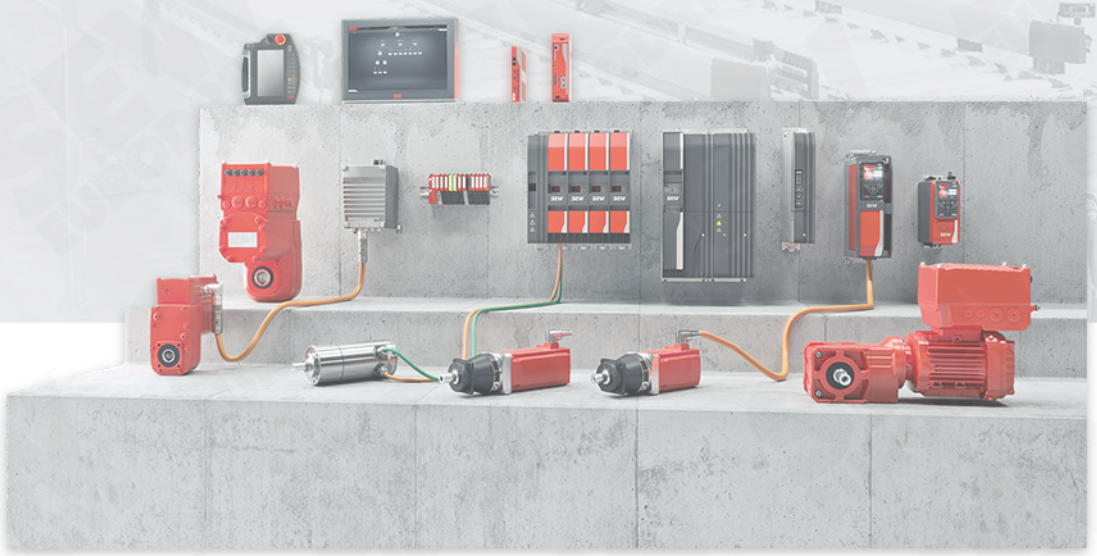
Product Training Workbook



MOVI-C® Automation System

MOVIKIT® MultiAxisController Software Module

Parameterization and Diagnostics

C210

DRIVE ACADEMY®

Urheberrecht

Disclaimer
This training document supplements the documentation available at SEW-EURODRIVE GmbH & Co KG.
They have been prepared as informative documents to accompany training to the best of our knowledge and belief.

The primary observance of the operating instructions of the devices mentioned in the training document is a basic prerequisite for safe operation. The safety regulations specified therein apply.
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Objectives of this training document:
- Get in contact with the MultiAxisController
- Learn the main functionality of the MultiAxisController

Additional documents:
- MOVIKIT® MultiMotion
- MOVIKIT® MultiAxisController
- MOVISUITE® IEC Project Creation

If you have any questions or suggestions, please do not hesitate to contact the product training department.

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Meaning of the symbols:


Operation instructions


Information


Safety-related information


Tip


Diagnostic and trouble-shooting


Practical task


Additional documentation

1 Startup

Objective:

- Functionality of the MultiAxisController Torque
- Functionality of the MultiAxisController Skewing
- Functionality of the Combined encoder evaluation integrated in the MultiAxisController
- Reference the MultiAxisController with limit switches

Steps if you change parameters of the inverter after integrating the MultiAxisController in your project. These steps have to be done for all MultiAxisControllers that are depending to the changed axis:

1 Open the page **Drive functions** of the MultiAxisController that the new parameters are read up.

2 After that you have to push the button **Apply all suggested values** in the **Advanced settings** > **Set parameter** of the MultiAxisController.

1.1 System configuration

1.1.1 MOVISUITE® version / modules

Modules:

- MOVIRUN flexible 6.0.10.0
- MultiAxisController 6.0.17.200
- MultiMotion 6.0.19.200

1.1.2 Firmware

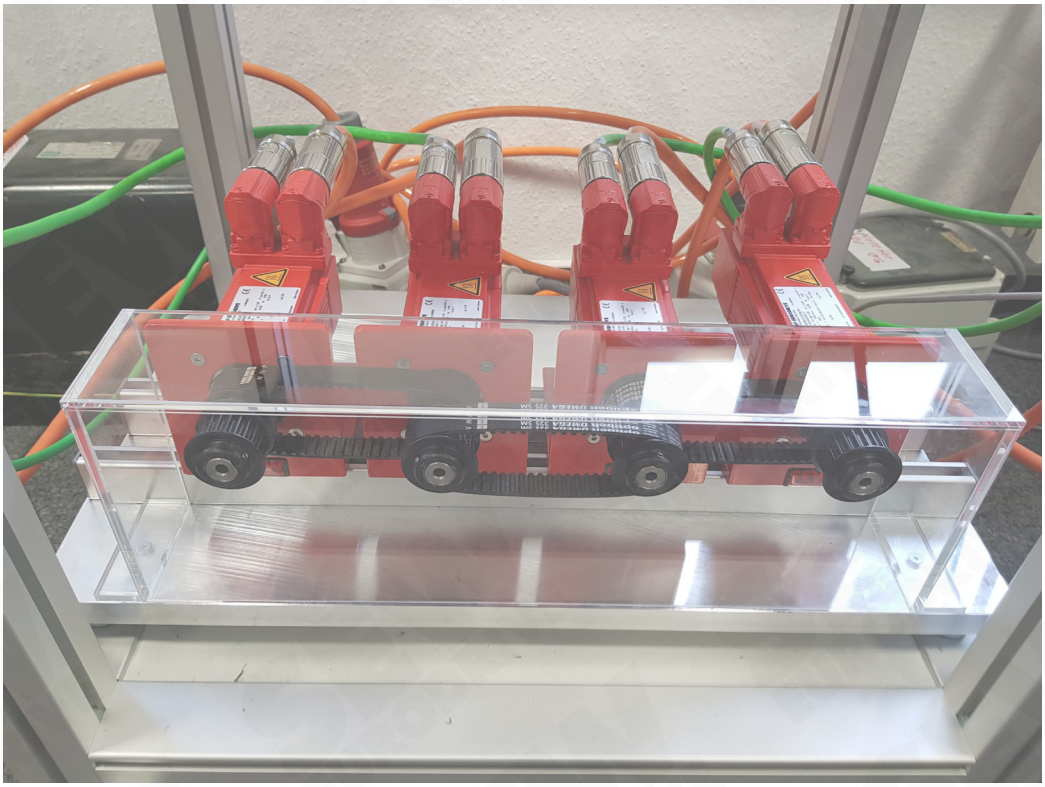
- Controller ≥ 6.00
- Inverter ≥ 5.00

1.1.3 Training model

For the following workbook the standard MultiAxisController training model is used. With four MDA and four CMP40S motors. In addition, the model was modified with a CES card to simulate the external encoder. The motor encoder of axis 4 is connected to the CES card of inverter 3. Therefore, the inverter 4 won't be used and configured.
The following picture shows the coupled drives that were used. Only the belt between drive 2 and 3 should be removed.

If it is not possible to use the model described above, it is also possible to use the standard MOVI-C® model with one MDD and one MDA and the CSS card. Your model has to fulfil the following conditions:

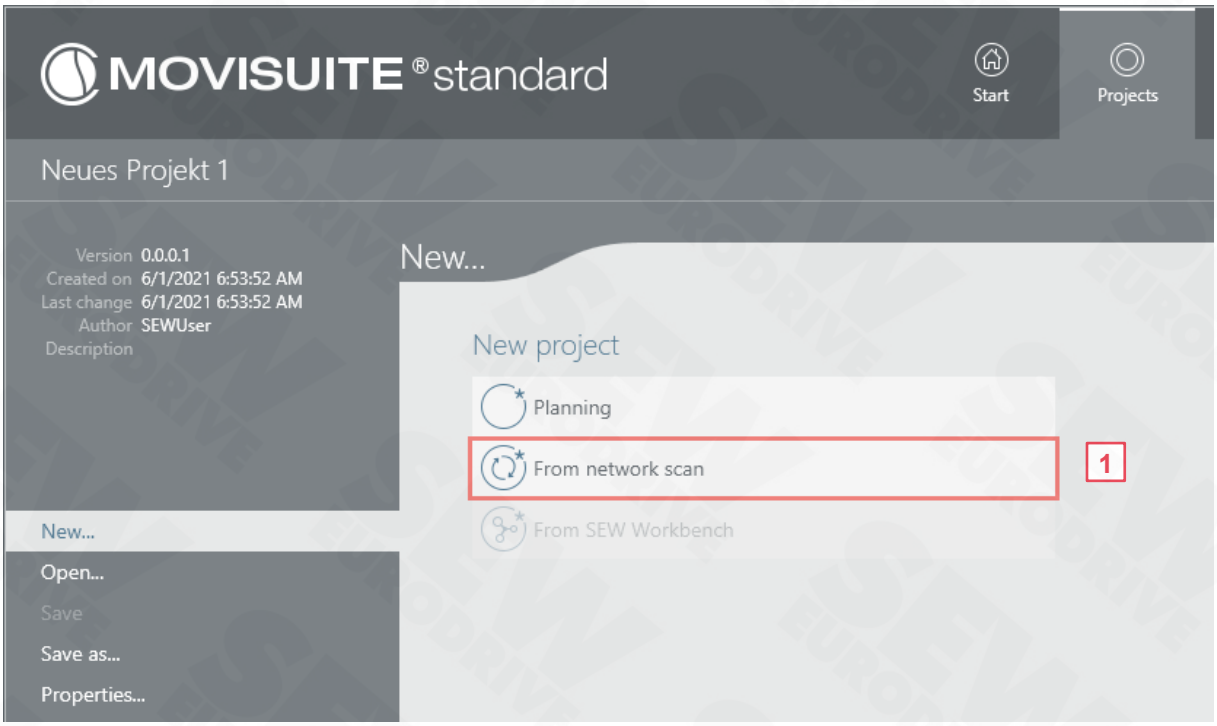
- 3 inverters connected to one PLC
- 3 identical drives
- Option to couple 2 motors
- 1 external encoder that is connected to a CES/CSS card (e.g. usage of one motor as external encoder)



1.2 Configuration axis 1-3

1.2.1 Set up project in MOVISUITE®

1. Create a new project from a network scan

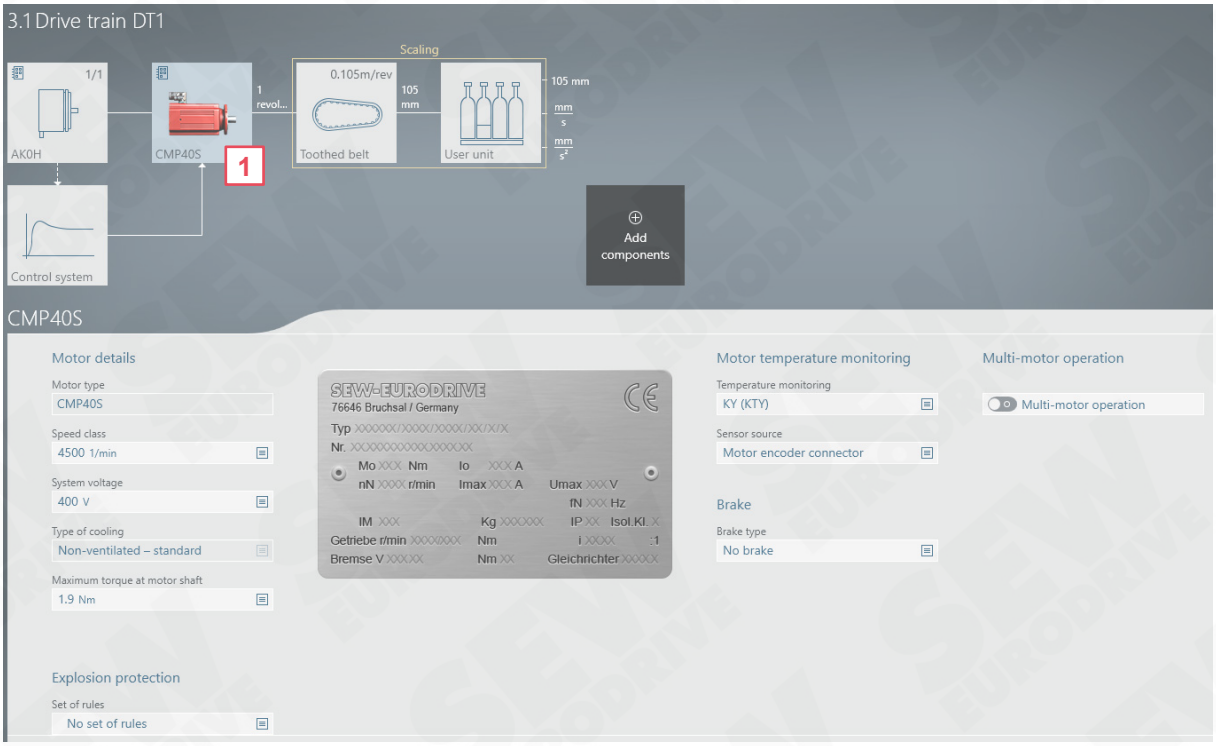


1 Create a new MOVISUITE® project **from network scan** and follow the lead of the MOVISUITE®.

If errors occur, please refer to the MOVISUITE® manual.

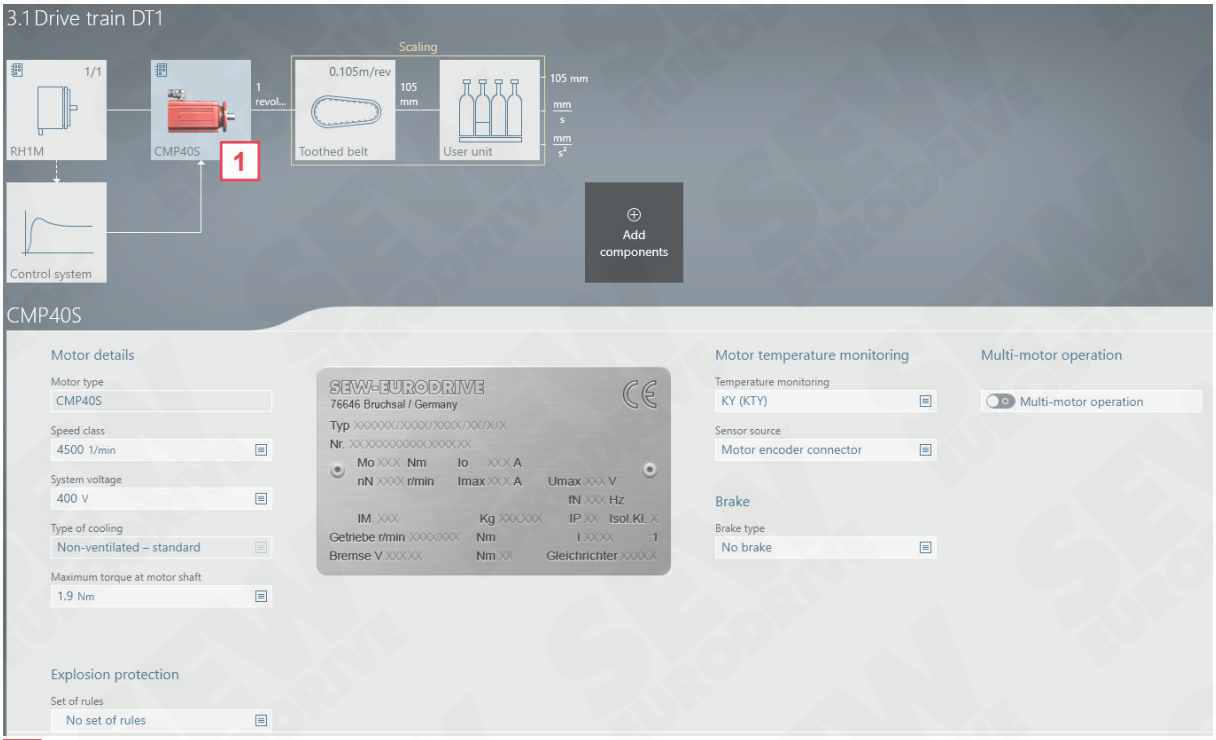
1.2.2 Configuration motor 1-3

1. Axis 1



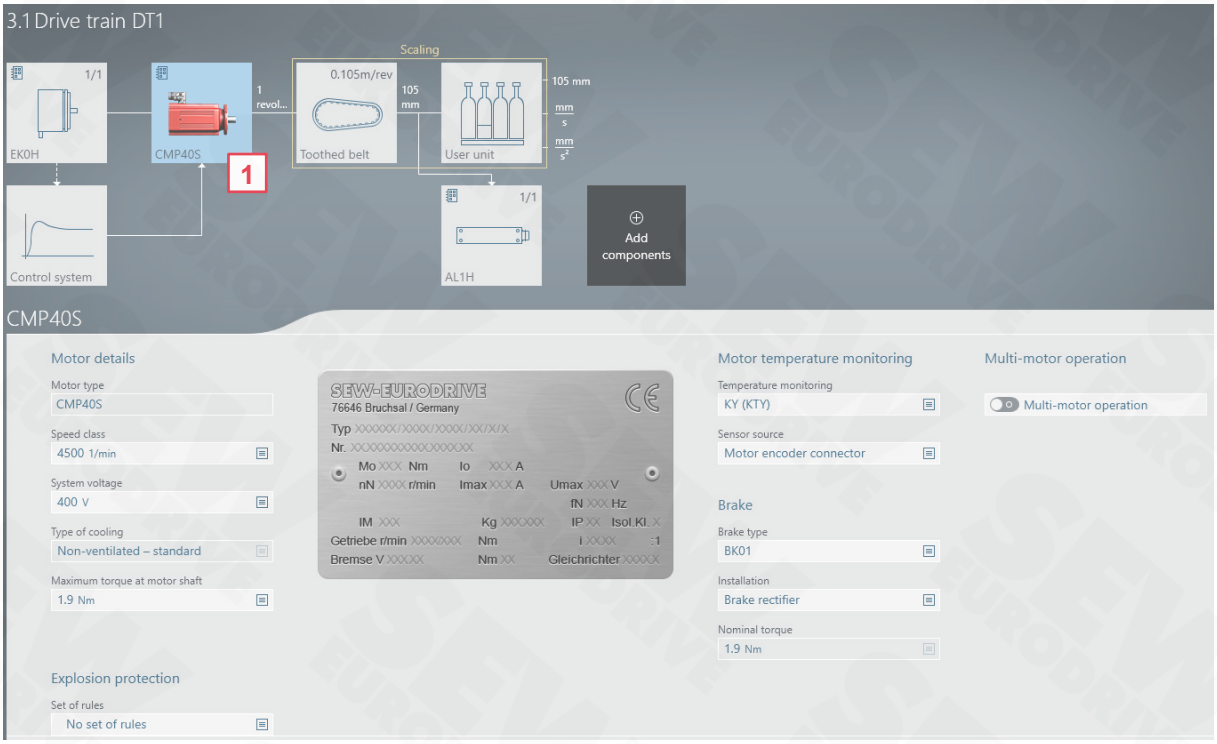
1 Configure the motor according to the technical data of your motor.

2. Axis 2



1 Configure the motor according to the technical data of your motor..

3. Axis 3

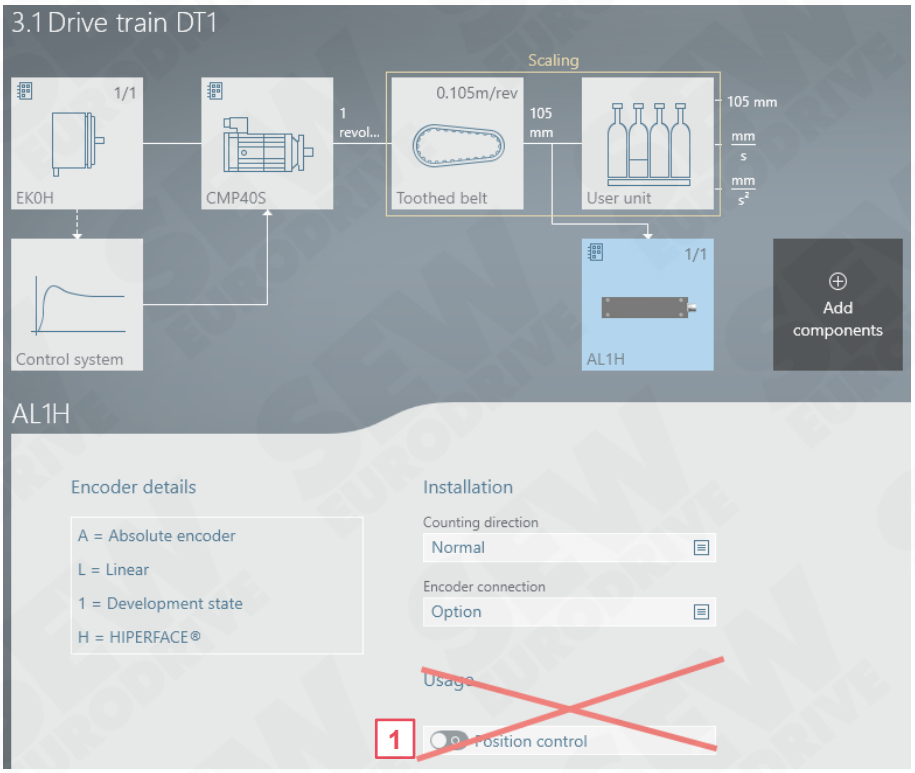


1 Configure the motor according to the technical data of your motor.

1.2.3 Configuration encoder 2

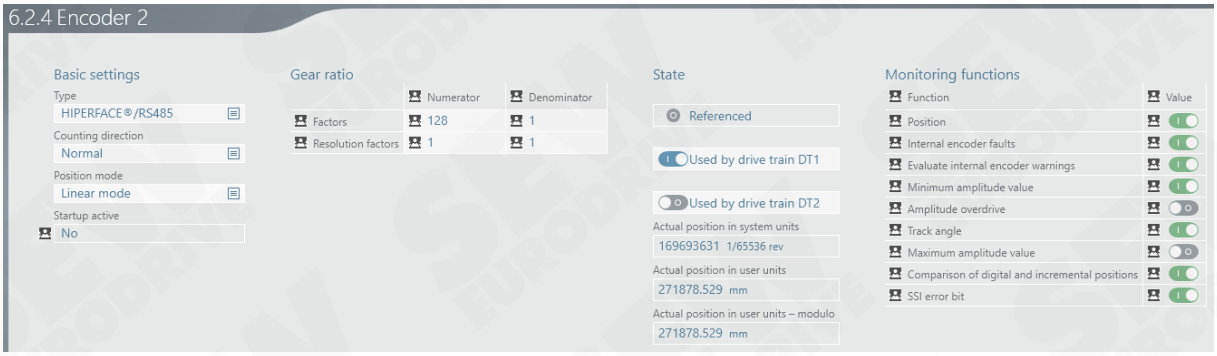
To work around the problem that it isn't possible to integrate a rotary encoder after a tooth belt the AL1H was integrated. In chapter 0 the encoder will be adjusted that its behavior is the same like the AK0H that is mounted to the CES card.

1. Deactivate position control



1 To combine the motor encoder and the external encoder with the MultiAxisController the position control won't be closed with the external encoder. Therefore, the switch in the drive train must not be activated.

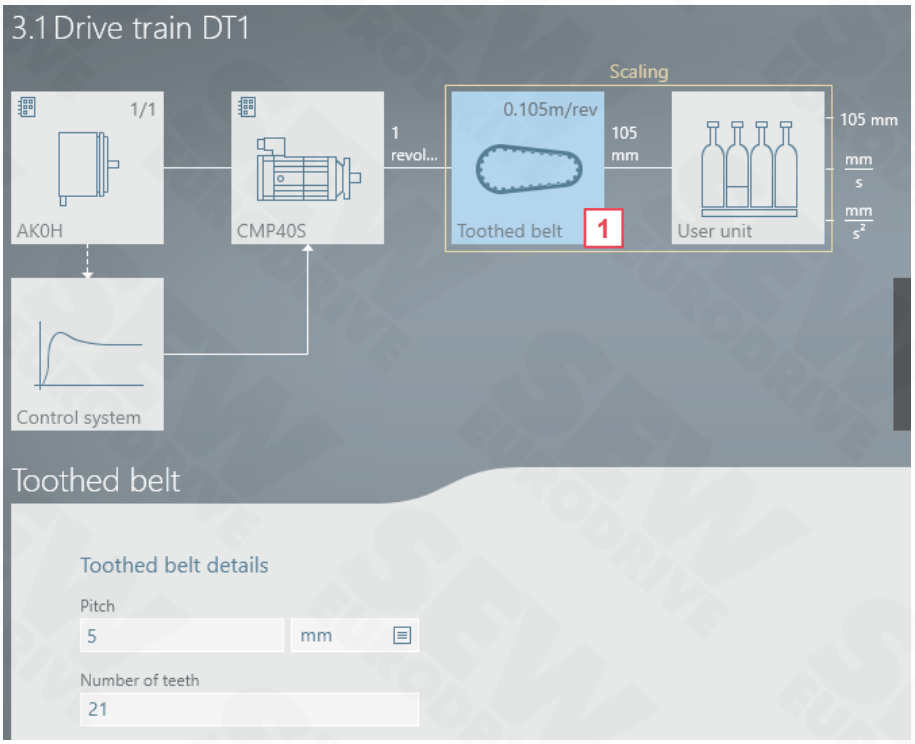
2. Process values encoder 2



1 As mentioned above the encoder 2 has to be scaled that its behavior is the same like the AK0H.

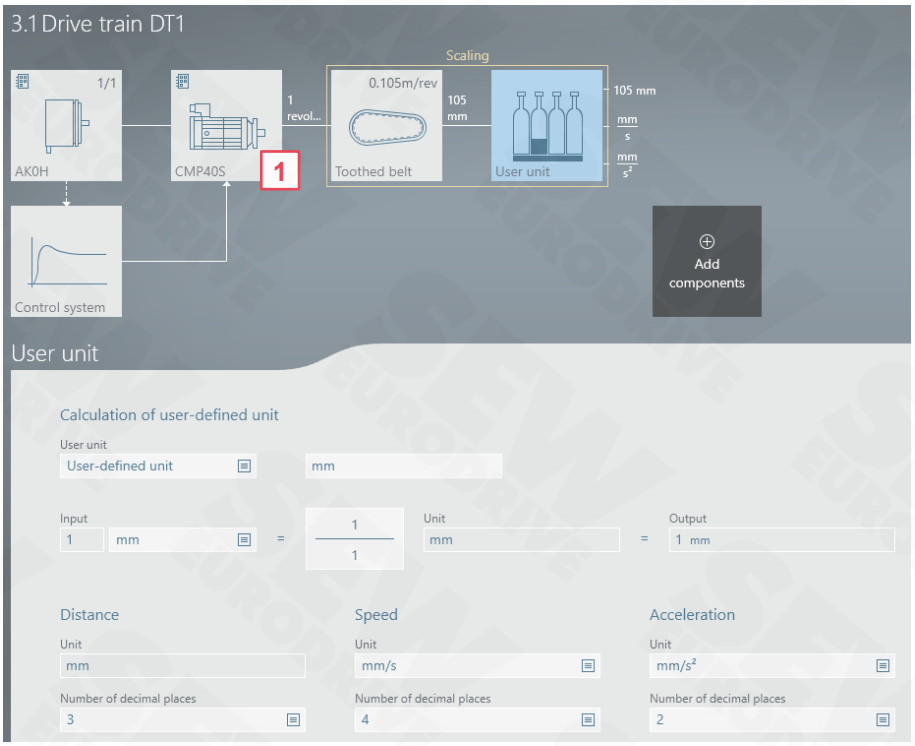
1.2.4 Configuration drive train 1-3

1. Toothed belt



1 Configure the **toothed belt** as shown in the picture.

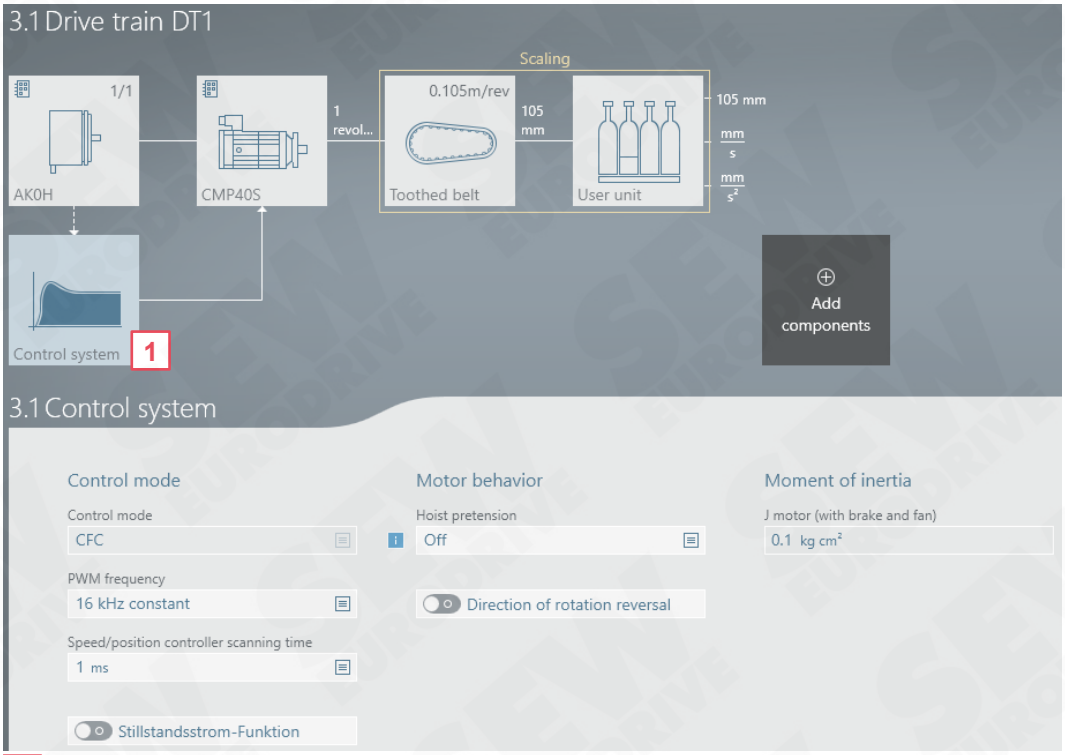
2. User unit



1 Define **user unit** as shown in the picture.

When using the MOVIKIT® MultiAxisController the time base of the user unit has to be “second”. The user unit itself can be anything (e.g. eggs, bottles, …) but the time base for velocity has to be second and per square second for acceleration. Otherwise, the control loop of the MultiAxisController won’t work as expected.

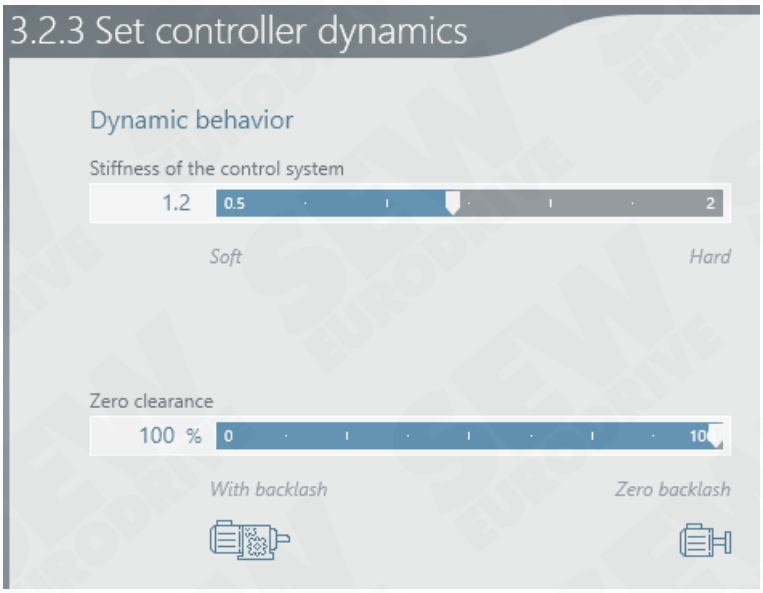
3. Control system



1 Define **control system** as shown in the picture.

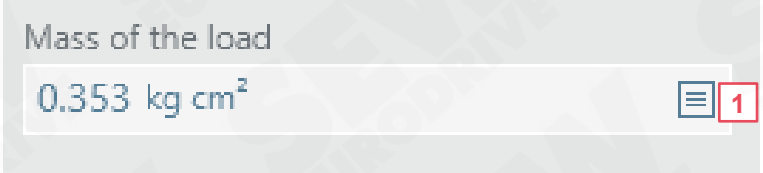
1.2.5 Optimization drive train 1

1. Set controller dynamics



1 For the exercises described in this workbook the dynamic of the velocity controller has to be as high as possible without getting an instable condition.

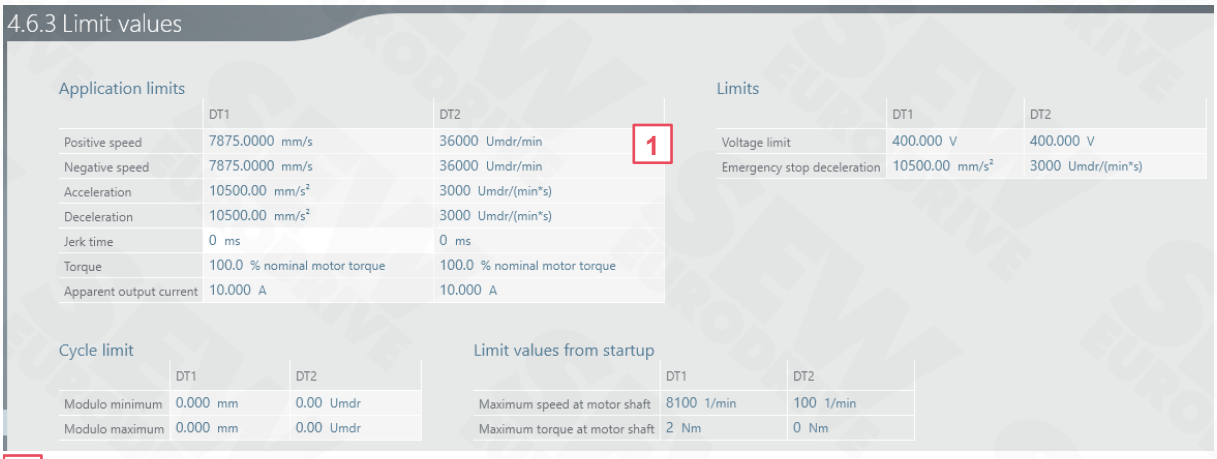
2. Load inertia



1 Parameterizing the **load moment of inertia**.

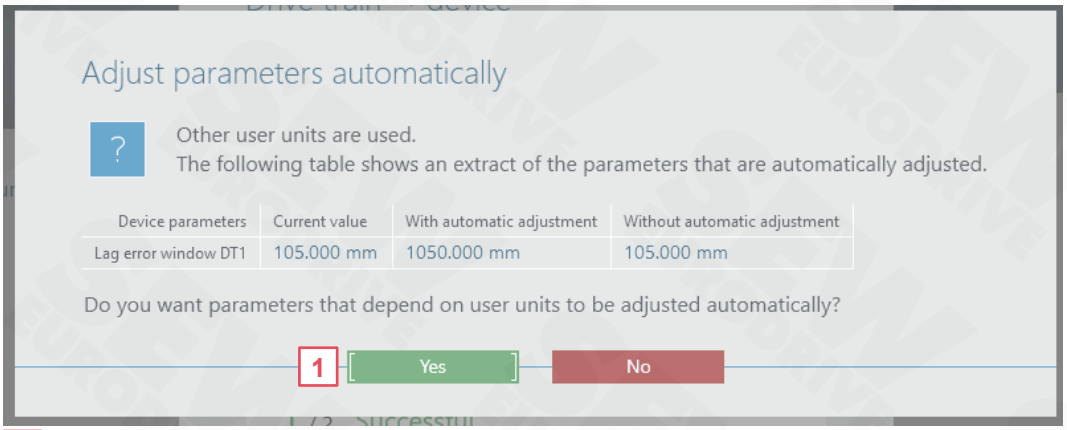
1.2.6 Configuration monitoring functions

1. Set Limit values



1 Set **limit values** as shown in the picture.

Based on the limit values of the first axis group member all suggested values of the MultiAxisController are calculated. If the limit values are wrong, the MultiAxisController won't work as expected.

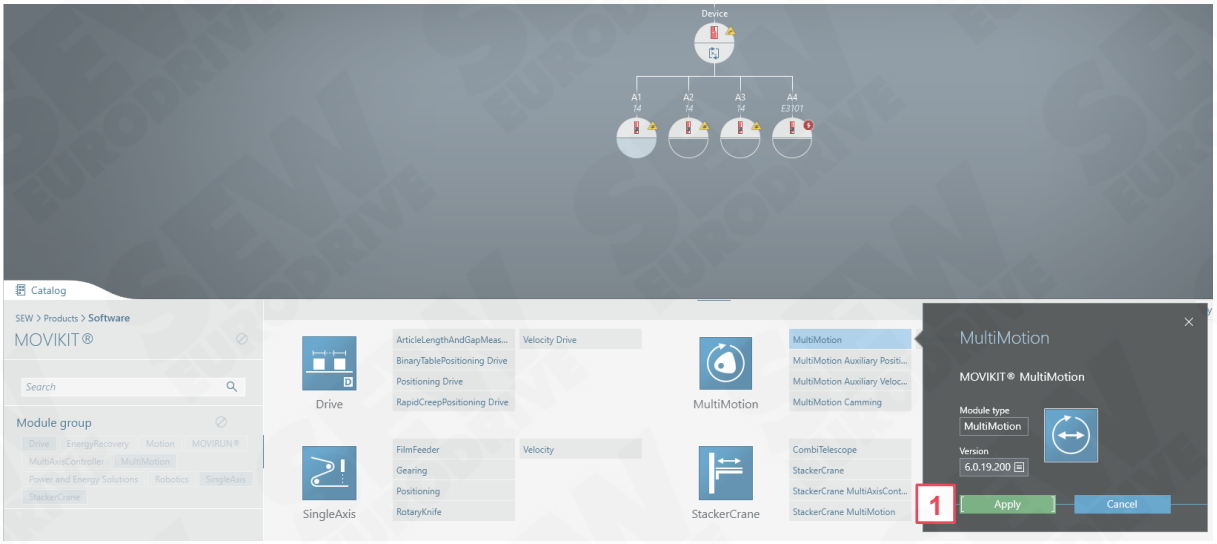


1 If you set up the limit values before integrating the toothed belt and the user unit, the MOVISUITE® offers the possibility to adjust the parameters automatically to the new user unit like the picture shows as example. So you don't have to calculate the limit values in user unit by hand.

1.3 Parametrize MOVIKIT® MultiMotion

1.3.1 Add MOVIKIT® MultiMotion

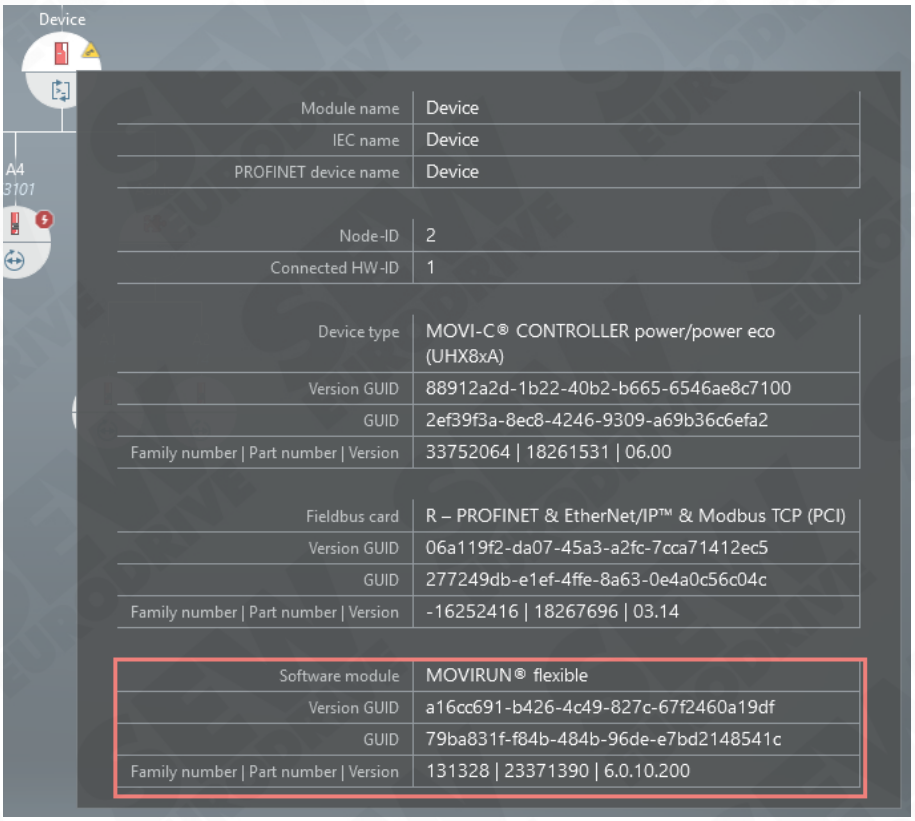
1. Add MOVIKIT® MultiMotion to each axis



1 Left click (double click) on the bottom part of each axis, choose from the catalog the software module MultiMotion in the version 6.0.19.200 (version of MOVISUITE 2.20), and apply it.

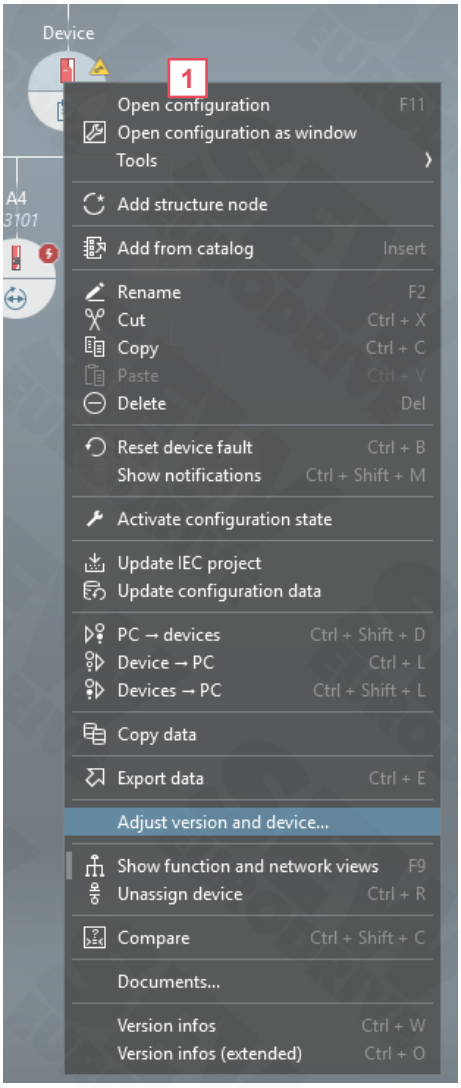
1.3.2 Check MOVIRUN® flexible version

1. Check MOVIRUN® flexible version



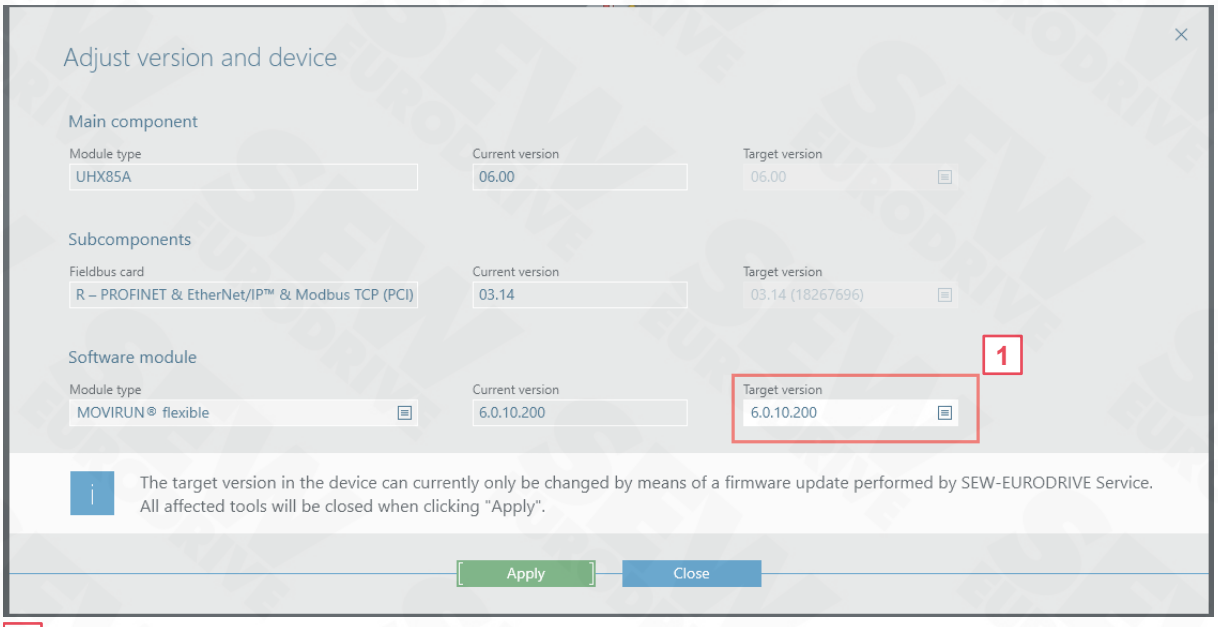
1 That the versions of each software module fits together control the version of the MOVIRUN® flexible of your controller. Therefore, have a look at the tooltip of the controller as the following picture shows. The version should be 6.0.10.200.

2. Open Context menü



1 If your controller has another version of the MOVIRUN® flexible, open the context menu of the controller per right click on the bottom part and choose **Adjust version and device…**.

3. Adjust version and device



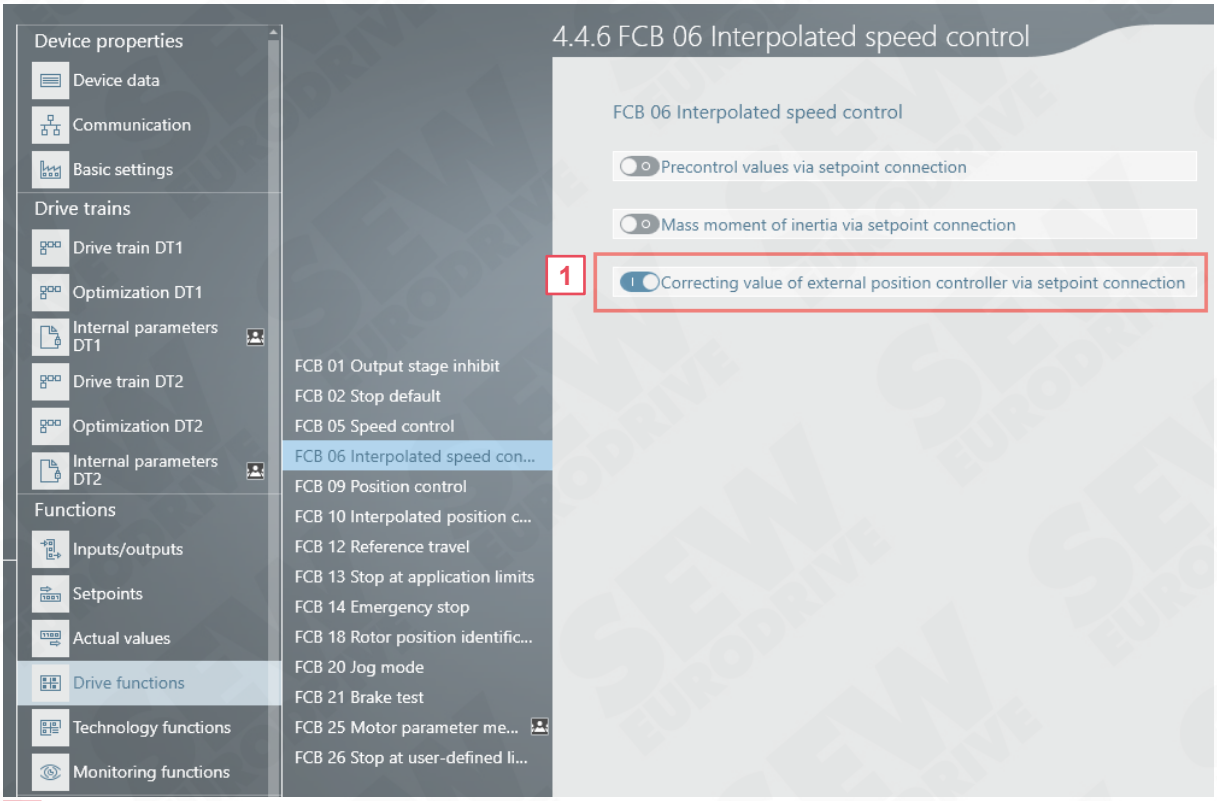
1 Change the **target version** of your MOVIRUN® flexible.

1.4 Important parameters

1.4.1 Drive functions > FCB06

That the manipulated values of the MOVIKIT® MultiAxisController has an effect the following parameter has to be set in the inverter. Normally this parameter will be set by default to TRUE when MOVIKIT® MultiMotion is inserted but if the lag error won't be compensated it's worth a try to take a look at this parameter if it's correct.

1. Set FCB06 Interpolated speed control



1 Set the **switches** as shown in the picture.

1.4.2 Actual values > Encoder 2 bits

The following two bits has to be set in the status word 1 & 2 when using an external encoder. Normally these two parameters are set when the IEC project was started for the first time. However, if you got any problems according the referenced bit or that the application won't stop after an encoder 2 error you could take a look at this two parameters.

1. Check Encoder 2 referenced

2. Check Encoder 2 / Encoder status / error

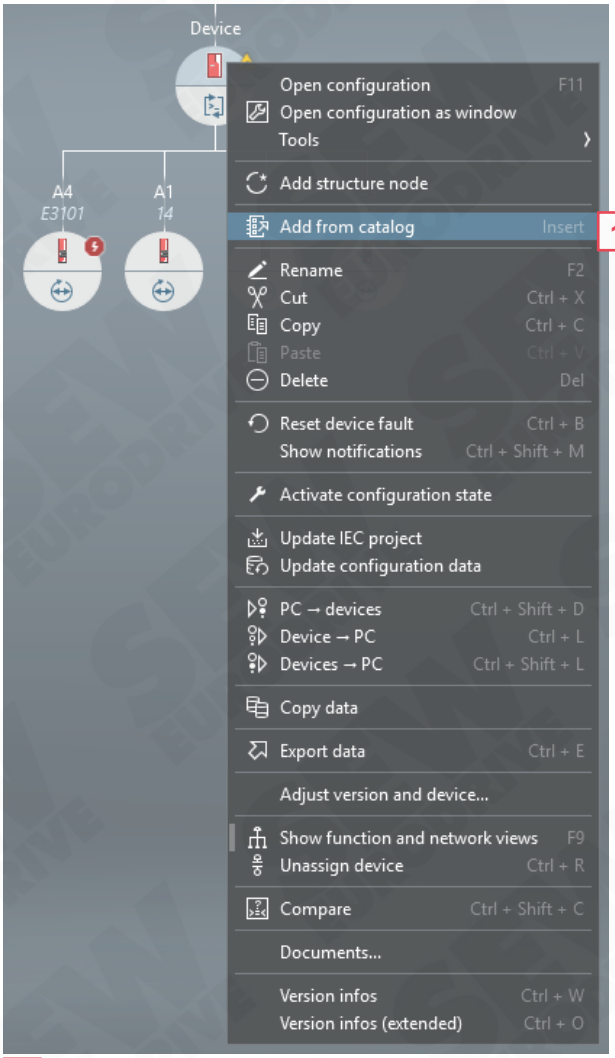
2 Exercise 1: Torque priority

In this tutorial you'll learn the following functions:

- Integrating a SoftwareNode in your MOVISUITE project
- Configure the MultiAxisController in Torque priority
- Functionality of the MultiAxisController in Torque priority
- Moving the MultiAxisController per IEC-Editor

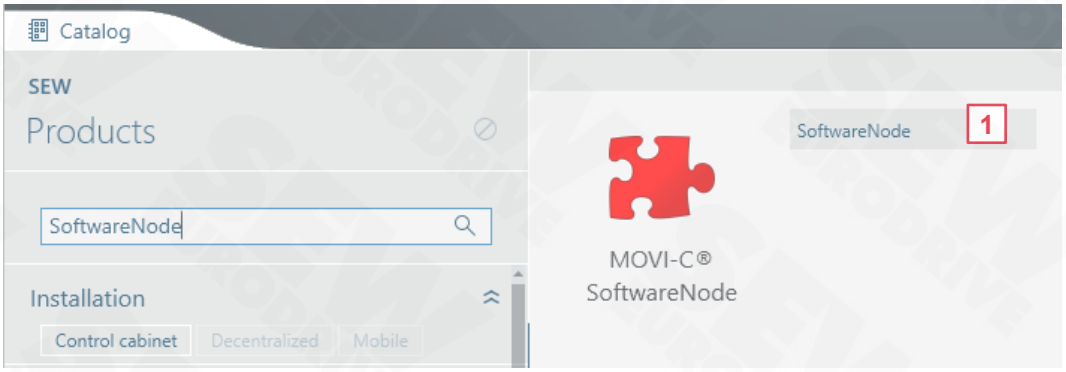
2.1 Add SoftwareNode and MOVIKIT® MultiAxisController

1. Add from catalog



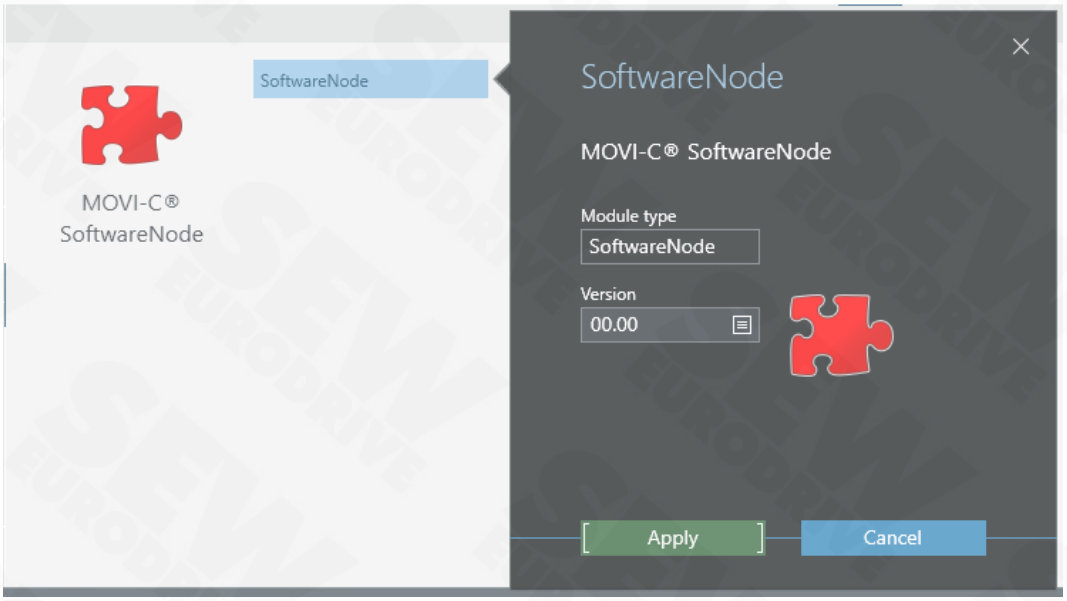
1 Right click on the controller and choose the option **Add from catalog** of the context menu.

2. Select SoftwareNode



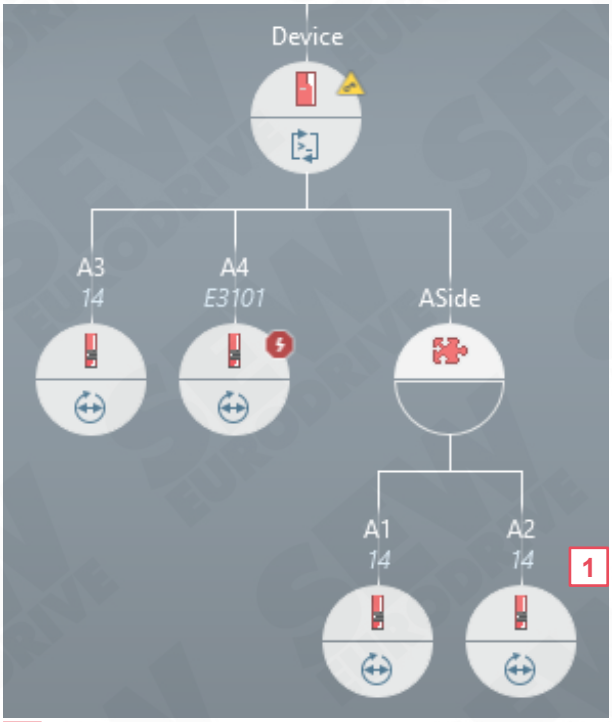
1 Choose the product **SoftwareNode** in the catalog. To find it in the catalog you can use the filter on the left side.

3. Apply SoftwareNode



1 Apply the SoftwareNode in the version 00.00

4. Arrange axes



1 Drag and Drop the axes 1 and 2 (named “A1” and “A2”) under the SoftwareNode named “ASide”.

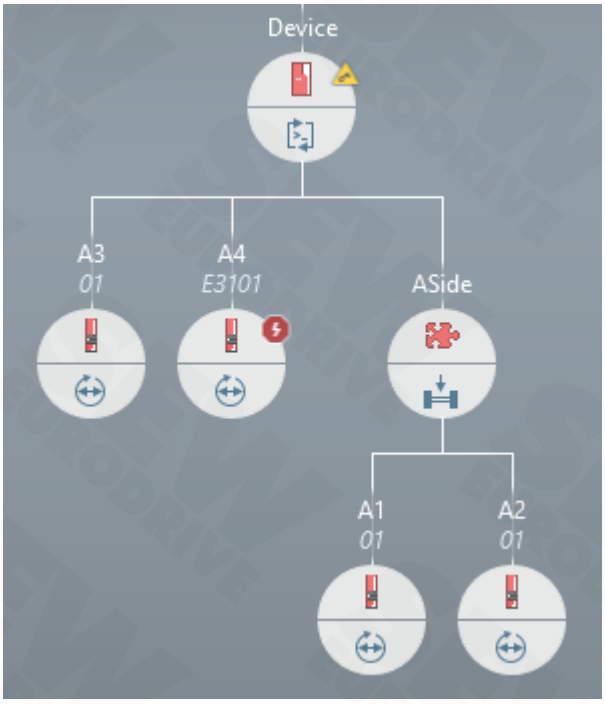
5. Insert the software module MOVIKIT® MultiAxisController to SoftwareNode

1 Left click (double click) on the bottom part of the SoftwareNode.

2 Then the catalog will open and you can choose the MultiAxisController in the version 6.0.17.200 (this is the version of MOVISUITE 2.20).

3 Apply the software version

6. The project should look like the following picture



2.2 Configure the MultiAxisController

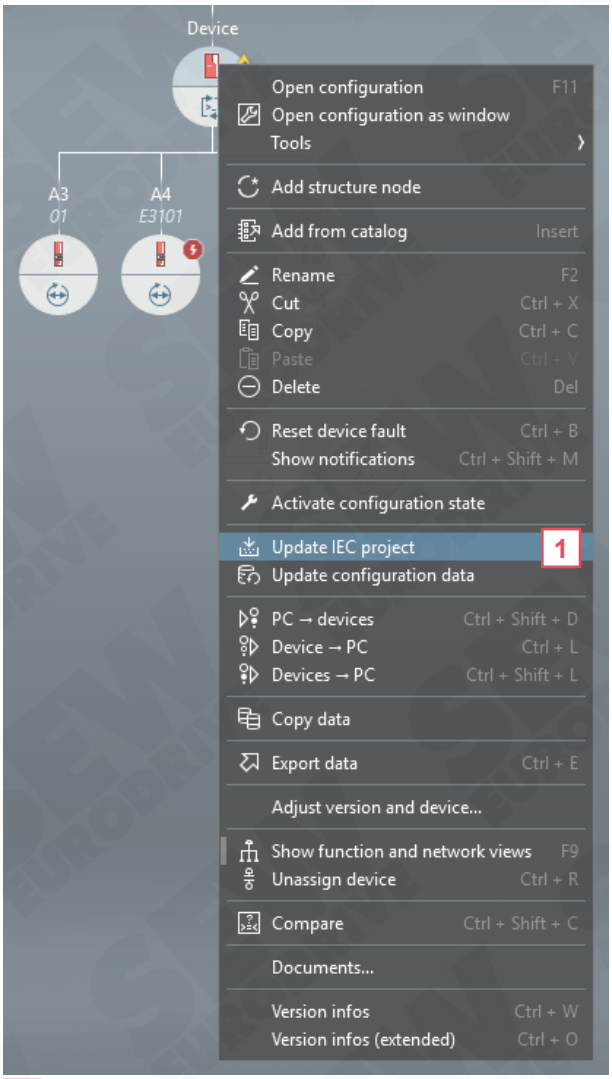
1. Parameterize Basic settings

Mostly every parameter will be set per default correctly.

1 Only the external encoder for axis 1 and axis 2 have to be disabled in the configuration section **Take account of external encoders**

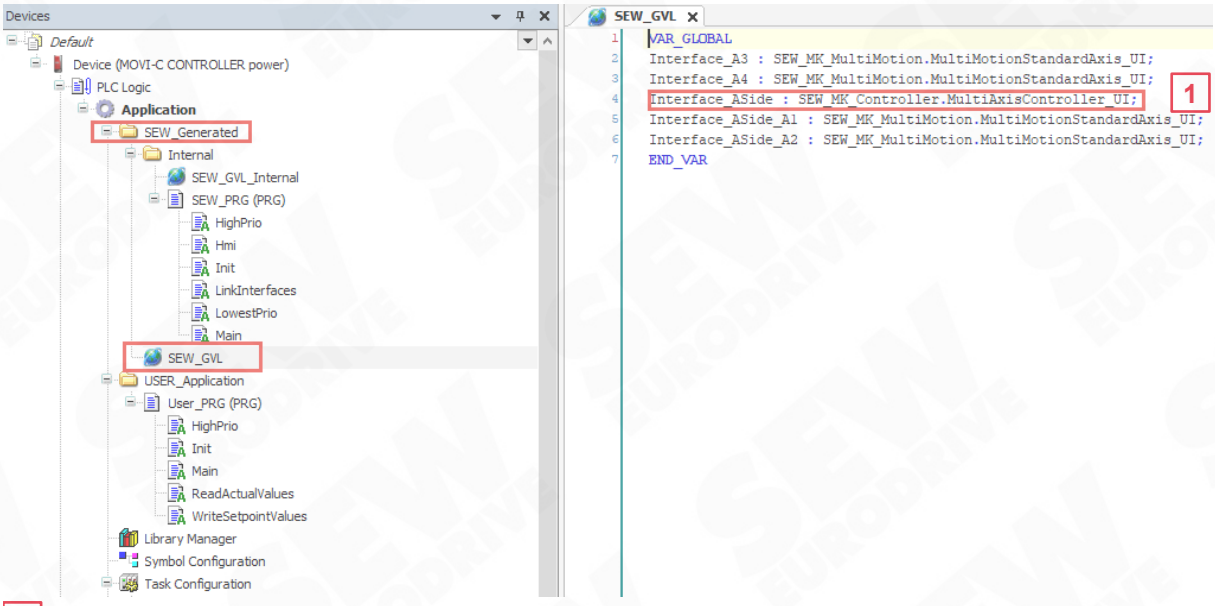
2.3 Generate IEC project

1. Generate the IEC project



1 For example per right click on the controller and then choose **Update IEC project**.

2. Control SEW_GVL



1 To control if everything went fine take a look in the “SEW_GVL” in the folder “SEW_Generated”. There should be an instance of the MultiAxisController_UI named “Interface_ASide”.

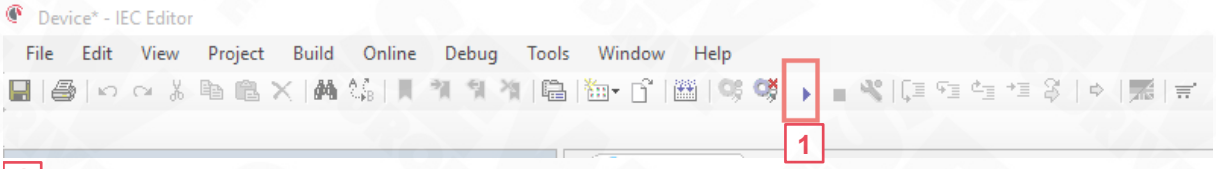
2.4 Exercise 1.1: Torque between

In this exercise, you'll get in contact with the functionality "torque between" of the MultiAxisController. With this function, you're able to change the tension of a belt or to reduce the backlash of a gear to do a better positioning.

1. LogIn

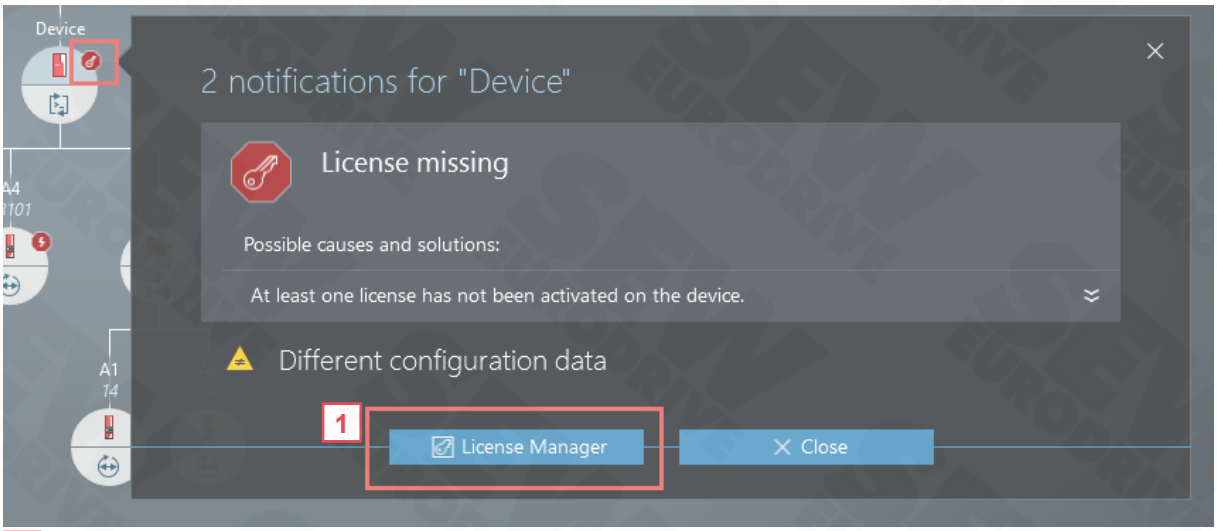
1 Click the button **Login**

2. Start application



1 Click the button **Start**

3. Open License Manager



1 Switch back to MOVISUITE® and click on the key icon of the controller and choose **License Manager**.

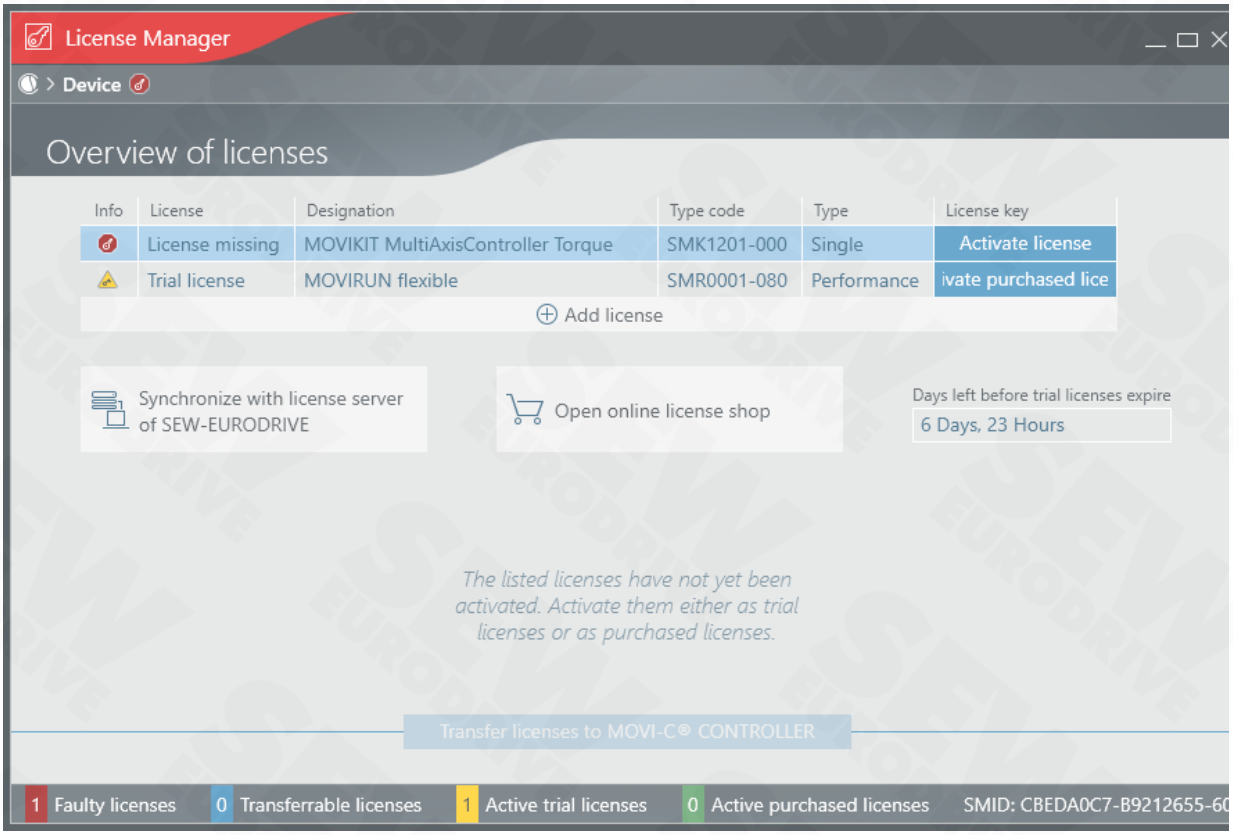
4. Activate and transfer licenses to MOVI-C® CONTROLLER

1 Click on the button **Activate license**

2 Choose **Activate trial license**

3 Click on the button **Transfer licenses to MOVI-C® CONTROLLER**

5. **Wait ca. 1 minute and the missing license of the MultiAxisController Torque should be shown in the license manager. Activate this license like the MOVIRUN® license in the step before.**



6. Optional step

SEW_GVL

Device.Application.SEW_GVL

Expression	Type	Value	Prepared value
Interface_A3	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_A4	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_ASide	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	TRUE	
xWarning	BOOL	FALSE	
udiMessageID	UDINT	25666	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIRUN flexible : is missing'	
xReset	BOOL	FALSE	TRUE 1
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
Inverter	SEW_IAx.ST_Inverter		
Brake	SEW_IAx.ST_Brake		
EnergySaving	SEW_IAx.ST_EnergySaving2		
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#01961CF8	
xAutomaticErrorReaction	BOOL	TRUE	
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL		
ProfileGeneration	ProfileGeneration_UI		
Controller	SEW_Ctrlr.ControllerAG_UI		
LimitSwitchEvaluation	SEW_LSEval.LimitSwitchEvaluation_UI		
Interface_ASide_A1	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_ASide_A2	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		

1 Reset error “MOVIRUN flexible is missing” by setting the “xReset” of the “Interface_ASide” in the “SEW_GVL”.

7. Enable Axes (A1 + A2)

SEW_GVL

Device.Application.SEW_GVL

Expression	Type	Value	Prepared value
Interface_A3	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_A4	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_ASide	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	FALSE	
xWarning	BOOL	FALSE	
udiMessageID	UDINT	0	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	''	
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
In	ST_Basic_In		
xEnable_EmergencyStop	BOOL	FALSE	TRUE 1
xEnable_ApplicationStop	BOOL	FALSE	TRUE
Out	ST_Basic_Out		
Inverter	SEW_IAx.ST_Inverter		

1 Setting the enable signals in the user interface of the MultiAxisController (“Interface_ASide”).

8. Set “Torque between” in the config structure in the controller section of the user interface.

SEW_GVL

Device.Application.SEW_GVL

Expression	Type	Value	Prepared value
Interface_A3	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_A4	SEW_MK_MultiMotion.MultiMotionStandardAxis_UI		
Interface_ASide	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	FALSE	
xWarning	BOOL	FALSE	
udiMessageID	UDINT	0	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	''	
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
In	ST_Basic_In		
xEnable_EmergencyStop	BOOL	TRUE	
xEnable_ApplicationStop	BOOL	TRUE	
Out	ST_Basic_Out		
Inverter	SEW_IAx.ST_Inverter		
Brake	SEW_IAx.ST_Brake		
EnergySaving	SEW_IAx.ST_EnergySaving2		
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#01961CF8	
xAutomaticErrorReaction	BOOL	TRUE	
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL		
ProfileGeneration	ProfileGeneration_UI		
Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
uiAssociatedAGMembers	UINT	3	
EnableExternalEncoder	ST_EnableExtEncoder		
EnableMotorEncoder	ST_EnableMotorEncoder		
SkewOffsetToMean	ST_SkewOffsetToMean		
TorqueRelation	ST_TorqueRelation		
TorqueBetween	ST_TorqueBetween		
lrAGMember1_2	LREAL	0	0.5 1
lrAGMember2_3	LREAL	0	
lrAGMember3_4	LREAL	0	
lrAGMember4_1	LREAL	0	
MAC	MAC_UI		

1 In this example, the value is set to 0.5, which means 50% of the nominal torque of the motor.

9. Create a watchlist and integrate the following lines by Copy and Paste

Device.Application.SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque
Device.Application.SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque

Watch 1

Expression	Application	Type	Value
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	0.252 1
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	-0.248

1 The actual torque in the watch list will show a positive torque for the first axis and a negative one for the second axis. The difference between these two axes will be the configured 0.5.

In this example, each axis offers halve the value that is configured, but depending on the application it doesn’t have to be like this. The MultiAxisController only controls the difference between the two axes that this torque difference is as high as the configured value. Therefore, the actual torque of axis 1 could also be 0.1 and the torque of axis 2 -0.4. Then the difference between those two axes would also be 0.5 and is correct as well.

10. Change the “tension between” to a negative value

TorqueBetween	ST_TorqueBetween			
lrAGMember1_2	LREAL	0.5	-0.5	1
lrAGMember2_3	LREAL	0		
lrAGMember3_4	LREAL	0		
lrAGMember4_1	LREAL	0		

Watch 1

Expression	Application	Type	Value	
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	-0.249	2
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	0.249	

1 Enter the negative value.

2 This also changes the actual torque of each axis in the other direction (to another sign).

2.5 Exercise 1.2: Torque relation

In this exercise, you'll get in contact with the functionality "torque relation" of the MultiAxisController. With this function, you're able to change the load distribution of the two axes. This is needed when using a trolley to give more torque to the front or rear wheel when accelerating/decelerating.

1. Optional step:

Set the torque between to 0 if you've made the exercise: Torque between above!

2. Enable axes per setting the enable signals in the user interface of the MultiAxisController like in the exercise "Torque between" shown.

3. Move the MultiAxisController per profile generation for example in the mode velocity.

SEW_GVL

Device.Application.SEW_GVL

Expression	Type	Value
Interface_ASide	SEW_MK_Controller.MultiAxisController_UI	
xError	BOOL	FALSE
xWarning	BOOL	TRUE
udiMessageID	UDINT	91208
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIRUN flexible:...
xReset	BOOL	FALSE
xGetAccessControl	BOOL	TRUE
xControlActive	BOOL	TRUE
xInitDone	BOOL	TRUE
Basic	SEW_IAx.ST_Basic	
In	ST_Basic_In	
xEnable_EmergencyStop	BOOL	TRUE
xEnable_ApplicationStop	BOOL	TRUE
Out	ST_Basic_Out	
lrActualPosition	LREAL	136255.584
lrActualVelocity	LREAL	1002.60895
xStandstill	BOOL	FALSE
Inverter	SEW_IAx.ST_Inverter	
Brake	SEW_IAx.ST_Brake	
EnergySaving	SEW_IAx.ST_EnergySaving2	
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#01961CF8
xAutomaticErrorReaction	BOOL	TRUE
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL	
ProfileGeneration	ProfileGeneration_UI	
In	SEW_IInterpolModes.ST_ProfileGeneration_In2	
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2	
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out	
Velocity	SEW_UIInterpolModes.ModeVelocity_UI	
In	SEW_IInterpolModes.ST_Velocity_In	
xActivate	BOOL	TRUE
xStart	BOOL	TRUE
lrVelocity	LREAL	1000
lrAcceleration	LREAL	1000
lrDeceleration	LREAL	1000
lrJerk	LREAL	0
xRapidStop	BOOL	FALSE
lrRapidStopDeceleration	LREAL	0
Config	SEW_IInterpolModes.ST_Velocity_Config	
Out	SEW_IInterpolModes.ST_Velocity_Out	
Positioning	SEW_UIInterpolModes.ModePositioning_UI	

4. Take a look at the same watch list like in the exercise above

Watch 1

Expression	Application	Type	Value
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	0.073
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	0.07

1

1 You will see that the torque of both axes is nearly the same.

In this example the torque can oscillate quite high because of the cogging and the small load.

5. Change the torque relation

Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
uiAssociatedAGMembers	UINT	3	
EnableExternalEncoder	ST_EnableExtEncoder		
EnableMotorEncoder	ST_EnableMotorEncoder		
SkewOffsetToMean	ST_SkewOffsetToMean		
TorqueRelation	ST_TorqueRelation		
lrAGMember1	LREAL	1	10
lrAGMember2	LREAL	1	
lrAGMember3	LREAL	1	
lrAGMember4	LREAL	1	
TorqueBetween	ST_TorqueBetween		
MAC	MAC_UI		

1

1 Change the torque relation for example to 10 : 1

Watch 1

Expression	Application	Type	Value
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	0.106
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	0.007

2

2 Axis 1 generates 10 times more torque than axis 2

The torque relation is independent of the sign of the value:

Controller	SEW_Ctrlr.ControllerAG_UI	
Config	SEW_ICtrlr.ST_AGConfig_UI4	
uiAssociatedAGMembers	UINT	3
EnableExternalEncoder	ST_EnableExtEncoder	
EnableMotorEncoder	ST_EnableMotorEncoder	
SkewOffsetToMean	ST_SkewOffsetToMean	
TorqueRelation	ST_TorqueRelation	
lrAGMember1	LREAL	-10
lrAGMember2	LREAL	1
lrAGMember3	LREAL	1
lrAGMember4	LREAL	1
TorqueBetween	ST_TorqueBetween	
MAC	MAC_UI	

Watch 1

Expression	Application	Type	Value
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	0.106
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	0.007

It’s possible to set one value to 0. In this example only axis 2 is responsible for the movement because the value of axis 1 is set to 0.

Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
uiAssociatedAGMembers	UINT	3	
EnableExternalEncoder	ST_EnableExtEncoder		
EnableMotorEncoder	ST_EnableMotorEncoder		
SkewOffsetToMean	ST_SkewOffsetToMean		
TorqueRelation	ST_TorqueRelation		
lrAGMember1	LREAL	-10	0
lrAGMember2	LREAL	1	
lrAGMember3	LREAL	1	
lrAGMember4	LREAL	1	
TorqueBetween	ST_TorqueBetween		
MAC	MAC_UI		

Watch 1

Expression	Application	Type	Value
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[1].lrTorque	Device.Application	LREAL	0.005
SEW_GVL.Interface_ASide.Controller.ActualValues.FromSubAxis[2].lrTorque	Device.Application	LREAL	0.135

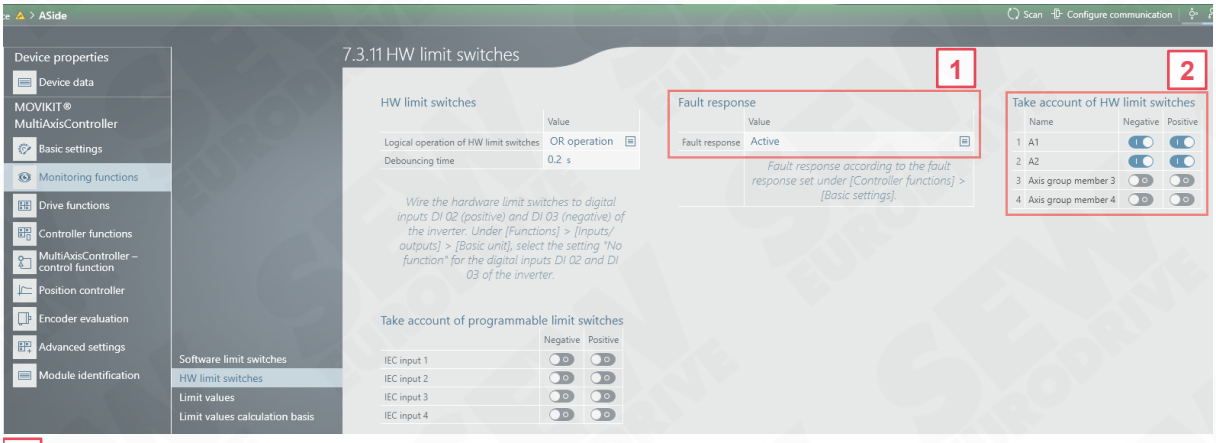
3 Exercise 2: Limit switch evaluation

In this exercise you'll get in contact with the following functions:

- Error management of the IEC
- Behavior of the MultiAxisController when a limit switch is hit

3.1 Configuration

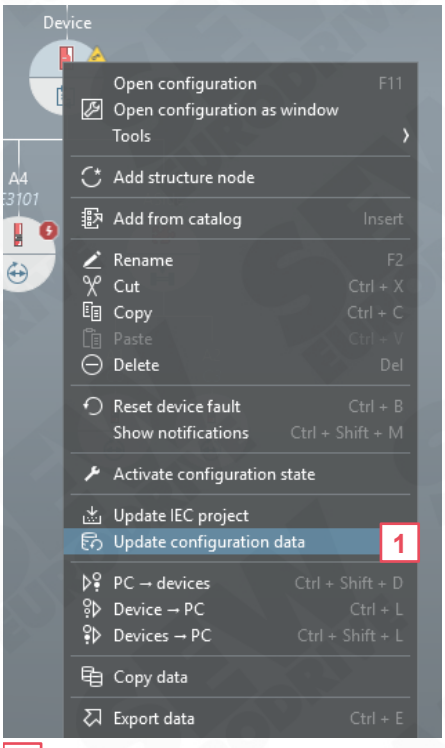
1. Configure the limit switches



1 Configure the limit switches by setting the **fault response= active** in Monitoring functions > HW limit switches, otherwise the limit switches will only be used for referencing.

2 Choose the **HW limit switches** of each axis in positive and negative direction.

2. Update configuration data



1 Right click on the controller to open the context menu and select **Update configuration data**.

3.2 Exercise

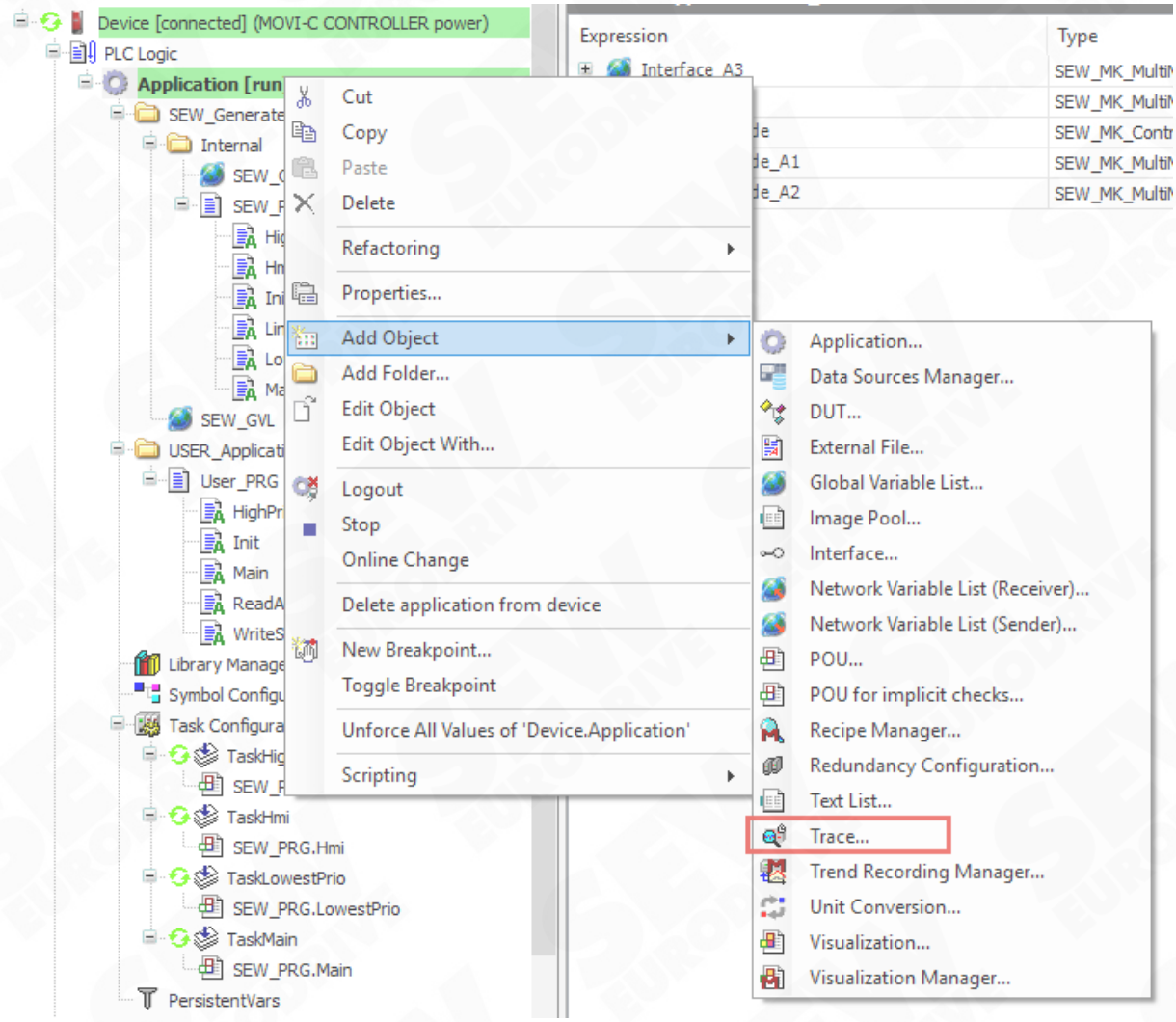
1. **Set the digital input DI02 and DI03 of axis 1 and 2 and reset the error in the IEC of “Interface_ASide” if necessary.**
2. **Move in mode velocity by setting the signals start, activate, velocity, acceleration and deceleration.**

SEW_GVL

Device.Application.SEW_GVL

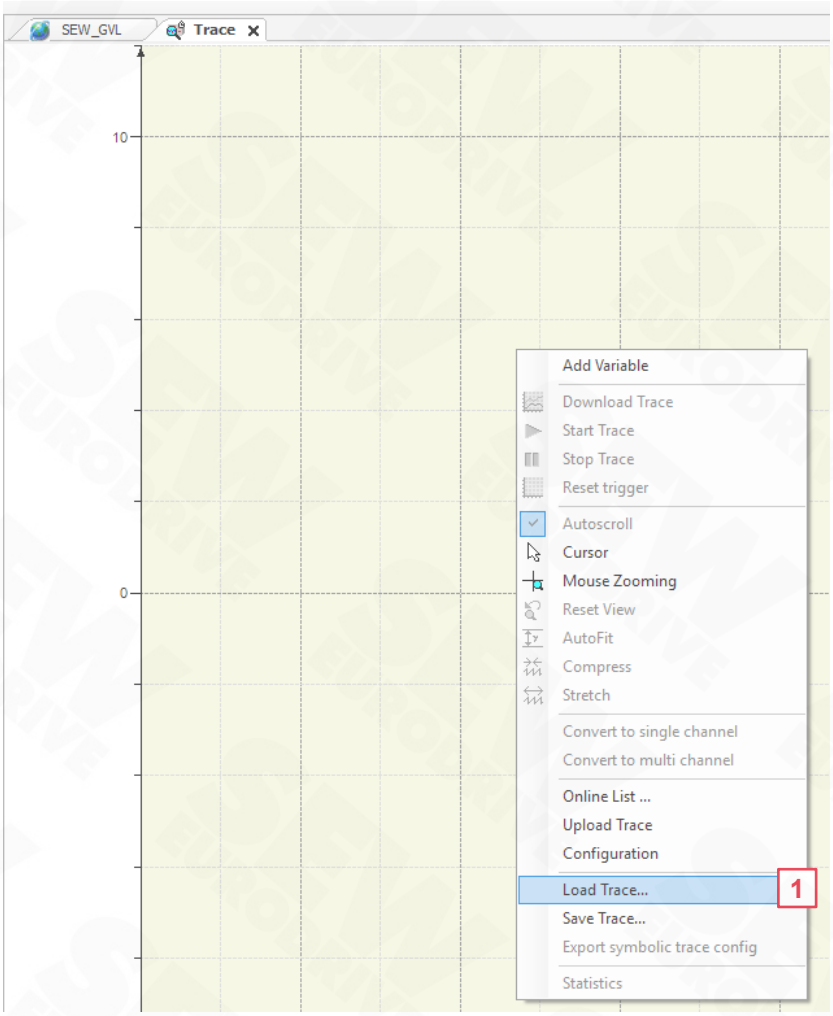
Expression	Type	Value
Interface_ASide	SEW_MK_Controller.MultiAxisController_UI	
xError	BOOL	FALSE
xWarning	BOOL	TRUE
udiMessageID	UDINT	91208
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIRUN flexible:...
xReset	BOOL	FALSE
xGetAccessControl	BOOL	TRUE
xControlActive	BOOL	TRUE
xInitDone	BOOL	TRUE
Basic	SEW_IAx.ST_Basic	
In	ST_Basic_In	
xEnable_EmergencyStop	BOOL	TRUE
xEnable_ApplicationStop	BOOL	TRUE
Out	ST_Basic_Out	
lrActualPosition	LREAL	136255.584
lrActualVelocity	LREAL	1002.60895
xStandstill	BOOL	FALSE
Inverter	SEW_IAx.ST_Inverter	
Brake	SEW_IAx.ST_Brake	
EnergySaving	SEW_IAx.ST_EnergySaving2	
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#01961CF8
xAutomaticErrorReaction	BOOL	TRUE
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL	
ProfileGeneration	ProfileGeneration_UI	
In	SEW_IInterpolModes.ST_ProfileGeneration_In2	
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2	
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out	
Velocity	SEW_UIInterpolModes.ModeVelocity_UI	
In	SEW_IInterpolModes.ST_Velocity_In	
xActivate	BOOL	TRUE
xStart	BOOL	TRUE
lrVelocity	LREAL	1000
lrAcceleration	LREAL	1000
lrDeceleration	LREAL	1000
lrJerk	LREAL	0
xRapidStop	BOOL	FALSE
lrRapidStopDeceleration	LREAL	0
Config	SEW_IInterpolModes.ST_Velocity_Config	
Out	SEW_IInterpolModes.ST_Velocity_Out	
Positioning	SEW_UIInterpolModes.ModePositioning_UI	

3. Add a trace



1 Right click on the application in your IEC project and choose **Add Object** > **Trace**.

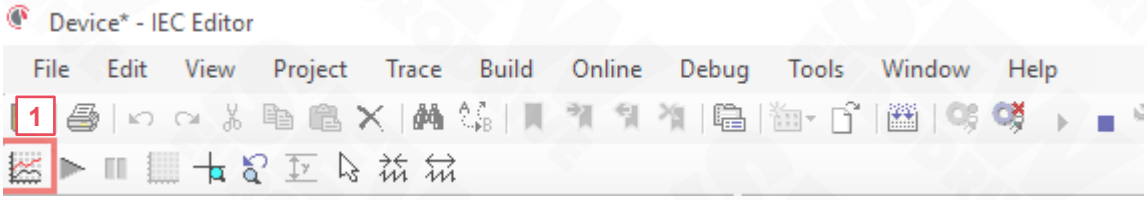
4. Load trace example



1 Right click in your trace and choose **Load Trace** and select the file **LimitSwitch.trace**

Link to the Trace-templates for download.

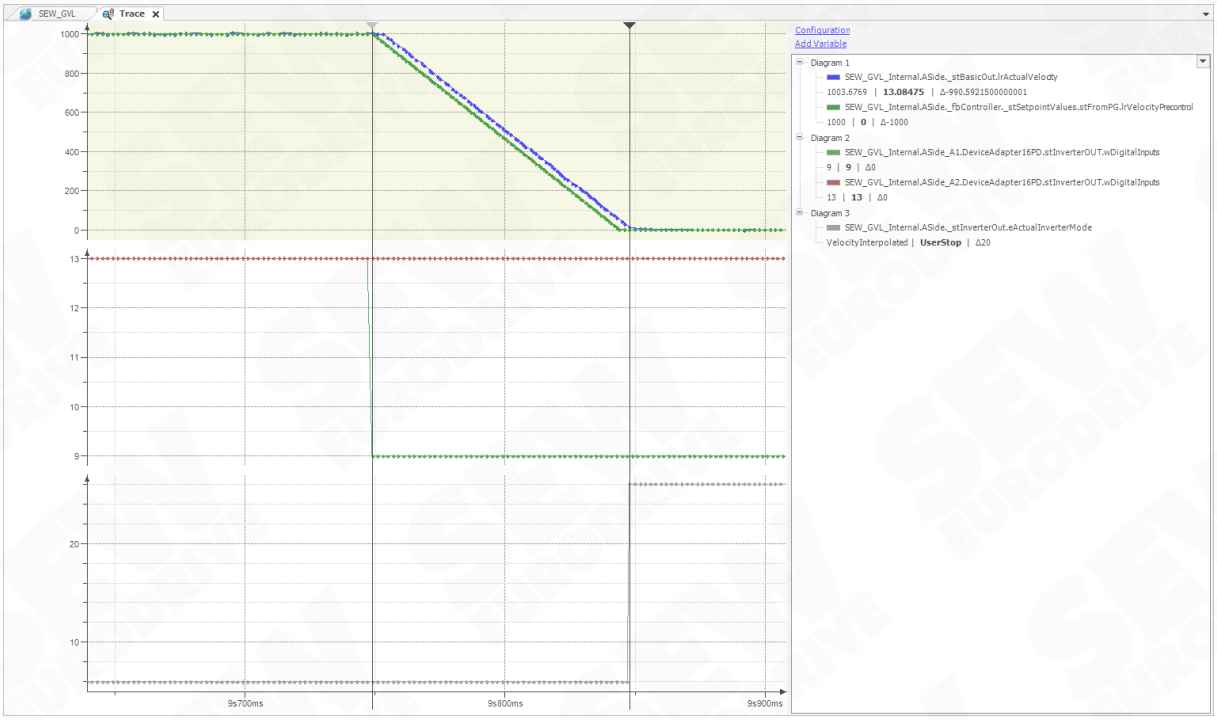
5. Start the trace



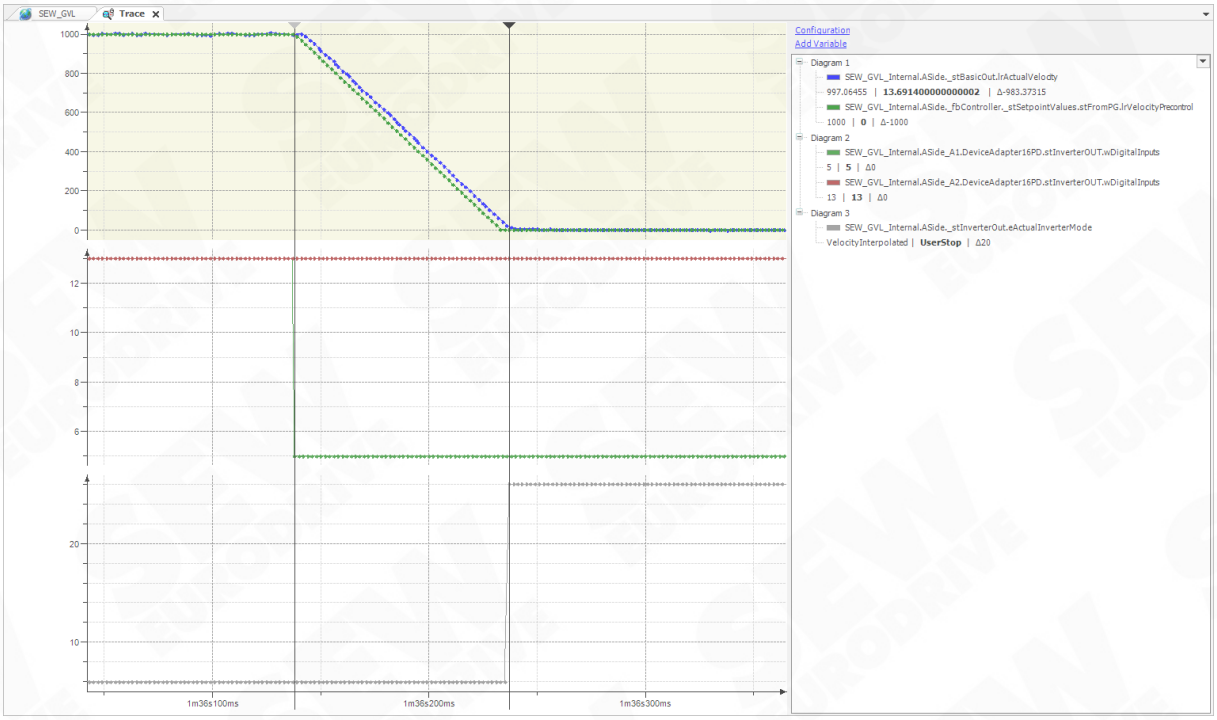
1 Start the trace per downloading it to the controller

6. **Simulate the hit of the positive limit switch by switching off the DI02 and take a look at the trace. When switching off the DI02 both axes ramp down in the inverter mode “velocity interpolated” with the emergency stop ramp. After that, both axes are set to FCB 26 (UserStop)**

To ramp down in the inverter mode “velocity interpolated” offers the possibility to balance both axes. If you’re using the inverter function for hardware limit switches this feature can’t be used.



7. **Reset the error of the “Interface_ASide” and start the Trace again. This time switch off the DI03 and have a look at the trace again. You’ll see that it’s the same behavior like before.**

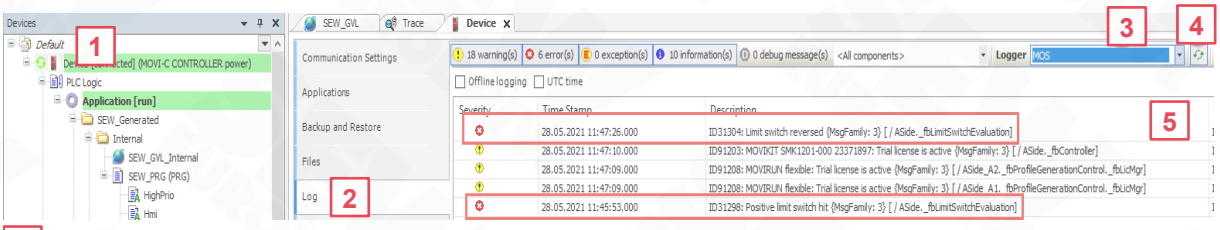


8. **Look at the “Interface_ASide” and you’ll see that we get an error “Limit switch reversed” because of the fact that we moved in positive direction and with DI03 the negative limit switch was hit.**

Interface_ASide	SEW_MK_Controller.MultiAxisController_UI	
xError	BOOL	TRUE
xWarning	BOOL	FALSE
udiMessageID	UDINT	31304
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'Limit switch reversed'
xReset	BOOL	FALSE
xGetAccessControl	BOOL	TRUE
xControlActive	BOOL	TRUE
xInitDone	BOOL	TRUE
Basic	SEW_IAx.ST_Basic	
In	ST_Basic_In	
xEnable_EmergencyStop	BOOL	TRUE
xEnable_ApplicationStop	BOOL	TRUE

3.3 Logging

The controller logs every error in the IEC.



1 To have a look in the log open the controller in the IEC editor.

2 In this controller section is a submenu “Log”.

3 In their select as Logger “MOS” in the upper right corner.

4 Left click nearby at the actualize button.

5 Afterwards you will see every warning and error that occurred since the last power on of the controller. In our example the error “Limit switch reversed” and “Positive limit switch hit” is shown according to the exercises in the chapter 3.2.

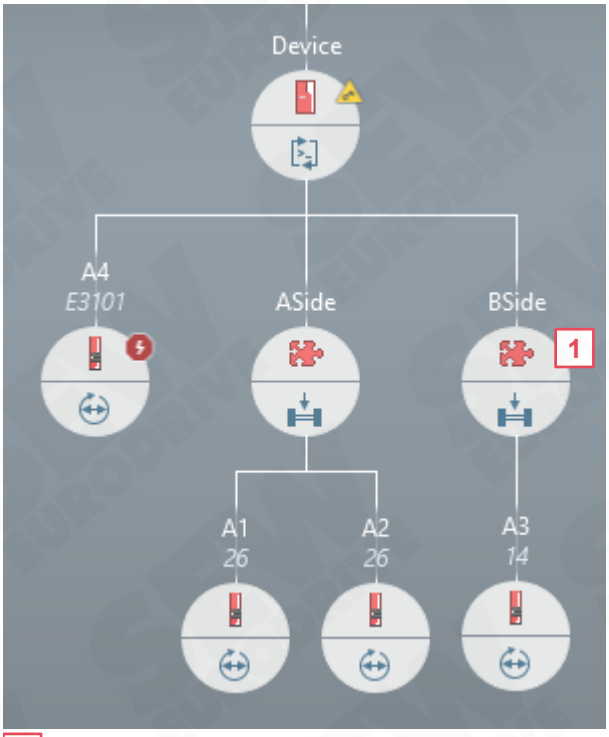
4 Exercise 3: External encoder

In this exercise you'll get in contact with the following functions:

- Advantage of the combined encoder evaluation

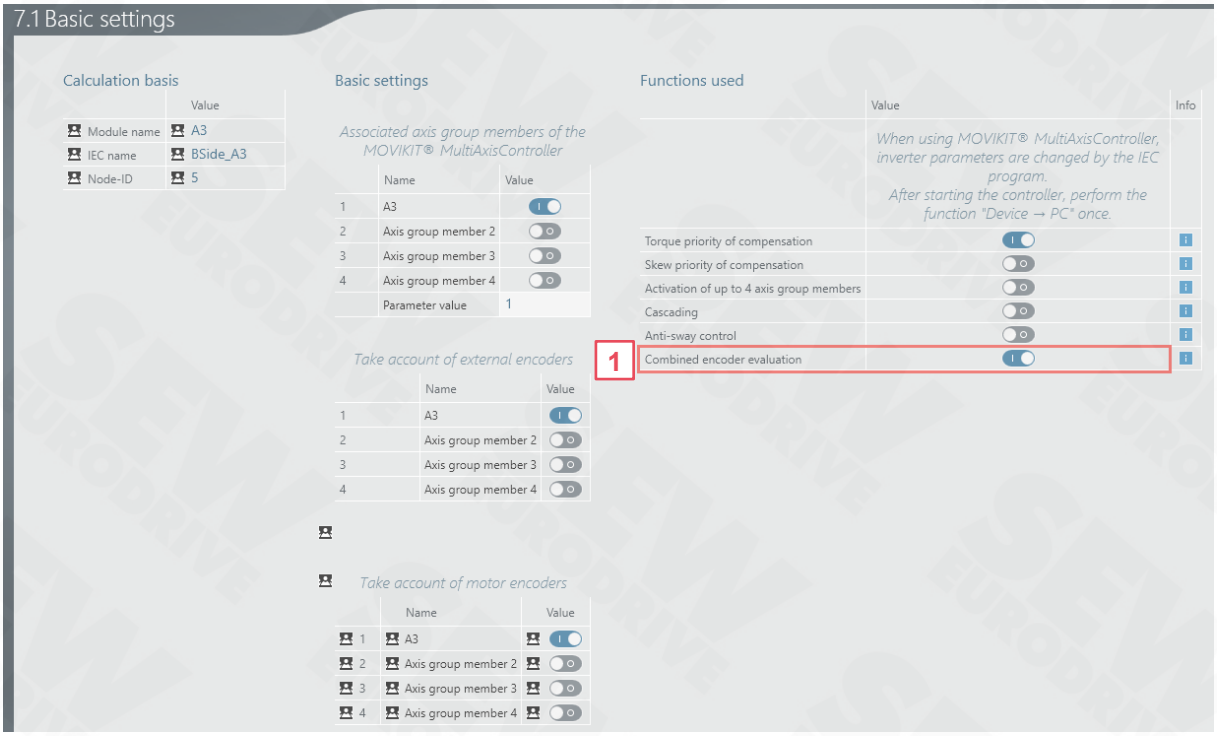
4.1 Configuration

1. Insert a second software node



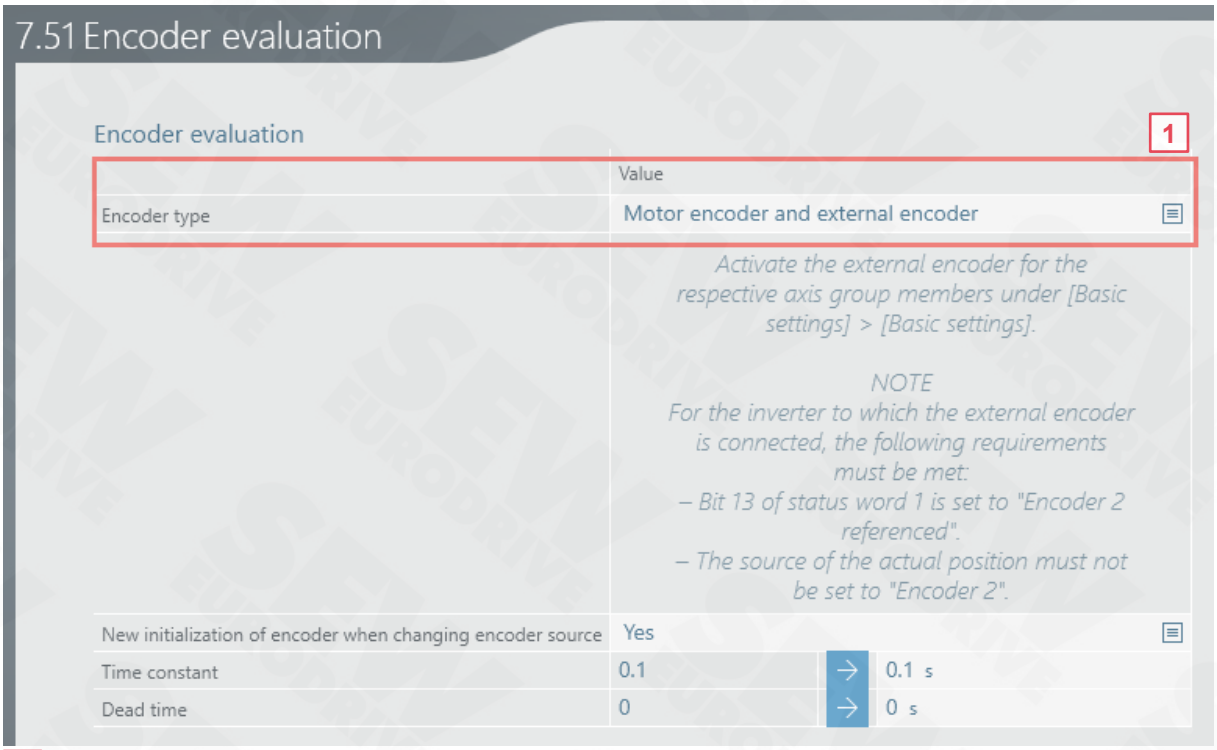
1 Insert a second software node with the software module MultiAxisController, like in the exercise 1 shown and put the third axis under this node. The project structure should look like this

2. Activate the function “Combined encoder evaluation”.



1 Activate the function “**Combined encoder evaluation**” in the “BSide” of the parameter side “Basic settings” to be able to use the combination of motor encoder and external encoder.

3. Change the encoder type

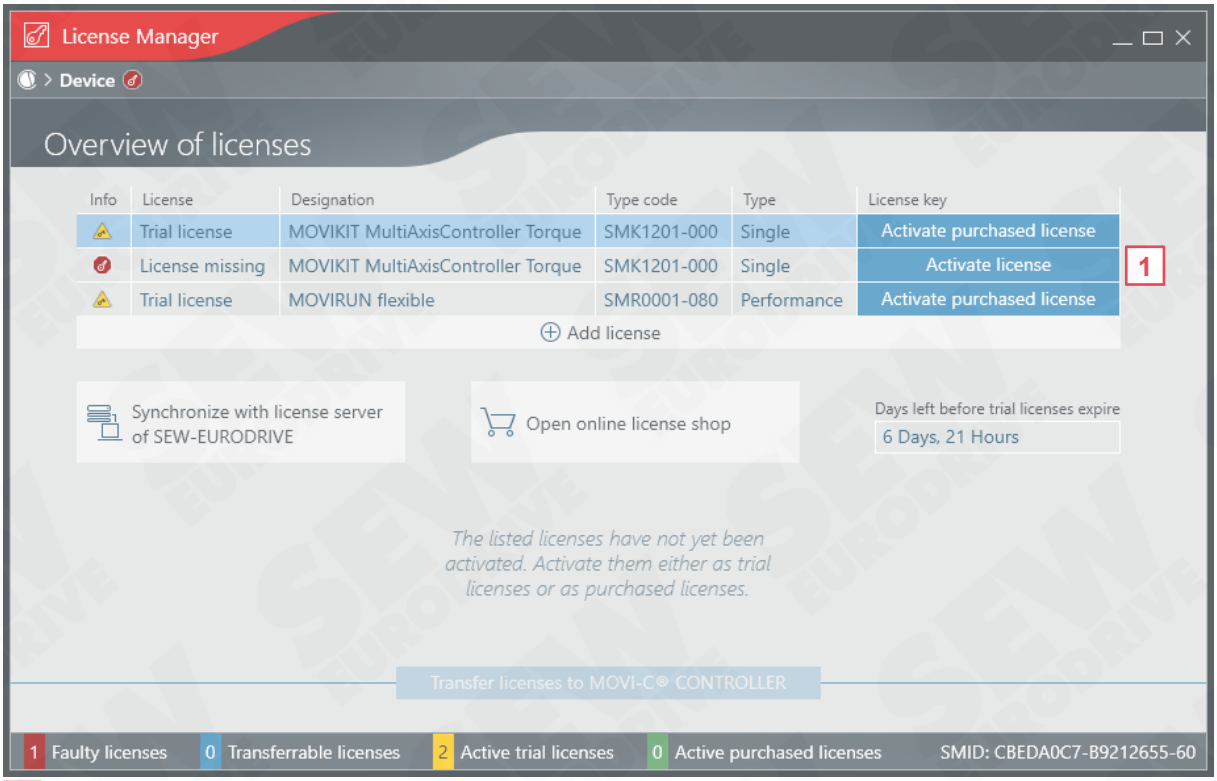


1 Set the encoder type to “**Motor encoder and external encoder**” on the parameter side “Encoder evaluation

4. Update the IEC project like in the exercise 1 shown.

If you’ve made the other exercises you have to log out in the IEC editor before updating the project.

5. Login and activate license

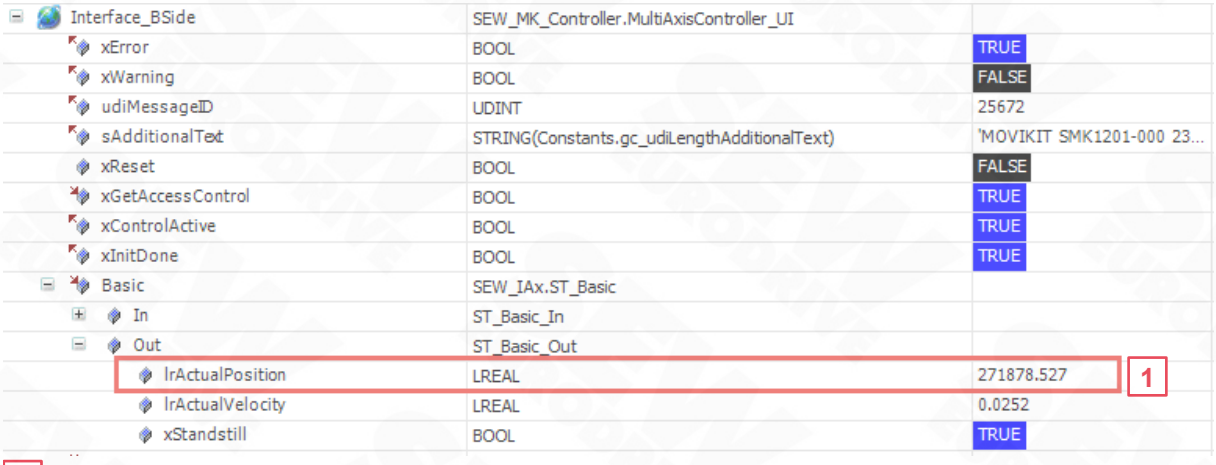


1 Login and activate the second MultiAxisController license in the license manager of the MOVISUITE®.

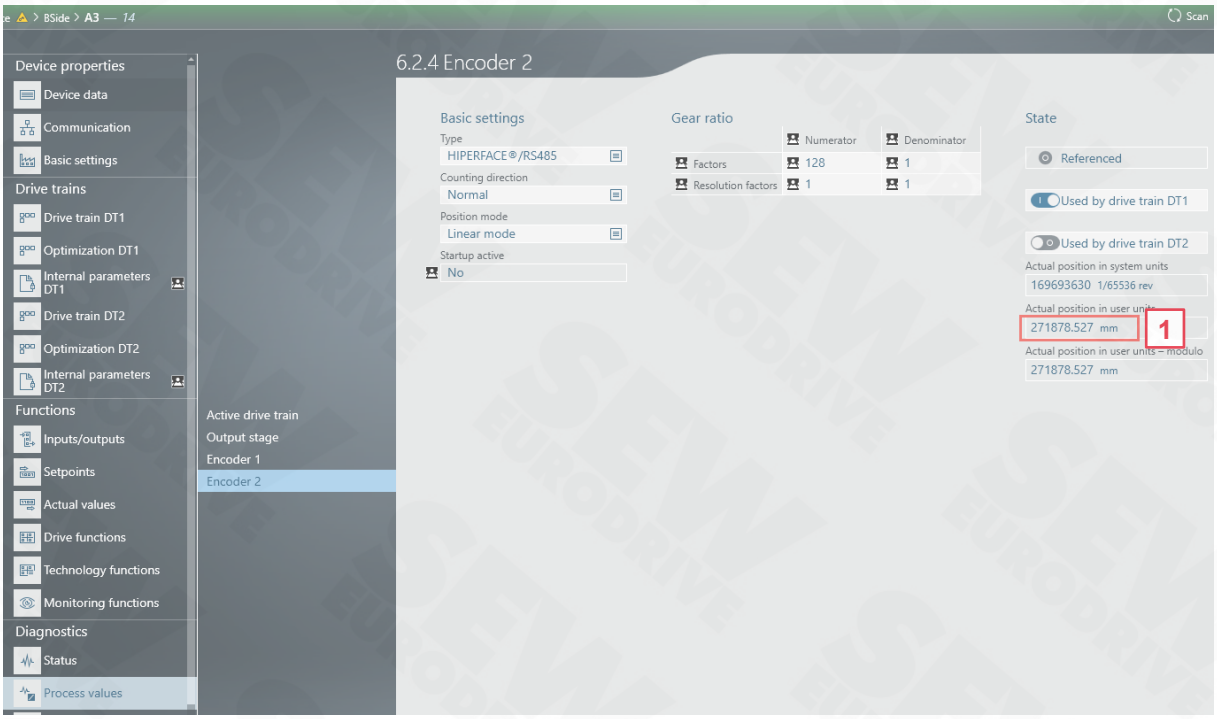
6. If necessary, reset the error in the IEC Editor

4.2 Exercise

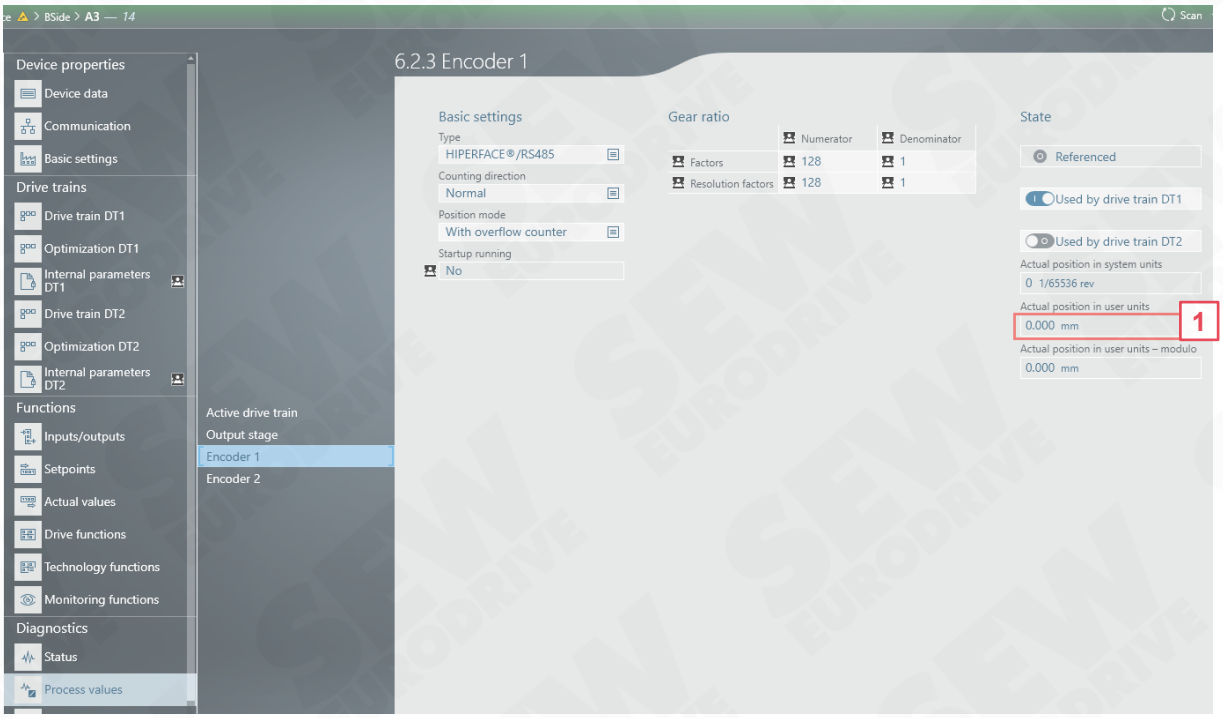
1. **Compare the actual position of “Interface_BSide.Basic.Out” to evaluate, if the position is the same and you’re really positioning on the external encoder. If encoder 1 shows the same position at encoder 2 then dismount the connection between axis 3 and 4 and move one motor by hand. Afterwards compare the three values again**



1 Actual position of “Interface_BSide.Basic.Out”



1 Compare the actual position of “Interface_BSide.Basic.Out” with MOVISUITE > process values > encoder 2



1 Also compare it to the position of MOVISUITE > process values > encoder 1.

2. Reference the MultiAxisController

Interface_BSide	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	TRUE	
xWarning	BOOL	FALSE	
udiMessageID	UDINT	25672	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIKIT SMK1201-000 23...	
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
In	ST_Basic_In		
xEnable_EmergencyStop	BOOL	FALSE	TRUE 1
xEnable_ApplicationStop	BOOL	FALSE	TRUE
Out	ST_Basic_Out		
lrActualPosition	LREAL	271878.527	
lrActualVelocity	LREAL	-0.020800000000000003	
xStandstill	BOOL	TRUE	
Inverter	SEW_IAx.ST_Inverter		
Brake	SEW_IAx.ST_Brake		
EnergySaving	SEW_IAx.ST_EnergySaving2		
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#01EE2F20	
xAutomaticErrorReaction	BOOL	TRUE	
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL		
ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
PositioningRelative	SEW_UIInterpolModes.ModePositioningRelative_UI		
Jog	SEW_UIInterpolModes.ModeJog_UI		
Tracking	SEW_UIInterpolModes.ModeTracking_UI		
Homing	HomingAxisGroup_UI		
In	SEW_IMAC.ST_HomingIn_UI		
xActivate	BOOL	FALSE	TRUE 1
xStart	BOOL	FALSE	TRUE
xReferenceCam	BOOL	FALSE	
Config	SEW_IMAC.ST_HomingConfig3_UI		

1 Set the enable signals of the “BSide” and the **xActivate** and **xStart** of “ProfileGeneration.Homing”.

3. Turn off the “xStart” and “xActivate” in the homing mode.

ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
PositioningRelative	SEW_UIInterpolModes.ModePositioningRelative_UI		
Jog	SEW_UIInterpolModes.ModeJog_UI		
Tracking	SEW_UIInterpolModes.ModeTracking_UI		
Homing	HomingAxisGroup_UI		
In	SEW_IMAC.ST_HomingIn_UI		
xActivate	BOOL	TRUE	FALSE
xStart	BOOL	TRUE	FALSE
xReferenceCam	BOOL	FALSE	
Config	SEW_IMAC.ST_HomingConfig3_UI		
Out	SEW_IMAC.ST_HomingOut_UI		

4. Import the attached trace and start it.

Right click in your trace, choose **Load Trace** and select the file **ExternalEncoder.trace**

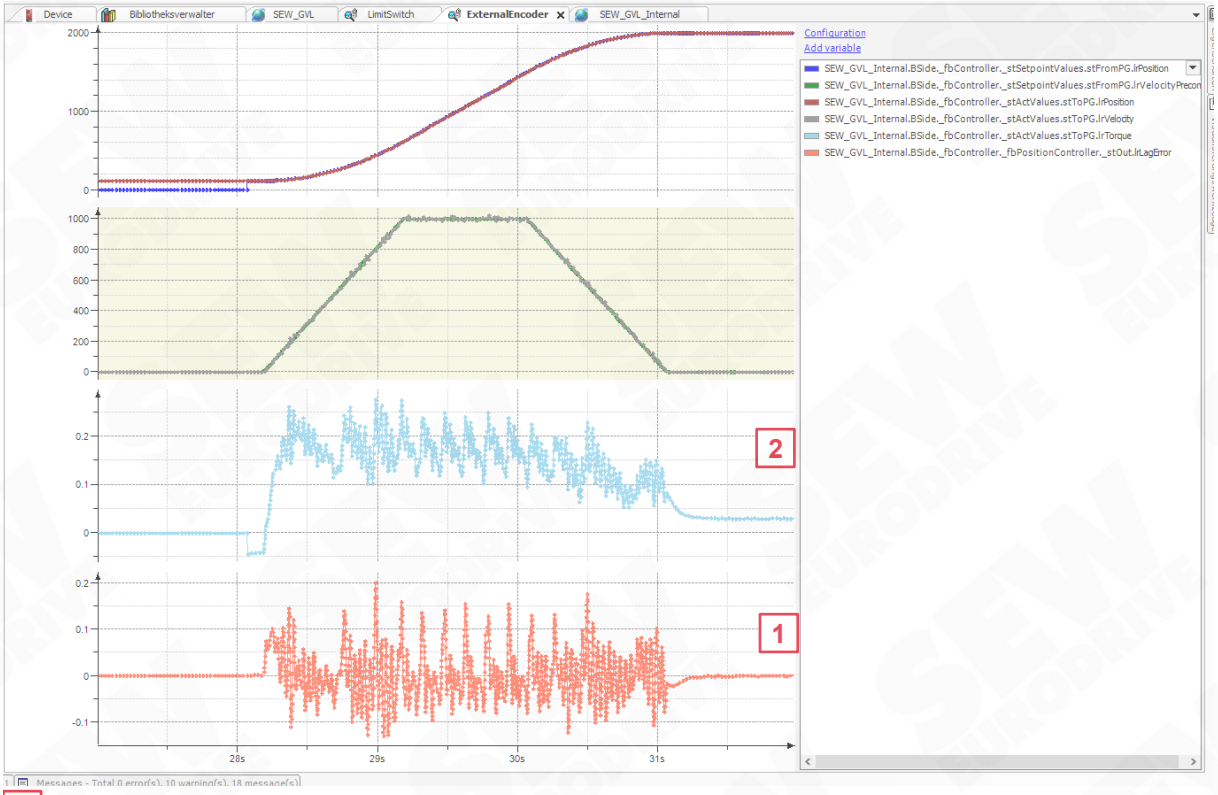
Link to the Trace-templates for download.

5. Start positioning to check that everything works fine.

ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
In	SEW_IInterpolModes.ST_Positioning_In		
xActivate	BOOL	TRUE	
xStart	BOOL	TRUE	
lrPosition	LREAL	5000	1
lrVelocity	LREAL	1000	
lrAcceleration	LREAL	1000	
lrDeceleration	LREAL	1000	
lrJerk	LREAL	0	
xRapidStop	BOOL	FALSE	
lrRapidStopDeceleration	LREAL	0	
Config	SEW_IInterpolModes.ST_Positioning_Config		
Out	SEW_IInterpolModes.ST_Positioning_Out		

1 In this example from 0 to 5000mm with 1000mm/s

6. Check Trace



1 Look at the trace and check if the lag error (forth diagram) is small (< 1mm).

2 The actual torque (third diagram) isn't oscillating (>15% of mean value).

7. Change the encoder type

Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
MAC	MAC_UI		
PositionController	PositionController_UI		
EncoderEvaluation	EncoderEvaluation_UI		
Config	SEW_ICtrlr.ST_EncoderEvalConfig_UI2		
eActPos_EncSelector	E_ENCODEREVALUATION	MotorAndExternalEncoder	ExternalEncoder 1
xDontInitializeAtEncSelectorCha...	BOOL	FALSE	
lrInputFilterTime_ExtEnc	LREAL	0.1	
lrDeadtime_ExtEnc	LREAL	0	
xInterpolationFilterOn	BOOL	TRUE	
AntiSway	AntiSway_UI		
ActualValues	SEW_ICtrlr.ST_ActualValuesAG_UI2		
SetpointValues	SEW_ICtrlr.ST_SetpointValuesAG_UI		

1 Change the encoder type in encoder evaluation > config from **MotorAndExternalEncoder** to **ExternalEncoder** to see the advantage of the combined encoder evaluation.

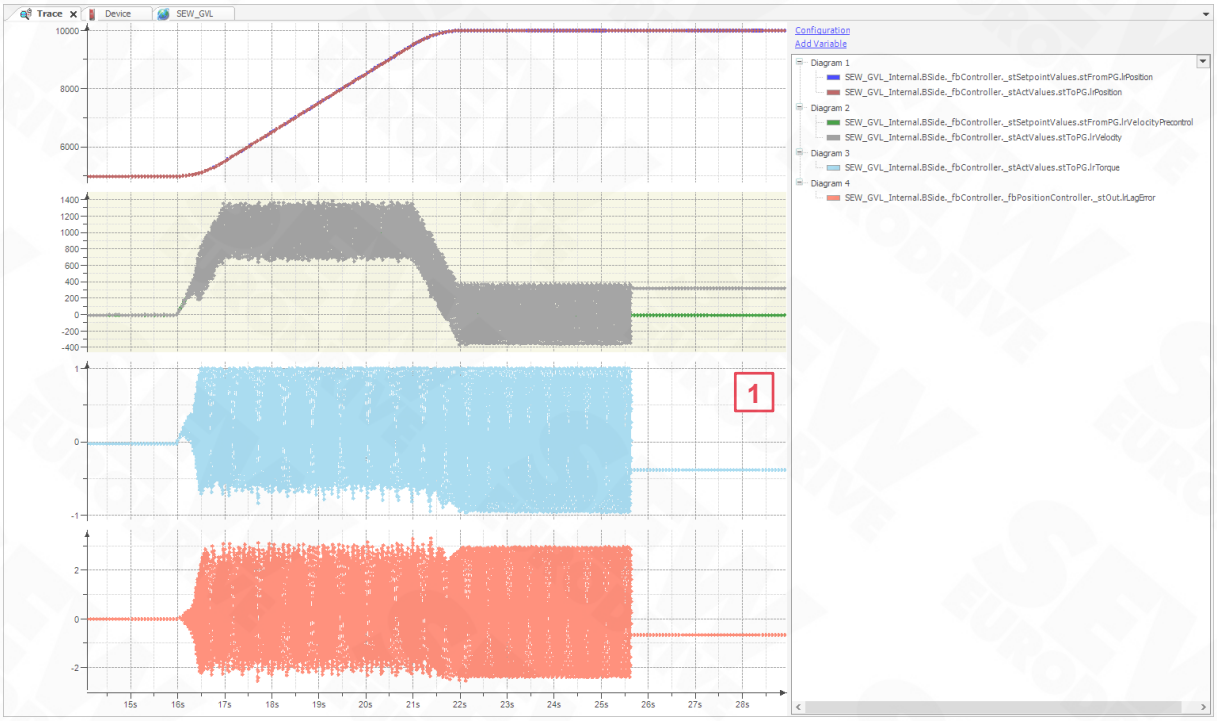
8. Start the trace again.

9. Move to position 10.000

ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
In	SEW_IInterpolModes.ST_Positioning_In		
xActivate	BOOL	TRUE	
xStart	BOOL	TRUE	
lrPosition	LREAL	5000	10000
lrVelocity	LREAL	1000	
lrAcceleration	LREAL	1000	
lrDeceleration	LREAL	1000	
lrJerk	LREAL	0	
xRapidStop	BOOL	FALSE	
lrRapidStopDeceleration	LREAL	0	
Config	SEW_IInterpolModes.ST_Positioning_Config		
Out	SEW_IInterpolModes.ST_Positioning_Out		

10. Check Trace

If the axis isn't oscillating the coupling between axis 3 and axis 4 (that is used as external encoder) is too stiff.



1 Your belt/drive will oscillate because of the fact that the high p-gain value of the position controller can't be used with the external encoder alone.

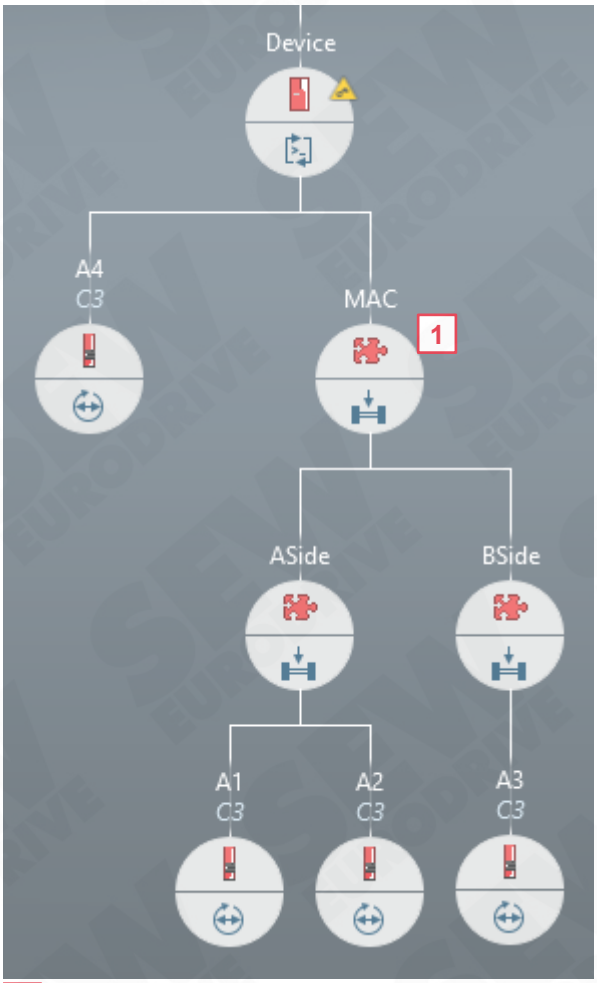
5 Exercise 4: Skew priority

In this exercise you'll learn the following functions:

- Skew priority of the MultiAxisController
- Setting up a cascade of MultiAxisControllers.
- Misalign the motors with the skew offset

5.1 Configuration

1. Add a new SoftwareNode



1 Drag and Drop the "ASide" and "BSide" under this new SoftwareNode and insert the MultiAxisController (like in the exercises above).

2. Parameterize basic settings

The add-on Cascading has to be activated because of the fact that the MultiAxisController named “MAC” is above another MultiAxisController (“ASide”, “BSide”).

1 Activate the **Skew priority of compensation=1**

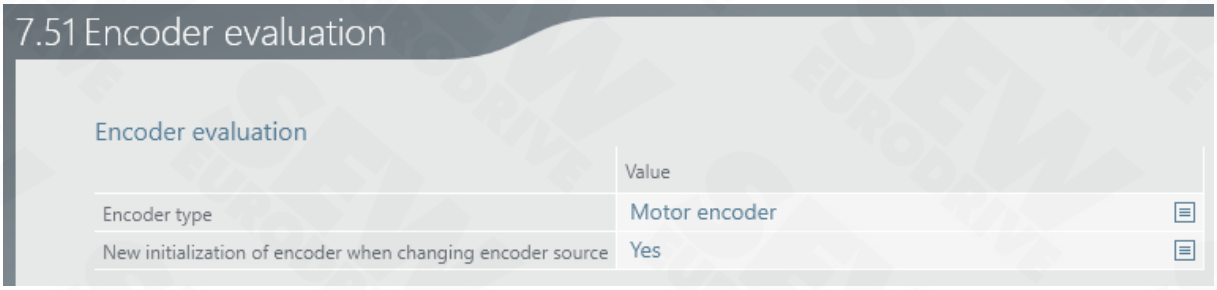
2 Disable the external encoders in “Take account of external encoders” **ASide=0** **BSide=0**

3 Activate the add-on “**Cascading=1**”.

3. Change the priority in “MultiAxisController – control function” from “Torque” as default mode to “Skew”.

When choosing the Mode “Skew” it means implicit “with overload guard” independent of the fact that it isn’t written like this.

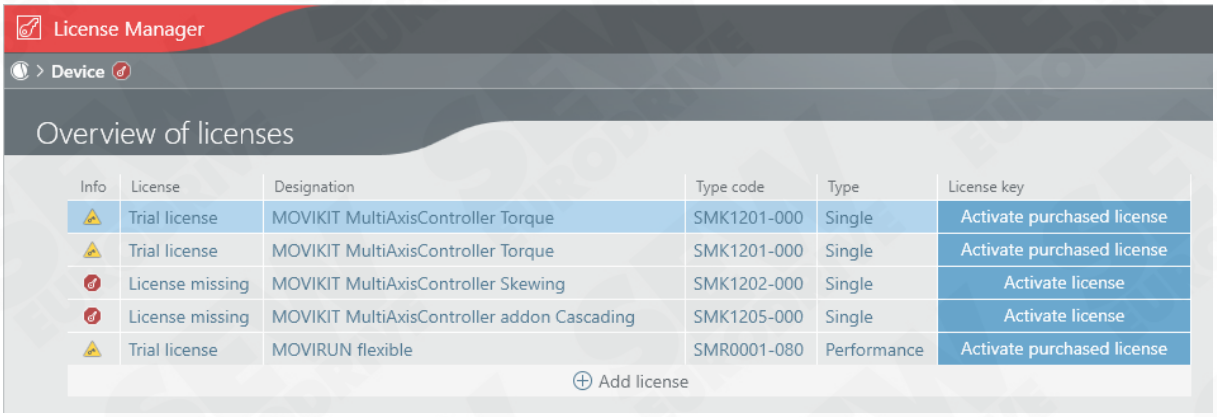
4. In this exercise, the encoder type will be motor encoder like the “ASide”.



It’s also possible to choose “Motor encoder and external encoder” to position on the external encoder but then the external encoder (“BSide”) has to be selected in “Basic settings” > “Take account of external encoders”.

5. Update IEC project like in the exercises above.

6. Login, start the application and activate the skewing and add-on cascading license



5.2 Exercise 4.1: Alignment

In this exercise you'll learn the following functions:

- Modes when the alignment will start
- What is the alignment?

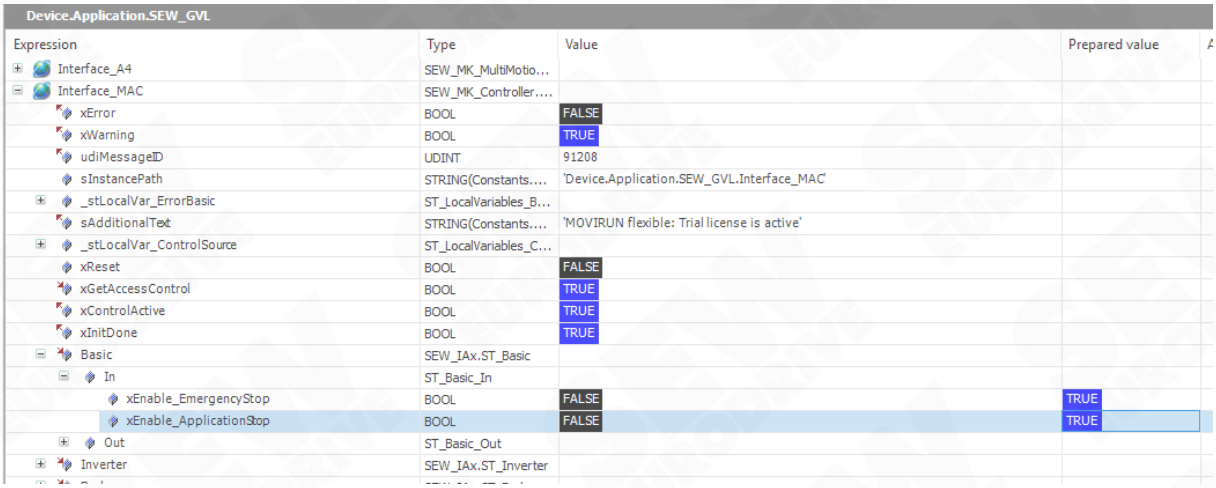
1. If necessary, reset the IEC error of missing licenses.

2. Before enabling the axes, import and start the trace.

Right click in your trace, choose **Load Trace** and select the file **Skewing.trace**

Link to the Trace-templates for download.

3. Enable the axes



4. Take a look at the trace

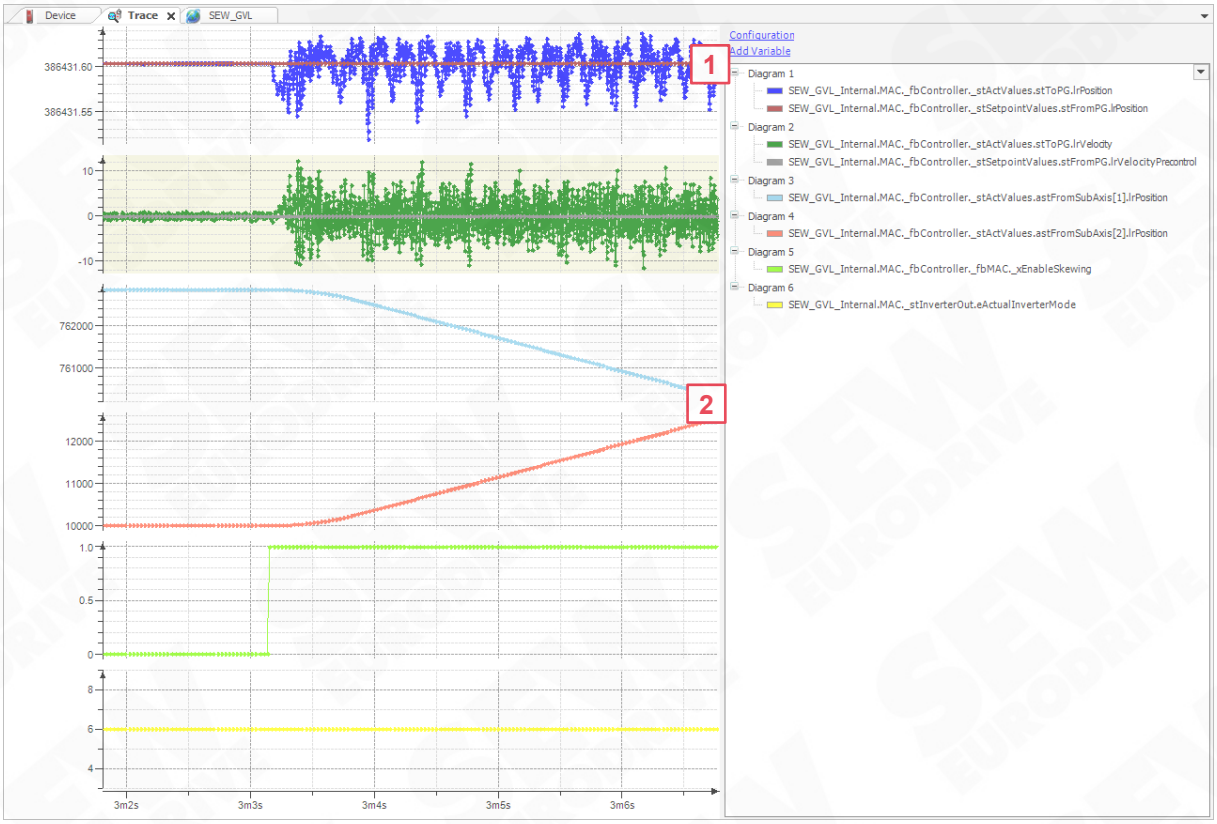
1 No movement appeared even though the positions of both axis groups are different (compare the third diagram with the forth). This is because of the fact that the alignment wasn't enabled so far.

5. Setting "xEnableSkewing" to TRUE and the axes will move together.

Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
MAC	MAC_UI		
In	SEW_ICtrlr.ST_MACIn_UI4		
xResetAndDisable	BOOL	FALSE	
xIgnoreSkewError	BOOL	FALSE	
SetpUserDefinedVelCorrection	ST_SetpUserDefinedVelCorrection		
xEnableSkewing	BOOL	FALSE	TRUE
Config	SEW_ICtrlr.ST_MACConfig_UI4		
Out	SEW_ICtrlr.ST_MACOut_UI5		
PositionController	PositionController_UI		

1 Setting **xEnableSkewing = TRUE** and the axes will move together.

6. Look at the trace



1 The profile generation stand still (red curve in the first diagram), the actual position of the axis group doesn't change (blue curve in the first diagram)

2 And only the two axes will be aligned (blue curve in the third diagram and the orange curve in the fourth diagram).
That's because the position between the two of them is different and the MultiAxisController in skewing mode corrects this situation.

7. Setting "xEnableSkewing" to FALSE will stop the drives of moving together.

8. To make this align movement every time we're enabling the axes

Controller	SEW_Ctrlr.ControllerAG_UI		
Config	SEW_ICtrlr.ST_AGConfig_UI4		
MAC	MAC_UI		
In	SEW_ICtrlr.ST_MACIn_UI4		
xResetAndDisable	BOOL	FALSE	
xIgnoreSkewError	BOOL	FALSE	
SetpUserDefinedVelCorrection	ST_SetpUserDefinedVelCorrection		
xEnableSkewing	BOOL	FALSE	
Config	SEW_ICtrlr.ST_MACConfig_UI4		
ePriority	E_PRIORITY	SkewLeveling	
TorqueLeveling	ST_TorqueLeveling_UI		
SkewLeveling	ST_SkewLeveling_UI3		
lrPGain	LREAL	158.4895	
eEnableSkewing	E_ENABLESKEWING	Manually	WithSetpointActive
xVelDecLimiterON	BOOL	TRUE	
xAccLimiterON	BOOL	TRUE	
lrAccDecMaxMin	LREAL	1050	
lrVelMaxMin	LREAL	787.5	
eEncSelector	E_SKEWLEVELING_ENCSELECTOR	MotorEncoders	
eOverloadGuard_EncSelector	E_SKEWLEVELINGOLGUARD_ENCSELECTOR	MotorEncoders	
lrSkewErrorWindow	LREAL	0	
Out	SEW_ICtrlr.ST_MACOut_UI5		
PositionController	PositionController_UI		

1 Change the **eEnableSkewing** to **WithSetpointActive**

9. Stop moving

Now the only option to stop them moving is to disable the axes (set “xEnable_EmergencyStop”/”xEnable_ApplicationStop” to false) or to make a Homing.

Interface_MAC	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	FALSE	
xWarning	BOOL	TRUE	
udiMessageID	UDINT	91203	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIKIT SMK1205-000...	
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
In	ST_Basic_In		
xEnable_EmergencyStop	BOOL	TRUE	
xEnable_ApplicationStop	BOOL	FALSE	TRUE 1
Out	ST_Basic_Out		
Inverter	SEW_IAx.ST_Inverter		
Brake	SEW_IAx.ST_Brake		
EnergySaving	SEW_IAx.ST_EnergySaving2		
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#0193C8B8	
xAutomaticErrorReaction	BOOL	TRUE	
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL		
ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
PositioningRelative	SEW_UIInterpolModes.ModePositioningRelative_UI		
Jog	SEW_UIInterpolModes.ModeJog_UI		
Tracking	SEW_UIInterpolModes.ModeTracking_UI		
Homing	HomingAxisGroup_UI		
In	SEW_IMAC.ST_HomingIn_UI		
xActivate	BOOL	FALSE	TRUE 1
xStart	BOOL	FALSE	TRUE
xReferenceCam	BOOL	FALSE	
Config	SEW_IMAC.ST_HomingConfig3_UI		
Out	SEW_IMAC.ST_HomingOut_UI		
Controller	SEW_Ctrlr.ControllerAG_UI		

1 Therefore, we are setting the enable and the activate/start of the Homing altogether.

10. Look at the trace

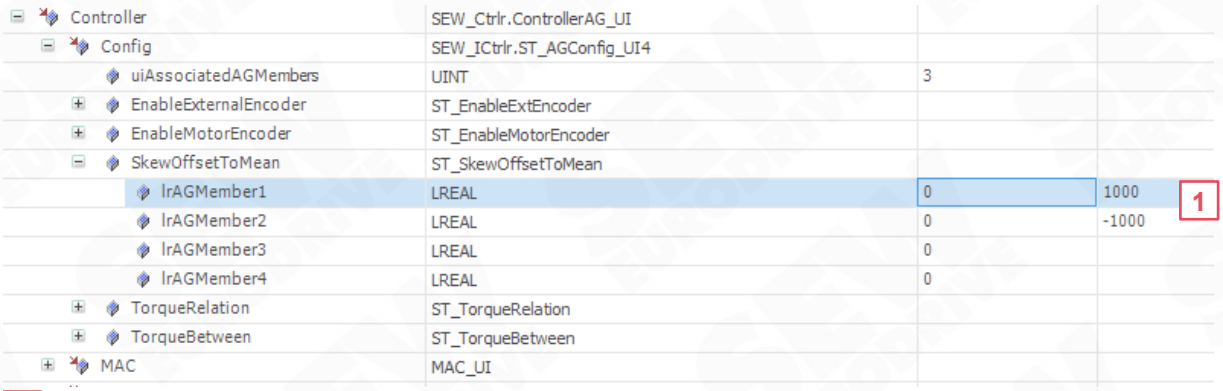
1 After the referencing both axes are aligned and no movement will occur. Actual position of axis group 1 (third diagram) and actual position of axis group 2 (forth diagram) stand still at position 0

5.3 Exercise 4.2: Skew offset

1. In the skewing priority, you have the option to misalign your drives.

The skew offset has to be symmetric like in our example. If you're using four drives the skew offsets could look like this:

Axis 1	Axis 2	Axis 3	Axis 4
-1000	1000	0	0
-1000	1000	1000	-1000
0	0	-500	500



1 Therefore, you have to set a skew offset for the enabled drives. In our example, we're setting the offset to +1000 for the first axis group member and -1000 for the second one.

2. Look at the trace

1 The MultiAxisController will move the axis groups to +1000 and -1000.

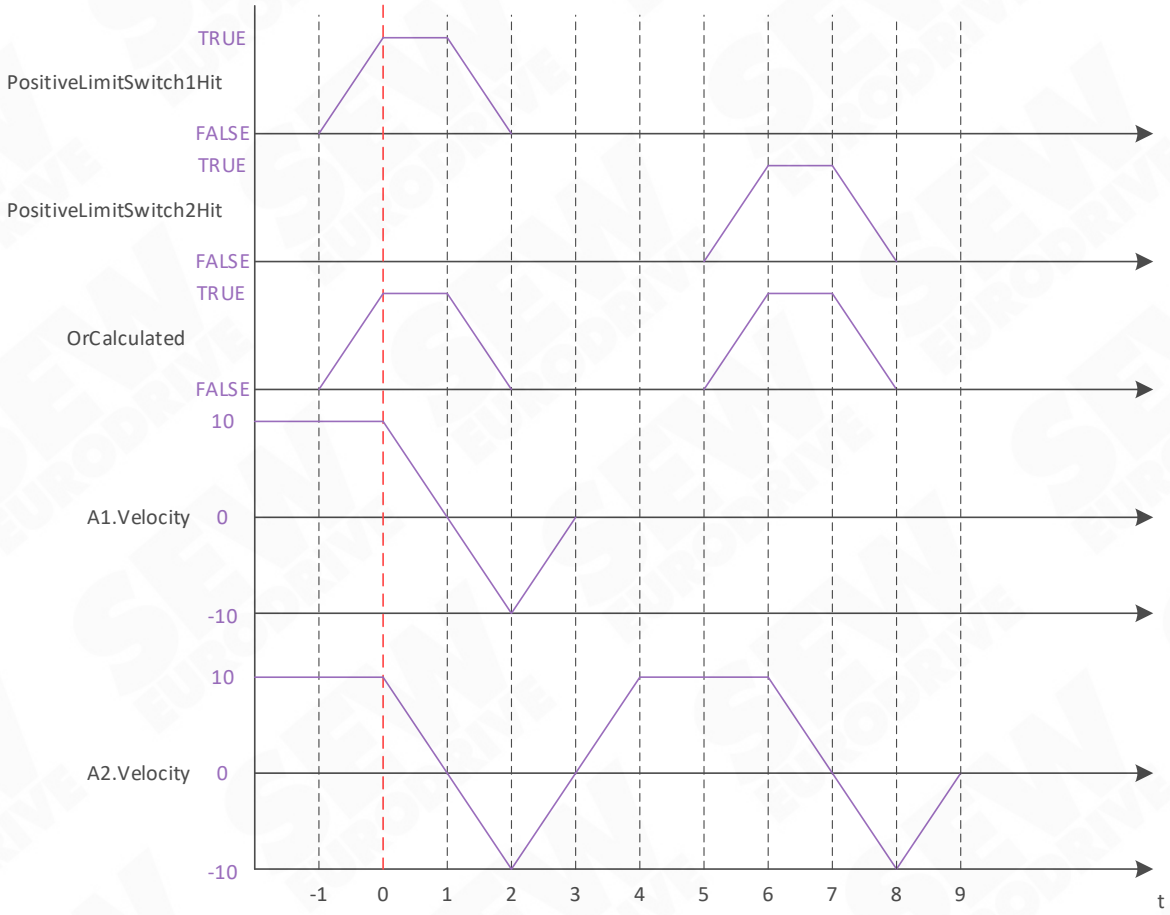
6 Exercise 5: Homing with limit switches

In this exercise you'll learn the following functions:

- Referencing with limit switches
- Readjustment function

6.1 Theory

The following time diagram shows the sequence of the homing process when using the readjustment function.



t < -1: Both axes are searching there positive limit switch.

t = -1: The positive limit switch of the first axis is hit

t = 0: Both axes are starting to ramp down.

t = 1: Both axes are moving in negative direction to clear the first limit switch.

t = 2: The positive limit switch of the first axis isn't hit anymore and both axes are starting to ramp down.

t = 3: Both axes stand still and the second axis is starting to accelerate because of the fact that her positive limit switch wasn't hit.

t = 5: The positive limit switch of axis 2 is hit.

t = 6: Axis 2 is starting to ramp down.

t = 7: Axis 2 is moving in negative direction to clear the limit switch.

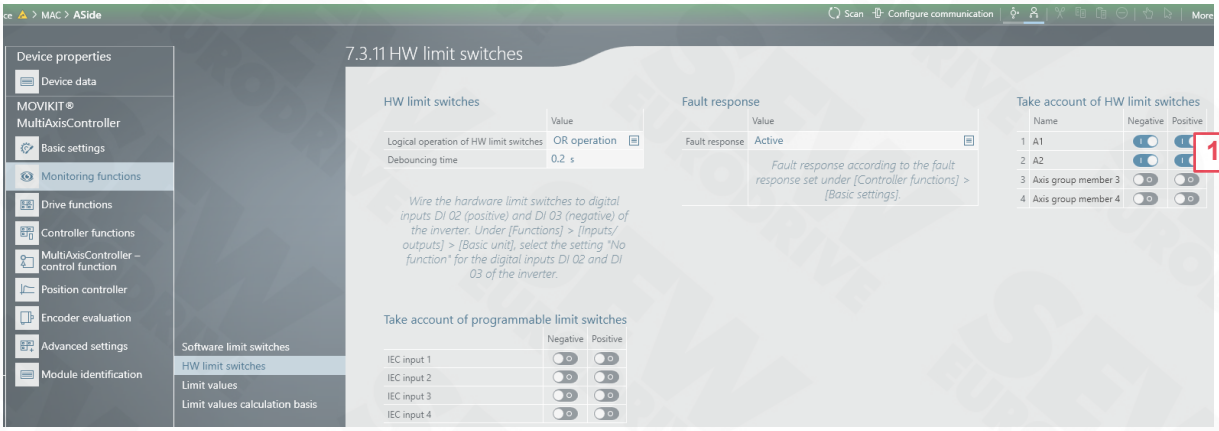
t = 8: The positive limit switch of the second axis isn't hit anymore and the axis is starting to ramp down.

t = 9: Both axes are standing at their reference position plus the position that occur because of the ramp down.

6.2 Configuration

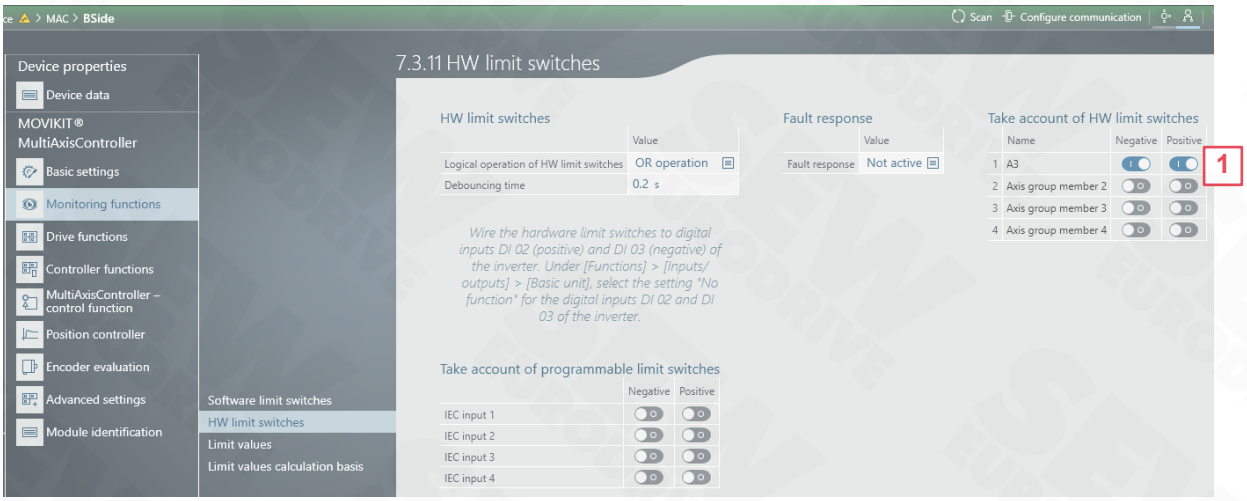
To select the limit switches that are used for the reference travel the page “Monitoring functions” > “Hardware limit switches” is used.

1. Set HW Limit switches ‘ASide’



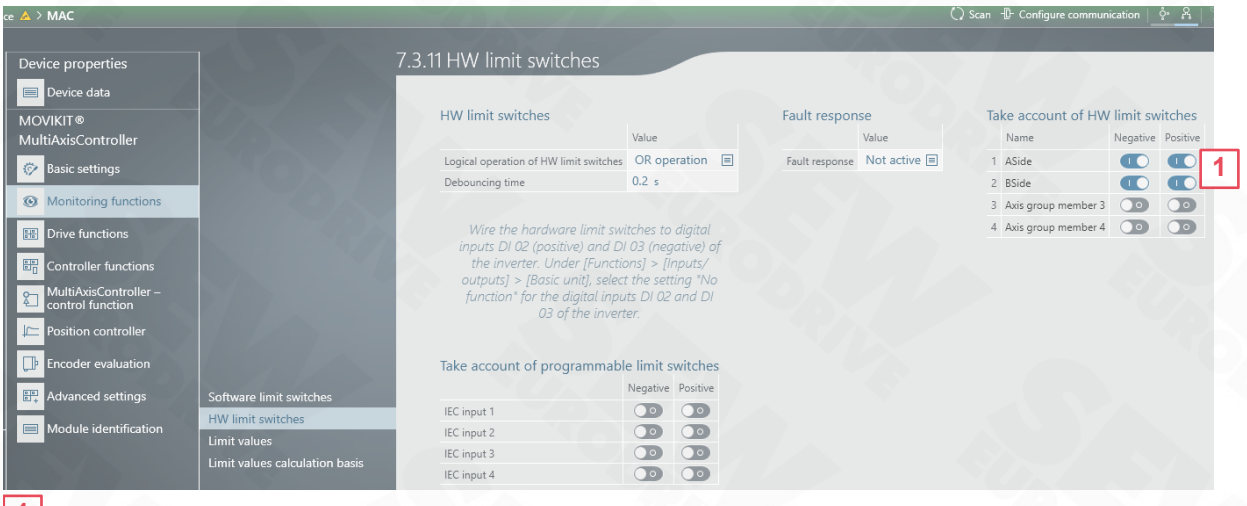
1 For the “ASide” use the same configuration like the one in exercise 3.

2. Set HW Limit switches ‘BSide’



1 For the ”BSide” activate the limit switches of axis 3.

3. Set HW Limit switches ‘MAC’



1 For the “MAC” activate the hardware limit switches of the “ASide” and the “BSide”

4. Set Controller functions

1 Set the **reference travel type** to **limit switch negative**

2 Activate the **Readjustment**. The combobox should appear after setting the reference travel type

5. Update the configuration data

6.3 Exercise 5.1: Readjustment of “BSide”

1. Load and start the attached trace example.

Right click in your trace, choose Load Trace and select the file **Homing.trace**.

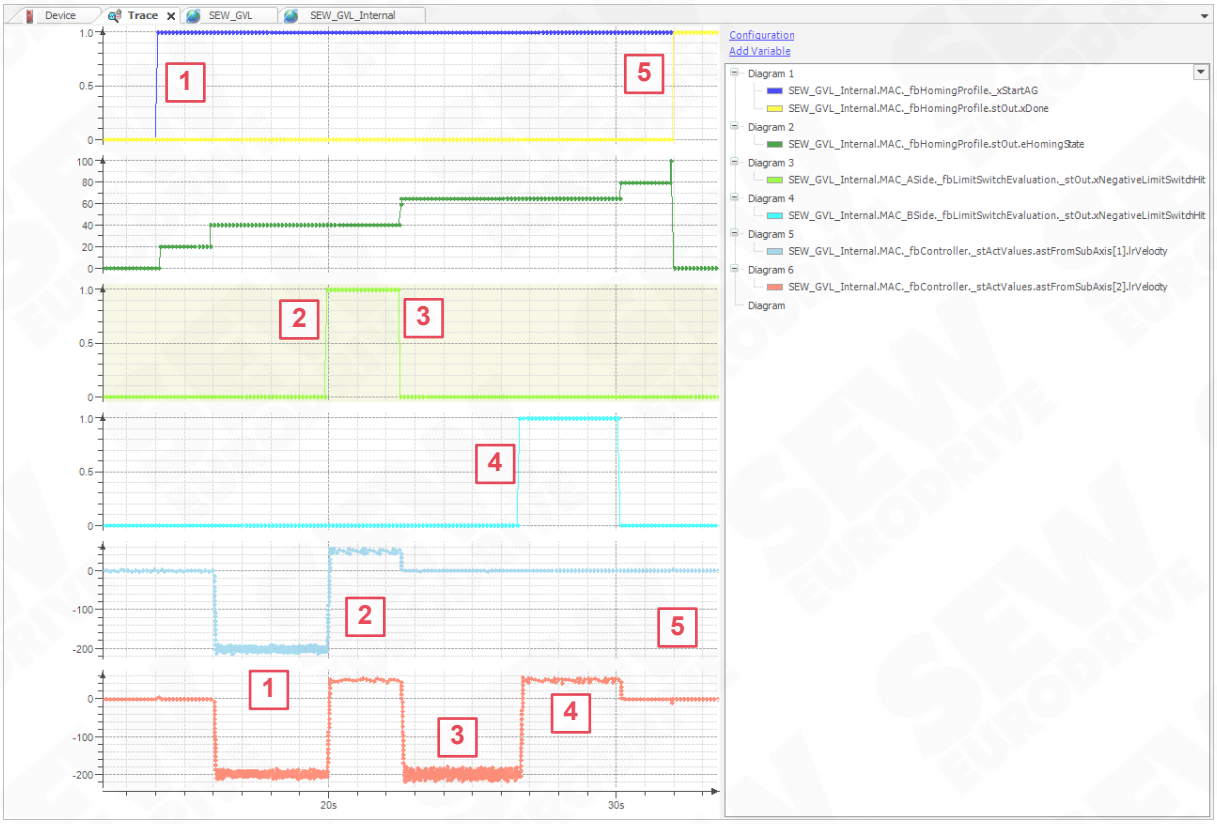
Link to the Trace-templates for download.

2. Enable the axes, activate and start the reference travel.

Interface_MAC	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	FALSE	
xWarning	BOOL	TRUE	
udiMessageID	UDINT	91203	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'MOVIKIT SMK1205-...	
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	
Basic	SEW_IAx.ST_Basic		
In	ST_Basic_In		
xEnable_EmergencyStop	BOOL	FALSE	TRUE
xEnable_ApplicationStop	BOOL	FALSE	TRUE
Out	ST_Basic_Out		
Inverter	SEW_IAx.ST_Inverter		
Brake	SEW_IAx.ST_Brake		
EnergySaving	SEW_IAx.ST_EnergySaving2		
_itfAccessToSubordinatedAxes	SEW_IAxGrBas.IAccessToSubordinatedAxes	16#0193C8B8	
xAutomaticErrorReaction	BOOL	TRUE	
axGetAccessForSubordinatedMember	ARRAY [1..SEW_ICtrlr.gc_usiMaxIndexOfController] OF BOOL		
ProfileGeneration	ProfileGeneration_UI		
In	SEW_IInterpolModes.ST_ProfileGeneration_In2		
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2		
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out		
Velocity	SEW_UIInterpolModes.ModeVelocity_UI		
Positioning	SEW_UIInterpolModes.ModePositioning_UI		
PositioningRelative	SEW_UIInterpolModes.ModePositioningRelative_UI		
Jog	SEW_UIInterpolModes.ModeJog_UI		
Tracking	SEW_UIInterpolModes.ModeTracking_UI		
Homing	HomingAxisGroup_UI		
In	SEW_IMAC.ST_HomingIn_UI		
xActivate	BOOL	FALSE	TRUE
xStart	BOOL	FALSE	TRUE
xReferenceCam	BOOL	FALSE	
Config	SEW_IMAC.ST_HomingConfig3_UI		
Out	SEW_IMAC.ST_HomingOut_UI		
Controller	SEW_Ctrlr.ControllerAG_UI		

3. Switch off the DI03 of axis 1 (limit switch negative) and wait a moment until you switch it back on. After that wait a few seconds, switch off the DI03 of axis 3, and wait a moment until you switch it back on.

4. Take a look at the trace



1 The moment after starting the reference travel both axes are moving at same speed (fifth and sixth diagram)

2 until the first limit switch was hit (third diagram). Then both axes are moving in positive direction to clear the limit switch.

3 When the limit switch isn't hit anymore (third diagram) both axes stopped and the "BSide" starting its movement in negative direction (sixth diagram).

4 After the negative limit switch of axis 3 was hit (forth diagram) the axis is also moving in positive direction to clear its limit switch.

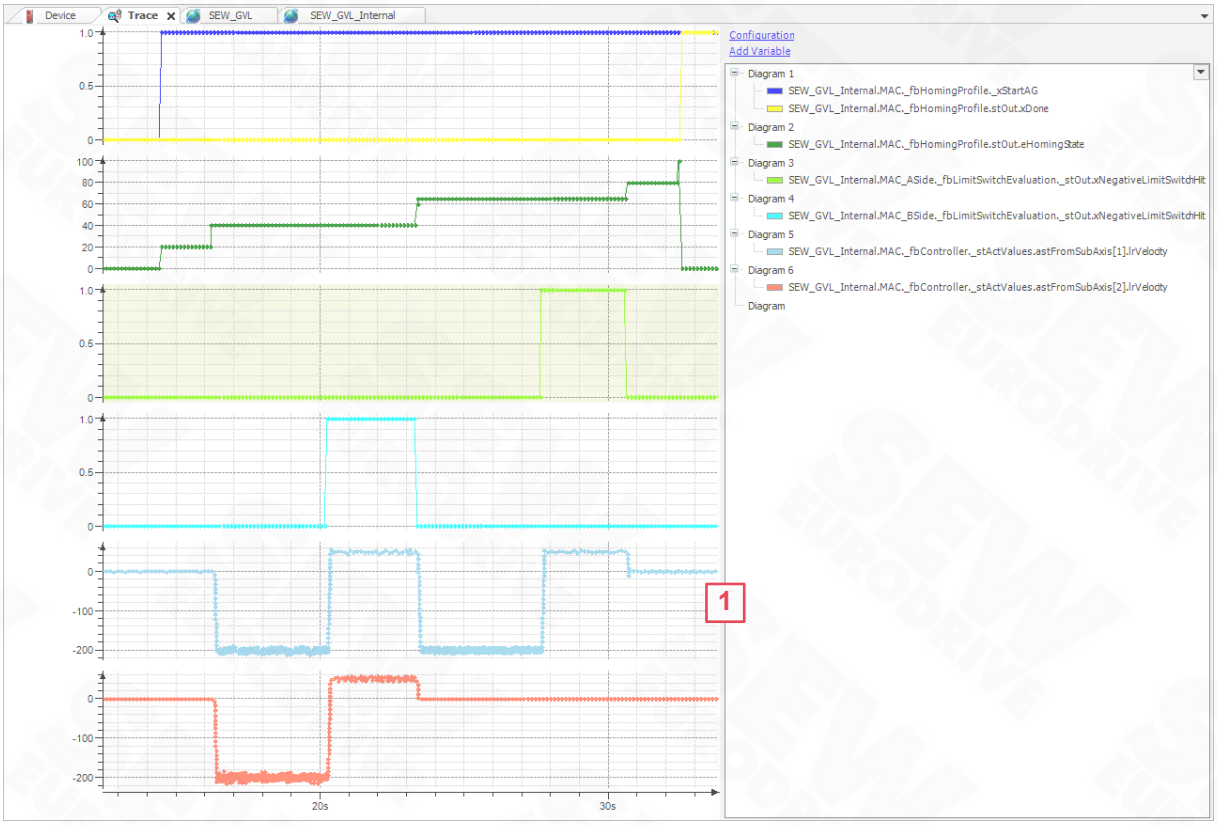
5 When this limit switch isn't hit anymore both axes are standing still and a few steps later the reference travel is done (first and second diagram).

6.4 Exercise 5.2: Readjustment of “ASide”

1. Start the reference travel again

- Switching off and on the “xStart” of the Homing-structure.
- After that do the same procedure as above but this time start with DI03 of axis 3 instead of axis 1.
- Afterwards, choose the DI03 of axis 2 instead of axis 1 when the readjustment will be done.

2. Take a look at the trace



1 There you’ll see the same process like before but this time the “ASide” starts its movement again to find its own limit switch (fifth diagram).

6.5 Exercise 5.3: Limit switch reversed

1. Start the reference travel again

- Switching off and on the “xStart” of the Homing-structure.
- After that switch off the positive limit switch (DI02) of any axis, you’d like.

2. All axes stop because of the error “Limit Switch reversed”

Interface_MAC	SEW_MK_Controller.MultiAxisController_UI		
xError	BOOL	TRUE	
xWarning	BOOL	FALSE	
udiMessageID	UDINT	30865	
sAdditionalText	STRING(Constants.gc_udiLengthAdditionalText)	'Homing: Limit switch reversed'	1
xReset	BOOL	FALSE	
xGetAccessControl	BOOL	TRUE	
xControlActive	BOOL	TRUE	
xInitDone	BOOL	TRUE	

1 This error can be seen in the structure “Interface_MAC”

6.6 Exercise 5.4: Safety time

In this exercise we´ll take a look at the situation that the limit switch that is used for readjustment is mounted falsely and won't be hit during the reference travel. This would lead to a misalignment of our mechanic and could damage it.

ProfileGeneration	ProfileGeneration_UI	
In	SEW_IInterpolModes.ST_ProfileGeneration_In2	
Config	SEW_IInterpolModes.ST_ProfileGeneration_Config2	
Out	SEW_IInterpolModes.ST_ProfileGeneration_Out	
Velocity	SEW_UIInterpolModes.ModeVelocity_UI	
Positioning	SEW_UIInterpolModes.ModePositioning_UI	
PositioningRelative	SEW_UIInterpolModes.ModePositioningRelative_UI	
Jog	SEW_UIInterpolModes.ModeJog_UI	
Tracking	SEW_UIInterpolModes.ModeTracking_UI	
Homing	HomingAxisGroup_UI	
In	SEW_IMAC.ST_HomingIn_UI	
xActivate	BOOL	TRUE
xStart	BOOL	TRUE
xReferenceCam	BOOL	FALSE
Config	SEW_IMAC.ST_HomingConfig3_UI	
eReferenceTravelType	E_REFSTRATEGY	LimitSwitchNeg
lrReferenceOffset	LREAL	0
lrSearchVelocity	LREAL	200
lrClearVelocity	LREAL	50
lrAcceleration	LREAL	3000
lrDeceleration	LREAL	3000
lrJerk	LREAL	0
xMoveToStartPosition	BOOL	FALSE
lrStartPosition	LREAL	0
lrStartPosVelocity	LREAL	0
HomingAG	ST_HomingConfigAG3_UI	
xActivateEncoderHoming	BOOL	TRUE
Readjustment	ST_Readjustment	
xActivate	BOOL	TRUE
usiLSNegativeAGMember1	USINT	1
usiLSPositiveAGMember1	USINT	1
usiLSNegativeAGMember2	USINT	2
usiLSPositiveAGMember2	USINT	2
lrSafetyDistance	LREAL	0
lrSafetyTime	LREAL	0
eSourceForReferencedSignal	E_SOURCEFORREFERENCEDSIGNAL	ProfileGeneration
Out	SEW_IMAC.ST_HomingOut_UI	
Controller	SEW_Ctrlr.ControllerAG_UI	

1

1 To prevent this situation the following two parameters in the homing structure can be set.

- Firstly the safety distance that regulates the distance that the axis can move after the first limit switch was reached.
- Secondly, the safety time that regulates how long the axis can move after the first limit switch was reached. Both parameters can also be combined. The limitation then results from the limit value (time/distance) that occurs first.

1. Set “lrSafetyTime”

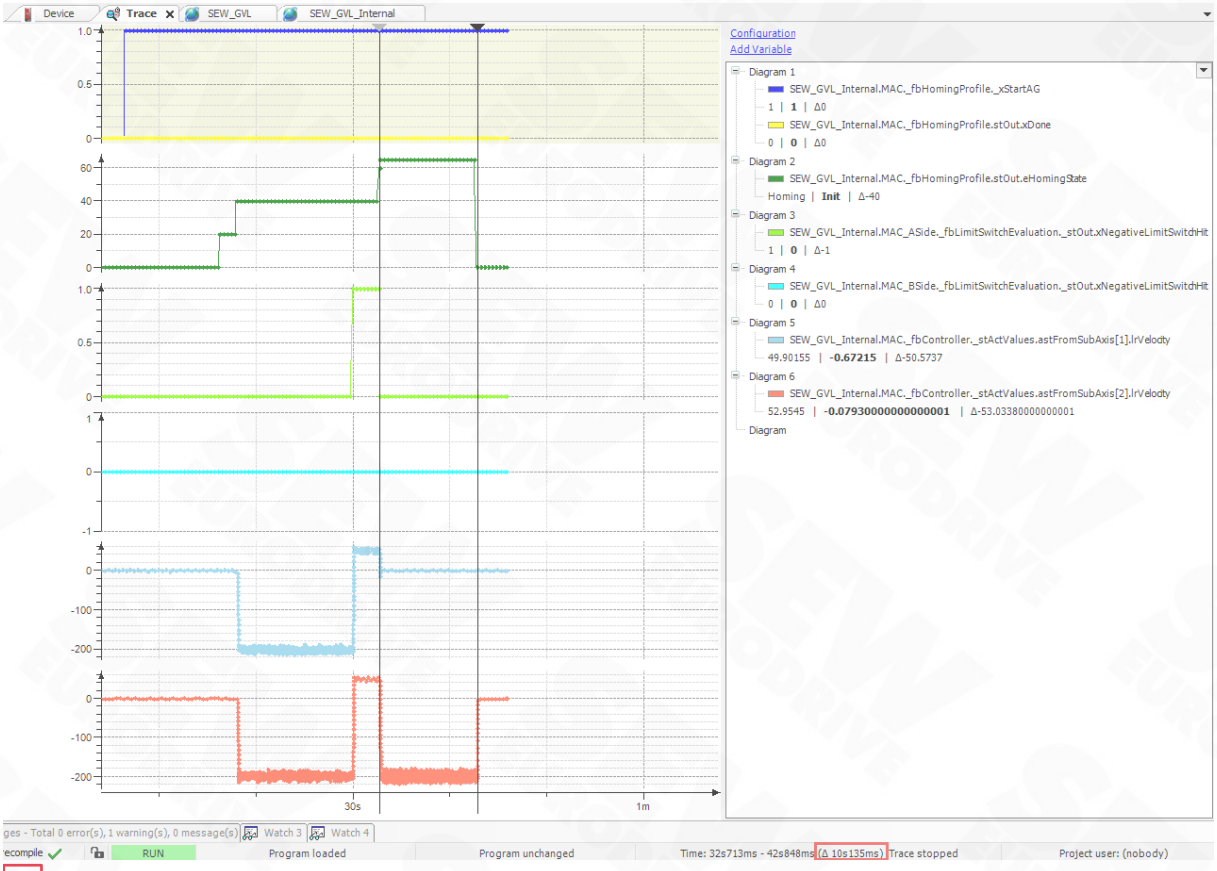
Homing	HomingAxisGroup_UI		
In	SEW_IMAC.ST_HomingIn_UI		
xActivate	BOOL	TRUE	
xStart	BOOL	TRUE	2
xReferenceCam	BOOL	FALSE	
Config	SEW_IMAC.ST_HomingConfig3_UI		
eReferenceTravelType	E_REFSTRATEGY	LimitSwitchNeg	
lrReferenceOffset	LREAL	0	
lrSearchVelocity	LREAL	200	
lrClearVelocity	LREAL	50	
lrAcceleration	LREAL	3000	
lrDeceleration	LREAL	3000	
lrJerk	LREAL	0	
xMoveToStartPosition	BOOL	FALSE	
lrStartPosition	LREAL	0	
lrStartPosVelocity	LREAL	0	
HomingAG	ST_HomingConfigAG3_UI		
xActivateEncoderHoming	BOOL	TRUE	
Readjustment	ST_Readjustment		
xActivate	BOOL	TRUE	
usiLSNegativeAGMember1	USINT	1	
usiLSPositiveAGMember1	USINT	1	
usiLSNegativeAGMember2	USINT	2	
usiLSPositiveAGMember2	USINT	2	
lrSafetyDistance	LREAL	0	
lrSafetyTime	LREAL	0	10 1
eSourceForReferencedSignal	E_SOURCEFORREFERENCEDSIGNAL	ProfileGeneration	
Out	SEW_IMAC.ST_HomingOut_UI		

1 Set the parameter **lrSafetyTime** to 10s.

2 Start the reference travel by switching off and on the **xStart** of the Homing-structure.

2. When all axes are moving switch off DI03 of axis 2, wait a moment and switch it back on.

3. Wait until all axes stopped, have a look at the trace



1 Measure the time in which axis 3 is moving on its own. In the screenshot it’s nearly the 10s that are configured. The derivation only occur because of the fact that it’s complicated to set the cursors at the right spot.

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