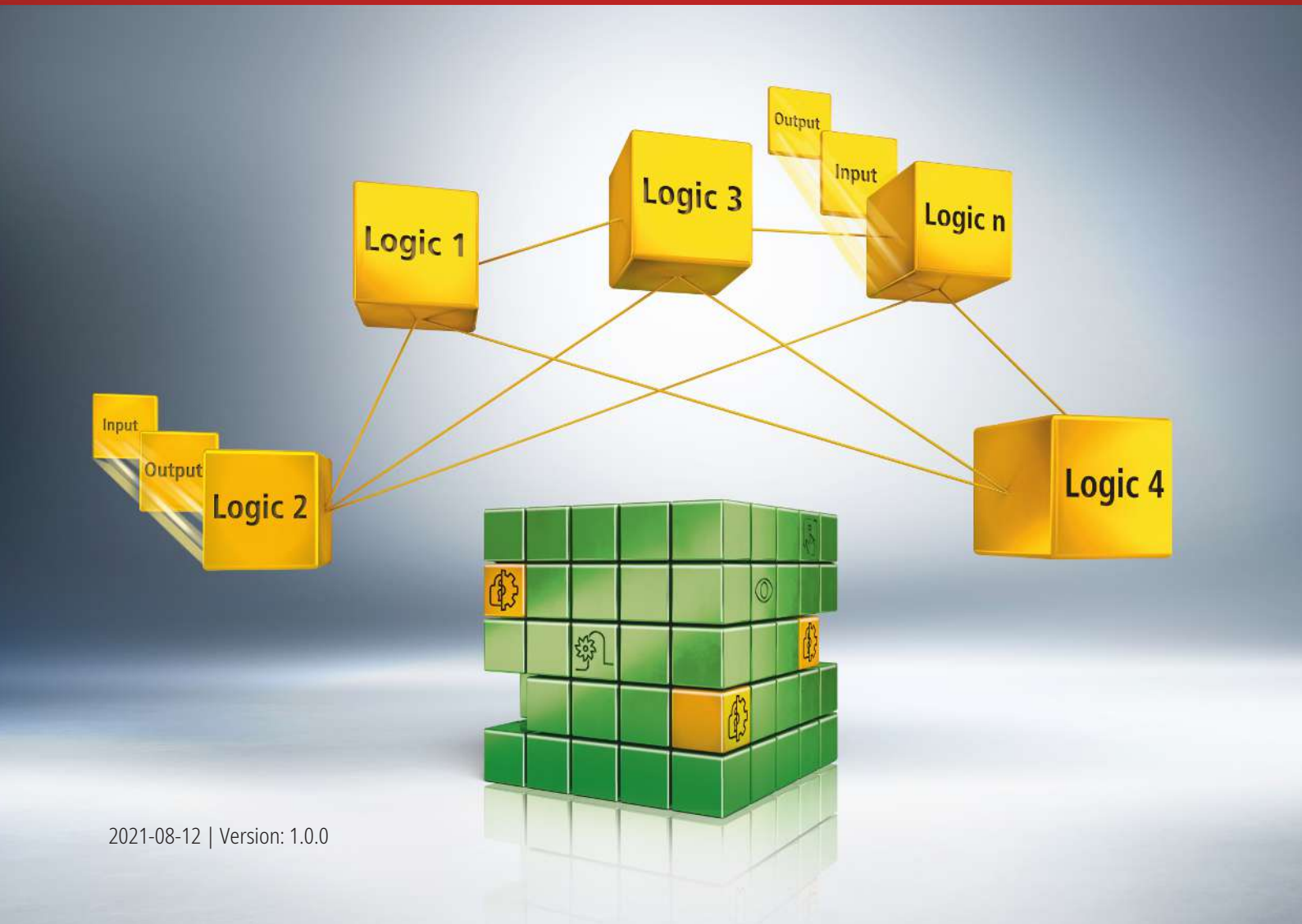
BECKHOFF New Automation Technology

TwinSAFE Tutorial 7 | EN

SafeMotion Wizard

Use of an EnDat 2.2 Safety encoder



2021-08-12 | Version: 1.0.0

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 7 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 generation and configuration of a SLS functionality for an AX8000 with an EnDat 2.2 Safey encoder.

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 standard PLC project 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 EnDat 2.2 Safety encoder

1.4.2 Desired safety functionality

This tutorial describes the realization of the following safety functionality:

- SLS functionality (Safe Limited Speed) with an EnDat 2.2 Safety encoder

1.5 Approach

1.5.1 Interpretation SafeMotion Wizard

The current version of SafeMotion Wizard is designed for OCT Safety (singleturn and multiturn). That means, the generated projects can process singleturn feedback or multiturn feedback OCT Safety and generate corresponding projects.

For other motors there is a separate category "Other motors". Here exists in the current SafeMotion Wizard version a restriction to STO and SS1.

1.5.2 Tutorial approach

Since the SLS functionality cannot be realized directly with the SafeMotion Wizard for other motors, intermediate steps are necessary.

Basically, the realization takes place as follows:

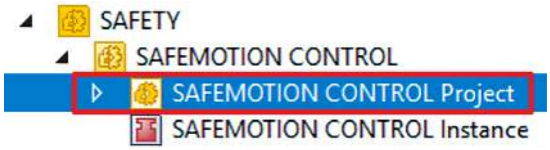
1. Generation of a project for OCT Safety
2. Modification to EnDat 2.2 Safety

2 Demonstration

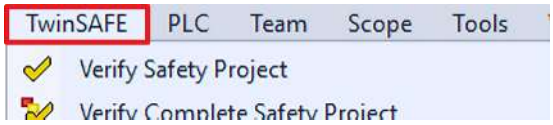
2.1 Create Safe Motion project

Starting point of the tutorial is an existing TwinCAT3 project with an existing I/O configuration and the two EnDat motors.

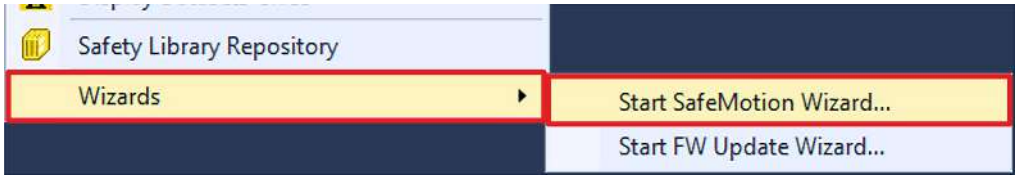
Proceed as follows to create a Safe Motion project with the SafeMotion Wizard:



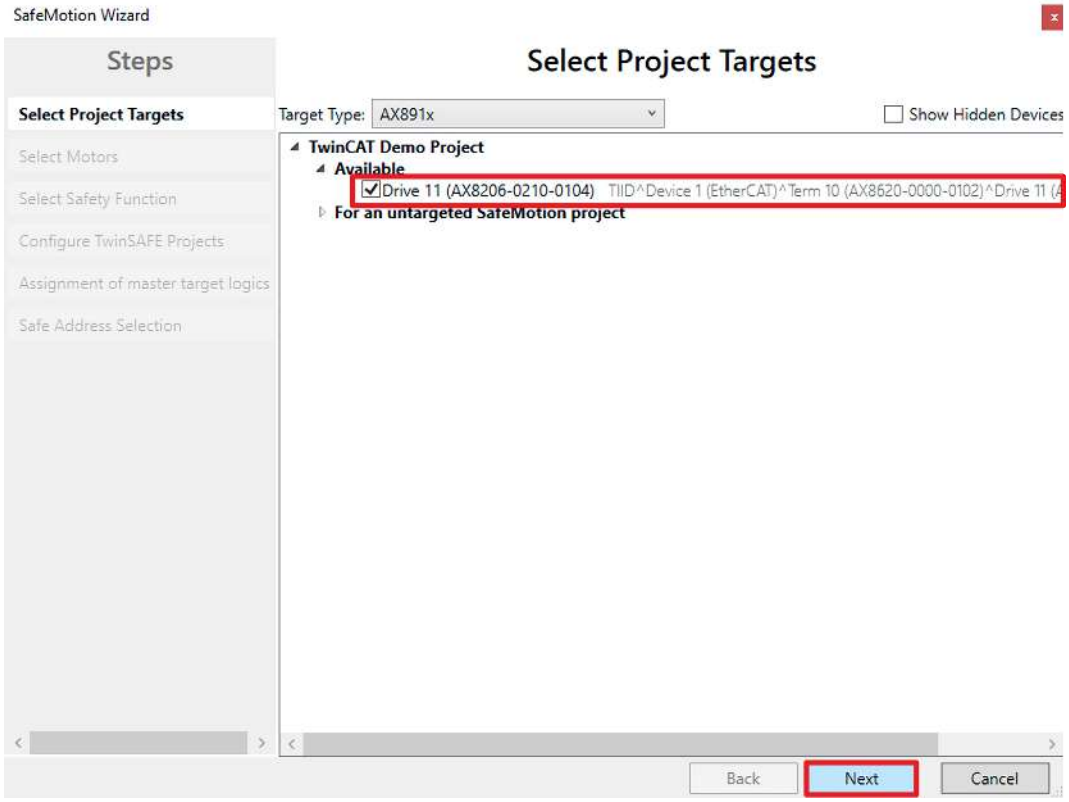
1. Select safety project



2. Select the "TwinSAFE" tab

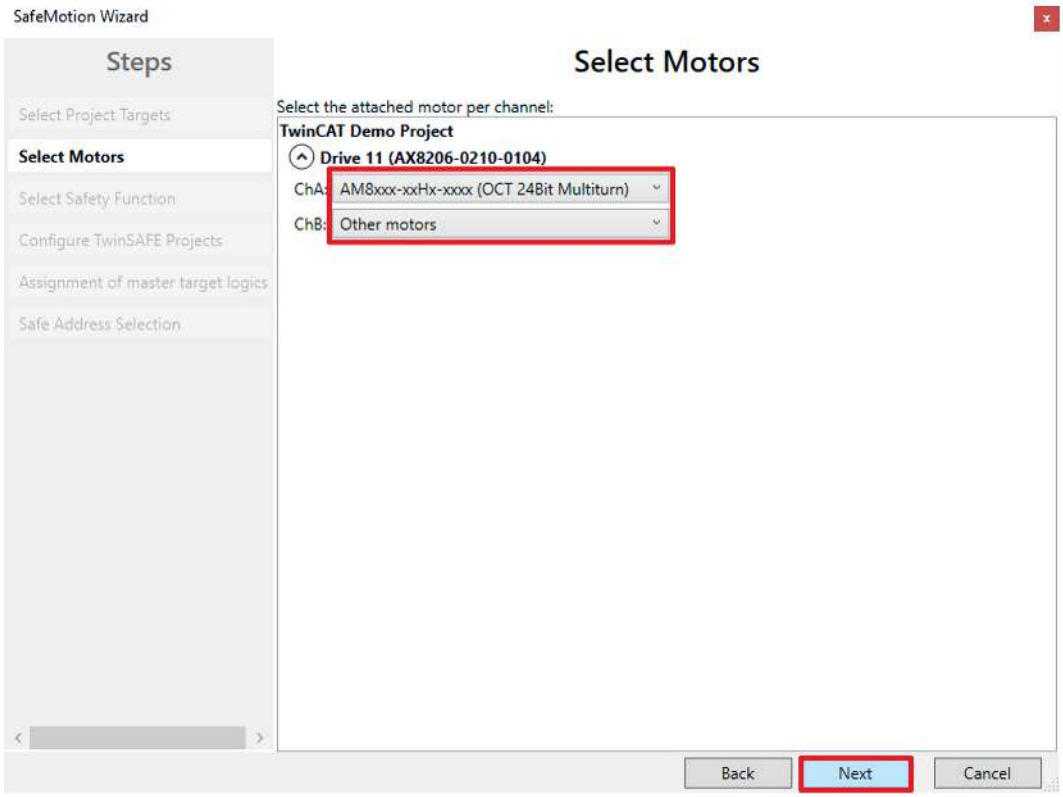


3. Select "Start SafeMotion Wizard..." via the Wizard field



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”



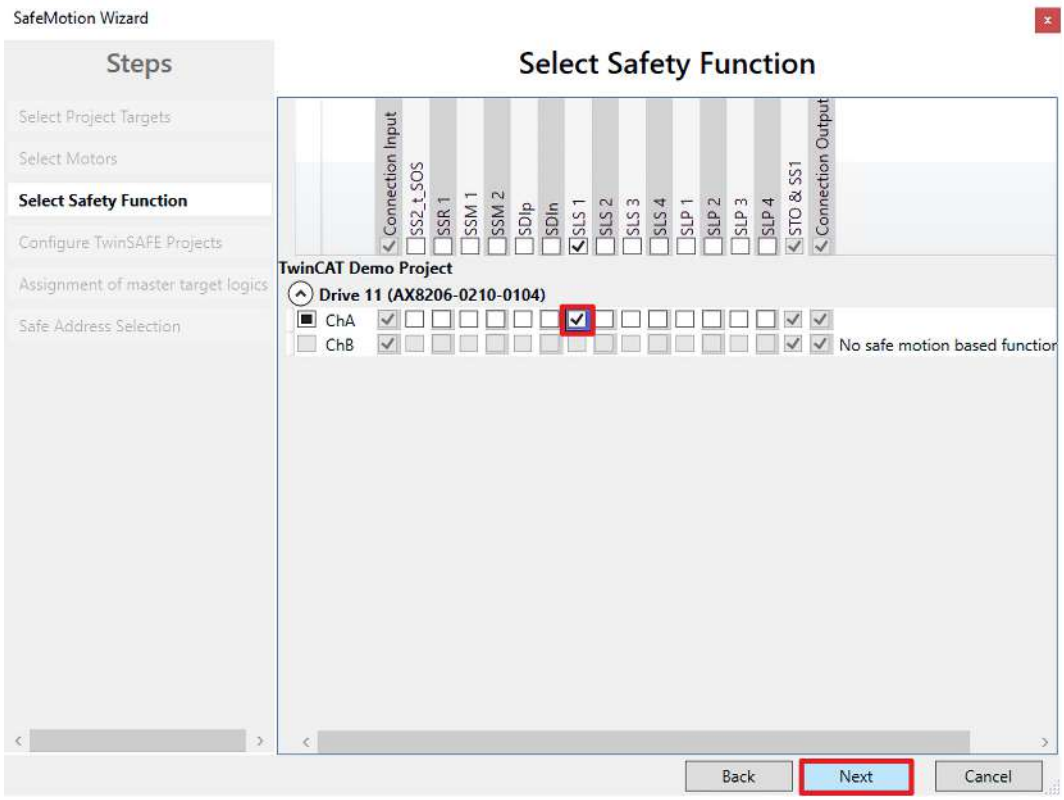
In the "Select Motors" window, configure the feedback for the individual axes.

6. Select "AM8xxx-xxHx-xxx (OCT 24Bit Multiturn)" for channel A (ChA)
7. Select "Other motors" for channel B (ChB)

Since the EnDat motor is not an OCT motor, the "Other motors" selection would be made at this point.

However, the aim of this tutorial is an SLS realization on ChA. Therefore select "AM8xxx-xxHx-xxx (OCT 24Bit Multiturn)" for ChA and "Other motors" for ChB.

8. Confirm selection with “Next”

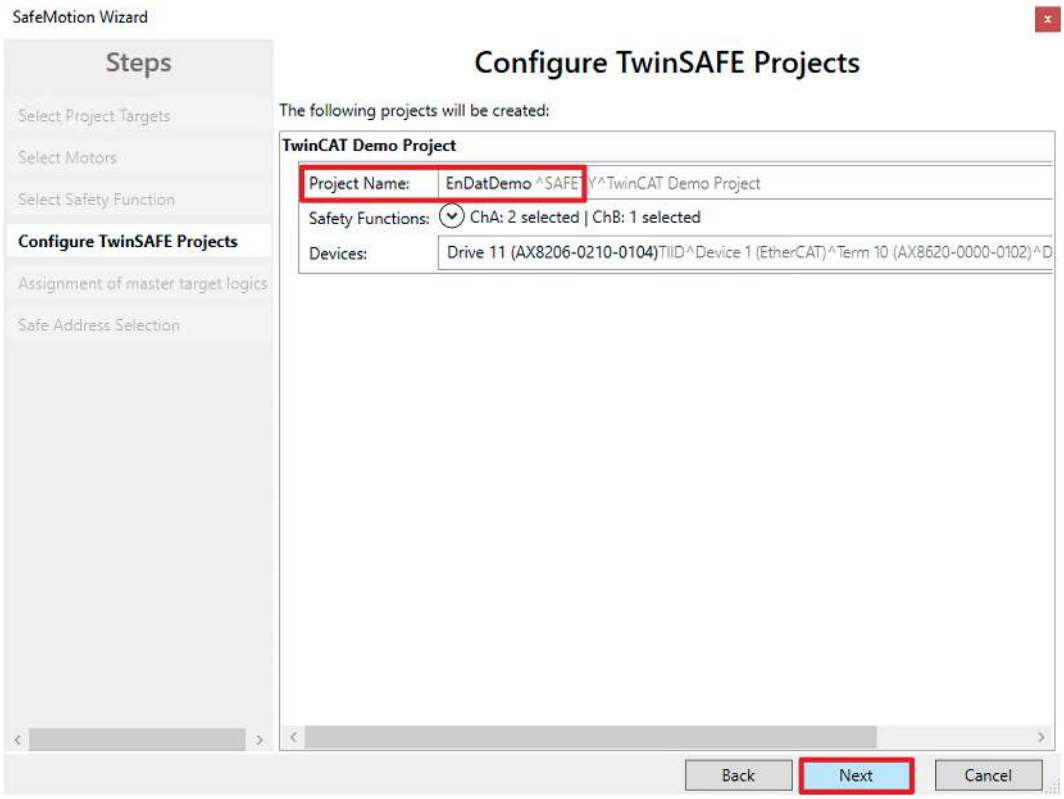


In the "Select Safety Function" window, select the desired safety functions.

9. For ChA select the SLS1 safety function

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

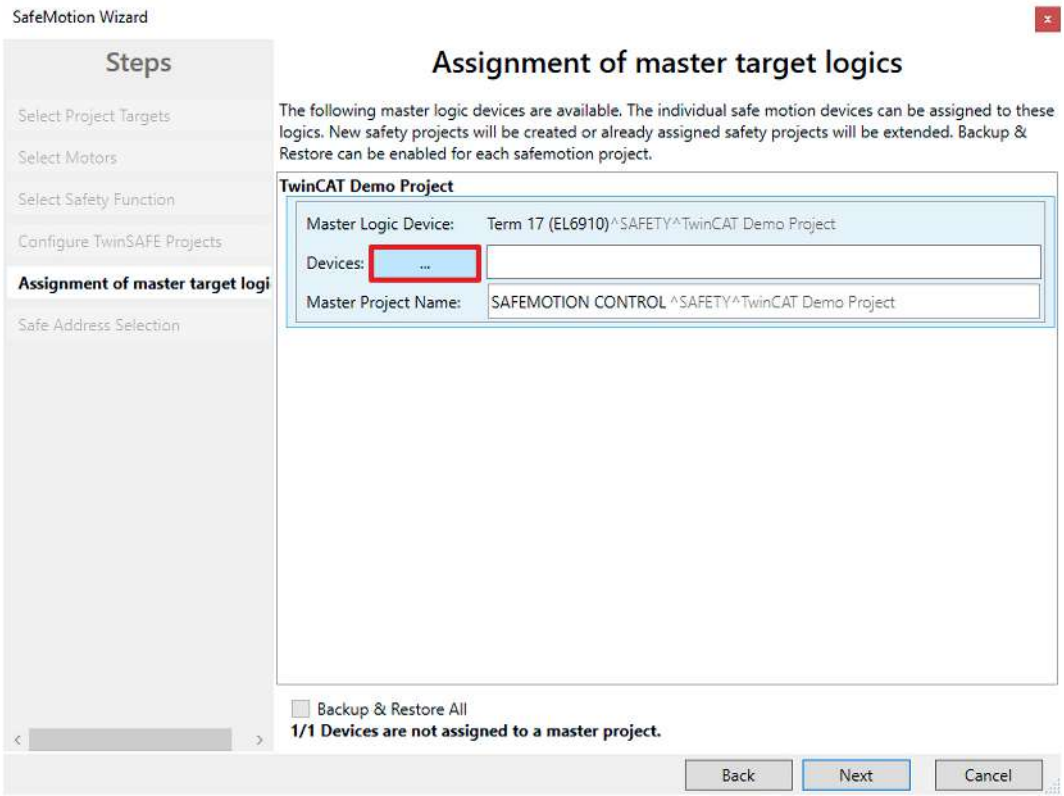
10. Confirm the selection with “Next”



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.

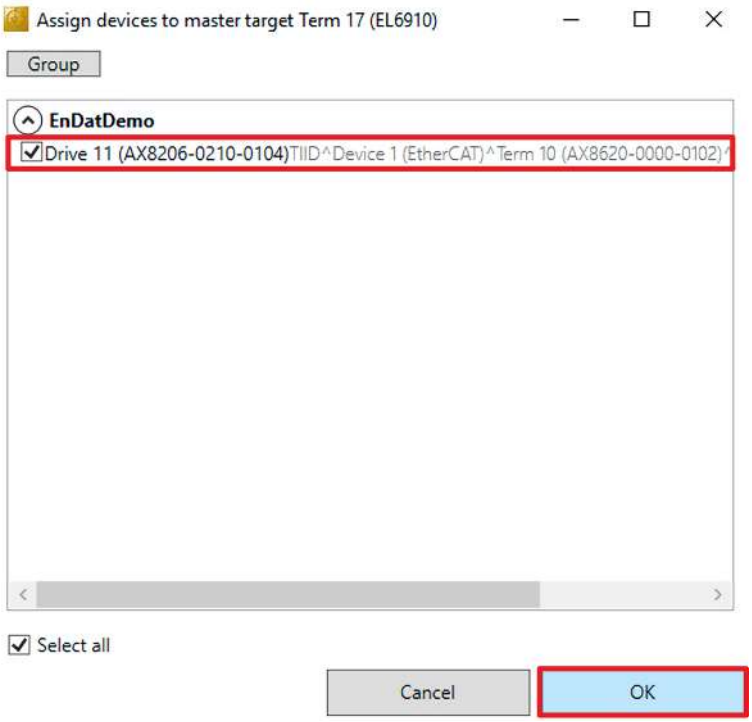
You also get an overview of the safety settings that have been made.

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

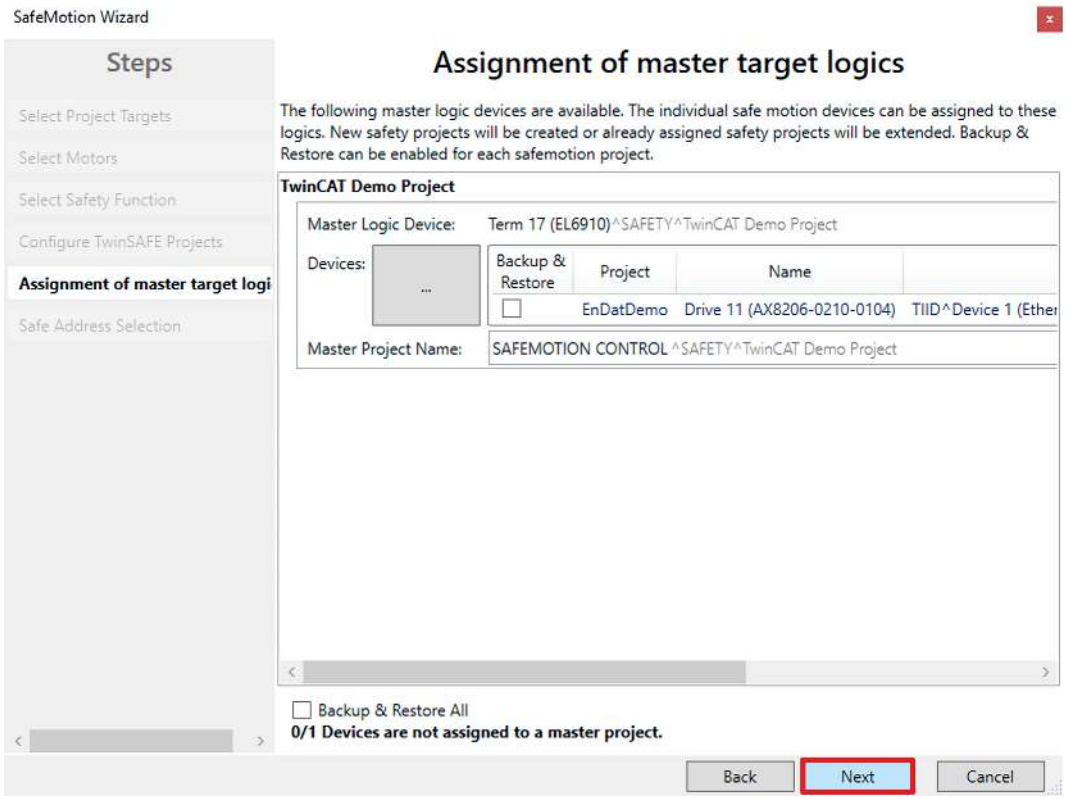


In the next window "Assignment of master target logics" the connection to the EL6910 project is closed, so that your Safe Motion component can communicate with the EL6910 project. The EL6910 project is automatically found and displayed.

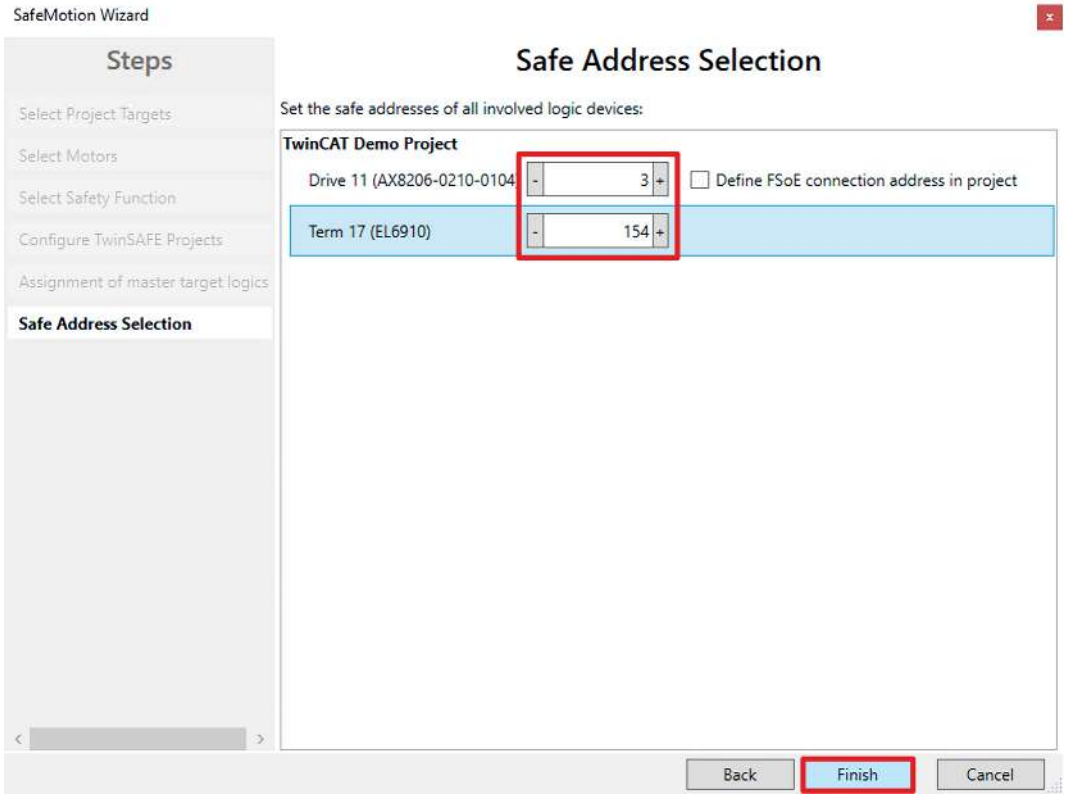
14. Click the button " ... "



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



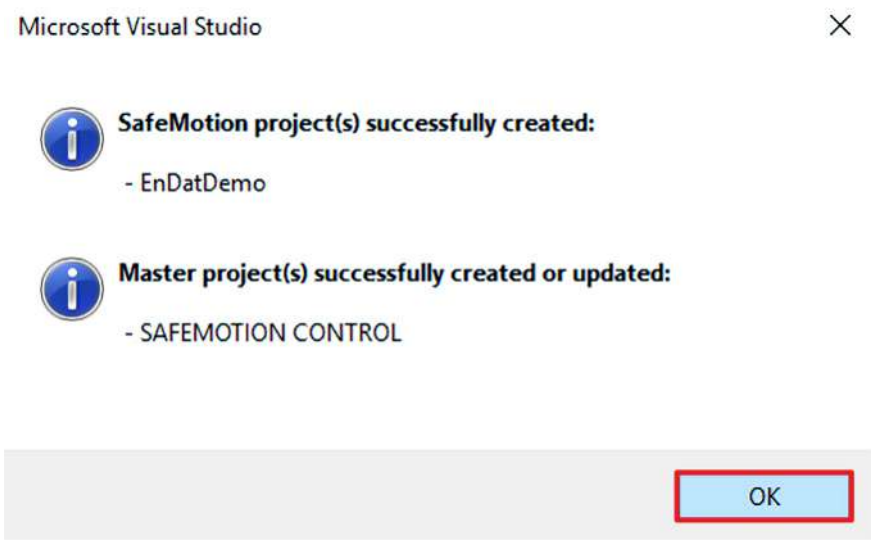
17. Confirm the window with “Next”



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.

18. Close window with “Finish”

The SafeMotion Wizard configures the projects.

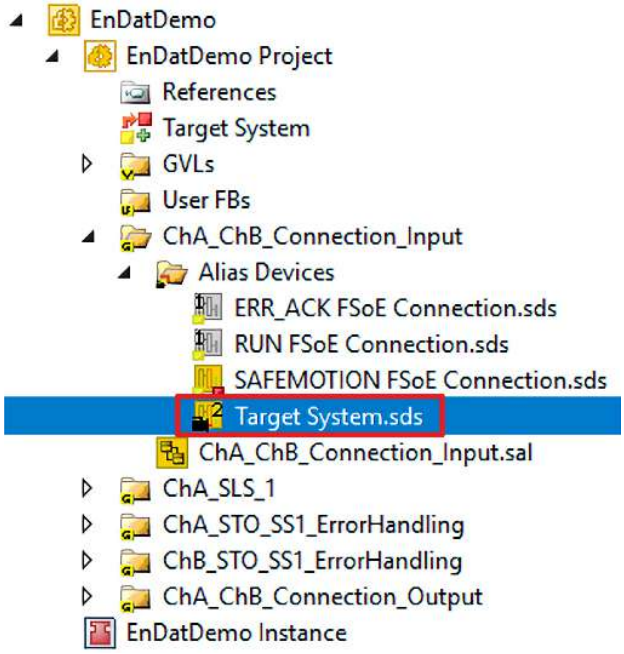


19. Close the window with “OK”

Now you have a safety project for OCT on ChA.

2.2 Configure safety parameters

Next, adjust the Primary Feedback parameter CRC. Proceed as follows:



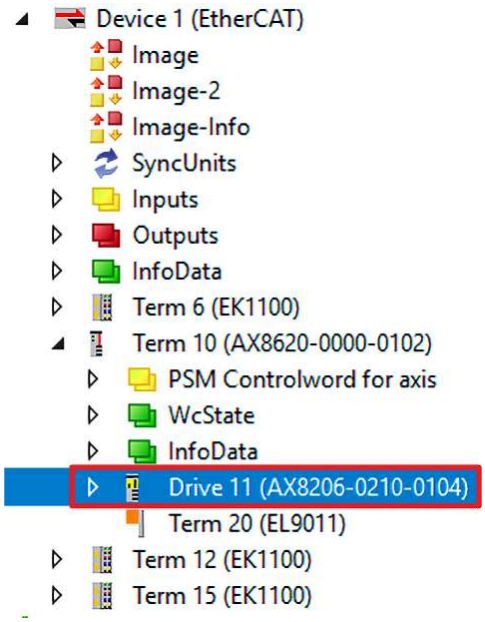
1. Open the “Target_Systems.sds” file in the “ChA_ChB_Connection_Input” folder

Linking | Connection | Safety Parameters | Process Image | Internal Safety Parameters | Internal Process Image

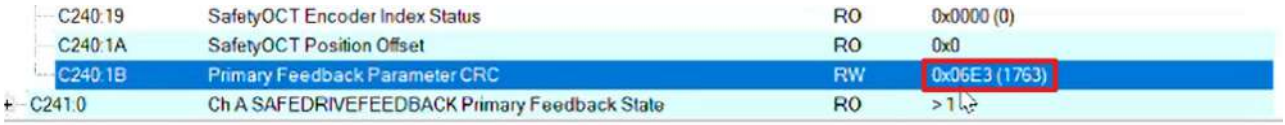
Index	Name	Value
C110:0	Ch A FSOUT BRAKE Settings Common	>4<
C121:0	Ch A FSIN Settings Channel	>5<
C130:0	Ch A FSDRIVE Settings	>3<
C140:0	Ch A SAFEDRIVEFEEDBACK Primary Feedback Settings	>25<
C141:0	Ch A SAFEDRIVEFEEDBACK Secondary Feedback Settings	>25<
C142:0	Ch A SAFEDRIVEFEEDBACK Primary Feedback Referencing Settings	>24<
C143:0	Ch A SAFEDRIVEFEEDBACK Secondary Feedback Referencing Settings	>24<
C240:0	Ch A SAFEDRIVEFEEDBACK Primary Feedback Parameter	>27<
C240:1B	Primary Feedback Parameter CRC	0xDF54 (57172)
C242:0	Ch A SAFEDRIVEFEEDBACK Secondary Feedback Parameter	>27<
C390:0	Ch B FSOUT BRAKE Settings Common	>4<
C3A1:0	Ch B FSIN Settings Channel	>5<
C3B0:0	Ch B FSDRIVE Settings	>3<
C3C0:0	Ch B SAFEDRIVEFEEDBACK Primary Feedback Settings	>25<
C3C1:0	Ch B SAFEDRIVEFEEDBACK Secondary Feedback Settings	>25<
C3C2:0	Ch B SAFEDRIVEFEEDBACK Primary Feedback Referencing Settings	>24<
C3C3:0	Ch B SAFEDRIVEFEEDBACK Secondary Feedback Referencing Settings	>24<
C4C0:0	Ch B SAFEDRIVEFEEDBACK Primary Feedback Parameter	>27<
C4C2:0	Ch B SAFEDRIVEFEEDBACK Secondary Feedback Parameter	>27<

2. Open “Internal Safety Parameter” tab

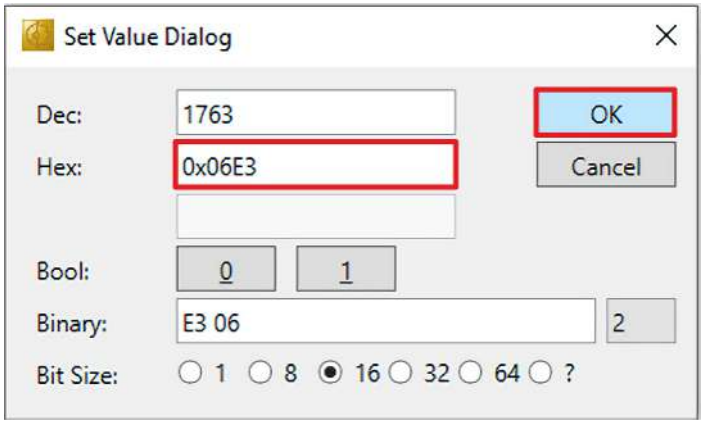
Under the parameter C240:0 "ChA SAFEDRIVEFEEDBACK Primary Feedback Parameter" you see the "C240:1B Primary Feedback Parameter CRC". This CRC is calculated for the OCT Safety. To change the encoder signal to an EnDat 2.2 Safety encoder, you need the corresponding CRC. You can find the CRC in the Safe Motion component. Proceed as follows:



3. Open safe motion component
4. Open the “CoE online” tab



5. At “C240:1B Primary Feedback Parameter CRC” take the parameter CRC “0x06E3”
6. Open Target System
7. Double click on the parameter C240:1B



8. Enter the parameter CRC at Hex in the “Set Value Dialog” window
9. Confirm entry with “OK”

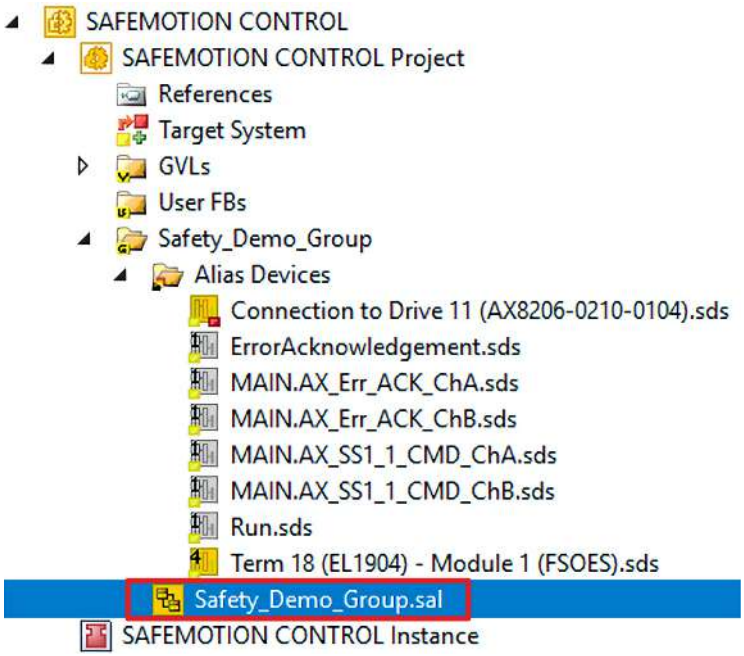
10. Click on "Save all" in the menu bar to save the settings

2.3 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.

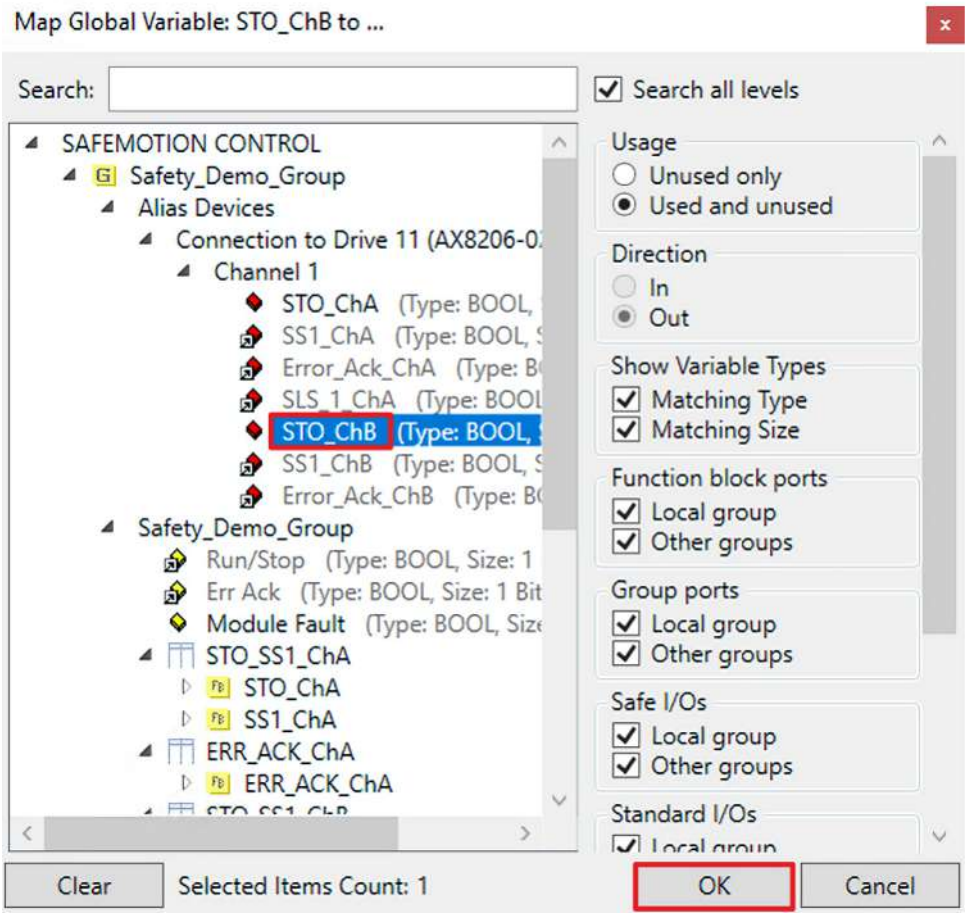
Proceed as follows:



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.

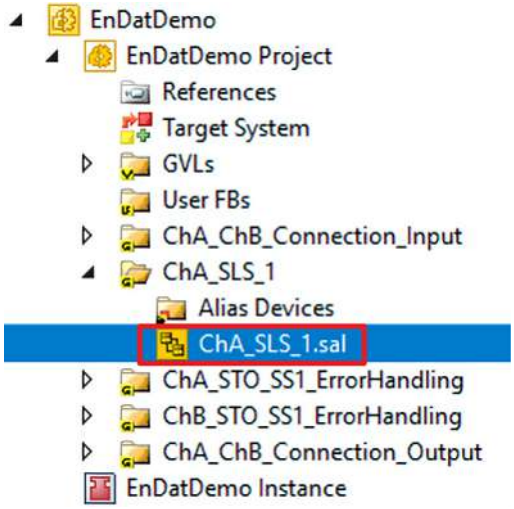
Parameter	Signal
ERR_ACK_AX8000_ChA	Error_Ack_ChA
SS1_AX8000_ChA	SS1_ChA
SS1_AX8000_ChB	SS1_ChB
ERR_ACK_AX8000_ChB	Error_Ack_ChB
SLS_AX8000_ChA	SLS_1_ChA
STO_ChA	STO_ChA
STO_ChB	STO_ChB

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

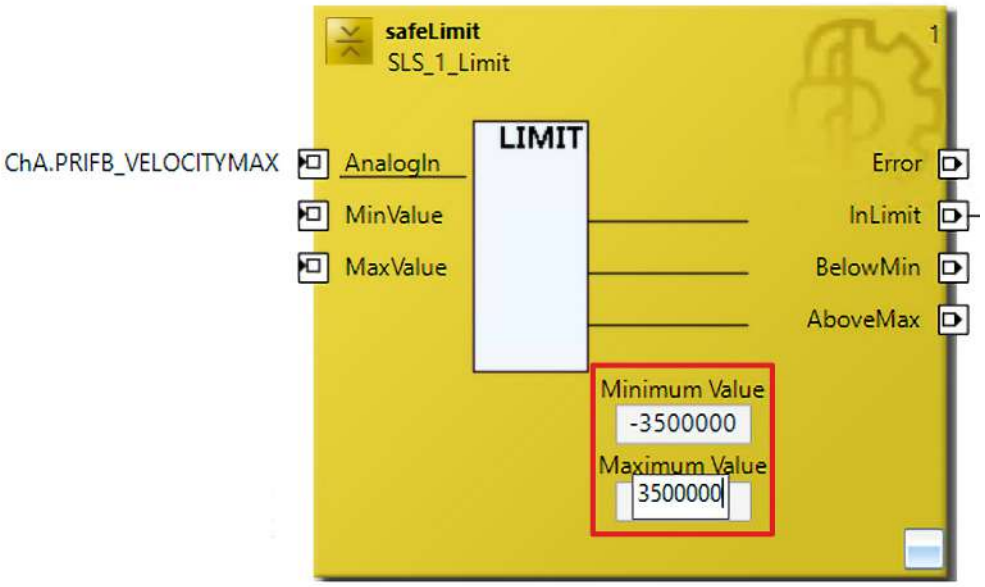
The Safe Motion project and the EL6910 project are now linked.

2.4 Configure SLS

To configure the SLS functionality, proceed as follows:



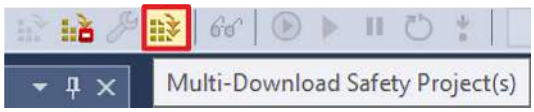
1. Open file “ChA_SLS_1.sal”



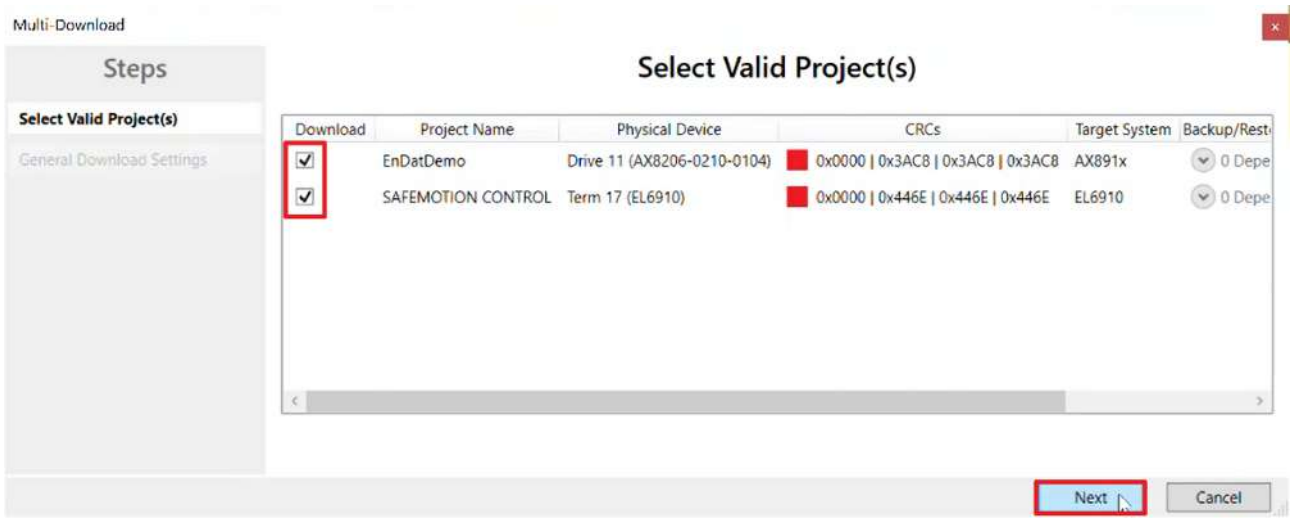
2. Enter the limits in the FB safeLimit according to the illustration

In the next chapter follows the download of the projects.

2.5 Download safety projects

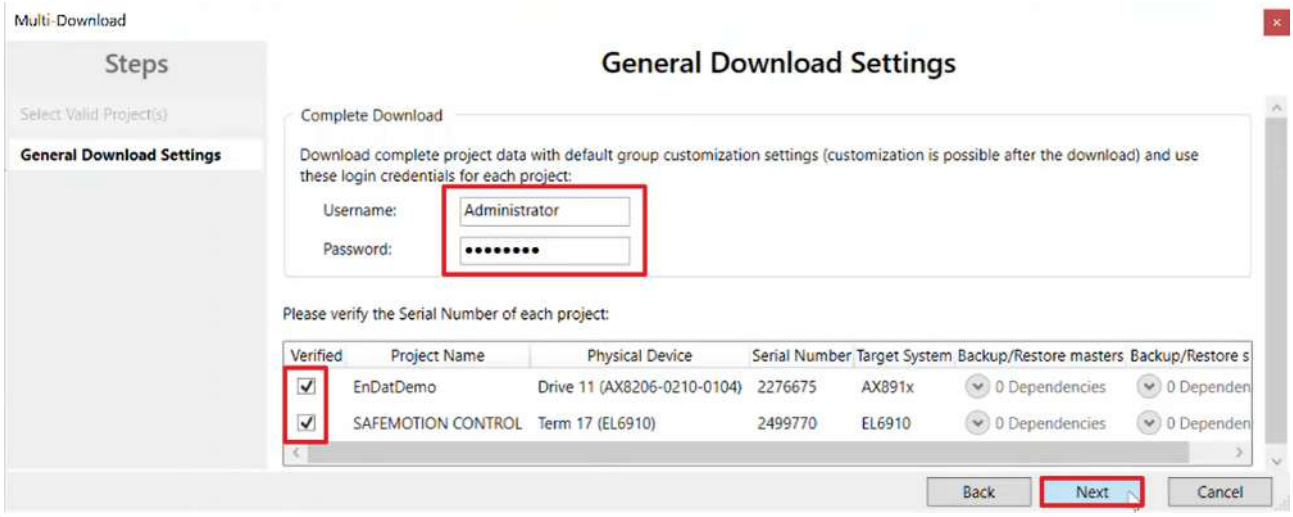


1. Click on "Multi-Download Safety Project(s)"



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”

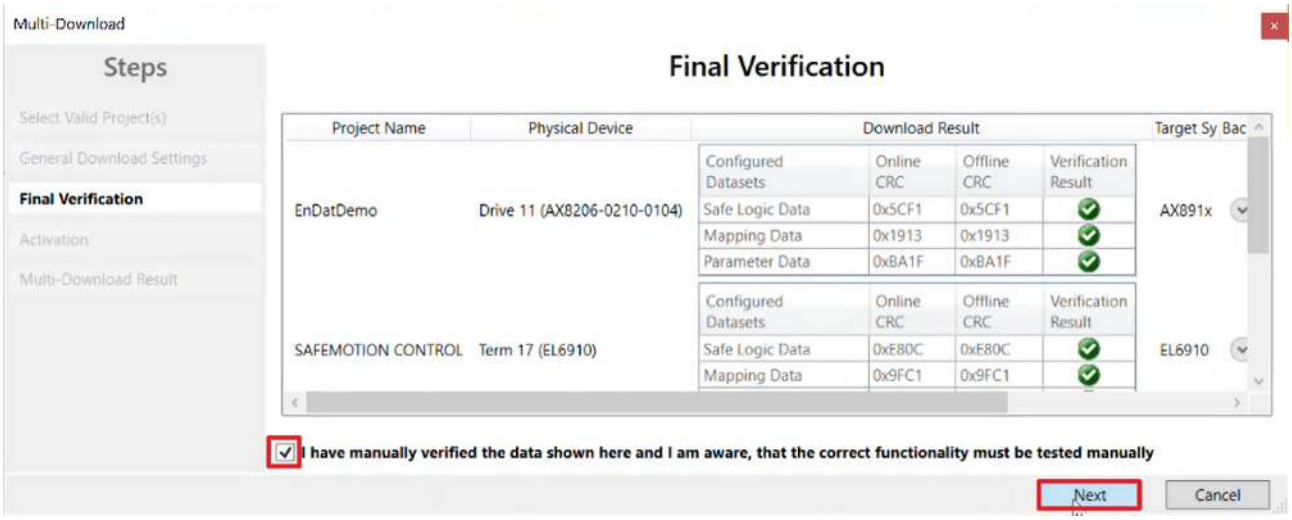


4. Enter the username and password in the "General Download Settings" window

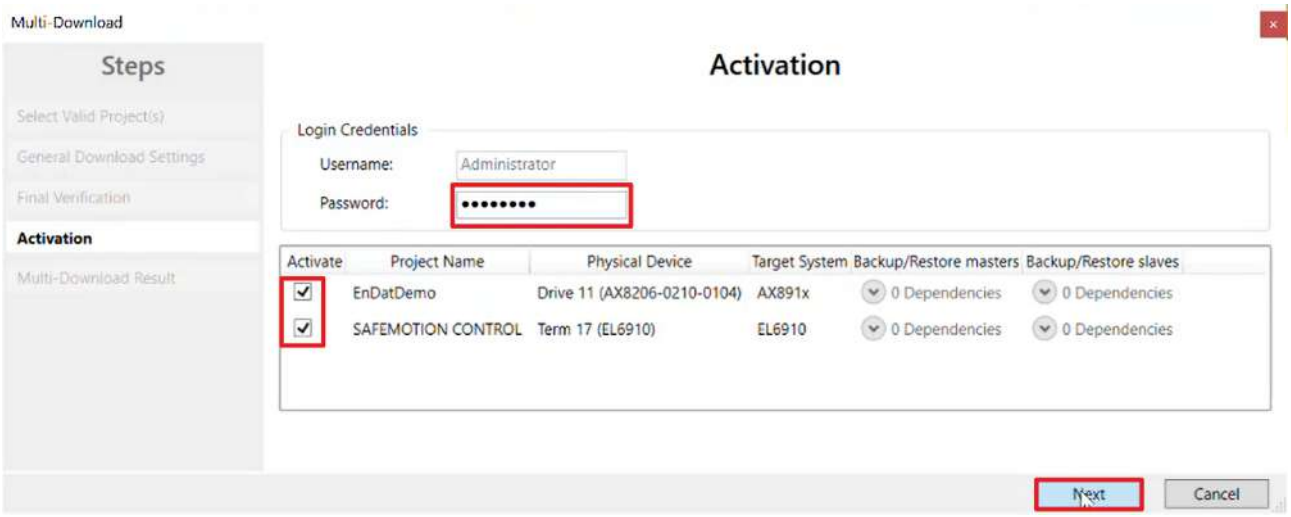
Default username: Administrator

Default password: TwinSAFE

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

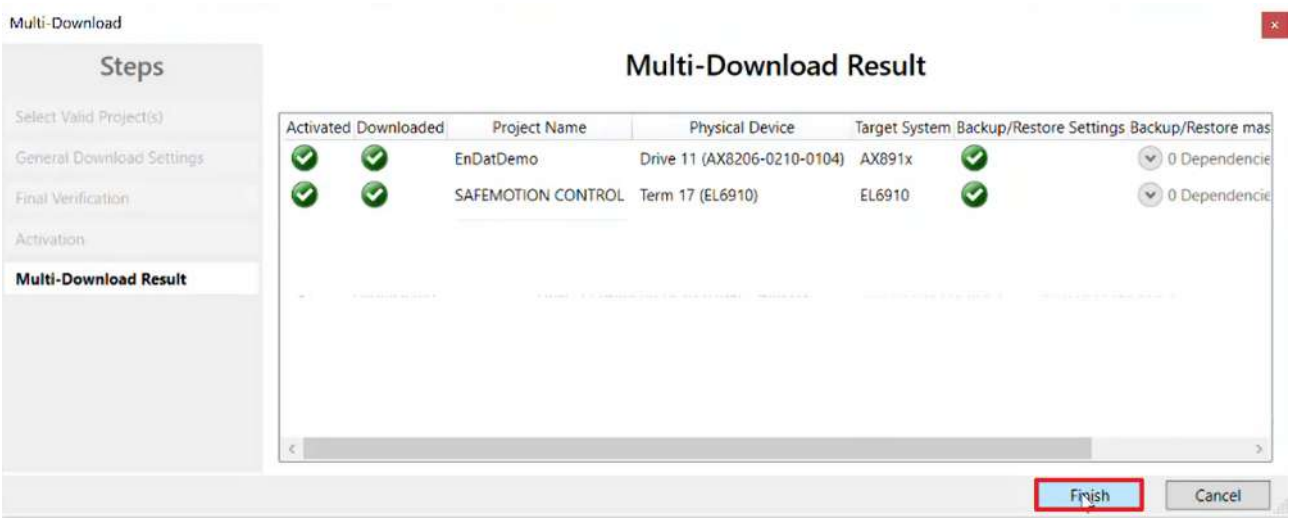


7. Check the CRCs in the "Final Verification" window
8. If the CRCs match, click on the box to confirm the verification
9. Confirm window with “Next”



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

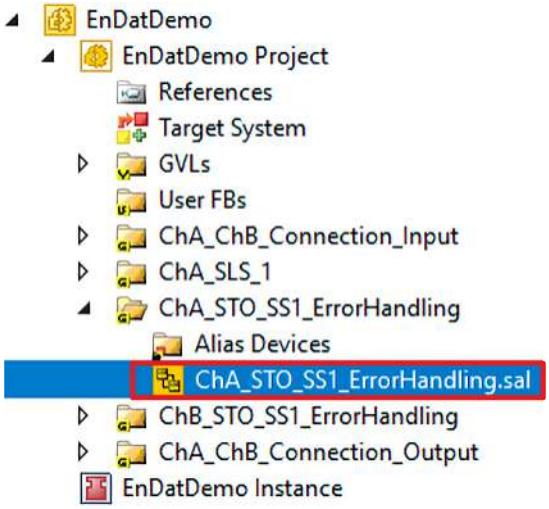
10. Enter the default password
11. Check if the safety projects are selected
12. Confirm selection with “Next”



13. Close the window "Multi-Download Result" with “Finish”

Your safety projects are now downloaded and active.

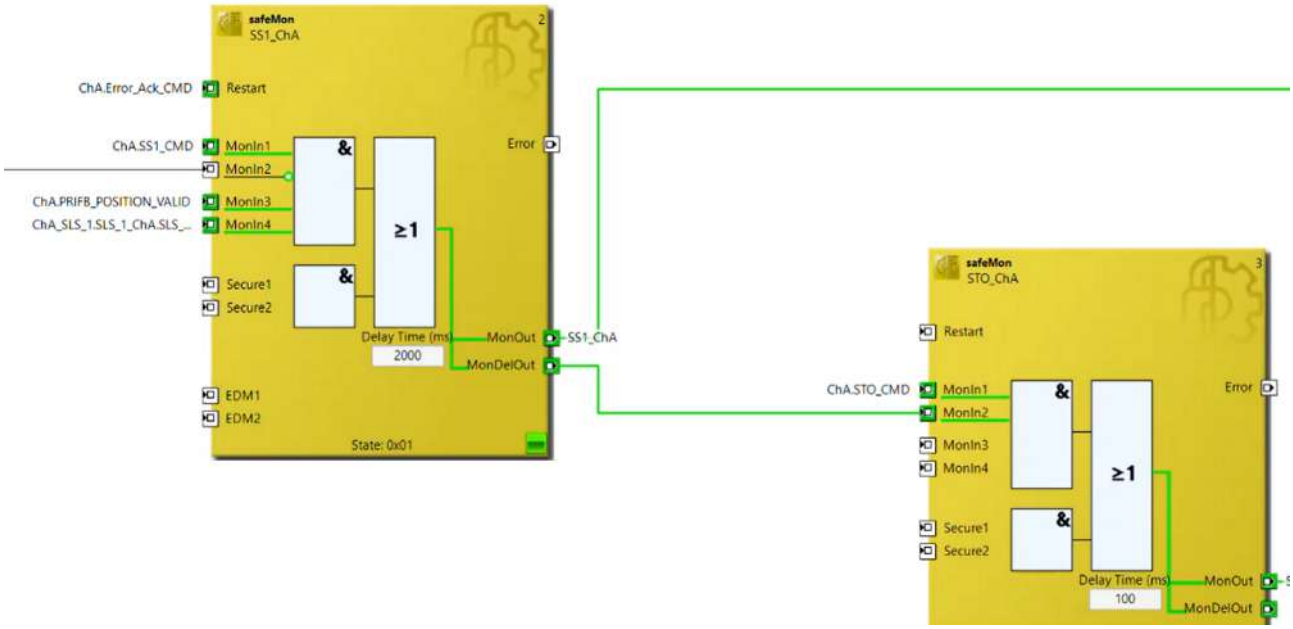
2.6 Check signals



1. Open the file “ChA_STO_SS1_ErrorHandling.sal”

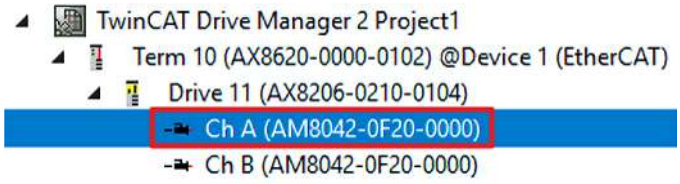
2. Click on “Show Online Data” in the menu bar to activate the online view

For ChA.PRIFB_POSITION_VALID, you will first see that this value is 0 because the protocol for EnDat 2.2 Safety takes more time to upload.

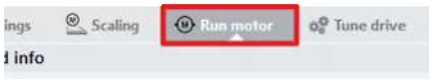


Once the log is finished uploading, you will see that all signals arrive correctly.

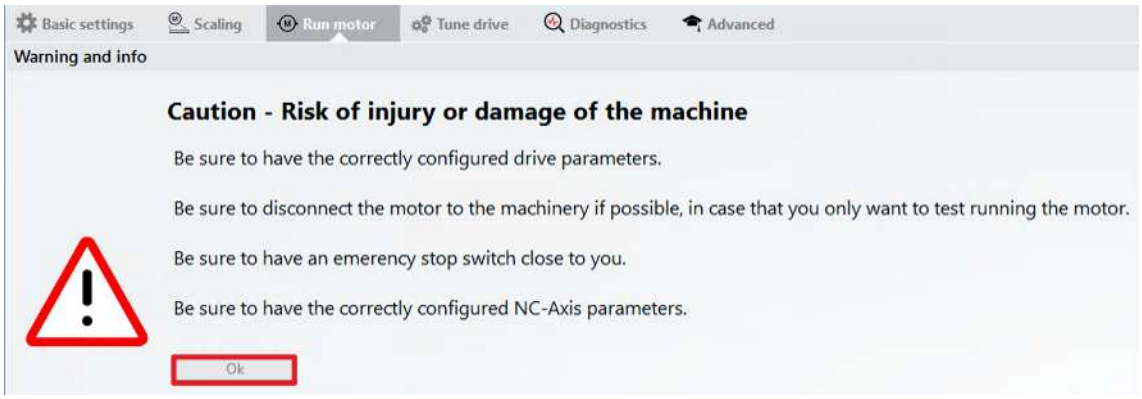
2.7 Let motor traverse



1. Open the ChA channel in the Drive Manager



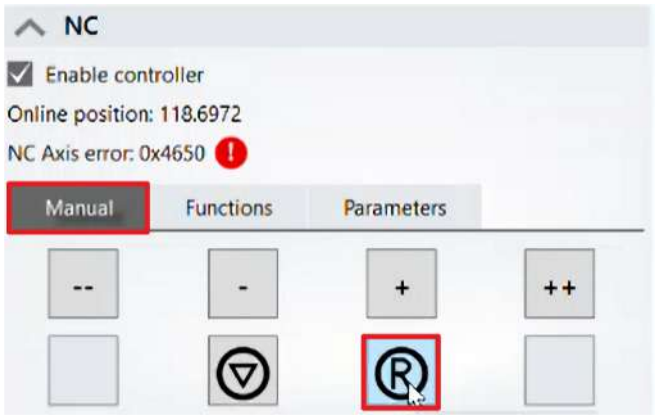
2. Open the tab “Run Motor”



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

3. Close the warning with “OK”

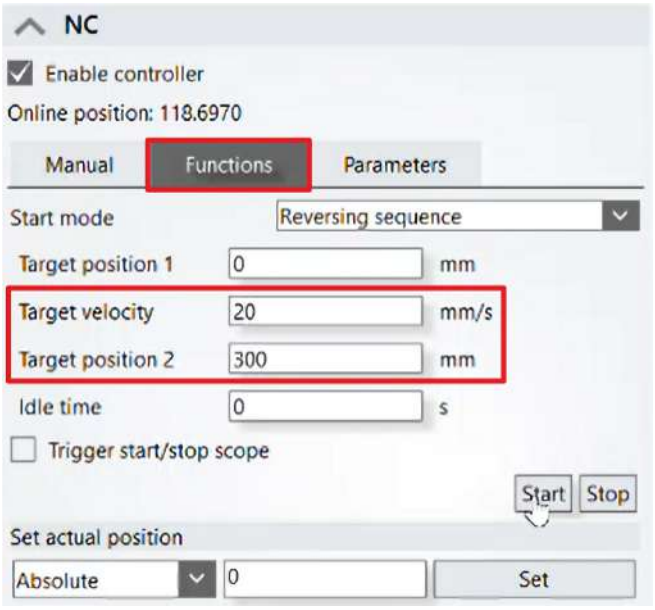
4. Click the box “Enable controller” in the field “NC”



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:

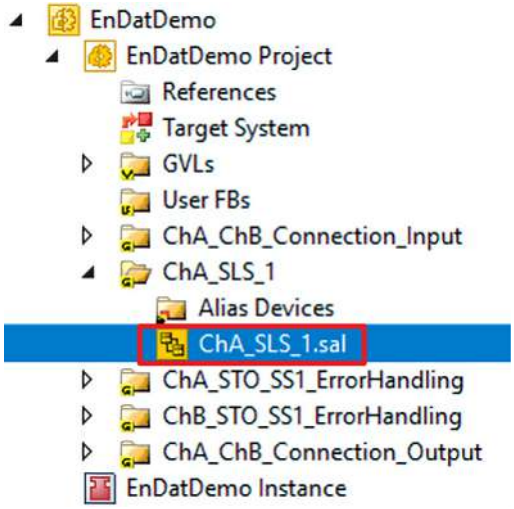


Setting	Value
Target velocity	20 mm/s
Target position 2	300 mm

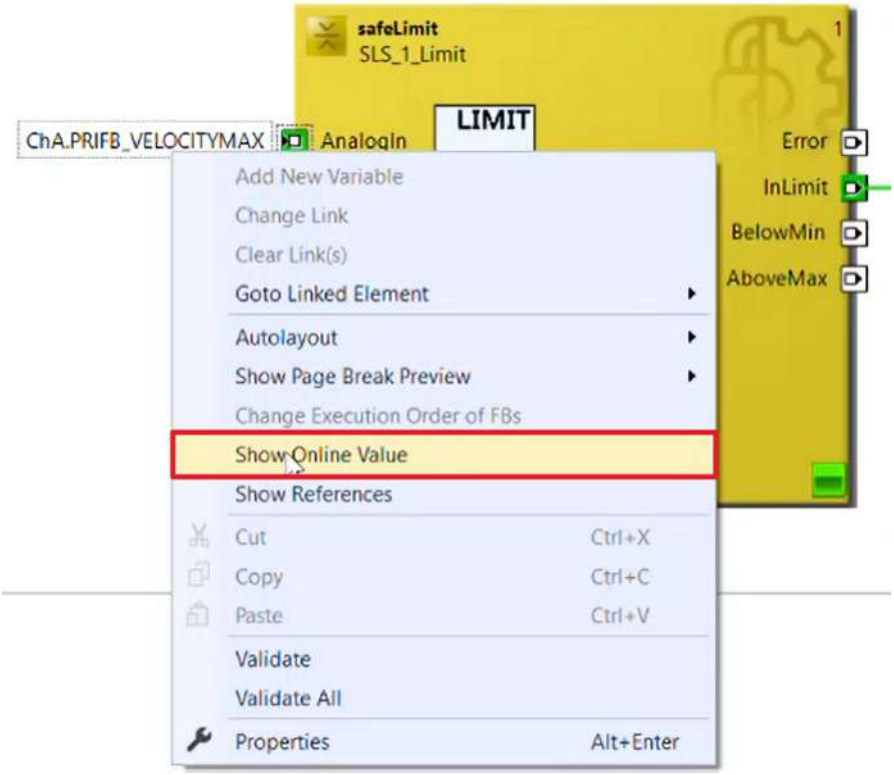
8. Click on "Start"

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

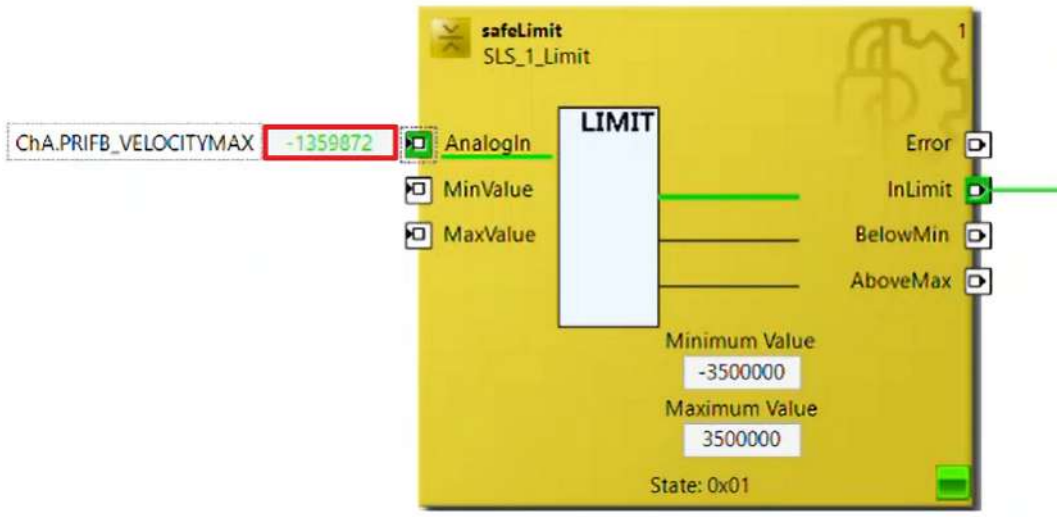
You will now see how the motor traverses.



10. Open the file "ChA_SLS_1.sal"
11. Right-click on a variable in the online view

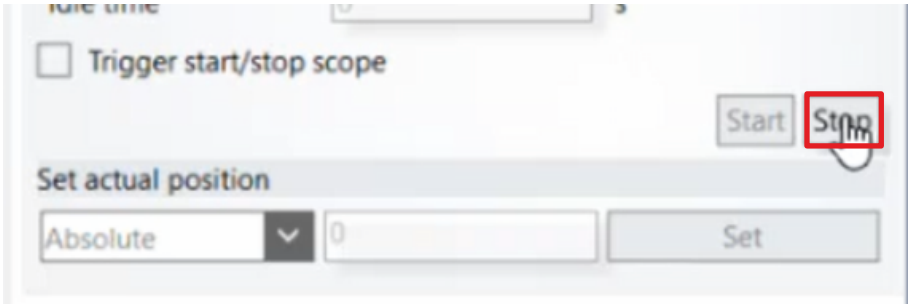


12. Click on "Show Online Data”



You can now see from the analog values that your function is working as desired. To stop the motor again, proceed as follows:

13. Open the tab "Run Motor" in the Drive Manager in ChA



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

Now you can continue with the further commissioning.

More Information:
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