BECKHOFF New Automation Technology

TwinSAFE Tutorial 16 | EN TwinSAFE Loader

Download via EtherCAT Mailbox Gateway



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1 Introduction

TwinSAFE includes several innovations that bring more functionality and performance to your safety controller. A major innovation is that the functionality of the safety controller is integrated in each TwinSAFE component. This means that you can, for example, use a TwinSAFE input component both as an input component and the safety control integrated on it to use application-specific pre-processing.

This is tutorial 16 of a tutorial series.

The aim of this tutorial series is to familiarize you with the TwinSAFE innovations using individual examples.

This tutorial is about the configuration of a system for the TwinSAFE Loader and the subsequent download of a project via the EtherCAT Mailbox Gateway.

1.1 Version numbers

Version	Comment
1.0.0	First released version
0.0.1	First draft

1.2 Requirements

Meet the following requirements for this tutorial:

- TwinCAT 3 version ≥ 3.x
- TwinSAFE Loader = p7

1.3 Starting point

At the starting point of the tutorial

• a TwinCAT 3 solution exists.

1.4 Demo system

1.4.1 Hardware

The demo system of this tutorial consists of the following hardware:

- CX for EtherCAT communication and the standard PLC controller
- EL6910 as master TwinSAFE Logic
- · EL1918 with safe inputs for reading light barrier signals
- · Light barrier
- AX8000-x2xx
- · Engineering system connected via Ethernet

1.4.2 Desired functionality

This tutorial describes the realization of the following functionality:

• Download of a Safety project without TwinCAT 3.

2 Demonstration

2.1 Load adapter



- 1. Right click on Devices
- 2. Click on "Scan" to scan all devices

TcXaeShell	×
HINT: Not all types of devices can be found automatically	
OK Cancel	

3. Confirm window with "OK"

Device 1 (EtherCAT) Device 2 (EtherCAT Automation Protocol) [Ethernet 2 (X001)] Device 4 (RT-Ethernet Protocol) [Ethernet (X000)] Device 3 (EtherCAT Slave)	ОК
Device 5 (COM Port) [Bus 0 Slot 126 UART 0 (0xD0B1A000)]	Cancel
	Select All Unselect All

- 4. Select EtherCAT adapter
- 5. Confirm selection with "OK"

TcXaeShell	×
? Scan for boxes	
Yes No	

6. Confirm window "Scan for boxes" with "Yes"

EtherCAT drive(s) addec	I	×
Append linked axis to:	 NC - Configuration CNC - Configuration 	OK Sancel

7. Close window "EtherCAT drive(s) added" with "Cancel" since no NC configuration is required in this application

TcXaeShell	×
Activate Free Run	
Yes No	

8. Close window "Activate Free Run" with "Yes"

2.2 Advanced Settings

▲	evices
	Image
	🛟 Image-Info
Þ	SyncUnits
Þ	🔁 Inputs
Þ	Uutputs
Þ	🛄 InfoData
Þ	Term 1 (EK1200)

1. Open EtherCAT master

General	Adapter	EtherCAT	Online	CoE - Online	
NetId:		5.53.213.218	3. <mark>2.1</mark>		Advanced Settings
Datarate:		100 MBit/s			Export Configuration File
					Sync Unit Assignment
					Topology

2. Open "Advanced Settings"



3. Select "EoE Support"

Virtual Ethernet Switch		Windows Network		
🗸 Enable		Connect to TCP/IP Stack		
Max Ports:	2	Windows IP Routing		
Max Frames:	120 🚖	✓ IP Enable Router		
Max MAC Ids:	100 🖨	Changes require system	reboot!	
EtherCAT Mailbo	Gateway			
🗸 Enable	192.168.100.254	Virtual MAC: 02 01 05 1	0 00 00	

- 4. Set the following checkmarks
 - Virtual Ethernet Switch
 - Enable
 - Windows Network
 - Connect to TCP/IP Stack
 - IP Enable Router
 - EtherCAT Mailbox Gateway
 - Enable
- 5. Assign an IP address to the EtherCAT Mailbox Gateway as shown in the figure
- 6. Close window "Advanced Settings" with "OK"

2.3 Activate configuration



1. Click on "Activate Configuration" in the menu bar

arget:	CX-35D5DA

2. Confirm window "Activate Configuration" with "OK"



A message box appears because currently no task is connected to the EtherCAT.

3. Close message box with "OK"

TcXaeShe	211	×
?	Restart TwinCAT System i	n Run Mode
	рок	Abbrechen

4. Confirm window "Restart TwinCAT System in Run Mode" with "OK"

2.4 Configuration of the EtherCAT Mailbox Gateway

2.4.1 Check availability

1. Open a command line

C:\Users\Administrator>ping **192.168.100.254**

Execute ping command for the IP address of the EtherCAT Mailbox Gateways
 Pinging 192.168.100.254 with 32 bytes of data:
 Request timed out.

You can see that the EtherCAT Mailbox Gateway is not reachable.

2.4.2 Configure Windows settings



1. Open Windows settings

Change adapter options View network a pters and change connection settings.

2. Open network adapter options

Etherno	et 3
Beckh	😌 Disable
	Status
	Diagnose
	💎 Bridge Connections
	Create Shortcut
	💎 Delete
	💎 Rename
[Properties

In this use case a virtual adapter called "Beckhoff Virtual Ethernet Adapter" is used resides at Ethernet 3.

- 3. Right click on Ethernet 3
- 4. Click on "Properties"

This connection uses the following iter	ns:
 Client for Microsoft Networks File and Printer Sharing for Mi QoS Packet Scheduler Internet Protocol Version 4 (1) 	icrosoft Networks
Microsoft Network Adapter M Microsoft LLDP Protocol Driv	lultiplexor Protocol er
 Internet Protocol Version 6 (T 	CP/IPv6)
Install Uninstall	Properties
 Select "Internet Protocol Version 4 (1 Click on "Properties" 	ſCP/IPv4)"
Internet Protocol Version 4 (TCP/IPv4)	Properties X
General	
You can get IP settings assigned autor this capability. Otherwise, you need to for the appropriate IP settings.	natically if your network supports ask your network administrator
• Use the following IP address:	•
IP address:	192.168.100.1
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	· · · · ·
Obtain DNS server address auton	natically
Use the following DNS server add	resses:
Preferred DNS server:	
Alternate DNS server:	
Validate settings upon exit	Advanced
	OK Cancel

- 7. Activate "Use the following IP address"
- 8. Enter the IP address of the EtherCAT Mailbox Gateway, here replace the 254 with a 1
- 9. Close window with "OK"
- 10. Close window "Ethernet 3 Properties" with "Close"
- 11. Close Windows settings

To check the correctness of the settings, check again the availability of the EtherCAT Mailbox Gateway as follows:

12. Reopen command line

C:\Administrator>ping **192.168.100.1**

13. Execute ping command for the adapter

You can see that the Adapter is reachable.

C:\Administrator>ping **192.168.100.254**

14. Execute ping command for the EtherCAT Mailbox Gateway

You see that the EtherCAT Mailbox Gateway is reachable.

2.4.3 Configure Gateway in engineering system

1. Open command line with administrator rights

C:\Windows\system32>ping 192.168.100.254

2. Execute ping command for EtherCAT Mailbox Gateway

You can see that the EtherCAT Mailbox Gateway is not available.

C:\Windows\system32>route print 192.168.100.0

3. Execute command "route print" for network 192.168.100.0

The command shows you all routes for the entered network. You can see in this use case that there is no active route for this network.

C:\Windows\system32>route add 192.168.100.0 mask 255.255.255.0.172.17.40.19

4. Use the "route add" command to add a route as shown

Enter the subnet mask and the address of the target system. In this application, the target system has the address 172.17.40.19.

5. Repeat the "route print" command for network 192.168.100.0

You can see that that you can reach the interface via the gateway 172.17.40.19.

6. Repeat the ping command for EtherCAT Mailbox Gateway

You can see that the EtherCAT Mailbox Gateway is reached.

Now you have everything ready for the use of the TwinSAFE Loader.

2.5 Prepare Safety project

2.5.1 Determine CRC

In this application, a TwinCAT 3 solution already exists with a Safety project for the demo system.



1. Open STO_ChA

Properties	
Network1 Network	
Customization Settings	
Passivation Allowed	False
Permanent Deactivation Allowed	True
Temporary Deactivation Allowed	False
Timeout Passivation Allowed (ms)	10000

You can see in the Customization Settings of the STO functionality for ChA that a permanent deactivation of the functionality is already allowed.



2. Click on "Verify Complete Safety Project" in the menu bar to verify the Safety project



3. Note CRC

2.5.2 Determine EtherCAT address

4	N	1/0	C		
	4		; De	vices	
	,	Þ	-	Device	1 (EtherCAT)

1. Open Device 1

Numb	er			Box Name	Address	Туре	In Size	Out Size	E-Bus (m
1				Term 1 (EK1200)		EK1200			
-	2			Term 2 (EL1918)	1001	EL1918	9.0	8.0	1835
	3			Term 3 (EL6910)	1002	EL6910	15.0	17.0	1645
-	4			Term 4 (EK1122)	1003	EK1122			1425
2	I	5		Term 5 (AX8620-0000-01	1004	AX8620-0000-0103	2.0		
	1		6	Drive 6 (AX8206-0210-01	1005	AX8206-0210-0104	32.0	32.0	1425
	1	•	7	Term 7 (EL9011)		EL9011			

2. Note EtherCAT address of the EL6910

2.5.3 Export Safety project

▲ 🚯 SafeEstop		
A Safe	Scope to This New Solution Explorer View	
▶ 💭	Build Dependencies	•
	Add	•
🔺 🍃 🗄	Manage NuGet Packages	
	Sort TwinSAFE Groups	•
	Edit TwinSAFE Group Order	
	Check Safe Addresses	
Safe	Generate Documentation	
\$€+ C++	Export Project (as xml file)	
	Export Project (as bin file)	
	Remove	Del
👂 🗮 Dev 🤿	Open Folder in File Explorer	
A Mappin Dev	Properties	Alt+Enter

- 1. Right click on the Safety project
- 2. Click on "Export Project (as bin file)"

Export project						×
\leftrightarrow \rightarrow \checkmark \uparrow \blacksquare \rightarrow This PC \rightarrow Windows	(C:) > TwinSAFE Loader Demo			~ C		
Organize 👻 New folder						10 • 🔞
★ Quick access	Name	Date modified	Туре	Size		
💻 This PC		No it	erns match your search.			
💼 3D Objects						
🥅 Desktop						
😁 Documents						
🕹 Downloads						
👌 Music						
📰 Pictures						
🚆 Videos						
🤚 Windows (C:)						
Network						
File name: SafeEstop.bin						Ý
Save as type: Binary File (*.bin)						
∧ Hide Folders					Save	Cancel

- 3. Select location on the hard disk
- 4. Confirm location with "Save"

2.6 Download Safety project

1. Open command line

You can also start the command line via HMI or a batch file.

First, download the Safety project via the following command:

C:\TwinSAFE Loader Demo>TwinSAFE_Loader.exe --gw 192.168.100.254 --user Administrator --pass TwinSAFE --slave 1002 --proj SafeEstop.bin

2. Call up the TwinSAFE-Loader, thereby enter the following information

- Gateway configuration --gw 192.168.100.254
- Username for the EL6910 as target system --user Administrator
- Password for the EL6910 as target system --pass TwinSAFE
- Slave address
- Path to project file --proj SafeEstop.bin
- 3. Confirm with Enter button

The Safety project is downloaded.

Next, enable the Safety project via the following command:

C:\TwinSAFE Loader Demo>TwinSAFE_Loader.exe --gw 192.168.100.254 --user Administrator --pass TwinSAFE --slave 1002 --proj SafeEstop.bin --crc 0xC019

- 4. Add the CRC information to the download command
- 5. Confirm with Enter button

After enabling, the EL6910 is completely configured with an activated Safety project.

More Information: www.beckhoff.com/twinsafe

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