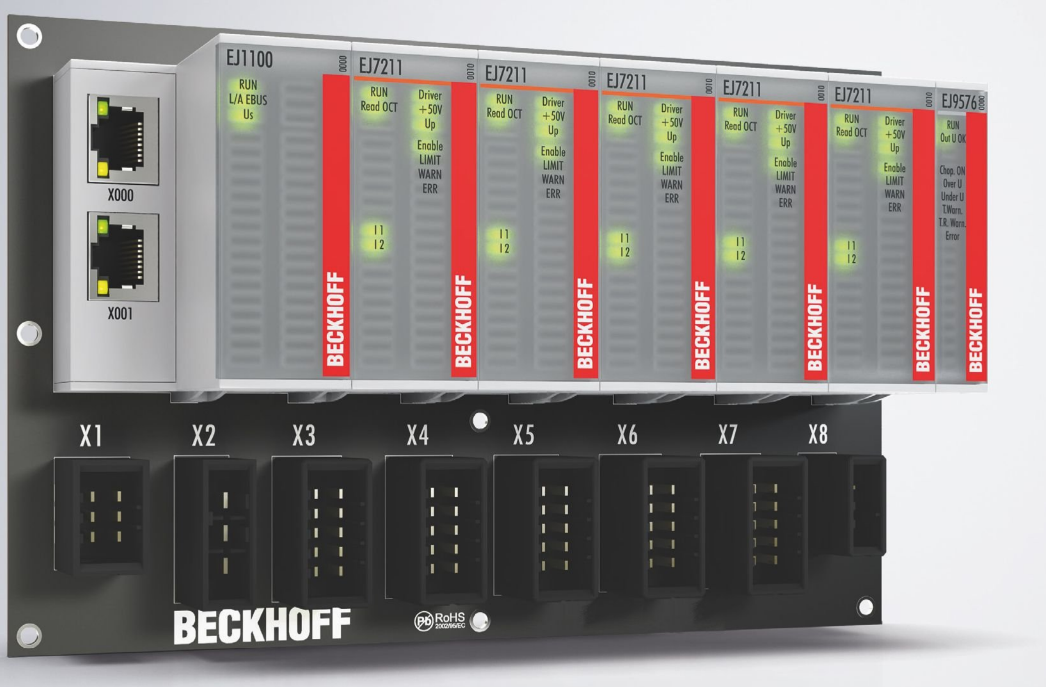
BECKHOFF New Automation Technology

Documentation | EN

EJ3314-0090

4-Channel analog input thermocouple, 16 bit, TwinSAFE SC



2024-12-16 | Version: 1.1

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1 Foreword

1.1 Notes on the documentation

Intended audience

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning these components.
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.

Trademarks

Beckhoff®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® are registered trademarks of and licensed by Beckhoff Automation GmbH. Other designations used in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owners.

Patent Pending

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

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

Copyright

1.2 Safety instructions

Safety regulations

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

Exclusion of liability

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

Personnel qualification

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

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.

1.3 Intended use

⚠ **WARNING**

Caution - Risk of injury!

EJ components may only be used for the purposes described below!

1.4 Signal distribution board

NOTICE

Signal distribution board

Make sure that the EtherCAT plug-in modules are used only on a signal distribution board that has been developed and manufactured in accordance with the Design Guide.

1.5 Documentation issue status

Version	Comment
1.1	• First release
1.0	• Preliminary documentation EJ3314-0090

1.6 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 device / 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
Design Guide EJ8xxx - Signal distribution board for standard EtherCAT plug-in modules (PDF)	Notes on the design of a signal distribution board for standard EtherCAT plug-in modules. • Requirements for the signal distribution board • Backplane mounting guidelines • Module placement • Routing guidelines
Documentation of the corresponding ELxxxx EtherCAT Terminal (s. note on documentation of ELxxxx) [▶ 58]	• Notes on the principle of operation and • descriptions for configuration and parameterization are transferable to the corresponding EtherCAT plug-in modules
I/O Analog Manual (PDF)	Notes on I/O components with analog in and outputs
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

1.7 Marking of EtherCAT plug-in modules

Designation

A Beckhoff EtherCAT device has a 14-digit **technical designation**, made up as follows (e.g. EJ1008-0000-0017)

- **Order identifier**
  - family key: EJ
  - product designation: The first digit of product designation is used for assignment to a product group (e.g. EJ2xxx = digital output module).
  - Version number: The four digit version number identifies different product variants.

- **Revision number:**
  It is incremented when changes are made to the product.

The Order identifier and the revision number are printed on the side of EtherCAT plug-in modules (s. following illustration (A and B).

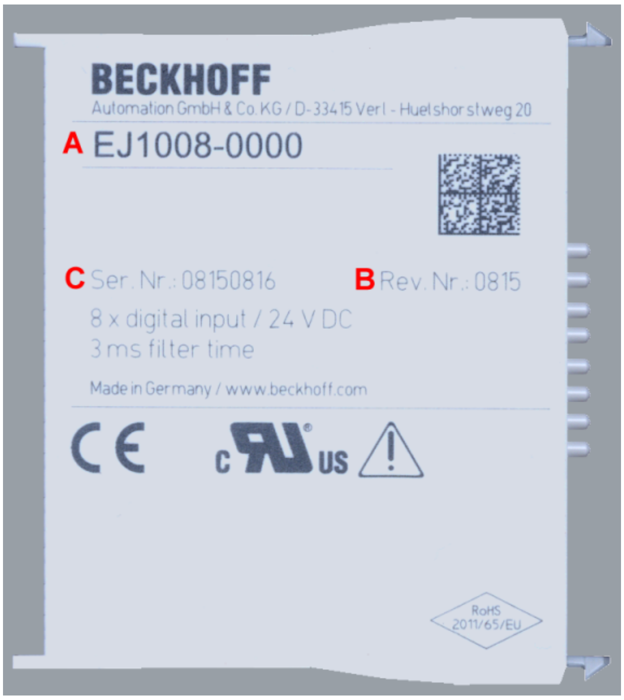


Fig. 1: Order identifier (A), Revision number (B) and serial number (C) using the example of EJ1008

Product group	**Example**		
	Product designation	**Version**	**Revision**
EtherCAT Coupler EJ11xx	EJ1101	-0022 (Coupler with external connectors, power supply module and optional ID switches	-0016
Digital input modules EJ1xxx	EJ1008 8-channel	-0000 (basic type)	-0017
Digital output modules EJ2xxx	EJ2521 1-channel	-0224 (2 x 24 V outputs)	-0016
Analog input modules EJ3xxx	EJ3318 8-channel thermocouple	-0000 (basic type)	-0017
Analog output modules EJ4xxx	EJ4134 4-channel	-0000 (basic type)	-0019
Special function modules EJ5xxx, EJ6xxx	EJ6224 IO-Link master	-0090 (with TwinSAFE SC)	-0016
Motion modules EJ7xxx	EJ7211 servomotor	-9414 (with ECT, STO and TwinSAFE SC)	-0029

Notes

- The elements mentioned above result in the **technical designation**. EJ1008-0000-0017 is used in the example below.
- EJ1008-0000 is the **order identifier**, in the case of “-0000” usually abbreviated to EJ1008.
- The **revision** -0017 shows the technical progress, such as the extension of features with regard to the EtherCAT communication, and is managed by Beckhoff.
  In principle, a device with a higher revision can replace a device with a lower revision, unless specified otherwise, e.g. in the documentation.
  Associated and synonymous with each revision there is usually a description (ESI, EtherCAT Slave Information) in the form of an XML file, which is available for download from the Beckhoff web site.
- The product designation, version and revision are read as decimal numbers, even if they are technically saved in hexadecimal.

Serial number

The serial number for EtherCAT plug-in modules is usually the 8-digit number printed on the side of the module (see following illustration C). The serial number indicates the configuration in delivery state and therefore refers to a whole production batch, without distinguishing the individual modules of a batch.

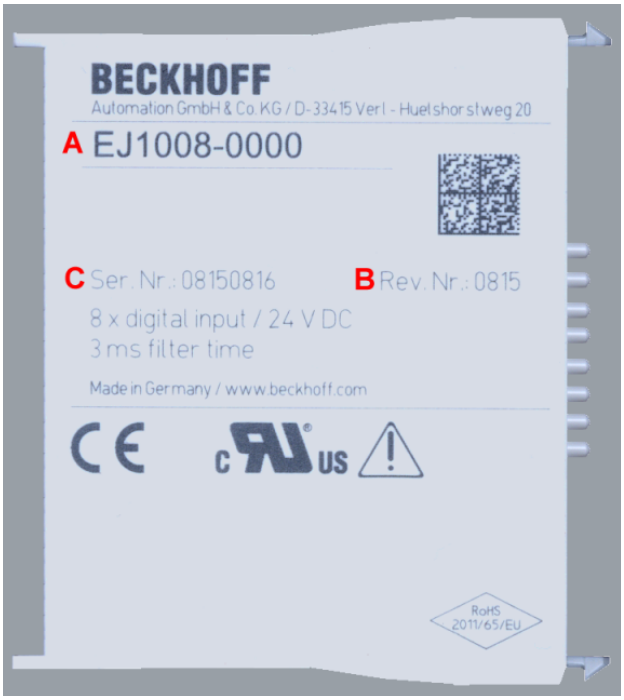


Fig. 2: Order identifier (A), revision number (B) and serial number (C) using the example of EJ1008

Serial number	Example serial number: 08 15 08 16
KK - week of production (CW, calendar week)	08 - week of production: 08
YY - year of production	15 - year of production: 2015
FF - firmware version	08 -f irmware version: 08
HH - hardware version	16 - hardware version: 16

1.7.1 Beckhoff Identification Code (BIC)

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

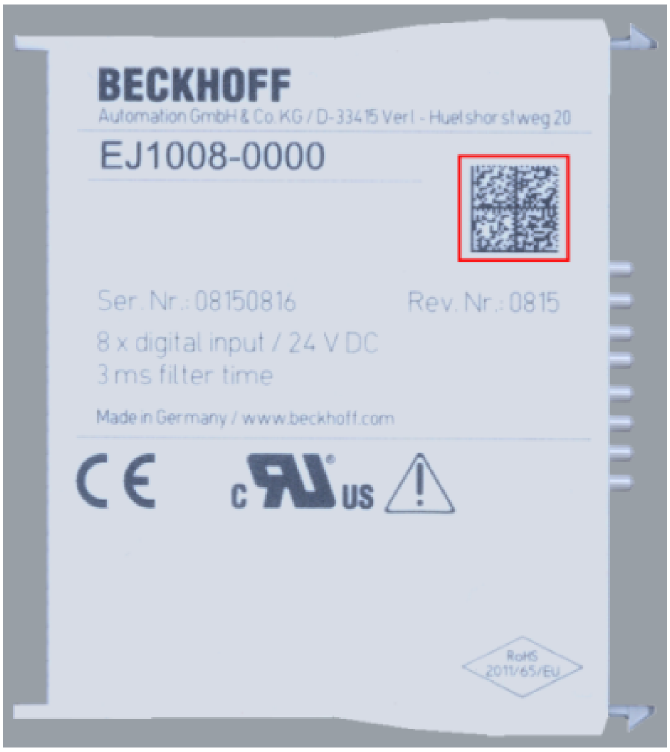


Fig. 3: BIC as data matrix code (DMC, code scheme ECC200)

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

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

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

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

Each piece of information can be uniquely identified using the so-called data identifier (ANSI MH10.8.2-2016). The data identifier is followed by a character string. Both together have a maximum length according to the table below. If the information is shorter, it shall be replaced by spaces. The data under positions 1-4 are always available.

The following information is contained:

Item no.	Type of information	Explanation	Data identifier	Number of digits incl. data identifier	Example
1	Beckhoff order number	**Beckhoff order number**	1P	8	1P072222
2	Beckhoff Traceability Number (BTN)	**Unique serial number, see note below**	S	12	SBTNk4p562d7
3	Article description	**Beckhoff article description, e.g. EL1008**	1K	32	1KEL1809
4	Quantity	**Quantity in packaging unit, e.g. 1, 10, etc.**	Q	6	Q1
5	Batch number	Optional: Year and week of production	2P	14	2P401503180016
6	ID/serial number	Optional: Present-day serial number system, e.g. with safety products	51S	12	51S678294104
7	Variant number	Optional: Product variant number on the basis of standard products	30P	12	30PF971 , 2*K183
...					

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

Structure of the BIC

Example of composite information from items 1 - 4 and with the above given example value on positon 6. The data identifiers are marked in bold font for better display:

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

Accordingly as DMC:

Fig. 4: Example DMC **1P**072222**S**BTNk4p562d7**1K**EL1809 **Q**1 **51S**678294

BTN

An important component of the BIC is the Beckhoff Traceability Number (BTN, item no. 2). The BTN is a unique serial number consisting of eight characters that will replace all other serial number systems at Beckhoff in the long term (e.g. batch designations on IO components, previous serial number range for safety products, etc.). The BTN will also be introduced step by step, so it may happen that the BTN is not yet coded in the BIC.

NOTICE

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

1.7.2 Electronic access to the BIC (eBIC)

Electronic BIC (eBIC)

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

The interface that the product can be electronically addressed by is crucial for the electronic readout.

K-bus devices (IP20, IP67)

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

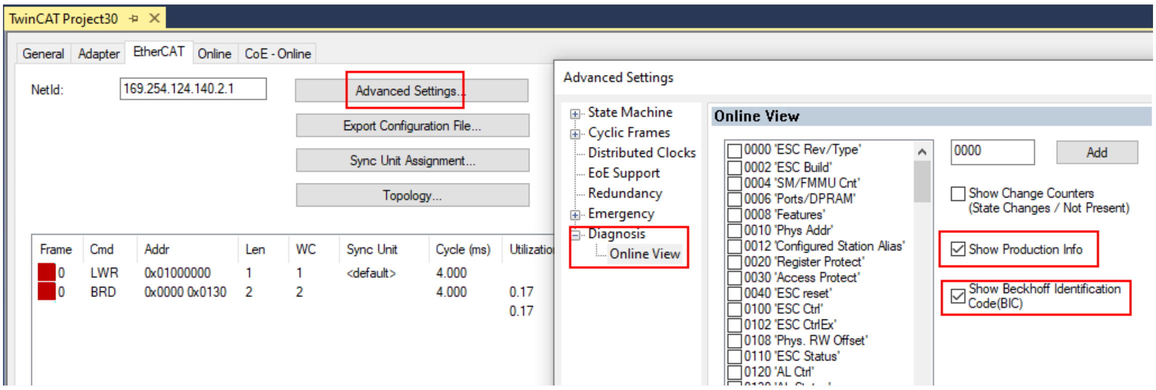
EtherCAT devices (IP20, IP67)

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

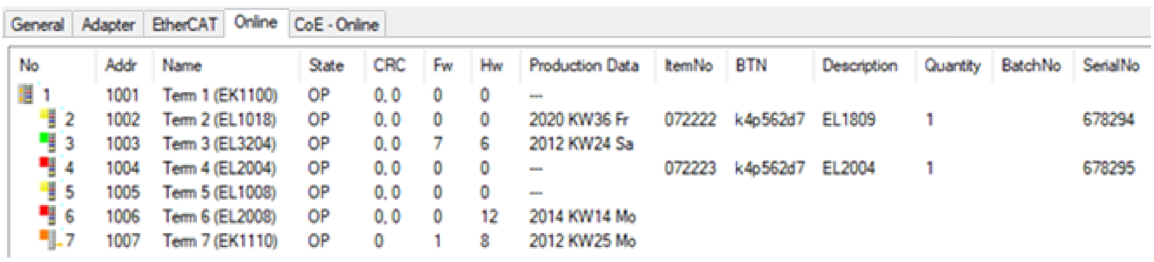
Beckhoff also stores the eBIC in the ESI-EEPROM. The eBIC was introduced into Beckhoff IO production (terminals, box modules) in 2020; as of 2023, implementation is largely complete.

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

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



  - The BTN and its contents are then displayed:



  - Note: As shown in the figure, the production data HW version, FW version, and production date, which have been programmed since 2012, can also be displayed with "Show production info".
  - Access from the PLC: From TwinCAT 3.1. build 4024.24, the functions *FB_EcReadBIC* and *FB_EcReadBTN* for reading into the PLC are available in the Tc2_EtherCAT library from v3.3.19.0.
- EtherCAT devices with a CoE directory may also have the object 0x10E2:01 to display their own eBIC, which can also be easily accessed by the PLC:

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

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

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

- The following auxiliary functions are available for processing the BIC/BTN data in the PLC in *Tc2_Utilities* as of TwinCAT 3.1 build 4024.24
    - F_SplitBIC: The function splits the Beckhoff Identification Code (BIC) sBICValue into its components using known identifiers and returns the recognized substrings in the ST_SplittedBIC structure as a return value
    - BIC_TO_BTN: The function extracts the BTN from the BIC and returns it as a return value
- Note: If there is further electronic processing, the BTN is to be handled as a string(8); the identifier "SBTN" is not part of the BTN.
- Technical background
  The new BIC information is written as an additional category in the ESI-EEPROM during device production. The structure of the ESI content is largely dictated by the ETG specifications, therefore the additional vendor-specific content is stored using a category in accordance with the ETG.2010. ID 03 tells all EtherCAT masters that they may not overwrite these data in the event of an update or restore the data after an ESI update.
  The structure follows the content of the BIC, see here. The EEPROM therefore requires approx. 50..200 bytes of memory.
- Special cases
    - If multiple hierarchically arranged ESCs are installed in a device, only the top-level ESC carries the eBIC information.
    - If multiple non-hierarchically arranged ESCs are installed in a device, all ESCs carry the eBIC information.
    - If the device consists of several sub-devices which each have their own identity, but only the top-level device is accessible via EtherCAT, the eBIC of the top-level device is located in the CoE object directory 0x10E2:01 and the eBICs of the sub-devices follow in 0x10E2:nn.

PROFIBUS; PROFINET, and DeviceNet devices

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

1.7.3 Certificates

- The EhterCAT plug-in modules meet the requirements of the EMC and Low Voltage Directive. The CE mark is printed on the side of the modules.
- The cRUus imprint identifies devices that meet product safety requirements according to U.S. and Canadian regulations.
- The warning symbol is a request to read the corresponding documentation. The documentations for EtherCAT plug-in modules can be downloaded from the Beckhoff homepage.

Fig. 5: Marking for CE and UL using EJ1008 as an example

2 System overview

Electronically, the EJxxxx EtherCAT plug-in modules are based on the EtherCAT I/O system. The EJ system consists of the signal distribution board and EtherCAT plug-in modules. It is also possible to connect an IPC to the EJ system.
The EJ system is suitable for mass production applications, applications with small footprint and applications requiring a low total weight.
The machine complexity can be extended by means of the following:

- reserve slots,
- the use of placeholder modules,
- linking of EtherCAT Terminals and EtherCAT Boxes via an EtherCAT connection.

The following diagram illustrates an EJ system. The components shown are schematic, to illustrate the functionality.

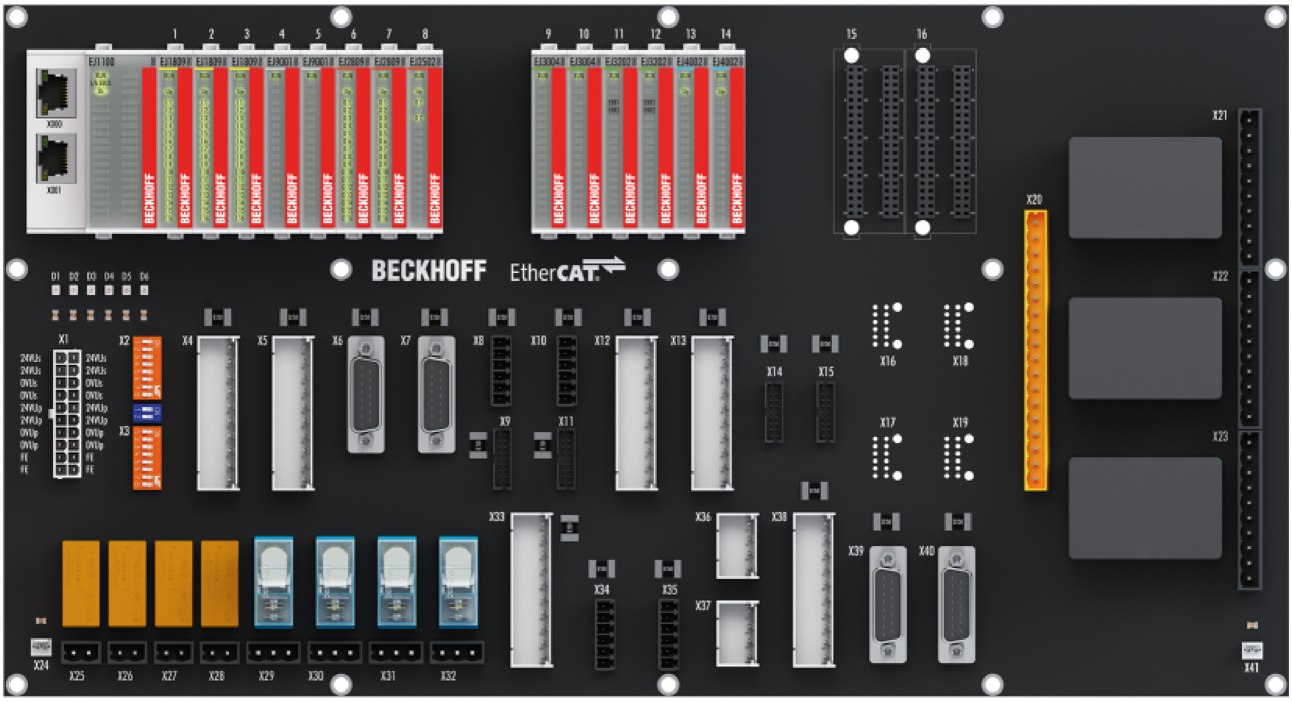


Fig. 6: EJ system sample

Signal distribution board

The signal distribution board distributes the signals and the power supply to individual application-specific plug connectors, in order to connect the controller to further machine modules. Using pre-assembled cable harnesses avoids the need for time-consuming connection of individual wires. Coded components reduce the unit costs and the risk of miswiring.
Beckhoff offers development of signal distribution boards as an engineering service. Customers have the option to develop their own signal distribution board, based on the design guide.

EtherCAT plug-in modules

Similar to the EtherCAT Terminal system, a module strand consists of a bus coupler and I/O modules. Almost all of the EtherCAT Terminals can also be manufactured in the EJ design as EtherCAT plug-in modules. The EJ modules are directly attached to the signal distribution board. The communication, signal distribution and supply take place via the contact pins at the rear of the modules and the PCB tracks of the signal distribution board. The coding pins at the rear serve as mechanical protection against incorrect connection. Color coding on the housing facilitates distinguishing of the modules.

3 EJ3314-0090 - Product description

3.1 Introduction

Fig. 7: EJ3314-0090

4-channel input thermocouple, TwinSAFE SC

The EJ3314-0090 EtherCAT module enables the direct connection of four thermocouples. The circuit of the EtherCAT module can operate thermocouple sensors in 2-wire technology. A microprocessor handles linearization across the whole temperature range, which is freely selectable. Cold junction compensation is achieved by external temperature measurement via RTDs. Measurements in the mV range are also possible with the EJ3314-0090 EtherCAT plug-in module.

The EJ3314-0090 also supports TwinSAFE SC (TwinSAFE Single Channel). This enables the use of standard signals for safety tasks in any networks or fieldbuses.

3.2 Technical data

Analog inputs	EJ3314-0090
Number of inputs	4 x TC 2 x PT1000 for cold junction compensation
Thermocouple sensor types	Type B, C, E, J, K, L, N, R, S, T, U (pre-set type K), mV measurement
Connection technology	2-wire
Maximum cable length to the sensor	30 m (see note [▸ 19])
Resolution	16 bits, display adjustable:0.1/ 0.01°C per digit or 1/ 2/4 µV per digit
Input filter limit frequency	Typ. 1 kHz; depending on sensor length, conversion time, sensor type
Conversion time	approx. 2.5 s up to 20 ms, depending on configuration and filter setting, pre-set approx. 250 ms
Wire break detection	yes
Special features	• Channel-by-channel wire break detection • Internal and external cold junction • Error detection of the external cold junction compensation (CJC) • Adjustable firmware filter • TwinSAFE SC

Voltage measurement	EJ3314-0090
Measuring range, technically available	approx. ±78 mV
Measuring ranges (nominal) and resolution	±30 mV (1 µV per digit, thus max. 32.768 mV can be displayed) ±60 mV (2 µV per digit, thus max. 65.536 mV can be displayed) ±75 mV (4 µV per digit, thus max. 131 mV can be displayed, note technically available measuring range) The measuring ranges 30 mV and 60 mV are executed in software to increase the resolution and always use the same electrical measuring range of ±75 mV.
Measurement uncertainty	at 23°C ambient temperature: < ±0.14% (relative to the full scale value); for further information, see chapter "Measurement ±30 mV, ±60 mV, ±75 mV [▸ 20]"

Temperature measurement	EJ3314-0090
Electrical measuring range used	±75 mV
Measuring ranges	Type B: +200...+1820°C Type C: 0...+2320°C Type E: -270...+1000°C Type J: -210...+1200°C Type K: -270…+1372°C (pre-set) Type L: -50...+900°C Type N: -270…+1300°C Type R: -50...+1768°C Type S: -50...+1768°C Type T: -270…+400°C Type U: -50...+600°C
Measurement uncertainty	at 23°C ambient temperature, with reference configuration, according to Type: B: ±8.5°C; Type C: ±6.2°C; Type E: ±2.5°C; Type J: ±2.7°C; Type K: ±3°C; Type L: ±2.3°C; Type N: ±3°C; Type R: ±6.7°C; Type S: ±7.1°C; Type T: ±2.9°C; U: ±2.5°C, for further details, see Chapter "Measurement of thermocouples [▸ 21]"

Supply and potentials	EJ3314-0090
Power supply	via the E-bus
Current consumption via E-bus	210 mA
Electrical isolation	500 V (E-bus/signal voltage)

Communication	EJ3314-0090
Distributed clocks	No

Environmental conditions	EJ3314-0090
Permissible ambient temperature range during operation	0°C ... + 55°C
Permissible ambient temperature range during storage	-25°C … +85°C
Permissible relative air humidity	95%, no condensation
Operating altitude	max. 2,000 m

General data	EJ3314-0090
Dimensions (W x H x D)	approx. 12 mm x 66 mm x 55 mm
Weight	approx. 30 g
Installation	on signal distribution board
Pollution degree	2
Installation position	Standard [▶ 42]
Position of the coding pins [▶ 45]	2 and 7
Color coding	green

Standards and approvals	EJ3314-0090
Vibration/shock resistance	conforms to EN 60068-2-6 /EN 60068-2-27 (with corresponding signal distribution board)
EMC immunity/emission	conforms to EN 61000-6-2 /EN 61000-6-4 (with corresponding signal distribution board)
Protection rating	EJ module: IP20 EJ system: dependent on the signal distribution board and housing
Approvals/markings*	CE, UKCA

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

CE approval

The CE Marking refers to the EtherCAT plug-in module mentioned above.
If the EtherCAT plug-in module is used in the production of a ready-to-use end product (PCB in conjunction with a housing), the manufacturer of the end product must check compliance of the overall system with relevant directives and CE certification.
To operate the EtherCAT plug-in modules, they must be installed in a housing.

Maximum cable length to the sensor

Without additional protective measures, the maximum cable length from the EtherCAT Module to the sensor is 30 m. For longer cable lengths, suitable surge protection should be provided.

3.2.1 Measurement ±30 mV...±75 mV

Specification ±30 mV

Note: this measuring range is not a separate electrical measuring range but a digital section of the 75 mV measuring range

Measurement mode		**±30 mV**
Measuring range, nominal		-30…+30 mV
Measuring range, end value (full scale value)		30 mV
PDO resolution		1 µV / digit
Basic accuracy: Measurement deviation, with averaging	@ 23°C ambient temperature[1]	< ±0.24%$_{FSV}$ typ. ≈ < ± 0.070 mV
	@ 55°C ambient temperature	< ±026%$_{FSV}$ typ. ≈ < ± 0.077 mV
Offset/zero point deviation (at 23°C)[2]	F_{Offset}	< ±60 µV
Gain/scale/amplification deviation (at 23°C)[2]	F_{Gain}	< 1200 ppm
Temperature coefficient	Tk_{Gain}	< 1 µV/K
	Tk_{Offset}	< 30 ppm/K

Specification ±60 mV

Note: this measuring range is not a separate electrical measuring range but a digital section of the 75 mV measuring range

Measurement mode		**±60 mV**
Measuring range, nominal		-60…+60 mV
Measuring range, end value (full scale value)		60 mV
PDO resolution		2 µV / digit
Basic accuracy: Measurement deviation, with averaging	@ 23°C ambient temperature[1]	< ±0.16%$_{FSV}$ typ. ≈ < ± 0.094 mV
	@ 55°C ambient temperature	< ±0.17%$_{FSV}$ typ. ≈ < ± 0.10 mV
Offset/zero point deviation (at 23°C)[2]	F_{Offset}	< ±60 µV
Gain/scale/amplification deviation (at 23°C)[2]	F_{Gain}	< 1200 ppm
Temperature coefficient	Tk_{Gain}	< 1 µV/K
	Tk_{Offset}	< 30 ppm/K

Specification ±75 mV

Measurement mode		**±75 mV**
Measuring range, nominal		-75…+75 mV
Measuring range, end value (full scale value)		75 mV
PDO resolution		4 µV / digit
Basic accuracy: Measurement deviation, with averaging	@ 23°C ambient temperature[1]	< ±0.14%$_{FSV}$ typ. ≈ < ± 0.11 mV
	@ 55°C ambient temperature	< ±0.15%$_{FSV}$ typ. ≈ < ± 0.12 mV
Offset/zero point deviation (at 23°C)[2]	F_{Offset}	< ±60 µV
Gain/scale/amplification deviation (at 23°C)[2]	F_{Gain}	< 1200 ppm
Temperature coefficient	Tk_{Gain}	< 1 µV/K
	Tk_{Offset}	< 30 ppm/K

[1] This specification value includes the temperature coefficient for gain (Tk_{Gain}) and offset (Tk_{Offset}).

[2] These specifications are already included in the basic accuracy. They are listed here for a detailed, individual uncertainty consideration.

3.2.2 Thermocouples measurement

In the measuring range of a specified thermocouple type, a measured voltage is converted internally into a temperature according to the set transformation. Since the channel measures a voltage internally, the corresponding measuring error in the voltage measuring range must be used.

NOTICE

Basics of thermocouple technology

- Observe the descriptions and notes on the basics of thermocouple technology in the I/O Analog Manual.

Specifications for reference configuration with EtherCAT Terminals (internal cold junction)

The following tables with the specification of the thermocouple measurement only apply to the reference configuration with EL331x EtherCAT Terminals when using the internal cold junction.

As the cold junction of EtherCAT plug-in modules is implemented externally on the application-specific signal distribution board, the specified values are to be regarded as reference values that are only achieved with a comparable implementation.

- The uncertainties must then be determined for the external cold junction on the application side. This temperature can then be transferred to the module for cold junction compensation and calculation of the absolute temperature via the process data.
- The effect on the measurement of the thermocouples must then be calculated on the system side.

The specifications for the internal cold junction and the measuring range given here apply only if the following times are adhered to for thermal stabilization at constant ambient temperature:

- after switching on: 60 min
- after changing wiring/connectors: 15 min

Specification of the internal cold junction measurement

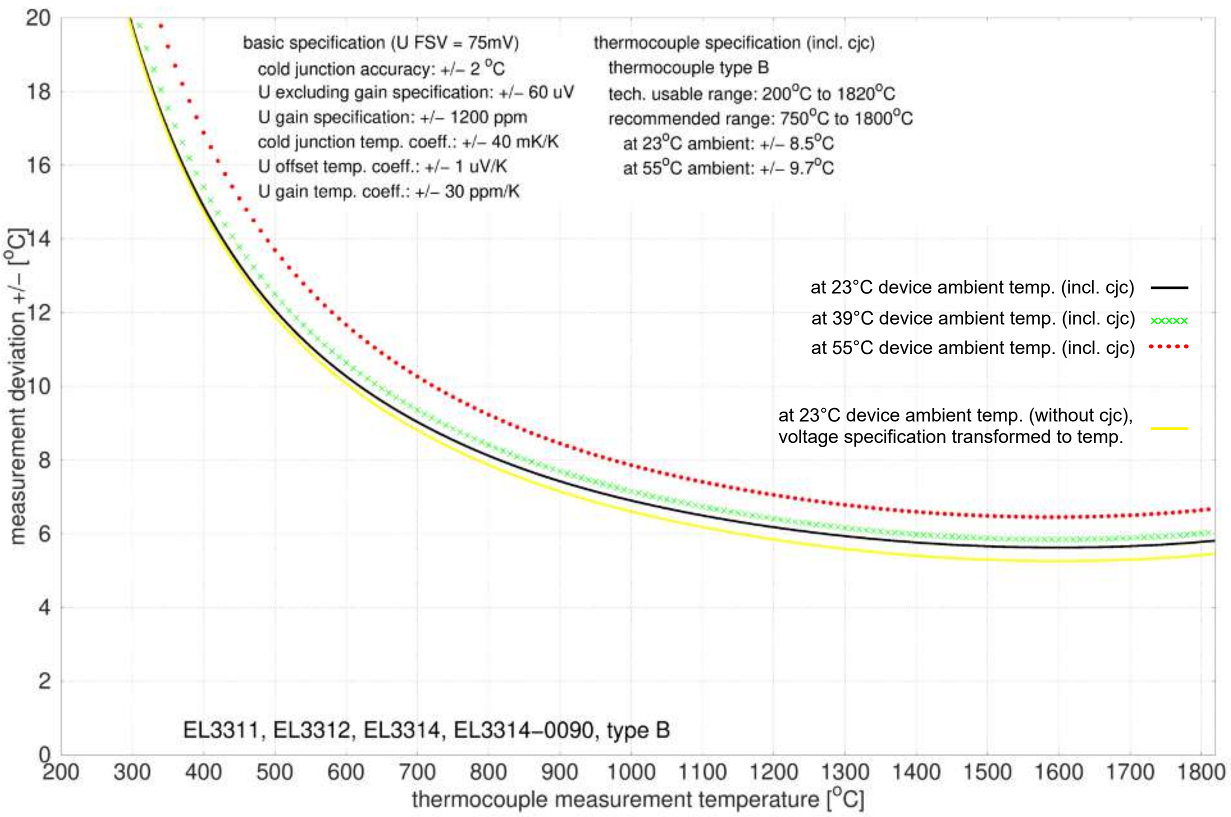
In the EL3314 and EL3314-0090, each channel has its own cold junction sensor.

Measurement mode		Cold junction
Basic accuracy: Measurement deviation at 23°C, with averaging		< ±2.0°C
Temperature coefficient	Tk	< 40 mK/K

3.2.2.1 Specification - thermocouple type B

Temperature measurement thermocouple		Type B
Electrical measuring range used		±75 mV
Measuring range, technically available		+600°C ≈ 1.792 mV … +1800°C ≈ 13.591 mV
Measuring range, end value (full scale value)		+1800°C
Measuring range, recommended		+750°C … +1800°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at “Resolution 0.01°C”; type B: approx. 0.05°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±8.5 K ≈ ±0.47%$_{FSV}$
	@ 55°C ambient temperature	±9.7 K ≈ ±0.54%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

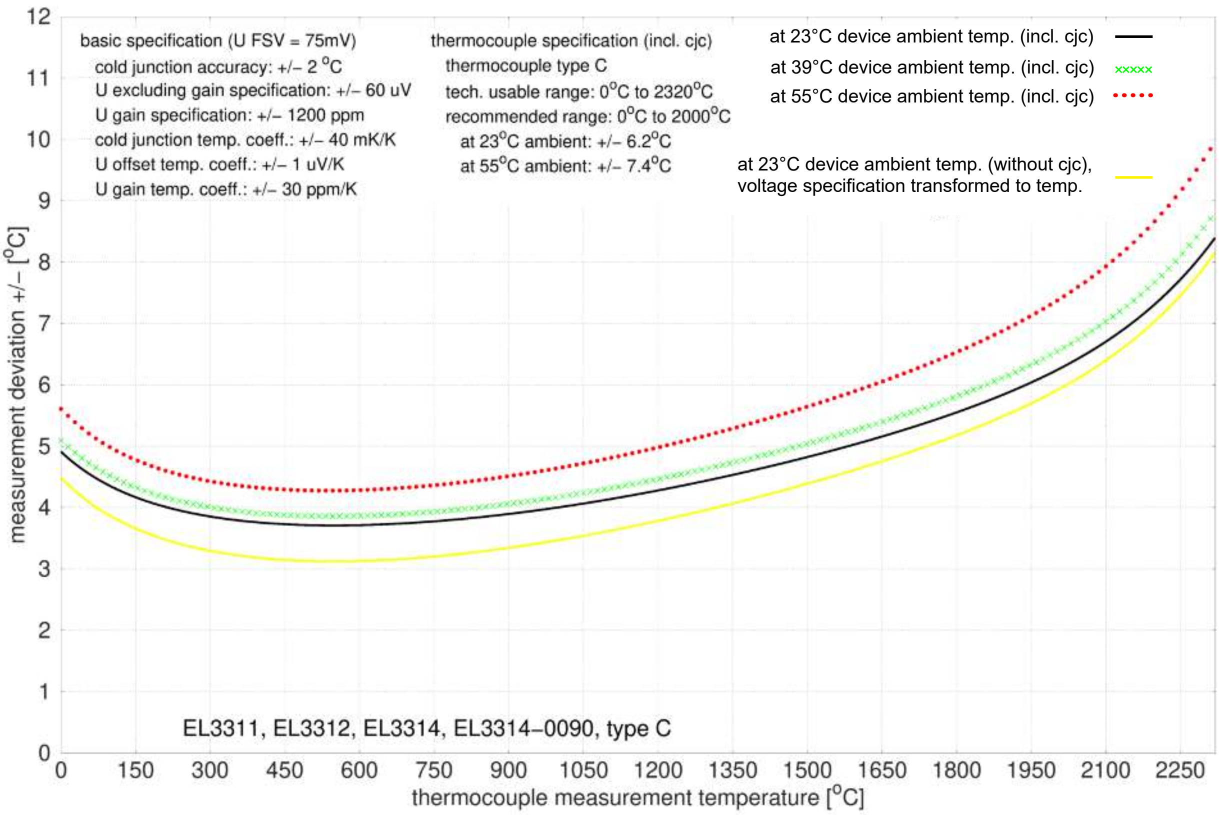
Measurement uncertainty for thermocouple type B:



3.2.2.2 Specification - thermocouple type C

Temperature measurement thermocouple		Type C
Electrical measuring range used		±75 mV
Measuring range, technically available		0°C ≈ 0 mV … +2320°C ≈ 37.107 mV
Measuring range, end value (full scale value)		+2320°C
Measuring range, recommended		0°C … +2000°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at “Resolution 0.01°C”; type C: approx. 0.07°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±6.2 K ≈ ±0.27%$_{FSV}$
	@ 55°C ambient temperature	±7.4 K ≈ ±0.32%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

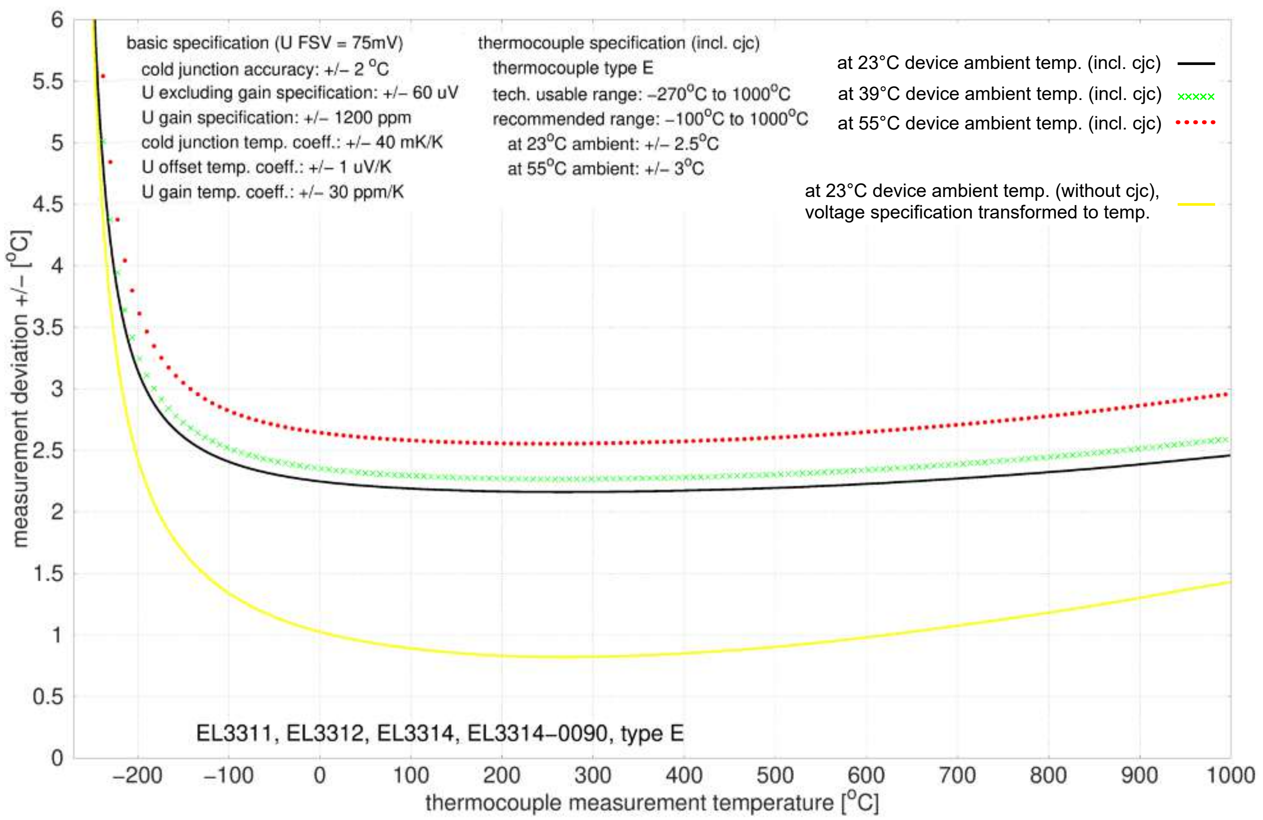
Measurement uncertainty for thermocouple type C:



3.2.2.3 Specification - thermocouple type E

Temperature measurement thermocouple		Type E
Electrical measuring range used		±75 mV
Measuring range, technically available		-100°C ≈ -5.237 mV … +1000°C ≈ 76.372 mV
Measuring range, end value (full scale value)		+1000°C
Measuring range, recommended		-100°C … +1000°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting **Notice Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type E: approx. 0.03°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±2.5 K ≈ ±0.25%$_{FSV}$
	@ 55°C ambient temperature	±3.0 K ≈ ±0.30%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

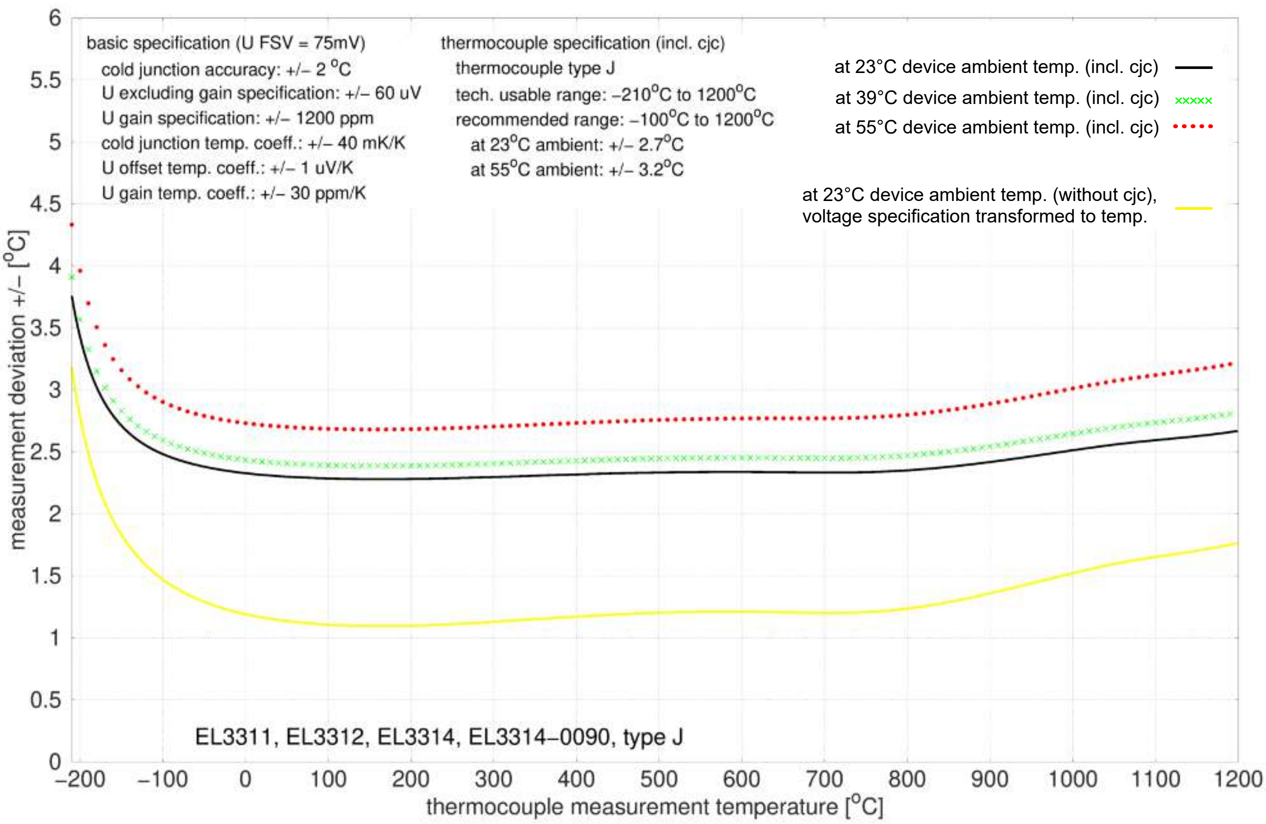
Measurement uncertainty for thermocouple type E:



3.2.2.4 Specification - thermocouple type J

Temperature measurement thermocouple		Type J
Electrical measuring range used		±75 mV
Measuring range, technically available		-100°C ≈ -4.632 mV … +1200°C ≈ 69.553 mV
Measuring range, end value (full scale value)		+1200°C
Measuring range, recommended		-100°C … +1200°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type J: approx. 0.04°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±2.7 K ≈ ±0.23%$_{FSV}$
	@ 55°C ambient temperature	±3.2 K ≈ ±0.27%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

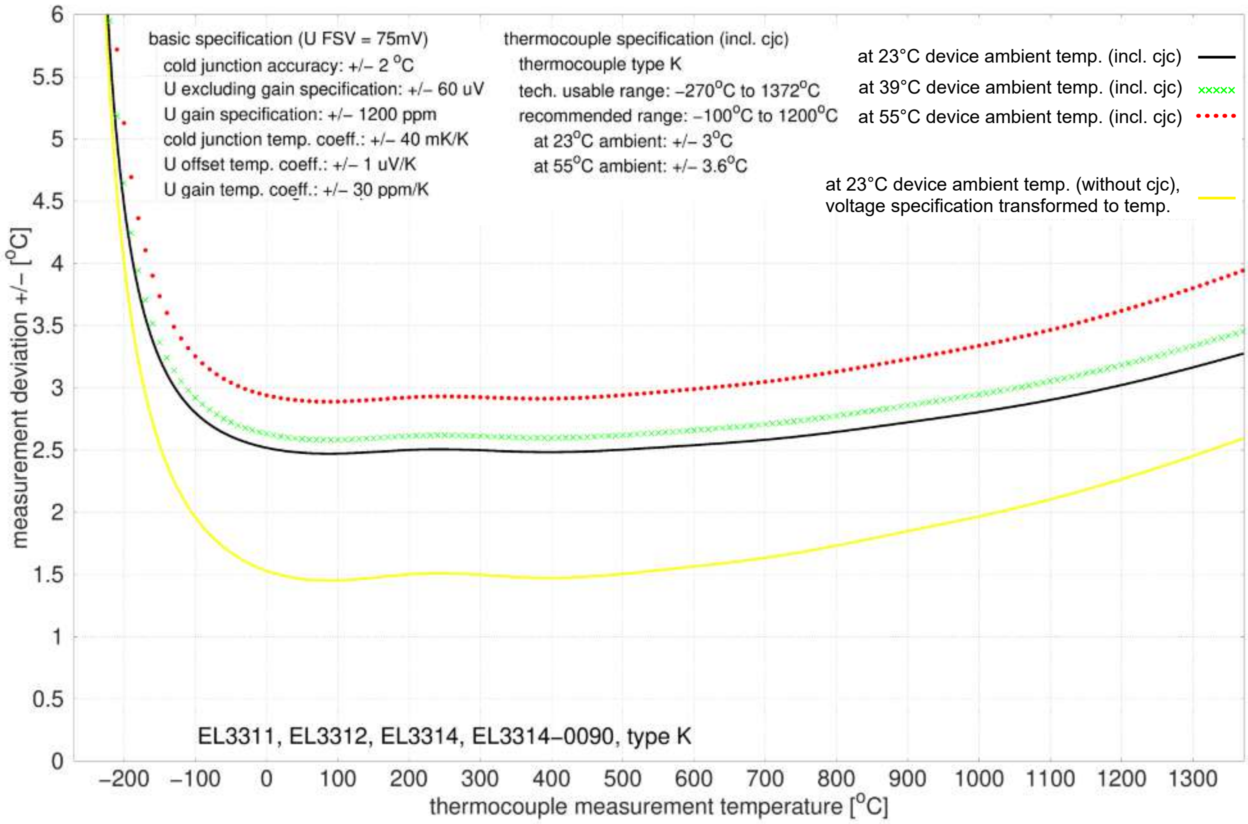
Measurement uncertainty for thermocouple type J:



3.2.2.5 Specification - thermocouple type K

Temperature measurement thermocouple		Type K
Electrical measuring range used		±75 mV
Measuring range, technically available		-200°C ≈ -5.891 mV … +1370°C ≈ 54.818 mV
Measuring range, end value (full scale value)		+1370°C
Measuring range, recommended		-100°C … +1200°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at “Resolution 0.01°C”; type K: approx. 0.04°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±3.0 K ≈ ±0.22%$_{FSV}$
	@ 55°C ambient temperature	±3.6 K ≈ ±0.26%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

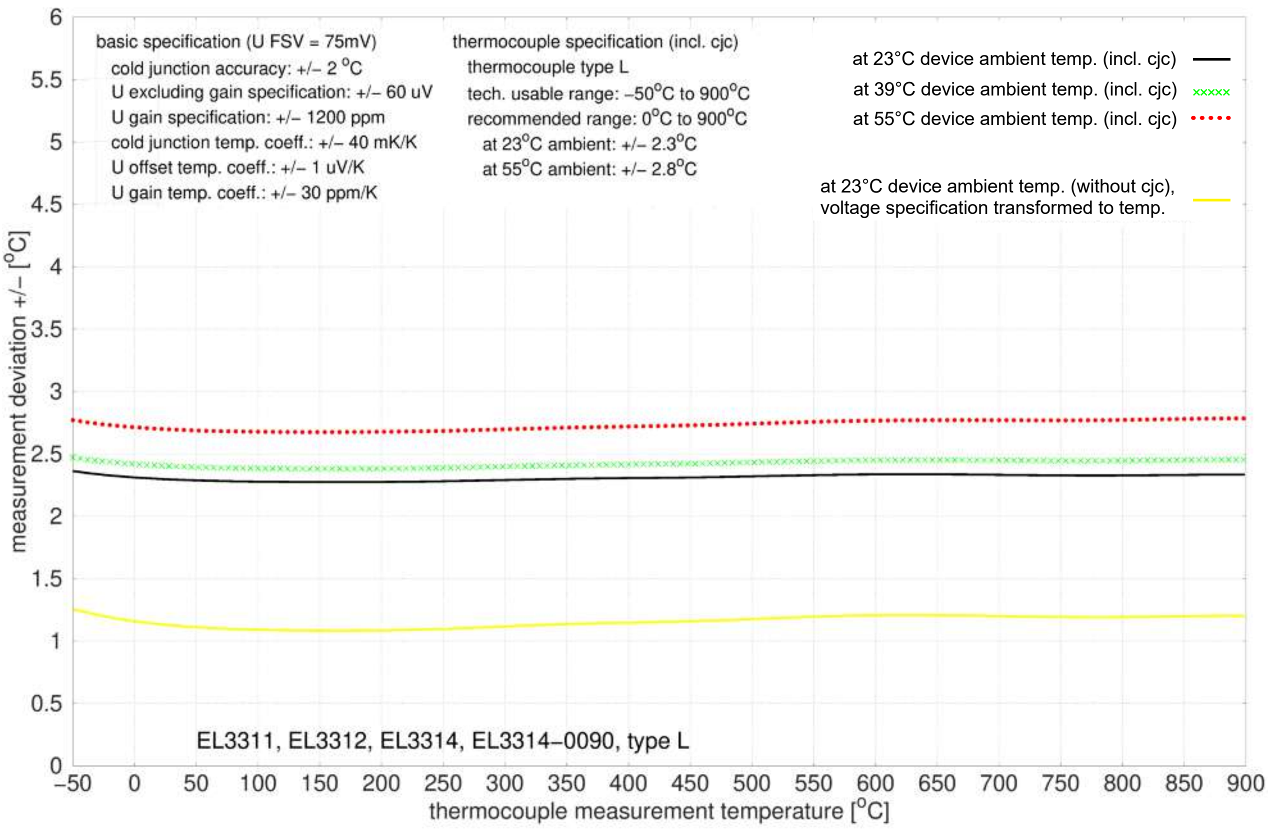
Measurement uncertainty for thermocouple type K:



3.2.2.6 Specification - thermocouple type L

Temperature measurement thermocouple		Type L
Electrical measuring range used		±75 mV
Measuring range, technically available		0°C ≈ 0 mV … +900°C ≈ 52.430 mV
Measuring range, end value (full scale value)		+900°C
Measuring range, recommended		0°C … +900°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting ***Notice*** **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type L: approx. 0.03°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±2.3 K ≈ ±0.26%$_{FSV}$
	@ 55°C ambient temperature	±2.8 K ≈ ±0.31%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

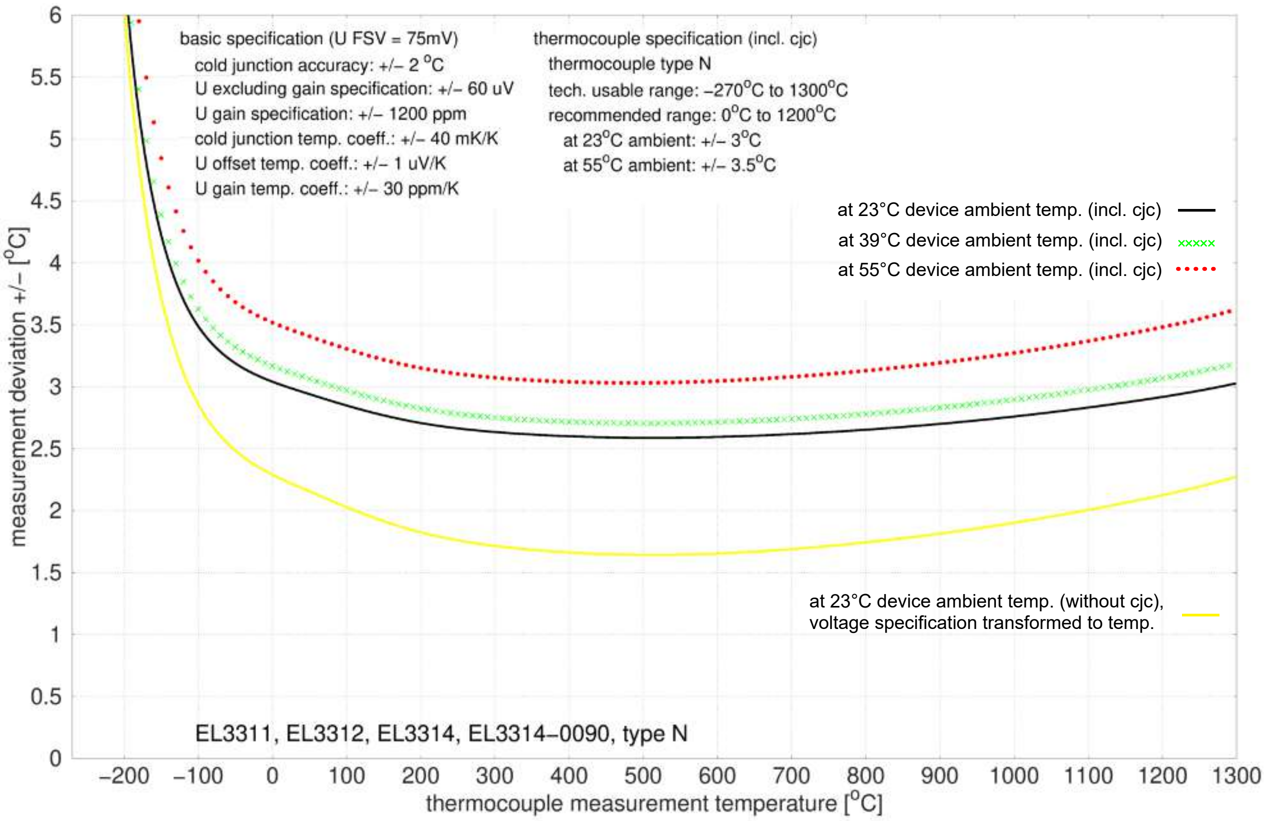
Measurement uncertainty for thermocouple type L:



3.2.2.7 Specification - thermocouple type N

Temperature measurement thermocouple		Type N
Electrical measuring range used		±75 mV
Measuring range, technically available		-100°C ≈ -2.406 mV … +1300°C ≈ 47.513 mV
Measuring range, end value (full scale value)		+1300°C
Measuring range, recommended		0°C … +1300°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type N: approx. 0.04°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±3.0 K ≈ ±0.23%$_{FSV}$
	@ 55°C ambient temperature	±3.5 K ≈ ±0.27%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

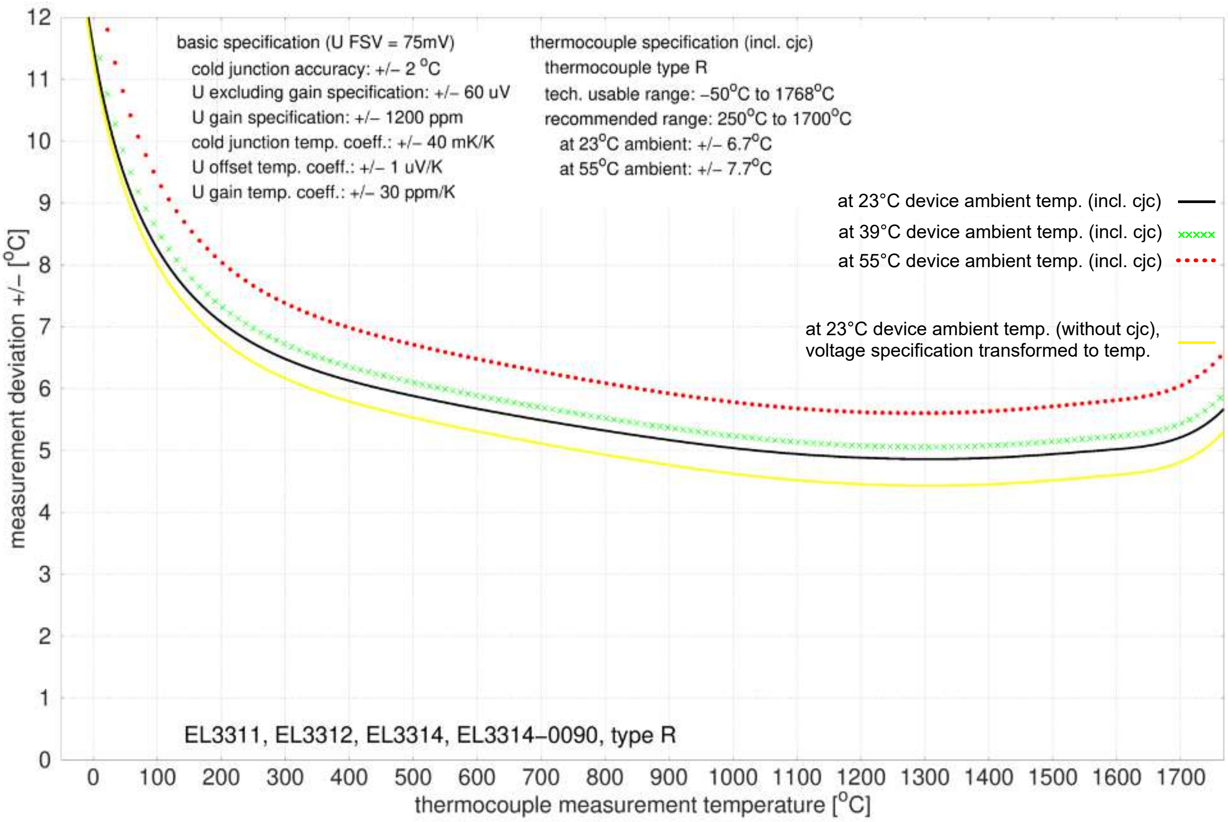
Measurement uncertainty for thermocouple type N:



3.2.2.8 Specification - thermocouple type R

Temperature measurement thermocouple		Type R
Electrical measuring range used		±75 mV
Measuring range, technically available		0°C ≈ 0 mV … +1767°C ≈ 21.089 mV
Measuring range, end value (full scale value)		+1767°C
Measuring range, recommended		+250°C … +1700°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type R: approx. 0.05°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±6.7 K ≈ ±0.38%$_{FSV}$
	@ 55°C ambient temperature	±7.7 K ≈ ±0.44%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

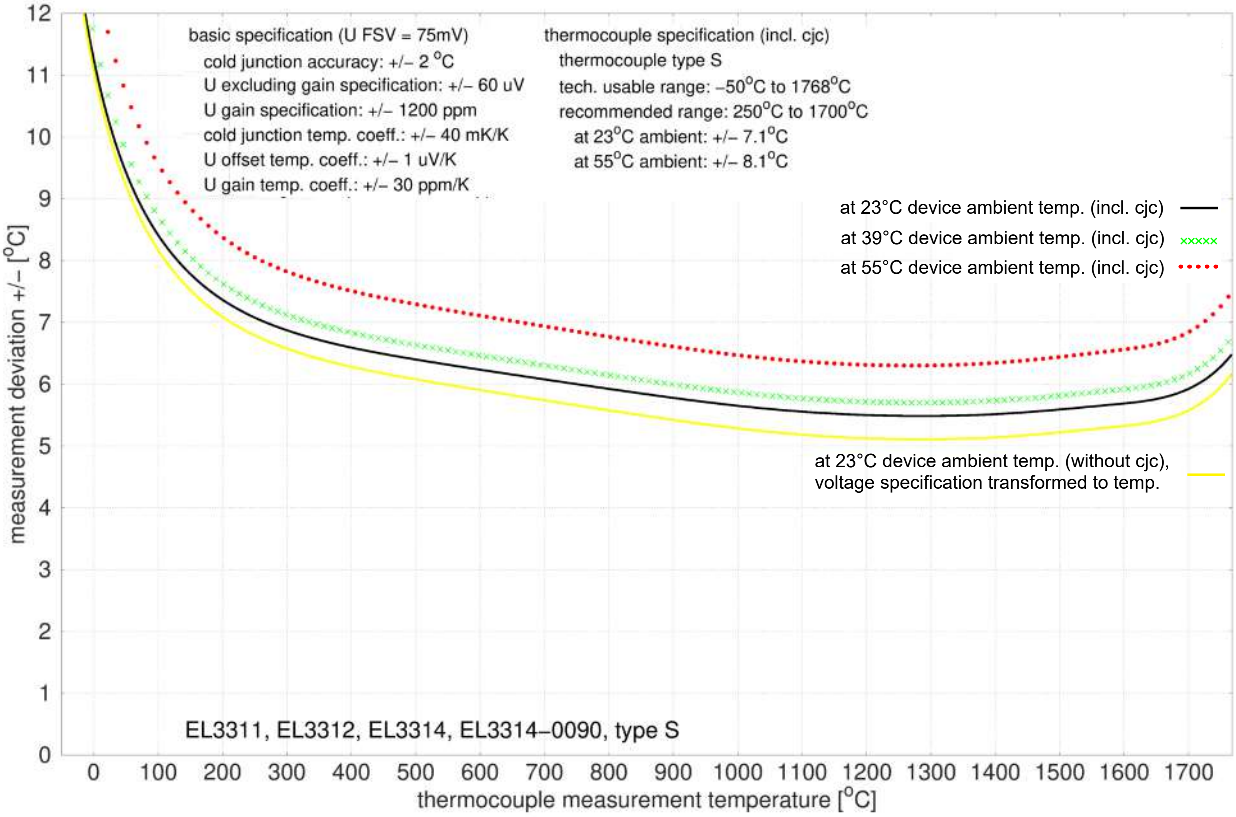
Measurement uncertainty for thermocouple type R:



3.2.2.9 Specification - thermocouple type S

Temperature measurement thermocouple		Type S
Electrical measuring range used		±75 mV
Measuring range, technically available		0°C ≈ 0 mV … +1760°C ≈ 17.947 mV
Measuring range, end value (full scale value)		+1760°C
Measuring range, recommended		+250°C … +1700°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type S: approx. 0.05°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±7.1 K ≈ ±0.40%$_{FSV}$
	@ 55°C ambient temperature	±8.1 K ≈ ±0.46%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

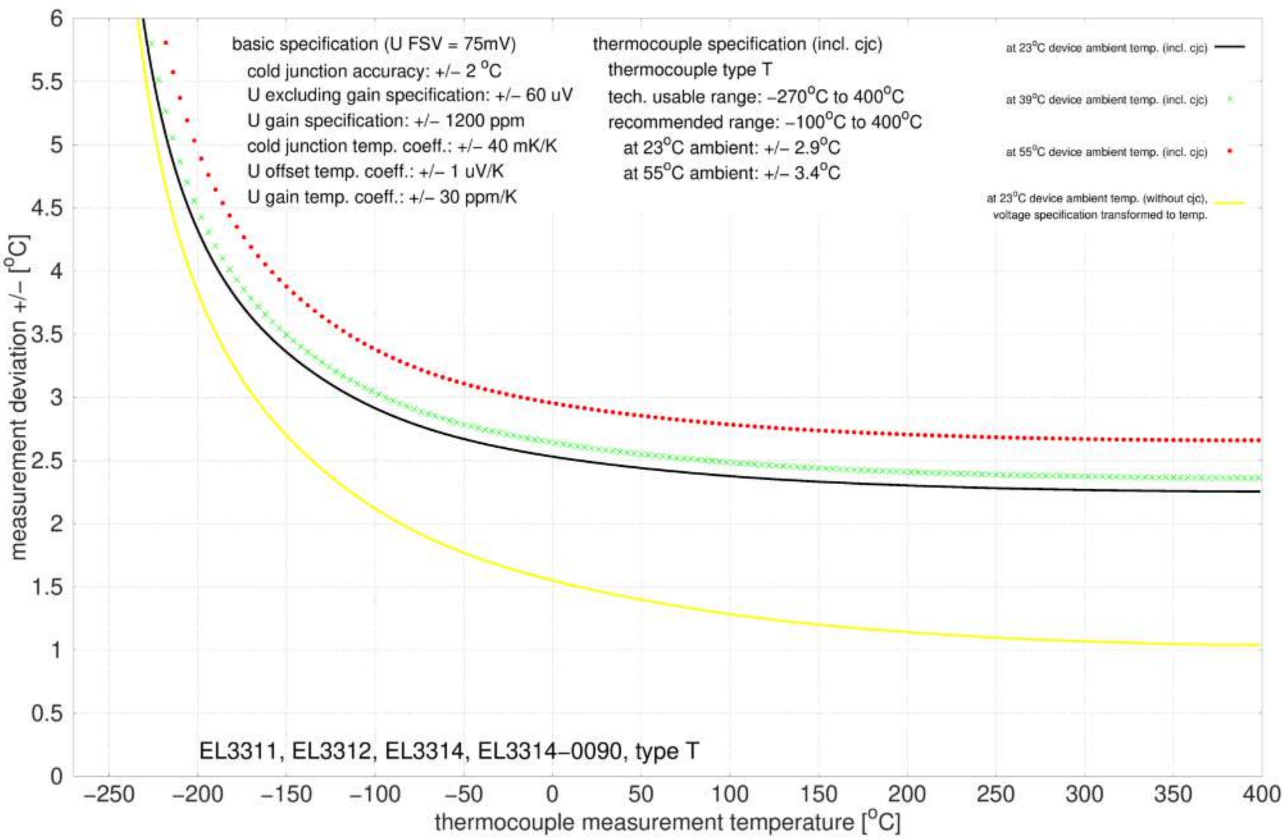
Measurement uncertainty for thermocouple type S:



3.2.2.10 Specification - thermocouple type T

Temperature measurement thermocouple		Type T
Electrical measuring range used		±75 mV
Measuring range, technically available		-200°C ≈ -5.603 mV … +400°C ≈ 20.872 mV
Measuring range, end value (full scale value)		+400°C
Measuring range, recommended		-100°C … +400°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±2.9 K ≈ ±0.73%$_{FSV}$
	@ 55°C ambient temperature	±3.4 K ≈ ±0.85%$_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

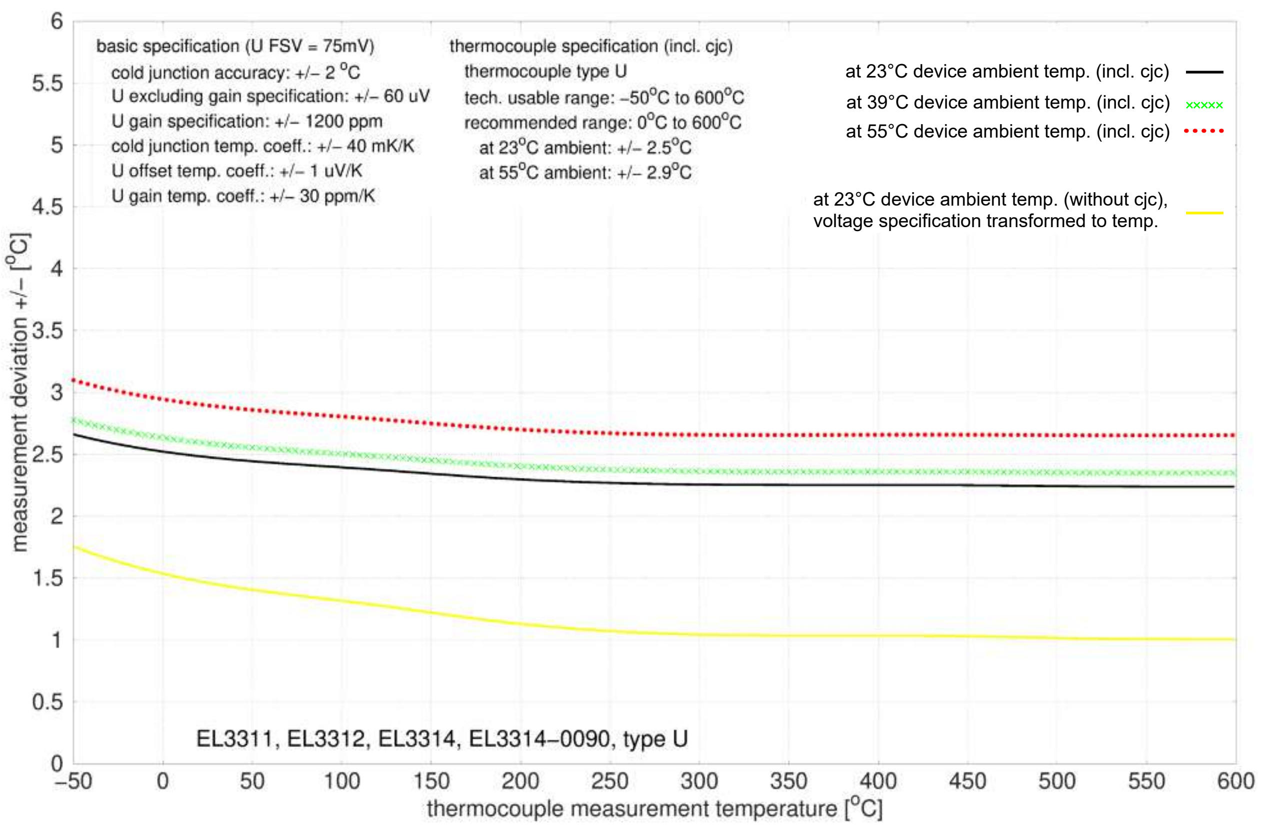
Measurement uncertainty for thermocouple type T:



3.2.2.11 Specification - thermocouple type U

Temperature measurement thermocouple		Type U
Electrical measuring range used		±75 mV
Measuring range, technically available		0°C ≈ 0 mV … +600°C ≈ 33.600 mV
Measuring range, end value (full scale value)		+600°C
Measuring range, recommended		0°C … +600°C
PDO LSB		0.1/0.01°C/digit, depending on PDO setting *Notice* **Internally, the full scale value is calculated with 16 bits, so depending on the thermocouple set, there may be value jumps >0.01°C at "Resolution 0.01°C"; type U: approx. 0.02°C.**
Uncertainty in the recommended measuring range, with averaging	@ 23°C ambient temperature	±2.5 K ≈ $\pm 0.42\%_{FSV}$
	@ 55°C ambient temperature	±2.9 K ≈ $\pm 0.48\%_{FSV}$
Temperature coefficient (change in the measured value when the ambient temperature of the terminals changes)		*Since the value is highly dependent on the sensor temperature, as can be seen in the specification plot shown below, it must basically be derived from the specification plot. For better approximation, the measurement uncertainty at T_{amb}= 39°C as the middle point between 23°C and 55°C is also shown informatively in order to illustrate the non-linear curve.*

Measurement uncertainty for thermocouple type U:



3.3 Connection

EJ3314-0090				
Pin#		Signal		
1	2	U_{EBUS}	U_{EBUS}	**E-Bus contacts** The power supply U_{EBUS} is provided by the coupler and supplied from the supply voltage U_S of the EtherCAT coupler.
3	4	GND	GND	
5	6	RX0+	TX1+	
7	8	RX0-	TX1-	
9	10	GND	GND	
11	12	TX0+	RX1+	
13	14	TX0-	RX1-	
15	16	GND	GND	
17	18	TC1-	TC1+	**Signals**
19	20	TC2-	TC2+	
21	22	TC3-	TC3+	
23	24	TC4-	TC4+	
25	26	NC	NC	
27	28	NC	NC	
29	30	R1- PT1000	R1+ PT1000	
31	32	R2- PT1000	R2+ PT1000	
33	34	NC	NC	**U_P-Contacts** The device has no U_P-contacts. The power is supplied exclusively via U_{EBUS}.
35	36	NC	NC	
37	38	NC	NC	
39	40	SGND	SGND	

Signal	Description
U_{EBUS}	E-Bus power supply 3.3 V
GND	E-Bus GND signal. Don`t connect with 0V Up!
RXn+	Positive E-Bus receive signal
RXn-	Negative E-Bus receive signal
TXn+	Positive E-Bus transmit signal
TXn-	Negative E-Bus transmit signal
TC1-...TC4-	Inputs TC1-...TC4-
TC1+...TC4+	Inputs TC1+...TC4+
NC	Do not connect
R1- PT1000	Input R1-
R2- PT1000	Input R2-
R1+ PT1000	Input R1+
R2+ PT1000	Input R2+
NC	Do not connect
SGND	Shield Ground

Fig. 8: EJ3314-0090 – connection

The PCB footprint can be downloaded from the Beckhoff homepage.

NOTICE

Damage may result!

- The pins labeled "NC" must not be contacted.
- Before installation and commissioning, please also read the chapters Installation of EJ modules [▶ 38] and Commissioning [▶ 53]!

Earthed thermocouples

Observe for earthed thermocouples: Differential inputs max. ±2 V to ground!

3.4 LEDs

LED No.	EJ3314-0090
A	RUN
B	
C	
1	ERR 1
2	ERR 2
3	ERR 3
4	ERR 4
5	ERR 5
6	ERR 6
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Fig. 9: E3314-0090 - LEDs

LED	Color	Display	State	Description
RUN	green	off	Init	State of the EtherCAT State Machine: **INIT** = initialization of the plug-in module
		flashing	Pre-Operational	State of the EtherCAT State Machine: **PREOP** = function for mailbox communication and different default settings set
		single flash	Safe-Operational	State of the EtherCAT State Machine: **SAFEOP** = verification of the Sync Manager channels and the distributed clocks. Outputs remain in safe state
		on	Operational	State of the EtherCAT State Machine: **OP** = normal operating state; mailbox and process data communication is possible
		flickering	Bootstrap	State of the EtherCAT State Machine: **BOOTSTRAP** = function for Firmware updates of the plug-in module
ERR 1 … ERR 4	red	off	-	No error
		on	-	Error TC 1 … 4
ERR 5	red	off	-	No error
		on	-	Error 5 CJC PT1000
ERR 6	red	off	-	No error
		on	-	Error 6 CJC PT1000

3.5 Notes for installation and commissioning

The accuracy of the TC temperature measurement is directly influenced by the cold junction measurement. Please note the following design guidelines!

- Use high-quality PT1000 thermocouples with low tolerance and position them very close to the TC connection on the "backplane" (or other position where the cold junction is located).
- Parasitic resistances in the RTD circuit, such as poor connections or long cables, should be avoided; approx. +3 Ω → +1°C applies.
- Covering the signal lines with SGND on both sides improves immunity to EMC interference.
- Avoid excessive external heating (e.g. near transformers) or cooling (e.g. air flow) of the PT1000 sensor, which lead to a significant temperature difference between the sensor and the connector of the TC elements.
- The cable can be adjusted using the indices

  ⇨ 0x8040:1B and 0x8050:1B "wire calibration 1/32 Ohm" (for 4-channel modules)

  ⇨ 0x8080:1B and 0x8090:1B "wire calibration 1/32 Ohm" (for 8-channel modules)

Notes on measuring the cold junction temperature

The measurement and calculation of the correct temperature with TC elements requires the additional measurement of the so-called cold junction temperature (CJC). The cold junction temperature is measured by two RTDs. These are positioned very close to the thermocouple connection on the "backplane" (setting the TC material copper).

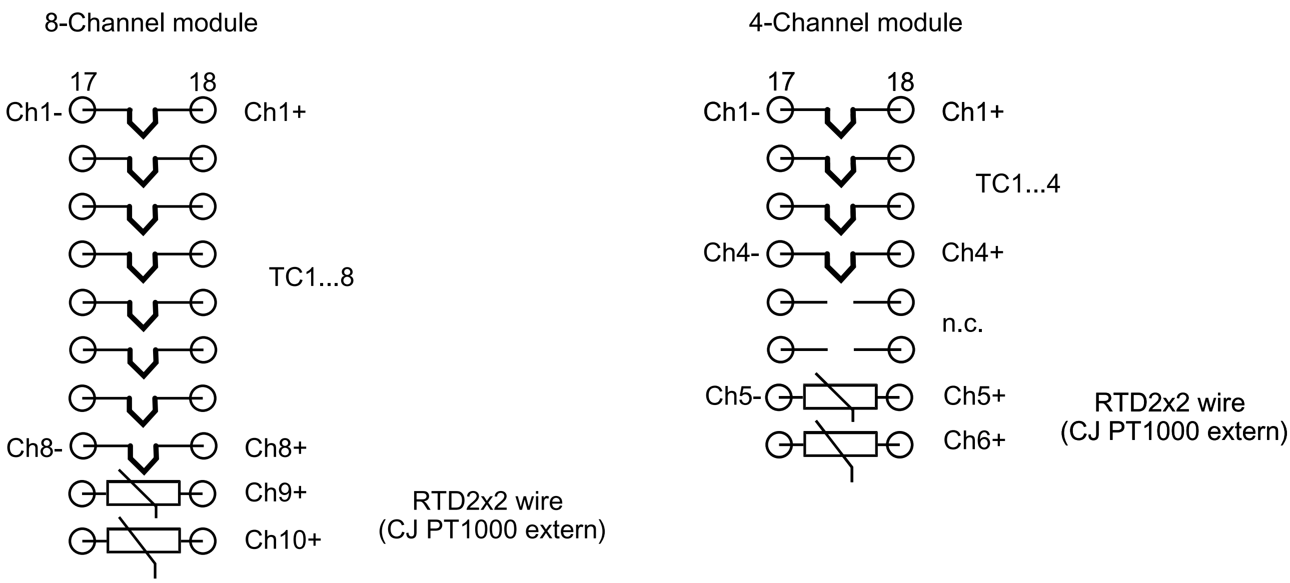


Fig. 10: TC/ RTD connections on the "backplane"

Examples:

1. An isothermal block → all TC connections on the "backplane" are located close together in one place and therefore have the same temperature:
   - one RTD is sufficient; any other TC can be referenced to RTD1.

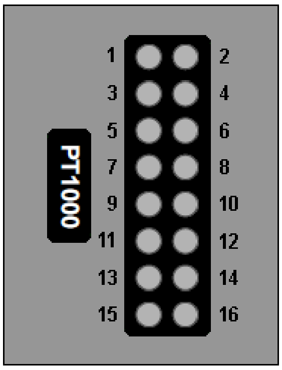


Fig. 11: An isothermal block

2. Two isothermal blocks with different temperatures and each with its own RTD:
   - the number of TCs on one and the other block can be freely selected, e.g. for EJ3318 TCs 1-3-4-7-8 close to RTD1 and TCs 2-5-6 close to RTD2.
3. If there is a temperature gradient across the connected connections of the TCs,
   - an average temperature can be calculated by the PLC and provided in the process data. In this case, the TC channels should be referenced as follows
     - for the 4-channel module, TC channels 1..2 on CJ1 and TC channels 3..4 on CJ2
     - for the 8-channel module 1..4 on CJ1 and the TC channels 5..8 on CJ2

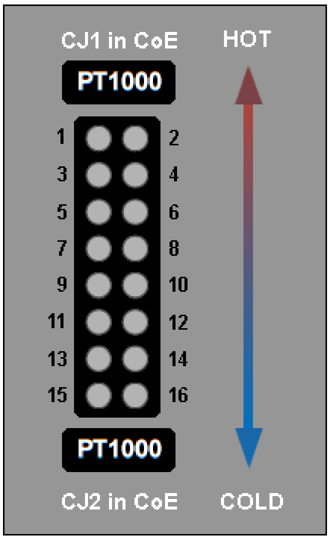


Fig. 12: Temperature gradient across the connected connections of the TCs

4. If necessary, the TC channels can be routed to two different TC connectors. Follow the rules mentioned above!

Fig. 13: Routing of the TCs to two different TC connectors using the example of EJ3318

Setting the cold junction compensation

intern RTD Ch1 is set for each channel, the assignment can be selected separately for each channel in index 0x80n0:0C (n=0: channel 1 ... n=7: channel 8, depending on the number of channels).

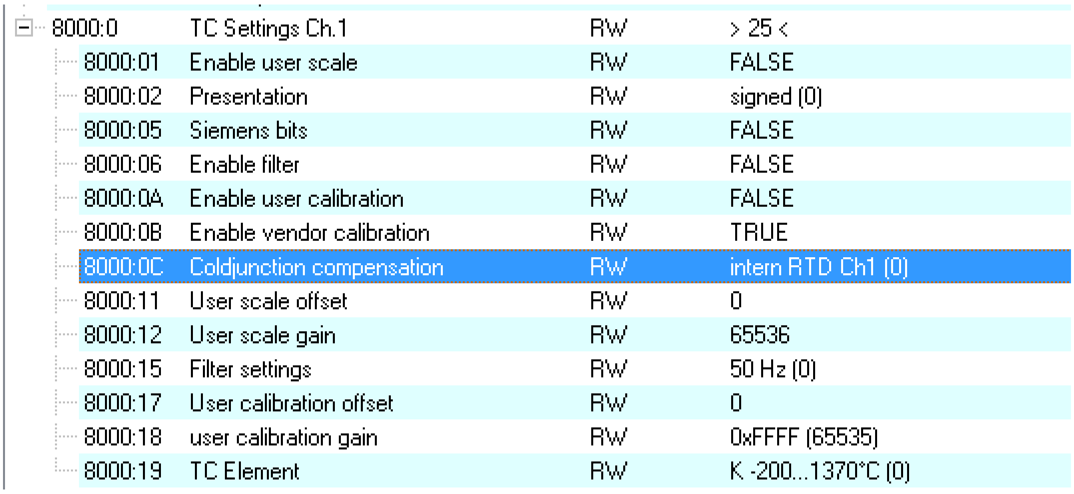


Fig. 14: TC Settings using the example of channel 1, index 0x8000:0C

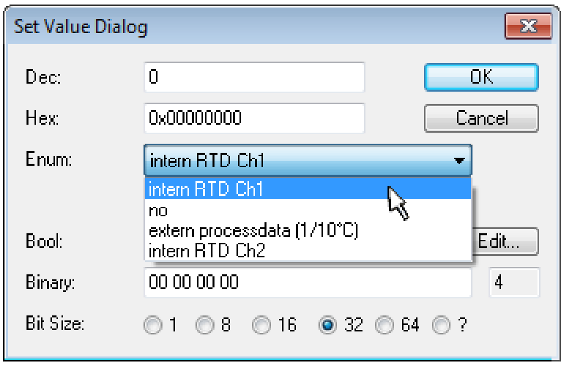


Fig. 15: CJC selection dialog

Name	Value	Description
intern RTD Ch1	0_{dec}	Cold junction compensation is carried out via *intern RTD Ch.1* of the module (default).
no	1_{dec}	Cold junction compensation is not active.
extern procecssdata (1/10°C)	2_{dec}	Cold junction compensation is carried out via the process data 0x160n (n=0: channel 1 ... n=7: channel 8, depending on the number of channels). These must then be mapped via the PDO assignment.
intern RTD Ch2	3_{dec}	Cold junction compensation is carried out via *intern RTD Ch.2* of the module.

Other settings:

1. Filter: the index 0x8000:15 applies to all channels, pre-set 50 Hz
2. Index 0x80n0:19 - Setting the TC element separately for each channel

4 Installation of EJ modules

4.1 Power supply for the EtherCAT plug-in modules

⚠ 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.

The signal distribution board should have a power supply designed for the maximum possible current load of the module string. Information on the current required from the E-bus supply can be found for each module in the respective documentation in section “Technical data”, online and in the catalog. The power requirement of the module string is displayed in the TwinCAT System Manager.

E-bus power supply with EJ1100 or EJ1101-0022 and EJ940x

The EJ1100 Bus Coupler supplies the connected EJ modules with the E-bus system voltage of 3.3 V. The Coupler can accommodate a load up to 2.2 A. If a higher current is required, a combination of the coupler EJ1101-0022 and the power supply units EJ9400 (2.5 A) or EJ9404 (12 A) should be used. The EJ940x power supply units can be used as additional supply modules in the module string.

Depending on the application, the following combinations for the E-bus supply are available:

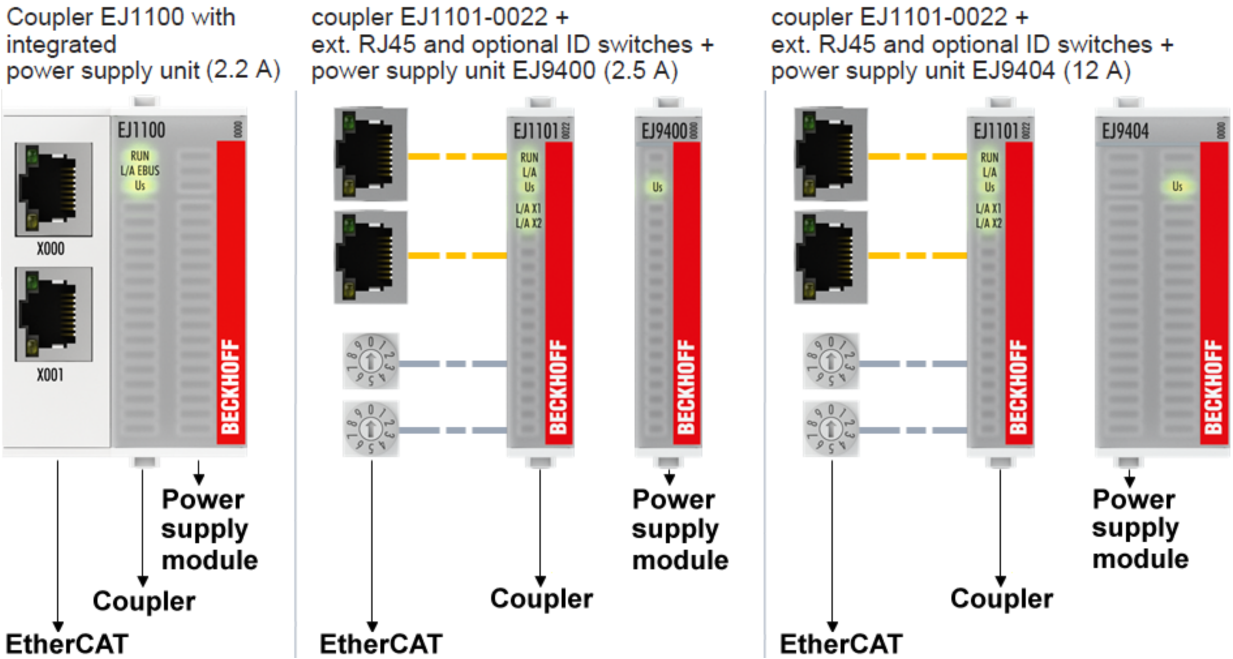


Fig. 16: E-bus power supply with EJ1100 or EJ1101-0022 + EJ940x

In the EJ1101-0022 coupler, the RJ45 connectors and optional ID switches are external and can be positioned anywhere on the signal distribution board, as required. This facilitates feeding through a housing.

The EJ940x power supply plug-in modules provide an optional reset function (see chapter Connection of the documentation for EJ9400 and EJ9404)

E-bus power supply with CXxxxx and EK1110-004x

The Embedded PC supplies the attached EtherCAT Terminals and the EtherCAT EJ coupler

- with a supply voltage Us of 24 V_{DC} (-15 %/+20 %). This voltage supplies the E-bus and the bus terminal electronics.
  The CXxxxx units supply the E-bus with up to 2,000 mA E-bus current. If a higher current is required due to the attached terminals, power feed terminals or power supply plug-in modules must be used for the E-bus supply.
- with a peripheral voltage Up of 24 V_{DC} to supply the field electronics.

The EK1110-004x EtherCAT EJ couplers relay the following parameters to the signal distribution board via the rear connector:

- the E-bus signals,
- the E-bus voltage U_{EBUS} (3.3 V) and
- the peripheral voltage U_P (24 V_{DC}).

Fig. 17: PCB with Embedded PC, EK1110-0043 and EJxxxx, rear view EK1110-0043

4.2 Note on load voltage supply

⚠ WARNING

Load voltage supply

Some devices permit an additional load voltage, e.g. 48 V DC, to be connected for the operation of a motor. In order to avoid stray currents on the protective conductor during operation, EN 60204-1:2018 provides for the possibility that the negative pole of the load voltage does not necessarily have to be connected to the protective conductor system (SELV).
Therefore, the load voltage supply should be designed as an SELV supply.

4.3 EJxxxx - dimensions

The EJ modules are compact and lightweight thanks to their design. Their volume is approx. 50% smaller than the volume of the EL terminals. A distinction is made between four different module types, depending on the width and the height:

Module type	Dimensions (W x H x D)	Sample in figure below
Coupler	44 mm x 66 mm x 55 mm	EJ1100 (ej_44_2xrj45_coupler)
Single module	12 mm x 66 mm x 55 mm	EJ1809 (ej_12_16pin_code13)
Double module	24 mm x 66 mm x 55 mm	EJ7342 (ej_24_2x16pin_code18)
Single module (long)	12 mm x 152 mm x 55 mm	EJ1957 (ej_12_2x16pin_extended_code4747)

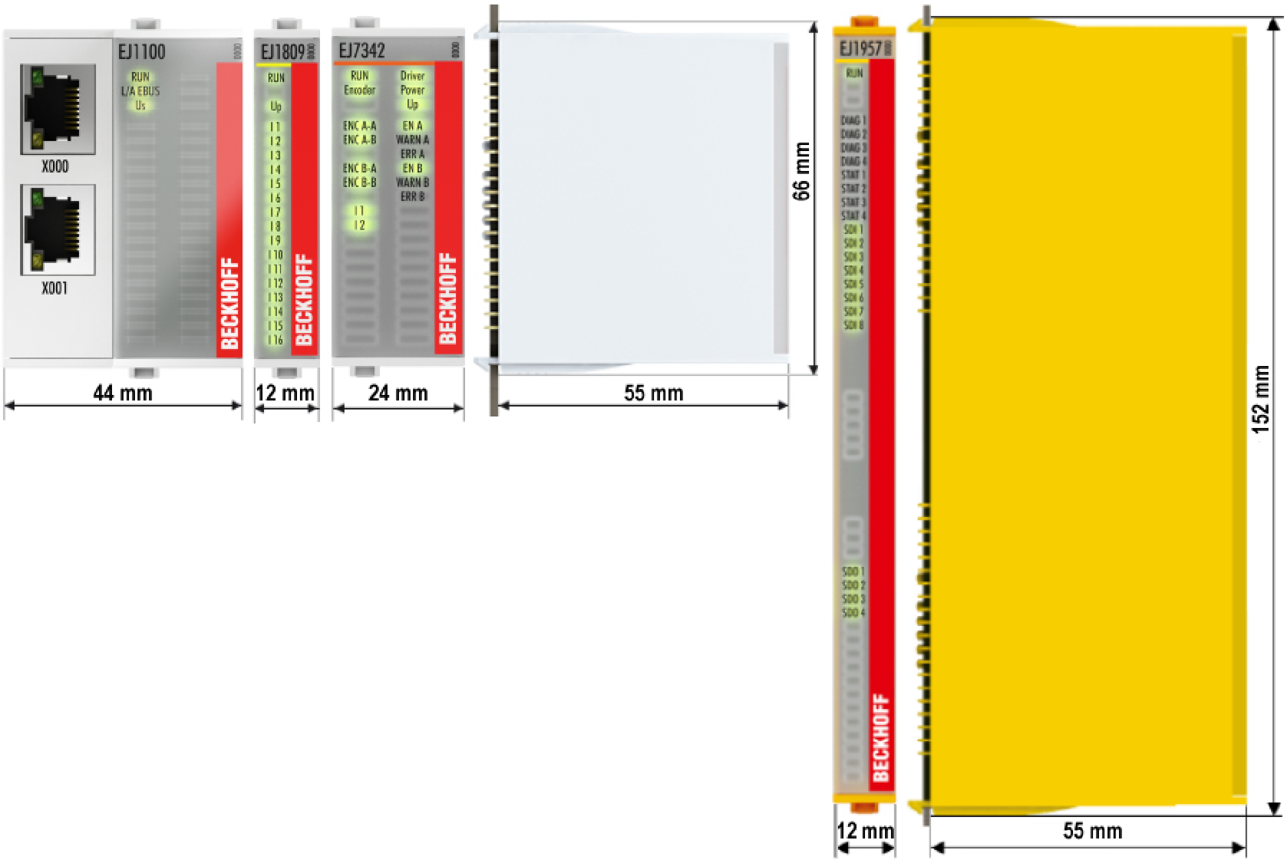


Fig. 18: EJxxxx - Dimensions

The technical drawings can be downloaded from the Beckhoff homepage. The drawings are named as described in the drawing below.

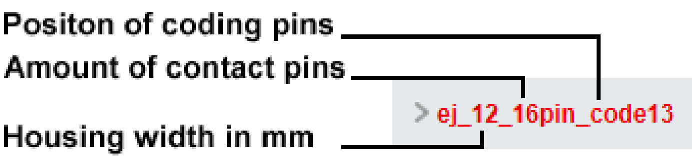


Fig. 19: Naming of the technical drawings

4.4 Installation positions and minimum distances

4.4.1 Minimum distances for ensuring installability

Note the dimensions shown in the following diagram for the design of the signal distribution board to ensure safe latching and simple assembly / disassembly of the modules.

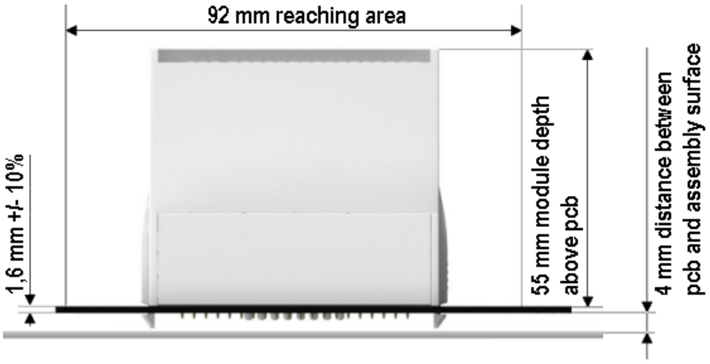


Fig. 20: Mounting distances EJ module - PCB

Observing the reaching area

A minimum reaching area of 92 mm is required for assembly / disassembly, in order to be able to reach the mounting tabs with the fingers.
Adherence to the recommended minimum distances for ventilation (see section Installation position [▶ 42]) ensures an adequate reaching area.

The signal distribution board must have a thickness of 1.6 mm and a minimum distance of 4 mm from the mounting surface, in order to ensure latching of the modules on the board.

4.4.2 Installation positions

NOTICE

Constraints regarding installation position and operating temperature range

Please refer to the technical data [▸ 18] for the installed components to ascertain whether any restrictions regarding the mounting position and/or the operating temperature range have been specified. During installation of modules with increased thermal dissipation, ensure adequate distance above and below the modules to other components in order to ensure adequate ventilation of the modules during operation!

The standard installation position is recommended. If a different installation position is used, check whether additional ventilation measures are required.

Ensure that the specified conditions (see Technical data) are adhered to!

Optimum installation position (standard)

For the optimum installation position the signal distribution board is installed horizontally, and the fronts of the EJ modules face forward (see Fig. *Recommended distances for standard installation position*). The modules are ventilated from below, which enables optimum cooling of the electronics through convection. “From below” is relative to the acceleration of gravity.

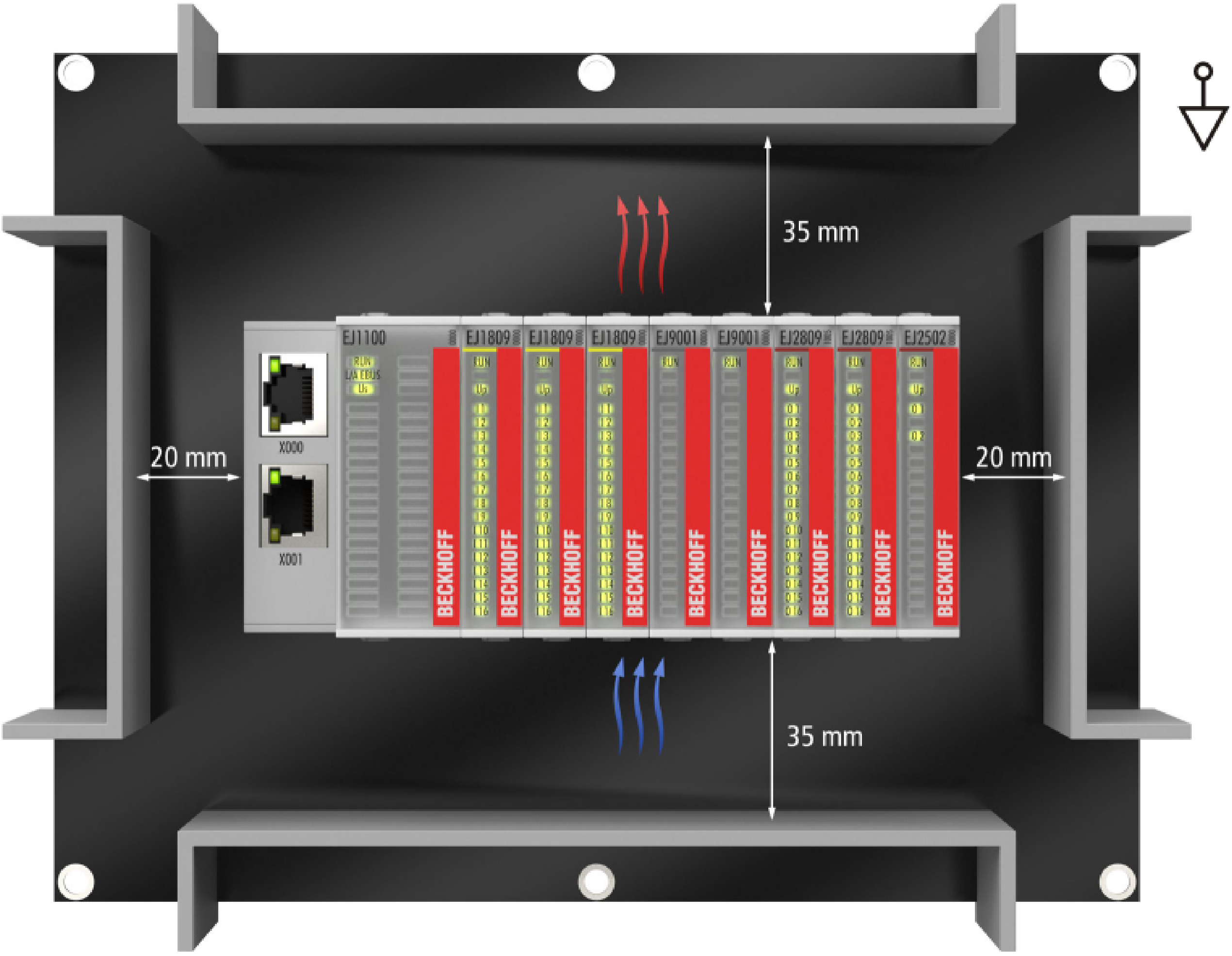


Fig. 21: Recommended distances for standard installation position

Compliance with the distances shown in Fig. *Recommended distances for standard installation position* is recommend. The recommended minimum distances should not be regarded as restricted areas for other components. The customer is responsible for verifying compliance with the environmental conditions described in the technical data. Additional cooling measures must be provided, if required.

Other installation positions

All other installation positions are characterized by a different spatial position of the signal distribution board, see Fig. *Other installation positions.*

The minimum distances to ambient specified above also apply to these installation positions.

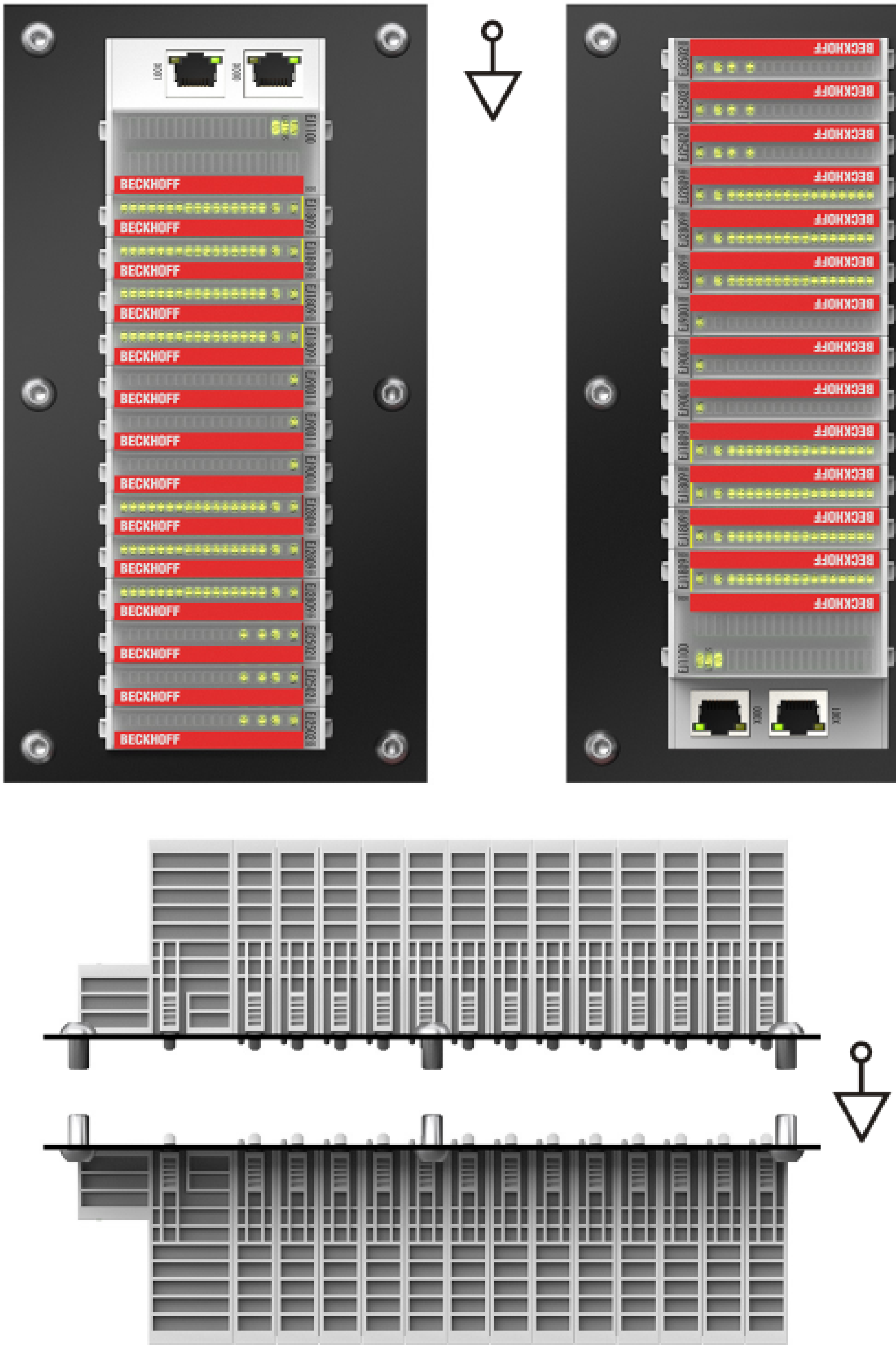


Fig. 22: Other installation positions

4.5 Codings

4.5.1 Color coding

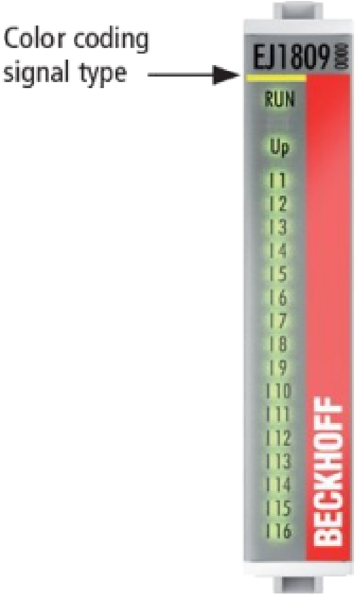


Fig. 23: EJ modules color code; sample: EJ1809

The EJ modules are color-coded for a better overview in the control cabinet (see diagram above). The color code indicates the signal type. The following table provides an overview of the signal types with corresponding color coding.

Signal type	Modules	Color
Coupler	EJ11xx	No color coding
Digital input	EJ1xxx	Yellow
Digital output	EJ2xxx	Red
Analog input	EJ3xxx	Green
Analog output	EJ4xxx	Blue
Position measurement	EJ5xxx	grey
Communication	EJ6xxx	grey
Motion	EJ7xxx	orange
System	EJ9xxx	grey

4.5.2 Mechanical position coding

The modules have two signal-specific coding pins on the underside (see Figs. B1 and B2 below). In conjunction with the coding holes in the signal distribution board (see Figs. A1 and A2 below), the coding pins provide an option for mechanical protection against incorrect connection. This significantly reduces the risk of error during installation and service.
Couplers and placeholder modules have no coding pins.

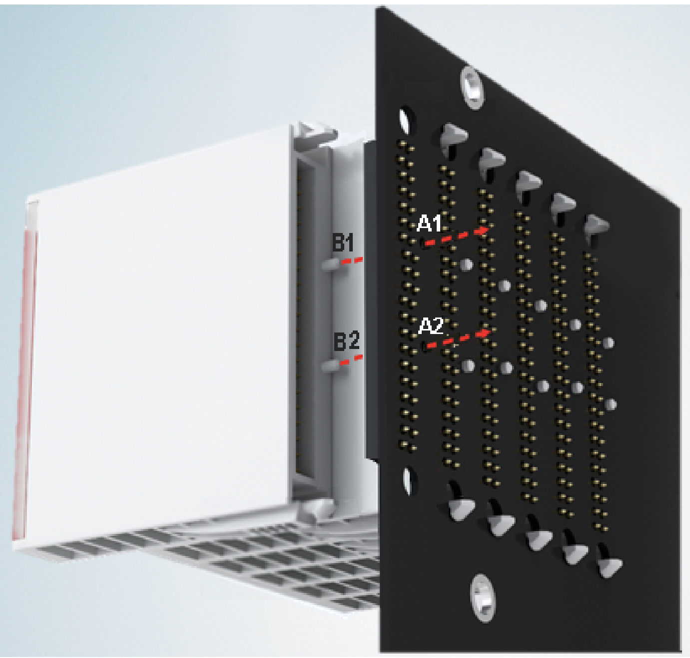


Fig. 24: Mechanical position coding with coding pins (B1 and B2) and coding holes (A1 and A2)

The following diagram shows the position of the position coding with position numbers on the left-hand side. Modules with the same signal type have the same coding. For sample, all digital input modules have the coding pins at positions one and three. There is no plug protection between modules with the same signal type. During installation the module type should therefore be verified based on the device name.

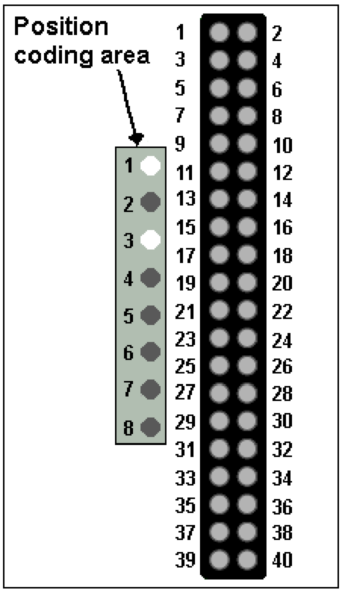


Fig. 25: Pin coding; sample: digital input modules

4.6 Installation on the signal distribution board

EJ modules are installed on the signal distribution board. The electrical connections between coupler and EJ modules are realized via the pin contacts and the signal distribution board.

The EJ components must be installed in a control cabinet or enclosure which must provide protection against fire hazards, environmental conditions and mechanical impact.

⚠ WARNING

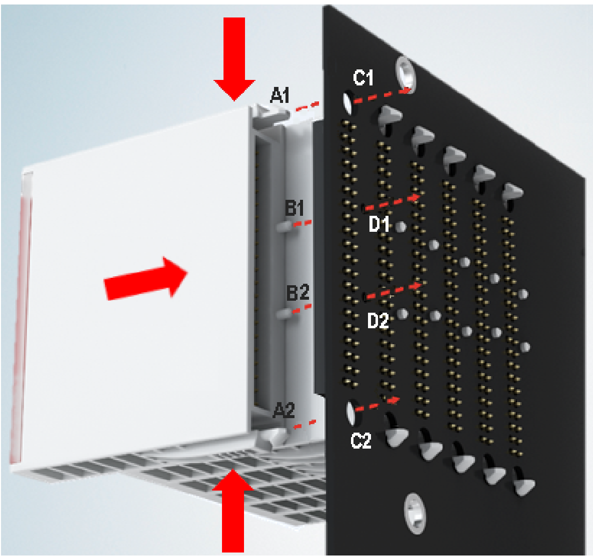
Risk of injury through electric shock and damage to the device!

Bring the module system into a safe, de-energized state before starting installation, disassembly or wiring of the modules.

NOTICE

Risk of damage to components through electrostatic discharge!

Observe the regulations for ESD protection.



A1 / A2: Latching lugs top / bottom
B1 / B2: Coding pins
C1 / C2: Mounting holes
D1 / D2: Coding holes

Installation of EJ modules

To install the modules on the signal distribution board proceed as follows:

1. Before the installation, ensure that the signal distribution board is securely connected to the mounting surface. Installation on an unsecured signal distribution board may result in damage to the board.
2. If necessary, check whether the positions of the coding pins (B) match the corresponding holes in the signal distribution board (D).
3. Compare the device name on the module with the information in the installation drawing.
4. Press the upper and the lower mounting tabs simultaneously and push the module onto the board while gently moving it up and down, until the module is latched securely.
   The required contact pressure can only be established and the maximum current carrying capacity ensured if the module is latched securely.
5. Use placeholder modules (EJ9001) to fill gaps in the module strand.

NOTICE

Ensure safe latching of the modules on the signal distribution board

- During installation ensure safe latching of the modules on the signal distribution board! The consequences of inadequate contact pressure include:

⇨ loss of quality of the transferred signals,

⇨ increased power dissipation of the contacts,

⇨ impairment of the service life.

4.7 Extension options

Three options are available for modifications and extensions of the EJ system.

- Replacing the placeholder modules with the function modules provided for the respective slot
- Assigning function modules specified for the respective slots for the reserve slots at the end of the module string
- Linking with EtherCAT Terminals and EtherCAT Box modules via an Ethernet/EtherCAT connection

4.7.1 Using placeholder modules for unused slots

The EJ9001 placeholder modules are used to close temporary gaps in the module strands (see Fig. A1 below). Gaps in the module strand cause interruption in EtherCAT communication and must be equipped with placeholder modules.
In contrast to the passive terminals of the EL series, the placeholder modules actively participate in the data exchange. Several placeholder modules can therefore be connected in series, without impairing the data exchange.
Unused slots at the end of the module strand can be left as reserve slots (see Fig. B1 below).

The machine complexity is extended (extended version) by allocating unused slots (see Figs. A2 below - Exchanging placeholder modules and B2 - Assigning reserve slots) according to the specifications for the signal distribution board.

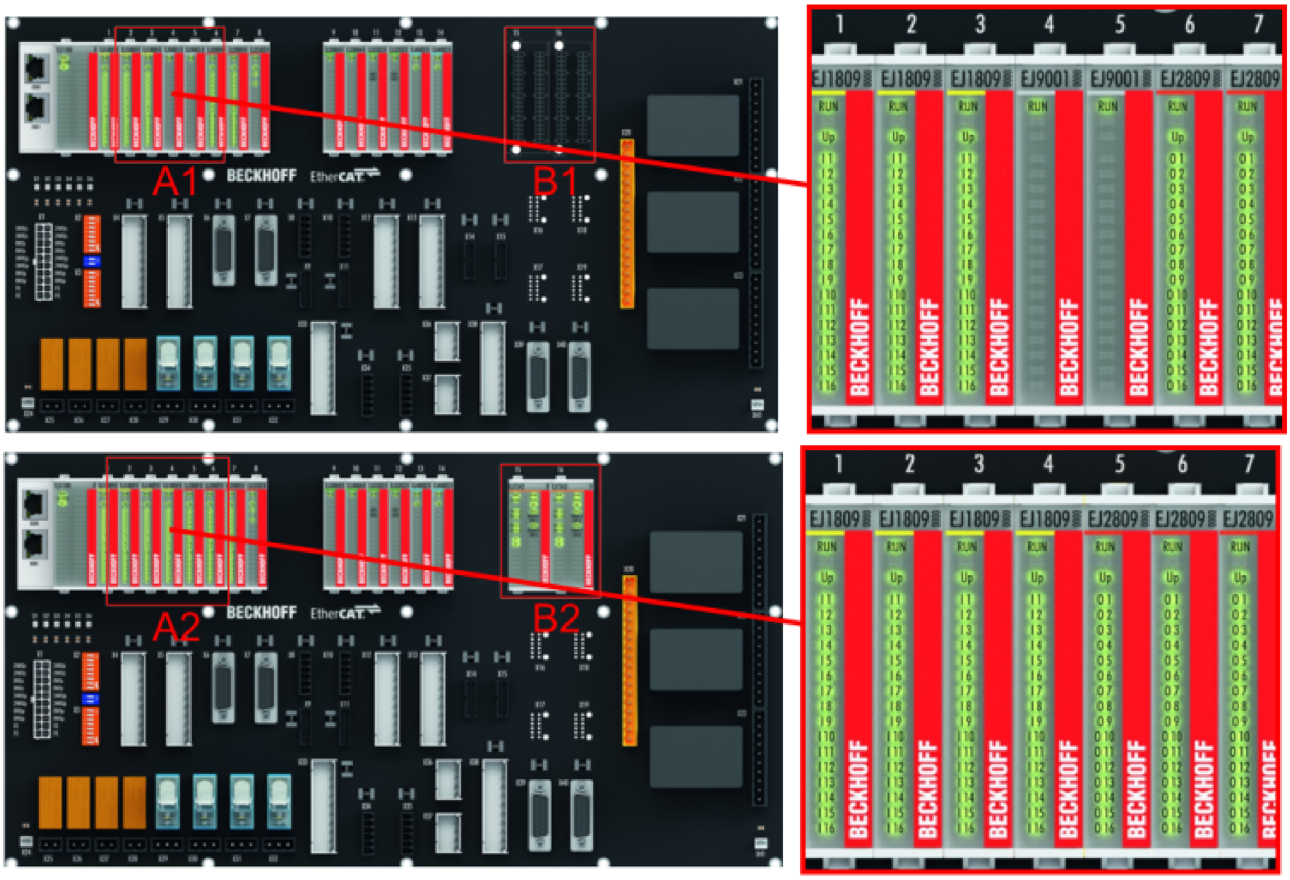


Fig. 26: Sample: Exchanging placeholder modules and assigning reserve slots

E-bus supply

Exchange the placeholder modules with other modules changes the current input from the E-Bus. Ensure that adequate power supply is provided.

4.7.2 Linking with EtherCAT Terminals and EtherCAT Box modules via an Ethernet/EtherCAT connection

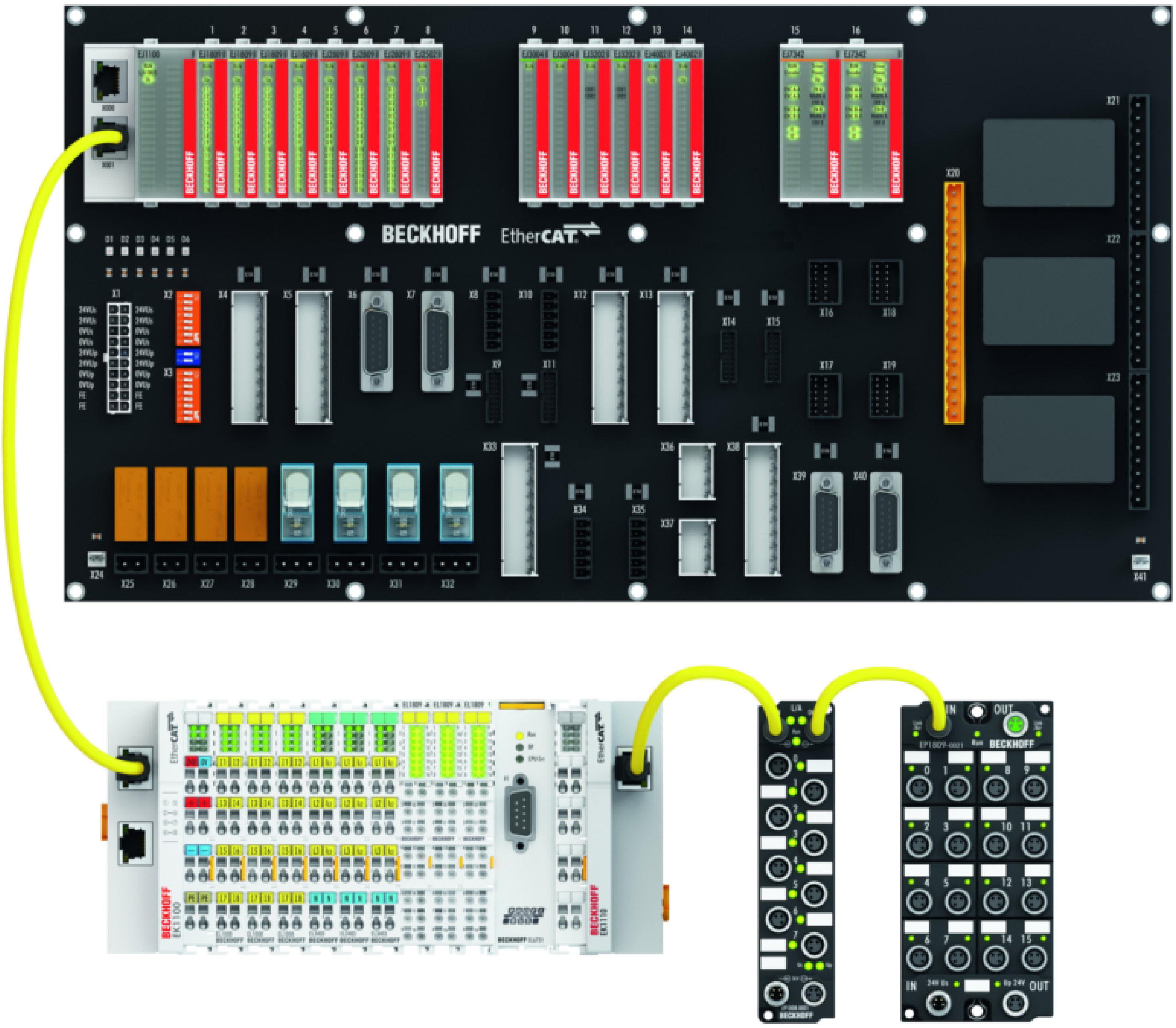


Fig. 27: Example of extension via an Ethernet/EtherCAT connection

4.8 IPC integration

Connection of CX and EL terminals via the EK1110-004x EtherCAT EJ coupler

The EK1110-0043 and EK1110-0044 EtherCAT EJ couplers connect the compact DIN-rail PCs of the CX series and attached EtherCAT Terminals (ELxxxx) with the EJ modules on the signal distribution board.

The EK1110-004x are supplied from the power supply unit of the Embedded PC.
The E-bus signals and the supply voltage of the field side U_P are routed directly to the PCB via a plug connector at the rear of the EtherCAT EJ couplers.

Due to the direct coupling of the Embedded PC and the EL terminals with the EJ modules on the PCB, no EtherCAT Extension (EK1110) or EtherCAT Coupler (EJ1100) is required.

The Embedded PC can be expanded with EtherCAT Terminals that are not yet available in the EJ system, for example.

Fig. 28: Example PCB with Embedded PC, EK1110-0043 and EJxxxx, rear view EK1110-0043

Connection of C6015 / C6017 via the EJ110x-00xx EtherCAT Coupler

Thanks to their ultra-compact design and versatile mounting options, the C6015 and C6017 IPCs are ideally suited for connection to an EJ system.

In combination with the ZS5000-0003 mounting set, it is possible to place the C6015 and C6017 IPCs compactly on the signal distribution board.
The EJ system is optimally connected to the IPC via the corresponding EtherCAT Cable (see following Fig. [A]).
The IPC can be supplied directly via the signal distribution board using the enclosed power plug (see Fig. [B] below).

NOTICE
Positioning on the signal distribution board The dimensions and distances for placement and other details can be found in the Design Guide and the documentation for the individual components.

The figure below shows the connection of a C6015 IPC to an EJ system as an example. The components shown are schematic, to illustrate the functionality.

Fig. 29: Example for the connection of a C6015 IPC to an EJ system

4.9 Disassembly of the signal distribution board

⚠ WARNING

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

Bring the module system into a safe, de-energized state before starting installation, disassembly or wiring of the modules.

Each module is secured through latching on the distribution board, which has to be released for disassembly.

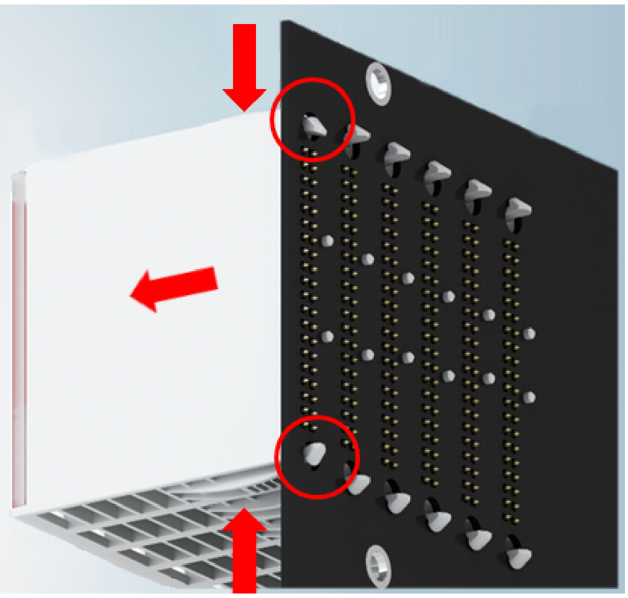


Fig. 30: Disassembly of EJ modules

To disassemble the module from the signal distribution board proceed as follows:

1. Before disassembly, ensure that the signal distribution board is securely connected to the mounting surface. Disassembly of an unsecured signal distribution board may result in damage to the board.
2. Press the upper and lower mounting tabs simultaneously and pull the module from board while gently moving it up and down.

4.10 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 EtherCAT basics

Please refer to the EtherCAT System Documentation for the EtherCAT fieldbus basics.

6 Commissioning

6.1 TwinSAFE SC

6.1.1 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.

6.1.2 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.

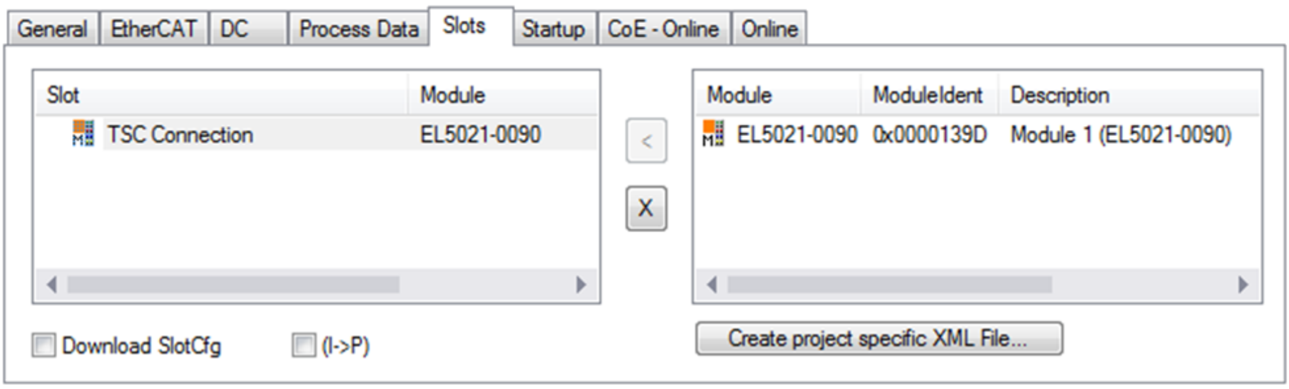


Fig. 31: Adding the TwinSAFE SC process data under the component, e.g. EL5021-0090

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

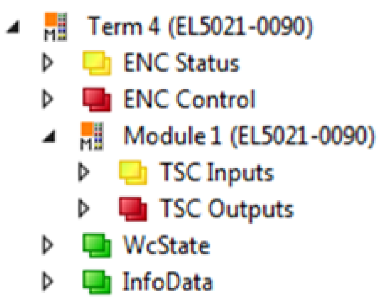


Fig. 32: TwinSAFE SC component process data, example EL5021-0090

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

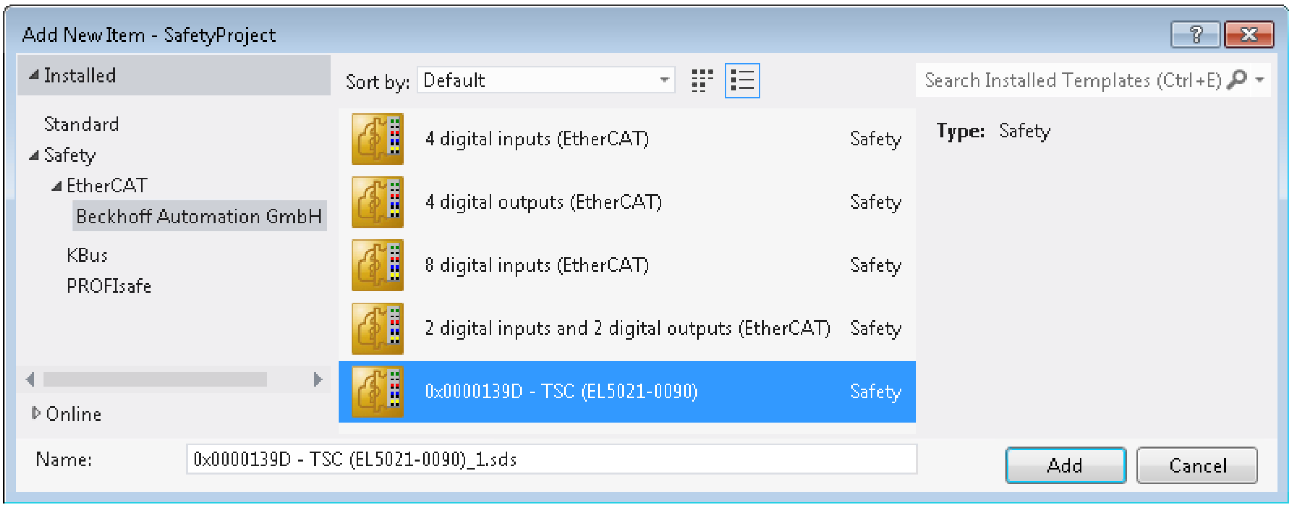


Fig. 33: Adding a TwinSAFE SC connection

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.

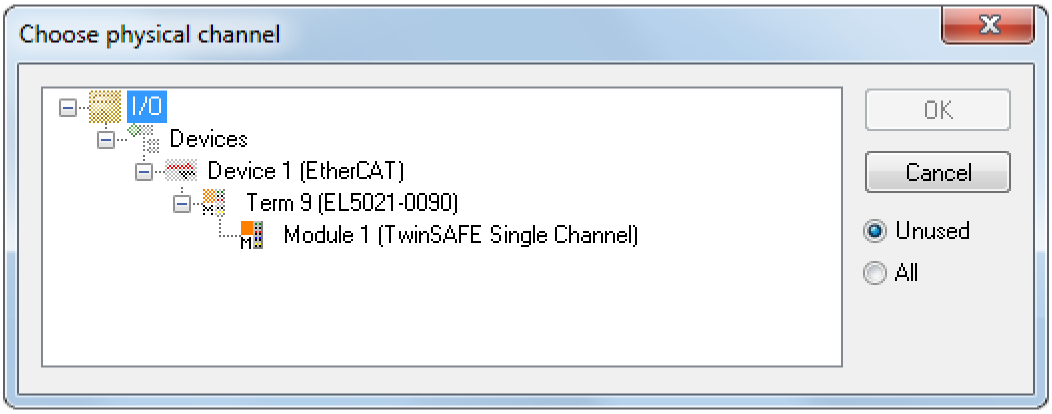


Fig. 34: Creating a link to TwinSAFE SC terminal

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

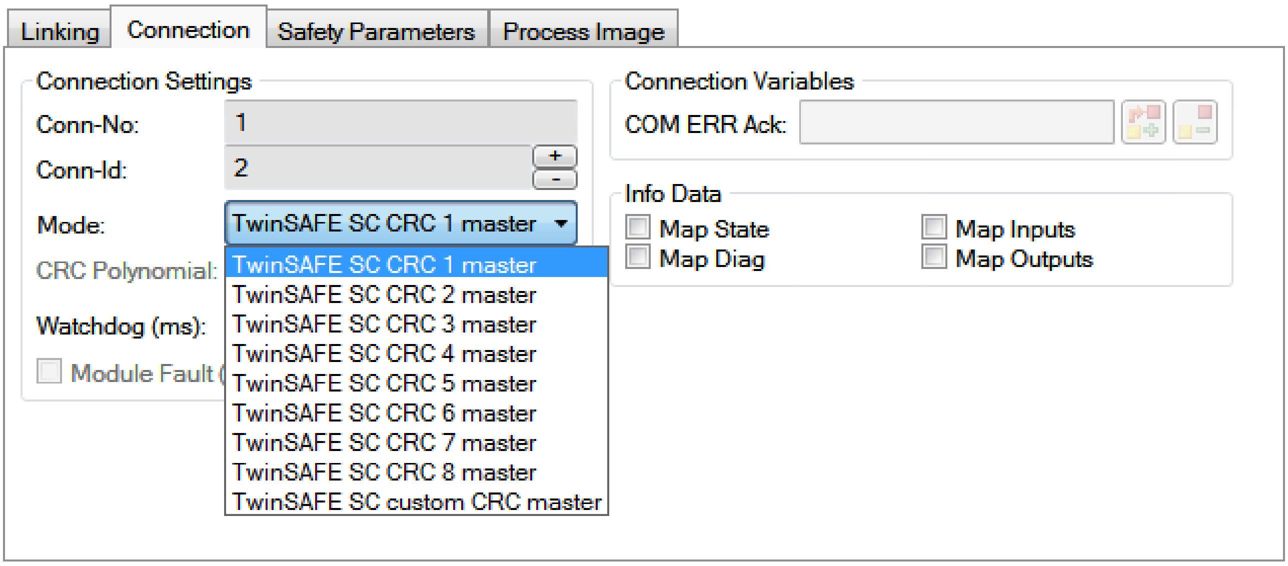


Fig. 35: Selecting a free CRC

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.

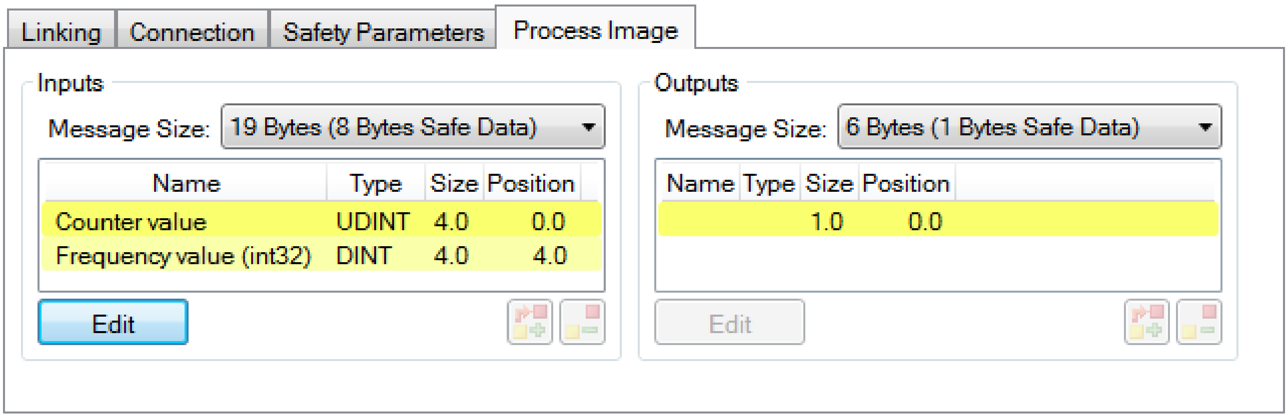


Fig. 36: Selecting the process data size and the process data

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)*.

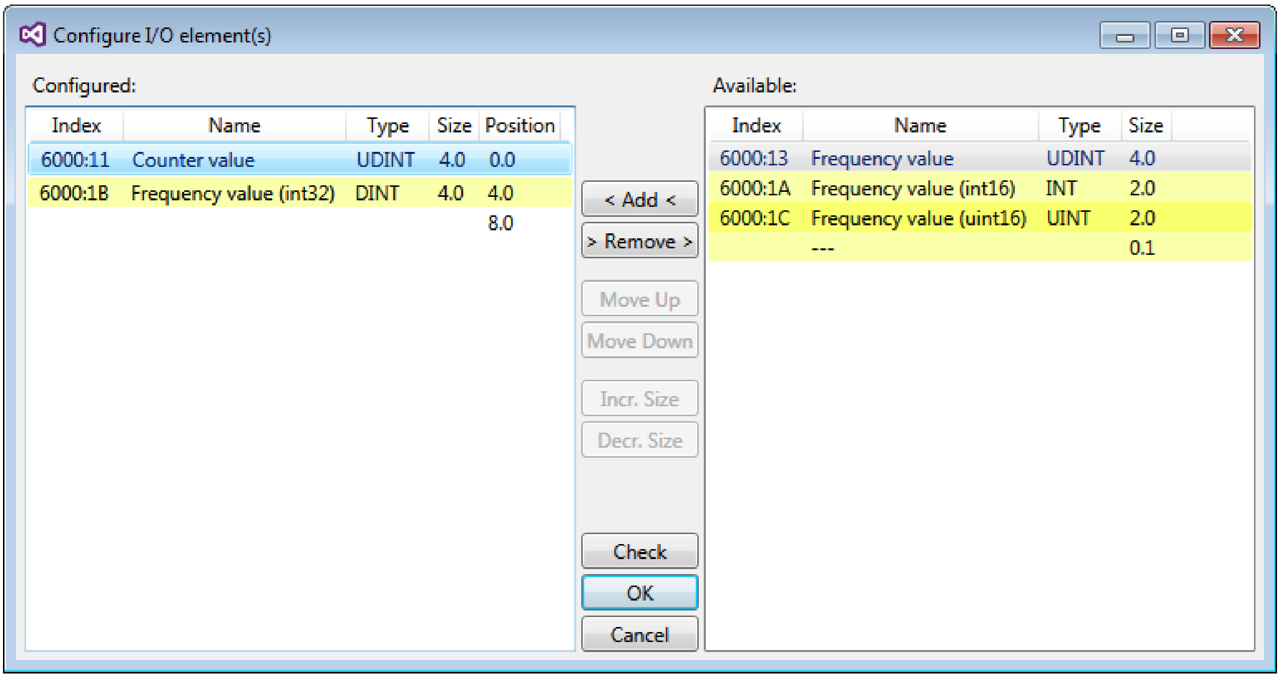


Fig. 37: Selection of the process data

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.

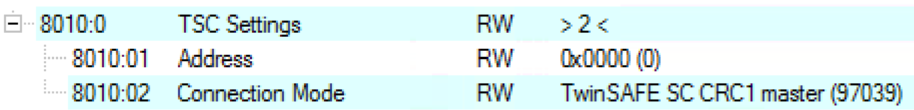


Fig. 38: CoE objects 0x8010:01 and 0x8010:02

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

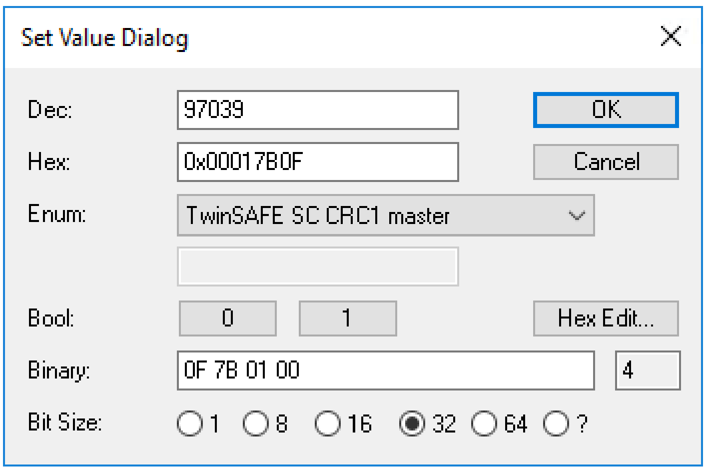


Fig. 39: Entering the safety address and the CRC

TwinSAFE SC connections

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

6.2 Note on documentation for the EL331x-00x0

Detailed documentation on the commissioning of the EJ3314-0090 module is being prepared.

NOTICE

Damage to devices or loss of data

The descriptions and notes on the commissioning of the EL3314-0090 EtherCAT Terminal are transferable to the EJ3314-0090 EtherCAT plug-in module.

Before commissioning, read the detailed description of the process data, operating modes and parameterization in the EL331x-00x0 documentation.

6.3 Object description and parameterization

EtherCAT XML Device Description

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

NOTICE

Parameterization via the CoE list (CAN over EtherCAT)

The EtherCAT device is parameterized via the CoE - Online tab (with a double click on the respective object) or via the Process Data tab (assignment of PDOs). A detailed description can be found in the EtherCAT System-Documentation in chapter “EtherCAT subscriber configuration”

Please note the general CoE notes in the EtherCAT System Documentation in chapter “CoE-interface” 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

Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization during commissioning:
  - Restore object [▸ 59] index 0x1011
  - Configuration data [▸ 59] index 0x80n0
- Profile-specific objects:
  - Configuration data [▸ 61] (manufacturer-specific) index 0x80nF
  - Input data [▸ 62] index 0x60n0
  - Output data [▸ 63] index 0x70n0
  - Information and diagnostic [▸ 63] data index 0x80nE, 0xF000, 0xF008, 0xF010
- Standard objects [▸ 64]

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

6.3.1 Restore object

Index 1011 Restore default parameters

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

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

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

6.3.3 Configuration data

Index 80n0 TC Settings (for Ch. 1 - 4 (0 ≤ n ≤ 3))

Index (hex)	Name	Meaning	Data type	Flags	Default
80n0:0	TC Settings Ch (n+1)	Maximum subindex	UINT8	RO	0x19 (25_{dec})
80n0:01	Enable user scale	User scaling is enabled.	BOOLEAN	RW	0x00 (0_{dec})
80n0:02	Presentation	0: Signed presentation, 0.1°C/digit 1: Absolute value with MSB as sign (signed amount representation), 0.1°C/digit 2: High resolution (0.01°C/digit)	BIT3	RW	0x00 (0_{dec})
80n0:05	Siemens bits	The S5 bits are displayed in the three low-order bits	BOOLEAN	RW	0x00 (0_{dec})
80n0:06	Enable filter	This setting generally activates the basic filters in object 0x80n0:15. These are technically implemented in the ADC and therefore cannot be switched off, even if this object is set to “disabled”.	BOOLEAN	RW	0x01 (1_{dec})
80n0:0A	Enable user calibration	Enable user calibration	BOOLEAN	RW	0x00 (0_{dec})
80n0:0B	Enable vendor calibration	Enable vendor calibration	BOOLEAN	RW	0x01 (1_{dec})
80n0:0C	Coldjunction compensation	0: intern RTD Ch1 1: no Cold junction compensation is not active 2: Extern process data Cold junction compensation takes place via the process data (resolution [1/10]°C) 3: intern RTD Ch2	BIT2	RW	0x00 (0_{dec})
80n0:11	User scale offset	User scale offset	INT16	RW	0x0000 (0_{dec})
8000:12	User scale gain	Gain of the user scaling. The gain has a fixed-point representation with a factor of 2^{-16}. The value 1 corresponds to 65536 (0x00010000)	INT32	RW	0x00010000 (65536_{dec})

Index (hex)	Name	Meaning		Data type	Flags	Default
80n0:15	Filter settings	This object determines the digital basic filter settings. The possible settings are numbered consecutively.		UINT16	RW	0x0000 (0_{dec})
		0: 50 Hz (default) 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			
80n0:17	User calibration offset	User calibration offset		INT16	RW	0x0000 (0_{dec})
80n0:18	User calibration gain	User calibration gain		UINT16	RW	0xFFFF (65535_{dec})
80n0:19	TC element	Thermocouple Implemented temperature range		UINT16	RW	0x0000 (0_{dec})
		0: Type: K -200°C to 1370°C 1: Type: J -100°C to 1200°C 2: Type: L 0°C to 900°C 3: Type: E -100°C to 1000°C 4: Type: T -200°C to 400°C 5: Type: N -100°C to 1300°C 6: Type: U 0°C to 600°C 7: Type: B 200…1820 8: Type: R -50…1767 9: Type: S -50…1760 10: Type: C 0°C to 2320°C 100: ±30 mV (1 µV resolution) 101: ±60 mV (2 µV resolution) 102: ±75 mV (4 µV resolution)				

Index 8040 RTD Settings Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
8040:0	RTD Settings Ch.1	Max. subindex	UINT8	RO	0x1B (27_{dec})
8040:19	RTD Element	Permitted values 2: PT1000 (-200 … 850°C) 8: Resistor 1/16 Ohm resolution (0…4095 Ohm)	UINT16	RW	0x0002 (2_{dec})
8040:1A	Connection technology	Permitted values 0: Two-wire connection 3: not connected	UINT16	RW	0x0000 (0_{dec})
8040:1B	Wire calibration 1/32 Ohm	Offset-value for calibration of supply lines [1/32] Ohm	UINT16	RW	0x0000 (0_{dec})

Index 8050 RTD Settings Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
8050:0	RTD Settings Ch.1	Max. subindex	UINT8	RO	0x1B (27_{dec})
8050:19	RTD Element	Permitted values 2: PT1000 (-200 … 850°C) 8: Resistor 1/16 Ohm resolution (0…4095 Ohm)	UINT16	RW	0x0002 (2_{dec})
8050:1A	Connection technology	Permitted values 0: Two-wire connection 3: not connected	UINT16	RW	0x0000 (0_{dec})
8050:1B	Wire calibration 1/32 Ohm	Calibration of supply lines	UINT16	RW	0x0000 (0_{dec})

Index 8060 TSC Settings

Index (hex)	Name	Meaning		Data type	Flags	Default
8060:0	TSC Settings	Max. subindex		UINT8	RO	0x02 (2_{dec})
8060:19	Address	TwinSAFE SC address		UINT16	RW	0x0001 (1_{dec})
8060:1A	Connection Mode	Selection of TwinSAFE SC CRC Permitted values		UINT32	RW	0x00017B0F (97039_{dec})
		97039	TwinSAFE SC CRC1 master			
		153375	TwinSAFE SC CRC2 master			
		204693	TwinSAFE SC CRC3 master			
		283633	TwinSAFE SC CRC4 master			
		389589	TwinSAFE SC CRC5 master			
		419387	TwinSAFE SC CRC6 master			
		506061	TwinSAFE SC CRC7 master			
		582077	TwinSAFE SC CRC8 master			

6.3.4 Configuration data (vendor-specific)

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

Index (hex)	Name	Meaning	Data type	Flags	Default
80nF:0*	TC Vendor data Ch. (n+1)	Maximum subindex	UINT8	RO	0x02 (2_{dec})
80nF:01	Calibration offset TC	Thermocouple offset (vendor calibration)	INT16	RW	0x0000 (0_{dec})
80nF:02	Calibration gain TC	Thermocouple gain (vendor calibration)	UINT16	RW	0x0000 (0_{dec})

*) hardware-dependent on, due to different cold junction (CJ)

Index 804F RTD Vendor data Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
804F:0	RTD Vendor data Ch.1	Maximum subindex	UINT8	RO	0x04 (4_{dec})
804F:03	Calibration offset PT1000	Thermocouple offset (vendor calibration)	INT16	RW	0x0000 (0_{dec})
804F:04	Calibration gain PT1000	Thermocouple gain (vendor calibration)	UINT16	RW	0x0000 (0_{dec})

Index 805F RTD Vendor data Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
805F:0	RTD Vendor data Ch.2	Maximum subindex	UINT8	RO	0x04 (4_{dec})
805F:03	Calibration offset PT1000	Thermocouple offset (vendor calibration)	INT16	RW	0x0000 (0_{dec})
805F:04	Calibration gain PT1000	Thermocouple gain (vendor calibration)	UINT16	RW	0x0000 (0_{dec})

6.3.5 Input data

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

Index (hex)	Name	Meaning	Data type	Flags	Default
60n0:0	TC Inputs Ch. (n+1)	Maximum subindex	UINT8	RO	0x11 (17_{dec})
60n0:01	Underrange	Value below measuring range.	BOOLEAN	RO	0x00 (0_{dec})
60n0:02	Overrange	Value above measuring range. (“Wire break” together with “Error” [Index 0x60n0:07])	BOOLEAN	RO	0x00 (0_{dec})
60n0:07	Error	The error bit is set if the value is invalid (wire break, overrange, underrange).	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	Analog input date (resolution: see configuration data index 0x80n0:02 [▸ 59])	INT16	RO	0x0000 (0_{dec})

Index 6040 RTD Inputs Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
6040:0	RTD Inputs Ch.1	Maximum subindex	UINT8	RO	0x11 (17_{dec})
6040:01	Underrange	Value below measuring range.	BOOLEAN	RO	0x00 (0_{dec})
6040:02	Overrange	Value above measuring range. (“Wire break” together with “Error” [Index 0x60n0:07])	BOOLEAN	RO	0x00 (0_{dec})
6040:07	Error	The error bit is set if the value is invalid (wire break, overrange, underrange).	BOOLEAN	RO	0x00 (0_{dec})
6040:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
6040:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
6040:11	Value	Analog input date (resolution: see configuration data index 0x80n0:02 [▸ 59])	INT16	RO	0x0000 (0_{dec})

Index 6050 RTD Inputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
6050:0	RTD Inputs Ch.2	Maximum subindex	UINT8	RO	0x11 (17_{dec})
6050:01	Underrange	Value below measuring range.	BOOLEAN	RO	0x00 (0_{dec})
6050:02	Overrange	Value above measuring range. (“Wire break” together with “Error” [Index 0x60n0:07])	BOOLEAN	RO	0x00 (0_{dec})
6050:07	Error	The error bit is set if the value is invalid (wire break, overrange, underrange).	BOOLEAN	RO	0x00 (0_{dec})
6050:0F	TxPDO State	Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).	BOOLEAN	RO	0x00 (0_{dec})
6050:10	TxPDO Toggle	The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.	BOOLEAN	RO	0x00 (0_{dec})
6050:11	Value	Analog input date (resolution: see configuration data index 0x80n0:02 [▸ 59])	INT16	RO	0x0000 (0_{dec})

Index 6060 TSC Slave Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default
6060:0	TSC Slave Frame Elements	Max. subindex	UINT8	RO	0x06 (6_{dec})
6060:01	TSC__Slave Cmd	reserved	UINT8	RO	0x00 (0_{dec})
6060:02	TSC__Slave ConnID	reserved	UINT16	RO	0x0000 (0_{dec})
6060:03	TSC__Slave CRC_0	reserved	UINT16	RO	0x0000 (0_{dec})
6060:04	TSC__Slave CRC_1	reserved	UINT16	RO	0x0000 (0_{dec})
6060:05	TSC__Slave CRC_2	reserved	UINT16	RO	0x0000 (0_{dec})
6060:06	TSC__Slave CRC_3	reserved	UINT16	RO	0x0000 (0_{dec})

6.3.6 Output data

Index 70n0 TC Outputs (for Ch. 1 - 4 (0 ≤ n ≤ 3))

Index (hex)	Name	Meaning	Data type	Flags	Default
70n0:0	TC Outputs Ch. (n+1)	Maximum subindex	UINT8	RO	0x11 (17_{dec})
70n0:11	CJCompensation	Temperature of the cold junction (resolution in 1/10 °C) (index 0x80n0:0C [▶ 59], comparison via the process data)	INT16	RO	0x0000 (0_{dec})

Index 7060 TSC Master Frame Elements

Index (hex)	Name	Meaning	Data type	Flags	Default
7060:0	TSC Master Frame Elements	Max. subindex	UINT8	RO	0x03 (3_{dec})
7060:01	TSC__Master Cmd	reserved	UINT8	RO	0x00 (0_{dec})
7060:02	TSC__Master ConnID	reserved	UINT16	RO	0x0000 (0_{dec})
7060:03	TSC__Master CRC_0	reserved	UINT16	RO	0x0000 (0_{dec})

6.3.7 Information and diagnostic data

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

Index (hex)	Name	Meaning	Data type	Flags	Default
80nE:0*	TC Internal data Ch. (n+1)	Maximum subindex	UINT8	RO	0x05 (5_{dec})
80nE:01	ADC raw value TC	ADC raw value thermocouple	UINT32	RO	0x00000000 (0_{dec})
80nE:03	CJ temperature	Cold junction temperature (resolution [1/10]°C)	INT16	RO	0x0000 (0_{dec})
80nE:04	CJ voltage	Cold junction voltage (resolution 1 µV)	INT16	RO	0x0000 (0_{dec})
80nE:05	CJ resistor	Cold junction resistance (PT1000 temperature sensor) (resolution 1/10 Ohm)	UINT16	RO	0x0000 (0_{dec})

*) Depending on the hardware, because of different **C**old **J**unctions (CJ)

Index 804E RTD Internal data Ch. 1

Index (hex)	Name	Meaning	Data type	Flags	Default
804E:0	RTD Internal data Ch. 1	Maximum subindex	UINT8	RO	0x02 (2_{dec})
804E:01	ADC raw value	ADC raw value	INT32	RO	0x00000000 (0_{dec})
804E:02	Resistor	Resulting measured resistor	UINT32	RO	0x0000 (0_{dec})

Index 805E RTD Internal data Ch. 2

Index (hex)	Name	Meaning	Data type	Flags	Default
805E:0	RTD Internal data Ch. 2	Maximum subindex	UINT8	RO	0x02 (2_{dec})
805E:01	ADC raw value	ADC raw value	INT32	RO	0x00000000 (0_{dec})
805E:02	Resistor	Resulting measured resistor	UINT32	RO	0x0000 (0_{dec})

Index F000 Modular device profile

Index (hex)	Name	Meaning	Data type	Flags	Default
F000:0	Modular device profile	General information for the modular device profile	UINT8	RO	0x02 (2_{dec})
F000:01	Module index distance	Index spacing of the objects of the individual channels	UINT16	RO	0x0010 (16_{dec})
F000:02	Maximum number of modules	Number of channels	UINT16	RO	0x0007 (7_{dec})

Index F008 Code word

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

Index F010 Module list

Index (hex)	Name	Meaning	Data type	Flags	Default
F010:0	Module list	Maximum subindex	UINT32	RW	0x07 (7_{dec})
F010:01	SubIndex 001	TC Profile	UINT32	RW	0x0000014A (330_{dec})
F010:02	SubIndex 002	TC Profile	UINT32	RW	0x0000014A (330_{dec})
F010:03	SubIndex 003	TC Profile	UINT32	RW	0x0000014A (330_{dec})
F010:04	SubIndex 004	TC Profile	UINT32	RW	0x0000014A (330_{dec})
F010:05	SubIndex 005	Reserved	UINT32	RW	0x00000140 (320_{dec})
F010:06	SubIndex 006	Reserved	UINT32	RW	0x00000140 (320_{dec})
F010:07	SubIndex 007	Reserved	UINT32	RW	0x00000140 (320_{dec})

6.3.8 Standard objects (0x1000-0x1FFF)

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

Index 1000 Device type

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

Index 1008 Device name

Index (hex)	Name	Meaning	Data type	Flags	Default
1008:0	Device name	Device name of the EtherCAT slave	STRING	RO	EJ3314-0090

Index 1009 Hardware version

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

Index 100A Software version

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

Index 1018 Identity

Index (hex)	Name	Meaning	Data type	Flags	Default
1018:0	Identity	Information for identifying the slave	UINT8	RO	0x04
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	0x0CF22852 (214196626_{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
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

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 160n TC RxPDO-Map (for Ch. 1 - 4 (0 ≤ n ≤ 3))

Index (hex)	Name	Meaning	Data type	Flags	Default
160n:0	TC RxPDO-Map Ch. (n+1)	PDO Mapping RxPDO (n+1)	UINT8	RW	0x01 (1_{dec})
160n:01	SubIndex 001	n. PDO Mapping entry (object 0x70n0 (TC Outputs Ch. n+1), entry 0x11 (CJCompensation))	UINT32	RW	0x70n0:11, 16

Index 1608 TSC RxPDO-Map Master Message

Index (hex)	Name	Meaning	Data type	Flags	Default
1608:0	TSC RxPDO-Map Master Message	PDO Mapping RxPDO	UINT8	RO	0x04 (4_{dec})
1608:01	SubIndex 001	1. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x01 (TSC__Master Cmd))	UINT32	RO	0x7060:01, 8
1608:02	SubIndex 002	2. PDO Mapping entry (8 bits align)	UINT32	RO	0x0000:00, 8
1608:03	SubIndex 003	3. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x03 (TSC__Master CRC_0))	UINT32	RO	0x7060:03, 16
1608:04	SubIndex 004	4. PDO Mapping entry (object 0x7040 (TSC Master Frame Elements), entry 0x02 (TSC__Master ConnID))	UINT32	RO	0x7060:02, 16

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

Index (hex)	Name	Meaning	Data type	Flags	Default
1A0n:0	TC TxPDO-Map Ch. (n+1)	PDO Mapping TxPDO 1	UINT8	RW	0x08 (8_{dec})
1A0n:01	SubIndex 001	1. PDO Mapping entry (object 0x60n0 (TC Inputs Ch. (n+1)), entry 0x01 (Underrange))	UINT32	RW	0x60n0:01, 1
1A0n:02	SubIndex 002	2. PDO Mapping entry (object 0x60n0 (TC 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 (TC 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 0x60n0 (TC Inputs Ch. (n+1)), entry 0x0F (TxPDO State))	UINT32	RW	0x60n0:0F, 1
1A0n:07	SubIndex 007	7. PDO Mapping entry (object 0x60n0 (TC Inputs Ch. (n+1)), entry 0x10 (TxPDO Toggle))	UINT32	RW	0x60n0:10, 1
1A0n:08	SubIndex 008	8. PDO Mapping entry (object 0x60n0 (TC Inputs Ch. (n+1)), entry 0x11 (Value))	UINT32	RW	0x60n0:11, 16

Index 1A04 RTD TxPDO-Map Inputs Ch.1

Index (hex)	Name	Meaning	Data type	Flags	Default
1A04:0	RTD TxPDO-Map Inputs Ch.1	PDO Mapping TxPDO	UINT8	RW	0x08 (8_{dec})
1A04:01	SubIndex 001	1. PDO Mapping entry (object 0x6040 (RTD Inputs Ch. 1), entry 0x01 (Underrange))	UINT32	RW	0x6040:01, 1
1A04:02	SubIndex 002	2. PDO Mapping entry (object 0x6040 (RTD Inputs Ch. 1), entry 0x02 (Overrange))	UINT32	RW	0x6040:02, 1
1A04:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A04:04	SubIndex 004	4. PDO Mapping entry (object 0x6040 (RTD Inputs Ch. 1), entry 0x07 (Error))	UINT32	RW	0x6040:07, 1
1A04:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A04:06	SubIndex 006	6. PDO Mapping entry (object 0x6040 (RTD Inputs Ch. 1), entry 0x0F (TxPDO State))	UINT32	RW	0x6040:0F, 1
1A04:07	SubIndex 007	7. PDO Mapping entry (object 0x6040 (RTD Inputs Ch. 1), entry 0x10 (TxPDO Toggle))	UINT32	RW	0x6040:10, 1
1A04:08	SubIndex 008	8. PDO Mapping entry (object 0x6040 (RTD Inputs Ch.1), entry 0x11 (Counter value))	INT16	RW	0x6040:11, 16

Index 1A05 RTD TxPDO-Map Inputs Ch.2

Index (hex)	Name	Meaning	Data type	Flags	Default
1A05:0	RTD TxPDO-Map Inputs Ch.2	PDO Mapping TxPDO	UINT8	RW	0x08 (8_{dec})
1A05:01	SubIndex 001	1. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x01 (Underrange))	UINT32	RW	0x6050:01, 1
1A05:02	SubIndex 002	2. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x02 (Overrange))	UINT32	RW	0x6050:02, 1
1A05:03	SubIndex 003	3. PDO Mapping entry (4 bits align)	UINT32	RW	0x0000:00, 4
1A05:04	SubIndex 004	4. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x07 (Error))	UINT32	RW	0x6050:07, 1
1A05:05	SubIndex 005	5. PDO Mapping entry (7 bits align)	UINT32	RW	0x0000:00, 7
1A05:06	SubIndex 006	6. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x0F (TxPDO State))	UINT32	RW	0x6050:0F, 1
1A05:07	SubIndex 007	7. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x10 (TxPDO Toggle))	UINT32	RW	0x6050:10, 1
1A05:08	SubIndex 008	8. PDO Mapping entry (object 0x6050 (RTD Inputs Ch.2), entry 0x11 (Value))	INT16	RW	0x6050:11, 16

Index 1A08 TSC TxPDO-Map Slave Message

Index (hex)	Name	Meaning	Data type	Flags	Default
1A08:0	TSC TxPDO-Map Slave Message	PDO Mapping TxPDO	UINT8	RW	0x0A (10$_{dec}$)
1A08:01	SubIndex 001	1. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x01 (TSC_Slave Cmd))	UINT32	RW	0x6060:01, 8
1A08:02	SubIndex 002	2. PDO Mapping entry (object 0x6000 (TC Inputs Ch.1), entry 0x11 (Value))	UINT32	RW	0x6000:11, 16
1A08:03	SubIndex 003	3. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x03 (TSC_Slave CRC_0))	UINT32	RW	0x6060:03, 16
1A08:04	SubIndex 004	4. PDO Mapping entry (object 0x6010 (TC Inputs Ch.2), entry 0x11 (Value))	UINT32	RW	0x6010:11, 16
1A08:05	SubIndex 005	5. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x04 (TSC_Slave CRC_1))	UINT32	RW	0x6060:04, 16
1A08:06	SubIndex 006	6. PDO Mapping entry (object 0x6020 (TC Inputs Ch.3), entry 0x11 (Value))	UINT32	RW	0x6020:11, 16
1A08:07	SubIndex 007	7. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x05 (TSC_Slave CRC_2))	UINT32	RW	0x6060:05, 16
1A08:08	SubIndex 008	8. PDO Mapping entry (object 0x6030 (TC Inputs Ch.4), entry 0x11 (Value))	UINT32	RW	0x6030:11, 16
1A08:09	SubIndex 009	9. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x06 (TSC_Slave CRC_3))	UINT32	RW	0x6060:06, 16
1A08:0A	SubIndex 010	10. PDO Mapping entry (object 0x6060 (TSC Slave Frame Elements), entry 0x02 (TSC_Slave ConnID))	UINT32	RW	0x6060:02, 16

Index 1C00 Sync manager type

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

Index 1C12 RxPDO assign

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

Index 1C13 TxPDO assign

Index (hex)	Name	Meaning	Data type	Flags	Default
1C13:0	TxPDO assign	PDO Assign Inputs	UINT8	RW	0x06 (6$_{dec}$)
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$_{dec}$)
1C13:01	Subindex 003	3. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A02 (6658$_{dec}$)
1C13:01	Subindex 004	4. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A03 (6659$_{dec}$)
1C13:01	Subindex 005	5. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A04 (6660$_{dec}$)
1C13:01	Subindex 006	6. allocated TxPDO (contains the index of the associated TxPDO mapping object)	UINT16	RW	0x1A05 (6661$_{dec}$)

Index 1C32 SM output parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C32:0	SM output parameter	Synchronization parameters for the outputs	UINT8	RO	0x20 (32_{dec})
1C32:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchron with SM 2 Event • 2: DC-Mode - Synchron with SYNC0 Event • 3: DC-Mode - Synchron with SYNC1 Event	UINT16	RW	0x0000 (0_{dec})
1C32:02	Cycle time	Cycle time (in ns): • Free Run: cycle time of the local timer • Synchron with SM 2 Event: cycle time of the master • DC-Mode: SYNC0/SYNC1 Cycle Time	UINT32	RW	0x00000000 (0_{dec})
1C32:03	Shift time	Time between SYNC0 event and output of the outputs (in ns, DC Mode only)	UINT32	RW	0x00000000 (0_{dec})
1C32:04	Sync modes supported	Supported synchronization modes: • Bit 0 = 1: Free Run is supported • Bit 1 = 1: Synchron with SM 2 Event is supported • Bit 3:2 = 10: DC Mode is supported • Bit 5-4 = 01: Output Shift with SYNC1 Event (DC Mode only) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08)	UINT16	RO	0x4001 (16385_{dec})
1C32:05	Minimum cycle time	Minimum cycle time (in ns)	UINT32	RO	0x00000000 (0_{dec})
1C32:06	Calc and copy time	Minimum time between SYNC0 and SYNC1 event (in ns, DC Mode only)	UINT32	RO	0x00000000 (0_{dec})
1C32:07	Minimum delay time	Minimum time between SYNC1 event and output of the outputs (in ns) 0, since EJ3314-0090 does not support DC Mode	UINT32	RO	0x00000000 (0_{dec})
1C32:08	Get Cycle Time	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C32:03, 0x1C32:05, 0x1C32:06, 0x1C32:09, 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})
1C32:09	Maximum delay time	Time between SYNC1 event and output of the outputs (in ns, DC Mode only)	UINT32	RO	0x00000000 (0_{dec})
1C32:0B	SM event missed counter	Number of missed SM events in OPERATIONAL (DC Mode only)	UINT16	RO	0x0000 (0_{dec})
1C32:0C	Cycle exceeded counter	Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)	UINT16	RO	0x0000 (0_{dec})
1C32:0D	Shift too short counter	Number of intervals between SYNC0 and SYNC1 events that are too short (DC Mode only)	UINT16	RO	0x0000 (0_{dec})
1C32:20	Sync error	The synchronization was not correct in the last cycle (outputs were output too late; DC Mode only)	BOOLEAN	RO	0x00 (0_{dec})

Index 1C33 SM input parameter

Index (hex)	Name	Meaning	Data type	Flags	Default
1C33:0	SM input parameter	Synchronization parameters for the inputs	UINT8	RO	0x20 (32_{dec})
1C33:01	Sync mode	Current synchronization mode: • 0: Free Run • 1: Synchron with SM 3 Event (no outputs available) • 2: DC - Synchron with SYNC0 Event • 3: DC - Synchron with SYNC1 Event • 34: Synchron 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 • Synchron with SM 2 Event: cycle time of the master DC-Mode: SYNC0/SYNC1 Cycle	UINT32	RW	0x00000000 (0_{dec})
1C33:03	Shift time	Time between SYNC0 event and reading of the inputs (in ns, DC Mode only)	UINT32	RW	0x00000000 (0_{dec})
1C33:04	Sync modes supported	Supported synchronization modes: • Bit 0: Free Run is supported • Bit 1: Synchron with SM 2 Event is supported (outputs available) • Bit 1: Synchron with SM 3 Event is supported (no outputs available) • Bit 3:2 = 10: DC Mode is supported • Bit 5:4 = 10: Input shift through local event (outputs available) • Bit 5:4 = 101: Input shift with SYNC1 event (no outputs available) • Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 [▶ 68] or 0x1C33:08)	UINT16	RO	0x4001 (16385_{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 the inputs being available for the master (in ns, DC Mode only)	UINT32	RO	0x00000000 (0_{dec})
1C33:07	Minimum delay time	Min. time between SYNC1 event and the reading of the inputs (in ns, DC Mode only) 0, since EJ3314-0090 does not support DC Mode	UINT32	RO	0x00000000 (0_{dec})
1C33:08	Get Cycle Time	• 0: Measurement of the local cycle time is stopped • 1: Measurement of the local cycle time is started The entries 0x1C32:03, 0x1C32:05, 0x1C32:06, 0x1C32:09 [▶ 68], 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, DC Mode only)	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 intervals between SYNC0 and SYNC1 events that are 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})

7 Appendix

7.1 Support and Service

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

Beckhoff's branch offices and representatives

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

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

You will also find further documentation for Beckhoff components there.

Support

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

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

Hotline:	+49 5246 963 157
e-mail:	support@beckhoff.com
web:	www.beckhoff.com/support

Service

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

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

Hotline:	+49 5246 963 460
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