BECKHOFF New Automation Technology

Documentation | EN

EPP3204-0002

4-channel analog input Pt100 (RTD)

2023-01-30 | Version: 1.4

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1 Foreword

1.1 Notes on the documentation

Intended audience

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

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

Disclaimer

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

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

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

Trademarks

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Patent Pending

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

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

Copyright

1.2 Safety instructions

Safety regulations

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

Exclusion of liability

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

Personnel qualification

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

Description of instructions

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

⚠ DANGER

Serious risk of injury!

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

⚠ WARNING

Risk of injury!

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

⚠ CAUTION

Personal injuries!

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

NOTE

Damage to environment/equipment or data loss

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

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Documentation issue status

Version	Comment
1.4	• EtherCAT P status LEDs updated
1.3	• Dimensions updated • UL requirements updated
1.2	• Terminology update • Structure update
1.1	• Front page updated • Structure update
1.0	• First release

Firmware and hardware versions

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

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

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

Syntax of the batch number (D-number)

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

Further information on this topic: Version identification of EtherCAT devices [▶ 59].

2 Product group: EtherCAT P Box modules

EtherCAT P

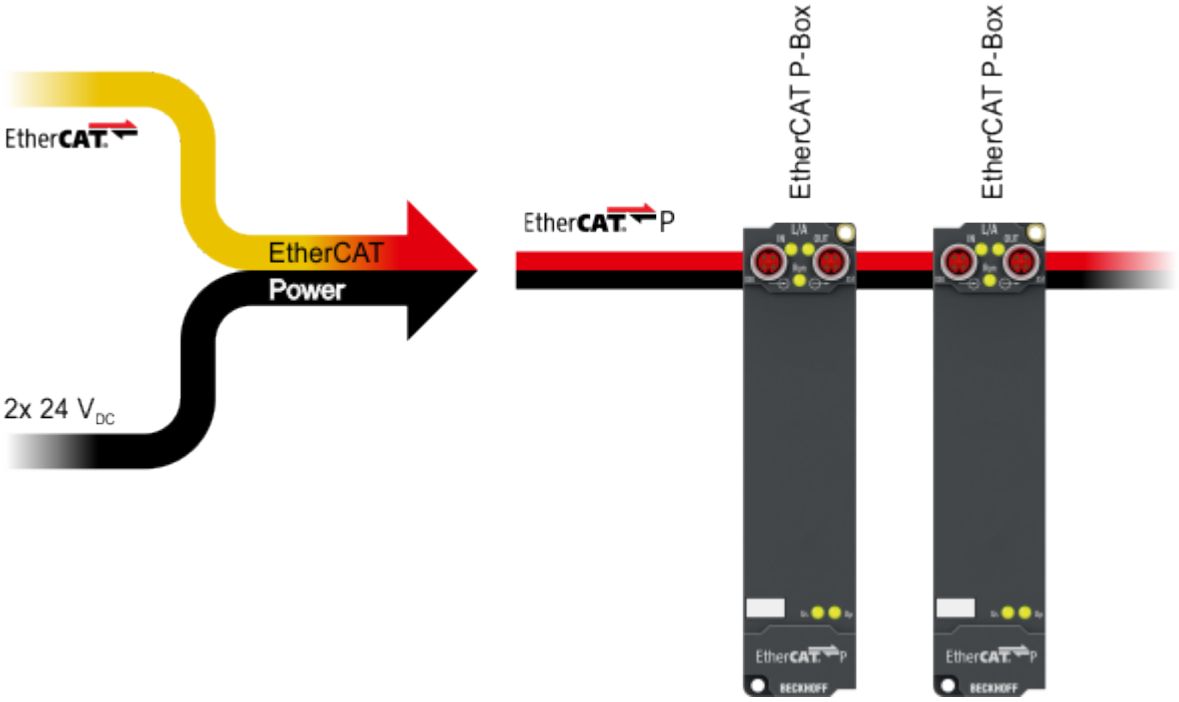
EtherCAT P supplements the EtherCAT technology with a process in which communication and supply voltages are transmitted on a common line. All EtherCAT properties are retained with this process.

Two supply voltages are transmitted per EtherCAT P line. The supply voltages are electrically isolated from each other and can therefore be switched individually. The nominal supply voltage for both is 24 V_{DC}.

EtherCAT P uses the same cable structure as EtherCAT: a 4-core Ethernet cable with M8 connectors. The connectors are mechanically coded so that EtherCAT connectors and EtherCAT P connectors cannot be interchanged.

EtherCAT P Box modules

EtherCAT P Box modules are EtherCAT P slaves with degree of protection IP67. They are designed for operation in wet, dirty or dusty industrial environments.

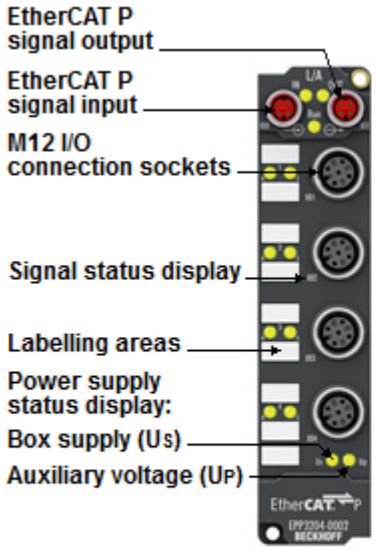


EtherCAT basics

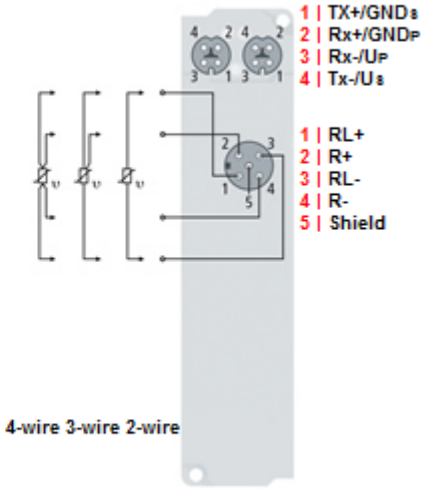
A detailed description of the EtherCAT system can be found in the EtherCAT system documentation.

3 Product overview

3.1 Introduction



EPP3204-0002



I/O connection

Connector assignment

EPP3204-0002 | 4-channel analog input Pt100 (RTD)

The EPP3204 EtherCAT P Box with analog inputs allows resistance sensors to be connected directly. The module's circuitry can operate the sensors using 2-, 3- or 4-wire connection techniques. Linearisation over the full temperature range is realised with the aid of a microprocessor. The temperature range can be selected freely. The module can also be used for simple resistance measurement with the output in ohms. The module's standard settings are: resolution 0.1°C in the temperature range of Pt100 sensors in 2-wire connection. Sensor malfunctions such as broken wires are indicated by error LEDs. The module is quite versatile, but the default values are selected in such a way that in most cases it is not necessary to perform configuration. The input filter and associated conversion times can be set within a wide range; several data output formats may be chosen. If required, the inputs can be scaled differently. Automatic limit monitoring is also available. Parameterisation is carried out via EtherCAT.

Quick links

Technical data [▶ 10]
Process image [▶ 12]
Signal connection [▶ 20]
Commissioning [▶ 24]

3.2 Technical data

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

EtherCAT P	
Connection	2 x M8 socket, 4-pin, P-coded, red

Supply voltages	
Connection	See EtherCAT P connection
U_S nominal voltage	24 V_{DC} (-15 % / +20 %)
U_S sum current: $I_{S,sum}$	max. 3 A
Current consumption from U_S	100 mA
Rated voltage U_P	24 V_{DC} (-15 % / +20 %)
U_P sum current: $I_{P,sum}$	max. 3 A
Current consumption from U_P	None. U_P is only forwarded.

RTD inputs	
Number	4
Connectors	4 x M12 socket
Sensor types	• Platinum RTD: Pt100, Pt200, Pt500, Pt1000 • Nickel RTD: Ni100, Ni120, Ni1000 • Resistance/potentiometer up to 4095 Ω
Connection technology	• 2-wire connection • 3-wire connection • 4-wire connection
Electrical isolation	The measuring channels have a common isolated ground potential.
Measuring current RL+, RL-	Max. 0.5 mA, load-dependent
Measuring range	Platinum RTD: -200…+850 °C Nickel RTD: -60…+250 °C (Ni120: -60…+320 °C) Resistance: 0…4095 Ω
Measuring error	max. ±0.5 K (Pt sensors in 4-wire connection)
Digital resolution	16 Bit
Value of an LSB	Temperature measurement: Standard: 0.1 °C High-precision: 0.01 °C Resistance measurement: Measuring range 1023 Ω: 1/64 Ω Measuring range 4095 Ω: 1/16 Ω
Filter	Digital filter. Cut-off frequency parameterizable: 5 Hz … 30 kHz..
Conversion time	2…800 ms, depending on the parameterization Default: approx. 85 ms
Diagnostics	• Open-circuit recognition • Limit value monitoring

Environmental conditions	
Ambient temperature during operation	-25 … +60 °C -25 … +55 °C according to cULus
Ambient temperature during storage	-40 … +85 °C
Vibration resistance, shock resistance	conforms to EN 60068-2-6 / EN 60068-2-27 Additional checks [▶ 11]
EMC immunity / emission	conforms to EN 61000-6-2 / EN 61000-6-4
Protection class	IP65, IP66, IP67 (conforms to EN 60529)

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

Approvals / markings	
Approvals / markings *)	CE, cULus [▶ 22]

*) Real applicable approvals/markings see type plate on the side (product marking).

Additional tests

The devices have undergone the following additional tests:

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

3.3 Scope of supply

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

- 1x EPP3204-0002
- 2x protective cap for EtherCAT P socket, M8, red (pre-assembled)
- 10x labels, blank (1 strip of 10)

Pre-assembled protective caps do not ensure IP67 protection

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

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

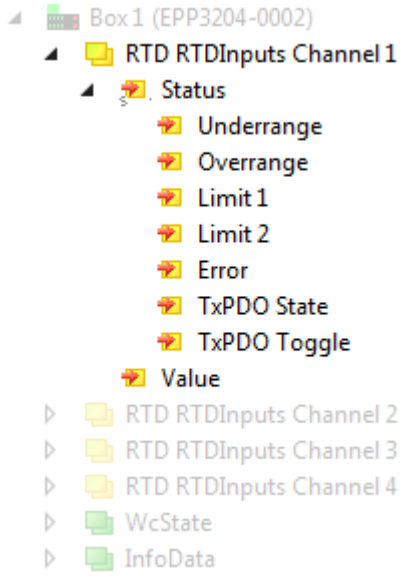
3.4 Process image

3.4.1 Assignment of connectors to the process data objects

Process image in TwinCAT	Connector	Process data object
Box 1 (EPP3204-0002) RTD RTDInputs Channel 1 RTD RTDInputs Channel 2 RTD RTDInputs Channel 3 RTD RTDInputs Channel 4 WcState InfoData	X01	RTD RTDInputs Channel 1
	X02	RTD RTDInputs Channel 2
	X03	RTD RTDInputs Channel 3
	X04	RTD RTDInputs Channel 4

3.4.2 Contents of the process data objects

The structure of the content of all process data objects is the same. The content of the process data object of channel 1 is described here by way of example.



Status

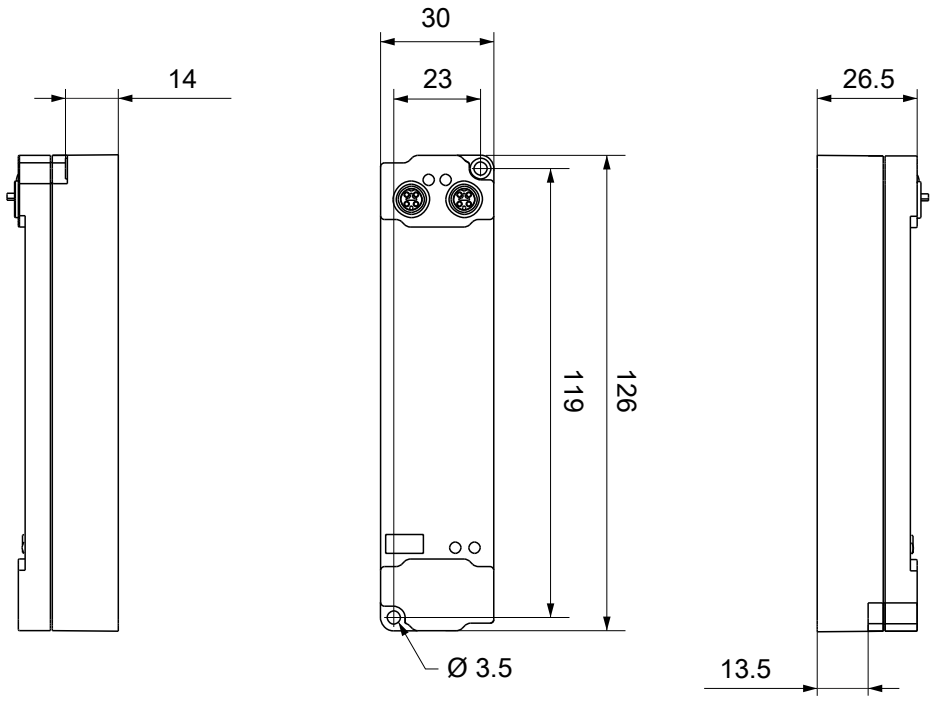
Variable	Description
Underrange	TRUE if the measured value falls below the measuring range.
Overrange	TRUE if the measured value exceeds the measuring range.
Limit 1	Limit value monitoring [▶ 34]
Limit 2	Limit value monitoring [▶ 34]
Error	TRUE if the measured value is invalid. Possible reasons: • open circuit • Measured value outside of the measuring range
TxPDO State	TRUE if an internal error occurs.
TxPDO Toggle	This bit is inverted on each update of the measured value. You can determine the present conversion time from the time between two edges of this bit.

Value

The measured value.

4 Mounting and connection

4.1 Dimensions



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

Housing features

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

4.2 Fixing

NOTE

Dirt during assembly

Dirty connectors can lead to malfunctions. Protection class IP67 can only be guaranteed if all cables and connectors are connected.

- Protect the plug connectors against dirt during the assembly.

Mount the module with two M3 screws on the mounting holes in the corners of the module. The mounting holes have no thread.

4.3 Functional earth (FE)

The upper mounting holes also serves as a connection for functional earth (FE).

Make sure that the box is grounded to low impedance via the functional earth (FE) connection. You can achieve this, for example, by mounting the box on a grounded machine bed.

Fig. 1: Connection for functional earth (FE)

4.4 EtherCAT P

⚠ WARNING

Power supply from SELV/PELV power supply unit!

SELV/PELV circuits (Safety Extra Low Voltage, Protective Extra Low Voltage) according to IEC 61010-2-201 must be used to supply the EtherCAT P Power Sourcing Device (PSD).

Notes:

- SELV/PELV circuits may give rise to further requirements from standards such as IEC 60204-1 et al, for example with regard to cable spacing and insulation.
- A SELV (Safety Extra Low Voltage) supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor,
  a PELV (Protective Extra Low Voltage) supply also requires a safe connection to the protective conductor.

⚠ CAUTION

Observe the UL requirements

- When operating under UL conditions, observe the warnings in the chapter UL Requirements [▶ 22].

EtherCAT P transmits two supply voltages:

- **Control voltage U_S**
  The following sub-functions are supplied from the control voltage U_S:
  - the fieldbus
  - the processor logic
  - typically the inputs and the sensors if the EtherCAT P Box has inputs.
- **Peripheral voltage U_P**
  The digital outputs are typically supplied from the peripheral voltage U_P for EtherCAT P Box modules with digital outputs. U_P can be supplied separately. If U_P is switched off, the fieldbus function, the function of the inputs and the supply of the sensors are maintained.

The exact assignment of U_S and U_P can be found in the pin assignment of the I/O connections.

Redirection of the supply voltages

The supply voltages are passed on internally from the "IN" connection to the "OUT" connection. Hence, the supply voltages U_S and U_P can be passed from one EtherCAT P Box to the next EtherCAT P Box in a simple manner.

NOTE

Note the maximum current.

Ensure that the maximum permitted current of 3 A for the M8 connectors is not exceeded when redirecting EtherCAT P.

4.4.1 Connectors

NOTE

Risk of damage to the device!

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

Two M8 sockets at the upper end of the modules are provided for supply and downstream connection of EtherCAT P:

- IN: left M8 socket for EtherCAT P supply
- OUT: right M8 socket for downstream connection of EtherCAT P

The metal threads of the M8 EtherCAT P sockets are internally linked to the FE connection via high impedance RC combination. See chapter Functional earth (FE) [▶ 15].

Fig. 2: Connectors for EtherCAT P

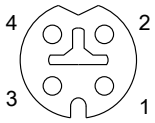


Fig. 3: M8 socket, p-coded

Contact	Signal	Voltage	Core color [1)]
1	Tx +	GND_S	yellow
2	Rx +	GND_P	white
3	Rx -	U_P: peripheral voltage, +24 V_{DC}	blue
4	Tx -	U_S: control voltage, +24 V_{DC}	orange
Housing	Shield	Shield	Shield

[1)] The core colors apply to EtherCAT P cables and ECP cables from Beckhoff.

4.4.2 Status LEDs

4.4.2.1 Supply voltages

EtherCAT P Box modules indicate the status of the supply voltages via two status LEDs. The status LEDs are labeled with the designations of the supply voltages: Us and Up.

LED	Display	Meaning
U_S (control voltage)	off	The supply voltage U_S is not available.
	green illuminated	The supply voltage U_S is available.
U_P (peripheral voltage)	off	The supply voltage U_P is not available.
	green illuminated	The supply voltage U_P is available.

4.4.2.2 EtherCAT

L/A (Link/Act)

A green LED labeled "L/A" or "Link/Act" is located next to each EtherCAT/EtherCAT P socket. The LED indicates the communication state of the respective socket:

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

Run

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

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

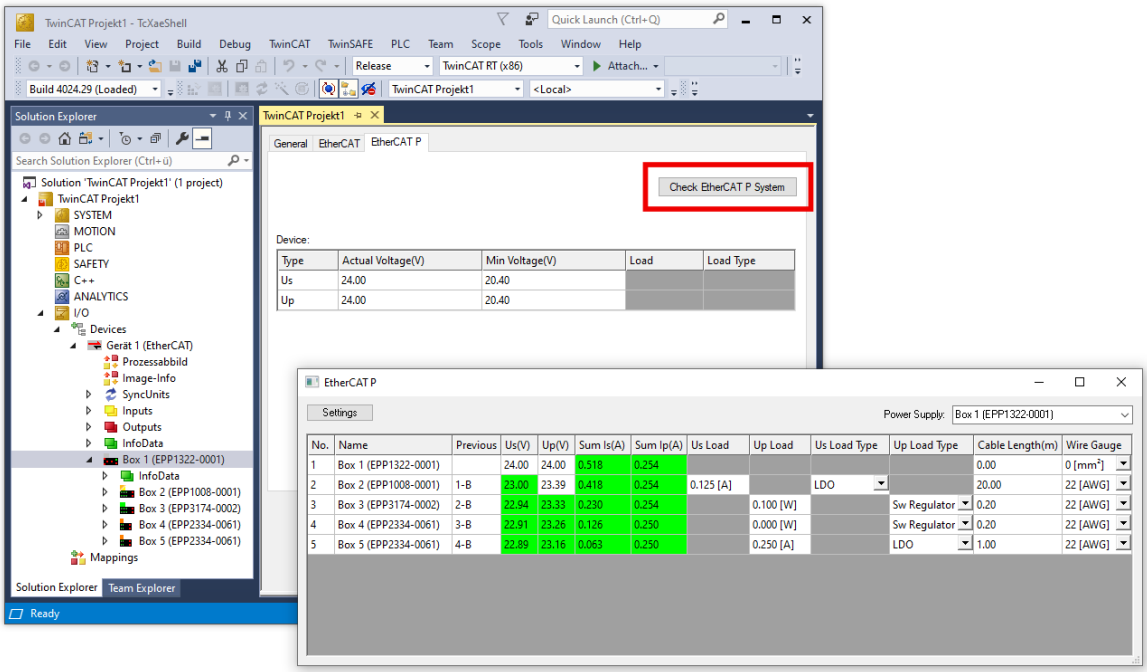
Description of the EtherCAT slave states

4.4.3 Conductor losses

Take into account the voltage drop on the supply line when planning a system. Avoid the voltage drop being so high that the supply voltage at the box lies below the minimum nominal voltage.
Variations in the voltage of the power supply unit must also be taken into account.

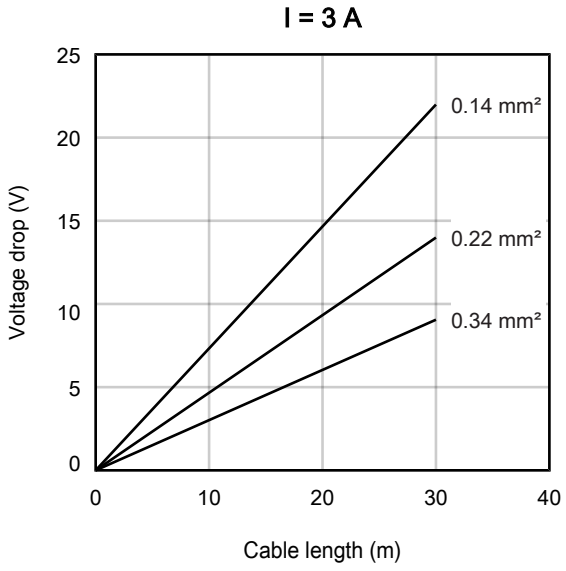
Planning tool for EtherCAT P

You can plan cable lengths, voltages and currents of your EtherCAT P system using TwinCAT 3. The requirement for this is TwinCAT 3 Build 4020 or higher.



Further information can be found in the quick start guide IO configuration in TwinCAT in chapter "Configuration of EtherCAT P via TwinCAT".

Voltage drop on the supply line



4.5 RTD inputs

4.5.1 Connector

M12 sockets

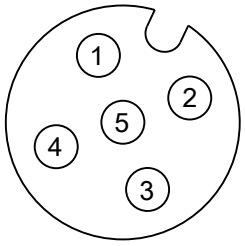


Fig. 4: M12 socket

Contact	Core color [1]	4-wire		3-wire		2-wire	
1	brown	RL+	Measuring current +	RL+	Measuring current +	RL+ R+	Measuring current + Measurement input +
2	white	R+	Measurement input +	R+	Measurement input +	-	-
3	blue	RL-	Measuring current -	RL- R-	Measuring current – Measurement input -	RL- R-	Measuring current - Measurement input -
4	black	R-	Measurement input -	-	-	-	-
5	-	Shield		Shield		Shield	

[1] The core colors apply to shielded M12 sensor cables from Beckhoff: ZK2000-7xxx

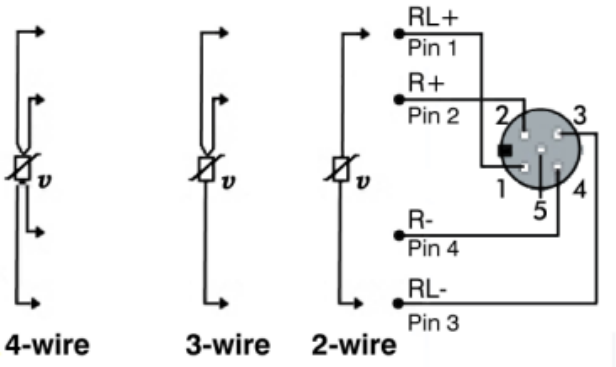


Fig. 5: Connection technology

4.5.2 Cabling

- Connect each sensor with a shielded, sheathed cable in which the cable shield is connected to contact 5 of the M12 plug. e.g. Beckhoff ZK2000-7xxx.
- Two-conductor measurement: use cables with the lowest possible resistance.
- Three-conductor measurement: Make sure that the resistances of the conductors for RL+ and RL- are as equal as possible.

4.5.3 Status LEDs

There is a green *Run* LED and a red *Error* LED for each channel.
Correct function is indicated if the green *Run* LED is on and the red *Error* is off.

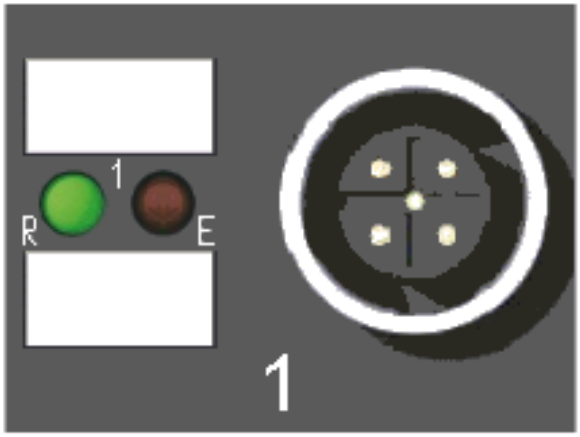


Fig. 6: Status LEDs at the signal connections

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

4.6 UL Requirements

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

Supply voltage

⚠ CAUTION

CAUTION!

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

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

⚠ CAUTION

CAUTION!

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

Networks

⚠ CAUTION

CAUTION!

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

Ambient temperature range

⚠ CAUTION

CAUTION!

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

Marking for UL

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

Fig. 7: UL label

4.7 Disposal

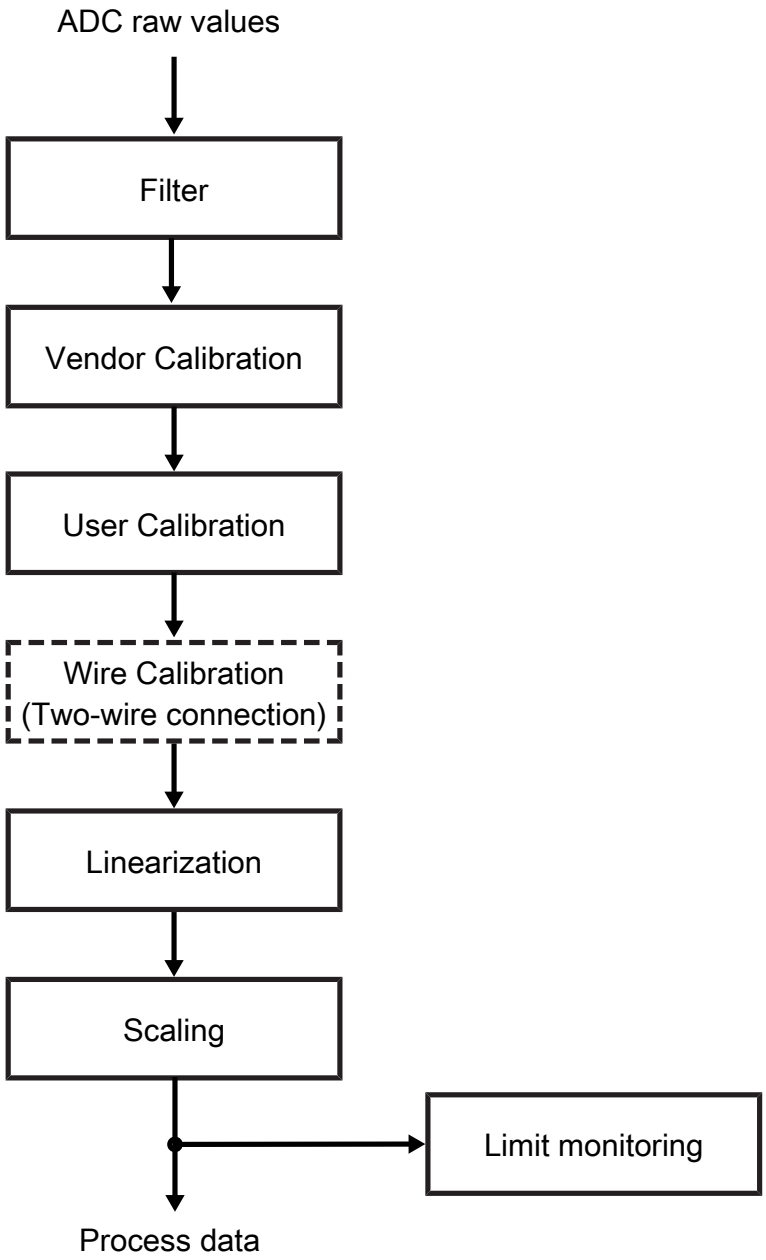
Products marked with a crossed-out wheeled bin shall not be discarded with the normal waste stream. The device is considered as waste electrical and electronic equipment. The national regulations for the disposal of waste electrical and electronic equipment must be observed.

5 Commissioning/Configuration

5.1 Integrating into a TwinCAT project

The procedure for integration in a TwinCAT project is described in these Quick start guide.

5.2 Measured value processing



5.2.1 Vendor calibration

5.2.1.1 2 and 4-wire resistance measurement

Whether a measurement is executed as a 2 or 4-wire measurement is determined by the connection points at which the measurement takes place. A comparison value is stored in the firmware for both measuring methods.

- **With the 2-wire measurement**
  - a current is applied between the contact points RL+ und RL- and the voltage drop is measured in order to determine the resistance.
  - The parasitic line resistance cannot be determined by the box itself, but must be entered as a correction value in the CoE register 0x80n0:1B.
- **With the 4-wire measurement**
  - the sensor current is applied between the contact points RL+ und RL- of the M12 socket and the voltage drop at the contact points R+ and R- is used to measure the resistance.
  - The conducting wire is thus not part of the measuring circuit and is not incorporated into the measurement as a source of error.

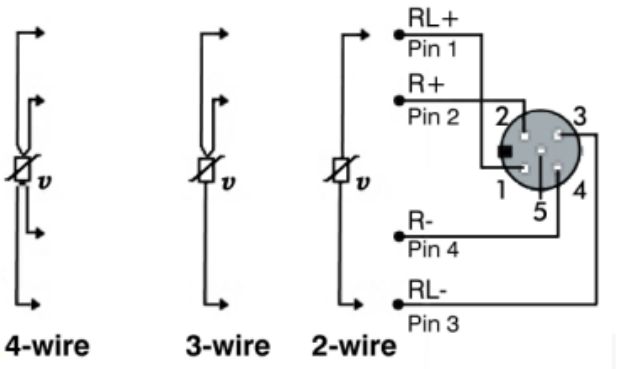


Fig. 8: Resistance measurement with a 4-wire, 3-wire and 2-wire connection technique

The box uses the following calculation rule:

$$Y_R = \frac{(X+O_V)}{2^2} \cdot \frac{G_V}{2^{14}}$$

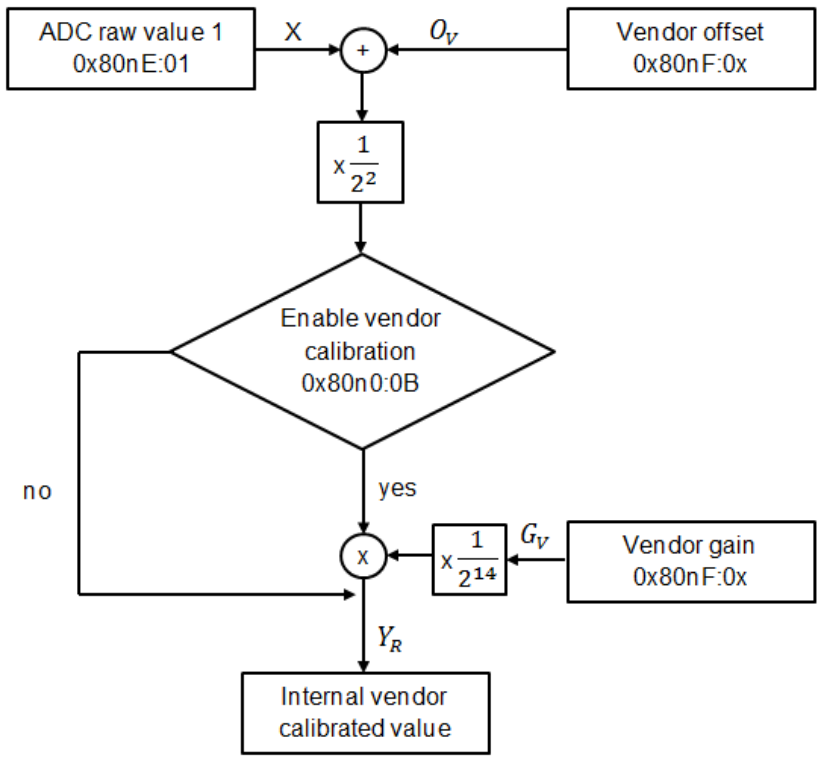


Fig. 9: Data flow: resistance measurement with a 2 and 4-wire connection technique

With the values:

	Index in the CoE directory with n: channel number with 0 ≤ n ≤ 3 (channel 1 - 4)			
X: Raw value	0x80nE:01			
	Pt100		Pt1000	
	2-wire	4-wire	2-wire	4-wire
Gv: Vendor Gain	0x80nF:04	0x80nF:06	0x80nF:0A	0x80nF:0C
Ov: Vendor Offset	0x80nF:03	0x80nF:05	0x80nF:09	0x80nF:0B
Y_R: Output value in 1/256 Ω	0x80nE:02			

Overflow Y_R after 16 bits

This value is only for fault finding. The register overflows after 16 bits, i.e. at 65536.

5.2.1.2 3-wire resistance measurement

- **With the 3-wire measurement**
  - a defined current is initially applied between the contact points RL+ und RL- and the resistance between them is determined on the basis of the voltage drop.
  - The same procedure is subsequently carried out at the contact points R+ und RL-.
  - The difference between the two measurements is the line resistance of one of the cores of the sensor cable. By knowing the line resistance the resulting measuring error can be compensated.
  - The cores of the sensor cable must have the same resistance in order for the method to work.

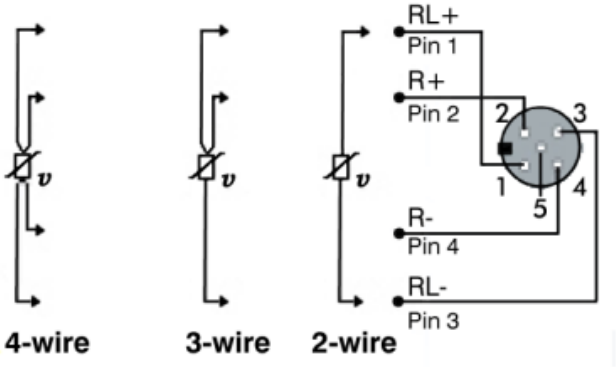


Fig. 10: Resistance measurement with a 4-wire, 3-wire and 2-wire connection technique

The box uses the following calculation rule

$$Y_{R1} = \frac{(X_1+O_{V1})}{2^2} \cdot \frac{G_{V1}}{2^{14}}, Y_{R2} = \frac{(X_2+O_{V2})}{2^2} \cdot \frac{G_{V2}}{2^{14}}$$

$$Y_R = Y_{R2} - (Y_{R1} - Y_{R2}) = 2Y_{R2} - Y_{R1}$$

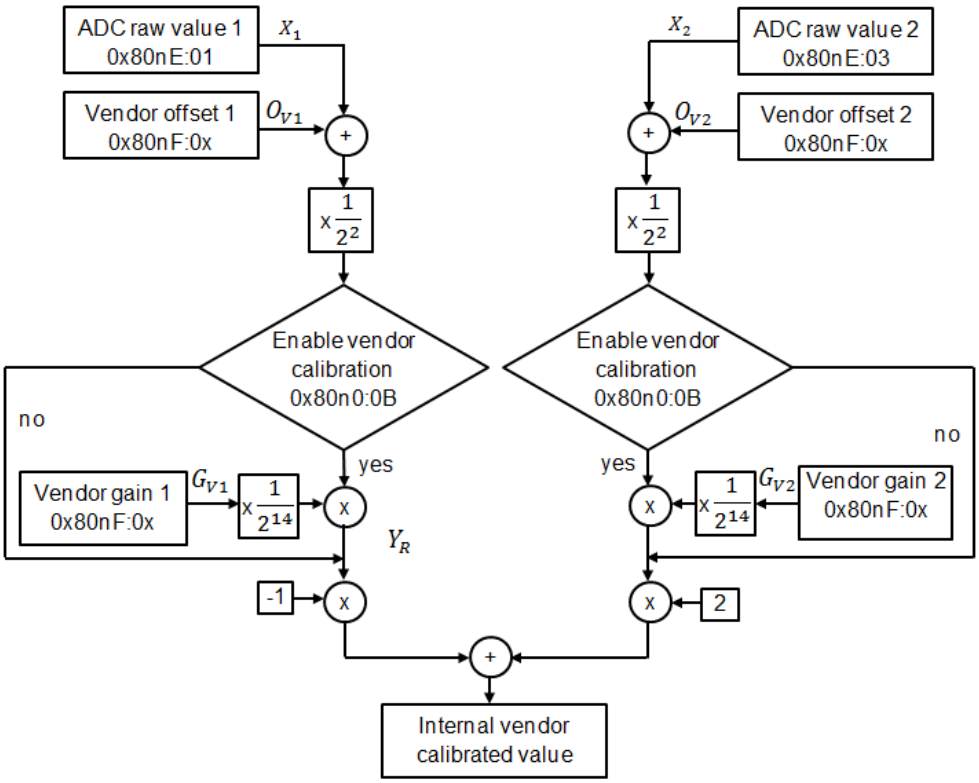


Fig. 11: Data flow: resistance measurement with a 3-wire connection technique

With the values:

	Index in the CoE directory with n: channel number with 0 ≤ n ≤ 3 (channel 1 - 4)	
X_1: raw value of the 1st measurement	0x80nE:01	
X_2: raw value of the 2nd measurement	0x80nE:03	
	Pt100	Pt1000
Gv_1: Vendor gain, 1st measurement	0x80nF:04	0x80nF:0A
Ov_1: Vendor offset, 1st measurement	0x80nF:03	0x80nF:09
Gv_2: Vendor gain, 2nd measurement	0x80nF:02	0x80nF:08
Ov_2: Vendor offset, 2nd measurement	0x80nF:01	0x80nF:07
Y_{R1}: Output value in 1/256 Ω	0x80nE:02	
Y_{R2}: Output value in 1/256 Ω	0x80nE:04	
Y_R: Output value in 1/256 Ω		

Overflow Y_{R1} and Y_{R2} after 16 bits

These values are only for fault finding. The registers overflow after 16 bits, i.e. at 65536.

5.2.2 User calibration and linearization

- The calibrated measured value may also be modified by the user calibration values.
- The result of the resistance measurement is mapped onto a temperature value. The fundamental linearization function cannot be modified by the user.
- The user scaling is only included after the linearization.

The box uses the following calculation rule

$$Y_{int} = X_V \cdot \frac{G_U}{2^{14}} + O_U$$

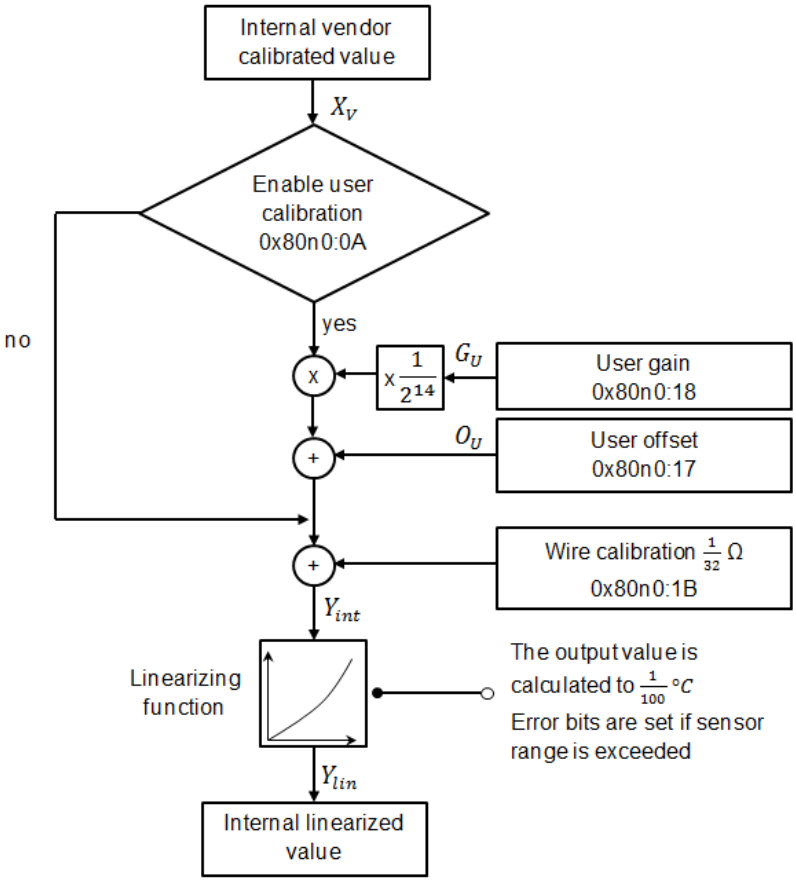


Fig. 12: Data flow: user compensation and linearization

With the values:

	Index in the CoE directory with n: channel number with 0 ≤ n ≤ 3 (channel 1 - 4)
X_V: Output value of the vendor calibration	
G_U: User Gain	0x80n0:18
O_U: User Offset	0x80n0:17
Y_{int}: Output value in 1/256 Ω prior to the linearization	

5.2.3 Scaling, limits and formatting

- Following the calculation of the resistance value, the scaling and the limit bits are evaluated.
- The result is formatted in accordance with the set presentation and copied into the process image.

The box uses the following calculation rule

$$Y = Y_{lin} \cdot \frac{G_S}{2^{16}} + O_S$$

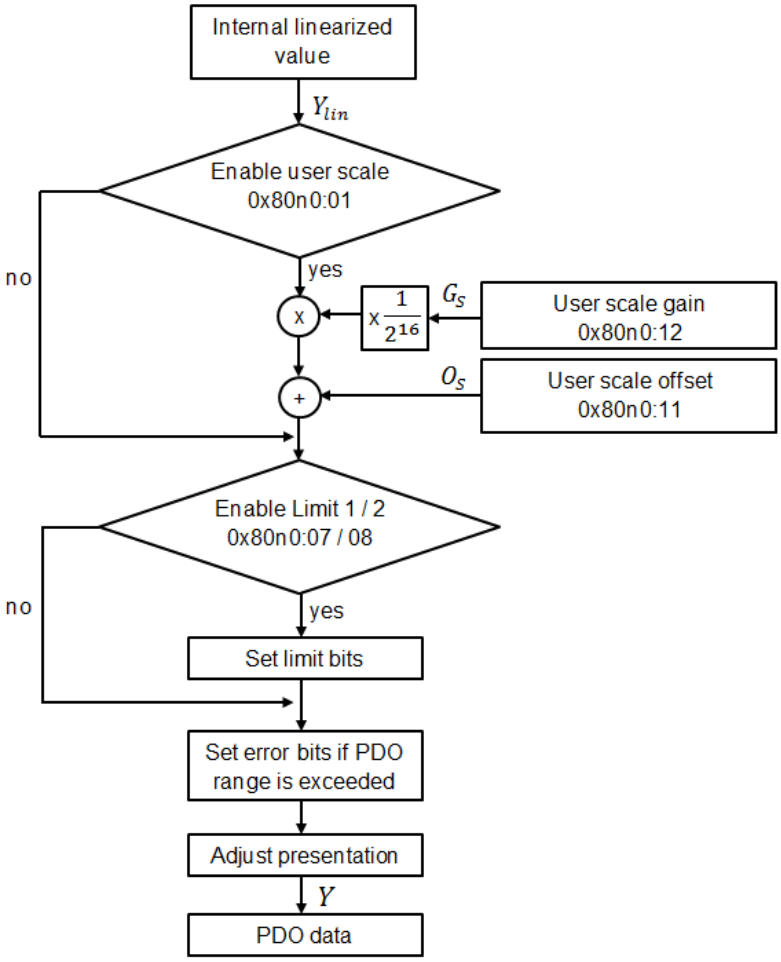


Fig. 13: Data flow: user scaling, limit evaluation, error bits and formatting

With the values:

	Index in the CoE directory with n: channel number with 0 ≤ n ≤ 3 (channel 1 - 4)
Y_{lin}: Output value in 1/100 °C	
G_S: User Scale Gain	0x80n0:12
O_S: User Scale Offset	0x80n0:11
Y: Output value PDO	

5.2.4 Summary

Summary of the calculation rules:

Vendor calibration **2- and 4-wire** measurement	$Y_R = \frac{(X_1+O_V)}{2^2} \cdot \frac{G_V}{2^{14}}$
Vendor calibration **3-wire** measurement	$Y_{R1} = \frac{(X_1+O_{V1})}{2^2} \cdot \frac{G_{V1}}{2^{14}}, Y_{R2} = \frac{(X_2+O_{V2})}{2^2} \cdot \frac{G_{V2}}{2^{14}}$ $Y_R = 2Y_{R2} - Y_{R1}$
User calibration and linearization	$Y_{int} = X_V \cdot \frac{G_U}{2^{14}} + O_U$
User scale, limits and presentation	$Y = Y_{lin} \cdot \frac{G_S}{2^{16}} + O_S$
Summary **2-, 4-wire** measurement	$Y = f_{pres}\left(\frac{G_s}{2^{16}} \cdot f_{lin}\left(\frac{(X_1 + O_V)}{2^2} \cdot \frac{G_V}{2^{14}} \cdot \frac{G_U}{2^{14}} + O_U\right) + O_S\right)$
Summary **3-wire** measurement	$Y = f_{pres}\left(\frac{G_s}{2^{16}} \cdot f_{lin}\left((2Y_{R2} - Y_{R1}) \cdot \frac{G_V}{2^{14}} \cdot \frac{G_U}{2^{14}} + O_U\right) + O_S\right)$

With the values:

	Index in the CoE directory with n: channel number with 0 ≤ n ≤ 3 (channel 1 - 4)			
X_1: Raw value of the 1st measurement	0x80nE:01			
X_2: Raw value of the 2nd measurement	0x80nE:03			
	Pt100		**Pt1000**	
	2-wire	**4-wire**	**2-wire**	**4-wire**
Gv: Vendor Gain	0x80nF:04	0x80nF:06	0x80nF:0A	0x80nF:0C
Ov: Vendor Offset	0x80nF:03	0x80nF:05	0x80nF:09	0x80nF:0B
	3-wire			
Gv_1: Vendor gain, 1st measurement	0x80nF:04		0x80nF:0A	
Ov_1: Vendor offset, 1st measurement	0x80nF:03		0x80nF:09	
Gv_2: Vendor gain, 2nd measurement	0x80nF:02		0x80nF:08	
Ov_2: Vendor offset, 2nd measurement	0x80nF:01		0x80nF:07	
G_U: User Gain	0x80n0:18			
O_U: User Scale Offset	0x80n0:17			
G_S: User Scale Gain	0x80n0:12			
O_S: User Scale Offset	0x80n0:11			
f_{lin}: Function for mapping to the selected method of representation				
f_{pres}: Linearization function				
Y_{R1}: Output value in 1/256 Ω	0x80nE:02			
Y_{R2}: Output value in 1/256 Ω	0x80nE:04			
Y: Output value PDO				

Overflow Y_{R1} and Y_{R2} after 16 bits

These values are only for fault finding. The registers overflow after 16 bits, i.e. at 65536.

5.3 Two-point user calibration

The vendor calibration is to be deactivated via index (0x80n0:0B).

Up to FW version 07 the deactivation of the vendor calibration only results in the vendor gain being set to 2^{14} (fixed-point representation for 1.0). The vendor offset remains unchanged and is still included. This results in the following with vendor calibration deactivated:

$$Y_{int} = (X + O_V) \cdot G_U \cdot \frac{1}{2^{16}} + O_U$$

$$Y_{int} = X \cdot G_U \cdot \frac{1}{2^{16}} + \underbrace{O_V \cdot G_U \cdot \frac{1}{2^{16}} + O_U}_{constant}$$

Since the last part of the term is constant, a user calibration can be performed despite the unavoidable influence of the vendor offset. The influence of the vendor offset can thereby be fully compensated.
The following method is to be applied:

Carry out two reference measurements with $Y_1(X_1)$ and $Y_2(X_2)$. Then the following applies:

$$g_f = \frac{X_2 - X_1}{Y_2 - Y_1} \qquad (1)$$

$$G_U = g_f \cdot 2^{16} \qquad (2)$$

$$O_U = X_1 - (Y_1 + O_V) \cdot g_f \qquad (3)$$

G_U and O_U are to be rounded to the nearest whole number and entered in index 0x80n0:18 and index 0x80n0:17.

X	Raw value (0x80nE:01)
O_V:	Vendor Offset (index depends on the mode, see chapter Vendor calibration [▶ 25])
G_U:	User Gain (0x80n0:18)
O_U:	User Offset (0x80n0:17)
g_f:	Gain as a floating value
O_R:	Offset as a raw value
X_n:	Measured raw value with reference measurement *n*
Y_n:	Reference value in 1/256 Ω
Y_{int}:	Output value in 1/256 Ω prior to the linearization

NOTE

Y_n: Use of the raw value

Since the resistance value in index 0x8xxE:02 overflows, the raw value in index 0x8xxE:01 is used for Y_n.

5.3.1 Example

Channel 1 is to be calibrated with four-wire connection at two points with 100 Ω and 350 Ω. The vendor offset for the 2-wire calibration is -2607 (taken from index 0x800F:03).

The following measured values are recorded:

100 Ω through precision resistor	X_1 = 25600 (1/256 Ω)
171125, read in index 0x800E:01	Y_1 = 171125
350 Ω through precision resistor	X_2 = 89600 (1/256 Ω)
592224, read in index 0x800E:01	Y_2 = 592224

With the equations (1) - (3):

$$g_f = \frac{X_2 - X_1}{Y_2 - Y_1} \qquad (1)$$

$$G_U = g_f \cdot 2^{16} \qquad (2)$$

$$O_U = X_1 - (Y_1 + O_V) \cdot g_f \qquad (3)$$

the resulting values for g_f, G_U and O_U are:

$$g_f = \frac{89600 - 25600}{592224 - 171125} = 0.15198326 \qquad (1)$$

$$G_U = 0.15198326 \cdot 2^{16} = 9960.375114 \qquad (2)$$

$$O_U = 25600 - (171125 + 2607) \cdot 0.15198326 = -11.915 \qquad (3)$$

The indices accept only integer values. The following entries are to be made in the CoE:
Index 0x8000:17 = -12
Index 0x8000:18 = 9960

Subsequently the vendor calibration is to be deactivated (0x8000:0B) and the user calibration activated (0x8000:0A).

5.4 Limit value monitoring

You can define two limit values for each measured value. A variable indicates whether the measured value lies above or below the limit value.

Defining a limit value

Enter the limit value in the appropriate CoE object.
Data format: the same data format as that of the measured value to be monitored.

CoE Index	Name
80n0:13	Limit 1
80n0:14	Limit 2

(n = 0 .. 3 for the RTD inputs X01 .. X04)

Activating the monitoring

Set the CoE object for the respective limit value to TRUE:

CoE Index	Name
80n0:07	Enable limit 1
80n0:08	Enable limit 2

Evaluation

Evaluate the input variables "Limit 1" and "Limit 2" in the process data:

Value	Meaning
0	Monitoring is not activated for this limit value.
1	The measured value is smaller than the limit value.
2	The measured value is greater than the limit value.

5.5 CoE objects

5.5.1 Object overview

EtherCAT XML Device Description

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

Index (hex)		Name	Flags	Default value
1000 [▶ 47]		Device type	RO	0x01401389 (20976521$_{dec}$)
1008 [▶ 47]		Device name	RO	EPP3204-0002
1009 [▶ 47]		Hardware version	RO	01
100A [▶ 47]		Software version	RO	03
1011:0 [▶ 41]	**Subindex**	Restore default parameters	RO	0x01 (1$_{dec}$)
	1011:01	SubIndex 001	RW	0x00000000 (0$_{dec}$)
1018:0 [▶ 47]	**Subindex**	Identity	RO	0x04 (4$_{dec}$)
	1018:01	Vendor ID	RO	0x00000002 (2$_{dec}$)
	1018:02	Product code	RO	0x0C844052 (209993810$_{dec}$)
	1018:03	Revision	RO	0x00120002 (1179650$_{dec}$)
	1018:04	Serial number	RO	0x00000000 (0$_{dec}$)
10F0:0 [▶ 47]	**Subindex**	Backup parameter handling	RO	0x01 (1$_{dec}$)
	10F0:01	Checksum	RO	0x00000000 (0$_{dec}$)
1A00:0 [▶ 48]	**Subindex**	RTD TxPDO-Map RTDInputs Ch.1	RO	0x0A (10$_{dec}$)
	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, 7
	1A00:07	SubIndex 007	RO	0x6000:0F, 1
	1A00:08	SubIndex 008	RO	0x6000:10, 1
	1A00:09	SubIndex 009	RO	0x1800:11, 16
1A01:0 [▶ 48]	**Subindex**	RTD TxPDO-Map RTDInputs Ch.2	RO	0x0A (10$_{dec}$)
	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, 7
	1A01:07	SubIndex 007	RO	0x6010:0F, 1
	1A01:08	SubIndex 008	RO	0x6010:10, 1
	1A01:09	SubIndex 009	RO	0x6010:11, 16
1A02:0 [▶ 48]	**Subindex**	RTD TxPDO-Map RTDInputs Ch.3	RO	0x0A (10$_{dec}$)
	1A02:01	SubIndex 001	RO	0x6020:01, 1
	1A02:02	SubIndex 002	RO	0x6020:02, 1
	1A02:03	SubIndex 003	RO	0x6020:03, 2
	1A02:04	SubIndex 004	RO	0x6020:05, 2
	1A02:05	SubIndex 005	RO	0x6020:07, 1
	1A02:06	SubIndex 006	RO	0x0000:00, 7
	1A02:07	SubIndex 007	RO	0x6020:0F, 1
	1A02:08	SubIndex 008	RO	0x6020:10, 1
	1A02:09	SubIndex 009	RO	0x6020:11, 16

Index (hex)		Name	Flags	Default value
1A03:0 [▶ 48]	**Subindex**	RTD TxPDO-Map RTDInputs Ch.4	RO	0x0A (10_{dec})
	1A03:01	SubIndex 001	RO	0x6030:01, 1
	1A03:02	SubIndex 002	RO	0x6030:02, 1
	1A03:03	SubIndex 003	RO	0x6030:03, 2
	1A03:04	SubIndex 004	RO	0x6030:05, 2
	1A03:05	SubIndex 005	RO	0x6030:07, 1
	1A03:06	SubIndex 006	RO	0x0000:00, 7
	1A03:07	SubIndex 007	RO	0x6030:0F, 1
	1A03:08	SubIndex 008	RO	0x6030:10, 1
	1A03:09	SubIndex 009	RO	0x6030:11, 16
1C00:0 [▶ 49]	**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 [▶ 49]	**Subindex**	RxPDO assign	RW	0x00 (0_{dec})
1C13:0 [▶ 49]	**Subindex**	TxPDO assign	RW	0x04 (4_{dec})
	1C13:01	SubIndex 001	RW	0x1A00 (6656_{dec})
	1C13:02	SubIndex 002	RW	0x1A01 (6657_{dec})
	1C13:03	SubIndex 003	RW	0x1A02 (6658_{dec})
	1C13:04	SubIndex 004	RW	0x1A03 (6659_{dec})
1C33:0 [▶ 49]	**Subindex**	SM input parameter	RO	0x20 (32_{dec})
	1C33:01	Sync mode	RW	0x0000 (0_{dec})
	1C33:02	Cycle time	RW	0x000F4240 (1000000_{dec})
	1C33:03	Shift time	RO	0x00000000 (0_{dec})
	1C33:04	Sync modes supported	RO	0xC007 (49159_{dec})
	1C33:05	Minimum cycle time	RO	0x00002710 (10000_{dec})
	1C33:06	Calc and copy time	RO	0x00000000 (0_{dec})
	1C33:07	Minimum delay time	RO	0x00000000 (0_{dec})
	1C33:08	Command	RW	0x0000 (0_{dec})
	1C33:09	Maximum Delay time	RO	0x00000000 (0_{dec})
	1C33:0B	SM event missed counter	RO	0x0000 (0_{dec})
	1C33:0C	Cycle exceeded counter	RO	0x0000 (0_{dec})
	1C33:0D	Shift too short counter	RO	0x0000 (0_{dec})
	1C33:20	Sync error	RO	0x00 (0_{dec})
6000:0 [▶ 50]	**Subindex**	RTD Inputs Ch.1	RO	0x11 (17_{dec})
	6000:01	Underrange	RO	0x00 (0_{dec})
	6000:02	Overrange	RO	0x00 (0_{dec})
	6000:03	Limit 1	RO	0x00 (0_{dec})
	6000:05	Limit 2	RO	0x00 (0_{dec})
	6000:07	Error	RO	0x00 (0_{dec})
	6000:0E	Sync error	RO	0x00 (0_{dec})
	6000:0F	TxPDO State	RO	0x00 (0_{dec})
	6000:10	TxPDO Toggle	RO	0x00 (0_{dec})
	6000:11	Value	RO	0x0000 (0_{dec})
6010:0 [▶ 50]	**Subindex**	RTD Inputs Ch.2	RO	0x11 (17_{dec})
	6010:01	Underrange	RO	0x00 (0_{dec})
	6010:02	Overrange	RO	0x00 (0_{dec})
	6010:03	Limit 1	RO	0x00 (0_{dec})
	6010:05	Limit 2	RO	0x00 (0_{dec})
	6010:07	Error	RO	0x00 (0_{dec})
	6010:0E	Sync error	RO	0x00 (0_{dec})
	6010:0F	TxPDO State	RO	0x00 (0_{dec})
	6010:10	TxPDO Toggle	RO	0x00 (0_{dec})
	6010:11	Value	RO	0x0000 (0_{dec})

Index (hex)		Name	Flags	Default value
6020:0 [▶ 51]	**Subindex**	RTD Inputs Ch.3	RO	0x11 (17_{dec})
	6020:01	Underrange	RO	0x00 (0_{dec})
	6020:02	Overrange	RO	0x00 (0_{dec})
	6020:03	Limit 1	RO	0x00 (0_{dec})
	6020:05	Limit 2	RO	0x00 (0_{dec})
	6020:07	Error	RO	0x00 (0_{dec})
	6020:0E	Sync error	RO	0x00 (0_{dec})
	6020:0F	TxPDO State	RO	0x00 (0_{dec})
	6020:10	TxPDO Toggle	RO	0x00 (0_{dec})
	6020:11	Value	RO	0x0000 (0_{dec})
6030:0 [▶ 51]	**Subindex**	RTD Inputs Ch.4	RO	0x11 (17_{dec})
	6030:01	Underrange	RO	0x00 (0_{dec})
	6030:02	Overrange	RO	0x00 (0_{dec})
	6030:03	Limit 1	RO	0x00 (0_{dec})
	6030:05	Limit 2	RO	0x00 (0_{dec})
	6030:07	Error	RO	0x00 (0_{dec})
	6030:0E	Sync error	RO	0x00 (0_{dec})
	6030:0F	TxPDO State	RO	0x00 (0_{dec})
	6030:10	TxPDO Toggle	RO	0x00 (0_{dec})
	6030:11	Value	RO	0x0000 (0_{dec})
8000:0 [▶ 42]	**Subindex**	RTD Settings Ch.1	RW	0x1B (27_{dec})
	8000:01	Enable user scale	RW	0x00 (0_{dec})
	8000:02	Presentation	RW	0x00 (0_{dec})
	8000:05	Siemens bits	RW	0x00 (0_{dec})
	8000:06	Enable filter	RW	0x00 (0_{dec})
	8000:07	Enable limit 1	RW	0x00 (0_{dec})
	8000:08	Enable limit 2	RW	0x00 (0_{dec})
	8000:0A	Enable user calibration	RW	0x00 (0_{dec})
	8000:0B	Enable vendor calibration	RW	0x01 (1_{dec})
	8000:0E	Swap limit bits	RW	0x00 (0_{dec})
	8000:11	User scale offset	RW	0x0000 (0_{dec})
	8000:12	User scale gain	RW	0x00010000 (65536_{dec})
	8000:13	Limit 1	RW	0x0000 (0_{dec})
	8000:14	Limit 2	RW	0x0000 (0_{dec})
	8000:15	Filter settings	RW	0x0000 (0_{dec})
	8000:16	Calibration intervall	RW	0x0000 (0_{dec})
	8000:17	User calibration offset	RW	0x0000 (0_{dec})
	8000:18	User calibration gain	RW	0x4000 (16384_{dec})
	8000:19	RTD Element	RW	0x0000 (0_{dec})
	8000:1A	Connection technology	RW	0x0000 (0_{dec})
	8000:1B	Wire calibration 1/32 Ohm	RW	0x0000 (0_{dec})
800E:0 [▶ 52]	**Subindex**	RTD Internal data Ch.1	RO	0x04 (4_{dec})
	800E:01	ADC raw value 1	RO	0x00000000 (0_{dec})
	800E:02	Resistor 1	RO	0x0000 (0_{dec})
	800E:03	ADC raw value 2	RO	0x00000000 (0_{dec})
	800E:04	Resistor 2	RO	0x0000 (0_{dec})
800F:0 [▶ 52]	**Subindex**	RTD Vendor data Ch.1	RW	0x07 (7_{dec})
	800F:01	Calibration offset 3-wire	RW	0x0000 (0_{dec})
	800F:02	Calibration gain 3-wire	RW	0x4000 (16384_{dec})
	800F:03	Calibration offset 2-wire	RW	0x0000 (0_{dec})
	800F:04	Calibration gain 2-wire	RW	0x4000 (16384_{dec})
	800F:05	Calibration offset 4-wire	RW	0x0000 (0_{dec})
	800F:06	Calibration gain 4-wire	RW	0x4000 (16384_{dec})
	800F:07	PGA Gain Correction	RW	0x0000 (0_{dec})

Index (hex)		Name	Flags	Default value
8010:0 [▶ 43]	**Subindex**	RTD Settings Ch.2	RW	0x1B (27_{dec})
	8010:01	Enable user scale	RW	0x00 (0_{dec})
	8010:02	Presentation	RW	0x00 (0_{dec})
	8010:05	Siemens bits	RW	0x00 (0_{dec})
	8010:06	Enable filter	RW	0x00 (0_{dec})
	8010:07	Enable limit 1	RW	0x00 (0_{dec})
	8010:08	Enable limit 2	RW	0x00 (0_{dec})
	8010:0A	Enable user calibration	RW	0x00 (0_{dec})
	8010:0B	Enable vendor calibration	RW	0x01 (1_{dec})
	8010:0E	Swap limit bits	RW	0x00 (0_{dec})
	8010:11	User scale offset	RW	0x0000 (0_{dec})
	8010:12	User scale gain	RW	0x00010000 (65536_{dec})
	8010:13	Limit 1	RW	0x0000 (0_{dec})
	8010:14	Limit 2	RW	0x0000 (0_{dec})
	8010:15	Filter settings	RW	0x0000 (0_{dec})
	8010:16	Calibration intervall	RW	0x0000 (0_{dec})
	8010:17	User calibration offset	RW	0x0000 (0_{dec})
	8010:18	User calibration gain	RW	0x4000 (16384_{dec})
	8010:19	RTD Element	RW	0x0000 (0_{dec})
	8010:1A	Connection technology	RW	0x0000 (0_{dec})
	8010:1B	Wire calibration 1/32 Ohm	RW	0x0000 (0_{dec})
801E:0 [▶ 52]	**Subindex**	RTD Internal data Ch.2	RO	0x04 (4_{dec})
	801E:01	ADC raw value 1	RO	0x00000000 (0_{dec})
	801E:02	Resistor 1	RO	0x0000 (0_{dec})
	801E:03	ADC raw value 2	RO	0x00000000 (0_{dec})
	801E:04	Resistor 2	RO	0x0000 (0_{dec})
801F [▶ 52]	**Subindex**	RTD Vendor data Ch.2	RW	0x07 (7_{dec})
	801F:01	Calibration offset 3-wire	RW	0x0000 (0_{dec})
	801F:02	Calibration gain 3-wire	RW	0x4000 (16384_{dec})
	801F:03	Calibration offset 2-wire	RW	0x0000 (0_{dec})
	801F:04	Calibration gain 2-wire	RW	0x4000 (16384_{dec})
	801F:05	Calibration offset 4-wire	RW	0x0000 (0_{dec})
	801F:06	Calibration gain 4-wire	RW	0x4000 (16384_{dec})
	801F:07	PGA Gain Correction	RW	0x0000 (0_{dec})
8020:0 [▶ 44]	**Subindex**	RTD Settings Ch.3	RW	0x1B (27_{dec})
	8020:01	Enable user scale	RW	0x00 (0_{dec})
	8020:02	Presentation	RW	0x00 (0_{dec})
	8020:05	Siemens bits	RW	0x00 (0_{dec})
	8020:06	Enable filter	RW	0x00 (0_{dec})
	8020:07	Enable limit 1	RW	0x00 (0_{dec})
	8020:08	Enable limit 2	RW	0x00 (0_{dec})
	8020:0A	Enable user calibration	RW	0x00 (0_{dec})
	8020:0B	Enable vendor calibration	RW	0x01 (1_{dec})
	8020:0E	Swap limit bits	RW	0x00 (0_{dec})
	8020:11	User scale offset	RW	0x0000 (0_{dec})
	8020:12	User scale gain	RW	0x00010000 (65536_{dec})
	8020:13	Limit 1	RW	0x0000 (0_{dec})
	8020:14	Limit 2	RW	0x0000 (0_{dec})
	8020:15	Filter settings	RW	0x0000 (0_{dec})
	8020:16	Calibration intervall	RW	0x0000 (0_{dec})
	8020:17	User calibration offset	RW	0x0000 (0_{dec})
	8020:18	User calibration gain	RW	0x4000 (16384_{dec})
	8020:19	RTD Element	RW	0x0000 (0_{dec})
	8020:1A	Connection technology	RW	0x0000 (0_{dec})
	8020:1B	Wire calibration 1/32 Ohm	RW	0x0000 (0_{dec})

Index (hex)		Name	Flags	Default value
802E:0 [▶ 53]	**Subindex**	RTD Internal data Ch.3	RO	0x04 (4_{dec})
	802E:01	ADC raw value 1	RO	0x00000000 (0_{dec})
	802E:02	Resistor 1	RO	0x0000 (0_{dec})
	802E:03	ADC raw value 2	RO	0x00000000 (0_{dec})
	802E:04	Resistor 2	RO	0x0000 (0_{dec})
802F:0 [▶ 53]	**Subindex**	RTD Vendor data Ch.3	RW	0x07 (7_{dec})
	802F:01	Calibration offset 3-wire	RW	0x0000 (0_{dec})
	802F:02	Calibration gain 3-wire	RW	0x4000 (16384_{dec})
	802F:03	Calibration offset 2-wire	RW	0x0000 (0_{dec})
	802F:04	Calibration gain 2-wire	RW	0x4000 (16384_{dec})
	802F:05	Calibration offset 4-wire	RW	0x0000 (0_{dec})
	802F:06	Calibration gain 4-wire	RW	0x4000 (16384_{dec})
	802F:07	PGA Gain Correction	RW	0x0000 (0_{dec})
8030:0 [▶ 45]	**Subindex**	RTD Settings Ch.4	RW	0x1B (27_{dec})
	8030:01	Enable user scale	RW	0x00 (0_{dec})
	8030:02	Presentation	RW	0x00 (0_{dec})
	8030:05	Siemens bits	RW	0x00 (0_{dec})
	8030:06	Enable filter	RW	0x00 (0_{dec})
	8030:07	Enable limit 1	RW	0x00 (0_{dec})
	8030:08	Enable limit 2	RW	0x00 (0_{dec})
	8030:0A	Enable user calibration	RW	0x00 (0_{dec})
	8030:0B	Enable vendor calibration	RW	0x01 (1_{dec})
	8030:0E	Swap limit bits	RW	0x00 (0_{dec})
	8030:11	User scale offset	RW	0x0000 (0_{dec})
	8030:12	User scale gain	RW	0x00010000 (65536_{dec})
	8030:13	Limit 1	RW	0x0000 (0_{dec})
	8030:14	Limit 2	RW	0x0000 (0_{dec})
	8030:15	Filter settings	RW	0x0000 (0_{dec})
	8030:16	Calibration intervall	RW	0x0000 (0_{dec})
	8030:17	User calibration offset	RW	0x0000 (0_{dec})
	8030:18	User calibration gain	RW	0x4000 (16384_{dec})
	8030:19	RTD Element	RW	0x0000 (0_{dec})
	8030:1A	Connection technology	RW	0x0000 (0_{dec})
	8030:1B	Wire calibration 1/32 Ohm	RW	0x0000 (0_{dec})
803E:0 [▶ 53]	**Subindex**	RTD Internal data Ch.4	RO	0x04 (4_{dec})
	803E:01	ADC raw value 1	RO	0x00000000 (0_{dec})
	803E:02	Resistor 1	RO	0x0000 (0_{dec})
	803E:03	ADC raw value 2	RO	0x00000000 (0_{dec})
	803E:04	Resistor 2	RO	0x0000 (0_{dec})
803F:0 [▶ 53]	**Subindex**	RTD Vendor data Ch.4	RW	0x07 (7_{dec})
	803F:01	Calibration offset 3-wire	RW	0x0000 (0_{dec})
	803F:02	Calibration gain 3-wire	RW	0x4000 (16384_{dec})
	803F:03	Calibration offset 2-wire	RW	0x0000 (0_{dec})
	803F:04	Calibration gain 2-wire	RW	0x4000 (16384_{dec})
	803F:05	Calibration offset 4-wire	RW	0x0000 (0_{dec})
	803F:06	Calibration gain 4-wire	RW	0x4000 (16384_{dec})
	803F:07	PGA Gain Correction	RW	0x0000 (0_{dec})
F000:0 [▶ 54]	**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 [▶ 54]		Code word	RW	0x00000000 (0_{dec})
F010:0 [▶ 54]	**Subindex**	Module list	RW	0x04 (4_{dec})
	F010:01	SubIndex 001	RW	0x00000140 (320_{dec})
	F010:02	SubIndex 002	RW	0x00000140 (320_{dec})
	F010:03	SubIndex 003	RW	0x00000140 (320_{dec})
	F010:04	SubIndex 004	RW	0x00000140 (320_{dec})

Index (hex)		Name	Flags	Default value
F080:0 [▶ 54]	**Subindex**	Channel Enable	RO	0x04 (4_{dec})
	F080:01	SubIndex 001	RW	0xFF (255_{dec})
	F080:02	SubIndex 002	RW	0xFF (255_{dec})
	F080:03	SubIndex 003	RW	0xFF (255_{dec})
	F080:04	SubIndex 004	RW	0xFF (255_{dec})

Key

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

5.5.2 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 (double-click on the respective object) or via the Process Data tab (allocation of PDOs).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 41] during commissioning
- Objects intended for regular operation [▶ 46], e.g. through ADS access.
- Objects for indicating internal settings [▶ 47] (may be fixed)
- Further profile-specific objects [▶ 50] 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.

5.5.2.1 Objects to be parameterized during commissioning

Index 1011: Restore default parameters

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

Index 8000: RTD Settings Ch.1

Index (hex)	Name	Meaning		Data type	Flags	Default
8000:0	RTD Settings Ch.1	Maximum subindex		UINT8	RO	0x1B (27_{dec})
8000:01	Enable user scale	Activates user scaling		BOOLEAN	RW	0x00 (0_{dec})
8000:02	Presentation	Presentation of the measured value		BIT3	RW	0x00 (0_{dec})
		0	Signed, in two's complement			
		1	Most significant bit as sign			
		2	High-resolution (1/100 °C steps)			
8000:05	Siemens bits	The S5 bits are displayed in the three low-order bits		BOOLEAN	RW	0x00 (0_{dec})
8000:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary		BOOLEAN	RW	0x00 (0_{dec})
8000:07	Enable limit 1	Activates limit check for limit 1		BOOLEAN	RW	0x00 (0_{dec})
8000:08	Enable limit 2	Activates limit check for limit 2		BOOLEAN	RW	0x00 (0_{dec})
8000:0A	Enable user calibration	Activates user calibration		BOOLEAN	RW	0x00 (0_{dec})
8000:0B	Enable vendor calibration	Activates vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8000:0E	Swap limit bits	Swaps the two limit bits, in order to achieve compatibility with older hardware versions.		BOOLEAN	RW	0x00 (0_{dec})
8000:11	User scale offset	User scaling offset		INT16	RW	0x0000 (0_{dec})
8000:12	User scale gain	Gain of the user scaling		INT32	RW	0x00010000 (65536_{dec})
8000:13	Limit 1	Value for limit 1		INT16	RW	0x0000 (0_{dec})
8000:14	Limit 2	Value for limit 2		INT16	RW	0x0000 (0_{dec})
8000:15	Filter settings	Filter settings		UINT16	RW	0x0000 (0_{dec})
		0	50 Hz			
		1	60 Hz			
		2	100 Hz			
		3	500 Hz			
		4	1 kHz			
		5	2 kHz			
		6	3.75 kHz			
		7	7.5 kHz			
		8	15 kHz			
		9	30 kHz			
		10	5 Hz			
		11	10 Hz			
8000:16	Calibration interval	reserved		UINT16	RW	0x0000 (0_{dec})
8000:17	User calibration offset	User calibration offset		INT16	RW	0x0000 (0_{dec})
8000:18	User calibration gain	Gain of the user calibration		UINT16	RW	0x4000 (16384_{dec})
8000:19	RTD element	Sensor type		UINT16	RW	0x0000 (0_{dec})
		0	Pt100			
		1	Ni100			
		2	Pt1000			
		3	Pt500			
		4	Pt200			
		5	Ni1000			
		6	Ni1000 (Siemens)			
		7	Ni120			
		8	Resistance measurement with 1/16 ohm resolution			
		9	Resistance measurement with 1/64 ohm resolution			

Index 8000: RTD Settings Ch.1

Index (hex)	Name	Meaning		Data type	Flags	Default
8000:1A	Connection technology	Connection technology:		UINT16	RW	0x0000 (0_{dec})
		0	2-wire			
		1	3-wire			
		2	4-wire			
		3	No sensor connected (only supported by hardware version 00): This setting skips the whole measurement, thus speeding up the data acquisition for the other channels. The green status LED of the respective channel remains lit. The error bit of a deactivated channel is canceled and no longer set.			
8000:1B	Wire calibration 1/32 Ohm	Only for 2-wire measurements: contains the resistance of the supply line for the temperature sensor (in 1/32 ohm).		INT16	RW	0x0000 (0_{dec})

Index 8010: RTD Settings Ch.2

Index (hex)	Name	Meaning		Data type	Flags	Default
8010:0	RTD Settings Ch.2	Maximum subindex		UINT8	RO	0x1B (27_{dec})
8010:01	Enable user scale	Activates user scaling		BOOLEAN	RW	0x00 (0_{dec})
8010:02	Presentation	Presentation of the measured value		BIT3	RW	0x00 (0_{dec})
		0	Signed, in two's complement			
		1	Most significant bit as sign			
		2	High-resolution (1/100 °C steps)			
8010:05	Siemens bits	The S5 bits are displayed in the three low-order bits		BOOLEAN	RW	0x00 (0_{dec})
8010:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary		BOOLEAN	RW	0x00 (0_{dec})
8010:07	Enable limit 1	Activates limit check for limit 1		BOOLEAN	RW	0x00 (0_{dec})
8010:08	Enable limit 2	Activates limit check for limit 2		BOOLEAN	RW	0x00 (0_{dec})
8010:0A	Enable user calibration	Activates user calibration		BOOLEAN	RW	0x00 (0_{dec})
8010:0B	Enable vendor calibration	Activates manufacturer calibration		BOOLEAN	RW	0x01 (1_{dec})
8010:0E	Swap limit bits	Swaps the two limit bits, in order to achieve compatibility with older hardware versions.		BOOLEAN	RW	0x00 (0_{dec})
8010:11	User scale offset	User scaling offset		INT16	RW	0x0000 (0_{dec})
8010:12	User scale gain	Gain of the user scaling		INT32	RW	0x00010000 (65536_{dec})
8010:13	Limit 1	Value for limit 1		INT16	RW	0x0000 (0_{dec})
8010:14	Limit 2	Value for limit 2		INT16	RW	0x0000 (0_{dec})
8010:15	Filter settings	Filter settings		UINT16	RW	0x0000 (0_{dec})
		0	50 Hz			
		1	60 Hz			
		2	100 Hz			
		3	500 Hz			
		4	1 kHz,			
		5	2 kHz			
		6	3.75 kHz			
		7	7.5 kHz			
		8	15 kHz			
		9	30 kHz			
		10	5 Hz			
		11	10 Hz			
8010:16	Calibration interval	reserved		UINT16	RW	0x0000 (0_{dec})
8010:17	User calibration offset	User calibration offset		INT16	RW	0x0000 (0_{dec})
8010:18	User calibration gain	Gain of the user calibration		UINT16	RW	0x4000 (16384_{dec})

Index 8010: RTD Settings Ch.2

Index (hex)	Name	Meaning		Data type	Flags	Default
8010:19	RTD element	Sensor type		UINT16	RW	0x0000 (0_{dec})
		0	Pt100			
		1	Ni100			
		2	Pt1000			
		3	Pt500			
		4	Pt200			
		5	Ni1000			
		6	Ni1000 (Siemens)			
		7	Ni120			
		8	Resistance measurement with 1/16 ohm resolution			
		9	Resistance measurement with 1/64 ohm resolution			
8010:1A	Connection technology	Connection technology:		UINT16	RW	0x0000 (0_{dec})
		0	2-wire			
		1	3-wire			
		2	4-wire			
		3	No sensor connected (only supported by hardware version 00): This setting skips the whole measurement, thus speeding up the data acquisition for the other channels. The green status LED of the respective channel remains lit. The error bit of a deactivated channel is cancelled and no longer set.			
8010:1B	Wire calibration 1/32 Ohm	Only for 2-wire measurements: contains the resistance of the supply line for the temperature sensor (in 1/32 ohm).		INT16	RW	0x0000 (0_{dec})

Index 8020: RTD Settings Ch.3

Index (hex)	Name	Meaning		Data type	Flags	Default
8020:0	RTD Settings Ch.3	Maximum subindex		UINT8	RO	0x1B (27_{dec})
8020:01	Enable user scale	Activates user scaling		BOOLEAN	RW	0x00 (0_{dec})
8020:02	Presentation	Presentation of the measured value		BIT3	RW	0x00 (0_{dec})
		0	Signed, in two's complement			
		1	Most significant bit as sign			
		2	High-resolution (1/100 °C steps)			
8020:05	Siemens bits	The S5 bits are displayed in the three low-order bits		BOOLEAN	RW	0x00 (0_{dec})
8020:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary		BOOLEAN	RW	0x00 (0_{dec})
8020:07	Enable limit 1	Activates limit check for limit 1		BOOLEAN	RW	0x00 (0_{dec})
8020:08	Enable limit 2	Activates limit check for limit 2		BOOLEAN	RW	0x00 (0_{dec})
8020:0A	Enable user calibration	Activates user calibration		BOOLEAN	RW	0x00 (0_{dec})
8020:0B	Enable vendor calibration	Activates vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8020:0E	Swap limit bits	Swaps the two limit bits, in order to achieve compatibility with older hardware versions.		BOOLEAN	RW	0x00 (0_{dec})
8020:11	User scale offset	User scaling offset		INT16	RW	0x0000 (0_{dec})
8020:12	User scale gain	Gain of the user scaling		INT32	RW	0x00010000 (65536_{dec})
8020:13	Limit 1	Value for limit 1		INT16	RW	0x0000 (0_{dec})
8020:14	Limit 2	Value for limit 2		INT16	RW	0x0000 (0_{dec})

Index 8020: RTD Settings Ch.3

Index (hex)	Name	Meaning		Data type	Flags	Default
8020:15	Filter settings	Filter settings		UINT16	RW	0x0000 (0_{dec})
		0	50 Hz			
		1	60 Hz			
		2	100 Hz			
		3	500 Hz			
		4	1 kHz,			
		5	2 kHz			
		6	3.75 kHz			
		7	7.5 kHz			
		8	15 kHz			
		9	30 kHz			
		10	5 Hz			
		11	10 Hz			
8020:16	Calibration interval	reserved		UINT16	RW	0x0000 (0_{dec})
8020:17	User calibration offset	User calibration offset		INT16	RW	0x0000 (0_{dec})
8020:18	User calibration gain	Gain of the user calibration		UINT16	RW	0x4000 (16384_{dec})
8020:19	RTD element	Sensor type		UINT16	RW	0x0000 (0_{dec})
		0	Pt100			
		1	Ni100			
		2	Pt1000			
		3	Pt500			
		4	Pt200			
		5	Ni1000			
		6	Ni1000 (Siemens)			
		7	Ni120			
		8	Resistance measurement with 1/16 ohm resolution			
		9	Resistance measurement with 1/64 ohm resolution			
8020:1A	Connection technology	Connection technology:		UINT16	RW	0x0000 (0_{dec})
		0	2-wire			
		1	3-wire			
		2	4-wire			
		3	No sensor connected (only supported by hardware version 00): This setting skips the whole measurement, thus speeding up the data acquisition for the other channels. The green status LED of the respective channel remains lit. The error bit of a deactivated channel is canceled and no longer set.			
8020:1B	Wire calibration 1/32 Ohm	Only for 2-wire measurements: contains the resistance of the supply line for the temperature sensor (in 1/32 ohm).		INT16	RW	0x0000 (0_{dec})

Index 8030: RTD Settings Ch.4

Index (hex)	Name	Meaning		Data type	Flags	Default
8030:0	RTD Settings Ch.4	Maximum subindex		UINT8	RO	0x1B (27_{dec})
8030:01	Enable user scale	Activates user scaling		BOOLEAN	RW	0x00 (0_{dec})
8030:02	Presentation	Presentation of the measured value		BIT3	RW	0x00 (0_{dec})
		0	Signed, in two's complement			
		1	Most significant bit as sign			
		2	High-resolution (1/100 °C steps)			
8030:05	Siemens bits	The S5 bits are displayed in the three low-order bits		BOOLEAN	RW	0x00 (0_{dec})
8030:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary		BOOLEAN	RW	0x00 (0_{dec})
8030:07	Enable limit 1	Activates limit check for limit 1		BOOLEAN	RW	0x00 (0_{dec})
8030:08	Enable limit 2	Activates limit check for limit 2		BOOLEAN	RW	0x00 (0_{dec})

Index 8030: RTD Settings Ch.4

Index (hex)	Name	Meaning		Data type	Flags	Default
8030:0A	Enable user calibration	Activates user calibration		BOOLEAN	RW	0x00 (0_{dec})
8030:0B	Enable vendor calibration	Activates vendor calibration		BOOLEAN	RW	0x01 (1_{dec})
8030:0E	Swap limit bits	Swaps the two limit bits, in order to achieve compatibility with older hardware versions.		BOOLEAN	RW	0x00 (0_{dec})
8030:11	User scale offset	User scaling offset		INT16	RW	0x0000 (0_{dec})
8030:12	User scale gain	Gain of the user scaling		INT32	RW	0x00010000 (65536_{dec})
8030:13	Limit 1	Value for limit 1		INT16	RW	0x0000 (0_{dec})
8030:14	Limit 2	Value for limit 2		INT16	RW	0x0000 (0_{dec})
8030:15	Filter settings	Filter settings		UINT16	RW	0x0000 (0_{dec})
		0	50 Hz			
		1	60 Hz			
		2	100 Hz			
		3	500 Hz			
		4	1 kHz,			
		5	2 kHz			
		6	3.75 kHz			
		7	7.5 kHz			
		8	15 kHz			
		9	30 kHz			
		10	5 Hz			
		11	10 Hz			
8030:16	Calibration interval	reserved		UINT16	RW	0x0000 (0_{dec})
8030:17	User calibration offset	User calibration offset		INT16	RW	0x0000 (0_{dec})
8030:18	User calibration gain	Gain of the user calibration		UINT16	RW	0x4000 (16384_{dec})
8030:19	RTD element	Sensor type		UINT16	RW	0x0000 (0_{dec})
		0	Pt100			
		1	Ni100			
		2	Pt1000			
		3	Pt500			
		4	Pt200			
		5	Ni1000			
		6	Ni1000 (Siemens)			
		7	Ni120			
		8	Resistance measurement with 1/16 ohm resolution			
		9	Resistance measurement with 1/64 ohm resolution			
8030:1A	Connection technology	Connection technology:		UINT16	RW	0x0000 (0_{dec})
		0	2-wire			
		1	3-wire			
		2	4-wire			
		3	No sensor connected (only supported by hardware version 00): This setting skips the whole measurement, thus speeding up the data acquisition for the other channels. The green status LED of the respective channel remains lit. The error bit of a deactivated channel is canceled and no longer set.			
8030:1B	Wire calibration 1/32 Ohm	Only for 2-wire measurements: contains the resistance of the supply line for the temperature sensor (in 1/32 ohm).		INT16	RW	0x0000 (0_{dec})

5.5.2.2 Objects for regular operation

EPP3204 has no such objects.

5.5.2.3 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	0x01401389 (20976521_{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	EPP3204-0002

Index 1009: Hardware version

Index (hex)	Name	Meaning	Data type	Flags	Default
1009:0	Hardware version	Hardware version of the EtherCAT slave	STRING	RO	05

Index 100A: Software version

Index (hex)	Name	Meaning	Data type	Flags	Default
100A:0	Software version	Firmware version of the EtherCAT slave	STRING	RO	07

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	0x0C844052 (209993810_{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	0x00120002 (1179650_{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 1A00: RTD TxPDO-Map RTDInputs Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1A00:0	RTD TxPDO-Map RTDInputs Ch.1	PDO Mapping TxPDO 1	UINT8	RO	0x09 (9_{dez})
1A00:01	SubIndex 001	1. PDO Mapping entry	UINT32	RO	0x6000:01, 1
1A00:02	SubIndex 002	2. PDO Mapping entry	UINT32	RO	0x6000:02, 1
1A00:03	SubIndex 003	3. PDO Mapping entry	UINT32	RO	0x6000:03, 2
1A00:04	SubIndex 004	4. PDO Mapping entry	UINT32	RO	0x6000:05, 2
1A00:05	SubIndex 005	5. PDO Mapping entry	UINT32	RO	0x6000:07, 1
1A00:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RO	0x0000:00, 7
1A00:07	SubIndex 007	7. PDO Mapping entry	UINT32	RO	0x6000:0, 1
1A00:08	SubIndex 008	8. PDO Mapping entry	UINT32	RO	0x6000:10, 1
1A00:09	SubIndex 009	9. PDO Mapping entry	UINT32	RO	0x6000:11, 16

Index 1A01: RTD TxPDO-Map RTDInputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1A01:0	RTD TxPDO-Map RTDInputs Ch.2	PDO Mapping TxPDO 2	UINT8	RO	0x09 (9_{dez})
1A01:01	SubIndex 001	1. PDO Mapping entry	UINT32	RO	0x6010:01, 1
1A01:02	SubIndex 002	2. PDO Mapping entry	UINT32	RO	0x6010:02, 1
1A01:03	SubIndex 003	3. PDO Mapping entry	UINT32	RO	0x6010:03, 2
1A01:04	SubIndex 004	4. PDO Mapping entry	UINT32	RO	0x6010:05, 2
1A01:05	SubIndex 005	5. PDO Mapping entry	UINT32	RO	0x6010:07, 1
1A01:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RO	0x0000:00, 7
1A01:07	SubIndex 007	7. PDO Mapping entry	UINT32	RO	0x6010:0F, 1
1A01:08	SubIndex 008	8. PDO Mapping entry	UINT32	RO	0x6010:10, 1
1A01:09	SubIndex 009	9. PDO Mapping entry	UINT32	RO	0x6010:11, 16

Index 1A02: RTD TxPDO-Map RTDInputs Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
1A02:0	RTD TxPDO-Map RTDInputs Ch.3	PDO Mapping TxPDO 3	UINT8	RO	0x09 (9_{dez})
1A02:01	SubIndex 001	1. PDO Mapping entry	UINT32	RO	0x6020:01, 1
1A02:02	SubIndex 002	2. PDO Mapping entry	UINT32	RO	0x6020:02, 1
1A02:03	SubIndex 003	3. PDO Mapping entry	UINT32	RO	0x6020:03, 2
1A02:04	SubIndex 004	4. PDO Mapping entry	UINT32	RO	0x6020:05, 2
1A02:05	SubIndex 005	5. PDO Mapping entry	UINT32	RO	0x6020:07, 1
1A02:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RO	0x0000:00, 7
1A02:07	SubIndex 007	7. PDO Mapping entry	UINT32	RO	0x6020:0F, 1
1A02:08	SubIndex 008	8. PDO Mapping entry	UINT32	RO	0x6020:10, 1
1A02:09	SubIndex 009	9. PDO Mapping entry	UINT32	RO	0x6020:11, 16

Index 1A03: RTD TxPDO-Map RTDInputs Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
1A03:0	RTD TxPDO-Map RTDInputs Ch.4	PDO Mapping TxPDO 4	UINT8	RO	0x09 (9_{dez})
1A03:01	SubIndex 001	1. PDO Mapping entry	UINT32	RO	0x6030:01, 1
1A03:02	SubIndex 002	2. PDO Mapping entry	UINT32	RO	0x6030:02, 1
1A03:03	SubIndex 003	3. PDO Mapping entry	UINT32	RO	0x6030:03, 2
1A03:04	SubIndex 004	4. PDO Mapping entry	UINT32	RO	0x6030:05, 2
1A03:05	SubIndex 005	5. PDO Mapping entry	UINT32	RO	0x6030:07, 1
1A03:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RO	0x0000:00, 7
1A03:07	SubIndex 007	7. PDO Mapping entry	UINT32	RO	0x6030:0F, 1
1A03:08	SubIndex 008	8. PDO Mapping entry	UINT32	RO	0x6030:10, 1
1A03:09	SubIndex 009	9. PDO Mapping entry	UINT32	RO	0x6030:11, 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	0x00 (0_{dec})

Index 1C13: TxPDO assign

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

Index 1C33: SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C33:0	SM input parameter	Maximum subindex	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode		UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time		UINT32	RW	0x000F4240 (1000000_{dec})
1C33:03	Shift time		UINT32	RO	0x00000000 (0_{dec})
1C33:04	Sync modes supported		UINT16	RO	0xC007 (49159_{dec})
1C33:05	Minimum cycle time		UINT32	RO	0x00002710 (10000_{dec})
1C33:06	Calc and copy time		UINT32	RO	0x00000000 (0_{dec})
1C33:07	Minimum delay time		UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command		UINT16	RW	0x0000 (0_{dec})
1C33:09	Maximum Delay time		UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter		UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter		UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter		UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error		BOOLEAN	RO	0x00 (0_{dec})

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

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

Index 6000: RTD Inputs Ch.1

Index (hex)	Name	Meaning		Data type	Flags	Default
6000:0	RTD Inputs Ch.1	Maximum subindex		UINT8	RO	0x11 (17_{dec})
6000:01	Underrange	Is set if the value falls below the operating range of the sensor or the process record contains the lowest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6000:02	Overrange	Is set if the value exceeds the operating range of the sensor or the process record contains the highest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6000:03	Limit 1	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6000:05	Limit 2	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6000:07	Error	The error bit is set if the process data is invalid (wire breakage, overrange, underrange).		BOOLEAN	RO	0x00 (0_{dec})
6000:0E	Sync error	Only in DC: bit is set if the slave is not able to operate synchronous with master, because it cannot keep up with the cycle time.		BOOLEAN	RO	0x00 (0_{dec})
6000:0F	TxPDO State	Validity of the data of the associated TxPDO		BOOLEAN	RO	0x00 (0_{dec})
		0	valid			
		1	invalid			
6000:10	TxPDO Toggle	TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.		BOOLEAN	RO	0x00 (0_{dec})
6000:11	Value	Analog input date		INT16	RO	0x0000 (0_{dec})

Index 6010: RTD Inputs Ch.2

Index (hex)	Name	Meaning		Data type	Flags	Default
6010:0	RTD Inputs Ch.2	Maximum subindex		UINT8	RO	0x11 (17_{dec})
6010:01	Underrange	Is set if the value falls below the operating range of the sensor or the process record contains the lowest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6010:02	Overrange	Is set if the value exceeds the operating range of the sensor or the process record contains the highest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6010:03	Limit 1	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6010:05	Limit 2	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6010:07	Error	The error bit is set if the process data is invalid (wire breakage, overrange, underrange).		BOOLEAN	RO	0x00 (0_{dec})
6010:0E	Sync error	Only in DC: bit is set if the slave is not able to operate synchronous with master, because it cannot keep up with the cycle time.		BOOLEAN	RO	0x00 (0_{dec})
6010:0F	TxPDO State	Validity of the data of the associated TxPDO		BOOLEAN	RO	0x00 (0_{dec})
		0	valid			
		1	invalid			
6010:10	TxPDO Toggle	TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.		BOOLEAN	RO	0x00 (0_{dec})
6010:11	Value	Analog input date		INT16	RO	0x0000 (0_{dec})

Index 6020: RTD Inputs Ch.3

Index (hex)	Name	Meaning		Data type	Flags	Default
6020:0	RTD Inputs Ch.3	Maximum subindex		UINT8	RO	0x11 (17_{dec})
6020:01	Underrange	Is set if the value falls below the operating range of the sensor or the process record contains the lowest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6020:02	Overrange	Is set if the value exceeds the operating range of the sensor or the process record contains the highest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6020:03	Limit 1	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6020:05	Limit 2	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6020:07	Error	The error bit is set if the process data is invalid (cable break, overrange, underrange)		BOOLEAN	RO	0x00 (0_{dec})
6020:0E	Sync error	Only in DC: bit is set if the slave is not able to operate synchronous with master, because it cannot keep up with the cycle time.		BOOLEAN	RO	0x00 (0_{dec})
6020:0F	TxPDO State	Validity of the data of the associated TxPDO		BOOLEAN	RO	0x00 (0_{dec})
		0	valid			
		1	invalid			
6020:10	TxPDO Toggle	TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.		BOOLEAN	RO	0x00 (0_{dec})
6020:11	Value	Analog input date		INT16	RO	0x0000 (0_{dec})

Index 6030: RTD Inputs Ch.4

Index (hex)	Name	Meaning		Data type	Flags	Default
6030:0	RTD Inputs Ch.4	Maximum subindex		UINT8	RO	0x11 (17_{dec})
6030:01	Underrange	Is set if the value falls below the operating range of the sensor or the process record contains the lowest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6030:02	Overrange	Is set if the value exceeds the operating range of the sensor or the process record contains the highest possible value.		BOOLEAN	RO	0x00 (0_{dec})
6030:03	Limit 1	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6030:05	Limit 2	Only when limit check is active		BIT2	RO	0x00 (0_{dec})
		1	Value below set limit			
		2	Set limit exceeded			
		3	Set limit reached			
6030:07	Error	The error bit is set if the process data is invalid (wire breakage, overrange, underrange).		BOOLEAN	RO	0x00 (0_{dec})
6030:0E	Sync error	Only in DC: bit is set if the slave is not able to operate synchronous with master, because it cannot keep up with the cycle time.		BOOLEAN	RO	0x00 (0_{dec})
6030:0F	TxPDO State	Validity of the data of the associated TxPDO		BOOLEAN	RO	0x00 (0_{dec})
		0	valid			
		1	invalid			
6030:10	TxPDO Toggle	TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.		BOOLEAN	RO	0x00 (0_{dec})
6030:11	Value	Analog input date		INT16	RO	0x0000 (0_{dec})

Index 800E: RTD Internal data Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
800E:0	RTD Internal data Ch.1	Maximum subindex	UINT8	RO	0x04 (4_{dec})
800E:01	ADC raw value 1	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
800E:02	Resistor 1	Resistance value of the first measurement	UINT16	RO	0x0000 (0_{dec})
800E:03	ADC raw value 2	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
800E:04	Resistor 2	Resistance value of the second measurement	UINT16	RO	0x0000 (0_{dec})

Index 800F: RTD Vendor data Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
800F:0	RTD Vendor data Ch.1	Maximum subindex	UINT8	RO	0x07 (7_{dec})
800F:01	Calibration offset 3-wire	Calibration for 3-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
800F:02	Calibration gain 3-wire	Calibration for 3-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
800F:03	Calibration offset 2-wire	Calibration for 2-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
800F:04	Calibration gain 2-wire	Calibration for 2-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
800F:05	Calibration offset 4-wire	Calibration for 4-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
800F:06	Calibration gain 4-wire	Calibration for 4-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
800F:07	PGA Gain Correction	Gain correction for Pt1000 measurement	INT16	RW	0x0000 (0_{dec})

Index 801E: RTD Internal data Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
801E:0	RTD Internal data Ch.2	Maximum subindex	UINT8	RO	0x04 (4_{dec})
801E:01	ADC raw value 1	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
801E:02	Resistor 1	Resistance value of the first measurement	UINT16	RO	0x0000 (0_{dec})
801E:03	ADC raw value 2	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
801E:04	Resistor 2	Resistance value of the second measurement	UINT16	RO	0x0000 (0_{dec})

Index 801F: RTD Vendor data Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
801F:0	RTD Vendor data Ch.2	Maximum subindex	UINT8	RO	0x07 (7_{dec})
801F:01	Calibration offset 3-wire	Calibration for 3-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
801F:02	Calibration gain 3-wire	Calibration for 3-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
801F:03	Calibration offset 2-wire	Calibration for 2-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
801F:04	Calibration gain 2-wire	Calibration for 2-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
801F:05	Calibration offset 4-wire	Calibration for 4-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
801F:06	Calibration gain 4-wire	Calibration for 4-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
801F:07	PGA Gain Correction	Gain correction for Pt1000 measurement	INT16	RW	0x0000 (0_{dec})

Index 802E: RTD Internal data Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
802E:0	RTD Internal data Ch.3	Maximum subindex	UINT8	RO	0x04 (4_{dec})
802E:01	ADC raw value 1	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
802E:02	Resistor 1	Resistance value of the first measurement	UINT16	RO	0x0000 (0_{dec})
802E:03	ADC raw value 2	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
802E:04	Resistor 2	Resistance value of the second measurement	UINT16	RO	0x0000 (0_{dec})

Index 802F: RTD Vendor data Ch.3

Index (hex)	Name	Meaning	Data type	Flags	Default
802F:0	RTD Vendor data Ch.3	Maximum subindex	UINT8	RO	0x07 (7_{dec})
802F:01	Calibration offset 3-wire	Calibration for 3-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
802F:02	Calibration gain 3-wire	Calibration for 3-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
802F:03	Calibration offset 2-wire	Calibration for 2-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
802F:04	Calibration gain 2-wire	Calibration for 2-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
802F:05	Calibration offset 4-wire	Calibration for 4-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
802F:06	Calibration gain 4-wire	Calibration for 4-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
802F:07	PGA Gain Correction	Gain correction for Pt1000 measurement	INT16	RW	0x0000 (0_{dec})

Index 803E: RTD Internal data Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
803E:0	RTD Internal data Ch.4	Maximum subindex	UINT8	RO	0x04 (4_{dec})
803E:01	ADC raw value 1	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
803E:02	Resistor 1	Resistance value of the first measurement	UINT16	RO	0x0000 (0_{dec})
803E:03	ADC raw value 2	Raw value of the analog/digital converter	INT32	RO	0x00000000 (0_{dec})
803E:04	Resistor 2	Resistance value of the second measurement	UINT16	RO	0x0000 (0_{dec})

Index 803F: RTD Vendor data Ch.4

Index (hex)	Name	Meaning	Data type	Flags	Default
803F:0	RTD Vendor data Ch.4		UINT8	RO	0x07 (7_{dec})
803F:01	Calibration offset 3-wire	Calibration for 3-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
803F:02	Calibration gain 3-wire	Calibration for 3-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
803F:03	Calibration offset 2-wire	Calibration for 2-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
803F:04	Calibration gain 2-wire	Calibration for 2-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
803F:05	Calibration offset 4-wire	Calibration for 4-wire measurement: Offset	INT16	RW	0x0000 (0_{dec})
803F:06	Calibration gain 4-wire	Calibration for 4-wire measurement: Gain	UINT16	RW	0x4000 (16384_{dec})
803F:07	PGA Gain Correction	Gain correction for Pt1000 measurement	INT16	RW	0x0000 (0_{dec})

Index F000: Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	Maximum subindex	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index spacing for 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	reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010: Module list

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module list	Maximum subindex	UINT8	RW	0x04 (4_{dec})
F010:01	SubIndex 001		UINT32	RW	0x00000140 (320_{dec})
F010:02	SubIndex 002		UINT32	RW	0x00000140 (320_{dec})
F010:03	SubIndex 003		UINT32	RW	0x00000140 (320_{dec})
F010:04	SubIndex 004		UINT32	RW	0x00000140 (320_{dec})

Index F080: Channel Enable

Index (hex)	Name	Meaning			Data type	Flags	Default
F080:0	Channel Enable	Maximum subindex			UINT8	RO	0x04 (4_{dec})
F080:01	SubIndex 001	0	Channel 1 disabled	(from hardware version 01 deactivated channels are not measured, and the green LED R for these channels goes out)	BOOLEAN	RW	0x01 (1_{dec})
		1	Channel 1 enabled				
F080:02	SubIndex 002	0	Channel 2 disabled		BOOLEAN	RW	0x01 (1_{dec})
		1	Channel 2 enabled				
F080:03	SubIndex 003	0	Channel 3 disabled		BOOLEAN	RW	0x01 (1_{dec})
		1	Channel 3 enabled				
F080:04	SubIndex 004	0	Channel 4 disabled		BOOLEAN	RW	0x01 (1_{dec})
		1	Channel 5 enabled				

5.6 Restoring the delivery state

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

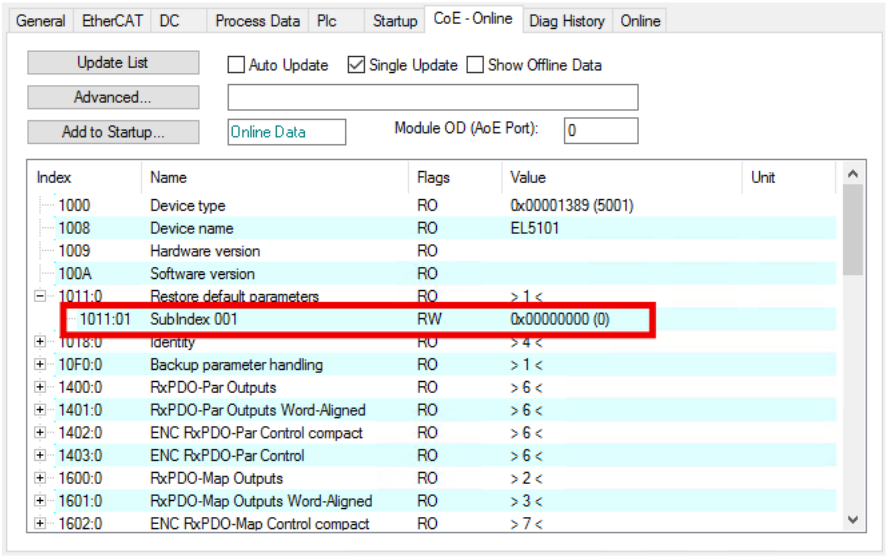


Fig. 14: Selecting the Restore default parameters PDO

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.

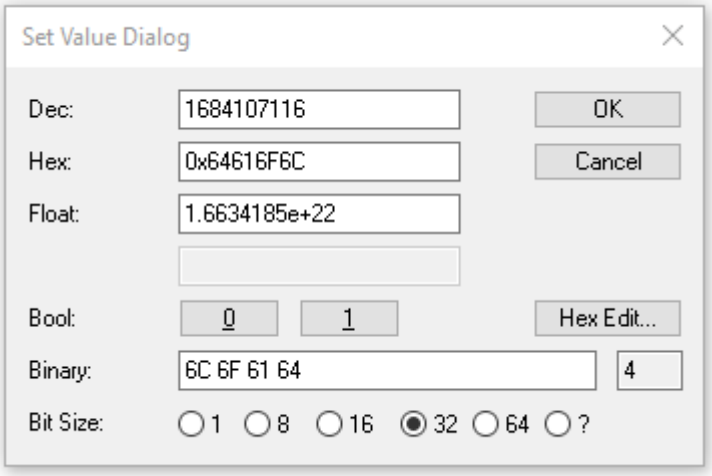


Fig. 15: Entering a restore value in the Set Value dialog

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.

5.7 Decommissioning

⚠ WARNING

Risk of electric shock!

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

6 Appendix

6.1 General operating conditions

Protection degrees (IP-Code)

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

1. Number: dust protection and touch guard	Definition
0	Non-protected
1	Protected against access to hazardous parts with the back of a hand. Protected against solid foreign objects of Ø 50 mm
2	Protected against access to hazardous parts with a finger. Protected against solid foreign objects of Ø 12.5 mm.
3	Protected against access to hazardous parts with a tool. Protected against solid foreign objects Ø 2.5 mm.
4	Protected against access to hazardous parts with a wire. Protected against solid foreign objects Ø 1 mm.
5	Protected against access to hazardous parts with a wire. Dust-protected. Intrusion of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the device or to impair safety.
6	Protected against access to hazardous parts with a wire. Dust-tight. No intrusion of dust.
2. Number: water* protection	Definition
0	Non-protected
1	Protected against water drops
2	Protected against water drops when enclosure tilted up to 15°.
3	Protected against spraying water. Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects.
4	Protected against splashing water. Water splashed against the disclosure from any direction shall have no harmful effects
5	Protected against water jets
6	Protected against powerful water jets
7	Protected against the effects of temporary immersion in water. Intrusion of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water for 30 min. in 1 m depth.

*) These protection classes define only protection against water.

Chemical Resistance

The Resistance relates to the Housing of the IP67 modules and the used metal parts. In the table below you will find some typical resistance.

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

Key

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

6.2 Accessories

Mounting

Ordering information	Description	Link
ZS5300-0011	Mounting rail	Website

Cables

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

Ordering information	Description	Link
ZK2000-7xxx-0xxx	Sensor cable M12, 4-pin + shield	Website
ZK700x-xxxx-xxxx	EtherCAT P cable M8	Website

Labeling material, protective caps

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

Tools

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

Further accessories

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

6.3 Version identification of EtherCAT devices

6.3.1 General notes on marking

Designation

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

- family key
- type
- version
- revision

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

Notes

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

6.3.2 Version identification of EP/EPI/EPP/ER/ERI boxes

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

Structure of the serial number: **KK YY FF HH**	Example with serial number 12 06 3A 02:
KK - week of production (CW, calendar week)	12 - production week 12
YY - year of production	06 - production year 2006
FF - firmware version	3A - firmware version 3A
HH - hardware version	02 - hardware version 02

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

Syntax: D ww yy x y z u

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

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

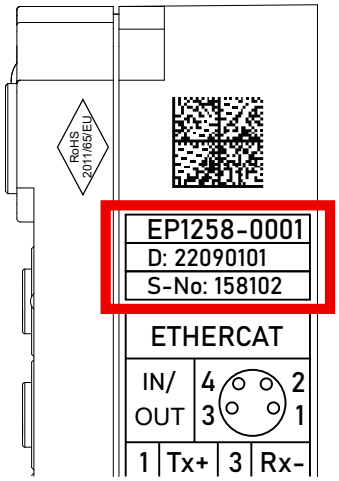


Fig. 16: EP1258-00001 IP67 EtherCAT Box with batch number/DateCode 22090101 and unique serial number 158102

6.3.3 Beckhoff Identification Code (BIC)

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

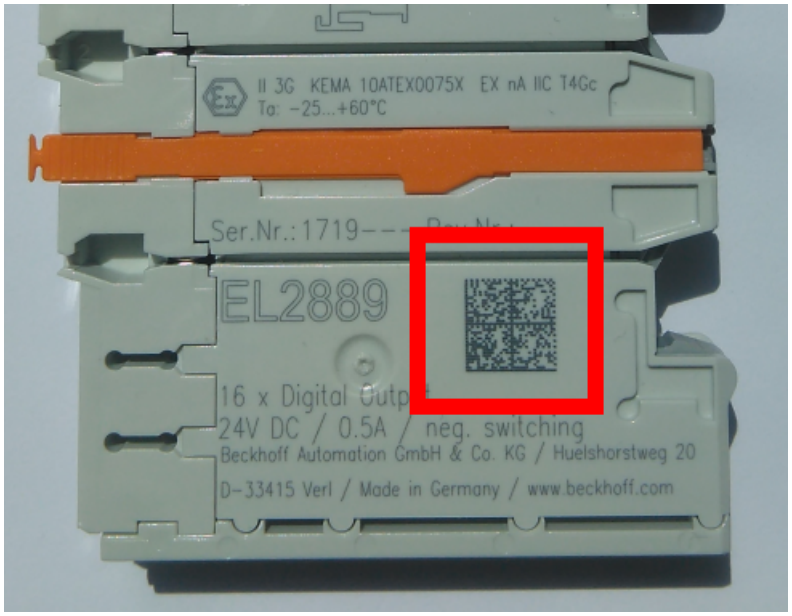


Fig. 17: BIC as data matrix code (DMC, code scheme ECC200)

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

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

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

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

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

Following information is possible, positions 1 to 4 are always present, the other according to need of production:

Position	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	**Beckhoff order number**	1P	8	1P072222
2	Beckhoff Traceability Number (BTN)	**Unique serial number, see note below**	SBTN	12	SBTNk4p562d7
3	Article description	**Beckhoff article description, e.g. EL1008**	1K	32	1KEL1809
4	Quantity	**Quantity in packaging unit, e.g. 1, 10, etc.**	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products	51S	12	51S678294
7	Variant number	Optional: Product variant number on the basis of standard products	30P	32	30PF971, 2*K183
...					

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

Structure of the BIC

Example of composite information from positions 1 to 4 and with the above given example value on position 6. The data identifiers are highlighted in bold font:

1P072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

Accordingly as DMC:

Fig. 18: Example DMC **1P**072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, position 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTE

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

6.3.4 Electronic access to the BIC (eBIC)

Electronic BIC (eBIC)

The Beckhoff Identification Code (BIC) is applied to the outside of Beckhoff products in a visible place. If possible, it should also be electronically readable.

Decisive for the electronic readout is the interface via which the product can be electronically addressed.

K-bus devices (IP20, IP67)

Currently, no electronic storage and readout is planned for these devices.

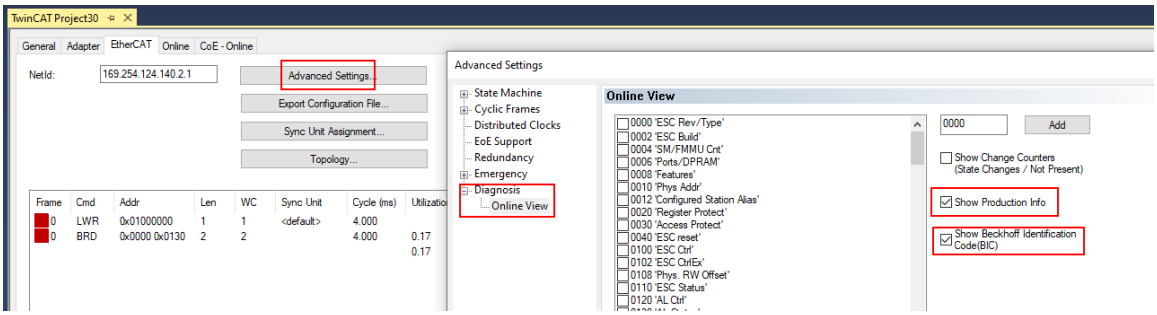
EtherCAT devices (IP20, IP67)

All Beckhoff EtherCAT devices have a so-called ESI-EEPROM, which contains the EtherCAT identity with the revision number. Stored in it is the EtherCAT slave information, also colloquially known as ESI/XML configuration file for the EtherCAT master. See the corresponding chapter in the EtherCAT system manual (Link) for the relationships.

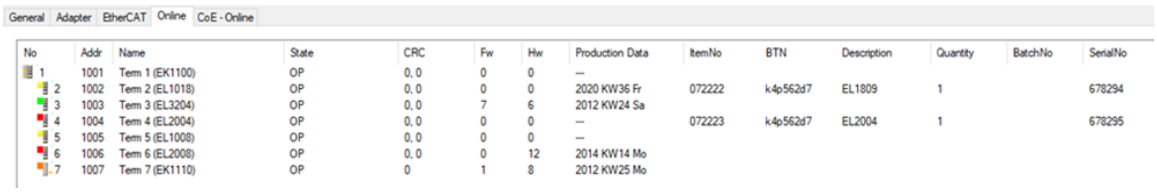
The eBIC is also stored in the ESI-EEPROM. The eBIC was introduced into the Beckhoff I/O production (terminals, box modules) from 2020; widespread implementation is expected in 2021.

The user can electronically access the eBIC (if existent) as follows:

- With all EtherCAT devices, the EtherCAT master (TwinCAT) can read the eBIC from the ESI-EEPROM
  - From TwinCAT 3.1 build 4024.11, the eBIC can be displayed in the online view.
  - To do this,
    check the checkbox "Show Beckhoff Identification Code (BIC)" under
    EtherCAT → Advanced Settings → Diagnostics:



  - The BTN and its contents are then displayed:



  - Note: as can be seen in the illustration, the production data HW version, FW version and production date, which have been programmed since 2012, can also be displayed with "Show Production Info".
  - From TwinCAT 3.1. build 4024.24 the functions *FB_EcReadBIC* and *FB_EcReadBTN* for reading into the PLC and further eBIC auxiliary functions are available in the Tc2_EtherCAT Library from v3.3.19.0.
- In the case of EtherCAT devices with CoE directory, the object 0x10E2:01 can additionally by used to display the device's own eBIC; the PLC can also simply access the information here:

- The device must be in PREOP/SAFEOP/OP for access:

Index	Name	Flags	Value
1000	Device type	RO	0x015E1389 (22942601)
1008	Device name	RO	ELM3704-0000
1009	Hardware version	RO	00
100A	Software version	RO	01
100B	Bootloader version	RO	J0.1.27.0
1011:0	Restore default parameters	RO	> 1 <
1018:0	Identity	RO	> 4 <
10E2:0	Manufacturer-specific Identification C...	RO	> 1 <
10E2:01	SubIndex 001	RO	1P158442SBTN0008jekp1KELM3704 Q1 2P482001000016
10F0:0	Backup parameter handling	RO	> 1 <
10F3:0	Diagnosis History	RO	> 21 <
10F8	Actual Time Stamp	RO	0x170bfb277e

- the object 0x10E2 will be introduced into stock products in the course of a necessary firmware revision.
- From TwinCAT 3.1. build 4024.24 the functions *FB_EcCoEReadBIC* and *FB_EcCoEReadBTN* for reading into the PLC and further eBIC auxiliary functions are available in the Tc2_EtherCAT Library from v3.3.19.0.

- Note: in the case of electronic further processing, the BTN is to be handled as a string(8); the identifier "SBTN" is not part of the BTN.
- Technical background
  The new BIC information is additionally written as a category in the ESI-EEPROM during the device production. The structure of the ESI content is largely dictated by the ETG specifications, therefore the additional vendor-specific content is stored with the help of a category according to ETG.2010. ID 03 indicates to all EtherCAT masters that they must not overwrite these data in case of an update or restore the data after an ESI update.
  The structure follows the content of the BIC, see there. This results in a memory requirement of approx. 50..200 bytes in the EEPROM.
- Special cases
  - If multiple, hierarchically arranged ESCs are installed in a device, only the top-level ESC carries the eBIC Information.
  - If multiple, non-hierarchically arranged ESCs are installed in a device, all ESCs carry the eBIC Information.
  - If the device consists of several sub-devices with their own identity, but only the top-level device is accessible via EtherCAT, the eBIC of the top-level device is located in the CoE object directory 0x10E2:01 and the eBICs of the sub-devices follow in 0x10E2:nn.

Profibus/Profinet/DeviceNet... Devices

Currently, no electronic storage and readout is planned for these devices.

6.4 Support and Service

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

Beckhoff's branch offices and representatives

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

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

You will also find further documentation for Beckhoff components there.

Beckhoff Support

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

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

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Beckhoff Service

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

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

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