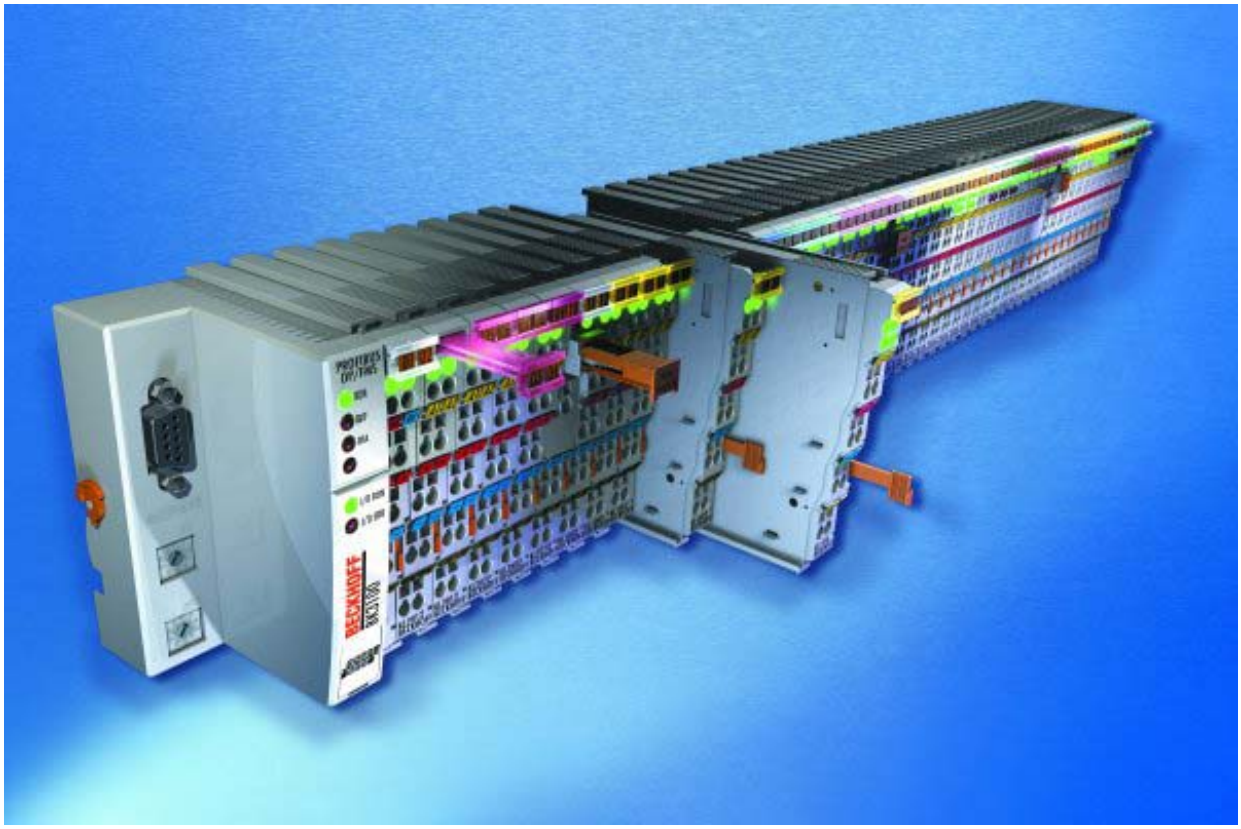

Documentation for

KL2502, KL2512

2-Channel Pulse Width Output Terminals, 24 V_{DC}

Version: 3.0
Date: 2008-02-12

BECKHOFF

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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.

1.1.1 Liability Conditions

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.

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. None of the statements of this manual represents a guarantee (Garantie) in the meaning of § 443 BGB of the German Civil Code or a statement about the contractually expected fitness for a particular purpose in the meaning of § 434 par. 1 sentence 1 BGB. 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 apply.

1.1.3 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.

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

This symbol is intended to highlight risks for the life or health of personnel.

Attention

This symbol is intended to highlight risks for equipment, materials or the environment.

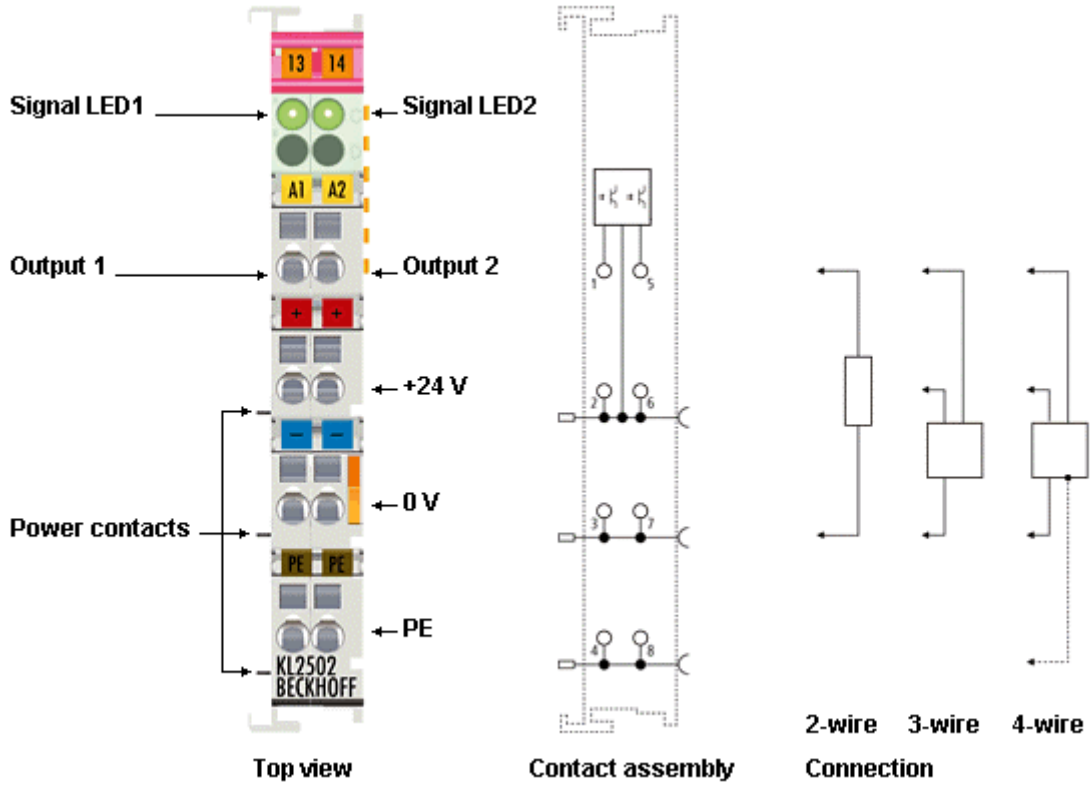
Note

This symbol indicates information that contributes to better understanding.

2 Product overview

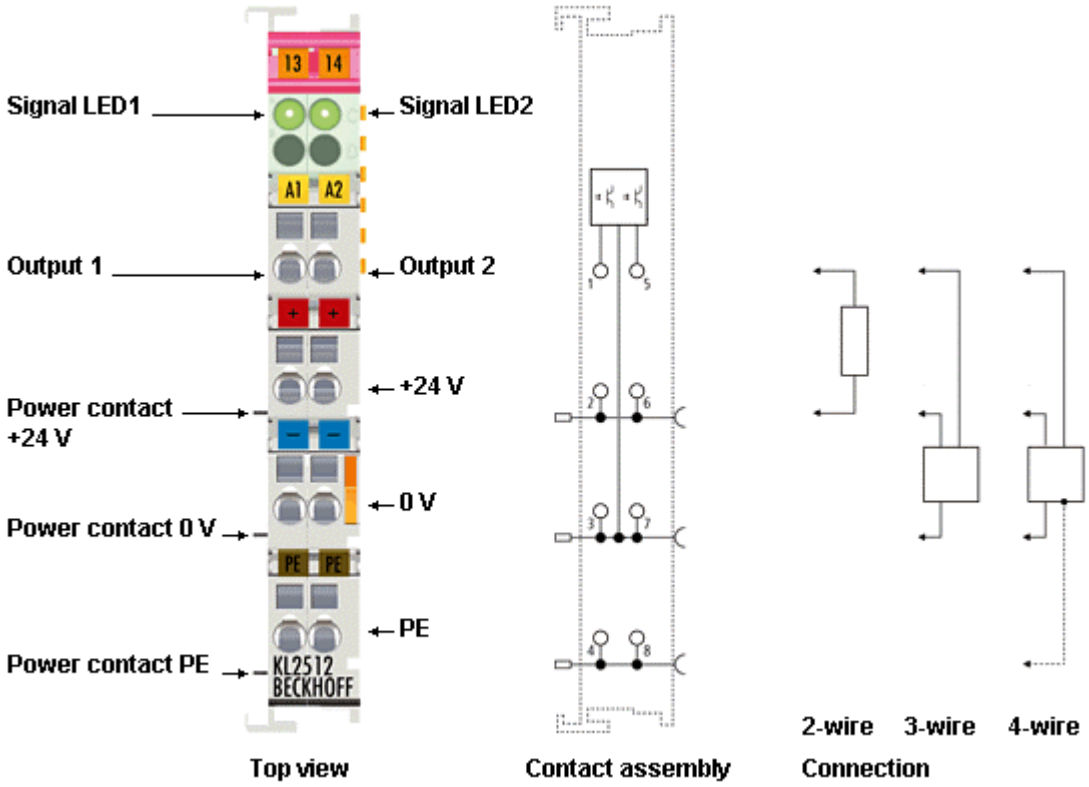
2.1 Introduction

KL2502 - 2-channel pulse width output terminal 24 V_{DC}, switching to high potential



The KL2502 output terminal modulates the pulse width of a binary signal, and outputs it electrically isolated from the K-bus. The mark/space ratio is prescribed by a 16 bit value from the automation unit. The output stage is protected against overload and short-circuit. The Bus Terminal contains two channels that indicate their signal state by means of light emitting diodes. The LEDs are driven in time with the outputs, and show the mark/space ratio by their brightness.

KL2512 - 2-channel pulse width output terminal, 24 V_{DC}, switching to negative potential



The KL2512 Bus Terminal enables direct connection of different ohmic loads. The output signal is a pulse-width modulated voltage. The typical load of an LED group or an incandescent lamp is connected between the positive side of the supply voltage and the output of the KL2512. Via the fieldbus the output can be set independently for two channels with a resolution of more than 30,000 steps. The PWM frequency can be changed. The power transistors switch the ground connection and are galvanically isolated from the internal K-bus.

2.2 Technical data

Technical data		KL2502	KL2512
Number of outputs		2	
Rated load voltage		24 V_{DC} (20 V ... 29 V)	
switched potential		24 V	0 V
Load type		resistive, inductive	resistive
Max. output current (per channel)		0.1 A (short-circuit-proof)	1,0 A
Fundamental frequency		1 ... 20 kHz, 250 Hz default	
Keying ratio		0 ... 100% (T_{on} > 750 ns, T_{off} >500 ns)	0 ... 100%
Resolution		max. 10 bits	
Electrical isolation		500 V_{rms} (K-Bus / field voltage)	
Current consumption from K-Bus		18 mA typ.	
Leakage current		10 mA typ.	
Bit width in the process image		48 I/O: 2 x 16 bits data, 2 x 8 bits control/status	
Configuration		no address settings, configurations via bus coupler or control system	
Weight approx.		50 g	
Permissible ambient temperature range	during operation	0°C ... +55°C	
	during storage	-25°C ... +85°C	
Relative humidity		95%, no condensation	
Vibration/Shock resistance		conforms to EN 60068-2-6 / EN 60068-2-27, EN 60068-2-29	
EMC resistance Burst / ESD		conforms to EN 61000-6-2 / EN 61000-6-4	
Installation position		any	
Type of protection		IP20	

2.3 Description of functions

The output terminal KL2502 modulates the pulse width of a binary signal. The peripheral end of the electronic circuitry is electrically isolated from the internal K bus and therefore also from the field bus. The clock pulse (base frequency) and the pause ratio are adjustable. Via the control system's process image, 16-bit values can be specified for setting.

By default, the terminal KL2502 occupies 6 bytes in the process image. Mapping of the KL2502 is adjustable via the control system or via the bus coupler's configuration interface using the Beckhoff KS2000 configuration software.

Besides operation in the PWM mode, the KL2502 can also be operated in the FM mode (frequency modulation) or in the stepper motor control mode (Frq-Cnt-Pulse mode).

The terminal's default setting is the PWM mode with a base frequency of 250 Hz and a resolution of 10 bits.

LED display

RUN LEDs
On: normal operation
Off: watchdog timer overflow has occurred. If no process data is transferred by the bus coupler for 100 ms, the green LED goes off and the outputs are set to 0% duty cycle.

Process data

Input format:
KL2502: 2's complement representation (integer -1 corresponds to 0xFFFF)
The duty cycle/period ratio is specified with a maximum resolution of 10 bits.
KL2512: 16 bit unsigned Integer

output value	process data		
	KL2502	KL2512*	
0% duty cycle	0x0000 (0_{dez})	0x7FFF (32767_{dez})	0xFFFF (65535_{dez})
50% duty cycle	0x3FFF (16383_{dez})	0x3FFF (16383_{dez})	0xBFFF (49151_{dez})
100% duty cycle	0x7FFF (32767_{dez})	0x0000 (0_{dez})	0x8000 (32768_{dez})

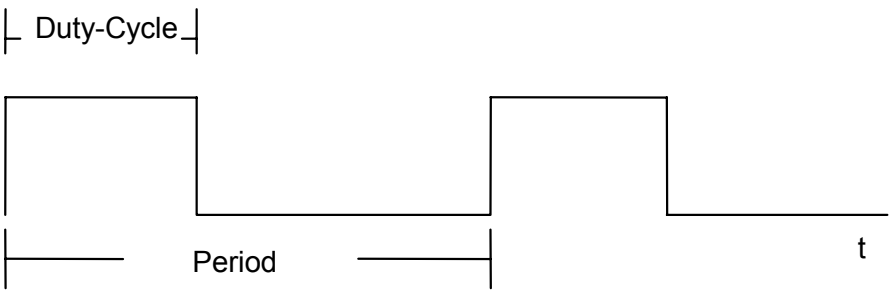
*) The KL2512 runs twice trough the output range (0...100% duty cycle).

2.4 Operating modes

The operating mode of the terminal is set via the feature register R32.

PWM mode

In the PWMx modes, two channels can be operated. Attention must be paid to the fact that the operating mode and the period are identical for both channels.



PWMH	In the PWM mode, the ratio of the duty cycle to the period is specified via the process data. In doing so, 100% duty cycle corresponds to the process data item 0x7FFF. During operation, the period can be specified via the register R2. This is loaded out of R35 (SEEROM) after a system start and is entered in R2. The frequency range is from 245 Hz to 20 kHz (0xFA0 in R2 corresponds to 250 Hz) with a resolution of 10 bits at 245 Hz, 976 Hz and 3.9 kHz.
PWML	In the PWM mode, the ratio of the duty cycle to the period is specified via the process data. In doing so, 100% duty cycle corresponds to the process data item 0x7FFF (32767). During operation, the period can be specified via the register R2. After a system start, this is loaded out of R35 (SEEROM) and is entered in R2. The frequency range is from 2 Hz to 250 Hz (250 Hz corresponds to 0x01F4 in R2).
Frq-Cnt-PWM mode	Via the process output data of the control system, the frequency is specified as 2 Hz per digit. The number of periods output by the terminal is returned to the control system as process input data. In this operating mode, the counting direction is defined by the sign of the output data. Here, 2 Hz corresponds to the value 0x0001 and -2Hz corresponds to the value 0xFFFF (signed integer). The frequency ranges from 2 Hz to 2 kHz. The pulses are output in channel O1 and the counting direction is output in channel O2. "Down" corresponds to the GND level and "up" corresponds to the Vcc (24V) level. The counter is set to the value of the output data with a rising edge of the control bits 0 (control byte in the process data mode, i.e. bit7 = 0). The pulse width ratio is defined via R36.
Frq-Cnt pulse mode	The frequency is specified as 2 Hz per digit via the process output data of the control system. The number of pulses output by the terminal is returned to the control system as process input data. In this operating mode, the counting direction is defined via the sign of the output data. Here, 2 Hz corresponds to the value 0x0001 and -2Hz corresponds to the value 0xFFFF (signed integer). The pulses are output in channel O1 and the counting direction is output in channel O2. "Down" corresponds to the GND level and "up" corresponds to the Vcc level. The frequency range is from 2 Hz to 2 KHz. The counter is set to the value of the output data with a rising edge of the control bit0 (control byte in the process data mode, i.e. bit7 = 0).. The fixed pulse width for all frequencies is defined via R37.
Cnt-Cnt-PWM mode	The number of pulses is specified via the process output data. The number of output periods is returned to the control system as process input data. At the same time, the pulse width ratio is defined via R36 and the period is defined via R35. Output is started with a positive edge of control bit 0. Output can be retriggered with each further edge. The pulses are output in channel O1, Channel O2 can be started via control bit 2. Acceptance and simultaneous starting of pulse output is returned as status information to the control system in status bit0. Status bit1 remains for as long as output is active and status bit 2 returns the status of channel 1.

3 Terminal configuration

3.1 Register overview

The terminal can be configured and parameterized by way of the internal register structure.

Register set for each channel:

Address	Description	Default	R/W	Storage medium
R0	reserved	0x0000	R	
R1	reserved	0x0000	R	
R2	Period	variable	R	RAM
R3	Fundamental frequency	variable	R	RAM
R4	reserved	0x0000	R	
R5	Raw PWM value	variable	R	RAM
R6	Diagnostic register - not used	0x0000	R	
R7	Command register - not used	0x0000	R	
R8	Terminal type	2502/2512	R	ROM
R9	Firmware version number	0x????	R	ROM
R10	Multiplex shift register	0x0218/0130	R	ROM
R11	Signal channels	0x0218	R	ROM
R12	Minimum data length	0x1818	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	specific	R/W	SEEROM
R18	reserved	specific	R/W	SEEROM
R19	Manufacturer scaling: offset	0x0000	R/W	SEEROM
R20	Manufacturer scaling: gain	0x0020	R/W	SEEROM
R21	reserved	0x0000	R/W	SEEROM
...	...	...	...	...
R30	reserved	0x0000	R/W	SEEROM
R31	Code word register	variable	R/W	RAM
R32	Feature register	0x0004	R/W	SEEROM
R33	User offset	0x0000	R/W	SEEROM
R34	User gain	0x0100	R/W	SEEROM
R35	Period PWM	0x0000	R/W	SEEROM
R36	Duty-Cycle	0x0000	R/W	SEEROM
R37	Pulse-Radiation	0x0000	R/W	SEEROM
R38	reserved	0x0000	R/W	SEEROM
...	...	...	...	...
R63	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 end of this documentation).

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

3.2.1.1 R0 to 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.

3.2.1.2 R0 toR5: Terminal specific registers

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

3.2.1.3 R8 to 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: Firmware version X.y
The firmware 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.

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

3.2.1.4 R14: not used

3.2.1.5 R15: Alignment bits (RAM)

The analog terminal is set to a byte limit in the terminal bus with the alignment bits.

Manufacturer parameters

3.2.1.6 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

3.2.1.7 R31 to 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.

3.2.1.8 R33 to R47

Registers that depend on the terminal type

Extended application area

3.2.1.9 R47 to R63

These registers have not yet been implemented.

3.2.2 Terminal-specific register description

Process variables

R0, R1: no function

3.2.2.1 R2: Period

In the PWM mode, the period for current operation can be specified here. Following a power on reset, the period is taken from R35.

PWMH mode, Cnt-Cnt PWM mode:

1 digit corresponds to one 1 microsecond here
e.g.: 250 Hz => 4000 µs = 0xFA0
4 KHz => 250 µs = 0xFA

PWML mode, Frq-Cnt PWM mode, Frq-Cnt pulse mode:

1 digit corresponds to 8 microseconds
e.g.: 2 Hz => 500 ms = 0xF424
200Hz => 5 ms = 0x271

R3: Base frequency
In the PWM mode, the base frequency can be specified here. [R/W]

1 digit corresponds to 1 Hz

R5: PWM raw vale
The value of the processor's PWM unit is stored in this register. The maximum resolution for a given frequency can be computed with this value.

R6: Diagnostic register
Not used

Manufacturer parameters

R19: Manufacturer offset B_h
16-bit signed integer
Linear equation: $Y = A\_h\ X + B\_h$
This register contains the offset of the manufacturer's linear equation. The linear equation is activated via R32.

R20: Manufacturer scaling A_h
16-bit unsigned integer * 2^{-8}
This register contains the scaling value of the manufacturer's linear equation. The linear equation is activated via R32.

1 corresponds to the register value 0x0100

Application parameters

R32: Feature register
[0x0004]
The feature register defines the terminal's operating mode.

Feature bit No.		Description of the mode	
Bit 0	1	User scaling active [0]	
Bit 1	1	Manufacturer scaling active [0]	
Bit 2	1	Watchdog timer active. If the terminal does not receive any data for 100 ms, the PWM signal is set to 0% duty cycle. [1]	
Bit 12-3	0	reserved, don't change!	
Bit15,Bit14,Bit13		Mode	Value range
	000	PWMH mode [000]	250 Hz to 20 kHz
	001	PWML mode	2 Hz to 250 Hz
	011	Frq-Cnt PWM mode	2 Hz to 2 kHz
	101	Frq-Cnt pulse mode	2 Hz to 2 kHz
	111	Cnt-Cnt PWM mode	250 Hz to 8 kHz

R33: User offset B_w
16-bit signed integer

Linear equation: $Y = A_w X + B_w$

This register contains the offset of the user linear equation. The linear equation is activated via R32.

R34: User scaling A_w
16-bit signed Integer * 2^{-8}

This register contains the scaling factor of the user linear equation. The linear equation is activated via R32.

R35: Period for PWM mode
[0x0FA0]
Subsequent to a restart of the processor, the period of R35 is entered in R2.
During operation, this can be modified via R2 or R3.
Input is as described in R2.

R36: Duty cycle
[0x4000]
The ratio of the duty cycle to the period in the Frq-Cnt-PWM mode and in the Cnt-Cnt-PWM mode is defined by this register.

0x2000 corresponds to 25% duty cycle
0x4000 corresponds to 50% duty cycle

R37: Pulse duration for the Frq-Cnt pulse mode
[0x0005]
The pulse duration in the Frq-Cnt pulse mode is entered in this register.

1 digit corresponds to 8 microseconds.

3.3 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).

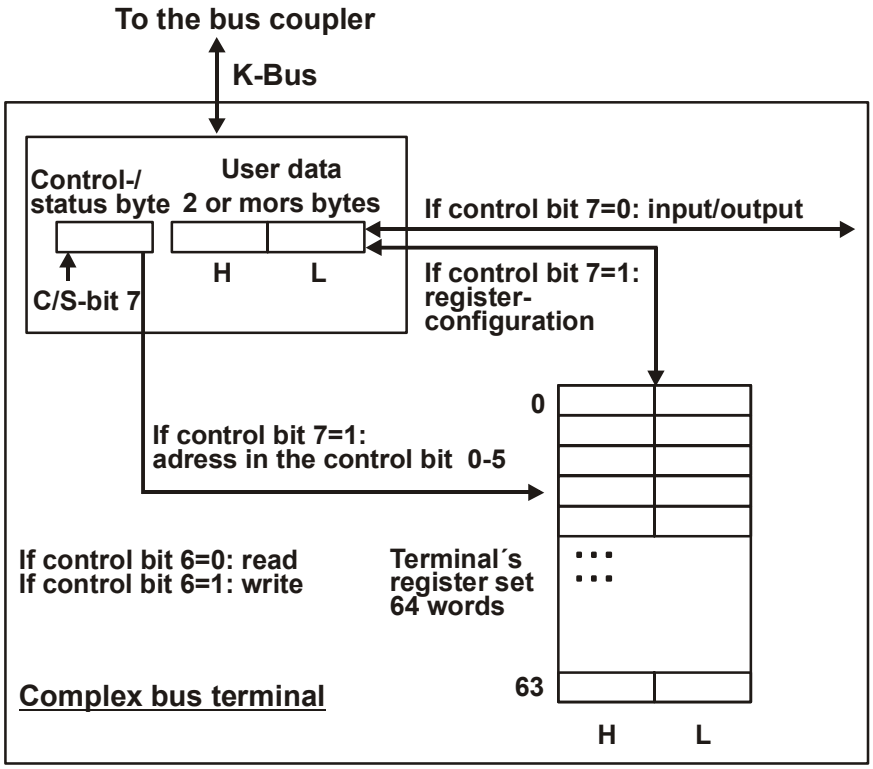
Bits 0 to 5: address

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

3.4 Mapping in the bus coupler

As already described in the chapter terminal configuration, each bus terminal 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 KL2502 maps itself in the bus coupler depending on the set parameters.

Mapping in the bus coupler

The KL2502 is mapped in the bus coupler with 6 bytes input and 6 bytes output data.

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	Ch1 D0	Ch1 CB/SB
1	Ch2 CB/SB	Ch1 D1
2	Ch2 D1	Ch2 D0
3	-	-

Default mapping for Profibus and Interbus Couplers

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

Word offset	High byte	Low byte
0	Ch1 D1	Ch1 CB/SB
1	Ch2 CB/SB	Ch1 D0
2	Ch2 D0	Ch2 D1
3	-	-

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	res.	Ch1 CB/SB
1	Ch1 D1	Ch1 D0
2	res.	Ch2 CB/SB
3	Ch2 D1	Ch2 D0

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

Word offset	High byte	Low byte
0	res.	Ch1 CB/SB
1	Ch1 D0	Ch1 D1
2	res.	Ch2 CB/SB
3	Ch2 D0	Ch2 D1

Key

Complete evaluation:
The terminal is mapped with control and status byte.

Motorola format:
Motorola or Intel format can be set.

Word alignment:
The terminal is at word limit in the Bus Coupler.

Ch n SB: status byte for channel n (appears in the input process image).
Ch n CB: control byte for channel n (appears in the output process image).

Ch n D0: channel n, data byte 0 (byte with the lowest value)
Ch n D1: channel n, data byte 1 (byte with the highest value)

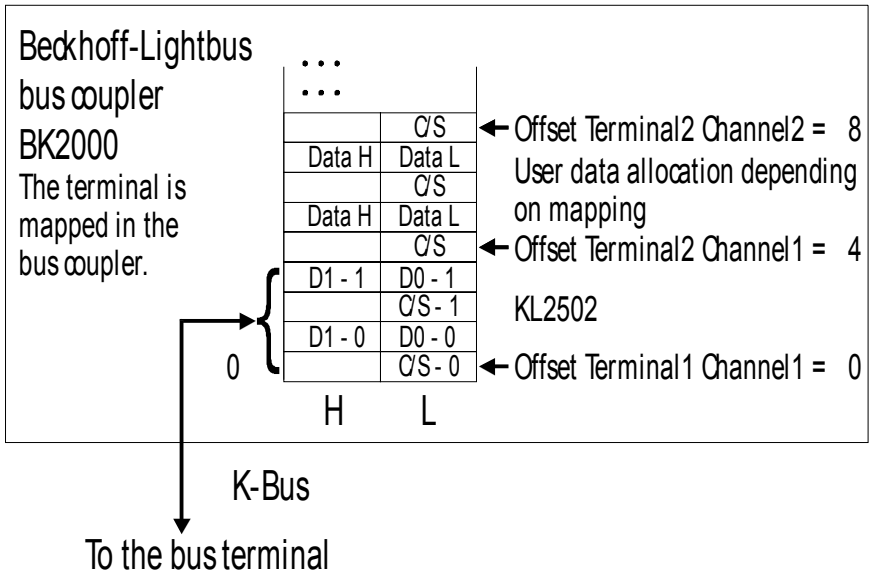
"-": This byte is not used or occupied by the terminal.
res.: reserved:
This byte occupies process data memory, although it is not used.

3.4.1 Examples

Each terminal channel is mapped in the bus coupler. The terminal's data is mapped differently in the bus coupler's memory 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 KL2502 the control and status byte is **always** also mapped regardless of the field bus system used.

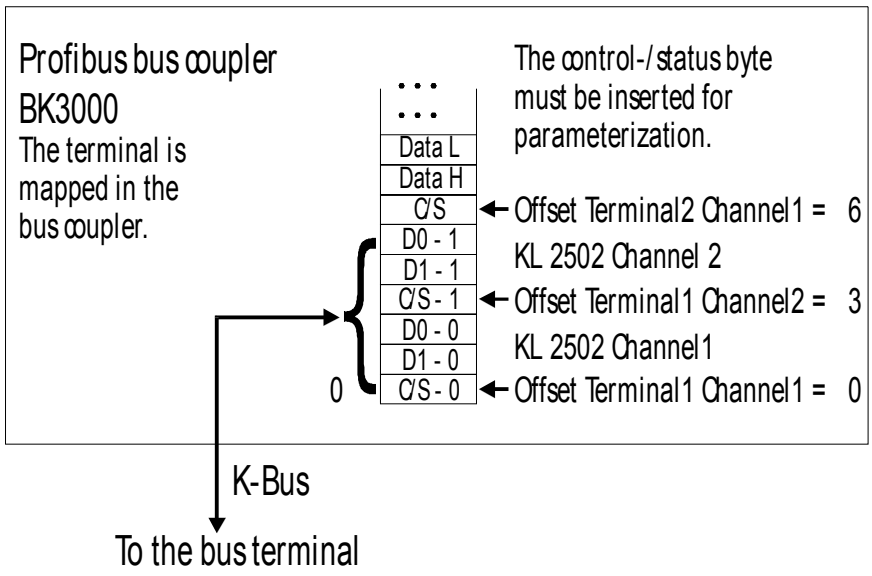
Lightbus Coupler BK2000

In the case of the Lightbus Coupler BK2000, the control /status byte is always mapped besides the data bytes. It is always in the low byte at the offset address of the terminal channel.



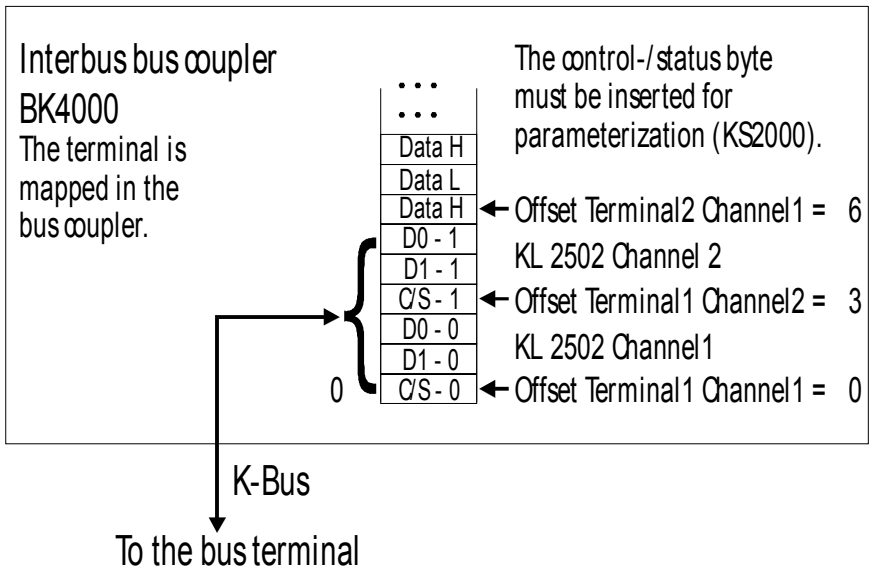
Profibus Coupler BK3000

In the case of the Profibus coupler BK3000, by default the KL2502 is mapped with 6 bytes of input data and 6 bytes of output data (3 bytes per channel). Therefore, 2 bytes of user information data and 1 control/status byte are mapped for each channel.



Interbus Coupler BK4000

By default, the Interbus coupler BK4000 maps the KL2502 with 6 bytes of input and 6 bytes of output data. Parameterization via the field bus is not possible. The KS2000 software is needed for configuration if it is intended to use the control / status byte.



Other bus couplers and further information

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

Note

The annex contains an overview of the possible mapping configurations depending on the adjustable parameters.

Parameterization with KS2000

Parameterization operations can be carried out independently of the field bus system using the Beckhoff KS2000 configuration software via the serial configuration interface in the bus coupler.

4 Annex

4.1 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.

4.1.1 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.

4.1.2 Beckhoff Headquarters

Beckhoff Automation GmbH
Eiserstr. 5
33415 Verl
Germany
phone: + 49 (0) 5246/963-0
fax: + 49 (0) 5246/963-198
e-mail: info@beckhoff.com
web: www.beckhoff.com

Beckhoff Support
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- design, programming and commissioning of complex automation systems
- and extensive training program for Beckhoff system components

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fax: + 49 (0) 5246/963-9157
e-mail: support@beckhoff.com

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hotline: + 49 (0) 5246/963-460
fax: + 49 (0) 5246/963-479
e-mail: service@beckhoff.com