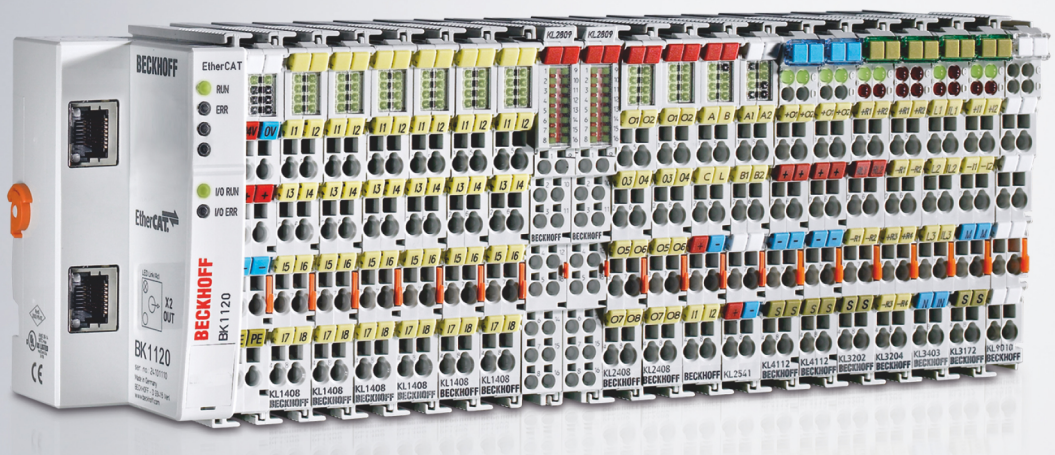
BECKHOFF New Automation Technology

Documentation | EN

KL2692/KS2692

Watchdog Terminal



2022-01-31 | Version: 2.1.0

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1 Foreword

1.1 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

Trademarks

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702 with corresponding applications or registrations in various other countries.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

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

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of instructions

In this documentation the following instructions are used.
These instructions must be read carefully and followed without fail!

⚠ DANGER

Serious risk of injury!

Failure to follow this safety instruction directly endangers the life and health of persons.

⚠ WARNING

Risk of injury!

Failure to follow this safety instruction endangers the life and health of persons.

⚠ CAUTION

Personal injuries!

Failure to follow this safety instruction can lead to injuries to persons.

NOTE

Damage to environment/equipment or data loss

Failure to follow this instruction can lead to environmental damage, equipment damage or data loss.

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Documentation issue status

Version	Comment
2.1.0	• Chapter “Technical data” • Document structure updated • Chapter “Instructions for ESD protection” added • Chapter “Disposal” added • New title page • Update revision status
2.0.0	• Migration
1.0.1	• Process image corrected • Information on basic function principles expanded
1.0	Description of KL2692 parameterization with the KS2000 configuration software expanded.
0.2	Preliminary Version
0.1	Preliminary version for internal use

Firmware and hardware versions

Documentation Version	KL2692-0000, KS2692-0000	
	Firmware	Hardware
2.0.0	1C	04
1.0.1	1B	01
1.0	1B	00
0.2	-	00
0.1	-	00

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

Example with serial number 39 04 1B 01:

39 - week of production 39
04 - year of production 2004
1B - firmware version 1B
01 - hardware version 01

2 Product overview

2.1 Introduction

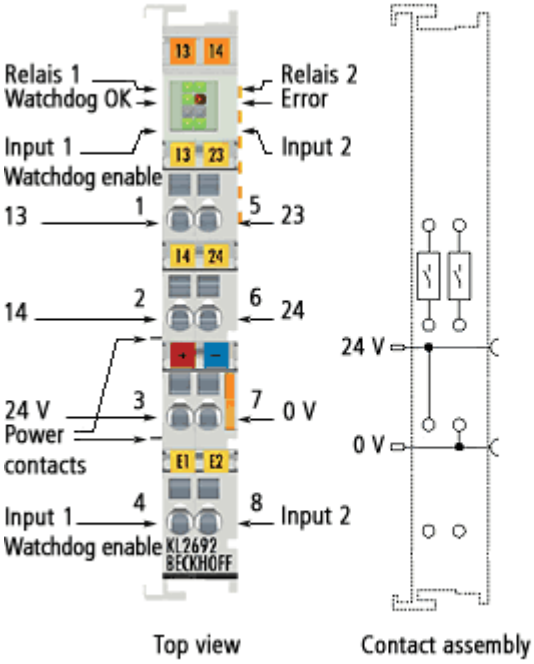


Fig. 1: KL2692

The KL2692 Bus Terminal monitors a bit that is toggled by the controller during each cycle. If the toggle signal fails, the terminal switches off two potential-free relays in order to prevent damage to the machine. Failure of the toggle signal may be caused by the PLC cycle stopping, by a fault in the bus cable or connector, or by a fault in a bus device. The cycle monitoring time can be parameterized. The Bus Terminal has an enable input that enables the relay to be switched on if a correct toggle signal is detected.

⚠ DANGER

No personal protection!

The KL2692 may only be used for cycle monitoring with the purpose of preventing machine damage!

The KL2692 must not be used for cycle monitoring for personal protection under any circumstances!

The KL2692 must not be used for protection functions such as emergency stop, access protection, secure room monitoring, robot range monitoring, press safety valves etc.!

2.2 Technical data

Technical data	KL2692-0000, KS2692-0000
Number of outputs	2 potential-free relay outputs (make contacts)
Rated load voltage of the outputs	230 V_{AC} / 30 V_{DC}
Ohmic switching current	5 A_{AC} / 5 A_{DC}
Inductive switching current	2 A_{AC} / 2 A_{DC}
Minimum permitted load	10 mA at 5 V_{DC}
Number of inputs	2 digital inputs (24 V)
Rated voltage of the inputs	24 V_{DC} (-15% / +20%)
Signal voltage "0"	-3 V ... 5 V (EN 61131-3, type 1)
Signal voltage "1"	15 V ... 30V (EN 61131-3, Type 1)
Input filter	3.0 ms
Input current	typically 5 mA
Electrical isolation	500 V (K-bus/field voltage)
Power supply for the electronics	via the K-bus
Current consumption from K-bus	typically 165 mA
Bit width in the input process image	2 x 8 bit data, 1 x 8 bit status
Bit width in the output process image	2 x 8 bit data, 1 x 8 bit control
Mechanical switching cycles	minimum 2 x 10^7
Electrical switching cycles	minimum 1 x 10^5 (5 A / 30 V_{DC})
Configuration	via the Bus Coupler or the controller
Weight	approx. 60 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. 15 mm x 100 mm x 70 mm
Mounting	on 35 mm mounting rail conforms to EN 60715
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
Approval/markings*	CE, UKCA, cULus, EAC

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

2.3 Basic function principles

Pulse sequence monitoring (cycle)

1. Monitoring is enabled with a falling edge at *Input 1*.
2. If the pulse sequence is too slow (cycle time t_P too long), the output relays switch off for a minimum switch-off time t_{Amin}. The minimum switch-off time can be specified in register R36 [▶ 31].
3. If a pulse sequence (1 cycle) was recognized as correct, the output relays will only switch on again once monitoring is enabled again. This switching mode ensures that triggering of the watchdog remains recognizable.
4. The two output contacts are looped into the control circuit of the switch-off relay.
   Automatic self-start is prevented, since the switch-off function block has to be reset through an explicit manual intervention (monitoring enable).

Monitoring enable with falling edge

Monitoring is enabled with a falling edge at *Input 1*. Therefore, monitoring cannot be enabled with a continuous signal (high) at *Input 1*!

Example

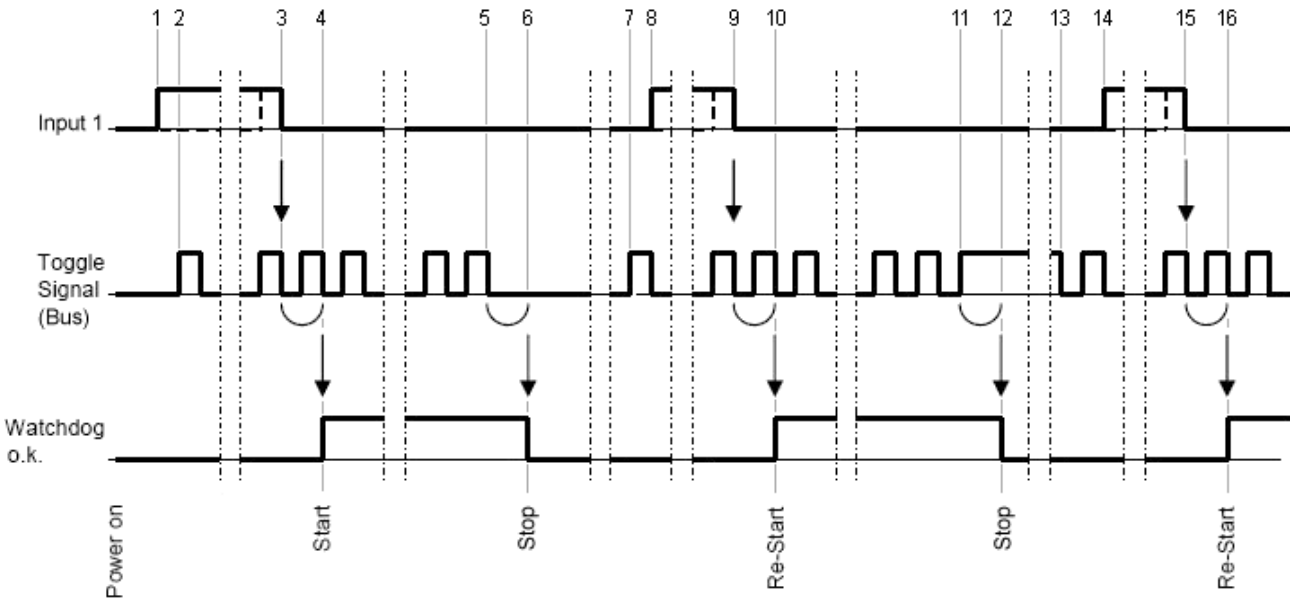


Fig. 2: Signal sequence

Sequence

1. Rising edge at input 1
2. Toggle signal on the bus starts to toggle
3. Falling edge at input 1 (monitoring enable)
4. A full toggle cycle after the falling edge switches on the relays (**Start**)
5. Toggle signal on the bus stops toggling and remains in *low* state
6. The relays switch off after a missed toggle cycle (**Stop**)
7. Toggle signal on the bus starts to toggle again
8. Rising edge at input 1
9. Falling edge at input 1 (monitoring enable)
10. A full toggle cycle after the falling edge switches the relays back on again (**Re-start**)
11. Toggle signal on the bus stops toggling and remains in *high* state
12. The relays switch off after a missed toggle cycle (**Stop**)
13. Toggle signal on the bus starts to toggle again
14. Rising edge at input 1
15. Falling edge at input 1 (monitoring enable)
16. A full toggle cycle after the falling edge switches the relays back on again (**Re-start**)

2.4 LED displays

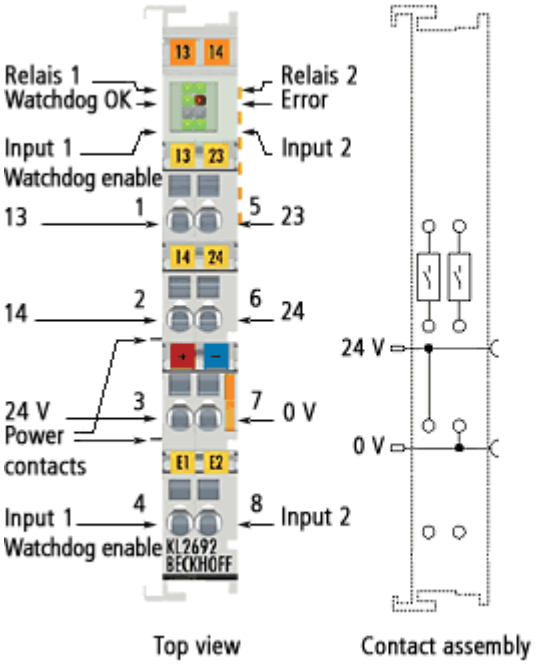


Fig. 3: KL2692 - LED displays

LED	Display	
Relay 1 (green)	On	Relay contact 13/14 (make contact 1) closed
Relay 2 (green)	On	Relay contact 23/24 (make contact 2) closed
Watchdog OK (green)	On	The watchdog is triggered on a regular basis.
Error (red)	not used	
-	not used	
-	not used	
Input 1 (green)	Status input 1 (watchdog enable)	
Input 2 (green)	Status input 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 by grounded probably, when handling with the devices.
- Each assembly must be terminated at the right hand end with a KL9010 bus end terminal, to ensure the protection class and ESD protection.

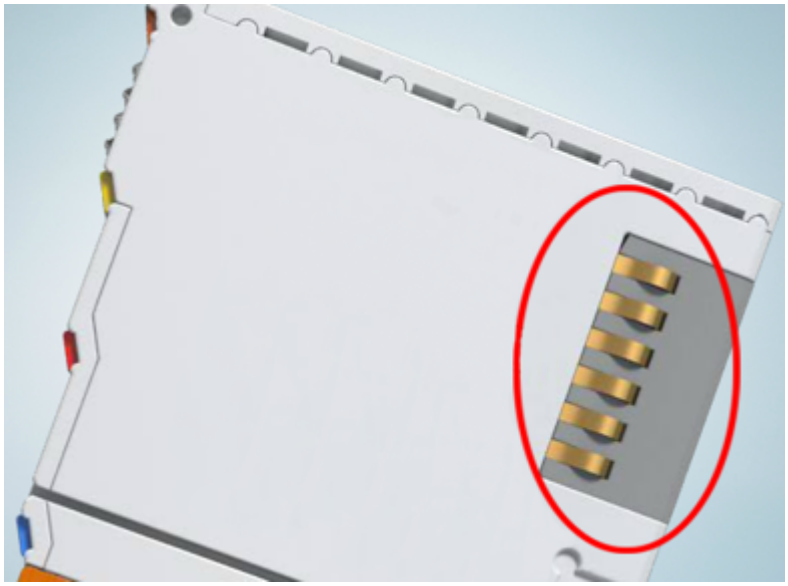


Fig. 4: Spring contacts of the Beckhoff I/O components

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

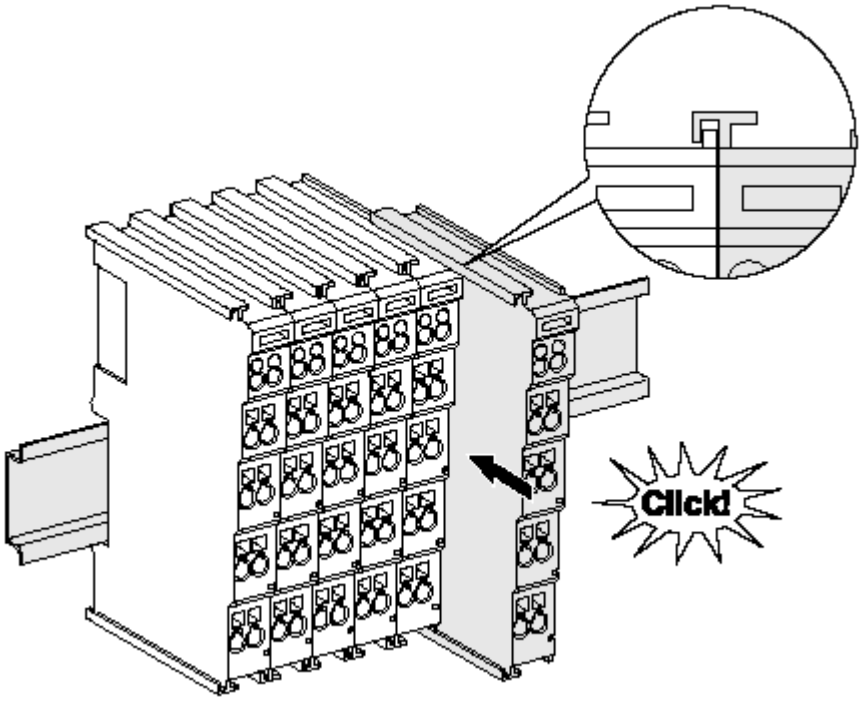


Fig. 5: Attaching on mounting rail

The bus coupler and bus terminals are attached to commercially available 35 mm mounting rails (DIN rails according to EN 60715) by applying slight pressure:

1. First attach the fieldbus coupler to the mounting rail.
2. The bus terminals are now attached on the right-hand side of the fieldbus coupler. Join the components with tongue and groove and push the terminals against the mounting rail, until the lock clicks onto the mounting rail.
   If the terminals are clipped onto the mounting rail first and then pushed together without tongue and groove, the connection will not be operational! When correctly assembled, no significant gap should be visible between the housings.

Fixing of mounting rails

The locking mechanism of the terminals and couplers extends to the profile of the mounting rail. At the installation, the locking mechanism of the components must not come into conflict with the fixing bolts of the mounting rail. To mount the mounting rails with a height of 7.5 mm under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

Disassembly

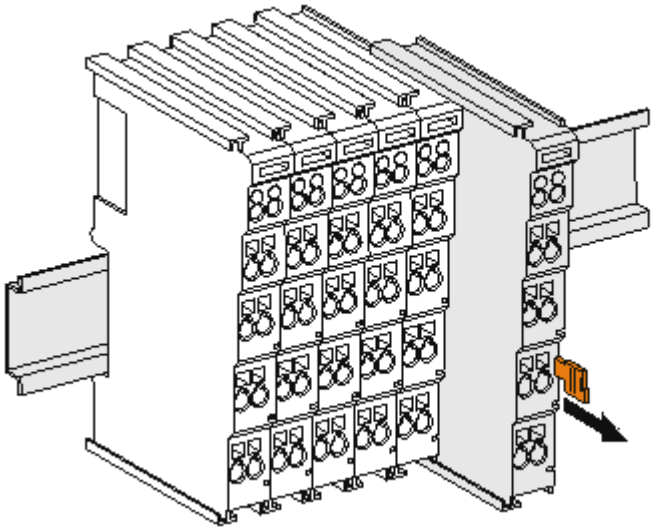


Fig. 6: Disassembling of terminal

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

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

Connections within a bus terminal block

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

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

Power Contacts

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

PE power contact

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

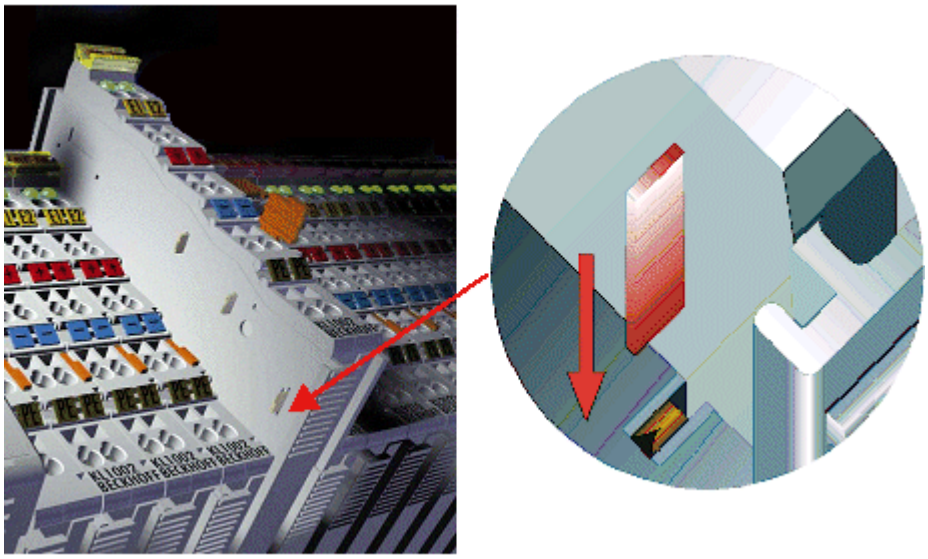


Fig. 7: Power contact on left side

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. 8: 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)

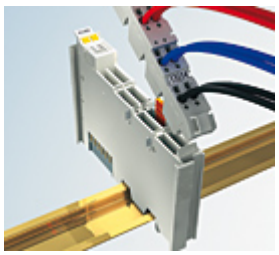


Fig. 9: Pluggable wiring

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 mm² and 2.5 mm² 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. 10: High Density Terminals

The terminals from these series with 16 terminal points are distinguished by a particularly compact design, as the packaging density is twice as large as that of the standard 12 mm bus terminals. Massive conductors and conductors with a wire end sleeve can be inserted directly into the spring loaded terminal point without tools.

Wiring HD Terminals

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

Ultrasonically “bonded” (ultrasonically welded) conductors

Ultrasonically “bonded” conductors

It is also possible to connect the Standard and High Density Terminals with ultrasonically “bonded” (ultrasonically welded) conductors. In this case, please note the tables concerning the wire-size width [▶ 18]!

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

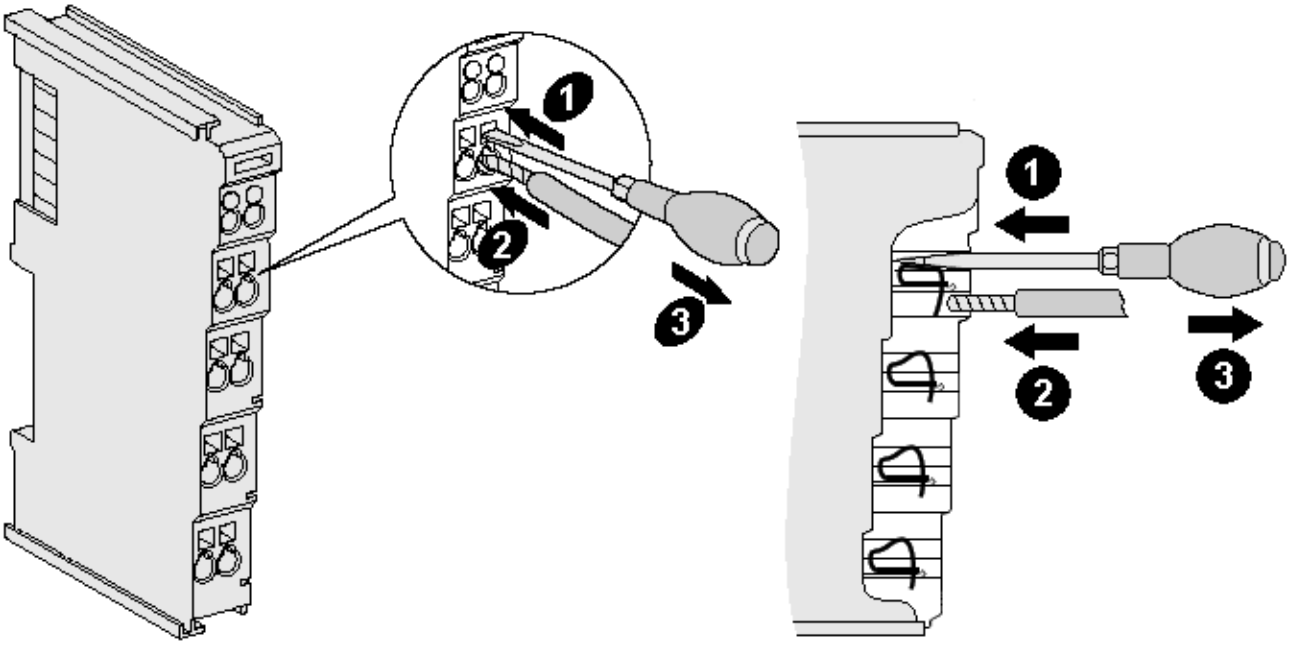


Fig. 11: Connecting a cable on a terminal point

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 mm²	0.08 ... 2.5 mm²
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm²	0.14 ... 1.5 mm²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals (HD Terminals [▶ 17]) 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 mm²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm²
Wire size width (ultrasonically “bonded" conductors)	only 1.5 mm² (see notice [▶ 17])
Wire stripping length	8 ... 9 mm

3.3.3 Contact assembly

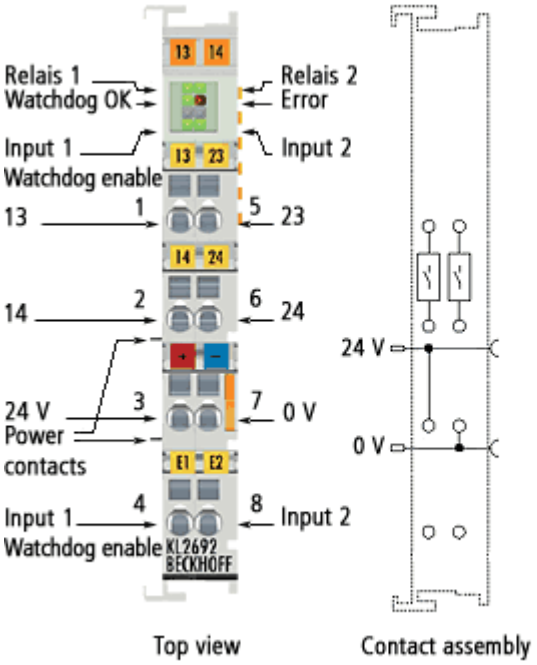


Fig. 12: KL2692 - Contact assembly

Terminal point	No.	Connection for
13	1	Relay contact 13 (NO contact 1)
14	2	Relay contact 14 (NO contact 2)
+24 V	3	24 V power contact
Input 1 (Watchdog Enable)	4	Input 1 (24 V_{DC}), watchdog enabled with negative edge
23	5	Relay contact 23 (NO contact 1)
24	6	Relay contact 24 (NO contact 2)
0 V	7	0 V power contact
Input 2	8	Input 2 (24 V_{DC})

3.4 Application example

⚠ DANGER

No personal protection!

The KL2692 may only be used for cycle monitoring with the purpose of preventing machine damage!

The KL2692 must not be used for cycle monitoring for personal protection under any circumstances!

The KL2692 must not be used for protection functions such as emergency stop, access protection, secure room monitoring, robot range monitoring, press safety valves etc.!

Switching off the voltage for the power contacts

The NO contacts of the KL2692 control a contactor that switches the supply voltage (24 V) for the power contacts..

Fig. 13: Application example

Function

1. Monitoring can be enabled via push button S1 (negative edge) when the watchdog is triggered. The KL2692 relays are switched on, and contactor K1 switches on the supply voltage (24 V) for the power contacts.
2. If the watchdog is not triggered over the watchdog time specified in register R35 [▶ 31], the KL2692 relays are de-energized and contactor K1 switches off the supply voltage for the power contacts.
3. If the watchdog is triggered again, monitoring has to be re-enabled via push button S1, so that the KL2692 relays switch on again!
4. NC contacts S2 and S3 can be used for manually switching off contactor K1 and therefore the supply voltage for the power contacts.

3.5 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. 14: 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 KL2692 watchdog terminal
- a KL9010 bus end terminal

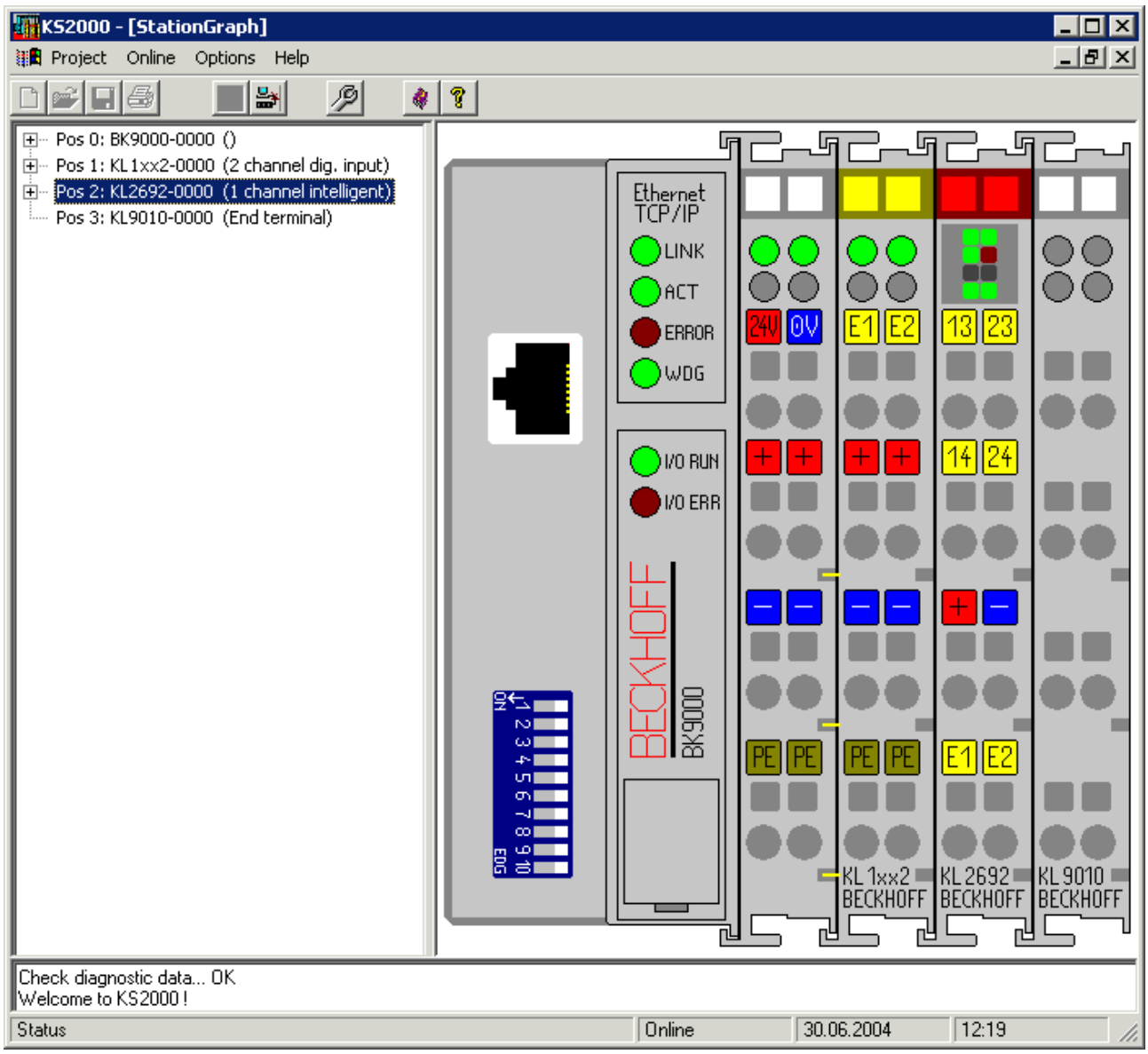


Fig. 15: Display of the fieldbus station in KS2000

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).

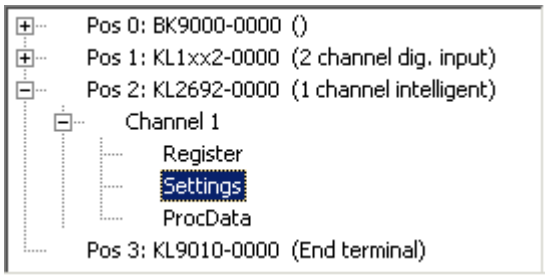


Fig. 16: KS2000 branch for channel 1 of the KL2692

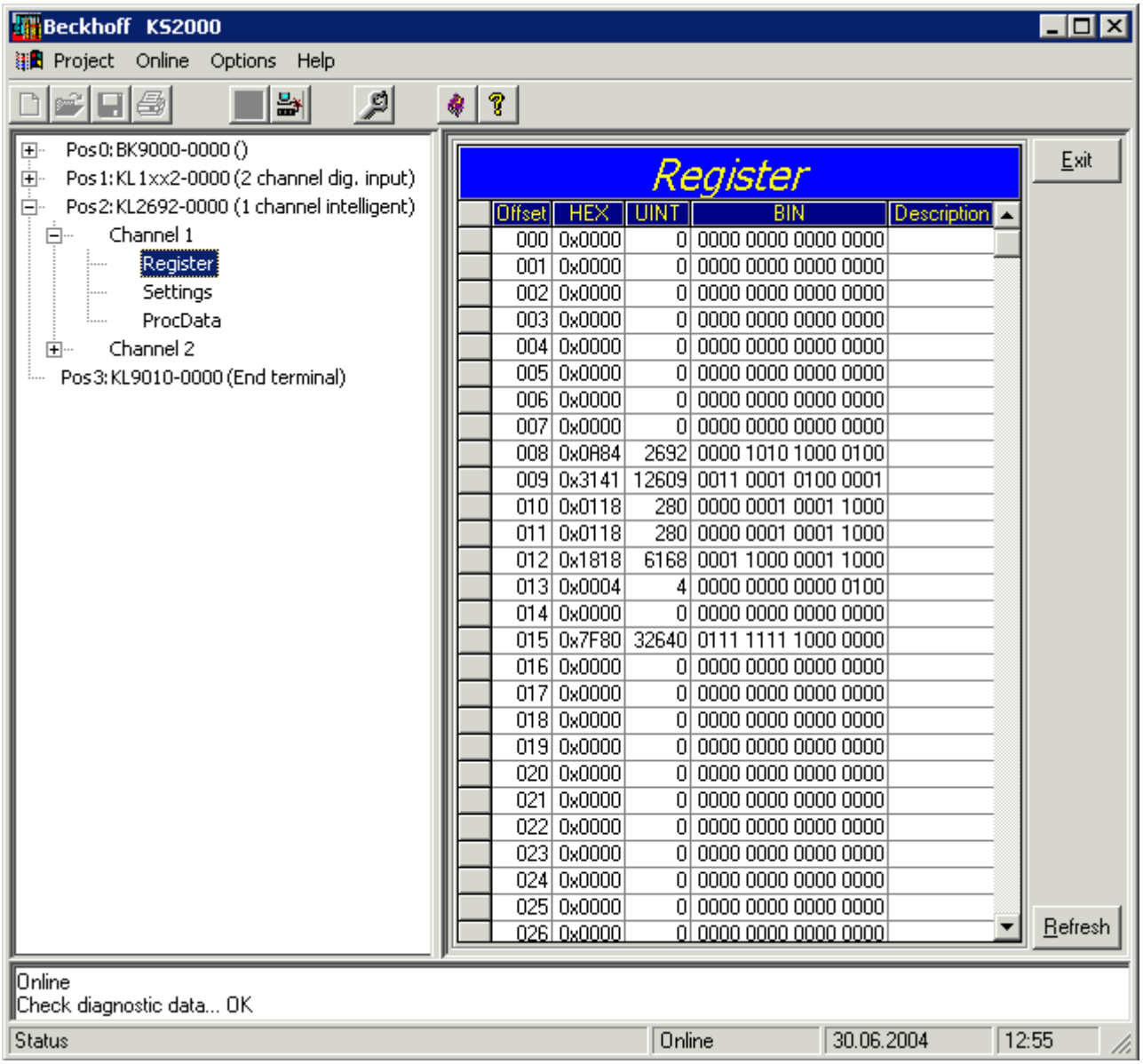
For the KL2692, the branches *Register*, *Settings* and *ProcData* are displayed:

- Register [▶ 25] permits direct access to the registers of the KL2692.
- Under Settings [▶ 26] you find dialog boxes for parameterizing the KL2692.

- ProcData [▶ 26] shows the process data of the KL2692.

4.3 Register

You can access the registers of the KL2692 directly under *Register*. The meaning of the register is explained in the register overview [▶ 30].



Offset	HEX	UINT	BIN	Description
000	0x0000	0	0000 0000 0000 0000	
001	0x0000	0	0000 0000 0000 0000	
002	0x0000	0	0000 0000 0000 0000	
003	0x0000	0	0000 0000 0000 0000	
004	0x0000	0	0000 0000 0000 0000	
005	0x0000	0	0000 0000 0000 0000	
006	0x0000	0	0000 0000 0000 0000	
007	0x0000	0	0000 0000 0000 0000	
008	0x0A84	2692	0000 1010 1000 0100	
009	0x3141	12609	0011 0001 0100 0001	
010	0x0118	280	0000 0001 0001 1000	
011	0x0118	280	0000 0001 0001 1000	
012	0x1818	6168	0001 1000 0001 1000	
013	0x0004	4	0000 0000 0000 0100	
014	0x0000	0	0000 0000 0000 0000	
015	0x7F80	32640	0111 1111 1000 0000	
016	0x0000	0	0000 0000 0000 0000	
017	0x0000	0	0000 0000 0000 0000	
018	0x0000	0	0000 0000 0000 0000	
019	0x0000	0	0000 0000 0000 0000	
020	0x0000	0	0000 0000 0000 0000	
021	0x0000	0	0000 0000 0000 0000	
022	0x0000	0	0000 0000 0000 0000	
023	0x0000	0	0000 0000 0000 0000	
024	0x0000	0	0000 0000 0000 0000	
025	0x0000	0	0000 0000 0000 0000	
026	0x0000	0	0000 0000 0000 0000	

Fig. 17: Register view in KS2000

4.4 Settings

The dialog mask for the parameterization of the KL2692 can be found under *Settings*.

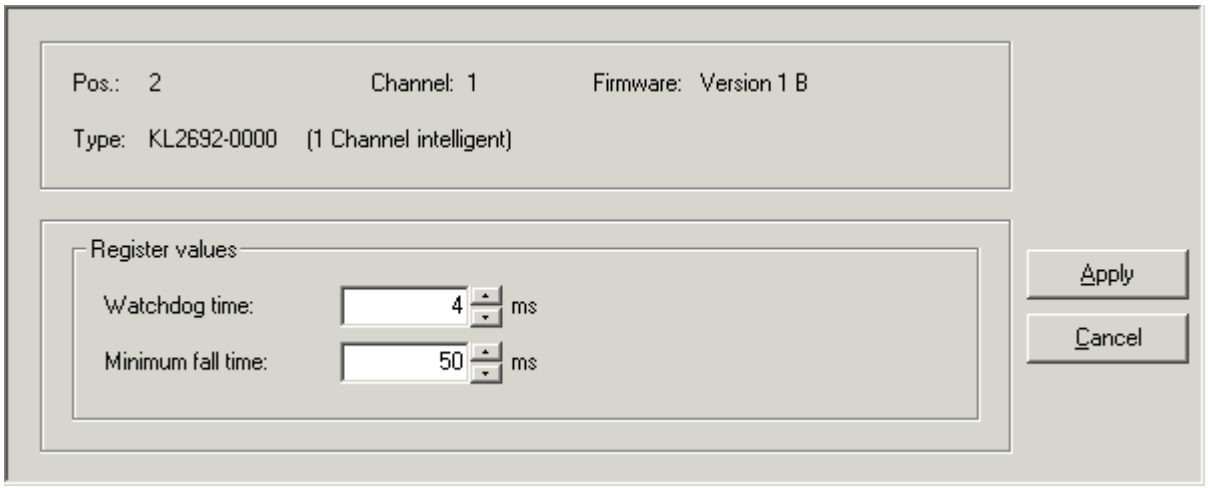


Fig. 18: Settings via KS2000

Watchdog time (R35 [▶ 31])

This can be used for setting the watchdog time (default: 4 ms). Within the watchdog time, an edge change must occur on the toggle bit of the control bytes (CB.0 [▶ 28]), in order to prevent the drop-out of the output relays.

Minimum switch-off time (R36 [▶ 31])

This can be used for setting the minimum time (default: 50 ms) for which the relays remain switched off after the watchdog has been triggered, even if, after a subsequent monitoring activation, the following pulse sequence is recognized as correct.

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*.

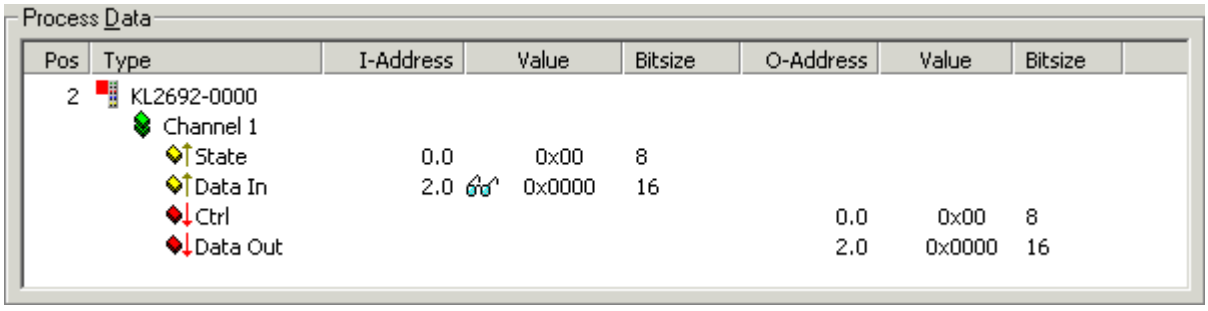


Fig. 19: ProcData

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

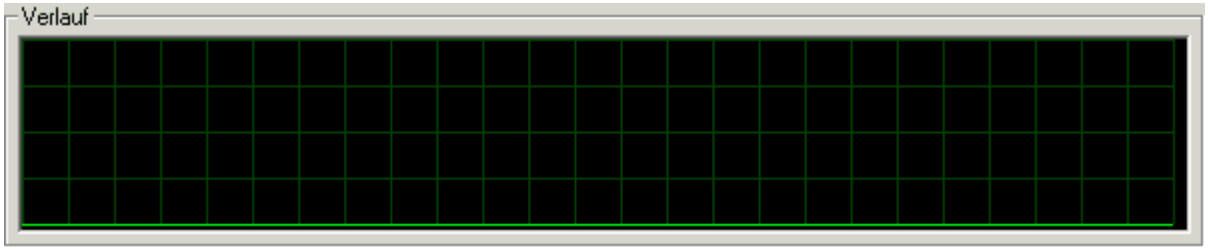


Fig. 20: History field

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

Fig. 21: Value field

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

Fig. 22: Value field

⚠ CAUTION

Danger for persons, the environment or devices!

Note that changing output values (forcing them) can have a direct effect on your automation application. Only modify these output 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.

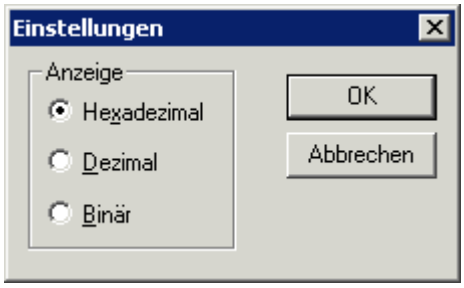


Fig. 23: Settings

5 Access from the user program

5.1 Process image

The KL2692 is represented in the process image with a minimum of 3 bytes of input data and 3 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	SB [▶ 28]	CB [▶ 28]
1	2	Word	DataIN	DataOUT

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

Key

SB: Status byte
CB: Control byte
DataIN: input word
DataOUT: output word

No compact process image

The KL2692 cannot be operated with compact process image (without control and status bytes), since control and status bytes are required for process data operation of the KL2692 to function correctly. Even if your Bus Coupler is set to compact process image, the KL2692 is represented with its complete process image!

5.2 Control and status byte

Process data mode

Control byte (for process data mode)

The control byte (CB) is located in the output image [▶ 28], and is transmitted from the controller to the terminal.

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

Key

Bit	Name	Description	
CB7	RegAccess	0_{bin}	Register communication off (process data mode)
CB.6 to CB.2	-	0_{bin}	reserved
CB.0	Toggle	Toggle bit	

Status byte (for process data mode)

The status byte (SB) is located in the input image [▶ 28], and is transmitted from terminal to the controller.

Bit	SB.7	SB.6	SB.5	SB.4	SB.3	SB.2	SB.1	SB.0
Name	RegAccess	-	-	-	IN_2	IN_1	WDT_Run	Toggle_St

Key

Bit	Name	Description	
SB.7	RegAccess	0_{bin}	Acknowledgment for process data mode
SB.6 to SB.4	-	0_{bin}	reserved
SB.3	IN_2	Status input 2	
SB.2	IN_1	Status input 1	
SB.1	WDT_Run	0_{bin}	Watchdog timer is not triggered. The outputs are not set.
		1_{bin}	Watchdog timer is active and locked. The outputs are set.
SB.0	Toggle_St	This bit follows the toggle bit in the control byte	

Register communication

Control byte (for register communication)

The control byte (CB) is located in the output image [▶ 28], and is transmitted from the controller to the terminal.

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

Key

Bit	Name	Description	
CB.7	RegAccess	1_{bin}	Register communication switched on
CB.6	R/W	0_{bin}	Read access
		1_{bin}	Write access
CB.5 to CB.0	Reg. no.	Register number: Enter here the number of the register [▶ 30] that you wish - to read with input data word DataIn [▶ 28], or - to write with output data word DataOut [▶ 28].	

Status byte (for register communication)

The status byte (SB) is located in the input image [▶ 28], and is transmitted from terminal to the controller.

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

Key

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

5.3 Register overview

All registers can be read or written via register communication [▶ 29]. They are used for parameterizing the KL2692.

Register no.	Comment	Default value		R/W	Memory
R0	reserved	-	-	-	-
...	...	...	...	...	...
R5	reserved	-	-	-	-
R6	Diagnostic register (not used)	0x0000	0_{dec}	R	RAM
R7	Command register (not used)	0x0000	0_{dec}	R/W	RAM
R8 [▶ 31]	Terminal type	0x0A84	2692_{dec}	R	ROM
R9 [▶ 31]	Firmware version	e.g. 0x3141	e.g. $1A_{ASCII}$	R	ROM
R10	Multiplex shift register	0x0118	280_{dec}	R	ROM
R11	Signal channels	0x0118	280_{dec}	R	ROM
R12	Minimum data length	0x1818	6168_{dec}	R	ROM
R13	Data structure	0x0000	0_{dec}	R	ROM
R14	reserved	-	-	-	-
R15	Alignment register	variable	variable	R/W	RAM
R16 [▶ 31]	Hardware version number	e.g. 0x0000	e.g. 0_{dec}	R/W	SEEPROM
R17	reserved	-	-	-	-
...	...	-	-	-	-
R30	reserved	-	-	-	-
R31 [▶ 31]	Code word register	0x0000	0_{dec}	R/W	RAM
R32 [▶ 31]	Feature register	0x0000	0_{dec}	R/W	SEEPROM
R33	reserved	-	-	-	-
R34	reserved	-	-	-	-
R35 [▶ 31]	Watchdog time t_P	0x0004	4_{dec}	-	SEEPROM
R36 [▶ 31]	Minimum switch-off time t_{Amin}	0x0064	100_{dec}	-	SEEPROM
R37	reserved	-	-	-	-
...	...	...	...	...	...
R63	reserved	-	-	-	-

5.4 Register description

All registers can be read or written via register communication [▶ 29]. They are used for parameterizing the KL2692.

R8: Terminal description

The description of the terminal is contained in register R8. KL2692: 0x0A84 (2692_{dec})

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.
- If you write values into the user registers and have previously entered the user code word (0x1235) in the code word register, these values are stored in the RAM registers and in the SEEPROM registers and are therefore retained if the terminal is restarted.

The code word is reset if the terminal is restarted.

R32: Feature register

The feature register specifies the configuration of the terminal (in preparation).

R35: Watchdog time t_p

An edge change within the watchdog time is required to prevent the drop-out of the watchdog.
Scaling: 500 µs / bit
Default value: 8_{dec} (4 ms).

R36: Minimum switch-off time t_{Amin}

Minimum time for which the relays remain switched off after the watchdog has been triggered, even if, after a subsequent monitoring activation, the following pulse sequence is recognized as correct.
Scaling: 500 µs / bit
Default value: 100_{dec} (50 ms).

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_{bin})	0xXX	0xXX

Explanation:

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

Input Data (answer of the Bus Terminal)

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

Explanation:

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

5.5.2 Example 2: Writing to an user register

Code word

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

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

Output Data

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

Explanation:

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

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

Input Data (answer of the Bus Terminal)

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

Explanation:

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

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

Output Data

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

Explanation:

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

Input Data (answer of the Bus Terminal)

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

Explanation:

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

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

Output data

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

Explanation:

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

⚠ CAUTION

Observe the register description!

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

Input data (response from the Bus Terminal)

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

Explanation:

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

IV. Read Register 32 (check changed feature register)

Output Data

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

Explanation:

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

Input Data (answer of the Bus Terminal)

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

Explanation:

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

V. Write Register 31 (reset code word)

Output Data

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

Explanation:

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

Input Data (answer of the Bus Terminal)

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

Explanation:

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

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!

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Table of figures

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