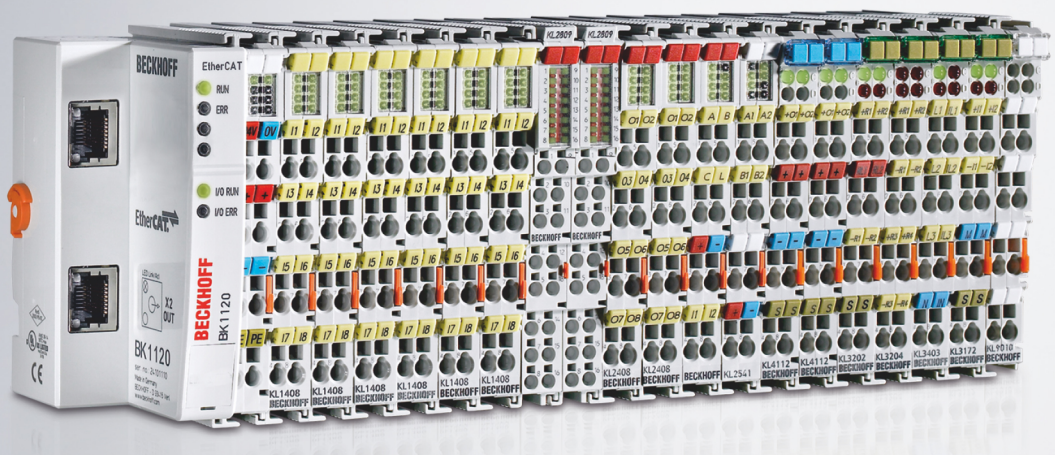
BECKHOFF New Automation Technology

Documentation | EN

KL6021-0023 and KL6023

Serial interface terminal and wireless adaptor for EnOcean radio technology



2022-09-15 | Version: 2.1

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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
2.1	• Chapter *Technical data* updated • 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
2.0	• Migration
1.1	• Mounting description expanded • Information on basic function principles expanded • Introduction to the KL6023 added
1.0	• Description of the KL6023 (wireless adapter for EnOcean radio technology) added • Wiring instructions added • Description of the KS2000 configuration software added • Technical data added
0.1	First preliminary version

Firmware and hardware versions

Documentation Version	KL6021-0023		KL6023	
	Firmware	Hardware	Firmware	Hardware
2.1	5D	04	1A	02
2.0	5D	03	1A	02
1.1	5D	01	1A	01
1.0	5A	00	1A	00
0.1	5A	00	-	-

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

Syntax of the serial number

Structure of the serial number: WW YY FF HH

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

Example with serial number 12 06 3A 02:

12 - week of production 12
06 - year of production 2006
3A - firmware version 3A
02 - hardware version 02

2 Product overview

2.1 KL6021-0023 - Introduction

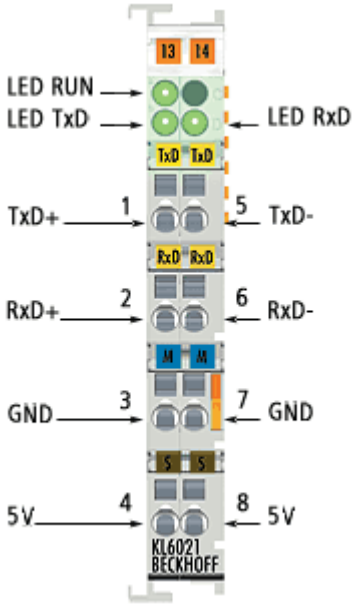


Fig. 1: KL6021-0023 - Serial interface terminal for the connection of the KL6023 wireless adapter

The KL6021-0023 serial interface connects the wireless adapter via an RS485 signal. The KL6023 wireless adapter operates as an EnOcean radio receiver and receives the radio signals from EnOcean sensors.

Contact assignment

Terminal point	Name	Signal
1	TxD+	Signal line (Transmit Data)
5	TxD-	Signal line (Transmit Data)
2	RxD+	Signal line (Receive Data)
6	RxD-	Signal line (Receive Data)
3	GND	Ground for the KL6023 (bridged internally with terminal point 7)
7	GND	Ground for the KL6023 (bridged internally with terminal point 3)
4	+5 V	Supply voltage for the KL6023 (bridged internally with terminal point 8)
8	+5 V	Supply voltage for the KL6023 (bridged internally with terminal point 4)

LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		on	normal operation
		off	A watchdog timer overflow has occurred. The RUN LED goes out if no process data is transmitted to the terminal from the Bus Coupler for 100 ms.
TxD	green	State of the transmit signal line	
RxD	green	State of the receive signal line	

2.2 KL6021-0023 - Technical Data

Technical data	KL6021-0023
Number of inputs	1, for wireless adapter (EnOcean radio technology)
Cable impedance	approx. 120 Ω
Connecting cable to KL6023 wireless adapter	2 twisted pairs
Length of connection to KL6023 wireless adapter	max. 300 m
Bit width in process image	11 x 8 bit user data, 1 x 8 bit control/status
Power supply for the electronics	via the K-bus
Current consumption via K-bus	typically 65 mA
Weight	approx. 60 g
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm
Mounting [▶ 15]	on 35 mm mounting rail according to EN 60715
Permissible ambient temperature range during operation	0 °C ... + 55 °C
Permissible ambient temperature range during storage	-25 °C ... + 85 °C
Permissible relative 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
Protection class	IP20
Mounting position	variable
Approvals/markings*	CE

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

Supported EnOcean telegrams

Telegram	RORG	ORG	Communication
RPS	F6	05	Repeated Switch Communication
1BS	D5	06	1 Byte Communication
4BS	A5	07	4 Byte Communication

2.3 KL6023 - Introduction

Fig. 2: KL6023 - Wireless Adapter for EnOcean radio technology

The KL6023 Wireless Adapter receives signals from battery-less sensors with EnOcean technology. These signals are converted by the Wireless Adapter to a RS485 signal and directly processed further by the KL6021-0023 serial Bus Terminal. With a radio signal range of at least 30 m, the wiring of buildings can be simplified significantly.

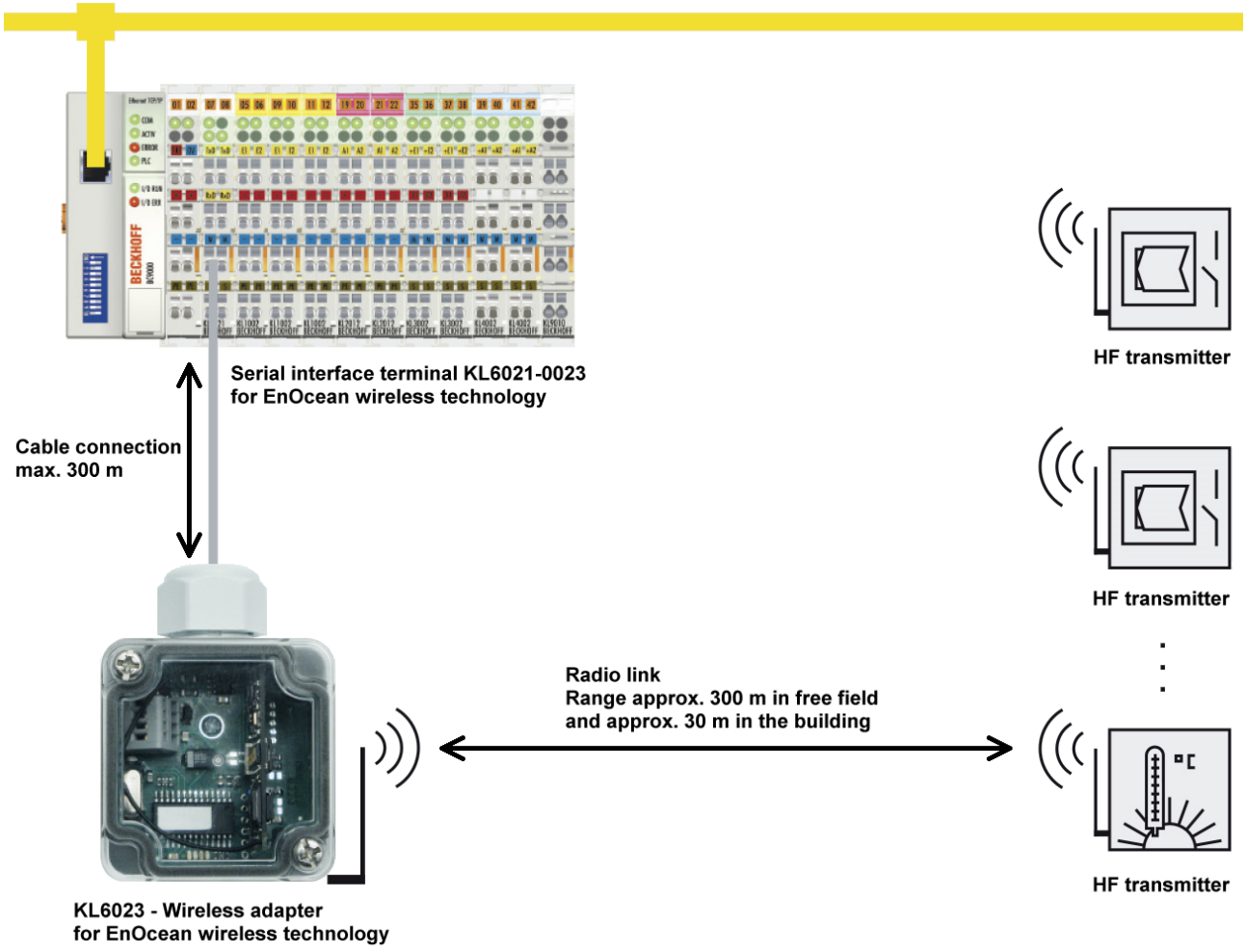


Fig. 3: Application

The status LEDs of the Wireless Adapter are helpful during commissioning. The LEDs indicate all telegrams they receive as faulty or faultless. With a maximum distance of 300 m between the receiver and the Bus Terminal station, it is possible to place the receivers at any radio-technically favorable location within a building. The system does not stipulate a maximum number of transmitters per receiver unit. In practice, between 25 and 100 transmitters per receiver are used.

2.4 KL6023 - Technical Data

Technical data	KL6023 (Wireless Adapter for EnOcean radio technology)
Connection	2 twisted pairs, direct to Bus Terminal KL6021-0023
Power supply	via KL6021-0023 Bus Terminal (with electrical isolation)
Length of connecting cable to the KL6021-0023	max. 300 m
Configuration	not required
Frequency band	868.35 MHz
Transfer range	In open spaces: approx. 300 m Inside buildings: approx. 30 m
Radio telegram	depending on sensor type: - 32 bit sensor identification number - number of user bytes is not limited
Receiving aerial	integrated in the housing
Housing	Box: Polystyrene (grey) with M16 PG threaded fitting for cable connection Cover: polycarbonate (transparent)
Weight	approx. 55 g
Dimensions (W x H x D)	approx. 52 mm x 50 mm x 35.5 mm (without PG threaded fitting)
Permissible ambient temperature range during operation	0 °C ... + 55 °C
Permissible ambient temperature range during storage	-25 °C ... + 85 °C
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	IP66
Mounting position	variable
Approvals/markings*	CE

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

Supported EnOcean telegrams

Telegram	RORG	ORG	Communication
RPS	F6	05	Repeated Switch Communication
1BS	D5	06	1 Byte Communication
4BS	A5	07	4 Byte Communication

2.5 Basic Function Principles

The KL6021-0023 [▶ 8] serial communication terminal connects the KL6023 [▶ 10] EnOcean receiver module with the Beckhoff Bus Terminal system. EnOcean (http://www.enocean.de) permits radio transmission without either batteries or an external power supply to the transmitter.

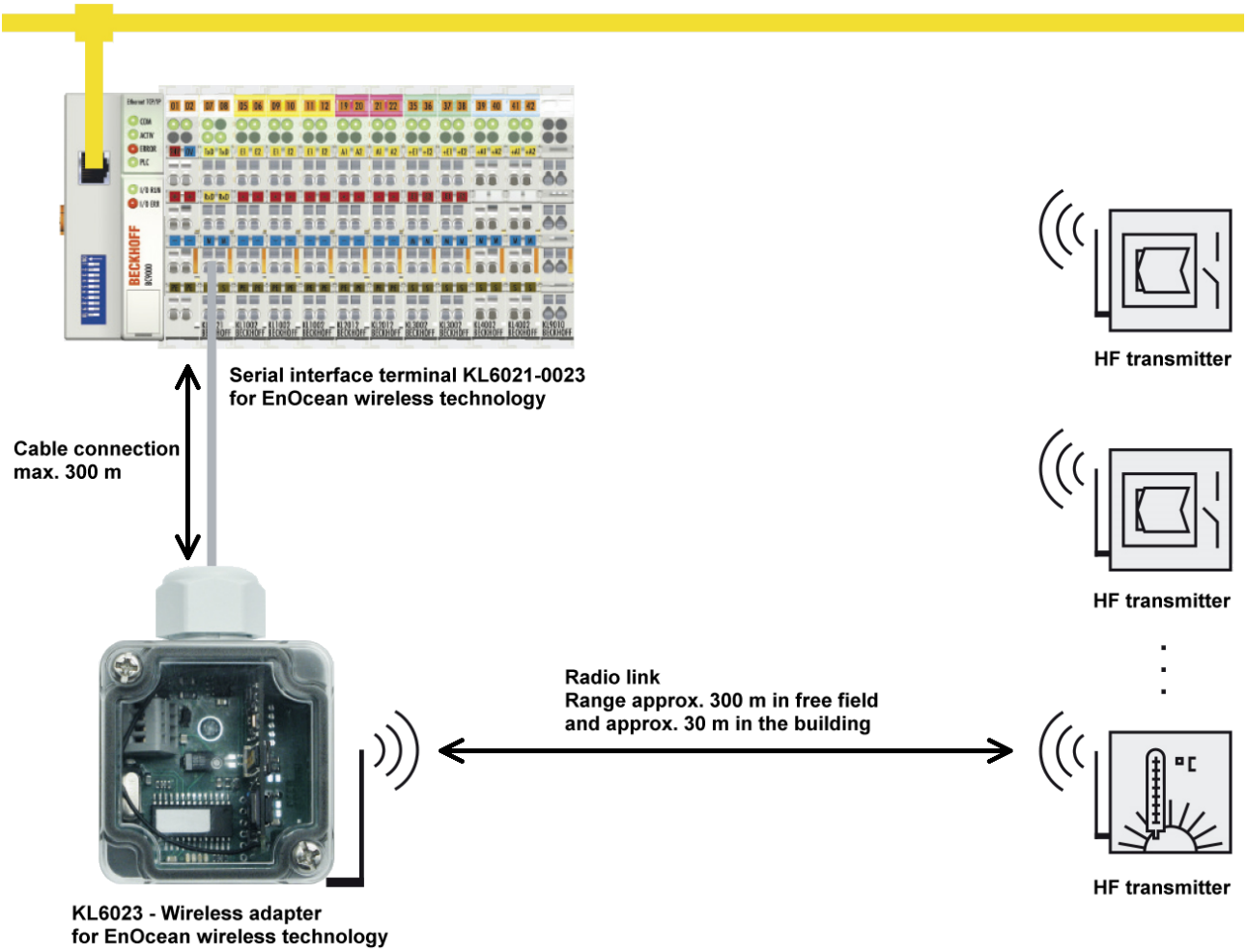


Fig. 4: KL6021-0023 and KL6023

Approval of EnOcean radio technology

NOTE

Nature and source of the danger

The KL6032 EnOcean receiver module can be operated in the following countries without registration and fees.
Permission for use in other countries must be clarified explicitly!

- European union
- Switzerland

Reading received telegrams

When the KL6021-0023 has received new telegrams it indicates this by setting the bit SB.2 [▶ 27] in the status byte to 1. Reading out received telegrams is initiated through bit CB.0 [▶ 27] in the control byte being inverted by the higher-level controller. The change from 0 to 1 or from 1 to 0 always causes the next telegram in the memory to be displayed in the process data. The value of the bit CB.0 [▶ 27] is adopted by SB.0 [▶ 27] as acknowledgement.

The leading synchronization byte and the closing checksum are part of the EnOcean standard, and the KL6021-0023 filters them out of the telegram, so that the displayed data starts with the telegram header [▶ 13] and ends with the status field [▶ 13].

Longer telegrams

If the telegram from an EnOcean transmitter consists of more than 4 data bytes, it cannot be transferred in a single K-bus cycle. In that case, the KL6021-0023 sets bit SB.1 [▶ 27] in the status byte in the next read cycle, placing the next data block from the telegram into the process data.

Faulty telegrams

The KL6021-0023 calculates the checksum for every EnOcean telegram that is received. If this does not agree with the checksum that has been transmitted the terminal sets bit SB.6 [▶ 27] in the status byte. A telegram is not then placed into the data memory, and is lost.

Data memory overflow

If the telegrams received by the KL6021-0023 are not read by the higher-level controller, the terminal's receive memory will overflow, and it will set bit SB.3 [▶ 27] in the status byte. It is also possible for a telegram only to be partially written into the memory. This will automatically cause an error in the checksum, and it will be displayed and handled accordingly.

Protocol

The following table illustrates the general structure of an EnOcean telegram:

<table>
<tr><th colspan="2">Bit 7</th><th>Bit 0</th><th colspan="2">Description</th></tr>
<tr><td colspan="3">Sync_Byte1 (0xA5)</td><td colspan="2" rowspan="2">Synchronization byte</td></tr>
<tr><td colspan="3">Sync_Byte0 (0x5A)</td></tr>
<tr><td colspan="2">H_Seq</td><td>Length</td><td>Header identification</td><td>H_Seq (3 bit)
• 0 unknown transmitter ID received
• 1 known transmitter ID received
• 2 new transmitter learnt
Length (5 bit)
• Number of byte following the header (here: 11)</td></tr>
<tr><td colspan="3">ORG</td><td colspan="2">Telegram type</td></tr>
<tr><td colspan="3">Data Byte 3</td><td colspan="2" rowspan="4">Data byte</td></tr>
<tr><td colspan="3">Data Byte 2</td></tr>
<tr><td colspan="3">Data Byte 1</td></tr>
<tr><td colspan="3">Data Byte 0</td></tr>
<tr><td colspan="3">ID Byte 3</td><td colspan="2" rowspan="4">32 bit transmitter ID</td></tr>
<tr><td colspan="3">ID Byte 2</td></tr>
<tr><td colspan="3">ID Byte 1</td></tr>
<tr><td colspan="3">ID Byte 0</td></tr>
<tr><td colspan="3">Status</td><td colspan="2">Status field</td></tr>
<tr><td colspan="3">Check Sum</td><td colspan="2">Checksum (LSB resulting from the addition of all bytes, not including the synchronization byte or the checksum itself)</td></tr>
</table>

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.

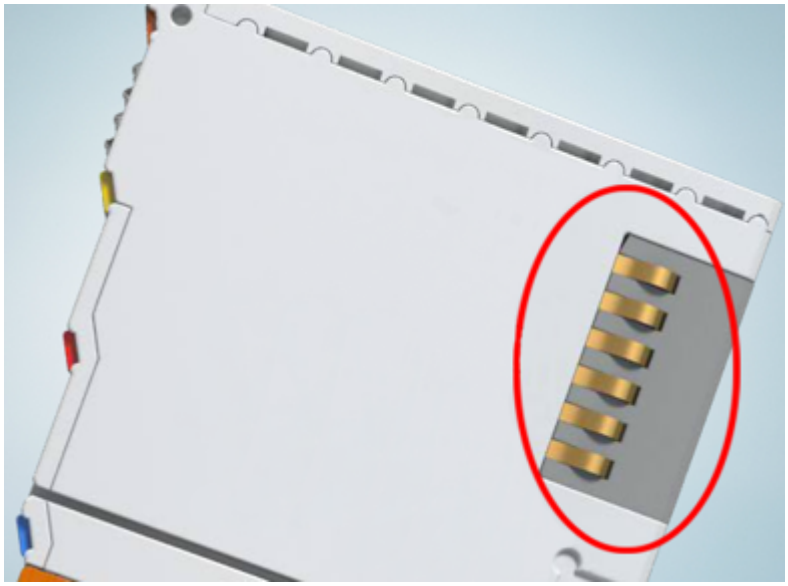


Fig. 5: Spring contacts of the Beckhoff I/O components

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

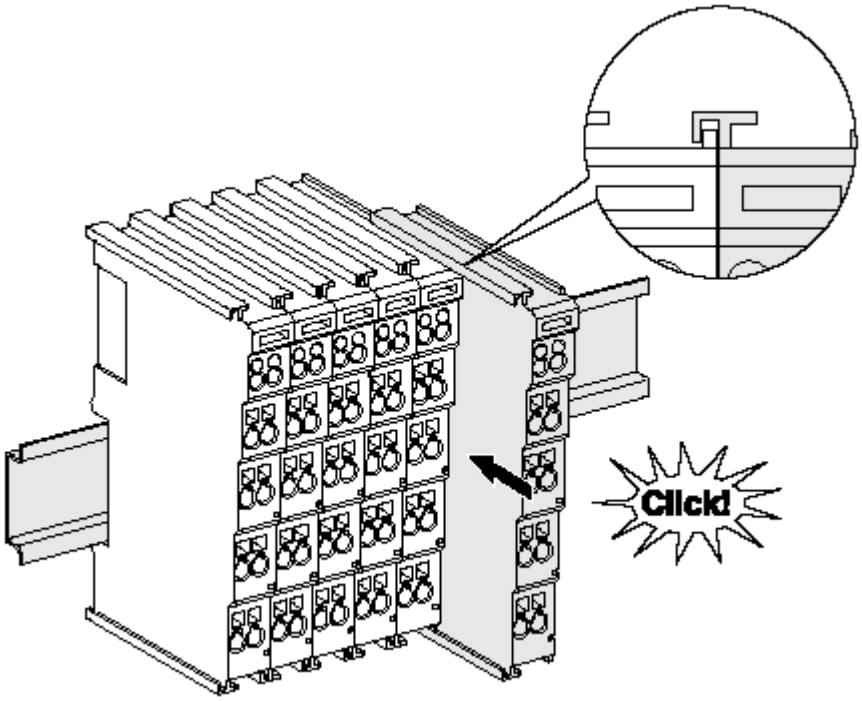


Fig. 6: Attaching on mounting rail

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

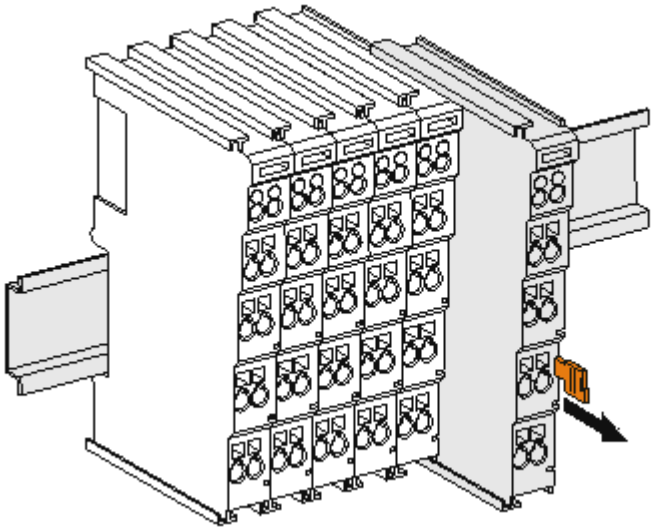


Fig. 7: Disassembling of terminal

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.

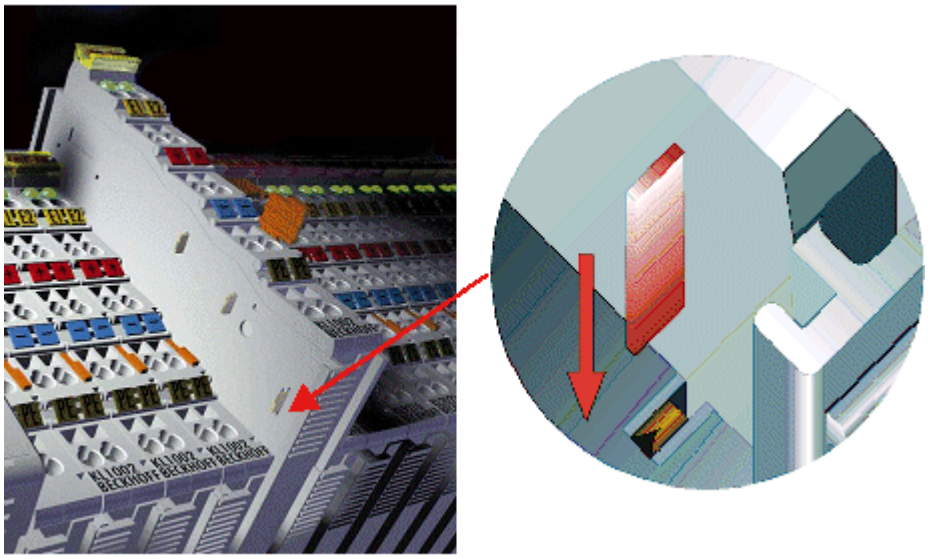


Fig. 8: Power contact on left side

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 Connection of the wireless adapter

⚠ 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!

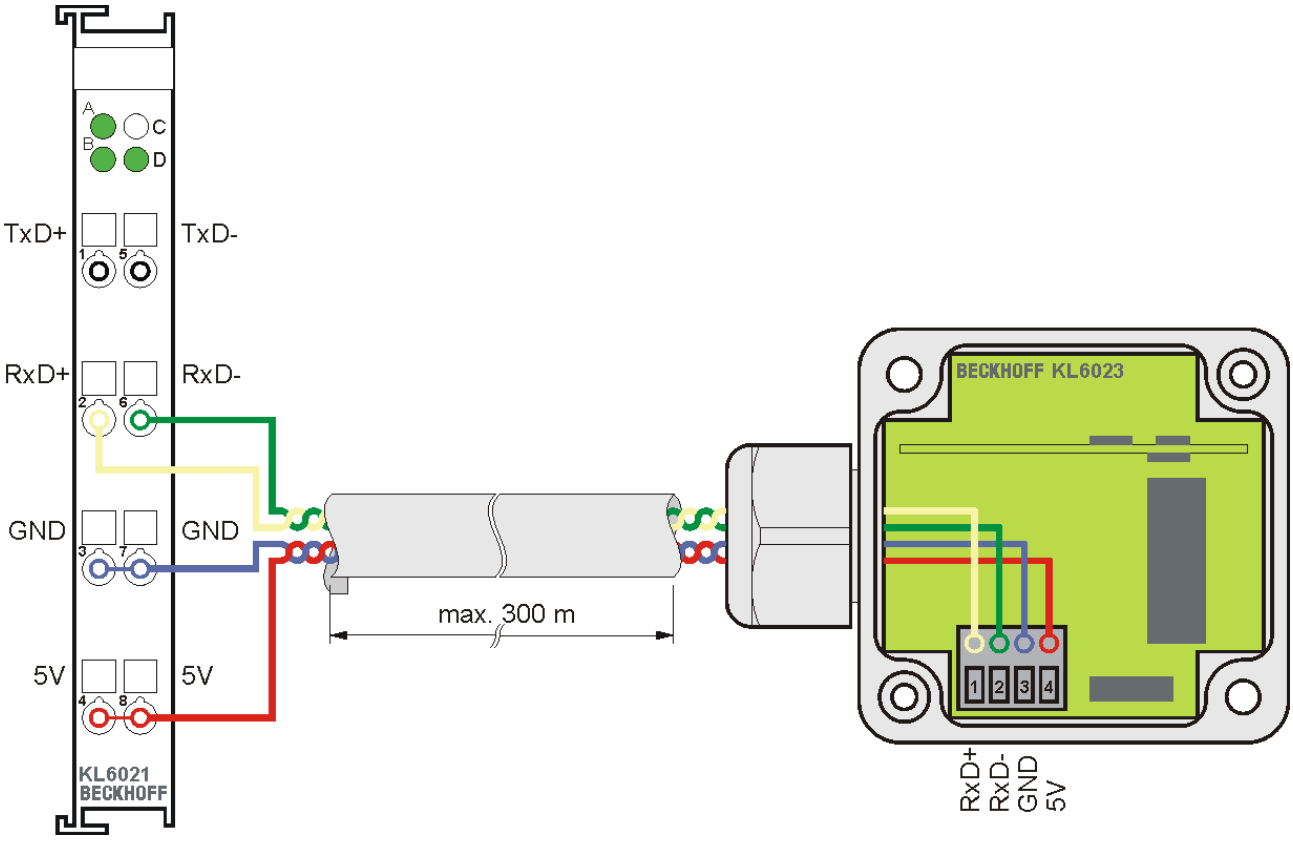


Fig. 9: Connection of the wireless adapter

KL6021-0023		KL6023 – Wireless adapter	
Signal	**Terminal point no.**	**Signal**	**Terminal point no.**
RxD+	2	RxD+	1
RxD-	6	RxD-	2
GND	3 or 7	GND	3
5 V	4 or 8	5 V	4

4 KS2000 Configuration Software

4.1 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. 10: 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.

4.2 Parameterization with KS2000

Connect the configuration interface of your Fieldbus Coupler with the serial interface of your PC via the configuration cable and start the *KS2000* Configuration Software.

Click on the *Login* button. The configuration software will now load the information for the connected fieldbus station.
In the example shown, this is

- a BK2020 Lightbus Coupler
- a KL1xx2 Digital Input Terminal
- a KL6021-0023 serial interface terminal (RS485 for EnOcean receiver KL6023)
- a KL9010 Bus End Terminal

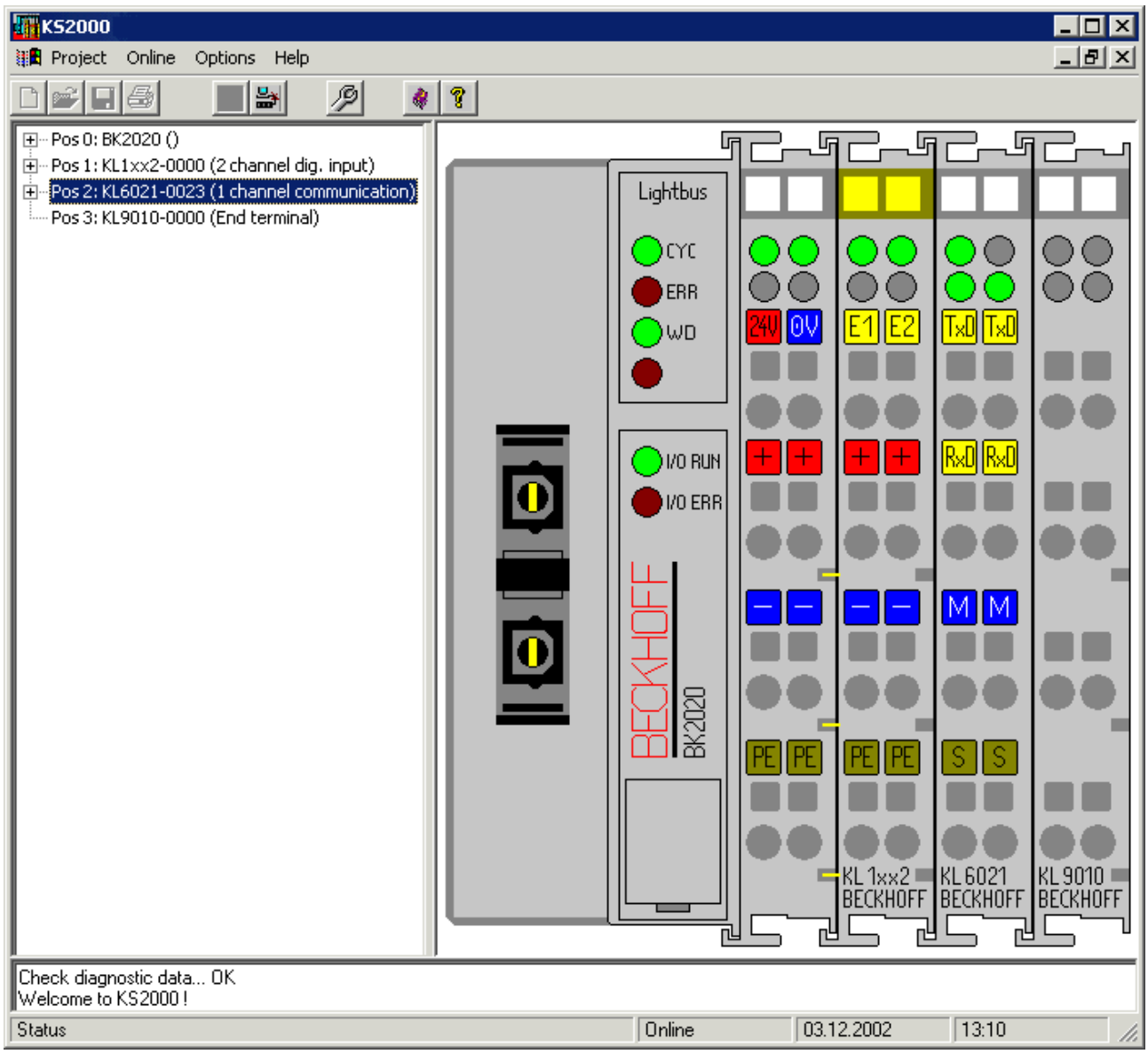


Fig. 11: Display of the fieldbus station in KS2000

The left-hand KS2000 window displays the terminals of the fieldbus station in a tree structure.
The right-hand KS2000 window contains a graphic display of the fieldbus station terminals.

In the tree structure of the left-hand window, click on the plus-sign next to the terminal whose parameters you wish to change (item 2 in the example).

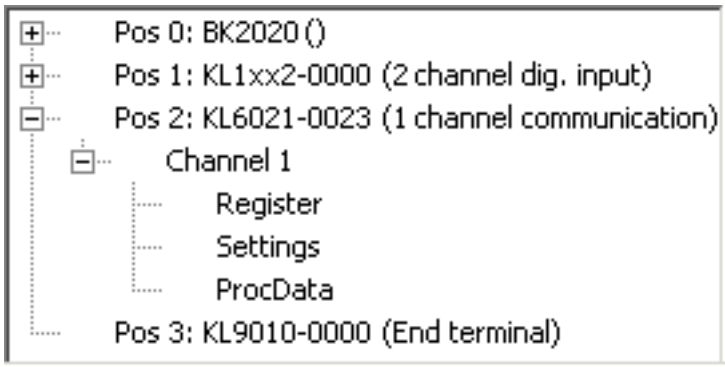


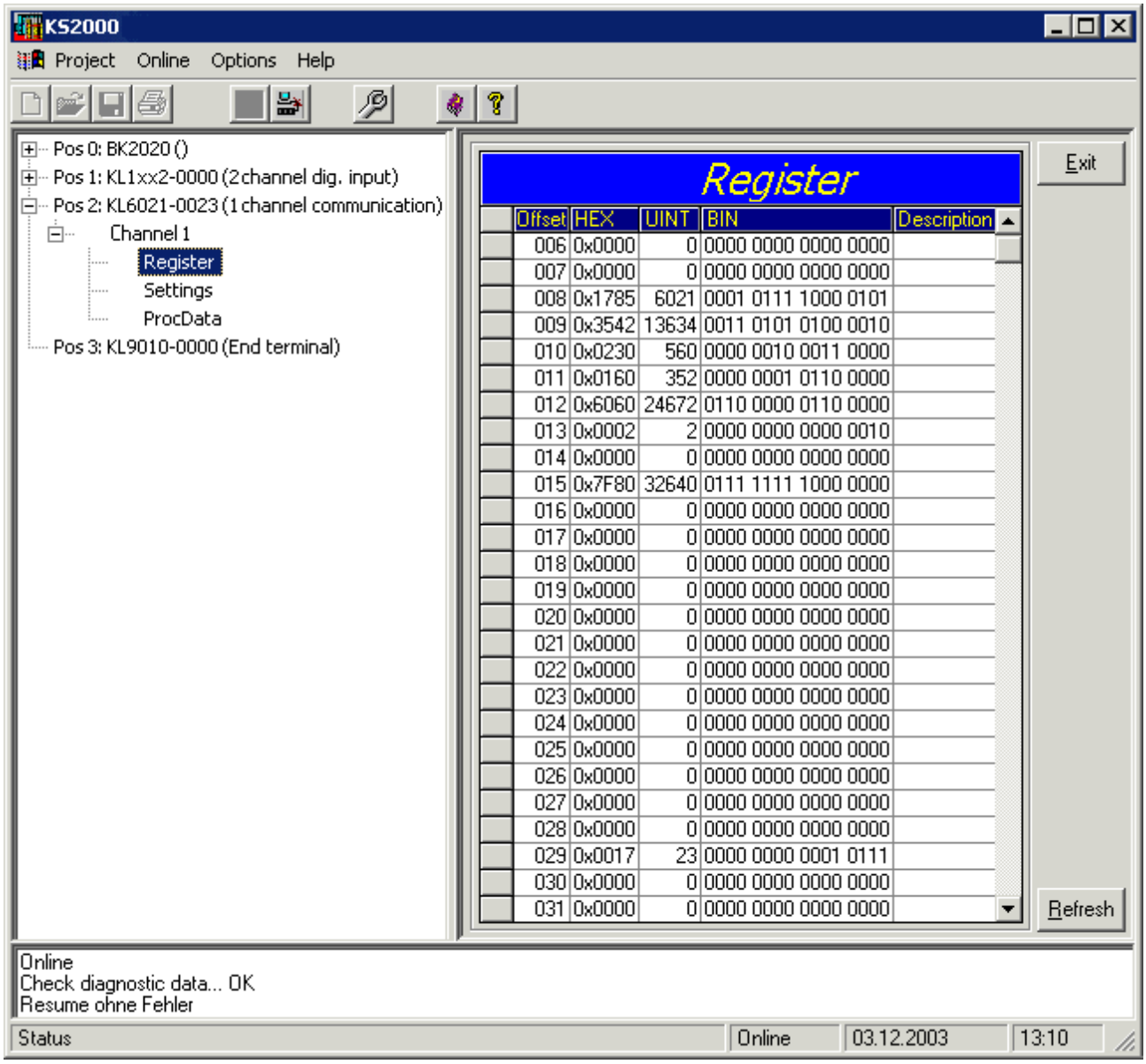
Fig. 12: KS2000 branch for channel 1 of the KL6021-0023

For the KL6021-0023, the branches *Register*, *Settings* and *ProcData* are displayed:

- Register [▶ 22] permits direct access to the registers of the KL6021-0023.
- There are no dialog masks to be found for parameterizing the KL6021-0023 under Settings, since no terminal-specific settings are required.
- ProcData [▶ 23] displays the KL6021-0023 process data.

4.3 Register

Under *Register* you can directly access the registers of the KL6021-0023. The meaning of the register is explained in the Register Overview [▶ 28].



Offset	HEX	UINT	BIN	Description
006	0x0000	0	0000 0000 0000 0000	
007	0x0000	0	0000 0000 0000 0000	
008	0x1785	6021	0001 0111 1000 0101	
009	0x3542	13634	0011 0101 0100 0010	
010	0x0230	560	0000 0010 0011 0000	
011	0x0160	352	0000 0001 0110 0000	
012	0x6060	24672	0110 0000 0110 0000	
013	0x0002	2	0000 0000 0000 0010	
014	0x0000	0	0000 0000 0000 0000	
015	0x7F80	32640	0111 1111 1000 0000	
016	0x0000	0	0000 0000 0000 0000	
017	0x0000	0	0000 0000 0000 0000	
018	0x0000	0	0000 0000 0000 0000	
019	0x0000	0	0000 0000 0000 0000	
020	0x0000	0	0000 0000 0000 0000	
021	0x0000	0	0000 0000 0000 0000	
022	0x0000	0	0000 0000 0000 0000	
023	0x0000	0	0000 0000 0000 0000	
024	0x0000	0	0000 0000 0000 0000	
025	0x0000	0	0000 0000 0000 0000	
026	0x0000	0	0000 0000 0000 0000	
027	0x0000	0	0000 0000 0000 0000	
028	0x0000	0	0000 0000 0000 0000	
029	0x0017	23	0000 0000 0001 0111	
030	0x0000	0	0000 0000 0000 0000	
031	0x0000	0	0000 0000 0000 0000	

Fig. 13: Register view in KS2000

4.4 Settings

No terminal-specific settings are necessary for the KL6021-0023 and the KL6023.

4.5 Process data

The Status byte (Status), the Control byte (Ctrl) and the process data (Data) are displayed in a tree structure under *Process Data*.

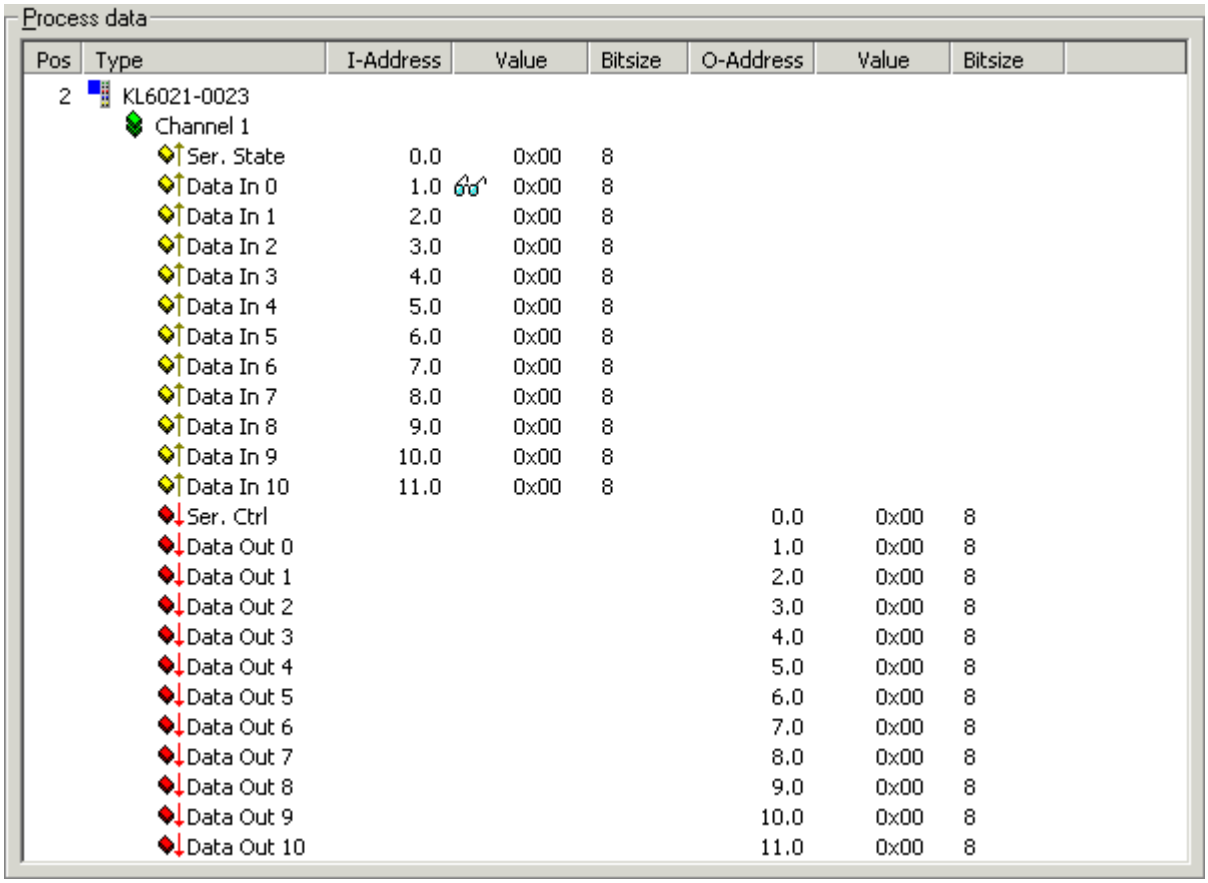


Fig. 14: Process Data

The spectacles mark the data that are currently graphically displayed in the *History* field.

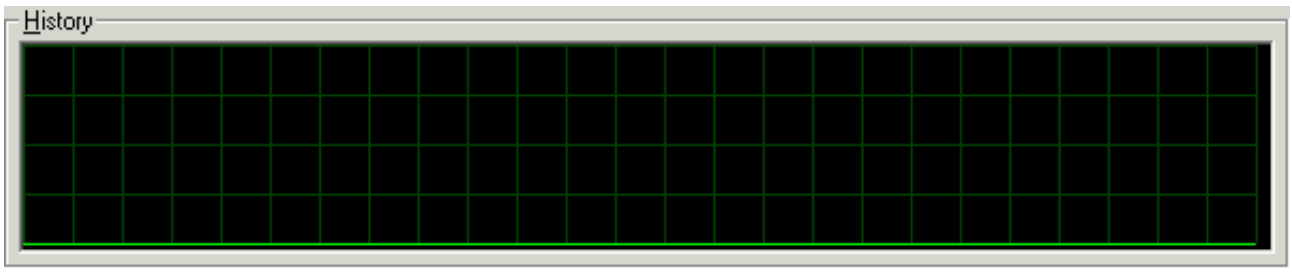


Fig. 15: *History* field

The current input value is displayed numerically in the *Value* field.

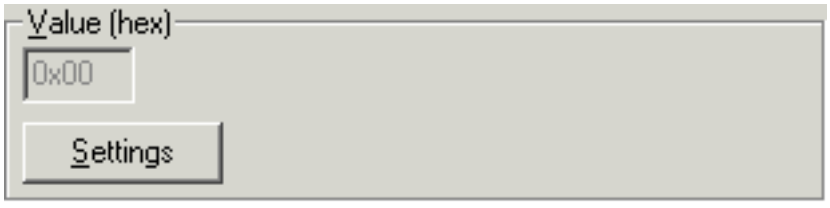


Fig. 16: *Value* field

Output values can be modified through direct input or by means of the fader control.

Fig. 17: *Value* field

⚠ WARNING

Changing output values (forcing)

Note that changing output values (forcing) can have a direct effect on your automation application.
Only change these output values if you are certain that the state of your system permits it, and that there will be no risk to people or to the machine!

After pressing the *Settings* button you can set the format of the numerical display to hexadecimal, decimal or binary.

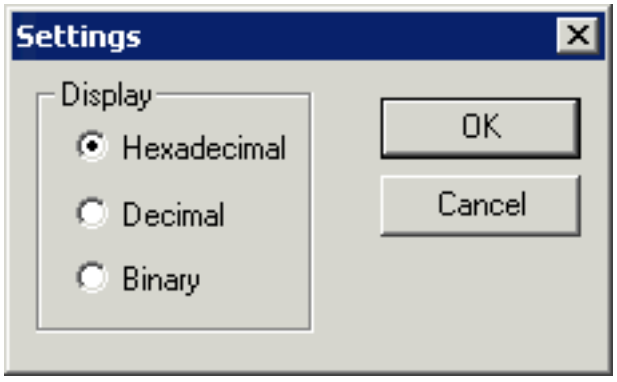


Fig. 18: Settings

5 Programming

5.1 TwinCAT libraries

Software documentation in the Beckhoff Information System:

TwinCAT 2: TwinCAT 2 | PLC Lib: TcEnOcean

TwinCAT 3: TwinCAT 3 | PLC Lib: Tc2_EnOcean

6 Access from the user program

6.1 Process image

The KL6021-0023 is represented in the process image with 12 bytes of input data and 12 bytes of output data. These are organized as follows:

Byte offset	Format	Input data	Output data
0	Byte	Status byte (SB [▶ 26])	Control byte (CB [▶ 26])
1	Byte	DataIn0	DataOut0
2	Byte	DataIn1	DataOut1
3	Byte	DataIn2	DataOut2
4	Byte	DataIn3	DataOut3
5	Byte	DataIn4	DataOut4
6	Byte	DataIn5	DataOut5
7	Byte	DataIn6	DataOut6
8	Byte	DataIn7	DataOut7
9	Byte	DataIn8	DataOut8
10	Byte	DataIn9	DataOut9
11	Byte	DataIn10	DataOut10

6.2 Control and status byte

Register communication

Control byte (for register communication)

The control byte (CB) is located in the output image [▶ 26], and is transmitted from the controller to the terminal.

Bit	CB.7	CB.6	CB.5	CB.4	CB.3	CB.2	CB.1	CB.0
Name	RegAccess	R/W	Reg. no.					

Key

Bit	Name	Description	
CB.7	RegAccess	1_{bin}	Register communication switched on
CB.6	R/W	0_{bin}	Read access
		1_{bin}	Write access
CB.5 to CB.0	Reg. no.	Register number: Enter the number of the register [▶ 28] that you want to read or write here.	

Status byte (for register communication)

The status byte (SB) is located in the input image [▶ 26], and is transmitted from the terminal to the controller.

Bit	SB.7	SB.6	SB.5	SB.4	SB.3	SB.2	SB.1	SB.0
Name	RegAccess	R/W	Reg. no.					

Key

Bit	Name	Description	
SB.7	RegAccess	1_{bin}	Acknowledgment for register access
SB.6	R	0_{bin}	Read access
SB.5 to SB.0	Reg. no.	Number of the register that was read or written.	

Process data during the register communication

The process data that is displayed is set to zero during the register communication!

Process data mode

Control byte in process data mode

The control byte (CB) is located in the output image [▶ 26], and is transmitted from the controller to the terminal.

Bit	CB.7	CB.6	CB.5	CB.4	CB.3	CB.2	CB.1	CB.0
Name	RegAccess	-	-	-	-	-	-	NextTelegramReq

Key

Bit	Name	Description	
CB.7	RegAccess	0_{bin}	Register communication off (process data mode)
CB.6 to CB.1	-	0_{bin}	reserved
CB.0	NextTelegramReq	$0/1_{bin}$	By inverting this bit, the next EnOcean telegram in the input memory of the KL6021-0023 is copied into the process data.

Status byte in process data mode

The status byte (SB) is located in the input image [▶ 26], and is transmitted from the terminal to the controller.

Bit	SB.7	SB.6	SB.5	SB.4	SB.3	SB.2	SB.1	SB.0
Name	RegAccess	Error	-	-	BufferFull	NewTelegram	SameTelegram	NextTelegramAck

Key

Bit	Name	Description	
SB.7	RegAccess	0_{bin}	Acknowledgment for process data mode
SB.6	Error	1_{bin}	The EnOcean telegram presently displayed in the process data of the KL6021-0023 has an incorrect checksum.
SB.5	-	0_{bin}	reserved
SB.4	-	0_{bin}	reserved
SB.3	BufferFull	1_{bin}	The receive memory of the KL6021-0023 is full.
SB.2	NewTelegram	1_{bin}	There is at least one new EnOcean telegram in the receive memory of the KL6021-0023.
SB.1	SameTelegram	1_{bin}	The data currently displayed belongs to the same EnOcean telegram as the data previously displayed, because the telegram contains more than 4 data bytes.
SB.0	NextTelegramAck	$0/1_{bin}$	Acknowledgement of having copied the EnOcean telegram into the process data. The bit adopts the value of the control bit CB.0 [▶ 27] when the telegram has been copied into the process data.

6.3 Register overview

These registers are used to parameterize the terminal KL6021. They can be read or written by means of the register communication.

Register no.	Comment	Default value		R/W	Memory
R0	reserved	-	-	-	-
...	...	...	...	...	...
R5	reserved	-	-	-	-
R6 [▶ 29]	Diagnostic register	0x0000	0_{dec}	R	RAM
R7 [▶ 29]	Command register	0x0000	0_{dec}	R/W	RAM
R8 [▶ 29]	Terminal type	0x1785	6021_{dec}	R	ROM
R9 [▶ 29]	Firmware version	e.g. 0x3541	e.g. 13633_{dec}	R	ROM
R10	Multiplex shift register	0x0230	560_{dec}	R	ROM
R11	Signal channels	0x0160	352_{dec}	R	ROM
R12	Minimum data length	0x6060	24672_{dec}	R	ROM
R13	Data structure	0x0002	2_{dec}	R	ROM
R14	reserved	-	-	-	-
R15	Alignment register	typically 0x7F80	typically 32640_{dec}	R/W	RAM
R16 [▶ 29]	Hardware version number	e.g. 0x0000	e.g. 0_{dec}	R/W	SEEPROM
R17	reserved	-	-	-	-
...	...	...	...	...	...
R28	reserved	-	-	-	-
R29 [▶ 29]	Terminal type - special identification	0x0017	23_{dec}	R	ROM
R30	reserved	-	-	-	-
R31 [▶ 29]	Code word register	0x0000	0_{dec}	R/W	RAM
R32 [▶ 29]	Feature register	0x0000	0_{dec}	R/W	SEEPROM
R33	reserved	-	-	-	-
R34	reserved	-	-	-	-
R35 [▶ 29]	Number of data bytes sent to the Bus Coupler	0x000B	11_{dec}	R	ROM
R36	reserved	-	-	-	-
...	...	...	...	...	...
R63	reserved	-	-	-	-

6.4 Register description

The registers are used to parameterize the terminal. They can be read or written by means of the register communication.

R6: Diagnostic register

Status byte SB [▶ 26] is placed into register R6.

R7: Command register

No commands are implemented in this terminal.

R8: Terminal description

The name of the terminal is contained in register R8. KL6021: 0x1785 (6021_{dec})

R9: Firmware version

Register R9 contains the ASCII coding of the terminal's firmware version, e.g. **0x3541 = '5A'**. The **'0x35'** corresponds here to the ASCII character **'5'**, while the **'0x41'** represents the ASCII character **'A'**.
This value cannot be changed.

R16: Hardware version number

Register R16 contains the hardware version of the terminal; this value cannot be changed.

R29: Terminal type - special identification

The name of the special type of the terminal is contained in register R29. KL6021-0023: 0x0017 (0023_{dec})

R31: Code word register

- If you write values into the user registers without first entering the user code word (0x1235) into the code word register, the terminal will not accept the supplied data.
- If you write values into the user registers and have previously entered the user code word (0x1235) in the code word register, these values are stored in the RAM registers and in the SEEPROM registers and are therefore retained when the terminal is restarted.

The code word is reset when the terminal is restarted.

R32: Feature register

The feature register specifies the terminal's configuration. There are no configurations that can be made for this terminal.

R35: Number of data bytes sent to the Bus Coupler

Register R35 indicates the number of data bytes that transmitted to the Bus Coupler. This value cannot be changed.

6.5 Examples of Register Communication

The numbering of the bytes in the examples corresponds to the display without word alignment.

6.5.1 Example 1: Reading the firmware version from register 9

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0x89 (1000 1001_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 specify the register number 9 with 00 1001_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access. To change a register, write the required value into the output word.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x89	0x33	0x41

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.
- The terminal returns the firmware version 0x3341 in the input data word (byte 1 and byte 2). This is to be interpreted as an ASCII code:
  - ASCII code 0x33 represents the digit 3
  - ASCII code 0x41 represents the letter A
    The firmware version is thus 3A.

6.5.2 Example 2: Writing to an user register

Code word

In normal mode all user registers are read-only with the exception of Register 31. In order to deactivate this write protection you must write the code word (0x1235) into Register 31. If a value other than 0x1235 is written into Register 31, write protection is reactivated. Please note that changes to a register only become effective after restarting the terminal (power-off/power-on).

I. Write the code word (0x1235) into register 31.

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xDF (1101 1111_{bin})	0x12	0x35

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.

- The output data word (byte 1 and byte 2) contains the code word (0x1235) for deactivating write protection.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

II. Read Register 31 (check the set code word)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0x12	0x35

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.
- The terminal returns the current value of the code word register in the input data word (byte 1 and byte 2).

III. Write to Register 32 (change contents of the feature register)

Output data

Byte 0: Control byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xE0 (1110 0000_{bin})	0x00	0x02

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 indicate register number 32 with 10 0000_{bin}.
- The output data word (byte 1 and byte 2) contains the new value for the feature register.

⚠ CAUTION

Observe the register description!

The value of 0x0002 given here is just an example!
The bits of the feature register change the properties of the terminal and have a different meaning, depending on the type of terminal. Refer to the description of the feature register of your terminal (chapter *Register description*) regarding the meaning of the individual bits before changing the values.

Input data (response from the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xA0 (1010 0000_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

IV. Read register 32 (check changed feature register)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xA0 (1010 0000_{bin})	0xXX	0xXX

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 not set means: reading the register.
- Bits 0.5 to 0.0 indicate register number 32 with 10 0000_{bin}.
- The output data word (byte 1 and byte 2) has no meaning during read access.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0xA0 (1010 0000_{bin})	0x00	0x02

Explanation:

- The terminal returns the value of the control byte as a receipt in the status byte.
- The terminal returns the current value of the feature register in the input data word (byte 1 and byte 2).

V. Write register 31 (reset code word)

Output Data

Byte 0: Control byte	Byte 1: DataOUT1, high byte	Byte 2: DataOUT1, low byte
0xDF (1101 1111_{bin})	0x00	0x00

Explanation:

- Bit 0.7 set means: Register communication switched on.
- Bit 0.6 set means: writing to the register.
- Bits 0.5 to 0.0 specify the register number 31 with 01 1111_{bin}.
- The output data word (byte 1 and byte 2) contains 0x0000 for reactivating write protection.

Input Data (answer of the Bus Terminal)

Byte 0: Status byte	Byte 1: DataIN1, high byte	Byte 2: DataIN1, low byte
0x9F (1001 1111_{bin})	0xXX	0xXX

Explanation:

- The terminal returns a value as a receipt in the status byte that differs only in bit 0.6 from the value of the control byte.
- The input data word (byte 1 and byte 2) is of no importance after the write access. Any values still displayed are invalid!

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.

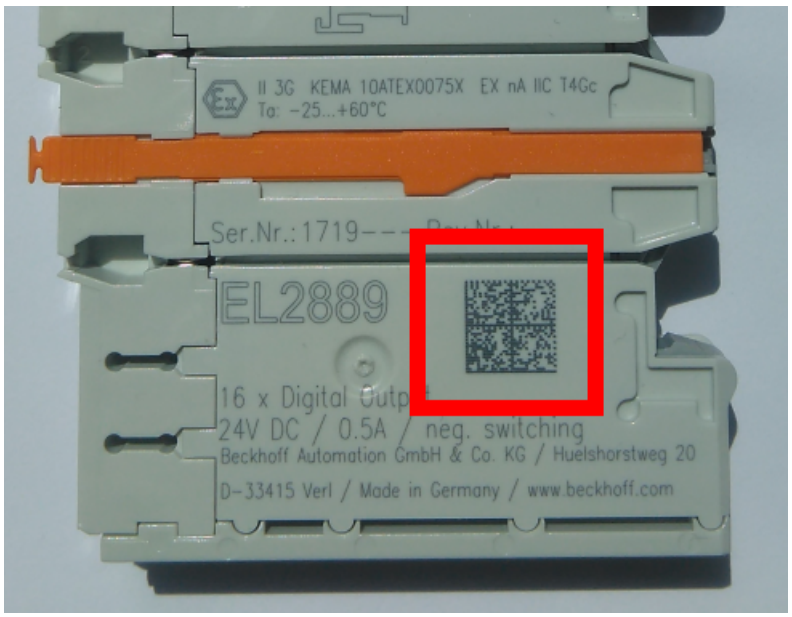


Fig. 19: BIC as data matrix code (DMC, code scheme ECC200)

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. 20: 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.

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