BECKHOFF New Automation Technology

Documentation | EN

KM2002, KM2004, KM2008

Terminal modules with digital outputs, 24 V, 0.5 A

2024-03-11 | Version: 3.4.0

Table of contents

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.
The qualified personnel is obliged to always use the currently valid documentation.

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.

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Copyright

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.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

1.3 Documentation Issue Status

Version	Comment
3.4.0	• Chapter “Instructions for ESD protection” added • Chapter “Recommended mounting rails” updated • Chapter “Technical data” updated
3.3.0	• Chapter “Technical data” updated • Document structure updated • Chapter “Disposal” added • New title page • Revision status updated
3.2.0	• Technical data for KM plug-in connectors updated
3.1.0	• Technical data for KM plug-in connectors extended • Update structure
3.0.0	• Migration • Update structure • Technical data updated
2.0.0	• Notes about wiring and mounting updated • Technical data updated
1.0.2	• Technical data updated • Pinning of terminal block X1 corrected
1.0.1	• Notes about wiring and mounting updated • Notes about wiring technique corrected • Technical data updated
1.0.0	• KM2004 and KM2008 added • Mounting and demounting added • Dimension drawings added
0.1	• first preliminary documentation for KM2002

Firm and hardware versions

Documentation version	Hardware version		
	KM2002	KM2004	KM2008
3.4.0	09	06	05
3.3.0	09	06	05
3.2.0	06	05	04
3.1.0	06	05	04
3.0.0	06	05	04
2.0.0	05	03	02
1.0.2	02	02	00
1.0.1	01	00	00
1.0.0	01	00	00
0.1	00	-	-

The hardware version can be found in the serial number printed at the top of the terminal module.

Syntax of the serial number

Structure of the serial number: WW YY FF HH	Example with serial number 35 05 00 01
WW - week of production (CW, calendar week)	35 - week of production 35
YY - year of production	05 - year of production 2005
FF - firmware version*	00 - firmware version 00
HH - hardware version	01 - hardware version 01

*) 00 for digital modules

2 Product overview

Module	Outputs	Output current per channel
KM2002 [▶ 13]	16	max. 0.5 A
KM2004 [▶ 15]	32	max. 0.5 A
KM2008 [▶ 17]	64	max. 0.5 A

2.1 Terminal Modules - System Overview

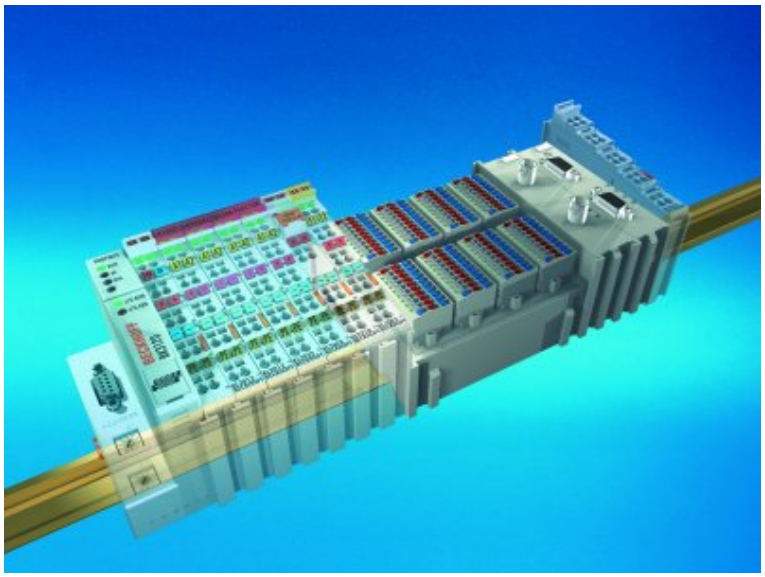


Fig. 1: Bus Terminal Block

Better sensor and actuator functionality makes machines and systems more and more powerful. The Bus Terminal reliably meets increased requirements for I/O signals through its modularity and compact design. The existing Beckhoff Bus Terminal system is complemented by the new version of the EMxxxx / KMxxxx Terminal Module with increased packing density. In many areas of application, cost benefits can be realized through lower overall installed size and application-specific signal mix.

The new Terminal Modules are fully system-compatible. Like the Bus Terminals, they are bus-neutral and can therefore be operated with any Beckhoff Bus Coupler and Bus Terminal Controller. Like the standard Bus Terminals, the EM / KM modules are integrated in the I/O system and connected with the internal terminal bus (E-bus / K-bus). Bus Terminals and terminal modules can be combined without restriction.

Plug connector

Like for the Bus Terminals, no tools are required for the wiring. Spring-loaded technology is used, however the connection layer is pluggable (fixed wiring).

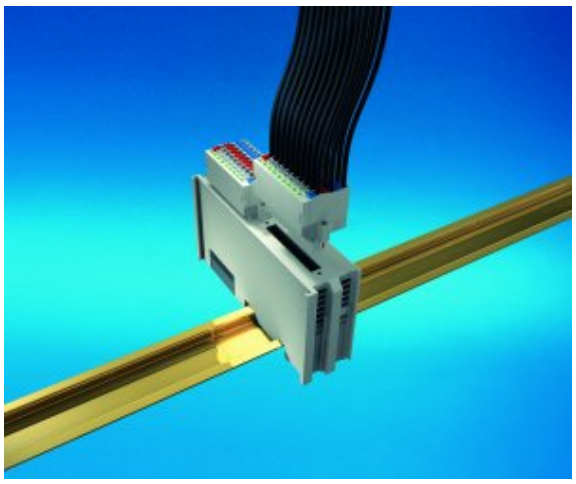


Fig. 2: Pluggable connection (fixed wiring)

Connection

Plug connectors are available for single and triple conductor connection methods.

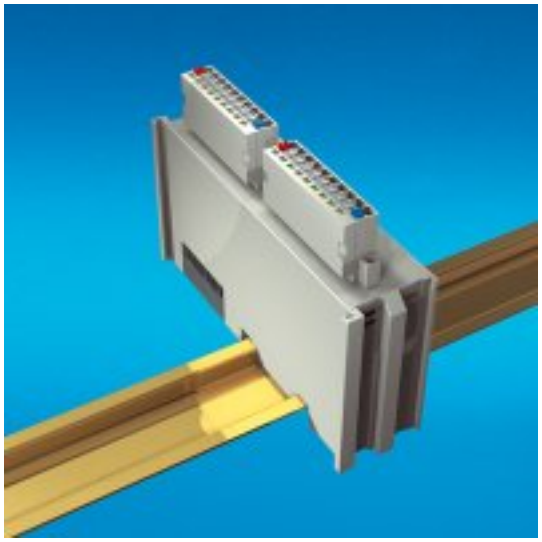


Fig. 3: Terminal module with plug connector for single conductor connection method (ZS2001-0002)

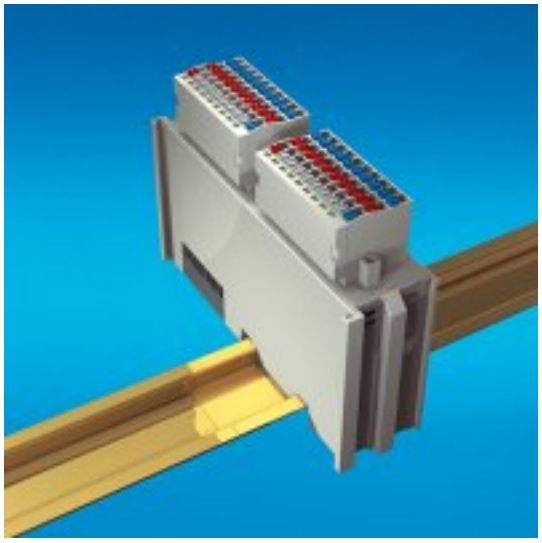


Fig. 4: Terminal module with plug connector for triple-conductor connection method (ZS2001-0004)

Packing density

The Terminal Modules combine 16, 32 or 64 digital inputs or outputs on a very small area. This compact and slimline design enables very high packing densities, leading to smaller control cabinets and terminal boxes.

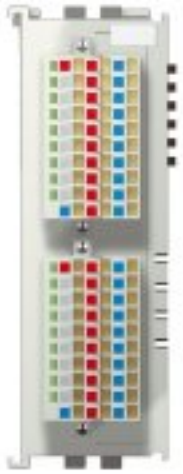


Fig. 5: Terminal module with 16 channels

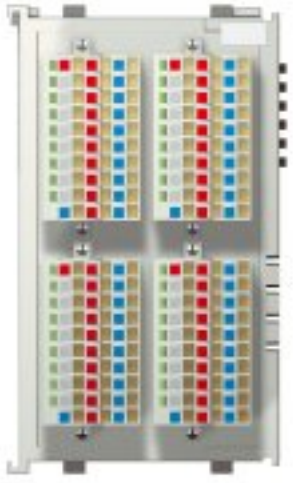


Fig. 6: Terminal module with 32 channels

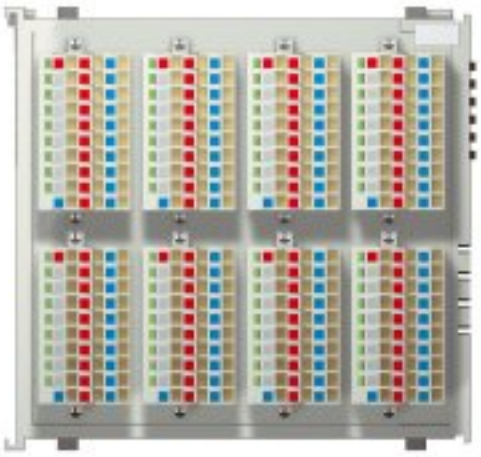


Fig. 7: Terminal module with 64 channels

2.2 KM2002

2.2.1 Introduction

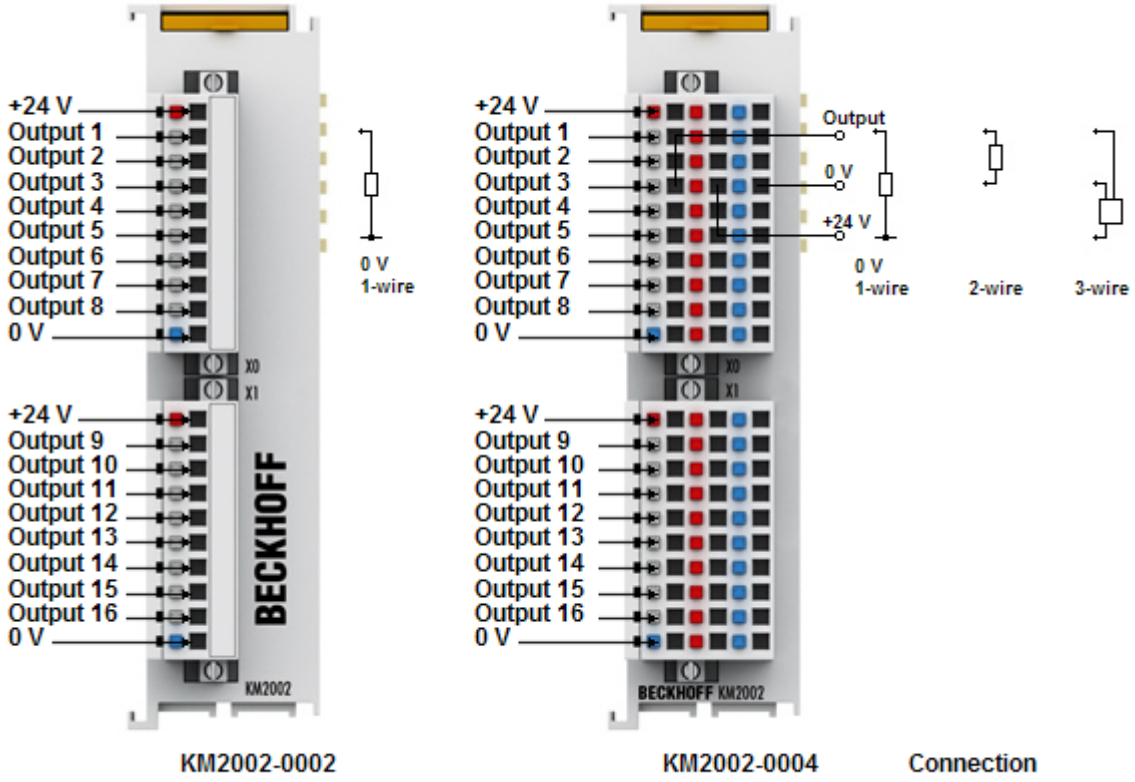


Fig. 8: Digital Terminal Module with 16 output channels

Digital Terminal Module with 16 output channels (24 V_{DC})

The terminal module KM2002 combines 16 digital outputs with 8 channels per plug connector in a compact design with high packing density. The binary control signals are transferred (electrically isolated) to the actuators at the process level. Like the standard Bus Terminals, the terminal modules are integrated in the Beckhoff I/O system. Plug connectors with spring connections enable plug-in wiring and are available with 1 or 3 pins. LEDs integrated in the connector indicate the signal state for each channel directly at the wire. The outputs are protected against overload and short circuit.

Ordering information for terminal modules with 16 digital inputs

Ordering name	Scope of supply
KM2002-0000	digital output module, 16 channels (0.5 A), without connectors
KM2002-0001	digital output module, 16 channels (0.5 A), with 2 connectors ZS2001-0001
KM2002-0002	digital output module, 16 channels (0.5 A), with 2 connectors ZS2001-0002
KM2002-0004	digital output module, 16 channels (0.5 A), with 2 connectors ZS2001-0004

See also chapter ordering information for KM plug-in connectors [▶ 18].

2.2.2 Technical data

Technical data	KM2002
Number of outputs	16 (2 x 8)
Nominal voltage	24 V_{DC} (-15%/+20%)
Load type	ohmic, inductive, lamp load
Output current per channel	max. 0.5 A
Short circuit current	0.6 ... 1.0 A
Breaking energy (inductive)	< 150 mJ/channel
Power supply for the electronics	via the K-Bus
Current consumption from K-bus	typically 5 mA
Current consumption from the load voltage (24 V)	typically 15 mA
With of a bus terminal block	max. [▶ 22] 64 standard bus terminals or 80 cm (for this a KM2002 is equivalent to 2 standard bus terminals)
Electrical isolation	500 V (K-Bus / signal voltage)
Bit width in the output process image	16 bit
Dimensions with connector (W x H x D)	approx. 26.5mm x 100 mm x 71mm (aligned width: 24mm), see dimensional drawing [▶ 21]
Weight (without connector)	approx. 70 g
Permissible ambient temperature range during operation	0°C...+55°C
Permissible ambient temperature range during storage	-25°C...+85°C
Permissible relative humidity	95%, no condensation
Mounting [▶ 25]	on 35 mm mounting rail according to EN 60715
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
Protection class	IP20
Installation position	variable
Approvals / markings*	CE, UKCA, EAC

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

2.3 KM2004

2.3.1 Introduction

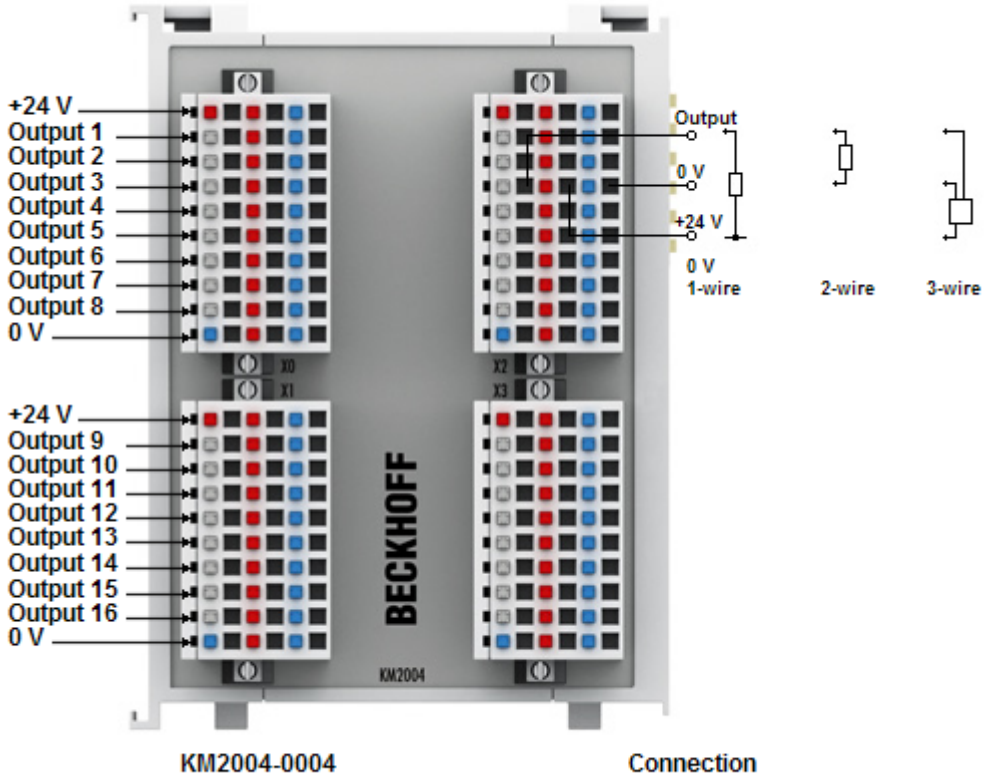


Fig. 9: Digital Terminal Modules with 32 output channels

Digital Terminal Modules with 32 output channels (24 V_{DC})

The terminal module KM2004 combines 32 digital outputs with 8 channels per plug connector in a compact design with high packing density. The binary control signals are transferred (electrically isolated) to the actuators at the process level. Like the standard Bus Terminals, the terminal modules are integrated in the Beckhoff I/O system. Plug connectors with spring connections enable plug-in wiring and are available with 1 or 3 pins. LEDs integrated in the connector indicate the signal state for each channel directly at the wire. The outputs are protected against overload and short circuit.

Ordering information for terminal modules with 32 digital inputs

Ordering name	Scope of supply
KM2004-0000	digital output module, 32 channels (0.5 A), without connectors
KM2004-0001	digital output module, 32 channels (0.5 A), with 4 connectors ZS2001-0001
KM2004-0002	digital output module, 32 channels (0.5 A), with 4 connectors ZS2001-0002
KM2004-0004	digital output module, 32 channels (0.5 A), with 4 connectors ZS2001-0004

See also chapter ordering information for KM plug-in connectors [▶ 18].

2.3.2 Technical data

Technical data	KM2004
Number of outputs	32 (4 x 8)
Nominal voltage	24 V_{DC} (-15%/+20%)
Load type	ohmic, inductive, lamp load
Output current per channel	max. 0.5 A
Short circuit current	0.6 ... 1.0 A
Breaking energy (inductive)	< 150 mJ/channel
Power supply for the electronics	via the K-Bus
Current consumption from K-bus	typically 5 mA
Current consumption from the load voltage (24 V)	typically 15 mA
With of a bus terminal block	max. [▶ 22] 64 standard bus terminals or 80 cm (for this a KM2004 is equivalent to 4 standard bus terminals)
Electrical isolation	500 V (K-Bus / signal voltage)
Bit width in the output process image	32 bit
Dimensions with connector (W x H x D)	approx. 75mm x 100 mm x 55mm (aligned width: 73mm), see dimensional drawing [▶ 21]
Weight (without connector)	approx. 150 g
Permissible ambient temperature range during operation	0°C...+55°C
Permissible ambient temperature range during storage	-25°C...+85°C
Permissible relative humidity	95%, no condensation
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715, see Recommended mounting rails [▶ 20]
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
Protection class	IP20
Installation position	variable
Approvals / markings*	CE, UKCA, EAC

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

2.4 KM2008

2.4.1 Introduction

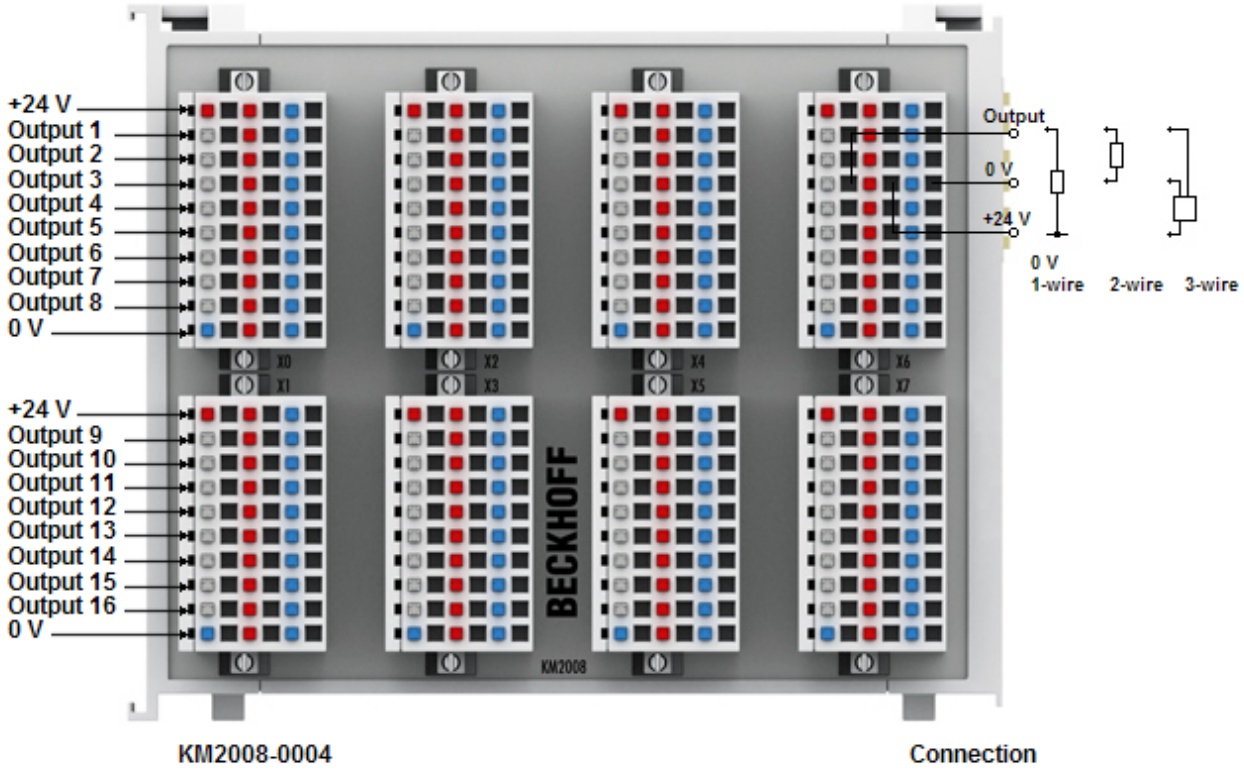


Fig. 10: Digital Terminal Modules with 64 output channels

Digital Terminal Modules with 64 output channels (24 V_{DC})

The terminal module KM2008 combines 64 digital outputs with 8 channels per plug connector in a compact design with high packing density. The binary control signals are transferred (electrically isolated) to the actuators at the process level. Like the standard Bus Terminals, the terminal modules are integrated in the I/O system. Plug connectors with spring connections enable plug-in wiring and are available with 1 or 3 pins. LEDs integrated in the connector indicate the signal state for each channel directly at the wire. The outputs are protected against overload and short circuit.

Ordering information for terminal modules with 64 digital inputs

Ordering name	Scope of supply
KM2008-0000	digital output module, 64 channels (0.5 A), without connectors
KM2008-0001	digital output module, 64 channels (0.5 A), with 8 connectors ZS2001-0001
KM2008-0002	digital output module, 64 channels (0.5 A), with 8 connectors ZS2001-0002
KM2008-0004	digital output module, 64 channels (0.5 A), with 8 connectors ZS2001-0004

See also chapter ordering information for KM plug-in connectors [▶ 18].

2.4.2 Technical data

Technical data	KM2008
Number of outputs	64 (8 x 8)
Nominal voltage	24 V_{DC} (-15%/+20%)
Load type	ohmic, inductive, lamp load
Output current per channel	max. 0.5 A
Short circuit current	0.6 ... 1.0 A
Breaking energy (inductive)	< 150 mJ/channel
Power supply for the electronics	via the K-Bus
Current consumption from K-bus	typically 5 mA
Current consumption from the load voltage (24 V)	typically 15 mA
With of a bus terminal block	max. [▶ 22] 64 standard bus terminals or 80 cm (for this a KM2008 is equivalent to 8 standard bus terminals)
Electrical isolation	500 V (K-Bus / signal voltage)
Bit width in the output process image	64 bit
Dimensions with connector (W x H x D)	approx. 123mm x 100 mm x 55mm (aligned width: 121mm), see dimensional drawing [▶ 22]
Weight (without connector)	approx. 225 g
Permissible ambient temperature range during operation	0°C...+55°C
Permissible ambient temperature range during storage	-25°C...+85°C
Permissible relative humidity	95%, no condensation
Mounting [▶ 23]	on 35 mm mounting rail according to EN 60715, see Recommended mounting rails [▶ 20]
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
Protection class	IP20
Installation position	variable
Approvals / markings*	CE, UKCA, EAC

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

2.5 KM plug-in connectors

2.5.1 Ordering information for KM plug-in connector

Fig. 11: KM plug-in connector for single-wire connection (ZS2001-0001, ZS2001-0002)

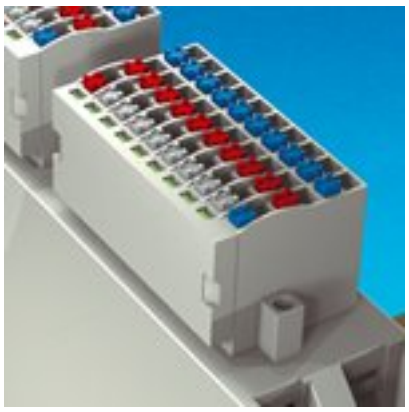


Fig. 12: KM plug-in connector for tree-wire connection (ZS2001-0004)

Ordering name	Signal LEDs	Wiring technique		
		single-wire	two-wire	three-wire
ZS2001-0001	no	yes	no	no
ZS2001-0002	yes	yes	no	no
ZS2001-0004	yes	yes	yes	yes

2.5.2 Technical Data

Technical Data	ZS2001-0001	ZS2001-0002	ZS2001-0004
Number of terminal points	10	10	30
Signal LEDs	no	yes	yes
Nominal voltage	24 V_{DC}		
Nominal current	2 A		
Cycle of connector operation	25		
Wire size width Solid: stranded: with ferrule:	 0.2 mm^2 ... 1.0 mm^2 (H05V-U, H07V-U) 0.2 mm^2 ... 1.5 mm (H05V-K, H07V-K) 0.2 mm^2 ... 1.0 mm^2 (ferrule to DIN 46 228 pt 1) 0.2 mm^2 ... 0.75 mm^2 (ferrule with plastic collar to DIN 46 228 pt 4)		
Maximum outer diameter of the conductor	2.9 mm		
Wire stripping length	8 mm, 10 mm for use with ferrule		
Dimensions (w x h x d)	app. 42mm x 10.3mm x 26.9mm	app. 42mm x 12.7mm x 26.9mm	app. 42mm x 20.8mm x 26.9mm
Weight	app. 11 g	app. 13 g	app. 23 g
Permissible ambient temperature range during operation	0°C ... +55°C		
Permissible ambient temperature range during storage	-25°C ... +55°C		
Permissible relative humidity	80%, 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		
Protection class	IP20		
Installation position	variable		

3 Mounting and Wiring

3.1 Instructions for ESD protection

NOTICE

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 spring contacts (see fig.) 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.

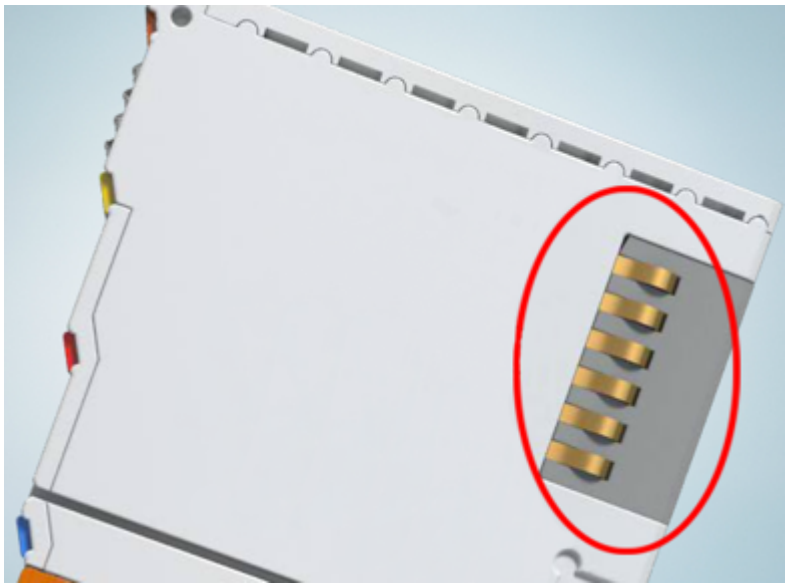


Fig. 13: Spring contacts of the Beckhoff I/O components

3.2 Recommended mounting rails

Terminal Modules and EtherCAT Modules of KMxxxx and EMxxxx series, same as the terminals of the EL66xx and EL67xx series can be snapped onto the following recommended mounting rails:

- mounting rail TH 35-7.5 with 1 mm material thickness (according to EN 60715)
- mounting rail TH 35-15 with 1.5 mm material thickness
- mounting rail TH 35-15 with 2.2 to 2.5 mm material thickness (according to EN 60715)

For older modules pay attention to the material thickness of the mounting rail

Modules of KM10x4, KM10x8, KM2004, KM2008, KM26x4 and KM2774 series, do not fit to the mounting rail TH 35-15 with 2.2 to 2.5 mm material thickness (according to EN 60715)!

3.3 Dimensions

KM10x2, KM20x2

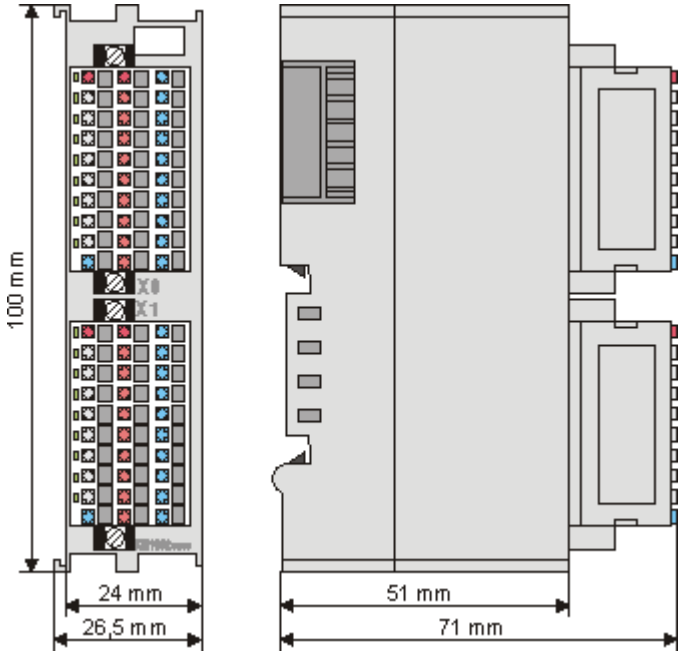


Fig. 14: Dimensions KM10x2, KM20x2

KM10x4, KM20x4

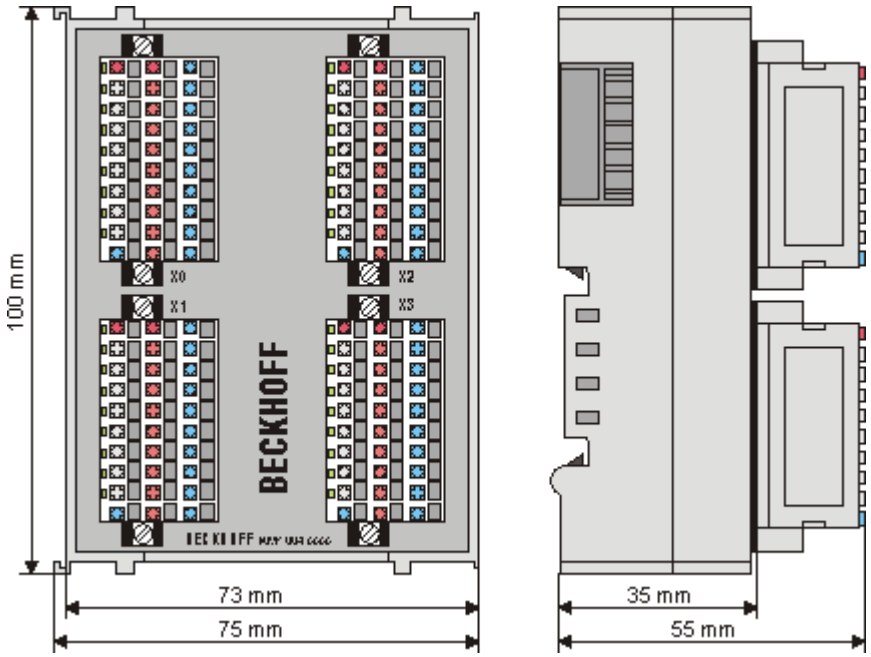


Fig. 15: Dimensions KM10x4, KM20x4

KM10x8, KM20x8

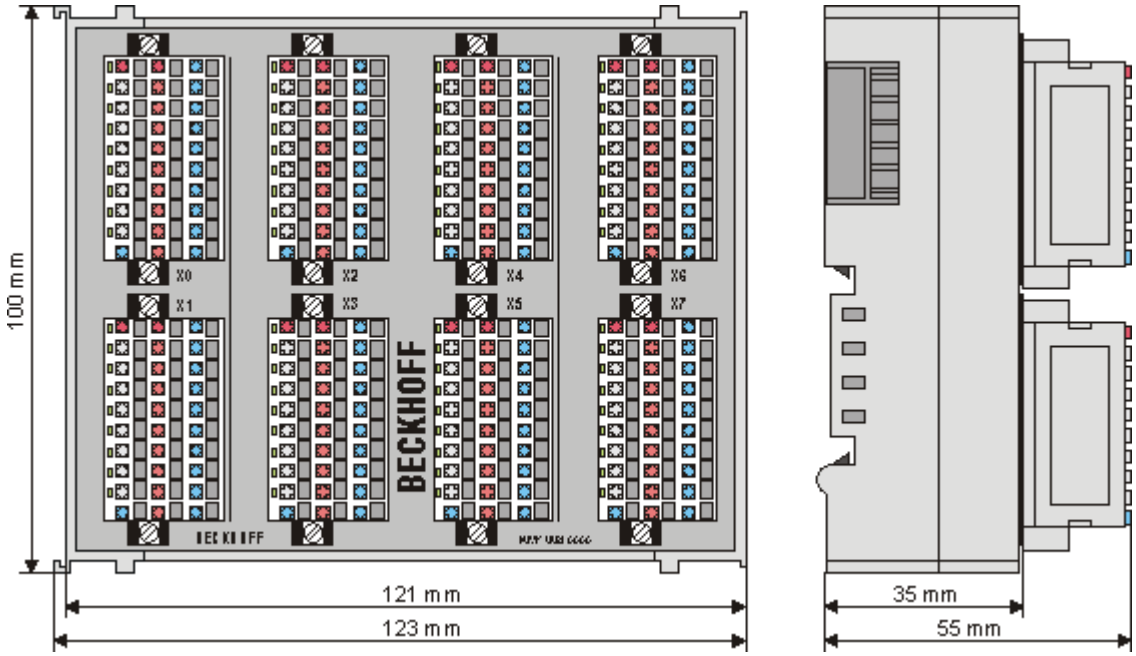


Fig. 16: Dimensions KM10x8, KM20x8

Width of a Bus Terminal block

NOTICE

Pay attention to the maximum with and the current consumption

A maximum of 64 Bus Terminals or Bus Terminal Modules may be aligned to a Bus Coupler! An overall with of 80 cm must not be exceeded! Also take care that the current consumption of the Bus Terminals / Bus Terminal Modules does not overstrain the K-Bus power supply of the Bus Coupler!

3.4 Mounting and demounting - traction lever unlocking

The terminal modules are fastened to the assembly surface with the aid of a 35 mm mounting rail (e. g. mounting rail TH 35-15).

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 recommended mounting rails under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

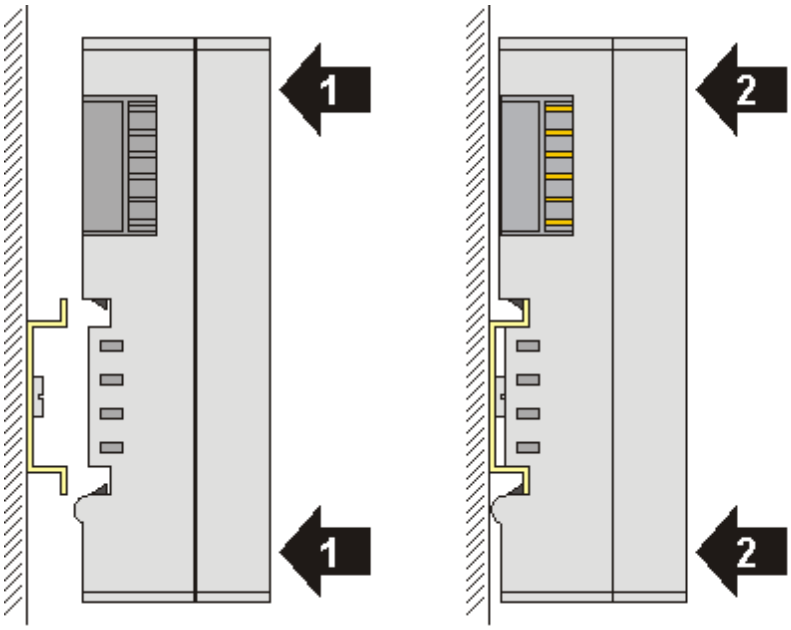
⚠ WARNING

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!

Mounting

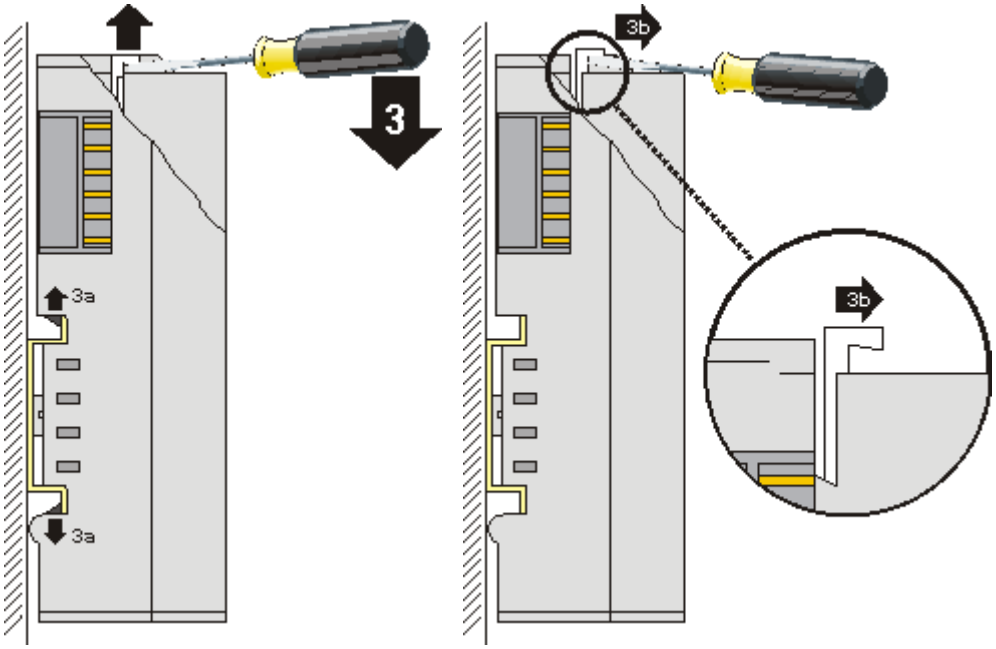
- Fit the mounting rail to the planned assembly location.



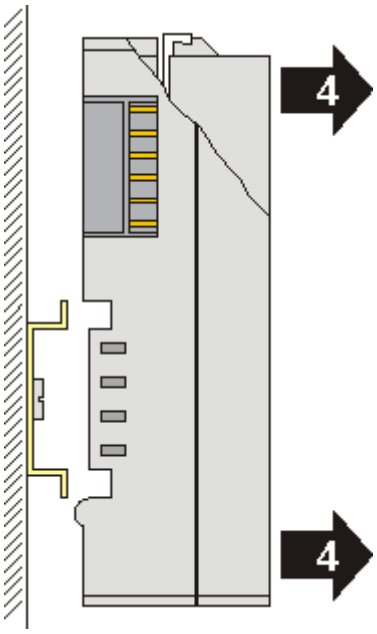
  and press (1) the terminal module against the mounting rail until it latches in place on the mounting rail (2).
- Attach the cables.

Demounting

- Remove all the cables. Thanks to the KM/EM connector, it is not necessary to remove all the cables separately for this, but for each KM/EM connector simply undo 2 screws so that you can pull them off (fixed wiring)!
- Lever the unlatching hook on the left-hand side of the terminal module upwards with a screwdriver (3). As you do this
  - an internal mechanism pulls the two latching lugs (3a) from the top hat rail back into the terminal module,
  - the unlatching hook moves forwards (3b) and engages



- In the case 32 and 64 channel terminal modules (KMxxx4 and KMxxx8 or EMxxx4 and EMxxx8) you now lever the second unlatching hook on the right-hand side of the terminal module upwards in the same way.
- Pull (4) the terminal module away from the mounting surface.



3.5 Mounting and demounting - top front unlocking

The terminal modules are fastened to the assembly surface with the aid of a 35 mm mounting rail (e. g. mounting rail TH 35-15).

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 recommended mounting rails under the terminals and couplers, you should use flat mounting connections (e.g. countersunk screws or blind rivets).

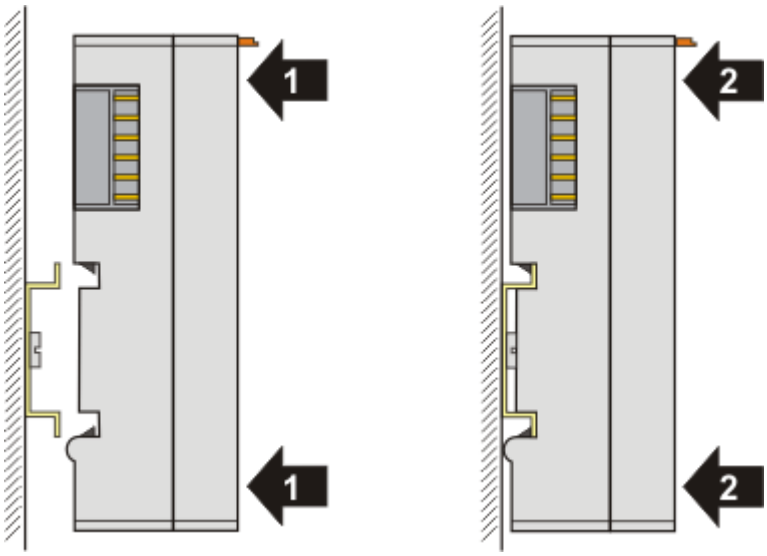
⚠ WARNING

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!

Mounting

- Fit the mounting rail to the planned assembly location.

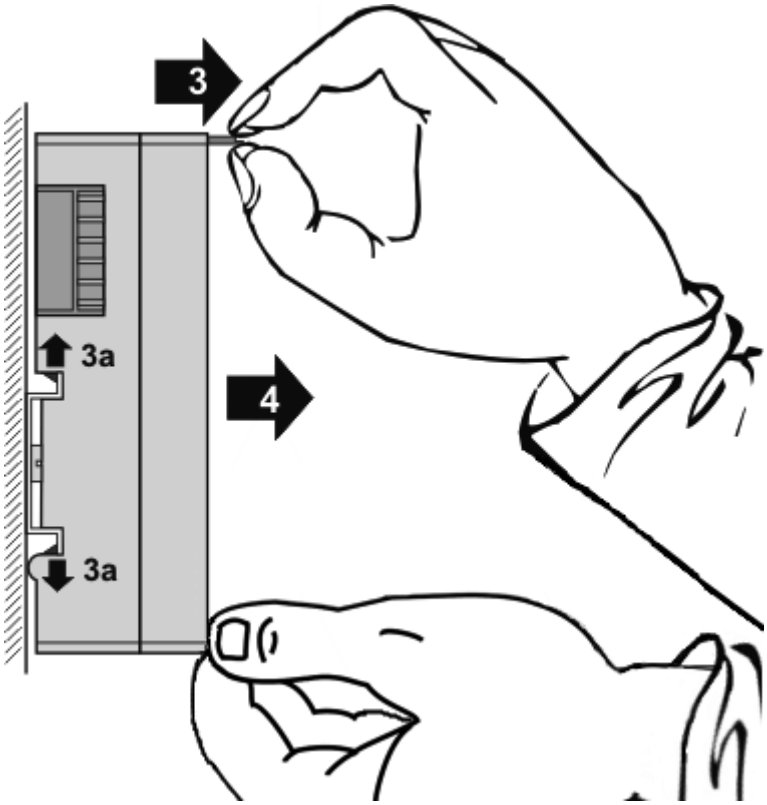


and press (1) the terminal module against the mounting rail until it latches in place on the mounting rail (2).

- Attach the cables.

Demounting

- Remove all the cables.
- Lever the unlatching hook back with thumb and forefinger (3). An internal mechanism pulls the two latching lugs (3a) from the top hat rail back into the terminal module.



- Pull (4) the terminal module away from the mounting surface.
  Avoid canting of the module; you should stabilize the module with the other hand, if required.

3.6 Disposal

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

3.7 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!

Supply voltage connection

The illustration shows the connection of the supply voltage for the module electronics and the actuators to two KM connectors.

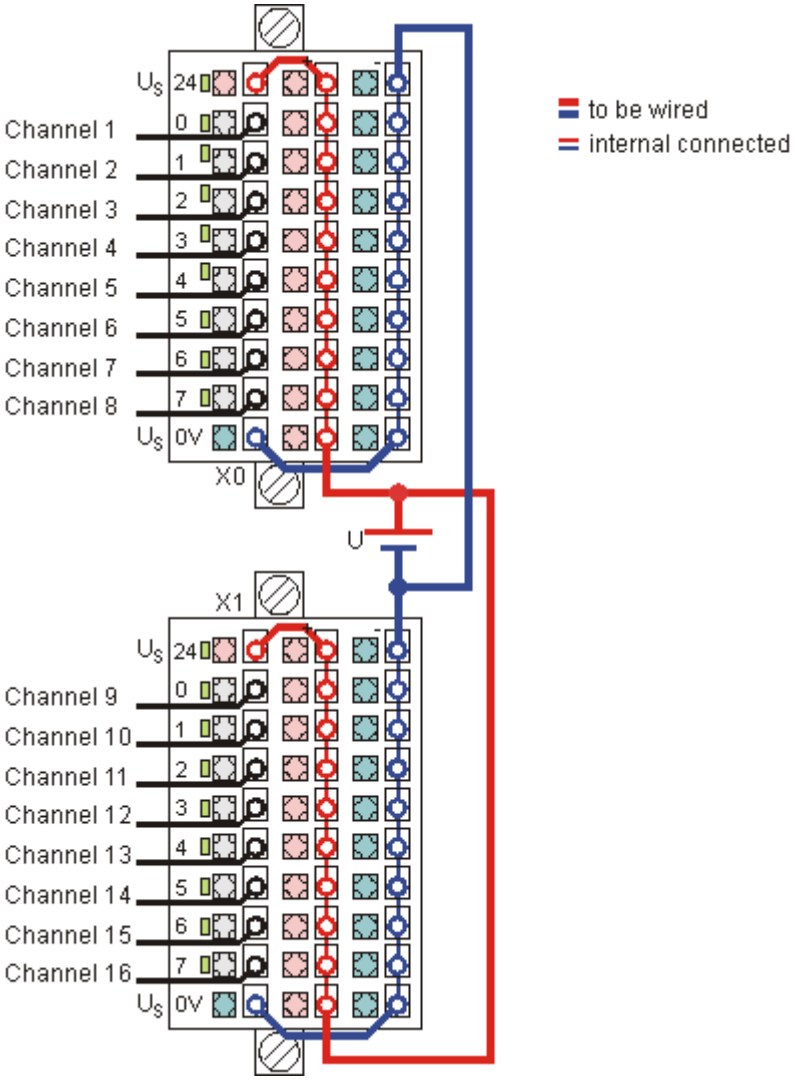


Fig. 17: Supply voltage connection

Power the internal electronics

- the positive supply voltage to terminal location +24 V
- the negative supply voltage to terminal location 0 V

Connecting the actuators

Pin assignment for channels 1 to 16

Channel	Terminal point	at KM connector
1	0	X0
2	1	X0
3	2	X0
4	3	X0
5	4	X0
6	5	X0
7	6	X0
8	7	X0
9	0	X1
10	1	X1
11	2	X1
12	3	X1
13	4	X1
14	5	X1
15	6	X1
16	7	X1

For terminal modules with more than 16 channels, you will find the assignment of the channels to the additional KM connectors in the description of the Process image [▶ 30].

3.8 Connection

The actuators can be connected in

- single- (see example, terminal point 0),
- two- (see example, terminal point 3) or
- three wire technique (see example, terminal point 6).

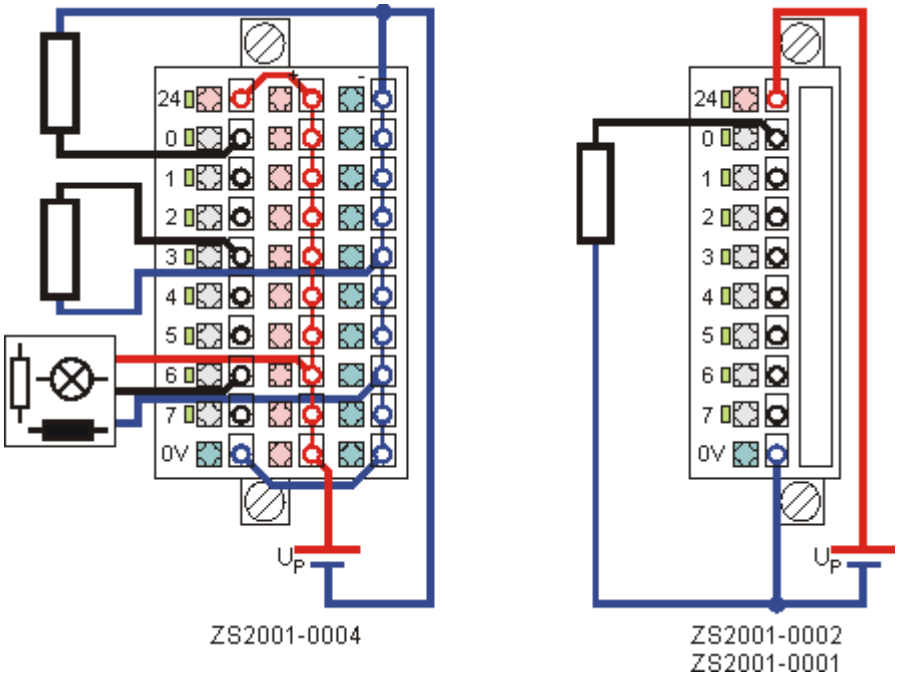


Fig. 18: Connection

4 Access from the user programm

4.1 Process Image

KM2002

The process image of the terminal module KM2002 consists of 2 byte output data.

Byte offset	Format	Output data	KM plug-in connector
0	byte	DataOUT (channel 1 to 8)	X0
1	byte	DataOUT (channel 9 to 16)	X1

KM2004

The process image of the terminal module KM2004 consists of 4 byte output data.

Byte offset	Format	Output data	KM plug-in connector
0	byte	DataOUT (channel 1 to 8)	X0
1	byte	DataOUT (channel 9 to 16)	X1
2	byte	DataOUT (channel 17 to 24)	X2
3	byte	DataOUT (channel 25 to 32)	X3

KM2008

The process image of the terminal module KM2008 consists of 8 byte output data.

Byte offset	Format	Output data	KM plug-in connector
0	byte	DataOUT (channel 1 to 8)	X0
1	byte	DataOUT (channel 9 to 16)	X1
2	byte	DataOUT (channel 17 to 24)	X2
3	byte	DataOUT (channel 25 to 32)	X3
4	byte	DataOUT (channel 33 to 40)	X4
5	byte	DataOUT (channel 41 to 48)	X5
6	byte	DataOUT (channel 49 to 56)	X6
7	byte	DataOUT (channel 57 to 64)	X7

5 Appendix

5.1 Support and Service

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

Beckhoff's branch offices and representatives

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

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages: www.beckhoff.com

You will also find further documentation for Beckhoff components there.

Support

The Beckhoff Support offers you comprehensive technical assistance, helping you not only with the application of individual Beckhoff products, but also with other, wide-ranging services:

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

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web:	www.beckhoff.com/support

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