BECKHOFF New Automation Technology

Documentation | EN

EL32xx

EtherCAT Terminals, analog input, temperature, RTD (Pt100, Pt1000,...), 16 bit

2026-09-11 | Version: 8.0.0

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1 Overview Analog Input Terminals Pt100 (RTD)

EL3201 [▶ 12]	1 Channel Input Terminals Pt100 (RTD)
EL3201-0010/0020/0030 [▶ 16]	1 Channel Input Terminals Pt100 (RTD), high precision / with certificate
EL3202 [▶ 20]	2 Channel Input Terminals Pt100 (RTD)
EL3202-0010/0020/0030 [▶ 24]	2 Channel Input Terminals Pt100 (RTD), high precision / with certificate
EL3204 [▶ 28]	4 Channel Input Terminals Pt100 (RTD)
EL3204-0200 [▶ 32]	4 Channel Input Terminal for RTD up to 240 kΩ, NTC 20 k, 16 bit
EL3214 [▶ 44]	4 Channel HD Input Terminal Pt100 for 3-wire connection
EL3214-0090 [▶ 48]	4 Channel HD Input Terminal Pt100, 3-wire connection, TwinSAFE Single Channel
EL3208 [▶ 36]	8 Channel HD Input Terminal Pt100 (RTD)
EL3208-0010 [▶ 40]	8 Channel HD input terminal PT1000, Ni1000 (RTD); NTC sensors, potentiometer
EL3218 [▶ 52]	8 Channel analog HD input terminal for Pt100 (RTD) 2/3-wire connection

2 Foreword

2.1 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.
The qualified personnel is obliged to always use the currently valid documentation.

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

Disclaimer

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

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

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

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2.2 Guide through documentation

NOTICE

Further components of documentation

This documentation describes device-specific content. It is part of the modular documentation concept for Beckhoff I/O components. For the use and safe operation of the devices described in this documentation, additional cross-product descriptions are required, which can be found in the following table.

Title	Description
EtherCAT System Documentation (PDF)	• System overview • EtherCAT basics • Cable redundancy • Hot Connect • EtherCAT devices configuration
I/O Analog Manual (PDF)	Notes on I/O components with analog in and outputs
Application guide TwinSAFE (PDF)	Examples for the calculation of safety parameters for safety functions
Explosion Protection for Terminal Systems (PDF)	Notes on the use of the Beckhoff terminal systems in hazardous areas according to ATEX and IECEx
Control Drawing I/O, CX, CPX (PDF)	Connection diagrams and Ex markings (conform to cFMus)
Infrastructure for EtherCAT/Ethernet (PDF)	Technical recommendations and notes for design, implementation and testing
Software Declarations I/O (PDF)	Open source software declarations for Beckhoff I/O components

The documentations can be viewed at and downloaded from the Beckhoff website (www.beckhoff.com) via:

- the “Documentation and Download” area of the respective product page,
- the Download finder,
- the Beckhoff Information System.

If you have any suggestions or proposals for our documentation, please send us an e-mail stating the documentation title and version number to: documentation@beckhoff.com

2.3 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.

Signal words

The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER
Hazard with high risk of death or serious injury.

⚠ WARNING
Hazard with medium risk of death or serious injury.

⚠ CAUTION
There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE
The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

2.4 Documentation issue status

Version	Comment
8.0.0	• Update chapter "Technical data" • Update chapter "Commissioning” • Update revision status • Structural update
7.5.0	• Update chapter "Technical data" • Update chapter "Commissioning” • Update revision status • Structural update
7.4.0	• Update chapter "Technical data" • Structural update
7.3.0	• Update chapter "Technical data" • Structural update
7.2.0	• Structural update
7.1	• Update chapter "Commissioning” • Structural update
7.0	• Update chapter "Commissioning” • Structural update
0.1 - 6.9	*archived*

3 Product description

3.1 EL3201

3.1.1 Introduction

1-channel analog input, temperature, RTD (Pt100), 16 bit

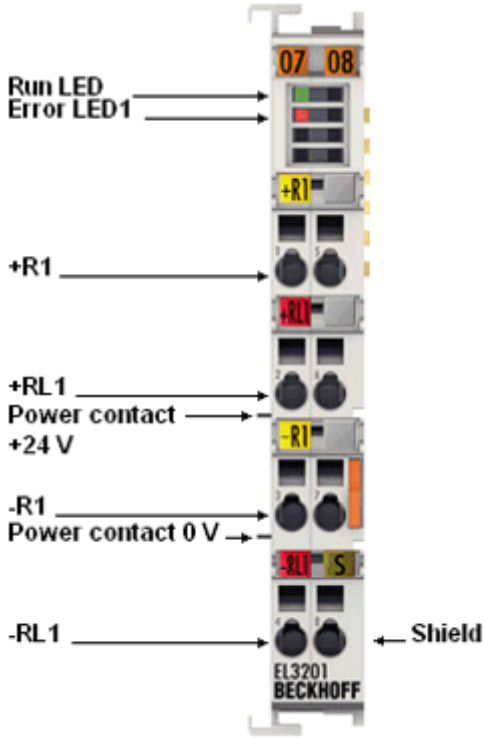


Fig. 1: EL3201

The analog input terminal EL3201 allows the direct connection of one resistance sensor.

The measured resistance value can either be output directly in ohm or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3201 can operate sensors in 3- and 4-wire technology, for 2-wire connection an external bridge is necessary.

The EtherCAT Terminals indicate their measuring capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 13]
- Pin assignment, display and diagnosis [▶ 14]
- Object description EL3201 [▶ 127]

3.1.2 Technical data

Technical data	EL3201
Number of inputs	1
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY from firmware 06 [▶ 219] resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e.g. for potentiometer connection)
Connection technology	2-, 3-, 4-wire
Temperature range	Range-dependent: -200...+850°C (Pt sensors); -60...+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Simultaneous
Ground reference	Single-ended
Conversion time	Approx. 4... 500 ms (configurable), depending on configuration and filter setting approx. 24 ms, preset
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Support NoCoEStorage	Yes
Measuring error	for Pt sensors: < ±0.5°C at ambient temperature 0°C... +55°C < ±1.5°C in extended temperature range
Width in the process image	Max. 4 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 190 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA, CCC ATEX [▶ 70], IECEx [▶ 71], cULus [▶ 74]

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

3.1.3 Pin assignment, display and diagnosis

EL3201

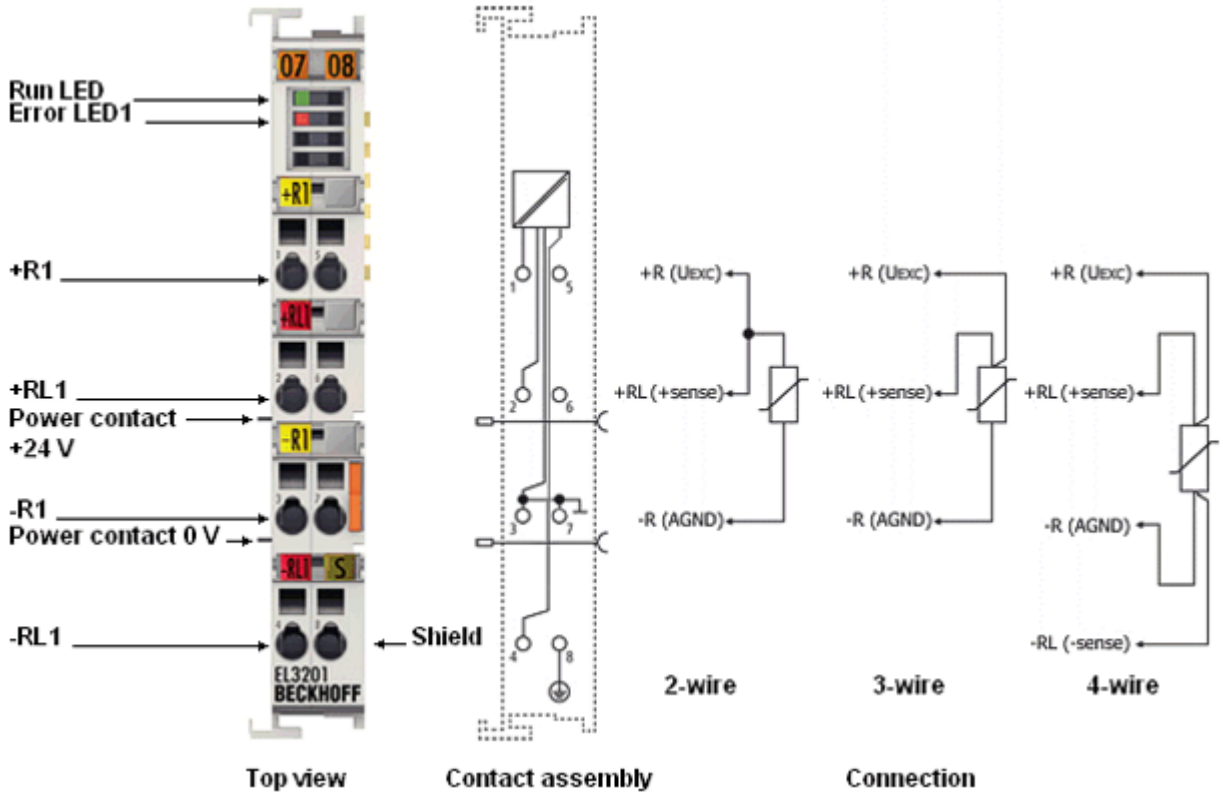


Fig. 2: EL3201 pin assignment

Two-wire connection EL3201

If the EL3201 is operated with a two-wire connection, the inputs +R and +RL must be bridged by the user.

EL3201 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+RL1	2	Input +RL1, de-energized sense line
-R1	3	Input -R1, current-carrying
-RL1	4	Input -RL1, de-energized sense line
n. c.	5	not used
n. c.	6	not used
-R1	7	Input -R1, current-carrying
Shield	8	Shield

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3201 - LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT state machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates of the terminal
		flashing	State of the EtherCAT state machine: **PREOP** = function for mailbox communication and different standard-settings set
		Single flash	State of the EtherCAT state machine: **SAFEOP** = verification of the sync manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT state machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1	red	Short circuit or wire breakage. The resistance is in the invalid range of the characteristic curve	

3.2 EL3201-0010, EL3201-0020, EL3201-0030

3.2.1 Introduction

1-channel analog input, temperature, RTD (Pt100), 16 bit, high-precision

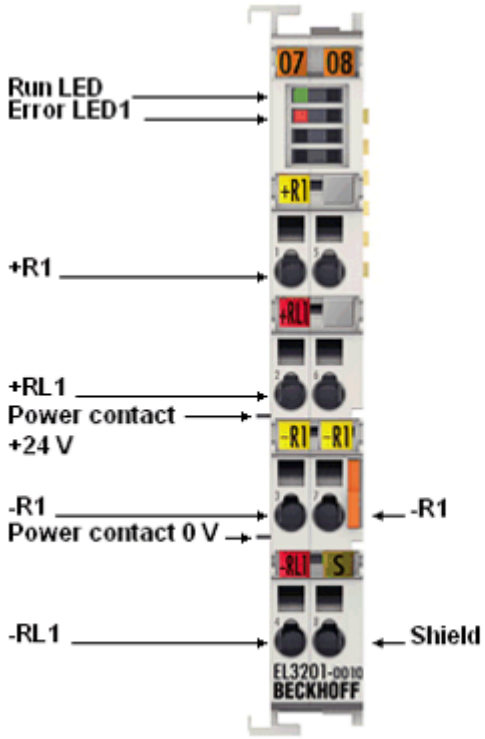


Fig. 3: EL3201-0010/0020/0030

The EL3201-0010 is the high precision version of the EL3201.

The analog input terminal EL3201-0010 allows the direct connection of a resistance sensor.

The measured resistance value can either be output directly in ohm or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3201-00x0 can currently operate sensors in 4-wire technology, external bridges must be set for 2- and 3-wire sensors. However, the intended operation for achieving the best accuracy is the 4-wire operation.

The EtherCAT Terminals indicate their measuring capability via LEDs and status bits in the EtherCAT process image.

The EL3201-0010 is also available as a calibrated version with a factory calibration certificate [▶ 61] (EL3201-0020) or optionally with a DAkkS or ISO 17025 certificate [▶ 61] (EL3201-0030) from an accredited service provider in cooperation with Beckhoff.

Also see about this

- Technical data [▶ 17]
- Pin assignment, display and diagnosis [▶ 18]
- Object description EL3201-0010, EL3201-0020, EL3201-0030 [▶ 135]

3.2.2 Technical data

Technical data	EL3201-0010	EL3201-0020/0030
Number of inputs	1	
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY from firmware 06 [▶ 219] resistance measurement 10 Ω…1 kΩ or 10 Ω…4 kΩ (e. g. for potentiometer connection)	
Connection technology	4-wire	
Temperature range	Range-dependent: -200…+850°C (Pt sensors); -60…+250°C (Ni sensors) High-precision measurement only for Pt100 sensors, Measuring range -200…+320°C, see Note [▶ 110]!	
Resolution (default)	0.01°C per digit	
Sampling type	Simultaneous	
Ground reference	Single-ended	
Conversion time	Approx. 4…500 ms (configurable), depending on configuration and filter setting approx. 24 ms, preset	
ADC conversion method	ΔΣ (Delta-Sigma)	
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA	
Sensor supply	Continuous current (not switched)	
Measuring error	for Pt100 sensors, 4-wire connection technology, measuring range -200 to 320°C, 50 Hz filter, according to the local mains frequency (example: EU/China: 50 Hz, North America: 60 Hz): < ±0.1°C at ambient temperature of 40°C < ±0.3°C in operating temperature range < ±1.0°C (extended temperature range, EL3201-0010) Note: other sensor cases according to CoE can be used with reduced accuracy (e. g. Pt1000, 3-wire connection etc.)	
Support NoCoEStorage	Yes	
Width in the process image	Max. 4 bytes input	
Power supply for the electronics	via the E-bus	
Current consumption via E-bus	typ. 190 mA	
Electrical isolation	500 V (E-bus/field voltage)	
Configuration	via TwinCAT System Manager	
Weight	Approx. 60 g	
Permissible ambient temperature range during operation	-25°C…+60°C	
Permissible ambient temperature range during storage	-40°C…+85°C	
Permissible relative air humidity	95%, no condensation	
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)	
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715	
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27	
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4	
Protection rating	IP20	
Installation position	Any	
Identification / approval*)	CE, EAC, UKCA, CCC ATEX [▶ 70], IECEx [▶ 71], cULus [▶ 74]	

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

Also see about this

- Installation instructions for enhanced mechanical load capacity [▶ 78]

3.2.3 Pin assignment, display and diagnosis

EL3201-00x0

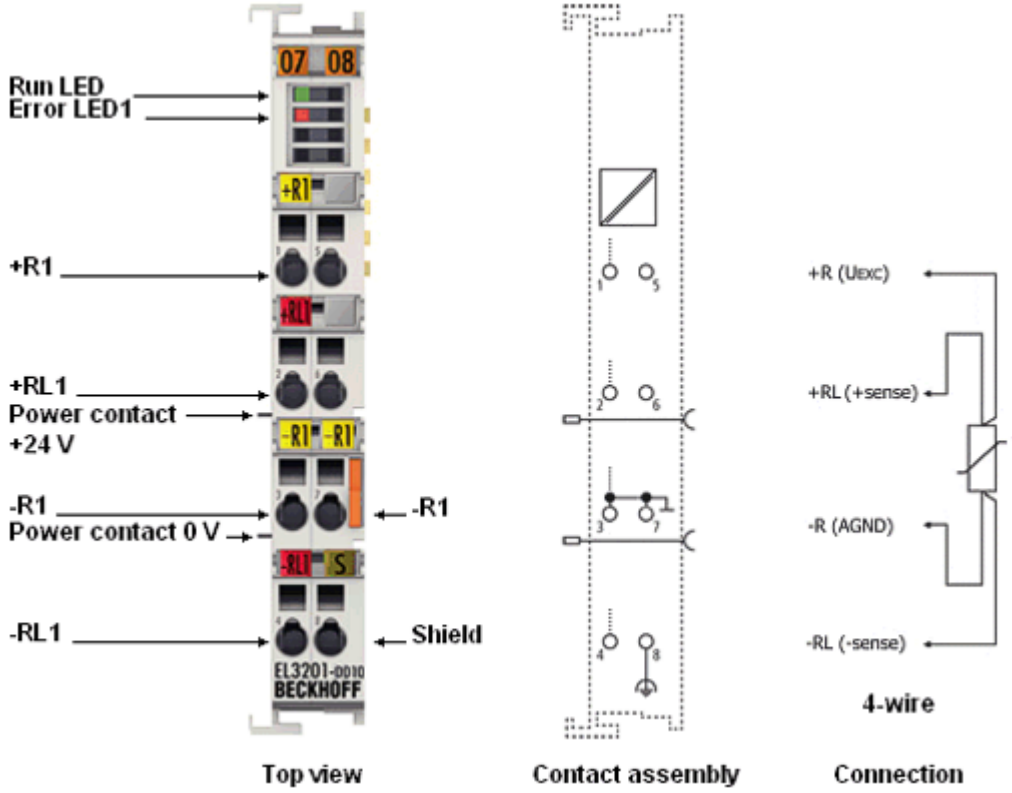


Fig. 4: EL3201-00x0 pin assignment

Four-wire connection

The EL3201-0010/0020/0030 high-precision terminals may be operated as intended only using the 4-wire connection technique!

EL3201-00x0 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+RL1	2	Input +RL1, de-energized sense line
-R1	3	Input -R1, current-carrying
-RL1	4	Input -RL1, de-energized sense line
n. c.	5	not used
n. c.	6	not used
-R1	7	Input -R1, current-carrying
Shield	8	Shield

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3201-00x0 - LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT state machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates of the terminal
		flashing	State of the EtherCAT state machine: **PREOP** = function for mailbox communication and different standard-settings set
		Single flash	State of the EtherCAT state machine: **SAFEOP** = verification of the sync manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT state machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1	red	Short circuit or wire breakage. The resistance is in the invalid range of the characteristic curve	

3.3 EL3202

3.3.1 Introduction

2-channel analog input, temperature, RTD (Pt100), 16 bit

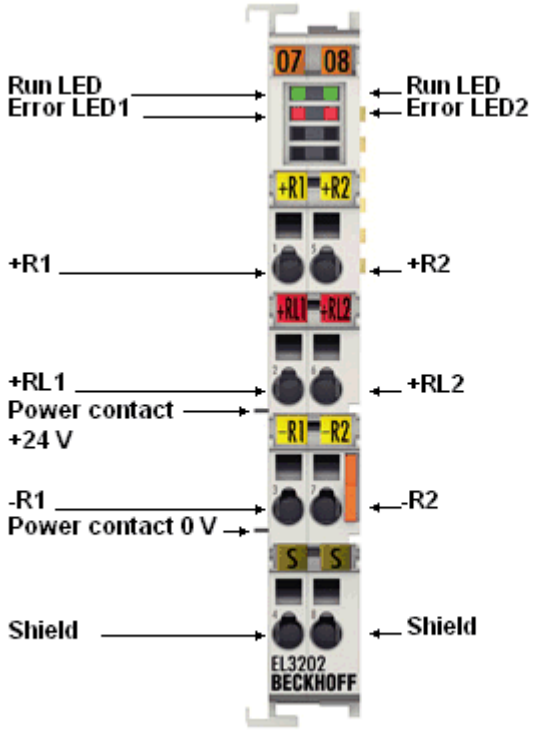


Fig. 5: EL3202

The EL3202 analog input terminal allows direct connection of two resistance sensors.

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3202 can operate sensors in 3-wire technology, for 2-wire connection an external bridge is necessary.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 21]
- Pin assignment, display and diagnosis [▶ 22]
- Object description EL3202 [▶ 143]

3.3.2 Technical data

Technical data	EL3202
Number of inputs	2
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY from firmware 06 [▶ 219] resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e. g. for potentiometer connection)
Connection technology	2-, 3-wire
Temperature range	Range-dependent: -200…+850°C (Pt sensors); -60…+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Multiplex
Ground reference	Single-ended
Conversion time	Approx. 800 ms.. 2 ms (configurable), depending on configuration and filter setting approx. 85 ms, preset
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Measuring error	for Pt sensors: < ±0.5°C at ambient temperature 0°C... +55°C < ±1.5°C in extended temperature range
Support NoCoEStorage	Yes
Width in the process image	Max. 8 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 190 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA, CCC ATEX [▶ 70], IECEx [▶ 71], cULus [▶ 74]

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

3.3.3 Pin assignment, display and diagnosis

EL3202

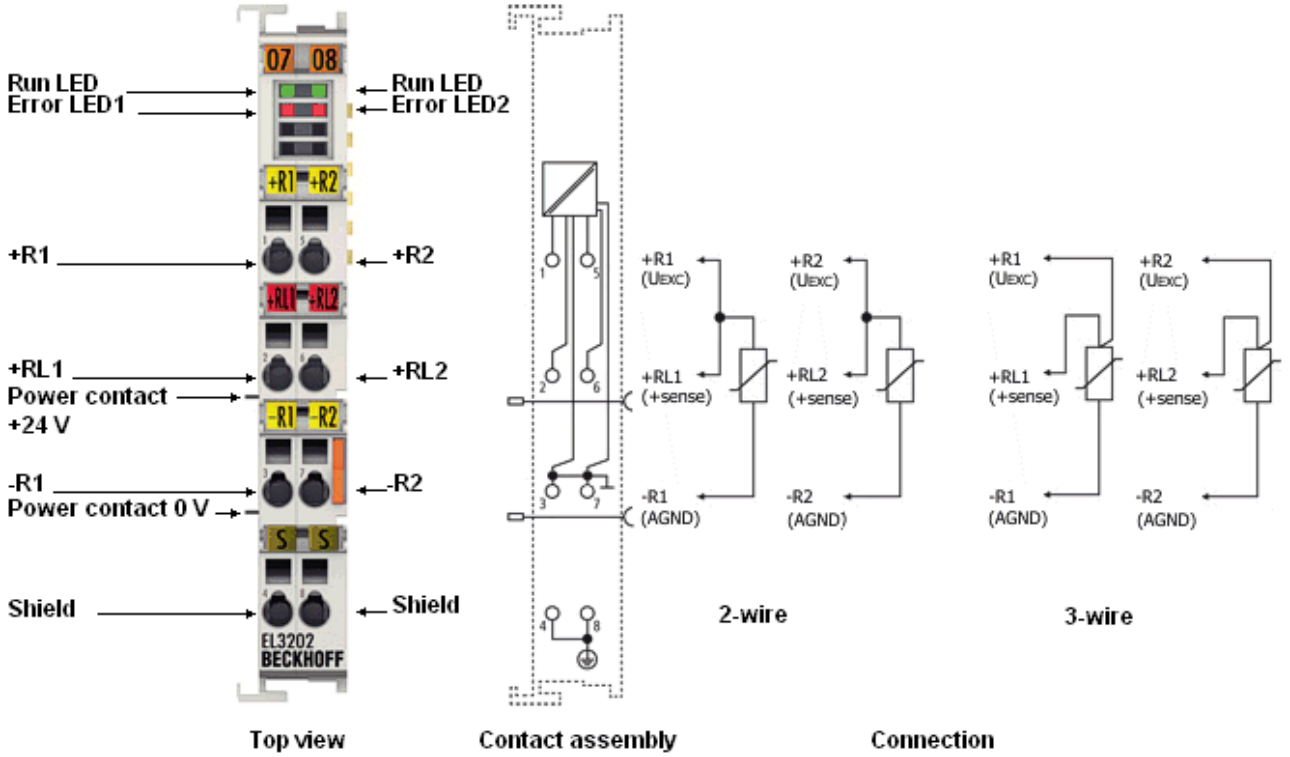


Fig. 6: EL3202 pin assignment

Two-wire connection EL3202

If the EJ3202 is operated in 2-wire connection, the +R and +RL inputs must be bridged by the user.

EL3202 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+RL1	2	Input +RL1, de-energized sense line
-R1	3	Input -R1, current-carrying
Shield	4	Shield (internally connected to terminal point 8)
+R2	5	Input +R2, current-carrying
+RL2	6	Input +RL2, de-energized sense line
-R2	7	Input -R2, current-carrying
Shield	8	Shield (internally connected to terminal point 4)

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3202 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1, ERROR2	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve	

3.4 EL3202-0010, EL3202-0020, EL3202-0030

3.4.1 Introduction

2-channel analog input, temperature, RTD (Pt100), 16 bit, high-precision

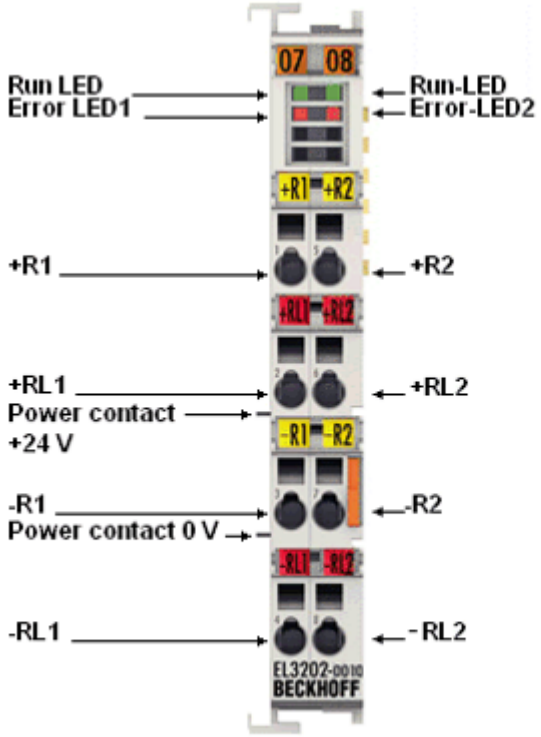


Fig. 7: EL3202-0010/0020/0030

The EL3202-0010 is the high-precision version of the EL3202.

The analog input terminal EL3202-0010 allows the direct connection of two resistance sensors.

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be performed in the terminal according to various sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types, etc.).

The EL3202-00x0 can currently operate sensors in 4-wire technology, external bridges must be set for 2- and 3-wire sensors. However, 4-wire operation is the intended mode for achieving the best accuracy.

The EtherCAT Terminals indicate their measuring capability via LEDs and status bits in the EtherCAT process image.

The EL3202-0010 is also available as a calibrated variant with a factory calibration certificate [▶ 61] (EL3202-0020) or optionally with a DAkkS or ISO 17025 certificate [▶ 61] (EL3202-0030) from an accredited service provider in cooperation with Beckhoff.

Also see about this

- Technical data [▶ 17]
- Pin assignment, display and diagnosis [▶ 18]
- Object description EL3202-0010, EL3202-0020, EL3202-0030 [▶ 151]

3.4.2 Technical data

Technical data	EL3202-0010	EL3202-0020/0030
Number of inputs	2	
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY from firmware 06 [▶ 219] resistance measurement 10 Ω…1 kΩ or 10 Ω…4 kΩ (e. g. for potentiometer connection)	
Connection technology	4-wire	
Temperature range	Range-dependent: -200…+850°C (Pt sensors) -60…+250°C (Ni sensors) High-precision measurement only for Pt100 sensors, Measuring range -200…+320°C, see Note [▶ 110]!	
Resolution (default)	0.01°C per digit	
Sampling type	Multiplex	
Ground reference	Single-ended	
Conversion time	Approx. 800 ms…2 ms (configurable), depending on configuration and filter setting approx. 85 ms, preset	
ADC conversion method	ΔΣ (Delta-Sigma)	
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA	
Sensor supply	Continuous current (not switched)	
Measuring error	for Pt100 sensors, 4-wire connection technology, measuring range -200 to 320°C, 50 Hz filter, according to the local mains frequency (example: EU/China: 50 Hz, North America: 60 Hz): < ±0.1°C at ambient temperature of 40°C < ±0.3°C in operating temperature range < ±1.0°C (extended temperature range, EL3201-0010) Note: other sensor cases according to CoE can be used with reduced accuracy (e. g. Pt1000, 3-wire connection etc.)	
Support NoCoEStorage	Yes	
Width in the process image	Max. 8 bytes input	
Power supply for the electronics	via the E-bus	
Current consumption via E-bus	typ. 190 mA	
Electrical isolation	500 V (E-bus/field voltage)	
Configuration	via TwinCAT System Manager	
Weight	Approx. 60 g	
Permissible ambient temperature range during operation	-25°C…+60°C	
Permissible ambient temperature range during storage	-40°C…+85°C	
Permissible relative air humidity	95%, no condensation	
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)	
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715	
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27	
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4	
Protection rating	IP20	
Installation position	Any	
Identification / approval*)	CE, EAC, UKCA, CCC ATEX [▶ 70], IECEx [▶ 71], cULus [▶ 74]	

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

3.4.3 Pin assignment, display and diagnosis

EL3202-00x0

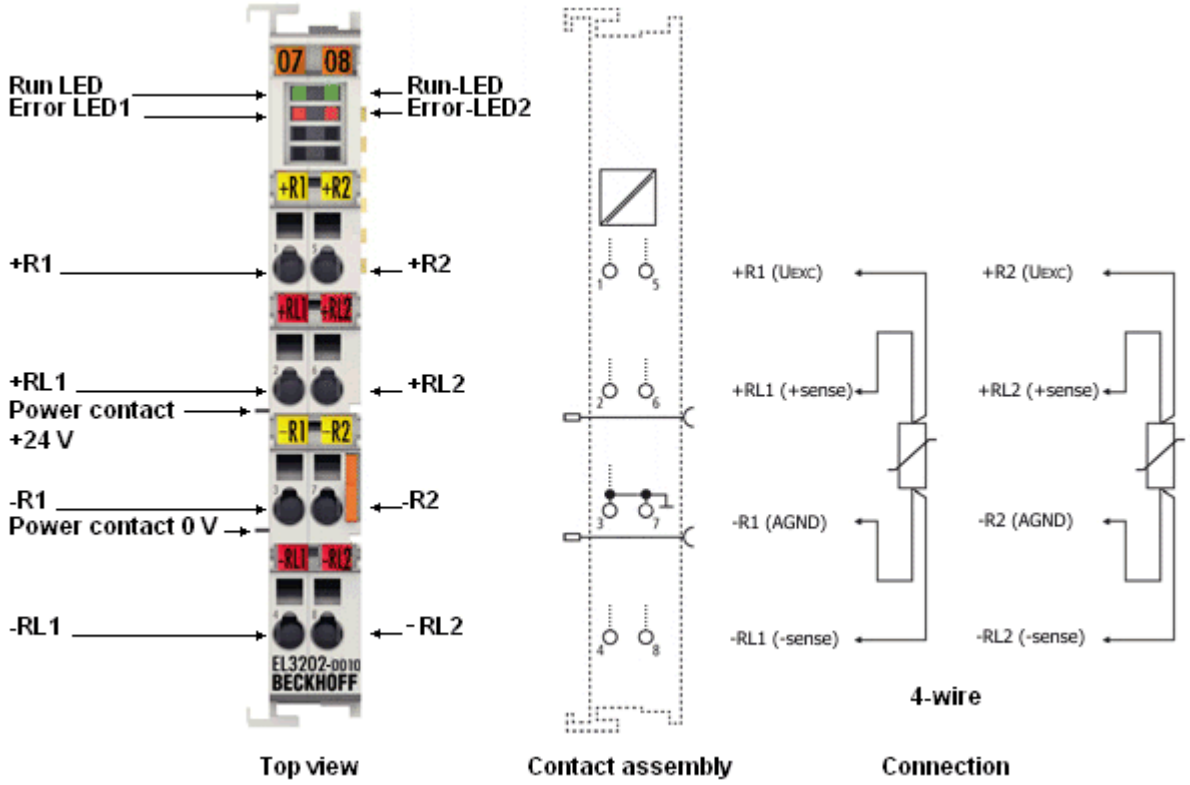


Fig. 8: EL3202-0010/0020/0030 pin assignment

Four-wire connection

The EL3202-0010/0020/0030 high-precision terminals may be operated as intended only using the 4-wire connection technique!

EL3202-00x0 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+RL1	2	Input +RL1, de-energized sense line
-R1	3	Input -R1, current-carrying
-RL1	4	Input -RL1, de-energized sense line
+R2	5	Input +R2, current-carrying
+RL2	6	Input +RL2, de-energized sense line
-R2	7	Input -R2, current-carrying
-RL2	8	Input -RL2, de-energized sense line

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3202-00x0 - LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT state machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates of the terminal
		flashing	State of the EtherCAT state machine: **PREOP** = function for mailbox communication and different standard-settings set
		Single flash	State of the EtherCAT state machine: **SAFEOP** = verification of the sync manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT state machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1, ERROR2	red	Short circuit or wire breakage. The resistance is in the invalid range of the characteristic curve	

3.5 EL3204

3.5.1 Introduction

4-channel analog input, temperature, RTD (Pt100), 16 bit

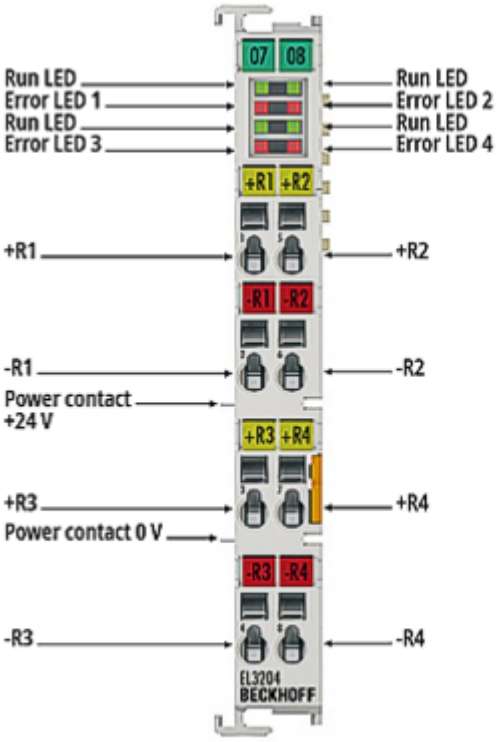


Fig. 9: EL3204

The EL3204 analog input terminal allows direct connection of four resistance sensors.

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be performed in the terminal according to various sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types, etc.).

The EL3204 can operate sensors in 2-wire technology.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 29]
- Pin assignment, display and diagnosis [▶ 30]
- Object description EL3204 [▶ 159]

3.5.2 Technical data

Technical data	EL3204
Number of inputs	4
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY from firmware 06 [▶ 219] resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e.g. for potentiometer connection)
Connection technology	2-wire
Temperature range	Range-dependent: -200...+850°C (Pt sensors); -60...+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Multiplex
Ground reference	Single-ended
Conversion time	Approx. 800 ms.. 2 ms (configurable), depending on configuration and filter setting approx. 85 ms, preset
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Measuring error	< ±0.5°C for Pt sensors < ±1.5°C (extended temperature range)
Support NoCoEStorage	Yes
Width in the process image	Max. 16 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 190 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA, CCC ATEX [▶ 70], IECEx [▶ 71], cFMus [▶ 72], cULus [▶ 74]

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc
cFMus	Class I, Division 2, Groups A, B, C, D Class I, Zone 2, AEx/Ex ec IIC T4 Gc

3.5.3 Pin assignment, display and diagnosis

EL3204

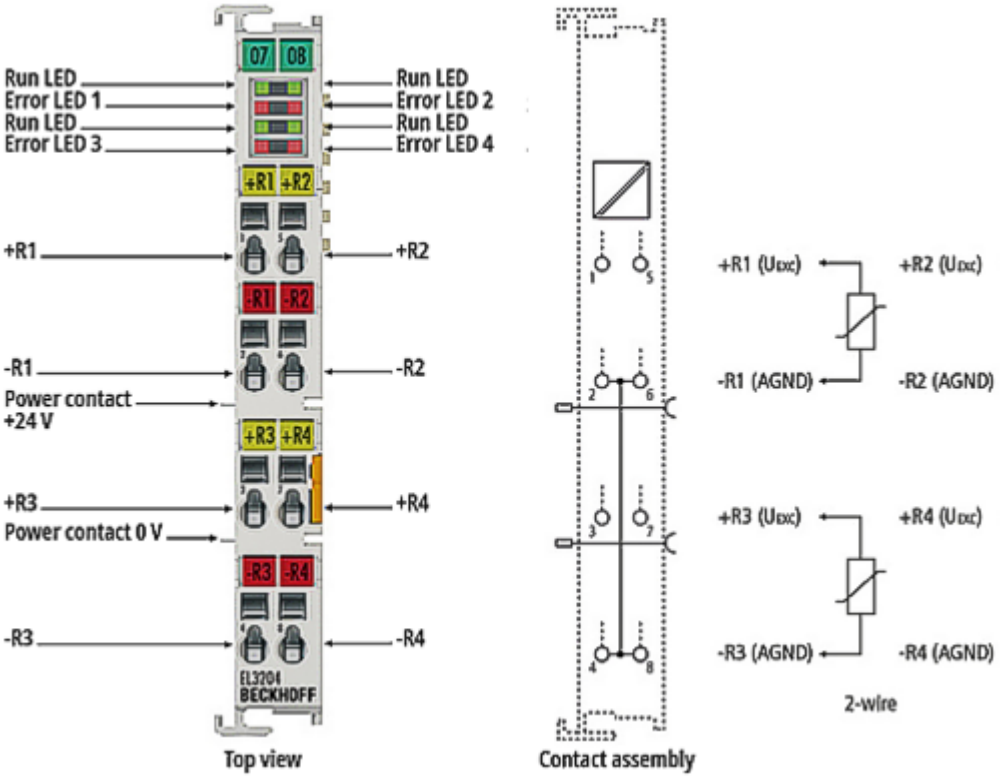


Fig. 10: EL3204 pin assignment

EL3204 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
-R1	2	Input -R1, current-carrying
+R3	3	Input +R3, current-carrying
-R3	4	Input -R3, current-carrying
+R2	5	Input +R2, current-carrying
-R2	6	Input -R2, current-carrying
+R4	7	Input +R4, current-carrying
-R4	8	Input -R4, current-carrying

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3204 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 4	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve.	

3.6 EL3204-0200

3.6.1 Introduction

4-channel analog input, temperature, RTD/NTC, 16 bit

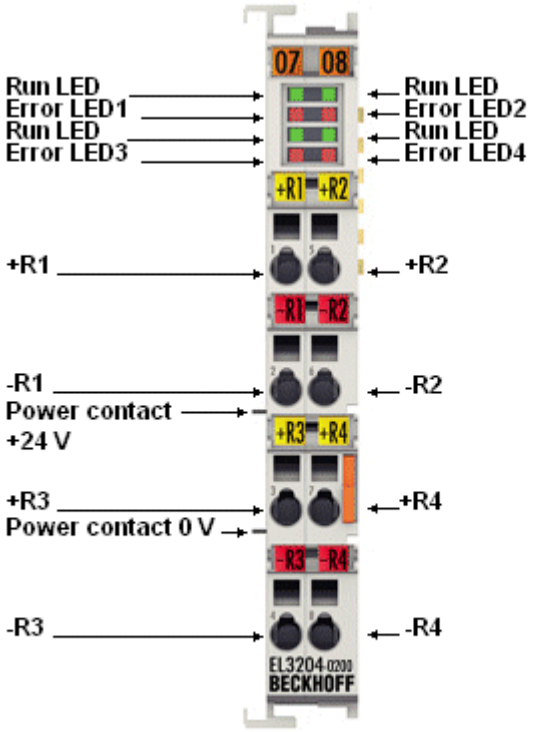


Fig. 11: EL3204-0200

The EL3204-0200 analog input terminal allows the direct connection of four resistance sensors up to 240 kΩ in the 2-wire connection, so that a significantly increased measuring range is available compared to the EL320x-0000 and thus the use of high-resistance NTC sensors is possible.

The measured resistance value can either be output directly in ohms or immediately transformed into a temperature in the terminal. In the second case, the conversion from resistance to temperature can be performed either according to selectable characteristic curves (Pt1000, Ni1000, various NTC types), conversion formulas with specific material parameters (e.g. according to IEC 60751, Steinhart-Hart equation, B parameter equation) or according to a freely programmable conversion table.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 33]
- Pin assignment, display and diagnosis [▶ 34]
- Object description EL3204-0200 [▶ 169]

3.6.2 Technical data

Technical data	EL3204-0200
Number of inputs	4
Sensor types	any RTD within the range 0 Ω...240 kΩ
Connection technology	2-wire
Temperature range	Range-dependent
Resolution (default)	Default: 0.1°C per digit for temperature measurement
Sampling type	Multiplex
Ground reference	Differential
Conversion time	Approx. 4 ms.. 500 ms (configurable), depending on configuration and filter setting approx. 24 ms, preset
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.03 mA
Sensor supply	Continuous current (not switched)
Measuring error	< ±0.3% from measuring range end value 240 kΩ equivalent to < ±720 Ω
Support NoCoEStorage	Yes
Width in the process image	Max. 16 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 150 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA, CCC DNV, ATEX [▶ 70], IECEx [▶ 71], cULus [▶ 74]

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

3.6.3 Pin assignment, display and diagnosis

EL3204-0200

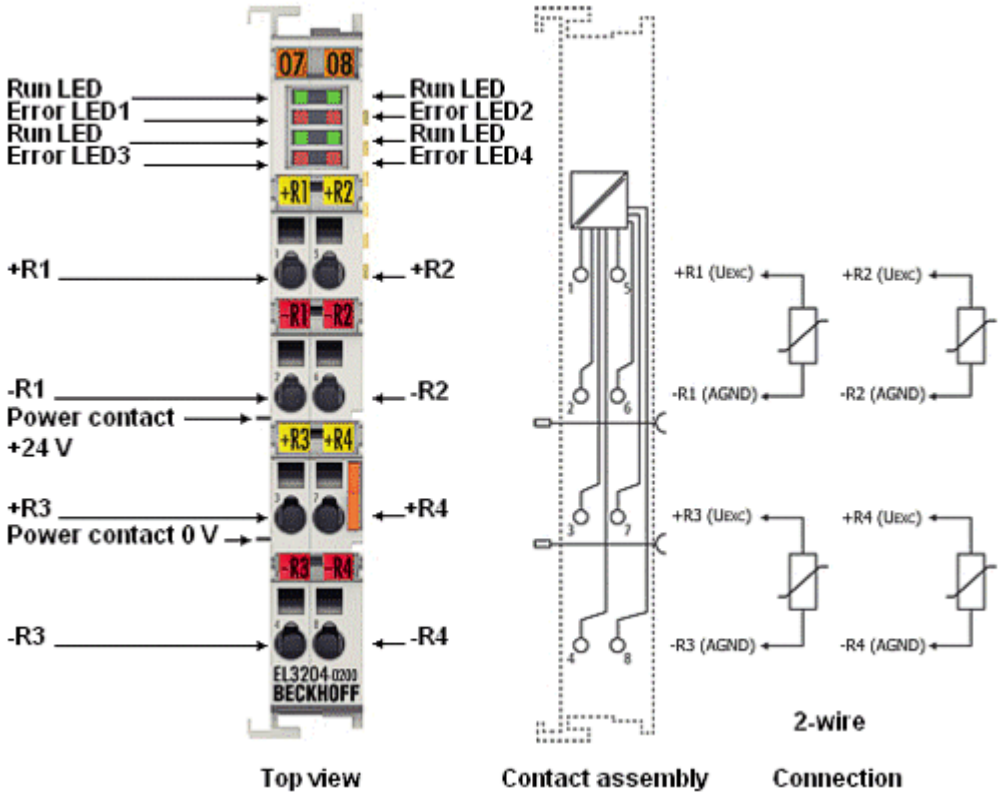


Fig. 12: EL3204-0200 pin assignment

EL3204-0200 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
-R1	2	Input -R1, current-carrying
+R3	3	Input +R3, current-carrying
-R3	4	Input -R3, current-carrying
+R2	5	Input +R2, current-carrying
-R2	6	Input -R2, current-carrying
+R4	7	Input +R4, current-carrying
-R4	8	Input -R4, current-carrying

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3204-0200 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 4	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve.	

3.7 EL3208

3.7.1 Introduction

8-channel analog input, temperature, RTD (Pt100), 16 bit

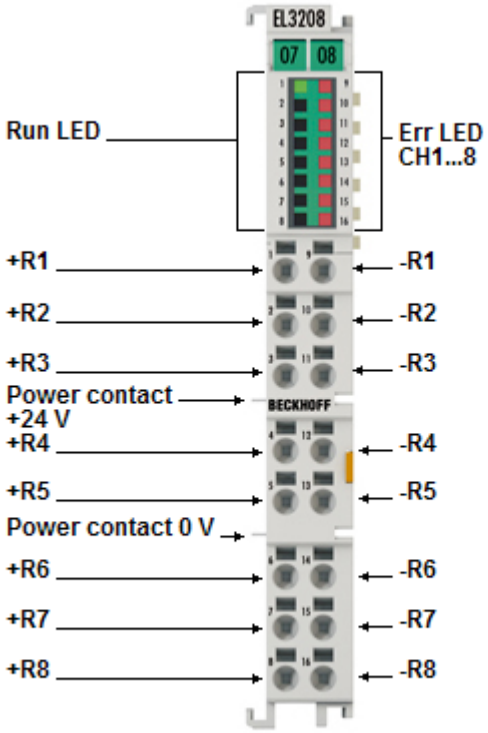


Fig. 13: EL3208

The analog input terminal EL3208 allows the direct connection of eight resistance sensors on 12 mm width (high density housing).

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3208 can operate sensors in 2-wire technology.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 37]
- Pin assignment, display and diagnosis [▶ 38]
- Object description EL3208 [▶ 178]

3.7.2 Technical data

Technical data	EL3208
Number of inputs	8
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY, resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e.g. for potentiometer connection)
Connection technology	2-wire
Input filter limit range	typ. 1 kHz
Measuring range	-200…+850°C (PT sensors); -60…+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Multiplex
Ground reference	Single-ended
Conversion time	Approx. 3 ms.. 1600 ms (configurable), depending on configuration and filter setting
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Measuring error	< ±0.5°C for Pt sensors < ±1.5°C (extended temperature range)
Support NoCoEStorage	Yes
Width in the process image	Max. 32 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 140 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA cULus [▶ 74]

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

3.7.3 Pin assignment, display and diagnosis

EL3208

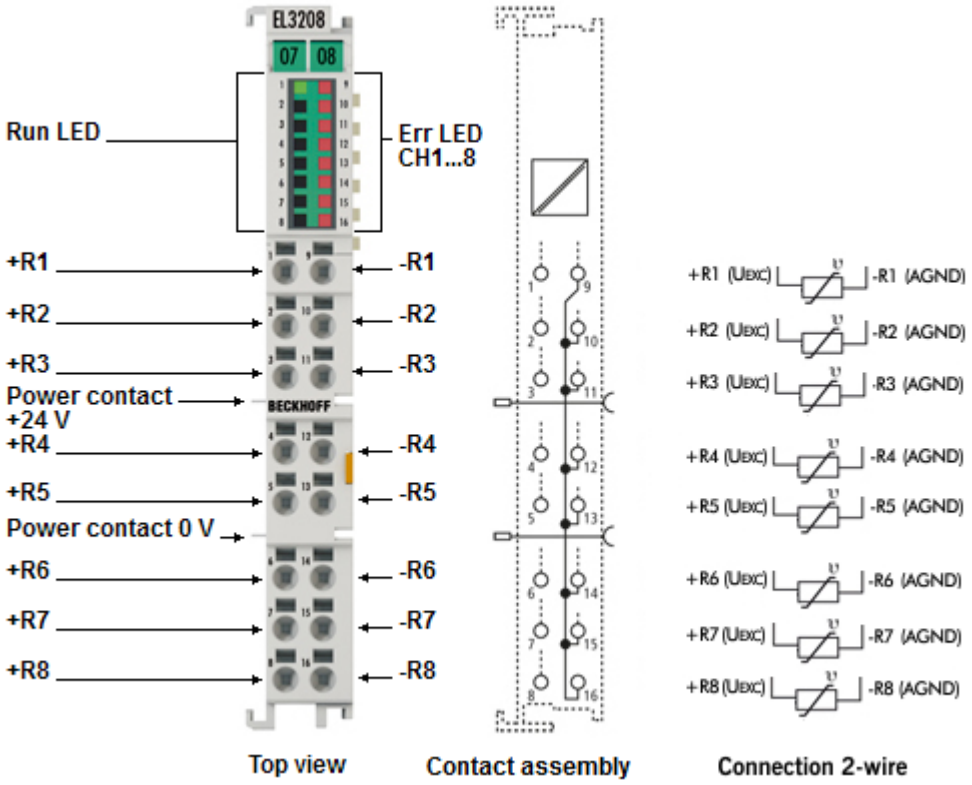


Fig. 14: EL3208 pin assignment

EL3208 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+R2	2	Input +R2, current-carrying
+R3	3	Input +R3, current-carrying
+R4	4	Input +R4, current-carrying
+R5	5	Input -R5, current-carrying
+R6	6	Input +R6, current-carrying
+R7	7	Input +R7, current-carrying
+R8	8	Input +R8, current-carrying
-R1	9	Input -R1, current-carrying
-R2	10	Input -R2, current-carrying
-R3	11	Input -R3, current-carrying
-R4	12	Input -R4, current-carrying
-R5	13	Input -R5, current-carrying
-R6	14	Input -R6, current-carrying
-R7	15	Input -R7, current-carrying
-R8	16	Input -R8, current-carrying

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3208 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 8	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve.	

3.8 EL3208-0010

3.8.1 Introduction

8-channel analog input, temperature, RTD (Pt1000, NTC), 16 bit

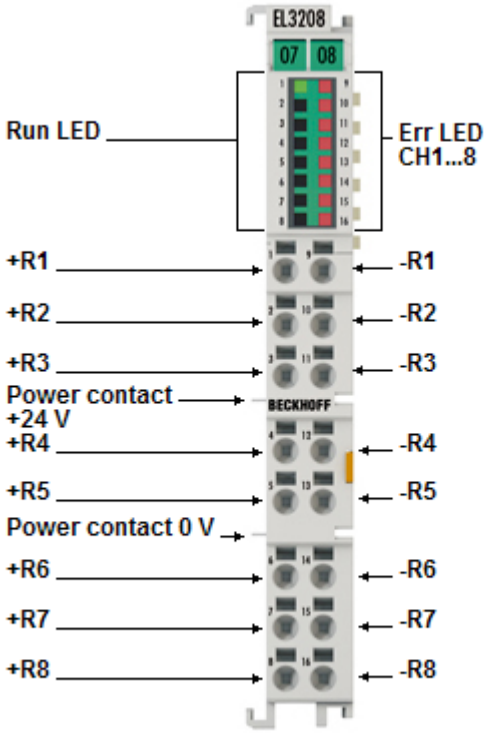


Fig. 15: EL3208-0010

The analog input terminal EL3208-0010 allows the direct connection of eight resistance sensors on 12 mm width (high density housing).

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt1000, Ni1000, NTC and others).

The EL3208-0010 can operate sensors in 2-wire technology.

The EtherCAT Terminals indicate their measuring capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 41]
- Pin assignment, display and diagnosis [▶ 42]
- Object description EL3208-0010 [▶ 185]

3.8.2 Technical data

Technical data	EL3208-0010
Number of inputs	8
Connection technology	2-wire
Sensor types	Pt1000 (default), Ni1000, NTC 1.8k / 2.2k / 3k / 5k / 10k / 20k / 100k: typ. -50...+150°C (sensor dependent) Resistance measurement (poti) 0 ... 4 / 6.5 / 65 / 655 / 1310 kΩ
Input filter limit range	typ. 1 kHz
Resolution (default)	RTD: 0.01°C for Digit R: 0.0625 / 0.1 / 1 / 10 / 20 Ω for Digit
Sampling type	multiplex
Ground reference	Single-ended
Conversion time	approx. 1 s (configurable), depending on configuration and filter setting
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	multiplex (switched in sequence)
Measuring error / uncertainty	with Pt/Ni sensors and 25°C ambient temperature: -50 ... -20°C: ±1.5°C -20 ... +60°C: ±0.25°C (corresponding to 921 ... 1232 Ω: ±0.975 Ω) +60 ... +150°C: ±1.5°C
Support NoCoEStorage	yes
Width in the process image	max. 32 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 95 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	approx. 60 g
Permissible ambient temperature range during operation	-25°C ... +60°C
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	on 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	any
Identification / approval*)	CE, EAC, UKCA cULus [▶ 74]

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

Ex markings

Standard	Marking
ATEX	II 3 G Ex ec IIC T4 Gc
IECEx	Ex ec IIC T4 Gc

3.8.3 Pin assignment, display and diagnosis

EL3208-0010

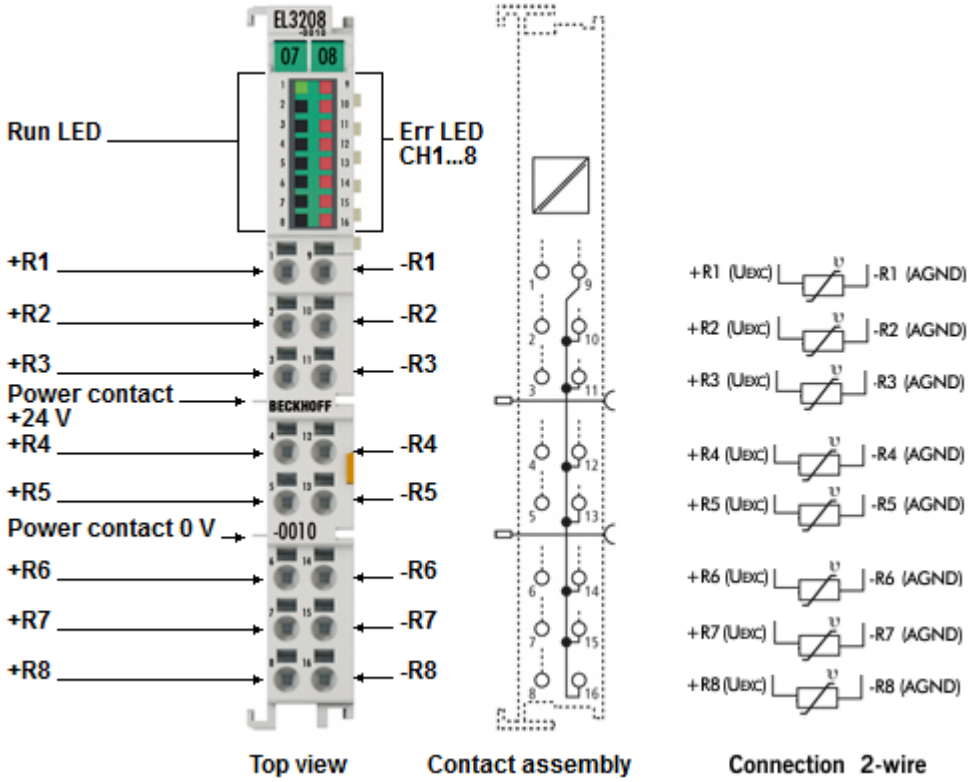


Fig. 16: EL3208-0010 pin assignment

EL3208-0010 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
+R2	2	Input +R2, current-carrying
+R3	3	Input +R3, current-carrying
+R4	4	Input +R4, current-carrying
+R5	5	Input -R5, current-carrying
+R6	6	Input +R6, current-carrying
+R7	7	Input +R7, current-carrying
+R8	8	Input +R8, current-carrying
-R1	9	Input -R1, current-carrying
-R2	10	Input -R2, current-carrying
-R3	11	Input -R3, current-carrying
-R4	12	Input -R4, current-carrying
-R5	13	Input -R5, current-carrying
-R6	14	Input -R6, current-carrying
-R7	15	Input -R7, current-carrying
-R8	16	Input -R8, current-carrying

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3208-0010 - LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT state machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates of the terminal
		flashing	State of the EtherCAT state machine: **PREOP** = function for mailbox communication and different standard-settings set
		Single flash	State of the EtherCAT state machine: **SAFEOP** = verification of the sync manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT state machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 8	red	Short circuit or wire breakage. The resistance is in the invalid range of the characteristic curve.	

3.9 EL3214

3.9.1 Introduction

4-channel analog input, temperature, RTD (Pt100), 16 bit, 3-wire connection

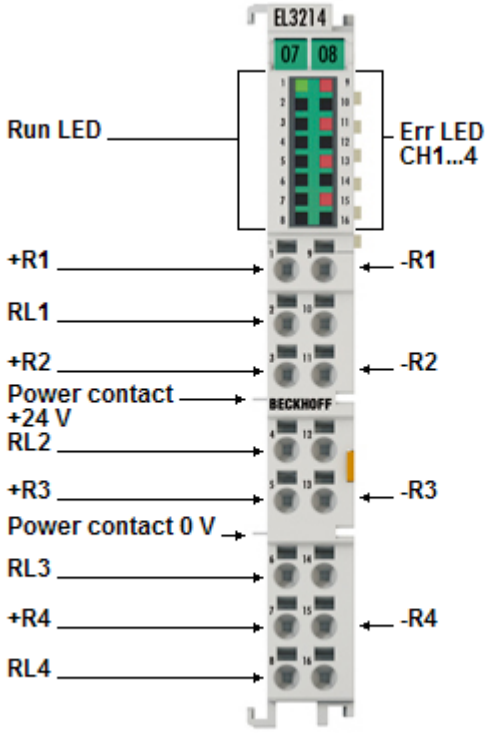


Fig. 17: EL3214

The analog input terminal EL3214 allows the direct connection of four resistance sensors in 3-wire technology on 12 mm width (high density housing).

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3214 can operate sensors in 2- and 3-wire technology.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 45]
- Pin assignment, display and diagnosis [▶ 46]
- Object description EL3214 [▶ 194]

3.9.2 Technical data

Technical data	EL3214
Number of inputs	4
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY, resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e.g. for potentiometer connection)
Connection technology	3-wire
Temperature range	Range-dependent: -200...+850°C (Pt sensors); -60...+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Multiplex
Ground reference	Differential
Conversion time	Approx. 5 ms .. 1600 ms (configurable), depending on configuration and filter setting
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Measuring error	< ±0.5°C for Pt sensors, 4 x 3-wire connection < ±1.5°C (extended temperature range)
Support NoCoEStorage	Yes
Width in the process image	Max. 16 bytes input
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 140 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA DNV, cULus [▶ 74]

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

3.9.3 Pin assignment, display and diagnosis

EL3214

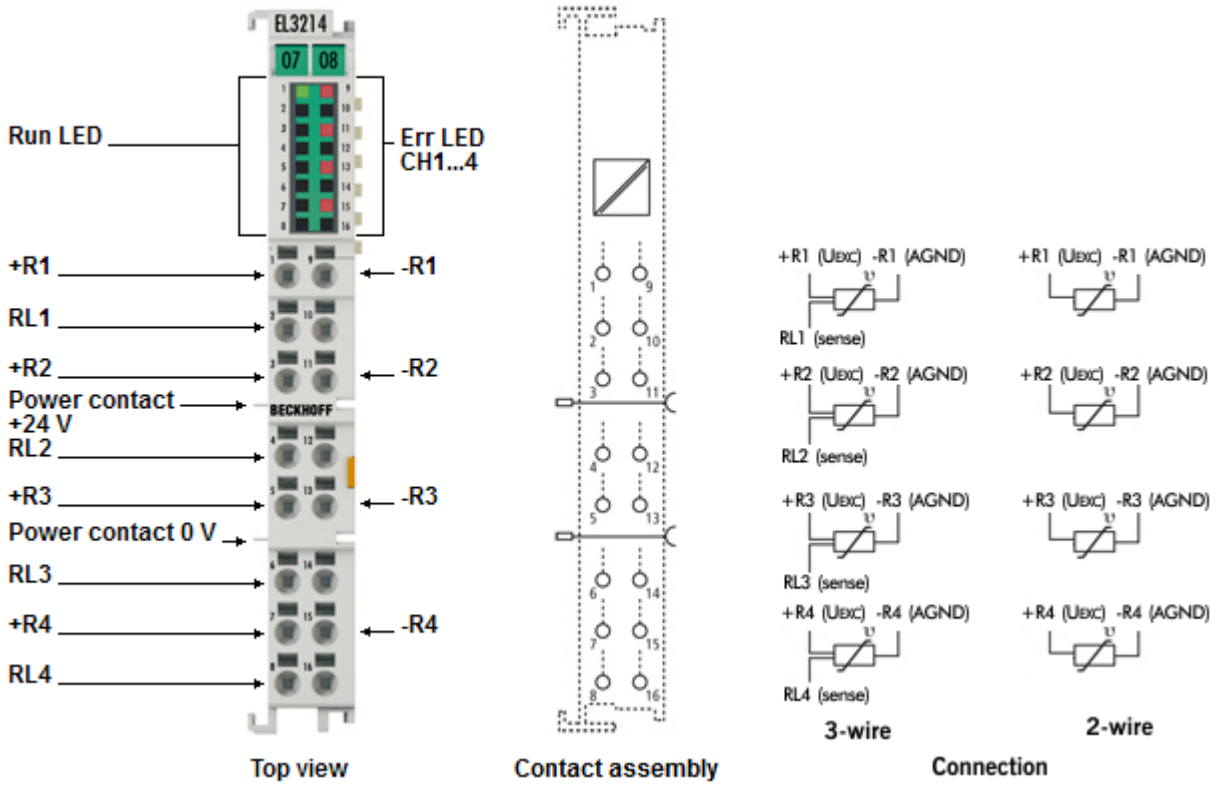


Fig. 18: EL3214 pin assignment

EL3214 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
RL1	2	Input RL1, de-energized sense line
+R2	3	Input +R2, current-carrying
RL2	4	Input RL2, de-energized sense line
+R3	5	Input +R3, current-carrying
RL3	6	Input RL3, de-energized sense line
+R4	7	Input +R4, current-carrying
RL4	8	Input RL4, de-energized sense line
-R1	9	Input -R1, current-carrying
n. c.	10	not used
-R2	11	Input -R2, current-carrying
n. c.	12	not used
-R3	13	Input -R3, current-carrying
n. c.	14	not used
-R4	15	Input -R4, current-carrying
n. c.	16	not used

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3214 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 4	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve.	

3.10 EL3214-0090

3.10.1 Introduction

4-channel analog input, temperature, RTD (Pt100), 16 bit, 3-wire connection, TwinSAFE SC

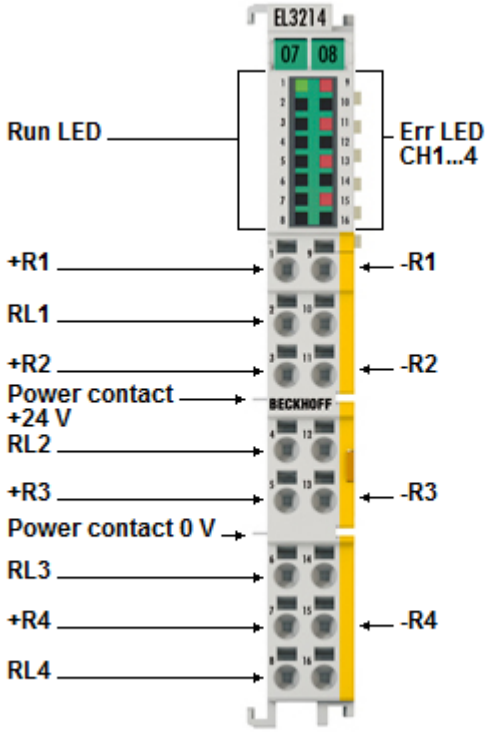


Fig. 19: EL3214-0090

The EL3214-0090 is the TwinSAFE-SC [▶ 121] version of the EL3214.

The EL3214-0090 analog input terminal allows direct connection of four resistance sensors.

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3214-0090 can operate sensors in 2- and 3-wire technology.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

The EL3214-0090 supports TwinSAFE single channel technology. With the aid of the TwinSAFE SC technology (TwinSAFE Single Channel) it is possible to make use of standard signals for safety tasks in any network or fieldbus. To do this, EtherCAT I/Os from the areas of analog input, position measurement or communication (4…20 mA, incremental encoder, IO-Link, etc.) are extended by the TwinSAFE SC function. The properties typical for the signals and the standard functions of the I/O components are retained. TwinSAFE SC I/Os differ optically from standard I/Os by a yellow stripe on the front of the housing.

The TwinSAFE SC technology enables communication via a TwinSAFE protocol. These connections can be distinguished from the usual secure communication via Safety over EtherCAT.

The data from the TwinSAFE SC components is fed via a TwinSAFE protocol to the TwinSAFE Logic, where it can be used in the context of safety-relevant applications. Detailed examples confirmed/calculated by the TÜV SÜD for the correct application of the TwinSAFE SC components and the respective normative classifications can be found in the TwinSAFE application manual.

Also see about this

- Technical data [▶ 49]
- Pin assignment, display and diagnosis [▶ 50]
- Object description EL3214-0090 [▶ 202]

3.10.2 Technical data

Technical data	EL3214-0090
Number of inputs	4
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000 KT/KTY, resistance measurement 10 Ω...1 kΩ or 10 Ω...4 kΩ (e.g. for potentiometer connection)
Connection technology	2-wire (from firmware 02), 3-wire
Input filter cut-off frequency	typ. 1 kHz
Temperature range	Range-dependent: -200...+850°C (Pt sensors); -60...+250°C (Ni sensors)
Resolution (default)	0.1°C per digit
Sampling type	Multiplex
Ground reference	Differential
Conversion time	Approx. 170 ms (preset)
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current (depending on the sensor element and temperature)	typ. < 0.5 mA
Sensor supply	Continuous current (not switched)
Support NoCoEStorage	Yes
Measuring error	< ±0.5°C for Pt sensors, 4 x 3-wire connection < ±1.5°C (extended temperature range)
MTBF (55°C)	> 890,000 h
Power supply for the electronics	via the E-bus
Current consumption via E-bus	typ. 140 mA
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 60 g
Permissible ambient temperature range during operation	-25°C... +60°C
Permissible ambient temperature range during storage	-40°C... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 15 mm x 100 mm x 70 mm (width aligned: 12 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Identification / approval*)	CE, EAC, UKCA cULus [▶ 74]

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

3.10.3 Pin assignment, display and diagnosis

EL3214-0090

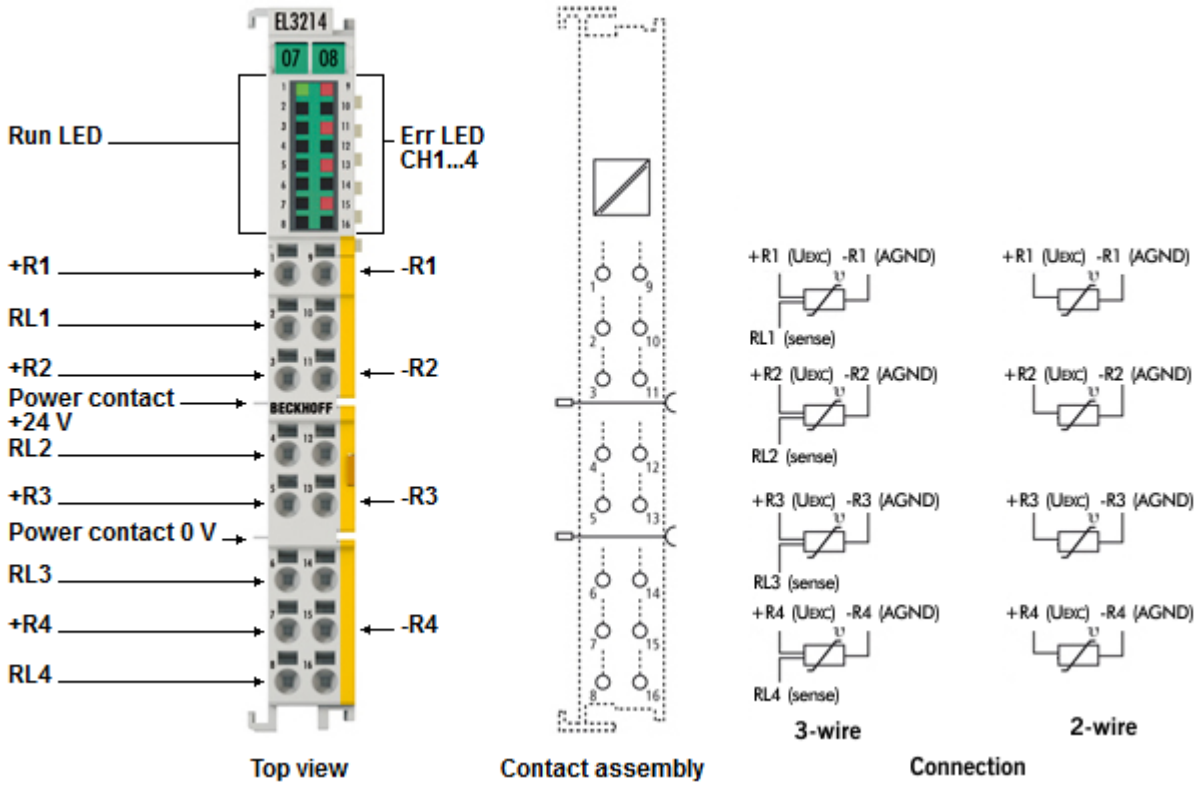


Fig. 20: EL3214-0090 pin assignment

EL3214-0090 – pin assignment

Terminal point	No.	Comment
+R1	1	Input +R1, current-carrying
RL1	2	Input RL1, de-energized sense line
+R2	3	Input +R2, current-carrying
RL2	4	Input RL2, de-energized sense line
+R3	5	Input +R3, current-carrying
RL3	6	Input RL3, de-energized sense line
+R4	7	Input +R4, current-carrying
RL4	8	Input RL4, de-energized sense line
-R1	9	Input -R1, current-carrying
n. c.	10	not used
-R2	11	Input -R2, current-carrying
n. c.	12	not used
-R3	13	Input -R3, current-carrying
n. c.	14	not used
-R4	15	Input -R4, current-carrying
n. c.	16	not used

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3214-0090 - LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT state machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for firmware updates of the terminal
		flashing	State of the EtherCAT state machine: **PREOP** = function for mailbox communication and different standard-settings set
		Single flash	State of the EtherCAT state machine: **SAFEOP** = verification of the sync manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT state machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 4	red	Short circuit or wire breakage. The resistance is in the invalid range of the characteristic curve.	

3.11 EL3218

3.11.1 Introduction

8-channel analog input, temperature, RTD (Pt100), 16 bit, 3-wire connection

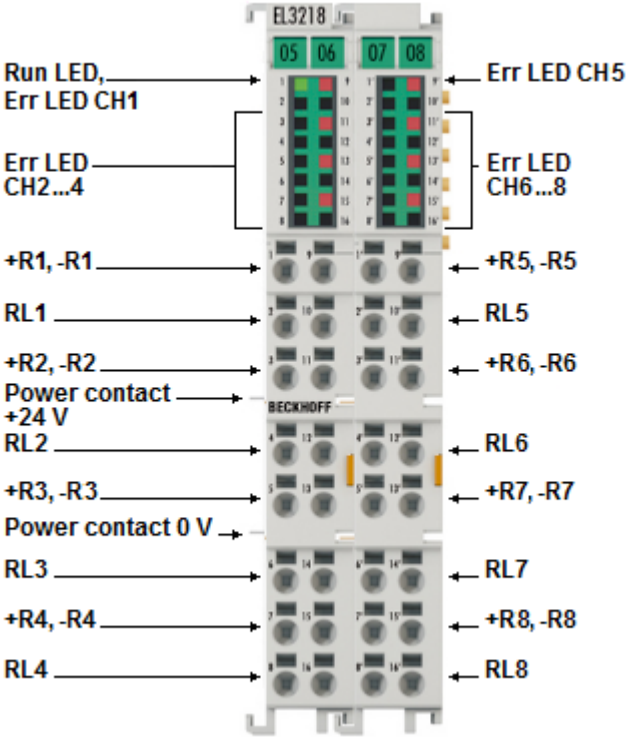


Fig. 21: EL3218

The analog input terminal EL3218 allows the direct connection of eight resistance sensors in 3-wire technology on 24 mm width (high density housing).

The measured resistance value can either be output directly in ohms or transformed into a temperature. If the temperature at the measuring point is of interest, the conversion from resistance to temperature can be done in the terminal according to different sensor characteristics (Pt100, Pt1000, Ni120, Ni1000, KTY types and others).

The EL3218 can operate sensors in 2- and 3-wire technology.

The EtherCAT Terminals indicate their measurement capability via LEDs and status bits in the EtherCAT process image.

Also see about this

- Technical data [▶ 53]
- Pin assignment, display and diagnosis [▶ 54]
- Object description EL3218 [▶ 211]

3.11.2 Technical data

Technical data	EL3218
Number of inputs	8
Connection technology	2 or 3-wire (adjustable)
Distributed clocks	-
Input filter cut-off frequency	typ. 1 kHz
Sensor types	Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000, resistance measurement (e. g. potentiometer connection, 10 Ω...1/4 kΩ), KTY sensors (types see documentation)
Measuring range/ temperature range	-200…+850°C (PT sensors); -60…+250°C (Ni sensors)
Resolution	0.1°C or 0.01°C per digit
Sampling type	Multiplex
Ground reference	Differential
Conversion time	Approx. 170 ms preset
ADC conversion method	ΔΣ (Delta-Sigma)
Measuring current	< 0.5 mA (load-dependent)
Sensor supply	Continuous current (not switched)
Support NoCoEStorage	Yes
Measuring error	< ±0.5°C with Pt sensors, 8 x 3-wire connection < ±1.5°C (extended temperature range)
Width in the process image	max. 32 bytes input
Power supply for the electronics	via the E-bus
Current consumption Power contacts	-
Current consumption via E-bus	typ. 120 mA
Special features	Integrated digital filter, limit value monitoring, variable connection technology
Electrical isolation	500 V (E-bus/field voltage)
Configuration	via TwinCAT System Manager
Weight	Approx. 95 g
Permissible ambient temperature range during operation	-25°C ... +60°C
Permissible ambient temperature range during storage	-40°C ... +85°C
Permissible relative air humidity	95%, no condensation
Dimensions (W x H x D)	Approx. 30 mm x 100 mm x 70 mm (width aligned: 24 mm)
Assembly [▶ 75]	On 35 mm mounting rail in compliance with EN 60715
Enhanced mechanical load capacity	Yes, see also Installation instructions for terminals with enhanced mechanical load capacity [▶ 78]
Vibration / shock resistance	In accordance with EN 60068-2-6 / EN 60068-2-27
EMC immunity / emission	In accordance with EN 61000-6-2 / EN 61000-6-4
Protection rating	IP20
Installation position	Any
Marking/Approval*)	CE, EAC, UKCA cULus [▶ 74]

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

3.11.3 Pin assignment, display and diagnosis

EL3218

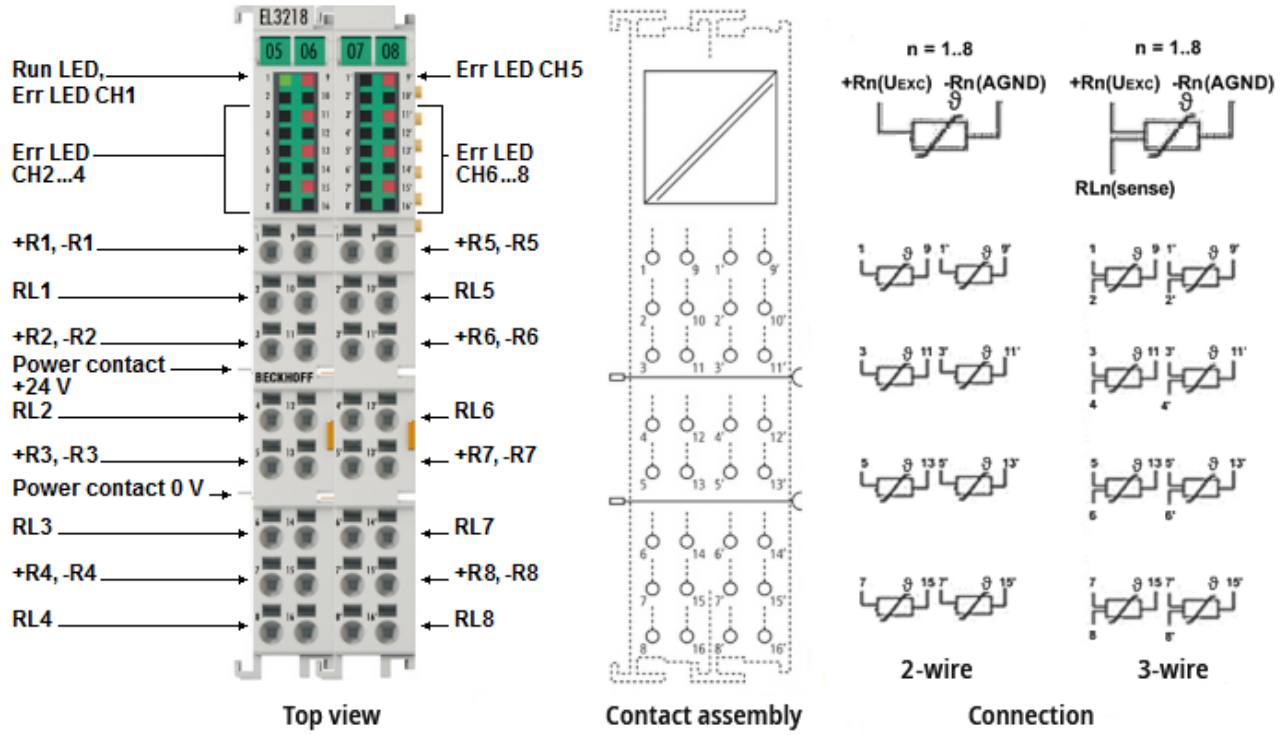


Fig. 22: EL3218 pin assignment

EL3218 – pin assignment

Terminal points 1 – 16 (left side)			Terminal points 1' – 16' (right side)		
Terminal point	**No.**	**Comment**	**Terminal point**	**No.**	**Comment**
+R1	1	Input +R1, current-carrying	+R5	1‘	Input -R5, current-carrying
RL1	2	Input RL1, de-energized sense line	RL5	2‘	Input RL5, de-energized sense line
+R2	3	Input +R2, current-carrying	+R6	3‘	Input +R6, current-carrying
RL2	4	Input RL2, de-energized sense line	RL6	4‘	Input RL6, de-energized sense line
+R3	5	Input +R3, current-carrying	+R7	5‘	Input +R7, current-carrying
RL3	6	Input RL3, de-energized sense line	RL7	6‘	Input RL7, de-energized sense line
+R4	7	Input +R4, current-carrying	+R8	7‘	Input +R8, current-carrying
RL4	8	Input RL4, de-energized sense line	RL8	8‘	Input RL8, de-energized sense line
-R1	9	Input -R1, current-carrying	-R5	9‘	Input -R5, current-carrying
n. c.	10	not used	n. c.	10‘	not used
-R2	11	Input -R2, current-carrying	-R6	11‘	Input -R6, current-carrying
n. c.	12	not used	n. c.	12‘	not used
-R3	13	Input -R3, current-carrying	-R7	13‘	Input -R7, current-carrying
n. c.	14	not used	n. c.	14‘	not used
-R4	15	Input -R4, current-carrying	-R8	15‘	Input -R8, current-carrying
n. c.	16	not used	n. c.	16‘	not used

NOTICE

Increased measurement uncertainty with signal bundling of the AGND line

In this terminal, the AGND contacts (signal return line -R) are connected in the terminal.
If the connection lines are to be reduced on the system side, one line instead of n lines can be used for all n RTD sensors at this terminal.
However, since each channel individually permanently drives its measuring current (some 100 µA, see explanations chapter "RTD measurement in EL32xx [▶ 56]"), all n RTD currents then flow via one line, there is an n-fold increase in voltage drop there, which is also recorded by the ratiometric voltage measurement in the terminal.
The result is the same as for long lines. If RTD sensors are to be connected in this way, a system-side check and, if necessary, compensation using WireCalibration CoE 0x80n0:1B (convert voltage drop to apparent line resistance for this purpose) or UserScale 0x80n0:11/12 is recommended.
Since the line resistances are temperature-dependent and the measuring current depends on the RTD resistance, however, such a static "compensation" cannot achieve the measurement uncertainty as in operation with two lines connected short.

Connection of analog RTD signal lines

To ensure that the analog signals can be measured with as little interference as possible, also observe the notes in the chapter "Connection of analog RTD signal lines [▶ 58]".

EL3218 – LEDs

LED	Color	Meaning	
RUN	green	This LED indicates the terminal's operating state:	
		off	State of the EtherCAT State Machine: **INIT** = initialization of the terminal or **BOOTSTRAP** = function for terminal firmware updates
		flashing	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
ERROR1 - 8	red	Short circuit or wire break. The resistance value is in the invalid range of the characteristic curve.	

3.12 RTD measurement in EL32xx

NOTICE

Further documentation for I/O components with analog in and outputs

Also pay attention to the further documentation:

I/O Analog Manual
Notes on I/O components with analog inputs and outputs,

which is available in the Beckhoff Information-System and for download on the Beckhoff website www.beckhoff.com on the respective product pages!

The content includes the basics of sensor technology and information on analog measured values.

The EL32xx-xxxx series analog input terminals offer the option to take a resistance measurement, as well as the evaluation of a resistance sensor by computational transformation R→T. Common characteristic curves are implemented in the terminal for directly converting the resistance value into a temperature (see IO Analog Manual chapter Overview of implemented RTD transformations). In addition, resolutions, output formats and scaling can be adjusted depending on the device.

The analog input terminals of the EL32xx-xxxx series measure the connected resistance directly ratiometrically by voltage comparison and convert this into a temperature if required. This is performed as shown in the diagram in the following figure:

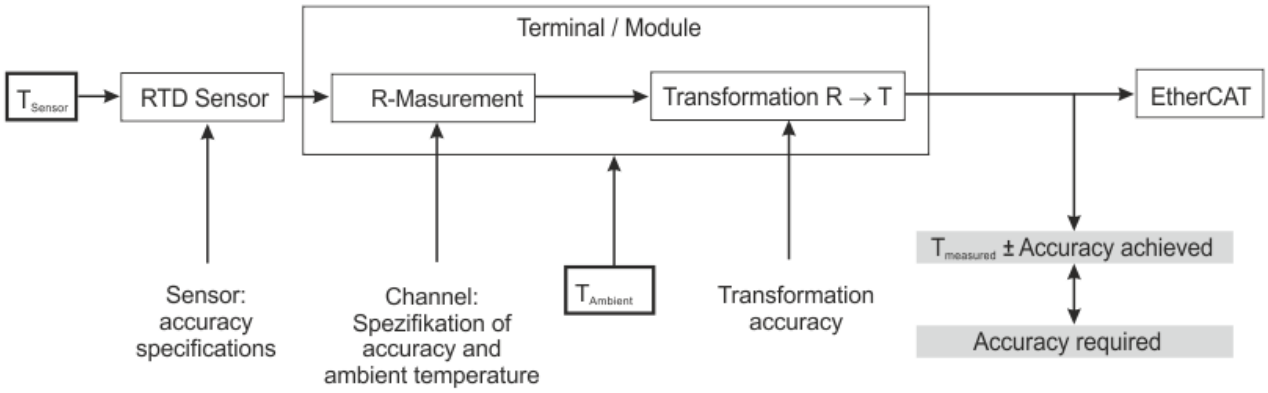


Fig. 23: Representation of the measurement of the resistance and calculation of the temperature

R measurement

The measurement is performed ratiometrically:

A constant voltage of 2.5 V is fed through a known reference resistor $R_{reference}$ and through the sensor R_{sensor}. The size of the reference resistor is 5 kΩ (except EL3024-0200: $R_{reference}$ = 120 kΩ).

By voltage comparison of $U_{R, Reference}$ and $U_{R, Sensor}$, the sensor resistance R_{sensor} can be determined.

The measuring current at the sensor is thus dependent on the sensor resistance R_{sensor}, which must be taken into account when considering any sensor self-heating.

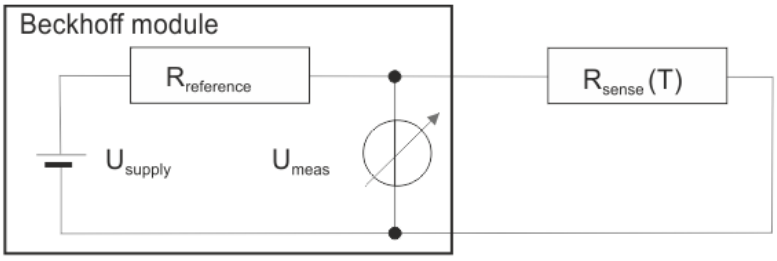


Fig. 24: Circuit diagram for direct resistance measurement

Terminal families

- **EL320x:**
  - Terminals switchable for operation in 2/3/4-wire technology (depending on version)
- **EL321x:**
  - Terminals preferred for operation in 3-wire technology
  - Operation in 2-wire technology is possible depending on the version (see information in the technical data), but is not recommended due to the lower measuring accuracy (see IO Analog Manual, chapter Connection techniques and supply line resistance compensation).

Additional notes

- Special characteristic curves that are not included in the CoE transformations, e. g. Pt375, can be acquired via the freely parameterizable EL3204-0200
- Due to the measuring principle, an RTD sensor may not be connected in parallel to several input channels.
- To improve measuring accuracy, the empirically determined supply line resistance in the CoE can be made known to the firmware in two-wire mode.
- Connection of resistance sensors
  - EL32xx: in the range 0... 4096 Ω
  - EL3204-0200: up to 240 kΩ
  - EL3692: 0...10 Ω
    The EL3692 is recommended for measurements in the range 0...10 Ω, since the measuring range of 1 or 4 kΩ is only poorly utilized with the EL32xx terminals and the measurement uncertainty (specified in $\%_{FSV}$) becomes relatively high
- Additional transition resistances are to be expected with the ES32xx connector variants. In case of doubt, the EL32xx variant is preferable.
- Resolution
  - Default setting: temperature measurement in 1 digit = 0.1°C
  - Increased resolution: 1 digit = 0.01°C
    The resolution is increased purely computationally in the firmware, the ADC resolution does not increase. Measured value jumps of > 0.01°C are to be expected.
  - For resistance measurement
    - 1/64 Ω (0 Ω... 1024 Ω)
    - 1/16 Ω (0 Ω... 4096 Ω)

Notes on connection in two-wire operation and on characteristic curves of KT/KTY sensors

Terminals	For operation with two-wire technology	Characteristic curves for KT/KTY sensors
EL3201-xxxx	the +R and +RL inputs must be bridged by the user.	are implemented from firmware 06 and can be selected via the CoE directory.
EL3202-xxxx		
EL3204	-	
EL3214	the +R and +RL inputs must be bridged by the user.	-
EL3218	the sensor must be connected between +R and -R without an external bridge to RL.	-

3.13 Connection of analog RTD signal lines

The RTD input terminals of the EL32xx series measure the analog resistance of the sensor. The voltage drop at the sensor (including the line resistances, depending on the connection technology) is equivalent to the sensor resistance and therefore a measure for the sensor temperature, if the characteristic sensor curve is known. The following procedure serves for connecting analog signal cables in order to ensure error-free measurement of the analog signals.

Measures

- Sensor cable to be used
  - Tightly twisted
  - Shielded copper braid
  - Use low-impedance cable, particularly for 2-wire connection
- Keep the sensor and sensor cables free from external potential.
  On no account should the GND connections (3/7 for EL3201, EL3202) be connected with other potentials.
- The resistor for the RTD sensor (e.g. 100 or 1000 Ω nominal) should be chosen based on the ratio between sensor resistance and line resistance, taking account of the connection type (2/3/4-wire).

Shielding measures

Shielding measures

Due to the complexity in the "EMC" area, there is no generally applicable guideline, but only technical measures in accordance with the state of the art, which can sometimes contradict each other. These must be checked for feasibility and effectiveness, taking into account the plant specifications, and applied by the plant installer following assessment.
The following notes on shielding are to be understood as technical suggestions that have proven themselves from time to time in practical use.

- It must be checked in each case which measures can be applied, depending on the installation and plant.
- The effectiveness of each measure must be checked individually. The formal transferability of measures to other types of plant is in general not possible.
- Priority is to be given to typical national or general normative specifications.

A shielding approach is described below that in many cases improves the measurement quality. The suggested measures must be checked for feasibility and effectiveness in the actual plant.

- Apply the shield with a low resistance and enveloping the cable by 360°
- at the entry point into the control cabinet, the shield should be earthed conductively
- the shield should be earthed again at the terminal
  - at the terminal connection point, if present
  - if no terminal connection point is available, earth the shield as close to the terminal as possible.
  - to avoid ground loops the shield can be undone after entry into the control cabinet.
    A capacitive connection to the terminal shield contact is possible.
  - avoid unshielded cable lengths of > 50 cm!

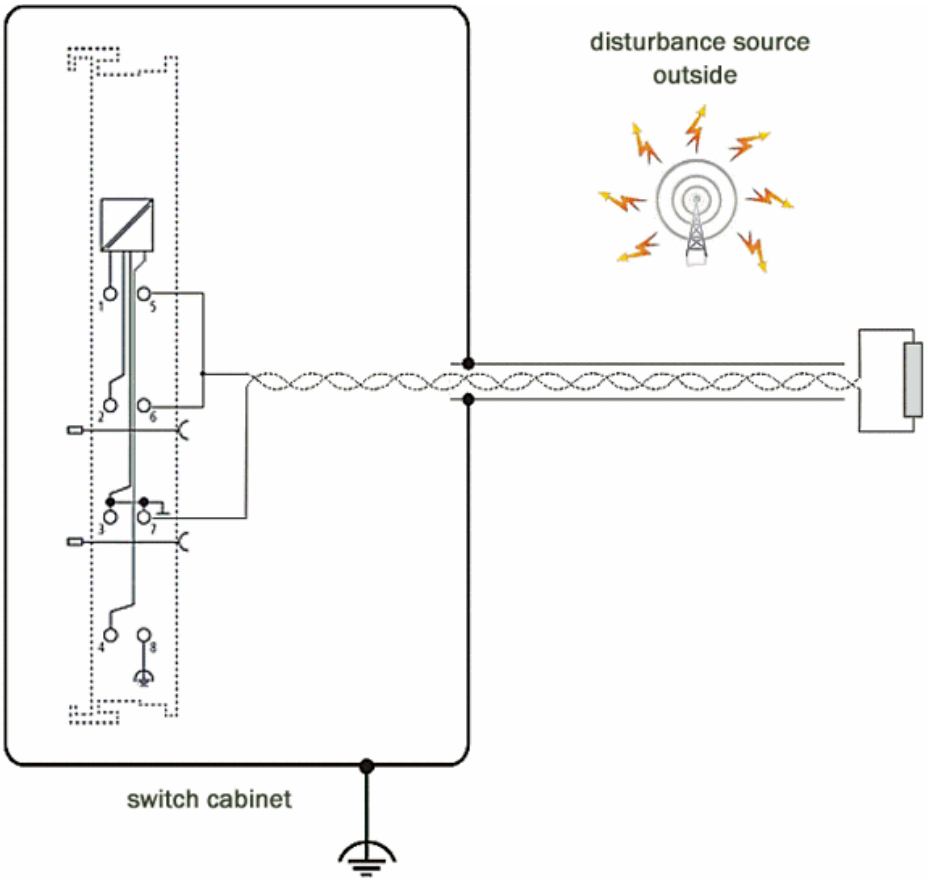


Fig. 25: Example of EL3202 shield connection with shield contact, in the case of potential interference sources inside the control cabinet

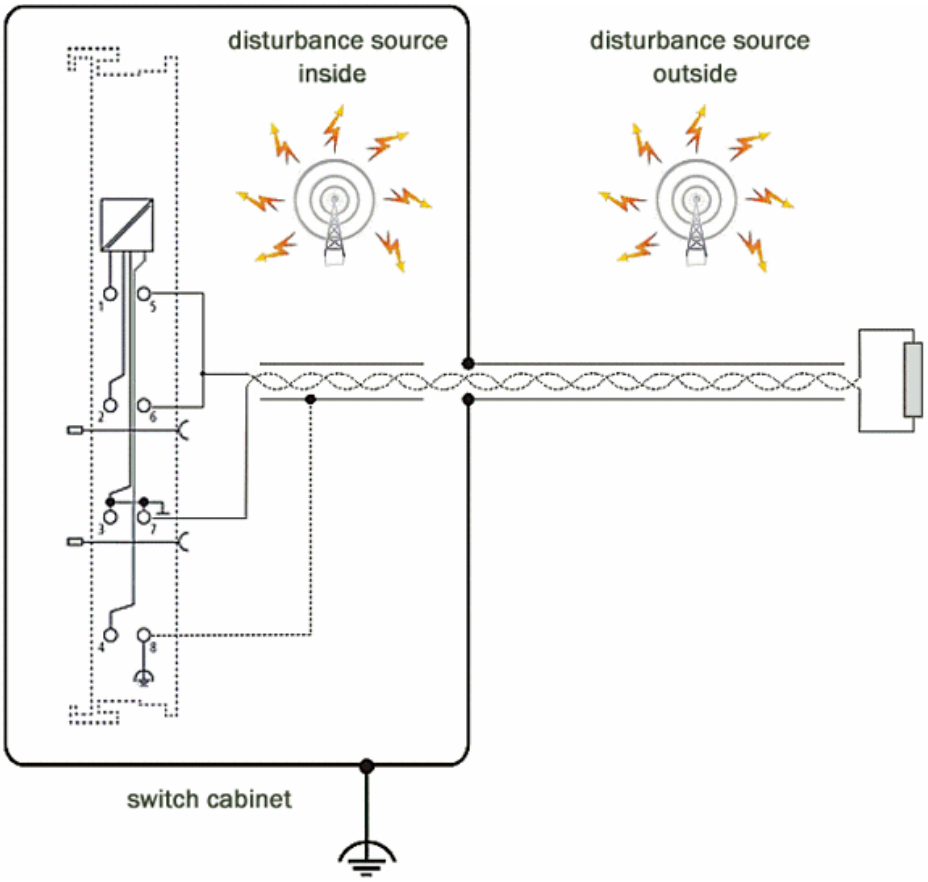


Fig. 26: Example of EL3202 shield connection with shield contact, in the case of potential interference sources inside and outside the control cabinet

3.14 Note on Beckhoff calibration certificates

Basically every Beckhoff analog device (input or output) will be justified i.e. will be calibrated during production. However, this process is not documented individually. This documentation in the form of a calibration certificate is only provided for devices that are explicitly supplied with a certificate.

The calibration certificate indicates the remaining deviation from the standard used (reference device) after adjustment. The calibration certificate (as a PDF document) can be assigned to the device via a unique number. It is therefore not a statement about a device class, such as an approval, but only applies to an individual, named device. It is available for download from the Beckhoff website.

The calibration certificate documents the measuring accuracy at the time the certificate was issued and includes information about the ambient conditions and the reference device used. It contains no statement about the behavior or the change of measuring accuracy in the future. A calibration certificate is used to review the previous period of use. If the calibration process is repeated several times over several years (without readjusting the device), it allows conclusions to be drawn about the aging behavior, the so-called calibration history.

Performance levels of the calibration certificates

Different "qualities" of a calibration certificate are common:

- *Beckhoff factory working standard calibration certificates*
  These IP20 terminals can usually be recognized by the product suffix -0020.
  The device-specific certificate is issued by Beckhoff as a PDF. It is available for download on the Beckhoff website. The terminals can be obtained from Beckhoff and recalibrated via the Beckhoff service.
- *ISO17025 calibration certificates*
  These IP20 terminals can usually be recognized by the suffix -0030.
  The device-specific certificate is issued by a service provider on behalf of Beckhoff as part of Beckhoff production and delivered by Beckhoff as a PDF. For the initial calibration (newly delivered terminals), it is available for download on the Beckhoff website. The terminals can be obtained from Beckhoff, recalibration must be carried out directly by the service provider (see details in the certificate).
- *DAkkS calibration certificates (Deutsche Akkreditierungsstelle GmbH)*
  These IP20 terminals can usually be recognized by the suffix -0030.
  The device-specific certificate is issued by a service provider on behalf of Beckhoff as part of Beckhoff production and delivered by Beckhoff as a PDF. For the initial calibration (newly delivered terminals), it is available for download on the Beckhoff website. The terminals can be obtained from Beckhoff, recalibration must be carried out directly by the service provider (see details in the certificate).

Unique device number

Depending on the device, the following numbers are used for identification:

- EL/ELM terminals up to year of manufacture 2020: the ID number lasered on the side.

Fig. 27: ID number

- From year of manufacture 2021 onwards, the BTN number (Beckhoff Traceability Number) will gradually replace the ID number, this is also lasered on the side.

Beckhoff produces a wide range of analog input/output devices as IP20 terminals or IP67 boxes. A selection is also available with factory/ISO/DAkkS calibration certificates. For specific details and availability, please refer to the technical data of the devices or contact Beckhoff Sales.

Linguistic note

In American English, "calibration" or "alignment" is understood to mean compensation/adjustment, thus a modifying effect on the device. "Verification", on the other hand, refers to observational determination and documentation of the residual error, referred to in German as *Kalibrierung*.

3.15 Start

For commissioning:

- Install the EL32xx as described in section Installation [▶ 64].
- Configure the EL32xx in TwinCAT as described in section Commissioning [▶ 89].

4 Installation

4.1 Safety instructions

Before installing and commissioning the TwinSAFE components please read the safety instructions in the foreword of this documentation.

4.2 Environmental conditions

Please ensure that the TwinSAFE components are only transported, stored and operated under the specified conditions (see technical data)!

⚠ WARNING

Risk of injury!

The TwinSAFE components must not be used under the following operating conditions.

- under the influence of ionizing radiation (that exceeds the level of the natural environmental radiation)
- in corrosive environments[1]
- in an environment that leads to unacceptable soiling of the TwinSAFE component

[1] A corrosive environment exists when corrosion damage becomes apparent.

NOTICE

Electromagnetic compatibility

The TwinSAFE components comply with the current standards on electromagnetic compatibility with regard to spurious radiation and immunity to interference in particular.
However, in cases where devices such as mobile phones, radio equipment, transmitters or high-frequency systems that exceed the interference emissions limits specified in the standards are operated near TwinSAFE components, the function of the TwinSAFE components may be impaired.

4.3 Transport / storage

Use the original packaging in which the components were delivered for transporting and storing the TwinSAFE components.

⚠ CAUTION

Note the specified environmental conditions

Please ensure that the digital TwinSAFE components are only transported and stored under the specified environmental conditions (see technical data).

4.4 Control cabinet / terminal box

The TwinSAFE terminals must be installed in a control cabinet or terminal box with IP54 protection class according to IEC 60529 as a minimum.

4.5 Notes on ESD protection

NOTICE

Devices can be destroyed by electrostatic charging!

The devices contain electrostatically sensitive components which can be damaged by improper handling.

- When handling the components, take care to avoid electrostatic discharge; also, prevent direct contact with the spring-loaded contacts (see illustration).
- Contact with highly insulating materials (synthetic fibers, plastic films, etc.) should be avoided when simultaneously handling components.
- When handling the components, ensure proper earthing of the environment (workplace, packaging, and persons).
- Each bus station must be terminated with the EL9011 or EL9012 end cap on its right side to guarantee the protection rating and ESD protection.

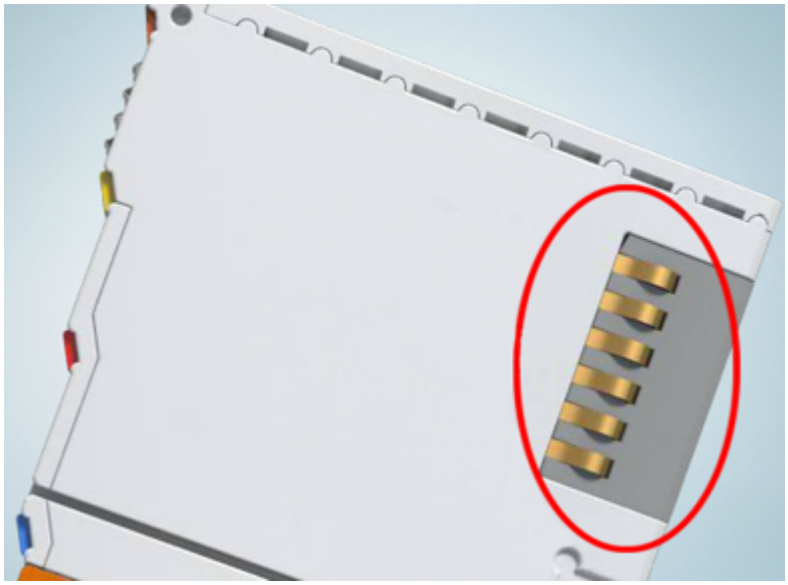


Fig. 28: Spring contacts of Beckhoff I/O components

4.6 Explosion protection

4.6.1 ATEX - Special conditions (standard temperature range)

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components with standard temperature range in potentially explosive areas!

- The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60079-7! The environmental conditions during use are thereby to be taken into account!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of 0 to 55°C for the use of Beckhoff fieldbus components standard temperature range in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The fuses of the KL92xx/EL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

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

- EN IEC 60079-0:2018
- EN 60079-7:2015+A1:2018

Marking

The Beckhoff fieldbus components with standard temperature range certified according to regulations for potentially explosive areas bear the following marking:

II 3 G Ex ec IIC T4 Gc
KEMA 10 ATEX0075 X
DEKRA 22UKEX6024X
Ta: 0 ... + 55°C

4.6.2 ATEX - Special conditions (extended temperature range)

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components with extended temperature range (ET) in potentially explosive areas!

- The certified components are to be installed in a suitable housing that guarantees a protection class of at least IP54 in accordance with EN 60079-7! The environmental conditions during use are thereby to be taken into account!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of -25 to 60°C for the use of Beckhoff fieldbus components with extended temperature range (ET) in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The fuses of the KL92xx/EL92xx power feed terminals may only be exchanged if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

Standards

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

- EN IEC 60079-0:2018
- EN 60079-7:2015+A1:2018

Marking

The Beckhoff fieldbus components with extended temperature range (ET) certified according to regulations for potentially explosive areas bear the following marking:

II 3 G Ex ec IIC T4 Gc
KEMA 10 ATEX0075 X
DEKRA 22UKEX6024X
Ta: -25 ... + 60°C

4.6.3 IECEx - Special conditions

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components in potentially explosive areas!

- For gas: The equipment shall be installed in a suitable enclosure providing a degree of protection of IP54 according to IEC 60079-7, taking into account the environmental conditions under which the equipment is used!
- The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1!
- Provisions shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 119 V!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range for the use of Beckhoff fieldbus components in potentially explosive areas!
- The individual terminals may only be unplugged or removed from the Bus Terminal system if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- Address selectors and ID switches may only be adjusted if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!
- The front hatch of certified units may only be opened if the supply voltage has been switched off or a non-explosive atmosphere is ensured!

Standards

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

- IEC 60079-0:2017 (Edition 7.0)
- IEC 60079-7:2017 (Edition 5.1)

Marking

Beckhoff fieldbus components that are certified in accordance with IECEx for use in areas subject to an explosion hazard bear the following marking:

IECEx DEK 16.0078 X

Ex ec IIC T4 Gc

4.6.4 Continuative documentation for ATEX and IECEx

NOTICE

Continuative documentation about explosion protection according to ATEX and IECEx

Pay also attention to the continuative documentation

Ex. Protection for Terminal Systems
Notes on the use of the Beckhoff terminal systems in hazardous areas according to ATEX and IECEx,

that is available for download within the download area of your product on the Beckhoff homepage www.beckhoff.com!

4.6.5 cFMus - Special conditions

⚠ WARNING

Observe the special conditions for the intended use of Beckhoff fieldbus components in potentially explosive areas!

- The equipment shall be installed within an enclosure that provides a minimum ingress protection of IP54 in accordance with ANSI/UL 60079-0 (US) or CSA C22.2 No. 60079-0 (Canada).
- The equipment shall only be used in an area of at least pollution degree 2, as defined in IEC 60664-1.
- Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value at the supply terminals to the equipment.
- The circuits shall be limited to overvoltage Category II as defined in IEC 60664-1.
- The Fieldbus Components may only be removed or inserted when the system supply and the field supply are switched off, or when the location is known to be non-hazardous.
- The Fieldbus Components may only be disconnected or connected when the system supply is switched off, or when the location is known to be non-hazardous.

Standards

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

M20US0111X (US):

- FM Class 3600:2018
- FM Class 3611:2018
- FM Class 3810:2018
- ANSI/UL 121201:2019
- ANSI/ISA 61010-1:2012
- ANSI/UL 60079-0:2020
- ANSI/UL 60079-7:2017

FM20CA0053X (Canada):

- CAN/CSA C22.2 No. 213-17:2017
- CSA C22.2 No. 60079-0:2019
- CAN/CSA C22.2 No. 60079-7:2016
- CAN/CSA C22.2 No.61010-1:2012

Marking

Beckhoff fieldbus components that are certified in accordance with cFMus for use in areas subject to an explosion hazard bear the following markings:

FM20US0111X (US):	**Class I, Division 2, Groups A, B, C, D** **Class I, Zone 2, AEx ec IIC T4 Gc**
FM20CA0053X (Canada):	**Class I, Division 2, Groups A, B, C, D** **Ex ec T4 Gc**

4.6.6 Continuative documentation for cFMus

NOTICE	
	Continuative documentation about explosion protection according to cFMus Pay also attention to the continuative documentation **Control Drawing I/O, CX, CPX** Connection diagrams and Ex markings, that is available for download within the download area of your product on the Beckhoff homepage www.beckhoff.com!

4.7 UL notice

⚠ CAUTION

Application

Beckhoff EtherCAT modules are intended for use with Beckhoff's UL Listed EtherCAT System only.

⚠ CAUTION

Examination

For cULus examination, the Beckhoff I/O System has only been investigated for risk of fire and electrical shock (in accordance with UL508 and CSA C22.2 No. 142).

⚠ CAUTION

For devices with Ethernet connectors

Not for connection to telecommunication circuits.

Basic principles

UL certification according to UL508. Devices with this kind of certification are marked by this sign:

4.8 Mounting rail installation

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

The bus terminal system is designed for installation in a control cabinet or junction box.

Installation

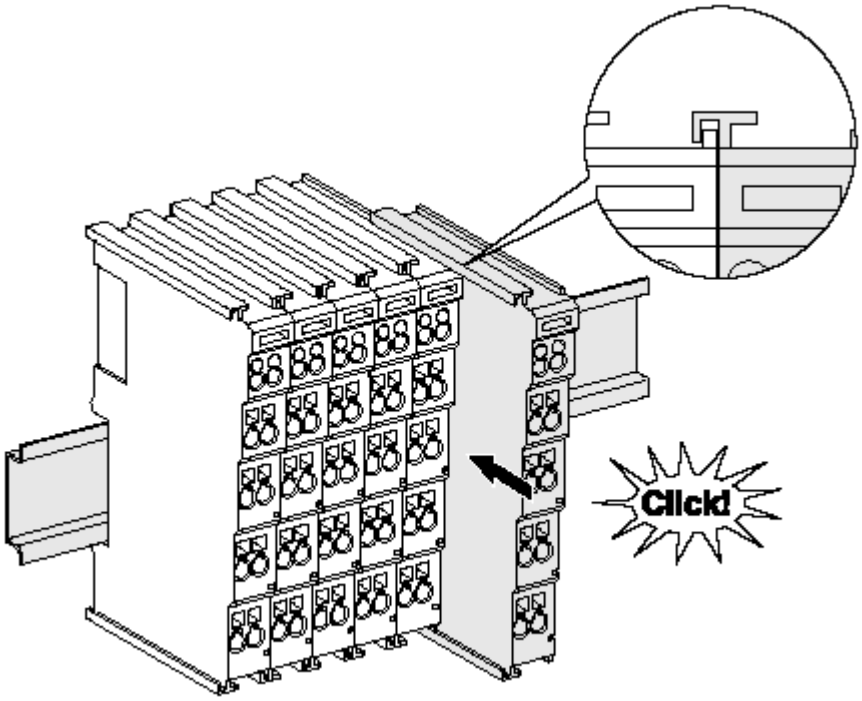


Fig. 29: Installation on the mounting rail

The bus couplers and bus terminals are attached to commercially available 35 mm mounting rails (DIN rail according to EN 60715) by applying slight pressure:

1. First attach the fieldbus coupler to the mounting rail.
2. The bus terminals are now attached on the right-hand side of the fieldbus coupler. To do this, connect the components with the slot and key and push the terminals against the mounting rail until the latch audibly engages on the mounting rail.
   If you snap the terminals onto the mounting rail first and then push them next to each other without the slot and key engaging, no functional connection will be established! When correctly assembled, no significant gap should be visible between the housing units.

Fastening the mounting rails

The locking mechanism of the terminals and couplers protrudes into the profile of the mounting rail. When installing the components, make sure that the locking mechanism doesn't come into conflict with the fixing bolts of the mounting rail. When fastening mounting rails with a height of 7.5 mm under the terminals and couplers, use flat fastening components such as countersunk head screws or blind rivets.

NOTICE

Earth the mounting rail!

Make sure the mounting rail is properly earthed.

Connections within a bus terminal block

The electric connections between the bus coupler and the bus terminals are made automatically by joining the components:

- The six spring-loaded contacts of the E-bus/K-bus deal with the data transfer and the supply of the bus terminal electronics.
- The power contacts deal with the supply for the field electronics and thus represent a supply rail within the bus terminal block. The power contacts are supplied via terminal points on the bus coupler (up to 24 V) or via power supply terminals for higher voltages.

Power contacts

When configuring a bus terminal block, note the contact assignments of the individual bus terminals, as some types

- do not loop through the power contacts or do not loop them through completely (e. g. analog bus terminals or digital 4-channel bus terminals),
- the power contacts are disconnected, thus marking the start of a new supply rail (power supply terminals).

Power contact ⏚

The power contact marked ⏚ (ground connection in accordance with IEC 60417-5017) can be used as a ground. For safety reasons this contact mates first when plugging together, and can ground short-circuit currents of up to 125 A.

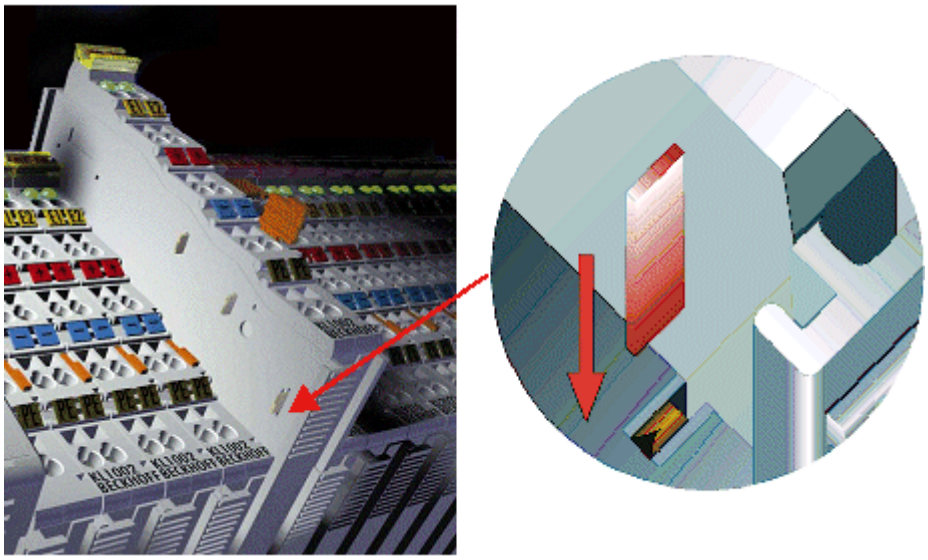


Fig. 30: Power contact on the left

⚠ WARNING

Risk of injury from electric shock!

The power contact marked ⏚ may not be used for other potentials!

NOTICE

Risk of damage to the device

Note that, for electromagnetic compatibility, the earth contacts are capacitatively coupled to the mounting rail. This may lead to incorrect results during insulation testing or to damage to the terminal (e.g. disruptive discharge to the earth line during insulation testing of a consumer with a rated voltage of 230 V). For insulation testing, disconnect the earth supply line at the bus coupler or the power supply terminal! In order to decouple further supply points for testing, these power supply terminals can be released and pulled at least 10 mm from the group of terminals.

Disassembly

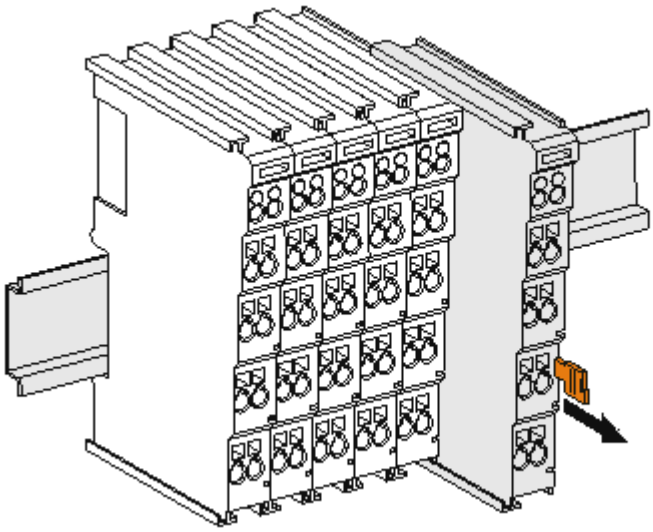


Fig. 31: Removal from mounting rail

Each terminal is secured by a lock on the mounting rail, which must be released for disassembly:

1. Pull down the terminal at its orange-colored straps from the mounting rail by approx. 1 cm. The rail locking of this terminal is automatically released, and you can now pull the terminal out of the bus terminal block with little effort.
2. To do this, grasp the unlocked terminal simultaneously at the top and bottom of the housing surfaces with your thumb and index finger and pull it out of the bus terminal block.

4.9 Installation instructions for enhanced mechanical load capacity

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the Bus Terminal system into a safe, de-energized state before starting mounting, disassembly or wiring of the Bus Terminals!

Additional checks

The terminals have undergone the following additional tests:

Verification	Explanation
Vibration	10 frequency runs in 3 axes
	6 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
	25 *g*, 6 ms

Additional installation instructions and notes

For terminals with enhanced mechanical load capacity, the following additional installation instructions and notes apply:

- The enhanced mechanical load capacity is valid for all permissible installation positions.
- Use a mounting rail according to EN 60715 TH35-15.
- Fix the terminal segment on both sides of the mounting rail with a mechanical fixture, e.g. an earth terminal or reinforced end clamp.
- The maximum total extension of the terminal segment (without coupler) is:
  64 terminals (12 mm mounting width) or 32 terminals (24 mm mounting width)
- Avoid deformation, twisting, crushing and bending of the mounting rail during edging and installation of the rail.
- The mounting points of the mounting rail must be set at 5 cm intervals.
- Use countersunk head screws to fasten the mounting rail.
- The free length between the strain relief and the wire connection should be kept as short as possible. A distance of approx. 10 cm should be maintained to the cable duct.

4.10 Positioning of passive terminals

Note on the placement of passive terminals in the bus terminal block

EtherCAT Terminals that do not take part in active data exchange within the bus terminal block are referred to as passive terminals. These terminals can be recognized because they do not consume power from the E-bus. To ensure optimal data exchange, no more than two passive terminals may be connected directly to each other!

Examples of the placement of passive terminals (highlighted in light color)

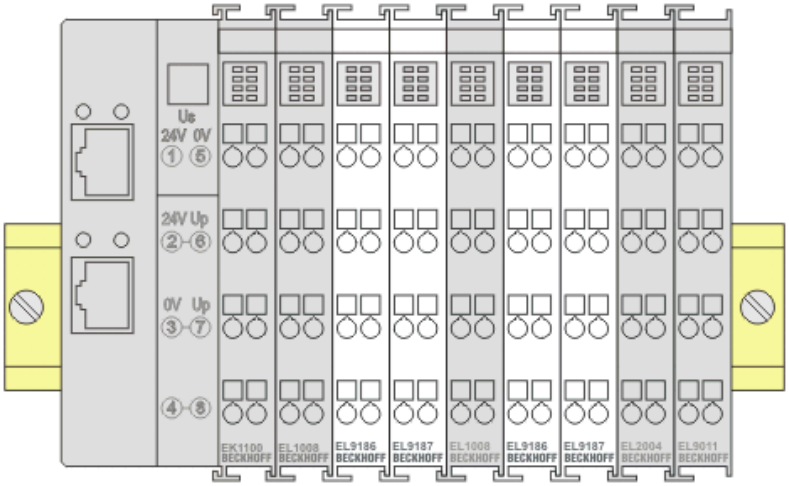


Fig. 32: Proper positioning

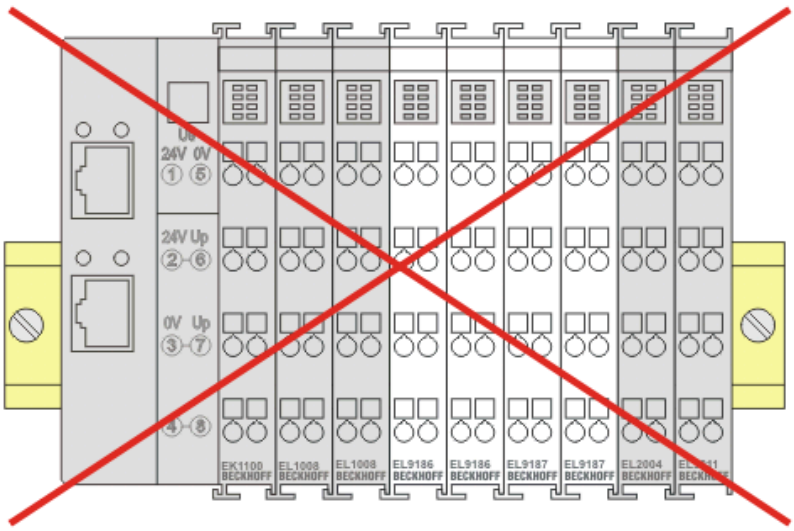


Fig. 33: Incorrect positioning

4.11 Installation positions

NOTICE

Constraints regarding installation position and operating temperature range

- Please refer to the technical data of the device to ascertain whether any restrictions regarding the installation position and/or the operating temperature range have been specified.
- When installing devices with increased heat dissipation, ensure that there is sufficient space above and below the devices during operation to guarantee adequate ventilation!

The installation positions and their names for mounting devices on mounting rails are specified below. The illustration of the devices in the following figures is an example.
The following applies to all installation positions: the reference direction “down” (see arrow) is the direction of the earth's gravitational force.

Horizontal installation (standard installation)

The mounting rail is mounted horizontally on a vertical mounting plate.
The connection level of the devices points to the front.

The devices are ventilated from below, which enables optimum cooling of the electronics through convection. This is therefore also the recommended installation position.

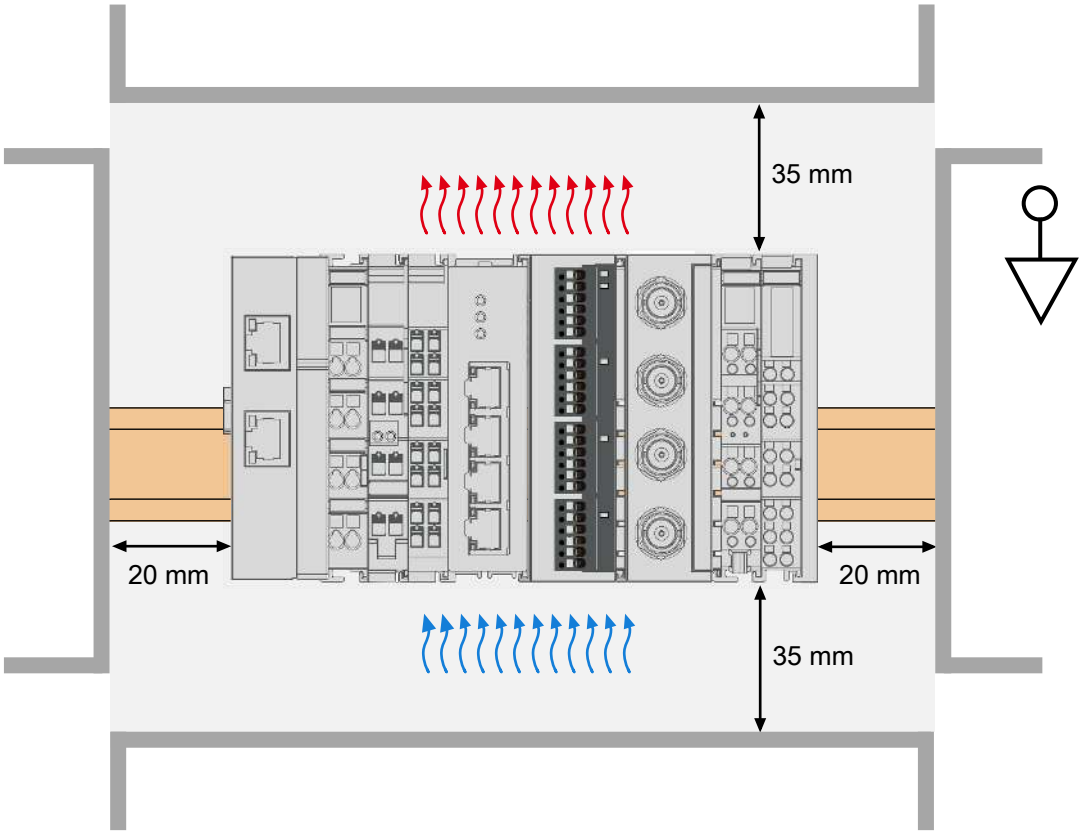


Fig. 34: Recommended minimum distances for standard installation position

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure “Recommended minimum distances for standard installation position” is strongly recommended in all installation positions.

Vertical installation

The mounting rail is mounted vertically on a vertical mounting plate.
The connection level of the devices faces the front.
The devices can be arranged as follows:

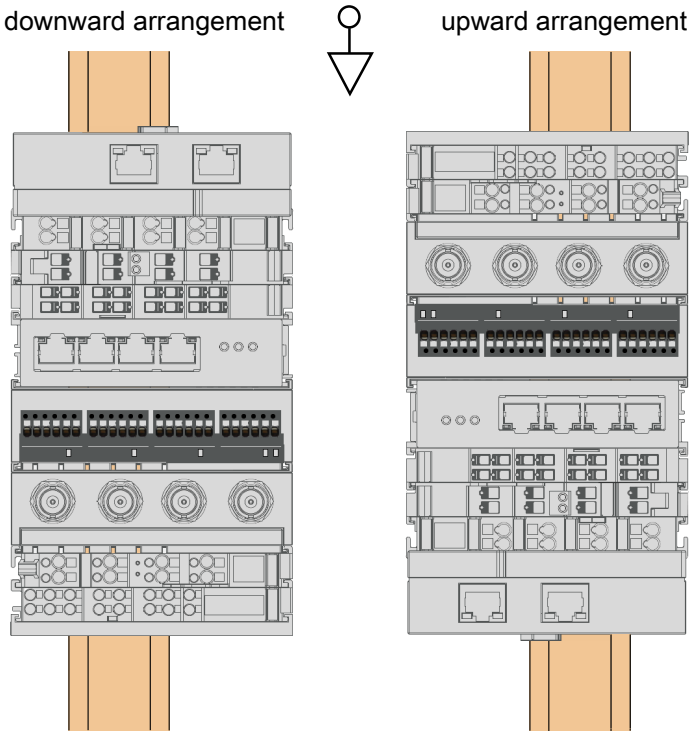


Fig. 35: Installation position: Vertical, downward arrangement (left)/upward arrangement (right)

Flat installation

The mounting rail is mounted on a horizontal mounting plate.
The connection level of the devices points upwards.

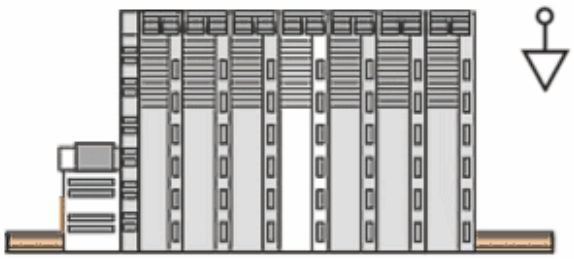


Fig. 36: Flat installation

NOTICE

Danger of sliding off the mounting rail

Particularly in the “vertical” installation position, but also in other installation positions under corresponding mechanical load, the terminal segment may move on the mounting rail. These can lead to undesirable malfunctions.

- If this risk exists, secure the terminal segment with appropriate locking devices, e.g. by clamping it to the mounting rail.

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances shown in the figure “Recommended minimum distances for standard installation position” is strongly recommended in all installation positions.

Installation positions with ZB8610 fan cartridge

If the cooling should or must be increased for the intended application, the ZB8610 fan cartridge can be mounted on the underside of the device. In the horizontal installation position, the devices are ventilated from bottom to top by the fan cartridge. This optimum cooling is further enhanced by convection ventilation (see following figure).

The fan cartridge can be used in any installation position.

Further information on operation with and without a fan can be found in the technical data for the device (e.g. derating, information on installation positions, etc.).

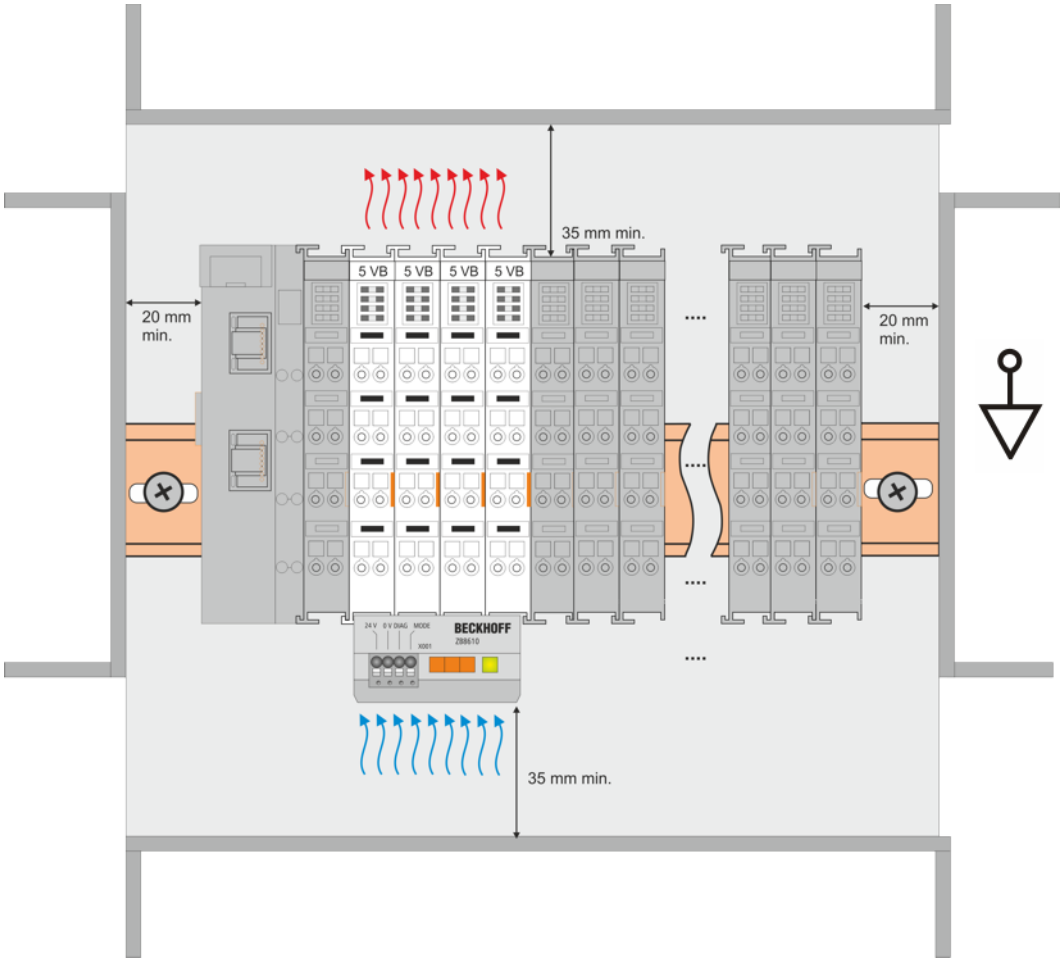


Fig. 37: Recommended minimum distances for operation with fan, using horizontal installation position as an example

NOTICE

Compliance with the minimum distances

Compliance with the minimum distances as shown in the figure “Recommended minimum distances for operation with fan” is strongly recommended.

4.12 Connection

4.12.1 Connection system

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

Overview

The bus terminal system offers different connection options for optimum adaptation to the respective application:

- The terminals of ELxxxx and KLxxxx series with standard wiring include electronics and connection level in a single enclosure.
- The terminals of ESxxxx and KSxxxx series feature a pluggable connection level and enable steady wiring while replacing.
- The High Density Terminals (HD Terminals) include electronics and connection level in a single enclosure and have advanced packaging density.

Standard wiring (ELxxxx / KLxxxx)

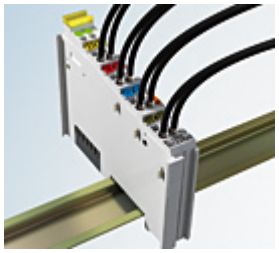


Fig. 38: Standard wiring

The terminals of the ELxxxx and KLxxxx series integrate screwless spring-cage technology for quick and easy wiring.

Pluggable wiring (ESxxxx / KSxxxx)

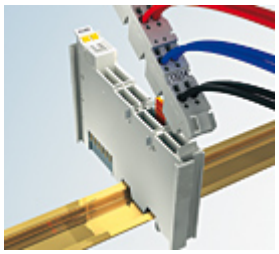


Fig. 39: Pluggable wiring

The terminals of ESxxxx and KSxxxx series feature a pluggable connection level.
The assembly and wiring procedure is the same as for the ELxxxx and KLxxxx series.
The pluggable connection level enables the complete wiring to be removed as a plug connector from the top of the housing for servicing.
The lower section can be removed from the terminal block by pulling the unlocking tab.
Insert the new component and plug in the connector with the wiring. This reduces the installation time and eliminates the risk of wires being mixed up.

The familiar dimensions of the terminal only had to be changed slightly. The new connector adds about 3 mm. The maximum height of the terminal remains unchanged.

A tab for strain relief of the cable simplifies assembly in many applications and prevents tangling of individual connection wires when the connector is removed.

Conductor cross sections between 0.08 mm² and 2.5 mm² can continue to be used with the proven spring force technology.

The overview and nomenclature of the product names for ESxxxx and KSxxxx series has been retained as known from ELxxxx and KLxxxx series.

High Density Terminals (HD Terminals)

Fig. 40: High Density Terminals

The terminals from these series with 16/32 terminal points are distinguished by a particularly compact design, as the packaging density is twice as large as that of the standard 12 mm bus terminals. Massive conductors and conductors with a wire end sleeve can be inserted directly into the spring loaded terminal point without tools.

Wiring HD Terminals

The High Density Terminals of the ELx8xx and KLx8xx series doesn't support pluggable wiring.

Ultrasonically compacted (ultrasonically welded) strands

Ultrasonically compacted (ultrasonically welded) strands

Ultrasonically compacted (ultrasonically welded) strands can also be connected to the standard and high-density terminals. In this case, please note the tables concerning the wire-size width [▶ 86]!

4.12.2 Wiring

⚠ WARNING

Risk of injury through electric shock and damage to the device!

Bring the bus terminal system into a safe, de-energized state before beginning to mount, disassemble, or wire the bus terminals!

Terminals for standard wiring ELxxxx/KLxxxx and for pluggable wiring ESxxxx/KSxxxx

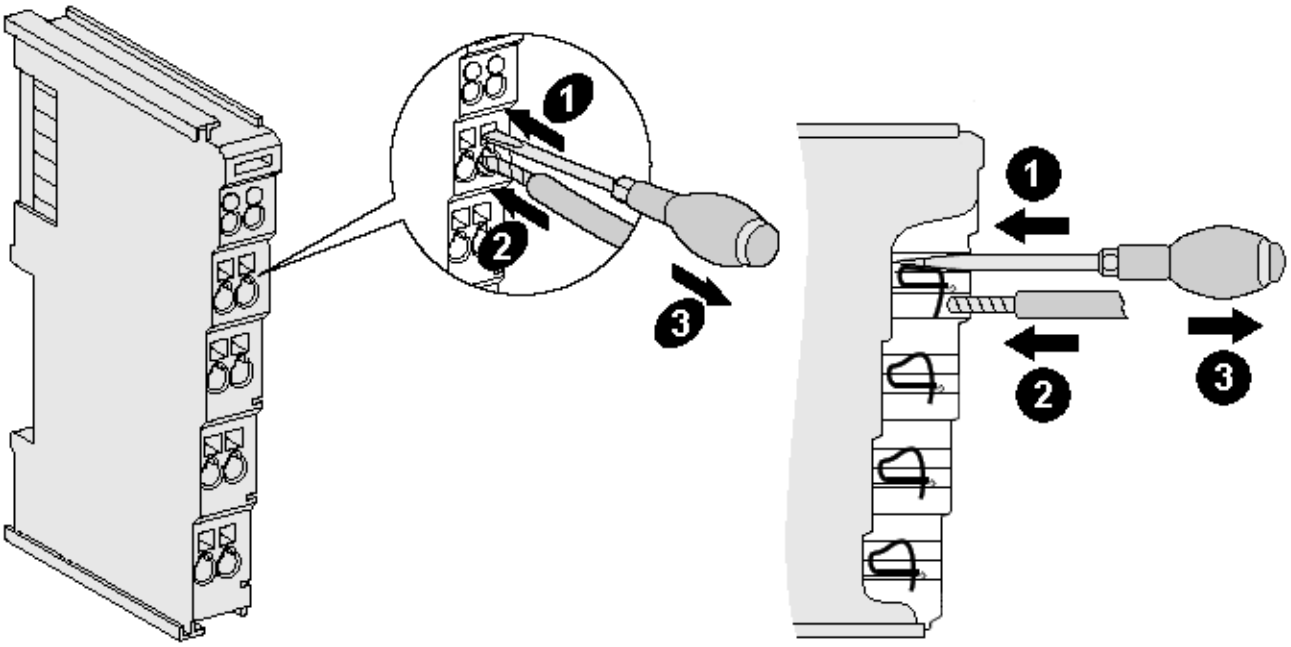


Fig. 41: Connecting a cable on a terminal point

Up to eight terminal points enable the connection of solid or finely stranded cables to the bus terminal. The terminal points are implemented in spring force technology. Connect the cables as follows (see fig. “Connecting a cable on a terminal point”:

1. Open a terminal point by pushing a screwdriver straight against the stop into the square opening above the terminal point. Do not turn the screwdriver or move it alternately (don't toggle).
2. The wire can now be inserted into the round terminal opening without any force.
3. When the screwdriver is removed, the terminal point closes automatically and holds the wire securely and permanently in place

See the following table for the suitable wire size width:

Terminal housing	ELxxxx, KLxxxx	ESxxxx, KSxxxx
Wire size width (single core wires)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (fine-wire conductors)	0.08 ... 2.5 mm²	0.08 ... 2.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 1.5 mm²	0.14 ... 1.5 mm²
Wire stripping length	8 ... 9 mm	9 ... 10 mm

High Density Terminals (HD Terminals [▶ 84]) with 16/32 terminal points

The conductors of the HD Terminals are connected without tools for single-wire conductors using the direct plug-in technique, i.e. after stripping the wire is simply plugged into the terminal point. The cables are released, as usual, using the contact release with the aid of a screwdriver. See the following table for the suitable wire size width.

Terminal housing	High Density Housing
Wire size width (single core wires)	0.08 ... 1.5 mm²
Wire size width (fine-wire conductors)	0.25 ... 1.5 mm²
Wire size width (conductors with a wire end sleeve)	0.14 ... 0.75 mm²
Wire size width (ultrasonically compacted [ultrasonically welded] strands)	only 1.5 mm² (see notice [▶ 84])
Wire stripping length	8 ... 9 mm

4.12.3 Shielding

Shielding

Encoders, analog sensors, and actuators should always be connected with shielded, pair-wise twisted cables.

4.13 Note on power supply

⚠ 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 this device.

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 supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor, a PELV supply also requires a safe connection to the protective conductor.

4.14 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

NOTICE

Further information

For information on commissioning with TwinCAT and EtherCAT basics, please refer to the "EtherCAT system manual".

5.1 EL32xx settings

The following chapters list the necessary and optional settings for taking temperature or resistance measurements with the EL32xx:

Basic settings [▶ 93]	• Sensor type 0x80n00:19 • Connection method 0x80n0:1A
Further settings [▶ 95] (optional)	• PDO presentation 0x80n00:02 • Compensation of the supply line resistance 0x80n0:1B • User scaling 0x80n00:01 • Calibration and calculation of process data: user calibration 0x80n00:18/17 and manufacturer calibration 0x80nF • Siemens bits 0x80n00:05 • Notch filter 0x80n00:06 and conversion times (not for EL3214, EL3208 and EL3218) • Limit 1 0x80n00:13, Limit 2 0x80n00:14 (not for EL3214, EL3208 and EL3218)

NOTICE

Mixed operation of low-impedance and high-impedance sensors within a terminal operating in multiplex mode must be avoided!

Due to large differences in resistance between the sensor types, mixed operation of low-impedance sensors, e.g. Pt/Ni, and high-impedance sensors, e.g. NTC, within a terminal should be avoided if the terminal operates in multiplex mode, i.e. channels are read in successively by an ADC. In this case, larger measuring errors can occur for the low-resistance sensors.
Alternatively, 1-channel or simultaneously operating devices (each channel has its own ADC) should be used, since no changeover processes occur here.

NOTICE

RTD basics

The RTD basics in chapter "Basics of RTD technology" of the IO Analog Manual and "RTD measurement in EL32xx [▶ 56]" must be observed.

Overarching orientation is provided by the data flow, the successive processing steps from the ADC converter to the process data output to EtherCAT:

Data flow

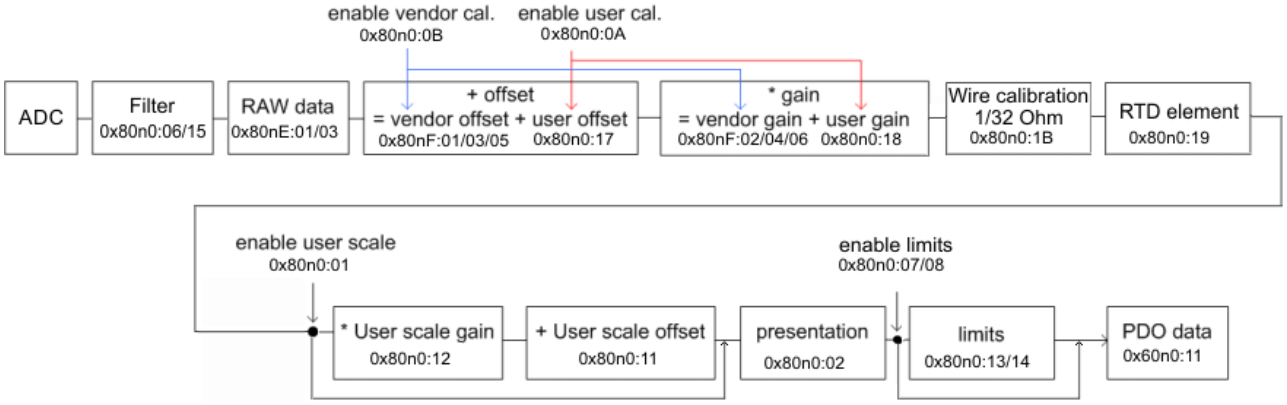


Fig. 42: Data diagram

- The terminal permanently records measured values and puts the filtered raw values X_{ADC} of the A/D converter into the ADC raw value object 0x80nE:01.
- After each acquisition of the analog signal, the correction calculation is performed with the calibration values, measured value after calibration:
  $Y_{calibrated}$ = ((ADC raw data / 8) - Calibration offset) * Calibration gain * 2^{-18}
- optional: Wire calibration
- optional: Transformation RTD element R [Ohm] -> T [°C]
- If user scaling is activated (0x80n0:01 = TRUE) the measured value is calculated including user scaling: $Y_{scaled} = (Y_{calibrated} * A_W * 2^{-16}) + B_W$
  Otherwise $Y_{scaled} = Y_{calibrated}$
- Application "Presentation
- optional: limit evaluation
- Measured value output to EtherCAT

Changes of the slave parameters in the CoE directory

The CoE parameters may have to be changed in the "CoE online" tab of the EtherCAT slave during commissioning.

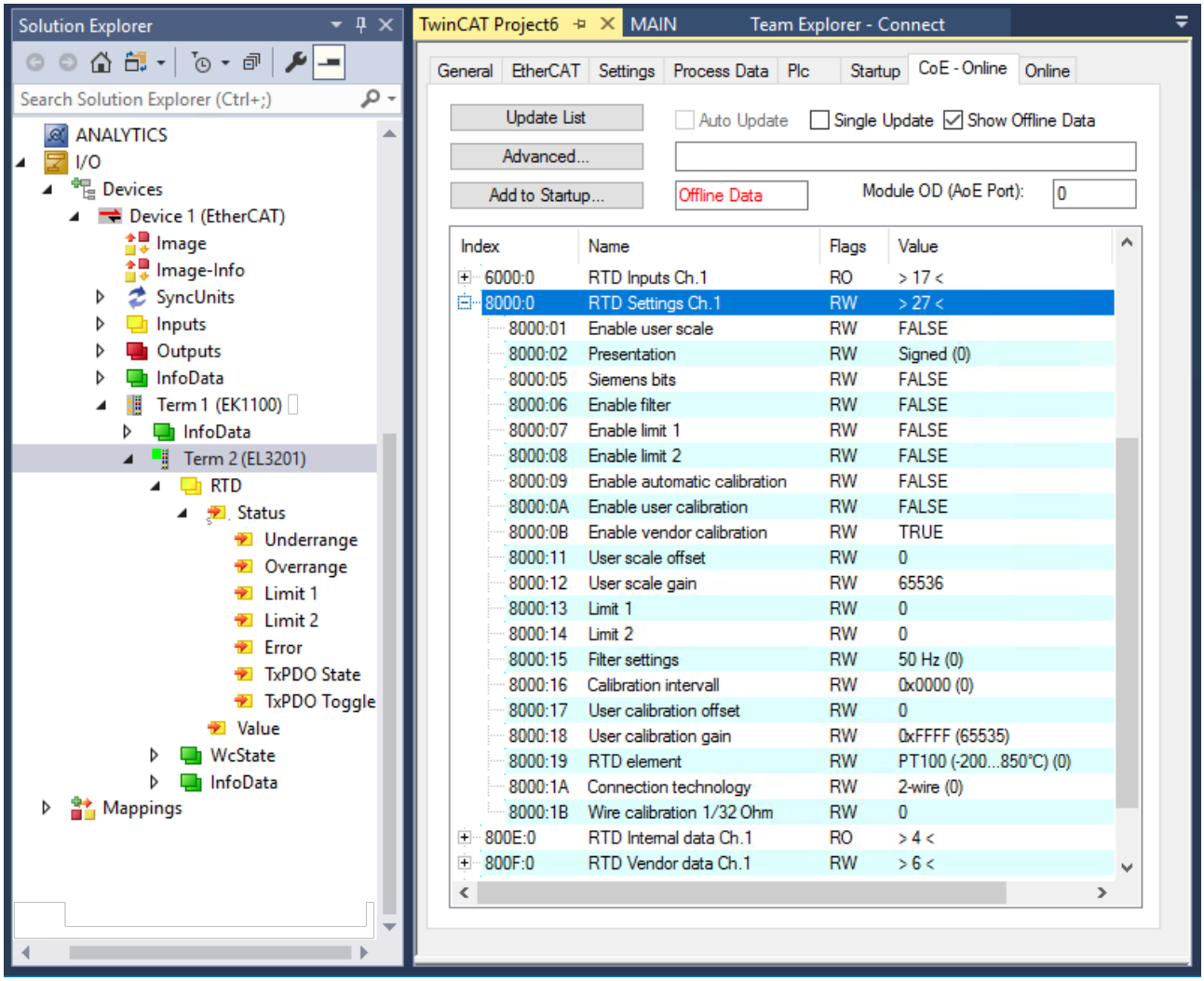


Fig. 43: Accessing the CoE parameters in TwinCAT System Manager, EL3201

For detailed information on settings and operation modes, please read the following chapters on Basic settings [▶ 93] and "Further settings (optional) [▶ 95]".

Reset the terminal

If an EL32xx which was already configured in use is to be put into operation, it is recommended that the settings in the CoE be reset to the factory settings if necessary (see chapter "Restoring the delivery state")

NOTICE

Changes in the CoE directory (CAN over EtherCAT directory), program access

When using/manipulating the CoE parameters observe the general CoE notes in chapter "CoE interface" of the EtherCAT system documentation:

- Keep a startup list if components have to be replaced,
- Distinction between online/offline dictionary,
- Existence of current XML description (download from the Beckhoff website),
- "CoE-Reload" for resetting the changes
- Program access during operation via PLC (see TwinCAT 3 | PLC Library: "Tc2_EtherCAT" and Example program R/W CoE)

5.1.1 Basic settings

Depending on the measuring task, it is essential to set the measuring type and connection method.

5.1.1.1 Measuring type: CoE 0x80n00:19 "RTD element"

When measuring temperature via RTD sensors, the measuring device (here: the EL32xx terminal) measures the sensor resistance electrically and transforms it into a temperature in the firmware. As an example, the relationship between the temperature and the resistance of a Pt100 and Pt1000 sensor is shown below:

Temperature	Pt1000 typical resistance, approx.	Pt100 typical resistance, approx.
850°C	3.9 kΩ	390 Ω
320°C	2.2 kΩ	220 Ω
-200°C	180 Ω	18 Ω

Further characteristic sensor curves are available from the sensor manufacturers. Extensive background information is provided by chapter "Basics of RTD technology" of the IO Analog Manual.

CoE 0x80n00:19 "RTD element"

A large number of different R -> T transformations can be selected in the firmware (see also chapter "Overview of implemented RTD transformations" of the IO Analog Manual). The terminal then outputs the converted temperature value:

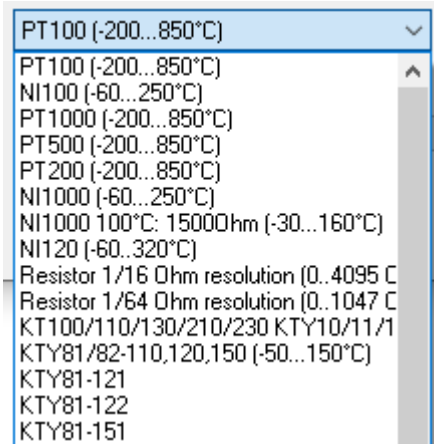


Fig. 44: Selection of R->T transformation in CoE 0x080n00:19 "RTD element"

Alternatively, a direct resistance output can be selected:

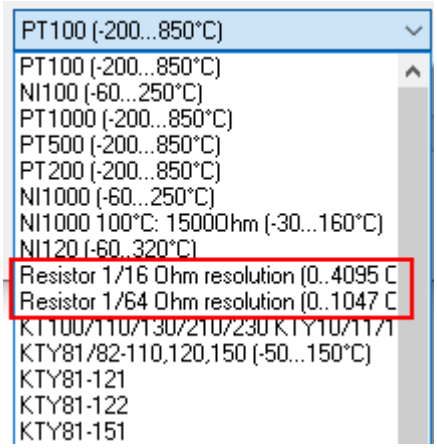


Fig. 45: Selection of resistance output in CoE 0x080n00:19 "RTD element

5.1.1.2 Connection method: CoE 0x08n0:1A "Connection Technology"

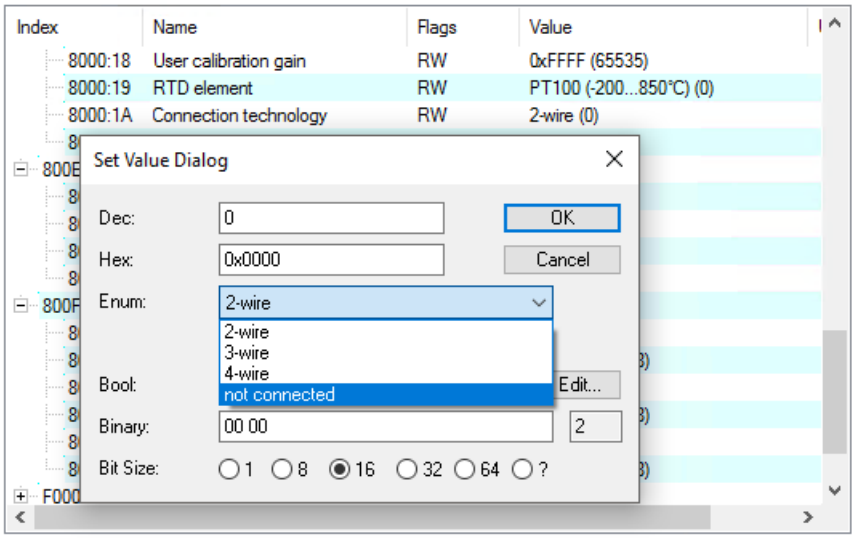


Fig. 46: "Connection technology" selection dialog using the EL3201 as an example

2-, 3- or 4-wire connection of the sensor can be selected here depending on the terminal type. Basically, the lowest measurement uncertainty (colloquially: lowest measuring error) can be achieved with a 4-wire connection (if available), since supply line resistances are actively deducted.
With "not connected" (if present) the respective channel is completely disabled, the conversion time of the EL32xx is shortened accordingly.

The number of connection wires of the sensor and the terminal setting in CoE 0x80n0:1A should match! This is the only way to assure that the capabilities of the sensor and measuring device are used in the best possible way. Otherwise you have to work with wire jumpers (sensor has less lines than are possible in the measuring device) or double assignment (sensor has more lines than are possible in the measuring device). This increases the measurement uncertainty. Here are a few (bad) examples:

- 4-wire sensor and 2-wire terminal:
  The added value of the 4-wire sense measurement cannot be exploited, the complex 4-wire sensor is operated as an uncompensated 2-wire sensor, either the sense lines of the RTD are not connected at all or are also plugged into the 2-wire contacts.
- 2-wire sensor and 4-wire terminal:
  External wire jumpers must be plugged into the terminal to trick the terminal into believing that it is a 4-wire sensor, the 4-wire capability of the terminal cannot be exploited.

5.1.2 Further settings (optional)

Further settings are possible if required and are described in the following chapters.

5.1.2.1 PDO presentation, 0x80n00:02

Index 0x80n00:02 "Presentation" offers the possibility to change the digital presentation of the measured value in the 16-bit value. Three value presentations are possible in the 16-bit PDO:

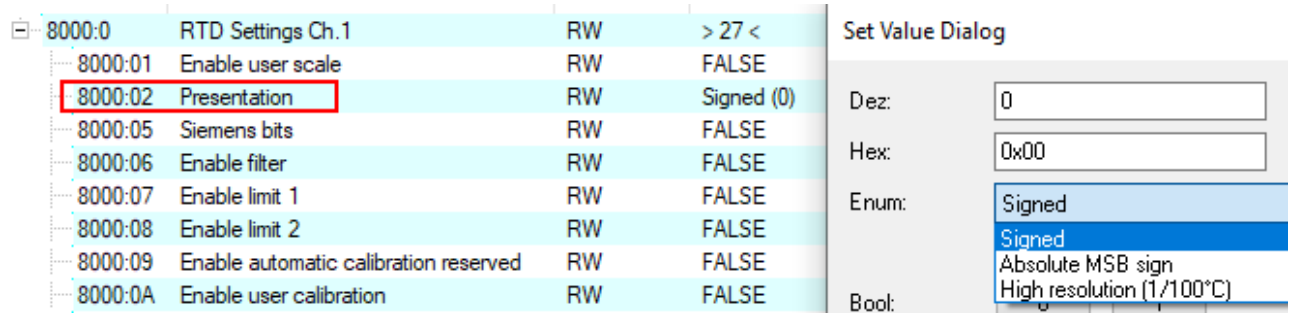
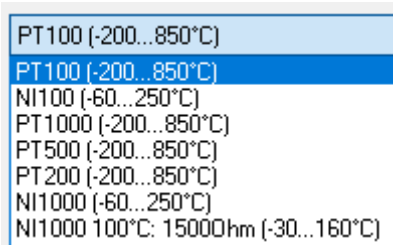


Fig. 47: Setting the presentation of the measured value in 0x8000:02 "Settings"

- **Signed (default setting):**
  The measured value with resolution 1 bit = 1/10°C is displayed signed in two's complement. Maximum representation range for 16 bit = -32768... +32767, corresponding theoretically to -3276.8°C... +3276.7°C (in reality, the measured value is limited by the set RTD transformation).



  Example:
  - $1000\ 0000\ 0000\ 0000_{bin} = 0x8000_{hex} = -\ 32768_{dec}$
  - $1111\ 1111\ 1111\ 1110_{bin} = 0xFFFE_{hex} = -\ 2_{dec}$
  - $1111\ 1111\ 1111\ 1111_{bin} = 0xFFFF_{hex} = -\ 1_{dec}$
  - $0000\ 0000\ 0000\ 0001_{bin} = 0x0001_{hex} = +1_{dec}$
  - $0000\ 0000\ 0000\ 0010_{bin} = 0x0002_{hex} = +2_{dec}$
  - $0111\ 1111\ 1111\ 1111_{bin} = 0x7FFF_{hex} = +32767_{dec}$
- **High resolution:**
  The measured value with resolution 1 bit = 1/100°C is displayed signed in two's complement, see there. Maximum representation range for 16 bit = -32768... +32767, corresponding theoretically to -327.68°C... +327.67°C (in reality the measured value is limited by the set transformation, but can be extended by user scaling [▶ 128]).
  The achievable accuracy is not increased by the more detailed presentation! However, the additional decimal place can be useful for control tasks, where the internal ADC resolution limits the resolution.

Measured value and process data output

Measured value	Output (hexadecimal)	Output (signed integer, decimal)	In 1/10°C, corresponds to	In 1/100°C, corresponds to
-250.0°C	0xF63C	-2500	-250°C	-25°C
-200.0°C	0xF830	-2000	-200°C	-20°C
-100.0°C	0xFC18	-1000	-100°C	-10°C
-0.1°C	0xFFFF	-1	-0.1°C	-0.01°C
0.0°C	0x0000	0	0°C	0°C
0.1°C	0x0001	1	0.1°C	0.01°C
100.0°C	0x03E8	1000	100°C	10°C
200.0°C	0x07D0	2000	200°C	20°C
500.0°C	0x1388	5000	500°C	50°C
850.0°C	0x2134	8500	850°C	85°C
1000.0°C	0x2170	10000	1000°C	100°C

- **Absolute value with MSB as sign:**
  The measured value with resolution 1 bit = 1/10°C is output signed in the signed amount presentation. Maximum presentation range with 16 bit = -32768... +32767, corresponding theoretically to -3276.8°C ... +3276.7°C (in reality the measured value is limited by the set transformation)
  Example:
  - $1111\ 1111\ 1111\ 1111_{bin} = 0xFFFF_{hex} = -\ 32767_{dec}$
  - $1000\ 0000\ 0000\ 0010_{bin} = 0x8002_{hex} = -\ 2_{dec}$
  - $1000\ 0000\ 0000\ 0001_{bin} = 0x8001_{hex} = -\ 1_{dec}$
  - $0000\ 0000\ 0000\ 0001_{bin} = 0x0001_{hex} = +1_{dec}$
  - $0000\ 0000\ 0000\ 0010_{bin} = 0x0002_{hex} = +2_{dec}$
  - $0111\ 1111\ 1111\ 1111_{bin} = 0x7FFF_{hex} = +32767_{dec}$

Presentation note on the "Resistance measurement" operation mode

In "Resistance Measurement" mode, the measured value is always displayed unsigned, irrespective of the "Presentation" setting (object 0x80n00:02), as 0..0xFFFF with the respective value.

1/16 Ω -> ~62 mΩ/digit

1/64 Ω -> ~15 mΩ/digit

5.1.2.2 Compensation of the supply line resistance, 0x80n0:1B

When measuring resistance with the two-wire technique, the firmware can take the line resistance into account, provided it is made known to it. For this purpose, the separately measured static supply line resistance can be entered in the CoE object 0x80n0:1B "Wire calibration 1/32 ohm". It is then taken into account in the firmware. (unit [1/32 Ω]). An example of the calculation can be found in the chapter "Basics of RTD technology" of the IO Analog Manual.

However, line changes occurring after commissioning (temperature change, corrosion) are not detected in this way! The use of 3- or 4-wire connection technology is recommended for this purpose.

5.1.2.3 Measured value calculation: calibration, adjustment, scaling

As can be seen in the data flow [▶ 89], the measured value can be manipulated computationally in two places:

- In the calibration object
  - The manufacturer calibration takes place in the manufacturer part (password protected). The Beckhoff adjustment on the production side ensures that the channel complies with the device specification.
  - In the user part, the user can enter their own gain/offset values.
- In the scaling object

User scaling, index 0x80n00:01

The user scaling is enabled via index 0x80n00:01, the parameterization via indices

- 0x80n00:11 offset user scaling
- 0x80n00:12 gain user scaling

User calibration, index 0x80n00:18, 0x80n00:17

The user calibration is enabled via index 0x80n0:0A, the parameterization via indices

- 0x80n00:17 user offset calibration
- 0x80n00:18 user gain calibration

Manufacturer calibration, index 0x80xF

The manufacturer calibration is enabled via index 0x80n0:0B.
Beckhoff reserves the right to parameterize via the device-specific indices of object 0x80nF (see CoE object directory [▶ 127]) (see Note Producer Codeword [▶ 97]).

Producer codeword

Beckhoff reserves the right to perform basic adjustment of the terminals. The producer codeword is therefore not public.

5.1.2.4 Siemens bits, 0x80n00:05

If this bit is set, status displays are superimposed on the lowest three bits. In the error case "overrange" or "underrange", bit 0 is set.

5.1.2.5 Notch filter

The EL32xx terminals are equipped with a digital filter. The filter performs a notch filter function and determines the conversion time of the terminal. It is parameterized via the index 0x8000:15. The higher the filter frequency, the faster the conversion time.

Notch filter means that the filter has zeros (notches) in the frequency response at the specified filter frequency and multiples thereof, i.e. it masks these frequencies. In order to filter out 50 Hz, therefore, the 50 or the 10 Hz filter can be used. Since all frequencies lower than the notch frequency usually have to be measured, however, the "50 Hz" setting is to be used in this case.

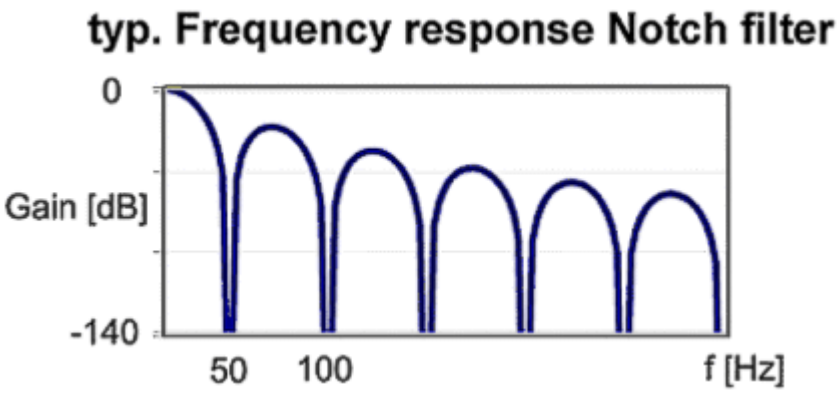


Fig. 48: Typical frequency response of a notch filter set to 50 Hz

Index 0x80n00:06

The filter function is always active even if the bit is not set, since this is obligatory for the measurement process! The firmware filter can therefore not be switched off.

Details on the conversion time

- The conversion time depends on the *number of active channels, number of measurements (2/4-wire), filter time, const. computing time*
- The conversion time for the 2-wire measurement is about twice as long as for the 4-wire measurement
- The resistance measurement corresponds to a 4-wire measurement
- The process data *TxPDO Toggle* changes its state if a new measured value is present

The filter characteristics are set via index 0x8000:15

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1). The corresponding indices 0x8010:15 of the EL3202 or 0x8010:15, 0x8020:15, 0x8030:15 of the EL3204 have no parameterization function.

Switching off the unused channels of multi-channel terminals

Unused channels should be switched off by "not connected" if filter frequencies are ≥ 1 kHz (optimization of conversion times)!
The channel concerned is completely disabled and the conversion time of the EL32xx is correspondingly shortened.

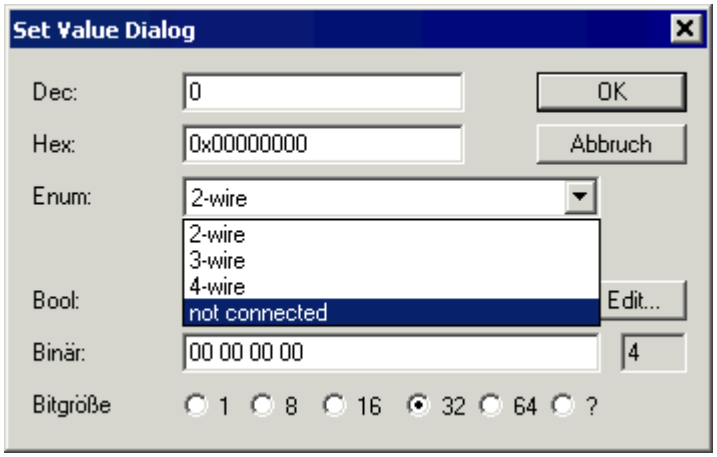


Fig. 49: Set Value Dialog

By means of a double click on the corresponding object 0x80n0:1A, the respective channels can be switched off in the Set Value Dialog by selecting the "Enum" value "not connected" (see fig. *"Set Value Dialog"*).

Interference from equipment

When operating the fast analog EL320x EtherCAT terminals, high frequency superimposed signals from interfering devices (e.g. proportional valves, stepper motors or DC motor output stages) can be picked up by the terminal.

- In order to guarantee interference-free operation, we recommend that separate power supply units be used for the terminals and the interference-causing devices.
- The integrated filter of the terminal (see index 0x80n00:06) should be switched on as an additional measure.

Typical conversion times

EL3201, EL3201-0010, EL3201-0020, EL3201-0030

Filter frequency	Conversion time (update time)
5 Hz	205 ms
10 Hz	105 ms
50 Hz	25 ms
60 Hz	21 ms
100 Hz	15 ms
500 Hz	5 ms
1000 Hz	4 ms
2000 Hz	4 ms
3750 Hz	4 ms
7500 Hz	4 ms
15000 Hz	4 ms
30000 Hz	4 ms
Conversion times in relation to the filter frequencies, 4-wire measurement	

EL3202

Filter frequency	Conversion time (update time)
5 Hz	807 ms
10 Hz	410 ms
50 Hz	88 ms
60 Hz	75 ms
100 Hz	46 ms
500 Hz	13 ms
1000 Hz	10 ms
2000 Hz	7 ms
3750 Hz	6 ms
7500 Hz	5 ms
15000 Hz	5 ms
30000 Hz	5 ms
Conversion times in relation to the filter frequencies, 3-wire measurement	

EL3202-0010, EL3202-0020, EL3202-0030

Filter frequency	Conversion time (update time)	
	4-wire update rate	3-wire update rate
5 Hz	410 ms	610 ms
10 Hz	210 ms	310 ms
50 Hz	47 ms	67 ms
60 Hz	40 ms	57 ms
100 Hz	25 ms	35 ms
500 Hz	7 ms	10 ms
1000 Hz	5 ms	7 ms
2000 Hz	4 ms	5 ms
3750 Hz	4 ms	5 ms
7500 Hz	4 ms	5 ms
15000 Hz	4 ms	5 ms
30000 Hz	4 ms	5 ms

EL3204

Filter frequency	Conversion time (update time)
5 Hz	800 ms
10 Hz	400 ms
50 Hz	82 ms (21 ms / 1 channel)
60 Hz	70 ms
100 Hz	43 ms
500 Hz	11 ms
1000 Hz	7 ms
2000 Hz	6.5 ms (2 ms / 1 channel)
3750 Hz	6 ms
7500 Hz	6 ms
15000 Hz	6 ms
30000 Hz	6 ms
Conversion times in relation to the filter frequencies, 4-wire measurement	

EL3208

Filter frequency	Conversion time (update time)	
	1 channel active	8 channels active
5 Hz	201 ms	1600 ms
10 Hz	101 ms	807 ms
50 Hz	22 ms	171 ms
60 Hz	18 ms	145 ms
100 Hz	12 ms	92 ms
500 Hz	4 ms	29 ms
1000 Hz	3 ms	20 ms
2000 Hz	3 ms	20 ms
3750 Hz	3 ms	20 ms
7500 Hz	3 ms	20 ms
15000 Hz	3 ms	20 ms
30000 Hz	3 ms	20 ms
Conversion times in relation to the filter frequencies, 2-wire measurement		

EL3214 and EL3218

Filter frequency	Conversion time (update time)	
	1 channel active	4 channels active
5 Hz	402 ms	1607 ms
10 Hz	203 ms	811 ms
50 Hz	44 ms	175 ms
60 Hz	37 ms	148 ms
100 Hz	24 ms	95 ms
500 Hz	8 ms	32 ms
1000 Hz	6 ms	24 ms
2000 Hz	6 ms	22 ms
3750 Hz	5 ms	21 ms
7500 Hz	5 ms	20 ms
Conversion times in relation to the filter frequencies, 3-wire measurement		

5.1.2.6 Limit 1 0x80n00:13, Limit 2 0x80n00:14 (not for EL3214, EL3208 and EL3218)

The limit function is enabled via the indices 0x80n00:07 "Enable limit 1" and Index 0x80n00:08 "Enable limit 2".

With the indices 0x80n00:13 "Limit 1" and 0x80n00:14 "Limit 2", a value range can be set, which is continuously compared with the current measured value. When the "Limits" limit values are not met/ exceeded, the corresponding bits in the PDO status are set.

The limit evaluation takes place after taking into account the set characteristic curve and negative values, s. data flow diagram [▶ 89].

Limit [2 Bit] Interpretation (default), Index 0x60n00:03, 0x60n00:05:

0x00, 0: not active
0x01, 1: value is greater than limit value
0x10, 2: value is less than limit value
0x11, 3: value is equal to limit value

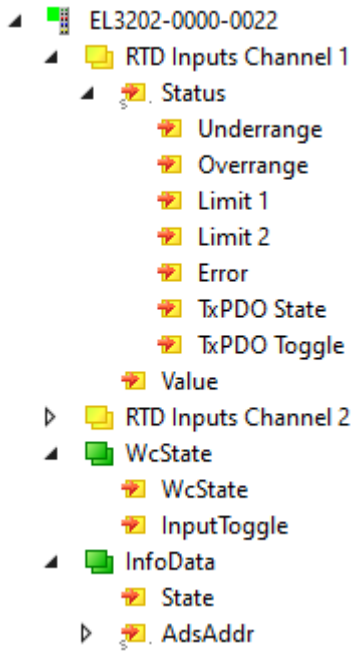
5.2 Process data

EtherCAT process data PDO (process data objects)

The EL32xx-xxxx provide a default process image consisting of

- per channel
  - Status: 16 bit
    Content: see chapter Status word [▶ 105]
  - Value: 16 bit measured value
    Presentation: see chapter "PDO presentation [▶ 95]"
- Device information (real-time, i.e. updated cyclically)
  See also chapter “General Commissioning Instructions for an EtherCAT Slave”
  - WcState: 1 bit
    TRUE: terminal has not transferred any valid values to EtherCAT in this cycle, measured values of the terminal may not be used.
    Cause: either the terminal itself or another device in the same SyncUnit is not participating in the EtherCAT data exchange, rectify fault.
  - InputToggle: 1 bit
    Bit change indicates new process data
- Device information (non-realtime)
  - State: EtherCAT state of the device INIT – PreOP – SafeOP – OP, BOOTSTRAP
  - ADS address in the AMS Net ID system: for read/write access from the controller

Taking the example here of the EL3202, rev. 0022 (version 2022):



It is strongly recommended that the channel and device diagnostics be evaluated on the application side so that measured values do not continue to be not processed incorrectly, although the RTD terminal has already declared that it is incapable of measurement.

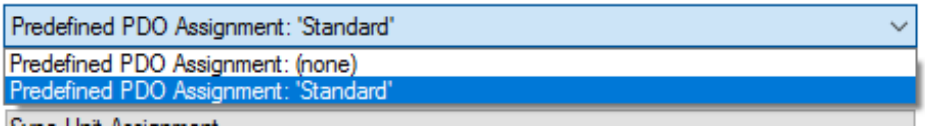
SyncManager

SM3, PDO assignment 0x1C13, for 0 ≤ n ≤ 7 (ch. 1 - 8) (depending on number of channels)				
Index	**Index of excluded PDOs**	**Size (byte.bit)**	**Name**	**PDO content**
0x1A0n (default)	-	4.0	RTD Inputs Channel 1 - 8	Index 0x60n00:01 - Underrange Index 0x60n00:02 - Overrange Index 0x60n00:03 - Limit 1* Index 0x60n00:05 - Limit 2* Index 0x6000:07 - Error Index 0x180n:07 - TxPDO Status Index 0x180n:09 - TxPDO Toggle Index 0x60n00:11 - Value

*) not for EL3214, EL3208 and EL3218

Process data preselection (predefined PDOs)

Since the EL32xx only have the standard process image, there are no selectable Predefined PDO:

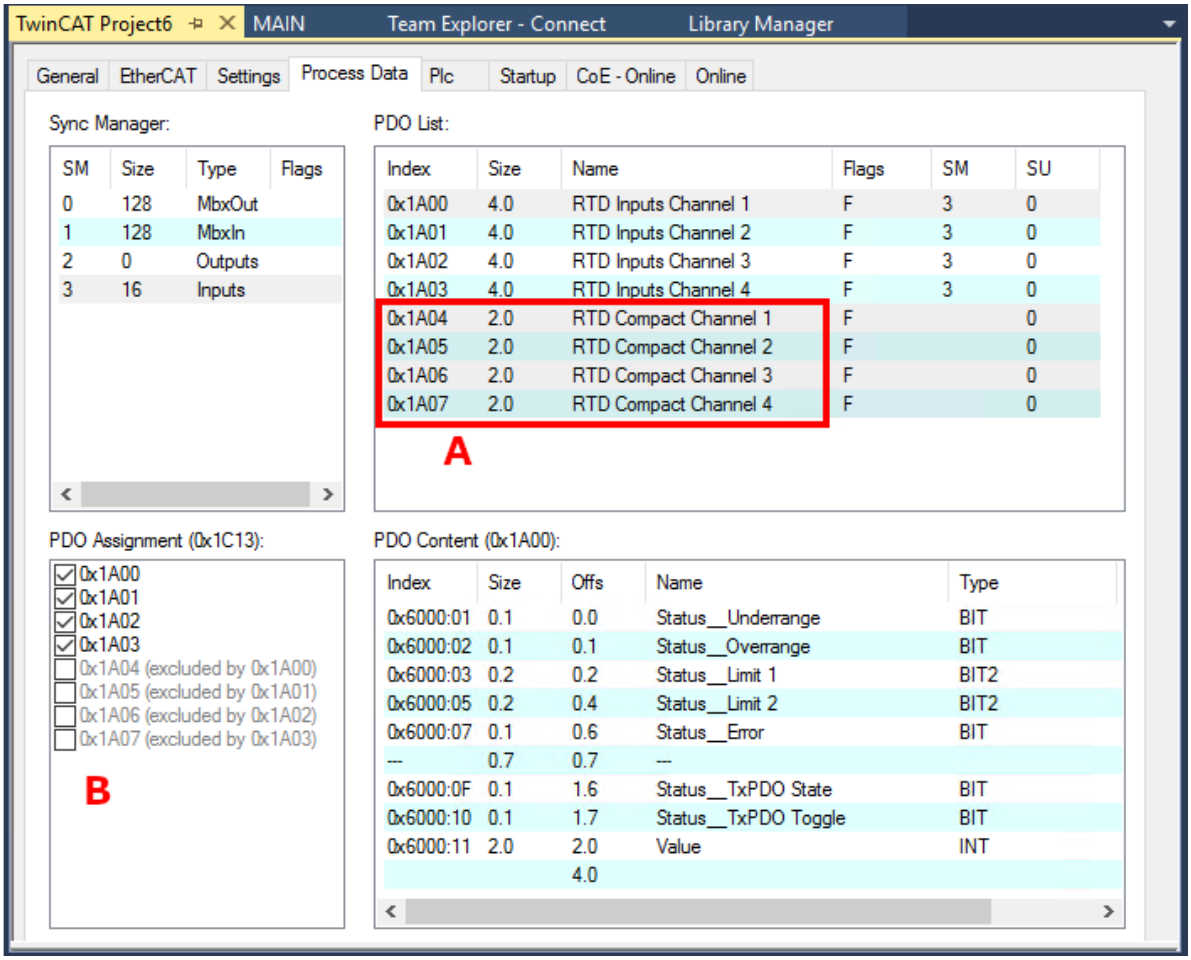


Compact process image

Function available from EL3204 FW10

To save process data width, the 16-bit status can be excluded from transmission. Since no diagnostic information can be evaluated after this, this operation is not recommended.

EL3204 example: in the TwinCAT EtherCAT configuration, select the PDO objects 0x1A04 ... 0x1A07 (A) in the PDO assignment 0x1C13 (B) instead of the standard PDO 0x1A00...0x1A03.


TwinCAT Project6
MAIN
Team Explorer - Connect
Library Manager
General
EtherCAT
Settings
Process Data
Plc
Startup
CoE - Online
Online
Sync Manager:
SM Size Type Flags
0 128 MbxOut
1 128 MbxIn
2 0 Outputs
3 16 Inputs
PDO List:
Index Size Name Flags SM SU
0x1A00 4.0 RTD Inputs Channel 1 F 3 0
0x1A01 4.0 RTD Inputs Channel 2 F 3 0
0x1A02 4.0 RTD Inputs Channel 3 F 3 0
0x1A03 4.0 RTD Inputs Channel 4 F 3 0
0x1A04 2.0 RTD Compact Channel 1 F 0
0x1A05 2.0 RTD Compact Channel 2 F 0
0x1A06 2.0 RTD Compact Channel 3 F 0
0x1A07 2.0 RTD Compact Channel 4 F 0
A
PDO Assignment (0x1C13):
0x1A00
0x1A01
0x1A02
0x1A03
0x1A04 (excluded by 0x1A00)
0x1A05 (excluded by 0x1A01)
0x1A06 (excluded by 0x1A02)
0x1A07 (excluded by 0x1A03)
B
PDO Content (0x1A00):
Index Size Offs Name Type
0x6000:01 0.1 0.0 Status__Underrange BIT
0x6000:02 0.1 0.1 Status__Overrange BIT
0x6000:03 0.2 0.2 Status__Limit 1 BIT2
0x6000:05 0.2 0.4 Status__Limit 2 BIT2
0x6000:07 0.1 0.6 Status__Error BIT
--- 0.7 0.7 ---
0x6000:0F 0.1 1.6 Status__TxPDO State BIT
0x6000:10 0.1 1.7 Status__TxPDO Toggle BIT
0x6000:11 2.0 2.0 Value INT
4.0

5.3 Status word

The status information for each channel of the EL32xx and EL33xx is transmitted cyclically from the terminal to the EtherCAT Master as process data (PDO). Two versions of the device description are available for the EL32xx and EL33xx, representing the process image in individual and extended forms.

The difference can be seen in the revision number EL3xxx-xxxx-**XXXX**.

The EL32xx or EL33xx transmit the following process data:

- **Underrange**: value below measuring range
- **Overrange**: value above measuring range ("Wire break" together with "Error")
- **Limit 1 (depending on terminal type):** Limit value monitoring 0: ok, 1: limit range exceeded, 2: limit range undershot
- **Limit 2 (depending on terminal type):** Limit value monitoring 0: ok, 1: limit range exceeded, 2: limit range undershot
- **Error**: the error bit is set if the process data is invalid (wire break, overrange, underrange)
- **TxPDO State:** validity of the data of the associated TxPDO (0=valid, 1=invalid).
- **TxPDO Toggle**: the TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated. This allows the currently required conversion time to be derived.

The limit evaluation is set in the "8000" objects in the CoE directory.

Differences in the versions of the EL32xx and EL33xx series

The revision differences are illustrated below, using the EL32xx series as an example. The principles of the description apply equally to the EL33xx series.

Revision -0016 (EL32xx-xxxx-0016)

These terminal revisions have the **single process image**, see *“EL32xx-0000-0016 process image in the TwinCAT 2.11 representation”.*
Each item of status information is transmitted as a single, linkable process data.

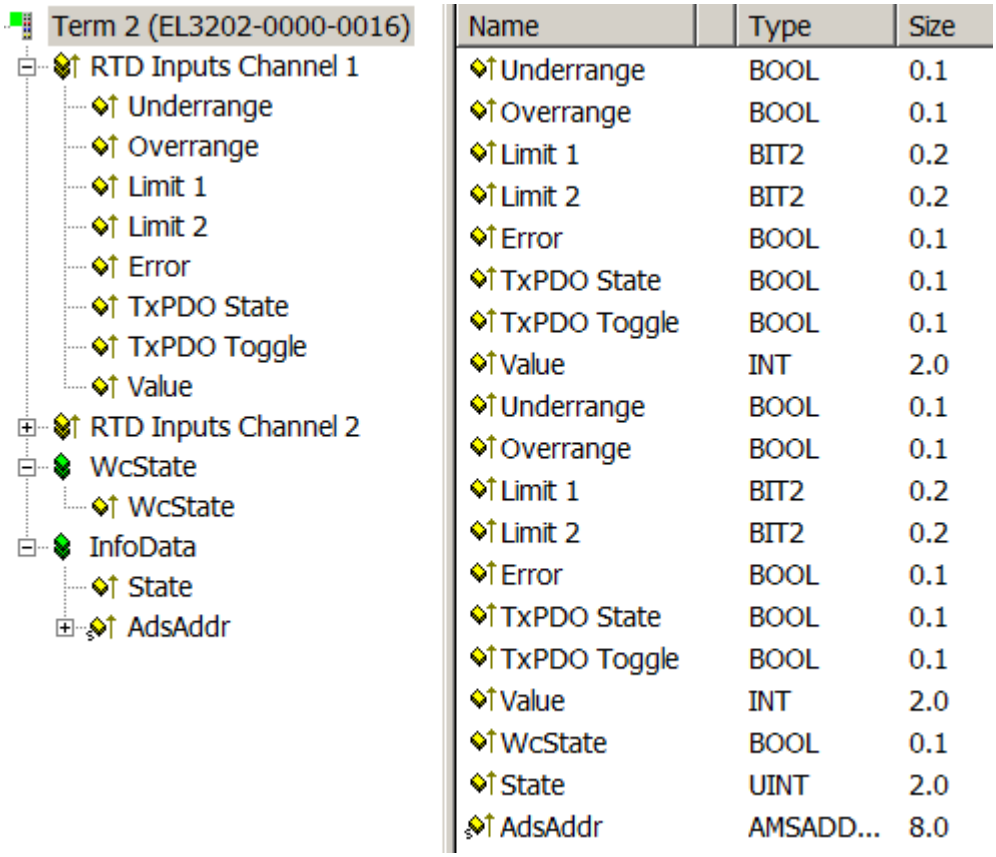


Fig. 50: EL32xx-0000-0016 process image in the TwinCAT 2.11 representation

Revisions -0017 (EL32xx-xxxx-0017) and higher

These terminal revisions also have the **summarized process image**, see *"EL32xx-0000-0017 process image in the TwinCAT 2.11 representation"*.
The individual units of information are assembled here in the usual Beckhoff representation as a 16-bit status word, and can be linked into the controller in this way.

Status word

Bit	SW.15	SW.14	SW.13	SW.12	SW.11	SW.10	SW.9	SW.8	SW.7	SW.6	SW.5	SW.4	SW.3	SW.2	SW.1	SW.0
Name	TxPDO Toggle	TxPDO State	-	-	-	-	-	-	-	Error	Limit 2		Limit 1		Overrange	Underrange

In addition to this, the consolidated "status" can be folded out through the "+" symbol, and the items of process data linked individually.

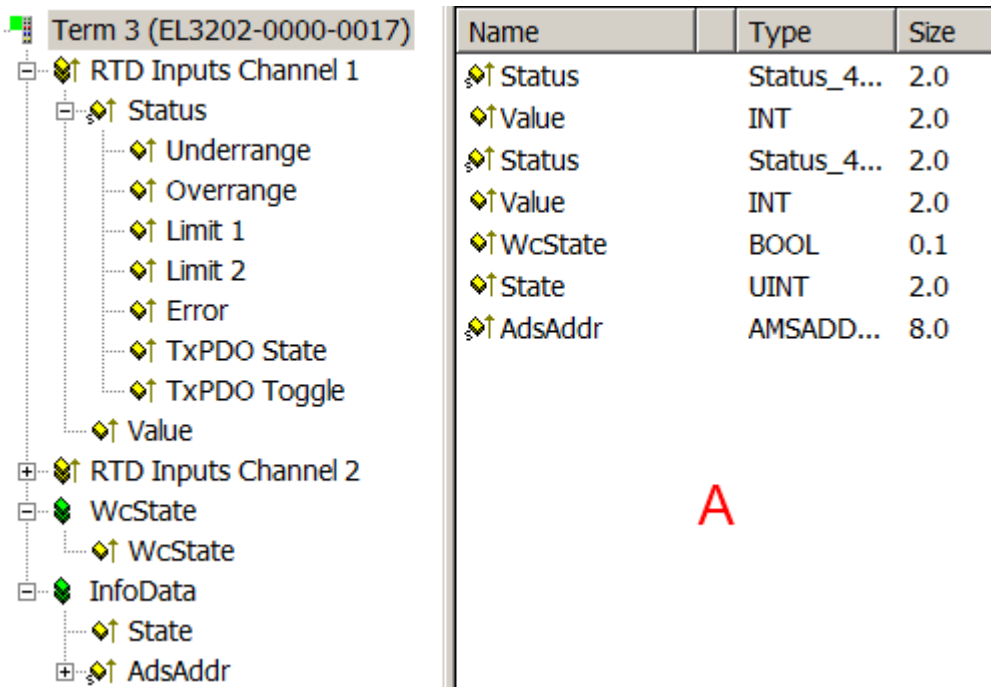


Fig. 51: EL32xx-0000-0017 process image in the TwinCAT 2.11 representation

The individual items of information can also be displayed in the overview window (A) on the right. By clicking on the button

in the menu bar the information can also be displayed there.

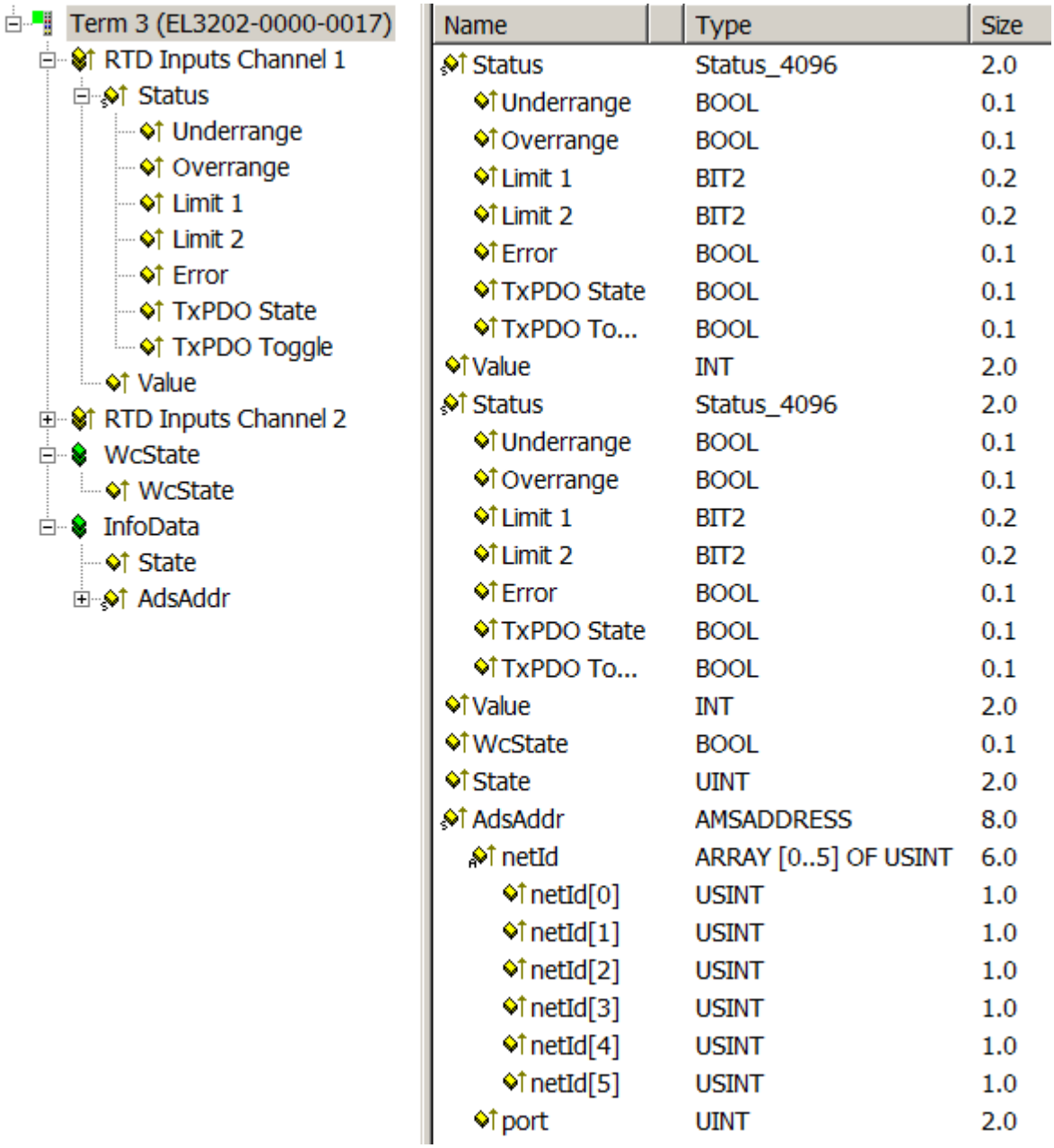


Fig. 52: Consolidated process image in the extended representation under TwinCAT 2.11

Notes

- The **consolidated representation** is only visible from TwinCAT 2.11 and above. For reasons of compatibility, if a EL32xx-xxxx-0017 (or later) is operated in earlier TwinCAT configurations, the individual process image is displayed, prepended with the identifier "Status__".

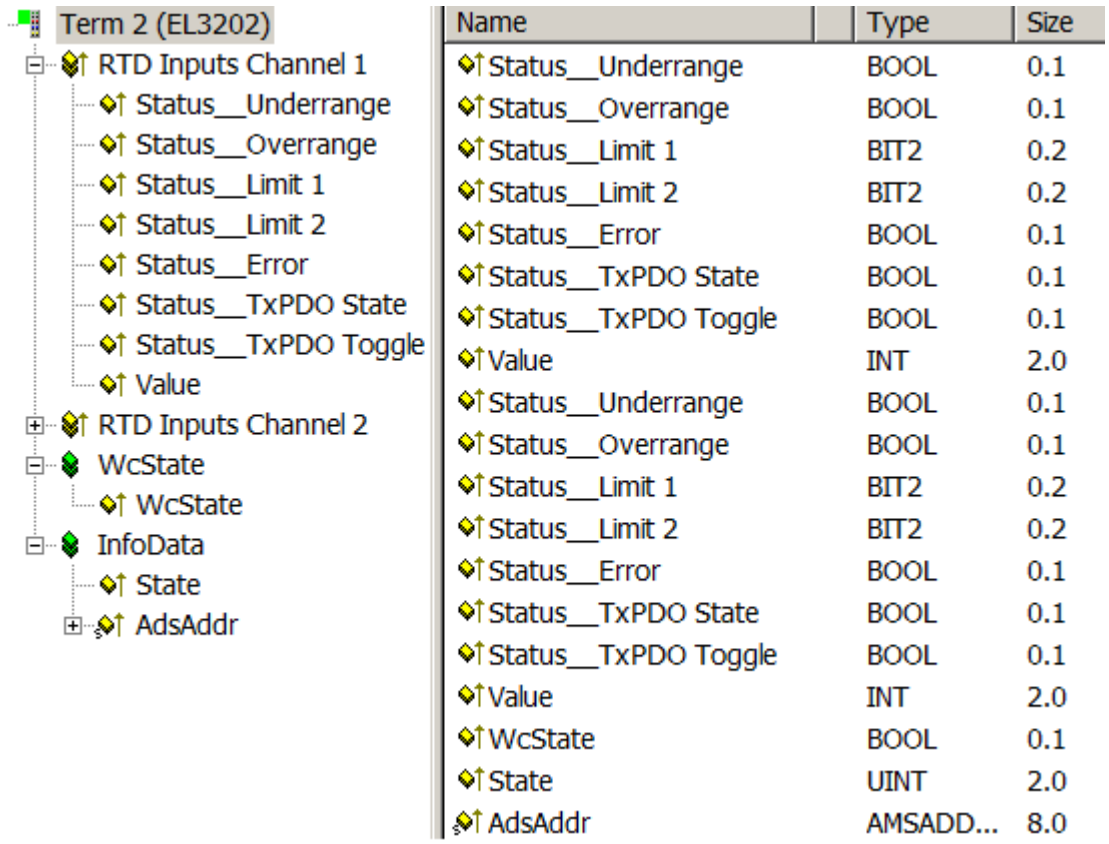


Fig. 53: Consolidated process image represented under TwinCAT 2.10

- Revisions -0016 and -0017 do not depend on the revision of the firmware installed in the terminal. This means that terminals that were supplied as EL32xx-xxxx-0016 can also be operated with a "newer" -0017 configuration, and therefore can be addressed using the consolidated process image.
  This case of "upwards compatibility" is permitted for the EL32xx-xxxx-0016 and -0017.
- The easiest way to determine the revision that is installed in the terminal is through a scan of the EtherCAT system. The comparison report shows the differences.

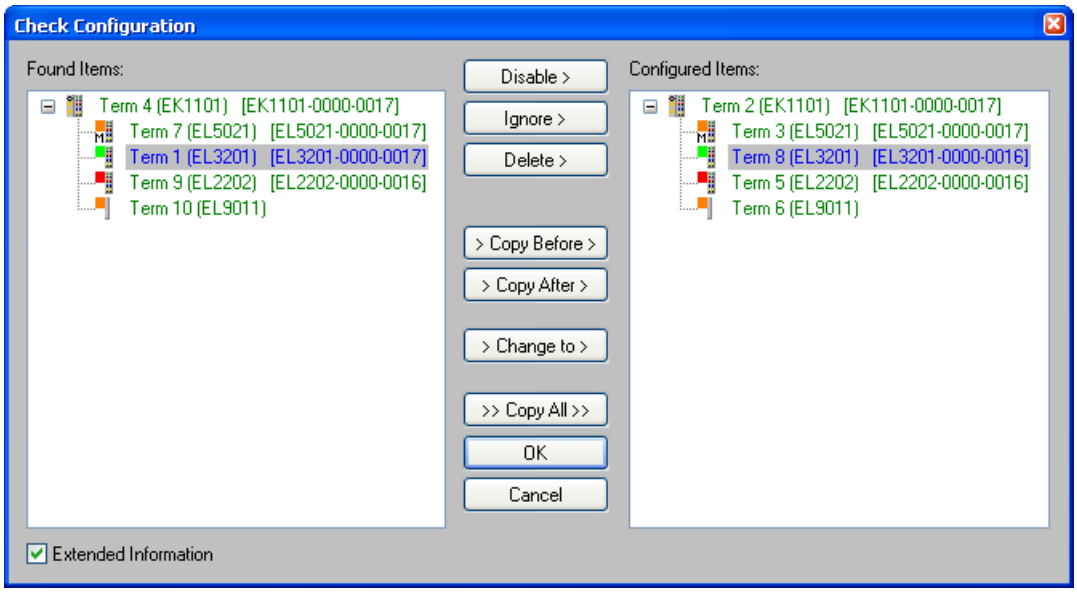


Fig. 54: Typical result after scanning an EtherCAT system

Explanation about fig. *“Typical result after scanning an EtherCAT system”*: According to the overview on the right, an EL3201-0000-0016 was found in the configuration (*.tsm file), whereas the overview on the left shows revision -0017. The general downward compatibility of the EL terminals ensures that this kind of application is possible.

5.4 Settings and application notes for EL3201/2-0010/-0020/-0030

Commissioning EL32xx-xxxx

The basic EL32xx-xxxx notes in chapter "EL32xx settings [▶ 89]" must be observed.

The EL3201/EL3202 series is designed for temperature or resistance measurement

- version -0010 offers enhanced measurement precision
- version -0020 is the factory calibrated version of the EL32xx-0010
- version -0030 is the variant with external calibration certificate of the EL32xx-0010

Notes regarding EL3201/2-0010/-0020/-0030 series (high-precision)

Due to special features in hardware and firmware, the mentioned terminals are able to measure the resistance value and thus, if necessary, the temperature with high accuracy. Please note:

Increased accuracy EL320x-0010/-0020/-0030

In the case of the high-precision terminals the settings in the object 0x80n0 / RTD-Settings may not be changed! The high-precision resistance measurement/temperature measurement can only be performed in the range 10... 220 ohm, this corresponds to a Pt100 measuring range of -200 ... 320°C.

In order to be able to display the high accuracy, the 0.01°C/digit presentation is preset. The increased accuracy of the EL320x-00x0 is therefore only valid for the following settings:

• Resistance measurement or Pt100 characteristic curve (0.00385 Ω/Ω/°C, IEC60751 characteristic curve Pt385) – other characteristic curve without guarantee!
• Ambient temperature: see table of technical data
• 4-wire connection technology
• Measuring range -200 to 320°C
• 50/60 Hz filter

Temperatures or resistances outside the above-mentioned range cannot be measured with high accuracy. If these basic values are not maintained, the high-precision terminal behaves like a terminal with standard accuracy.

To ensure that the measurements are also carried out with the desired increased accuracy in the long term, regular checking of the measuring accuracy is recommended, e. g. annually. Ageing effects or environmental influences can then be compensated by recalibration (user calibration).

Default/factory setting

CoE Index	EL32xx-0000 (standard accuracy)	EL320x-0010/-0020/-0030 (increased accuracy)
0x80n0:1A (connection technology)	• 2-wire connection • All channels enabled **for EL3214 and EL3218:** • 3-wire connection • All channels enabled	• 4-wire connection The connection type is not detected automatically. • All channels enabled
0x80n00:19 (RTD element)	• Pt100 (-200 … 850°C)	• Pt100 Measurements take place in a reduced measuring range of -200 ... 320°C or an equivalent resistance range. ◦ The type label "Pt100 (-200 ... 850°C)" indicates the usual measuring range of a Pt100 element
0x80n00:02 (Presentation)	• Signed The temperature is displayed with 1/10°C per digit (signed).	• HighResolution The temperature is displayed with 1/100°C per digit (signed).
0x80n00:07/08 (Enable Limit 1/2) if present	• FALSE Limits disabled **for EL3214 and EL3218:** • No limit function available	• FALSE Limits disabled
0x8000:15 (Filter settings)	• 50 Hz Filter enabled	• 50 Hz Filter enabled

Area of application

EL32xx-0000 (standard accuracy)	EL320x-0010/-0020/-0030 (increased accuracy)
The terminal is calibrated in the measuring range "1/16 Ω" (10 Ω ... 4 kΩ) and can be used in this resistance range. It provides a normal measurement uncertainty in a wide ambient temperature range, see specification.	The high-precision version is calibrated in the measuring range "1/64 Ω" (10 Ω ... 1 kΩ) and over a measuring range of 18 ... 220 Ω and should only be used in this range or for Pt100 measurements. It provides a comparatively lower measurement uncertainty in the temperature range of a standard switch cabinet environment, see specification.

5.5 Settings and application notes for EL3204-0200

The EL3204-0200 differs from the EL3204-0000 (standard type) in terms of an

- extended measuring range 0 ... 240 kΩ
- additional linearizations/characteristic sensor curves
  - programmed characteristic sensor curves match the measuring range
  - freely programmable according to sampling points table
  - parameterizable formulas according to IEC 60751, Steinhart-Hart equation and B-parameter equation

NOTICE

Changes in the CoE directory, in the case of exchange

So that, in the case of exchanging an EtherCAT device, the CoE parameters are set correctly in the new device, CoE changes on the customer side must be entered in the start-up list.

Changes in the CoE directory, program access

The CoE parameters can also be read and written during operation (insofar as it makes sense) by the PLC using corresponding control commands. For details, see the corresponding articles in the Beckhoff Information System, for example.
Notice: The CoE parameters should be written in status PreOp or SafeOp, after which the slave should be switched to status OP.

Measuring range

The specified terminal precision refers to the full-scale value for the resistance measurement.

It is not advisable to use the terminal in the range 0 to 10 Ω, due to the relatively low (relative) measuring accuracy in this range. Specialized resistance measurement terminals such as the EL3692 with 4-wire measurement are to be used for such measurements.

Notes regarding accuracy

In addition to the accuracy in terminal resistance measurement, the measurement result is influenced by further factors, as described below:

- Measuring error of the measuring sensor used
- Measuring error of the terminal: < +/- 0.3% of full-scale value (240 kΩ for resistance measurement); < +/- 0.5°C for Pt sensors
- Implementation of the calculation parameters in the firmware, e.g. number of sampling points, accuracy of the calculated parameters,...

⇨ We recommend verifying the settings against a calibrated temperature source.

5.5.1 Programmed characteristic sensor curves

Direct resistance measurement

The EL3204-0200 can be used for direct resistance measurement in three measuring ranges (n = channel 0 ... 3).

CoE 0x80n00:19 setting	Measuring range	Resolution/digit
0x101	0 ...6,553.5 Ω	0.1 Ω
0x102	0 ...65,535 Ω	1 Ω
0x103	0 ...240,000 Ω	10 Ω

Note: the way in which the EL3204-0200 measures is electrically the same with these three settings. Only the displayed resolution is changed in the firmware. The full scale value is therefore 240 kΩ for all three measurements.

Fixed sensor curves

Further programmed sensor curves in the defined measuring range can be selected individually in the CoE entry 0x80n00:19 for each channel (n = channel 0... 3).

Type	Resistance range	Implemented temperature range	Resolution/digit
Pt1000 (0.00385 Ω/Ω/°C, IEC60751 characteristic curve Pt385) (PTC)	~180... ~ 3,900 Ω	-200°C to 850°C	0.1°C
Ni1000 (PTC)	~700... ~ 2,300 Ω	-60°C to 250°C	0.1°C
Ni1000 TK1500 (at 100°C: 1500 Ω) (PTC)		-30 to 160°C	0.1°C
NTC 5k (0°C: 16325 Ω)	~167,000... ~ 340 Ω	-40...100°C	0.1°C
NTC 10k (0°C: 32650 Ω)	~176,000... ~ 180 Ω	-30...150°C	0.1°C
NTC 10k (0°C: 29490 Ω)	~135,000... ~ 240 Ω	-30...150°C	0.1°C
NTC 10k (0°C: 27280 Ω, same as KL3204-0030)	~190,000... ~ 760 Ω	-40...110°C	0.1°C
NTC 20k (0°C: 70200 Ω)	~221,000... ~ 270 Ω	-20...150°C	0.1°C
FeT (0°C: 2226 Ω)	~1,900... ~ 3,900 Ω	-30...150°C	0.1°C

5.5.2 Freely programmable characteristic curves

To connect a resisitive sensor with a characteristic curve that is known to the application side but not implemented in the EL32xx-xxxx, the characteristic curve can be entered in the terminal via one of four different options.
Each linearization and each NTC/PTC characteristic curve can be implemented within the measuring range. The suitability of the different implementation procedures depends on the sensor type.

CoE entry in 0x80n00:19	Characteristic curve type	PTC sensors (e.g. Pt100, Pt1000, Ni100, Ni1000,...)	NTC sensors (NTC 5k, NTC 10k, ...)
0x110	RTD table/sampling points table	X	X
0x111	B-parameter equation	-	X
0x112	DIN EN 60751 equation	X (standard for Pt sensors)	-
0x113	Steinhart-Hart equation	-	X

Select the procedure for the channel in CoE entry 0x80n00:19. Please note that for each procedure only one parameter set can be stored in the terminal, which is then available for all channels.

Example: two sensors are connected to channels 1 and 2. Both are to be linearized with the B-parameter equation. The two sensors have to be "identical", since it is not possible to specify different sets of B-parameters for channels 1 and 2. The same applies to the lookup table.

5.5.2.1 Lookup table (0x80n00:19, Entry 0x110)

The required characteristic curve for a PTC or NTC sensor can be stored as a table in CoE 0x8001. It can either be loaded directly from the PLC into the CoE, or the user can enter it in the startup list for the terminal as an XML file. The entries from the TwinCAT startup list are automatically written to the terminal whenever EtherCAT starts.

In general, the lookup table has the following structure: a temperature is assigned to the corresponding resistance. The temperature increment must be constant. Linearization is performed between these steps. A maximum of 100 interpolation points with a maximum measuring range of 0...240 kΩ are permitted.
The exact structure of the lookup table is explained in the CoE overview rand additionally in a sample file (https://infosys.beckhoff.com/content/1033/el32xx/Resources/1525761547.zip) for a Pt1000 sensor.
The sample file illustrates the structure of an XML file to be imported. An Excel file (Excel 2010 format) for creating an XML file is also included. Explanations on how to use the Excel file can be taken from the attached description.

The XML file can be imported directly via the Startup field and activated via “Activate configuration”.

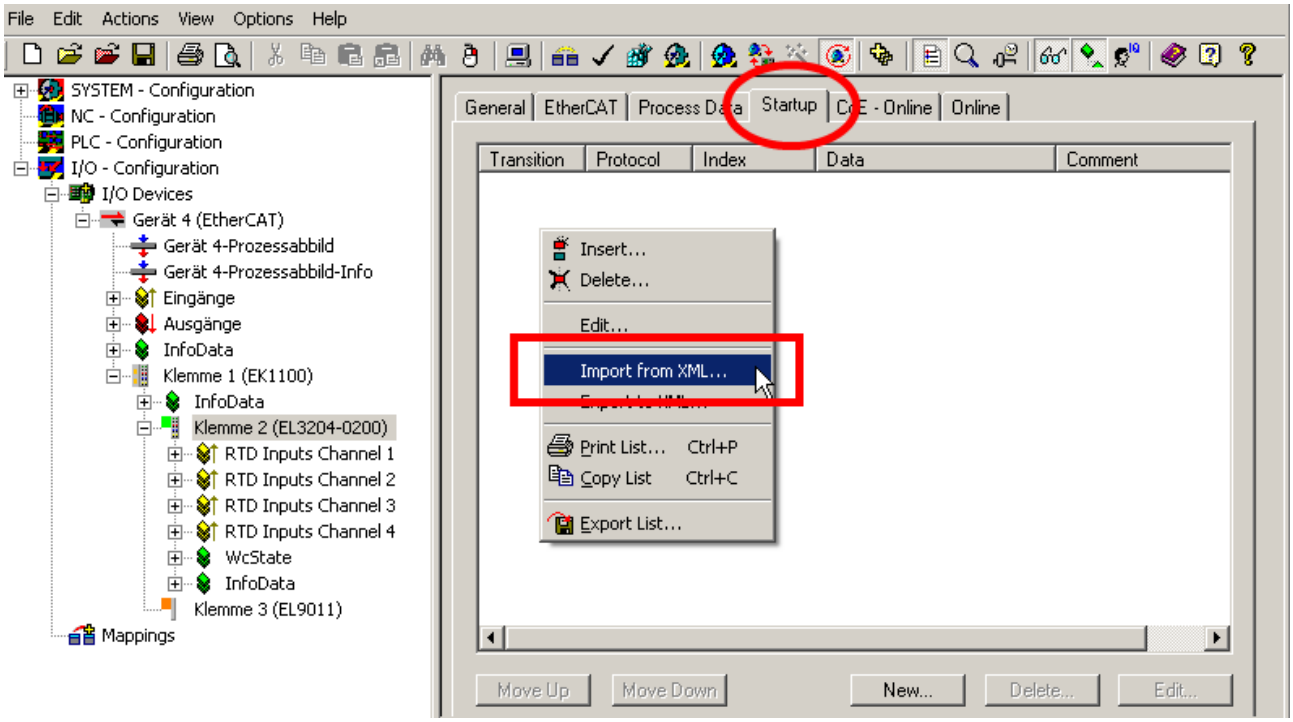


Fig. 55: Importing the XML file

5.5.2.2 B-parameter equation (0x80n00:19, entry 0x111)

The B-parameter equation can be used for NTC sensors (thermistors), i.e. RTD elements with negative coefficient k.

$$R_T = R(T) = A \cdot e^{\frac{B}{T}} = R_{T_0} \cdot e^{B\left(\frac{1}{T}-\frac{1}{T_0}\right)}$$

Here the coefficient R_{T0} indicates the resistance at the temperature T_0, the B-parameter can be taken from the information provided by the sensor manufacturer, or it can be determined by measuring the resistance at two known temperatures.
The following sample file (https://infosys.beckhoff.com/content/1033/el32xx/Resources/1525763723.zip) can be used to calculate the B-parameter. Enter the calculated parameters in the CoE directory 0x8002.

	A	B	D
1	To solve the B-Parameter Equation 2 resistor parameters at 2 defined		
2	temperatures are required:		
3			
4		**Temperatur [°C]**	**Resistance [Ω]**
5	Value 1	25	10000
6	Value 2	85	1450
7			
8	**CoE Index**	**Name**	**CoE Value**
9	8002:0	RTD B-Parameter Equation	
10	8002:01	Min Temperature	-50
11	8002:02	Max Temperature	110
12	8002:03	Rn	10000
13	8002:04	Tn	25
14	8002:05	B-Parameter	3437

Fig. 56: Table for calculating the B-parameter

5.5.2.3 Programmable according to DIN 60751 for Pt sensors (0x80n00:19, entry 0x112)

IEC 751 (and the German version DIN EN 60751) defines the electrical properties of platinum temperature sensors. The characteristic curve is described as follows:

for temperatures -200.. 0°C:

$$R(T) = R_0(1 + AT + BT^2 + C(T - 100°C)T^3)$$

for temperatures 0.. 850°C:

$$R(T) = R_0(1 + AT + BT^2)$$

With the parameters:

$$A = 3.9083 \times 10^{-3}\ °C^{-1}$$
$$B = -5.775 \times 10^{-7}\ °C^{-2}$$
$$C = -4.183 \times 10^{-12}\ °C^{-4}$$

The parameter R_0 indicates the resistance in Ω of the platinum sensor at T = 0°C. The sensors are qualified according to these designations, thus they are termed Pt100 if R_0=100 Ω at T=0°C.
The parameters A, B and C defined in the standard are already stored in the CoE directory 0x8003:yy. The Pt sensor is specified via parameter 0x8003:03, which corresponds to R_0.

5.5.2.4 Steinhart-Hart equation (0x80n00:19, entry 0x113)

The Steinhart-Hart equation can be used for NTC sensors (thermistors), i.e. RTD elements with negative coefficient k.

$$\frac{1}{T} = C_1 + C_2 \ln(R) + C_4(\ln(R))^3$$

The coefficients C_1, C_2 and C_4 can either be taken directly from the manufacturer data or calculated.
A sample file (https://infosys.beckhoff.com/content/1033/el32xx/Resources/1525765899.zip) is available for calculating the Steinhart-Hart parameters. For determining the parameters the resistance values at three known temperatures are required. These can either be taken from the manufacturer data or measured directly at the sensor. Enter the calculated parameters in the CoE directory 0x8004. In most cases the parameter C_3 is close to zero, i.e. negligible. It is therefore not used in the sample file calculation.

EL3204-0200_Steinhart-Hart.xlsx

	A	B	D
1	To solve the Steinhart-Hart Equation 3 resistor parameters at 3 defined		
2	temperatures are required:		
3		**Temperatur [°C]**	**Resistance [Ω]**
4	Value 1	0	27280
5	Value 2	25	10000
6	Value 3	85	1450
7			
8	**CoE Index**	**Name**	**CoE Value**
9	8004:0	RTD Steinhart-Hart Equation	
10	8004:01	Min Temperature	-50
11	8004:02	Max Temperature	110
12	8004:03	C1	8,84E-04
13	8004:04	C2	2,52E-04
14	8004:05	C3	0,00E+00
15	8004:06	C4	1,90E-07

Fig. 57: Table for calculating the Steinhart-Hart parameters

5.5.3 Sample implementation of an NTC sensor

The procedure below illustrates the implementation of an NTC sensor whose characteristic curve is not already stored in the EL3204-0200 terminal based on three methods, i.e. RTD table [▶ 117], B-parameter equation [▶ 118] and Steinhart-Hart equation [▶ 118].
An NTC030WP00 sensor is used in the example.

In this case the manufacturer provides a table with temperature and corresponding resistance values and the following sensor characteristics: NTC 10 kΩ +/- 1% at 25°C, Beta 3435.

Example for the implementation of an NTC sensor with the RTD lookup table

The general procedure is described in chapter Lookup table [▶ 114]. This example illustrates some special cases. An example XML file (https://infosys.beckhoff.com/content/1033/el32xx/Resources/1525768075.zip) for the NTC030WP00 sensor is available for download.

<table>
<tr><th>Description</th><th colspan="2">Problem</th><th colspan="2">Approach</th></tr>
<tr><td>The table covers the temperature range -50°C...110°C, in 1°C steps</td><td colspan="2">Total number of interpolation points 160.
Currently, 100 interpolation points can be entered using the RTD table.</td><td colspan="2">1. Limit the measuring range to correspond to 100 interpolation points in total
2. Increase the step size, e.g. implement a table with 5°C steps. The step size should not be too large, since NTC sensors have an exponential characteristic curve (i.e. not linear as with the PTC sensors).</td></tr>
<tr><td>Resistance values in the temperature range -50°C... -44°C are between 330 kΩ... 240 kΩ</td><td colspan="2">Measured values at low temperatures exceed the total measuring range of 240 kΩ</td><td colspan="2">1. Check whether the measuring range is required
2. Select an alternative sensor with lower resistance values at low temperatures.</td></tr>
<tr><td colspan="2">The range of -40°C... 110°C should be mapped in 2°C steps.
In addition to the table the following settings are implemented in CoE 0x8001:</td><td rowspan="6">Errors occur with default settings of the conversion factor 10: measuring range was not observed. Adjust the unit of the resistance values to the conversion factor</td><td colspan="2">Comply with the measuring range. For the range 0... 240 kΩ, a conversion factor of 100 should be entered in 0x8001:04. The resistance values should then be specified in 1/10 Ω.
The ranges are defined as follows:</td></tr>
<tr><td>0x8001:01 Distance in Degrees</td><td>2</td><td colspan="2"></td></tr>
<tr><td>0x8001:02 Amount of Entries</td><td>75</td><td>Conversion Factor 0x8001:04</td><td>Measuring range</td></tr>
<tr><td>0x8001:03 Start Temperature</td><td>-40</td><td>1</td><td>0.. 6,533.5 Ω</td></tr>
<tr><td>0x8001:04 Conversion Factor</td><td>10</td><td>10</td><td>0..65,535.0 Ω</td></tr>
<tr><td>0x8001:05 Value 1</td><td>188500</td><td>100</td><td>0..240,000.0 Ω</td></tr>
</table>

Example of NTC sensor implementation with B-parameter equation

The B-parameter (Beta 3435) and the parameters R_n (10 kΩ) and T_n (25°C) can be taken from the manufacturer's data and entered directly in the CoE directory 0x8002.

CoE Entry	Entry
0x8002:01 Min Temperature	-40
0x8002:02 Max Temperature	110
0x8002:03 Rn	10000
0x8002:04 Tn	25
0x8002:05 B-Parameter	3435

If one compares the implementation of the table and the B-parameter equation, as shown in the diagram [▶ 118] below, it becomes clear that the B-parameter equation is only valid in a limited range (large deviations at low temperatures). If the whole temperature range is required, it is preferable to use the Steinhart-Hart equation for the implementation.

Example for the implementation of an NTC sensor with Steinhart-Hart equation

The Steinhart-Hart parameters can be calculated based on the sample file. The required resistance values at three defined temperatures (e.g. 0°C, 25°C and 85°C) can be taken from the manufacturer's table or measured directly at the sensor.

CoE Entry	Entry
0x8004:01 Min Temperature	-40
0x8004:02 Max Temperature	110
0x8004:03 C1	8.8424E-4
0x8004:04 C2	2.5202E-4
0x8002:04 C3	0
0x8002:04 C4	1.9018E-7

Comparison of the implementation via Steinhart-Hart and B-parameter equation

The diagram shows that the implementation via the Steinhart-Hart equation gains values closer to those from the manufacturer's table than the implementation via the B-parameter equation. If a manufacturer's table is available, this method is always preferable.

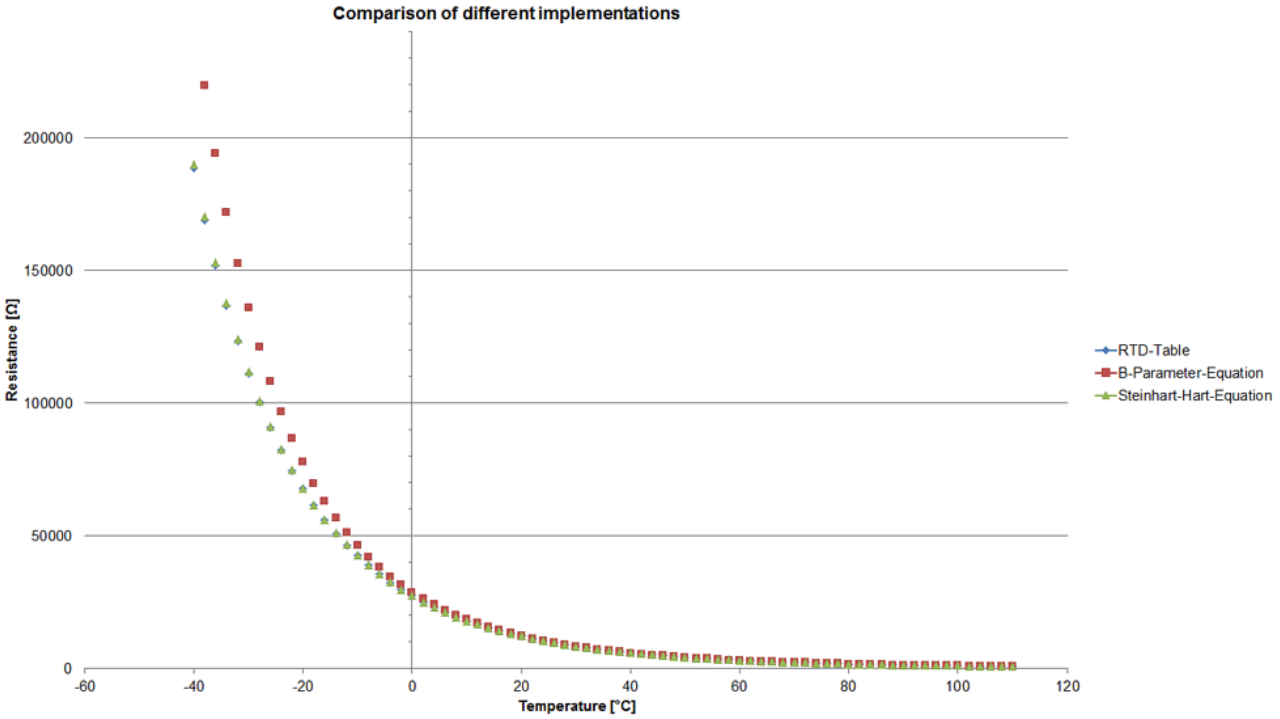


Fig. 58: Comparison of implementation via B-parameters and Steinhart-Hart parameters

5.5.4 Sample implementation of a PTC sensor

The example below illustrates the implementation of a PTC sensor, in particular a platinum sensor (Pt sensor), based on the RTD table [▶ 119] and according to DIN EN 60751 [▶ 119].

Example for the implementation of a PTC sensor with the RTD lookup table

The general procedure is explained in chapter Lookup table [▶ 114]. The example describes the implementation of table for a Pt500 sensor.

<table>
<tr><th>Description</th><th>Problem</th><th colspan="2">Approach</th></tr>
<tr><td>For Pt sensors, tables with several 100 entries in 1°C steps are available.</td><td>Total number of interpolation points is exceeded.
Currently, 100 interpolation points can be entered using the RTD table.</td><td colspan="2">1. Limit the measuring range to correspond to 100 interpolation points in total
2. Increase the step size, e.g. implement a table with 5°C or 10°C steps. Since the Pt sensor curves are almost linear, an increment value only has a small effect on the measuring accuracy. This is in contrast to NTC sensors, where the curve is exponential and a smaller increment is therefore preferable.</td></tr>
<tr><td rowspan="5">The manufacturer tables contain universal values</td><td rowspan="5">The table values should be adjusted to the specific sensor type</td><td colspan="2">For different Pt sensors, the table entries have to be multiplied with the R_0 value. R_0 indicates the resistance at 0°C. The sensor designation is based on the temperature value.</td></tr>
<tr><td>Pt sensor</td><td>R_0 (resistance at 0°C)</td></tr>
<tr><td>Pt100</td><td>100</td></tr>
<tr><td>Pt500</td><td>500</td></tr>
<tr><td>Pt1000</td><td>1000</td></tr>
</table>

For the Pt500 sensor, the following CoE entries can be selected and edited with the following XML file (https://infosys.beckhoff.com/content/1033/el32xx/Resources/1525770251.zip):

CoE Entry	Entry
0x8001:01 Distance in Degrees	10
0x8001:02 Amount of Entries	60
0x8001:03 Start Temperature	-40
0x8001:04 Conversion Factor	10
0x8001:05 Value 1	4247
0x8001:0x further table entries	.....

Example for the implementation of a PTC sensor, programmable according to DIN 60751 for Pt sensors

The implementation according to DIN EN 60751 is described in the section Programmable according to DIN 60751 for Pt sensors [▶ 116]. The parameters A, B, C are already stored in the CoE. Only the temperature range and the R_0 parameter for the specific sensor need to be added. R_0 indicates the resistance at 0°C. The sensor designation is based on the temperature value. The CoE entry has to be adjusted for the specific sensor.

Pt sensor	CoE Entry 0x8003:03
Pt100	100
Pt200	200
Pt500	500
Pt1000	1000

Comparison of implementation via RTD table and according to DIN EN 60751

If we now compare the course of the resistance values as a function of temperature, by the RTD table and according to DIN EN 60751, it becomes clear that both implementation methods provide almost the same result. Due to the easier implementation, the parameterization according to DIN 60571 is preferable.

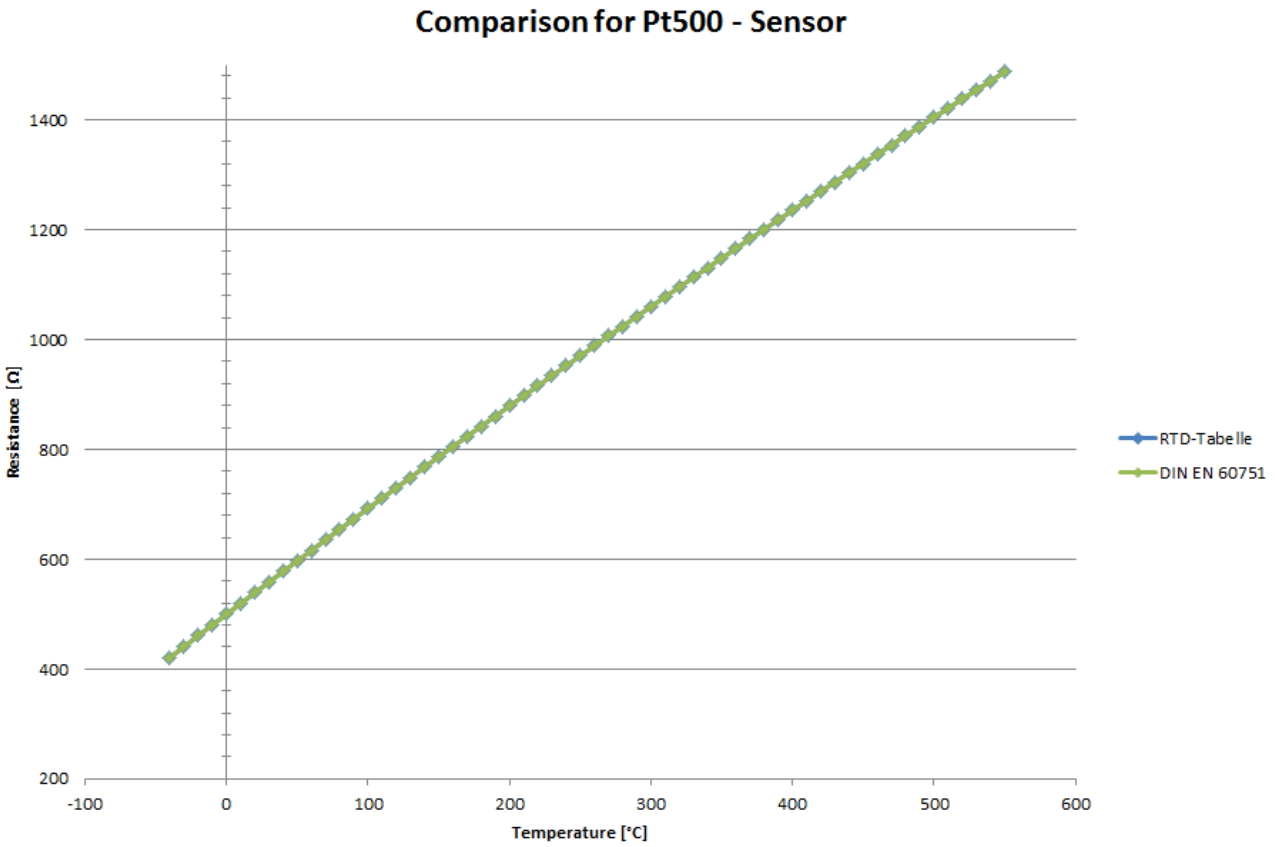


Fig. 59: Comparison of Pt500 sensor implementation

5.6 Settings and application notes for EL3208-0010

The EL3208-0010 is designed for multi-channel RTD measurements in the range -50 ... +150°C. In order to be able to offer 8 channels on 12 mm, it supports 2-wire measurement.
To ensure that unavoidable lead resistances are of little consequence, sensors R20°C >> 100 Ohm are implemented here. A side effect of this design is the measurement capability for resistors up to 1.3 MΩ.

Like all EL32xx terminals, it has two evaluation options:

- Measurement of the resistance, transformation according to choice and output as temperature [°C]. The terminal automatically selects the appropriate electrical measuring range.
  - Pt500/1000, Ni1000
  - Various NTC (up to max. 1.3 MΩ)
  - B-parameter equation (up to max. 1.3 MΩ)

    The temperature output of this terminal is limited to approx. -50 ... +150°C depending on the sensor, for range limits see in the CoE overview [▶ 186].
- -Measurement of resistance and output as resistance [Ω].
  - 4 measuring ranges (called "potentiometer [poti]") with
    Resolution 0.1 Ω / digit: Measuring range 0 ... 6,553.5 Ω
    Resolution 1 Ω / digit: Measuring range 0 ... 65,535 Ω
    Resolution 10 Ω / digit: Measuring range 0 ... 655,350 Ω
    Resolution 20 Ω / digit: Measuring range 0 ... 1,310,700 Ω

    Note: the INT-PDO Value is to be interpreted in these modes as unsigned 16bit UINT with 0 ... 65535 digits.
  - 1 Measuring range "1/16 Ohm" with
    Resolution 0.0625 Ω / digit: Measuring range 0 ... 2,000 Ω

    Note: the INT-PDO Value is to be interpreted in these modes as unsigned 16bit UINT with 0 ... 65535 digits.

5.7 TwinSAFE SC

5.7.1 TwinSAFE SC - operating principle

The TwinSAFE SC (Single Channel) technology enables the use of standard signals for safety tasks in any networks of fieldbuses. To do this, EtherCAT Terminals from the areas of analog input, angle/displacement measurement or communication (4…20 mA, incremental encoder, IO-Link, etc.) are extended by the TwinSAFE SC function. The typical signal characteristics and standard functionalities of the I/O components are retained. TwinSAFE SC I/Os have a yellow strip at the front of the housing to distinguish them from standard I/Os.

The TwinSAFE SC technology enables communication via a TwinSAFE protocol. These connections can be distinguished from the usual safe communication via Safety over EtherCAT.

The data of the TwinSAFE SC components are transferred via a TwinSAFE protocol to the TwinSAFE logic, where they can be used in the context of safety-relevant applications. Detailed examples for the correct application of the TwinSAFE SC components and the respective normative classification, which were confirmed/calculated by TÜV SÜD, can be found in the TwinSAFE application manual.

5.7.2 TwinSAFE SC - configuration

The TwinSAFE SC technology enables communication with standard EtherCAT terminals via the Safety over EtherCAT protocol. These connections use another checksum, in order to be able to distinguish between TwinSAFE SC and TwinSAFE. Eight fixed CRCs can be selected, or a free CRC can be entered by the user.

By default the TwinSAFE SC communication channel of the respective TwinSAFE SC component is not enabled. In order to be able to use the data transfer, the corresponding TwinSAFE SC module must first be added under the Slots tab. Only then is it possible to link to a corresponding alias device.

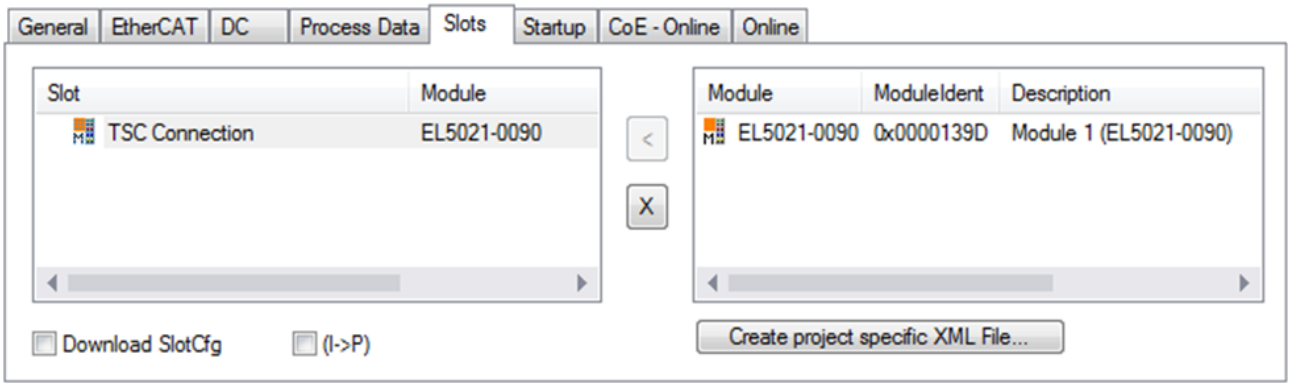


Fig. 60: Adding the TwinSAFE SC process data under the component, e.g. EL5021-0090

Additional process data with the ID TSC Inputs, TSC Outputs are generated (TSC - TwinSAFE Single Channel).

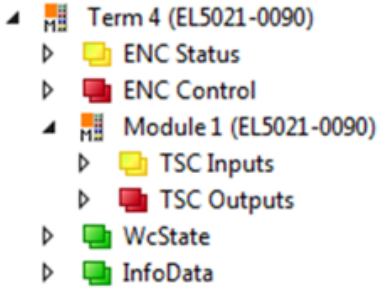


Fig. 61: TwinSAFE SC component process data, example EL5021-0090

A TwinSAFE SC connection is added by adding an alias devices in the safety project and selecting TSC (*TwinSAFE Single Channel*)

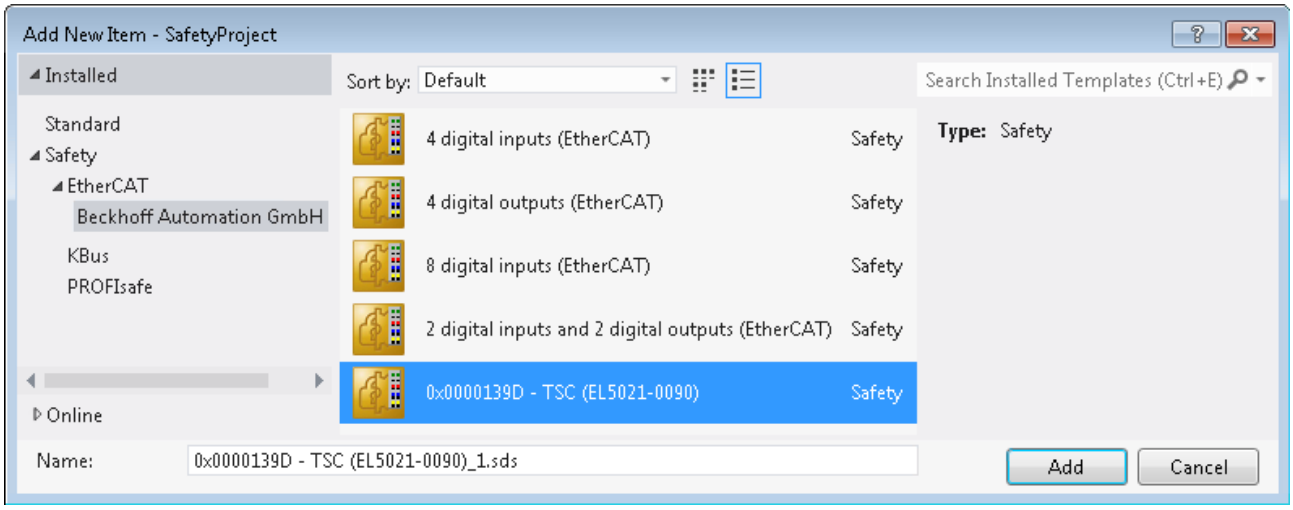


Fig. 62: Adding a TwinSAFE SC connection

After opening the alias device by double-clicking, select the Link button next to *Physical Device,* in order to create the link to a TwinSAFE SC terminal. Only suitable TwinSAFE SC terminals are offered in the selection dialog.

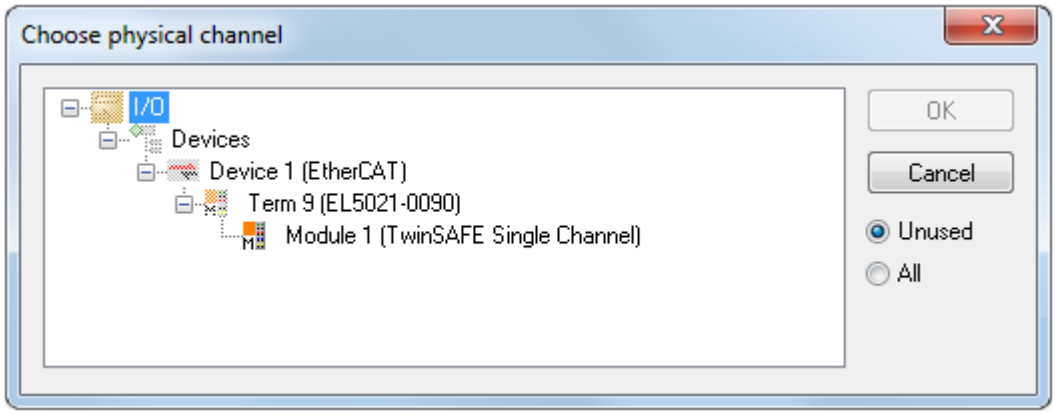


Fig. 63: Creating a link to TwinSAFE SC terminal

The CRC to be used can be selected or a free CRC can be entered under the Connection tab of the alias device.

Entry Mode	Used CRCs
TwinSAFE SC CRC 1 master	0x17B0F
TwinSAFE SC CRC 2 master	0x1571F
TwinSAFE SC CRC 3 master	0x11F95
TwinSAFE SC CRC 4 master	0x153F1
TwinSAFE SC CRC 5 master	0x1F1D5
TwinSAFE SC CRC 6 master	0x1663B
TwinSAFE SC CRC 7 master	0x1B8CD
TwinSAFE SC CRC 8 master	0x1E1BD

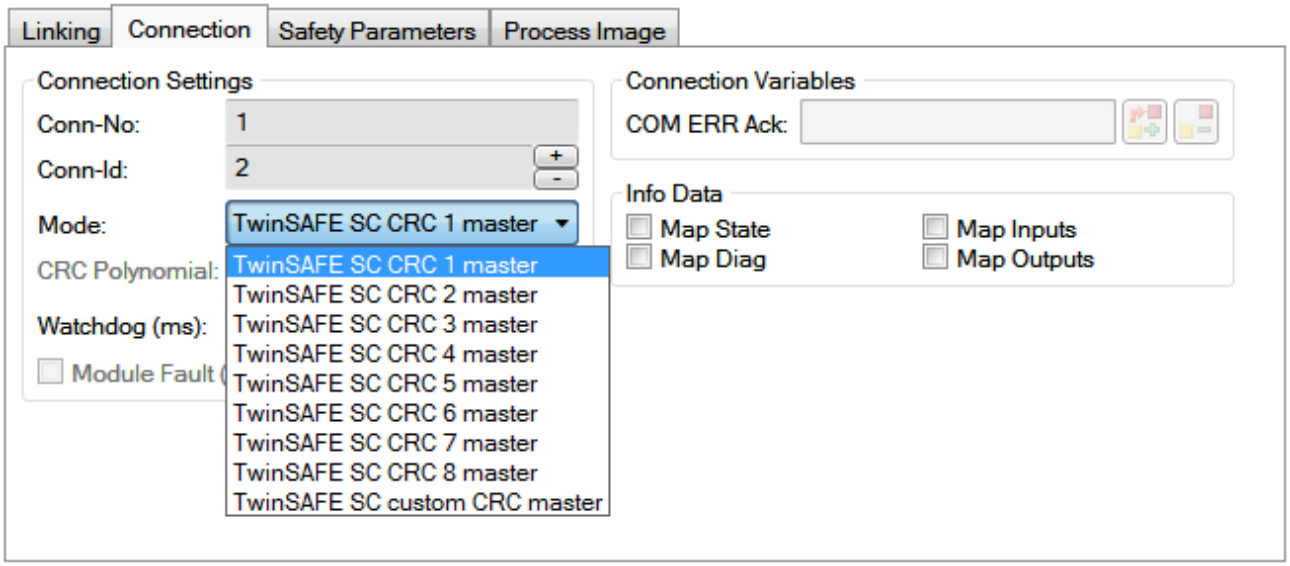


Fig. 64: Selecting a free CRC

These settings must match the settings in the CoE objects of the TwinSAFE SC component.
The TwinSAFE SC component initially makes all available process data available. The *Safety Parameters* tab typically contains no parameters. The process data size and the process data themselves can be selected under the *Process Image* tab.

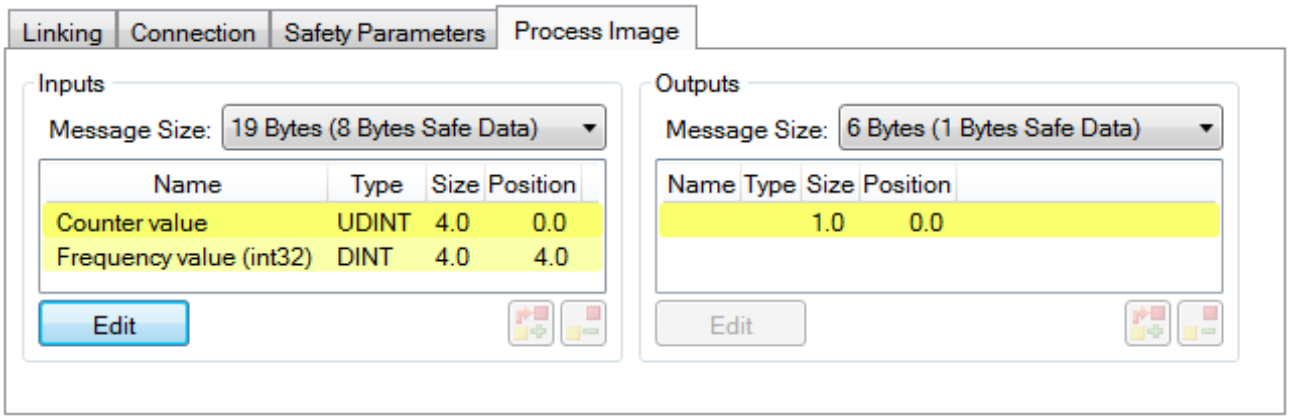


Fig. 65: Selecting the process data size and the process data

The process data (defined in the ESI file) can be adjusted to user requirements by selecting the *Edit* button in the dialog *Configure I/O element(s)*.

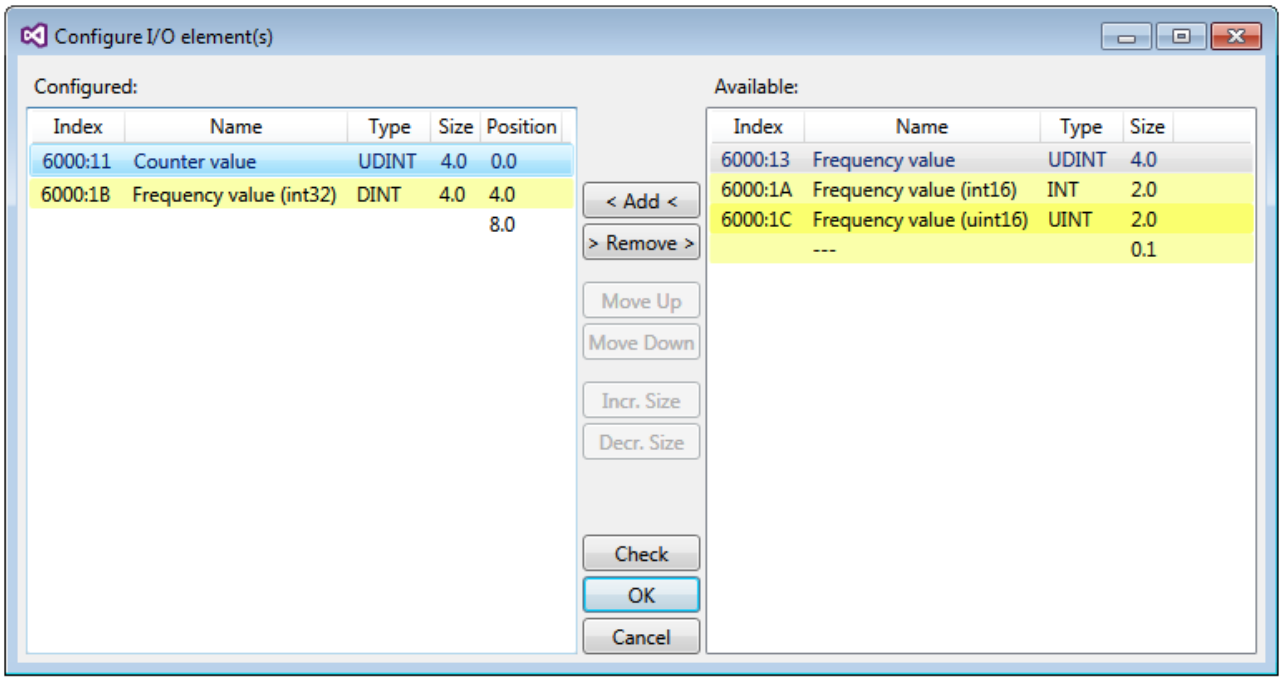


Fig. 66: Selection of the process data

The safety address together with the CRC must be entered on the TwinSAFE SC slave side. This is done via the CoE objects under *TSC settings* of the corresponding TwinSAFE SC component (here, for example, EL5021-0090, 0x8010: 01 and 0x8010: 02). The address set here must also be set in the *alias device* as *FSoE* address under the *Linking* tab.

Under the object 0x80n0:02 Connection Mode the CRC to be used is selected or a free CRC is entered. A total of 8 CRCs are available. A free CRC must start with 0x00ff in the high word.

8010:0	TSC Settings	RW	> 2 <
8010:01	Address	RW	0x0000 (0)
8010:02	Connection Mode	RW	TwinSAFE SC CRC1 master (97039)

Fig. 67: CoE objects 0x8010:01 and 0x8010:02

Object *TSC Settings*

Depending on the terminal, the index designation of the configuration object *TSC Settings* can vary.
Example:
- EL3214-0090 and EL3314-0090, TSC Settings, Index 8040
- EL5021-0090, TSC Settings, Index 8010
- EL6224-0090, TSC Settings, Index 800F

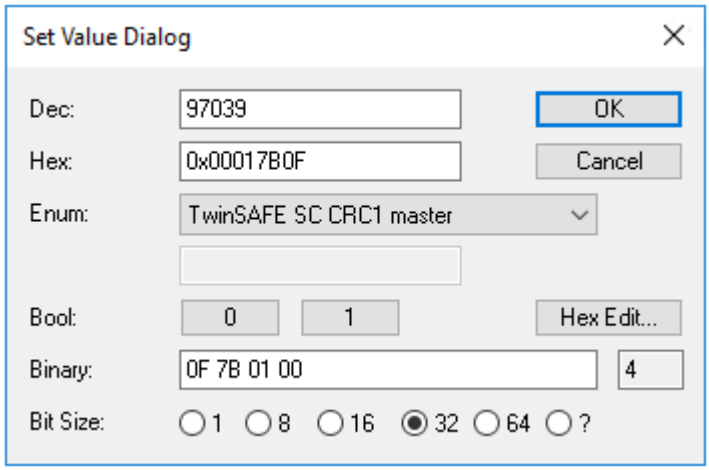


Fig. 68: Entering the safety address and the CRC

TwinSAFE SC connections

If several TwinSAFE SC connections are used within a configuration, a different CRC must be selected for each TwinSAFE SC connection.

5.8 TwinSAFE SC process data EL3214-0090

The EL3214-0090 transmits the following process data to the TwinSAFE logic:

Index (hex)	Name	Type	Size
6000:11	RTD Module 1.Value	INT	2.0
6010:11	RTD Module 2.Value	INT	2.0
6020:11	RTD Module 3.Value	INT	2.0
6030:11	RTD Module 4.Value	INT	2.0

The process data of all four channels are transmitted by default. Via the „Process Image“ tab, the other data types of the frequency value can be selected or completely deselected in the Safety Editor.

Depending on the TwinCAT 3.1 version, process data can be renamed automatically when linking to the Safety Editor.

5.9 CoE object descriptions

5.9.1 Object description EL3201

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 127] and profile-specific objects [▶ 132] required during commissioning
- Objects for indicating internal settings [▶ 129] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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

Index (hex)	Name	Meaning	Data type	Flags	Default
8000:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
8000:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
8000:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C)	BIT3	RW	0x00 (0_{dec})
8000:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x6000:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
8000:06	Enable filter [▶ 97]	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
8000:07	Enable limit 1 [▶ 101]	The status bits are set in relation to Limit 1.	BOOLEAN	RW	0x00 (0_{dec})
8000:08	Enable limit 2 [▶ 101]	The status bits are set in relation to Limit 2.	BOOLEAN	RW	0x00 (0_{dec})
8000:09	Enable automatic calibration	A calibration is cyclically started. (optional)	BOOLEAN	RW	0x00 (0_{dec})
8000:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
8000:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
8000:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
8000:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
8000:13	Limit 1 [▶ 101]	First limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
8000:14	Limit 2 [▶ 101]	Second limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
8000:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x8000:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
8000:16	Calibration interval	Interval of cyclic calibration	INT16	RW	0x0000 (0_{dec})
8000:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
8000:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
8000:19	RTD element [▶ 93]	RTD element 0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!	UINT16	RW	0x0000 (0_{dec})
8000:1A	Connection technology	Connection technology 0: 2-wire 1: 3-wire 2: 4-wire 3: not connected	UINT16	RW	0x0000 (0_{dec})
8000:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 TxPDO Map

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A00:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A00:01	SubIndex 001	1. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x01 (Underrange))	UINT32	RW	0x6000:01, 1
1A00:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x02 (Overrange))	UINT32	RW	0x6000:02, 1
1A00:03	SubIndex 003	3. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x03 (Limit 1))	UINT32	RW	0x6000:03, 2
1A00:04	SubIndex 004	4. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x05 (Limit 2))	UINT32	RW	0x6000:05, 2
1A00:05	SubIndex 005	5. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x07 (Error))	UINT32	RW	0x6000:07, 1
1A00:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A00:07	SubIndex 007	7. PDO Mapping entry (object 0x1800 (TxPDO-Par Ch.1), entry 0x07 (TxPDO-State))	UINT32	RW	0x1800:07, 1
1A00:08	SubIndex 008	8. PDO Mapping entry (object 0x1800 (TxPDO-Par Ch.1), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x1800:09, 1
1A00:09	SubIndex 009	9. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x11 (Value))	UINT32	RW	0x6000:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{dec})
1C13:01	Subindex 001	1. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A00 (6656_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

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

Index (hex)	Name	Meaning	Data type	Flags	Default value
6000:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
6000:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
6000:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x6000:07 [▶ 133]]) is set	BOOLEAN	RO	0x00 (0_{dec})
6000:03	Limit 1	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
6000:05	Limit 2	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
6000:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
6000:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
6000:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
6000:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 800F RTD Vendor data

Index (hex)	Name	Meaning	Data type	Flags	Default value
800F:0	RTD Vendor data	Maximum subindex	UINT8	RO	0x06 (6_{dec})
800F:01	Calibration offset	Manufacturer calibration offset	INT16	RW	0x0000 (0_{dec})
800F:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	0x9E50 (40528_{dec})
800F:03	Calibration offset RL	Manufacturer calibration offset (input RL)	INT16	RW	0x0000 (0_{dec})
800F:04	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	0x9E50 (40528_{dec})
800F:05	Calibration offset 4-wire	Manufacturer calibration offset (4-wire connection technology)	INT16	RW	0x0000 (0_{dec})
800F:06	Calibration gain 4-wire	Manufacturer calibration gain (4-wire connection technology)	UINT16	RW	0x9E50 (40528_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0001 (1_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.2 Object description EL3201-0010, EL3201-0020, EL3201-0030

EtherCAT XML Device Description

The presentation 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 terminal is parameterized via the CoE – Online tab (double-click on the respective object) or via the Process Data tab (assignment of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: – Keep a startup list in case components have to be replaced – Differentiation between online/offline dictionary, existence of current XML description – Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 135] and profile-specific objects [▶ 140] required during commissioning
- Objects for indicating internal settings [▶ 137] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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

Index (hex)	Name	Meaning	Data type	Flags	Default
8000:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
8000:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
8000:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x02 (2_{dec})
8000:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x6000:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
8000:06	Enable filter [▶ 97]	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
8000:07	Enable limit 1 [▶ 101]	The status bits are set in relation to Limit 1.	BOOLEAN	RW	0x00 (0_{dec})
8000:08	Enable limit 2 [▶ 101]	The status bits are set in relation to Limit 2.	BOOLEAN	RW	0x00 (0_{dec})
8000:09	Enable automatic calibration	A calibration is cyclically started. (optional)	BOOLEAN	RW	0x00 (0_{dec})
8000:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
8000:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
8000:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
8000:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
8000:13	Limit 1 [▶ 101]	First limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
8000:14	Limit 2 [▶ 101]	Second limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
8000:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x8000:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
8000:16	Calibration interval	Interval of cyclic calibration	INT16	RW	0x0000 (0_{dec})
8000:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
8000:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
8000:19	RTD element [▶ 93]	RTD element 0: Pt100 (for high-precision terminals see note [▶ 110])! 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!	UINT16	RW	0x0000 (0_{dec})
8000:1A	Connection technology	Connection technology 0: 2-wire bridged/4-wire 1: 3-wire 2: 4-wire 3: not connected 4: 2-wire unbridged	UINT16	RW	0x0000 (0_{dec})
8000:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 TxPDO Map

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A00:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A00:01	SubIndex 001	1. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x01 (Underrange))	UINT32	RW	0x6000:01, 1
1A00:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x02 (Overrange))	UINT32	RW	0x6000:02, 1
1A00:03	SubIndex 003	3. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x03 (Limit 1))	UINT32	RW	0x6000:03, 2
1A00:04	SubIndex 004	4. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x05 (Limit 2))	UINT32	RW	0x6000:05, 2
1A00:05	SubIndex 005	5. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x07 (Error))	UINT32	RW	0x6000:07, 1
1A00:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A00:07	SubIndex 007	7. PDO Mapping entry (object 0x1800 (TxPDO-Par Ch.1), entry 0x07 (TxPDO-State))	UINT32	RW	0x1800:07, 1
1A00:08	SubIndex 008	8. PDO Mapping entry (object 0x1800 (TxPDO-Par Ch.1), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x1800:09, 1
1A00:09	SubIndex 009	9. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1), entry 0x11 (Value))	UINT32	RW	0x6000:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{dec})
1C13:01	Subindex 001	1. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A00 (6656_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

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

Index (hex)	Name	Meaning	Data type	Flags	Default value
6000:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
6000:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
6000:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x6000:07 [▶ 141]]) is set	BOOLEAN	RO	0x00 (0_{dec})
6000:03	Limit 1	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
6000:05	Limit 2	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
6000:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
6000:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
6000:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
6000:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 800F RTD Vendor data

Index (hex)	Name	Meaning	Data type	Flags	Default value
800F:0	RTD Vendor data	Maximum subindex	UINT8	RO	0x06 (6_{dec})
800F:01	Calibration offset	Manufacturer calibration offset	INT16	RW	0x0000 (0_{dec})
800F:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	0x9E50 (40528_{dec})
800F:03	Calibration offset RL	Manufacturer calibration offset (input RL)	INT16	RW	0x0000 (0_{dec})
800F:04	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	0x9E50 (40528_{dec})
800F:05	Calibration offset 4-wire	Manufacturer calibration offset (4-wire connection technology)	INT16	RW	0x0000 (0_{dec})
800F:06	Calibration gain 4-wire	Manufacturer calibration gain (4-wire connection technology)	UINT16	RW	0x9E50 (40528_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0001 (1_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.3 Object description EL3202

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 143] and profile-specific objects [▶ 148] required during commissioning
- Objects for indicating internal settings [▶ 145] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 1 (Ch. 1 – 2)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding index 0x8010:15 of the EL3202 has no parameterization function!

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n00:06	Enable filter [▶ 97]	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
80n00:07	Enable limit 1 [▶ 101]	The status bits are set in relation to Limit 1.	BOOLEAN	RW	0x00 (0_{dec})
80n00:08	Enable limit 2 [▶ 101]	The status bits are set in relation to Limit 2.	BOOLEAN	RW	0x00 (0_{dec})
80n00:09	Enable automatic calibration	A calibration is cyclically started. (optional)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:13	Limit 1 [▶ 101]	First limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:14	Limit 2 [▶ 101]	Second limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 (for high-precision terminals see note [▶ 110])! 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!		RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection 1: 3-wire connection 2: 4-wire connection [default for EL320x-00x0 high-precision terminals, see note [▶ 110]]! 3: not connected	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x03 (Limit 1))	UINT32	RW	0x60n0:03, 2
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x05 (Limit 2))	UINT32	RW	0x60n0:05, 2
1A0n:05	SubIndex 005	5. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:09	SubIndex 009	9. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x02 (2_{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})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 149]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:03	Limit 1	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:05	Limit 2	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	0x06 (6_{dec})
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	0x0000 (0_{dec})
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	0x9E50 (40528_{dec})
80nF:03	Calibration offset RL	Manufacturer calibration offset (input RL)	INT16	RW	0x0000 (0_{dec})
80nF:04	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	0x9E50 (40528_{dec})
80nF:05	Calibration offset 4-wire	Manufacturer calibration offset (4-wire connection technology)	INT16	RW	0x0000 (0_{dec})
80nF:06	Calibration gain 4-wire	Manufacturer calibration gain (4-wire connection technology)	UINT16	RW	0x9E50 (40528_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0002 (2_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.4 Object description EL3202-0010, EL3202-0020, EL3202-0030

EtherCAT XML Device Description

The presentation 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 terminal is parameterized via the CoE – Online tab (double-click on the respective object) or via the Process Data tab (assignment of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: – Keep a startup list in case components have to be replaced – Differentiation between online/offline dictionary, existence of current XML description – Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 151] and profile-specific objects [▶ 156] required during commissioning
- Objects for indicating internal settings [▶ 153] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 1 (Ch. 1 – 2)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding index 0x8010:15 of the EL3202 has no parameterization function!

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n00:06	Enable filter [▶ 97]	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
80n00:07	Enable limit 1 [▶ 101]	The status bits are set in relation to Limit 1.	BOOLEAN	RW	0x00 (0_{dec})
80n00:08	Enable limit 2 [▶ 101]	The status bits are set in relation to Limit 2.	BOOLEAN	RW	0x00 (0_{dec})
80n00:09	Enable automatic calibration	A calibration is cyclically started. (optional)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:13	Limit 1 [▶ 101]	First limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:14	Limit 2 [▶ 101]	Second limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 (for high-precision terminals see note [▶ 110])! 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!		RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection 1: 3-wire connection 2: 4-wire connection [default for EL320x-00x0 high-precision terminals, see note [▶ 110]]! 3: not connected	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x03 (Limit 1))	UINT32	RW	0x60n0:03, 2
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x05 (Limit 2))	UINT32	RW	0x60n0:05, 2
1A0n:05	SubIndex 005	5. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:09	SubIndex 009	9. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x02 (2_{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})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 157]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:03	Limit 1	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:05	Limit 2	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	0x06 (6_{dec})
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	0x0000 (0_{dec})
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	0x9E50 (40528_{dec})
80nF:03	Calibration offset RL	Manufacturer calibration offset (input RL)	INT16	RW	0x0000 (0_{dec})
80nF:04	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	0x9E50 (40528_{dec})
80nF:05	Calibration offset 4-wire	Manufacturer calibration offset (4-wire connection technology)	INT16	RW	0x0000 (0_{dec})
80nF:06	Calibration gain 4-wire	Manufacturer calibration gain (4-wire connection technology)	UINT16	RW	0x9E50 (40528_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0002 (2_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 1 (Ch. 1 - 2)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

5.9.5 Object description EL3204

EtherCAT XML Device Description

The presentation 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 terminal is parameterized via the CoE – Online tab (double-click on the respective object) or via the Process Data tab (assignment of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: – Keep a startup list in case components have to be replaced – Differentiation between online/offline dictionary, existence of current XML description – Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 159] and profile-specific objects [▶ 166] required during commissioning
- Objects for indicating internal settings [▶ 161] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 3 (Ch. 1 – 4)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n00:15 of the EL3204 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n00:06	Enable filter [▶ 97]	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
80n00:07	Enable limit 1 [▶ 101]	The status bits are set in relation to Limit 1.	BOOLEAN	RW	0x00 (0_{dec})
80n00:08	Enable limit 2 [▶ 101]	The status bits are set in relation to Limit 2.	BOOLEAN	RW	0x00 (0_{dec})
80n00:09	Enable automatic calibration	A calibration is cyclically started. (optional)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:13	Limit 1 [▶ 101]	First limit value for setting the status bits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:14	Limit 2 [▶ 101]	Second limit value for setting the statusbits (resolution 0.1°C)	INT16	RW	0x0000 (0_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:16	Calibration interval reserved	Interval of cyclic calibration (Serves only for compatibility, no configuration for EL3204)			

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!	UINT16	RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection 3: not connected	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

Index 10E2 Manufacturer-specific Identification Code

Index (hex)	Name	Meaning	Data type	Flags	Default
10E2:0*	Manufacturer-specific identification code		UINT8	RO	0x01 (1_{dec})
10E2:01*	SubIndex 001		STRING	RO	

*) EL3204 from FW10, Rev. -0022

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 1800 RTD TxPDO-Par Ch. 1

Index (hex)	Name	Meaning	Data type	Flags	Default
1800:0	RTD TxPDO-Par Ch.1	PDO parameter TxPDO 1	UINT8	RO	0x06 (6_{dec})
1800:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 1	OCTET STRING[2]	RO	04 1A

Index 1801 RTD TxPDO-Par Ch. 2

Index (hex)	Name	Meaning	Data type	Flags	Default
1801:0	RTD TxPDO-Par Ch. 2	PDO parameter TxPDO 2	UINT8	RO	0x06 (6_{dec})
1801:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 2	OCTET STRING[2]	RO	05 1A

Index 1802 RTD TxPDO-Par Ch. 3

Index (hex)	Name	Meaning	Data type	Flags	Default
1802:0	RTD TxPDO-Par Ch. 3	PDO parameter TxPDO 3	UINT8	RO	0x06 (6_{dec})
1802:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 3	OCTET STRING[2]	RO	06 1A

Index 1803 RTD TxPDO-Par Ch. 4

Index (hex)	Name	Meaning	Data type	Flags	Default
1803:0	RTD TxPDO-Par Ch. 4	PDO parameter TxPDO 4	UINT8	RO	0x06 (6_{dec})
1803:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 4	OCTET STRING[2]	RO	07 1A

Index 1804 RTD TxPDO-Par Compact Ch. 1

Index (hex)	Name	Meaning	Data type	Flags	Default
1804:0	RTD TxPDO-Par Compact Ch. 1	PDO parameter TxPDO 5	UINT8	RO	0x06 (6_{dec})
1804:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 5	OCTET STRING[2]	RO	00 1A

Index 1805 RTD TxPDO-Par Compact Ch. 2

Index (hex)	Name	Meaning	Data type	Flags	Default
1805:0	RTD TxPDO-Par Compact Ch. 2	PDO parameter TxPDO 6	UINT8	RO	0x06 (6_{dec})
1805:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 6	OCTET STRING[2]	RO	01 1A

Index 1806 RTD TxPDO-Par Compact Ch. 3

Index (hex)	Name	Meaning	Data type	Flags	Default
1806:0	RTD TxPDO-Par Compact Ch. 3	PDO parameter TxPDO 7	UINT8	RO	0x06 (6_{dec})
1806:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 7	OCTET STRING[2]	RO	02 1A

Index 1807 RTD TxPDO-Par Compact Ch. 4

Index (hex)	Name	Meaning	Data type	Flags	Default
1807:0	RTD TxPDO-Par Compact Ch. 4	PDO parameter TxPDO 8	UINT8	RO	0x06 (6_{dec})
1807:06	Exclude TxPDOs	Specifies the TxPDOs (index of TxPDO mapping objects) that may not be transferred together with TxPDO 8	OCTET STRING[2]	RO	03 1A

Index 1A0n TxPDO Map for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x03 (Limit 1))	UINT32	RW	0x60n0:03, 2
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x05 (Limit 2))	UINT32	RW	0x60n0:05, 2
1A0n:05	SubIndex 005	5. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:06	SubIndex 006	6. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:09	SubIndex 009	9. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1A04 TxPDO-Map Compact Ch. 1

Index (hex)	Name	Meaning	Data type	Flags	Default
1A04:0	TxPDO-Map Compact Ch.1	PDO Mapping TxPDO 5	UINT8	RW	0x01 (1_{dec})
1A04:01	SubIndex 001	1. PDO Mapping entry (object 0x6000 (RTD Inputs Ch.1]), entry 0x11 (Value))	UINT32	RW	0x6000:01, 16

Index 1A05 TxPDO-Map Compact Ch. 2

Index (hex)	Name	Meaning	Data type	Flags	Default
1A05:0	TxPDO-Map Compact Ch.2	PDO Mapping TxPDO 6	UINT8	RW	0x01 (1_{dec})
1A05:01	SubIndex 001	1. PDO Mapping entry (object 0x6010 (RTD Inputs Ch.2), entry 0x11 (Value))	UINT32	RW	0x6010:01, 16

Index 1A06 TxPDO-Map Compact Ch. 3

Index (hex)	Name	Meaning	Data type	Flags	Default
1A06:0	TxPDO-Map Compact Ch.3	PDO Mapping TxPDO 7	UINT8	RW	0x01 (1_{dec})
1A06:01	SubIndex 001	1. PDO Mapping entry (object 0x6020 (RTD Inputs Ch.3), entry 0x11 (Value))	UINT32	RW	0x6020:01, 16

Index 1A07 TxPDO-Map Compact Ch. 4

Index (hex)	Name	Meaning	Data type	Flags	Default
1A07:0	TxPDO-Map Compact Ch.4	PDO Mapping TxPDO 8	UINT8	RW	0x01 (1_{dec})
1A07:01	SubIndex 001	1. PDO Mapping entry (object 0x6030 (RTD Inputs Ch.4), entry 0x11 (Value))	UINT32	RW	0x6030:01, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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 value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs für 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 167]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:03*	Limit 1	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:05*	Limit 2	Limit value monitoring 0: not active 1: Value is larger than the limit value 2: Value is smaller than the limit value 3: Value is equal to the limit value	BIT2	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Manufacturer data für 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default
80nF:0	RTD Manufacturer data	Maximum subindex	UINT8	RO	0x06 (6_{dec})
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	0x0000 (0_{dec})
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	0x9E50 (40528_{dec})
80nF:03	Calibration offset RL	Manufacturer calibration offset (input RL)	INT16	RW	0x0000 (0_{dec})
80nF:04	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	0x9E50 (40528_{dec})
80nF:05	Calibration offset 4-wire	Manufacturer calibration offset (4-wire connection technology)	INT16	RW	0x0000 (0_{dec})
80nF:06	Calibration gain 4-wire	Manufacturer calibration gain (4-wire connection technology)	UINT16	RW	0x9E50 (40528_{dec})
80nF:07*	Calibration offset Pt1000	Manufacturer calibration offset Pt1000	INT16	RW	0x0000 (0_{dec})
80nF:08*	Calibration gain Pt1000	Manufacturer calibration gain Pt1000	UINT16	RW	0x9E50 (40528_{dec})

*) from FW10, rev. -0022

Index F000 Modular device profile

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

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.6 Object description EL3204-0200

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 169] and profile-specific objects required during commissioning
- Objects for indicating internal settings (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 3 (Ch. 1 - 4)

The filter properties are set only via index 0x8000:15

The filter frequencies are set for all channels of the EL3204-0200 terminals centrally via index 0x8000:15 (channel 1). The corresponding indices 0x80n0:15 have no parameterization function!

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n0:01	Enable user scale	User scale is active.	BOOLEAN	RW	0x00 (0_{dec})
80n0:02	Process data Presentation	permitted values 0: Signed 1: Absolute MSB sign 2: High resolution (1/100°C)	BIT3	RW	0x00 (0_{dec})
80n0:05	Siemens bits	The S5 bits are superimposed on the three low-order bits (value 0x60n0:11 [▶ 177]) Bit 0 = 1 (“overrange” or “underrange”) Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:06	Enable filter	Enable filter, which makes PLC-cycle-synchronous data exchange unnecessary	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration	Enabling of the user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable vendor calibration	Enabling of the vendor calibration	BOOLEAN	RW	0x01 (1_{dec})
80n0:11	User scale offset	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n0:12	User scale gain	This is the user scaling gain. The gain is represented in fixed-point format, with the factor 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n0:15	Filter settings	This object determines the digital filter settings, if it is active via Enable filter (index 0x80n0:06 [▶ 170]). The possible settings are sequentially numbered. permitted values: 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	UINT16	RW	0x0000 (0_{dec})
80n0:17	User calibration offset	User offset calibration	INT16	RW	0x0000 (0_{dec})
80n0:18	User calibration gain	User gain compensation	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n0:19	RTD element	permitted values: 0: Pt1000 (-200...850°C) 2: Ni1000 100 °C (TK5000, at 100 °C 1500 Ohm, -30 to 160 °C) 3: Ni1000 (-60...250°C) 4: NTC 5k (0°C: 16325 Ohm, -40...100°C) 5: NTC 10k (0°C: 32650 Ohm, -30...150°C) 6: NTC 10k (0°C: 29490 Ohm, -30...150°C) 7: NTC 10k (0°C: 27280 Ohm, -40...110°C, as for KL3204-0030) 8: NTC 20k (0°C: 70200 Ohm, -20...150°C) 9: Fet (-30...150°C) 101: Resolution 1/10 Ohm (0 to 6553.5 Ohm) 102: Resolution 1/10 Ohm (0 to 65535 Ohm) 103: Resolution 1/10 Ohm (0 to 240 kOhm) 110: RTD table (for further parameters see 0x80n1 [▶ 172]) 111: B-parameter equation (for further parameters see 0x80n2 [▶ 172]) 112: DIN IEC 60751 equation (for further parameters see 0x80n3 [▶ 173]) 113: Steinhart-Hart equation (for further parameters see 0x80n4 [▶ 173])	UINT16	RW	0x0000 (0_{dec})
80n0:1A	Connection technology	permitted values 0: Two-wire connection 3: n. c. (channel deactivated)	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration	Offset value for the calibration of the supply lines [1/10] Ohm	INT16	RW	0x0000 (0_{dec})

Index 80n1 RTD Table

The standard values in the following table show by way of example the conversion values of a Pt1000 within the range from 0 °C to 140 °C with a resolution of 1/10 Ohm

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n1:0	RTD Table	The sensor characteristic can be programmed with this table	UINT8	RO	105
80n1:01	Distance in Degrees	The value set describes the distance of the entries in °C	UINT16	RW	10
80n1:02	Amount of Entries	The value entered describes the number of entries with which the dependence on distance in °C, start temperature of the measuring range and final temperature are displayed according to the equation below Final temperature = start temperature + ((number of entries -1) * distance in °C)	UINT16	RW	15
80n1:03	Start Temperature	The value entered describes the start of the measuring range Standard value 0 °C	INT16	RW	0
80n1:04	Conversion Factor	1 = 1/10 Ohm per digit in the table entries 10 = 1 Ohm per digit in the table entries 100 = 10 Ohm per digit in the table entries	UINT16	RW	1
80n1:05	Value 1		UINT16	RW	0x2710 (10000_{dec})
80n1:06	Value 2		UINT16	RW	0x2896 (10390_{dec})
80n1:07	Value 3		UINT16	RW	0x2A1B (10779_{dec})
80n1:08	Value 4		UINT16	RW	0x2B9F (11167_{dec})
80n1:09	Value 5		UINT16	RW	0x2D22 (11554_{dec})
80n1:0A	Value 6		UINT16	RW	0x2EA3 (11939_{dec})
80n1:0B	Value 7		UINT16	RW	0x3024 (12324_{dec})
80n1:0C	Value 8		UINT16	RW	0x31A3 (12707_{dec})
80n1:0D	Value 9		UINT16	RW	0x3321 (13089_{dec})
80n1:0E	Value 10		UINT16	RW	0x349E (13470_{dec})
80n1:0F	Value 11		UINT16	RW	0x361A (13850_{dec})
80n1:10	Value 12		UINT16	RW	0x3795 (14229_{dec})
80n1:11	Value 13		UINT16	RW	0x390E (14606_{dec})
80n1:13	Value 14		UINT16	RW	0x3A87 (14983_{dec})
80n1:14	Value 15		UINT16	RW	0x3BFE (15358_{dec})
80n1:15	Value 16		UINT16	RW	0x0000 (0_{dec})
…	…		…	…	…
80n1:69	Value 100		UINT16	RW	0x0000 (0_{dec})

Index 80n2 RTD B-parameter equation for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n2:0	RTD B-Parameter Equation		UINT8	RO	0x05 (5_{dec})
80n2:01	Min Temperature	Start of the measuring range in °C.	INT16	RW	-30
80n2:02	Max Temperature	End of the measuring range in °C.	INT16	RW	150
80n2:03	Rn	Resistance value at Tn. In most cases = 25 °C.	INT16	RW	1000
80n2:04	Tn	Reference temperature for Rn [°C]	INT16	RW	25
80n2:05	B-parameter	B-parameter [Kelvin]	REAL32	RW	3710

Index 80n3 RTD DIN EN 60751 equation for 0 ≤ n ≤ 3 (Ch. 1 - 4) 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n3:0	RTD DIN EN 60751 equation	Standard parameter for Pt1000 within the range 0 to 850°C.	UINT8	RO	0x06 (6_{dec})
80n3:01	Min Temperature	Start of the measuring range in °C.	INT16	RW	0
80n3:02	Max Temperature	End of the measuring range in °C.	INT16	RW	850
80n3:03	R0	see equation [▶ 116]	UINT16	RW	1000
80n3:04	A parameter	see equation [▶ 116]	REAL32	RW	3.908E-3
80n3:05	B parameter	see equation [▶ 116]	REAL32	RW	-5.775E-7
80n3:06	C parameter	see equation [▶ 116]	REAL32	RW	-4.183E-12

Index 80n4 RTD Steinhart-Hart equation for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80n4:0	RTD Steinhart Hart Equation	Standard values for an NTC10K with 32650 Ohm at 0 °C: C1 default = 1.12119E-03 C2 default = 2.35346E-04 C3 default = 0 C4 default = 8.34620E-08	UINT8	RO	0x06 (6_{dec})
80n4:01	Min Temperature	Start of the measuring range in °C.	INT16	RW	-30
80n4:02	Max Temperature	End of the measuring range in °C.	INT16	RW	150
80n4:03	C1	see equation [▶ 114]	REAL32	RW	1.1211E-03
80n4:04	C2	see equation [▶ 114]	REAL32	RW	2.35346E-04
80n4:05	C3	see equation [▶ 114]	REAL32	RW	0
80n4:06	C4	see equation [▶ 114]	REAL32	RW	8.24620E-08

Complete overview

Standard objects

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

Index 1000 Device type

Index (hex)	Name	Meaning	Data type	Flags	Default value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	0x01401389 (20976521_{dec})

Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default value
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EL3204-0200

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 ($_{2dec}$)
1018:02	Product code	Product code of the EtherCAT slave	UINT32	RO	0x0C843052 (209989714_{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	0x00000000 (0_{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 value
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 180n RTD TxPDO-Par for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
180n:0	RTD TxPDO-Par	PDO parameter TxPDO 1	UINT8	RO	0x09 (9_{dec})
180n:06	Exclude TxPDOs	This entry specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 1	OCTET-STRING[0]	RO	
180n:07	TxPDO State	The TxPDO state is set if it was not possible to correctly read in the associated input data	BOOLEAN	RO	0x00 (0_{dec})
180n:09	TxPDO Toggle	The TxPDO toggle is toggled with each update the corresponding input data	BOOLEAN	RO	0x00 (0_{dec})

Index 1A0n RTD TxPDO-Map 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	RTD TxPDO-Map	PDO Mapping TxPDO 1	UINT8	RO	0x08 (8_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.1), entry 0x01 (Underrange))	UINT32	RO	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.1), entry 0x02 (Overrange))	UINT32	RO	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RO	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.1), entry 0x07 (Error))	UINT32	RO	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RO	0x00n0:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (RTD TxPDO-Par Ch.1), entry 0x07 (TxPDO State))	UINT32	RO	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (RTD TxPDO-Par Ch.1), entry 0x09 (TxPDO Toggle))	UINT32	RO	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.1), entry 0x11 (Value))	UINT32	RO	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RO	0x00 (0_{dec})

Index 1C13 TxPDO assign

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

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 1C33:08)	UINT16	RO	0xC007 (49159_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:07	Minimum delay time		UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Maximum delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 3 (Ch. 1 – 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal Data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal Data	Max. subindex	UINT8	RO	
80nE:01	ADC raw value	ADC raw value.	INT32	RO	
80nE:02	Resistor (1/10 Ohm)	resulting measured resistance	UINT32	RO	

Index 80nF RTD Vendor Data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor Data	Max. subindex	UINT8	RO	0x03 (3_{dec})
80nF:01	Calibration offset	Calibration offset	INT32	RW	0x00000DAC (3500_{dec})
80nF:02	Calibration gain	Gain value for measuring range 0 to 5000 Ohm	UINT16	RW	0x3D68 (15720_{dec})
80nF:03	Calibration gain ext.	Gain value for measuring range 5 to 240 kOhm	UINT16	RW	0x05A0 (1440_{dec})

Index F000 Modular device profile

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

Index F008 Code word

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

Index F010 Module list

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

5.9.7 Object description EL3208

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 178] and profile-specific objects [▶ 183] required during commissioning
- Objects for indicating internal settings [▶ 180] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 7 (Ch. 1 – 8)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n00:15 of the EL3208 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n0:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n0:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n0:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (“Value” 0x60n0:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n0:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n0:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n0:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via “Enable “filter (index 0x80n0:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n0:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n0:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!		RW	0x0002 (2_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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})
1C13:05	Subindex 005	5. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A04 (6660_{dec})
1C32:06	Subindex 006	6. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A05 (6661_{dec})
1C13:07	Subindex 007	7. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A06 (6662_{dec})
1C13:08	Subindex 008	8. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A07 (6663_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 184]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	-
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	-
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	-
80nF:03	Calibration offset Pt1000	Manufacturer calibration offset Pt1000	INT16	RW	-
80nF:04	Calibration gain Pt1000	Manufacturer calibration gain Pt000)	UINT16	RW	-

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default value
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index spacing of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0008 (8_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.8 Object description EL3208-0010

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 185] and profile-specific objects [▶ 191] required during commissioning
- Objects for indicating internal settings [▶ 188] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 7 (Ch. 1 – 8)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n0:15 of the EL3208-0010 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n0:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n0:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n0:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (“Value” 0x60n0:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n0:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n0:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via “Enable filter” (index 0x80n0:06). The possible settings are sequentially numbered. 0: 50/60 Hz 120 ms 1: 4 ms 2: 8 ms 3: 16 ms 4: 32 ms 5: 40 ms 6: 48 ms 7: 60 ms 8: 101 ms 9: 120 ms 10: 50/60 Hz 11: 160 ms 12: 200 ms 13: 240 ms 14: 320 ms 15: 480 ms	UINT16	RW	0x0000 (0_{dec})
80n0:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n0:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		2: Pt1000 -50°C to 150°C 3: Pt500 -50°C to 150°C 5: Ni1000 -50°C to 150°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30°C to 150°C) 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 50: NTC1K8 -40°C to 130°C $R_{0^\circ C}$=4940 ohm 51: NTC1K8 TK -30°C to 150°C $R_{0^\circ C}$=5200 ohm 52: NTC2K2 -50°C to 130°C $R_{0^\circ C}$=7373 ohm 53: NTC3K -30°C to 80°C $R_{0^\circ C}$=9822 ohm 54: NTC5K -40°C to 100°C $R_{0^\circ C}$=9822 ohm 55: NTC10K -30°C to 150°C $R_{0^\circ C}$=32650 ohm 56: NTC10K PRE -30°C to 150°C $R_{0^\circ C}$=29490 ohm 57: NTC10k 3204 -40°C to 110°C $R_{0^\circ C}$=27080 ohm 58: NTC10k Type 2 -50°C to 130°C $R_{0^\circ C}$=32770 ohm 59: NTC10k Type 3 -50°C to 130°C $R_{0^\circ C}$=29588 ohm 60: NTC10K Dale -50°C to 130°C $R_{0^\circ C}$=32660 ohm 61: NTC10K 3A221 -40°C to 130°C $R_{0^\circ C}$=32639 ohm 62: NTC20K -20 to 150°C $R_{0^\circ C}$=70200 ohm 99: B-parameter equation 100: potentiometer 0.1 ohm 0..5k 101: potentiometer 1 ohm res 102: potentiometer 10 ohm res 103: potentiometer 20 ohm res 200: NTC100K $R_{0^\circ C}$=3266 kΩ	UINT16	RW	0x0002 (2_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Index 8002 B-Parameter Equation

Index (hex)	Name	Meaning	Data type	Flags	Default value
8002:0	B_parameter Equation	Max. subindex	UINT8	RO	0x05 (5_{dec})
8002:01	Min Temperature		UINT16	RW	- 50
8002:02	Max Temperature		UINT16	RW	150
8002:03	Rn 10 Ohm res.		UINT16	RW	1000
8002:04	Tn		UINT16	RW	25
8002:05	B-Parameter		UINT32	RO	3710.000000

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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})
1C13:05	Subindex 005	5. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A04 (6660_{dec})
1C32:06	Subindex 006	6. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A05 (6661_{dec})
1C13:07	Subindex 007	7. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A06 (6662_{dec})
1C13:08	Subindex 008	8. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A07 (6663_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 192]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default
80nF:0	RTD Vendor data	Max. subindex	UINT8	RO	-
80nF:01	Calibration offset	Vendor offset calibration	INT16	RW	-
80nF:02	Calibration gain	Vendor gain calibration	UINT16	RW	-
80nF:03	Calibration offset NTC1	Vendor offset calibration NTC1	INT16	RW	-
80nF:04	Calibration gain NTC1	Vendor gain calibration NTC1	UINT16	RW	-
80nF:05	Calibration offset NTC2	Vendor offset calibration NTC2	INT16	RW	-
80nF:06	Calibration gain NTC2	Vendor gain calibration NTC2	UINT16	RW	-
80nF:07	RefA_5k	Extended vendor calibration reference resistor 5k	UINT16	RW	-
80nF:08	RefC_5k	Extended vendor calibration reference resistor 5k	UINT16	RW	-
80nF:09	RefA_35k	Extended vendor calibration reference resistor 35k	UINT16	RW	-
80nF:0A	RefC_35k	Extended vendor calibration reference resistor 35k	UINT16	RW	-

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default value
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index spacing of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0008 (8_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.9 Object description EL3214

EtherCAT XML Device Description

The presentation 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 terminal is parameterized via the CoE – Online tab (double-click on the respective object) or via the Process Data tab (assignment of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: – Keep a startup list in case components have to be replaced – Differentiation between online/offline dictionary, existence of current XML description – Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 194] and profile-specific objects [▶ 199] required during commissioning
- Objects for indicating internal settings [▶ 196] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 3 (Ch. 1 – 4)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n00:15 of the EL3214-00x0 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!	UINT16	RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: Two-wire connection 1: Three-wire connection	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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 value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 200]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	-
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	-
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	-
80nF:03	Calibration offset Pt1000	Manufacturer calibration offset Pt1000	INT16	RW	-
80nF:04	Calibration gain Pt1000	Manufacturer calibration gain Pt1000)	UINT16	RW	-
80nF:05	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-
80nF:06	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-

Index F000 Modular device profile

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

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.10 Object description EL3214-0090

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 202] and profile-specific objects [▶ 208] required during commissioning
- Objects for indicating internal settings [▶ 204] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 3 (Ch. 1 – 4)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n00:15 of the EL3214-00x0 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!	UINT16	RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: Two-wire connection (EL3214-0090 from firmware 02) 1: Three-wire connection	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Index 8040 TSC Settings

Index (hex)	Name	Meaning	Data type	Flags	Default value
8040:0	TSC Settings [▶ 121]	Max. ubindex	UINT8	RO	0x02 (2_{dec})
8040:01	Address	TwinSAFE SC Address	UINT16	RW	0x0000 (0_{dec})
8040:02	Connection Mode	Selection of TwinSAFE SC CRC	UINT32	RO	0x00000000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1604 TSC RxPDO-Map Master Message

Index (hex)	Name	Meaning	Data type	Flags	Default value
1604:0	TSC RxPDO-Map Master Message	PDO Mapping RxPDO	UINT8	RO	0x04 (4_{dec})
1604:01	SubIndex 001	1. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x01 (TSC__Master Cmd))	UINT32	RO	0x7040:01, 8
1604:02	SubIndex 002	2. PDO Mapping entry (8 bits align)	UINT32	RO	0x0000:00, 8
1604:03	SubIndex 003	3. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x03 (TSC__Master CRC_0))	UINT32	RO	0x7040:03, 16
1604:04	SubIndex 004	4. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x02 (TSC__Master ConnID))	UINT32	RO	0x7040:02, 16

Index 1A0n TxPDO Map for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1A04 TSC TxPDO-Map Slave Message

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A04:0	TSC TxPDO-Map Slave Message	PDO Mapping TxPDO	UINT8	RW	0x0A (10_{dec})
1A04:01	SubIndex 001	1. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x01 (TSC__Slave Cmd))	USINT8	RW	0x6040:01, 8
1A04:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))	INT16	RW	0x6000:11, 16
1A04:03	SubIndex 003	3. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x03 (TSC__Slave CRC_0))	UINT16	RW	0x6040:03, 16
1A04:04	SubIndex 004	4. PDO Mapping entry (object 0x6010 (ENC Inputs), entry 0x11 (Counter value))	INT16	RW	0x6010:11, 16
1A04:05	SubIndex 005	5. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x04 (TSC__Slave CRC_1))	UINT16	RW	0x6040:04, 16
1A04:06	SubIndex 006	6. PDO Mapping entry (object 0x6020 (ENC Inputs), entry 0x11 (Counter value))	INT16	RW	0x6020:11, 16
1A04:07	SubIndex 007	7. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x05 (TSC__Slave CRC_2))	UINT16	RW	0x6040:05, 16
1A04:08	SubIndex 008	8. PDO Mapping entry (object 0x6030 (ENC Inputs), entry 0x11 (Counter value))	INT16	RW	0x6030:11, 16
1A04:09	SubIndex 009	9. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x06 (TSC__Slave CRC_3))	UINT16	RW	0x6040:06, 16
1A04:0A	SubIndex 010	10. PDO Mapping entry (object 0x6040 (TSC Slave Frame Elements), entry 0x02 (TSC__Slave ConnID))	UINT16	RW	0x6040:02, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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 value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 209]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 6040 TSC Slave Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default value
6040:0	TSC Slave Frame Elements [▶ 121]	Max. subindex	UINT8	RO	0x06 (6_{dec})
6040:01	TSC__Slave Cmd	reserved	UINT8	RO	0x00 (0_{dec})
6040:02	TSC__Slave ConnID	reserved	UINT16	RO	0x0000 (0_{dec})
6040:03	TSC__Slave CRC_0	reserved	UINT16	RO	0x0000 (0_{dec})
6040:04	TSC__Slave CRC_1	reserved	UINT16	RO	0x0000 (0_{dec})
6040:05	TSC__Slave CRC_2	reserved	UINT16	RO	0x0000 (0_{dec})
6040:06	TSC__Slave CRC_3	reserved	UINT16	RO	0x0000 (0_{dec})

Index 7040 TSC Master Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default value
7040:0	TSC Master Frame Elements	Max. subindex	UINT8	RO	0x03 (3_{dec})
7040:01	TSC__Master Cmd	reserved	UINT8	RO	0x00 (0_{dec})
7040:02	TSC__Master ConnID	reserved	UINT16	RO	0x0000 (0_{dec})
7040:03	TSC__Master CRC_0	reserved	UINT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 3 (Ch. 1 - 4)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	-
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	-
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	-
80nF:03	Calibration offset Pt1000	Manufacturer calibration offset Pt1000	INT16	RW	-
80nF:04	Calibration gain Pt1000	Manufacturer calibration gain Pt1000)	UINT16	RW	-
80nF:05	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-
80nF:06	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index distance of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0005 (5_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

5.9.11 Object description EL3218

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 terminal is parameterized via the CoE - Online tab (double-click on the respective object) or via the Process Data tab (allocation of PDOs). Please note the following general CoE information when using/manipulating the CoE parameters: - Keep a startup list if components have to be replaced - Differentiation between online/offline dictionary, existence of current XML description - Use "CoE reload" for resetting changes

Relevant objects

The object description refers to the analog input terminals for Pt100 (RTD) in 1 to 8 channel versions. Observe the indices with regard to the objects relevant for the respective terminal (channel dependent).

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization [▶ 211] and profile-specific objects [▶ 216] required during commissioning
- Objects for indicating internal settings [▶ 213] (may be fixed)

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

Objects for commissioning

Index 1011 Restore default parameters

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 80n0 RTD settings for 0 ≤ n ≤ 7 (Ch. 1 - 8)

The filter properties are set via index 0x8000:15 only

The filter frequencies are set centrally for all channels of the EL32xx terminals via index 0x8000:15 (channel 1).
The corresponding indices 0x80n00:15 of the EL3218 have no parameterization function.

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	RTD Settings	Maximum subindex	UINT8	RO	0x1B (27_{dec})
80n00:01	Enable user scale [▶ 97]	User scaling is active.	BOOLEAN	RW	0x00 (0_{dec})
80n00:02	Presentation [▶ 95]	0: Signed presentation 1: Absolute value with MSB as sign Signed amount representation 2: High resolution (1/100°C) [default for EL3201/2-00x0 high-precision terminals, see note [▶ 110]!	BIT3	RW	0x00 (0_{dec})
80n00:05	Siemens bits [▶ 97]	The S5 bits are shown in the three low-order bits (value 0x60n00:11) Bit 0 = 1 ("Overange" or "Underrange") Bit 1 (not used) Bit 2 (not used)	BOOLEAN	RW	0x00 (0_{dec})
80n0:0A	Enable user calibration [▶ 97]	Enabling of user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable manufacturer calibration [▶ 97]	Enabling of the manufacturer calibration	BOOLEAN	RW	0x01 (1_{dec})
80n00:11	User scale offset [▶ 97]	User scaling offset	INT16	RW	0x0000 (0_{dec})
80n00:12	User scale gain [▶ 97]	This is the gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65535 (0x00010000).	INT32	RW	0x00010000 (65536_{dec})
80n00:15	Filter settings [▶ 97]	This object determines the digital filter settings, if it is activated via Enable filter (index 0x80n00:06). The possible settings are sequentially numbered. 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	UINT16	RW	0x0000 (0_{dec})
80n00:17	User calibration offset [▶ 97]	User calibration offset	INT16	RW	0x0000 (0_{dec})
80n00:18	User calibration gain [▶ 97]	User calibration gain	UINT16	RW	0xFFFF (65535_{dec})

Index (hex)	Name	Meaning	Data type	Flags	Default
80n00:19	RTD element [▶ 93]	RTD element	UINT16	RW	0x0000 (0_{dec})
		0: Pt100 1: Ni100 -60°C to 250°C 2: Pt1000 -200°C to 850°C 3: Pt500 -200°C to 850°C 4: Pt200 -200°C to 850°C 5: Ni1000 -60°C to 250°C 6: Ni1000 TK5000, 100°C: 1500 ohm (-30 to 160°C) 7: Ni120 -60°C to 320°C 8: Output in ohm Resolution 1/16 ohm (0 .. 4096 ohm)*** 9: Output in ohm Resolution 1/64 ohm (0 .. 1024 ohm)*** 10-32: KT100/110/130/210/230 KTY10/11/13/16/19 KTY81/82-110,120,150 (-50...150°C) KTY81-121 KTY81-122 KTY81-151 KTY81-152 KTY81/82-210,220,250 KTY81-221 KTY81-222 KTY81-251 KTY81-252 KTY83-110,120,150 (-50...175°C) KTY83-121 KTY83-122 KTY83-151 KTY83-152 KTY84-130,150 (-40...300°C) KTY84-151 KTY21/23-6 (-50...150°C) KTY1x-5 KTY1x-7 KTY21/23-5 KTY21/23-7 ***) please observe further notes [▶ 57] in chapter "RTD measurement in EL32xx"!		RW	0x0000 (0_{dec})
80n0:1A	Connection technology	Connection technology 0: 2-wire connection 1: 3-wire connection	UINT16	RW	0x0000 (0_{dec})
80n0:1B	Wire calibration 1/32 ohm [▶ 96]	Calibration of the supply lines	INT16	RW	0x0000 (0_{dec})

Complete overview

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 value
1000:0	Device type	Device type of the EtherCAT slave: the Lo-Word contains the CoE profile used (5001). The Hi-Word contains the module profile according to the modular device profile.	UINT32	RO	( )

Index 1008 Device name

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

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default value
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	( )
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	( )
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	( )

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 1A0n TxPDO Map for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
1A0n:0	TxPDO Map Ch.1	PDO Mapping TxPDO 1	UINT8	RW	0x09 (9_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x02 (Overrange))	UINT32	RW	0x60n0:02, 1
1A0n:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A0n:04	SubIndex 004	4. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x07 (Error))	UINT32	RW	0x60n0:07, 1
1A0n:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A0n:06	SubIndex 006	6. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x07 (TxPDO-State))	UINT32	RW	0x180n:07, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x180n (TxPDO-Par Ch.[n+1]), entry 0x09 (TxPDO-Toggle))	UINT32	RW	0x180n:09, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (RTD Inputs Ch.[n+1]), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1C00 Sync manager type

Index (hex)	Name	Meaning	Data type	Flags	Default value
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 value
1C12:0	RxPDO assign	PDO Assign Outputs	UINT8	RW	0x00 (0_{dec})

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x08 (8_{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})
1C13:05	Subindex 005	5. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A04 (6660_{dec})
1C32:06	Subindex 006	6. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A05 (6661_{dec})
1C13:07	Subindex 007	7. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A06 (6662_{dec})
1C13:08	Subindex 008	8. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A07 (6663_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default value
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchronous with SM 3 event (no outputs available) • 2: DC - Synchronous with SYNC0 Event • 3: DC - Synchronous with SYNC1 Event • 34: Synchronous with SM 2 event (outputs available)	UINT16	RW	0x0000 (0_{dec})
1C33:02	Cycle time	Cycle time (in ns): • Free Run: Cycle time of the local timer • Synchronous with SM 2 event: Master cycle time • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, only DC mode)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: free run is supported • Bit 1: synchronous with SM 2 event is supported (outputs available) • Bit 1: synchronous with SM 3 event is supported (no outputs available) • Bit 2-3 = 01: DC mode is supported • Bit 4-5 = 01: input shift through local event (outputs available) • Bit 4-5 = 10: input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)	UINT16	RO	0x8007 (32775_{dec})
1C33:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C33:06	Calc and copy time	Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Command	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values. For a subsequent measurement the measured values are reset	UINT16	RW	0x0000 (0_{dec})
1C33:09	Delay time	Time between SYNC1 event and reading of the inputs (in ns, only DC mode)	UINT32	RO	0x00000000 (0_{dec})
1C33:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C33:0D	Shift too short counter	Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)	UINT16	RO	0x0000 (0_{dec})
1C33:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)	BOOLEAN	RO	0x00 (0_{dec})

Profile-specific objects (0x6000-0xFFFF)

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

Index 60n0 RTD Inputs for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
60n0:0	RTD Inputs	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	The measuring range is undershot.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	The measuring range is overshot. (“open circuit” detection if “error” [index 0x60n0:07 [▶ 217]]) is set	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the data is invalid.	BOOLEAN	RO	0x00 (0_{dec})
60n0:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
60n0:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
60n0:11	Value	The analog input data	INT16	RO	0x0000 (0_{dec})

Index 80nE RTD Internal data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nE:0	RTD Internal data	Maximum subindex	UINT8	RO	0x04 (4_{dec})
80nE:01	ADC raw value 1	ADC raw value 1	INT32	RO	0x00000000 (0_{dec})
80nE:02	Resistor 1	Resistance 1 (measured value of resistance sensor, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})
80nE:03	ADC raw value 2 (RL)	ADC raw value 2 (RL)	INT32	RO	0x00000000 (0_{dec})
80nE:04	Resistor 2 (RL)	Resistance 2 (RL) (measured value of the supply line, resolution 1/32 Ohm)	UINT16	RO	0x0000 (0_{dec})

Index 80nF RTD Vendor data for 0 ≤ n ≤ 7 (Ch. 1 - 8)

Index (hex)	Name	Meaning	Data type	Flags	Default value
80nF:0	RTD Vendor data	Maximum subindex	UINT8	RO	-
80nF:01	Calibration offset	Manufacturer calibration offset	INT16	RW	-
80nF:02	Calibration gain	Manufacturer calibration gain	UINT16	RW	-
80nF:03	Calibration offset Pt1000	Manufacturer calibration offset Pt1000	INT16	RW	-
80nF:04	Calibration gain Pt1000	Manufacturer calibration gain Pt1000)	UINT16	RW	-
80nF:05	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-
80nF:06	Calibration gain RL	Manufacturer calibration gain (input RL)	UINT16	RW	-

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default value
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index spacing of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0008 (8_{dec})

Index F008 Code word

Index (hex)	Name	Meaning	Data type	Flags	Default value
F008:0	Code word [▶ 97]	currently reserved	UINT32	RW	0x00000000 (0_{dec})

Index F010 Module list [for {n=1} (1-channel) to {n=1,..,n=8} (8-channel)]

Index (hex)	Name	Meaning	Data type	Flags	Default value
F010:0	Module list	Maximum subindex	UINT8	RO	0x08 (n_{dec})
F010:0n	Subindex 00n	Profile 320	INT32	RO	0x00000140 (320_{dec})

6 Appendix

6.1 Firmware compatibility

Beckhoff EtherCAT devices are delivered with the latest available firmware version. Firmware and hardware must be compatible; not every combination ensures compatibility. The overview below shows the hardware versions on which a firmware can be operated.

Note

- The newest possible firmware for the respective hardware should be implemented
- Beckhoff is not under any obligation to provide customers with free firmware updates for delivered products.

NOTICE

Risk of damage to the device!

Observe the notes on the firmware update in the EtherCAT System Manual in chapter “Firmware Update”.
If a device is set to BOOTSTRAP mode for firmware update, it may not check whether the new firmware is suitable during download.
This may result in damage to the device! Therefore, always make sure that the firmware is suitable for the hardware version!

EL3201			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 02	03	EL3201-0000-0016	2008/03
	04		2009/04
	05		2009/05
02	06	EL3201-0000-0017	2010/04
03 - 14*	07*		2010/06
		EL3201-0000-0018	2012/06
		EL3201-0000-0019	2012/07
		EL3201-0000-0020	2014/07
		EL3201-0000-0021	2015/01
		EL3201-0000-0022	2016/01

EL3201-0010			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 02	03	EL3201-0010-0016	2008/11
	04		2009/04
	05		2009/05
02	06	EL3201-0010-0017	2010/04
03 - 13*	07*		2010/06
		EL3201-0010-0018	2012/06
		EL3201-0010-0019	2012/07
		EL3201-0010-0020	2014/07
		EL3201-0010-0021	2015/01
		EL3201-0010-0022	2016/02

EL3201-0020			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 02	03	EL3201-0020-0016	2008/11
	04		2009/04
	05		2009/05
02	06	EL3201-0020-0017	2010/04
03 - 14*	07*		2010/06
		EL3201-0020-0018	2012/06
		EL3201-0020-0019	2012/07
		EL3201-0020-0020	2014/07
		EL3201-0020-0021	2015/01
		EL3201-0020-0022	2016/02

EL3202			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 02	03	EL3202-0000-0016	2008/03
	04		2009/04
	05		2009/05
03 - 15*	06	EL3202-0000-0017	2010/04
	07*		2010/06
		EL3202-0000-0018	2012/06
		EL3202-0000-0019	2012/07
		EL3202-0000-0020	2014/07
		EL3202-0000-0021	2015/01
		EL3202-0000-0022	2016/01

EL3202-0010			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 01	05	EL3202-0010-0016	2009/07
	06	EL3202-0010-0017	2010/04
01 - 12*	07		2010/06
	08		2010/10
	09		2011/07
	10		2011/09
		EL3202-0010-0018	2012/06
		EL3202-0010-0019	2012/07
		EL3202-0010-0020	2014/07
		EL3202-0010-0021	2015/01
		EL3202-0010-0022	2016/01
	11*		2021/07

EL3202-0020			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
01 - 12*	09	EL3202-0020-0017	2011/02
	10		2011/09
		EL3202-0020-0018	2012/06
		EL3202-0020-0019	2012/07
		EL3202-0020-0020	2014/07
		EL3202-0020-0021	2015/01
		EL3202-0020-0022	2016/01
	11*		2021/07

EL3204			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 02	03	EL3204-0000-0016	2008/03
	04		2009/04
	05		2009/05
03 - 12	06	EL3204-0000-0017	2010/04
	07		2011/06
		EL3204-0000-0018	2012/07
		EL3204-0000-0019	2014/07
		EL3204-0000-0020	2015/01
		EL3204-0000-0021	2016/01
13 – 16*	10	EL3204-0000-0022	2022/08

EL3204-0200			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 06*	01	EL3204-0200-0016	2013/08
	02*	EL3204-0200-0017	2014/04
		EL3204-0200-0018	2016/02

EL3208			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 06	01	EL3208-0000-0017	2014/04
		EL3208-0000-0018	2016/02
08*	10*	EL3208-0000-0019	2023/06

EL3208-0010			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 - 06*	01	EL3208-0010-0016	2018/09
	02		2023/05
	03*		2026/04

EL3214			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 – 03	01	EL3214-0000-0016	2015/01
		EL3214-0000-0017	2017/06
01	02		2020/11
05 – 08	10	EL3214-0000-0018	2023/06
04 – 08*	11*		2024/11

EL3214-0090			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
00 – 04	01	EL3214-0090-0016	2017/02
	02		2018/09
05 – 08*	10*	EL3214-0090-0017	2024/07

EL3218			
Hardware (HW)	**Firmware (FW)**	**Revision no.**	**Date of release**
01 – 02*	01	EL3218-0000-0016	2020/02
	02	EL3218-0000-0017	2021/07
	03*		2025/04

*) This is the current compatible firmware/hardware version at the time of the preparing this documentation. Check on the Beckhoff website whether more up-to-date documentation is available.

6.2 Support and Service

Beckhoff Support and Service provides assistance with questions regarding Beckhoff products and system solutions, as well as with their planning, commissioning, and operation.

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