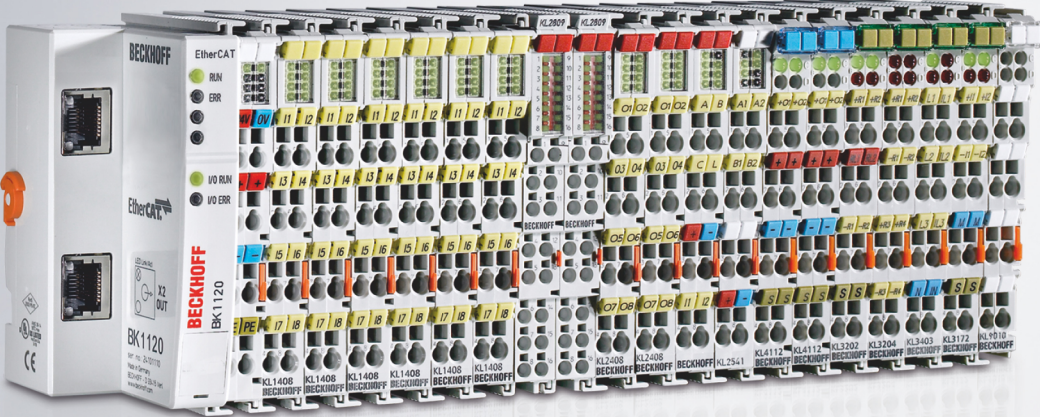


Documentation | EN

## KL2542/KS2542

Two channel output stage terminals for DC motors





# Table of contents

<b>1 Foreword .....</b>	<b>5</b>
1.1 Notes on the documentation.....	5
1.2 Safety instructions .....	6
1.3 Documentation issue status .....	7
<b>2 Product overview.....</b>	<b>8</b>
2.1 Introduction.....	8
2.2 Technical data .....	9
2.3 LED displays.....	10
<b>3 Mounting and wiring.....</b>	<b>11</b>
3.1 Instructions for ESD protection.....	11
3.2 Installation on mounting rails .....	12
3.3 Connection .....	15
3.3.1 Connection system .....	15
3.3.2 Wiring.....	16
3.3.3 Contact assignment.....	18
3.4 Disposal.....	19
<b>4 KS2000 Configuration Software .....</b>	<b>20</b>
4.1 KS2000 - Introduction.....	20
4.2 Parameterization with KS2000 .....	21
4.3 Settings.....	23
4.4 Register .....	26
4.5 Process data.....	27
<b>5 Access from the user program .....</b>	<b>29</b>
5.1 Process image.....	29
5.2 Control and status byte.....	30
5.3 Register overview .....	32
5.4 Register description.....	34
5.5 Examples of Register Communication .....	39
5.5.1 Example 1: reading the firmware version from Register 9.....	39
5.5.2 Example 2: Writing to an user register.....	39
<b>6 Appendix .....</b>	<b>43</b>
6.1 Support and Service .....	43



# 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
2.1.0	<ul style="list-style-type: none"> <li>• Chapter “Technical data”</li> <li>• Document structure updated</li> <li>• Chapter “Instructions for ESD protection” added</li> <li>• Chapter “Disposal” added</li> <li>• New title page</li> <li>• Update revision status</li> </ul>
2.0.0	<ul style="list-style-type: none"> <li>• Migration</li> </ul>
1.0.0	<ul style="list-style-type: none"> <li>• Register description expanded</li> </ul>
0.5	<ul style="list-style-type: none"> <li>• KL2532 removed</li> </ul>
0.4	<ul style="list-style-type: none"> <li>• Description of control and status byte updated</li> <li>• Register description corrected</li> </ul>
0.3	<ul style="list-style-type: none"> <li>• Connection description added</li> <li>• LED descriptions updated</li> <li>• Technical data updated</li> </ul>
0.2	<ul style="list-style-type: none"> <li>• Information on KL2532 added</li> <li>• Description of parameterization using the KS2000 configuration software added</li> </ul>
0.1	First provisional documentation for KL2542

#### Firmware and hardware versions

Documentation Version	Firmware	Hardware
2.1.0	3A	13
2.0.0	3A	10
1.0.0	1C	05
0.5	1C	05
0.4	1B	03
0.3	1B	03
0.2	1A	01
0.1	1A	01

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

#### Syntax of the serial number

Structure of the serial number: WW YY FF HH  
 WW - week of production (calendar week)  
 YY - year of production  
 FF - firmware version  
 HH - hardware version

Sample with serial number 49 05 1B 03:  
 49 - week of production 49  
 05 - year of production 2005  
 1B - firmware version 1B  
 03 - hardware version 03

## 2 Product overview

### 2.1 Introduction

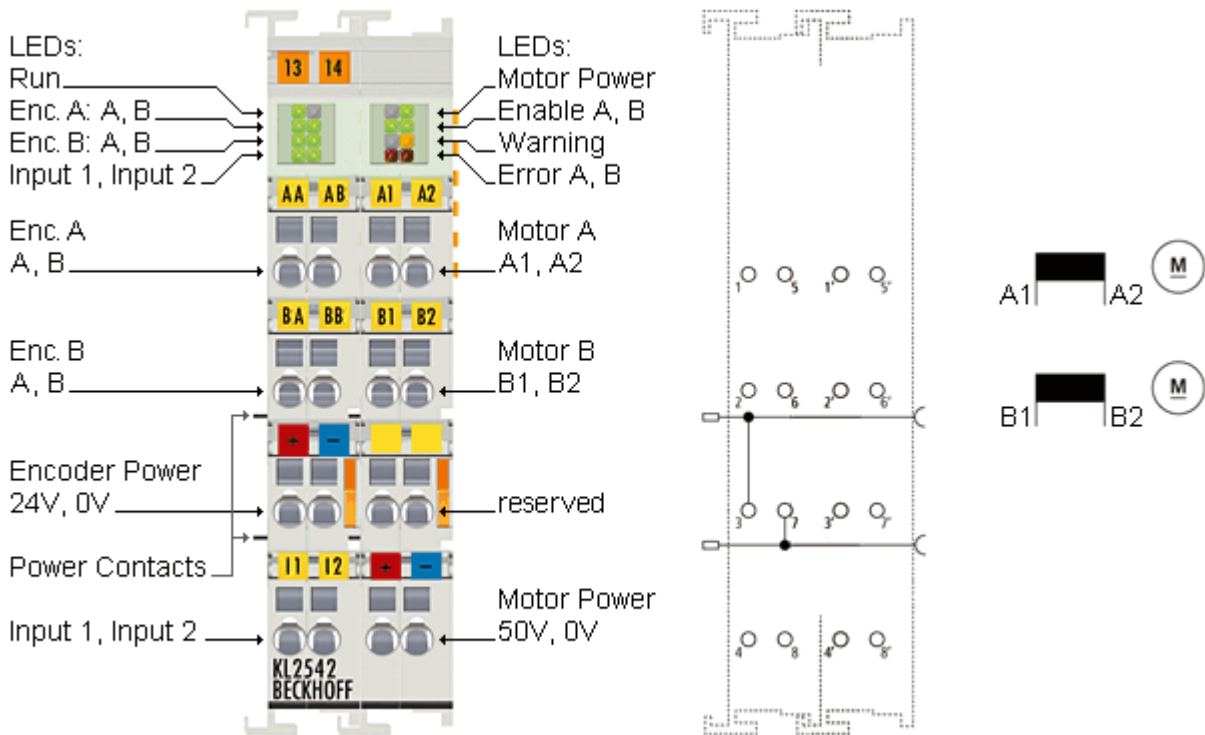


Fig. 1: KL2542

The two-channel KL2542 DC motor output stage enables direct operation of two DC motors. The set speed or the position is specified by the automation device through a 16-bit value. The output stage is protected against overload and short-circuit and is electrically isolated from the K-bus. Both channels indicate their state by LEDs, enabling fast on-the-spot diagnosis. A servo axis can easily be realized by connecting an incremental encoder.



## 2.2 Technical data

Technical data		KL2542 / KS2542
Number of DC motor output stages		2
Load type		DC brush motors, inductive
Supply for the output stage		via terminal points
Rated load voltage		8 V <sub>DC</sub> to 48 V <sub>DC</sub>
Output current per channel		Rated current 3.5 A, peak current 5 A (short-circuit-proof, common thermal overload warning for both output stages)
PWM clock frequency		36 kHz, channels out of phase by 180° relative to each other
Duty factor		0 ... 100% (voltage-controlled)
Resolution	Current	12 bit
	Voltage (velocity)	16 bit
Number of digital inputs		2 (for end positions)
Rated voltage of the inputs		24 V <sub>DC</sub> (-15% / +20%)
Signal voltage at digital input "0"		-3 V ... 2 V
Signal voltage at digital input "1"		15 V ... 30 V
Input filter		0.2 ms
Input current		typically 5 mA
Number of encoder inputs		4 (for an encoder system)
Encoder voltage "0"		-3 V ... 1.5 V
Encoder voltage "1"		2.5 V ... 24 V
Encoder frequency		max. 250 kHz
Electrical isolation		500 V (K-bus/mains voltage)
Power supply for the electronics		via the K-bus
Current consumption from K-bus		typically: 100 mA
Current consumption from power contacts		typically: 20 mA
Bit width in the input process image		2 x 16 bit data, 2 x 8 bit status
Bit width in the output process image		2 x 16 bit data, 2 x 8 bit control
Configuration		via the Bus Coupler or the controller
Weight		approx. 100 g
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
Dimensions (W x H x D)		approx. 27 mm x 100 mm x 70 mm (width aligned: 24 mm)
Mounting		on 35 mm mounting rail conforms to EN
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, EAC

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

## 2.3 LED displays

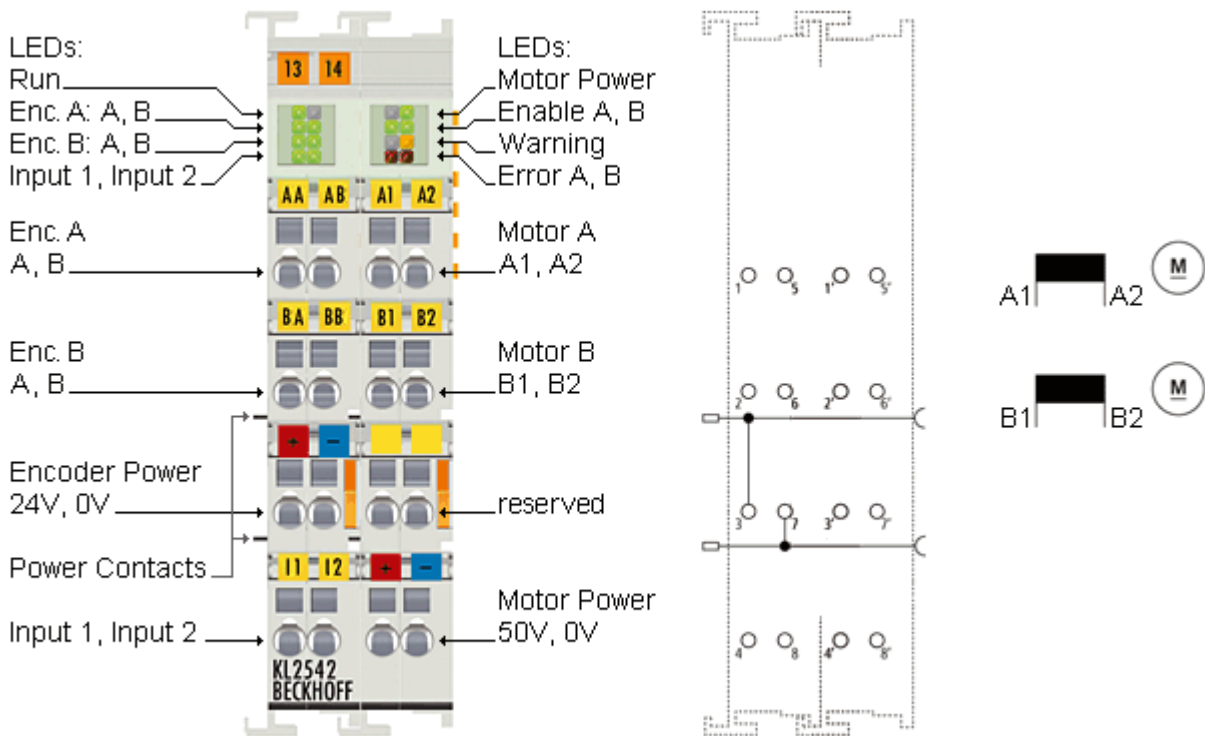


Fig. 2: KL2542 - LED displays

### Left LED prism

LED	Display	
Run (green)	on	Data transmission on the K-bus is active
Enc. A: A (green)	on	There is a signal at input A for encoder A.
Enc. B: A (green)	on	There is a signal at input A for encoder B.
Input 1 (green)	on	There is a signal at input 1.
-	reserved	
Enc. A: B (green)	on	There is a signal at input B for encoder A.
Enc. B: B (green)	on	There is a signal at input B for encoder B.
Input 2 (green)	on	There is a signal at input 2.

### Right LED prism

LED	Display	
-	reserved	
Enable A (green)	off	Channel 1 is either not enabled or not ready to operate.
	on	Channel 1 is enabled and is ready to operate.
-	reserved	
Error A (red)	on	There is an error at channel 1
Motor power (green)	off	The motor supply voltage is not available (less than 7 V).
	on	The motor supply voltage is available (greater than 8 V).
Enable B (green)	off	Channel 2 is either not enabled or not ready to operate.
	on	Channel 2 is enabled and is ready to operate.
Warning (yellow)	on	The internal temperature has risen to more than 80 °C, or the power supply voltage has dropped.
Error B (red)	on	There is an error at channel 2

## 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 be 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.

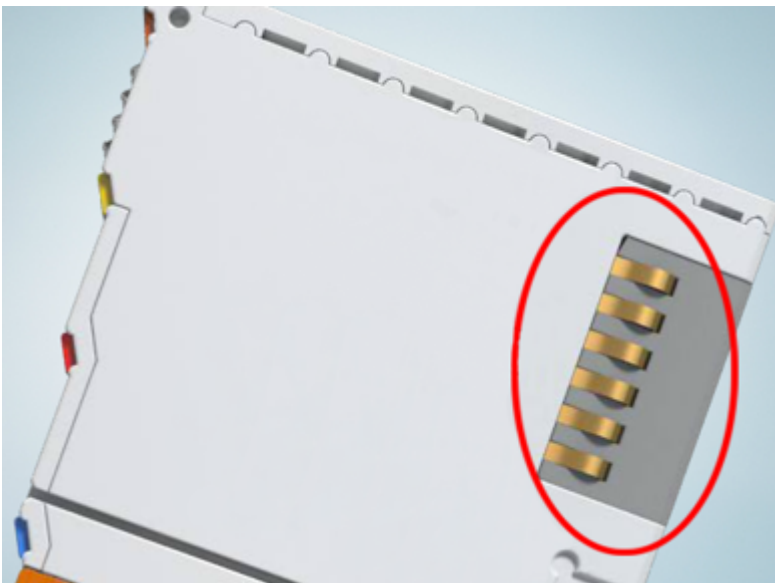


Fig. 3: Spring contacts of the Beckhoff I/O components

## 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

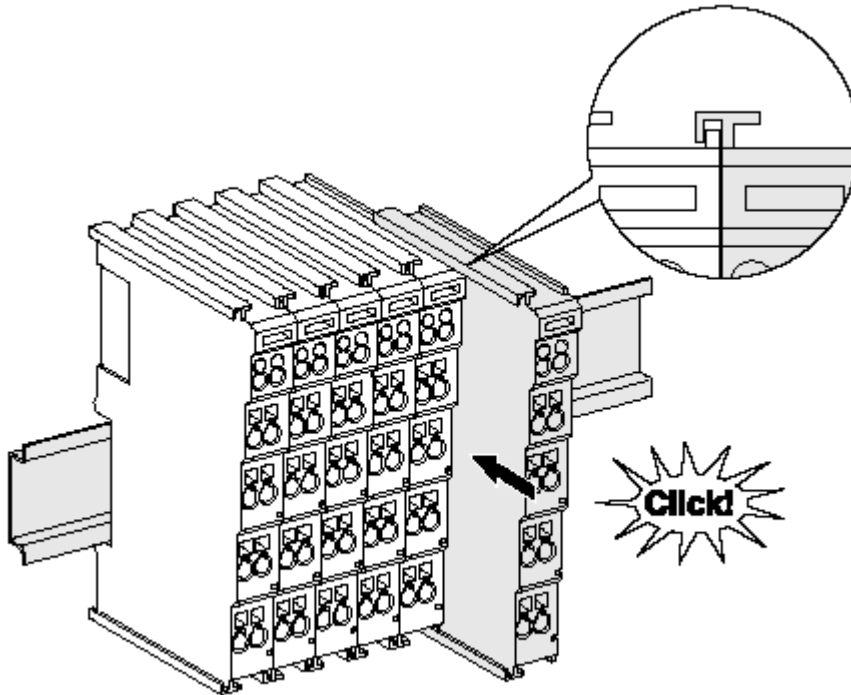


Fig. 4: Attaching on mounting rail

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.

#### **i** 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. 5: Disassembling of terminal

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

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

**Connections within a bus terminal block**

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

- The six spring contacts of the K-Bus/E-Bus deal with the transfer of the data and the supply of the Bus Terminal electronics.
- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminals on the Bus Coupler (up to 24 V) or for higher voltages via power feed terminals.

**● Power Contacts**

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

**PE power contact**

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

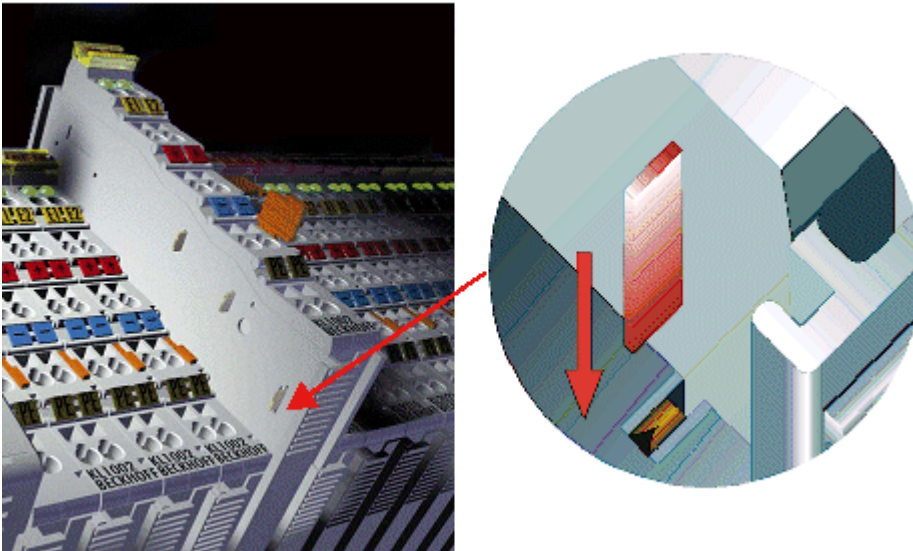


Fig. 6: Power contact on left side

**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 Connection

### 3.3.1 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. 7: 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. 8: 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<sup>2</sup> and 2.5 mm<sup>2</sup> 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. 9: 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

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

### Ultrasonically “bonded” (ultrasonically welded) conductors

#### ● Ultrasonically “bonded” conductors

**i** 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]!

## 3.3.2 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**

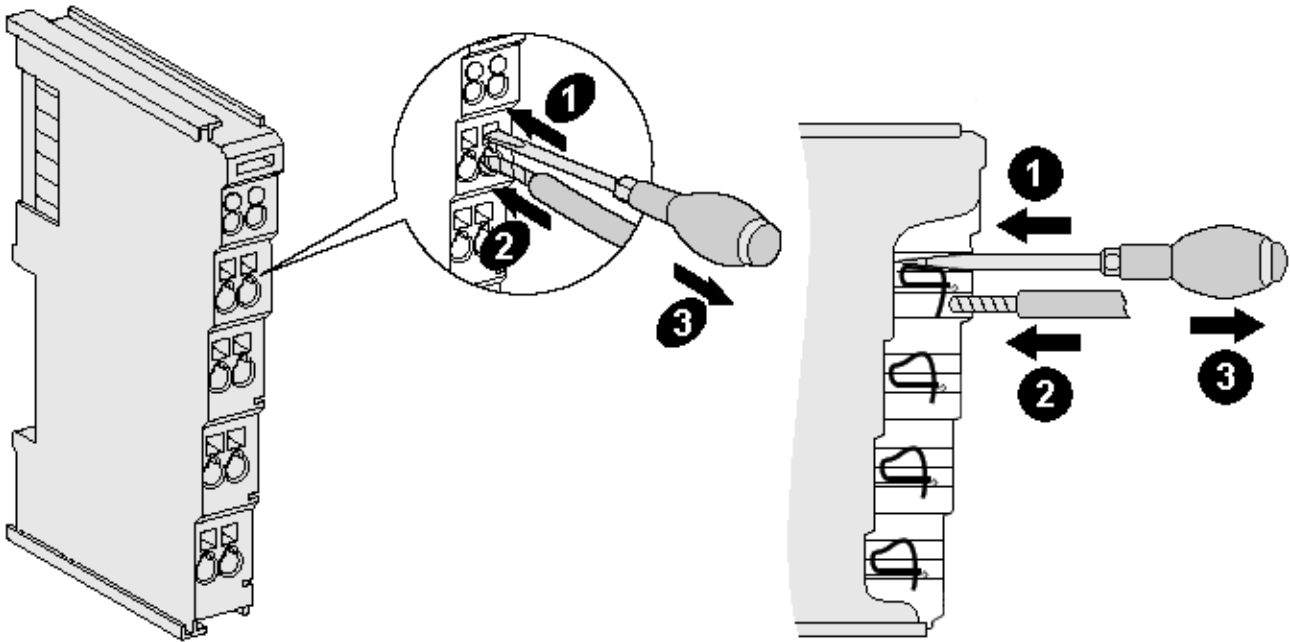


Fig. 10: Connecting a cable on a terminal point

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 <sup>2</sup>	0.08 ... 2.5 mm <sup>2</sup>
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm <sup>2</sup>	0.08 ... 2.5 mm <sup>2</sup>
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm <sup>2</sup>	0.14 ... 1.5 mm <sup>2</sup>
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 <sup>2</sup>
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm <sup>2</sup>
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm <sup>2</sup>
Wire size width (ultrasonically "bonded" conductors)	only 1.5 mm <sup>2</sup> (see notice [▶ 16])
Wire stripping length	8 ... 9 mm

### 3.3.3 Contact assignment

**⚠ WARNING**

**Risk of injury from electric shock and damage to the device!**

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

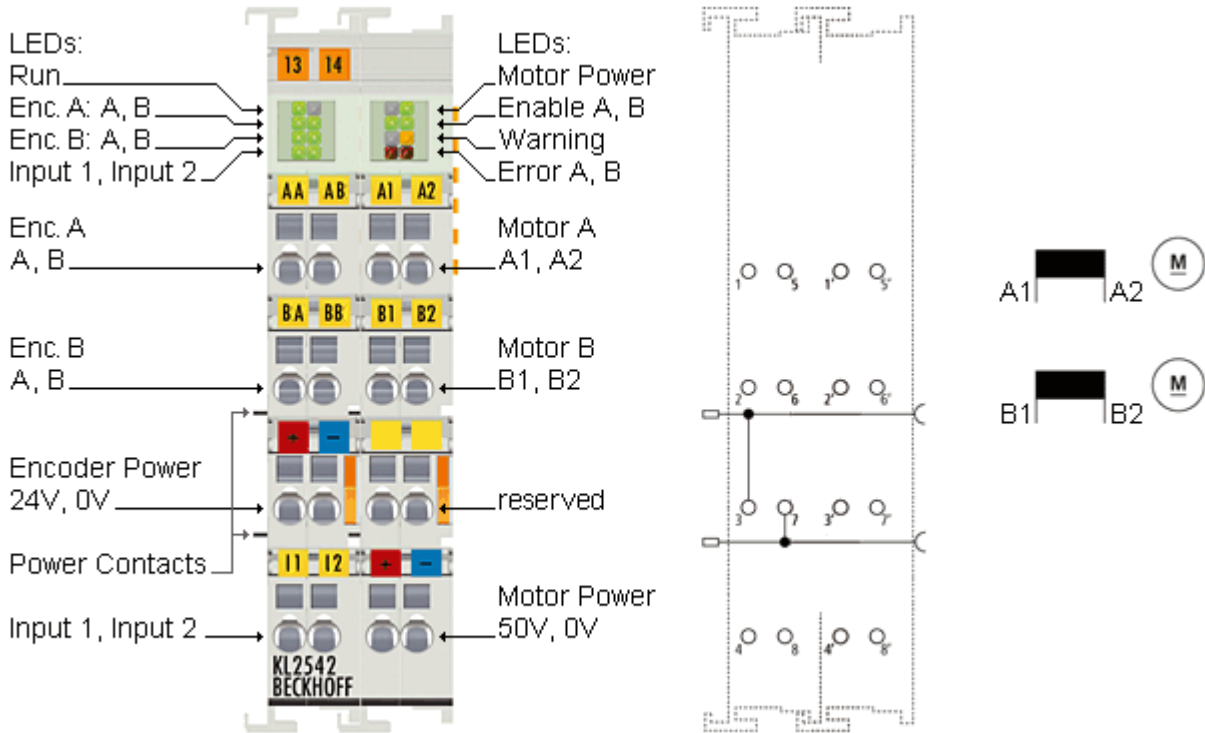


Fig. 11: KL2542 - Contact assignment

**Left-hand section of the housing**

Terminal point	No.	Connection for
Encoder A, A	1	Encoder A, connection A
Encoder B, A	2	Encoder B, connection A
Encoder power +24 V	3	Encoder supply (from positive power contact)
Input 1	4	Digital input 1 (24 V <sub>DC</sub> ). The current counter value is saved as a reference mark in the latch register if bit <b>CB.1</b> [► 30] is set in the control byte and a rising edge occurs at digital input 1.
Encoder A, B	5	Encoder A, connection B
Encoder B, B	6	Encoder B, connection B
Encoder Power 0 V	7	Encoder supply (from negative power contact)
Input 2	8	Digital input 2 (24 V <sub>DC</sub> ). The current counter value is saved as a reference mark in the latch register if bit <b>CB.2</b> [► 30] is set in the control byte and a rising edge occurs at digital input 2.

**Right-hand section of the housing**

Terminal point	No.	Connection for
Motor A, A1	1'	Motor A, connection A1
Motor B, B1	2'	Motor B, connection B1
n. c.	3'	reserved
Power Motor 48 V	4'	Motor supply feed (maximum +48 V <sub>DC</sub> )
Motor A, A2	5'	Motor A, connection A2
Motor B, B2	6'	Motor B, connection B2
n. c.	7'	reserved
Power Motor 0 V	8'	Motor supply feed (0 V <sub>DC</sub> )

**⚠ CAUTION**

**Danger for persons, the environment or devices!**

If the K-bus voltage (5 V, supplied via the Bus Coupler supply voltage U<sub>s</sub>) fails, the output drivers are not reset. This means that the motors are not stopped if they are in motion!

**Power contacts**

The voltage U<sub>p</sub> of the power contacts (+24 V<sub>DC</sub>) supplies the following consumers:

- Incremental encoder (terminal points 3 and 7)
- Digital inputs (terminal points 4 and 8)
- Output driver of the DC motor output stage

**⚠ CAUTION**

**Please note the order of the supply voltages.**

The voltage U<sub>p</sub> must already be present at the power contacts when the K-bus voltage is switched on so that the internal circuits (output stage drivers) can be initialized. If this is not possible due to the application (supply is switched, for example, via emergency stop circuit), the terminal performs a software reset after the system starts up. If the voltage U<sub>p</sub> at the power contacts fails, this is indicated in register 0 through bit R0.14 [▶ 34]. The return of the voltage is automatically detected and an initialization is performed.

**3.4 Disposal**



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

## 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. 12: 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 BK9000 Bus Coupler for Ethernet
- a KL1xx2 Digital Input Terminal
- a two-channel KL2542 DC motor output stage
- a KL9010 bus end terminal

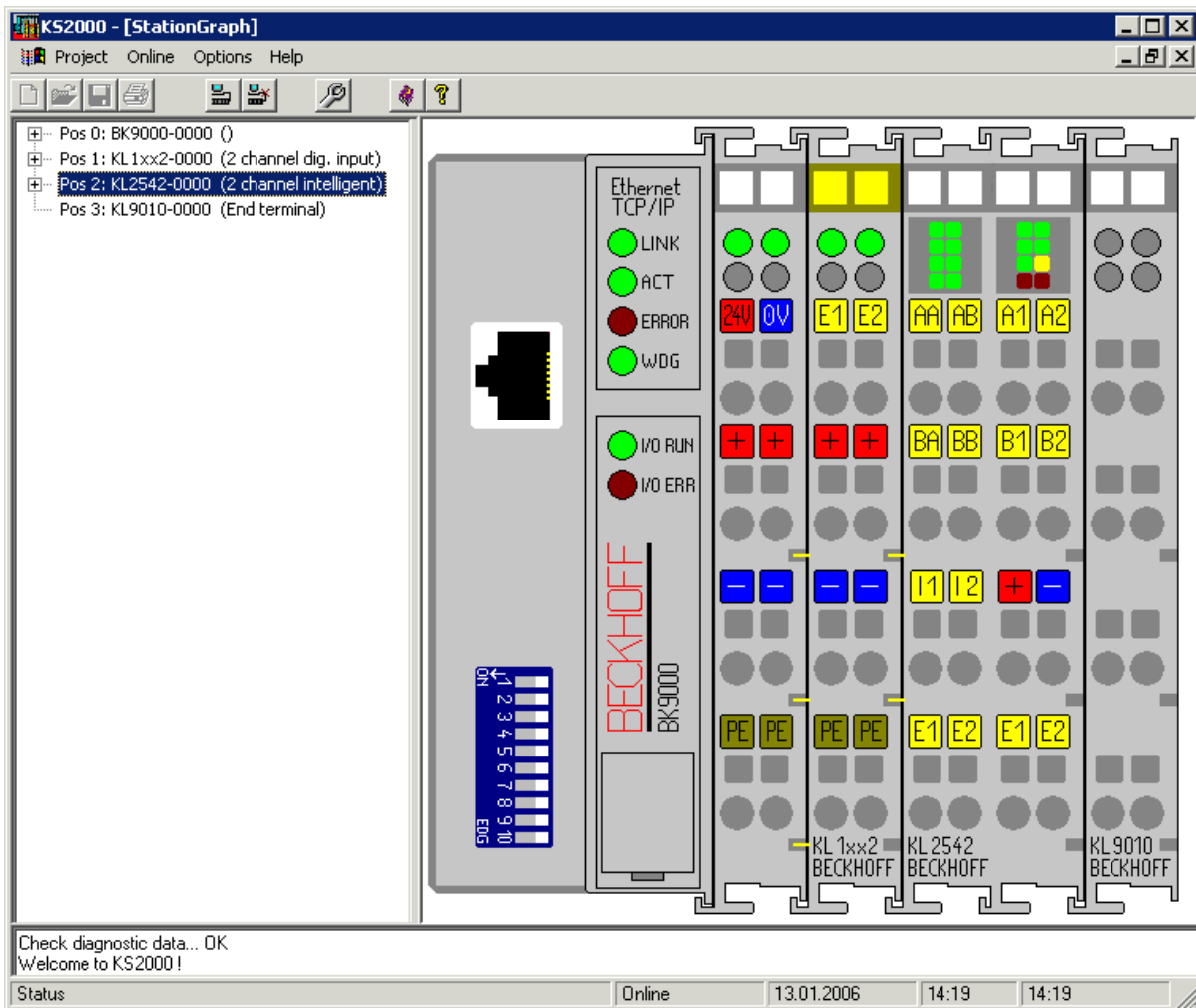


Fig. 13: Display of the fieldbus station in KS2000

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).

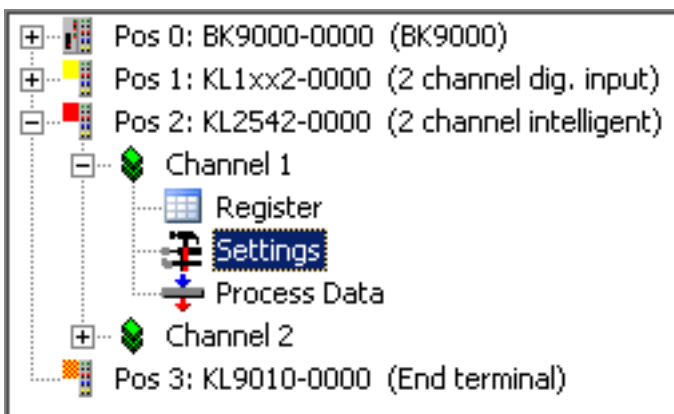


Fig. 14: KS2000 branch for channel 1 of the KL2542

For the KL2542, the branches *Register*, *Settings* and *ProcData* are displayed:

- [Register \[▶ 26\]](#) permits direct access to the registers of the KL2542.
- Under [Settings \[▶ 23\]](#) you find dialog boxes for parameterizing the KL2542.
- [ProcData \[▶ 27\]](#) displays the KL2542 process data.

### 4.3 Settings

KL2542 parameterization settings.

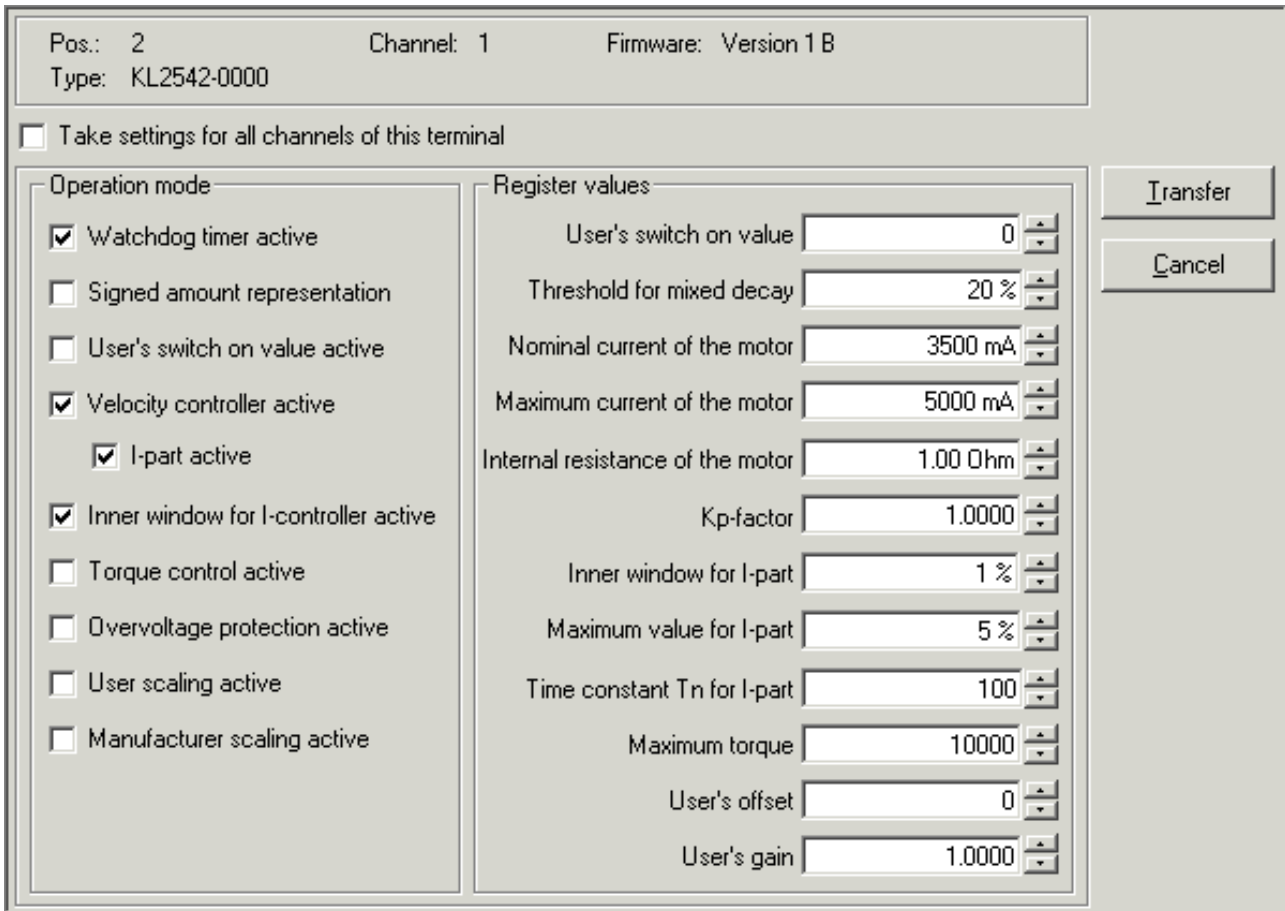


Fig. 15: Settings via KS2000

#### Operation mode

##### Watchdog timer active (R32.2 [▶ 36])

Here you can deactivate the watchdog (default: active). If the DC motor output stage fails to receive process data from the controller for 100 ms when the watchdog is active, the watchdog is triggered, and the motor stops.

##### Signed amount representation (R32.3 [▶ 36])

Here you can activate the signed amount representation (default: inactive).

##### User switch-on value active (R32.8 [▶ 36])

You can activate the user switch-on value [▶ 24] here (the default is inactive).

##### Velocity control active (R32.15 [▶ 36])

Here you can deactivate the velocity control (default: active).

##### I-controller active (R32.14 [▶ 36])

Here you can deactivate the I-controller (default: active).



**Inner window for I-controller active (R32.13 [▶ 36])**

Here you can deactivate the inner window for the I-controller (default: active).

**Torque monitoring active (R32.9 [▶ 36])**

Here you can activate torque monitoring (default: inactive).

**Overvoltage protection active (R32.10 [▶ 36])**

Here you can activate overvoltage protection (chopper resistor) for channel 2 (default: inactive).

**User scaling active (R32.0 [▶ 36])**

Here you can activate user scaling (default: inactive).

**Manufacturer scaling active (R32.1 [▶ 36])**

Here you can activate manufacturer scaling (default: inactive).

**Register values****User switch-on value (R35 [▶ 37])**

Here you can specify the user switch-on value for the velocity (default: 0).

**Switching threshold for MixedDecay (R41 [▶ 37])**

Here you can specify the automatic switch-off threshold for MixedDecay (default: 20%).

**Rated motor current (R37 [▶ 37])**

Here you can specify the rated motor current.  
The default is 3500 mA

**Maximum motor current (R36 [▶ 37])**

Here you can specify the maximum motor coil current.  
The default is 5000 mA

**Internal motor resistance (R40 [▶ 37])**

Here you can specify the internal motor resistance (default: 1 ohm).

**Kp factor (R42 [▶ 37])**

Here you can specify the Kp factor for the internal velocity control (default: 1).

**Inner window for I-controller (R43 [▶ 37])**

Here you can specify the Kp factor for the internal velocity control (default: 1%).  
The I-component of the velocity control is attenuated towards the zero point. This register specifies the value from which the attenuation is activated.

**Maximum value for I-controller (R44 [▶ 38])**

Here you can specify the maximum value for the I-component (default: 5%).



**Time constant Tn for I-controller (R45 [▶ 38])**

Here you can specify the time constant Tn (default: 100).  
The time constant controls the time response of the I-controller.

**Maximum torque (R38 [▶ 37])**

Here you can specify the maximum torque for the application (default: 10000), see description of register R2 [▶ 34].

If the current value (register R2) exceeds this threshold, only a warning is issued if torque monitoring [▶ 34] is disabled (SB1.5 [▶ 30]=1 and R0.13=1 [▶ 34]). If torque monitoring is active (R32.9 [▶ 36]=1), the motor is de-energized and an error is issued (SB1.6 [▶ 30]=1 and R0.13 [▶ 34]=1).

**User offset (R33 [▶ 36])**

You can specify the offset for the user-scaling here (default: 0).

**User gain (R34 [▶ 36])**

Here you can specify the user scaling gain (default: 1).

## 4.4 Register

You can access the registers of the KL2542 directly under *Register*. The meaning of the register is explained in the [register overview](#) [▶ 32].

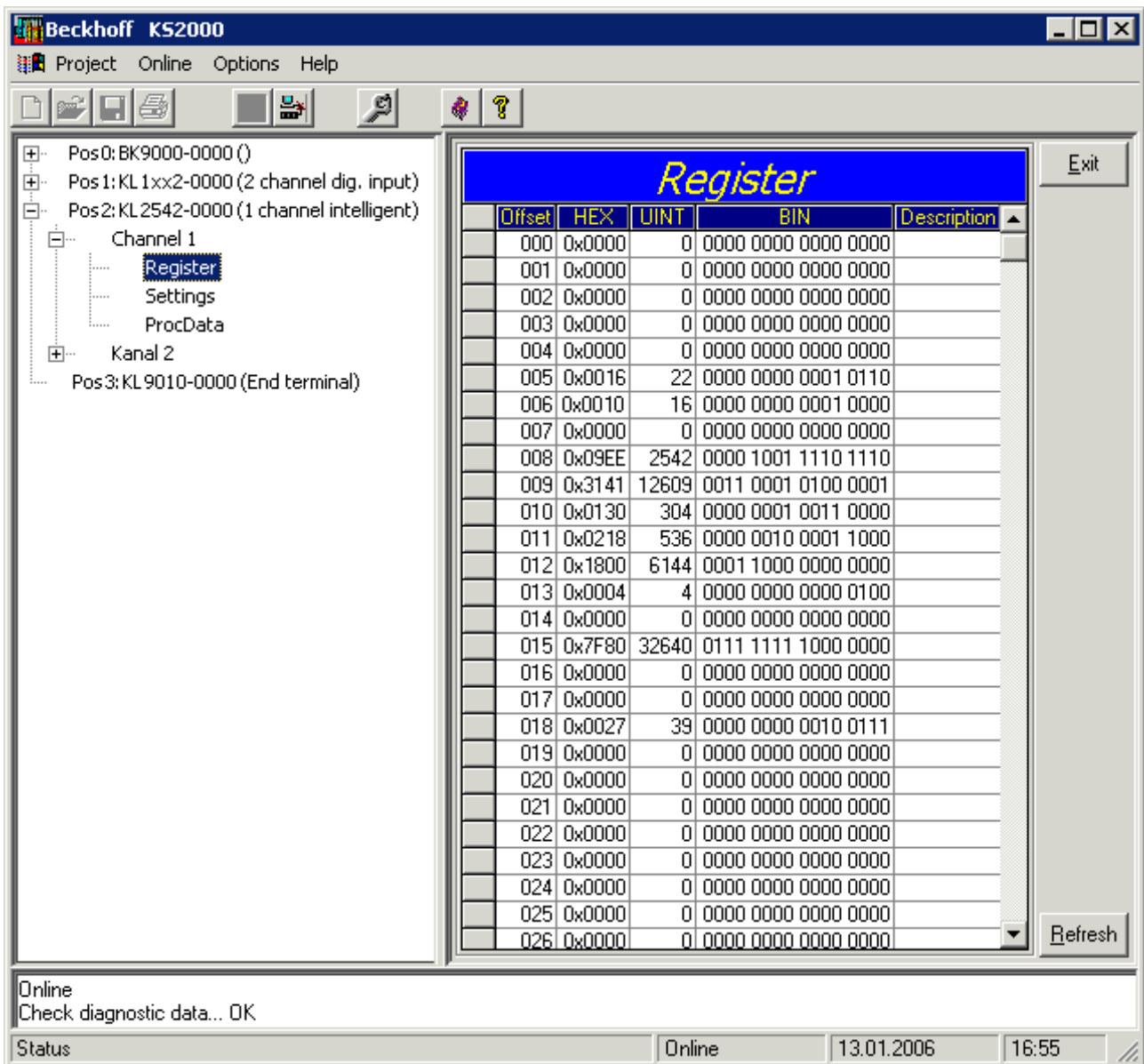


Fig. 16: Register view in KS2000

## 4.5 Process data

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

Pos	Type	I-Address	Value	Bitsize	O-Address	Value	Bitsize
2	KL2542-0000						
	Channel 1						
	Status	0.0	0x00	8			
	Data In	2.0	0x0000	16			
	Ctrl				0.0	0x00	8
	Data Out				2.0	0x0000	16
	Channel 2						
	Status	4.0	0x00	8			
	Data In	6.0	0x0000	16			
	Ctrl				4.0	0x00	8
	Data Out				6.0	0x0000	16

Fig. 17: ProcData

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

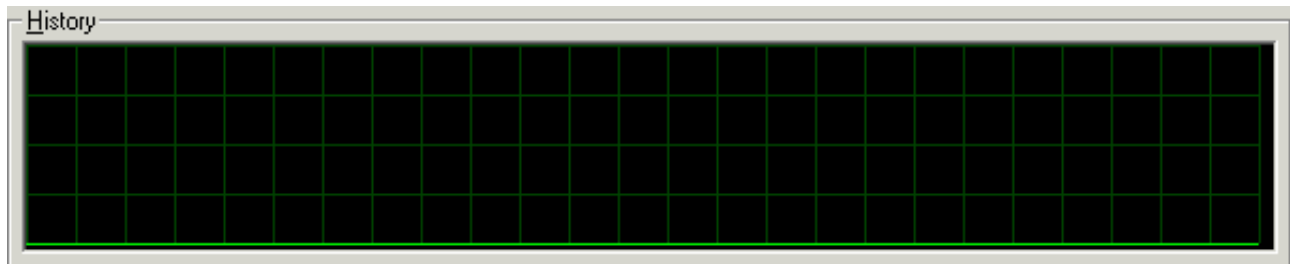


Fig. 18: History field

The current input values are displayed numerically in the *Value* field.

Fig. 19: Value field

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

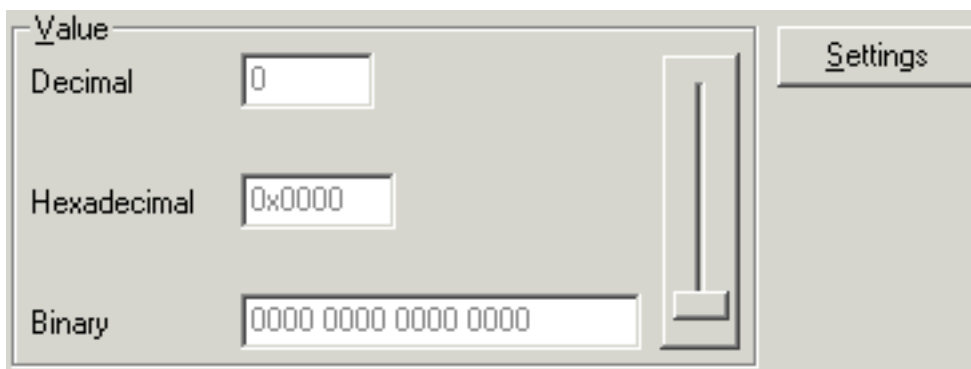


Fig. 20: Value field

**⚠ CAUTION**

**Danger for persons, the environment or devices!**

Note that changing initial values (forcing them) can have a direct effect on your automation application. Only modify these initial values if you are certain that the state of your equipment 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.

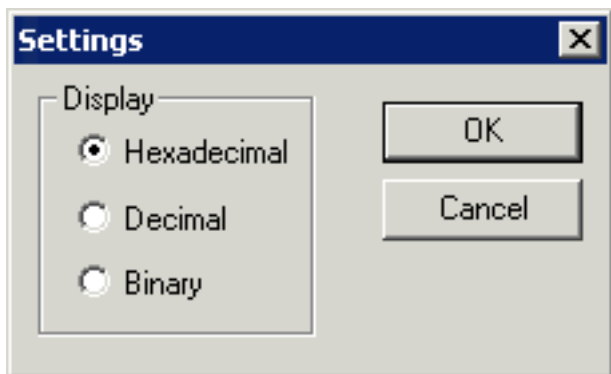


Fig. 21: Settings

## 5 Access from the user program

### 5.1 Process image

#### Complex mapping

In the complex process image the KL2542 is represented with at least 6 bytes of input data and 6 bytes of output data. These are organized as follows:

Byte offset (without word alignment)	Byte offset (with word alignment*)	Format	Input data	Output data
0	0	Byte	SB1 [►_30]:	CB1 [►_30]
1	2	Word	DataIN1	DataOUT1
3	4	Byte	SB2 [►_32]	CB2 [►_32]
4	6	Word	DataIN2	DataOUT2

#### Compact mapping

The KL2542 devices are represented in the compact process image with a minimum of 6 bytes of output data. These are organized as follows:

Byte offset (without word alignment)	Byte offset (with word alignment*)	Format	Input data	Output data
0	0	Byte	-	CB1 [►_30]
1	2	Word	-	DataOUT1
3	4	Byte	-	CB2 [►_32]
4	6	Word	-	DataOUT2

\*) Word alignment: The Bus Coupler places values on even byte addresses

#### Key

SB n: Status byte of channel n

CB n: Control byte of channel n

DataIN n: Input word of channel n

DataOUT n: Output word of channel n



#### Control-Bytes

The KL2542 cannot be operated without control bytes, since the control bytes are required for enabling the channels. Even if your Bus Coupler is set to compact process image, the KL2542 is represented with its control bytes.

## 5.2 Control and status byte

### Channel 1

#### Process data mode

#### Control byte 1 (for process data mode)

Control byte 1 (CB1) is located in the [output image \[► 29\]](#), and is transmitted from the controller to the terminal.

Bit	CB1.7	CB1.6	CB1.5	CB1.4	CB1.3	CB1.2	CB1.1	CB1.0
Name	RegAccess	Reset	Enable	GetLatchData	enLatch FallEdge	enLatch RiseEdge	SetPos	disMixed DecayMan

#### Key

Bit	Name	Description
CB1.7	RegAccess	0 <sub>bin</sub> Register communication off (process data mode)
CB1.6	Reset	1 <sub>bin</sub> all errors that may have occurred are reset by setting this bit (rising edge)
CB1.5	Enable	1 <sub>bin</sub> Enables channel 1
CB1.4	GetLatchData	0 <sub>bin</sub> Show the current position in the input process data
		1 <sub>bin</sub> Show the current latch value in the input process data
CB1.3	enLatch FallEdge	1 <sub>bin</sub> External latch event is enabled (for latch inputs with falling edge, the terminal saves the current position)
CB1.2	enLatch RiseEdge	1 <sub>bin</sub> External latch event is enabled (for latch inputs with rising edge, the terminal saves the current position) ATTENTION: Higher priority than CB1.3 !
CB1.1	SetPos	1 <sub>bin</sub> Position value is set with register R1 [► 34] (rising edge)
CB1.0	disMixed DecayMan	0 <sub>bin</sub> Motor control via 2 pulsed transistors per half-wave
		1 <sub>bin</sub> Motor control via one pulsed and one switched transistor per half-wave (manual deactivation. Automatic deactivation is triggered through a threshold that is specified with register R41 [► 37]).

#### Status byte 1 (for process data mode)

The status byte 1 (SB1) is located in the [input image \[► 29\]](#), and is transmitted from terminal to the controller.

Bit	SB1.7	SB1.6	SB1.5	SB1.4	SB1.3	SB1.2	SB1.1	SB1.0
Name	RegAccess	Error	Warning	Ready	LatchData	LatchValid	SetPos Ready	Input E1

**Key**

Bit	Name	Description	
SB1.7	RegAccess	0 <sub>bin</sub>	Acknowledgement for process data mode
SB1.6	Error	1 <sub>bin</sub>	An error has occurred (is displayed in the status word in register R0)
SB1.5	Warning	1 <sub>bin</sub>	The internal temperature exceeds 80 °C, the supply voltage has dropped, or the current torque [▶ 34] exceeds the value specified in register R38 [▶ 37] (with torque monitoring [▶ 36] switched off).
SB1.4	Ready	0 <sub>bin</sub>	Motor control is disabled or an error has occurred (SB.6=1)
		1 <sub>bin</sub>	Motor control is enabled and no error has occurred (acknowledgement for enable, SB.6=0)
SB1.3	LatchData	0 <sub>bin</sub>	The current position is mapped into the input process data
		1 <sub>bin</sub>	The most recent latch value is mapped into the input process data, provided a valid latch value exists (acknowledgement for GetLatchData)
SB1.2	LatchValid	1 <sub>bin</sub>	A latch event has occurred (with CB1.2=1 or CB1.3=1)
SB1.1	SetPos Ready	1 <sub>bin</sub>	The current position has been set (acknowledgement for SetPos)
SB1.0	Input E1	Status of input E1	

**Register communication**

**Control byte 1 (in register communication)**

Control byte 1 (CB1) is located in the output image [▶ 29], and is transmitted from the controller to the terminal.

Bit	CB1.7	CB1.6	CB1.5	CB1.4	CB1.3	CB1.2	CB1.1	CB1.0
<b>Name</b>	RegAccess	R/W	Reg. no.					

**Key**

Bit	Name	Description	
CB1.7	RegAccess	1 <sub>bin</sub>	Register communication switched on
CB1.6	R/W	0 <sub>bin</sub>	Read access
		1 <sub>bin</sub>	Write access
CB1.5 to CB1.0	Reg. no.	Register number: Enter the number of the <u>register</u> [▶ 29] that you - want to read with input data word <u>DataIn</u> [▶ 29] or - want to write with output data word <u>DataOut</u> [▶ 29].	

**Status byte 1 (in register communication)**

The status byte 1 (SB1) is located in the input image [▶ 29], and is transmitted from terminal to the controller.

Bit	SB1.7	SB1.6	SB1.5	SB1.4	SB1.3	SB1.2	SB1.1	SB1.0
<b>Name</b>	RegAccess	R/W	Reg. no.					

**Key**

Bit	Name	Description	
SB1.7	RegAccess	1 <sub>bin</sub>	Acknowledgement for register access
SB1.6	R	0 <sub>bin</sub>	Read access
SB1.5 to SB1.0	Reg. no.	Number of the register that was read or written.	

**Channel 2**

The control and status bytes of channel 2 (CB2 and SB2) have the same structure as the control and status bytes of [channel 1](#) [[▶ 30](#)].

**5.3 Register overview**

The registers are used to parameterize the DC motor output stages. They can be read or written by means of register communication.

Register no.	Comment	Default value		R/W	Memory
<a href="#">R0</a> [ <a href="#">▶ 34</a> ]	Status word	0x0000	0 <sub>dec</sub>	R	RAM
<a href="#">R1</a> [ <a href="#">▶ 34</a> ]	Set position	0x0000	0 <sub>dec</sub>	R/W	RAM
<a href="#">R2</a> [ <a href="#">▶ 34</a> ]	Torque	e.g. 0x015E	e.g. 350 <sub>dec</sub>	R	RAM
<a href="#">R3</a> [ <a href="#">▶ 35</a> ]	Supply voltage	e.g. 0x0030	e.g. 48 <sub>dec</sub>	R	RAM
R4	reserved	-	-	-	-
<a href="#">R5</a> [ <a href="#">▶ 35</a> ]	Temperature	e.g. 0x0023	e.g. 35 <sub>dec</sub>	R	RAM
<a href="#">R6</a> [ <a href="#">▶ 35</a> ]	Status byte	e.g. 0x0010	e.g. 16 <sub>dec</sub>	R	RAM
<a href="#">R7</a> [ <a href="#">▶ 35</a> ]	Command register	0x0000	0 <sub>dec</sub>	R/W	RAM
<a href="#">R8</a> [ <a href="#">▶ 35</a> ]	Terminal type	0x09EE	2542 <sub>dec</sub>	R	ROM
<a href="#">R9</a> [ <a href="#">▶ 35</a> ]	Firmware version	e.g. 0x3141	e.g. 1A <sub>ASCII</sub>	R	ROM
R10	Multiplex shift register	0x0130	304 <sub>dec</sub>	R	ROM
R11	Signal channels	0x0218	536 <sub>dec</sub>	R	ROM
R12	Minimum data length	0x1800	6144 <sub>dec</sub>	R	ROM
R13	Data structure	0x0004	4 <sub>dec</sub>	R	ROM
R14	reserved	-	-	-	-
R15	Alignment register	0x7F80	32640 <sub>dec</sub>	R/W	RAM
<a href="#">R16</a> [ <a href="#">▶ 36</a> ]	Hardware version number	e.g. 0x0000	e.g. 0 <sub>dec</sub>	R/W	EEPROM
R17	reserved	-	-	-	-
...	...	...	...	...	...
R30	reserved	-	-	-	-



Register no.	Comment	Default value		R/W	Memory
R31 [ <a href="#">▶</a> <a href="#">36</a> ]	Code word register	0x0000	0 <sub>dec</sub>	R/W	RAM
R32 [ <a href="#">▶</a> <a href="#">36</a> ]	Feature register	0x0000	0 <sub>dec</sub>	R/W	EEPROM
R33 [ <a href="#">▶</a> <a href="#">36</a> ]	User scaling - offset	0x0000	0 <sub>dec</sub>	R/W	EEPROM
R34 [ <a href="#">▶</a> <a href="#">36</a> ]	User scaling - gain	0x1000	4096 <sub>dec</sub>	R/W	EEPROM
R35 [ <a href="#">▶</a> <a href="#">37</a> ]	User's switch-on value	0x0000	0 <sub>dec</sub>	R/W	EEPROM
R36 [ <a href="#">▶</a> <a href="#">37</a> ]	Maximum coil current of the motor	0x1388	5000 <sub>dec</sub>	R/W	EEPROM
R37 [ <a href="#">▶</a> <a href="#">37</a> ]	Rated current of the motor	0x0DAC	3500 <sub>dec</sub>	R/W	EEPROM
R38 [ <a href="#">▶</a> <a href="#">37</a> ]	Maximum torque	0x2710	10000 <sub>dec</sub>	R/W	EEPROM
R39 [ <a href="#">▶</a> <a href="#">37</a> ]	Chopper voltage (channel 2 only)	0x0000	0 <sub>dec</sub>	R/W	EEPROM
R40 [ <a href="#">▶</a> <a href="#">37</a> ]	Internal resistance of the motor	0x0064	100 <sub>dec</sub>	R/W	EEPROM
R41 [ <a href="#">▶</a> <a href="#">37</a> ]	Automatic switch-off threshold for MixedDecay	0x0014	20 <sub>dec</sub>	R/W	EEPROM
R42 [ <a href="#">▶</a> <a href="#">37</a> ]	Kp factor	0x1000	4096 <sub>dec</sub>	R/W	EEPROM
R43 [ <a href="#">▶</a> <a href="#">37</a> ]	Inner window of the I component	0x0001	1 <sub>dec</sub>	R/W	EEPROM
R44 [ <a href="#">▶</a> <a href="#">38</a> ]	Maximum value of the I component	0x0005	5 <sub>dec</sub>	R/W	EEPROM
R45 [ <a href="#">▶</a> <a href="#">38</a> ]	Time constant Tn of the I component	0x0064	100 <sub>dec</sub>	R/W	EEPROM
R46 [ <a href="#">▶</a> <a href="#">38</a> ]	Time constant for deleting or limiting the maximum torque	0x01F4	500 <sub>dec</sub>	R/W	EEPROM
R47 [ <a href="#">▶</a> <a href="#">38</a> ]	Time constant for limiting the rated motor current	0x2710	10000 <sub>dec</sub>	R/W	EEPROM
R48	reserved				
...	...	...	...	...	...
R61	reserved				
R62 [ <a href="#">▶</a> <a href="#">38</a> ]	Internal parameters for current control	0x03E8	1000 <sub>dec</sub>	R/W	EEPROM
R63 [ <a href="#">▶</a> <a href="#">38</a> ]	Internal parameters for current control	0x0064	100 <sub>dec</sub>	R/W	EEPROM

## 5.4 Register description

All registers can be read or written via [register communication](#) [[▶ 39](#)]. They are used for the parameterization of the terminal.

### R0: Status word

The status word contains information about internal states, and provides an indication of errors that have occurred.

Bit	R0.15	R0.14	R0.13	R0.12	R0.11	R0.10	R0.9	R0.8
Name	-	NoControl Power	Torque Overload	Over Current	Under Voltage	Over Voltage	Low Voltage	Over Temperature

Bit	R0.7	R0.6	R0.5	R0.4	R0.3	R0.2	R0.1	R0.0
Name	-	-	-	-	-	-	-	-

### Key

Bit	Name	Description
R0.15	-	reserved
R0.14	NoControl Power	1 <sub>bin</sub> The 24 V control voltage is not present at the power contacts
R0.13	Torque Overload	1 <sub>bin</sub> Torque is greater than specified in R38
R0.12	Over Current	1 <sub>bin</sub> Overcurrent in the driver stage
R0.11	Under Voltage	1 <sub>bin</sub> Supply voltage less than 7 V
R0.10	Over Voltage	1 <sub>bin</sub> Supply voltage greater than 15% of the switch-on voltage (with R39=0) or greater than specified in R39 (with R39<>0)
R0.9	Low Voltage	1 <sub>bin</sub> The supply voltage is 10 V less than the switch-on voltage
R0.8	Over Temperature	1 <sub>bin</sub> The internal temperature of the terminal is greater than 80 °C (see <a href="#">R5</a> [ <a href="#">▶ 35</a> ])
R0.0 - R0.7	-	reserved

### R1: Set position

You can specify the desired position, with which the terminal is to be loaded, here.

### R2: Torque

This register always contains the last and maximum value of the previous milliseconds (register [R46](#) [[▶ 38](#)]) for the current torque. This value is unitless, normalized relative to 1000, and always positive. It is calculated as follows:

$$1.0 \quad M = | E \times 1000 / V_C |$$

where

$$1.1 \quad E = V_C - V_G$$

$$1.2 \quad V_C = V_S \times \text{DataOUT} / 32767$$

with

M	Torque (magnitude)	[M] = 1
E	Control error	[E] = 1 V
V <sub>S</sub>	Supply voltage	[V <sub>S</sub> ] = 1 V
V <sub>G</sub>	Countervoltage of the motor	[V <sub>G</sub> ] = 1 V
V <sub>C</sub>	Set velocity (set voltage, relative to the process data)	[V <sub>C</sub> ] = 1 V

**R3: Supply voltage**

Enables reading of the motor supply voltage. The unit is 1 mV (for example: 4800 = 48 V).

**R5: Temperature register**

The internal temperature of the terminal can be read, in °C, through register R6. The terminal will set bit SB.5 [30] in the status byte as a warning if the temperature exceeds the threshold of 80°C. When the temperature falls back below 60°C, bit SB.5 [30] will automatically be reset.

**R6: Status byte**

The status byte of the relevant channel is mapped here in addition.

**R7: Command register**



**User code word**

For the following commands to be executed, it is first necessary for the user code word, 0x1235, to be entered into register R31 [36].

**Command 0x7000: Restore Factory Settings**

Entering 0x7000 in register R7 restores the factory settings for the following registers of both channels:

R32 [ <u>36</u> ]: 0 <sub>dec</sub>	R40 [ <u>37</u> ]: 100 <sub>dec</sub>
R33 [ <u>36</u> ]: 0 <sub>dec</sub>	R41 [ <u>37</u> ]: 20 <sub>dec</sub>
R34 [ <u>36</u> ]: 4096 <sub>dec</sub>	R42 [ <u>37</u> ]: 4096 <sub>dec</sub>
R35 [ <u>37</u> ]: 0 <sub>dec</sub>	R43 [ <u>37</u> ]: 1 <sub>dec</sub>
R36 [ <u>37</u> ]: 5000 <sub>dec</sub>	R44 [ <u>38</u> ]: 5 <sub>dec</sub>
R37 [ <u>37</u> ]: 3500 <sub>dec</sub>	R45 [ <u>38</u> ]: 100 <sub>dec</sub>
R38 [ <u>37</u> ]: 10000 <sub>dec</sub>	R46 [ <u>38</u> ]: 500 <sub>dec</sub>
R39 [ <u>37</u> ]: 0 <sub>dec</sub>	R47 [ <u>38</u> ]: 10000 <sub>dec</sub>



**Restore Factory Settings**

The command **Restore Factory Settings** simultaneously resets both channels of the DC motor output stage terminal to the delivery state, irrespective of which register set it is called!

**Command 0x8000: Software Reset**

Entering 0x8000 in register R7 initiates a full software reset for the terminal. All internal variables (positions, latched values, errors, etc.) are cleared or are set to defined values that are read from the EEPROM. The internal circuits (D/A converter, output driver) are reinitialized during a software reset.

**⚠ CAUTION**

**Danger to persons and machines!**

During a software reset the motor is de-energized. Ensure that your system state permits this and that hazards for persons or machinery have been ruled out!

**R8: Terminal type**

The terminal name is contained in register R8:  
0x09EE (2542<sub>dec</sub>)

**R9: Firmware version**

Register R9 contains the ASCII coding of the terminal's firmware version, e.g. **0x3141 = '1A'**. The **'0x31'** corresponds here to the ASCII character **'1'**, while the **'0x41'** represents the ASCII character **'A'**. This value can not be changed.

**R16: Hardware version number**

Register R16 contains the hardware version of the terminal.

**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. The code word is reset if the terminal is restarted.

**R32: Feature register**

The feature register specifies the terminal's configuration.

Bit	R32.15	R32.14	R32.13	R32.12	R32.11	R32.10	R32.9	R32.8
<b>Name</b>	disVelocity Controller	disIPart	disIWindow	-	-	enChopper	enTorque Error	enUser StartValue

Bit	R32.7	R32.6	R32.5	R32.4	R32.3	R32.2	R32.1	R32.0
<b>Name</b>	-	-	-	-	enAverage Notation	disWatchdog	enManu Scale	enUser Scale

**Key**

Bit	Name	Description	default
R32.15	disVelocity Controller	1 <sub>bin</sub> Velocity control is deactivated (proportional and integral component), see <a href="#">R42 [▶ 37]</a>	0 <sub>bin</sub>
R32.14	disIPart	1 <sub>bin</sub> I component of the velocity control is deactivated (see <a href="#">R44 [▶ 38]</a> + <a href="#">R45 [▶ 38]</a> )	0 <sub>bin</sub>
R32.13	disIWindow	1 <sub>bin</sub> Inner window of the I component is deactivated (see <a href="#">R43 [▶ 37]</a> )	0 <sub>bin</sub>
R32.11 - R32.12	-	reserved	
R32.10	enChopper	1 <sub>bin</sub> Chopper resistor is active (overvoltage protection, channel 2 only, see <a href="#">R39 [▶ 37]</a> )	0 <sub>bin</sub>
R32.9	enTorque Error	1 <sub>bin</sub> Torque cutoff active (see <a href="#">R38 [▶ 37]</a> )	0 <sub>bin</sub>
R32.8	enUser StartValue	1 <sub>bin</sub> User switch-on value active (see <a href="#">R35 [▶ 37]</a> )	0 <sub>bin</sub>
R32.4 - R32.7	-	reserved	
R32.3	enAverage Notation	1 <sub>bin</sub> Signed amount representation active	0 <sub>bin</sub>
R32.2	disWatchdog	1 <sub>bin</sub> Internal 100 ms watchdog deactivated	0 <sub>bin</sub>
R32.1	enManuScale	1 <sub>bin</sub> Manufacturer scaling is active	0 <sub>bin</sub>
R32.0	enUserScale	1 <sub>bin</sub> User scaling active (see <a href="#">R33 [▶ 36]</a> + <a href="#">R34 [▶ 36]</a> )	0 <sub>bin</sub>

**R33: User scaling - offset**

Here you can enter the user scaling offset, if user scaling is enabled ([R32.0 \[▶ 36\]](#)=1) (default: 0x0000).  
Examples:

<b>hex</b>	...	0xFFFFD	0xFFFFE	0xFFFFF	<b>0x0000</b>	0x0001	0x0002	...
<b>Offset</b>	...	-3	-2	-1	<b>0</b>	1	2	...

**R34: User scaling - gain**

Here you can enter the user scaling gain, if user scaling is activated ([R32.0 \[▶ 36\]](#)=1) is (default 4096<sub>dec</sub>).  
Examples:

<b>hex</b>	0x0001	0x0800	0x0FFF	<b>0x1000</b>	0x1001	0x1800	0x2000	0xFFFF
<b>dec</b>	1 <sub>dec</sub>	2048 <sub>dec</sub>	4095 <sub>dec</sub>	<b>4096</b> <sub>dec</sub>	4097 <sub>dec</sub>	6144 <sub>dec</sub>	8192 <sub>dec</sub>	65535 <sub>dec</sub>
<b>Offset</b>	0.0002	0.5	0.0098	<b>1</b>	1.0002	1.5	2	15.9998

**R35: User's switch-on value**

If the activated watchdog ([R32.2 \[▶ 36\]](#) = 0<sub>bin</sub>) is triggered after 100 ms due to a fieldbus or Terminal Bus error, this value becomes the output value.

**R36: Maximum coil current of the motor**

This register specifies the maximum coil current of the motor. The unit is 1 mA (example: 1500<sub>dec</sub> = 1.5 A). 5000 mA max.

**R37: Rated current of the motor**

This register specifies the rated current of the motor. The unit is 1 mA (example: 1,000<sub>dec</sub> = 1.0 A). 3500 mA max.

**R38: Maximum torque**

This register is used for configuring the maximum permitted torque for the application (default: 10000<sub>dec</sub>), see register description [R2 \[▶ 34\]](#)

If the current value (register [R2 \[▶ 34\]](#)) exceeds this threshold, with [R32.9 \[▶ 36\]](#)=0 only a warning is issued ([SB1.5 \[▶ 30\]](#)=1 and [R0.13 \[▶ 34\]](#)=1). If torque cutoff is active ([R32.9 \[▶ 36\]](#)=1), the motor is de-energized and an error is issued ([SB1.6 \[▶ 30\]](#)=1 and [R0.13 \[▶ 34\]](#)=1).

**R39: Chopper voltage (channel 2 only)**

If the supply voltage increases above the set chopper voltage due to feedback, the second channel (chopper resistor must be connected) is fully opened and the overvoltage reduced, provided the chopper function is activated ([R32.10 \[▶ 36\]](#)=1).

**R40: Internal resistance of the motor**

This register contains the internal resistance of the motor (default: 100<sub>dec</sub>). The unit is 0.01 ohm (example: 100<sub>dec</sub> = 1.00 ohm).

**R41: Automatic switch-off threshold for MixedDecay**

MixedDecay: To avoid motor resonances at low speed, the motor is controlled via two pulsed transistors per half-wave.

This register contains the threshold at which the MixedDecay function of the motor controller chip is automatically deactivated (default: 20<sub>dec</sub>). The unit is 1% (example: 20 = 20%).

**R42: Kp factor**

This register contains the Kp factor of the internal velocity control (default: 4096<sub>dec</sub>). The unit is 1 / 4096 (example: 4096<sub>dec</sub> => Kp = 1.00).

**R43: Inner window of the I component**

The I-component of the velocity control is reduced towards zero (default: 1<sub>dec</sub>). This register specifies the value from which the attenuation is activated. The unit is 1% (example: 1 = 1%).

**R44: Maximum value of the I component**

This register specifies the maximum value of the I-component (default: 5<sub>dec</sub>).  
The unit is 1% (example: 5<sub>dec</sub> = 5%).

**R45: Time constant Tn of the I component**

This register controls the dynamic response of the I-controller (default: 100<sub>dec</sub>).  
The unit is 1 (example: 100<sub>dec</sub> = 100).

**R46: Time constant for deleting or limiting the maximum torque**

The maximum torque is stored in register [R2 \[► 34\]](#) for the time set in this register (default: 500<sub>dec</sub>).

The unit is 1 ms (example: 500 = 0.5 s).

The saved torque is then deleted and overwritten with the next larger value.

If torque cutoff is active, the motor is de-energized if the current torque for this time is greater than the value set in register [R38 \[► 37\]](#).

**R47: Time constant for limiting the rated motor current**

The terminal energizes a connected motor with increasing mechanical load up to the current set in register [R36 \[► 37\]](#). If this mechanical load is maintained, the motor current is reduced to the rated current via a 1/T function after this set time (default: 10,000<sub>dec</sub>).

The unit is 1 ms (example: 10000 = 10 s).

**R62, R63: Internal parameters for current control**

These registers are used internally by the terminal for current control and must not be modified!

## 5.5 Examples of Register Communication

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

### 5.5.1 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 <sub>bin</sub> )	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<sub>bin</sub>.
- 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.

### 5.5.2 Example 2: Writing to a user register

#### **i** 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 <sub>bin</sub> )	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<sub>bin</sub>.

- 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 <sub>bin</sub> )	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 <sub>bin</sub> )	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<sub>bin</sub>.
- 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 <sub>bin</sub> )	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 <sub>bin</sub> )	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<sub>bin</sub>.
- 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 <sub>bin</sub> )	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 <sub>bin</sub> )	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<sub>bin</sub>.
- 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 <sub>bin</sub> )	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 <sub>bin</sub> )	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<sub>bin</sub>.
- 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 <sub>bin</sub> )	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!

## 6 Appendix

### 6.1 Support and Service

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

#### Beckhoff's branch offices and representatives

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

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages: <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  
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e-mail: [support@beckhoff.com](mailto:support@beckhoff.com)

#### Beckhoff Service

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

- on-site service
- repair service
- spare parts service
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## Table of figures

Fig. 1	KL2542 .....	8
Fig. 2	KL2542 - LED displays .....	10
Fig. 3	Spring contacts of the Beckhoff I/O components.....	11
Fig. 4	Attaching on mounting rail .....	12
Fig. 5	Disassembling of terminal.....	13
Fig. 6	Power contact on left side.....	14
Fig. 7	Standard wiring.....	15
Fig. 8	Pluggable wiring .....	15
Fig. 9	High Density Terminals.....	16
Fig. 10	Connecting a cable on a terminal point .....	17
Fig. 11	KL2542 - Contact assignment .....	18
Fig. 12	KS2000 configuration software.....	20
Fig. 13	Display of the fieldbus station in KS2000 .....	22
Fig. 14	KS2000 branch for channel 1 of the KL2542.....	22
Fig. 15	Settings via KS2000 .....	23
Fig. 16	Register view in KS2000.....	26
Fig. 17	ProcData.....	27
Fig. 18	History field .....	27
Fig. 19	Value field .....	27
Fig. 20	Value field.....	28
Fig. 21	Settings.....	28



More Information:  
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