JAT JENAER ANTRIEBSTECHNIK

EtherCAT®

Application Note No. 26

ECOVARIO® + ECOMPACT® 23E

Operation with EtherCAT® Interface

Published editions:

Edition	Comment
Feb. 2009	First English edition
Feb. 2011	„Distributed Clocks" function added.
June 2011	ECOVARIO 114 D support
April 2013	ECOMPACT 23E support. Editorial improvements.
Sept. 2013	Note added for inserting new PDOs
Feb. 2015	ECOVARIO 114D revision level 3with enhanced PDO size. ECOVARIO 616(D) support.
August 2016	ECOVARIO with support for SDOInfo
May 2018	Revision / update, configuration for Freerun
June 2018	Note added for following error calculation
May 2022	Servo amplifier revision levels updated
April 2024	Automatic setting of the SyncPhase in ECOMODUL

Jenaer Antriebstechnik GmbH
Buchaer Straße 1
07745 Jena
Germany

The content of this document has been worked out and checked carefully. Nevertheless differences from the real state of the hard and software can never be fully excluded. Necessary corrections will be carried out in the next edition.

Contents

0 About this Documentation 4

1 Features and Applications 4

2 Settings in the servo amplifier 4

3 Configuration of the EtherCAT Interface using „TwinCAT“ 5
3.1 Preparations 5
3.2 Project Settings 5
3.3 Specific Settings 6
3.4 Configuration of the Distributed Clocks (DC) 8
3.5 Servo Amplifier Configuration 9
3.6 Switch on the Axis 10
3.7 Manual and NC-controlled Movement 10
3.8 Optional: Adding axes to an existing project 11
3.9 Option: Following error monitoring and dead-time compensation 13
3.10 Option: Operating Mode 9 - Cyclic Synchronous Velocity Mode (ECOVARIO only) 15
3.11 Option: Setting new PDOs 17
3.12 Option: Customizing the TwinCAT System Manager project to new Servo Amplifier Revision Level 22

0 About this Documentation

This application note describes the procedure for configuring an EtherCAT® connection with ECOVARIO® or ECOMPACT® 23E, respectively. The description of the interface hardware and examples of topologies can be found in the ECOVARIO® Installation Manual or in the ECOMPACT® 23E User Manual.

1 Features and Applications

EtherCAT provides the following features:

- Real-time bus system
- Processing of standard Ethernet frames according to IEEE 802.3
- Data addressed to the device is read while the frame passes through. Similarly, input data is inserted while the telegram passes through
- Direct Memory Access (DMA), results in very short cycle times (≤ 100 µs)
- Low jitter for an exact synchronization (≤ 1 µs)
- A large variety of topologies like line, tree, ring, star and their combinations
- Line length up to 100 m per segment

ECOVARIO® with EtherCAT interface can be operated in pure EtherCAT networks as well as in parallel topologies EtherCAT/CAN bus (cf. „CiA Draft Standard 301“) and conforms to the „CANopen Device Profile for Drives and Motion Control“ (cf. „CiA Draft Standard Proposal 402“). The ECOMPACT® is designed for operation in pure EtherCAT networks.

As transmission protocol CAN over EtherCAT (CoE) is used. SDO, PDO and EMCY telegrams are supported, PDO in the following modes:

Mode	**ECOVARIO** 114 / 214 / 414	**ECOVARIO 114 D / 616 (D)**	**ECOMPACT 23E**
8 (cyclic synchronous position)	from firmware version 5.188 on	from firmware version 1.12 on	from firmware version 5.145 on
9 (cyclic synchronous velocity)	from firmware version 5.223 on	from firmware version 1.123 on	-

All CANopen messages as well as the PDO Mapping are supported in the length typical for CAN (8 bytes per frame; ECOVARIO 114D from revision 3 on and ECOVARIO 114/214/414, also ECOVARIO 616(D), from revision 2 on 32 bytes per frame), the EtherCAT state machine is mapped to the „NMT state“.

The specific features of the EtherCAT bus and of the data Transmission are not described here. For further information please refer to the homepage of the EtherCAT technology group: www.ethercat.org.

2 Settings in the servo amplifier

First, the ECOVARIO® or the ECOMPACT, respectively, has to be configured correctly for the use together with the connected motor. For this pupose the parameterization and commissioning software ECOSTUDIO® can be used (cf. ECOSTUDIO® online help or ECOSTUDIO® operation manual ECOVARIO®, ECOSTEP®, ECOMPACT®).

3 Configuration of the EtherCAT Interface using „TwinCAT“

For process control and visualization of the EtherCAT devices Jenaer Antriebstechnik GmbH proposes the PC software tool „TwinCAT“ (Beckhoff) for ECOVARIO® and ECOMPACT®. However, operation with other EtherCAT master systems is possible.

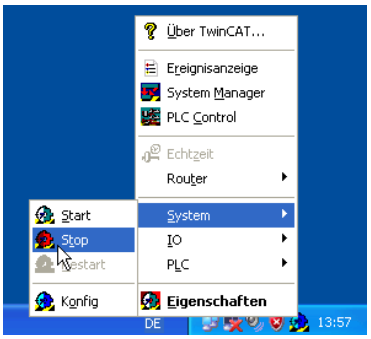
3.1 Preparations

1. Install TwinCAT with axis interpolation NCI or TwinCAT NC PTP on the PC.
2. Copy the XML device description file
   - ➲ JAT_GmbH_EcoVario.xml (for 1-axis ECOVARIO 114, 214, 414) or
   - ➲ JAT_GmbH_EcoVarioDual.xml (for ECOVARIO 114 D, ECOVARIO 616(D)) or
   - ➲ JAT_GmbH_ Ecompact.xml (for ECOMPACT 23E),

   to ..\TwinCAT\Io\EtherCAT. You find the device description file on our homepage under http://www.jat-gmbh.de/download/ecosoftware/progs.html.
3. Start the TwinCAT system manager in the „Config Mode“.
4. Check the network settings under ***Options\Show Real Time Ethernet Compatible Devices*** and if necessary configure compatible network adapters (listed in ***Compatible devices***) for real-time ethernet (the adapters are then displayed under ***Installed and ready to use devices***).
5. Switch on the servo amplifier and establish the network connection.

☞ Note: Currently, TwinCAT supports the following network cards:
Intel network adapters (10/100/1000 Mbit), e.g. Intel 8255x, Intel Pro 100/1000.
See also under http://infosys.beckhoff.com/english.php?content=content/1033/tcsystem-manager/reference/ethercat/html/ethercat_supnetworkcontroller.htm

☞ Note: Please note that a parallel connection to TwinCAT and to ECOSTUDIO® via one network card is not possible. For online diagnosis by means of ECOSTUDIO® one of the other interfaces of the servo amplifier should be used (RS232, USB, ... depending on the device).
Alternatively you can stop TwinCAT (cf. figure on the right side), then the port is free again and you can access the servo amplifier via ECOSTUDIO®.



3.2 Project Settings

The project settings can be carried out automatically by means of the TwinCAT scan function:

1. In the selection tree select in the context menu of the ***I/O Devices*** item (right-click) ***Scan Devices*** and then ***EtherCAT***.
2. Answer the query „***Search for new boxes***“ with ***Yes***.
3. Answer the query „***EtherCAT drives found. Create respective NC axes?***“ with ***Yes***.
4. In the selection tree select in the context menu of the ***NC-Task1 SAF*** item (right-click) ***Append Channel***. Keep the ***Name*** as proposed, as ***Type*** select „NC Channel (for Interpolation)“. Confirm by clicking ***OK***.

The resulting project settings are displayed in the TwinCAT selection tree as shown in Fig. 3.1.

☞ Note: If you wish to add further axes to an existing project proceed as described in chapter 3.8.

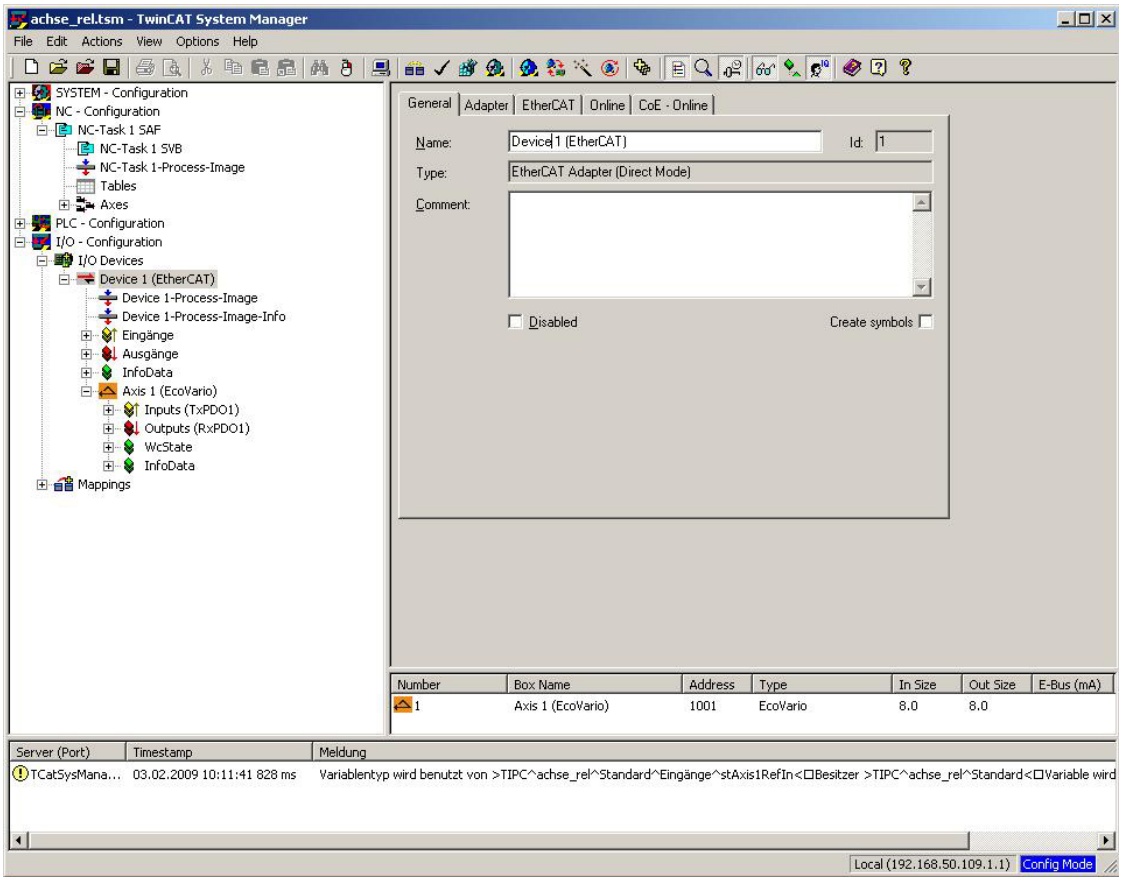


Fig. 3.1 Resulting project settings displayed in TwinCAT (Example)

3.3 Specific Settings

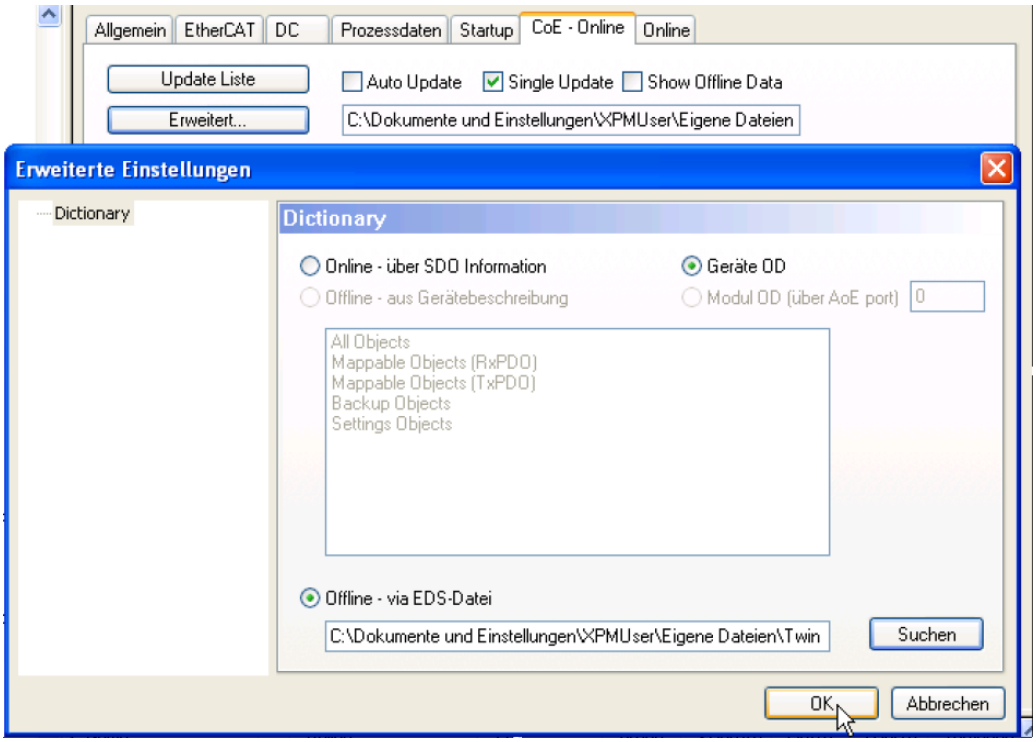
1. In the selection tree select in the ***I/O Devices*** item the entries ***<Device name>\<Axis name> (EcoVario or Ecompact)***. In the ***Process Data*** tabs check the PDO assignment for all ECOVARIOs and in the ***Download*** group box check the two check boxes ***PDO Assignment*** and ***PDO Configuration***.

2. TwinCAT assigns the control_word, the status_word and the position_demand_value automatically to the respective NC axis.

   Note for ECOMPACT: In the simplest case (no SPS, NC only) the position_actual_value can be linked to the axis encoder. In the selection tree select in the ***NC Configuration*** item the entries ***Axes\Axis n\ Axis n_Enc\Inputs\Axis n_Enc_In\nInData1***. In the window displayed click ***Linked to m.*** In the window ***Attach Variable*** for Axis n (Ecompact) select the value „pos_actual_value“ of the assigned servo amplifier and click ***OK***. For the other servo amplifier types the assignment is already made by default.

3. In the selection tree select for the ***Axis n*** item in the ***Settings*** tab the measuring ***Unit*** according to the used measuring system (mm, degrees, etc.).
4. Select the ***CoE - Online*** tab and click to ***Advanced***.

5. In the ***Advanced Settings*** window there are two possibilities:
   a) For devices ECOVARIO 114/214/414 from firmware release 6.17 on as well as for ECOVARIO 114D/616(D) from firmware release 4.31on the complete object dictionary can be retrieved from the device by selecting the ***Online - via SDO Information*** option.
   b) Otherwise, click the selection button ***Offline - via EDS File***. Load the appropriate EDS file delivered together with the product on the software CD or available via http://www.jat-gmbh.de/download/ecosoftware/progs
   (EcoVario_114_214_414.eds bzw. EcoVario_114D.eds bzw. ECOMPACT.eds).



6. If you wish to generate additional PDOs, proceed as described in chapter 3.11.

7. Additional settings can be carried out by means of user specific SDOs. Therefore, in the selection tree in the ***I/O Devices*** item select the entries ***<Device name>\<Axis name>(EcoVario or Ecompact)***. The settings are made in the ***Startup*** tab.

8. In the selection tree click to ***NC task 1 SAF***. In the ***Task*** tab set the required cycle time for the interpolated mode (250 µs, 500 µs, 1 ms, 2 ms or 4 ms).

3.4 Synchronization methods via EtherCAT

Currently two synchronization methods are available in the ECOVARIO with Distributed Clocks function:

- DC-Synchronous -> Distributed Clocks function with Sync0 Synchronisation
- SM-Synchronous -> Synchronisation via process data

☞ Note: For all devices from JAT the Distributed Clocks Function is already activated by means of the XML device description file (Cycle Time: 1 ms).

The synchronization modes are configured by means of two objects (0x1C32 and 0x1C33). The configuration is transmitted via SDO during the power-up of the servo amplifier into the operational state.

3.4.1 Snchronization via Process Data Event - SM-Synchronous

Synchronization via Prozess Daten Event means that a synchronization of the servo amplifiers is done with every process data query of the master. Signal propagation times in the Ethernet are not considered.

Configuration:

0x1C32:01 = 0x01, Output Syncmanager
0x1C33:01 = 0x22, Input Syncmanager

Syncp phases for SM-Synchronous 0x2F88:0A

SyncTime = 250µs -> SyncPhase = 5
SyncTime = 500µs -> SyncPhase = 11
SyncTime = 1 ms -> SyncPhase = 17
SyncTime = 2 ms -> SyncPhase = 35
SyncTime = 4 ms -> SyncPhase = 65

☞ Note: With the ECOMODUL servo amplifier, manual adjustment of the sync phase is not possible; the optimal setting occurs automatically.

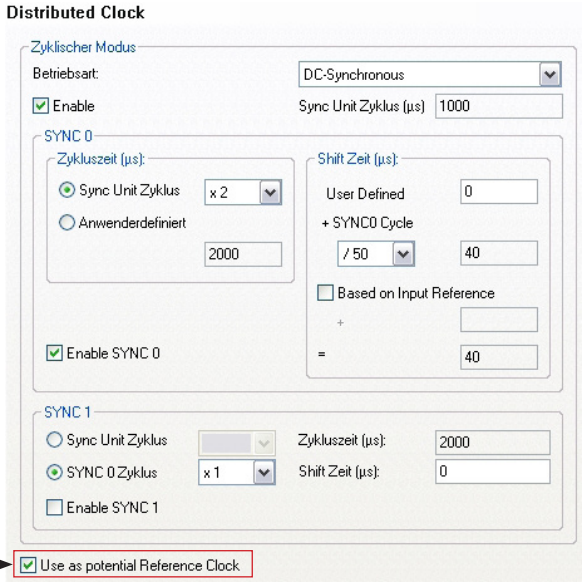
3.4.2. Configuration of the Distributed Clocks (DC)

In DC-synchronous communication, the servo amplifier synchronizes to the bus clock with the aid of a synchronization signal. The signal is generated by means of a clock on the communication card of the servo amplifier. Before the network subscribers change to the operational state, the DC for each individual subscriber is set so that every subscriber generates its sync signal at the same time. The advantage of DC sync is that it eliminates signal propagation times over the bus.

Setting Distributed Clocks in TwinCAT:

1. In the selection tree select in the context menu ***I/O Configuration*** -> ***I/O Devices*** the items <***device name***>\<***axis name***>***(EcoVario)***. In the menu which pops up on the right side select the ***DC*** tab. Activate the Distributed Clocks function by selecting ***DC-Synchronous*** and specify the required cycle time. The set cycle time must always be the same as the cycle time specified for the NC task (cf. schapter 3.3, step 8). Otherwise, the servo amplifier reports a FATAL SYNC ERROR (error code 0xB00).

In the ***Distributed Clock*** window in the ***Use as potential Reference Clock*** check box define a servo amplifier as reference clock where the whole drive system is synchronized to.



Reference clock →

3.4.3. Configuration for Freerun

The Freerun mode is the non-synchronous mode in EtherCAT. Devices which support this mode do not require bus synchronism to reach the operation state. Operating modes 7, 8 and 9 should not be used in this mode.

Configuration (cf. chapter 3.5):

0x2F88:01 = 0, deactivates the interpolated mode
0x1C32:01 = 0, Freerun mode for Sync manager 2
0x1C33:01 = 0, Freerun mode for Sync manager 3

For ECOMPACT devices the types of cyclic PDO have to be adapted in this case:

0x1400:02 = 0xFE
0x1400:03 = 10 or higher
0x1800:02 = 0xFE
0x1800:03 = 10 or higher

In the synchronization settings in TwinCAT select ***Freerun***.

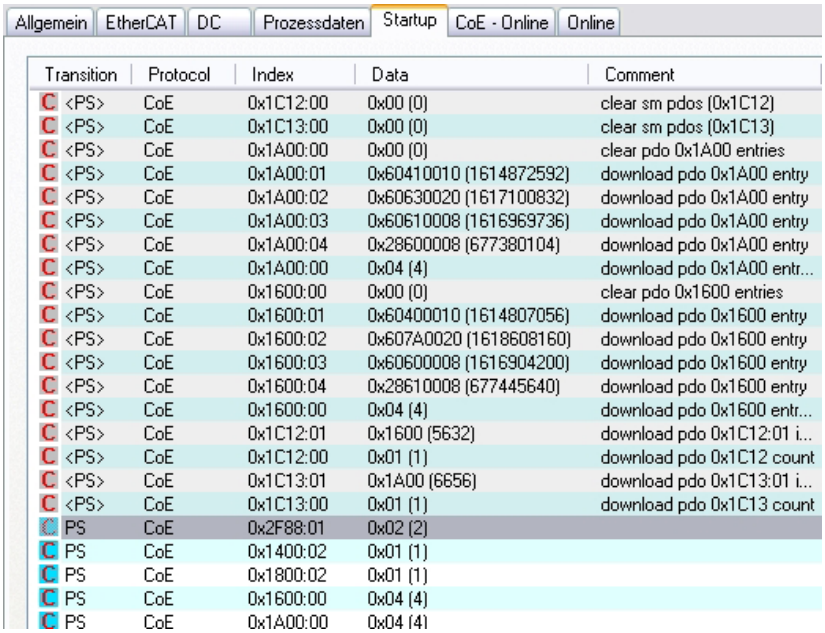
3.5 Servo Amplifier Configuration

The following settings have to be carried out for the servo amplifiers used. In the selection tree in the ***I/O Devices*** item select the entries ***<Device name>\<Axis name>(EcoVario)***. It is recommended to carry out these settings in the ***Startup*** tab because in this case they are stored permanently in the project. In the window displayed click ***New*** and complete the following object specific parameters:

1. If the synchronization on distributed clocks is required, set the Sync time according to the value chosen in Chap. 3.3, step 6 and Chap. 3.4, step 1, i.e., object 0x2F88 sub-index 01 to 0xFA (250 µs), 0x1F4 (500 µs), 0x01 (1 ms), 0x02 (2 ms) or 0x04 (4 ms). Set the SyncPhase (Object 0x2F88 sub-index 10) to 0x01.

   ☞ Note: With the ECOMODUL servo amplifier, manual adjustment of the sync phase is not possible; the optimal setting occurs automatically.

   Set object 0x1C32 sub-index 01 to 0x02.
   Set object 0x1C33 sub-index 01 to 0x02.



Transition	Protocol	Index	Data	Comment
<PS>	CoE	0x1C12:00	0x00 (0)	clear sm pdos (0x1C12)
<PS>	CoE	0x1C13:00	0x00 (0)	clear sm pdos (0x1C13)
<PS>	CoE	0x1A00:00	0x00 (0)	clear pdo 0x1A00 entries
<PS>	CoE	0x1A00:01	0x60410010 (1614872592)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:02	0x60630020 (1617100832)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:03	0x60610008 (1616969736)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:04	0x28600008 (677380104)	download pdo 0x1A00 entry
<PS>	CoE	0x1A00:00	0x04 (4)	download pdo 0x1A00 entr...
<PS>	CoE	0x1600:00	0x00 (0)	clear pdo 0x1600 entries
<PS>	CoE	0x1600:01	0x60400010 (1614807056)	download pdo 0x1600 entry
<PS>	CoE	0x1600:02	0x607A0020 (1618608160)	download pdo 0x1600 entry
<PS>	CoE	0x1600:03	0x60600008 (1616904200)	download pdo 0x1600 entry
<PS>	CoE	0x1600:04	0x28610008 (677445640)	download pdo 0x1600 entry
<PS>	CoE	0x1600:00	0x04 (4)	download pdo 0x1600 entr...
<PS>	CoE	0x1C12:01	0x1600 (5632)	download pdo 0x1C12:01 i...
<PS>	CoE	0x1C12:00	0x01 (1)	download pdo 0x1C12 count
<PS>	CoE	0x1C13:01	0x1A00 (6656)	download pdo 0x1C13:01 i...
<PS>	CoE	0x1C13:00	0x01 (1)	download pdo 0x1C13 count
PS	CoE	0x2F88:01	0x02 (2)	
PS	CoE	0x1400:02	0x01 (1)	
PS	CoE	0x1800:02	0x01 (1)	
PS	CoE	0x1600:00	0x04 (4)	
PS	CoE	0x1A00:00	0x04 (4)	

2. If synchronisation by process data events is required, either modify the configuration in the XML device description file, or just write the following to the data fields:
   -> set object 0x1C32 sub-index 01 to 0x01
   -> set object 0x1C33 sub-index 01 to 0x22.
   Set the cycle time (object 0x2F88 sub-index 01) and the sync phase (object 0x2F88 sub-index 10=. The following sync phases should be set for the repsective cycle times:
   - cycle time = 250µs -> SyncPhase = d5
   - cycle time = 500µs -> SyncPhase = d11
   - cycle time = 1 ms -> SyncPhase = d17 (x11)
   - cycle time = 2 ms -> SyncPhase = d35 (x23)
   - cycle time = 4 ms -> SyncPhase = d65.

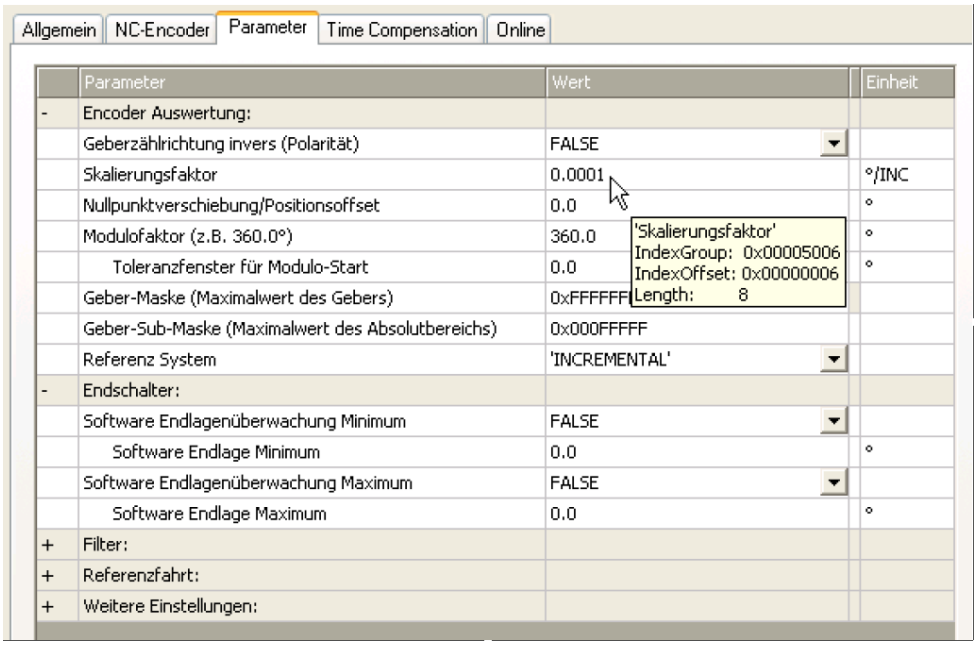
☞ Note: With the ECOMODUL servo amplifier, manual adjustment of the sync phase is not possible; the optimal setting occurs automatically.

3. If the Freerun-Mode is required, configure the objects as described in chapter 3.4.3.

3.6 Switch on the Axis

Carry out the following application specific settings and switch on the axis:

1. In the selection tree in the ***Axis n_Enc*** item select the ***Global*** tab and adapt the encoder resolution in the ***Scaling factor*** field. The scaling factor is calculated e.g. with rotary systems by dividing 360° by the encoder increments per revolution.



2. After entering the factor click ***Download***.

3. In the selection tree in the ***Axis n*** item select the ***Global*** tab and adapt the velocities and other application specific parameters, e.g. the following error, for manual movement. Click ***Download*** after each parameter entry.

4. In the menu bar select in the ***Actions*** item the ***Activate configuration*** entry. Answer the upcoming three queries with ***Yes*** or ***OK***. TwinCAT now works in the „Run Mode“.

3.7 Manual and NC-controlled Movement

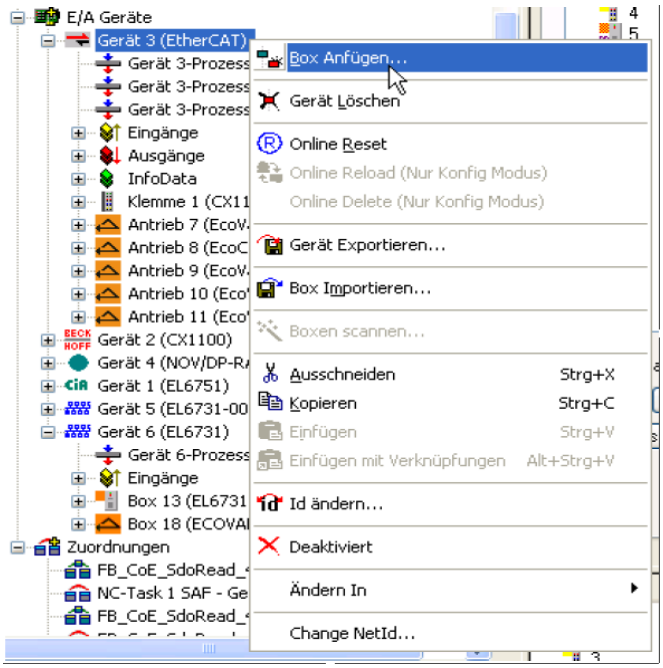
In order to start the movement of the axis (or axes) proceed as follows:

1. In the selection tree in the ***NC-Task 1 SAF\Axes\Axis n*** item in the ***Online*** tab check all check boxes in the group box ***Enable*** by clicking ***Set***. Configure ***Override*** to 100%
2. Now the axis can be moved via the controls.
3. Select ***Channel n\GroupX\3D-Online\Axis 1..X***. Check the actual configuration.
4. Set ***Channel n Override*** to 100%
5. Now the interpolated mode can be tested by means of an NC program.

3.7 Optional: Adding axes to an existing project

If you wish to add axes to an existing TwinCAT project, proceed as follows. Precondition is that the respective servo amplifier is connected to the EtherCAT line.

1. In the selection tree under the respective EtherCAT device entry select ***Add Box*** in the context menu (right click).

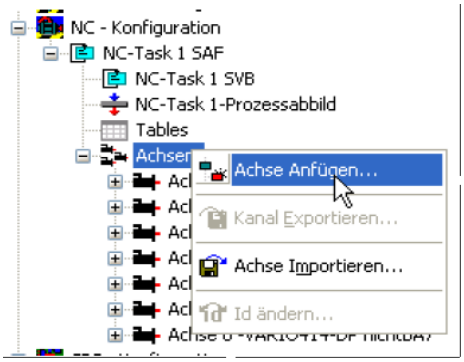


2. In the window ***Add EtherCAT device*** select the servo amplifier to be added.

   Note: By activating the ***Further Information*** check box additionally the revisions of the products are displayed. For the servo amplifiers of Jenaer Antriebstechnik the following values are possible (***latest revisions highlighted***):

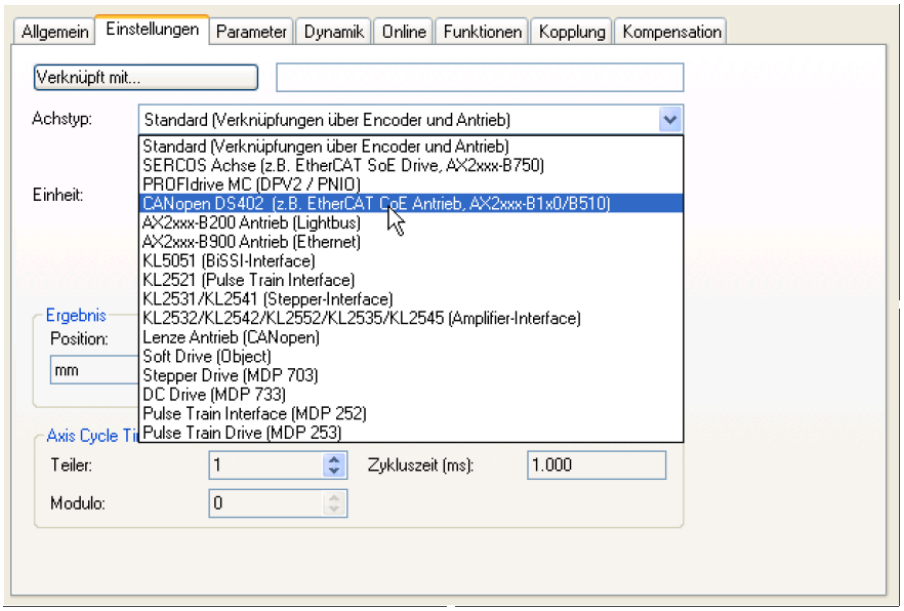
Device (Product / Revision)	Remark
EcoCompact (22039875 / 0)	ECOMPACT 23E (valid until 01.10.2018)
EcoCompact (22039875 / 1)	***ECOMPACT 23E***
ECOVARIO® (1 / 0) and (1 / 1)	prior revision ECOVARIO - 114 - 214 - 414
ECOVARIO® (1 / 2)	ECOVARIO - 114 - 214 - 414 (valid until 01.10.2015)
ECOVARIO® (1 / 3)	***ECOVARIO - 114 - 214 - 414 (Syncmanager size32 bytes, SDO Info)***
ECOVARIO® 114D (21779780 / 1)	prior revision ECOVARIO 114 D (no DC, SM addresses deviating)
ECOVARIO® 114D (21779780 / 2)	ECOVARIO 114 D (limited Syncmanager size, valid until 29.01.2015)
ECOVARIO® 114D (21779780 / 3)	ECOVARIO 114 D (Syncmanager size 32 bytes, valid until 20.01.2016)
ECOVARIO® 114D (21779780 / 4)	***ECOVARIO 114 D (Syncmanager size 32 bytes, SDO Info)***
ECOVARIO® 616 (55722326 / 1)	ECOVARIO 616 one-axis device (limited Syncmanager size, valid until 29.01.2015)
ECOVARIO® 616 (55722326 / 2)	ECOVARIO 616 one-axis device (Syncmanager size 32 bytes, valid until 20.01.2016)
ECOVARIO® 616 (55722326 / 3)	***ECOVARIO 616 one-axis device (Syncmanager size 32 bytes, SDO Info)***
ECOVARIO® 616D (38556996 / 1)	ECOVARIO 616D (limited Syncmanager size, valid until 29.01.2015)
ECOVARIO® 616D (38556996 / 2)	ECOVARIO 616D (Syncmanager size 32 bytes, valid until 20.01.2016)
ECOVARIO® 616D (38556996 / 3)	***ECOVARIO 616D (Syncmanager size 32 bytes, SDO Info)***

4. In the selection tree under ***NC-Configuration\NC-Task 1 SAF\Axes*** in the context menu (right click) select ***Append Axis***.

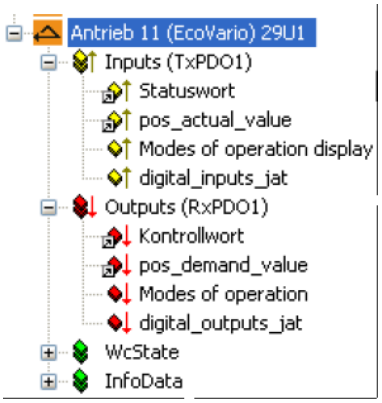


5. In the window ***Add an NC Axis*** enter the name of the axis and select „Continuous Axis“ as ***Type***.

6. In the selection tree select the axis, click the ***Settings*** tab in the right window and set the axis type to „CANopen DS402“.



7. Link the axis to the drive (servo amplifier) by clicking the ***Link to ...*** button. By linking the axis the required PDO are linked automatically to the drive (servo amplifier).

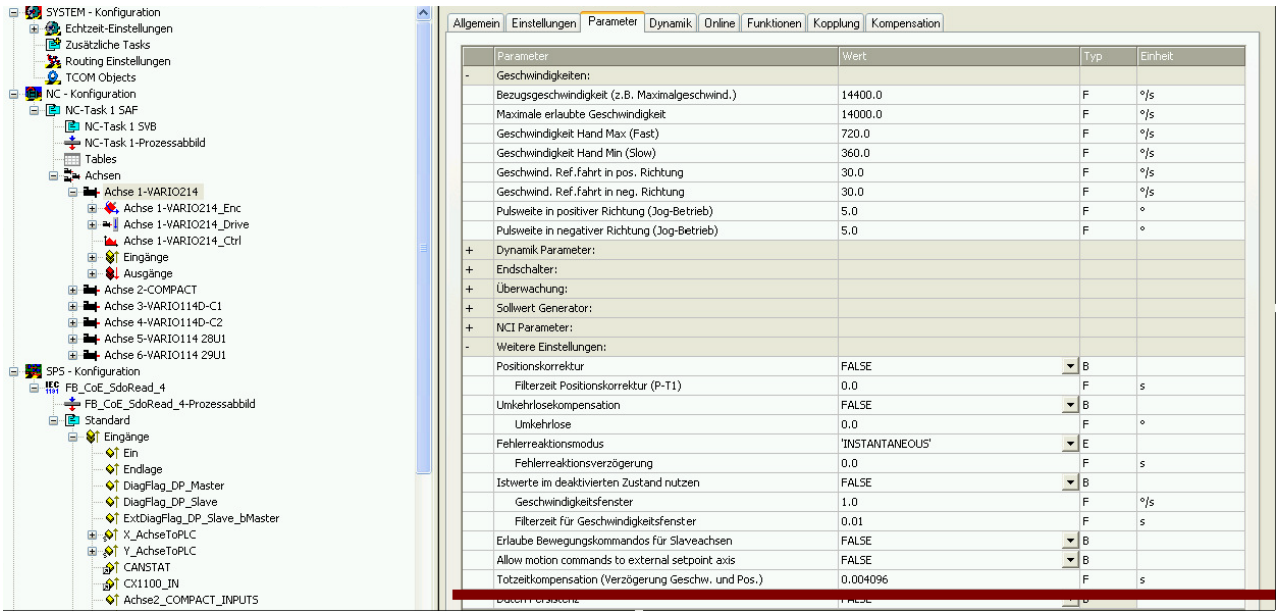


3.8 Option: Following error monitoring and dead-time compensation

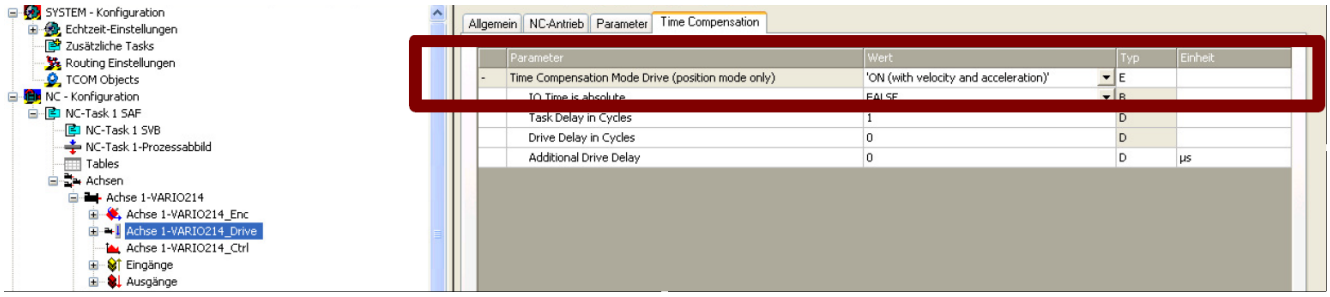
At a constant velocity TwinCAT shows a constant following error. This error depends on the synchronization time and on the velocity. The error can be compensated by means of the following TwinCAT settings.

For **internal following error compensation** Beckhoff recommends a dead-time compensation of approx. three times the NC-Task time.

1. In the selection tree under *NC-Configuration* -> *Axes* -> *Axis x* select the *Parameter* tab:

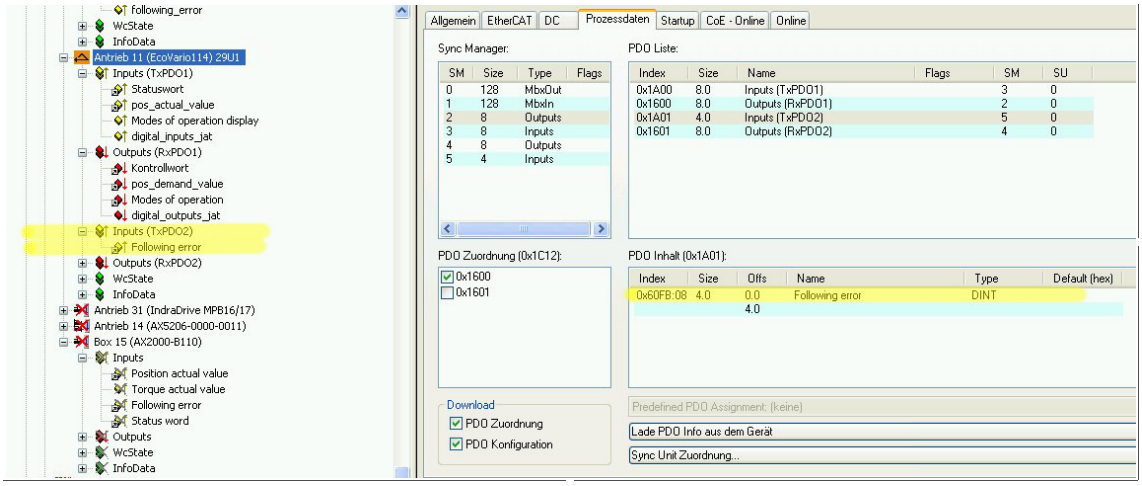


2. In the selection tree under *NC-Configuration* -> *Axes* -> *Axis x* -> *Axis x_Drive* select the *Time Compensation* tab. Set the parameters as follows:
   - *Time Compensation Mode* = ON (switch for activating the compensation)
   - *Drive Delay in Cycles* = 0 (dead-time of the servo amplifier in whole IO cycles)
   - *Additional Drive Delay* = 0 (fix delay in [µs]).

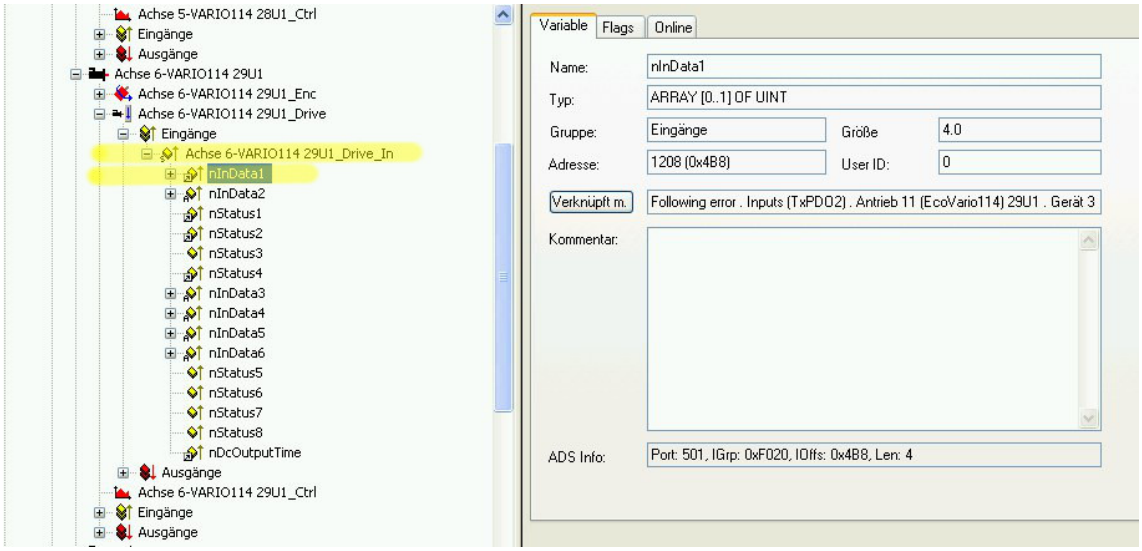


Optionally, an external **following error calculation** can be carried out. After activation of the external following error calculation a dead-time compensation is not necessary anymore.

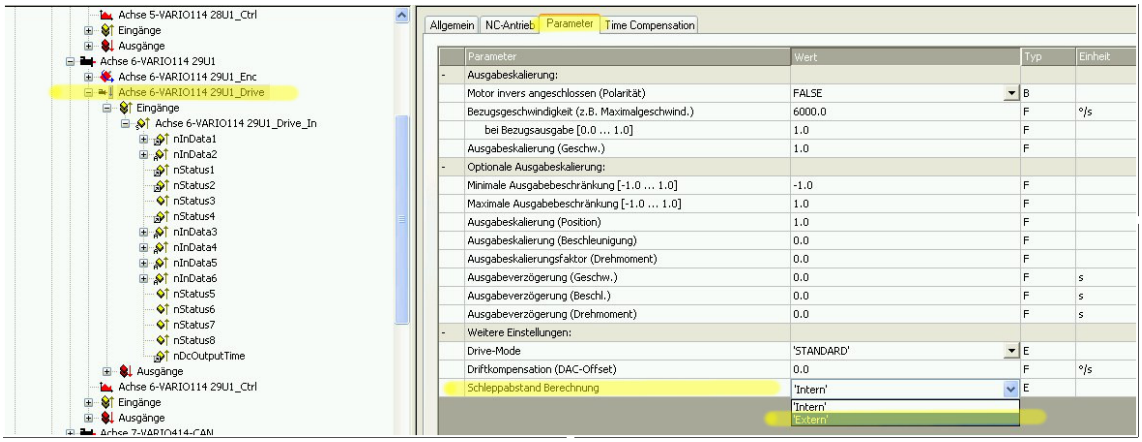
1. First, the following additional PDO input mapping for the following error (Objekt 0x60FB:08) has to be set.
   In the selection tree under *I/O Devices* select the items *<Device name>\<Axis name> (EcoVario or Ecompact)* and select the *Process Data* tab. Note: ECOMPACT only supports PDO-1-Input.



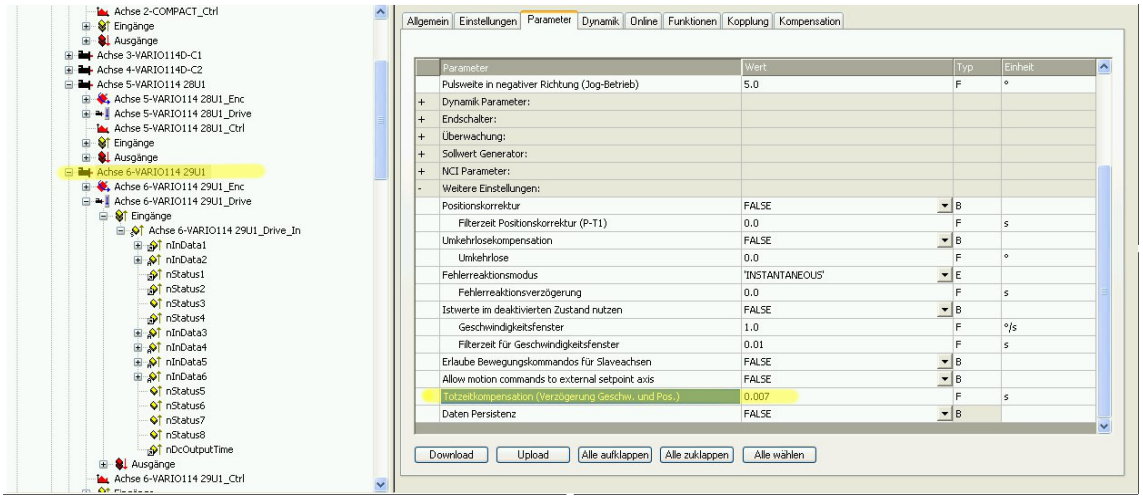
2. ***Note***: Depending on the existing firmware version, it may be necessary to perform the link to ***nInData1*** in ***Drive_In*** manually :



3. For activating the external following distance calculation in the selection tree under ***NC-Configuration*** -> ***Axes*** -> ***Axis x*** -> ***Axis x_Drive*** select the ***Parameter*** tab. The value for ***Following error calculation*** has to be set to „External“.



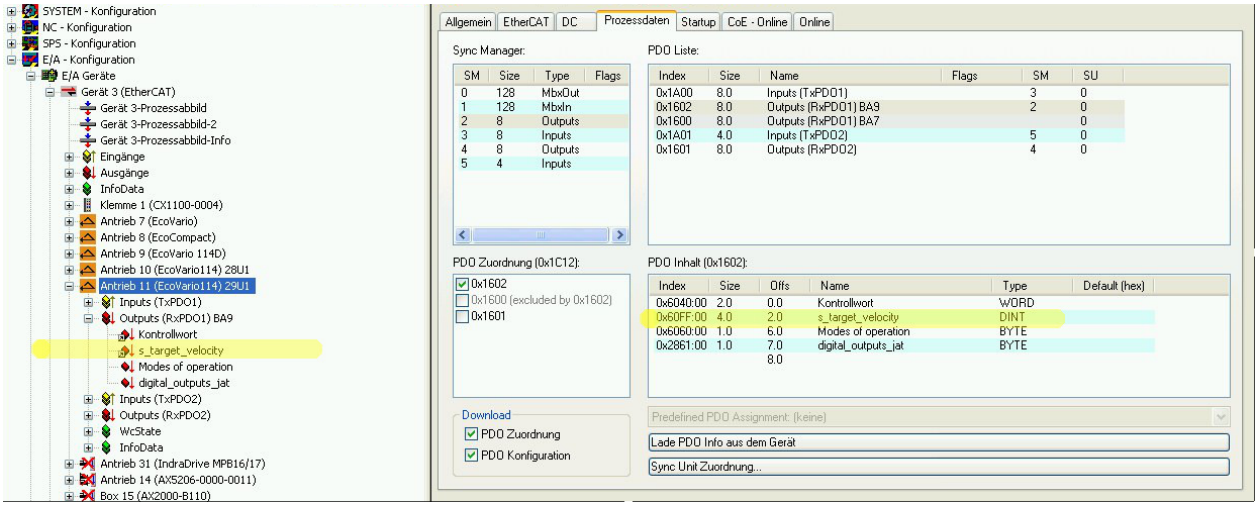
4. In the selection tree under ***NC-Konfiguration*** -> ***Axes*** -> ***Axis x*** select the ***Parameter*** tab. Deactivate the dead-time compensation: Set parameter ***Dead-time compensation (Delay velocity and Position)*** to „0“.



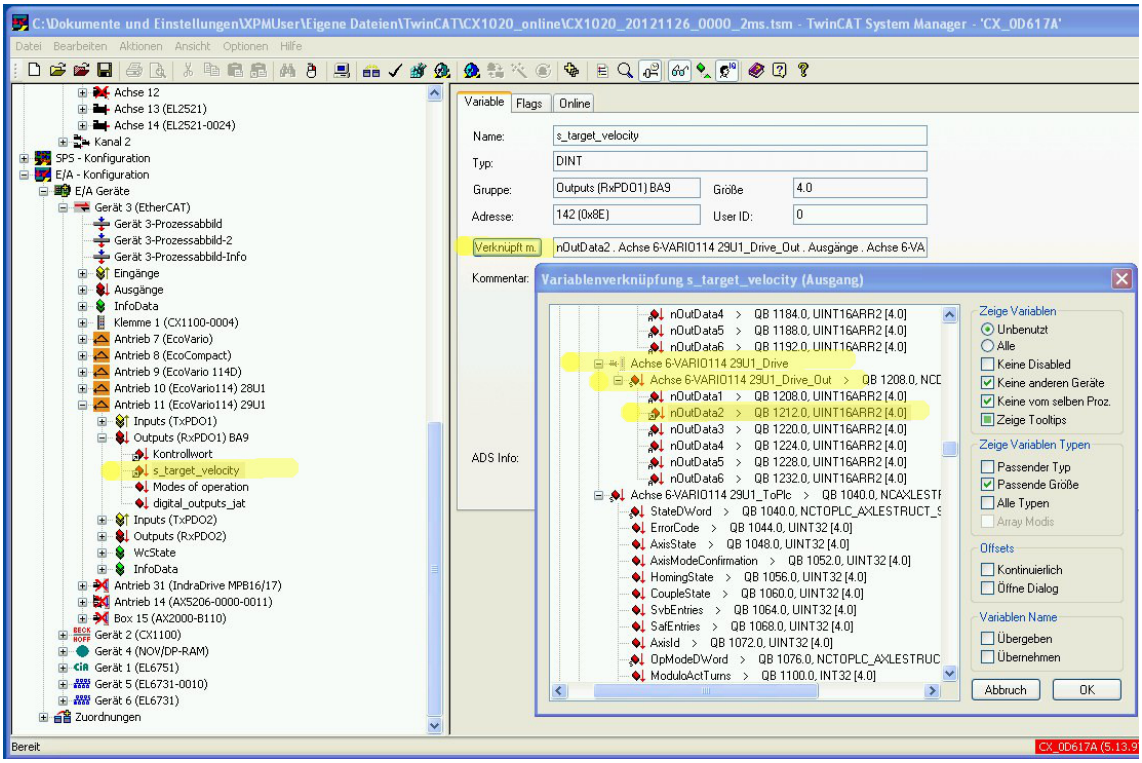
3.9 Option: Operating Mode 9 - Cyclic Synchronous Velocity Mode (ECOVARIO only)

As an alternative to operating mode 8 (cyclic synchronous position mode) ECOVARIO supports the operating mode 9 (cyclic synchronous velocity mode). The following setting have to be made:

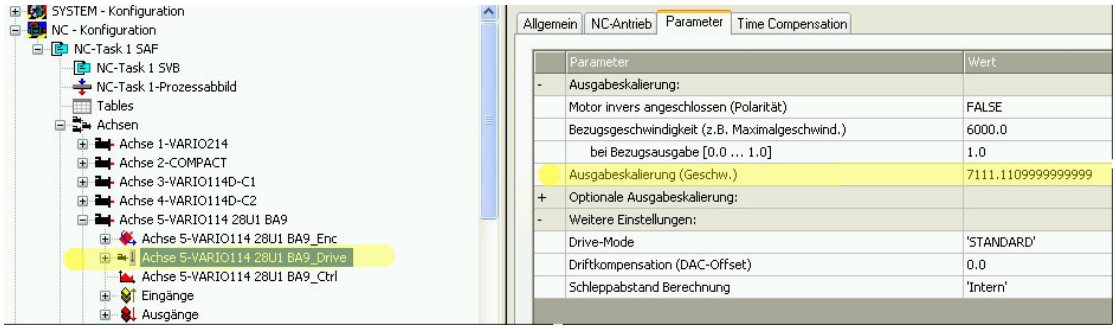
1. In the selection tree under ***I/O Devices*** select the items ***<Device Name>\<Axis Name> (EcoVario or Ecompact)*** and click the ***Process Data*** tab. Adapt the PDO mapping as follows:
   - exchange target position x607A:00 against target velocity x60FF:00



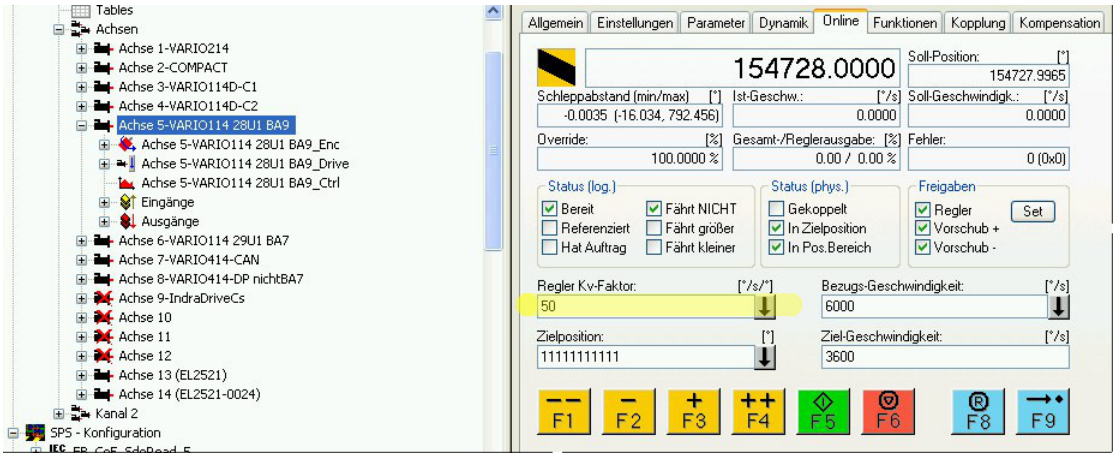
2. Check the linking to the NC axis. If required, link the target velocity (object 0x60FF, sub-index 00) to the NC axis manually.



3. Enter the values for the output scaling of the velocity.
   Example calculation for encoder resolution 40,000 inc/rev:
   1°/s / 360° = 0.00277 rev/s
   0.00277 U/s * 60min =0.166 rev/min
   (0.166U/min * 40000inc/U *64) / 60 = 7111.11



4. In the operating mode 9 the position control is carried out via TwinCAT and is set under ***NC-Configuration*** -> ***Axes*** -> ***Axis x*** in the ***Online*** tab as follows:



5. If required, carry out settings concerning the dead-time compensation as described in chapter 3.9.

3.10 Option: Setting new PDOs

For the communication via process data additional PDOs can be set in the TwinCAT project. In the selection tree under ***I/O Devices*** select the items <***Device name***>\<***Axis name***> ***(EcoVario or Ecompact)***. Select the ***Process Data*** tab.

The following PDO objects are available:
– Receive data: 0x1601..0x1607 (for 2-axis devices: additionally 0x1611 .. 0x1617 for axis 2)
map to Sync Manager 4
– Transmit data: 0x1A01..0x1A07 (for 2-axis devices: addionally 0x1A11 .. 0x1A17 for axis 2)
map to Sync Manager 5
– Depending on the revision level, in the ECOVARIO 8 Byte or 32 byte can be mapped to each PDO object (cf. table 1 on page 21).
Note: In the ECOMPACT the Sync Managers 4 and 5 are not available.

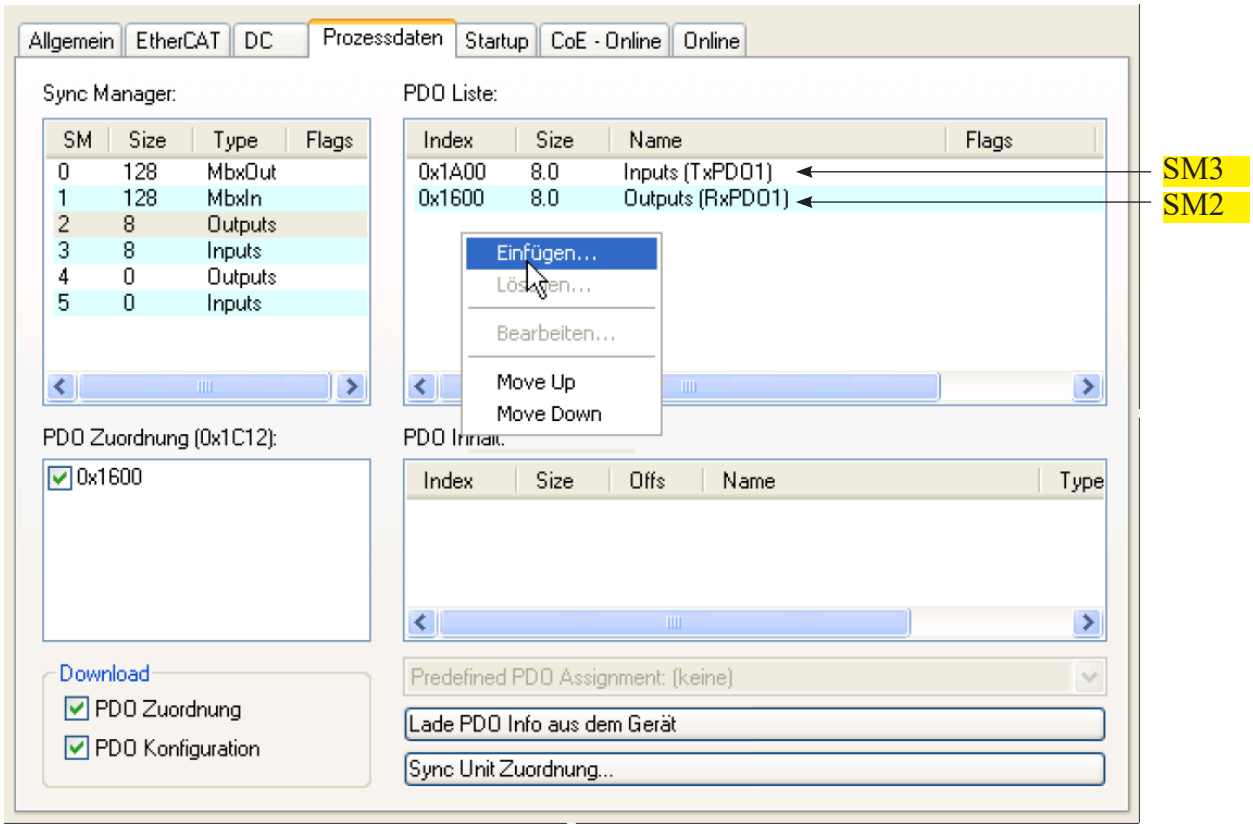
In the example a Rx-PDO2 (Object 0x1601) and a Tx-PDO2 (Object 0x1A01) is added.

Important: The arrangement in the ***PDO List*** on the top right (cf. screenshot on the next page) must be in ascending order for the Sync Managers of one direction, i.e. **SM2 before SM4** and **SM3 before SM5**.

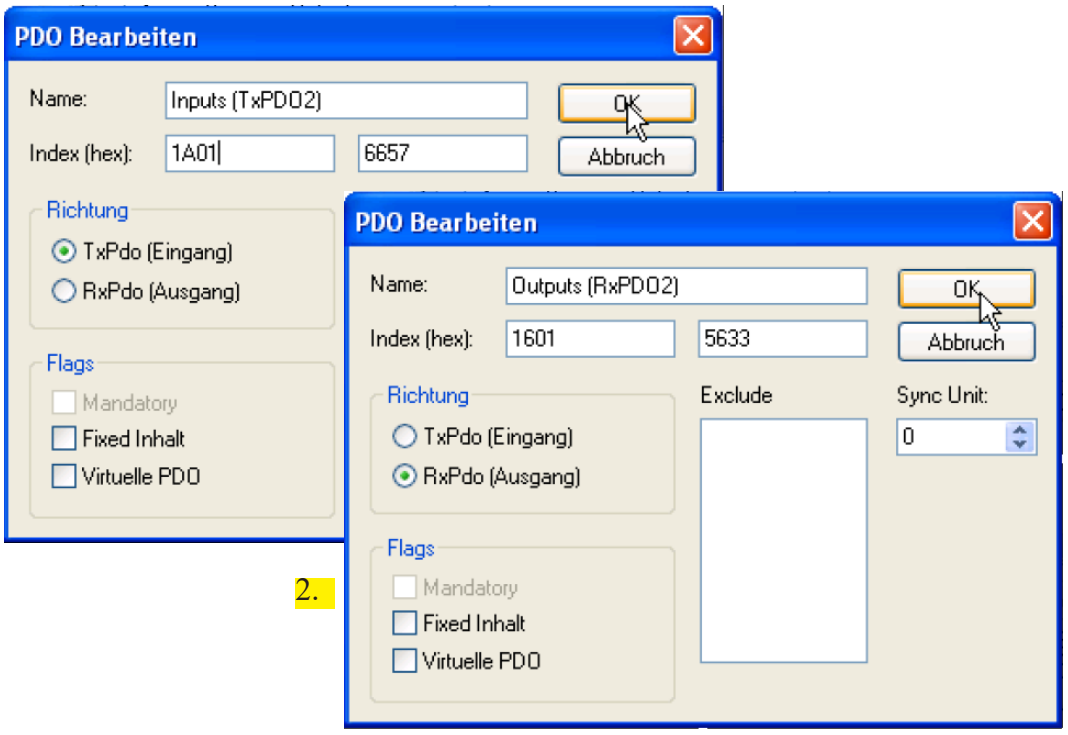
Examples:

PDO Object	0x1A00	0x1600	0x1A01	0x1601	0x1A02	0x1602	...
Sync Manager	SM3	SM2	SM5	SM4	SM5	SM4	
Direction	Tx	Rx	Tx	Rx	Tx	Rx	

PDO Object	0x1600	0x1A00	0x1601	0x1602	0x1A01	0x1A02	...
Sync Manager	SM2	SM3	SM4	SM4	SM5	SM5	
Direction	Rx	Tx	Rx	Rx	Tx	Tx	

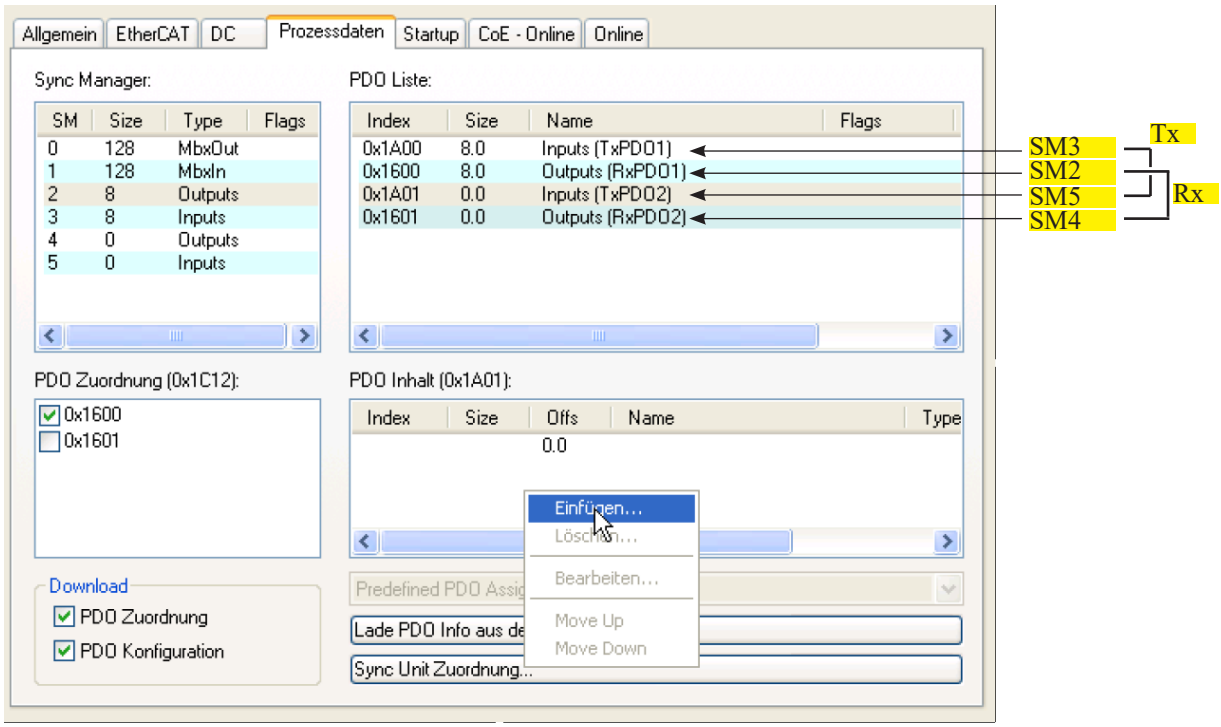

Allgemein
EtherCAT
DC
Prozessdaten
Startup
CoE - Online
Online
Sync Manager:
SM Size Type Flags
0 128 MbxOut
1 128 MbxIn
2 8 Outputs
3 8 Inputs
4 0 Outputs
5 0 Inputs
PDO Liste:
Index Size Name Flags
0x1A00 8.0 Inputs (TxPDO1)
0x1600 8.0 Outputs (RxPDO1)
SM3
SM2
Einfügen...
Löschen...
Bearbeiten...
Move Up
Move Down
PDO Zuordnung (0x1C12):
0x1600
PDO Inhalt:
Index Size Offs Name Type
Download
PDO Zuordnung
PDO Konfiguration
Predefined PDO Assignment: (keine)
Lade PDO Info aus dem Gerät
Sync Unit Zuordnung...

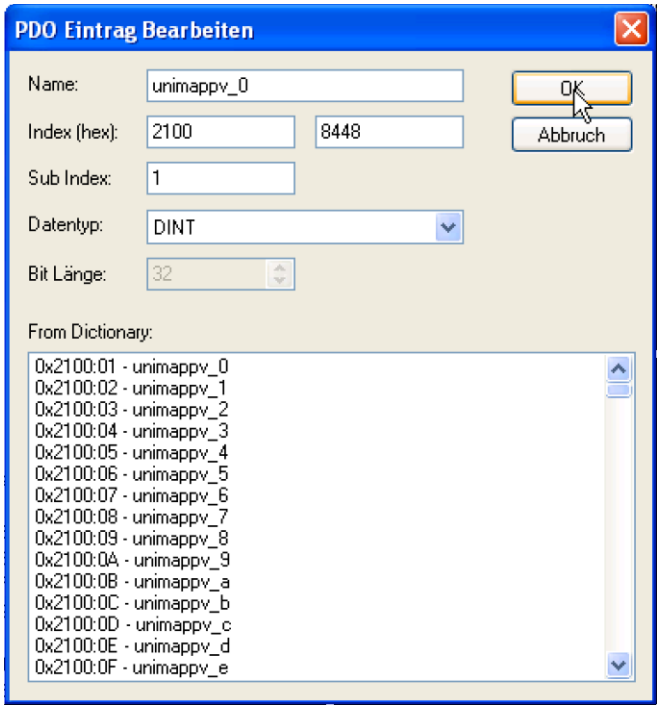
1.


PDO Bearbeiten
Name: Inputs (TxPDO2)
Index (hex): 1A01 6657
OK
Abbruch
Richtung
TxPdo (Eingang)
RxPdo (Ausgang)
Flags
Mandatory
Fixed Inhalt
Virtuelle PDO
PDO Bearbeiten
Name: Outputs (RxPDO2)
Index (hex): 1601 5633
OK
Abbruch
Richtung
TxPdo (Eingang)
RxPdo (Ausgang)
Exclude
Sync Unit:
0
Flags
Mandatory
Fixed Inhalt
Virtuelle PDO

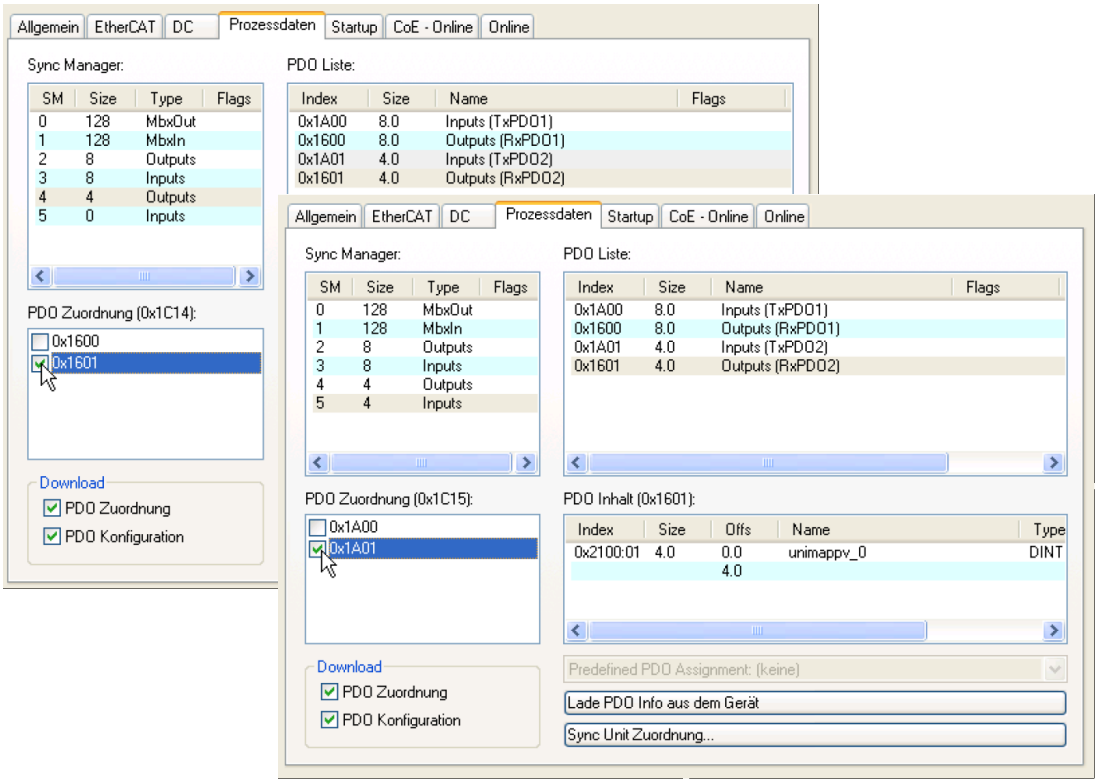
2.

Define the PDO contents. In the PDO list select the PDO which was generated before. In the ***Edit PDO Entry*** window assign a new contents (objects). In the example the object 0x2100, sub-index 01 (Unimapper), is assigned.





Assign the new PDOs to the sync managers by setting the respective check box ***PDO Assignment (0x1C14)***. The new PDOs have to be mapped to the Sync Managers 4 and 5. In TwinCat this can be configured via the ***Process Data*** tab in the controller settings,



Notes on the assignment of the Sync Managers:
Sync Manager 0 (SM0): **0x1C10** for SDO

- Sync Manager 1 (SM1): **0x1C11** for SDO
- Sync Manager 2 (SM2): **0x1C12** for cyclic synchronous Rx-PDOs (incoming PDOs from servo amplifier's view). For mapping of time-critical objects such as target position, target velocity, etc.
- Sync Manager 3 (SM3): **0x1C13** for cyclic synchronous Tx-PDOs (outgoing PDOs from servo amplifier's view). For mapping of time-critical objects such as actual position, actual velocity, etc.
- Sync Manager 4 (SM4): **0x1C14** for acyclic synchronous Rx-PDOs (incoming PDOs from servo amplifier's view). For mapping of not time-critical objects such as control word, digital outputs, etc.
- Sync Manager 5 (SM5): 0x1C15 for acyclic synchronous Tx-PDOs (outgoing PDOs from servo amplifier's view). For mapping of not time-critical objects such as status word, digital inputs, etc.

Sync Manager 2 must always have index x1600 and Sync Manager 3 must always have index x1A00.

The table 1 on the next page shows in detail the assignment of the Sync Managers and the available PDO sizes depending on the revisions of the servo amplifiers used. The currently delivered revisions are shown in italics.

Important: Checking the correct mapping in TwinCAT Master:

In order to avoid errors concerning the process data mapping on master side, the following has to be observed: The mapping must be in ascending order for the Sync Managers of one direction, i.e. **SM2 before SM4** and **SM3 before SM5**.
An example for correct mapping is shown on the right.

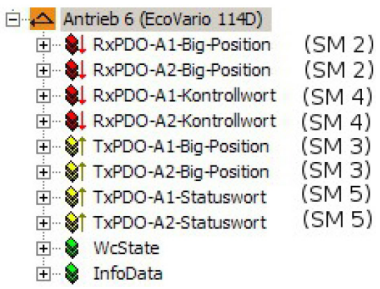


Table 1: Assignment and size of the Sync managers

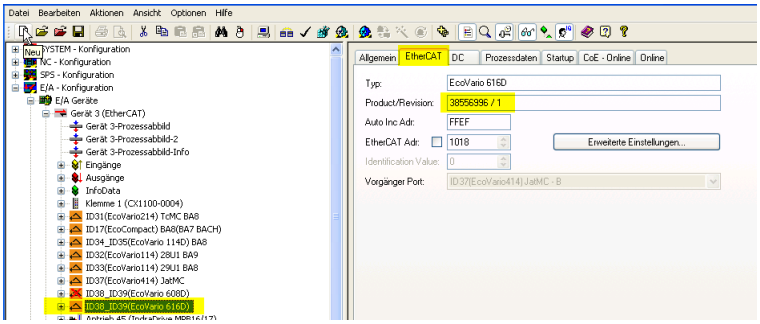
Device (Product / Revision)	SM 0	SM 1	SM 2 (cyclic Out RX from the servo amplifier perspective)	SM 3 (cyclic In TX from the servo amplifier perspective)	SM4, SM5 (synchronous acyclic)	Info	Synchronization times	Remarks
EcoCompact (22039875 / 0)	SDO	SDO	Max. 8 PDOs/Max. 64 bytes, 8 bytes per PDO	Max. 8 PDOs/Max. 64 bytes, 8 bytes per PDO	-	PDO1 synchronous, PDO2 to 8 synchronous acyclic	1 ms, 2 ms, 4 ms	ECOMPACT 23E until 01.10.2018
EcoCompact (22039875 / 1)	SDO	SDO			-			***ECOMPACT 23E***
EcoVario (1 / 0)	SDO	SDO	Max. 1 PDO with max. 8 bytes	Max. 1 PDO max. 8 bytes	Max. 8 PDOs / Max. 64 bytes / 8 bytes per PDO each	Max. 8 PDOs per direction, SM2+SM4 and SM3+SM5 with max. 64 bytes each	250 µs, 500 µs, 1 ms, 2 ms, 4 ms	prior revision ECOVARIO - 114 - 214 - 414 (no DC, SM addresses deviating)
EcoVario (1 / 1)	SDO	SDO						ECOVARIO - 114 - 214 - 414 (limited Syncmanager size)
EcoVario (1 / 2)	SDO	SDO	Max. 1 PDO with max. 32 bytes*	Max. 1 PDO max. 32 bytes	Je max. 8 PDOs /Max. 128 bytes / 32 bytes je PDO	Max. 8 PDOs per direction, SM2+SM44 and SM3+SM5 with max. 128 bytes each		ECOVARIO - 114 - 214 - 414 from firmware release 5.242 on
EcoVario (1 / 3)	SDO	SDO						***ECOVARIO - 114 - 214 - 414 from firmware release 6.20 on, SDOInfo supported***
EcoVario (0 / 0)	SDO	SDO	Each axis max. 1 PDO with max. 8 bytes	Each axis max. 1 PDO max. 8 bytes	Each axis max. 8 PDOs Max. 64 bytes / 8 bytes per PDO each	Max. 8 PDOs per direction and axis, SM2+SM4 and SM3+SM5 with max. 64 bytes each		prior revision ECOVARIO - 114 - 214 - 414 (no DC, SM addresses deviating)
EcoVario 114D (21779780 / 1)	SDO	SDO						prior revision ECOVARIO 114 D (no DC, SM addresses deviating)
EcoVario 114D (21779780 / 2)	SDO	SDO						ECOVARIO 114 D (limited Syncmanager size)
EcoVario 114D (21779780 / 3)	SDO	SDO	Each axis max. 1 PDO with max. 32 bytes *	Each axis max. 1 PDO max. 32 bytes	Each axis max. 8 PDOs Max. 128 bytes / 32 bytes per PDO each	Max. 8 PDOs per direction and axis; SM2+SM44 and SM3+SM5 with max. 128 bytes each		ECOVARIO 114 D
EcoVario 114D (21779780 / 4)	SDO	SDO						***ECOVARIO 114 D, SDOInfo supported***
EcoVario 616 (55722326 / 1)	SDO	SDO	Max. 1 PDO with max. 8 bytes	Max. 1 PDO max. 8 bytes	Max. 8 PDOs / max. 64 bytes / 8 bytes per PDO each	Max. 8 PDOs per direction, SM2+SM4 and SM3+SM5 with max. 64 bytes each		ECOVARIO 616 one-axis device (limited Syncmanager size)
EcoVario 616 (55722326 / 2)	SDO	SDO	Max. 1 PDO with max. 32 bytes *	Max. 1 PDO max. 32 bytes	Max. 8 PDOs /max. 128 bytes / 32 bytes per PDO each	Max. 8 PDOs per direction, SM2+SM44 and SM3+SM5 with max. 128 bytes each		ECOVARIO 616 one-axis device
EcoVario 616 (55722326 / 3)	SDO	SDO						***ECOVARIO 616 one-axis device, SDOInfo supported***
EcoVario 616D (38556996 / 1)	SDO	SDO	Each axis max. 1 PDO with max. 8 bytes	Each axis max. 1 PDO max. 8 bytes	Each axis max. 8 PDOs / max. 64 bytes / 8 bytes per PDO each	Max. 8 PDOs per direction and axis; SM2+SM4 and SM3+SM5 with max. 64 bytes each		ECOVARIO 616D (limited Syncmanager size)
EcoVario 616D (38556996 / 2)	SDO	SDO	Each axis max. 1 PDO with max. 32 bytes *	Each axis max. 1 PDO max. 32 bytes	Each axis max. 8 PDOs /max. 128 bytes / 32 bytes per PDO each	Max. 8 PDOs per direction and axis; SM2+SM4 and SM3+SM5 with max. 128 bytes each		ECOVARIO 616D
EcoVario 616D (38556996 / 3)	SDO	SDO						***ECOVARIO 616D, SDOInfo supported***

****)*** @ synchronization time 250 µs: max. 16 Bytes

3.11 Option: Customizing the TwinCAT System Manager project to new Servo Amplifier Revision Level

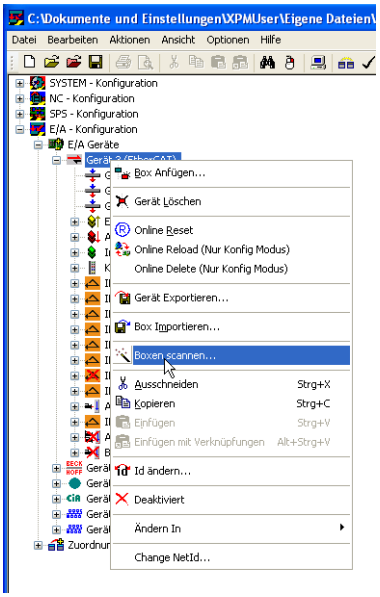
For ECOVARIO 114D with revision levels 1 and 2 or ECOVARIO 616(D) with revision level 1 the maximum size of a PDO is restricted to 8 bytes. New deliveries have revision level 4 or 3, where the PDO size is max. 32 bytes. Because of the larger PDOs the start addresses of the SYNC Managers are re-assigned.
When exchanging a unit with a former revision level by a new unit, functional compatibility to the former revision is guaranteed. However, in order to use the extended PDO size, it is recommended to update the TwinCAT System Manager project:

1. In the System Manager check the configured revision level.

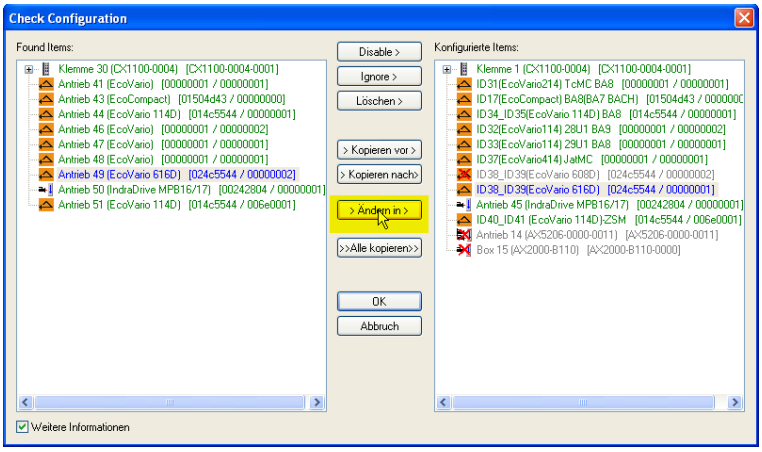


2. Set the system into the „Config“ mode.

3. Scan the boxes.



4. Apply the results.



5. Apply the new configuration with „Modify to“ and „OK“.

6. Save and load the project.

7. Finally, check the revision level configured in the System Manager. An overview of all possible revision levels can be found in chapter 3.11, table 1.