

**Documentation** 

# EP23xx

EtherCAT box modules with digital inputs and outputs

Version: 3.1

Date: 2020-04-29





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# 1 Foreword

# 1.1 Notes on the documentation

#### Intended audience

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

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

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

#### Disclaimer

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

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

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

#### **Trademarks**

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#### **Patent Pending**

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



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# 1.2 Safety instructions

#### **Safety regulations**

Please note the following safety instructions and explanations!

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

#### **Exclusion of liability**

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

# **Personnel qualification**

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

#### **Description of instructions**

In this documentation the following instructions are used.

These instructions must be read carefully and followed without fail!

#### **▲ DANGER**

## Serious risk of injury!

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

#### **⚠ WARNING**

## Risk of injury!

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

#### **A 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   |
|---------|---|
| 3.1     | 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

29 - week of production 29

10 - year of production 2010

02 - firmware version 02

HH - hardware version 01 - hardware version 01

Further information on this topic: <u>Version identification of EtherCAT devices [ > 72]</u>.

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# 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  $126 \times 30 \times 26.5 \text{ mm}$  (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.

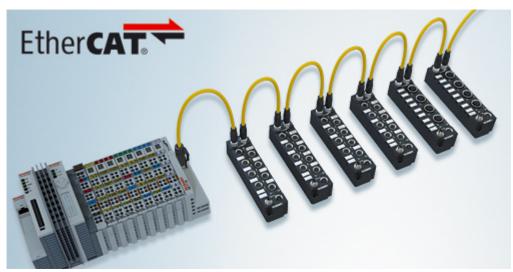


Fig. 1: EtherCAT Box Modules within an EtherCAT network

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.

# EtherCAT XML Device Description

You will find XML files (XML Device Description Files) for Beckhoff EtherCAT modules on our website (www.beckhoff.com) under Downloads, in the Configuration Files area.

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# 3 Product overview

# 3.1 Module overview EP23xx

| Module             | Signal       | Number of | Output current |     | Number of | Input  |
|--------------------|--------------|-----------|----------------|-----|-----------|--------|
|                    | connection   | outputs   | per output     | Sum | inputs    | filter |
| 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 [▶ 14] | 2 x ZS2001   | 8         | 0,5 A          | 4 A | 8         | 10 µs  |
| EP2316-0008 [> 15] | 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 [▶ 21] | 8 x M8       | 0 to 8    | 0,5 A          | 4 A | 8 to 0    | 10 µs  |
| EP2338-0002 [▶ 21] | 4 x M12      | 0 to 8    | 0,5 A          | 4 A | 8 to 0    | 10 µs  |
| EP2338-1001 [▶ 21] | 8 x M8       | 0 to 8    | 0,5 A          | 4 A | 8 to 0    | 3,0 ms |
| EP2338-1002 [▶ 21] | 4 x M12      | 0 to 8    | 0,5 A          | 4 A | 8 to 0    | 3,0 ms |
| EP2339-0003 [▶ 25] | 2 x ZS2001   | 0 to 16   | 0.5 A          | 4 A | 16 to 0   | 3.0 ms |
| EP2339-0021 [▶ 29] | 16 x M8      | 0 to 16   | 0,5 A          | 4 A | 16 to 0   | 3,0 ms |
| EP2339-0022 [▶ 30] | 8 x M12      | 0 to 16   | 0,5 A          | 4 A | 16 to 0   | 3,0 ms |
| EP2339-0042 [▶ 33] | 8 x M12      | 0 to 16   | 0.5 A          | 4 A | 16 to 0   | 3.0 ms |
| EP2349-0021 [▶ 36] | 16 x M8      | 0 to 16   | 0,5 A          | 4 A | 16 to 0   | 10 µs  |
| EP2349-0022 [▶ 36] | 8 x M12      | 0 to 16   | 0,5 A          | 4 A | 16 to 0   | 10 µs  |



# 3.2 EP2308, EP2318, EP2328

# 3.2.1 EP2308, EP2318, EP2328 - Introduction

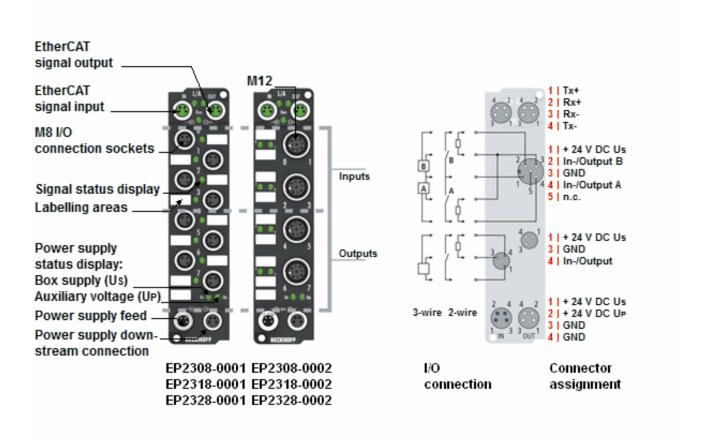


Fig. 4: EP2308, EP2318, EP2328

#### 4 digital inputs 24 VDC and 4 digital outputs 24 VDC, Imax 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**

Technical data [▶ 12]

Process image [ 13]

Abmessungen [▶ 40]

Actuator connection [▶ 52]

Sensor connection [▶ 53]



# 3.2.2 EP2308, EP2318, EP2328 - Technical Data

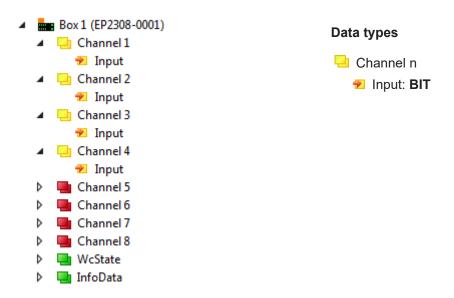
| Technical data                                  | EP2308-<br>0001   | EP2308-<br>0002                         | EP2318-<br>0001    | EP2318-<br>0002 | EP2328-<br>0001 | EP2328-<br>0002 |
|---|---|---|--------------------|-----------------|-----------------|-----------------|
| Fieldbus  | EtherCAT  |   |                    |                 | ·               |                 |
| Fieldbus connection                             | 2 x M8 sock   | ket (green)                             |                    |                 |                 |                 |
| Number of inputs                                | 4   |   |                    |                 |                 |                 |
| Input connections                               | M8  | M12                                     | M8                 | M12             | M8              | M12             |
| Nominal input voltage                           | 24 V <sub>DC</sub> (-15   | %/+20%)                                 | '                  |                 | '               |                 |
| Input filter                                    | 3.0 ms  | 3.0 ms                                  | 10 µs              | 10 µs           | 3.0 ms          | 3.0 ms          |
| Signal voltage "0"                              | -3+5 V (E   | N 61131-2,                              | type 3)            | <u> </u>        |                 |                 |
| Signal voltage "1"                              | +11+30 V  | (EN 61131-                              | -2, type 3)        |                 |                 |                 |
| Input current                                   | typically 3 n   | nA (EN 6113                             | 31-2, type 3)      |                 |                 |                 |
| Sensor supply                                   | derived fror  | n control vol                           | tage, max. 0       | .5 A total, sho | ort-circuit pro | of              |
| Number of outputs                               | 4   |   |                    |                 |                 |                 |
| Output connections                              | M8  | M12                                     | M8                 | M12             | M8              | M12             |
| Load type                                       | ohmic, indu   | ctive, lamp l                           | oad                |                 | '               | '               |
| Nominal output voltage                          | 24 V <sub>DC</sub> (-15   | %/+20%)                                 |                    |                 |                 |                 |
| Output current                                  | max. 0.5 A  | per channel                             |                    |                 | max. 2.0 A      | per channel     |
|   |   |   |                    |                 | max. 4.0 A      | total           |
| Short circuit current                           | maximum 1   | .5 A                                    |                    |                 | max. 4.0 A      | \               |
| Supply of the module electronics                | from the co   | from the control voltage Us             |                    |                 |                 |                 |
| Current consumption of the module electronics   | typically 12  | typically 120 mA                        |                    |                 |                 |                 |
| Output driver supply                            | from load v   | oltage Up                               |                    |                 |                 |                 |
| Output driver current consumption               | typically 8 n   | nA per chan                             | nel                |                 |                 |                 |
| Power supply connection                         |   | 18 plug, 4-pii<br>n connectior          | า<br>า: 1 x M8 soc | cket, 4-pin     |                 |                 |
| Electrical isolation                            |   |   |                    |                 |                 |                 |
| Fieldbus<br>GND <sub>s</sub> / GND <sub>P</sub> | 500 V<br>no   |   |                    |                 |                 |                 |
| Ambient temperature during operation            | -25+60 °C<br>-25+55 °C conforms to cURus<br>0+55 °C according to ATEX |   |                    |                 |                 |                 |
| Ambient temperature during storage              | -40+85 °C   |   |                    |                 |                 |                 |
| Vibration / shock resistance                    | conforms to   | EN 60068-                               | 2-6 / EN 600       | 68-2-27         |                 |                 |
| EMC immunity / emission                         | conforms to   | EN 61000-                               | 6-2 / EN 610       | 00-6-4          |                 |                 |
| Protection class                                | IP65, IP66,   | IP65, IP66, IP67 (conforms to EN 60529) |                    |                 |                 |                 |
| Mounting position                               | variable  |   |                    |                 |                 |                 |
| Approvals                                       | CE, cURus   | [▶ <u>60],</u> ATEX                     | [ <u>• 61]</u>     |                 |                 |                 |
| -   |   |   |                    |                 |                 |                 |



# 3.2.3 EP2308, EP2318, EP2328 - Process image

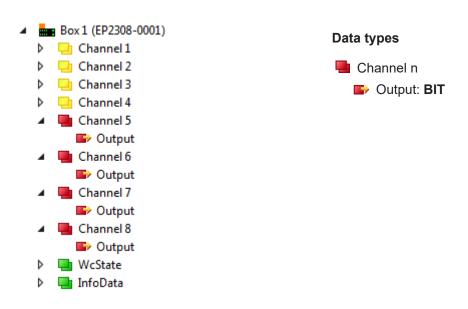
## **DI Inputs**

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



# **DO Outputs**

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





# 3.3 EP2316-0003, EP2316-0008

## 3.3.1 EP2316-0003 - Introduction

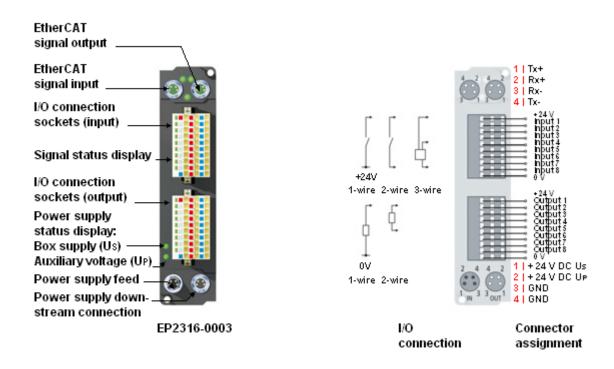


Fig. 5: EP2316-0003

## 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  $\mu$ s 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 <u>ZS2001 connectors [> 57]</u> with spring-loaded system, optionally available with 1 or 3 pins. The module is delivered without connectors.

#### **Quick links**

Technical data [▶ 16]

Process image [▶ 18]

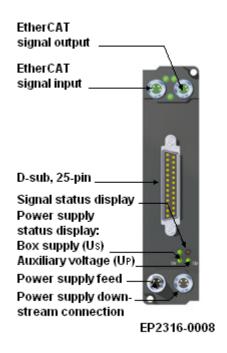
Dimensions [▶ 40]

Actuator connection [▶ 56]

Sensor connection [▶ 56]



## 3.3.2 EP2316-0008 - Introduction



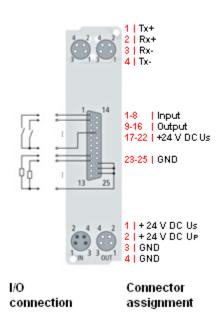


Fig. 6: EP2316-0008

## 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  $\mu$ s 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 [▶ 16]

Process image [▶ 18]

Dimensions [▶ 40]

Sensor/actuator connection [▶ 59]

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# 3.3.3 EP2316-000x - Technical Data

| Technical data                                  | EP2316-0003   | EP2316-0008                                 |  |  |
|---|---|---|--|--|
| Fieldbus  | EtherCAT  |   |  |  |
| Fieldbus connection                             | 2 x M8 socket (green)   |   |  |  |
| Number of inputs                                | 8   |   |  |  |
| Input connections                               | ZS2001 connector  | 25-pin D-Sub socket (pins 1 – 8)            |  |  |
| Nominal input voltage                           | 24 V <sub>DC</sub> (-15%/+20%)  |   |  |  |
| Input filter                                    | 10 µs   |   |  |  |
| Signal voltage "0"                              | -3+5 V (EN 61131-2, type 3)   |   |  |  |
| Signal voltage "1"                              | +11+30 V (EN 61131-2, type  | 3)  |  |  |
| Input current                                   | typically 3 mA (EN 61131-2, typ   | e 3)  |  |  |
| Sensor supply                                   | derived from control voltage, mapproof  | ax. 0.5 A total, short-circuit              |  |  |
| Number of outputs                               | 8   |   |  |  |
| Output connections                              | ZS2001 connector  | 25-pin D-Sub socket (pins 9 – 16)           |  |  |
| Load type                                       | ohmic, inductive, lamp load   |   |  |  |
| Nominal output voltage                          | 24 V <sub>DC</sub> (-15%/+20%)  |   |  |  |
| Output current                                  | max. 0.5 A per channel, individually short-circuit proof, sum current of all outputs max. 4 A |   |  |  |
| Short circuit current                           | maximum 1.5 A   |   |  |  |
| Supply of the module electronics                | from the control voltage Us   |   |  |  |
| Current consumption of the module electronics   | typically 120 mA  |   |  |  |
| Output driver supply                            | from load voltage Up  |   |  |  |
| Output driver current consumption               | max. 30 mA for all channels   |   |  |  |
| Power supply connection                         | Feed: 1 x M8 plug, 4-pin<br>Downstream connection: 1 x M8                                     | 3 socket, 4-pin                             |  |  |
| Electrical isolation                            |   |   |  |  |
| Fieldbus<br>GND <sub>s</sub> / GND <sub>P</sub> | 500 V<br>no   |   |  |  |
| Ambient temperature during operation            | -25+60 °C   | -25+60 °C<br>-25+55 °C conforms to<br>cURus |  |  |
| 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                                | IP20  | IP65, IP66, IP67 (conforms to EN 60529)     |  |  |
| Mounting position                               | variable  |   |  |  |
| Approvals                                       | CE  | CE, <u>cURus [▶ 60]</u>                     |  |  |



# 3.3.4 EP2316-0008 - Status LEDs



Fig. 7: EP2316-0008 - Status LEDs

# **LED Displays**

| LED                                      | Display  | Meaning   |
|--|--|---|
| STATUS 1-8                               | STATUS 1-8 green illuminated A signal (24 V) is present at a least one of the inputs for channel |   |
| 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 n      |  | The supply voltage, Us, is not present              |
|  | green illuminated  | The supply voltage, Us, is present                  |
| Up off The supply voltage, Up, is not pr |  | The supply voltage, Up, is not present              |
|  | green illuminated  | The supply voltage, Up, is present                  |

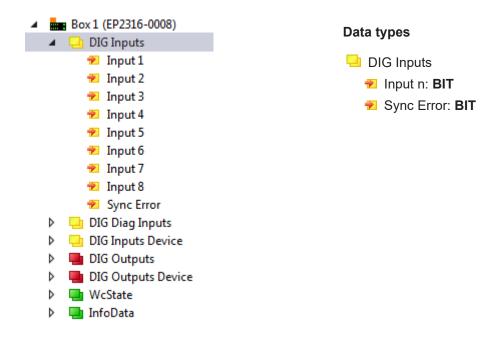
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# 3.3.5 **EP2316-000x - Process image**

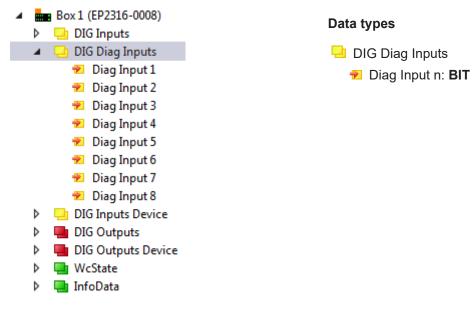
## **DIG Inputs**

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



#### **DIG Diag Inputs**

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



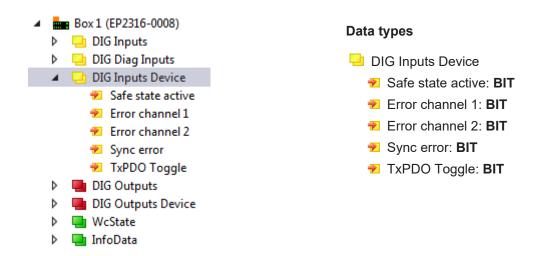
## Diag Input n

Indicates an error on Output n.



#### **DIG Inputs Device**

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



#### 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**

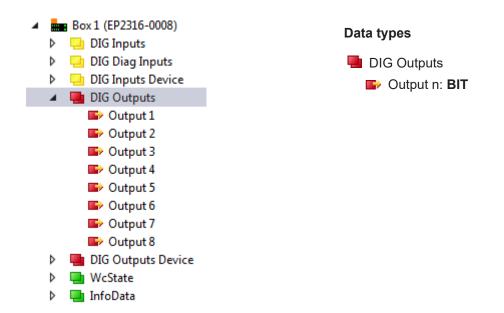
See EtherCAT system documentation. The EtherCAT system documentation is available on the Beckhoff homepage under <a href="Downloads">Downloads</a>.

#### **TxPDO Toggle**

See EtherCAT system documentation.

#### **DIG Outputs**

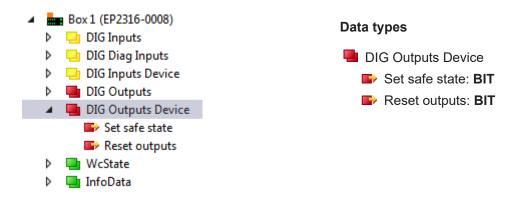
You will find the 8 digital outputs of the module under **DIG Outputs**.





## **DIG Outputs Device**

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



#### 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**

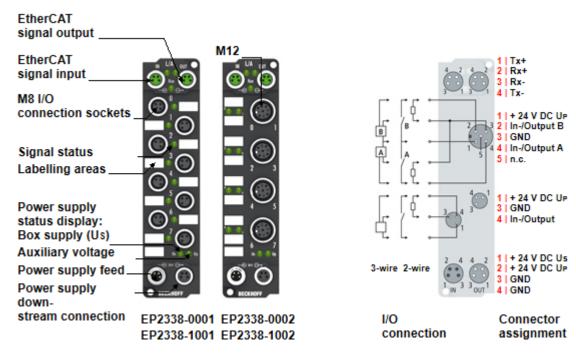


Fig. 8: EP2338-x00x

#### 8 digital inputs or outputs, 24 V<sub>DC</sub>

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  $\mu$ s (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<sub>P</sub>, not from U<sub>S</sub>

In contrast to many other modules, the EP2338 EtherCAT Box supplies digital sensors from the  $U_{\text{P}}$  peripheral voltage and not from the  $U_{\text{S}}$  control voltage! Nevertheless, an overload of the sensor supply (current > 0.5 A) is also indicated here by the illuminated red  $U_{\text{S}}$  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  $U_{\text{P}}$  is switched off in the event of a fault, you must not power the connected sensors externally, but only through EP2338! Otherwise, when the  $U_{\text{P}}$  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 [▶ 22]
Process image [▶ 23]
Dimensions [▶ 40]
Sensor/actuator connection [▶ 54]



# 3.4.2 EP2338-x00x - Technical Data

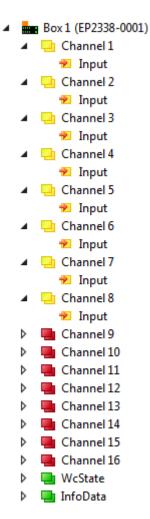
| Technical data                                  | EP2338-0001                                     | EP2338-1001                    | EP2338-0002           | EP2338-1002     |  |  |
|---|---|--------------------------------|-----------------------|-----------------|--|--|
| Fieldbus  | EtherCAT  |                                |                       |                 |  |  |
| Fieldbus connection                             | 2 x M8 socket (green)                           |                                |                       |                 |  |  |
| Number of outputs                               | 8 to 0  | 8 to 0                         |                       |                 |  |  |
| Output connections                              | M8  |                                | M12                   |                 |  |  |
| Load type                                       | ohmic, inductive,                               | lamp load                      |                       |                 |  |  |
| Nominal output voltage                          | 24 V <sub>DC</sub> (-15%/+20                    | )%)                            |                       |                 |  |  |
| Output current                                  | max. 0.5 A per ch                               | nannel                         |                       |                 |  |  |
| Short circuit current                           | maximum 1.5 A                                   |                                |                       |                 |  |  |
| Supply of the module electronics                | from the control v                              | oltage Us                      |                       |                 |  |  |
| Current consumption of the module electronics   | typically 120 mA                                |                                |                       |                 |  |  |
| Output driver supply                            | from load voltage                               | Up                             |                       |                 |  |  |
| Output driver current consumption               | typically 20 mA                                 |                                |                       |                 |  |  |
| Number of inputs                                | 0 to 8  |                                |                       |                 |  |  |
| Input connections                               | M8  |                                | M12                   |                 |  |  |
| Nominal input voltage                           | 24 V <sub>DC</sub> (-15%/+20                    | )%)                            |                       |                 |  |  |
| Input filter                                    | 10 µs   | 3 ms                           | 10 µs                 | 3 ms            |  |  |
| Signal voltage "0"                              | -3+5 V (EN 611                                  | 31-2, type 3)                  |                       |                 |  |  |
| Signal voltage "1"                              | +11+30 V (EN 61131-2, type 3)                   |                                |                       |                 |  |  |
| Input current                                   | typically 3 mA (EN 61131-2, type 3)             |                                |                       |                 |  |  |
| Sensor supply                                   | from the peripher                               | al voltage Up, max             | x. 0.5 A, total short | t-circuit proof |  |  |
| Power supply connection                         | Feed: 1 x M8 plug<br>Downstream con             | g, 4-pin<br>nection: 1 x M8 so | cket, 4-pin           |                 |  |  |
| Electrical isolation                            |   |                                |                       |                 |  |  |
| Fieldbus<br>GND <sub>s</sub> / GND <sub>P</sub> | 500 V<br>no                                     |                                |                       |                 |  |  |
| Ambient temperature during operation            | -25 +60 °C<br>-25 +55 °C con<br>0 +55 °C accord | _                              |                       |                 |  |  |
| 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 6                                | 1000-6-2 / EN 610              | 000-6-4               |                 |  |  |
| Protection class                                | IP65, IP66, IP67                                | (conforms to EN 6              | 0529)                 |                 |  |  |
| Mounting position                               | variable  |                                |                       |                 |  |  |
| Approvals                                       | CE, <u>cURus [▶ 60]</u> ,                       | <u>ATEX [▶ 61]</u>             |                       |                 |  |  |



# 3.4.3 **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).





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).

■ Box 1 (EP2338-0001) Channel 1 Channel 2 Channel 3 Channel 4 Channel 5 Channel 6 Channel 7 Channel 8 Channel 9 Output Channel 10 Output Channel 11 Output Channel 12 Output Channel 13 Output Channel 14 Output Channel 15 Output Channel 16 Output

WcState
InfoData

# **Data types**

- Channel n
  - Output: BIT



# 3.5 EP2339-0003

## 3.5.1 EP2339-0003 - Introduction

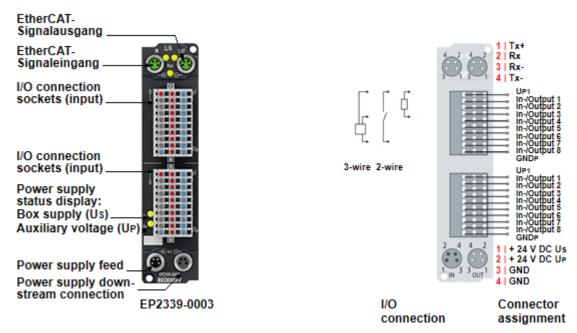


Fig. 9: EP2339-0003

## 16-channel digital input or output 24 V<sub>DC</sub>

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  $U_{\rm P}$ .

#### **Quick links**

Technical data [▶ 26]

Process image [▶ 27]

Dimensions [▶ 40]

Signal connection [▶ 56]

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# 3.5.2 EP2339-0003 - Technical data

| Technical data                                | EP2339-0003  |
|---|--|
| Fieldbus                                      | EtherCAT   |
| Fieldbus connection                           | 2 x M8 socket (green)  |
| Distributed Clocks                            | yes  |
| Cable length for inputs/outputs               | max. 30 m  |
| Number of outputs                             | 0 to 16  |
| Output connections                            | 2x ZS2001  |
| Load type                                     | ohmic, inductive, lamp load  |
| Nominal output voltage                        | 24 V <sub>DC</sub> (-15%/+20%)   |
| Output current                                | max. 0,5 A per channel, short-circuit proof  |
|   | max. 4.0 A total   |
| Short circuit current                         | max. 1,5 A   |
| Supply of the module electronics              | from the control voltage Us  |
| Current consumption of the module electronics | typically 120 mA   |
| Output driver supply                          | from the load voltage U <sub>P</sub>   |
| Output driver current consumption             | typically 20 mA + load   |
| Input connections                             | 2x ZS2001  |
| Number of inputs                              | 0 to 16  |
| Nominal input voltage                         | 24 V <sub>DC</sub> (-15%/+20%)   |
| Input filter                                  | 3,0 ms   |
| Signal voltage "0"                            | -3+5 V (EN 61131-2, type 3)  |
| Signal voltage "1"                            | +11+30 V (EN 61131-2, type 3)  |
| Input current                                 | typically 5 mA at 24 V   |
| Sensor supply                                 | from the peripheral voltage U <sub>P</sub> , max. 0,5 A, total short-circuit proof |
| Power supply connection                       | Feed: 1 x M8 plug, 4-pin   |
|   | Downstream connection: 1 x M8 socket, 4-pin  |
| Electrical isolation                          |  |
| Fieldbus                                      | 500 V  |
| GND <sub>s</sub> / GND <sub>P</sub>           | no   |
| Ambient temperature during operation          | -25 +60 °C   |
|   | -25 +55 °C conforms to cURus   |
| 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                              | IP20   |
| Mounting position                             | variable   |
| Approvals                                     | CE, <u>cURus [▶ 60]</u>  |



# 3.5.3 EP2339-0003 - Process image

Box 1 (EP2339-0003)

DI Inputs Channel 1

DI Inputs Channel 2

DO Outputs Channel 1

DO Outputs Channel 2

WcState

InfoData

Fig. 10: EP2339-0003 - Process image

## DI Inputs Channel n

DI Inputs Channel 1

Input 1

Input 2

Input 3

Input 4

Input 5

Input 6

Input 7

Input 8

Sync error

TxPDO State

TxPDO Toggle

DI Inputs Channel 2

Input 1

Input 2

Input 3

Input 4

Input 5

Input 6

Input 7

Input 8

Sync errorTxPDO State

TxPDO Toggle

#### 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

- DO Outputs Channel 1
  - Output 1
  - Output 2
  - Output 3
  - Output 4
  - Output 5
  - Output 6
  - Output 7
  - Output 8
- DO Outputs Channel 2
  - Output 1
  - Output 2
  - Output 3
  - Output 4
  - Output 5
  - Output 6
  - Output 7
  - Output 8

Output *x* 

Digital outputs. Data type: BIT.



# 3.6 EP2339-002x

## 3.6.1 EP2339-0021 - Introduction

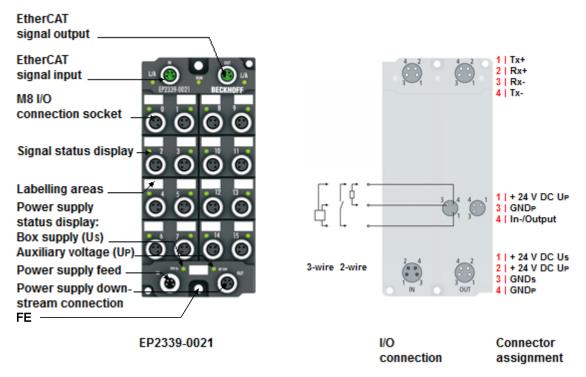


Fig. 11: EP2339-0021

#### 16 digital inputs or outputs, 24 V<sub>pc</sub>

The EP2339-0021 EtherCAT Box has 16 digital channels, each of which can be operated as inputs or outputs. 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 filter constant of the inputs is 3 ms. The state of each signal is indicated by means of light emitting diodes. The signals are connected via M8 connectors.



# Supply of the connected sensors from U<sub>P</sub>, not from U<sub>S</sub>



In contrast to many other modules, the EP2339-0021 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 EP2339-0021! Otherwise, when the  $U_P$  energy is switched off, EP2339-0021 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

#### **Quick links**

Technical data [▶ 31]

Process image [ 32]

Dimensions [▶ 41]

Sensor/actuator connection [▶ 54]



## 3.6.2 EP2339-0022 - Introduction

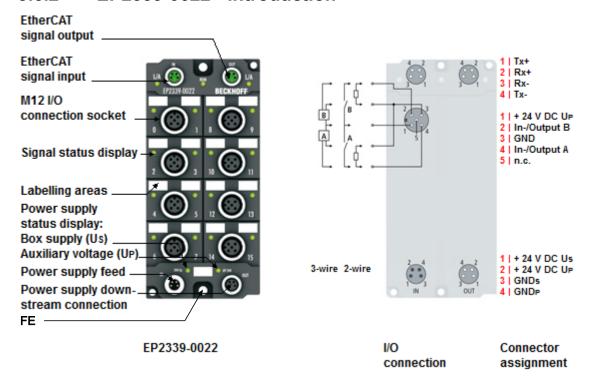


Fig. 12: EP2339-0022

# 16 digital inputs or outputs, 24 $V_{DC}$

The EP2339-0022 EtherCAT Box has 16 digital channels, each of which can be operated as inputs or outputs. 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 filter constant of the inputs is 3 ms.

The state of each signal is indicated by means of light emitting diodes. The signals are connected via M12 connectors.



## Supply of the connected sensors from U<sub>P</sub>, not from U<sub>S</sub>



In contrast to many other modules, the EP2339-0022 EtherCAT Box supplies digital sensors from the  $U_{\text{P}}$  peripheral voltage and not from the  $U_{\text{S}}$  control voltage! Nevertheless, an overload of the sensor supply (current > 0.5 A) is also indicated here by the illuminated red  $U_{\text{S}}$  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  $U_{\text{P}}$  is switched off in the event of a fault, you must not power the connected sensors externally, but only through EP2339-0022! Otherwise, when the  $U_{\text{P}}$  energy is switched off, EP2339-0022 can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

## **Quick links**

Technical data [▶ 31]
Process image [▶ 32]
Dimensions [▶ 41]

Sensor/actuator connection [▶ 54]



# 3.6.3 **EP2339-002x - Technical data**

| Technical data                                | EP2339-0021  | EP2339-0022                     |  |
|---|--|---------------------------------|--|
| Fieldbus                                      | EtherCAT   |                                 |  |
| Fieldbus connection                           | 2 x M8 socket (green)  |                                 |  |
| Number of outputs                             | 0 to 16  |                                 |  |
| Output connections                            | 16x M8   | 8x M12                          |  |
| Load type                                     | ohmic, inductive, lamp load  |                                 |  |
| Nominal output voltage                        | 24 V <sub>DC</sub> (-15%/+20%)                                       |                                 |  |
| Output current                                | max. 0,5 A per channel   |                                 |  |
| Short circuit current                         | max. 1,5 A   |                                 |  |
| Supply of the module electronics              | from the control voltage Us  |                                 |  |
| Current consumption of the module electronics | typically 120 mA   |                                 |  |
| Output driver supply                          | from the load voltage U <sub>P</sub>                                 |                                 |  |
| Output driver current consumption             | typically 20 mA  |                                 |  |
| Input connections                             | 16x M8   | 8x M12                          |  |
| Number of inputs                              | 0 to 16  |                                 |  |
| Nominal input voltage                         | 24 V <sub>DC</sub> (-15%/+20%)                                       |                                 |  |
| Input filter                                  | 3,0 ms   |                                 |  |
| Signal voltage "0"                            | -3+5 V (EN 61131-2, type 3)  |                                 |  |
| Signal voltage "1"                            | +11+30 V (EN 61131-2, type 3)  |                                 |  |
| Input current                                 | typically 5 mA at 24 V   |                                 |  |
| Sensor supply                                 | from the peripheral voltage $U_{\mbox{\tiny P}},$ proof              | max. 0,5 A, total short-circuit |  |
| Power supply connection                       | Feed: 1 x M8 plug, 4-pin Downstream connection: 1 x M8 socket, 4-pin |                                 |  |
| Electrical isolation                          |  |                                 |  |
| Fieldbus                                      | 500 V  |                                 |  |
| GND <sub>S</sub> / GND <sub>P</sub>           | yes  |                                 |  |
| Ambient temperature during operation          | -25+60 °C  |                                 |  |
|   | -25+55 °C conforms to cURus  |                                 |  |
| 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)                              |                                 |  |
| Mounting position                             | variable   |                                 |  |
| Approvals                                     | CE, <u>cURus [▶ 60]</u>  |                                 |  |

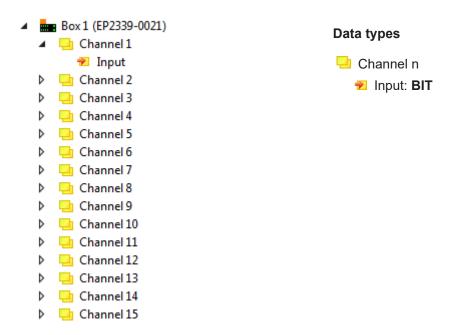
EP23xx Version: 3.1 31



# 3.6.4 EP2339-002x - Process image

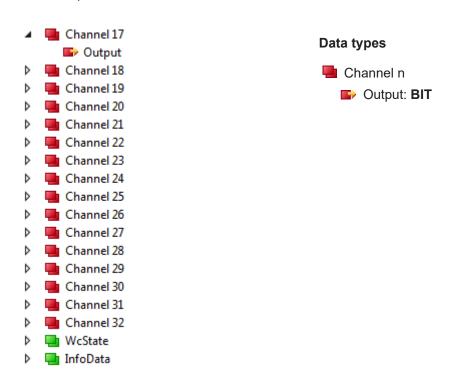
## Inputs

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



## **Outputs**

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





# 3.7 EP2339-0042

## 3.7.1 EP2339-0042 - Introduction

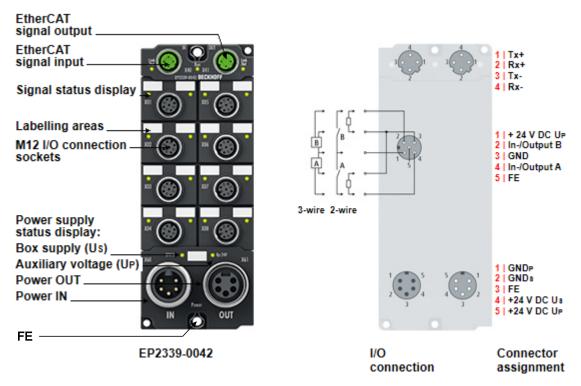


Fig. 13: EP2339-0042

#### 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.



#### Supply of the connected sensors from U<sub>P</sub>, not from U<sub>S</sub>



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 [▶ 34]

Process image [▶ 35]

Dimensions [▶ 42]

Sensor/actuator connection [▶ 55]



# 3.7.2 EP2339-0042 - Technical data

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

| Technical data                                | EP2339-0042   |
|---|---|
| Fieldbus                                      | EtherCAT  |
| Fieldbus connection                           | 2x M12 socket, D-coded, 4-pin, green                                    |
| Number of channels                            | 16 digital inputs or outputs  |
| Input / output connections                    | 8x M12  |
| Load type                                     | ohmic, inductive, lamp load   |
| Nominal output voltage                        | 24 V <sub>DC</sub> (-15%/+20%)  |
| Output current                                | max. 0.5 A on each channel, individually short-circuit proof            |
| Short circuit current                         | max. 1.5 A  |
| Supply of the module electronics              | from the control voltage U <sub>S</sub>                                 |
| Current consumption of the module electronics | 120 mA  |
| Output driver supply                          | from the peripheral voltage U <sub>P</sub>                              |
| Output driver current consumption             | 20 mA + load  |
| Nominal input voltage                         | 24 V <sub>DC</sub> (-15%/+20%)  |
| Input filter                                  | 3.0 ms  |
| Signal voltage "0"                            | -3+5 V (EN 61131-2, type 3)   |
| Signal voltage "1"                            | +11+30 V (EN 61131-2, type 3)   |
| Input current                                 | 6 mA at 24 V  |
| Sensor supply                                 | from the peripheral voltage U <sub>P</sub>                              |
|   | max. 0.5 A, short-circuit proof overall                                 |
| Power supply connection                       | Input: 1x 7/8" plug, 5-pin Downstream connection: 1x 7/8" socket, 5-pin |
|   | max. 16 A per Pin   |
| Electrical isolation                          | 500 V (fieldbus / IO)   |
| Ambient temperature during operation          | -25+60 °C<br>-25+55 °C conforms to cURus                                |
| 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)                                 |
| Weight  | approx. 440 g   |
| Installation position                         | variable  |
| Approvals                                     | CE, cURus in preparation  |

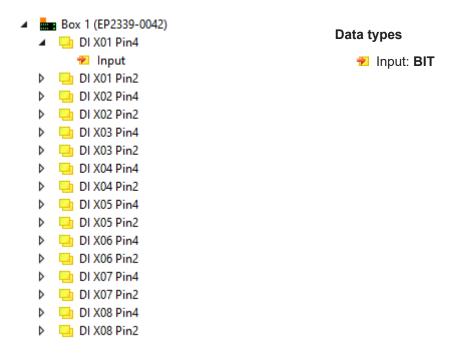


# 3.7.3 EP2339-0042 - Process image

#### Inputs

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

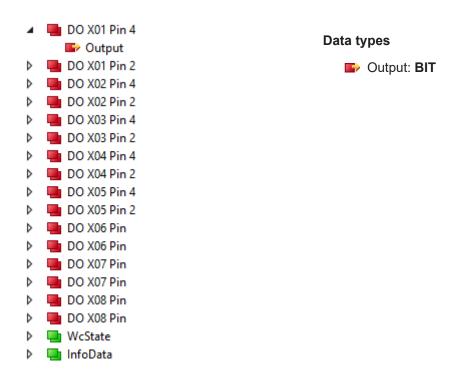
The name of each process data object contains the name of the socket and the pin number of the corresponding digital input.



#### **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.





# 3.8 EP2349-002x

# 3.8.1 **EP2349-002x - Introduction**

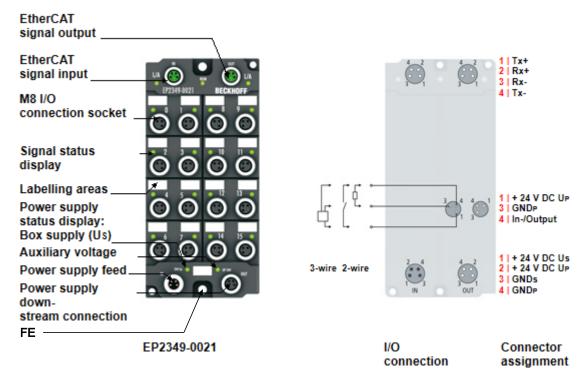


Fig. 14: EP2349-0021

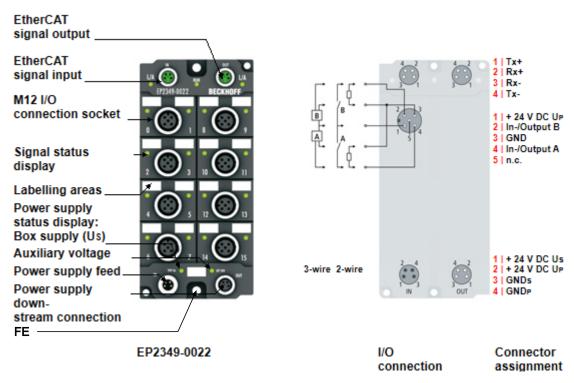


Fig. 15: EP2349-0022



## 16 digital inputs or outputs, 24 $V_{DC}$ , freely selectable, 10 $\mu s$ filter

The EP2349 EtherCAT Box has 16 freely selectable digital inputs or outputs on one device. The filter constant of the inputs is 10  $\mu$ s. The outputs are short-circuit proof and protected against inverse connection and process load currents up to 0.5 A, whereby the total current is limited to 4 A. The state of each signal is indicated by means of light emitting diodes. The signals are optionally connected via M8 (EP2349-0021) or M12 (EP2349-0022) connectors. The sensors are powered by the load voltage UP.



## Supply of the connected sensors from U<sub>P</sub>, not from U<sub>S</sub>



In contrast to many other modules, the EP2349-002x 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 EP2349-002x! Otherwise, when the  $U_P$  energy is switched off, EP2349-002x can continue to draw energy from the external sensor supply, and the outputs will not be switched off.

#### **Quick links**

Technical data [▶ 38]
Process image [▶ 39]
Dimensions [▶ 41]

Sensor/actuator connection [▶ 54]



# 3.8.2 **EP2349-002x - Technical data**

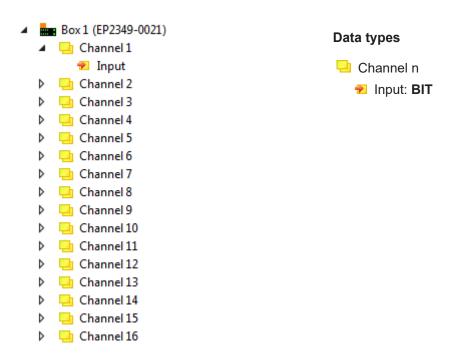
| Technical data                                | EP2349-0021   | EP2349-0022                           |  |
|---|---|---------------------------------------|--|
| Fieldbus                                      | EtherCAT  |                                       |  |
| Fieldbus connection                           | 2 x M8 socket (green)                                     |                                       |  |
| Number of outputs                             | 16 to 0   |                                       |  |
| Output connections                            | M8 sockets  | M12 sockets                           |  |
| Load type                                     | ohmic, inductive, lamp load                               |                                       |  |
| Nominal output voltage                        | 24 V <sub>DC</sub> (-15%/+20%)                            |                                       |  |
| Output current                                | max. 0.5 A each channel, individual current max. 4 A      | dually short-circuit proof, sum       |  |
| Short circuit current                         | maximum 1.5 A   |                                       |  |
| Supply of the module electronics              | from the control voltage Us                               |                                       |  |
| Current consumption of the module electronics | typically 130 mA  |                                       |  |
| Output driver supply                          | from load voltage Up                                      |                                       |  |
| Output driver current consumption             | typically 20 mA   |                                       |  |
| Input connections                             | M8 sockets  | M12 sockets                           |  |
| Number of inputs                              | 0 to 16   |                                       |  |
| Nominal input voltage                         | 24 V <sub>DC</sub> (-15%/+20%)                            |                                       |  |
| Input filter                                  | 10 μs   |                                       |  |
| Signal voltage "0"                            | -3+5 V (EN 61131-2, type 3)                               |                                       |  |
| Signal voltage "1"                            | +11+30 V (EN 61131-2, type 3)                             |                                       |  |
| Input current                                 | typically 6 mA (EN 61131-2, type 3)                       |                                       |  |
| Sensor supply                                 | from the peripheral voltage Up, r                         | max. 0.5 A, total short-circuit proof |  |
| Power supply connection                       | Feed: 1 x M8 plug, 4-pin<br>Downstream connection: 1 x M8 | socket, 4-pin                         |  |
| Electrical isolation                          |   |                                       |  |
| Fieldbus                                      | 500 V   |                                       |  |
| GND <sub>s</sub> / GND <sub>P</sub>           | yes   |                                       |  |
| Weight  | approx. 250 g   |                                       |  |
| Ambient temperature during operation          | -25+60 °C<br>-25+55 °C conforms to cURus                  | }                                     |  |
| Ambient temperature during storage            | -25+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 El                          | N 60529)                              |  |
| Mounting position                             | variable  |                                       |  |
| Approvals                                     | CE, <u>cURus [▶ 60]</u>                                   |                                       |  |



## 3.8.3 **EP2349-002x - Process image**

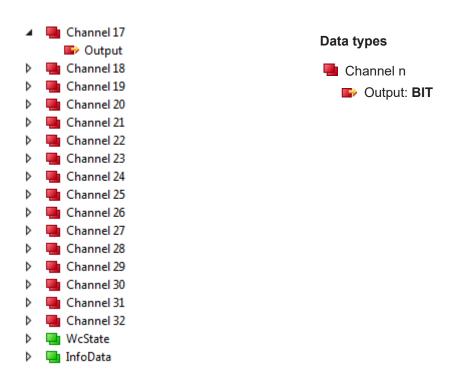
## Inputs

Under **Channel 1** to **Channel 16** you will find the 16 digital inputs of the module (here as an example the EP2349-0021).



## **Outputs**

Under **Channel 17** to **Channel 32** you will find the 16 digital outputs of the module (here as an example the EP2349-0021).





# 4 Mounting and connection

# 4.1 Mounting

## 4.1.1 Dimensions EPxxxx-xx0x and EPxxxx-xx1x

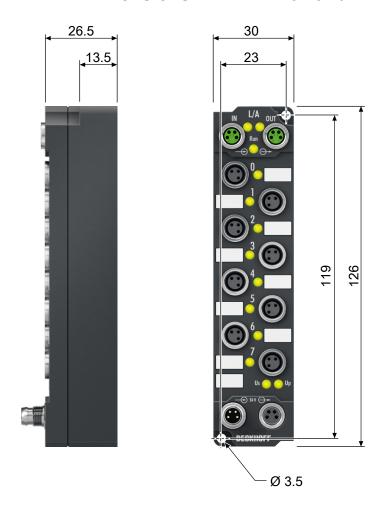


Fig. 16: Dimensions

All dimensions are given in millimeters.

## **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

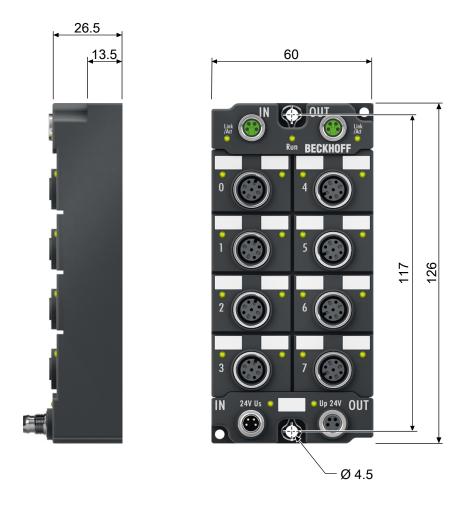


Fig. 17: Dimensions

All dimensions are given in millimeters.

## **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. 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 60 x 26.5 mm (without connectors)               |



# 4.1.3 EPxxxx-xx42 dimensions

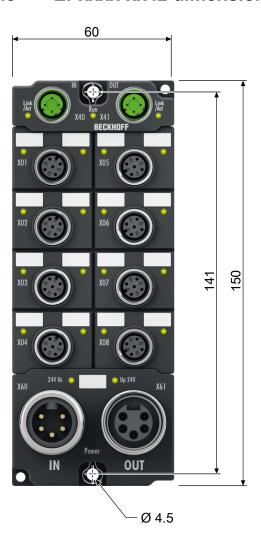


Fig. 18: Dimensions

All dimensions are given in millimeters.

## **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.

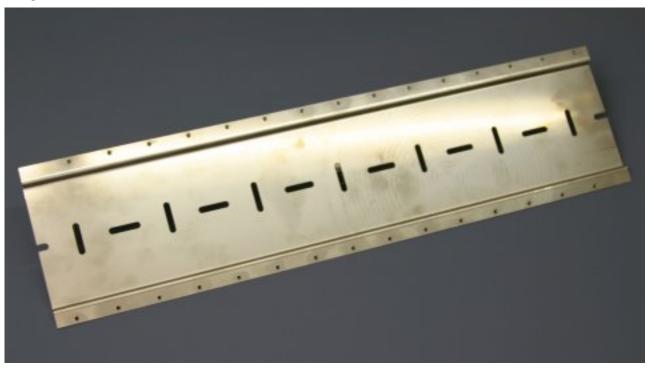


Fig. 19: Mounting Rail ZS5300-000

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.

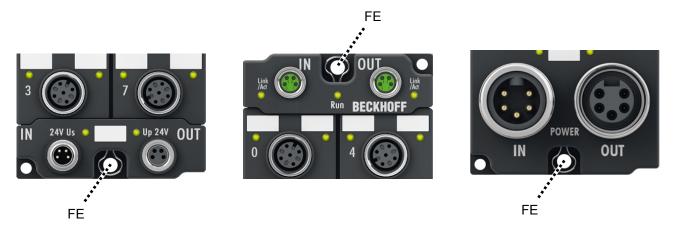


Fig. 20: Functional earth via the fastening holes



# 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

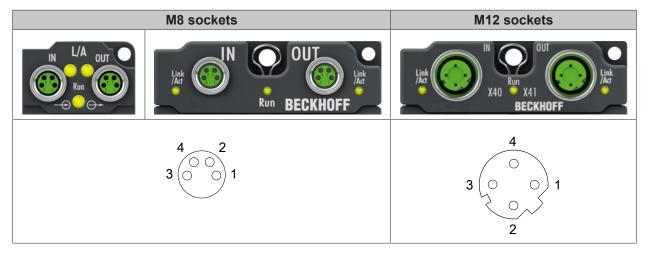
## Risk of confusion: supply voltages and EtherCAT

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.



## **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 <sup>1</sup> | ZB9010, ZB9020,<br>ZB9030, ZB9032,<br>ZK1090-6292,<br>ZK1090-3xxx-xxxx | ZB9030, ZB9032, sions of ZB9030, ZK1090-6292, ZB9032, |              |
| Tx +                    | Pin 1   | Pin 1 | Pin 1             | yellow <sup>2</sup>  | orange/white3   | white/orange |
| Tx -                    | Pin 4   | Pin 3 | Pin 2             | orange <sup>2</sup>  | orange <sup>3</sup>                                   | orange       |
| Rx +                    | Pin 2   | Pin 2 | Pin 3             | white <sup>2</sup>   | blue/white <sup>3</sup>                               | white/green  |
| Rx -                    | Pin 3   | Pin 4 | Pin 6             | blue <sup>2</sup>  | blue <sup>3</sup>                                     | green        |
| Shield                  | Housing |       | Shroud            | Shield   | Shield  | Shield       |

<sup>1)</sup> colored markings according to EN 61918 in the four-pin RJ45 connector ZS1090-0003

<sup>&</sup>lt;sup>3</sup>) 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.

<sup>2)</sup> wire colors according to EN 61918



## 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<sub>s</sub>

Power is supplied to the fieldbus, the processor logic, the inputs and the sensors from the control voltage  $U_s$ .

## Peripheral voltage U<sub>P</sub>

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

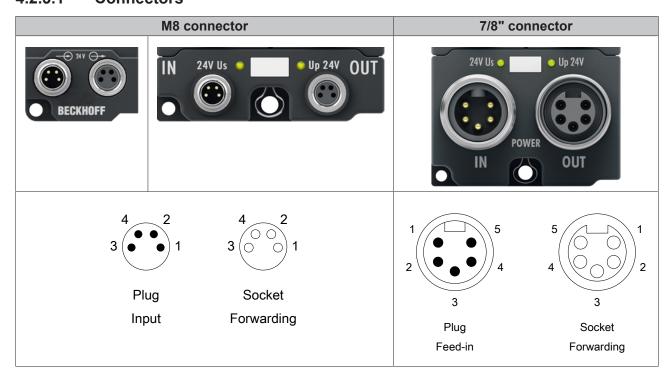
## Note the maximum current!

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



| Function         | M8 | 7/8" | Description           | Core color 1) |
|------------------|----|------|-----------------------|---------------|
| Us               | 1  | 4    | Control voltage       | Brown         |
| U <sub>P</sub>   | 2  | 5    | Peripheral voltage    | White         |
| GND <sub>s</sub> | 3  | 2    | GND to U <sub>s</sub> | Blue          |
| GND <sub>P</sub> | 4  | 1    | GND to U <sub>P</sub> | Black         |
| FE               | -  | 3    | Functional earth      | Grey          |

<sup>1)</sup> The core colors apply to cables of the type: Beckhoff ZK2020-xxxx-xxxx

GND<sub>S</sub> and GND<sub>P</sub> are linked for modules of the following types:

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

## NOTE

## The electrical isolation between GNDs and GND can be removed

In some EtherCAT Box modules the ground potentials GND<sub>s</sub> and GND<sub>P</sub> 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. 21: Status LEDs for the supply voltages

| LED                                     | Display           | Meaning  |
|---|-------------------|--|
| U <sub>s</sub> (control voltage)        | off               | Supply voltage U <sub>s</sub> is not present   |
|   | green illuminated | Supply voltage U <sub>s</sub> is present   |
|   | red illuminated   | Due to overload (current > 0.5 A), the sensor supply generated from the supply voltage Us was switched off for all sensors supplied from it. |
| J <sub>P</sub> (peripheral voltage) off |                   | Supply voltage U <sub>P</sub> is not present   |
|   | green illuminated | Supply voltage U <sub>P</sub> is present   |

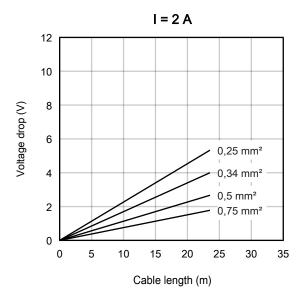


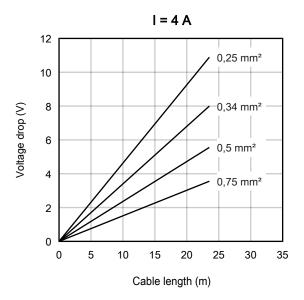
## 4.2.3.3 Conductor losses

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.

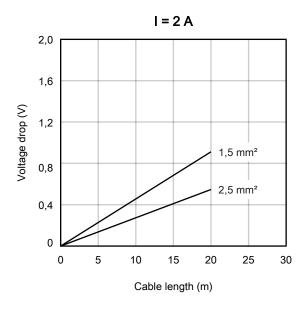
Variations in the voltage of the power supply unit must also be taken into account.

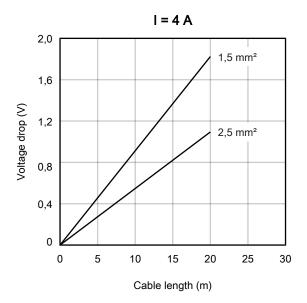
## Voltage drop on cables with M8 connectors





## 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).

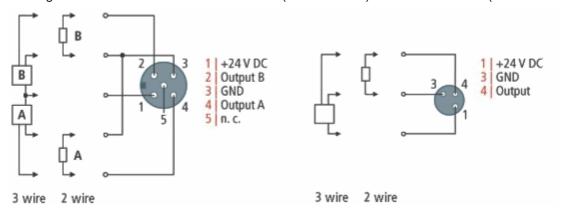


Fig. 22: Digital outputs M8 and M12

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).

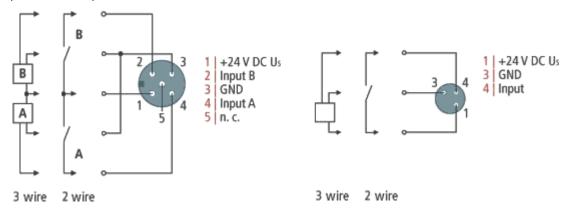


Fig. 23: Digital inputs M8 and M12

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 [▶ 55]

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.

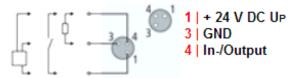


Fig. 24: Digital inputs/outputs M8

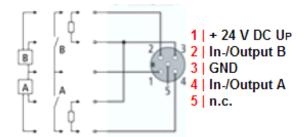


Fig. 25: Digital inputs/outputs M12

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.

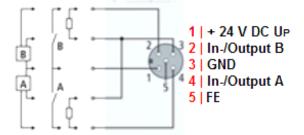


Fig. 26: Digital inputs/outputs M12

LEDs indicate the signal state of the inputs/outputs.



## 4.2.4.5 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

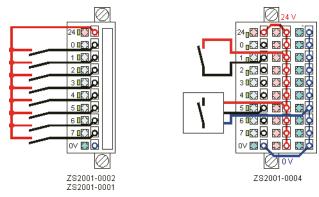


Fig. 27: Digital inputs ZS2001, 8 channels

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**

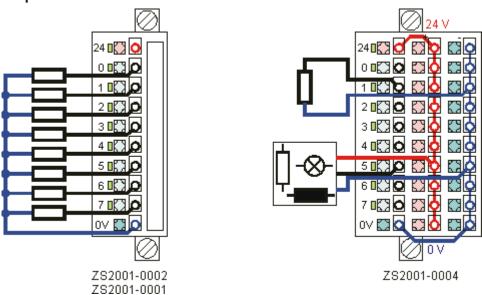


Fig. 28: Digital outputs ZS2001, 8 channels

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.



# 4.2.4.5.1 Ordering information for KM plug-in connector



Fig. 29: ZS2001-0001, ZS2001-0002: KM connectors for single wire connection



Fig. 30: 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 |



## 4.2.4.5.2 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 <sub>DC</sub>                       | 24 V <sub>DC</sub>             | 24 V <sub>DC</sub>             |  |
| Nominal current  | 2 A                                      |                                |                                |  |
| Wire cross-section                                     | 0.5 mm <sup>2</sup> 1.5 mm <sup>2</sup>  |                                |                                |  |
| 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                                       |                                |                                |  |



## 4.2.4.6 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.

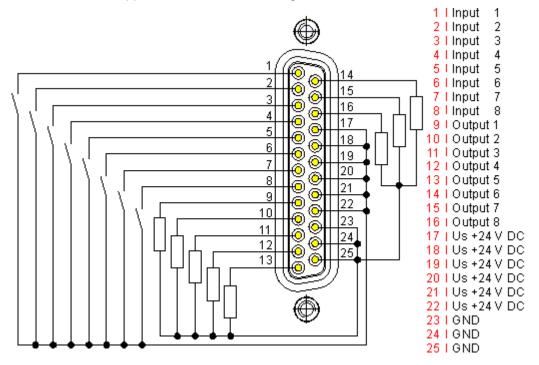


Fig. 31: Digital inputs and outputs D-sub 25



## 4.3 UL Requirements

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

## Supply voltage

## **A 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<sub>DC</sub> 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<sub>DC</sub> 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!

#### **A 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

## **A CAUTION**

#### **CAUTION!**

To meet the UL requirements, EtherCAT Box Modules has to be operated only at an ambient temperature range of 0 to 55°C!

## **Marking for UL**

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



Fig. 32: 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 <u>BG2000-0000 or BG2000-0010 protection enclosure</u> [<u>▶</u> 62] 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: 2006EN 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 <u>special conditions according to ATEX [\rightarrow 61]</u>, 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.

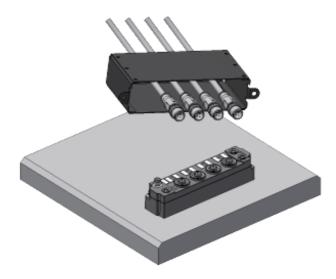


Fig. 33: BG2000 - putting the cables

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



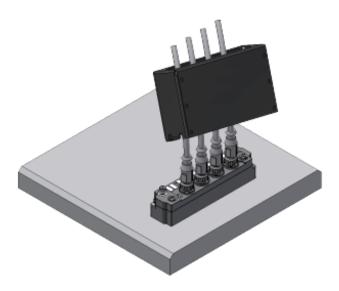


Fig. 34: BG2000 - fixing the cables

Mount the protection enclosure over the EtherCAT Box.

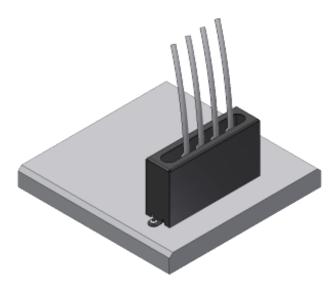


Fig. 35: BG2000 - mounting the protection enclosure

## 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.

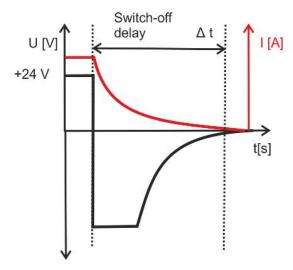


Fig. 36: Switch-off of inductive loads



# 5.3 Behavior of the outputs in case of error (only EPxx16 and EPxx17)

In the TwinCAT System Manager, you can set parameters for the modules

- EP2316-0003
- EP2316-0008
- EP2816-00xx
- EP2817-0008

in the register tab COE - Online.

The description of the parameter settings is done here using module EP2316-0008, but applies to all these modules.

## Behavior of the outputs 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.



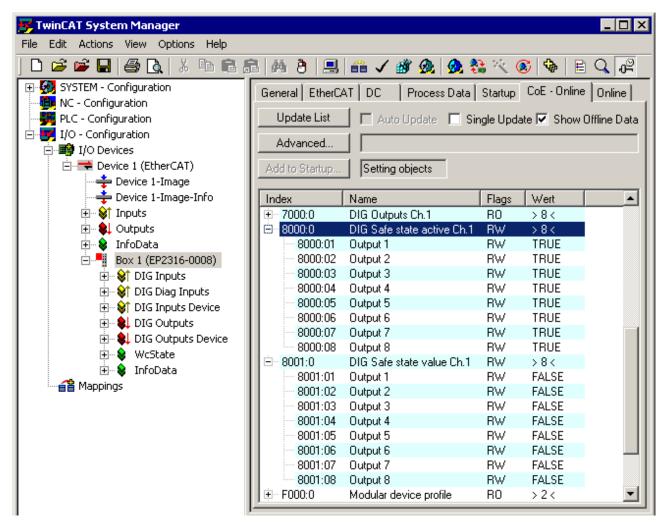


Fig. 37: EP2316-0008 - 8000:0 - DIG Safe state active Ch.1

## 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  |



#### Behavior of the outputs in the event of a short circuit

## F800:0 - DO Settings (Safe State Value)

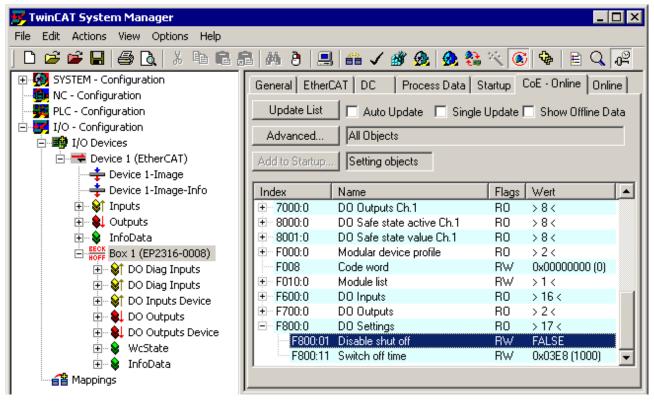


Fig. 38: EP2316-0008 - F800:0 - DO Settings (Safe State Value)

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 <i>Reset Outputs</i> .                                      |
|       | In the event of a short circuit at an output, only this output of the module is switched off.  After the short circuit has been removed, this output is automatically enabled again. see "Extracted nested table 4" |

## F800:11 - Switch off time (default: 0x03E8, 1000<sub>dec</sub>)

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.



#### Restoring the delivery state 5.4

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).

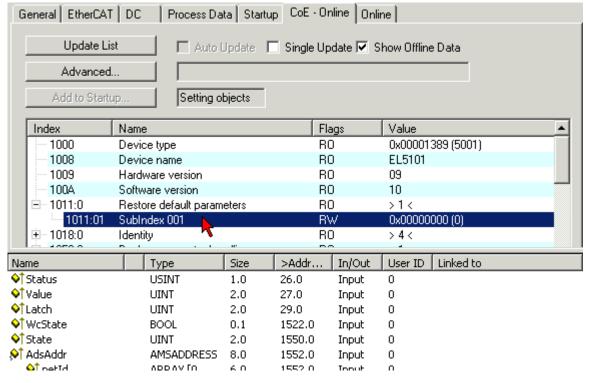


Fig. 39: Selecting the Restore default parameters PDO

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.

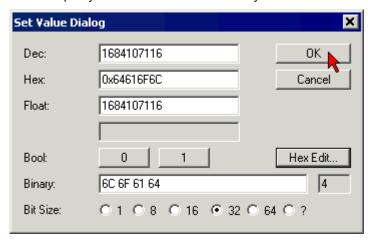


Fig. 40: Entering a restore value in the Set Value dialog

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.

| 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. |

<sup>\*)</sup> 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 EtherCAT Box- / EtherCAT P Box - Accessories

## **Fixing**

| Ordering information | Description                     |
|----------------------|---------------------------------|
| ZS5300-0001          | Mounting rail (500 mm x 129 mm) |

## Marking material, plugs

| Ordering information | Description   |
|----------------------|---|
| ZS5000-0000          | Fieldbus Box set M8 (contact labels, plugs)         |
| ZS5000-0002          | Fieldbus Box set M12 (contact labels, plugs)        |
| ZS5000-0010          | plugs M8, IP67 (50 pieces)                          |
| ZS5000-0020          | plugs M12, IP67 (50 pieces)                         |
| ZS5100-0000          | marking labels, not printed, 4 stripes at 10 pieces |
| ZS5100-xxxx          | printed marking labels, on request                  |

## **Tools**

| Ordering information | Description  |
|----------------------|--|
| ZB8800               | torque wrench for M8 cables with knurl, incl. ratchet                              |
| ZB8800-0001          | M12 ratchet for torque wrench ZB8800   |
| ZB8800-0002          | M8 ratchet (field assembly) for torque wrench ZB8800                               |
| ZB8801-0000          | torque wrench for hexagonal plugs, adjustable                                      |
| ZB8801-0001          | torque cable key, M8/wrench size 9, for torque wrench ZB8801-0000                  |
| ZB8801-0002          | torque cable key, M12/wrench size 13, for torque wrench ZB8801-0000                |
| ZB8801-0003          | torque cable key, M12 field assembly/wrench size 13, for torque wrench ZB8801-0000 |



## **Further accessories**



Further accessories may be found at the price list for Beckhoff fieldbus components and at the internet under <a href="https://www.beckhoff.com">https://www.beckhoff.com</a>



EP23xx

## 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  | Туре                                   | Version                           | Revision |
|------------------|---|--|-----------------------------------|----------|
| EL3314-0000-0016 | EL terminal<br>(12 mm, non-<br>pluggable connection<br>level) | 3314 (4-channel thermocouple terminal) | 0000 (basic type)                 | 0016     |
| ES3602-0010-0017 | ES terminal<br>(12 mm, pluggable<br>connection level)         |  | 0010 (high-<br>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: <u>TwinSafe</u>
- · Terminals with factory calibration certificate and other measuring terminals

## **Examples of markings**



Fig. 41: EL5021 EL terminal, standard IP20 IO device with serial/ batch number and revision ID (since 2014/01)





Fig. 42: EK1100 EtherCAT coupler, standard IP20 IO device with serial/ batch number



Fig. 43: CU2016 switch with serial/ batch number



Fig. 44: EL3202-0020 with serial/ batch number 26131006 and unique ID-number 204418



Fig. 45: EP1258-00001 IP67 EtherCAT Box with batch number/ date code 22090101 and unique serial number 158102



Fig. 46: EP1908-0002 IP67 EtherCAT Safety Box with batch number/ date code 071201FF and unique serial number 00346070



Fig. 47: EL2904 IP20 safety terminal with batch number/ date code 50110302 and unique serial number 00331701



Fig. 48: 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. 49: 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<br>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<br>Number (BTN) | Unique serial number, see note below                                  | S               | 12                                     | SBTNk4p562d7         |
| 3           | Article description                   | Beckhoff article<br>description, e.g.<br>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 | 51S             | 12                                     | <b>51S</b> 678294104 |
| 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 <u>local support and service</u> on Beckhoff products!

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

http://www.beckhoff.com

You will also find further documentation for Beckhoff components there.

## **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

#### **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



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