



## **AMKmotion**

### **TC3 startup with AMKmotion devices**

### **Software description**

Version: 2023/27

Part no.: 207197

Translation of the "Original Dokumentation"

# **AMK***motion*

MEMBER OF THE ARBURG FAMILY

## Imprint

**Name:** PDK\_207197\_TC3\_Inbetriebnahme\_de

**Version:**

Version: 2023/27		
Chapter / Topic	Change	Abbreviations
	AMKmotion Design	LeS

**Previous version:** 2019/03

**Product status:**

Product (part no.)	Software
PC	TwinCAT 3.1

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For fast and reliable troubleshooting, you can help us by informing our Customer Service about the following:

- Type plate data for each unit
- Software version
- Device configuration and application
- Type of fault/problem and suspected cause
- Diagnostic messages (error messages)

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## 1 About this documentation

### 1.1 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid!
	The arrow indicates points in a software, to which must be clicked.
 RMB	Click the 'right mouse button'.
'Names'	Names are represented with apostrophes e. g. parameters, variables, etc.
'Text'	Menu items and buttons in a software or on a controller, e. g.: Click the <b>'OK'</b> button in the <b>'Options'</b> menu to call up the 'Delete PLC program' function
See <a href="#">'chapter name'</a> on page x	Executable cross-reference in electronic output media

## 2 For your safety

### 2.1 Basic notes for your safety

- At electrical drive systems, hazards are present in principle that can result in death or fatal injuries:
  - Electrical hazard (e. g. electric shock due to touch on electrical connections)
  - Mechanical hazard (e. g. crush, retract due to the rotation of the motor shaft)
  - Thermal hazard (e. g. burns due to touch on hot surfaces)
- These hazards are present while starting up and operating the unit, and also during servicing or maintenance work.
- Safety instructions in the documentation and on the product warn about the hazards.
- Personnel must have read and understood the safety instructions before installing and operating the product. In the documentation about the product the usage warnings pertain to direct hazards and must therefore be followed directly when operating or handling the product by the operator.
- AMKmotion products must be kept in their original order, that means it is not allowed to do a significant constructional change on hardware side and software is not allowed to be decompiled and change the source code.
- Damaged or faulty products are not allowed to be integrated or put into operation.
- Do not start the system in which the AMKmotion products are installed (begin of intended use) until you can determine that all relevant standards, laws, and directives have been complied with, e. g. low voltage directive, EMC directive, and the machinery directive, and possible further product standards. The plant manufacturer is responsible for the compliance with the laws, directives, and standards.
- The devices must be installed, electrically connected and operated as shown in the device description documentation. The technical data and the required environmental conditions must be observed at all times.

### **3 Product description**

This document describes the startup of AMK EtherCAT devices with Beckhoff TwinCAT 3 control. Data exchange takes place via the SoE protocol (Servodrive Profile over EtherCAT) according to IEC 61800-7. The document also contains further practical examples.

## 4 ESI device description

The TwinCAT software requires the AMK ESI device description file (EtherCAT XML Device Description (ESI)) in order to create a configuration.

The AMK ESI file contains the interface description for the AMK EtherCAT devices.

Insert the AMK ESI file in the TwinCAT installation directory.

### **Description:**

EtherCAT XML Device Description (ESI)

ESI (EtherCAT Slave Information)

### **Example AMK ESI file:**

AMK\_ECsoe\_113\_205777.xml (113 = version rising)

### **Source path under AIPEX PRO:**

The AMK ESI file is installed with AIPEX PRO. Make a copy.

C:\Program Files (x86)\Common Files\AMK\EtherCAT

### **Target file under TwinCAT 3:**

Insert the AMK ESI file in the TwinCAT installation directory.

C:\TwinCAT\3.1\Config\Io\EtherCAT

## 5 Conversion AMK/TwinCAT Parameter

AMK parameter ranges:

ID00001 - ID32767, IDs defined by the SERCOS specification.

ID32768 - ID65536, IDs defined by AMK.



You will find the IDs supported by AMK in the parameter descriptions.

TwinCAT parameter ranges:

S designates IDNs defined by the SERCOS specification.

P designates IDNs defined by the device manufacturer.

Example:

parameter	TwinCAT	AMK	Designation
S parameter	S-0-0390	ID00390	Diagnostic number
P parameter	P-0-0007	ID32775	Number of poles of motor

### S parameter conversion

AMK		TwinCAT
ID0xxxx	=	S-0 xxx
Example: ID00390	=	S-0390

TwinCAT	→	AMK
S-0 xxxx	=	ID0xxxx
Example: P-0-0390	=	ID00390

### P parameter conversion

The difference between the P parameters and AMK ID is respectively 0x8000 (32768).

AMK	→	TwinCAT
IDxxxxx - <b>32768</b> (0x8000)	=	P-0 xxxx
Example: ID32775 - <b>32768</b> (0x8000)	=	P-0-0007

TwinCAT	→	AMK
P-0-xxxx + <b>32768</b> (0x8000)	=	IDxxxxx
Example: P-0-0007 + <b>32768</b> (0x8000)	=	ID32775

## 6 Startup list

The Startup list parameters are transferred to the AMK drive every time the TwinCAT system powers up. The parameter modifications are immediately active as soon as the bus state 'Operational' is reached



**Exception:**

The following parameters only become active after a system reset or 24 VDC OFF/ON.

ID2 'SERCOS cycle time' / S-0-0001 'SERCOS cycle time'

ID34023 'BUS address participant' / S-0-1255 'BUS address participant'

**Example:**

The Startup list is extended to include ID32796 'Source RF' with Code 5 (RF via field bus).

ID32796 'Source RF' = P-0-0028 'Source RF'

**Input in TwinCAT 'Run' mode**

In the TwinCAT 'Run' mode the 'Edit SERCOS Startup Entry' window with online values is available.

Online		NC: Online		NC: Functions	
General	EtherCAT	DC	Process Data	Startup	SoE - Online
Transition	Protocol	Index	Data		Comment
S <PS>	SoE	S-0-0015	0x0007 (7)		Telegram type
S <PS>	SoE	S-0-0016	04 00 04 00 33 00 28 00		AT list
S <PS>	SoE	S-0-0024	04 00 04 00 2F 00 24 00		MDT list
S PS	SoE	S-0-0001	0x07D0 (2000)		T Ncyc
S PS	SoE	S-0-0002	0x07D0 (2000)		T Scyc

In normal cases the parameter values in bus state 'P -> S' are transferred (Pre-Operational → Safe-Operational)

**Edit SERCOS Startup Entry**

Transition:  I -> P  P -> S  S -> O

Disable Entry

IDN: P-0-0028

Channel: A

Data (hexbin): 00 00

Validate Mask:

Comment: Quelle Reglerfreigabe

IDN	Name	Unit	Value
P-0-0010	Drehzahl bei 10V an A1	1/min	3000.0000
P-0-0011	Drehzahl Offset an A1	1/min	0.0000
P-0-0012	Hochlaufzeit TH	ms	100.0
P-0-0013	Tief Laufzeit TL	ms	100.0
P-0-0014	Tief Laufzeit RF inakt.	ms	100.0
P-0-0027	Quelle Umrichter-Ein	--	0
P-0-0028	Quelle Reglerfreigabe	--	0
P-0-0030	Anwenderliste 1	--	0
P-0-0032	AMK-Hauptbetriebsart	--	0
P-0-0033	AMK-Nebenbetriebsart 1	--	0
P-0-0034	AMK-Nebenbetriebsart 2	--	0
P-0-0035	AMK-Nebenbetriebsart 3	--	0
P-0-0036	AMK-Nebenbetriebsart 4	--	0
P-0-0037	AMK-Nebenbetriebsart 5	--	0
P-0-0038	AMK-Nebenbetriebsart 6	--	0

**Edit Value**

Quelle Reglerfreigabe

5

**TwinCAT\_Docu**

Online | NC: Online | NC: Functions

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

Transition	Protocol	Index	Data	Comment
S <PS>	SoE	S-0-0015	0x0007 (7)	Telegram type
S <PS>	SoE	S-0-0016	04 00 04 00 33 00 28 00	AT list
S <PS>	SoE	S-0-0024	04 00 04 00 2F 00 24 00	MDT list
S PS	SoE	S-0-0001	0x07D0 (2000)	T Ncyc
S PS	SoE	S-0-0002	0x07D0 (2000)	T Ncyc
S PS	SoE	P-0-0028	0x0005 (5)	Quelle Reglerfreigabe

Buttons: Move Up, Move Down, New..., Delete..., Edit...

**Input in TwinCAT 'Config' mode**

In TwinCAT 'Config Mode', the default values must be entered manually.

The initial value is predetermined in hex, Byte sequence Little-Endian.

P-0-0069 initial value 2300 [scaling 0.1 V] = Big-Endian 0x08FC; Little-Endian 0xFC08

The screenshot shows the TwinCAT configuration interface. The main window displays a table of startup entries. The entry for P-0-0069 is highlighted, and its data field is circled in red. A red arrow points from this entry to the 'Edit SERCOS Startup Entry' dialog box. In the dialog box, the 'New...' button is circled with a '1', the 'IDN' field is circled with a '2', the 'Data (hexbin)' field contains 'FC 08' and is circled with a '3', and the 'OK' button is circled with a '4'.

Transition	Protocol	Index	Data	Comment
S <PS>	SoE	S-0-0015	0x0007 (7)	Telegram type
S <PS>	SoE	S-0-0016	04 00 04 00 33 00 28 00	AT list
S <PS>	SoE	S-0-0024	04 00 04 00 2F 00 24 00	MDT list
S PS	SoE	S-0-0001	0x07D0 (2000)	T Ncyc
S PS	SoE	S-0-0002	0x07D0 (2000)	T Scyc
S PS	SoE	P-0-0028	0x0005 (5)	Quelle Reglerfreigabe
S PS	SoE	P-0-0069	0x08FC (2300)	

**Edit SERCOS Startup Entry**

Transition:  I -> P  P -> S  S -> O

Disable Entry

IDN: **2** P-0-0069

Channel: [Dropdown]

Validate

Data (hexbin): **3** FC 08

Validate Mask: [Text Field]

Comment: [Text Field]

Buttons: **1** New... **4** OK Cancel Edit...

IDN	Name	Unit	Value

## 7 AT/MTD configuration list

S-0-0016 / ID16 'Configuration list AT', driver telegram (AT)

S-0-0024 / ID24 'Configuration list MDT' Master data telegram (MDT)

The configuration lists define which parameters are transferred cyclically when 'Configured Telegram' is selected in ID15'Telegram types parameter'.

List of configurable parameters in the driver:

S-0-0187 / ID187 'List of data AT'

S-0-0188 / ID188 'List of data MDT'

Example:

Expansion of the driver telegram (AT) configuration list. The procedure for the expansion of the Master Data Telegram (MDT) is identical.

The screenshot shows the TwinCAT Project22 interface with the following configuration details:

**Solution Explorer:** I/O > Drive 1 (KW (-R06)) > InfoData (highlighted with a red circle and arrow labeled 1).

**Process Data Tab:**

- Sync Manager:**

SM	Size	Type	Flags
0	128	MbxOut	
1	128	MbxIn	
2	10	Outputs	
3	10	Inputs	
- PDO List:**

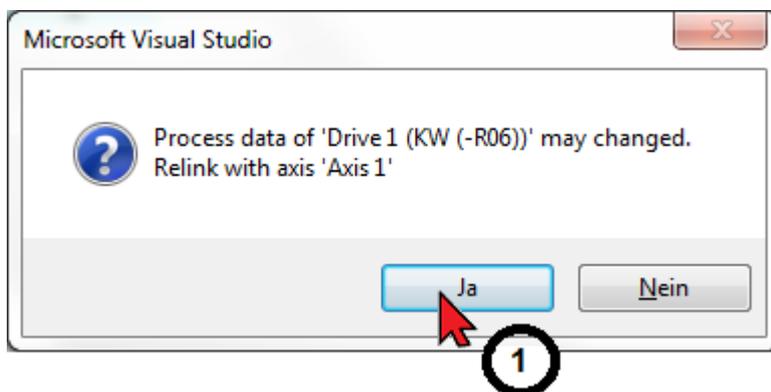
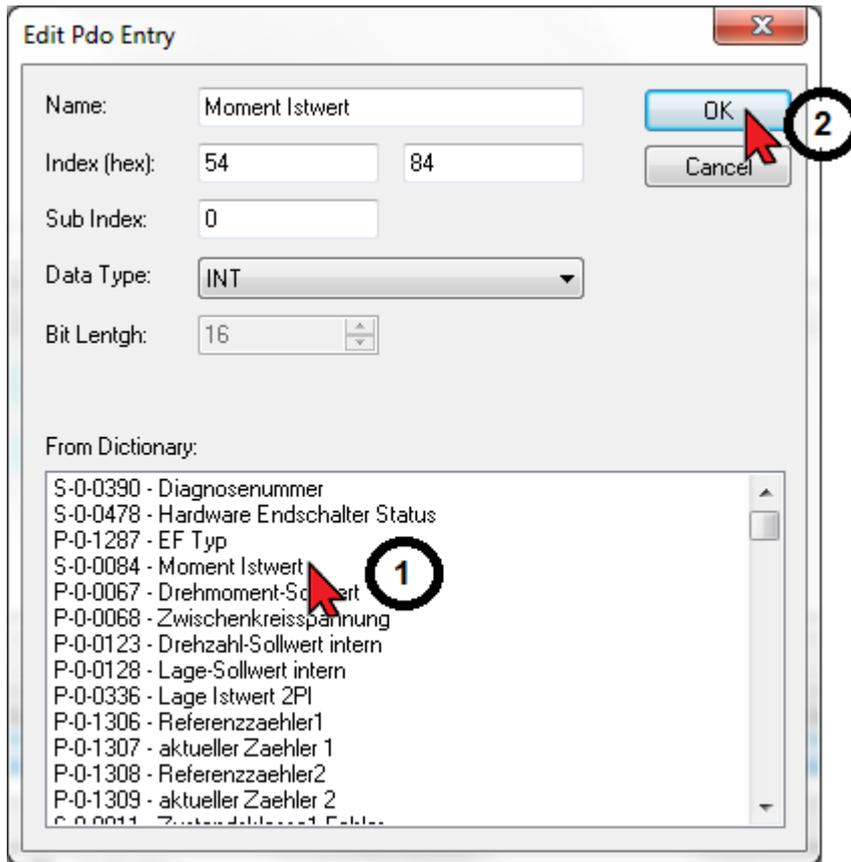
Index	Size	Name
S-0-0016	10.0	AT
S-0-0024	10.0	MDT
- PDO Content (S-0-0016):**

Index	Name
S-0-0135	Drive status word
S-0-0051	Position feedback value 1
S-0-0040	Velocity feedback value

**Download:**  PDO Assignment,  PDO Configuration

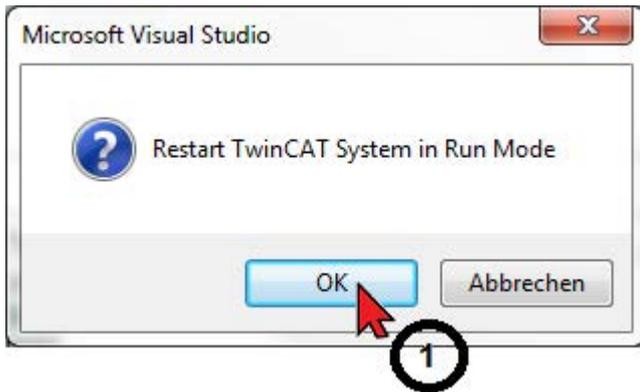
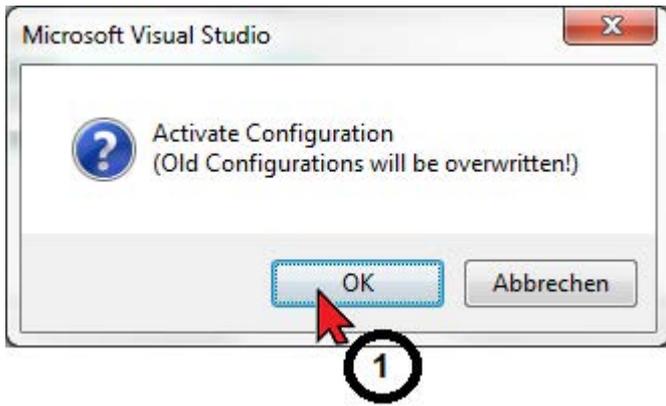
**Context Menu (RMT):** Insert..., Delete..., Edit..., Move Up, Move Down

Example: S-0-0084 / ID84 'Torque feedback value'



Activate configuration and start TwinCAT 'Run Mode'





Function test: Display of current actual value, 'Process Data' tab

Name		Online	Type	Size	>Addr...	In/Out	User ID
Drive status word	X	32769	UINT	2.0	114.0	Input	0
Position feedback value 1	X	10244	DINT	4.0	116.0	Input	0
Velocity feedback value	X	-20	DINT	4.0	120.0	Input	0
Moment Istwert	X	15	INT	2.0	124.0	Input	0
WcStateOut		0	BIT	0.1	1522.3	Input	0

## 8 Hot Connect

Hot Connect supports the disconnection and coupling of EtherCAT devices during operation. The devices are recognized independently of their position by the address assigned in advance in the EtherCAT bus.

A fixed address can be assigned e.g. by AIPEX PRO (ID34023 'BUS address participant') or by DIP switches.

Example: AMK drive with fixed address 10 [Hex]. Address preset with AIPEX PRO 'Direct mode'.

In TwinCAT, the 'Drive 1' drive is linked to address 10 [Hex] and added to the 'Hot Connect Group'.

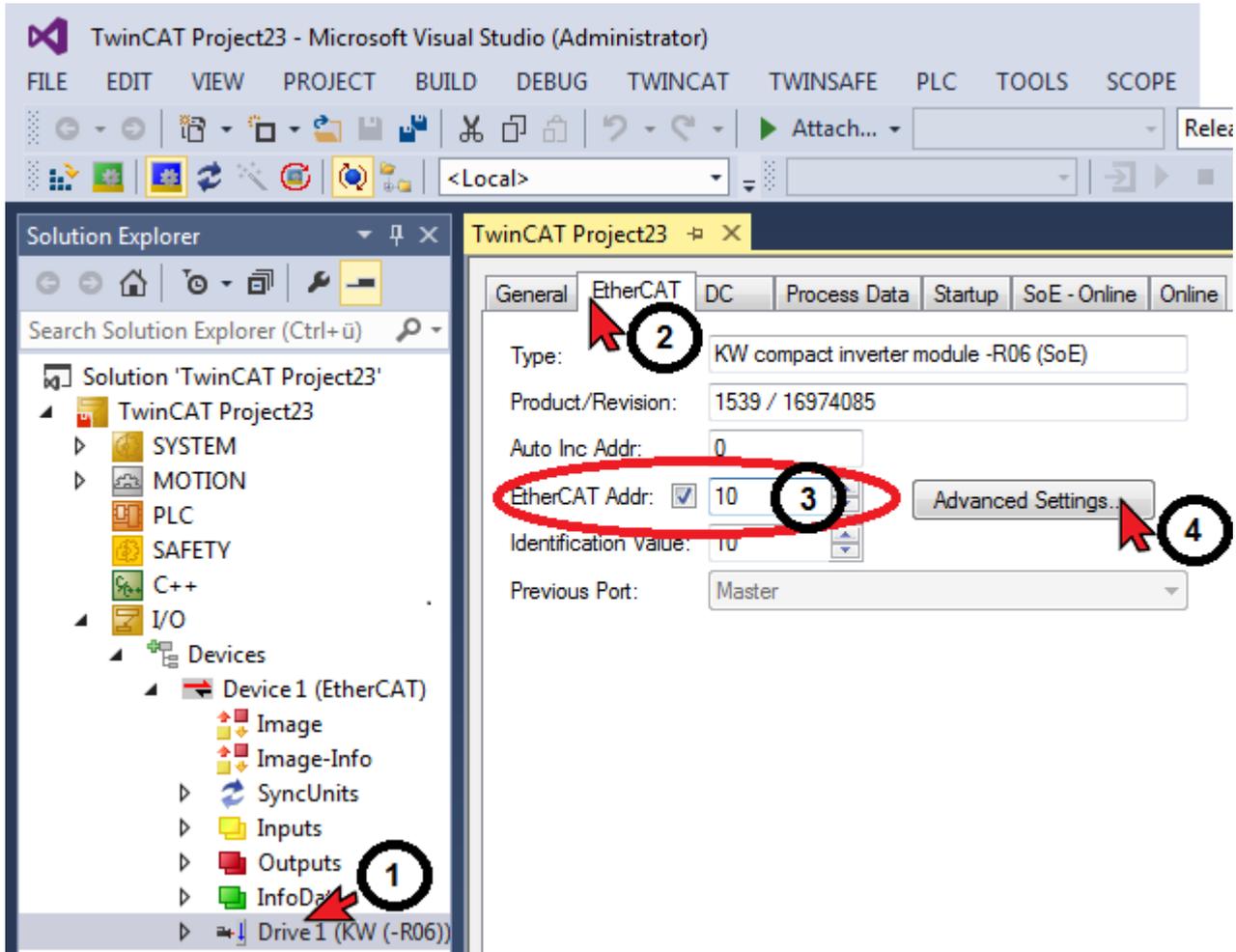
ID	Name	Value	Unit	Length	Type
34023	BUS address part.	0010		2	Hex
34024	BUS transmit rate	0.00		4	Dec
34025	BUS mode	0002		2	Hex
34026	BUS mode attribut	0000		2	Hex
34027	BUS fail.charac.	2		2	Dec
34037	Offset analog input 1	0.00	V	2	±Dec
34038	Offset analog input 2	0.00	V	2	±Dec
34045	Inductance LD	0.00	mH	2	Dec
34046	Inductance LQ	0.00	mH	2	Dec
34047	Dead time meas.1	0.000	ms	2	Dec
34048	PWM frequency	8	kHz	2	Dec
34050	TN current Q	0.0	ms	2	Dec
34052	TN current D	0.0	ms	2	Dec
34055	EF type	2		2	Dec
34070	Home signal distance	0	incr.	4	±Dec
34071	System name			*1	Ascii
34072	Data set name			*1	Ascii



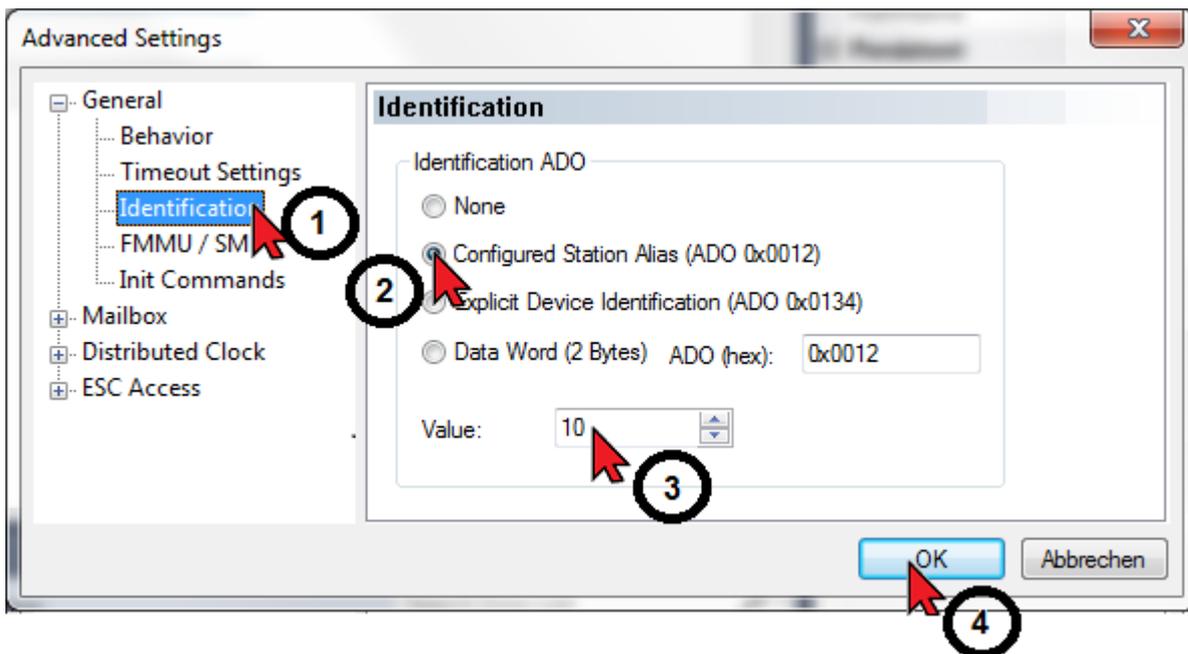
The ID34023 'BUS address participant' / S-0-1255 'BUS address participant' only becomes active after a system reset or 24 VDC OFF/ON.

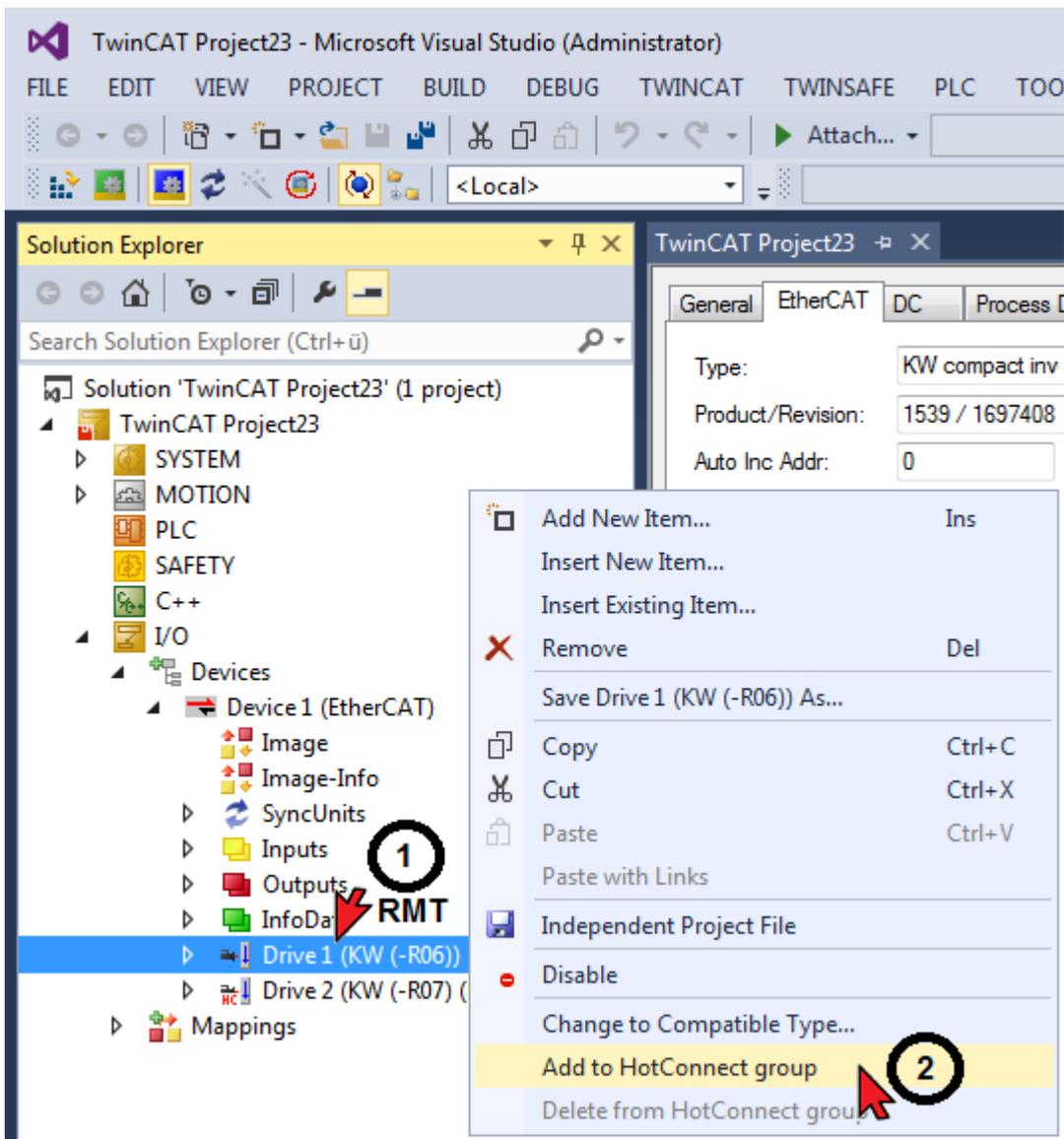
'Activate EtherCAT address'

Enter fixed address for driver (example 10)



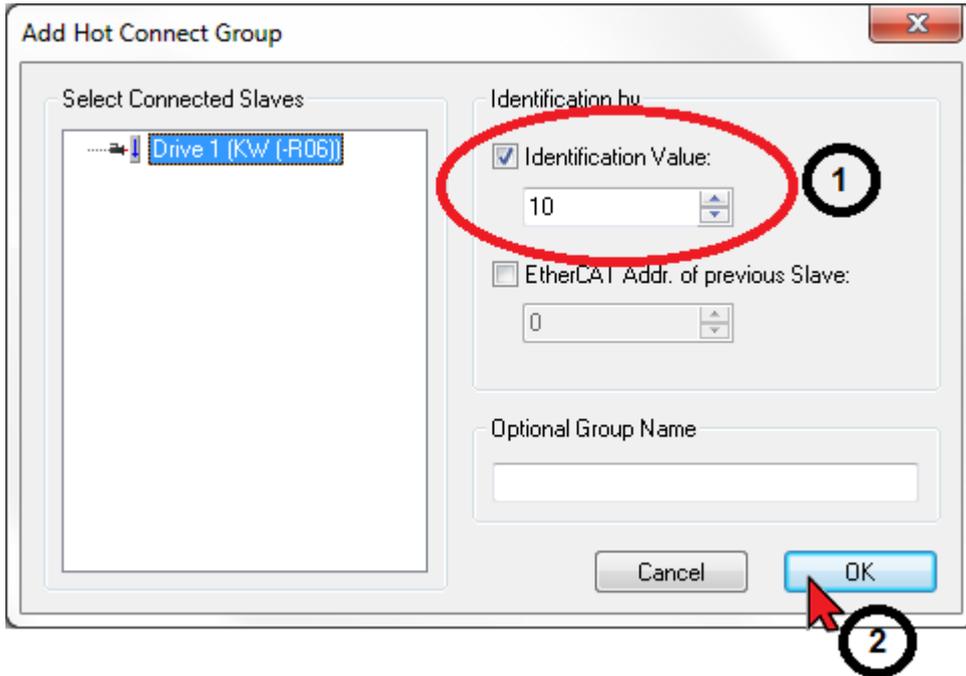
The EtherCAT Master uses the stored address from the EtherCAT Slave E<sup>2</sup>PROM.



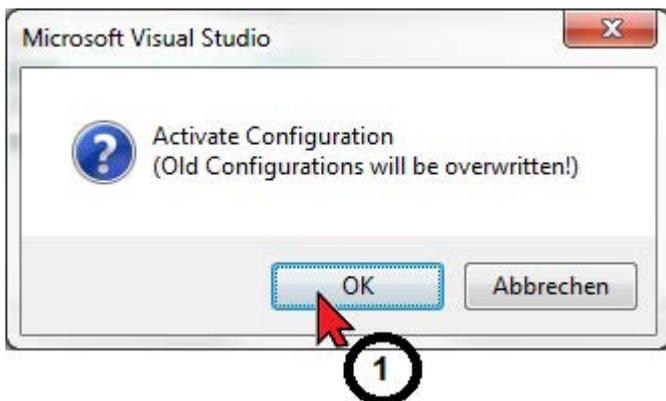


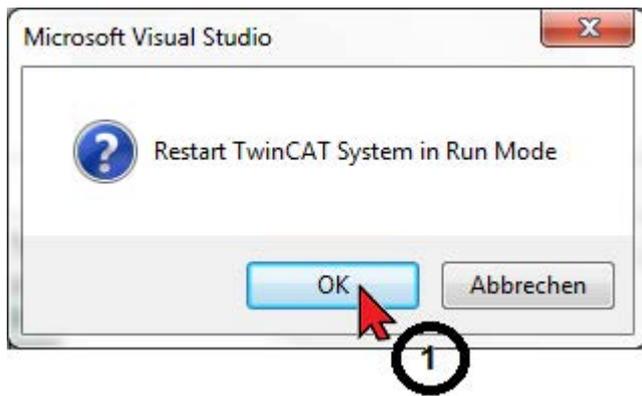
Identification by: Identification Value

Enter fixed address for driver (example 10)



Activate configuration and start TwinCAT 'Run Mode'





## 9 Firmware update via FoE

The example describes how to transfer AMK firmware to an AMK driver.

The screenshot shows the TwinCAT Project24 interface. On the left, the Solution Explorer shows a project structure with 'I/O' expanded to 'Devices', where 'Device1 (EtherCAT)' is selected (marked with a red arrow and circle 1). The main window has the 'EtherCAT' tab selected (marked with a red arrow and circle 2). Below the tabs, there are buttons for 'Advanced Settings...', 'Export Configuration File...', 'Sync Unit Assignment...', and 'Topology...'. A table below shows command frames:

Frame	Cmd	Addr	Len	WC	Sync Unit
0	NOP	0x0000 0x0900	4		
0	ARMW	0x0000 0x0910	4		

Below the table is another table with columns 'Num...', 'Box Name', 'RMT', and 'Type'. The first row is selected (marked with a red arrow and circle 3):

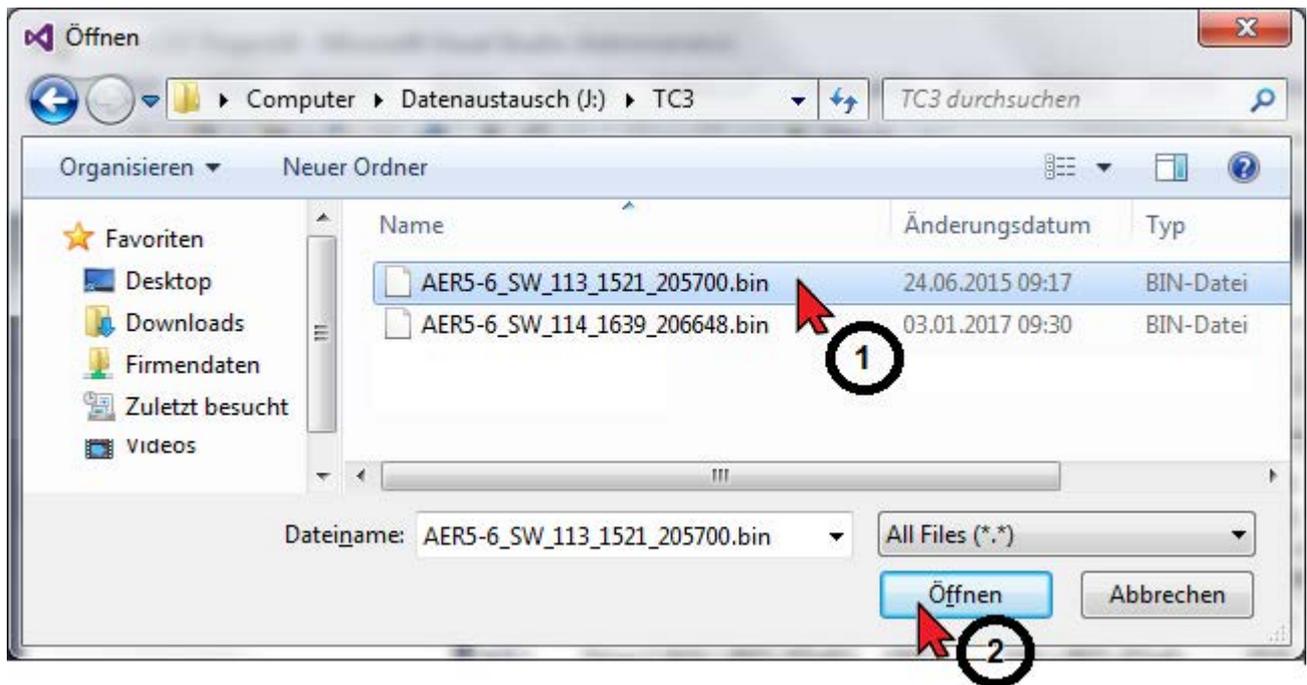
Num...	Box Name	RMT	Type
1	Drive 1 (KW (-R06))	RMT	KW (-R06)
2	Drive 2 (KW (-R07) (FSOE))		

A context menu is open over the first row, with 'Firmware Update...' selected (marked with a red arrow and circle 4). Other options include 'EEPROM Update...', 'FPGA Update...', 'Change Address...', and 'Change to Compatible Type...'.

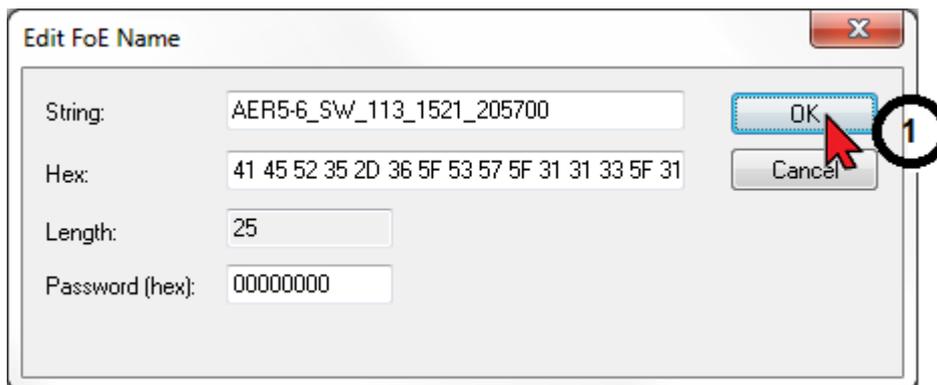


TwinCAT requires the AMK firmware file to be in \*.bin format.

AMK firmware files with the file extension \*.elf or \*.zip can be converted to the \*.bin format with the AMK Toolflasher (software ATF).



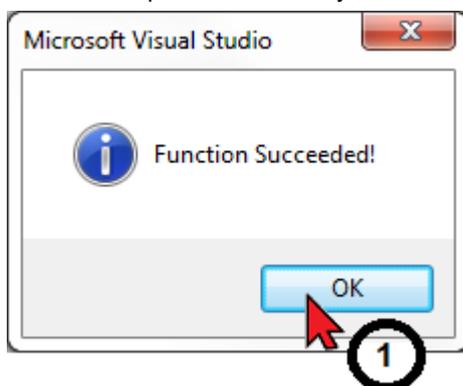
For this a password is not necessary.



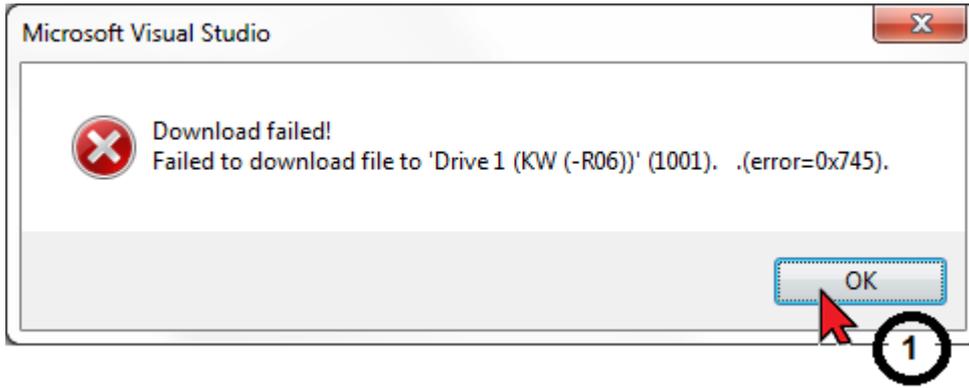
Transferring the firmware file takes around 150 seconds.

Please wait!

Transfer completed successfully.



## Transfer faulty



Please contact AMK Service in the event of repeated faulty transfer.



**Firmware is only activated after the device has been restarted!**



After restarting, please check whether the device has restarted without a fault!

**Diagnostic message 1293 'bootstrap EEPROM'**

The software has been replaced and is no longer address-compatible with the data in the parameter memory.

Execute the 'bootstrap' function.

Display of diagnosis message with TwinCAT. Alternatively, AMK software AIPEX PRO can be used.

TwinCAT Project24 - Microsoft Visual Studio (Administrator)

FILE EDIT VIEW PROJECT BUILD DEBUG TWINCAT TWINSAFE PLC TOOLS SCOPE

Attach... Release

<Local>

Solution Explorer

Search Solution Explorer (Ctrl+ü)

Solution 'TwinCAT Project24' (1 proj)

- TwinCAT Project24
  - SYSTEM
  - MOTION
  - PLC
  - SAFETY
  - C++
  - I/O
    - Devices
      - Device 1 (EtherCAT)
        - Image
        - Image-Info
        - SyncUnits
        - Inputs
        - Outputs
        - InfoData
        - Drive 1 (KW (-R06))
        - Drive 2 (KW (-R07))

TwinCAT Project24

General EtherCAT DC Process Data Startup SoE - Online Online

Diagnosis (Id.95) 129300Umladen !

Reset (Id.99) Update List  Auto Update

IDN	Name	Unit	Value
S-0-0001	NC-Zykluszeit	ms	1.000
S-0-0002	SERCOS-Zykluszeit	ms	1.000
S-0-0015	Telegrammat-Par.	--	6
S-0-0016	Konfigurationsliste AT	--	(list)
S-0-0024	Konfigurationsliste MDT	--	(list)
S-0-0017	Liste aller IDs	--	(list)
S-0-0030	Softwareversion	--	KW 113 1521 205700
S-0-0095	Diagnose [ ASCII-Text ]	--	129300Umladen ! ...
S-0-0262	KMD Umladen	--	00000000 00000000
S-0-0390	Diagnosenummer	--	1293
P-0-0072	Diagnoseliste	--	(list)
P-0-1292	Liste SEEP 1	--	(list)
P-0-1293	Liste SEEP 2	--	(list)
P-0-1438	Produktcode	--	0x00000603
P-0-1378	Memory Address	--	0x00000000

## 10 TwinCAT 3 project with CODESYS PLC

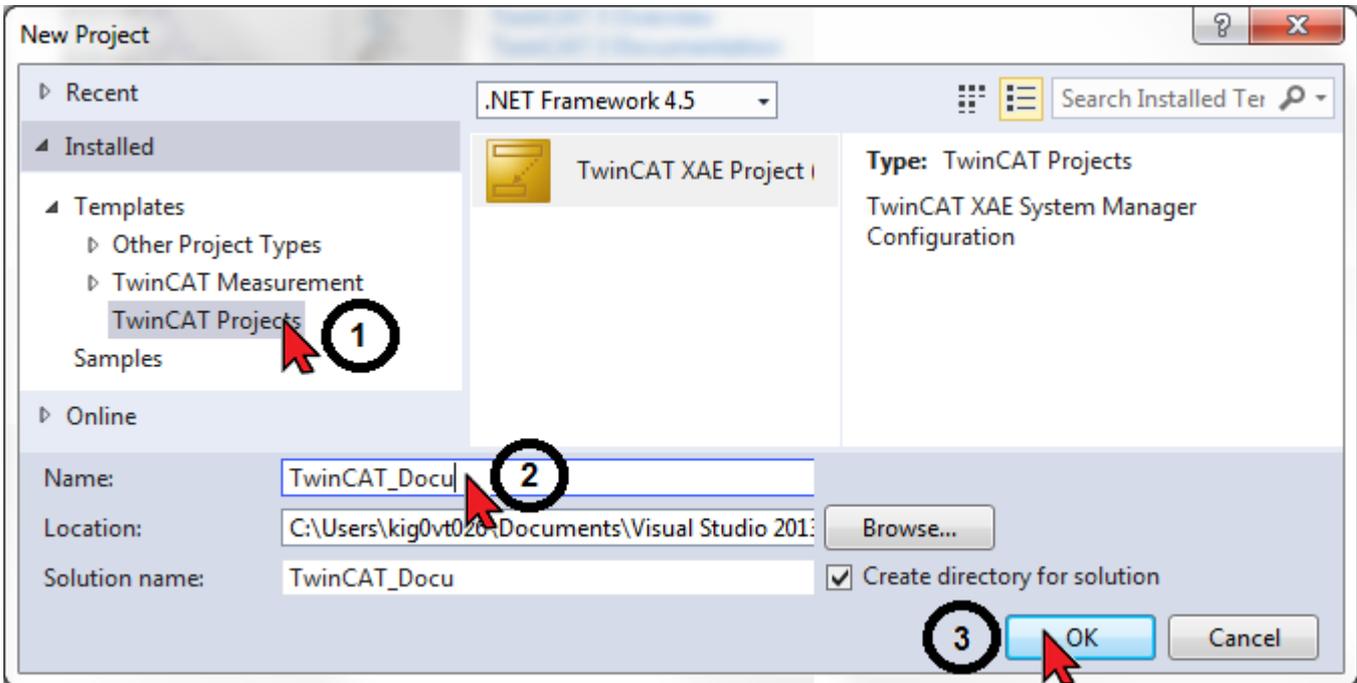
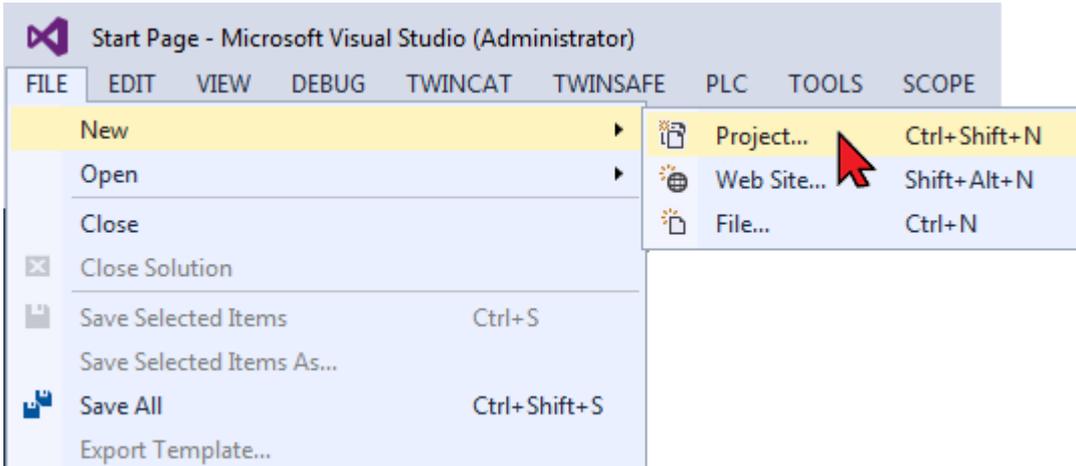
The example describes how to generate a PLC project (without TwinCAT NC axis / CNC axis).

In the PLC example project, the PLC controls and evaluates 'Master Control Word' and 'Drive Status Word'.

Start TwinCAT XAE (VS 2013)

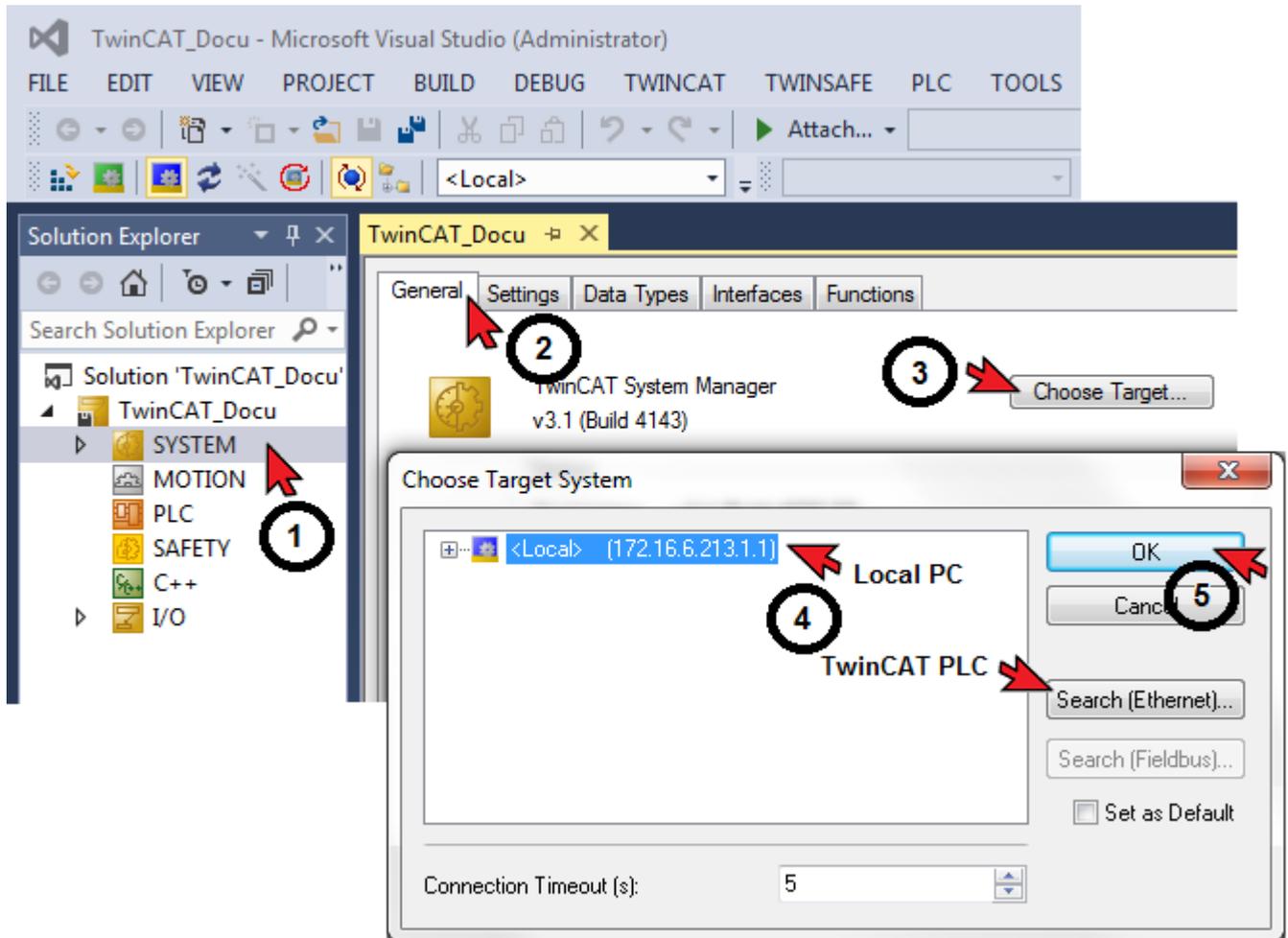


Create a new project

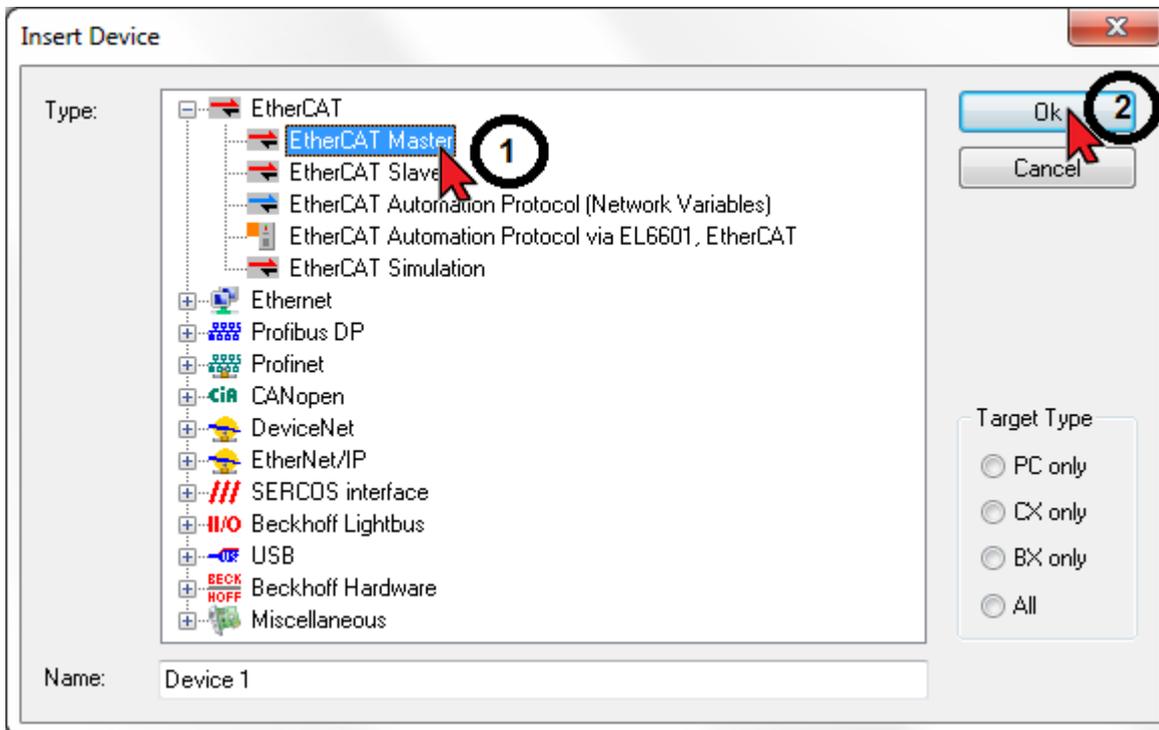
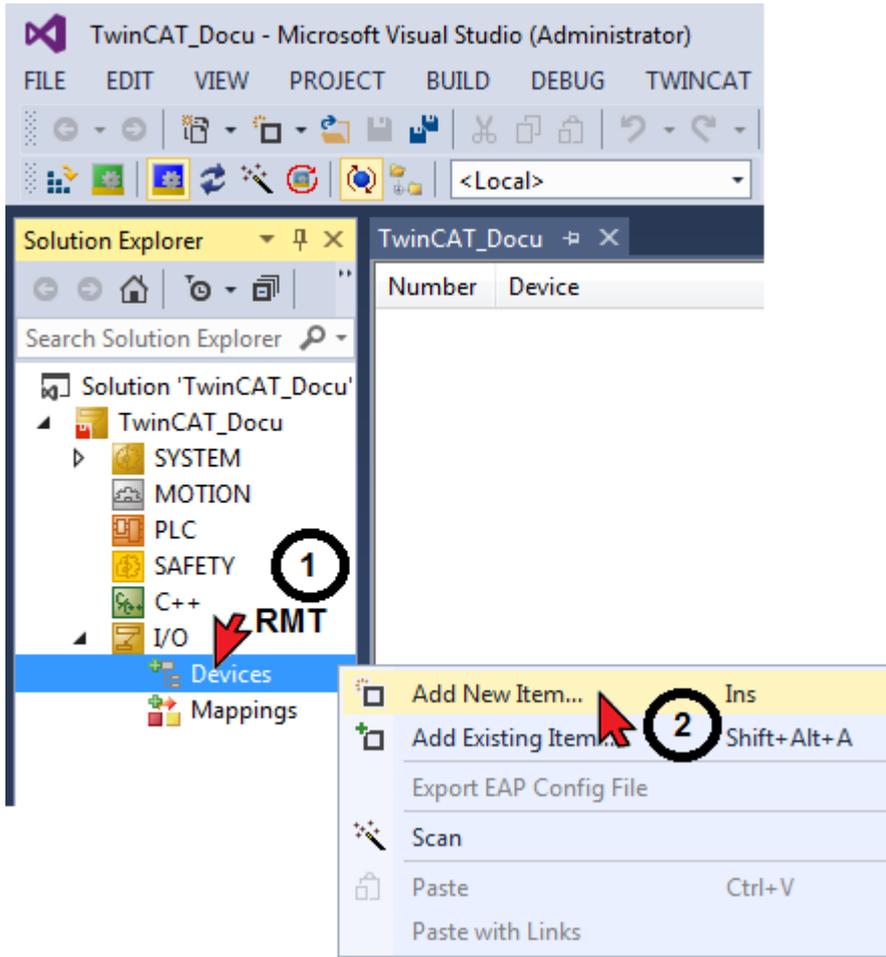


Select the target system:

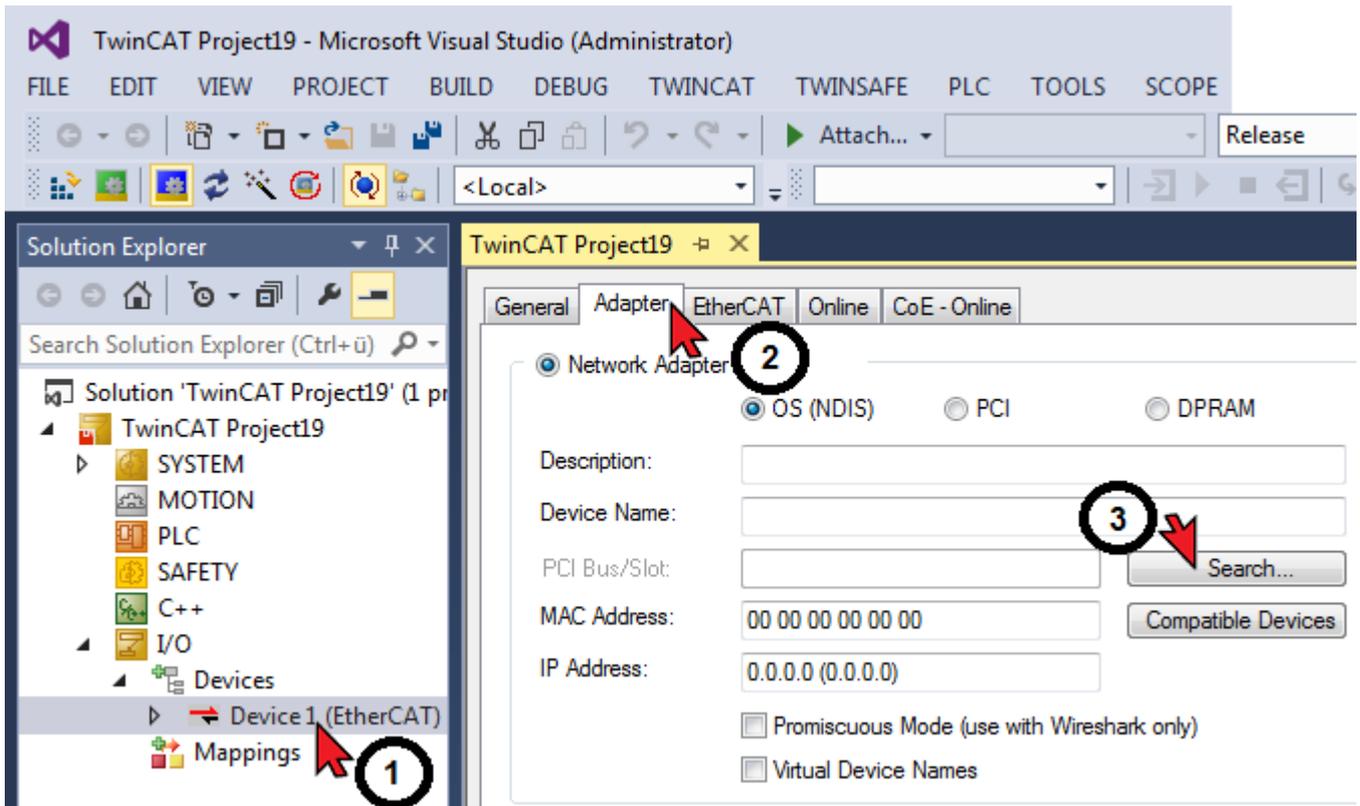
- Local (own PC)
- TwinCAT PLC



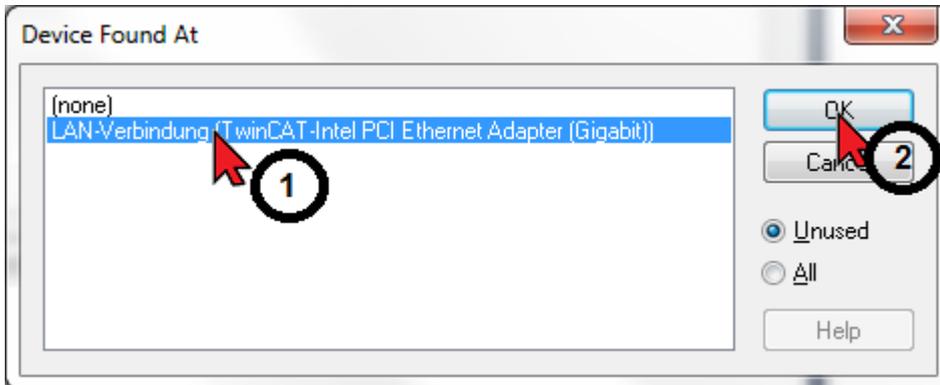
Add the EtherCAT Master functionality to the 'Device' icon



Activate existing network adapter

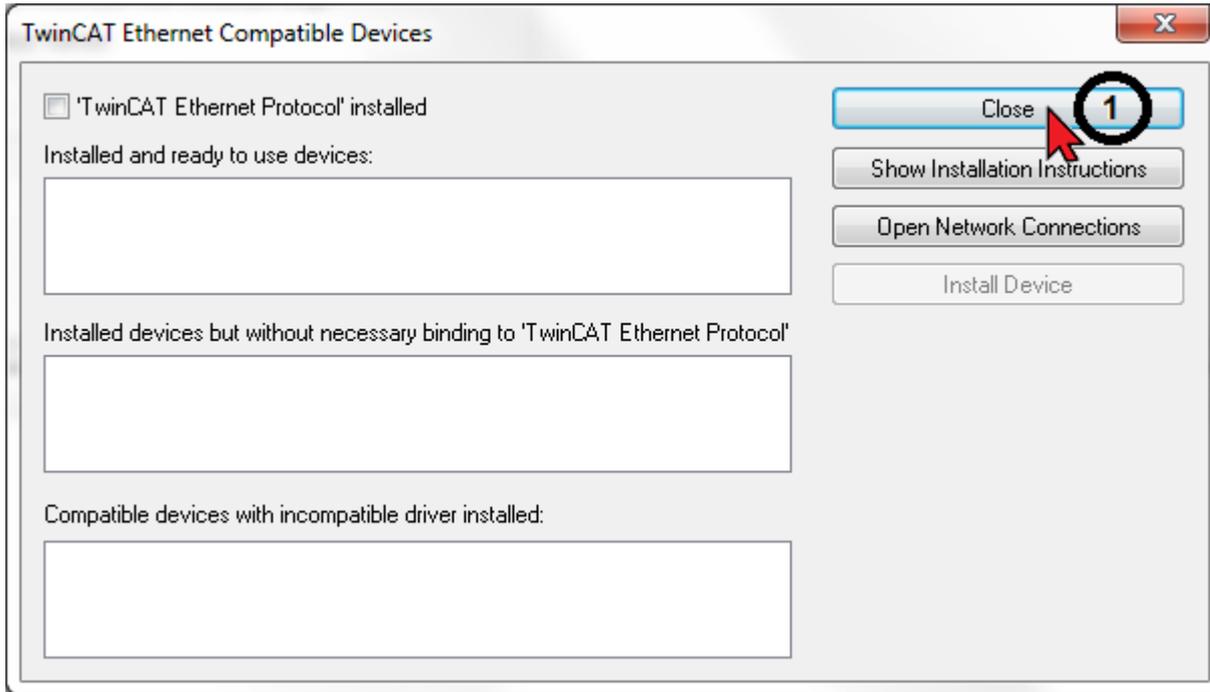


Driver installed  
Activate the adapter



Driver not installed

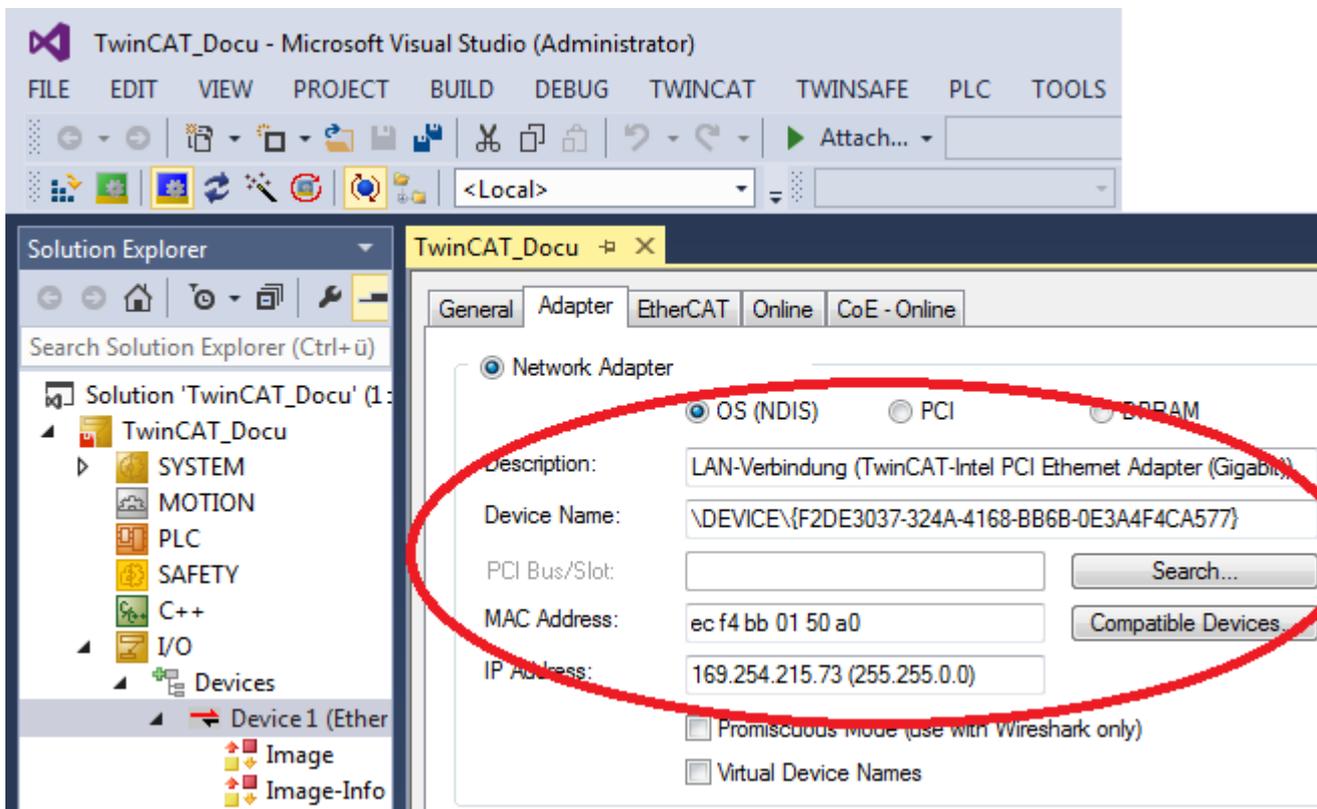
Siehe Adapter settings auf Seite 52.



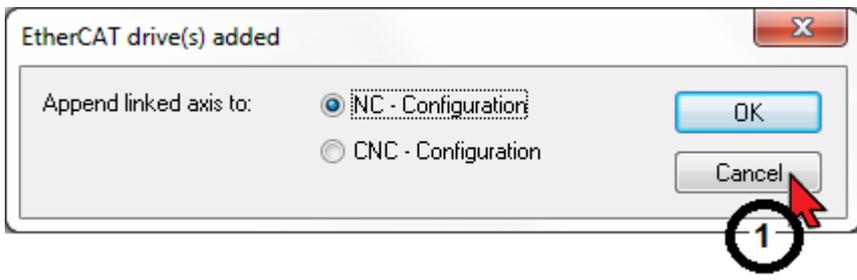
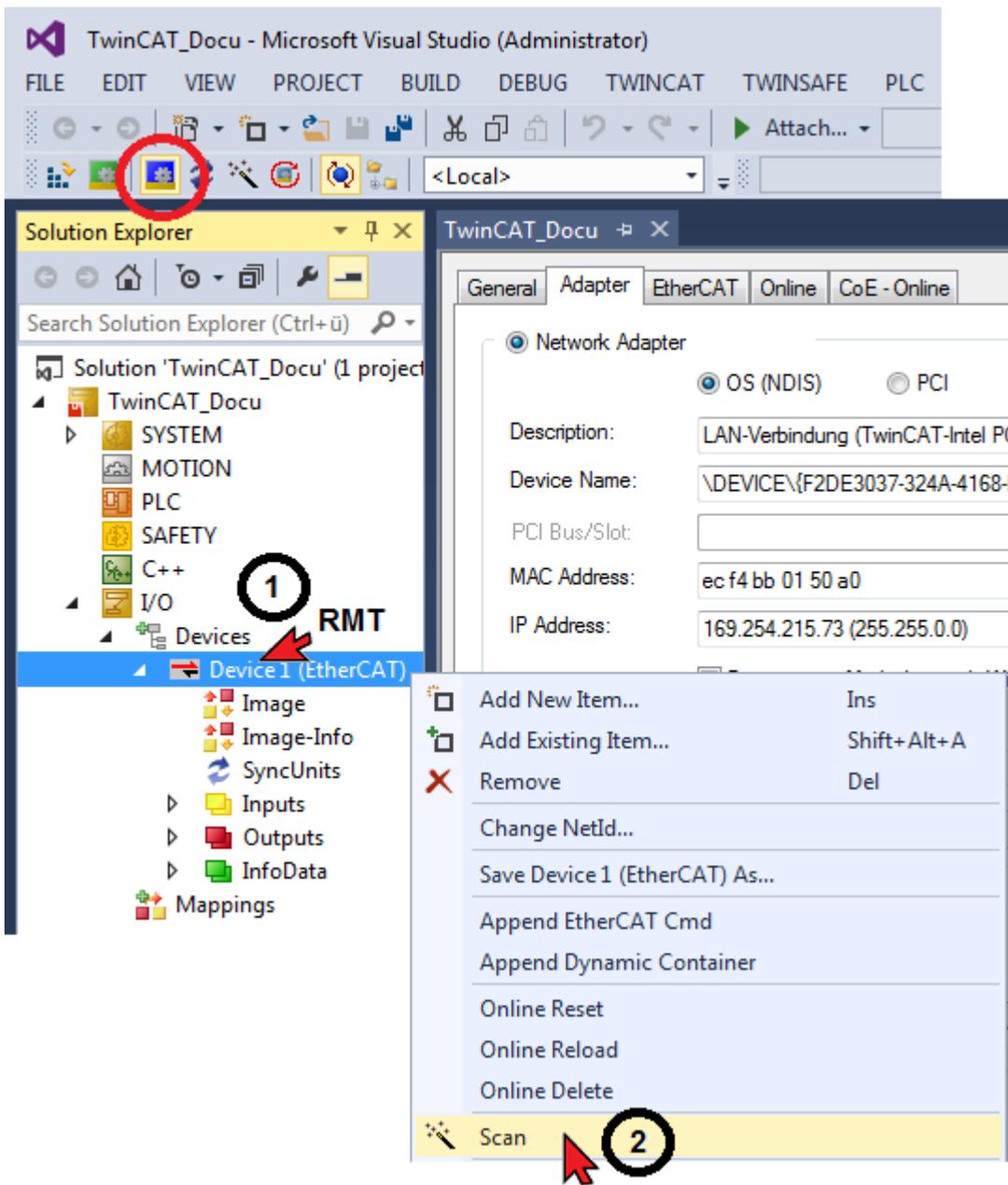
Scanning a network



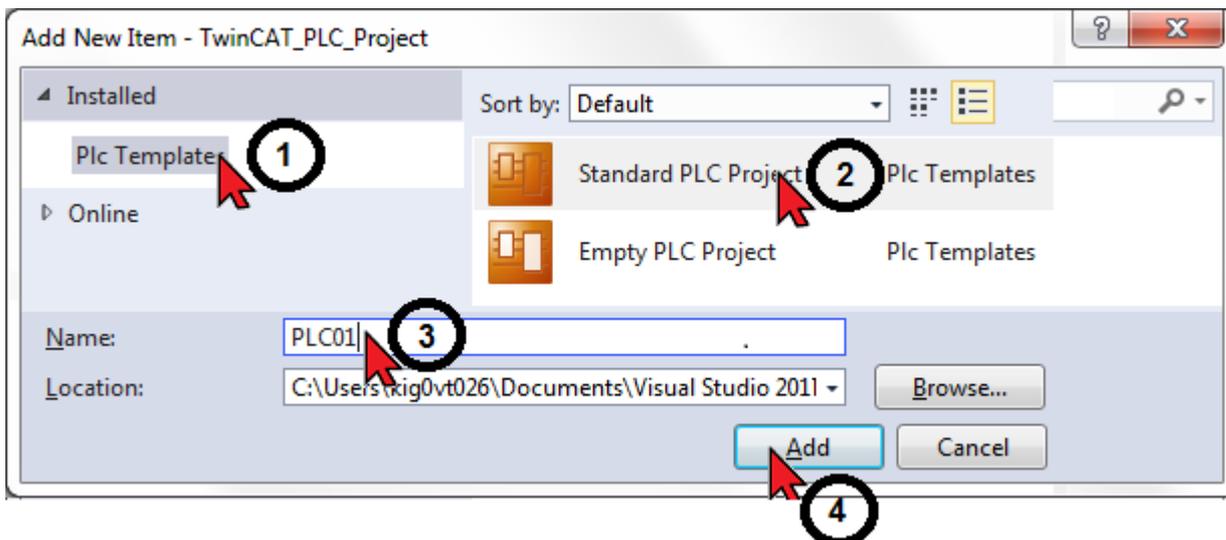
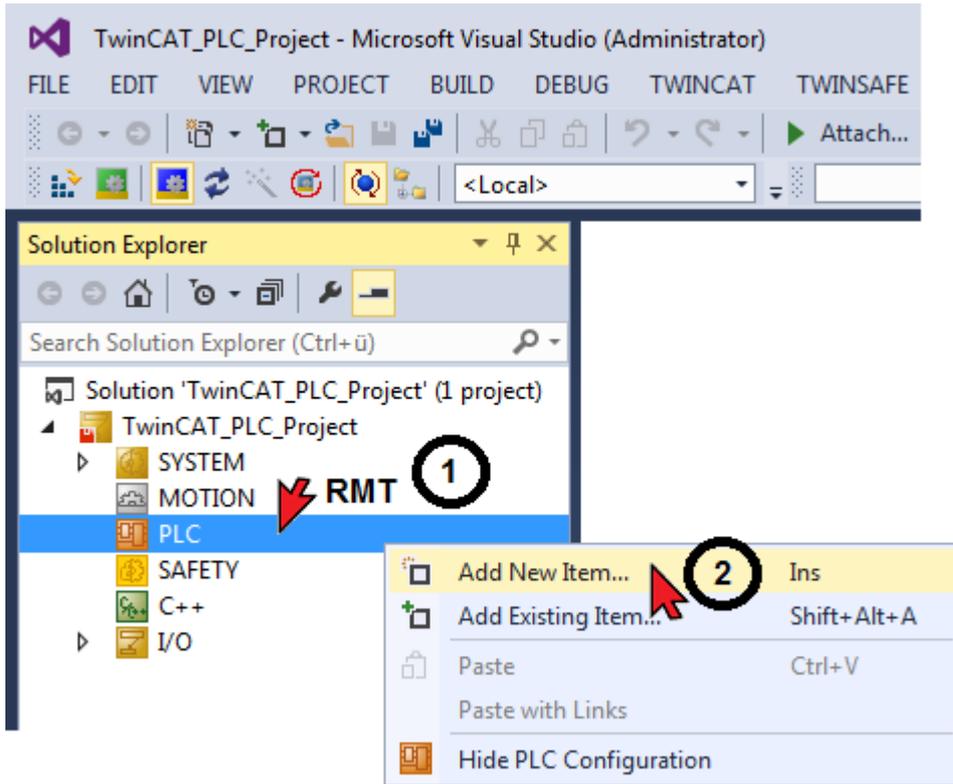
Scanning is only possible with an activated network adapter.



Scanning is only possible in TwinCAT 'Config Mode'.

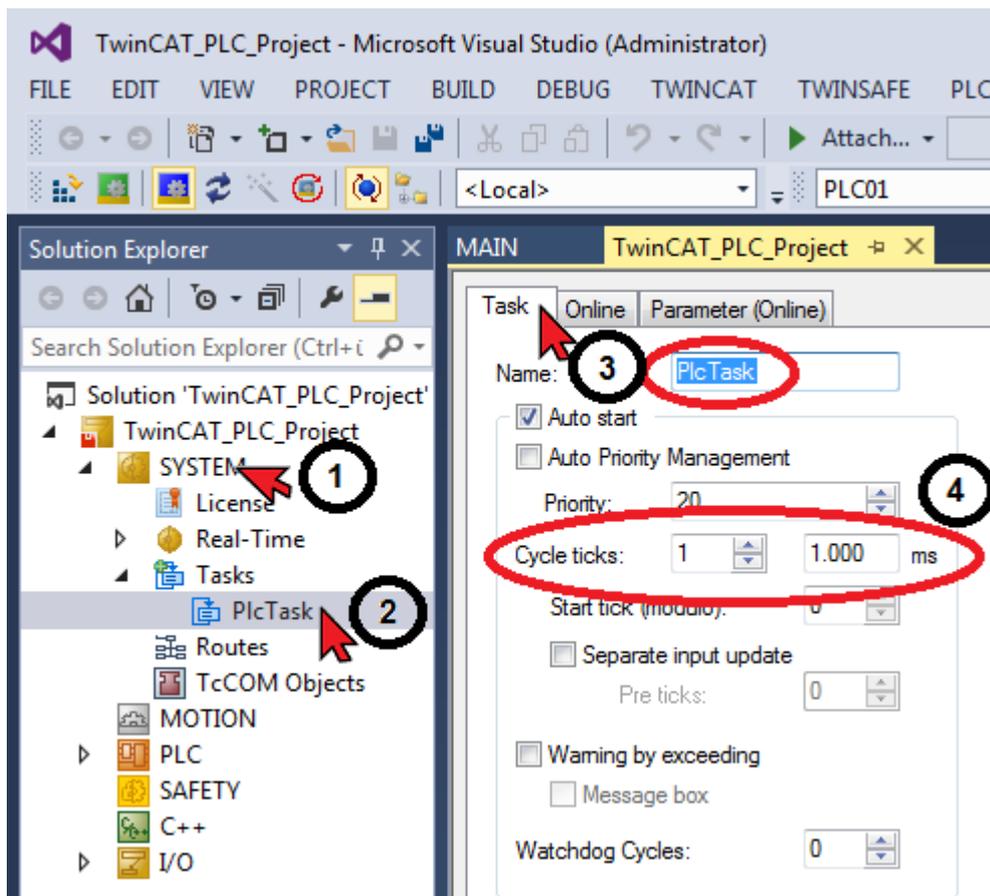


Creating a PLC project





The standard value of the TwinCAT PLC task is 10 ms.  
The cycle time is entered via the 'PlcTask' icon.

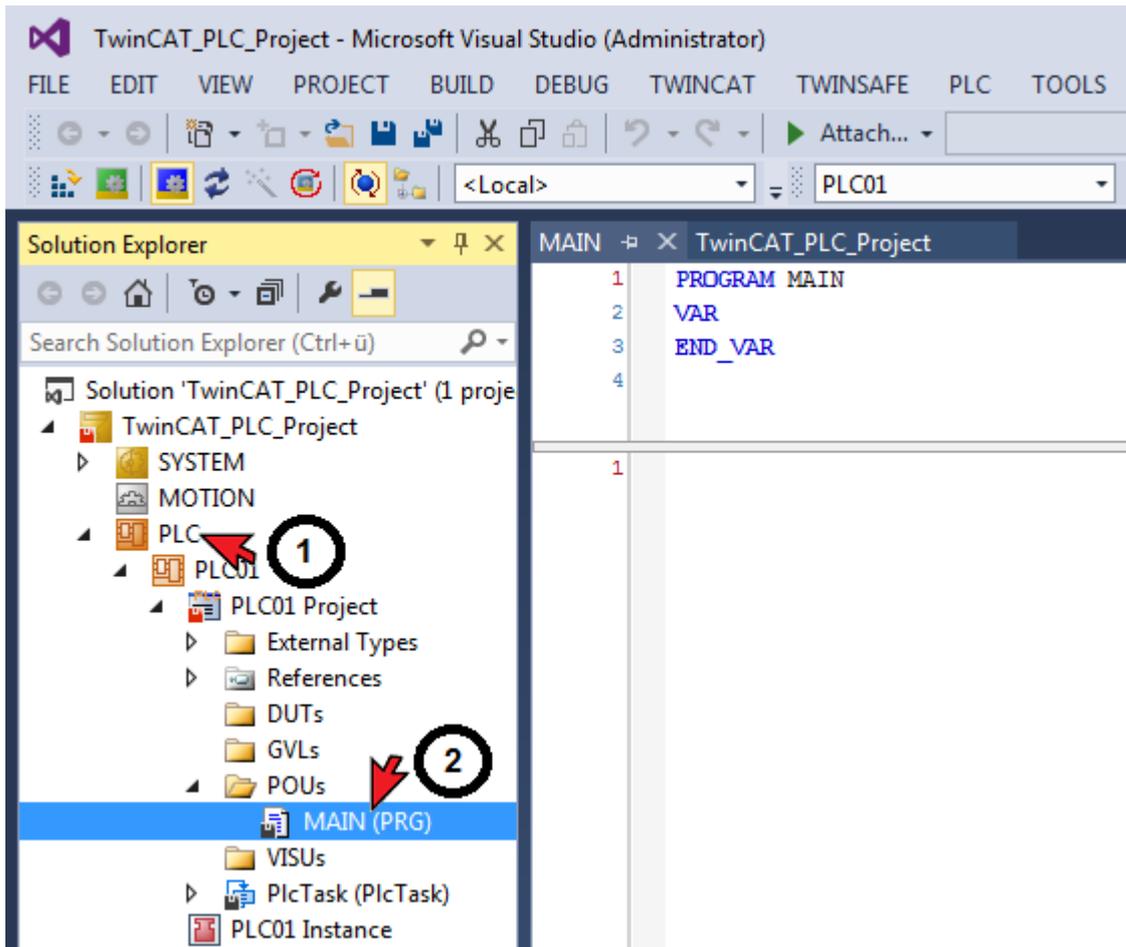


When the TwinCAT 'Activate Configuration' function is executed, the set PLC task value (cycle time) is automatically transferred to the AMK drive (ID1 'NC cycle time' and 'SERCOS cycle time')

The cycle times become active with the next initialization in the AMK drive.  
(System reset command, or 24 VDC OFF/ON)

For differing values, TwinCAT generates the status code '0x0037 - invalid SYNC1 cycle time'.

Opening PLC MAIN program module



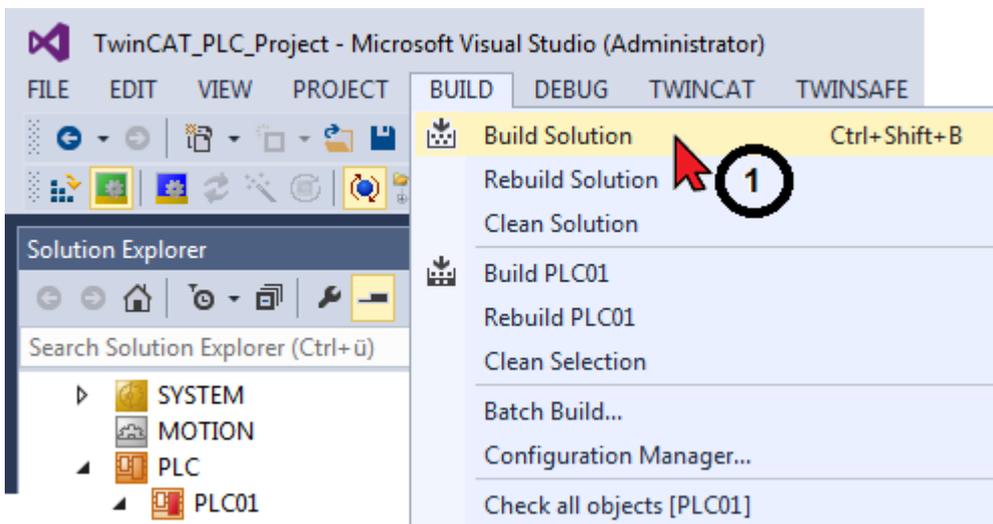
PLC variables

Variables declaration	Direction	
'Variable name' AT %I* : 'Declaration'	Input variable	Axis → PLC
'Variable name' AT %Q* : 'Declaration'	Output variable	PLC → axis

```

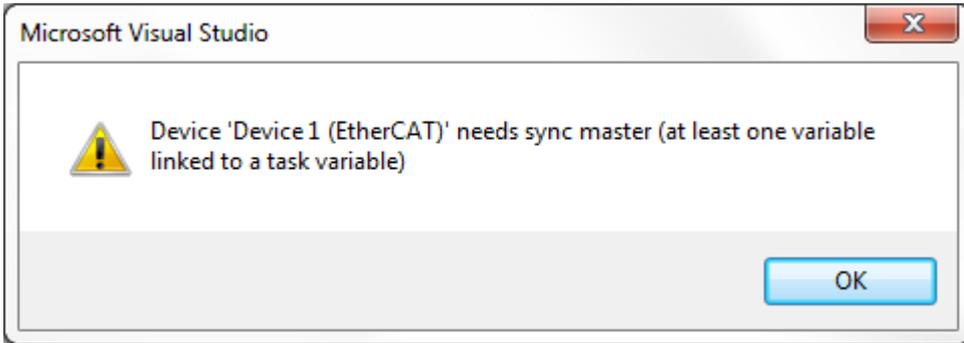
Library Manager  MAIN  TwinCAT_PLC_Project
1  PROGRAM MAIN
2  VAR
3
4      w_MasterControlWord      AT %Q*   : WORD; // AMK ID134
5      w_DriveStatusWord        AT %I*   : WORD; // AMK ID135
6      di_PositionFeedbackValue_Drive1  AT %I*   : DINT; // AMK ID51
7
8      bo_SBM      : BOOL;
9      bo_QUE      : BOOL;
10     bo_QRF      : BOOL;
11     bo_UE       : BOOL;
12     bo_RF       : BOOL;
13 END_VAR
14
15
16
17 // Drive Status
18 IF      NOT w_DriveStatusWord.14 AND NOT w_DriveStatusWord.15 THEN
19     bo_SBM := FALSE;
20
21 ELSIF   w_DriveStatusWord.14 AND NOT w_DriveStatusWord.15 THEN
22     bo_SBM := TRUE;
23
24 ELSIF   NOT w_DriveStatusWord.14 AND      w_DriveStatusWord.15 THEN
25     bo_QUE := TRUE;
26
27 ELSIF   w_DriveStatusWord.14 AND      w_DriveStatusWord.15 THEN
28     bo_QRF := TRUE;
29
30 END_IF
31
32 // Master Control
33 w_MasterControlWord.14 := bo_UE; // DC Bus ON
34 w_MasterControlWord.15 := bo_RF; // Drive ON
    
```

PLC project 'Transfer'

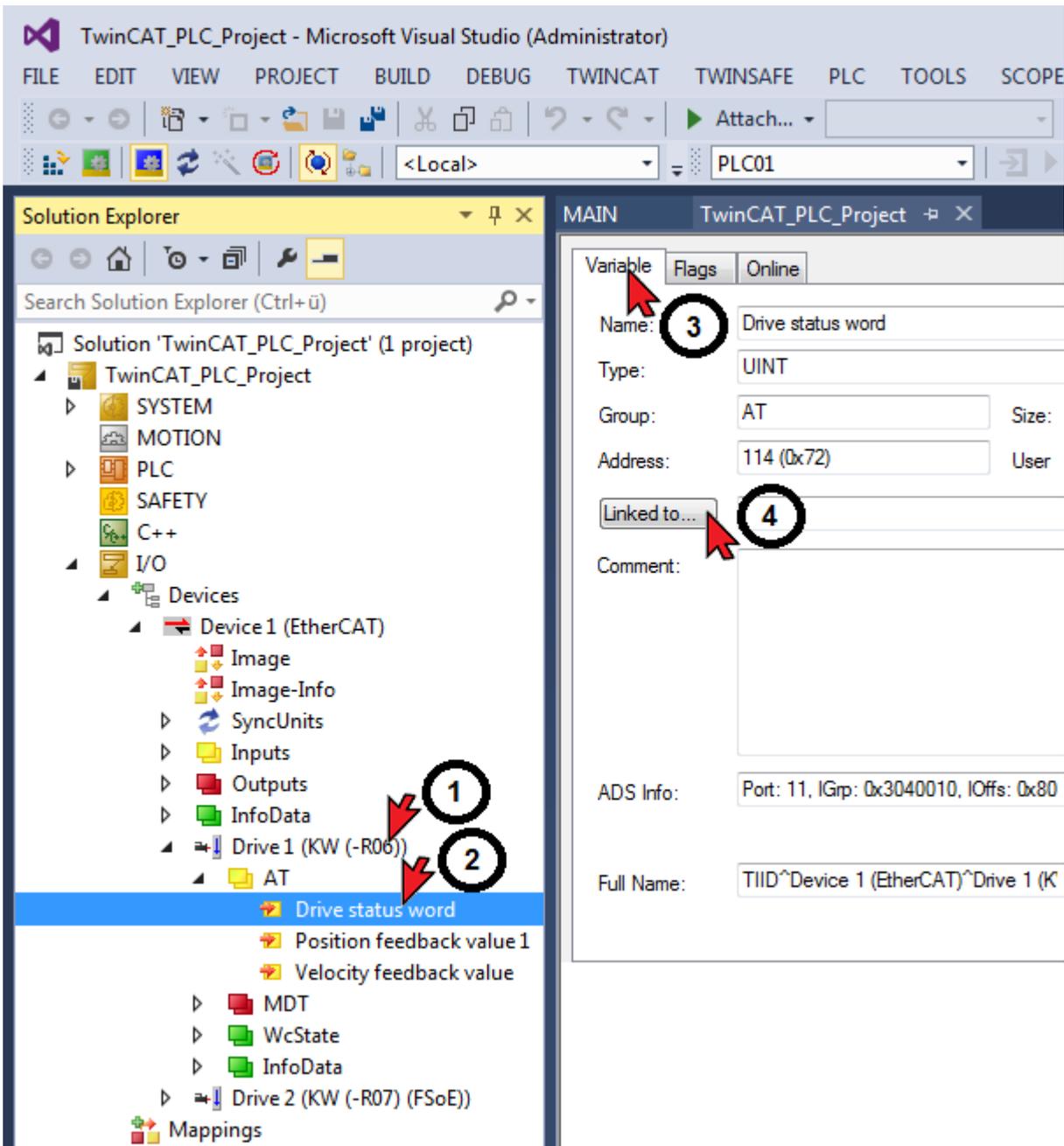


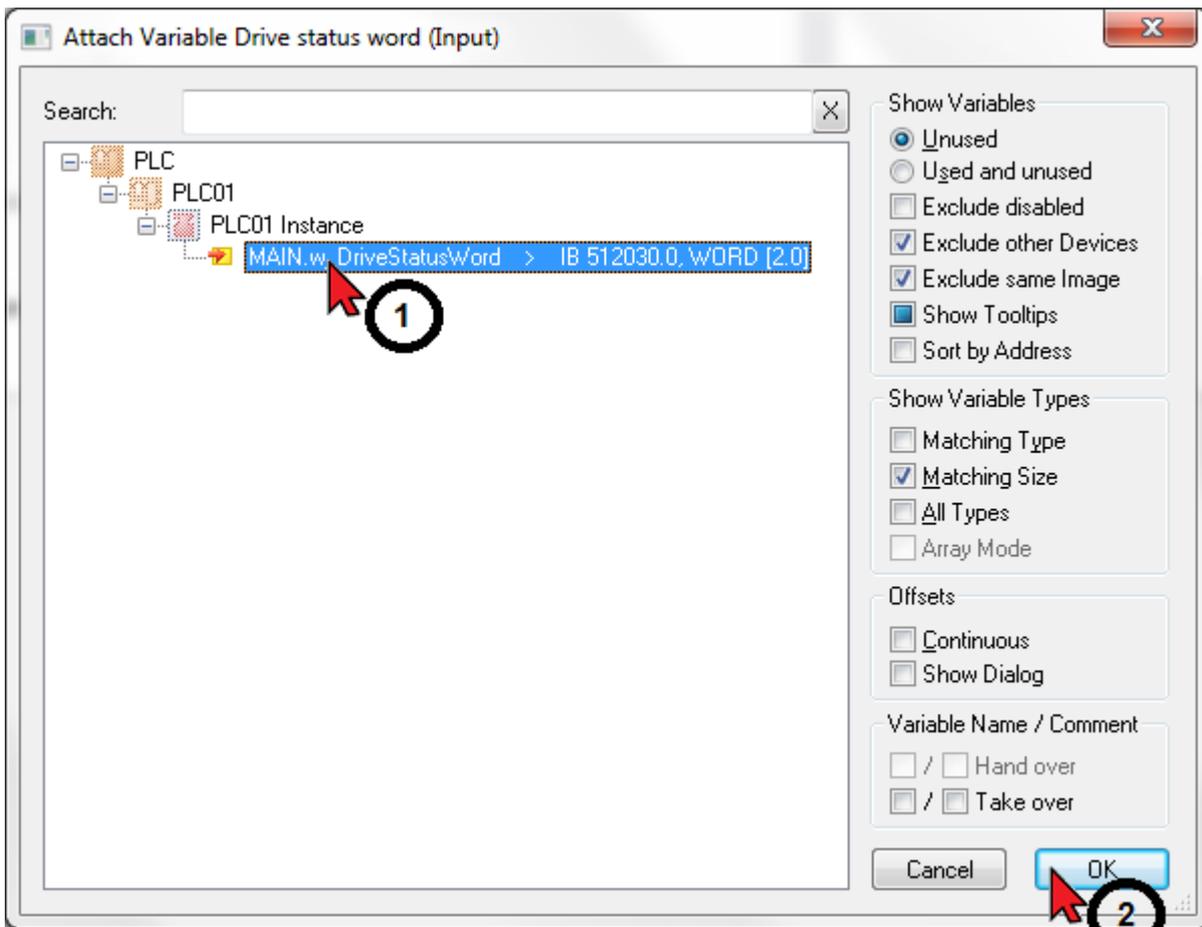
Connection between EtherCAT slave device and a task variable is missing, so that the cycle time cannot be determined. Bus start-up remains stuck in PREOP bus state.

Options for a solution can be, e.g. to connect the Status Word drive in the AT with a PLC variable or using the NC/CNC axis.

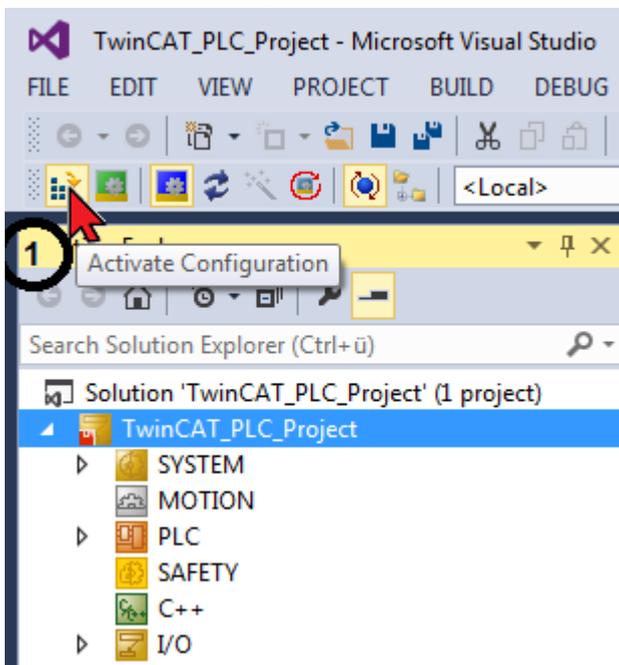


Linking variables

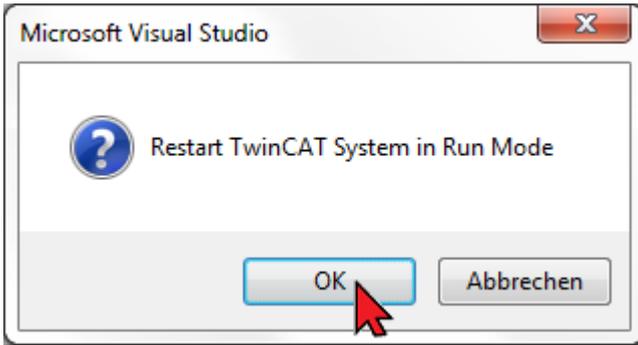




Creating a network configuration



Start TwinCAT 'Run Mode'

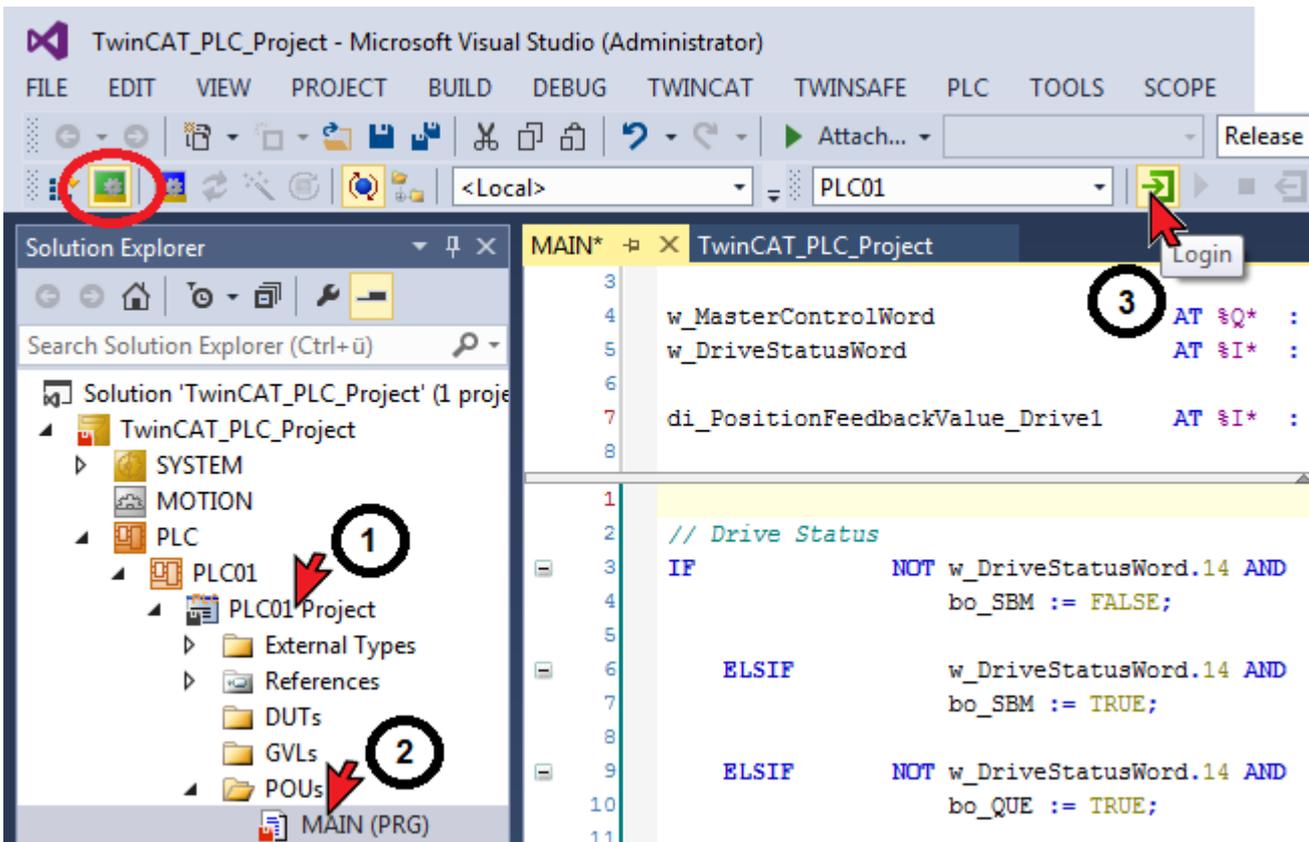


When the TwinCAT 'Activate Configuration' function is executed, the set PLC task value (cycle time) is automatically transferred to the AMK drive (ID1 'NC cycle time' and 'SERCOS cycle time')

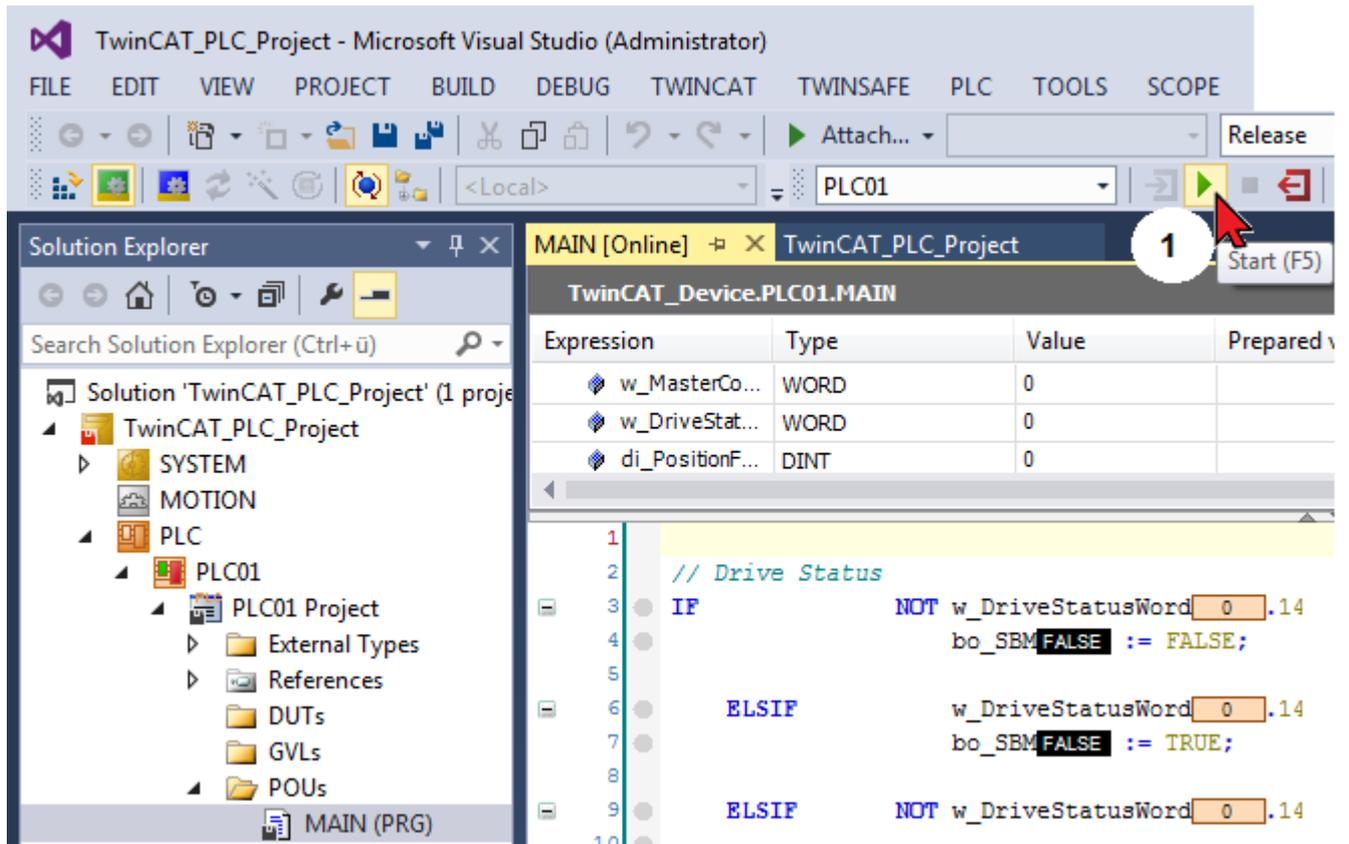
The cycle times become active with the next initialization in the AMK drive.  
(System reset command, or 24 VDC OFF/ON)

For differing values, TwinCAT generates the status code '0x0037 - invalid SYNC1 cycle time'.

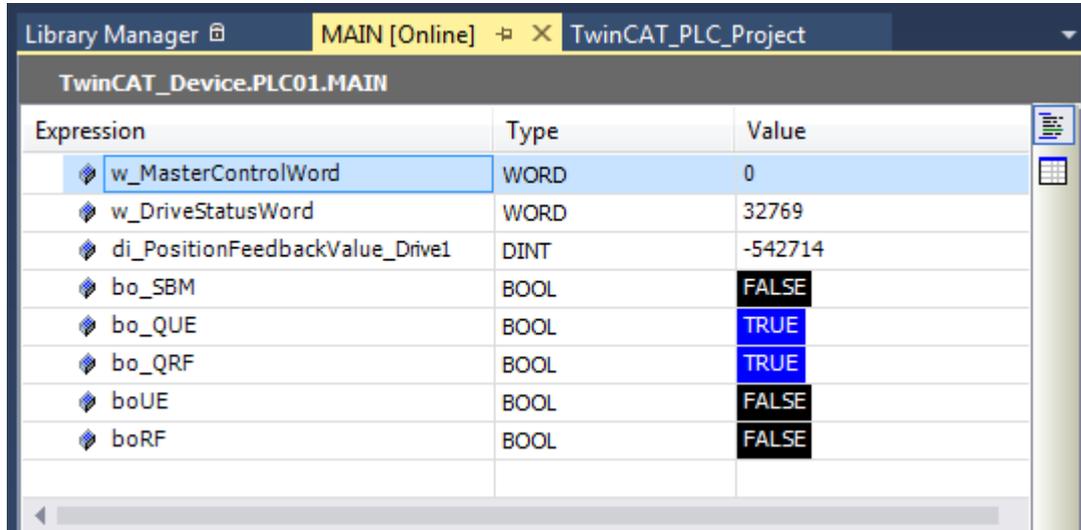
Log-in: transfer PLC program to the control unit



Start PLC



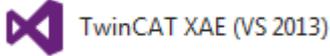
Function test: online values are displayed and updated



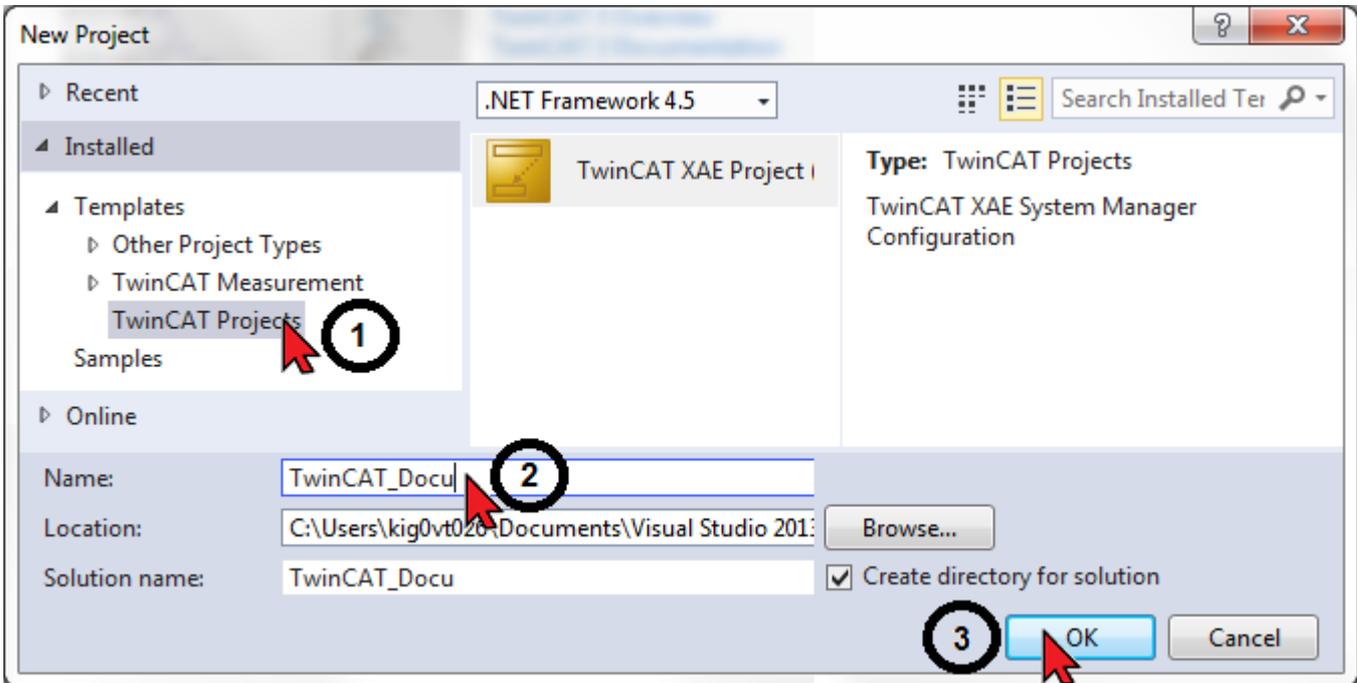
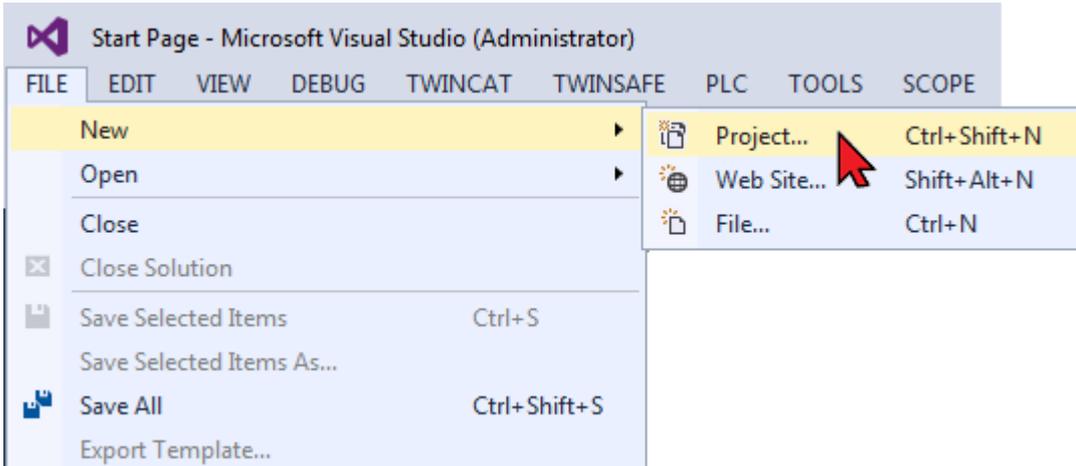
## 11 TwinCAT 3 project with NC axis

The example describes how to generate a project with a TwinCAT NC axis.  
The drives are controlled via the “Online” function of the NC axis.

Start TwinCAT XAE (VS 2013)

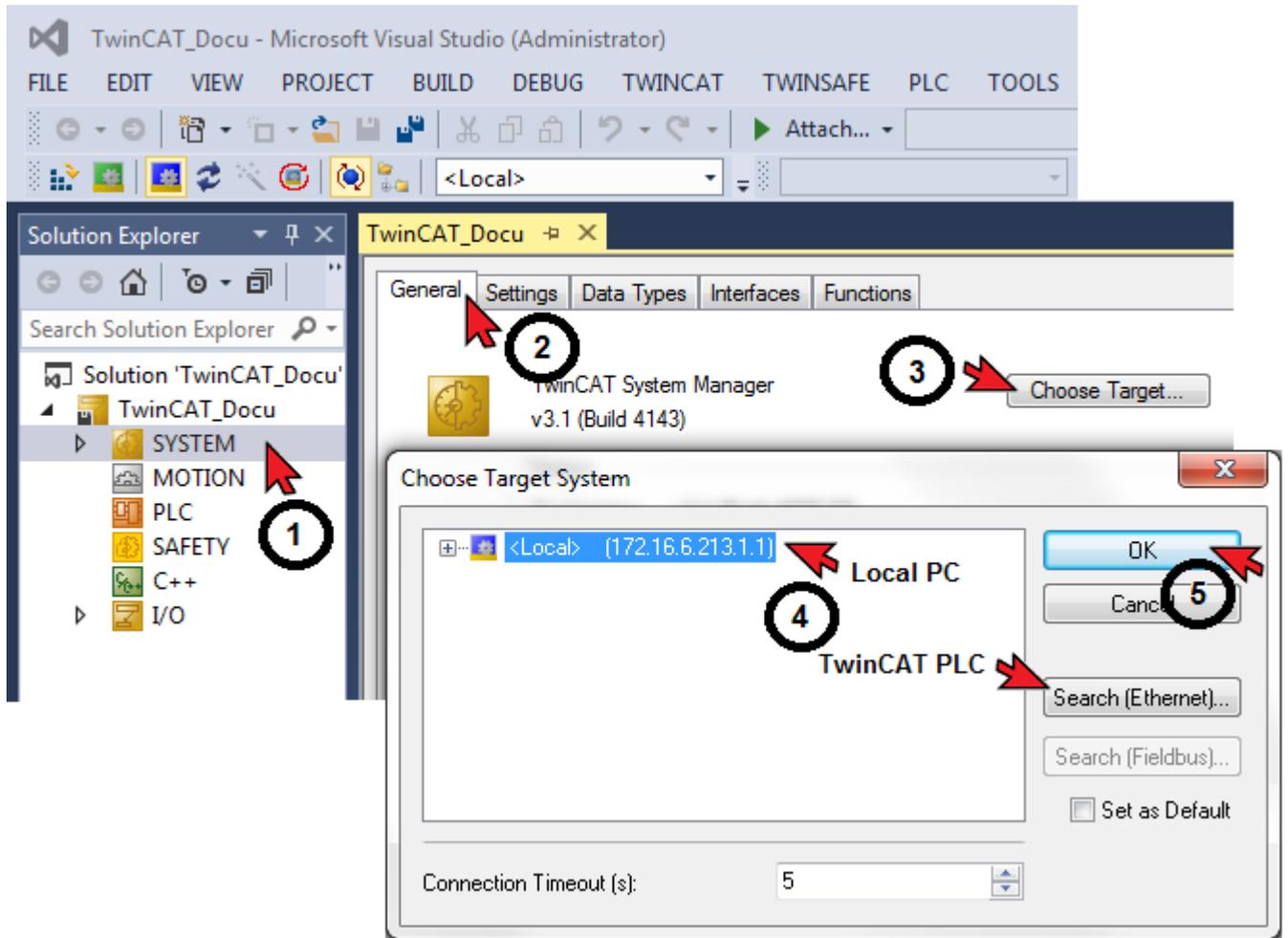


Create a new project

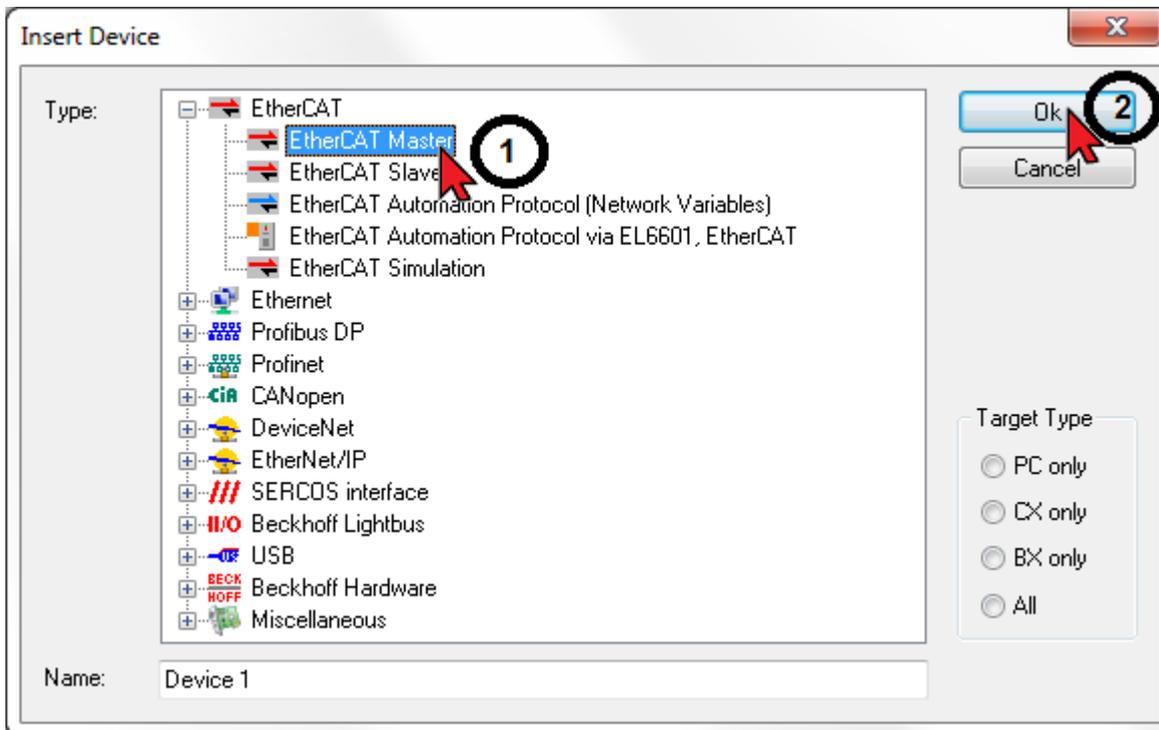
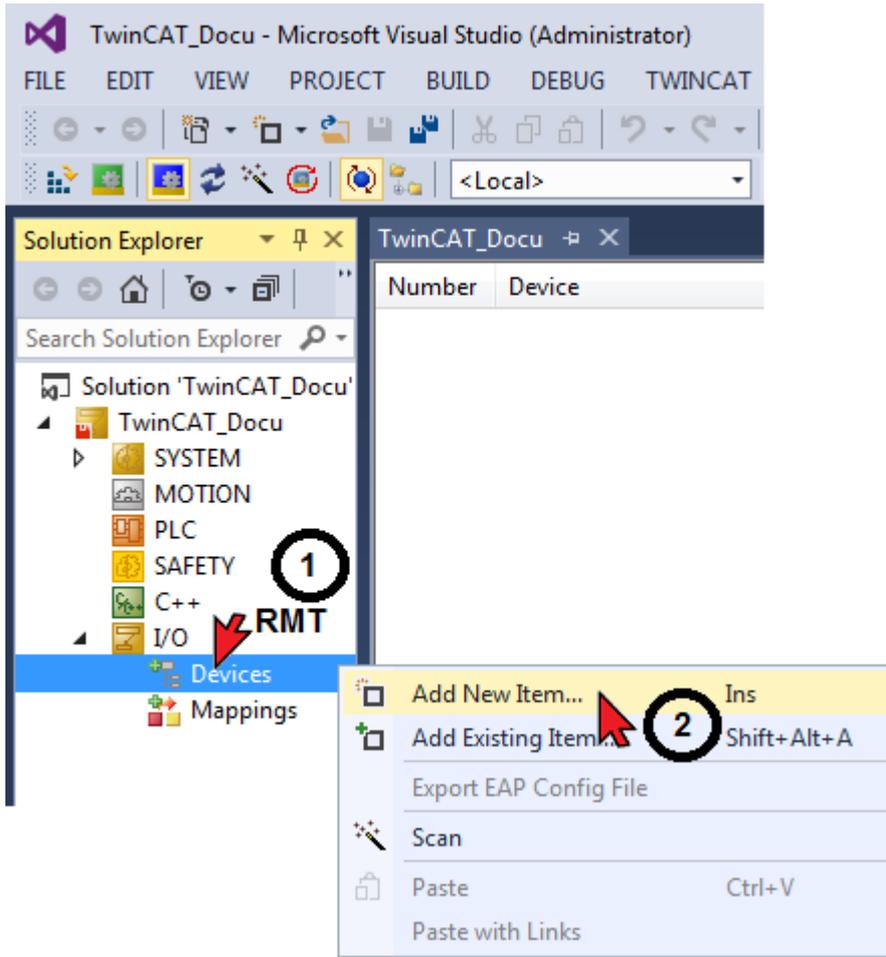


Select the target system:

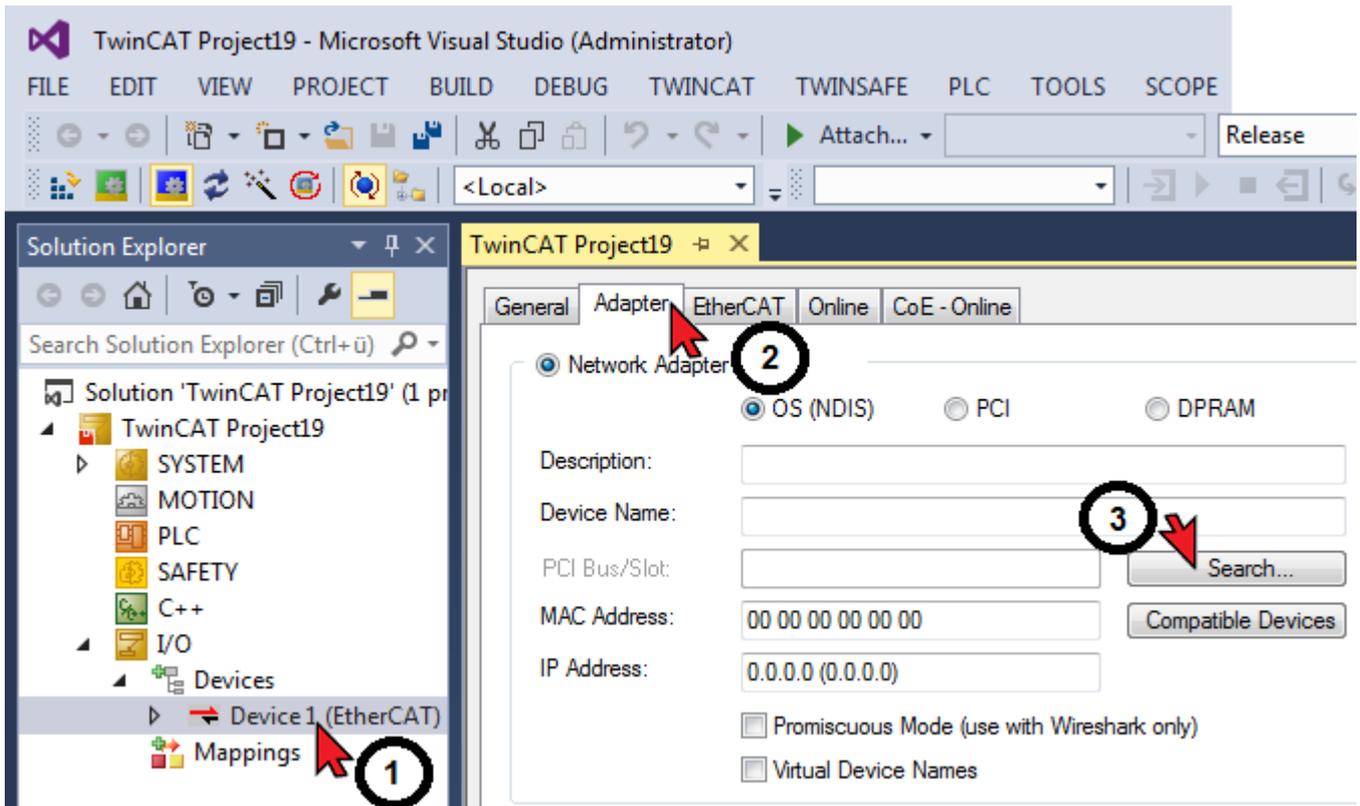
- Local (own PC)
- TwinCAT PLC



Add the EtherCAT Master functionality to the 'Device' icon

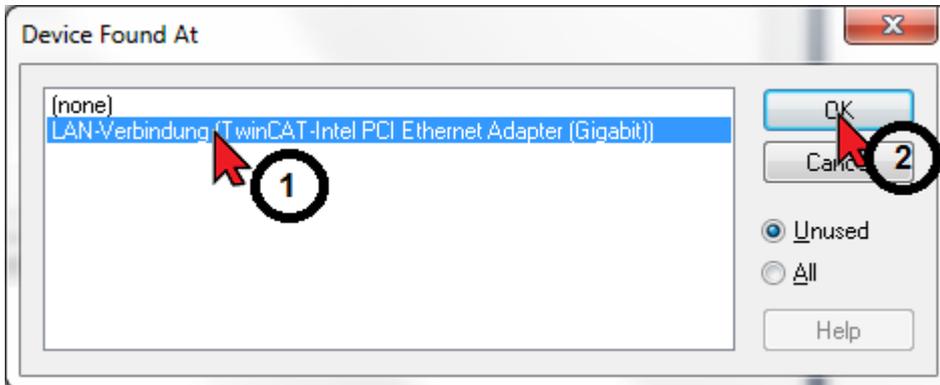


Activate existing network adapter



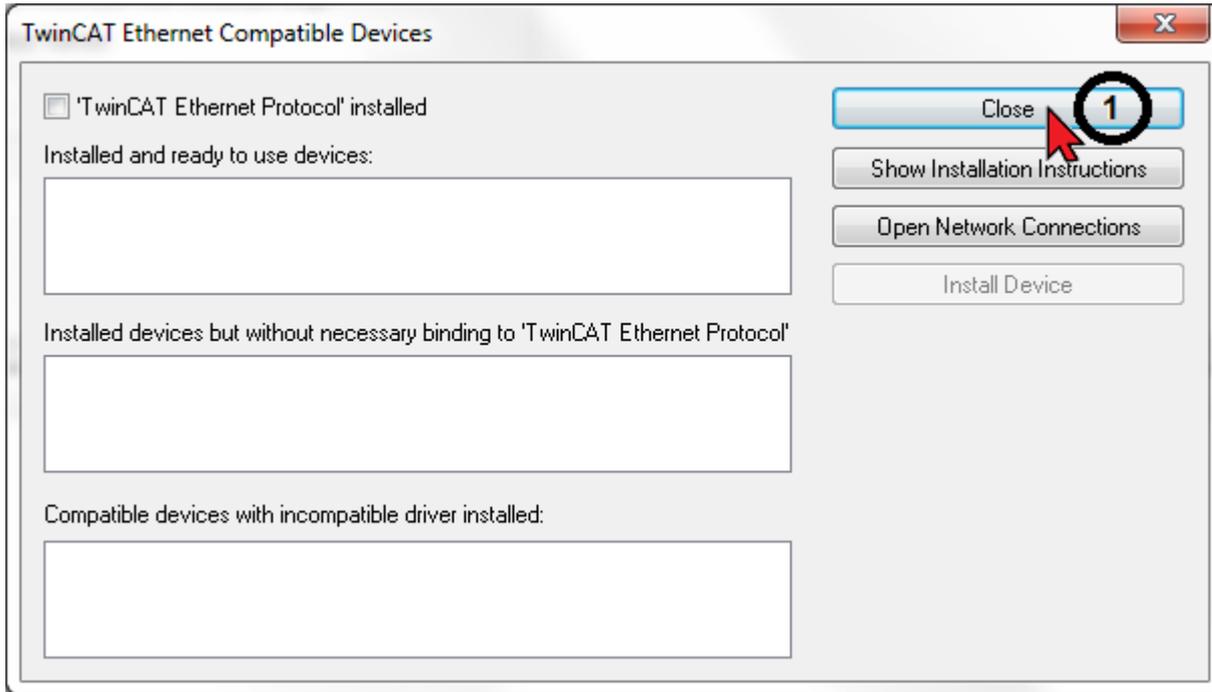
Driver installed

Activate the adapter



Driver not installed

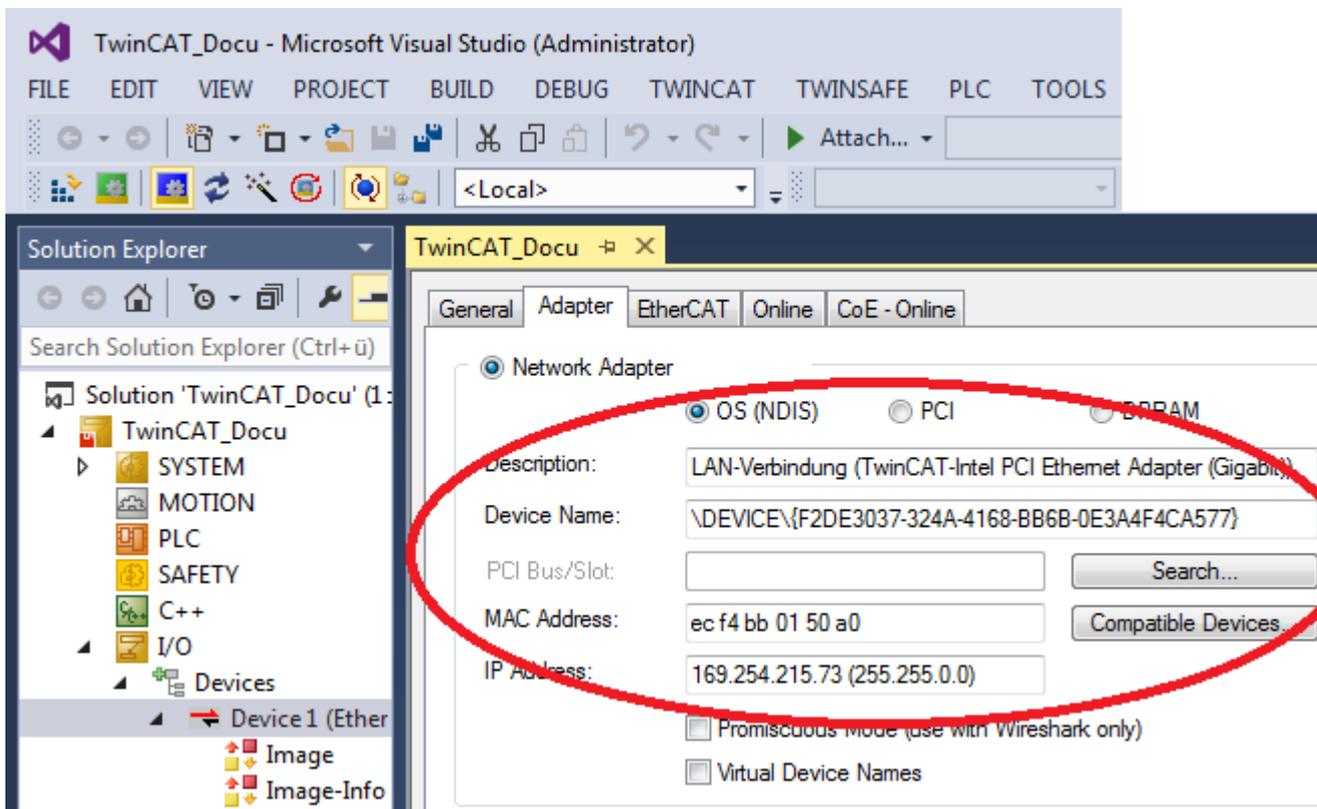
Siehe Adapter settings auf Seite 52.



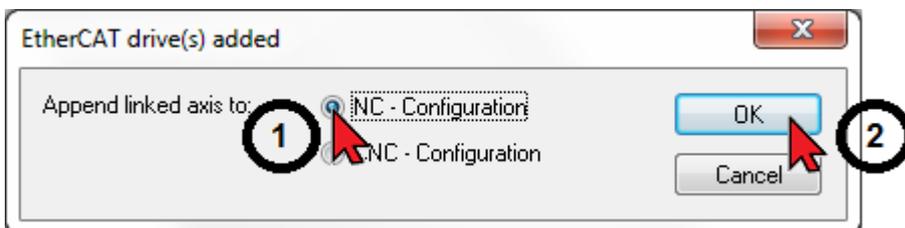
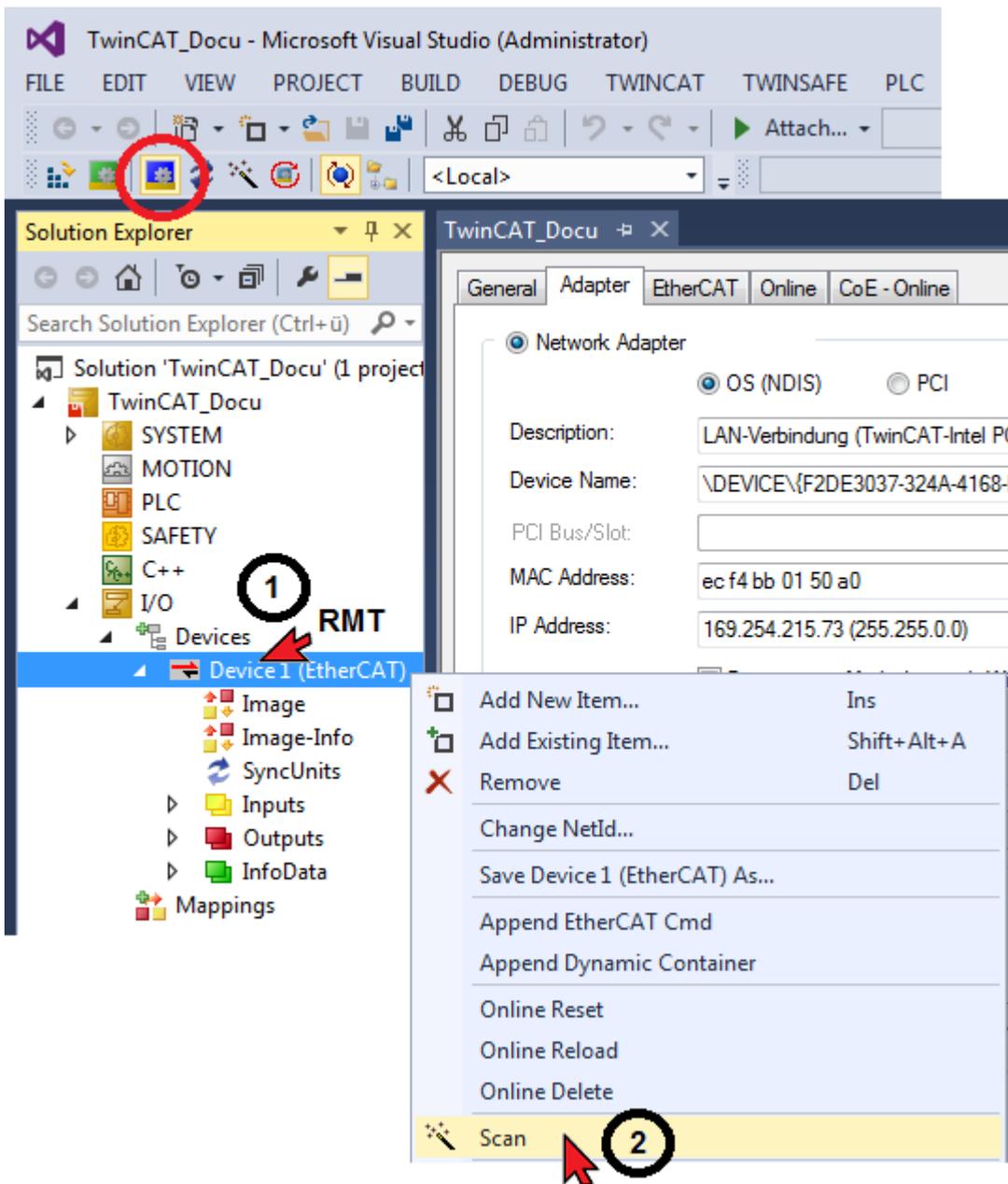
Scanning a network



Scanning is only possible with an activated network adapter.



Scanning is only possible in TwinCAT 'Config Mode'.



**TwinCAT/AMK cycle time**

The following cycle times must be set to identical values.

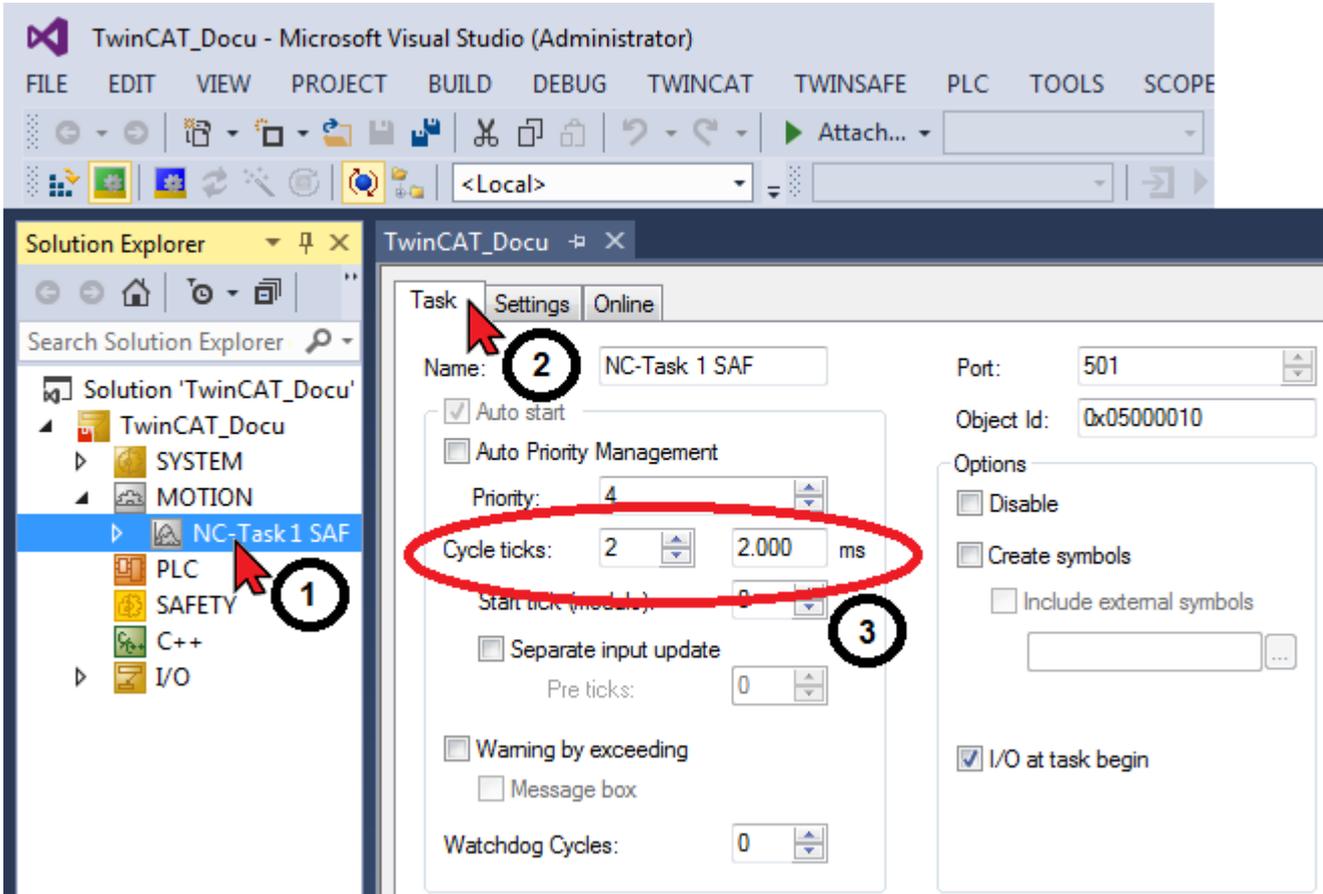
TwinCAT		AMK
NC Task 1 SAF	=	ID1 'NC cycle time' ID2 'SERCOS cycle time'



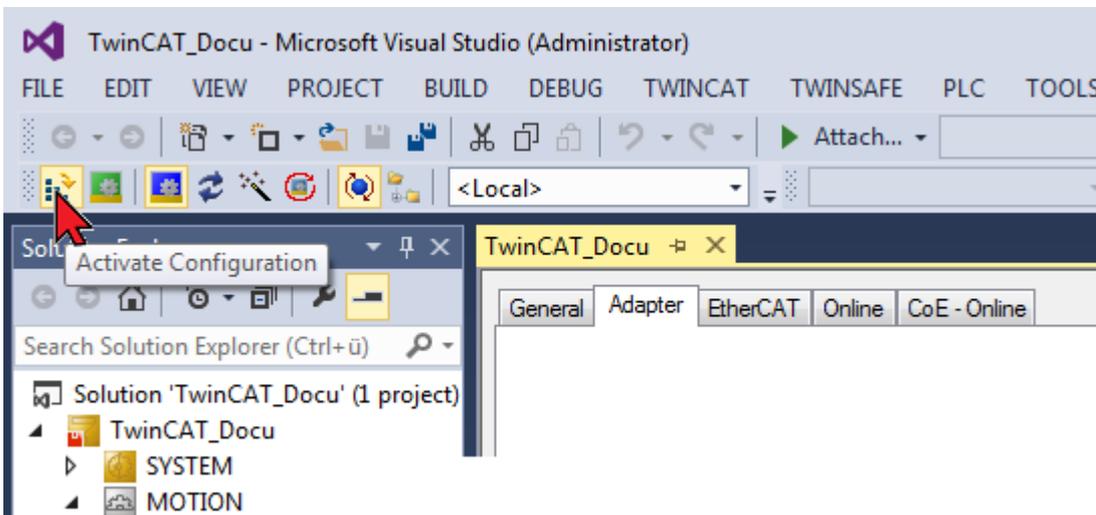
When the TwinCAT function 'Activate Configuration' is executed, the value from the NC task 1 SAF is automatically transferred to the AMK drive.

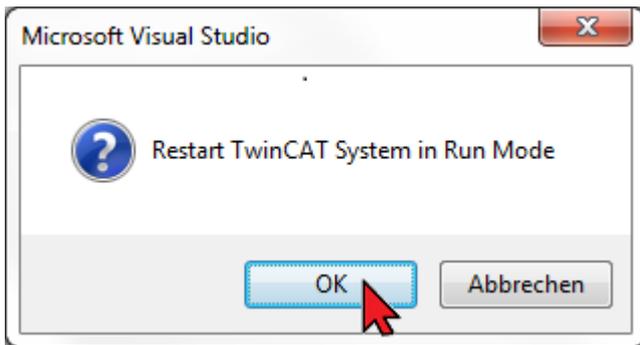
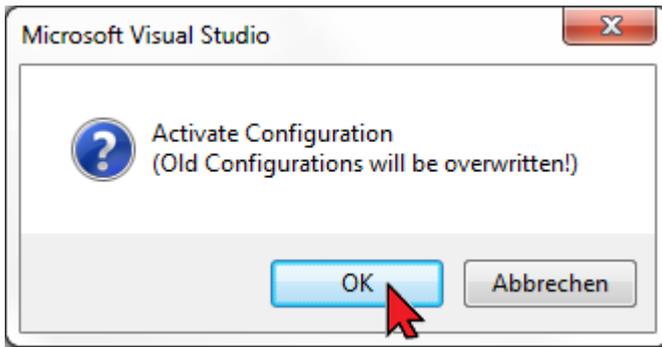
The cycle times become active with the next initialization in the AMK drive.  
(System reset command, or 24 VDC OFF/ON)

For differing values, TwinCAT generates the status code '0x0037 - invalid SYNC1 cycle time' and AMK the diagnostic message 2572, Info 27



Creating configuration and log-in





Function test 'General'

In TwinCAT 'Run Mode' the Slave devices are automatically switched to the Bus State OP (Operational) (3). For faultless operation, the EtherCAT Master must be in OP state (4).

The screenshot shows the TwinCAT software interface. The Solution Explorer on the left shows the project structure, with 'Device 1 (EtherCAT)' highlighted. The main window displays the 'Online' tab, which contains a table of devices and their states. The 'Actual State' dropdown is set to 'OP'. The 'Online' tab is circled in red, and the 'OP' state is also circled in red. The 'Device 1 (EtherCAT)' folder in the Solution Explorer is also circled in red.

No	Addr	Name	State	CRC
1	1001	Drive 1 (KW (-R06))	OP	0.0
2	1002	Drive 2 (KW (-R07) (FSOE))	OP	0

Actual State:

Buttons: Init, No Op, Safe Op, Op, Clear CRC, Clear Frames

Statistics:

Counter	Cyclic
Send Frames	123784
Frames / sec	499
Lost Frames	0
Tx/Rx Errors	0

Function test 'Drive'

Display of bus status (3) and current values of linked variables.

The screenshot displays the TwinCAT software interface. On the left, the Solution Explorer shows the project structure with 'Drive 1 (KW (-R06))' selected under 'Devices'. On the right, the State Machine window shows the 'Current State' as 3, which is circled in red. Below it, the Variable Declaration window shows a table of variables. A red circle highlights the 'WcStateOut' variable in the table, which is also circled with a '4'. Other callouts include '1' pointing to the selected drive, '2' pointing to the 'Online' tab, and '3' pointing to the 'Current State' value.

Name	Online	Type	Size
Drive status word	X 32768	UINT	2.0
Position feedback value 1	X -230332	DINT	4.0
Velocity feedback value	X -16	DINT	4.0
WcStateOut	0	BIT	0.1
WcStateIn	X 0	BIT	0.1
InputToggle	X 1	BIT	0.1
State	8	UINT	2.0
AdsAddr	172.16.6.21...	AMS...	8.0
Chn0	0	USINT	1.0
DcOutputShift	X 618600	DINT	4.0
DcInputShift	X 3381400	DINT	4.0
Master control word	X 0	UINT	2.0
Position command value	X 24	DINT	4.0
Velocity command value	X 0	DINT	4.0

### 11.1 Startup the NC axis

The NC axis operates in position control mode, independently of the operating mode (speed or position control) set for the drive. If the rotational speed control mode is active in the drive, the position control loop in the NC axis is automatically closed. The nominal value specified by the NC axis depends on the operating mode set in the drive and is adapted automatically. Non-adapted control parameters quickly generate a lag distance error, since this is monitored by the NC axis as standard.



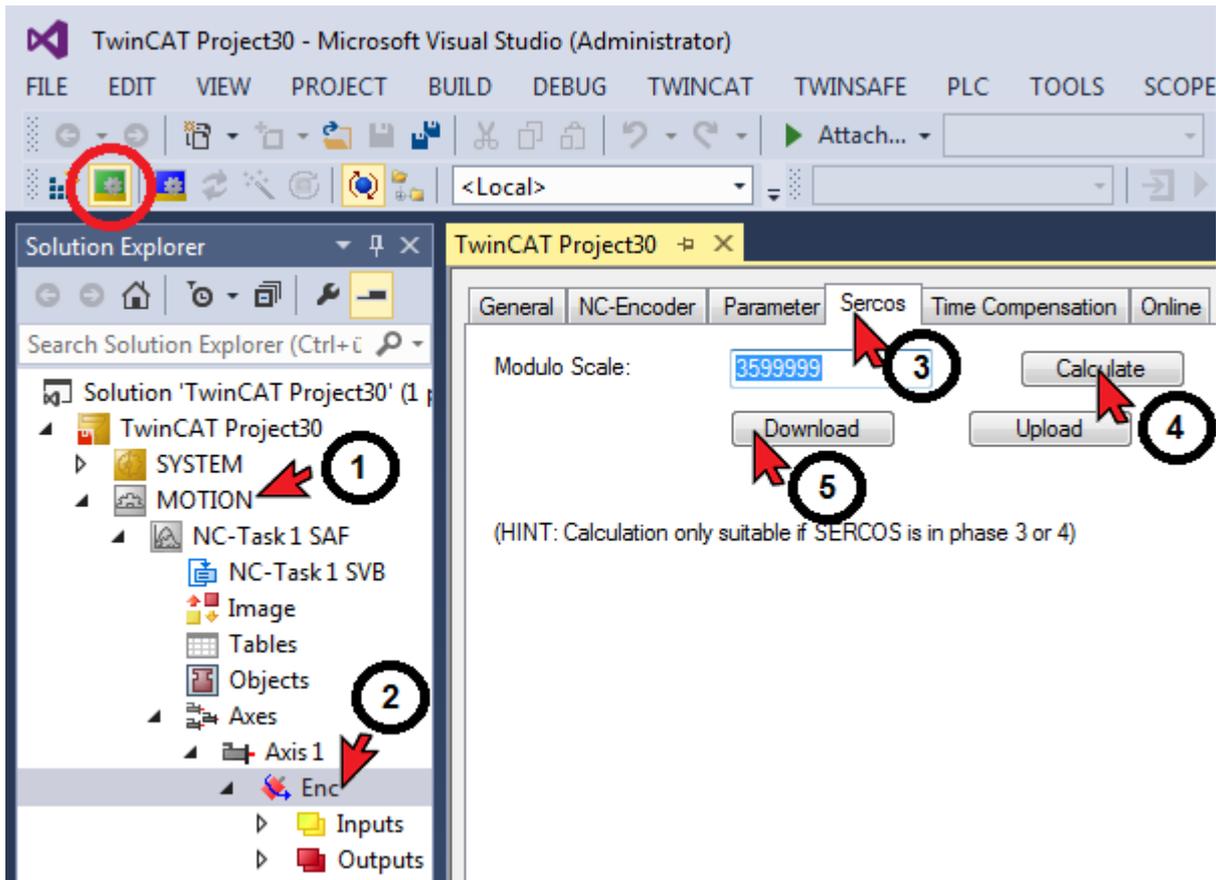
Requirement:  
 The direct-current link is charged  
 Acknowledgment DC converter ON (QUE) = 1

#### AMK position control mode



To operate the NC axis, the encoder overflow value for modulo operation must be calculated and transmitted.  
 An incorrect value leads to AMK diagnostic message 2318 'Control deviation' during operation.

TwinCAT 'Run Mode' is required (there is no confirmation after 'Download')



AMK drive:



NC axis lag distance (error code 0x4550)

Set ID104 'Position loop factor KV' to a value adjusted to the application.  
 Activate the SAK (lag distance compensation)

ID104 'Position loop factor KV'

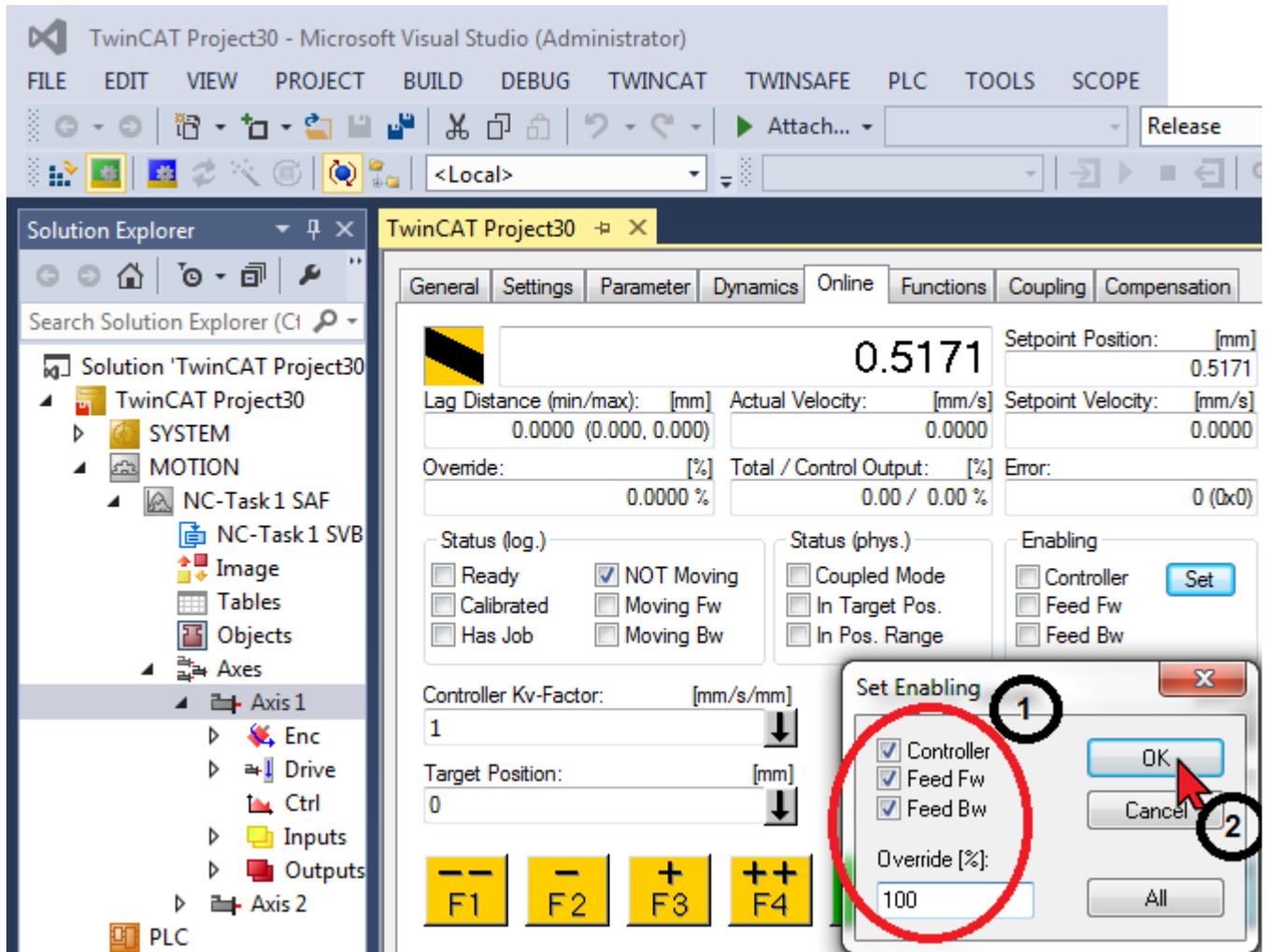
ID32796 'Source RF': 5 (RF via field bus)

ID32800 'AMK main operating mode': 00410004 (cyclic nominal value input via EtherCAT, position control mode)

Alternatively:

ID32800 'AMK main operating mode': 00410204 (cyclic nominal value input via EtherCAT, position control mode, SAK active)

Energize motor (activate RF), enable direction of rotation and set Override.



### AMK rotational speed control mode

The position control loop is closed by the control unit. The control unit determines the nominal rotational speeds.

AMK drive:

ID32796 'Source RF': 5 (RF via field bus)

ID32800 'AMK main operating mode': 00410003 (cyclic nominal value input via EtherCAT, rotational speed control mode)

TwinCAT NC:

Set the 'Controller Kv-Factor' to a value adequate to the application.

Value too low: large lag distance, lag error

Value too high: drive oscillates

The screenshot shows the TwinCAT Project30 interface. On the left, the Solution Explorer shows the project structure: Solution 'TwinCAT Project30' > TwinCAT Project30 > MOTION > NC-Task 1 SAF > NC-Task 1 SVB > Objects > Axis 1. A red arrow labeled '1' points to 'Axis 1'. The main panel is titled 'TwinCAT Project30' and has several tabs: General, Settings, Parameter, Dynamics, Online (selected), Functions, Coupling, and Compensation. A red arrow labeled '2' points to the 'Online' tab. The 'Online' tab displays the following data:

Setpoint Position: [mm]	0.5171
Setpoint Velocity: [mm/s]	0.0000
Actual Velocity: [mm/s]	0.0000
Override: [%]	0.0000 %
Total / Control Output: [%]	0.00 / 0.00 %
Error:	0 (0x0)

Below the data are status sections:

- Status (log.):** Ready, Calibrated, Has Job, NOT Moving (checked), Moving Fw, Moving Bw.
- Status (phys.):** Coupled Mode, In Target Pos., In Pos. Range.
- Enabling:** Controller, Feed Fw, Feed Bw. A 'Set' button is present.

At the bottom of the main panel are several fields and buttons:

- Controller Kv Factor: [mm/s/mm] 200 (Red arrow labeled '3' points to this field)
- Reference Velocity: [mm/s] 2200 (Red arrow labeled '4' points to this field)
- Target Position: [mm] 0
- Target Velocity: [mm/s] 0
- Buttons: F1 (F1), F2 (F2), F3 (F3), F4 (F4), F5 (F5), F6 (F6), F8 (F8), F9 (F9).

Energize motor (activate RF), enable direction of rotation and set Override.

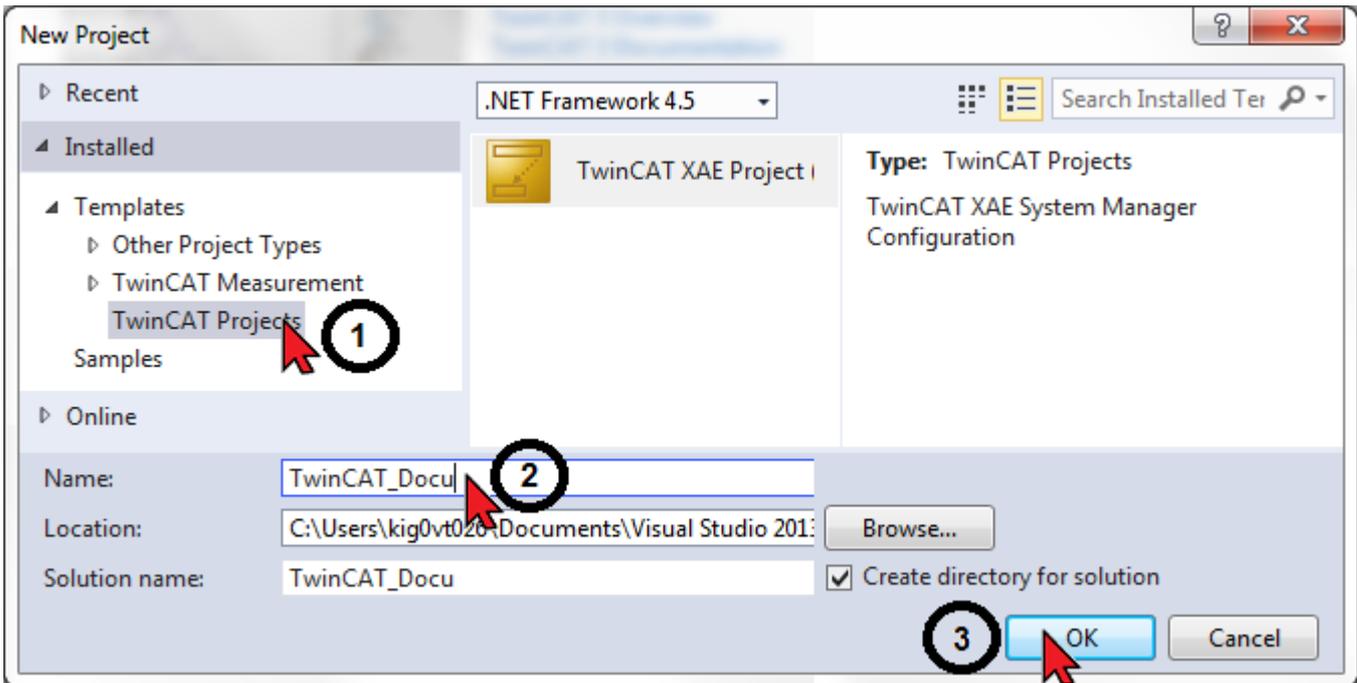
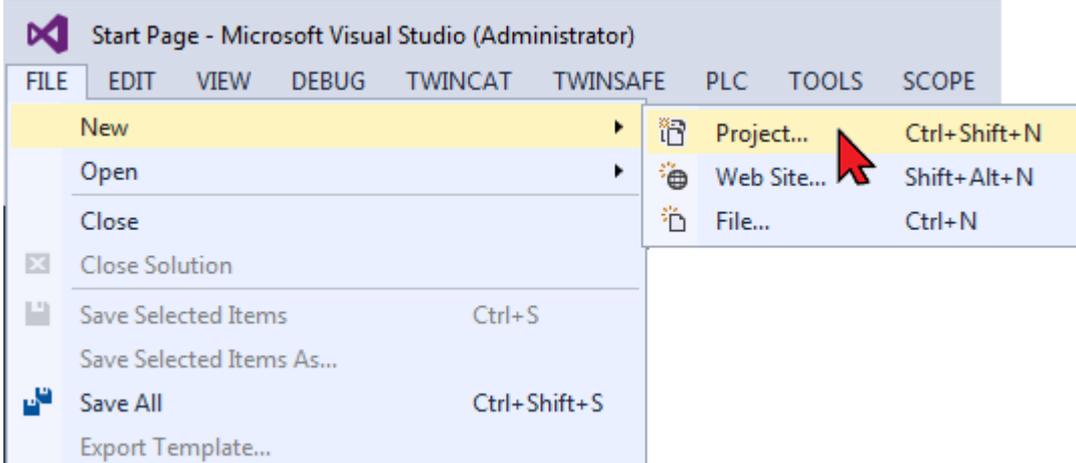
The screenshot displays the TwinCAT Project30 interface. On the left, the Solution Explorer shows the project structure: Solution 'TwinCAT Project30' > TwinCAT Project30 > MOTION > NC-Task 1 SAF > NC-Task 1 SVB > Axes > Axis 1. The main window shows the 'Settings' tab for Axis 1. Key parameters include: Setpoint Position: 0.5171 [mm], Actual Velocity: 0.0000 [mm/s], Lag Distance: 0.0000 (0.000, 0.000) [mm], and Controller Kv-Factor: 200 [mm/s/mm]. A 'Set Enabling' dialog box is open, with a red circle around the 'Controller', 'Feed Fw', and 'Feed Bw' checkboxes, labeled with a '1'. A red arrow points to the 'OK' button, labeled with a '2'. The dialog also shows 'Override [%]' set to 100.

## 12 Adapter settings

Start TwinCAT XAE (VS 2013)

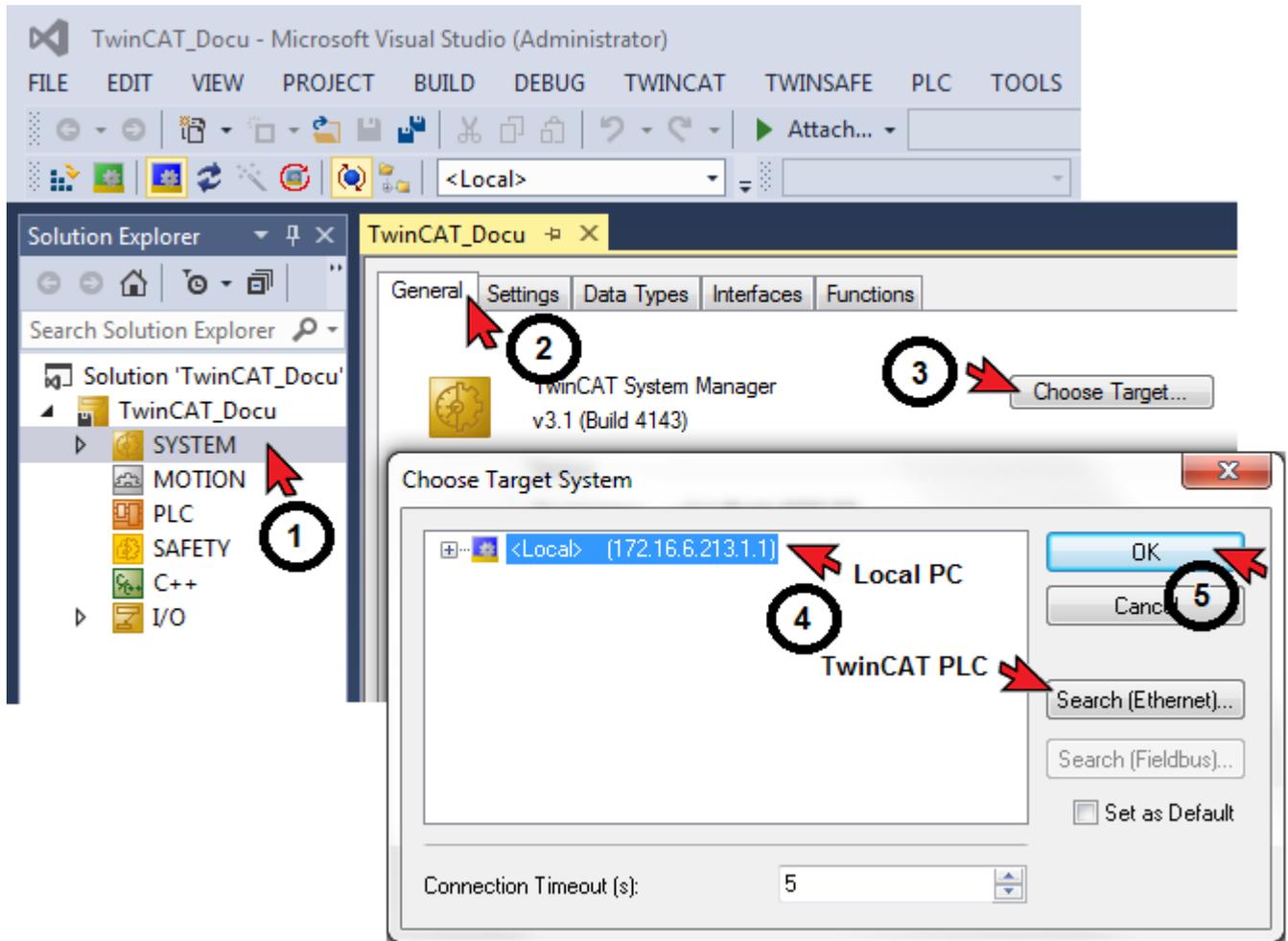


Create a new project

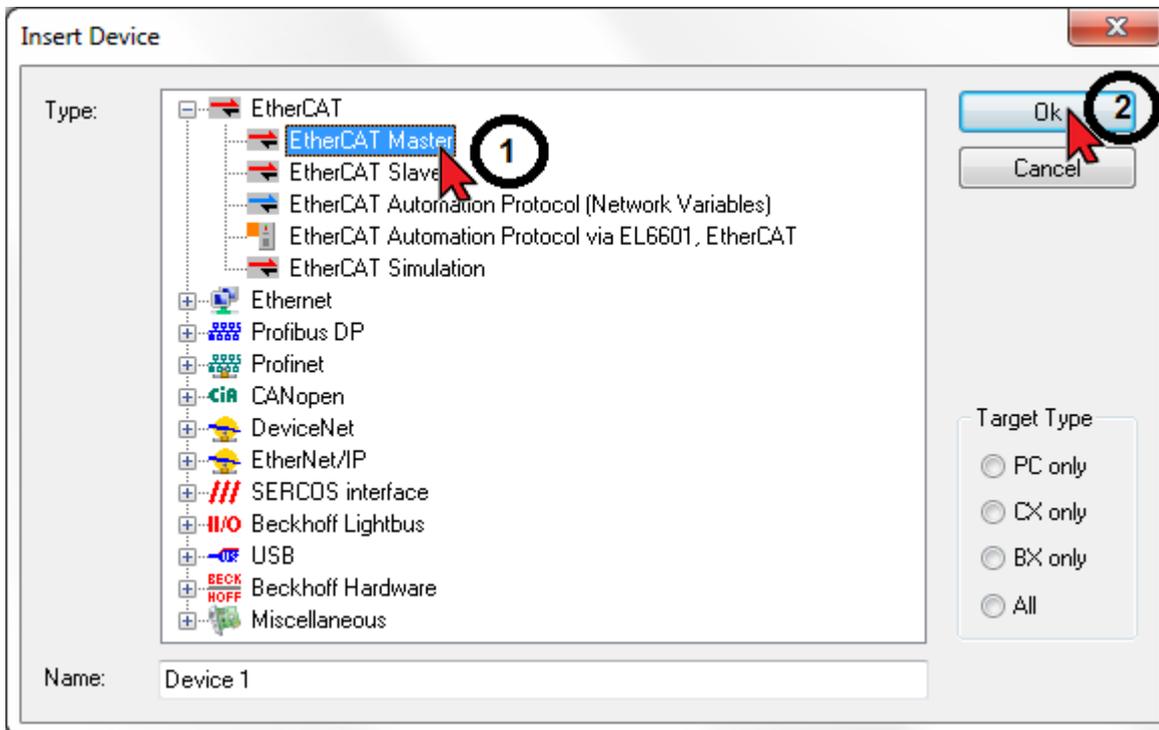
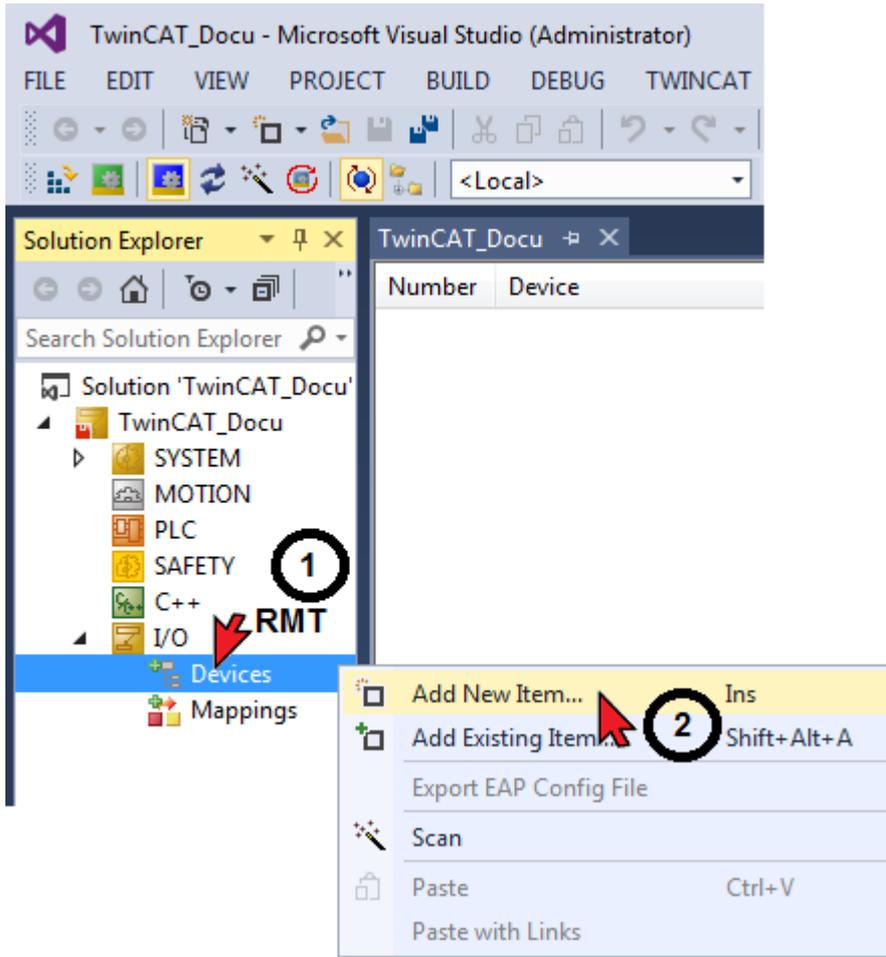


Select the target system:

- Local (own PC)
- TwinCAT PLC



Add the EtherCAT Master functionality to the 'Device' icon



Configuration of the PC network card (one time)



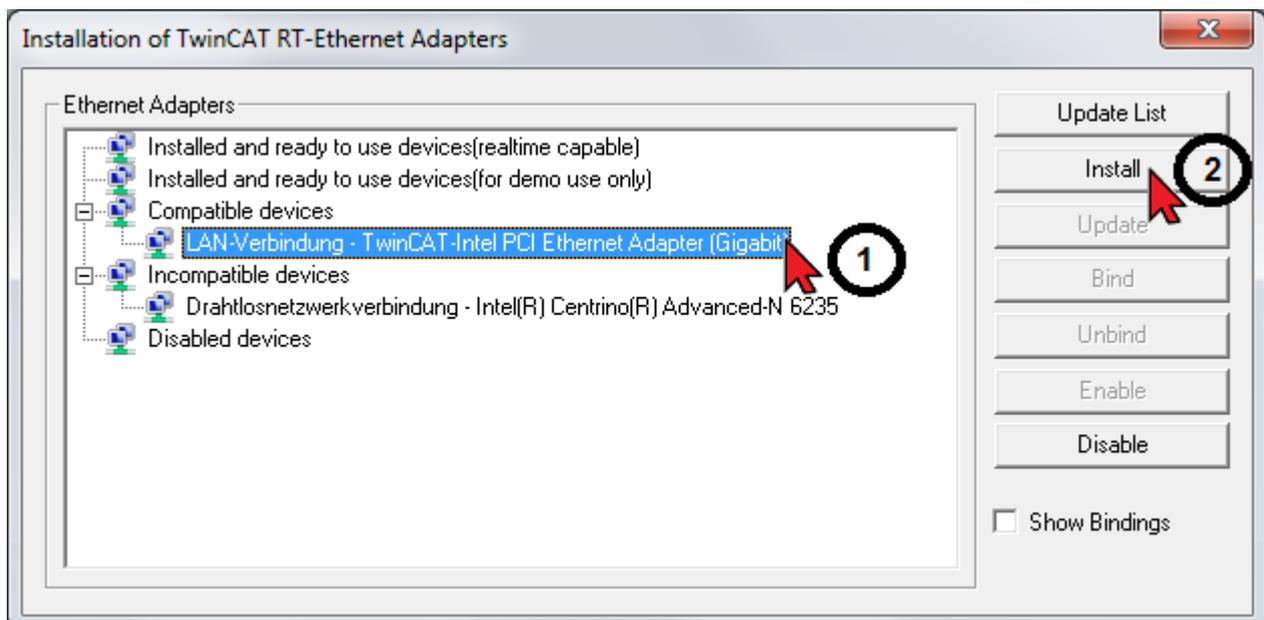
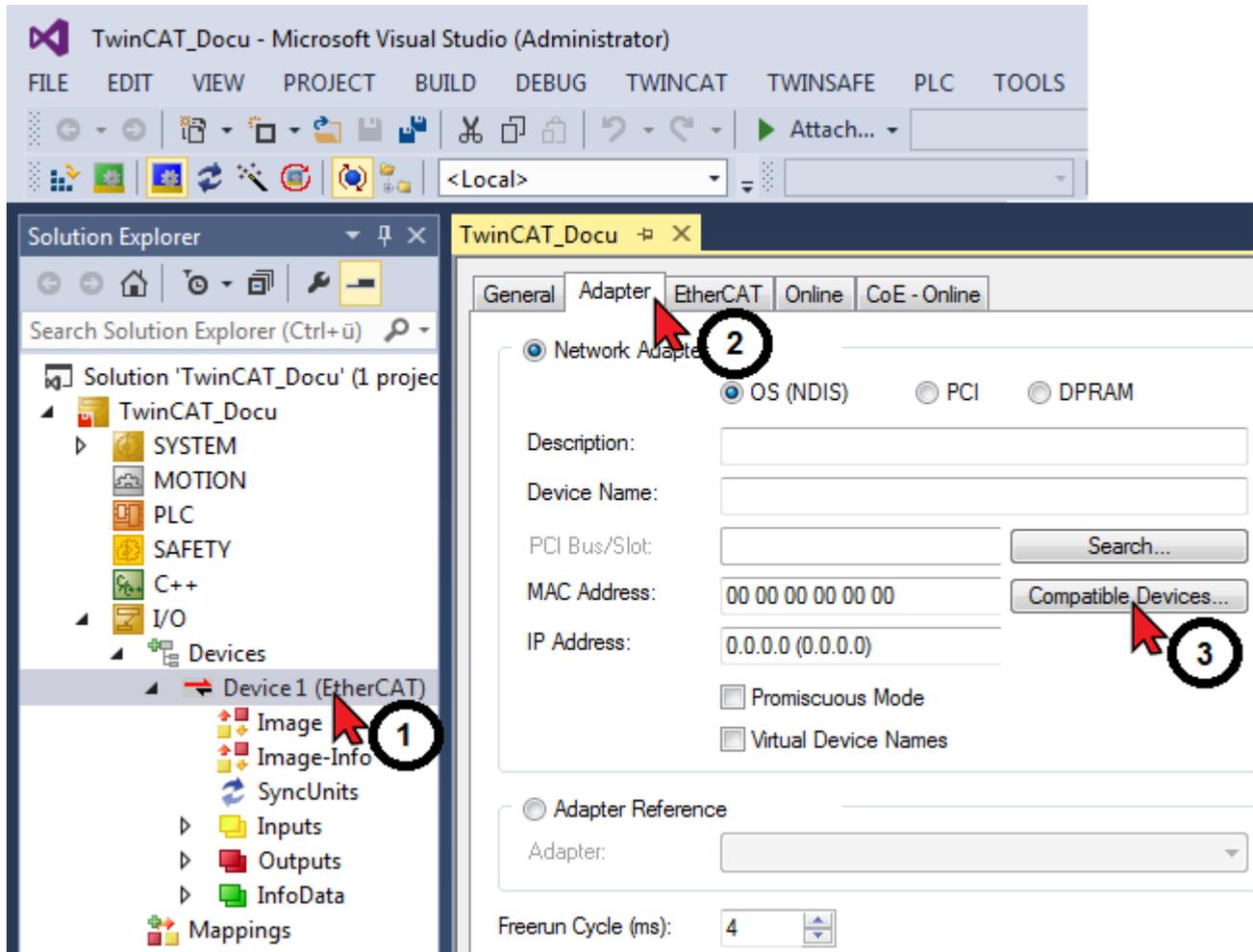
The TwinCAT software system can be used on virtually all PC-based systems as a real-time control.

Requirement:

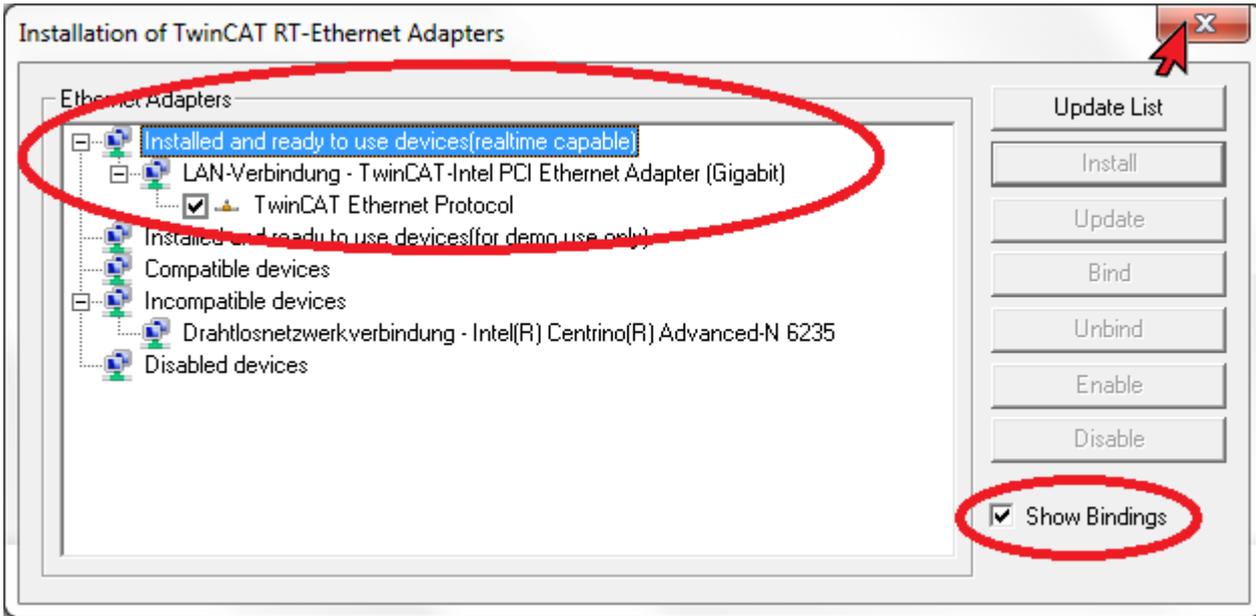
The TwinCAT driver for real-time Ethernet communication is installed.

The TwinCAT driver for real-time Ethernet only works with Ethernet cards with an Intel chip set.

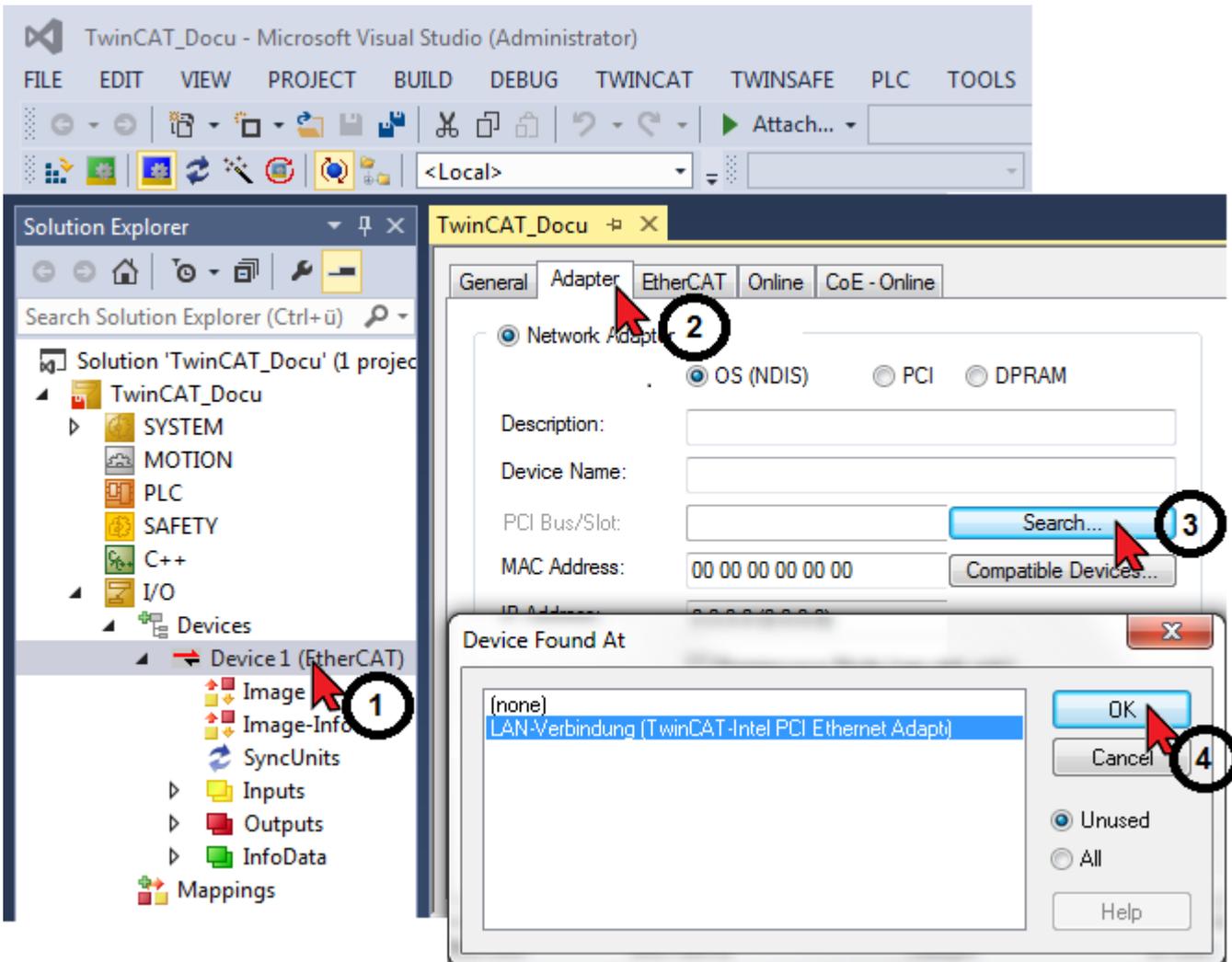
Install TwinCAT Intel PCI Ethernet adapter



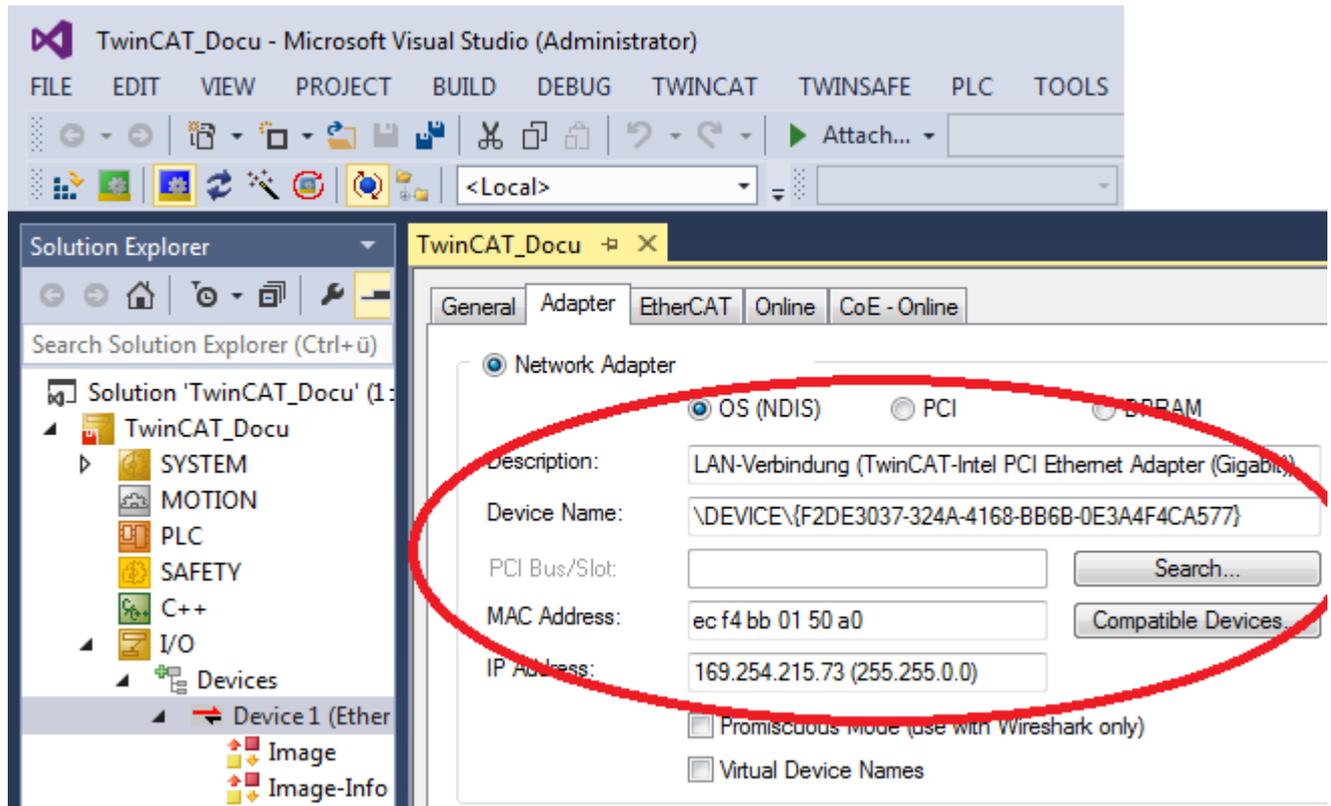
Feedback message: TwinCAT Intel PCI Ethernet adapter installed



Activate EtherCAT adapter



Feedback message: adapter activated



## Glossary

### A

#### AT

Drive telegram from slave to master

### C

#### CNC

Computerized Numerical Control

### E

#### ESI

EtherCAT Slave Information / EtherCAT XML Device Description

#### E2PROM

Electrically erasable programmable read-only memory

### I

#### ID

Parameter identification numbers acc. to SERCOS Standard

### M

#### MDT

Master Data Telegram from master to slave

### N

#### NC

Numerical Control

### P

#### PLC

Programmable Logic Controller

### R

#### RF

Command 'Controller enable'; the drive is energized and will be controlled depending on the selected operation mode. Controller enable can only be set if the device is error-free (SBM = TRUE) and acknowledgement DC bus on is set (QUE = TRUE). Acknowledgement controller enable (QRF) is set.

### S

#### SoE

Servodrive Profile (SERCOS) over EtherCAT (Acc. to IEC 61800-7-300)

### T

#### TC3

TwinCAT 3

## Your opinion is important!

With our documentation we want to offer you the highest quality support in handling the AMKmotion products.

That is why we are now working on optimizing our documentation.

Your comments or suggestions are always of interest to us.

We would be grateful if you take a bit of time and answer our questions. Please return a copy of this page to us.



e-mail: [Documentation@amk-motion.com](mailto:Documentation@amk-motion.com)

or

fax no.: +49 7021/50 05-199

**Thank you for your assistance.**

**Your AMKmotion documentation team**

1. How would you rate the layout of our AMKmotion documentation?  
(1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor
2. Is the content structured well?  
(1) very good (2) good (3) moderate (4) hardly (5) not at all
3. How easy is it to understand the documentation?  
(1) very easy (2) easy (3) moderately easy (4) difficult (5) extremely difficult
4. Did you miss any topics in the documentation?  
(1) no (2) if yes, which ones:
5. How would you rate the overall service at AMKmotion?  
(1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

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