

Documentation | EN

# EP5xxx

EtherCAT Box modules for Angle and Position Measurement





# Table of contents

|   |           |
|---|-----------|
| <b>1 Foreword .....</b>                             | <b>7</b>  |
| 1.1 Notes on the documentation .....                | 7         |
| 1.2 Safety instructions .....                       | 8         |
| 1.3 Documentation issue status .....                | 9         |
| <b>2 EtherCAT Box - Introduction .....</b>          | <b>11</b> |
| <b>3 Product overview .....</b>                     | <b>13</b> |
| 3.1 Module overview .....                           | 13        |
| 3.2 EP5001-0002 .....                               | 14        |
| 3.2.1 EP5001-0002 - Introduction .....              | 14        |
| 3.2.2 EP5001-0002 - Technical data.....             | 15        |
| 3.2.3 EP5001-0002 - Scope of supply .....           | 16        |
| 3.2.4 EP5001-0002 - Process image .....             | 17        |
| 3.3 EP5101-x002 .....                               | 18        |
| 3.3.1 EP5101-x002 - Introduction .....              | 18        |
| 3.3.2 EP5101-x002 - Technical data.....             | 19        |
| 3.3.3 EP5101-x002 - Scope of supply.....            | 20        |
| 3.3.4 EP5101-x002 - Process image .....             | 21        |
| 3.4 EP5101-x011 .....                               | 22        |
| 3.4.1 EP5101-x011 - Introduction .....              | 22        |
| 3.4.2 EP5101-x011 - Technical data.....             | 23        |
| 3.4.3 EP5101-x011 - Scope of supply.....            | 24        |
| 3.4.4 EP5101-0011 - Process image .....             | 25        |
| 3.4.5 EP5101-2011 - Process image .....             | 26        |
| 3.5 EP5151-0002 .....                               | 27        |
| 3.5.1 EP5151-0002 – Introduction .....              | 27        |
| 3.5.2 EP5151-0002 - Technical data.....             | 28        |
| 3.5.3 EP5151-0002 - Scope of supply .....           | 29        |
| 3.5.4 EP5151-0002 - Process image .....             | 30        |
| <b>4 Mounting and connection.....</b>               | <b>31</b> |
| 4.1 Mounting .....                                  | 31        |
| 4.1.1 Dimensions .....                              | 31        |
| 4.1.2 Fixing.....                                   | 32        |
| 4.1.3 Tightening torques for plug connectors.....   | 32        |
| 4.2 EtherCAT .....                                  | 33        |
| 4.2.1 Connectors.....                               | 33        |
| 4.2.2 Status LEDs .....                             | 34        |
| 4.2.3 Cables.....                                   | 34        |
| 4.3 Supply voltages .....                           | 35        |
| 4.3.1 Connectors.....                               | 36        |
| 4.3.2 Status LEDs .....                             | 36        |
| 4.3.3 Conductor losses .....                        | 37        |
| 4.4 Signal connection and meaning of the LEDs ..... | 38        |
| 4.4.1 Shielding .....                               | 38        |

|          |   |           |
|----------|---|-----------|
| 4.4.2    | EP5001-0002 - Signal connection.....                  | 38        |
| 4.4.3    | EP5101-x002 - Signal connection.....                  | 39        |
| 4.4.4    | EP5101-x011 - Signal connection.....                  | 40        |
| 4.4.5    | EP5151-0002 - Signal connection.....                  | 41        |
| 4.5      | UL Requirements .....                                 | 42        |
| 4.6      | ATEX notes .....                                      | 43        |
| 4.6.1    | ATEX - Special conditions.....                        | 43        |
| 4.6.2    | BG2000 - EtherCAT Box protection enclosures.....      | 44        |
| 4.6.3    | ATEX Documentation.....                               | 45        |
| 4.7      | Disposal .....  | 46        |
| <b>5</b> | <b>Commissioning/Configuration.....</b>               | <b>47</b> |
| 5.1      | Integrating into a TwinCAT project.....               | 47        |
| 5.2      | EP5001-0002 - Parameters and modes.....               | 48        |
| 5.2.1    | Basic principles of SSI communication .....           | 48        |
| 5.2.2    | Process data .....                                    | 49        |
| 5.2.3    | DC (Distributed Clocks).....                          | 51        |
| 5.2.4    | Features CoE .....                                    | 52        |
| 5.3      | EP51x1-x0xx - Parameters and modes .....              | 54        |
| 5.3.1    | Basic function principles.....                        | 54        |
| 5.3.2    | Process data .....                                    | 55        |
| 5.3.3    | DC (Distributed Clocks).....                          | 66        |
| 5.3.4    | Features CoE .....                                    | 67        |
| 5.4      | EP5001 - Interface signal level .....                 | 72        |
| 5.5      | EP5101 - Interface signal level .....                 | 73        |
| 5.6      | EP5151 - Interface signal level .....                 | 74        |
| 5.7      | Restore the delivery state .....                      | 75        |
| 5.8      | Decommissioning .....                                 | 76        |
| <b>6</b> | <b>CoE parameters.....</b>                            | <b>77</b> |
| 6.1      | EP5001-0002 .....                                     | 77        |
| 6.2      | EP5101-x002 .....                                     | 83        |
| 6.2.1    | Restore object .....                                  | 83        |
| 6.2.2    | Configuration data.....                               | 84        |
| 6.2.3    | Input data .....                                      | 85        |
| 6.2.4    | Output data .....                                     | 86        |
| 6.2.5    | Information / diagnostic data (channel specific)..... | 86        |
| 6.2.6    | Standard objects .....                                | 86        |
| 6.3      | EP5101-0011 .....                                     | 97        |
| 6.3.1    | Restore object .....                                  | 97        |
| 6.3.2    | Configuration data.....                               | 98        |
| 6.3.3    | Input data .....                                      | 100       |
| 6.3.4    | Output data .....                                     | 101       |
| 6.3.5    | Information / diagnostic data (channel specific)..... | 101       |
| 6.3.6    | Standard objects .....                                | 101       |
| 6.4      | EP5151-0002 .....                                     | 110       |
| 6.4.1    | Restore object .....                                  | 110       |

|          |  |            |
|----------|--|------------|
| 6.4.2    | Configuration data .....                         | 111        |
| 6.4.3    | Input data .....                                 | 113        |
| 6.4.4    | Output data .....                                | 114        |
| 6.4.5    | Standard objects .....                           | 114        |
| <b>7</b> | <b>Appendix .....</b>                            | <b>123</b> |
| 7.1      | General operating conditions .....               | 123        |
| 7.2      | Accessories .....                                | 124        |
| 7.3      | Version identification of EtherCAT devices ..... | 125        |
| 7.3.1    | General notes on marking .....                   | 125        |
| 7.3.2    | Version identification of IP67 modules .....     | 126        |
| 7.3.3    | Beckhoff Identification Code (BIC) .....         | 127        |
| 7.3.4    | Electronic access to the BIC (eBIC) .....        | 129        |
| 7.4      | Support and Service .....                        | 131        |



# 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.



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## 1.2 Safety instructions

### Safety regulations

Please note the following safety instructions and explanations!

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

### Exclusion of liability

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

### Personnel qualification

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

### 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 Documentation issue status

| Version | Comment  |
|---------|--|
| 2.10    | <ul style="list-style-type: none"><li>• Technical data of EP5151-0002 updated</li></ul>  |
| 2.9     | <ul style="list-style-type: none"><li>• Interface signal levels updated</li></ul>  |
| 2.8     | <ul style="list-style-type: none"><li>• Chapter "Supply voltages" updated</li></ul>  |
| 2.7     | <ul style="list-style-type: none"><li>• Introduction updated</li><li>• Technical data updated</li><li>• Signal connection updated</li></ul>  |
| 2.6     | <ul style="list-style-type: none"><li>• Dimensions updated</li><li>• UL requirements updated</li></ul>   |
| 2.5     | <ul style="list-style-type: none"><li>• Front page updated</li><li>• Scope of delivery added</li><li>• Structure update</li></ul>  |
| 2.4     | <ul style="list-style-type: none"><li>• EP5101-0011: Color of the Error LED corrected</li><li>• EP5151-0002: Color of the Error LED corrected</li></ul>  |
| 2.3.0   | <ul style="list-style-type: none"><li>• Note on <i>shielding</i> added</li></ul>   |
| 2.2.0   | <ul style="list-style-type: none"><li>• Update chapter EP5001-0002 – <i>Signal connection</i></li></ul>  |
| 2.1.0   | <ul style="list-style-type: none"><li>• EP5101-2011 added</li><li>• Chapter <i>Mounting</i> updated</li><li>• Update chapter <i>Commissioning</i></li><li>• Structural update</li></ul>            |
| 2.0.0   | <ul style="list-style-type: none"><li>• Migration</li><li>• EP5001-0002 added</li><li>• Renamed to EP5xxx</li><li>• Several chapters updated</li></ul>   |
| 1.6.0   | <ul style="list-style-type: none"><li>• Pin assignment updated</li><li>• Status LEDs updated</li><li>• Chapter on Tightening torque for connectors updated</li><li>• Accessories updated</li></ul> |
| 1.5.0   | <ul style="list-style-type: none"><li>• Power Connection updated</li></ul>   |
| 1.4.0   | <ul style="list-style-type: none"><li>• Introduction expanded</li></ul>  |

| <b>Version</b> | <b>Modifications</b>   |
|----------------|--|
| 1.3.0          | <ul style="list-style-type: none"> <li>• EP5101-1002 and EP5151-0002 added to title page</li> <li>• EP51x1 - EP5101-1002 and EP5151-0002 added to Introduction</li> <li>• EP5151 signal level (interface signal level) added</li> <li>• Status LEDs extended with EP5101-1002 and EP5151-0002</li> <li>• Technical data extended with EP5101-1002 and EP5151-0002</li> <li>• Encoder connection, M12, 8-pin extended with EP5151</li> <li>• Information on basic function principles amended</li> <li>• Parameters and modes amended</li> <li>• EP5151-0002 process image added</li> <li>• EP5101-0002 process image amended</li> <li>• Notes on the documentation updated</li> <li>• Support &amp; service updated</li> <li>• Safety instructions updated</li> <li>• EtherCAT cables updated</li> <li>• EtherCAT Box accessories updated</li> <li>• Nut torques for connectors updated</li> <li>• EtherCAT connection updated</li> <li>• Mounting instructions updated</li> </ul> |
| 1.2.0          | <ul style="list-style-type: none"> <li>• Interface signal level amended (single-ended and differential signals)</li> </ul>   |
| 1.1.0          | <ul style="list-style-type: none"> <li>• Description of the power connection updated</li> <li>• Notes on using EtherCAT Box modules (EPxxxx-xxxx) in potentially explosive atmospheres (ATEX) added to documentation.</li> </ul>   |
| 1.0.0          | <ul style="list-style-type: none"> <li>• First release</li> </ul>  |

### Firmware and hardware versions

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

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

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

### Syntax of the batch number (D-number)

D: WW YY FF HH

Example with D no. 29 10 02 01:

WW - week of production (calendar week)

29 - week of production 29

YY - year of production

10 - year of production 2010

FF - firmware version

02 - firmware version 02

HH - hardware version

01 - hardware version 01

Further information on this topic: [Version identification of EtherCAT devices \[▶ 125\]](#).

## 2 EtherCAT Box - Introduction

The EtherCAT system has been extended with EtherCAT Box modules with protection class IP67. Through the integrated EtherCAT interface the modules can be connected directly to an EtherCAT network without an additional Coupler Box. The high-performance of EtherCAT is thus maintained into each module.

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

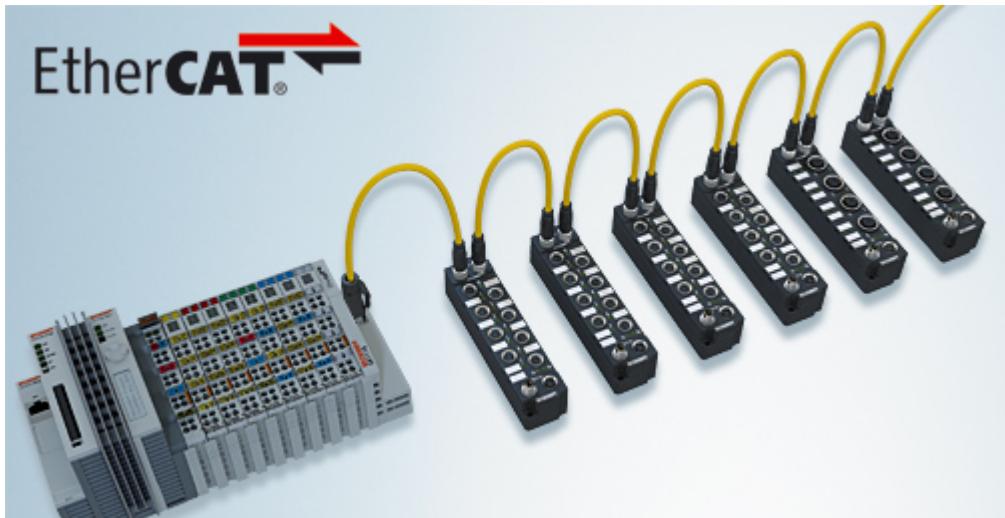


Fig. 1: EtherCAT Box Modules within an EtherCAT network

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

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

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

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

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



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



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



### Basic EtherCAT documentation

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

## 3 Product overview

### 3.1 Module overview

#### SSI encoder interface

| Module                             | Connection encoder/sensor | Number of channels | Sensor supply      | Comment            |
|------------------------------------|---------------------------|--------------------|--------------------|--------------------|
| <a href="#">EP5001-0002 [▶ 14]</a> | M12 socket, 8-pin         | 1                  | 24 V <sub>DC</sub> | Distributed Clocks |

#### Incremental encoder interface with differential inputs

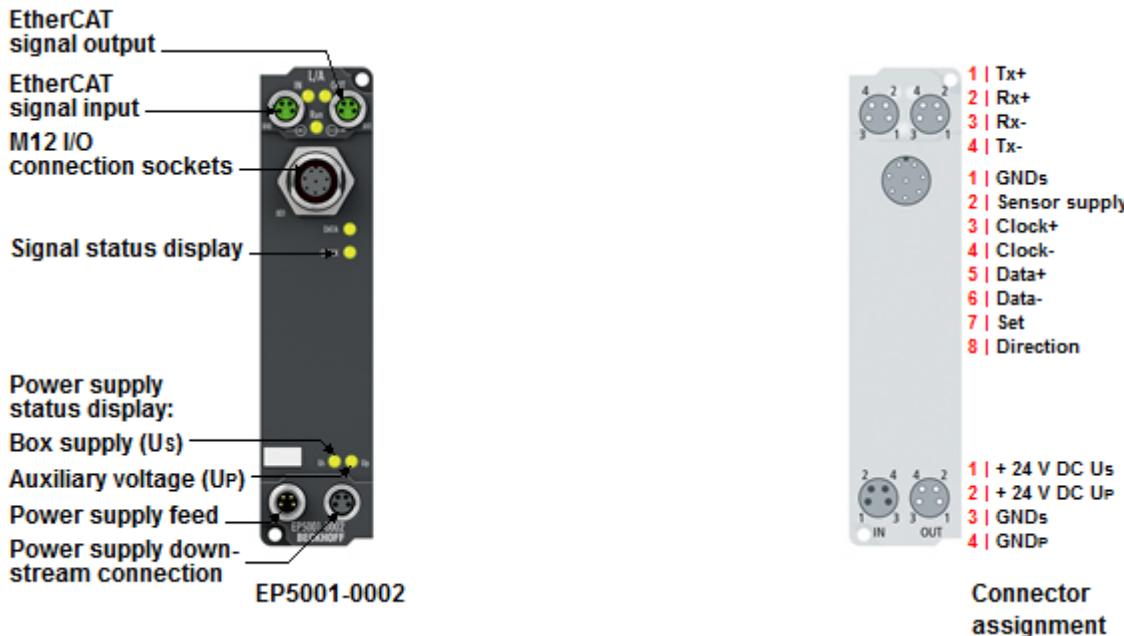
| Module                             | Connection encoder/sensor | Number of channels | Sensor supply               | Comment  |
|------------------------------------|---------------------------|--------------------|-----------------------------|--|
| <a href="#">EP5101-0002 [▶ 18]</a> | M12 socket, 8-pin         | 1                  | 5 V <sub>DC</sub> , 150 mA  | <ul style="list-style-type: none"> <li>Distributed Clocks</li> <li>4 million increments/s</li> </ul>                       |
| <a href="#">EP5101-0011 [▶ 22]</a> | D-sub socket, 15-pin      | 1                  | 5 V <sub>DC</sub> , 150 mA  | <ul style="list-style-type: none"> <li>Distributed Clocks</li> <li>4 million increments/s</li> <li>Latch, Gate</li> </ul>  |
| <a href="#">EP5101-1002 [▶ 18]</a> | M12 socket, 8-pin         | 1                  | 24 V <sub>DC</sub> , 500 mA | <ul style="list-style-type: none"> <li>Distributed Clocks</li> <li>4 million increments/s</li> </ul>                       |
| <a href="#">EP5101-2011 [▶ 22]</a> | D-sub socket, 15-pin      | 1                  | 5 V <sub>DC</sub> , 150 mA  | <ul style="list-style-type: none"> <li>Distributed Clocks</li> <li>20 million increments/s</li> <li>Latch, Gate</li> </ul> |

#### Incremental encoder interface with single-ended inputs

| Module                             | Connection encoder/sensor | Number of channels | Sensor supply              | Comment   |
|------------------------------------|---------------------------|--------------------|----------------------------|---|
| <a href="#">EP5151-0002 [▶ 27]</a> | M12 socket, 8-pin         | 1                  | 24 V <sub>DC</sub> , 0.5 A | <ul style="list-style-type: none"> <li>Distributed Clocks</li> <li>400,000 increments/s</li> <li>Latch, Gate</li> </ul> |

## 3.2 EP5001-0002

### 3.2.1 EP5001-0002 - Introduction



#### SSI encoder interface

The EP5001-0002 EtherCAT box is an SSI master and enables the direct connection of an absolute encoder with SSI (synchronous serial interface). Both singleturn and multturn encoders are supported. An 8-pin M12 socket is used as encoder connection. The 24 V supply of the encoder is made directly via the M12 socket of the box.

Extensive parameterization allow optimum adaptation to different encoder types.

#### Special features:

- Baud rate up to max. 1 MHz
- Coding: Gray and binary
- Data length up to 32 bit, flexibly adjustable.
- separate evaluation of a status error bit (power fail bit) in the process data.

Via the distributed clocks function, the position value is read out exactly synchronously with other processes. If the distributed clocks function is deactivated, the EP5001-0002 clocks synchronize with the EtherCAT cycle. The encoder profile enables simple and fast linking of the process data for motion control applications.

#### Quick links

[Technical data ▶ 15\]](#)

[Process image ▶ 17\]](#)

[Signal connection ▶ 38\]](#)

[Commissioning ▶ 48\]](#)

### 3.2.2 EP5001-0002 - Technical data

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

| <b>EtherCAT</b>      |   |
|----------------------|---|
| Connection           | 2 x M8 socket, 4-pin, A-coded, shielded |
| Electrical isolation | 500 V                                   |
| Distributed Clocks   | yes                                     |

| <b>Supply voltages</b>         |   |
|--------------------------------|---|
| Connection                     | Input: M8 connector, 4-pin, A-coded<br>Downstream connection: M8 socket, 4-pin, A-coded |
| $U_S$ nominal voltage          | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_S$ sum current: $I_{S,sum}$ | max. 4 A  |
| Current consumption from $U_S$ | 130 mA<br>+ sensor supply   |
| Rated voltage $U_P$            | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_P$ sum current: $I_{P,sum}$ | max. 4 A  |
| Current consumption from $U_P$ | None. $U_P$ is only forwarded.  |

| <b>SSI encoder</b>       |  |
|--------------------------|--|
| Number of encoder inputs | 1  |
| Connection               | M12 socket, 8-pin  |
| Signal type              | differential (RS422 / RS485)   |
| signals                  | Data input: Data+, Data-<br>Clock output: Clock+, Clock-<br>The data input has an internal termination resistor of 120 Ω |
| Sensor supply            | 24 V <sub>DC</sub> from $U_S$ .<br>max. 0.5 A, short-circuit proof.  |
| Data transfer rates      | Adjustable up to 1 MHz. 250 kHz preset.  |
| Serial input             | 24-bit width (adjustable)  |
| Data direction           | Read   |
| Special features         | Baud rate, coding and data length are adjustable.  |

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

| <b>Environmental conditions</b>        |   |
|--|---|
| Ambient temperature during operation   | 0 ... 55 °C   |
| Ambient temperature during storage     | -25 ... +85 °C  |
| Vibration resistance, shock resistance | conforms to EN 60068-2-6 / EN 60068-2-27<br><u>Additional checks [► 16]</u> |
| EMC immunity / emission                | conforms to EN 61000-6-2 / EN 61000-6-4                                     |
| Protection class                       | IP65, IP66, IP67 (conforms to EN 60529)                                     |

| <b>Approvals/markings</b> |                  |
|---------------------------|------------------|
| Approvals/markings *)     | CE, cURus [► 42] |

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

### Additional tests

The devices have undergone the following additional tests:

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

### 3.2.3 EP5001-0002 - Scope of supply

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

- 1x EP5001-0002 EtherCAT Box
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)



#### Pre-assembled protective caps do not ensure IP67 protection

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

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

### 3.2.4 EP5001-0002 - Process image

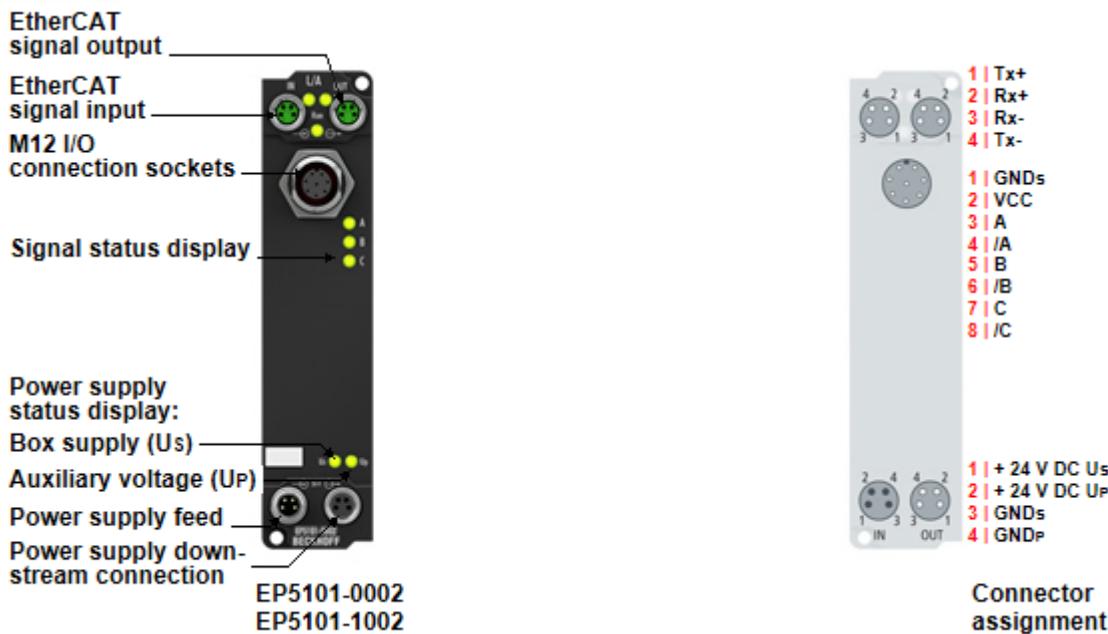
TwinCAT displays the process image in a tree structure.

TwinCAT shows the data of the EP5001-0002 in a tree structure.

| SSI Inputs          |  |
|---------------------|--|
| Box 1 (EP5001-0002) | Status   |
| SSI Inputs          | <ul style="list-style-type: none"><li>• Data error      SSI input error</li><li>• Frame error     Wrong data frame</li><li>• Power failure   An encoder-specific error has occurred.<br/>Enabling through <i>Enable Power failure bit</i><br/>(index 0x8000:02)</li><li>• Sync error       EtherCAT error, see <a href="#">EtherCAT system documentation</a></li><li>• TxPDO State     See <a href="#">object description [► 81]</a></li><li>• TxPDO Toggle    See <a href="#">object description [► 81]</a></li></ul> |
| Status              | Counter value  |
| Data error          |  |
| Frame error         |  |
| Power failure       |  |
| Sync error          |  |
| TxPDO State         |  |
| TxPDO Toggle        |  |
| Counter value       | Current encoder counter value  |
| WcState             |  |
| WcState             |  |
| InputToggle         |  |
| InfoData            |  |
| State               |  |
| AdsAddr             |  |
| netId               |  |
| port                |  |

## 3.3 EP5101-x002

### 3.3.1 EP5101-x002 - Introduction



#### Incremental encoder interface with differential inputs

The EP5101-x002 EtherCAT Box is an interface for the direct connection of incremental encoders with differential signals (RS422) or TTL single ended signals. Input frequencies up to 1 MHz can be evaluated. The C input can optionally be used as a latch input. The supply of the encoder is directly via the M12 socket of the EP5101-x002.

#### Special features:

- save, lock, set counter
- integrated frequency and period measurement
- optionally usable as 5 V counter
- Microincrements
- synchronous reading of the position value via distributed clocks
- Timestamp on the last-registered incremental edge

In addition, the EP5101-x002 enables the measurement of a period or frequency with a resolution of 100 ns. With the optional interpolating microincrement functionality, the EP5101-x002 can provide even more accurate axis positions for dynamic axes. It also supports synchronous reading of the encoder value together with other input data in the EtherCAT system via the high-precision EtherCAT distributed clocks (DC). A timestamp for the last-registered incremental edge is also available. The use of encoder profiles enables simple and fast linking of the process data for Motion Control applications.

#### Quick links

- [Technical data ▶ 19\]](#)
- [Process image ▶ 21\]](#)
- [Signal connection ▶ 39\]](#)
- [Commissioning ▶ 54\]](#)

### 3.3.2 EP5101-x002 - Technical data

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

| <b>EtherCAT</b>      |   |
|----------------------|---|
| Connection           | 2 x M8 socket, 4-pin, A-coded, shielded |
| Electrical isolation | 500 V                                   |
| Distributed Clocks   | yes                                     |

| <b>Supply voltages</b>         |   |
|--------------------------------|---|
| Connection                     | Input: M8 connector, 4-pin, A-coded<br>Downstream connection: M8 socket, 4-pin, A-coded |
| $U_S$ nominal voltage          | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_S$ sum current: $I_{S,sum}$ | max. 4 A  |
| Current consumption from $U_S$ | 130 mA<br>+ sensor supply   |
| Rated voltage $U_P$            | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_P$ sum current: $I_{P,sum}$ | max. 4 A  |
| Current consumption from $U_P$ | None. $U_P$ is only forwarded.  |

| <b>Incremental encoders</b> | <b>EP5101-0002</b>  | <b>EP5101-1002</b>   |
|-----------------------------|---|--|
| Number of encoder inputs    | 1   |  |
| Connection                  | M12 socket, 8-pin [▶ 39]  |  |
| signals                     | A, /A, B, /B, C, /C<br>(RS422 / RS485 differential inputs)<br><br>Also single-ended connection (5 V ±20%) possible. |  |
| Sensor supply Vcc           | 5 V <sub>DC</sub> from $U_S$ .<br>max. 150 mA   | 24 V <sub>DC</sub> from $U_S$ .<br>max. 0.5 A, short-circuit proof |
| Counter                     | 32-bit or 16-bit, binary  |  |
| Cut-off frequency           | 4 million increments/s (with four-fold evaluation)  |  |
| Quadrature decoder          | Four-fold evaluation  |  |
| Zero-pulse latch            | 16-bit  |  |
| Commands                    | read, set, enable   |  |

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

| <b>Environmental conditions</b>        | <b>EP5101-0002</b>  | <b>EP5101-1002</b>                              |
|--|---|---|
| Ambient temperature during operation   | -25...+60 °C<br>-25...+55 °C according to cURus<br>0...+55 °C according to ATEX | -25...+60 °C<br>-25...+55 °C according to cURus |
| Ambient temperature during storage     | -40...+85 °C  |   |
| Vibration resistance, shock resistance | conforms to EN 60068-2-6 / EN 60068-2-27<br>Additional checks [▶ 20]            |   |
| EMC immunity / emission                | conforms to EN 61000-6-2 / EN 61000-6-4   |   |
| Protection class                       | IP65, IP66, IP67 (conforms to EN 60529)   |   |

| Approvals/markings | EP5101-0002                       | EP5101-1002                 |
|--------------------|-----------------------------------|-----------------------------|
| Approvals/markings | ATEX, CE, cURus [▶ 42], EAC, UKCA | CE, cURus [▶ 42], EAC, UKCA |

### Additional tests

The devices have undergone the following additional tests:

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

### 3.3.3 EP5101-x002 - Scope of supply

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

- 1x EP5101-x002 EtherCAT Box
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)



#### Pre-assembled protective caps do not ensure IP67 protection

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

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

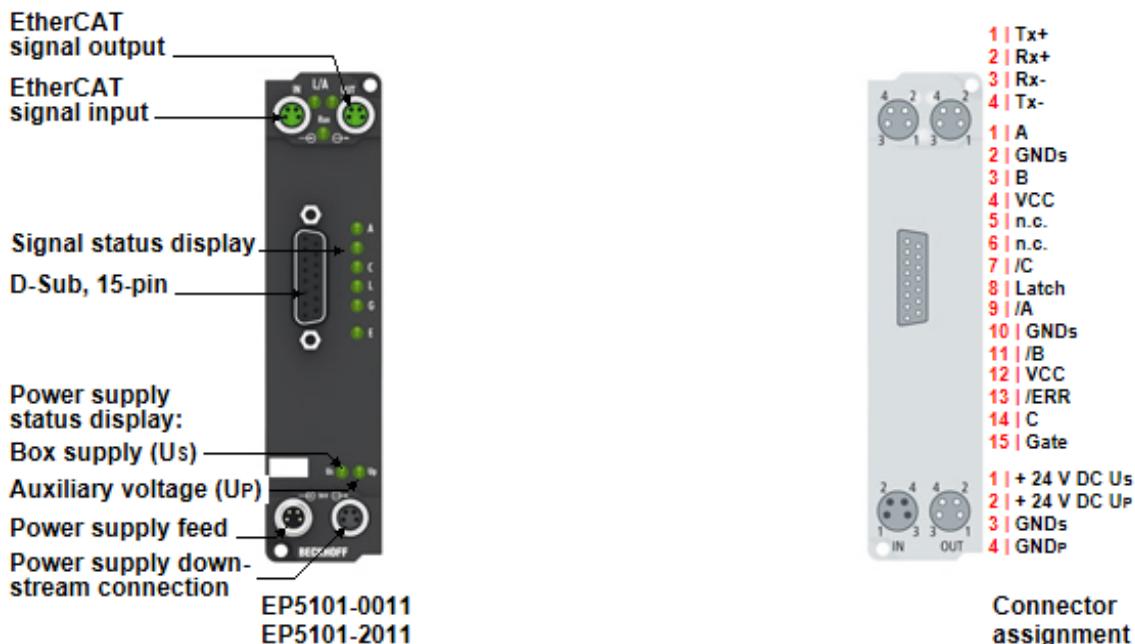
### 3.3.4 EP5101-x002 - Process image

TwinCAT shows the data of the EP5101-0002 and EP5101-1002 in a tree structure, using the EP5101-0002 as an example.

|  |                                 |   |
|--|---------------------------------|---|
|  <b>Box 1 (EP5101-0002)</b> | <b>ENC Status Compact</b>       | Input data of the encoder interface   |
|  <b>ENC Status compact</b>  | <b>Status</b>                   |   |
|  <b>Status</b>              | • <b>Latch C valid</b>          | New data are available in the process data <i>Latch value</i> . Reset via <i>Enable latch C</i>               |
|  <b>Latch C valid</b>       | • <b>Set Counter done</b>       | Acknowledgement for setting the <i>Set counter</i>  |
|  <b>Set counter done</b>    | • <b>Counter underflow</b>      | The counter is lower than the lowest counter value that can be displayed                                      |
|  <b>Counter underflow</b>   | • <b>Counter overflow</b>       | The counter is higher than the highest counter value that can be displayed                                    |
|  <b>Counter overflow</b>    | • <b>Open circuit</b>           | One of the channels (A, B or C) has an open circuit (configurable for each channel via CoE)                   |
|  <b>Open circuit</b>        | • <b>Extrapolation stall</b>    | Micro-increment value invalid (when micro-increment evaluation is enabled -> index 0x8000:0A)                 |
|  <b>Extrapolation stall</b> | • <b>Status of Input A, B,C</b> | Status of inputs A, B and C   |
|  <b>Status of input A</b>   | • <b>Sync error</b>             | EtherCAT error, see <a href="#">EtherCAT system documentation</a>   |
|  <b>Status of input B</b>   | • <b>TxPDO State</b>            | See <a href="#">object description ▶ 85</a>   |
|  <b>Status of input C</b>   | • <b>TxPDO Toggle</b>           | See <a href="#">object description ▶ 85</a>   |
|  <b>Sync error</b>          | <b>Counter value</b>            | Current encoder counter value   |
|  <b>TxPDO State</b>         | <b>Latch value</b>              | Counter value of the encoder with rising edge at the latch input  |
|  <b>TxPDO Toggle</b>        |                                 | Output data of the encoder interface.   |
|  <b>Counter value</b>       | <b>ENC Control Compact</b>      |   |
|  <b>Latch value</b>         | <b>Control</b>                  |   |
|  <b>Control</b>            | • <b>Enable latch C</b>         | Input C is activated. When an edge is encountered, the <i>Counter value</i> is stored in <i>Latch value</i> . |
|  <b>Enable latch C</b>    | • <b>Set counter</b>            | When a positive edge is encountered, the <i>Set counter value</i> is transferred to the <i>Counter value</i>  |
|  <b>Set counter</b>       |                                 |   |
|  <b>Set counter value</b> | <b>Set Counter value</b>        | Preselection value for <i>Counter value</i>   |
|  <b>WcState</b>           |                                 |   |
|  <b>WcState</b>           |                                 |   |
|  <b>InputToggle</b>       |                                 |   |
|  <b>InfoData</b>          |                                 |   |
|  <b>State</b>             |                                 |   |
|  <b>AdsAddr</b>           |                                 |   |
|  <b>netId</b>             |                                 |   |
|  <b>port</b>              |                                 |   |

## 3.4 EP5101-x011

### 3.4.1 EP5101-x011 - Introduction



#### Incremental encoder interface with differential inputs

The EP5101-x011 EtherCAT Box is an interface for the direct connection of incremental encoders with differential signals (RS422) or TTL single ended signals. Two additional 24 V digital inputs are available for storing, locking and setting the counter reading. The error message output of an encoder can be connected and evaluated via the status input. The 5 V supply of the encoder is directly provided via the D-Sub socket of the EP5101-x011.

#### Special features:

- save, lock, set counter
- integrated frequency and period measurement
- optionally usable as 5 V counter
- Microincrements
- synchronous reading of the position value via distributed clocks
- Timestamp on the last-registered incremental edge
- 20 MHz cut-off frequency (EP5101-2011)

In addition, the EP5101-x011 enables the measurement of a period or frequency with a resolution of 100 ns. With the optional interpolating microincrement functionality, the EP5101-x011 can provide even more accurate axis positions for dynamic axes. It also supports synchronous reading of the encoder value together with other input data in the EtherCAT system via the high-precision EtherCAT distributed clocks (DC). A timestamp for the last-registered incremental edge is also available. The use of encoder profiles enables simple and fast linking of the process data for Motion Control applications.

#### Quick links

- [Technical data \[▶ 23\]](#)
- [Process image EP5101-0011 \[▶ 25\]](#)
- [Process image EP5101-2011 \[▶ 26\]](#)
- [Signal connection \[▶ 40\]](#)

### 3.4.2 EP5101-x011 - Technical data

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

| <b>EtherCAT</b>      |   |
|----------------------|---|
| Connection           | 2 x M8 socket, 4-pin, A-coded, shielded |
| Electrical isolation | 500 V                                   |
| Distributed Clocks   | yes                                     |

| <b>Supply voltages</b>         |   |
|--------------------------------|---|
| Connection                     | Input: M8 connector, 4-pin, A-coded<br>Downstream connection: M8 socket, 4-pin, A-coded |
| $U_S$ nominal voltage          | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_S$ sum current: $I_{S,sum}$ | max. 4 A  |
| Current consumption from $U_S$ | 130 mA<br>+ sensor supply   |
| Rated voltage $U_P$            | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_P$ sum current: $I_{P,sum}$ | max. 4 A  |
| Current consumption from $U_P$ | None. $U_P$ is only forwarded.  |

| <b>Incremental encoders</b> | <b>EP5101-0011</b>   | <b>EP5101-2011</b>                                  |
|-----------------------------|--|---|
| Number of encoder inputs    | 1  |   |
| Connection                  | D-sub socket, 15-pin [▶ 39]  |   |
| signals                     | A, /A, B, /B, C, /C<br>(RS422 / RS485 differential inputs)<br><br>Also single-ended connection (5 V ±20%) possible.<br><br>Latch, Gate |   |
| Sensor supply Vcc           | 5 V <sub>DC</sub> from $U_S$ .<br>max. 150 mA  |   |
| Counter                     | 32-bit or 16-bit, binary   |   |
| Cut-off frequency           | 4 million increments/s (with four-fold evaluation)   | 20 million increments/s (with four-fold evaluation) |
| Quadrature decoder          | Four-fold evaluation   |   |
| Zero-pulse latch            | 16-bit   |   |
| Commands                    | read, set, enable  |   |

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

| <b>Environmental conditions</b>        |   |
|--|---|
| Ambient temperature during operation   | -25 ... +60 °C<br>-25 ... +55 °C according to cURus                 |
| Ambient temperature during storage     | -40 ... +85 °C  |
| Vibration resistance, shock resistance | conforms to EN 60068-2-6 / EN 60068-2-27<br>Additional tests [▶ 24] |
| EMC immunity / emission                | conforms to EN 61000-6-2 / EN 61000-6-4                             |
| Protection class                       | IP65, IP66, IP67 (conforms to EN 60529)                             |

**Approvals/markings**

|                       |                 |
|-----------------------|-----------------|
| Approvals/markings *) | CE, cURus ▶ 42] |
|-----------------------|-----------------|

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

**Additional tests**

The devices have undergone the following additional tests:

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

### 3.4.3 EP5101-x011 - Scope of supply

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

- 1x EtherCAT Box EP5101-x011
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

**Pre-assembled protective caps do not ensure IP67 protection**

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

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

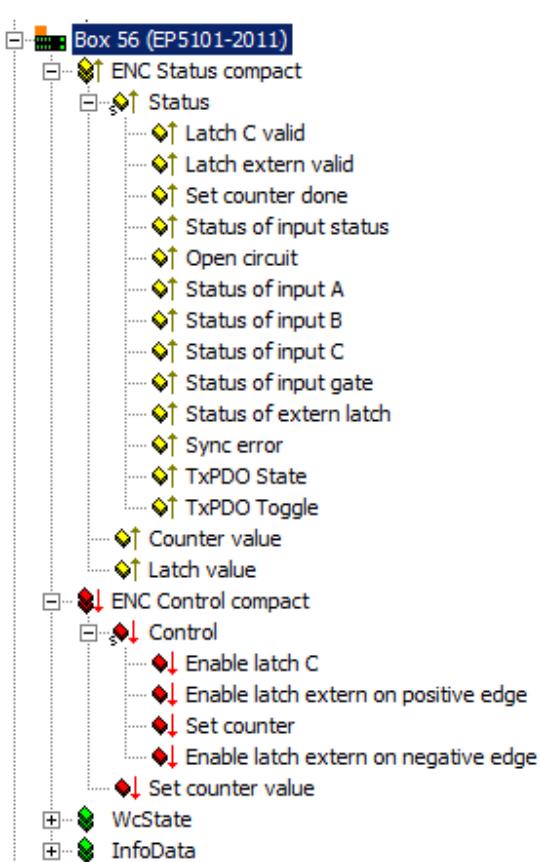
### 3.4.4 EP5101-0011 - Process image

TwinCAT shows the data of the EP5101-0011 in a tree structure.

| ENC Status Compact                            |   |
|---|---|
| Status  | <ul style="list-style-type: none"> <li>• <b>Latch C valid</b></li> <li>• <b>Latch extern valid</b></li> <li>• <b>Set counter done</b></li> <li>• <b>Counter underflow</b></li> <li>• <b>Counter overflow</b></li> <li>• <b>Status of input status</b></li> <li>• <b>Open circuit</b></li> <li>• <b>Extrapolation stall</b></li> <li>• <b>Status of input A</b></li> <li>• <b>Status of input B</b></li> <li>• <b>Status of input C</b></li> <li>• <b>Status of input gate</b></li> <li>• <b>Status of extern latch</b></li> <li>• <b>Sync error</b></li> <li>• <b>TxPDO State</b></li> <li>• <b>TxPDO Toggle</b></li> <li>• <b>Counter value</b></li> <li>• <b>Latch value</b></li> </ul> |
| ENC Control compact                           | <ul style="list-style-type: none"> <li>• <b>Control</b> <ul style="list-style-type: none"> <li>• <b>Enable latch C</b></li> <li>• <b>Enable latch extern on positive edge</b></li> <li>• <b>Set counter</b></li> <li>• <b>Enable latch extern on negative edge</b></li> </ul> </li> <li>• <b>Set counter value</b></li> </ul>   |
| WcState                                       | <ul style="list-style-type: none"> <li>• <b>WcState</b></li> <li>• <b>InputToggle</b></li> </ul>  |
| InfoData                                      | <ul style="list-style-type: none"> <li>• <b>State</b></li> <li>• <b>AdsAddr</b> <ul style="list-style-type: none"> <li>• <b>netId</b></li> <li>• <b>port</b></li> </ul> </li> </ul>   |
| ENC Control Compact                           |   |
| Control                                       | <ul style="list-style-type: none"> <li>• <b>Enable latch C</b></li> <li>• <b>Enable latch extern on positive edge</b></li> <li>• <b>Set counter</b></li> <li>• <b>Enable latch extern on negative edge</b></li> </ul>   |
| Set counter value                             | <b>Preselection value for Counter value</b>   |
| Status  |   |
| • <b>Latch C valid</b>                        | New data are available in the process data <i>Latch value</i> . Reset via <i>Enable latch C</i>   |
| • <b>Latch extern valid</b>                   | New data are available in the process data <i>Latch value</i> . Reset through <i>Enable latch extern on positive/negative edge</i>  |
| • <b>Set counter done</b>                     | Acknowledgement for setting the <i>Set counter</i>  |
| • <b>Counter underflow</b>                    | The counter is lower than the lowest counter value that can be displayed  |
| • <b>Counter overflow</b>                     | The counter is higher than the highest counter value that can be displayed  |
| • <b>Status of input status</b>               | Status of the error signal (typically from the encoder)   |
| • <b>Open circuit</b>                         | One of the channels (A, B or C) has an open circuit (configurable for each channel via CoE)   |
| • <b>Extrapolation stall</b>                  | Micro-increment value invalid (when micro-increment evaluation is enabled -> index 0x8000:0A)   |
| • <b>Status of Input A, B,C</b>               | Status of inputs A, B, and C  |
| • <b>Status of input gate</b>                 | Status of the gate input  |
| • <b>Status of extern latch</b>               | Status of the latch input   |
| • <b>Sync error</b>                           | EtherCAT error, see <a href="#">EtherCAT system documentation</a>   |
| • <b>TxPDO State</b>                          | See <a href="#">object description [► 85]</a>   |
| • <b>TxPDO Toggle</b>                         | See <a href="#">object description [► 85]</a>   |
| Counter value                                 | Current encoder counter value   |
| Latch value                                   | Counter value of the encoder with rising edge at the latch input  |
| Control                                       |   |
| • <b>Enable latch C</b>                       | Input C is activated. When an edge is encountered, the <i>Counter value</i> is stored in <i>Latch value</i> .   |
| • <b>Enable latch extern on positive edge</b> | External latch input is enabled. When a positive edge is encountered, the <i>Counter value</i> is stored in <i>Latch value</i> .  |
| • <b>Set counter</b>                          | When a positive edge is encountered, the <i>Set counter value</i> is transferred to the <i>Counter value</i>  |
| • <b>Enable latch extern on negative edge</b> | External latch input is enabled. When a negative edge is encountered, the <i>Counter value</i> is stored in <i>Latch value</i> .  |

### 3.4.5 EP5101-2011 - Process image

TwinCAT shows the data of the EP5101-2011 in a tree structure.



#### ENC Status Compact

##### Status

- **Latch C valid** New data are available in the process data *Latch value*. Reset via *Enable latch C*
- **Latch extern valid** New data are available in the process data *Latch value*. Reset through *Enable latch extern* on positive/negative edge
- **Set Counter done** Acknowledgement for setting the *Set counter*
- **Status of input status** Status of the error signal (typically from the encoder)
- **Open circuit** One of the channels (A, B or C) has an open circuit (configurable for each channel via CoE)
- **Status of Input A, B,C** Status of inputs A, B and C
- **Status of input gate** Status of the gate input
- **Status of extern latch** Status of the latch input
- **Sync error** EtherCAT error, see [EtherCAT system documentation](#)

##### TxPDO State

See object description

##### TxPDO Toggle

See object description

**Counter value** Current encoder counter value

**Latch value** Counter value of the encoder with rising edge at the latch input

#### ENC Control Compact

##### Control

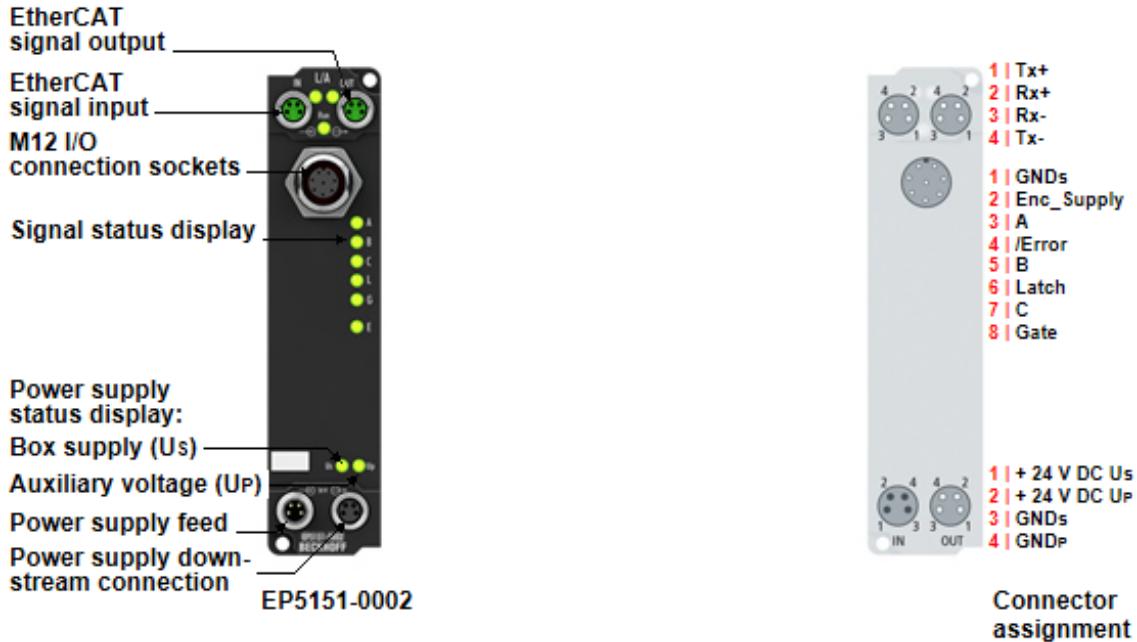
- **Enable latch C** Input C is activated. When an edge is encountered, the *Counter value* is stored in *Latch value*.
- **Enable latch extern on positive edge** External latch input is enabled. When a positive edge is encountered, the *Counter value* is stored in *Latch value*.
- **Set counter** When a positive edge is encountered, the *Set counter value* is transferred to the *Counter value*
- **Enable latch extern on negative edge** External latch input is enabled. When a negative edge is encountered, the *Counter value* is stored in *Latch value*.

##### Set Counter value

Preselection value for *Counter value*

## 3.5 EP5151-0002

### 3.5.1 EP5151-0002 – Introduction



#### 1-channel encoder interface, incremental, 24 V<sub>DC</sub> HTL, 100 kHz, M12

The EP5151-0002 EtherCAT Box module is an interface for direct connection of 24 V DC single-ended signals. Two additional 24 V digital inputs are available for saving, locking, and setting the counter value. The alarm output of an encoder can be connected and evaluated via the status input. The encoder is supplied with 24 V directly via the M12 socket of the EPP5151-0002.

#### Special features:

- save, lock, and set the counter
- integrated frequency and period measurement
- can optionally be used as 5 V counter
- microincrements
- synchronous reading of the position value via distributed clocks
- timestamp on the last registered incremental edge

In addition, the EP5151-0002 allows measurement of a period or frequency. Due to the optional interpolating microincrements functionality, the EP5151-0002 can supply even more precise axis positions for dynamic axes. In addition, it supports synchronous reading of the encoder value together with other input data in the EtherCAT system via the high-precision EtherCAT Distributed Clocks (DC). In addition, timestamps are available for the last registered incremental edge. The use of encoder profiles allows the process data to be linked to the motion control application quickly and easily.

#### Quick links

[Technical data ▶ 28\]](#)

[Process image ▶ 30\]](#)

[Signal connection ▶ 41\]](#)

[Commissioning ▶ 54\]](#)

### 3.5.2 EP5151-0002 - Technical data

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

| <b>EtherCAT</b>      |   |
|----------------------|---|
| Connection           | 2 x M8 socket, 4-pin, A-coded, shielded |
| Electrical isolation | 500 V                                   |
| Distributed Clocks   | yes                                     |

| <b>Supply voltages</b>         |   |
|--------------------------------|---|
| Connection                     | Input: M8 connector, 4-pin, A-coded<br>Downstream connection: M8 socket, 4-pin, A-coded |
| $U_S$ nominal voltage          | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_S$ sum current: $I_{S,sum}$ | max. 4 A  |
| Current consumption from $U_S$ | 130 mA<br>+ sensor supply   |
| Rated voltage $U_P$            | 24 V <sub>DC</sub> (-15 % / +20 %)  |
| $U_P$ sum current: $I_{P,sum}$ | max. 4 A  |
| Current consumption from $U_P$ | None. $U_P$ is only forwarded.  |

| <b>Incremental encoders</b>      |   |
|----------------------------------|---|
| Number of encoder inputs         | 1   |
| Connection                       | M12 socket, 8-pin [▶ 41]  |
| Signals                          | A, B, C (24 V <sub>DC</sub> , single-ended), latch, gate<br>HTL signal level (push-pull) [▶ 74] |
| "ENC_Supply" sensor power supply | 24 V <sub>DC</sub> from $U_S$   |
| Counter                          | 32 bit or 16 bit, binary  |
| Cut-off frequency                | 400,000 increments/s (with 4-fold evaluation), corresponds to 100 kHz                           |
| Quadrature decoder               | Four-fold evaluation  |
| Zero-pulse latch                 | 16-bit  |
| Commands                         | Read, set, enable   |

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

| <b>Environmental conditions</b>        |  |
|--|--|
| Ambient temperature during operation   | 0 ... 55 °C  |
| Ambient temperature during storage     | -25 ... +85 °C   |
| Vibration resistance, shock resistance | conforms to EN 60068-2-6 / EN 60068-2-27<br>Additional checks [▶ 29] |
| EMC immunity / emission                | conforms to EN 61000-6-2 / EN 61000-6-4                              |
| Protection class                       | IP65, IP66, IP67 (conforms to EN 60529)                              |

| <b>Approvals/markings</b> |                  |
|---------------------------|------------------|
| Approvals/markings *)     | CE, cURus [▶ 42] |

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

## Additional tests

The devices have undergone the following additional tests:

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

## 3.5.3 EP5151-0002 - Scope of supply

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

- 1x EtherCAT Box EP5151-0002
- 2x protective cap for EtherCAT socket, M8, green (pre-assembled)
- 1x protective cap for supply voltage input, M8, transparent (pre-assembled)
- 1x protective cap for supply voltage output, M8, black (pre-assembled)
- 10x labels, blank (1 strip of 10)

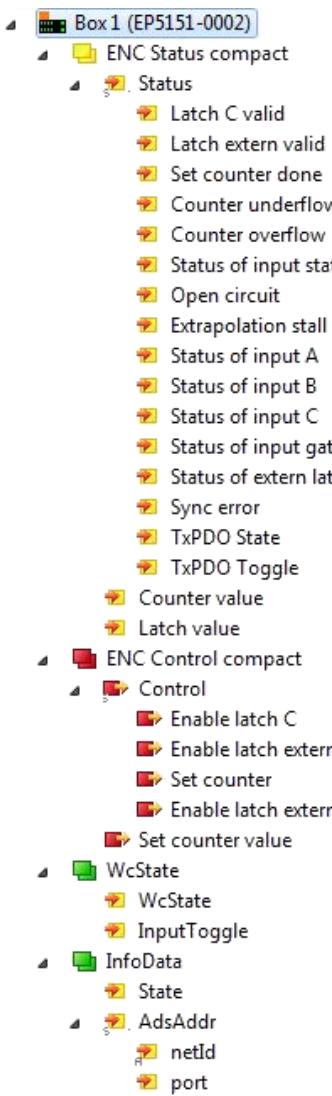


### Pre-assembled protective caps do not ensure IP67 protection

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

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

### 3.5.4 EP5151-0002 - Process image



#### ENC Status Compact

##### Status

- **Latch C valid** New data are available in the process data *Latch value*. Reset via *Enable latch C*
- **Latch extern valid** New data are available in the process data *Latch value*. Reset through *Enable latch extern on positive/negative edge*
- **Set Counter done** Acknowledgement for setting the *Set counter*
- **Counter underflow** The counter is lower than the lowest counter value that can be displayed
- **Counter overflow** The counter is higher than the highest counter value that can be displayed
- **Status of input status** Status of the error signal (typically from the encoder)
- **Open circuit** One of the channels (A, B or C) has an open circuit (configurable for each channel via CoE)
- **Extrapolation stall** Micro-increment value invalid (when micro-increment evaluation is enabled -> index 0x8000:0A)
- **Status of Input A, B,C** Status of inputs A, B and C
- **Status of input gate** Status of the gate input
- **Status of extern latch** Status of the latch input
- **Sync error** EtherCAT error, see [EtherCAT system documentation](#)

##### TxPDO State

See [object description](#) [▶ 113]

##### TxPDO Toggle

See [object description](#) [▶ 113]

##### Counter value

Current encoder counter value

##### Latch value

Counter value of the encoder with rising edge at the latch input

#### ENC Control Compact

##### Control

- **Enable latch C** Input C is activated. When an edge is encountered, the *Counter value* is stored in *Latch value*.
- **Enable latch extern on positive edge** External latch input is enabled. When a positive edge is encountered, the *Counter value* is stored in *Latch value*.
- **Set counter** When a positive edge is encountered, the *Set counter value* is transferred to the *Counter value*
- **Enable latch extern on negative edge** External latch input is enabled. When a negative edge is encountered, the *Counter value* is stored in *Latch value*.

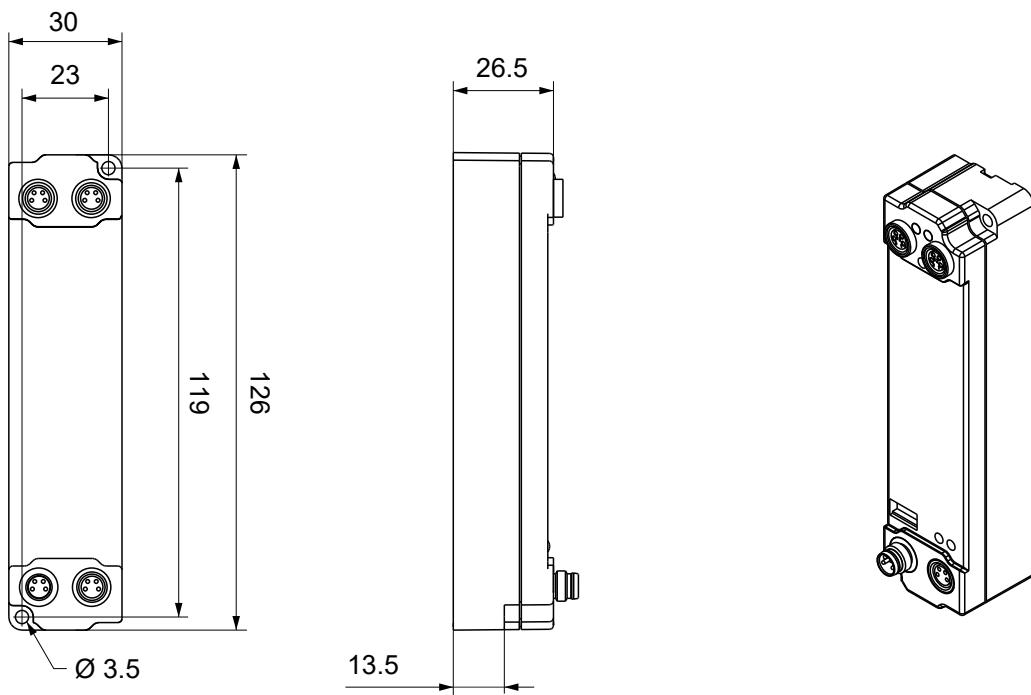
##### Set Counter value

Preselection value for *Counter value*

## 4 Mounting and connection

### 4.1 Mounting

#### 4.1.1 Dimensions



All dimensions are given in millimeters.

The drawing is not true to scale.

#### Housing features

|                        |   |
|------------------------|---|
| Housing material       | PA6 (polyamide)   |
| Sealing compound       | polyurethane  |
| Mounting               | two mounting holes Ø 3.5 mm for M3                            |
| Metal parts            | brass, nickel-plated  |
| Contacts               | CuZn, gold-plated   |
| Power feed through     | max. 4 A  |
| Installation position  | variable  |
| Protection class       | IP65, IP66, IP67 (conforms to EN 60529) when screwed together |
| Dimensions (H x W x D) | approx. 126 x 30 x 26.5 mm (without connectors)               |

## 4.1.2 Fixing

### ***NOTICE***

#### **Dirt during assembly**

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

- Protect the plug connectors against dirt during the assembly.

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

## 4.1.3 Tightening torques for plug connectors

Screw M8 connectors tight with a torque wrench. (e.g. ZB8801 from Beckhoff)

Torque: 0.4 Nm.

## 4.2 EtherCAT

### 4.2.1 Connectors

#### NOTICE

##### Risk of confusion: supply voltages and EtherCAT

Defect possible through incorrect insertion.

- Observe the color coding of the connectors:  
black: Supply voltages  
green: EtherCAT

EtherCAT Box Modules have two green M8 sockets for the incoming and downstream EtherCAT connections.



#### Connection

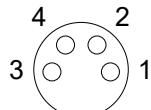


Fig. 4: M8 socket

| EtherCAT | M8 socket | Core colors   |   |              |
|----------|-----------|---|---|--------------|
| Signal   | Contact   | ZB9010, ZB9020, ZB9030, ZB9032, ZK1090-6292, ZK1090-3xxx-xxxx | ZB9031 and old versions of ZB9030, ZB9032, ZK1090-3xxx-xxxx | TIA-568B     |
| Tx +     | 1         | yellow <sup>1)</sup>  | orange/white  | white/orange |
| Tx -     | 4         | orange <sup>1)</sup>  | orange  | orange       |
| Rx +     | 2         | white <sup>1)</sup>   | blue/white  | white/green  |
| Rx -     | 3         | blue <sup>1)</sup>  | blue  | green        |
| Shield   | Housing   | Shield  | Shield  | Shield       |

<sup>1)</sup> Core colors according to EN 61918

#### Adaptation of core colors for cables ZB9030, ZB9032 and ZK1090-3xxxx-xxxx

**i** For standardization, the core colors of the ZB9030, ZB9032 and ZK1090-3xxx-xxxx cables have been changed to the EN61918 core colors: yellow, orange, white, blue. So there are different color codes in circulation. The electrical properties of the cables have been retained when the core colors were changed.

## 4.2.2 Status LEDs



### L/A (Link/Act)

A green LED labelled "L/A" is located next to each EtherCAT socket. The LED indicates the communication state of the respective socket:

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

### Run

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

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

### Description of the EtherCAT slave states

## 4.2.3 Cables

For connecting EtherCAT devices only shielded Ethernet cables that meet the requirements of at least category 5 (CAT5) according to EN 50173 or ISO/IEC 11801 should be used.

EtherCAT uses four wires for signal transmission.

Thanks to automatic line detection ("Auto MDI-X"), both symmetrical (1:1) or cross-over cables can be used between Beckhoff EtherCAT.

### Detailed recommendations for the cabling of EtherCAT devices

## 4.3 Supply voltages

### ⚠ 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 (Safety Extra Low Voltage) supply provides safe electrical isolation and limitation of the voltage without a connection to the protective conductor, a PELV (Protective Extra Low Voltage) supply also requires a safe connection to the protective conductor.

### ⚠ CAUTION

#### Observe the UL requirements

- When operating under UL conditions, observe the warnings in the chapter UL Requirements [▶ 42].

The EtherCAT Box has one input for two supply voltages:

- **Control voltage  $U_s$**

The following sub-functions are supplied from the control voltage  $U_s$ :

- the fieldbus
- the processor logic
- typically the inputs and the sensors if the EtherCAT Box has inputs.

- **Peripheral voltage  $U_p$**

For EtherCAT Box modules with digital outputs the digital outputs are typically supplied from the peripheral voltage  $U_p$ .  $U_p$  can be supplied separately. If  $U_p$  is switched off, the fieldbus function, the function of the inputs and the supply of the sensors are maintained.

The exact assignment of  $U_s$  and  $U_p$  can be found in the pin assignment of the I/O connections.

#### Redirection of the supply voltages

The power IN and OUT connections are bridged in the module. Hence, the supply voltages  $U_s$  and  $U_p$  can be passed from EtherCAT Box to EtherCAT Box in a simple manner.

### NOTICE

#### Note the maximum current!

Ensure that the permitted current for the connectors is not exceeded when routing the supply voltages  $U_s$  and  $U_p$ :

M8 connector: max. 4 A

7/8" connector: max 16 A

### NOTICE

#### Unintentional cancellation of the electrical isolation possible

In some types of EtherCAT Box modules the ground potentials  $GND_s$  and  $GND_p$  are connected.

- If several EtherCAT Box modules are supplied with the same electrically isolated voltages, check whether there is an EtherCAT Box among them in which the ground potentials are connected.

### 4.3.1 Connectors

#### NOTICE

##### Risk of confusion: supply voltages and EtherCAT

Defect possible through incorrect insertion.

- Observe the color coding of the connectors:  
black: Supply voltages  
green: EtherCAT

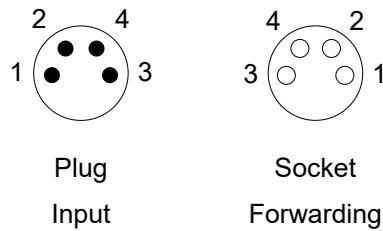


Fig. 5: M8 connector

| Contact | Function | Description        | Core color <sup>1)</sup> |
|---------|----------|--------------------|--------------------------|
| 1       | $U_S$    | Control voltage    | Brown                    |
| 2       | $U_P$    | Peripheral voltage | White                    |
| 3       | $GND_S$  | GND to $U_S$       | Blue                     |
| 4       | $GND_P$  | GND to $U_P$       | Black                    |

<sup>1)</sup> The core colors apply to cables of the type: Beckhoff ZK2020-3xxx-xxxx

### 4.3.2 Status LEDs

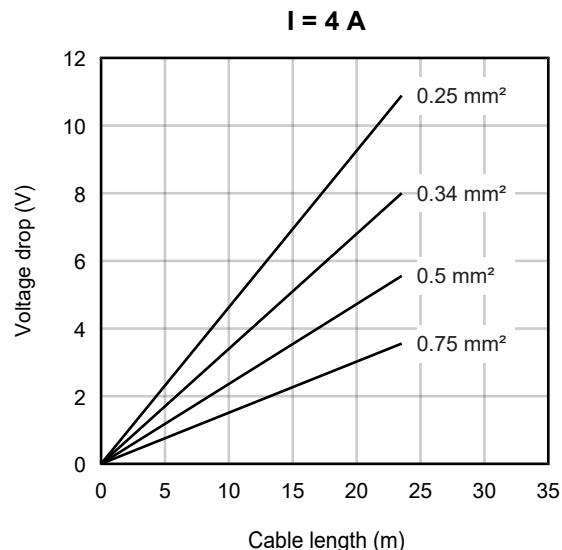
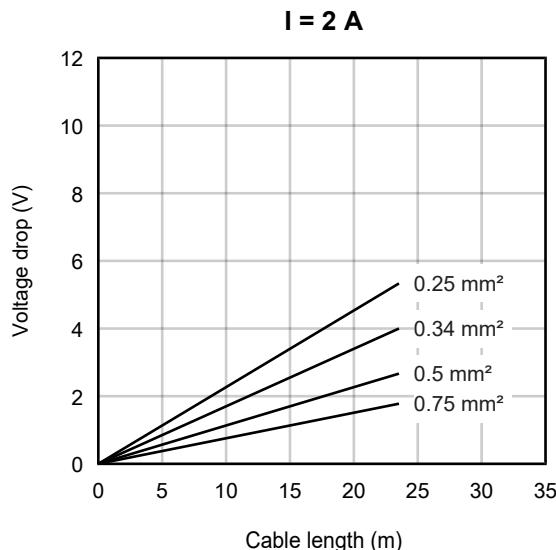


| LED                        | Display           | Meaning                                    |
|----------------------------|-------------------|--|
| $U_S$ (control voltage)    | off               | The supply voltage $U_S$ is not available. |
|                            | green illuminated | The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

### 4.3.3 Conductor losses

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

#### Voltage drop on the supply line



## 4.4 Signal connection and meaning of the LEDs

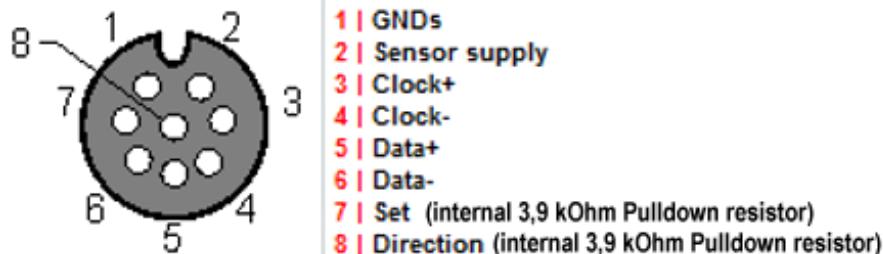
### 4.4.1 Shielding



#### Shielding

Encoder, analog sensors and actuators should always be connected with shielded, twisted paired wires.

### 4.4.2 EP5001-0002 - Signal connection



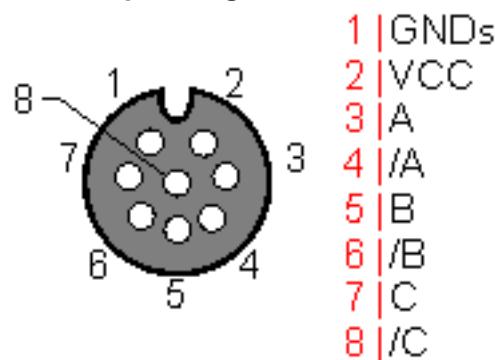
LED indicators - meanings



| LED   | green   | red  |
|-------|---|--|
| Data  | Encoder supply switched on (operational state, not short-circuited) | SSI without power supply<br>Open circuit on the SSI data input D+ or D-<br>Data cables interchanged<br>The SSI input is at Low level, no data transfer takes place.<br>Incorrect parameterization in the CoE<br>Wire breakage in the clock lines |
| CLOCK | No function   |  |

#### 4.4.3 EP5101-x002 - Signal connection

Encoder pin assignment, M12, socket, 8-pin

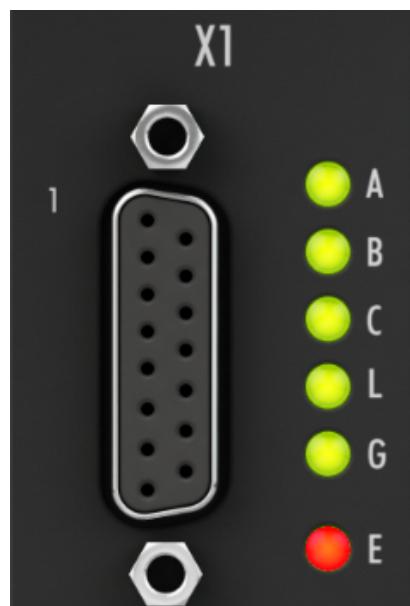
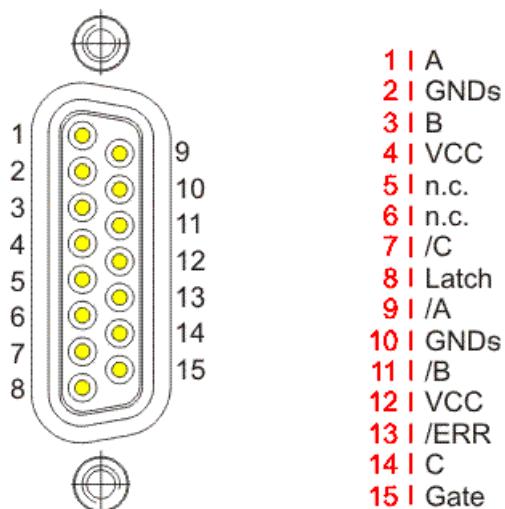


LED indicators - meanings

| Connection | LED | Display | Meaning                |
|------------|-----|---------|------------------------|
| M12        | A   | off     | Input A / track A low  |
|            |     | green   | Input A / track A high |
|            | B   | off     | Input B / track B low  |
|            |     | green   | Input B / track B high |
|            | C   | off     | Input C / track C low  |
|            |     | green   | Input C / track C high |

#### 4.4.4 EP5101-x011 - Signal connection

Encoder pin assignment, D-sub socket, 15-pin

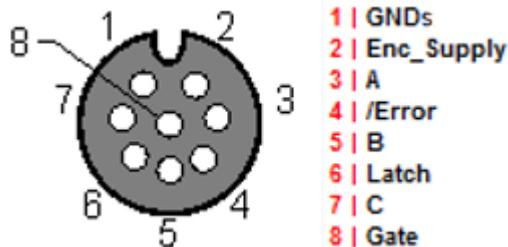


LED indicators - meanings

| Connection | LED | Display | Meaning                |
|------------|-----|---------|------------------------|
| D sub      | A   | off     | Input A / track A low  |
|            |     | green   | Input A / track A high |
|            | B   | off     | Input B / track B low  |
|            |     | green   | Input B / track B high |
|            | C   | off     | Input C / track C low  |
|            |     | green   | Input C / track C high |
|            | L   | off     | Input Latch low        |
|            |     | green   | Input Latch high       |
|            | G   | off     | Input Gate low         |
|            |     | green   | Input Gate high        |
|            | E   | off     | Input Error low        |
|            |     | red     | Input Error high       |

## 4.4.5 EP5151-0002 - Signal connection

Encoder connection, M12 socket, 8-pin



LED indicators - meanings



| Connection | LED | Display | Meaning                |
|------------|-----|---------|------------------------|
| M12        | A   | off     | Input A / track A low  |
|            |     | green   | Input A / track A high |
|            | B   | off     | Input B / track B low  |
|            |     | green   | Input B / track B high |
|            | C   | off     | Input C / track C low  |
|            |     | green   | Input C / track C high |
|            | L   | off     | Input Latch low        |
|            |     | green   | Input Latch high       |
|            | G   | off     | Input Gate low         |
|            |     | green   | Input Gate high        |
|            | E   | off     | Input Error low        |
|            |     | red     | Input Error high       |

## 4.5 UL Requirements

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

### Supply voltage

#### **⚠ CAUTION**

##### **CAUTION!**

This UL requirements are valid for all supply voltages of all marked EtherCAT Box Modules!

For the compliance of the UL requirements the EtherCAT Box Modules should only be supplied

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

#### **⚠ CAUTION**

##### **CAUTION!**

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

### Networks

#### **⚠ CAUTION**

##### **CAUTION!**

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

### Ambient temperature range

#### **⚠ CAUTION**

##### **CAUTION!**

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

### Marking for UL

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



Fig. 6: UL label

## 4.6 ATEX notes

### 4.6.1 ATEX - Special conditions

#### WARNING

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

- The certified components are to be installed with a [BG2000-0000 or BG2000-0010 protection enclosure \[► 44\]](#) that guarantees a protection against mechanical hazards!
- If the temperatures during rated operation are higher than 70°C at the feed-in points of cables, lines or pipes, or higher than 80°C at the wire branching points, then cables must be selected whose temperature data correspond to the actual measured temperature values!
- Observe the permissible ambient temperature range of 0 to 55°C for the use of EtherCAT Box modules in potentially explosive areas!
- Measures must be taken to protect against the rated operating voltage being exceeded by more than 40% due to short-term interference voltages!
- The connections of the certified components may only be connected or disconnected if the supply voltage has been switched off or if a non-explosive atmosphere is ensured!

#### Standards

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

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

#### Marking

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



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

or



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

#### Batch number (D number)

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

D: WW YY FF HH

WW - week of production (calendar week)

YY - year of production

FF - firmware version

HH - hardware version

Example with batch number 29 10 02 01:

29 - week of production 29

10 - year of production 2010

02 - firmware version 02

01 - hardware version 01

## 4.6.2 BG2000 - EtherCAT Box protection enclosures

### **WARNING**

#### **Risk of electric shock and damage of device!**

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

### **ATEX**

### **WARNING**

#### **Mount a protection enclosure!**

To fulfill the special conditions according to ATEX [► 43], a BG2000-0000 or BG2000-0010 protection enclosure has to be mounted over the EtherCAT Box.

### **Installation**

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

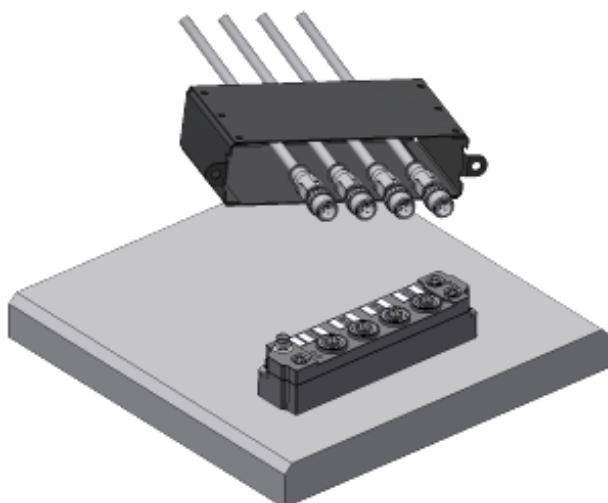


Fig. 7: BG2000 - putting the cables

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

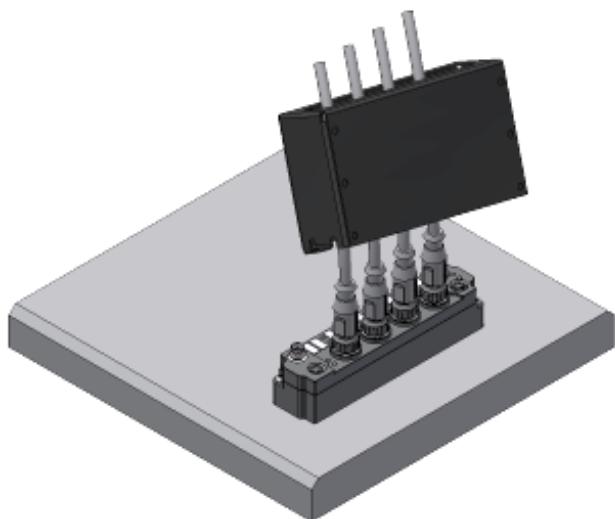


Fig. 8: BG2000 - fixing the cables

Mount the protection enclosure over the EtherCAT Box.

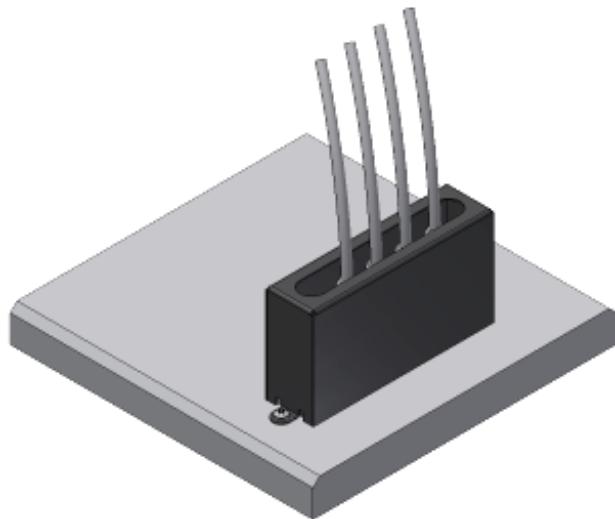


Fig. 9: BG2000 - mounting the protection enclosure

#### 4.6.3 ATEX Documentation



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

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

## 4.7 Disposal



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

## 5 Commissioning/Configuration

### 5.1 Integrating into a TwinCAT project

The procedure for integration in a TwinCAT project is described in this [Quick start guide](#).

## 5.2 EP5001-0002 - Parameters and modes

### 5.2.1 Basic principles of SSI communication

#### SSI principles

SSI communication sequence

- The SSI master starts pulsing on the clock line with a fixed cycle into the shift register of the SSI slave.
- The slave generally "pushes back" data with a width of 25 bits on the data line. An SSI encoder should determine its position with the first falling edge of the signal at the *Clock* input ("latching"), which is then transferred.
- Once the specified number of bits was pushed, the clock signal is terminated.
- After a pause, polling by the SSI master recommences.

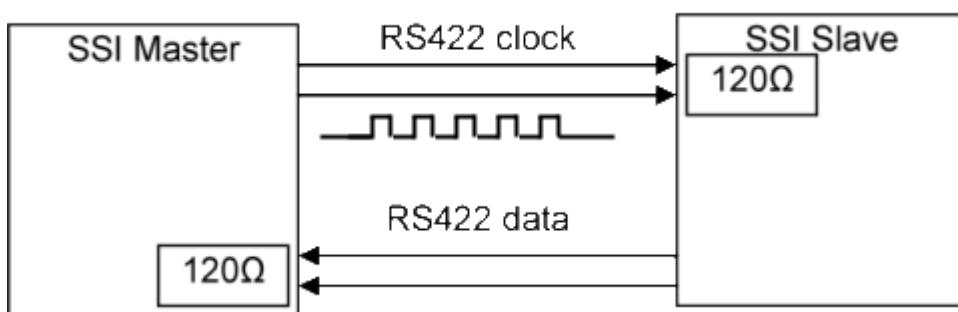
The last data bit can be a PowerFail bit, i.e. the slave signals a power failure. This output depends on the slave.

The number of bit changes equals the clock frequency, i.e. the maximum data transfer rate for a 1 MHz cycle is 1 Mbit/s.

Different SSI slaves have different communication parameters. The communication parameters of the slave must be set in the SSI master:

- Baud rate (e.g., 500 kBaud)
- Coding (e.g., Gray code)
- Data frame type, e.g., multi-turn 25 bits
- Data frame size, e.g., 25 bits
- Data length, i.e. how many bits in the data frame represent the actual position data, e.g., 24 bits.

The communication parameters can be found in the data sheet of the SSI slave.



#### Referencing an SSI signal

An SSI encoder is an absolute encoder, i.e. the position value is available without referencing immediately after switch-on.

Many SSI encoders offer the option of referencing or zeroing the position value via an additional digital input. This can be set via the [digital output "Set"](#) [▶ 38]: CoE parameter 800D:03 [▶ 82].

## 5.2.2 Process data

The EP5001-0002 can have 16 bit status data and a 32-bit counter value.

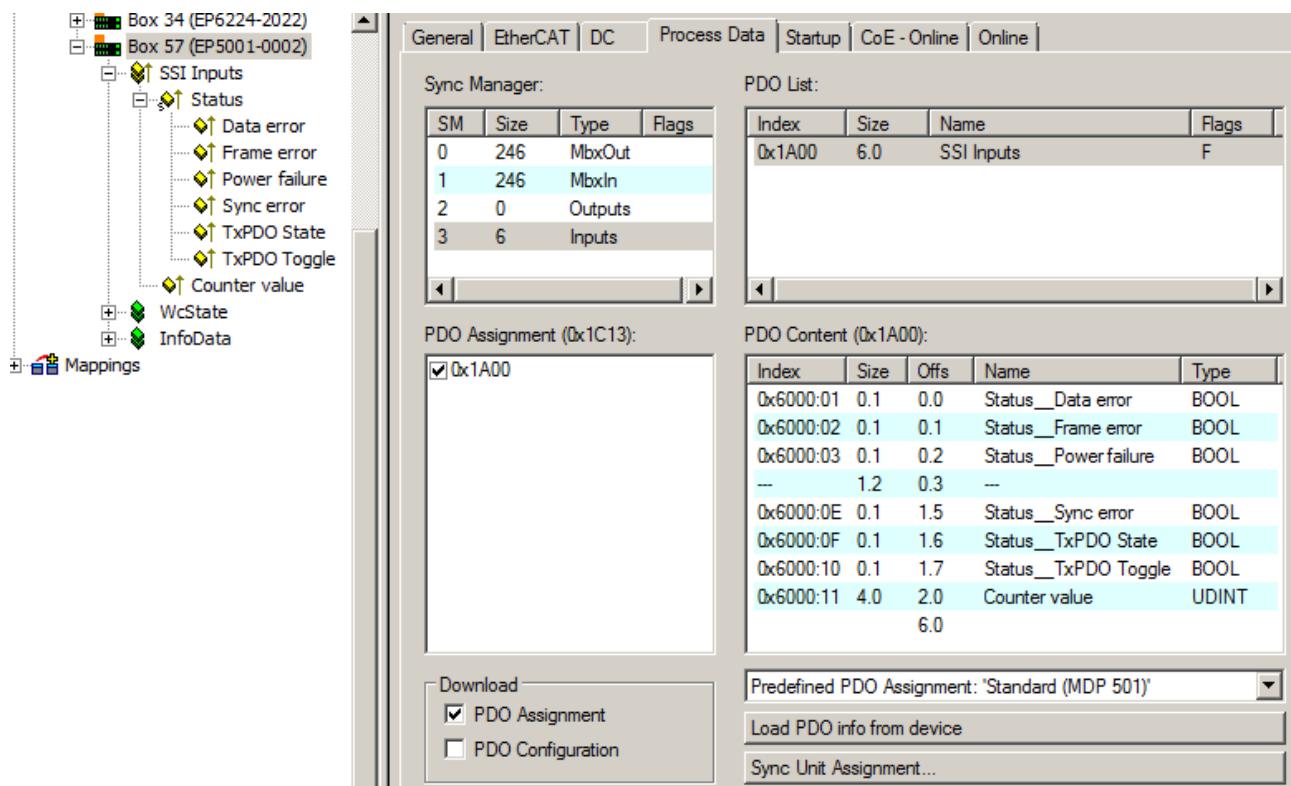


Fig. 10: EP5001-0002

### 5.2.2.1 EP5001-0002 - PDO assignment

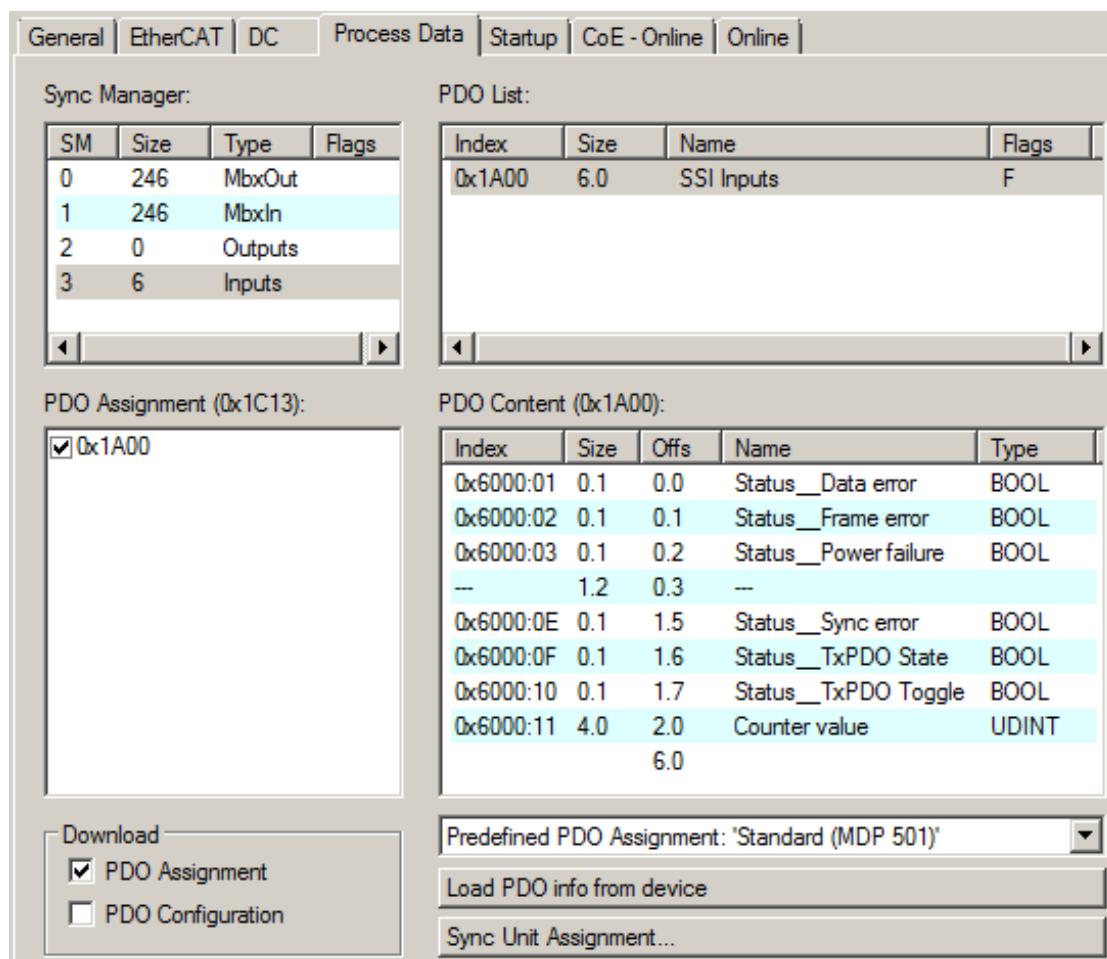


Fig. 11: PDO assignment and content; example: EP5001-0002

The PDO 0x1A00 configuration of the EP5001-0002 cannot be changed.

#### PDO Assignment

| SM3, PDO Assignment 0x1C13 |                        |                 |            |  |
|----------------------------|------------------------|-----------------|------------|--|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name       | PDO Content (index - name)   |
| 0x1A00<br>(default)        |                        | 6.0             | SSI Inputs | 0x6000:01 [▶ 81] - Data error<br>0x6000:02 [▶ 81] - Frame error<br>0x6000:03 [▶ 81] - Power failure<br>0x6000:0E [▶ 81] - Sync error<br>0x6000:0F [▶ 81] - TxPDO State<br>0x6000:10 [▶ 81] - TxPDO Toggle<br>0x6000:11 [▶ 81] - Counter value (32-Bit) |

### 5.2.3 DC (Distributed Clocks)

Describes whether the module is operated with support from distributed clocks:

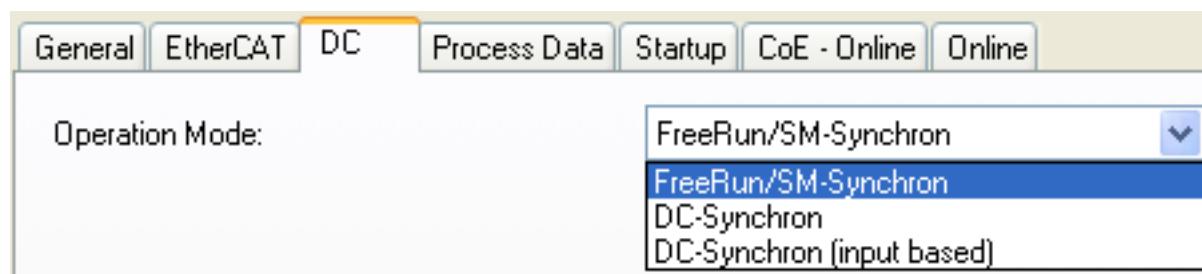


Fig. 12: Distributed Clocks

- **FreeRun:** The module operates frame-triggered. Cyclic operation is started via the SyncManagers during EtherCAT frame processing.
- **DC-Synchron:** Cyclic operation in the module is started by the local distributed clock at exact intervals. The start time is chosen such that it coincides with other output slaves in the EtherCAT system.
- **DC-Synchron (input based):** as DC-Synchron mode, with the cyclic start time chosen such that it coincides with other input slaves in the EtherCAT system.

## 5.2.4 Features CoE

Further settings can be selected in the CoE (CAN over EtherCAT)-list.



### Parameterization via the CoE list (CAN over EtherCAT)

Please note the following general CoE notes 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
- “CoE-Reload” for resetting the changes

The following CoE settings from objects 0x8000 and 0x800D are possible and are shown below in their default settings:

The parameters are described in the object description chapter.

#### SSI settings

- **Index 0x8000:01 [▶ 81], disable frame error**

If the bit is set to TRUE, data errors such as invalid telegram size are no longer shown in the *Data error* process data.

- **Index 0x8000:02 [▶ 81], enable power failure bit**

If the bit is set to TRUE, the last bit (LSB) in the SSI telegram is interpreted as PowerFail bit of the SSI slave and shown in the process data.

- **Index 0x8000:03 [▶ 81], enable inhibit time**

If the bit is set to TRUE, the system waits at least until the *Min. Inhibit time* (index 0x8000 [▶ 81]:13) has elapsed when the next SSI communication starts, even if the next start request has already been issued via EtherCAT or distributed clocks.

- **Index 0x8000:04 [▶ 81], enable test mode**

Only for production purposes.

- **Index 0x8000:06 [▶ 81], SSI-encoding**

Dual or gray coding setting (standard).

- **Index 0x8000:09 [▶ 81], SSI baud rate**

should be set to 125, 250, 500 kbaud (default) or 1 Mbaud.

- **Index 0x8000:0F [▶ 81], SSI-frame type**

25, 13 or variable bit width (default: 25).

- **Index 0x8000:11 [▶ 81], SSI-frame size**

Total data volume including PowerFail bit.

- **Index 0x8000:12 [▶ 81], SSI-data length**

Data volume without PowerFail bit.

- **Index 0x8000:13 [▶ 81], Min. inhibit time [μs]**

See index 0x8000:03 [▶ 81].

#### SSI advanced settings

- **Index 0x800D:01 [▶ 82], Encoder power supply on**

Switches the 24 V supply voltage

- **Index 0x800D:02 [▶ 82], Encoder direction pin on**

Switches the 24 V supply at the *Direction pin*

- **Index 0x800D:03 [▶ 82], Encoder reset pin on**

Switches the 24 V supply at the *Reset pin*

The total size of the data depends on the encoder used. It is also type-specific whether a power-fail bit or another auxiliary bit is supported. The counter value in the *Counter Value* index 0x6000:11 [▶ 81] is determined based on the value entered in object *SSI data length* index 0x8000:12 [▶ 81].

A few example configurations are shown below:

| Specification of the encoder |    |           | Settings in the CoE of the box    |                          |                           |                                    |
|------------------------------|----|-----------|-----------------------------------|--------------------------|---------------------------|------------------------------------|
| ST                           | MT | Error bit | 0x8000:0F SSI frame type          | 0x8000:11 SSI frame size | 0x8000:12 SSI data length | 0x8000:02 Enable power failure bit |
| 13                           | 0  | 0         | 1: Single-turn analysis is active | 13                       | 13                        | 0: Power failure bit is not active |
| 12                           | 12 | 1         | 0: Multi-turn analysis is active  | 25                       | 24                        | 1: Power failure bit is active     |
| 12                           | 12 | 0         | 2: Variable analysis is active    | 24                       | 24                        | 0: Power failure bit is not active |
| 12                           | 13 | 0         | 2: Variable analysis is active    | 25                       | 25                        | 0: Power failure bit is not active |
| 16                           | 16 | 0         | 2: Variable analysis is active    | 32                       | 32                        | 0: Power failure bit is not active |
| 16                           | 0  | 0         | 2: Variable analysis is active    | 16                       | 16                        | 0: Power failure bit is not active |
| 13                           | 16 | 1         | 2: Variable analysis is active    | 30                       | 29                        | 1: Power failure bit is active     |
| 12                           | 12 | 2         | 2: Variable analysis is active    | 26*                      | 26*                       | 0: Power failure bit is not active |

\*) Analysis of the data and division into position and auxiliary bits must take place in the PLC.

If the encoder offers more than 1 auxiliary bit, this can be done by means of suitable configuration of the objects *0x8000:11 SSI frame size* and *0x80n0 SSI data length*. The maximum size of 32 bits must be considered here. If the parameters have the same size, the *Counter Value* index [0x6000:11 \[► 81\]](#) does not only show the position, but also additional bits. Analysis of the data and division into position and auxiliary bits must take place in the PLC.

If the settings are not made correctly in the CoE, or if there is an error at the inputs, this is indicated via the status bits

| Data error<br>(Index<br><a href="#">0x6000:01</a><br>[► 81]) | Frame error<br>(Index <a href="#">0x6000:02</a><br>[► 81]) | Possible error type  |
|--|--|--|
| TRUE   | FALSE  | SSI input error:<br>- SSI without power supply<br>- Wire breakage on one of the SSI lines<br>If no data transmission occurs, the SSI input is on low signal level.         |
| FALSE  | TRUE   | There is an incorrect data frame, the data frame was not concluded with zero, or possibly<br>- Wire breakage in the clock lines<br>- Incorrect parameterization in the CoE |
| TRUE   | TRUE   | - Broken wire at SSI data inputs D+ or D-<br>- Data cables interchanged  |
| FALSE  | FALSE  | If bits are shifted in the counter value despite correct CoE parameterization, this may be to do with the clock lines being swapped  |

## 5.3 EP51x1-x0xx - Parameters and modes

### 5.3.1 Basic function principles

The box acquires the 90° phase-shifted digital output signal of an incremental encoder on channels A and B. The zero pulse is acquired on channel C. These signals are converted into a position value with quadruple evaluation with the aid of the quadrature encoder and the 32-bit counter. The latch and reset functions enable the exact referencing and saving of the counter value, irrespective of the speed.

Incremental encoders divide a 360° rotation of the encoder axis into individual steps (increments) and mark a full revolution by means of a special mark (zero pulse).

The phase angle between the signals on channels A and B sets the counting direction.

Up: signal on channel A leads signal on channel B by 90°

Down: signal on channel A lags signal on channel B by 90°

In case of single evaluation, the positive edges on channel A are counted.

In case of quadruple evaluation, the positive and negative edges on channel A and channel B are counted.

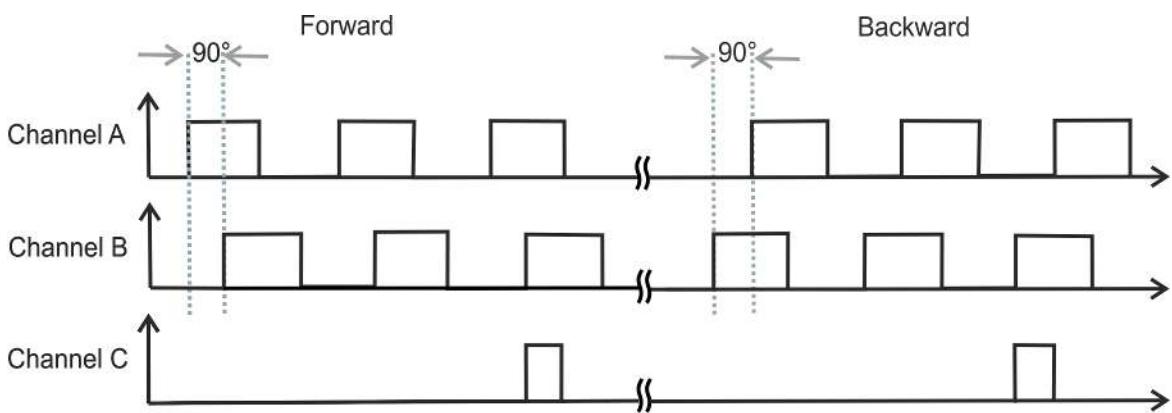


Fig. 13: Quadrature decoder

Whereas absolute value encoders deliver an absolute and unambiguous position value over the complete travel path directly after switching on, it is necessary with incremental encoders to perform a reference run (homing) after switching on in order to determine an unambiguous position.

Referencing can be carried out, for example, with the aid of reference cams or using the zero pulse of the encoder.

## 5.3.2 Process data

### 16 or 32 bit process data

The Box can be operated with 16 bit process data (default) or 32 bit process data. This can be set via the *Predefined PDO Assignment* in the *Process Data* table tab.

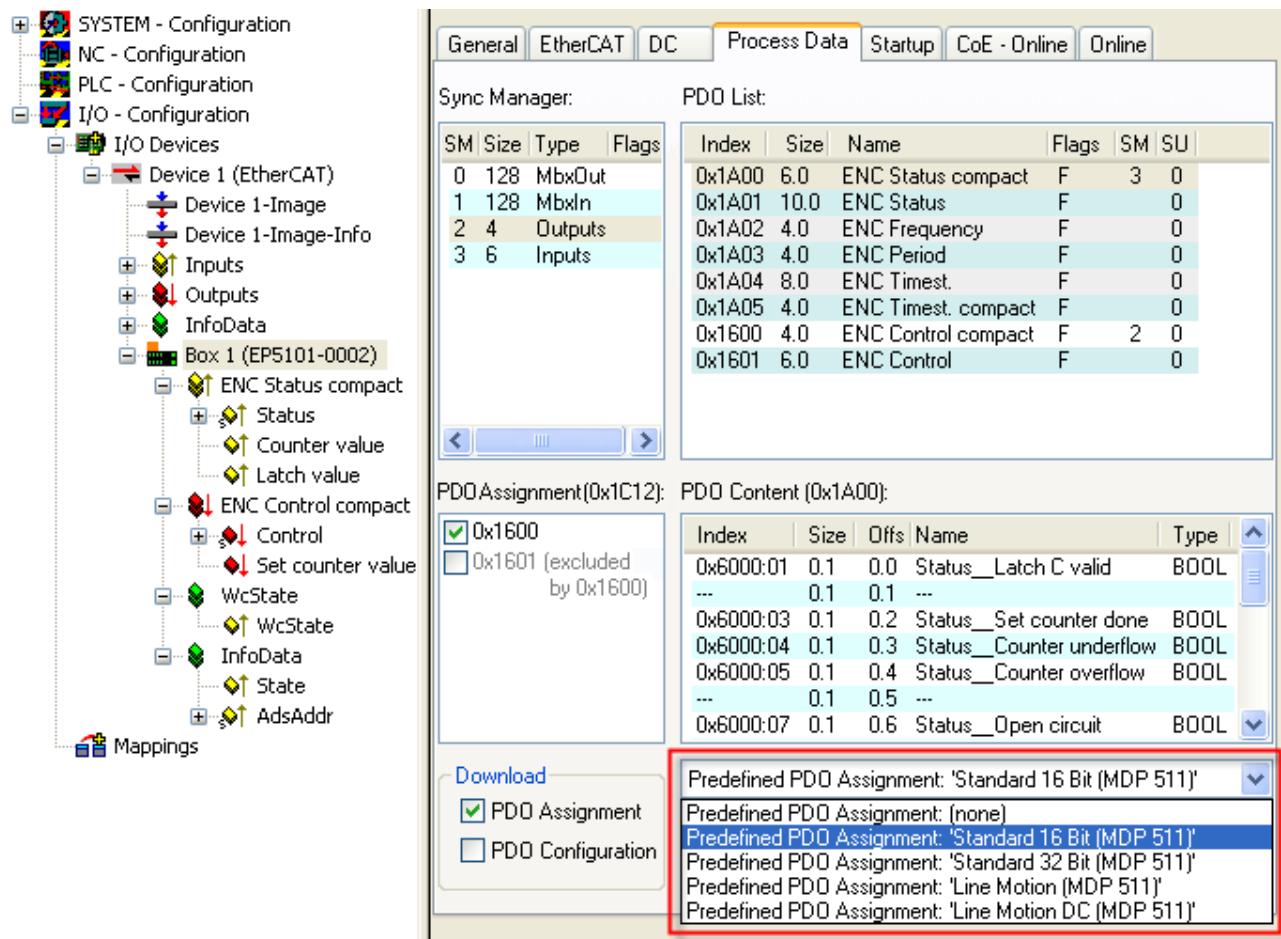


Fig. 14: 16 or 32 bit process data

**Main PDO**

Selection of basic process data

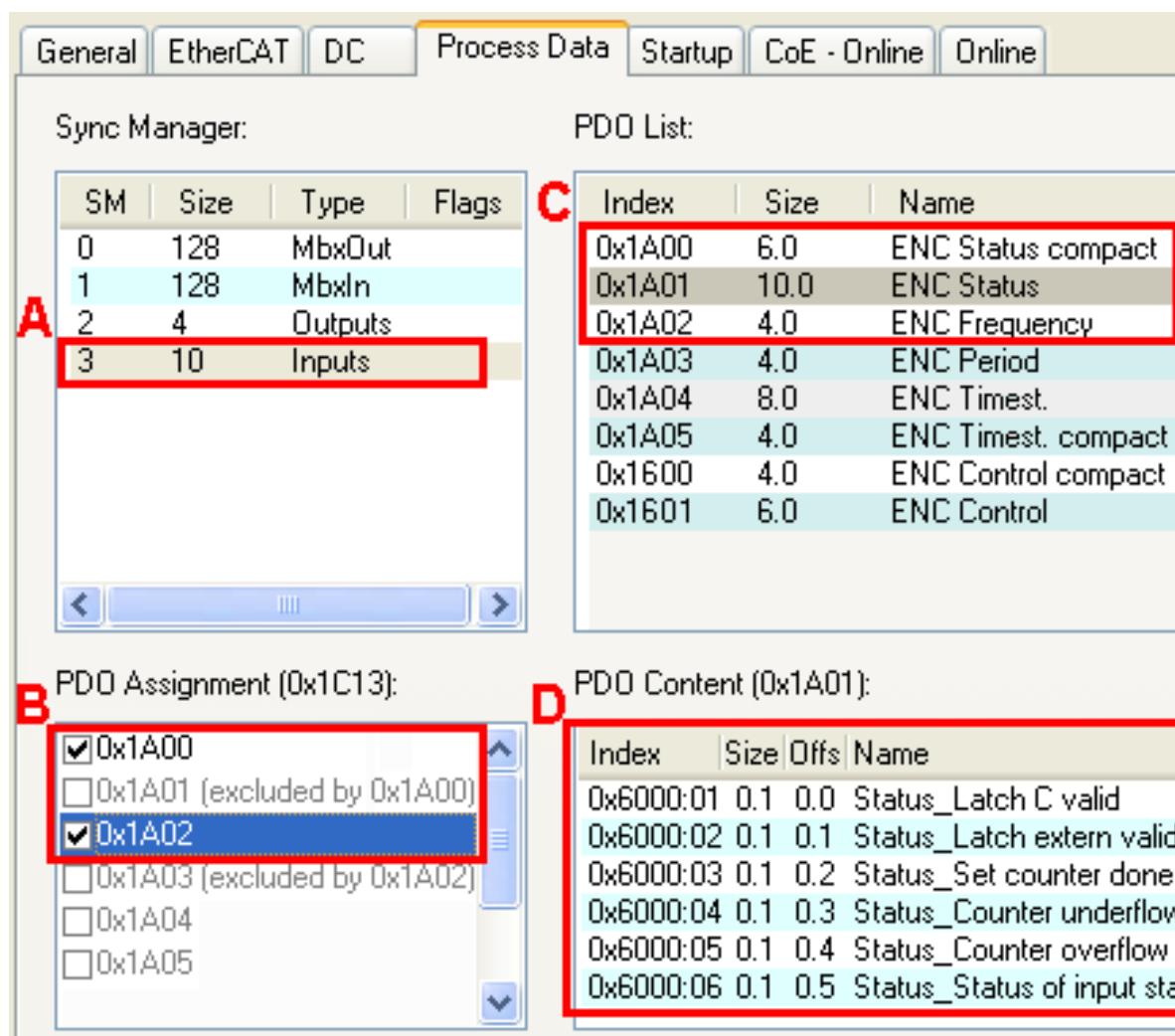


Fig. 15: Main PDO example

A: Selection of data direction: input or output  
 B: Selection of (optional) PDOs (process data objects)

C: Explanatory notes for PDOs

D: PDO content

- **compact:** The process data can be represented with 16 bits (*compact*) or with 32 bits.

**Optional PDOs**

Optional PDOs, in addition to the main PDO:

- PDO 1 (0x1A02 or 0x1A03): The **frequency** or the **period** can be selected as optional PDO 1.
- PDO 2 (0x1A04 or 0x1A05): In one of the DC modes a 32 bit or 64 bit **timestamp** can be selected. The timestamp specifies the time of the last registered increment edge, based on the Distributed Clocks system.

**PDO assignment and contents**

The PDO assignment and contents may differ for different Boxes. For PDO content and assignment please refer to the

- Process Data tab of the TwinCAT System Manager or the
- PDOs assignment chapter for the respective Box.

### 5.3.2.1 EP5101-x002 - PDO assignment

General EtherCAT DC Process Data Startup CoE - Online Online

| Sync Manager: |      |         |       | PDO List: |      |                     |       |    |    |
|---------------|------|---------|-------|-----------|------|---------------------|-------|----|----|
| SM            | Size | Type    | Flags | Index     | Size | Name                | Flags | SM | SU |
| 0             | 128  | MbxOut  |       | 0x1A00    | 6.0  | ENC Status compact  | F     | 3  | 0  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 10.0 | ENC Status          | F     |    | 0  |
| 2             | 4    | Outputs |       | 0x1A02    | 4.0  | ENC Frequency       | F     |    | 0  |
| 3             | 6    | Inputs  |       | 0x1A03    | 4.0  | ENC Period          | F     |    | 0  |
|               |      |         |       | 0x1A04    | 8.0  | ENC Timest.         | F     |    | 0  |
|               |      |         |       | 0x1A05    | 4.0  | ENC Timest. compact | F     |    | 0  |
|               |      |         |       | 0x1600    | 4.0  | ENC Control compact | F     | 2  | 0  |
|               |      |         |       | 0x1601    | 6.0  | ENC Control         | F     |    | 0  |

PDO Assignment (0x1C13):

|  |
|--|
| <input checked="" type="checkbox"/> 0x1A00           |
| <input type="checkbox"/> 0x1A01 (excluded by 0x1A00) |
| <input type="checkbox"/> 0x1A02                      |
| <input type="checkbox"/> 0x1A03                      |
| <input type="checkbox"/> 0x1A04                      |
| <input type="checkbox"/> 0x1A05                      |

PDO Content (0x1A00):

| Index     | Size | Offs | Name                       | Type | Default (hex) |
|-----------|------|------|----------------------------|------|---------------|
| 0x6000:01 | 0.1  | 0.0  | Status_Latch C valid       | BOOL |               |
| --        | 0.1  | 0.1  | --                         |      |               |
| 0x6000:03 | 0.1  | 0.2  | Status_Set counter done    | BOOL |               |
| 0x6000:04 | 0.1  | 0.3  | Status_Counter underflow   | BOOL |               |
| 0x6000:05 | 0.1  | 0.4  | Status_Counter overflow    | BOOL |               |
| --        | 0.1  | 0.5  | --                         |      |               |
| 0x6000:07 | 0.1  | 0.6  | Status_Open circuit        | BOOL |               |
| 0x6000:08 | 0.1  | 0.7  | Status_Extrapolation stall | BOOL |               |
| 0x6000:09 | 0.1  | 1.0  | Status_Status of input A   | BOOL |               |
| 0x6000:0A | 0.1  | 1.1  | Status_Status of input B   | BOOL |               |
| 0x6000:0B | 0.1  | 1.2  | Status_Status of input C   | BOOL |               |
| --        | 0.2  | 1.3  | --                         |      |               |
| 0x1C32:20 | 0.1  | 1.5  | Status_Sync error          | BOOL |               |
| 0x1800:07 | 0.1  | 1.6  | Status_TxPDO State         | BOOL |               |
| 0x1800:09 | 0.1  | 1.7  | Status_TxPDO Toggle        | BOOL |               |
| 0x6000:11 | 2.0  | 2.0  | Counter value              | UINT |               |
| 0x6000:12 | 2.0  | 4.0  | Latch value                | UINT |               |
|           |      | 6.0  |                            |      |               |

Download  PDO Assignment  PDO Configuration

Predefined PDO Assignment: "Standard 16 Bit (MDP 511)"

Load PDO info from device

Sync Unit Assignment...

#### PDO Assignment

To configure the process data, select the required Sync Manager (SM 2 or SM 3 can be changed) in the *Sync Manager* field at the top left (see illustration above). The process data assigned to this Sync Manager can then be switched on or off in the *PDO Assignment* field below. Restarting the EtherCAT system, or reloading the configuration in Config mode (F4), causes the EtherCAT communication to restart, and the process data is transferred from the box.

| SM2, PDO Assignment 0x1C12 |                        |                 |                     |  |
|----------------------------|------------------------|-----------------|---------------------|--|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)   |
| 0x1600 (default)           | 0x1601                 | 4.0             | ENC Control compact | 0x7000:01 [► 86] - Enable Latch C<br>0x7000:03 [► 86] - Set counter<br>0x7000:11 [► 86] - Set counter value (16-bit) |
| 0x1601                     | 0x1600                 | 6.0             | ENC Control         | 0x7000:01 [► 86] - Enable Latch C<br>0x7000:03 [► 86] - Set counter<br>0x7000:11 [► 86] - Set counter value (32-bit) |

| SM3, PDO Assignment 0x1C13 |                        |                 |                     |   |
|----------------------------|------------------------|-----------------|---------------------|---|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
| 0x1A00<br>(default)        | 0x1A01                 | 6.0             | ENC Status compact  | 0x6000:01 [▶ 85] - Latch C valid<br>0x6000:03 [▶ 85] - Set counter done<br>0x6000:04 [▶ 85] - Counter underflow<br>0x6000:05 [▶ 85] - Counter overflow<br>0x6000:07 [▶ 85] - Open circuit<br>0x6000:08 [▶ 85] - Extrapolation stall<br>0x6000:09 [▶ 85] - Status of input A<br>0x6000:0A [▶ 85] - Status of input B<br>0x6000:0B [▶ 85] - Status of input C<br>0x1C32:20 [▶ 94] - Sync error<br>0x1800:07 [▶ 88] - TxPDO State<br>0x1800:09 [▶ 88] - TxPDO Toggle<br>0x6000:11 [▶ 85] - Counter value (16-Bit)<br>0x6000:12 [▶ 85] - Latch value (16-Bit) |
| 0x1A01                     | 0x1A00                 | 10.0            | ENC Status          | 0x6000:01 [▶ 85] - Latch C valid<br>0x6000:03 [▶ 85] - Set counter done<br>0x6000:04 [▶ 85] - Counter underflow<br>0x6000:05 [▶ 85] - Counter overflow<br>0x6000:07 [▶ 85] - Open circuit<br>0x6000:08 [▶ 85] - Extrapolation stall<br>0x6000:09 [▶ 85] - Status of input A<br>0x6000:0A [▶ 85] - Status of input B<br>0x6000:0B [▶ 85] - Status of input C<br>0x1C32:20 [▶ 94] - Sync error<br>0x1800:07 [▶ 88] - TxPDO State<br>0x1800:09 [▶ 88] - TxPDO Toggle<br>0x6000:11 [▶ 85] - Counter value (32-Bit)<br>0x6000:12 [▶ 85] - Latch value (32-Bit) |
| 0x1A02                     | 0x1A03                 | 4.0             | ENC Frequency       | 0x6000:13 [▶ 85] - Frequency value  |
| 0x1A03                     | 0x1A02                 | 4.0             | ENC Period          | 0x6000:14 [▶ 85] - Period value   |
| 0x1A04                     | 0x1A05                 | 8.0             | ENC Timest.         | 0x6000:16 [▶ 85] - timestamp (64-bit)   |
| 0x1A05                     | 0x1A04                 | 4.0             | ENC Timest. compact | 0x6000:16 [▶ 85] - timestamp compact (32-bit)   |

## PDO Assignment

To configure the process data, select the required Sync Manager (SM 2 or SM 3 can be changed) in the *Sync Manager* field at the top left (see illustration above). The process data assigned to this Sync Manager can then be switched on or off in the *PDO Assignment* field below. Restarting the EtherCAT system, or reloading the configuration in Config mode (F4), causes the EtherCAT communication to restart, and the process data is transferred from the box.

| SM2, PDO Assignment 0x1C12 |                        |                 |                     |   |
|----------------------------|------------------------|-----------------|---------------------|---|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
| 0x1600<br>(default)        | 0x1601                 | 4.0             | ENC Control compact | 0x7000:01 [▶ 114] - Enable Latch C<br>0x7000:02 [▶ 114] - Enable Latch extern on positive edge<br>0x7000:03 [▶ 114] - Set counter<br>0x7000:04 [▶ 114] - Enable Latch extern on negative edge<br>0x7000:11 [▶ 114] - Set counter value (16-bit) |
| 0x1601                     | 0x1600                 | 6.0             | ENC Control         | 0x7000:01 [▶ 114] - Enable Latch C<br>0x7000:02 [▶ 114] - Enable Latch extern on positive edge<br>0x7000:03 [▶ 114] - Set counter<br>0x7000:04 [▶ 114] - Enable Latch extern on negative edge<br>0x7000:11 [▶ 114] - Set counter value (32-bit) |

| SM3, PDO Assignment 0x1C13 |                        |                 |                     |   |
|----------------------------|------------------------|-----------------|---------------------|---|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
| 0x1A00<br>(default)        | 0x1A01                 | 6.0             | ENC Status compact  | 0x6000:01 [▶ 113] - Latch C valid<br>0x6000:02 [▶ 113] - Latch extern valid<br>0x6000:03 [▶ 113] - Set counter done<br>0x6000:04 [▶ 113] - Counter underflow<br>0x6000:05 [▶ 113] - Counter overflow<br>0x6000:06 [▶ 113] - Status of input status<br>0x6000:07 [▶ 113] - Open circuit<br>0x6000:08 [▶ 113] - Extrapolation stall<br>0x6000:09 [▶ 113] - Status of input A<br>0x6000:0A [▶ 113] - Status of input B<br>0x6000:0B [▶ 113] - Status of input C<br>0x6000:0C [▶ 113] - Status of input gate<br>0x6000:0D [▶ 113] - Status of extern latch<br>0x1C32:20 [▶ 120] - Sync error<br>0x1800:07 [▶ 116] - TxPDO State<br>0x1800:09 [▶ 116] - TxPDO Toggle<br>0x6000:11 [▶ 113] - Counter value (16-Bit)<br>0x6000:12 [▶ 113] - Latch value (16-Bit) |
| 0x1A01                     | 0x1A00                 | 10.0            | ENC Status          | 0x6000:01 [▶ 113] - Latch C valid<br>0x6000:02 [▶ 113] - Latch extern valid<br>0x6000:03 [▶ 113] - Set counter done<br>0x6000:04 [▶ 113] - Counter underflow<br>0x6000:05 [▶ 113] - Counter overflow<br>0x6000:06 [▶ 113] - Status of input status<br>0x6000:07 [▶ 113] - Open circuit<br>0x6000:08 [▶ 113] - Extrapolation stall<br>0x6000:09 [▶ 113] - Status of input A<br>0x6000:0A [▶ 113] - Status of input B<br>0x6000:0B [▶ 113] - Status of input C<br>0x6000:0C [▶ 113] - Status of input gate<br>0x6000:0D [▶ 113] - Status of extern latch<br>0x1C32:20 [▶ 120] - Sync error<br>0x1800:07 [▶ 116] - TxPDO State<br>0x1800:09 [▶ 116] - TxPDO Toggle<br>0x6000:11 [▶ 113] - Counter value (32-Bit)<br>0x6000:12 [▶ 113] - Latch value (32-Bit) |
| 0x1A02                     | 0x1A03                 | 4.0             | ENC Frequency       | 0x6000:13 [▶ 113] - Frequency value   |
| 0x1A03                     | 0x1A02                 | 4.0             | ENC Period          | 0x6000:14 [▶ 113] - Period value  |
| 0x1A04                     | 0x1A05                 | 8.0             | ENC Timest.         | 0x6000:16 [▶ 113] - timestamp (64-bit)  |
| 0x1A05                     | 0x1A04                 | 4.0             | ENC Timest. compact | 0x6000:16 [▶ 113] - timestamp compact (32-bit)  |

### 5.3.2.2 EP5101-0011 - PDO assignment

General | EtherCAT | DC | Process Data | Startup | CoE - Online | Online |

| Sync Manager: |      |         |       | PDO List: |      |                     |       |    |    |  |
|---------------|------|---------|-------|-----------|------|---------------------|-------|----|----|--|
| SM            | Size | Type    | Flags | Index     | Size | Name                | Flags | SM | SU |  |
| 0             | 128  | MbxOut  |       | 0x1A00    | 6.0  | ENC Status compact  | F     | 3  | 0  |  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 10.0 | ENC Status          | F     |    | 0  |  |
| 2             | 4    | Outputs |       | 0x1A02    | 4.0  | ENC Frequency       | F     |    | 0  |  |
| 3             | 6    | Inputs  |       | 0x1A03    | 4.0  | ENC Period          | F     |    | 0  |  |
|               |      |         |       | 0x1A04    | 8.0  | ENC Timest.         | F     |    | 0  |  |
|               |      |         |       | 0x1A05    | 4.0  | ENC Timest. compact | F     |    | 0  |  |
|               |      |         |       | 0x1600    | 4.0  | ENC Control compact | F     | 2  | 0  |  |
|               |      |         |       | 0x1601    | 6.0  | ENC Control         | F     |    | 0  |  |

PDO Assignment (0x1C13):

|  |
|--|
| <input checked="" type="checkbox"/> 0x1A00           |
| <input type="checkbox"/> 0x1A01 (excluded by 0x1A00) |
| <input type="checkbox"/> 0x1A02                      |
| <input type="checkbox"/> 0x1A03                      |
| <input type="checkbox"/> 0x1A04                      |
| <input type="checkbox"/> 0x1A05                      |

PDO Content (0x1A00):

| Index     | Size | Offs | Name                          | Type | Default (hex) |
|-----------|------|------|-------------------------------|------|---------------|
| 0x6000:01 | 0.1  | 0.0  | Status_Latch C valid          | BOOL |               |
| 0x6000:02 | 0.1  | 0.1  | Status_Latch extem valid      | BOOL |               |
| 0x6000:03 | 0.1  | 0.2  | Status_Set counter done       | BOOL |               |
| 0x6000:04 | 0.1  | 0.3  | Status_Counter underflow      | BOOL |               |
| 0x6000:05 | 0.1  | 0.4  | Status_Counter overflow       | BOOL |               |
| 0x6000:06 | 0.1  | 0.5  | Status_Status of input status | BOOL |               |
| 0x6000:07 | 0.1  | 0.6  | Status_Open circuit           | BOOL |               |
| 0x6000:08 | 0.1  | 0.7  | Status_Extrapolation stall    | BOOL |               |
| 0x6000:09 | 0.1  | 1.0  | Status_Status of input A      | BOOL |               |
| 0x6000:0A | 0.1  | 1.1  | Status_Status of input B      | BOOL |               |
| 0x6000:0B | 0.1  | 1.2  | Status_Status of input C      | BOOL |               |
| 0x6000:0C | 0.1  | 1.3  | Status_Status of input gate   | BOOL |               |
| 0x6000:0D | 0.1  | 1.4  | Status_Status of extem latch  | BOOL |               |
| 0x1C32:20 | 0.1  | 1.5  | Status_Sync error             | BOOL |               |
| 0x1800:07 | 0.1  | 1.6  | Status_TxPDO State            | BOOL |               |
| 0x1800:09 | 0.1  | 1.7  | Status_TxPDO Toggle           | BOOL |               |
| 0x6000:11 | 2.0  | 2.0  | Counter value                 | UINT |               |
| 0x6000:12 | 2.0  | 4.0  | Latch value                   | UINT |               |
|           |      | 6.0  |                               |      |               |

Download  
 PDO Assignment  
 PDO Configuration

Predefined PDO Assignment: "Standard 16 Bit (MDP 511)"

#### PDO Assignment

To configure the process data, select the required Sync Manager (SM 2 or SM 3 can be changed) in the *Sync Manager* field at the top left (see illustration above). The process data assigned to this Sync Manager can then be switched on or off in the *PDO Assignment* field below. Restarting the EtherCAT system, or reloading the configuration in Config mode (F4), causes the EtherCAT communication to restart, and the process data is transferred from the box.

**SM2, PDO Assignment 0x1C12**

| Index            | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
|------------------|------------------------|-----------------|---------------------|---|
| 0x1600 (default) | 0x1601                 | 4.0             | ENC Control compact | 0x7000:01 [▶ 101] - Enable Latch C<br>0x7000:02 [▶ 101] - Enable Latch extern on positive edge<br>0x7000:03 [▶ 101] - Set counter<br>0x7000:04 [▶ 101] - Enable Latch extern on negative edge<br>0x7000:11 [▶ 101] - Set counter value (16-bit) |
| 0x1601           | 0x1600                 | 6.0             | ENC Control         | 0x7000:01 [▶ 101] - Enable Latch C<br>0x7000:02 [▶ 101] - Enable Latch extern on positive edge<br>0x7000:03 [▶ 101] - Set counter<br>0x7000:04 [▶ 101] - Enable Latch extern on negative edge<br>0x7000:11 [▶ 101] - Set counter value (32-bit) |

**SM3, PDO Assignment 0x1C13**

| Index            | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content   |
|------------------|------------------------|-----------------|---------------------|---|
| 0x1A00 (default) | 0x1A01                 | 6.0             | ENC Status compact  | 0x6000:01 [▶ 100] - Latch C valid<br>0x6000:02 [▶ 100] - Latch extern valid<br>0x6000:03 [▶ 100] - Set counter done<br>0x6000:04 [▶ 100] - Counter underflow<br>0x6000:05 [▶ 100] - Counter overflow<br>0x6000:06 [▶ 100] - Status of input status<br>0x6000:07 [▶ 100] - Open circuit<br>0x6000:08 [▶ 100] - Extrapolation stall<br>0x6000:09 [▶ 100] - Status of input A<br>0x6000:0A [▶ 100] - Status of input B<br>0x6000:0B [▶ 100] - Status of input C<br>0x6000:0C [▶ 100] - Status of input gate<br>0x6000:0D [▶ 100] - Status of extern latch<br>0x1C32:20 [▶ 107] - Sync error<br>0x1800:07 [▶ 103] - TxPDO State<br>0x1800:09 [▶ 103] - TxPDO Toggle<br>0x6000:11 [▶ 100] - Counter value (16-Bit)<br>0x6000:12 [▶ 100] - Latch value (16-Bit) |
| 0x1A01           | 0x1A00                 | 10.0            | ENC Status          | 0x6000:01 [▶ 100] - Latch C valid<br>0x6000:02 [▶ 100] - Latch extern valid<br>0x6000:03 [▶ 100] - Set counter done<br>0x6000:04 [▶ 100] - Counter underflow<br>0x6000:05 [▶ 100] - Counter overflow<br>0x6000:06 [▶ 100] - Status of input status<br>0x6000:07 [▶ 100] - Open circuit<br>0x6000:08 [▶ 100] - Extrapolation stall<br>0x6000:09 [▶ 100] - Status of input A<br>0x6000:0A [▶ 100] - Status of input B<br>0x6000:0B [▶ 100] - Status of input C<br>0x6000:0C [▶ 100] - Status of input gate<br>0x6000:0D [▶ 100] - Status of extern latch<br>0x1C32:20 [▶ 107] - Sync error<br>0x1800:07 [▶ 103] - TxPDO State<br>0x1800:09 [▶ 103] - TxPDO Toggle<br>0x6000:11 [▶ 100] - Counter value (32-Bit)<br>0x6000:12 [▶ 100] - Latch value (32-Bit) |
| 0x1A02           | 0x1A03                 | 4.0             | ENC Frequency       | 0x6000:13 [▶ 100] - Frequency value   |
| 0x1A03           | 0x1A02                 | 4.0             | ENC Period          | 0x6000:14 [▶ 100] - Period value  |
| 0x1A04           | 0x1A05                 | 8.0             | ENC Timest.         | 0x6000:16 [▶ 100] - timestamp (64-bit)  |
| 0x1A05           | 0x1A04                 | 4.0             | ENC Timest. compact | 0x6000:16 [▶ 100] - timestamp compact (32-bit)  |

### 5.3.2.3 EP5101-2011 - PDO assignment

General | EtherCAT | DC | Process Data | Startup | CoE - Online | Online |

| Sync Manager: |      |         |       | PDO List: |      |                     |       |    |    |
|---------------|------|---------|-------|-----------|------|---------------------|-------|----|----|
| SM            | Size | Type    | Flags | Index     | Size | Name                | Flags | SM | SU |
| 0             | 128  | MbxOut  |       | 0x1A00    | 10.0 | ENC Status          | F     | 0  |    |
| 1             | 128  | MbxIn   |       | 0x1A01    | 6.0  | ENC Status compact  | F     | 3  | 0  |
| 2             | 4    | Outputs |       | 0x1A02    | 4.0  | ENC Period          | F     | 0  |    |
| 3             | 6    | Inputs  |       | 0x1A03    | 4.0  | ENC Frequency       | F     | 0  |    |
|               |      |         |       | 0x1A04    | 8.0  | ENC Timest.         | F     | 0  |    |
|               |      |         |       | 0x1A05    | 4.0  | ENC Timest. compact | F     | 0  |    |
|               |      |         |       | 0x1600    | 6.0  | ENC Control         | F     | 0  |    |
|               |      |         |       | 0x1601    | 4.0  | ENC Control compact | F     | 2  | 0  |

PDO Assignment (0x1C13):

|  |
|--|
| <input type="checkbox"/> 0x1A00 (excluded by 0x1A01) |
| <input checked="" type="checkbox"/> 0x1A01           |
| <input type="checkbox"/> 0x1A02                      |
| <input type="checkbox"/> 0x1A03                      |
| <input type="checkbox"/> 0x1A04                      |
| <input type="checkbox"/> 0x1A05                      |

PDO Content (0x1A01):

| Index     | Size | Offs | Name                          | Type | Default (hex) |
|-----------|------|------|-------------------------------|------|---------------|
| 0x6000:01 | 0.1  | 0.0  | Status_Latch C valid          | BOOL |               |
| 0x6000:02 | 0.1  | 0.1  | Status_Latch extem valid      | BOOL |               |
| 0x6000:03 | 0.1  | 0.2  | Status_Set counter done       | BOOL |               |
| --        | 0.2  | 0.3  | --                            |      |               |
| 0x6000:06 | 0.1  | 0.5  | Status_Status of input status | BOOL |               |
| 0x6000:07 | 0.1  | 0.6  | Status_Open circuit           | BOOL |               |
| --        | 0.1  | 0.7  | --                            |      |               |
| 0x6000:09 | 0.1  | 1.0  | Status_Status of input A      | BOOL |               |
| 0x6000:0A | 0.1  | 1.1  | Status_Status of input B      | BOOL |               |
| 0x6000:0B | 0.1  | 1.2  | Status_Status of input C      | BOOL |               |
| 0x6000:0C | 0.1  | 1.3  | Status_Status of input gate   | BOOL |               |
| 0x6000:0D | 0.1  | 1.4  | Status_Status of extem latch  | BOOL |               |
| 0x6000:0E | 0.1  | 1.5  | Status_Sync error             | BOOL |               |
| 0x6000:0F | 0.1  | 1.6  | Status_TxPDO State            | BOOL |               |
| 0x6000:10 | 0.1  | 1.7  | Status_TxPDO Toggle           | BOOL |               |
| 0x6000:11 | 2.0  | 2.0  | Counter value                 | UINT |               |
| 0x6000:12 | 2.0  | 4.0  | Latch value                   | UINT |               |
|           |      | 6.0  |                               |      |               |

Download  
 PDO Assignment  
 PDO Configuration

Predefined PDO Assignment: 'Standard 16 Bit (MDP 511)'

Fig. 16: PDO assignment and content, EP5101-2011

#### PDO Assignment

To configure the process data, select the required Sync Manager (SM 2 or SM 3 can be changed) in the *Sync Manager* field at the top left (see illustration above). The process data assigned to this Sync Manager can then be switched on or off in the *PDO Assignment* field below. Restarting the EtherCAT system, or reloading the configuration in Config mode (F4), causes the EtherCAT communication to restart, and the process data is transferred from the box.

| <b>SM2, PDO Assignment 0x1C12</b> |                               |                        |                     |   |
|-----------------------------------|-------------------------------|------------------------|---------------------|---|
| <b>Index</b>                      | <b>Index of excluded PDOs</b> | <b>Size (byte.bit)</b> | <b>Name</b>         | <b>PDO Content (index - name)</b>   |
| 0x1600                            | 0x1601                        | 6.0                    | ENC Control         | 0x7000:01 - Enable Latch C<br>0x7000:02 - Enable Latch extern on positive edge<br>0x7000:03 - Set counter<br>0x7000:04 - Enable Latch extern on negative edge<br>0x7000:11 - Set counter value (32-bit) |
| 0x1601 (default)                  | 0x1600                        | 4.0                    | ENC Control compact | 0x7000:01 - Enable Latch C<br>0x7000:02 - Enable Latch extern on positive edge<br>0x7000:03 - Set counter<br>0x7000:04 - Enable Latch extern on negative edge<br>0x7000:11 - Set counter value (16-bit) |

| <b>SM3, PDO Assignment 0x1C13</b> |                               |                        |                     |   |
|-----------------------------------|-------------------------------|------------------------|---------------------|---|
| <b>Index</b>                      | <b>Index of excluded PDOs</b> | <b>Size (byte.bit)</b> | <b>Name</b>         | <b>PDO Content (index - name)</b>   |
| 0x1A00                            | 0x1A01                        | 10.0                   | ENC Status          | 0x6000:01 - Latch C valid<br>0x6000:02 - Latch extern valid<br>0x6000:03 - Set counter done<br>0x6000:06 - Status of input status<br>0x6000:07 - Open circuit<br>0x6000:09 - Status of input A<br>0x6000:0A - Status of input B<br>0x6000:0B - Status of input C<br>0x6000:0C - Status of input gate<br>0x6000:0D - Status of extern latch<br>0x6000:0E - Sync error<br>0x6000:0F - TxPDO State<br>0x6000:10 - TxPDO Toggle<br>0x6000:11 - Counter value (32-Bit)<br>0x6000:12 - Latch value (32-Bit) |
| 0x1A01 (default)                  | 0x1A00                        | 6.0                    | ENC Status compact  | 0x6000:01 - Latch C valid<br>0x6000:02 - Latch extern valid<br>0x6000:03 - Set counter done<br>0x6000:06 - Status of input status<br>0x6000:07 - Open circuit<br>0x6000:09 - Status of input A<br>0x6000:0A - Status of input B<br>0x6000:0B - Status of input C<br>0x6000:0C - Status of input gate<br>0x6000:0D - Status of extern latch<br>0x6000:0E - Sync error<br>0x6000:0F - TxPDO State<br>0x6000:10 - TxPDO Toggle<br>0x6000:11 - Counter value (16-Bit)<br>0x6000:12 - Latch value (16-Bit) |
| 0x1A02                            | 0x1A03                        | 4.0                    | ENC Period          | 0x6000:14 - Period value  |
| 0x1A03                            | 0x1A02                        | 4.0                    | ENC Frequency       | 0x6000:13 - Frequency value   |
| 0x1A04                            | 0x1A05                        | 8.0                    | ENC Timest.         | 0x6000:16 - timestamp (64-bit)  |
| 0x1A05                            | 0x1A04                        | 4.0                    | ENC Timest. compact | 0x6000:16 - timestamp compact (32-bit)  |

### 5.3.2.4 EP5151-0002 - PDO assignment

General | EtherCAT | DC | Process Data | Startup | CoE - Online | Online |

| Sync Manager: |      |         |       | PDO List: |      |                     |       |    |    |  |
|---------------|------|---------|-------|-----------|------|---------------------|-------|----|----|--|
| SM            | Size | Type    | Flags | Index     | Size | Name                | Flags | SM | SU |  |
| 0             | 128  | MbxOut  |       | 0x1A00    | 6.0  | ENC Status compact  | F     | 3  | 0  |  |
| 1             | 128  | MbxIn   |       | 0x1A01    | 10.0 | ENC Status          | F     |    | 0  |  |
| 2             | 4    | Outputs |       | 0x1A02    | 4.0  | ENC Frequency       | F     |    | 0  |  |
| 3             | 6    | Inputs  |       | 0x1A03    | 4.0  | ENC Period          | F     |    | 0  |  |
|               |      |         |       | 0x1A04    | 8.0  | ENC Timest.         | F     |    | 0  |  |
|               |      |         |       | 0x1A05    | 4.0  | ENC Timest. compact | F     |    | 0  |  |
|               |      |         |       | 0x1600    | 4.0  | ENC Control compact | F     | 2  | 0  |  |
|               |      |         |       | 0x1601    | 6.0  | ENC Control         | F     |    | 0  |  |

PDO Assignment (0x1C13):

|  |
|--|
| <input checked="" type="checkbox"/> 0x1A00           |
| <input type="checkbox"/> 0x1A01 (excluded by 0x1A00) |
| <input type="checkbox"/> 0x1A02                      |
| <input type="checkbox"/> 0x1A03                      |
| <input type="checkbox"/> 0x1A04                      |
| <input type="checkbox"/> 0x1A05                      |

PDO Content (0x1A00):

| Index     | Size | Offs | Name                          | Type | Default (hex) |
|-----------|------|------|-------------------------------|------|---------------|
| 0x6000:01 | 0.1  | 0.0  | Status_Latch C valid          | BOOL |               |
| 0x6000:02 | 0.1  | 0.1  | Status_Latch extem valid      | BOOL |               |
| 0x6000:03 | 0.1  | 0.2  | Status_Set counter done       | BOOL |               |
| 0x6000:04 | 0.1  | 0.3  | Status_Counter underflow      | BOOL |               |
| 0x6000:05 | 0.1  | 0.4  | Status_Counter overflow       | BOOL |               |
| 0x6000:06 | 0.1  | 0.5  | Status_Status of input status | BOOL |               |
| 0x6000:07 | 0.1  | 0.6  | Status_Open circuit           | BOOL |               |
| 0x6000:08 | 0.1  | 0.7  | Status_Extrapolation stall    | BOOL |               |
| 0x6000:09 | 0.1  | 1.0  | Status_Status of input A      | BOOL |               |
| 0x6000:0A | 0.1  | 1.1  | Status_Status of input B      | BOOL |               |
| 0x6000:0B | 0.1  | 1.2  | Status_Status of input C      | BOOL |               |
| 0x6000:0C | 0.1  | 1.3  | Status_Status of input gate   | BOOL |               |
| 0x6000:0D | 0.1  | 1.4  | Status_Status of extem latch  | BOOL |               |
| 0x1C32:20 | 0.1  | 1.5  | Status_Sync error             | BOOL |               |
| 0x1800:07 | 0.1  | 1.6  | Status_TxPDO State            | BOOL |               |
| 0x1800:09 | 0.1  | 1.7  | Status_TxPDO Toggle           | BOOL |               |
| 0x6000:11 | 2.0  | 2.0  | Counter value                 | UINT |               |
| 0x6000:12 | 2.0  | 4.0  | Latch value                   | UINT |               |
|           |      | 6.0  |                               |      |               |

Download  
 PDO Assignment  
 PDO Configuration

Predefined PDO Assignment: "Standard 16 Bit (MDP 511)"

#### PDO Assignment

To configure the process data, select the required Sync Manager (SM 2 or SM 3 can be changed) in the *Sync Manager* field at the top left (see illustration above). The process data assigned to this Sync Manager can then be switched on or off in the *PDO Assignment* field below. Restarting the EtherCAT system, or reloading the configuration in Config mode (F4), causes the EtherCAT communication to restart, and the process data is transferred from the box.

| SM2, PDO Assignment 0x1C12 |                        |                 |                     |   |
|----------------------------|------------------------|-----------------|---------------------|---|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
| 0x1600<br>(default)        | 0x1601                 | 4.0             | ENC Control compact | 0x7000:01 [P 114] - Enable Latch C<br>0x7000:02 [P 114] - Enable Latch extern on positive edge<br>0x7000:03 [P 114] - Set counter<br>0x7000:04 [P 114] - Enable Latch extern on negative edge<br>0x7000:11 [P 114] - Set counter value (16-bit) |
| 0x1601                     | 0x1600                 | 6.0             | ENC Control         | 0x7000:01 [P 114] - Enable Latch C<br>0x7000:02 [P 114] - Enable Latch extern on positive edge<br>0x7000:03 [P 114] - Set counter<br>0x7000:04 [P 114] - Enable Latch extern on negative edge<br>0x7000:11 [P 114] - Set counter value (32-bit) |

| SM3, PDO Assignment 0x1C13 |                        |                 |                     |   |
|----------------------------|------------------------|-----------------|---------------------|---|
| Index                      | Index of excluded PDOs | Size (byte.bit) | Name                | PDO Content (index - name)  |
| 0x1A00<br>(default)        | 0x1A01                 | 6.0             | ENC Status compact  | 0x6000:01 [P 113] - Latch C valid<br>0x6000:02 [P 113] - Latch extern valid<br>0x6000:03 [P 113] - Set counter done<br>0x6000:04 [P 113] - Counter underflow<br>0x6000:05 [P 113] - Counter overflow<br>0x6000:06 [P 113] - Status of input status<br>0x6000:07 [P 113] - Open circuit<br>0x6000:08 [P 113] - Extrapolation stall<br>0x6000:09 [P 113] - Status of input A<br>0x6000:0A [P 113] - Status of input B<br>0x6000:0B [P 113] - Status of input C<br>0x6000:0C [P 113] - Status of input gate<br>0x6000:0D [P 113] - Status of extern latch<br>0x1C32:20 [P 120] - Sync error<br>0x1800:07 [P 116] - TxPDO State<br>0x1800:09 [P 116] - TxPDO Toggle<br>0x6000:11 [P 113] - Counter value (16-Bit)<br>0x6000:12 [P 113] - Latch value (16-Bit) |
| 0x1A01                     | 0x1A00                 | 10.0            | ENC Status          | 0x6000:01 [P 113] - Latch C valid<br>0x6000:02 [P 113] - Latch extern valid<br>0x6000:03 [P 113] - Set counter done<br>0x6000:04 [P 113] - Counter underflow<br>0x6000:05 [P 113] - Counter overflow<br>0x6000:06 [P 113] - Status of input status<br>0x6000:07 [P 113] - Open circuit<br>0x6000:08 [P 113] - Extrapolation stall<br>0x6000:09 [P 113] - Status of input A<br>0x6000:0A [P 113] - Status of input B<br>0x6000:0B [P 113] - Status of input C<br>0x6000:0C [P 113] - Status of input gate<br>0x6000:0D [P 113] - Status of extern latch<br>0x1C32:20 [P 120] - Sync error<br>0x1800:07 [P 116] - TxPDO State<br>0x1800:09 [P 116] - TxPDO Toggle<br>0x6000:11 [P 113] - Counter value (32-Bit)<br>0x6000:12 [P 113] - Latch value (32-Bit) |
| 0x1A02                     | 0x1A03                 | 4.0             | ENC Frequency       | 0x6000:13 [P 113] - Frequency value   |
| 0x1A03                     | 0x1A02                 | 4.0             | ENC Period          | 0x6000:14 [P 113] - Period value  |
| 0x1A04                     | 0x1A05                 | 8.0             | ENC Timest.         | 0x6000:16 [P 113] - timestamp (64-bit)  |
| 0x1A05                     | 0x1A04                 | 4.0             | ENC Timest. compact | 0x6000:16 [P 113] - timestamp compact (32-bit)  |

### 5.3.3 DC (Distributed Clocks)

Describes whether the module is operated with support from distributed clocks:

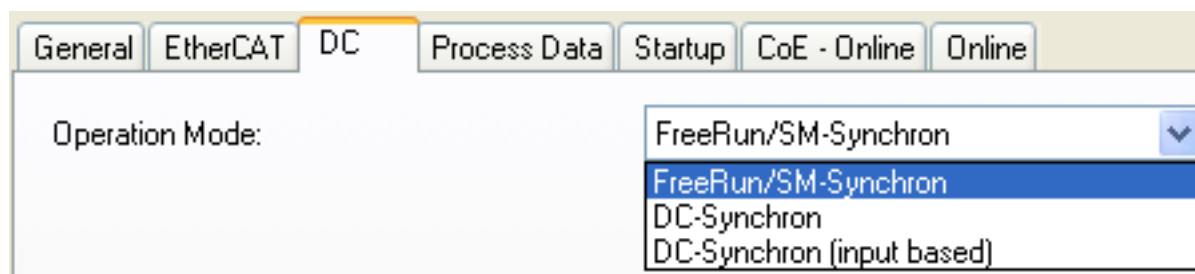


Fig. 17: Distributed Clocks

- **FreeRun:** The module operates frame-triggered. Cyclic operation is started via the SyncManagers during EtherCAT frame processing.
- **DC-Synchron:** Cyclic operation in the module is started by the local distributed clock at exact intervals. The start time is chosen such that it coincides with other output slaves in the EtherCAT system.
- **DC-Synchron (input based):** as DC-Synchron mode, with the cyclic start time chosen such that it coincides with other input slaves in the EtherCAT system.

### 5.3.4 Features CoE

Depending on the main PDO/optional PDOs further settings can be selected in the CoE list (CAN over EtherCAT).



#### Parameterization via the CoE list (CAN over EtherCAT)

Please note the following general CoE notes 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
- “CoE-Reload” for resetting the changes

The following CoE settings from object 0x8000 are possible and shown here in their default settings, based on the EP5101-0011 as an example:

| Index   | Name                     | Flags | Value                |
|---------|--------------------------|-------|----------------------|
| 8000:0  | ENC Settings             | RW    | > 23 <               |
| 8000:01 | Enable C reset           | RW    | FALSE                |
| 8000:02 | Enable extern reset      | RW    | FALSE                |
| 8000:03 | Enable up/down counter   | RW    | FALSE                |
| 8000:04 | Gate polarity            | RW    | Enable pos. gate (1) |
| 8000:08 | Disable filter           | RW    | TRUE                 |
| 8000:0A | Enable micro increments  | RW    | FALSE                |
| 8000:0B | Open circuit detection A | RW    | TRUE                 |
| 8000:0C | Open circuit detection B | RW    | TRUE                 |
| 8000:0D | Open circuit detection C | RW    | FALSE                |
| 8000:0E | Reversion of rotation    | RW    | FALSE                |
| 8000:10 | Extern reset polarity    | RW    | Rise (1)             |
| 8000:11 | Frequency window         | RW    | 0x2710 (10000)       |
| 8000:13 | Frequency scaling        | RW    | 0.01Hz (100)         |
| 8000:14 | Period scaling           | RW    | 100ns (100)          |
| 8000:15 | Frequency resolution     | RW    | 0.01Hz (100)         |
| 8000:16 | Period resolution        | RW    | 100ns (100)          |
| 8000:17 | Frequency wait time      | RW    | 0x0640 (1600)        |
| A000:0  | ENC Diag data            | RO    | > 3 <                |
| F000:0  | Modular device profile   | RO    | > 2 <                |
| F008    | Code word                | RW    | 0x00000000 (0)       |
| en1n-n  | Module list              | RO    | > 1 <                |

Fig. 18: Object 0x8000 - default, example: EP5101-0011

The parameters are explained in the object description chapter for the corresponding EtherCAT Box.

- Due to the different pin assignment, the following objects are not supported by the EP51x1-x002 modules!
  - 0x8000:02 - *Enable extern reset*
  - 0x8000:04 - *Gate polarity*
  - 0x8000:10 - *Extern reset polarity*
- Due to different firmware, the following objects are not supported by the EP5101-2011 module!
  - 0x8000:03 - *Enable up/down counter*
  - 0x8000:08 - *Disable filter*
  - 0x8000:0A - *Enable micro increments*

## Additional Notes

### Frequency

- The time window for the frequency calculation and the resolution can be parameterized in the CoE objects *Frequency window* 0x8000:11, *Frequency scaling* 0x8000:13, *Frequency resolution* 0x8000:15 and *Frequency wait time* 0x8000:17.
- The positive edges of track A are counted within the specified timeframe and the next edge including the time up to it are counted. The waiting time can be set in CoE object 0x8000:17 *Frequency Wait Time* (unit: ms). The default value is 1.6 sec. This is also the maximum value.
- The time window is 10 ms (default), min. 1 µs. With the default setting it is possible to measure frequencies up to approx. 800 kHz. At higher frequencies a smaller value must be selected for the timeframe.
- The time is measured with a resolution of 100 ns.
- This calculation is carried out in the slave without reference to the distributed clocks system. It is therefore independent of the DC mode.
- No frequency measurement is possible if the counter is blocked by the gate. In this case the period can be measured regardless.
- A C or external reset restarts the frequency measurement. The last frequency value remains unchanged until a new frequency value is determined.

### Frequency measurement

- Basic unit 1 µs: all window sizes

### Measurement sequence

- The measurement starts with a positive edge at track A. The current counter value and time (resolution: 100 ns) are stored.
- After the measuring window time has elapsed (index 0x8000:11), the system waits for the subsequent rising edge at track A, or a maximum of 1.6 seconds, or the time from *Frequency Wait Time* 0x8000:17.
- The frequency is calculated from the edge difference and the actual elapsed time.

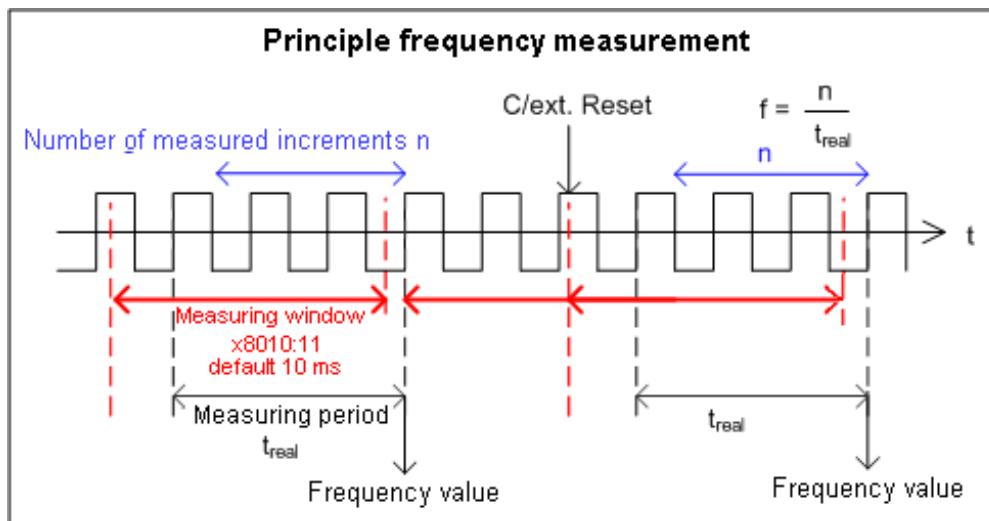


Fig. 19: Frequency measurement principle in enhanced operation mode

### Period calculation

- This calculation is carried out in the slave without reference to the distributed clocks system. It is therefore independent of the DC mode.
- During each cycle the interval between 2 positive edges of input A is counted.
- If no edge change occurs for approx. 1.6 s, any period specification is canceled.

## Latch

- Activation of latch C input (*Enable latch C* index 0x7000:01) and saving ("latching") of the counter value
  - The counter value is saved when the first external latch pulse (positive edge at input "C") is encountered after the bit has been set (TRUE) in *Enable latch C* index 0x7000:01 (this has priority over *Enable latch extern on positive / negative edge* 0x7000:02 / 0x7000:04). The subsequent pulses at the other inputs have no influence on the latch value in index 0x6000:12 if the bit is set.
  - Note for *Latch C valid* bit: A new counter value at the latch input can only be written once the value of the *Latch C valid* bit (index 0x6000:01) is FALSE.
- Activation of the external latch input ("Gate/Latch") and latching of the counter value (index 0x7000:02, 0x7000:04) (not for product version x002)
  - When the bit is set (TRUE) in *Enable latch extern on positive edge* index 0x7000:02, the counter value is saved on the latch input (index 0x6000:12) when the first external latch pulse with rising edge is encountered. The subsequent pulses have no influence on the latch value in index 0x6000:12.
  - When the bit is set (TRUE) in *Enable latch extern on negative edge* index 0x7000:04, the counter value is saved on the latch input (index 0x6000:12) when the first external latch pulse with falling edge is encountered. The subsequent pulses have no influence on the latch value in index 0x6000:12.
  - Note for *Latch extern valid* bit: A new counter value cannot be written to the latch input until the value of the *Latch extern valid* (index 0x6000:02) is FALSE.

## Reset

- Counter reset via input C:
  - To reset the counter, set the bit in *Enable latch C* index 0x8000:01.
- Resetting the counter via the external latch input (not for product version -x002)
  - For a reset via the external latch input, set the bit in *Enable extern reset* index 0x8000:02
  - *Extern reset polarity* index 0x8000:10 can be used to select the edge for setting the counter to zero.
    - Bit not set: Counter is set to zero with falling edge.
    - Bit set: Counter is set to zero with rising edge.
- The functions *Enable C reset* (0x8000:01) and *Enable extern reset* (0x8000:02) cannot be enabled simultaneously.

## Up/down counter

- The mode (encoder or up/down counter) can be set via *Enable up/down counter* index 0x8000:03. (not for product version -2011)
  - Click the corresponding row of the index to be parameterized,
  - enter the value "1" in the *SetValue* dialog and
  - confirm with OK.
- Set the gate polarity accordingly via object 0x8000:04.
- An additional option for reversing the direction of rotation is to set the *Reversion of rotation* bit index: 0x8000:0E.

**Overflow/underflow (not for product version -2011)**

- Overflow/underflow control is inactive in combination with an activated reset function (C/external).
- The underflow bit (0x6000:04) is set if an underflow ...00 ->...FF occurs. It is reset if 2/3 of the counter range are underrun.
- The overflow bit (0x6000:05) is set if an overflow FF...-> 0... occurs. It is reset if 1/3 of the counter range is exceeded.

**Open circuit detection**

- A separate open circuit detection can be activated for each of the channels A, B, and C (index 0x80n0:0B, 0x80n0:0C, 0x80n0:0D).
- Open circuit detection is activated for channels A and B by default.
- A differential voltage of < 1.5 V (typical, subject to modification) is interpreted as an open circuit.
- If an open circuit is detected, it is indicated as process data *Open circuit* = TRUE (bit in object *Open circuit* 0x6000:07 is set). An open circuit is also indicated separately in indices 0xA000:01 (track A), 0xA000:02 (track B), and 0xA000:03 (track C).
- TxPDO state also becomes TRUE if an open circuit is detected, since invalid data have to be assumed.

**Micro-increments**

- Works with and without distributed clocks, but it is only meaningful in conjunction with one of the DC modes.
- By setting the counter value only the integer component can be modified.
- The frequency measurement principle in enhanced operation mode:

## DC supported microelements - Application for determination of an axis position

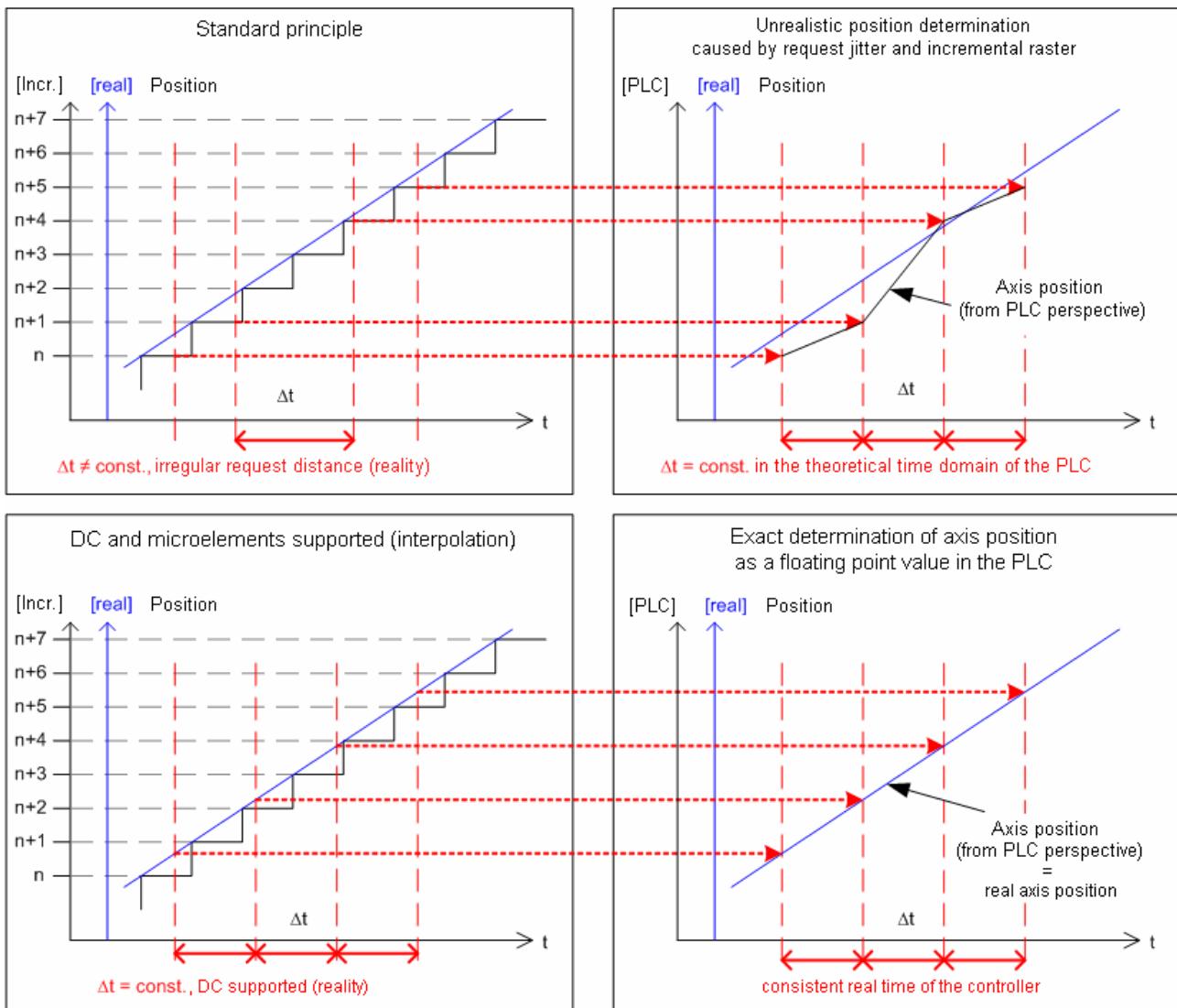


Fig. 20: DC-supported micro-increments

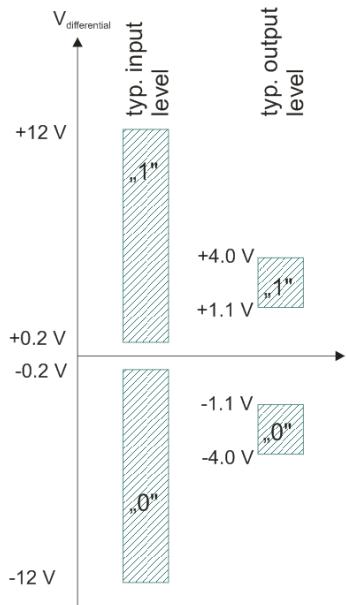
The highly constant query cycles (accuracy: 100 ns) of the distributed clocks systems enable the Box to interpolate axis positions between the counted encoder increments from a certain speed. The interpolation resolution is 8 bit, corresponding to 256 values. A standard encoder with 1,024 lines with 4-way evaluation and micro-increments thus becomes a high-resolution axis encoder with  $4096 \times 256 = 1,048,567$  lines.

If the velocity value falls below the minimum value, this is indicated by the object *Extrapolation stall* 0x6000:08 in the process data (not for product version -2011).

## 5.4 EP5001 - Interface signal level

The SSI interface works with differential signal levels conforms to RS422 / RS485.

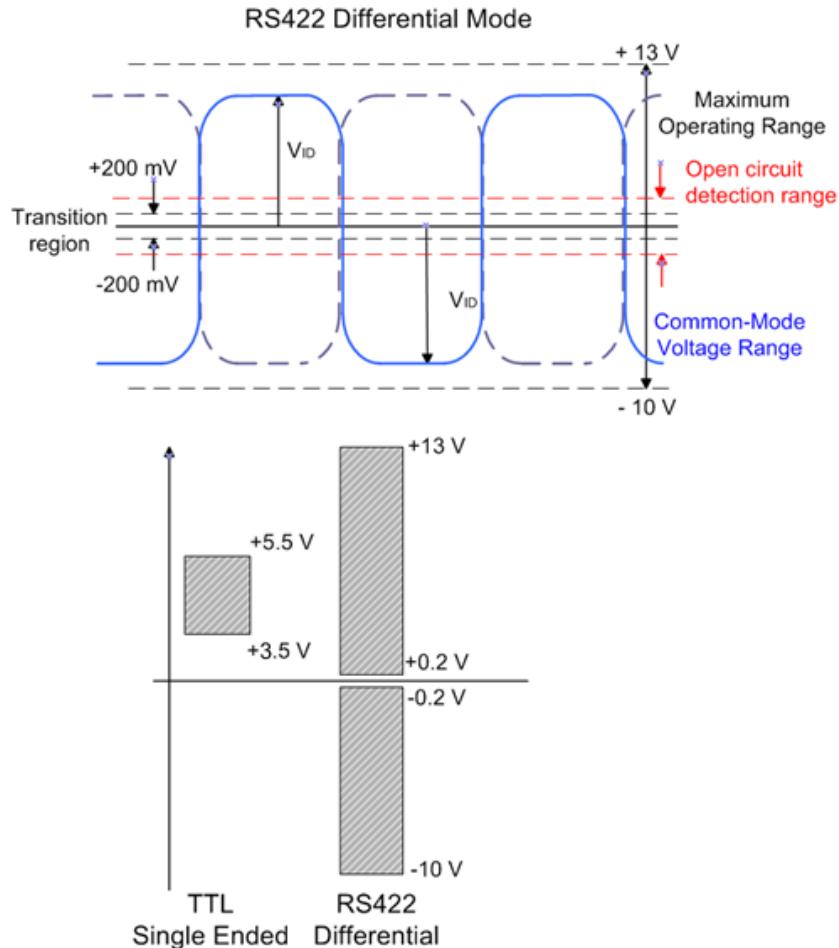
The “typical output level” applies for a load of 60 ohm or higher.



Single-ended signal levels are not supported.

## 5.5 EP5101 - Interface signal level

In differential mode the encoder input expects signal levels conform to RS422 / RS485. The data are transferred without ground reference as voltage difference between two cables (signal A and inverted signal / A). The encoder input analyses differences greater than 200 mV as valid signals. The differential signal must be in the common mode range (<+13.2 V and >-10 V, with respect to GND) (cf. diagram). Signal levels outside this range can lead to destruction



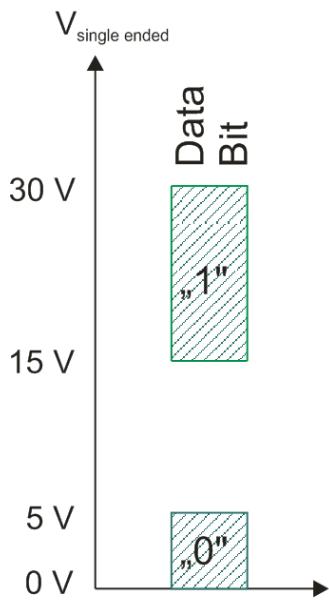
In differential mode only the voltage difference is evaluated, so that common-mode interference on the transmission link does not lead to corruption of the wanted signal, since any interference affects both cables simultaneously.

In single-ended mode the encoder input expects a signal level of nominally 3.5 V to 5.5 V.

A differential signal level between -1.5 V and +1.5 V is detected as [wire breakage \[▶ 70\]](#).

## 5.6 EP5151 - Interface signal level

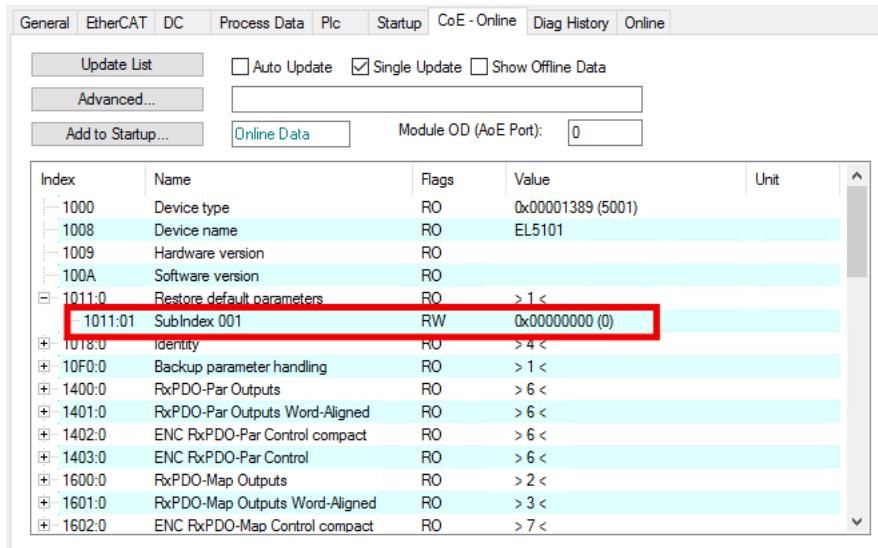
The encoder input expects level after HTL (push-pull).



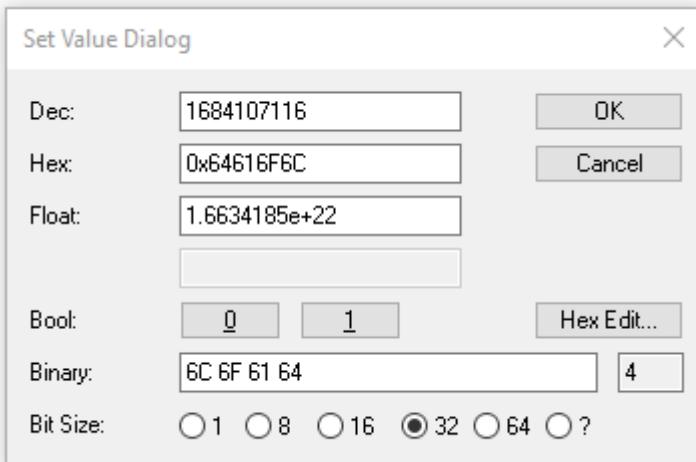
## 5.7 Restore the delivery state

You can restore the delivery state of the backup objects as follows:

1. Ensure that TwinCAT is running in Config mode.
2. In CoE object 1011:0 "Restore default parameters" select parameter 1011:01 "Subindex 001".



3. Double-click on "Subindex 001".
  - ⇒ The "Set Value Dialog" dialog box opens.
4. Enter the value 1684107116 in the "Dec" field.  
Alternatively: enter the value 0x64616F6C in the "Hex" field.



5. Confirm with "OK".  
⇒ All backup objects are reset to the delivery state.



### Alternative restore value

With some older modules the backup objects can be changed with an alternative restore value:  
Decimal value: 1819238756  
Hexadecimal value: 0x6C6F6164

An incorrect entry for the restore value has no effect.

## 5.8 Decommissioning

### **WARNING**

#### **Risk of electric shock!**

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

## 6 CoE parameters

### 6.1 EP5001-0002



#### Parameterization

You can parameterize the box via the "CoE - Online" tab in TwinCAT.



#### EtherCAT XML Device Description

The presentation matches that of the EtherCAT XML Device Description.

Recommendation: download the latest XML file from <https://www.beckhoff.com/> and install it according to the installation instructions.

#### Introduction

The CoE overview contains objects for different intended applications:

- Objects required for parameterization during commissioning
- Objects intended for regular operation, e.g. through ADS access.
- Objects for indicating internal settings (may be fixed)

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

#### 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    | 0x01F51389<br>(32838537 <sub>dec</sub> ) |

#### Index 1008 Device name

| Index (hex) | Name        | Meaning                           | Data type | Flags | Default     |
|-------------|-------------|-----------------------------------|-----------|-------|-------------|
| 1008:0      | Device name | Device name of the EtherCAT slave | STRING    | RO    | EP5001-0002 |

#### Index 1009 Hardware version

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

#### Index 100A Software version

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

#### Index 1011 Restore default parameters

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

**Index 1018 Identity**

| Index (hex) | Name          | Meaning   | Data type | Flags | Default                                |
|-------------|---------------|---|-----------|-------|--|
| 1018:0      | Identity      | Information for identifying the slave   | UINT8     | RO    | 0x04 (4 <sub>dec</sub> )               |
| 1018:01     | Vendor ID     | Vendor ID of the EtherCAT slave   | UINT32    | RO    | 0x00000002 (2 <sub>dec</sub> )         |
| 1018:02     | Product code  | Product code of the EtherCAT slave  | UINT32    | RO    | 0x13894052 (327762002 <sub>dec</sub> ) |
| 1018:03     | Revision      | Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |
| 1018:04     | Serial number | Serial number of the EtherCAT slave; the Low Byte (bit 0-7) of the Low Word contains the year of production, the High Byte (bit 8-15) of the Low Word contains the week of production, the High Word (bit 16-31) is 0 | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |

**Index 10F0 Backup parameter handling**

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

**Index 1800 SSI TxPDO-Par Inputs**

| Index (hex) | Name                 | Meaning  | Data type       | Flags | Default                  |
|-------------|----------------------|--|-----------------|-------|--------------------------|
| 1801:0      | SSI TxPDO-Par Inputs | PDO parameter TxPDO 1  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1801:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 1 | OCTET-STRING[2] | RO    | 00 1A                    |

**Index 1A00 SSI TxPDO-Map Inputs**

| Index (hex) | Name                 | Meaning   | Data type | Flags | Default                  |
|-------------|----------------------|---|-----------|-------|--------------------------|
| 1A00:0      | SSI TxPDO-Map Inputs | PDO Mapping TxPDO 1   | UINT8     | RO    | 0x08 (8 <sub>dec</sub> ) |
| 1A00:01     | SubIndex 001         | 1. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x01 (Data error))    | UINT32    | RO    | 0x6000:01, 1             |
| 1A00:02     | SubIndex 002         | 2. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x02 (Frame error))   | UINT32    | RO    | 0x6000:02, 1             |
| 1A00:03     | SubIndex 003         | 3. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x03 (Power failure)) | UINT32    | RO    | 0x6000:03, 1             |
| 1A00:04     | SubIndex 004         | 4. PDO Mapping entry (10 bits align)  | UINT32    | RO    | 0x0000:00, 10            |
| 1A00:05     | SubIndex 005         | 5. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x0E (Sync error))    | UINT32    | RO    | 0x6000:0E, 1             |
| 1A00:06     | SubIndex 006         | 6. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x0F (TxPDO State))   | UINT32    | RO    | 0x6000:0F, 1             |
| 1A00:07     | SubIndex 007         | 7. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x10 (TxPDO Toggle))  | UINT32    | RO    | 0x6000:10, 1             |
| 1A00:08     | SubIndex 008         | 8. PDO Mapping entry (object 0x6000 (SSI Inputs), entry 0x11 (Counter value)) | UINT32    | RO    | 0x6000:11, 32            |

**Index 1C00 Sync manager type**

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

**Index 1C12 RxPDO assign**

| Index (hex) | Name         | Meaning            | Data type | Flags | Default                  |
|-------------|--------------|--------------------|-----------|-------|--------------------------|
| 1C12:0      | RxPDO assign | PDO Assign Outputs | UINT8     | RW    | 0x00 (0 <sub>dec</sub> ) |

**Index 1C13 TxPDO assign**

| Index (hex) | Name         | Meaning  | Data type | Flags | Default                       |
|-------------|--------------|--|-----------|-------|-------------------------------|
| 1C13:0      | TxPDO assign | PDO Assign Inputs  | UINT8     | RO    | 0x02 (2 <sub>dec</sub> )      |
| 1C13:01     | SubIndex 001 | 1. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RO    | 0x1A00 (6656 <sub>dec</sub> ) |

**Index 1C33 SM input parameter**

| <b>Index (hex)</b> | <b>Name</b>             | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                       |
|--------------------|-------------------------|---|------------------|--------------|--------------------------------------|
| 1C33:0             | SM input parameter      | Synchronization parameters for the inputs   | UINT8            | RO           | 0x20 (32 <sub>dec</sub> )            |
| 1C33:01            | Sync mode               | Current synchronization mode:<br><ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchron with SM 3 Event (no outputs available)</li> <li>• 2: DC - Synchron with SYNC0 Event</li> <li>• 3: DC - Synchron with SYNC1 Event</li> <li>• 34: Synchron with SM 2 Event (outputs available)</li> </ul>  | UINT16           | RW           | 0x0022 (34 <sub>dec</sub> )          |
| 1C33:02            | Cycle time              | Cycle time (in ns):<br><ul style="list-style-type: none"> <li>• Free Run: Cycle time of the local timer</li> <li>• Synchron with SM 2 Event: Master cycle time</li> <li>• DC mode: SYNC0/SYNC1 Cycle Time</li> </ul>  | UINT32           | RW           | 0x000F4240 (1000000 <sub>dec</sub> ) |
| 1C33:03            | Shift time              | Time between SYNC0 event and reading of the inputs (in ns, only DC mode)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> )       |
| 1C33:04            | Sync modes supported    | Supported synchronization modes:<br><ul style="list-style-type: none"> <li>• Bit 0: free run is supported</li> <li>• Bit 1: Synchron with SM 2 Event is supported (outputs available)</li> <li>• Bit 1: Synchron with SM 3 Event is supported (no outputs available)</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 01: Input shift through local event (outputs available)</li> <li>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C33:08)</li> </ul> | UINT16           | RO           | 0xC00B (49163 <sub>dec</sub> )       |
| 1C33:05            | Minimum cycle time      | Minimum cycle time (in ns)  | UINT32           | RO           | 0x00030D40 (0 <sub>dec</sub> )       |
| 1C33:06            | Calc and copy time      | Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> )       |
| 1C33:07            | Minimum delay time      | -   | UINT32           | RO           | 0x000001B0 (7600 <sub>dec</sub> )    |
| 1C33:08            | Command                 | With this entry the real required process data provision time can be measured.<br><br><ul style="list-style-type: none"> <li>• 0: Measurement of the local cycle time is stopped</li> <li>• 1: Measurement of the local cycle time is started</li> </ul> <p>The entries 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values.<br/>For a subsequent measurement the measured values are reset</p>  | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )           |
| 1C33:09            | Maximum Delay time      | Time between SYNC1 event and reading of the inputs (in ns, only DC mode)  | UINT32           | RO           | 0x000001B0 (7600 <sub>dec</sub> )    |
| 1C33:0B            | SM event missed counter | Number of missed SM events in OPERATIONAL (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )           |
| 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 <sub>dec</sub> )           |
| 1C33:0D            | Shift too short counter | Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )           |
| 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 <sub>dec</sub> )             |

## Index 6000 SSI Inputs

| Index (hex) | Name          | Meaning  | Data type | Flags | Default                        |
|-------------|---------------|--|-----------|-------|--------------------------------|
| 6000:0      | SSI Inputs    | Length of this object  | UINT8     | RO    | 0x11 (17 <sub>dec</sub> )      |
| 6000:01     | Data error    | SSI input error:<br>- SSI without power supply<br>- Broken wire at SSI data inputs D+ or D-<br>- Data cables interchanged<br><br>If no data transmission occurs, the SSI input is on low signal level.   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:02     | Frame error   | The data frame is wrong, i.e. the data frame was not terminated with zero (perhaps wire breakage on clock cables)  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:03     | Power failure | An encoder-specific error has occurred. This error bit is only displayed if it was previously enabled through <i>Enable power failure bit</i> index 0x8000:02 [► 81].  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0E     | Sync error    | The Sync error bit is only required for DC mode. It indicates whether a synchronization error has occurred during the previous cycle.<br><br>This means a SYNC signal was triggered in the Box, although no new process data were available (0=OK, 1=NOK). | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0F     | TxPDO State   | Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:10     | TxPDO Toggle  | The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:11     | Counter value | Counter value  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |

## Index 8000 SSI Settings

| Index (hex) | Name                     | Meaning  | Data type | Flags | Default                     |
|-------------|--------------------------|--|-----------|-------|-----------------------------|
| 8000:0      | SSI Settings             | Length of this object  | UINT8     | RO    | 0x13 (19 <sub>dec</sub> )   |
| 8000:01     | Disable frame error      | 0: Frame error is not suppressed<br>1: Frame error is suppressed   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )    |
| 8000:02     | Enable power failure bit | 0: Power failure bit is not active<br>1: Power failure bit is active: The last bit of the data frame (sensor-specific error bit) is shown as error bit in the <i>Power failure</i> object (index 0x6000:03) and bit 2 of the status word.                      | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )    |
| 8000:03     | Enable inhibit time      | 0: Inhibit time is not active<br>1: Inhibit time is active   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )    |
| 8000:04     | Enable test mode         | 0: Test mode is not active<br>1: Test mode is active   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )    |
| 8000:06     | SSI-coding               | 0: Binary code active<br>1: Gray code active   | BIT1      | RW    | 0x01 (1 <sub>dec</sub> )    |
| 8000:09     | SSI-baudrate             | 0: reserved<br>1: 1250 kbaud<br>2: 1000 kbaud<br>3: 500 kBaud<br>4: 250 kbaud<br>5: 125 kbaud<br>6 - 65535: reserved   | BIT3      | RW    | 0x03 (3 <sub>dec</sub> )    |
| 8000:0F     | SSI-frame type           | 0: Multi-turn analysis is active (25 bit data frame)<br>1: Single-turn-analysis is active (13 bit data frame)<br>2: Variable analysis is active. The length of the data frame (1 to 32 bits) is specified with object <i>SSI frame size</i> (index 0x8000:11). | BIT2      | RW    | 0x00 (0 <sub>dec</sub> )    |
| 8000:11     | SSI-frame size           | Length of the SSI data frame (in bits)   | UINT16    | RW    | 0x0019 (25 <sub>dec</sub> ) |
| 8000:12     | SSI-data length          | Data length  | UINT16    | RW    | 0x0018 (24 <sub>dec</sub> ) |
| 8000:13     | Min. inhibit time[µs]    | Minimum inhibit time in µs (1 to 65535)  | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )  |

**Index 800D SSI Advanced Settings**

| <b>Index (hex)</b> | <b>Name</b>              | <b>Meaning</b>                                | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|--------------------------|---|------------------|--------------|--------------------------|
| 800D:0             | SSI advanced settings    | SSI advanced settings                         |                  | RW           | 0x03 (3 <sub>dec</sub> ) |
| 800D:01            | Encoder power supply on  | Switches the 24 V supply voltage              |                  | RW           | 0x01 (1 <sub>dec</sub> ) |
| 800D:02            | Encoder direction pin on | Switches the 24 V supply at the direction pin |                  | RW           | 0x00 (0 <sub>dec</sub> ) |
| 800D:03            | Encoder reset pin on     | Switches the 24 V supply at the reset pin     |                  | RW           | 0x00 (0 <sub>dec</sub> ) |

**Index F000 Modular device profile**

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

**Index F008 Code word**

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

**Index F010 Module list**

| <b>Index (hex)</b> | <b>Name</b>  | <b>Meaning</b>        | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                    |
|--------------------|--------------|-----------------------|------------------|--------------|-----------------------------------|
| F010:0             | Module list  | Length of this object | UINT8            | RW           | 0x02 (2 <sub>dec</sub> )          |
| F010:01            | SubIndex 001 | -                     | UINT32           | RW           | 0x0000001F5 (501 <sub>dec</sub> ) |

## 6.2 EP5101-x002



### Parameterization

You can parameterize the box via the "CoE - Online" tab in TwinCAT.



### EtherCAT XML Device Description

The presentation matches that of the EtherCAT XML Device Description.

Recommendation: download the latest XML file from <https://www.beckhoff.com/> and install it according to the installation instructions.

### 6.2.1 Restore object

#### Index 1011 Restore default parameters

| Index (hex) | Name                       | Meaning  | Data type | Flags | Default                        |
|-------------|----------------------------|--|-----------|-------|--------------------------------|
| 1011:0      | Restore default parameters | Restore the default settings   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> )       |
| 1011:01     | SubIndex 001               | If this object is set to " <b>0x64616F6C</b> " in the set value dialog, all backup objects are reset to their delivery state.<br>Note: Some FW versions also accept the following input: " <b>0xC6F6164</b> ". | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.2.2 Configuration data

### Index 8000 ENC Settings

| Index (hex) | Name                                   | Meaning   | Data type | Flags | Default                        |
|-------------|--|---|-----------|-------|--------------------------------|
| 8000:0      | ENC Settings                           | Maximum subindex  | UINT8     | RO    | 0x17 (23 <sub>dec</sub> )      |
| 8000:01     | <u>Enable C reset [▶ 69]</u>           | The counter is reset via the C input.   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:03     | <u>Enable up/down counter [▶ 69]</u>   | Enablement of the up/down counter in place of the encoder with the bit set.<br>Increments are counted at input A.<br>Input B specifies the counting direction.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:08     | Disable filter                         | 0: Activates the input filter (inputs A, /A, B, /B, C, /C only)<br>1: Deactivates the input filter<br>If a filter is activated a signal edge must be present for at least 2.4 µs in order to be counted as an increment.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0A     | <u>Enable micro increments [▶ 70]</u>  | If DC mode is activated, the Box interpolates micro-increments between the integer encoder increments. The lower 8 bits of the <i>Counter Value</i> are used in each case for the display. A 32-bit counter thus becomes a 24+8-bit counter, a 16-bit counter becomes an 8+8-bit counter.   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0B     | <u>Open circuit detection A [▶ 70]</u> | An open circuit on track A is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 85]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0C     | <u>Open circuit detection B [▶ 70]</u> | An open circuit on track B is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 85]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0D     | <u>Open circuit detection C [▶ 70]</u> | An open circuit on track C is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 85]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0E     | <u>Reversion of rotation [▶ 69]</u>    | Activates reversion of rotation   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:11     | <u>Frequency window [▶ 68]</u>         | This is the minimum time over which the frequency is determined; default value 10 ms [resolution: 1 µs]. The number of pulses in the timeframe + the following is measured. The maximum waiting time is specified in the <i>Frequency Wait Time</i> parameter. The number of pulses is divided by the actual time window size. The determined frequency is output in object <i>Frequency value</i> (index 0x6000:13 [▶ 85]) and as a process data. The frequency calculation is carried out locally without distributed clocks function.                              | UINT16    | RW    | 0x2710 (10000 <sub>dec</sub> ) |
| 8000:13     | <u>Frequency scaling [▶ 68]</u>        | Scaling of the frequency measurement (must be divided by this value to obtain the unit in Hz): 100: "0.01 Hz"   | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:14     | <u>Period scaling [▶ 68]</u>           | Resolution of the period value in the process data: 100: "100 ns" period value is a multiple of 100 ns<br>500: "500 ns" period value is a multiple of 500 ns  | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:15     | <u>Frequency resolution [▶ 68]</u>     | Resolution of the frequency measurement: 100: "0.01 Hz"   | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:16     | <u>Period resolution [▶ 68]</u>        | Internal resolution of the period value measurement: 100: "100 ns" period value is a multiple of 100 ns<br>The period is calculated internally with a resolution of 100 ns. The max. measurable period can then be approx. 1.6 seconds.<br><br>500: "500 ns" period value is a multiple of 500 ns<br>Internally the period is calculated with 500 ns resolution. The maximum measurable period is approx. 32.7 ms. The resolution of the process data continues to be the value according to object <i>Period scaling</i> (index 0x8000:14) (e.g., 100 ns [default]). | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                          |
|-------------|-------------------------------|---|-----------|-------|----------------------------------|
| 8000:17     | Frequency wait time<br>[▶ 68] | Waiting time [ms] for frequency measurement<br>Once the time specified in the <i>frequency window</i> has elapsed, the system waits for the next positive edge from track A. This enables the update speed for the <i>Frequency</i> process data to be optimized, depending on the expected frequencies. The minimum value to be entered here is twice the period value of the smallest measured frequency.<br>$T \geq 2 * (1 / f_{min})$ | UINT16    | RW    | 0x0640<br>(1600 <sub>dec</sub> ) |

## 6.2.3 Input data

### Index 6000 ENC Inputs

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                           |
|-------------|-------------------------------|---|-----------|-------|-----------------------------------|
| 6000:0      | ENC Inputs                    | Maximum subindex  | UINT8     | RO    | 0x16 (22 <sub>dec</sub> )         |
| 6000:01     | Latch C valid [▶ 69]          | The counter value was latched with the “C” input. The data with <i>Latch Value</i> (Index 0x6000:12) corresponds to the latched value if the bit is set.<br>To re-enable the latch input, <i>Enable latch C</i> (index 0x7000:01 [▶ 86]) must be canceled and then reset. | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:03     | Set counter done              | The counter was set.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:04     | Counter underflow<br>[▶ 70]   | The counter has passed the zero crossing backwards.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:05     | Counter overflow<br>[▶ 70]    | Counter overflow.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:07     | Open circuit [▶ 70]           | Indicates an open circuit.<br>Configuration via the objects<br><i>Open circuit detection A</i> Index 0x8000:0B [▶ 84],<br><i>Open circuit detection B</i> Index 0x8000:0C [▶ 84],<br><i>Open circuit detection C</i> Index 0x8000:0D [▶ 84]                               | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:08     | Extrapolation stall<br>[▶ 70] | The extrapolated part of the counter is invalid.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:09     | Status of input A             | Status of input A   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:0A     | Status of input B             | Status of input B   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:0B     | Status of input C             | Status of input C   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:0E     | Sync error                    | The Sync error bit is only required for DC mode. It indicates whether a synchronization error has occurred during the previous cycle. This means a SYNC signal was triggered in the Box, although no new process data were available (0=OK, 1=NOK).                       | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:0F     | TxPDO State                   | Validity of the data of the associated TxPDO (0 = valid, 1 = invalid).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:10     | TxPDO Toggle                  | The TxPDO toggle is toggled by the slave when the data of the associated TxPDO is updated.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )          |
| 6000:11     | Counter value                 | Counter value   | UINT32    | RO    | 0x00000000<br>(0 <sub>dec</sub> ) |
| 6000:12     | Latch value                   | Latch value   | UINT32    | RO    | 0x00000000<br>(0 <sub>dec</sub> ) |
| 6000:13     | Frequency value<br>[▶ 68]     | The frequency (setting of the scaling and resolution in the objects <i>Frequency scaling</i> index 0x8000:13 [▶ 84] and <i>Frequency resolution</i> index 0x8000:15 [▶ 84])   | UINT32    | RO    | 0x00000000<br>(0 <sub>dec</sub> ) |
| 6000:14     | Period value [▶ 68]           | The period value (setting of the scaling and resolution in the objects <i>Period scaling</i> index 0x8000:14 [▶ 84] and <i>Period resolution</i> index 0x8000:16 [▶ 84])  | UINT32    | RO    | 0x00000000<br>(0 <sub>dec</sub> ) |
| 6000:16     | Timestamp [▶ 56]              | Timestamp of the last counter change  | UINT64    | RO    |                                   |

## 6.2.4 Output data

### Index 7000 ENC Outputs

| Index (hex) | Name                         | Meaning   | Data type | Flags | Default                        |
|-------------|------------------------------|---|-----------|-------|--------------------------------|
| 7000:0      | ENC Outputs                  | Maximum subindex  | UINT8     | RO    | 0x11(17 <sub>dec</sub> )       |
| 7000:01     | <u>Enable latch C [► 69]</u> | Activate latching via input "C".                                      | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:03     | Set counter                  | Set counter value   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:11     | Set counter value            | The counter value to be set via <i>Set counter</i> (index 0x7000:03). | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.2.5 Information / diagnostic data (channel specific)

### Index A000 ENC Diag data

| Index (hex) | Name                         | Meaning                 | Data type | Flags | Default                  |
|-------------|------------------------------|-------------------------|-----------|-------|--------------------------|
| A000:0      | ENC Diag data                | Maximum subindex        | UINT8     | RO    | 0x03 (3 <sub>dec</sub> ) |
| A000:01     | <u>Open circuit A [► 70]</u> | Open circuit on track A | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |
| A000:02     | <u>Open circuit B [► 70]</u> | Open circuit on track B | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |
| A000:03     | <u>Open circuit C [► 70]</u> | Open circuit on track C | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |

## 6.2.6 Standard objects

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

### Index 1000 Device type

| Index (hex) | Name        | Meaning   | Data type | Flags | Default                               |
|-------------|-------------|---|-----------|-------|---------------------------------------|
| 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    | 0x01FF1389 (33493897 <sub>dec</sub> ) |

### Index 1008 Device name

| Index (hex) | Name        | Meaning                           | Data type | Flags | Default                    |
|-------------|-------------|-----------------------------------|-----------|-------|----------------------------|
| 1008:0      | Device name | Device name of the EtherCAT slave | STRING    | RO    | EP5101-0002<br>EP5101-1002 |

### Index 1009 Hardware version

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

### Index 100A Software version

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

### Index 1018 Identity

| Index (hex) | Name          | Meaning   | Data type | Flags | Default                                |
|-------------|---------------|---|-----------|-------|--|
| 1018:0      | Identity      | Information for identifying the slave   | UINT8     | RO    | 0x04 (4 <sub>dec</sub> )               |
| 1018:01     | Vendor ID     | Vendor ID of the EtherCAT slave   | UINT32    | RO    | 0x00000002 (2 <sub>dec</sub> )         |
| 1018:02     | Product code  | Product code of the EtherCAT slave  | UINT32    | RO    | 0x13ED4052 (334315602 <sub>dec</sub> ) |
| 1018:03     | Revision      | Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |
| 1018:04     | Serial number | Serial number of the EtherCAT slave; the Low Byte (bit 0-7) of the Low Word contains the year of production, the High Byte (bit 8-15) of the Low Word contains the week of production, the High Word (bit 16-31) is 0 | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |

**Index 10F0 Backup parameter handling**

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

**Index 1400 ENC RxPDO-Par Control compact**

| Index (hex) | Name                          | Meaning  | Data type       | Flags | Default                  |
|-------------|-------------------------------|--|-----------------|-------|--------------------------|
| 1400:0      | ENC RxPDO-Par Control compact | PDO Parameter RxPDO 1  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1400:06     | Exclude RxPDOs                | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 1 | OCTET-STRING[2] | RO    | 01 16                    |

**Index 1401 ENC RxPDO-Par Control**

| Index (hex) | Name                  | Meaning  | Data type       | Flags | Default                  |
|-------------|-----------------------|--|-----------------|-------|--------------------------|
| 1401:0      | ENC RxPDO-Par Control | PDO Parameter RxPDO 2  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1401:06     | Exclude RxPDOs        | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 2 | OCTET-STRING[2] | RO    | 00 16                    |

**Index 1600 ENC RxPDO Map Control compact (product version -0002)**

| Index (hex) | Name                          | Meaning  | Data type | Flags | Default                  |
|-------------|-------------------------------|--|-----------|-------|--------------------------|
| 1600:0      | ENC RxPDO-Map Control compact | PDO Mapping RxPDO 3  | UINT8     | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1600:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))    | UINT32    | RO    | 0x7000:01,1              |
| 1600:02     | SubIndex 002                  | 2. PDO Mapping entry (1 bit align)   | UINT32    | RO    | 0x0000:00, 1             |
| 1600:03     | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))       | UINT32    | RO    | 0x7000:03, 1             |
| 1600:04     | SubIndex 004                  | 4. PDO Mapping entry (5 bits align)  | UINT32    | RO    | 0x0000:00, 5             |
| 1600:05     | SubIndex 005                  | 5. PDO Mapping entry (8 bits align)  | UINT32    | RO    | 0x0000:00, 8             |
| 1600:06     | SubIndex 006                  | 6. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value)) | UINT32    | RO    | 0x7000:11, 16            |
| 1600:07     | SubIndex 007                  | 7. reserved  | UINT32    | RO    | -                        |

**Index 1600 ENC RxPDO Map Control compact (product version -1002)**

| Index (hex) | Name                          | Meaning  | Data type | Flags | Default                  |
|-------------|-------------------------------|--|-----------|-------|--------------------------|
| 1600:0      | ENC RxPDO-Map Control compact | PDO Mapping RxPDO 3  | UINT8     | RO    | 0x07 (7 <sub>dec</sub> ) |
| 1600:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))    | UINT32    | RO    | 0x7000:01,1              |
| 1600:02     | SubIndex 002                  | 2. PDO Mapping entry (1 bit align)   | UINT32    | RO    | 0x0000:00, 1             |
| 1600:03     | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))       | UINT32    | RO    | 0x7000:03, 1             |
| 1600:04     | SubIndex 004                  | 4. PDO Mapping entry (1 bits align)  | UINT32    | RO    | 0x0000:00, 1             |
| 1600:05     | SubIndex 005                  | 5. PDO Mapping entry (4 bits align)  | UINT32    | RO    | 0x0000:00, 4             |
| 1600:06     | SubIndex 006                  | 6. PDO Mapping entry (8 bits align)  | UINT32    | RO    | 0x0000:00, 8             |
| 1600:07     | SubIndex 007                  | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value)) | UINT32    | RO    | 0x7000:11, 16            |

**Index 1601 ENC RxPDO Map Control (product version -0002)**

| <b>Index (hex)</b> | <b>Name</b>                   | <b>Meaning</b>   | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|-------------------------------|--|------------------|--------------|--------------------------|
| 1601:0             | ENC RxPDO-Map Control compact | PDO Mapping RxPDO  | UINT8            | RO           | 0x06 (6 <sub>dec</sub> ) |
| 1601:01            | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))    | UINT32           | RO           | 0x7000:01,1              |
| 1601:02            | SubIndex 002                  | 2. PDO Mapping entry (1 bit align)   | UINT32           | RO           | 0x0000:00,1              |
| 1601:03            | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))       | UINT32           | RO           | 0x7000:03,1              |
| 1601:04            | SubIndex 004                  | 4. PDO Mapping entry (5 bits align)  | UINT32           | RO           | 0x0000:00,5              |
| 1601:05            | SubIndex 005                  | 5. PDO Mapping entry (8 bits align)  | UINT32           | RO           | 0x0000:00,8              |
| 1601:06            | SubIndex 006                  | 6. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value)) | UINT32           | RO           | 0x7000:11,32             |
| 1601:07            | SubIndex 007                  | 7. reserved  | UINT32           | RO           | -                        |

**Index 1601 ENC RxPDO Map Control (product version -1002)**

| <b>Index (hex)</b> | <b>Name</b>                   | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|-------------------------------|---|------------------|--------------|--------------------------|
| 1601:0             | ENC RxPDO-Map Control compact | PDO Mapping RxPDO   | UINT8            | RO           | 0x07 (7 <sub>dec</sub> ) |
| 1601:01            | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))                       | UINT32           | RO           | 0x7000:01,1              |
| 1601:02            | SubIndex 002                  | 2. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00,1              |
| 1601:03            | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))                          | UINT32           | RO           | 0x7000:03,1              |
| 1601:04            | SubIndex 004                  | 4. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x04 (Enable latch extern on negative edge)) | UINT32           | RO           | 0x7000:04,1              |
| 1601:05            | SubIndex 005                  | 5. PDO Mapping entry (4 bits align)   | UINT32           | RO           | 0x0000:00,4              |
| 1601:06            | SubIndex 006                  | 6. PDO Mapping entry (8 bits align)   | UINT32           | RO           | 0x0000:00,8              |
| 1601:07            | SubIndex 007                  | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value))                    | UINT32           | RO           | 0x7000:11,32             |

**Index 1800 ENC TxPDO-Par Status compact**

| <b>Index (hex)</b> | <b>Name</b>                  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|------------------------------|---|------------------|--------------|--------------------------|
| 1800:0             | ENC TxPDO-Par Status compact | PDO parameter TxPDO 1   | UINT8            | RO           | 0x09 (9 <sub>dec</sub> ) |
| 1800:06            | Exclude TxPDOs               | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 1. | OCTET-STRING[2]  | RO           | 01 1A                    |
| 1800:07            | TxPDO State                  | The TxPDO state is set if it was not possible to correctly read in the associated input data.             | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> ) |
| 1800:09            | TxPDO Toggle                 | The TxPDO toggle is toggled with each update the corresponding input data.                                | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> ) |

**Index 1801 ENC TxPDO-Par Status**

| <b>Index (hex)</b> | <b>Name</b>          | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|----------------------|---|------------------|--------------|--------------------------|
| 1801:0             | ENC TxPDO-Par Status | PDO parameter TxPDO 2   | UINT8            | RO           | 0x09 (9 <sub>dec</sub> ) |
| 1801:06            | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 2. | OCTET-STRING[2]  | RO           | 00 1A                    |
| 1801:07            | TxPDO State          | The TxPDO state is set if it was not possible to correctly read in the associated input data.             | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> ) |
| 1801:09            | TxPDO Toggle         | The TxPDO toggle is toggled with each update the corresponding input data.                                | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> ) |

**Index 1802 ENC TxPDO-Par Frequency**

| <b>Index (hex)</b> | <b>Name</b>             | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|-------------------------|---|------------------|--------------|--------------------------|
| 1802:0             | ENC TxPDO-Par Frequency | PDO parameter TxPDO 3   | UINT8            | RO           | 0x06 (6 <sub>dec</sub> ) |
| 1802:06            | Exclude TxPDOs          | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 3. | OCTET-STRING[2]  | RO           | 03 1A                    |

**Index 1803 ENC TxPDO-Par Period**

| Index (hex) | Name                 | Meaning   | Data type       | Flags | Default                  |
|-------------|----------------------|---|-----------------|-------|--------------------------|
| 1803:0      | ENC TxPDO-Par Period | PDO parameter TxPDO 4   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1803:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 4. | OCTET-STRING[2] | RO    | 02 1A                    |

**Index 1804 ENC TxPDO-Par Timestamp**

| Index (hex) | Name                    | Meaning   | Data type       | Flags | Default                  |
|-------------|-------------------------|---|-----------------|-------|--------------------------|
| 1804:0      | ENC TxPDO-Par Timestamp | PDO parameter TxPDO 5   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1804:06     | Exclude TxPDOs          | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 5. | OCTET-STRING[2] | RO    | 05 1A                    |

**Index 1805 ENC TxPDO-Par Timestamp compact**

| Index (hex) | Name                            | Meaning   | Data type       | Flags | Default                  |
|-------------|---------------------------------|---|-----------------|-------|--------------------------|
| 1805:0      | ENC TxPDO-Par Timestamp compact | PDO parameter TxPDO 6   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1805:06     | Exclude TxPDOs                  | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 6. | OCTET-STRING[2] | RO    | 04 1A                    |

**Index 1A00 ENC TxPDO Map Status compact (product version -0002)**

| Index (hex) | Name                         | Meaning   | Data type | Flags | Default                    |
|-------------|------------------------------|---|-----------|-------|----------------------------|
| 1A00:0      | ENC TxPDO-Map Status compact | ENC TxPDO-Map Status compact  | UINT8     | RO    | 0x011 (17 <sub>dec</sub> ) |
| 1A00:01     | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))                   | UINT32    | RO    | 0x6000:01, 1               |
| 1A00:02     | SubIndex 002                 | 2. PDO Mapping entry (1 bit align)  | UINT32    | RO    | 0x0000:00, 1               |
| 1A00:03     | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))                | UINT32    | RO    | 0x6000:03, 1               |
| 1A00:04     | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))               | UINT32    | RO    | 0x6000:04, 1               |
| 1A00:05     | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))                | UINT32    | RO    | 0x6000:05, 1               |
| 1A00:06     | SubIndex 006                 | 6. PDO Mapping entry (1 bit align)  | UINT32    | RO    | 0x0000:00, 1               |
| 1A00:07     | SubIndex 007                 | 7. PDO mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (open circuit))                    | UINT32    | RO    | 0x6000:07, 1               |
| 1A00:08     | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))             | UINT32    | RO    | 0x6000:08, 1               |
| 1A00:09     | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))               | UINT32    | RO    | 0x6000:09, 1               |
| 1A00:0A     | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))              | UINT32    | RO    | 0x6000:0A, 1               |
| 1A00:0B     | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))              | UINT32    | RO    | 0x6000:0B, 1               |
| 1A00:0C     | SubIndex 012                 | 12. PDO Mapping entry (2 bit align)   | UINT32    | RO    | 0x0000:00, 2               |
| 1A00:0D     | SubIndex 013                 | 13. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))            | UINT32    | RO    | 0x1C32:20, 1               |
| 1A00:0E     | SubIndex 014                 | 14. PDO mapping entry (object 0x1800 (ENC TxPDO Par Status compact), entry 0x07 (TxPDO state))  | UINT32    | RO    | 0x1800:07, 1               |
| 1A00:0F     | SubIndex 015                 | 15. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x09 (TxPDO Toggle)) | UINT32    | RO    | 0x1800:09, 1               |
| 1A00:10     | SubIndex 016                 | 16. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))                  | UINT32    | RO    | 0x6000:11, 16              |
| 1A00:11     | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))                    | UINT32    | RO    | 0x6000:12, 16              |
| 1A00:12     | SubIndex 018                 | reserved  | UINT32    | RO    | -                          |

**Index 1A00 ENC TxPDO Map Status compact (product version -1002)**

| <b>Index (hex)</b> | <b>Name</b>                  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>             |
|--------------------|------------------------------|---|------------------|--------------|----------------------------|
| 1A00:0             | ENC TxPDO-Map Status compact | ENC TxPDO-Map Status compact  | UINT8            | RO           | 0x012 (18 <sub>dec</sub> ) |
| 1A00:01            | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))                   | UINT32           | RO           | 0x6000:01, 1               |
| 1A00:02            | SubIndex 002                 | 2. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1               |
| 1A00:03            | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))                | UINT32           | RO           | 0x6000:03, 1               |
| 1A00:04            | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))               | UINT32           | RO           | 0x6000:04, 1               |
| 1A00:05            | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))                | UINT32           | RO           | 0x6000:05, 1               |
| 1A00:06            | SubIndex 006                 | 6. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1               |
| 1A00:07            | SubIndex 007                 | 7. PDO mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (open circuit))                    | UINT32           | RO           | 0x6000:07, 1               |
| 1A00:08            | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))             | UINT32           | RO           | 0x6000:08, 1               |
| 1A00:09            | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))               | UINT32           | RO           | 0x6000:09, 1               |
| 1A00:0A            | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))              | UINT32           | RO           | 0x6000:0A, 1               |
| 1A00:0B            | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))              | UINT32           | RO           | 0x6000:0B, 1               |
| 1A00:0C            | SubIndex 012                 | 12. PDO Mapping entry (1 bit align)   | UINT32           | RO           | 0x0000:00, 1               |
| 1A00:0D            | SubIndex 013                 | 13. PDO Mapping entry (1 bit align)   | UINT32           | RO           | 0x0000:00, 1               |
| 1A00:0E            | SubIndex 014                 | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))            | UINT32           | RO           | 0x1C32:20, 1               |
| 1A00:0F            | SubIndex 015                 | 15. PDO mapping entry (object 0x1800 (ENC TxPDO Par Status compact), entry 0x07 (TxPDO state))  | UINT32           | RO           | 0x1800:07, 1               |
| 1A00:10            | SubIndex 016                 | 16. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x09 (TxPDO Toggle)) | UINT32           | RO           | 0x1800:09, 1               |
| 1A00:11            | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))                  | UINT32           | RO           | 0x6000:11, 16              |
| 1A00:12            | SubIndex 018                 | 18. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))                    | UINT32           | RO           | 0x6000:12, 16              |

**Index 1A01 ENC TxPDO Map Status (product version -0002)**

| <b>Index (hex)</b> | <b>Name</b>                  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>            |
|--------------------|------------------------------|---|------------------|--------------|---------------------------|
| 1A01:0             | ENC TxPDO-Map Status compact | ENC TxPDO-Map Status  | UINT8            | RO           | 0x11 (17 <sub>dec</sub> ) |
| 1A01:01            | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))           | UINT32           | RO           | 0x6000:01, 1              |
| 1A01:02            | SubIndex 002                 | 2. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:03            | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))        | UINT32           | RO           | 0x6000:03, 1              |
| 1A01:04            | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))       | UINT32           | RO           | 0x6000:04, 1              |
| 1A01:05            | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))        | UINT32           | RO           | 0x6000:05, 1              |
| 1A01:06            | SubIndex 006                 | 6. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:07            | SubIndex 007                 | 7. PDO mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (open circuit))            | UINT32           | RO           | 0x6000:07, 1              |
| 1A01:08            | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))     | UINT32           | RO           | 0x6000:08, 1              |
| 1A01:09            | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))       | UINT32           | RO           | 0x6000:09, 1              |
| 1A01:0A            | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))      | UINT32           | RO           | 0x6000:0A, 1              |
| 1A01:0B            | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))      | UINT32           | RO           | 0x6000:0B, 1              |
| 1A01:0C            | SubIndex 012                 | 12. PDO Mapping entry (2 bit align)   | UINT32           | RO           | 0x0000:00, 2              |
| 1A01:0D            | SubIndex 013                 | 13. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))    | UINT32           | RO           | 0x1C32:20, 1              |
| 1A01:0E            | SubIndex 014                 | 14. PDO mapping entry (object 0x1801 (ENC TxPDO Par Status), entry 0x07 (TxPDO state))  | UINT32           | RO           | 0x1801:07, 1              |
| 1A01:0F            | SubIndex 015                 | 15. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x09 (TxPDO Toggle)) | UINT32           | RO           | 0x1801:09, 1              |
| 1A01:10            | SubIndex 016                 | 16. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))          | UINT32           | RO           | 0x6000:11, 32             |
| 1A01:11            | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))            | UINT32           | RO           | 0x6000:12, 32             |
| 1A01:12            | SubIndex 018                 | 18. reserved  | UINT32           | RO           | -                         |

**Index 1A01 ENC TxPDO Map Status (product version -1002)**

| <b>Index (hex)</b> | <b>Name</b>                  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>            |
|--------------------|------------------------------|---|------------------|--------------|---------------------------|
| 1A01:0             | ENC TxPDO-Map Status compact | ENC TxPDO-Map Status  | UINT8            | RO           | 0x12 (18 <sub>dec</sub> ) |
| 1A01:01            | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))           | UINT32           | RO           | 0x6000:01, 1              |
| 1A01:02            | SubIndex 002                 | 2. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:03            | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))        | UINT32           | RO           | 0x6000:03, 1              |
| 1A01:04            | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))       | UINT32           | RO           | 0x6000:04, 1              |
| 1A01:05            | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))        | UINT32           | RO           | 0x6000:05, 1              |
| 1A01:06            | SubIndex 006                 | 6. PDO Mapping entry (1 bit align)  | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:07            | SubIndex 007                 | 7. PDO mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (open circuit))            | UINT32           | RO           | 0x6000:07, 1              |
| 1A01:08            | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))     | UINT32           | RO           | 0x6000:08, 1              |
| 1A01:09            | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))       | UINT32           | RO           | 0x6000:09, 1              |
| 1A01:0A            | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))      | UINT32           | RO           | 0x6000:0A, 1              |
| 1A01:0B            | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))      | UINT32           | RO           | 0x6000:0B, 1              |
| 1A01:0C            | SubIndex 012                 | 12. PDO Mapping entry (1 bit align)   | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:0D            | SubIndex 013                 | 13. PDO Mapping entry (1 bit align)   | UINT32           | RO           | 0x0000:00, 1              |
| 1A01:0E            | SubIndex 014                 | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))    | UINT32           | RO           | 0x1C32:20, 1              |
| 1A01:0F            | SubIndex 015                 | 15. PDO mapping entry (object 0x1801 (ENC TxPDO Par Status), entry 0x07 (TxPDO state))  | UINT32           | RO           | 0x1801:07, 1              |
| 1A01:10            | SubIndex 016                 | 16. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x09 (TxPDO Toggle)) | UINT32           | RO           | 0x1801:09, 1              |
| 1A01:11            | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))          | UINT32           | RO           | 0x6000:11, 32             |
| 1A01:12            | SubIndex 018                 | 18. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))            | UINT32           | RO           | 0x6000:12, 32             |

**Index 1A02 ENC TxPDO-Map Frequency**

| <b>Index (hex)</b> | <b>Name</b>         | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|---------------------|---|------------------|--------------|--------------------------|
| 1A02:0             | TxPDO map frequency | PDO Mapping TxPDO   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A02:01            | SubIndex 001        | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x13 (Frequency value)) | UINT32           | RO           | 0x6000:13, 32            |

**Index 1A03 ENC TxPDO-Map Period**

| <b>Index (hex)</b> | <b>Name</b>          | <b>Meaning</b>   | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|----------------------|--|------------------|--------------|--------------------------|
| 1A03:0             | ENC TxPDO-Map Period | ENC TxPDO-Map Period   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A03:01            | SubIndex 001         | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x14 (Period value)) | UINT32           | RO           | 0x6000:14, 32            |

**Index 1A04 ENC TxPDO-Map Timest.**

| <b>Index (hex)</b> | <b>Name</b>           | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|-----------------------|---|------------------|--------------|--------------------------|
| 1A04:0             | ENC TxPDO-Map Timest. | ENC TxPDO-Map Timest.   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A04:01            | SubIndex 001          | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x16 (Timestamp)) | UINT32           | RO           | 0x6000:16, 64            |

**Index 1A05 ENC TxPDO-Map Timest. compact**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1A05:0      | ENC TxPDO-Map Timest. compact | ENC TxPDO-Map Timest. compact   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> ) |
| 1A05:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x16 (Timestamp)) | UINT32    | RO    | 0x6000:16, 32            |

**Index 1C00 Sync manager type**

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

**Index 1C12 RxPDO assign**

| Index (hex) | Name         | Meaning  | Data type | Flags | Default                       |
|-------------|--------------|--|-----------|-------|-------------------------------|
| 1C12:0      | RxPDO assign | PDO Assign Outputs   | UINT8     | RW    | 0x01 (1 <sub>dec</sub> )      |
| 1C12:01     | SubIndex 001 | 1. allocated RxPDO (contains the index of the associated RxPDO mapping object) | UINT16    | RW    | 0x1600 (5632 <sub>dec</sub> ) |

**Index 1C13 TxPDO assign**

| Index (hex) | Name         | Meaning  | Data type | Flags | Default                       |
|-------------|--------------|--|-----------|-------|-------------------------------|
| 1C13:0      | TxPDO assign | PDO Assign Inputs  | UINT8     | RW    | 0x01 (1 <sub>dec</sub> )      |
| 1C13:01     | SubIndex 001 | 1. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x1A00 (6656 <sub>dec</sub> ) |
| 1C13:02     | SubIndex 002 | 2. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )    |
| 1C13:03     | SubIndex 003 | 3. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )    |

**Index 1C32 SM output parameter**

| <b>Index (hex)</b> | <b>Name</b>             | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                 |
|--------------------|-------------------------|---|------------------|--------------|--------------------------------|
| 1C32:0             | SM output parameter     | Synchronization parameters for the outputs  | UINT8            | RO           | 0x20 (32 <sub>dec</sub> )      |
| 1C32:01            | Sync mode               | Current synchronization mode:<br><ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchron with SM 2 Event</li> <li>• 2: DC-Mode - Synchron with SYNC0 Event</li> <li>• 3: DC-Mode - Synchron with SYNC1 Event</li> </ul>   | UINT16           | RW           | 0x0001 (1 <sub>dec</sub> )     |
| 1C32:02            | Cycle time              | Cycle time (in ns):<br><ul style="list-style-type: none"> <li>• Free Run: Cycle time of the local timer</li> <li>• Synchron with SM 2 Event: Master cycle time</li> <li>• DC mode: SYNC0/SYNC1 Cycle Time</li> </ul>  | UINT32           | RW           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:03            | Shift time              | Time between SYNC0 event and output of the outputs (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:04            | Sync modes supported    | Supported synchronization modes:<br><ul style="list-style-type: none"> <li>• Bit 0 = 1: free run is supported</li> <li>• Bit 1 = 1: Synchron with SM 2 Event is supported</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 10: Output shift with SYNC1 event (only DC mode)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08)</li> </ul>  | UINT16           | RO           | 0xC007 (49159 <sub>dec</sub> ) |
| 1C32:05            | Minimum cycle time      | Minimum cycle time (in ns)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:06            | Calc and copy time      | Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:07            | Minimum delay time      |   | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:08            | Command                 | With this entry the real required process data provision time can be measured.<br><ul style="list-style-type: none"> <li>• 0: Measurement of the local cycle time is stopped</li> <li>• 1: Measurement of the local cycle time is started</li> </ul> <p>The entries 0x1C32:03, 0x1C32:05, 0x1C32:06, 0x1C32:09, 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values.<br/> For a subsequent measurement the measured values are reset</p> | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:09            | Maximum delay time      | Time between SYNC1 event and output of the outputs (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:0B            | SM event missed counter | Number of missed SM events in OPERATIONAL (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0C            | Cycle exceeded counter  | Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0D            | Shift too short counter | Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:20            | Sync error              | The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)  | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> )       |

**Index 1C33 SM input parameter**

| Index (hex) | Name                    | Meaning  | Data type | Flags | Default                        |
|-------------|-------------------------|--|-----------|-------|--------------------------------|
| 1C33:0      | SM input parameter      | Synchronization parameters for the inputs  | UINT8     | RO    | 0x20 (32 <sub>dec</sub> )      |
| 1C33:01     | Sync mode               | Current synchronization mode:<br><ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchron with SM 3 Event (no outputs available)</li> <li>• 2: DC - Synchron with SYNC0 Event</li> <li>• 3: DC - Synchron with SYNC1 Event</li> <li>• 34: Synchron with SM 2 Event (outputs available)</li> </ul>   | UINT16    | RW    | 0x0022 (34 <sub>dec</sub> )    |
| 1C33:02     | Cycle time              | as 0x1C32:02   | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:03     | Shift time              | Time between SYNC0 event and reading of the inputs (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:04     | Sync modes supported    | Supported synchronization modes:<br><ul style="list-style-type: none"> <li>• Bit 0: free run is supported</li> <li>• Bit 1: Synchron with SM 2 Event is supported (outputs available)</li> <li>• Bit 1: Synchron with SM 3 Event is supported (no outputs available)</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 01: Input shift through local event (outputs available)</li> <li>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 or 0x1C33:08)</li> </ul> | UINT16    | RO    | 0xC007 (49159 <sub>dec</sub> ) |
| 1C33:05     | Minimum cycle time      | as 0x1C32:05   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:06     | Calc and copy time      | Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:07     | Minimum delay time      |  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:08     | Command                 | as 0x1C32:08   | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:09     | Maximum delay time      | Time between SYNC1 event and reading of the inputs (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:0B     | SM event missed counter | as 0x1C32:11   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0C     | Cycle exceeded counter  | as 0x1C32:12   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0D     | Shift too short counter | as 0x1C32:13   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:20     | Sync error              | as 0x1C32:32   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |

**Index F000 Modular device profile**

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

**Index F008 Code word**

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

**Index F010 Module list**

| Index (hex) | Name         | Meaning          | Data type | Flags | Default                              |
|-------------|--------------|------------------|-----------|-------|--------------------------------------|
| F010:0      | Module list  | Maximum subindex | UINT8     | RW    | 0x02 (2 <sub>dec</sub> )             |
| F010:01     | SubIndex 001 | reserved         | UINT32    | RW    | 0x0000001FE<br>(510 <sub>dec</sub> ) |

## 6.3 EP5101-0011



### Parameterization

You can parameterize the box via the "CoE - Online" tab in TwinCAT.



### EtherCAT XML Device Description

The presentation matches that of the EtherCAT XML Device Description.

Recommendation: download the latest XML file from <https://www.beckhoff.com/> and install it according to the installation instructions.

### 6.3.1 Restore object

#### Index 1011 Restore default parameters

| Index (hex) | Name                       | Meaning  | Data type | Flags | Default                        |
|-------------|----------------------------|--|-----------|-------|--------------------------------|
| 1011:0      | Restore default parameters | Restore the default settings   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> )       |
| 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.<br>Note: Some FW versions also accept the following input: 0x6C6F6164". | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.3.2 Configuration data

### Index 8000 ENC Settings

| Index (hex) | Name                                   | Meaning  | Data type | Flags | Default                        |
|-------------|--|--|-----------|-------|--------------------------------|
| 8000:0      | ENC Settings                           | Maximum subindex   | UINT8     | RO    | 0x17 (23 <sub>dec</sub> )      |
| 8000:01     | <u>Enable C reset [▶ 69]</u>           | The counter is reset via the C input.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:02     | <u>Enable extern reset [▶ 69]</u>      | A counter reset is triggered via the external latch input (24 V).  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:03     | <u>Enable up/down counter [▶ 69]</u>   | Enablement of the up/down counter in place of the encoder with the bit set.<br>Increments are counted at input A.<br>Input B specifies the counting direction.   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:04     | <u>Gate polarity [▶ 69]</u>            | 0: Disable gate<br>1: Enable pos. gate (gate locks with HIGH signal level)<br>2: Enable neg. gate (gate locks with LOW signal level)   | BIT2      | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:08     | Disable filter                         | 0: Activates the input filter (inputs A, /A, B, /B, C, /C only)<br>1: Deactivates the input filter<br>If a filter is activated a signal edge must be present for at least 2.4 µs in order to be counted as an increment.   | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0A     | <u>Enable micro increments [▶ 70]</u>  | If DC mode is activated, the Box interpolates micro-increments between the integer encoder increments. The lower 8 bits of the <i>Counter Value</i> are used in each case for the display. A 32-bit counter thus becomes a 24+8-bit counter, a 16-bit counter becomes an 8+8-bit counter.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0B     | <u>Open circuit detection A [▶ 70]</u> | An open circuit on track A is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 100]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0C     | <u>Open circuit detection B [▶ 70]</u> | An open circuit on track B is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 100]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0D     | <u>Open circuit detection C [▶ 70]</u> | An open circuit on track C is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 100]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0E     | <u>Reversion of rotation [▶ 69]</u>    | Activates reversion of rotation  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:10     | <u>Extern reset polarity [▶ 69]</u>    | 0: Fall (the counter is set to zero with a falling edge)<br>1: Rise (the counter is set to zero with a rising edge)  | BIT2      | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:11     | <u>Frequency window [▶ 68]</u>         | This is the minimum time over which the frequency is determined; default value 10 ms [resolution: 1 µs]. The number of pulses in the timeframe + the following is measured. The maximum waiting time is specified in the <i>Frequency Wait Time</i> parameter. The number of pulses is divided by the actual time window size. The determined frequency is output in object <i>Frequency value</i> (index 0x6000:13 [▶ 100]) and as a process data.<br>The frequency calculation is carried out locally without distributed clocks function. | UINT16    | RW    | 0x2710 (10000 <sub>dec</sub> ) |
| 8000:13     | <u>Frequency scaling [▶ 68]</u>        | Scaling of the frequency measurement (must be divided by this value to obtain the unit in Hz): 100: "0.01 Hz"  | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:14     | <u>Period scaling [▶ 68]</u>           | Resolution of the period value in the process data: 100: "100 ns" period value is a multiple of 100 ns<br>500: "500 ns" period value is a multiple of 500 ns   | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:15     | <u>Frequency resolution [▶ 68]</u>     | Resolution of the frequency measurement: 100: "0.01 Hz"  | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |

| Index (hex) | Name                                 | Meaning  | Data type | Flags | Default                          |
|-------------|--------------------------------------|--|-----------|-------|----------------------------------|
| 8000:16     | <u>Period resolution</u><br>[► 68]   | Internal resolution of the period value measurement: 100:<br>“100 ns” period value is a multiple of 100 ns<br><br>The period is calculated internally with a resolution of<br>100 ns. The max. measurable period can then be approx.<br>1.6 seconds.<br><br>500: “500 ns” period value is a multiple of 500 ns<br><br>Internally the period is calculated with 500 ns resolution.<br>The maximum measurable period is approx. 32.7 ms. The<br>resolution of the process data continues to be the value<br>according to object <i>Period scaling</i> (index 0x8000:14)<br>(e.g., 100 ns [default]). | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )     |
| 8000:17     | <u>Frequency wait time</u><br>[► 68] | Waiting time [ms] for frequency measurement<br>Once the time specified in the <i>frequency window</i> has<br>elapsed, the system waits for the next positive edge from<br>track A. This enables the update speed for the <i>Frequency</i><br>process data to be optimized, depending on the expected<br>frequencies. The minimum value to be entered here is<br>$T \geq 2^* (1 / f_{min})$   | UINT16    | RW    | 0x0640<br>(1600 <sub>dec</sub> ) |

### 6.3.3 Input data

#### Index 6000 ENC Inputs

| Index (hex) | Name                              | Meaning   | Data type | Flags | Default                        |
|-------------|-----------------------------------|---|-----------|-------|--------------------------------|
| 6000:0      | ENC Inputs                        | Maximum subindex  | UINT8     | RO    | 0x16 (22 <sub>dec</sub> )      |
| 6000:01     | <u>Latch C valid</u> [▶ 69]       | The counter value was latched with the “C” input. The data with <i>Latch Value</i> (Index 0x6000:12) corresponds to the latched value if the bit is set.<br>To re-enable the latch input, <i>Enable latch C</i> (index 0x7000:01 [▶ 101]) must be canceled and then reset.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:02     | <u>Latch extern valid</u> [▶ 69]  | The counter value was locked via the external latch. The data with <i>Latch Value</i> (Index 0x6000:12) corresponds to the latched value if the bit is set.<br>To re-enable the latch input, <i>Enable latch extern on positive edge</i> (index 0x7000:02 [▶ 101]) or object <i>Enable latch extern on negative edge</i> (index 0x7000:04 [▶ 101]) must first be canceled and then reset. | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:03     | Set counter done                  | The counter was set.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:04     | <u>Counter underflow</u> [▶ 70]   | The counter has passed the zero crossing backwards.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:05     | <u>Counter overflow</u> [▶ 70]    | Counter overflow.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:06     | Status of input status            | State of the status input (alarm “input 1”)   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:07     | <u>Open circuit</u> [▶ 70]        | Indicates an open circuit.<br>Configuration via the objects:<br><i>Open circuit detection A</i> Index Index0x8000:0B [▶ 98],<br><i>Open circuit detection B</i> Index Index0x8000:0C, [▶ 98]<br><i>Open circuit detection C</i> Index Index0x8000:0D [▶ 98]   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:08     | <u>Extrapolation stall</u> [▶ 70] | The extrapolated part of the counter is invalid.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:09     | Status of input A                 | Status of input A   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0A     | Status of input B                 | Status of input B   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0B     | Status of input C                 | Status of input C   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0C     | Status of input gate              | The state of the gate input   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0D     | Status of external ledge          | Status of the extern latch input  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0E     | Sync error                        | The Sync error bit is only required for DC mode. It indicates whether a synchronization error has occurred during the previous cycle. This means a SYNC signal was triggered in the Box, although no new process data were available (0=OK, 1=NOK).   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0F     | TxDPO State                       | Validity of the data of the associated TxDPO (0 = valid, 1 = invalid).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:10     | TxDPO Toggle                      | The TxDPO toggle is toggled by the slave when the data of the associated TxDPO is updated.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:11     | Counter value                     | Counter value   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:12     | Latch value                       | Latch value   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:13     | <u>Frequency value</u> [▶ 68]     | The frequency (setting of the scaling in index 0x8000:13 [▶ 98] and resolution in index 0x8000:15 [▶ 98])   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:14     | <u>Period value</u> [▶ 68]        | The period value (setting of the scaling in index 0x8000:14 [▶ 98] and resolution in index 0x8000:16 [▶ 98])  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:16     | <u>Timestamp</u> [▶ 56]           | Timestamp of the last counter change  | UINT64    | RO    |                                |

## 6.3.4 Output data

### Index 7000 ENC Outputs

| Index (hex) | Name   | Meaning   | Data type | Flags | Default                        |
|-------------|--|---|-----------|-------|--------------------------------|
| 7000:0      | ENC Outputs  | Maximum subindex  | UINT8     | RO    | 0x11(17 <sub>dec</sub> )       |
| 7000:01     | <u>Enable latch C [▶ 69]</u>                       | Activate latching via input "C".                                      | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:01     | <u>Enable latch extern on positive edge [▶ 69]</u> | Activate external latch with positive edge.                           | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:03     | Set counter  | Set counter value   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:04     | <u>Enable latch extern on negative edge [▶ 69]</u> | Activate external latch with negative edge.                           | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:11     | Set counter value                                  | The counter value to be set via <i>Set counter</i> (index 0x7000:03). | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.3.5 Information / diagnostic data (channel specific)

### Index A000 ENC Diag data

| Index (hex) | Name                         | Meaning                 | Data type | Flags | Default                  |
|-------------|------------------------------|-------------------------|-----------|-------|--------------------------|
| A000:0      | ENC Diag data                | Maximum subindex        | UINT8     | RO    | 0x03 (3 <sub>dec</sub> ) |
| A000:01     | <u>Open circuit A [▶ 70]</u> | Open circuit on track A | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |
| A000:02     | <u>Open circuit B [▶ 70]</u> | Open circuit on track B | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |
| A000:03     | <u>Open circuit C [▶ 70]</u> | Open circuit on track C | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> ) |

## 6.3.6 Standard objects

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

### Index 1000 Device type

| Index (hex) | Name        | Meaning   | Data type | Flags | Default                               |
|-------------|-------------|---|-----------|-------|---------------------------------------|
| 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    | 0x01FF1389 (33493897 <sub>dec</sub> ) |

### Index 1008 Device name

| Index (hex) | Name        | Meaning                           | Data type | Flags | Default     |
|-------------|-------------|-----------------------------------|-----------|-------|-------------|
| 1008:0      | Device name | Device name of the EtherCAT slave | STRING    | RO    | EP5101-0011 |

### Index 1009 Hardware version

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

### Index 100A Software version

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

**Index 1018 Identity**

| Index (hex) | Name          | Meaning   | Data type | Flags | Default                                |
|-------------|---------------|---|-----------|-------|--|
| 1018:0      | Identity      | Information for identifying the slave   | UINT8     | RO    | 0x04 (4 <sub>dec</sub> )               |
| 1018:01     | Vendor ID     | Vendor ID of the EtherCAT slave   | UINT32    | RO    | 0x00000002 (2 <sub>dec</sub> )         |
| 1018:02     | Product code  | Product code of the EtherCAT slave  | UINT32    | RO    | 0x13ED4052 (334315602 <sub>dec</sub> ) |
| 1018:03     | Revision      | Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |
| 1018:04     | Serial number | Serial number of the EtherCAT slave; the Low Byte (bit 0-7) of the Low Word contains the year of production, the High Byte (bit 8-15) of the Low Word contains the week of production, the High Word (bit 16-31) is 0 | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |

**Index 10F0 Backup parameter handling**

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

**Index 1400 ENC RxPDO-Par Control compact**

| Index (hex) | Name                          | Meaning  | Data type       | Flags | Default                  |
|-------------|-------------------------------|--|-----------------|-------|--------------------------|
| 1400:0      | ENC RxPDO-Par Control compact | PDO Parameter RxPDO 1  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1400:06     | Exclude RxPDOs                | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 1 | OCTET-STRING[2] | RO    | 01 16                    |

**Index 1401 ENC RxPDO-Par Control**

| Index (hex) | Name                  | Meaning  | Data type       | Flags | Default                  |
|-------------|-----------------------|--|-----------------|-------|--------------------------|
| 1401:0      | ENC RxPDO-Par Control | PDO Parameter RxPDO 2  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1401:06     | Exclude RxPDOs        | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 2 | OCTET-STRING[2] | RO    | 00 16                    |

**Index 1600 ENC RxPDO-Map Control compact**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1600:0      | ENC RxPDO-Map Control compact | PDO Mapping RxPDO 3   | UINT8     | RO    | 0x07 (7 <sub>dec</sub> ) |
| 1600:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))                       | UINT32    | RO    | 0x7000:01,1              |
| 1600:02     | SubIndex 002                  | 2. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x02 (Enable latch extern on positive edge)) | UINT32    | RO    | 0x7000:02,1              |
| 1600:03     | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))                          | UINT32    | RO    | 0x7000:03, 1             |
| 1600:04     | SubIndex 004                  | 4. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x04 (Enable latch extern on negative edge)) | UINT32    | RO    | 0x7000:04, 1             |
| 1600:05     | SubIndex 005                  | 5. PDO Mapping entry (4 bits align)   | UINT32    | RO    | 0x0000:00, 4             |
| 1600:06     | SubIndex 006                  | 6. PDO Mapping entry (8 bits align)   | UINT32    | RO    | 0x0000:00, 8             |
| 1600:07     | SubIndex 007                  | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value))                    | UINT32    | RO    | 0x7000:11, 16            |

**Index 1601 ENC RxPDO-Map Control**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1601:0      | ENC RxPDO-Map Control compact | PDO Mapping RxPDO   | UINT8     | RO    | 0x07 (7 <sub>dec</sub> ) |
| 1601:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))                       | UINT32    | RO    | 0x7000:01,1              |
| 1601:02     | SubIndex 002                  | 2. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x02 (Enable latch extern on positive edge)) | UINT32    | RO    | 0x7000:02,1              |
| 1601:03     | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))                          | UINT32    | RO    | 0x700:03,1               |
| 1601:04     | SubIndex 004                  | 4. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x04 (Enable latch extern on negative edge)) | UINT32    | RO    | 0x700:04,1               |
| 1601:05     | SubIndex 005                  | 5. PDO Mapping entry (4 bits align)   | UINT32    | RO    | 0x0000:00,4              |
| 1601:06     | SubIndex 006                  | 6. PDO Mapping entry (8 bits align)   | UINT32    | RO    | 0x0000:00,8              |
| 1601:07     | SubIndex 007                  | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value))                    | UINT32    | RO    | 0x7000:11,32             |

**Index 1800 ENC TxPDO-Par Status compact**

| Index (hex) | Name                 | Meaning  | Data type       | Flags | Default                  |
|-------------|----------------------|--|-----------------|-------|--------------------------|
| 1800:0      | ENC TxPDO-Par Status | PDO parameter TxPDO 1  | UINT8           | RO    | 0x09 (9 <sub>dec</sub> ) |
| 1800:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 1 | OCTET-STRING[2] | RO    | 01 1A                    |
| 1800:07     | TxPDO State          | The TxPDO state is set if it was not possible to correctly read in the associated input data             | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |
| 1800:09     | TxPDO Toggle         | The TxPDO toggle is toggled with each update the corresponding input data                                | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |

**Index 1801 ENC TxPDO-Par Status**

| Index (hex) | Name                         | Meaning  | Data type       | Flags | Default                  |
|-------------|------------------------------|--|-----------------|-------|--------------------------|
| 1801:0      | ENC TxPDO-Par Status compact | PDO parameter TxPDO 2  | UINT8           | RO    | 0x09 (9 <sub>dec</sub> ) |
| 1801:06     | Exclude TxPDOs               | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 2 | OCTET-STRING[2] | RO    | 00 1A                    |
| 1801:07     | TxPDO State                  | The TxPDO state is set if it was not possible to correctly read in the associated input data             | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |
| 1801:09     | TxPDO Toggle                 | The TxPDO toggle is toggled with each update the corresponding input data                                | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |

**Index 1802 ENC TxPDO-Par Frequency**

| Index (hex) | Name                    | Meaning  | Data type       | Flags | Default                  |
|-------------|-------------------------|--|-----------------|-------|--------------------------|
| 1802:0      | ENC TxPDO-Par Frequency | PDO parameter TxPDO 3  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1802:06     | Exclude TxPDOs          | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 3 | OCTET-STRING[2] | RO    | 03 1A                    |

**Index 1803 ENC TxPDO-Par Period**

| Index (hex) | Name                 | Meaning  | Data type       | Flags | Default                  |
|-------------|----------------------|--|-----------------|-------|--------------------------|
| 1803:0      | ENC TxPDO-Par Period | PDO parameter TxPDO 4  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1803:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 4 | OCTET-STRING[2] | RO    | 02 1A                    |

**Index 1804 ENC TxPDO-Par Timest.**

| Index (hex) | Name                  | Meaning  | Data type       | Flags | Default                  |
|-------------|-----------------------|--|-----------------|-------|--------------------------|
| 1804:0      | ENC TxPDO-Par Timest. | PDO parameter TxPDO 5  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1804:06     | Exclude TxPDOs        | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 5 | OCTET-STRING[2] | RO    | 05 1A                    |

**Index 1805 ENC TxPDO-Par Timest. compact**

| Index (hex) | Name                          | Meaning  | Data type       | Flags | Default                  |
|-------------|-------------------------------|--|-----------------|-------|--------------------------|
| 1805:0      | ENC TxPDO-Par Timest. compact | PDO parameter TxPDO 6  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1805:06     | Exclude TxPDOs                | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 6 | OCTET-STRING[2] | RO    | 04 1A                    |

**Index 1A00 ENC TxPDO-Map Status compact**

| Index (hex) | Name                 | Meaning   | Data type | Flags | Default                    |
|-------------|----------------------|---|-----------|-------|----------------------------|
| 1A00:0      | ENC TxPDO-Map Status | ENC TxPDO-Map Status compact  | UINT8     | RO    | 0x012 (18 <sub>dec</sub> ) |
| 1A00:01     | SubIndex 001         | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))                   | UINT32    | RO    | 0x6000:01, 1               |
| 1A00:02     | SubIndex 002         | 2. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x02 (Latch extern valid))              | UINT32    | RO    | 0x6000:02, 1               |
| 1A00:03     | SubIndex 003         | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))                | UINT32    | RO    | 0x6000:03, 1               |
| 1A00:04     | SubIndex 004         | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))               | UINT32    | RO    | 0x6000:04, 1               |
| 1A00:05     | SubIndex 005         | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))                | UINT32    | RO    | 0x6000:05, 1               |
| 1A00:06     | SubIndex 006         | 6. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x06 (Status of input status))          | UINT32    | RO    | 0x6000:06, 1               |
| 1A00:07     | SubIndex 007         | 7. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (Open circuit))                    | UINT32    | RO    | 0x6000:07, 1               |
| 1A00:08     | SubIndex 008         | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))             | UINT32    | RO    | 0x6000:08, 1               |
| 1A00:09     | SubIndex 009         | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))               | UINT32    | RO    | 0x6000:09, 1               |
| 1A00:0A     | SubIndex 010         | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))              | UINT32    | RO    | 0x6000:0A, 1               |
| 1A00:0B     | SubIndex 011         | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))              | UINT32    | RO    | 0x6000:0B, 1               |
| 1A00:0C     | SubIndex 012         | 12. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0C (Status of input gate))           | UINT32    | RO    | 0x6000:0C; 2               |
| 1A00:0D     | SubIndex 013         | 13. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0D (Status of extern latch))         | UINT32    | RO    | 0x6000:0D; 2               |
| 1A00:0E     | SubIndex 014         | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))            | UINT32    | RO    | 0x1C32:20, 1               |
| 1A00:0F     | SubIndex 015         | 15. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x07 (TxPDO State))  | UINT32    | RO    | 0x1800:07, 1               |
| 1A00:10     | SubIndex 016         | 16. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x09 (TxPDO Toggle)) | UINT32    | RO    | 0x1800:09, 1               |
| 1A00:11     | SubIndex 017         | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))                  | UINT32    | RO    | 0x6000:11, 16              |
| 1A00:12     | SubIndex 018         | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))                    | UINT32    | RO    | 0x6000:12, 16              |

**Index 1A01 ENC TxPDO-Map Status**

| Index (hex) | Name                         | Meaning   | Data type | Flags | Default                   |
|-------------|------------------------------|---|-----------|-------|---------------------------|
| 1A01:0      | ENC TxPDO-Map Status compact | PDO Mapping TxPDO 2   | UINT8     | RO    | 0x12 (18 <sub>dec</sub> ) |
| 1A01:01     | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))           | UINT32    | RO    | 0x6000:01, 1              |
| 1A01:02     | SubIndex 002                 | 2. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x02 (Latch extern valid))      | UINT32    | RO    | 0x6000:02, 1              |
| 1A01:03     | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))        | UINT32    | RO    | 0x6000:03, 1              |
| 1A01:04     | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))       | UINT32    | RO    | 0x6000:04, 1              |
| 1A01:05     | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))        | UINT32    | RO    | 0x6000:05, 1              |
| 1A01:06     | SubIndex 006                 | 6. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x06 (Status of input status))  | UINT32    | RO    | 0x6000:06, 1              |
| 1A01:07     | SubIndex 007                 | 7. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (Open circuit))            | UINT32    | RO    | 0x6000:07, 1              |
| 1A01:08     | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))     | UINT32    | RO    | 0x6000:08, 1              |
| 1A01:09     | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))       | UINT32    | RO    | 0x6000:09, 1              |
| 1A01:0A     | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))      | UINT32    | RO    | 0x6000:0A, 1              |
| 1A01:0B     | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))      | UINT32    | RO    | 0x6000:0B, 1              |
| 1A01:0C     | SubIndex 012                 | 12. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0C (Status of input gate))   | UINT32    | RO    | 0x6000:0C, 1              |
| 1A01:0D     | SubIndex 013                 | 13. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0D (Status of extern latch)) | UINT32    |       | 0x6000:0D, 1              |
| 1A01:0E     | SubIndex 014                 | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))    | UINT32    | RO    | 0x1C32:20, 1              |
| 1A01:0F     | SubIndex 015                 | 15. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x07 (TxPDO State))  |           |       | 0x1801:07, 1              |
| 1A01:10     | SubIndex 016                 | 16. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x09 (TxPDO Toggle)) | UINT32    | RO    | 0x1801:09, 1              |
| 1A01:11     | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))          | UINT32    | RO    | 0x6000:11, 16             |
| 1A01:12     | SubIndex 018                 | 18. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))            | UINT32    | RO    | 0x6000:12, 16             |

**Index 1A02 ENC TxPDO-Map Frequency**

| Index (hex) | Name                | Meaning   | Data type | Flags | Default                  |
|-------------|---------------------|---|-----------|-------|--------------------------|
| 1A02:0      | TxPDO map frequency | PDO Mapping TxPDO   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> ) |
| 1A02:01     | SubIndex 001        | 1. PDO Mapping entry (object 0x6000 (Inputs), entry 0x13 (Frequency value)) | UINT32    | RO    | 0x6000:13, 32            |

**Index 1A03 ENC TxPDO-Map Period**

| Index (hex) | Name                 | Meaning  | Data type | Flags | Default                  |
|-------------|----------------------|--|-----------|-------|--------------------------|
| 1A03:0      | ENC TxPDO-Map Period | ENC TxPDO-Map Period   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> ) |
| 1A03:01     | SubIndex 001         | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x14 (Period value)) | UINT32    | RO    | 0x6000:14, 32            |

**Index 1A04 ENC TxPDO-Map Timest.**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1A04:0      | ENC TxPDO-Map Timest. compact | PDO Mapping TxPDO   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> ) |
| 1A04:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x6010 (ENC Inputs), entry 0x16 (Timestamp)) | UINT32    | RO    | 0x6000:16, 64            |

**Index 1A05 ENC TxPDO-Map Timest. compact**

| <b>Index (hex)</b> | <b>Name</b>                      | <b>Meaning</b>   | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|----------------------------------|--|------------------|--------------|--------------------------|
| 1A05:0             | ENC TxPDO-Map<br>Timest. compact | PDO Mapping TxPDO  | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A05:01            | SubIndex 001                     | 1. PDO Mapping entry (object 0x6010 (ENC Inputs),<br>entry 0x16 (Timestamp)) | UINT32           | RO           | 0x6000:16, 32            |

**Index 1C00 Sync manager type**

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

**Index 1C12 RxPDO assign**

| <b>Index (hex)</b> | <b>Name</b>  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                   |
|--------------------|--------------|---|------------------|--------------|----------------------------------|
| 1C12:0             | RxPDO assign | PDO Assign Outputs  | UINT8            | RW           | 0x01 (1 <sub>dec</sub> )         |
| 1C12:01            | SubIndex 001 | 1. allocated RxPDO (contains the index of the<br>associated RxPDO mapping object) | UINT16           | RW           | 0x1600<br>(5632 <sub>dec</sub> ) |

**Index 1C13 TxPDO assign**

| <b>Index (hex)</b> | <b>Name</b>  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                   |
|--------------------|--------------|---|------------------|--------------|----------------------------------|
| 1C13:0             | TxPDO assign | PDO Assign Inputs   | UINT8            | RW           | 0x01 (1 <sub>dec</sub> )         |
| 1C13:01            | SubIndex 001 | 1. allocated TxPDO (contains the index of the<br>associated TxPDO mapping object) | UINT16           | RW           | 0x1A00<br>(6656 <sub>dec</sub> ) |
| 1C13:02            | SubIndex 002 | 2. allocated TxPDO (contains the index of the<br>associated TxPDO mapping object) | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )       |
| 1C13:03            | SubIndex 003 | 3. allocated TxPDO (contains the index of the<br>associated TxPDO mapping object) | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )       |

## Index 1C32 SM output parameter

| Index (hex) | Name                    | Meaning   | Data type | Flags | Default                        |
|-------------|-------------------------|---|-----------|-------|--------------------------------|
| 1C32:0      | SM output parameter     | Synchronization parameters for the outputs  | UINT8     | RO    | 0x20 (32 <sub>dec</sub> )      |
| 1C32:01     | Sync mode               | Current synchronization mode: <ul style="list-style-type: none"><li>• 0: Free Run</li><li>• 1: Synchron with SM 2 Event</li><li>• 2: DC-Mode - Synchron with SYNC0 Event</li><li>• 3: DC-Mode - Synchron with SYNC1 Event</li></ul>   | UINT16    | RW    | 0x0001 (1 <sub>dec</sub> )     |
| 1C32:02     | Cycle time              | Cycle time (in ns): <ul style="list-style-type: none"><li>• Free Run: Cycle time of the local timer</li><li>• Synchron with SM 2 Event: Master cycle time</li><li>• DC mode: SYNC0/SYNC1 Cycle Time</li></ul>   | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:03     | Shift time              | Time between SYNC0 event and output of the outputs (in ns, DC mode only)  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:04     | Sync modes supported    | Supported synchronization modes: <ul style="list-style-type: none"><li>• Bit 0 = 1: free run is supported</li><li>• Bit 1 = 1: Synchron with SM 2 Event is supported</li><li>• Bit 2-3 = 01: DC mode is supported</li><li>• Bit 4-5 = 10: Output shift with SYNC1 event (only DC mode)</li><li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08)</li></ul>   | UINT16    | RO    | 0xC007 (49159 <sub>dec</sub> ) |
| 1C32:05     | Minimum cycle time      | Minimum cycle time (in ns)  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:06     | Calc and copy time      | Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:08     | Command                 | With this entry the real required process data provision time can be measured. <ul style="list-style-type: none"><li>• 0: Measurement of the local cycle time is stopped</li><li>• 1: Measurement of the local cycle time is started</li></ul> The entries 0x1C32:03, 0x1C32:05, 0x1C32:06, 0x1C32:09, 0x1C33:03 [▶ 108], 0x1C33:06 [▶ 107], 0x1C33:09 [▶ 108] are updated with the maximum measured values.<br>For a subsequent measurement the measured values are reset. | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:09     | Maximum delay time      | Time between SYNC1 event and output of the outputs (in ns, DC mode only)  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:0B     | SM event missed counter | Number of missed SM events in OPERATIONAL (DC mode only)  | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0C     | Cycle exceeded counter  | Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)  | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0D     | Shift too short counter | Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)  | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:20     | Sync error              | The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |

**Index 1C33 SM input parameter**

| <b>Index (hex)</b> | <b>Name</b>             | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                 |
|--------------------|-------------------------|---|------------------|--------------|--------------------------------|
| 1C33:0             | SM input parameter      | Synchronization parameters for the inputs   | UINT8            | RO           | 0x20 (32 <sub>dec</sub> )      |
| 1C33:01            | Sync mode               | Current synchronization mode: <ul style="list-style-type: none"><li>• 0: Free Run</li><li>• 1: Synchron with SM 3 Event (no outputs available)</li><li>• 2: DC - Synchron with SYNC0 Event</li><li>• 3: DC - Synchron with SYNC1 Event</li><li>• 34: Synchron with SM 2 Event (outputs available)</li></ul>   | UINT16           | RW           | 0x0022 (34 <sub>dec</sub> )    |
| 1C33:02            | Cycle time              | as <a href="#">0x1C32:02 [▶ 107]</a>  | UINT32           | RW           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:03            | Shift time              | Time between SYNC0 event and reading of the inputs (in ns, only DC mode)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:04            | Sync modes supported    | Supported synchronization modes: <ul style="list-style-type: none"><li>• Bit 0: free run is supported</li><li>• Bit 1: Synchron with SM 2 Event is supported (outputs available)</li><li>• Bit 1: Synchron with SM 3 Event is supported (no outputs available)</li><li>• Bit 2-3 = 01: DC mode is supported</li><li>• Bit 4-5 = 01: Input shift through local event (outputs available)</li><li>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li><li>• Bit 14 = 1: dynamic times (measurement through writing of <a href="#">0x1C32:08 [▶ 107]</a> or <a href="#">0x1C33:08</a>)</li></ul> | UINT16           | RO           | 0xC007 (49159 <sub>dec</sub> ) |
| 1C33:05            | Minimum cycle time      | as <a href="#">0x1C32:05 [▶ 107]</a>  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:06            | Calc and copy time      | Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:07            | Minimum delay time      |   | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:08            | Command                 | as <a href="#">0x1C32:08 [▶ 107]</a>  | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:09            | Delay time              | Time between SYNC1 event and reading of the inputs (in ns, only DC mode)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:0B            | SM event missed counter | as <a href="#">0x1C32:11 [▶ 107]</a>  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0C            | Cycle exceeded counter  | as <a href="#">0x1C32:12 [▶ 107]</a>  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0D            | Shift too short counter | as <a href="#">0x1C32:13 [▶ 107]</a>  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:20            | Sync error              | as <a href="#">0x1C32:32 [▶ 107]</a>  | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> )       |

**Index F000 Modular device profile**

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

**Index F008 Code word**

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

**Index F010 Module list**

| Index (hex) | Name         | Meaning          | Data type | Flags | Default                              |
|-------------|--------------|------------------|-----------|-------|--------------------------------------|
| F010:0      | Module list  | Maximum subindex | UINT8     | RW    | 0x02 (2 <sub>dec</sub> )             |
| F010:01     | SubIndex 001 | reserved         | UINT32    | RW    | 0x0000001FE<br>(510 <sub>dec</sub> ) |
| F010:02     | SubIndex 002 | reserved         | UINT32    | RW    | 0x0000001FF<br>(511 <sub>dec</sub> ) |

## 6.4 EP5151-0002



### Parameterization

You can parameterize the box via the "CoE - Online" tab in TwinCAT.



### EtherCAT XML Device Description

The presentation matches that of the EtherCAT XML Device Description.

Recommendation: download the latest XML file from <https://www.beckhoff.com/> and install it according to the installation instructions.

### 6.4.1 Restore object

#### Index 1011 Restore default parameters

| Index (hex) | Name                       | Meaning   | Data type | Flags | Default                        |
|-------------|----------------------------|---|-----------|-------|--------------------------------|
| 1011:0      | Restore default parameters | Restore the default settings  | UINT8     | RO    | 0x01 (1 <sub>dec</sub> )       |
| 1011:01     | SubIndex 001               | If this object is set to " <b>0x64616F6C</b> " in the set value dialog, all backup objects are reset to their delivery state.<br>Note: Some FW versions also accept the following input: <b>0x6C6F6164</b> ". | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.4.2 Configuration data

### Index 8000 ENC Settings

| Index (hex) | Name                                   | Meaning  | Data type | Flags | Default                        |
|-------------|--|--|-----------|-------|--------------------------------|
| 8000:0      | ENC Settings                           | Maximum subindex   | UINT8     | RO    | 0x17 (23 <sub>dec</sub> )      |
| 8000:01     | <u>Enable C reset</u> [▶ 69]           | The counter is reset via the C input.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:02     | <u>Enable extern reset</u> [▶ 69]      | A counter reset is triggered via the external latch input (24 V).  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:03     | <u>Enable up/down counter</u> [▶ 69]   | Enablement of the up/down counter in place of the encoder with the bit set.<br>Increments are counted at input A.<br>Input B specifies the counting direction.   | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:04     | <u>Gate polarity</u> [▶ 69]            | 0: Disable gate<br>1: Enable pos. gate (gate locks with HIGH signal level)<br>2: Enable neg. gate (gate locks with LOW signal level)   | BIT2      | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:08     | Disable filter                         | 0: Activates the input filter (inputs A, /A, B, /B, C, /C only)<br>1: Deactivates the input filter<br>If a filter is activated a signal edge must be present for at least 2.4 µs in order to be counted as an increment.   | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0A     | <u>Enable micro increments</u> [▶ 70]  | If DC mode is activated, the Box interpolates micro-increments between the integer encoder increments. The lower 8 bits of the <i>Counter Value</i> are used in each case for the display. A 32-bit counter thus becomes a 24+8-bit counter, a 16-bit counter becomes an 8+8-bit counter.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0B     | <u>Open circuit detection A</u> [▶ 70] | An open circuit on track A is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 113]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0C     | <u>Open circuit detection B</u> [▶ 70] | An open circuit on track B is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 113]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:0D     | <u>Open circuit detection C</u> [▶ 70] | An open circuit on track C is indicated in object <i>Open circuit</i> (index 0x6000:07 [▶ 113]) and as a process data. Diagnosis is only possible if the corresponding input is wired differentially. A differential voltage < 3.5 V (typical, subject to change) is detected as a broken wire.  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:0E     | <u>Reversion of rotation</u> [▶ 69]    | Activates reversion of rotation  | BOOLEAN   | RW    | 0x00 (0 <sub>dec</sub> )       |
| 8000:10     | <u>Extern reset polarity</u> [▶ 69]    | 0: Fall (the counter is set to zero with a falling edge)<br>1: Rise (the counter is set to zero with a rising edge)  | BIT2      | RW    | 0x01 (1 <sub>dec</sub> )       |
| 8000:11     | <u>Frequency window</u> [▶ 68]         | This is the minimum time over which the frequency is determined; default value 10 ms [resolution: 1 µs]. The number of pulses in the timeframe + the following is measured. The maximum waiting time is specified in the <i>Frequency Wait Time</i> parameter. The number of pulses is divided by the actual time window size. The determined frequency is output in object <i>Frequency value</i> (index 0x6000:13 [▶ 113]) and as a process data.<br>The frequency calculation is carried out locally without distributed clocks function. | UINT16    | RW    | 0x2710 (10000 <sub>dec</sub> ) |
| 8000:13     | <u>Frequency scaling</u> [▶ 68]        | Scaling of the frequency measurement (must be divided by this value to obtain the unit in Hz): 100: "0.01 Hz"  | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:14     | <u>Period scaling</u> [▶ 68]           | Resolution of the period value in the process data: 100: "100 ns" period value is a multiple of 100 ns<br>500: "500 ns" period value is a multiple of 500 ns   | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |
| 8000:15     | <u>Frequency resolution</u> [▶ 68]     | Resolution of the frequency measurement: 100: "0.01 Hz"  | UINT16    | RW    | 0x0064 (100 <sub>dec</sub> )   |

| <b>Index (hex)</b> | <b>Name</b>                          | <b>Meaning</b>   | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                   |
|--------------------|--------------------------------------|--|------------------|--------------|----------------------------------|
| 8000:16            | <u>Period resolution</u><br>[► 68]   | Internal resolution of the period value measurement: 100:<br>“100 ns” period value is a multiple of 100 ns<br><br>The period is calculated internally with a resolution of<br>100 ns. The max. measurable period can then be approx.<br>1.6 seconds.<br><br>500: “500 ns” period value is a multiple of 500 ns<br><br>Internally the period is calculated with 500 ns resolution.<br>The maximum measurable period is approx. 32.7 ms. The<br>resolution of the process data continues to be the value<br>according to object <i>Period scaling</i> (index 0x8000:14)<br>(e.g., 100 ns [default]). | UINT16           | RW           | 0x0064 (100 <sub>dec</sub> )     |
| 8000:17            | <u>Frequency wait time</u><br>[► 68] | Waiting time [ms] for frequency measurement<br>Once the time specified in the <i>frequency window</i> has<br>elapsed, the system waits for the next positive edge from<br>track A. This enables the update speed for the <i>Frequency</i><br>process data to be optimized, depending on the expected<br>frequencies. The minimum value to be entered here is<br>$T \geq 2^* (1 / f_{min})$   | UINT16           | RW           | 0x0640<br>(1600 <sub>dec</sub> ) |

## 6.4.3 Input data

### Index 6000 ENC Inputs

| Index (hex) | Name                              | Meaning   | Data type | Flags | Default                        |
|-------------|-----------------------------------|---|-----------|-------|--------------------------------|
| 6000:0      | ENC Inputs                        | Maximum subindex  | UINT8     | RO    | 0x16 (22 <sub>dec</sub> )      |
| 6000:01     | <u>Latch C valid</u> [▶ 69]       | The counter value was latched with the “C” input. The data with <i>Latch Value</i> (Index 0x6000:12) corresponds to the latched value if the bit is set.<br>To re-enable the latch input, <i>Enable latch C</i> (index 0x7000:01 [▶ 114]) must be canceled and then reset.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:02     | <u>Latch extern valid</u> [▶ 69]  | The counter value was locked via the external latch. The data with <i>Latch Value</i> (Index 0x6000:12) corresponds to the latched value if the bit is set.<br>To re-enable the latch input, <i>Enable latch extern on positive edge</i> (index 0x7000:02 [▶ 114]) or object <i>Enable latch extern on negative edge</i> (index 0x7000:04 [▶ 114]) must first be canceled and then reset. | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:03     | Set counter done                  | The counter was set.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:04     | <u>Counter underflow</u> [▶ 70]   | The counter has passed the zero crossing backwards.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:05     | <u>Counter overflow</u> [▶ 70]    | Counter overflow.<br>Overflow/underflow control is inactive in combination with a reset function (C/external).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:06     | Status of input status            | State of the status input (alarm “input 1”)   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:07     | <u>Open circuit</u> [▶ 70]        | Indicates an open circuit.<br>Configuration via object:<br><i>Open circuit detection A</i> Index 0x8000:0B [▶ 111],<br><i>Open circuit detection B</i> Index 0x8000:0C, [▶ 111]<br><i>Open circuit detection C</i> Index 0x8000:0D [▶ 111],   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:08     | <u>Extrapolation stall</u> [▶ 70] | The extrapolated part of the counter is invalid.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:09     | Status of input A                 | Status of input A   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0A     | Status of input B                 | Status of input B   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0B     | Status of input C                 | Status of input C   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0C     | Status of input gate              | The state of the gate input   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0D     | Status of external ledge          | Status of the extern latch input  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0E     | Sync error                        | The Sync error bit is only required for DC mode. It indicates whether a synchronization error has occurred during the previous cycle. This means a SYNC signal was triggered in the Box, although no new process data were available (0=OK, 1=NOK).   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:0F     | TxDPO State                       | Validity of the data of the associated TxDPO (0 = valid, 1 = invalid).  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:10     | TxDPO Toggle                      | The TxDPO toggle is toggled by the slave when the data of the associated TxDPO is updated.  | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 6000:11     | Counter value                     | Counter value   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:12     | Latch value                       | Latch value   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:13     | Frequency value                   | The frequency (setting of the scaling in index 0x8000:13 [▶ 111] and resolution in index 0x8000:15 [▶ 111])   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:14     | Period value                      | The period value (setting of the scaling in index 0x8000:14 [▶ 111] and resolution in index 0x8000:16 [▶ 111])  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 6000:16     | Timestamp                         | Timestamp of the last counter change  | UINT64    | RO    |                                |

## 6.4.4 Output data

### Index 7000 ENC Outputs

| Index (hex) | Name   | Meaning   | Data type | Flags | Default                        |
|-------------|--|---|-----------|-------|--------------------------------|
| 7000:0      | ENC Outputs  | Maximum subindex  | UINT8     | RO    | 0x11(17 <sub>dec</sub> )       |
| 7000:01     | <u>Enable latch C [► 69]</u>                       | Activate latching via input "C".                                      | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:01     | <u>Enable latch extern on positive edge [► 69]</u> | Activate external latch with positive edge.                           | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:03     | Set counter  | Set counter value   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:04     | <u>Enable latch extern on negative edge [► 69]</u> | Activate external latch with negative edge.                           | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |
| 7000:11     | Set counter value                                  | The counter value to be set via <i>Set counter</i> (index 0x7000:03). | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |

## 6.4.5 Standard objects

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

### Index 1000 Device type

| Index (hex) | Name        | Meaning   | Data type | Flags | Default                               |
|-------------|-------------|---|-----------|-------|---------------------------------------|
| 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    | 0x01FF1389 (33493897 <sub>dec</sub> ) |

### Index 1008 Device name

| Index (hex) | Name        | Meaning                           | Data type | Flags | Default     |
|-------------|-------------|-----------------------------------|-----------|-------|-------------|
| 1008:0      | Device name | Device name of the EtherCAT slave | STRING    | RO    | EP5151-0002 |

### Index 1009 Hardware version

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

### Index 100A Software version

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

### Index 1018 Identity

| Index (hex) | Name          | Meaning   | Data type | Flags | Default                                |
|-------------|---------------|---|-----------|-------|--|
| 1018:0      | Identity      | Information for identifying the slave   | UINT8     | RO    | 0x04 (4 <sub>dec</sub> )               |
| 1018:01     | Vendor ID     | Vendor ID of the EtherCAT slave   | UINT32    | RO    | 0x00000002 (2 <sub>dec</sub> )         |
| 1018:02     | Product code  | Product code of the EtherCAT slave  | UINT32    | RO    | 0x141F4052 (337592402 <sub>dec</sub> ) |
| 1018:03     | Revision      | Revision number of the EtherCAT slave; the Low Word (bit 0-15) indicates the special terminal number, the High Word (bit 16-31) refers to the device description  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |
| 1018:04     | Serial number | Serial number of the EtherCAT slave; the Low Byte (bit 0-7) of the Low Word contains the year of production, the High Byte (bit 8-15) of the Low Word contains the week of production, the High Word (bit 16-31) is 0 | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> )         |

**Index 10F0 Backup parameter handling**

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

**Index 1400 ENC RxPDO-Par Control compact**

| Index (hex) | Name                          | Meaning  | Data type       | Flags | Default                  |
|-------------|-------------------------------|--|-----------------|-------|--------------------------|
| 1400:0      | ENC RxPDO-Par Control compact | PDO Parameter RxPDO 1  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1400:06     | Exclude RxPDOs                | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 1 | OCTET-STRING[2] | RO    | 01 16                    |

**Index 1401 ENC RxPDO-Par Control**

| Index (hex) | Name                  | Meaning  | Data type       | Flags | Default                  |
|-------------|-----------------------|--|-----------------|-------|--------------------------|
| 1401:0      | ENC RxPDO-Par Control | PDO Parameter RxPDO 2  | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1401:06     | Exclude RxPDOs        | Specifies the RxPDOs (index of RxPDO mapping objects) that must not be transferred together with RxPDO 2 | OCTET-STRING[2] | RO    | 00 16                    |

**Index 1600 ENC RxPDO-Map Control compact**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1600:0      | ENC RxPDO-Map Control compact | PDO Mapping RxPDO 3   | UINT8     | RO    | 0x07 (7 <sub>dec</sub> ) |
| 1600:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))                       | UINT32    | RO    | 0x7000:01,1              |
| 1600:02     | SubIndex 002                  | 2. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x02 (Enable latch extern on positive edge)) | UINT32    | RO    | 0x7000:02,1              |
| 1600:03     | SubIndex 003                  | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))                          | UINT32    | RO    | 0x7000:03,1              |
| 1600:04     | SubIndex 004                  | 4. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x04 (Enable latch extern on negative edge)) | UINT32    | RO    | 0x7000:04,1              |
| 1600:05     | SubIndex 005                  | 5. PDO Mapping entry (4 bits align)   | UINT32    | RO    | 0x0000:00,4              |
| 1600:06     | SubIndex 006                  | 6. PDO Mapping entry (8 bits align)   | UINT32    | RO    | 0x0000:00,8              |
| 1600:07     | SubIndex 007                  | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value))                    | UINT32    | RO    | 0x7000:11,16             |

**Index 1601 ENC RxPDO-Map Control**

| Index (hex) | Name                  | Meaning   | Data type | Flags | Default                  |
|-------------|-----------------------|---|-----------|-------|--------------------------|
| 1601:0      | ENC RxPDO-Map Control | PDO Mapping RxPDO   | UINT8     | RO    | 0x07 (7 <sub>dec</sub> ) |
| 1601:01     | SubIndex 001          | 1. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x01 (Enable latch C))                       | UINT32    | RO    | 0x7000:01,1              |
| 1601:02     | SubIndex 002          | 2. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x02 (Enable latch extern on positive edge)) | UINT32    | RO    | 0x7000:02,1              |
| 1601:03     | SubIndex 003          | 3. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x03 (Set counter))                          | UINT32    | RO    | 0x7000:03,1              |
| 1601:04     | SubIndex 004          | 4. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x04 (Enable latch extern on negative edge)) | UINT32    | RO    | 0x7000:04,1              |
| 1601:05     | SubIndex 005          | 5. PDO Mapping entry (4 bits align)   | UINT32    | RO    | 0x0000:00,4              |
| 1601:06     | SubIndex 006          | 6. PDO Mapping entry (8 bits align)   | UINT32    | RO    | 0x0000:00,8              |
| 1601:07     | SubIndex 007          | 7. PDO Mapping entry (object 0x7000 (ENC Outputs), entry 0x11 (Set counter value))                    | UINT32    | RO    | 0x7000:11,32             |

**Index 1800 ENC TxPDO-Par Status compact**

| Index (hex) | Name                         | Meaning   | Data type       | Flags | Default                  |
|-------------|------------------------------|---|-----------------|-------|--------------------------|
| 1800:0      | ENC TxPDO-Par Status compact | PDO parameter TxPDO 1   | UINT8           | RO    | 0x09 (9 <sub>dec</sub> ) |
| 1800:06     | Exclude TxPDOs               | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 1. | OCTET-STRING[2] | RO    | 01 1A                    |
| 1800:07     | TxPDO State                  | The TxPDO state is set if it was not possible to correctly read in the associated input data.             | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |
| 1800:09     | TxPDO Toggle                 | The TxPDO toggle is toggled with each update the corresponding input data.                                | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |

**Index 1801 ENC TxPDO-Par Status**

| Index (hex) | Name                 | Meaning   | Data type       | Flags | Default                  |
|-------------|----------------------|---|-----------------|-------|--------------------------|
| 1801:0      | ENC TxPDO-Par Status | PDO parameter TxPDO 2   | UINT8           | RO    | 0x09 (9 <sub>dec</sub> ) |
| 1801:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 2. | OCTET-STRING[2] | RO    | 00 1A                    |
| 1801:07     | TxPDO State          | The TxPDO state is set if it was not possible to correctly read in the associated input data.             | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |
| 1801:09     | TxPDO Toggle         | The TxPDO toggle is toggled with each update the corresponding input data.                                | BOOLEAN         | RO    | 0x00 (0 <sub>dec</sub> ) |

**Index 1802 ENC TxPDO-Par Frequency**

| Index (hex) | Name                    | Meaning   | Data type       | Flags | Default                  |
|-------------|-------------------------|---|-----------------|-------|--------------------------|
| 1802:0      | ENC TxPDO-Par Frequency | PDO parameter TxPDO 3   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1802:06     | Exclude TxPDOs          | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 3. | OCTET-STRING[2] | RO    | 03 1A                    |

**Index 1803 ENC TxPDO-Par Period**

| Index (hex) | Name                 | Meaning   | Data type       | Flags | Default                  |
|-------------|----------------------|---|-----------------|-------|--------------------------|
| 1803:0      | ENC TxPDO-Par Period | PDO parameter TxPDO 4   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1803:06     | Exclude TxPDOs       | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 4. | OCTET-STRING[2] | RO    | 02 1A                    |

**Index 1804 ENC TxPDO-Par Timestamp**

| Index (hex) | Name                    | Meaning   | Data type       | Flags | Default                  |
|-------------|-------------------------|---|-----------------|-------|--------------------------|
| 1804:0      | ENC TxPDO-Par Timestamp | PDO parameter TxPDO 5   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1804:06     | Exclude TxPDOs          | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 5. | OCTET-STRING[2] | RO    | 05 1A                    |

**Index 1805 ENC TxPDO-Par Timestamp compact**

| Index (hex) | Name                            | Meaning   | Data type       | Flags | Default                  |
|-------------|---------------------------------|---|-----------------|-------|--------------------------|
| 1805:0      | ENC TxPDO-Par Timestamp compact | PDO parameter TxPDO 6   | UINT8           | RO    | 0x06 (6 <sub>dec</sub> ) |
| 1805:06     | Exclude TxPDOs                  | Specifies the TxPDOs (index of TxPDO mapping objects) that must not be transferred together with TxPDO 6. | OCTET-STRING[2] | RO    | 04 1A                    |

**Index 1A00 ENC TxPDO-Map Status compact**

| <b>Index (hex)</b> | <b>Name</b>          | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>             |
|--------------------|----------------------|---|------------------|--------------|----------------------------|
| 1A00:0             | ENC TxPDO-Map Status | ENC TxPDO-Map Status compact  | UINT8            | RO           | 0x012 (18 <sub>dec</sub> ) |
| 1A00:01            | SubIndex 001         | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))                   | UINT32           | RO           | 0x6000:01, 1               |
| 1A00:02            | SubIndex 002         | 2. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x02 (Latch extern valid))              | UINT32           | RO           | 0x6000:02, 1               |
| 1A00:03            | SubIndex 003         | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))                | UINT32           | RO           | 0x6000:03, 1               |
| 1A00:04            | SubIndex 004         | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))               | UINT32           | RO           | 0x6000:04, 1               |
| 1A00:05            | SubIndex 005         | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))                | UINT32           | RO           | 0x6000:05, 1               |
| 1A00:06            | SubIndex 006         | 6. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x06 (Status of input status))          | UINT32           | RO           | 0x6000:06, 1               |
| 1A00:07            | SubIndex 007         | 7. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (Open circuit))                    | UINT32           | RO           | 0x6000:07, 1               |
| 1A00:08            | SubIndex 008         | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))             | UINT32           | RO           | 0x6000:08, 1               |
| 1A00:09            | SubIndex 009         | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))               | UINT32           | RO           | 0x6000:09, 1               |
| 1A00:0A            | SubIndex 010         | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))              | UINT32           | RO           | 0x6000:0A, 1               |
| 1A00:0B            | SubIndex 011         | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))              | UINT32           | RO           | 0x6000:0B, 1               |
| 1A00:0C            | SubIndex 012         | 12. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0C (Status of input gate))           | UINT32           | RO           | 0x6000:0C, 1               |
| 1A00:0D            | SubIndex 013         | 13. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0D (Status of extern latch))         | UINT32           | RO           | 0x6000:0D, 1               |
| 1A00:0E            | SubIndex 014         | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))            | UINT32           | RO           | 0x1C32:20, 1               |
| 1A00:0F            | SubIndex 015         | 15. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x07 (TxPDO State))  | UINT32           | RO           | 0x1800:07, 1               |
| 1A00:10            | SubIndex 016         | 16. PDO Mapping entry (object 0x1800 (ENC TxPDO-Par Status compact), entry 0x09 (TxPDO Toggle)) | UINT32           | RO           | 0x1800:09, 1               |
| 1A00:11            | SubIndex 017         | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))                  | UINT32           | RO           | 0x6000:11, 16              |
| 1A00:12            | SubIndex 018         | 18. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))                    | UINT32           | RO           | 0x6000:12, 16              |

**Index 1A01 ENC TxPDO-Map Status**

| <b>Index (hex)</b> | <b>Name</b>                  | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>            |
|--------------------|------------------------------|---|------------------|--------------|---------------------------|
| 1A01:0             | ENC TxPDO-Map Status compact | PDO Mapping TxPDO 2   | UINT8            | RO           | 0x12 (17 <sub>dec</sub> ) |
| 1A01:01            | SubIndex 001                 | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x01 (Latch C valid))           | UINT32           | RO           | 0x6000:01, 1              |
| 1A01:02            | SubIndex 002                 | 2. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x02 (Latch extern valid))      | UINT32           | RO           | 0x6000:02, 1              |
| 1A01:03            | SubIndex 003                 | 3. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x03 (Set counter done))        | UINT32           | RO           | 0x6000:03, 1              |
| 1A01:04            | SubIndex 004                 | 4. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x04 (Counter underflow))       | UINT32           | RO           | 0x6000:04, 1              |
| 1A01:05            | SubIndex 005                 | 5. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x05 (Counter overflow))        | UINT32           | RO           | 0x6000:05, 1              |
| 1A01:06            | SubIndex 006                 | 6. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x06 (Status of input status))  | UINT32           | RO           | 0x6000:06, 1              |
| 1A01:07            | SubIndex 007                 | 7. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x07 (Open circuit))            | UINT32           | RO           | 0x6000:07, 1              |
| 1A01:08            | SubIndex 008                 | 8. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x08 (Extrapolation stall))     | UINT32           | RO           | 0x6000:08, 1              |
| 1A01:09            | SubIndex 009                 | 9. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x09 (Status of input A))       | UINT32           | RO           | 0x6000:09, 1              |
| 1A01:0A            | SubIndex 010                 | 10. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0A (Status of input B))      | UINT32           | RO           | 0x6000:0A, 1              |
| 1A01:0B            | SubIndex 011                 | 11. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0B (Status of input C))      | UINT32           | RO           | 0x6000:0B, 1              |
| 1A01:0C            | SubIndex 012                 | 12. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0C (Status of input gate))   | UINT32           | RO           | 0x6000:0C, 1              |
| 1A01:0D            | SubIndex 013                 | 13. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x0D (Status of extern latch)) | UINT32           | RO           | 0x6000:0D, 1              |
| 1A01:0E            | SubIndex 014                 | 14. PDO Mapping entry (object 0x1C32 (SM output parameter), entry 0x20 (Sync error))    | UINT32           | RO           | 0x1C32:20, 1              |
| 1A01:0F            | SubIndex 015                 | 15. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x07 (TxPDO State))  | UINT32           | RO           | 0x1801:07, 1              |
| 1A01:10            | SubIndex 016                 | 16. PDO Mapping entry (object 0x1801 (ENC TxPDO-Par Status), entry 0x09 (TxPDO Toggle)) | UINT32           | RO           | 0x1801:09, 1              |
| 1A01:11            | SubIndex 017                 | 17. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x11 (Counter value))          | UINT32           | RO           | 0x6000:11, 32             |
| 1A01:12            | SubIndex 018                 | 18. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x12 (Latch value))            | UINT32           | RO           | 0x6000:12, 32             |

**Index 1A02 ENC TxPDO-Map Frequency**

| <b>Index (hex)</b> | <b>Name</b>         | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|---------------------|---|------------------|--------------|--------------------------|
| 1A02:0             | TxPDO map frequency | PDO Mapping TxPDO   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A02:01            | SubIndex 001        | 1. PDO Mapping entry (object 0x6000 (Inputs), entry 0x13 (Frequency value)) | UINT32           | RO           | 0x6000:13, 32            |

**Index 1A03 ENC TxPDO-Map Period**

| <b>Index (hex)</b> | <b>Name</b>          | <b>Meaning</b>   | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|----------------------|--|------------------|--------------|--------------------------|
| 1A03:0             | ENC TxPDO-Map Period | ENC TxPDO-Map Period   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A03:01            | SubIndex 001         | 1. PDO Mapping entry (object 0x6010 (ENC Inputs), entry 0x14 (Period value)) | UINT32           | RO           | 0x6000:14,32             |

**Index 1A04 ENC TxPDO-Map Timest.**

| <b>Index (hex)</b> | <b>Name</b>                   | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>           |
|--------------------|-------------------------------|---|------------------|--------------|--------------------------|
| 1A04:0             | ENC TxPDO-Map Timest. compact | PDO Mapping TxPDO   | UINT8            | RO           | 0x01 (1 <sub>dec</sub> ) |
| 1A04:01            | SubIndex 001                  | 1. PDO Mapping entry (object 0x6010 (ENC Inputs), entry 0x16 (Timestamp)) | UINT32           | RO           | 0x6000:16, 64            |

**Index 1A05 ENC TxPDO-Map Timest. compact**

| Index (hex) | Name                          | Meaning   | Data type | Flags | Default                  |
|-------------|-------------------------------|---|-----------|-------|--------------------------|
| 1A05:0      | ENC TxPDO-Map Timest. compact | PDO Mapping TxPDO   | UINT8     | RO    | 0x01 (1 <sub>dec</sub> ) |
| 1A05:01     | SubIndex 001                  | 1. PDO Mapping entry (object 0x6000 (ENC Inputs), entry 0x16 (Timestamp)) | UINT32    | RO    | 0x6000:16, 32            |

**Index 1C00 Sync manager type**

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

**Index 1C12 RxPDO assign**

| Index (hex) | Name         | Meaning  | Data type | Flags | Default                       |
|-------------|--------------|--|-----------|-------|-------------------------------|
| 1C12:0      | RxPDO assign | PDO Assign Outputs   | UINT8     | RW    | 0x01 (1 <sub>dec</sub> )      |
| 1C12:01     | SubIndex 001 | 1. allocated RxPDO (contains the index of the associated RxPDO mapping object) | UINT16    | RW    | 0x1600 (5632 <sub>dec</sub> ) |

**Index 1C13 TxPDO assign**

| Index (hex) | Name         | Meaning  | Data type | Flags | Default                       |
|-------------|--------------|--|-----------|-------|-------------------------------|
| 1C13:0      | TxPDO assign | PDO Assign Inputs  | UINT8     | RW    | 0x01 (1 <sub>dec</sub> )      |
| 1C13:01     | SubIndex 001 | 1. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x1A00 (6656 <sub>dec</sub> ) |
| 1C13:02     | SubIndex 002 | 2. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )    |
| 1C13:03     | SubIndex 003 | 3. allocated TxPDO (contains the index of the associated TxPDO mapping object) | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )    |

**Index 1C32 SM output parameter**

| <b>Index (hex)</b> | <b>Name</b>             | <b>Meaning</b>  | <b>Data type</b> | <b>Flags</b> | <b>Default</b>                 |
|--------------------|-------------------------|---|------------------|--------------|--------------------------------|
| 1C32:0             | SM output parameter     | Synchronization parameters for the outputs  | UINT8            | RO           | 0x20 (32 <sub>dec</sub> )      |
| 1C32:01            | Sync mode               | Current synchronization mode:<br><ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchron with SM 2 Event</li> <li>• 2: DC-Mode - Synchron with SYNC0 Event</li> <li>• 3: DC-Mode - Synchron with SYNC1 Event</li> </ul>   | UINT16           | RW           | 0x0001 (1 <sub>dec</sub> )     |
| 1C32:02            | Cycle time              | Cycle time (in ns):<br><ul style="list-style-type: none"> <li>• Free Run: Cycle time of the local timer</li> <li>• Synchron with SM 2 Event: Master cycle time</li> <li>• DC mode: SYNC0/SYNC1 Cycle Time</li> </ul>  | UINT32           | RW           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:03            | Shift time              | Time between SYNC0 event and output of the outputs (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:04            | Sync modes supported    | Supported synchronization modes:<br><ul style="list-style-type: none"> <li>• Bit 0 = 1: free run is supported</li> <li>• Bit 1 = 1: Synchron with SM 2 Event is supported</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 10: Output shift with SYNC1 event (only DC mode)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08)</li> </ul>  | UINT16           | RO           | 0xC007 (49159 <sub>dec</sub> ) |
| 1C32:05            | Minimum cycle time      | Minimum cycle time (in ns)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:06            | Calc and copy time      | Minimum time between SYNC0 and SYNC1 event (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:07            | Minimum delay time      |   | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:08            | Command                 | With this entry the real required process data provision time can be measured.<br><ul style="list-style-type: none"> <li>• 0: Measurement of the local cycle time is stopped</li> <li>• 1: Measurement of the local cycle time is started</li> </ul> <p>The entries 0x1C32:03, 0x1C32:05, 0x1C32:06, 0x1C32:09, 0x1C33:03, 0x1C33:06, 0x1C33:09 are updated with the maximum measured values.<br/> For a subsequent measurement the measured values are reset</p> | UINT16           | RW           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:09            | Maximum delay time      | Time between SYNC1 event and output of the outputs (in ns, DC mode only)  | UINT32           | RO           | 0x00000000 (0 <sub>dec</sub> ) |
| 1C32:0B            | SM event missed counter | Number of missed SM events in OPERATIONAL (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0C            | Cycle exceeded counter  | Number of occasions the cycle time was exceeded in OPERATIONAL (cycle was not completed in time or the next cycle began too early)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:0D            | Shift too short counter | Number of occasions that the interval between SYNC0 and SYNC1 event was too short (DC mode only)  | UINT16           | RO           | 0x0000 (0 <sub>dec</sub> )     |
| 1C32:20            | Sync error              | The synchronization was not correct in the last cycle (outputs were output too late; DC mode only)  | BOOLEAN          | RO           | 0x00 (0 <sub>dec</sub> )       |

**Index 1C33 SM input parameter**

| Index (hex) | Name                    | Meaning  | Data type | Flags | Default                        |
|-------------|-------------------------|--|-----------|-------|--------------------------------|
| 1C33:0      | SM input parameter      | Synchronization parameters for the inputs  | UINT8     | RO    | 0x20 (32 <sub>dec</sub> )      |
| 1C33:01     | Sync mode               | Current synchronization mode:<br><ul style="list-style-type: none"> <li>• 0: Free Run</li> <li>• 1: Synchron with SM 3 Event (no outputs available)</li> <li>• 2: DC - Synchron with SYNC0 Event</li> <li>• 3: DC - Synchron with SYNC1 Event</li> <li>• 34: Synchron with SM 2 Event (outputs available)</li> </ul>   | UINT16    | RW    | 0x0022 (34 <sub>dec</sub> )    |
| 1C33:02     | Cycle time              | as 0x1C32:02   | UINT32    | RW    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:03     | Shift time              | Time between SYNC0 event and reading of the inputs (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:04     | Sync modes supported    | Supported synchronization modes:<br><ul style="list-style-type: none"> <li>• Bit 0: free run is supported</li> <li>• Bit 1: Synchron with SM 2 Event is supported (outputs available)</li> <li>• Bit 1: Synchron with SM 3 Event is supported (no outputs available)</li> <li>• Bit 2-3 = 01: DC mode is supported</li> <li>• Bit 4-5 = 01: Input shift through local event (outputs available)</li> <li>• Bit 4-5 = 10: Input shift with SYNC1 event (no outputs available)</li> <li>• Bit 14 = 1: dynamic times (measurement through writing of 0x1C32:08 or 0x1C33:08)</li> </ul> | UINT16    | RO    | 0xC007 (49159 <sub>dec</sub> ) |
| 1C33:05     | Minimum cycle time      | as 0x1C32:05   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:06     | Calc and copy time      | Time between reading of the inputs and availability of the inputs for the master (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:06     | Minimum delay time      |  | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:08     | Command                 | as 0x1C32:08   | UINT16    | RW    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:09     | Maximum delay time      | Time between SYNC1 event and reading of the inputs (in ns, only DC mode)   | UINT32    | RO    | 0x00000000 (0 <sub>dec</sub> ) |
| 1C33:0B     | SM event missed counter | as 0x1C32:11   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0C     | Cycle exceeded counter  | as 0x1C32:12   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:0D     | Shift too short counter | as 0x1C32:13   | UINT16    | RO    | 0x0000 (0 <sub>dec</sub> )     |
| 1C33:20     | Sync error              | as 0x1C32:32   | BOOLEAN   | RO    | 0x00 (0 <sub>dec</sub> )       |

**Index F000 Modular device profile**

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

**Index F008 Code word**

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

**Index F010 Module list**

| Index (hex) | Name         | Meaning          | Data type | Flags | Default                             |
|-------------|--------------|------------------|-----------|-------|-------------------------------------|
| F010:0      | Module list  | Maximum subindex | UINT8     | RW    | 0x01 (1 <sub>dec</sub> )            |
| F010:01     | SubIndex 001 | reserved         | UINT32    | RW    | 0x000001FF<br>(511 <sub>dec</sub> ) |

## 7 Appendix

### 7.1 General operating conditions

#### Protection rating according to IP code

The degrees of protection are defined and divided into different classes in the IEC 60529 standard (EN 60529). Degrees of protection are designated by the letters "IP" and two numerals: **IP<sub>xy</sub>**

- Numeral x: Dust protection and contact protection
- Numeral y: Protection against water

| x | Meaning   |
|---|---|
| 0 | Not protected   |
| 1 | Protected against access to dangerous parts with the back of the hand.<br>Protected against solid foreign objects of 50 mm Ø  |
| 2 | Protected against access to dangerous parts with a finger.<br>Protected against solid foreign objects of 12.5 mm Ø  |
| 3 | Protected against access to dangerous parts with a tool.<br>Protected against solid foreign objects of 2.5 mm Ø   |
| 4 | Protected against access to dangerous parts with a wire.<br>Protected against solid foreign objects of 1 mm Ø   |
| 5 | Protection against access to dangerous parts with a wire.<br>Dust-protected. Ingress of dust is not prevented completely, although the quantity of dust able to penetrate is limited to such an extent that the proper function of the device and safety are not impaired |
| 6 | Protection against access to dangerous parts with a wire.<br>Dust-tight. No ingress of dust   |

| y | Meaning   |
|---|---|
| 0 | Not protected   |
| 1 | Protection against vertically falling water drops   |
| 2 | Protection against vertically falling water drops when enclosure tilted up to 15°   |
| 3 | Protection against spraying water. Water sprayed at an angle of up to 60° on either side of the vertical shall have no harmful effects  |
| 4 | Protection against splashing water. Water splashed against the enclosure from any direction shall have no harmful effects   |
| 5 | Protection against water jets.  |
| 6 | Protection against powerful water jets.   |
| 7 | Protected against the effects of temporary immersion in water.<br>Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is immersed in water at a depth of 1 m for 30 minutes |

#### Chemical resistance

The resistance refers to the housing of the IP67 modules and the metal parts used. In the table below you will find some typical resistances.

| Type   | Resistance                                     |
|--|--|
| Water vapor                                  | unstable at temperatures > 100 °C              |
| Sodium hydroxide solution<br>(ph value > 12) | stable at room temperature<br>unstable > 40 °C |
| Acetic acid                                  | unstable                                       |
| Argon (technically pure)                     | stable   |

#### Key

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

## 7.2 Accessories

### Mounting

| Ordering information | Description   | Link                    |
|----------------------|---------------|-------------------------|
| ZS5300-0011          | Mounting rail | <a href="#">Website</a> |

### Labeling material, protective caps

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

### Cables

A complete overview of pre-assembled cables for fieldbus components can be found [here](#).

| Ordering information | Description               | Link                    |
|----------------------|---------------------------|-------------------------|
| ZK1090-3xxx-xxxx     | EtherCAT cable M8, green  | <a href="#">Website</a> |
| ZK1093-3xxx-xxxx     | EtherCAT cable M8, yellow | <a href="#">Website</a> |
| ZK2000-8xxx-xxxx     | Sensor cable M12, 8-pin   | <a href="#">Website</a> |
| ZK2020-3xxx-xxxx     | Power cable M8, 4-pin     | <a href="#">Website</a> |

### Tools

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



### Further accessories

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

## 7.3 Version identification of EtherCAT devices

### 7.3.1 General notes on marking

#### Designation

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

- family key
- type
- version
- revision

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

#### Notes

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

### 7.3.2 Version identification of IP67 modules

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

Structure of the serial number: **KK YY FF HH**

KK - week of production (CW, calendar week)

YY - year of production

FF - firmware version

HH - hardware version

Example with serial number 12 06 3A 02:

12 - production week 12

06 - production year 2006

3A - firmware version 3A

02 - hardware version 02

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

Syntax: D ww yy x y z u

D - prefix designation

ww - calendar week

yy - year

x - firmware version of the bus PCB

y - hardware version of the bus PCB

z - firmware version of the I/O PCB

u - hardware version of the I/O PCB

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

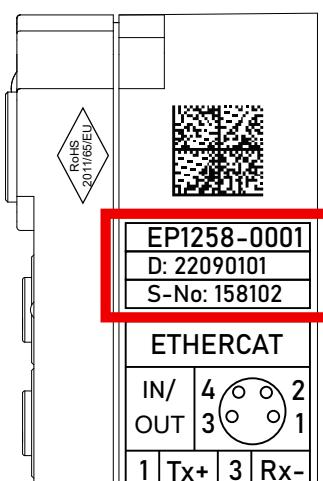


Fig. 21: EP1258-0001 IP67 EtherCAT Box with batch number/DateCode 22090101 and unique serial number 158102

### 7.3.3 Beckhoff Identification Code (BIC)

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

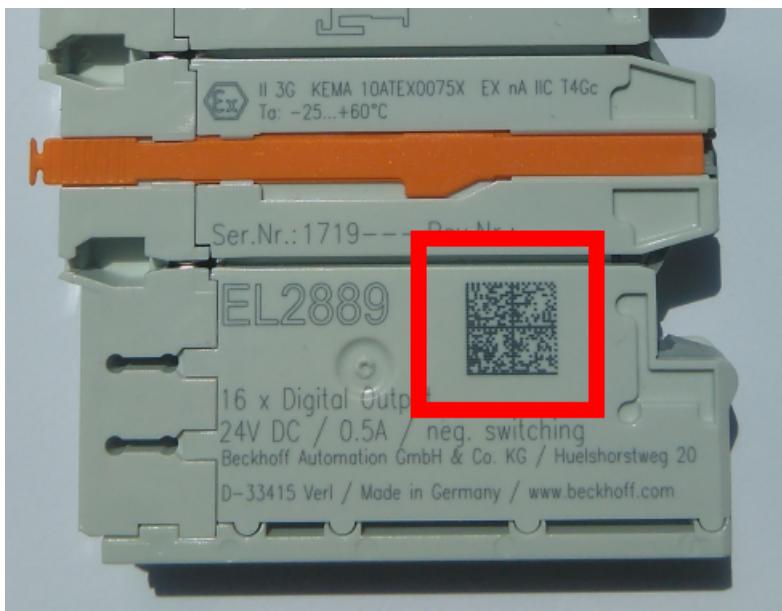


Fig. 22: BIC as data matrix code (DMC, code scheme ECC200)

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

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

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

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

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

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

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

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

### Structure of the BIC

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

**1P072222SBTNk4p562d71KEL1809 Q1 51S678294**

Accordingly as DMC:



Fig. 23: Example DMC **1P072222SBTNk4p562d71KEL1809 Q1 51S678294**

### BTN

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

#### 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.

### 7.3.4 Electronic access to the BIC (eBIC)

#### Electronic BIC (eBIC)

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

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

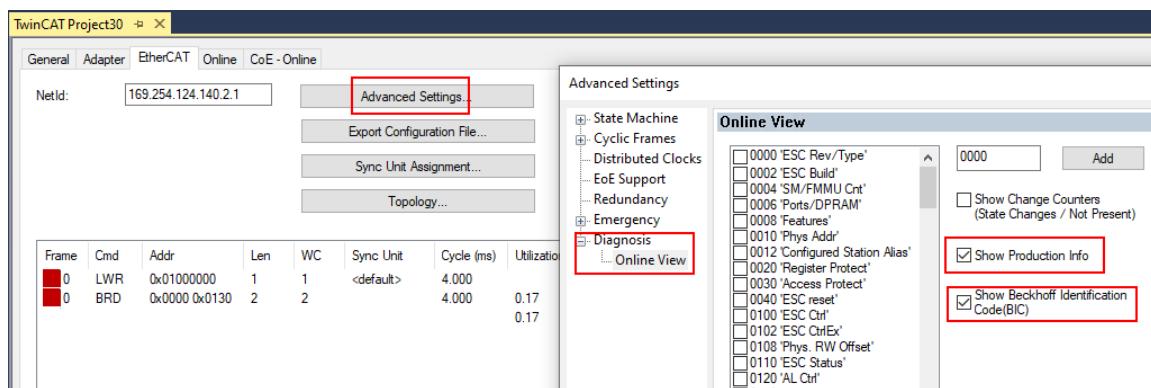
#### EtherCAT devices (IP20, IP67)

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:

| No | Addr | Name            | State | CRC | Fw | Hw | Production Date | ItemNo | BTN      | Description | Quantity | BatchNo | SerialNo |
|----|------|-----------------|-------|-----|----|----|-----------------|--------|----------|-------------|----------|---------|----------|
| 1  | 1001 | Term 1 (EK1100) | OP    | 0.0 | 0  | 0  | ---             |        |          |             | 1        |         | 678294   |
| 2  | 1002 | Term 2 (EL1018) | OP    | 0.0 | 0  | 0  | 2020 KW36 Fr    | 072222 | k4p562d7 | EL1809      | 1        |         |          |
| 3  | 1003 | Term 3 (EL3204) | OP    | 0.0 | 7  | 6  | 2012 KW24 Sa    |        |          |             |          |         |          |
| 4  | 1004 | Term 4 (EL2004) | OP    | 0.0 | 0  | 0  | ---             | 072223 | k4p562d7 | EL2004      | 1        |         | 678295   |
| 5  | 1005 | Term 5 (EL1008) | OP    | 0.0 | 0  | 0  | ---             |        |          |             |          |         |          |
| 6  | 1006 | Term 6 (EL2008) | OP    | 0.0 | 0  | 12 | 2014 KW14 Mo    |        |          |             |          |         |          |
| 7  | 1007 | Term 7 (EK1110) | OP    | 0   | 1  | 8  | 2012 KW25 Mo    |        |          |             |          |         |          |

- 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    | 1P1584425BTN0008jekp1KELM3704 Q1 2P482001000016 |
| 10F0:0  | Backup parameter handling                 | RO    | >1<   |
| 10F3:0  | Diagnosis History                         | RO    | >21<  |
| 10F8    | Actual Time Stamp                         | RO    | 0x170fb277e                                     |

- 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.

## 7.4 Support and Service

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

### Beckhoff's branch offices and representatives

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

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