Documentation

# EP1518-0002

## EtherCAT Box with 8 digital inputs and 2 counters

Version: 2.1.0
Date: 2018-12-05

BECKHOFF

# Table of contents

# 1 Foreword

## 1.1 Notes on the documentation

### Intended audience

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

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

### Disclaimer

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

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

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

### Trademarks

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Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

### Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, DE102004044764, DE102007017835 with corresponding applications or registrations in various other countries.

The TwinCAT Technology is covered, including but not limited to the following patent applications and patents: EP0851348, US6167425 with corresponding applications or registrations in various other countries.

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

### Copyright

## 1.2 Safety instructions

### Safety regulations

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

### Exclusion of liability

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

### Personnel qualification

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

### Description of instructions

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

**⚠ DANGER**

**Serious risk of injury!**

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

**⚠ WARNING**

**Risk of injury!**

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

**⚠ CAUTION**

**Personal injuries!**

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

***NOTE***

**Damage to environment/equipment or data loss**

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

**Tip or pointer**

This symbol indicates information that contributes to better understanding.

## 1.3 Documentation Issue Status

| Version | Comment |
|---|---|
| 2.1.0 | • Update Safety instructions<br>• Correction chapter *Power cable*<br>• Update chapter *Mounting* |
| 2.0.0 | • Migration<br>• Basic function principles chapter corrected |
| 1.1.0 | • Power Connection updated |
| 1.0.0 | • First release |

**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.

| Documentation Version | EP1518-0002 | |
|---|---|---|
| | Firmware | Hardware |
| 2.1 | 04 | 06 |
| 2.0.0 | 04 | 05 |
| 1.0.0 | 02 | 00 |

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)**

WW YY FF HH

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

Example with D no.: 55 09 01 00:

55 - week of production 55
09 - year of production 2009
01 - firmware version 01
00 - hardware version 001

# 2 Product overview

## 2.1 EtherCAT Box - Introduction

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

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

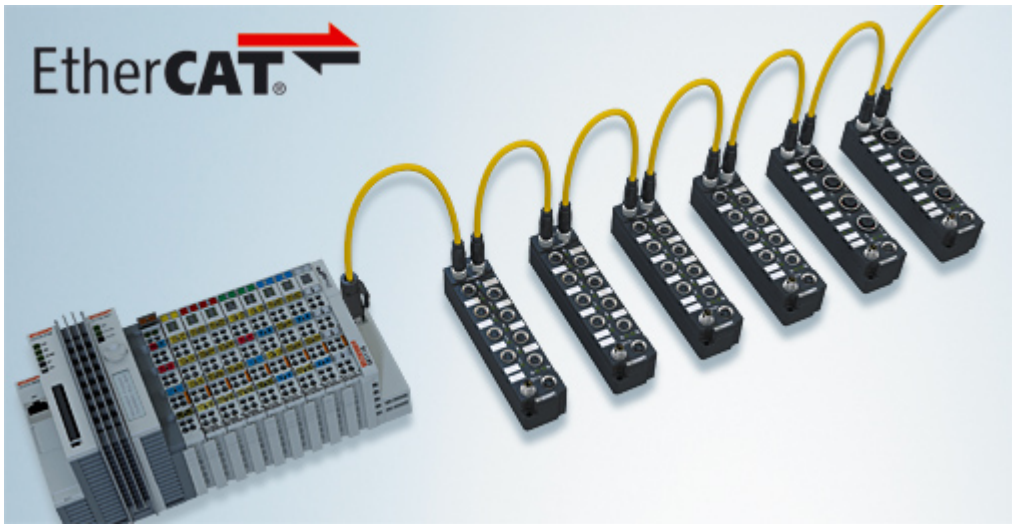



Fig. 1: EtherCAT Box Modules within an EtherCAT network

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

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

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

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

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

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

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

**Basic EtherCAT documentation**

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

**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.

## 2.2 EP1518 - Introduction

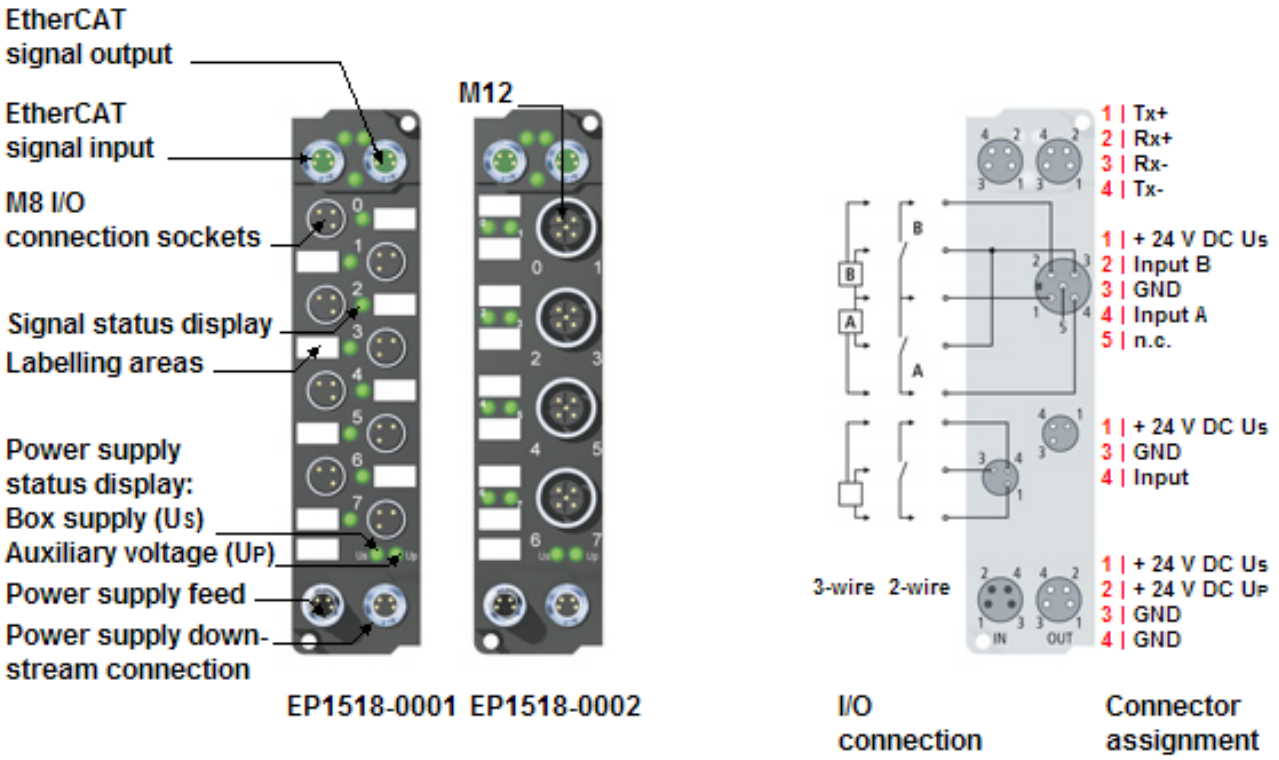



Fig. 4: EP1518-0001 and EP1518-0002

**8 digital inputs (24 $V_{DC}$), 2 counters**

The EP1518-0002 EtherCAT Box with digital inputs acquires binary control signals from the process level and transfers them, with electrical isolation, to the controller.
The signal state is indicated by means of light emitting diodes. Connection is via M12 connectors. The input filters can be set between 0 and 100 ms via EtherCAT.
Inputs 0 and 4 can be used as up/down counters (32-bit). Inputs 1 and 5 operate as GATES and inputs 2 and 6 control Up/Down.
The EP1518 has three modes of operation that can be selected via the PDOs using the Sync-Manager:

- 2 digital inputs and 2 counters (delivery state)
- 5 digital inputs and 1 counter
- 8 digital inputs

All inputs continue to be shown in the process image even in the counter operation modes. Signal acquisition takes place with the filter times set via CoE.
Irrespective of that, the counter pulses are always counted with a filter of 150 µs. Further parameters can be set via the CoE objects.
The sensors are supplied via the control voltage US in two groups of four sensors each. Any short circuits on the sensor side are detected and reported to the controller.
The load voltage Up is not used in the input module, but may optionally be connected in order to be relayed downstream.

**Quick links**

- Installation [▶ 14]
- Configuration [▶ 36]

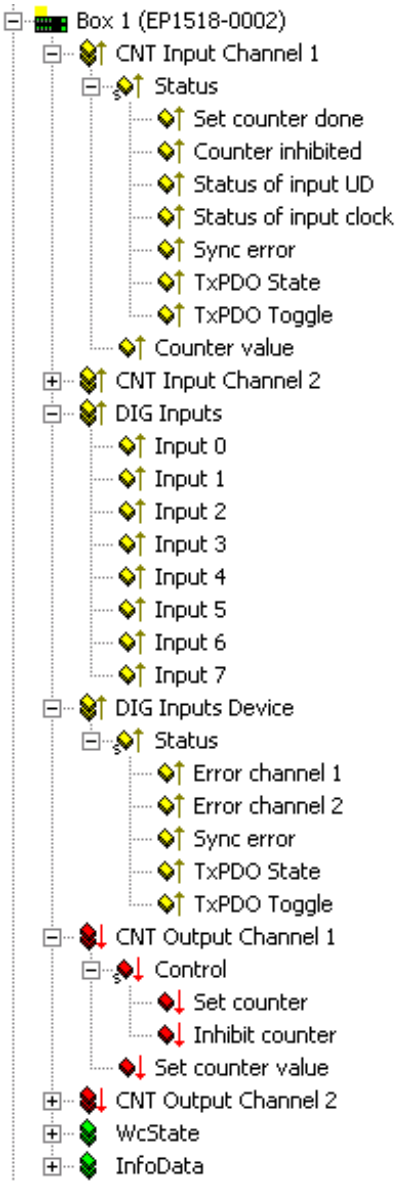
## 2.3 EP1518 - Technical data

| Technical data | EP1518-0001 | EP1518-0002 |
|---|---|---|
| Fieldbus | EtherCAT | |
| Fieldbus connection | 2 x M8 socket (green) | |
| Number of inputs | 8, 2 of which can be used as 32-bit up/down counters | |
| Input connections [▶ 27] | M8 | M12 |
| Nominal input voltage | 24 $V_{DC}$ (-15%/+20%) | |
| Input filter (binary inputs) | adjustable 10 µs…100 ms | |
| Input filter (counter input) | 150 µs | |
| "0" signal voltage | -3...+5 V (EN 61131-2, type 3) | |
| "1" signal voltage | +11...+30 V (EN 61131-2, type 3) | |
| Input current | typically 3 mA (EN 61131-2, type 3) | |
| Module electronic supply | derived from control voltage Us | |
| Module electronic current consumption | typically 120 mA | |
| Sensor supply | derived from control voltage Us | |
| Sensor current consumption | max. 0.5 A per 4 sensors, short-circuit proof | |
| Power supply connection | Power supply: 1 x M8 plug, 4-pole<br>Onward connection: 1 x M8 socket, 4-pole | |
| Input process image | 8 bits data, 8 bits diagnostics, 48 bits counter | |
| Output process image | 48 bits counter | |
| Distributed clocks | yes | |
| Electrical isolation control voltage/fieldbus | 500 V | |
| Weight | approx. 165 g | |
| Permissible ambient temperature during operation | -25°C ... +60°C<br>0°C ... +55°C (conforms to cULus, see UL requirements [▶ 29])<br>0°C ... +55°C (conforms to ATEX, see special conditions [▶ 30]) | |
| Permissible ambient temperature during storage | -40°C ... +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) | |
| Installation position | variable | |
| Approvals | CE, cULus [▶ 29], ATEX [▶ 30] | |

## 2.4 EP1518 – Process image

The process image depends on the selected operation mode [▶ 49].

**Operation mode: 2 counters and 2 digital inputs (delivery state)**




The input data of the 1st counter can be found under **CNT Input Channel 1**.

The adoption of the **Set counter** bit from **CNT Output Channel 1** is displayed with **Set counter done.**

The adoption of the **Inhibit counter** bit from **CNT Output Channel 1** is displayed with **Counter inhibited**.

**Status of input UD** shows the status of the Up/Down counter input of the 1st counter.

**Status of input clock** shows the status of the input clock input of the 1st counter.

Sync Error, TxPDO State and TxPDO Toggle are standard EtherCAT process data.

The input data of the 2nd counter can be found under **CNT Input Channel** 2. Their structure corresponds to that of the 1st counter.

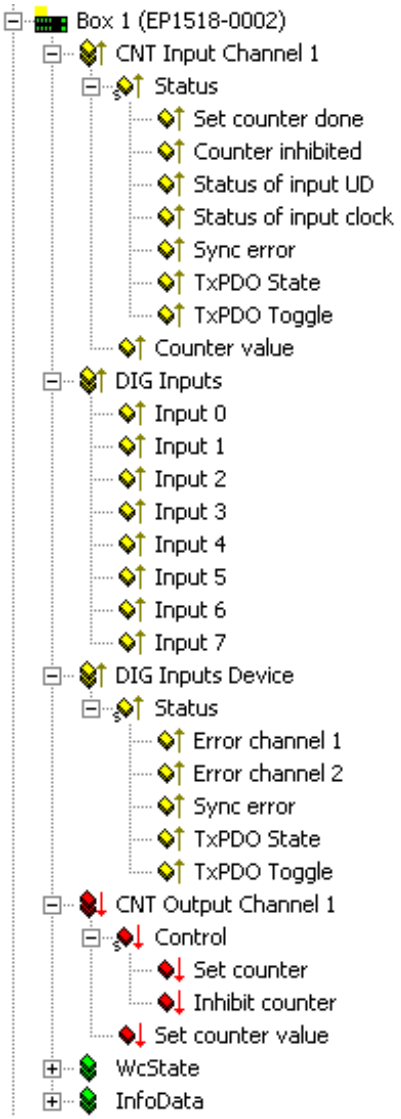
**DIG Inputs** shows the states of the individual inputs irrespective of the selected operation mode.

**Error channel 1** displays a short circuit of the supply voltage Us to digital inputs 0 to 3.
**Error channel 2** displays a short circuit of the supply voltage Us to digital inputs 4 to 7.

The output data of the 1st counter can be found under **CNT Output Channel 1**.
The setting of **Set counter** activates the adoption of the **Set Counter Value** into the **Counter Value** of the 1st counter.
The setting of **Inhibit Counter** disables the 1st counter.
Alternatively the counter can be disabled or enabled by the physical GATE input.
The two values are XORed.

The output data of the 2nd counter can be found under **CNT Output Channel 1**. Their structure corresponds to that of the 1st counter.

### Operation mode: 1 counter and 5 digital inputs




The input data of the 1st counter can be found under **CNT Input Channel 1**.

The adoption of the **Set counter** bit from **CNT Output Channel 1** is displayed with **Set counter done.**

The adoption of the **Inhibit counter** bit from **CNT Output Channel 1** is displayed with **Counter inhibited**.

**Status of input UD** shows the status of the Up/Down counter input of the 1st counter.

**Status of input clock** shows the status of the input clock input of the 1st counter.

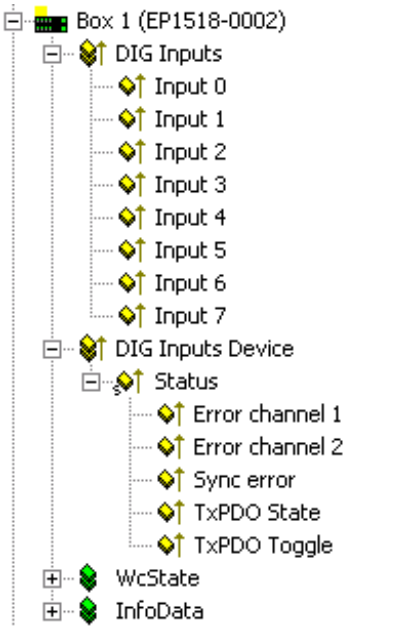
Sync Error, TxPDO State and TxPDO Toggle are standard EtherCAT process data.

**DIG Inputs** shows the states of the individual inputs irrespective of the selected operation mode.

**Error channel 1** displays a short circuit of the supply voltage Us to digital inputs 0 to 3.
**Error channel 2** displays a short circuit of the supply voltage Us to digital inputs 4 to 7.

The output data of the 1st counter can be found under **CNT Output Channel 1**.
The setting of **Set counter** activates the adoption of the **Set Counter Value** into the **Counter Value** of the 1st counter.
The setting of **Inhibit Counter** disables the 1st counter.
Alternatively the counter can be disabled or enabled by the physical GATE input.
The two values are XORed.

### Operation mode: 8 digital inputs




**DIG Inputs** shows the states of the individual inputs irrespective of the selected mode.

**Error channel 1** displays a short circuit of the supply voltage Us to digital inputs 0 to 3.

**Error channel 2** displays a short circuit of the supply voltage Us to digital inputs 4 to 7.

# 3 Installation

## 3.1 Mounting

### 3.1.1 Dimensions

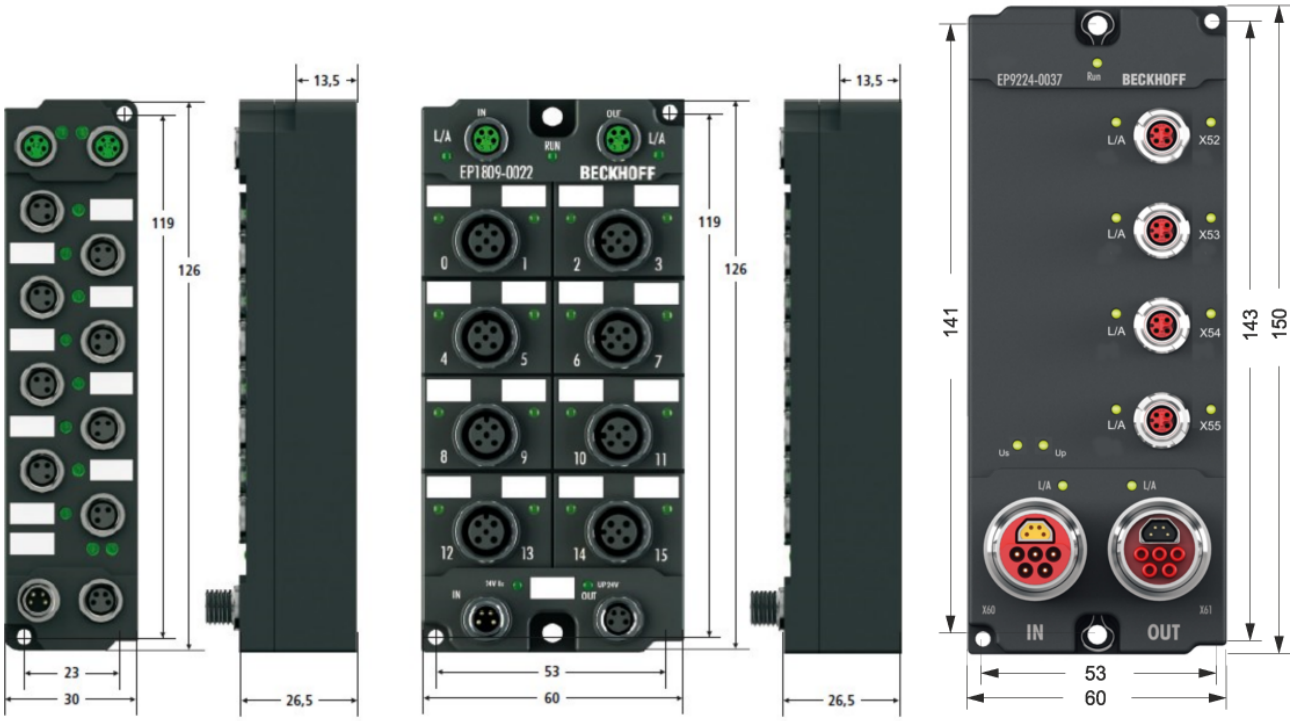



Fig. 5: Dimensions of the EtherCAT Box Modules

All dimensions are given in millimeters.

**Housing properties**

| EtherCAT Box | lean body | wide bodies |
|---|---|---|
| Housing material | PA6 (polyamide) | |
| Casting compound | Polyurethane | |
| Mounting | two fastening holes Ø 3 mm for M3 | two fastening holes Ø 3 mm for M3<br>two fastening holes Ø 4.5 mm for M4 |
| Metal parts | Brass, nickel-plated | |
| Contacts | CuZn, gold-plated | |
| Power feed through | max. 4 A (M8)<br>max. 16 A (7/8“)<br>max. 15.5 A (B17 5G 1.5 mm$^2$) | |
| Installation position | variable | |
| Protection class | IP65, IP66, IP67 (conforms to EN 60529) when screwed together | |
| Dimensions<br>(H x W x D) | app. 126 x 30 x 26.5 mm | app. 126 x 60 x 26,5 mm<br>app. 150 x 60 x 26.5 mm (without 7/8", B17) |

## 3.1.2 Fixing

**Note or pointer**

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.

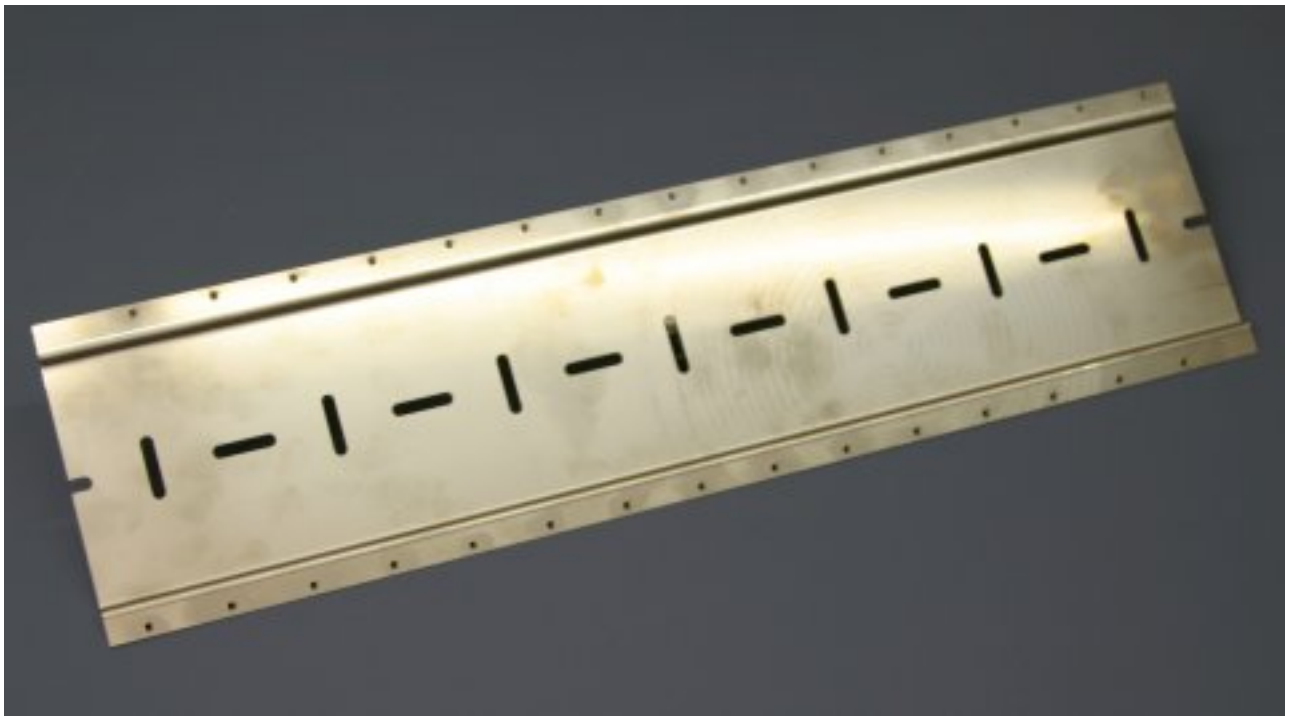


Fig. 6: Mounting Rail ZS5300-000

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.

### 3.1.3 Nut torque for connectors

**M8 connectors**

It is recommended to pull the M8 connectors tight with a nut torque of **0.4 Nm**. When using the torque control screwdriver ZB8800 is also a max. torque of **0.5 Nm** permissible.


Fig. 7: EtherCAT Box with M8 connectors

**M12 connectors**

It is recommended to pull the M12 connectors tight with a nut torque of **0.6 Nm**.

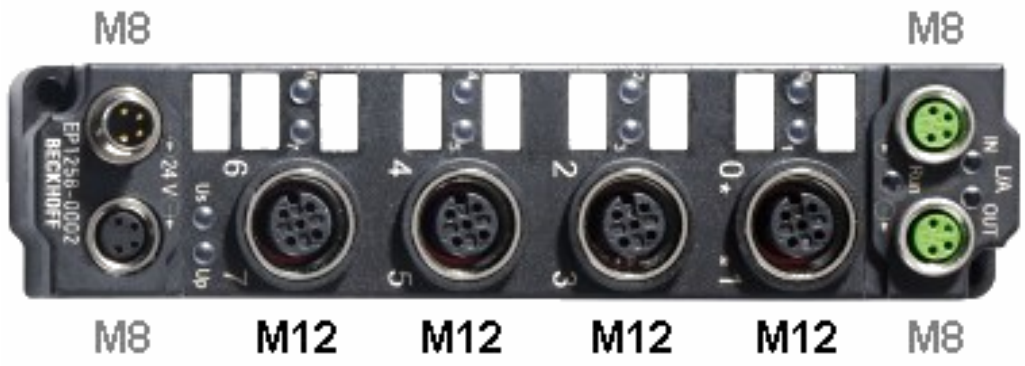



Fig. 8: EtherCAT Box with M8 and M12 connectors

### 7/8" plug connectors

We recommend fastening the 7/8" plug connectors with a torque of **1.5 Nm**.

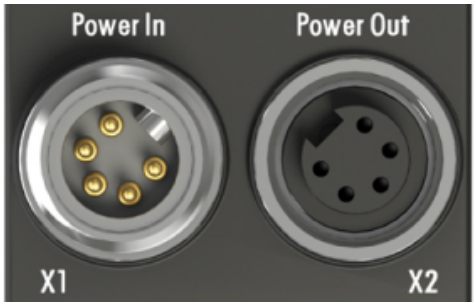



Fig. 9: 7/8" plug connectors

### Torque socket wrenches

Fig. 10: ZB8801 torque socket wrench

**Ensure the right torque**

Use the torque socket wrenches available by Beckhoff to pull the connectors tight (ZB8800, ZB8801-0000)!

# 3.2 Connection

## 3.2.1 EtherCAT connection

For the incoming and ongoing EtherCAT connection,

- the EtherCAT Box (EPxxxx) has two M8 sockets, marked in **green**
- the Coupler Box (FBB-x110) has two M12 sockets

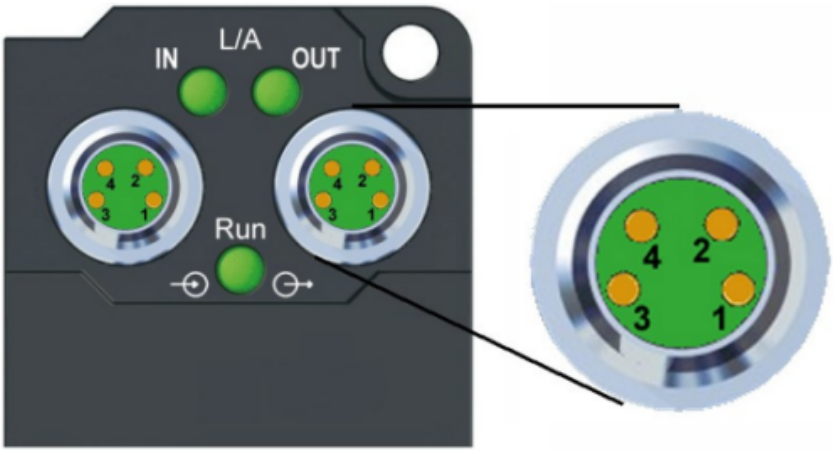



Fig. 11: EtherCAT Box: M8, 30 mm housing

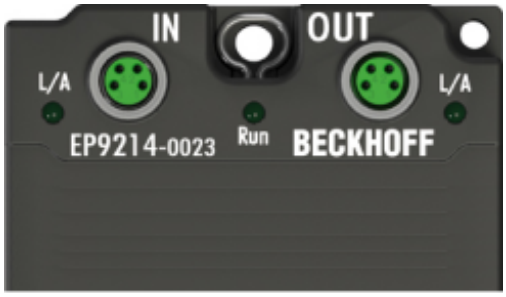



Fig. 12: EtherCAT Box: M860 mm housing (example: EP9214)


Fig. 13: Coupler Box: M12

**Assignment**

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

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

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

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

For unification the prevalent cables ZB9030, ZB9032 and ZK1090-3xxx-xxxx this means the pre assembled cables with M8 connectors were changed to the colors of EN61918 (yellow, orange, white, blue).So different color coding exists. But the electrical properties are absolutely identical.

**EtherCAT connector**

The following connectors can be supplied for use in Beckhoff EtherCAT systems.

| Name | Connector | Comment |
|---|---|---|
| ZS1090-0003 | RJ45 | four-pole, IP20, field-configurable |
| ZS1090-0004 | M12, male | four-pin, IP67, for field assembly |
| ZS1090-0005 | RJ45 | eight-pole, IP20, field-configurable, suitable for gigabit Ethernet |
| ZS1090-0006 | M8 plug connector | four-pole, IP67, field-configurable, for cable type ZB903x |
| ZS1090-0007 | M8 socket | four-pole, IP67, field-configurable, for cable type ZB903x |
| ZS1090-1006 | M8 plug connector | four-pole, IP67, field-configurable up to OD = 6.5 mm |
| ZS1090-1007 | M8 socket | four-pole, IP67, field-configurable up to OD = 6.5 mm |

## 3.2.2 EtherCAT - Fieldbus LEDs


Fig. 14: EtherCAT-LEDs

### LED display

| LED | Display | Meaning |
|---|---|---|
| IN L/A | off | no connection to the preceding EtherCAT module |
| | Lit | LINK: connection to the preceding EtherCAT module |
| | flashing | ACT: Communication with the preceding EtherCAT module |
| OUT L/A | off | no connection to the following EtherCAT module |
| | Lit | LINK: connection to the following EtherCAT module |
| | flashing | ACT: Communication with the following EtherCAT module |
| Run | off | Status of the EtherCAT module is Init |
| | flashes quickly | Status of the EtherCAT module is pre-operational |
| | flashes slowly | Status of the EtherCAT module is safe-operational |
| | Lit | Status of the EtherCAT module is operational |

**EtherCAT statuses**

The various statuses in which an EtherCAT module may be found are described in the Basic System Documentation for EtherCAT, which is available for download from our website (www.beckhoff.com) under Downloads.

### 3.2.3 Power Connection

The feeding and forwarding of supply voltages is done via two M8 connectors at the bottom end of the modules:

- IN: left M8 connector for feeding the supply voltages
- OUT: right M8 connector for forwarding the supply voltages


Fig. 15: EtherCAT Box, Connectors for power supply

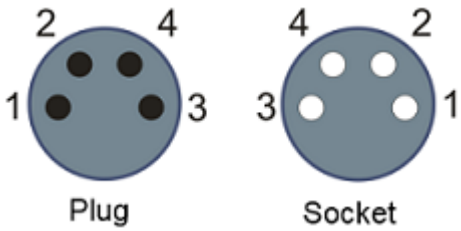



Fig. 16: Pin assignment M8, Power In and Power Out

*Table 1: PIN assignment*

| Pin | Voltage | |
|---|---|---|
| 1 | Control voltage Us, +24 $V_{DC}$ | |
| 2 | Auxiliary voltage Up, +24 $V_{DC}$ | |
| 3 | GNDs* | *) may be connected internally to each other depending on the module: see specific module descriptions |
| 4 | GNDp* | |

The pins M8 connectors carry a maximum current of 4 A.

Two LEDs display the status of the supply voltages.

**NOTE**

**Don't confuse the power connectors with the EtherCAT connectors!**

Never connect the power cables (M8, 24 $V_{DC}$) with the green marked EtherCAT sockets of the EtherCAT Box Modules! This can damage the modules!

#### Control voltage Us: 24 $V_{DC}$

Power is supplied to the fieldbus, the processor logic, the inputs and the sensors from the 24 $V_{DC}$ control voltage Us. The control voltage is electrically isolated from the fieldbus circuitry.

#### Auxiliary voltage Up 24 $V_{DC}$

The Auxiliary voltage Up supplies the digital outputs; it can be brought in separately. If the load voltage is switched off, the fieldbus functions and the power supply and functionality of the inputs are retained.

### Redirection of the supply voltages

The IN and OUT power connections are bridged in the module (not IP204x-Bxxx and IE204x). The supply voltages Us and Up can thus easily be transferred from EtherCAT Box to EtherCAT Box.

**NOTE**

**Pay attention to the maximum permissible current!**

Pay attention also for the redirection of the supply voltages Us and Up, the maximum permissible current for M8 connectors of 4 A must not be exceeded!

### Supply via EP92x4-0023 PowerBox modules

If the machine requires higher current or if the EtherCAT Box Modules are installed far away from the control cabinet with included power supply, the usage of four cannel power distribution modules EP9214 or EP9224 (with integrated data logging, see www.beckhoff.com/EP9224) is recommended.

With these modules intelligent power distribution concepts with up to 2 x 16 A and a maximum of 2.5 mm² cable cross-section can be realized.

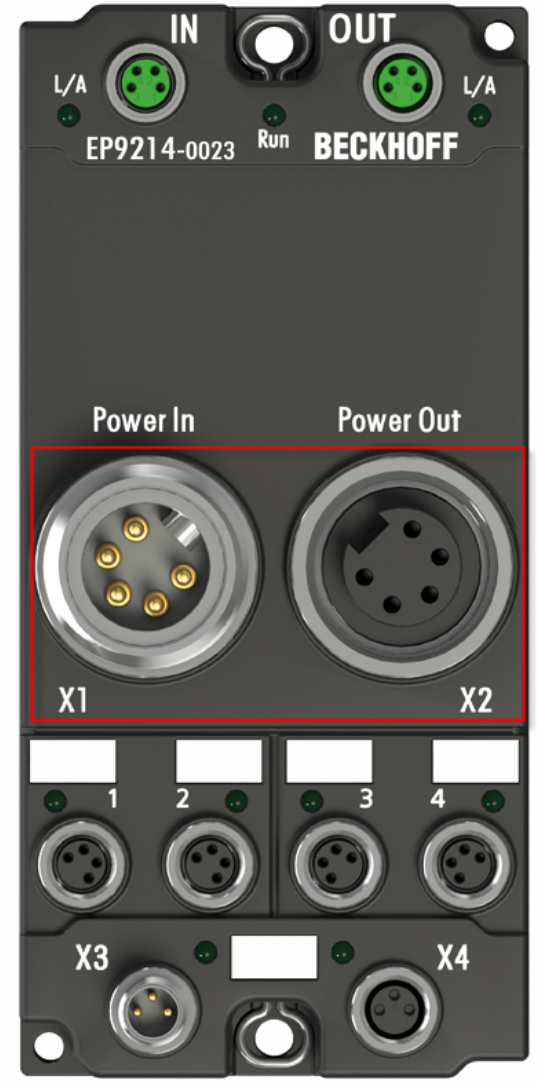



Fig. 17: EP92x4-0023, Connectors for Power In and Power Out

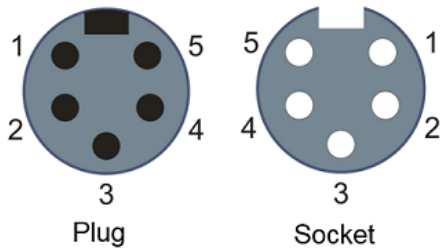



Fig. 18: Pin assignment 7/8”, Power In and Power Out

### Electrical isolation

#### Digital modules

In the digital input/output modules, the grounds of the control voltage (GNDs) and the auxiliary voltage (GNDp) are connected to each other!

Check this at the documentation of each used EtherCAT Box.

#### Analog modules

In the analog input/output modules the grounds of the control voltage (GNDs) and the auxiliary voltage (GNDp) are separated from each other in order to ensure electrical isolation of the analog signals from the control voltage.

In some of the analog modules the sensors or actuators are supplied by Up - this means, for instance, that in the case of 0...10 V inputs, any reference voltage (0...30 V) may be connected to Up; this is then available to the sensors (e.g. smoothed 10 V for measuring potentiometers).

Details of the power supply may be taken from the specific module descriptions.

**NOTE**

**Electrical isolation may be cancelled!**

If digital and analog fieldbus boxes are connected directly via four-core power leads, the analog signals in the fieldbus boxes may be no longer electrically isolated from the control voltage!

## 3.2.4 EP1518 - Status LEDs for the power supply


Fig. 19: Status LEDs for the power supply

All LEDs, green and red, are activated once briefly during the initialization phase of the box.

| LED | Display | Meaning |
|---|---|---|
| Us (control voltage) | off | The supply voltage, Us, is not present |
| | green illuminated | The supply voltage, Us, is present |
| | red illuminated | Due to overload (current > 0.5 A), the sensor supply generated from the supply voltage Us is switched off for all sensors in group 1 (inputs 0 to 3) or group 2 (inputs 4 to 7) that it supplies. |
| Up (peripheral voltage) | off | The supply voltage, Up, is not present |
| | green illuminated | The supply voltage, Up, is present |

## 3.2.5 Power cables

### Ordering data

| Order designation | Power cable | Screw-in connector | Contacts | Cross-section | Length |
|---|---|---|---|---|---|
| ZK2020-3200-0020 | Straight socket, open end | M8 | 4-pin | 0.34 $mm^2$ | 2.00 m |
| ZK2020-3200-0050 | | | | | 5.00 m |
| ZK2020-3200-0100 | | | | | 10.00 m |
| ZK2020-3400-0020 | Angled socket, open end | | | | 2.00 m |
| ZK2020-3400-0050 | | | | | 5.00 m |
| ZK2020-3400-0100 | | | | | 10.00 m |
| ZK2020-3132-0001 | Straight socket, straight socket | | | | 0.15 m |
| ZK2020-3132-0005 | | | | | 0.50 m |
| ZK2020-3132-0010 | | | | | 1.00 m |
| ZK2020-3132-0020 | | | | | 2.00 m |
| ZK2020-3132-0050 | | | | | 5.00 m |
| ZK2020-3334-0001 | Angled socket, angled socket | | | | 0.15 m |
| ZK2020-3334-0005 | | | | | 0.50 m |
| ZK2020-3334-0010 | | | | | 1.00 m |
| ZK2020-3334-0020 | | | | | 2.00 m |
| ZK2020-3334-0050 | | | | | 5.00 m |

Further available power cables may be found in the Beckhoff catalog or on our internet pages (http://www.beckhoff.com).

### Technical data

| Technical data | |
|---|---|
| Rated voltage according to IEC61076-2-101 | 30 $V_{DC}$ |
| Contamination level according to IEC 60 664-1 | 3/2 |
| Insulation resistance IEC 60 512-2 | $>10^9\Omega$ |
| Current carrying capacity according to IEC 60512-3 | 4 A |
| Volume resistance according to IEC 60512-2 | < 5 mΩ |
| Protection class according to IEC 60529 | IP65/66/67, when screwed together |
| Ambient temperature | -30°C to +80°C |

## 3.2.6 Power cable conductor losses M8

The ZK2020-xxxx-yyyy power cables should not exceed the total length of 15 m at 4 A (with continuation). When planning the cabling, note that at 24 V nominal voltage, the functionality of the module can no longer be assured if the voltage drop reaches 6 V. Variations in the output voltage from the power supply unit must also be taken into account.

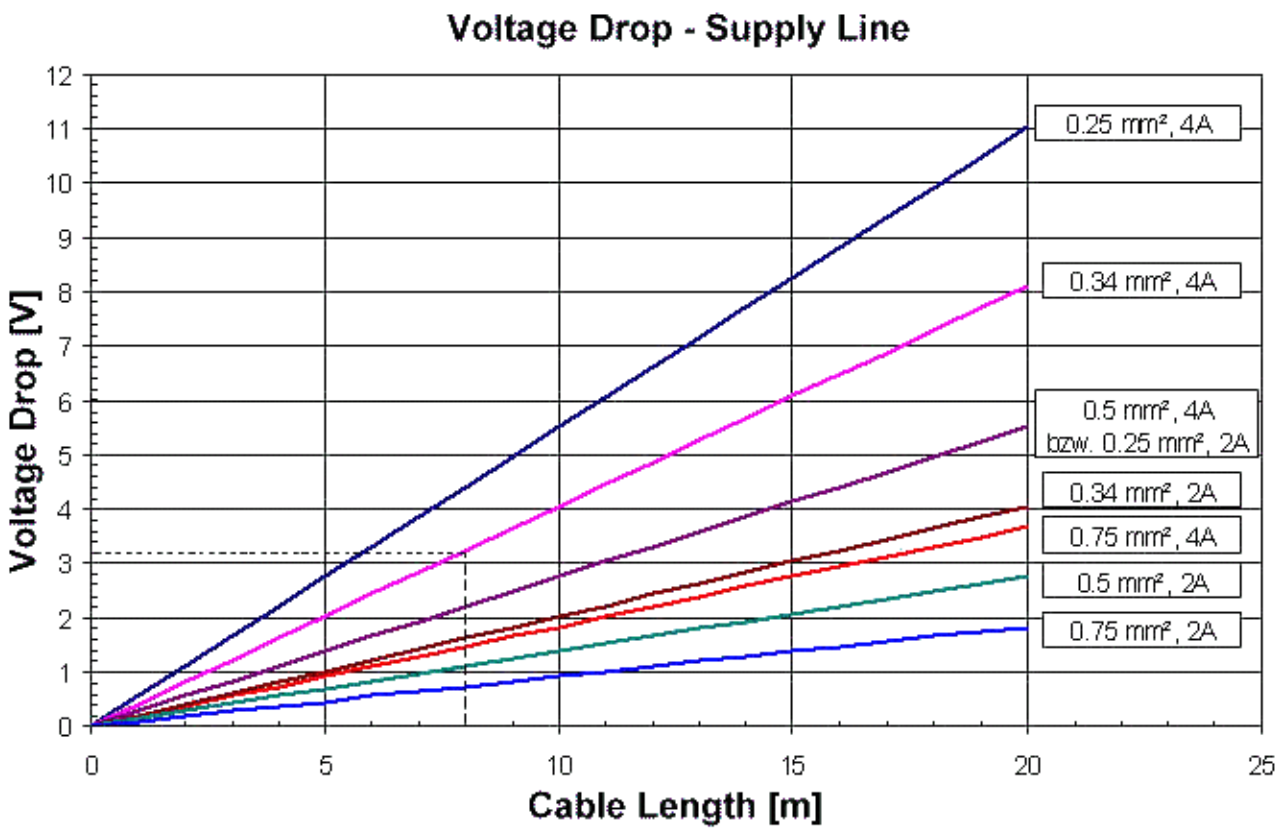



Fig. 20: Power cable conductor losses

**Example**

8 m power cable with 0.34 mm² cross-section has a voltage drop of 3.2 V at 4 A.

**EP92x4 Power Distribution Modules**

With EP9214 and EP9224 Power Distribution Modules intelligent concepts for voltage supply are available. Further information may be found under www.beckhoff.com/EP9224.

## 3.2.7 Signal connection

**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 device.

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

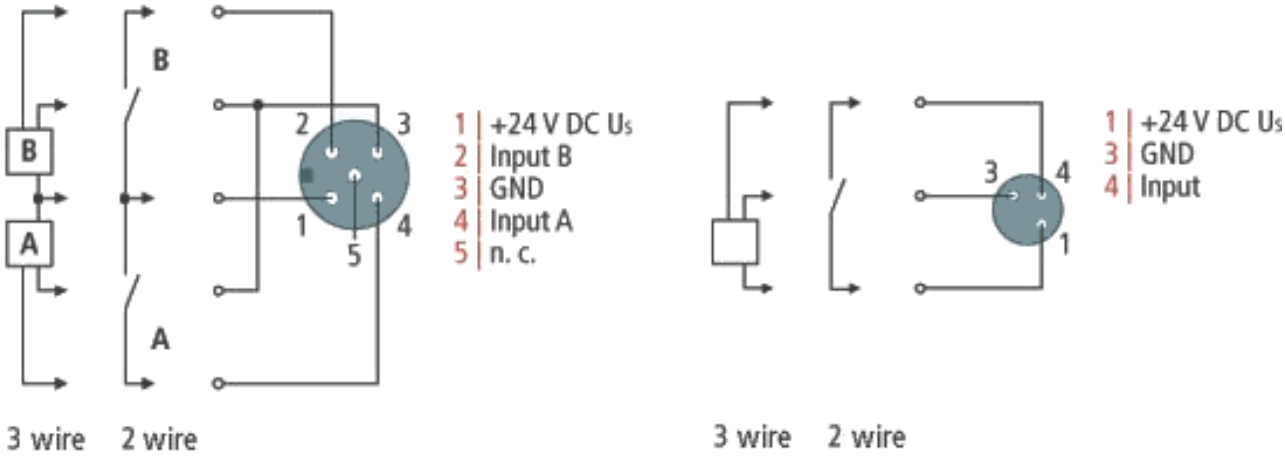



Fig. 21: Signal connection - digital inputs M8 and M12

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

Light emitting diodes indicate the signal state of the inputs.

### 3.2.8 Status LEDs at the signal connections

Irrespective of the operation mode set, each channel indicates the status of its connected sensor by a green LED adjacent to the signal socket.

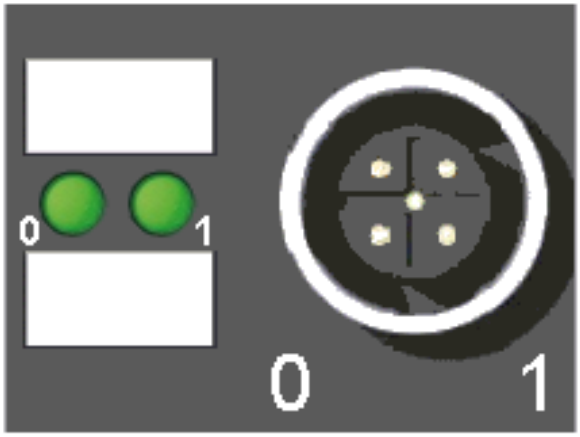



Fig. 22: Status LEDs at the signal connections

| Connection | LED | Display | Meaning |
|---|---|---|---|
| M12 socket no. 1 | channel 0, channel 1 | off | input not set |
| | | green | input set |
| M12 socket no. 2 | channel 2, channel 3 | off | input not set |
| | | green | input set |
| M12 socket no. 3 | channel 4, channel 5 | off | input not set |
| | | green | input set |
| M12 socket no. 4 | channel 6, channel 7 | off | input not set |
| | | green | input set |

## 3.3 UL Requirements

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

### Supply voltage

**⚠ CAUTION**

**CAUTION!**

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

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

**⚠ CAUTION**

**CAUTION!**

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

### Networks

**⚠ CAUTION**

**CAUTION!**

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

### Ambient temperature range

**⚠ CAUTION**

**CAUTION!**

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

### Marking for UL

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


Fig. 23: UL label

## 3.4 ATEX notes

### 3.4.1 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 in the BG2000-0000 protection enclosure [▶ 31] 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!
- Observethe permissible ambient temperature range of 0 - 55°C for the use of EtherCAT Box modules in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

**Standards**

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

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

**Marking**

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

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

or

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

**Batch number (D number)**

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

D: WW YY FF HH

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

Beispiel mit Ser. Nr.: 29 10 02 01:

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

## 3.4.2 BG2000-0000 - EtherCAT Box protection enclosure

**⚠ 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

The BG2000-0000 protection enclosure has to be mounted over a single EtherCAT Box to fulfill the special conditions according to ATEX [▶ 30].

### Installation

Put the cables for EtherCAT, power supply and sensors/actuators through the hole of the BG2000-0000 protection enclosure.

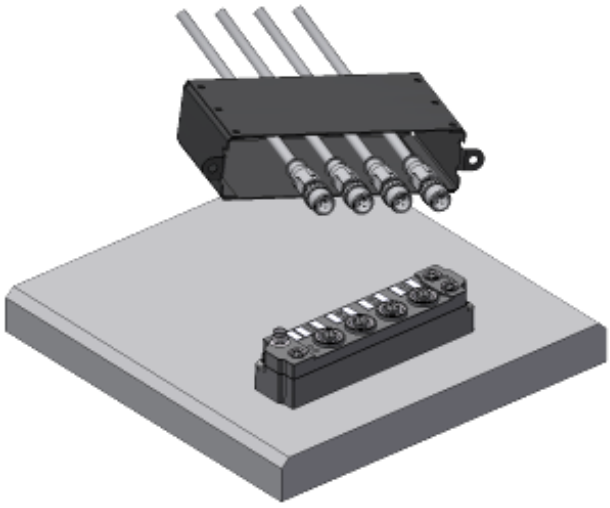


Fig. 24: BG2000-0000, putting the cables

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

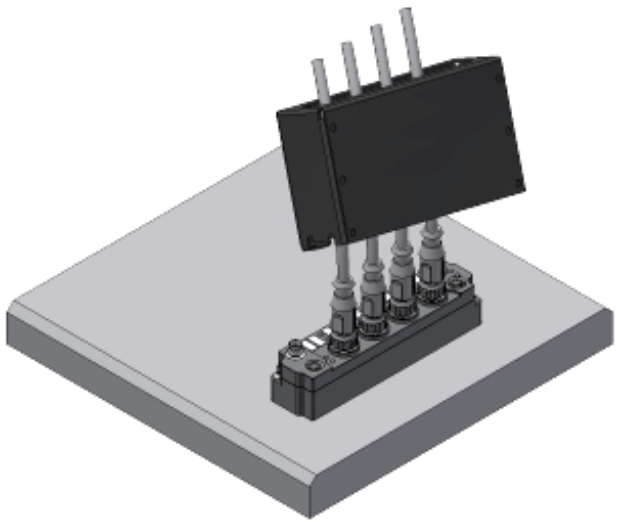


Fig. 25: BG2000-0000, fixing the cables

Mount the BG2000-0000 protection enclosure over the EtherCAT Box.

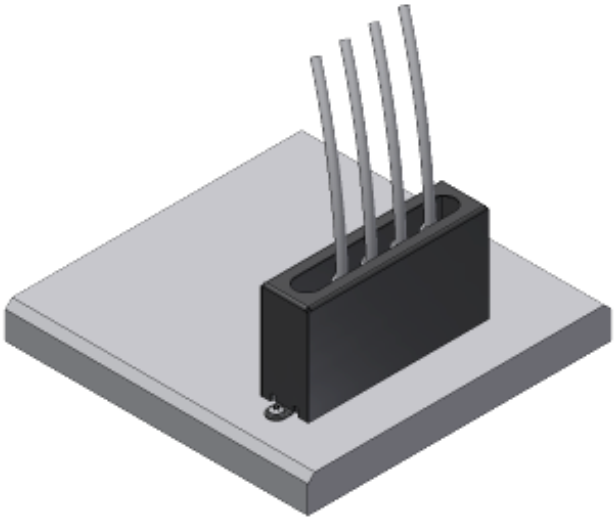


Fig. 26: BG2000-0000, mounting the protection enclosure

### 3.4.3 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!

# 4 Commissioning and configuration

## 4.1 Integration in TwinCAT

### 4.1.1 Inserting into the EtherCAT network

**Installation of the latest XML device description**

Please ensure that you have installed the latest XML device description in TwinCAT. This can be downloaded from the Beckhoff website (http://www.beckhoff.de/english/download/elconfg.htm?id=1983920606140) and installed according to the installation instructions.

At the Beckhoff TwinCAT System Manager the configuration tree can be build in two different ways:

- by scanning [▶ 33] for existing hardware (called "online") and
- by manual inserting/appending [▶ 33] of fieldbus devices, couplers and slaves.

**Automatic scanning in of the box**

- The EtherCAT system must be in a safe, de-energized state before the EtherCAT modules are connected to the EtherCAT network!
- Switch on the operating voltage, open the TwinCAT System Manager [▶ 36] (Config mode), and scan in the devices (see Fig. 1). Acknowledge all dialogs with "*OK*", so that the configuration is in "FreeRun" mode.

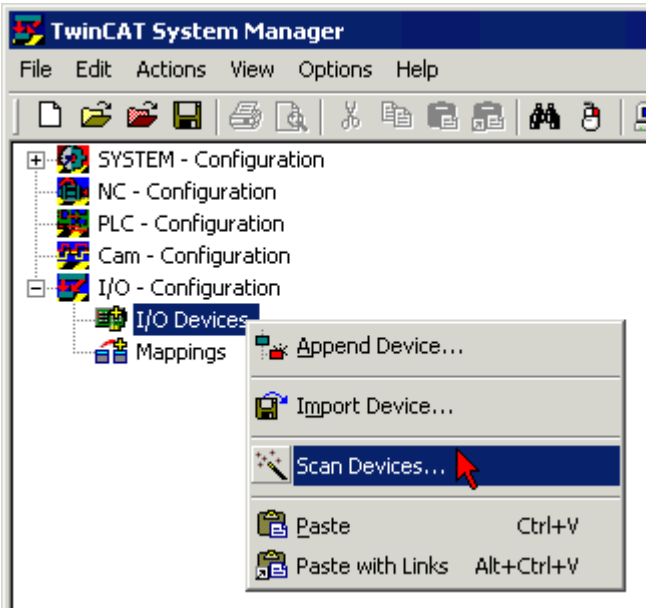



Fig. 27: Scanning in the configuration (I/O Devices -> right-click -> Scan Devices...)

**Appending a module manually**

- The EtherCAT system must be in a safe, de-energized state before the EtherCAT modules are connected to the EtherCAT network!
- Switch on the operating voltage, open the TwinCAT System Manager [▶ 36] (Config mode)
- Append a new I/O device. In the dialog that appears select the device *EtherCAT (Direct Mode),* and confirm with *OK*.

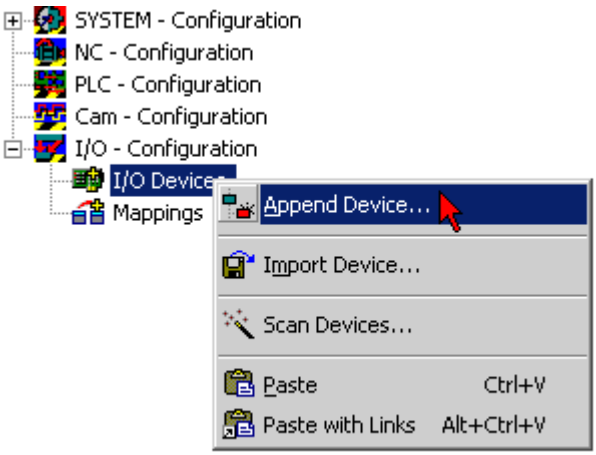



Fig. 28: Appending a new I/O device (I/O Devices -> right-click -> Append Device...)

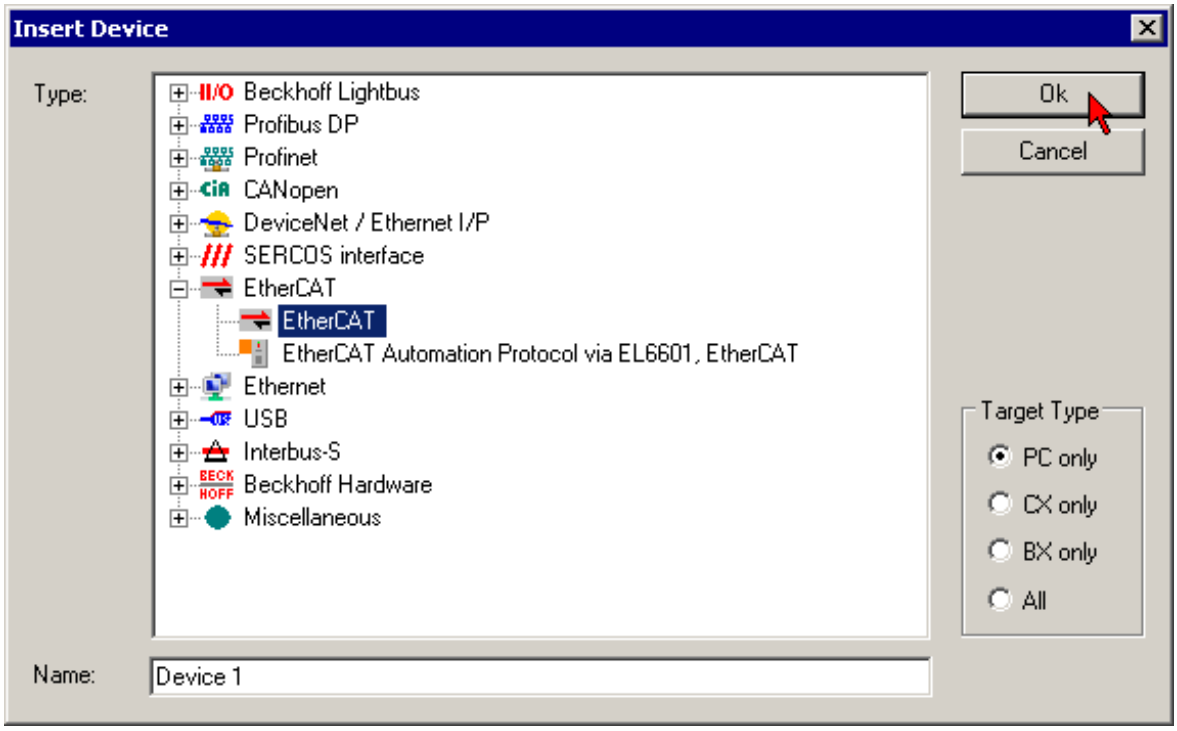



Fig. 29: Selecting the device EtherCAT

- Append a new box.

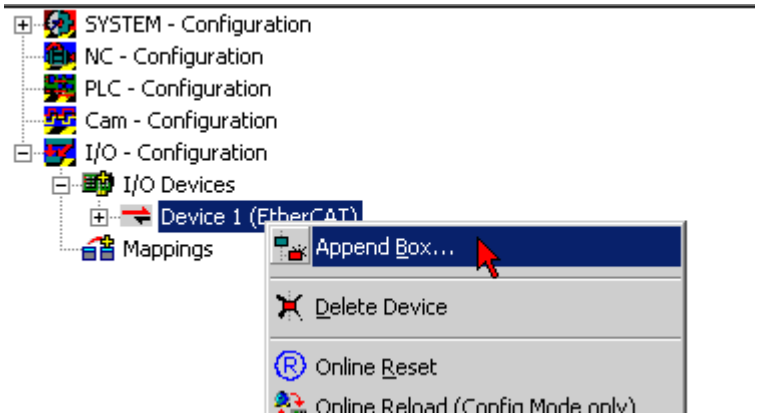



Fig. 30: Appending a new box (Device -> right-click -> Append Box...)

- In the dialog that appears select the desired box (e.g. EP2816-0008), and confirm with *OK*.

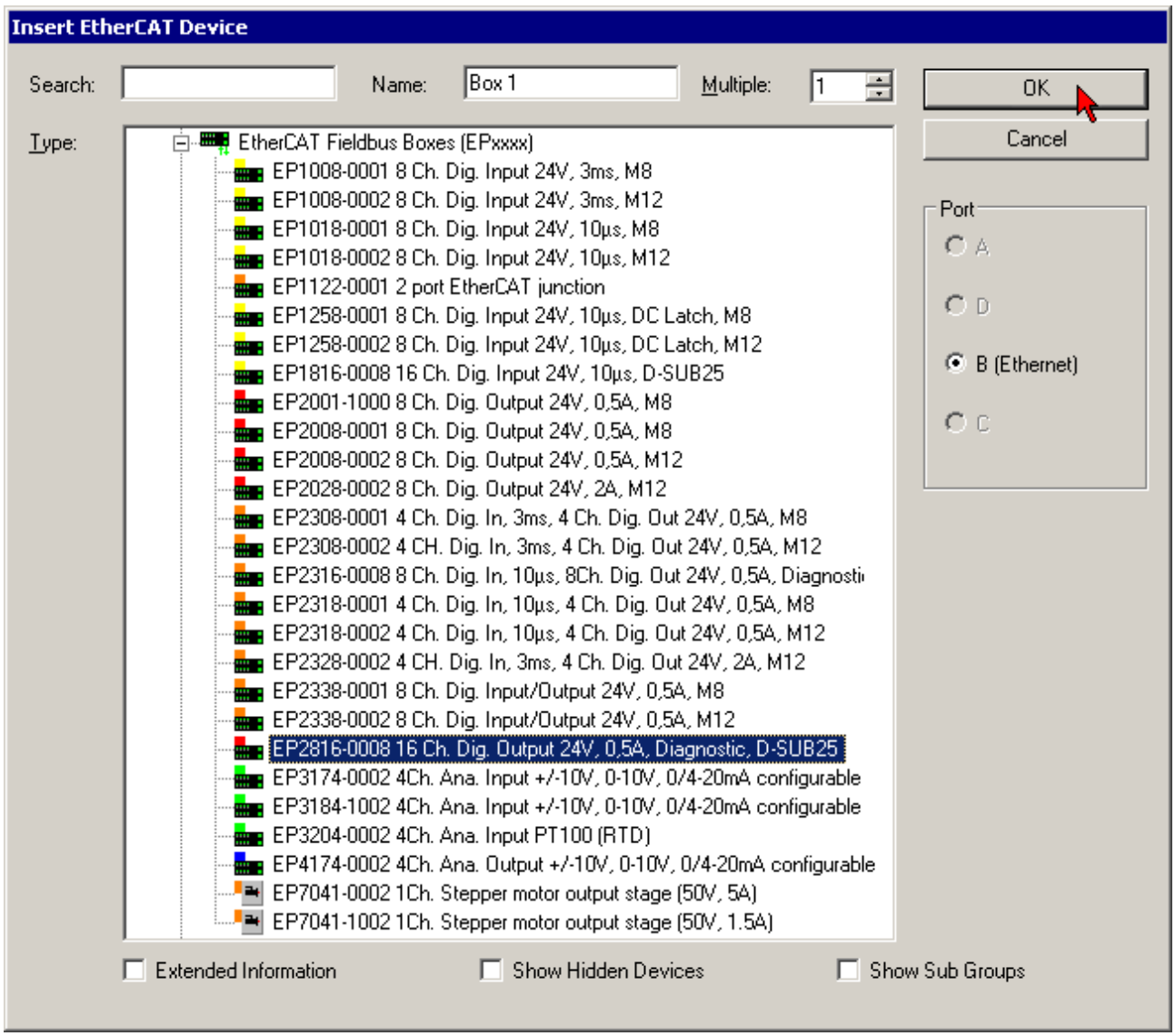



Fig. 31: Selecting a Box (e.g. EP2816-0008)

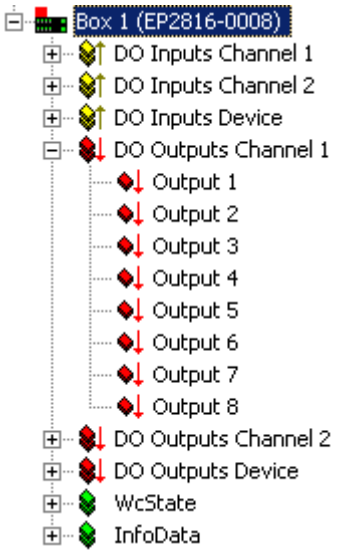



Fig. 32: Appended Box in the TwinCAT tree

## 4.1.2 Configuration via TwinCAT

In the left-hand window of the TwinCAT System Manager, click on the branch of the EtherCAT Box you wish to configure (EP2816-0008 in this example).

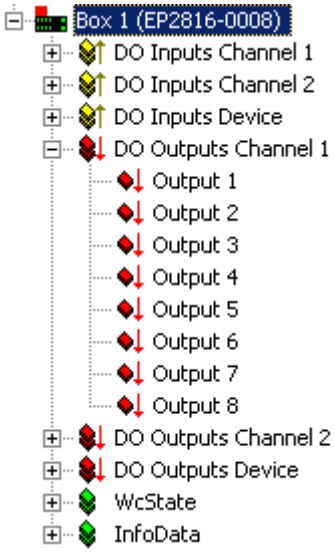



Fig. 33: Branch of the EtherCAT box to be configured

In the right-hand window of the TwinCAT System manager, various tabs are now available for configuring the EtherCAT Box.

**General tab**

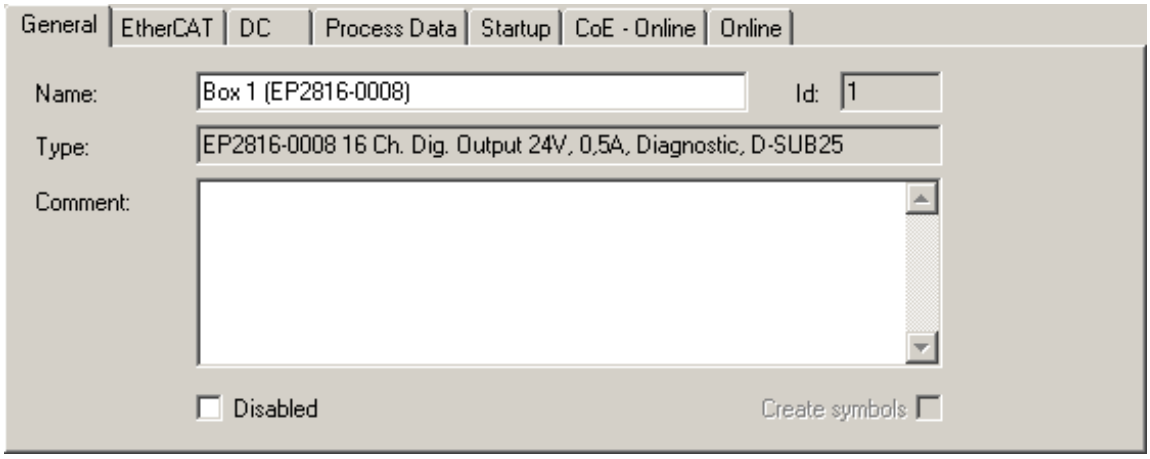



Fig. 34: General tab

| | |
|---|---|
| **Name** | Name of the EtherCAT device |
| **Id** | Number of the EtherCAT device |
| **Type** | EtherCAT device type |
| **Comment** | Here you can add a comment (e.g. regarding the system). |
| **Disabled** | Here you can deactivate the EtherCAT device. |
| **Create symbols** | Access to this EtherCAT slave via ADS is only available if this checkbox is activated. |

### EtherCAT tab

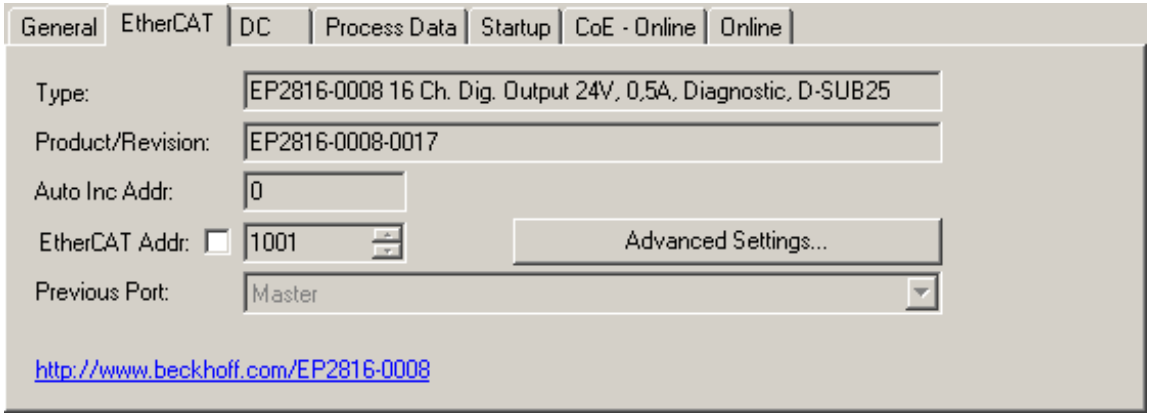



Fig. 35: EtherCAT tab

| | |
|---|---|
| **Type** | EtherCAT device type |
| **Product/Revision** | Product and revision number of the EtherCAT device |
| **Auto Inc Addr.** | Auto increment address of the EtherCAT device. The auto increment address can be used for addressing each EtherCAT device in the communication ring through its physical position. Auto increment addressing is used during the start-up phase when the EtherCAT master allocates addresses to the EtherCAT devices. With auto increment addressing the first EtherCAT slave in the ring has the address $0000_{hex}$. For each further slave the address is decremented by 1 ($FFFF_{hex}$, $FFFE_{hex}$ etc.). |
| **EtherCAT Addr.** | Fixed address of an EtherCAT slave. This address is allocated by the EtherCAT master during the start-up phase. Tick the checkbox to the left of the input field in order to modify the default value. |
| **Previous Port** | Name and port of the EtherCAT device to which this device is connected. If it is possible to connect this device with another one without changing the order of the EtherCAT devices in the communication ring, then this combobox is activated and the EtherCAT device to which this device is to be connected can be selected. |
| **Advanced Settings** | This button opens the dialogs for advanced settings. |

The link at the bottom of the tab points to the product page for this EtherCAT device on the web.

### Process Data tab

Indicates the configuration of the process data. The input and output data of the EtherCAT slave are represented as CANopen process data objects (PDO). The user can select a PDO via PDO assignment and modify the content of the individual PDO via this dialog, if the EtherCAT slave supports this function.

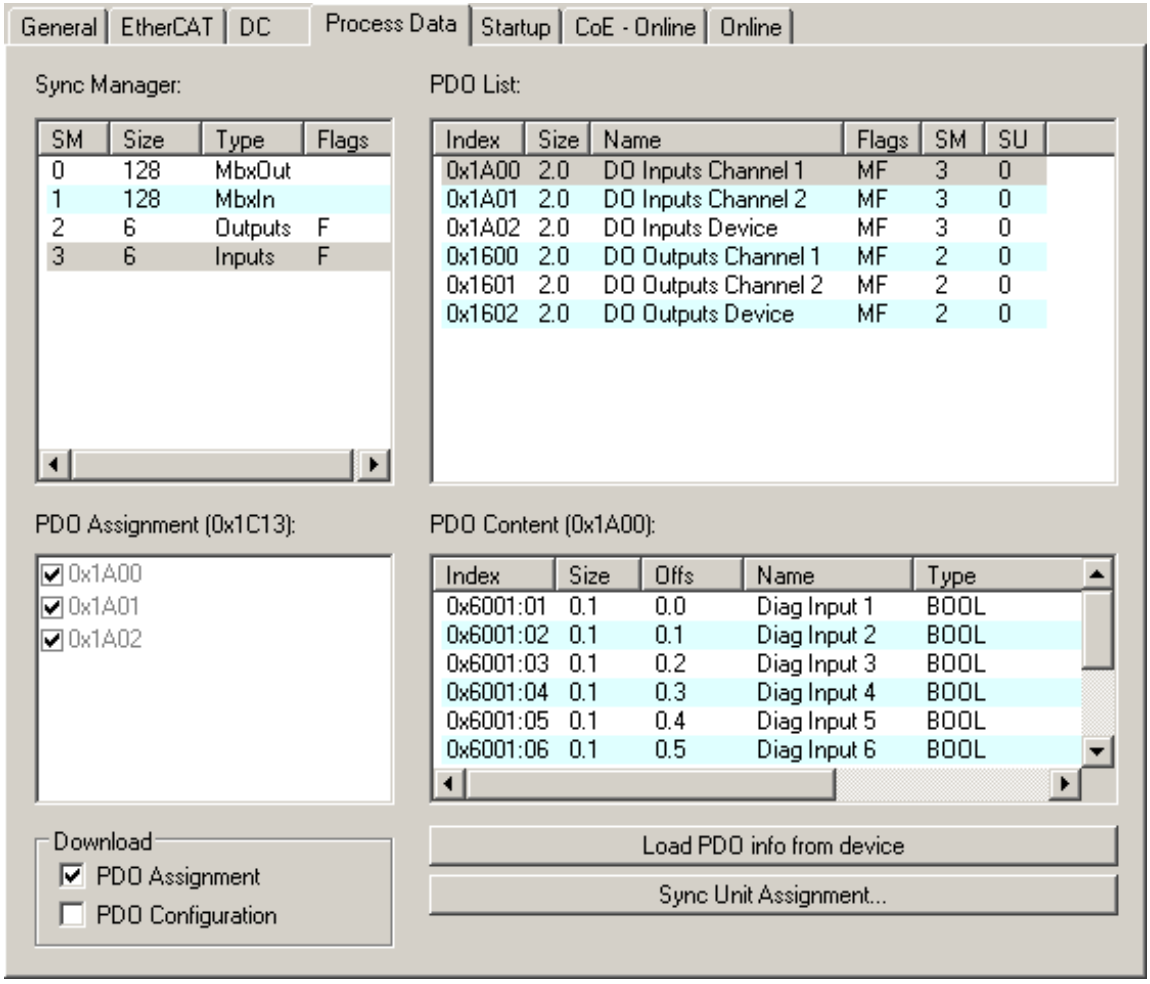



Fig. 36: Process Data tab

### Sync Manager

Lists the configuration of the Sync Manager (SM).
If the EtherCAT device has a mailbox, SM0 is used for the mailbox output (MbxOut) and SM1 for the mailbox input (MbxIn).
SM2 is used for the output process data (outputs) and SM3 (inputs) for the input process data.

If an input is selected, the corresponding PDO assignment is displayed in the *PDO Assignment* list below.

### PDO Assignment

PDO assignment of the selected Sync Manager. All PDOs defined for this Sync Manager type are listed here:

- If the output Sync Manager (outputs) is selected in the Sync Manager list, all RxPDOs are displayed.
- If the input Sync Manager (inputs) is selected in the Sync Manager list, all TxPDOs are displayed.

The selected entries are the PDOs involved in the process data transfer. In the tree diagram of the System Manager these PDOs are displayed as variables of the EtherCAT device. The name of the variable is identical to the *Name* parameter of the PDO, as displayed in the PDO list. If an entry in the PDO assignment list is deactivated (not selected and greyed out), this indicates that the input is excluded from the PDO assignment. In order to be able do select a greyed out PDO, the currently selected PDO has to be deselected first.

**Activation of PDO assignment**

- the EtherCAT slave has to run through the PS status transition cycle (from pre-operational to safe-operational) once (see Online tab [▶ 42]),
- and the System Manager has to reload the EtherCAT slaves ( button)

### PDO list

List of all PDOs supported by this EtherCAT device. The content of the selected PDOs is displayed in the *PDO Content* list. The PDO configuration can be modified by double-clicking on an entry.

| Column | Description | |
|---|---|---|
| Index | PDO index. | |
| Size | Size of the PDO in bytes. | |
| Name | Name of the PDO.<br>If this PDO is assigned to a Sync Manager, it appears as a variable of the slave with this parameter as the name. | |
| Flags | F | Fixed content: The content of this PDO is fixed and cannot be changed by the System Manager. |
| | M | Mandatory PDO. This PDO is mandatory and must therefore be assigned to a Sync Manager! Consequently, this PDO cannot be deleted from the *PDO Assignment* list |
| SM | Sync Manager to which this PDO is assigned. If this entry is empty, this PDO does not take part in the process data traffic. | |
| SU | Sync unit to which this PDO is assigned. | |

### PDO Content

Indicates the content of the PDO. If flag F (fixed content) of the PDO is not set the content can be modified.

### Download

If the device is intelligent and has a mailbox, the configuration of the PDO and the PDO assignments can be downloaded to the device. This is an optional feature that is not supported by all EtherCAT slaves.

### PDO Assignment

If this check box is selected, the PDO assignment that is configured in the PDO Assignment list is downloaded to the device on startup. The required commands to be sent to the device can be viewed in the Startup [▶ 39] tab.

### PDO Configuration

If this check box is selected, the configuration of the respective PDOs (as shown in the PDO list and the PDO Content display) is downloaded to the EtherCAT slave.

### Startup tab

The *Startup* tab is displayed if the EtherCAT slave has a mailbox and supports the *CANopen over EtherCAT* (CoE) or *Servo drive over EtherCAT* protocol. This tab indicates which download requests are sent to the mailbox during startup. It is also possible to add new mailbox requests to the list display. The download requests are sent to the slave in the same order as they are shown in the list.

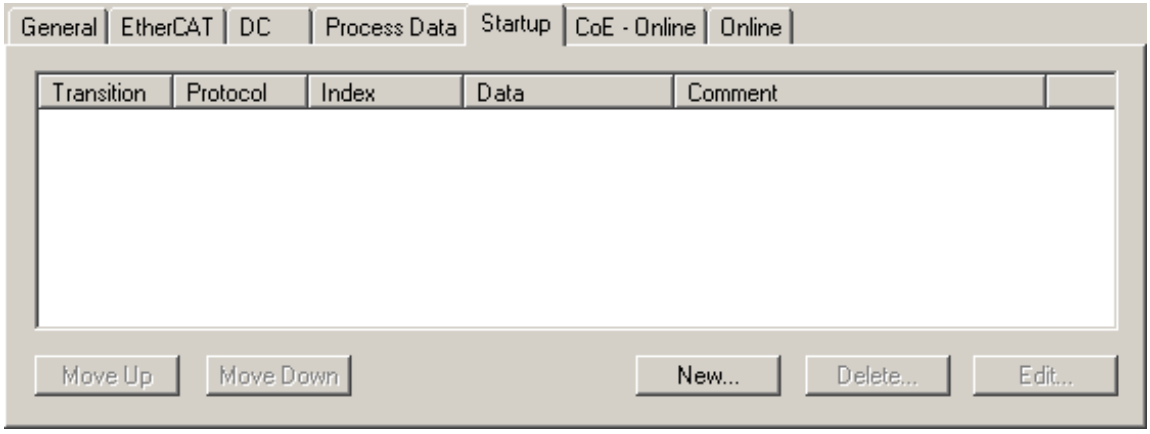



Fig. 37: Startup tab

| Column | Description |
|---|---|
| Transition | Transition to which the request is sent. This can either be<br>• the transition from pre-operational to safe-operational (PS), or<br>• the transition from safe-operational to operational (SO).<br>If the transition is enclosed in "<>" (e.g. <PS>), the mailbox request is fixed and cannot be modified or deleted by the user. |
| Protocol | Type of mailbox protocol |
| Index | Index of the object |
| Data | Date on which this object is to be downloaded. |
| Comment | Description of the request to be sent to the mailbox |

| | |
|---|---|
| **Move Up** | This button moves the selected request up by one position in the list. |
| **Move Down** | This button moves the selected request down by one position in the list. |
| **New** | This button adds a new mailbox download request to be sent during startup. |
| **Delete** | This button deletes the selected entry. |
| **Edit** | This button edits an existing request. |

### CoE - Online tab

The additional *CoE - Online* tab is displayed if the EtherCAT slave supports the *CANopen over EtherCAT* (CoE) protocol. This dialog lists the content of the object directory of the slave (SDO upload) and enables the user to modify the content of an object from this list. Details for the objects of the individual EtherCAT devices can be found in the device-specific object descriptions.

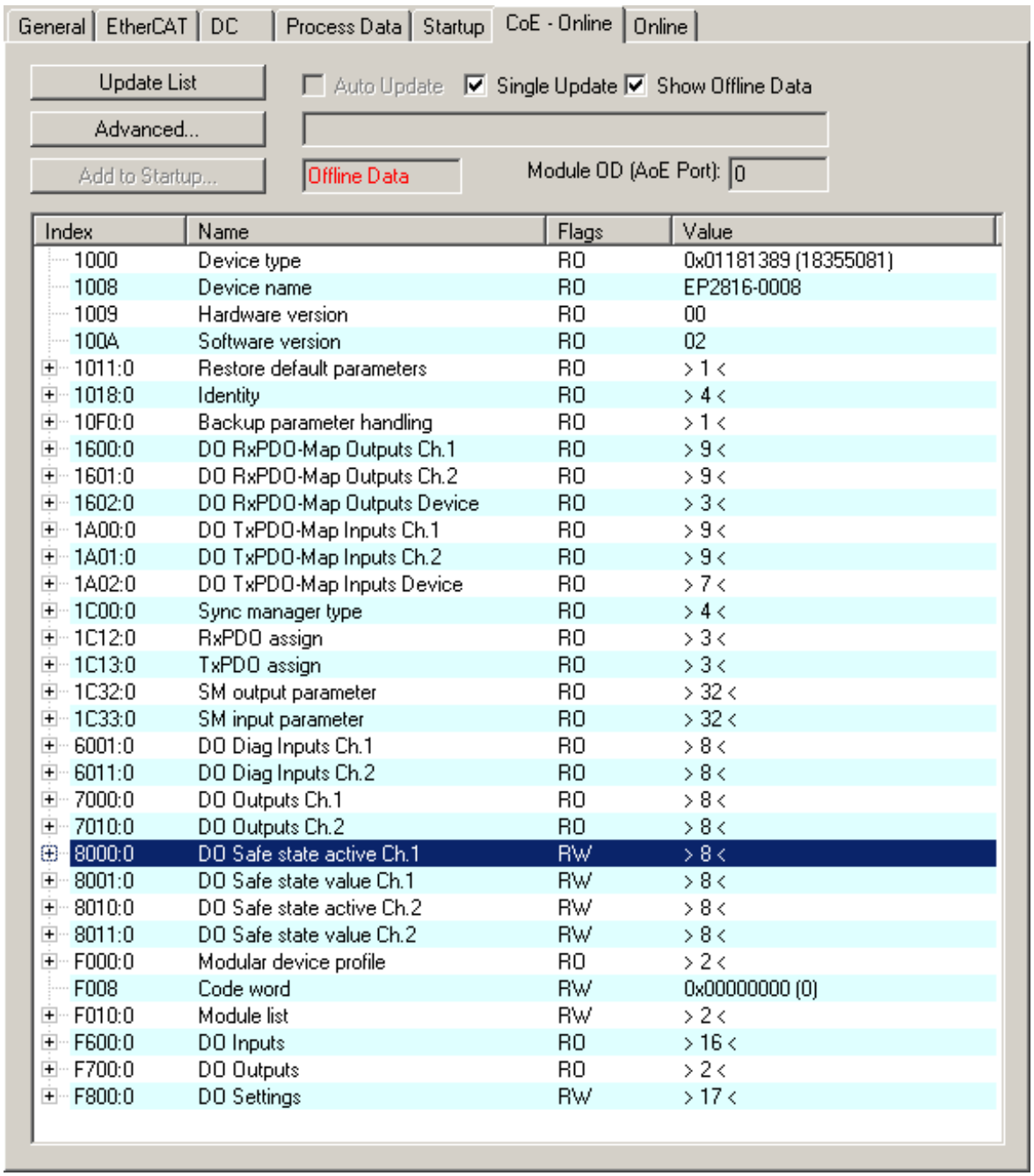



Fig. 38: CoE - Online tab

**Object list display**

| Column | Description | |
|---|---|---|
| Index | Index and subindex of the object | |
| Name | Name of the object | |
| Flags | RW | The object can be read, and data can be written to the object (read/write) |
| | RO | The object can be read, but no data can be written to the object (read only) |
| | P | An additional P identifies the object as a process data object. |
| Value | Value of the object | |

**Update List** The *Update list* button updates all objects in the displayed list

**Auto Update** If this check box is selected, the content of the objects is updated automatically.

**Advanced** The *Advanced* button opens the *Advanced Settings* dialog. Here you can specify which objects are displayed in the list.

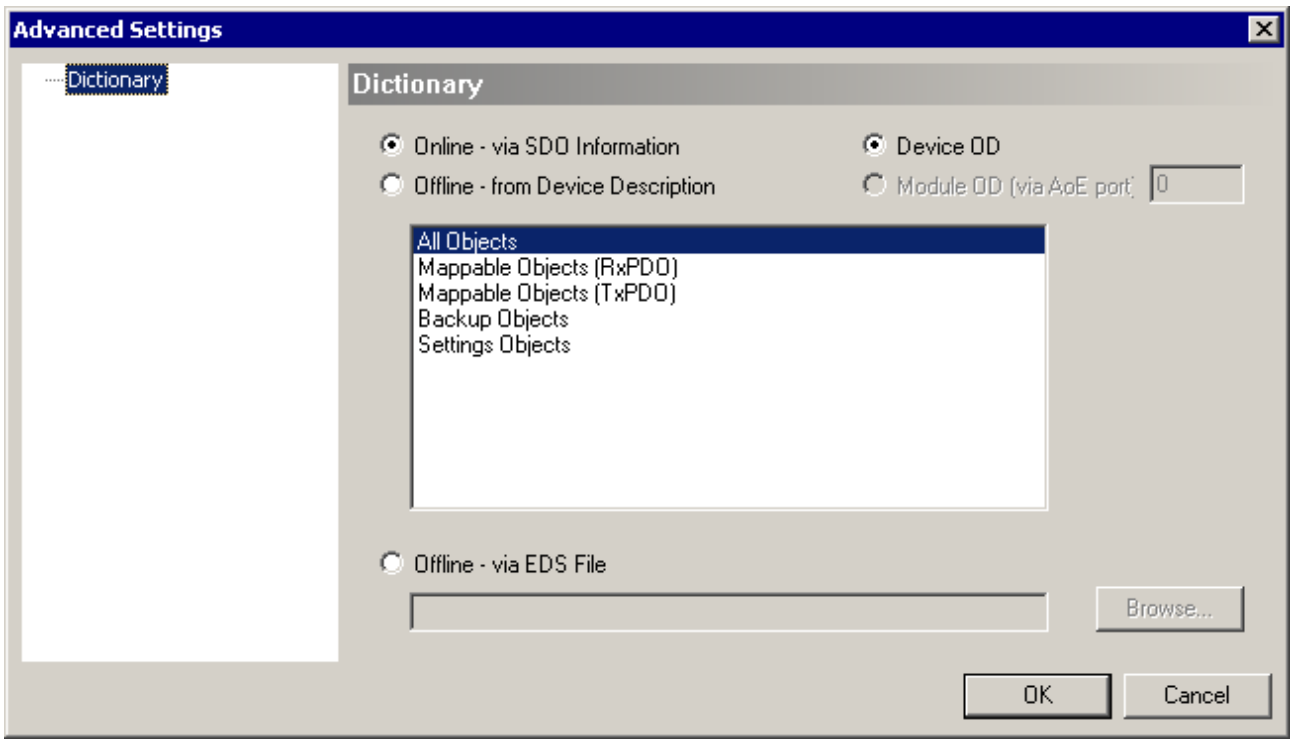



Fig. 39: Advanced settings

| | |
|---|---|
| **Online**<br>**- via SDO information** | If this option button is selected, the list of the objects included in the object directory of the slave is uploaded from the slave via SDO information. The list below can be used to specify which object types are to be uploaded. |
| **Offline**<br>**- via EDS file** | If this option button is selected, the list of the objects included in the object directory is read from an EDS file provided by the user. |

**Online tab**

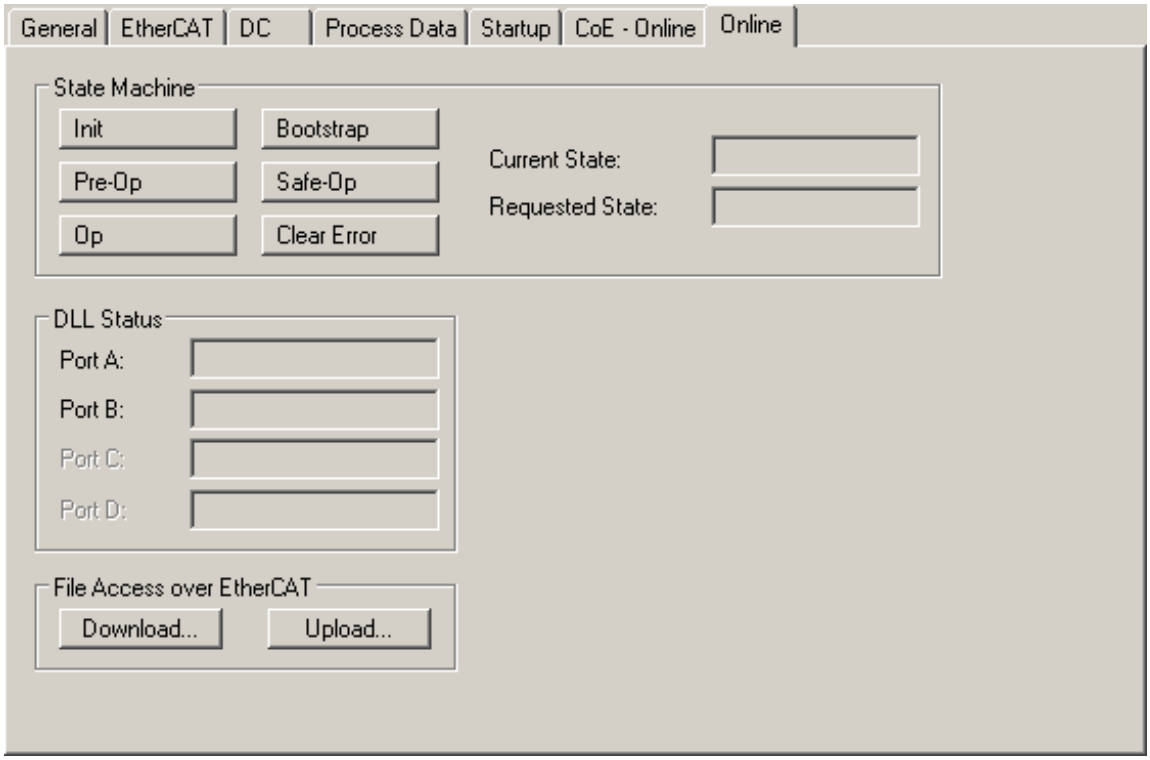



Fig. 40: Online tab

### State Machine

| | |
|---|---|
| **Init** | This button attempts to set the EtherCAT device to the *Init* state. |
| **Pre-Op** | This button attempts to set the EtherCAT device to the *pre-operational* state. |
| **Op** | This button attempts to set the EtherCAT device to the *operational* state. |
| **Bootstrap** | This button attempts to set the EtherCAT device to the *Bootstrap* state. |
| **Safe-Op** | This button attempts to set the EtherCAT device to the *safe-operational* state. |
| **Clear Error** | This button attempts to delete the fault display. If an EtherCAT slave fails during change of state it sets an error flag.<br>Example: An EtherCAT slave is in PREOP state (pre-operational). The master now requests the SAFEOP state (safe-operational). If the slave fails during change of state it sets the error flag. The current state is now displayed as ERR PREOP. When the *Clear Error* button is pressed the error flag is cleared, and the current state is displayed as PREOP again. |
| **Current State** | Indicates the current state of the EtherCAT device. |
| **Requested State** | Indicates the state requested for the EtherCAT device. |

### DLL Status

Indicates the DLL status (data link layer status) of the individual ports of the EtherCAT slave. The DLL status can have four different states:

| Status | Description |
|---|---|
| No Carrier / Open | No carrier signal is available at the port, but the port is open. |
| No Carrier / Closed | No carrier signal is available at the port, and the port is closed. |
| Carrier / Open | A carrier signal is available at the port, and the port is open. |
| Carrier / Closed | A carrier signal is available at the port, but the port is closed. |

### File Access over EtherCAT

| | |
|---|---|
| **Download** | With this button a file can be written to the EtherCAT device. |
| **Upload** | With this button a file can be read from the EtherCAT device. |

### 4.1.3 Distributed Clocks (DC)

**EtherCAT System Documentation**

A basic introduction to the topic of EtherCAT and Distributed Clocks is available in the Download area on the Beckhoff homepage: EtherCAT System Documentation.

The EtherCAT Box supports Distributed Clocks functionality. In order for the Box to be able to make the current counter value available in the designated process data in time before the arrival of the querying EtherCAT datagram, a suitable signal must be generated cyclically within the terminal. This signal can be triggered in the Box through 2 events: the SyncManager (SM) and the distributed clock (DC). Under operation mode selection the following options are available (see Fig. *"DC" (Disributed Clocks) tab*)

- **SM-synchron**
  The SynManager event occurs when an EtherCAT frame successfully exchanges process data with the EP1518. Frame-triggered, the current counter value is thus cyclically determined, but with the low temporal jitter of the Ethernet frame.
- **DC-synchron**
  In DC operation mode determination of the counter value is triggered cyclically at constant intervals through the integrated DC unit, synchronous with the bus cycle as standard. More uniform polling offers higher-quality position data for a higher-level control algorithm, for example. In the EP1518 the SYNC0 signal acts as trigger.

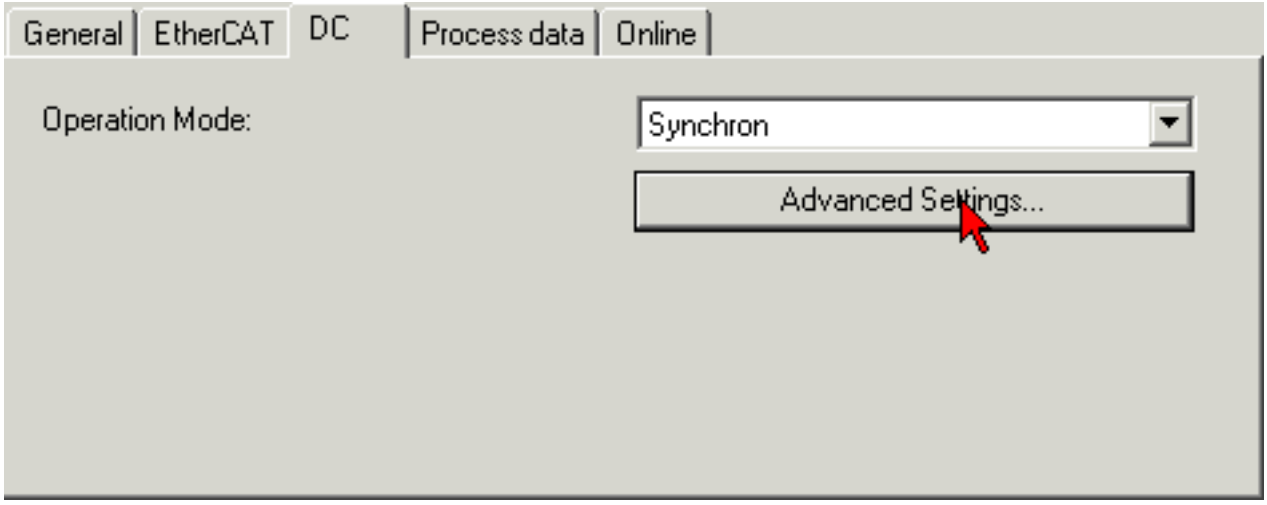



Fig. 41: DC tab (Distributed Clocks)

When *DC-Synchron* operation mode is activated TwinCAT selects settings that ensure reliable operation of the Box with current position data. This means that determination of the current counter value is triggered by the SYNC0 signal at highly constant intervals and in good time (i.e. with an adequate safety buffer) before retrieving EtherCAT datagram is started.

If necessary, the SYNC0 signal can be shifted along the time axis to the right/later or left/earlier in associated dialogs by specifying a user-defined shift time, see Fig. *Advanced Distributed Clock (DC) settings*.

- A right-shift (positive shift value) will delay the counter value query, which means the position value becomes more current from the PLC perspective. However, this increases the risk that the position determination may not be finished in time before the arrival of EtherCAT frame, so that no current position value is available in this cycle.
- A left-shift (negative shift value) means the counter value will be queried earlier, resulting in older position values, with an associated increase in the safety buffer before the arrival of the EtherCAT datagram. This setting may be useful in systems with high real-time jitter, if no Industrial PCs from Beckhoff are used for control purposes, for example.

**NOTE**

**Risk of device damage**

The mentioned notes and information should be used advisedly.
The EtherCAT master automatically allocates SYNC0 and SYNC1 settings that support reliable and timely process data acquisition.
User intervention at this point may lead to undesired behavior.
If these settings are changed in the System Manager, no plausibility checks are carried out on the software side. Correct function of the terminal with all conceivable setting options cannot be guaranteed.

### Default setting

The cyclic reading of the inputs is triggered by the SYNC0 pulse (interrupt) of the DC in the EtherCAT Box. The EtherCAT master sets the *Sync Unit Cycle* time value to the PLC cycle time and therefore the EtherCAT cycle time as standard. See Fig. *Advanced Distributed Clock (DC) settings*: 4000 µs = 4 ms, as TwinCAT is in configuration mode.

### DC settings

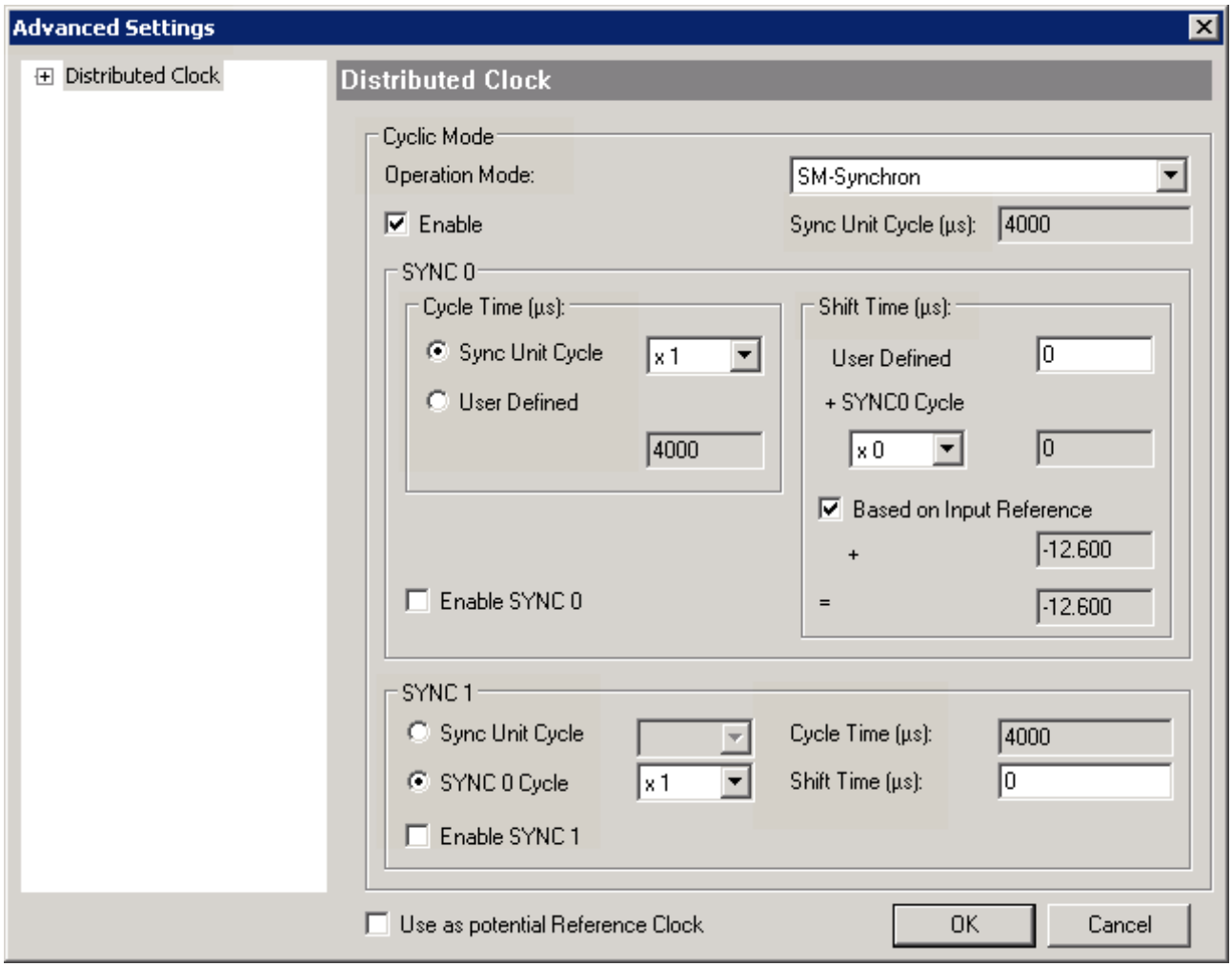



Fig. 42: Advanced settings for Distributed Clocks (DC)

### SYNC0

Sync Unit cycle: a multiple of the bus cycle time. The counter value is periodically determined at this interval (in µs).

### User defined

Any number up to $2^{32}$ ns, or about 4.3 seconds. Use of decimal points is allowed.

### Shift Time

The Shift Time can be used to shift the SYNC0 pulse for this EtherCAT Box relative to other Boxes/ Terminals and the global SYNC pulse in nanosecond steps. If the inputs of several Boxes are read simultaneously, the same value must be entered here.

### Based on input reference

If this option is activated an additional Input Shift is added to the configurable terminal-specific SYNC0 shift (user defined). This value is calculated and made available by the EtherCAT master (SysMan/Device EtherCAT/Tab EtherCAT/Advanced Settings/Distributed Clocks/Input Shift Time). As a result, *all* the input terminals in the system (EL1xxx, EL3xxx, EP1xxx, EP3xxx) read their inputs as close as possible to the time of the EtherCAT frame that will fetch them, thereby supplying the most recent possible input data to the controller.

### Enable SYNC0

Automatically activated in *DC-synchron* operation mode.

### SYNC1

Additional SYNC pulse, derived from SYNC0 or from the DC itself.

### DC settings for EtherCAT master

Higher-level distributed clock parameters can be modified under advanced settings for the EtherCAT master. Refer also to the basic introduction to the topic of EtherCAT and Distributed Clocks; download: the Distributed Clocks system description.

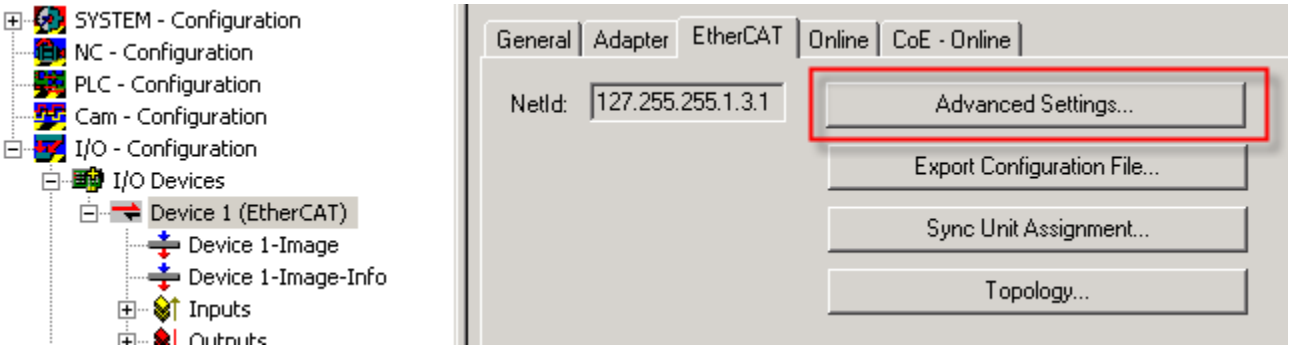



Fig. 43: EtherCAT Master, EtherCAT tab, Advanced Settings

## 4.1.4 Distributed Clocks and EP1518

**Digital inputs and Distributed Clocks**

If the Distributed Clock of the EP1518 is activated, the digital inputs are read in without the set filter promptly before the arrival of the querying EtherCAT datagram.

# 4.2 Configuration of the EP1518

## 4.2.1 Basic Function Principles

The EP1518 EtherCAT Box has 8 digital inputs. Of these, inputs 0, 1 and 2 as well as 4, 5 and 6 can each be used for one counter. The states of the individual inputs are always illustrated in the process image, irrespective of their use.

| Input | M8 | M12 | Properties |
|---|---|---|---|
| 0 | Socket 1, pin 4 | Socket 1, pin 4 | Digital input or counter input 1 |
| 1 | Socket 2, pin 4 | Socket 1, pin 2 | Digital input or Gate 1 |
| 2 | Socket 3, pin 4 | Socket 2, pin 4 | Digital input or Up/Down 1 |
| 3 | Socket 4, pin 4 | Socket 2, pin 2 | Digital input |
| 4 | Socket 5, pin 4 | Socket 3, pin 4 | Digital input or counter input 2 |
| 5 | Socket 6, pin 4 | Socket 3, pin 2 | Digital input or Gate 2 |
| 6 | Socket 7, pin 4 | Socket 4, pin 4 | Digital input or Up/Down 2 |
| 7 | Socket 8, pin 4 | Socket 4, pin 2 | Digital input |

### Operation modes

The EP1518 can be operated in 3 modes; the mode is set by selecting the PDOs in the Sync-Manager [▶ 38]:

| Operation mode | Number of counter channels | Number of "free" digital inputs | Properties |
|---|---|---|---|
| 2 up/down counters (32-bit) | 2 | 2 | Single pulses are counted at the counter inputs.<br>The gate input or the software gate enables the counter.<br>The count direction is specified via CoE. |
| 2 up/down counters (32-bit) | 1 | 5 | |
| 8 digital inputs, no counter | - | 8 | digital inputs:<br>Filter for inputs 0 and 4 permanently set to 150 µs.<br>The filter setting for the other inputs is configurable by software. |

The GATE and Up/Down inputs can be converted to standard inputs.

### Counting mode

The following settings for GATE and Up/Down can be combined and apply independently to each counter.

### Counting mode with standard setting (up counter)

In the delivery state the Counter Value is incremented on each rising edge. The count direction is up.

The counter is disabled by applying a high level to the GATE input or by setting the *Inhibit Counters* bit.

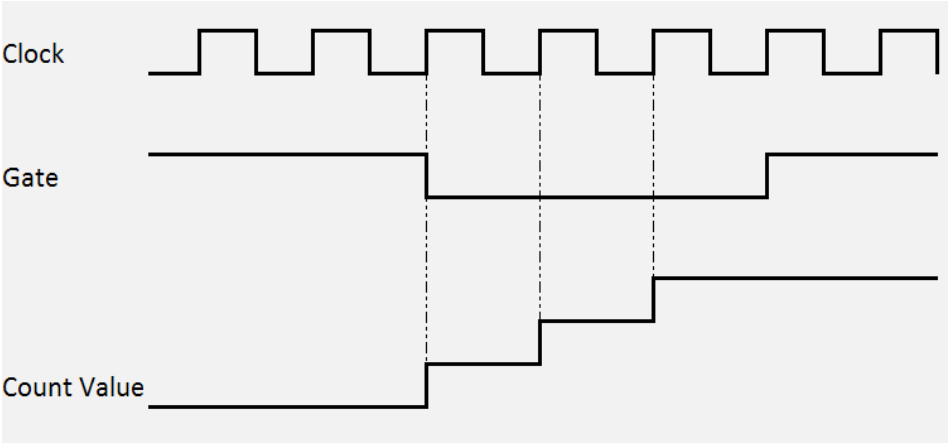



Fig. 44: Counting mode with standard setting

**Counting mode with reversed count direction (down counter)**

The count direction is changed by applying a high level to the Up/Down input or by setting the CoE object 0x80x0:04 *Count down.* The count direction is down.

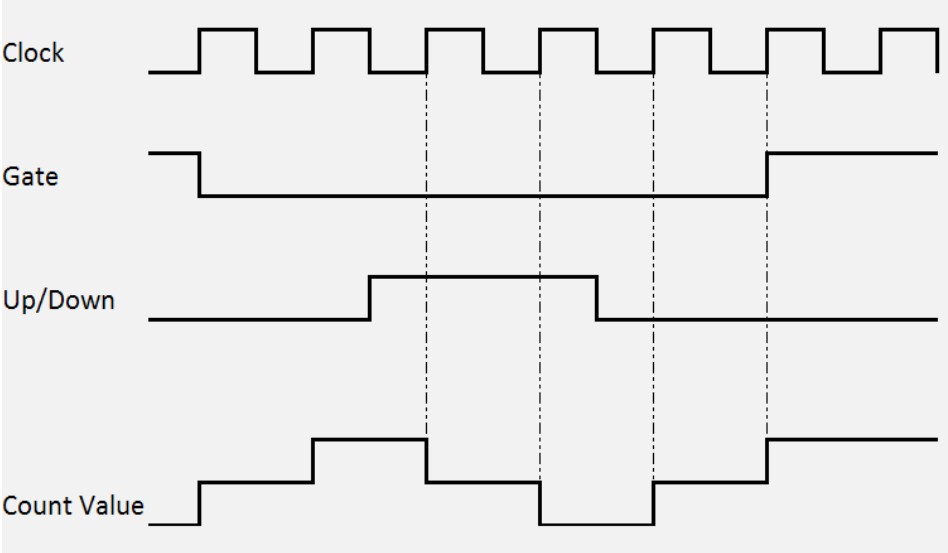



Fig. 45: Counting mode with reversed counting direction

**Counting mode with inverted (negated) GATE input**

In the default setting the counter is disabled by applying a high level to the GATE input or by setting the *Inhibit Counters* bit

Setting the CoE object 0x80x0:05 *Enable input gate* activates the counter if GATE is set and deactivates it if GATE is not set.

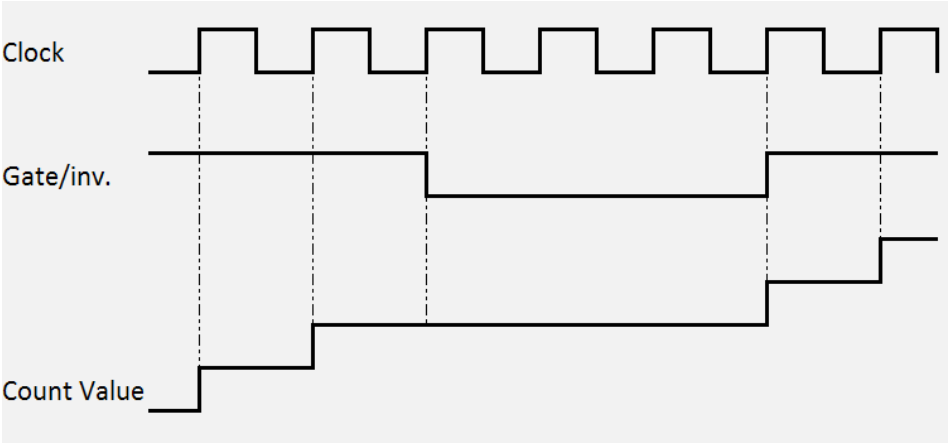



Fig. 46: Counting mode with inverted GATE input

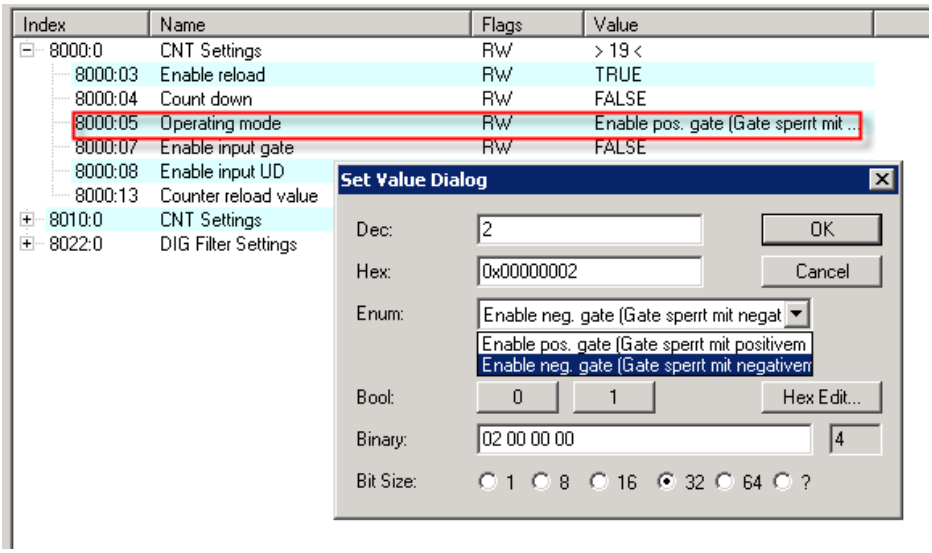



Fig. 47: CoE for inverting the GATE input

## 4.2.2 Operation modes

### Operation mode selection

The EP1518 can be operated in 3 modes:

- Two up/down counters [▶ 50](delivery state)
- One up/down counter [▶ 51]
- 8 digital inputs [▶ 52]

The setting takes place by selecting the PDOs in the Sync-Manager [▶ 38]:

| Operation mode | Number of 32-bit counters | Number of "free" digital inputs | Properties |
|---|---|---|---|
| 2 up/down counters | 2 | 2 | Single pulses at the counter inputs are counted; the Gate input or the software gate enables the counter; count direction via CoE |
| 1 up/down counters | 1 | 5 | |
| 8 digital inputs, no counter | - | 8 | digital inputs:<br>Filter for inputs 0 and 4 permanently set to 150 µs.<br>The filter setting for the other inputs is configurable by software. |

| Operation mode settings of the PDOs | 0x1600 | 0x1601 | 0x1A00 | 0x1A01 | 0x1A02 | 0x1A03 | Comments |
|---|---|---|---|---|---|---|---|
| 2 up/down counters (32-bit) | 1 | 1 | 1 | 1 | 0/1 | 0/1 | 2 counters, digital inputs, diagnosis of Us |
| 1 up/down counters (32-bit) | 1 | 0 | 1 | 0 | 0/1 | 0/1 | |
| 8 digital inputs, no counter | 0 | 0 | 0 | 0 | 0/1 | 0/1 | digital inputs:<br>Filter for inputs 0 and 4 permanently set to 150 µs. The filter setting for the other inputs is configurable by software. |

The module parameters are set in the CoE objects 0x8000:0 for counter 1, 0x8010:0 for counter 2 and 0x8022:0 for the digital inputs. (integrate links)

**The second counter is always active internally**

Internally the second counter is always active, so that when switching from one 32-bit counter to two 32-bit counters the previous incoming pulses were counted in the second counter and saved in the Counter Value.

### Two up/down counters

This is the delivery mode of the EP1518.

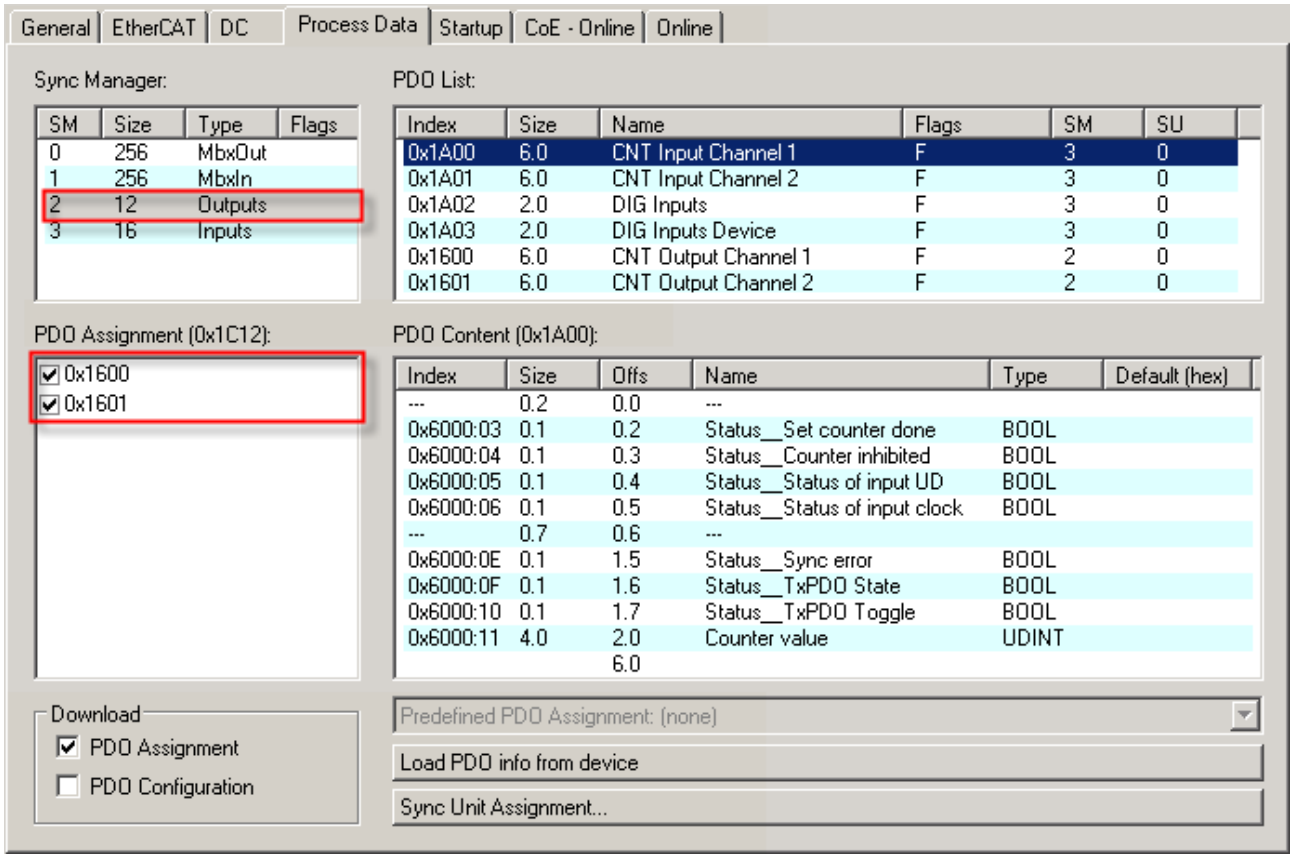



Fig. 48: Setting of the PDOs 0x1600 and 0x1601, default settings of the objects 0x8000 to 0x8022:0

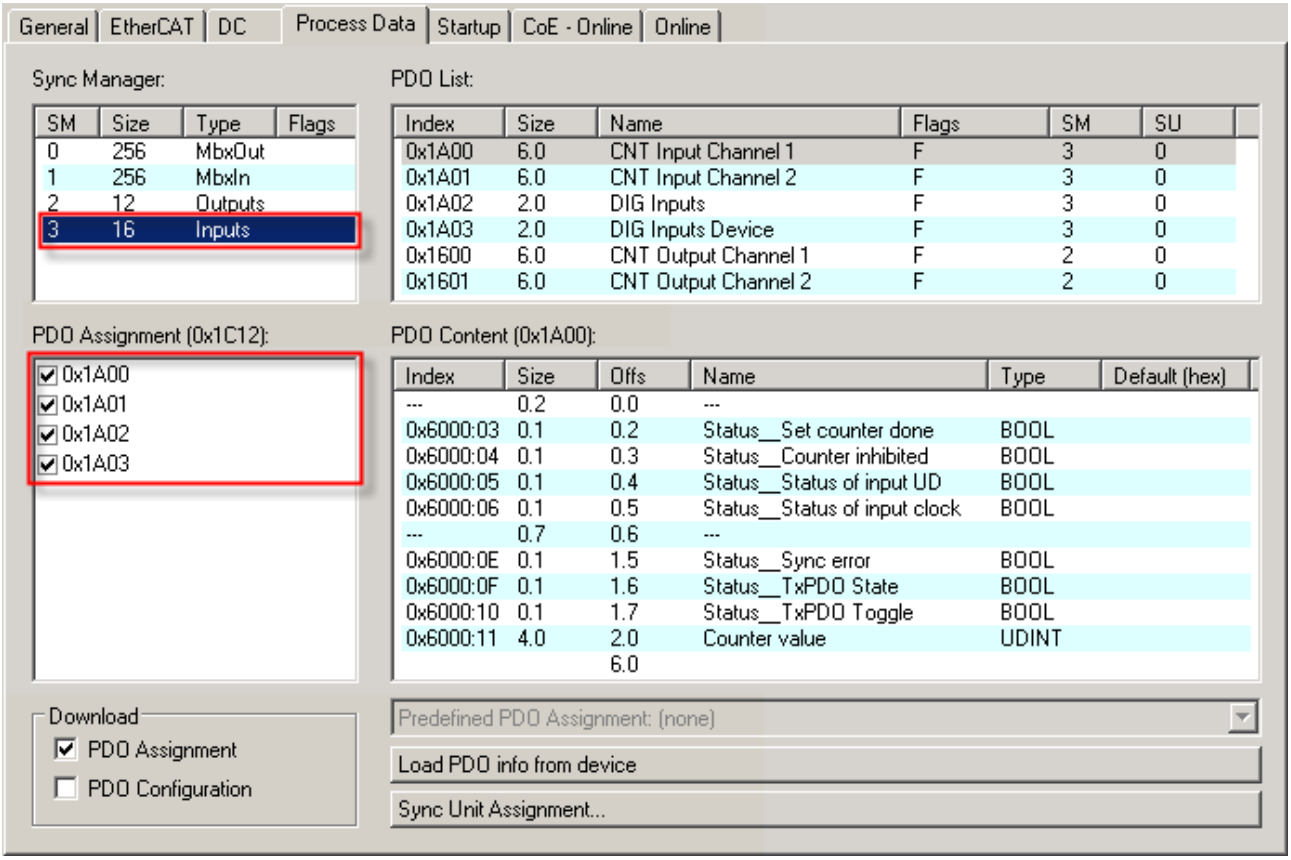



Fig. 49: Setting of the PDOs 0x1A00 to 0x1A03, default settings of the objects 0x8000 to 0x8002:0

The PDOs 0x1600 [▶ 62], 0x1601 [▶ 63] as well as 0x1A00 [▶ 63], 0x1A01 [▶ 63], 0x1A02 [▶ 64] and 0x1A03 [▶ 64] are activated. The meaning of the individual objects is explained in the object description.

**One up/down counter (0x1601 deactivated, 0x1A01 deactivated)**

This mode can be set as follows:

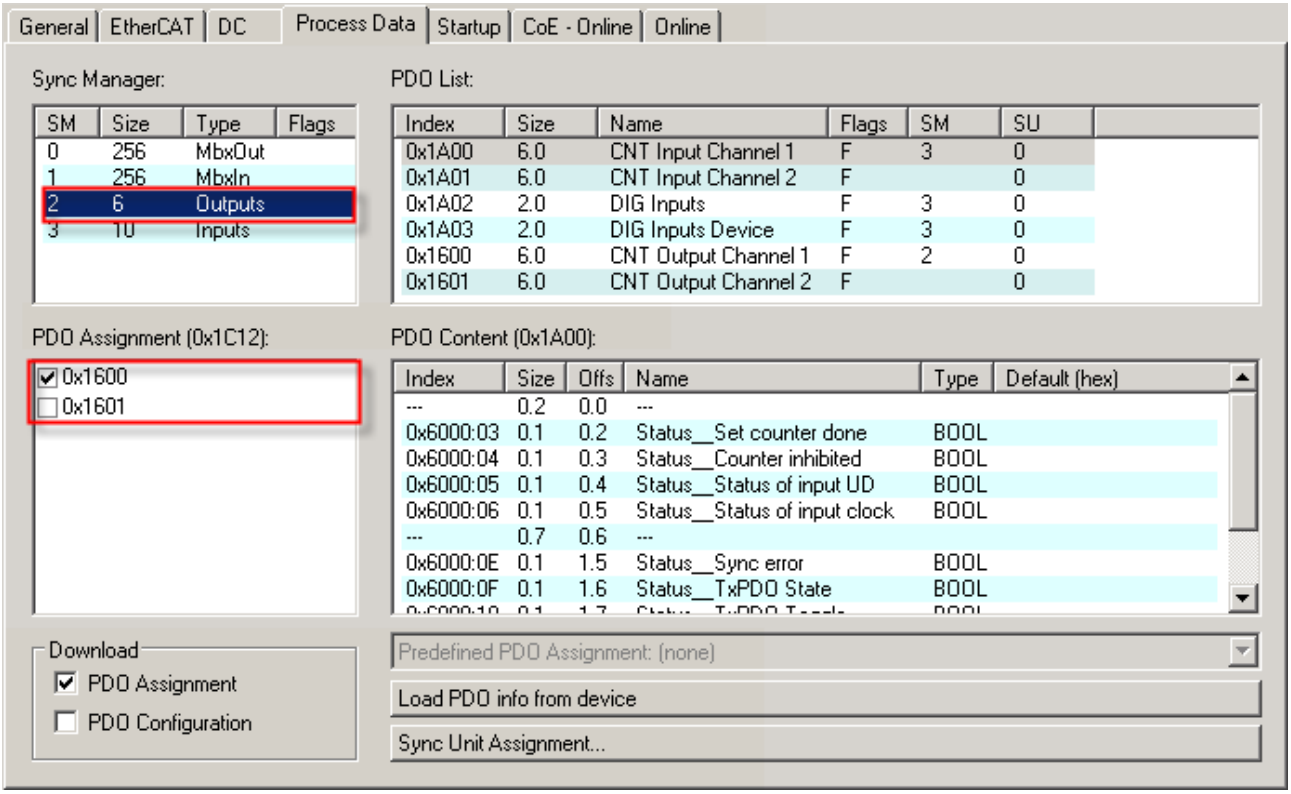



Fig. 50: Setting the PDOs 0x1600

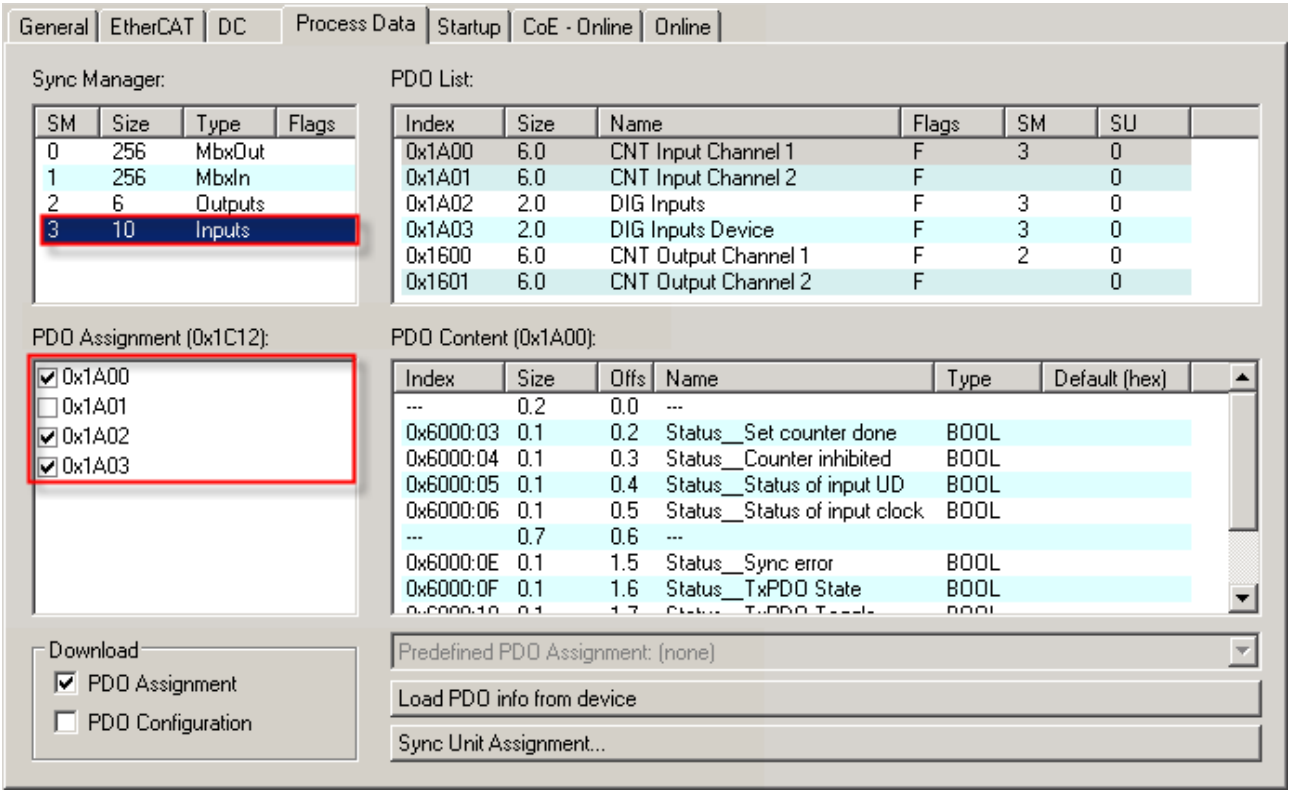



Fig. 51: Setting the PDOs 0x1A00, 0x1A02 and 0x1A03

The PDOs 0x1600 [▶ 62] as well as 0x1A00 [▶ 63], 0x1A02 [▶ 64] and 0x1A03 [▶ 64] are activated. The CoE objects are identical to the 2 x 32-bit counter operation mode.

**8 digital inputs, no counter**

This mode can be set as follows:

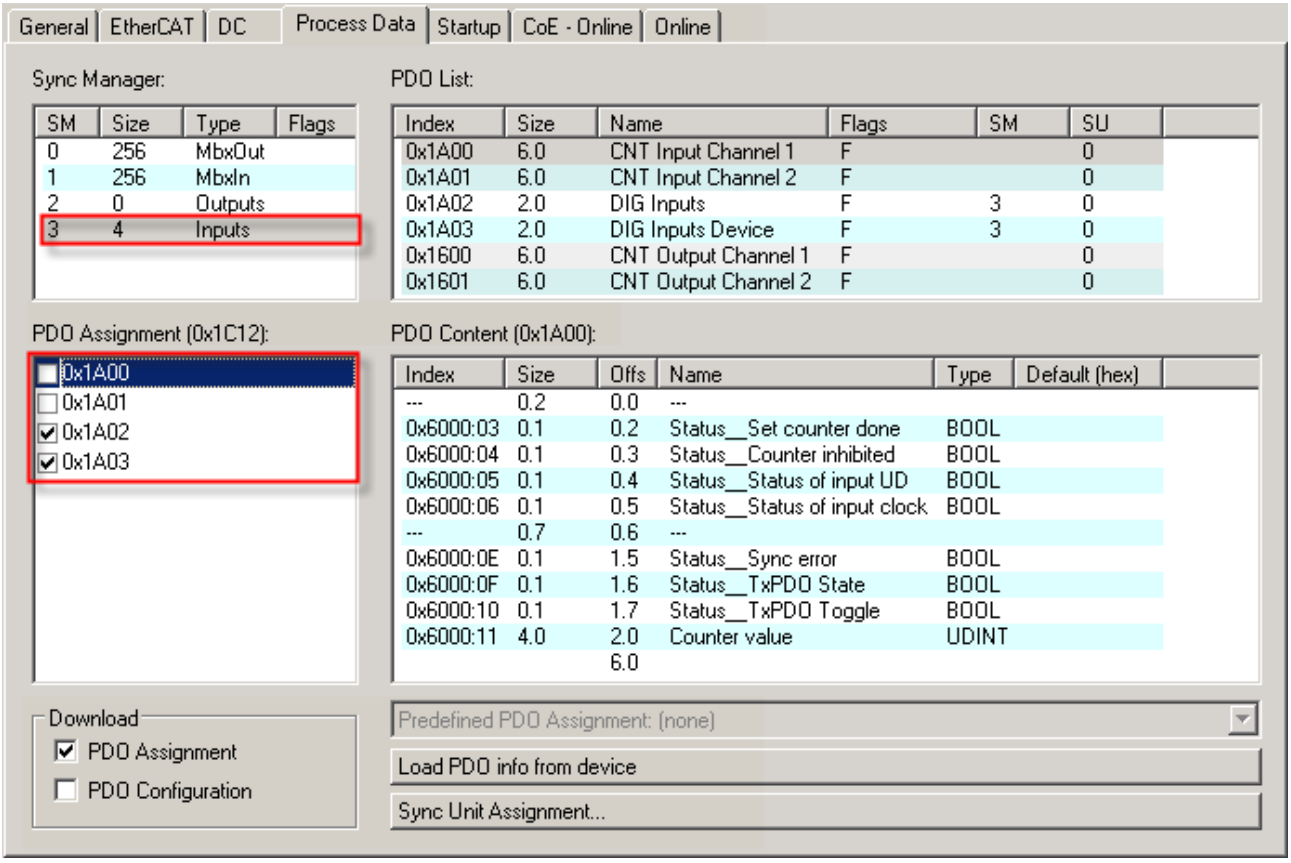



Fig. 52: Setting the PDOs 0x1A02 and 0x1A03

The PDOs 0x1A02 [▶ 64] and 0x1A03 [▶ 64] are activated. The meaning of the individual objects is explained in the object description.

## 4.2.3 Counter settings

### Enabling the GATE and Up/Down inputs as standard inputs

By setting the CoE objects *Enable Input gate* and *Enable input UD*, the inputs are no longer allocated to the counters, but are used as standard inputs.

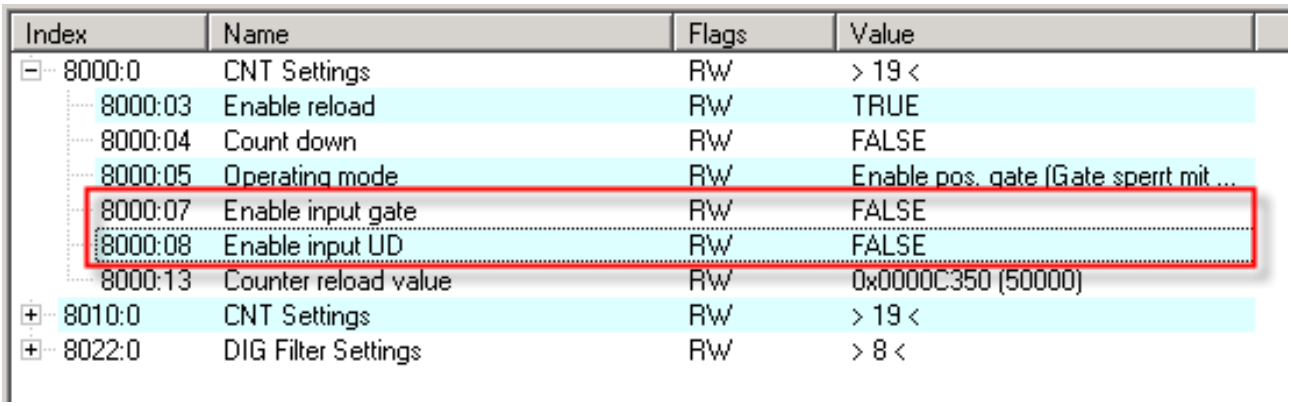



Fig. 53: Enabling the inputs

### Setting the counter to a value specified by the process data

The counter (counter value) can be set to any desired value by the controller.

To do this, set the desired value in *Set counter value*. The value is then adopted by *Counter value* on a rising edge of the *Set counter* control bit.

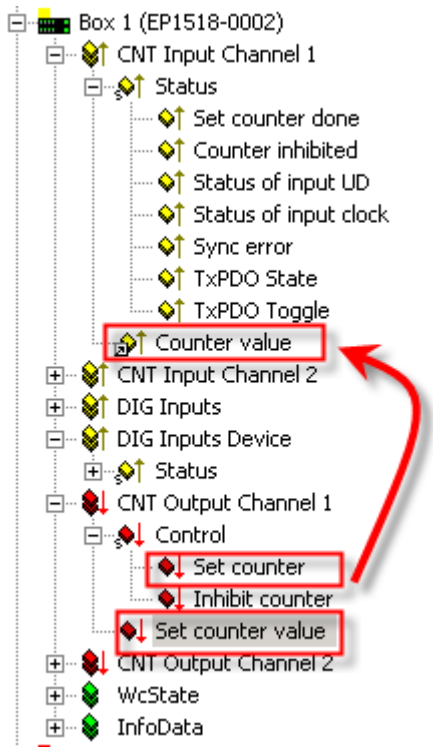



Fig. 54: Setting the counter

### Automatic setting/resetting of the counter to a defined value

If a desired value is set in *Counter reload value* and the *Enable reload* bit is activated, the counter is set to 0 or to the set value if the specified value is exceeded or fallen below (depending on the counting direction).

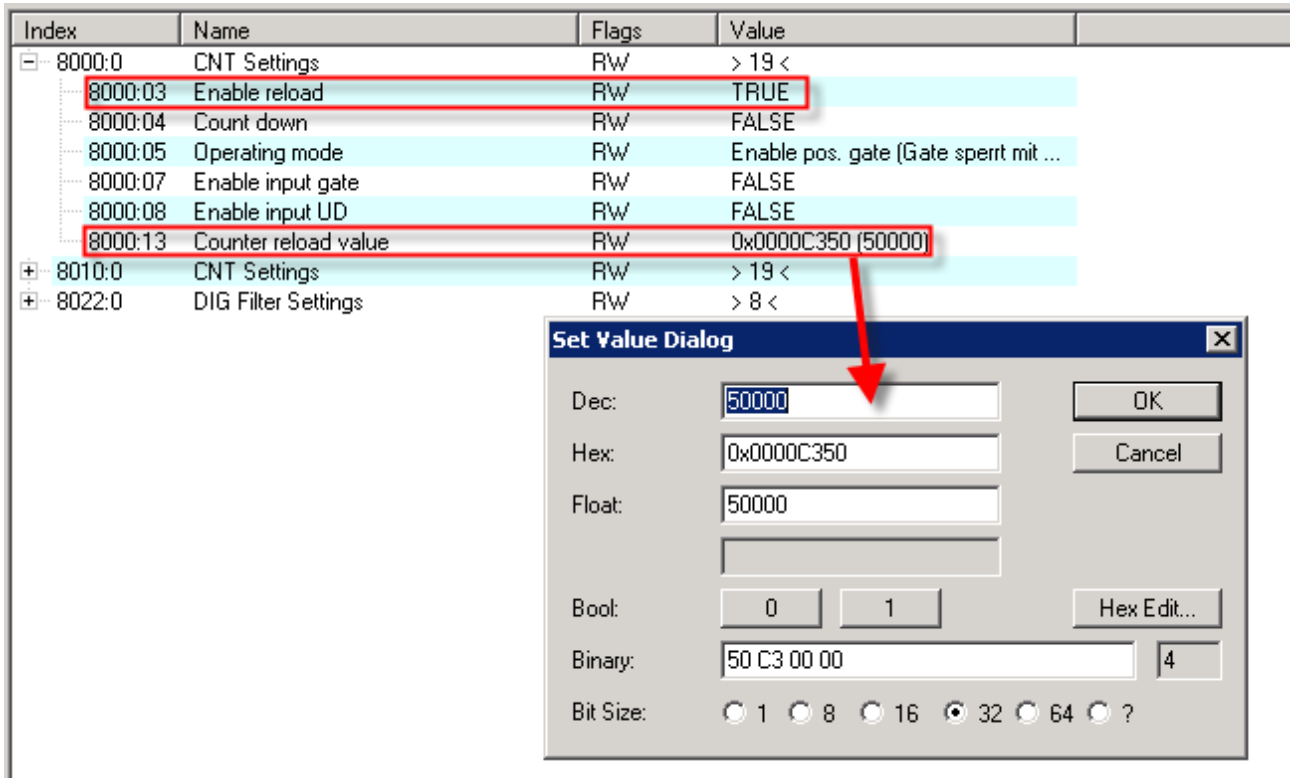



Fig. 55: Automatic setting of the counter

### 4.2.4 Restoring the delivery state

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

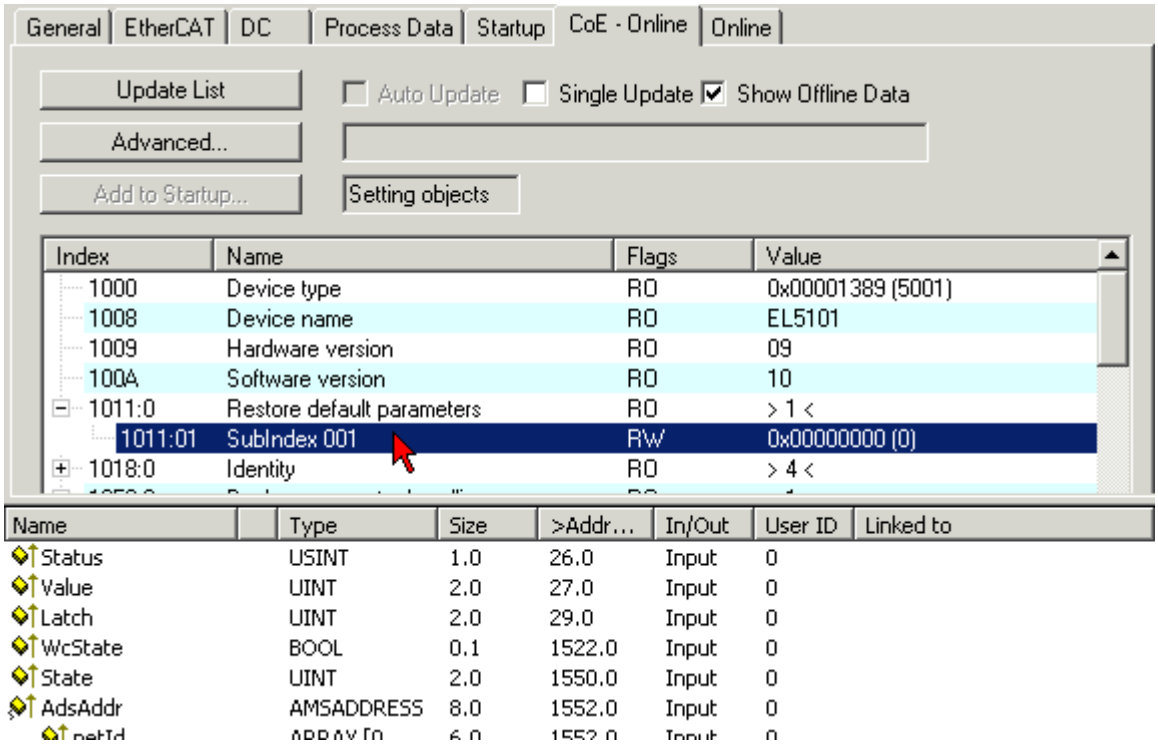



Fig. 56: Selecting the Restore default parameters PDO

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.

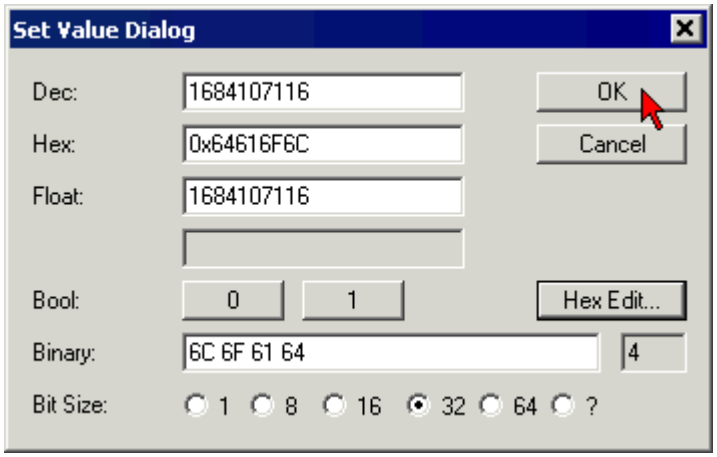



Fig. 57: Entering a restore value in the Set Value dialog

**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.

# 4.3 CoE objects

## 4.3.1 Object overview

**EtherCAT XML Device Description**

The display matches that of the CoE objects from the EtherCAT XML Device Description. We recommend downloading the latest XML file from the download area of the Beckhoff website and installing it according to installation instructions.

| Index (hex) | | Name | Flags | Default value |
|---|---|---|---|---|
| 1000 [▶ 62] | | Device type | RO | 0x00001389 ($5001_{dec}$) |
| 1008 [▶ 62] | | Device name | RO | EP1518-0002 |
| 1009 [▶ 62] | | Hardware version | RO | 00 |
| 100A [▶ 62] | | Software version | RO | 01.03 |
| 1011:0 [▶ 60] | **Subindex** | Restore default parameters | RO | 0x01 ($1_{dec}$) |
| | 1011:01 | SubIndex 001 | RW | 0x00000000 ($0_{dec}$) |
| 1018:0 [▶ 62] | **Subindex** | Identity | RO | 0x04 ($4_{dec}$) |
| | 1018:01 | Vendor ID | RO | 0x00000002 ($2_{dec}$) |
| | 1018:02 | Product code | RO | 0x05EE4052 ($99500114_{dec}$) |
| | 1018:03 | Revision | RO | 0x00100002 ($1048578_{dec}$) |
| | 1018:04 | Serial number | RO | 0x00000000 ($0_{dec}$) |
| 10F0:0 [▶ 62] | **Subindex** | Backup parameter handling | RO | 0x01 ($1_{dec}$) |
| | 10F0:01 | Checksum | RO | 0x00000000 ($0_{dec}$) |
| 1600:0 [▶ 62] | **Subindex** | CNT RxPDO-Map Outputs Ch.1 | RO | 0x05 ($5_{dec}$) |
| | 1600:01 | SubIndex 001 | RO | 0x0000:00, 2 |
| | 1600:02 | SubIndex 002 | RO | 0x7000:03, 1 |
| | 1600:03 | SubIndex 003 | RO | 0x7000:04, 1 |
| | 1600:04 | SubIndex 004 | RO | 0x0000:00, 12 |
| | 1600:05 | SubIndex 005 | RO | 0x7000:11, 32 |
| 1601:0 [▶ 63] | **Subindex** | CNT RxPDO-Map Outputs Ch.2 | RO | 0x05 ($5_{dec}$) |
| | 1601:01 | SubIndex 001 | RO | 0x0000:00, 2 |
| | 1601:02 | SubIndex 002 | RO | 0x7010:03, 1 |
| | 1601:03 | SubIndex 003 | RO | 0x7010:04, 1 |
| | 1601:04 | SubIndex 004 | RO | 0x0000:00, 12 |
| | 1601:05 | SubIndex 005 | RO | 0x7010:11, 32 |
| 1A00:0 [▶ 63] | **Subindex** | CNT TxPDO-Map InputsCh.1 | RO | 0x0A ($10_{dec}$) |
| | 1A00:01 | SubIndex 001 | RO | 0x0000:00, 2 |
| | 1A00:02 | SubIndex 002 | RO | 0x6000:03, 1 |
| | 1A00:03 | SubIndex 003 | RO | 0x6000:04, 1 |
| | 1A00:04 | SubIndex 004 | RO | 0x6000:05, 1 |
| | 1A00:05 | SubIndex 005 | RO | 0x6000:06, 1 |
| | 1A00:06 | SubIndex 006 | RO | 0x0000:00, 7 |
| | 1A00:07 | SubIndex 007 | RO | 0x6000:0E, 1 |
| | 1A00:08 | SubIndex 008 | RO | 0x6000:0F, 1 |
| | 1A00:09 | SubIndex 009 | RO | 0x6000:10, 1 |
| | 1A00:0A | SubIndex 010 | RO | 0x6000:11, 32 |

| Index (hex) | | Name | Flags | Default value |
|---|---|---|---|---|
| 1A01:0 [▶ 63] | **Subindex** | CNT TxPDO-Map Inputs Ch.2 | RO | 0x0A ($10_{dec}$) |
| | 1A01:01 | SubIndex 001 | RO | 0x0000:00, 2 |
| | 1A01:02 | SubIndex 002 | RO | 0x6010:03, 1 |
| | 1A01:03 | SubIndex 003 | RO | 0x6010:04, 1 |
| | 1A01:04 | SubIndex 004 | RO | 0x6010:05, 1 |
| | 1A01:05 | SubIndex 005 | RO | 0x6010:06, 1 |
| | 1A01:06 | SubIndex 006 | RO | 0x0000:00, 7 |
| | 1A01:07 | SubIndex 007 | RO | 0x6010:0E, 1 |
| | 1A01:08 | SubIndex 008 | RO | 0x6010:0F, 1 |
| | 1A01:09 | SubIndex 009 | RO | 0x6010:10, 1 |
| | 1A01:0A | SubIndex 010 | RO | 0x6010:11, 32 |
| 1A02:0 [▶ 64] | **Subindex** | DIG TxPDO-Map Inputs | RO | 0x09 ($9_{dec}$) |
| | 1A02:01 | SubIndex 001 | RO | 0x6020:01, 1 |
| | 1A02:02 | SubIndex 002 | RO | 0x6020:02, 1 |
| | 1A02:03 | SubIndex 003 | RO | 0x6020:03, 1 |
| | 1A02:04 | SubIndex 004 | RO | 0x6020:04, 1 |
| | 1A02:05 | SubIndex 005 | RO | 0x6020:05, 1 |
| | 1A02:06 | SubIndex 006 | RO | 0x6020:06, 1 |
| | 1A02:07 | SubIndex 007 | RO | 0x6020:07, 1 |
| | 1A02:08 | SubIndex 008 | RO | 0x6020:08, 1 |
| | 1A02:09 | SubIndex 009 | RO | 0x0000:00, 8 |
| 1A03:0 [▶ 64] | **Subindex** | DIG TxPDO-Map Inputs Device | RO | 0x07 ($7_{dec}$) |
| | 1A03:01 | SubIndex 001 | RO | 0x0000:00, 1 |
| | 1A03:02 | SubIndex 002 | RO | 0xF600:02, 1 |
| | 1A03:03 | SubIndex 003 | RO | 0xF600:03, 1 |
| | 1A03:04 | SubIndex 004 | RO | 0x0000:00, 10 |
| | 1A03:05 | SubIndex 005 | RO | 0xF600:0E, 1 |
| | 1A03:06 | SubIndex 006 | RO | 0xF600:0F, 1 |
| | 1A03:07 | SubIndex 007 | RO | 0xF600:10, 1 |
| 1C00:0 [▶ 64] | **Subindex** | Sync manager type | RO | 0x04 ($4_{dec}$) |
| | 1C00:01 | SubIndex 001 | RO | 0x01 ($1_{dec}$) |
| | 1C00:02 | SubIndex 002 | RO | 0x02 ($2_{dec}$) |
| | 1C00:03 | SubIndex 003 | RO | 0x03 ($3_{dec}$) |
| | 1C00:04 | SubIndex 004 | RO | 0x04 ($4_{dec}$) |
| 1C12:0 [▶ 64] | **Subindex** | RxPDO assign | RW | 0x02 ($2_{dec}$) |
| | 1C12:01 | SubIndex 001 | RW | 0x1600 ($5632_{dec}$) |
| | 1C12:02 | SubIndex 002 | RW | 0x1601 ($5633_{dec}$) |
| 1C13:0 [▶ 65] | **Subindex** | TxPDO assign | RW | 0x04 ($4_{dec}$) |
| | 1C13:01 | SubIndex 001 | RW | 0x1A00 ($6656_{dec}$) |
| | 1C13:02 | SubIndex 002 | RW | 0x1A01 ($6657_{dec}$) |
| | 1C13:03 | SubIndex 003 | RW | 0x1A02 ($6658_{dec}$) |
| | 1C13:04 | SubIndex 004 | RW | 0x1A03 ($6659_{dec}$) |

| Index (hex) | | Name | Flags | Default value |
|---|---|---|---|---|
| 1C32:0 [▶ 65] | **Subindex** | SM output parameter | RO | 0x20 ($32_{dec}$) |
| | 1C32:01 | Sync mode | RW | 0x0001 ($1_{dec}$) |
| | 1C32:02 | Cycle time | RW | 0x000F4240 ($1000000_{dec}$) |
| | 1C32:03 | Shift time | RO | 0x00000000 ($0_{dec}$) |
| | 1C32:04 | Sync modes supported | RO | 0xC007 ($49159_{dec}$) |
| | 1C32:05 | Minimum cycle time | RO | 0x0003D090 ($250000_{dec}$) |
| | 1C32:06 | Calc and copy time | RO | 0x00000000 ($0_{dec}$) |
| | 1C32:07 | Minimum delay time | RO | 0x00000000 ($0_{dec}$) |
| | 1C32:08 | Command | RW | 0x0000 ($0_{dec}$) |
| | 1C32:09 | Maximum delay time | RO | 0x00000000 ($0_{dec}$) |
| | 1C32:0B | SM event missed counter | RO | 0x0000 ($0_{dec}$) |
| | 1C32:0C | Cycle exceeded counter | RO | 0x0000 ($0_{dec}$) |
| | 1C32:0D | Shift too short counter | RO | 0x0000 ($0_{dec}$) |
| | 1C32:20 | Sync error | RO | 0x00 ($0_{dec}$) |
| 1C33:0 [▶ 66] | **Subindex** | SM input parameter | RO | 0x20 ($32_{dec}$) |
| | 1C33:01 | Sync mode | RW | 0x0022 ($34_{dec}$) |
| | 1C33:02 | Cycle time | RW | 0x000F4240 ($1000000_{dec}$) |
| | 1C33:03 | Shift time | RO | 0x00000000 ($0_{dec}$) |
| | 1C33:04 | Sync modes supported | RO | 0xC007 ($49159_{dec}$) |
| | 1C33:05 | Minimum cycle time | RO | 0x0003D090 ($250000_{dec}$) |
| | 1C33:06 | Calc and copy time | RO | 0x00000000 ($0_{dec}$) |
| | 1C33:07 | Minimum delay time | RO | 0x00000000 ($0_{dec}$) |
| | 1C33:08 | Command | RW | 0x0000 ($0_{dec}$) |
| | 1C33:09 | Maximum delay time | RO | 0x00000000 ($0_{dec}$) |
| | 1C33:0B | SM event missed counter | RO | 0x0000 ($0_{dec}$) |
| | 1C33:0C | Cycle exceeded counter | RO | 0x0000 ($0_{dec}$) |
| | 1C33:0D | Shift too short counter | RO | 0x0000 ($0_{dec}$) |
| | 1C33:20 | Sync error | RO | 0x00 ($0_{dec}$) |
| 6000:0 [▶ 67] | **Subindex** | CNT Inputs | RO | 0x11 ($17_{dec}$) |
| | 6000:03 | Set counter done | RO | 0x00 ($0_{dec}$) |
| | 6000:04 | Counter inhibited | RO | 0x00 ($0_{dec}$) |
| | 6000:05 | Status of input UD | RO | 0x00 ($0_{dec}$) |
| | 6000:06 | Status of input clock | RO | 0x00 ($0_{dec}$) |
| | 6000:0E | Sync error | RO | 0x00 ($0_{dec}$) |
| | 6000:0F | TxPDO State | RO | 0x00 ($0_{dec}$) |
| | 6000:10 | TxPDO Toggle | RO | 0x00 ($0_{dec}$) |
| | 6000:11 | Counter value | RO | 0x00000000 ($0_{dec}$) |
| 6010:0 [▶ 67] | **Subindex** | CNT Inputs | RO | 0x11 ($17_{dec}$) |
| | 6010:03 | Set counter done | RO | 0x00 ($0_{dec}$) |
| | 6010:04 | Counter inhibited | RO | 0x00 ($0_{dec}$) |
| | 6010:05 | Status of input UD | RO | 0x00 ($0_{dec}$) |
| | 6010:06 | Status of input clock | RO | 0x00 ($0_{dec}$) |
| | 6010:0E | Sync error | RO | 0x00 ($0_{dec}$) |
| | 6010:0F | TxPDO State | RO | 0x00 ($0_{dec}$) |
| | 6010:10 | TxPDO Toggle | RO | 0x00 ($0_{dec}$) |
| | 6010:11 | Counter value | RO | 0x00000000 ($0_{dec}$) |

| Index (hex) | | Name | Flags | Default value |
|---|---|---|---|---|
| 6020:0 [▶ 67] | **Subindex** | DIG Inputs | RO | 0x08 ($8_{dec}$) |
| | 6020:01 | Input 0 | RO | 0x00 ($0_{dec}$) |
| | 6020:02 | Input 1 | RO | 0x00 ($0_{dec}$) |
| | 6020:03 | Input 2 | RO | 0x00 ($0_{dec}$) |
| | 6020:04 | Input 3 | RO | 0x00 ($0_{dec}$) |
| | 6020:05 | Input 4 | RO | 0x00 ($0_{dec}$) |
| | 6020:06 | Input 5 | RO | 0x00 ($0_{dec}$) |
| | 6020:07 | Input 6 | RO | 0x00 ($0_{dec}$) |
| | 6020:08 | Input 7 | RO | 0x00 ($0_{dec}$) |
| 7000:0 [▶ 67] | **Subindex** | CNT Outputs | RO | 0x11 ($17_{dec}$) |
| | 7000:03 | Set counter | RO | 0x00 ($0_{dec}$) |
| | 7000:04 | Inhibit counter | RO | 0x00 ($0_{dec}$) |
| | 7000:11 | Set counter value | RO | 0x00000000 ($0_{dec}$) |
| 7010:0 [▶ 68] | **Subindex** | CNT Outputs | RO | 0x11 ($17_{dec}$) |
| | 7010:03 | Set counter | RO | 0x00 ($0_{dec}$) |
| | 7010:04 | Inhibit counter | RO | 0x00 ($0_{dec}$) |
| | 7010:11 | Set counter value | RO | 0x00000000 ($0_{dec}$) |
| 8000:0 [▶ 61] | **Subindex** | CNT Settings | RW | 0x13 ($19_{dec}$) |
| | 8000:03 | Enable reload | RW | 0x00 ($0_{dec}$) |
| | 8000:04 | Count down | RW | 0x00 ($0_{dec}$) |
| | 8000:05 | Operating mode | RW | 0x01 ($1_{dec}$) |
| | 8000:13 | Counter reload value | RW | 0x00000000 ($0_{dec}$) |
| 8010:0 [▶ 61] | **Subindex** | CNT Settings | RW | 0x13 ($19_{dec}$) |
| | 8010:03 | Enable reload | RW | 0x00 ($0_{dec}$) |
| | 8010:04 | Count down | RW | 0x00 ($0_{dec}$) |
| | 8010:05 | Operating mode | RW | 0x01 ($1_{dec}$) |
| | 8010:13 | Counter reload value | RW | 0x00000000 ($0_{dec}$) |
| 8022:0 [▶ 61] | **Subindex** | DIG Filter Settings | RW | 0x08 ($8_{dec}$) |
| | 8022:01 | Input 0 | RW | 0x00 ($0_{dec}$) |
| | 8022:02 | Input 1 | RW | 0x00 ($0_{dec}$) |
| | 8022:03 | Input 2 | RW | 0x00 ($0_{dec}$) |
| | 8022:04 | Input 3 | RW | 0x00 ($0_{dec}$) |
| | 8022:05 | Input 4 | RW | 0x00 ($0_{dec}$) |
| | 8022:06 | Input 5 | RW | 0x00 ($0_{dec}$) |
| | 8022:07 | Input 6 | RW | 0x00 ($0_{dec}$) |
| | 8022:08 | Input 7 | RW | 0x00 ($0_{dec}$) |
| F000:0 [▶ 68] | **Subindex** | Modular device profile | RO | 0x02 ($2_{dec}$) |
| | F000:01 | Module index distance | RO | 0x0010 ($16_{dec}$) |
| | F000:02 | Maximum number of modules | RO | 0x0003 ($3_{dec}$) |
| F008 [▶ 68] | | Code word | RW | 0x00000000 ($0_{dec}$) |
| F010:0 [▶ 68] | **Subindex** | Module list | RW | 0x03 ($3_{dec}$) |
| | F010:01 | SubIndex 001 | RW | 0x00000096 ($150_{dec}$) |
| | F010:02 | SubIndex 002 | RW | 0x00000096 ($150_{dec}$) |
| | F010:03 | SubIndex 003 | RW | 0x00000118 ($280_{dec}$) |

| Index (hex) | | Name | Flags | Default value |
|---|---|---|---|---|
| F600:0 [▶ 68] | **Subindex** | DIG Inputs | RO | 0x10 ($16_{dec}$) |
| | F600:02 | Error channel 1 | RO | 0x00 ($0_{dec}$) |
| | F600:03 | Error channel 2 | RO | 0x00 ($0_{dec}$) |
| | F600:0E | Sync error | RO | 0x00 ($0_{dec}$) |
| | F600:0F | TxPDO State | RO | 0x00 ($0_{dec}$) |
| | F600:10 | TxPDO Toggle | RO | 0x00 ($0_{dec}$) |

**Key**

Flags:
RO (Read Only): this object can be read only
RW (Read/Write): this object can be read and written to

## 4.3.2 Object description and parameterization

**Parameterization**

The terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (assignment of PDOs).

**EtherCAT XML Device Description**

The display matches that of the CoE objects from the EtherCAT XML Device Description. We recommend downloading the latest XML file from the download area on the Beckhoff website (http://www.beckhoff.de/german/default.htm?download/elconfg.htm) and installing it according to the installation instructions.

**Introduction**

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 60] during commissioning
- Objects intended for regular operation, e.g. through ADS access.
- Objects for indicating internal settings (may be fixed)
- Further profile-specific objects [▶ 67] indicating inputs, outputs and status information

The following section first describes the objects required for normal operation, followed by a complete overview of missing objects.

**Additional objects**

### 4.3.2.1 Objects to be parameterized during commissioning

**Index 1011 Restore default parameters**

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1011:0 | Restore default parameters | Restore default parameters | UINT8 | RO | 0x01 ($1_{dec}$) |
| 1011:01 | SubIndex 001 | If this object is set to "**0x64616F6C**" in the set value dialog, all backup objects are reset to their delivery state. | UINT32 | RW | 0x00000000 ($0_{dec}$) |

### Index 8000 CNT Settings

| Index (hex) | Name | Meaning | | Data type | Flags | Default |
|---|---|---|---|---|---|---|
| 8000:0 | CNT Settings | Maximum subindex | | UINT8 | RO | 0x13 ($19_{dec}$) |
| 8000:03 | Enable reload | The counter counts to the value in index 0x8000:13 [▶ 61] | | BOOLEAN | RW | 0x00 ($0_{dec}$) |
| 8000:04 | Count down | Counting direction: | | BOOLEAN | RW | 0x00 ($0_{dec}$) |
| | | $0_{bin}$ | Forward | | | |
| | | $1_{bin}$ | Down | | | |
| 8000:05 | Operating mode | Operation mode | | BIT2 | RW | 0x01 ($1_{dec}$) |
| | | $01_{bin}$ | Enable pos. gate (gate inhibits with positive level) | | | |
| | | $10_{bin}$ | Enable neg. gate (gate inhibits with negative level) | | | |
| 8000:13 | Counter reload value | The limit that can be activated via "Enable reload" (index 0x8000:03 [▶ 61]).<br>If counting upward, the counter counts up to this limit and, on exceeding it, starts again from zero. If counting downward, the counter counts down to 0 and, on falling below 0, is reloaded with the value from this register. | | UINT32 | RW | 0x00000000 ($0_{dec}$) |

### Index 8010 CNT Settings

| Index (hex) | Name | Meaning | | Data type | Flags | Default |
|---|---|---|---|---|---|---|
| 8010:0 | CNT Settings | Maximum subindex | | UINT8 | RO | 0x13 ($19_{dec}$) |
| 8010:03 | Enable reload | The counter counts to the value in index 0x8010:13 [▶ 61] | | BOOLEAN | RW | 0x00 ($0_{dec}$) |
| 8010:04 | Count down | Counting direction: | | BOOLEAN | RW | 0x00 ($0_{dec}$) |
| | | $0_{bin}$ | Forward | | | |
| | | $1_{bin}$ | Down | | | |
| 8010:05 | Operating mode | Operation mode | | BIT2 | RW | 0x01 ($1_{dec}$) |
| | | $01_{bin}$ | Enable pos. gate (gate inhibits with positive level) | | | |
| | | $10_{bin}$ | Enable neg. gate (gate inhibits with negative level) | | | |
| 8010:13 | Counter reload value | The limit that can be activated via "Enable reload" (index 0x8010:03 [▶ 61]).<br>If counting upward, the counter counts up to this limit and, on exceeding it, starts again from zero. If counting downward, the counter counts down to 0 and, on falling below 0, is reloaded with the value from this register. | | UINT32 | RW | 0x00000000 ($0_{dec}$) |

### Index 8022 DIG Filter Settings

| Index (hex) | Name | Meaning | | Data type | Flags | Default |
|---|---|---|---|---|---|---|
| 8022:0 | DIG Filter Settings | Maximum subindex | | UINT8 | RO | 0x08 ($8_{dec}$) |
| 8022:01 | Input 0 | Filter time for the input | | UINT8 | RW | 0x00 ($0_{dec}$) |
| | | $0_{dec}$ | 10 µs | | | |
| | | $1_{dec}$ | 200 µs | | | |
| | | $2_{dec}$ | 1 ms | | | |
| | | $3_{dec}$ | 3 ms | | | |
| | | $4_{dec}$ | 10 ms | | | |
| | | $5_{dec}$ | 100 ms | | | |
| 8022:02 | Input 1 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:03 | Input 2 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:04 | Input 3 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:05 | Input 4 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:06 | Input 5 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:07 | Input 6 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |
| 8022:08 | Input 7 | see 0x8022:01 [▶ 61] | | UINT8 | RW | 0x00 ($0_{dec}$) |

### 4.3.2.2 Standard objects (0x1000-0x1FFF)

The standard objects have the same meaning for all EtherCAT slaves.

#### Index 1000 Device type

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1000:0 | Device type | Device type of the EtherCAT slave: The Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile. | UINT32 | RO | 0x00001389 ($5001_{dec}$) |

#### Index 1008 Device name

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1008:0 | Device name | Device name of the EtherCAT slave | STRING | RO | EP1518-0002 |

#### Index 1009 Hardware version

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1009:0 | Hardware version | Hardware version of the EtherCAT slave | STRING | RO | 00 |

#### Index 100A Software Version

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 100A:0 | Software version | Firmware version of the EtherCAT slave | STRING | RO | 01.03 |

#### Index 1018 Identity

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1018:0 | Identity | Information for identifying the slave | UINT8 | RO | 0x04 ($4_{dec}$) |
| 1018:01 | Vendor ID | Vendor ID of the EtherCAT slave | UINT32 | RO | 0x00000002 ($2_{dec}$) |
| 1018:02 | Product code | Product code of the EtherCAT slave | UINT32 | RO | 0x05EE4052 ($99500114_{dec}$) |
| 1018:03 | Revision | Revision number of the EtherCAT slave; the low word (bit 0-15) indicates the special terminal number, the high word (bit 16-31) refers to the device description | UINT32 | RO | 0x00100002 ($1048578_{dec}$) |
| 1018:04 | Serial number | Serial number of the EtherCAT slave; the low byte (bit 0-7) of the low word contains the year of production, the high byte (bit 8-15) of the low word contains the week of production, the high word (bit 16-31) is 0 | UINT32 | RO | 0x00000000 ($0_{dec}$) |

#### Index 10F0 Backup parameter handling

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 10F0:0 | Backup parameter handling | Information for standardized loading and saving of backup entries | UINT8 | RO | 0x01 ($1_{dec}$) |
| 10F0:01 | Checksum | Checksum across all backup entries of the EtherCAT slave | UINT32 | RO | 0x00000000 ($0_{dec}$) |

#### Index 1600 CNT RxPDO-Map Outputs Ch.1

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1600:0 | CNT RxPDO-Map Outputs Ch.1 | PDO Mapping RxPDO 1 | UINT8 | RO | 0x05 ($5_{dec}$) |
| 1600:01 | SubIndex 001 | 1. PDO Mapping entry (object 0x7040 (DO Outputs), entry 0x01 (Output 0)) | UINT32 | RO | 0x0000:00, 2 |
| 1600:02 | SubIndex 002 | 2. PDO Mapping entry (15 bits align) | UINT32 | RO | 0x7000:03, 1 |
| 1600:03 | SubIndex 003 | 3. PDO Mapping entry (object 0x7010 (CNT Outputs), entry 0x03 (Set counter)) | UINT32 | RO | 0x7000:04, 1 |
| 1600:04 | SubIndex 004 | 4. PDO Mapping entry (object 0x7010 (CNT Outputs), entry 0x04 (Inhibit counter)) | UINT32 | RO | 0x0000:00, 12 |
| 1600:05 | SubIndex 005 | 5. PDO Mapping entry (12 bits align) | UINT32 | RO | 0x7000:11, 32 |

### Index 1601 CNT RxPDO-Map OutputsCh.2

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1601:0 | CNT RxPDO-Map Outputs Ch.2 | PDO Mapping RxPDO 2 | UINT8 | RO | 0x05 ($5_{dec}$) |
| 1601:01 | SubIndex 001 | 1. PDO Mapping entry (object 0x7020 (CNT Outputs), entry 0x01 (Enable output functions)) | UINT32 | RO | 0x0000:00, 2 |
| 1601:02 | SubIndex 002 | 2. PDO Mapping entry (object 0x7020 (CNT Outputs), entry 0x02 (Set output)) | UINT32 | RO | 0x7010:03, 1 |
| 1601:03 | SubIndex 003 | 3. PDO Mapping entry (object 0x7020 (CNT Outputs), entry 0x03 (Set counter)) | UINT32 | RO | 0x7010:04, 1 |
| 1601:04 | SubIndex 004 | 4. PDO Mapping entry (object 0x7020 (CNT Outputs), entry 0x04 (Inhibit counter)) | UINT32 | RO | 0x0000:00, 12 |
| 1601:05 | SubIndex 005 | 5. PDO Mapping entry (12 bits align) | UINT32 | RO | 0x7010:11, 32 |

### Index 1A00 CNT TxPDO-Map InputsCh.1

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1A00:0 | CNT TxPDO-Map InputsCh.1 | PDO Mapping TxPDO 1 | UINT8 | RO | 0x0A ($10_{dec}$) |
| 1A00:01 | SubIndex 001 | 1. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x01 (Input 0)) | UINT32 | RO | 0x0000:00, 2 |
| 1A00:02 | SubIndex 002 | 2. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x02 (Input 1)) | UINT32 | RO | 0x6000:03, 1 |
| 1A00:03 | SubIndex 003 | 3. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x03 (Input 2)) | UINT32 | RO | 0x6000:04, 1 |
| 1A00:04 | SubIndex 004 | 4. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x04 (Input 3)) | UINT32 | RO | 0x6000:05, 1 |
| 1A00:05 | SubIndex 005 | 5. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x05 (Input 4)) | UINT32 | RO | 0x6000:06, 1 |
| 1A00:06 | SubIndex 006 | 6. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x06 (Input 5)) | UINT32 | RO | 0x0000:00, 7 |
| 1A00:07 | SubIndex 007 | 7. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x06 (Input 6)) | UINT32 | RO | 0x6000:0E, 1 |
| 1A00:08 | SubIndex 008 | 8. PDO Mapping entry (object 0x6000 (DI Inputs Ch.1), entry 0x08 (Input 7)) | UINT32 | RO | 0x6000:0F, 1 |
| 1A00:09 | SubIndex 009 | 9. PDO Mapping entry (8 bits align) | UINT32 | RO | 0x6000:10, 1 |
| 1A00:0A | SubIndex 010 | 10. PDO Mapping entry (object 0x6000 (CNT Inputs), entry 0x11 (Counter value)) | UINT32 | RO | 0x6000:11, 32 |

### Index 1A01 CNT TxPDO-Map InputsCh.2

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1A01:0 | CNT TxPDO-Map Inputs Ch.2 | PDO Mapping TxPDO 2 | UINT8 | RO | 0x0A ($10_{dec}$) |
| 1A01:01 | SubIndex 001 | 1. PDO Mapping entry (15 bits align) | UINT32 | RO | 0x0000:00, 2 |
| 1A01:02 | SubIndex 002 | 2. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x10 (TxPDO Toggle)) | UINT32 | RO | 0x6010:03, 1 |
| 1A01:03 | SubIndex 003 | 3. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x11 (Counter value)) | UINT32 | RO | 0x6010:04, 1 |
| 1A01:04 | SubIndex 004 | 4. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x04 (Counter inhibited)) | UINT32 | RO | 0x6010:05, 1 |
| 1A01:05 | SubIndex 005 | 5. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x05 (Status of input UD)) | UINT32 | RO | 0x6010:06, 1 |
| 1A01:06 | SubIndex 006 | 6. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x06 (Status of input clock)) | UINT32 | RO | 0x0000:00, 7 |
| 1A01:07 | SubIndex 007 | 7. PDO Mapping entry (8 bits align) | UINT32 | RO | 0x6010:0E, 1 |
| 1A01:08 | SubIndex 008 | 8. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x0F (TxPDO State)) | UINT32 | RO | 0x6010:0F, 1 |
| 1A01:09 | SubIndex 009 | 9. PDO Mapping entry (object 0x6020 (CNT Inputs), entry 0x10 (TxPDO Toggle)) | UINT32 | RO | 0x6010:10, 1 |
| 1A01:0A | SubIndex 010 | 10. PDO Mapping entry (object 0x6010 (CNT Inputs), entry 0x11 (Counter value)) | UINT32 | RO | 0x6010:11, 32 |

### Index 1A02 DIG TxPDO-Map Inputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1A02:0 | DIG TxPDO-Map Inputs | PDO Mapping TxPDO 3 | UINT8 | RO | 0x09 ($9_{dec}$) |
| 1A02:01 | SubIndex 001 | 1. PDO Mapping entry (2 bits align) | UINT32 | RO | 0x6020:01, 1 |
| 1A02:02 | SubIndex 002 | 2. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x03 (Set counter done)) | UINT32 | RO | 0x6020:02, 1 |
| 1A02:03 | SubIndex 003 | 3. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x04 (Counter underflow)) | UINT32 | RO | 0x6020:03, 1 |
| 1A02:04 | SubIndex 004 | 4. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x05 (Counter overflow)) | UINT32 | RO | 0x6020:04, 1 |
| 1A02:05 | SubIndex 005 | 5. PDO Mapping entry (3 bits align) | UINT32 | RO | 0x6020:05, 1 |
| 1A02:06 | SubIndex 006 | 6. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x09 (Status of input A)) | UINT32 | RO | 0x6020:06, 1 |
| 1A02:07 | SubIndex 007 | 7. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x0A (Status of input B)) | UINT32 | RO | 0x6020:07, 1 |
| 1A02:08 | SubIndex 008 | 8. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x0B (Status of input C)) | UINT32 | RO | 0x6020:08, 1 |
| 1A02:09 | SubIndex 009 | 9. PDO Mapping entry (4 bits align) | UINT32 | RO | 0x0000:00, 8 |

### Index 1A03 DIG TxPDO-Map Inputs Device

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1A03:0 | DIG TxPDO-Map Inputs Device | PDO Mapping TxPDO 4 | UINT8 | RO | 0x07 ($7_{dec}$) |
| 1A03:01 | SubIndex 001 | 1. PDO Mapping entry (1 bits align) | UINT32 | RO | 0x0000:00, 1 |
| 1A03:02 | SubIndex 002 | 2. PDO Mapping entry (object 0xF600 (DIG Inputs), entry 0x02 (Error channel 1)) | UINT32 | RO | 0xF600:02, 1 |
| 1A03:03 | SubIndex 003 | 3. PDO Mapping entry (object 0xF600 (DIG Inputs), entry 0x03 (Error channel 2)) | UINT32 | RO | 0xF600:03, 1 |
| 1A03:04 | SubIndex 004 | 4. PDO Mapping entry (10 bits align) | UINT32 | RO | 0x0000:00, 10 |
| 1A03:05 | SubIndex 005 | 5. PDO Mapping entry (object 0xF600 (DIG Inputs), entry 0x0E (Sync error)) | UINT32 | RO | 0xF600:0E, 1 |
| 1A03:06 | SubIndex 006 | 6. PDO Mapping entry (1 bits align) | UINT32 | RO | 0xF600:0F, 1 |
| 1A03:07 | SubIndex 007 | 7. PDO Mapping entry (object 0xF600 (DIG Inputs), entry 0x10 (TxPDO Toggle)) | UINT32 | RO | 0xF600:10, 1 |

### Index 1C00 Sync manager type

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1C00:0 | Sync manager type | Using the sync managers | UINT8 | RO | 0x04 ($4_{dec}$) |
| 1C00:01 | SubIndex 001 | Sync-Manager Type Channel 1: Mailbox Write | UINT8 | RO | 0x01 ($1_{dec}$) |
| 1C00:02 | SubIndex 002 | Sync-Manager Type Channel 2: Mailbox Read | UINT8 | RO | 0x02 ($2_{dec}$) |
| 1C00:03 | SubIndex 003 | Sync-Manager Type Channel 3: Process Data Write (Outputs) | UINT8 | RO | 0x03 ($3_{dec}$) |
| 1C00:04 | SubIndex 004 | Sync-Manager Type Channel 4: Process Data Read (Inputs) | UINT8 | RO | 0x04 ($4_{dec}$) |

### Index 1C12 RxPDO assign

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1C12:0 | RxPDO assign | PDO Assign Outputs | UINT8 | RW | 0x02 ($2_{dec}$) |
| 1C12:01 | Subindex 001 | 1. allocated RxPDO (contains the index of the associated RxPDO mapping object) | UINT16 | RW | 0x1600 ($5632_{dec}$) |
| 1C12:02 | Subindex 002 | 2. allocated RxPDO (contains the index of the associated RxPDO mapping object) | UINT16 | RW | 0x1601 ($5633_{dec}$) |

### Index 1C13 TxPDO assign

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1C13:0 | TxPDO assign | PDO Assign Inputs | UINT8 | RW | 0x04 ($4_{dec}$) |
| 1C13:01 | Subindex 001 | 1. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16 | RW | 0x1A00 ($6656_{dec}$) |
| 1C13:02 | Subindex 002 | 2. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16 | RW | 0x1A01 ($6657_{dec}$) |
| 1C13:03 | Subindex 003 | 3. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16 | RW | 0x1A02 ($6658_{dec}$) |
| 1C13:04 | Subindex 004 | 4. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16 | RW | 0x1A03 ($6659_{dec}$) |

### Index 1C32 SM output parameter

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1C32:0 | SM output parameter | Synchronization parameters for the outputs | UINT8 | RO | 0x20 ($32_{dec}$) |
| 1C32:01 | Sync mode | • 0: Free Run<br>• 1: Synchronous with SM 2 event<br>• 2: DC-Mode - Synchronous with SYNC0 Event<br>• 3: DC-Mode - Synchronous with SYNC1 event | UINT16 | RW | 0x0001 ($1_{dec}$) |
| 1C32:02 | Cycle time | Cycle time (in ns):<br>• Synchronous with SM 2 event: Master cycle time<br>• DC mode: SYNC0/SYNC1 Cycle Time | UINT32 | RW | 0x000F4240 ($1000000_{dec}$) |
| 1C32:03 | Shift time | Time between SYNC0 event and output of the outputs (in ns, DC mode only) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C32:04 | Sync modes supported | Supported synchronization modes:<br>• Bit 0 = 1: free run is supported<br>• Bit 1 = 1: synchronous with SM 2 event is supported<br>• Bit 2-3 = 01: DC mode is supported<br>• Bit 4-5 = 10: Output shift with SYNC1 event (only DC mode)<br>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 [▶ 65]) | UINT16 | RO | 0xC007 ($49159_{dec}$) |
| 1C32:05 | Minimum cycle time | Minimum cycle time (in ns) | UINT32 | RO | 0x0003D090 ($250000_{dec}$) |
| 1C32:06 | Calc and copy time | Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C32:07 | Minimum delay time | Minimum time between SYNC1 event and output of the outputs (in ns, DC mode only) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C32:08 | Command | • 0: Measurement of the local cycle time is stopped<br>• 1: Measurement of the local cycle time is started<br>The entries 0x1C32:03 [▶ 65], 0x1C32:05 [▶ 65], 0x1C32:06 [▶ 65], 0x1C32:07 [▶ 65], 0x1C32:09 [▶ 65], 0x1C33:03 [▶ 66], 0x1C33:06 [▶ 65], 0x1C33:07 [▶ 65] and 0x1C33:09 [▶ 66] are updated with the maximum measured values.<br>For a subsequent measurement the measured values are reset | UINT16 | RW | 0x0000 ($0_{dec}$) |
| 1C32:09 | Maximum delay time | Minimum time between SYNC1 event and output of the outputs (in ns, DC mode only) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C32:0B | SM event missed counter | Number of missed SM events in OPERATIONAL (DC mode only) | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C32:0C | Cycle exceeded counter | Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early) | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C32:0D | Shift too short counter | Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only) | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C32:20 | Sync error | The synchronization was not correct in the last cycle (outputs were output too late; DC mode only) | BOOLEAN | RO | 0x00 ($0_{dec}$) |

### Index 1C33 SM input parameter

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 1C33:0 | SM input parameter | Synchronization parameters for the inputs | UINT8 | RO | 0x20 ($32_{dec}$) |
| 1C33:01 | Sync mode | Current synchronization mode:<br>• 0: Free Run<br>• 1: Synchronous with SM 3 Event (no outputs available)<br>• 2: DC - Synchronous with SYNC0 Event<br>• 3: DC - Synchronous with SYNC1 Event<br>• 34: Synchronous with SM 2 event (outputs available) | UINT16 | RW | 0x0022 ($34_{dec}$) |
| 1C33:02 | Cycle time | as 0x1C32:02 [▶ 65] | UINT32 | RW | 0x000F4240 ($1000000_{dec}$) |
| 1C33:03 | Shift time | Time between SYNC0 event and reading of the inputs (in ns, only DC mode) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C33:04 | Sync modes supported | Supported synchronization modes:<br>• Bit 0: free run is supported<br>• Bit 1: Synchronous with SM 2 Event is supported (outputs available)<br>• Bit 1: Synchronous with SM 3 Event is supported (no outputs available)<br>• Bit 2-3 = 01: DC mode is supported<br>• Bit 4-5 = 01: Input shift through local event (outputs available)<br>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)<br>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 [▶ 65] or 0x1C33:08 [▶ 66]) | UINT16 | RO | 0xC007 ($49159_{dec}$) |
| 1C33:05 | Minimum cycle time | as 0x1C32:05 [▶ 65] | UINT32 | RO | 0x0003D090 ($250000_{dec}$) |
| 1C33:06 | Calc and copy time | Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode) | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C33:07 | Minimum delay time | as 0x1C32:07 [▶ 65] | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C33:08 | Command | as 0x1C32:08 [▶ 65] | UINT16 | RW | 0x0000 ($0_{dec}$) |
| 1C33:09 | Maximum delay time | as 0x1C32:09 [▶ 65] | UINT32 | RO | 0x00000000 ($0_{dec}$) |
| 1C33:0B | SM event missed counter | as 0x1C32:11 | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C33:0C | Cycle exceeded counter | as 0x1C32:12 | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C33:0D | Shift too short counter | as 0x1C32:13 | UINT16 | RO | 0x0000 ($0_{dec}$) |
| 1C33:20 | Sync error | as 0x1C32:32 | BOOLEAN | RO | 0x00 ($0_{dec}$) |

### 4.3.2.3 Profile-specific objects (0x6000-0xFFFF)

The profile-specific objects have the same meaning for all EtherCAT slaves that support the profile 5001.

#### Index 6000 CNT Inputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 6000:0 | CNT Inputs | Maximum subindex | UINT8 | RO | 0x11 ($17_{dec}$) |
| 6000:03 | Set counter done | The counter was set | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:04 | Counter inhibited | The counter is stopped for as long as this bit is set | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:05 | Status of input UD | The state of the up/down input | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:06 | Status of input clock | The state of the clock input | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:0E | Sync error | Synchronization error | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:0F | TxPDO State | Validity of the data of the associated TxPDO (0 = valid, 1 = invalid) | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:10 | TxPDO Toggle | The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6000:11 | Counter value | Counter value | UINT32 | RO | 0x00000000 ($0_{dec}$) |

#### Index 6010 CNT Inputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 6010:0 | CNT Inputs | Maximum subindex | UINT8 | RO | 0x11 ($17_{dec}$) |
| 6010:03 | Set counter done | The counter was set | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:04 | Counter inhibited | The counter is stopped for as long as this bit is set | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:05 | Status of input UD | The state of the up/down input | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:06 | Status of input clock | The state of the clock input | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:0E | Sync error | Synchronization error | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:0F | TxPDO State | Validity of the data of the associated TxPDO (0 = valid, 1 = invalid) | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:10 | TxPDO Toggle | The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6010:11 | Counter value | Counter value | UINT32 | RO | 0x00000000 ($0_{dec}$) |

#### Index 6020 DIG Inputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 6020:0 | DIG Inputs | Maximum subindex | UINT8 | RO | 0x08 ($8_{dec}$) |
| 6020:01 | Input 0 | Digital input 0 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:02 | Input 1 | Digital input 1 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:03 | Input 2 | Digital input 2 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:04 | Input 3 | Digital input 3 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:05 | Input 4 | Digital input 4 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:06 | Input 5 | Digital input 5 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:07 | Input 6 | Digital input 6 | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 6020:08 | Input 7 | Digital input 7 | BOOLEAN | RO | 0x00 ($0_{dec}$) |

#### Index 7000 CNT Outputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 7000:0 | CNT Outputs | Maximum subindex | UINT8 | RO | 0x11 ($17_{dec}$) |
| 7000:03 | Set counter | Set counter value | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 7000:04 | Inhibit counter | The counter is stopped, as long as this bit is active. The previous counter state is retained. | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 7000:11 | Set counter value | This is the counter value to be set via “Set counter” (index 0x7000:03 [▶ 67]). | UINT32 | RO | 0x00000000 ($0_{dec}$) |

### Index 7010 CNT Outputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| 7010:0 | CNT Outputs | Maximum subindex | UINT8 | RO | 0x11 ($17_{dec}$) |
| 7010:03 | Set counter | Set counter value | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 7010:04 | Inhibit counter | The counter is stopped, as long as this bit is active. The previous counter state is retained. | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| 7010:11 | Set counter value | This is the counter value to be set via “Set counter” (index 0x7000:03 [▶ 68]). | UINT32 | RO | 0x00000000 ($0_{dec}$) |

### Index F000 Modular Device Profile

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| F000:0 | Modular device profile | General information for the modular device profile | UINT8 | RO | 0x02 ($2_{dec}$) |
| F000:01 | Module index distance | Index distance of the objects of the individual channels | UINT16 | RO | 0x0010 ($16_{dec}$) |
| F000:02 | Maximum number of modules | Number of channels | UINT16 | RO | 0x0003 ($3_{dec}$) |

### Index F008 Code word

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| F008:0 | Code word | reserved | UINT32 | RW | 0x00000000 ($0_{dec}$) |

### Index F010 Module List

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| F010:0 | Module list | Maximum subindex | UINT8 | RW | 0x03 ($3_{dec}$) |
| F010:01 | SubIndex 001 | reserved | UINT32 | RW | 0x00000096 ($150_{dec}$) |
| F010:02 | SubIndex 002 | reserved | UINT32 | RW | 0x00000096 ($150_{dec}$) |
| F010:03 | SubIndex 003 | reserved | UINT32 | RW | 0x00000118 ($280_{dec}$) |

### Index F600 DIG Inputs

| Index (hex) | Name | Meaning | Data type | Flags | Default |
|---|---|---|---|---|---|
| F600:0 | DIG Inputs | Maximum subindex | UINT8 | RO | 0x10 ($16_{dec}$) |
| F600:02 | Error channel 1 | If this bit is set, a short circuit has been detected in the supply voltage to sensor group 1 (inputs 0 - 3). | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| F600:03 | Error channel 2 | If this bit is set, a short circuit has been detected in the supply voltage to sensor group 2 (inputs 4 - 7). | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| F600:0E | Sync error | Synchronization error | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| F600:0F | TxPDO State | Validity of the data of the associated TxPDO (0 = valid, 1 = invalid) | BOOLEAN | RO | 0x00 ($0_{dec}$) |
| F600:10 | TxPDO Toggle | The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated | BOOLEAN | RO | 0x00 ($0_{dec}$) |

# 5 Appendix

## 5.1 General operating conditions

### Protection degrees (IP-Code)

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

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

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

*) These protection classes define only protection against water!

### Chemical Resistance

The Resistance relates to the Housing of the Fieldbus/EtherCAT Box 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<br>(ph-Value > 12) | at room temperature: resistant<br>> 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

## 5.2 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 https://www.beckhoff.com

## 5.3 Support and Service

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# List of illustrations