BECKHOFF New Automation Technology

Documentation | EN

EP23xx

EtherCAT box modules with digital inputs and outputs

2021-06-07 | Version: 3.3

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.
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

Beckhoff®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered trademarks of and licensed by Beckhoff Automation GmbH. Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

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.

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
3.3	• EP2339-0121 added • Technical data updated • Dimensions updated • UL requirements updated
3.2	• Front page updated • Scope of delivery added
3.1	• EP2339-0042: Technical data and connections updated
3.0	• Documentation separated from EP2xxx 2.9.2 • EP2339-0042 added

Firmware and hardware versions

This documentation refers to the firmware and hardware version that was applicable at the time the documentation was written.

The module features are continuously improved and developed further. Modules having earlier production statuses cannot have the same properties as modules with the latest status. However, existing properties are retained and are not changed, so that older modules can always be replaced with new ones.

The firmware and hardware version (delivery state) can be found in the batch number (D-number) printed on the side of the EtherCAT Box.

Syntax of the batch number (D-number)

D: WW YY FF HH	Example with D no. 29 10 02 01:
WW - week of production (calendar week) YY - year of production FF - firmware version HH - hardware version	29 - week of production 29 10 - year of production 2010 02 - firmware version 02 01 - hardware version 01

Further information on this topic: Version identification of EtherCAT devices [▶ 90].

2 EtherCAT Box - Introduction

The EtherCAT system has been extended with EtherCAT Box modules with protection class IP 67. Through the integrated EtherCAT interface the modules can be connected directly to an EtherCAT network without an additional Coupler Box. The high-performance of EtherCAT is thus maintained into each module.

The extremely low dimensions of only 126 x 30 x 26.5 mm (h x w x d) are identical to those of the Fieldbus Box extension modules. They are thus particularly suitable for use where space is at a premium. The small mass of the EtherCAT modules facilitates applications with mobile I/O interface (e.g. on a robot arm). The EtherCAT connection is established via screened M8 connectors.

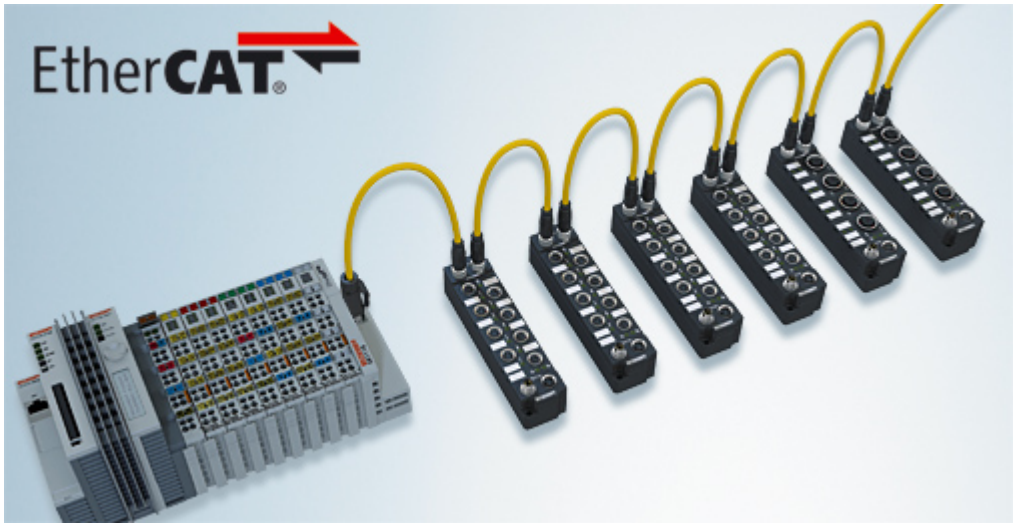


Fig. 1: EtherCAT Box Modules within an EtherCAT network

The robust design of the EtherCAT Box modules enables them to be used directly at the machine. Control cabinets and terminal boxes are now no longer required. The modules are fully sealed and therefore ideally prepared for wet, dirty or dusty conditions.

Pre-assembled cables significantly simplify EtherCAT and signal wiring. Very few wiring errors are made, so that commissioning is optimized. In addition to pre-assembled EtherCAT, power and sensor cables, field-configurable connectors and cables are available for maximum flexibility. Depending on the application, the sensors and actuators are connected through M8 or M12 connectors.

The EtherCAT modules cover the typical range of requirements for I/O signals with protection class IP67:

- digital inputs with different filters (3.0 ms or 10 µs)
- digital outputs with 0.5 or 2 A output current
- analog inputs and outputs with 16 bit resolution
- Thermocouple and RTD inputs
- Stepper motor modules

XFC (eXtreme Fast Control Technology) modules, including inputs with time stamp, are also available.

Fig. 2: EtherCAT Box with M8 connections for sensors/actuators

Fig. 3: EtherCAT Box with M12 connections for sensors/actuators

Basic EtherCAT documentation

You will find a detailed description of the EtherCAT system in the Basic System Documentation for EtherCAT, which is available for download from our website (www.beckhoff.com) under Downloads.

3 Product overview

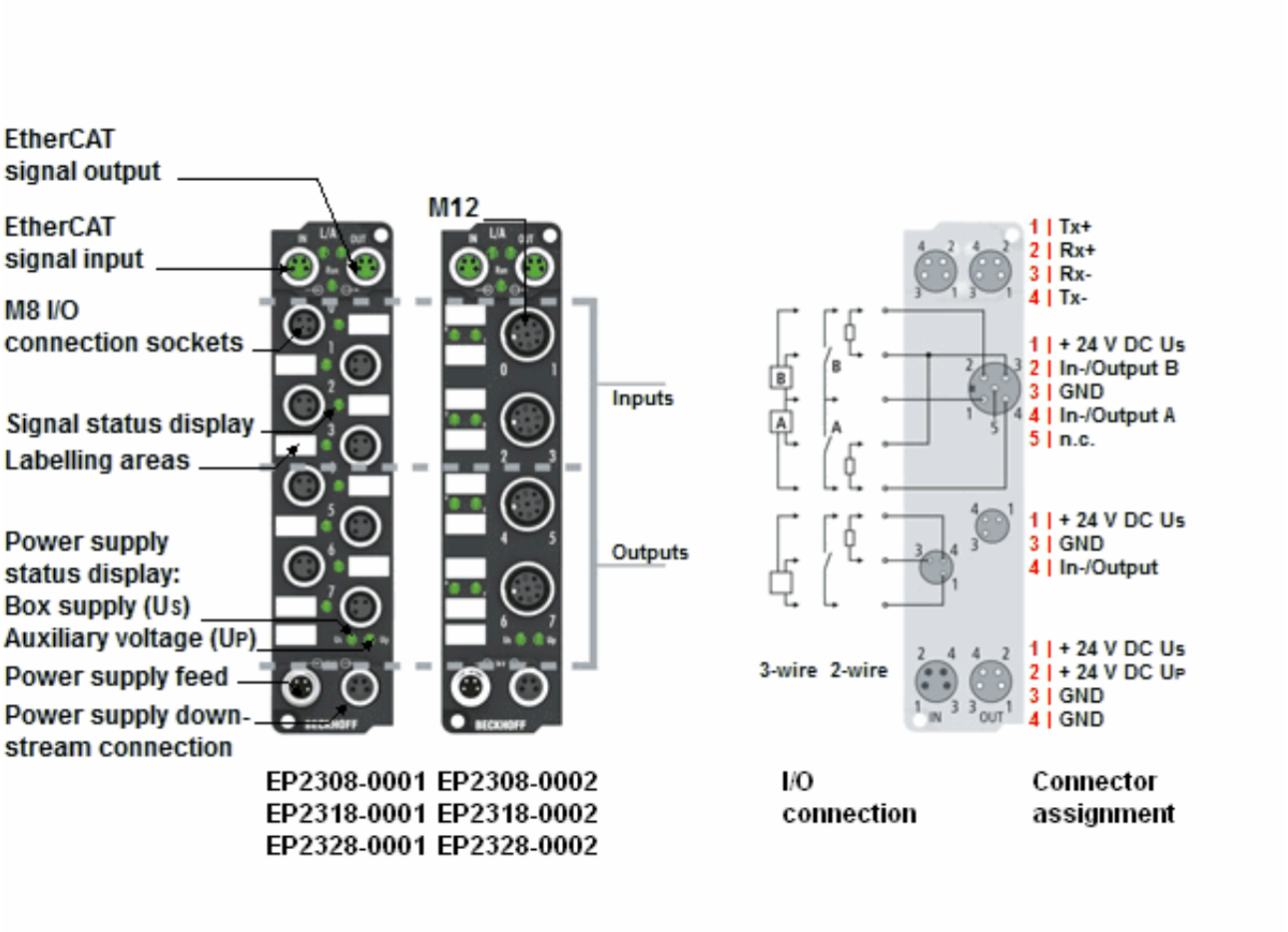
3.1 Module overview EP23xx

Module	Signal connection	Number of outputs	Output current		Number of inputs	Input filter
			per output	Sum		
EP2308-0001 [▶ 11]	8 x M8	4	0.5 A	4 A	4	3.0 ms
EP2308-0002 [▶ 11]	4 x M12	4	0.5 A	4 A	4	3.0 ms
EP2316-0003 [▶ 18]	2 x ZS2001	8	0.5 A	4 A	8	10 µs
EP2316-0008 [▶ 19]	1 x D-sub 25	8	0.5 A	4 A	8	10 µs
EP2318-0001 [▶ 11]	8 x M8	4	0.5 A	4 A	4	10 µs
EP2318-0002 [▶ 11]	4 x M12	4	0.5 A	4 A	4	10 µs
EP2328-0001 [▶ 11]	4 x M8	4	2.0 A	4 A	4	3.0 ms
EP2328-0002 [▶ 11]	4 x M12	4	2.0 A	4 A	4	3.0 ms
EP2338-0001 [▶ 26]	8 x M8	0 to 8	0.5 A	4 A	8 to 0	10 µs
EP2338-0002 [▶ 26]	4 x M12	0 to 8	0.5 A	4 A	8 to 0	10 µs
EP2338-1001 [▶ 26]	8 x M8	0 to 8	0.5 A	4 A	8 to 0	3.0 ms
EP2338-1002 [▶ 26]	4 x M12	0 to 8	0.5 A	4 A	8 to 0	3.0 ms
EP2339-0003 [▶ 31]	2 x ZS2001	0 to 16	0.5 A	4 A	16 to 0	3.0 ms
EP2339-0021 [▶ 37]	16 x M8	0 to 16	0.5 A	4 A	16 to 0	3.0 ms
EP2339-0022 [▶ 39]	8 x M12	0 to 16	0.5 A	4 A	16 to 0	3.0 ms
EP2339-0042 [▶ 45]	8 x M12	0 to 16	0.5 A	16 A	16 to 0	3.0 ms
EP2339-0121 [▶ 51]	16 x M8	0 to 16 [1)]	0.5 A	4 A	16 to 0 [1)]	3.0 ms
EP2349-0021 [▶ 37]	16 x M8	0 to 16	0.5 A	4 A	16 to 0	10 µs
EP2349-0022 [▶ 39]	8 x M12	0 to 16	0.5 A	4 A	16 to 0	10 µs

[1)] The inputs and outputs of the EP2339-0121 are ground switching.

3.2 EP2308, EP2318, EP2328

3.2.1 EP2308, EP2318, EP2328 - Introduction



4 digital inputs 24 VDC and 4 digital outputs 24 V_{DC}, I_{max} 0.5 A oder 2 A

The EP2308, EP2318 and EP2328 EtherCAT-Box modules combine four digital inputs and four digital outputs in one device.

The state of each signal is indicated by means of light emitting diodes. The signals are optionally connected via M8 connectors (EP23x8-0001) or M12 connectors (EP23x8-0002).

Various filter constants are available for the inputs. The outputs process load currents up to 0.5 A (EP2308, EP2318) or 2 A (EP2328) and are short-circuit proof and protected against inverse polarity.

Quick links

EP2308 – Technical data [▶ 12]
EP2318 – Technical data [▶ 12]
EP2328 – Technical data [▶ 14]
Process image [▶ 17]
Dimensions [▶ 55]
Actuator connection [▶ 67]
Sensor connection [▶ 68]

3.2.2 EP2308, EP2318 - Technical Data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current: $I_{S,sum}$	max. 4 A
Current consumption from U_S	120 mA + sensor supply
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current: $I_{P,sum}$	max. 4 A
Current consumption from U_P	20 mA + Loads at digital outputs
Electrical isolation GND_S / GND_P	no

Digital inputs	EP2308-0001	EP2308-0002	EP2318-0001	EP2318-0002
Number	4			
Connection	4 x M8 socket	2 x M12 socket	4 x M8 socket	2 x M12 socket
Input filter	3.0 ms	3.0 ms	10 µs	10 µs
Characteristics	Type 3 according to EN61131-2, compatible with type 1			
Signal voltage "0"	-3…+5 V			
Signal voltage "1"	+11…+30 V			
Input current	6 mA			
Sensor supply U_{S1}	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_S.			

Digital outputs	EP2308-0001	EP2308-0002	EP2318-0001	EP2318-0002
Number	4			
Connection	4 x M8 socket	2 x M12 socket	4 x M8 socket	2 x M12 socket
Load type	Ohmic, inductive, lamp load			
Nominal output voltage	24 V_{DC}			
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.			
Output sum current	max. 4 A			
Short circuit current	max. 1.5 A			
Output driver supply	From the peripheral voltage U_P.			

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 13]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76], ATEX [▶ 77]

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.2.3 EP2328 – Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current: $I_{S,sum}$	max. 4 A
Current consumption from U_S	120 mA + sensor supply
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current: $I_{P,sum}$	max. 4 A
Current consumption from U_P	20 mA + Loads at digital outputs
Electrical isolation GND_S / GND_P	no

Digital inputs	EP2328-0001	EP2328-0002
Number	4	
Connection	4 x M8 socket	2 x M12 socket
Input filter	3.0 ms	
Characteristics	Type 3 according to EN61131-2, compatible with type 1	
Signal voltage "0"	-3…+5 V	
Signal voltage "1"	+11…+30 V	
Input current	6 mA	
Sensor supply U_{S1}	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_S.	

Digital outputs	EP2328-0001	EP2328-0002
Number	4	
Connection	4 x M8 socket	2 x M12 socket
Load type	Ohmic, inductive, lamp load	
Nominal output voltage	24 V_{DC}	
Output current per channel	max. 2 A. Each output is independently short-circuit proof.	
Output sum current	max. 4 A	
Short circuit current	max. 4 A	
Output driver supply	From the peripheral voltage U_P.	

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 15]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76], ATEX [▶ 77]

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.2.4 EP2308, EP2318, EP2328 - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP23x8-000x
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

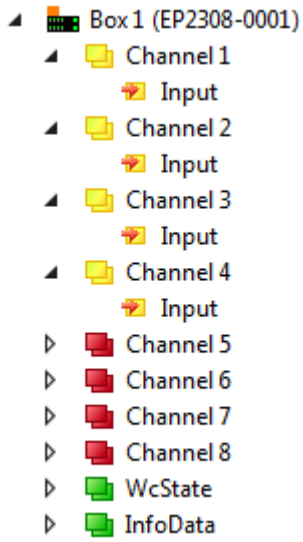
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

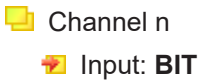
3.2.5 EP2308, EP2318, EP2328 - Process image

DI Inputs

Under **Channel 1** to **Channel 4** you will find the 4 digital inputs of the module (in the example the EP2308-0001).

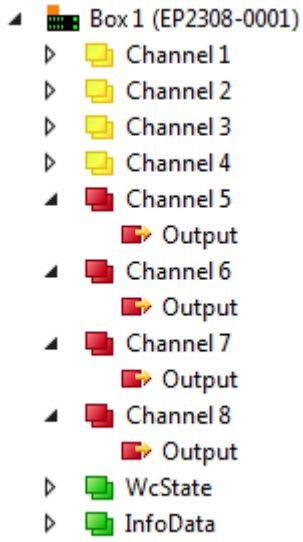


Data types

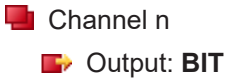


DO Outputs

Under **Channel 5** to **Channel 8** you will find the 4 digital outputs of the module (in the example the EP2308-0001).



Data types



3.3 EP2316-0003, EP2316-0008

3.3.1 EP2316-0003 - Introduction

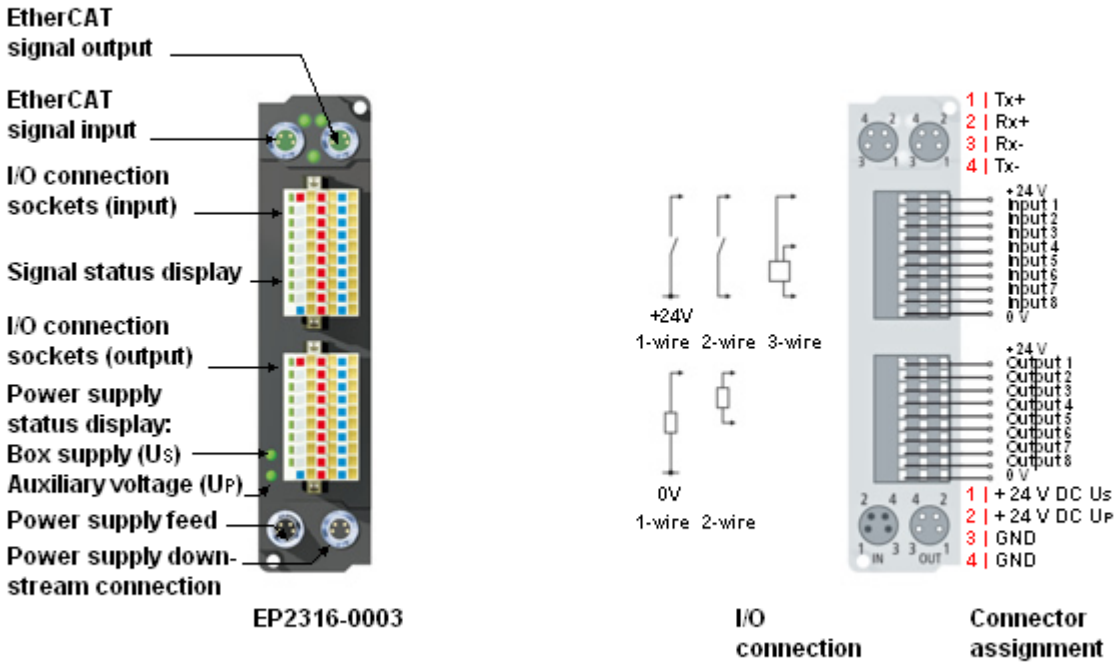


Fig. 4: EP2316-0003

8 digital inputs 24 V_{DC}, 8 digital outputs 24 V_{DC}, I_{max} 0.5 A

The EP2316 EtherCAT Box combines eight digital inputs and eight digital outputs in one device . The inputs are available with a 10 µs filter constant.

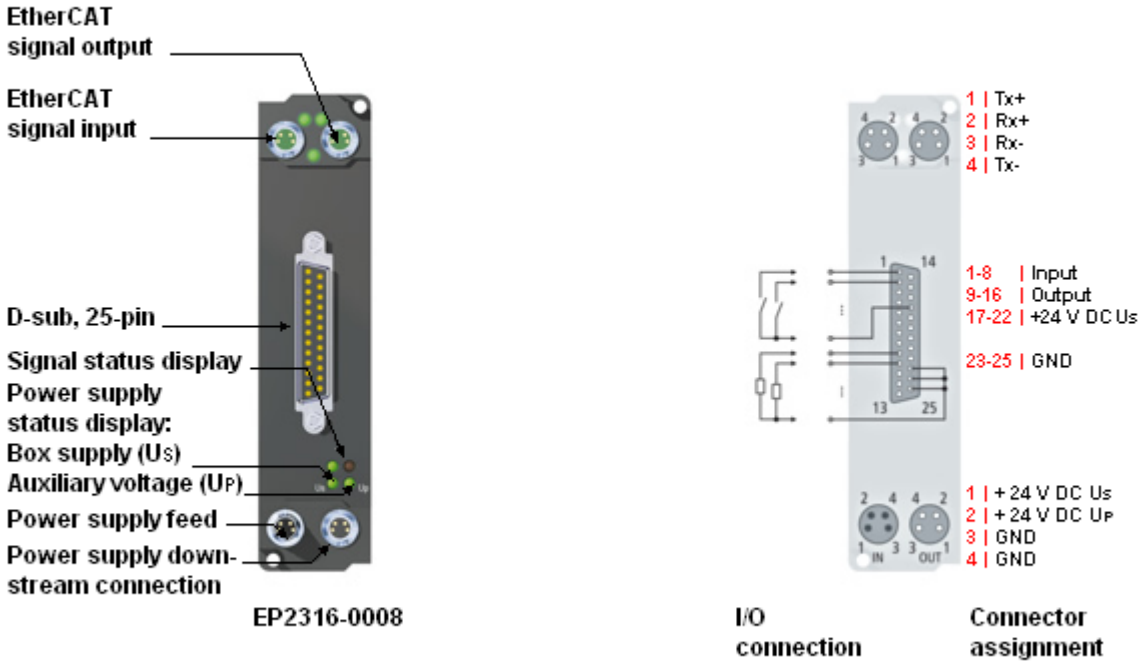
The outputs process load currents up to 0.5 A, are short-circuit proof and protected against inverse polarity. Signal state and status are indicated by LEDs.

The signal connection is made via two ZS2001 connectors [▶ 73] with spring-loaded system, optionally available with 1 or 3 pins. The module is delivered without connectors.

Quick links

Technical data [▶ 20]
Process image [▶ 23]
Dimensions [▶ 55]
Actuator connection [▶ 72]
Sensor connection [▶ 72]

3.3.2 EP2316-0008 - Introduction



8 digital inputs, 24 V_{DC}, 8 digital outputs, 24 V_{DC}, I_{max} 0.5 A

The EP2316 EtherCAT Box combines eight digital inputs and eight digital outputs in one device . The inputs are available with a 10 µs filter constant.

The outputs process load currents up to 0.5 A, are short-circuit proof and protected against inverse polarity.

The signal connection is made through a 25-pin D-Sub socket.

The signal state and the status are displayed in groups by light emitting diodes.

Quick links

Technical data [▶ 20]
Process image [▶ 23]
Dimensions [▶ 55]
Sensor/actuator connection [▶ 75]

3.3.3 EP2316-000x - Technical Data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current: $I_{S,sum}$	max. 4 A
Current consumption from U_S	120 mA + sensor supply
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current: $I_{P,sum}$	max. 4 A
Current consumption from U_P	20 mA + Loads at digital outputs
Electrical isolation GND_S / GND_P	no

Digital inputs	EP2316-0003	EP2316-0008
Number	8	
Connection	1 x ZS2001 connector	1 x D-sub socket, 25-pin, UNC4-40 thread Pins 1…8
Input filter	10 µs	
Characteristics	Type 3 according to EN61131-2, compatible with type 1	
Signal voltage "0"	-3…+5 V	
Signal voltage "1"	+11…+30 V	
Input current	6 mA	
Sensor supply U_{S1}	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_S.	

Digital outputs	EP2316-0003	EP2316-0008
Number	8	
Connection	1 x ZS2001 connector	1 x D-sub socket, 25-pin, UNC4-40 thread Pins 9…16

Load type	Ohmic, inductive, lamp load
Nominal output voltage	24 V_{DC}
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.
Output sum current	max. 4 A
Short circuit current	max. 1.5 A
Output driver supply	From the peripheral voltage U_P.

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 13]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76]

3.3.4 EP2316-000x - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP2316-000x
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.3.5 EP2316-0008 - Status LEDs

Fig. 5: EP2316-0008 - Status LEDs

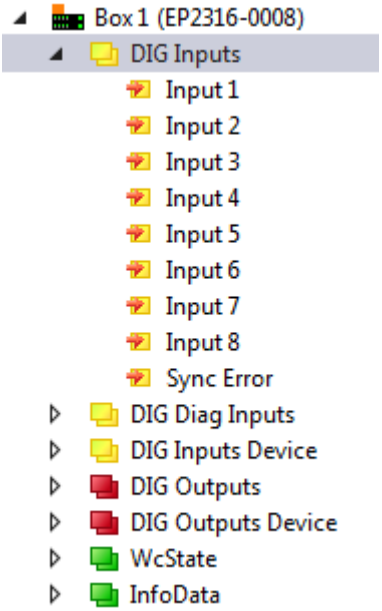
LED Displays

LED	Display	Meaning
STATUS 1-8	green illuminated	A signal (24 V) is present at a least one of the inputs for channels 1-8
STATUS 9-16	green illuminated	at least one of the outputs for channel 9-16 is set
	red illuminated	at least one output of channels 9-16 has an error
Us	off	The supply voltage, Us, is not present
	green illuminated	The supply voltage, Us, is present
Up	off	The supply voltage, Up, is not present
	green illuminated	The supply voltage, Up, is present

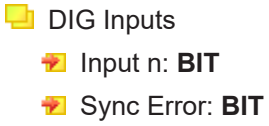
3.3.6 EP2316-000x - Process image

DIG Inputs

You will find the 8 digital inputs of the module under **DIG Inputs**.

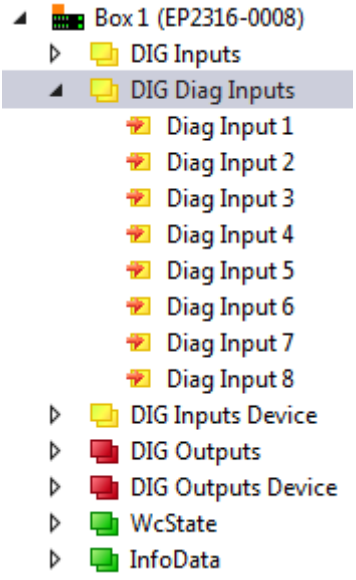


Data types

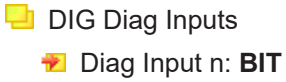


DIG Diag Inputs

You will find the diagnostic inputs for the module's 8 digital outputs under **DIG Diag Inputs**.



Data types

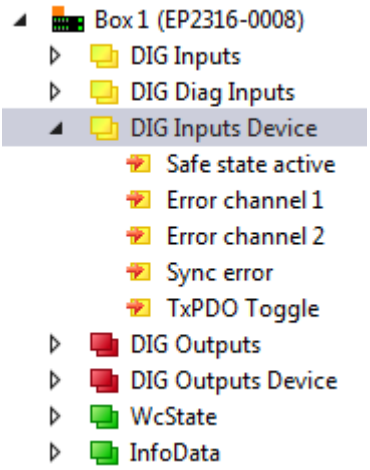


Diag Input n

Indicates an error on Output n.

DIG Inputs Device

You will find the module's status inputs under **DIG Inputs Device**.



Data types

- DIG Inputs Device
  - Safe state active: **BIT**
  - Error channel 1: **BIT**
  - Error channel 2: **BIT**
  - Sync error: **BIT**
  - TxPDO Toggle: **BIT**

Safe state active

Indicates whether the safe state has been assumed. The display only works if the network transmits process input data, i.e. in the network states Operational (OP) and Safe-Operational (Safe-OP), but not in the network state INIT.

Error channel X

Indicates an error on channel X.

Sync Error

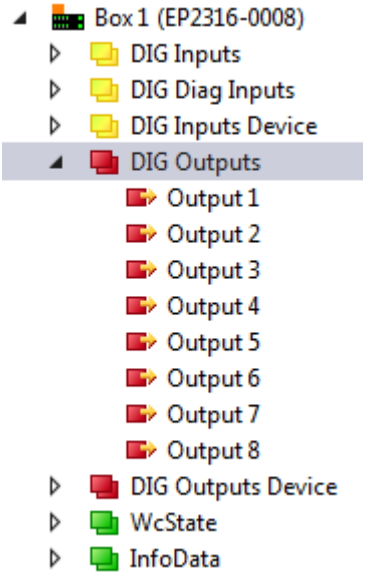
See EtherCAT system documentation. The EtherCAT system documentation is available on the Beckhoff homepage under Downloads.

TxPDO Toggle

See EtherCAT system documentation.

DIG Outputs

You will find the 8 digital outputs of the module under **DIG Outputs**.

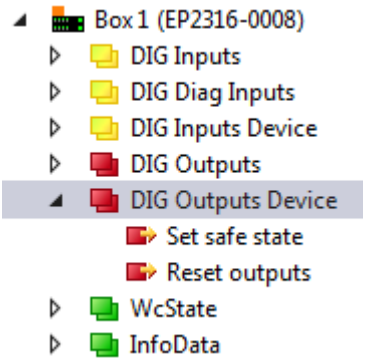


Data types

- DIG Outputs
  - Output n: **BIT**

DIG Outputs Device

You will find the module's control outputs under **DIG Outputs Device**.



Data types

- DIG Outputs Device
  - Set safe state: **BIT**
  - Reset outputs: **BIT**

Set safe state

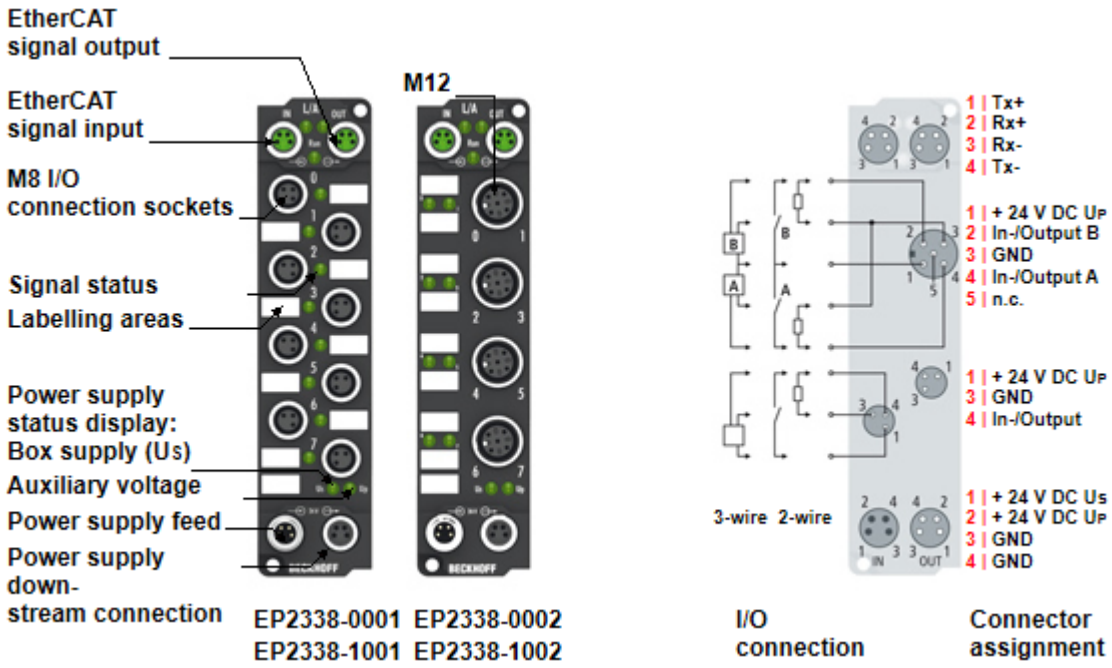
Sets the module to the safe state.

Reset outputs

Resets the error bits "Error channel X" of the module. The outputs are reactivated.

3.4 EP2338-x00x

3.4.1 EP2338-x00x - Introduction



8 digital inputs or outputs, 24 V_{DC}

The EP2338 EtherCAT Box has eight digital channels, each of which can optionally be operated as an input or as an output. A configuration whether a channel is to be used as input or output is not required; the input circuit is internally fixed to the output driver so that a set output is automatically displayed in the input process image.

The outputs process load currents up to 0.5 A, are short-circuit proof and protected against inverse polarity. The inputs have a filter constant of 10 µs (EP2338-0001, EP2338-0002) or a filter constant of 3 ms (EP2338-1001, EP2338-1002). The state of each signal is indicated by means of light emitting diodes. The signals are optionally connected via M8 (EP2338-x001) or M12 connectors (EP2338-x002).

Supply of the connected sensors from U_P, not from U_S

In contrast to many other modules, the EP2338 EtherCAT Box supplies digital sensors from the U_P peripheral voltage and not from the U_S control voltage! Nevertheless, an overload of the sensor supply (current > 0.5 A) is also indicated here by the illuminated red U_S LED.

NOTE

For switch-off in the event of a fault, do not supply sensors externally

If the design of your installation is such that the power supply voltage U_P is switched off in the event of a fault, you must not power the connected sensors externally, but only through EP2338! Otherwise, when the U_P energy is switched off, EP2338 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

Quick links

Technical data [▶ 27]
Process image [▶ 29]
Dimensions [▶ 55]
Sensor/actuator connection [▶ 69]

3.4.2 EP2338-x00x - Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
Current consumption from U_S	120 mA
U_S sum current: $I_{S,sum}$	max. 4 A
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
Current consumption from U_P	20 mA + Loads at digital outputs + sensor supply
U_P sum current: $I_{P,sum}$	max. 4 A
Electrical isolation GND_S / GND_P	no

Digital inputs	EP2338-0001	EP2338-1001	EP2338-0002	EP2338-1002
Number	0 to 8 Each digital input can alternatively be used as a digital output.			
Connection	8 x M8 socket		4 x M12 socket	
Input filter	10 µs	3.0 ms	10 µs	3.0 ms
Characteristics	Type 3 according to EN61131-2, compatible with type 1			
Signal voltage "0"	-3…+5 V			
Signal voltage "1"	+11…+30 V			
Input current	6 mA			
Sensor supply	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_P.			

Digital outputs	EP2338-0001	EP2338-1001	EP2338-0002	EP2318-1002
Number	0 to 8 Each digital output can alternatively be used as a digital input.			
Connection	8 x M8 socket		4 x M12 socket	
Load type	Ohmic, inductive, lamp load			
Nominal output voltage	24 V_{DC}			
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.			
Output sum current	max. 4 A			
Short circuit current	max. 1.5 A			
Output driver supply	From the peripheral voltage U_P.			

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 28]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76], ATEX [▶ 77]

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.4.3 EP2338-x00x - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP2338-x00x
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

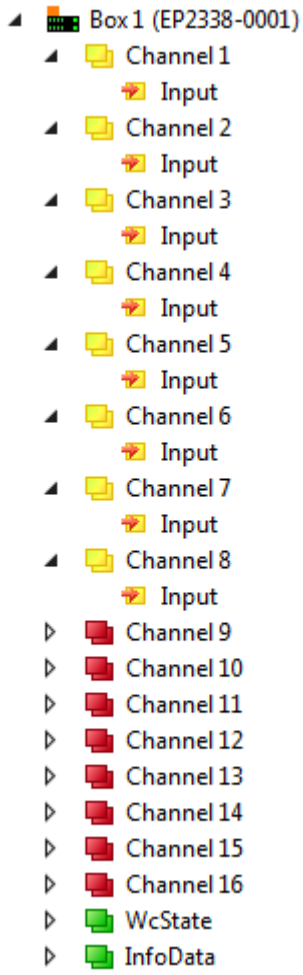
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.4.4 EP2338-x00x - Process image

DI Inputs

Under **Channel 1** to **Channel 8** you will find the 8 digital inputs of the module (in the example the EP2338-0001).



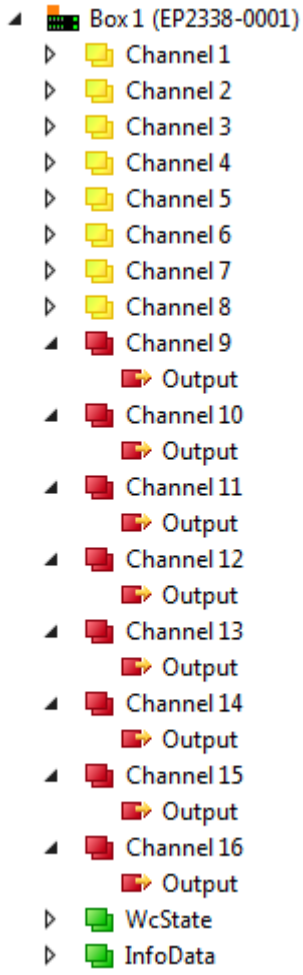
Data types

Channel n

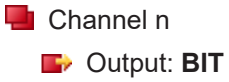
Input: **BIT**

DO Outputs

Under **Channel 1** to **Channel 8** you will find the 8 digital outputs of the module (in the example the EP2338-0001).

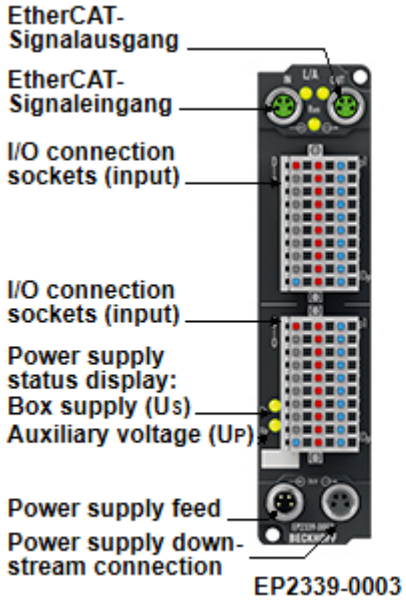


Data types

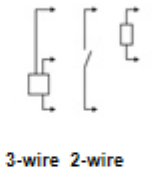


3.5 EP2339-0003

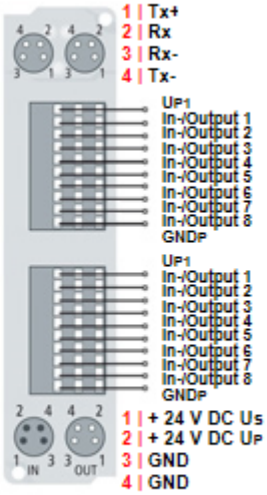
3.5.1 EP2339-0003 - Introduction



EP2339-0003



I/O connection



Connector assignment

16-channel digital input or output 24 V_{DC}

The EP2339-0003 EtherCAT Box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.

A filter constant of 3.0 ms is available for the inputs. The outputs are short-circuit proof and protected against inverse polarity. They handle load currents of up to 0.5 A each, although the total current is limited to 4 A. The state of each signal is indicated by means of light emitting diodes on the connectors. For the signal connection connectors with a spring-loaded system are used, optionally available with 1 or 3 pins. The module is supplied without connectors. The sensors are powered by the load voltage U_P.

Quick links

Technical data [▶ 32]
Process image [▶ 35]
Dimensions [▶ 55]
Signal connection [▶ 72]

3.5.2 EP2339-0003 - Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V
Distributed Clocks	yes

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
Current consumption from U_S	120 mA
U_S sum current: $I_{S,sum}$	max. 4 A
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
Current consumption from U_P	20 mA + Loads at digital outputs + sensor supply
U_P sum current: $I_{P,sum}$	max. 4 A
Electrical isolation GND_S / GND_P	no

Digital inputs	
Number	0 to 16 Each digital input can alternatively be used as a digital output.
Connection	2 x ZS2001 connector. Not included in the scope of delivery.
Cable length	max. 30 m
Input filter	3 ms
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Signal voltage "0"	-3…+5 V
Signal voltage "1"	+11…+30 V
Input current	6 mA
Sensor supply	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_P.

Digital outputs	
Number	0 to 16 Each digital input can alternatively be used as a digital output.
Connection	2 x ZS2001 connector. Not included in the scope of delivery.
Load type	Ohmic, inductive, lamp load
Nominal output voltage	24 V_{DC}
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.
Output sum current	max. 4 A
Short circuit current	max. 1.5 A
Output driver supply	From the peripheral voltage U_P.

Housing data	
Dimensions W x H x D	30 mm x 126 mm x 26.5 mm (without connectors)
Weight	approx. 165 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25…+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 33]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP20

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.5.3 EP2339-0003 - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP2339-0003
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.5.4 EP2339-0003 - Process image

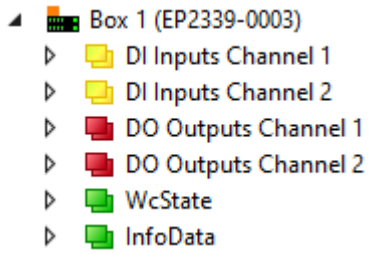
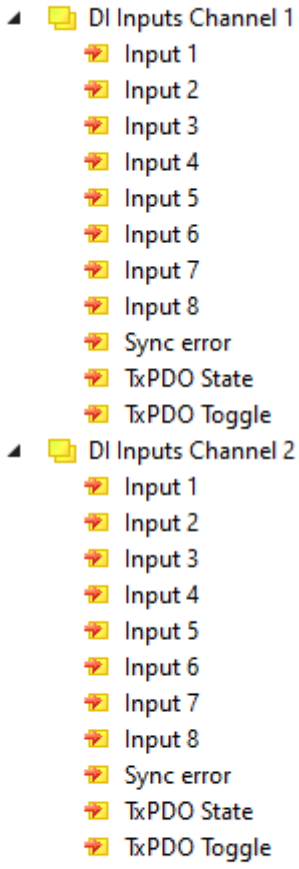


Fig. 6: EP2339-0003 - Process image

DI Inputs Channel *n*



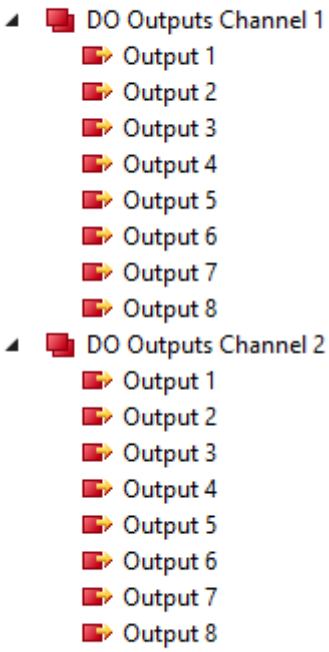
Input x
Digital inputs. Data type: BIT.

Sync error
This bit is only relevant in Distributed Clocks mode.
It is TRUE if a synchronization error occurred during the elapsed EtherCAT cycle.

TxPDO State
Validity of the input data. This bit is TRUE if the input data could not be read correctly due to an error.

TxPDO Toggle
This bit is inverted each time an input data update occurs.

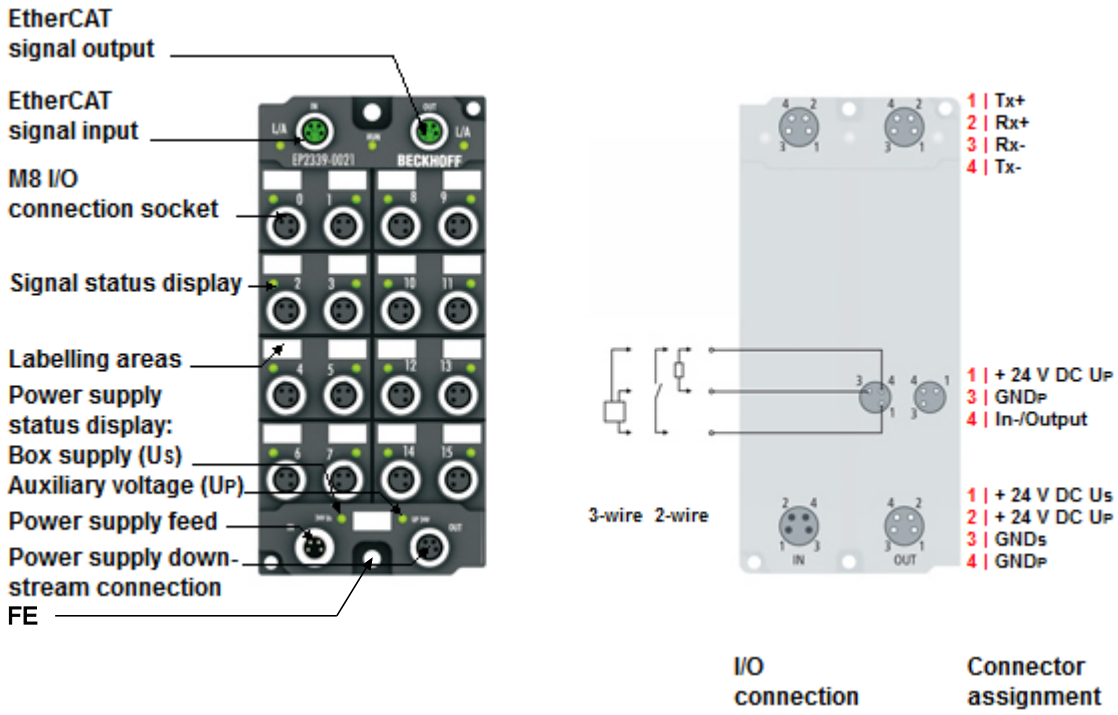
DO Outputs Channel *n*



Output *x*
Digital outputs. Data type: BIT.

3.6 EP23x9-002x

3.6.1 EP23x9-0021 - Introduction



16 digital inputs or outputs, 24 V_{DC}

The EP23x9-0021 EtherCAT Box has 16 digital channels that can each be operated as inputs or outputs. It is not necessary to configure whether a channel (pin 2 and 4 of the M12) is to be used as input or output; the input circuit is permanently connected internally to the output driver, so that a set output is automatically displayed in the input process image.

The inputs of the EP2339-0021 have a filter of 3.0 ms.
The inputs of the EP2349-0021 have a filter of 10 µs.

The outputs handle load currents up to 0.5 A and are short-circuit-proof and protected against reverse polarity. The total current of all outputs is limited to 4 A.

The connected sensors are supplied by an internal, short-circuit-proof driver module with a total of 0.5 A for all sensors. The inputs and outputs are supplied via U_P. The signal status is indicated by LEDs. The signals are connected via M12 connectors.

Supply of the connected sensors from U_P, not from U_S

In contrast to many other modules, the EP23x9-0021 EtherCAT Box supplies digital sensors from the U_P peripheral voltage and not from the U_S control voltage! Nevertheless, an overload of the sensor supply (current > 0.5 A) is also indicated here by the illuminated red U_S LED.

NOTE

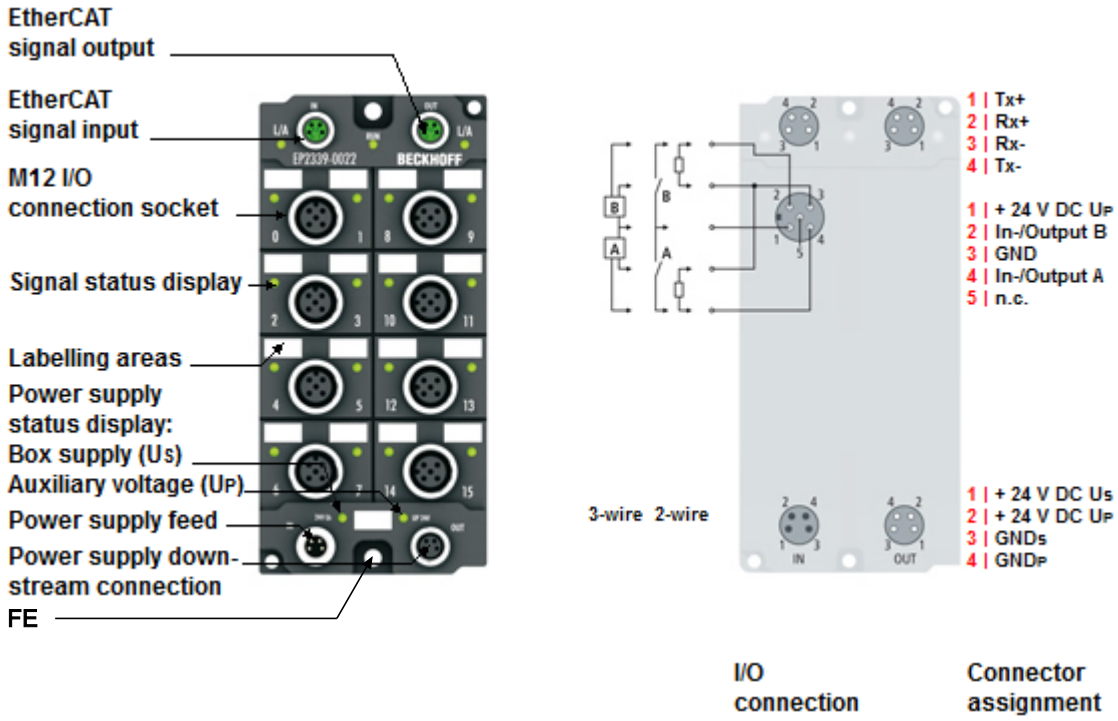
For shutdown in the event of a fault, do not supply sensors externally

If the design of your installation is such that the power supply voltage U_P is switched off in the event of a fault, you must not power the connected sensors externally, but only through EP23x9-0021! Otherwise, when the U_P energy is switched off, EP23x9-0021 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

Quick links

Technical data [▶ 41]
Process image [▶ 44]
Dimensions [▶ 56]
Sensor/actuator connection [▶ 69]

3.6.2 EP23x9-0022 - Introduction



16 digital inputs or outputs, 24 V_{DC}

The EP23x9-0022 EtherCAT Box has 16 digital channels that can each be operated as inputs or outputs. It is not necessary to configure whether a channel (pin 2 and 4 of the M12) is to be used as input or output; the input circuit is permanently connected internally to the output driver, so that a set output is automatically displayed in the input process image. The outputs process load currents up to 0.5 A, are short-circuit proof and protected against inverse polarity.

The inputs of the EP2339-0022 have a filter of 3.0 ms.
The inputs of the EP2349-0022 have a filter of 10 µs.

The outputs handle load currents up to 0.5 A and are short-circuit-proof and protected against reverse polarity. The total current of all outputs is limited to 4 A.

The connected sensors are supplied by an internal, short-circuit-proof driver module with a total of 0.5 A for all sensors. The inputs and outputs are supplied via U_P. The signal status is indicated by LEDs. The signals are connected via M12 connectors.

Supply of the connected sensors from U_P, not from U_S

In contrast to many other modules, the EP23x9-0022 EtherCAT Box supplies digital sensors from the U_P peripheral voltage and not from the U_S control voltage! Nevertheless, an overload of the sensor supply (current > 0.5 A) is also indicated here by the illuminated red U_S LED.

NOTE

For switch-off in the event of a fault, do not supply sensors externally

If the design of your installation is such that the power supply voltage U_P is switched off in the event of a fault, you must not power the connected sensors externally, but only through EP23x9-0022! Otherwise, when the U_P energy is switched off, EP23x9-0022 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

Quick links

Technical data [▶ 41]
Process image [▶ 44]
Dimensions [▶ 56]
Sensor/actuator connection [▶ 69]

3.6.3 EP23x9-002x - Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
Current consumption from U_S	120 mA
U_S sum current: $I_{S,sum}$	max. 4 A
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
Current consumption from U_P	20 mA + Loads at digital outputs + sensor supply
U_P sum current: $I_{P,sum}$	max. 4 A
Electrical isolation GND_S / GND_P	yes

Digital inputs	EP2339-0021	EP2339-0022	EP2349-0021	EP2349-0022
Number	0 to 16 Each digital input can alternatively be used as a digital output.			
Connection	16 x M8 socket	8 x M12 socket	16 x M8 socket	8 x M12 socket
Input filter	3.0 ms	3.0 ms	10 µs	10 µs
Characteristics	Type 3 according to EN61131-2, compatible with type 1			
Signal voltage "0"	-3…+5 V			
Signal voltage "1"	+11…+30 V			
Input current	6 mA			
Sensor supply	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_P.			

Digital outputs	EP2339-0021	EP2339-0022	EP2349-0021	EP2349-0022
Number	0 to 16 Each digital output can alternatively be used as a digital input.			
Connection	16 x M8 socket	8 x M12 socket	16 x M8 socket	8 x M12 socket
Load type	Ohmic, inductive, lamp load			
Nominal output voltage	24 V_{DC}			
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.			
Output sum current	max. 4 A			
Short circuit current	max. 1.5 A			
Output driver supply	From the peripheral voltage U_P.			

Housing data	
Dimensions W x H x D	60 mm x 126 mm x 26.5 mm (without plug connectors)
Weight	approx. 250 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 42]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76]

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.6.4 EP23x9-002x - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP23x9-002x
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

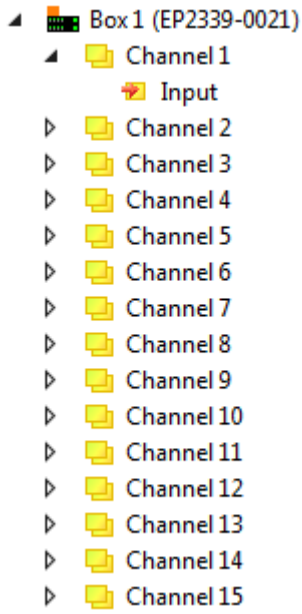
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.6.5 EP23x9-002x - Process image

Inputs

Under **Channel 1** to **Channel 16** you will find the 16 digital inputs of the module (here as an example the EP2339-0021).

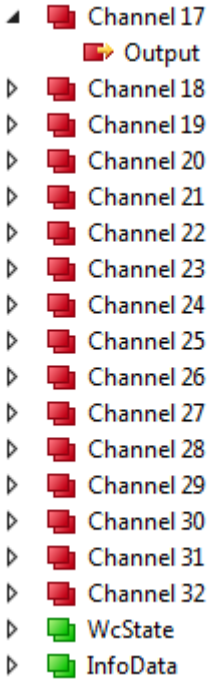


Data types

Channel n
Input: **BIT**

Outputs

Under **Channel 17** to **Channel 32** you will find the 16 digital outputs of the module (here as an example the EP2339-0021).

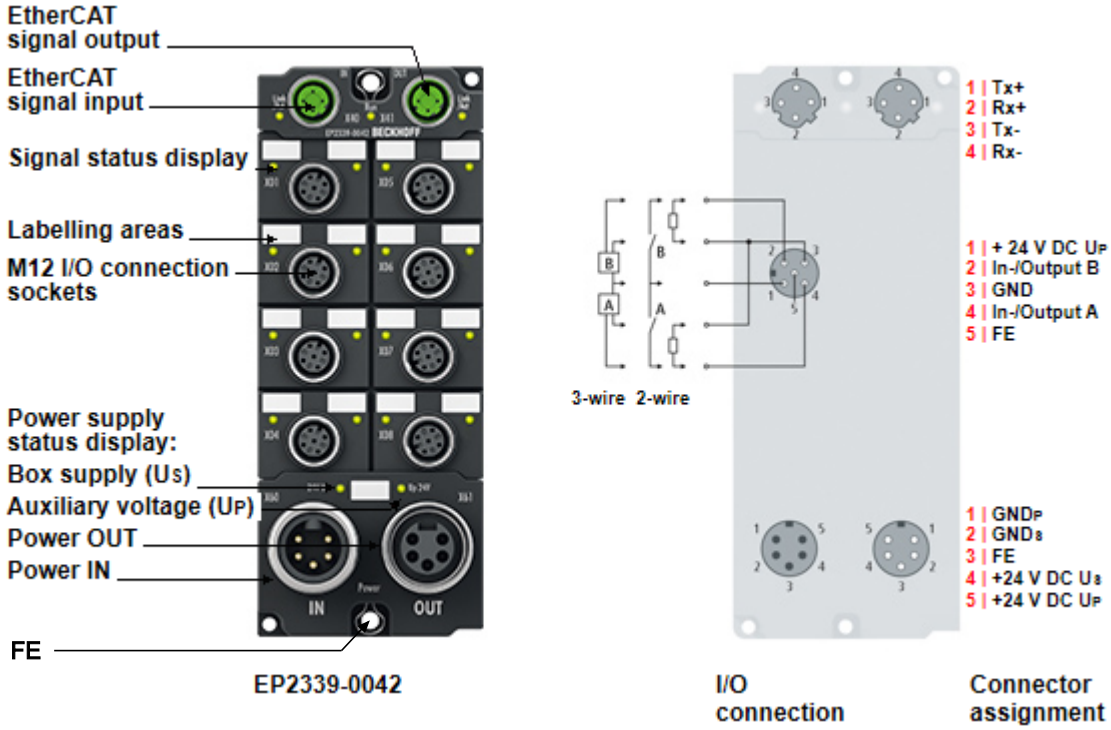


Data types

Channel n
Output: **BIT**

3.7 EP2339-0042

3.7.1 EP2339-0042 - Introduction



16-channel digital input or output 24 V DC

The EP2339-0042 EtherCAT Box has 16 digital channels, each of which can optionally be operated as an input or as an output. A configuration for using a channel as input or output is not necessary; the input circuit is internally connected to the output driver, so that a set output is displayed automatically in the input process image.

A filter constant of 3.0 ms is available for the inputs. The outputs are short-circuit proof. They handle load currents of up to 0.5 A each. The state of each signal is indicated by means of light emitting diodes. The signals are connected via M12 screw type connectors.

The EP2339-0042 is interference-free. You can use the EP2339-0042 instead of an interference-free standard terminal in accordance with the following chapters of the TwinSAFE Application Guide:

- Chapter 4.1 "All-pole disconnection of a potential group with downstream interference-free standard terminals (Category 4, PL e)"
- Chapter 4.2 "Single-pole disconnection of a potential group with downstream interference-free standard terminals with fault exclusion (Category 4, PL e)"
- Chapter 4.3 "EL2911 potential group with interference-free standard terminals (Category 4, PL e)"

Supply of the connected sensors from U_P, not from U_S

In contrast to many other modules, the EP2339-0042 EtherCAT Box supplies digital sensors from the U_P peripheral voltage and not from the U_S control voltage.

NOTE

For shutdown in the event of a fault, do not supply sensors externally

If the design of your installation is such that the power supply voltage U_P is switched off in the event of a fault, you must not power the connected sensors externally, but only through the EP2339-0042! Otherwise, when the U_P energy is switched off, the EP2339-0042 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

Quick links

Technical data [▶ 47]
Process image [▶ 50]
Dimensions [▶ 57]
Sensor/actuator connection [▶ 70]

3.7.2 EP2339-0042 - Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: 7/8" plug, 5-pin Downstream connection: 7/8" socket, 5-pin
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current	max. 16 A at 40 °C
Current consumption from U_S	120 mA
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current	max. 16 A at 40 °C
Current consumption from U_P	20 mA + Loads at digital outputs + sensor supply
Electrical isolation GND_S / GND_P	yes

Digital inputs	
Number	0 to 16 Each digital input can alternatively be used as a digital output.
Connection	8 x M12 socket
Input filter	3 ms
Characteristics	Type 3 according to EN61131-2, compatible with type 1
Signal voltage "0"	-3…+5 V
Signal voltage "1"	+11…+30 V
Input current	6 mA
Sensor supply	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_P.

Digital outputs	
Number	0 to 16 Each digital output can alternatively be used as a digital input.
Connection	8 x M12
Load type	Ohmic, inductive, lamp load
Nominal output voltage	24 V_{DC}
Output current per channel	max. 0.5 A. Each output is independently short-circuit proof.
Output sum current	max. 4 A
Short circuit current	max. 1.5 A
Output driver supply	From the peripheral voltage U_P.

Housing data	
Dimensions W x H x D	60 mm x 150 mm x 26,5 mm (without connectors)
Weight	approx. 440 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C
Ambient temperature during storage	-40…+85 °C
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	IP65, IP66, IP67 conforms to EN 60529

Approvals	
Approvals	CE, UL in preparation

Additional checks

The boxes have been subjected to the following checks:

Verification	Explanation
Vibration	10 frequency sweeps in 3 axes
	5 Hz < f < 60 Hz displacement 0.35 mm, constant amplitude
	60.1 Hz < f < 500 Hz acceleration 5 g, constant amplitude
Shocks	1000 shocks in each direction, in 3 axes
	35 g, 11 ms

3.7.3 EP2339-0042 - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EtherCAT Box EP2339-0042
- 2x protective cap for EtherCAT socket, M12 (pre-assembled)
- 1x Protective cap for supply voltage output, 7/8”, black (pre-fitted)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

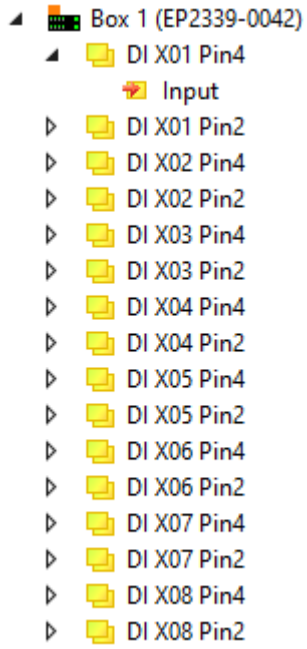
Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.7.4 EP2339-0042 - Process image

Inputs

The process image contains a process data object for each digital input.

The name of each process data object contains the name of the socket and the pin number of the corresponding digital input.



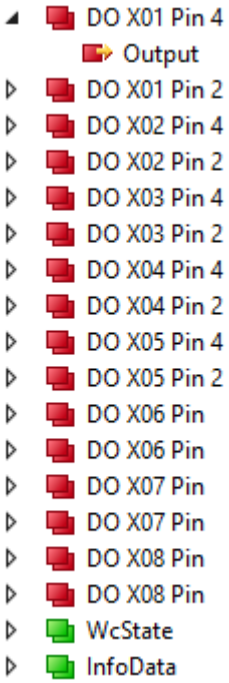
Data types

Input: **BIT**

Outputs

The process image contains a process data object for each digital output.

The name of each process data object contains the name of the socket and the pin number of the corresponding digital output.

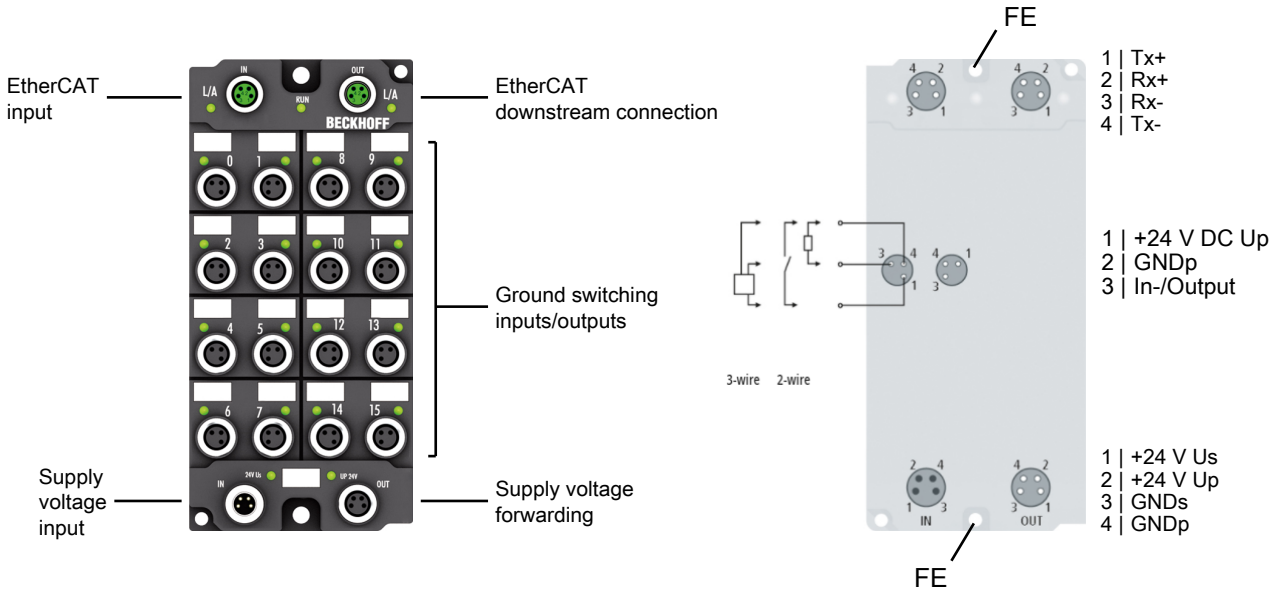


Data types

Output: **BIT**

3.8 EP2339-0121

3.8.1 EP2339-0121 - Introduction



16-channel digital input or output 24 V_{DC}, ground switching

The EP2339-0121 EtherCAT Box has 16 digital channels that can each be operated as inputs or outputs. It is not necessary to configure whether a channel (pin 4 of the M8) is to be used as input or output; the input circuit is permanently connected internally to the output driver, so that a set output is automatically displayed in the input process image. Inputs and outputs are ground switching.

The inputs have a filter of 3.0 ms. The outputs handle load currents up to 0.5 A and are short-circuit-proof and protected against reverse polarity. The total current of all outputs is limited to 4 A.

The connected sensors are supplied by an internal, short-circuit-proof driver module with a total of 0.5 A for all sensors. The inputs and outputs are supplied via U_P. The signal status is indicated by LEDs. The signals are connected via M8 connectors.

Quick links

Technical data [▶ 52]
Process image [▶ 54]
Dimensions [▶ 56]
Sensor/actuator connection [▶ 71]

3.8.2 EP2339-0121 - Technical data

All values are typical values over the entire temperature range, unless stated otherwise.

EtherCAT	
Connection	2 x M8 socket, 4-pin, green
Electrical isolation	500 V

Supply voltages	
Connection	Input: M8 connector, 4-pin Downstream connection: M8 socket, 4-pin, black
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current: $I_{S,sum}$	max. 4 A
Current consumption from U_S	60 mA
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current: $I_{P,sum}$	max. 4 A
Current consumption from U_P	50 mA + sensor supply

Digital inputs	
Number	0 to 16 Each digital input can alternatively be used as a digital output.
Connection	16 x M8 socket
Input filter	3.0 ms
Characteristics	Ground switching
Signal voltage "0"	18…30 V
Signal voltage "1"	0…7 V
Sensor supply	Output voltage: 24 V_{DC}. Sum current: max. 0.5 A, short-circuit proof. The sensor supply is branched off from the supply voltage U_P.

Digital outputs	
Number	0 to 16 Each digital output can alternatively be used as a digital input.
Connection	16 x M8 socket
Characteristics	Ground switching
Load current	max. 0.5 A

Housing data	
Dimensions W x H x D	60 mm x 126 mm x 26.5 mm (without plug connectors)
Weight	approx. 260 g
Installation position	variable
Material	PA6 (polyamide)

Environmental conditions	
Ambient temperature during operation	-25…+60 °C -25...+55 °C according to cURus
Ambient temperature during storage	-40…+85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 48]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

Approvals	
Approvals	CE, cURus [▶ 76]

3.8.3 EP2339-0121 - Scope of supply

Make sure that the following components are included in the scope of delivery:

- 1x EP2339-0121
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

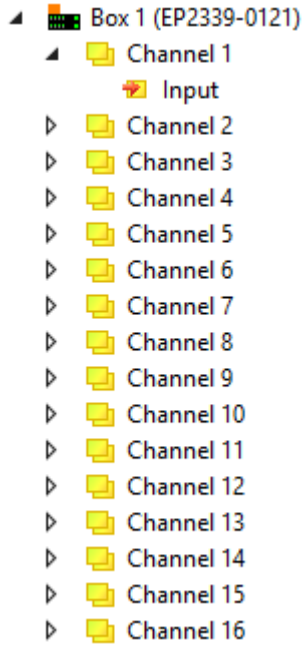
Protective caps are pre-assembled at the factory to protect connectors during transport. They may not be tight enough to ensure IP67 protection.

Ensure that the protective caps are correctly seated to ensure IP67 protection.

3.8.4 EP2339-0121 - Process image

Inputs

Under „Channel 1“ to „Channel 16“ you will find the input variables for the digital inputs/outputs.

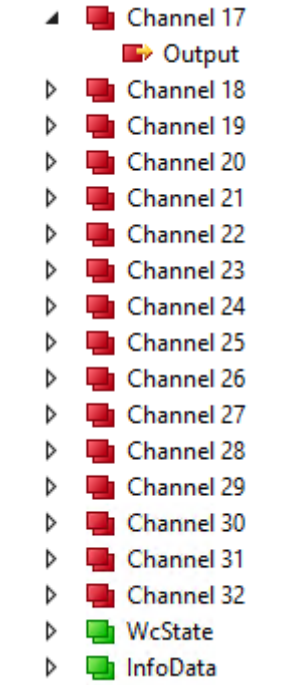


Data types

Input: **BIT**

Outputs

Under „Channel 17“ to „Channel 32“ you will find the output variables for the digital inputs/outputs.



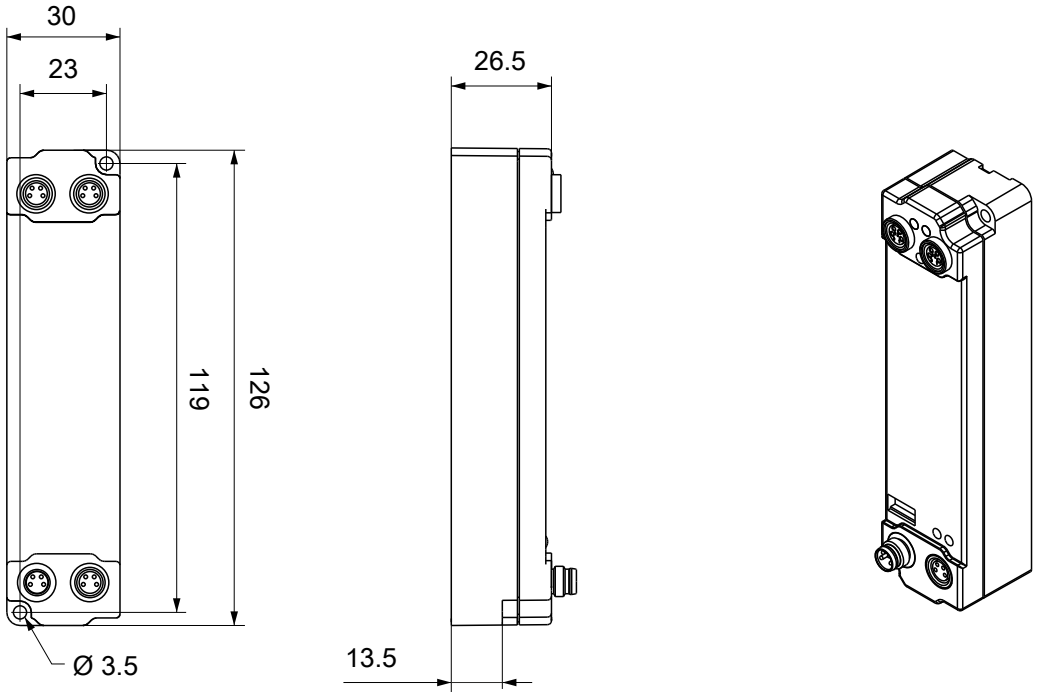
Data types

Output: **BIT**

4 Mounting and connection

4.1 Mounting

4.1.1 Dimensions EPxxxx-xx0x and EPxxxx-xx1x

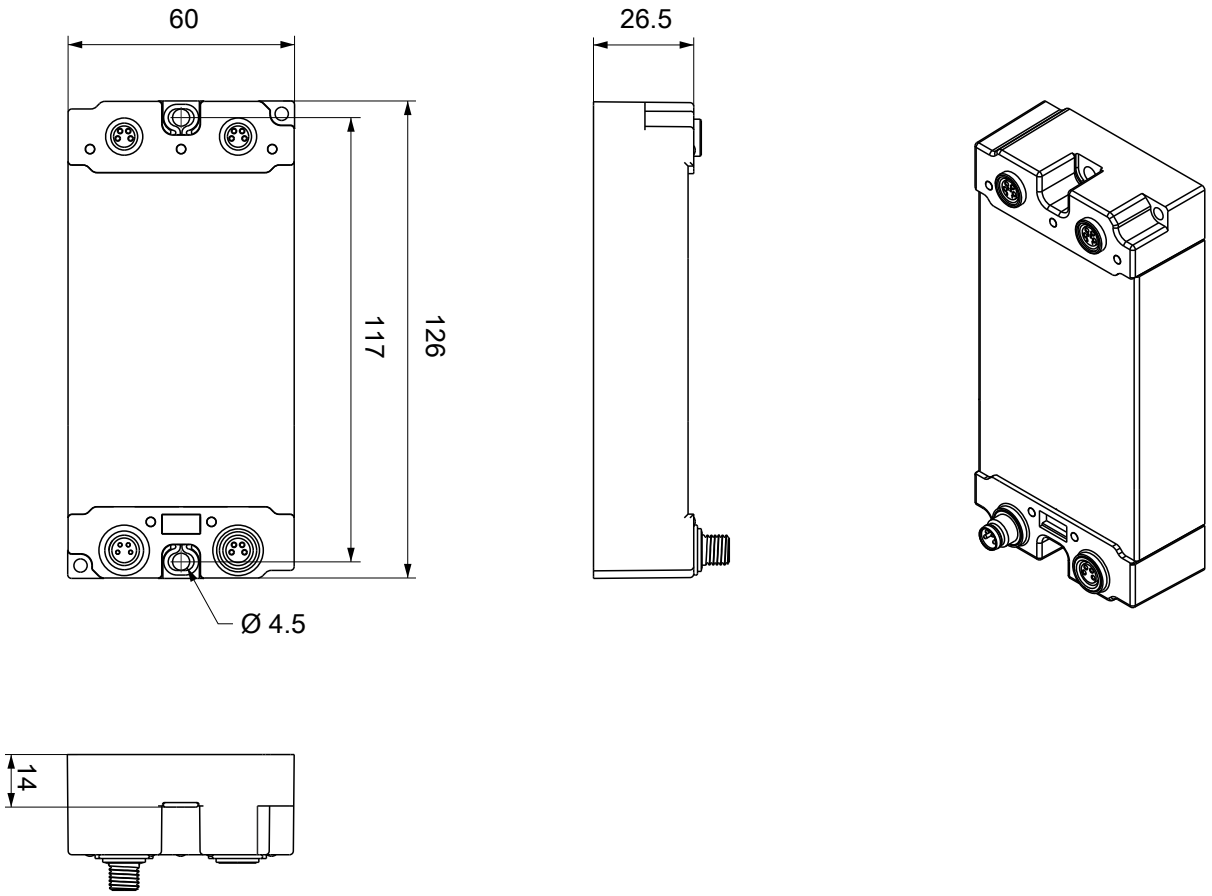


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two fastening holes Ø 3.5 mm for M3
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Power feed through	max. 4 A
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 30 x 26.5 mm (without connectors)

4.1.2 Dimensions EPxxxx-xx2x

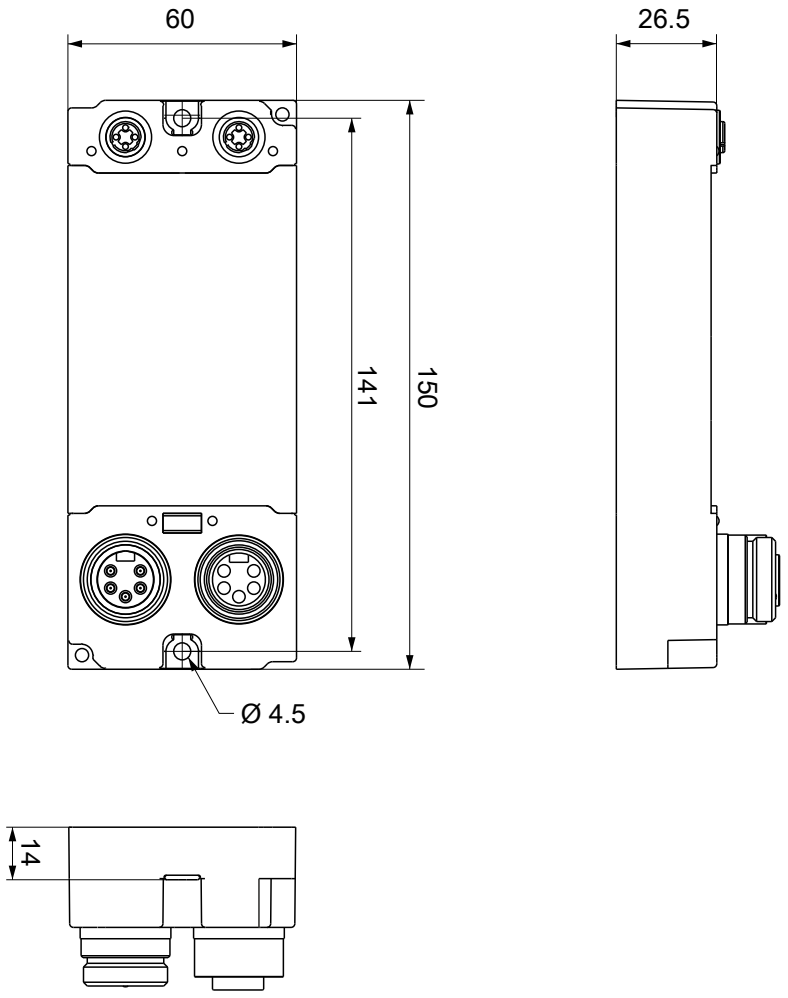


All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two fastening holes Ø 4.5 mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 126 x 60 x 26.5 mm (without connectors)

4.1.3 EPxxxx-xx42 dimensions



All dimensions are given in millimeters.
The drawing is not true to scale.

Housing features

Housing material	PA6 (polyamide)
Sealing compound	polyurethane
Mounting	two fastening holes Ø 4.5 mm for M4
Metal parts	brass, nickel-plated
Contacts	CuZn, gold-plated
Power feed through	max. 16 A at 40°C (according to IEC 60512-3)
Installation position	variable
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together
Dimensions (H x W x D)	approx. 150 x 60 x 26.5 mm (without connectors)

4.1.4 Fixing

Protection of connectors against contamination!

While mounting the modules, protect all connectors, especially the IP-Link, against contamination! Only with connected cables or plugs the protection class IP67 is guaranteed! Unused connectors have to be protected with the right plugs! See for plug sets in the catalogue.

Modules with narrow housing are mounted with two M3 bolts.
Modules with wide housing are mounted with two M3 bolts to the fixing holes located at the corners or mounted with two M4 bolts to the fixing holes located centrally.

The bolts must be longer than 15 mm. The fixing holes of the modules are not threaded.

When assembling, remember that the fieldbus connectors increases the overall height. See chapter accessories.

Mounting Rail ZS5300-0001

The mounting rail ZS5300-0001 (500 mm x 129 mm) allows the time saving assembly of modules.

The rail is made of stainless steel, 1.5 mm thick, with already pre-made M3 threads for the modules. The rail has got 5.3 mm slots to mount it via M5 screws to the machine.

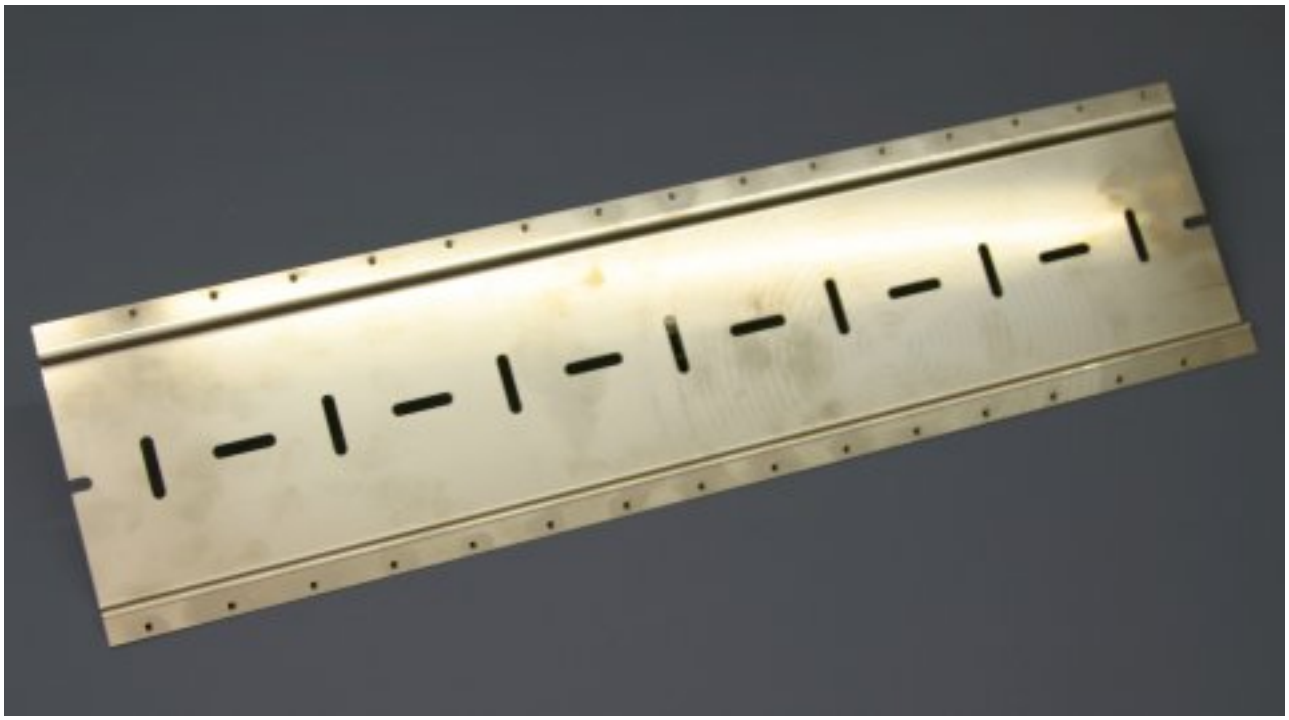


Fig. 7: Mounting Rail ZS5300-000

The mounting rail is 500 mm long, that way 15 narrow modules can be mounted with a distance of 2 mm between two modules. The rail can be cut to length for the application.

Mounting Rail ZS5300-0011

The mounting rail ZS5300-0011 (500 mm x 129 mm) has in addition to the M3 treads also pre-made M4 treads to fix 60 mm wide modules via their middle holes.

Up to 14 narrow or 7 wide modules may be mixed mounted.

4.1.5 Functional earth (FE)

EtherCAT Box modules of types EPxxxx-002x and EPxxxx-0042 must be grounded:

The fastening holes also serve as connections for the functional earth (FE).

Make sure that the box is earthed with low impedance via both fastening screws. You can achieve this, for example, by mounting the box on a grounded machine bed.

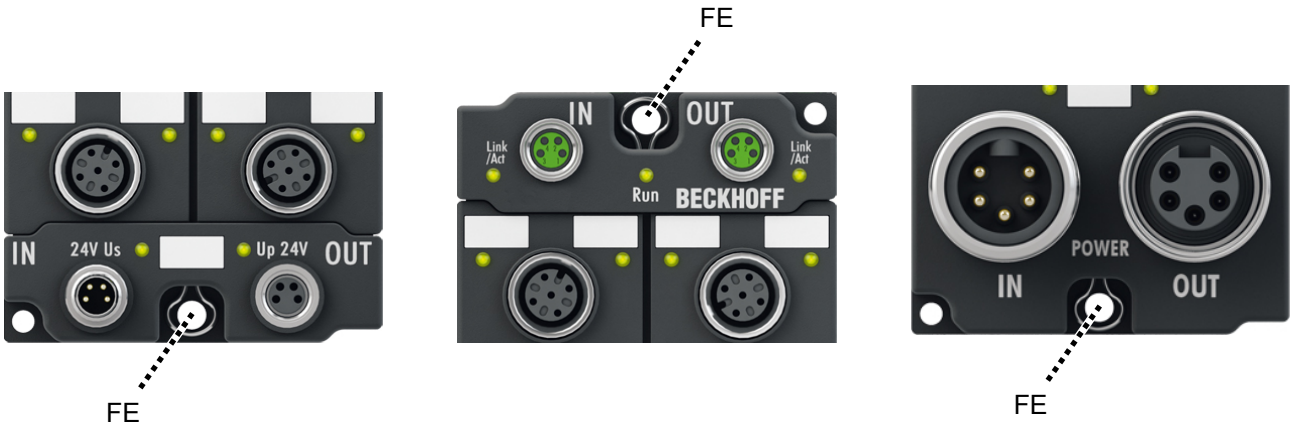


Fig. 8: Functional earth via the fastening holes

4.2 Connections

4.2.1 Tightening torques for plug connectors

Screw connectors tight with a torque wrench. (e.g. ZB8801 from Beckhoff)

Connector diameter	Tightening torque
M8	0.4 Nm
M12	0.6 Nm
7/8”	1.5 Nm

4.2.2 EtherCAT

4.2.2.1 Connectors

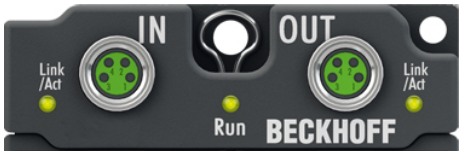
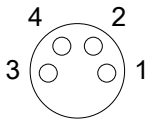
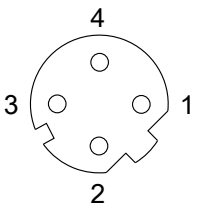
NOTE

Risk of confusion: supply voltages and EtherCAT

Defect possible through incorrect insertion.

- Observe the color coding of the connectors:
  black: Supply voltages
  green: EtherCAT

EtherCAT Box modules have two green M8 or M12 sockets for the incoming and outgoing EtherCAT connections.

M8 sockets		M12 sockets
		
		

Assignment

There are various different standards for the assignment and colors of connectors and cables for EtherCAT.

EtherCAT	Plug connector			Cable		Standard
Signal	M8	M12	RJ45[1]	ZB9010, ZB9020, ZB9030, ZB9032, ZK1090-6292, ZK1090-3xxx-xxxx	ZB9031 and old versions of ZB9030, ZB9032, ZK1090-3xxx-xxxx	TIA-568B
Tx +	Pin 1	Pin 1	Pin 1	yellow[2]	orange/white[3]	white/orange
Tx -	Pin 4	Pin 3	Pin 2	orange[2]	orange[3]	orange
Rx +	Pin 2	Pin 2	Pin 3	white[2]	blue/white[3]	white/green
Rx -	Pin 3	Pin 4	Pin 6	blue[2]	blue[3]	green
Shield	Housing		Shroud	Shield	Shield	Shield

[1]) colored markings according to EN 61918 in the four-pin RJ45 connector ZS1090-0003
[2]) wire colors according to EN 61918
[3]) wire colors

Assimilation of color coding for cable ZB9030, ZB9032 and ZK1090-3xxxx-xxxx (with M8 connectors)

For unification, the prevalent cables ZB9030, ZB9032 and ZK1090-3xxx-xxxx were changed to the colors of EN61918 (yellow, orange, white, blue). So different color coding exists. But the electrical properties are absolutely identical.

4.2.2.2 Status LEDs

L/A (Link/Act)

A green LED labelled "L/A" is located next to each EtherCAT socket. The LED indicates the communication state of the respective socket:

LED	Meaning
off	no connection to the connected EtherCAT device
lit	LINK: connection to the connected EtherCAT device
flashes	ACT: communication with the connected EtherCAT device

Run

Each EtherCAT slave has a green LED labelled "Run". The LED signals the status of the slave in the EtherCAT network:

LED	Meaning
off	Slave is in "Init" state
flashes uniformly	Slave is in "Pre-Operational“ state
flashes sporadically	Slave is in "Safe-Operational" state
lit	Slave is in "Operational" state

Description of the EtherCAT slave states

4.2.2.3 Cables

For connecting EtherCAT devices only shielded Ethernet cables that meet the requirements of at least category 5 (CAT5) according to EN 50173 or ISO/IEC 11801 should be used.

EtherCAT uses four wires for signal transmission.
Thanks to automatic line detection ("Auto MDI-X"), both symmetrical (1:1) or cross-over cables can be used between Beckhoff EtherCAT.

Detailed recommendations for the cabling of EtherCAT devices

4.2.3 Supply voltages

The EtherCAT Box is supplied with two supply voltages.

- **Control voltage U_S**
  Power is supplied to the fieldbus, the processor logic, the inputs and the sensors from the control voltage U_S.
- **Peripheral voltage U_P**
  The peripheral voltage U_P supplies the digital outputs; it can be brought in separately. Hence, if the peripheral voltage is switched off, the fieldbus function as well as the supply and function of the inputs are retained.

Redirection of the supply voltages

The power IN and OUT connections are bridged in the module. Hence, the supply voltages U_s and U_p can be passed from EtherCAT Box to EtherCAT Box in a simple manner.

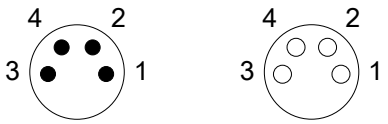
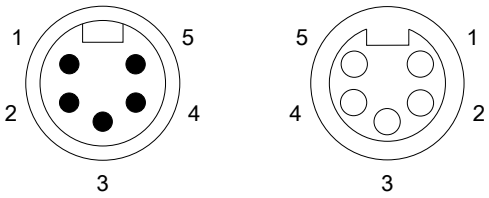
NOTE

Note the maximum current!

Ensure that the permitted current for the connectors is not exceeded when routing the supply voltages U_S and U_P:

M8 connector: max. 4 A
7/8" connector: max 16 A

4.2.3.1 Connectors

<table>
<tr><th>M8 connector</th><th>7/8" connector</th></tr>
<tr><td colspan="2"> 
</td><td> 
</td></tr>
<tr><td colspan="2"> 
</td><td> 
</td></tr>
</table>

Function	M8	7/8"	Description	Core color [1]
U_S	1	4	Control voltage	Brown
U_P	2	5	Peripheral voltage	White
GND_S	3	2	GND to U_S	Blue
GND_P	4	1	GND to U_P	Black
FE	-	3	Functional earth	Grey

[1] The core colors apply to cables of the type: Beckhoff ZK2020-xxxx-xxxx

GND_S and GND_P are linked for modules of the following types:

- EPxxxx-0001
- EPxxxx-0002
- EPxxxx-0008

NOTE

The electrical isolation between GND_S and GND_P can be removed

In some EtherCAT Box modules the ground potentials GND_S and GND_P are linked.

If several EtherCAT Box modules are supplied with the same electrically isolated voltages, check whether there is an EtherCAT Box among them in which the ground potentials are linked.

4.2.3.2 Status LEDs

Fig. 9: Status LEDs for the supply voltages

EtherCAT Box modules have two LEDs which indicate the state of the supply voltages. The LEDs are labelled with the designations of the supply voltages: Us and Up.

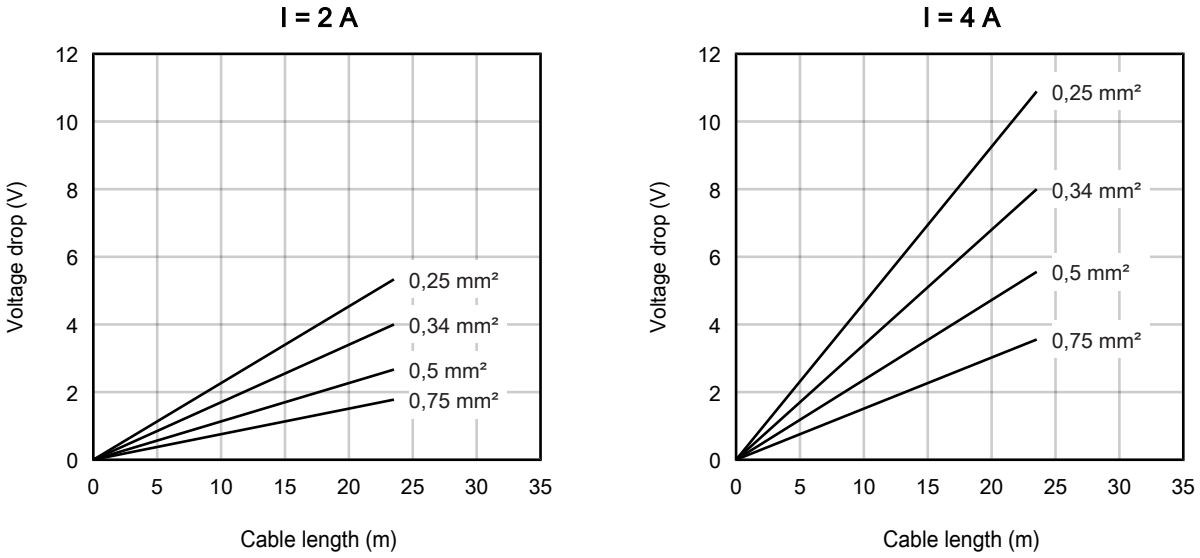
- An LED lights up green when the respective supply voltage is present.
- If an LED lights up red, the sensor supply was switched off due to overload.
  It is irrelevant which of the LEDs lights up red. The sensor supply can as well be derived from the other supply voltage. See specification „Sensor supply“ in the technical data.

4.2.3.3 Conductor losses

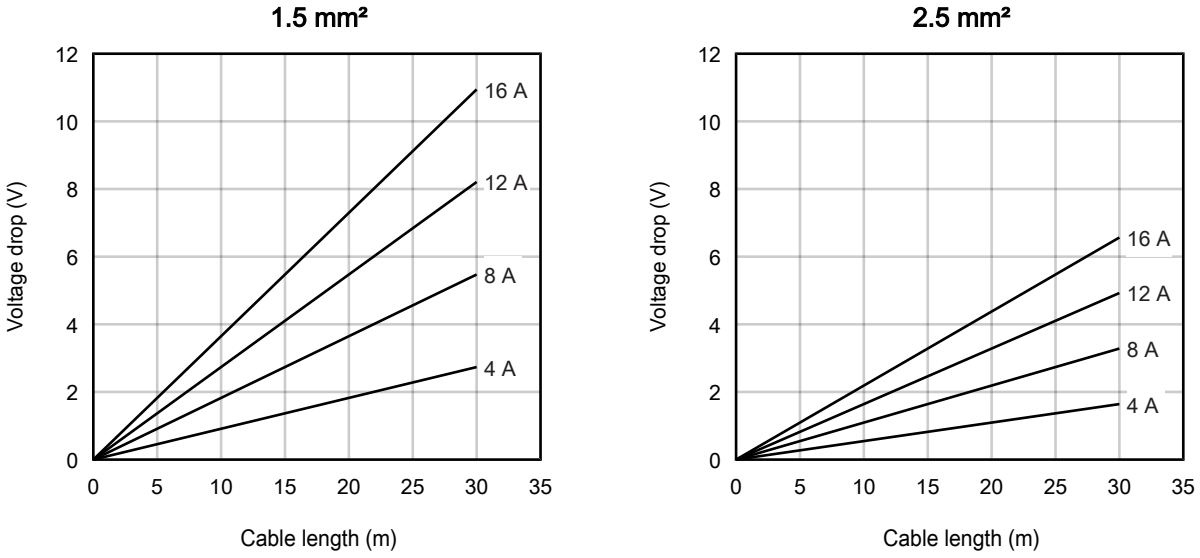
Take into account the voltage drop on the supply line when planning a system. Avoid the voltage drop being so high that the supply voltage at the box lies below the minimum nominal voltage.

Variations in the voltage of the power supply unit must also be taken into account.

Voltage drop on cables with M8 connectors



Voltage drop on cables with 7/8" connectors



4.2.4 Digital inputs and outputs

4.2.4.1 Digital outputs M8 and M12

The digital output modules forward the binary control signals of the automation device to the actuators at the process level.

The signals are connected via M8 connectors (EP2xxx-0001) or M12 connectors (EP2xxx-0002).

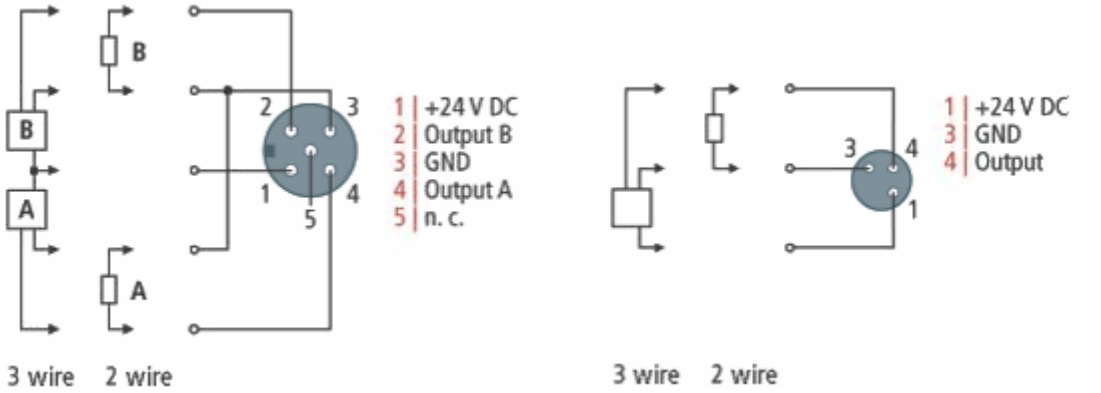


Fig. 10: Digital outputs M8 and M12

The outputs are short-circuit proof and protected against inverse connection.

LEDs indicate the signal state of the outputs.

4.2.4.2 Digital inputs M8 and M12

The digital input modules acquire the binary control signals from the process level and transmit them to the higher-level automation unit.

The signals are optionally connected via screw-in M8 connectors (EPxxxx-0001) or screw-in M12 connectors (EPxxxx-0002).

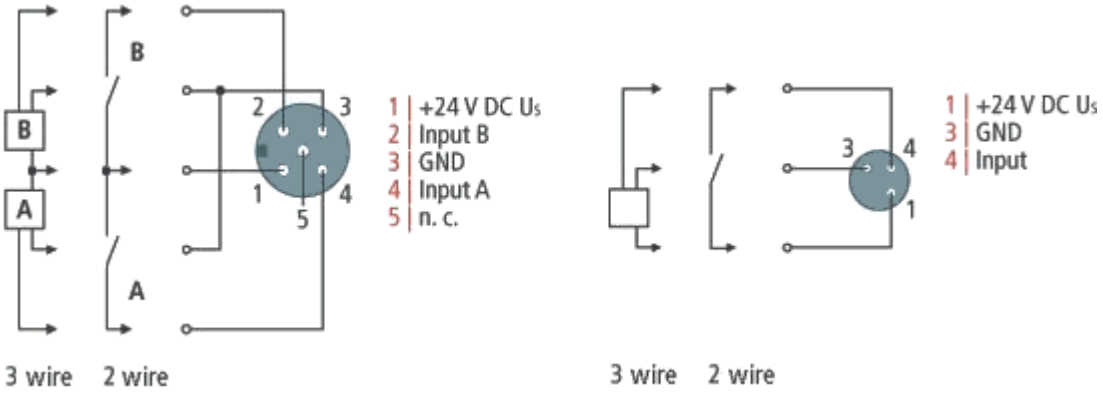


Fig. 11: Digital inputs M8 and M12

The sensors are supplied from the control voltage Us with a maximum current of 0.5 A.

The state of the signals is indicated by light emitting diodes.

4.2.4.3 Digital inputs/outputs M8 and M12

NOTE

EP2339-0042: different pin assignment.

Pin assignment of the digital inputs/outputs of EP2339-0042 [▶ 70]

Digital inputs/outputs can be operated as inputs or outputs.

If the channels are operated as digital inputs, the modules record the binary control signals from the process level and transport them to the higher-level automation device. The sensors are powered by the peripheral voltage U_P.

If the channels are operated as a digital output, the modules forward the binary control signals of the automation device to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.

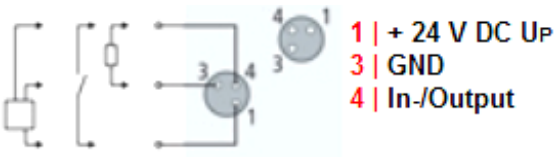


Fig. 12: Digital inputs/outputs M8

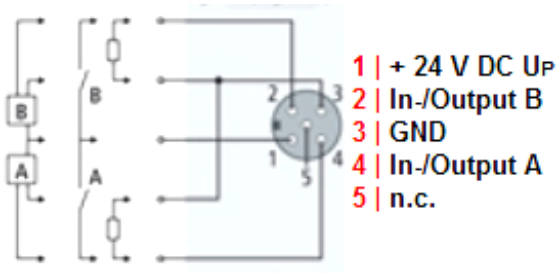


Fig. 13: Digital inputs/outputs M12

The state of the signals is indicated by light emitting diodes.

4.2.4.4 Digital inputs/outputs M12 for EP2339-0042

Digital inputs/outputs can be operated as inputs or outputs.

If the channels are operated as digital inputs, the modules record the binary control signals from the process level and transport them to the higher-level automation device. The sensors are powered by the peripheral voltage U_P.

If the channels are operated as a digital output, the modules forward the binary control signals of the automation device to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.

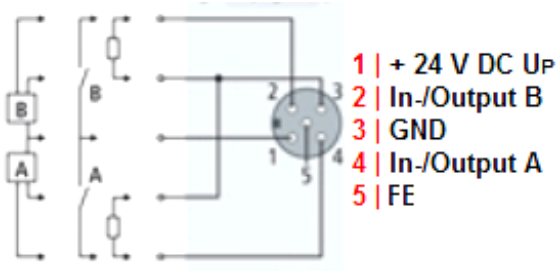


Fig. 14: Digital inputs/outputs M12

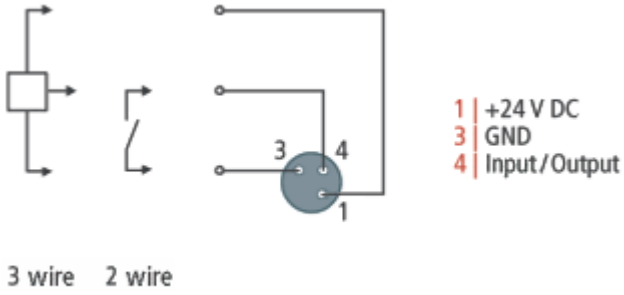
LEDs indicate the signal state of the inputs/outputs.

4.2.4.5 Ground switching digital inputs/outputs M8

Digital inputs/outputs can be operated as inputs or outputs.

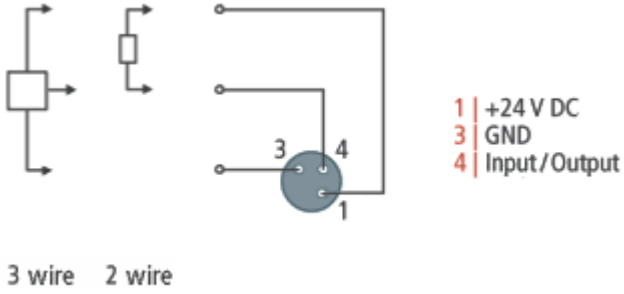
Operation as input

If the channels are operated as digital inputs, the modules record the binary control signals from the process level and transport them to the higher-level automation device. The sensors are powered by the peripheral voltage U_P.



Operation as output

If the channels are operated as a digital output, the modules forward the binary control signals of the automation device to the actuators at the process level. The outputs are short-circuit proof and protected against inverse connection.



4.2.4.6 Digital inputs and outputs ZS2001, 8 channels

The digital outputs forward the binary control signals of the automation device to the actuators at the process level. The 8 outputs process load currents up to 0.5 A, and indicate their signal state through LEDs. The signal is optionally connected via various ZS2001 connectors. The outputs are short-circuit proof and protected against inverse connection.

The digital inputs acquire the binary control signals from the process level and transmit them to the higher-level automation device. The signal state is indicated by means of LEDs. The signal is optionally connected via various ZS2001 connectors.

The sensors are supplied from the control voltage U_S. The peripheral voltage U_P is required for the output drivers. If U_P and U_S are used for passing the power on, the maximum current must not exceed the 4 A.

Inputs

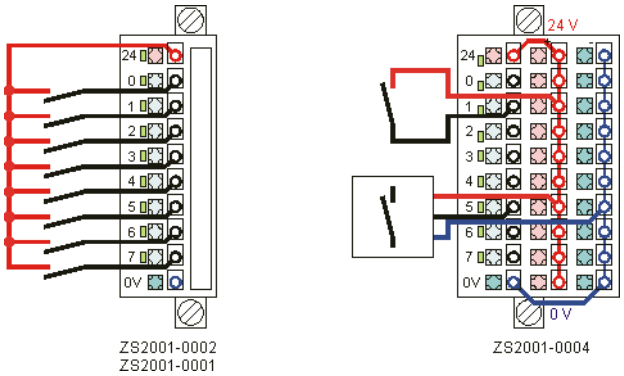


Fig. 15: Digital inputs ZS2001, 8 channels

The diagram shows the connection of 8 sensors in single-wire technology as well as one sensor each in two-wire and three-wire technology.
Please note for ZS2001-0004 connectors: two bridges (24 V and 0 V) are required to supply the terminal points for two- and three-wire connection technology.

Outputs

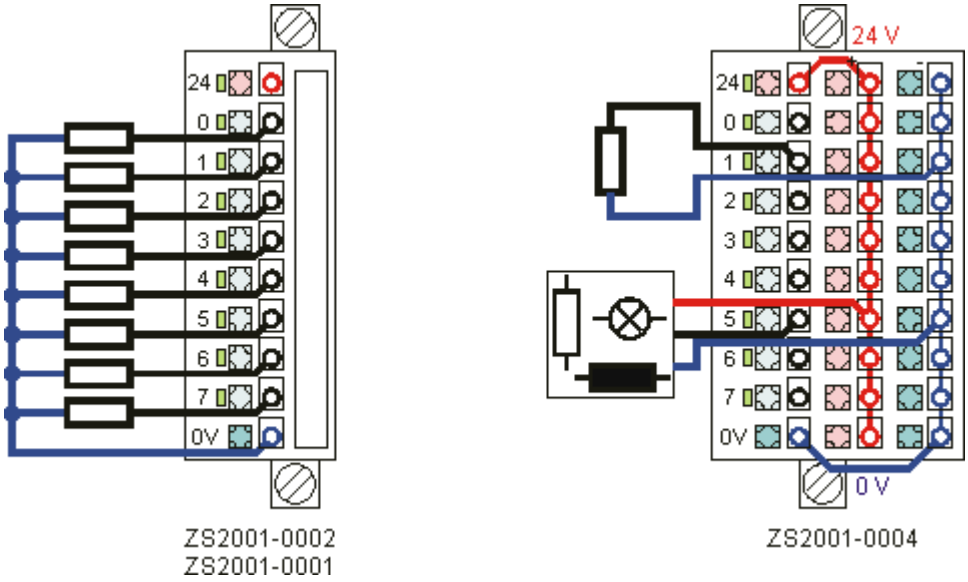


Fig. 16: Digital outputs ZS2001, 8 channels

The diagram shows the connection of 8 actuators in single-wire technology and one actuator each in two-wire and three-wire technology.
Please note for ZS2001-0004 connectors: two bridges (24 V and 0 V) are required to supply the terminal points for two- and three-wire connection technology.

4.2.4.6.1 Ordering information for KM plug-in connector

Fig. 17: ZS2001-0001, ZS2001-0002: KM connectors for single wire connection

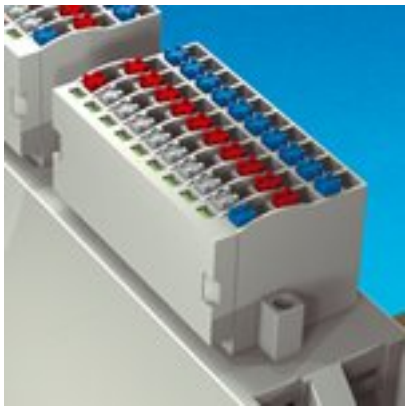


Fig. 18: ZS2001-0004: KM connectors for three-wire connection

Order designation	Signal LEDs	Connection technology		
		single-wire	two-wire	three-wire
ZS2001-0001	no	yes	no	no
ZS2001-0002	yes	yes	no	no
ZS2001-0004	yes	yes	yes	yes

4.2.4.6.2 Technical data of the KM connectors

Technical data	ZS2001-0001	ZS2001-0002	ZS2001-0004
Number of terminal points	10	10	30
Signal LEDs	no	yes	yes
Nominal voltage	50 V_{DC}	24 V_{DC}	24 V_{DC}
Nominal current	2 A		
Wire cross-section	0.5 mm^2 ... 1.5 mm^2		
Strip length	8 mm		
Dimensions (W x H x D)	approx. 42mm x 10.3mm x 26.9mm	approx. 42mm x 12.7mm x 26.9mm	approx. 42mm x 20.8mm x 26.9mm
Weight	approx. 10 g	approx. 10 g	approx. 20 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		
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		
Mounting position	variable		
Approval	CE		

4.2.4.7 digital inputs and outputs D-sub 25

The EP2316-0008 digital combination module

- connects the binary control signals from the automation device on to the actuators at the process level.
- acquires the binary control signals from the process level and transmits them to the higher-level automation unit.

The 8 outputs supply load currents up to 0.5 A, although the total current from all the outputs must not exceed 4 A. The outputs are short-circuit proof and protected against inverse connection.

The sensors are supplied from the control voltage Us.

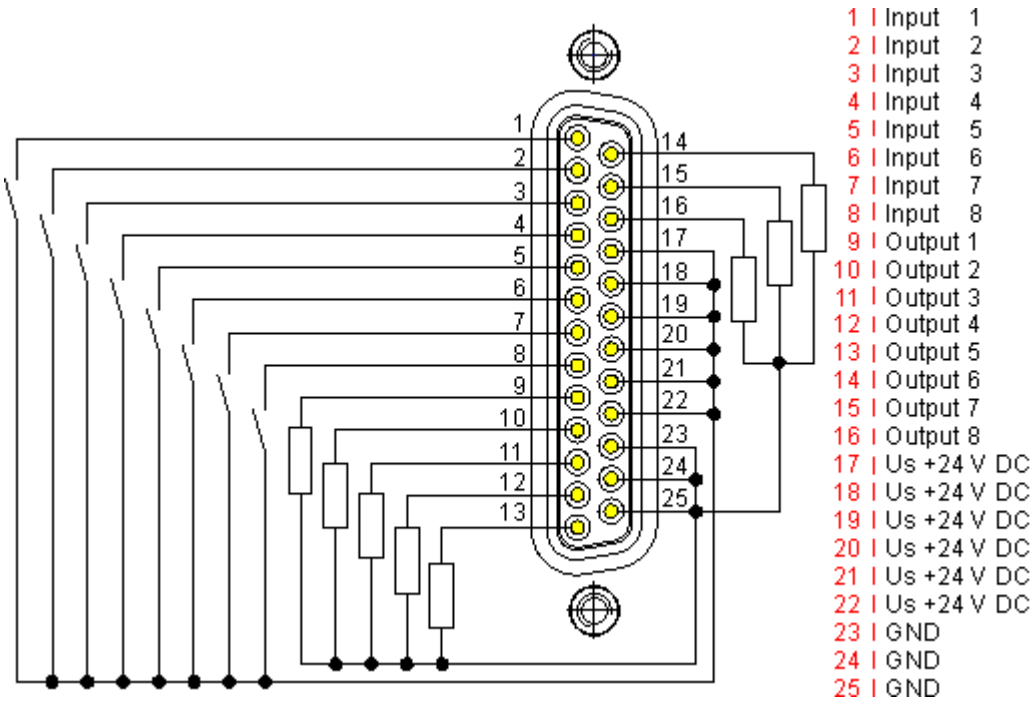


Fig. 19: Digital inputs and outputs D-sub 25

4.3 UL Requirements

The installation of the EtherCAT Box Modules certified by UL has to meet the following requirements.

Supply voltage

⚠ CAUTION

CAUTION!

This UL requirements are valid for all supply voltages of all marked EtherCAT Box Modules!
For the compliance of the UL requirements the EtherCAT Box Modules should only be supplied

- by a 24 V_{DC} supply voltage, supplied by an isolating source and protected by means of a fuse (in accordance with UL248), rated maximum 4 Amp, or
- by a 24 V_{DC} power source, that has to satisfy *NEC class 2*.
  A *NEC class 2* power supply shall not be connected in series or parallel with another (class 2) power source!

⚠ CAUTION

CAUTION!

To meet the UL requirements, the EtherCAT Box Modules must not be connected to unlimited power sources!

Networks

⚠ CAUTION

CAUTION!

To meet the UL requirements, EtherCAT Box Modules must not be connected to telecommunication networks!

Ambient temperature range

⚠ CAUTION

CAUTION!

To meet the UL requirements, EtherCAT Box Modules has to be operated only at an ambient temperature range of -25 °C to +55 °C!

Marking for UL

All EtherCAT Box Modules certified by UL (Underwriters Laboratories) are marked with the following label.

Fig. 20: UL label

4.4 ATEX notes

4.4.1 ATEX - Special conditions

⚠ WARNING

Observe the special conditions for the intended use of EtherCAT Box modules in potentially explosive areas – directive 94/9/EU.

- The certified components are to be installed with a BG2000-0000 or BG2000-0010 protection enclosure [▶ 78] that guarantees a protection against mechanical hazards!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of 0 to 55°C for the use of EtherCAT Box modules in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

The fundamental health and safety requirements are fulfilled by compliance with the following standards:

- EN 60079-0: 2006
- EN 60079-15: 2005

Marking

The EtherCAT Box modules certified for potentially explosive areas bear the following marking:

II 3 G Ex nA II T4 DEKRA 11ATEX0080 X Ta: 0 - 55°C

or

II 3 G Ex nA nC IIC T4 DEKRA 11ATEX0080 X Ta: 0 - 55°C

Batch number (D number)

The EtherCAT Box modules bear a batch number (D number) that is structured as follows:

D: WW YY FF HH

WW - week of production (calendar week)
YY - year of production
FF - firmware version
HH - hardware version

Example with batch number 29 10 02 01:

29 - week of production 29
10 - year of production 2010
02 - firmware version 02
01 - hardware version 01

4.4.2 BG2000 - EtherCAT Box protection enclosures

⚠ WARNING

Risk of electric shock and damage of device!

Bring the EtherCAT system into a safe, powered down state before starting installation, disassembly or wiring of the modules!

ATEX

⚠ WARNING

Mount a protection enclosure!

To fulfill the special conditions according to ATEX [▶ 77], a BG2000-0000 or BG2000-0010 protection enclosure has to be mounted over the EtherCAT Box.

Installation

Put the cables for EtherCAT, power supply and sensors/actuators through the hole of the protection enclosure.

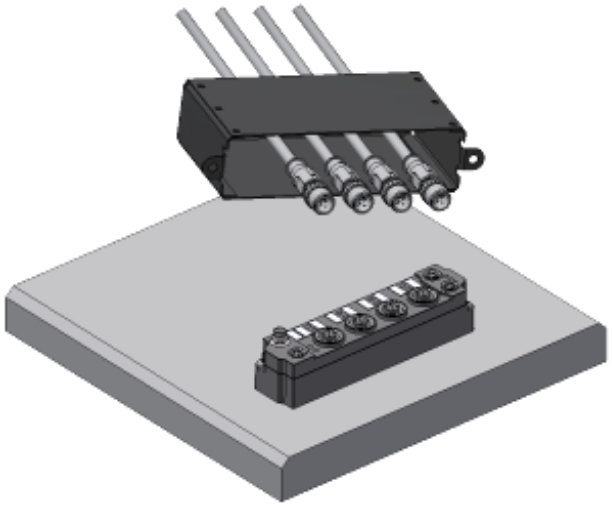


Fig. 21: BG2000 - putting the cables

Fix the wires for EtherCAT, power supply and sensors/actuators to the EtherCAT Box.

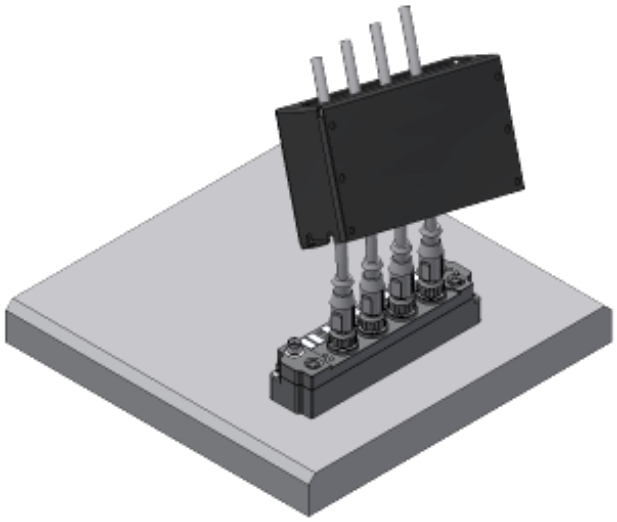


Fig. 22: BG2000 - fixing the cables

Mount the protection enclosure over the EtherCAT Box.

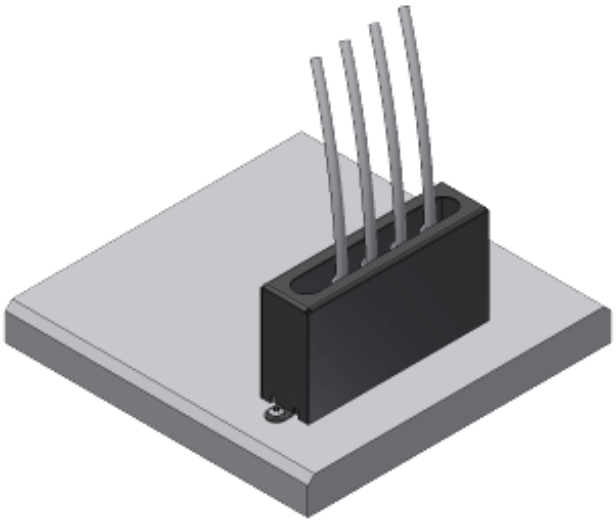


Fig. 23: BG2000 - mounting the protection enclosure

4.4.3 ATEX Documentation

Notes about operation of EtherCAT Box Modules (EPxxxx-xxxx) in potentially explosive areas (ATEX)

Pay also attention to the continuative documentationNotes about operation of EtherCAT Box Modules (EPxxxx-xxxx) in potentially explosive areas (ATEX) that is available in the download area of the Beckhoff homepage http:\\www.beckhoff.com!

5 Commissioning and configuration

5.1 Integration in TwinCAT

The procedure for integration in TwinCAT is described in this Quick start guide.

5.2 Switching inductive loads

When switching off inductive loads, high induction voltages result from interrupting the current too quickly. These are limited by an integrated free-wheeling diode. Since the current reduces only slowly, a delayed switch-off can occur in many control applications. For example, a valve remains open for many milliseconds. Switch-off times are realized that correspond, for instance, to the switch-on time of the coil.

Protection against high induction voltages

To protect against voltage peaks such as can occur when switching inductive loads, we recommend to provide suitable protective circuits (e.g. with the free-wheeling diode, RC combination or varistor) directly at the actuator.

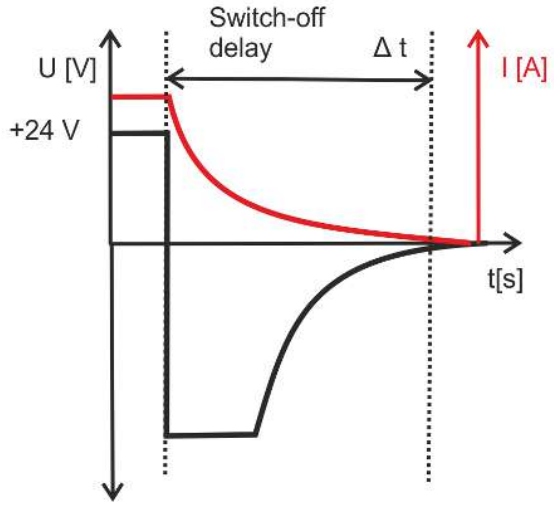


Fig. 24: Switch-off of inductive loads

5.3 Behavior of the outputs in case of a fault (EP2316 only)

EtherCAT Box Modules of the type EP2316 have diagnostic functions. They can detect faults and automatically react to them. The following chapters describe the configuration of the behavior in case of various types of fault.

5.3.1 Behavior in case of network failure

You can use bit 8000:0n (Safe State Active) to specify whether channel n should assume a certain value (Safe State Value) when data transmission is interrupted.

With bit 8001:0n (Safe State Value) you define this value for channel n.

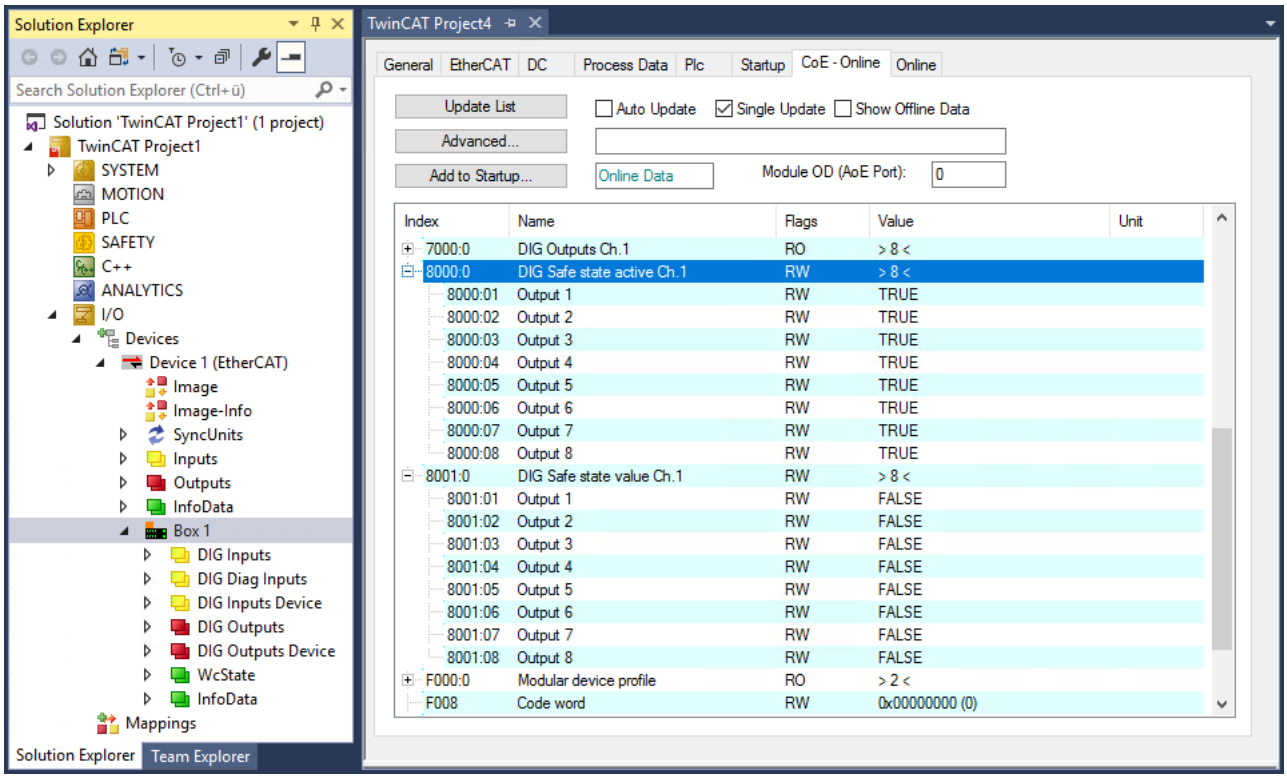
Safe State Value during network start-up

The network transmits output process data only in the network states Save-Operational (SAFE-OP) and Operational (OP). Also at the network states INIT, Pre-Operational (PRE-OP) and BOOT passed through during network start-up no output process data is transmitted. If Safe State is activated for an output, this output also adopts the specified value during network start-up.

8000:0 - DIG Safe state active Ch.1

Observe the maximum short-circuit current!

When dimensioning the power supply unit and choosing the fuses, observe that the short-circuit current is approximately 1.7 A.



8000:01 to 8000:08 - DIG Safe state active Ch.1, Output 1 to Output 8 (default: TRUE)

Specifies whether or not the outputs should adopt a safe state in the case of a network failure.

Value	Meaning
FALSE	Safe state disabled
TRUE	Safe state enabled

8001:01 to 8001:08 - DIG Safe state value Ch.1, Output 1 to Output 8 (default: FALSE)

Specifies what the safe state is.

Value	Meaning
FALSE	Output switched off
TRUE	Output switched on

5.3.2 Behavior in case of short circuit

You can set the behavior of the outputs in case of short circuit in the CoE object F800 "DO Settings".

F800:0 - DO Settings (Safe State Value)

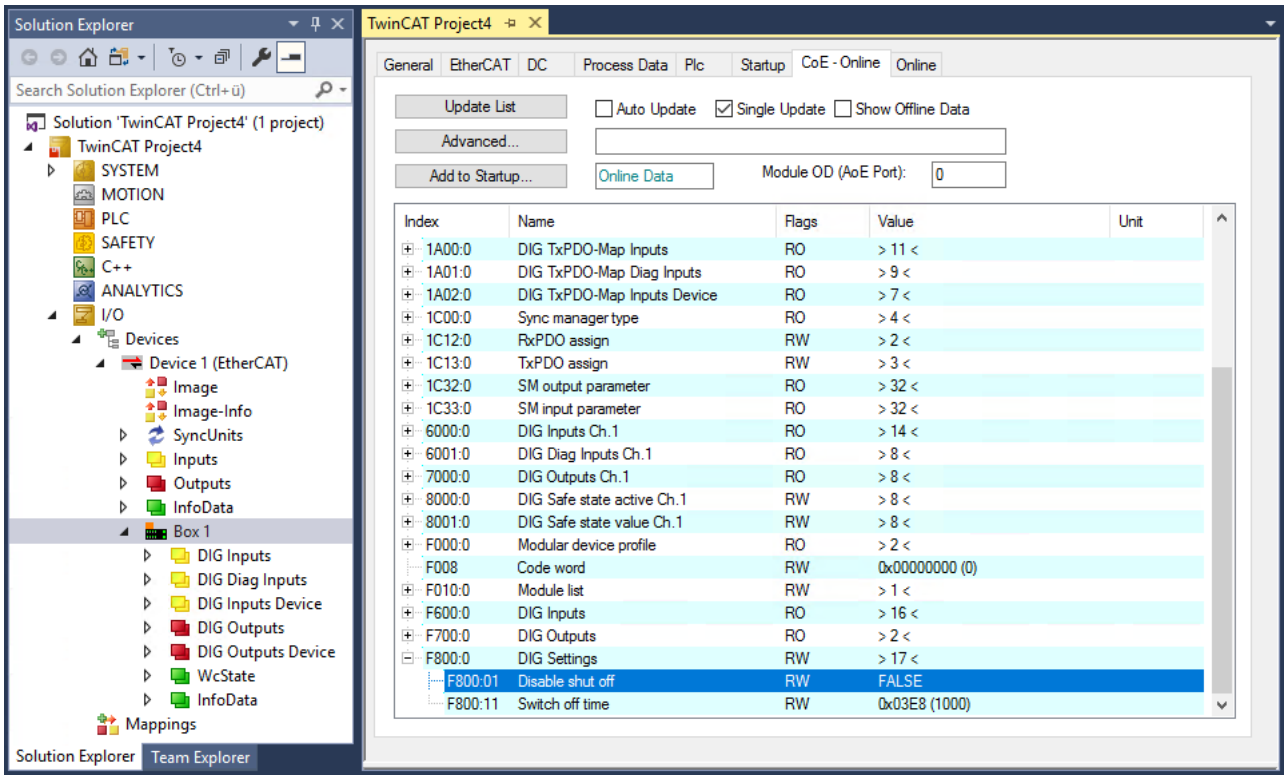


Table 1: F800:01 - Disable shut off (default: FALSE)

Value	Meaning
FALSE	In the event of a short circuit at one output, all outputs of the module are switched off. This disabling can be removed through the process data value *Reset Outputs*.
TRUE	In the event of a short circuit at an output, only this output of the module is switched off. After rectifying the short circuit, this output is automatically enabled again.

F800:11 - Switch off time (default: 0x03E8, 1000_{dec})

Here you can enter a time in milliseconds. During this time, the module checks whether the short circuit has been eliminated by switching itself on again.
Default = 1000 ms (depending on module type and internal cycle time). Errors are only displayed after this time.

5.3.3 Behavior in case of lack of supply voltage

The digital outputs are supplied from the supply voltage U_P. If the supply voltage U_P is not present, the digital outputs cannot output a high level.

If an output is set and does not output a high level, this is detected as a fault. On expiry of the fault reaction time, the fault is reported in the process data:

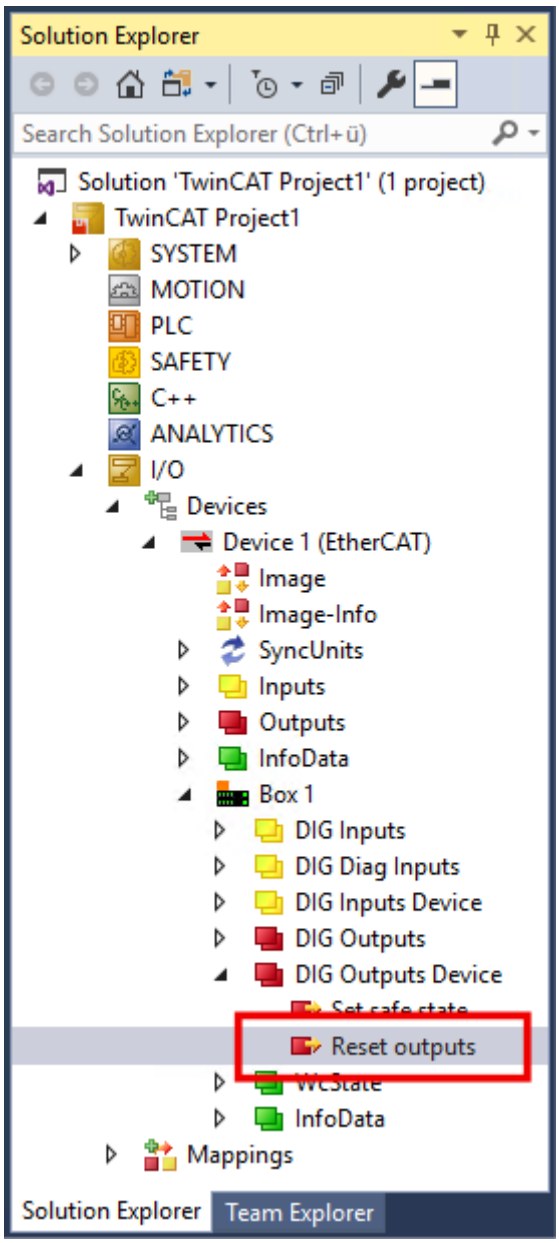
- The "Diag Input *x*" bit of the output is set to "1".
- The "Error Channel *y*" bit of the channel to which the output belongs is set to "1".

In the factory setting, all outputs of a channel in which a fault has occurred are disabled. The outputs also remain disabled when U_P is switched on again.

Re-enabling outputs

There are two ways to re-enable disabled outputs:

- Manual: Apply a positive edge to the variable "Reset outputs".



- Automatic: Set the parameter F800:01 to TRUE. All outputs will then be re-enabled as soon as U_P is switched on.
  Note: F800:01 also influences the behavior in case of short circuit [▶ 84].

5.4 Restoring the delivery state

To restore the delivery state for backup objects in ELxxxx terminals / EPxxxx- and EPPxxxx boxes, the CoE object *Restore default parameters, SubIndex 001* can be selected in the TwinCAT System Manager (Config mode).

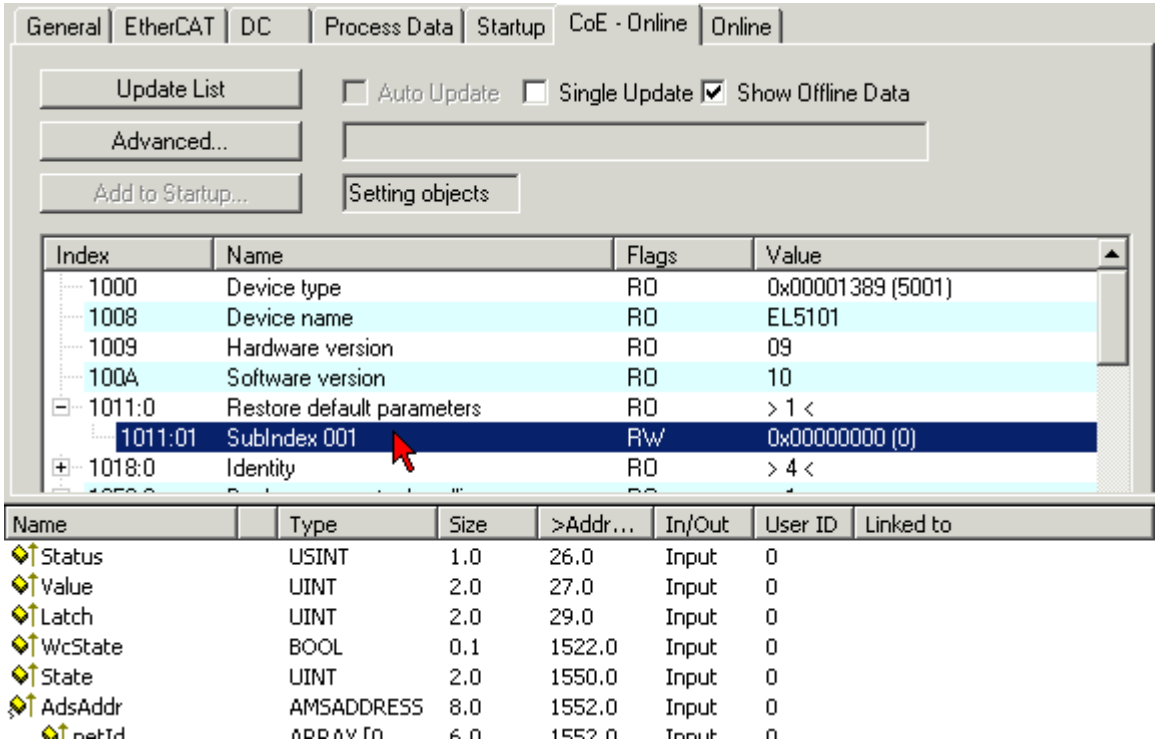


Fig. 25: Selecting the Restore default parameters PDO

Double-click on *SubIndex 001* to enter the Set Value dialog. Enter the value **1684107116** in field *Dec* or the value **0x64616F6C** in field *Hex* and confirm with OK.

All backup objects are reset to the delivery state.

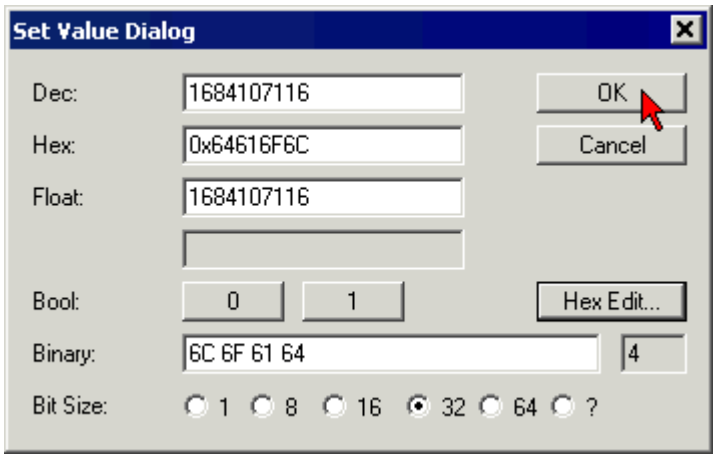


Fig. 26: Entering a restore value in the Set Value dialog

Alternative restore value

In some older terminals / boxes the backup objects can be switched with an alternative restore value:
Decimal value: 1819238756
Hexadecimal value: 0x6C6F6164

An incorrect entry for the restore value has no effect.

5.5 Decommissioning

⚠ WARNING

Risk of electric shock!

Bring the bus system into a safe, de-energized state before starting disassembly of the devices!

Disposal

In order to dispose of the device, it must be removed.

In accordance with the WEEE Directive 2012/19/EU, Beckhoff takes back old devices and accessories in Germany for proper disposal. Transport costs will be borne by the sender.

Return the old devices with the note "for disposal" to:

Beckhoff Automation GmbH & Co. KG
Service Department
Stahlstraße 31
D-33415 Verl

6 Appendix

6.1 General operating conditions

Protection degrees (IP-Code)

The standard IEC 60529 (DIN EN 60529) defines the degrees of protection in different classes.

1. Number: dust protection and touch guard	Definition
0	Non-protected
1	Protected against access to hazardous parts with the back of a hand. Protected against solid foreign objects of Ø 50 mm
2	Protected against access to hazardous parts with a finger. Protected against solid foreign objects of Ø 12.5 mm.
3	Protected against access to hazardous parts with a tool. Protected against solid foreign objects Ø 2.5 mm.
4	Protected against access to hazardous parts with a wire. Protected against solid foreign objects Ø 1 mm.
5	Protected against access to hazardous parts with a wire. Dust-protected. Intrusion of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the device or to impair safety.
6	Protected against access to hazardous parts with a wire. Dust-tight. No intrusion of dust.

2. Number: water* protection	Definition
0	Non-protected
1	Protected against water drops
2	Protected against water drops when enclosure tilted up to 15°.
3	Protected against spraying water. Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects.
4	Protected against splashing water. Water splashed against the disclosure from any direction shall have no harmful effects
5	Protected against water jets
6	Protected against powerful water jets
7	Protected against the effects of temporary immersion in water. Intrusion of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water for 30 min. in 1 m depth.

*) These protection classes define only protection against water!

Chemical Resistance

The Resistance relates to the Housing of the IP 67 modules and the used metal parts. In the table below you will find some typical resistance.

Character	Resistance
Steam	at temperatures >100°C: not resistant
Sodium base liquor (ph-Value > 12)	at room temperature: resistant > 40°C: not resistant
Acetic acid	not resistant
Argon (technical clean)	resistant

Key

- resistant: Lifetime several months
- non inherently resistant: Lifetime several weeks
- not resistant: Lifetime several hours resp. early decomposition

6.2 Accessories

Mounting

Ordering information	Description
ZS5300-0011	Mounting rail

Cables

A complete overview of pre-assembled cables for fieldbus components can be found here.

Ordering information	Description	Link
ZK1090-3xxx-xxxx	EtherCAT cable M8, green	Website
ZK1093-3xxx-xxxx	EtherCAT cable M8, yellow	Website
ZK1090-6xxx-xxxx	EtherCAT cable M12, green	Website
ZK2000-2xxx-xxxx	Sensor cable M8, 3-pin	Website
ZK2000-6xxx-xxxx	Sensor cable M12, 4-pin	Website
ZK2000-7xxx-0xxx	Sensor cable M12, 4-pin + shield	Website
ZK2020-3xxx-xxxx	Power cable M8, 4-pin	Website
ZK203x-xxxx-xxxx	Power cable 7/8 ", 5-pin	Website

Connector

Ordering information	Description	Link
ZS2001-000x	Female header with spring connection, IP20	Website
ZS2002-0111	D-Sub plug, 25-pin	Website

Labeling material, protective caps

Ordering information	Description
ZS5000-0010	Protective cap for M8 sockets, IP67 (50 pieces)
ZS5000-0020	Protective cap for M12 sockets, IP67 (50 pcs.)
ZS5100-0000	Inscription labels, unprinted, 4 strips of 10
ZS5000-xxxx	Printed inscription labels on enquiry

Tools

Ordering information	Description
ZB8801-0000	Torque wrench for plugs, 0.4…1.0 Nm
ZB8801-0001	Torque cable key for M8 / wrench size 9 for ZB8801-0000
ZB8801-0002	Torque cable key for M12 / wrench size 13 for ZB8801-0000
ZB8801-0003	Torque cable key for M12 field assembly / wrench size 18 for ZB8801-0000

Further accessories

Further accessories can be found in the price list for fieldbus components from Beckhoff and online at https://www.beckhoff.com.

6.3 Version identification of EtherCAT devices

Designation

A Beckhoff EtherCAT device has a 14-digit designation, made up of

- family key
- type
- version
- revision

Example	Family	Type	Version	Revision
EL3314-0000-0016	EL terminal (12 mm, non-pluggable connection level)	3314 (4-channel thermocouple terminal)	0000 (basic type)	0016
ES3602-0010-0017	ES terminal (12 mm, pluggable connection level)	3602 (2-channel voltage measurement)	0010 (high-precision version)	0017
CU2008-0000-0000	CU device	2008 (8-port fast ethernet switch)	0000 (basic type)	0000

Notes

- The elements mentioned above result in the **technical designation**. EL3314-0000-0016 is used in the example below.
- EL3314-0000 is the order identifier, in the case of “-0000” usually abbreviated to EL3314. “-0016” is the EtherCAT revision.
- The **order identifier** is made up of
  - family key (EL, EP, CU, ES, KL, CX, etc.)
  - type (3314)
  - version (-0000)
- The **revision** -0016 shows the technical progress, such as the extension of features with regard to the EtherCAT communication, and is managed by Beckhoff.
  In principle, a device with a higher revision can replace a device with a lower revision, unless specified otherwise, e.g. in the documentation.
  Associated and synonymous with each revision there is usually a description (ESI, EtherCAT Slave Information) in the form of an XML file, which is available for download from the Beckhoff web site.
  From 2014/01 the revision is shown on the outside of the IP20 terminals, see Fig. *“EL5021 EL terminal, standard IP20 IO device with batch number and revision ID (since 2014/01)”*.
- The type, version and revision are read as decimal numbers, even if they are technically saved in hexadecimal.

Identification number

Beckhoff EtherCAT devices from the different lines have different kinds of identification numbers:

Production lot/batch number/serial number/date code/D number

The serial number for Beckhoff IO devices is usually the 8-digit number printed on the device or on a sticker. The serial number indicates the configuration in delivery state and therefore refers to a whole production batch, without distinguishing the individual modules of a batch.

Structure of the serial number: **KK YY FF HH**

KK - week of production (CW, calendar week)
YY - year of production
FF - firmware version
HH - hardware version

Example with
Ser. no.: 12063A02: 12 - production week 12 06 - production year 2006 3A - firmware version 3A 02 - hardware version 02

Exceptions can occur in the **IP67 area**, where the following syntax can be used (see respective device documentation):

Syntax: D ww yy x y z u

D - prefix designation
ww - calendar week
yy - year
x - firmware version of the bus PCB
y - hardware version of the bus PCB
z - firmware version of the I/O PCB
u - hardware version of the I/O PCB

Example: D.22081501 calendar week 22 of the year 2008 firmware version of bus PCB: 1 hardware version of bus PCB: 5 firmware version of I/O PCB: 0 (no firmware necessary for this PCB) hardware version of I/O PCB: 1

Unique serial number/ID, ID number

In addition, in some series each individual module has its own unique serial number.

See also the further documentation in the area

- IP67: EtherCAT Box
- Safety: TwinSafe
- Terminals with factory calibration certificate and other measuring terminals

Examples of markings

Fig. 27: EL5021 EL terminal, standard IP20 IO device with serial/ batch number and revision ID (since 2014/01)

Fig. 28: EK1100 EtherCAT coupler, standard IP20 IO device with serial/ batch number

Fig. 29: CU2016 switch with serial/ batch number

Fig. 30: EL3202-0020 with serial/ batch number 26131006 and unique ID-number 204418

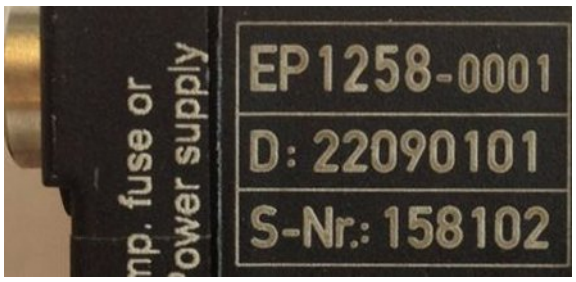


Fig. 31: EP1258-00001 IP67 EtherCAT Box with batch number/ date code 22090101 and unique serial number 158102

Fig. 32: EP1908-0002 IP67 EtherCAT Safety Box with batch number/ date code 071201FF and unique serial number 00346070

Fig. 33: EL2904 IP20 safety terminal with batch number/ date code 50110302 and unique serial number 00331701

Fig. 34: ELM3604-0002 terminal with unique ID number (QR code) 100001051 and serial/ batch number 44160201

6.3.1 Beckhoff Identification Code (BIC)

The Beckhoff Identification Code (BIC) is increasingly being applied to Beckhoff products to uniquely identify the product. The BIC is represented as a Data Matrix Code (DMC, code scheme ECC200), the content is based on the ANSI standard MH10.8.2-2016.

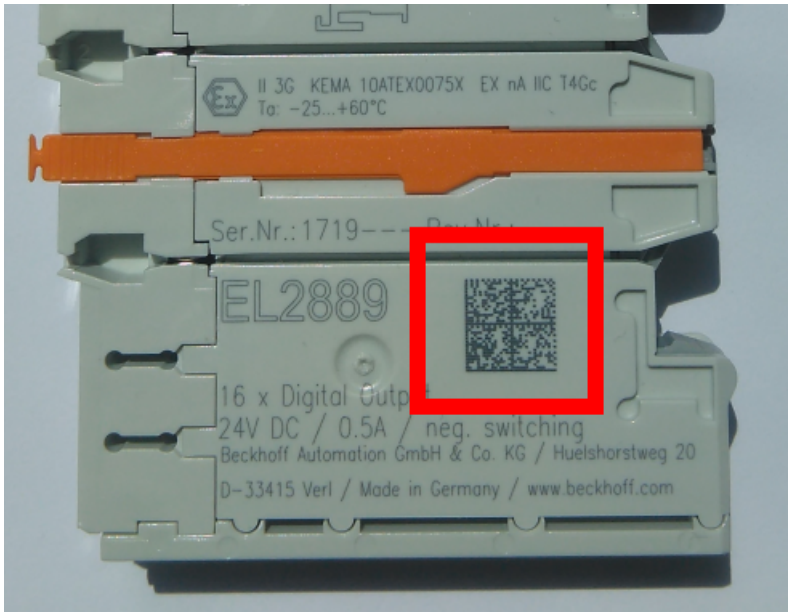


Fig. 35: BIC as data matrix code (DMC, code scheme ECC200)

The BIC will be introduced step by step across all product groups.

Depending on the product, it can be found in the following places:

- on the packaging unit
- directly on the product (if space suffices)
- on the packaging unit and the product

The BIC is machine-readable and contains information that can also be used by the customer for handling and product management.

Each piece of information can be uniquely identified using the so-called data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length according to the table below. If the information is shorter, spaces are added to it. The data under positions 1 to 4 are always available.

The following information is contained:

Item no.	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	**Beckhoff order number**	1P	8	1P072222
2	Beckhoff Traceability Number (BTN)	**Unique serial number, see note below**	S	12	SBTNk4p562d7
3	Article description	**Beckhoff article description, e.g. EL1008**	1K	32	1KEL1809
4	Quantity	**Quantity in packaging unit, e.g. 1, 10, etc.**	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products or calibrated terminals	51S	12	51S678294104
7	Variant number	Optional: Product variant number on the basis of standard products	30P	32	30PF971, 2*K183
...					

Further types of information and data identifiers are used by Beckhoff and serve internal processes.

Structure of the BIC

Example of composite information from item 1 to 4 and 6. The data identifiers are marked in red for better display:

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, item no. 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTE

This information has been carefully prepared. However, the procedure described is constantly being further developed. We reserve the right to revise and change procedures and documentation at any time and without prior notice. No claims for changes can be made from the information, illustrations and descriptions in this information.

6.4 Support and Service

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

Beckhoff's branch offices and representatives

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

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

You will also find further documentation for Beckhoff components there.

Beckhoff Support

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

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

Hotline:	+49 5246 963 157
Fax:	+49 5246 963 9157
e-mail:	support@beckhoff.com

Beckhoff Service

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

- on-site service
- repair service
- spare parts service
- hotline service

Hotline:	+49 5246 963 460
Fax:	+49 5246 963 479
e-mail:	service@beckhoff.com

Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG

Huelshorstweg 20
33415 Verl
Germany

Phone:	+49 5246 963 0
Fax:	+49 5246 963 198
e-mail:	info@beckhoff.com
web:	https://www.beckhoff.com

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com