BECKHOFF New Automation Technology

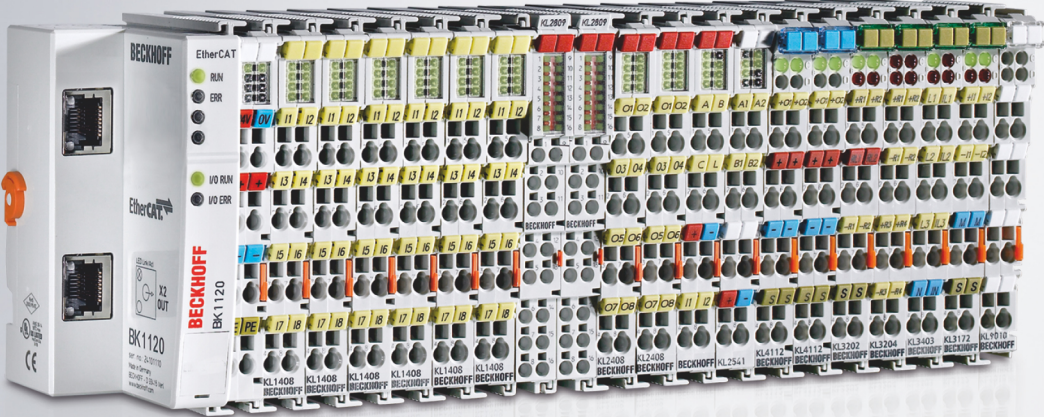Documentation | EN

KL6401

LON Bus Terminal

Table of contents

BECKHOFF

Version: 2.2.0

KL6401

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 • Ex markings added to technical data • Chapter *Instructions for ESD protection* added • Chapter *Disposal* added • Chapter *Beckhoff Identification Code (BIC)* added • Links to TwinCAT libraries updated • Document structure updated • New title page
2.1.0	• Links updated
2.0.0	• Migration
1.3.0	• Programming description moved to the <u>Beckhoff Information System [▶ 36]</u> • TwinCAT library TcLON (formerly TcKL6401) updated to version 2.2.0 • ATEX notes added
1.2.0	• TwinCAT library TcKL6401 updated to version 1.004.000
1.1.0	• Mounting description expanded • Files updated: ◦ TwinCAT library ◦ XML file of SNVT types for KS2000 configuration software
1.0.0	First release

Firmware and hardware versions

Documentation Version	KL6401	
	Firmware	**Hardware**
2.2.0	B1	05
2.1.0	B1	04
2.0.0	B1	04
1.3.0	B1	02
1.2.0	B1	01
1.1.0	B1	01
1.0.0	B1	00

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: WW YY FF HH

WW - week of production (calendar week)
YY - year
FF - firmware version
HH - hardware version

Example with serial number 35 04 B1 00:

35 - week of production 35
04 - year of production 2004
B1 - firmware version B1
00 - hardware version 00

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2 Product overview

2.1 Introduction
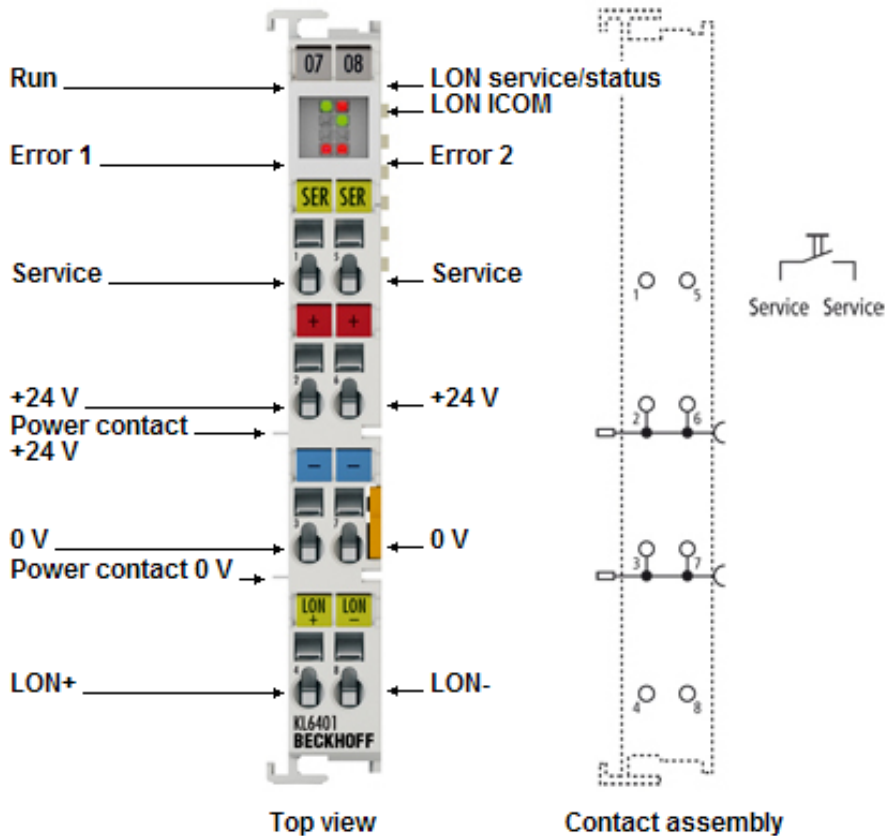
Fig. 1: KL6401

The LON Bus Terminal KL6401 connects the LON bus system to the Beckhoff Bus Terminal system.

The KL6401 permits a maximum of 62 network variables (SNVT) to be configured. These 62 SNVTs can be configured as any mixture of inputs and/or outputs.

Configuration of the SNVTs is performed using the KS2000 configuration software. The KS2000 configuration software is required for the configuration and operation of the KL6401. You also require a LON tool (e.g. Echelon LonMaker) to perform the binding of the SNVTs involved. Beckhoff does not offer a LON tool.

Software required for use of the KL6401

1. KS2000 configuration software to configure the network variables
2. A LON tool to bind the network variables
3. TwinCAT PLC and an appropriate library to communicate with the KL6401 from the application.

Support for KL6401

The KL6401 is only supported in connection with the TwinCAT library for the LON Bus Terminal! If the KL6401 is used under a control system other than TwinCAT, Bus Couplers (BC) are not supported. In this case a Bus Terminal controller (BC or BX) would be required! Without TwinCAT PLC, the KL6401 is not supported at an Embedded PC (CX)!

2.2   Technical data

Technical data	KL6401
Number of outputs	1
Network variables	max. 62
Transmission standard	FTT-10/LPT
Data transfer rate	78 kbyte
Electrical isolation	500 V (K-bus/LON)
Power supply for the electronics	via the K-bus and through the power contacts
Current consumption from the K-bus	typically 55 mA
Bit width in process image	Output: 36 bytes data, input: 36 bytes data
Weight	approx. 85 g
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm
Mounting [▶ 11]	on 35 mm mounting rail conforms to EN 60715
Permissible ambient temperature during operation	0°C ... + 55°C
Permissible ambient temperature during storage	-25°C ... + 85°C
Permissible relative air humidity	95 %, no condensation
Enhanced mechanical load capacity	yes, see Installation instructions [▶ 14] for enhanced mechanical load capacity
Vibration / shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20
Installation position	variable
Approvals/markings*	CE, UKCA, cULus, EAC, ATEX [▶ 21]

*) 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. |
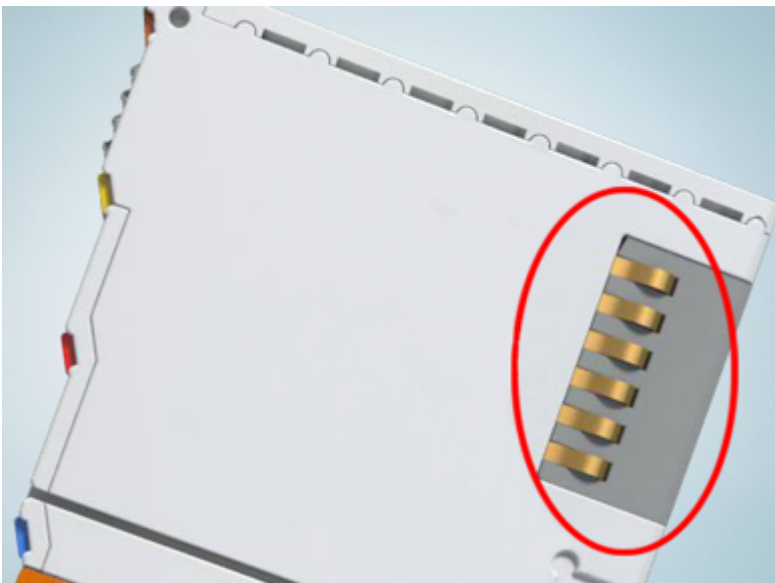
Fig. 2: Spring contacts of the Beckhoff I/O components

3.2 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
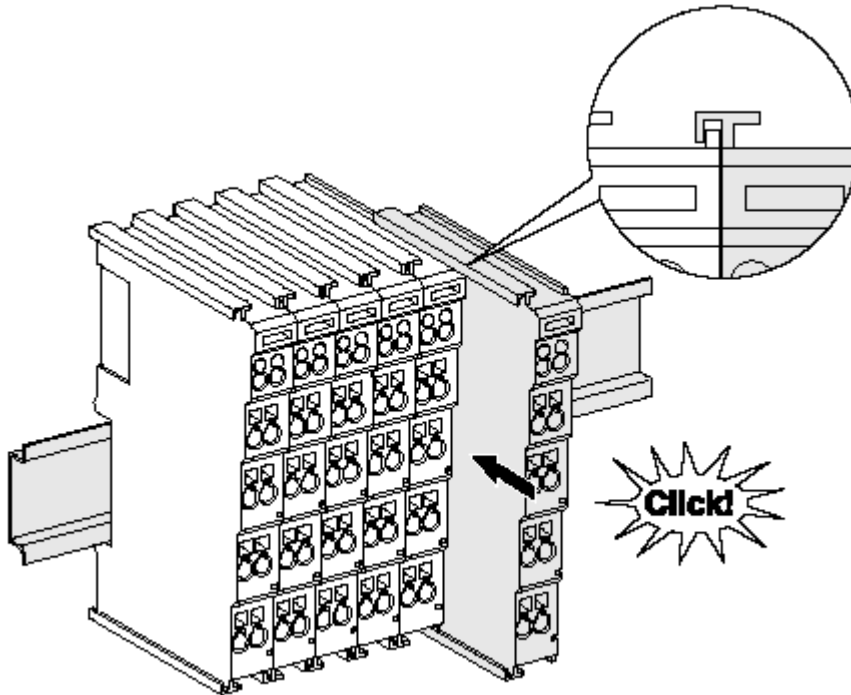
Fig. 3: Attaching on mounting rail

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**

 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:

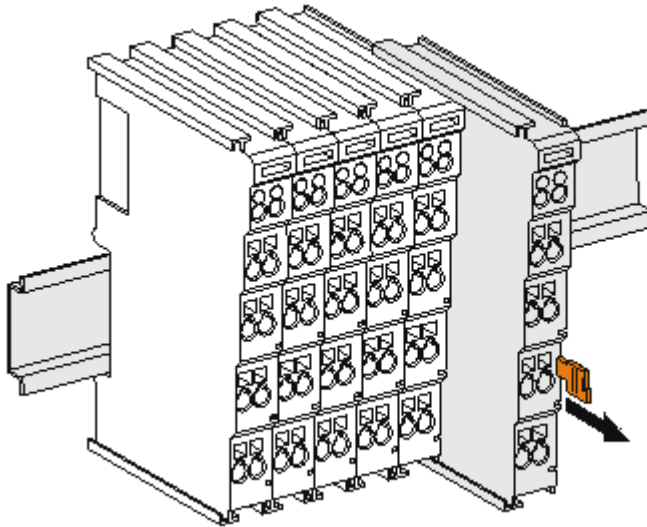1. Pull the terminal by its orange-colored lugs approximately 1 cm away from the mounting rail. In doing so for this terminal the mounting rail lock is released automatically and you can pull the terminal out of the bus terminal block easily without excessive force.
2. Grasp the released terminal with 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**
>
> 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.
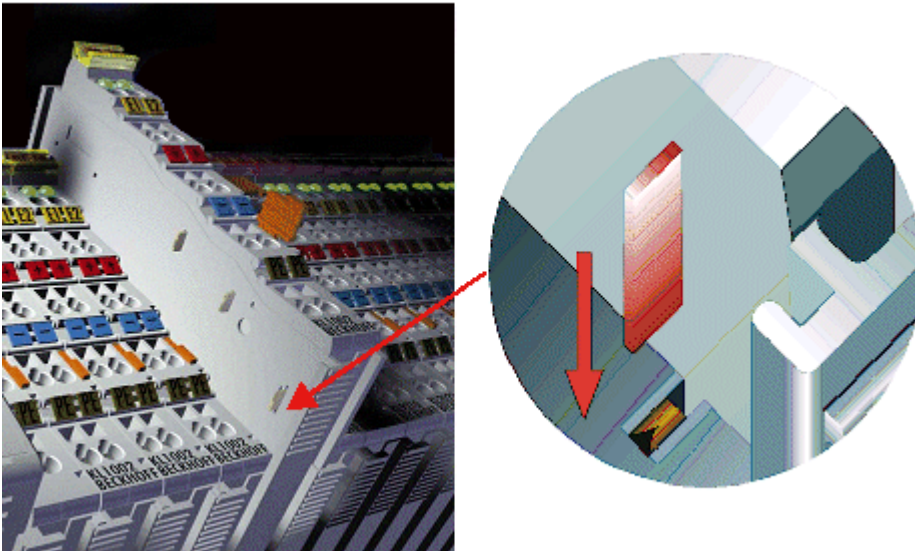
Fig. 5: Power contact on left side

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!

3.3   Disposal

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

3.4 Installation instructions for enhanced mechanical load capacity

⚠ WARNING
Risk of injury through electric shock and damage to the device!
Bring the Bus Terminal system into a safe, de-energized state before starting mounting, disassembly or wiring of the Bus Terminals!

Additional checks

The terminals have undergone the following additional tests:

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

Additional installation instructions

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 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. 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 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. 8: 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 [▶ 17]!

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
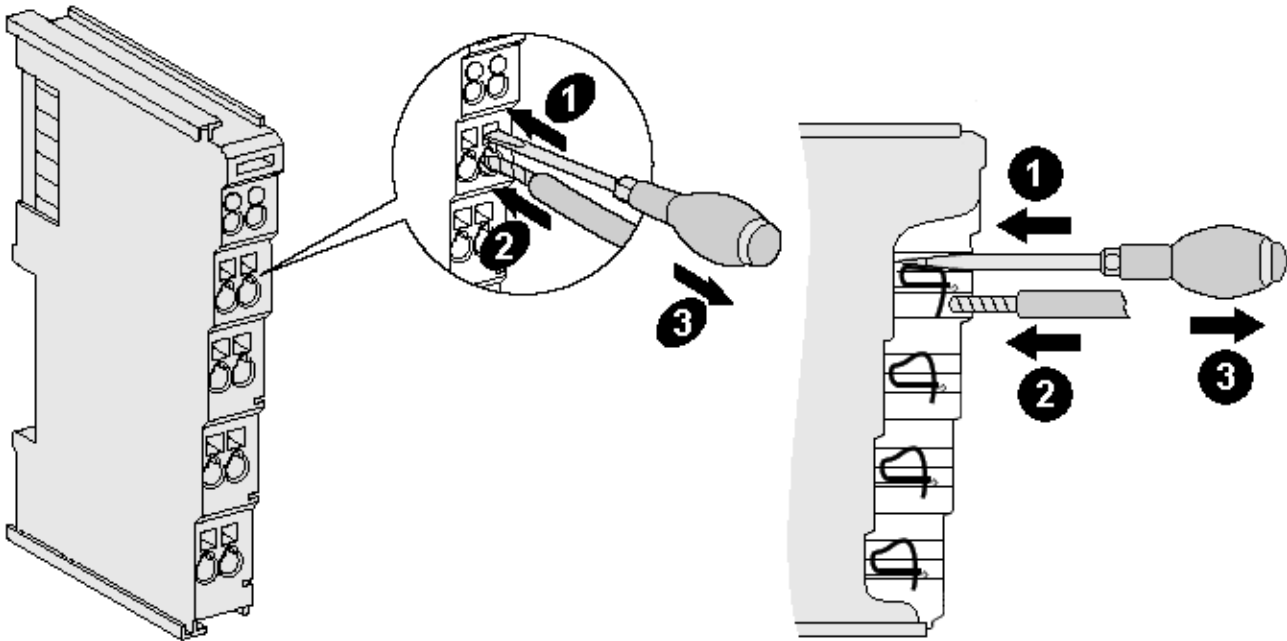

Fig. 9: Connecting a cable on a terminal point

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 [▶ 16]) 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 (see notice [▶ 16])
Wire stripping length	8 ... 9 mm

3.5.3 Shielding

● Shielding

i Encoder, analog sensors and actors should always be connected with shielded, twisted paired wires.

3.5.4 Connection
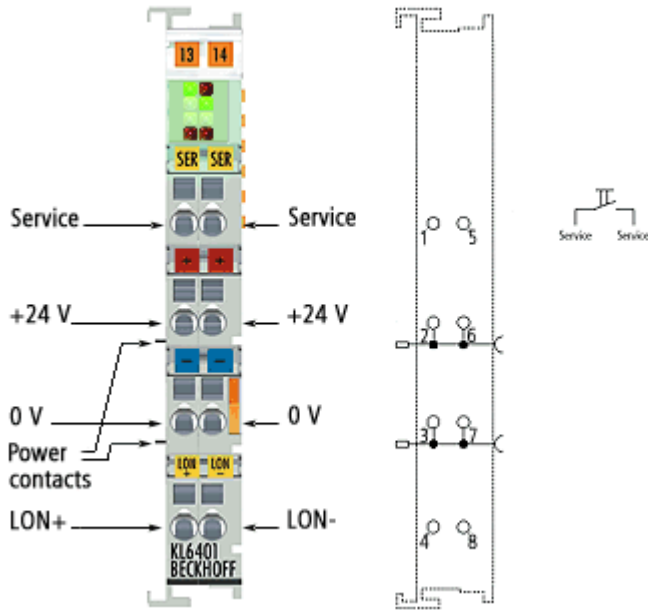
Fig. 10: Connection

Terminal point	No.	Connection for
Service	1	Service PIN
+ 24 V_{DC}	2	24 V supply voltage
0 V	3	Ground
LON	4	LON communication
Service	5	Service PIN
+ 24 V_{DC}	6	24 V supply voltage
0 V	7	Ground
LON	8	LON communication

Service PINs

The service PINs (terminal points 2 and 6 or 3 and 7) only operate when 24 V is being supplied via the power contacts.

Neuron ID via broadcast

Short circuiting terminal points 1 and 5 (rising edge) causes the KL6401 to broadcast its Neuron ID.

3.5.5 Diagnostic LEDs

The LEDs indicate the operating state of the KL6401.
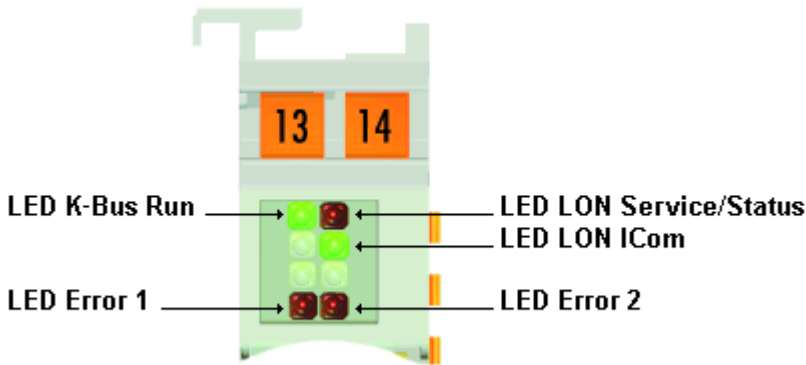
Fig. 11: LEDs

Meaning of the LED displays

LED	Color	Channel	State and significance		
			On	off	flashes
K-Bus Run	green	1	Lit, either weakly or strongly: K-bus communication is OK	No K-bus communication	K-bus communication
Error 1	red		Hardware error	No error	-
LON service/ status	red		Service PIN enabled or error in the LON controller	KL6401 commissioned and in operation	KL6401 not commissioned and not operational
LON ICom	green		Lit, either weakly or strongly: LON communication is OK	No LON communication	LON communication
Error 2	red		LON error	No error	-

3.6   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)

3.7 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 <u>download</u> within the download area of your product on the Beckhoff homepage www.beckhoff.com!

4   LON

4.1   LON - Overview
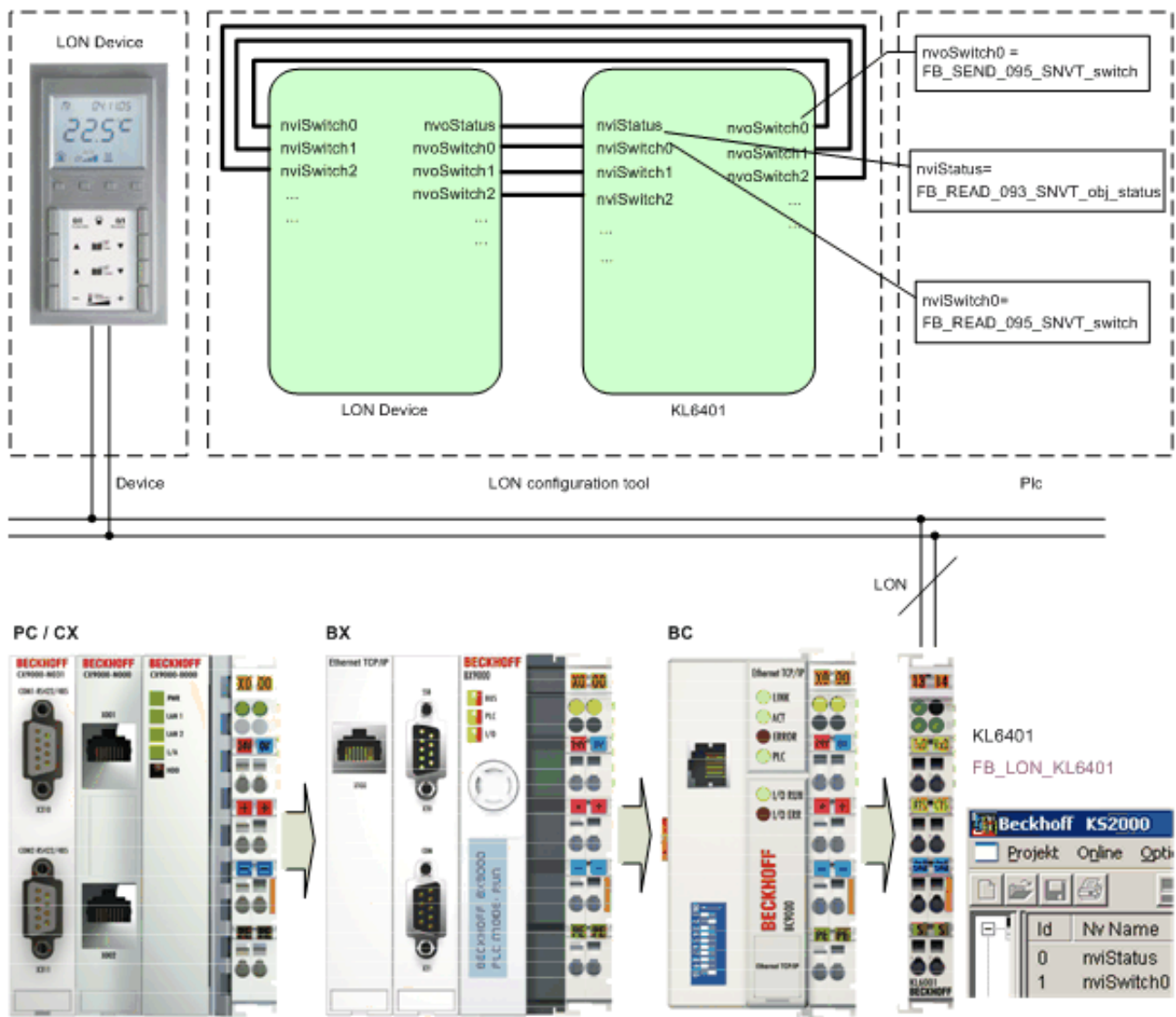
Fig. 12: LON - Overview

Each LON device provides network variables (SNVTs) for communication with other devices. The required variables are selected based on the device documentation or the Xif file (machine-readable representation of all SNVTs used) and entered in the KL6401 via the KS2000 [▶ 31] configuration software. The KS2000 [▶ 31] can now be used to create another Xif file. In this case, import both Xif files with a LON configuration tool (not offered by Beckhoff) and link them. For more information, see the documentation for the LON configuration tool.

For each SNVT entered in the KL6401, a suitable function block has to be programmed on the PLC side. These function blocks can then be used to access the SNVTs of the devices.

4.2   Supported SNVTs

General information on SNVTs can be found online under https://www.lonmark.org/nvs/.

The KL6401 supports the following SNVTs (LonMark data types).

SNVT ID	SNVT NAME	Description	Additional information
1	SNVT_amp	Electric current (ampere)	
2	SNVT_amp_mil	Electric current (milliampere)	
3	SNVT_angle	Angular distance (radian)	
4	SNVT_angle_vel	Angular velocity (radian / second)	
5	SNVT_btu_kilo	Thermal energy (kiloBtu)	
6	SNVT_btu_mega	Thermal energy (megaBtu)	
7	SNVT_char_ascii	ASCII character (8-bit ASCII character)	
8	SNVT_count	Absolute number (items)	
9	SNVT_count_inc	Increment counter (items(delta))	
10	SNVT_date_cal		SNVT outdated, not implemented
11	SNVT_date_day	Day of the week	
12	SNVT_date_time		SNVT outdated, not implemented
13	SNVT_elec_kwh	Electric energy (kW/h)	
14	SNVT_elec_whr	Electric energy (W/h)	
15	SNVT_flow	Volume flow (liters / second)	
16	SNVT_flow_mil	Volume flow (milliliters / second)	
17	SNVT_length	Length (meter)	
18	SNVT_length_kilo	Length (kilometer)	
19	SNVT_length_micr	Length (micrometer)	
20	SNVT_length_mil	Length (millimeter)	
21	SNVT_lev_cont	Continuous change in value (% from maximum level)	
22	SNVT_lev_disc		SNVT outdated, not implemented
23	SNVT_mass	Mass (gram)	
24	SNVT_mass_kilo	Mass (kilogram)	
25	SNVT_mass_mega	Mass (metric ton)	
26	SNVT_mass_mil	Mass (milligram)	
27	SNVT_power	Power (watt)	
28	SNVT_power_kilo	Power (kilowatt)	
29	SNVT_ppm	Concentration (ppm)	
30	SNVT_press	Pressure (overpressure) (kilopascal)	
31	SNVT_res	Electric resistance (ohm)	
32	SNVT_res_kilo	Electric resistance (kiloohm)	
33	SNVT_sound_db	Sound pressure level (dB)	
34	SNVT_speed	Linear velocity (meters / second)	
35	SNVT_speed_mil	Linear velocity (millimeters / second)	
36	SNVT_str_asc	String	
37	SNVT_str_int	Wide Character String	
38	SNVT_telcom	Telephone status (telephone status name)	
39	SNVT_temp	Temperature (°C)	
40	SNVT_time_passed		SNVT outdated, not implemented

SNVT ID	SNVT NAME	Description	Additional information
41	SNVT_vol	Volume (liter)	
42	SNVT_vol_kilo	Volume (kiloliter)	
43	SNVT_vol_mil	Volume (milliliter)	
44	SNVT_volt	Electrical voltage (volt)	
45	SNVT_volt_dbmv	Electrical voltage (dB microvolt)	
46	SNVT_volt_kilo	Electrical voltage (kilovolt)	
47	SNVT_volt_mil	Electrical voltage (millivolt)	
48	SNVT_amp_f	Electric current (ampere)	
49	SNVT_angle_f	Angular distance (radian)	
50	SNVT_angle_vel_f	Angular velocity (radian / second)	
51	SNVT_count_f	Absolute number (items)	
52	SNVT_count_inc_f	Increment counter (items(delta))	
53	SNVT_flow_f	Volume flow (liters / second)	
54	SNVT_length_f	Length (meter)	
55	SNVT_lev_cont_f	Continuous change in value (% from maximum level)	
56	SNVT_mass_f	Mass (gram)	
57	SNVT_power_f	Power (watt)	
58	SNVT_ppm_f	Concentration (ppm)	
59	SNVT_press_f	Pressure (overpressure) (pascal)	
60	SNVT_res_f	Electric resistance (ohm)	
61	SNVT_sound_db_f	Sound pressure level (dBspl)	
62	SNVT_speed_f	Linear velocity (meters / second)	
63	SNVT_temp_f	Temperature (°C)	
64	SNVT_time_f	Elapsed time (seconds)	
65	SNVT_vol_f	Volume (liter)	
66	SNVT_volt_f	Electrical voltage (volt)	
67	SNVT_btu_f	Thermal energy (Btu)	
68	SNVT_elec_whr_f	Electric energy (Watt / hour)	
69	SNVT_config_src	Configuration properties	
70	SNVT_color	Color according to CIE standard	
71	SNVT_grammage	American measure for paper weight and density	
72	SNVT_grammage_f	American measure for paper weight and density	
73	SNVT_file_req	File request	In preparation, please do not use for the time being.
74	SNVT_file_status	File information	
75	SNVT_freq_f	Frequency (hertz)	
76	SNVT_freq_hz	Frequency (hertz)	
77	SNVT_freq_kilohz	Frequency (kilohertz)	
78	SNVT_freq_milhz	Frequency (millihertz)	
79	SNVT_lux	Illuminance (lux)	
80	SNVT_ISO_7811		SNVT outdated, not implemented

SNVT ID	SNVT NAME	Description	Additional information
81	SNVT_lev_percent	Percentage value	
82	SNVT_multiplier	Multiplier	
83	SNVT_state	Status information	
84	SNVT_time_stamp	Time stamp	
85	SNVT_zerospan	Zero point and proportionality factor	
86	SNVT_magcard	ISO 7811 (40 hexadecimal numbers)	
87	SNVT_elapsed_tm	Elapsed time	
88	SNVT_alarm	Alarm status	
89	SNVT_currency	Currency	
90	SNVT_file_pos	File position	
91	SNVT_muldiv	Gain factor/attenuation factor	
92	SNVT_obj_request	Function selection	
93	SNVT_obj_status	Object status	
94	SNVT_preset	Preliminary setting	
95	SNVT_switch	Switch	
96	SNVT_trans_table	Conversion table	
97	SNVT_override	Override mode	
98	SNVT_pwr_fact	Power factor	
99	SNVT_pwr_fact_f	Power factor	
100	SNVT_density	Density (kg/m³)	
101	SNVT_density_f	Density (kg/m³)	
102	SNVT_rpm	Angular velocity (revolutions/minute (RPM))	
103	SNVT_hvac_emerg	HVAC emergency mode	
104	SNVT_angle_deg	Angle indication	
105	SNVT_temp_p	Temperature (°C)	
106	SNVT_temp_setpt	Temperature (6 temperature values)	
107	SNVT_time_sec	Elapsed time (second)	
108	SNVT_hvac_mode	HVAC operating mode	
109	SNVT_occupancy	Occupancy signal (states)	
110	SNVT_area	Area (square meter)	
111	SNVT_hvac_overid	HVAC override mode	
112	SNVT_hvac_status	HVAC status	
113	SNVT_press_p	Pressure (overpressure) (pascal)	
114	SNVT_address	Neuron address	
115	SNVT_scene	Scenes	
116	SNVT_scene_cfg	Scene setting	
117	SNVT_setting	Settings	
118	SNVT_evap_state	Evaporator status	
119	SNVT_therm_mode	Thermostat mode	
120	SNVT_defr_mode	Defrost mode	

SNVT ID	SNVT NAME	Description	Additional information
121	SNVT_defr_term	Completion of the defrost cycle	
122	SNVT_defr_state	Defrost status (enumeration)	
123	SNVT_time_min	Elapsed time (minutes)	
124	SNVT_time_hour	Elapsed time (hour)	
125	SNVT_ph	Acidity (pH)	
126	SNVT_ph_f	Acidity (pH)	
127	SNVT_chlr_status	Refrigeration unit status	
128	SNVT_tod_event	Presence time	
129	SNVT_smo_obscur	Darkening due to smoke	
130	SNVT_fire_test	Request fire alarm system test	
131	SNVT_temp_ror	Value of the temperature change/increase	
132	SNVT_fire_init	Fire detector type	
133	SNVT_fire_indcte	Fire alarm display	
134	SNVT_time_zone	Time zone description	
135	SNVT_earth_pos	Position on Earth	
136	SNVT_reg_val	Register value	
137	SNVT_reg_val_ts	Register value	
138	SNVT_volt_ac	Alternating voltage (Volt AC)	
139	SNVT_amp_ac	Alternating current	
143	SNVT_turbidity	Turbidity	
144	SNVT_turbidity_f	Turbidity	
145	SNVT_hvac_type	HVAC plant type	
146	SNVT_elec_kwh_l	Electric energy (kW / hour)	
147	SNVT_temp_diff_p	Temperature difference (°C)	
148	SNVT_ctrl_req	Control request	
149	SNVT_ctrl_resp	Control response	
150	SNVT_ptz	Camera PTZ (SNZ)	
151	SNVT_privacyzone	Private zone	
152	SNVT_pos_ctrl	Position setting for cameras in networks	
153	SNVT_enthalpy	Enthalpy (kilojoules/kg)	
154	SNVT_gfci_status	Residual current circuit breaker status	
155	SNVT_motor_state	Motor status (motor status designation)	
156	SNVT_pumpset_mn	Pump group	
157	SNVT_ex_control	Exclusive control	
158	SNVT_pumpset_sn	Pump group sensor	
159	SNVT_pump_sensor	Pump sensor	
160	SNVT_abs_humid	Absolute humidity	

SNVT ID	SNVT NAME	Description	Additional information
161	SNVT_flow_p	Volume flow (cubic meters / hour)	
162	SNVT_dev_c_mode	Device operating mode	
163	SNVT_valve_mode	Valve state	
164	SNVT_alarm_2	Alarm status 2	
165	SNVT_state_64	Status information (64 individual bit values)	
166	SNVT_nv_type	Network variable type	
168	SNVT_ent_opmode	Operating mode for access objects	
169	SNVT_ent_state	State for access objects	
170	SNVT_ent_status	Status of access objects	
171	SNVT_flow_dir	Flow direction	
172	SNVT_hvac_satsts	HVAC saturation status	
173	SNVT_dev_status	Device status	
174	SNVT_dev_fault	Error state	
175	SNVT_dev_maint	Device maintenance status	
176	SNVT_date_event	Event status	
177	SNVT_sched_val	Calendar value	
178	SNVT_sec_state		SNVT outdated, not implemented
179	SNVT_sec_status		SNVT outdated, not implemented
180	SNVT_sblnd_state	Blind status	
181	SNVT_rac_ctrl	Sound function control	
182	SNVT_rac_req	Sound function request	
183	SNVT_count_32	Absolute counter	
184	SNVT_clothes_w_c	Washing machine / commands	
185	SNVT_clothes_w_m	Washing machine /management status	
186	SNVT_clothes_w_s	Washing machine / status	
187	SNVT_clothes_w_a	Washing machine / alarm messages	
188	SNVT_multiplier_s	Multiplier	
189	SNVT_switch_2	Switch for setting scenes and settings.	
190	SNVT_color_2	Color	
191	SNVT_log_status	Log status	
192	SNVT_time_stamp_p	Precise time stamp	
193	SNVT_log_fx_request	Log file transfer request	
194	SNVT_log_fx_status	Log file transfer status	
195	SNVT_log_request	Log status request	
196	SNVT_enthalpy_d	Enthalpy difference (kJ/kg)	
197	SNVT_amp_ac_mil	Electric current (milliampere)	
198	SNVT_time_hour_p	Time in hours	
199	SNVT_lamp_status	Lamp status	
200	SNVT_environment	Environment	
201	SNVT_geo_loc	Geographical location	

4.3 Principle of operation

Sending

The KL6401 sends single SNVT variables. This means that an SNVT variable sent to the KL6401 is sent to the LON network individually. Only when this has successfully been sent can the next SNVT variable be transferred to the KL6401.

Receiving

The KL6401 has 2 buffers, the telegram buffer and the index buffer.

The input variables of a LON telegram that has been received are placed in the telegram buffer. The index number of the incoming telegram is also entered into the index buffer.

The TwinCAT LON function block evaluates the index buffer, transfers input variables that have been received to the application program, and removes them from the index buffer. If the function block does not read the data out of the telegram buffer quickly enough, it can save up to 62 entries (i.e. the maximum number of SNVT variables).

If a telegram that has already been received (which the function block has not yet transferred to the application program, and which therefore still has an entry in the index buffer) is received from the KL6401 again, then a new entry is not made in the index buffer, but the input variables in the telegram buffer are updated.

5 KS2000 Configuration Software

5.1 KS2000 - Introduction

The KS2000 configuration software permits configuration, commissioning and parameterization of bus couplers, of the affiliated bus terminals and of Fieldbus Box Modules. The connection between bus coupler / Fieldbus Box Module and the PC is established by means of the serial configuration cable or the fieldbus.

Fig. 13: KS2000 configuration software

Configuration

You can configure the Fieldbus stations with the Configuration Software KS2000 offline. That means, setting up a terminal station with all settings on the couplers and terminals resp. the Fieldbus Box Modules can be prepared before the commissioning phase. Later on, this configuration can be transferred to the terminal station in the commissioning phase by means of a download. For documentation purposes, you are provided with the breakdown of the terminal station, a parts list of modules used and a list of the parameters you have modified. After an upload, existing fieldbus stations are at your disposal for further editing.

Parameterization

KS2000 offers simple access to the parameters of a fieldbus station: specific high-level dialogs are available for all bus couplers, all intelligent bus terminals and Fieldbus Box modules with the aid of which settings can be modified easily. Alternatively, you have full access to all internal registers of the bus couplers and intelligent terminals. Refer to the register description for the meanings of the registers.

Commissioning

The KS2000 software facilitates commissioning of machine components or their fieldbus stations: Configured settings can be transferred to the fieldbus modules by means of a download. After a *login* to the terminal station, it is possible to define settings in couplers, terminals and Fieldbus Box modules directly *online*. The same high-level dialogs and register access are available for this purpose as in the configuration phase.

The KS2000 offers access to the process images of the bus couplers and Fieldbus Box modules.

- • Thus, the coupler's input and output images can be observed by monitoring.
- • Process values can be specified in the output image for commissioning of the output modules.

All possibilities in the *online mode* can be used in parallel with the actual fieldbus mode of the terminal station. The fieldbus protocol always has the higher priority in this case.

5.2 Configuration with KS2000

Commissioning procedure

1. Install the configuration software KS2000, version 4.3.0.39 or higher.
2. Plug the KL6401 into your Bus Coupler, and terminate the K-Bus with a KL9010.
3. Log on. Should the dialog box *Create new XML Device Files* open, you should cancel the procedure at this point.
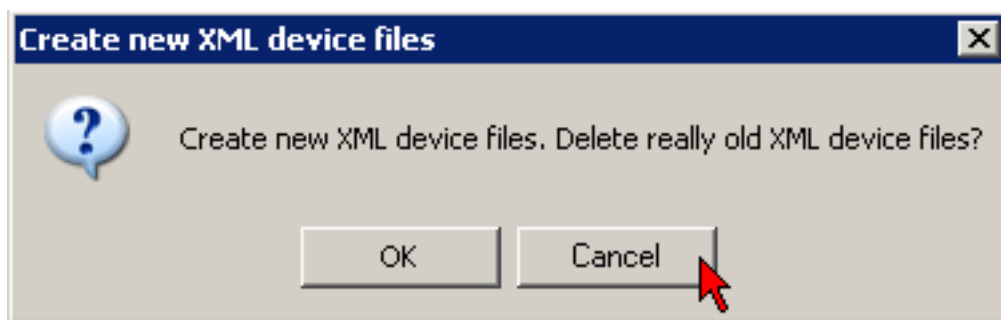

Fig. 14: Canceling *Create new XML Device Files*

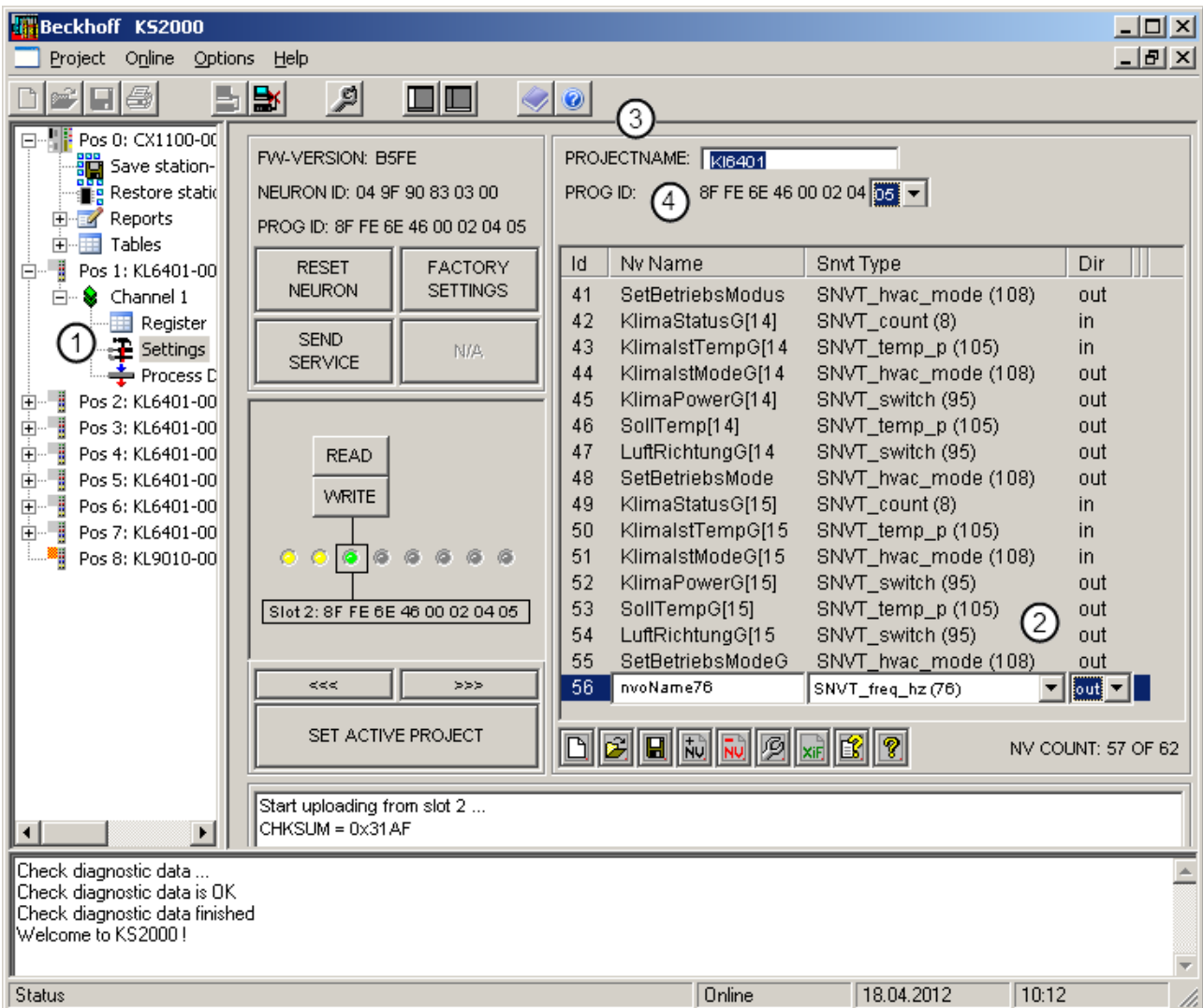The terminal can now be configured under Settings (1) .

Fig. 15: Configuration of the KL6401

Enter the SNVTs in the table ② . Use 🗎 to add a variable and 🗎 to remove a selected variable.

The *Id* column cannot be edited. It contains the NV index. This index is also required as input variable *wNVIndex* for the PLC function blocks (see TwinCAT Information System [▶ 36]).

In column *Nv Name* any text can be entered. These descriptions are required in the LON configuration tool (not provided by Beckhoff) for identifying the respective variables.

Select the required SNVT in column *SNVT Type*.

Column *Dir* (Direction) indicates whether the variable is sent (out) or received (in).

③ Set a project name (click on PROJECT NAME).

Then edit the program ID (Prog ID) ④ . Do this by clicking Program ID, and selecting a Program ID. This program ID may only be issued once in your LON project. A maximum of 256 (0-255) program IDs can be used. This means that you can use 256 different configurations in one project.
NOTE: LON terminals with the same configuration also have the same program ID.

Use the button ![XiF] to create the Xif file. This file is required in the LON configuration tool (not provided by Beckhoff).

Use the button ![save] to save the configuration in a BLC file. This file can be used to load the configuration if a terminal is replaced or to use the same configuration in another terminal.

The data can now be written to the terminal. Use the buttons [>>>] or [<<<] to select the required slot and then the button WRITE to write the data to the terminal. The slot may not be activated (green) during this process.

NOTE regarding the slots: The terminal is supplied with slot 0 active (factory setting). This slot contains a <u>fixed configuration [▶ 34]</u> and cannot be modified. To transfer other values a different slot has to be configured and activated. Only one slot at a time is active.

The project must be activated after the download has successfully been completed. Use the button SET ACTIVE PROJECT. Power must now be removed from the KL6401. After switching on the KL6401 (switching the power supply on again) the desired configuration is active.

Description of the editing functions

![toolbar icons]

![icon] Deletes the table

![icon] Opens an existing SNVT configuration file (*.BLC) for the KL6401

![icon] Saves the current configuration as a BLC file

![icon] Edits an SNVT variable

![icon] Inserts an SNVT variable

![icon] Deletes an SNVT variable

![icon] Creates an XIF file for a LON configuration tool (not provided by Beckhoff)

![icon] Opens the Help

[image] Info

5.3 SNVT variables (OFF)

[image] XIF file (https://infosys.beckhoff.com/content/1033/kl6401/Resources/4547222667/.zip)

[image] KS2000 BLC file (https://infosys.beckhoff.com/content/1033/kl6401/Resources/4547224843/.zip)

Implemented SNVT variables (KL6401_0FF)

Description	INPUT/OUTPUT	SNVT ID	Length	NV ID
nviSwitch00	INPUT	95	2	0
nviSwitch01	INPUT	95	2	1
nviSwitch02	INPUT	95	2	2
nviSwitch03	INPUT	95	2	3
nviSwitch04	INPUT	95	2	4
nviSwitch05	INPUT	95	2	5
nviSwitch06	INPUT	95	2	6
nviSwitch07	INPUT	95	2	7
nviSwitch08	INPUT	95	2	8
nviSwitch09	INPUT	95	2	9
nviSwitch10	INPUT	95	2	10
nviSwitch11	INPUT	95	2	11
nviSetting0	INPUT	117	4	12
nviSetting1	INPUT	117	4	13
nviSetting2	INPUT	117	4	14
nviSetting3	INPUT	117	4	15
nviTemp0	INPUT	105	2	16
nviTemp1	INPUT	105	2	17
nviTemp2	INPUT	105	2	18
nviTemp3	INPUT	105	2	19
nviTemp4	INPUT	105	2	20
nviHvacStatus0	INPUT	112	12	21
nviHvacStatus1	INPUT	112	12	22
nviHvacStatus2	INPUT	112	12	23
nviHvacStatus3	INPUT	112	12	24
nviHvacStatus4	INPUT	112	12	25

Description	INPUT/OUTPUT	SNVT ID	Length	NV ID
nvoSwitch00	OUTPUT	95	2	26
nvoSwitch01	OUTPUT	95	2	27
nvoSwitch02	OUTPUT	95	2	28
nvoSwitch03	OUTPUT	95	2	29
nvoSwitch04	OUTPUT	95	2	30
nvoSwitch05	OUTPUT	95	2	31
nvoSwitch06	OUTPUT	95	2	32
nvoSwitch07	OUTPUT	95	2	33
nvoSwitch08	OUTPUT	95	2	34
nvoSwitch09	OUTPUT	95	2	35
nvoSwitch10	OUTPUT	95	2	36
nvoSwitch11	OUTPUT	95	2	37
nvoSwitch12	OUTPUT	95	2	38
nvoSwitch13	OUTPUT	95	2	39
nvoSwitch14	OUTPUT	95	2	40
nvoSwitch15	OUTPUT	95	2	41
nvoSwitch16	OUTPUT	95	2	42
nvoSwitch17	OUTPUT	95	2	43
nvoSetting0	OUTPUT	117	4	44
nvoSetting1	OUTPUT	117	4	45
nvoSetting2	OUTPUT	117	4	46
nvoSetting3	OUTPUT	117	4	47
nvoLevP0	OUTPUT	81	2	48
nvoLevP1	OUTPUT	81	2	49
nvoLevP2	OUTPUT	81	2	50
nvoLevP3	OUTPUT	81	2	51
nvoLevP4	OUTPUT	81	2	52
nvoHvacMode0	OUTPUT	108	1	53
nvoHvacMode1	OUTPUT	108	1	54
nvoHvacMode2	OUTPUT	108	1	55
nvoHvacMode3	OUTPUT	108	1	56
nvoHvacMode4	OUTPUT	108	1	57

6 Programming

6.1 TwinCAT libraries

Software documentation in the Beckhoff Information System:

TwinCAT 2: TwinCAT 2 | PLC Lib: TcLON

TwinCAT 3: TwinCAT 3 | PLC Lib: Tc2_LON

7 Appendix

7.1 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.
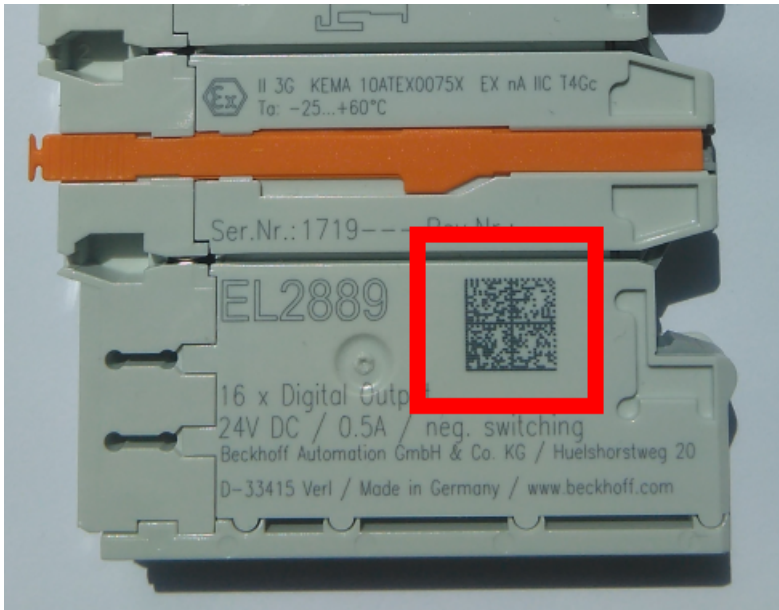

Fig. 16: BIC as data matrix code (DMC, code scheme ECC200)

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:

Posi-tion	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.

7.2 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

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- repair service
- spare parts service
- hotline service

Hotline:	+49 5246 963 460
Fax:	+49 5246 963 479
e-mail:	service@beckhoff.com

Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG

Huelshorstweg 20
33415 Verl
Germany

Phone:	+49 5246 963 0
Fax:	+49 5246 963 198
e-mail:	info@beckhoff.com
web:	https://www.beckhoff.com

Table of figures

More Information:
www.beckhoff.com/KL6401