BECKHOFF New Automation Technology

TwinSAFE Tutorial 10 | EN

SafeMotion Wizard

SLP with automatic referencing

9/8/2021 | Version: 1.0.0

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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 10 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 adding automatic referencing to an existing SafeMotion Wizard project with SLP functionality.

1.1 Issue statuses

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 ≥ 3.1.4024.11
- TwinCAT Safety Editor TE9000 ≥ 1.2.1.1
- TwinSAFE firmware ≥ 03
- AX8000 firmware ≥ 0104; with default module ID active

1.3 Starting point

At the starting point of the tutorial

- a TwinCAT 3 project with standard PLC exists,
- an EL6910 project exists,
- an AX8000 project with SLP functionality 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

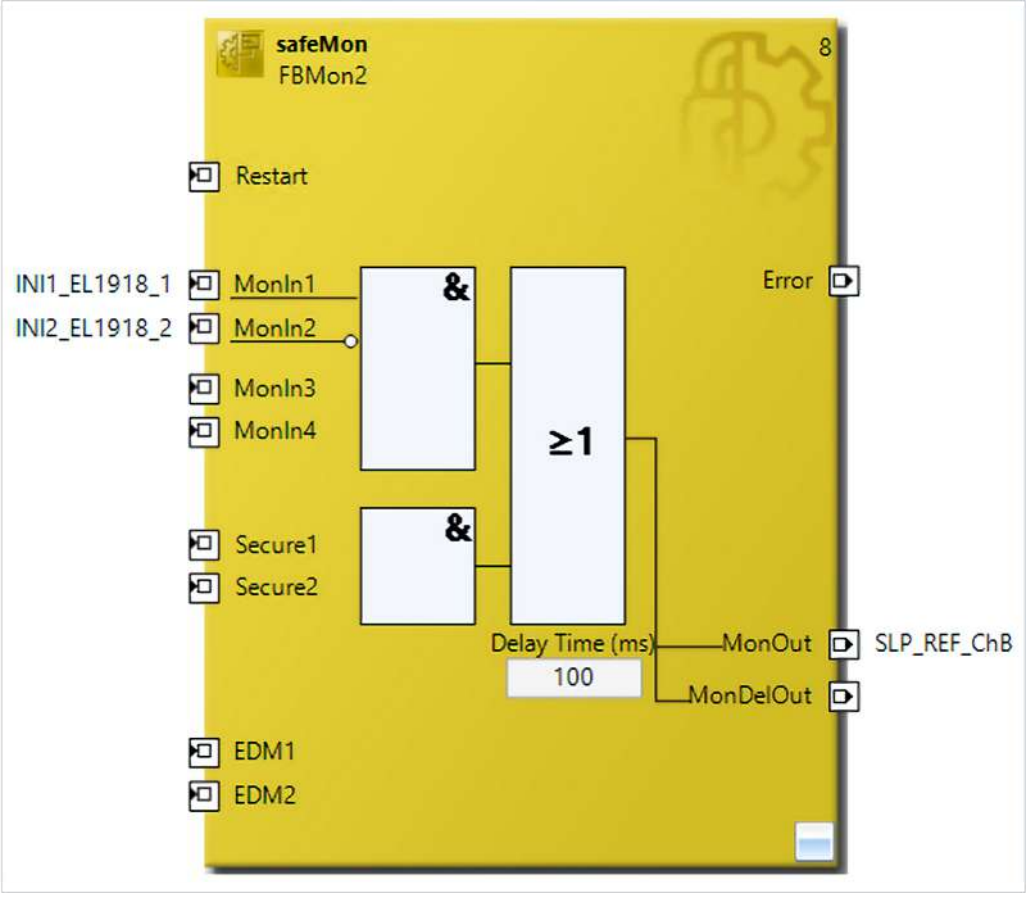
1.4.2 Desired safety functionality

This tutorial describes the realization of the following safety functionality:

- Configuration of SLP (Safe Limited Position) with automatic referencing.

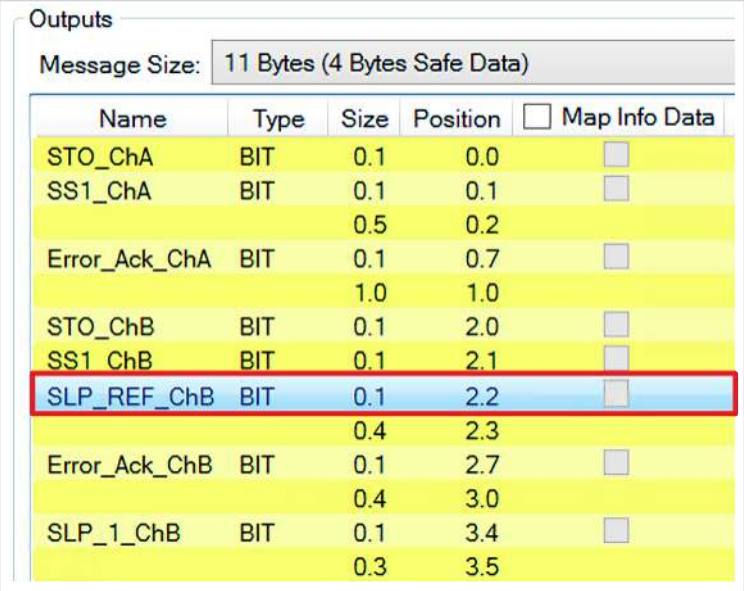
1.5 Approach

1.5.1 Recording the ini signals



- Use of safe inputs of the EL1918 on the EL6910 for recording the ini signals
- Accumulation of the ini signals to the reference signal
- Transmission of the reference signal to the AX8000

1.5.2 Transmission to the AX8000



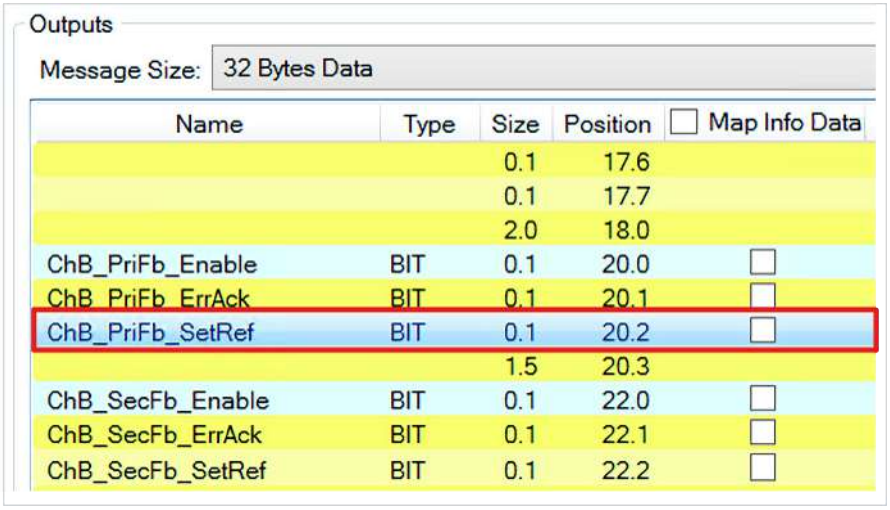
Outputs

Message Size: 11 Bytes (4 Bytes Safe Data)

Name	Type	Size	Position	Map Info Data
STO_ChA	BIT	0.1	0.0	
SS1_ChA	BIT	0.1	0.1	
		0.5	0.2	
Error_Ack_ChA	BIT	0.1	0.7	
		1.0	1.0	
STO_ChB	BIT	0.1	2.0	
SS1_ChB	BIT	0.1	2.1	
SLP_REF_ChB	BIT	0.1	2.2	
		0.4	2.3	
Error_Ack_ChB	BIT	0.1	2.7	
		0.4	3.0	
SLP_1_ChB	BIT	0.1	3.4	
		0.3	3.5	

- Expansion of the process image on the output side of the EL6910 by inserting an additional bit
- Corresponding change on the AX8000

1.5.3 Setting the reference point



Outputs

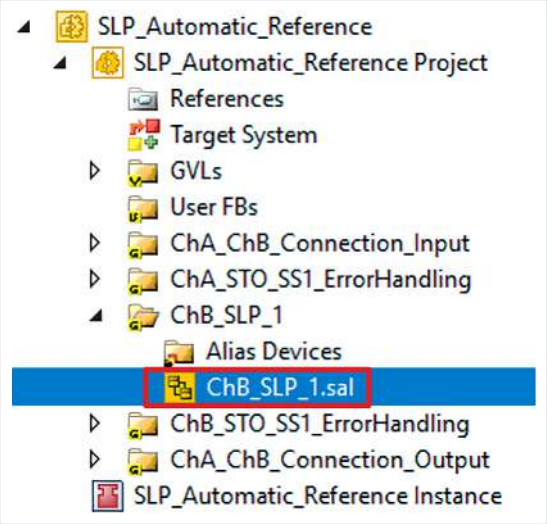
Message Size: 32 Bytes Data

Name	Type	Size	Position	Map Info Data
		0.1	17.6	
		0.1	17.7	
		2.0	18.0	
ChB_PriFb_Enable	BIT	0.1	20.0	
ChB_PriFb_ErrAck	BIT	0.1	20.1	
ChB_PriFb_SetRef	BIT	0.1	20.2	
		1.5	20.3	
ChB_SecFb_Enable	BIT	0.1	22.0	
ChB_SecFb_ErrAck	BIT	0.1	22.1	
ChB_SecFb_SetRef	BIT	0.1	22.2	

- Extension of the process image on the input side of the AX8000 by inserting an additional bit
- Link to the ChB_PriFb_SetRef signal of the internal process image

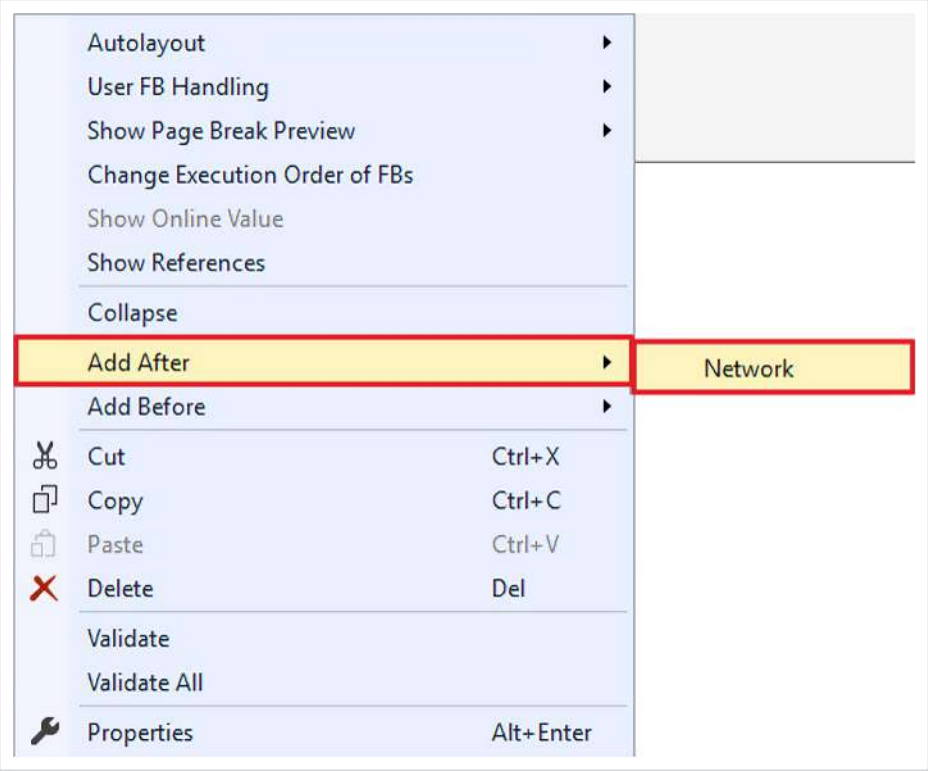
2 Demonstration

2.1 Link reference signal

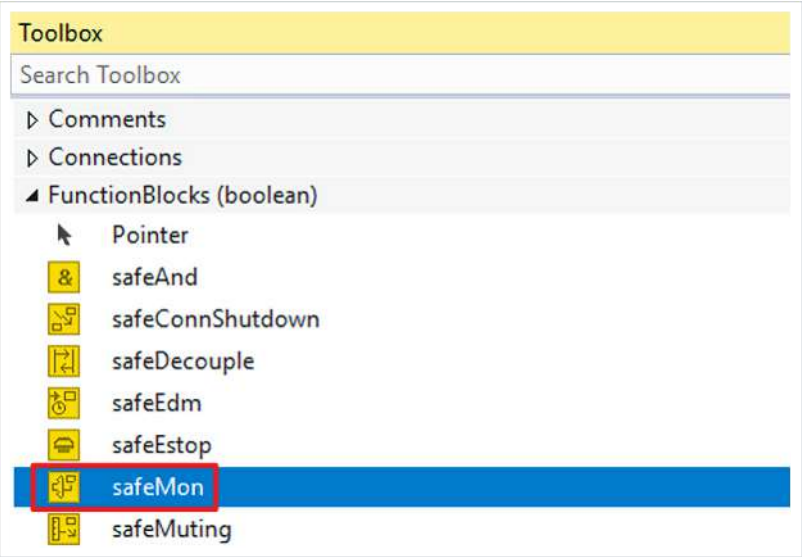


1. Open file “ChB_SLP_1.sal”

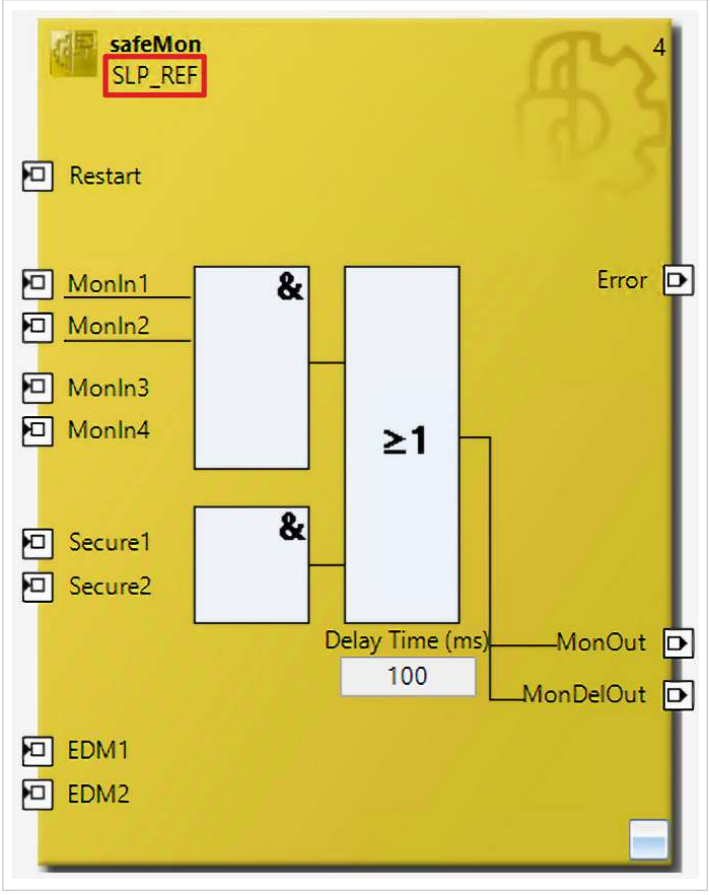
You will see the already configured SLP functionality.



2. Right click in the network
3. Click on “Network” via the “Add After” field to add another network

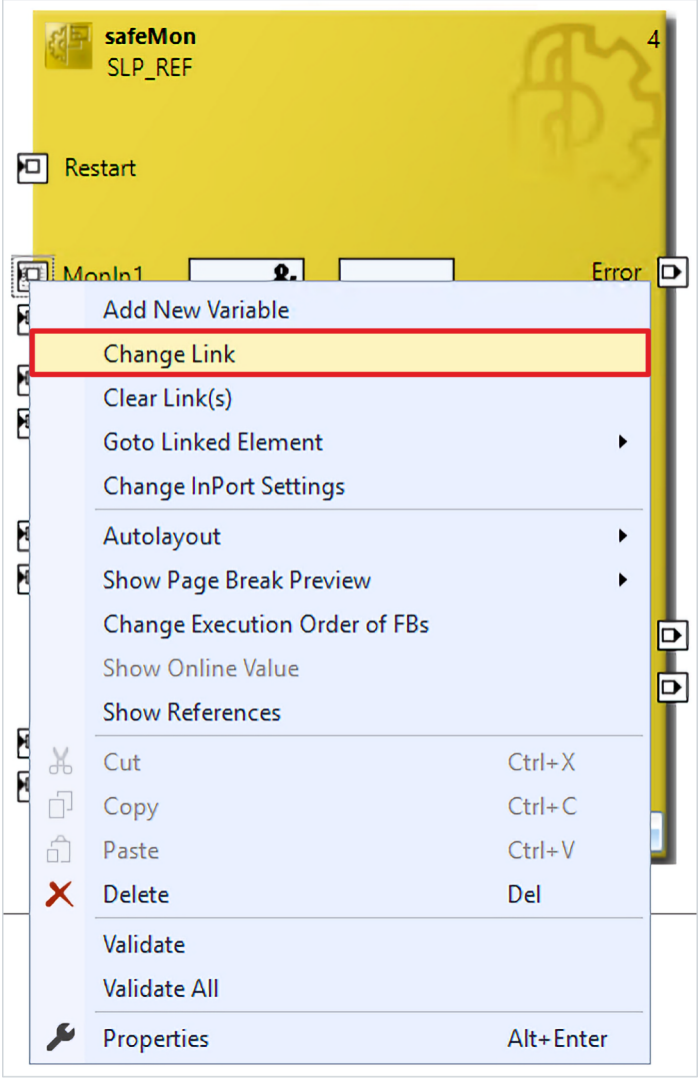


4. Open toolbox
5. Add a safeMon module to the new network

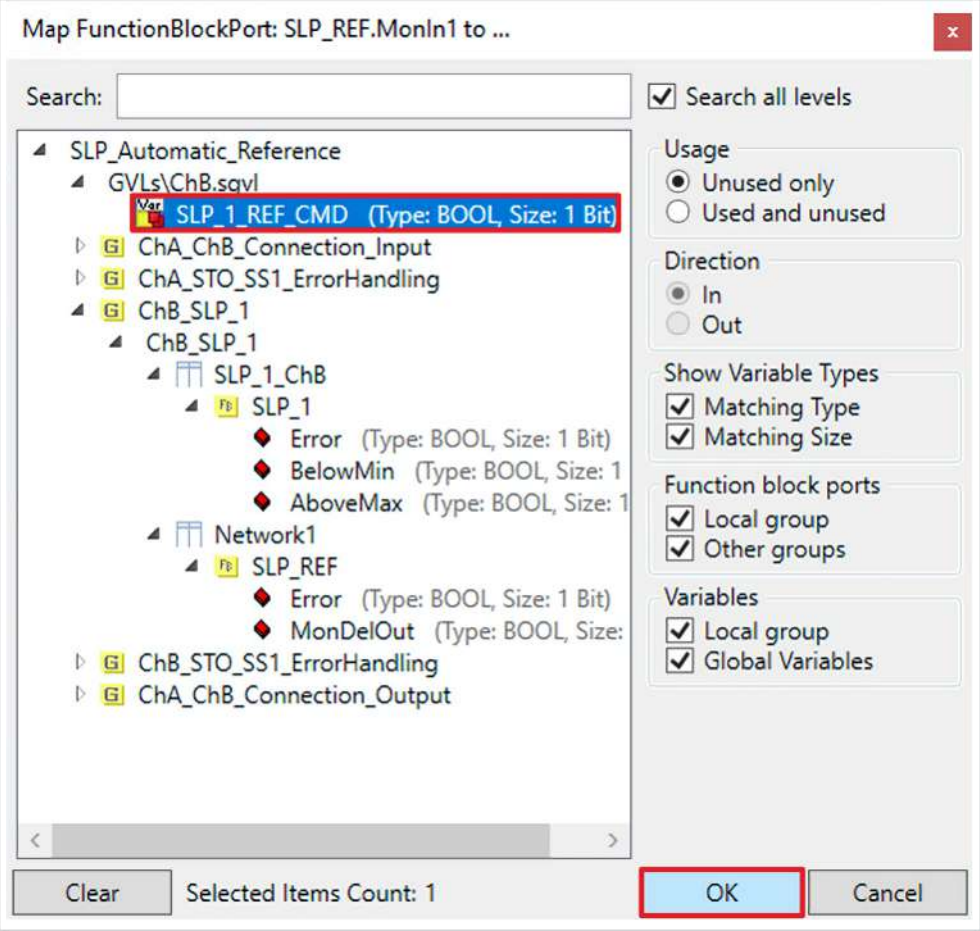


6. Rename FB

The next step is to link the block. The procedure is identical for all inputs and outputs and is illustrated here using the screenshots for one input as an example.



7. Right click on an input
8. Click on “Change Link”



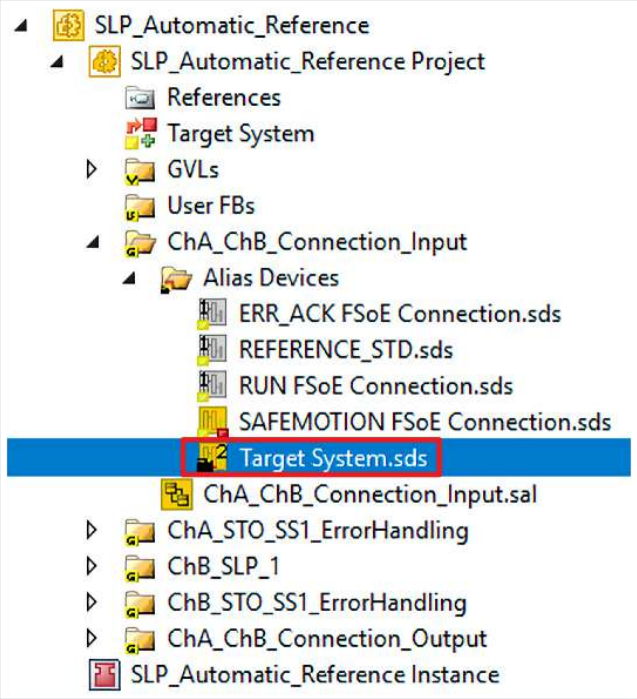
9. Select variable
10. Confirm selection with “OK”

This results in the following links for the inputs and outputs of the safeMon module:

Input/Output	Variable
MonIn1	SLP_1_REF_CMD
MonIn2	ACK_REFERENCE_STD
MonOut	SIGNAL_TO_SDF

11. Click on “Save all” in the menu bar to save the settings

2.2 Configure reference behavior



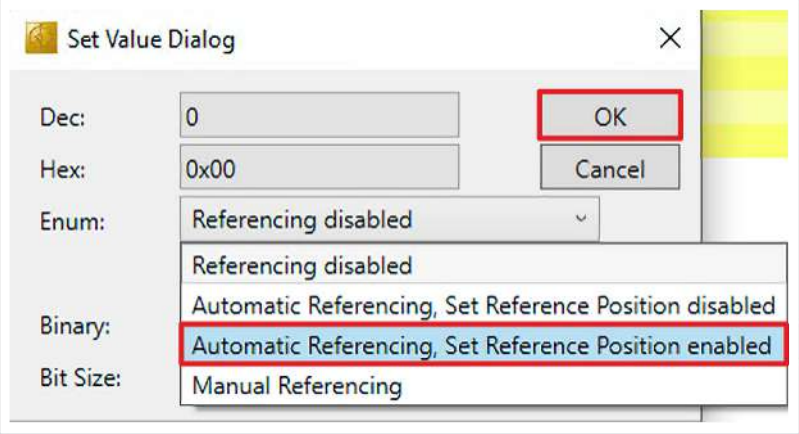
1. Open the “Target Systems.sds” file
2. Open the “Internal Safety Parameters” tab

Under C3C2:0 you will find the reference settings for ChB.

In the following you must make the parameter settings.

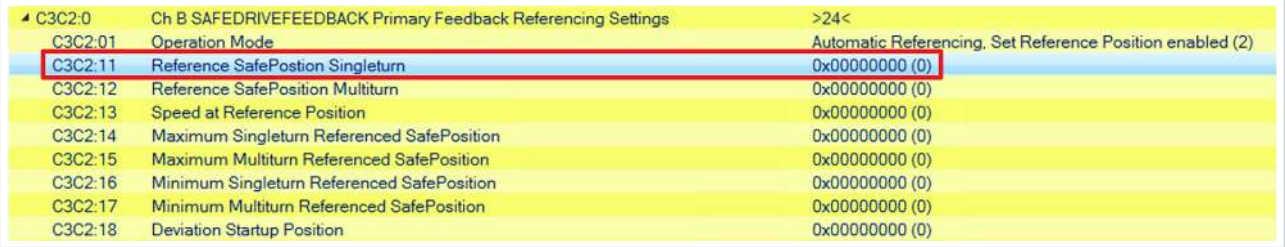
C3C2:0	Ch B SAFEDRIVEFEEDBACK Primary Feedback Referencing Settings	>24<
C3C2:01	Operation Mode	Referencing disabled (0)
C3C2:11	Reference SafePostion Singleturn	0x00000000 (0)
C3C2:12	Reference SafePosition Multiturn	0x00000000 (0)
C3C2:13	Speed at Reference Position	0x00000000 (0)
C3C2:14	Maximum Singleturn Referenced SafePosition	0x00000000 (0)
C3C2:15	Maximum Multiturn Referenced SafePosition	0x00000000 (0)
C3C2:16	Minimum Singleturn Referenced SafePosition	0x00000000 (0)
C3C2:17	Minimum Multiturn Referenced SafePosition	0x00000000 (0)
C3C2:18	Deviation Startup Position	0x00000000 (0)

3. Double click on “C3C2:01 Operation Mode”

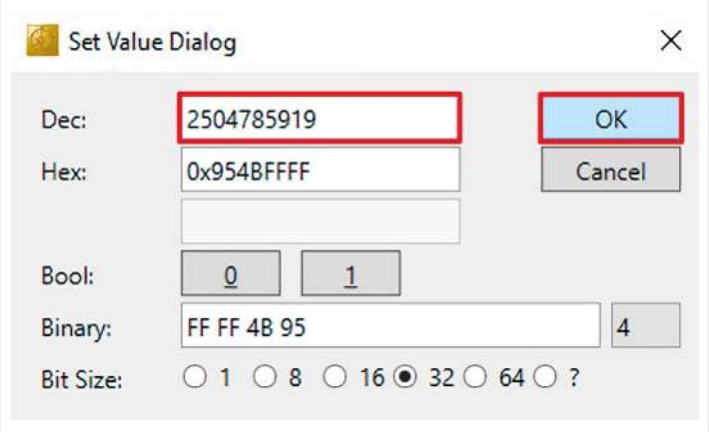


4. Select “Automatic Referencing, Set Reference Position enabled” in the “Enum” drop-down menu
5. Confirm selection with “OK”

For the other parameters, the procedure is identical and is shown here using the screenshots for one parameter as an example.



6. Double click on the desired parameter



7. Enter the corresponding value in the “Dec” field
8. Confirm window with “OK”

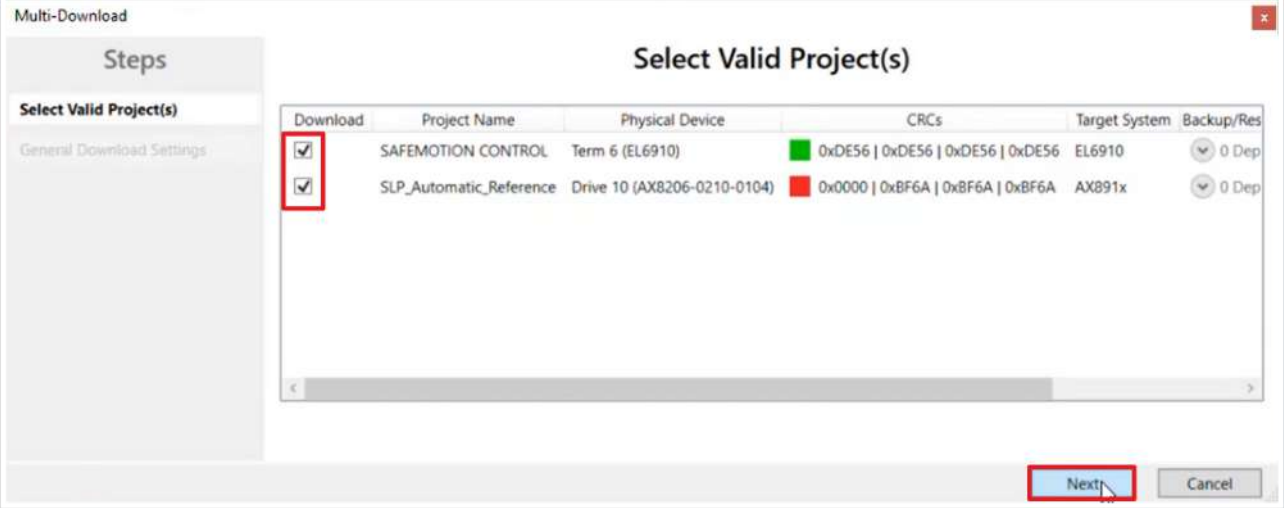
Enter the following values for the parameters:

Parameter		Value
C3C2:11	Reference safePosition Singleturn	2504785919
C3C2:12	Reference safePosition Multiturn	-11
C3C2:13	Speed at Reference Position	2000
C3C2:15	Maximum Multiturn Referenced SafePosition	20
C3C2:17	Minimum Multiturn Referenced SafePosition	-20

9. Click on “Save all” in the menu bar to save the settings

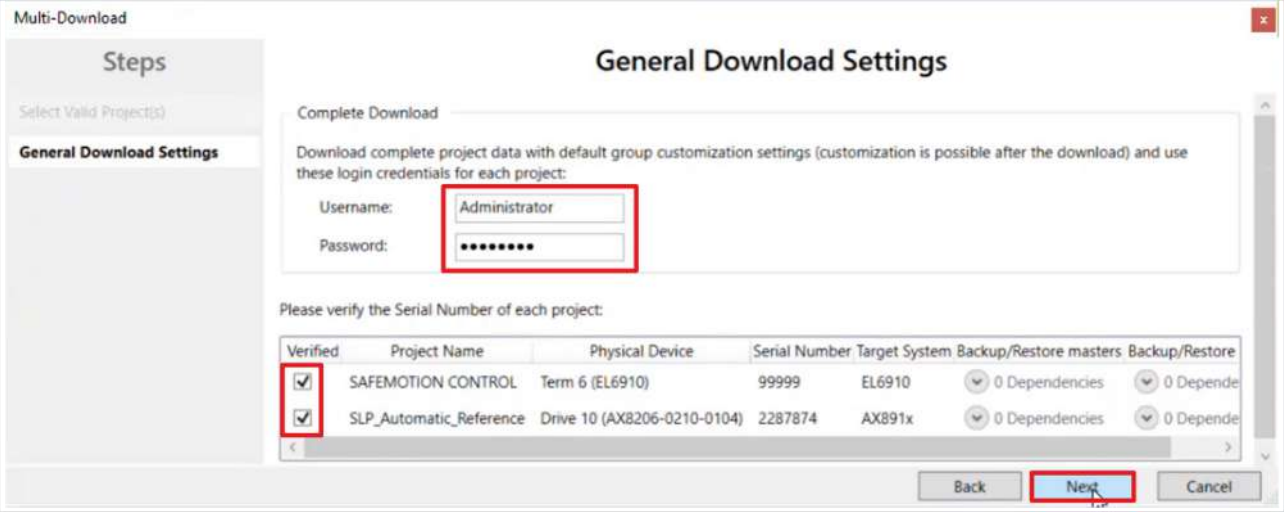
2.3 Download safety projects

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”

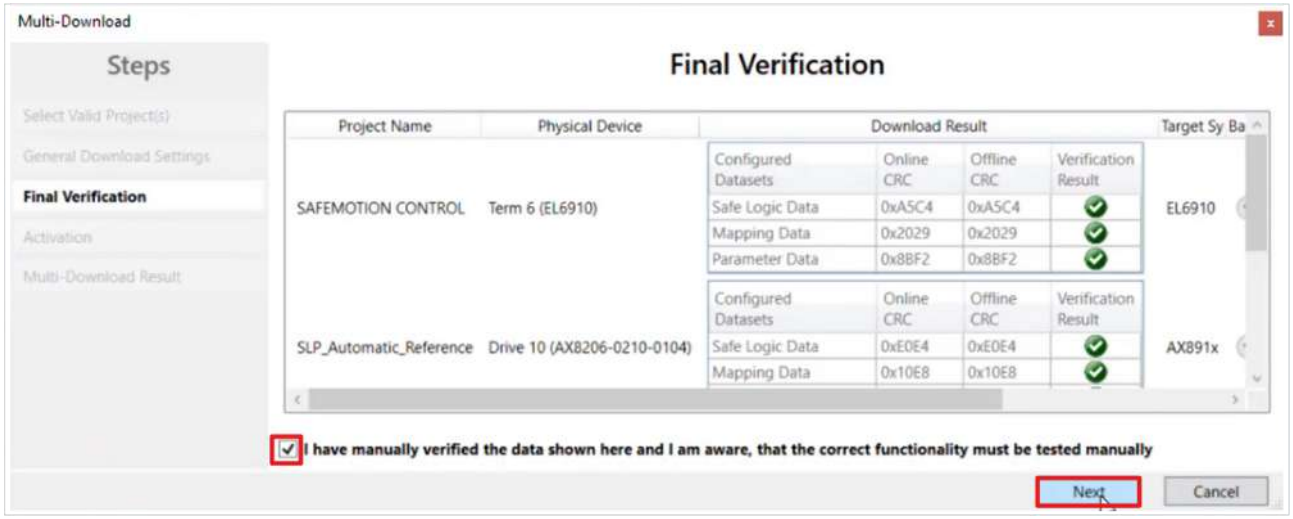


4. Enter the username and password in the “General Download Settings” window

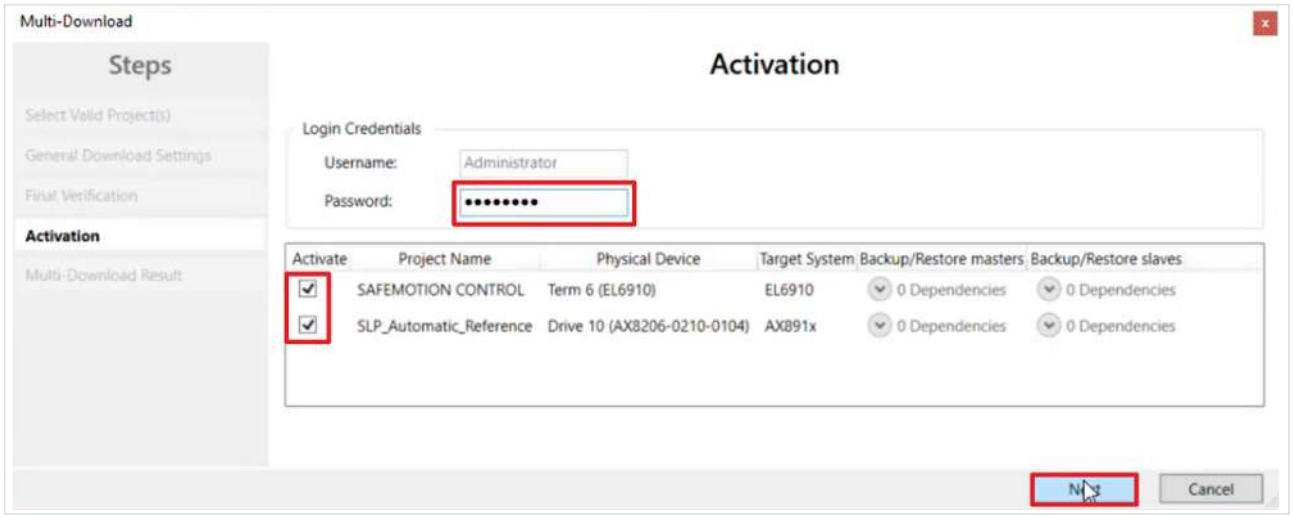
Default username: Administrator

Default password: TwinSAFE

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

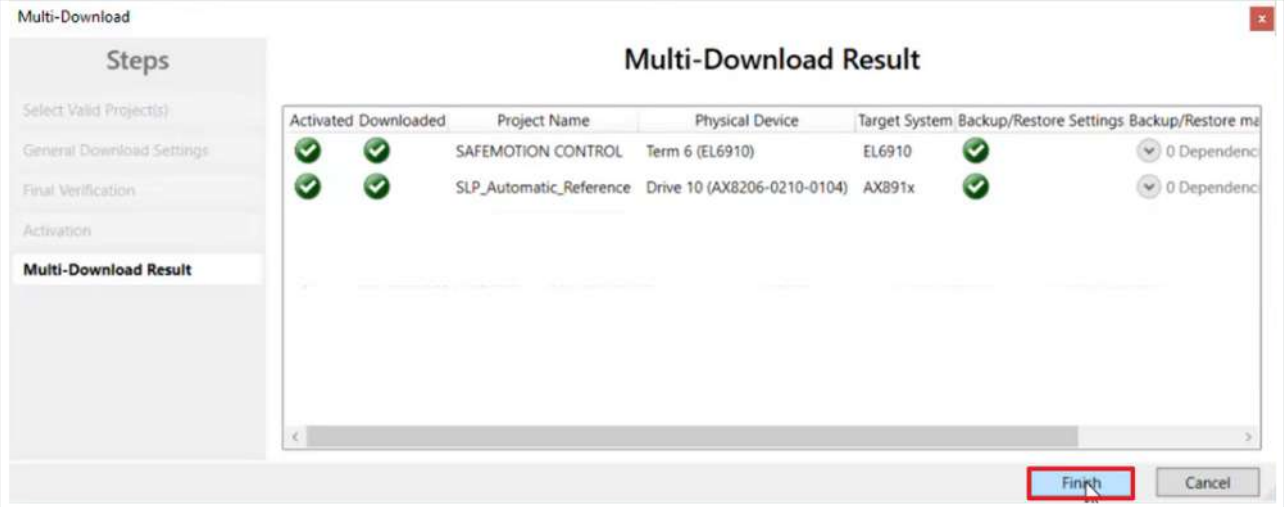


7. Check the CRCs in the “Final Verification” window
8. If the CRCs match, click on the box to confirm the verification
9. Confirm window with “Next”



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”

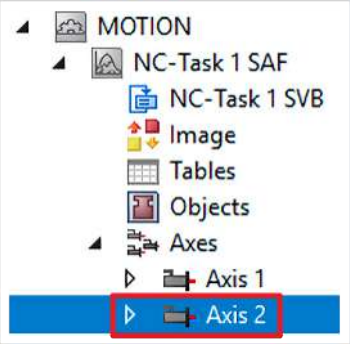


13. Close the window “Multi-Download Result” with “Finish”
14. Click “Save all” in the menu bar to save the settings

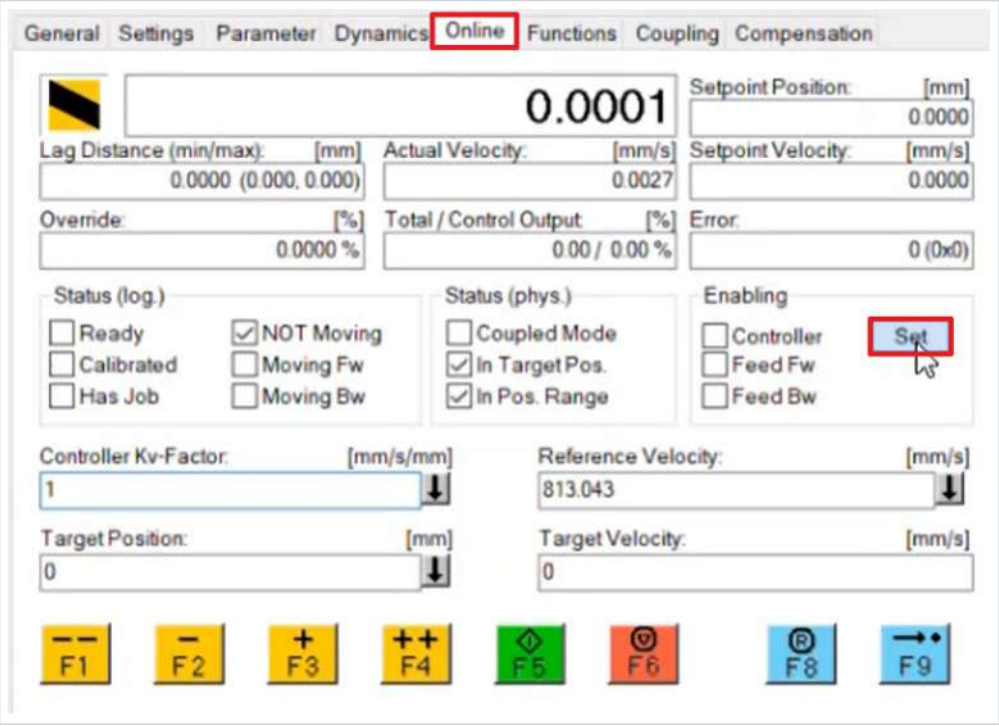
Your safety projects are now downloaded and active.

2.4 Check referencing

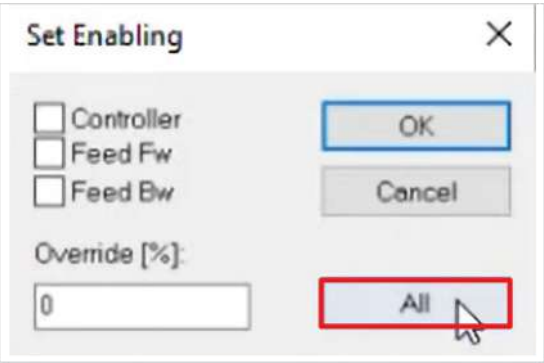
Activate the axis as follows:



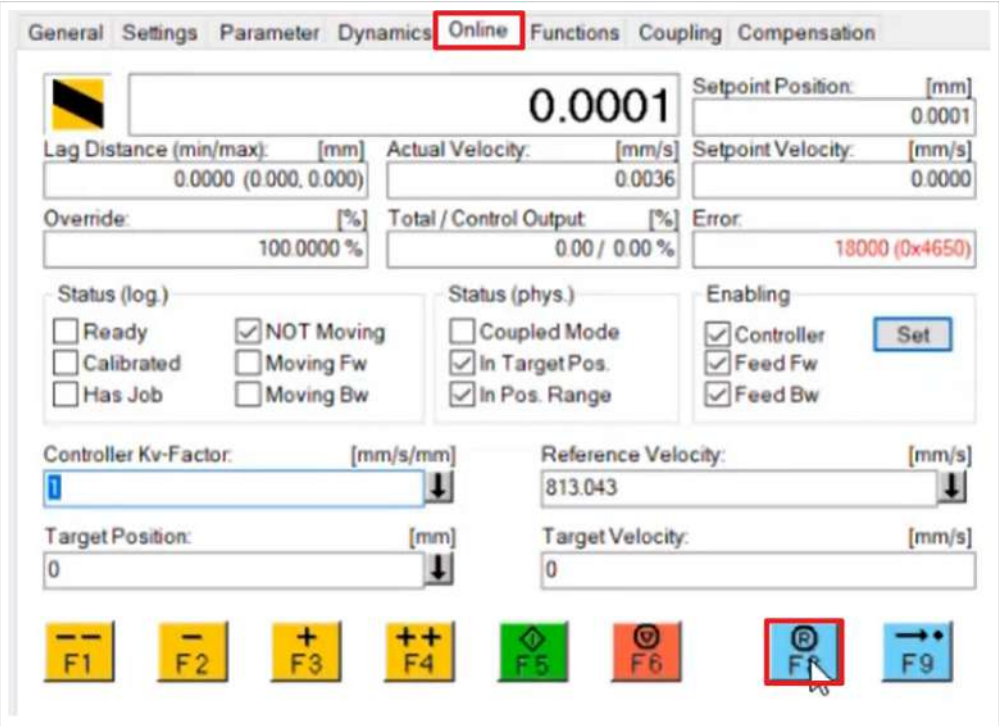
1. Open “Axis 2”



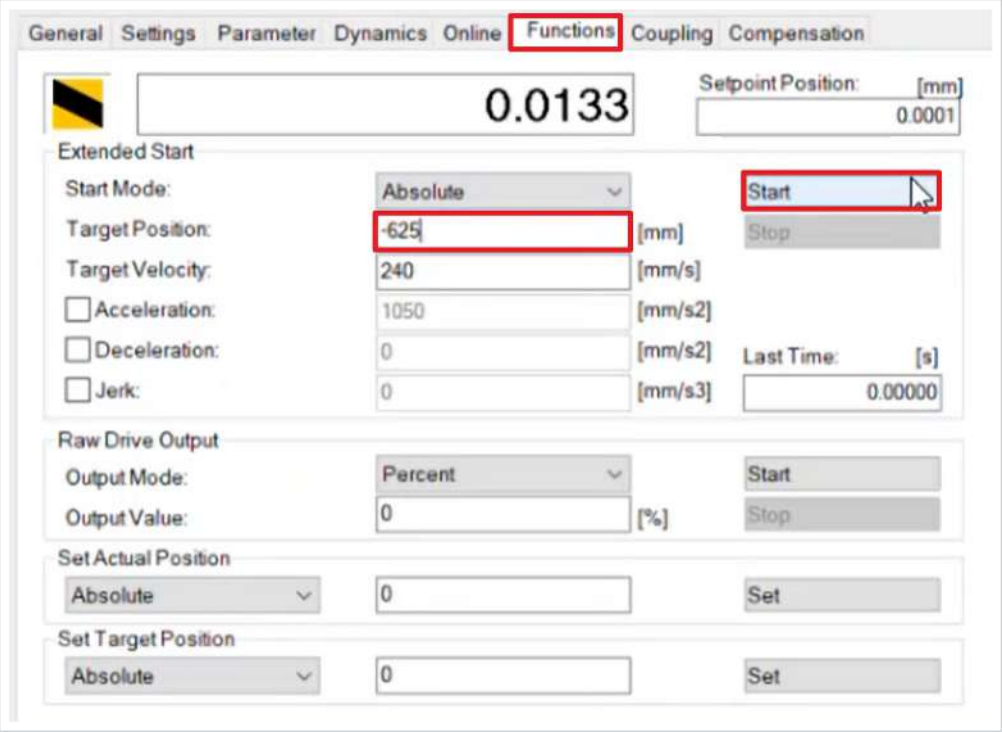
2. Open tab “Online”
3. Click on “Set”



4. Close window with “All”

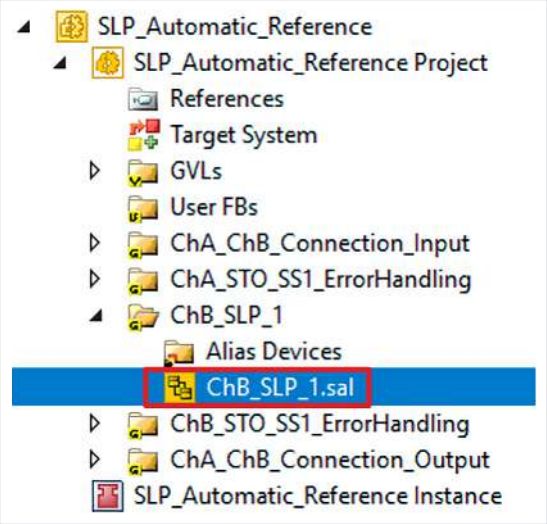


5. Click “F8” to reset the error

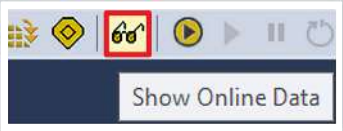


6. Open the tab ”Functions”
7. Enter the position at “TargetPosition” as shown
8. Click on “Start”

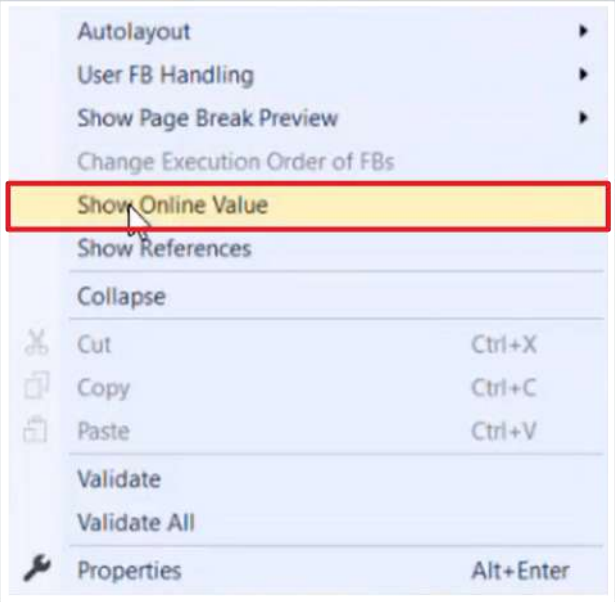
Now check the referencing:



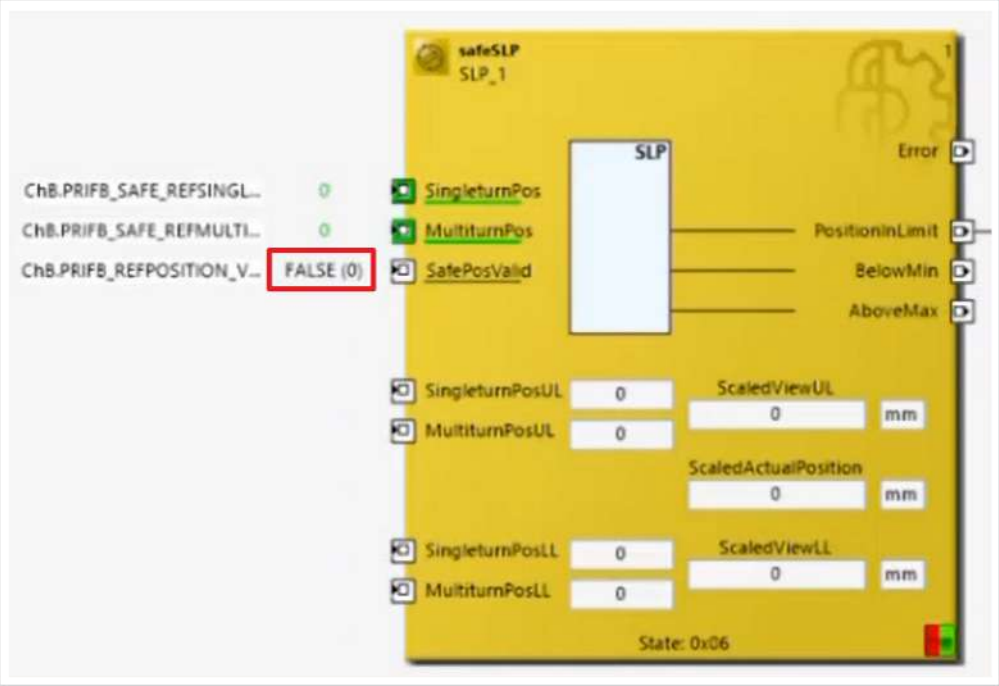
9. Open file “ChB_SLP_1.sal”



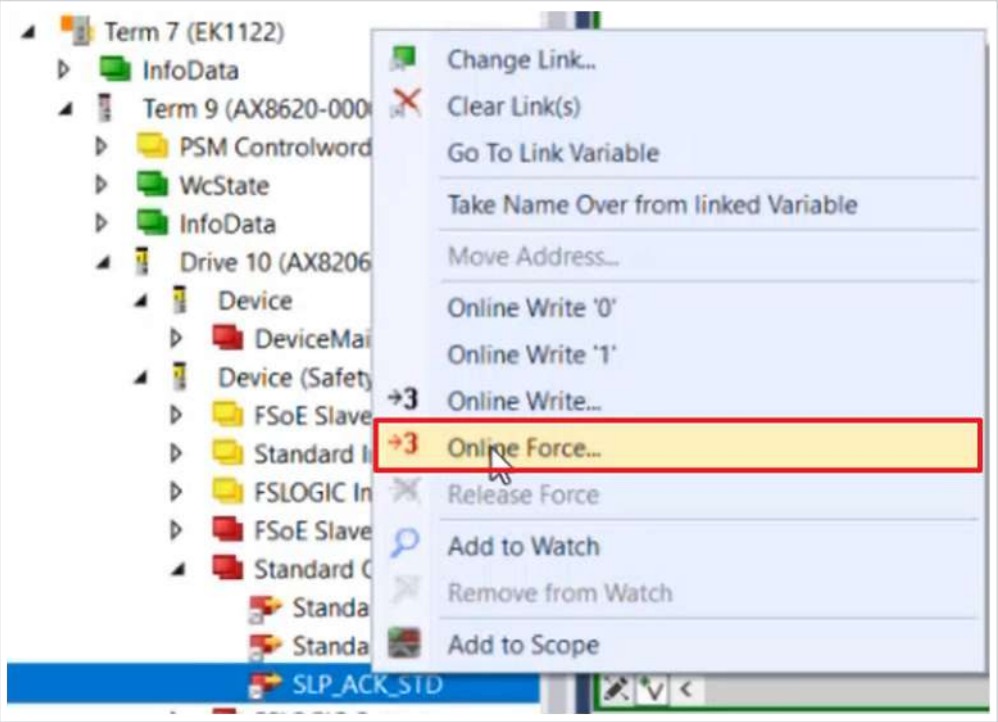
10. Click on “Show Online Data” in the menu bar to activate the Online View



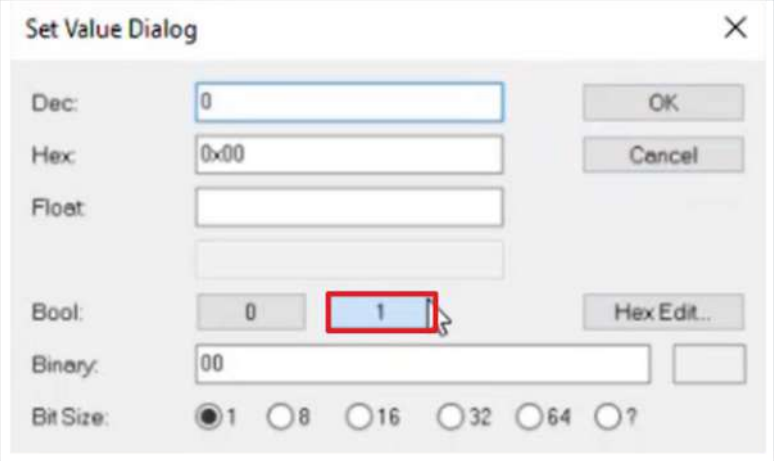
11. Right click on the network
12. Click “Show Online Value”



You see that the command from the EL6910 arrives correctly. Furthermore, you see at the safeSLP block that the command ChB.PriFb_REFPOSITION_VALID is still on FALSE.



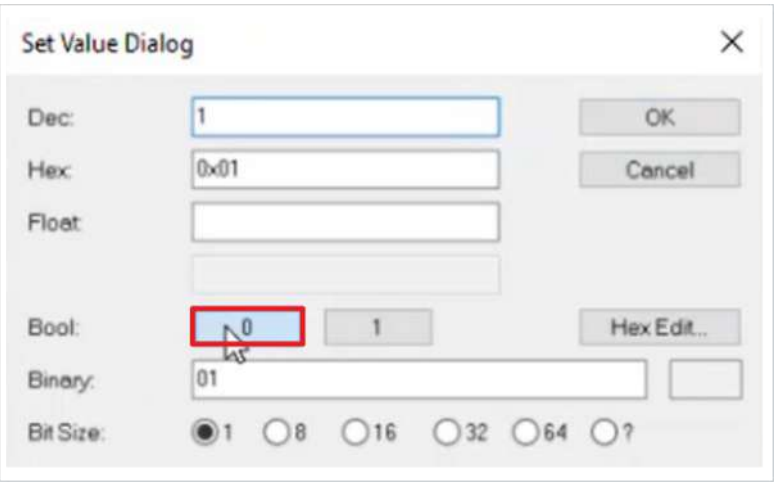
13. In the process image right click on “SLP_ACK_STD”
14. Click on “Online Force”



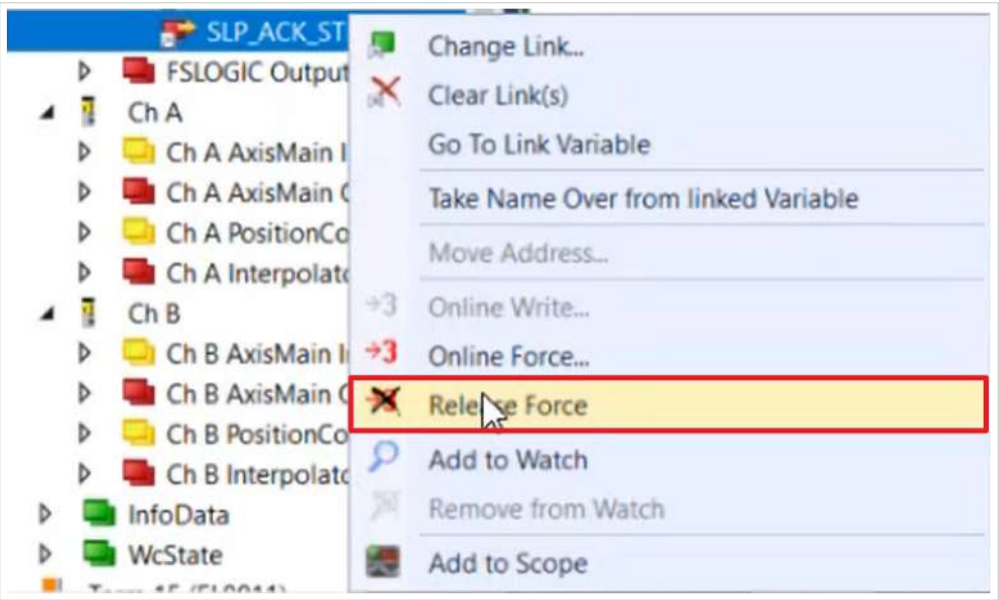
15. In the window “Set Value Dialog” click at bool “1”

You see in the newly added safeMon module that the acknowledgment is available and the signal is transferred to the process image.

16. Right click on “SLP_ACK_STD”
17. Click on “Online Force”



18. Click in the window “Set Value Dialog” at bool “0”

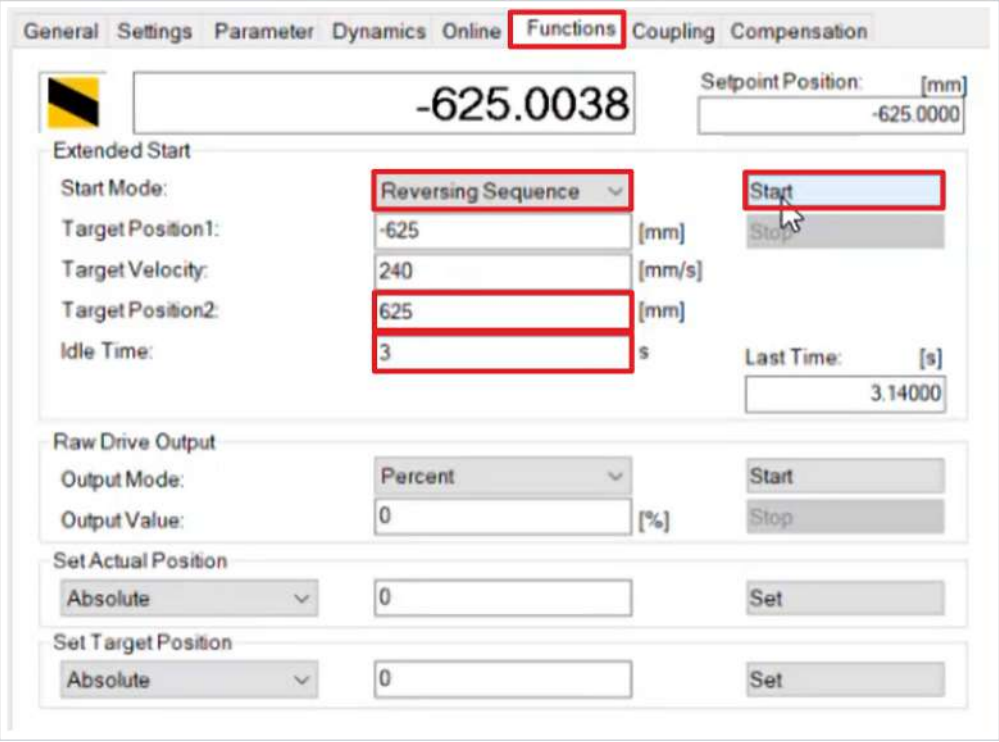


19. Right click on “SLP_ACK_STD”
20. Click on “Release Force”

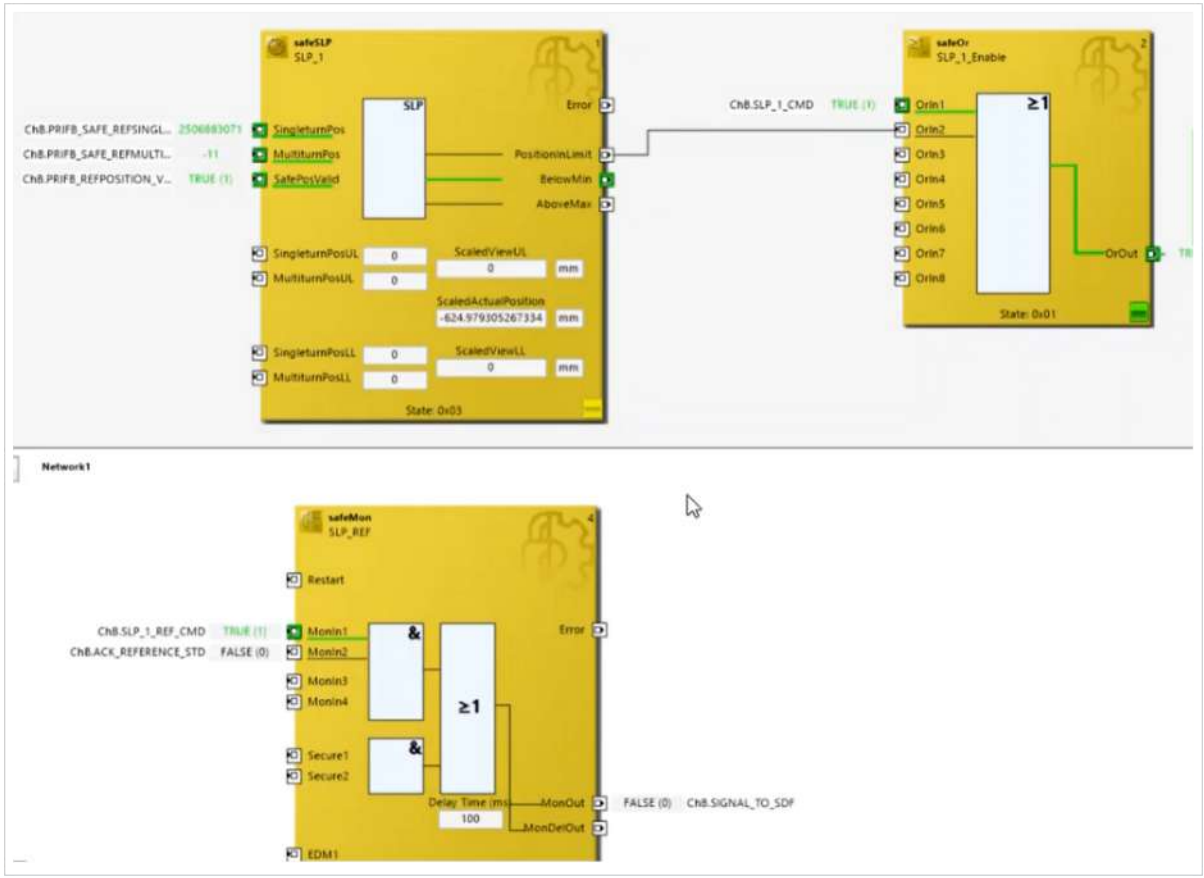
In the safeSLP block you see that the command ChB.PriFb_REFPOSITION_VALID is now TRUE and you have successfully referenced.

Next, let the engine proceed as follows:

21. Open “Axis 2”



22. Open tab “Functions”
23. Select “Reversing Sequence” in the drop-down menu of Start Mode
24. Enter position and time according to the figure
25. Click on “Start”
26. Open file “ChB_SLP_1.sal”



Based on the values, you can now see how the motor traverses.

2.5 Additional information

If it is necessary to move the axis in switched-off state

→ automatic referencing

If the position information is invalid after startup

→ manual referencing → new download

→ automatic referencing → reference run

If it is necessary to move the axis while the safety project is running

→ no problem

More Information:
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