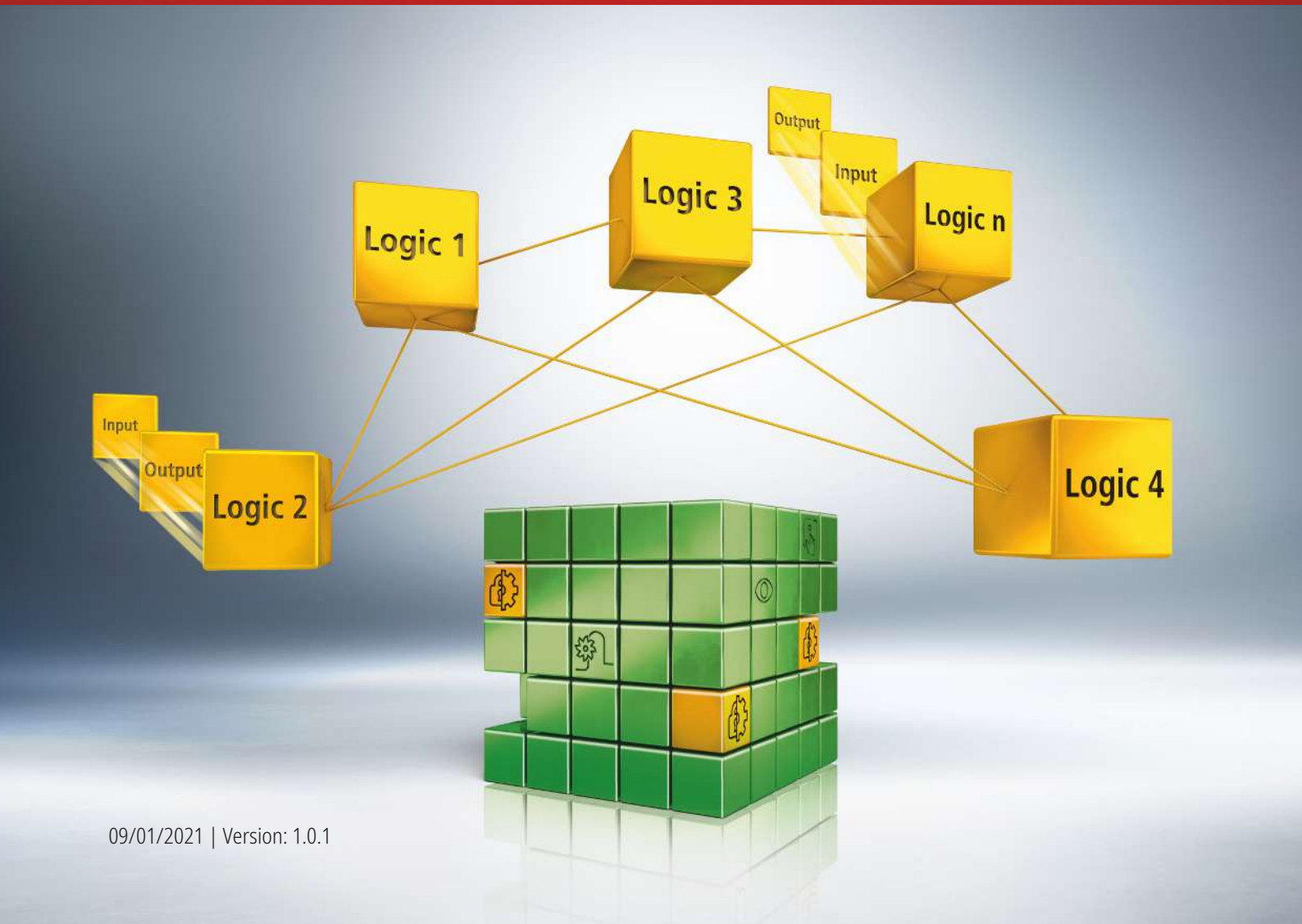
BECKHOFF New Automation Technology

TwinSAFE Tutorial 8 | EN

# SafeMotion Wizard

## Usage Safe Brake Control (SBC)

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# Table of contents

**1 Introduction ..... 5**
1.1 Issue statuses ..... 5
1.2 Requirements ..... 5
1.3 Starting point ..... 5
1.4 Demo system ..... 6
1.4.1 Hardware ..... 6
1.4.2 Desired safety functionality ..... 6
1.5 Approach ..... 6
**2 Demonstration ..... 7**
2.1 Create Safe Motion project ..... 7
2.2 Activate SBC ..... 12
2.3 Configure process image ..... 14
2.4 Add variable ..... 19
2.5 Configure ErrorHandling ..... 21
2.6 Link projects ..... 25
2.7 Download safety projects ..... 27
2.8 Activate configuration ..... 30
2.9 Check signals ..... 31
2.10 Let motor traverse ..... 32
**3 Alternative solution ..... 34**

# 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 8 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 extension of an existing SafeMotion Wizard project with SBC functionality.

## 1.1 Issue statuses

| Version | Comment |
|---|---|
| 1.0.1 | • Headline “Table of contents” added |
| 1.0.0 | • First released version |
| 0.0.1 | • First draft |

## 1.2 Requirements

Meet the following requirements for this tutorial:

- TwinCAT 3 version ≥ 3.1.4024.11
- TwinCAT Safety Editor TE9000 ≥ 1.2.1.1
- TwinSAFE firmware ≥ 03
- AX8000 firmware ≥ 0104; with default module ID active
- Motor with integrated holding brake

## 1.3 Starting point

At the starting point of the tutorial

- a TwinCAT 3 project with standard PLC exists,
- an EL6910 project 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
- Motor with integrated holding brake

### 1.4.2 Desired safety functionality

This tutorial describes the realization of the following safety functionality:

- Realization of brake release and brake lock from AX8000 project via FSoE (EL6910).

## 1.5 Approach

**SBC**

SBC is deactivated by default.

With the internal safety parameters, SBC can be activated in object C130:01.

**Implication**

- Release in TwinSAFE required (output ChA_Brake_Release)
- Functional control possible
- Evaluation of functional request in TwinSAFE optional (input ChA_DriveReq_Activate_Brake)

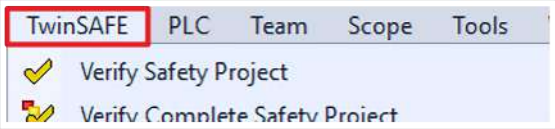
# 2 Demonstration

## 2.1 Create Safe Motion project

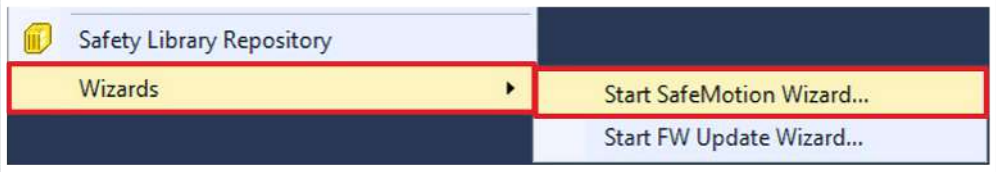
Starting point of the tutorial is an existing TwinCAT3 project with an existing I/O configuration and the corresponding Safe Motion entries.

Proceed as follows to create a Safe Motion project with the SafeMotion Wizard:

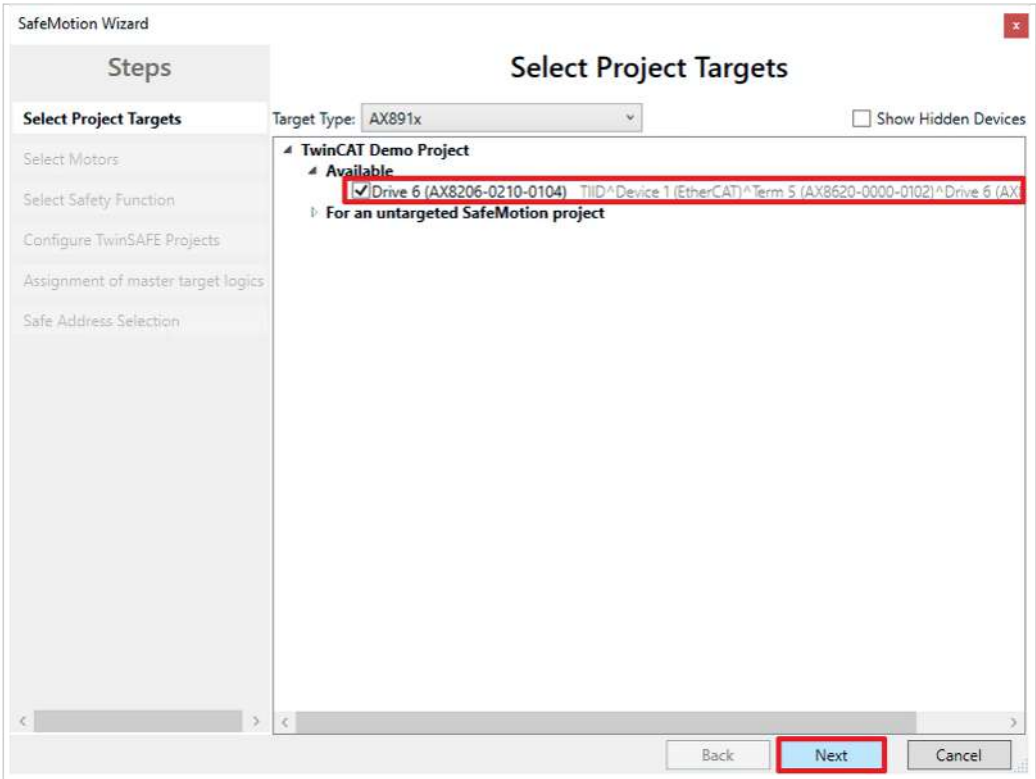
1. Select safety project




2. Select the “TwinSAFE” tab

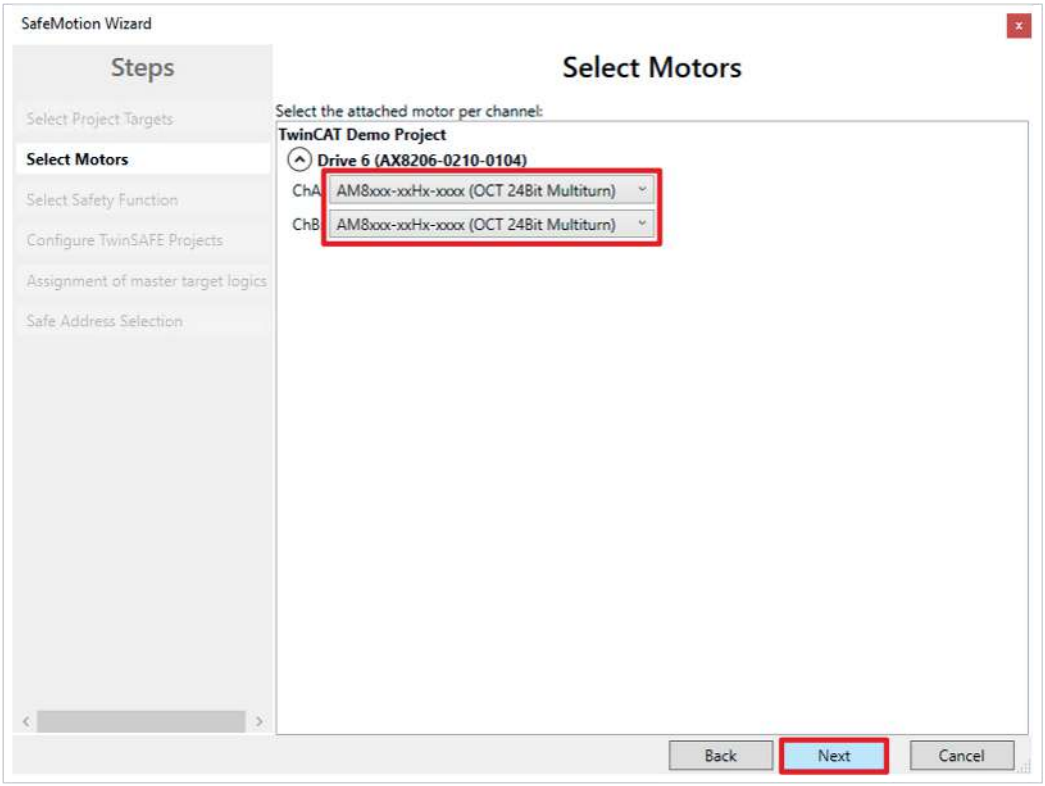



3. Select “Start SafeMotion Wizard...” via the Wizard field



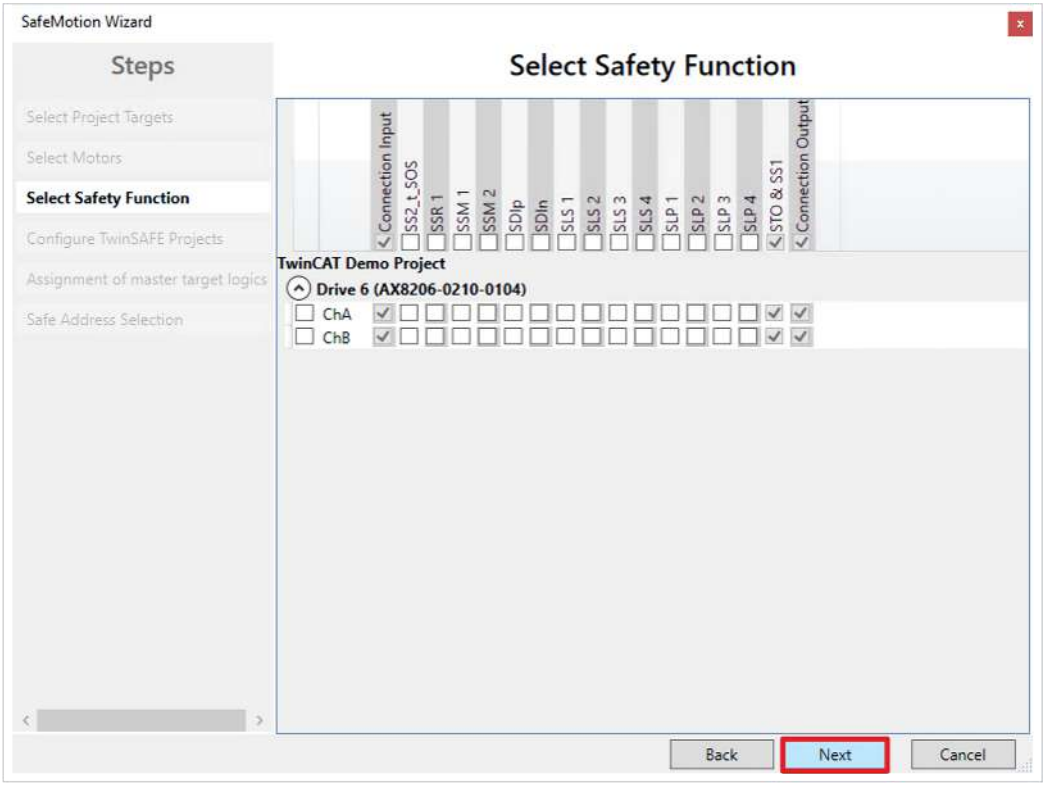

The “Select Project Targets” window opens and shows you an overview of all existing and virtual axes.

4. Select your Safe Motion component
5. Confirm selection with “Next”




In the “Select Motors” window, configure the feedback for the individual axes.

6. Select “AM8xxx-xxHx-xxx (OCT 24Bit Multiturn)” for both channels ChA and ChB
7. Confirm selection with “Next”

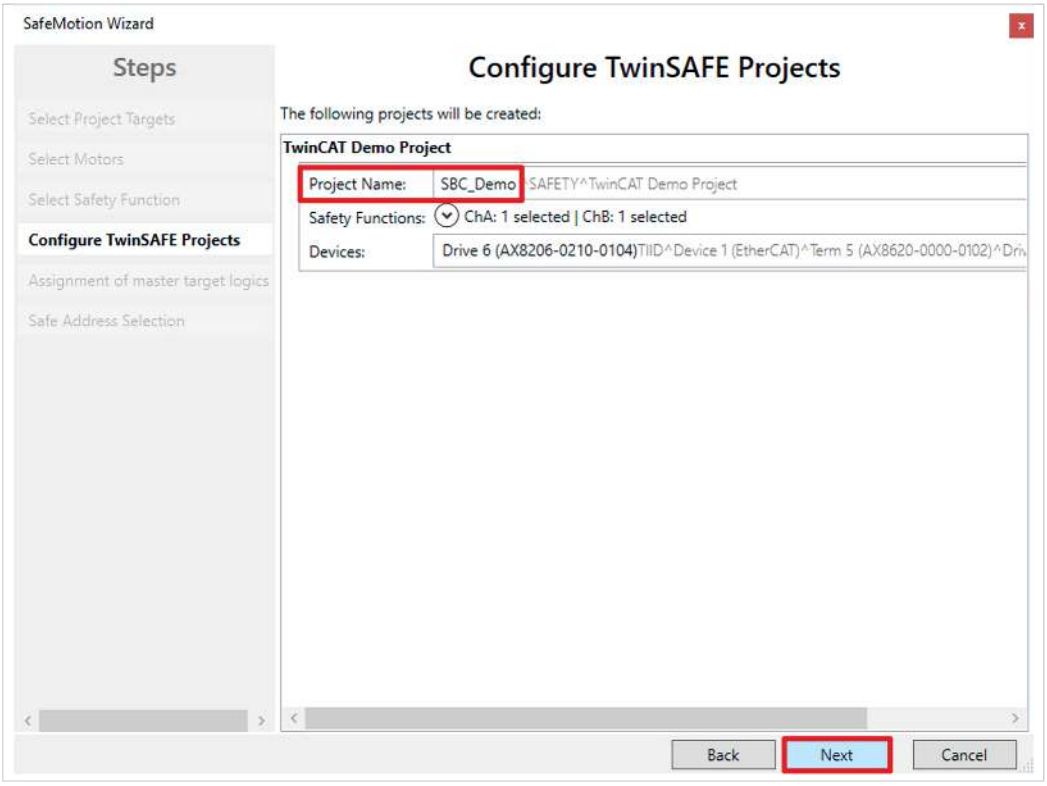



In the “Select Safety Function” window, select the desired safety functions.

8. Do not select any additional security functions, as the default settings are sufficient here

The STO safety function is active as a default setting for all channels.

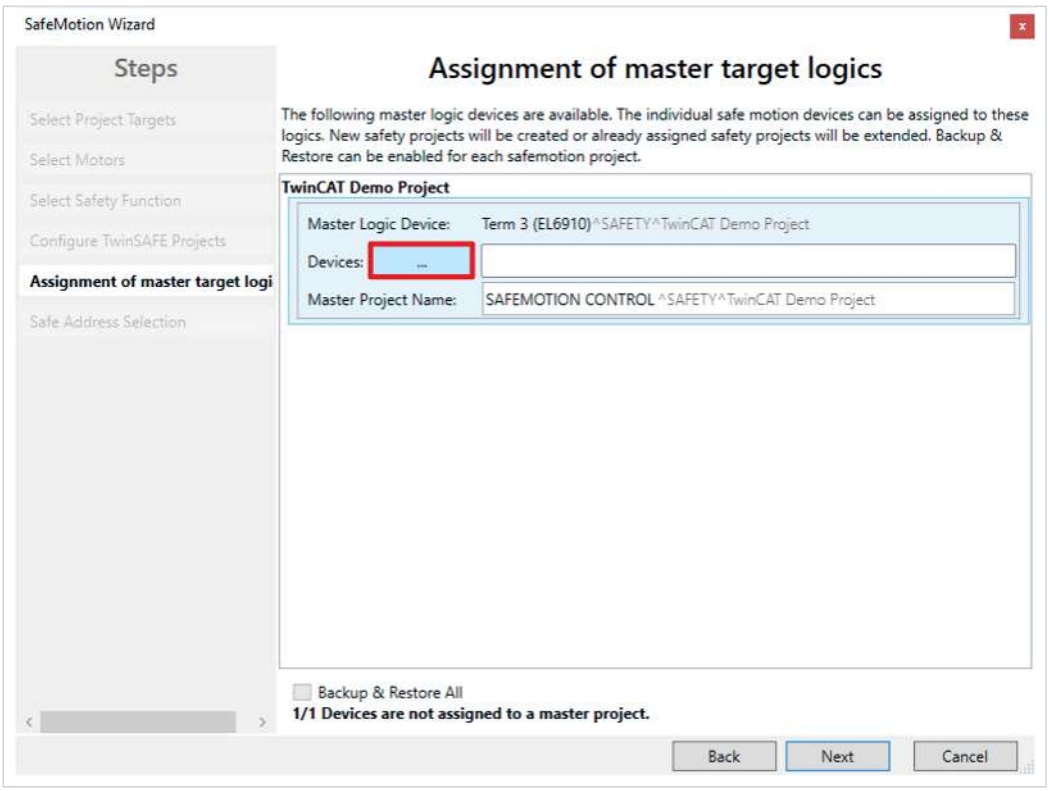
9. Confirm the selection with “Next”




The “Configure TwinSAFE Projects” window opens. Here you have the option of renaming your Safe Motion project, which is generated for your Safe Motion component.

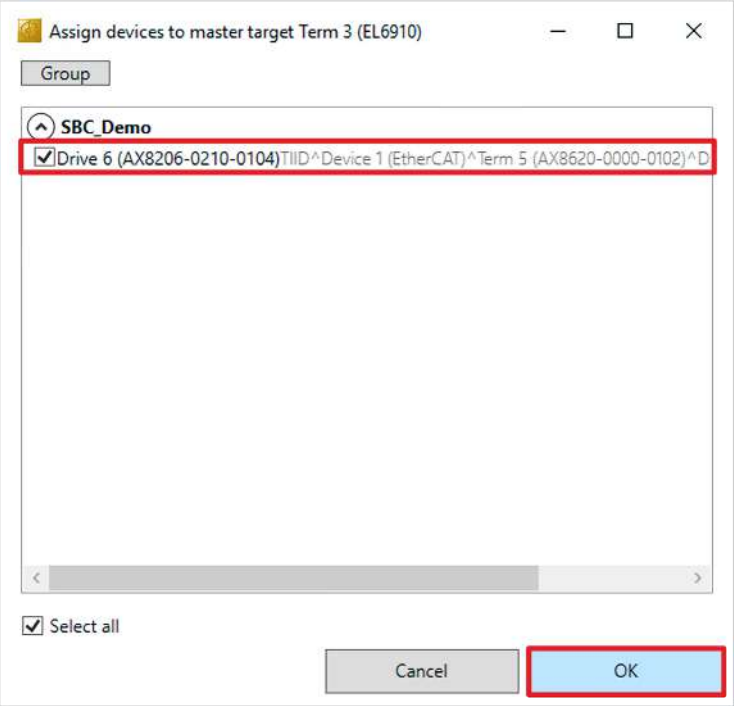
You also get an overview of the safety settings that have been made.

10. Rename project as desired
11. Check the settings
12. Confirm the selection with “Next”

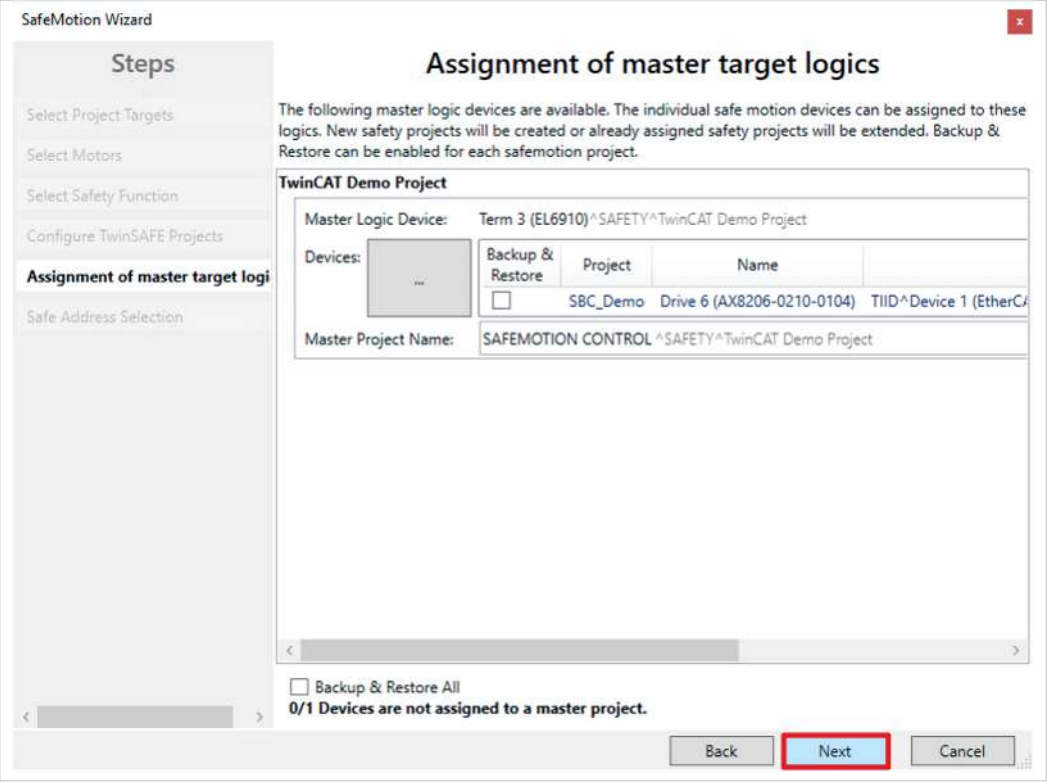


In the next window “Assignment of master target logics” the connection to the EL6910 project is closed, so that your Safe Motion component can communicate with the EL6910 project. The EL6910 project is automatically found and displayed.

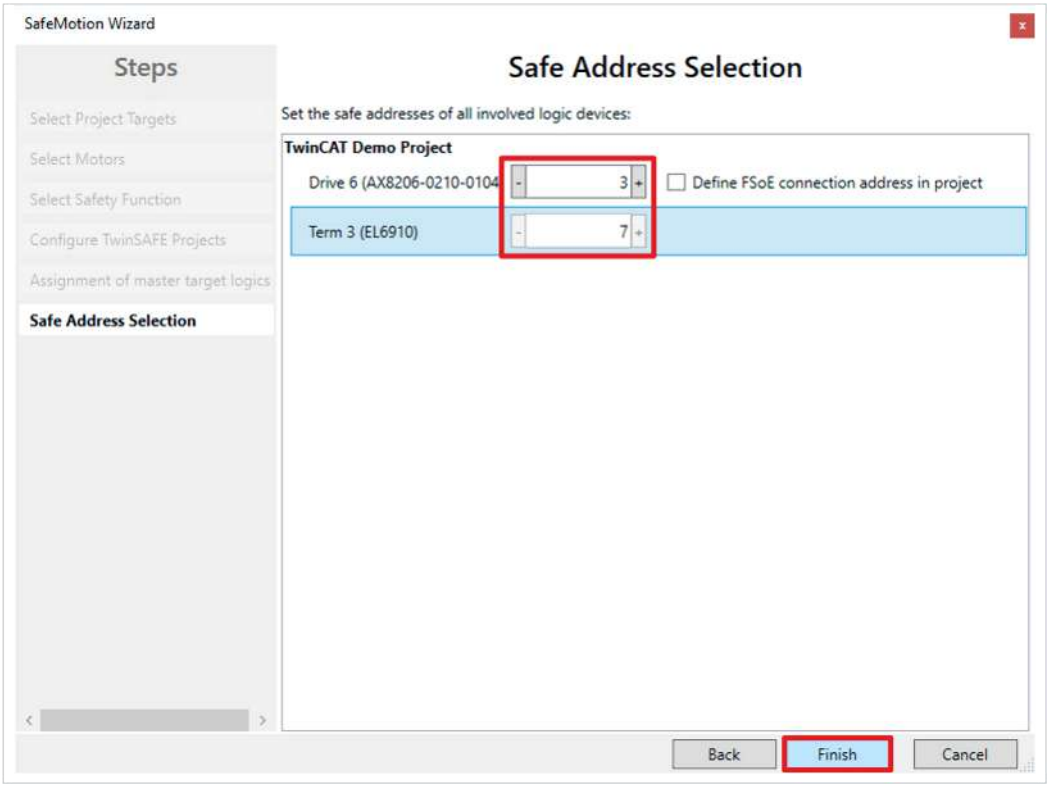
13. Click the button “ ... “




14. Select the Safe Motion component that you want to connect to the EL6910 project
15. Confirm your selection with “OK”



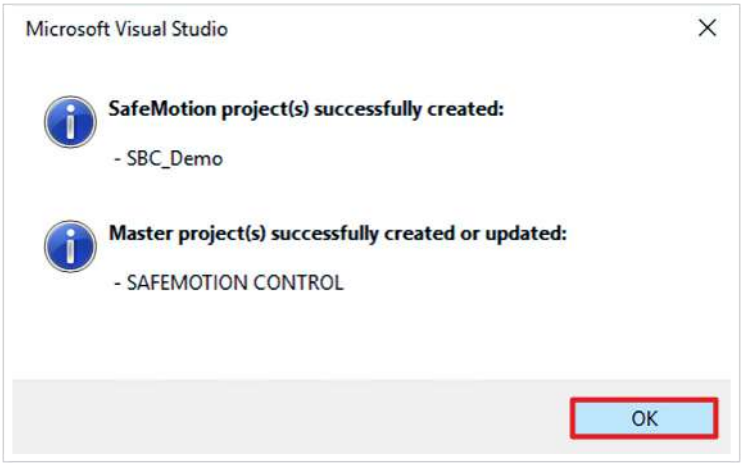

16. Confirm the window with “Next”




The “Safe Address Selection” window opens. Here the safe addresses are read out automatically. For virtual axes or axes that cannot be reached, you have the option of configuring the addresses yourself.

17. Close window with “Finish”

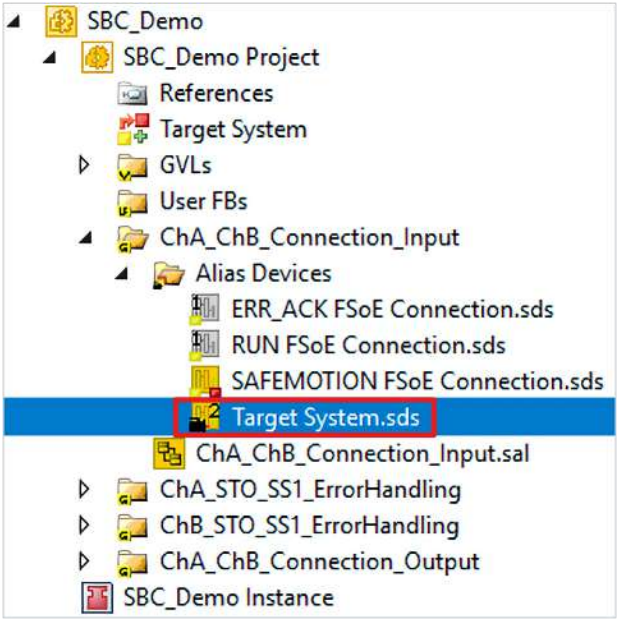
The SafeMotion Wizard configures the projects.




18. Close the window with “OK”

## 2.2 Activate SBC

The next step is the SBC activation. Proceed as follows:

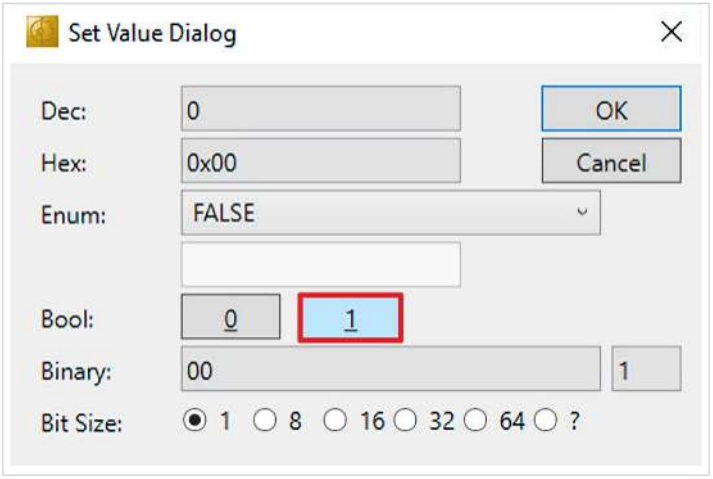



1. Open the “Target_Systems.sds” file in the “ChA_ChB_Connection_Input” folder

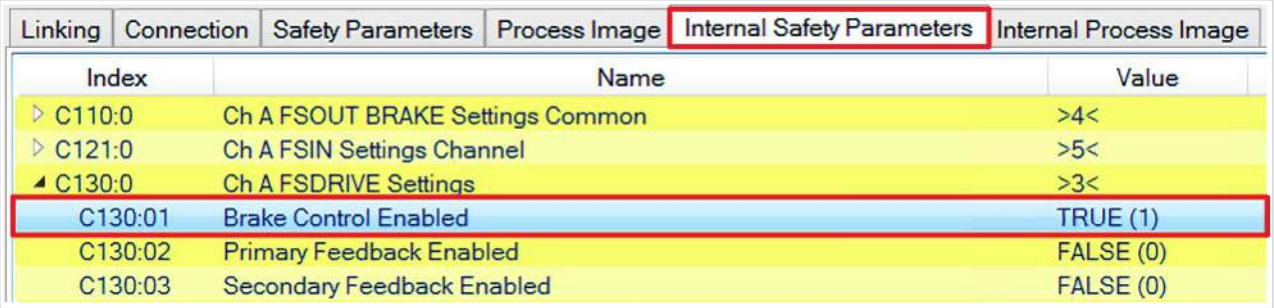
2. Open “Internal Safety Parameter” tab

Under the parameter “C130:01 Brake Control Enabled” you activate the SBC functionality.

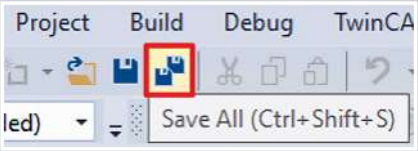
3. Double click on the parameter C130:01




4. In the “Set Value Dialog” window, click on “1” at Bool to set the parameter to TRUE




You can now see that the parameter is set to TRUE and the SBC functionality is active.

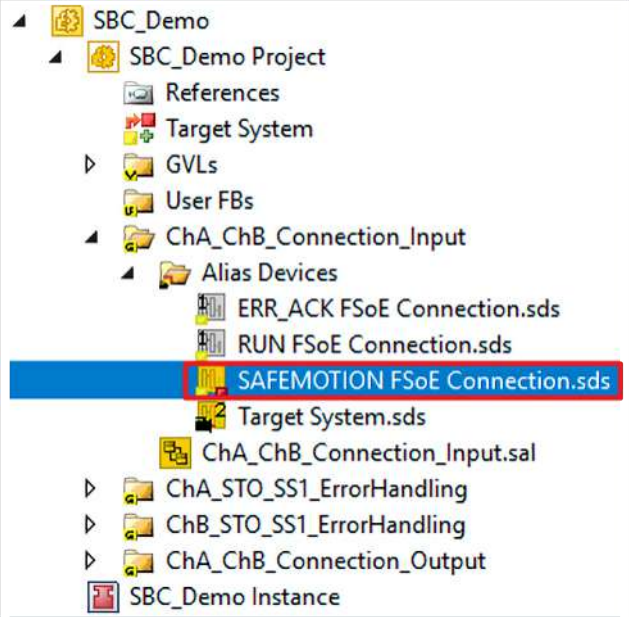



5. Click on "Save all" in the menu bar to save the settings

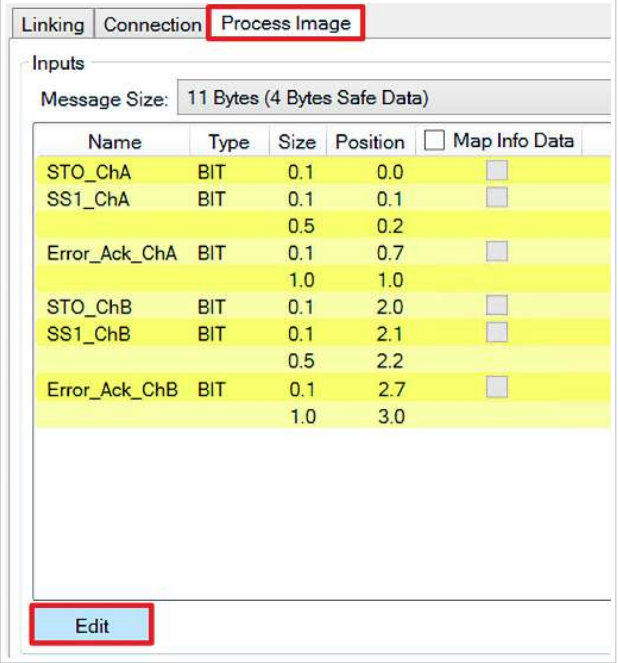
## 2.3 Configure process image

Since SBC is to be controlled via the FSoE connection with the EL6910, next configure the process images of the components so that the bits are transferred.

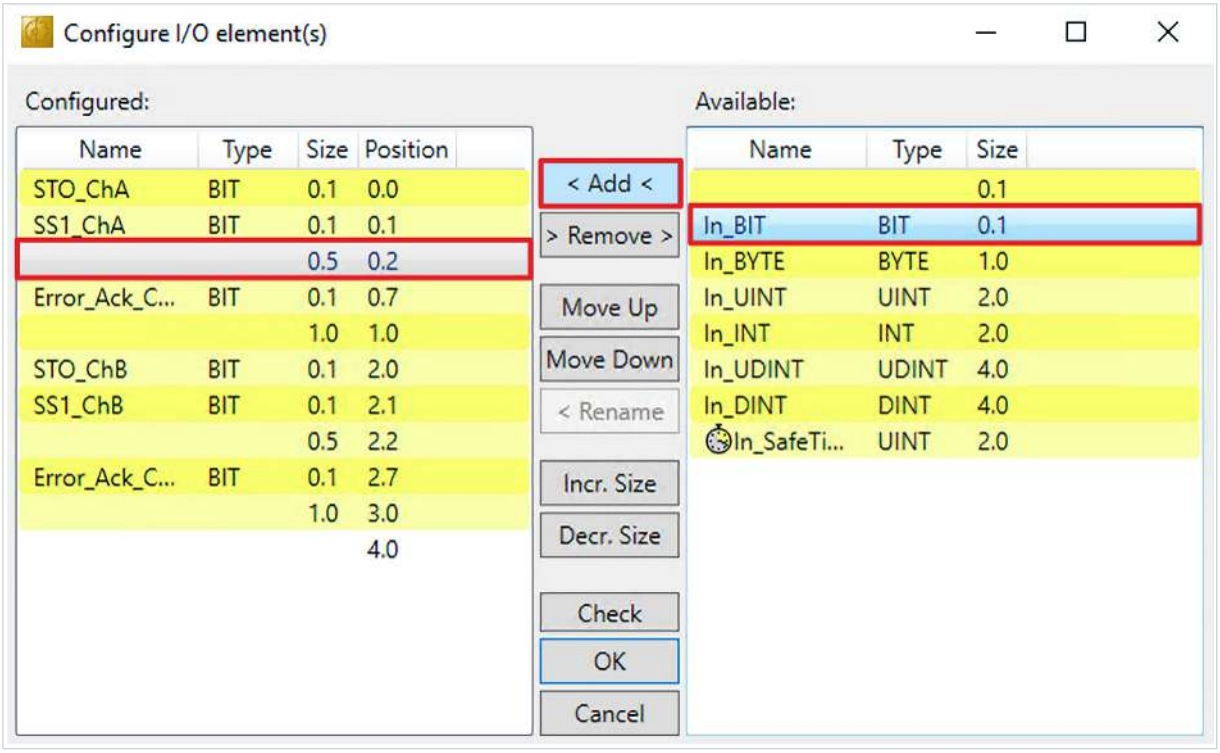
Proceed as follows:




1. In the AX8000 project open the file “SAFEMOTION FSoE Connection.sds”

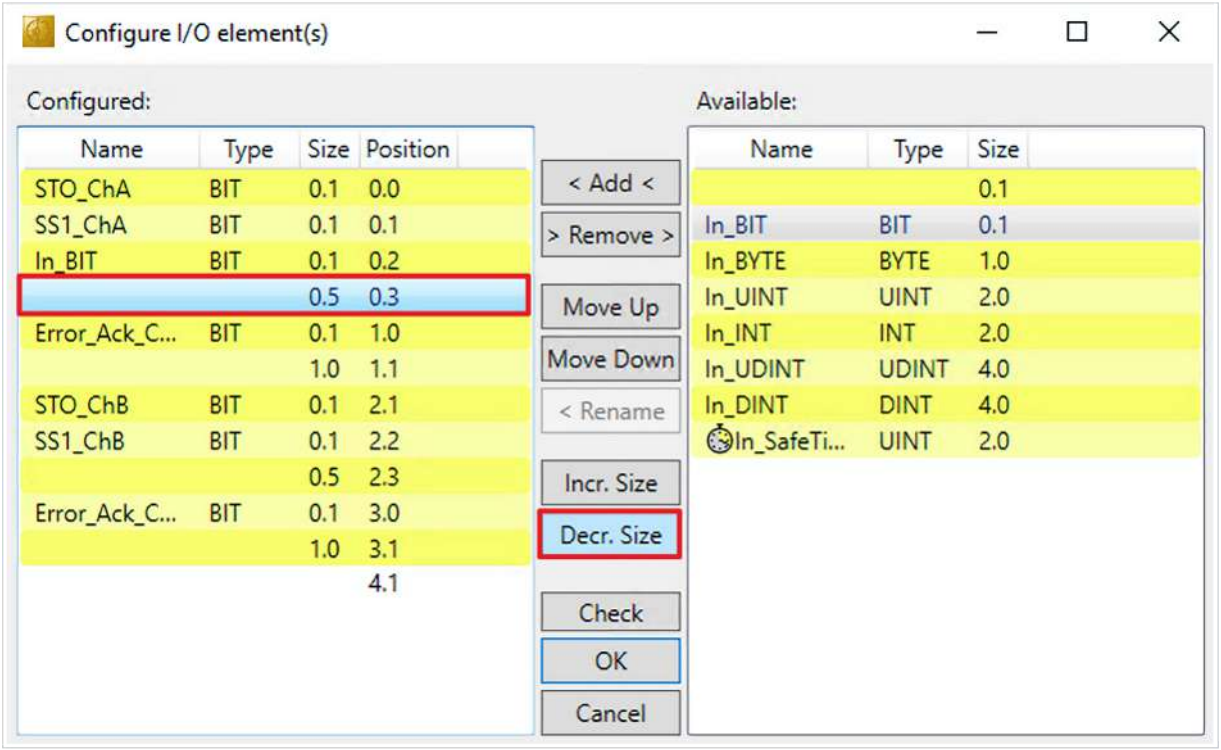



2. Open the “Process Image” tab
3. Click on the “Edit” field on the input page

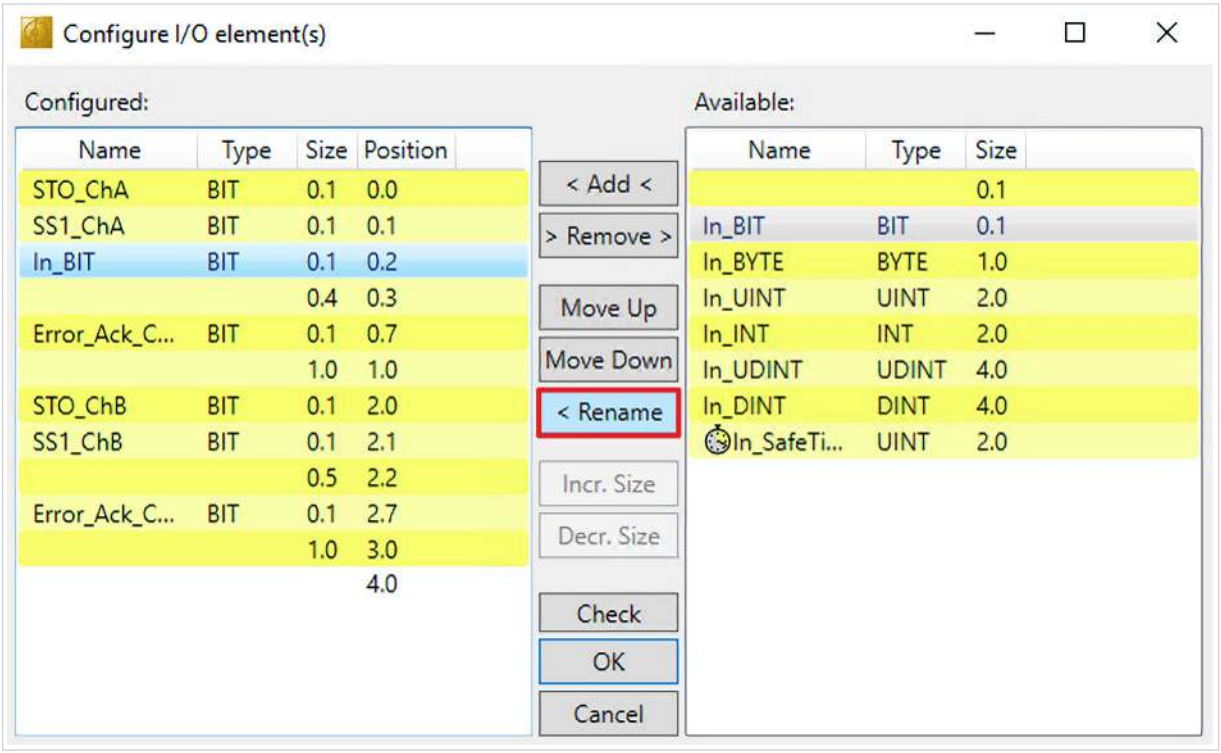



The "Configure I/O element(s)" window opens, where you can customize the input process image.

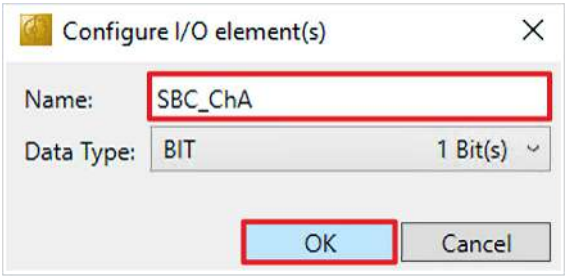
4. Select the reserved space
5. Select the bit “In_BIT“
6. Click on “< Add <”



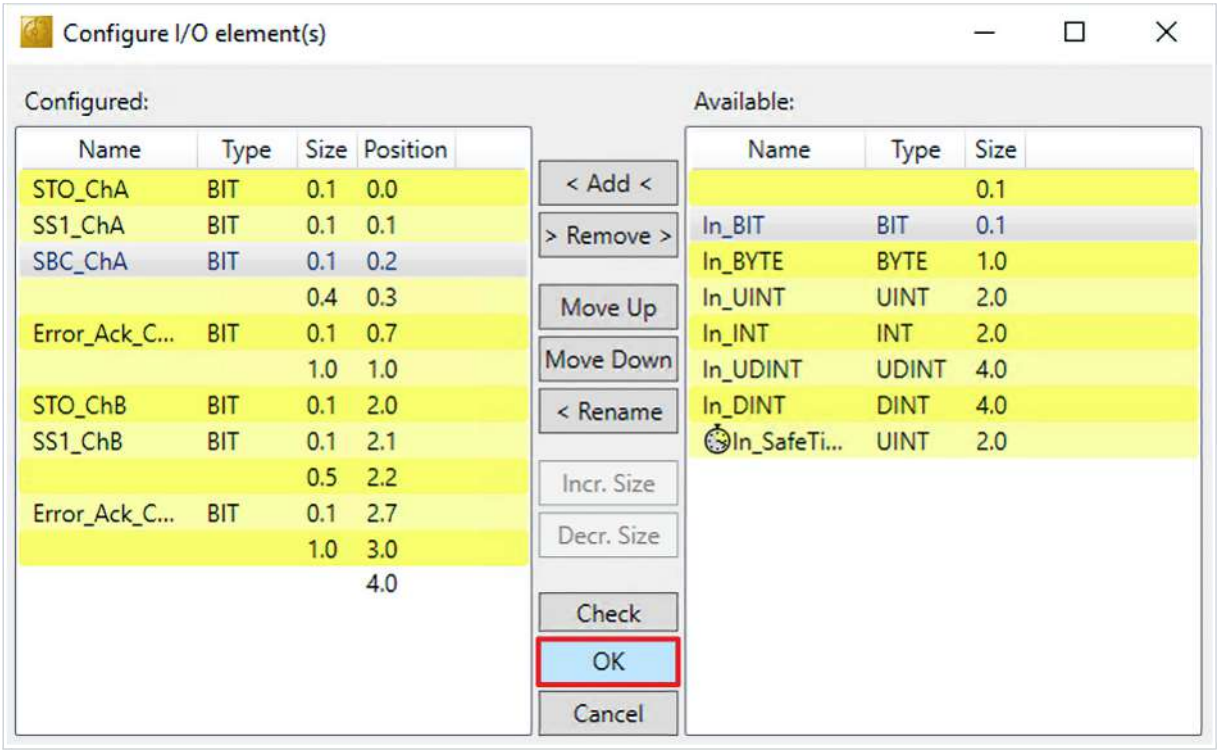

7. Select the reserved space again
8. Click on "Decr. Size" to decrease the reserved space by one bit to make the FSoE match again




9. Select newly added bit
10. Click on “< Rename”

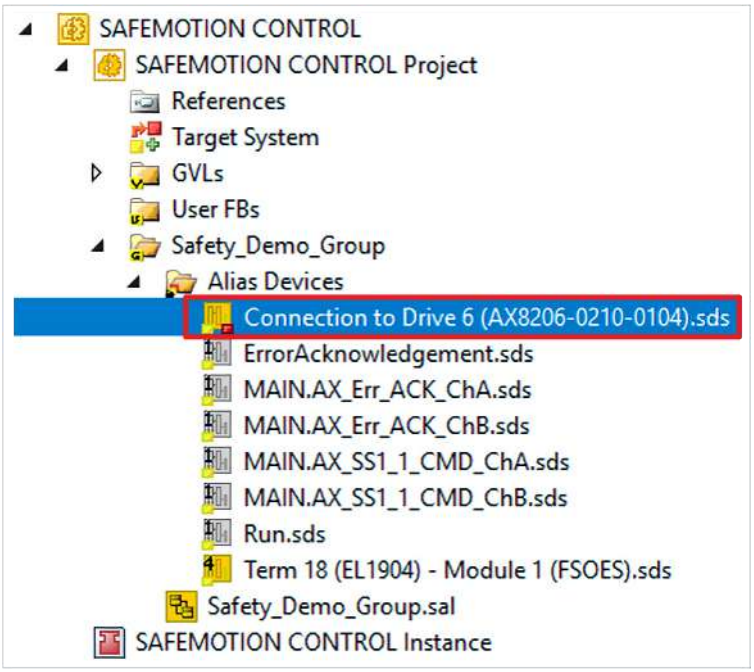



11. Rename bit as desired
12. Confirm naming with “OK”

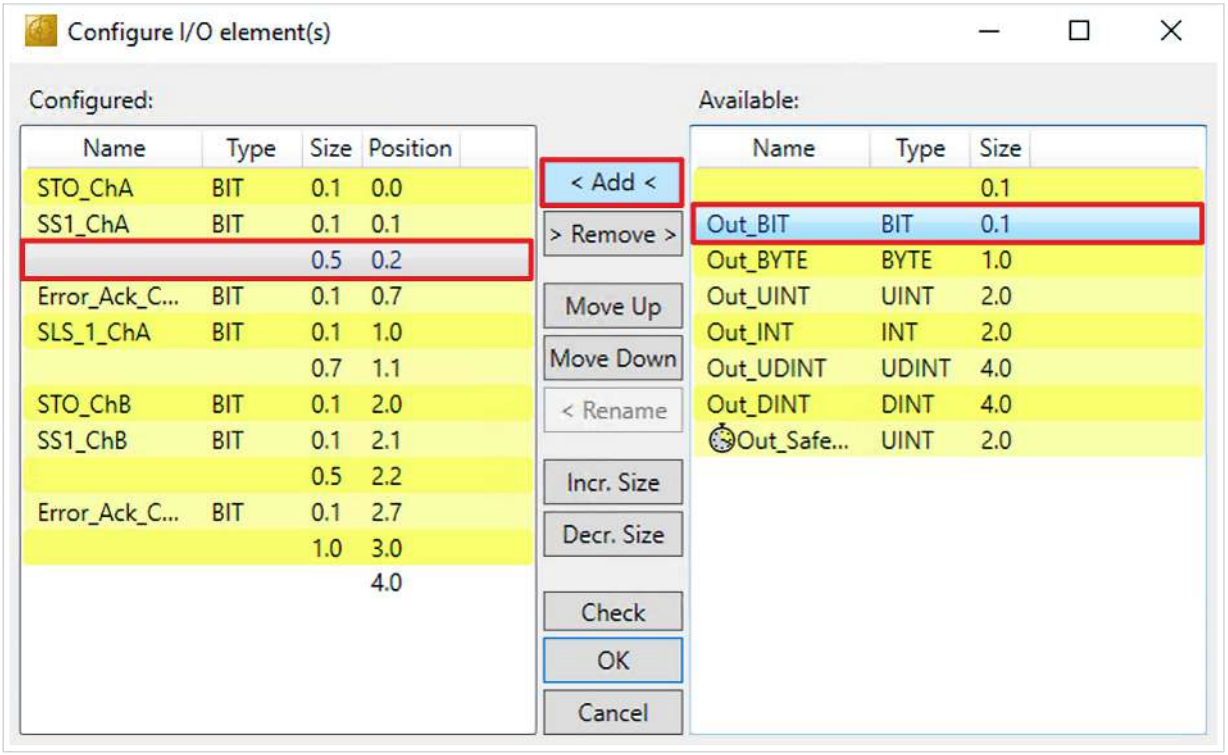



13. Close the window “Configure I/O element(s)” with “OK”

Next, adjust the process image of the EL6910. Proceed as follows:



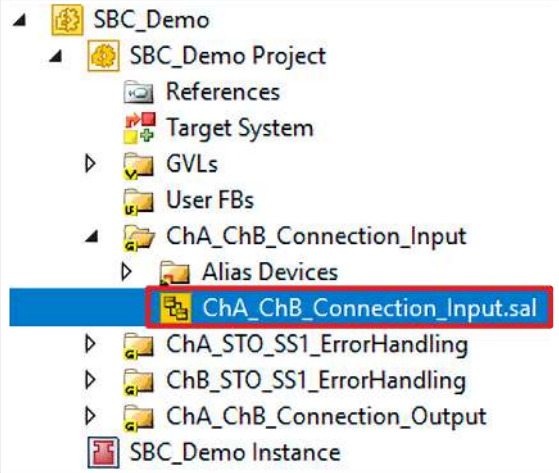

14. Open the file “Connection to Drive 6 (AX8206-0210-0104).sds” in the EL6910 project
15. Open the tab “Process Image”
16. Click the “Edit” field on the output page



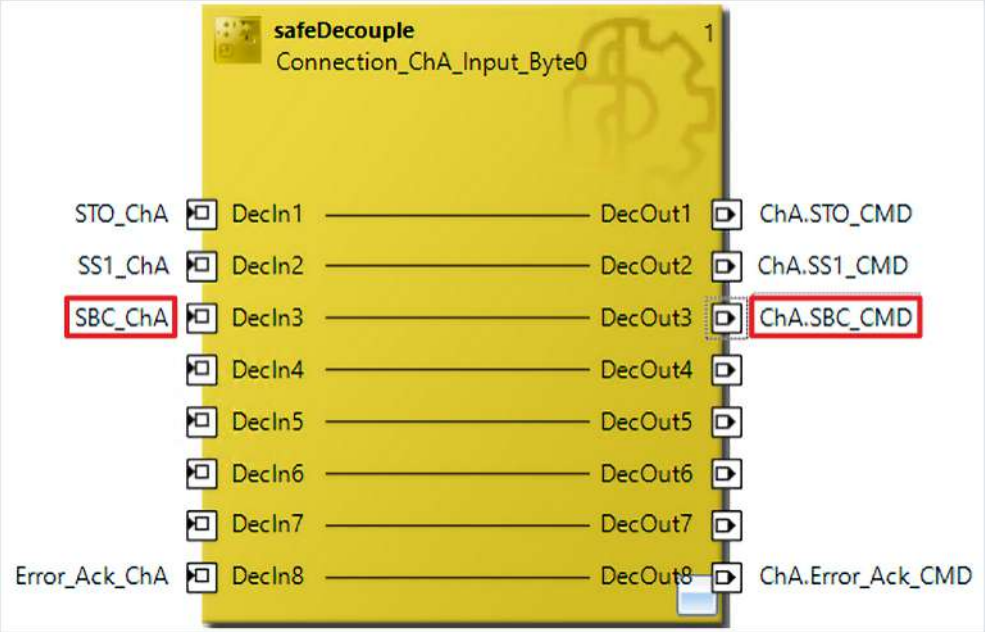

17. Repeat steps 4 to 13 for the bit “Out_BIT”
18. Click on “Save all” in the menu bar to save the settings

## 2.4 Add variable

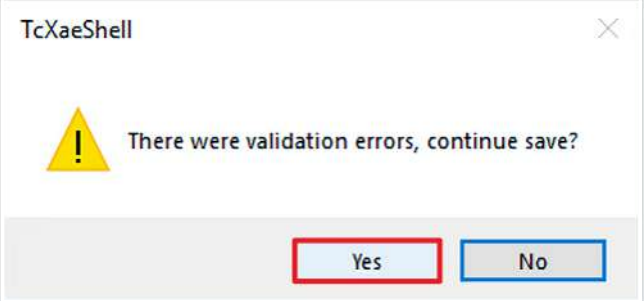
Next is the SBC link within the logic. Proceed as follows:




1. Open file “ChA_ChB_Connection_Input.sal”



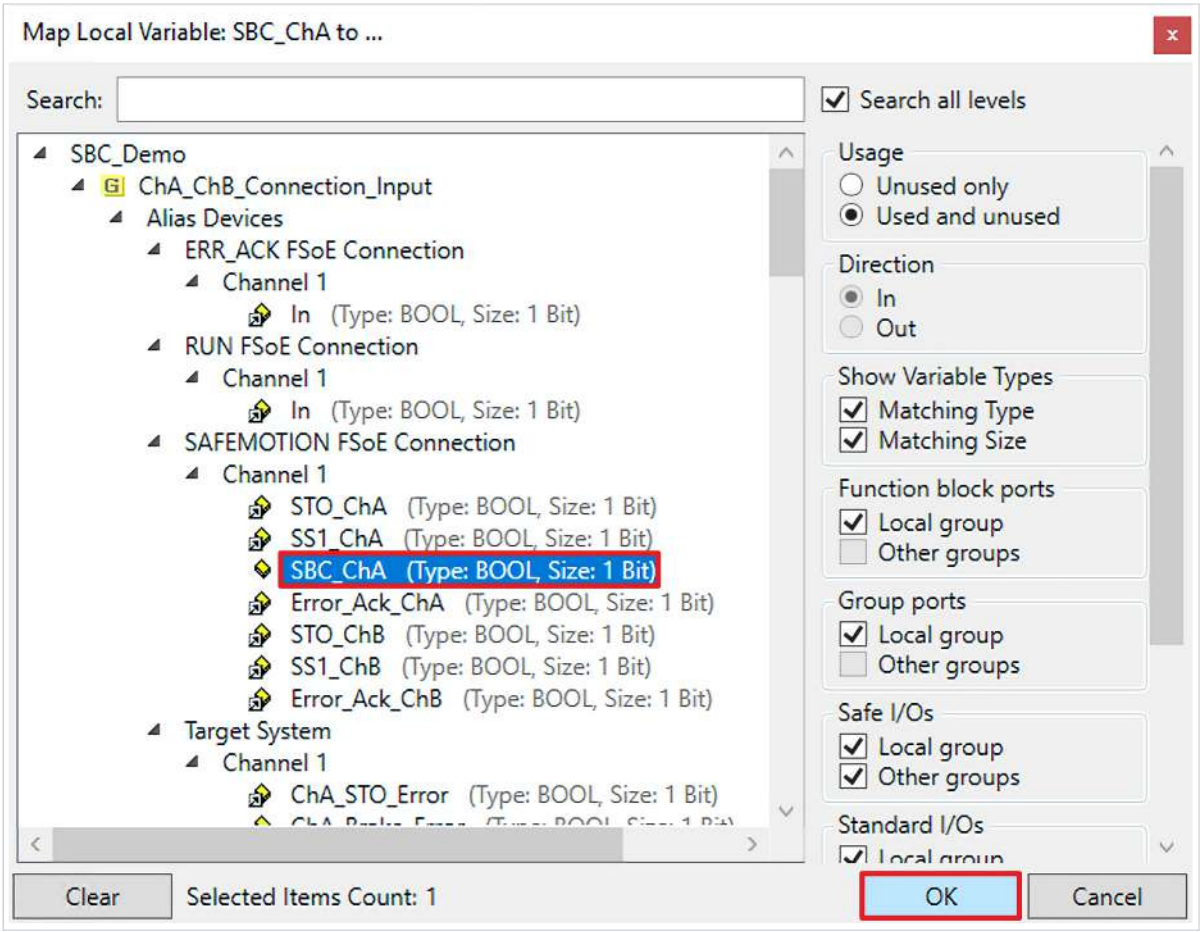

2. Insert the variable “SBC_ChA” at the first FB at the input “DecIn3”
3. Insert the variable “ChA.SBC_CMD” at the output “DecOut3”
4. Click “Save all” in the menu bar to save the settings




5. Close the warning window with “OK”

You see that a shortcut is missing. Create the shortcut as follows:

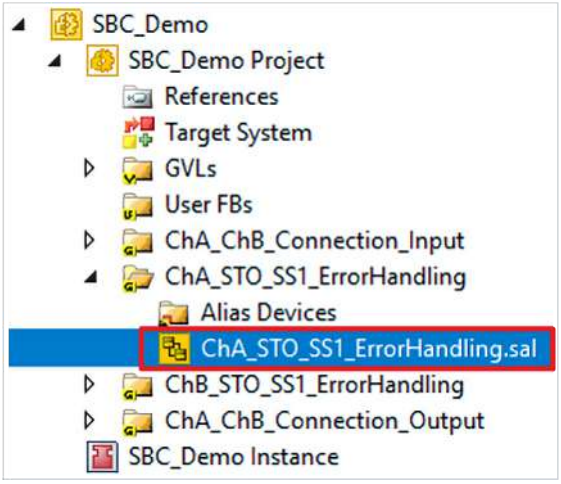
6. Open the tab “Variable Mapping”
7. Click on the field “ ... “ for the variable “SBC_ChA”



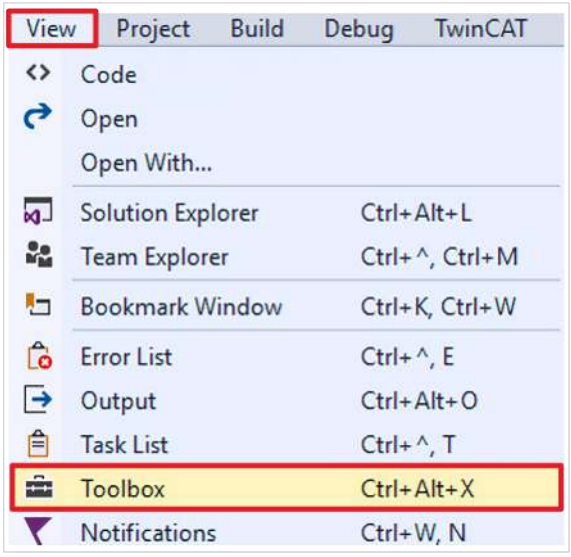

8. Select “SBC_ChA”
9. Confirm selection with “OK”
10. Click “Save all” in the menu bar to save the settings.

## 2.5 Configure ErrorHandling

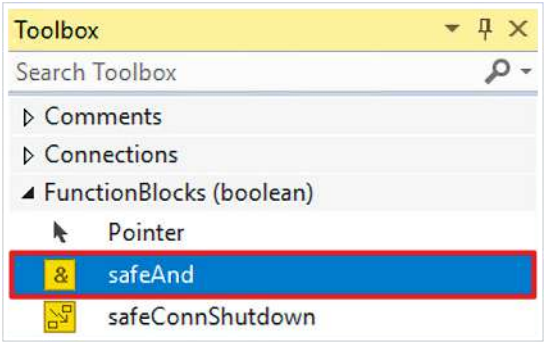
At this point STO and SBC are linked in ErrorHandling. Proceed as follows:



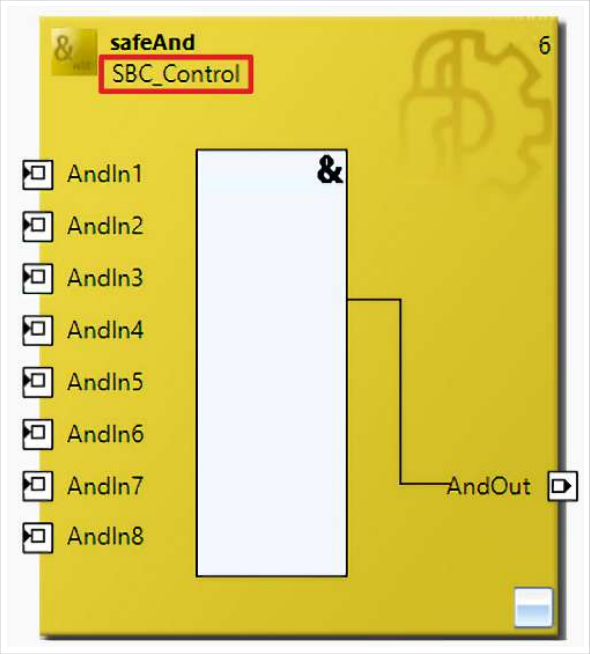

1. Open file “ChA_STO_SS1_ErrorHandling.sal”



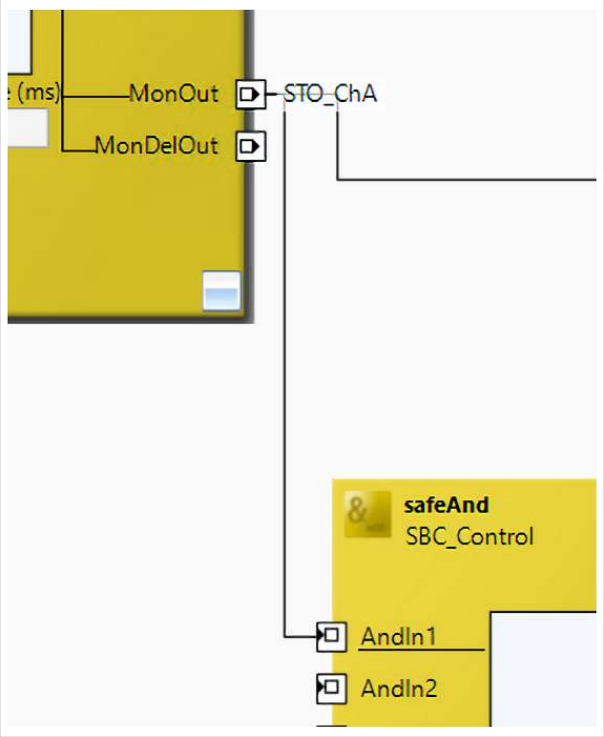

2. Click on “Toolbox” via the “View” tab



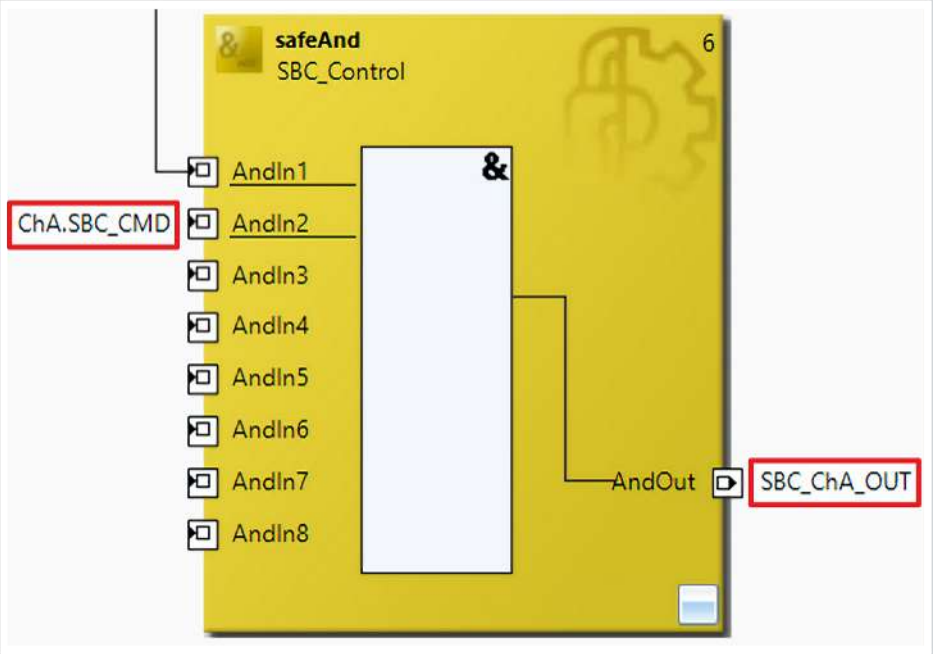

3. Insert the FB safeAnd from the toolbox into the network as shown in the figure




4. Rename FB

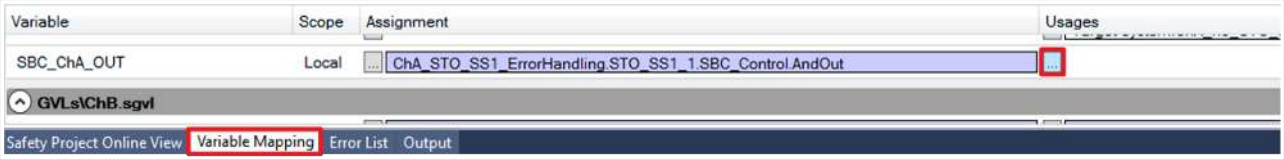



5. Link FB with FB safeMon according to the illustration

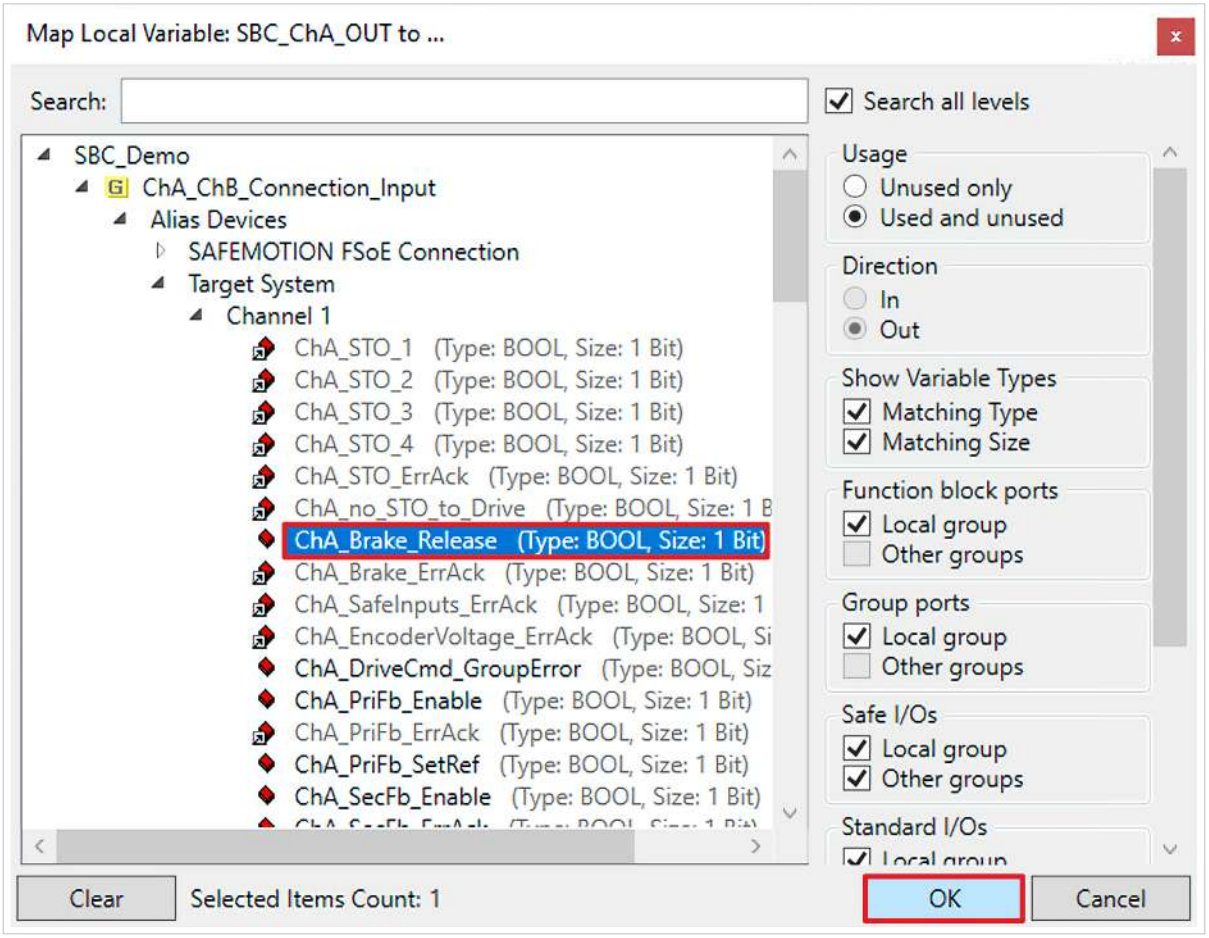



6. Label the input AndIn2 as shown
7. Label the output AndOut as shown.

Next, link the newly added variable “SBC_ChA_OUT” as follows:




8. Open tab “Variable Mapping”
9. At variable “SBC_ChA_OUT” click the field “ ... “




10. Select “ChA_Brake_Release”
11. Confirm selection with “OK”

Now the STO and SBC functions are directly linked and the brake is controlled safely.

## 2.6 Link projects

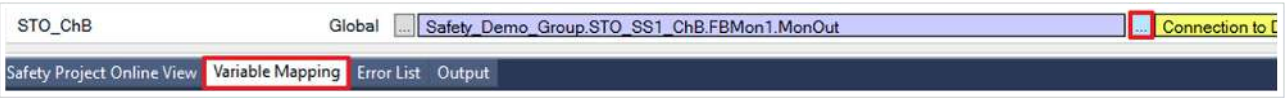
This chapter describes the step-by-step procedure for connecting the Safe Motion project to the EL6910 project via the parameters.

The SafeMotion Wizard has already created the connections via the Alias Devices.

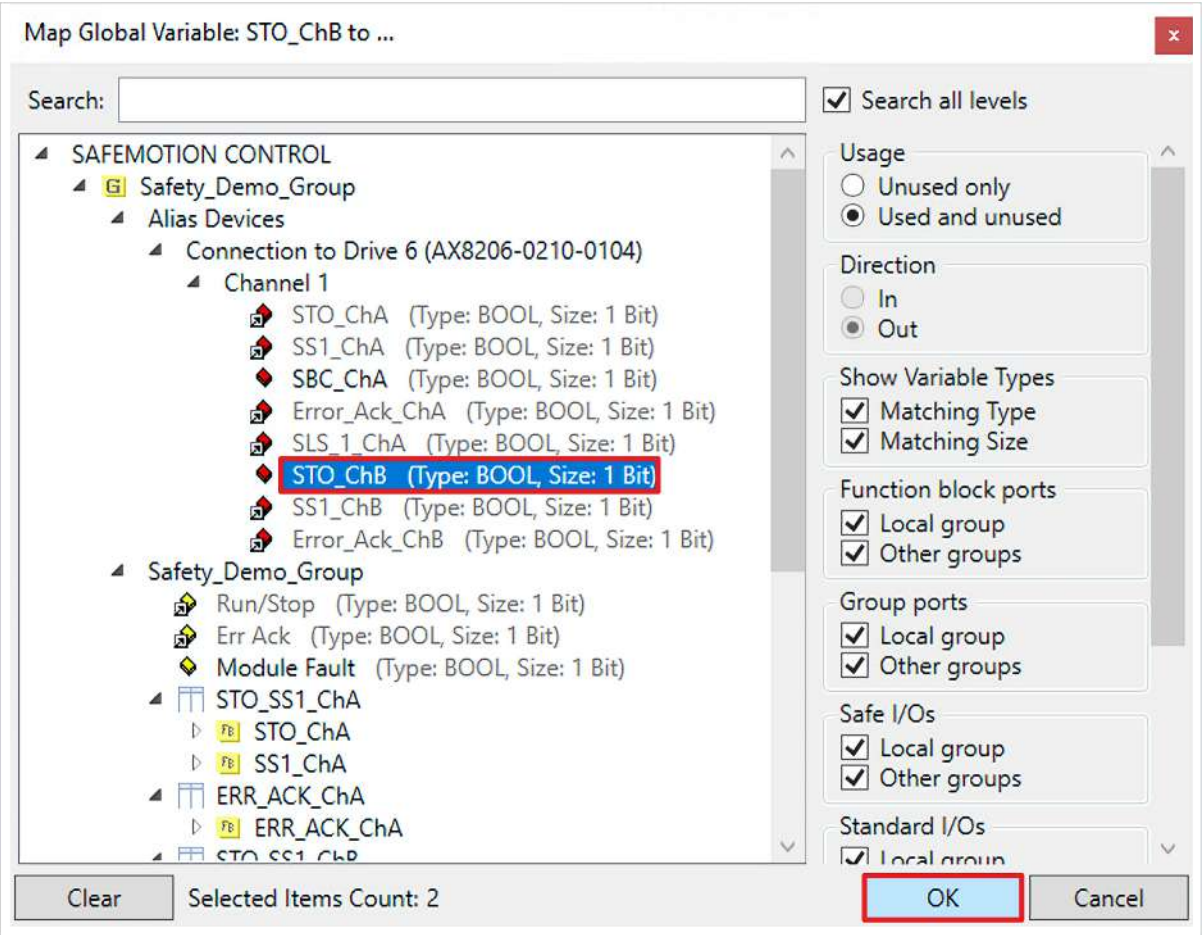
Proceed as follows:

1. Open the “Safety_Demo_Group.sal” file in your EL6910 project
2. Open the “Variable Mapping” tab

In the following you must link the individual signals and parameters in the "Variable Mapping" tab. The procedure is identical for all parameters and is shown here as an example for one parameter using the screenshots.




3. Click the " ... " button for the desired parameter



4. Select the signal for the parameter
5. Confirm selection with “OK”

The following links result for the parameters:

**Note When aliasing the STO parameters, make sure that the existing links are retained.**

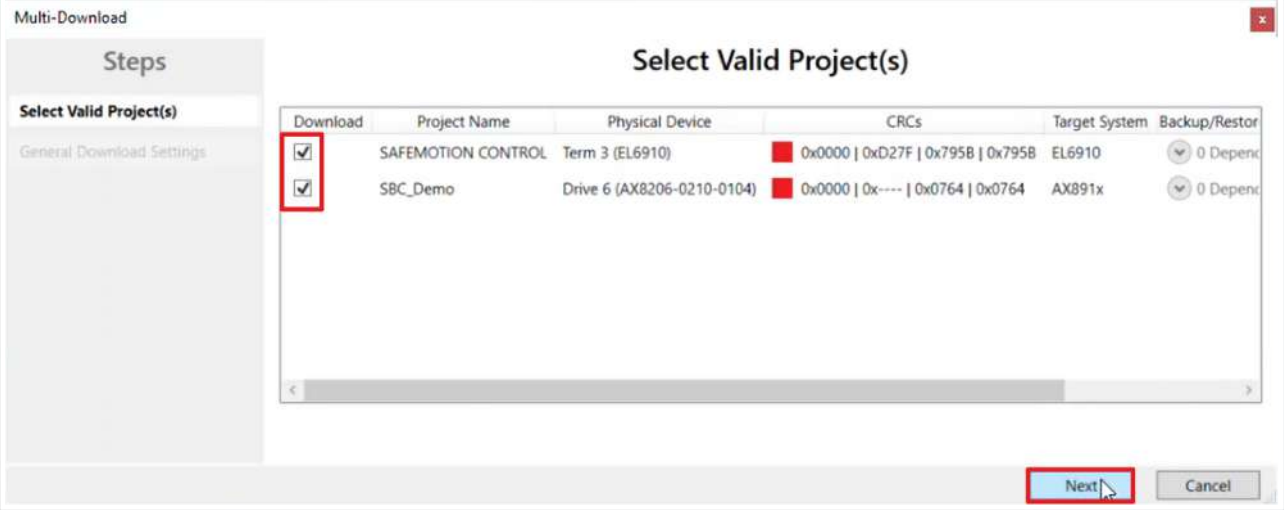
| Parameter | Signal |
|---|---|
| ERR_ACK_AX8000_ChA | Error_Ack_ChA |
| SS1_AX8000_ChA | SS1_ChA |
| SS1_AX8000_ChB | SS1_ChB |
| ERR_ACK_AX8000_ChB | Error_Ack_ChB |
| SBC_AX8000_ChA | SBC_ChA |
| STO_ChA | STO_ChA |
| STO_ChB | STO_ChB |

6. Click on "Save all" in the menu bar to save the settings

The link is now complete. In the next chapter you will download the safety projects.

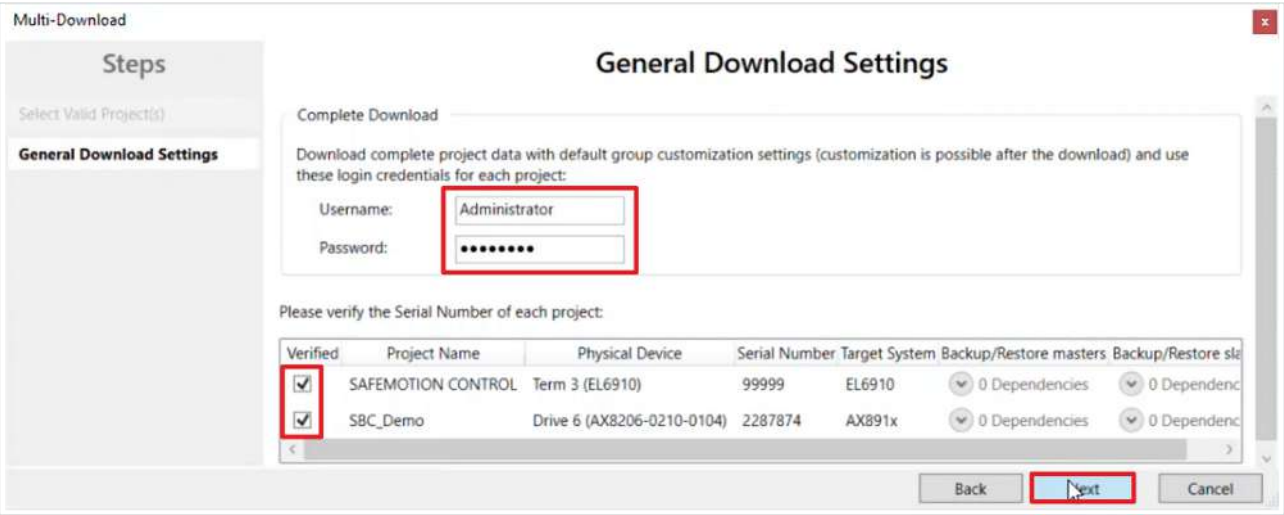
## 2.7 Download safety projects

1. Click on “Multi-Download Safety Project(s)”




The “Select Valid Project(s)” window opens. Here you can see which safety projects you can download.

2. Select the safety projects that you want to download
3. Confirm selection with “Next”

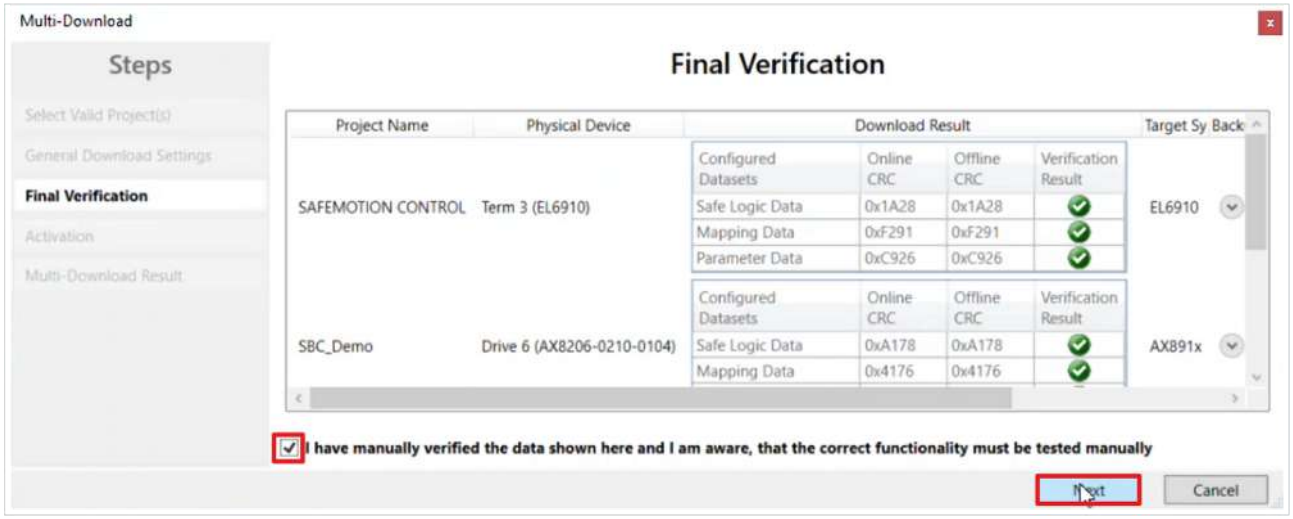



4. Enter the username and password in the “General Download Settings” window

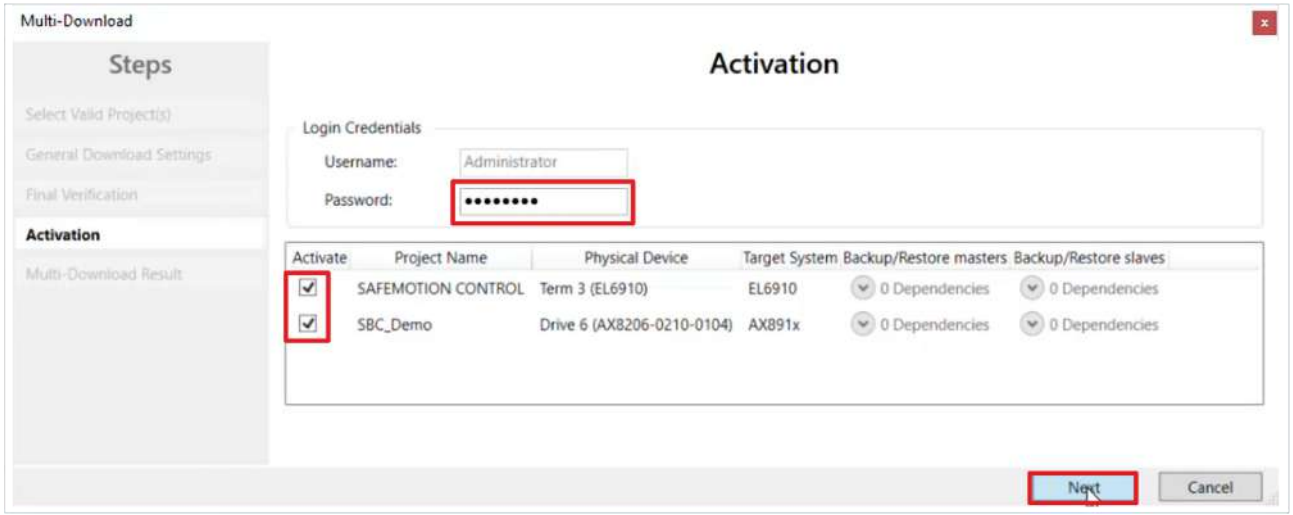
Default username: Administrator

Default password: TwinSAFE

5. Select the safety projects that you want to download
6. Confirm selection with “Next”

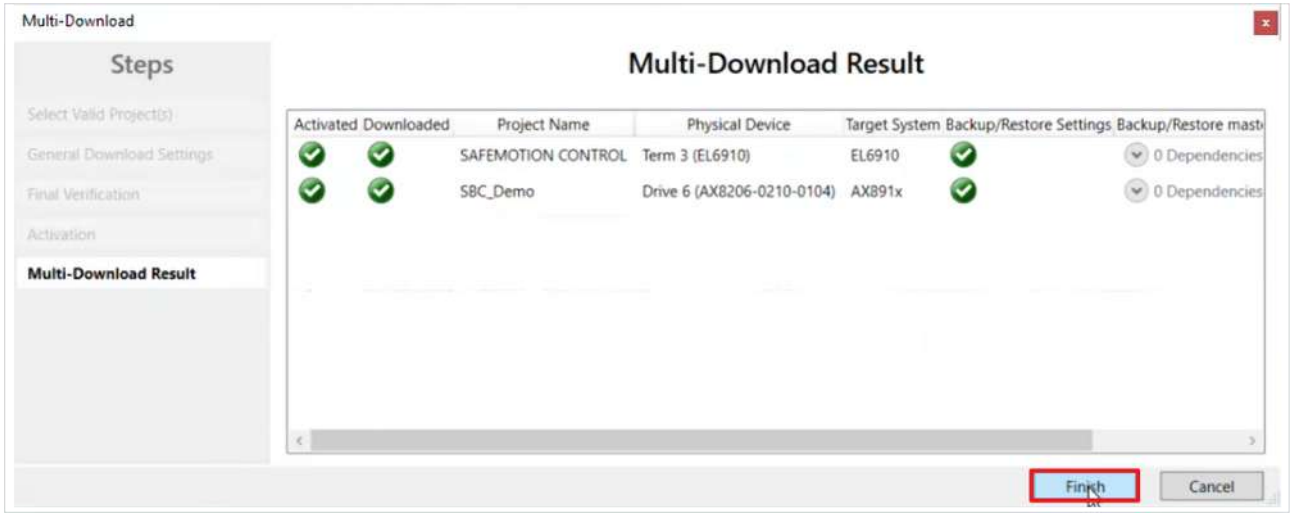



7. Check the CRCs in the “Final Verification” window
8. If the CRCs match, click on the box to confirm the verification
9. Confirm window with “Next”




The “Activation” window opens, in which you activate the safety projects.

10. Enter the default password
11. Check if the safety projects are selected
12. Confirm selection with “Next”



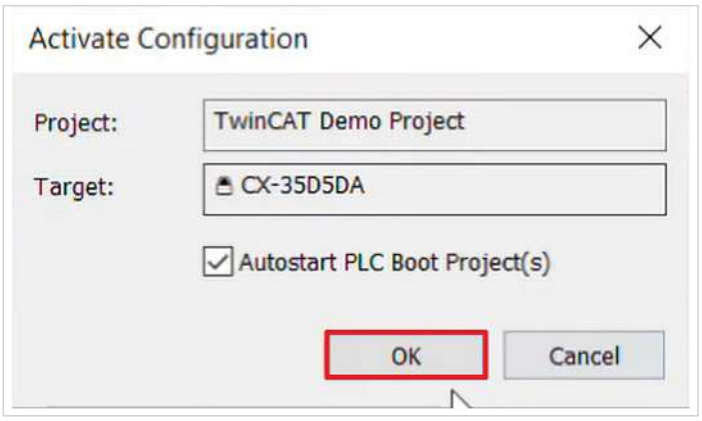

13. Close the window “Multi-Download Result” with “Finish”
14. Click “Save all” in the menu bar to save the settings

Your safety projects are now downloaded and active.

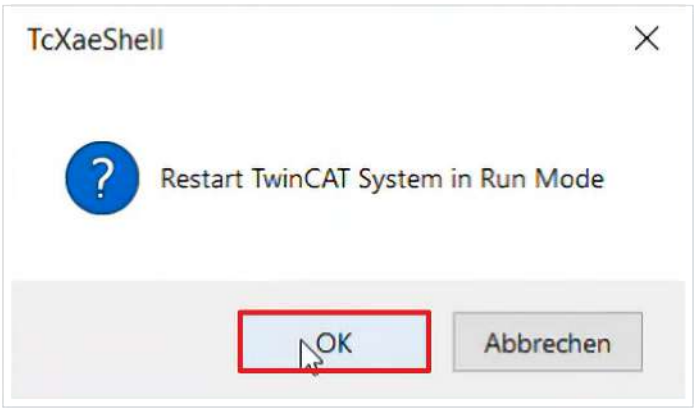
## 2.8 Activate configuration

Since the process images of the Safe Motion component and the EL6910 have been changed, it is necessary to reactivate the configuration. To do this, proceed as follows:

1. Click on “Activate Configuration” in the menu bar



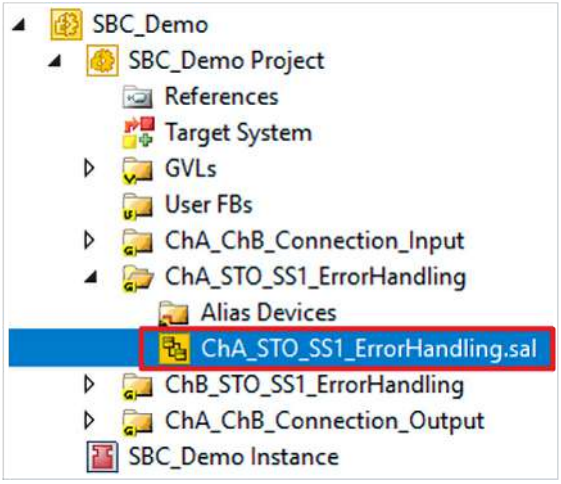

2. Confirm the “Activate Configuration” window with “OK”



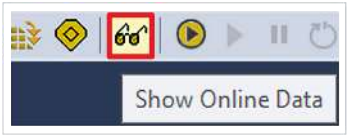

3. Confirm the “Restart TwinCAT System in Run Mode” window with “OK”

## 2.9 Check signals

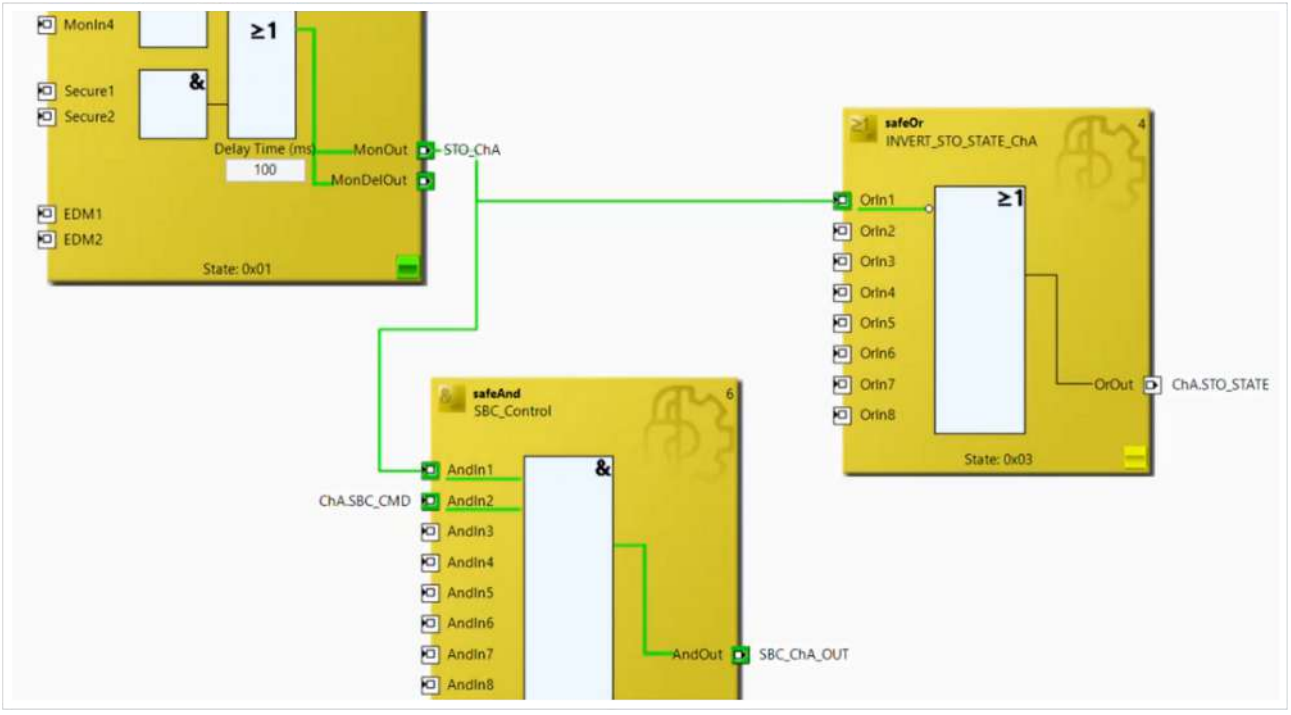
This chapter describes how to check whether the brake enable is forwarded from the EL6910 to the AX8000.




1. Open the file “ChA_STO_SS1_ErrorHandling.sal”



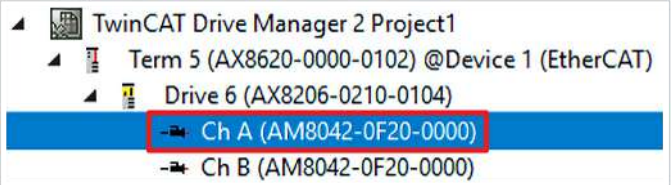

2. Click on “Show Online Data” in the menu bar to activate the online view



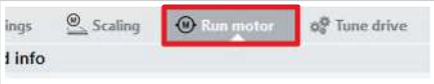

You will see that all signals arrive correctly.

## 2.10 Let motor traverse

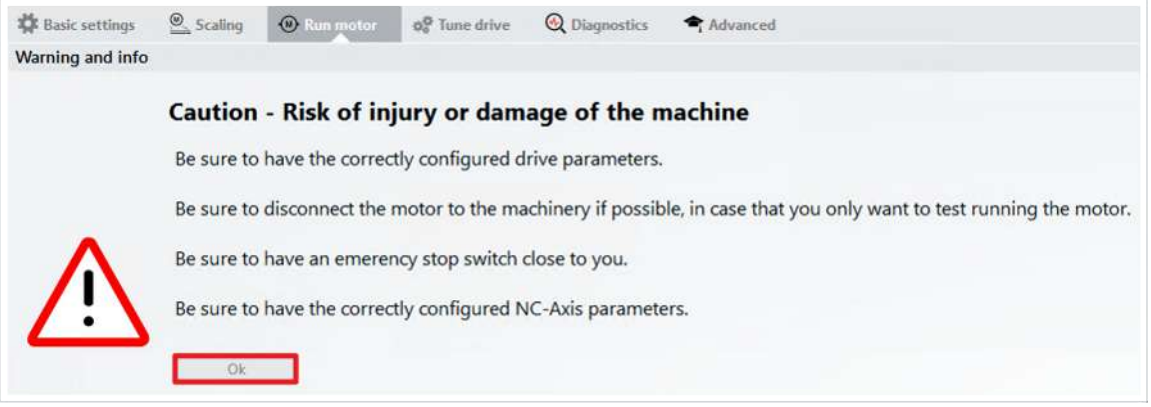
Since the brake enable is successfully transferred, you now have the option to move the motor. Proceed as follows:




1. Open the ChA channel in the Drive Manager

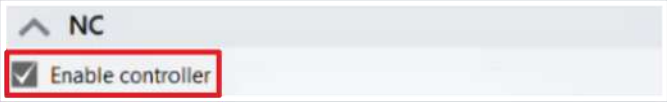



2. Open the tab “Run Motor”

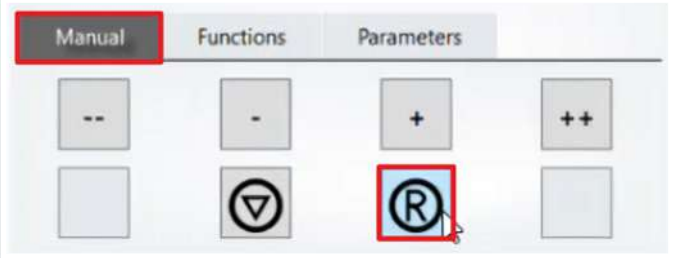



A warning message appears. Since this application is a demo system, there is no danger here.

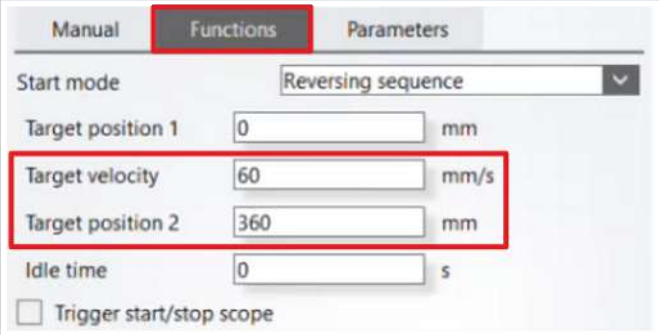
3. Close the warning with “OK”




4. Click the box “Enable controller” in the field “NC”




5. Click on the "R" symbol in the "Manual" tab to reset the error




6. Open the "Functions" tab

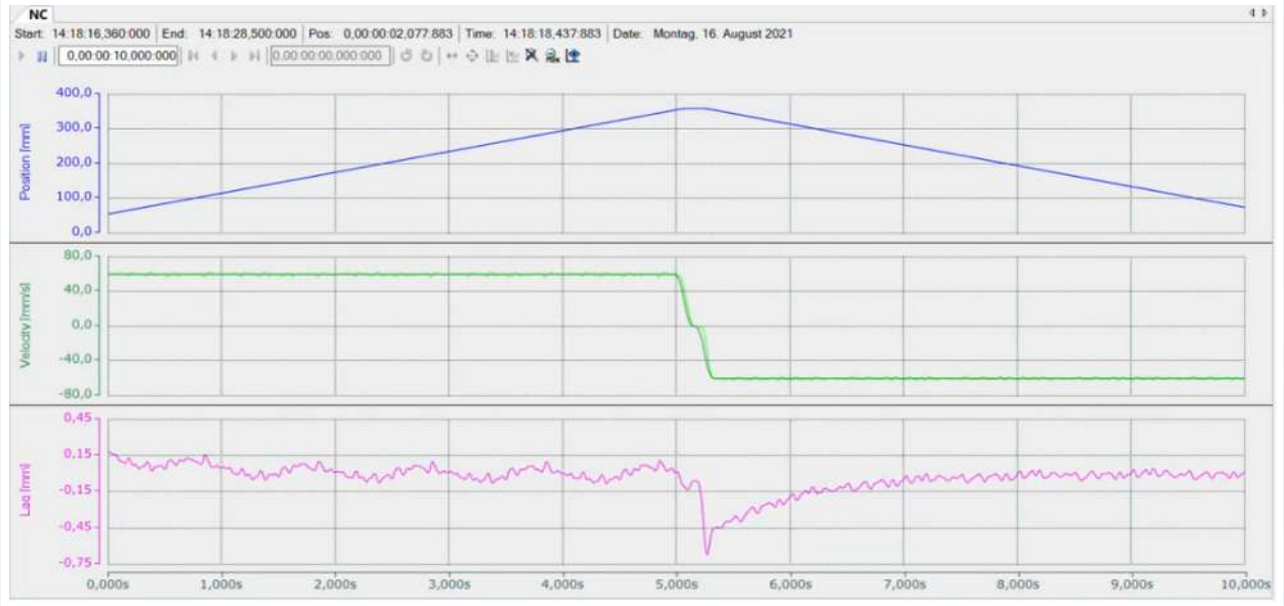
In the "Functions" tab, now configure the movement.

7. Enter the following values:

| Setting | Value |
|---|---|
| Target velocity | 60 mm/s |
| Target position 2 | 360 mm |

8. Click on "Start"

9. Click on the "Start record" field to start the Drive Manager Scope




You will now see how the motor traverses.

To stop the motor again, proceed as follows:

10. Click on "Stop" in the "Functions" tab

Now you can continue with the further commissioning.

# 3 Alternative solution

### Tutorial solution

STO + SBC CMD → SBC

STO and SBC CMD control SBC on the AX8000.

### Alternative solution

SBC CMD → STO + SBC

When SBC CMD comes, STO first makes sure that no more torque is built up and then SBC follows at the brake.

Which solution you choose depends on your application. Note that with SBC you can no longer build up torque. A combination of SBC and STO always makes sense.

More Information:
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