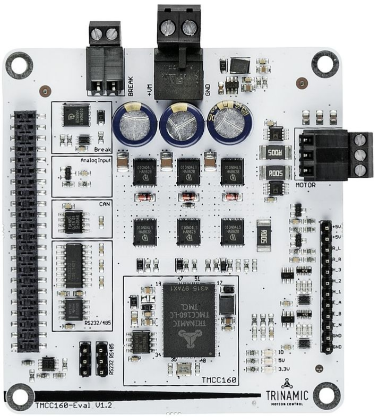
APPLICATION NOTE



# AN55: How to run TMCC160 and TMC8462 with TwinCAT3

Document Revision V1.3 • 2020-May -25

**This appnote shows how to configure and operate the TMCC160-EVAL with TMC8462-EVAL as CoE Slave Device. The TMCC160 is a ready to use PMSM/ BLDC motor controller in a miniaturized system in a package. It integrates a powerful programmed microcontroller with efficient state of the art commutation algorithm. In the TMCC160-LC CoE the CoE protocol is integrated TMCC160 motionCookie™microsystem with 3-Phase BLDC/PMSM gate driver for up to 24V and 1A gate current. The TMC8462 is a complete EtherCAT® Slave Controller optimized for real time. It comprises all blocks required for an EtherCAT slave including two 100-Mbit PHYs.**

## Contents

**1 Items needed** **2**

**2 Connecting the TMCC160-EVAL with TMC8462-EVAL** **2**
- 2.1 Replacement of the CAN Transceiver . . . 2
- 2.2 Jumpers . . . 3
- 2.3 Wiring . . . 3

**3 How to configure with with TMCL-IDE** **6**
- 3.1 Connection with TMCL-IDE . . . 6
- 3.2 Hall Wizard . . . 8
- 3.3 Encoder Wizard . . . 9

**4 Interfacing with TwinCAT** **11**
- 4.1 TwinCAT Master . . . 11
- 4.2 Include the ESI File . . . 11
- 4.3 Add the TMCC160-EVAL to TwinCAT . . . 11
- 4.4 How to update the EEPROM . . . 14
- 4.5 Check the connectivity with TwinCAT . . . 17

**5 How to move the motor with TwinCAT** **19**
- 5.1 How to move the motor in Profile Position Mode . . . 19
- 5.2 How to move the motor in pv mode . . . 22

**6 Revision History** **23**

Download newest version at: www.trinamic.com

# 1 Items needed

- TwinCAT3 (Engineering)
- TMCC160-EVAL v.1.2 with TMCC160-LC CoE (Firmware V4.01 or higher)
- TMC8462-EVAL v.3.1, the EtherCAT Slave Controller (alternatively the TMC8462-EVAL or TMC8460-EVAL can be used)
- Ethernet Cable CAT5
- TMCL-IDE
- RS485/RS232-USB Adapter

# 2 Connecting the TMCC160-EVAL with TMC8462-EVAL

The TMCC160-EVAL needs to be connected with the TMC8462-EVAL as described in the following. Additionally the motor and the feedback (Hall/Encoder) needs to be connected to the TMCC160-EVAL. For detail electrical ratings and pinnings refer to the TMCC160 and TMC8462 datasheet.

## 2.1 Replacement of the CAN Transceiver

The CAN transceiver on the TMCC160-EVAL needs to be replaced by following connection.

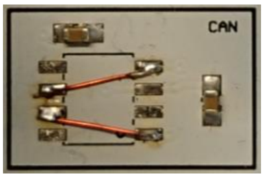


*Figure 1: Replacement of the CAN transceiver*

## 2.2 Jumpers

The TMC8462-EVAL jumper may be set as following:

- JP1: VOUT = VIO2 (don't care)
- JP2: VOUT = Fixed (don't care)
- JP3: PDI SH(ARED) BUS = 0 (don't care)
- JP4: PDI EMU = 0 (Emulation Mode deactivated, state machine changes are processed by TMCC160)
- JP5: EXT = nES SEL (don't care)

As a reference see Figure 2.

## 2.3 Wiring

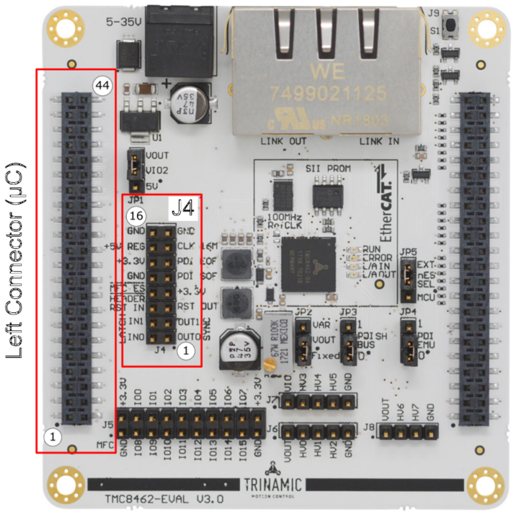


*Figure 2: TMC8462-EVAL connectors*

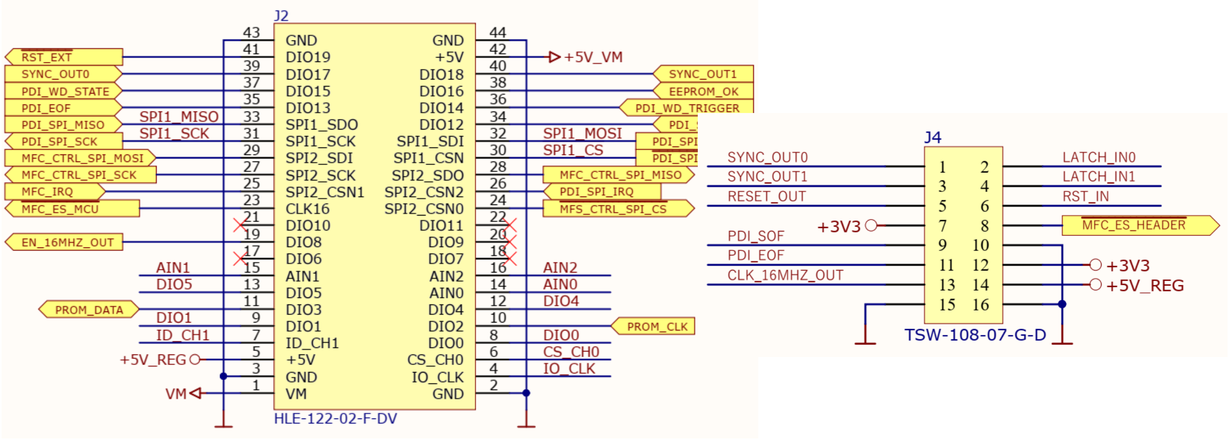


*Figure 3: TMC8462-EVAL: Left connector and J4*

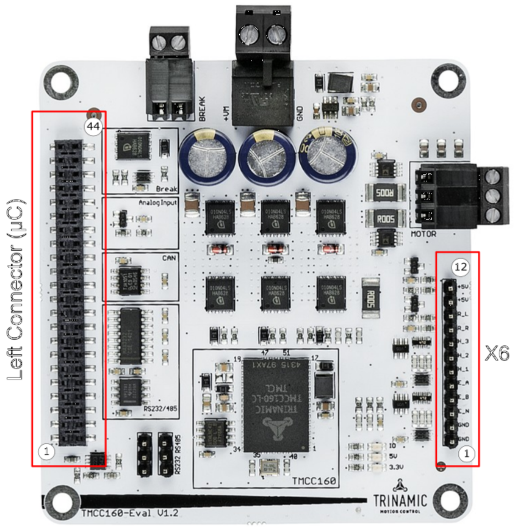


*Figure 4: TMCC160-EVAL connectors*

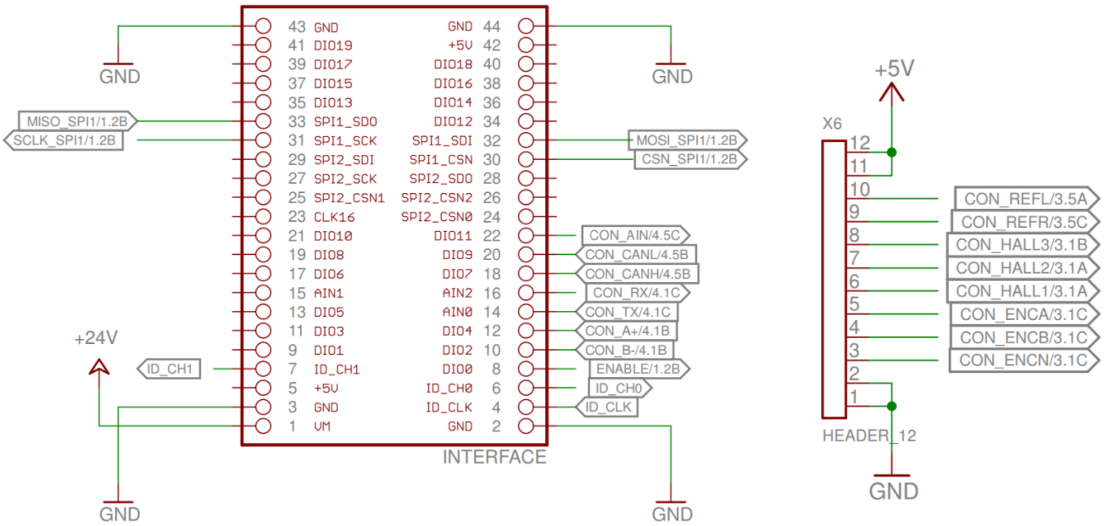


*Figure 5: TMCC160-EVAL: Left connector and X6*

*Table 1: Wiring of TMC8462-EVAL and TMCC160-EVAL*

| | **TMC8462-EVAL** | **TMC8462-EVAL** | **TMCC160-EVAL** | **TMCC160-EVAL** |
|---|---|---|---|---|
| **Signal** | **Left Connector** | **JP4** | **Left connector** | X6 |
| 5,0V | | Pin_27: +5V_USB | | Pin_12: +5V |
| GND | Pin_2: GND | | Pin_2: GND | |
| SCLK | Pin_31: PDI_SPI_SCK | | Pin_31: SCLK_SPI1 | |
| MOSI | Pin_33: PDI_SPI_MISO | | Pin_32: MOSI_SPI1 | |

*Table 1: Wiring of TMC8462-EVAL and TMCC160-EVAL*

| | **TMC8462-EVAL** | **TMC8462-EVAL** | **TMCC160-EVAL** | **TMCC160-EVAL** |
|---|---|---|---|---|
| **Signal** | **Left Connector** | **JP4** | **Left connector** | X6 |
| MISO | Pin_32: PDI_SPI_MOSI | | Pin_33: MISO_SPI1 | |
| /CS | Pin_30: /PDI_SPI_CS | | Pin_30: CSN_SPI1 | |
| PDI | Pin_26: PDI_SPI_IRQ | | Pin_20: CON_CANL | |
| SYNC | Pin_39: SYNC_OUT0 | | PIN_18: CON_CANH | |

Due to firmware configuration the PDI_SPI is cross connected (MOSI <-> MISO).

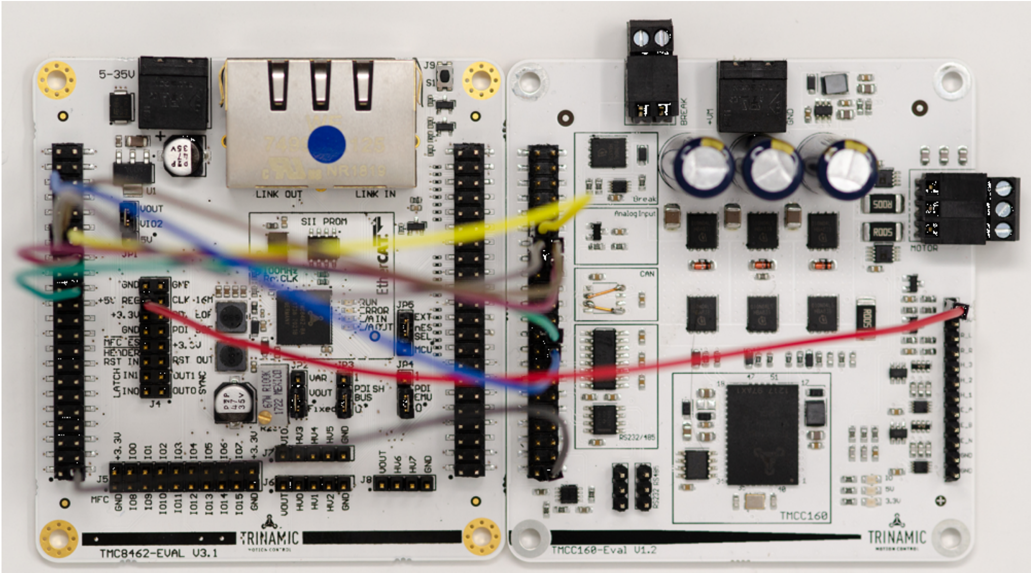


*Figure 6: TMCC160-EVAL and TMC8462-EVAL*

# 3 How to configure with with TMCL-IDE

It is recommended to connect the TMCC160-EVAL with the TMCL-IDE for the first setup. This way the the correct configuration (e.g pole pairs, encoder resolution) can be checked and parameters can be set (current, PI-parameter). Connect with the TMCL-IDE using RS232 or RS485 connection. The TMCC160-EVAL needs to be powered for communication (VS).

Note: The TMCL-IDE should only be used for configuration. If the motor is moved by the TMCL-IDE (e.g. by wizard), the Evalboard should be powercycled before controlling the motor with TwinCAT3.

## 3.1 Connection with TMCL-IDE

TMCC160-EVAL board supports RS232 or RS485 interface. To switch between both, two jumpers have to be configured as described in the table below.

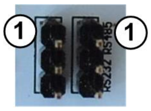
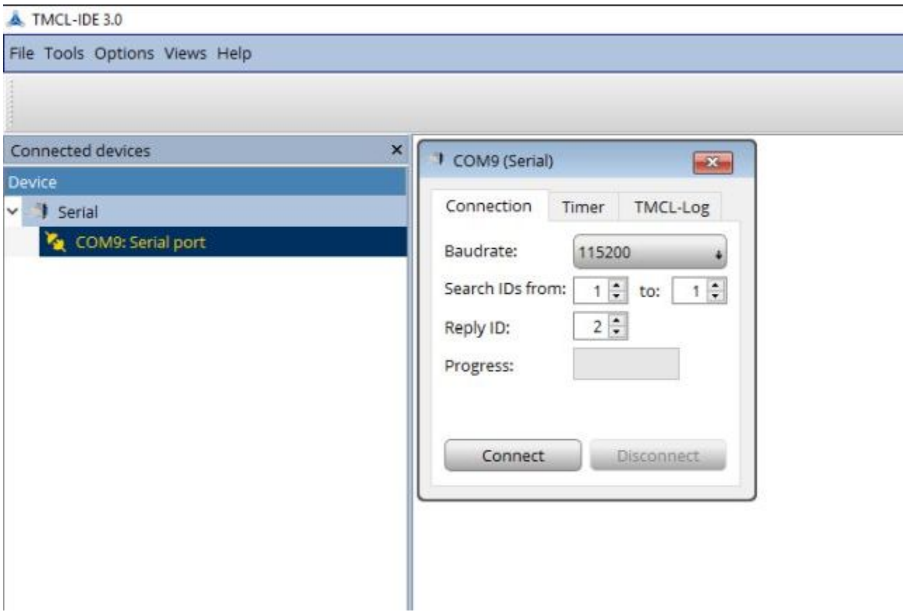
| $R_{PIN}$ | Description | Connector |
|---|---|---|
|  | 1-2 | If pin 1 and 2 of the interface switch is connected, RS485 interface is active. |
| | 2-3 | If pin 2 and 3 of the interface switch is connected, RS232 interface is active. |

*Table 2: Interface Jumper RS32/RS485*

Note: With an USB-RS232 cable (e.g. TTL-232R-5V) both Pin 2 of the Jumper can directly be used.

Connect with the RS232 or RS485:



Baudrate: 115200

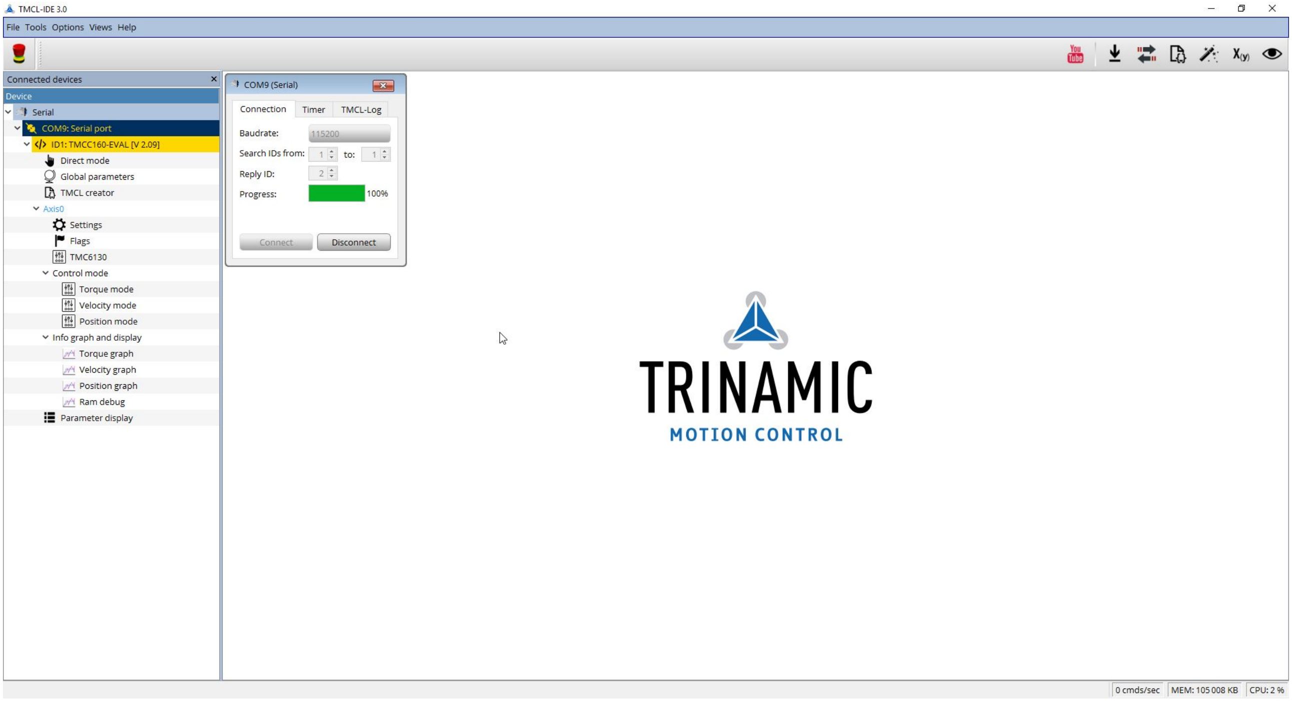
Search IDs from: 1 to: 1

Reply ID: 2

Progress:

*Figure 7: Connection with RS232*

After successful connection the TMCC160-EVAL shows in the TMCL-IDE.



Baudrate: 115200

Search IDs from: 1 to: 1

Reply ID: 2

Progress: 100%

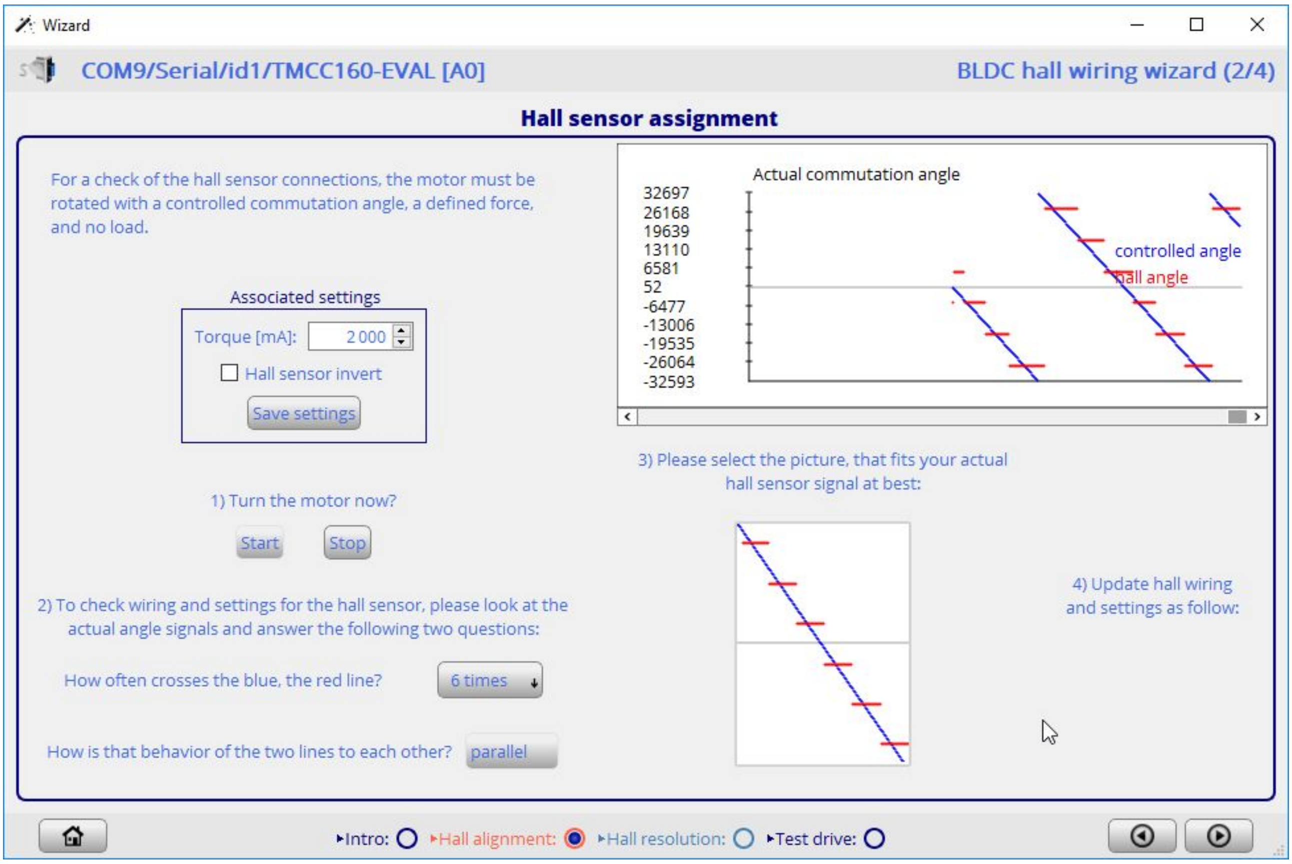
0 cmds/sec | MEM: 105 008 KB | CPU: 2 %

*Figure 8: TMCC160-EVAL in the TMCL-IDE*

The wizards can be used to check the Encoder and Hall settings. If encoder and hall feedback are used, it is recommended to execute the Hall Wizard first. In the wizards the detailed steps are given.

## 3.2 Hall Wizard

1. Check the halls signals.



Wizard

COM9/Serial/id1/TMCC160-EVAL [A0] BLDC hall wiring wizard (2/4)

Hall sensor assignment

For a check of the hall sensor connections, the motor must be rotated with a controlled commutation angle, a defined force, and no load.

Associated settings

Torque [mA]: 2 000

□ Hall sensor invert

1) Turn the motor now?

2) To check wiring and settings for the hall sensor, please look at the actual angle signals and answer the following two questions:

How often crosses the blue, the red line? 6 times

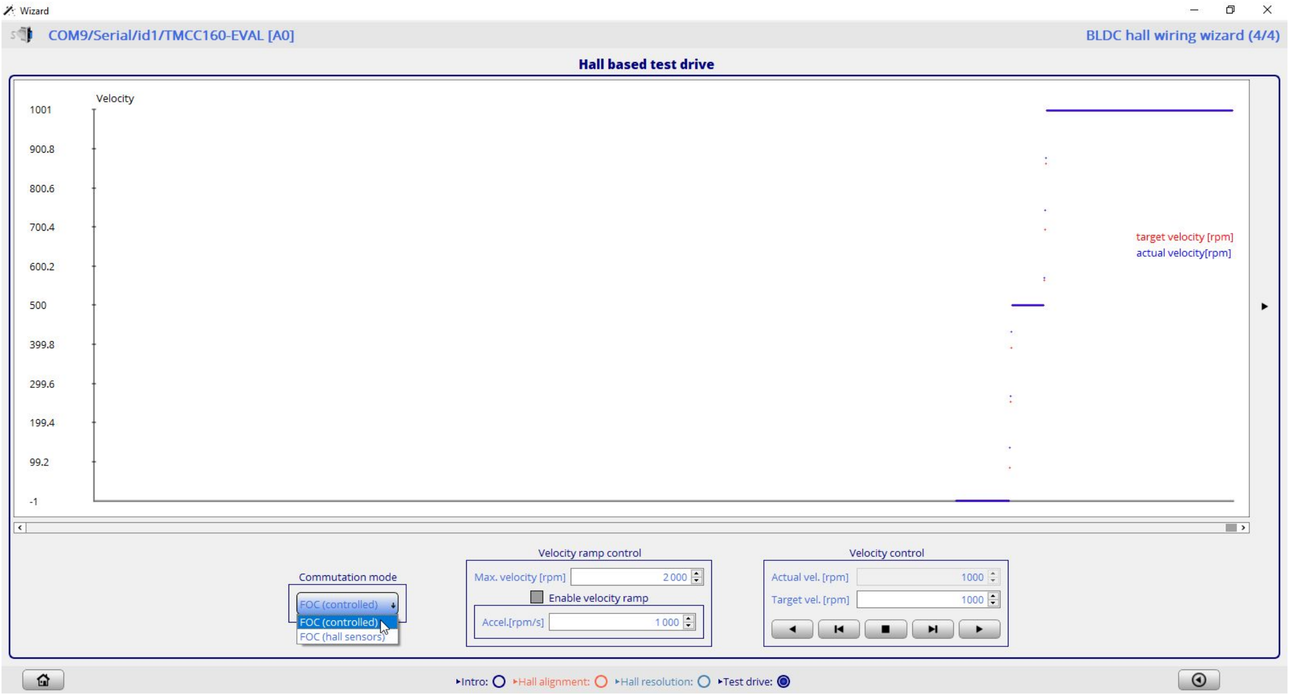
How is that behavior of the two lines to each other? parallel

3) Please select the picture, that fits your actual hall sensor signal at best:

4) Update hall wiring and settings as follow:

*Figure 9: Hall Wizard - Hall alignment*

2. In the Test Drive window the Motor can be run in open loop (Controlled Mode) or with in closed loop (FOC (hallsensor)).


Wizard
COM9/Serial/id1/TMCC160-EVAL [A0]
BLDC hall wiring wizard (4/4)
Hall based test drive
Velocity
1001
900.8
800.6
700.4
600.2
500
399.8
299.6
199.4
99.2
-1
target velocity [rpm]
actual velocity[rpm]
▸Intro: ○ ▸Hall alignment: ○ ▸Hall resolution: ○ ▸Test drive: ●

Commutation mode: FOC (controlled)
FOC (controlled)
FOC (hall sensors)

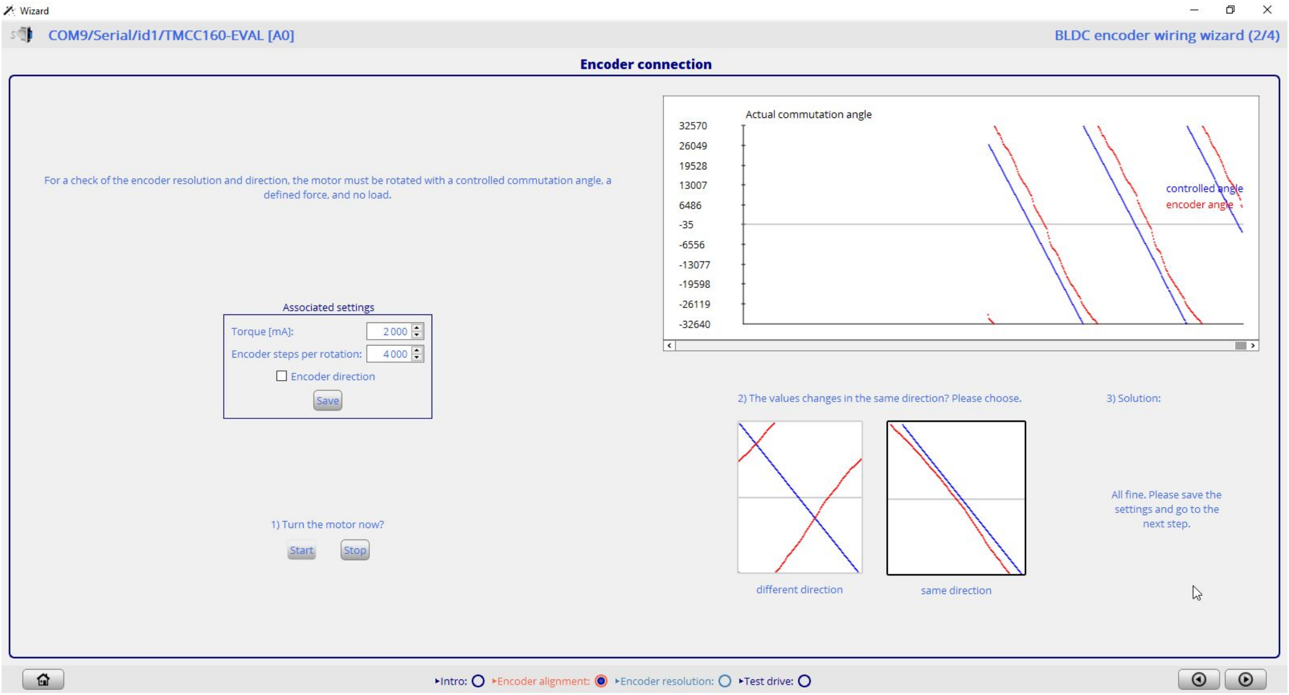
Velocity ramp control
Max. velocity [rpm] 2 000
Enable velocity ramp
Accel.[rpm/s] 1 000

Velocity control
Actual vel. [rpm] 1000
Target vel. [rpm] 1000

*Figure 10: Hall Wizard - test drive*

## 3.3 Encoder Wizard

1. In the encoder alignment window the Encoder signals and their direction can be checked.



For a check of the encoder resolution and direction, the motor must be rotated with a controlled commutation angle, a defined force, and no load.

Associated settings
Torque [mA]: 2 000
Encoder steps per rotation: 4 000
□ Encoder direction
Save

1) Turn the motor now?
Start Stop

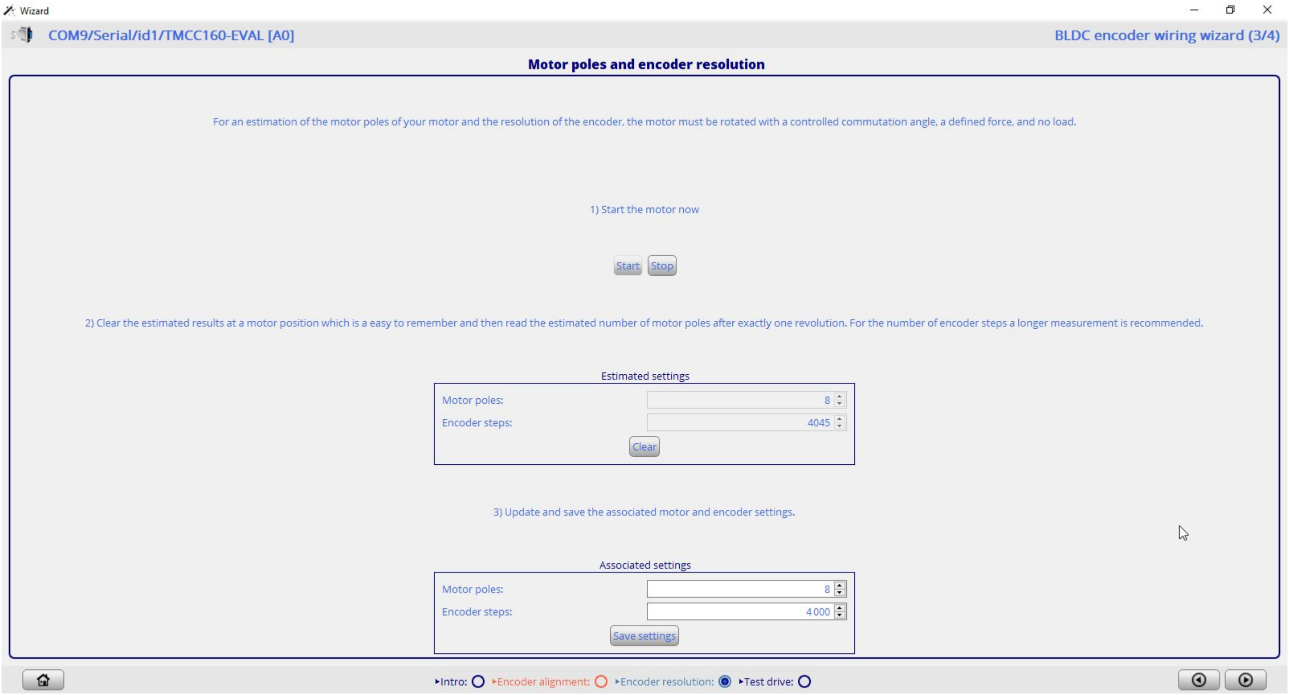
2) The values changes in the same direction? Please choose.

3) Solution:

All fine. Please save the settings and go to the next step.

*Figure 11: Encoder Wizard - Encoder alignment*

2. Setting of the encoder resolution and number motor pole pairs.



Wizard

COM9/Serial/id1/TMCC160-EVAL [A0] BLDC encoder wiring wizard (3/4)

Motor poles and encoder resolution

For an estimation of the motor poles of your motor and the resolution of the encoder, the motor must be rotated with a controlled commutation angle, a defined force, and no load.

1) Start the motor now

Start Stop

2) Clear the estimated results at a motor position which is a easy to remember and then read the estimated number of motor poles after exactly one revolution. For the number of encoder steps a longer measurement is recommended.

Estimated settings

Motor poles: 8

Encoder steps: 4045

Clear

3) Update and save the associated motor and encoder settings.

Associated settings

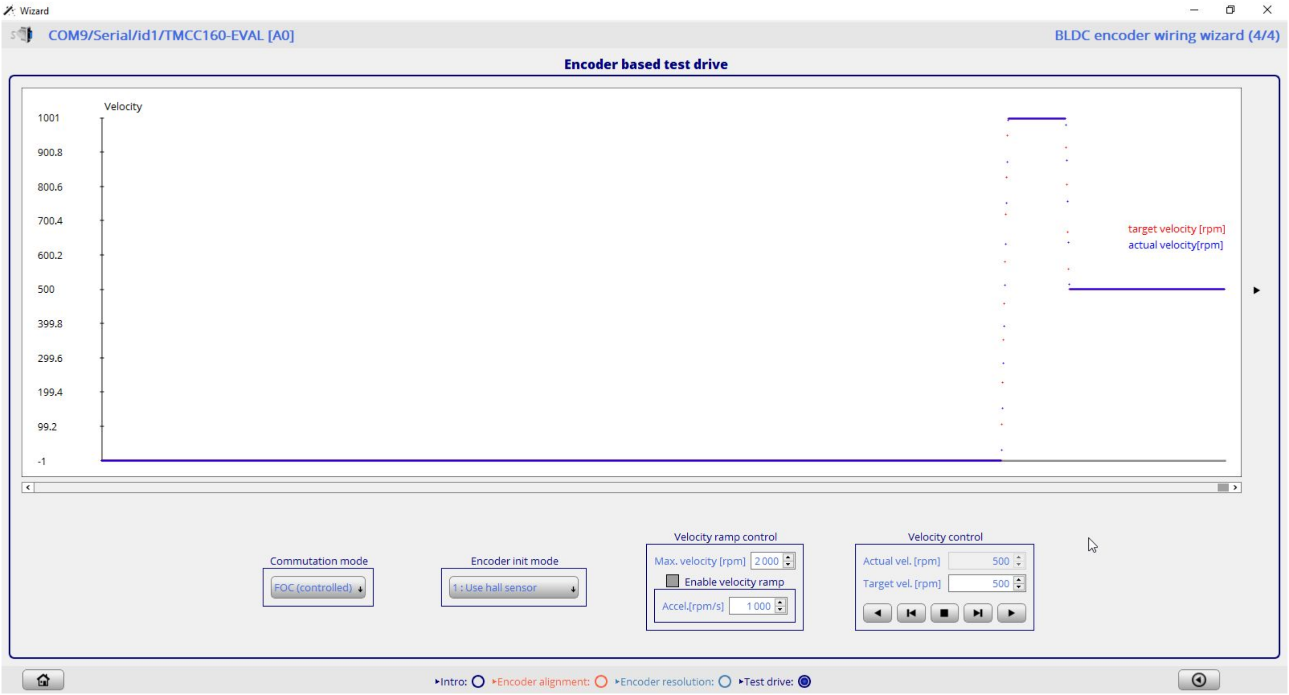
Motor poles: 8

Encoder steps: 4 000

Save settings

▸Intro: ○ ▸Encoder alignment: ○ ▸Encoder resolution: ● ▸Test drive: ○

Figure 12: Encoder Wizard - Encoder resolution



Wizard

COM9/Serial/id1/TMCC160-EVAL [A0] BLDC encoder wiring wizard (4/4)

Encoder based test drive

Commutation mode: FOC (controlled)

Encoder init mode: 1 : Use hall sensor

Velocity ramp control

Max. velocity [rpm] 2 000

□ Enable velocity ramp

Accel.[rpm/s] 1 000

Velocity control

Actual vel. [rpm] 500

Target vel. [rpm] 500

▸Intro: ○ ▸Encoder alignment: ○ ▸Encoder resolution: ○ ▸Test drive: ●

Figure 13: Encoder Wizard - Test drive

The TMCC160 needs to be powercycled for the encoder change to become effective.

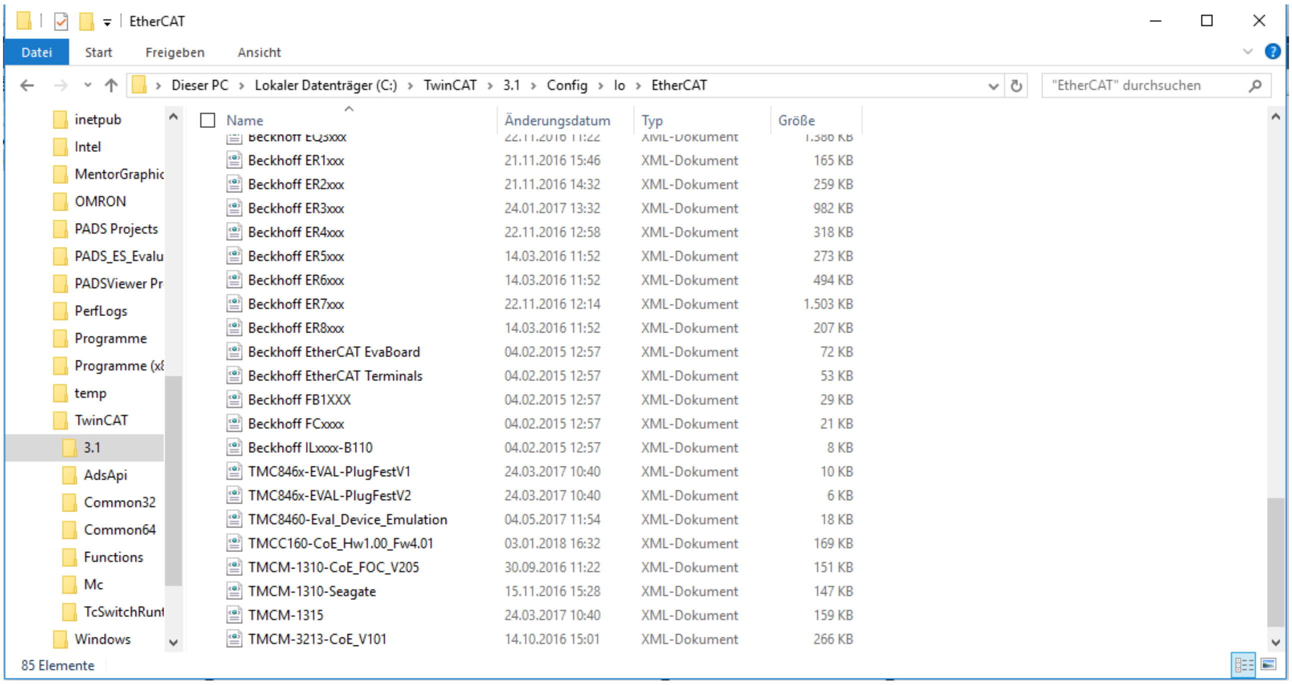
# 4 Interfacing with TwinCAT

## 4.1 TwinCAT Master

For the following steps TwinCAT3 Engineering version will be used.

## 4.2 Include the ESI File

Include the ESI file in TwinCAT. The ESI file can be found on the TMCC160 page. Put the TMCC160-LC CoE_Hw1.00_Fw4.01.xml into the following TwinCAT folder: ..\TwinCAT\3.1 \Config\Io\EtherCAT



| Name | Änderungsdatum | Typ | Größe |
|---|---|---|---|
| Beckhoff EQ3xxx | 22.11.2016 11:22 | XML-Dokument | 1.380 KB |
| Beckhoff ER1xxx | 21.11.2016 15:46 | XML-Dokument | 165 KB |
| Beckhoff ER2xxx | 21.11.2016 14:32 | XML-Dokument | 259 KB |
| Beckhoff ER3xxx | 24.01.2017 13:32 | XML-Dokument | 982 KB |
| Beckhoff ER4xxx | 22.11.2016 12:58 | XML-Dokument | 318 KB |
| Beckhoff ER5xxx | 14.03.2016 11:52 | XML-Dokument | 273 KB |
| Beckhoff ER6xxx | 14.03.2016 11:52 | XML-Dokument | 494 KB |
| Beckhoff ER7xxx | 22.11.2016 12:14 | XML-Dokument | 1.503 KB |
| Beckhoff ER8xxx | 14.03.2016 11:52 | XML-Dokument | 207 KB |
| Beckhoff EtherCAT EvaBoard | 04.02.2015 12:57 | XML-Dokument | 72 KB |
| Beckhoff EtherCAT Terminals | 04.02.2015 12:57 | XML-Dokument | 53 KB |
| Beckhoff FB1XXX | 04.02.2015 12:57 | XML-Dokument | 29 KB |
| Beckhoff FCxxxx | 04.02.2015 12:57 | XML-Dokument | 21 KB |
| Beckhoff ILxxxx-B110 | 04.02.2015 12:57 | XML-Dokument | 8 KB |
| TMC846x-EVAL-PlugFestV1 | 24.03.2017 10:40 | XML-Dokument | 10 KB |
| TMC846x-EVAL-PlugFestV2 | 24.03.2017 10:40 | XML-Dokument | 6 KB |
| TMC8460-Eval_Device_Emulation | 04.05.2017 11:54 | XML-Dokument | 18 KB |
| TMCC160-CoE_Hw1.00_Fw4.01 | 03.01.2018 16:32 | XML-Dokument | 169 KB |
| TMCM-1310-CoE_FOC_V205 | 30.09.2016 11:22 | XML-Dokument | 151 KB |
| TMCM-1310-Seagate | 15.11.2016 15:28 | XML-Dokument | 147 KB |
| TMCM-1315 | 24.03.2017 10:40 | XML-Dokument | 159 KB |
| TMCM-3213-CoE_V101 | 14.10.2016 15:01 | XML-Dokument | 266 KB |

*Figure 14: Copy the .xml to TwinCAT folder*

## 4.3 Add the TMCC160-EVAL to TwinCAT

Connect the Evalboard with the PC with an Ethernet cable (CAT5 is sufficient).

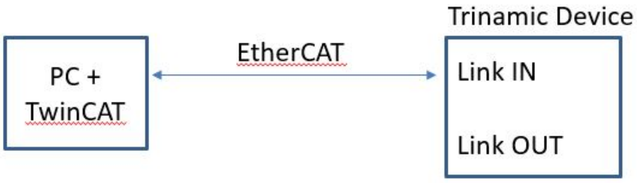


*Figure 15: Connection EtherCAT Master and Slave*

1. Open TwinCAT XAE (VS2013)
2. Create *TwinCAT XAE Project (XML Format)*
3. I/O → Devices → Scan

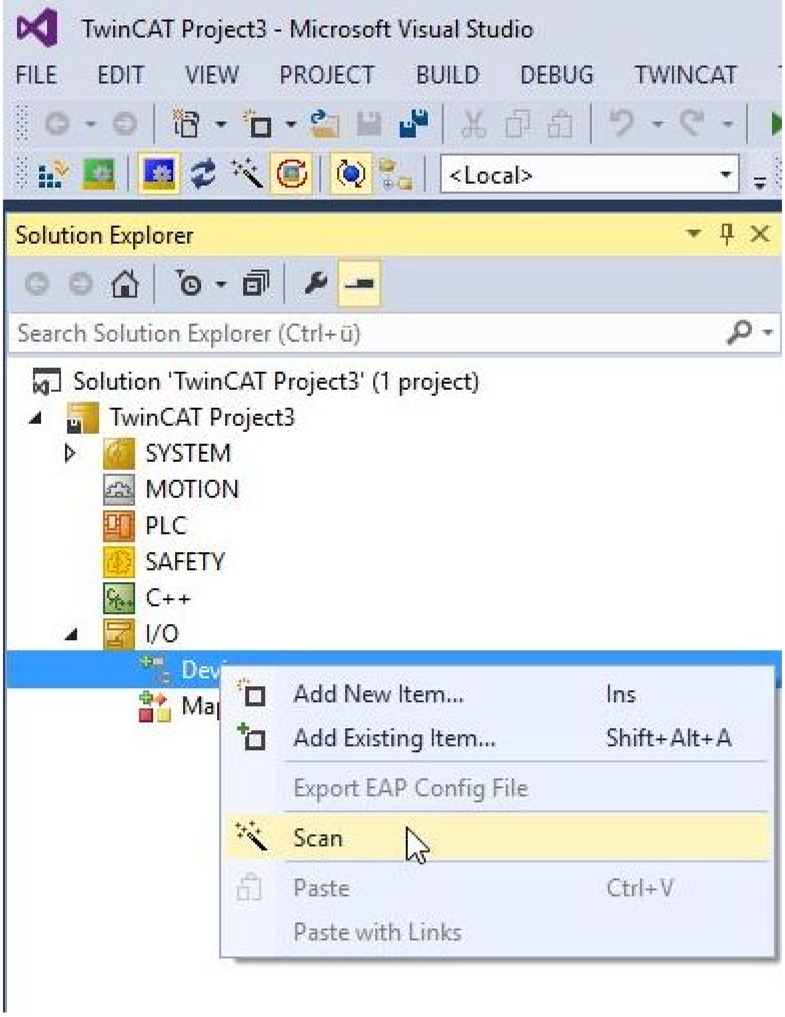
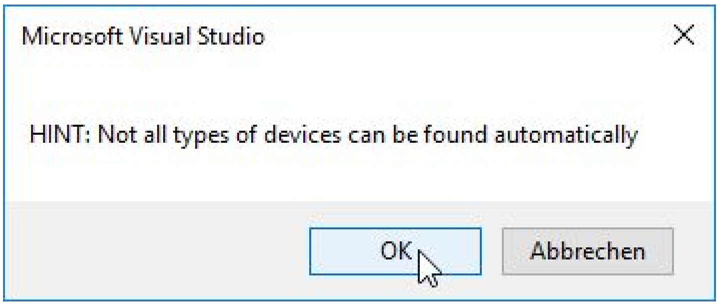
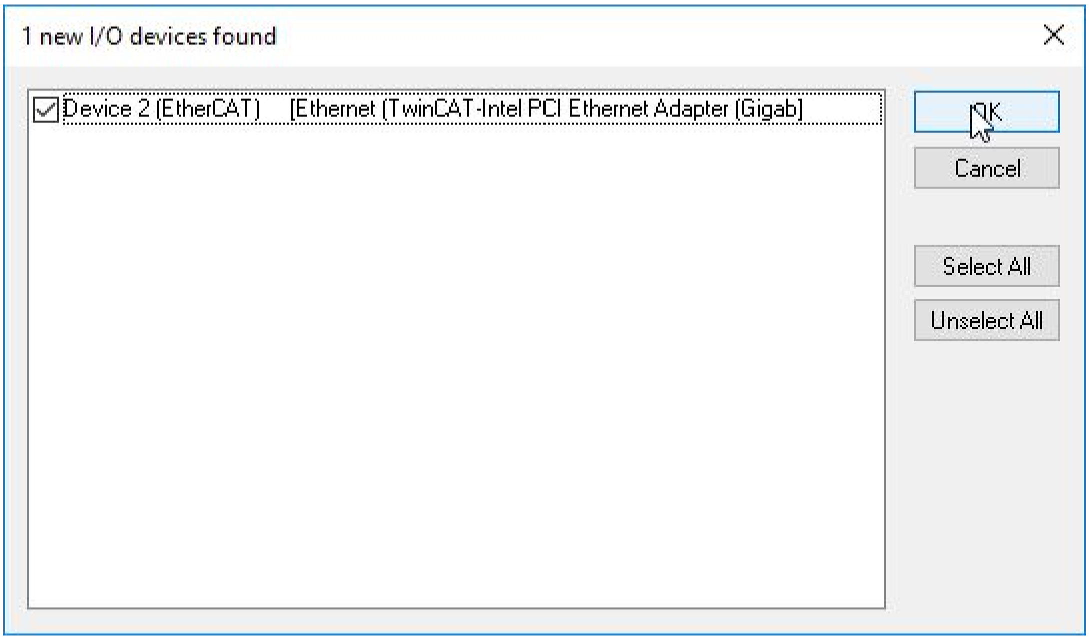


*Figure 16: Scan for the TMCC160-EVAL*


Microsoft Visual Studio

HINT: Not all types of devices can be found automatically

*Figure 17: Confirm*

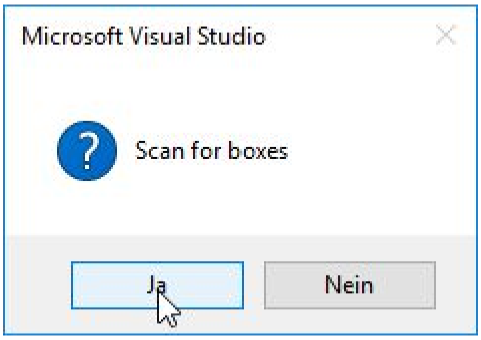


1 new I/O devices found

☑ Device 2 (EtherCAT) [Ethernet (TwinCAT-Intel PCI Ethernet Adapter (Gigab)]

*Figure 18: Found EtherCAT devices are displayed*

4. Scan for boxes → *yes*
   (Modul is a box)

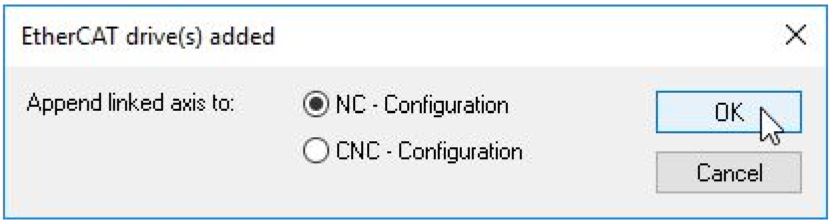


Microsoft Visual Studio

Scan for boxes

*Figure 19: Scan for boxes*

5. NC configuration → *OK*

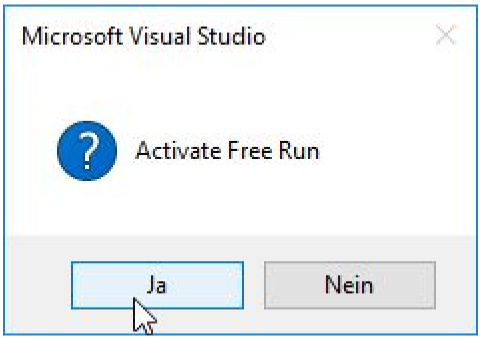


EtherCAT drive(s) added

Append linked axis to: ● NC - Configuration ○ CNC - Configuration

*Figure 20: NC-configuration*

6. Activate Free run → *yes*
   (activate PDOs)



Microsoft Visual Studio

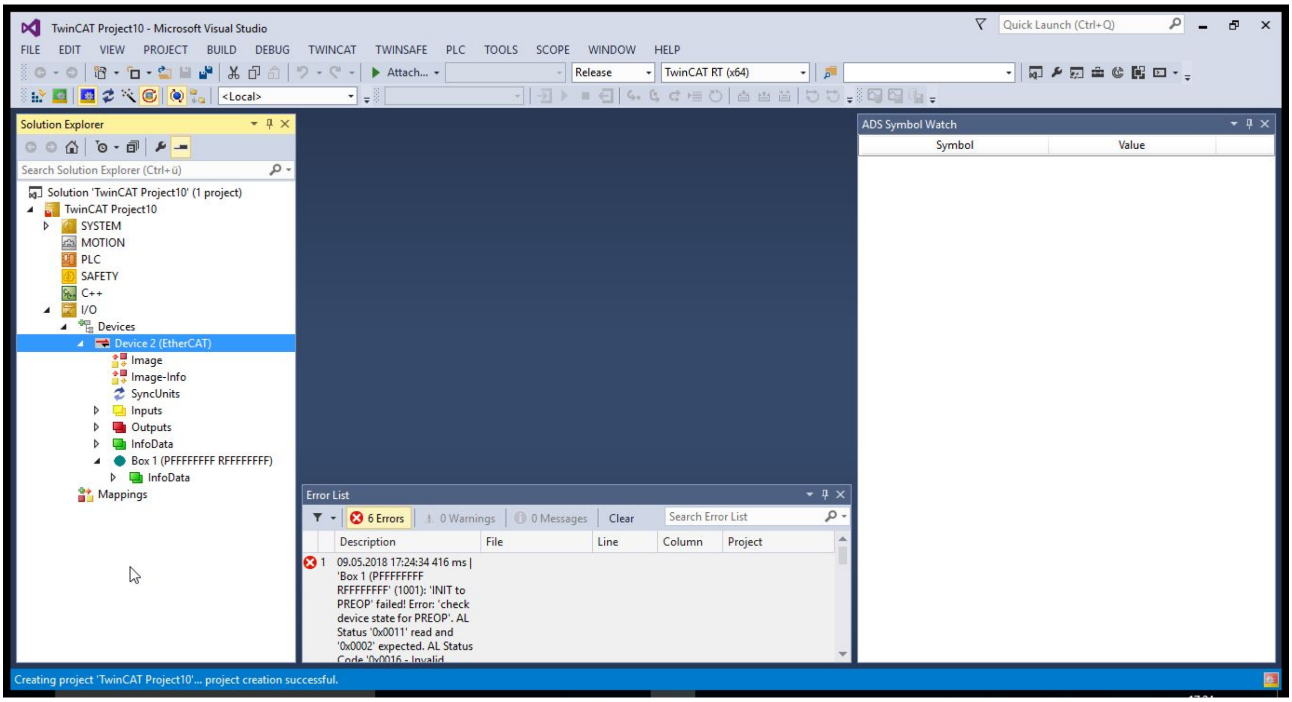
Activate Free Run

*Figure 21: Activate Free Run*

The TMCC160 Evalboard is displayed as *Drive 1 (TMCC160)* as depicted in 25.
If displayed as *Box (..)* as in Figure 23 the steps described in 4.4 should be executed.

## 4.4 How to update the EEPROM

This section will describe an EEPROM Update. If the Device shows as *Box1* a EEPROM update is mandatory.

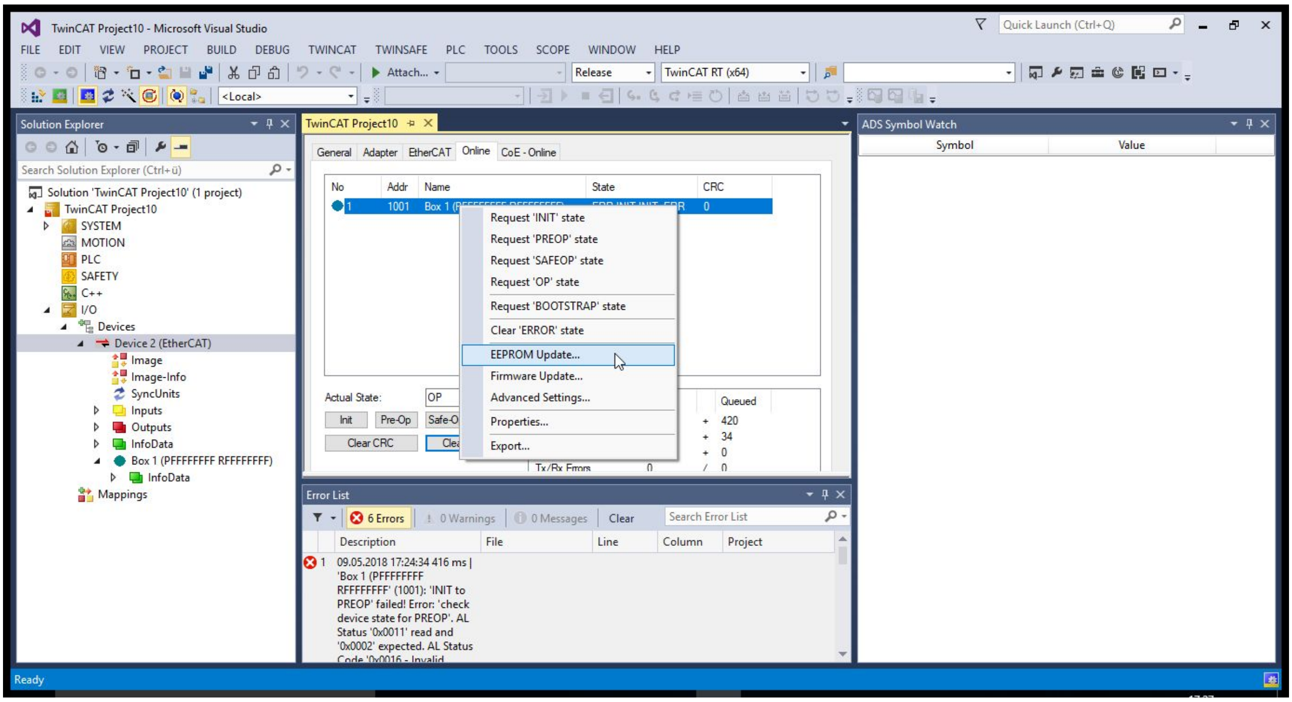


1 09.05.2018 17:24:34 416 ms | 'Box 1 (PFFFFFFFF RFFFFFFFF' (1001): 'INIT to PREOP' failed! Error: 'check device state for PREOP'. AL Status '0x0011' read and '0x0002' expected. AL Status Code '0x0016 - Invalid

Creating project 'TwinCAT Project10'... project creation successful.

*Figure 22: TMCC160 without EEPROM update*

1. Doubleclick *Box 1(..)* → Online → Rightclick EEPROM Update



1 09.05.2018 17:24:34 416 ms | 'Box 1 (PFFFFFFFF RFFFFFFFF' (1001): 'INIT to PREOP' failed! Error: 'check device state for PREOP'. AL Status '0x0011' read and '0x0002' expected. AL Status Code '0x0016 - Invalid

*Figure 23: Update EEPROM of TMCC160-EVAL*

2. Select the TMCC160 Drive
   Note: In case the drive doesn't show up the .xml has yet to be put into the the TwinCAT I/O folder.

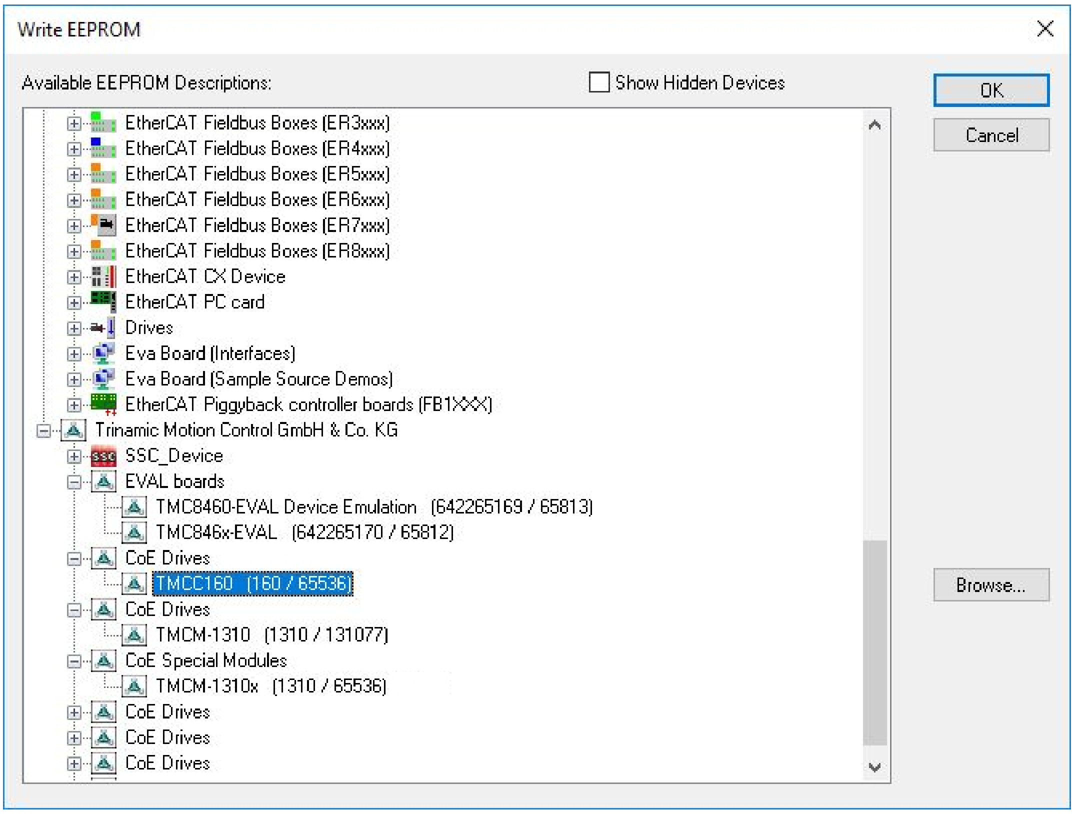
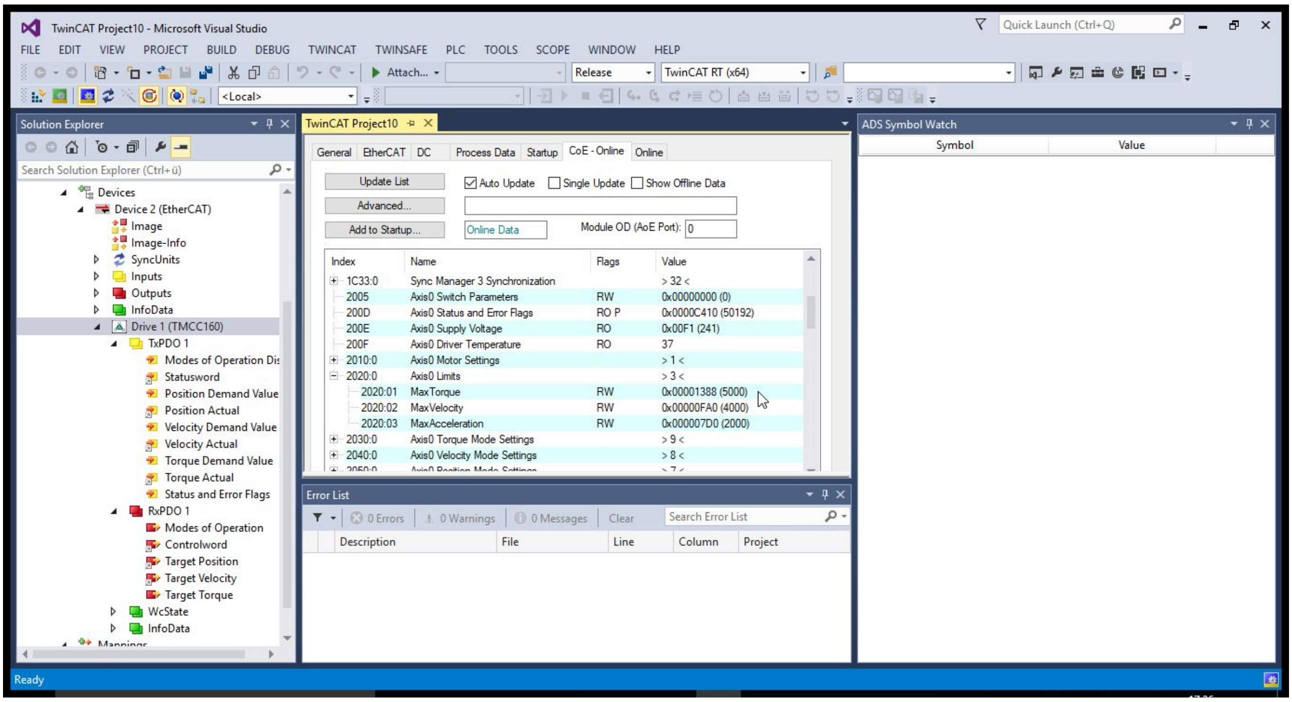

Write EEPROM
Available EEPROM Descriptions:
□ Show Hidden Devices
OK
Cancel
Browse...
EtherCAT Fieldbus Boxes (ER3xxx)
EtherCAT Fieldbus Boxes (ER4xxx)
EtherCAT Fieldbus Boxes (ER5xxx)
EtherCAT Fieldbus Boxes (ER6xxx)
EtherCAT Fieldbus Boxes (ER7xxx)
EtherCAT Fieldbus Boxes (ER8xxx)
EtherCAT CX Device
EtherCAT PC card
Drives
Eva Board (Interfaces)
Eva Board (Sample Source Demos)
EtherCAT Piggyback controller boards (FB1XXX)
Trinamic Motion Control GmbH & Co. KG
SSC_Device
EVAL boards
TMC8460-EVAL Device Emulation (642265169 / 65813)
TMC846x-EVAL (642265170 / 65812)
CoE Drives
TMCC160 (160 / 65536)
CoE Drives
TMCM-1310 (1310 / 131077)
CoE Special Modules
TMCM-1310x (1310 / 65536)
CoE Drives
CoE Drives
CoE Drives

*Figure 24: Selection of the TMCC160 device description*

3. After update is completed, power cycle and remove and reconnect the device. Alternatively create a new TwinCAT project. If the EEPROM update was successful the Evalboard will show as TMCC160 with the Trinamic Logo.



☑ Auto Update ☐ Single Update ☐ Show Offline Data

Online Data

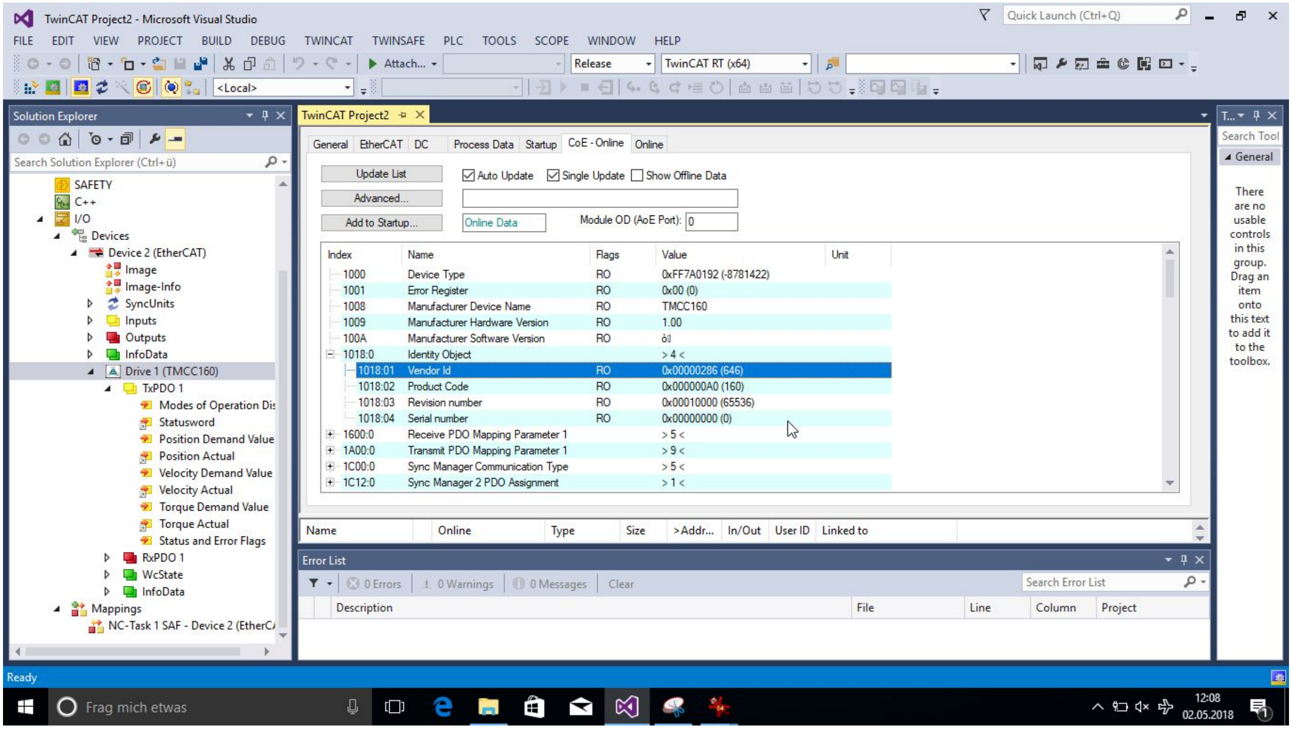
Module OD (AoE Port): 0

| Index | Name | Flags | Value |
|---|---|---|---|
| 1C33:0 | Sync Manager 3 Synchronization | | > 32 < |
| 2005 | Axis0 Switch Parameters | RW | 0x00000000 (0) |
| 200D | Axis0 Status and Error Flags | RO P | 0x0000C410 (50192) |
| 200E | Axis0 Supply Voltage | RO | 0x00F1 (241) |
| 200F | Axis0 Driver Temperature | RO | 37 |
| 2010:0 | Axis0 Motor Settings | | > 1 < |
| 2020:0 | Axis0 Limits | | > 3 < |
| 2020:01 | MaxTorque | RW | 0x00001388 (5000) |
| 2020:02 | MaxVelocity | RW | 0x00000FA0 (4000) |
| 2020:03 | MaxAcceleration | RW | 0x000007D0 (2000) |
| 2030:0 | Axis0 Torque Mode Settings | | > 9 < |
| 2040:0 | Axis0 Velocity Mode Settings | | > 8 < |
| 2050:0 | Axis0 Position Mode Settings | | > 7 < |

*Figure 25: TMCC160-EVAL in TwinCAT*

## 4.5 Check the connectivity with TwinCAT

Under the Tab CoE-Online the communication of TwinCAT with the Evalboard can be checked by reading the SDOs such as the Vendor Id (Object x1018:01) or the Driver Temperature (Object 0x200F).



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

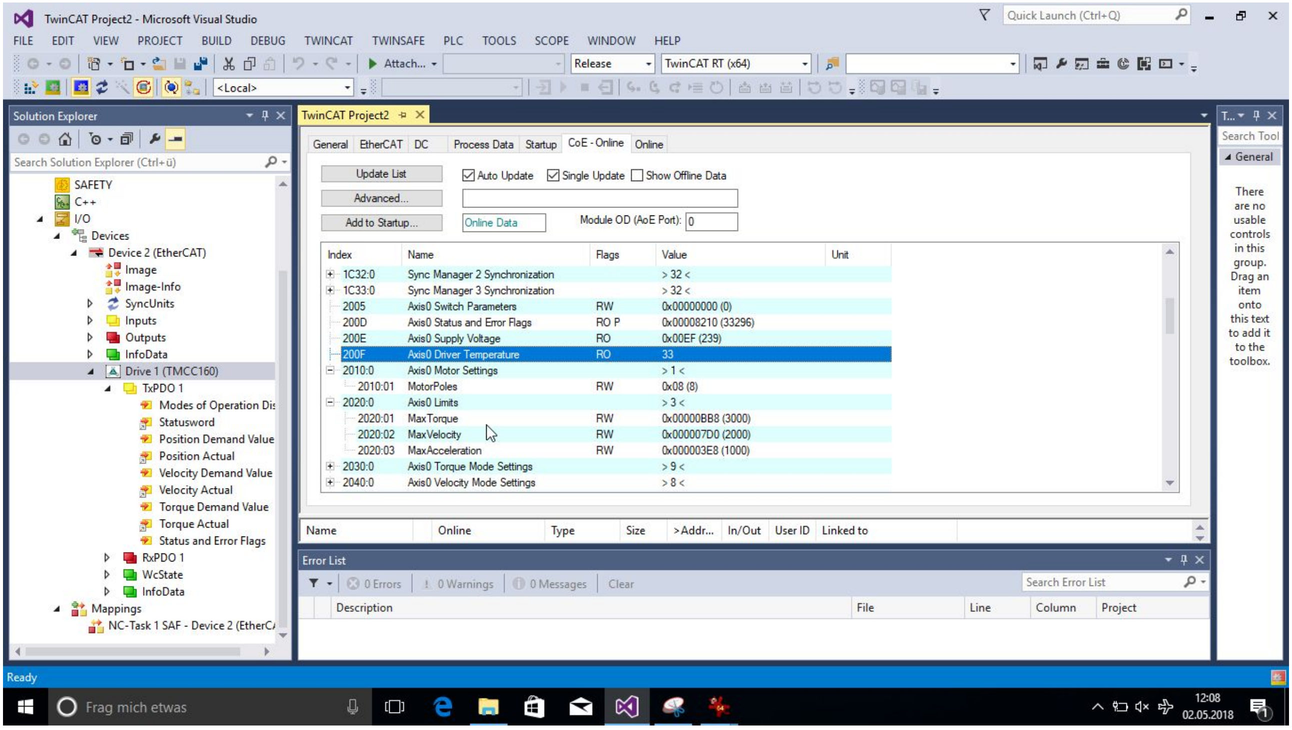
Update List | ☑ Auto Update | ☑ Single Update | ☐ Show Offline Data

Advanced...

Add to Startup... | Online Data | Module OD (AoE Port): 0

| Index | Name | Flags | Value | Unit |
|---|---|---|---|---|
| 1000 | Device Type | RO | 0xFF7A0192 (-8781422) | |
| 1001 | Error Register | RO | 0x00 (0) | |
| 1008 | Manufacturer Device Name | RO | TMCC160 | |
| 1009 | Manufacturer Hardware Version | RO | 1.00 | |
| 100A | Manufacturer Software Version | RO | ò | |
| 1018:0 | Identity Object | | > 4 < | |
| 1018:01 | Vendor Id | RO | 0x00000286 (646) | |
| 1018:02 | Product Code | RO | 0x000000A0 (160) | |
| 1018:03 | Revision number | RO | 0x00010000 (65536) | |
| 1018:04 | Serial number | RO | 0x00000000 (0) | |
| 1600:0 | Receive PDO Mapping Parameter 1 | | > 5 < | |
| 1A00:0 | Transmit PDO Mapping Parameter 1 | | > 9 < | |
| 1C00:0 | Sync Manager Communication Type | | > 5 < | |
| 1C12:0 | Sync Manager 2 PDO Assignment | | > 1 < | |

Figure 26: EtherCAT SDO Object: 0x1018:01 - Vendor ID


TwinCAT Project2 - Microsoft Visual Studio
FILE EDIT VIEW PROJECT BUILD DEBUG TWINCAT TWINSAFE PLC TOOLS SCOPE WINDOW HELP
Release
TwinCAT RT (x64)
Solution Explorer
Drive 1 (TMCC160)
TwinCAT Project2
Error List
Ready
12:08
02.05.2018

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

Update List | ☑ Auto Update | ☑ Single Update | ☐ Show Offline Data

Advanced...

Add to Startup... | Online Data | Module OD (AoE Port): 0

| Index | Name | Flags | Value | Unit |
|---|---|---|---|---|
| 1C32:0 | Sync Manager 2 Synchronization | | > 32 < | |
| 1C33:0 | Sync Manager 3 Synchronization | | > 32 < | |
| 2005 | Axis0 Switch Parameters | RW | 0x00000000 (0) | |
| 200D | Axis0 Status and Error Flags | RO P | 0x00008210 (33296) | |
| 200E | Axis0 Supply Voltage | RO | 0x00EF (239) | |
| 200F | Axis0 Driver Temperature | RO | 33 | |
| 2010:0 | Axis0 Motor Settings | | > 1 < | |
| 2010:01 | MotorPoles | RW | 0x08 (8) | |
| 2020:0 | Axis0 Limits | | > 3 < | |
| 2020:01 | MaxTorque | RW | 0x00000BB8 (3000) | |
| 2020:02 | MaxVelocity | RW | 0x000007D0 (2000) | |
| 2020:03 | MaxAcceleration | RW | 0x000003E8 (1000) | |
| 2030:0 | Axis0 Torque Mode Settings | | > 9 < | |
| 2040:0 | Axis0 Velocity Mode Settings | | > 8 < | |

Figure 27: EtherCAT SDO Object: 0x200F - temperature

# 5 How to move the motor with TwinCAT

In the following section the operation of the TMCC160 in the different Modes of Operation are described.

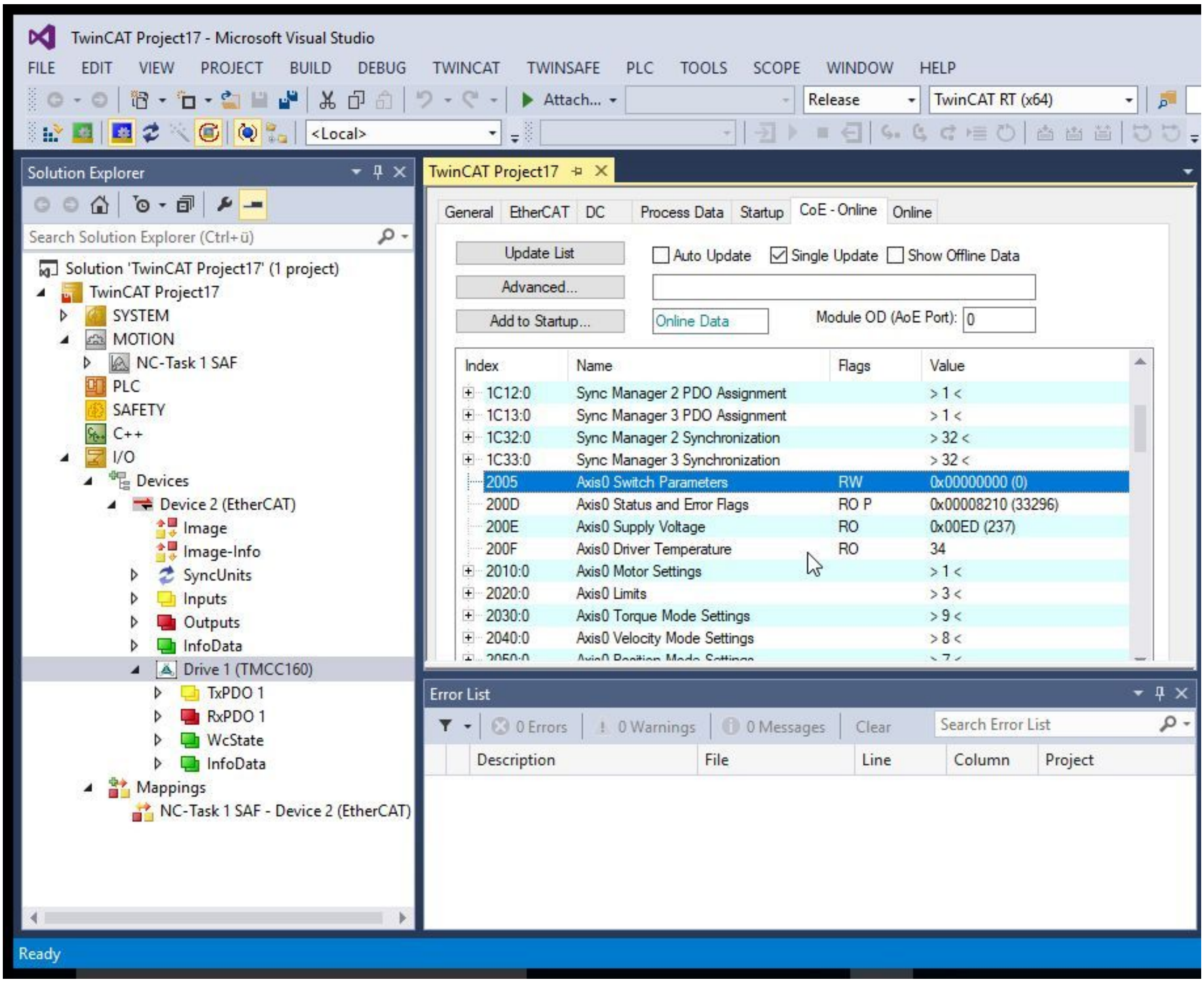
These modes of operation are supported by the TMCC160:

- PP, Profile Position
- PV, Profile Velocity
- Homing Mode
- CSP, Cyclic Synchonous Position
- CSV, Cyclic Synchonous Velocity
- CST, Cyclic Synchronous Torque Mode

In this guide the PP and PV will be covered. The SDOs and PDOs for the TMCC160-EVAL are being written. TwinCAT will be used in Config Mode. For further information refer to the TMCC160-LC CoE Firmware Datasheet.

## 5.1 How to move the motor in Profile Position Mode

1. If no limit switches are connected, the limit switch inputs needs to be disabled.
   Drive 1 (TMCC160) → CoE-Online → write 3 to object 0x2005

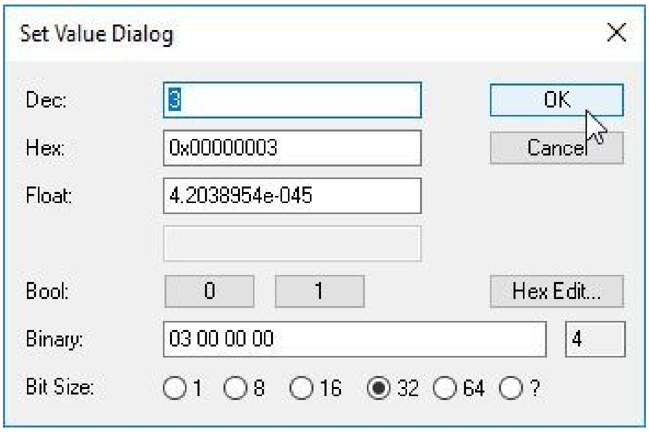

TwinCAT Project17 - Microsoft Visual Studio
FILE EDIT VIEW PROJECT BUILD DEBUG TWINCAT TWINSAFE PLC TOOLS SCOPE WINDOW HELP
Attach...
Release
TwinCAT RT (x64)
<Local>
Solution Explorer
Search Solution Explorer (Ctrl+ü)
Solution 'TwinCAT Project17' (1 project)
TwinCAT Project17
SYSTEM
MOTION
NC-Task 1 SAF
PLC
SAFETY
C++
I/O
Devices
Device 2 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Outputs
InfoData
Drive 1 (TMCC160)
TxPDO 1
RxPDO 1
WcState
InfoData
Mappings
NC-Task 1 SAF - Device 2 (EtherCAT)
TwinCAT Project17
General EtherCAT DC Process Data Startup CoE - Online Online
Update List
Advanced...
Add to Startup...
Online Data
Error List
0 Errors 0 Warnings 0 Messages Clear
Search Error List
Description File Line Column Project
Ready

☐ Auto Update ☑ Single Update ☐ Show Offline Data

Module OD (AoE Port): 0

| Index | Name | Flags | Value |
|---|---|---|---|
| 1C12:0 | Sync Manager 2 PDO Assignment | | > 1 < |
| 1C13:0 | Sync Manager 3 PDO Assignment | | > 1 < |
| 1C32:0 | Sync Manager 2 Synchronization | | > 32 < |
| 1C33:0 | Sync Manager 3 Synchronization | | > 32 < |
| 2005 | Axis0 Switch Parameters | RW | 0x00000000 (0) |
| 200D | Axis0 Status and Error Flags | RO P | 0x00008210 (33296) |
| 200E | Axis0 Supply Voltage | RO | 0x00ED (237) |
| 200F | Axis0 Driver Temperature | RO | 34 |
| 2010:0 | Axis0 Motor Settings | | > 1 < |
| 2020:0 | Axis0 Limits | | > 3 < |
| 2030:0 | Axis0 Torque Mode Settings | | > 9 < |
| 2040:0 | Axis0 Velocity Mode Settings | | > 8 < |
| 2050:0 | Axis0 Position Mode Settings | | > 7 < |

*Figure 28: Write an SDO*



Dec: 3

Hex: 0x00000003

Float: 4.2038954e-045

Bool: 0 1

Binary: 03 00 00 00 4

Bit Size: ○ 1 ○ 8 ○ 16 ● 32 ○ 64 ○ ?

2. Write 1 to the PDO Object Modes of Operation (0x6060) to choose the Profile Position Mode.

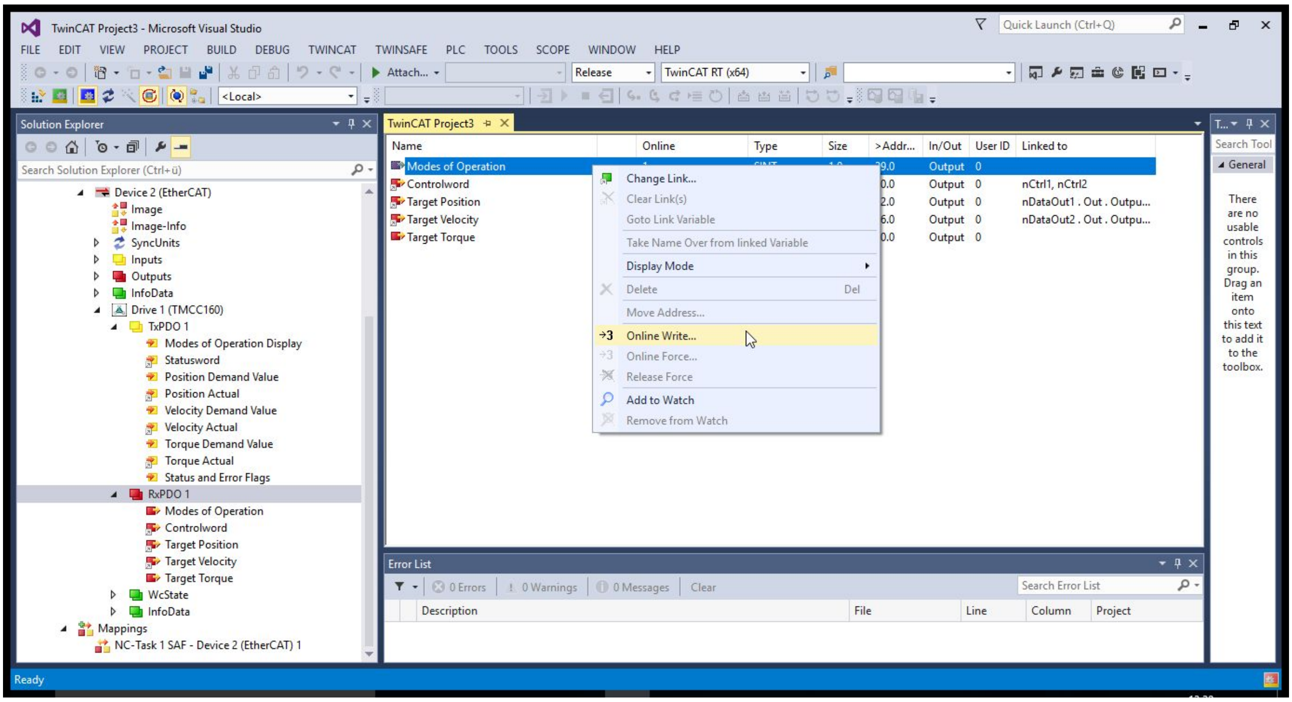
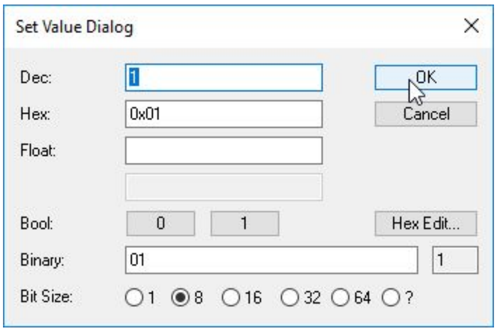


*Figure 29: Write an Value to PDO*



Dec: 1

Hex: 0x01

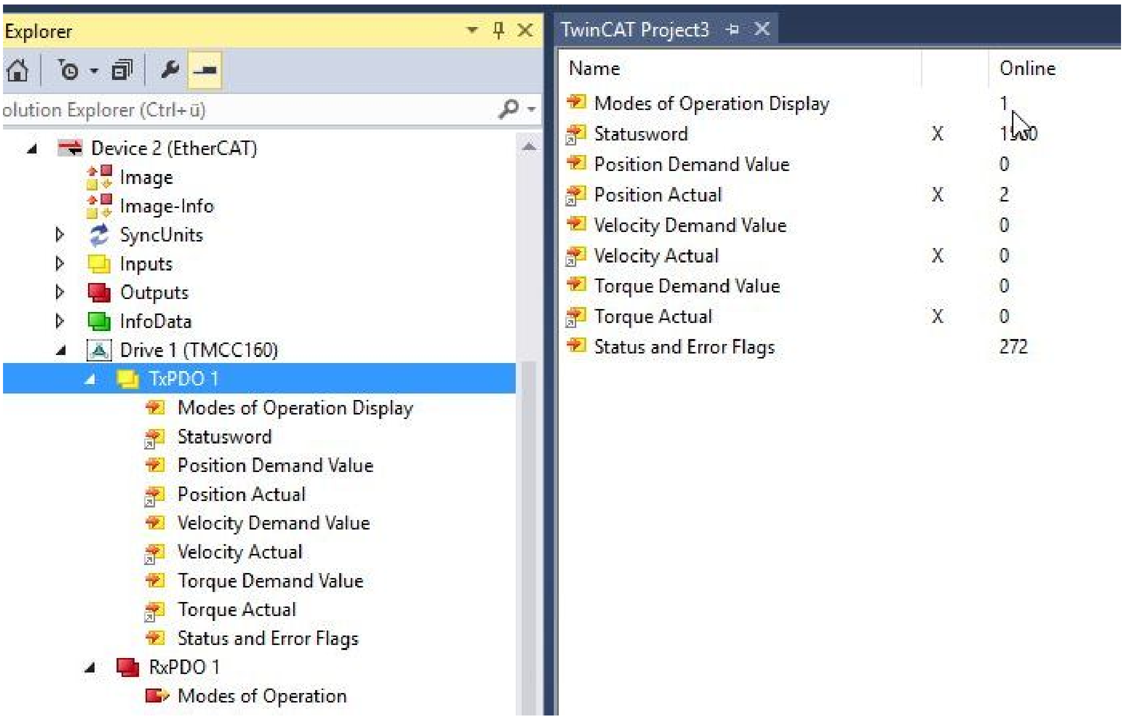
Float:

Bool: 0 1

Binary: 01 1

Bit Size: ○ 1 ● 8 ○ 16 ○ 32 ○ 64 ○ ?

3. Verify by reading the TxPDO which was sent from the Evalboard.



- Device 2 (EtherCAT)
  - Image
  - Image-Info
  - SyncUnits
  - Inputs
  - Outputs
  - InfoData
  - Drive 1 (TMCC160)
    - TxPDO 1
      - Modes of Operation Display
      - Statusword
      - Position Demand Value
      - Position Actual
      - Velocity Demand Value
      - Velocity Actual
      - Torque Demand Value
      - Torque Actual
      - Status and Error Flags
    - RxPDO 1
      - Modes of Operation

| Name | | Online |
|---|---|---|
| Modes of Operation Display | | 1 |
| Statusword | X | 1560 |
| Position Demand Value | | 0 |
| Position Actual | X | 2 |
| Velocity Demand Value | | 0 |
| Velocity Actual | X | 0 |
| Torque Demand Value | | 0 |
| Torque Actual | X | 0 |
| Status and Error Flags | | 272 |

*Figure 30: TXPDO of the TMCC160*

4. Write 6 to the Controlword object (0x6040) to switch to READY_TO_SWITCH_ ON state.
5. Write 7 to Controlword object (0x6040) to switch to SWITCHED_ON state.
6. Write 15 to Controlword object 6040h to switch to OPERATION_ENABLED state.
7. Write the desired target position (e.g. 500000) to object 607Ah.
8. The TMCC160 can be monitored by the TMCL-IDE (via RS232/RS485). Specific parameters can be configured (such as current)

## 5.2 How to move the motor in pv mode

1. Select pv mode by writing 3 to object 6060h (Modes_of_Operation).
2. Write 6 to object 6040h (Controlword) to switch to READY_TO_SWITCH_ON state.
3. Write 7 to object 6040h to switch to SWITCHED_ON state.
4. Write the desired target velocity (e.g. 2000) to object 60FFh (Target_Velocity).
5. Write 15 to object 6040h to switch to OPERATION_ENABLED state. The motor now accelerates to the target velocity.
6. Stop the motor by writing 0 to object 60FFh.

# 6 Revision History

| Version | Date | Author | Description |
|---|---|---|---|
| V1.0 | 25.05.2018 | ED, JPX | Inital version |
| V1.1 | 23.01.2020 | JPX | Added TMC8462 |
| V1.2 | 12.03.2020 | JPX | Correction Table 1: PDI_SPI_MOSI Signal |
| V1.3 | 25.05.2020 | JPX | Added Jumper/wiring note |