Baumer

Passion for Sensors

Manual

Absolute encoders EAx with EtherCAT interface

Firmware Version V1.0.0 and later

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Subject to modification in technic and design.
Errors and omissions excepted.

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1. Introduction

1.1. Scope of delivery

Please check the delivery upon completeness prior to commissioning.
Depending on encoder configuration and part number the delivery may include:

- EtherCAT encoder
- ESI file and manual (available at www.baumer.com)

1.2. Product classification

Product	Product family	Suitable input in catalog
EAL580-xxx.xxEC.13160.x	optical - multiturn	EAL580 MT encoder ST13 MT16, optical
EAL580-xxx.xxEC.18130.x	optical - multiturn	EAL580 MT encoder ST18 MT13, optical
EAM580-xxx.xxEC.14160.x	magnetic - multiturn	EAM580 MT encoder ST14 MT16, magnetic

Explanation
- Placeholders marked “x” in the product reference number will not influence the selection
- “MT” means “multiturn”
- “ST” means “singleturn”
- “ST13 MT16” means “13 bits physical singleturn resolution, 16 bits physical multiturn resolution”

ESI file
The ESI file is the same for all products mentioned above. For details see chapters Import ESI file (for TwinCAT 2) and Import ESI file (for TwinCAT 3).

Supported standards and protocols
CANopen CiA 406 version 4.0.2, 18.08.2016
EtherCAT specification ETG.1000 V1.03

Encoder passed ETG certification with Conformance Test Tool version 2.1.0.0.

2. Safety and operating instructions

Intended use

- The encoder is a precision measuring device that is used to record positions and speeds. It provides measuring values as electronic output signals for the subsequently connected device. It must not be used for any other purpose. Unless this product is specially labeled, it may not be used for operation in potentially explosive environments.
- Make sure by appropriate safety measures, that in case of error or failure of the encoder, no danger to persons or damage to the system or operating facilities occurs.

Personnel qualification

- Installation and assembly of this product may be performed only by a person qualified in electronics and precision mechanics.

Maintenance

- The encoder is maintenance-free and must not be opened up nor mechanically or electronically modified. Opening up the encoder can lead to injury.

Disposal

- The encoder contains electronic components. At its disposal, local environmental guidelines must be followed.

Mounting

- Solid shaft: Do not connect encoder shaft and drive shaft rigidly. Connect drive and encoder shaft with a suitable coupling.
- Hollow shaft: Open clamping ring completely before mounting the encoder. Foreign objects must be kept at a sufficient distance from the stator coupling. The stator coupling is not allowed to have any contact to the encoder or the machine except at the mounting points.

Electrical commissioning

- Do not proceed any electrical modifications at the encoder.
- Do not proceed any wiring work while encoder is live.
- Do not remove or plug on connector whilst under power supply.
- Ensure that the entire system is installed in line with EMC/EMI requirements. Operating environment and wiring have an impact on the electromagnetic compatibility of the encoder. Install encoder and supply cables separately or far away from sources with high emitted interference (frequency converters, contactors, etc.).
- When working with consumers with high emitted interference provide separate encoder supply voltage.
- Completely shield encoder housing and connecting cables.
- Connect encoder to protective earth (PE) using shielded cables. The braided shield must be connected to the cable gland or connector. Ideally, aim at dual connection to protective earth (PE), i.e. housing by mechanical assembly and cable shield by the downstream devices.

Supplementary information

- The present manual is intended as a supplement to already existing documentation (e.g. catalogues, data sheets or mounting instructions).

3. Commissioning

3.1. Mechanical mounting

Shaft encoders

- Mount the encoder using the mounting holes in the encoder flange and fitting screws. Observe thread diameter and depth.
- There is an alternative mounting option in any angular position by eccentric fixings available as an accessory.
- Connect drive shaft and encoder shaft by using an appropriate coupling. The shaft ends must not touch each other. The coupling must compensate temperature and mechanical tolerances. Observe the maximum permitted axial or radial shaft load. For appropriate couplings please refer to accessories.
- Tighten the mounting screws firmly.

Hollow shaft encoders

- Mounting by clamping ring
  Prior to mounting the encoder open the clamping ring completely. Push encoder onto the drive shaft and tighten the clamping ring firmly.
- Adjusting element with rubber buffer
  Push the encoder onto the drive shaft and insert the cylindrical pin into the adjusting element (customer-mounted) and the rubber buffer.
- Spring washer
  Fasten the spring washer at the mounting holes of the encoder housing using screws. Push the encoder onto the drive shaft and mount the spring washer to the contact surface.

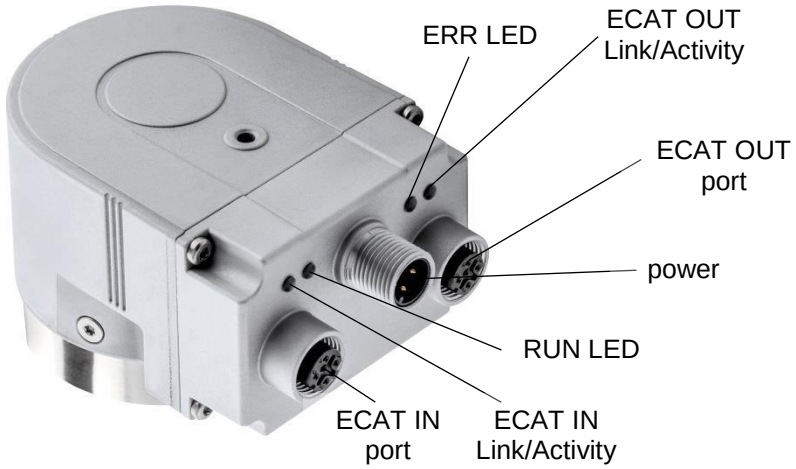
3.2. Electrical connection

3.2.1. Cabling

EtherCAT utilizes Fast Ethernet cables (100 Mbit/s, Cat. 5).

3.2.2. Connecting

The encoder provides three M12 flange connectors.
Two M12 flange connectors (D-coding, according IEC 61076-2-101) serve for EtherCAT connection.



- For power supply use an A-coded M12 connector only.
- The D-coded M12 connector “ECAT IN” may only be used to connect the encoder to the EtherCAT network segment which is next to the EtherCAT Master. For example, if there are no other EtherCAT Slaves between EtherCAT Master and encoder the EtherCAT Master shall be directly connected to “ECAT IN”.
- The D-coded M12 connector “ECAT OUT” may only be used to connect the encoder to subsequent EtherCAT Slaves which are more distant to the EtherCAT Master.
- Seal up any unused M12 connector using a screw cap (included in the delivery).

There are no user serviceable parts inside the encoder. There is no need for setting a node ID or a terminating resistor. All settings required for encoder access are made in the engineering tool (for example TwinCAT).

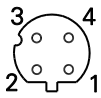
Pin assignment

Power supply

1 x M12 flange connector (male)
A-coded

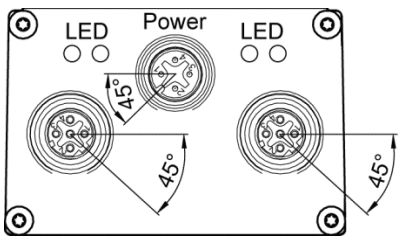
Pin	Assignment
1	UB (10...30 VDC)
2	Do not connect
3	GND
4	Do not connect

EtherCAT (Bus line)

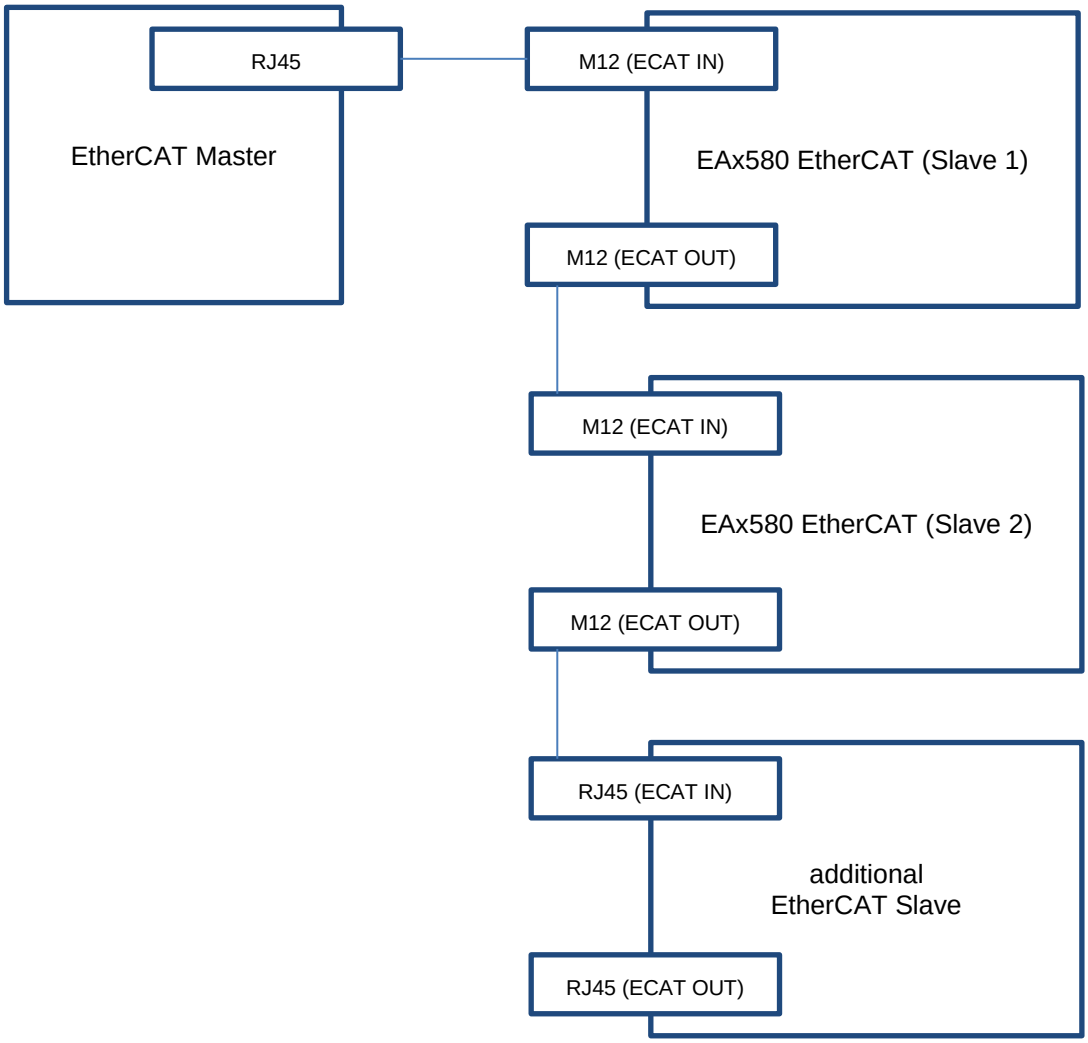


2 x M12 flange connector (female)
D-coded

Pin	Assignment
1	TxD+
2	RxD+
3	TxD-
4	RxD-



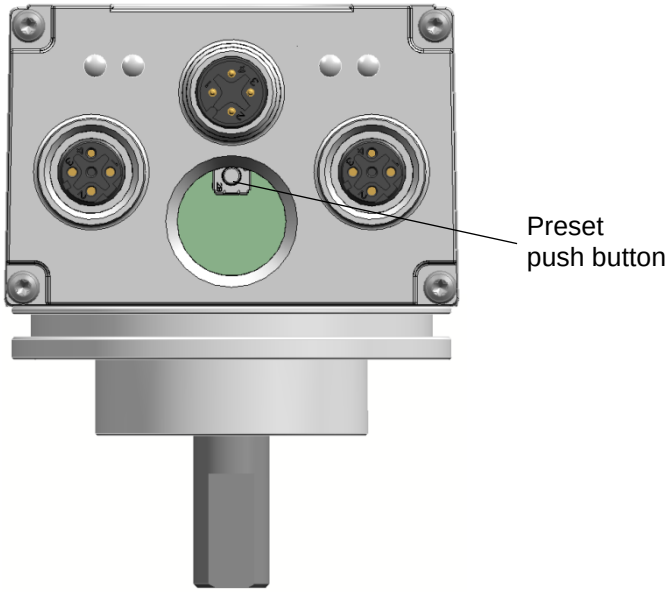
The following drawing shows how to connect “EAx580 EtherCAT” encoders and other EtherCAT Slaves to an EtherCAT Master.



The suitable hardware for an EtherCAT Master can be for example a standard PC with a standard network interface card or a programmable logic controller (PLC).

3.2.3. Push button for preset

Depending on the encoder type the encoder may have a screw cap located where connectors and LEDs are located as well. After removing the screw cap the preset push button is visible.



If the EAx580 EtherCAT encoder is in EtherCAT state “Operational” and connected to an EtherCAT Master the push button triggers a preset. For functionality details see chapter Preset using the push button.

Note:
After having used the push button the screw cap must be screwed in again and tightened with a torque of **1.5 Nm**.

4. Engineering (Beckhoff TwinCAT 2)

The following examples relate to Beckhoff PLCs using the engineering tool TwinCAT 2. To get information how to configure the EAx580 EtherCAT encoder with TwinCAT 3 see chapter Engineering (Beckhoff TwinCAT 3).

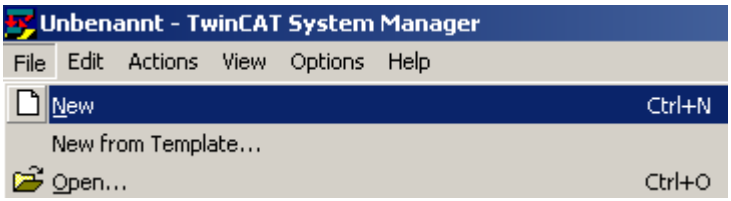
Of course the encoder will also accept engineering software of other manufacturers. In this case please proceed in an analog way.

4.1. Start TwinCAT

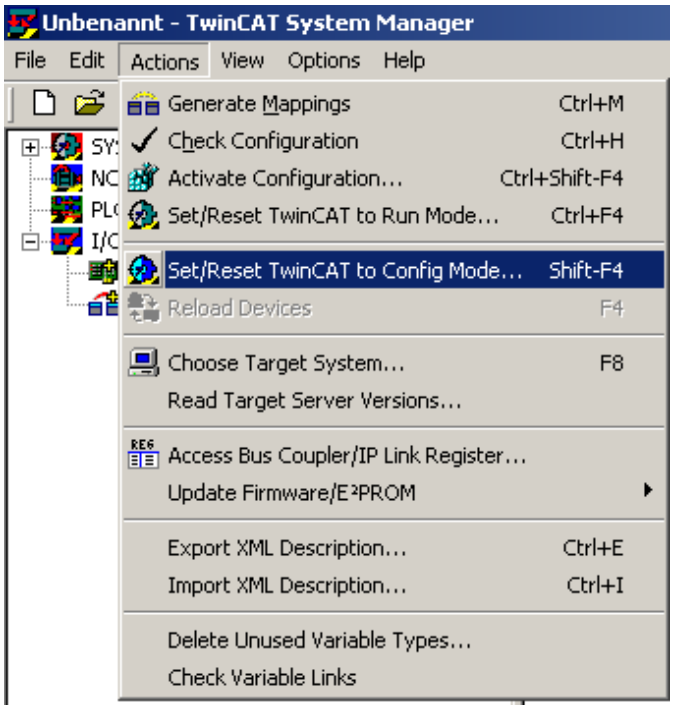
Start TwinCAT for example from the Windows start menu.

4.2. Create project

Select “New” in menu “File”.



Set TwinCAT to “Config Mode”.

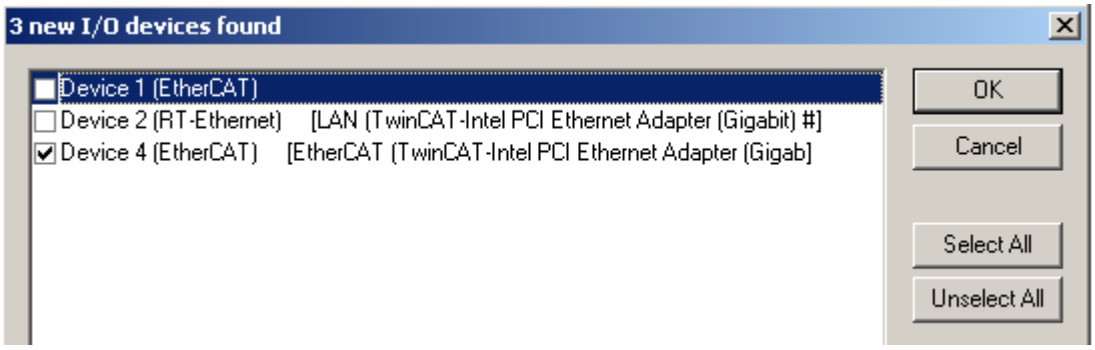


Confirm following message.

4.3. Scan EtherCAT network

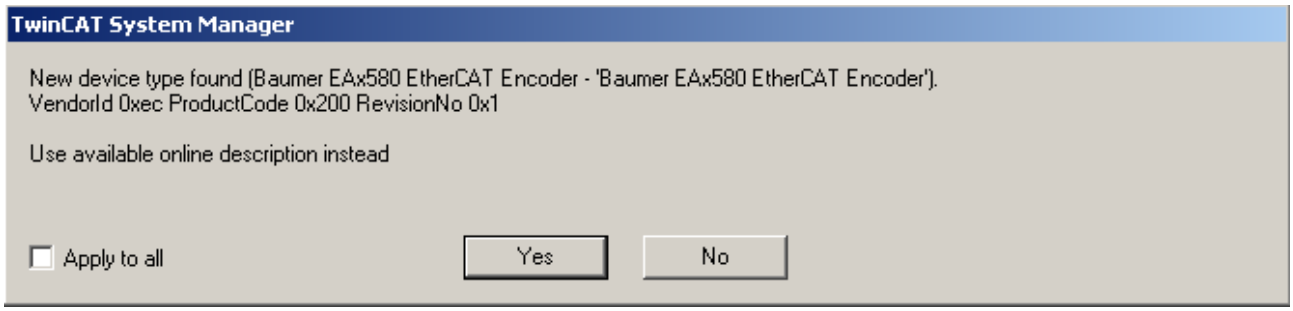
Right-click on „I/O Devices". Then click on "Scan Devices". Press OK if following message occurs.

Select network adapter and press OK.



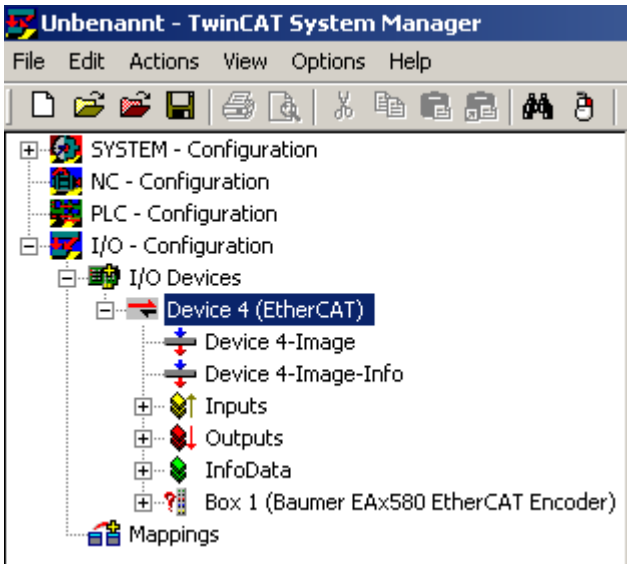
Confirm following message.

Confirm following message by clicking „Yes“.



Message above occurred because no EtherCAT Slave Information (ESI) file was provided to TwinCAT yet. Confirm following message.

The result is shown below.



4.4. Import ESI file

An EtherCAT Slave is described by a so-called “EtherCAT Slave Information” (ESI) file. The file format is XML (“Extensible Markup Language”).

The ESI file for an EAx580 EtherCAT encoder is available for download at www.baumer.com.

Use this ESI file:

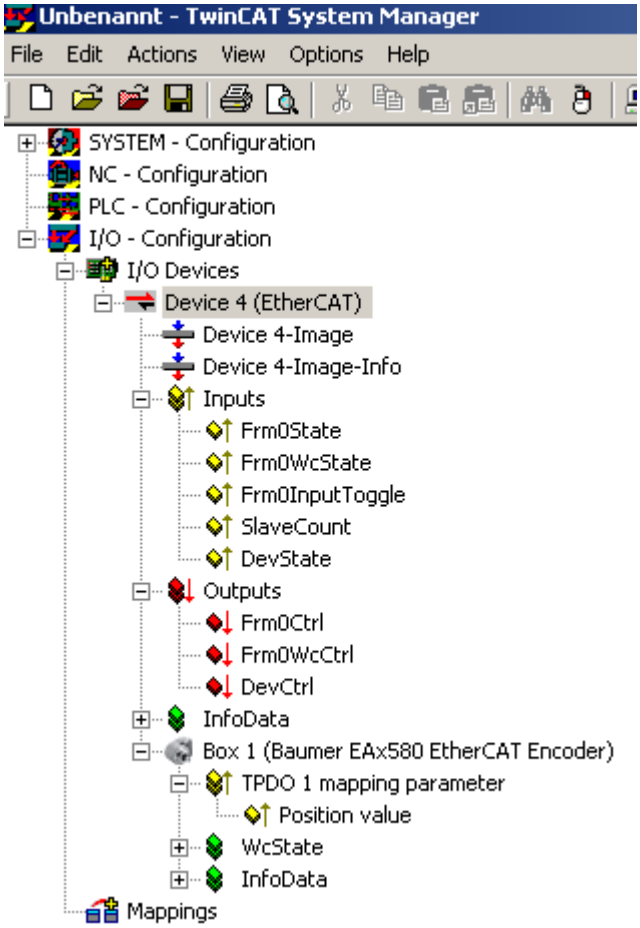
- **Baumer_EAx580_EtherCAT_Encoders_ESI_V102.xml**
  for encoders with firmware V1.0.0 or later
  The version in the filename indicates the ESI file version and may change without notice.

To provide the EtherCAT Slave Information (ESI) file to TwinCAT the following steps have to be done:

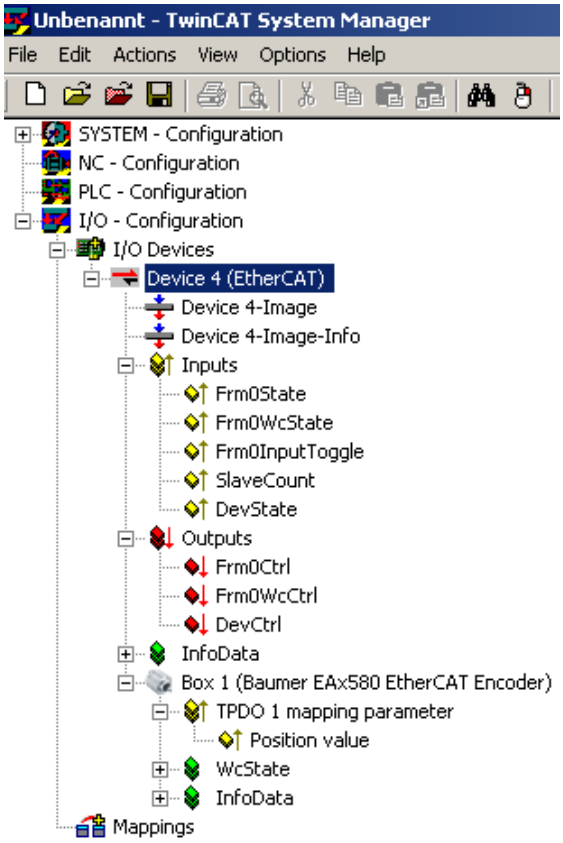
- Close TwinCAT.
- Delete ESI file “OnlineDescriptionCache000000EC.xml” which was generated automatically by TwinCAT before for example in folder C:\TwinCAT\Io\EtherCAT.
- Copy ESI file of encoder to folder C:\TwinCAT\Io\EtherCAT.

Repeat the steps mentioned in the chapters before. Now TwinCAT uses the ESI file for configuration.

The encoder is displayed as follows:



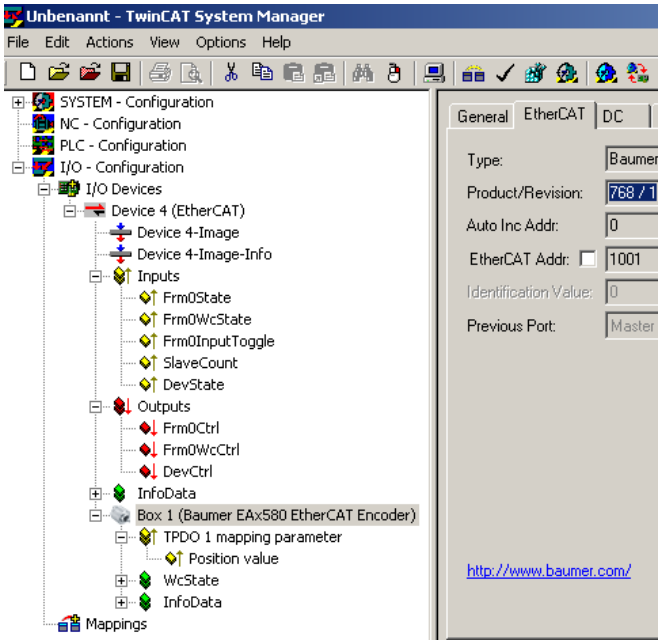
Notice:
The icon for “Box 1 (Baumer EAx580 EtherCAT Encoder)” in the screenshot above is shown when an EA**L**580 EtherCAT encoder is connected to the EtherCAT master. If an EA**M**580 EtherCAT encoder is connected to the EtherCAT master the following will be displayed.



Please note that EA**L**580 and EA**M**580 EtherCAT encoders have different icons and different EtherCAT product codes.

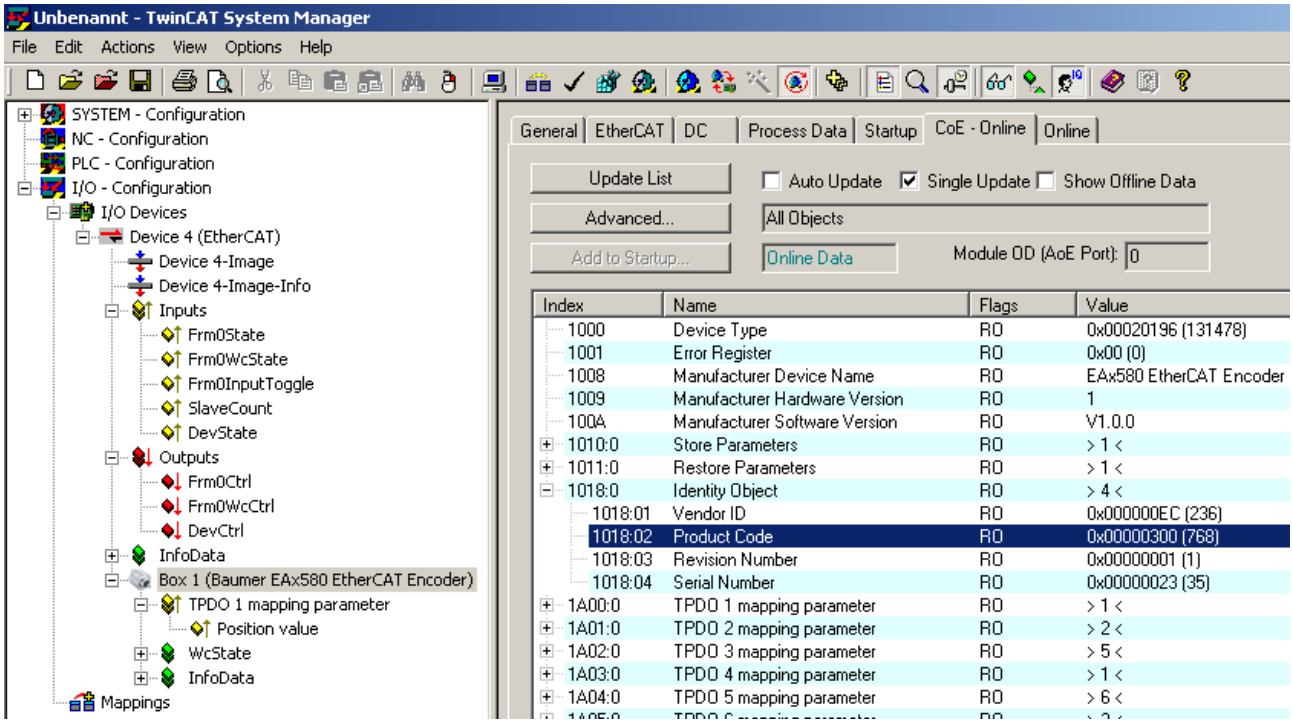
- EA**L**580 EtherCAT encoders have EtherCAT product code 0x200 (decimal: 512).
- EA**M**580 EtherCAT encoders have EtherCAT product code 0x300 (decimal: 768).

The EtherCAT product code 512 or 768 can be found in tab “EtherCAT” of an EtherCAT slave. You find it behind the text “Product/Revision:”. If you click on “Box 1 (Baumer EAx580 EtherCAT Encoder)” the following appears if an EA**M**580 EtherCAT encoder is connected (as an example).



The EtherCAT product code can also be found in the CoE object dictionary of the encoder in object 0x1018:02 (subindex 2 of index 0x1018).

If you click on “Box 1 (Baumer EAx580 EtherCAT Encoder)” and select the tab “CoE - Online” the following appears if an EA**M**580 EtherCAT encoder is connected (as an example).



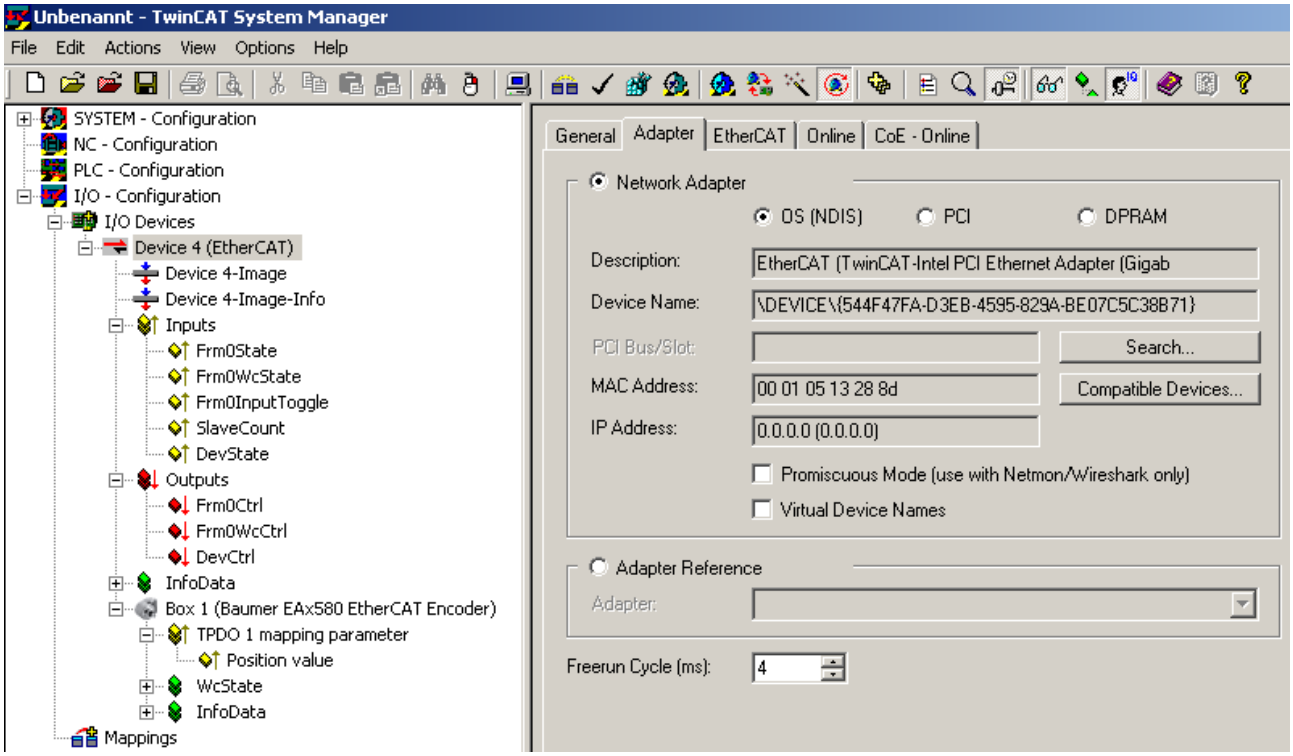
In general the screenshots in this manual refer to EA**L**580 EtherCAT encoders but the handling for other encoder types is very similar.

4.5. Config Mode

TwinCAT provides a so-called “Config Mode”. In this mode real-time handling of the encoder data in TwinCAT is usually not possible. By default TwinCAT uses the “Config Mode” and the “Free Run” cycle time of the EtherCAT Master is set to 4 milliseconds.

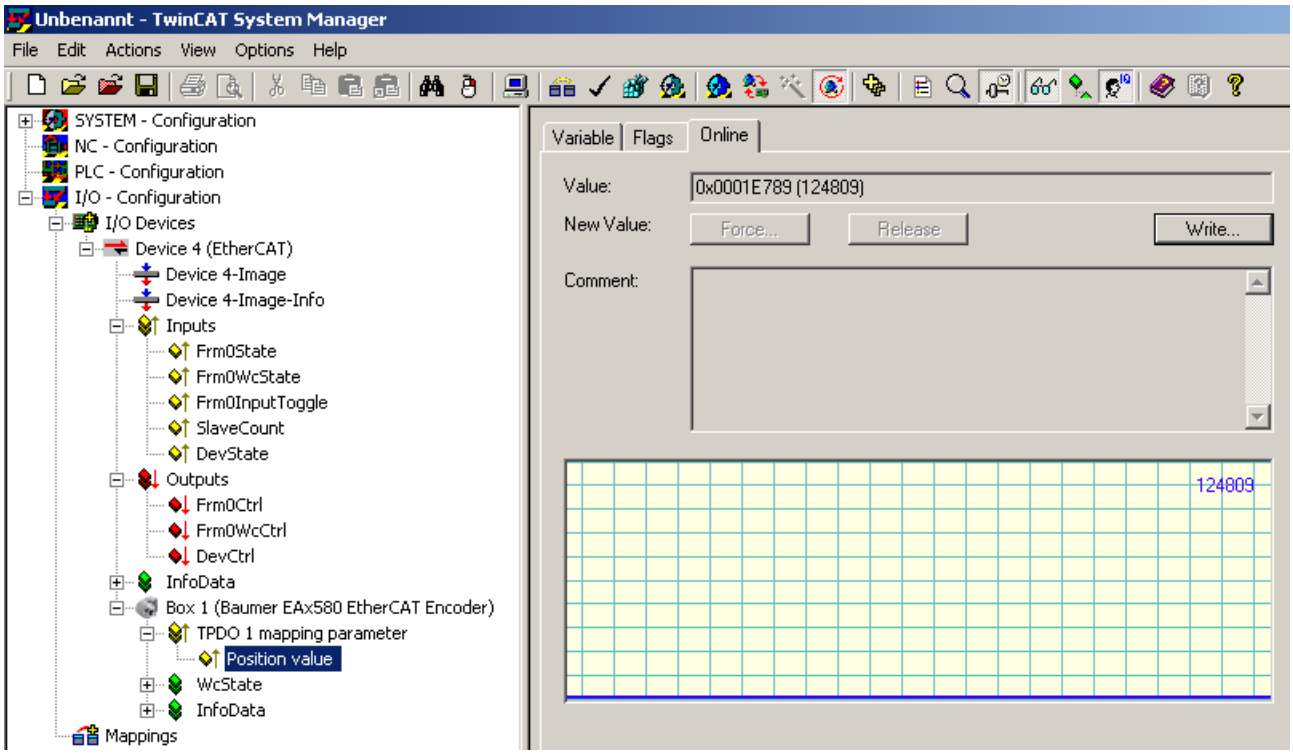
To check or change the EtherCAT Master cycle time in “Config Mode” proceed as follows:

- double-click on “Device 4 (EtherCAT)”
- click on tab “Adapter”



To watch the current position value of the encoder the following has to be done:

- double-click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- double-click on “TPDO 1 mapping parameter”
- click on “Position value”
- open tab “Online”
- rotate the encoder axis manually and watch the position value

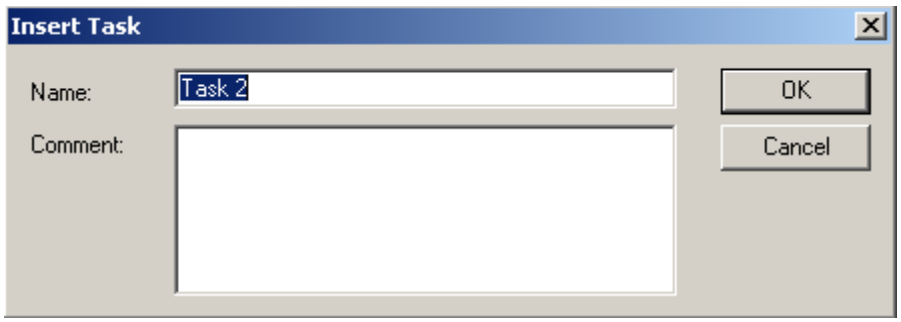


4.6. Run Mode (real-time)

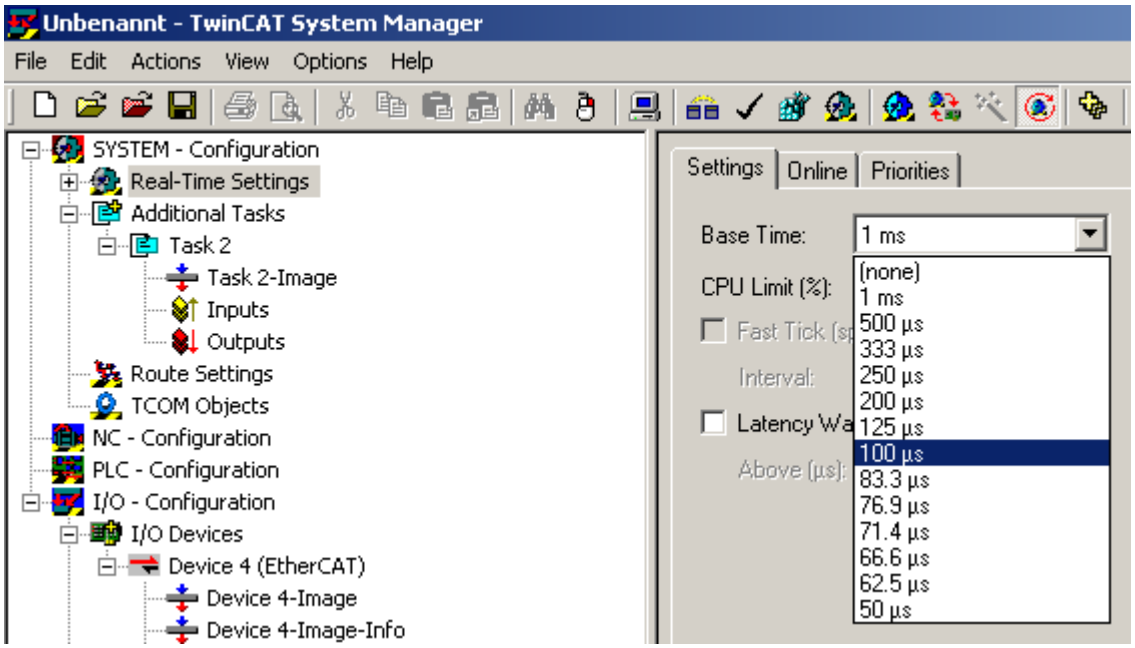
If you want to run the EtherCAT Master with a cycle time below 1 millisecond the so-called “Run Mode” can be used.

Proceed as follows:

- double-click on “SYSTEM - Configuration”
- right-click on “Additional Tasks”
- select “Append Task”
- confirm following message with OK

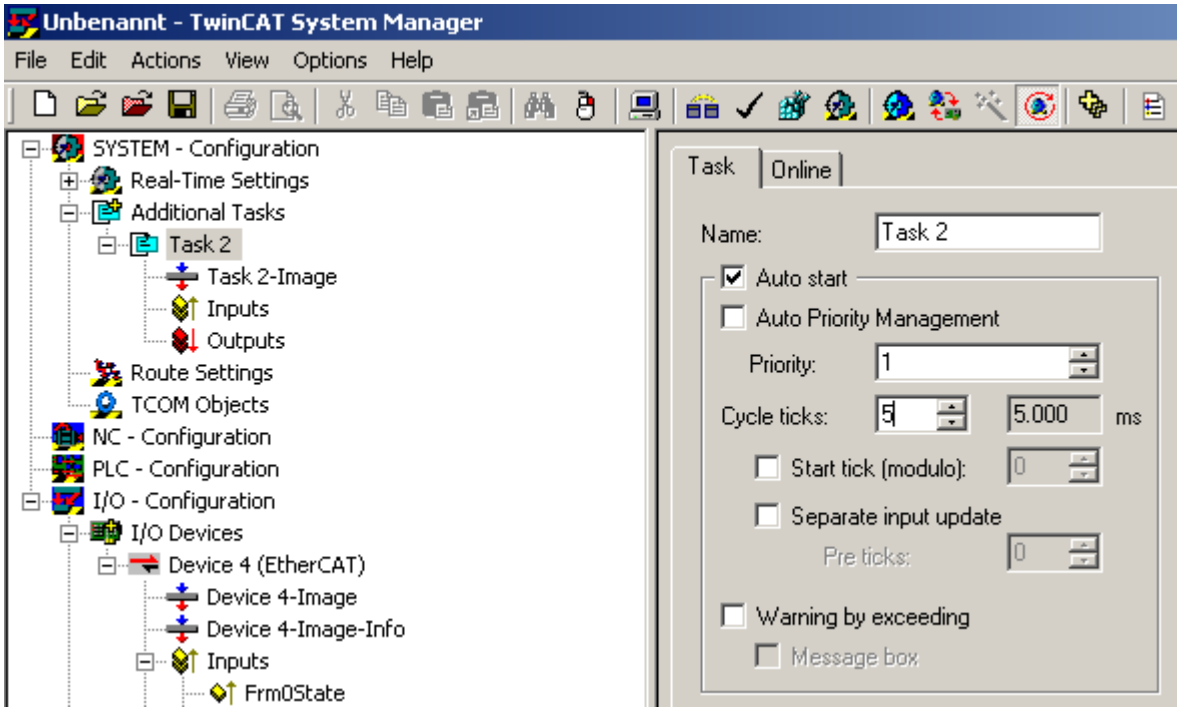


Adjust „Base Time“ (“SYSTEM – Configuration” -> “Real-Time Settings”) to 100 microseconds (as an example) as follows:

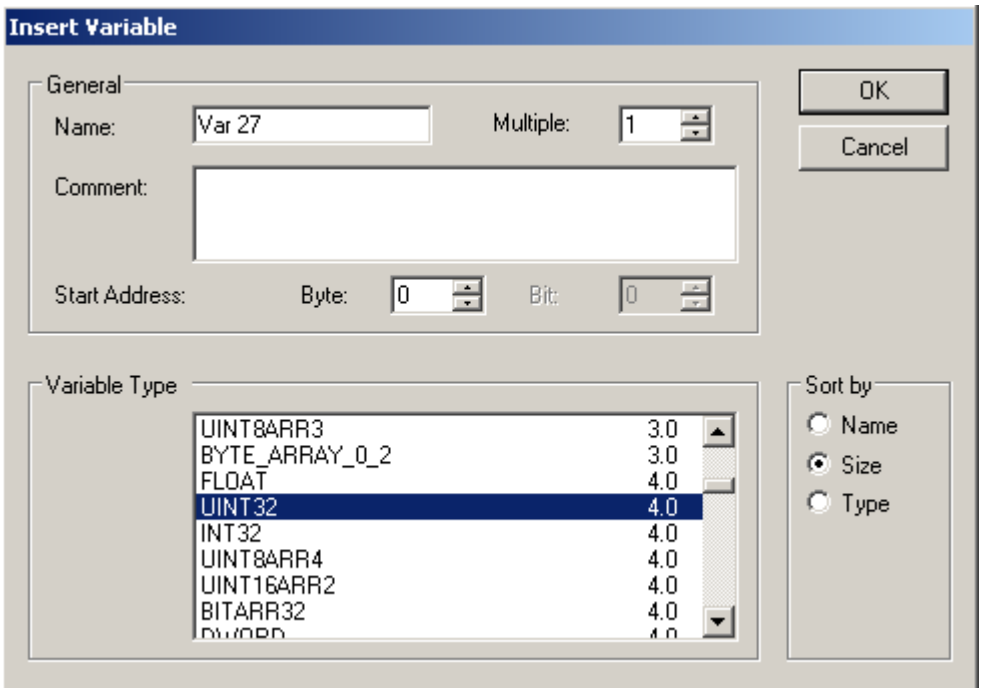


Double-click on “Task 2”.
Activate checkbox “Auto start” in tab “Task”.

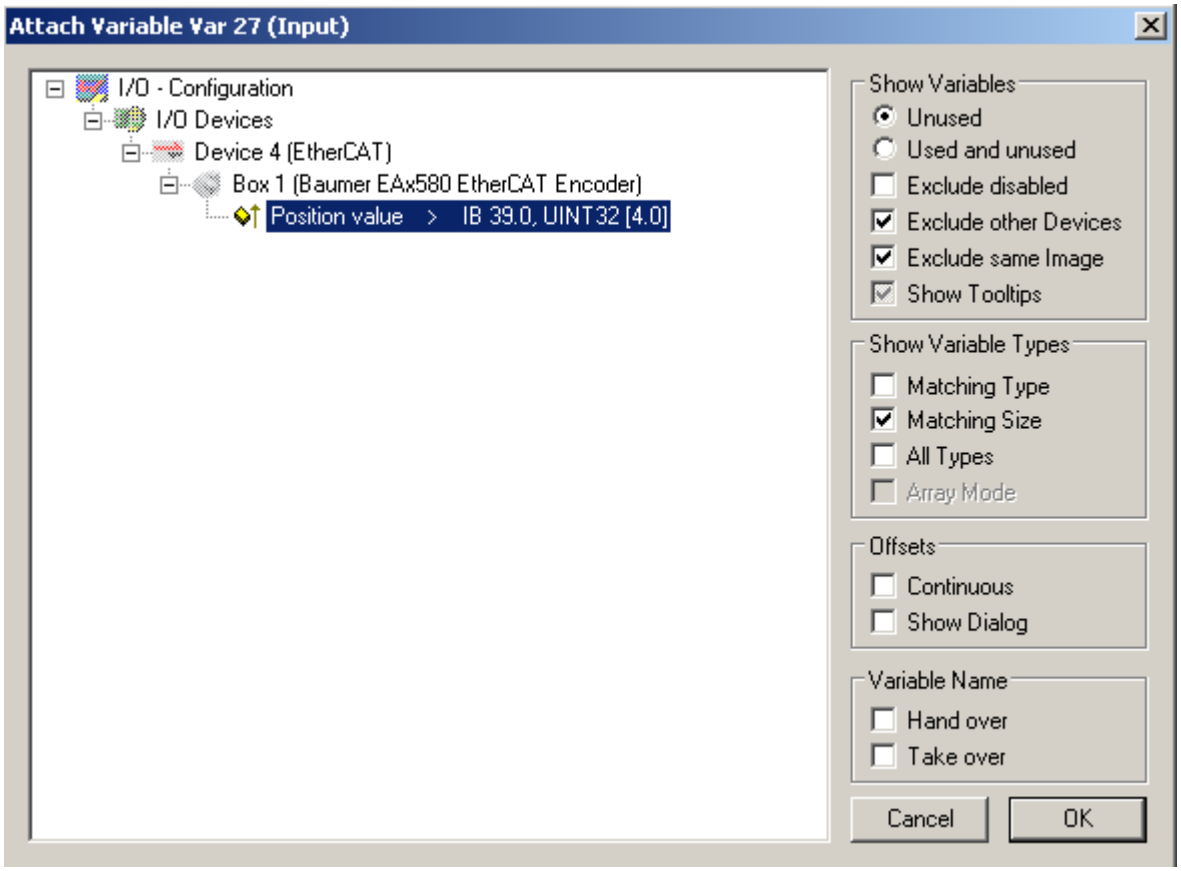
Change value “Cycle ticks” of application task for example to “5”. The application task will work with 500 microseconds cycle time (5 multiplied by 100 microseconds “Base Time”). If a process data variable of an EtherCAT Slave device is linked to a variable of an application task the EtherCAT Master will send frames to update the process data with an update rate of 2 kHz (500 microseconds cycle time). The following screenshot shows an example where parameter “Base Time” has been set to 1 millisecond.



Add one input variable of type UINT32 (length: 4 bytes). To do this right-click on “Inputs”. Then select “Insert Variable…” and select “UINT32”. Confirm the following with “OK”.

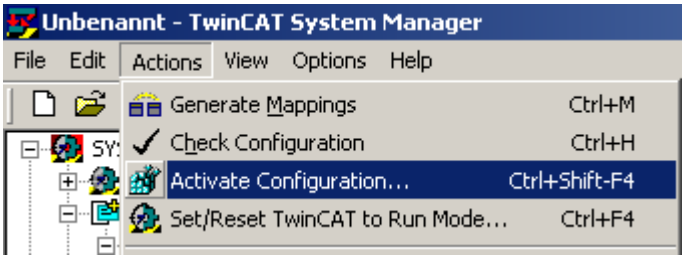


Now the process data variable of the Baumer encoder has to be linked to a variable of the application task “Task 2”. To do this double-click on the created input variable and choose “Position value” as follows:

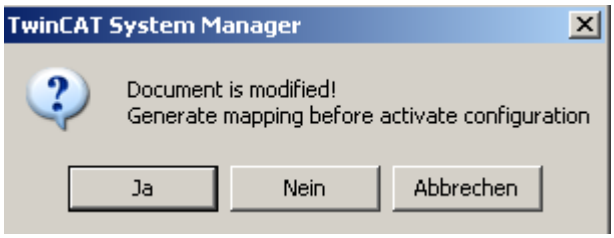


Confirm with “OK”.

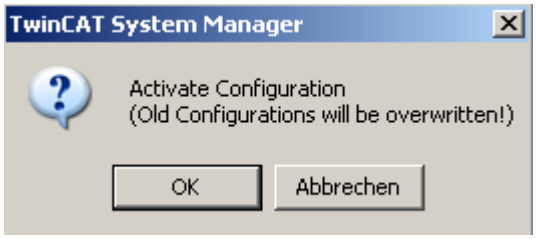
Now the configuration has to be activated by selecting “Activate Configuration” in menu “Actions” as follows:



Confirm following message if it occurs.

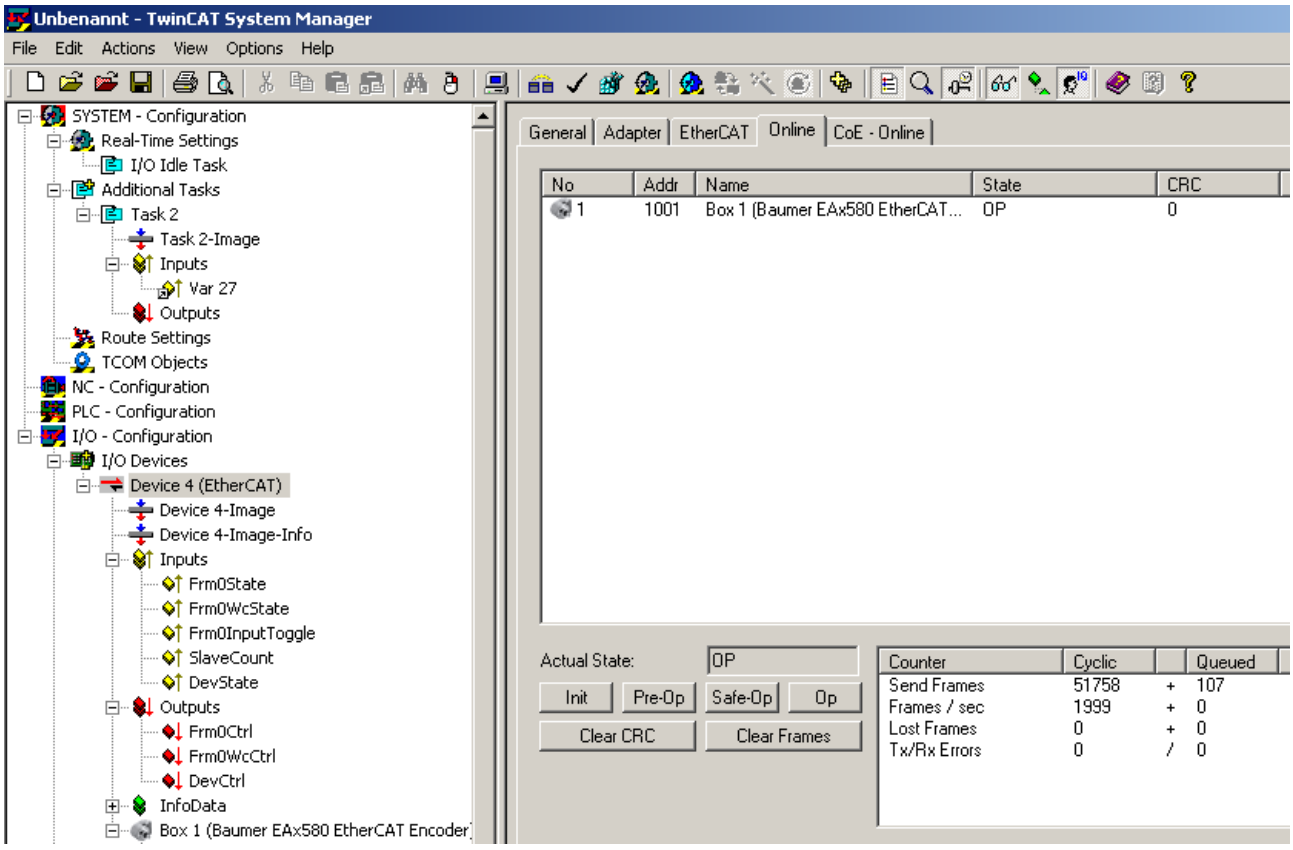


Confirm following message by “OK”.



Confirm following message by “OK”.

TwinCAT is started in „Run Mode”. To verify that the EtherCAT Master works with the correct cycle time check tab “Online” of “Device 4 (EtherCAT)”. Value of “Frames / sec” should be near 2000 if 500 microseconds cycle time was configured as described above.



4.7. Process image of encoder

The layout of the cyclic process image of the encoder is defined in a so-called “PDO mapping”. PDO means “process data object”. Several PDO mappings are available. Objects 0x1A00 to 0x1A06 contain descriptions of different PDO mappings.

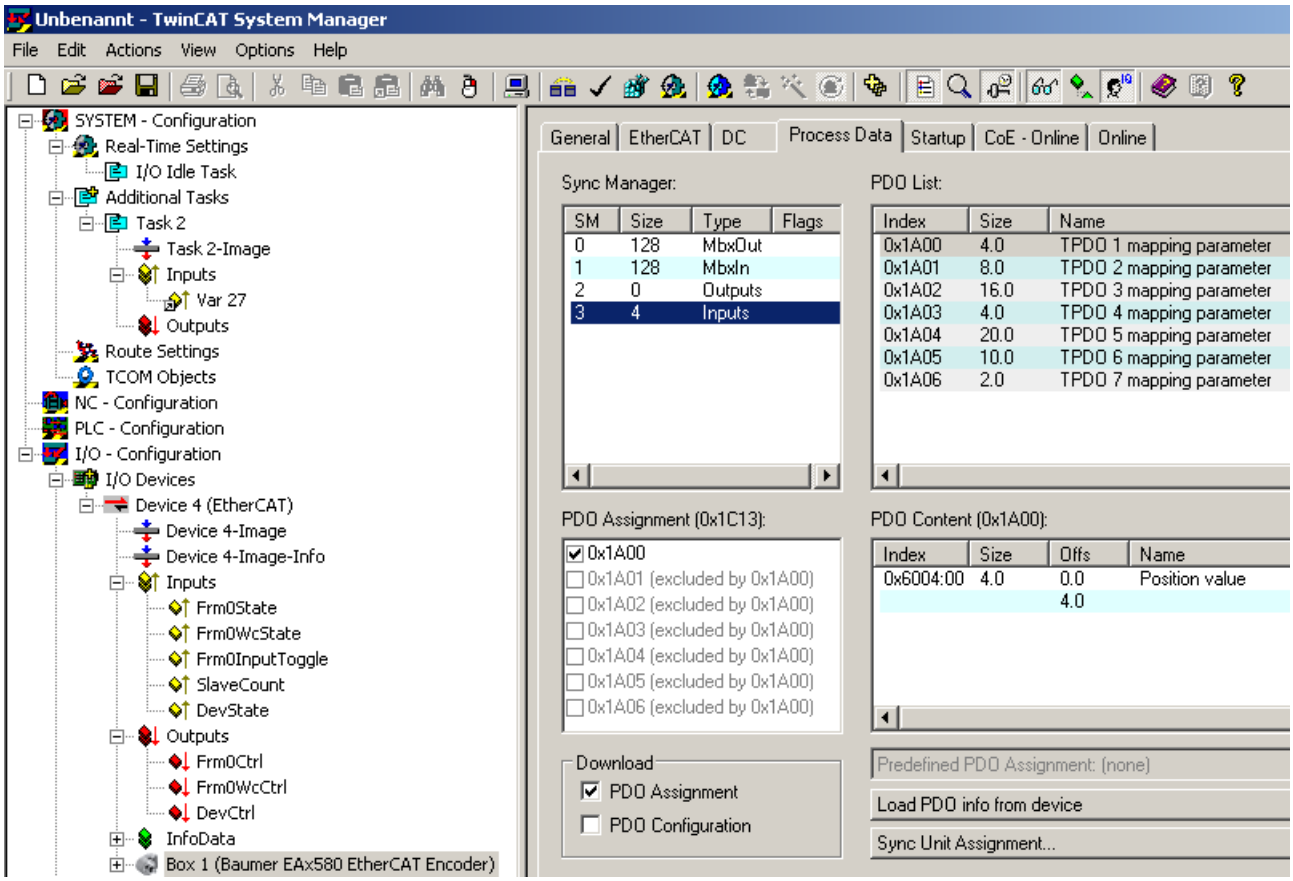
4.7.1. Default settings

When the encoder is powered on the PDO mapping which is described in object 0x1A00 is active. This PDO mapping contains object 0x6004 (position value).

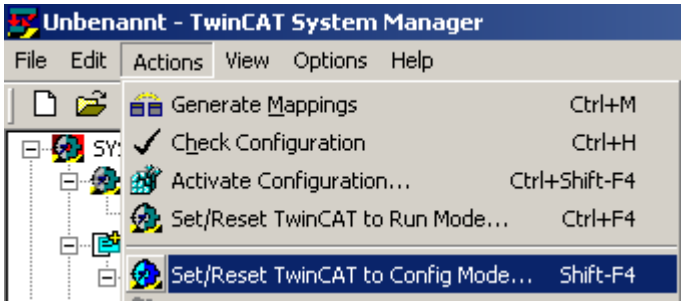
4.7.2. Change content of process image

The PDO mapping of the encoder can be changed as follows:

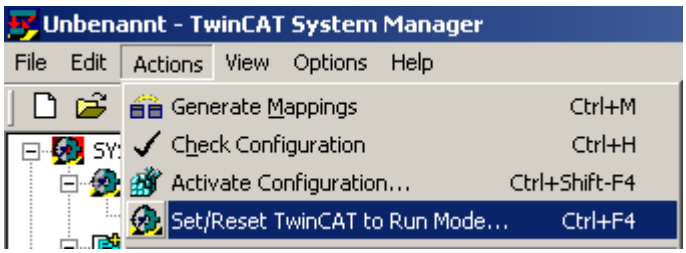
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- open tab “Process Data”
- select one of the PDO mappings in the box below “PDO Assignment (0x1C13):” (deselect old PDO assignment before)



In TwinCAT “Config Mode” press “Set/Reset TwinCAT To Config Mode” as follows:

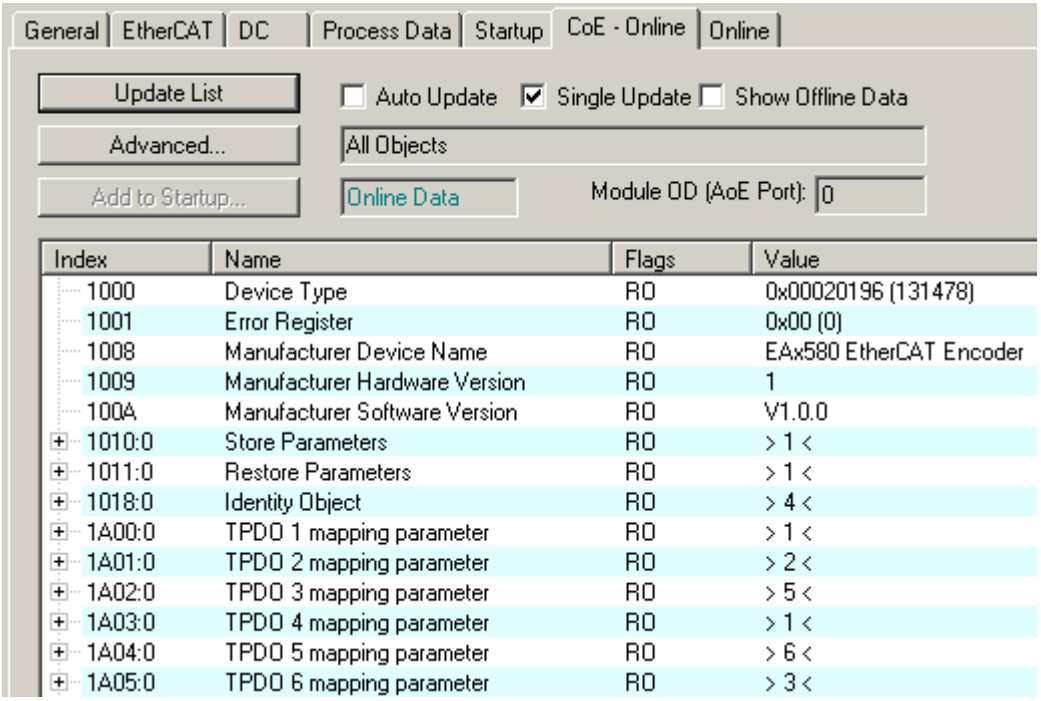


In TwinCAT “Run Mode” press “Set/Reset TwinCAT To Run Mode” as follows:



4.8. Read/Write CoE objects

- click on „Box 1 (Baumer EAx580 EtherCAT Encoder)“
- select tab „CoE – Online“



Index	Name	Flags	Value
1000	Device Type	RO	0x00020196 (131478)
1001	Error Register	RO	0x00 (0)
1008	Manufacturer Device Name	RO	EAx580 EtherCAT Encoder
1009	Manufacturer Hardware Version	RO	1
100A	Manufacturer Software Version	RO	V1.0.0
1010:0	Store Parameters	RO	> 1 <
1011:0	Restore Parameters	RO	> 1 <
1018:0	Identity Object	RO	> 4 <
1A00:0	TPDO 1 mapping parameter	RO	> 1 <
1A01:0	TPDO 2 mapping parameter	RO	> 2 <
1A02:0	TPDO 3 mapping parameter	RO	> 5 <
1A03:0	TPDO 4 mapping parameter	RO	> 1 <
1A04:0	TPDO 5 mapping parameter	RO	> 6 <
1A05:0	TPDO 6 mapping parameter	RO	> 3 <

If checkbox „Auto Update“ is selected instead of “Single Update” the EtherCAT Master will update (read) the CoE object dictionary cyclically.

To write an object in tab „CoE – Online“ double-click on the line which contains the value of the object.

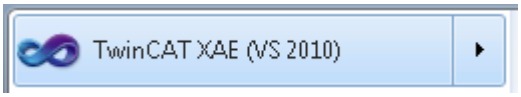
5. Engineering (Beckhoff TwinCAT 3)

The following examples relate to Beckhoff PLCs using the engineering tool TwinCAT 3. To get information how to configure the EAx580 EtherCAT encoder with TwinCAT 2 see chapter Engineering (Beckhoff TwinCAT 2).

Of course the encoder will also accept engineering software of other manufacturers. In this case please proceed in an analog way.

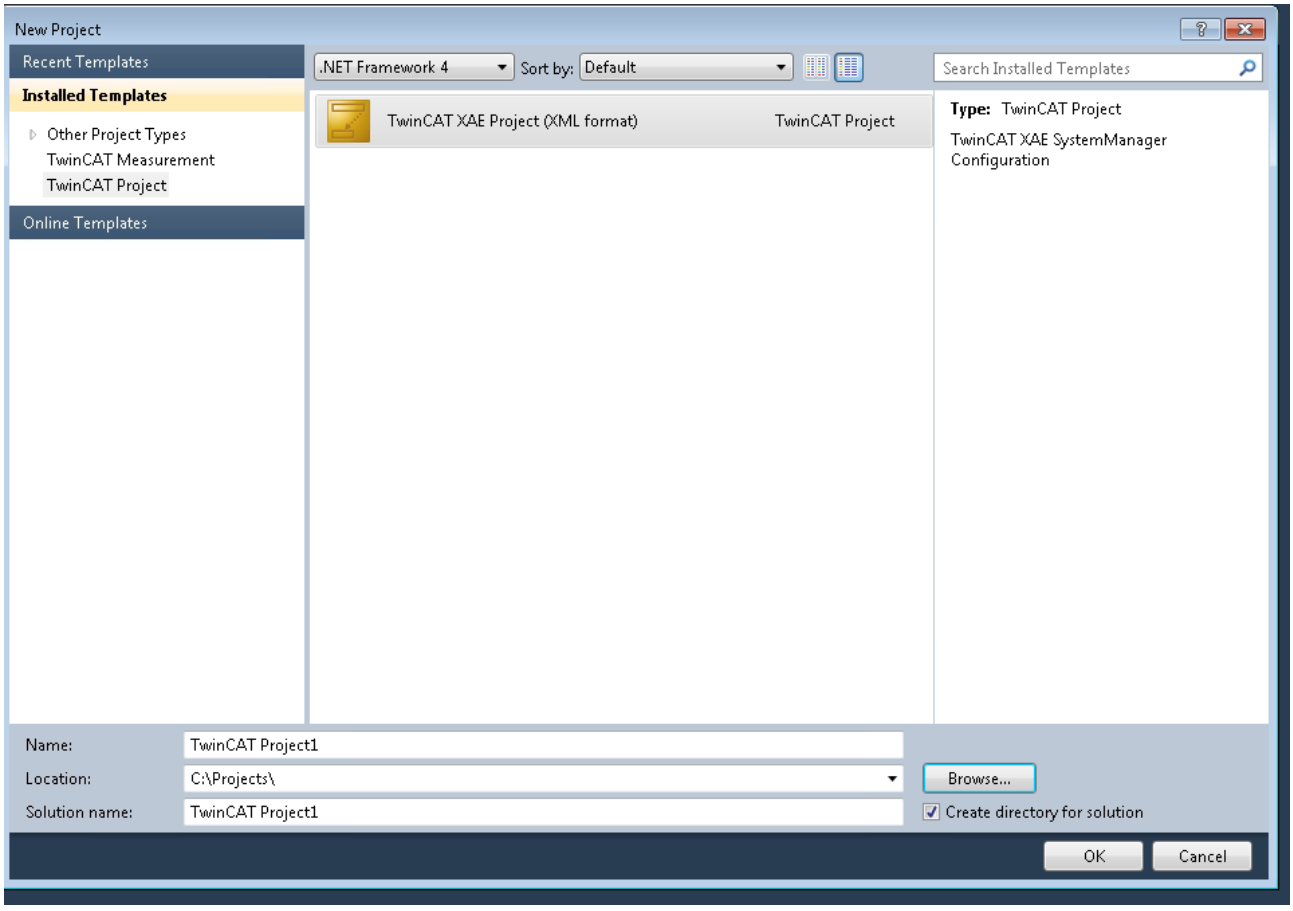
5.1. Start TwinCAT

Start TwinCAT 3 (“TwinCAT XAE (VS2010)”) for example from the Windows start menu.



5.2. Create project

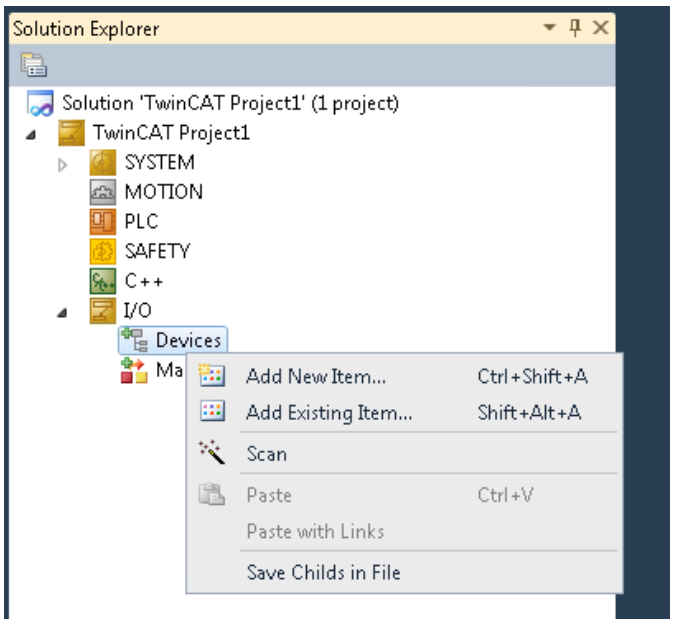
Menu: File -> New -> Project



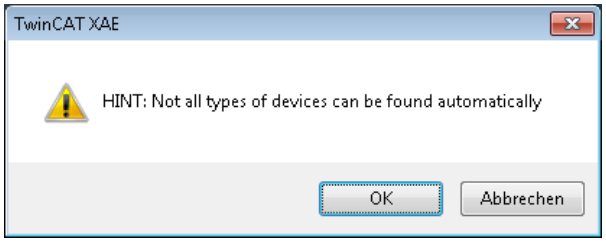
Set project name and press “OK”.

5.3. Scan EtherCAT network

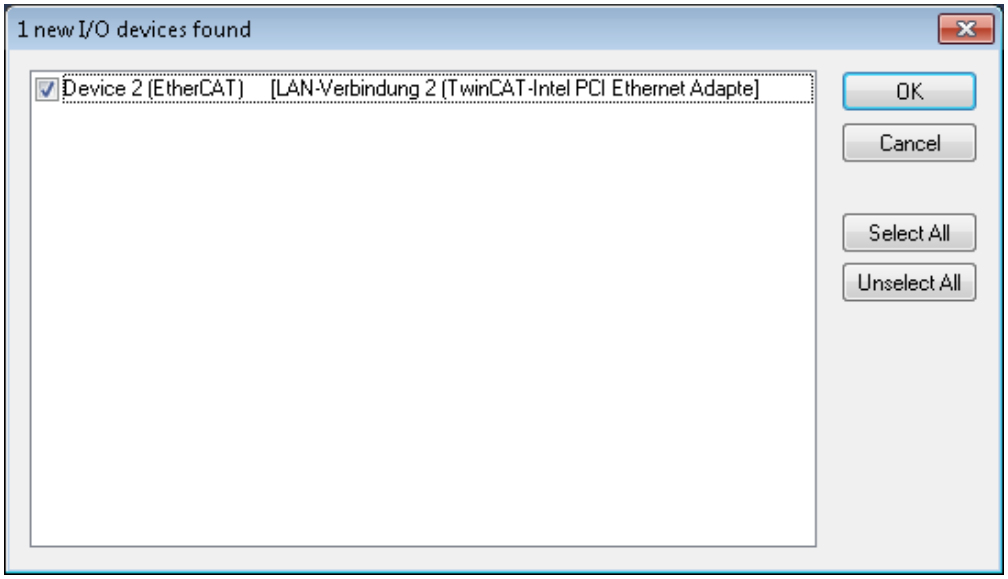
Double-click on „I/O". Then right-click on "Devices" and select "Scan".



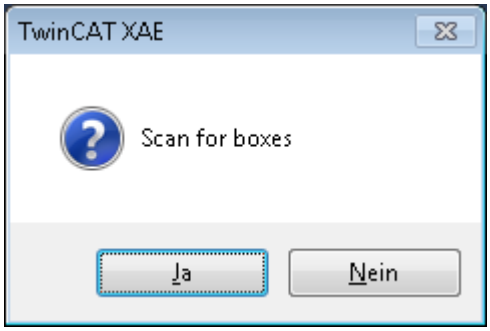
Press OK if following message occurs.



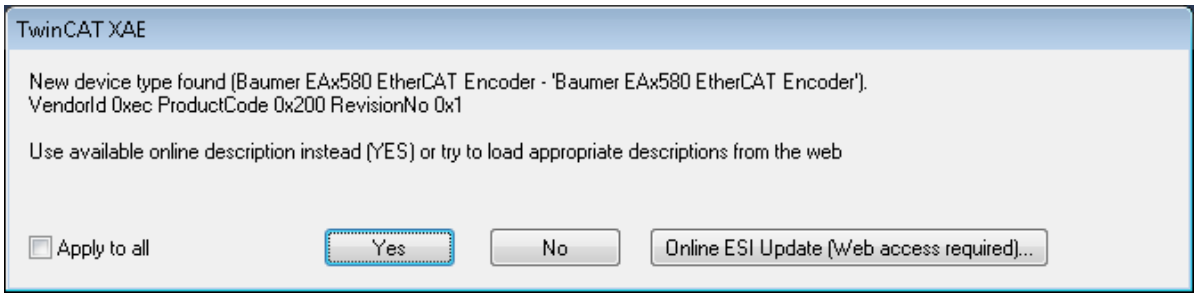
Select network adapter and press OK.



Confirm following message.

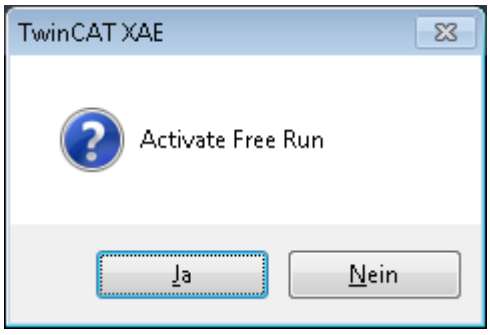


Confirm following message by clicking „Yes“.

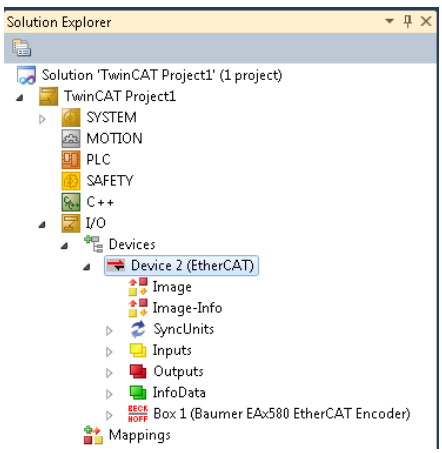


Message above occurred because no EtherCAT Slave Information (ESI) file was provided to TwinCAT yet.

Confirm following message.



Result is shown below.



5.4. Import ESI file

An EtherCAT Slave is described by a so-called “EtherCAT Slave Information” (ESI) file. The file format is XML (“Extensible Markup Language”).

The ESI file for an EAx580 EtherCAT encoder is available for download at www.baumer.com.

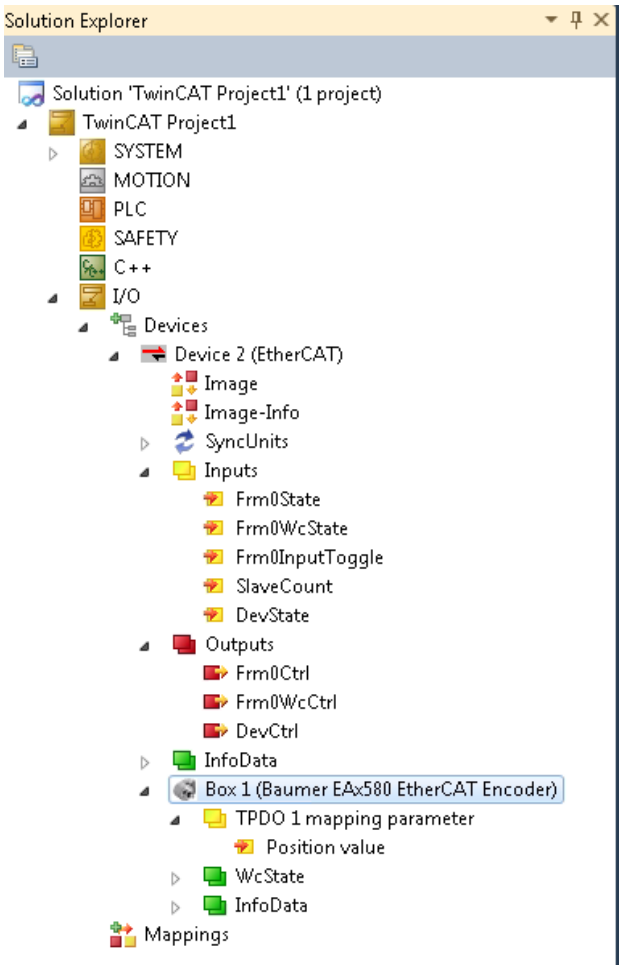
Use this ESI file:

- **Baumer_EAx580_EtherCAT_Encoders_ESI_V102.xml**
  for encoders with firmware V1.0.0 or later
  The version in the filename just indicates the ESI file version and may change without notice.

To provide the EtherCAT Slave Information (ESI) file to TwinCAT the following steps have to be done:

- Close TwinCAT.
- Delete ESI file “OnlineDescriptionCache000000EC.xml” which was generated automatically by TwinCAT before for example in folder C:\TwinCAT\Io\EtherCAT.
- Copy ESI file of encoder to folder C:\TwinCAT\Io\EtherCAT.

Repeat the steps mentioned in the chapters before. Now TwinCAT 3 uses the ESI file for configuration. The encoder is displayed as follows:

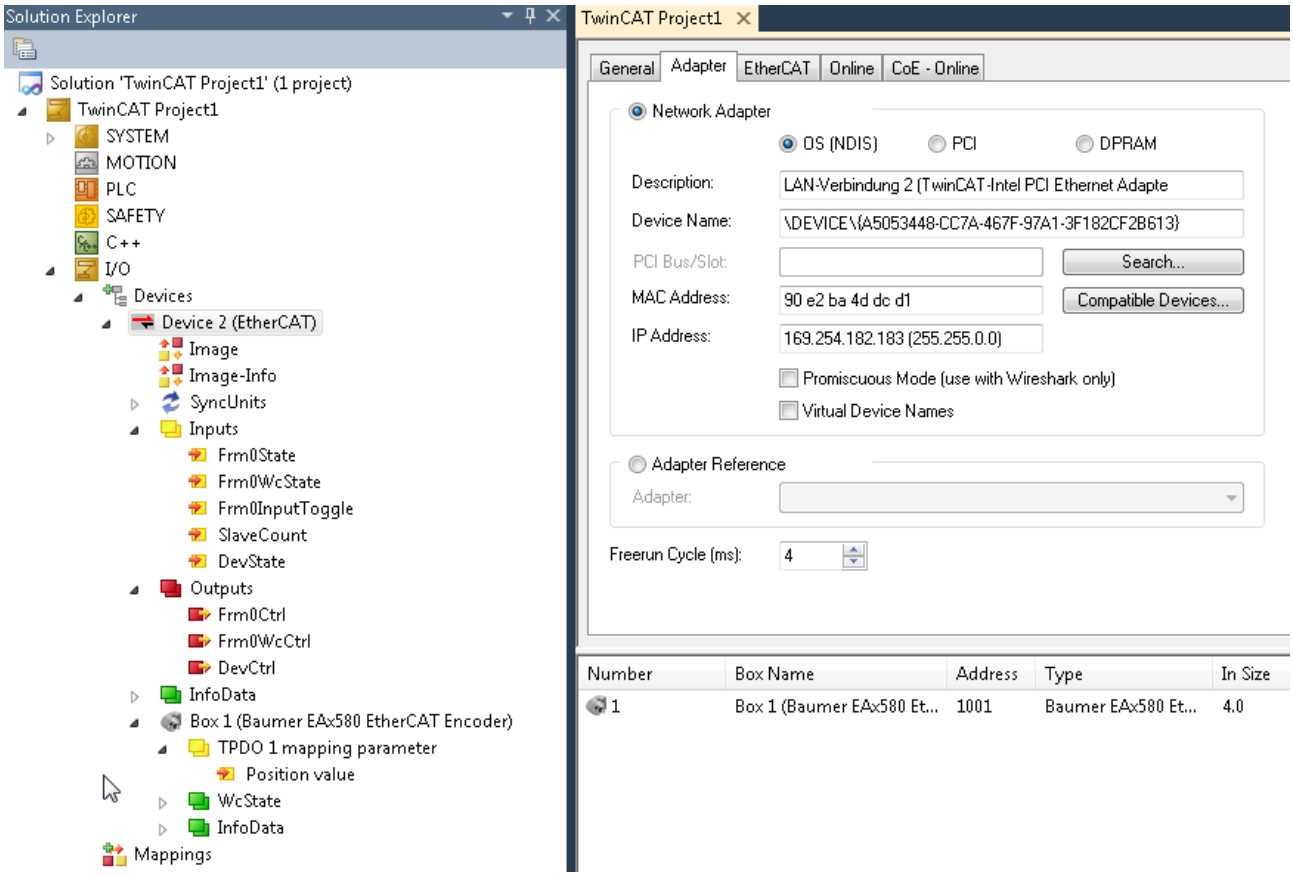


Notice:
The icon for “Box 1 (Baumer EAx580 EtherCAT Encoder)” in the screenshot above is shown when an EA**L**580 EtherCAT encoder is connected to the EtherCAT master. If an EA**M**580 EtherCAT encoder is connected to the EtherCAT master a different icon is displayed. Additionally EA**M**580 EtherCAT encoders have different EtherCAT product codes. Please see chapter Import ESI file for details.

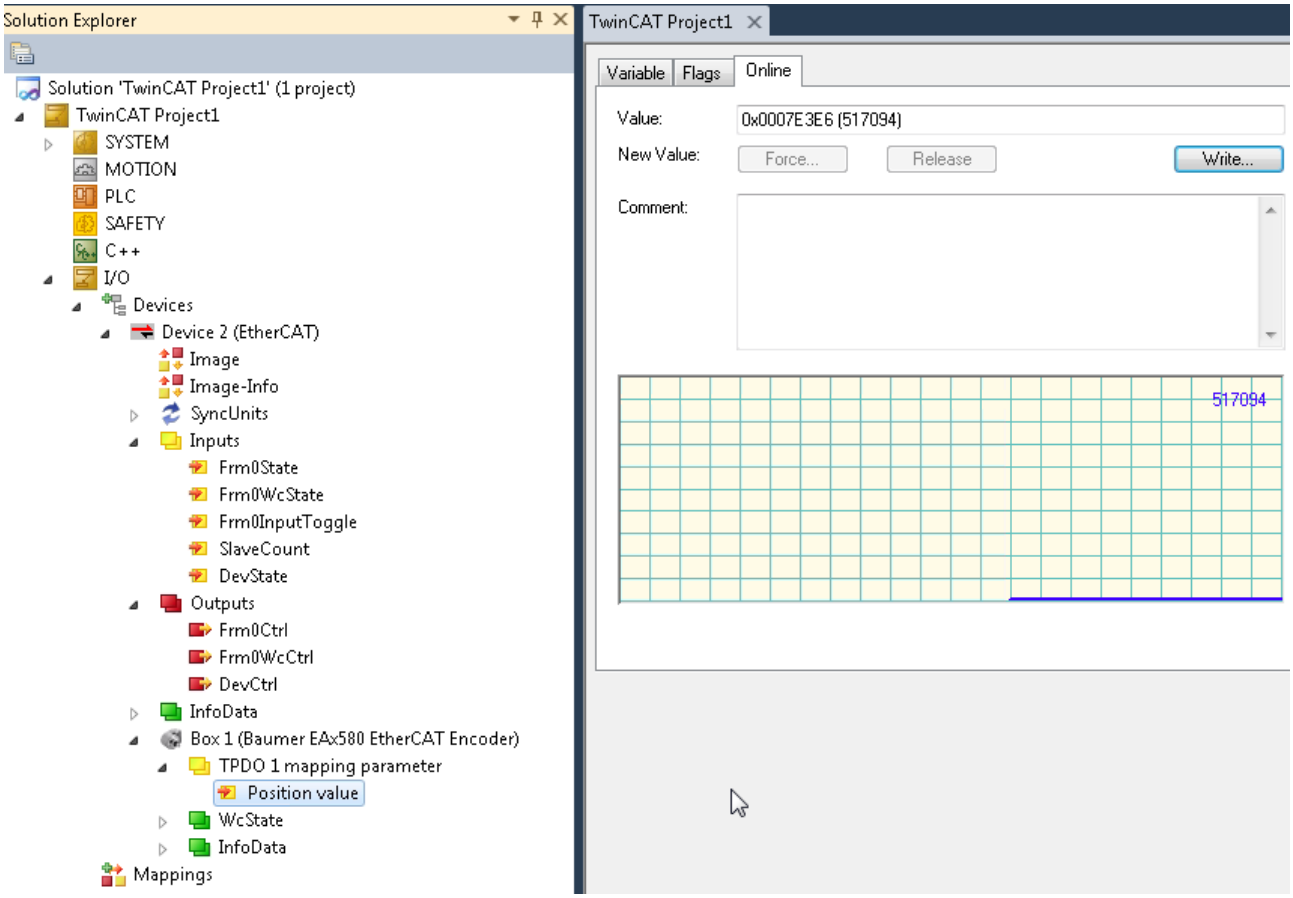
5.5. Config Mode

TwinCAT provides a so-called “Config Mode”. In this mode real-time handling of the encoder data in TwinCAT is usually not possible. By default TwinCAT uses the “Config Mode” and the “Free Run” cycle time of the EtherCAT Master is set to 4 milliseconds.

To check or change the EtherCAT Master cycle time in “Config Mode” proceed as follows:
- double-click on “Device 2 (EtherCAT)”
- click on tab “Adapter”



To watch the current position value of the encoder the following has to be done:
- double-click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- double-click on “TPDO 1 mapping parameter”
- click on “Position value”
- open tab “Online”
- rotate the encoder axis manually and watch the position value

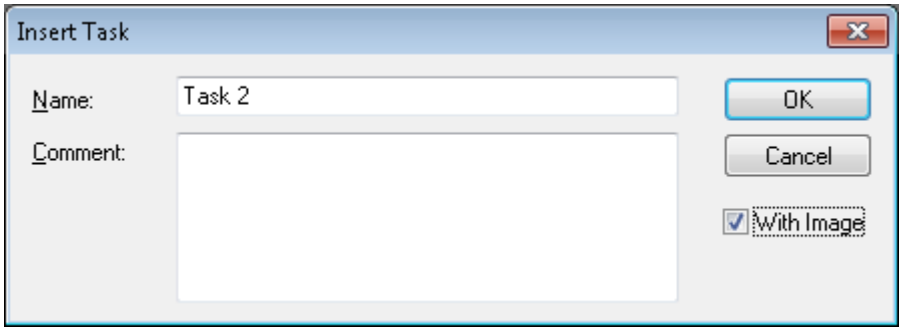


5.6. Run Mode (real-time)

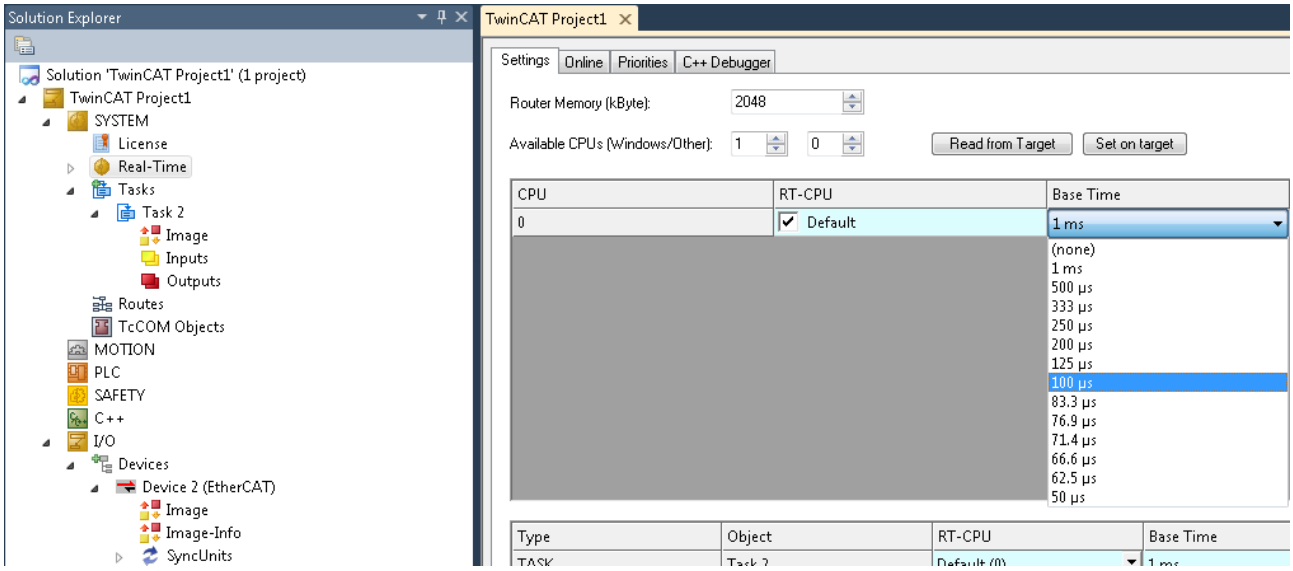
If you want to run the EtherCAT Master with a cycle time below 1 millisecond the so-called “Run Mode” can be used.

Proceed as follows:

- double-click on “SYSTEM”
- right-click on “Tasks”
- select “Add New Item…”
- activate checkbox “With Image” (folders for input and output data will be created automatically)
- confirm following message with OK

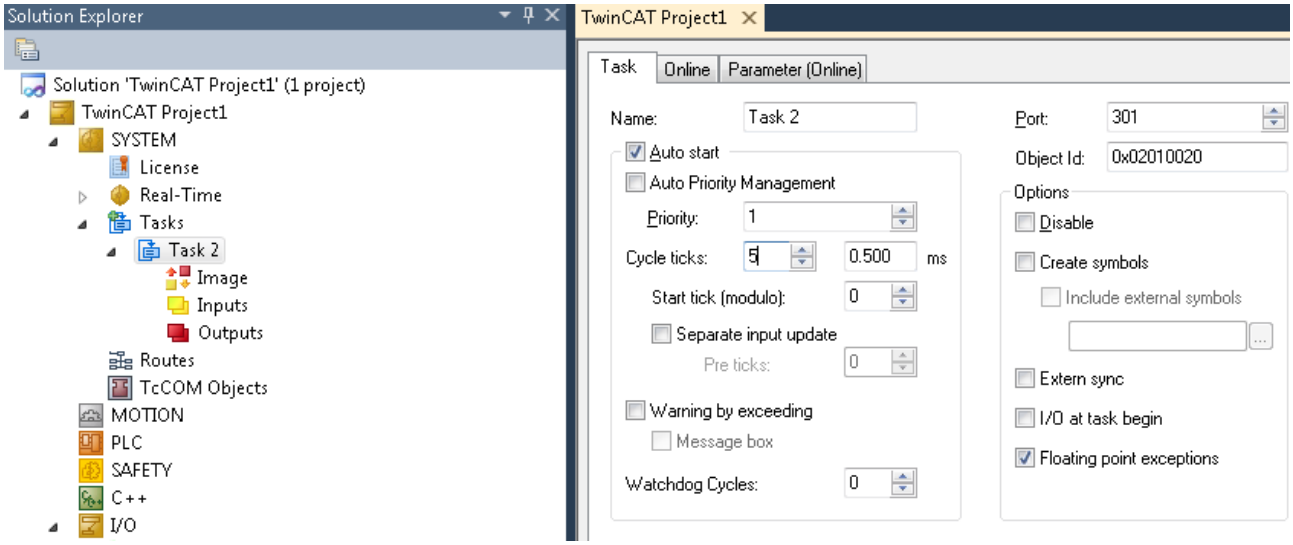


Adjust „Base Time“ (SYSTEM -> Real-Time) to 100 microseconds (as an example) as follows:

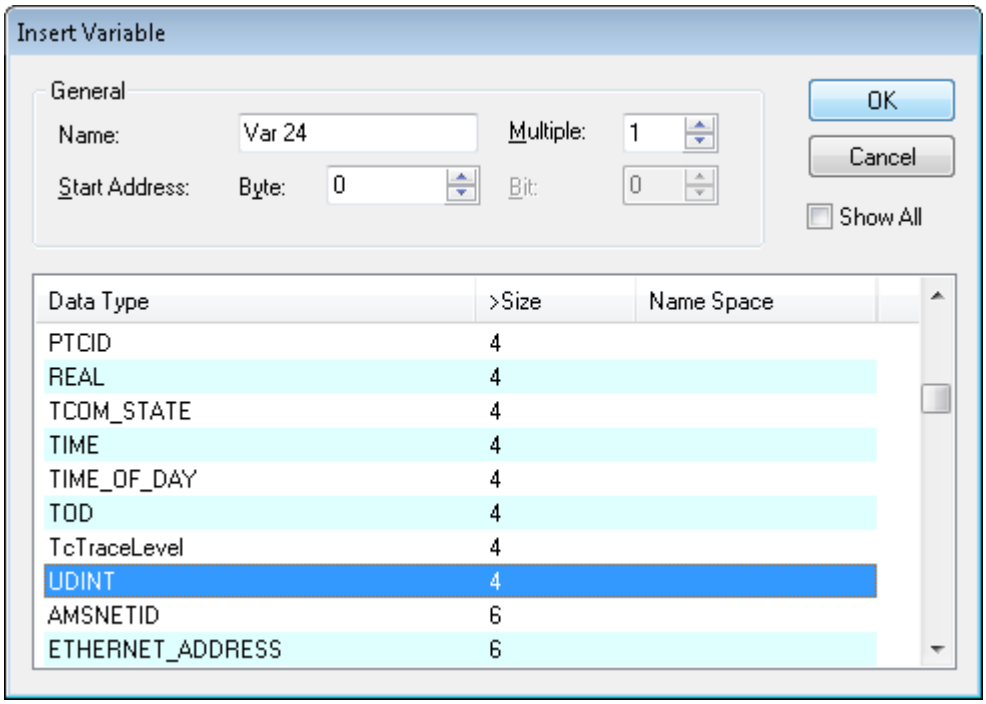


Double-click on “Task 2”.

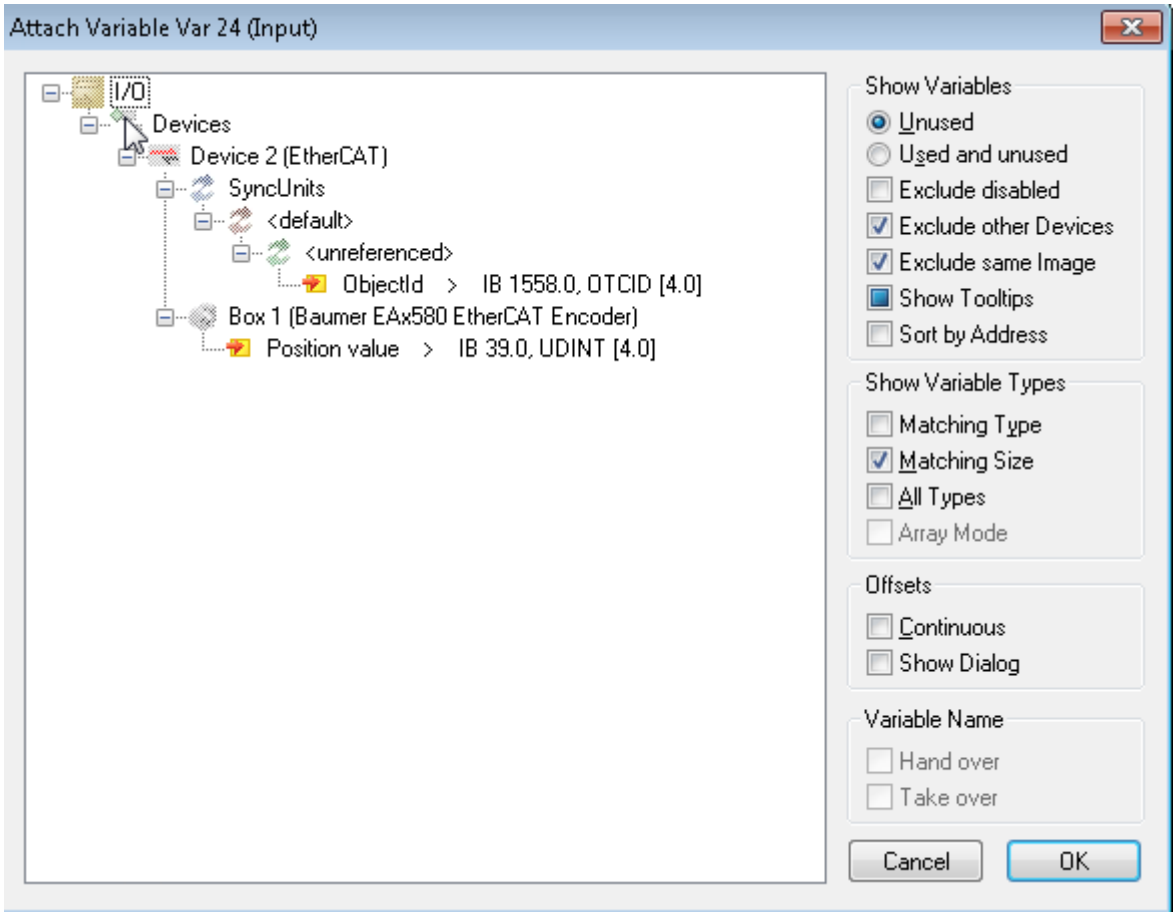
Change value “Cycle ticks” of application task for example to “5”. The application task will work with 500 microseconds cycle time (5 multiplied by 100 microseconds “Base Time”). If a process data variable of an EtherCAT Slave device is linked to a variable of an application task the EtherCAT Master will send frames to update the process data with an update rate of 2 kHz (500 microseconds cycle time).



Add one input variable of type UDINT (length: 4 bytes). To do this right-click on “Inputs” (below “Task 2”, see screenshot above). Then select “Add New Item…” and select “UDINT”. Confirm the following with “OK”.

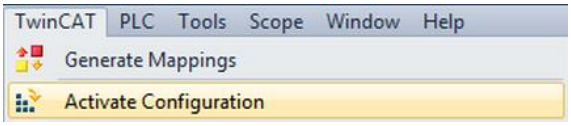


Now the process data variable of the Baumer encoder has to be linked to a variable of the application task “Task 2”. To do this double-click on the created input variable (“Var 24” in example above) and choose “Position value” as follows:

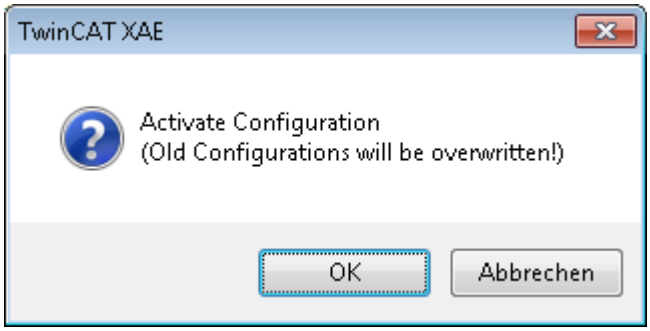


Confirm with “OK”.

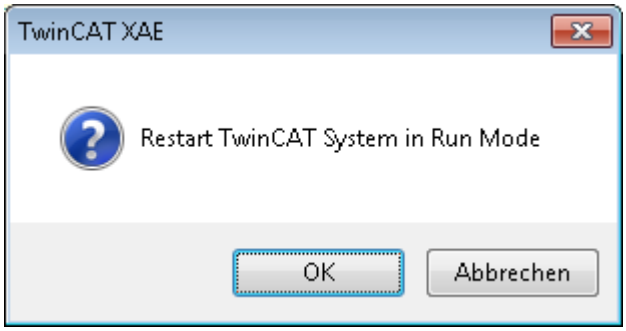
Now the configuration has to be activated by selecting “Activate Configuration” in menu “TwinCAT” as follows:



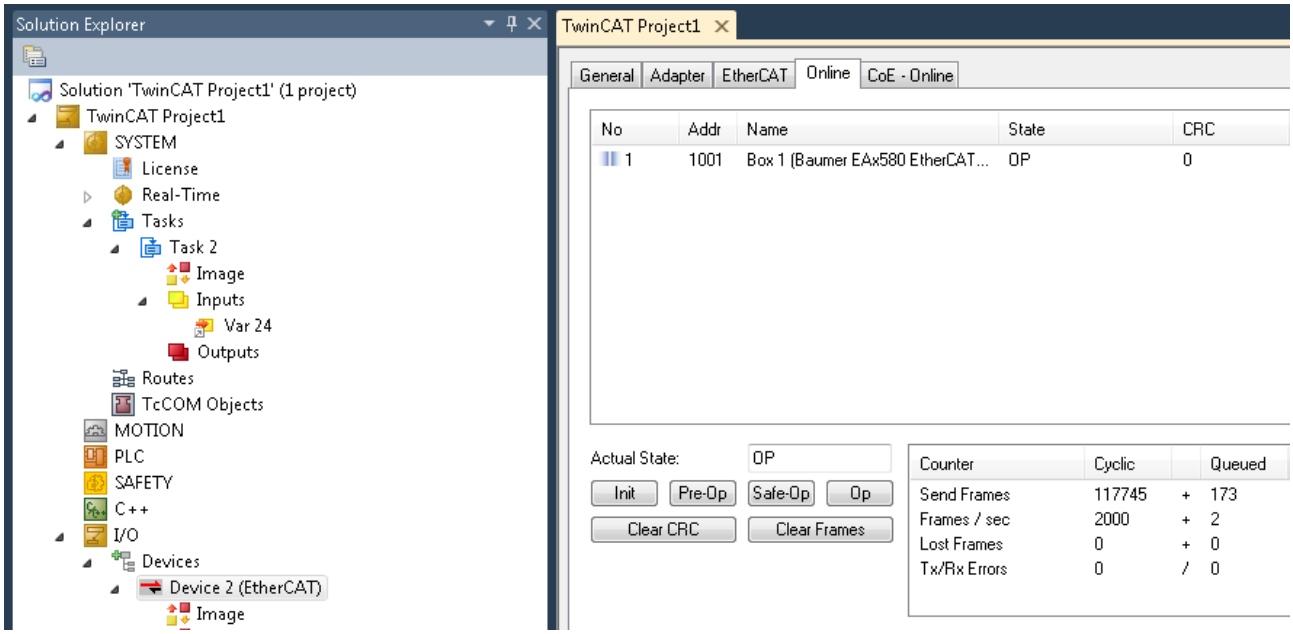
Confirm following message by “OK”.



Confirm following message by “OK”.



TwinCAT is started in „Run Mode”. To verify that the EtherCAT Master works with the correct cycle time check tab “Online” of “Device 2 (EtherCAT)”. Value of “Frames / sec” should be near 2000 if 500 microseconds cycle time was configured as described above.



5.7. Process image of encoder

The layout of the cyclic process image of the encoder is defined in a so-called “PDO mapping”. PDO means “process data object”. Several PDO mappings are available. Objects 0x1A00 to 0x1A06 contain descriptions of different PDO mappings.

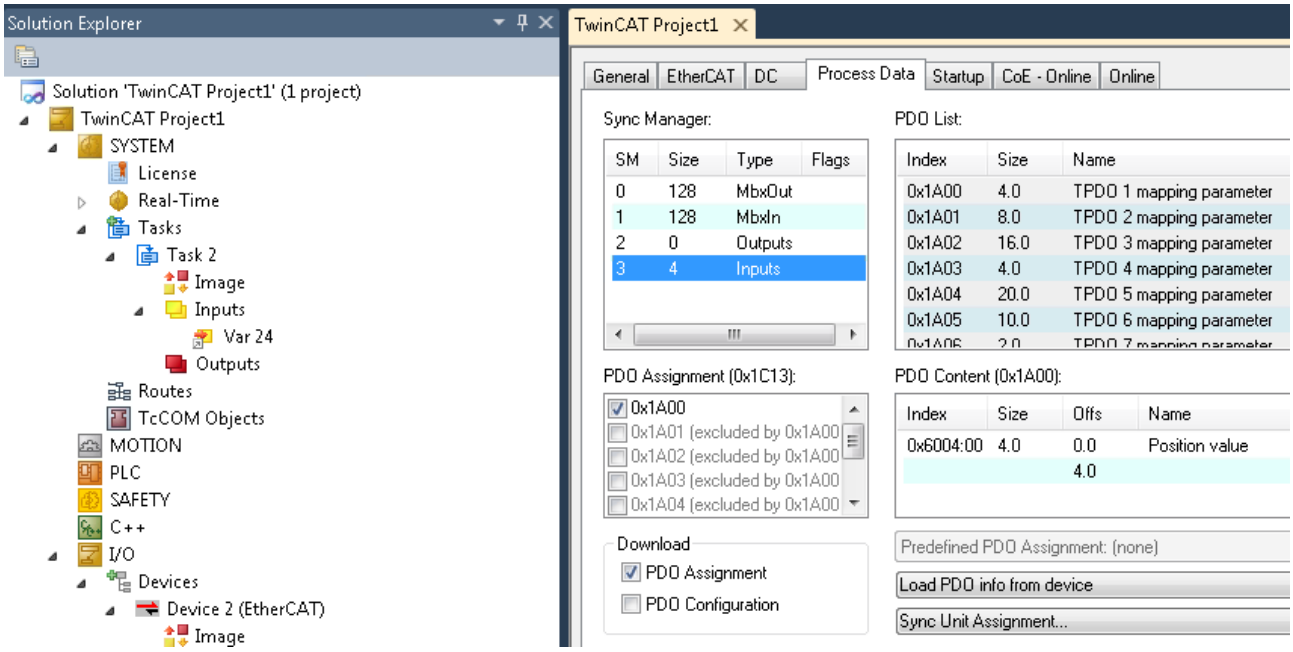
5.7.1. Default settings

When the encoder is powered on the PDO mapping which is described in object 0x1A00 is active. This PDO mapping contains object 0x6004 (position value).

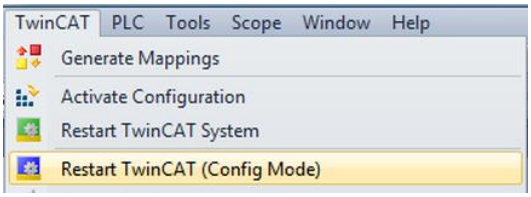
5.7.2. Change content of process image

The PDO mapping of the encoder can be changed as follows:

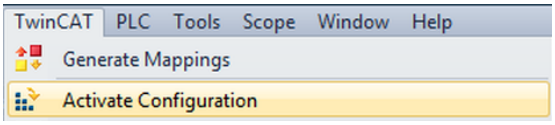
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- open tab “Process Data”
- select one of the PDO mappings in the box below “PDO Assignment (0x1C13):” (deselect old PDO assignment before)



In TwinCAT “Config Mode” press “Restart TwinCAT (Config Mode)” as follows:

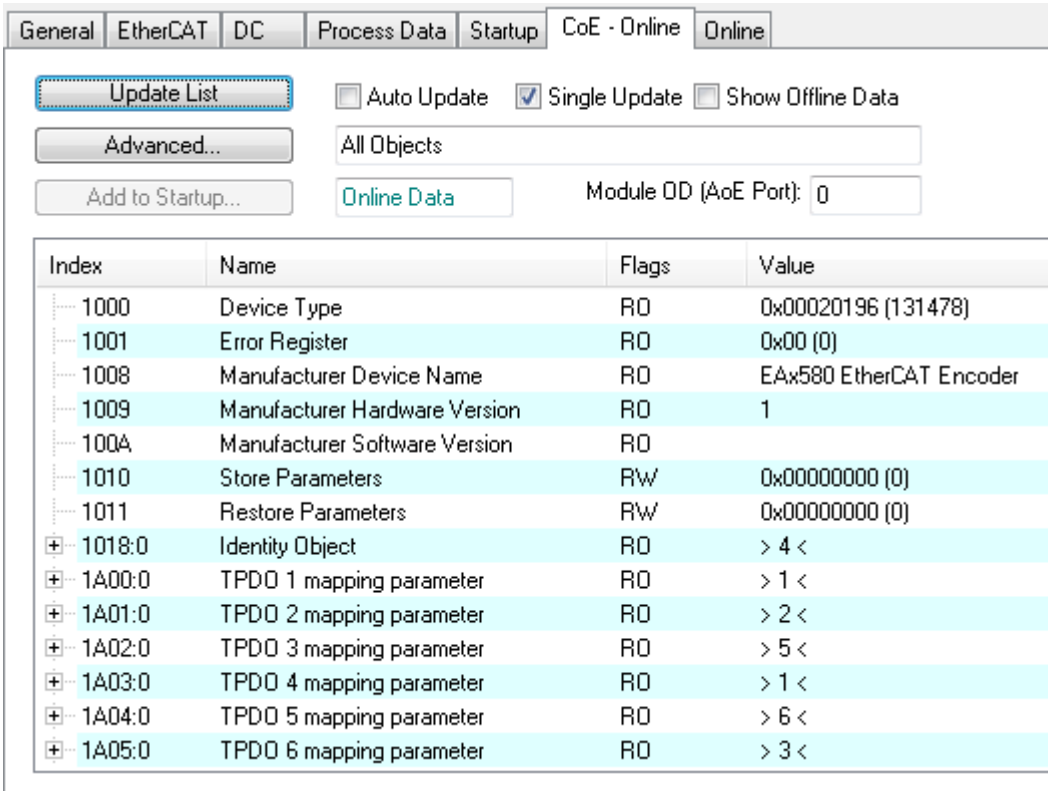


In TwinCAT “Run Mode” press “Activate Configuration” as follows:



5.8. Read/Write CoE objects

- click on „Box 1 (Baumer EAx580 EtherCAT Encoder)“
- select tab „CoE – Online“



Index	Name	Flags	Value
1000	Device Type	RO	0x00020196 (131478)
1001	Error Register	RO	0x00 (0)
1008	Manufacturer Device Name	RO	EAx580 EtherCAT Encoder
1009	Manufacturer Hardware Version	RO	1
100A	Manufacturer Software Version	RO	
1010	Store Parameters	RW	0x00000000 (0)
1011	Restore Parameters	RW	0x00000000 (0)
1018:0	Identity Object	RO	> 4 <
1A00:0	TPDO 1 mapping parameter	RO	> 1 <
1A01:0	TPDO 2 mapping parameter	RO	> 2 <
1A02:0	TPDO 3 mapping parameter	RO	> 5 <
1A03:0	TPDO 4 mapping parameter	RO	> 1 <
1A04:0	TPDO 5 mapping parameter	RO	> 6 <
1A05:0	TPDO 6 mapping parameter	RO	> 3 <

If checkbox „Auto Update“ is selected instead of “Single Update” the EtherCAT Master will update the CoE object dictionary cyclically.

To write an object in tab „CoE – Online“ double-click on the line which contains the value of the object.

6. EtherCAT cyclic operation

6.1. PLC (EtherCAT Master)

There are several EtherCAT Masters from different vendors available. An EtherCAT Master can be realized as software which accesses an Ethernet controller. In general EtherCAT uses standard Ethernet frames. The EtherCAT Master sends Ethernet frames into the network. The EtherCAT Slaves in the network access these frames "on the fly". This requires real-time capabilities in the EtherCAT Slaves.

6.2. Basics

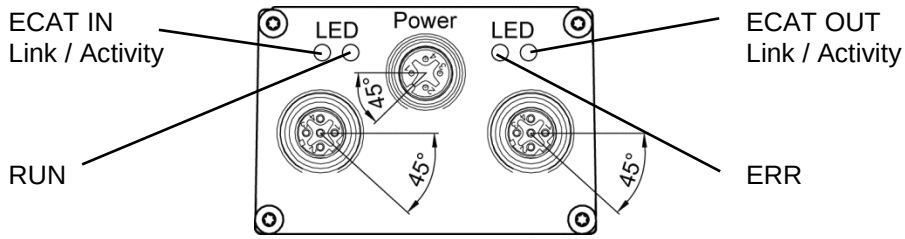
For cyclic operation a so-called cyclic process data image is used. This image contains input and output data. The EAx580 EtherCAT encoder only sends cyclic process data to the master. From the master to the EAx580 EtherCAT encoder no cyclic process data is transmitted.

EtherCAT Slaves implement the EtherCAT state machine which consists of the following states.

State	Description
Initial	No EtherCAT mailbox active, no cyclic process data
Pre-Operational	EtherCAT mailbox active, no cyclic process data
Safe-Operational	EtherCAT mailbox active, only cyclic process input data active
Operational	EtherCAT mailbox active, cyclic process input and output data active
Bootstrap	For firmware update via FoE, no cyclic process data active

6.3. Diagnostic LEDs

The LEDs of the encoder have the following meaning.



6.3.1. Link/Activity (L/A) LEDs

The encoder provides two green LEDs to indicate the status of the Ethernet ports. The following table shows the different possible states of the link/activity LEDs.

LED behavior	Link	Activity	Condition
LED constantly on (green)	yes	no	port open
LED blinks at 10 Hz (green)	yes	yes	port open
LED constantly off	no	no	port closed

6.3.2. EtherCAT RUN LED

The encoder provides a green RUN LED to indicate the EtherCAT-specific operation status of the device.

LED behavior	EtherCAT state	Description
LED constantly off	INITIALISATION	Encoder is in state INIT.
LED blinks at 2.5 Hz	PRE-OPERATIONAL	Encoder is in state PRE-OPERATIONAL.
LED shows one short flash (200 ms) followed by a long off phase (1000 ms)	SAFE-OPERATIONAL	Encoder is in state SAFE-OPERATIONAL.
LED constantly on	OPERATIONAL	Encoder is in state OPERATIONAL.
LED blinks at 10 Hz	BOOTSTRAP	Encoder is in state BOOTSTRAP. In this state a firmware download (via protocol FoE) is possible.

6.3.3. EtherCAT ERR LED

The encoder provides a red ERR LED to indicate the EtherCAT-specific error status of the device.

LED behavior	ERR state	Description
LED constantly off	no error	
LED blinks at 2.5 Hz	invalid configuration	General configuration error occured.
LED shows one short flash (200 ms) followed by a long off phase (1000 ms)	local error	Due to a local error (for example a synchronization error) the encoder application has changed the EtherCAT state autonomously.
LED shows a sequence of two short flashes (200 ms), separated by an off phase (200 ms), and followed by a long off phase (1000 ms)	Process Data Watchdog Timeout / EtherCAT Watchdog Timeout	An application watchdog timeout has occured.

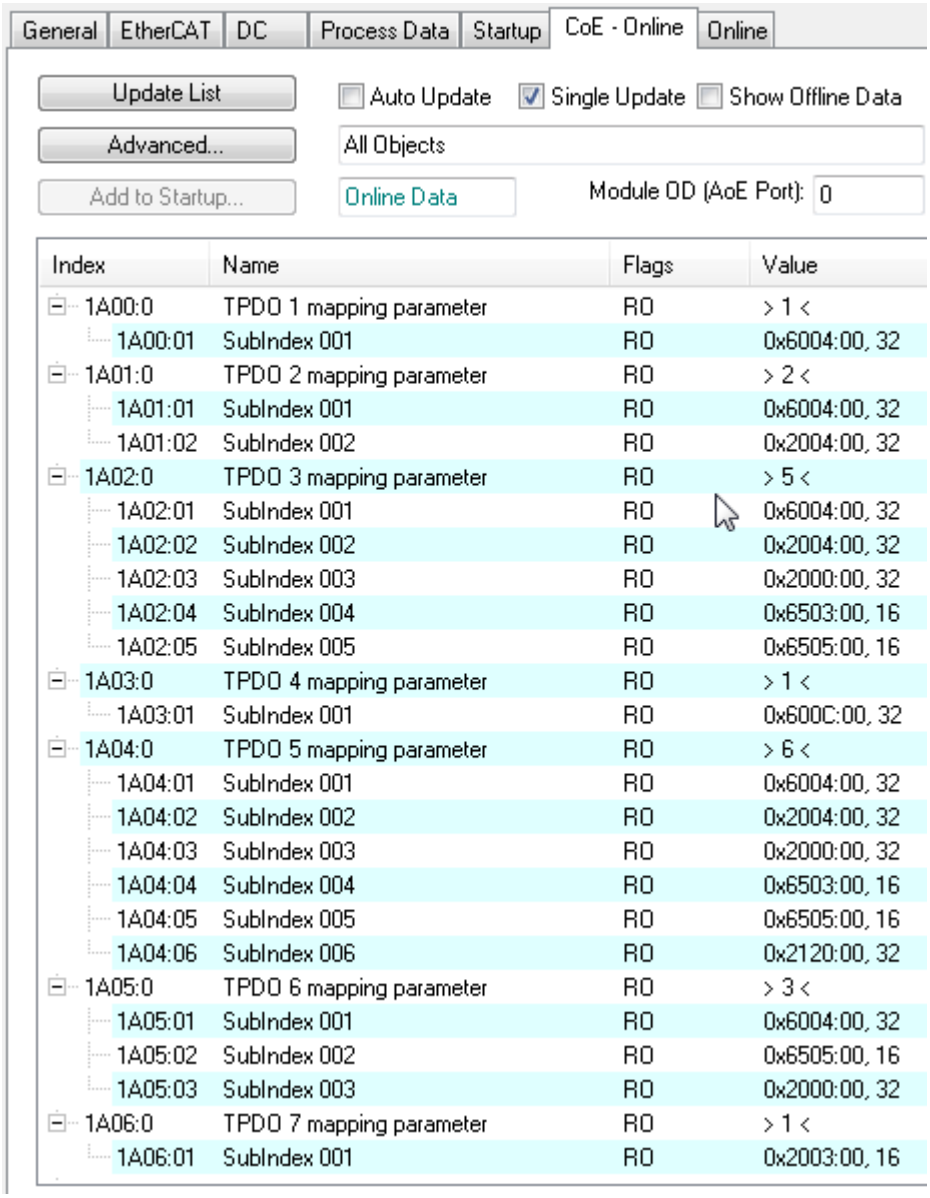
6.4. Mapping of Process Data Objects (PDOs)

For the EAx580 EtherCAT encoder it is possible to change the content and layout of the cyclic process data which is sent to the EtherCAT Master. Process data of the device is organized in process data objects (PDOs). It is possible to map PDOs to the cyclic process image (called “PDO mapping”). The PDO Mapping is configured via “CAN application protocol over EtherCAT” (CoE) objects 0x1A00 - 0x1A06 of the so-called “object dictionary”. This “object dictionary” can be accessed by acyclic messages. See chapter EtherCAT acyclic operation for further details.

By default the object 0x6004 (scaled position value) is mapped into the cyclic process image. See Index 0x6004 (Position value) for details.

Chapter Index 0x1A00 to 0x1A06 (PDO mapping) describes the possible PDO mappings.

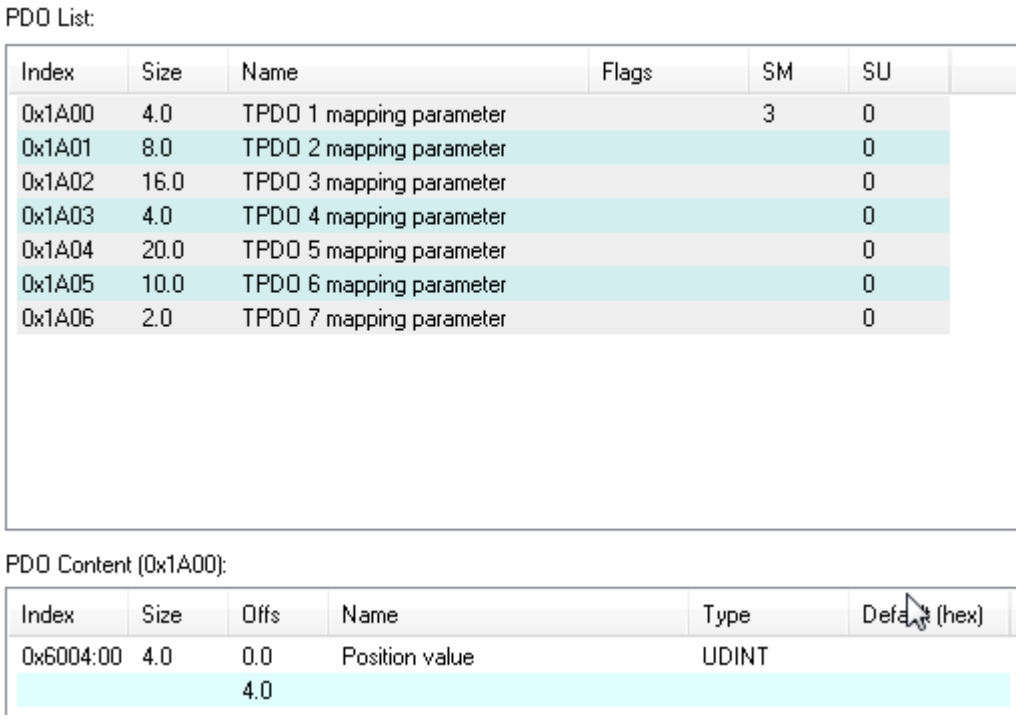
Index 0x1A00 to 0x1A06 (PDO mapping)
Objects 0x1A00 to 0x1A06 contain descriptions of the different PDO mappings:



Index	Name	Flags	Value
1A00:0	TPDO 1 mapping parameter	RO	> 1 <
1A00:01	SubIndex 001	RO	0x6004:00, 32
1A01:0	TPDO 2 mapping parameter	RO	> 2 <
1A01:01	SubIndex 001	RO	0x6004:00, 32
1A01:02	SubIndex 002	RO	0x2004:00, 32
1A02:0	TPDO 3 mapping parameter	RO	> 5 <
1A02:01	SubIndex 001	RO	0x6004:00, 32
1A02:02	SubIndex 002	RO	0x2004:00, 32
1A02:03	SubIndex 003	RO	0x2000:00, 32
1A02:04	SubIndex 004	RO	0x6503:00, 16
1A02:05	SubIndex 005	RO	0x6505:00, 16
1A03:0	TPDO 4 mapping parameter	RO	> 1 <
1A03:01	SubIndex 001	RO	0x600C:00, 32
1A04:0	TPDO 5 mapping parameter	RO	> 6 <
1A04:01	SubIndex 001	RO	0x6004:00, 32
1A04:02	SubIndex 002	RO	0x2004:00, 32
1A04:03	SubIndex 003	RO	0x2000:00, 32
1A04:04	SubIndex 004	RO	0x6503:00, 16
1A04:05	SubIndex 005	RO	0x6505:00, 16
1A04:06	SubIndex 006	RO	0x2120:00, 32
1A05:0	TPDO 6 mapping parameter	RO	> 3 <
1A05:01	SubIndex 001	RO	0x6004:00, 32
1A05:02	SubIndex 002	RO	0x6505:00, 16
1A05:03	SubIndex 003	RO	0x2000:00, 32
1A06:0	TPDO 7 mapping parameter	RO	> 1 <
1A06:01	SubIndex 001	RO	0x2003:00, 16

For further information see chapter Process image of encoder (TwinCAT 2) or chapter Process image of encoder (TwinCAT 3).

Objects 0x1A00 to 0x1A06 can also be found at tab “Process Data” below “PDO List:”.



PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter		3	0
0x1A01	8.0	TPDO 2 mapping parameter			0
0x1A02	16.0	TPDO 3 mapping parameter			0
0x1A03	4.0	TPDO 4 mapping parameter			0
0x1A04	20.0	TPDO 5 mapping parameter			0
0x1A05	10.0	TPDO 6 mapping parameter			0
0x1A06	2.0	TPDO 7 mapping parameter			0

PDO Content (0x1A00):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
		4.0			

See following chapters for details:
Index 0x1A00 (TPDO 1 mapping)
Index 0x1A01 (TPDO 2 mapping)
Index 0x1A02 (TPDO 3 mapping)
Index 0x1A03 (TPDO 4 mapping)
Index 0x1A04 (TPDO 5 mapping)
Index 0x1A05 (TPDO 6 mapping)
Index 0x1A06 (TPDO 7 mapping)

6.5. Speed

PDO mapping objects 0x1A01, 0x1A02 and 0x1A04 contain rotational speed information together with the absolute position information.

6.5.1. Speed measuring unit

The speed measuring unit can be configured using subindex 2 of CoE object Index 0x2002 (Speed Calculation Configuration).

Speed scaling provides four options:

- rpm revolutions per minute
- steps/10ms number of steps in the configured singleturn resolution per 10 ms
- steps/100ms number of steps in the configured singleturn resolution per 100 ms
- steps/1000ms number of steps in the configured singleturn resolution per second

Each scaling option provides the measured value as a „signed integer“. Positive values indicate the direction of rotation with rising position values. Which rotational direction is assigned “positive” depends on the CW/CCW parameter setting. See CoE object 0x6000 for details.

6.5.2. Speed update period

The speed update period can be configured using subindex 3 of CoE object Index 0x2002 (Speed Calculation Configuration).

A short speed update period entails a more dynamic speed output. An extended update period ensures more stable values. The optimum speed update period depends on the application requirements.

The update period can be configured within the range of 1 ms to 255 ms.

6.5.3. Speed filter depth

The speed filter depth can be configured using subindex 4 of CoE object Index 0x2002 (Speed Calculation Configuration).

The speed information acquired within the update period can be filtered during several update cycles.

A flat speed filter depth (number of update cycles) entails a more dynamic speed output. A larger filter depth ensures more stable values. The optimum speed filter depth in interaction with the configured speed update time depends on the application requirements.

The speed filter depth is configurable within the range of 1 to 255.

6.6. Preset function

The preset function in the encoder is triggered by writing CoE object 0x6003 or by pushing the preset button. When the preset is triggered the encoder position value is set to the given preset value.

For the optimum alignment of the mechanical position we recommend to set the preset value during encoder standstill.

It is mandatory to parameterize the required resolution or code sequence (cw/ccw) prior to performing the preset operation.

Upon performing a preset operation an internal offset is calculated and stored in the non-volatile memory to make sure that the encoder will be at the same position after power cycling. Although the non-volatile memory provides more than 100 000 write cycles frequent software-triggered or event-triggered preset operations may consume even this capacity. This has to be considered in the PLC software configuration.

Note:
Any alteration of the total measuring range, measuring units per revolution or a gear factor parameter during encoder re-parameterization will trigger clearing the internal preset offset value. This however has no effect in practice since in these cases the position reference is lost anyway.

6.6.1. Preset via CoE object 0x6003

To execute a preset the preset value has to be written into CoE object 0x6003. See Index 0x6003 (Preset value) for details.

6.6.2. Preset using the push button

Depending on the encoder type the encoder may have a screw cap located where connectors and LEDs are located as well. After removing the screw cap the preset push button is visible.

While the encoder is connected to an EtherCAT Master a preset can be performed using the push button. When the preset is executed the encoder position is set to the value held in CoE object Index 0x2005 (Button Preset Value). The contained position value will be interpreted absolute. A relative preset is not possible using the push button.

Note:
Prior to using the push button it is strictly recommended to execute a potential equalization between operator and encoder (touching the encoder housing) in order to eliminate the danger of damaging the encoder by electrostatic discharge (ESD).

In order to perform a preset the push button must be pressed for a duration of at least three seconds and longest five seconds.

6.7. Operation modes

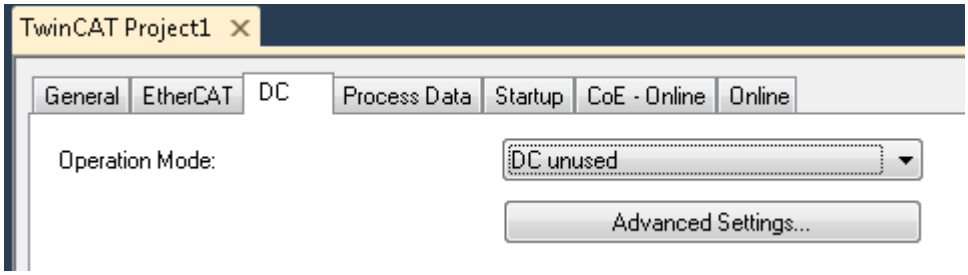
6.7.1. Overview

The encoder supports the operation modes “Free run”, “Synchronous with SM3 Event” and “DC Mode (Synchronous with Sync0 Event)”. DC means “Distributed Clocks”. The following table provides an overview.

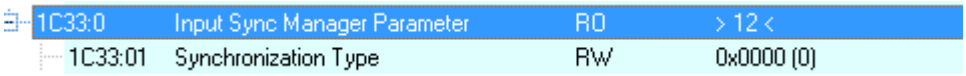
Operation mode	Description	Cycle time of process data update	Value of object 0x1C33:01	Selected operation mode in tab "DC" (in TwinCAT 3)
Free Run	Cyclic process data is updated on local timer event. The local timer event is not synchronized to the EtherCAT Master application.	1 millisecond (fix)	0	DC unused
Synchronous with SM3 Event	Cyclic process data is updated on SM3 event. The SM3 event occurs when the EtherCAT Master reads the cyclic process data of the encoder.	Cycle time of reading data from the encoder by the EtherCAT Master has to be written into object 0x2201 (“Expected Cycle Time For Position Update”). The write access to object 0x2201 has to happen in EtherCAT state PRE-OPERATIONAL (before the encoder is set to EtherCAT state SAFE-OPERATIONAL).	1	DC unused
DC Mode (Synchronous with Sync0 Event)	Cyclic process data is updated on the Sync0 event which is based on the “Distributed Clocks” (DC) functionality.	Sync0 cycle time (configured by EtherCAT Master)	2	DC Sync0 for synchronization

6.7.2. Free Run

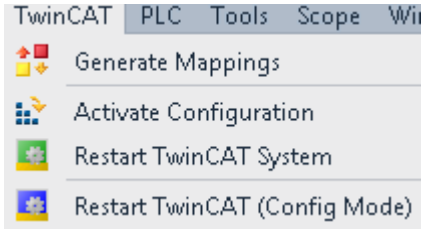
Set "DC unused" in tab "DC". In TwinCAT 3 (as an example) tab "DC" is available when the encoder is selected.



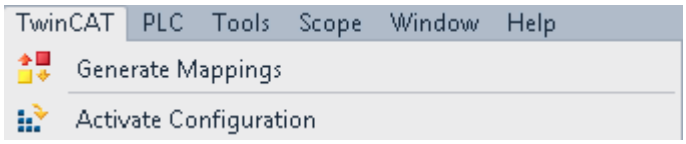
Set object 0x1C33:01 to value "0".



In TwinCAT “Config Mode” press “Restart TwinCAT (Config Mode)” as follows:

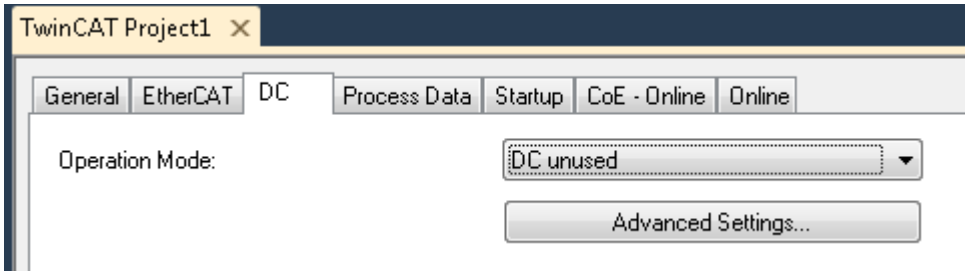


In TwinCAT “Run Mode” press “Activate Configuration” as follows:

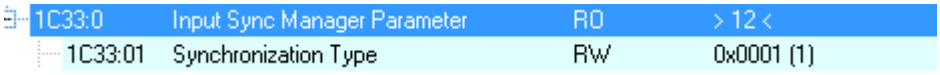


6.7.3. Synchronous with SM3 event

Set "DC unused" in tab "DC". In TwinCAT 3 (as an example) tab "DC" is available when the encoder is selected.



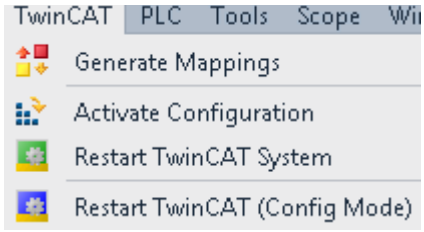
Set object 0x1C33:01 to value "1".



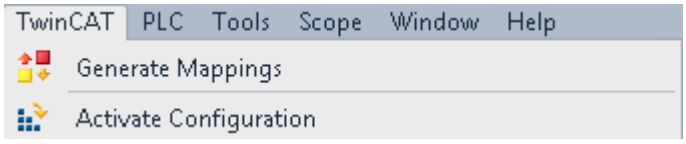
The cycle time of reading data from the encoder by the EtherCAT Master has to be written into object 0x2201 (“Expected Cycle Time For Position Update”). The write access to object 0x2201 has to happen in EtherCAT state PRE-OPERATIONAL (before the encoder is set to EtherCAT state SAFE-OPERATIONAL).

The value of object 0x2201 has the unit nanoseconds. If the expected EtherCAT Master cycle time is for example 1 millisecond the value “1000000” has to be written into object 0x2201.

In TwinCAT “Config Mode” press “Restart TwinCAT (Config Mode)” as follows:

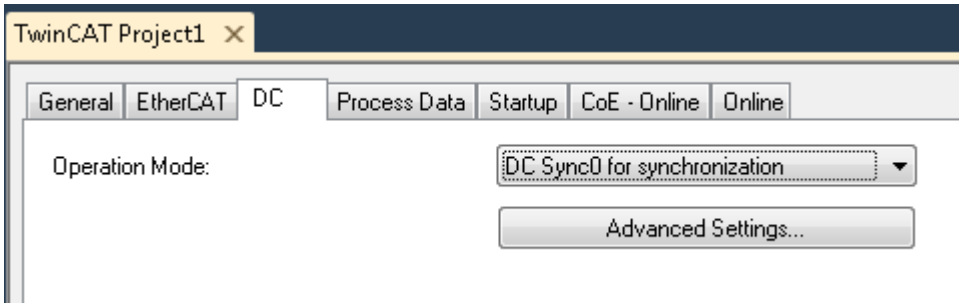


In TwinCAT “Run Mode” press “Activate Configuration” as follows:

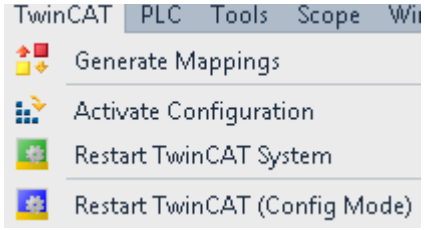


6.7.4. DC Mode (Synchronous with Sync0 Event)

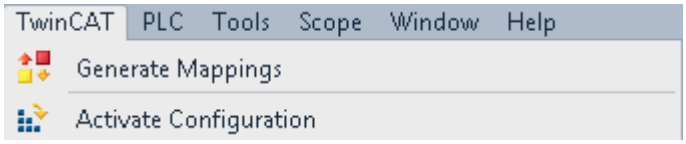
Set "DC Sync0 for synchronization" in tab "DC". In TwinCAT 3 (as an example) tab "DC" is available when the encoder is selected.



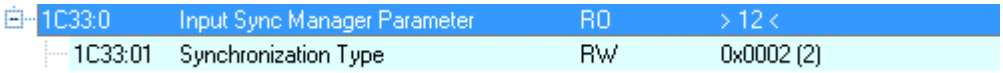
In TwinCAT “Config Mode” press “Restart TwinCAT (Config Mode)” as follows:



In TwinCAT “Run Mode” press “Activate Configuration” as follows:



The encoder will automatically set 0x1C33:01 to value “2”.



6.8. Cycle time and supported functionality

Depending on the configured EtherCAT cycle time the following PDO mappings are supported.

Cycle time	Configured PDO mapping	Transmitted cyclic process data	Speed violation check
62,5 to 100 microseconds	0x1A03	raw position data	disabled
62,5 to 100 microseconds	0x1A00 0x1A01 0x1A02 0x1A04 0x1A05 0x1A06	scaled position value and speed value are constantly zero (even during moving of the shaft of the encoder)	disabled
above 100 us	0x1A00 0x1A01 0x1A02 0x1A03 0x1A04 0x1A05 0x1A06	no restrictions	enabled

Notice:
The table above shall not be applied for operation mode “Free Run” of the encoder. The cycle time in operation mode “Free Run” is a set to 1 millisecond (fix).

7. EtherCAT acyclic operation

Cyclic and acyclic data communication run in parallel and independently of each other. Acyclic parameters are divided into standard parameters, vendor-specific parameters and profile-specific parameters (according to CiA profile 406).

7.1. CANopen over EtherCAT (CoE)

EtherCAT uses the protocol “CAN application protocol over EtherCAT” (CoE) for acyclic data exchange. Like in the “CANopen world” data is organized in objects and “subobjects” which are accessed by index and subindex.

7.2. CiA 406 (encoder profile)

The encoder has been developed according to profile 406 of CAN in Automation (CiA) in version 4.0.2.

7.3. Standard CoE objects (index range 0x1000 to 0x1FFF)

7.3.1. Overview

Object	Name	Type	Access	Default Value	PDO mappable
0x1000	Device Type	UNSIGNED32	ro	0x00020196	no
0x1001	Error Register	UNSIGNED8	ro	0	no
0x1008	Device Name	VISIBLE_STRING	ro	"EAx580 EtherCAT Encoder"	no
0x1009	Manufacturer Hardware Version	VISIBLE_STRING	ro		no
0x100A	Manufacturer Software Version	VISIBLE_STRING	ro		no
0x1010	Save Parameters				
0x01	Save all parameters	UNSIGNED32	rw	0x00000001	no
0x1011	Restore Parameters				no
0x01	Restore all parameters	UNSIGNED32	rw	0x00000001	no
0x1018	Identity Object				no
0x01	Vendor ID	UNSIGNED32	ro	0x000000EC	no
0x02	Product Code	UNSIGNED32	ro	0x00000200 (for „EAL580 EtherCAT“ devices) 0x00000300 (for „EAM580 EtherCAT“ devices)	no
0x03	Revision Number	UNSIGNED32	ro	0x00000001	no
0x04	Serial Number	UNSIGNED32	ro		no
0x1A00	TPDO 1 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x60040020	no
0x1A01	TPDO 2 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x60040020	no
0x02	SubIndex 002	UNSIGNED32	ro	0x20040020	no
0x1A02	TPDO 3 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x60040020	no
0x02	SubIndex 002	UNSIGNED32	ro	0x20040020	no
0x03	SubIndex 003	UNSIGNED32	ro	0x20000020	no
0x04	SubIndex 004	UNSIGNED32	ro	0x65030010	no
0x05	SubIndex 005	UNSIGNED32	ro	0x65050010	no
0x1A03	TPDO 4 mapping				
	SubIndex 001	UNSIGNED32	ro	0x600C0020	no
0x1A04	TPDO 5 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x60040020	no
0x02	SubIndex 002	UNSIGNED32	ro	0x20040020	no
0x03	SubIndex 003	UNSIGNED32	ro	0x20000020	no
0x04	SubIndex 004	UNSIGNED32	ro	0x65030010	no
0x05	SubIndex 005	UNSIGNED32	ro	0x65050010	no
0x06	SubIndex 006	UNSIGNED32	ro	0x21200020	no
0x1A05	TPDO 6 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x60040020	no
0x02	SubIndex 002	UNSIGNED32	ro	0x65050010	no
0x03	SubIndex 003	UNSIGNED32	ro	0x20000020	no
0x1A06	TPDO 7 mapping				
0x01	SubIndex 001	UNSIGNED32	ro	0x20030010	no
0x1C00	Sync Manager Communication Types				
0x01		UNSIGNED8	ro	0x00000001	no
0x02		UNSIGNED8	ro	0x00000002	no
0x03		UNSIGNED8	ro	0x00000003	no
0x04		UNSIGNED8	ro	0x00000004	no

Object	Name	Type	Access	Default Value	PDO mappable
0x1C12	Sync Manager 2 PDO Assignment				no
0x00		UNSIGNED8	rw	0	no
0x1C13	Sync Manager 3 PDO Assignment				
0x01		UNSIGNED8	rw	0x1A00	no
0x1C33	Input Sync Manager Parameter				
0x01	Synchronization Type	UNSIGNED16	rw	0	no
0x02	Cycle Time	UNSIGNED32	ro	1000000 (equals 1 millisecond)	no
0x04	Synchronization Types supported	UNSIGNED16	ro	0x00000007	no
0x05	Minimum Cycle Time	UNSIGNED32	ro	62500 (equals 62,5 microseconds)	no
0x06	Calc and Copy Time	UNSIGNED32	ro		no
0x0C	"Cycle Time Too Small" counter	UNSIGNED16	ro	0	no

7.3.2. Index 0x1000 (Device Type)

This object contains information about the device profile and the encoder type. The value is set to 0x00020196. The lower 16 bits contain the device profile number of CiA. 0x196 equals 406 (decimal). This means that the CiA profile has number 406. Bits 16 to 23 contain the encoder type according to CiA profile 406. The value “2” means “Multiturn absolute rotary encoder“.

Attribute	Value
Name	Device Type
Object Code	VAR
Data Type	UNSIGNED32
Access	ro
PDO Mapping	no
Value Range	Bit 0-15: device profile number Bit 16-31: additional information depending on the used device profile
Default Value	0x00020196

7.3.3. Index 0x1001 (Error Register)

This object contains an error status of the encoder. As described below only bit 0 is supported.

Attribute	Value
Name	Error Register
Object Code	VAR
Data Type	UNSIGNED8
Access	ro
PDO Mapping	no
Value Range	Bit 0: generic error Bit 1: current error (not supported) Bit 2: voltage error (not supported) Bit 3: temperature error (not supported) Bit 4: communication error (not supported) Bit 5: device profile specific error (not supported) Bit 6: reserved Bit 7: manufacturer specific error (not supported)
Default Value	0

7.3.4. Index 0x1008 (Device Name)

This object contains the name of the encoder as a string.

Attribute	Value
Name	Manufacturer Device Name
Object Code	VAR
Data Type	VISIBLE_STRING
Access	ro
PDO Mapping	no
Default Value	"EAx580 EtherCAT Encoder"

7.3.5. Index 0x1009 (Manufacturer Hardware Version)

This object contains the hardware version of the encoder as a string.

Attribute	Value
Name	Manufacturer Hardware Version
Object Code	VAR
Data Type	VISIBLE_STRING
Access	ro
PDO Mapping	no
Default Value	1

7.3.6. Index 0x100A (Manufacturer Software version)

This object contains the software version of the encoder as a string.

Attribute	Value
Name	Manufacturer Software Version
Object Code	VAR
Data Type	VISIBLE_STRING
Access	ro
PDO Mapping	no

7.3.7. Index 0x1010 (Save Parameters)

This object is used to request the encoder to store parameters in non-volatile memory.

Object description:

Attribute	Value
Index	0x1010
Name	Store Parameters
Object Code	RECORD

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Value range	UNSIGNED8
Default value	1

Attribute	Value
Subindex	0x01
Description	Save all parameters
Access	rw
PDO mapping	no
Value range	UNSIGNED32 **read:** Only value 0x00000001 is possible. According to CiA 301 V4.2.0 (of 2011) ch. 7.5.2.13 value 0x00000001 means: - bit "cmd" (bit 0): value 1 means "CANopen device saves parameters on command" - bit "auto" (bit 1): value 0 means "CANopen device does not save parameters autonomously" **write:** To trigger the store process please write value 0x65766173 (means "save" in ASCII code). Only value 0x65766173 is allowed. For all other values the SDO abort code 0x08000022 ("Data cannot be transferred or stored to the application because of the present device state.") is reported. If it is not possible to execute the store command because of an hardware error the SDO abort code 0x06060000 is reported.
Default value	0x00000001

7.3.8. Index 0x1011 (Restore Parameters)

This object is used to restore hard-coded default values of the encoder.

Object description:

Attribute	Value
Index	0x1011
Name	Restore Parameters
Object Code	RECORD

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Value range	UNSIGNED8
Default value	1

Attribute	Value
Subindex	0x01
Description	Restore all parameters
Access	rw
PDO mapping	no
Value range	UNSIGNED32 **read:** Only value 0x00000001 is possible. According to CiA 301 V4.2.0 (of 2011) ch. 7.5.2.14 value 0x00000001 means: - bit "cmd" (bit 0): value 1 means "CANopen device restores parameters" **write:** To trigger the restore process please write value 0x64616F6C (means "load" in ASCII code). For all other values the SDO abort code 0x08000022 ("Data cannot be transferred or stored to the application because of the present device state.") is reported.
Default value	0x00000001

For the EAx580 EtherCAT encoder the following is realized:
When value 0x64616F6C (means "load" in ASCII code) is written into subindex 1 of CoE object 0x1011 the "wish to restore defaults after next power-on" is stored in non-volatile memory. If the device later is powered off and on again the default parameters are written into the following CoE objects:
- 0x2001
- 0x2002
- 0x6000
- 0x6001
- 0x6002

Notice:
The preset offset (object 0x6509) is set to 0 after "restore defaults after next power-on".

7.3.9. Index 0x1018 (Identity Object)

This object contains basic information to identify the encoder. The vendor ID, the product code and the revision number are often used by EtherCAT Masters to identify an EtherCAT Slave when scanning the network.

Object description:

Attribute	Value
Index	0x1018
Name	Identity Object
Object Code	RECORD

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Value range	UNSIGNED8
Default value	4

Attribute	Value
Subindex	0x01
Description	Vendor ID
Access	ro
PDO mapping	no
Value range	UNSIGNED32
Default value	0x000000EC

Attribute	Value
Subindex	0x02
Description	Product Code
Access	ro
PDO mapping	no
Value range	UNSIGNED32 0x200 for „EAL580 EtherCAT“ devices 0x300 for „EAM580 EtherCAT“ devices
Default value	0x00000200

Attribute	Value
Subindex	0x03
Description	Revision Number
Access	ro
PDO mapping	no
Value range	UNSIGNED32
Default value	0x00000001

Attribute	Value
Subindex	0x04
Description	Serial Number
Access	ro
PDO mapping	no
Value range	UNSIGNED32

7.3.10. Index 0x1A00 (TPDO 1 mapping)

This object describes the content of transmit PDO 1.

Object description:

Attribute	Value
Index	0x1A00
Name	TPDO 1 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x01
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x60040020
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 1 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 1 in section “PDO List:”
- in section “PDO Content (0x1A00):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A00):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
		4.0			

7.3.11. Index 0x1A01 (TPDO 2 mapping)

This object describes the content of transmit PDO 2.

Object description:

Attribute	Value
Index	0x1A01
Name	TPDO 2 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x02
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x60040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x02
Access	ro
Default value	0x20040020
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 2 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 2 in section “PDO List:”
- in section “PDO Content (0x1A01):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A01):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
0x2004:00	4.0	4.0	Speed value 4 bytes	DINT	
		8.0			

7.3.12. Index 0x1A02 (TPDO 3 mapping)

This object describes the content of transmit PDO 3.

Object description:

Attribute	Value
Index	0x1A02
Name	TPDO 3 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x05
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x60040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x02
Access	ro
Default value	0x20040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x03
Access	ro
Default value	0x20000020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x04
Access	ro
Default value	0x65030010
Data type	UNSIGNED32

Attribute	Value
Subindex	0x05
Access	ro
Default value	0x65050010
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 3 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 3 in section “PDO List:”
- in section “PDO Content (0x1A02):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A02):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
0x2004:00	4.0	4.0	Speed value 4 bytes	DINT	
0x2000:00	4.0	8.0	System Time	UDINT	
0x6503:00	2.0	12.0	Alarms	UINT	
0x6505:00	2.0	14.0	Warnings	UINT	
		16.0			

7.3.13. Index 0x1A03 (TPDO 4 mapping)

This object describes the content of transmit PDO 4.

Object description:

Attribute	Value
Index	0x1A03
Name	TPDO 4 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x01
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x600C0020
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 4 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 4 in section “PDO List:”
- in section “PDO Content (0x1A03):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A03):

Index	Size	Offs	Name	Type	Default (hex)
0x600C:00	4.0	0.0	Position raw value	UDINT	
		4.0			

7.3.14. Index 0x1A04 (TPDO 5 mapping)

This object describes the content of transmit PDO 5.

Object description:

Attribute	Value
Index	0x1A04
Name	TPDO 5 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x06
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x60040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x02
Access	ro
Default value	0x20040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x03
Access	ro
Default value	0x20000020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x04
Access	ro
Default value	0x65030010
Data type	UNSIGNED32

Attribute	Value
Subindex	0x05
Access	ro
Default value	0x65050010
Data type	UNSIGNED32

Attribute	Value
Subindex	0x06
Access	ro
Default value	0x21200020
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 5 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 5 in section “PDO List:”
- in section “PDO Content (0x1A04):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A04):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
0x2004:00	4.0	4.0	Speed value 4 bytes	DINT	
0x2000:00	4.0	8.0	System Time	UDINT	
0x6503:00	2.0	12.0	Alarms	UINT	
0x6505:00	2.0	14.0	Warnings	UINT	
0x2120:00	4.0	16.0	Sensor Temperature	DINT	
		20.0			

7.3.15. Index 0x1A05 (TPDO 6 mapping)

This object describes the content of transmit PDO 6.

Object description:

Attribute	Value
Index	0x1A05
Name	TPDO 6 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x03
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x60040020
Data type	UNSIGNED32

Attribute	Value
Subindex	0x02
Access	ro
Default value	0x65050010
Data type	UNSIGNED32

Attribute	Value
Subindex	0x03
Access	ro
Default value	0x20000020
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 6 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 6 in section “PDO List:”
- in section “PDO Content (0x1A05):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A05):

Index	Size	Offs	Name	Type	Default (hex)
0x6004:00	4.0	0.0	Position value	UDINT	
0x6505:00	2.0	4.0	Warnings	UINT	
0x2000:00	4.0	6.0	System Time	UDINT	
		10.0			

7.3.16. Index 0x1A06 (TPDO 7 mapping)

This object describes the content of transmit PDO 7.

Object description:

Attribute	Value
Index	0x1A06
Name	TPDO 7 mapping parameter
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
Default value	0x01
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Access	ro
Default value	0x20030010
Data type	UNSIGNED32

In TwinCAT 3 you can display the content of TPDO 7 as follows:
- click on “Box 1 (Baumer EAx580 EtherCAT Encoder)”
- click on tab “Process Data”
- select TPDO 7 in section “PDO List:”
- in section “PDO Content (0x1A06):” below the content is shown

PDO List:

Index	Size	Name	Flags	SM	SU
0x1A00	4.0	TPDO 1 mapping parameter	F	3	0
0x1A01	8.0	TPDO 2 mapping parameter	F		0
0x1A02	16.0	TPDO 3 mapping parameter	F		0
0x1A03	4.0	TPDO 4 mapping parameter	F		0
0x1A04	20.0	TPDO 5 mapping parameter	F		0
0x1A05	10.0	TPDO 6 mapping parameter	F		0
0x1A06	2.0	TPDO 7 mapping parameter	F		0

PDO Content (0x1A06):

Index	Size	Offs	Name	Type	Default (hex)
0x2003:00	2.0	0.0	Position value 2 bytes	UINT	
		2.0			

7.3.17. Index 0x1C00 (Sync Manager Communication Types)

This object is a standard EtherCAT object. It gives the user information about the number of the available EtherCAT "sync managers" and the usage of these "sync managers".

Background:
An EtherCAT "sync manager" protects a certain memory area in an EtherCAT Slave Controller ("the chip which is responsible for the real-time"). Normally an EtherCAT Slave device uses four sync managers: two for acyclic EtherCAT mailbox data and two for cyclic EtherCAT process data. Two sync managers for each mentioned purpose are needed because one sync manager is needed for each direction (master to slave / slave to master).

This object is not directly connected to the operation modes ("Free Run", "SM3 sync." and "DC SYNC0"). It only gives the user information about the number of the available EtherCAT "sync managers" and the usage of these "sync managers".

Object description:

Attribute	Value
Index	0x1C00
Name	Sync Manager Communication Types
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	No
Value range	UNSIGNED8
Default value	0x04

Attribute	Value
Subindex	0x01
Access	ro
PDO mapping	No
Value range	UNSIGNED8
Default value	0x01 Notice: According to ETG.1000.6 V1.03 (table 75) value 0x01 represents the sync manager "mailbox receive (master to slave)".

Attribute	Value
Subindex	0x02
Access	ro
PDO mapping	No
Value range	UNSIGNED8
Default value	0x02 Notice: According to ETG.1000.6 V1.03 (table 75) value 0x02 represents the sync manager "mailbox send (slave to master)".

Attribute	Value
Subindex	0x03
Access	ro
PDO mapping	No
Value range	UNSIGNED8
Default value	0x03 Notice: According to ETG.1000.6 V1.03 (table 75) value 0x03 represents the sync manager "process data output".

Attribute	Value
Subindex	0x04
Access	ro
PDO mapping	No
Value range	UNSIGNED8
Default value	0x04 Notice: According to ETG.1000.6 V1.03 (table 75) value 0x04 represents the sync manager "process data input (slave to master)".

7.3.18. Index 0x1C12 (Sync Manager 2 PDO Assignment)

This object is used to configure the layout of the cyclic EtherCAT process data which is sent from master to slave.

Object description:

Attribute	Value
Index	0x1C12
Name	Sync Manager 2 PDO Assignment
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	rw (only in state "Pre-Operational")
PDO mapping	no
Value range	UNSIGNED8
Default value	0

No further entries are supported because the EAx580 EtherCAT encoder does not support cyclic process data in the direction from the EtherCAT Master to the EAx580 EtherCAT encoder.

7.3.19. Index 0x1C13 (Sync Manager 3 PDO Assignment)

This object is used to configure the layout of the cyclic EtherCAT process data which is sent from slave to master. Object 0x1C13 contains the PDO assignment which is currently active.

Object description:

Attribute	Value
Index	0x1C13
Name	Sync Manager 3 PDO Assignment
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	rw (only in state "Pre-Operational")
PDO mapping	no
Value range	UNSIGNED8
Default value	1

Attribute	Value
Subindex	0x01
Access	rw (only in state "Pre-Operational")
PDO mapping	no
Value range	one of: - 0x1A00 - 0x1A01 - 0x1A02 - 0x1A03 - 0x1A04 - 0x1A05 - 0x1A06
Default value	0x1A00

7.3.20. Index 0x1C33 (Input Sync Manager Parameter)

This object is used to describe and configure the settings for the input sync manager (SM3).

Object description:

Attribute	Value
Index	0x1C33
Name	Input Sync Manager Parameter
Object Code	RECORD

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Default value	0x0C
Data type	UNSIGNED8

Attribute	Value
Subindex	0x01
Description	Synchronization Type
Access	rw
PDO mapping	no
Value range	0x0000: operation mode "Free Run" 0x0001: operation mode "SM3 sync." 0x0002: operation mode "DC Sync0" **Possible SDO abort code:** 0x06090030 ("range of parameter exceeded") for all values > 0x02
Default value	0x00
Data type	UNSIGNED16

Attribute	Value
Subindex	0x02
Description	Cycle Time
Access	ro
PDO mapping	no
Value range	cycle time in nanoseconds - for operation mode "Free Run": time between two local timer events in nanoseconds - for operation mode "SM3 sync.": minimal time between two SM3 events in nanoseconds (62500 ns) - for operation mode "DC Sync0": "Sync0 cycle time" in nanoseconds (time of EtherCAT Slave Controller register 0x9A0 to 0x9A3)
Default value	1000000 (equals 1 ms)
Data type	UNSIGNED32

Attribute	Value
Subindex	0x04
Description	Synchronization Types supported
Access	ro
PDO mapping	no
Value range	bit 0: "Free Run" supported bit 1: "SM3 sync." supported bit 2 "DC Sync0" supported
Default value	0x07
Data type	UNSIGNED16

Attribute	Value
Subindex	0x05
Description	Minimum Cycle Time (minimum cycle time supported by the slave in nanoseconds)
Access	ro
PDO mapping	no
Value range	62500
Default value	62500
Data type	UNSIGNED32

Attribute	Value
Subindex	0x06
Description	Calc and Copy Time
Access	ro
PDO mapping	no
Data type	UNSIGNED32

Attribute	Value
Subindex	0x0C
Description	"Cycle Time Too Small" counter
Access	ro
PDO mapping	no
Data type	UNSIGNED16

7.4. Vendor-specific CoE objects (index range 0x2000 to 0x5FFF)

7.4.1. Overview

Object	Name	Type	Access	Default Value	PDO mappable
0x2000	System Time	UNSIGNED32	ro		yes
0x2001	Gear Factor Configuration				
0x01	Gear Factor Mode Control	UNSIGNED16	rw	1	no
0x02	Numerator	UNSIGNED32	rw	see chapter for object 0x2001	no
0x03	Denominator	UNSIGNED32	rw	see chapter for object 0x2001	no
0x2002	Speed Calculation Configuration				
0x01	Operation Control	UNSIGNED8	rw	0x01	no
0x02	Speed Measuring Unit	UNSIGNED8	rw	0x03	no
0x03	Speed Filter Update Time In Milliseconds	UNSIGNED8	rw	0x10	no
0x04	Speed Filter Depth	UNSIGNED8	rw	0x05	no
0x2003	Position value 2 bytes	UNSIGNED16	ro		yes
0x2004	Speed value 4 bytes	INTEGER32	ro		yes
0x2005	Button Preset Value	UNSIGNED32	rw	0	no
0x2120	Sensor Temperature	INTEGER32	ro		yes
0x2122	Order ID	VISIBLE_STRING	ro		no
0x2201	Expected Cycle Time For Position Update	UNSIGNED32	rw	1000000 (equals 1 millisecond)	no

7.4.2. Index 0x2000 (System Time)

This object contains a timestamp of when the position data was sampled internally.

Object description:

Attribute	Value
Index	0x2000
Name	System Time
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Value range	UNSIGNED32
Default value	No

7.4.3. Index 0x2001 (Gear Factor Configuration)

This object is used to configure the gear factor functionality. The gear factor configuration affects the (scaled) position value.

Object description:

Attribute	Value
Index	0x2001
Name	Gear Factor Configuration
Object Code	RECORD

Entry descriptions:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Default value	0x03

Attribute	Value
Subindex	0x01
Description	Gear Factor Mode Control
Access	rw
PDO mapping	no
Value range	0x0000: gear factor functionality is inactive The parameters *Numerator* (0x2002:02) and *Denominator* (0x2002:03) are ignored. 0x0001: gear factor functionality is active The parameters *Numerator* (0x2002:02) and *Denominator* (0x2002:03) are used and not ignored. All other values are not allowed.
Default value	0x0000
Data Type	UNSIGNED16

Attribute	Value
Subindex	0x02
Description	Numerator
Access	rw
PDO mapping	no
Value range	1..8192 (for "MT16ST13" device variant) 1..4096 (for "MT16ST14" device variant) 1..16384 (for "MT13ST18" device variant) all other values not allowed
Default value	8192 (for "MT16ST13" device variant) 4096 (for "MT16ST14" device variant) 16384 (for "MT13ST18" device variant)
Data Type	UNSIGNED32

Attribute	Value
Subindex	0x03
Description	Denominator
Access	rw
PDO mapping	no
Value range	1..65535 (for "MT16ST13", "MT16ST14" and "MT13ST18" device variants) all other values not allowed
Default value	1 (for "MT16ST13", "MT16ST14" and "MT13ST18" device variants)
Data Type	UNSIGNED32

Possible SDO abort code for subindex 1:
0x06090031 ("value of parameter written too high") if value > 1

Possible SDO abort codes for subindex 2:
- 0x06090030 ("range of parameter exceeded") if combination of parameters numerator, denominator and total measuring range exceeds 32 bit value range of the position value
- 0x06090031 ("value of parameter written too high") if value > maximum value of value range for a specific device variant (for example 8192 for "MT16ST13" variant)
- 0x06090032 ("value of parameter written too low") if value < 1

Possible SDO abort codes for subindex 3:
- 0x06090030 ("range of parameter exceeded") if combination of parameters numerator, denominator and total measuring range exceeds 32 bit value range of the position value
- 0x06090031 ("value of parameter written too high") if value > 65535
- 0x06090032 ("value of parameter written too low") if value < 1

7.4.4. Index 0x2002 (Speed Calculation Configuration)

This object is used to configure the speed calculation which affects the speed value of the encoder.

Object description:

Attribute	Value
Index	0x2002
Name	Speed Calculation Configuration
Object Code	RECORD

Entry descriptions:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Value range	0x04
Default value	0x04

Attribute	Value
Subindex	0x01
Description	Operation Control
Access	rw
PDO mapping	no
Value range	0x00..0x01 0x00: inactive (speed is not calculated) 0x01: active (speed is calculated)
Default value	0x01
Data Type	UNSIGNED8

Attribute	Value
Subindex	0x02
Description	Speed Measuring Unit
Access	rw
PDO mapping	no
Value range	0x00..0x03 0x00: steps/1000 ms 0x01: steps/100 ms 0x02: steps/10 ms 0x03: revolutions per Minute (rpm)
Default value	0x03
Data Type	UNSIGNED8

Attribute	Value
Subindex	0x03
Description	Speed Filter Update Time In Milliseconds
Access	rw
PDO mapping	no
Value range	0x01 to 0xFF
Default value	0x10 (16 milliseconds)
Data Type	UNSIGNED8

Attribute	Value
Subindex	0x04
Description	Speed Filter Depth
Access	rw
PDO mapping	no
Value range	0x01 to 0xFF
Default value	0x05
Data Type	UNSIGNED8

Possible SDO abort codes for subindex 1:
- 0x06090031 ("value of parameter written too high") if value > 1
- 0x08000022 (" Data cannot be transferred or stored to the application because of the present device state.") if configured EtherCAT cycle time is below 100 microseconds

Possible SDO abort code for subindex 2:
0x06090031 ("value of parameter written too high") if value > 3

Possible SDO abort code for subindex 3:
0x06090032 ("value of parameter written too low") if value < 1

Possible SDO abort code for subindex 4:
0x06090032 ("value of parameter written too low") if value < 1

7.4.5. Index 0x2003 (Position value 2 bytes)

This object contains the scaled position value if scaling is enabled. The object contains the raw position value if scaling is disabled. To enable or disable position scaling bit 2 of object 0x6000 has to be set or reset.

Object description:

Attribute	Value
Index	0x2003
Name	Position value 2 bytes
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Default value	No

7.4.6. Index 0x2004 (Speed value 4 bytes)

This object contains the speed value and can be mapped into a PDO.

Notice:
If the encoder is used in operation mode "Synchronous with SM3 Event" object 0x2201 has to be set correctly in order to read out a valid speed value in object 0x2004.

Object description:

Attribute	Value
Index	0x2004
Name	Speed value 4 bytes
Object Code	VAR
Data type	SIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Default value	No

7.4.7. Index 0x2005 (Button Preset Value)

This object contains the value which will be used as preset value when a preset is triggered by the push button.

Object description:

Attribute	Value
Index	0x2005
Name	Button Preset Value
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Value range	0 to TMR-1 TMR: total measuring range (content of CoE object 0x6002)
Default value	0x00000000

Possible SDO abort code:
0x08000022 ("Data cannot be transferred or stored to the application because of the present device state.")
f position calculation is disabled

7.4.8. Index 0x2120 (Sensor Temperature)

This object contains the signed sensor temperature in degrees Celsius.

Object description:

Attribute	Value
Index	0x2120
Name	Sensor Temperature
Object Code	VAR
Data type	SIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Value range	-128 to 127 degrees Celsius
Default value	No

7.4.9. Index 0x2122 (Order ID)

This object contains the order ID of the encoder as a string.

Attribute	Value
Name	Order ID
Object Code	VAR
Data Type	VISIBLE_STRING[32]
Access	ro
PDO Mapping	no

7.4.10. Index 0x2201 (Expected Cycle Time For Position Update)

This object contains the expected cycle time (in nanoseconds) for reading position values.

Only values which can be divided by 1000 without remainder are allowed. Value 62500 is the only exception. In case 62500 (62,5 us) is written into CoE object 0x2201 the value of CoE object 0x2201 is reduced to 62000 (62 us).

Object description:

Attribute	Value
Index	0x2201
Name	Expected Cycle Time For Position Update
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Value range	62500 (62,5 us) to 255000000 (255 ms)
Default value	1000000

Possible SDO abort codes:
- 0x06090030 ("range of parameter exceeded") if it is not possible to divide the value by 1000 without remainder (exception: 62500 for "62,5 us")
- 0x06090031 ("value of parameter written too high") if value is above 255000000 (255 milliseconds)
- 0x06090032 ("value of parameter written too low") if value is below 62500 (62,5 microseconds)

The value depends on the operation mode. In subindex 1 of CoE object 0x1C33 the operation mode is configured. These operation modes are possible:
- "Free Run"
- "SM3 sync."
- "DC Sync0"

"Free Run"
Object 0x2201 has the fix value 1000000 (1 millisecond). This value is written into the object by the firmware without user interaction.

"SM3 sync."
The expected time between two SM3 events in nanoseconds has to be written into the object.

"DC Sync0"
The configured "Sync0 cycle time" in nanoseconds is read by the firmware directly from registers 0x9A0 to 0x9A3 of the EtherCAT Slave Controller in transition from Pre-Operational to Safe-Operational. The read value is written directly into object 0x2201.

Attention (in all operation modes)
If the value of object 0x2201 is changed the time base for speed calculation, speed violation checks etc. will be changed which might lead to wrong results!

For speed calculation the cycle time given in object 0x2201 is used as time base. A write access to object 0x2201 can be done in TwinCAT for example by using the tab "startup". SDO downloads in transition from Pre-Op. to Safe-Op. can be defined by tab "startup".

Two SDO downloads can be added to switch the device into operation mode "SM3 sync." with a desired cycle time. If the device shall run in "SM3 sync." mode with 2 milliseconds cycle time you have to:
- add a SDO download to object 0x1C33:01 with value 0x0001
- add a SDO download to object 0x2201 with value 2000000 (equals 2 milliseconds)

7.5. Profile-specific CoE objects (index range 0x6000 to 0xFFFF)

7.5.1. Overview

Object	Name	Type	Access	Default	PDO mappable
0x6000	Operating parameters	UNSIGNED16	ro	0x0004	no
0x6001	Measuring units per revolution	UNSIGNED32	rw		no
0x6002	Total measuring range in measuring units	UNSIGNED32	rw		no
0x6003	Preset value	UNSIGNED32	rw	0x00000000	no
0x6004	Position value	UNSIGNED32	ro		yes
0x600C	Position raw value	UNSIGNED32	ro		yes
0x6500	Operating status	UNSIGNED16	ro		no
0x6501	Single-turn resolution	UNSIGNED32	ro		no
0x6502	Number of distinguishable revolutions	UNSIGNED32	ro		no
0x6503	Alarms	UNSIGNED16	ro	0x0000	no
0x6504	Supported alarms	UNSIGNED16	ro	0xF003	no
0x6505	Warnings	UNSIGNED16	ro	0x0000	no
0x6506	Supported warnings	UNSIGNED16	ro	0xD013 (for „EAL580 EtherCAT“ devices) 0xF011 (for „EAM580 EtherCAT“ devices)	no
0x6507	Profile and software version	UNSIGNED32	ro	0x01000400	no
0x6508	Operating time	UNSIGNED32	ro		no
0x6509	Offset value	INTEGER32	ro		no
0x650A	Module identification				no
0x01		INTEGER32	ro	0x00000000	
0x650B	Serial number	UNSIGNED32			no

7.5.2. Index 0x6000 (Operating parameters)

This object is used to configure the code sequence and scaling.

Object description:

Attribute	Value
Index	0x6000
Name	Operating parameters
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Value range	see table below
Default value	see table below

Field	Bit	Value range	Default value	Description
cs: Code sequence	0	0 to 1	0	If bit is not set the position value increases if the shaft is rotated clockwise (looking at the shaft). If bit is set the position value increases if the shaft is rotated counterclockwise (looking at the shaft).
cdc: Commissioning diagnostic control	1		0	not supported
sfc: Scaling function control	2	0 to 1	1	If bit is not set scaling of the position value is disabled. If bit is set scaling of the position value is enabled.
md: Measuring direction	3		0	not supported
hsfc: High resolution scaling function control	4		0	not supported
reserved	5 to 11		0	reserved
msp1 to msp4: Manufacturer-specific operating parameter 1 to 4	12 to 15		0	not supported

7.5.3. Index 0x6001 (Measuring units per revolution)

This object contains the desired singleturn resolution within the range from 1 to maximum encoder resolution.

Object description:

Attribute	Value
Index	0x6001
Name	Measuring units per revolution
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Value range	1..8192 (for "MT16ST13" device variant) 1..16384 (for "MT16ST14" device variant) 1..262144 (for "MT13ST18" device variant) all other values not allowed
Default value	8192 (for "MT16ST13" device variant) 16384 (for "MT16ST14" device variant) 262144 (for "MT13ST18" device variant)

Possible SDO abort codes:
- 0x06090030 ("range of parameter exceeded") if parameter does not match to value of CoE object 0x6002
- 0x06090031 ("value of parameter written too high") if value > maximum value of value range for a specific device variant (for example 8192 for "MT16ST13" variant)
- 0x06090032 ("value of parameter written too low") if value < 1

7.5.4. Index 0x6002 (Total measuring range in measuring units)

This object contains the parameterization of the total measuring range (TMR).

Object description:

Attribute	Value
Index	0x6002
Name	Total measuring range in measuring units
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Value range	2..536870912 (for "MT16ST13" device variant) 2..1073741824 (for "MT16ST14" device variant) 2..2147483648 (for "MT13ST18" device variant)
Default value	536870912 (for "MT16ST13" device variant) 1073741824 (for "MT16ST14" device variant) 2147483648 (for "MT13ST18" device variant

Possible SDO abort codes:

- 0x06090030 ("range of parameter exceeded") if parameter does not match to value of CoE object 0x6001
- 0x06090031 ("value of parameter written too high") if value > maximum value of value range for a specific device variant (for example 536870912 for "MT16ST13")
- 0x06090032 ("value of parameter written too low") if value < 1

7.5.5. Index 0x6003 (Preset value)

This object contains the desired absolute preset value. Writing this object executes a preset. The encoder position will immediately be set to the absolute position value given in object 0x6003. The encoder internally calculates a preset offset value which is being stored in a non-volatile memory (no store command via CoE object 0x1010 required).

Object description:

Attribute	Value
Index	0x6003
Name	Preset value
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	rw
PDO mapping	no
Default value	0

Possible SDO abort codes:
- 0x06090031 ("value of parameter written too high") if preset value is out of range
- 0x08000022 ("Data cannot be transferred or stored to the application because of the present device state.") if position calculation is disabled (for example if EtherCAT cycle time is below 100 microseconds)

7.5.6. Index 0x6004 (Position value)

This object contains the scaled position value if scaling is enabled. The object contains the raw position value if scaling is disabled. To enable or disable position scaling bit 2 of object 0x6000 has to be set or reset.

Object description:

Attribute	Value
Index	0x6004
Name	Position value
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Default value	No

7.5.7. Index 0x600C (Position raw value)

This object contains the raw position value (without the influence of scaling).

Object description:

Attribute	Value
Index	0x600C
Name	Position raw value
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Default value	No

7.5.8. Index 0x6500 (Operating status)

This object provides the operating status of the encoder functions configured in object 0x6000.

Object description:

Attribute	Value
Index	0x6500
Name	Operating status
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Value range	see Index 0x6000 (Operating parameters)
Default value	see Index 0x6000 (Operating parameters)

7.5.9. Index 0x6501 (Singleturn resolution)

This object contains the maximum singleturn resolution in steps.

Object description:

Attribute	Value
Index	0x6501
Name	Singleturn resolution
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Default value	8192 = 0x2000 (for "MT16ST13" device variant) 16384 = 0x4000 (for "MT16ST14" device variant) 262144 = 0x40000 (for "MT13ST18" device variant)

7.5.10. Index 0x6502 (Number of distinguishable revolutions)

This object contains the maximum number of revolutions.

Object description:

Attribute	Value
Index	0x6502
Name	Number of distinguishable revolutions
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Default value	65536 = 0x10000 (for "MT16ST13" device variant) 65536 = 0x10000 (for "MT16ST14" device variant) 8192 = 0x2000 (for "MT13ST18" device variant)

7.5.11. Index 0x6503 (Alarms)

This object contains the alarm bits of the encoder.

Object description:

Attribute	Value
Index	0x6503
Name	Alarms
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Value range	see table below
Default value	all bits set to 0

Bit	Description
0	pe: position error
1	cde: commissioning diagnostic state
2..11	reserved
12	msa1: manufacturer-specific alarm 1
13	msa2: manufacturer-specific alarm 2
14	msa3: manufacturer-specific alarm 3
15	msa4: manufacturer-specific alarm 4

7.5.12. Index 0x6504 (Supported alarms)

This object describes which alarm bits are supported by the encoder.

Object description:

Attribute	Value
Index	0x6504
Name	Supported alarms
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no
Value range	see table below
Default value	0xF003

Bit	Description	Settable
0	pe: position error	yes
1	cde: commissioning diagnostic state	yes
2..11	reserved	-
12	msa1: manufacturer-specific alarm 1	yes
13	msa2: manufacturer-specific alarm 1	yes
14	msa3: manufacturer-specific alarm 1	yes
15	msa4: manufacturer-specific alarm 4	yes

7.5.13. Index 0x6505 (Warnings)

This object contains the warning bits of the encoder.

Object description:

Attribute	Value
Index	0x6505
Name	Warnings
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	TPDO
Value range	see table below
Default value	all bits set to 0

Bit	Description
0	fe: frequency exceeded
1	lcr: light control reserve
2..3	not supported
4	bc: battery charge
5	not supported
6	not supported
7..11	reserved
12	msw1: manufacturer-specific warning 1
13	msw2: manufacturer-specific warning 2
14	msw3: manufacturer-specific warning 3
15	msw4: manufacturer-specific warning 4

7.5.14. Index 0x6506 (Supported warnings)

This object describes which warning bits are supported by the encoder.

Object description:

Attribute	Value
Index	0x6506
Name	Supported warnings
Object Code	VAR
Data type	UNSIGNED16

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Value range	see table below
Default value	0xD013 for EAL devices 0xF011 for EAM devices

Bit	Description	Settable
0	fe: frequency exceeded	yes
1	lcr: light control reserve	yes
2..3	not supported	-
4	bc: battery charge	yes
5	not supported	-
6	not supported	-
7..11	reserved	-
12	msw1: manufacturer-specific warning 1	yes
13	msw2: manufacturer-specific warning 2	yes
14	msw3: manufacturer-specific warning 3	yes
15	msw4: manufacturer-specific warning 4	yes

7.5.15. Index 0x6507 (Profile and software version)

This object contains information about the profile and software version of the encoder.

Object description:

Attribute	Value
Index	0x6507
Name	Profile and software version
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Default value	0x01000400 meaning of "0x01000400": - software version is 1.0 - profile version is 4.0 (of CiA 406 profile)

7.5.16. Index 0x6508 (Operating time)

This object contains the operating time of the encoder in multiples of 6 minutes.

Object description:

Attribute	Value
Index	0x6508
Name	Operating time
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no

7.5.17. Index 0x6509 (Offset value)

This object contains the preset offset of the encoder. The value of this object is calculated when object 0x6003 (preset) is written or when a preset is triggered via the push button.

Object description:

Attribute	Value
Index	0x6509
Name	Offset value
Object Code	VAR
Data type	INTEGER32

Entry description:

Attribute	Value
Subindex	0x00
Access	ro
PDO mapping	no

7.5.18. Index 0x650A (Module identification)

This object contains a fix manufacturer offset value.

Object description:

Attribute	Value
Index	0x650A
Name	Module identification
Object Code	ARRAY

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no
Default value	0x01

Attribute	Value
Subindex	0x01
Description	Manufacturer offset value
Access	ro
PDO mapping	no
Value range	INTEGER32
Default value	0

7.5.19. Index 0x650B (Serial number)

This object provides the encoder serial number and is hard-wired to subindex 4 of object 0x1018.

Object description:

Attribute	Value
Index	0x650B
Name	Serial number
Object Code	VAR
Data type	UNSIGNED32

Entry description:

Attribute	Value
Subindex	0x00
Access	const
PDO mapping	no

7.6. Parameterization

7.6.1. Measuring units per revolution

The value for measuring units per revolution has to be within the range of 1 to maximum encoder resolution.

For details please refer to Index 0x6001 (Measuring units per revolution).

7.6.2. Total measuring range

Admissible values range from 2 to the product of the programmed resolution multiplied by the encoder's maximum number of revolutions.

For details please refer to Index 0x6002 (Total measuring range in measuring units).

7.6.3. Code sequence

Position data behavior relates to the rotation direction of the shaft of the encoder when looking at the flange.
CW („clockwise“) = ascending values with clockwise rotation
CCW („counter-clockwise“) = ascending values with counter-clockwise rotation

For details please refer to Index 0x6000 (Operating parameters).

7.6.4. Scaling functionality

If scaling functionality is active the settings of „measuring units per revolution“ and „total measuring range“ are considered.

For details please refer to Index 0x6000 (Operating parameters).

7.6.5. Speed measuring unit

Please refer to Speed Measuring Unit.

7.6.6. Speed update period

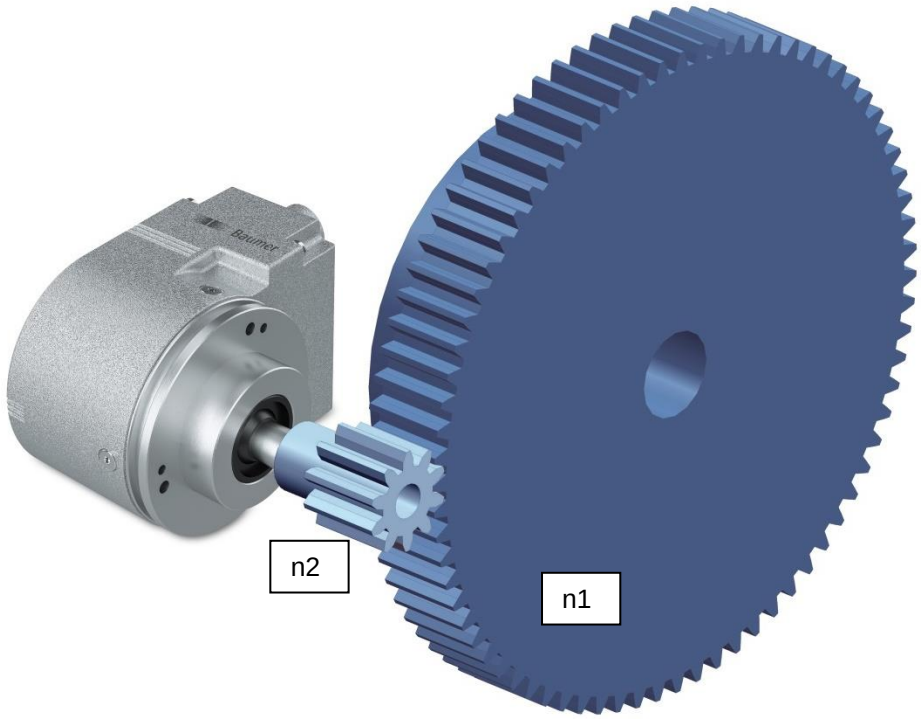
Please refer to Speed Update Period.

7.6.7. Speed filter depth

Please refer to Speed Filter Depth.

7.6.8. Gear factor activation

With gear factor active the encoder is mechanically mounted on the primary side of the gearbox while it outputs position data as if it was mounted on the secondary side of the gearbox. The parameter „total measuring range“ always defines the number of requested steps for *one* turn of the secondary gear box shaft.



The gear factor functionality does not take the parameter „measuring units per revolution“ into account. Instead, the „measuring units per revolution“ result from the parameters „total measuring range“ and the gear factor (consisting of numerator and denominator) is taken into account. The resulting number of „measuring units per revolution“ is not necessarily an integer value. But it may be a rational number (includes a fractional portion) as well.

$$\text{Measuring Units per Revolution} = \text{Total Measuring Range} * \frac{Denominator}{\text{Numerator}}$$

Example:
A reduction gear factor of 7.5 : 1 shall be used.
One turn of the secondary side of the gearbox shall resolve to 10000 steps.

The numerator is 75 and the denominator is 1. Only integer values are admissible for numerator and denominator. So the fraction must be expanded to numerator = 75 und denominator = 10 or (equivalent) numerator = 15 and denominator = 2.
As „total measuring range“ the value of 10000 must be provided.

The encoder turns 7.5 revolutions for one revolution on the secondary gearbox side. The resulting „measuring units per revolution“ for the encoder are 10000 / 7.5 = 1333,3333.

The „endless operation“ is automatically active (if necessary) also when using gear factor functionality.

Note:
An change of CoE object 0x2001:01 (“Gear Factor Mode Control”) clears internal position offsets (if any) so that the current position reference will be lost. See also Preset function.

Note:
The gear factor functionality is also known as „numerator/denominator scaling“ or „round axis function“.

7.6.9. Gear factor numerator

This parameter is only taken into account when using gear factor functionality.

When using a reduction gear (n2 < n1) the numerator of the gear factor is always > 1.

Note:
For the „numerator“ the following restrictions apply:

EAL580 MT encoder ST13 MT16, optical:	numerator <= 8192
EAL580 MT encoder ST18 MT13, optical:	numerator <= 4096
EAM580 MT encoder ST14 MT16, magnetic	numerator <= 16384

7.6.10. Gear factor denominator

This parameter is only taken into account when using gear factor functionality.

When using a reduction gear (n2 < n1) the divider is „1“. However, with a non-integral gear ratio it may be necessary to expand the fraction (see example above) so that the divider is > 1.

When using a step-up gear (n2 > n1) the denominator is larger than the numerator.

7.6.11. Gear factor parametrization

Valid combinations of numerator, denominator and total measuring range result from the formula noted below. The „measuring units per revolution“ must not exceed the maximum allowable values depending on the type of encoder.

$$\text{Measuring Units per Revolution} = \text{Total Measuring Range} * \frac{Denominator}{\text{Numerator}}$$

EAL580 MT Encoder ST13 MT16, optical:	Measuring units per Revolution <= 65536
EAL580 MT Encoder ST18 MT13, optical	Measuring units per Revolution <= 524288
EAM580 MT Encoder ST14 MT16, magnetic	Measuring units per Revolution <= 65536

7.6.12. Important note for multiturn encoder operation

„Endless operation“ is automatically supported where required.

Thus, there are no special requirements for the encoder parameters “total measuring range” and “measuring units per revolution” to stand in a certain ratio.

With endless operation active, the encoder shaft must not rotate when the encoder is unpowered. In those cases where powerless motion cannot be avoided, the encoder has to be referenced (presetted) after every power-up. With endless operation inactive the encoder shaft may rotate unlimitedly when encoder is not powered.

How to determine if „Endless Operation“ is in use together with given parameters:

- multiply the encoder’s „max. possible revolutions“ (depending on encoder type: for 16 bits the value is 65536, for 13 bits the value is 8192) by the value of parameter „measuring units per revolution“
- divide this value by the value of parameter „total measuring range“
- if there is a division remainder endless operation is in use

Example for parameters without endless operation:

Maximum possible revolutions	65536	(16 bits multiturn)
Measuring units per revolution	3600	
Total measuring range	29491200	(8192 x 3600)
Calculation:	65536 x 3600 / 29491200 = 8 (no remainder)	

Example for parameters with endless operation:

Maximum possible revolutions	65536	(16 bits multiturn)
Measuring units per revolution	3600	
Total measuring range	100000	
Calculation:	65536 x 3600 / 100000 = 2359 (remainder 29600)	

7.6.13. Preset

Please refer to Preset function.

7.6.14. Parametrization sequence

Please proceed in the following sequence if you want to configure and write CoE objects 0x6000 to 0x6003:

- write CoE object Index 0x6000 (Operating parameters)
- write CoE object Index 0x6002 (Total measuring range in measuring units)
- write CoE object Index 0x6001 (Measuring units per revolution)
- write CoE object Index 0x6003 (Preset value)

If you want to save the content of CoE objects 0x6000, 0x6001 and 0x6002 in non-volatile memory CoE object Index 0x1010 (Save Parameters) has to be written.

7.7. Error Handling

7.7.1. CoE Emergency messages

CoE emergency messages can be seen as alarms which are sent by an EtherCAT Slave when an "alarm event" occurs. The EtherCAT Slave sends the message without being previously asked to do so by the EtherCAT Master. This means that a CoE emergency message is not a response to a message of an EtherCAT Master. CoE Emergency Messages have the following format:

Variable	Type	Description
error code	UINT16	Error code as defined by IEC 61158 Part 2-6 Type 12 (or ETG 1000.6)
error register	UINT8	Error register as defined by IEC 61158 Part 2-6 Type 12 (or ETG 1000.6)
diagnostic data	UINT8[5]	Diagnostic data

7.7.2. Mapping table

The following table describes the reaction to certain diagnosis events in CoE objects 0x1001, 0x6503 and 0x6505. Additionally the resulting CoE emergency messages for certain diagnosis events are listed.

Diagnosis event	Bit(s) in CoE object 0x6505 set	Bit(s) in CoE object 0x6503 set	CoE emergency content	Value of CoE object 0x1001
temperature sensor communication	15	-	-	no change
light control reserve error	1	0 and 12	error code: 0xFF02 diagnostic data: 0x[00 00 00 **01 02**]	bit 0 is set
internal CRC error	-	0 and 13	error code: 0xFF04, diagnostic data: 0x[00 00 00 **01 04**]	bit 0 is set
internal frame error	-	0 and 14	error code: 0xFF05, diagnostic data: 0x[00 00 00 **01 05**]	bit 0 is set
speed violation	0	0	error code: 0xFF06, diagnostic data: 0x[00 00 00 **01 06**]	bit 0 is set
electronic device label (EDL) error	-	1 and 15	error code: 0xFF07, diagnostic data: 0x[00 00 00 **01 07**]	bit 0 is set
operation hours counter error	14	-	-	no change
encoder runtime data error	-	15	error code: 0xFF0C, diagnostic data: 0x[00 00 00 **01 0C**]	bit 0 is set
parameter data error	-	15	error code: 0xFF0E, diagnostic data: 0x[00 00 00 **01 0E**]	bit 0 is set
low battery voltage	4	-	error code: 0xFF10, diagnostic data: 0x[00 00 00 **01 10**]	bit 0 is set
magnetic sampling error	-	0 and 12	error Code: 0xFF11, diagnostic data: 0x[00 00 00 **01 11**]	bit 0 is set
magnetic sampling warning	13	-	error Code: 0xFF12, diagnostic data: 0x[00 00 00 **01 12**]	bit 0 is set
position measurement trigger error	12	-	-	no change
cyclic group CRC check error	-	1 and 15	error Code: 0xFF14, diagnostic data: 0x[00 00 00 **01 14**]	bit 0 is set
CRC error of SII data	-	15	error Code: 0xFFF0, Diagnostic Data: 0x[00 00 00 **02 00**]	bit 0 is set

Diagnosis event (with CoE emergency message) appeared

A CoE emergency message with the content as described in the table above is sent from the EAx580 EtherCAT encoder to the EtherCAT Master. Bit 0 of CoE object 0x1001 (error register) is set.

Diagnosis event (with CoE emergency message) disappeared

A CoE emergency message with the content as described in the table above is sent from the EAx580 EtherCAT encoder to the EtherCAT Master. The content is the same as specified in the table above but the value of variable “error code” is 0x0000. The diagnostic data contains the “code” of the diagnosis event which disappeared.

Additionally if all errors which influence bit 0 of CoE object 0x1001 (error register) are not present anymore bit 0 of CoE object 0x1001 (error register) is set to 0.

7.7.3. SDO abort codes

The following (application-specific) SDO abort codes can occur when CoE objects are accessed (read or written) by an EtherCAT Master.

SDO abort code	Description
0x06090030	“Value range of parameter exceeded”
0x06090031	“Value of parameter written too high”
0x06090032	“Value of parameter written too low”
0x08000022	“Data cannot be transferred or stored to the application because of the present device state”
0x06060000	“Hardware error”

7.7.4. Speed violation check

In addition to the activation of the speed violation check depending on the configured EtherCAT cycle time (see chapter 6.8 Cycle time and supported functionality) the speed violation check is enabled or disabled depending on the operation mode and the EtherCAT state. The table below shows the behavior.

EtherCAT States	Initial	Pre-Operational	Safe-Operational	Operational	Bootstrap
Operation Mode					
"Free Run"	disabled	disabled	enabled	enabled	disabled
"SM3 sync."	disabled	disabled	enabled	enabled	disabled
"DC Sync0"	disabled	disabled	disabled	enabled	disabled

7.8. FoE

The EAx580 EtherCAT encoder supports the protocol “File over EtherCAT” (FoE). By using this protocol it is possible to update the firmware of the EAx580 EtherCAT encoder.

8. Troubleshooting – Frequently Asked Questions – FAQ

8.1. FAQ: Project Work

8.1.1. Where do I get an encoder manual?

The manual is available for download at www.baumer.com (freeware „Adobe Reader®“ required). Make sure the manual is the right one for your encoder by verifying the table at the beginning of the manual. You will find the encoder type on the product label (e.g. EAL580-xxx.xxEC-13160.x).

Should your encoder not be on the list please contact Baumer.

8.1.2. Where do I get the applicable ESI file?

The ESI file is available at www.baumer.com. To find out if the ESI file is applicable for your encoder please use the table at the beginning of the manual. You will find the encoder type on the product label (e.g. EAL580-xxx.xxEC-13160.x).

Should your encoder not be on the list please contact Baumer.

8.2. FAQ: Operation

8.2.1. What is the significance of the LEDs provided at the encoder?

The encoder integrates several LEDs indicating activity status of the encoder. Both link/activity LEDs visualize encoder activity on the bus, meaning data communication on each of the two Ethernet ports. In particular upon commissioning and in case of error the LEDs provide first information on the system status. For details on the respective status please refer to chapter Diagnostic LEDs.

8.2.2. How to adapt the resolution?

The encoder resolution in steps per turn („measuring units per turn“) is programmed within the project by corresponding parameterization. Usually this is performed by the PLC’s engineering tool (for example Beckhoff TwinCAT).The encoder resolution is programmable in individual steps between the maximum limit (encoder-specific, for example 8192 for EAL580-xxx.xxEC-13160.x) and the minimum limit of 1 step/turn.