



**Documentation for**

**EP8309-1022**

**Multi functional I/O Box**

**Version: 2.0.0**  
**Date: 2017-11-07**

**BECKHOFF**



# Table of contents

<b>1</b>	<b>Foreword</b> .....	<b>5</b>
1.1	Notes on the documentation .....	5
1.2	Safety instructions .....	6
1.3	Documentation Issue Status .....	7
<b>2</b>	<b>Product Overview</b> .....	<b>8</b>
2.1	EtherCAT Box - Introduction .....	8
2.2	EP8309 - Introduction .....	10
2.3	EP8309 - Technical data .....	11
2.4	EP8309 - Process image .....	13
2.5	Pulse width modulation (PWM).....	15
2.6	Influencing of the PWMi output value by the parameters .....	16
<b>3</b>	<b>Basics of EtherCAT</b> .....	<b>17</b>
3.1	EtherCAT basics .....	17
3.2	Watchdog setting .....	17
3.3	EtherCAT State Machine .....	20
3.4	CoE interface .....	22
<b>4</b>	<b>Mounting and cabling</b> .....	<b>27</b>
4.1	Mounting .....	27
4.1.1	Dimensions .....	27
4.1.2	Fixing.....	28
4.2	Cabling.....	29
4.2.1	Connections .....	29
4.2.2	Nut torque for connectors .....	30
4.2.3	EtherCAT .....	32
4.2.4	Power Connection.....	35
4.2.5	Signal connection.....	41
4.2.6	UL Requirements .....	44
<b>5</b>	<b>Commissioning and Configuration</b> .....	<b>45</b>
5.1	Inserting into the EtherCAT network.....	45
5.2	Configuration via TwinCAT .....	48
5.3	Tacho analysis.....	56
5.4	Switching between PWMi and analog output .....	59
5.5	Quick start.....	60
5.6	Range settings for inputs and outputs .....	65
5.7	CoE objects .....	66
5.7.1	CoE interface .....	66
5.7.2	Object overview.....	71
5.7.3	Object description and parameterization .....	79
5.8	Restoring the delivery state .....	98
<b>6</b>	<b>Diagnostics</b> .....	<b>100</b>
<b>7</b>	<b>Appendix</b> .....	<b>101</b>
7.1	General operating conditions .....	101
7.2	Firmware Update EL/ES/EM/EPxxxx.....	102
7.2.1	Device description ESI file/XML .....	103
7.2.2	Firmware explanation.....	106

7.2.3	Updating controller firmware *.efw .....	107
7.2.4	FPGA firmware *.rbf.....	108
7.2.5	Simultaneous updating of several EtherCAT devices .....	112
7.3	EtherCAT Box- / EtherCAT P Box - Accessories.....	113
7.4	Support and Service .....	114

# 1 Foreword

## 1.1 Notes on the documentation

### Intended audience

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

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

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

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

### Disclaimer

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

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

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

### Trademarks

Beckhoff®, TwinCAT®, EtherCAT®, Safety over EtherCAT®, TwinSAFE®, XFC® and XTS® are registered trademarks of and licensed by Beckhoff Automation GmbH.

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

### Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents: EP1590927, EP1789857, 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.

The logo for EtherCAT, featuring the word "EtherCAT" in a bold, sans-serif font. A red arrow points from the top of the "A" towards the right, ending above the "T". A registered trademark symbol (®) is located to the right of the "T".

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

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## 1.2 Safety instructions

### Safety regulations

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

### Exclusion of liability






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

### Personnel qualification

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

### Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

 <b>DANGER</b>	<p><b>Serious risk of injury!</b> Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.</p>
 <b>WARNING</b>	<p><b>Risk of injury!</b> Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.</p>
 <b>CAUTION</b>	<p><b>Personal injuries!</b> Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.</p>
 <b>Attention</b>	<p><b>Damage to the environment or devices</b> Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.</p>
 <b>Note</b>	<p><b>Tip or pointer</b> This symbol indicates information that contributes to better understanding.</p>

## 1.3 Documentation Issue Status

Version	Comment
2.0.0	<ul style="list-style-type: none"> <li>• Migration</li> <li>• Technical data updated</li> </ul>
1.1.0	<ul style="list-style-type: none"> <li>• Power Connection updated</li> </ul>
1.0.0	<ul style="list-style-type: none"> <li>• First release</li> </ul>

### 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	EP8309-0002	
	Firmware	Hardware
2.0.0	06	06
1.0.0	06	03

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.: 25 13 06 03:

25 - week of production 25

13 - year of production 2013

06 - firmware version 06

03 - hardware version 03

## 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.

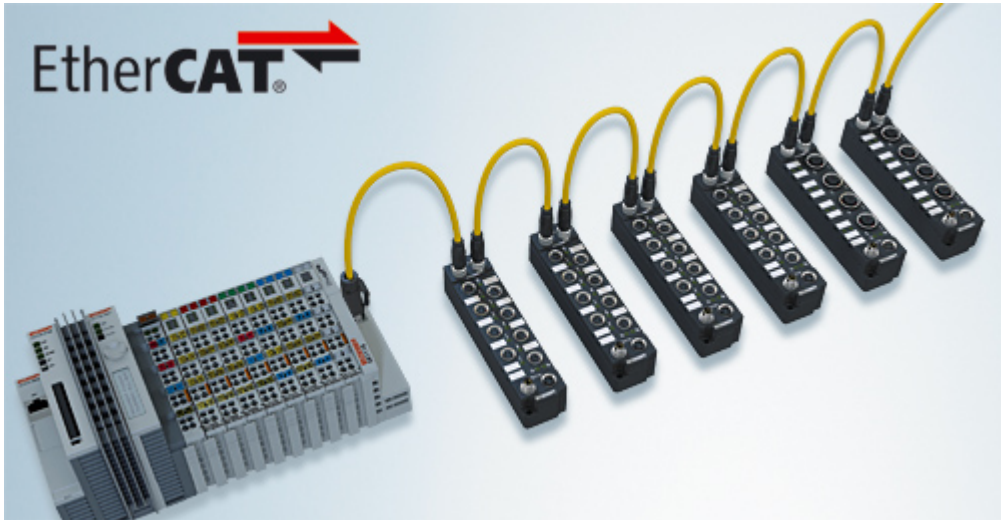


Fig. 1: EtherCAT Box Modules within an EtherCAT network

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  $\mu$ s)
- 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

	<p><b>Basic EtherCAT documentation</b></p> <p>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 (<a href="http://www.beckhoff.com">www.beckhoff.com</a>) under Downloads.</p>
	<p><b>XML files</b></p> <p>You will find XML files (XML Device Description Files) for Beckhoff EtherCAT modules on our website (<a href="http://www.beckhoff.com">www.beckhoff.com</a>) under Downloads, in the Configuration Files area.</p>

## 2.2 EP8309 - Introduction



Fig. 4: EP8309

### EtherCAT Box with different digital and analog inputs and outputs

The EP8309-x022 EtherCAT Box has various digital and analog inputs and outputs. The analog signals can be processed and output in the range 0/4...20 mA, the digital signals in the range 24 V<sub>DC</sub>.

The possible output currents are different and can be found in the technical data. The resolution for the current signals takes place with 12 bits, signed. This applies to input and output signals.

The signal channels and the 24 V<sub>DC</sub> supply have a common ground potential.

A PWMi output is integrated for connecting a proportional valve. For valves with integrated electronics, this output can alternatively be operated as an analog current output with continuous 24V supply for the valve.

### Quick links

- [Installation \[► 27\]](#)
- [Configuration \[► 48\]](#)
- [UL requirements \[► 44\]](#)

## 2.3 EP8309 - Technical data

### Fieldbus

Technical Data	EP8309-x022
Fieldbus	EtherCAT
Fieldbus connection	2 x M8 socket (green)

### Tacho inputs

Technical Data	EP8309-x022
Number of tacho inputs	1 or 2 (dual-shaft mode or single-shaft mode)
Input type	Single-shaft mode: two digital sensors on a common axis Dual-shaft mode: two digital sensors on two different axes, no direction detection, no error detection)
Tacho inputs connection [ <a href="#">▶ 41</a> ]	M12
Rated input voltage	24 V <sub>DC</sub> (-15%/+20%)
Input filter	2.5 kHz
Signal voltage "0"	-3...+5 V (EN 61131-2, type 3)
Signal voltage "1"	+11...+30 V (EN 61131-2, type 3)
Input current	typically 3 mA (EN 61131-2, type 3)
Sensor supply	from the control voltage U <sub>s</sub>
Current consumption of the sensors	max. 0.5 A, short-circuit-proof overall

### Digital inputs and outputs (DIO)

Technical Data	EP8309-x022
Number of digital inputs and outputs (DIO) [ <a href="#">▶ 42</a> ]	8
<b>Inputs</b>	
Input connections	M12
Rated input voltage	24 V <sub>DC</sub> (-15%/+20%)
Input filter	3.0 ms
Signal voltage "0"	-3...+5 V (EN 61131-2, type 3)
Signal voltage "1"	+11...+30 V (EN 61131-2, type 3)
Input current	typically 3 mA (EN 61131-2, type 3)
Sensor supply	from the control voltage U <sub>s</sub>
Current consumption of the sensors	max. 0.5 A, short-circuit-proof overall
<b>Outputs</b>	
Output connections	M12
Load type	ohmic, inductive, lamp load
Rated output voltage	24 V <sub>DC</sub> (-15%/+20%)
Output current	max. 0.5 A per channel for sockets 4 and 5 max. 1.0 A per channel for sockets 6 and 7
Short circuit current	typically 1.5 A
Output driver supply	from load voltage U <sub>p</sub>
Output driver current consumption	typically 8 mA per channel

**PWM outputs**

Technical Data	EP8309-x022
Number of PWM outputs (alternatively analog output)	1
<a href="#">Output connections [► 43]</a>	M12
Load type	ohmic/inductive > 1 mH
Supply for the output stage	24 V <sub>DC</sub> via power contacts
Output current per channel	1.2 A (short-circuit-proof, common thermal overload warning for both output stages)
PWM clock frequency	approx. 30 kHz
Rated load voltage	24 V <sub>DC</sub> (-15 %/+20 %)
Resolution	10 bit
Distributed Clocks	yes

**Analog inputs (AI)**

Technical Data	EP8309-x022
Number of analog inputs	2
<a href="#">Input connections [► 42]</a>	M12 sockets
Signal type	0...20 mA or 4...20 mA (can be set for each CoE)
Input resistance	85 Ω typ. + diode voltage
Resolution	12 bit (including sign)
Input filter limit frequency	5 kHz
Conversion time	approx. 100 μs
Measuring error	< 0,3 % (relative to full scale value)

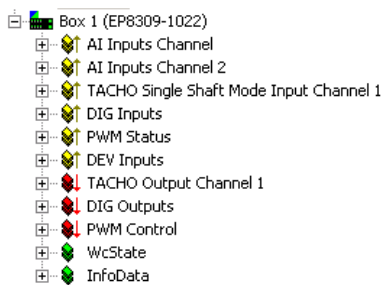
**Analog outputs (AO)**

Technical Data	EP8309-x022
Number of analog outputs (alternatively PWMi output)	1
<a href="#">Output connections [► 43]</a>	M12 sockets
Signal type	0...20 mA or 4...20 mA (can be set for each CoE)
Load	< 500 Ω
Resolution	12 bit
Conversion time	approx. 40 μs
Measuring error	< 0,3 % (relative to full scale value)

General technical data

Technical Data	EP8309-x022
Special features	Multi-function module
Module electronic supply	from the control voltage Us
Module electronic current consumption	typically 120 mA
Sensor supply	from load voltage Up, DC, any value up to 30 V
Actuator supply	from load voltage Up, DC, any value up to 30 V
Power supply connection	Power supply: 1 x M8 plug, 4-pole Onward connection: 1 x M8 socket, 4-pole
Process image	Inputs: 2 x 16 bit Outputs: 2 x 16 bit
Electrical isolation	Control voltage / fieldbus: 500 V
Weight	approx. 165 g
Permissible ambient temperature during operation	-25°C ... +60°C
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 (according to EN 60529)
Installation position	variable
Approvals	CE, cULus

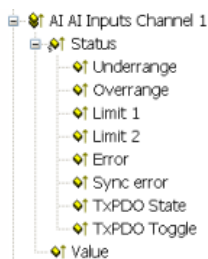
## 2.4 EP8309 - Process image



In the default setting the EP8309 is configured for:

- analog input channel 1
- analog input channel 2
- Tacho signal from two sensors on one axis (single-shaft mode)
- 6 digital inputs
- Status of PWM output
- Acknowledge / Reset in the event of a PWM error.
- 6 digital outputs
- General EtherCAT process data

### AI Inputs Channel 1 and 2



The data for the first analog channel can be found under **AI Inputs Channel 1**.

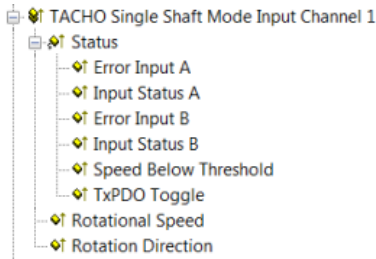
Underrange: Value of the analog input is less than 0/4 mA or -10/0 V  
Ovrerrange: Value of the analog input is greater than 20 mA or +10 V

Limit 1: with activated Limit 1 (object 0x8000:07 [▶ 80] = 1) means  
1: value less than limit 1 (set in object 0x8000:13 [▶ 80])  
2: value greater than limit 1 (set in object 0x8000:13 [▶ 80])  
3: value equal to limit 1 (set in object 0x8000:13 [▶ 80])

Limit 2: with activated Limit 2 (object 0x8000:08 [▶ 80] = 1) means  
1: value less than limit 2 (set in object 0x8000:14 [▶ 80])  
2: value greater than limit 2 (set in object 0x8000:14 [▶ 80])  
3: value equal to limit 2 (set in object 0x8000:14 [▶ 80])

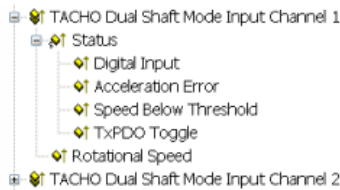
Error: This bit is set if over- or under-range was detected.

**Tacho single-shaft mode (depending on the setting in the PDO assignment)**



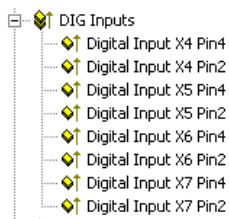
The data for the tacho input can be found under **TACHO Single Shaft Mode Input Channel 1**.  
see data under commissioning

**Tacho dual-shaft mode (depending on the setting in the PDO assignment)**



The data for the tacho input can be found under **TACHO Dual Shaft Mode Input Channel 1 or 2**.  
see data under commissioning

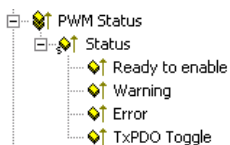
**DIG Inputs**



The data for the digital inputs can be found under **DIG Inputs**.  
X4 Pin4 -> socket 4, pin 4

....

**PWM Status**



The data for the PWM output can be found under **PWM Status**

**DEV Inputs**

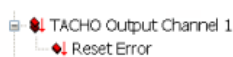


The diagnostic data for the two voltages Us and Up can be found under **DEV Inputs**.

TRUE = voltage <= approx. 18 V<sub>DC</sub>

....

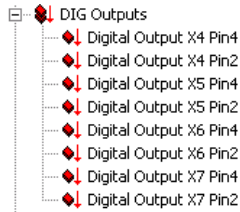
**TACHO Output Channel 1**



The control data for the tacho input can be found under **TACHO Output Channel 1**.

Reset Error - error reset

**DO Outputs**

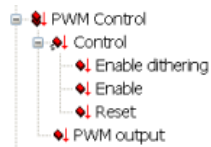


The data for the digital outputs can be found under **DO Outputs**.

X5 pin4 -> socket 5, pin 4

....

**PWM control (activated through PDO assignment 0x1602, default PWM, alternatively AO)**



The control data for the PWM output can be found under **PWM Control**.

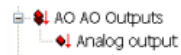
Enable Dithering -> activate dithering

Enable -> activate PWM output

Reset -> reset on error

PWM output -> load-independent current, depending on module rating (e.g. 1.2 A and setting in object 0x8060:10)

**AO outputs (activated through PDO assignment 0x1603), not activated by default**



The values for the analog output can be found under **AO Outputs**.

Analog Output - output value

**2.5 Pulse width modulation (PWM)**

The Beckhoff terminals and box modules integrate compact PWM output stages in the smallest of designs.

PWM output stages control the output current through pulse width modulation (PWM) of the supply voltage. This means that the full supply voltage is activated or deactivated at the output. The duty cycle (pulse width) is modified, but not the voltage level. The current is built up based on the load connected to the inductance.

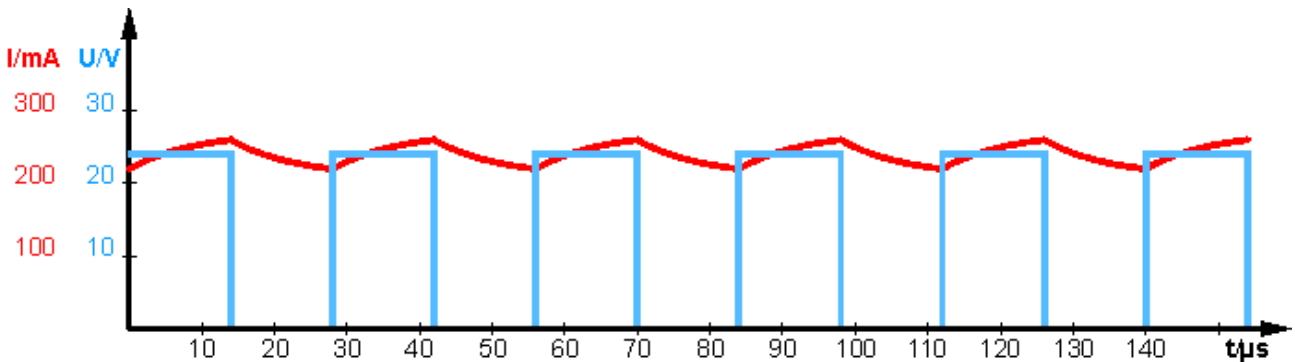


Fig. 5: Operation at load with adequate inductance

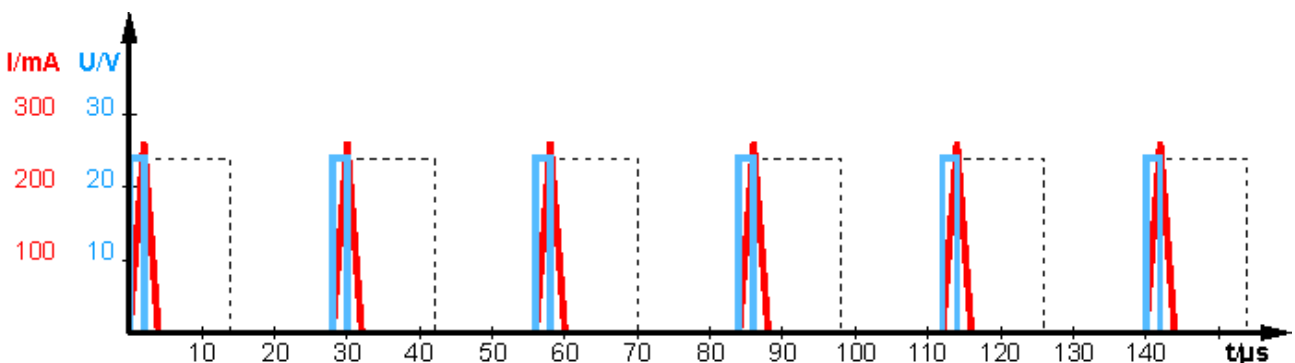



Fig. 6: Operation at load with inadequate inductance (near ohmic)

The figure *Operation at load with inadequate inductance (virtually ohmic)* illustrates operation with an inadequate inductance. Continuous current flow is not reached. The current has "gaps". This mode of operation is not permitted.

 <b>Note</b>	<p><b>Pulse width current terminals require inductive loads</b></p> <p>The load inductance should have a minimum inductance of 1 mH. Operation of the pulse width current terminals at loads with an inductance of less than 1 mH is not recommended, since the intermittent current flow prevents reference between the set value and the arithmetic mean of the current.</p>
--------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## 2.6 Influencing of the PWMi output value by the parameters

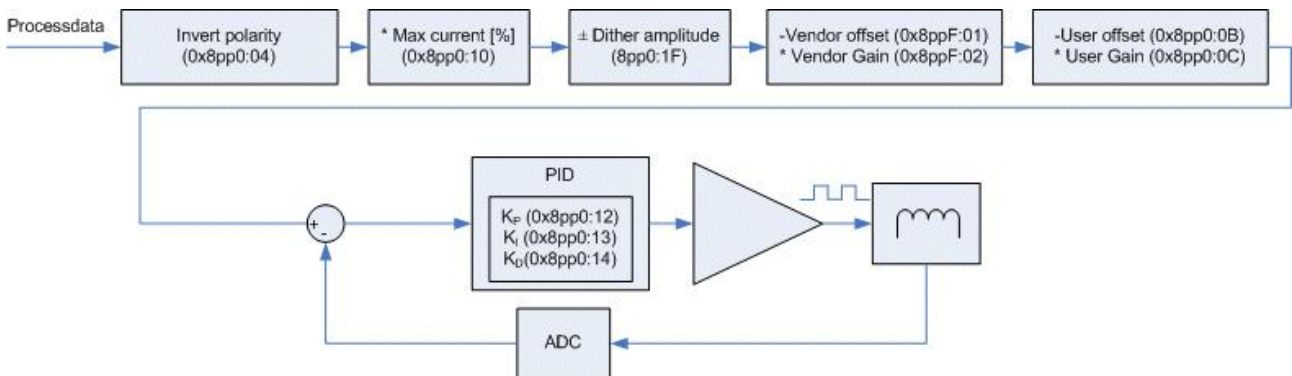


Fig. 7: Influencing of the PWMi output value

## 3 Basics of EtherCAT

### 3.1 EtherCAT basics

Basic information on the EtherCAT fieldbus can be found in the [EtherCAT system documentation](#).

### 3.2 Watchdog setting

#### General information on watchdog settings

The ELxxxx Terminals and EPxxxx Box Modules are equipped with a safety device (watchdog) that switches the outputs to a safe state after a time that can be preset, for example in the case of interrupted process data traffic, or to OFF, for example depending on device and setting.

The EtherCAT Slave Controller (ESC) has two watchdogs:

- SM watchdog (default: 100 ms)
- PDI watchdog (default: 100 ms)

#### SM Watchdog (SyncManagerWatchdog)

The SyncManager watchdog is reset after each successful EtherCAT process data communication with the terminal/box. If no EtherCAT process data communication takes place with the terminal/box for longer than the set and activated SM watchdog time, e.g. in the event of a line interruption, the watchdog is triggered and the outputs are set to FALSE. The OP status of the terminal/box is unaffected by this. The watchdog is only reset after a successful EtherCAT process data access. Set the monitoring time as specified below.

The SyncManager watchdog monitors correct and timely process data communication with the ESC from the EtherCAT side.

#### PDI watchdog (process data watchdog)

If no PDI communication with the EtherCAT slave controller (ESC) takes place for longer than the set and activated PDI watchdog time, this watchdog is triggered.

PDI (Process Data Interface) is the internal interface between the ESC and local processors in the EtherCAT slave, for example. The PDI watchdog can be used to monitor this communication for failure.

The PDI watchdog monitors correct and timely process data communication with the ESC but from the application side.

The SM and PDI watchdogs should be set separately for each slave in the TwinCAT System Manager:

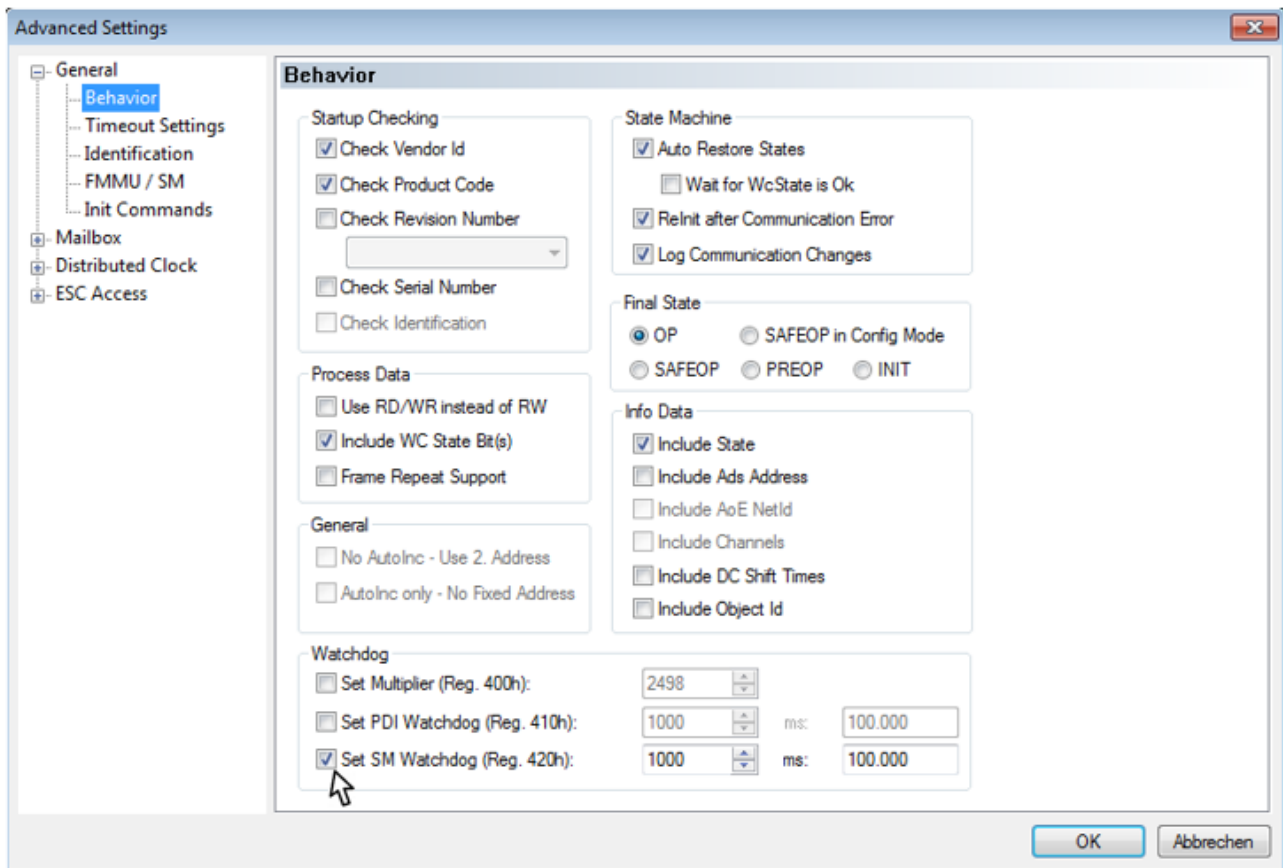


Fig. 8: EtherCAT tab --> Advanced settings --> Behavior --> Watchdog

#### Comments:

- The multiplier applies to both watchdogs.
- Each watchdog has its own timer setting, which together with the multiplier results in a time.
- Important: The multiplier/timer setting is loaded into the slave on start-up, if the corresponding checkbox is ticked. If the checkbox is not ticked, no download takes place, and the ESC setting remains unchanged.

#### Multiplier

Both watchdogs receive their pulses from the local terminal/box clock, divided by the watchdog multiplier.

$1/25 \text{ MHz} * (\text{watchdog multiplier} + 2) = 100 \text{ } \mu\text{s}$  (for default setting of 2498 for the multiplier)

The standard setting of 1000 for the SM watchdog corresponds to a release time of 100 ms.

The value in multiplier + 2 corresponds to the number of basic 40 ns ticks representing a watchdog tick.

The multiplier can be modified in order to adjust the watchdog time over a larger range.




#### Example "Set SM watchdog"

This checkbox enables manual setting of the watchdog times. If the outputs are set and the EtherCAT communication is interrupted, the SM watchdog is triggered after the set time and the outputs are deleted. This setting can be used for adapting a terminal to a slower EtherCAT master or long cycle times. The default SM watchdog setting is 100 ms. The setting range is from 0 to 65535. Together with a multiplier in a range from 1 to 65535, this covers a watchdog period of 0 to ~170 seconds.

#### Calculation

Multiplier = 2498 → watchdog base time =  $1 / 25 \text{ MHz} * (2498 + 2) = 0.0001 \text{ seconds} = 100 \text{ } \mu\text{s}$

SM watchdog = 10000 →  $10000 * 100 \text{ } \mu\text{s} = 1 \text{ second watchdog monitoring time}$

 CAUTION	<p><b>Caution! Unintended behavior of the system is possible!</b></p> <p>The function for switching off of the SM watchdog via SM watchdog = 0 is only implemented in terminals from version -0016. In previous versions this operating mode should not be used.</p>
 CAUTION	<p><b>Caution! Damage to the equipment and unintended behavior of the system is possible!</b></p> <p>If the SM watchdog is activated and a value of 0 is entered the watchdog switches off completely. This is watchdog deactivation! Outputs are then <i>NOT</i> set to a safe state, in the event of an interruption in communication!</p>
 Note	<p><b>Outputs in SAFEOP</b></p> <p>Watchdog monitoring is activated by default. It sets the outputs in the module to a safe state (e.g. OFF), depending on the <i>SAFEOP</i> and <i>OP</i> settings, and depending on the device and its settings. If this is prevented due to deactivation of watchdog monitoring in the module, outputs can be switched or remain set in device state <i>SAFEOP</i>.</p>

### 3.3 EtherCAT State Machine

The state of the EtherCAT slave is controlled via the EtherCAT State Machine (ESM). Depending upon the state, different functions are accessible or executable in the EtherCAT slave. Specific commands must be sent by the EtherCAT master to the device in each state, particularly during the bootup of the slave.

A distinction is made between the following states:

- Init
- Pre-Operational
- Safe-Operational and
- Operational
- Boot

The regular state of each EtherCAT slave after bootup is the OP state.

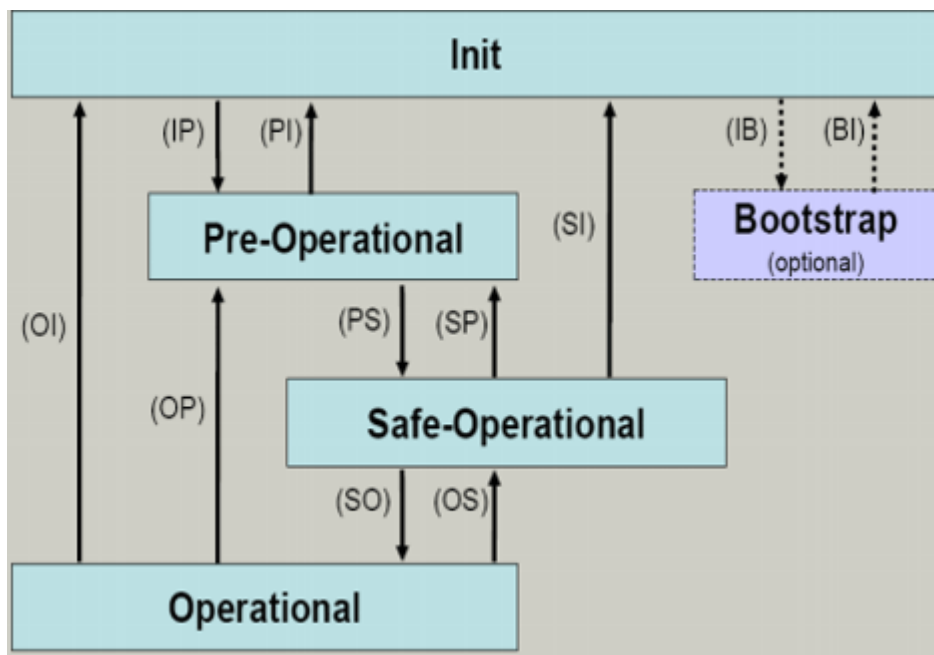


Fig. 9: EtherCAT State Machine

#### Init

After switch-on the EtherCAT slave in the *Init* state. No mailbox or process data communication is possible. The EtherCAT master initializes sync manager channels 0 and 1 for mailbox communication.

#### Pre-Operational (Pre-Op)

During the transition between *Init* and *Pre-Op* the EtherCAT slave checks whether the mailbox was initialized correctly.

In *Pre-Op* state mailbox communication is possible, but not process data communication. The EtherCAT master initializes the sync manager channels for process data (from sync manager channel 2), the FMMU channels and, if the slave supports configurable mapping, PDO mapping or the sync manager PDO assignment. In this state the settings for the process data transfer and perhaps terminal-specific parameters that may differ from the default settings are also transferred.

#### Safe-Operational (Safe-Op)

During transition between *Pre-Op* and *Safe-Op* the EtherCAT slave checks whether the sync manager channels for process data communication and, if required, the distributed clocks settings are correct. Before it acknowledges the change of state, the EtherCAT slave copies current input data into the associated DP-RAM areas of the EtherCAT slave controller (ECSC).

Mailbox and process data communication is possible in the *Safe-Op* state, but the slave keeps its outputs in the safe state. However, the input data are cyclically updated.

**Operational (Op)**

Before the EtherCAT master switches the EtherCAT slave from *Safe-Op* to *Op* it must transfer valid output data.

In the *Op* state the slave copies the output data of the masters to its outputs. Process data and mailbox communication is possible.

**Boot**

In the *Boot* state the slave firmware can be updated. The *Boot* state can only be reached via the *Init* state.

In the *Boot* state mailbox communication via the *file access over EtherCAT* (FoE) protocol is possible, but no other mailbox communication and no process data communication.

## 3.4 CoE interface

### General description

The CoE interface (CANopen over EtherCAT) is used for parameter management of EtherCAT devices. EtherCAT slaves or the EtherCAT master manage fixed (read only) or variable parameters which they require for operation, diagnostics or commissioning.

CoE parameters are arranged in a table hierarchy. In principle, the user has read access via the fieldbus. The EtherCAT master (TwinCAT System Manager) can access the local CoE lists of the slaves via EtherCAT in read or write mode, depending on the properties.

Different CoE parameter types are possible, including string (text), integer numbers, Boolean values or larger byte fields. They can be used to describe a wide range of features. Examples of such parameters include manufacturer ID, serial number, process data settings, device name, calibration values for analog measurement or passwords.

Organization takes place on 2 levels by means of hexadecimal numbering: the (main) index is named first, then the subindex. The value ranges are:

- Index 0 to 65535
- Subindex: 0...255

A parameter localized in this way is normally written as x8010:07, with preceding "x" to identify the hexadecimal numerical range and a colon between index and subindex.

The relevant ranges for EtherCAT fieldbus users are:

- x1000: This is where fixed identity information for the device is stored, including name, manufacturer, serial number etc., plus information about the current and available process data configurations.
- x8000: This is where the operational and functional parameters for all channels are stored, such as filter settings or output frequency.

Other important ranges are:

- x4000: In some EtherCAT devices the channel parameters are stored here (as an alternative to the x8000 range).
- x6000: Input PDOs ("input" from the perspective of the EtherCAT master)
- x7000: Output PDOs ("output" from the perspective of the EtherCAT master)



#### Note

#### Availability

Not every EtherCAT device must have a CoE list. Simple I/O modules without dedicated processor usually have no variable parameters and therefore no CoE list.

If a device has a CoE list, it is shown in the TwinCAT System Manager as a separate tab with a listing of the elements:

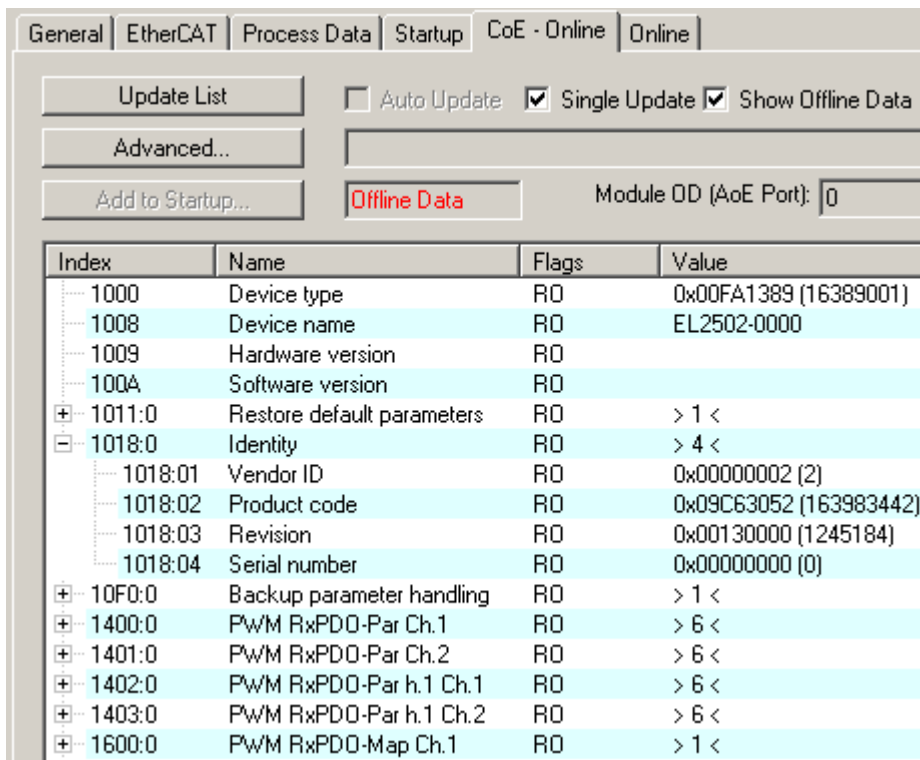



Fig. 10: CoE-Online tab

The CoE objects from x1000 to x1600, which are available in the example device "EL2502", can be seen in the above figure; the subindices from x1018 are expanded.


**Data management**

Some parameters, particularly the setting parameters of the slave, are configurable and writeable. This can be done in write or read mode

- via the System Manager (figure above) by clicking. This is useful for commissioning of the system/slaves. Click on the row of the index to be parameterized and enter a value in the *SetValue* dialog.
- from the control system/PLC via ADS, e.g. through function blocks from the TcEtherCAT.lib library This is recommended for modifications while the system is running or if no System Manager or operating staff are available.

 <b>Note</b>	<p><b>Data management</b></p> <p>If CoE parameters on the slave are changed online, this is saved fail-safe in the device (EEPROM) in Beckhoff devices. This means that the changed CoE parameters are still retained after a restart. The situation may be different with other manufacturers.</p>
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**Startup list**

 <b>Note</b>	<p><b>Startup list</b></p> <p>Changes in the local CoE list of the terminal are lost <b>if the terminal is replaced</b>. If a terminal is replaced with a new Beckhoff terminal, it will have the factory settings. It is therefore advisable to link all changes in the CoE list of an EtherCAT slave with the <b>Startup list</b> of the slave, which is processed whenever the EtherCAT fieldbus is started. In this way a replacement EtherCAT slave can automatically be parameterized with the specifications of the user.</p> <p>If EtherCAT slaves are used which are unable to store local CoE values permanently, the Startup list must be used.</p>
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**Recommended approach for manual modification of CoE parameters**

- Make the required change in the System Manager. The values are stored locally in the EtherCAT slave

- If the value is to be stored permanently, enter it in the Startup list. The order of the Startup entries is usually irrelevant.

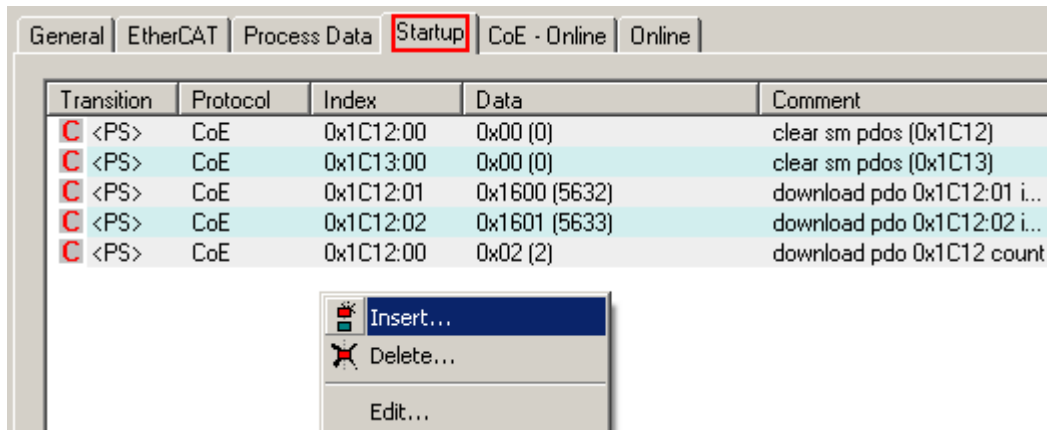


Fig. 11: Startup list in the TwinCAT System Manager

The Startup list may already contain values that were configured by the System Manager based on the ESI specifications. Additional application-specific entries can be created.

### Online/offline directory

While working with the TwinCAT System Manager, a distinction has to be made whether the EtherCAT device is "available", i.e. switched on and linked via EtherCAT and therefore **online**, or whether a configuration is created **offline** without connected slaves.

In both cases a CoE directory is visible according to the figure "CoE-Online tab", but the connectivity is displayed as offline/online.

If the slave is offline

- the offline list from the ESI file is displayed. In this case modifications are not meaningful or possible.
- the configured status is shown under Identity
- no firmware or hardware version is displayed, since these are features of the physical device.
- Offline is shown in red

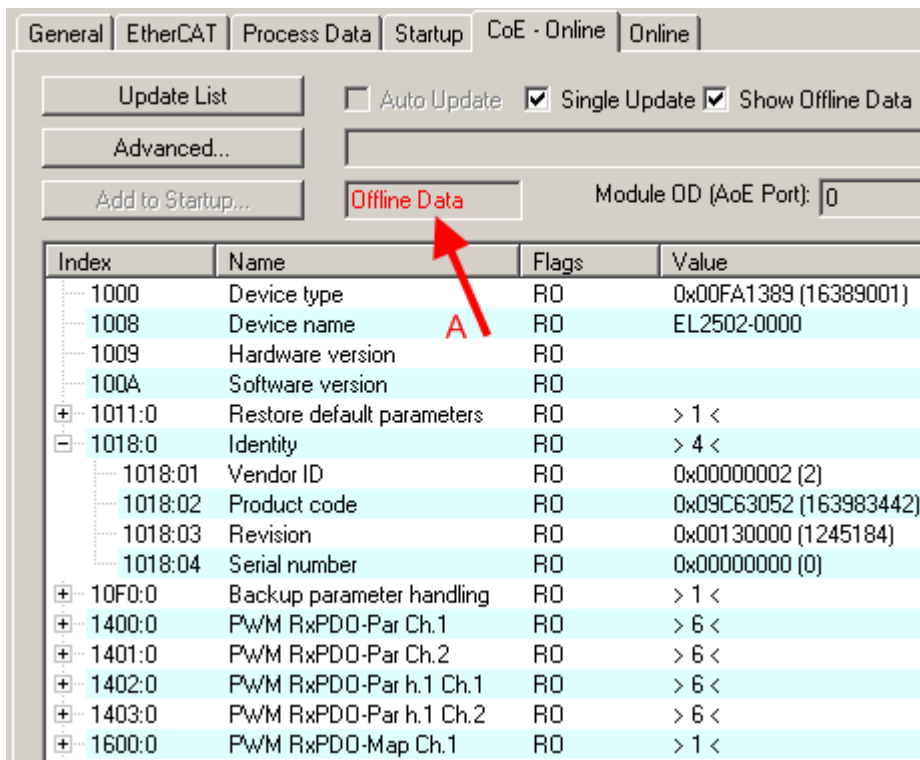


Fig. 12: Offline list

If the slave is online

- the actual current slave directory is read. This may take several seconds, depending on the size and cycle time.
- the actual identity is displayed
- the firmware and hardware version of the equipment according to the electronic information is displayed.
- Online is shown in green

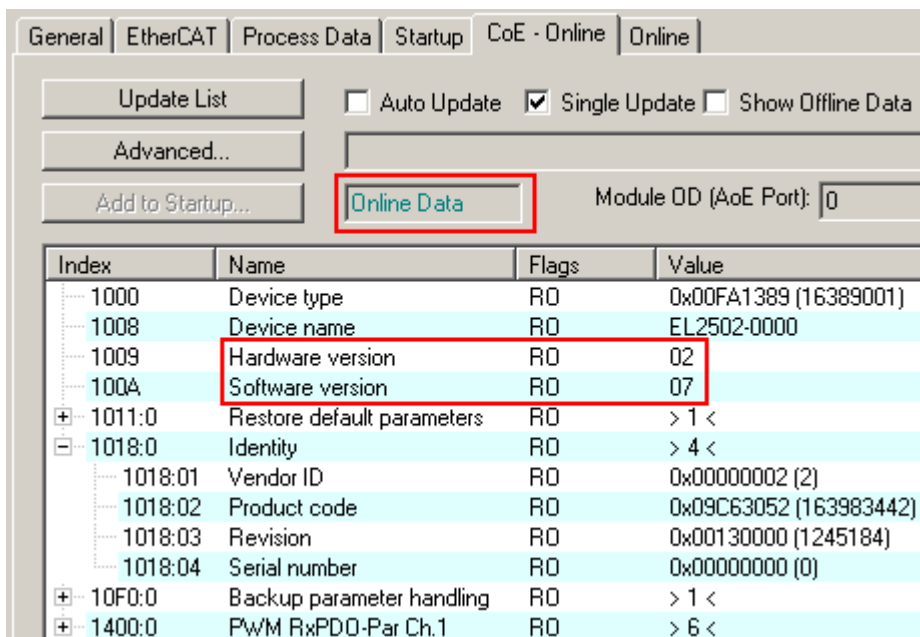


Fig. 13: Online list

### Channel-based order

The CoE directory is located in EtherCAT devices that usually encompass several functionally equivalent channels. e.g. a 4-channel 0 – 10 V analog input terminal also has 4 logical channels and thus 4 identical sets of parameter data for the channels. In order to avoid having to list each channel in the documentation, the placeholder "n" tends to be used for the individual channel numbers.

In the CoE system 16 indices, each with 255 subindices, are generally sufficient for representing all channel parameters. The channel-based order is therefore arranged in  $16_{\text{dec}}/10_{\text{hex}}$  steps. The parameter range x8000 exemplifies this:

- Channel 0: parameter range x8000:00 ... x800F:255
- Channel 1: parameter range x8010:00 ... x801F:255
- Channel 2: parameter range x8020:00 ... x802F:255
- ...

This is generally written as x80n0. Detailed information on the CoE interface can be found in the [EtherCAT system documentation](#) on the Beckhoff website.

## 4 Mounting and cabling

### 4.1 Mounting

#### 4.1.1 Dimensions

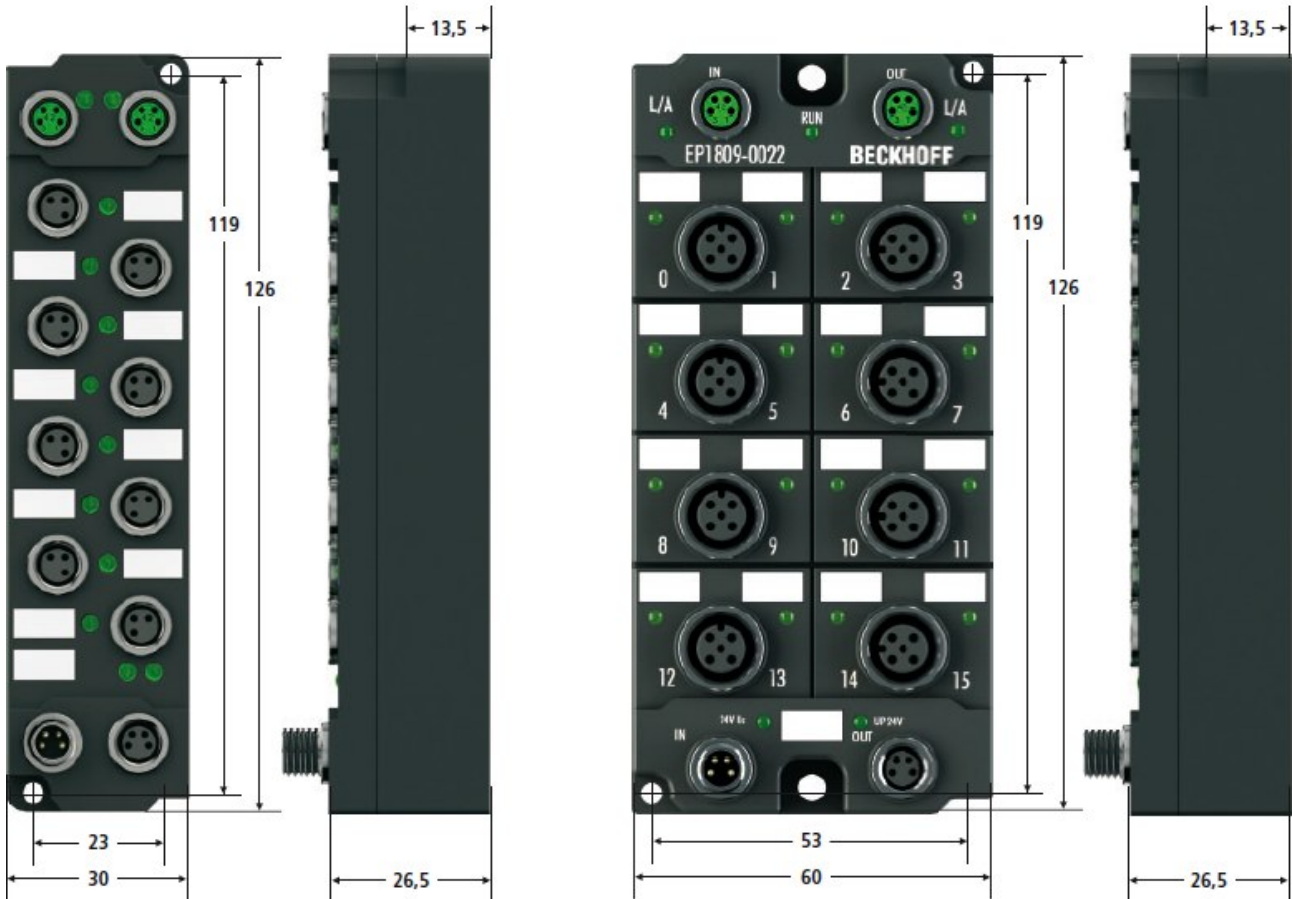


Fig. 14: Dimensions of the EtherCAT Box Modules

All dimensions are given in millimeters.

#### Housing properties

EtherCAT Box	lean body	wide body
Housing material	PA6 (polyamide)	
Casting compound	Polyurethane	
Mounting	two fastening holes Ø 3 mm for M3	two fastening holes Ø 3 mm for M3 two fastening holes Ø 4,5 mm for M4
Metal parts	Brass, nickel-plated	
Contacts	CuZn, gold-plated	
Power feed through	max. 4 A	
Installation position	variable	
Protection class	IP65, IP66, IP67 (conforms to EN 60529) when screwed together	
Dimensions (H x W x D)	ca. 126 x 30 x 26,5 mm	ca. 126 x 60 x 26,5 mm
Weight	approx. 125 g, depending on module type	approx. 250 g, depending on module type

## 4.1.2 Fixing



### Note

#### 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.

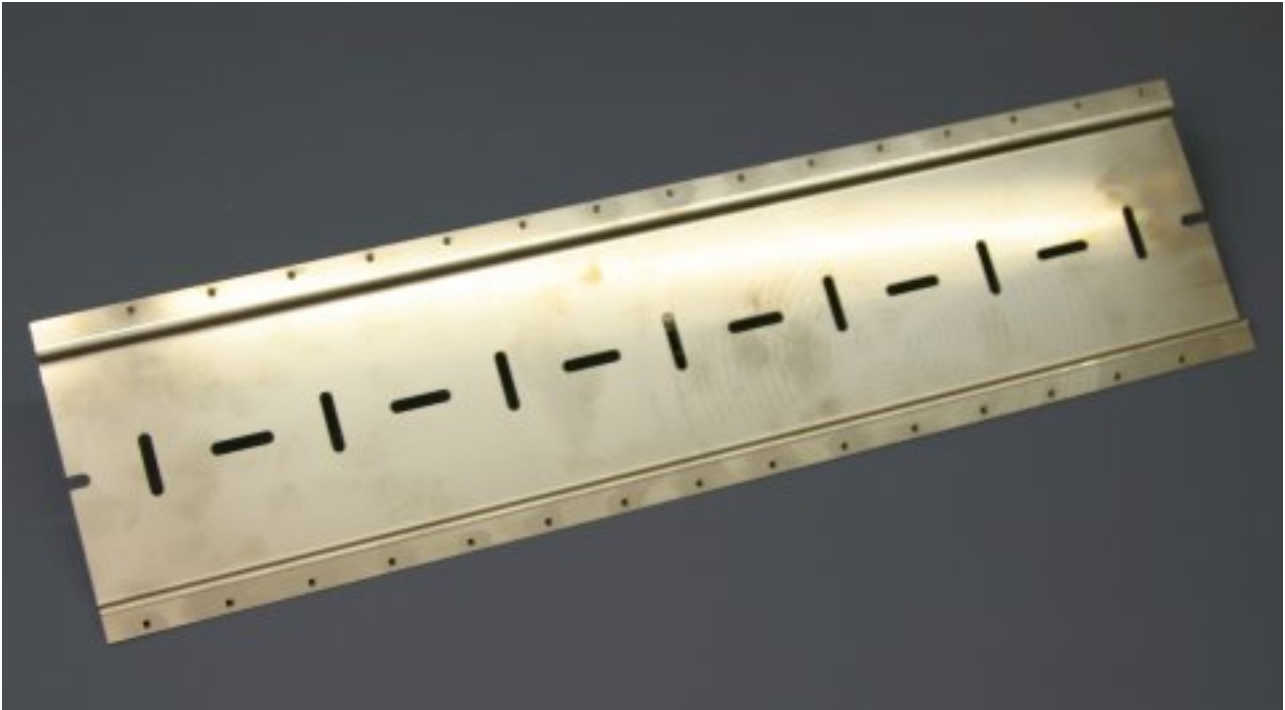


Fig. 15: Mounting Rail ZS5300-000

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 threads also pre-made M4 threads to fix 60 mm wide modules via their middle holes.

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

## 4.2 Cabling

### 4.2.1 Connections

The EP8309 has different signals that can be connected via the eight M12 sockets.

Comment	Connector	Comment
EtherCAT IN		EtherCAT OUT
Socket 1: • analog In		Socket 5: • digital In/Out channel 1 • digital In/Out channel 2
Socket 2: • analog In		Socket 6: • digital In/Out channel 1 • digital In/Out channel 2
Socket 3: • digital In channel 1 / Tacho input 1 • digital In channel 2 / Tacho input 2		Socket 7: • digital In/Out channel 3 • digital In/Out channel 4
Socket 4: • digital In/Out channel 3 • digital In/Out channel 4		Socket 8: • pulse width current output or • analog output
Power In		Power Out

## 4.2.2 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.

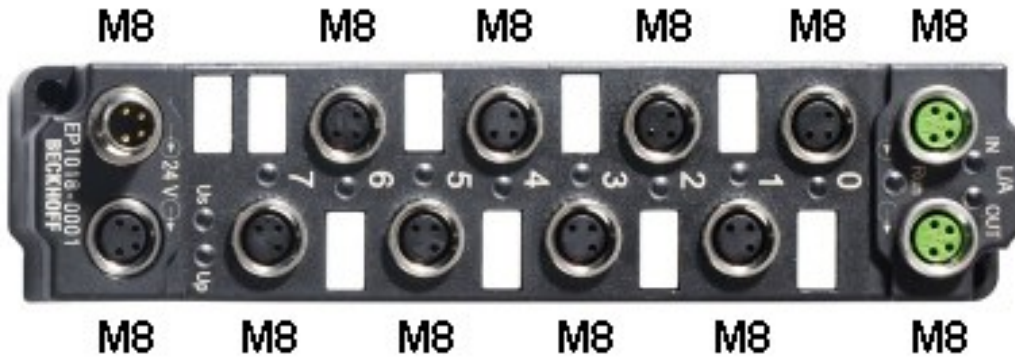


Fig. 16: EtherCAT Box with M8 connectors

### M12 connectors

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

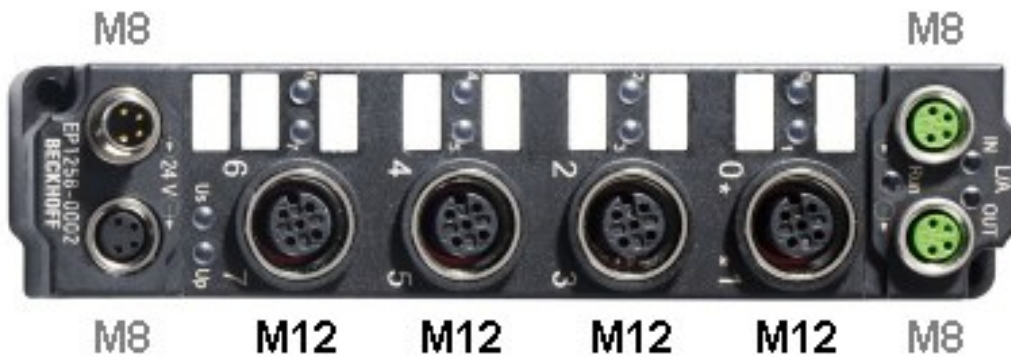


Fig. 17: EtherCAT Box with M8 and M12 connectors

**7/8" plug connectors**

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

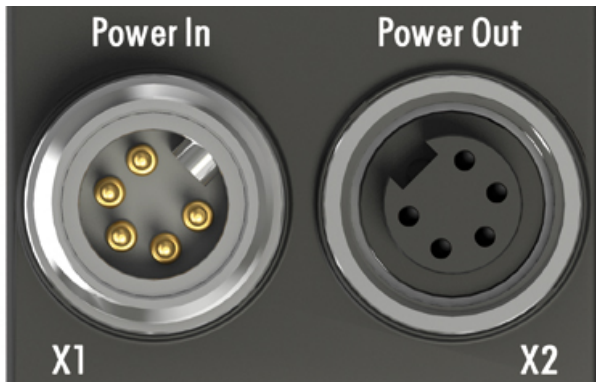


Fig. 18: 7/8" plug connectors

**Torque socket wrenches**



Fig. 19: ZB8801 torque socket wrench



**Note**

**Ensure the right torque**

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

## 4.2.3 EtherCAT

### 4.2.3.1 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

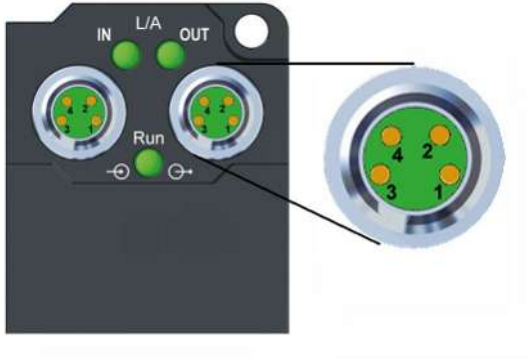


Fig. 20: EtherCAT Box: M8 (30 mm housing)

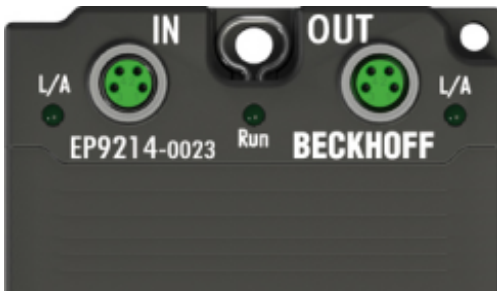


Fig. 21: EtherCAT Box: M8 60 mm housing (EP9214 for example )

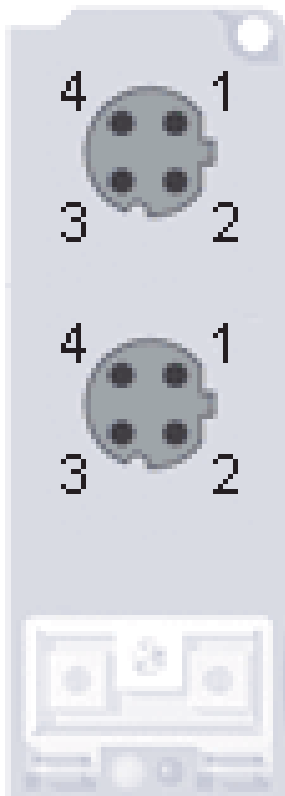


Fig. 22: Coupler Box: M12

**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 <sup>1</sup>	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 <sup>2</sup>	orange/white <sup>3</sup>	white/orange
Tx -	Transmit Data-	Pin 4	Pin 3	Pin 2	orange <sup>2</sup>	orange <sup>3</sup>	orange
Rx +	Receive Data+	Pin 2	Pin 2	Pin 3	white <sup>2</sup>	blue/white <sup>3</sup>	white/green
Rx -	Receive Data-	Pin 3	Pin 4	Pin 6	blue <sup>2</sup>	blue <sup>3</sup>	green
Shield	Shield	Housing		Shroud	Screen	Screen	Screen

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

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

<sup>3</sup>) wire colors

 <b>Note</b>	<p><b>Assimilation of color coding for cable ZB9030, ZB9032 and ZK1090-3xxxx-xxxx (with M8 connectors)</b></p> <p>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.</p>
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**EtherCAT connectors**

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

Designation	Plug connector	Comment
ZS1090-0003	RJ45	four-pin, IP20, for field assembly
ZS1090-0004	M12	four-pin, IP67, for field assembly
ZS1090-0005	RJ45	eight-pin, IP20, for field assembly, suitable for GigaBit Ethernet
ZS1090-0006	M8 male	four-pin, IP67, for field assembly, for ZB903x cable
ZS1090-0007	M8 female	four-pin, IP67, for field assembly, for ZB903x cable
ZS1090-1006	M8 male	four-pin, IP67, for field assembly up to OD = 6.5 mm
ZS1090-1007	M8 female	four-pin, IP67, for field assembly up to OD = 6.5 mm

### 4.2.3.2 EtherCAT - Fieldbus LEDs



Fig. 23: 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



**Note**

**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](http://www.beckhoff.com)) under Downloads.

## 4.2.4 Power Connection

### 4.2.4.1 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. 24: EtherCAT Box, Connectors for power supply

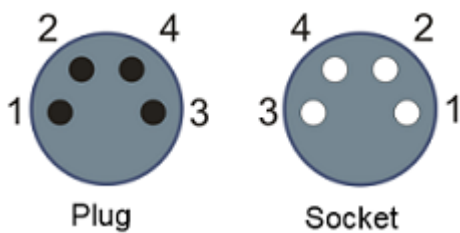


Fig. 25: Pin assignment M8, Power In and Power Out

Table 1: PIN assignment

Pin	Voltage	
1	Control voltage $U_s$ , +24 V <sub>DC</sub>	
2	Auxiliary voltage $U_p$ , +24 V <sub>DC</sub>	
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.

 <b>Attention</b>	<p><b>Don't confuse the power connectors with the EtherCAT connectors!</b></p> <p>Never connect the power cables (M8, 24 V<sub>DC</sub>) with the green marked EtherCAT sockets of the EtherCAT Box Modules! This can damage the modules!</p>
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#### Control voltage $U_s$ : 24 V<sub>DC</sub>

Power is supplied to the fieldbus, the processor logic, the inputs and the sensors from the 24 V<sub>DC</sub> control voltage  $U_s$ . The control voltage is electrically isolated from the fieldbus circuitry.

**Auxiliary voltage  $U_p$  24 V<sub>DC</sub>**

The Auxiliary voltage  $U_p$  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  $U_s$  and  $U_p$  can thus easily be transferred from EtherCAT Box to EtherCAT Box.

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

Pay attention also for the redirection of the supply voltages  $U_s$  and  $U_p$ , 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 channel power distribution modules EP9214 or EP9224 (with integrated data logging, see [www.beckhoff.com/EP9224](http://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 mm<sup>2</sup> cable cross-section can be realized.

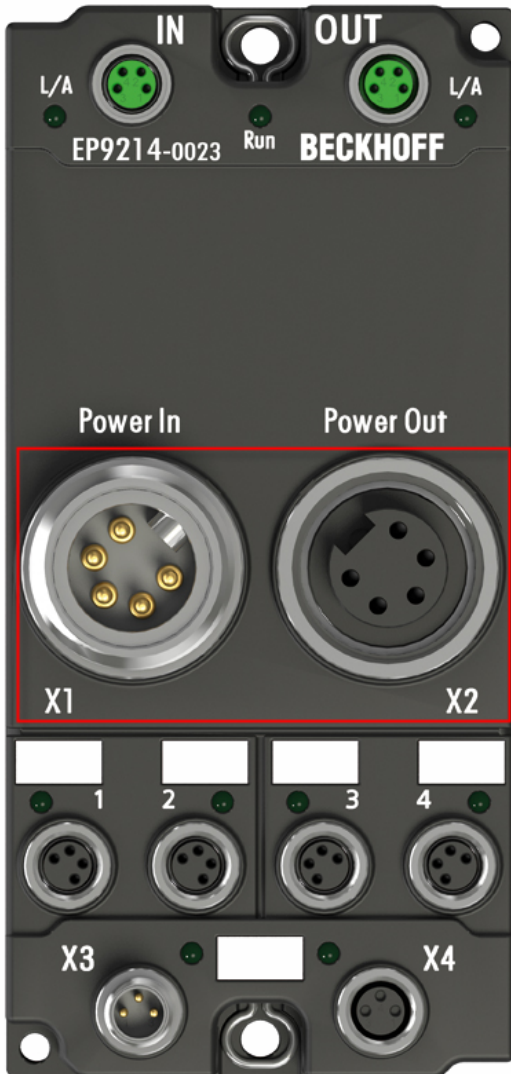


Fig. 26: EP92x4-0023, Connectors for Power In and Power Out

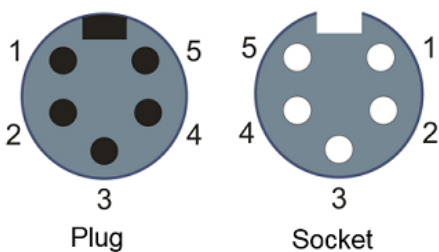


Fig. 27: Pin assignment 7/8", Power In and Power Out

## 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.



#### Attention

#### 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!

### 4.2.4.2 Status LEDs for power supply



Fig. 28: Status LEDs for power supply

#### LED display

LED	Display	Meaning
Us (Control voltage)	off	The power supply voltage Us is not present
	green illuminated	The power supply voltage Us is present
	red illuminated	Because of overload (current > 0.5 A) the sensor supply generated from power supply voltage Us was switched off for all sensors fed from this.
Up (Auxiliary voltage)	off	The power supply voltage Up is not present
	green illuminated	The power supply voltage Up is present

### 4.2.4.3 Power cable

#### Ordering data

Order identifier	Power cable	Screw connector	Contacts	Cross-section	Length
ZK2020-3200-0020	Straight socket, open end	M8	4-pole	0.34 mm <sup>2</sup>	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 connector				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 connector				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 and the associated data sheets can be found in the Beckhoff catalogue or on our website (<http://www.beckhoff.de>).

#### Technical Data

Data	
Rated voltage according to IEC61076-2-101	30 V <sub>DC</sub>
Contamination level according to IEC 60 664-1	3/2
Insulation resistance IEC 60 512-2	>10 <sup>9</sup> Ω
Current carrying capacity according to IEC 60512-3	4 A
Volume resistance according to IEC 60512-2	< 5 mΩ
Protection class conforms to IEC 60529	IP65/66/67, when screwed together
Ambient temperature	-30 °C to +80 °C

### 4.2.4.4 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.

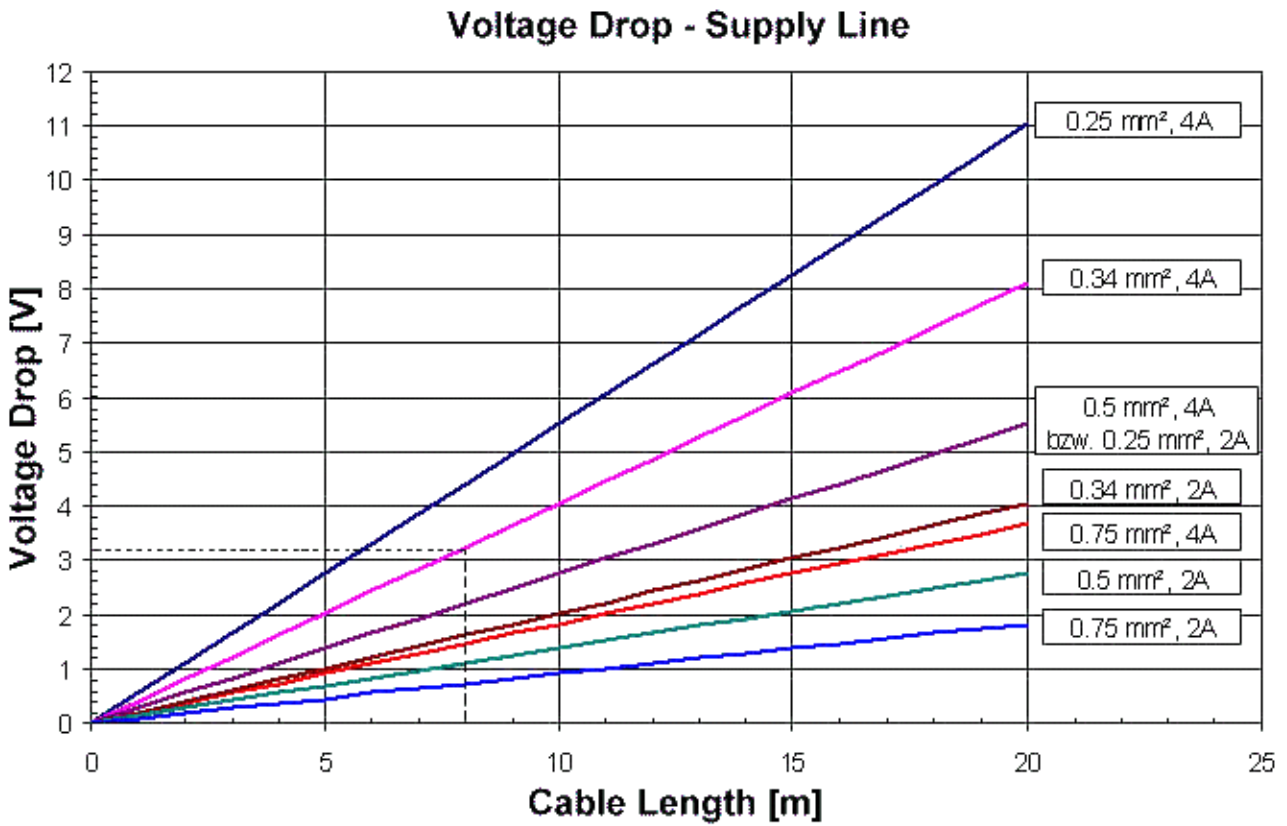


Fig. 29: Power cable conductor losses

**Example**

8 m power cable with 0.34 mm<sup>2</sup> cross-section has a voltage drop of 3.2 V at 4 A.

<p><b>Note</b></p>	<p><b>EP92x4 Power Distribution Modules</b></p> <p>With EP9214 and EP9224 Power Distribution Modules intelligent concepts for voltage supply are available. Further information may be found under <a href="http://www.beckhoff.com/EP9224">www.beckhoff.com/EP9224</a>.</p>
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## 4.2.5 Signal connection

### 4.2.5.1 Digital inputs 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 M12 connectors.

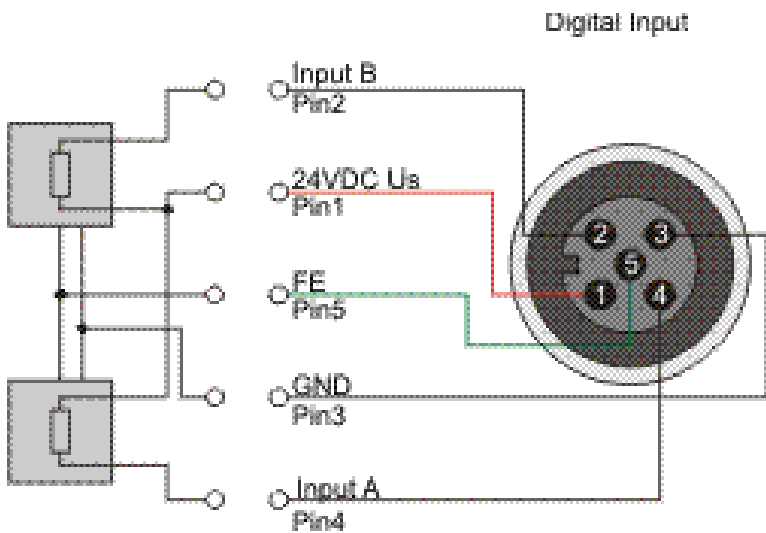


Fig. 30: Digital inputs M12

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

Light emitting diodes indicate the signal state of the inputs.

### 4.2.5.2 Digital inputs/outputs M12

The digital input/output channels connect the binary control signals from the automation device for the process level with the actuators or read digital input signals.

No configuration is required. For each channel one input or output can be connected.

If an output is used, the change in status can be verified on switch-on via the corresponding signal in the input process image.

The signals are connected via M12 connectors.

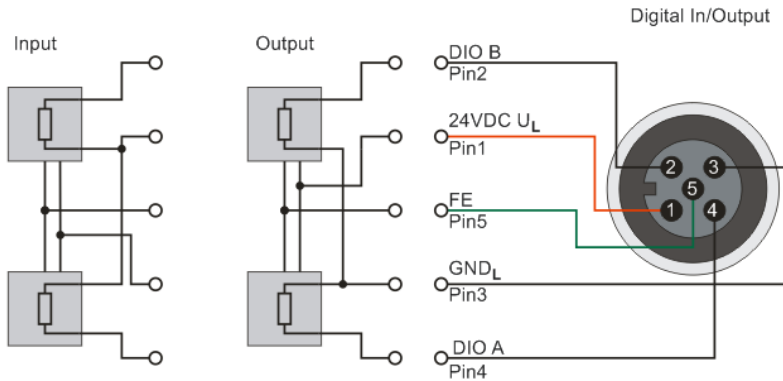


Fig. 31: Digital inputs/outputs M12

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

LEDs indicate the signal state of the outputs.

### 4.2.5.3 Analog inputs M12

The analog signal inputs pick up analog control signals from the process level and transmit them to the higher-level automation device.

The signals are connected via M12 connectors.

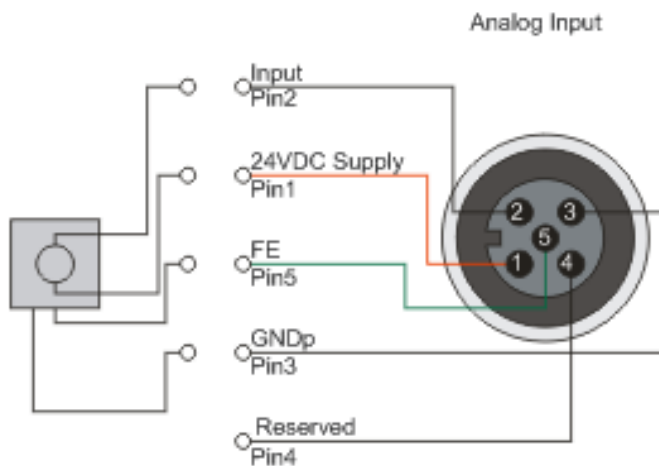


Fig. 32: Analog inputs M12

The sensors are supplied with a common maximum current of 0.5 A from the control voltage U<sub>s</sub>.

LEDs indicate the status of the inputs.

### 4.2.5.4 Analog output and PWMi output M12

Via the multi-function output either an analog output or a PWMi output can be output to a proportional valve, for example.

The signals are connected via M12 connectors.

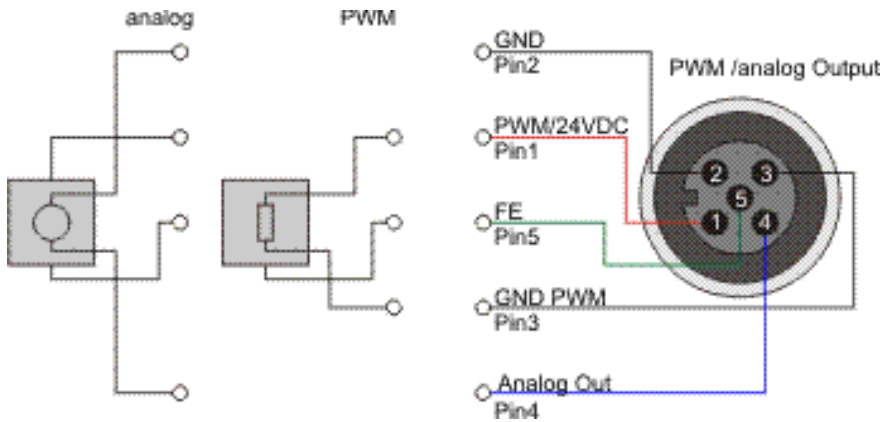


Fig. 33: Analog output and PWMi output M12

The outputs are short-circuit-proof.

LEDs indicate the signal state of the output.

### 4.2.5.5 Status LEDs

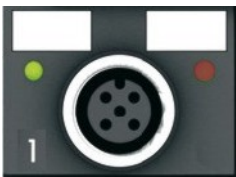


Fig. 34: Status LEDs

#### Status LEDs at the M12 connections

Connection	LED	Display	Meaning
M12 socket analog inputs, PWMi	left	off	No data transfer to the D/A converter
		green	Data transfer to the D/A converter
	right	off	Function OK
		red	Analog error: broken wire or measured value outside the measuring range PWMi: general error, see status word

Correct function is indicated if the green *Run* LED is on and the red *Error* LED is off.


#### Status LEDs at the M12 connections

Connection	LED	Display	Meaning
M12 socket digital inputs/outputs	left / right	off	Input / output off or Low
		green	Input / output on or High

## 4.2.6 UL Requirements


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

### Supply voltage


 <b>CAUTION</b>	<p><b>CAUTION!</b></p> <p>This UL requirements are valid for all supply voltages of all marked EtherCAT Box Modules!</p> <p>For the compliance of the UL requirements the EtherCAT Box Modules should only be supplied</p> <ul style="list-style-type: none"> <li>• by a 24 V<sub>DC</sub> supply voltage, supplied by an isolating source and protected by means of a fuse (in accordance with UL248), rated maximum 4 Amp, or</li> <li>• by a 24 V<sub>DC</sub> power source, that has to satisfy <i>NEC class 2</i>. A <i>NEC class 2</i> power supply shall not be connected in series or parallel with another (class 2) power source!</li> </ul>
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 <b>CAUTION</b>	<p><b>CAUTION!</b></p> <p>To meet the UL requirements, the EtherCAT Box Modules must not be connected to unlimited power sources!</p>
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### Networks

 <b>CAUTION</b>	<p><b>CAUTION!</b></p> <p>To meet the UL requirements, EtherCAT Box Modules must not be connected to telecommunication networks!</p>
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### Ambient temperature range

 <b>CAUTION</b>	<p><b>CAUTION!</b></p> <p>To meet the UL requirements, EtherCAT Box Modules has to be operated only at an ambient temperature range of 0 to 55°C!</p>
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### Marking for UL

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



Fig. 35: UL label

## 5 Commissioning and Configuration

### 5.1 Inserting into the EtherCAT network



#### Note

#### 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 [▶ 45] for existing hardware (called "online") and
- by manual inserting/appendig [▶ 45] 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 [▶ 48] (Config mode), and scan in the devices (see Fig. 1). Acknowledge all dialogs with "OK", so that the configuration is in "FreeRun" mode.

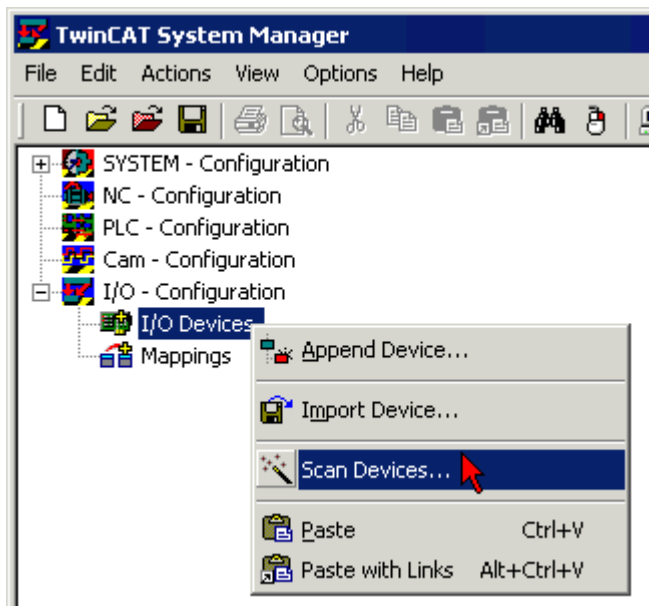


Fig. 36: Scanning in the configuration (I/O Devices -> right-click -> Scan Devices...)

#### 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 [▶ 48] (Config mode)
- Append a new I/O device. In the dialog that appears select the device *EtherCAT (Direct Mode)*, and confirm with *OK*.

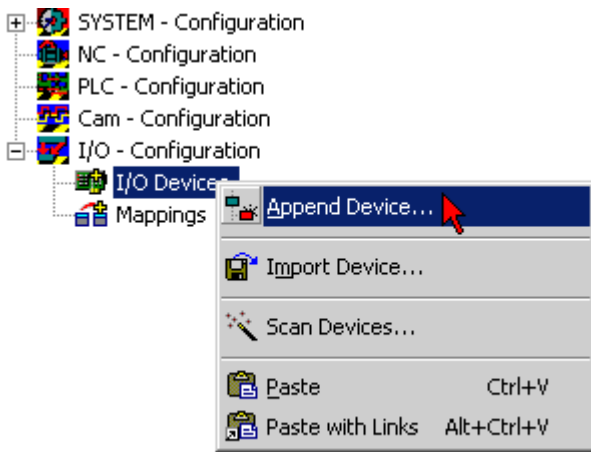


Fig. 37: Appending a new I/O device (I/O Devices -> right-click -> Append Device...)

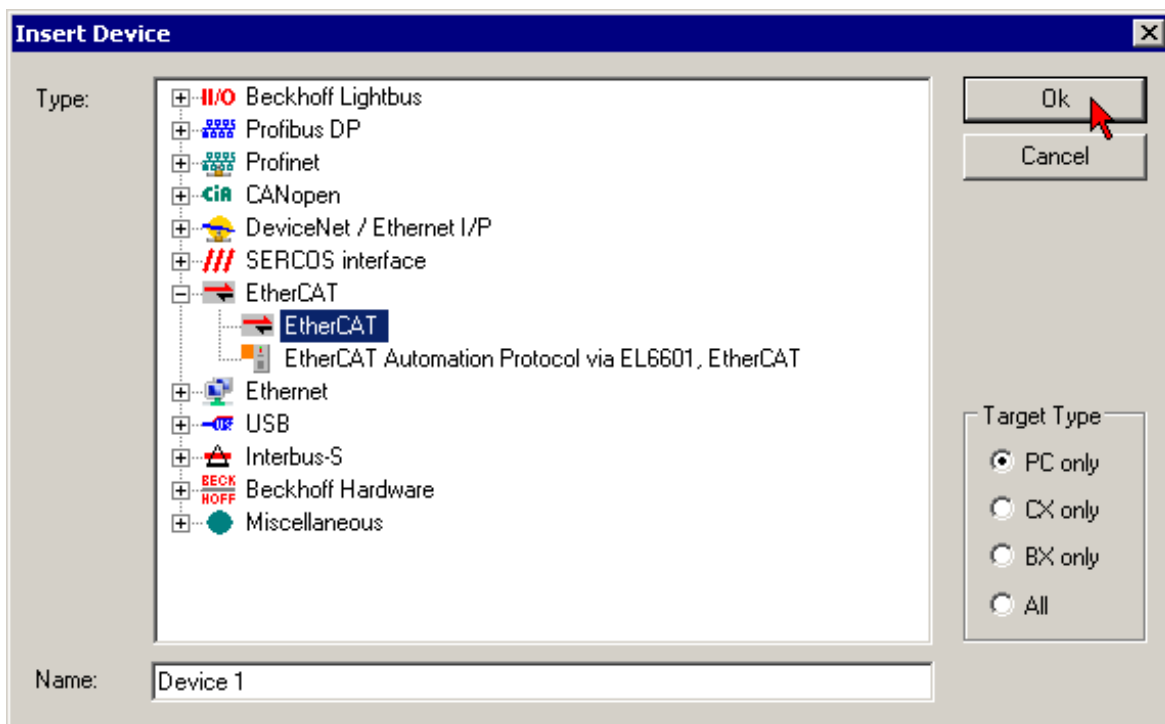


Fig. 38: Selecting the device EtherCAT

- Append a new box.

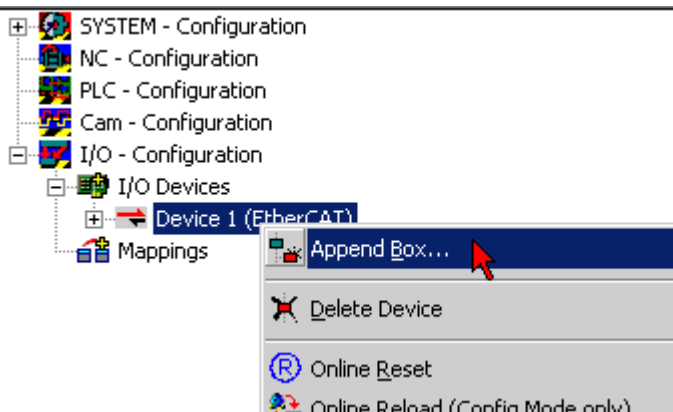


Fig. 39: Appending a new box (Device -> right-click -> Append Box...)

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

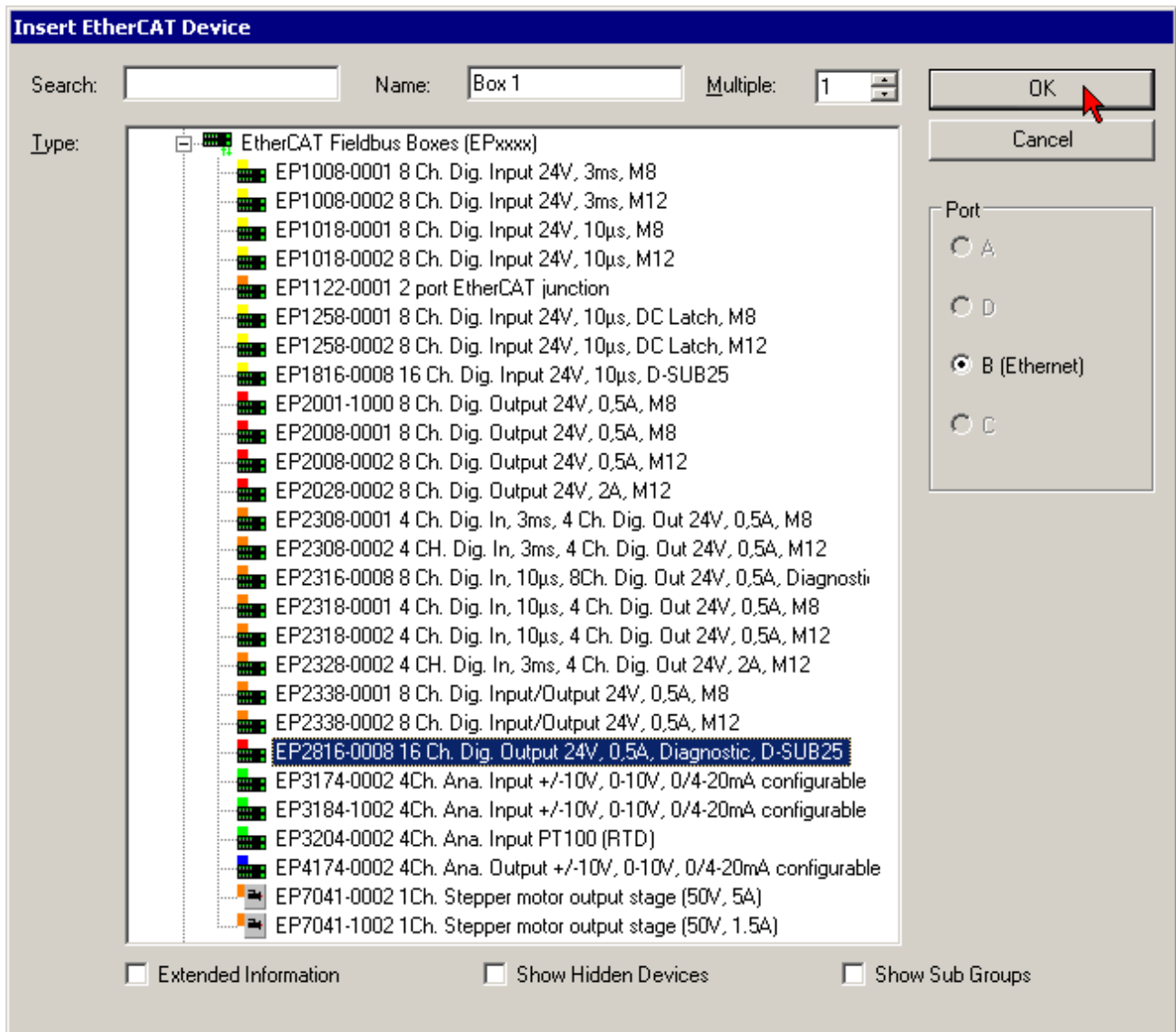


Fig. 40: Selecting a Box (e.g. EP2816-0008)

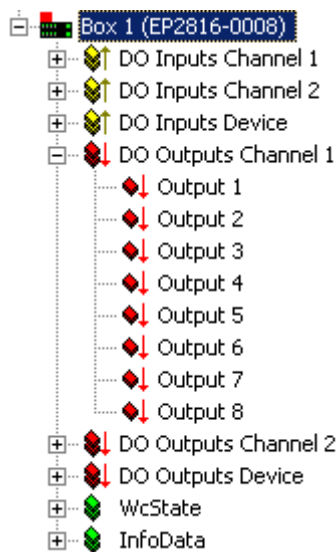


Fig. 41: Appended Box in the TwinCAT tree

## 5.2 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).

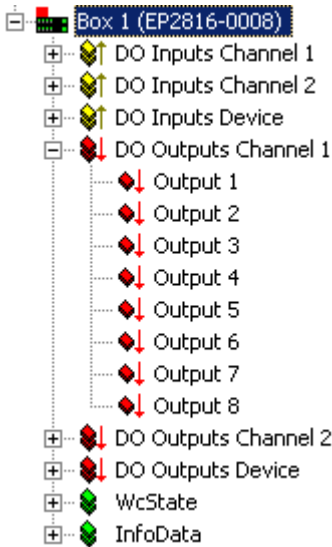


Fig. 42: Branch of the EtherCAT box to be configured

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

### General tab

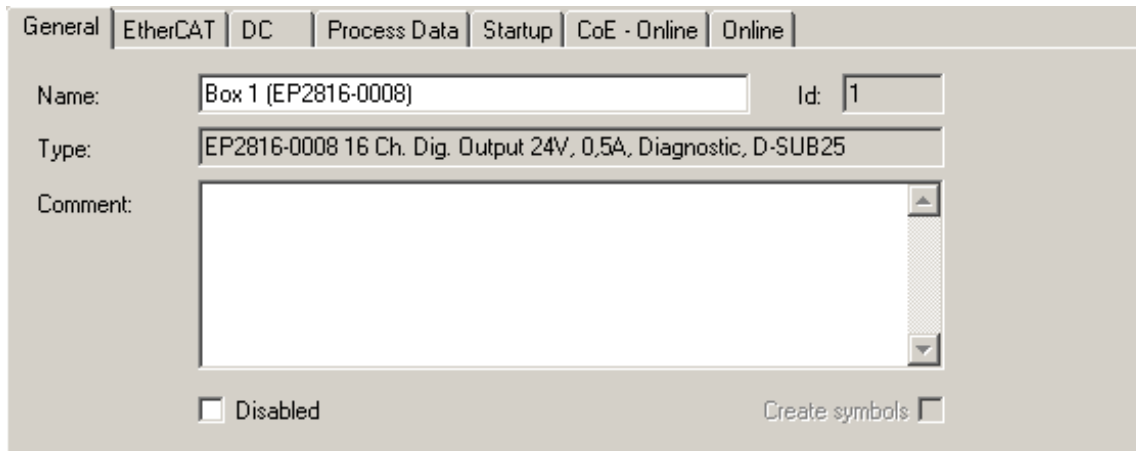


Fig. 43: General tab

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

**EtherCAT tab**

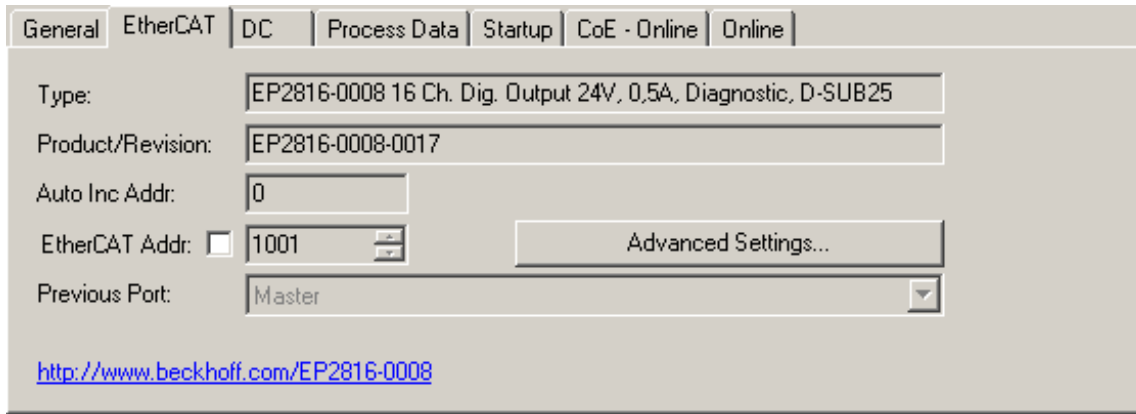


Fig. 44: EtherCAT tab

<b>Type</b>	EtherCAT device type
<b>Product/Revision</b>	Product and revision number of the EtherCAT device
<b>Auto Inc Addr.</b>	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 <sub>hex</sub> . For each further slave the address is decremented by 1 (FFFF <sub>hex</sub> , FFFE <sub>hex</sub> etc.).
<b>EtherCAT Addr.</b>	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.
<b>Previous Port</b>	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.
<b>Advanced Settings</b>	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.

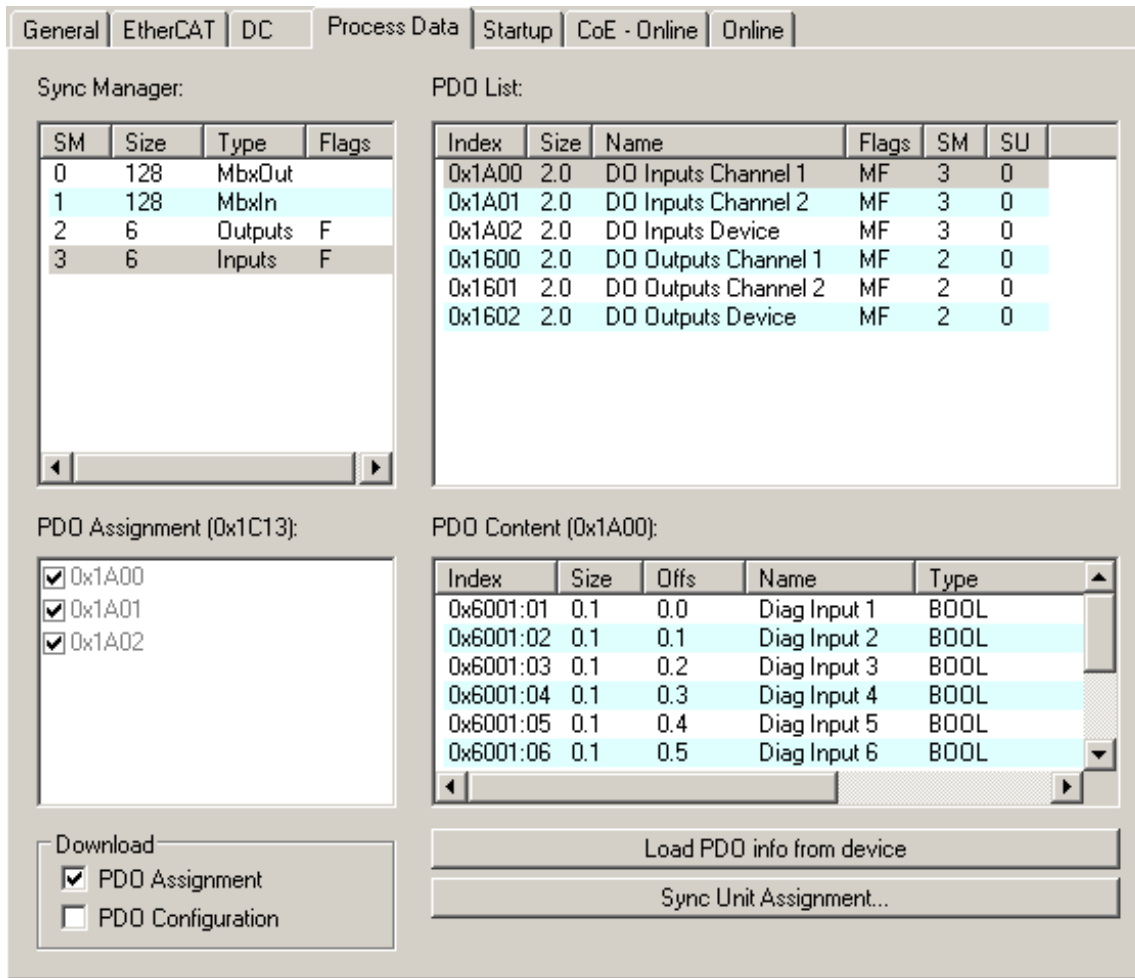


Fig. 45: Process Data tab

**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.

 <b>Note</b>	<p><b>Activation of PDO assignment</b></p> <ul style="list-style-type: none"> <li>the EtherCAT slave has to run through the PS status transition cycle (from pre-operational to safe-operational) once (see <a href="#">Online tab [► 54]</a>),</li> <li>and the System Manager has to reload the EtherCAT slaves (  button)</li> </ul>
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**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. 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 <i>PDO Assignment</i> 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 \[► 51\]](#) 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.

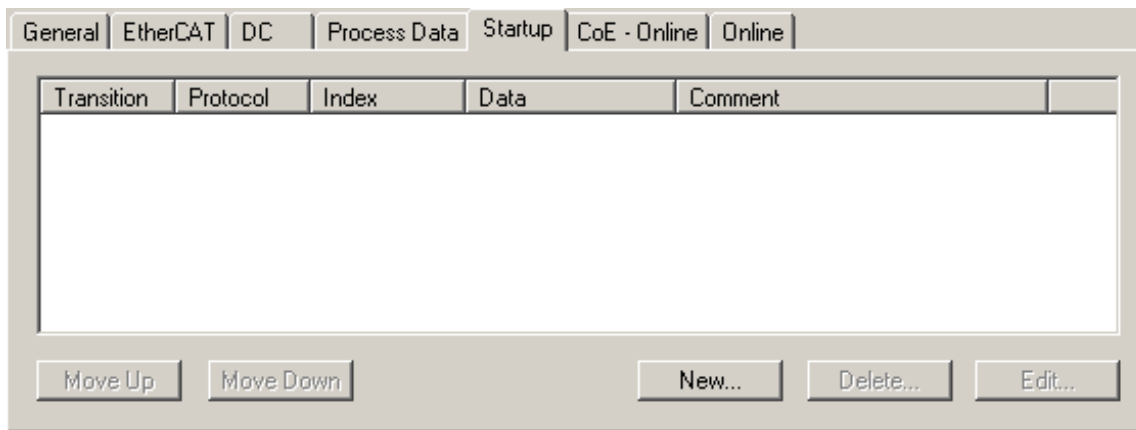


Fig. 46: Startup tab

Column	Description
Transition	Transition to which the request is sent. This can either be <ul style="list-style-type: none"> <li>• the transition from pre-operational to safe-operational (PS), or</li> <li>• the transition from safe-operational to operational (SO).</li> </ul> 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.

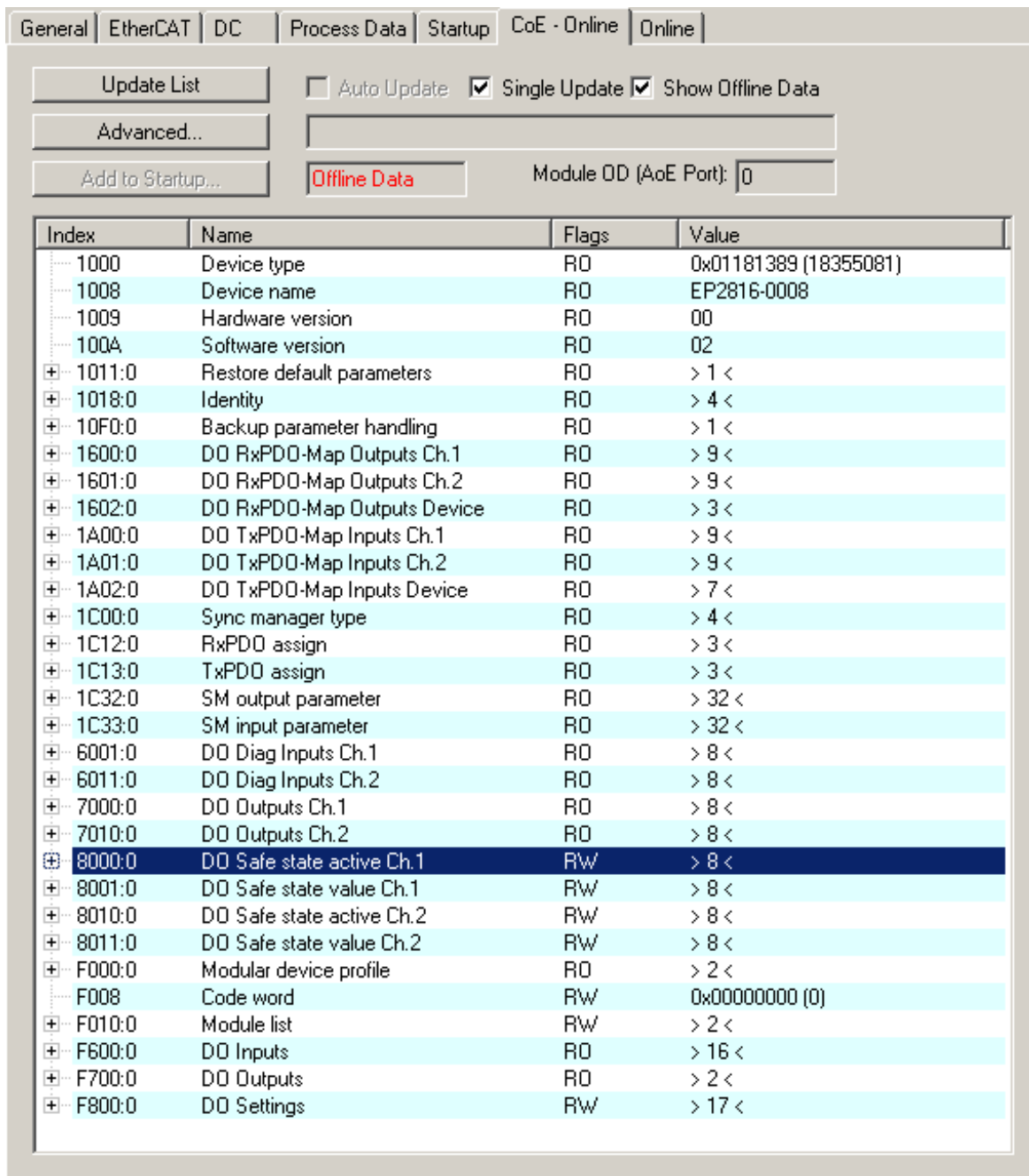


Fig. 47: CoE - Online tab

**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.

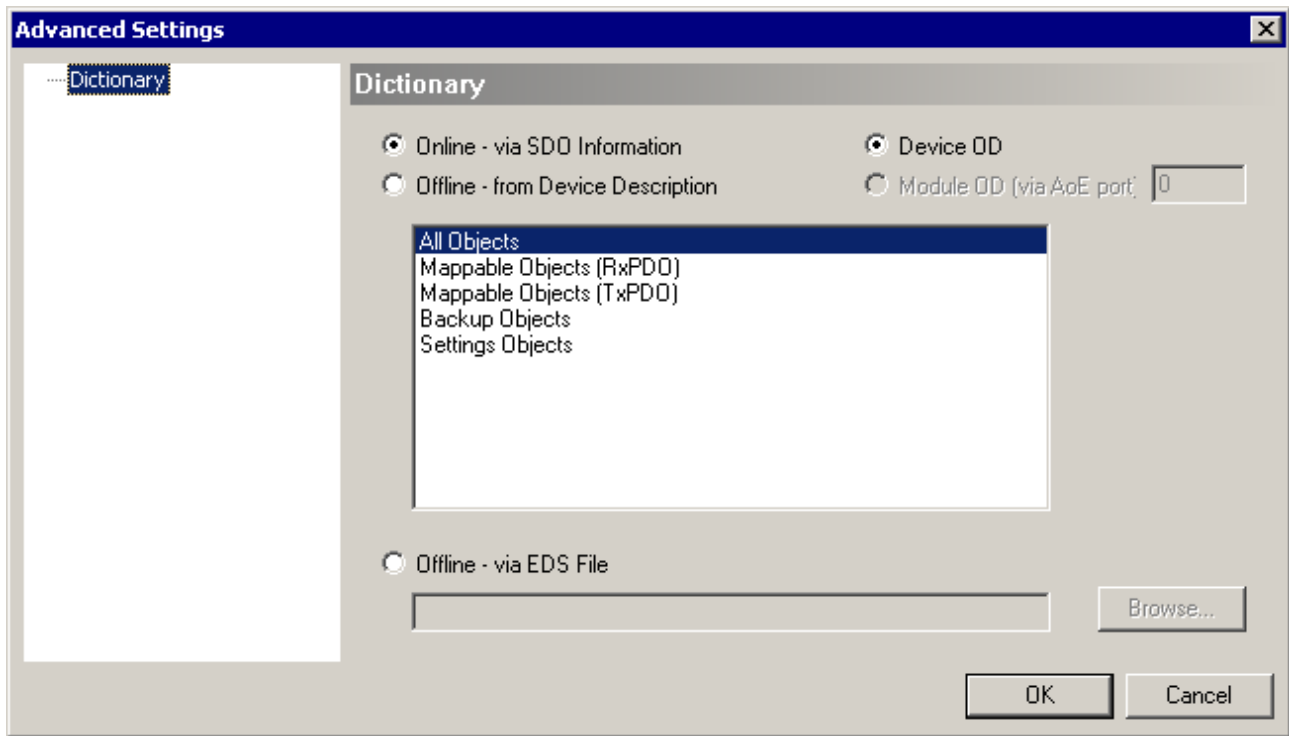


Fig. 48: Advanced settings

**Online - 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 - 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**

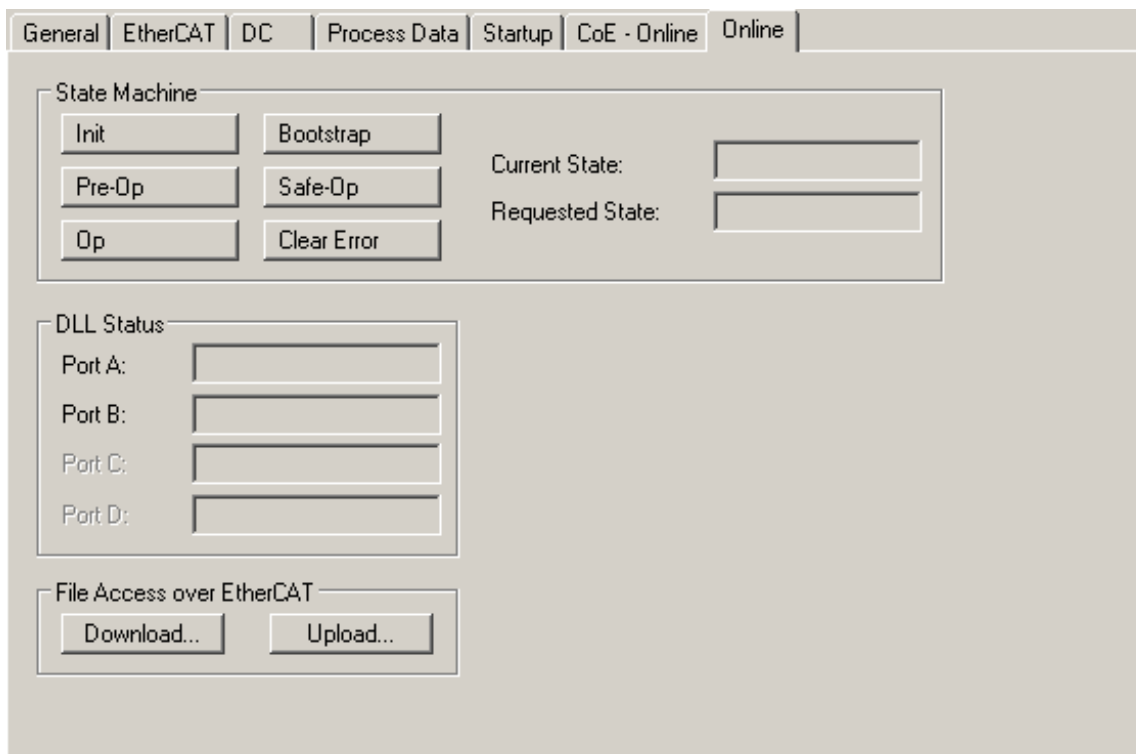


Fig. 49: Online tab

**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.  
  
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.

## 5.3 Tacho analysis

Tacho analysis refers to velocity or frequency logging for two digital sensors mounted on one shaft (single-shaft mode) or on two shafts (dual-shaft mode).

In single-shaft mode a plausibility check can be run for the two sensors (e.g. velocity deviation of the two sensors).

The targets (sensor markings) should show a 90° overlapping signal when triggered. The minimum ON of OFF time must not be less than 0.2ms, otherwise detection is not possible due to the sampling frequency.

The number of targets on the axis can be set in CoE object 0x80x0:11. In this way slower velocity/speed detection with many targets or high velocity with few targets can be achieved.

### Mode selection via the PDOs

The different modes are activated via the PDO assignment.

### Single-shaft mode

The input PDO 0x1A02 activates the corresponding setting. The output data are always set.

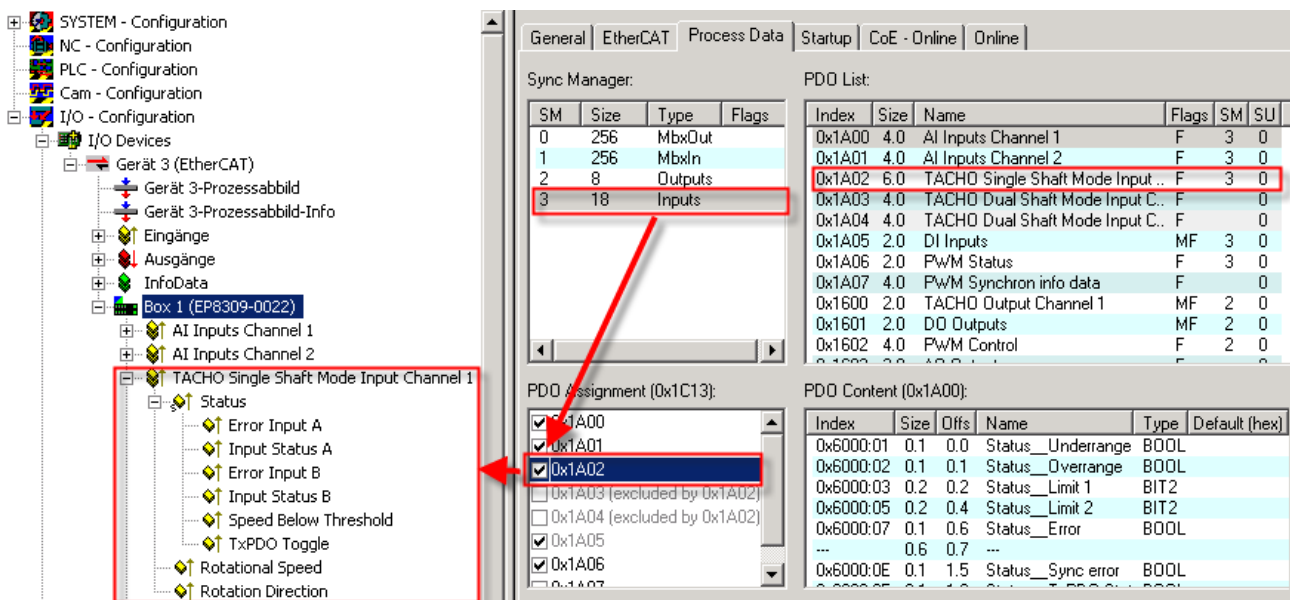


Fig. 50: Tacho evaluation – single shaft mode

### Process data

Value	Description
Error Input A	The measured velocity/frequency is lower than that of track B, or it is 0 (sensor faulty)
Input Status A	Status of input A
Error Input B	The measured velocity/frequency is lower than that of track A, or it is 0 (sensor faulty)
Input Status B	Status of input B
Speed below threshold	The velocity is lower than the limit in CoE 0x8020:12 <i>Rotational Speed Threshold</i> or = 0
Rotational Speed	Rotational speed and frequency, shown as a function of CoE object 0x80x0:15
Rotation Direction	0: rising edge of input A occurs before rising edge of input B

Display of the rotational speed

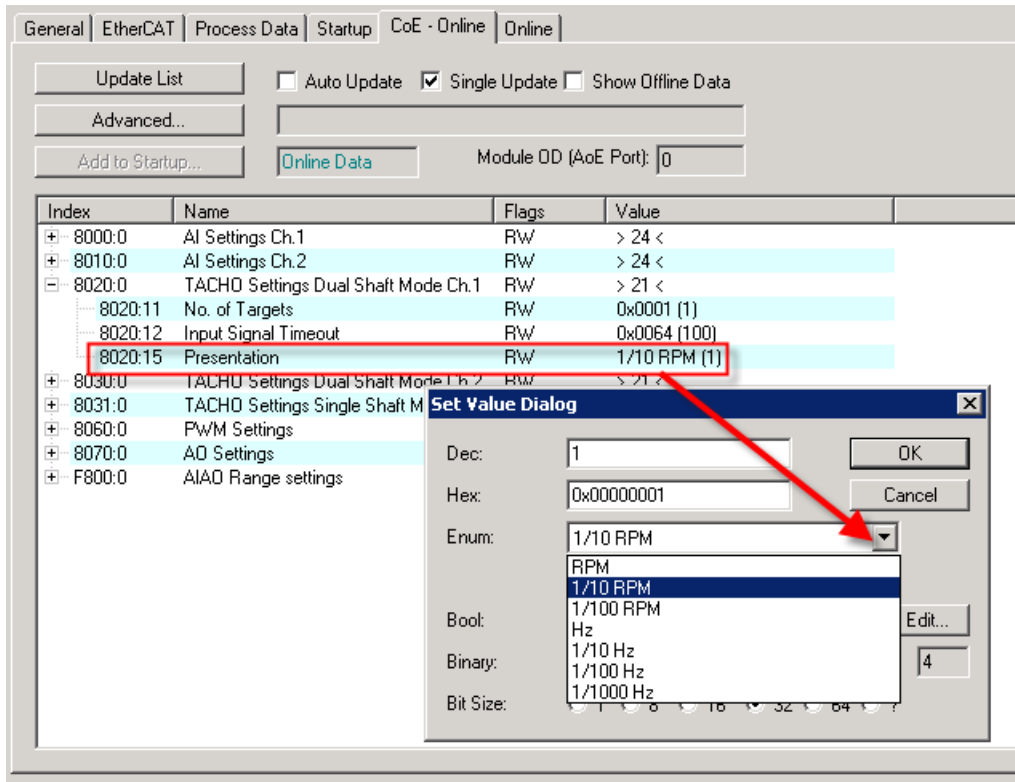


Fig. 51: Tacho evaluation - display of the rotational speed

Dual Shaft Mode

The input PDOs 0x1A03 and 0x1A04 activate the two dual-shaft process data. The output data are always set.

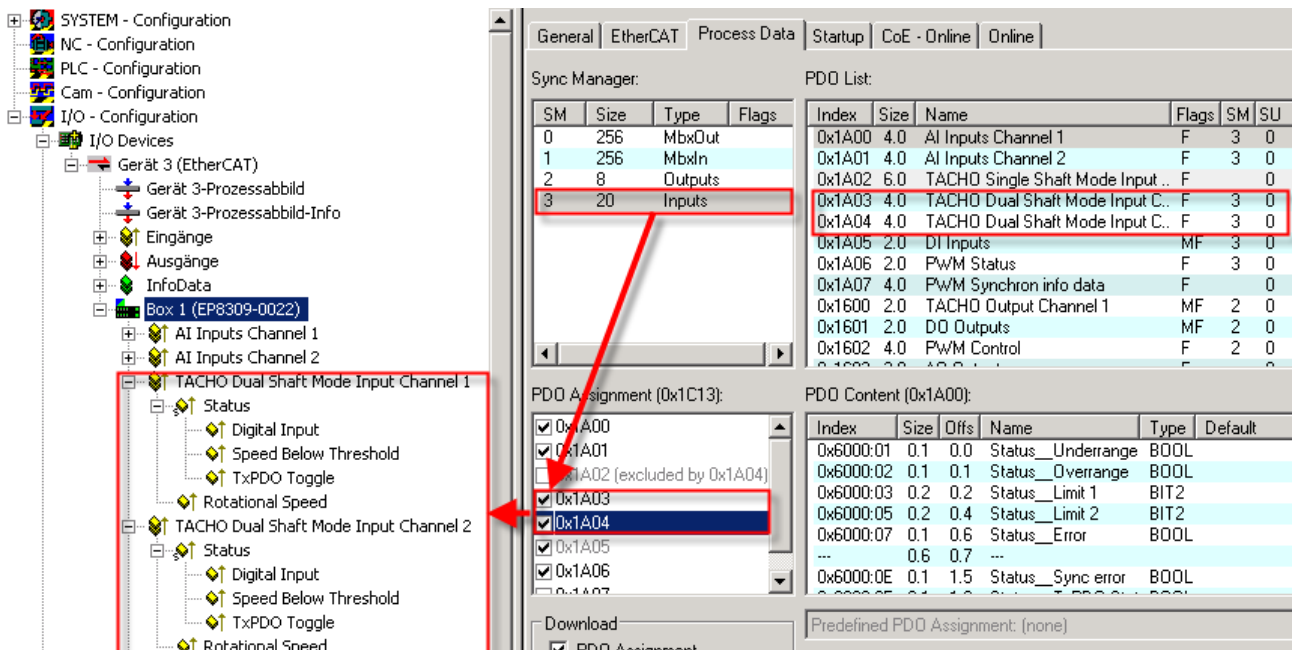


Fig. 52: Tacho evaluation - dual shaft mode

**Process data (settings for the second channel equivalent)**

Value	Description
Digital input	Status of input
Speed below threshold	The velocity is lower than the limit in CoE 0x8020:12 or = 0
Rotational Speed	Rotational speed and frequency, shown as a function of CoE object 0x80x0:15

**Display of the rotational speed**

see single-shaft mode

**CoE settings**

The behavior of the tacho inputs is set via the CoE objects.

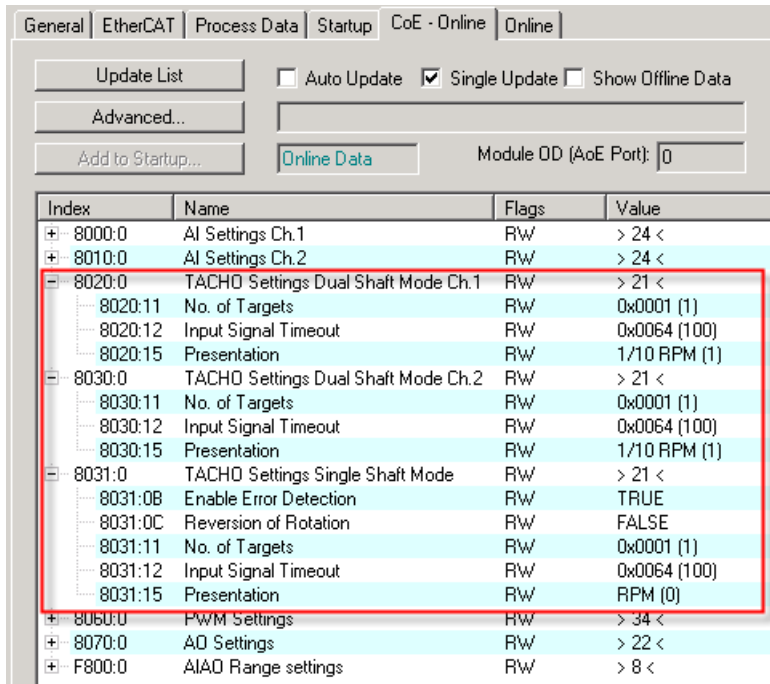


Fig. 53: Tacho evaluation -

The following settings apply to all channels:

CoE	Value	Description
80xx:12	Input Signal Timeout	The process record <Speed Below Threshold> is set after x msec without signal change at the input.

The following settings are only available in single-shaft mode

**CoE objects for tacho settings (0x8020 and 0x8030)**

CoE	Value	Description
80x0:0B	Enable Error Detection	Enable/disable error display
80x0:0C	Reversion of rotation	Reversion of rotation display in <i>Rotation direction</i>
80x0:11	No. of Targets	Number of "cams" on the shaft/axis
80x0:12	Rotational Speed Threshold	Limit value below which the corresponding status bit is set
80x0:15	Presentation	Display of the measured value in RPM, Hz, ...

## 5.4 Switching between PWMi and analog output

### Mode selection via the PDOs

PWMi mode or analog mode can be selected for operating a proportional valve at socket 7, for example.

- In PWMi mode (default) the coil is controlled directly via a PWM signal. The valve requires no control electronics.
- In analog mode a current value of 0...20 mA or 4...20 mA is output, via which the control electronics integrated in the valve controls the valve travel.

The 24V<sub>DC</sub> supply is switched on continuously.

The different modes are activated via the PDO assignment.

### PWMi mode

The output PDO **0x1602** activates the PWMi mode.

The screenshot displays the configuration interface for a device. On the left, a tree view shows the configuration hierarchy: SYSTEM - Configuration, NC - Configuration, PLC - Configuration, I/O - Configuration, I/O Devices, Device 1 (EtherCAT), Device 1-Image, Device 1-Image-Info, Inputs, Outputs, InfoData, Box 1 (EP8309-0022), AI AI Inputs Channel 1, AI AI Inputs Channel 2, TACHO Single Shaft Mode Input, DI Inputs, PWM Status, TACHO Output Channel 1, DO Outputs, PWM Control (selected), Control, PWM output, WcState, and InfoData. The 'PWM Control' node is highlighted with a red box. In the center, the 'Process Data' tab is active, showing 'Sync Manager' and 'PDO List' tables. The 'PDO List' table has the following data:

Index	Size	Name	Flags	SM	SU
0x1A04	4.0	TACHO Dual Shaft Mode I...	F		0
0x1A05	2.0	DI Inputs	MF	3	0
0x1A06	2.0	PWM Status	F	3	0
0x1A07	4.0	PWM Synchron info data	F		0
0x1600	2.0	TACHO Output Channel 1	MF	2	0
0x1601	2.0	DO Outputs	MF	2	0
0x1602	4.0	PWM Control	F	2	0
0x1603	2.0	AO AO Outputs	F		0

The '0x1602 PWM Control' row is highlighted with a red box. Below the 'PDO List' table, the 'PDO Assignment (0x1C12)' table shows:

Index	Assignment
0x1600	<input checked="" type="checkbox"/>
0x1601	<input checked="" type="checkbox"/>
0x1602	<input checked="" type="checkbox"/>
0x1603 (excluded by 0x1602)	<input type="checkbox"/>

The '0x1602' row is checked. The 'PDO Content (0x1A00)' table shows:

Index	Size	Offs	Name	Type
0x6000...	0.1	0.0	Status__Underrange	BOOL
0x6000...	0.1	0.1	Status__Overrange	BOOL
0x6000...	0.2	0.2	Status__Limit 1	BIT2
0x6000...	0.2	0.4	Status__Limit 2	BIT2
0x6000...	0.1	0.6	Status__Error	BOOL

The 'Download' section shows 'PDO Assignment' checked and 'PDO Configuration' unchecked. The 'Predefined PDO Assignment (none)' is selected, and 'Load PDO info from device' and 'Sync Unit Assignment...' buttons are visible.

Fig. 54: Switching the PWMi/analog output - PWMi mode

### Analog mode

The output PDO **0x1603** activates the analog mode.

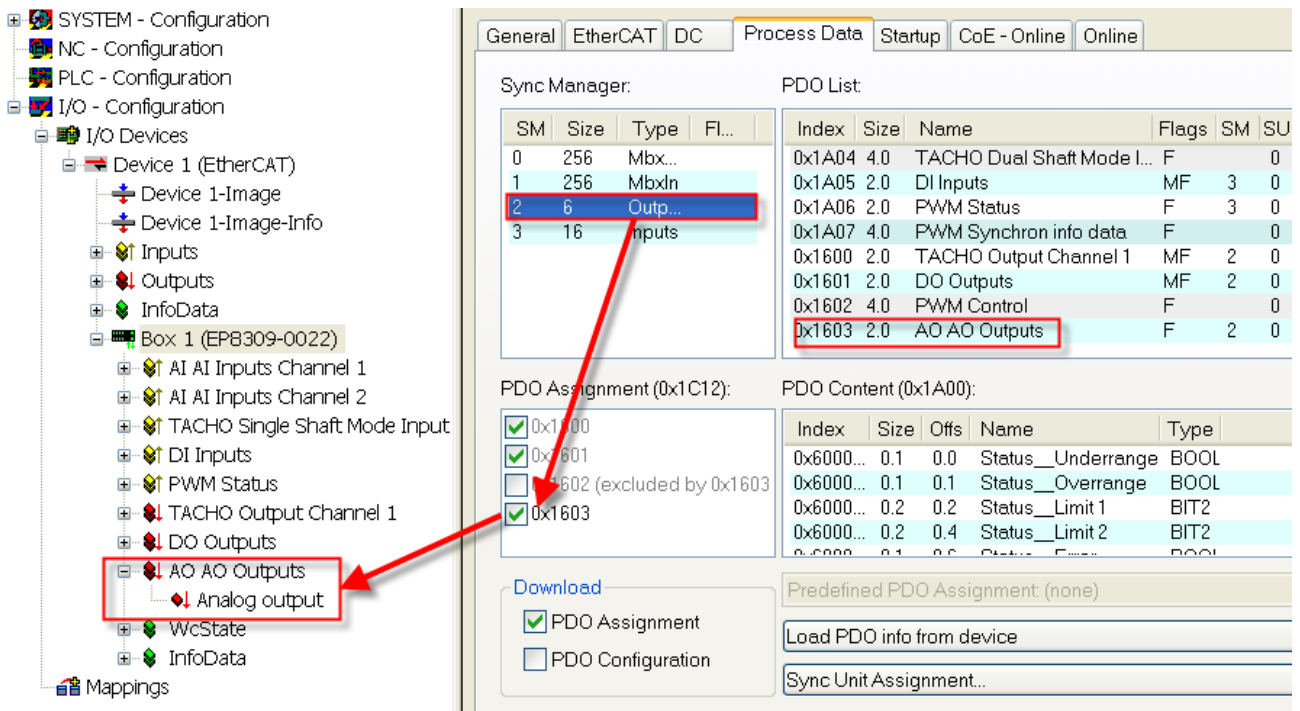


Fig. 55: Switching the PWMi/analog output - analog mode

## 5.5 Quick start

### Parameterization of the main settings

The module is factory-set such that in most applications it is operational without further parameterization.

Set the parameter *Max Current [%]* (0x8pp0:10 |▶ 80]) such that the maximum inductance current is not exceeded. If an EP8309 with 1.2 A rated current and an inductance with a maximum current of 600 mA is used, this parameter can be set to 50 (50%). This means that, at a maximum process data value of 32767<sub>dec</sub>, a coil current of +600 mA is reached (not +1 A).

### Info data objects

Via the info data objects additional information can be transferred synchronously. For each channel two of these objects are available.

The synchronous info data can be activated in the TwinCAT System Manager via the "Process Data" tab (0x1A07).

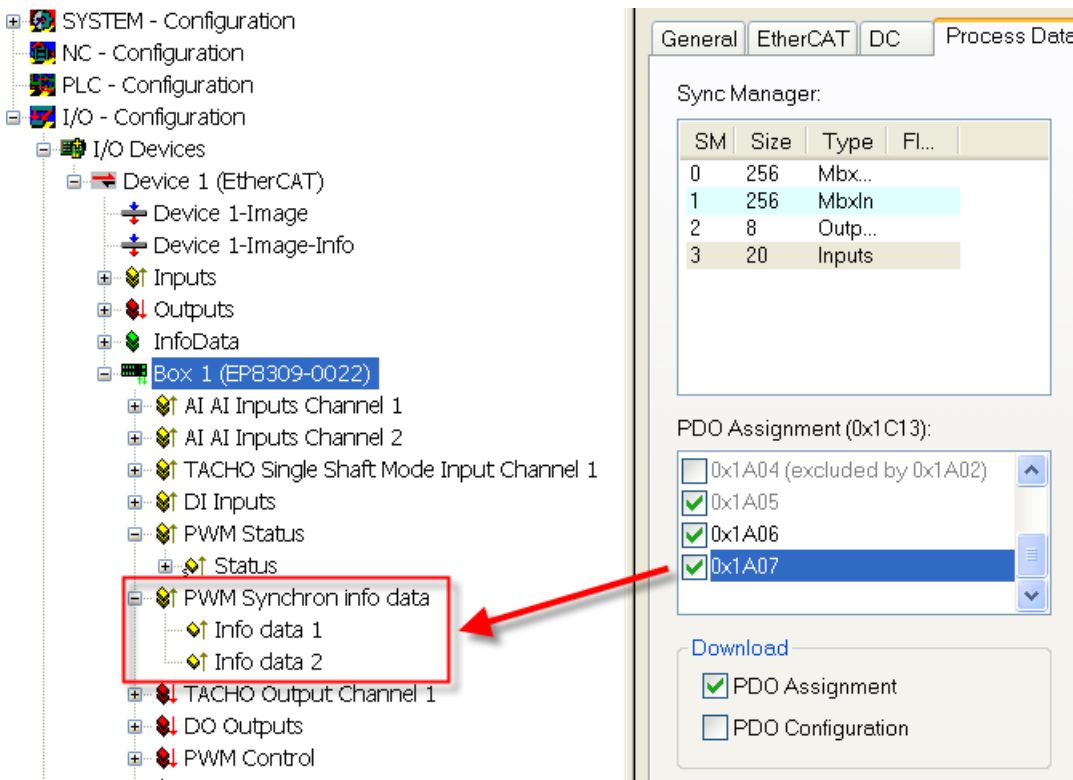


Fig. 56: Info data objects - activation of the synchronous info data

Objects 0x8060:21 [▶ 80] and 0x8060:22 [▶ 80] can be used to set the value to be transferred synchronously.

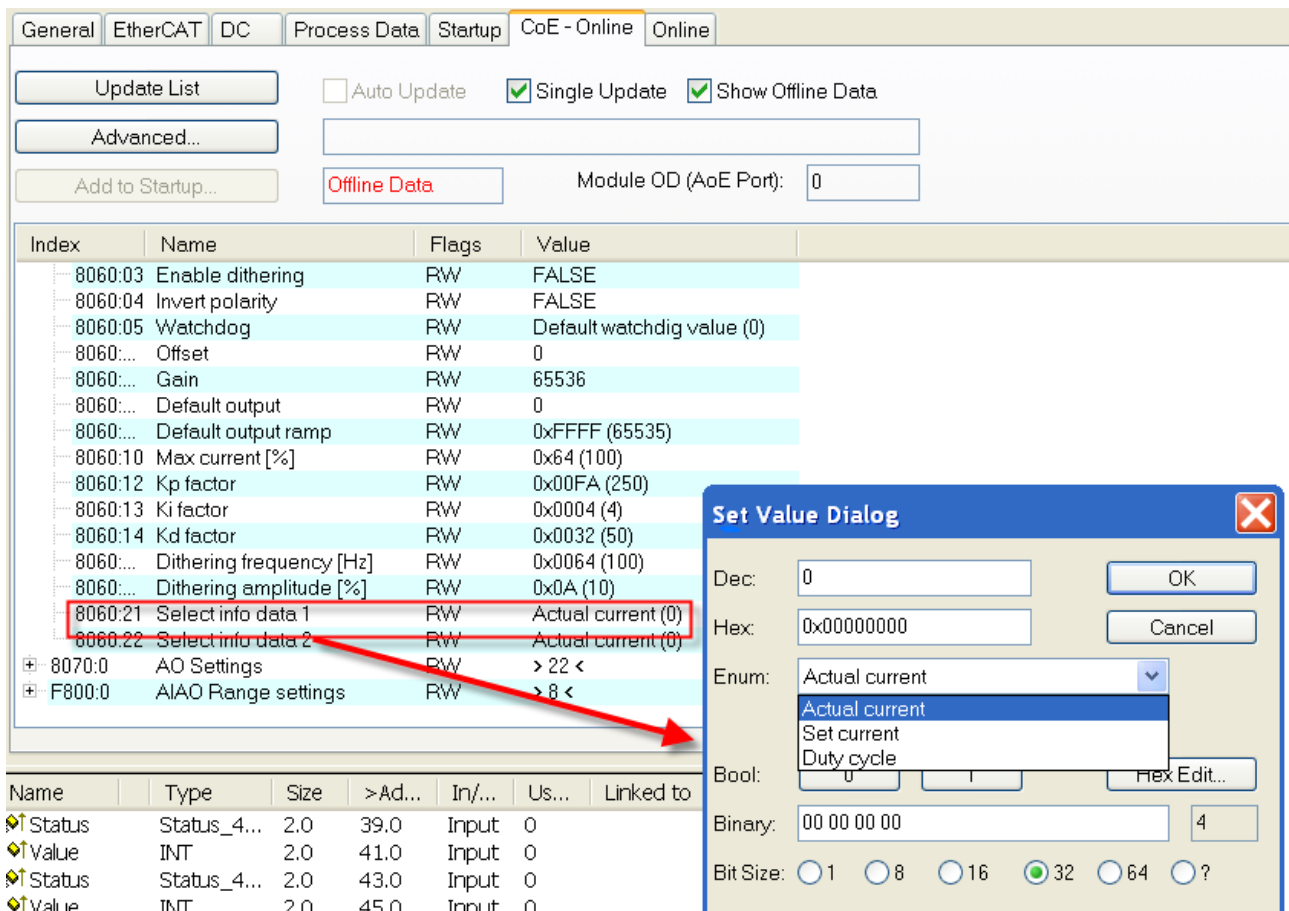


Fig. 57: Info data objects – selection of the value to be transmitted

The following entries are available:

Value	Text	Description
0	Actual current	Actual current in mA
1	Set current	Set current in mA
2	Duty Cycle	The PWM duty cycle of the output stage. A value of 1000 corresponds to 100% duty cycle.

**Watchdog**

The analog output value can, e.g. in the case of a failure of communication with the controller, be set to a user-specific value.

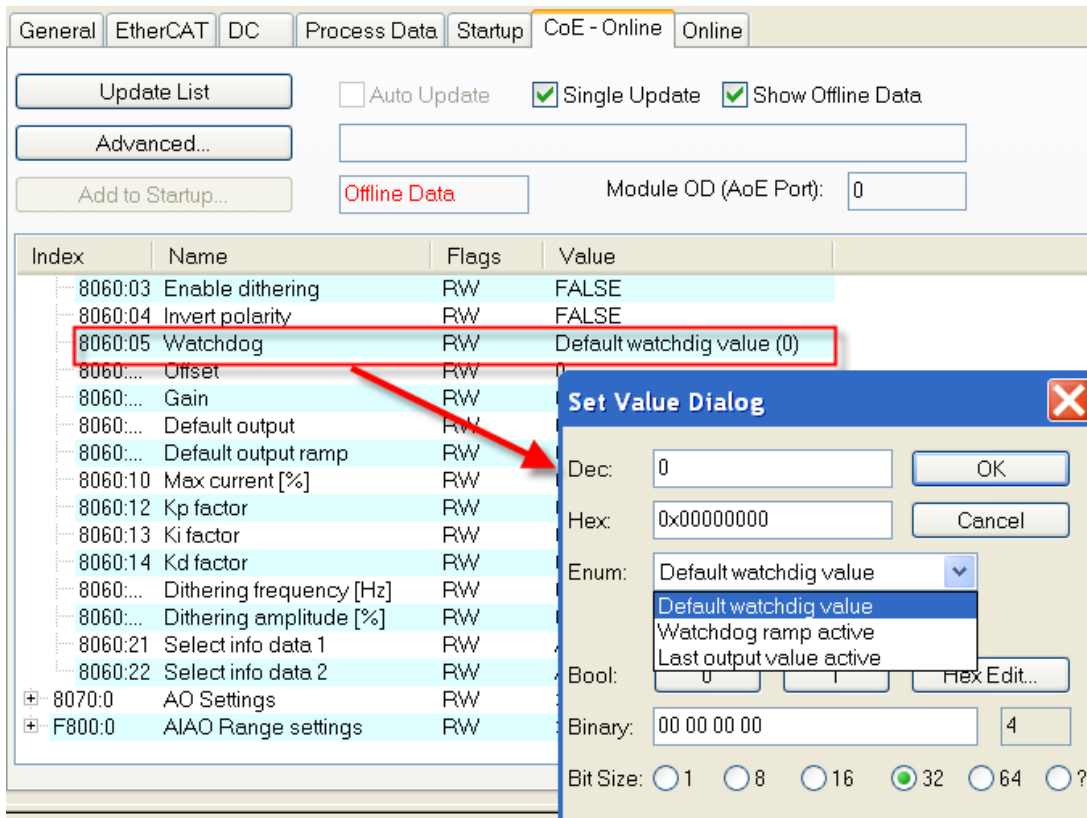


Fig. 58: Watchdog

Three parameterization options are available for this purpose:

Watchdog object (0x8060:05 [▶ 83])	Behavior
0: Default watchdog value	The substitute switching value (0x8060:0D [▶ 83]) is output on error.
1: Watchdog ramp active	On error the output value is moved to the default value (0x8060:0D [▶ 83]) with the ramp time set under 0x8060:0E [▶ 83] The ramp time is specified in digits / ms. If the entry is 100 and the default value 0, for example, it takes 327 ms (32767/100) for the output value to change from the maximum value (32767) to the default value in the event of a fault.
2: Last output value active	In the event of a fault (watchdog drop) the last process data is issued.

**Optimization of the current control parameters**

In order to be able to support all possible loads ex factory, the terminal was parameterized with moderate controller characteristics. Current regulation can be improved significantly by adapting the controller parameters to the actual load.

To determine the settings a current pulse is applied to the load. This pulse can be picked up with an oscilloscope or with TwinCAT ScopeView.

For evaluation with TwinCAT ScopeView the set and actual current is displayed in the synchronous info data.

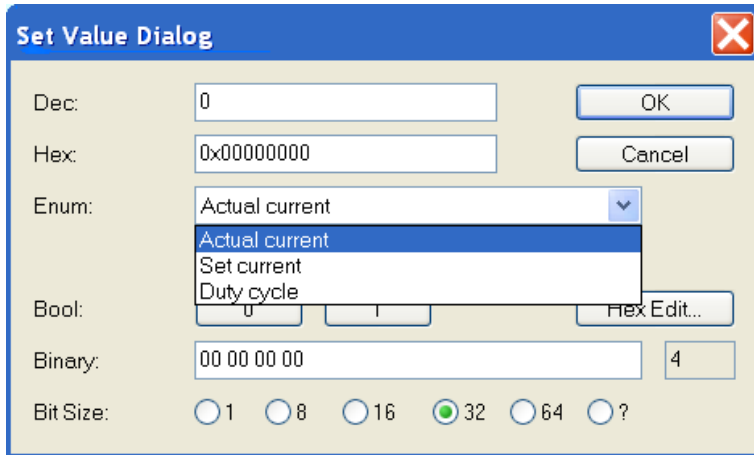


Fig. 59: Selecting the synchronous info data



*EP8309 standard parameters (20 ms/div)*

Green: Set current  
Red: Actual current



*Optimized parameters (20 ms/div)*

Green: Set current  
Red: Actual current

The required step response can be set using the parameters  $K_p$ ,  $K_i$ , and  $K_d$  ([0x8060:12 \[▶ 83\]](#) to [0x8060:14 \[▶ 83\]](#)).

**Dithering**

Dithering involves modulating a square wave signal on top of the actual output value. The modulated signal results in continuous movement of a valve piston, for example. This reduces static friction and prevents sudden "breakaway" of the piston.

The configuration required for this depends a lot on the particular application.

To activate dithering, the object `0x8060:03 [▶ 83]` ("Enable dithering") and the corresponding control bit must be set.

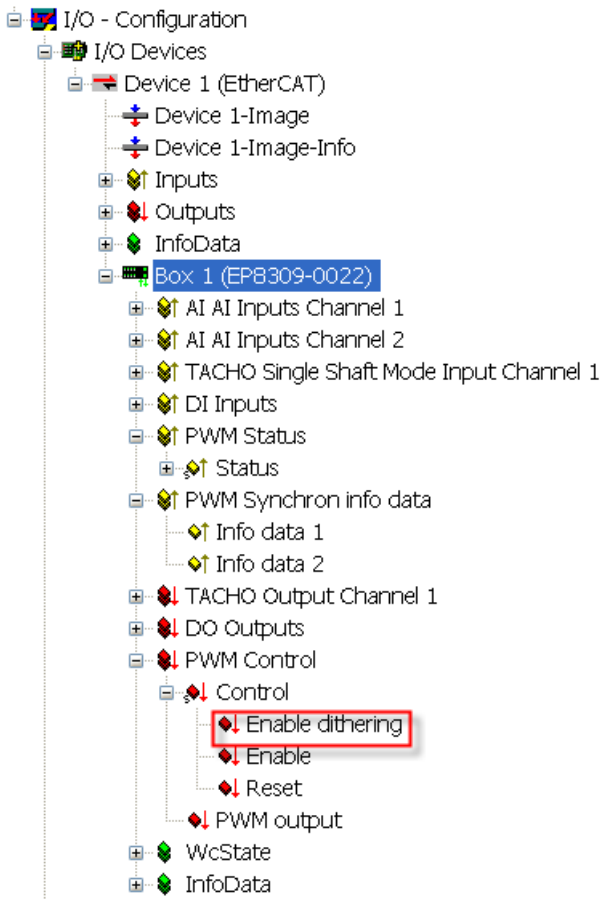


Fig. 60: Enable dithering

The following parameters can be set:

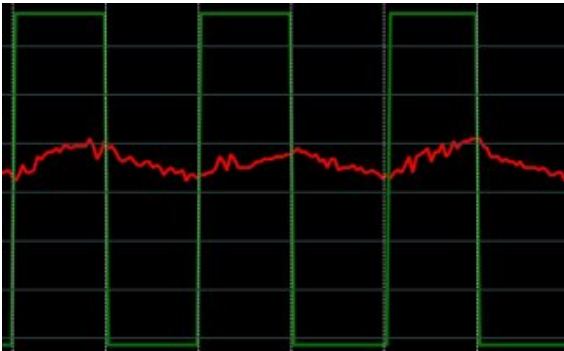
Value	Text	Description
<code>0x8060:1E [▶ 83]</code>	Dithering frequency [Hz]	Frequency of the applied dither in Hz
<code>0x8060:1F [▶ 83]</code>	Dithering amplitude [%]	Amplitude of the applied dither (in % of the rated terminal current)

The controller parameters themselves ( $K_p$ ,  $K_i$ , and  $K_d$ ) also play a role.

In the diagrams a dither of 10 % of the rated current is shown as 100 Hz.

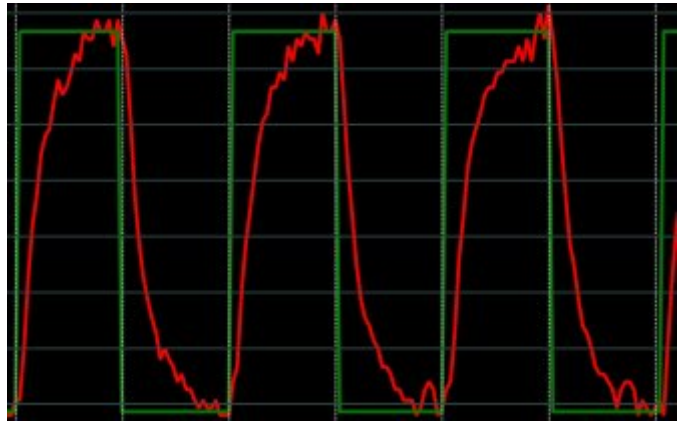
The controller has 5 ms for compensating a current pulse of 10 %. The steepness of the current rise is limited by the controller parameters and the inductance.

The actual current should follow the set current. This is enabled through suitable settings of the controller and dither parameters (frequency and amplitude).



EP8309 100 Hz dither with 10 % amplitude, poor parameterization (5 ms/div)

Green: Set current  
Red: Actual current



EP8309 100 Hz dither with 10 % amplitude, better parameterization (5 ms/div)

Green: Set current  
Red: Actual current

## 5.6 Range settings for inputs and outputs

### CoE-Online tab

The *CoE-Online* tab lists the contents of the slave object directory of the slave (SDO upload) and enables the user to modify the content of an object in this list.

Object 0xF800:0 [▶ 84] contains the range settings for the inputs and outputs of channels 1 to 4.

Index	Name	Flags	Value
8000:0	AI Settings Ch.1	RW	> 24 <
8010:0	AI Settings Ch.2	RW	> 24 <
8020:0	TACHO Settings Ch.1	RW	> 21 <
8030:0	TACHO Settings Ch.2	RW	> 21 <
8060:0	PWM Settings	RW	> 34 <
8070:0	AO Settings	RW	> 22 <
F800:0	AI/AO Range settings	RW	> 8 <
F800:...	Input type Ch1	RW	0..20 mA (1)
F800:...	Input type Ch2	RW	0..20 mA (1)
F800:...	Output type Ch1	RW	0..20 mA (1)

Fig. 61: CoE-Online tab

Click on objects 0xF800:01 to 0xF800:04 to change the settings.

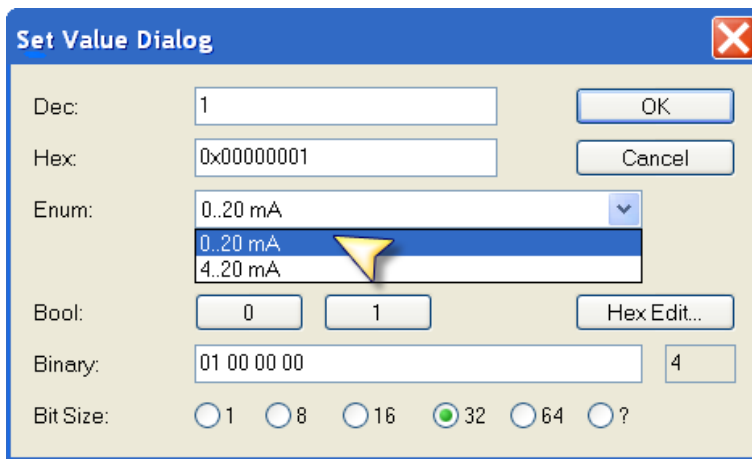


Fig. 62: Changing the settings

## 5.7 CoE objects

### 5.7.1 CoE interface

#### General description

The CoE interface (CANopen over EtherCAT) is used for parameter management of EtherCAT devices. EtherCAT slaves or the EtherCAT master manage fixed (read only) or variable parameters which they require for operation, diagnostics or commissioning.

CoE parameters are arranged in a table hierarchy. In principle, the user has read access via the fieldbus. The EtherCAT master (TwinCAT System Manager) can access the local CoE lists of the slaves via EtherCAT in read or write mode, depending on the properties.

Different CoE parameter types are possible, including string (text), integer numbers, Boolean values or larger byte fields. They can be used to describe a wide range of features. Examples of such parameters include manufacturer ID, serial number, process data settings, device name, calibration values for analog measurement or passwords.

Organization takes place on 2 levels by means of hexadecimal numbering: the (main) index is named first, then the subindex. The value ranges are:

- Index 0 to 65535
- Subindex: 0...255


A parameter localized in this way is normally written as x8010:07, with preceding "x" to identify the hexadecimal numerical range and a colon between index and subindex.

The relevant ranges for EtherCAT fieldbus users are:

- x1000: This is where fixed identity information for the device is stored, including name, manufacturer, serial number etc., plus information about the current and available process data configurations.
- x8000: This is where the operational and functional parameters for all channels are stored, such as filter settings or output frequency.

Other important ranges are:

- x4000: In some EtherCAT devices the channel parameters are stored here (as an alternative to the x8000 range).
- x6000: Input PDOs ("input" from the perspective of the EtherCAT master)
- x7000: Output PDOs ("output" from the perspective of the EtherCAT master)

 <b>Note</b>	<p><b>Availability</b></p> <p>Not every EtherCAT device must have a CoE list. Simple I/O modules without dedicated processor usually have no variable parameters and therefore no CoE list.</p>
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If a device has a CoE list, it is shown in the TwinCAT System Manager as a separate tab with a listing of the elements:

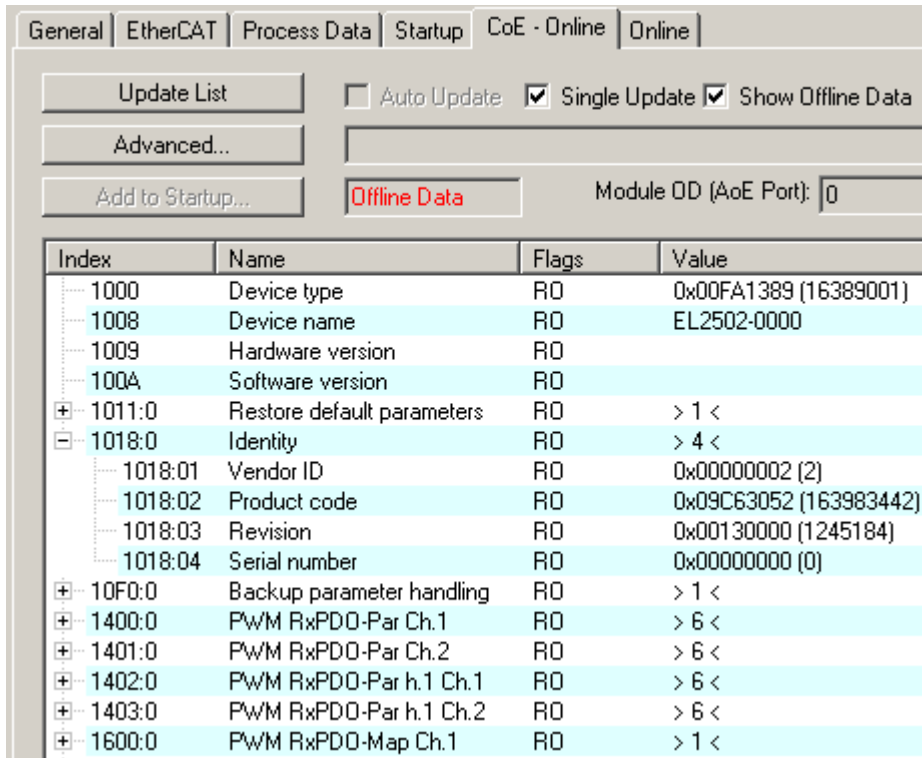



Fig. 63: CoE-Online tab

The CoE objects from x1000 to x1600, which are available in the example device "EL2502", can be seen in the above figure; the subindices from x1018 are expanded.


**Data management**

Some parameters, particularly the setting parameters of the slave, are configurable and writeable. This can be done in write or read mode

- via the System Manager (figure above) by clicking. This is useful for commissioning of the system/slaves. Click on the row of the index to be parameterized and enter a value in the *SetValue* dialog.
- from the control system/PLC via ADS, e.g. through function blocks from the TcEtherCAT.lib library This is recommended for modifications while the system is running or if no System Manager or operating staff are available.

 <b>Note</b>	<p><b>Data management</b></p> <p>If CoE parameters on the slave are changed online, this is saved fail-safe in the device (EEPROM) in Beckhoff devices. This means that the changed CoE parameters are still retained after a restart. The situation may be different with other manufacturers.</p>
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**Startup list**

 <b>Note</b>	<p><b>Startup list</b></p> <p>Changes in the local CoE list of the terminal are lost <b>if the terminal is replaced</b>. If a terminal is replaced with a new Beckhoff terminal, it will have the factory settings. It is therefore advisable to link all changes in the CoE list of an EtherCAT slave with the <b>Startup list</b> of the slave, which is processed whenever the EtherCAT fieldbus is started. In this way a replacement EtherCAT slave can automatically be parameterized with the specifications of the user.</p> <p>If EtherCAT slaves are used which are unable to store local CoE values permanently, the Startup list must be used.</p>
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**Recommended approach for manual modification of CoE parameters**

- Make the required change in the System Manager. The values are stored locally in the EtherCAT slave
- If the value is to be stored permanently, enter it in the Startup list. The order of the Startup entries is usually irrelevant.

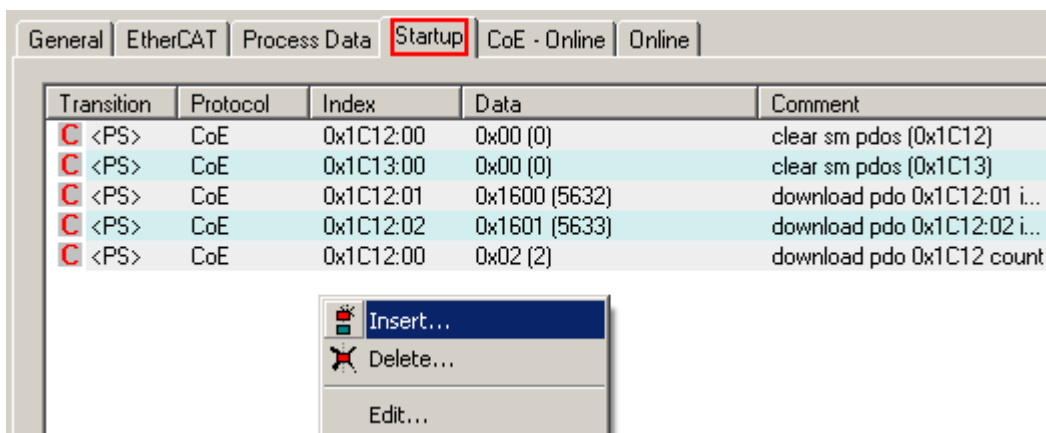


Fig. 64: Startup list in the TwinCAT System Manager

The Startup list may already contain values that were configured by the System Manager based on the ESI specifications. Additional application-specific entries can be created.

**Online/offline directory**

While working with the TwinCAT System Manager, a distinction has to be made whether the EtherCAT device is "available", i.e. switched on and linked via EtherCAT and therefore **online**, or whether a configuration is created **offline** without connected slaves.

In both cases a CoE directory is visible according to the figure "CoE-Online tab", but the connectivity is displayed as offline/online.

If the slave is offline

- the offline list from the ESI file is displayed. In this case modifications are not meaningful or possible.
- the configured status is shown under Identity
- no firmware or hardware version is displayed, since these are features of the physical device.
- Offline is shown in red

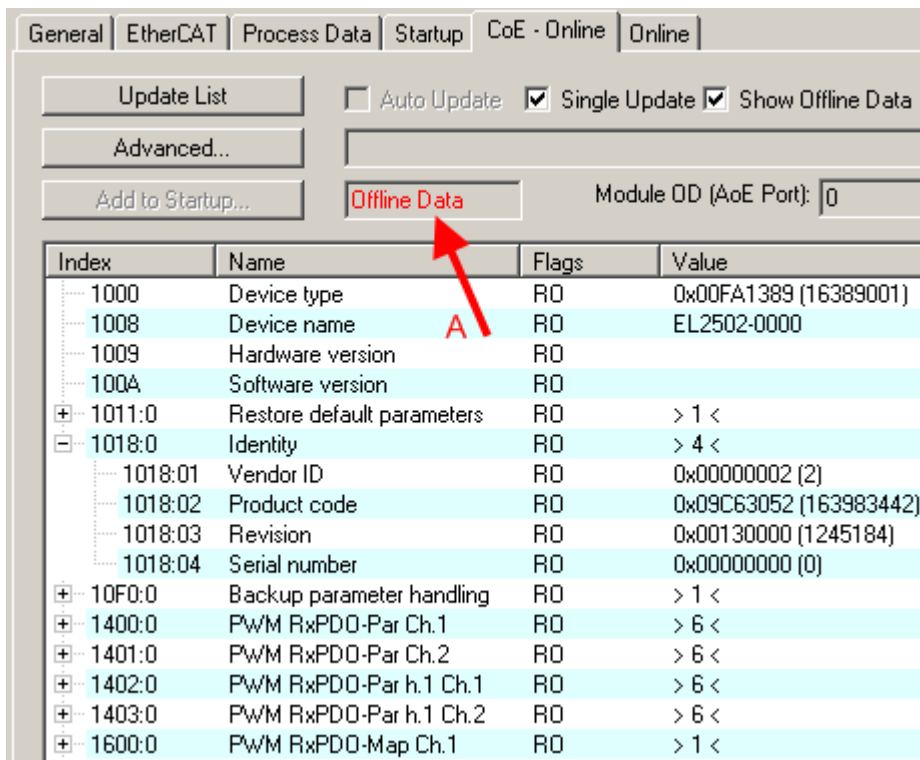


Fig. 65: Offline list

If the slave is online

- the actual current slave directory is read. This may take several seconds, depending on the size and cycle time.
- the actual identity is displayed
- the firmware and hardware version of the equipment according to the electronic information is displayed.
- Online is shown in green

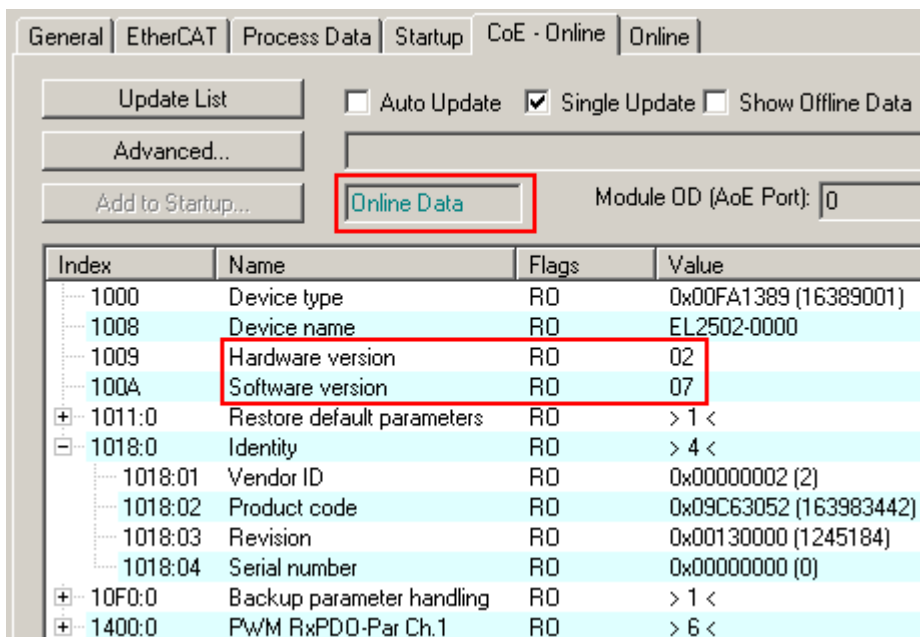


Fig. 66: Online list

**Channel-based order**

The CoE directory is located in EtherCAT devices that usually encompass several functionally equivalent channels. e.g. a 4-channel 0 – 10 V analog input terminal also has 4 logical channels and thus 4 identical sets of parameter data for the channels. In order to avoid having to list each channel in the documentation, the placeholder "n" tends to be used for the individual channel numbers.

In the CoE system 16 indices, each with 255 subindices, are generally sufficient for representing all channel parameters. The channel-based order is therefore arranged in  $16_{\text{dec}}/10_{\text{hex}}$  steps. The parameter range x8000 exemplifies this:

- Channel 0: parameter range x8000:00 ... x800F:255
- Channel 1: parameter range x8010:00 ... x801F:255
- Channel 2: parameter range x8020:00 ... x802F:255
- ...

This is generally written as x80n0. Detailed information on the CoE interface can be found in the [EtherCAT system documentation](#) on the Beckhoff website.

### 5.7.2 Object overview



Note

#### 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
<a href="#">1000</a> [ <a href="#">▶ 85</a> ]	Device type	RO	0x00001389 (5001 <sub>dec</sub> )
<a href="#">1008</a> [ <a href="#">▶ 85</a> ]	Device name	RO	EP8309-1022
<a href="#">1009</a> [ <a href="#">▶ 85</a> ]	Hardware version	RO	00
<a href="#">100A</a> [ <a href="#">▶ 85</a> ]	Software version	RO	02
<a href="#">1011</a> [ <a href="#">▶ 85</a> ]:0	<b>Subindex</b> 1011:01	RO RW	0x01 (1 <sub>dec</sub> ) 0x00000000 (0 <sub>dec</sub> )
<a href="#">1018</a> [ <a href="#">▶ 85</a> ]:0	<b>Subindex</b> 1018:01	RO	0x04 (4 <sub>dec</sub> )
	1018:02	RO	0x00000002 (2 <sub>dec</sub> )
	1018:03	RO	0x20754052 (544555090 <sub>dec</sub> )
	1018:04	RO	0x00110016 (1114134 <sub>dec</sub> )
<a href="#">10F0</a> [ <a href="#">▶ 85</a> ]:0	<b>Subindex</b> 10F0:01	RO	0x01 (1 <sub>dec</sub> ) 0x00000000 (0 <sub>dec</sub> )
<a href="#">1402</a> [ <a href="#">▶ 86</a> ]:0	<b>Subindex</b> 1402:06	RO	PWM RxPDO-Par Control 0x06 (6 <sub>dec</sub> ) 03 16
<a href="#">1403</a> [ <a href="#">▶ 86</a> ]:0	<b>Subindex</b> 1403:06	RO	AO RxPDO-Par Outputs 0x06 (6 <sub>dec</sub> ) 02 16
<a href="#">1600</a> [ <a href="#">▶ 86</a> ]:0	<b>Subindex</b> 1600:01	RO	TACHO RxPDO-Map OutputsCh.1 0x03 (3 <sub>dec</sub> ) 0x0000:00, 8
	1600:02	RO	0x7020:09, 1
	1600:03	RO	0x0000:00, 7
<a href="#">1601</a> [ <a href="#">▶ 86</a> ]:0	<b>Subindex</b> 1601:01	RO	DO RxPDO-Map Outputs 0x07 (7 <sub>dec</sub> ) 0x7050:01, 1
	1601:02	RO	0x7050:02, 1
	1601:03	RO	0x7050:03, 1
	1601:04	RO	0x7050:04, 1
	1601:05	RO	0x7050:05, 1
	1601:06	RO	0x7050:06, 1
	1601:07	RO	0x0000:00, 10
<a href="#">1602</a> [ <a href="#">▶ 86</a> ]:0	<b>Subindex</b> 1602:01	RO	PWM RxPDO-Map Control 0x06 (6 <sub>dec</sub> ) 0x7060:01, 1
	1602:02	RO	0x0000:00, 4
	1602:03	RO	0x7060:06, 1
	1602:04	RO	0x7060:07, 1
	1602:05	RO	0x0000:00, 9
	1602:06	RO	0x7060:11, 16

Index (hex)	Name	Flags	Default value
1603	<b>Subindex</b> AO RxPDO-Map Outputs	RO	0x01 (1 <sub>dec</sub> )
▶ 87]:0	1603:01 SubIndex 001	RO	0x7070:11, 16
1802	<b>Subindex</b> TACHO TxPDO-Par Single Shaft Mode Input Ch.1	RO	0x06 (6 <sub>dec</sub> )
▶ 87]:0	1802:06 Exclude TxPDOs	RO	03 1A 04 1A
1803	<b>Subindex</b> TACHO TxPDO-Par Dual Shaft Mode Input Ch.1	RO	0x06 (6 <sub>dec</sub> )
▶ 87]:0	1803:06 Exclude TxPDOs	RO	02 1A 00 00
1804	<b>Subindex</b> TACHO TxPDO-Par Dual Shaft Mode Input Ch.2	RO	0x06 (6 <sub>dec</sub> )
▶ 87]:0	1804:06 Exclude TxPDOs	RO	02 1A 00 00
1A00	<b>Subindex</b> AI TxPDO-Map Inputs Ch.1	RO	0x0A (10 <sub>dec</sub> )
▶ 87]:0	1A00:01 SubIndex 001	RO	0x6000:01, 1
	1A00:02 SubIndex 002	RO	0x6000:02, 1
	1A00:03 SubIndex 003	RO	0x6000:03, 2
	1A00:04 SubIndex 004	RO	0x6000:05, 2
	1A00:05 SubIndex 005	RO	0x6000:07, 1
	1A00:06 SubIndex 006	RO	0x0000:00, 6
	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, 16
1A01	<b>Subindex</b> AI TxPDO-Map Inputs Ch.2	RO	0x0A (10 <sub>dec</sub> )
▶ 88]:0	1A01:01 SubIndex 001	RO	0x6010:01, 1
	1A01:02 SubIndex 002	RO	0x6010:02, 1
	1A01:03 SubIndex 003	RO	0x6010:03, 2
	1A01:04 SubIndex 004	RO	0x6010:05, 2
	1A01:05 SubIndex 005	RO	0x6010:07, 1
	1A01:06 SubIndex 006	RO	0x0000:00, 6
	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, 16
1A02	<b>Subindex</b> TACHO TxPDO-Map Single Shaft Mode Input Ch.1	RO	0x0C (12 <sub>dec</sub> )
▶ 88]:0	1A02:01 SubIndex 001	RO	0x0000:00, 1
	1A02:02 SubIndex 002	RO	0x6037:02, 1
	1A02:03 SubIndex 003	RO	0x6037:03, 1
	1A02:04 SubIndex 004	RO	0x6037:04, 1
	1A02:05 SubIndex 005	RO	0x6037:05, 1
	1A02:06 SubIndex 006	RO	0x0000:00, 3
	1A02:07 SubIndex 007	RO	0x0000:00, 3
	1A02:08 SubIndex 008	RO	0x6037:0C, 1
	1A02:09 SubIndex 009	RO	0x0000:00, 3
	1A02:0A SubIndex 010	RO	0x6037:10, 1
	1A02:0B SubIndex 011	RO	0x6037:11, 16
	1A02:0C SubIndex 012	RO	0x6037:12, 16

Index (hex)	Name	Flags	Default value
<u>1A03</u>	<b>Subindex</b> TACHO TxPDO-Map Dual Shaft Mode Input Ch.1	RO	0x09 (9 <sub>dec</sub> )
[▶ 89]:0	1A03:01	RO	0x6020:01, 1
	1A03:02	RO	0x0000:00, 2
	1A03:03	RO	0x0000:00, 1
	1A03:04	RO	0x0000:00, 4
	1A03:05	RO	0x0000:00, 3
	1A03:06	RO	0x6020:0C, 1
	1A03:07	RO	0x0000:00, 3
	1A03:08	RO	0x6020:10, 1
	1A03:09	RO	0x6020:11, 16
<u>1A04</u>	<b>Subindex</b> TACHO TxPDO-Map Dual Shaft Mode Input Ch.2	RO	0x09 (9 <sub>dec</sub> )
[▶ 89]:0	1A04:01	RO	0x6030:01, 1
	1A04:02	RO	0x0000:00, 2
	1A04:03	RO	0x0000:00, 1
	1A04:04	RO	0x0000:00, 4
	1A04:05	RO	0x0000:00, 3
	1A04:06	RO	0x6030:0C, 1
	1A04:07	RO	0x0000:00, 3
	1A04:08	RO	0x6030:10, 1
	1A04:09	RO	0x6030:11, 16
<u>1A05</u>	<b>Subindex</b> DI TxPDO-Map Inputs	RO	0x07 (7 <sub>dec</sub> )
[▶ 89]:0	1A05:01	RO	0x6040:01, 1
	1A05:02	RO	0x6040:02, 1
	1A05:03	RO	0x6040:03, 1
	1A05:04	RO	0x6040:04, 1
	1A05:05	RO	0x6040:05, 1
	1A05:06	RO	0x6040:06, 1
	1A05:07	RO	0x0000:00, 10
<u>1A06</u>	<b>Subindex</b> PWM TxPDO-Map Status	RO	0x08 (8 <sub>dec</sub> )
[▶ 90]:0	1A06:01	RO	0x0000:00, 1
	1A06:02	RO	0x0000:00, 3
	1A06:03	RO	0x6060:05, 1
	1A06:04	RO	0x6060:06, 1
	1A06:05	RO	0x6060:07, 1
	1A06:06	RO	0x0000:00, 1
	1A06:07	RO	0x0000:00, 7
	1A06:08	RO	0x6060:10, 1
<u>1A07</u>	<b>Subindex</b> PWM TxPDO-Map Synchronous Info Data	RO	0x02 (2 <sub>dec</sub> )
[▶ 90]:0	1A07:01	RO	0x6060:11, 16
	1A07:02	RO	0x6060:12, 16
<u>1C00</u>	<b>Subindex</b> Sync manager type	RO	0x04 (4 <sub>dec</sub> )
[▶ 90]:0	1C00:01	RO	0x01 (1 <sub>dec</sub> )
	1C00:02	RO	0x02 (2 <sub>dec</sub> )
	1C00:03	RO	0x03 (3 <sub>dec</sub> )
	1C00:04	RO	0x04 (4 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
1C12 [▶ 90]:0	<b>Subindex</b>	RxPDO assign	RW 0x03 (3 <sub>dec</sub> )
	1C12:01	SubIndex 001	RW 0x1600 (5632 <sub>dec</sub> )
	1C12:02	SubIndex 002	RW 0x1601 (5633 <sub>dec</sub> )
	1C12:03	SubIndex 003	RW 0x1602 (5634 <sub>dec</sub> )
	1C12:04	SubIndex 004	RW 0x0000 (0 <sub>dec</sub> )
1C13 [▶ 91]:0	<b>Subindex</b>	TxPDO assign	RW 0x05 (5 <sub>dec</sub> )
	1C13:01	SubIndex 001	RW 0x1A00 (6656 <sub>dec</sub> )
	1C13:02	SubIndex 002	RW 0x1A01 (6657 <sub>dec</sub> )
	1C13:03	SubIndex 003	RW 0x1A02 (6658 <sub>dec</sub> )
	1C13:04	SubIndex 004	RW 0x1A05 (6661 <sub>dec</sub> )
	1C13:05	SubIndex 005	RW 0x1A06 (6662 <sub>dec</sub> )
	1C13:06	SubIndex 006	RW 0x0000 (0 <sub>dec</sub> )
	1C13:07	SubIndex 007	RW 0x0000 (0 <sub>dec</sub> )
1C32 [▶ 92]:0	<b>Subindex</b>	SM output parameter	RO 0x20 (32 <sub>dec</sub> )
	1C32:01	Sync mode	RW 0x0001 (1 <sub>dec</sub> )
	1C32:02	Cycle time	RW 0x000F4240 (1000000 <sub>dec</sub> )
	1C32:03	Shift time	RO 0x00000000 (0 <sub>dec</sub> )
	1C32:04	Sync modes supported	RO 0xC007 (49159 <sub>dec</sub> )
	1C32:05	Minimum cycle time	RO 0x0007A120 (500000 <sub>dec</sub> )
	1C32:06	Calc and copy time	RO 0x00000000 (0 <sub>dec</sub> )
	1C32:07	Minimum delay time	RO 0x00000000 (0 <sub>dec</sub> )
	1C32:08	Command	RW 0x0000 (0 <sub>dec</sub> )
	1C32:09	Maximum delay time	RO 0x00000000 (0 <sub>dec</sub> )
	1C32:0B	SM event missed counter	RO 0x0000 (0 <sub>dec</sub> )
	1C32:0C	Cycle exceeded counter	RO 0x0000 (0 <sub>dec</sub> )
	1C32:0D	Shift too short counter	RO 0x0000 (0 <sub>dec</sub> )
	1C32:20	Sync error	RO 0x00 (0 <sub>dec</sub> )
1C33 [▶ 93]:0	<b>Subindex</b>	SM input parameter	RO 0x20 (32 <sub>dec</sub> )
	1C33:01	Sync mode	RW 0x0022 (34 <sub>dec</sub> )
	1C33:02	Cycle time	RW 0x000F4240 (1000000 <sub>dec</sub> )
	1C33:03	Shift time	RO 0x00000000 (0 <sub>dec</sub> )
	1C33:04	Sync modes supported	RO 0xC007 (49159 <sub>dec</sub> )
	1C33:05	Minimum cycle time	RO 0x0007A120 (500000 <sub>dec</sub> )
	1C33:06	Calc and copy time	RO 0x00000000 (0 <sub>dec</sub> )
	1C33:07	Minimum delay time	RO 0x00000000 (0 <sub>dec</sub> )
	1C33:08	Command	RW 0x0000 (0 <sub>dec</sub> )
	1C33:09	Maximum delay time	RO 0x00000000 (0 <sub>dec</sub> )
	1C33:0B	SM event missed counter	RO 0x0000 (0 <sub>dec</sub> )
	1C33:0C	Cycle exceeded counter	RO 0x0000 (0 <sub>dec</sub> )
	1C33:0D	Shift too short counter	RO 0x0000 (0 <sub>dec</sub> )
	1C33:20	Sync error	RO 0x00 (0 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
6000 [▶ 94]:0	<b>Subindex</b>	AI Inputs Ch.1	RO 0x11 (17 <sub>dec</sub> )
	6000:01	Underrange	RO 0x00 (0 <sub>dec</sub> )
	6000:02	Overrange	RO 0x00 (0 <sub>dec</sub> )
	6000:03	Limit 1	RO 0x00 (0 <sub>dec</sub> )
	6000:05	Limit 2	RO 0x00 (0 <sub>dec</sub> )
	6000:07	Error	RO 0x00 (0 <sub>dec</sub> )
	6000:0E	Sync error	RO 0x00 (0 <sub>dec</sub> )
	6000:0F	TxPDO State	RO 0x00 (0 <sub>dec</sub> )
	6000:10	TxPDO Toggle	RO 0x00 (0 <sub>dec</sub> )
6000:11	Value	RO 0x0000 (0 <sub>dec</sub> )	
6010 [▶ 94]:0	<b>Subindex</b>	AI Inputs Ch.2	RO 0x11 (17 <sub>dec</sub> )
	6010:01	Underrange	RO 0x00 (0 <sub>dec</sub> )
	6010:02	Overrange	RO 0x00 (0 <sub>dec</sub> )
	6010:03	Limit 1	RO 0x00 (0 <sub>dec</sub> )
	6010:05	Limit 2	RO 0x00 (0 <sub>dec</sub> )
	6010:07	Error	RO 0x00 (0 <sub>dec</sub> )
	6010:0E	Sync error	RO 0x00 (0 <sub>dec</sub> )
	6010:0F	TxPDO State	RO 0x00 (0 <sub>dec</sub> )
	6010:10	TxPDO Toggle	RO 0x00 (0 <sub>dec</sub> )
6010:11	Value	RO 0x0000 (0 <sub>dec</sub> )	
6020 [▶ 94]:0	<b>Subindex</b>	TACHO Dual Shaft Mode Input Ch.1	RO 0x11 (17 <sub>dec</sub> )
	6020:01	Digital input	RO 0x00 (0 <sub>dec</sub> )
	6020:0C	Speed Below Threshold	RO 0x00 (0 <sub>dec</sub> )
	6020:10	TxPDO Toggle	RO 0x00 (0 <sub>dec</sub> )
6020:11	Rotational Speed	RO 0x0000 (0 <sub>dec</sub> )	
6030 [▶ 94]:0	<b>Subindex</b>	TACHO Dual Shaft Mode Input Ch.2	RO 0x11 (17 <sub>dec</sub> )
	6030:01	Digital input	RO 0x00 (0 <sub>dec</sub> )
	6030:0C	Speed Below Threshold	RO 0x00 (0 <sub>dec</sub> )
	6030:10	TxPDO Toggle	RO 0x00 (0 <sub>dec</sub> )
6030:11	Rotational Speed	RO 0x0000 (0 <sub>dec</sub> )	
6037 [▶ 95]:0	<b>Subindex</b>	TACHO Single Shaft Mode Input	RO 0x12 (18 <sub>dec</sub> )
	6037:02	Error Input A	RO 0x00 (0 <sub>dec</sub> )
	6037:03	Input Status A	RO 0x00 (0 <sub>dec</sub> )
	6037:04	Error Input B	RO 0x00 (0 <sub>dec</sub> )
	6037:05	Input Status B	RO 0x00 (0 <sub>dec</sub> )
	6037:0C	Speed Below Threshold	RO 0x00 (0 <sub>dec</sub> )
	6037:10	TxPDO Toggle	RO 0x00 (0 <sub>dec</sub> )
	6037:11	Rotational Speed	RO 0x0000 (0 <sub>dec</sub> )
6037:12	Rotation Direction	RO 0x0000 (0 <sub>dec</sub> )	
6040 [▶ 95]:0	<b>Subindex</b>	DI Inputs	RO 0x06 (6 <sub>dec</sub> )
	6040:01	Digital Input X4 Pin4	RO 0x00 (0 <sub>dec</sub> )
	6040:02	Digital Input X4 Pin2	RO 0x00 (0 <sub>dec</sub> )
	6040:03	Digital Input X6 Pin4	RO 0x00 (0 <sub>dec</sub> )
	6040:04	Digital Input X6 Pin2	RO 0x00 (0 <sub>dec</sub> )
	6040:05	Digital Input X7 Pin4	RO 0x00 (0 <sub>dec</sub> )
	6040:06	Digital Input X7 Pin2	RO 0x00 (0 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
6060	<b>Subindex</b> PWM Inputs	RO	0x12 (18 <sub>dec</sub> )
[▶ 95]:0	6060:05 Ready to enable	RO	0x00 (0 <sub>dec</sub> )
	6060:06 Warning	RO	0x00 (0 <sub>dec</sub> )
	6060:07 Error	RO	0x00 (0 <sub>dec</sub> )
	6060:10 TxPDO Toggle	RO	0x00 (0 <sub>dec</sub> )
	6060:11 Info data 1	RO	0x0000 (0 <sub>dec</sub> )
	6060:12 Info data 2	RO	0x0000 (0 <sub>dec</sub> )
7020	<b>Subindex</b> TACHO Outputs	RO	0x09 (9 <sub>dec</sub> )
[▶ 95]:0	7020:09 Reset Error	RO	0x00 (0 <sub>dec</sub> )
7030	<b>Subindex</b> TACHO Outputs	RO	0x09 (9 <sub>dec</sub> )
[▶ 95]:0	7030:09 Reset Error	RO	0x00 (0 <sub>dec</sub> )
7050	<b>Subindex</b> DO Outputs	RO	0x06 (6 <sub>dec</sub> )
[▶ 95]:0	7050:01 Digital Output X5 Pin4	RO	0x00 (0 <sub>dec</sub> )
	7050:02 Digital Output X5 Pin2	RO	0x00 (0 <sub>dec</sub> )
	7050:03 Digital Output X6 Pin4	RO	0x00 (0 <sub>dec</sub> )
	7050:04 Digital Output X6 Pin2	RO	0x00 (0 <sub>dec</sub> )
	7050:05 Digital Output X7 Pin4	RO	0x00 (0 <sub>dec</sub> )
	7050:06 Digital Output X7 Pin2	RO	0x00 (0 <sub>dec</sub> )
7060	<b>Subindex</b> PWM Outputs	RO	0x11 (17 <sub>dec</sub> )
[▶ 96]:0	7060:01 Enable dithering	RO	0x00 (0 <sub>dec</sub> )
	7060:06 Enable	RO	0x00 (0 <sub>dec</sub> )
	7060:07 Reset	RO	0x00 (0 <sub>dec</sub> )
	7060:11 PWM output	RO	0x0000 (0 <sub>dec</sub> )
7070	<b>Subindex</b> AO Outputs	RO	0x11 (17 <sub>dec</sub> )
[▶ 96]:0	7070:11 Analog output	RO	0x0000 (0 <sub>dec</sub> )
8000:0	<b>Subindex</b> AI Settings Ch. 1	RW	0x18 (24 <sub>dec</sub> )
[▶ 80]	8000:01 Enable user scale	RW	0x00 (0 <sub>dec</sub> )
	8000:02 Presentation	RW	0x00 (0 <sub>dec</sub> )
	8000:05 Siemens bits	RW	0x00 (0 <sub>dec</sub> )
	8000:06 Enable filter	RW	0x00 (0 <sub>dec</sub> )
	8000:07 Enable limit 1	RW	0x00 (0 <sub>dec</sub> )
	8000:08 Enable limit 2	RW	0x00 (0 <sub>dec</sub> )
	8000:0A Enable user calibration	RW	0x00 (0 <sub>dec</sub> )
	8000:0B Enable vendor calibration	RW	0x01 (1 <sub>dec</sub> )
	8000:0E Swap limit bits	RW	0x00 (0 <sub>dec</sub> )
	8000:11 User scale offset	RW	0x0000 (0 <sub>dec</sub> )
	8000:12 User scale gain	RW	0x00010000 (65536 <sub>dec</sub> )
	8000:13 Limit 1	RW	0x0000 (0 <sub>dec</sub> )
	8000:14 Limit 2	RW	0x0000 (0 <sub>dec</sub> )
	8000:15 Filter settings	RW	0x0000 (0 <sub>dec</sub> )
	8000:17 User calibration offset	RW	0x0000 (0 <sub>dec</sub> )
	8000:18 User calibration gain	RW	0x4000 (16384 <sub>dec</sub> )
800E	<b>Subindex</b> AI Internal data Ch. 1	RO	0x01 (1 <sub>dec</sub> )
[▶ 96]:0	800E:01 ADC raw value	RO	0x0000 (0 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
800F	<b>Subindex</b> AI Vendor data Ch.1	RW	0x06 (6 <sub>dec</sub> )
[▶ 96]:0	800F:01	RW	0x0000 (0 <sub>dec</sub> )
	800F:02	RW	0x4000 (16384 <sub>dec</sub> )
	800F:03	RW	0x0000 (0 <sub>dec</sub> )
	800F:04	RW	0x4000 (16384 <sub>dec</sub> )
	800F:05	RW	0x0000 (0 <sub>dec</sub> )
	800F:06	RW	0x4000 (16384 <sub>dec</sub> )
8010:0	<b>Subindex</b> AI Settings Ch.2	RW	0x18 (24 <sub>dec</sub> )
[▶ 81]	8010:01	RW	0x00 (0 <sub>dec</sub> )
	8010:02	RW	0x00 (0 <sub>dec</sub> )
	8010:05	RW	0x00 (0 <sub>dec</sub> )
	8010:06	RW	0x00 (0 <sub>dec</sub> )
	8010:07	RW	0x00 (0 <sub>dec</sub> )
	8010:08	RW	0x00 (0 <sub>dec</sub> )
	8010:0A	RW	0x00 (0 <sub>dec</sub> )
	8010:0B	RW	0x01 (1 <sub>dec</sub> )
	8010:0E	RW	0x00 (0 <sub>dec</sub> )
	8010:11	RW	0x0000 (0 <sub>dec</sub> )
	8010:12	RW	0x00010000 (65536 <sub>dec</sub> )
	8010:13	RW	0x0000 (0 <sub>dec</sub> )
	8010:14	RW	0x0000 (0 <sub>dec</sub> )
	8010:15	RW	0x0000 (0 <sub>dec</sub> )
8010:17	RW	0x0000 (0 <sub>dec</sub> )	
8010:18	RW	0x4000 (16384 <sub>dec</sub> )	
801E	<b>Subindex</b> AI Internal Data Ch.2	RO	0x01 (1 <sub>dec</sub> )
[▶ 96]:0	801E:01	RO	0x0000 (0 <sub>dec</sub> )
801F	<b>Subindex</b> AI Vendor Data Ch.2	RW	0x06 (6 <sub>dec</sub> )
[▶ 96]:0	801F:01	RW	0x0000 (0 <sub>dec</sub> )
	801F:02	RW	0x4000 (16384 <sub>dec</sub> )
	801F:03	RW	0x0000 (0 <sub>dec</sub> )
	801F:04	RW	0x4000 (16384 <sub>dec</sub> )
	801F:05	RW	0x0000 (0 <sub>dec</sub> )
	801F:06	RW	0x4000 (16384 <sub>dec</sub> )
8020	<b>Subindex</b> TACHO Settings Dual Shaft Mode Ch.1	RW	0x15 (21 <sub>dec</sub> )
[▶ 81]:0	8020:11	RW	0x0001 (1 <sub>dec</sub> )
	8020:12	RW	0x0064 (100 <sub>dec</sub> )
	8020:15	RW	0x0001 (1 <sub>dec</sub> )
8030	<b>Subindex</b> TACHO Settings Dual Shaft Mode Ch.2	RW	0x15 (21 <sub>dec</sub> )
[▶ 81]:0	8030:11	RW	0x0001 (1 <sub>dec</sub> )
	8030:12	RW	0x0064 (100 <sub>dec</sub> )
	8030:15	RW	0x0001 (1 <sub>dec</sub> )
8031	<b>Subindex</b> TACHO Settings Single Shaft Mode	RW	0x15 (21 <sub>dec</sub> )
[▶ 82]:0	8031:0B	RW	0x01 (1 <sub>dec</sub> )
	8031:0C	RW	0x00 (0 <sub>dec</sub> )
	8031:11	RW	0x0001 (1 <sub>dec</sub> )
	8031:12	RW	0x0064 (100 <sub>dec</sub> )
	8031:15	RW	0x0000 (0 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
8060	<b>Subindex</b> PWM settings	RW	0x22 (34 <sub>dec</sub> )
▶ 83]:0	8060:03	RW	0x00 (0 <sub>dec</sub> )
	8060:04	RW	0x00 (0 <sub>dec</sub> )
	8060:05	RW	0x00 (0 <sub>dec</sub> )
	8060:0B	RW	0x0000 (0 <sub>dec</sub> )
	8060:0C	RW	0x00010000 (65536 <sub>dec</sub> )
	8060:0D	RW	0x0000 (0 <sub>dec</sub> )
	8060:0E	RW	0xFFFF (65535 <sub>dec</sub> )
	8060:10	RW	0x64 (100 <sub>dec</sub> )
	8060:12	RW	0x00FA (250 <sub>dec</sub> )
	8060:13	RW	0x0004 (4 <sub>dec</sub> )
	8060:14	RW	0x0032 (50 <sub>dec</sub> )
	8060:1E	RW	0x0064 (100 <sub>dec</sub> )
	8060:1F	RW	0x0A (10 <sub>dec</sub> )
	8060:21	RW	0x00 (0 <sub>dec</sub> )
	8060:22	RW	0x00 (0 <sub>dec</sub> )
806F	<b>Subindex</b> PWM Vendor data	RW	0x02 (2 <sub>dec</sub> )
▶ 96]:0	806F:01	RW	0x0000 (0 <sub>dec</sub> )
	806F:02	RW	0x4000 (16384 <sub>dec</sub> )
8070	<b>Subindex</b> AO Settings	RW	0x16 (22 <sub>dec</sub> )
▶ 84]:0	8070:01	RW	0x00 (0 <sub>dec</sub> )
	8070:02	RW	0x00 (0 <sub>dec</sub> )
	8070:05	RW	0x00 (0 <sub>dec</sub> )
	8070:07	RW	0x00 (0 <sub>dec</sub> )
	8070:08	RW	0x01 (1 <sub>dec</sub> )
	8070:11	RW	0x0000 (0 <sub>dec</sub> )
	8070:12	RW	0x00010000 (65536 <sub>dec</sub> )
	8070:13	RW	0x0000 (0 <sub>dec</sub> )
	8070:14	RW	0xFFFF (65535 <sub>dec</sub> )
	8070:15	RW	0x0000 (0 <sub>dec</sub> )
	8070:16	RW	0x4000 (16384 <sub>dec</sub> )
807E	<b>Subindex</b> AO Internal Data	RO	0x01 (1 <sub>dec</sub> )
▶ 97]:0	807E:01	RO	0x0000 (0 <sub>dec</sub> )
807F	<b>Subindex</b> AO Vendor Data	RW	0x06 (6 <sub>dec</sub> )
▶ 97]:0	807F:01	RW	0x0000 (0 <sub>dec</sub> )
	807F:02	RW	0x4000 (16384 <sub>dec</sub> )
	807F:03	RW	0x0000 (0 <sub>dec</sub> )
	807F:04	RW	0x4000 (16384 <sub>dec</sub> )
	807F:05	RW	0x0000 (0 <sub>dec</sub> )
	807F:06	RW	0x4000 (16384 <sub>dec</sub> )
A060	<b>Subindex</b> PWM Diag data	RO	0x06 (6 <sub>dec</sub> )
▶ 97]:0	A060:02	RO	0x00 (0 <sub>dec</sub> )
	A060:06	RO	0x00 (0 <sub>dec</sub> )
F000	<b>Subindex</b> Modular device profile	RO	0x02 (2 <sub>dec</sub> )
▶ 97]:0	F000:01	RO	0x0010 (16 <sub>dec</sub> )
	F000:02	RO	0x0008 (8 <sub>dec</sub> )

Index (hex)	Name	Flags	Default value
F008 [▶ 97]	Code word	RW	0x00000000 (0 <sub>dec</sub> )
F010 [▶ 97]:0	<b>Subindex</b> Module list	RW	0x08 (8 <sub>dec</sub> )
	F010:01 SubIndex 001	RW	0x0000012C (300 <sub>dec</sub> )
	F010:02 SubIndex 002	RW	0x0000012C (300 <sub>dec</sub> )
	F010:03 SubIndex 003	RW	0x00000208 (520 <sub>dec</sub> )
	F010:04 SubIndex 004	RW	0x00000208 (520 <sub>dec</sub> )
	F010:05 SubIndex 005	RW	0x00000064 (100 <sub>dec</sub> )
	F010:06 SubIndex 006	RW	0x000000C8 (200 <sub>dec</sub> )
	F010:07 SubIndex 007	RW	0x000000FA (250 <sub>dec</sub> )
	F010:08 SubIndex 008	RW	0x00000190 (400 <sub>dec</sub> )
F800 [▶ 84]:0	<b>Subindex</b> AIAO Range settings	RW	0x08 (8 <sub>dec</sub> )
	F800:01 Input type Ch1	RW	0x0001 (1 <sub>dec</sub> )
	F800:02 Input type Ch2	RW	0x0001 (1 <sub>dec</sub> )
	F800:08 Output type	RW	0x0001 (1 <sub>dec</sub> )
F900 [▶ 98]:0	<b>Subindex</b> PWM Info data	RO	0x02 (2 <sub>dec</sub> )
	F900:02 Temperature [°C]	RO	0x00 (0 <sub>dec</sub> )
FB00 [▶ 98]:0	<b>Subindex</b> PWM Command	RO	0x03 (3 <sub>dec</sub> )
	FB00:01 Request	RW	{0}
	FB00:02 Status	RO	0x00 (0 <sub>dec</sub> )
	FB00:03 Response	RO	{0}



**Key**

Flags:

RO (Read Only): this object can be read only

RW (Read/Write): this object can be read and written to

**5.7.3 Object description and parameterization**

 <b>Note</b>	<p><b>Parameterization</b></p> <p>The terminal is parameterized via the <a href="#">CoE - Online tab [▶ 52]</a> (double-click on the respective object) or via the <a href="#">Process Data tab [▶ 49]</a>(assignment of PDOs).</p>
 <b>Note</b>	<p><b>EtherCAT XML Device Description</b></p> <p>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 <a href="#">website</a> and installing it according to installation instructions.</p>

**Introduction**

The CoE overview contains objects for different intended applications:

- [Objects required for parameterization \[▶ 80\]](#) during commissioning
- [Objects intended for regular operation \[▶ 84\]](#), e.g. through ADS access.
- [Objects for indicating internal settings \[▶ 85\]](#) (may be fixed)
- Further [profile-specific objects \[▶ 94\]](#) 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.

### 5.7.3.1 Objects to be parameterized during commissioning

#### Index 8000 AI Settings Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
8000:0	AI Settings	Maximum subindex	UINT8	RO	0x18 (24 <sub>dec</sub> )
8000:01	Enable user scale	1 User scale is active.	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8000:02	Presentation	0 Signed presentation	BIT3	RW	0x00 (0 <sub>dec</sub> )
		1 Unsigned presentation			
		2 Absolute value with MSB as sign (signed amount representation)			
8000:06	Enable filter	1 Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8000:07	Enable limit 1	1 Limit 1 enabled	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8000:08	Enable limit 2	1 Limit 2 enabled	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8000:0A	Enable user calibration	1 Enabling of the user calibration	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8000:0B	Enable vendor calibration	1 Enabling of the vendor calibration	BOOLEAN	RW	0x01 (1 <sub>dec</sub> )
8000:11	User scale offset	User scale offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8000:12	User scale gain	User scale gain. The gain is represented in fixed-point format, with the factor 2 <sup>-16</sup> . The value 1 corresponds to 65535 <sub>dez</sub> (0x00010000 <sub>hex</sub> ) and is limited to +/- 0x7FFFF	INT32	RW	0x00010000 (65536 <sub>dec</sub> )
8000:13	Limit 1	First limit value for setting the status bits	INT16	RW	0x0000 (0 <sub>dec</sub> )
8000:14	Limit 2	Second limit value for setting the status bits	INT16	RW	0x0000 (0 <sub>dec</sub> )
8000:15	Filter settings	This object determines the digital filter settings <b>for all channels of the module</b> , if it is activated via Enable filter (index 0x80n0:06 [▶ 80]). The possible settings are sequentially numbered.	UINT16	RW	0x0000 (0 <sub>dec</sub> )
		0 50 Hz FIR			
		1 60 Hz FIR			
		2 IIR 1			
		3 IIR 2			
		4 IIR 3			
		5 IIR 4			
		6 IIR 5			
		7 IIR 6			
		8 IIR 7			
9 IIR 8					
8000:17	User calibration offset	User calibration: Offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8000:18	User calibration gain	User calibration: Gain	INT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index 8000 AI Settings Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
8010:0	AI Settings	Maximum subindex	UINT8	RO	0x18 (24 <sub>dec</sub> )
8010:01	Enable user scale	1 User scale is active.	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8010:02	Presentation	0 Signed presentation	BIT3	RW	0x00 (0 <sub>dec</sub> )
		1 Unsigned presentation			
		2 Absolute value with MSB as sign (signed amount representation)			
8010:06	Enable filter	1 Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8010:07	Enable limit 1	1 Limit 1 enabled	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8010:08	Enable limit 2	1 Limit 2 enabled	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8010:0A	Enable user calibration	1 Enabling of the user calibration	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8010:0B	Enable vendor calibration	1 Enabling of the vendor calibration	BOOLEAN	RW	0x01 (1 <sub>dec</sub> )
8010:11	User scale offset	User scale offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8010:12	User scale gain	User scale gain. The gain is represented in fixed-point format, with the factor 2 <sup>-16</sup> . The value 1 corresponds to 65535 <sub>dez</sub> (0x00010000 <sub>hex</sub> ) and is limited to +/- 0x7FFFF	INT32	RW	0x00010000 (65536 <sub>dec</sub> )
8010:13	Limit 1	First limit value for setting the status bits	INT16	RW	0x0000 (0 <sub>dec</sub> )
8010:14	Limit 2	Second limit value for setting the status bits	INT16	RW	0x0000 (0 <sub>dec</sub> )
8010:15	Filter settings	This object determines the digital filter settings for all channels of the module, if it is activated via Enable filter (index 0x80n0:06 [▶ 80]). The possible settings are sequentially numbered.	UINT16	RW	0x0000 (0 <sub>dec</sub> )
		0 50 Hz FIR			
		1 60 Hz FIR			
		2 IIR 1			
		3 IIR 2			
		4 IIR 3			
		5 IIR 4			
		6 IIR 5			
		7 IIR 6			
		8 IIR 7			
9 IIR 8					
8010:17	User calibration offset	User calibration: Offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8010:18	User calibration gain	User calibration: Gain	INT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index 8020 TACHO Settings Dual Shaft Mode Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
8020:0	TACHO Settings Dual Shaft Mode Ch.1		UINT8	RO	0x15 (21 <sub>dec</sub> )
8020:11	No. of Targets	Number of "cams" on the shaft/axis	UINT16	RW	0x0001 (1 <sub>dec</sub> )
8020:12	Input Signal Timeout	The process record <Speed Below Threshold> is set after x msec without signal change at the input.	UINT16	RW	0x0064 (100 <sub>dec</sub> )
8020:15	Presentation	Display of the measured value in RPM, Hz, ...	UINT16	RW	0x0001 (1 <sub>dec</sub> )

**Index 8030 TACHO Settings Dual Shaft Mode Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
8030:0	TACHO Settings Dual Shaft Mode Ch.2		UINT8	RO	0x15 (21 <sub>dec</sub> )
8030:11	No. of Targets	Number of "cams" on the shaft/axis	UINT16	RW	0x0001 (1 <sub>dec</sub> )
8030:12	Input Signal Timeout	The process record <Speed Below Threshold> is set after x msec without signal change at the input.	UINT16	RW	0x0064 (100 <sub>dec</sub> )
8030:15	Presentation	Display of the measured value in RPM, Hz, ...	UINT16	RW	0x0001 (1 <sub>dec</sub> )

**Index 8031 TACHO Settings Single Shaft Mode**

Index (hex)	Name	Meaning	Data type	Flags	Default
8031:0	TACHO Settings Single Shaft Mode		UINT8	RO	0x15 (21 <sub>dec</sub> )
8031:0B	Enable Error Detection	Enable/disable error display	BOOLEAN	RW	0x01 (1 <sub>dec</sub> )
8031:0C	Reversion of Rotation	Reversion of rotation display in <i>Rotation direction</i>	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8031:11	No. of Targets	Number of "cams" on the shaft/axis	UINT16	RW	0x0001 (1 <sub>dec</sub> )
8031:12	Input Signal Timeout	The process record <Speed Below Threshold> is set after x msec without signal change at the input.	UINT16	RW	0x0064 (100 <sub>dec</sub> )
8031:15	Presentation	Display of the measured value in RPM, Hz, ...	UINT16	RW	0x0000 (0 <sub>dec</sub> )

**Index 8040 DIG Safe State Active**

Index (hex)	Name	Meaning	Data type	Flags	Default
8040:0	DIG Safe State Active		UINT8	RO	0x08 (8 <sub>dec</sub> )
8040:01	X4 Pin4	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:02	X4 Pin2	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:03	X5 Pin4	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:04	X5 Pin2	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:05	X6 Pin4	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:05	X6 Pin2	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:07	X7 Pin4	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE
8040:08	X7 Pin2	Activation of Safe State Value if communication is canceled	BOOLEAN	RW	TRUE

**Index 8041 DIG Safe State Value**

Index (hex)	Name	Meaning	Data type	Flags	Default
8040:0	DIG Safe State Value		UINT8	RO	0x00 (0 <sub>dec</sub> )
8040:01	X4 Pin4	Output value if communication is canceled	BOOLEAN	RW	False
8040:02	X4 Pin2	Output value if communication is canceled	BOOLEAN	RW	False
8040:03	X5 Pin4	Output value if communication is canceled	BOOLEAN	RW	False
8040:04	X5 Pin2	Output value if communication is canceled	BOOLEAN	RW	False
8040:05	X6 Pin4	Output value if communication is canceled	BOOLEAN	RW	False
8040:05	X6 Pin2	Output value if communication is canceled	BOOLEAN	RW	False
8040:07	X7 Pin4	Output value if communication is canceled	BOOLEAN	RW	False
8040:08	X7 Pin2	Output value if communication is canceled	BOOLEAN	RW	False

**Index 8043 DIG Safe State Delay**

Index (hex)	Name	Meaning	Data type	Flags	Default
8040:0	DIG Safe State Delay		UINT8	RO	0x00 (0 <sub>dec</sub> )
8040:01	X4 Pin4	Delay in msec after communication is canceled	UINT16	RW	False
8040:02	X4 Pin2	Delay in msec after communication is canceled	UINT16	RW	False
8040:03	X5 Pin4	Delay in msec after communication is canceled	UINT16	RW	False
8040:04	X5 Pin2	Delay in msec after communication is canceled	UINT16	RW	False
8040:05	X6 Pin4	Delay in msec after communication is canceled	UINT16	RW	False
8040:05	X6 Pin2	Delay in msec after communication is canceled	UINT16	RW	False
8040:07	X7 Pin4	Delay in msec after communication is canceled	UINT16	RW	False
8040:08	X7 Pin2	Delay in msec after communication is canceled	UINT16	RW	False

**Index 8060 PWM Settings**

Index (hex)	Name	Meaning	Data type	Flags	Default
8060:0	PWM settings	Maximum subindex	UINT8	RO	0x22 (34 <sub>dec</sub> )
8060:03	Enable dithering	Dithering is "enabled", activation via process data	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8060:04	Invert polarity	Reverse current direction	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8060:05	Watchdog	0: Default watchdog value The default value (0x8pp0:0D) is active.  1: Watchdog ramp active The ramp (0x8pp0:0E) for moving to the default value ((0x8pp0:0D)) is active.  2: Last output value active In the event of a fault (watchdog drop) the last process data is issued.	BIT2	RW	0x00 (0 <sub>dec</sub> )
8060:0B	Offset	This is the user scaling offset Scaling: 1 = rated terminal current / 1024	INT16	RW	0x0000 (0 <sub>dec</sub> )
8060:0C	Gain	This is the user scaling gain. The gain is a fixed-point number with the factor 2 <sup>-16</sup> . The value one corresponds to 65536 (0x00010000).	INT32	RW	0x00010000 (65536 <sub>dec</sub> )
8060:0D	Default output	This is the default output value. The value is output if it is activated via 0x8pp0:05.	INT16	RW	0x0000 (0 <sub>dec</sub> )
8060:0E	Default output ramp	This value defines the ramps for the ramp-down to the default value. The value is specified in digits / ms. If the entry is 100 and the default value 0, for example, it takes 327 ms (32767/100) for the output value to change from the maximum value (32767) to the default value in the event of a fault.	UINT16	RW	0xFFFF (65535 <sub>dec</sub> )
8060:10	Max current [%]	Maximum output current mA	UINT8	RW	0x64 (100 <sub>dec</sub> )
8060:12	Kp factor	This is the user scaling gain. The gain is a fixed-point number with the factor 2 <sup>-16</sup> . The value 1 corresponds to 65535 (0x00010000).	UINT16	RW	0x00FA (250 <sub>dec</sub> )
8060:13	Ki factor	This is the default output value	UINT16	RW	0x0004 (4 <sub>dec</sub> )
8060:14	Kd factor	This value defines the ramps for the ramp-down to the default value. The value is specified in digits / ms. If the entry is 100 and the default value 0, for example, it takes 327 ms (32767/100) for the output value to change from the maximum value (32767) to the default value in the event of a fault.	UINT16	RW	0x0032 (50 <sub>dec</sub> )
8060:1E	Dithering frequency [Hz]	Dither frequency in Hertz	UINT16	RW	0x0064 (100 <sub>dec</sub> )
8060:1F	Dithering amplitude [%]	Dithering amplitude in percent of the maximum permitted current (rated box current * 0x8pp0:10)	UINT8	RW	0x0A (10 <sub>dec</sub> )
8060:21	Select info data 1	Selection of synchronous info data (s. 0x6pp0:11)	UINT8	RW	0x00 (0 <sub>dec</sub> )
8060:22	Select info data 2	Selection of synchronous info data (s. 0x6pp0:12)	UINT8	RW	0x00 (0 <sub>dec</sub> )

## Index 8070 AO Settings

Index (hex)	Name	Meaning	Data type	Flags	Default
8070:0	AO Settings		UINT8	RO	0x16 (22 <sub>dec</sub> )
8070:01	Enable user scale	This entry activates the scaling for 0x8pp0:11 and 0x8pp0:12.	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8070:02	Presentation	0: Signed presentation The output value range 0x7pp1:11 is shown as 16 bit signed integer. For unipolar terminals (0-10V or 0-20 mA) the negative range is set to zero.  1: Unsigned presentation The output value range 0x7pp1:11 is shown as 16 bit unsigned integer. Negative values are not possible.  2: Absolute value with MSB as sign, signed amount representation is active.  3: Absolute value, the absolute value of the signed representation is formed.	BIT3	RW	0x00 (0 <sub>dec</sub> )
8070:05	Watchdog	0: Default watchdog value The default value (0x8pp0:13) is active.  1: Watchdog ramp The ramp (0x8pp0:14) for moving to the default value ((0x8pp0:13)) is active.  2: Last output value In the event of a fault (watchdog drop) the last process data is issued.	BIT2	RW	0x00 (0 <sub>dec</sub> )
8070:07	Enable user calibration	Enabling of the user calibration	BOOLEAN	RW	0x00 (0 <sub>dec</sub> )
8070:08	Enable vendor calibration	Enable vendor calibration	BOOLEAN	RW	0x01 (1 <sub>dec</sub> )
8070:11	User scale offset	This is the user scaling offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8070:12	User scale gain	This is the user scaling gain. The gain is a fixed-point number with the factor 2 <sup>-16</sup> . The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536 <sub>dec</sub> )
8070:13	Default output	This is the default output value	INT16	RW	0x0000 (0 <sub>dec</sub> )
8070:14	Default output ramp	This value defines the ramps for the ramp-down to the default value. The value is specified in digits / ms.  If the entry is 100 and the default value 0, for example, it takes 327 ms (32767/100) for the output value to change from the maximum value (32767) to the default value in the event of a fault.	UINT16	RW	0xFFFF (65535 <sub>dec</sub> )
8070:15	User calibration offset	User calibration offset	INT16	RW	0x0000 (0 <sub>dec</sub> )
8070:16	User calibration gain	User gain compensation	UINT16	RW	0x4000 (16384 <sub>dec</sub> )

## Index F800 AIAO Range settings

Index (hex)	Name	Meaning	Data type	Flags	Default
F800:0	AIAO Range settings		UINT8	RO	0x08 (8 <sub>dec</sub> )
F800:01	Input type Ch1	Select input type for Ch1	UINT16	RW	0x0001 (1 <sub>dec</sub> )
F800:02	Input type Ch2	Select input type for Ch2	UINT16	RW	0x0001 (1 <sub>dec</sub> )
F800:08	Output type	Select input type for Ch1	UINT16	RW	0x0001 (1 <sub>dec</sub> )

## 5.7.3.2 Objects for regular operation

The EP8309 has no such objects.

### 5.7.3.3 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 Low-Word contains the CoE profile used (5001). The High-Word contains the module profile according to the modular device profile.	UINT32	RO	0x00001389 (5001 <sub>dec</sub> )

#### Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EP8309-1022

#### 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	02

#### 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 <sub>dec</sub> )
1011:01	SubIndex 001	If this object is set to " <b>0x64616F6C</b> " in the set value dialog, all backup objects are reset to their delivery state.	UINT32	RW	0x00000000 (0 <sub>dec</sub> )

#### Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default
1018:0	Identity	Information for identifying the slave	UINT8	RO	0x04 (4 <sub>dec</sub> )
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	0x00000002 (2 <sub>dec</sub> )
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	0x20754052 (544555090 <sub>dec</sub> )
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	0x00110016 (1114134 <sub>dec</sub> )
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 <sub>dec</sub> )

#### 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 <sub>dec</sub> )
10F0:01	Checksum	Checksum across all backup entries of the EtherCAT slave	UINT32	RO	0x00000000 (0 <sub>dec</sub> )

**Index 1402 PWM RxPDO-Par Control**

Index (hex)	Name	Meaning	Data type	Flags	Default
1402:0	PWM RxPDO-Par Control	PDO Parameter RxPDO 3	UINT8	RO	0x06 (6 <sub>dec</sub> )
1402:06	Exclude RxPDOs	Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 3	OCTET-STRING[2]	RO	03 16

**Index 1403 AO RxPDO-Par Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
1403:0	AO RxPDO-Par Outputs	PDO Parameter RxPDO 4	UINT8	RO	0x06 (6 <sub>dec</sub> )
1403:06	Exclude RxPDOs	Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 4	OCTET-STRING[2]	RO	02 16

**Index 1600 TACHO RxPDO-Map OutputsCh.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
1600:0	TACHO RxPDO-Map OutputsCh.1	PDO Mapping RxPDO 1	UINT8	RO	0x03 (3 <sub>dec</sub> )
1600:01	SubIndex 001	1. PDO Mapping entry (object 0x7020 (PWM Outputs Ch.1), entry 0x01 (Enable dithering))	UINT32	RO	0x0000:00, 8
1600:02	SubIndex 002	2. PDO Mapping entry (4 bits align)	UINT32	RO	0x7020:09, 1
1600:03	SubIndex 003	3. PDO Mapping entry (object 0x7020 (PWM Outputs Ch.1), entry 0x06 (Enable))	UINT32	RO	0x0000:00, 7

**Index 1601 DO RxPDO-Map Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
1601:0	DO RxPDO-Map Outputs	PDO Mapping RxPDO 2	UINT8	RO	0x07 (7 <sub>dec</sub> )
1601:01	SubIndex 001	1. PDO Mapping entry (object 0x7030 (PWM Outputs Ch.2), entry 0x01 (Enable dithering))	UINT32	RO	0x7050:01, 1
1601:02	SubIndex 002	2. PDO Mapping entry (4 bits align)	UINT32	RO	0x7050:02, 1
1601:03	SubIndex 003	3. PDO Mapping entry (object 0x7030 (PWM Outputs Ch.2), entry 0x06 (Enable))	UINT32	RO	0x7050:03, 1
1601:04	SubIndex 004	4. PDO Mapping entry (object 0x7050 (DO Outputs), entry 0x04 (Digital Output X6 Pin2))	UINT32	RO	0x7050:04, 1
1601:05	SubIndex 005	5. PDO Mapping entry (object 0x7050 (DO Outputs), entry 0x05 (Digital Output X7 Pin4))	UINT32	RO	0x7050:05, 1
1601:06	SubIndex 006	6. PDO Mapping entry (object 0x7050 (DO Outputs), entry 0x06 (Digital Output X7 Pin2))	UINT32	RO	0x7050:06, 1
1601:07	SubIndex 007	7. PDO Mapping entry (10 bits align)	UINT32	RO	0x0000:00, 10

**Index 1602 PWM RxPDO-Map Control**

Index (hex)	Name	Meaning	Data type	Flags	Default
1602:0	PWM RxPDO-Map Control	PDO Mapping RxPDO 3	UINT8	RO	0x06 (6 <sub>dec</sub> )
1602:01	SubIndex 001	1. PDO Mapping entry (object 0x7040 (DO Outputs), entry 0x01 (Output 10))	UINT32	RO	0x7060:01, 1
1602:02	SubIndex 002	2. PDO Mapping entry (object 0x7040 (DO Outputs), entry 0x02 (Output 11))	UINT32	RO	0x0000:00, 4
1602:03	SubIndex 003	3. PDO Mapping entry (14 bits align)	UINT32	RO	0x7060:06, 1
1602:04	SubIndex 004	4. PDO Mapping entry (6 bits align)	UINT32	RO	0x7060:07, 1
1602:05	SubIndex 005	5. PDO Mapping entry (object 0x7050 (DO Outputs), entry 0x0E (Output 14))	UINT32	RO	0x0000:00, 9
1602:06	SubIndex 006	6. PDO Mapping entry (object 0x7050 (DO Outputs), entry 0x0E (Output 15))	UINT32	RO	0x7060:11, 16

**Index 1603 AO RxPDO-Map Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
1603:0	AO RxPDO-Map Outputs	PDO Mapping RxPDO 4	UINT8	RO	0x01 (1 <sub>dec</sub> )
1603:01	SubIndex 001	1. PDO Mapping entry (object 0x7060 (AO Outputs Ch.3), entry 0x11 (Analog output))	UINT32	RO	0x7070:11, 16

**Index 1802 TACHO TxPDO-Par Single Shaft Mode Input Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
1802:0	TACHO TxPDO-Par Single Shaft Mode Input Ch.1	PDO parameter TxPDO 3	UINT8	RO	0x06 (6 <sub>dec</sub> )
1802:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 3	OCTET STRING[4]	RO	03 1A 04 1A

**Index 1803 TACHO TxPDO-Par Dual Shaft Mode Input Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
1803:0	TACHO TxPDO-Par Dual Shaft Mode Input Ch.1	PDO parameter TxPDO 4	UINT8	RO	0x06 (6 <sub>dec</sub> )
1803:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 4	OCTET STRING[4]	RO	02 1A 00 00

**Index 1804 TACHO TxPDO-Par Dual Shaft Mode Input Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
1804:0	TACHO TxPDO-Par Dual Shaft Mode Input Ch.2	PDO parameter TxPDO 5	UINT8	RO	0x06 (6 <sub>dec</sub> )
1804:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 5	OCTET STRING[4]	RO	02 1A 00 00

**Index 1A00 AI TxPDO-Map Inputs Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A00:0	AI TxPDO-Map Inputs Ch.1	PDO Mapping TxPDO 1	UINT8	RO	0x0A (10 <sub>dec</sub> )
1A00:01	SubIndex 001	1. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x01 (Underrange))	UINT32	RO	0x6000:01, 1
1A00:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x02 (Overrange))	UINT32	RO	0x6000:02, 1
1A00:03	SubIndex 003	3. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x03 (Limit 1))	UINT32	RO	0x6000:03, 2
1A00:04	SubIndex 004	4. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x05 (Limit 2))	UINT32	RO	0x6000:05, 2
1A00:05	SubIndex 005	5. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x07 (Error))	UINT32	RO	0x6000:07, 1
1A00:06	SubIndex 006	6. PDO Mapping entry (6 bits align)	UINT32	RO	0x0000:00, 6
1A00:07	SubIndex 007	7. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x0E (Sync error))	UINT32	RO	0x6000:0E, 1
1A00:08	SubIndex 008	8. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x0F (TxPDO State))	UINT32	RO	0x6000:0F, 1
1A00:09	SubIndex 009	9. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x6000:10, 1
1A00:0A	SubIndex 010	10. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x11 (Value))	UINT32	RO	0x6000:11, 16

## Index 1A01 AI TxPDO-Map Inputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1A01:0	AI TxPDO-Map Inputs Ch.2	PDO Mapping TxPDO 2	UINT8	RO	0x0A (10 <sub>dec</sub> )
1A01:01	SubIndex 001	1. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x01 (Underrange))	UINT32	RO	0x6010:01, 1
1A01:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x02 (Overrange))	UINT32	RO	0x6010:02, 1
1A01:03	SubIndex 003	3. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x03 (Limit 1))	UINT32	RO	0x6010:03, 2
1A01:04	SubIndex 004	4. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x05 (Limit 2))	UINT32	RO	0x6010:05, 2
1A01:05	SubIndex 005	5. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x07 (Error))	UINT32	RO	0x6010:07, 1
1A01:06	SubIndex 006	6. PDO Mapping entry (6 bits align)	UINT32	RO	0x0000:00, 6
1A01:07	SubIndex 007	7. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x0E (Sync error))	UINT32	RO	0x6010:0E, 1
1A01:08	SubIndex 008	8. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x0F (TxPDO State))	UINT32	RO	0x6010:0F, 1
1A01:09	SubIndex 009	9. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x6010:10, 1
1A01:0A	SubIndex 010	10. PDO Mapping entry (object 0x6000 (AI Inputs Ch.1), entry 0x11 (Value))	UINT32	RO	0x6010:11, 16

## Index 1A02 TACHO TxPDO-Map Single Shaft Mode Input Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1A02:0	TACHO TxPDO-Map Single Shaft Mode Input Ch.1	PDO Mapping TxPDO 3	UINT8	RO	0x0C (12 <sub>dec</sub> )
1A02:01	SubIndex 001	1. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x01 (Underrange))	UINT32	RO	0x0000:00, 1
1A02:02	SubIndex 002	2. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x02 (Track Error A))	UINT32	RO	0x6037:02, 1
1A02:03	SubIndex 003	3. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x03 (Input Status Track A))	UINT32	RO	0x6037:03, 1
1A02:04	SubIndex 004	4. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x04 (Track Error B))	UINT32	RO	0x6037:04, 1
1A02:05	SubIndex 005	5. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x05 (Input Status Track B))	UINT32	RO	0x6037:05, 1
1A02:06	SubIndex 006	6. PDO Mapping entry (6 bits align)	UINT32	RO	0x0000:00, 3
1A02:07	SubIndex 007	7. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x0C (Speed Below Threshold))	UINT32	RO	0x0000:00, 3
1A02:08	SubIndex 008	8. PDO Mapping entry (3 bits align)	UINT32	RO	0x6037:0C, 1
1A02:09	SubIndex 009	9. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x0000:00, 3
1A02:0A	SubIndex 010	10. PDO Mapping entry (object 0x6027 (TACHO Redundant Tracks Inputs Ch.1), entry 0x11 (Rotational Speed))	UINT32	RO	0x6037:10, 1
1A02:0B	SubIndex 011	11. PDO Mapping entry (object 0x6027 (TACHO Single Shaft Mode Input), entry 0x11 (Rotational Speed))	UINT32	RO	0x6037:11, 16
1A02:0C	SubIndex 012	12. PDO Mapping entry (object 0x6027 (TACHO Single Shaft Mode Input), entry 0x12 (Rotation Direction))	UINT32	RO	0x6037:12, 16

**Index 1A03 TACHO TxPDO-Map Dual Shaft Mode Input Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A03:0	TACHO TxPDO-Map Dual Shaft Mode Input Ch.1	PDO Mapping TxPDO 4	UINT8	RO	0x09 (9 <sub>dec</sub> )
1A03:01	SubIndex 001	1. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x01 (Underrange))	UINT32	RO	0x6020:01, 1
1A03:02	SubIndex 002	2. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x02 (Ovrange))	UINT32	RO	0x0000:00, 2
1A03:03	SubIndex 003	3. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x03 (Limit 1))	UINT32	RO	0x0000:00, 1
1A03:04	SubIndex 004	4. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x05 (Limit 2))	UINT32	RO	0x0000:00, 4
1A03:05	SubIndex 005	5. PDO Mapping entry (object 0x6010 (AI Inputs Ch.2), entry 0x07 (Error))	UINT32	RO	0x0000:00, 3
1A03:06	SubIndex 006	6. PDO Mapping entry (6 bits align)	UINT32	RO	0x6020:0C, 1
1A03:07	SubIndex 007	7. PDO Mapping entry (object 0x6020 (TACHO Dual Shaft Mode Input Ch.1), entry 0x11 (Rotational Speed))	UINT32	RO	0x0000:00, 3
1A03:08	SubIndex 008	8. PDO Mapping entry (object 0x6020 (TACHO Dual Shaft Mode Input Ch.1), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x6020:10, 1
1A03:09	SubIndex 009	9. PDO Mapping entry (object 0x6020 (TACHO Dual Shaft Mode Input Ch.1), entry 0x11 (Rotational Speed))	UINT32	RO	0x6020:11, 16

**Index 1A04 TACHO TxPDO-Map Dual Shaft Mode Input Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A04:0	TACHO TxPDO-Map Dual Shaft Mode Input Ch.2	PDO Mapping TxPDO 5	UINT8	RO	0x09 (9 <sub>dec</sub> )
1A04:01	SubIndex 001	1. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x01 (Digital input 1))	UINT32	RO	0x6030:01, 1
1A04:02	SubIndex 002	2. PDO Mapping entry (3 bits align)	UINT32	RO	0x0000:00, 2
1A04:03	SubIndex 003	3. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x05 (Ready to enable))	UINT32	RO	0x0000:00, 1
1A04:04	SubIndex 004	4. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x06 (Warning))	UINT32	RO	0x0000:00, 4
1A04:05	SubIndex 005	5. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x07 (Error))	UINT32	RO	0x0000:00, 3
1A04:06	SubIndex 006	6. PDO Mapping entry (8 bits align)	UINT32	RO	0x6030:0C, 1
1A04:07	SubIndex 007	7. PDO Mapping entry (object 0x6030 (TACHO Dual Shaft Mode Input Ch.2), entry 0x11 (Rotational Speed))	UINT32	RO	0x0000:00, 3
1A04:08	SubIndex 008	8. PDO Mapping entry (object 0x6030 (TACHO Dual Shaft Mode Input Ch.2), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x6030:10, 1
1A04:09	SubIndex 009	9. PDO Mapping entry (object 0x6030 (TACHO Dual Shaft Mode Input Ch.2), entry 0x11 (Rotational Speed))	UINT32	RO	0x6030:11, 16

**Index 1A05 DI TxPDO-Map Inputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A05:0	DI TxPDO-Map Inputs	PDO Mapping TxPDO 6	UINT8	RO	0x07 (7 <sub>dec</sub> )
1A05:01	SubIndex 001	1. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x01 (Digital input 1))	UINT32	RO	0x6040:01, 1
1A05:02	SubIndex 002	2. PDO Mapping entry (3 bits align)	UINT32	RO	0x6040:02, 1
1A05:03	SubIndex 003	3. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x05 (Ready to enable))	UINT32	RO	0x6040:03, 1
1A05:04	SubIndex 004	4. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x06 (Warning))	UINT32	RO	0x6040:04, 1
1A05:05	SubIndex 005	5. PDO Mapping entry (object 0x6020 (PWM Inputs Ch.1), entry 0x07 (Error))	UINT32	RO	0x6040:05, 1
1A05:06	SubIndex 006	6. PDO Mapping entry (8 bits align)	UINT32	RO	0x6040:06, 1
1A05:07	SubIndex 007	7. PDO Mapping entry (object 0x6020 (PM Inputs Ch.1), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x0000:00, 10

**Index 1A06 PWM TxPDO-Map Status**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A06:0	PWM TxPDO-Map Status	PDO Mapping TxPDO 7	UINT8	RO	0x08 (8 <sub>dec</sub> )
1A06:01	SubIndex 001	1. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x01 (Digital Input X4 Pin4))	UINT32	RO	0x0000:00, 1
1A06:02	SubIndex 002	2. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x02 (Digital Input X4 Pin2))	UINT32	RO	0x0000:00, 3
1A06:03	SubIndex 003	3. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x03 (Digital Input X6 Pin4))	UINT32	RO	0x6060:05, 1
1A06:04	SubIndex 004	4. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x04 (Digital Input X6 Pin2))	UINT32	RO	0x6060:06, 1
1A06:05	SubIndex 005	5. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x05 (Digital Input X7 Pin4))	UINT32	RO	0x6060:07, 1
1A06:06	SubIndex 006	6. PDO Mapping entry (object 0x6040 (DI Inputs), entry 0x06 (Digital Input X7 Pin2))	UINT32	RO	0x0000:00, 1
1A06:07	SubIndex 007	7. PDO Mapping entry (10 bits align)	UINT32	RO	0x0000:00, 7
1A06:08	SubIndex 008	8. PDO Mapping entry (object 0x6060 (PWM Inputs), entry 0x10 (TxPDO Toggle))	UINT32	RO	0x6060:10, 1

**Index 1A07 PWM TxPDO-Map Synchronous info data**

Index (hex)	Name	Meaning	Data type	Flags	Default
1A07:0	PWM TxPDO-Map Synchronous Info Data	PDO Mapping TxPDO 8	UINT8	RO	0x02 (2 <sub>dec</sub> )
1A07:01	SubIndex 001	1. PDO Mapping entry (object 0x6060 (PWM Inputs), entry 0x01 (Digital input 1))	UINT32	RO	0x6060:11, 16
1A07:02	SubIndex 002	2. PDO Mapping entry (3 bits align)	UINT32	RO	0x6060:12, 16

**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 <sub>dec</sub> )
1C00:01	SubIndex 001	Sync-Manager Type Channel 1: Mailbox Write	UINT8	RO	0x01 (1 <sub>dec</sub> )
1C00:02	SubIndex 002	Sync-Manager Type Channel 2: Mailbox Read	UINT8	RO	0x02 (2 <sub>dec</sub> )
1C00:03	SubIndex 003	Sync-Manager Type Channel 3: Process Data Write (Outputs)	UINT8	RO	0x03 (3 <sub>dec</sub> )
1C00:04	SubIndex 004	Sync-Manager Type Channel 4: Process Data Read (Inputs)	UINT8	RO	0x04 (4 <sub>dec</sub> )

**Index 1C12 RxPDO Assign**

Index (hex)	Name	Meaning	Data type	Flags	Default
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x03 (3 <sub>dec</sub> )
1C12:01	Subindex 001	1st allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1600 (5632 <sub>dec</sub> )
1C12:02	Subindex 002	2nd allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1601 (5633 <sub>dec</sub> )
1C12:03	Subindex 003	3rd allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1602 (5634 <sub>dec</sub> )
1C12:04	Subindex 004	4th allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x0000 (0 <sub>dec</sub> )

**Index 1C13 TxPDO Assign**

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x05 (5 <sub>dec</sub> )
1C13:01	Subindex 001	1st allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A00 (6656 <sub>dec</sub> )
1C13:02	Subindex 002	2nd allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A01 (6657 <sub>dec</sub> )
1C13:03	Subindex 003	3rd allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A02 (6658 <sub>dec</sub> )
1C13:04	Subindex 004	4th allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A05 (6661 <sub>dec</sub> )
1C13:05	Subindex 005	5th allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A06 (6662 <sub>dec</sub> )
1C13:06	Subindex 006	6th allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x0000 (0 <sub>dec</sub> )
1C13:07	Subindex 007	7th allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x0000 (0 <sub>dec</sub> )

## 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 <sub>dec</sub> )
1C32:01	Sync mode	Current synchronization mode: <ul style="list-style-type: none"> <li>0: Free Run</li> <li>1: Synchronous with SM 2 event</li> <li>2: DC-Mode - Synchronous with SYNC0 Event</li> <li>3: DC-Mode - Synchronous with SYNC1 event</li> </ul>	UINT16	RW	0x0001 (1 <sub>dec</sub> )
1C32:02	Cycle time	Cycle time (in ns): <ul style="list-style-type: none"> <li>Free Run: Cycle time of the local timer</li> <li>Synchronous with SM 2 event: Master cycle time</li> <li>DC mode: SYNC0/SYNC1 Cycle Time</li> </ul>	UINT32	RW	0x000F4240 (1000000 <sub>dec</sub> )
1C32:03	Shift time	Time between SYNC0 event and output of the outputs (in ns, DC mode only)	UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C32:04	Sync modes supported	Supported synchronization modes: <ul style="list-style-type: none"> <li>Bit 0 = 1: free run is supported</li> <li>Bit 1 = 1: Synchronous with SM 2 event is supported</li> <li>Bit 2-3 = 01: DC mode is supported</li> <li>Bit 4-5 = 10: Output shift with SYNC1 event (only DC mode)</li> <li>Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 [► 92])</li> </ul>	UINT16	RO	0xC007 (49159 <sub>dec</sub> )
1C32:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x0007A120 (500000 <sub>dec</sub> )
1C32:06	Calc and copy time	Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)	UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C32:07	Minimum delay time		UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C32:08	Command	<ul style="list-style-type: none"> <li>0: Measurement of the local cycle time is stopped</li> <li>1: Measurement of the local cycle time is started</li> </ul> <p>The entries 0x1C32:03 [► 92], 0x1C32:05 [► 92], 0x1C32:06 [► 92], 0x1C32:09 [► 92], 0x1C33:03 [► 93], 0x1C33:06 [► 92], 0x1C33:09 [► 93] are updated with the maximum measured values. For a subsequent measurement the measured values are reset</p>	UINT16	RW	0x0000 (0 <sub>dec</sub> )
1C32:09	Maximum delay time	Time between SYNC1 event and output of the outputs (in ns, DC mode only)	UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C32:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0 <sub>dec</sub> )
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 <sub>dec</sub> )
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 <sub>dec</sub> )
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 <sub>dec</sub> )

**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 <sub>dec</sub> )
1C33:01	Sync mode	Current synchronization mode: <ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchronous with SM 3 Event (no outputs available)</li> <li>• 2: DC - Synchronous with SYNC0 Event</li> <li>• 3: DC - Synchronous with SYNC1 Event</li> <li>• 34: Synchronous with SM 2 event (outputs available)</li> </ul>	UINT16	RW	0x0022 (34 <sub>dec</sub> )
1C33:02	Cycle time	as <a href="#">0x1C32:02</a> [ <a href="#">▶ 92</a> ]	UINT32	RW	0x000F4240 (1000000 <sub>dec</sub> )
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C33:04	Sync modes supported	Supported synchronization modes: <ul style="list-style-type: none"> <li>• Bit 0: free run is supported</li> <li>• Bit 1: Synchronous with SM 2 Event is supported (outputs available)</li> <li>• Bit 1: Synchronous with SM 3 Event is supported (no outputs available)</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 01: Input shift through local event (outputs available)</li> <li>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of <a href="#">0x1C32:08</a> [<a href="#">▶ 92</a>] or <a href="#">0x1C33:08</a> [<a href="#">▶ 93</a>])</li> </ul>	UINT16	RO	0xC007 (49159 <sub>dec</sub> )
1C33:05	Minimum cycle time	as <a href="#">0x1C32:05</a> [ <a href="#">▶ 92</a> ]	UINT32	RO	0x0007A120 (500000 <sub>dec</sub> )
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 <sub>dec</sub> )
1C33:07	Minimum delay time		UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C33:08	Command	as <a href="#">0x1C32:08</a> [ <a href="#">▶ 92</a> ]	UINT16	RW	0x0000 (0 <sub>dec</sub> )
1C33:09	Maximum delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0 <sub>dec</sub> )
1C33:0B	SM event missed counter	as <a href="#">0x1C32:11</a> [ <a href="#">▶ 92</a> ]	UINT16	RO	0x0000 (0 <sub>dec</sub> )
1C33:0C	Cycle exceeded counter	as <a href="#">0x1C32:12</a> [ <a href="#">▶ 92</a> ]	UINT16	RO	0x0000 (0 <sub>dec</sub> )
1C33:0D	Shift too short counter	as <a href="#">0x1C32:13</a> [ <a href="#">▶ 92</a> ]	UINT16	RO	0x0000 (0 <sub>dec</sub> )
1C33:20	Sync error	as <a href="#">0x1C32:32</a> [ <a href="#">▶ 92</a> ]	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

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

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

#### Index 6000 AI Inputs Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
6000:0	AI Inputs Ch.1		UINT8	RO	0x11 (17 <sub>dec</sub> )
6000:01	Underrange	Underrange event active	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:02	Overrange	Overrange event active	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:03	Limit 1	Bit0: Value greater than Limit1 Bit1: Value smaller than Limit1	BIT2	RO	0x00 (0 <sub>dec</sub> )
6000:05	Limit 2	Bit0: Value greater than Limit2 Bit1: Value smaller than Limit2	BIT2	RO	0x00 (0 <sub>dec</sub> )
6000:07	Error	Bit set when Over- or Underrange	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:0E	Sync error		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:0F	TxPDO State		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6000:11	Value		INT16	RO	0x0000 (0 <sub>dec</sub> )

#### Index 6010 AI Inputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
6010:0	AI Inputs Ch.2		UINT8	RO	0x11 (17 <sub>dec</sub> )
6010:01	Underrange	Underrange event active	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:02	Overrange	Overrange event active	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:03	Limit 1	Bit0: Value greater than Limit1 Bit1: Value smaller than Limit1	BIT2	RO	0x00 (0 <sub>dec</sub> )
6010:05	Limit 2	Bit0: Value greater than Limit2 Bit1: Value smaller than Limit2	BIT2	RO	0x00 (0 <sub>dec</sub> )
6010:07	Error	Bit set when Over- or Underrange	BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:0E	Sync error		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:0F	TxPDO State		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6010:11	Value		INT16	RO	0x0000 (0 <sub>dec</sub> )

#### Index 6020 TACHO Dual Shaft Mode Input Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
6020:0	TACHO Dual Shaft Mode Input Ch.1		UINT8	RO	0x11 (17 <sub>dec</sub> )
6020:01	Digital input		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6020:0C	Speed Below Threshold		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6020:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6020:11	Rotational Speed		INT16	RO	0x0000 (0 <sub>dec</sub> )

#### Index 6030 TACHO Dual Shaft Mode Input Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
6030:0	TACHO Dual Shaft Mode Input Ch.2		UINT8	RO	0x11 (17 <sub>dec</sub> )
6030:01	Digital input		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6030:0C	Speed Below Threshold		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6030:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6030:11	Rotational Speed		INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 6037 TACHO Single Shaft Mode Input**

Index (hex)	Name	Meaning	Data type	Flags	Default
6037:0	TACHO Single Shaft Mode Input		UINT8	RO	0x12 (18 <sub>dec</sub> )
6037:02	Error Input A		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:03	Input Status A		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:04	Error Input B		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:05	Input Status B		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:0C	Speed Below Threshold		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6037:11	Rotational Speed		INT16	RO	0x0000 (0 <sub>dec</sub> )
6037:12	Rotation Direction		UINT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 6040 DI Inputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
6040:0	DI Inputs		UINT8	RO	0x06 (6 <sub>dec</sub> )
6040:01	Digital Input X4 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6040:02	Digital Input X4 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6040:03	Digital Input X6 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6040:04	Digital Input X6 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6040:05	Digital Input X7 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6040:06	Digital Input X7 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

**Index 6060 PWM Inputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
6060:0	PWM Inputs		UINT8	RO	0x12 (18 <sub>dec</sub> )
6060:05	Ready to enable		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6060:06	Warning		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6060:07	Error		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6060:10	TxPDO Toggle		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
6060:11	Info data 1		INT16	RO	0x0000 (0 <sub>dec</sub> )
6060:12	Info data 2		INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 7020 TACHO Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
7020:0	TACHO Outputs		UINT8	RO	0x09 (9 <sub>dec</sub> )
7020:09	Reset Error		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

**Index 7030 TACHO Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
7030:0	TACHO Outputs		UINT8	RO	0x09 (9 <sub>dec</sub> )
7030:09	Reset Error		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

**Index 7040 DIG Output**

Index (hex)	Output 11>Name	Meaning	Data type	Flags	Default
7050:0	DIG Outputs		UINT8	RO	0x06 (6 <sub>dec</sub> )
7050:01	Digital Output X4 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:02	Digital Output X4 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:03	Digital Output X5 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:04	Digital Output X5 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:05	Digital Output X6 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:06	Digital Output X6 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:07	Digital Output X7 Pin4		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7050:08	Digital Output X7 Pin2		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

**Index 7060 PWM Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
7060:0	PWM Outputs		UINT8	RO	0x11 (17 <sub>dec</sub> )
7060:01	Enable dithering		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7060:06	Enable		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7060:07	Reset		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
7060:11	PWM output	Analog output data	INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 7070 AO Outputs**

Index (hex)	Name	Meaning	Data type	Flags	Default
7070:0	AO Outputs		UINT8	RO	0x11 (17 <sub>dec</sub> )
7070:11	Analog output	Analog output data	INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 800E AI Internal data Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
800E:0	AI Internal data Ch.1		UINT8	RO	0x01 (1 <sub>dec</sub> )
800E:01	ADC raw value		INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 800F AI Vendor data Ch.1**

Index (hex)	Name	Meaning	Data type	Flags	Default
800F:0	AI Vendor data Ch.1		UINT8	RO	0x06 (6 <sub>dec</sub> )
800F:01	R0 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
800F:02	R0 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )
800F:03	R1 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
800F:04	R1 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )
800F:05	R2 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
800F:06	R2 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index 801E AI Internal data Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
801E:0	AI Internal Data Ch.2		UINT8	RO	0x01 (1 <sub>dec</sub> )
801E:01	ADC raw value		INT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 801F AI Vendor data Ch.2**

Index (hex)	Name	Meaning	Data type	Flags	Default
801F:0	AI Vendor Data Ch.2		UINT8	RO	0x06 (6 <sub>dec</sub> )
801F:01	R0 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
801F:02	R0 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )
801F:03	R1 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
801F:04	R1 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )
801F:05	R2 Offset		INT16	RW	0x0000 (0 <sub>dec</sub> )
801F:06	R2 Gain		INT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index 806F PWM Vendor data**

Index (hex)	Name	Meaning	Data type	Flags	Default
806F:0	PWM Vendor data		UINT8	RO	0x02 (2 <sub>dec</sub> )
806F:01	Offset	Vendor calibration for +/-10 V	INT16	RW	0x0000 (0 <sub>dec</sub> )
806F:02	Gain	Vendor calibration for +/-10 V	INT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index 807E AO Internal data**

Index (hex)	Name	Meaning	Data type	Flags	Default
807E:0	AO Internal Data		UINT8	RO	0x01 (1 <sub>dec</sub> )
807E:01	DAC Raw Value	This is the raw DAC value.	UINT16	RO	0x0000 (0 <sub>dec</sub> )

**Index 807F AO Vendor data**

Index (hex)	Name	Meaning	Data type	Flags	Default
807F:0	AO Vendor Data		UINT8	RO	0x06 (6 <sub>dec</sub> )
807F:01	R0 Calibration Offset	Vendor calibration for +/-10 V	INT16	RW	0x0000 (0 <sub>dec</sub> )
807F:02	R0 Calibration Gain	Vendor calibration for +/-10 V	UINT16	RW	0x4000 (16384 <sub>dec</sub> )
807F:03	R1 Calibration Offset	Vendor calibration for 0-20 mA	INT16	RW	0x0000 (0 <sub>dec</sub> )
807F:04	R1 Calibration Gain	Vendor calibration for 0-20 mA	UINT16	RW	0x4000 (16384 <sub>dec</sub> )
807F:05	R2 Calibration Offset	Vendor calibration for 4-20 mA	INT16	RW	0x0000 (0 <sub>dec</sub> )
807F:06	R2 Calibration Gain	Vendor calibration for 4-20 mA	UINT16	RW	0x4000 (16384 <sub>dec</sub> )

**Index A060 PWM Diag data**

Index (hex)	Name	Meaning	Data type	Flags	Default
A060:0	PWM Diag data		UINT8	RO	0x06 (6 <sub>dec</sub> )
A060:02	Overtemperature		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )
A060:06	Short circuit		BOOLEAN	RO	0x00 (0 <sub>dec</sub> )

**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 <sub>dec</sub> )
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16 <sub>dec</sub> )
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0008 (8 <sub>dec</sub> )

**Index F008 Code word**

Index (hex)	Name	Meaning	Data type	Flags	Default
F008:0	Code word		UINT32	RW	0x00000000 (0 <sub>dec</sub> )

**Index F010 Module List**

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module list		UINT8	RW	0x08 (8 <sub>dec</sub> )
F010:01	SubIndex 001		UINT32	RW	0x0000012C (300 <sub>dec</sub> )
F010:02	SubIndex 002		UINT32	RW	0x0000012C (300 <sub>dec</sub> )
F010:03	SubIndex 003		UINT32	RW	0x00000208 (520 <sub>dec</sub> )
F010:04	SubIndex 004		UINT32	RW	0x00000208 (520 <sub>dec</sub> )
F010:05	SubIndex 005		UINT32	RW	0x00000064 (100 <sub>dec</sub> )
F010:06	SubIndex 006		UINT32	RW	0x000000C8 (200 <sub>dec</sub> )
F010:07	SubIndex 007		UINT32	RW	0x000000FA (250 <sub>dec</sub> )
F010:08	SubIndex 008		UINT32	RW	0x00000190 (400 <sub>dec</sub> )

**Index F900 PWM Info data**

Index (hex)	Name	Meaning	Data type	Flags	Default
F900:0	PWM Info data		UINT8	RO	0x02 (2 <sub>dec</sub> )
F900:02	Temperature [°C]		UINT8	RO	0x00 (0 <sub>dec</sub> )

**Index FB00 PWM Command**

Index (hex)	Name	Meaning	Data type	Flags	Default
FB00:0	PWM Command		UINT8	RO	0x03 (3 <sub>dec</sub> )
FB00:01	Request		OCTET-STRING[2]	RW	{0}
FB00:02	Status		UINT8	RO	0x00 (0 <sub>dec</sub> )
FB00:03	Response		OCTET-STRING[4]	RO	{0}

## 5.8 Restoring the delivery state

The CoE object *Restore default parameters, Subindex 001* can be selected in the TwinCAT System Manager (Config mode) in order to restore the delivery state of the back-up objects for the EPPxxxx Boxes.

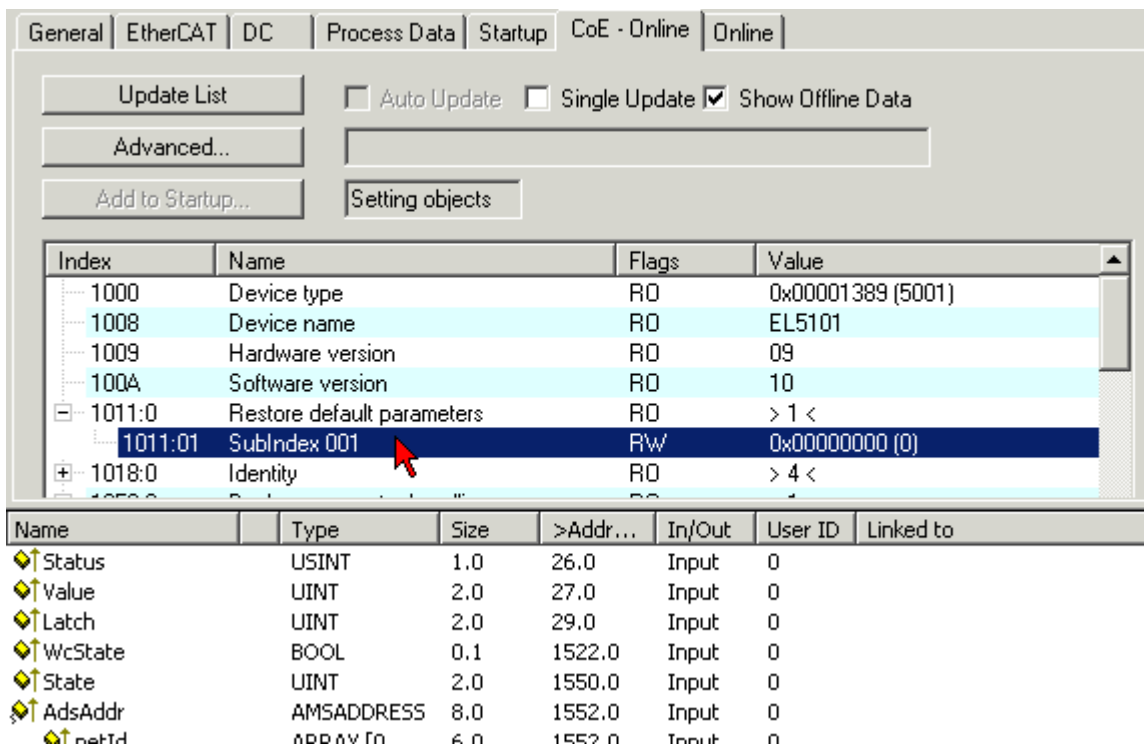


Fig. 67: Selecting the PDO restore default parameter

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

All backup objects are reset to the delivery state.

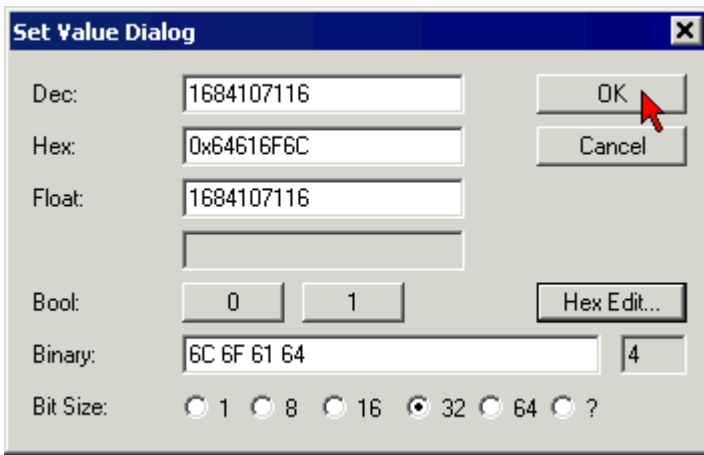


Fig. 68: Entering a restore value in the Set Value dialog



**Note**

**Alternative restore value**

With some older modules the backup objects can be changed with an alternative restore value:

Decimal value: 1819238756

Hexadecimal value: 0x6C6F6164

An incorrect entry for the restore value has no effect.

## 6 Diagnostics

The module offers various diagnostic options for users. These messages are divided into hardware warnings and hardware errors. The respective status words for the channels (except digital inputs and outputs) contain a bit for warnings and errors. The exact cause is analyzed via the diagnostic data (0xA050). Warnings are reset automatically. Errors may result in the output stage being switched off (PWMi) and have to be acknowledged in the control word (0x7050:07 Reset)

### Error/warning for the PWM stage

Index (hex)	Warning	Meaning
A050:02	Overtemperature	from 100 °C
A050:06	Short circuit	An overcurrent/short circuit of more than 105% of the rated current has occurred for more than 200 ms

### Control voltage (Us) and peripheral voltage (Up) of the EP8309



Fig. 69: Diagnostic control voltage (Us) and peripheral voltage (Up) of the EP8309

DEV input process data	Meaning
Undervoltage Us	Warning below 18 V <sub>DC</sub>
Undervoltage Up	Warning below 18 V <sub>DC</sub>

# 7 Appendix

## 7.1 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 (ph-Value > 12)	at room temperature: resistant > 40°C: not resistant
Acetic acid	not resistant
Argon (technical clean)	resistant

**Key**

resistant: Lifetime several months

non inherently resistant: Lifetime several weeks

not resistant: Lifetime several hours resp. early decomposition

**7.2 Firmware Update EL/ES/EM/EPxxxx**

This section describes the device update for Beckhoff EtherCAT slaves from the EL/ES, EM, EK and EP series. A firmware update should only be carried out after consultation with Beckhoff support.

**Storage locations**

An EtherCAT slave stores operating data in up to 3 locations:

- Depending on functionality and performance EtherCAT slaves have one or several local controllers for processing I/O data. The corresponding program is the so-called **firmware** in \*.efw format.
- In some EtherCAT slaves the EtherCAT communication may also be integrated in these controllers. In this case the controller is usually a so-called **FPGA** chip with \*.rbf firmware.
- In addition, each EtherCAT slave has a memory chip, a so-called **ESI-EEPROM**, for storing its own device description (ESI: EtherCAT Slave Information). On power-up this description is loaded and the EtherCAT communication is set up accordingly. The device description is available from the download area of the Beckhoff website at (<http://www.beckhoff.de>). All ESI files are accessible there as zip files.

Customers can access the data via the EtherCAT fieldbus and its communication mechanisms. Acyclic mailbox communication or register access to the ESC is used for updating or reading of these data.

The TwinCAT System Manager offers mechanisms for programming all 3 parts with new data, if the slave is set up for this purpose. Generally the slave does not check whether the new data are suitable, i.e. it may no longer be able to operate if the data are unsuitable.

**Simplified update by bundle firmware**

The update using so-called **bundle firmware** is more convenient: in this case the controller firmware and the ESI description are combined in a \*.efw file; during the update both the firmware and the ESI are changed in the terminal. For this to happen it is necessary

- for the firmware to be in a packed format: recognizable by the file name, which also contains the revision number, e.g. ELxxx-xxx\_REV0016\_SW01.efw
- for password=1 to be entered in the download dialog. If password=0 (default setting) only the firmware update is carried out, without an ESI update.
- for the device to support this function. The function usually cannot be retrofitted; it is a component of many new developments from year of manufacture 2016.

Following the update, its success should be verified

- ESI/Revision: e.g. by means of an online scan in TwinCAT ConfigMode/FreeRun – this is a convenient way to determine the revision
- Firmware: e.g. by looking in the online CoE of the device


**Attention****Risk of damage to the device!**

Note the following when downloading new device files

- Firmware downloads to an EtherCAT device must not be interrupted
- Flawless EtherCAT communication must be ensured. CRC errors or LostFrames must be avoided.
- The power supply must adequately dimensioned. The signal level must meet the specification.

In the event of malfunctions during the update process the EtherCAT device may become unusable and require re-commissioning by the manufacturer.

### 7.2.1 Device description ESI file/XML

 <b>Attention</b>	<p><b>Attention regarding update of the ESI description/EEPROM</b></p> <p>Some slaves have stored calibration and configuration data from the production in the EEPROM. These are irretrievably overwritten during an update.</p>
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The ESI device description is stored locally on the slave and loaded on start-up. Each device description has a unique identifier consisting of slave name (9 characters/digits) and a revision number (4 digits). Each slave configured in the System Manager shows its identifier in the EtherCAT tab:

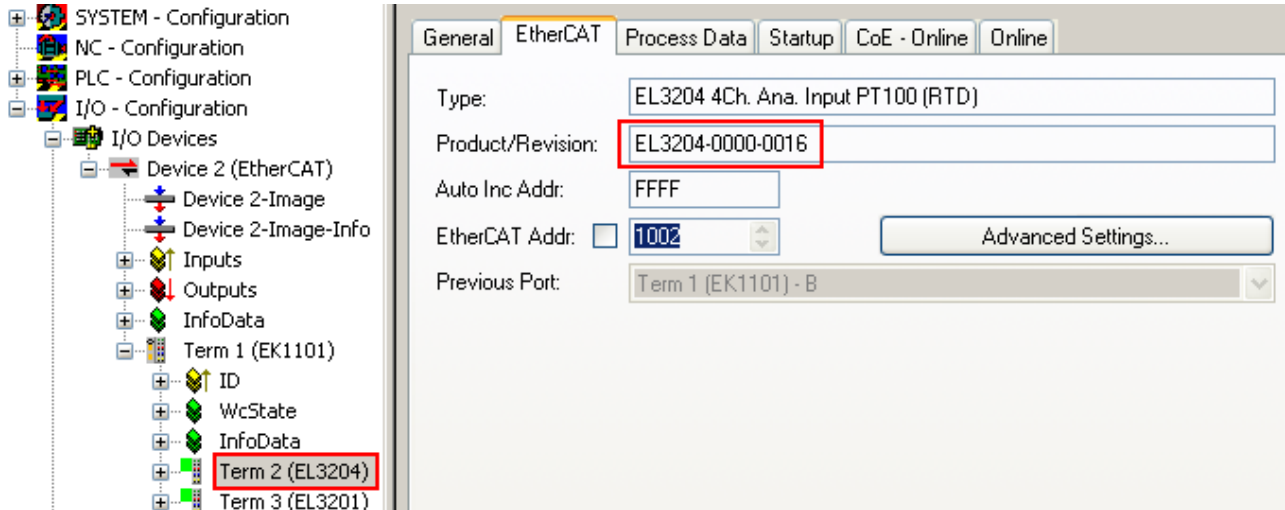



Fig. 70: Device identifier consisting of name EL3204-0000 and revision -0016

The configured identifier must be compatible with the actual device description used as hardware, i.e. the description which the slave has loaded on start-up (in this case EL3204). Normally the configured revision must be the same or lower than that actually present in the terminal network.

For further information on this, please refer to the [EtherCAT system documentation](#).

 <b>Note</b>	<p><b>Update of XML/ESI description</b></p> <p>The device revision is closely linked to the firmware and hardware used. Incompatible combinations lead to malfunctions or even final shutdown of the device. Corresponding updates should only be carried out in consultation with Beckhoff support.</p>
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#### Display of ESI slave identifier

The simplest way to ascertain compliance of configured and actual device description is to scan the EtherCAT boxes in TwinCAT mode Config/FreeRun:

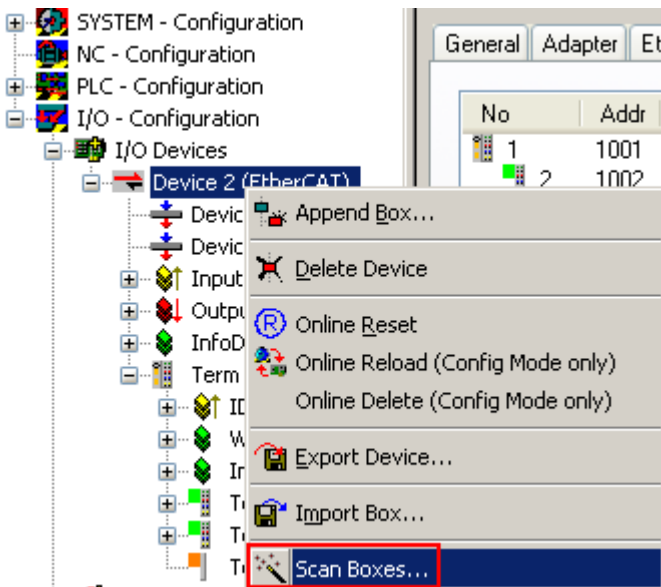


Fig. 71: Scan the subordinate field by right-clicking on the EtherCAT device in Config/FreeRun mode

If the found field matches the configured field, the display shows



Fig. 72: Configuration is identical

otherwise a change dialog appears for entering the actual data in the configuration.

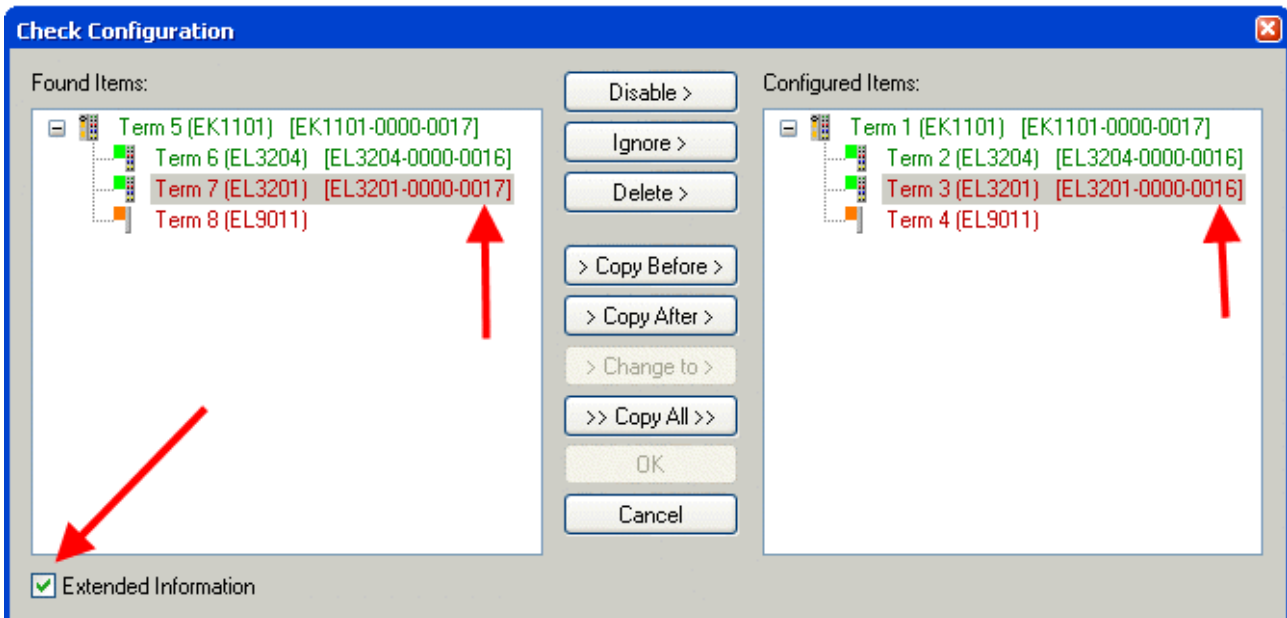


Fig. 73: Change dialog

In this example in Fig. *Change dialog*, an EL3201-0000-0017 was found, while an EL3201-0000-0016 was configured. In this case the configuration can be adapted with the *Copy Before* button. The *Extended Information* checkbox must be set in order to display the revision.

### Changing the ESI slave identifier

The ESI/EEPROM identifier can be updated as follows under TwinCAT:

- Trouble-free EtherCAT communication must be established with the slave.
- The state of the slave is irrelevant.
- Right-clicking on the slave in the online display opens the *EEPROM Update* dialog, Fig. *EEPROM Update*

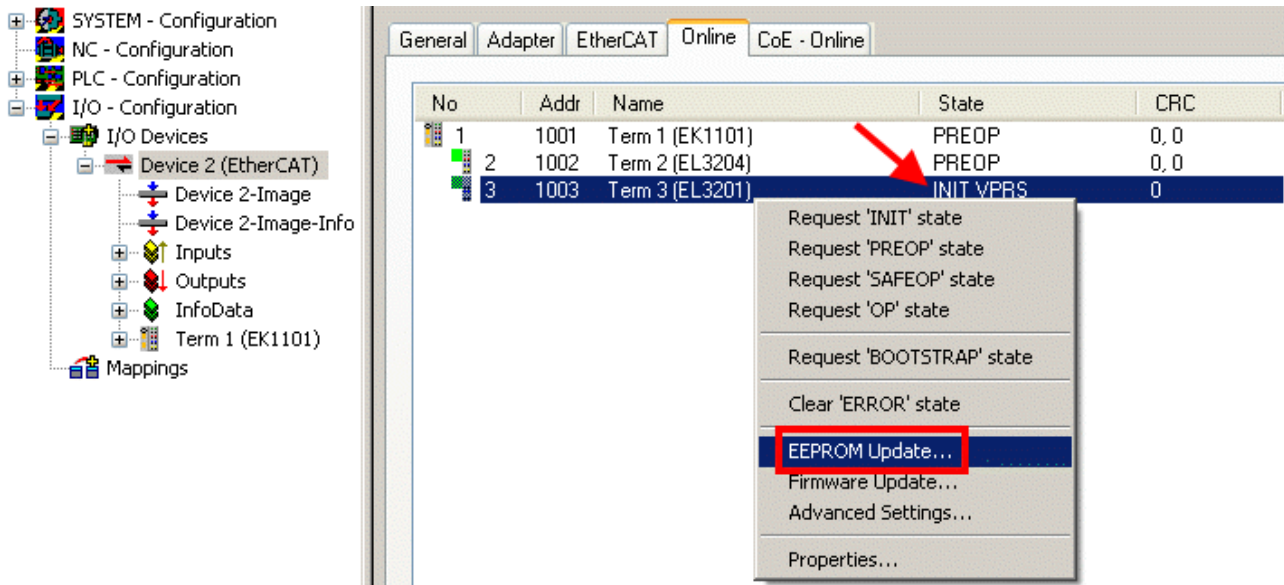


Fig. 74: EEPROM Update

The new ESI description is selected in the following dialog, see Fig. *Selecting the new ESI*. The checkbox *Show Hidden Devices* also displays older, normally hidden versions of a slave.

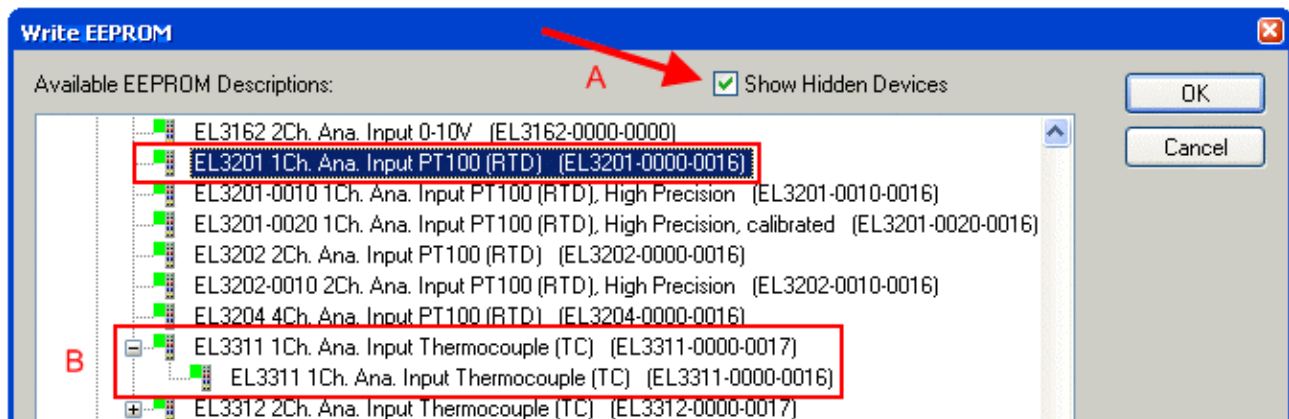


Fig. 75: Selecting the new ESI

A progress bar in the System Manager shows the progress. Data are first written, then verified.



**Note**

**The change only takes effect after a restart.**

Most EtherCAT devices read a modified ESI description immediately or after startup from the INIT. Some communication settings such as distributed clocks are only read during power-on. The EtherCAT slave therefore has to be switched off briefly in order for the change to take effect.

## 7.2.2 Firmware explanation

### Determining the firmware version

#### Determining the version on laser inscription

Beckhoff EtherCAT slaves feature serial numbers applied by laser. The serial number has the following structure: **KK YY FF HH**

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

Example with ser. no.: 12 10 03 02:

12 - week of production 12  
 10 - year of production 2010  
 03 - firmware version 03  
 02 - hardware version 02

#### Determining the version via the System Manager

The TwinCAT System Manager shows the version of the controller firmware if the master can access the slave online. Click on the E-Bus Terminal whose controller firmware you want to check (in the example terminal 2 (EL3204)) and select the tab *CoE Online* (CAN over EtherCAT).

**i**

**Note**

**CoE Online and Offline CoE**

Two CoE directories are available:

- **online**: This is offered in the EtherCAT slave by the controller, if the EtherCAT slave supports this. This CoE directory can only be displayed if a slave is connected and operational.
- **offline**: The EtherCAT Slave Information ESI/XML may contain the default content of the CoE. This CoE directory can only be displayed if it is included in the ESI (e.g. "Beckhoff EL5xxx.xml").

The Advanced button must be used for switching between the two views.

In Fig. *Display of EL3204 firmware version* the firmware version of the selected EL3204 is shown as 03 in CoE entry 0x100A.

The screenshot shows the TwinCAT System Manager interface. On the left, a tree view shows the configuration structure, with 'Term 2 (EL3204)' selected. The main window displays the 'CoE - Online' view for this device. A table lists CoE entries:

Index	Name	Flags	Value
1000	Device type	RO	0x01401389 (20976521)
1008	Device name	RO	EL3204-0000
1009	Hardware version	RO	00
100A	Software version	RO	03
1011:0	Restore default parameters	RU	> 1 <

The 'Advanced Settings' dialog is open, showing the 'Online' radio button selected under 'via SDO Information'. The 'Offline' radio button is under 'from Device Description'. The 'All Objects' button is also visible.

Fig. 76: Display of EL3204 firmware version

In (A) TwinCAT 2.11 shows that the Online CoE directory is currently displayed. If this is not the case, the Online directory can be loaded via the *Online* option in Advanced Settings (B) and double-clicking on *AllObjects*.

### 7.2.3 Updating controller firmware \*.efw

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**CoE directory**

The Online CoE directory is managed by the controller and stored in a dedicated EEPROM, which is generally not changed during a firmware update.

**Note**

Switch to the *Online* tab to update the controller firmware of a slave, see Fig. *Firmware Update*.

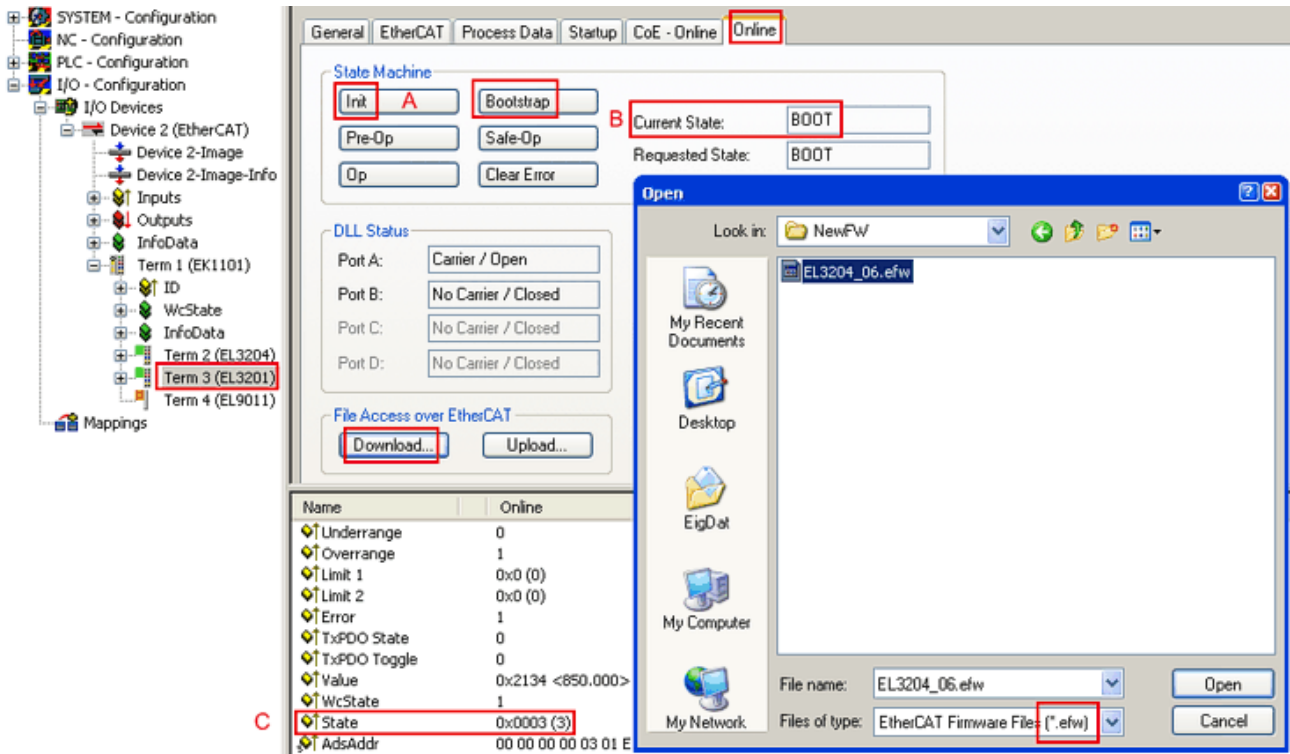
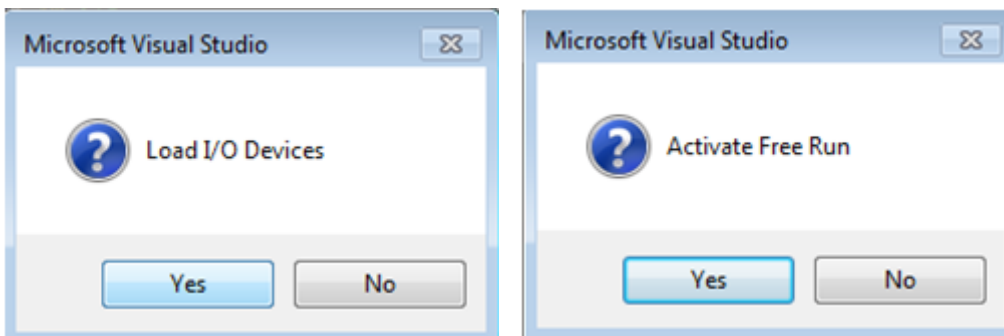


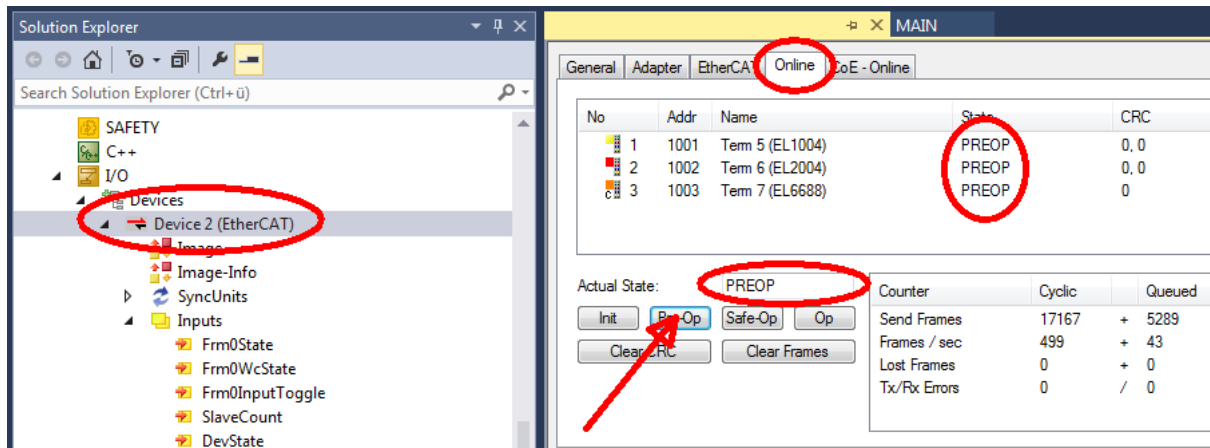
Fig. 77: Firmware Update

Proceed as follows, unless instructed otherwise by Beckhoff support. Valid for TwinCAT 2 and 3 as EtherCAT master.

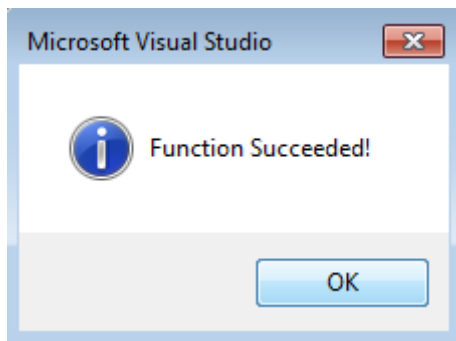
- Switch TwinCAT system to ConfigMode/FreeRun with cycle time  $\geq 1$  ms (default in ConfigMode is 4 ms). A FW-Update during real time operation is not recommended.



- Switch EtherCAT Master to PreOP



- Switch slave to INIT (A)
- Switch slave to BOOTSTRAP
- Check the current status (B, C)
- Download the new \*efw file (wait until it ends). A pass word will not be necessary usually.



- After the download switch to INIT, then PreOP
- Switch off the slave briefly (don't pull under voltage!)
- Check within CoE 0x100A, if the FW status was correctly overtaken.

## 7.2.4 FPGA firmware \*.rbf

If an FPGA chip deals with the EtherCAT communication an update may be accomplished via an \*.rbf file.

- Controller firmware for processing I/O signals
- FPGA firmware for EtherCAT communication (only for terminals with FPGA)

The firmware version number included in the terminal serial number contains both firmware components. If one of these firmware components is modified this version number is updated.

### Determining the version via the System Manager

The TwinCAT System Manager indicates the FPGA firmware version. Click on the Ethernet card of your EtherCAT strand (Device 2 in the example) and select the *Online* tab.

The *Reg:0002* column indicates the firmware version of the individual EtherCAT devices in hexadecimal and decimal representation.

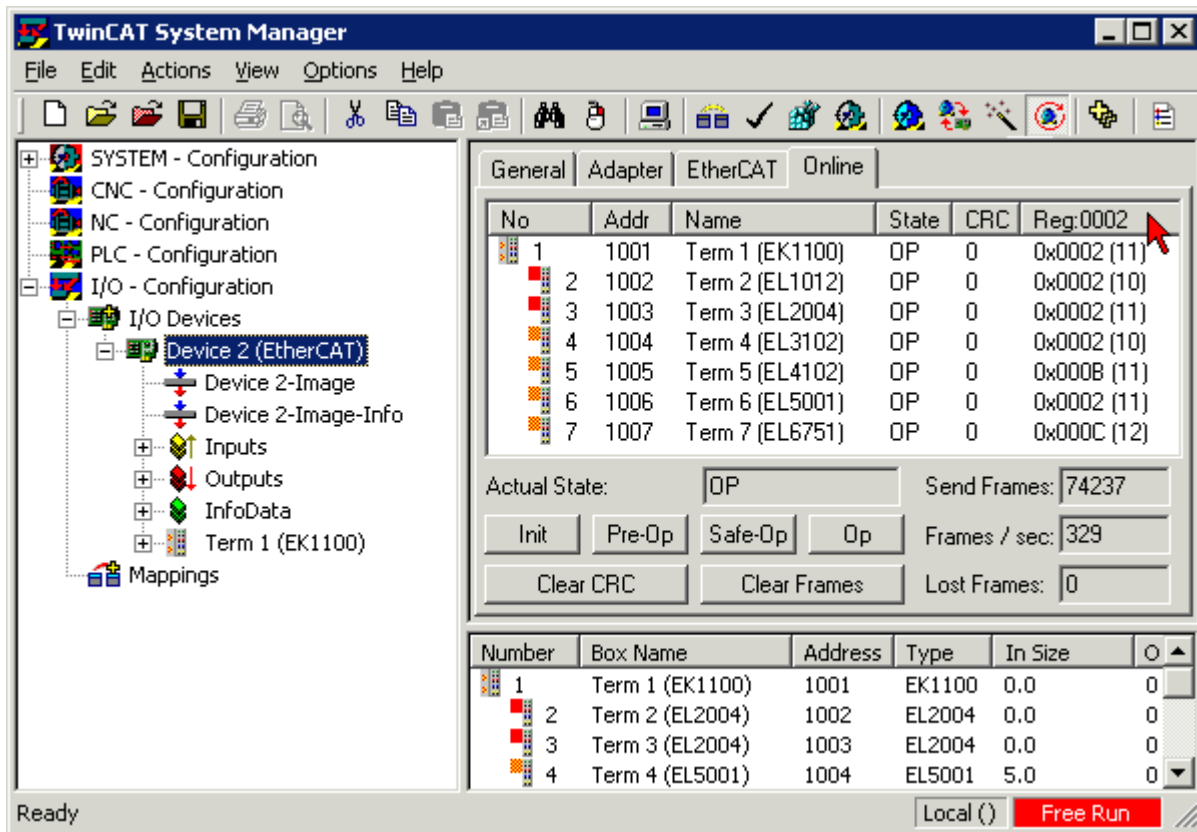


Fig. 78: FPGA firmware version definition

If the column *Reg:0002* is not displayed, right-click the table header and select *Properties* in the context menu.

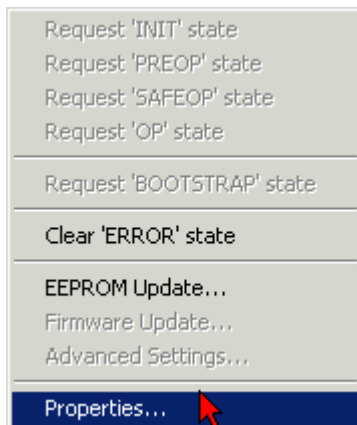


Fig. 79: Context menu *Properties*

The *Advanced Settings* dialog appears where the columns to be displayed can be selected. Under *Diagnosis/Online View* select the *'0002 ETxxx Build'* check box in order to activate the FPGA firmware version display.

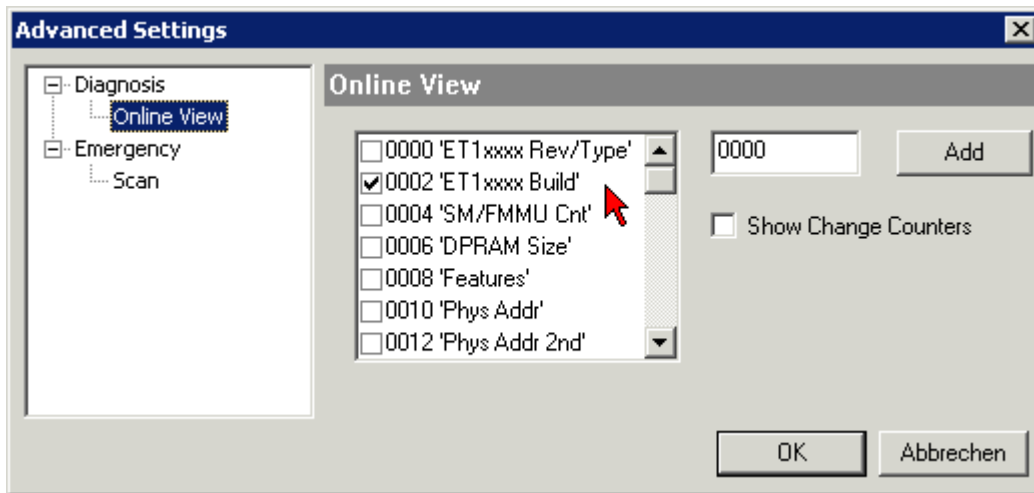


Fig. 80: Dialog *Advanced Settings*

### Update

For updating the FPGA firmware

- of an EtherCAT coupler the coupler must have FPGA firmware version 11 or higher;
- of an E-Bus Terminal the terminal must have FPGA firmware version 10 or higher.

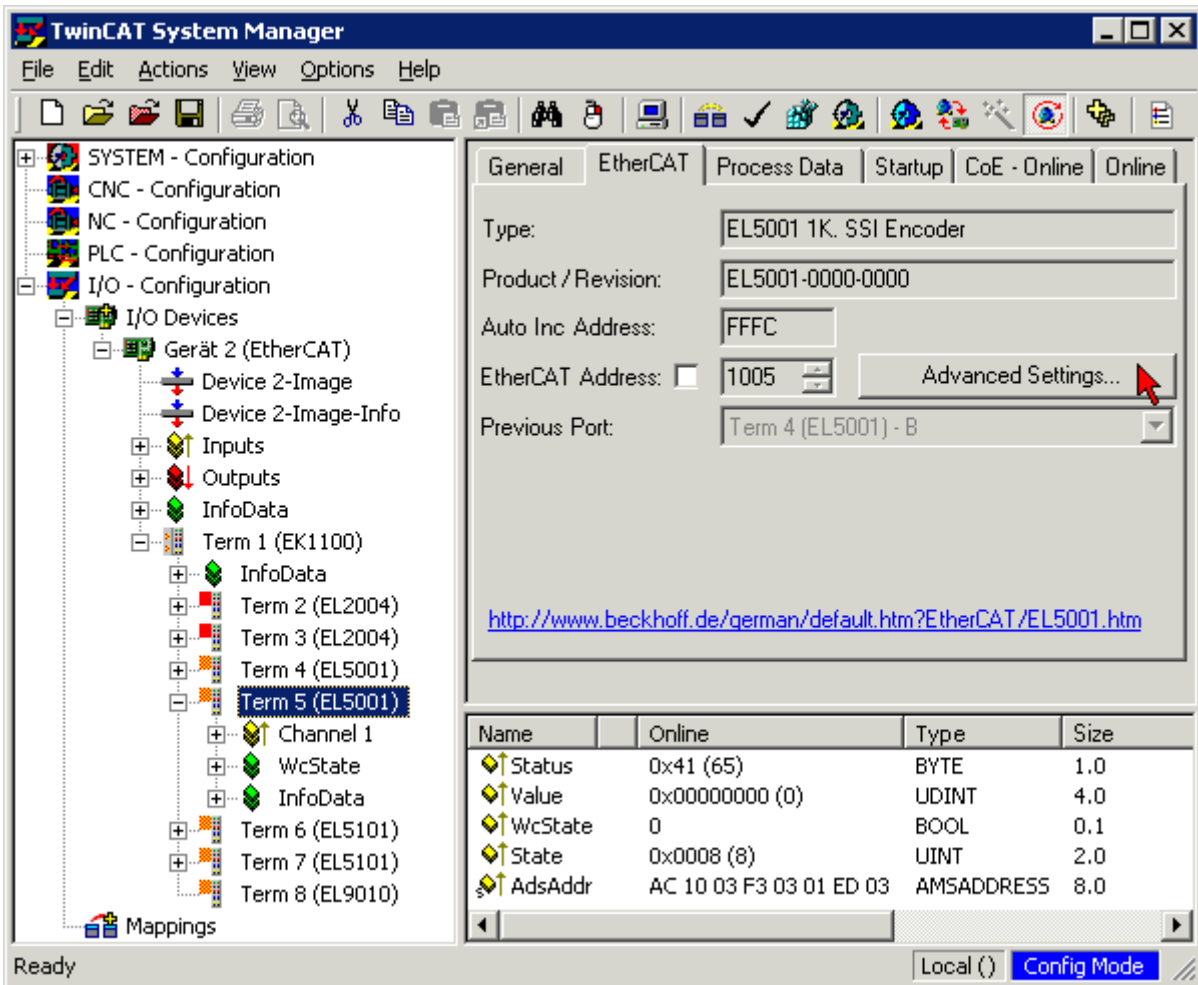
Older firmware versions can only be updated by the manufacturer!

### Updating an EtherCAT device

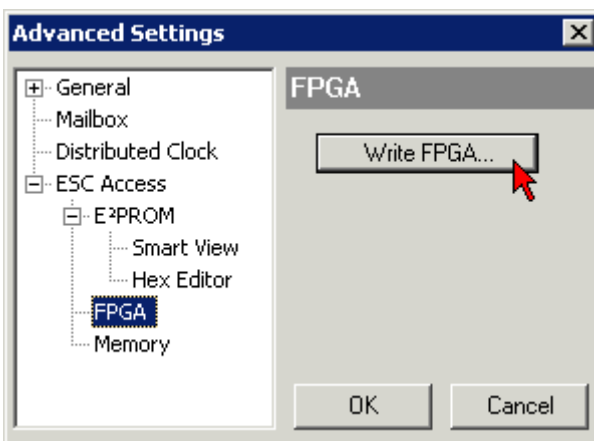
The following sequence order have to be met if no other specifications are given (e.g. by the Beckhoff support):

- Switch TwinCAT system to ConfigMode/FreeRun with cycle time  $\geq 1$  ms (default in ConfigMode is 4 ms). A FW-Update during real time operation is not recommended.

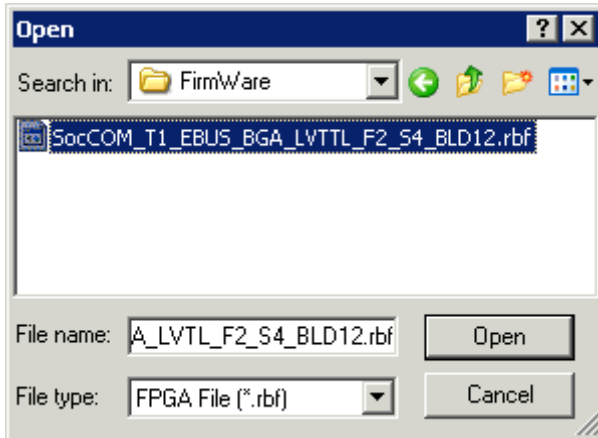
- In the TwinCAT System Manager select the terminal for which the FPGA firmware is to be updated (in the example: Terminal 5: EL5001) and click the *Advanced Settings* button in the *EtherCAT* tab:



- The *Advanced Settings* dialog appears. Under *ESC Access/E<sup>2</sup>PROM/FPGA* click on *Write FPGA* button:



- Select the file (\*.rbf) with the new FPGA firmware, and transfer it to the EtherCAT device:



- Wait until download ends
- Switch slave current less for a short time (don't pull under voltage!). In order to activate the new FPGA firmware a restart (switching the power supply off and on again) of the EtherCAT device is required.
- Check the new FPGA status

**Attention****Risk of damage to the device!**

A download of firmware to an EtherCAT device must not be interrupted in any case! If you interrupt this process by switching off power supply or disconnecting the Ethernet link, the EtherCAT device can only be recommissioned by the manufacturer!

## 7.2.5 Simultaneous updating of several EtherCAT devices

The firmware and ESI descriptions of several devices can be updated simultaneously, provided the devices have the same firmware file/ESI.

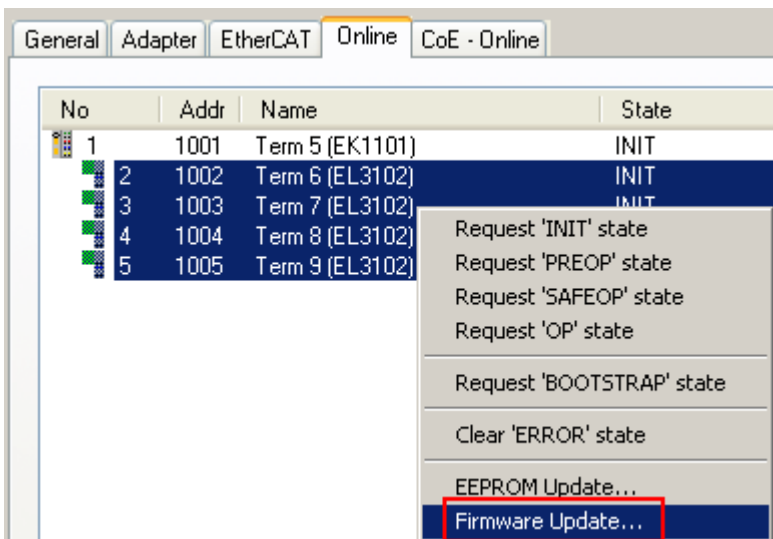


Fig. 81: Multiple selection and firmware update

Select the required slaves and carry out the firmware update in BOOTSTRAP mode as described above.

## 7.3 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



#### Note

#### Further accessories

Further accessories may be found at the price list for Beckhoff fieldbus components and at the internet under [www.beckhoff.com](http://www.beckhoff.com).

## 7.4 Support and Service

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

### Beckhoff's branch offices and representatives

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

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

<http://www.beckhoff.com>

You will also find further documentation for Beckhoff components there.

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### Beckhoff Support

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

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- repair service
- spare parts service
- hotline service

Hotline:	+49(0)5246/963-460
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# List of illustrations

Fig. 1	EtherCAT Box Modules within an EtherCAT network.....	8
Fig. 2	EtherCAT Box with M8 connections for sensors/actuators.....	9
Fig. 3	EtherCAT Box with M12 connections for sensors/actuators.....	9
Fig. 4	EP8309.....	10
Fig. 5	Operation at load with adequate inductance .....	15
Fig. 6	Operation at load with inadequate inductance (near ohmic) .....	15
Fig. 7	Influencing of the PWMi output value .....	16
Fig. 8	EtherCAT tab --> Advanced settings --> Behavior --> Watchdog.....	18
Fig. 9	EtherCAT State Machine .....	20
Fig. 10	CoE-Online tab .....	23
Fig. 11	Startup list in the TwinCAT System Manager .....	24
Fig. 12	Offline list.....	25
Fig. 13	Online list.....	25
Fig. 14	Dimensions of the EtherCAT Box Modules .....	27
Fig. 15	Mounting Rail ZS5300-000 .....	28
Fig. 16	EtherCAT Box with M8 connectors.....	30
Fig. 17	EtherCAT Box with M8 and M12 connectors.....	30
Fig. 18	7/8" plug connectors .....	31
Fig. 19	ZB8801 torque socket wrench .....	31
Fig. 20	EtherCAT Box: M8 (30 mm housing).....	32
Fig. 21	EtherCAT Box: M8 60 mm housing (EP9214 for example ) .....	32
Fig. 22	Coupler Box: M12 .....	33
Fig. 23	EtherCAT-LEDs .....	34
Fig. 24	EtherCAT Box, Connectors for power supply .....	35
Fig. 25	Pin assignment M8, Power In and Power Out.....	35
Fig. 26	EP92x4-0023, Connectors for Power In and Power Out .....	37
Fig. 27	Pin assignment 7/8", Power In and Power Out.....	37
Fig. 28	Status LEDs for power supply .....	38
Fig. 29	Power cable conductor losses .....	40
Fig. 30	Digital inputs M12 .....	41
Fig. 31	Digital inputs/outputs M12 .....	42
Fig. 32	Analog inputs M12 .....	42
Fig. 33	Analog output and PWMi output M12 .....	43
Fig. 34	Status LEDs.....	43
Fig. 35	UL label.....	44
Fig. 36	Scanning in the configuration (I/O Devices -> right-click -> Scan Devices.....)	45
Fig. 37	Appending a new I/O device (I/O Devices -> right-click -> Append Device.....)	46
Fig. 38	Selecting the device EtherCAT.....	46
Fig. 39	Appending a new box (Device -> right-click -> Append Box.....)	46
Fig. 40	Selecting a Box (e.g. EP2816-0008) .....	47
Fig. 41	Appended Box in the TwinCAT tree .....	47
Fig. 42	Branch of the EtherCAT box to be configured .....	48
Fig. 43	General tab .....	48
Fig. 44	EtherCAT tab.....	49

Fig. 45	Process Data tab .....	50
Fig. 46	Startup tab .....	52
Fig. 47	CoE - Online tab .....	53
Fig. 48	Advanced settings .....	54
Fig. 49	Online tab .....	54
Fig. 50	Tacho evaluation – single shaft mode .....	56
Fig. 51	Tacho evaluation - display of the rotational speed .....	57
Fig. 52	Tacho evaluation - dual shaft mode.....	57
Fig. 53	Tacho evaluation - .....	58
Fig. 54	Switching the PWMi/analog output - PWMi mode .....	59
Fig. 55	Switching the PWMi/analog output - analog mode .....	60
Fig. 56	Info data objects - activation of the synchronous info data .....	61
Fig. 57	Info data objects – selection of the value to be transmitted.....	61
Fig. 58	Watchdog.....	62
Fig. 59	Selecting the synchronous info data.....	63
Fig. 60	Enable dithering.....	64
Fig. 61	CoE-Online tab .....	65
Fig. 62	Changing the settings.....	66
Fig. 63	CoE-Online tab .....	67
Fig. 64	Startup list in the TwinCAT System Manager .....	68
Fig. 65	Offline list.....	69
Fig. 66	Online list.....	69
Fig. 67	Selecting the PDO restore default parameter.....	98
Fig. 68	Entering a restore value in the Set Value dialog.....	99
Fig. 69	Diagnostic control voltage (Us) and peripheral voltage (Up) of the EP8309 .....	100
Fig. 70	Device identifier consisting of name EL3204-0000 and revision -0016 .....	103
Fig. 71	Scan the subordinate field by right-clicking on the EtherCAT device in Config/FreeRun mode .	104
Fig. 72	Configuration is identical .....	104
Fig. 73	Change dialog .....	104
Fig. 74	EEPROM Update .....	105
Fig. 75	Selecting the new ESI.....	105
Fig. 76	Display of EL3204 firmware version .....	106
Fig. 77	Firmware Update .....	107
Fig. 78	FPGA firmware version definition .....	109
Fig. 79	Context menu Properties .....	109
Fig. 80	Dialog Advanced Settings .....	110
Fig. 81	Multiple selection and firmware update .....	112