Manual

TC3 Virtual Serial COM

TwinCAT 3

Version: 1.1
Date: 2018-05-02
Order No.: TF 6360

BECKHOFF

Table of Contents

1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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Patent Pending

The EtherCAT Technology is covered, including but not limited to the following patent applications and patents:
EP1590927, EP1789857, DE102004044764, DE102007017835
with corresponding applications or registrations in various other countries.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of symbols

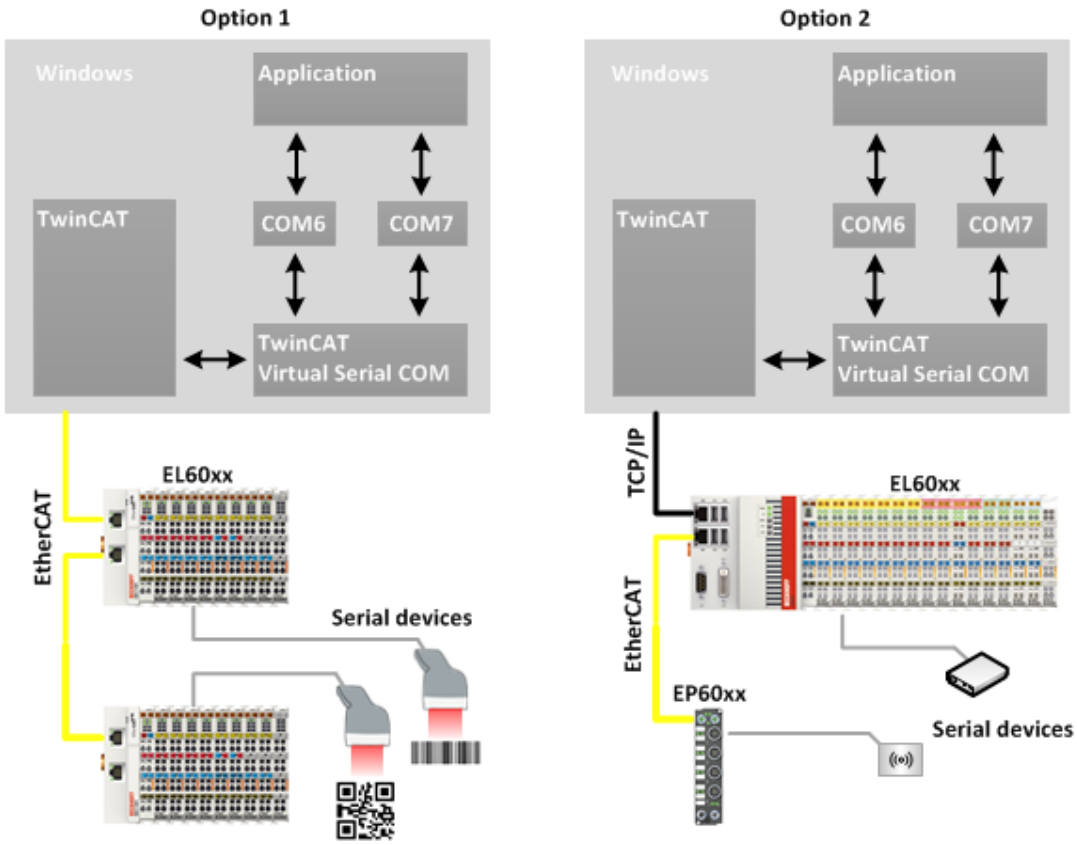
In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

 **DANGER**	**Serious risk of injury!** Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.
 **WARNING**	**Risk of injury!** Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.
 **CAUTION**	**Personal injuries!** Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.
 **Attention**	**Damage to the environment or devices** Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.
 **Note**	**Tip or pointer** This symbol indicates information that contributes to better understanding.

2 Overview

2.1 Product description

The TwinCAT Virtual Serial COM enables to access serial EtherCAT terminals from a Windows application. This allows to communicate with your serial devices from your own written application (e.g .NET, C/C++). The access to a virtual serial com port is provided by the standard Windows API for serial communication.



Option 1:

The TwinCAT Virtual Serial COM can be used on a local TwinCAT system, where the EtherCAT bus is connected. Therefore you can easily enlarge the limited distance of serial communication upto several hundred meters.

Option 2:

Alternatively, the TwinCAT Function can be installed on a remote system, which is connected to the local network. The TwinCAT Virtual COM communicates via ADS over TCP/IP to the target system.

MSDN C++ sample

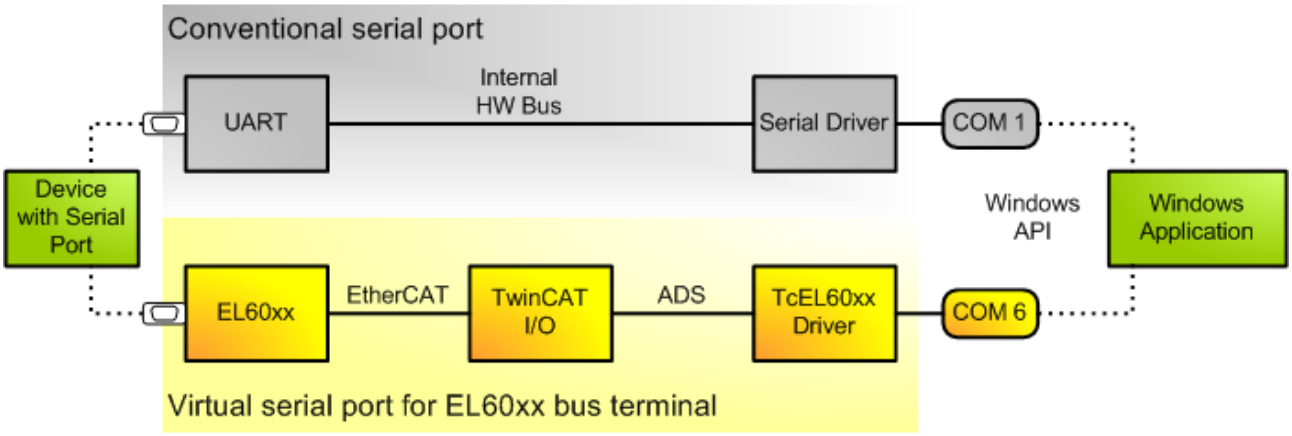
http://msdn.microsoft.com/en-us/library/ff802693.aspx

MSDN C# sample

http://msdn.microsoft.com/en-US/library/c8zc5kah(v=VS.80).aspx

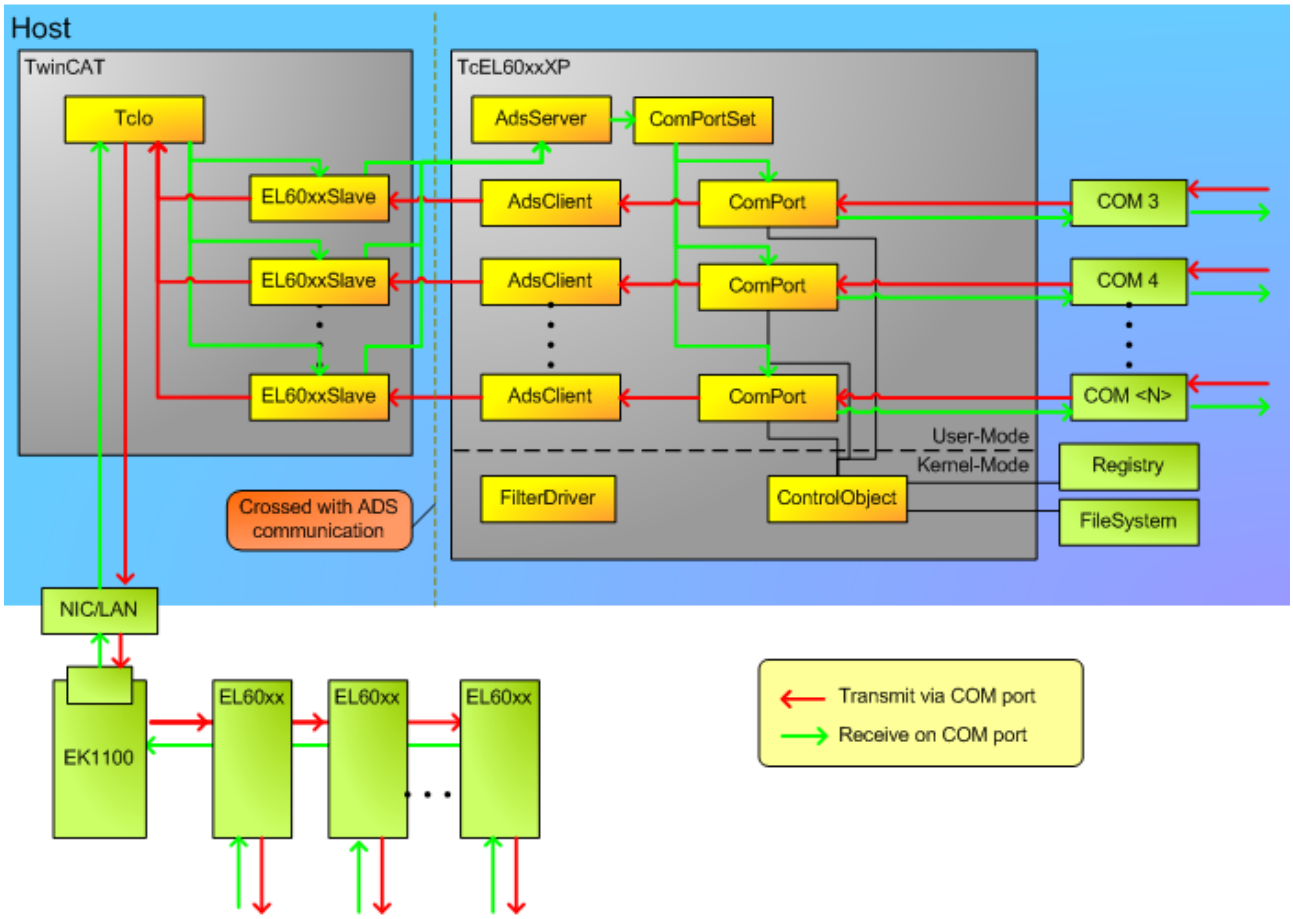
2.2 Architecture

Considering a conventional serial port the driver communicates with the UART chip through an internal hardware bus. In case of the TwinCAT-Virtual-Serial-COM-Driver this communication is implemented using ADS and EtherCAT protocol.

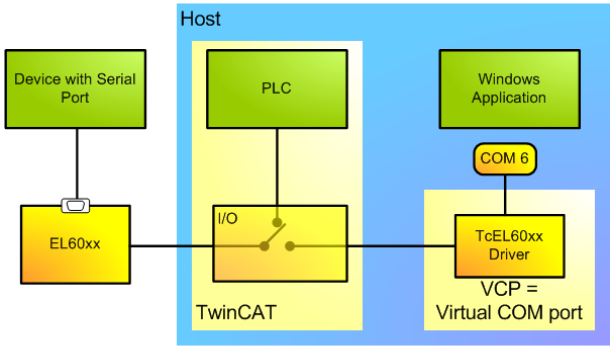


When the driver is installed on a computer, it instantiates an ADS server with fixed port number, the so-called TcEL60xx-AdsServer. This ADS server provides an ADS interface to create serial COM ports. Within the TcIO driver EtherCAT slave objects are the clients of the TcEL60xx-AdsServer. TcIo has a special class of EtherCAT slave objects that are created for each EL60xx bus terminal on TwinCAT start. They have the capability to transmit data packets from the TwinCAT-Virtual-Serial-COM-Driver to the bus terminal, and to receive data from the bus terminal which is in turn forwarded to the driver. The driver will forward it to a Windows application which has a pending read on the respective serial port.

The following image illustrates the architecture for the Windows driver variant.



Attention	**Data loss** If an EL60xx bus terminal is utilized from PLC and also as virtual COM port, then access to the bus terminal must be coordinated by a superior mechanism. On opening the respective virtual COM port, accesses by PLC are blocked as long as the virtual COM port is open. When the virtual COM port is closed, PLC can access the bus terminal again. However, the driver will not regard any running transfers. It will also not restore the bus terminal configuration like baud rate, or stop bit settings, even if it has been modified by an application which used it through a virtual COM port.



Requirements

Development environment	Target system type
TwinCAT v3.0.0	PC or CX (x86)

3 Installation

3.1 System Requirements

Technical Data	TF6360 TC3 Virtual Serial COM
Target System	Windows XP/7/8/10 (32/64-Bit) Windows CE6/CE7
Min. TwinCAT-Version	3.0.0
Min. TwinCAT-Level (local)	TC1100 TC3 | IO (local)
Min. TwinCAT-Level (remote)	TC1000 TC3 | ADS (remote) *

*TwinCAT3 Virtual Serial COM needs TC3| TC1000 ADS if it communicates with a remote TwinCAT system, where the serial EtherCAT terminal is connected. The minimum TwinCAT-Level for the remote system is TwinCAT 3 IO.

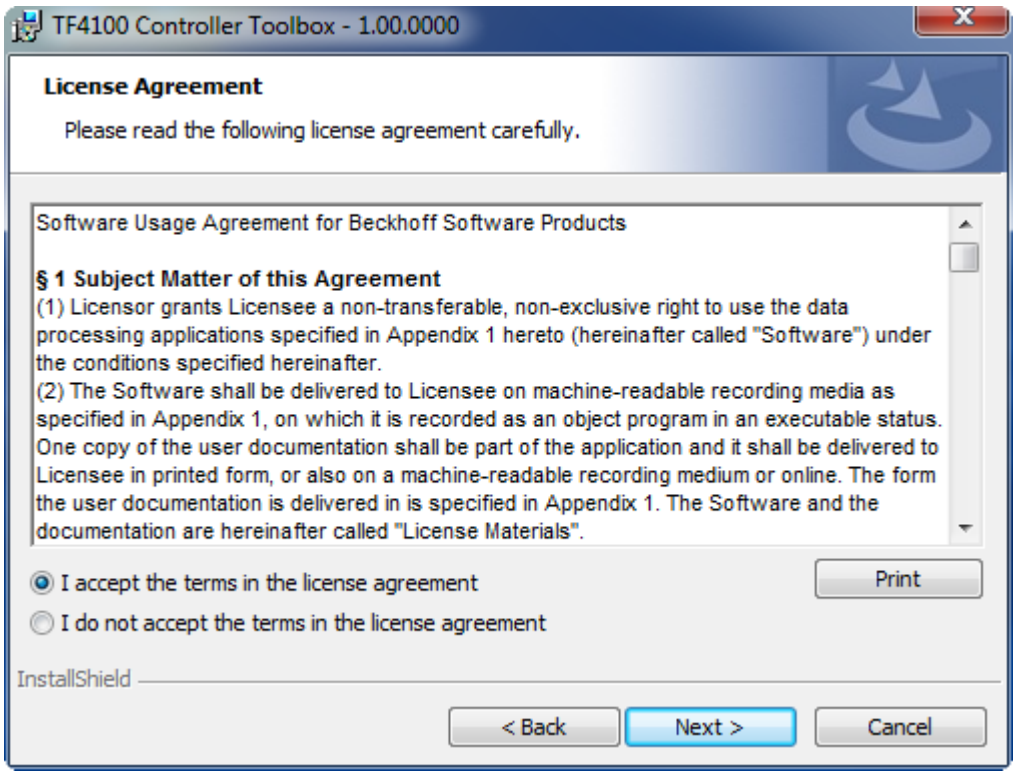
Requirements

Development environment	Target system type
TwinCAT v3.0.0	PC or CX (x86)

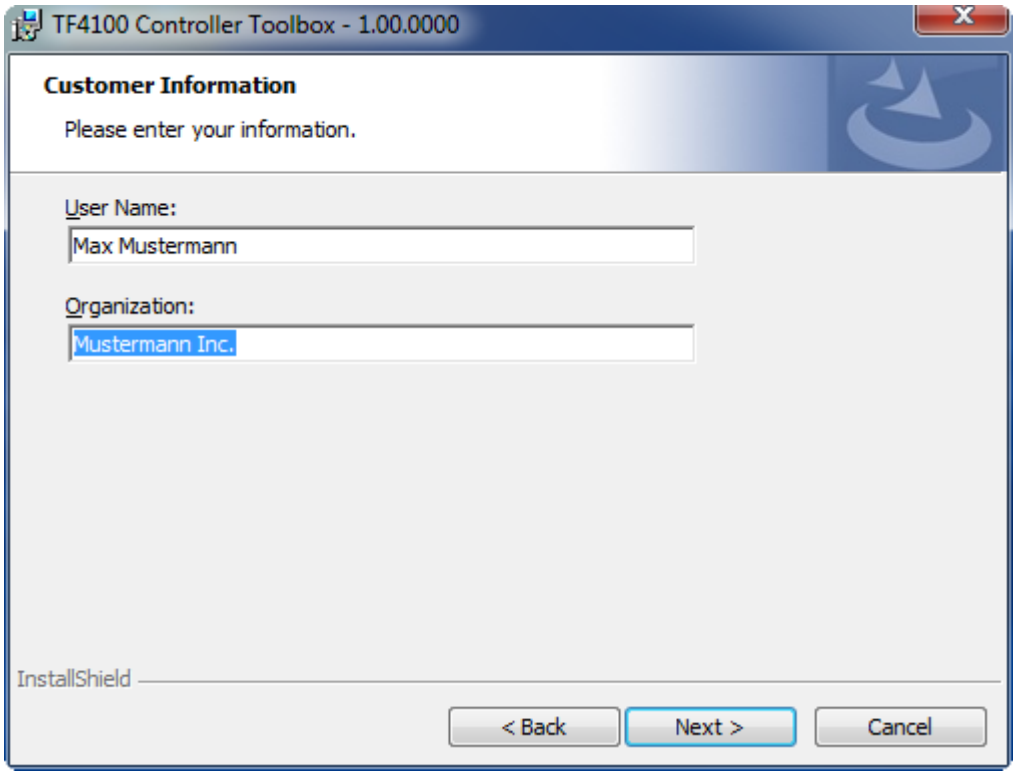
3.2 Installation

Description of the installation procedure of a TwinCAT 3 Function for Windows-based operating Systems.

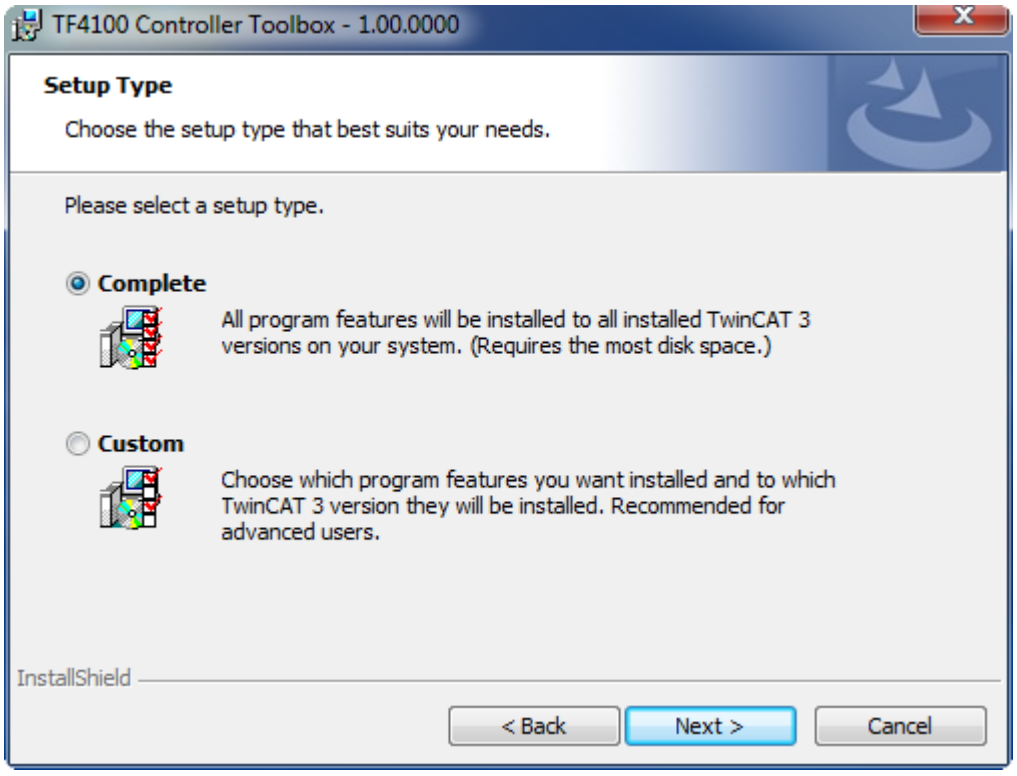
1. Double-click the downloaded setup file *TFxxxx*.
   Please note: Under Windows 32-bit/64-bit, please start the installation with "Run as Administrator" by right-clicking the setup file and selecting the corresponding option in the context menu.
2. Click **Next** and accept the license agreement.



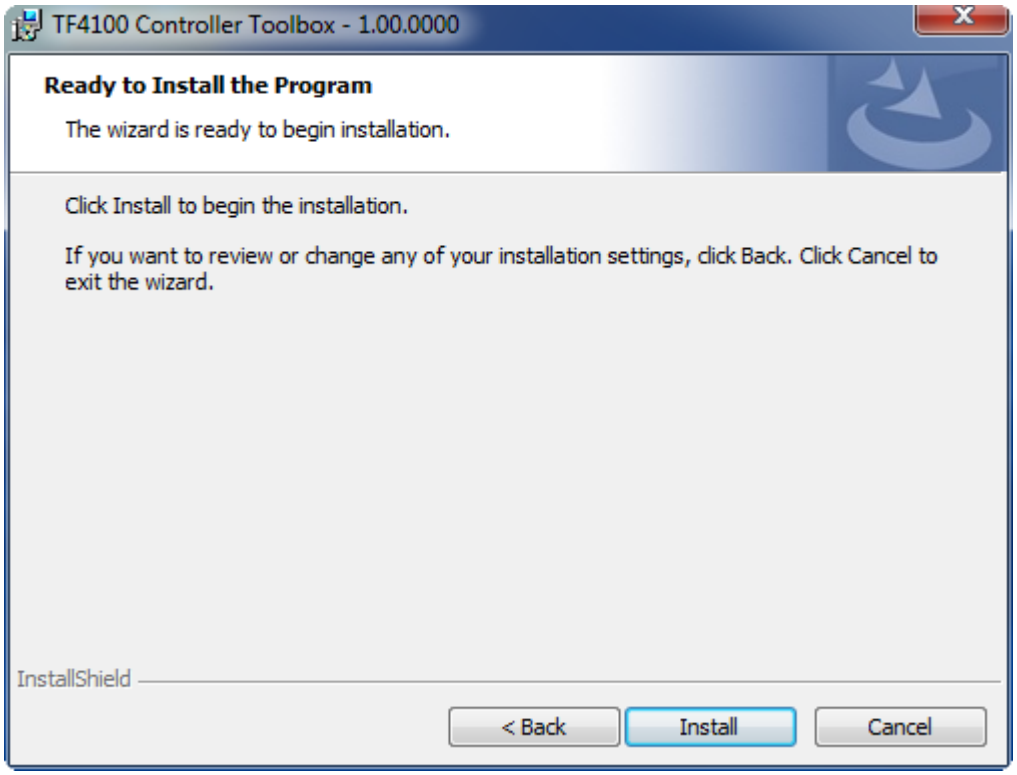
3. Enter your user information in the specified area.



4. To install the full product, including all sub-components, please choose **Complete** as the Setup Type. Alternatively, you can also install each component separately by choosing **Custom**.

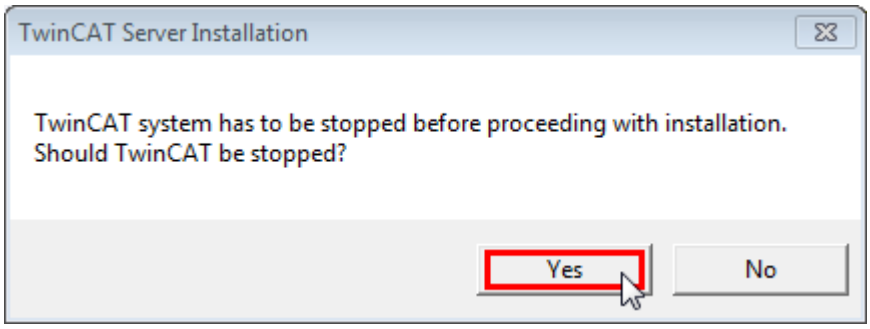


5. Click **Next** and **Install** to start the installation.

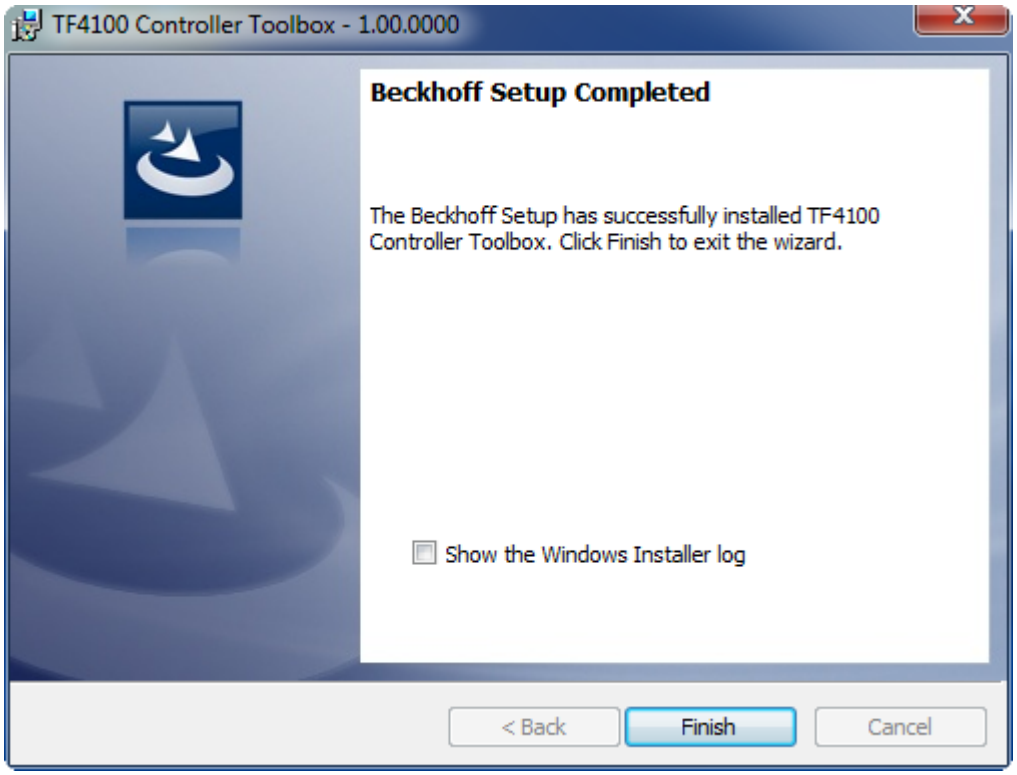


The TwinCAT system must be stopped before proceeding with installation.

6. Confirm the Dialog with **Yes**.



7. Select **Finish** to end the installation process.



⇨ The installation is now complete.

After a successful installation, the TC 3 Function needs to be licensed. [▶ 14]

3.3 Installation Windows CE

This part of the documentation describes, how you can install the TwinCAT 3 Function TF6360 Virtual Serial COM on a Beckhoff Embedded PC Controller based on Windows CE.

The setup process consists of four steps:

- Downloading the setup file
- Installation on a host computer
- Transfering the executable to the Windows CE device
- Software installation
- Software upgrade

Downloading the setup file

The CAB installation files for Windows CE are part of the TF6360 Virtual Serial COM setup. Therefore you only need to download one setup file from www.beckhoff.com.

The installation procedure of the TF6360 Virtual Serial COM setup is described in the regular installation article.

Installation on a host computer

After installation, the install folder (e.g. C:\TwinCAT\Functions\TF6360-Virtual-Serial-COM) contains three directories - each one for a different hardware platform:

- **CE-ARM:** ARM-based Embedded Controllers running Windows CE, e.g. CX8090, CX9020
- **CE-X86:** X86-based Embedded Controllers running Windows CE, e.g. CX50xx. CX20x0

The CE-ARM and CE-X86 folders contain the TF6360 CAB-File for Windows CE - corresponding to the hardware platform of your Windows CE device. This file needs to be transfered to the Windows CE device, see next chapter.

Transfering the executable file to the Windows CE device

Transfer the corresponding CAB-File to you Windows CE device. This can be done via one of the following ways:

- via a Shared Folder
- via the integrated FTP-Server
- via a USB Stick, CF card or SD-Card

Software installation

After the file has been transfered via one of the above methods, you need to execute the file and acknowledge the following dialog with "Ok". Restart your Windows CE device after the installation has finished.

After the restart has been completed, the TF6360 Virtual Serial COM and configuration will be automatically started in background and is now available to use.

The software will be installed in the following directory on the CE device: **\Hard Disk\TwinCAT\Functions \TF6360-Virtual-Serial-COM**

Software upgrade

If you already have a version of TF6360 installed on your Windows CE device, you can execute the new version of the CAB-File.

After the installation a restart is needed.

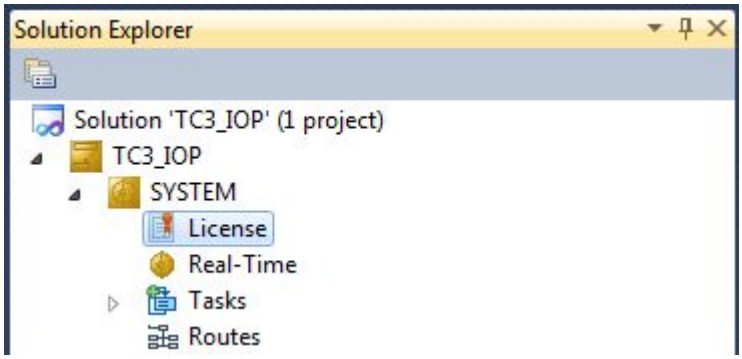
3.4 Licensing

The TwinCAT 3 functions are available both as a full and as a 7-Day trial version. Both license types can be activated via TwinCAT XAE.For more information about TwinCAT 3 licensing, please consult the TwinCAT 3 Help System.The following document describes both licensing scenarios for a TwinCAT 3 function on TwinCAT 3 and is divided into the following sections:

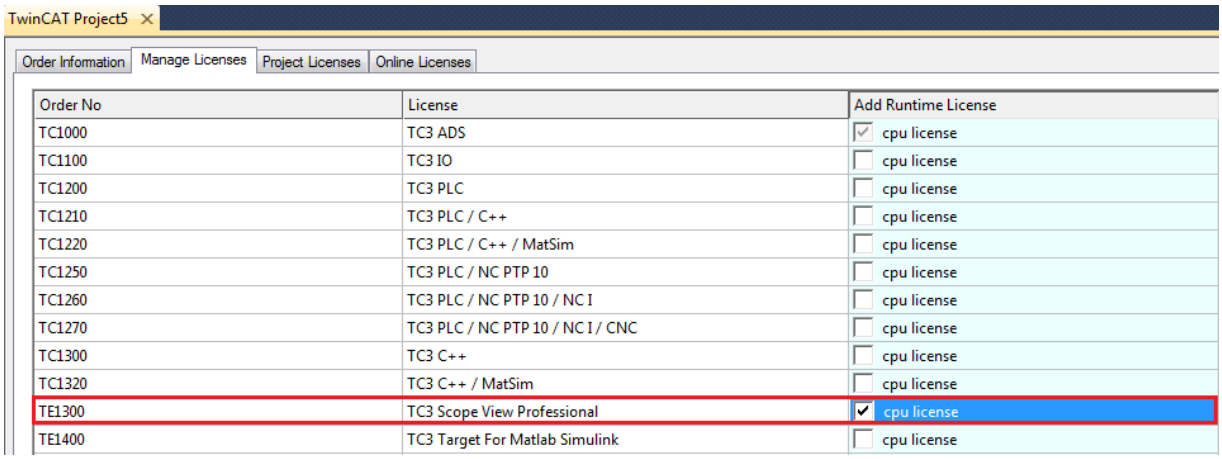
- Licensing a 7-Day trial version [▶ 14]
- Licensing a full version [▶ 15]

Licensing a 7-Day trial version

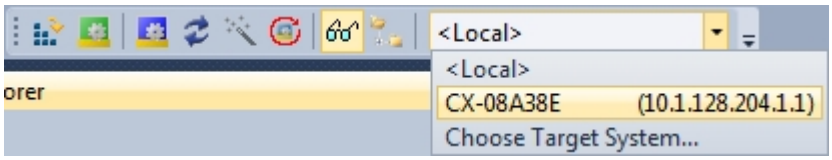
1. Start TwinCAT XAE
2. Open an existing TwinCAT 3 project or create a new project
3. In **Solution Explorer**, please navigate to the entry **System\License**



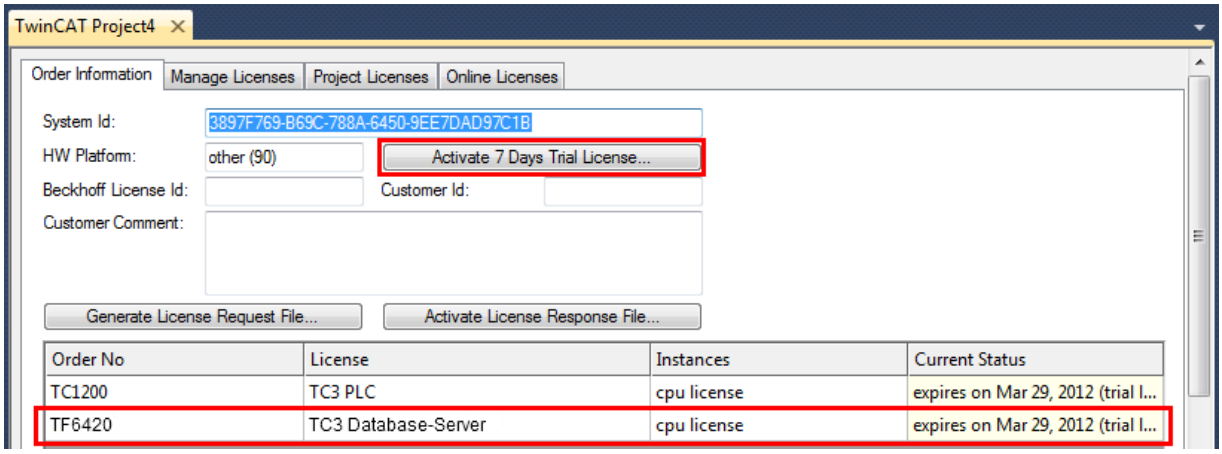
4. Open the tab **Manage Licenses** and add a **Runtime License** for your product (in this screenshot **TE1300: TC3 Scope View Professional**)



5. **Optional**: If you would like to add a license for a remote device, you first need to connect to the remote device via TwinCAT XAE toolbar



6. Switch to the tab **Order Information** and click the button **Activate 7 Days Trial License...** to activate a test version

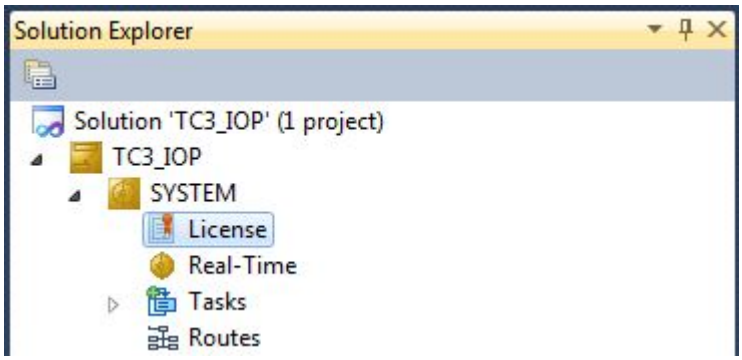


7. Please restart TwinCAT 3 afterwards.

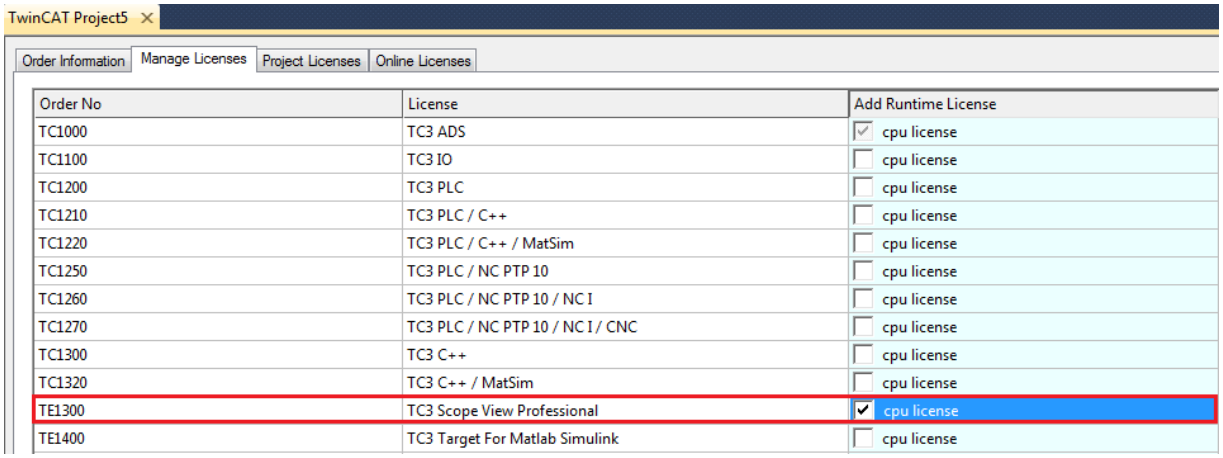
Licensing a full version

8. Start TwinCAT XAE
9. Open an existing TwinCAT 3 project or create a new project

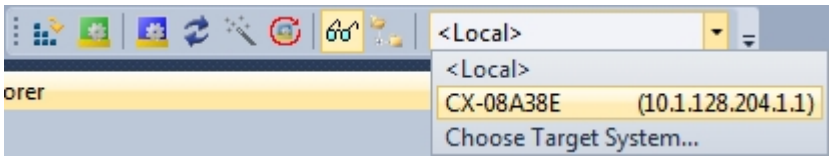
10. In **Solution Explorer**, please navigate to the entry **SYSTEM\License**



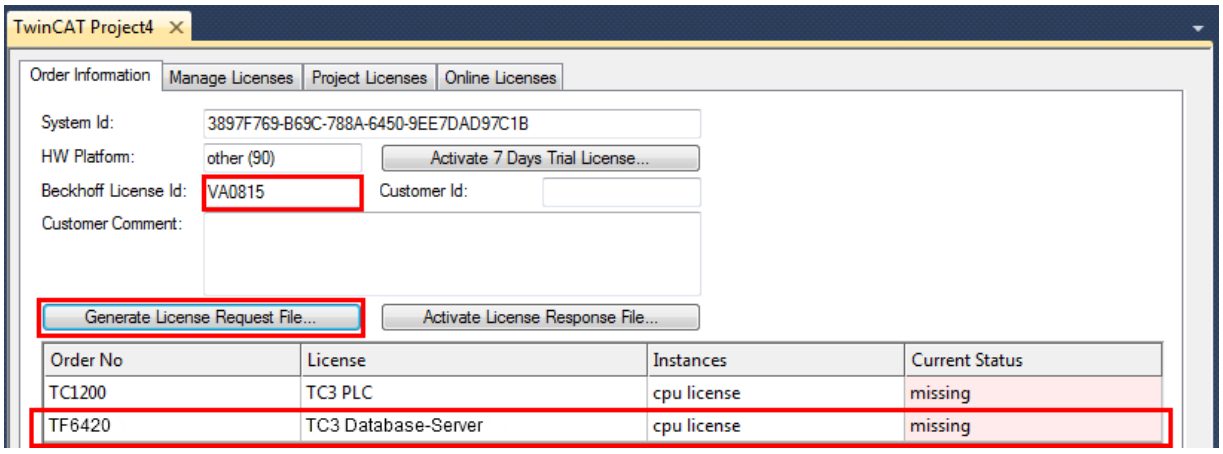
11. Open the tab **Manage Licenses** and add a **Runtime License** for your product (in this screenshot **TE1300: TC3 Scope View Professional**).



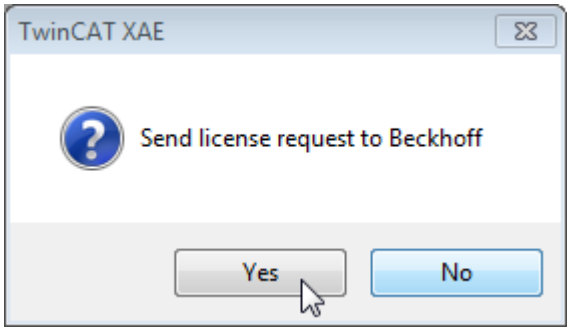
12. **Optional:**If you would like to add a license for a remote device, you first need to connect to the remote device via TwinCAT XAE toolbar



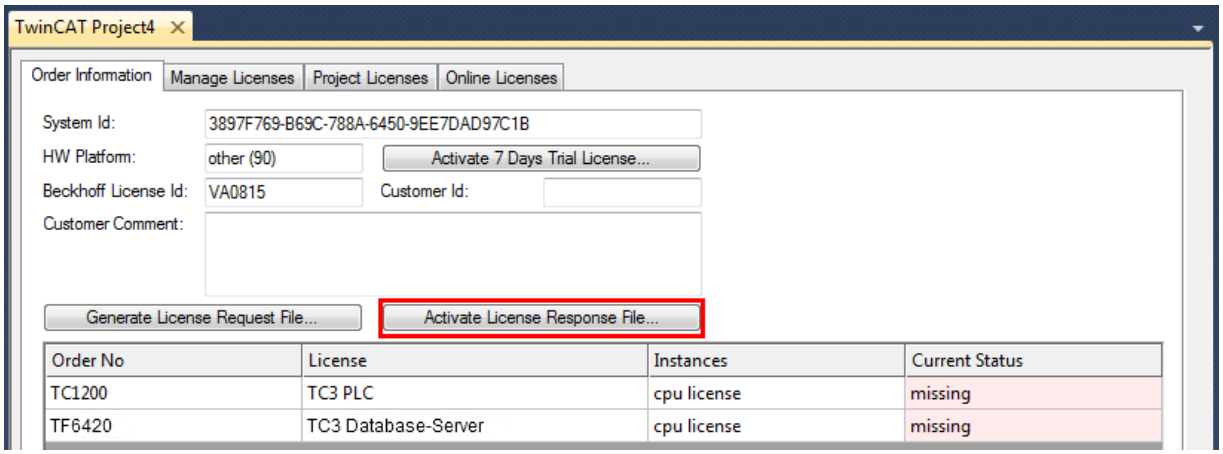
13. Navigate to the **Order Information** tab
The fields **System-ID** and **HW Platform** cannot be changed and just describe the platform for the licensing process in general a TwinCAT 3 license is always bound to these two identifiers:
the **System-ID** uniquely identifies your system.
The **HW Platform** is an indicator for the performance of the device.
14. Optionally, you may also enter an own order number and description for your convenience



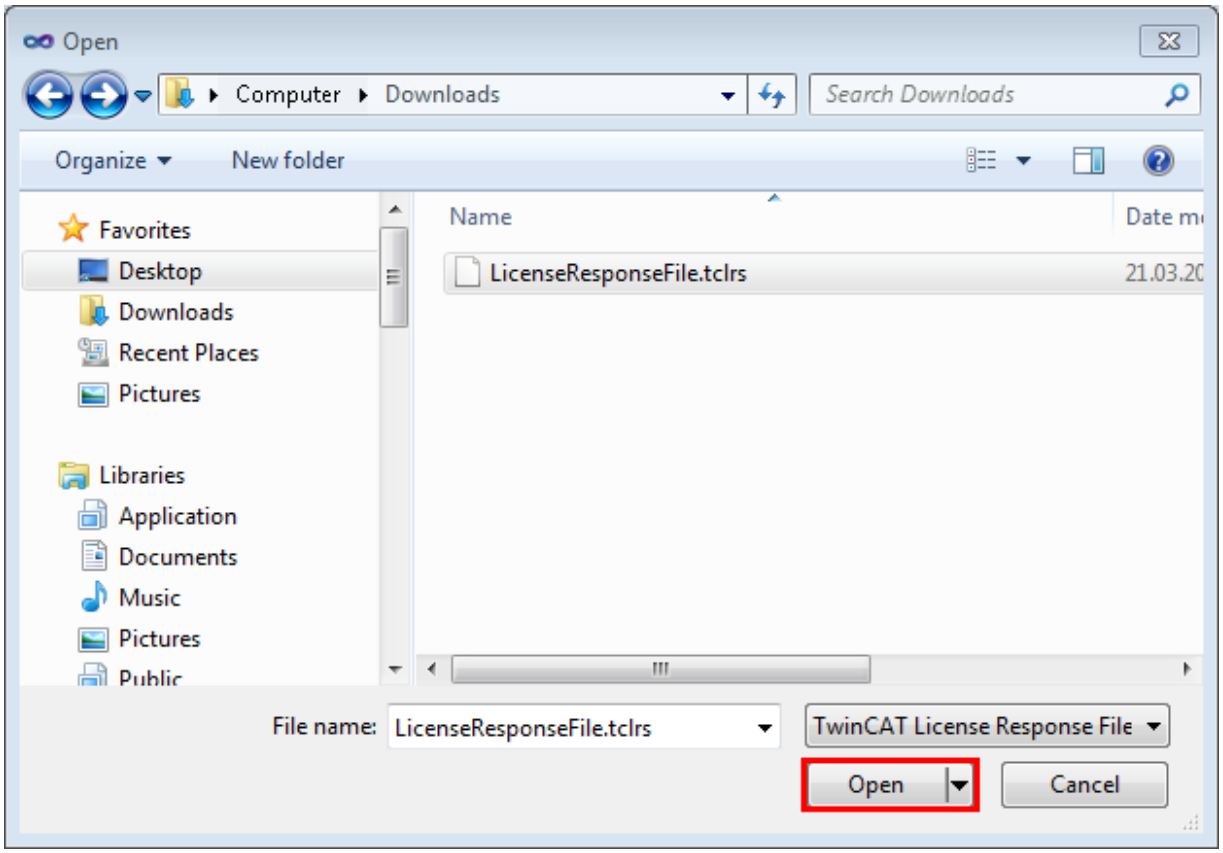
15. enter the **Beckhoff License ID** and click on **Generate License Request File...**. If you are not aware of your **Beckhoff License ID** please contact your local sales representative.
16. After the license request file has been saved, the system asks whether to send this file via E-Mail to the Beckhoff Activation Server



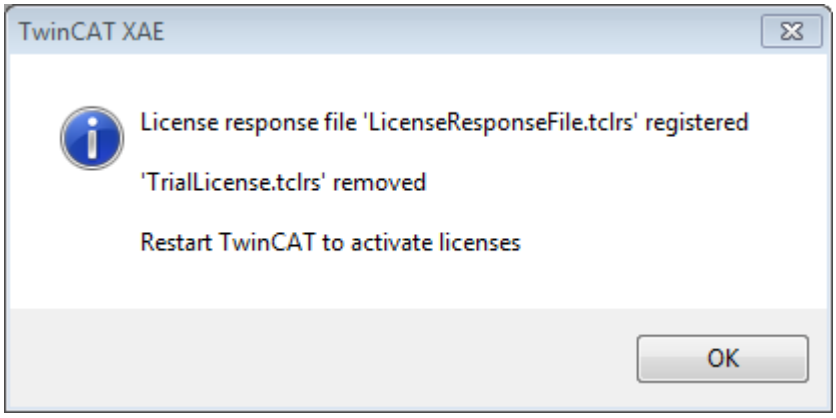
17. After clicking **Yes**, the standard E-Mail client opens and creates a new E-Mail message to "tclicense@beckhoff.com" which contains the "License Request File"
18. Send this Activation Request to Beckhoff
    NOTE! The License Response File will be sent to the same E-Mail address used for sending out the License Request File
19. After receiving the activation file, please click on the button **Activate License Response File...** in the TwinCAT XAE license Interface.



20. Select the received License response file and click on **Open**



21. The License Response File will be imported and all included licenses will be activated. If there have been any trial licenses, these will be removed accordingly.
22. Please restart TwinCAT to activate licenses.

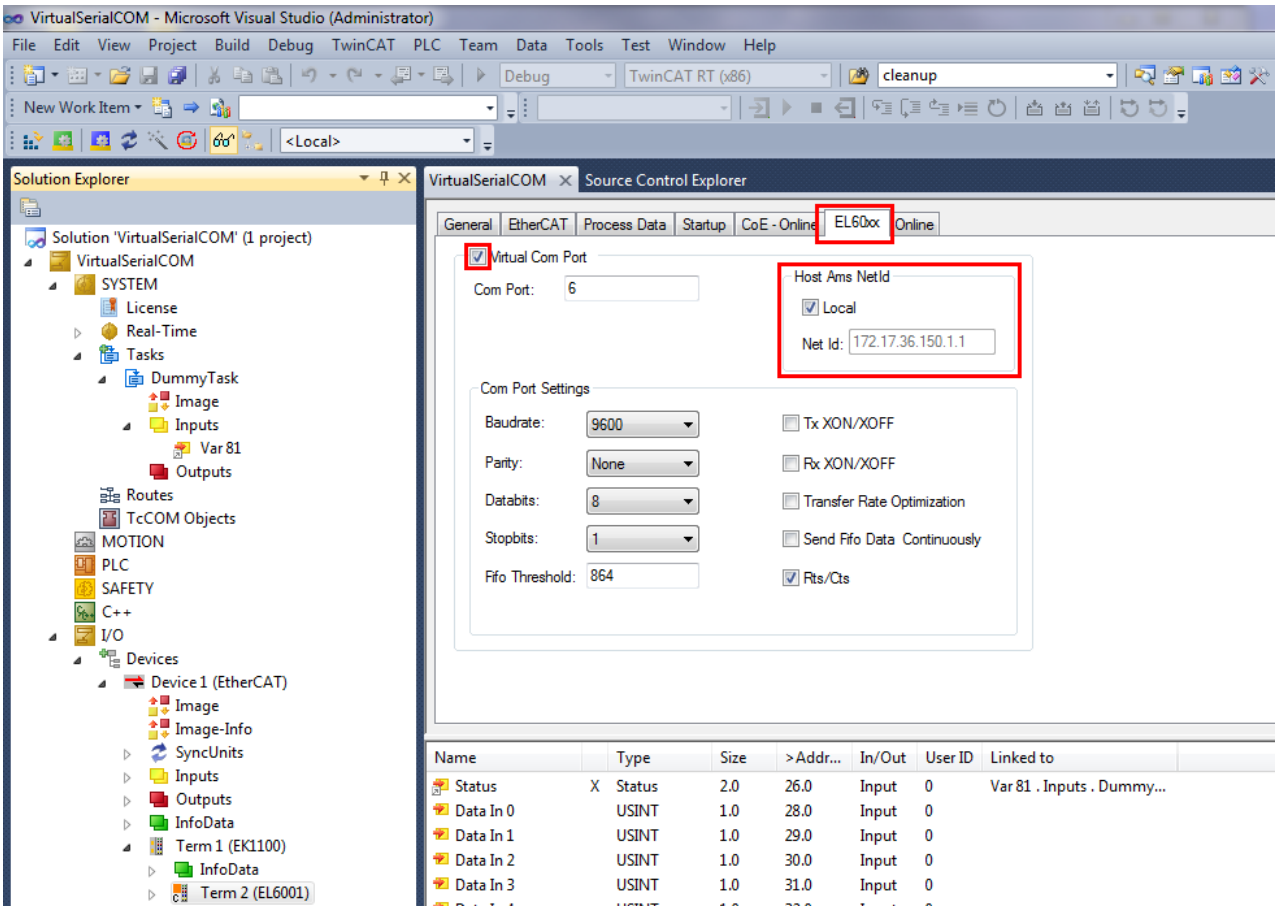


NOTE! The license file will be automatically copied to...\TwinCAT\3.1\Target\License on the local device.

4 Configuration in TwinCAT 3

Activate Virtual Com Port

TwinCAT 3 provides the EL60xx configuration tab for bus terminals of type EL60xx. For EL60xx terminals with checked "Virtual Com Port" check box TwinCAT creates on configuration activation a virtual serial COM port.



The number of the COM port is defined in edit field "Com Port". Note, that a com port number must be unique within a computer. The computer on which the virtual com port should be created must not have a com port with this number. TwinCAT starts with com port number 6. The com port number must be less than 65536.

Local or Remote

Edit field "Host Ams NetId" determines the computer on which the virtual com port should be created. By default the local computer is used, which is the one where the configuration is activated and with which the bus terminal is connected. It is also possible to create the virtual com port on a remote computer just by changing the "Host Ams NetId" respectively. Note, that the TwinCAT-Virtual-Serial-COM-Driver has to be installed on this computer.

COM Port Settings

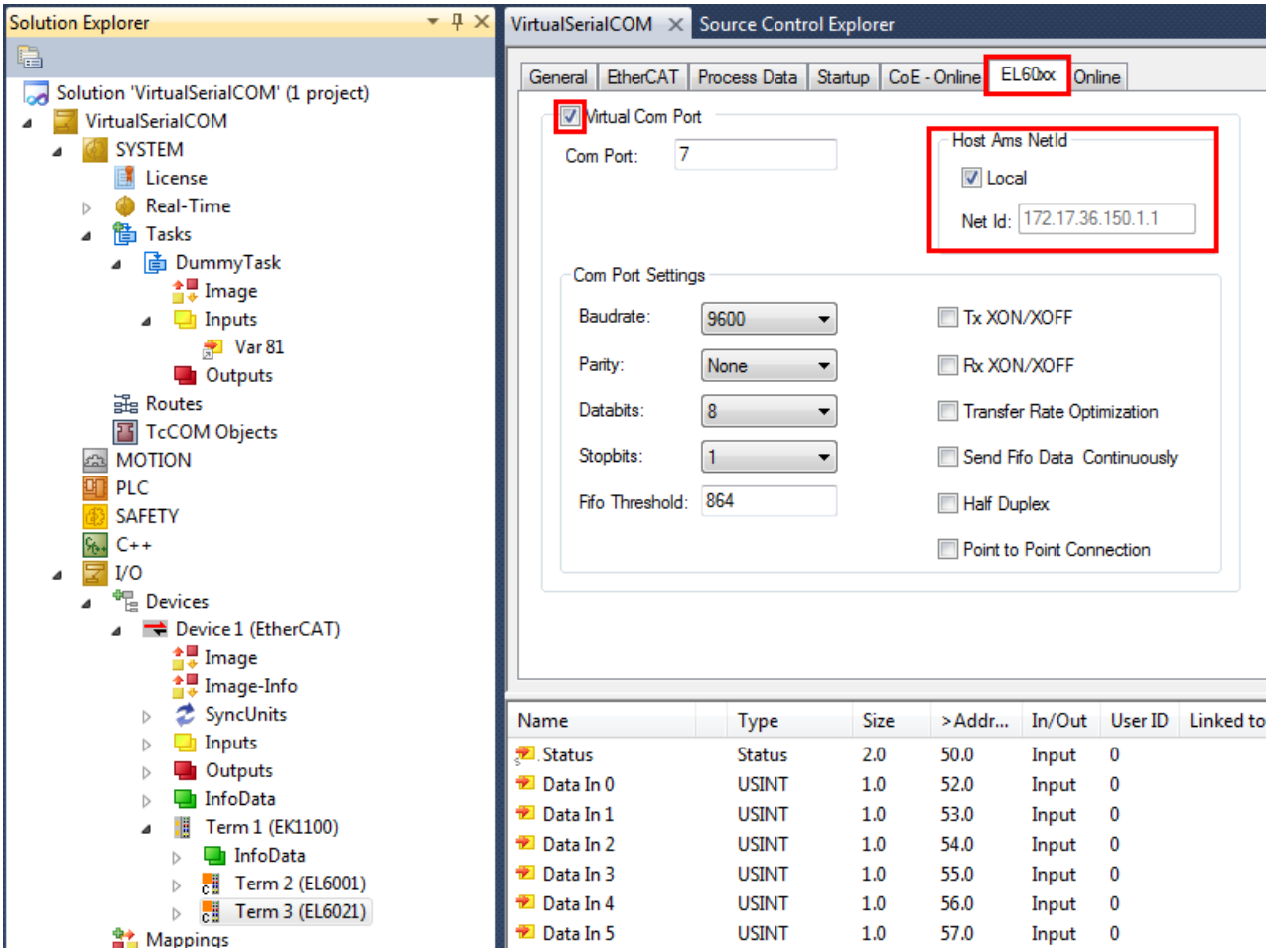
Within "Com Port Settings" panel one can change the common parameters of a com port, i.e. baud rate, parity, data bits, stop bits, and also flow control settings as RTS/CTS, Tx XON/XOFF, and Rx XON/XOFF. The bus terminal is initialized with the configured parameters on TwinCAT activation. However, usually applications that open a com port will also reconfigure it with their own particular default settings overriding the settings from system manager.

Not all possible combinations of parity, data bit count and stop bit count are valid. The following table lists the allowed combinations:

7 data bits, even parity, 1 stop bit
7 data bits, even parity, 2 stop bits
7 data bits, odd parity, 1 stop bit
7 data bits, odd parity, 2 stop bits
8 data bits, no parity, 1 stop bit
8 data bits, no parity, 2 stop bits
8 data bits, even parity, 1 stop bit
8 data bits, even parity, 2 stop bits
8 data bits, odd parity, 1 stop bit
8 data bits, odd parity, 2 stop bits

In addition to common parameters there are some proprietary settings for an EL60xx bus terminal, i.e. "Transfer Rate Optimization" and "Fifo threshold". With enabled "Transfer Rate Optimization" the bus terminal first collects enough data to fill the available space in the process image before it is sent to the TcIo driver. With disabled "Transfer Rate Optimization" the data is sent as soon as possible to the TcIo driver. The "Fifo Threshold" setting determines when the bus terminal indicates "Fifo Full" state.

Parameters of the EL6021 bus terminal are somewhat different. Therefore the configuration dialog differs:

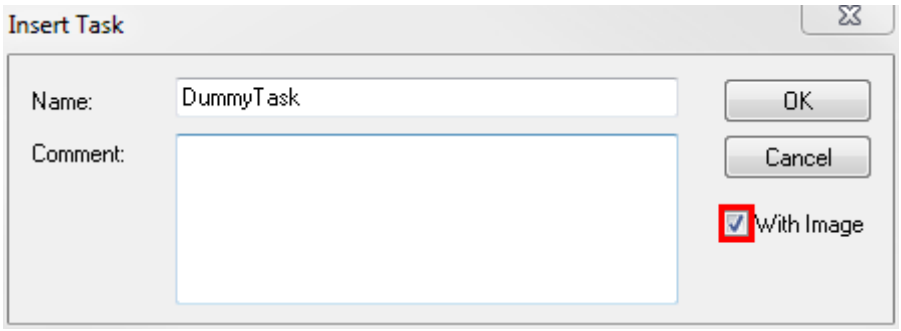


The EL6021 does not support RTS/CTS handshake. It does support a half duplex mode and it can be configured for point to point connections.

For more details on the special settings refer to bus terminal documentation of EL6001 and EL6021.

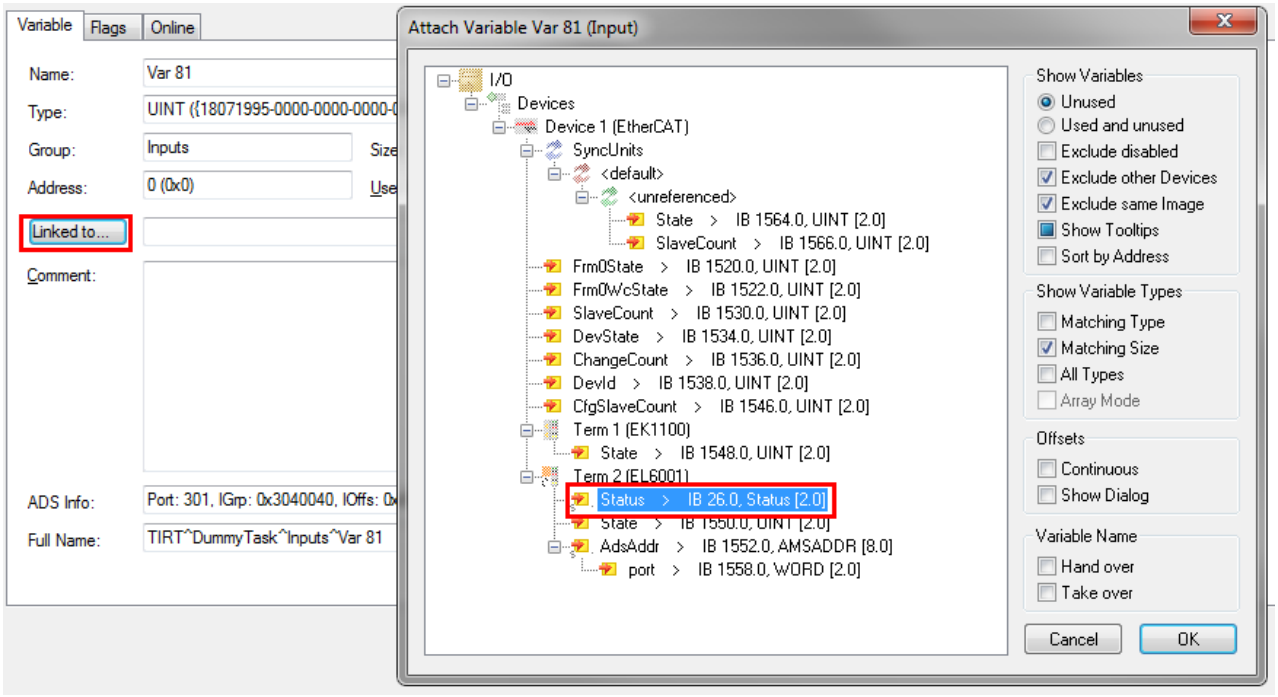
Add IO-Task

The TwinCAT IO driver only processes data from bus terminals, if at least one input variable is linked to a Task variable. Otherwise, the data is ignored. Therefore, a dummy Task with one variable for each bus terminal that is used as virtual com port is needed. Create a Dummy Task with IO-Image.



Insert a Input Variable of UINT-Typ and link the input status word of the bus terminal to a respective Task variable as shown in the screen shot below.

Make sure to configure the task with "Auto start" enabled. The "Cycle Ticks" settings controls the update frequency for the variables. In order to get the full data transfer rate through a virtual COM port, the cycle time should be about 1ms.



Requirements

Development environment	Target system type
TwinCAT v3.0.0	PC or CX (x86)

5 Appendix

5.1 Differences to COM

- Interval Timeout
  The virtual COM port for an EL60xx bus terminal does not support interval timeouts, because the driver has no access to the required information
- DSR/DTR Handshake
  EL6001 and EL6021 do not have DSR/DTR lines
- Explicit Setting of RTS/CTS lines
  The explicit setting of RTS and CTS lines is not supported.
- XON/XOFF char cannot be changed
  The EL6001/EL6021 has fixed values for XON and XOFF characters, i.e. 0x11 and 0x13, respectively. These cannot be changed.

On TwinCAT stop all virtual COM ports created by the TcEL60xx driver on this computer are removed. A TwinCAT start creates the virtual COM port defined by the current configuration. So an application, which had opened a COM port, has to open it again, after a TwinCAT re-start. An application, which uses one of the virtual COM ports, must close this port before the TwinCAT stop, because in general it is undefined how an application will handle the removal of an open COM port.

Virtual COM Port on Remote Computer

Suppose that an EL60xx bus terminal is connected to computer A, while the associated virtual COM port is created on computer B. The driver handles TwinCAT start and stop as follows:

TwinCAT stop on computer A breaks the connection to the bus terminal while the virtual COM port on computer B persists. Read and write request for the virtual COM port on computer B would fail. A successive TwinCAT start on computer A again creates the virtual COM on computer B. Using the AMS address the EL60xx driver on computer B checks, if a virtual COM port for this address exists and removes it respectively. Then the virtual COM port is created, possibly with another number, which could be changed within System Manager.

TwinCAT Stop on computer B removes all virtual COM ports on this computer. After TwinCAT start on computer B virtual COM ports can be created again. However, the virtual COM port, which was created from computer A, will not be available. Not until the TwinCAT on computer A has been restarted the virtual COM port on computer B is created again.

As the TwinCAT on computer B will not be notified when the TwinCAT on computer A is stopped, it is not possible to remove the virtual COM port. If the configuration on computer A is changed, e.g. such that no virtual COM port is created, then an orphaned virtual COM port on computer B persists until the next TwinCAT stop on this computer.

Requirements

Development environment	Target system type
TwinCAT v3.0.0	PC or CX (x86)

5.2 Troubleshooting

In case of any problem related to the TwinCAT Virtual Serial COM under Windows, check the following steps:

1. Check if the Virtual Com Driver is installed in the Device Manager of Windows
2. Check if the Virtual Com Driver "TcEL60xxStartSync.exe" is started with TwinCAT (Config-Mode)
3. Check the Windows Application log for entries about the TcEL60xxXPAdsServer
4. Try to connect to the virtual com via Putty

5. Try to communicate between a virtual com and a pc com port via Putty

Requirements

Development environment	Target system type
TwinCAT v3.0.0	PC or CX (x86)