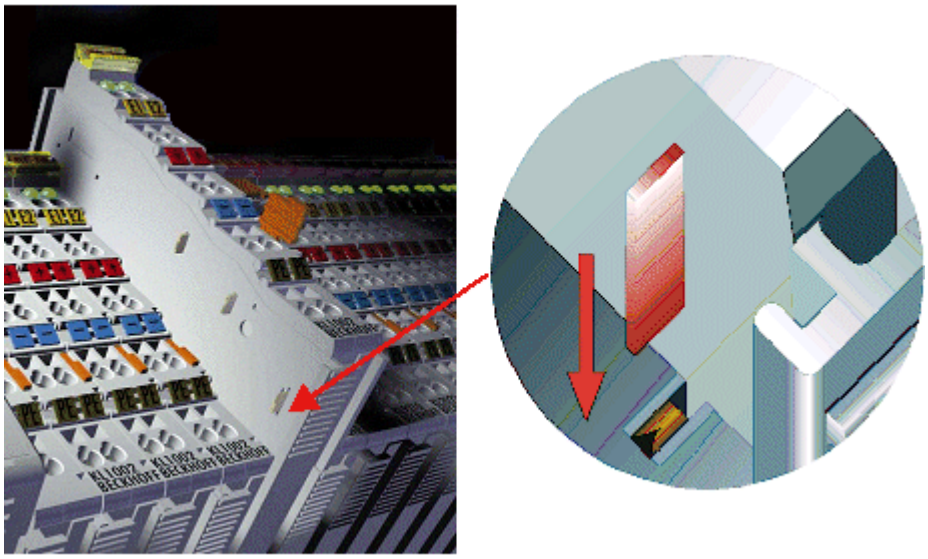

Fig. 9: Power contact on left side

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!

3.4 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.

3.5 Connection

3.5.1 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. 10: 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)

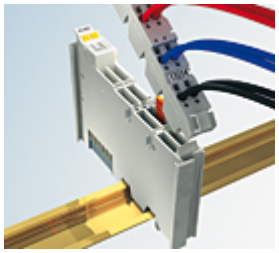

Fig. 11: Pluggable wiring

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 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 ESxxxx and KSxxxx series has been retained as known from ELxxxx and KLxxxx series.

High Density Terminals (HD Terminals)

Fig. 12: High Density Terminals

The 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.

Wiring HD Terminals

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

Ultrasonically “bonded” (ultrasonically welded) conductors

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 [▶ 20]!

3.5.2 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

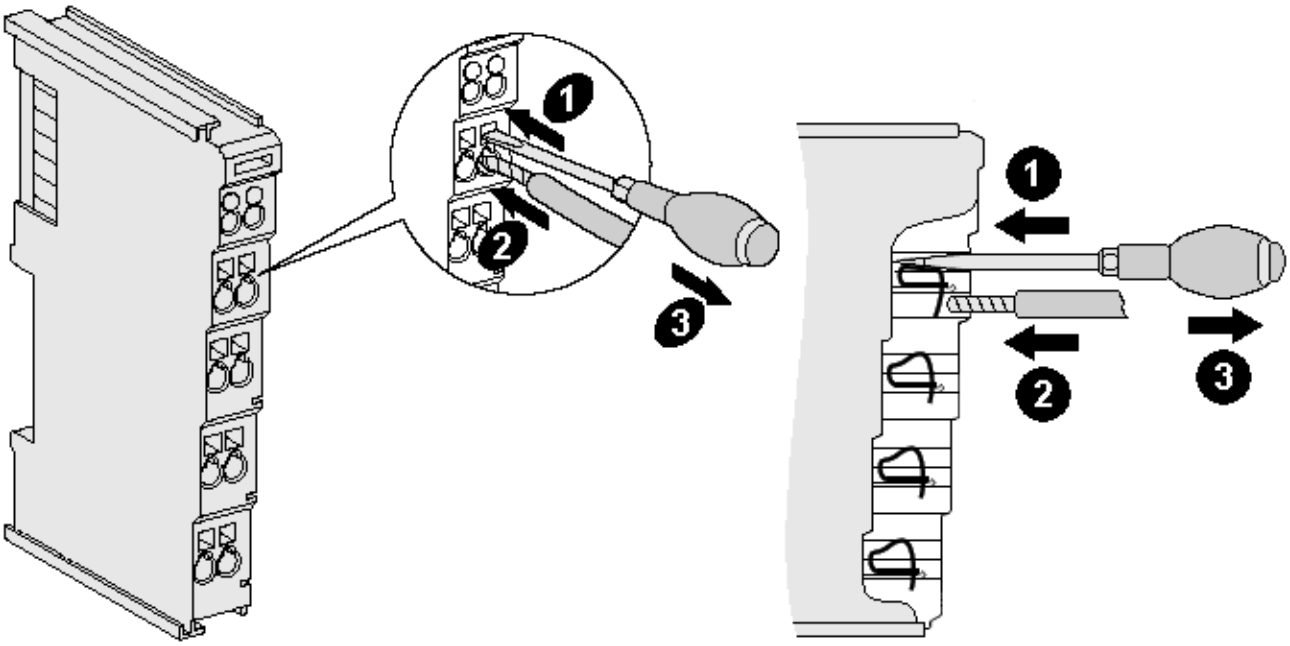

Fig. 13: Connecting a cable on a terminal point

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 mm²	0.08 ... 2.5 mm²
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm²	0.14 ... 1.5 mm²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals (HD Terminals [▶ 19]) 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 mm²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm²
Wire size width (ultrasonically “bonded" conductors)	only 1.5 mm² (see notice [▶ 19])
Wire stripping length	8 ... 9 mm

3.6 Power supply

⚠ WARNING

Danger for persons, the environment or equipment

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

The supply connections V_k for the module electronics (K-bus) and supply connections for the field devices (power contacts) of a terminal block are galvanically separated from each other and can be supplied via separate 24 V_{DC} voltage sources. If no electrical isolation is required between K-bus and field devices, the module electronics and the field devices can be supplied from a single voltage source.

NOTE

Notes on fail-safe operation

For the trouble-free operation of a K-bus extension system, the ground connection of the K-Bus power supplies (Vk 0V) of all terminal blocks must be connected with each other via a low-resistance connection (see Figure). This also includes the ground connection of the K-bus power supply of the higher-level Fieldbus Coupler!

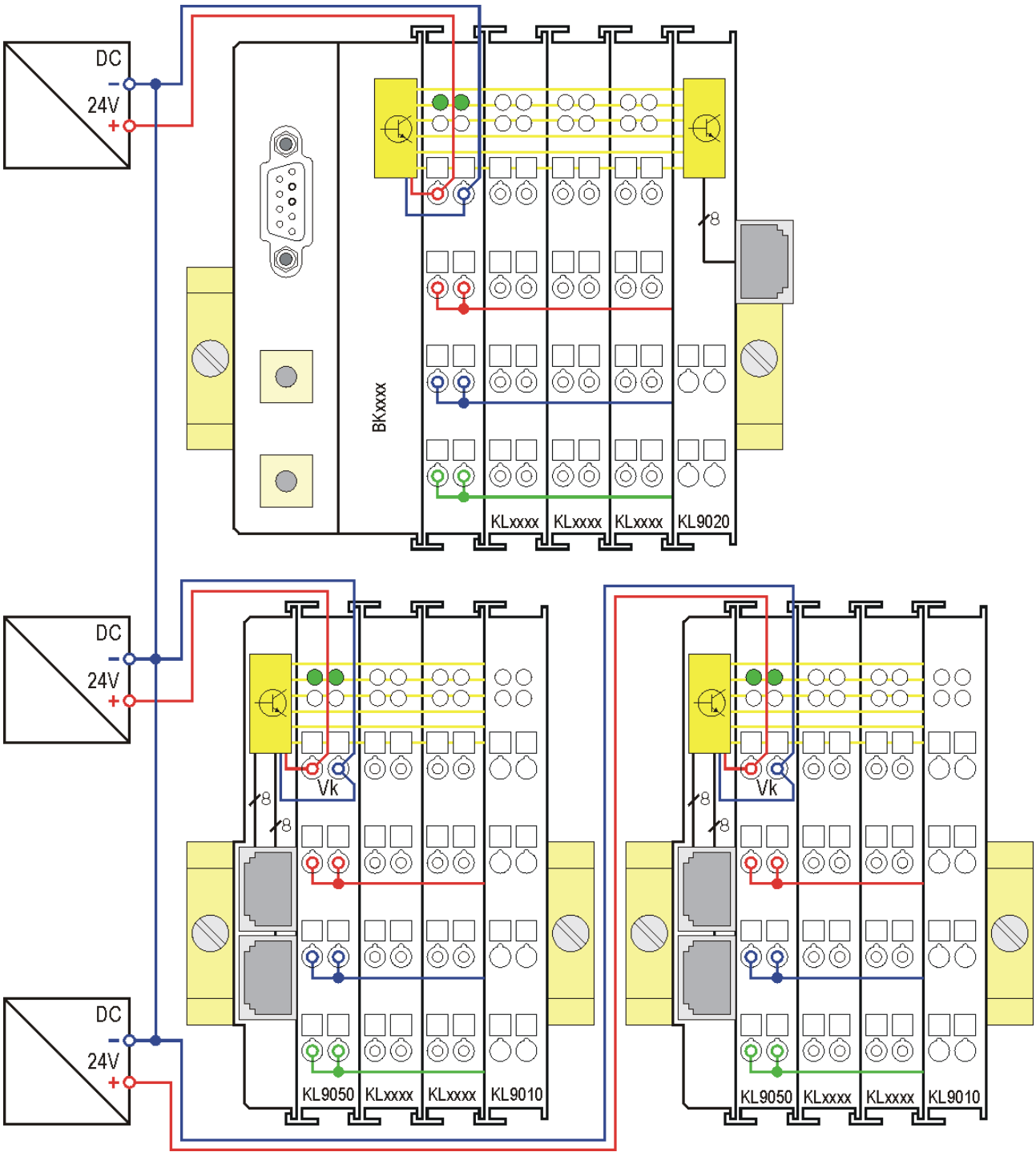

Fig. 14: KL9020, KL9050 – Connection of the power supply

3.7 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 2014/34/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 60079-15! The environmental conditions during use are thereby to be taken into account!
- For dust (only the fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9): The equipment shall be installed in a suitable enclosure providing a degree of protection of IP54 according to EN 60079-31 for group IIIA or IIIB and IP6X for group IIIC, taking into account the environmental conditions under which the equipment is used!
- 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
- EN 60079-31:2013 (only for certificate no. KEMA 10ATEX0075 X Issue 9)

Marking

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

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

II 3D KEMA 10ATEX0075 X Ex tc IIIC T135°C Dc Ta: 0 ... +55°C
(only for fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9)

or

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

II 3D KEMA 10ATEX0075 X Ex tc IIIC T135°C Dc Ta: 0 ... +55°C
(only for fieldbus components of certificate no. KEMA 10ATEX0075 X Issue 9)

3.8 Continuative documentation for ATEX and IECEx

NOTE	
	**Continuative documentation about explosion protection according to ATEX and IECEx** Pay also attention to the continuative documentation **Ex. Protection for Terminal Systems** Notes on the use of the Beckhoff terminal systems in hazardous areas according to ATEX and IECEx, that is available for download within the download area of your product on the Beckhoff homepage www.beckhoff.com!

4 Diagnostics

4.1 Diagnostic LEDs

Coupler Terminal (KL9050)

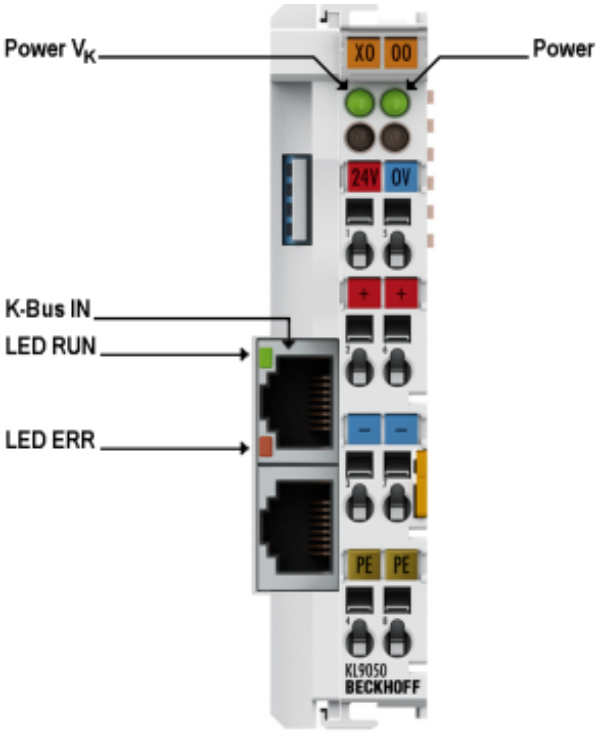

Fig. 15: KL9050 - LEDs

Diagnostic LEDs for power supply

LED	Function	Display	Meaning
Power V_k (green)	Indicates whether the supply voltage for the electronics of the Coupler Terminal is switched on.	on	Supply voltage present
		off	Power supply has failed or is switched off
Power (green)	Indicates whether the supply voltage for the I/O terminals of the terminal block is switched on. The power supply of the terminals is via the power contacts.	on	Supply voltage present
		off	Power supply has failed or is switched off

Diagnostic LEDs on the RJ45 socket for the incoming K-Bus extension (K-Bus IN)

LED *RUN* (green)	LED *ERR* (red)	Meaning	Possible causes
on	off	Data transmission on the K-bus extension is active	• Supply voltage present • Connection established properly
off	on	Data transmission on the K-bus extension is interrupted	• Ethernet cable not connected • Wire breakage or short-circuit in the Ethernet cable • RJ45 plug has been pulled out • Function Switch [▶ 14] of a KL9050 not set correctly
off	off	Data transmission on the K-bus extension is interrupted	• Supply voltage for the electronics in the coupler terminal has failed • Coupler terminal defective

End Terminal with RJ45 socket (KL9020)

The End Terminal KL9020 has no separate diagnostic LEDs. For diagnosing the K-bus of your bus terminal block, the diagnostic LEDs *I/O RUN* and *I/O ERR* of the Fieldbus Coupler installed there are used.

Typical diagnostic LEDs of a Fieldbus Coupler

LED *I/O RUN* (green)	LED *I/O ERR* (red)	Meaning	Possible causes
on	off	Data transmission on the K-bus is active	• Supply voltage present • Connection established properly
off	flashes	Data transmission on the K-bus is interrupted	• Bus Terminal not plugged in properly • Configuration error • A mounted Bus Terminal is defective
off	off	Data transmission on the K-bus is interrupted	• Supply voltage for the electronics in the Fieldbus Coupler has failed • Fieldbus Coupler defective

Behavior in case of an error

If the communication between two or several bus terminal blocks of a K-bus extension system is interrupted

- the green *RUN* LEDs go out on the RJ45 sockets for the incoming K-bus extension (K-bus IN) on all KL9050s,
- the red *ERR* LEDs light up on the RJ45 sockets for the incoming K-bus extension (K-bus IN) on all KL9050s,
- the green LED I/O RUN of your Fieldbus Coupler will go out;
- the red LED *I/O ERR* of the higher-level Fieldbus Coupler will flash rapidly, indicating an interruption of the communication.

Flashing Code

If you now perform a reset for the Fieldbus Coupler, the Fieldbus Coupler searches for the cause of the fault and indicates it as a flashing code via the LED *I/O ERR*.

A flashing code is made up as follows:

- rapid flicker
- short break
- LED flashes m times for error code m
- short break
- LED flashes n times for error argument n
- short break

Count the error code and the error argument. The flashing code is repeated continuously.

The error code for a K-bus interruption is 4. The error argument indicates the Bus Terminal after which communication was interrupted. Examples are shown in the Fault table for K-bus interruption [▶ 27].

4.2 Fault table for K-Bus interruption

Examples of fault indications in the event of communication interruption on the K-bus

Error	Display	Specific display	Possible cause	Remedy
no data transmission on the K-bus and K-bus extension	LED *ERR* of the Coupler Terminals KL9050 are on	LED *I/O ERR* of the higher-level Fieldbus Coupler flashes rapidly	K-bus or K-bus extension was interrupted	After any interruption of the data transmission on the K-bus, the higher-level Fieldbus Coupler requires a reset in order to restart the data transmission or to locate the fault.
	LED *ERR* of the Coupler Terminals KL9050 are on *I/O ERR* LED of the higher-level Fieldbus Coupler flashes after switching on in succession (flashing code [▶ 26]): • fast • 4 times slowly • n [▶ 26] times slow		The Ethernet cable of a K-bus extension is not plugged in correctly	Fault after the n-th Bus Terminal: ensure that the RJ45 plug is connected correctly.
			The *Function Switch* of the last Coupler Terminal is not in position *Last*	Set the Function Switch [▶ 14] to Last!
			Wrong Ethernet cable	Fault after the n-th Bus Terminal: Do not use a crossed Ethernet cable for K-Bus extension!
		LED *Power* V_k of the affected Coupler Terminal is not on	Supply voltage of a coupler terminal has failed	Check the supply voltages of the bus terminal block after the n-th Bus Terminal
	LED *ERR* of the Coupler Terminals KL9050 are on	LED *I/O ERR* of the higher-level Fieldbus Coupler flashes rapidly	Ethernet cable too long	The length of the Ethernet cable between two terminal blocks must not exceed 5 m.
				The overall length of the K-bus extension must not exceed 155 m (31 x 5 m).
			Ethernet cable defective	Check the Ethernet cable.
			Wrong End Terminal installed: The End Terminal with RJ45 socket (KL9020) is only used at the bus terminal block with the Fieldbus Coupler.	All extension terminal blocks must be terminated with the standard end terminal (KL9010)! See Notes on the topology [▶ 14] of the K-bus extension.

Please see the documentation of your Fieldbus Coupler for further error codes (m¹4) and the associated error arguments.

5 Appendix

5.1 Ordering information

Order identifier	Description
KL9020	End Terminal with RJ45 socket [▶ 9] for K-bus extension
KL9050	K-bus Extension Coupler Terminal [▶ 10]
ZK1090-0101-1005	K-bus extension cable with two plugs attached, double shielded, grey, 50 cm
ZK1090-0101-1010	K-bus extension cable with two plugs attached, double shielded, grey, 100 cm
ZK1090-0101-1020	K-bus extension cable with two plugs attached, double shielded, grey, 200 cm
ZK1090-0101-1030	K-bus extension cable with two plugs attached, double shielded, grey, 300 cm
ZK1090-0101-1050	K-bus extension cable with two plugs attached, double shielded, grey, 500 cm
ZK1090-0000-1000	K-bus extension cable without plug, double shielded, grey, goods sold in rings
ZS1090-0001-0000	Modular RJ45 plug with anti-kink envelope, grey

5.2 Beckhoff Identification Code (BIC)

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

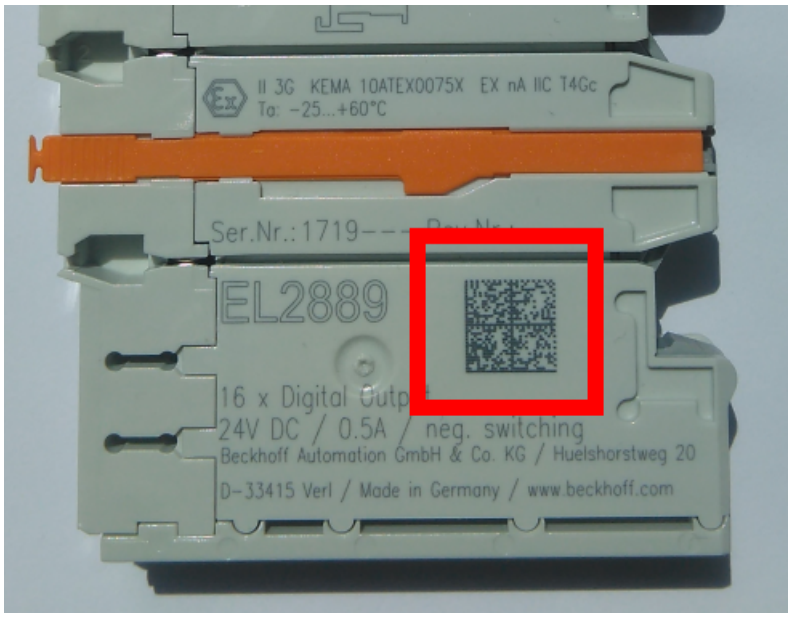

Fig. 16: BIC as data matrix code (DMC, code scheme ECC200)

The BIC will be introduced step by step across all product groups.

Depending on the product, it can be found in the following places:

- 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 also be used by the customer for handling and product management.

Each piece of information can be uniquely identified using the so-called data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length according to the table below. If the information is shorter, spaces are added to it.

Following information is possible, positions 1 to 4 are always present, the other according to need of production:

Position	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	**Beckhoff order number**	1P	8	1P072222
2	Beckhoff Traceability Number (BTN)	**Unique serial number, see note below**	SBTN	12	SBTNk4p562d7
3	Article description	**Beckhoff article description, e.g. EL1008**	1K	32	1KEL1809
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	2P401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products	51S	12	51S678294
7	Variant number	Optional: Product variant number on the basis of standard products	30P	32	30PF971, 2*K183
...					

Further types of information and data identifiers are used by Beckhoff and serve internal processes.

Structure of the BIC

Example of composite information from positions 1 to 4 and with the above given example value on position 6. The data identifiers are highlighted in bold font:

1P072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

Accordingly as DMC:

Fig. 17: Example DMC **1P**072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, position 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTE

This information has been carefully prepared. However, the procedure described is constantly being further developed. We reserve the right to revise and change procedures and documentation at any time and without prior notice. No claims for changes can be made from the information, illustrations and descriptions in this information.

5.3 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: https://www.beckhoff.com

You will also find further documentation for Beckhoff components there.

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

Hotline:	+49 5246 963 157
Fax:	+49 5246 963 9157
e-mail:	support@beckhoff.com

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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