



AN54: Ethercat using realtime TC3

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This application note describes how to use Trinamic EtherCAT Stepper controller with TwinCAT 3 in realtime.

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1 Introduction

This appnote shows step by step how to configure realtime operation with TwinCAT3 and Trinamic EtherCAT modules. For example the TMCM-6213 is a six axes controller/driver module for 2-phase bipolar stepper. It supports EtherCAT interface with CoE CiA-402 Drive Profile for all axis. General usage of TwinCAT is not explained.

2 Preparation

It is recommended to update the Trinamic module:

- Firmware
- EEPROM
- ESI file (.xml)

Trinamic module firmware should be at least v1.09. Example for files notation as follows:

- TMCM-6213.xml
- TMCM-6213_CoE_V109.bin
- TMCM-6213_CoE_V109.hex

The files can be downloaded from the module page:

<https://www.trinamic.com/products/modules/details/tmcm-6213/>

3 Create a new TwinCAT XAE project

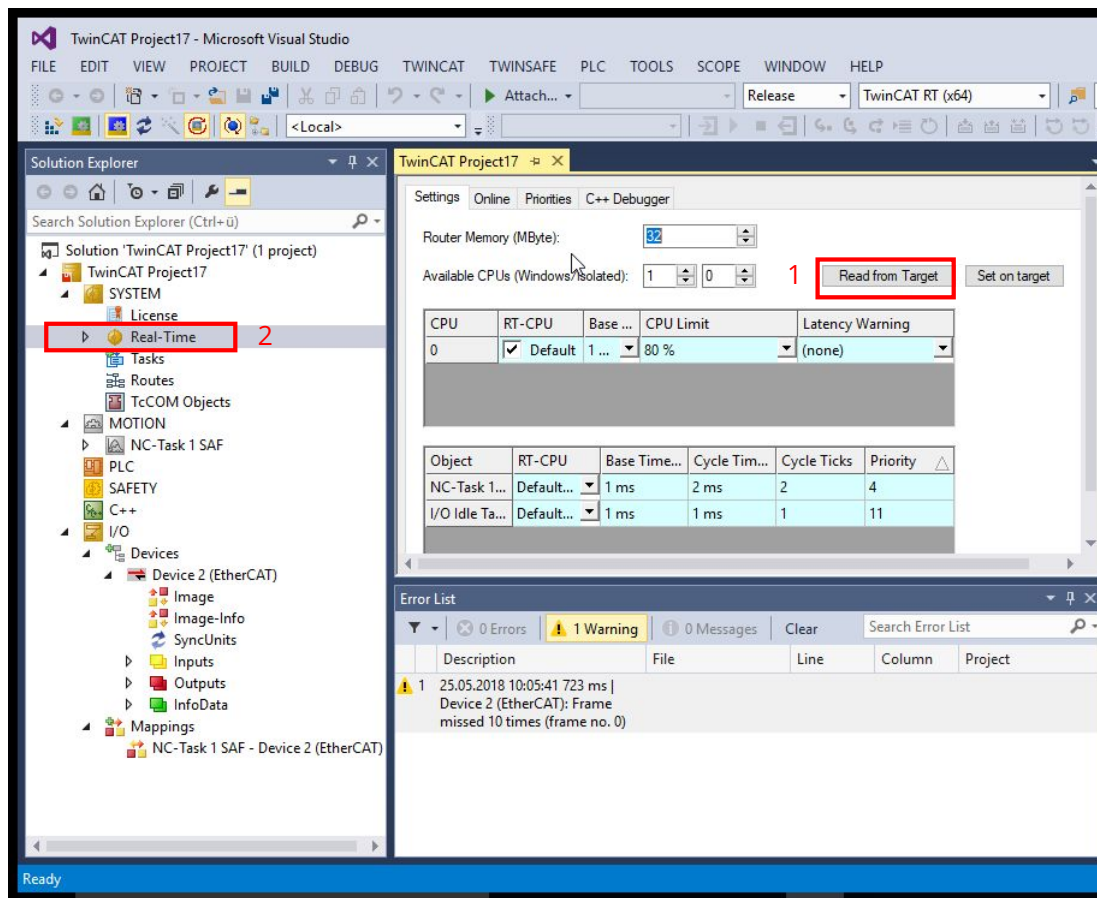
4 Assign dedicated processor core to TwinCAT

Assignment of processor core needs to be done only once !

The processor core will be used for realtime motion NC_Task

1. Read from Target





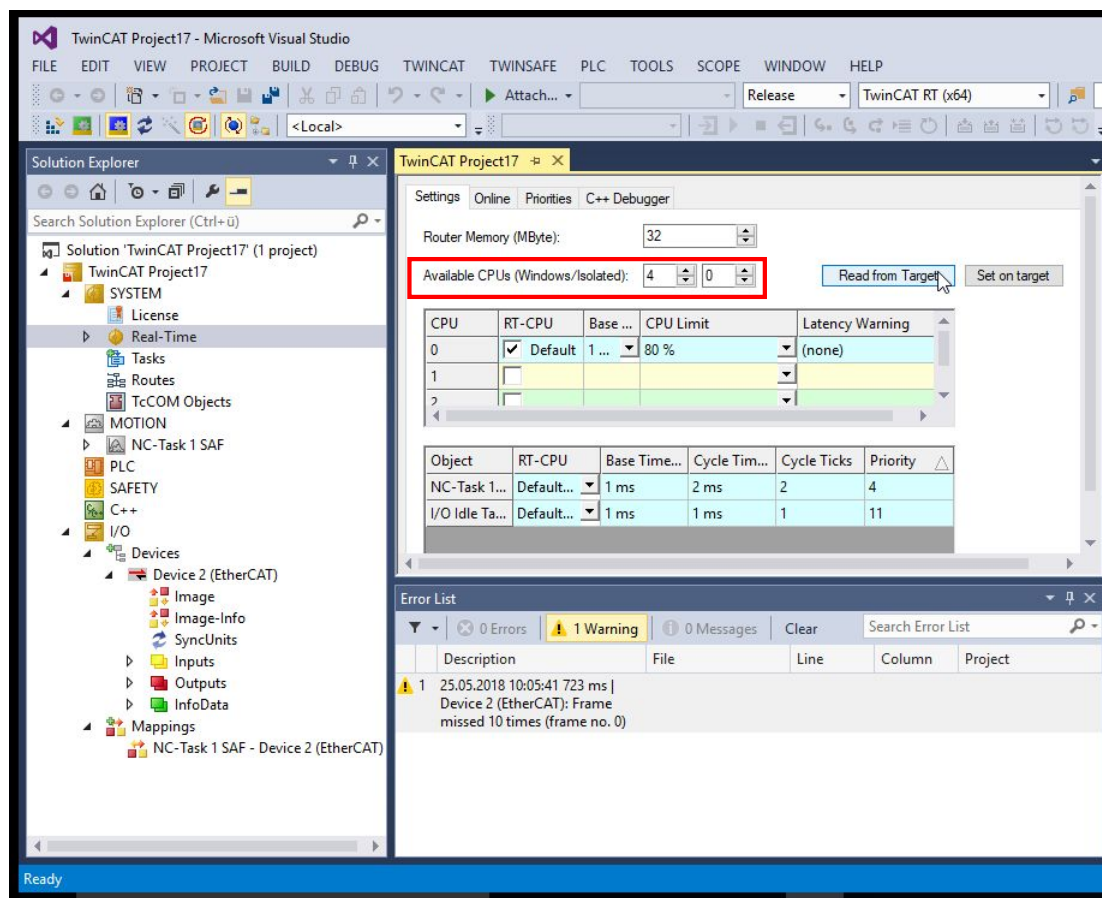
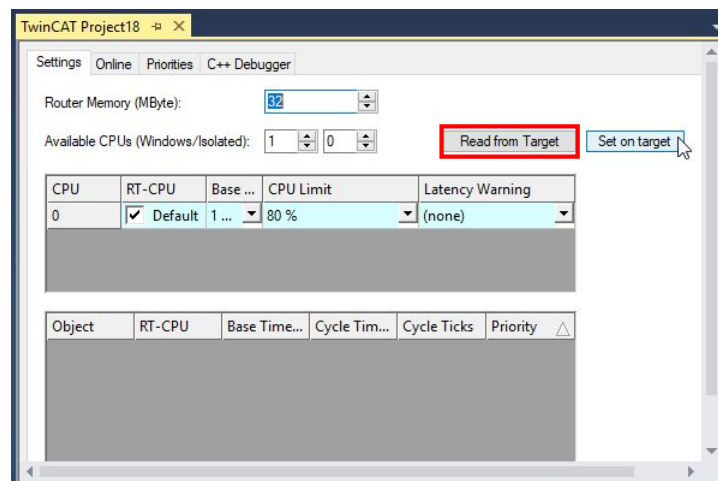
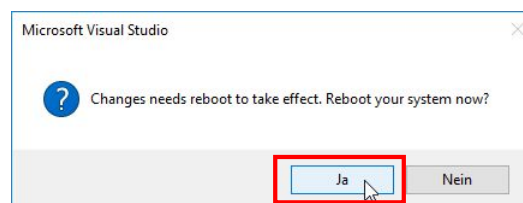
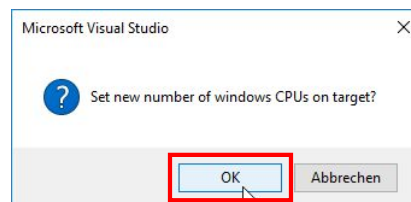
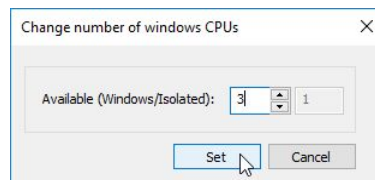
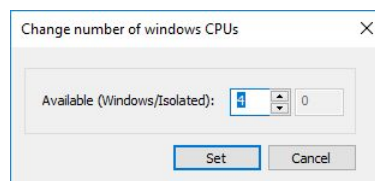


Figure 1: Available CPU (Windows/Isolated) = 4/0 → no processor core is assigned to TwinCAT yet

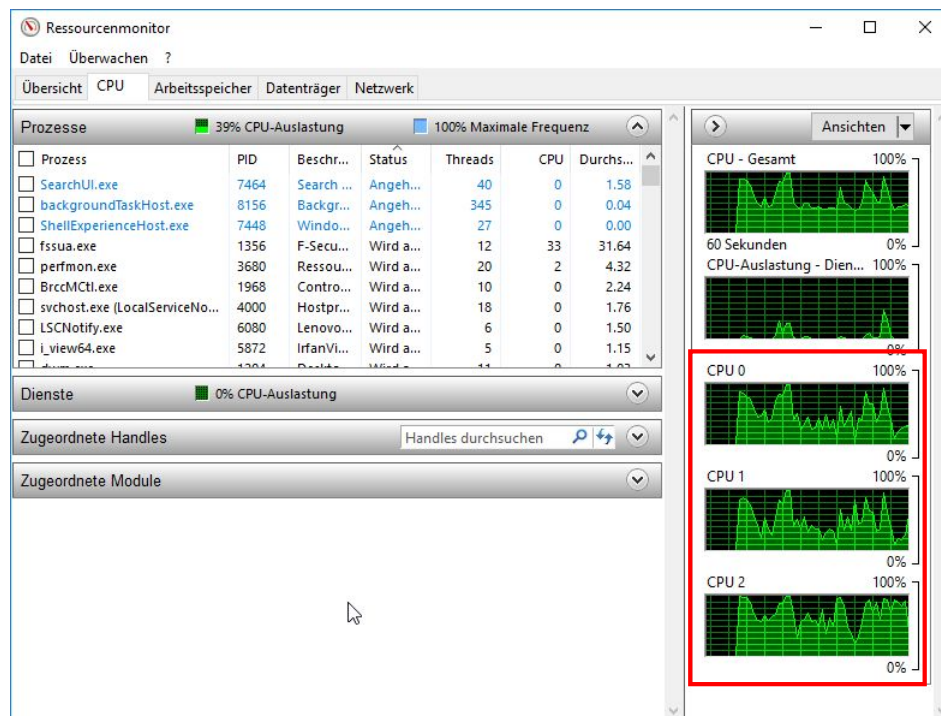
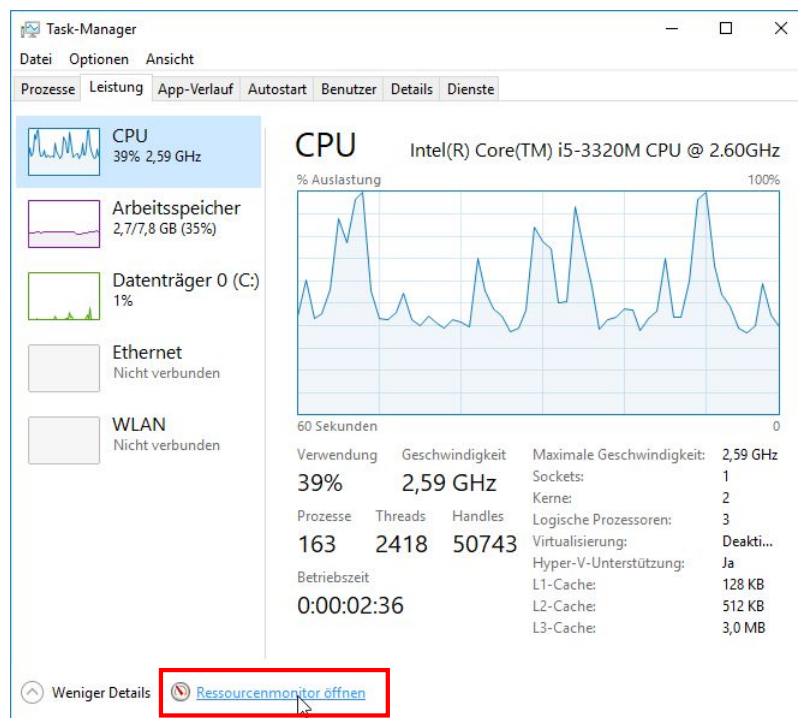
2. Set on target Assign processor core to TwinCAT:



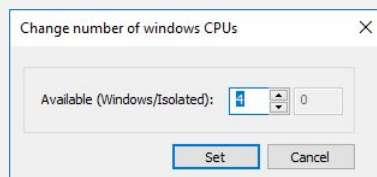


3. After restart check the Task Manager -> ressource monitor





The core assignment is permanent. In order to unassign processor core again repeat step 2. Using the *Set on target* dialog and set *Available (Windows/Isolated): 4/0*

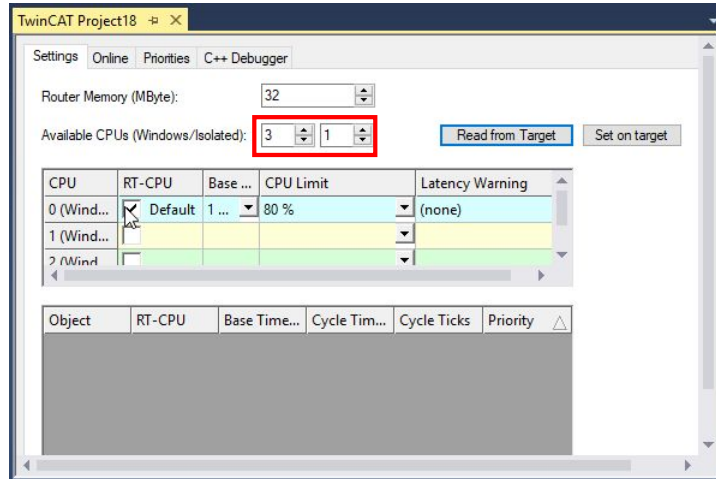


For the next steps in this appnote the configuration should be set to *Available CPUs (Windows/Isolated): 3/1*

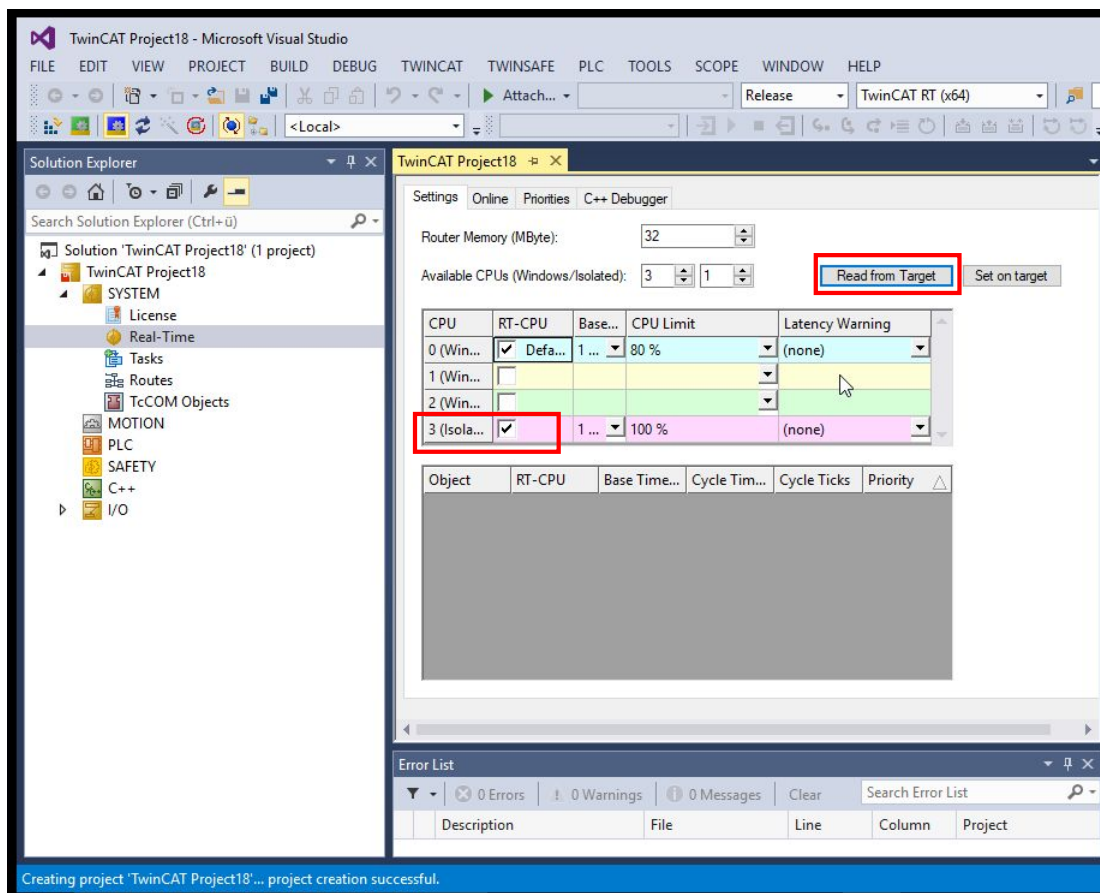


5 Select assigned processor core

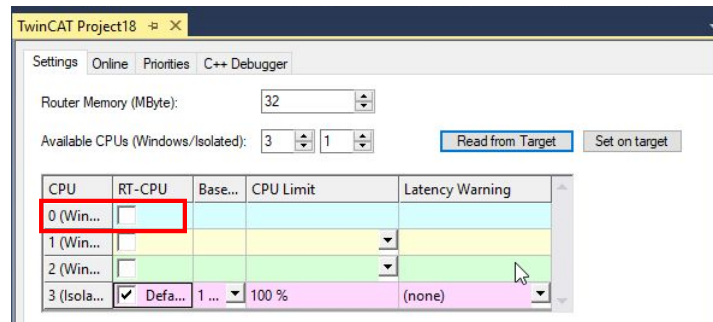
1. Open TwinCAT Project
Project → System → Real-Time → Settings Tab



2. Choose Isolated CPU core



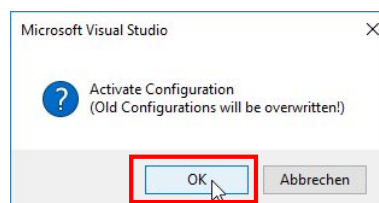
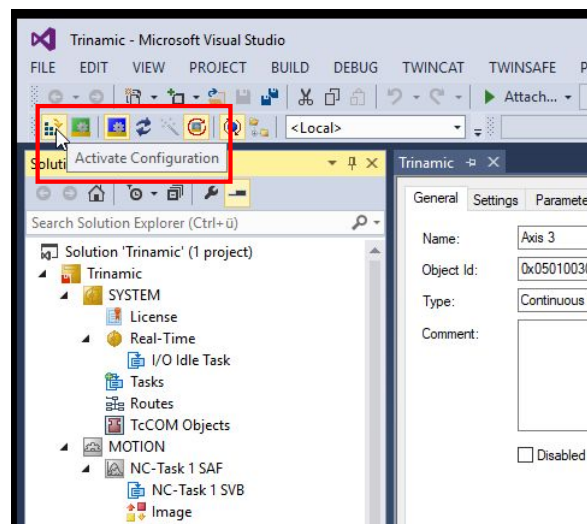
3. Deactivate Windows CPU core

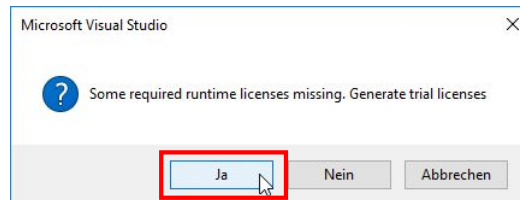
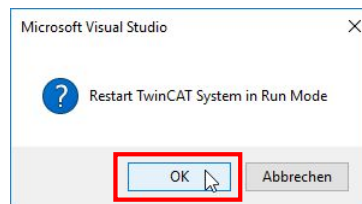


Thus the windows core is reserved for TwinCAT realtimes operations. In the next step the realtime operation will be activated.

6 Activate Configuration (Motion Task)

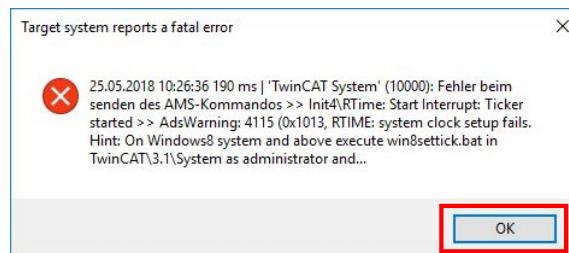
1. Activate configuration

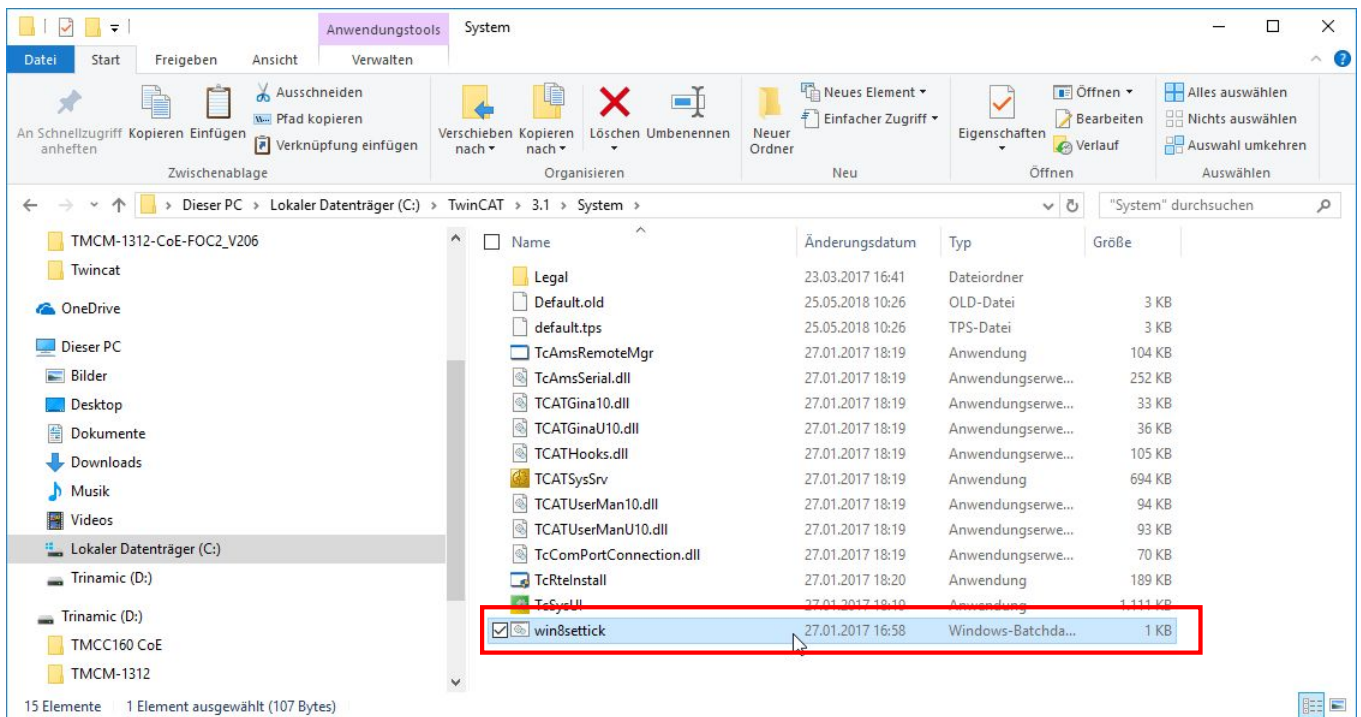




Enter License code which is generated.

2. Execute win8settick.bat as administrator if the following Error shows up. This is a TwinCat specific Error.





If configuration is active, green logo shows up in the bottom right corner.



7 Use Jogging Mode

Axis 1 is driven in Jogging Mode in this section.

1. Configure Monitoring

Axis 1 → Parameter → Monitoring → Set Every Value to False (since not provided by the module)

Confirm every value by clicking on Download.



The screenshot shows the Trinamic software interface. On the left is the Solution Explorer showing a project named 'Trinamic' with a tree structure including SYSTEM, License, Real-Time, I/O Idle Task, Tasks, Routes, TcCOM Objects, MOTION, NC-Task 1 SAF, NC-Task 1 SVB, Image, Tables, Objects, and Axes (Axis 1, Axis 2, Axis 3). The main window displays the 'Parameter' tab for 'Axis 1'. The table lists various parameters with their Offline and Online values.

Parameter	Offline Value	Online Value
Fast Axis Stop:		
Limit Switches:		
Monitoring:		
Position Lag Monitoring	TRUE	TRUE
Maximum Position Lag Value	5.0	5.0
Maximum Position Lag Filter Time	0.02	0.02
Position Range Monitoring	TRUE	TRUE
Position Range Window	5.0	5.0
Target Position Monitoring	TRUE	TRUE
Target Position Window	2.0	2.0
Target Position Monitoring Time	0.02	0.02
In-Target Alarm	FALSE	FALSE
In-Target Timeout	5.0	5.0
Motion Monitoring	FALSE	FALSE
Motion Monitoring Window	0.1	0.1

Below the parameter table is the Error List, showing 5 errors and 11 messages. The first error (11) is a CoE - Emergency (Hex: 8130, 00, '00 ff 00 00'). The second error (12) is related to 'Drive 1 (TMCM-3213)'.

The screenshot shows the Trinamic software interface with the ADS Symbol Watch window open. The window displays the same parameter table as the previous screenshot, but with a red box highlighting the 'In-Target Alarm' parameter and the 'Download' button at the bottom.

Parameter	Offline Value	Online Value	Unit
Fast Axis Stop:			
Limit Switches:			
Monitoring:			
Position Lag Monitoring	FALSE	TRUE	
Maximum Position Lag Value	5.0	5.0	mm
Maximum Position Lag Filter Time	0.02	0.02	s
Position Range Monitoring	FALSE	TRUE	
Position Range Window	5.0	5.0	mm
Target Position Monitoring	FALSE	TRUE	
Target Position Window	2.0	2.0	mm
Target Position Monitoring Time	0.02	0.02	s
In-Target Alarm	FALSE	FALSE	
In-Target Timeout	5.0	5.0	s
Motion Monitoring	FALSE	FALSE	
Motion Monitoring Window	0.1	0.1	mm
Motion Monitoring Time	0.5	0.5	s
Setpoint Generator:			
NCI Parameter:			
Other Settings:			

At the bottom of the ADS Symbol Watch window, there are buttons for 'Download', 'Upload', 'Expand All', 'Collapse All', and 'Select All'. The 'Download' button is highlighted with a red box and labeled with a red '2'.



2. Set axis 1 to CSP mode. Write 8 to Axis0 Modes of Operation 1

Modes of Operation as SDO (Firmware v207)

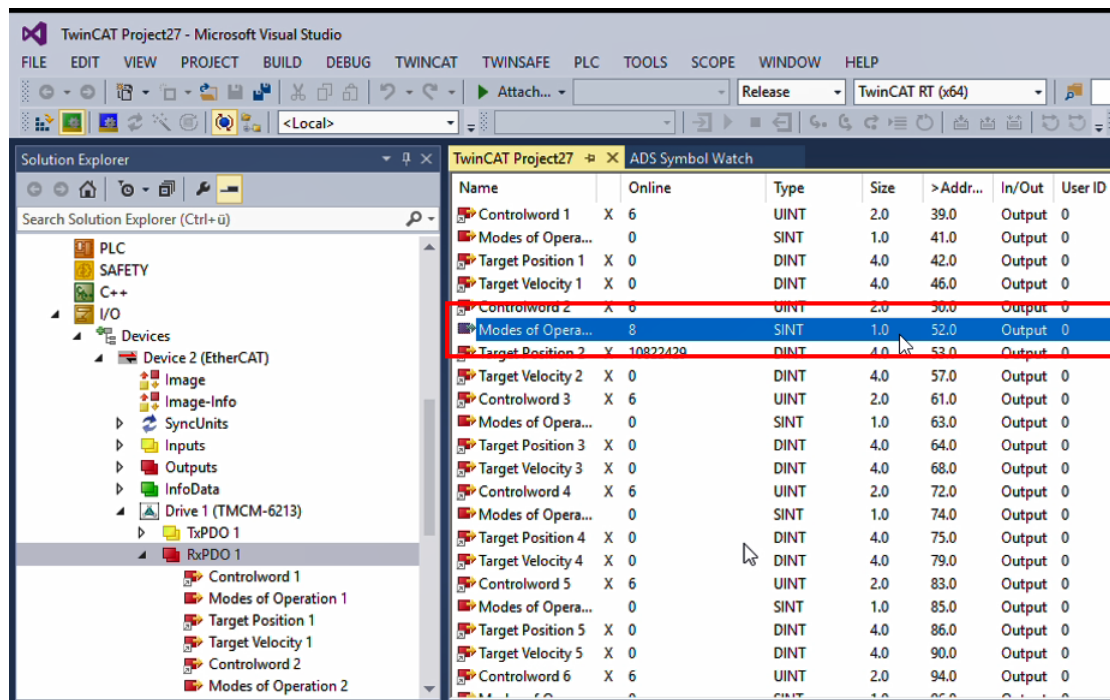
The screenshot displays the ADS Symbol Watch window for a Trinamic device. The left pane shows the project structure with 'Device 2 (EtherCAT)' selected. The main pane shows the SDO data for Axis 0. The 'Axis0 Modes of Operation 1' (Index 6060) is highlighted with a red box, showing a value of 8. The 'Axis0 Modes of Operation Display 1' (Index 6061) also shows a value of 8. The bottom pane shows the online data for various variables, including 'Controlword 1' and 'Target Position 1'.

Index	Name	Flags	Value	Unit
270E:0	Device Analog Inputs		> 8 <	
270F	Service Period	RW	0	
6040	Axis0 Controlword 1	RW P	0x001F (31)	
6041	Axis0 Statusword 1	RO P	0x1637 (5687)	
605A	Axis0 Quick Stop Option Code 1	RW	2	
605B	Axis0 Shutdown Option Code 1	RW	0	
605C	Axis0 Disable Operation Option Code 1	RW	1	
605D	Axis0 Halt Option Code 1	RW	1	
605E	Axis0 Fault Reaction Option Code 1	RW	2	
6060	Axis0 Modes of Operation 1	RW P	8	
6061	Axis0 Modes of Operation Display 1	RO P	8	
6062	Axis0 Position Demand Value 1	RO	0	
6063	Axis0 Position Actual Internal Value 1	RO	0	
6064	Axis0 Position Actual Value 1	RO P	0	

Name	Online	Type	Size	> Addr...	In/Out	User ID	Linked to
Chn2	2	USINT	1.0	1560.0	Input	0	
Controlword 1	X	UINT	2.0	39.0	Output	0	nCtrl1, nCtrl2
Target Position 1	X	DINT	4.0	41.0	Output	0	nDataOut1 . Out . Outpu...
Target Velocity 1	X	DINT	4.0	45.0	Output	0	nDataOut2 . Out . Outpu...
Controlword 2	X	UINT	2.0	49.0	Output	0	nCtrl1, nCtrl2
Target Position 2	X	DINT	4.0	51.0	Output	0	nDataOut1 . Out . Outpu...

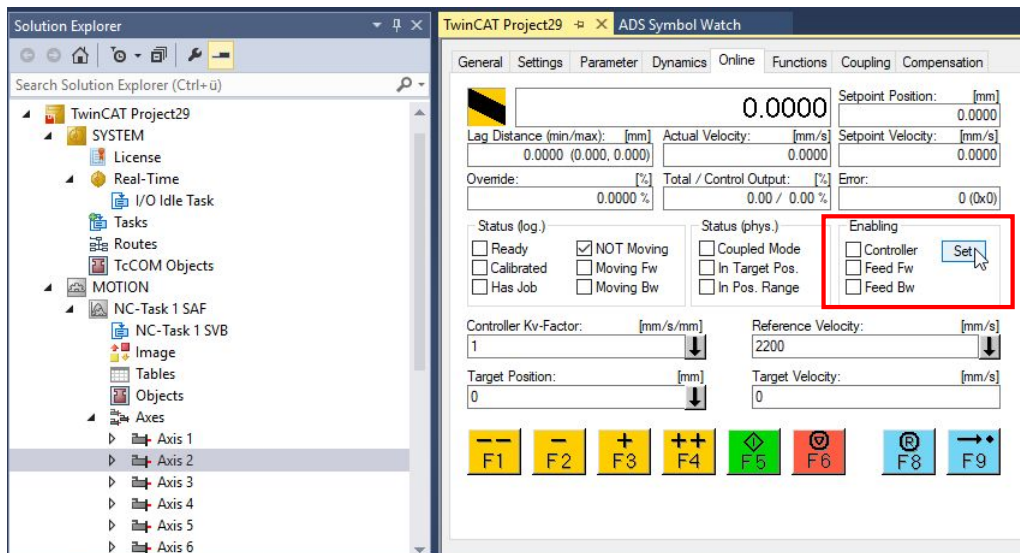
Modes of Operation as PDO in (Firmware v208)

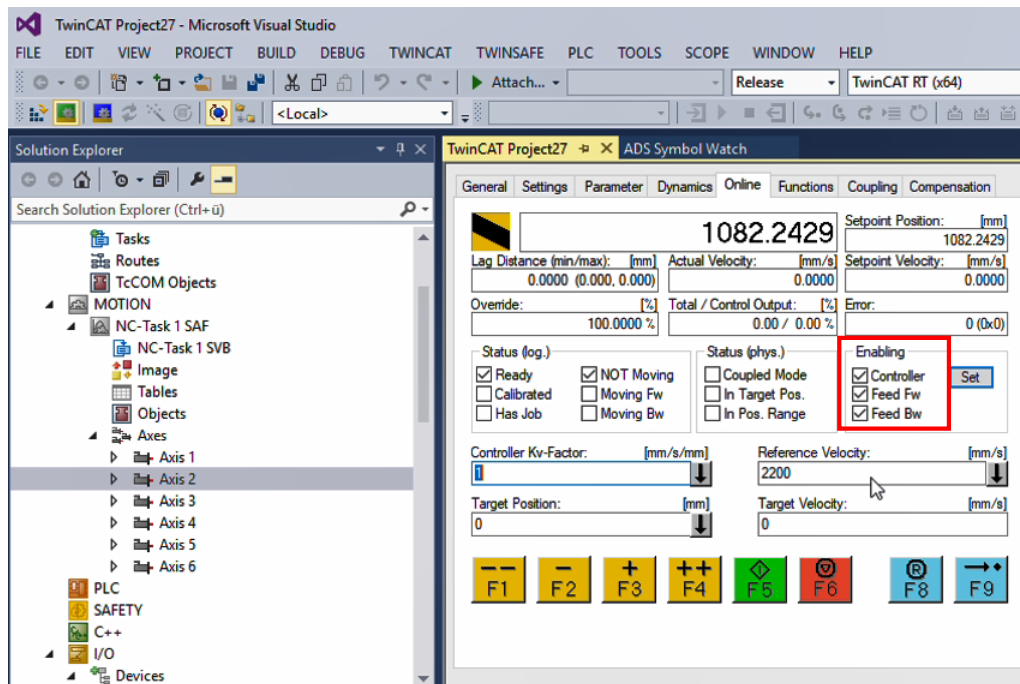
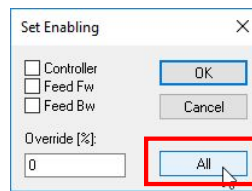




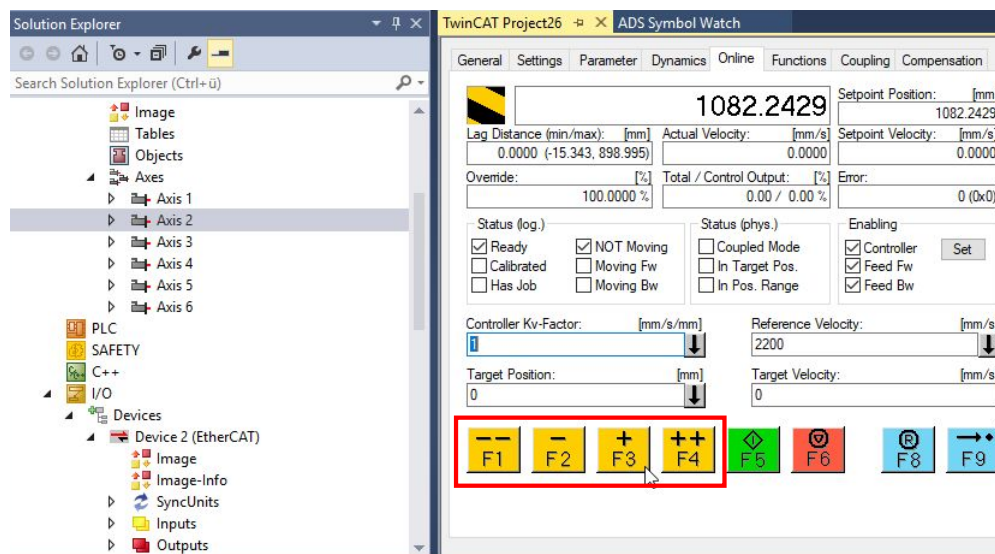
3. Enable Controller and Feed Fw/Bw

Motion → Axes → Axis X → Tab Online → Enabling → Set → All





4. Use Jog Control Buttons to move the axis X



8 Revision History

Version	Date	Author	Description
V1.00	10.01.2020	OK, JPX	V1.00 release version
V1.01	10.03.2020	JPX	add note on core unassignment

Table 1: Document Revision

