Documentation

EP4174-0002

EtherCAT Box with configurable analog outputs

Version: 1.1.0
Date: 2018-12-06

BECKHOFF

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1 Foreword

1.1 Notes on the documentation

Intended audience

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

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

Disclaimer

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

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

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

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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.

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1.2 Safety instructions

Safety regulations

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

Exclusion of liability

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

Personnel qualification

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

Description of instructions

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

⚠ DANGER

Serious risk of injury!

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

⚠ WARNING

Risk of injury!

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

⚠ CAUTION

Personal injuries!

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

NOTE

Damage to environment/equipment or data loss

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

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Documentation issue status

Version	Modifications
1.1.0	• Update Safety instructions • Correction chapter *Power cable* • Update chapter *Mounting*
1.0.0	• Migration
0.5	• First preliminary version

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	EP4174-0002	
	Firmware	Hardware
1.1.0	02	11
1.0.0	02	10
0.5	01	00

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

Syntax of the serial number

Structure of the serial number: WW YY FF HH

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

Example with ser. no.: 55 09 01 00:

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

2 Product overview

2.1 EtherCAT Box - Introduction

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

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

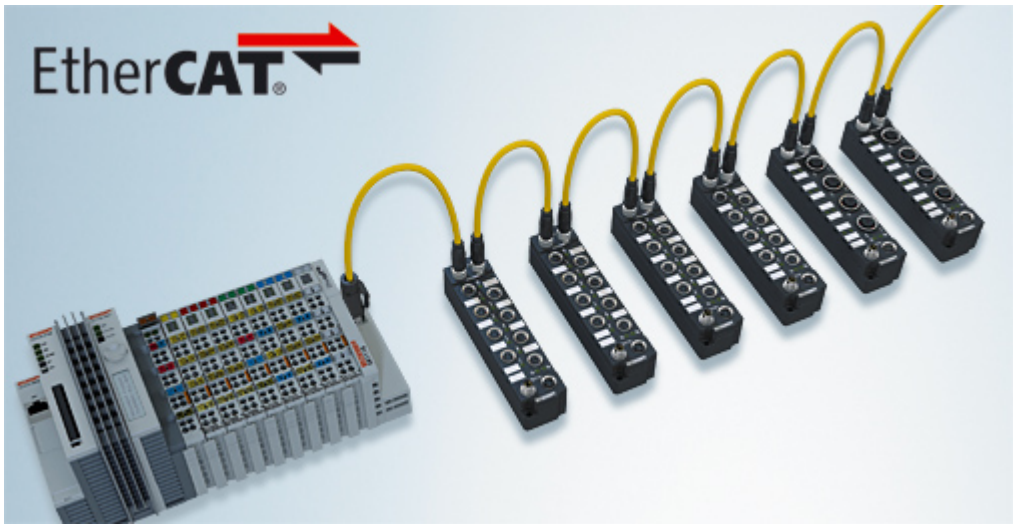

Fig. 1: EtherCAT Box Modules within an EtherCAT network

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

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

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

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

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

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

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

Basic EtherCAT documentation

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

EtherCAT XML Device Description

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

2.2 EP4174-0002 - Introduction

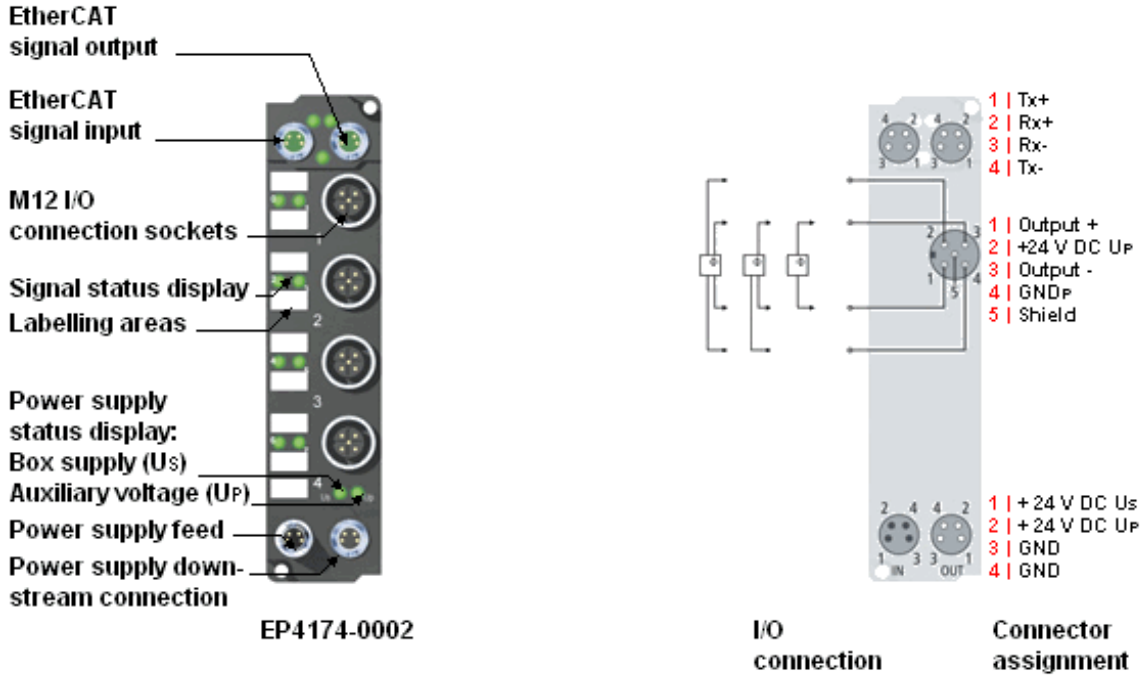

Fig. 4: EP4174-0002

EtherCAT Box with four configurable analog outputs

The EP4174-0002 EtherCAT Box has four analog outputs which can be individually parameterized, so that they generate signals either in the -10 to +10 V range or the 0/4…20 mA range.

The voltage or output current is fed to the process level, electrically isolated with a resolution of 15 bit (default). The output scaling can be changed if required.

Ground potential for the four output channels is common with the 24 V_{DC} supply. The analog actuators are fed from the load voltage (freely selectable up to 30 V_{DC}). The applied load voltage is available for supplying actuators in further EtherCAT Box modules.

2.3 EP4174-0002 - Technical data

Technical data	EP4174-0002
Fieldbus	EtherCAT
Fieldbus connection	2 x M8 socket (green)
Number of outputs	4
Connection outputs [▶ 27]	M12 sockets
Signal type	Configurable: 0…+10 V -10…+10 V 0…20 mA 4…20 mA
Load	> 5 kΩ | < 500 Ω
Resolution	16 bit (including sign)
Conversion time	< 4 ms
Measuring error	< 0,1 % (relative to full scale value)
Supply of the module circuitry	From the control voltage Us
Current consumption of the module circuitry	typically 120 mA
Sensor supply	from load supply voltage Up, DC, any value up to 30 V
Power supply connection	Power supply: 1 x M8 plug, 4-pin Onward connection: 1 x M8 socket, 4-pin
Process image	Outputs: 4 x 16 bit
Electrical isolation	Control voltage / fieldbus: yes
Permissible ambient temperature during operation	-25°C ... +60°C 0°C ... +55 °C (according to cULus, see UL requirements [▶ 28]) 0°C ... +55°C (according to ATEX, see special conditions [▶ 30])
Permissible ambient temperature during storage	-25°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)
Approvals	CE, cULus [▶ 28], ATEX [▶ 30]
Installation position	variable

2.4 EP4174 - Status LEDs

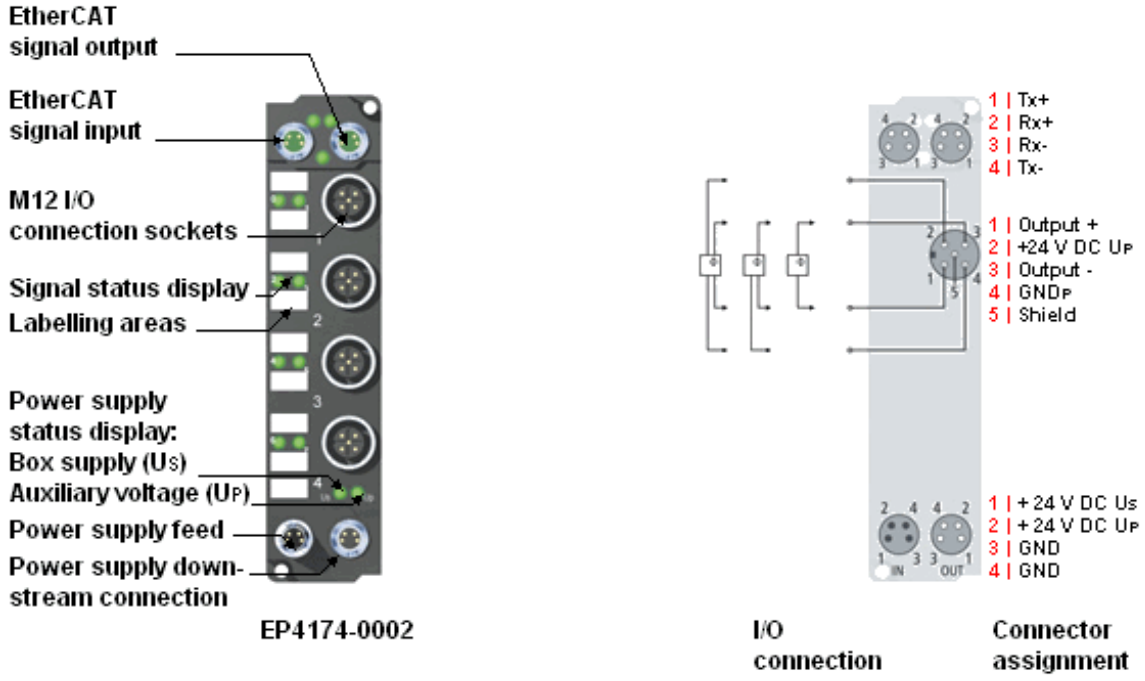

Fig. 5: EP4174 LEDs

Status LEDs at the M12 connections

Connection	LED	Display	Meaning
M12 socket no. 1-4	R left	off	No data transfer to the D/A converter
		green	Data transfer to the D/A converter
	E right	off	Function OK
		red	Error: Broken wire or measured value outside the measuring range

Power supply

LED	Display	Meaning
Us	off	the power supply voltage, Us, is not present
	green illuminated	the power supply voltage, Us, is present
Up	off	the power supply voltage, Up, is not present
	green illuminated	The power supply voltage, Up, is present

2.5 EP4174-0002 - Process image

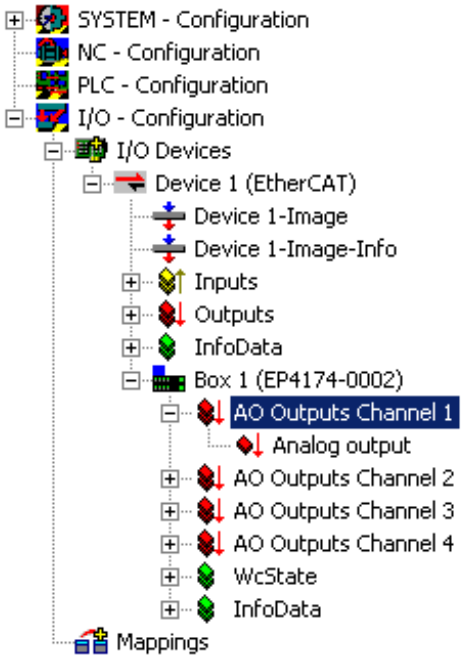

Fig. 6: EP4174-0002 - Process image

AO Outputs Channel 1

The data for the first analog channel can be found under **AO Outputs Channel 1**.

AO Outputs Channel 2 to 4

The data of analog channels 2 to 4 have the same structure as those of the first channel.

3 Mounting and connection

3.1 Mounting

3.1.1 Dimensions

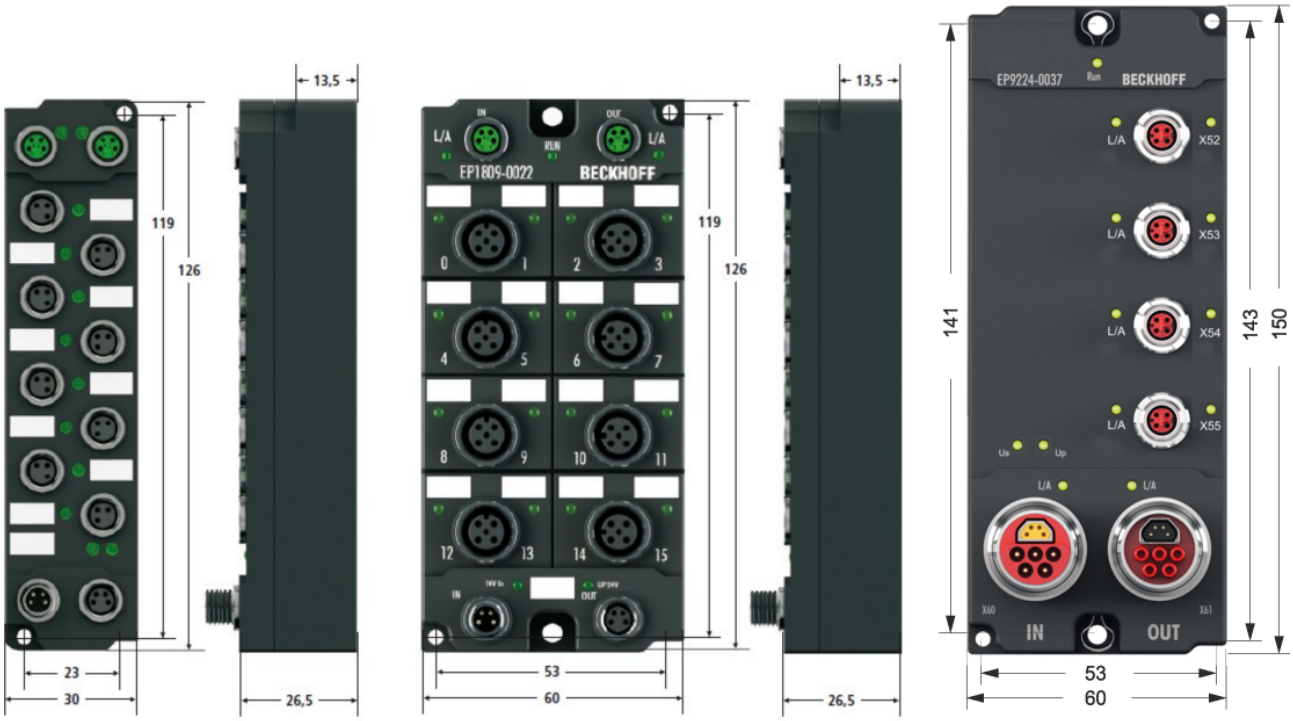

Fig. 7: Dimensions of the EtherCAT Box Modules

All dimensions are given in millimeters.

Housing properties

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

3.1.2 Fixing

Note or pointer

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

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

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

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

Mounting Rail ZS5300-0001

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

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

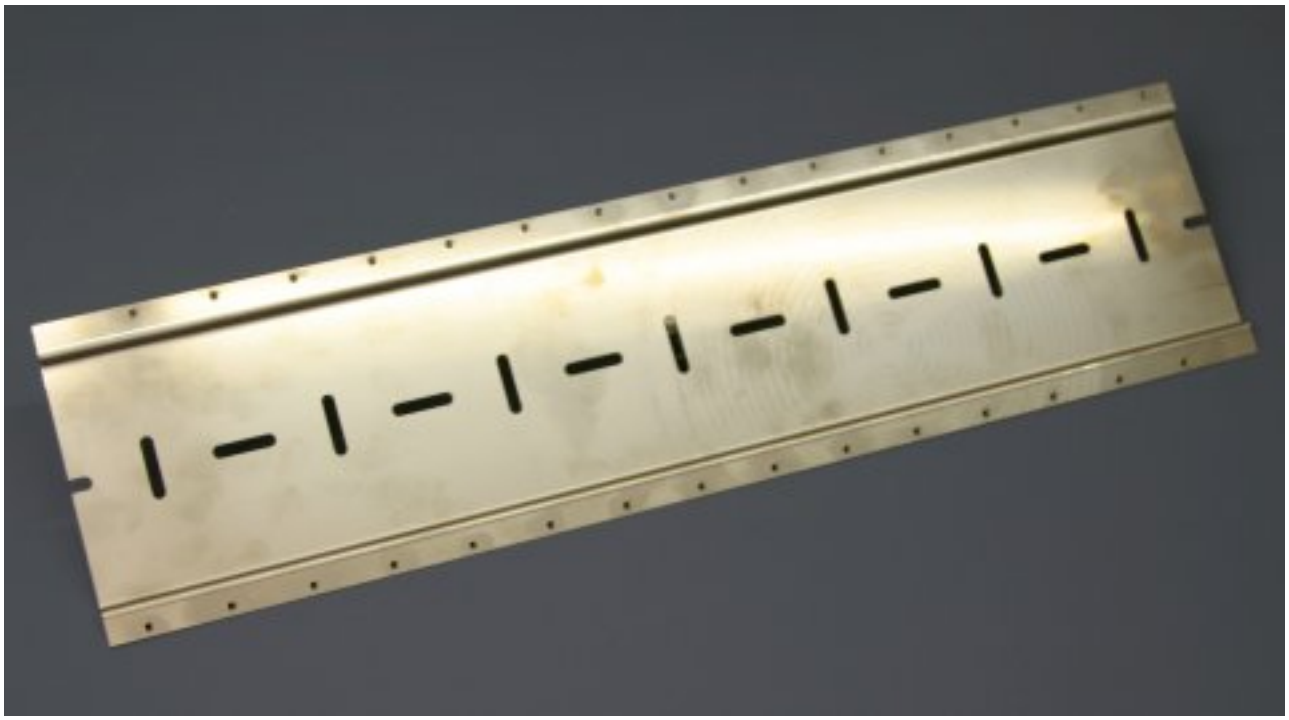

Fig. 8: Mounting Rail ZS5300-000

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

Mounting Rail ZS5300-0011

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

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

3.1.3 Nut torque for connectors

M8 connectors

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

Fig. 9: EtherCAT Box with M8 connectors

M12 connectors

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

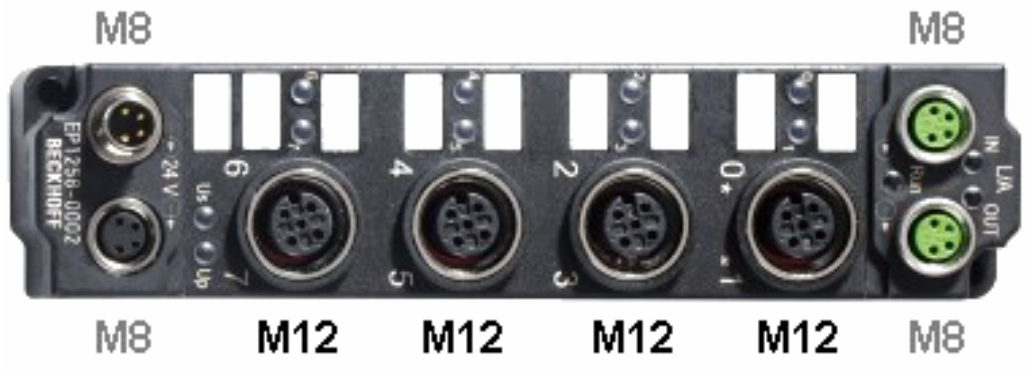

Fig. 10: EtherCAT Box with M8 and M12 connectors

7/8" plug connectors

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

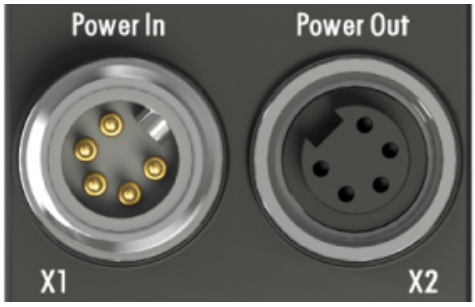

Fig. 11: 7/8" plug connectors

Torque socket wrenches

Fig. 12: ZB8801 torque socket wrench

Ensure the right torque

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

3.1.4 Additional checks

The boxes have undergone the following additional tests:

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

3.2 Connection

3.2.1 EtherCAT connection

For the incoming and ongoing EtherCAT connection,

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

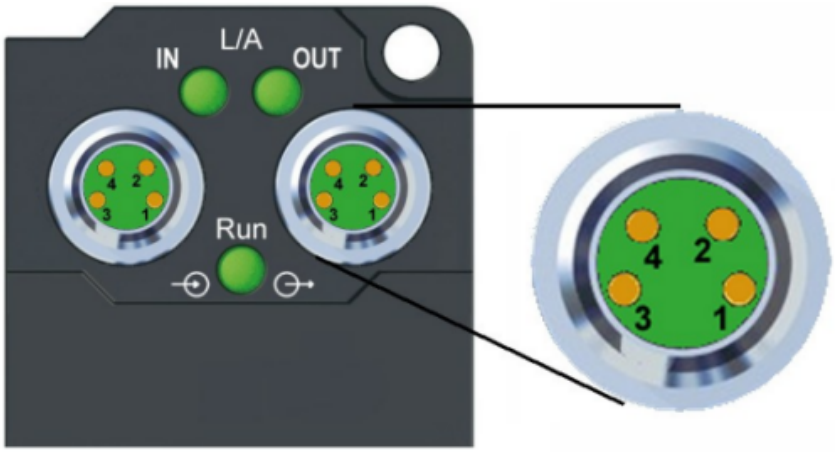

Fig. 13: EtherCAT Box: M8, 30 mm housing

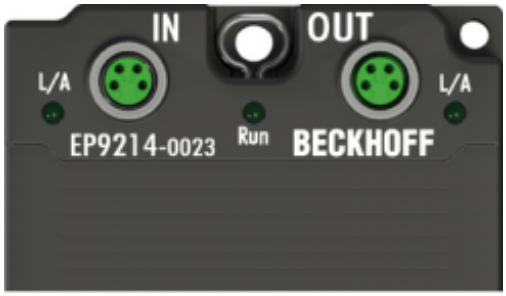

Fig. 14: EtherCAT Box: M860 mm housing (example: EP9214)

Fig. 15: Coupler Box: M12

Assignment

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

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

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

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

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

EtherCAT connector

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

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

3.2.2 EtherCAT - Fieldbus LEDs

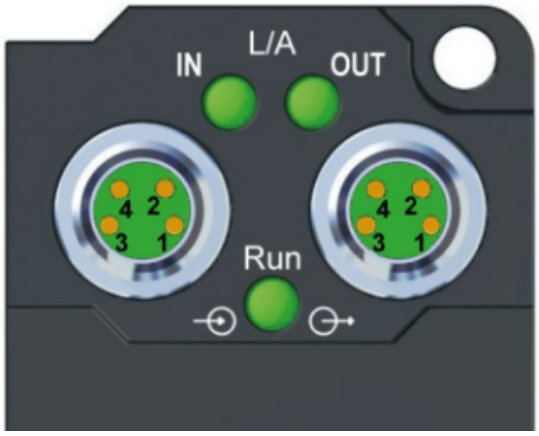

Fig. 16: EtherCAT-LEDs

LED display

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

EtherCAT statuses

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

3.2.3 Power Connection

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

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

Fig. 17: EtherCAT Box, Connectors for power supply

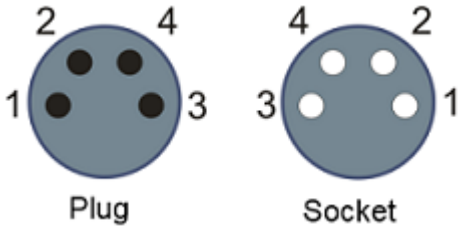

Fig. 18: Pin assignment M8, Power In and Power Out

Table 1: PIN assignment

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

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

Two LEDs display the status of the supply voltages.

NOTE

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

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

Control voltage Us: 24 V_{DC}

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

Auxiliary voltage Up 24 V_{DC}

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

Redirection of the supply voltages

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

NOTE

Pay attention to the maximum permissible current!

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

Supply via EP92x4-0023 PowerBox modules

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

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

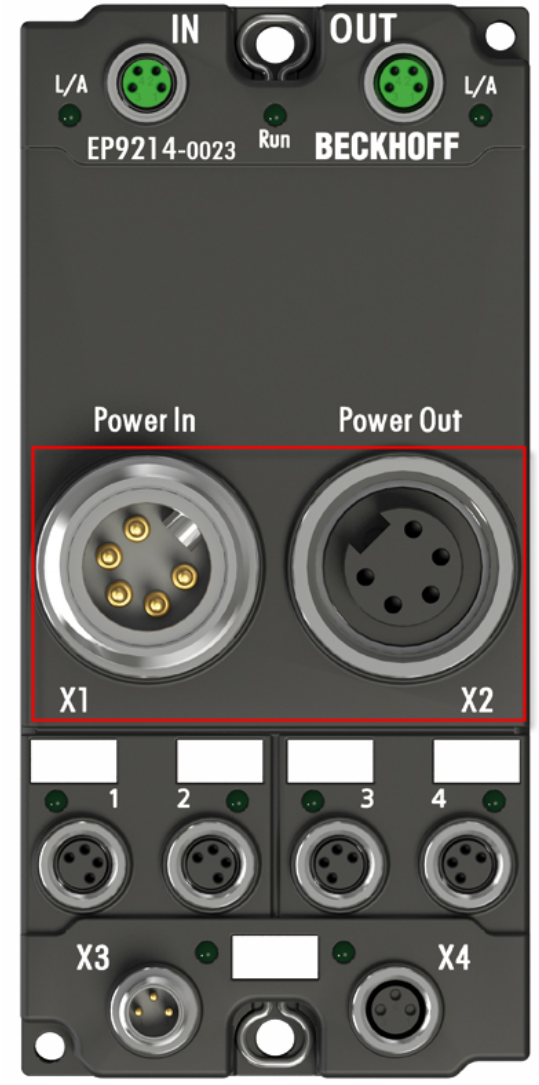

Fig. 19: EP92x4-0023, Connectors for Power In and Power Out

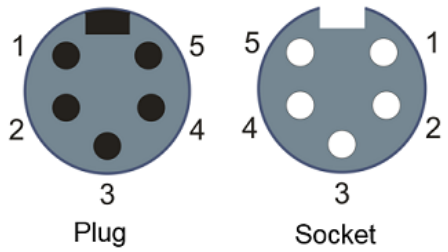

Fig. 20: Pin assignment 7/8”, Power In and Power Out

Electrical isolation

Digital modules

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

Check this at the documentation of each used EtherCAT Box.

Analog modules

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

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

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

NOTE

Electrical isolation may be cancelled!

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

3.2.4 Power cables

Ordering data

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

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

Technical data

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

3.2.5 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.

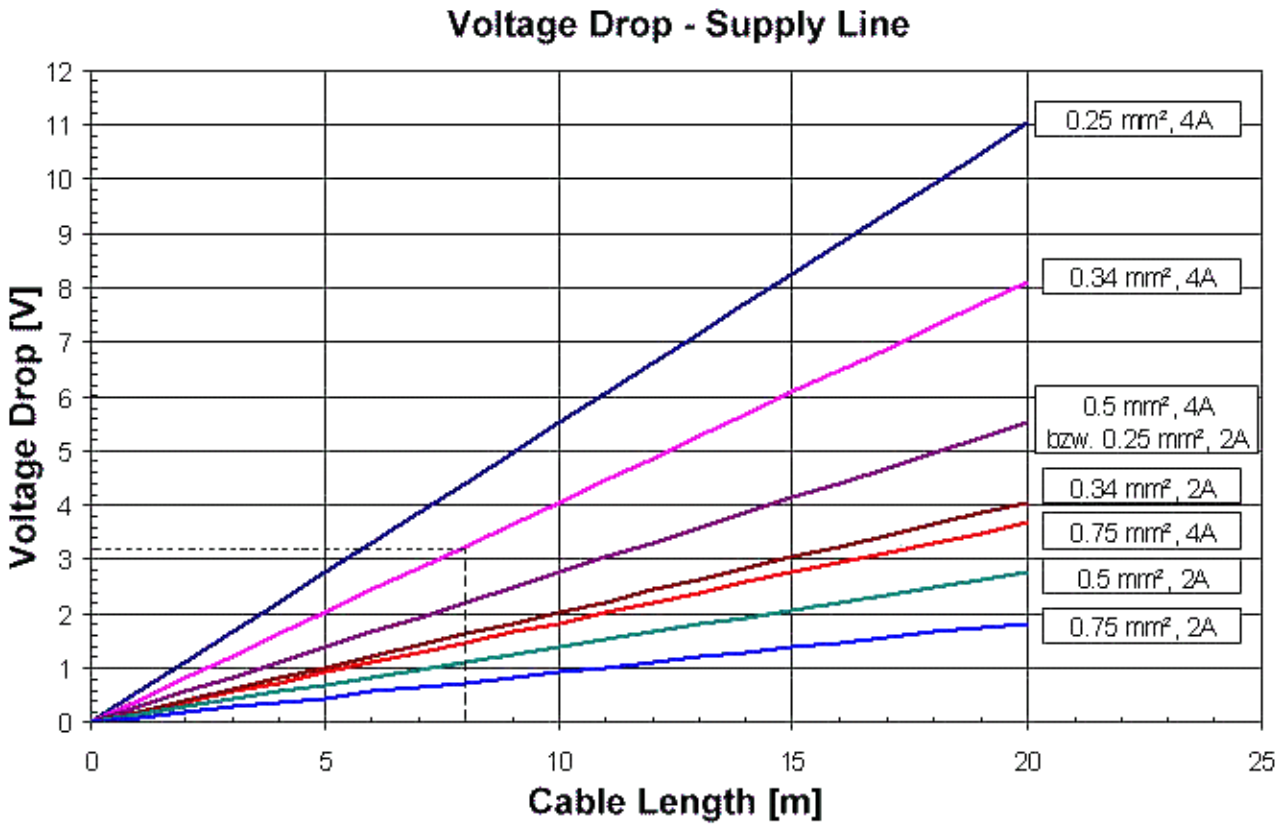

Fig. 21: Power cable conductor losses

Example

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

EP92x4 Power Distribution Modules

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

3.2.6 EP4174-0002 - Signal connection

3.2.6.1 Analog voltage outputs (M12)

Analog outputs, -10 to +10 V

The actuator is connected via output +/- and output GND. The actuator can optionally be operated/supplied with 24 V_{DC}.

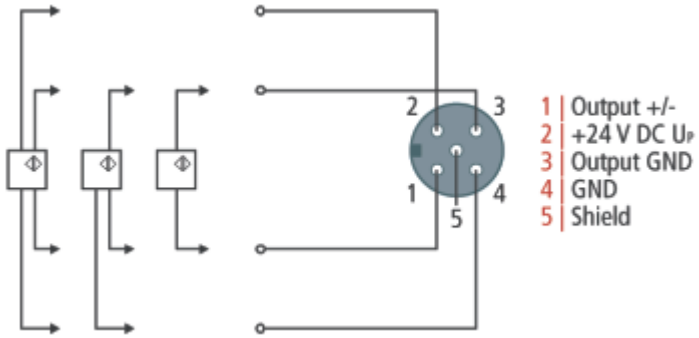

Fig. 22: Connecting the analog voltage outputs (M12)

LED indicators - meanings

There is a green *Run* LED and a red *Error* LED for each channel. The green *Run* LED is lit when data are transferred to the D/A converter. The red *Error* LED indicates that there is an error (open circuit, measured value outside the range).
Correct function is indicated if the green *Run* LED is on and the red *Error* is off.

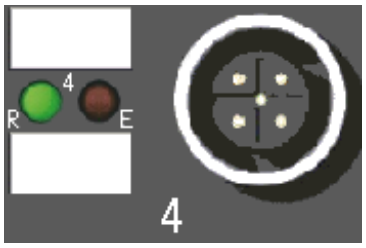

Fig. 23: Status and diagnostic LED at the M12 connector

3.2.6.2 Analog current outputs (M12)

Analog outputs, 0 to 20 mA or 4 to 20 mA

The actuator is connected via output + and output -. The actuator can optionally be operated/supplied with 24 V_{DC}.

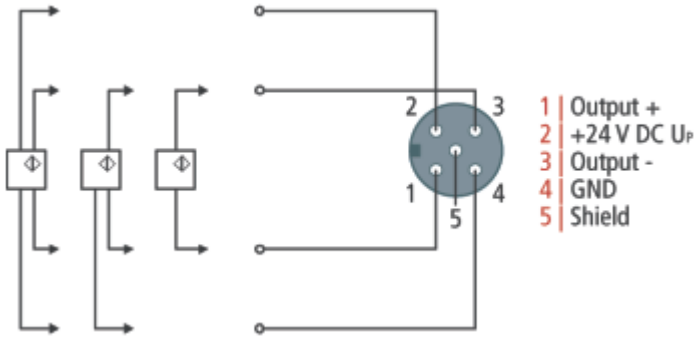

Fig. 24: Connecting the analog current outputs (M12)

LED indicators - meanings

There is a green *Run* LED and a red *Error* LED for each channel. The green *Run* LED is lit when data are transferred to the D/A converter. The red *Error* LED indicates that there is an error (open circuit, measured value outside the range).
Correct function is indicated if the green *Run* LED is on and the red *Error* is off.

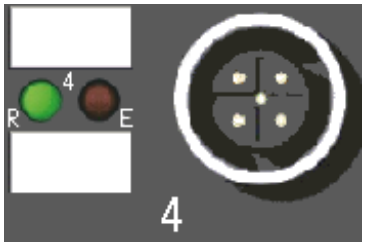

Fig. 25: Status and diagnostic LED at the M12 connector

3.3 UL Requirements

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

Supply voltage

⚠ CAUTION

CAUTION!

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

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

⚠ CAUTION

CAUTION!

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

Networks

⚠ CAUTION

CAUTION!

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

Ambient temperature range

⚠ CAUTION

CAUTION!

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

Marking for UL

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

Fig. 26: UL label

3.4 ATEX notes

3.4.1 ATEX - Special conditions

⚠ WARNING

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

- The certified components are to be installed in the BG2000-0000 protection enclosure [▶ 31] that guarantees a protection against mechanical hazards!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observethe permissible ambient temperature range of 0 - 55°C for the use of EtherCAT Box modules in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

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

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

Marking

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

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

or

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

Batch number (D number)

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

D: WW YY FF HH

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

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

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

3.4.2 BG2000-0000 - EtherCAT Box protection enclosure

⚠ WARNING

Risk of electric shock and damage of device!

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

ATEX

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

Installation

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

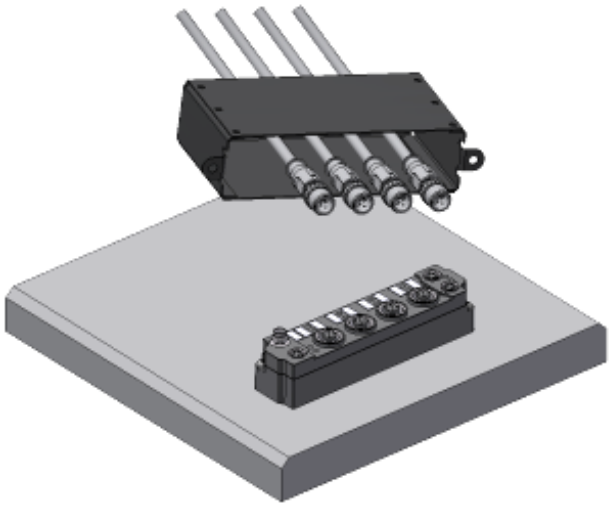

Fig. 27: BG2000-0000, putting the cables

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

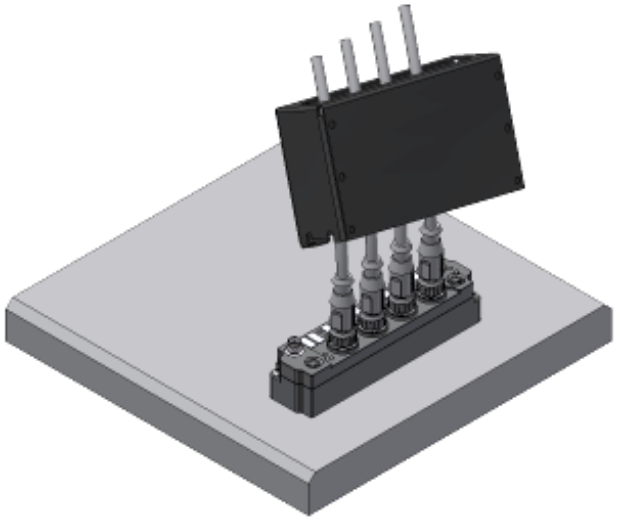

Fig. 28: BG2000-0000, fixing the cables

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

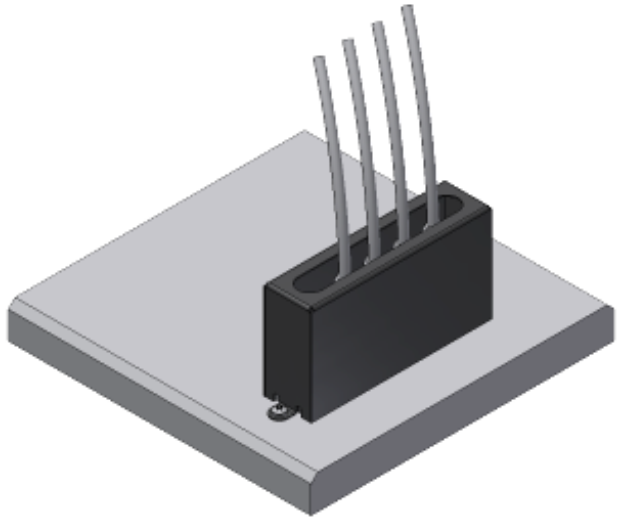

Fig. 29: BG2000-0000, mounting the protection enclosure

3.4.3 ATEX Documentation

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

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

4 Commissioning/Configuration

4.1 Inserting into the EtherCAT network

Installation of the latest XML device description

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

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

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

Automatic scanning in of the box

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

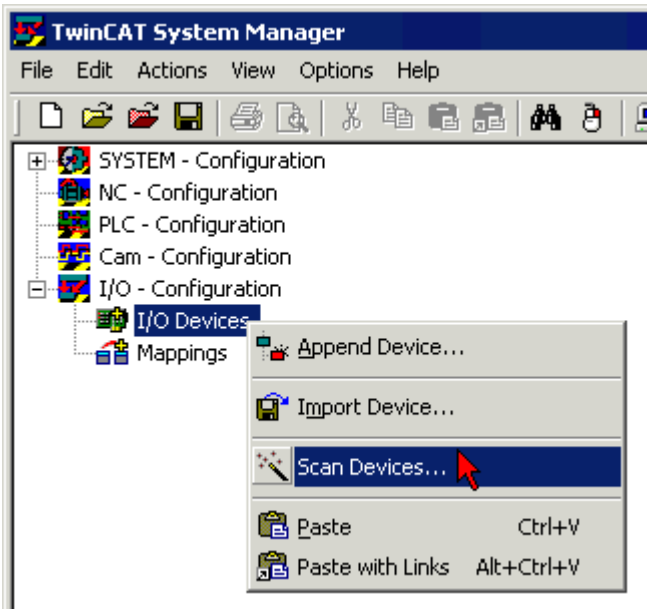

Fig. 30: Scanning in the configuration (I/O Devices -> right-click -> Scan Devices...)

Appending a module manually

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

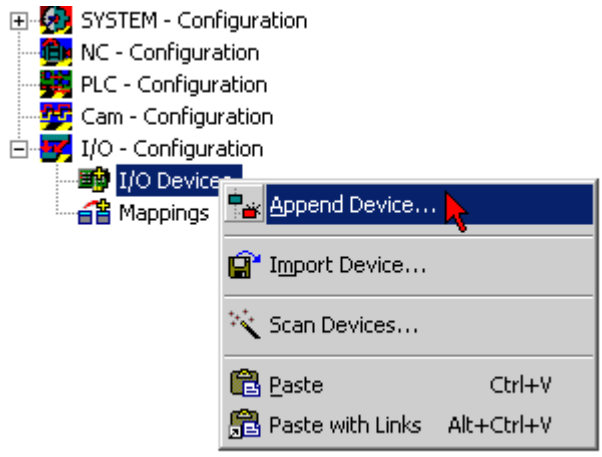

Fig. 31: Appending a new I/O device (I/O Devices -> right-click -> Append Device...)

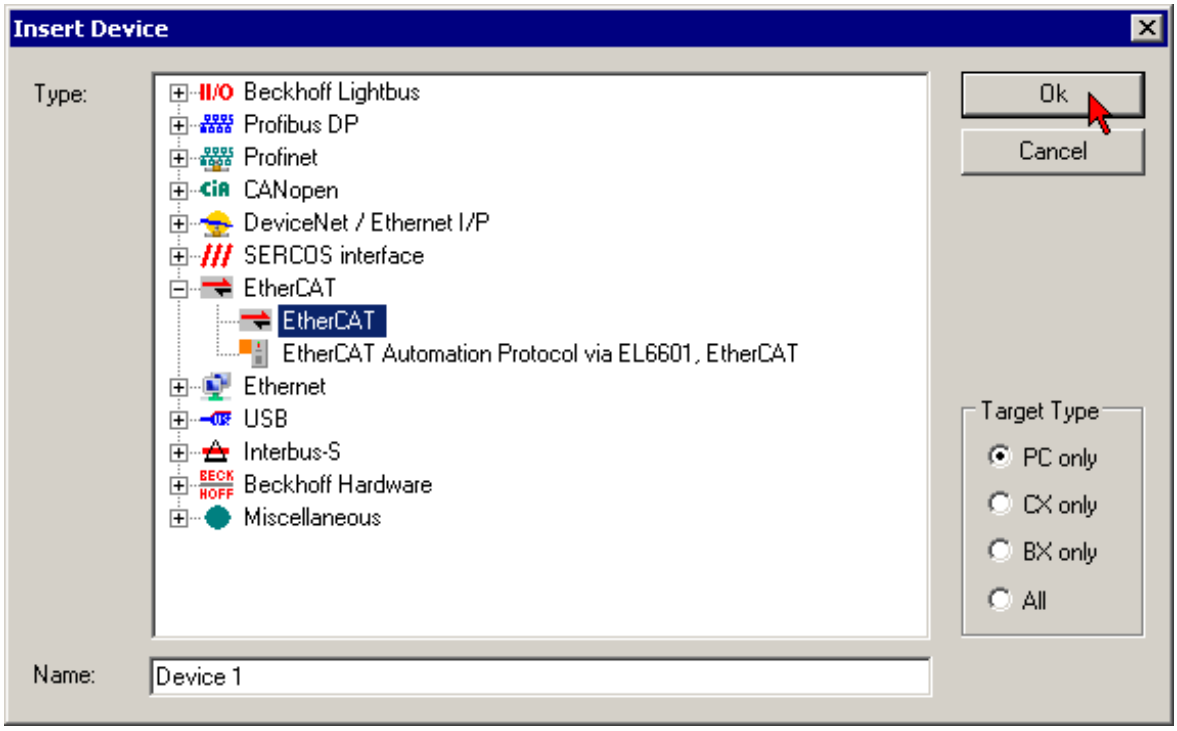

Fig. 32: Selecting the device EtherCAT

- Append a new box.

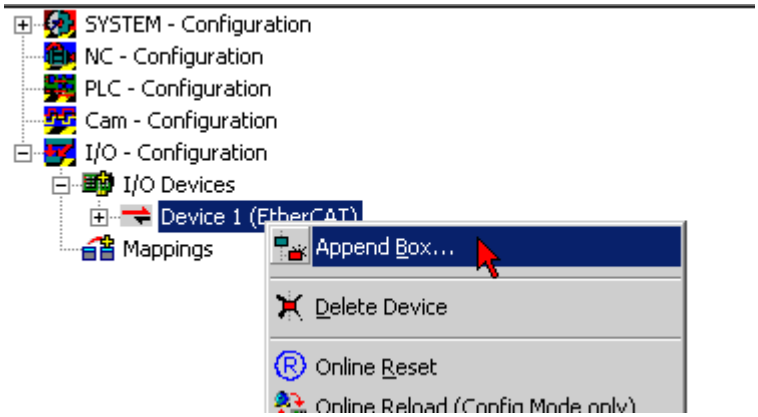

Fig. 33: Appending a new box (Device -> right-click -> Append Box...)

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

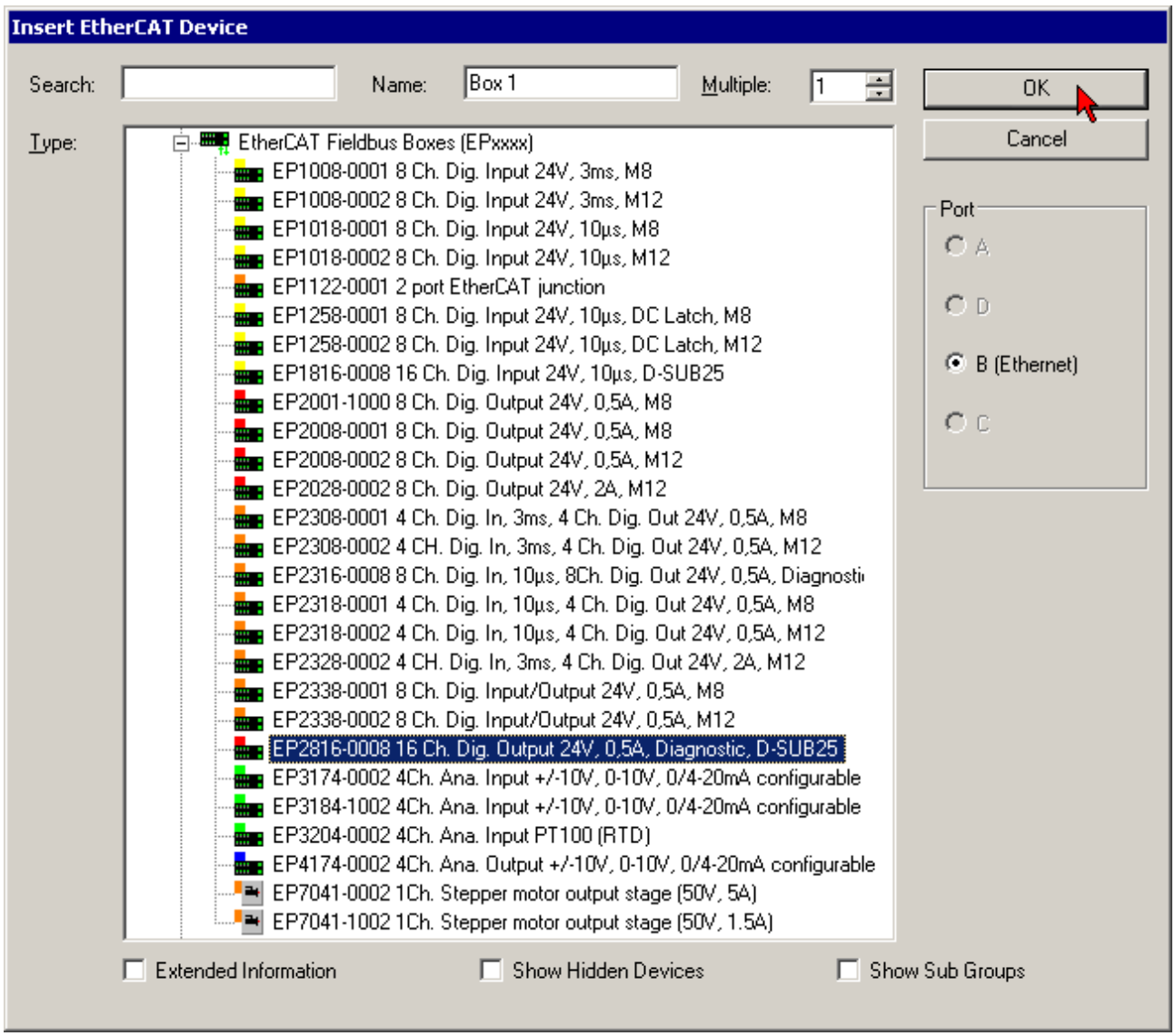

Fig. 34: Selecting a Box (e.g. EP2816-0008)

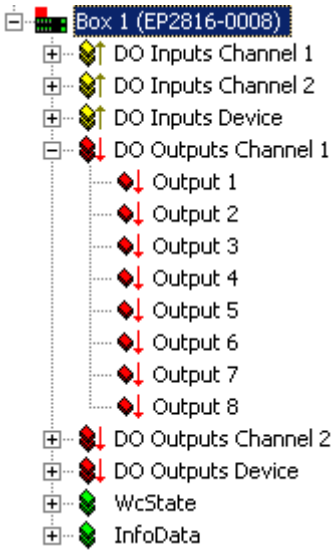

Fig. 35: Appended Box in the TwinCAT tree

4.2 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).

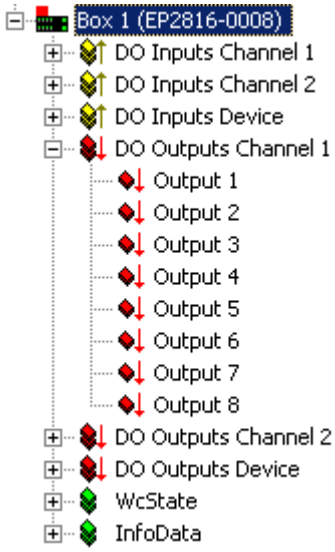

Fig. 36: Branch of the EtherCAT box to be configured

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

General tab

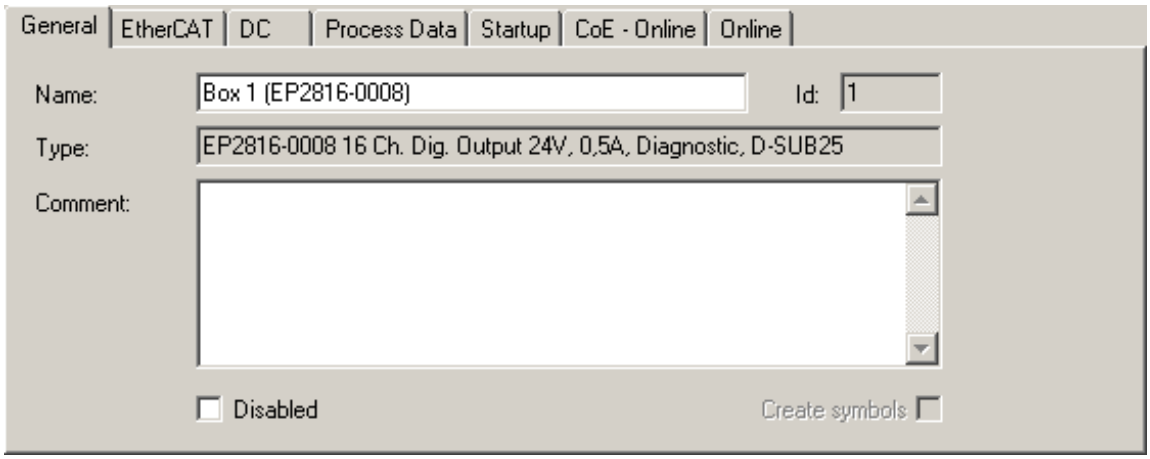

Fig. 37: General tab

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

EtherCAT tab

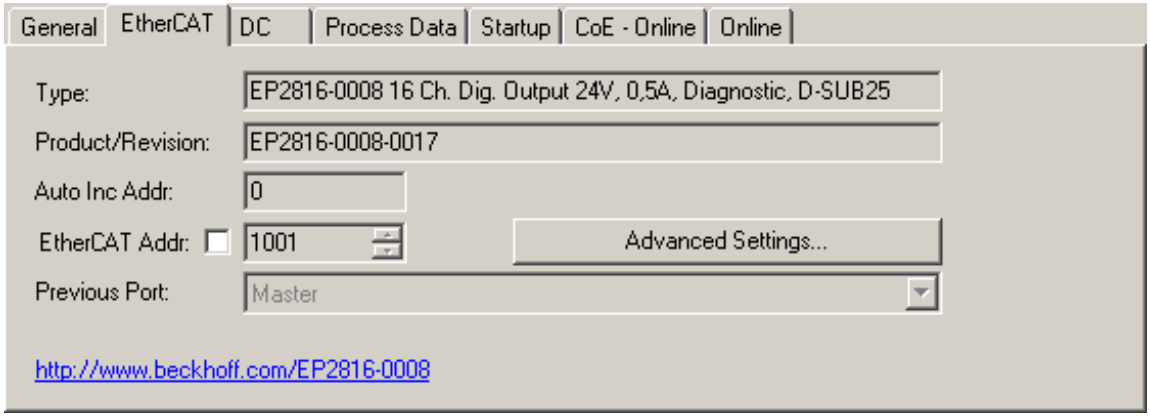

Fig. 38: EtherCAT tab

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

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

Process Data tab

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

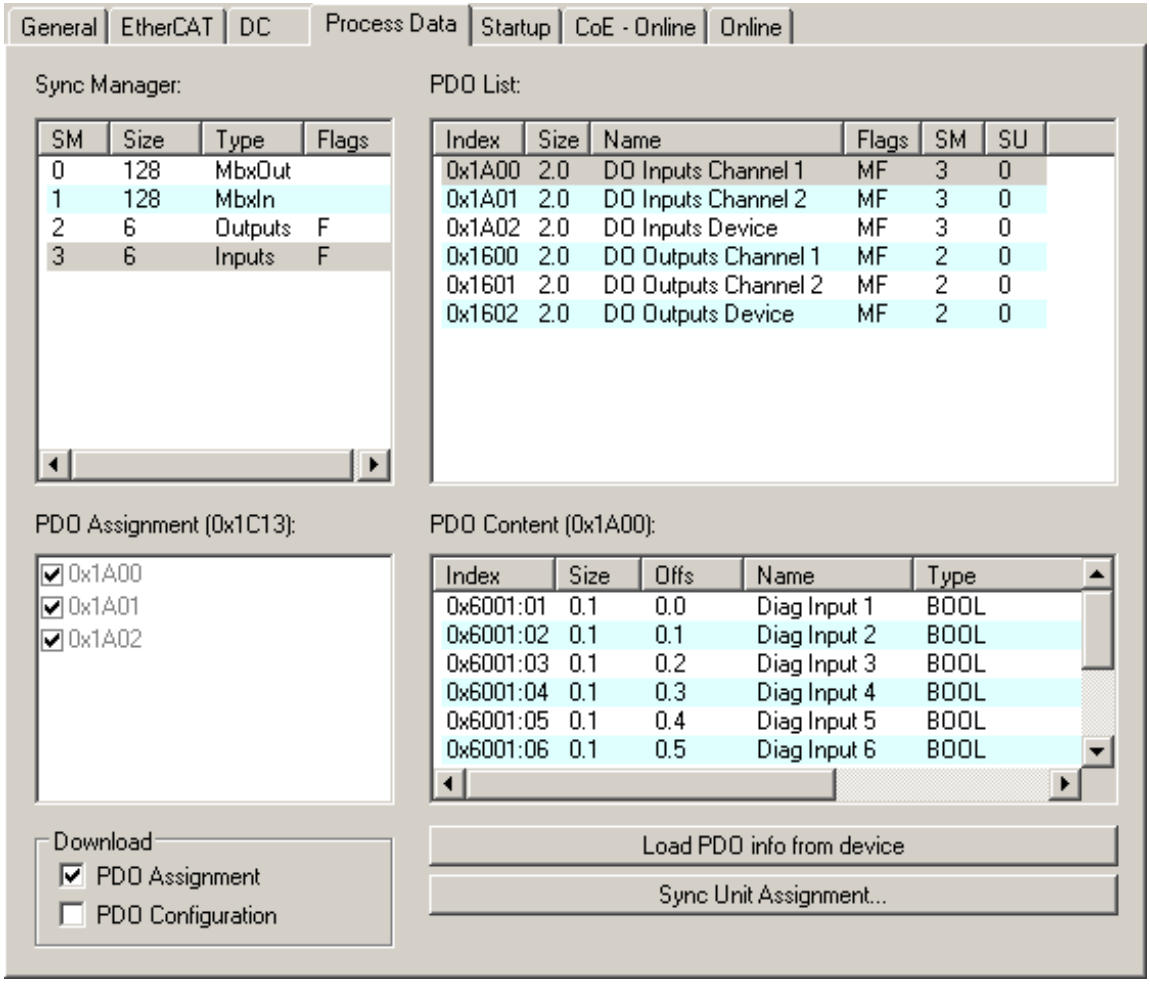

Fig. 39: Process Data tab

Sync Manager

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

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

PDO Assignment

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

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

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

Activation of PDO assignment

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

PDO list

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

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

PDO Content

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

Download

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

PDO Assignment

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

PDO Configuration

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

Startup tab

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

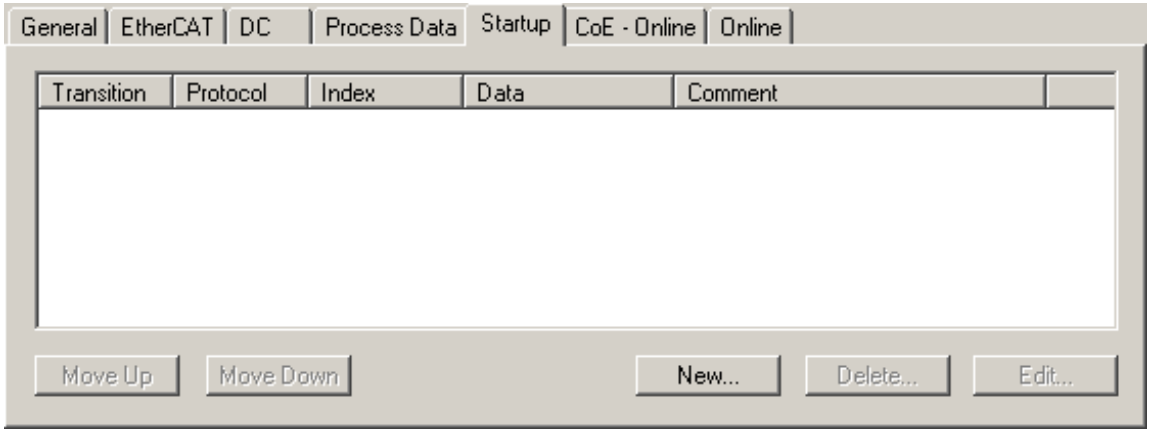

Fig. 40: Startup tab

Column	Description
Transition	Transition to which the request is sent. This can either be • the transition from pre-operational to safe-operational (PS), or • the transition from safe-operational to operational (SO). 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.

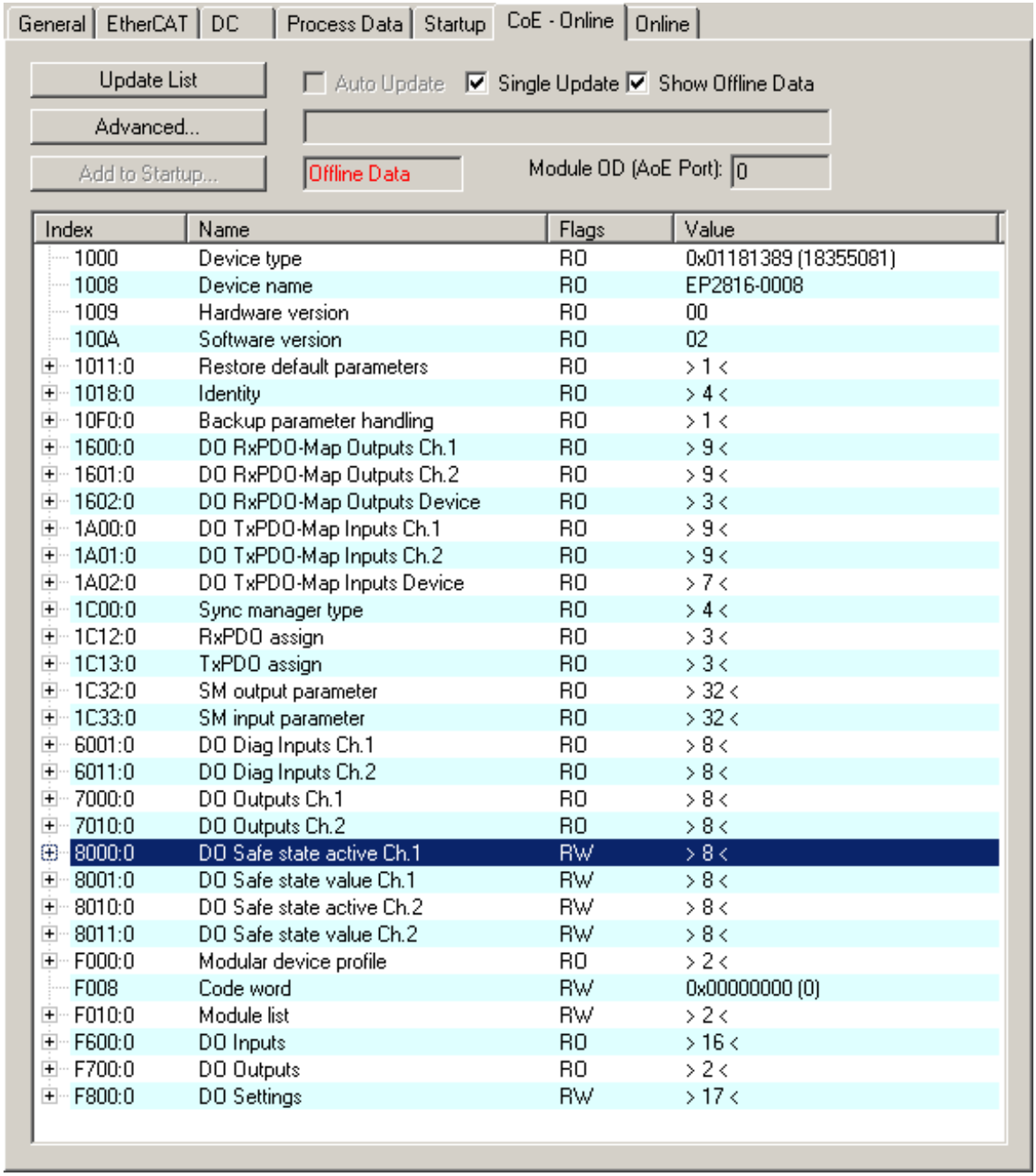

Fig. 41: CoE - Online tab

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.

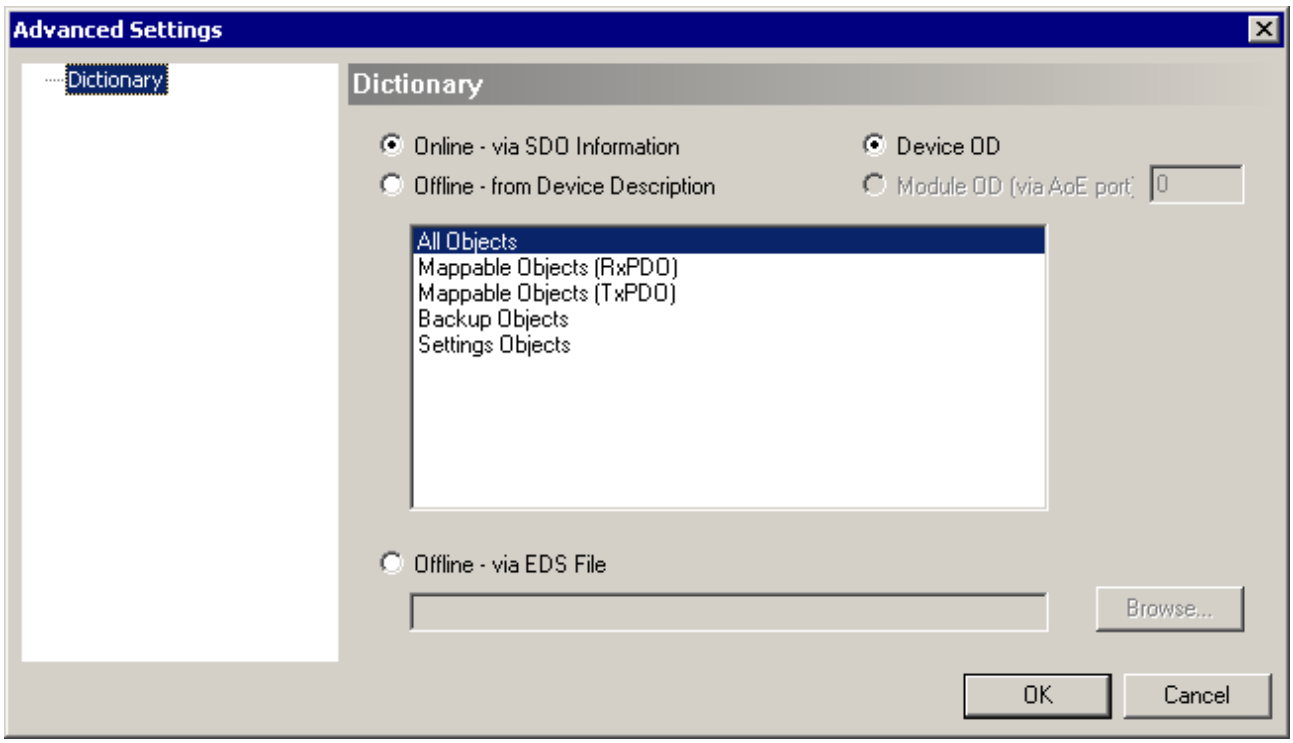

Fig. 42: Advanced settings

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

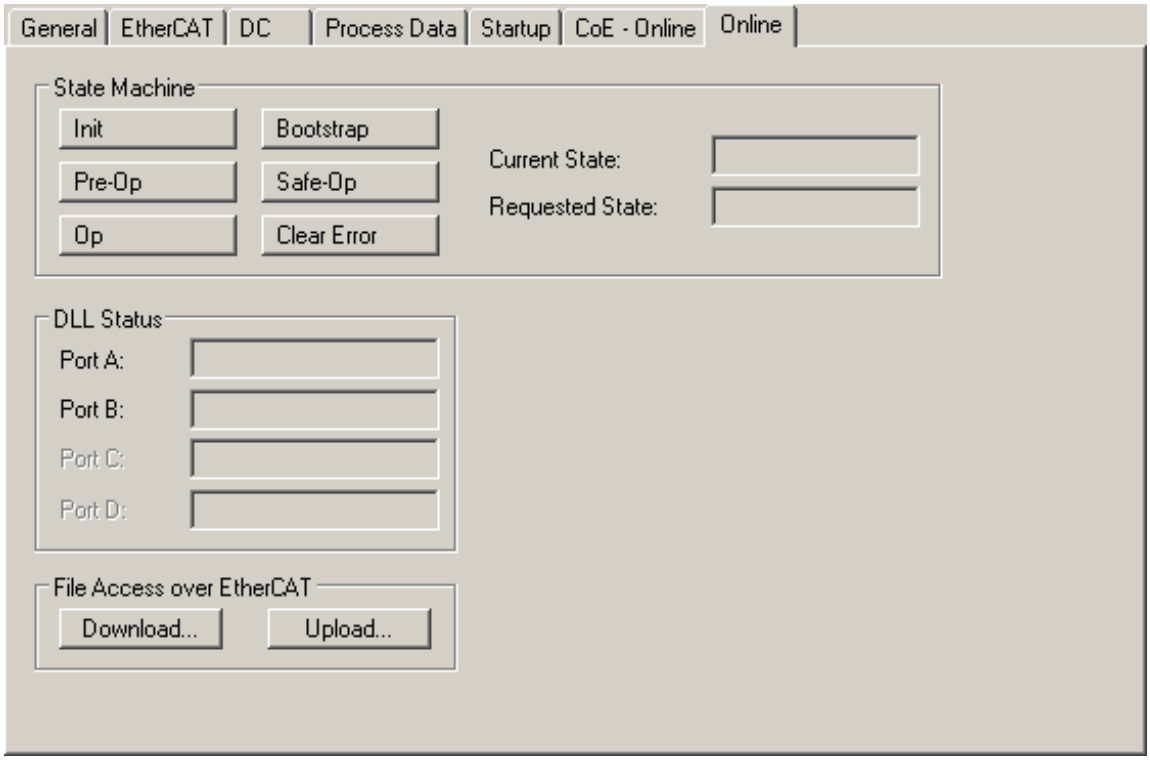

Fig. 43: Online tab

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.

4.3 Object overview

EtherCAT XML Device Description

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

Index (hex)		Name	Flags	Default value
1000 [▶ 52]		Device type	RO	0x01901389 (26219401$_{dec}$)
1008 [▶ 52]		Device name	RO	EP4174-0002
1009 [▶ 52]		Hardware version	RO	00
100A [▶ 52]		Software version	RO	01
1011:0 [▶ 47]	**Subindex**	Restore default parameters	RO	0x01 (1$_{dec}$)
	1011:01	SubIndex 001	RW	0x00000000 (0$_{dec}$)
1018:0 [▶ 52]	**Subindex**	Identity	RO	0x04 (4$_{dec}$)
	1018:01	Vendor ID	RO	0x00000002 (2$_{dec}$)
	1018:02	Product code	RO	0x104E4052 (273563730$_{dec}$)
	1018:03	Revision	RO	0x00100002 (1048578$_{dec}$)
	1018:04	Serial number	RO	0x00000000 (0$_{dec}$)
10F0:0 [▶ 52]	**Subindex**	Backup parameter handling	RO	0x01 (1$_{dec}$)
	10F0:01	Checksum	RO	0x00000000 (0$_{dec}$)
1600:0 [▶ 52]	**Subindex**	AO RxPDO-Map Ch.1	RO	0x01 (1$_{dec}$)
	1600:01	SubIndex 001	RO	0x7000:11, 16
1601:0 [▶ 53]	**Subindex**	AO RxPDO-Map Ch.2	RO	0x01 (1$_{dec}$)
	1601:01	SubIndex 001	RO	0x7010:11, 16
1602:0 [▶ 53]	**Subindex**	AO RxPDO-Map Ch.3	RO	0x01 (1$_{dec}$)
	1602:01	SubIndex 001	RO	0x7020:11, 16
1603:0 [▶ 53]	**Subindex**	AO RxPDO-Map Ch.4	RO	0x01 (1$_{dec}$)
	1603:01	SubIndex 001	RO	0x7030:11, 16
1C00:0 [▶ 53]	**Subindex**	Sync manager type	RO	0x04 (4$_{dec}$)
	1C00:01	SubIndex 001	RO	0x01 (1$_{dec}$)
	1C00:02	SubIndex 002	RO	0x02 (2$_{dec}$)
	1C00:03	SubIndex 003	RO	0x03 (3$_{dec}$)
	1C00:04	SubIndex 004	RO	0x04 (4$_{dec}$)
1C12:0 [▶ 53]	**Subindex**	RxPDO assign	RW	0x04 (4$_{dec}$)
	1C12:01	SubIndex 001	RW	0x1600 (5632$_{dec}$)
	1C12:02	SubIndex 002	RW	0x1601 (5633$_{dec}$)
	1C12:03	SubIndex 003	RW	0x1602 (5634$_{dec}$)
	1C12:04	SubIndex 004	RW	0x1603 (5635$_{dec}$)
1C13:0 [▶ 53]	**Subindex**	TxPDO assign	RW	0x00 (0$_{dec}$)
1C32:0 [▶ 54]	**Subindex**	SM output parameter	RO	0x20 (32$_{dec}$)
	1C32:01	Sync mode	RW	0x0001 (1$_{dec}$)
	1C32:02	Cycle time	RW	0x000F4240 (1000000$_{dec}$)
	1C32:03	Shift time	RO	0x00003A98 (15000$_{dec}$)
	1C32:04	Sync modes supported	RO	0xC007 (49159$_{dec}$)
	1C32:05	Minimum cycle time	RO	0x000493E0 (300000$_{dec}$)
	1C32:06	Calc and copy time	RO	0x00000000 (0$_{dec}$)
	1C32:07	Minimum delay time	RO	0x00003A98 (15000$_{dec}$)
	1C32:08	Command	RW	0x0000 (0$_{dec}$)
	1C32:09	Maximum Delay time	RO	0x00003A98 (15000$_{dec}$)
	1C32:0B	SM event missed counter	RO	0x0000 (0$_{dec}$)
	1C32:0C	Cycle exceeded counter	RO	0x0000 (0$_{dec}$)
	1C32:0D	Shift too short counter	RO	0x0000 (0$_{dec}$)
	1C32:20	Sync error	RO	0x00 (0$_{dec}$)

Index (hex)		Name	Flags	Default value
7000:0 [▶ 55]	**Subindex**	AO outputs Ch.1	RO	0x11 (17_{dec})
	7000:11	Analog output	RO	0x0000 (0_{dec})
7010:0 [▶ 55]	**Subindex**	AO outputs Ch.2	RO	0x11 (17_{dec})
	7010:11	Analog output	RO	0x0000 (0_{dec})
7020:0 [▶ 55]	**Subindex**	AO outputs Ch.3	RO	0x11 (17_{dec})
	7020:11	Analog output	RO	0x0000 (0_{dec})
7030:0 [▶ 55]	**Subindex**	AO outputs Ch.4	RO	0x11 (17_{dec})
	7030:11	Analog output	RO	0x0000 (0_{dec})
8000:0 [▶ 48]	**Subindex**	AO settings Ch.1	RW	0x16 (22_{dec})
	8000:01	Enable user scale	RW	0x00 (0_{dec})
	8000:02	Presentation	RW	0x00 (0_{dec})
	8000:05	Watchdog	RW	0x00 (0_{dec})
	8000:07	Enable user calibration	RW	0x00 (0_{dec})
	8000:08	Enable vendor calibration	RW	0x01 (1_{dec})
	8000:11	User scale offset	RW	0x0000 (0_{dec})
	8000:12	User scale gain	RW	0x00010000 (65536_{dec})
	8000:13	Default output	RW	0x0000 (0_{dec})
	8000:14	Default output ramp	RW	0xFFFF (65535_{dec})
	8000:15	User calibration offset	RW	0x0000 (0_{dec})
	8000:16	User calibration gain	RW	0x4000 (16384_{dec})
800E:0 [▶ 55]	**Subindex**	AO internal data Ch.1	RO	0x01 (1_{dec})
	800E:01	DAC raw value	RO	0x0000 (0_{dec})
800F:0 [▶ 55]	**Subindex**	AO vendor data Ch.1	RW	0x06 (6_{dec})
	800F:01	R0 Calibration Offset	RW	0x0000 (0_{dec})
	800F:02	R0 Calibration Gain	RW	0x4000 (16384_{dec})
	800F:03	R1 Calibration Offset	RW	0x0000 (0_{dec})
	800F:04	R1 Calibration Gain	RW	0x4000 (16384_{dec})
	800F:05	R2 Calibration Offset	RW	0x0000 (0_{dec})
	800F:06	R2 Calibration Gain	RW	0x4000 (16384_{dec})
8010:0 [▶ 49]	**Subindex**	AO settings Ch.2	RW	0x16 (22_{dec})
	8010:01	Enable user scale	RW	0x00 (0_{dec})
	8010:02	Presentation	RW	0x00 (0_{dec})
	8010:05	Watchdog	RW	0x00 (0_{dec})
	8010:07	Enable user calibration	RW	0x00 (0_{dec})
	8010:08	Enable vendor calibration	RW	0x01 (1_{dec})
	8010:11	User scale offset	RW	0x0000 (0_{dec})
	8010:12	User scale gain	RW	0x00010000 (65536_{dec})
	8010:13	Default output	RW	0x0000 (0_{dec})
	8010:14	Default output ramp	RW	0xFFFF (65535_{dec})
	8010:15	User calibration offset	RW	0x0000 (0_{dec})
	8010:16	User calibration gain	RW	0x4000 (16384_{dec})
801E:0 [▶ 55]	**Subindex**	AO internal data Ch.2	RO	0x01 (1_{dec})
	801E:01	DAC raw value	RO	0x0000 (0_{dec})
801F:0 [▶ 56]	**Subindex**	AO vendor data Ch.2	RW	0x06 (6_{dec})
	801F:01	R0 Calibration Offset	RW	0x0000 (0_{dec})
	801F:02	R0 Calibration Gain	RW	0x4000 (16384_{dec})
	801F:03	R1 Calibration Offset	RW	0x0000 (0_{dec})
	801F:04	R1 Calibration Gain	RW	0x4000 (16384_{dec})
	801F:05	R2 Calibration Offset	RW	0x0000 (0_{dec})
	801F:06	R2 Calibration Gain	RW	0x4000 (16384_{dec})

Index (hex)		Name	Flags	Default value
8020:0 [▶ 50]	**Subindex**	AO settings Ch.3	RW	0x16 (22_{dec})
	8020:01	Enable user scale	RW	0x00 (0_{dec})
	8020:02	Presentation	RW	0x00 (0_{dec})
	8020:05	Watchdog	RW	0x00 (0_{dec})
	8020:07	Enable user calibration	RW	0x00 (0_{dec})
	8020:08	Enable vendor calibration	RW	0x01 (1_{dec})
	8020:11	User scale offset	RW	0x0000 (0_{dec})
	8020:12	User scale gain	RW	0x00010000 (65536_{dec})
	8020:13	Default output	RW	0x0000 (0_{dec})
	8020:14	Default output ramp	RW	0xFFFF (65535_{dec})
	8020:15	User calibration offset	RW	0x0000 (0_{dec})
	8020:16	User calibration gain	RW	0x4000 (16384_{dec})
802E:0 [▶ 56]	**Subindex**	AO internal data Ch.3	RO	0x01 (1_{dec})
	802E:01	DAC raw value	RO	0x0000 (0_{dec})
802F:0 [▶ 56]	**Subindex**	AO vendor data Ch.3	RW	0x06 (6_{dec})
	802F:01	R0 Calibration Offset	RW	0x0000 (0_{dec})
	802F:02	R0 Calibration Gain	RW	0x4000 (16384_{dec})
	802F:03	R1 Calibration Offset	RW	0x0000 (0_{dec})
	802F:04	R1 Calibration Gain	RW	0x4000 (16384_{dec})
	802F:05	R2 Calibration Offset	RW	0x0000 (0_{dec})
	802F:06	R2 Calibration Gain	RW	0x4000 (16384_{dec})
8030:0 [▶ 51]	**Subindex**	AO settings Ch.4	RW	0x16 (22_{dec})
	8030:01	Enable user scale	RW	0x00 (0_{dec})
	8030:02	Presentation	RW	0x00 (0_{dec})
	8030:05	Watchdog	RW	0x00 (0_{dec})
	8030:07	Enable user calibration	RW	0x00 (0_{dec})
	8030:08	Enable vendor calibration	RW	0x01 (1_{dec})
	8030:11	User scale offset	RW	0x0000 (0_{dec})
	8030:12	User scale gain	RW	0x00010000 (65536_{dec})
	8030:13	Default output	RW	0x0000 (0_{dec})
	8030:14	Default output ramp	RW	0xFFFF (65535_{dec})
	8030:15	User calibration offset	RW	0x0000 (0_{dec})
	8030:16	User calibration gain	RW	0x4000 (16384_{dec})
803E:0 [▶ 56]	**Subindex**	AO internal data Ch.4	RO	0x01 (1_{dec})
	803E:01	DAC raw value	RO	0x0000 (0_{dec})
803F:0 [▶ 56]	**Subindex**	AO vendor data Ch.4	RW	0x06 (6_{dec})
	803F:01	R0 Calibration Offset	RW	0x0000 (0_{dec})
	803F:02	R0 Calibration Gain	RW	0x4000 (16384_{dec})
	803F:03	R1 Calibration Offset	RW	0x0000 (0_{dec})
	803F:04	R1 Calibration Gain	RW	0x4000 (16384_{dec})
	803F:05	R2 Calibration Offset	RW	0x0000 (0_{dec})
	803F:06	R2 Calibration Gain	RW	0x4000 (16384_{dec})
F000:0 [▶ 56]	**Subindex**	Modular device profile	RO	0x02 (2_{dec})
	F000:01	Module index distance	RO	0x0010 (16_{dec})
	F000:02	Maximum number of modules	RO	0x0004 (4_{dec})
F008 [▶ 57]		Code word	RW	0x00000000 (0_{dec})
F010:0 [▶ 57]	**Subindex**	Module list	RW	0x04 (4_{dec})
	F010:01	SubIndex 001	RW	0x00000190 (400_{dec})
	F010:02	SubIndex 002	RW	0x00000190 (400_{dec})
	F010:03	SubIndex 003	RW	0x00000190 (400_{dec})
	F010:04	SubIndex 004	RW	0x00000190 (400_{dec})
F800:0 [▶ 51]	**Subindex**	AO Range Settings	RW	0x04 (4_{dec})
	F800:01	Output type Ch1	RW	0x0000 (0_{dec})
	F800:02	Output type Ch2	RW	0x0000 (0_{dec})
	F800:03	Output type Ch3	RW	0x0000 (0_{dec})
	F800:04	Output type Ch4	RW	0x0000 (0_{dec})

Legend

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

4.4 Object description and parameterization

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.

Parameterization via the CoE list (CAN over EtherCAT)

The EtherCAT device is parameterized via the CoE - Online tab [▶ 40] (double-click on the respective object) or via the Process Data [▶ 37] tab (allocation of PDOs).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 47] during commissioning
- Objects intended for regular operation [▶ 52], e. g. through ADS access.
- Objects for indicating internal settings [▶ 52] (may be fixed)
- Further profile-specific objects [▶ 55] 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.

4.4.1 Objects to be parameterized during commissioning

Index 1011 Restore default parameters

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

Index 8000 AO settings Ch.1

Index (hex)	Name	Meaning		Data type	Flags	Default
8000:0	AO settings Ch.1	Maximum subindex		UINT8	RO	0x16 (22_{dec})
8000:01	Enable user scale	This entry activates the scaling for 0x8pp0:11 and 0x8pp0:12.		BOOLEAN	RW	0x00 (0_{dec})
8000:02	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.	BIT3	RW	0x00 (0_{dec})
		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.			
8000:05	Watchdog	0	Default watchdog value The default value (0x8pp0:13) is active.	BIT2	RW	0x00 (0_{dec})
		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 an error (triggering of the watchdog) the last process data is output.			
8000:07	Enable user calibration	Enables user calibration		BOOLEAN	RW	0x00 (0_{dec})
8000:08	Enable vendor calibration	Enable vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8000:11	User scale offset	User scaling: Offset		INT16	RW	0x0000 (0_{dec})
8000:12	User scale gain	User scaling: Gain. The gain is represented in fixed-point format, with the factor 2^{-16}. The value one corresponds to 65535 (0x00010000).		INT32	RW	0x00010000 (65536_{dec})
8000:13	Default output	Default output value		INT16	RW	0x0000 (0_{dec})
8000:14	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_{dec})
8000:15	User calibration offset	User calibration: Offset		INT16	RW	0x0000 (0_{dec})
8000:16	User calibration gain	User calibration: Gain		UINT16	RW	0x4000 (16384_{dec})

Index 8010 AO settings Ch.2

Index (hex)	Name	Meaning		Data type	Flags	Default
8010:0	AO settings Ch.2	Maximum subindex		UINT8	RO	0x16 (22_{dec})
8010:01	Enable user scale	This entry activates the scaling for 0x8pp0:11 and 0x8pp0:12.		BOOLEAN	RW	0x00 (0_{dec})
8010:02	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.	BIT3	RW	0x00 (0_{dec})
		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.			
8010:05	Watchdog	0	Default watchdog value The default value (0x8pp0:13) is active.	BIT2	RW	0x00 (0_{dec})
		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 an error (triggering of the watchdog) the last process data is output.			
8010:07	Enable user calibration	Enables user calibration		BOOLEAN	RW	0x00 (0_{dec})
8010:08	Enable vendor calibration	Enable vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8010:11	User scale offset	User scaling: Offset		INT16	RW	0x0000 (0_{dec})
8010:12	User scale gain	User scaling: Gain. The gain is represented in fixed-point format, with the factor 2^{-16}. The value one corresponds to 65535 (0x00010000).		INT32	RW	0x00010000 (65536_{dec})
8010:13	Default output	Default output value		INT16	RW	0x0000 (0_{dec})
8010:14	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_{dec})
8010:15	User calibration offset	User calibration: Offset		INT16	RW	0x0000 (0_{dec})
8010:16	User calibration gain	User calibration: Gain		UINT16	RW	0x4000 (16384_{dec})

Index 8020 AO settings Ch.3

Index (hex)	Name	Meaning		Data type	Flags	Default
8020:0	AO settings Ch.3	Maximum subindex		UINT8	RO	0x16 (22_{dec})
8020:01	Enable user scale	This entry activates the scaling for 0x8pp0:11 and 0x8pp0:12.		BOOLEAN	RW	0x00 (0_{dec})
8020:02	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.	BIT3	RW	0x00 (0_{dec})
		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.			
8020:05	Watchdog	0	Default watchdog value The default value (0x8pp0:13) is active.	BIT2	RW	0x00 (0_{dec})
		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 an error (triggering of the watchdog) the last process data is output.			
8020:07	Enable user calibration	Enables user calibration		BOOLEAN	RW	0x00 (0_{dec})
8020:08	Enable vendor calibration	Enable vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8020:11	User scale offset	User scaling: Offset		INT16	RW	0x0000 (0_{dec})
8020:12	User scale gain	User scaling: Gain. The gain is represented in fixed-point format, with the factor 2^{-16}. The value one corresponds to 65535 (0x00010000).		INT32	RW	0x00010000 (65536_{dec})
8020:13	Default output	Default output value		INT16	RW	0x0000 (0_{dec})
8020:14	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_{dec})
8020:15	User calibration offset	User calibration: Offset		INT16	RW	0x0000 (0_{dec})
8020:16	User calibration gain	User calibration: Gain		UINT16	RW	0x4000 (16384_{dec})

Index 8030 AO settings Ch.4

Index (hex)	Name	Meaning		Data type	Flags	Default
8030:0	AO settings Ch.4	Maximum subindex		UINT8	RO	0x16 (22_{dec})
8030:01	Enable user scale	This entry activates the scaling for 0x8pp0:11 and 0x8pp0:12.		BOOLEAN	RW	0x00 (0_{dec})
8030:02	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.	BIT3	RW	0x00 (0_{dec})
		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.			
8030:05	Watchdog	0	Default watchdog value The default value (0x8pp0:13) is active.	BIT2	RW	0x00 (0_{dec})
		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 an error (triggering of the watchdog) the last process data is output.			
8030:07	Enable user calibration	Enables user calibration		BOOLEAN	RW	0x00 (0_{dec})
8030:08	Enable vendor calibration	Enable vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8030:11	User scale offset	User scaling: Offset		INT16	RW	0x0000 (0_{dec})
8030:12	User scale gain	User scaling: Gain. The gain is represented in fixed-point format, with the factor 2^{-16}. The value one corresponds to 65535 (0x00010000).		INT32	RW	0x00010000 (65536_{dec})
8030:13	Default output	Default output value		INT16	RW	0x0000 (0_{dec})
8030:14	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_{dec})
8030:15	User calibration offset	User calibration: Offset		INT16	RW	0x0000 (0_{dec})
8030:16	User calibration gain	User calibration: Gain		UINT16	RW	0x4000 (16384_{dec})

Index F800 AO Range Settings

Index (hex)	Name	Meaning		Data type	Flags	Default
F800:0	AO Range Settings	Maximum subindex		UINT8	RO	0x04 (4_{dec})
F800:01	Output type Ch1	Output signal range for channel 1		UINT16	RW	0x0000 (0_{dec})
		0	-10…+10 V			
		1	0...20 mA			
		2	4...20 mA			
		6	0...10 V			
F800:02	Output type Ch2	Output signal range for channel 2 (values see channel 1)		UINT16	RW	0x0000 (0_{dec})
F800:03	Output type Ch3	Output signal range for channel 3 (values see channel 1)		UINT16	RW	0x0000 (0_{dec})
F800:04	Output type Ch4	Output signal range for channel 4 (values see channel 1)		UINT16	RW	0x0000 (0_{dec})

4.4.2 Objects for regular operation

The EP4174 has no such objects.

4.4.3 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 Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	0x01901389 (26219401_{dec})

Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EP4174-0002

Index 1009 Hardware version

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

Index 100A Software version

Index (hex)	Name	Meaning	Data type	Flags	Default
100A:0	Software version	Firmware version of the EtherCAT slave	STRING	RO	01

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default
1018:0	Identity	Information for identifying the slave	UINT8	RO	0x04 (4_{dec})
1018:01	Vendor ID	Vendor ID of the EtherCAT slave	UINT32	RO	0x00000002 (2_{dec})
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	0x104E4052 (273563730_{dec})
1018:03	Revision	Revision number of the EtherCAT slave; the low word (bit 0-15) indicates the special terminal number, the high word (bit 16-31) refers to the device description	UINT32	RO	0x00100002 (1048578_{dec})
1018:04	Serial number	Serial number of the EtherCAT slave; the low byte (bit 0-7) of the low word contains the year of production, the high byte (bit 8-15) of the low word contains the week of production, the high word (bit 16-31) is 0	UINT32	RO	0x00000000 (0_{dec})

Index 10F0 Backup parameter handling

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

Index 1600 AO RxPDO-Map Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1600:0	AO RxPDO-Map Ch.1	PDO Mapping RxPDO 1	UINT8	RO	0x01 (1_{dec})
1600:01	SubIndex 001	1. PDO Mapping entry (object 0x7000 (AO outputs Ch.1), entry 0x11 (Analog output))	UINT32	RO	0x7000:11, 16

Index 1601 AO RxPDO-Map Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1601:0	AO RxPDO-Map Ch.2	PDO Mapping RxPDO 2	UINT8	RO	0x01 (1_{dec})
1601:01	SubIndex 001	1. PDO Mapping entry (object 0x7010 (AO outputs Ch.2), entry 0x11 (Analog output))	UINT32	RO	0x7010:11, 16

Index 1602 AO RxPDO-Map Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
1602:0	AO RxPDO-Map Ch.3	PDO Mapping RxPDO 3	UINT8	RO	0x01 (1_{dec})
1602:01	SubIndex 001	1. PDO Mapping entry (object 0x7020 (AO outputs Ch.3), entry 0x11 (Analog output))	UINT32	RO	0x7020:11, 16

Index 1603 AO RxPDO-Map Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
1603:0	AO RxPDO-Map Ch.4	PDO Mapping RxPDO 4	UINT8	RO	0x01 (1_{dec})
1603:01	SubIndex 001	1. PDO Mapping entry (object 0x7030 (AO outputs Ch.4), entry 0x11 (Analog output))	UINT32	RO	0x7030:11, 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_{dec})
1C00:01	SubIndex 001	Sync-Manager Type Channel 1: Mailbox Write	UINT8	RO	0x01 (1_{dec})
1C00:02	SubIndex 002	Sync-Manager Type Channel 2: Mailbox Read	UINT8	RO	0x02 (2_{dec})
1C00:03	SubIndex 003	Sync-Manager Type Channel 3: Process Data Write (Outputs)	UINT8	RO	0x03 (3_{dec})
1C00:04	SubIndex 004	Sync-Manager Type Channel 4: Process Data Read (Inputs)	UINT8	RO	0x04 (4_{dec})

Index 1C12 RxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x04 (4_{dec})
1C12:01	Subindex 001	1. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1600 (5632_{dec})
1C12:02	Subindex 002	2. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1601 (5633_{dec})
1C12:03	Subindex 003	3. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1602 (5634_{dec})
1C12:04	Subindex 004	4. allocated RxPDO (contains the index of the associated RxPDO mapping object)	UINT16	RW	0x1603 (5635_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x00 (0_{dec})

Index 1C32 SM output parameter

Index (hex)	Name	Meaning			Data type	Flags	Default
1C32:0	SM output parameter	Synchronization parameters for the outputs			UINT8	RO	0x20 (32_{dec})
1C32:01	Sync mode	**Value**	Current synchronization mode		UINT16	RW	0x0001 (1_{dec})
		0	Free Run				
		1	Synchron with SM 2 Event				
		2	DC-Mode - Synchron with SYNC0 Event				
		3	DC-Mode - Synchron with SYNC1 Event				
1C32:02	Cycle time	Cycle time (in ns):			UINT32	RW	0x000F4240 (1000000_{dec})
		Free Run		Cycle time of the local timer			
		Synchron with SM 2 Event		Master cycle time			
		DC-Mode		SYNC0/SYNC1 Cycle Time			
1C32:03	Shift time	Time between SYNC0 event and output of the outputs (in ns, DC mode only)			UINT32	RO	0x00003A98 (15000_{dec})
1C32:04	Sync modes supported	**Bit**	**Value**	Supported synchronization modes:	UINT16	RO	0xC007 (49159_{dec})
		0	1	free run is supported			
		1	1	Synchronous with SM 2 event is supported			
		3.2	01	DC mode is supported			
		5.4	10	Output shift with SYNC1 event (only DC mode)			
		14	1	dynamic times (measurement through writing of 0x1C32:08 [▶ 54])			
1C32:05	Minimum cycle time	Minimum cycle time (in ns)			UINT32	RO	0x000493E0 (300000_{dec})
1C32:06	Calc and copy time	Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)			UINT32	RO	0x00000000 (0_{dec})
1C32:07	Minimum delay time				UINT32	RO	0x00003A98 (15000_{dec})
1C32:08	Command	0	Measurement of the local cycle time is stopped		UINT16	RW	0x0000 (0_{dec})
		1	Measurement of the local cycle time is started				
		The entries 0x1C32:03 [▶ 54], 0x1C32:05 [▶ 54], 0x1C32:06 [▶ 54], 0x1C32:09 [▶ 54], 0x1C33:03, 0x1C33:06 [▶ 54], 0x1C33:09					
1C32:09	Maximum Delay time	Time between SYNC1 event and output of the outputs (in ns, DC mode only)			UINT32	RO	0x00003A98 (15000_{dec})
1C32:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)			UINT16	RO	0x0000 (0_{dec})
1C32:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)			UINT16	RO	0x0000 (0_{dec})
1C32:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)			UINT16	RO	0x0000 (0_{dec})
1C32:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)			BOOLEAN	RO	0x00 (0_{dec})

4.4.4 Profile-specific objects (0x6000-0xFFFF)

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

Index 7000 AO outputs Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
7000:0	AO outputs Ch.1		UINT8	RO	0x11 (17_{dec})
7000:11	Analog output	Analog output data	INT16	RO	0x0000 (0_{dec})

Index 7010 AO outputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
7010:0	AO outputs Ch.2		UINT8	RO	0x11 (17_{dec})
7010:11	Analog output	Analog output data	INT16	RO	0x0000 (0_{dec})

Index 7020 AO outputs Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
7020:0	AO outputs Ch.3		UINT8	RO	0x11 (17_{dec})
7020:11	Analog output	Analog output data	INT16	RO	0x0000 (0_{dec})

Index 7030 AO outputs Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
7030:0	AO outputs Ch.4		UINT8	RO	0x11 (17_{dec})
7030:11	Analog output	Analog output data	INT16	RO	0x0000 (0_{dec})

Index 800E AO internal data Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
800E:0	AO internal data Ch.1		UINT8	RO	0x01 (1_{dec})
800E:01	DAC raw value	Raw value of the D/A converter	UINT16	RO	0x0000 (0_{dec})

Index 800F AO vendor data Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
800F:0	AO vendor data Ch.1		UINT8	RO	0x06 (6_{dec})
800F:01	R0 Calibration Offset	Vendor calibration: Offset for +/-10 V	INT16	RW	0x0000 (0_{dec})
800F:02	R0 Calibration Gain	Vendor calibration: Gain for +/-10 V	UINT16	RW	0x4000 (16384_{dec})
800F:03	R1 Calibration Offset	Vendor calibration: Offset for 0-20 mA	INT16	RW	0x0000 (0_{dec})
800F:04	R1 Calibration Gain	Vendor calibration: Gain for 0-20 mA	UINT16	RW	0x4000 (16384_{dec})
800F:05	R2 Calibration Offset	Vendor calibration: Offset for 4-20 mA	INT16	RW	0x0000 (0_{dec})
800F:06	R2 Calibration Gain	Vendor calibration: Gain for 4-20 mA	UINT16	RW	0x4000 (16384_{dec})

Index 801E AO internal data Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
801E:0	AO internal data Ch.2		UINT8	RO	0x01 (1_{dec})
801E:01	DAC raw value	Raw value of the D/A converter	UINT16	RO	0x0000 (0_{dec})

Index 801F AO vendor data Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
801F:0	AO vendor data Ch.2		UINT8	RO	0x06 (6_{dec})
801F:01	R0 Calibration Offset	Vendor calibration: Offset for +/-10 V	INT16	RW	0x0000 (0_{dec})
801F:02	R0 Calibration Gain	Vendor calibration: Gain for +/-10 V	UINT16	RW	0x4000 (16384_{dec})
801F:03	R1 Calibration Offset	Vendor calibration: Offset for 0-20 mA	INT16	RW	0x0000 (0_{dec})
801F:04	R1 Calibration Gain	Vendor calibration: Gain for 0-20 mA	UINT16	RW	0x4000 (16384_{dec})
801F:05	R2 Calibration Offset	Vendor calibration: Offset for 4-20 mA	INT16	RW	0x0000 (0_{dec})
801F:06	R2 Calibration Gain	Vendor calibration: Gain for 4-20 mA	UINT16	RW	0x4000 (16384_{dec})

Index 802E AO internal data Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
802E:0	AO internal data Ch.3		UINT8	RO	0x01 (1_{dec})
802E:01	DAC raw value	Raw value of the D/A converter	UINT16	RO	0x0000 (0_{dec})

Index 802F AO vendor data Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
802F:0	AO vendor data Ch.3		UINT8	RO	0x06 (6_{dec})
802F:01	R0 Calibration Offset	Vendor calibration: Offset for +/-10 V	INT16	RW	0x0000 (0_{dec})
802F:02	R0 Calibration Gain	Vendor calibration: Gain for +/-10 V	UINT16	RW	0x4000 (16384_{dec})
802F:03	R1 Calibration Offset	Vendor calibration: Offset for 0-20 mA	INT16	RW	0x0000 (0_{dec})
802F:04	R1 Calibration Gain	Vendor calibration: Gain for 0-20 mA	UINT16	RW	0x4000 (16384_{dec})
802F:05	R2 Calibration Offset	Vendor calibration: Offset for 4-20 mA	INT16	RW	0x0000 (0_{dec})
802F:06	R2 Calibration Gain	Vendor calibration: Gain for 4-20 mA	UINT16	RW	0x4000 (16384_{dec})

Index 803E AO internal data Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
803E:0	AO internal data Ch.4		UINT8	RO	0x01 (1_{dec})
803E:01	DAC raw value	Raw value of the D/A converter	UINT16	RO	0x0000 (0_{dec})

Index 803F AO vendor data Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
803F:0	AO vendor data Ch.4		UINT8	RO	0x06 (6_{dec})
803F:01	R0 Calibration Offset	Vendor calibration: Offset for +/-10 V	INT16	RW	0x0000 (0_{dec})
803F:02	R0 Calibration Gain	Vendor calibration: Gain for +/-10 V	UINT16	RW	0x4000 (16384_{dec})
803F:03	R1 Calibration Offset	Vendor calibration: Offset for 0-20 mA	INT16	RW	0x0000 (0_{dec})
803F:04	R1 Calibration Gain	Vendor calibration: Gain for 0-20 mA	UINT16	RW	0x4000 (16384_{dec})
803F:05	R2 Calibration Offset	Vendor calibration: Offset for 4-20 mA	INT16	RW	0x0000 (0_{dec})
803F:06	R2 Calibration Gain	Vendor calibration: Gain for 4-20 mA	UINT16	RW	0x4000 (16384_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0004 (4_{dec})

Index F008 Code word

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

Index F010 Module list

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module list		UINT8	RW	0x04 (4_{dec})
F010:01	SubIndex 001		UINT32	RW	0x00000190 (400_{dec})
F010:02	SubIndex 002		UINT32	RW	0x00000190 (400_{dec})
F010:03	SubIndex 003		UINT32	RW	0x00000190 (400_{dec})
F010:04	SubIndex 004		UINT32	RW	0x00000190 (400_{dec})

4.5 Restoring the delivery state

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

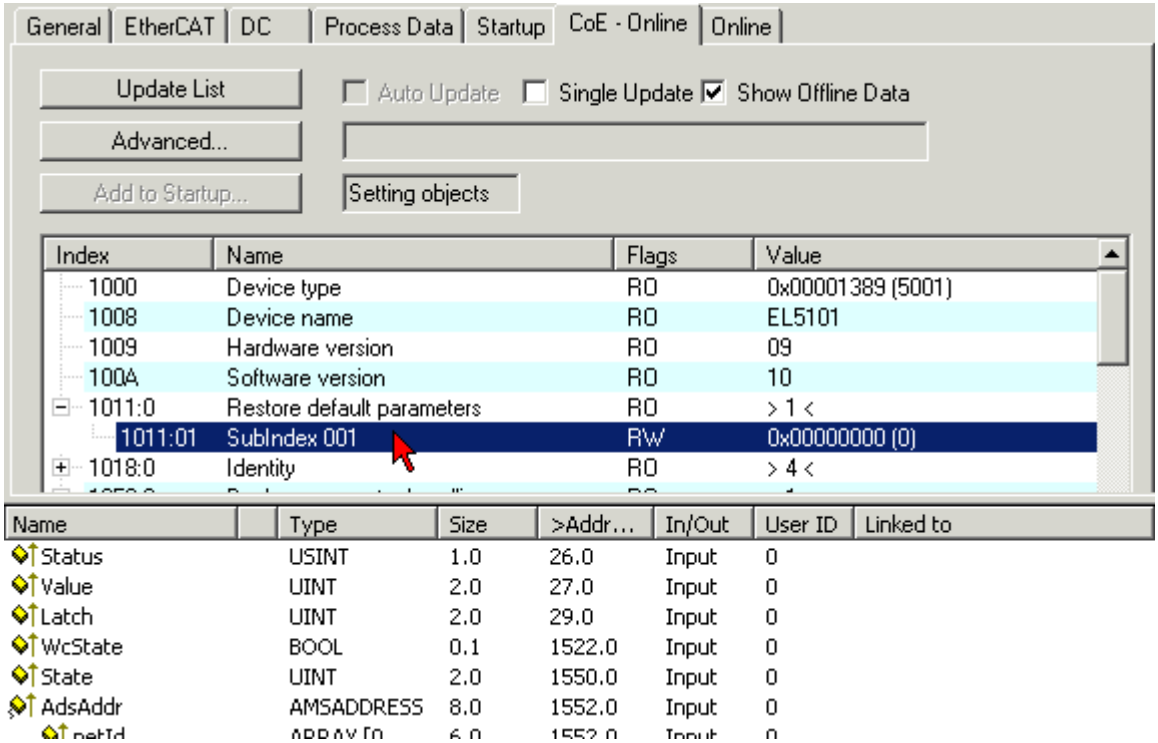

Fig. 44: Selecting the Restore default parameters PDO

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

All backup objects are reset to the delivery state.

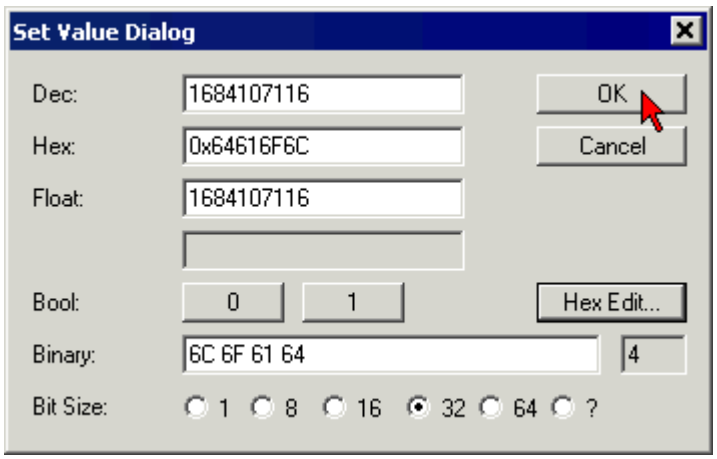

Fig. 45: Entering a restore value in the Set Value dialog

Alternative restore value

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

An incorrect entry for the restore value has no effect.

5 Appendix

5.1 General operating conditions

Protection degrees (IP-Code)

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

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

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

*) These protection classes define only protection against water!

Chemical Resistance

The Resistance relates to the Housing of the Fieldbus/EtherCAT Box and the used metal parts. In the table below you will find some typical resistance.

Character	Resistance
Steam	at temperatures >100°C: not resistant
Sodium base liquor (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

5.2 EtherCAT Box- / EtherCAT P Box - Accessories

Fixing

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

Marking material, plugs

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

Tools

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

Further accessories

Further accessories may be found at the price list for Beckhoff fieldbus components and at the internet under https://www.beckhoff.com

5.3 Support and Service

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