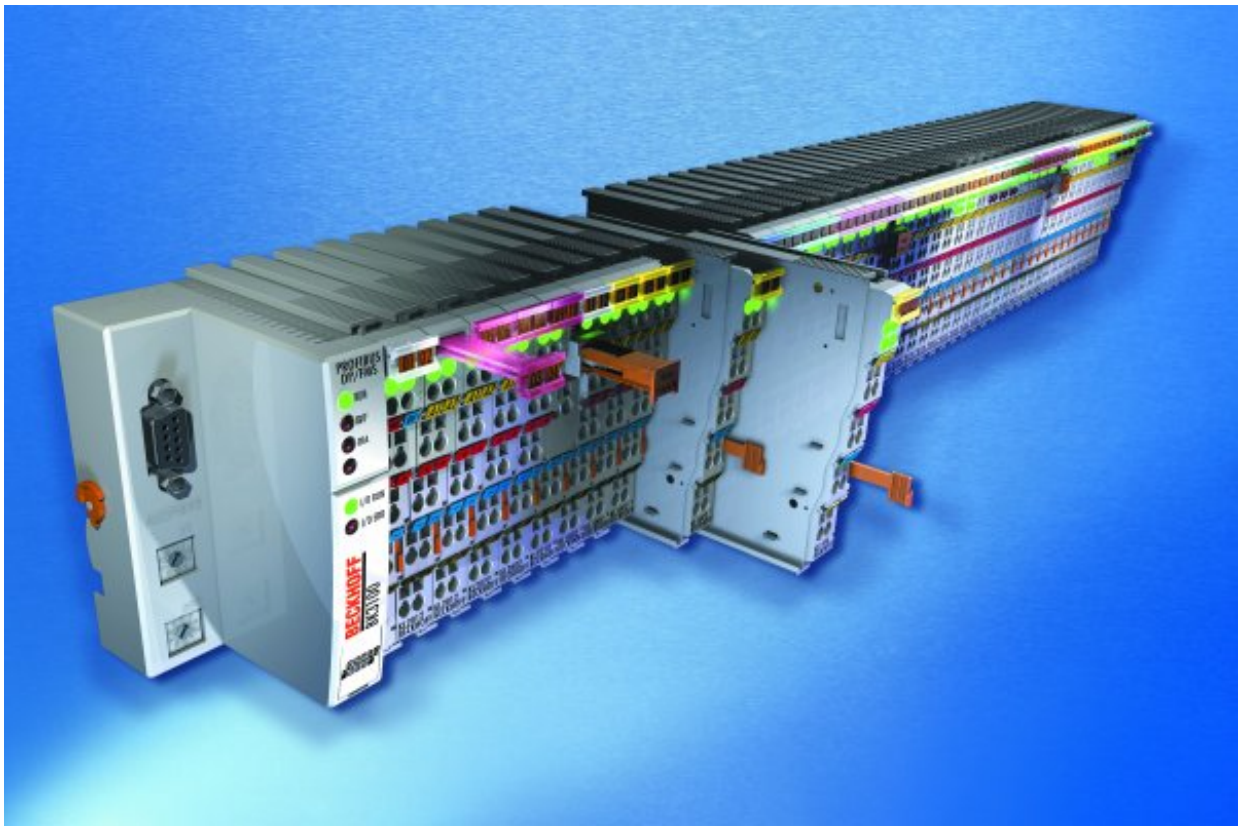

**Documentation for**

# KL5101-0000

## Interface Terminal for Incremental Encoder

**Version:** 2.4
**Date:** 2015-07-22

BECKHOFF

# Table of Contents

# 1 Foreword

## 1.1 Notes on the documentation

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 following notes and explanations are followed when installing and commissioning these components.
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.

### 1.1.1 Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development. For that reason the documentation is not in every case checked for consistency with performance data, standards or other characteristics. In the event that it contains technical or editorial errors, we retain the right to make alterations at any time and without warning. 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.

### 1.1.2 Delivery conditions

In addition, the general delivery conditions of the company Beckhoff Automation GmbH & Co. KG apply.

### 1.1.3 Trademarks

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### 1.1.4 Patent Pending

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

### 1.1.5 Copyright

# 1.2 Safety Instructions

## 1.2.1 State at Delivery

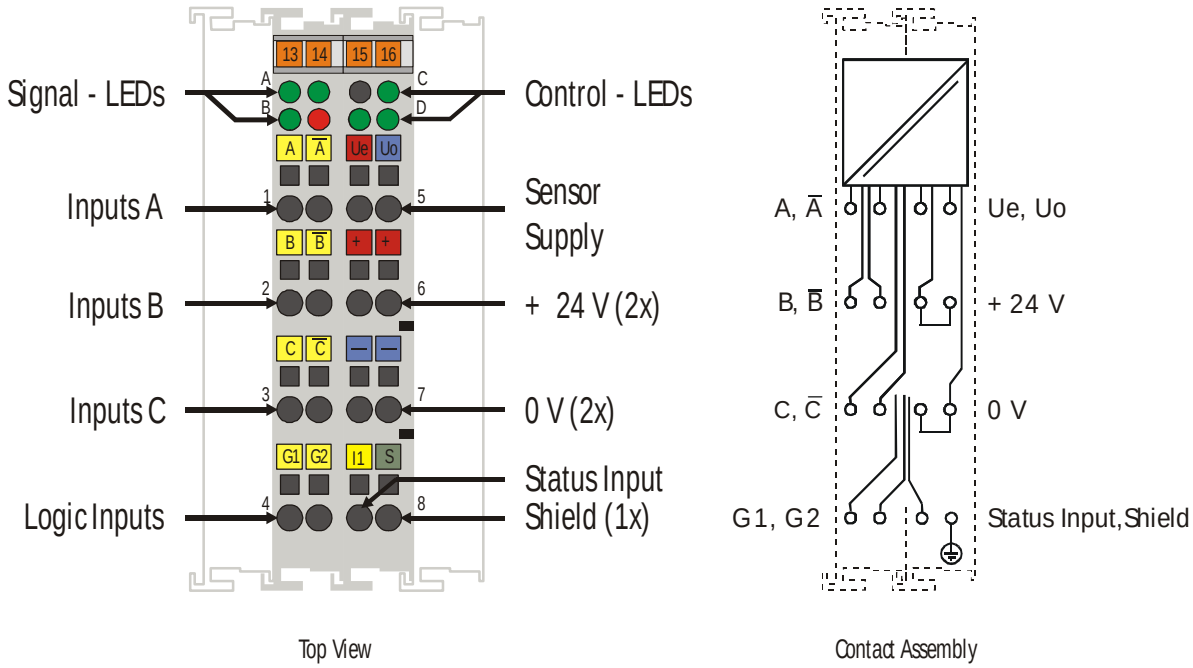
All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

## 1.2.2 Description of safety symbols

The following safety symbols are used in this documentation. They are intended to alert the reader to the associated safety instructions.

| | |
|---|---|
|  **DANGER** | **Serious risk of injury!**<br><br>**Failure** to follow the safety instructions associated with this symbol directly endangers the life and health of persons. |
|  **WARNING** | **Caution - Risk of injury!**<br><br>**Failure** to follow the safety instructions associated with this symbol endangers the life and health of persons. |
|  **CAUTION** | **Personal injuries!**<br><br>**Failure** to follow the safety instructions associated with this symbol can lead to injuries to persons. |
|  **Attention** | **Damage to the environment or devices**<br><br>**Failure** to follow the instructions associated with this symbol can lead to damage to the environment or equipment. |
|  **Note** | **Tip or pointer**<br><br>This symbol indicates information that contributes to better understanding. |

# 2 Product overview




Top View Contact Assembly

## 2.1 Technical data

| Technical data | | KL5101-0000 |
|---|---|---|
| Sensor connection | | A, A(inv), B, B(inv), zero, zero(inv), difference signal (RS 485); Status input |
| Sensor operating voltage | | 5 V DC |
| Sensor output current | | 0.5 A |
| Counter | | 16 bits binary |
| Cut off frequency | | 1 MHz (at 4 time evaluation) |
| Quadrature decoder | | 1-2-4 time evaluation |
| Zero pulse latch | | 16 bits |
| Commands | | read, set, activate |
| Supply voltage | | 24 V DC (20 V ... 29 V) |
| Current consumption from power contacts | | 0.1 A (without sensor load current) |
| Bit width in the process image | | I/O: 2 x 16 bits data, 1 x 8 bits control/status |
| Current consumption from K-Bus | | 25 mA |
| Weight approx.. | | 85 g |
| Permissible ambient temperature range | during operation | -25°C ... +60°C<br>0°C ... +55°C (according to cULus for Canada and USA)<br>0°C ... +55°C (according to ATEX, see special conditions) |
| | during storage | -40°C ... +85°C |
| Relative humidity | | 95%, no condensation |
| Vibration/shock resistance | | conforms to EN 60068-2-6 / EN 60068-2-27 |
| EMC resistance Burst / ESD | | conforms to EN 61000-6-2 / EN 61000-6-4 |
| Installation position | | any |
| Type of protection | | IP20 |
| Approvals | | CE, cULus, ATEX |

## 2.2 Functional description

The incremental encoder interface terminal KL5101 enables the connection of any incremental encoders to the bus coupler or the PLC. A 16-bit counter with a quadrature decoder and a 16-bit latch can be read, set or activated. Besides the decoder inputs A, B, C, an additional latch input G1 (24 V) and a gate input G2 (24 V) for disabling the counter are available.

The 16-bit up / down counter mode can also be selected. In this mode of operation, input B is the counting input.

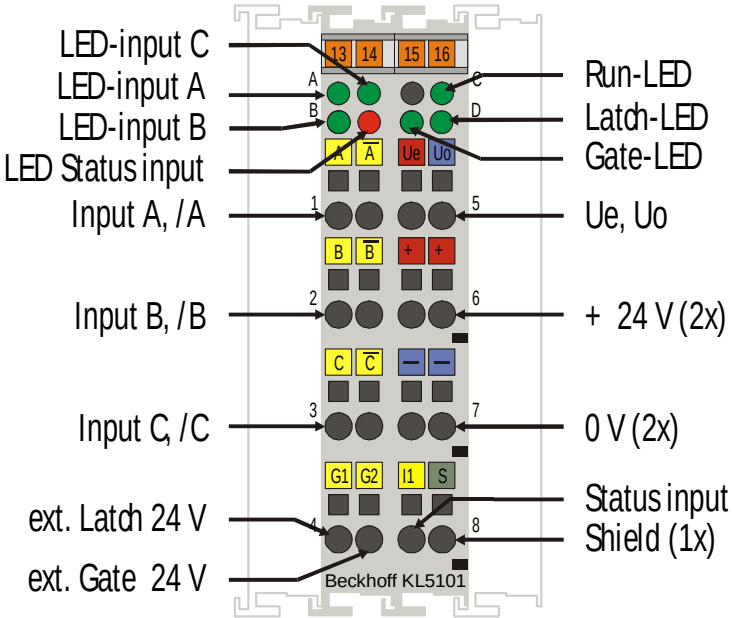
1-fold, 2-fold or 4-fold evaluation of the encoder signals A, B, C in simple or complementary form can be parameterized via the field bus.

The terminal is supplied as a 4-fold quadrature decoder with complementary evaluation of the encoder signals A, B, C. For operation of the encoder interface, the operating voltage of 24 V DC must be connected to the terminal contacts in addition to the encoder inputs.

Starting from hardware state 03 (beginning from 6.18.98) the KL5101 has new, additional features:
Incremental encoder with fault alarm outputs can be connected to the Status input of the KL5101.

A period measurement with a resolution of 200 ns can also be performed.

Assignments of terminal contacts




**Inputs A, /A**
Pulse input in the terminal's encoder and counter mode.

**Inputs B, /B**
Phase-shifted pulse input in the terminal's encoder mode.

Counting direction input in the terminal's counter mode.
Counting direction:
+ 5 V (or open contact): up
0 V: down

**Inputs C, /C**
Zero point pulse input for the terminal's latch register.
This input is activated via the EN_LATC bit in the terminal's control byte.

**External Latch 24 V**
Additional latch input of the terminal.
This input is activated via the EN_LAT_EXT bit in the terminal's control byte.

The counter value is latched when this input is alerted and an edge change takes place from 0 V to 24 V.

**External Gate 24 V**
A high level at this contact suppresses counting by the terminal.

**Status Input 5 V**
Incremental encoder with fault alarm outputs can be connected to the Status input of the KL5101.

**Ue**
Voltage supply for the encoder (+5 V).
**Uo**
Voltage supply for the encoder (0 V).

**0 V, 24 V**
A supply of 0 V and 24 V voltage must be applied to these contacts for operation of the terminal.

Operating modes

These can be set via the feature register (default: incremental encoder):

A, B, zero pulse incremental encoder (default)

Up/down counter with:
- A = Count , the positive edges of the input pulses are counted
- B = Up/down input
  B = 0: up counting direction
  B = 1: down counting direction
- C = Gate input
  C = 0: counter enabled
  C = 1: counter disabled

Functions

- Counting
- Counter setting
- Arming the zero pulse and storing the valid value
- Determining the period between two pulses with a resolution of two 200 ns (the time between two positive edges of the input signal A is evaluated)
- Indication of a counter overflow or underflow.

LED display

The signal LEDs indicate the status of the encoder inputs A, B, C, Status input and of the logic inputs of the gate and of the additional external latch. The RUN LED indicates cyclic data transfer with the higher-level controller. The RUN LED goes off if no process data is exchanged for 100 ms.

Process data

The KL5101 always occupies 6 bytes of input data and 6 bytes of output data. The control / status byte is at the least significant byte offset.

The data word D0/D1 contains the counter value (read/set) and the data word D3/D4 contains the latch word (read).

In the period measurement mode the value can be found in D2 together with D3 and D4.

# 3 Terminal configuration

## 3.1 Register overview

The terminal can be configured and parameterized via the internal register structure.

| Address | Description | Default value | R/W | Storage medium |
|---|---|---|---|---|
| **R0** | reserved | 0x0000 | R | |
| **...** | ... | ... | ... | ... |
| **R5** | reserved | 0x0000 | R | |
| **R6** | Diagnostic register – not used | 0x0000 | R | |
| **R7** | Command register - not used | 0x0000 | R | |
| **R8** | Terminal type | 5101 | R | ROM |
| **R9** | Software version number | 0x???? | R | ROM |
| **R10** | Multiplex shift register | 0x0218/0130 | R | ROM |
| **R11** | Signal channels | 0x0130 | R | ROM |
| **R12** | Minimum data length | 0x3030 | R | ROM |
| **R13** | Data structure | 0x0000 | R | ROM |
| **R14** | reserved | 0x0000 | R | |
| **R15** | Alignment register | variable | R/W | RAM |
| **R16** | Hardware version number | 0x???? | R/W | SEEROM |
| **R17** | reserved | 0x0000 | R/W | SEEROM |
| **...** | ... | ... | ... | ... |
| **R31** | Code word register | variable | R/W | RAM |
| **R32** | Feature register | 0x2200 | R/W | SEEROM |
| **R33** | reserved | 0x0000 | R/W | SEEROM |
| **...** | ... | ... | ... | ... |
| **R61** | reserved | 0x0000 | R/W | SEEROM |

# 3.2 Register description

The complex terminals can be adjusted to different operating modes or functionalities. The " general description of register " describes the contents of the registers, which are identical for all complex terminals.

The terminal-specific registers are explained in the section following to it.

The access to the internal registers of the terminal is described in the section " register communication ".

## 3.2.1 General register description

Complex terminals that possess a processor are capable of bidirectionally ex-changing data with the higher-level control system. Below, these terminals are referred to as intelligent bus terminals. They include the analog inputs (0-10V, -10-10V, 0-20mA, 4-20mA), the analog outputs (0-10V, -10-10V, 0-20mA, 4-20mA), serial interface terminals (RS485, RS232, TTY, data transfer terminals), counter terminals, encoder interfaces, SSI interfaces, PWM terminals and all other parameterizable terminals.

Internally, all intelligent terminals possess a data structure that is identical in terms of it's essential characteristics. This data area is organized in words and embraces 64 memory locations. The essential data and parameters of the terminal can be read and adjusted by way of the structure. Function calls with corresponding parameters are also possible. Each logical channel of an intelligent terminal has such a structure (therefore, 4-channel analog terminals have 4 register sets.

This structure is broken down into the following areas:
(You will find a list of all registers at the register overview).

| Area | Address |
|---|---|
| **Process variables** | 0-7 |
| **Type registers** | 8-15 |
| **Manufacturer parameters** | 16-30 |
| **User parameters** | 31-47 |
| **Extended user area** | 48-63 |

Process variables

**R0 - R7: Registers in the terminal’s internal RAM:**
The process variables can be used in additional to the actual process image and their functions are specific to the terminal.

**R0 - R5: These registers have a function that depends on the terminal type.**

**R6: Diagnostic register**
The diagnostic register may contain additional diagnostic information. In the case of serial interface terminals, for example, parity errors that have occurred during data transfer are indicated.

**R7: Command register**
High-Byte_Write = function parameter
Low-Byte_Write = function number
High-Byte_Read = function result
Low-Byte_Read = function number

Type registers

**R8 - R15 Registers in the terminal's internal ROM**
The type and system parameters are programmed permanently by the manufacturer and can only be read by the user but cannot be modified.

**R8: Terminal type:**
The terminal type in register R8 is needed to identify the terminal.

**R9: Software version X.y**
The software version can be read as an ASCII character string.

**R10: Data length**
R10 contains the number of multiplexed shift registers and their length in bits.
The bus coupler sees this structure.

**R11: Signal channels**
In comparison with R10, the number of logically existing channels is located here. For example, one physically existing shift register may consist of several signal channels.

**R12: Minimum data length**
The respective byte contains the minimum data length of a channel to be transferred. If the MSB is set, then the control/status byte is not necessarily needed for the function of the terminal and, with appropriate configuration of the coupler, is not transferred to the control system.
3.2.1.1

**R13: Data type register**

| Data type register | |
|---|---|
| **0x00** | Terminal without valid data type |
| **0x01** | Byte array |
| **0x02** | 1 byte n bytes structure |
| **0x03** | Word array |
| **0x04** | 1 byte n words structure |
| **0x05** | Double word array |
| **0x06** | 1 byte n double words structure |
| **0x07** | 1 byte 1 double word structure |
| **0x08** | 1 byte 1 double word structure |
| **0x11** | Byte-array with a variable logical channel length |
| **0x12** | 1 byte n bytes structure with a variable logical channel length (eg 60xx) |
| **0x13** | Word-array with a variable logical channel length |
| **0x14** | 1 byte n words structure with a variable logical channel length |
| **0x15** | Double word array with a variable logical channel length |
| **0x16** | 1 byte n double words structure with a variable logical channel length |

**R14: reserved**

**R15: Alignment bits (RAM)**
The analog terminal is set to a byte limit in the terminal bus with the alignment bits.

Manufacturer parameters

**R16 - R30 is the area of the "Manufacturer parameters" (SEEROM)**
The manufacturer parameters are specific to each terminal type. They are programmed by the manufacturer but can also be modified from the control system. The manufacturer parameters are stored permanently in a serial EEPROM and are therefore not destroyed by power failures.
These registers can only be modified after setting a code word in R31.

User parameters

**R31 - R47 "Application parameters" area (SEEROM)**
The application parameters are specific to each terminal type. They can be modified by the programmer. The application parameters are stored permanently in a serial EEPROM in the terminal and cannot be destroyed by power failures. The user area is write protected over a Codeword.

**Note**

**R31: Code word-register in the RAM**
The code word **0x1235** must be entered here to enable modification of parameters in the user area. Write-protection is set if a different value is entered in this register. When write protection is inactive, the code word is returned during reading of the register. The register contains the value zero when write protection is active.

**R32: Feature-register**
This register defines the operating modes of the terminal. For example, a user-specific scaling can be activated for the analog I/O's.

**R33 - R47**
Registers that depend on the terminal type

Extended application area

**R47 - R63**
These registers have not yet been implemented.

### 3.2.2 Terminal-specific register description

Application parameters

**R32: Feature register:**
[0x2200]
The feature register determines the operating modes of the terminal.

| Feature Bit No. | | Mode description |
|---|---|---|
| **Bit 0** | 0 | reserved, don't change |
| **Bit 1** | 0/1 | 0: Counter inhibit with high-level at Gate input [0]<br>1: Counter inhibit with low-level at Gate-input |
| **Bit 3, Bit 2** | 0 0 | Status input (active-low) is mapped into the status-byte.5 (ST.5) [00] |
| | 0 1 | reserved |
| | 1 0 | ST.5 = Status input, ST.6 = Status input |
| | 1 1 | ST.5 = Status input, ST.6 = !Status input |
| **Bit 6 - Bit 4** | 0 0 0 | External Latch function active [000] |
| | 0 0 1 | Period measurement active |
| | 0 1 0<br>...<br>1 1 1 | reserved |
| **Bit 7 - 9** | 0 | reserved, don't change |
| **Bit 11, Bit 10** | 0 0 | 4-fold evaluation of the encoder signals A,B,C,<br>i.e. both rising and falling edges of the encoder signals A, B are counted. [00] |
| | 0 1 | 1-fold evaluation of the encoder signals A, B, C.<br>i.e. every period of the encoder signal A is counted. |
| | 1 0 | 2-fold evaluation of the encoder signals A, B, C,<br>i.e. every edge of the encoder signal A is counted. |
| | 1 1 | 4-fold evaluation of the encoder signals A, B, C |
| **Bit 14 - 12** | 0 | reserved, don't change |
| **Bit 15** | 0/1 | 0: Encoder interface. [0]<br>1: Counter mode is activated.<br>16-bit up/down counter<br>Input A: Counter<br>Input B: Counting direction (5 V or open = up, 0 V = down)<br>Input C: Latch |

# 3.3 Control-/Status-Byte

## 3.3.1 Control byte in process transfer

The control byte is transferred from the controller to the terminal. It can be used in the register mode (REG = 1) or in process data transfer (REG = 0). Various actions are triggered in the the KL5101 with the control byte:

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Name | REG=0 | - | - | - | En_Latch_Ext_n | Cnt_Set | EN_LAT_EXT / RD_PERIOD | EN_LATC |

| Bit | Bit | Function |
|---|---|---|
| 3 | **En_Latch_Ext_n** | The external latch input is activated for negative edge. With the first external latch impulse after validity of the EN_Latch_Ext_n bit, the counter value in the latch register is stored. The pulses that follow have no influence on the latch register when the bit is set. Attention must be paid to ensuring that the corresponding latch valid bit (Latch_Ext_Val) has been removed from the terminal before alerting of the zero pulse. This functionality is adjustable in the feature register (default). |
| 2 | **Cnt_Set** | The counter is set to the value that is specified via the process data with the rising edge of Cnt_Set. |
| 1 | **En_Latch_Ext** | The external latch input is activated for positive edge. With the first external latch impulse after validity of the En_Latch_Ext bit, the counter value in the latch register is stored. The pulses that follow have no influence on the latch register when the bit is set. Attention must be paid to ensuring that the corresponding latch valid bit (Latch_Ext_Val) has been removed from the terminal before alerting of the zero pulse. This functionality is adjustable in the feature register (default). |
| | **RD_Period** | The periods between two positive edges of the input A are measured with a resolution of 200 ns. When the bit is set, this period is output in the data bytes D2, D3, D4. This functionality is adjustable in the feature register. |
| 0 | **En_Latch** | The zero point latch (C input) is activated. The counter value is stored in the latch register with the first external latch pulse after validity of the En_Latch bit (this has priority over En_Latch_Ext). The pulses that follow have no influence on the latch register when the bit is set. Attention must be paid to ensuring that the corresponding latch valid bit (Latch_Val) has been removed from the terminal before the zero pulse is alerted (the Latch_Val bit cannot be removed from the terminal until the C pulse has a low level). |

**Note**

For the external latch input:
The activation of the positive edge (En_Latch_Ext = 1) has priority to the activation of the negative edge (En_Latch_Ext_n = 1).

### 3.3.2 Status byte in process data transfer

The status byte is transferred from the terminal to the controller. The status byte contains various status bits of the KL5101.

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Name | REG=0 | - | State_Input | Overflow | Underflow | CntSet_Acc | Latch_Ext_Val/ RD_Period_Q | Latch_Val |

| Bit | Name | |
|---|---|---|
| 5 | **State_Input** | The state of the Status input is mapped in this Bit (adjustable via feature register) |
| 4 | **Overflow** | This bit is set if an overflow (65535 to 0) of the 16-bit counter occurs. It is reset when the counter exceeds a third of the measurement range (21845 to 21846) or as soon as an underflow occurs. |
| 3 | **Underflow** | This bit is set if an underflow (0 to 65535) of the 16-bit counter occurs. It is reset when the counter drops below two thirds of the measurement range (43690 to 43689) or as soon as an overflow occurs. |
| 2 | **CntSet_Acc** | The data for setting the counter has been accepted by the terminal. |
| 1 | **RD_Period_Q** | The data bytes 2, 3, 4 contain the period time |
| | **Latch_Ext_Val** | An external latch pulse has occurred. The data D2,D3 in the process image corresponds to the latched value when the bit is set. To activate the latch input again, En_Latch_Ext must first be removed and then set again. |
| 0 | **Latch_Val** | A zero point latch has occurred. The data D2, D3 in the process image corresponds to the latched value when the bit is set. To activate the latch input again, En_Latch must first be removed and then set again. |

# 3.4 Register communication

Register access via process data transfer Bit 7=1: register mode

When bit 7 of the control byte is set, the first two bytes of the user data are not used for process data transfer, but are written into or read out of the terminal's register.

Bit 6=0: read
Bit 6=1: write

In bit 6 of the control byte, you define whether a register is to be read or written. When bit 6 is not set, a register is read without modification. The value can be taken from the input process image.

When bit 6 is set, the user data is written into a register. The operation is concluded as soon as the status byte in the input process image has supplied an acknowledgement (see examples).

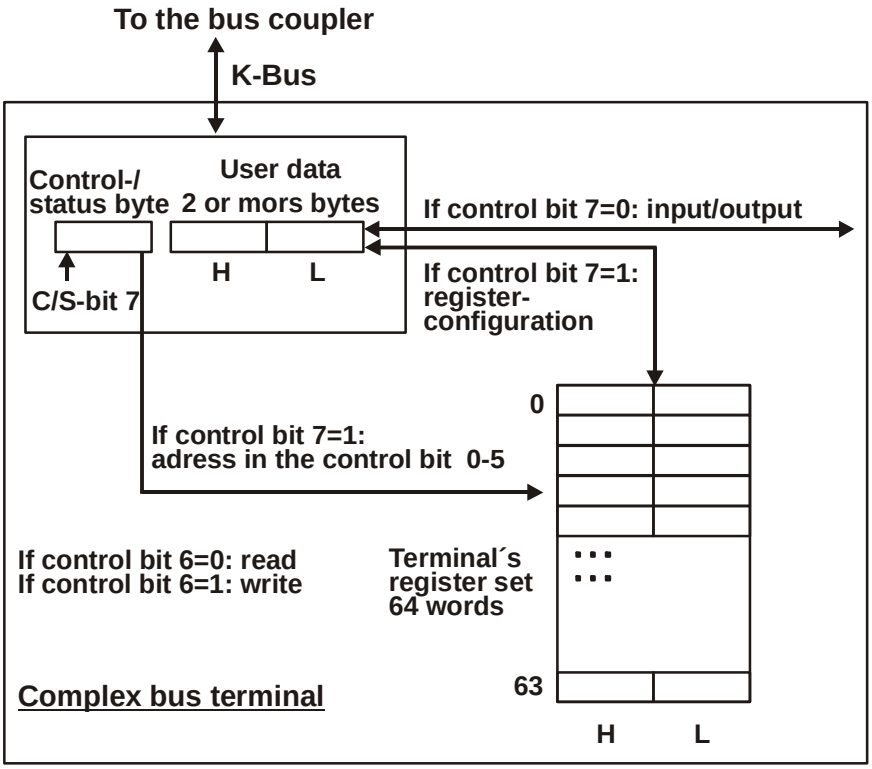
Bits 0 to 5: address

The address of the register to be addressed is entered in bits 0 to 5 of the control byte.

Control byte in the register mode

| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Name | REG=1 | W/R | A5 | A4 | A3 | A2 | A1 | A0 |

REG = 0: Process data transfer
REG = 1: Access to register structure
W/R = 0: Read register
W/R = 1: Write register
A5...A0 = Register address
A total of 64 registers can be addressed with the addresses A5...A0.




The control or status byte occupies the lowest address of a logical channel. The corresponding register values are located in the following 2 data bytes (the BK2000 is an exception to the rule: here, an unused data byte is inserted after the control or status byte, thus setting the register value to a word limit).

**Example 1**

Reading register 8 in the BK2000 with a KL3022 and the end terminal.

If the following bytes are transferred from the controller to the terminal,

| **Byte** | Byte3 | Byte2 | Byte1 | Byte0 |
|---|---|---|---|---|
| **Name** | DataOUT, low byte | DataOUT, high byte | Not used | Control Byte |
| **Value** | 0xXX | 0xXX | 0xXX | 0x88 |

the terminal returns the following type designation (0x0BCE corresponds to the unsigned integer 3022).

| **Byte** | Byte3 | Byte2 | Byte1 | Byte0 |
|---|---|---|---|---|
| **Name** | DataIN, low byte | DataIN, high byte | Not used | Status Byte |
| **Value** | 0xCE | 0x0B | 0x00 | 0x88 |

**Example 2**

Writing register 31 in the BK2000 with an intelligent terminal and the end terminal.

If the following bytes (user code word) are transferred from the controller to the terminal,

| **Byte** | Byte3 | Byte2 | Byte1 | Byte0 |
|---|---|---|---|---|
| **Name** | DataOUT, low byte | DataOUT, high byte | Not used | Control Byte |
| **Value** | 0x35 | 0x12 | 0xXX | 0xDF |

the user code word is set and the terminal returns the register address with the bit 7 for register access and the acknowledgement.

| **Byte** | Byte3 | Byte2 | Byte1 | Byte0 |
|---|---|---|---|---|
| **Name** | DataIN, low byte | DataIN, high byte | Not used | Status Byte |
| **Value** | 0x00 | 0x00 | 0x00 | 0x9F |

## 3.5 Mapping in the bus coupler

Each terminal channel is mapped in the bus coupler. In the standard case, this mapping is done with the default setting in the bus coupler / bus terminal. This default setting can be modified with the Beckhoff KS2000 configuration software or using master configuration software (e.g. ComProfibus or TwinCAT System Manager). The following tables provide information on how the KL5101 maps itself in the bus coupler depending on the set parameters.

Mapping in the bus coupler

The KL5101 is mapped in the bus coupler depending on the set parameters. The terminal is always evaluated completely, the terminal occupies memory space in the process image of the input and outputs.

Default mapping for CANopen, CANCAL, DeviceNet, ControlNet, Modbus, RS232 und RS485 Couplers

| Conditions | |
|---|---|
| Complete evaluation: | any |
| Motorola format: | no |
| Word alignment: | no |

| word offset | high byte | low byte |
|---|---|---|
| 0 | D0 | CB/SB |
| 1 | D2 | D1 |
| 2 | D4 | D3 |

Default mapping for Profibus and Interbus Couplers

| Conditions | |
|---|---|
| Complete evaluation: | any |
| Motorola format: | yes |
| Word alignment: | no |

| word offset | high byte | low byte |
|---|---|---|
| 0 | D1 | CB/SB |
| 1 | D2 | D0 |
| 2 | D3 | D4 |

Default mapping for Lightbus, EtherCAT and Ethernet Couplers and Bus Terminal Controllers (BCxxxx, BXxxxx)

| Conditions | |
|---|---|
| Complete evaluation: | any |
| Motorola format: | no |
| Word alignment: | yes |

| word offset | high byte | low byte |
|---|---|---|
| 0 | - | CB/SB |
| 1 | D1 | D0 |
| 2 | - | D2 |
| 3 | D4 | D3 |

| Conditions | |
|---|---|
| Complete evaluation: | any |
| Motorola format: | yes |
| Word alignment: | yes |

| word offset | high byte | low byte |
|---|---|---|
| 0 | - | CB/SB |
| 1 | D0 | D1 |
| 2 | - | D2 |
| 3 | D3 | D4 |

Key

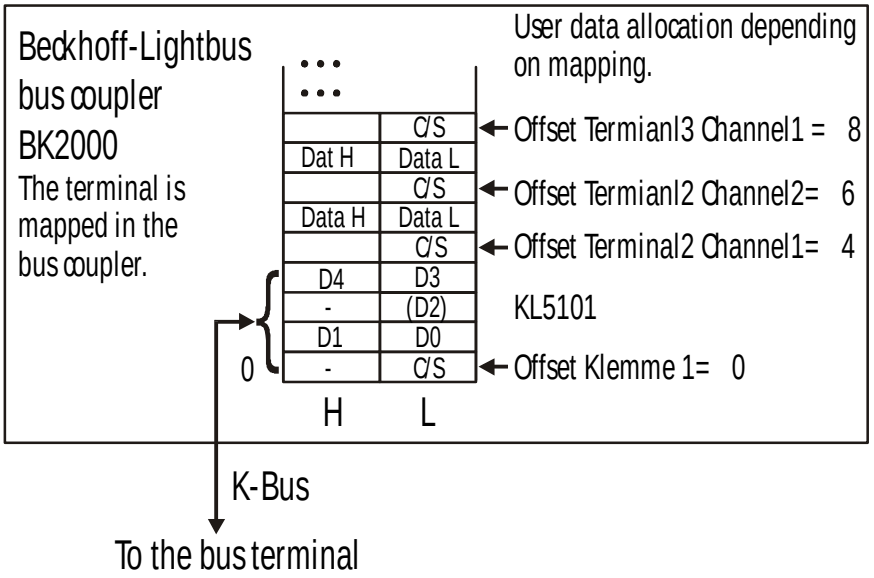
Complete evaluation: The terminal is mapped with control / status byte.
Motorola format: The Motorola or Intel formal can be set.
Word alignment: The terminal is at a word limit in the bus coupler.
CB: Control- Byte (appears in the process image of the outputs).
SB: Status- Byte (appears in the process image of the inputs).
D0/D1: Counter word (read/set)
(D2): contains the period, together with 3/D4
D3/D4: Latch word (read)

### 3.5.1 Examples

Each terminal channel is mapped in the bus coupler. The data of the terminal is mapped differently in the memory of the bus coupler depending on the type of the bus coupler and on the set mapping configuration (e.g. Motorola/ Intel format, word alignment,...). Contrary to the analog input and output terminals, in the case of the KL5101 the control and status byte is always mapped regardless of the higher-level field bus system.

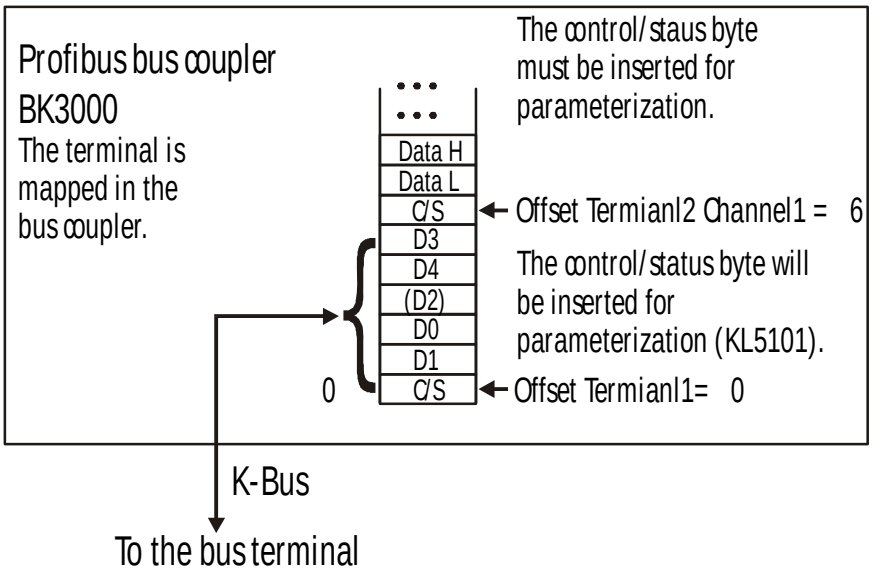
Lightbus coupler BK2000

In the case of the Beckhoff Lightbus coupler BK2000, the control /status byte is also always (i.e. in the case of all analog terminals) mapped in addition to the data bytes. It is always in the low byte at the offset address of the terminal channel.



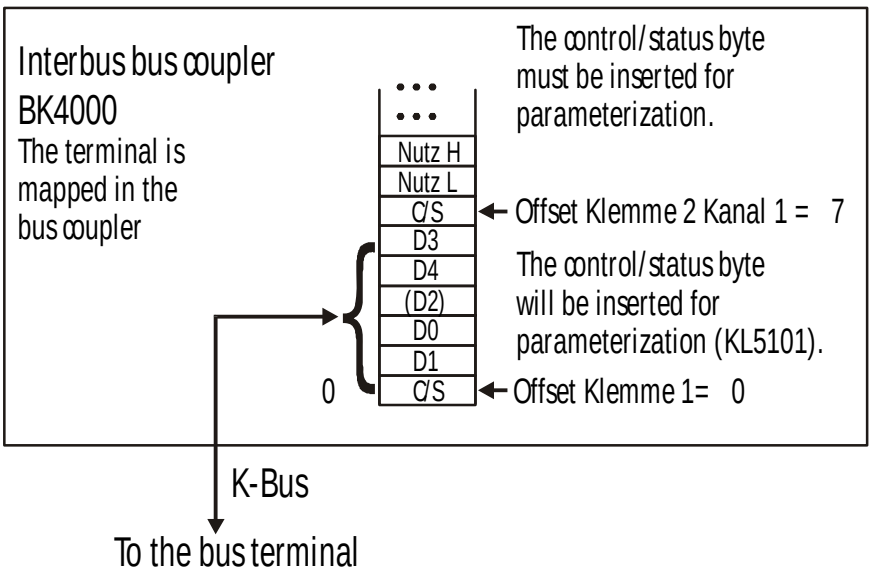

PROFIBUS coupler BK3000

In the case of the PROFIBUS coupler BK3000, the KL5101 is always mapped with 6 bytes of input data and 6 bytes of output data.



Interbus coupler BK4000

By default, the Interbus coupler BK4000 maps the KL5101 with 6 bytes of input data and 6 bytes of output data.




Other bus couplers and further information

You will find further information on the mapping configuration of bus couplers in the annex of the respective bus coupler manual and under the heading of "Configuration of Masters".

Parameterization with the KS2000 configuration software

Independently of the field bus system, parameters can be set via the serial configuration interface in the bus coupler using the Beckhoff KS2000 configuration software.

# 4 Appendix

## 4.1 ATEX - Special conditions

| | |
|---|---|
|  **WARNING** | **Observe the special conditions for the intended use of Beckhoff fieldbus components in potentially explosive areas (directive 94/9/EU)!**<br>• The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60529! The environmental conditions during use are thereby to be taken into account!<br>• If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!<br>• Observe the permissible ambient temperature range of 0°C to 55°C for the use of Beckhoff fieldbus components in potentially explosive areas!<br>• Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!<br>• The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!<br>• The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!<br>• The fuses of the KL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!<br>• Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured! |

| | |
|---|---|
|  **Note** | **Operation of the Bus Terminal System in potentially explosive areas (ATEX)!**<br><br>Pay also attention to the continuative documentation<br>*Notes about operation of the Bus Terminal System in potentially explosive areas (ATEX)*<br>that is available in the download area of the Beckhoff homepage http://www.beckhoff.com! |

# 4.2 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.

## 4.2.1 Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for local support and service on Beckhoff products!
The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages: http://www.beckhoff.com
You will also find further documentation for Beckhoff components there.

## 4.2.2 Beckhoff Headquarters

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