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Parameterization, programming, startup, and diagnostics

C200

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Objectives of this training document

- You will learn how to configure, program, and start up a storage/retrieval system with the MOVIKIT® StackerCrane application module.
- You will learn about the operating principle of the MOVIKIT® StackerCrane with effiDRIVE, MOVIKIT® StackerCrane MultiMotion, and MOVIKIT® StackerCrane MultiAxis Controller

Please do not hesitate to contact product training if you have any questions or suggestions.

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Meaning of the symbols:



Operating notes



Information



Safety-relevant information



Tip



Diagnostics and troubleshooting



Practical task



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1 Functions of an storage/retrieval system (SRS)

Goals

- Be acquainted with the scope of functions of the MOVIKIT® StackerCrane effiDRIVE® software module
- Be acquainted with the main startup procedure
- Be acquainted with the options for energy optimization



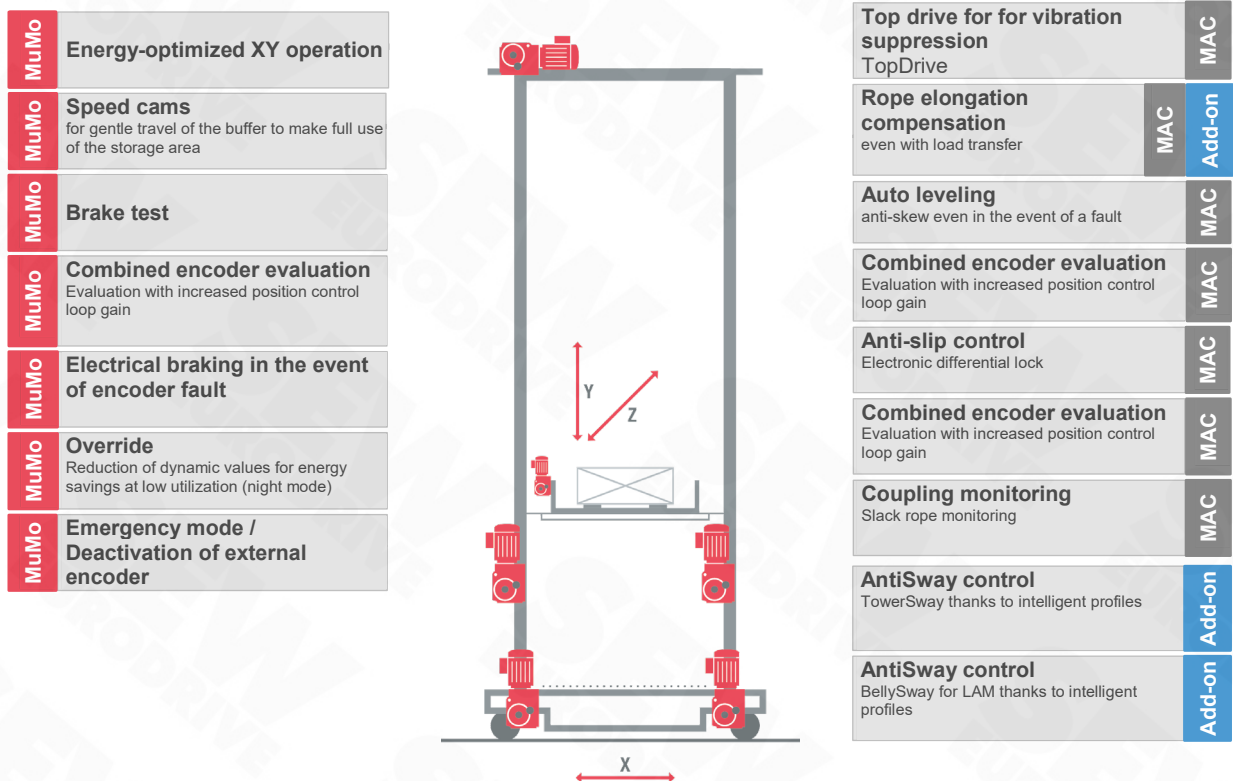
1.1 Scope of functions MOVIKIT® StackerCrane effiDRIVE®



The MOVIKIT® StackerCrane effiDRIVE® software module is used to operate storage/retrieval systems in an energy-efficient manner. By optimizing the travel cycles of lifting and travel drives, energy savings of up to approx. 10% are achieved compared to the connected DC link.

The software module can be used to implement storage/retrieval systems with up to 4 travel axes and up to

For 4 lifting axes. Both directions of travel require at least one external encoder each or must be connected to the environment without slippage (e.g. through a gear rack). The target positions and dynamic parameters for the travel and hoist are specified via an easy-to-use "process data interface". The "MOVIKIT® StackerCrane MultiMotion" and "MOVIKIT® Stacker-Crane MultiAxisController" software modules are available for inserting lower-level single axes or axis groups, and the "MultiMotion add-on PositionController" and "MultiMotion add-on CombinedEncoderEvaluation" add-ons are in preparation. These software modules or Add-ons extend the range of functions by the functions shown in the following figure.



Scope of functions of MOVIKIT® StackerCrane effiDRIVE® in combination with MOVIKIT®...

MuMo	MOVIKIT® MultiMotion
MAC	MOVIKIT® MultiAxisController
Add-on	Motion add-on AntiSway

1.2 Energy optimization in XY optimized mode



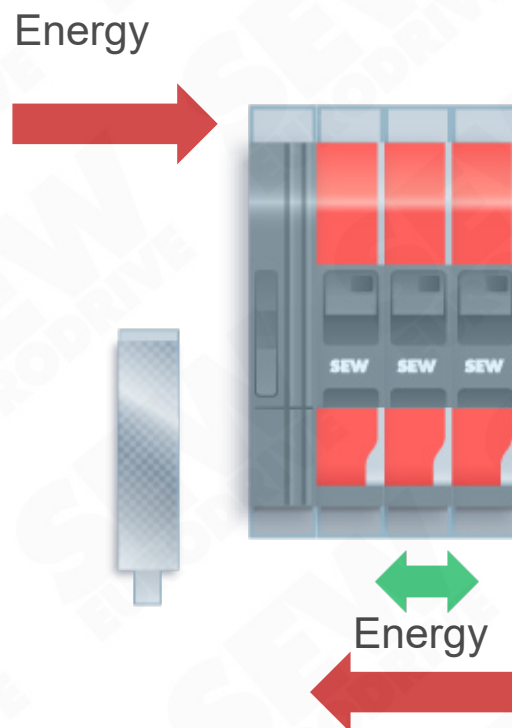
The software module offers the option of positioning the travel and lifting axes in an energy-optimized manner.

The application module coordinates the travel and lifting axes of an SRS in such a way that the energy balance is as favorable as possible. The goal is to make the energy that is generated when decelerating one axis available to the other axis that is currently accelerating. For this purpose, the speed, starting time and brake application time of the axes is adapted without extending the total time of the storage/retrieval process.

The total time of a storage/retrieval process is defined by the axis with the longest travel time (master axis). The travel time depends on the travel distance and the maximum possible acceleration, deceleration, and speed of the respective axis.

Due to a shorter distance or a higher speed, the second axis requires less time for completing the travel job.

It occurs only rarely that both axes need exactly the same time for their travel job. There is no room for optimization in this case.

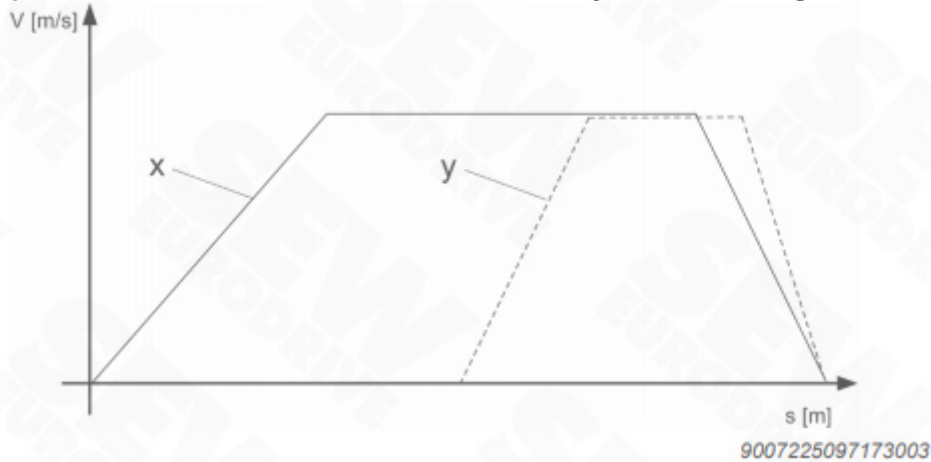


- Energy is exchanged between the horizontal and vertical drive via the DC link coupling
- The axes are controlled in a manner that optimizes energy use, and as little energy as possible is lost via the braking resistance
- Detectable axis start delays are desired and monitored
- No reduction in / influence of the cycle time
- Also worthwhile when using a power feedback unit

Important: Target position and dynamics process data must not be changed during the movement!



Optimization case 1 – x-axis is the master axis, y-axis is in lifting mode



Initial situation: $t_{xVmax} > t_{yVmax}$

The x-axis is the master axis because its travel time is longer than that of the y-axis due to a longer travel distance and the dynamic parameters. The y-axis is in lifting mode.

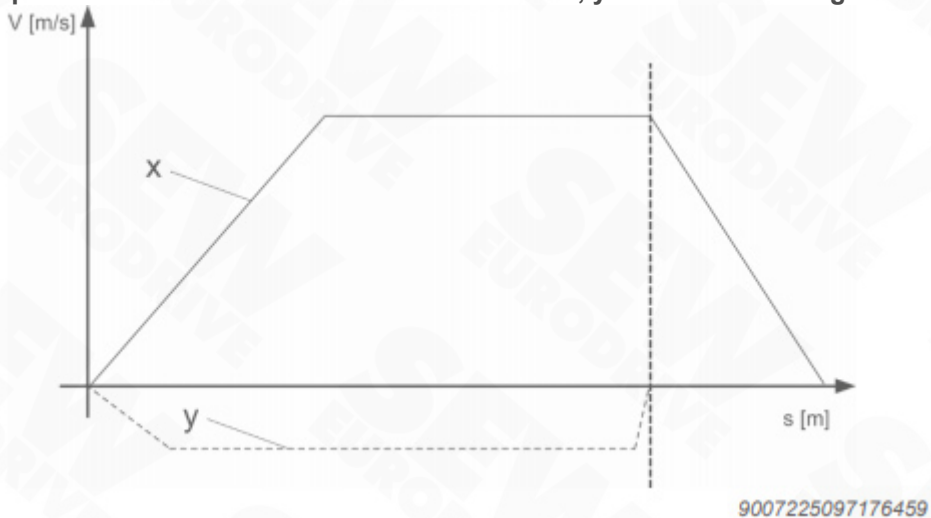
Optimization parameters:

The x-axis starts immediately and is operated with maximum dynamic parameters to achieve the required cycle time. The starting time of the y-axis is calculated so that both axes arrive at their target at the same time.

Energy saving:

The energy generated by decelerating the x-axis is used for lifting the y-axis.

Optimization case 2 – x-axis is the master axis, y-axis is in lowering mode



Initial situation: $t_{xVmax} > t_{yVmax}$

The x-axis is the master axis because its travel time is longer than that of the y-axis due to a longer travel distance and the dynamic parameters. The y-axis is in lowering mode.

Optimization parameters: $t_{xVmax} - t_{xVStopRamp} = t_{yVadjusted}$

The x-axis starts immediately and is operated with maximum dynamic parameters to achieve the required cycle time. The y-axis also starts immediately but travels at a reduced speed.

The speed of the y-axis is calculated so that the y-axis is in lowering mode while the x-axis is accelerating or traveling at constant speed.

Energy saving:

The energy generated by lowering the y-axis is used for accelerating the x-axis and for moving it at constant speed.

Optimization case 3 – y-axis is the master axis, y-axis is in lifting mode**Initial situation: $t_y V_{max} > t_x V_{max}$**

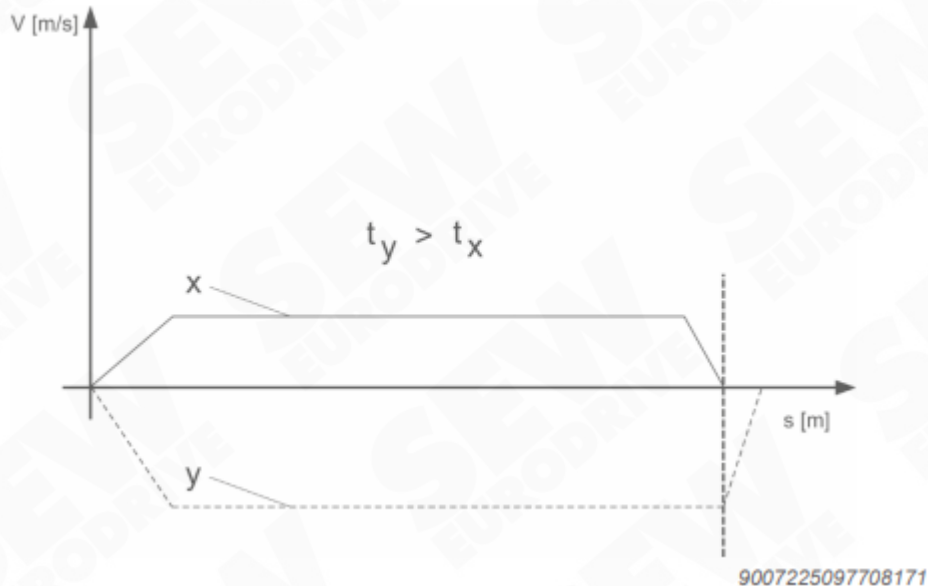
The y-axis is the master axis because its travel time is longer than that of the x-axis due to a longer travel distance and the dynamic parameters. The y-axis is in lifting mode.

Optimization parameters: $t_y V_{max} = t_x V_{adjusted}$

The y-axis starts immediately and is operated with the maximum dynamic parameters to achieve the required cycle time. The x-axis also starts immediately but travels at a reduced speed. The speed of the x-axis is calculated so that both axes arrive at their target at the same time.

Energy saving:

As the speed of the x-axis is reduced, this axis uses less energy. The energy generated by the x-axis is used for lifting the y-axis.

Optimization case 4 – y-axis is the master axis, y-axis is in lowering mode**Initial situation: $t_y V_{max} > t_x V_{max}$**

The y-axis is the master axis because its travel time is longer than that of the x-axis due to a longer travel distance and the dynamic parameters. The y-axis is in lowering mode.

Optimization parameters: $t_y V_{max} = t_x V_{adjusted}$

The y-axis starts immediately and is operated with the maximum dynamic parameters to achieve the required cycle time. The x-axis also starts immediately but travels at a reduced speed. The speed of the x-axis is calculated so that the x-axis completes its travel motion when the y-axis begins to decelerate.

Energy saving:

As the speed of the x-axis is reduced, this axis uses less energy. The energy generated by lowering the y-axis is made available to the x-axis.

XY optimized mode: Mechanics-optimized positioning (1210)**Initial situation: $t_y V_{max} > t_x V_{max}$**

The y-axis is the master axis because its travel time is longer than that of the x-axis due to a longer travel distance and the dynamic parameters.

Optimization parameters: $t_y V_{max} = t_x V_{adjusted}$

The y-axis starts immediately and is operated with the maximum dynamic parameters to achieve the required cycle time. The x-axis also starts immediately but travels at a reduced speed. The speed of the x-axis is calculated so that both axes arrive at their target at the same time.

Energy saving:

As the speed of the x-axis is reduced, this axis uses less energy. Furthermore, the forces acting on the mechanics of the optimized axis are reduced. (Optimization: $t_y = t_x$)

1.3 Basic startup procedure



Configuration

- Start up X and Y axis group members with safety
- Process data in StackerCrane: Start, length, and content
- Fieldbus in the controller



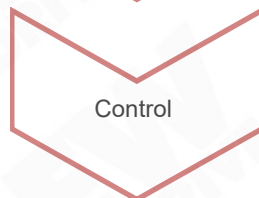
Project generation

- Right-click "Update project" in MOVISUITE



Download

- IEC Editor → Right-click "Application" → to insert PD Monitor → scripts
- IEC Editor → Online → Login/Create boot project



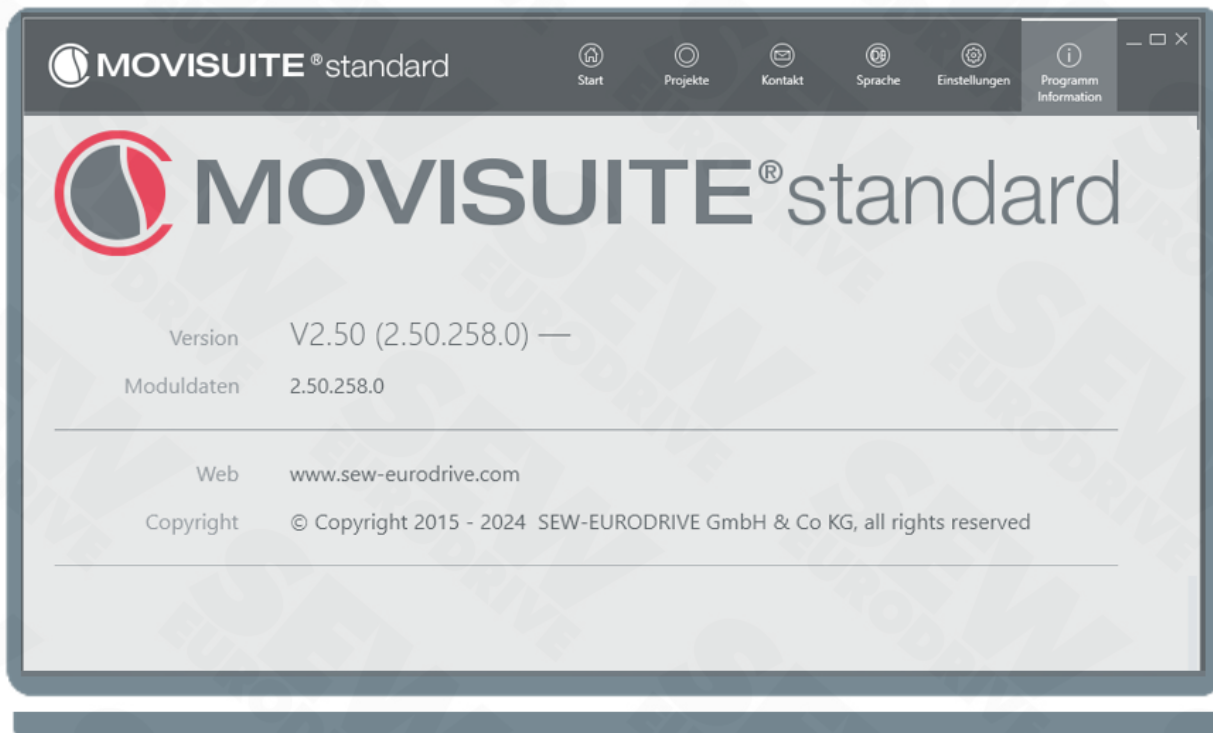
Control

- Using the PD monitor
- Using the customer's PLC

2 System configuration

Goals

- Getting to know the versions of MOVISUITE® and MOVIKIT® StackerCrane
- Library SEW MOVIKIT® StackerCrane
- Training models Stackercrane



2.1 MOVISUITE® engineering software

2.1.1 Version and module package



Version V2.50 (2.50.258.0) —
Moduldaten 2.50.258.0

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- MOVISUITE® version 2.50.258.0
- Module package 2.50.258.0
- MOVIRUN flexible version 9.0.8.200
- StackerCrane version ≥ 9.0.36.200
- StackerCrane MultiMotion ≥ 9.0.36.200
- StackerCrane MultiAxisController version ≥ 9.0.36.200

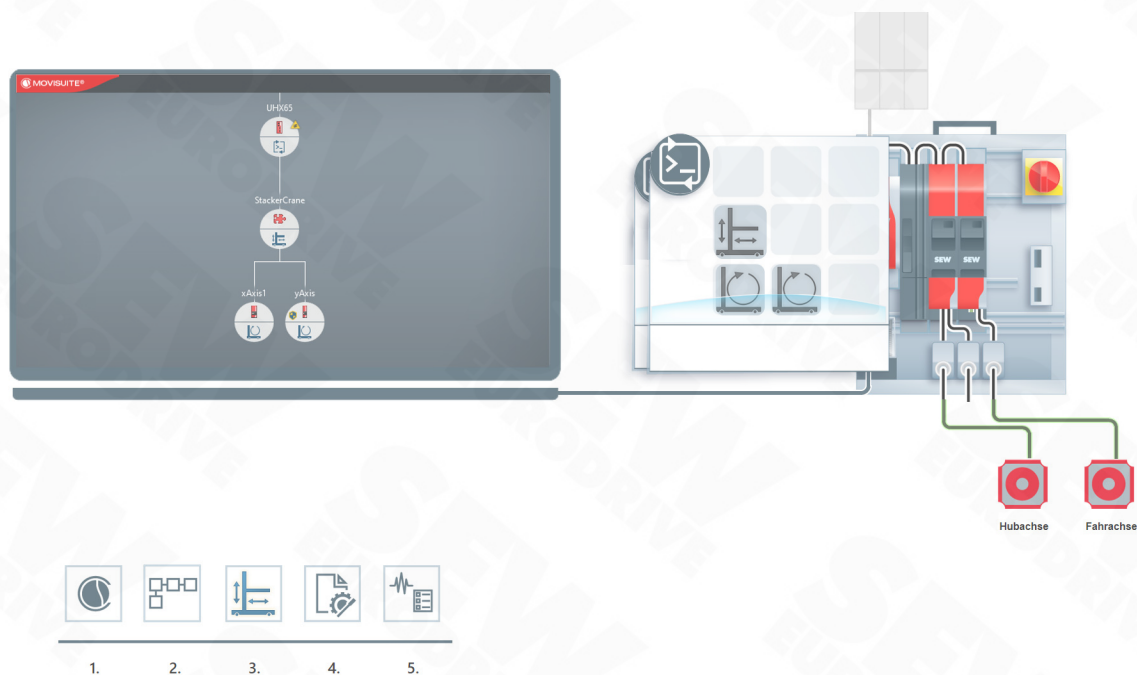
2.1.2 Firmware



- Controller firmware ≥ 9.00
- Firmware of the axis modules ≥ 11.00

3 Tutorial 1 – SRS with MOVIKIT® StackerCrane

Workbook steps – Tutorial 1



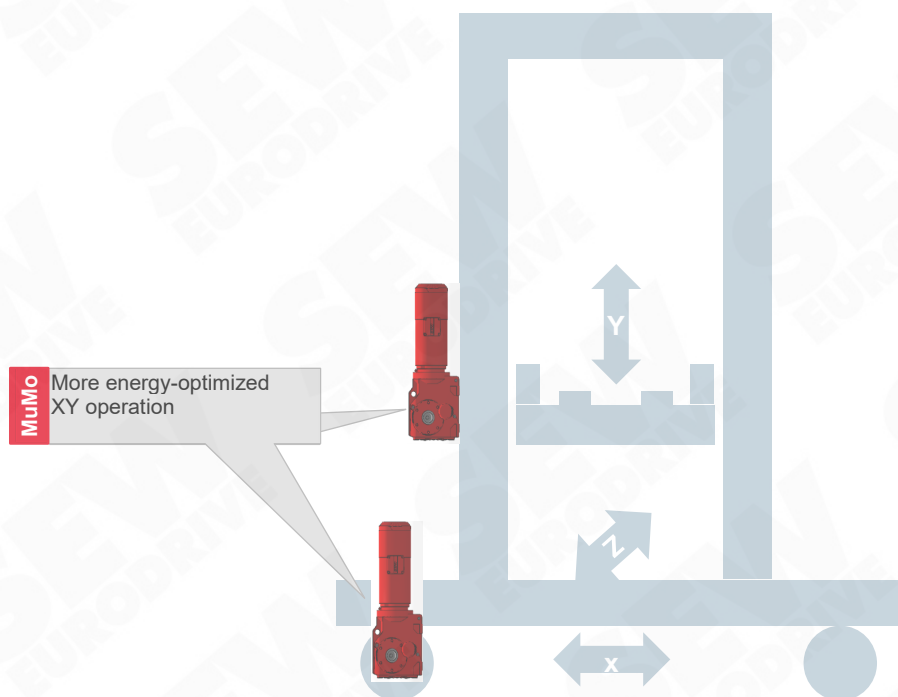
1. MOVISUITE® project structure
2. Startup of the travel and hoist axis
3. Parameterization of MOVIKIT® StackerCrane
4. Generation of the software project
5. MOVIKIT® StackerCrane effiDRIVE process data monitor

3.1 Scope of functions Tutorial 1



In this tutorial, an SRS with 2 axes is started up. The x-axis and the y-axis each have a motor encoder.

- X-axis 1 drive with motor encoder => MOVIKIT® StackerCrane MultiMotion
- Y-axis 1 drive with motor encoder => MOVIKIT® StackerCrane MultiMotion

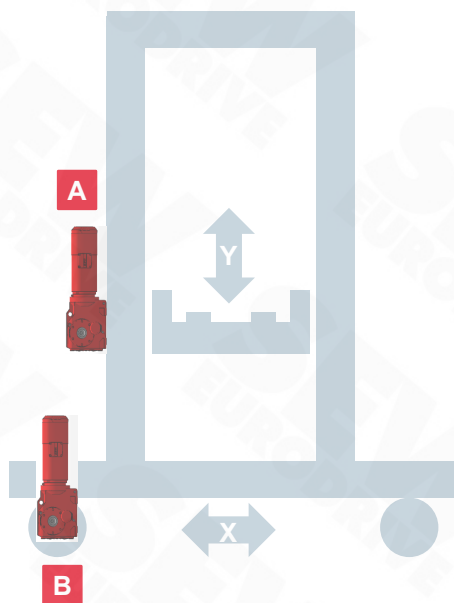
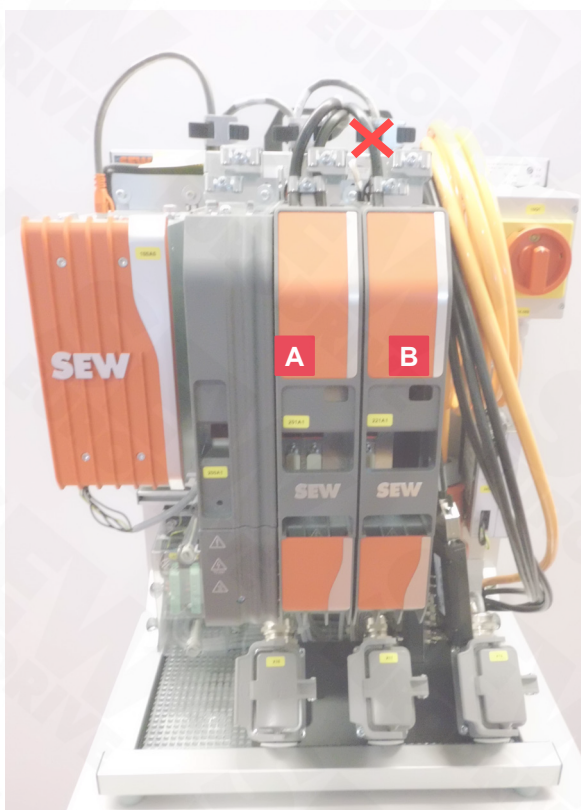


Scope of functions of MOVIKIT® StackerCrane effiDRIVE® in combination with MOVIKIT®...



MultiMotion

3.2 Training model / training system storage/retrieval system



- | | | |
|----------|--------------|-----------------------|
| A | Hoist | CMP50S/BK/KY/AK0H/SB1 |
| B | Running gear | CMP50S/BK/KY/RH1M/SB1 |

3.3 Step 1 – Project setup in MOVISUITE®

Goals

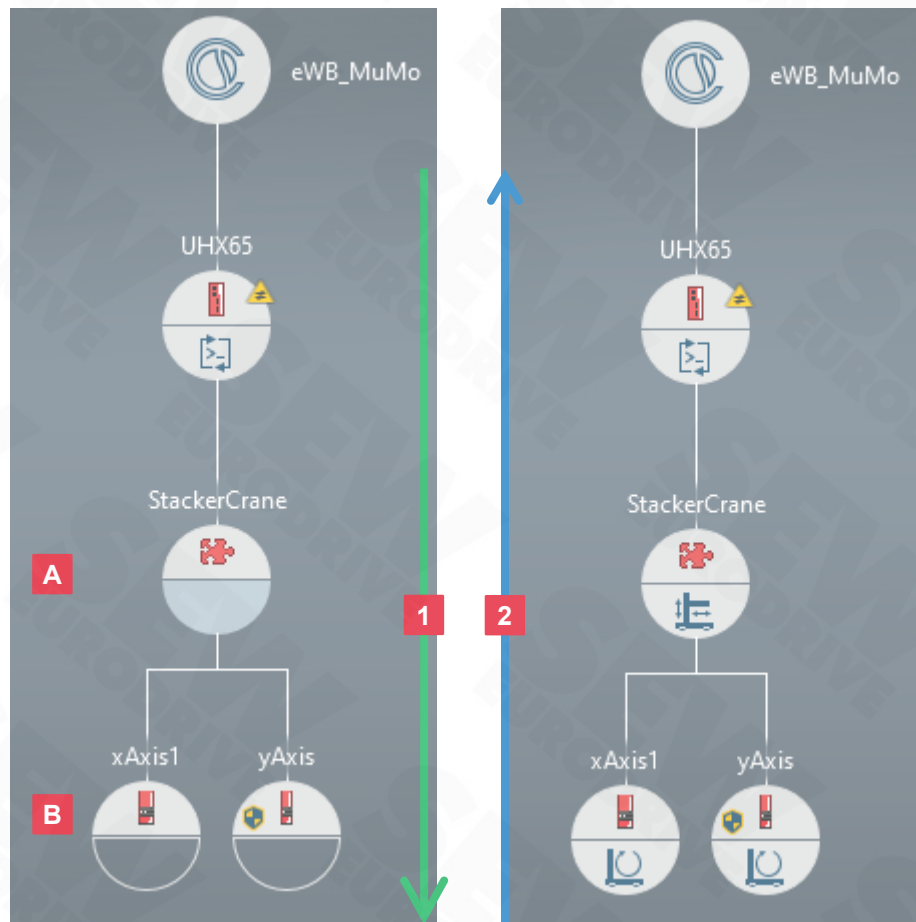
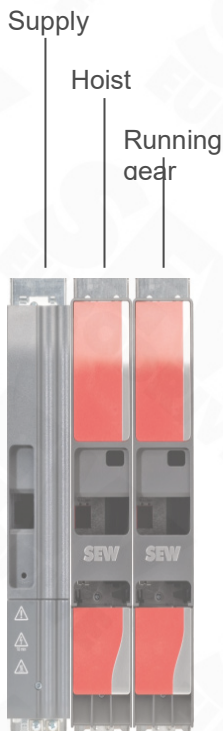
- Procedure for setting up the project offline and online
- Can set up a project



3.3.1 Useful information about the project structure



General information



1 Set up structure: **From the top to the bottom**

2 Configure and start up: **From the bottom to the top**

A Software nodes: A MOVIKIT® software module can be added to each software node for an axis group or higher-level functionality, such as:

- StackerCrane
- MultiAxisController (can also be used with only one subordinate axis)
- Robot
- ...

B **Horizontal drive** must be positioned **TO THE LEFT** under the StackerCrane, regardless of the hardware structure of the axis block

Note: The vertical drive usually needs more current than the horizontal drive. The vertical drive's axis module is therefore positioned on the left next to the horizontal drive in the hardware structure.

Observe and/or produce positioning in the MOVISUITE view during online startup



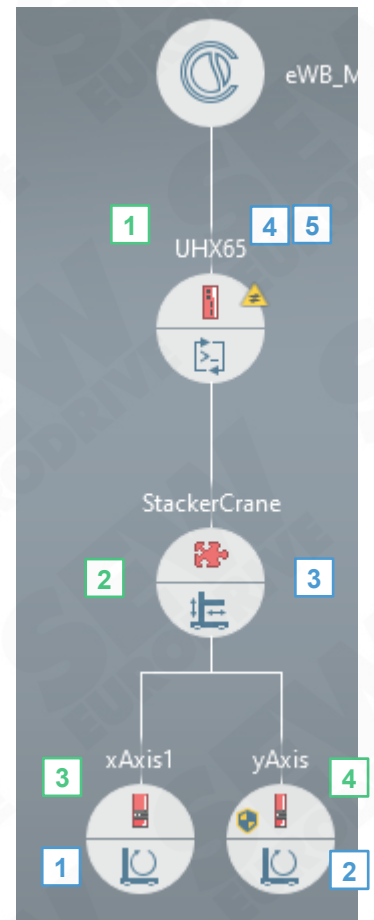
Project setup offline – MOVISUITE® planning phase

1. Build structure

- 1 Add MOVI-C® Controller
- 2 Add SoftwareNode
- 3 Add horizontal drive (x-axis)
- 4 Add lifting drive (y-axis)

2. Configuring the modules

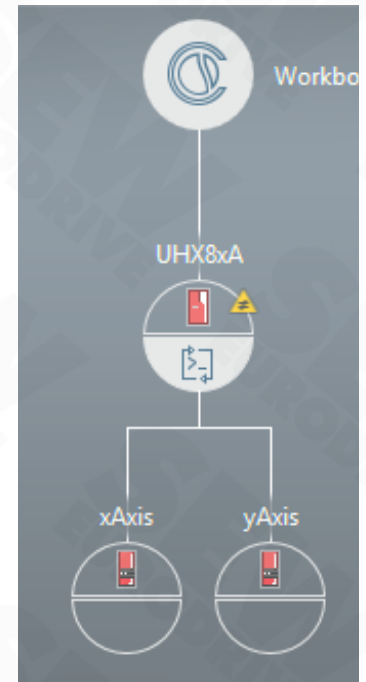
- 1 Start up & parameterize travel drive train (x-axis)
- 2 Start up & parameterize lifting drive train (y-axis)
- 3 Add & parameterize StackerCrane MultiMotion
- 4 Add & parameterize StackerCrane MultiMotion
- 5 Add StackerCrane to the SoftwareNode & parameterize
- 6 Configure MOVI-C® CONTROLLER
- 7 Create IEC project





Online project setup – MOVISUITE® startup phase

1. New project from scan

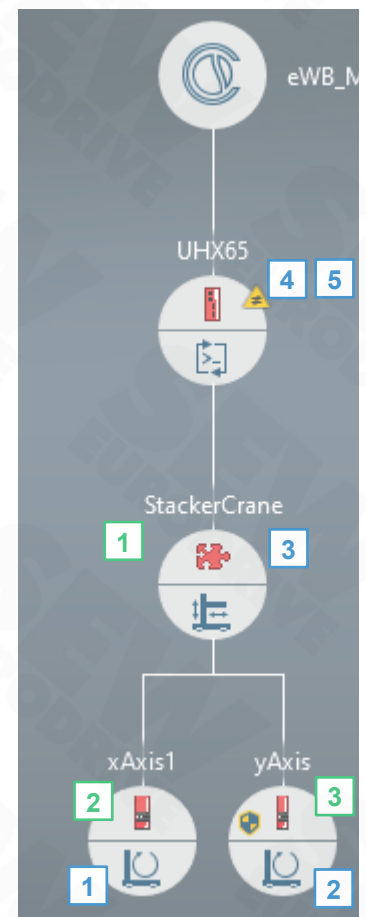


2. Configure modules

- 1 Insert software node
- 2 Inserting x-axis
- 3 Insert y-axis

3. Configure modules

- 1 Start up & parameterize the x-axis drive train with the startup wizard
- 2 Start up & parameterize the x-axis drive train with the startup wizard
- 3 Insert and parameterize StackerCrane in the software code
- 4 CONFIGURE MOVI-C® CONTROLLER
- 5 Create IEC project



3.3.2 Create project structure

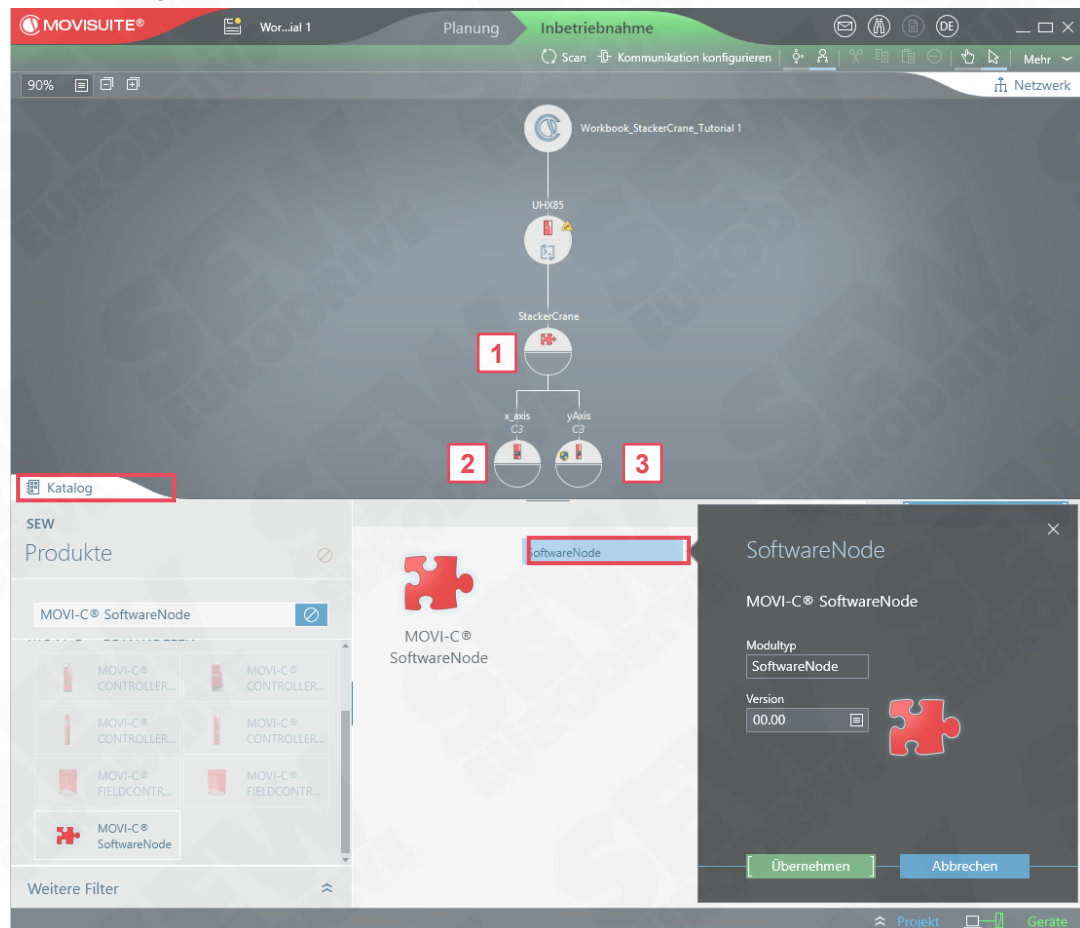


1. Scan axes



1 Click **Scan**

2. Build up the structure



- 1 Insert a **MOVI-C® SoftwareNode** from the **catalog**
- 2 Drag the horizontal drive (x-axis) TO THE LEFT under the StackerCrane SoftwareNode
- 3 Drag the vertical drive (y-axis) TO THE RIGHT under the StackerCrane SoftwareNode

3.4 Step 2 – Startup of the travel and hoist

Goals

- Start up and parameterize travel axis and lifting axis drive trains.

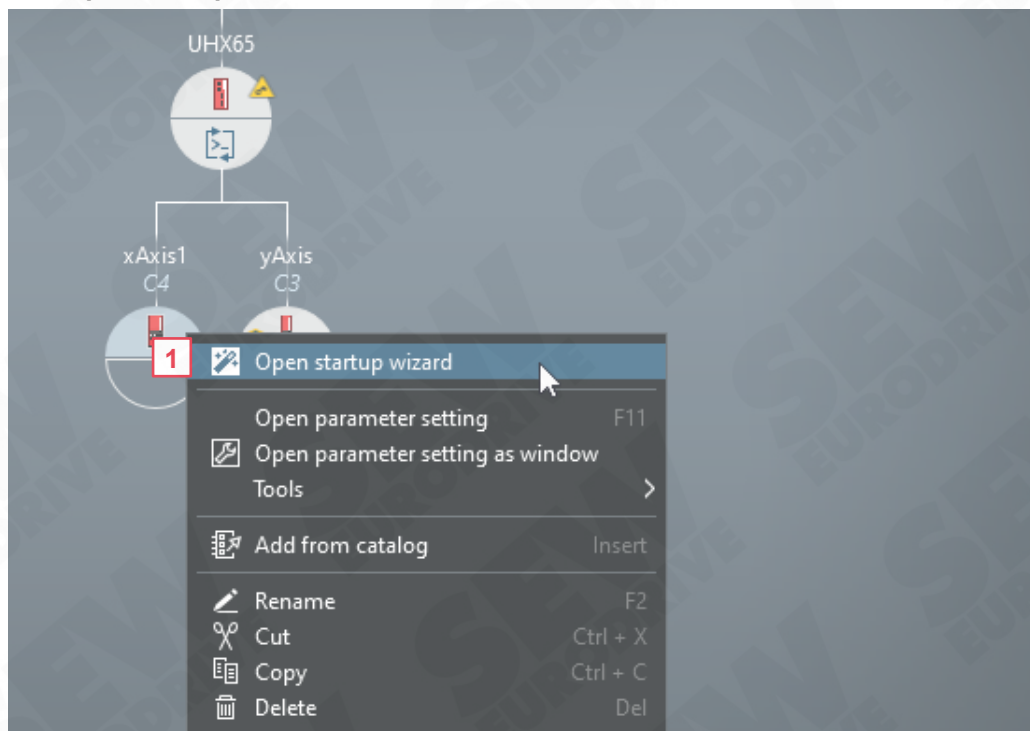


3.4.1 Start up the drive trains

3.4.1.1 Travel unit (x-axis)



1. Open startup assistant



1 Right-click to open the **startup wizard**.

2. Voltage supply

Startup wizard

> UHX65 > xAxis1 — C4

xAxis1

Device identification
MDD90A-0040-503-X-S00

1 Basic settings

2 Voltage supply

3 Drive train DT1

4 MOVIKIT®

5 Optimization DT1

6 Completion

Basic settings

Voltage supply

Select the voltage supply used and enter the voltage.

Voltage supply
MDP90 power supply module

Nominal line voltage AC
400 V

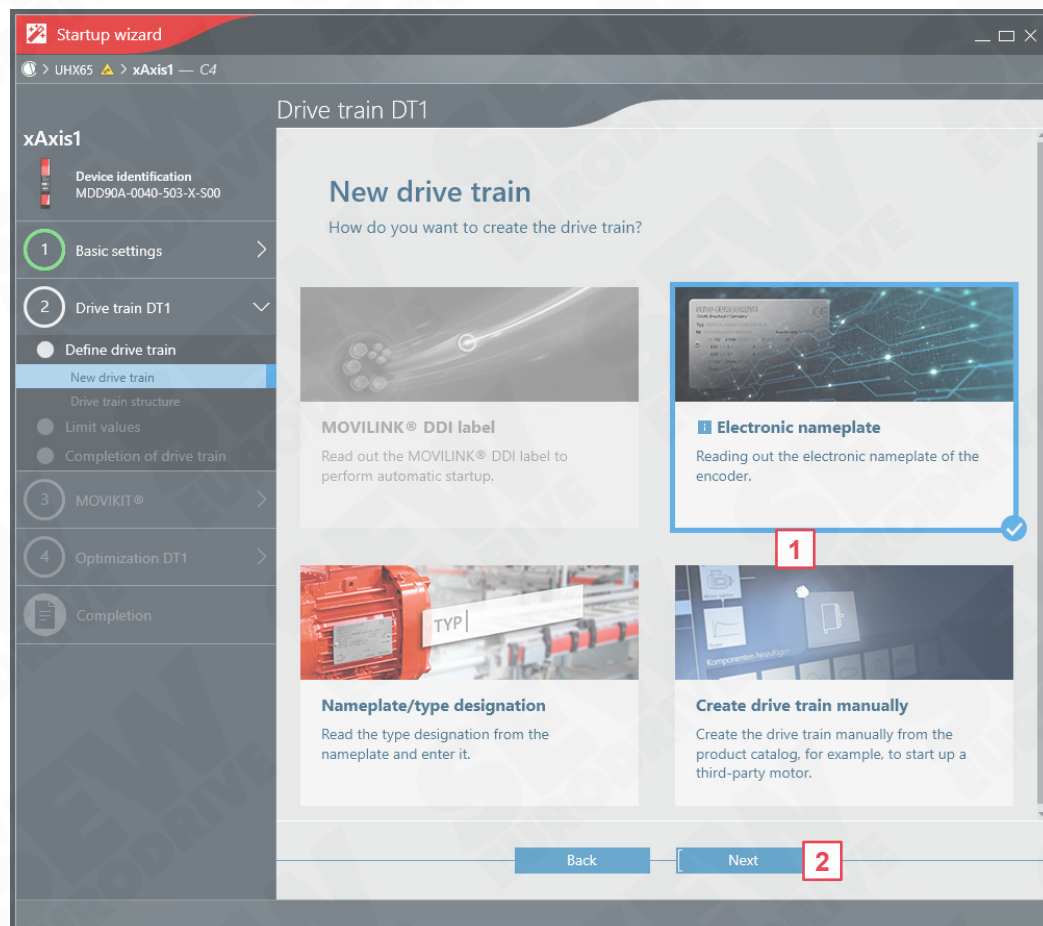
Remote axis system

Back Next

1 Select the power supply module and the line voltage.

2 Press **Next**

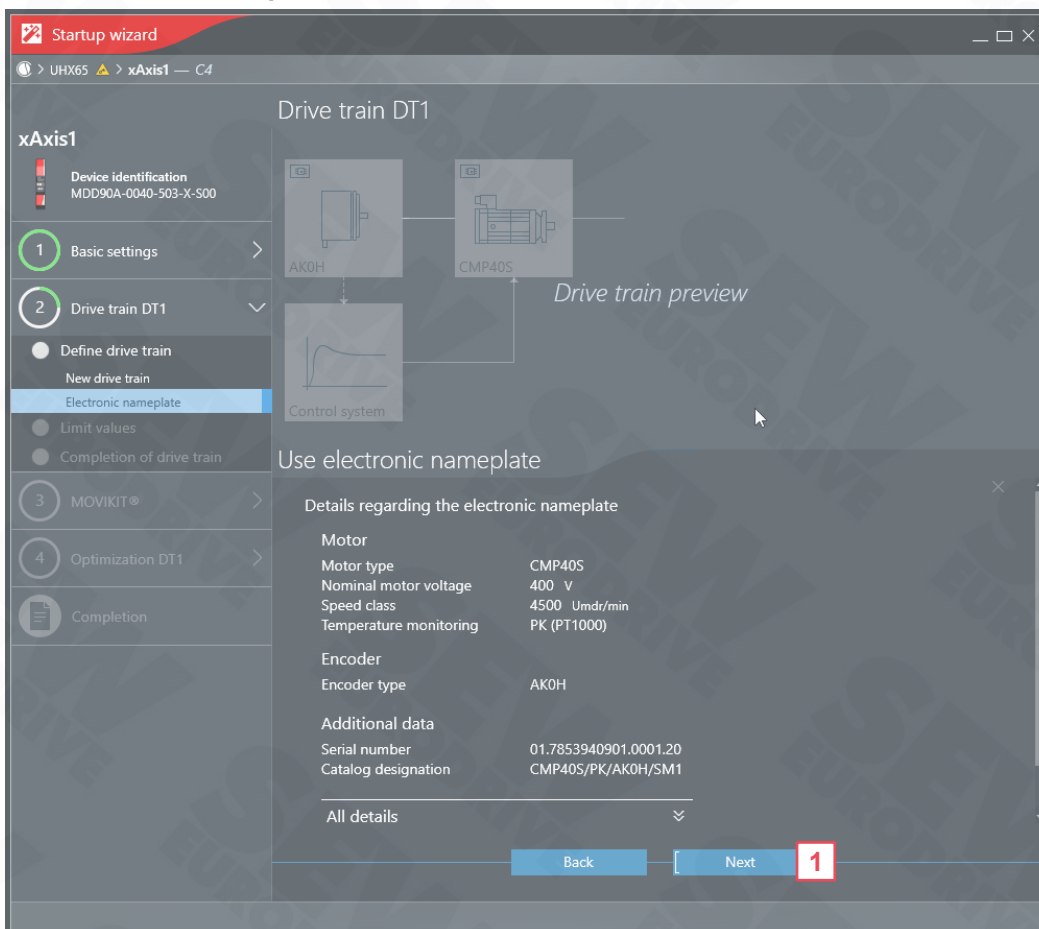
3. Edit the drive train



1 Select how you want to start up the drive train.

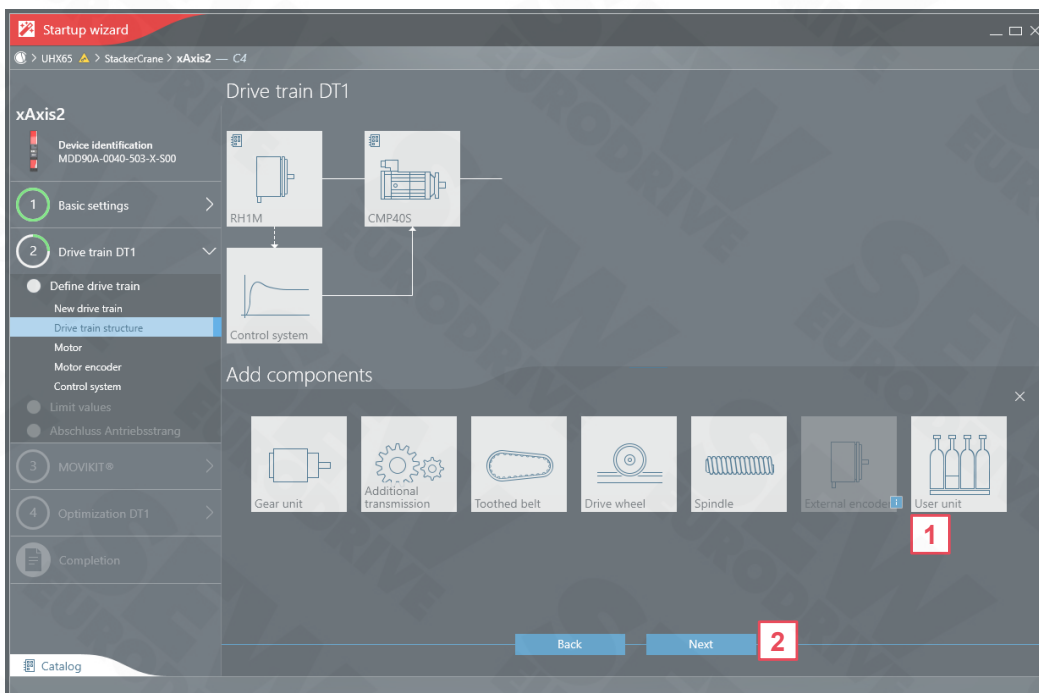
2 Press **Next**.

4. Electronic nameplate



1 Press **Next**.

5. User units



1 Add the user units.

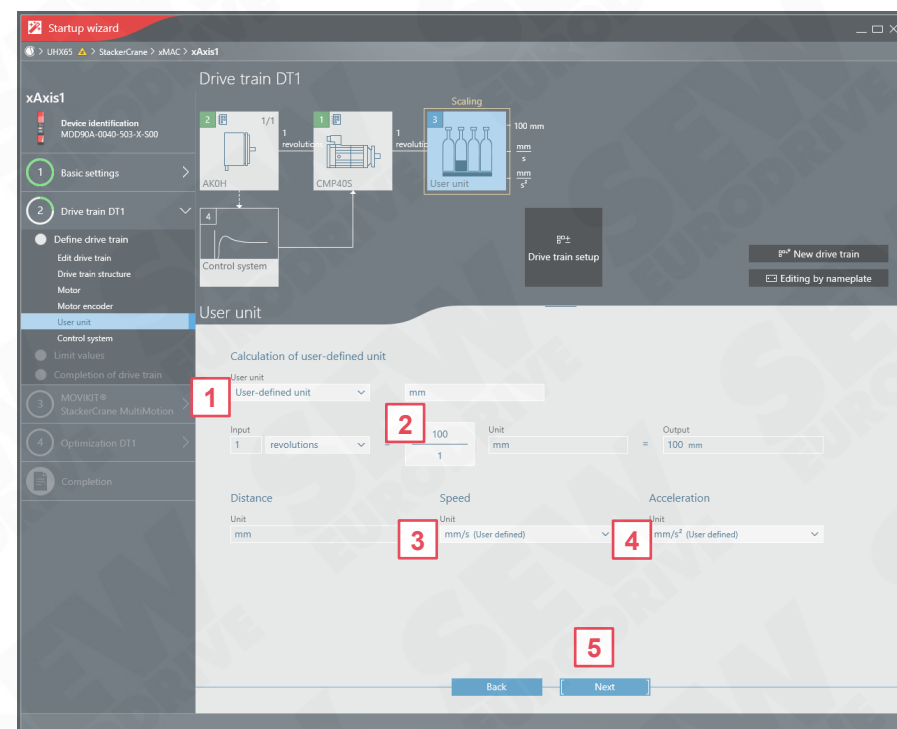
2 Press **Next**.

6. Select position-given encoder



1 Press **Next**

7. User units

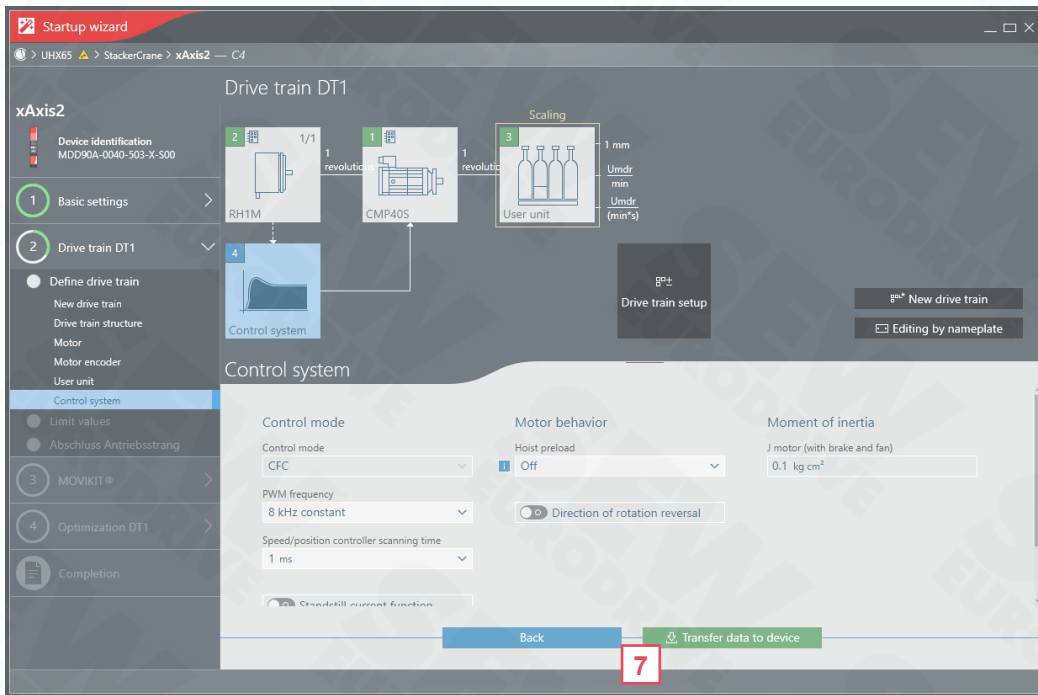


- 1** Define user unit. We recommend mm.
- 2** Set input revolutions to 100 mm.
- 3** Select user-defined speed unit. **User unit/s** must be used.
- 4** Select user-defined acceleration unit. **User unit/s²** must be used.
- 5** Press **Next**.



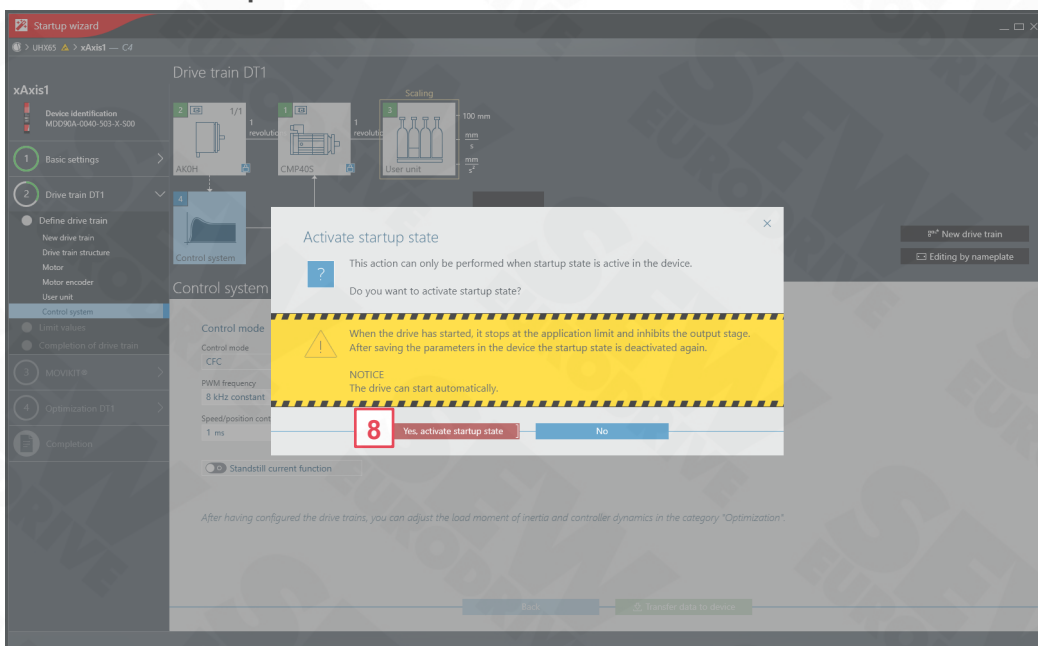
The jerk is transferred in the StackerCrane in user unit/s³.

8. Transfer data to device



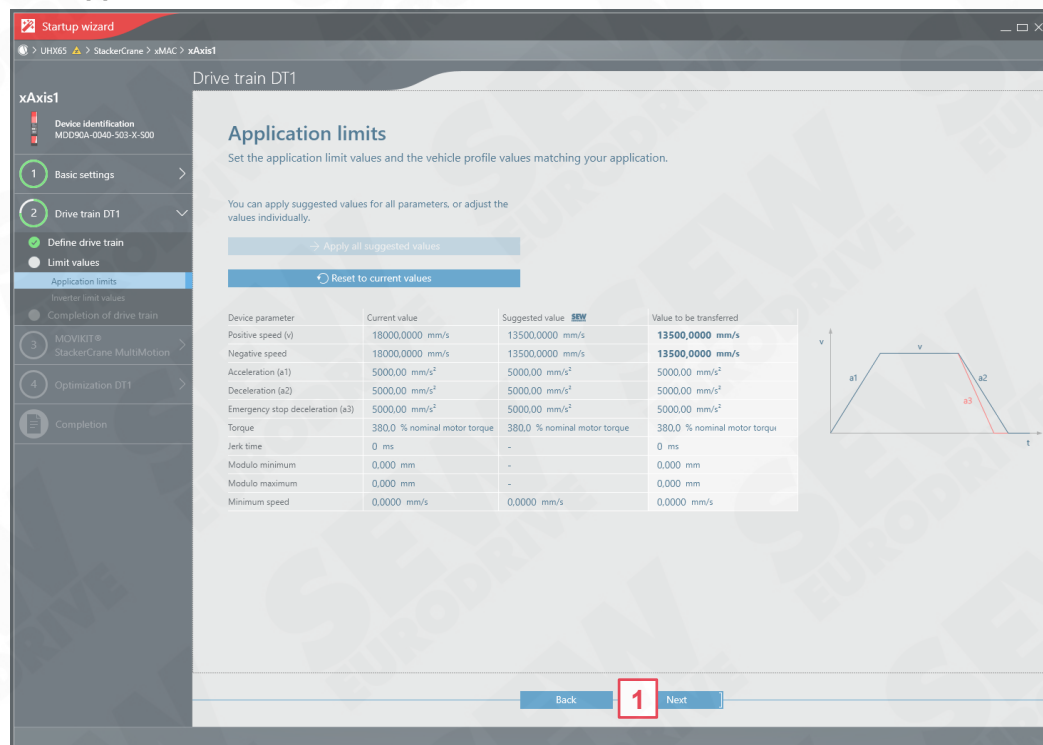
7 Press **Transfer data to device**

9. Activate startup state



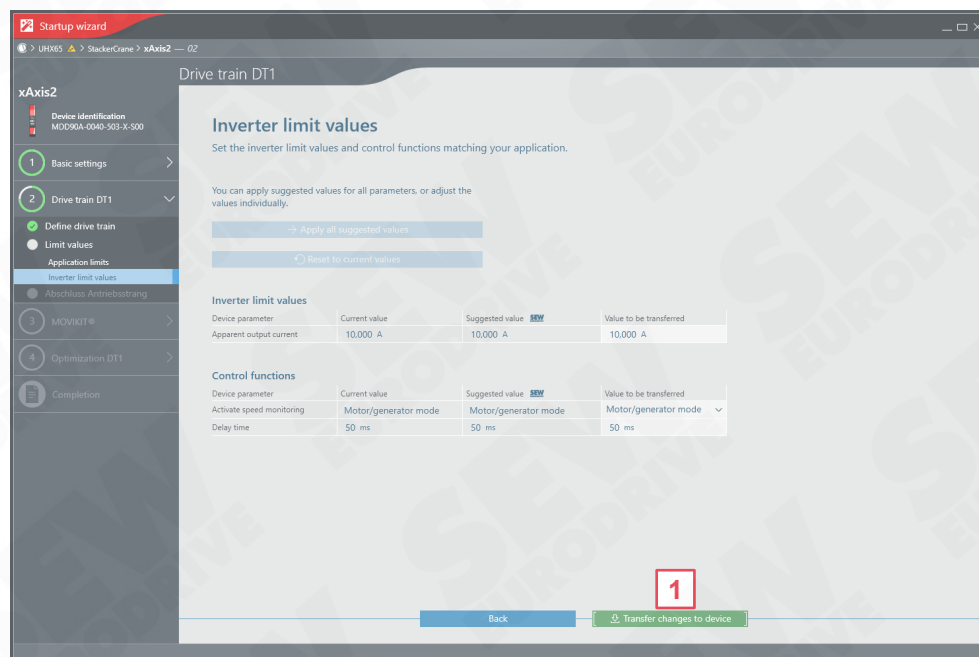
8 Press **Yes, activate startup state**

10. Application limits



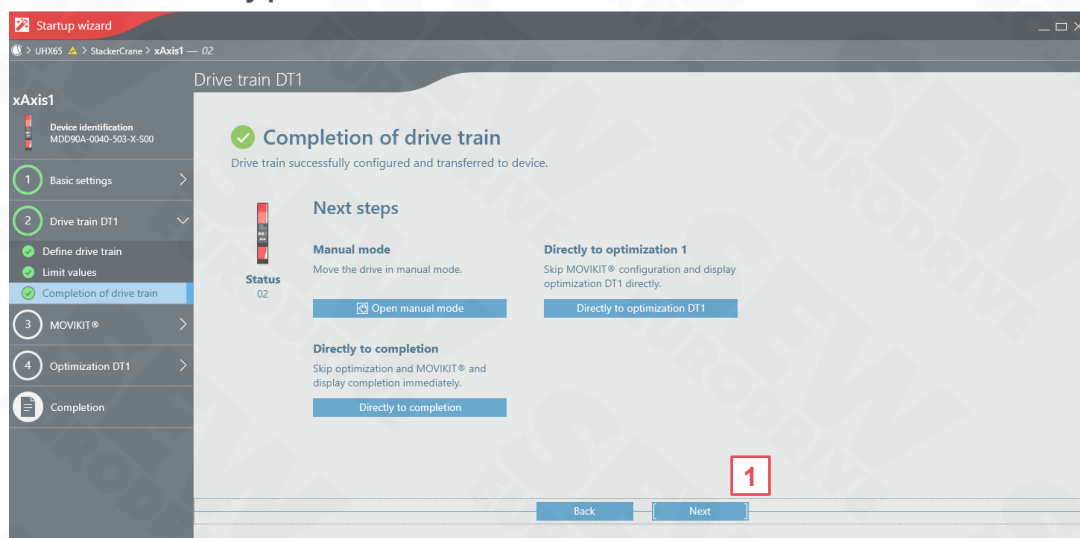
1 Press **Next**.

11. Inverter limits



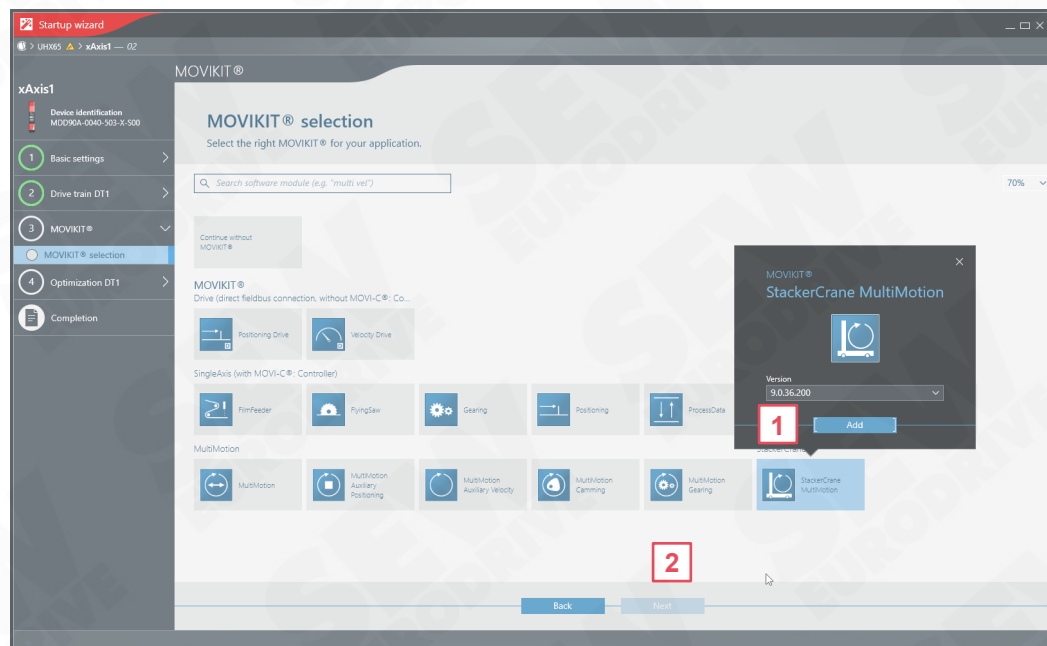
1 Press **Next**.

12. Drive train fully parameterized



1 Press **Next**

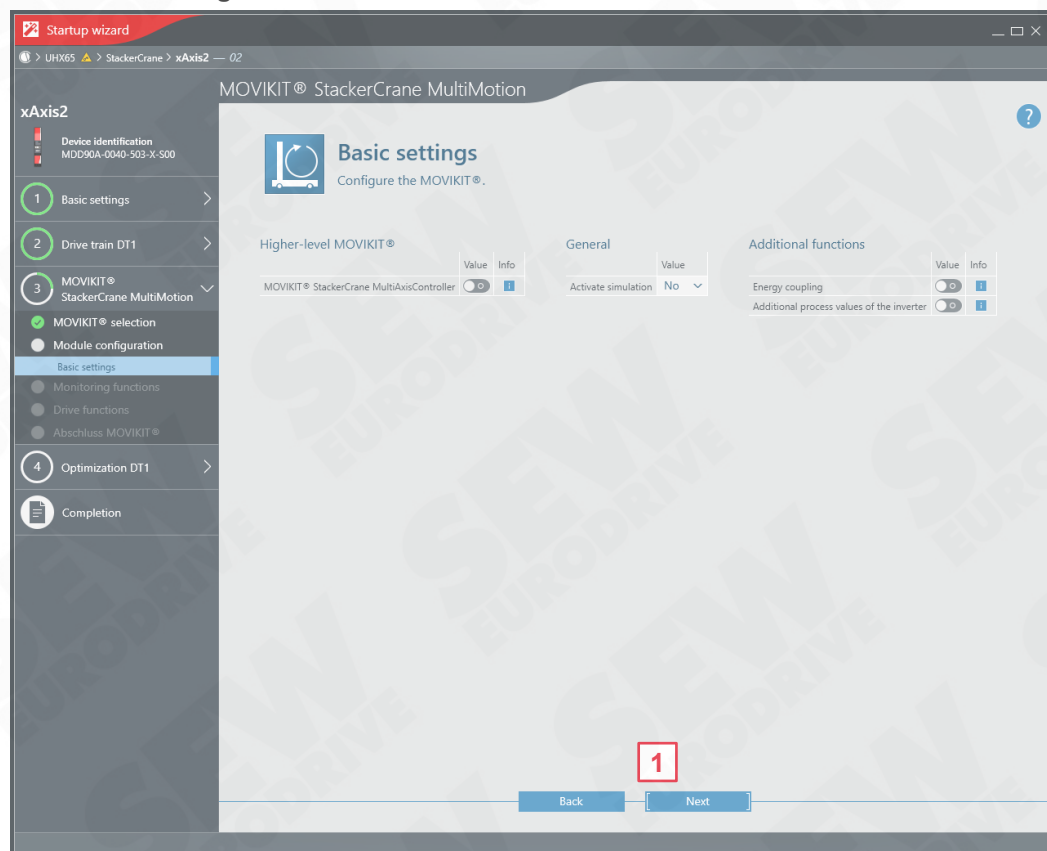
13. Add MOVIKIT®



1 Add MOVIKIT® StackerCrane MultiMotion.

2 Press **Next**.

14. Basic settings



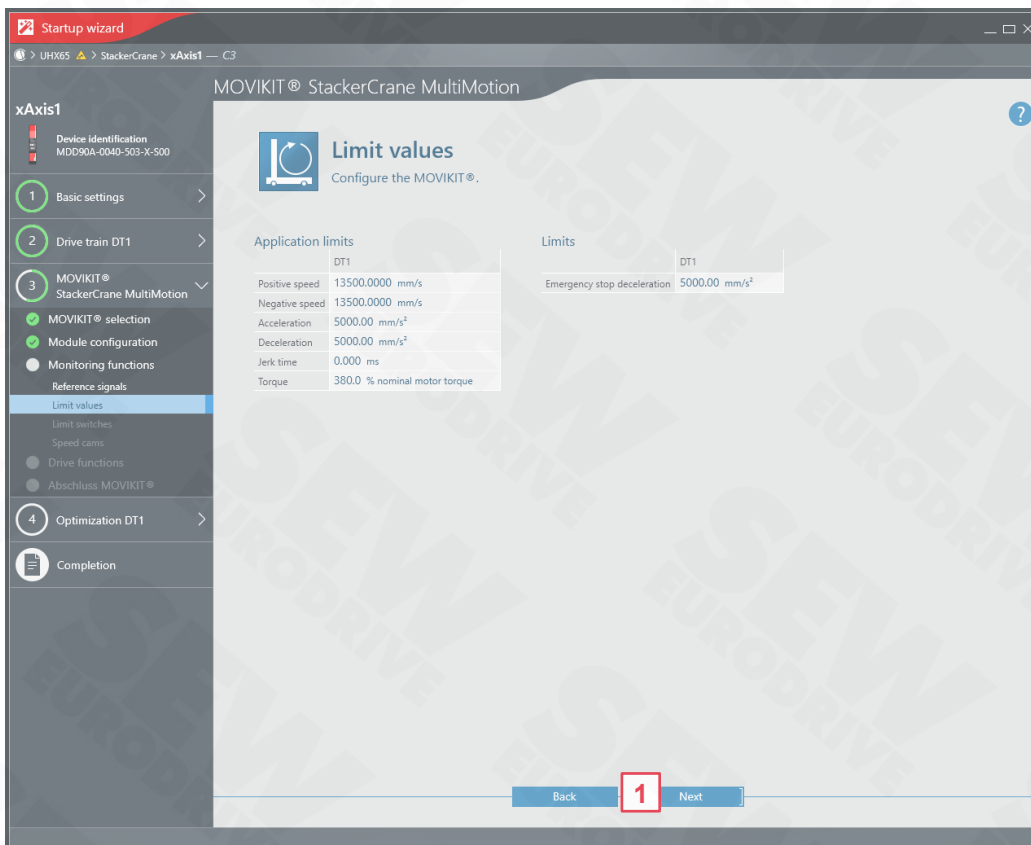
1 Press **Next**.

15. Reference signal



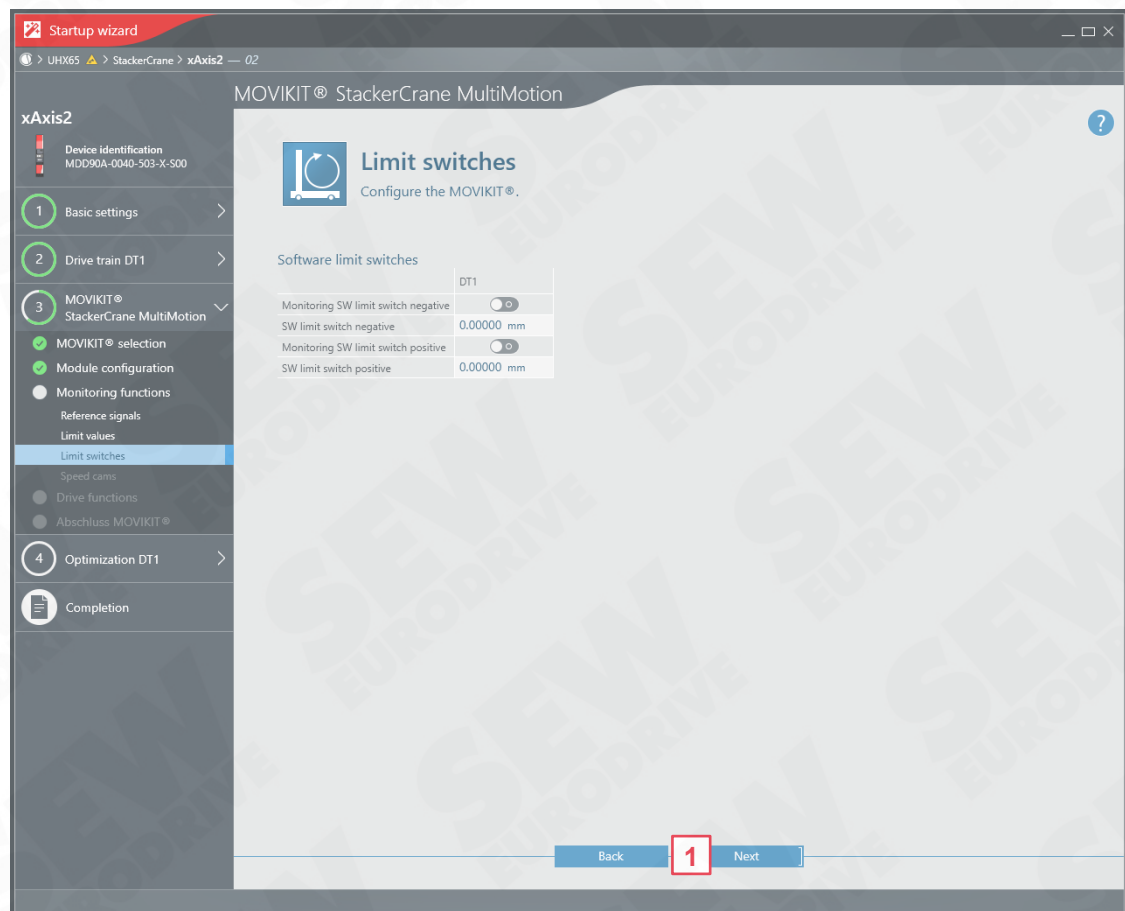
1 Press **Next**.

16. Limit values



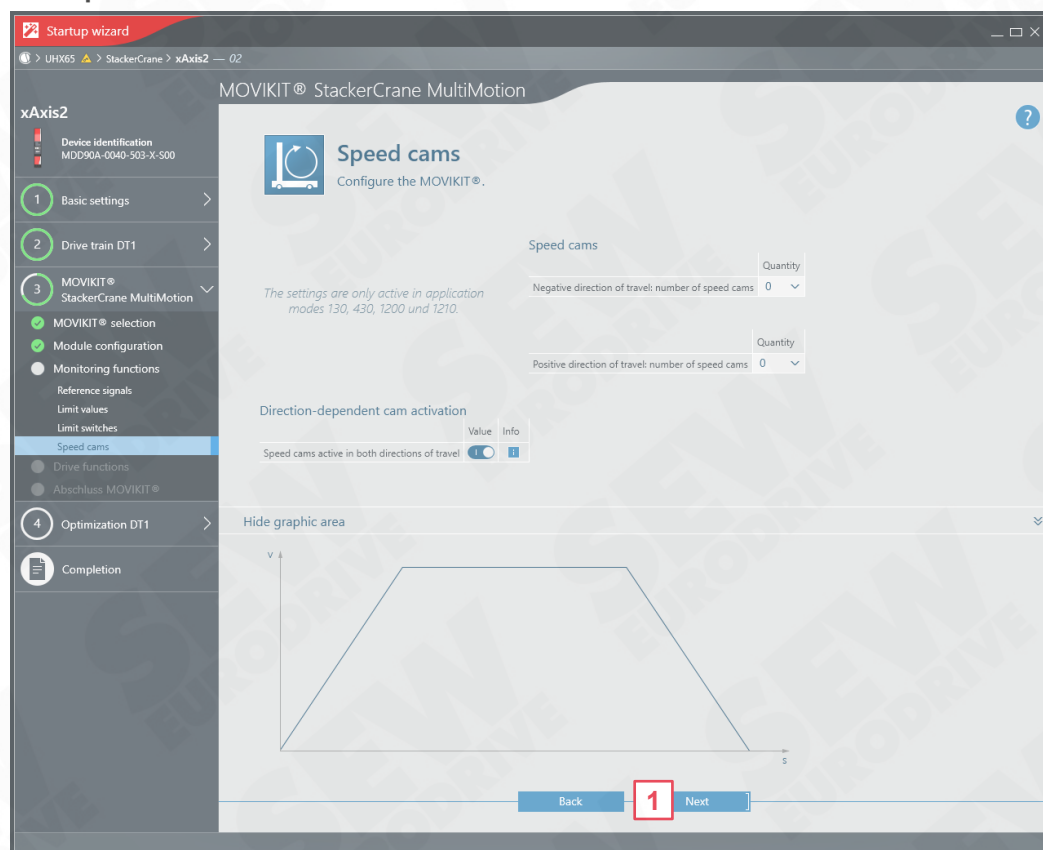
1 Press **Next**.

17. Limit switch



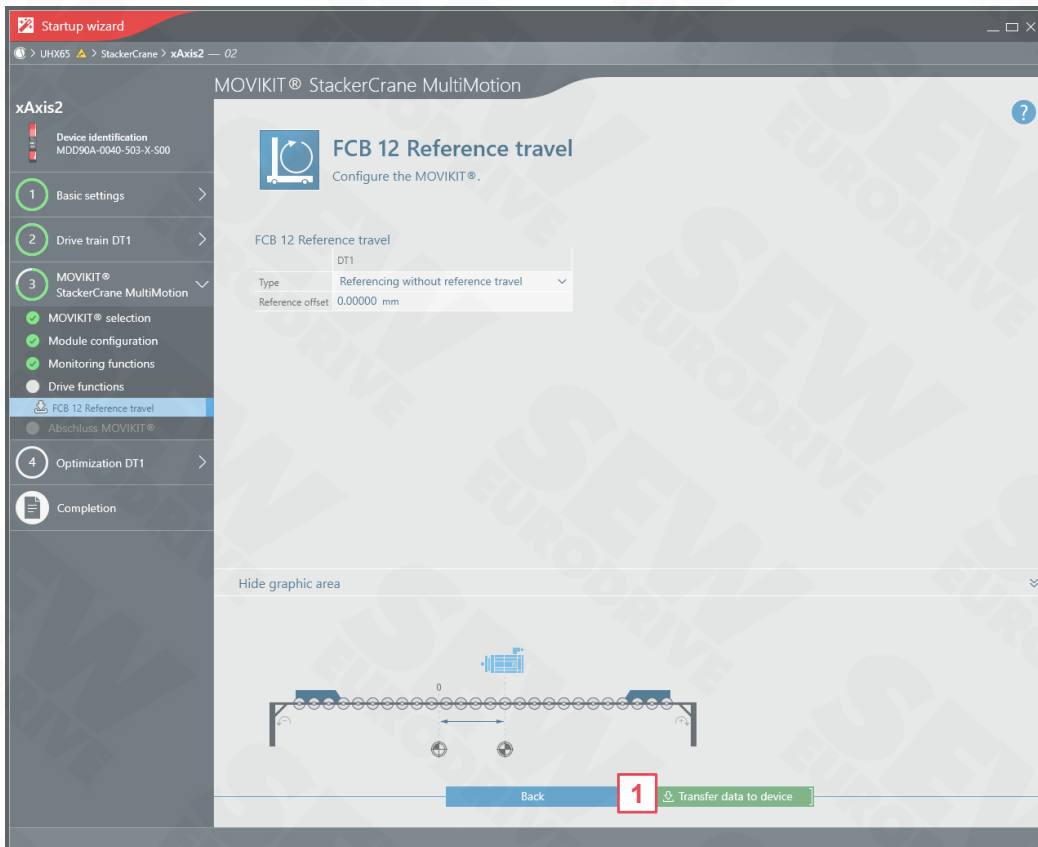
1 Press **Next.**

18. Speed cam



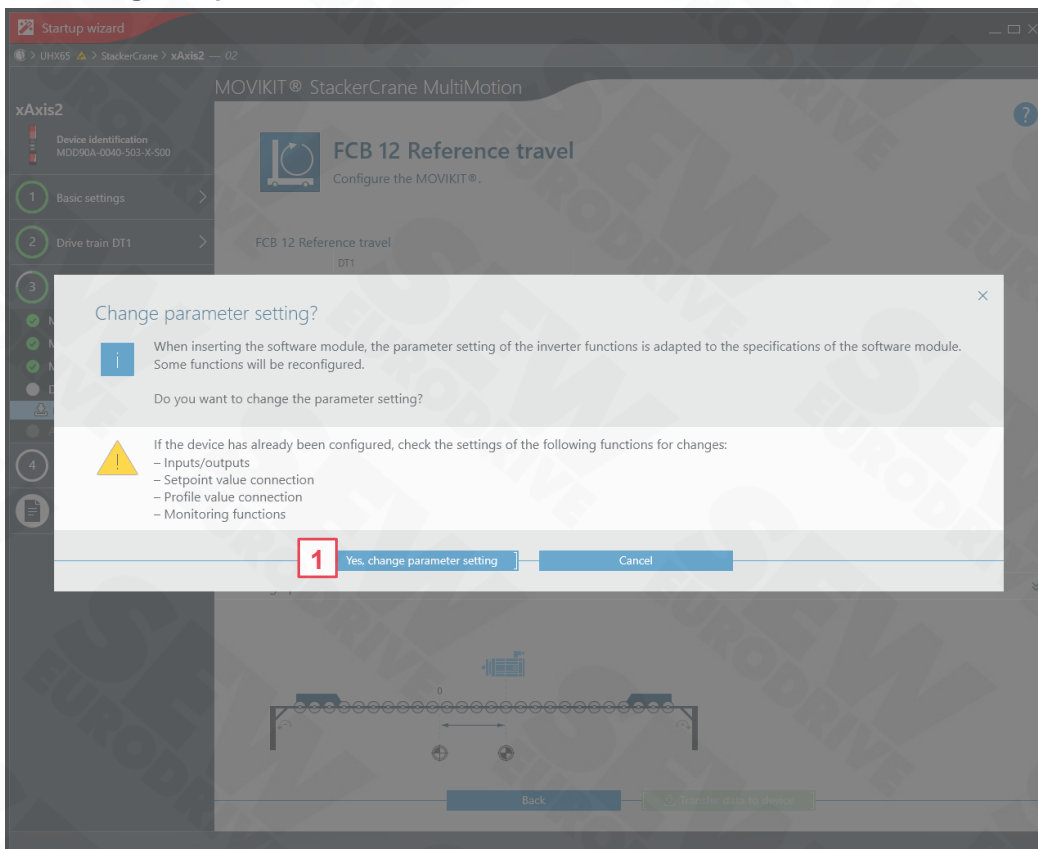
1 Press **Next.**

19. FCB 12 Reference travel



1 Press **Transfer data to device**

20. Change the parameterization



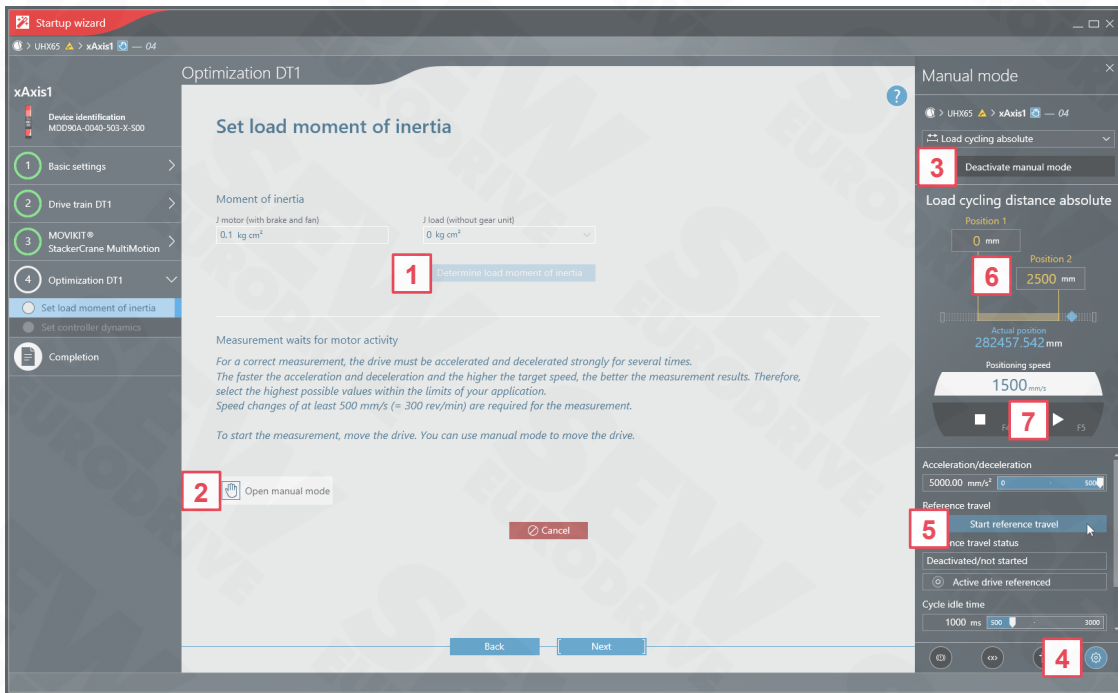
1 Press **Change parameter data.**

21. MOVIKIT® completion

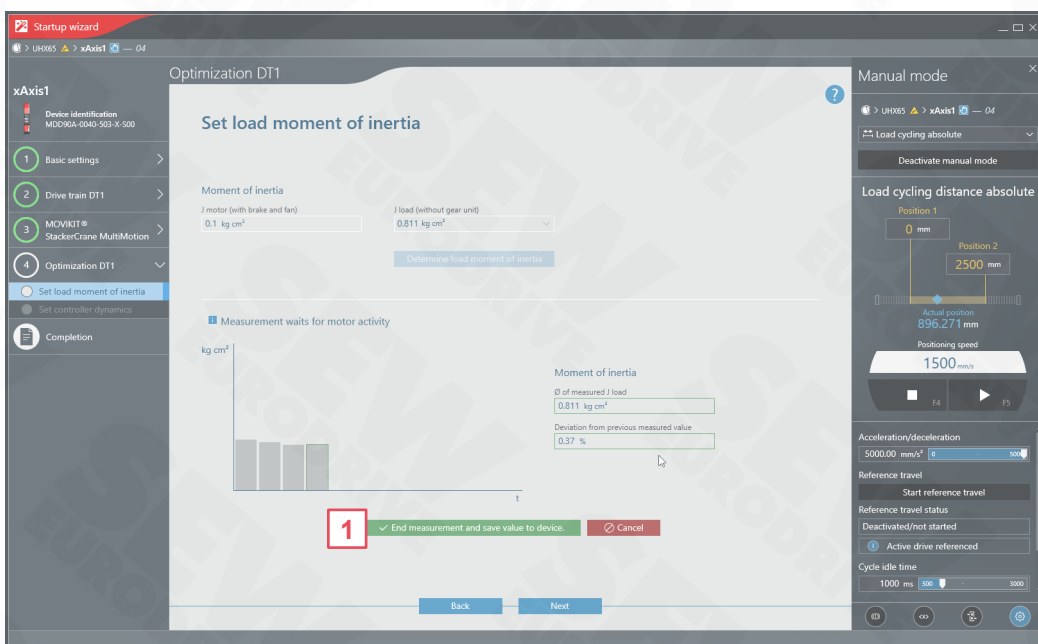
The screenshot displays the MOVIKIT® StackerCrane MultiMotion software interface. On the left is a sidebar for 'xAxis1' with a menu containing: 'Device identification MDD90A-0040-503-X-S00', '1 Basic settings', '2 Drive train DT1', '3 MOVIKIT® StackerCrane MultiMotion' (expanded), 'MOVIKIT® selection', 'Module configuration', 'Monitoring functions', 'Drive functions', 'Completion of MOVIKIT®' (highlighted), '4 Optimization DT1', and 'Completion'. The main area shows a green checkmark and the title 'Completion of MOVIKIT®' with the message 'MOVIKIT® successfully configured and transferred to device.' Below this is a 'Status E3401' icon and 'Next steps' section. The 'Next steps' section has two options: 'Manual mode' (Move the drive in manual mode. Button: Open manual mode) and 'Directly to completion' (Skip optimization and MOVIKIT® and display completion immediately. Button: Directly to completion). At the bottom right, there is a red box with the number '1' above a 'Next' button. A 'Back' button is also visible at the bottom left of the main area.

1 Press **Next.**

22. Optimization – set load moment of inertia



- 1 Activate the load moment of inertia determination
- 2 Activate manual mode
- 3 Switch on manual mode
- 4 Open the Reference travel tab using the "Gear wheel" button
- 5 Start reference travel
- 6 Defining positions 1 and 2 for the oscillation distance in absolute order
- 7 Start oscillation section ▶, F5

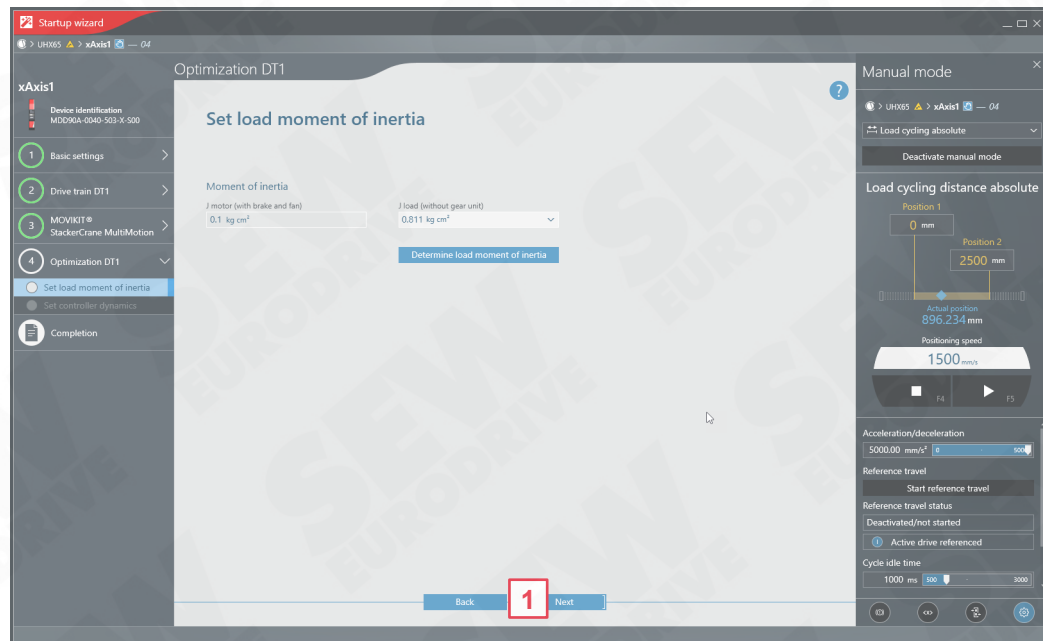


- 8 End measurement and save value in device

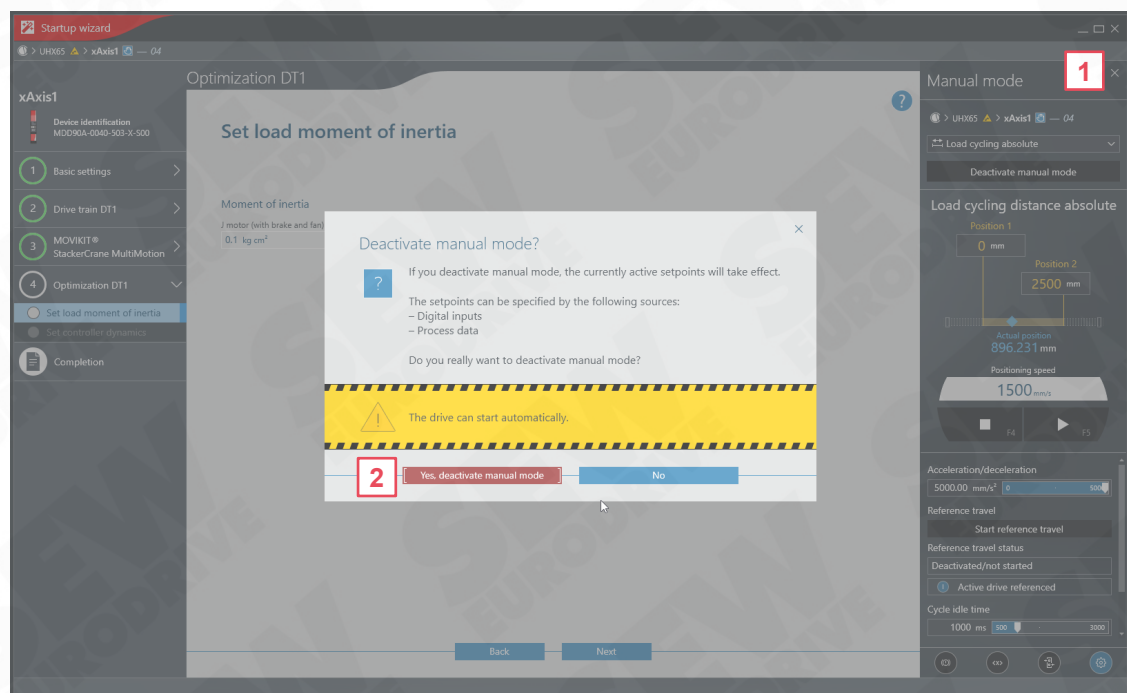


General information:

If the load moment of inertia cannot be determined, increase the acceleration and deceleration and restart the process. If the load moment of inertia still cannot be determined, also increase the positioning speed.

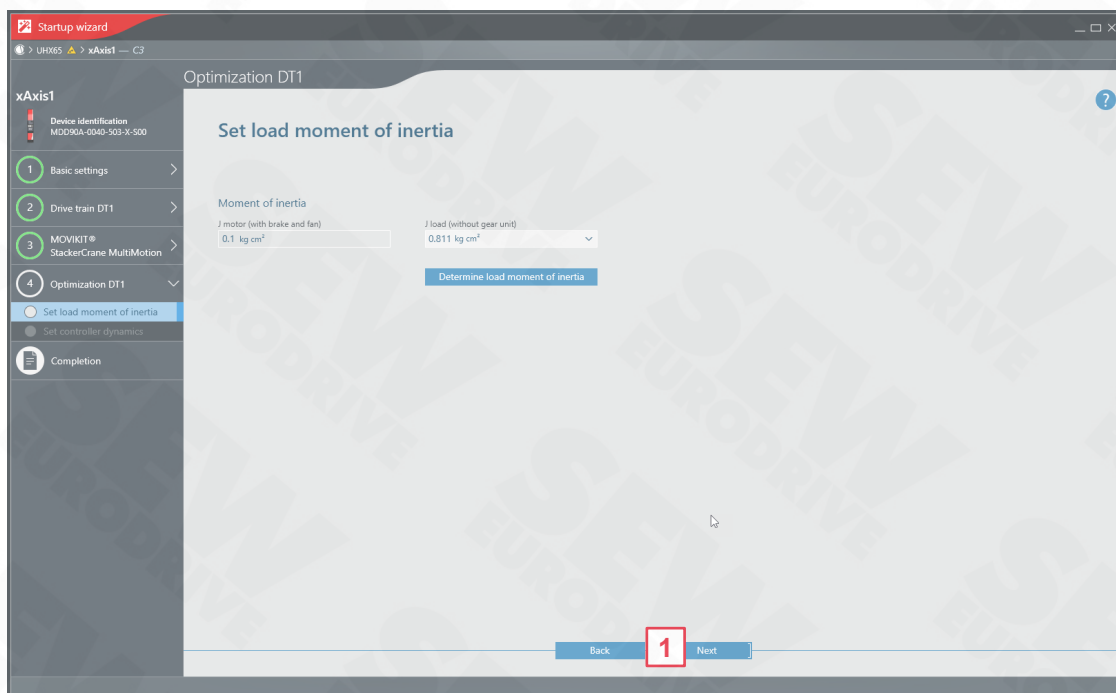


1 Press **Next**.



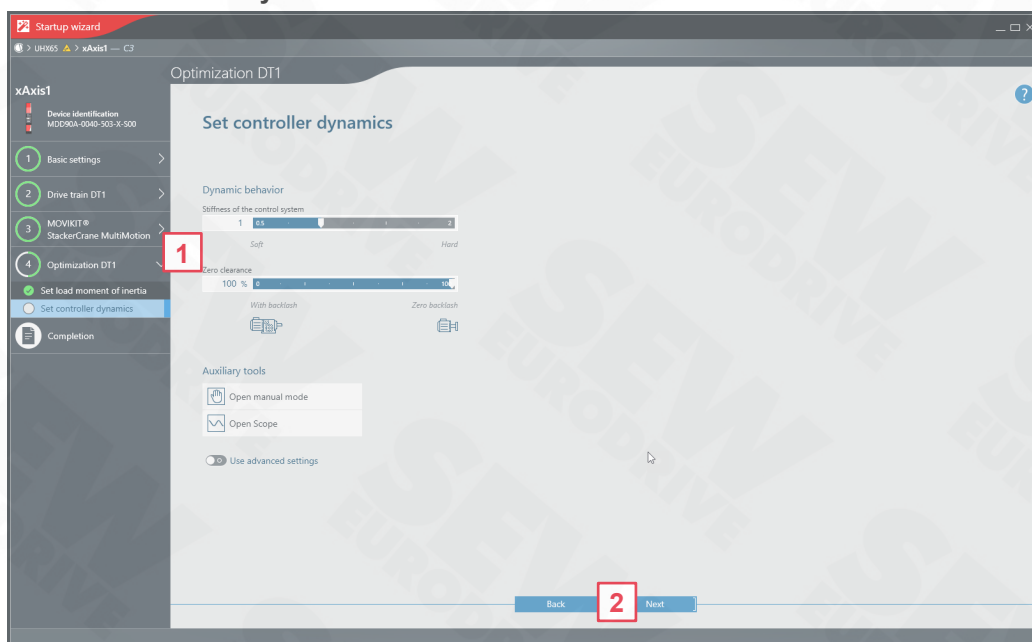
1 Close manual mode.

2 Press **Yes, activate startup state**



1 Press **Next**.

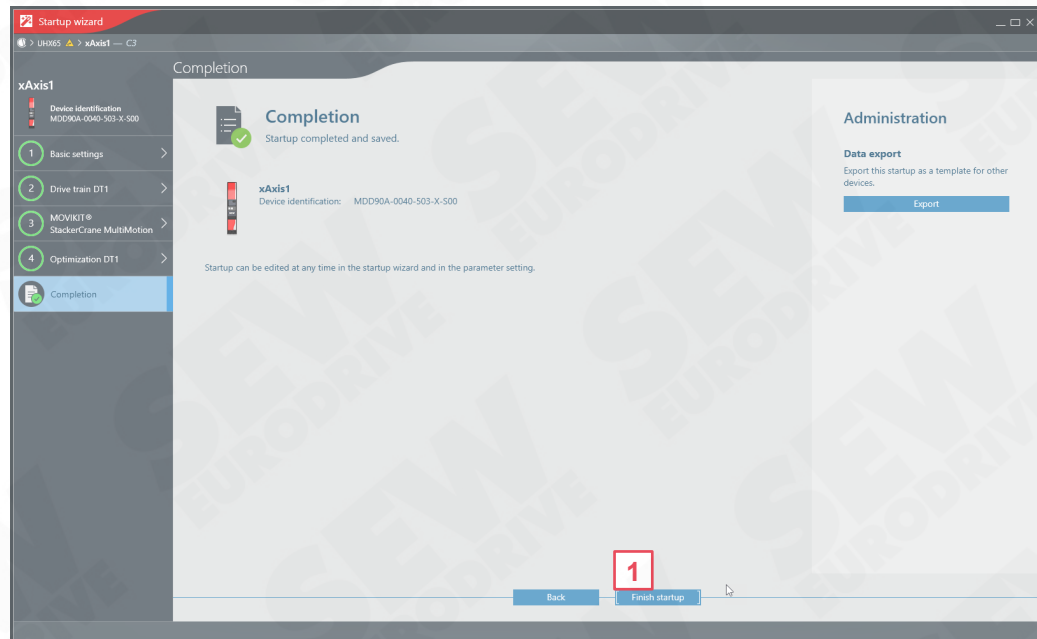
23. Set controller dynamics



1 Set stiffness and clearance. Press **Next**.

2 Press **Next**.

24. Conclusion



1 Press **Finish startup**.

3.4.1.2 Hoist (y-axis)

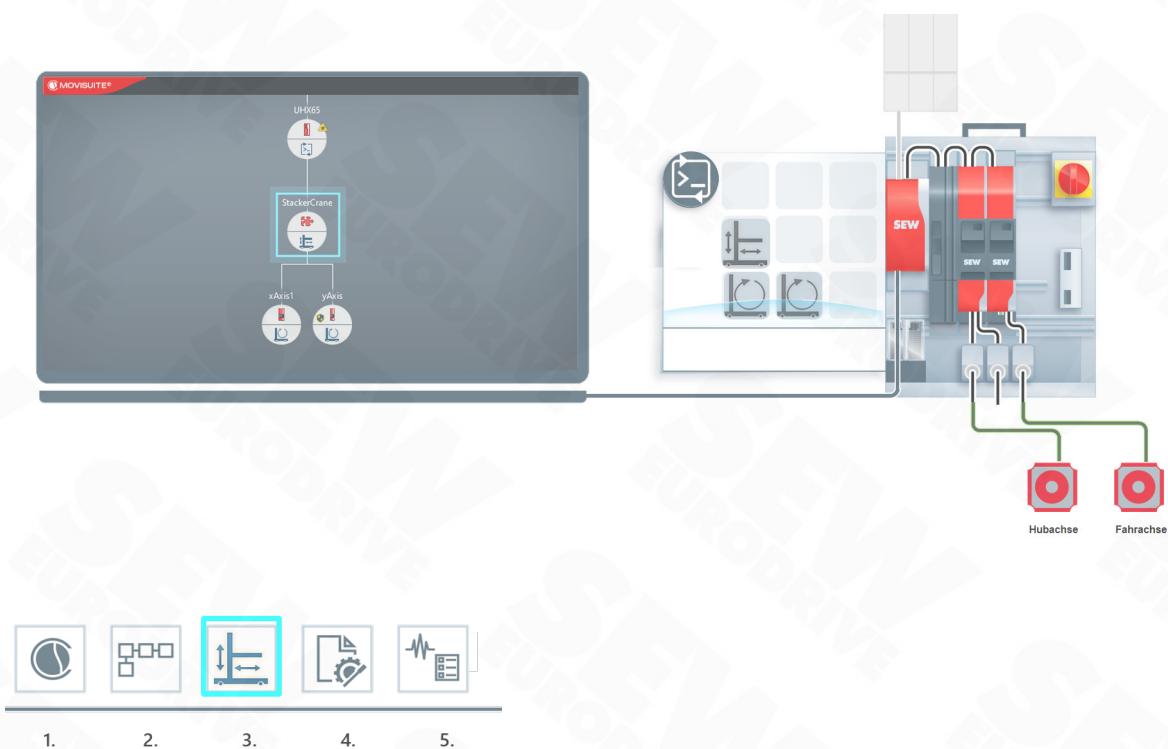


1. Repeat the startup for the y-axis with the startup assistant as in the previous chapter (travel axis x-axis)

3.5 Step 3 – Parameterization of MOVIKIT® StackerCrane

Goals

- Assigning and parameterizing MOVIKIT® StackerCrane
- Get to know the process data assignment of the fieldbus interface



3.5.1 Parameterize MOVIKIT® StackerCrane



1. Assign MOVIKIT®



- 1** Activate the **lower semicircle of the software node**
- 2** Select the latest version of the **MOVIKIT® StackerCrane effiDRIVE** in the **catalog**
And click **Add**.

2. Configure the fieldbus interface

Parameter tree

Fieldbus interface

Fieldbus configuration

Value

1

Activate fieldbus connection Yes

Start address 1

Optional process data

	Value	Number of PD	PD info
MultiAxisController – x-direction and y-direction	<input checked="" type="radio"/>	12 PD	1
Number of axes under MultiAxisController – x-direction	0	6 PD/axis	1
Number of axes under MultiAxisController – y-direction	0	6 PD/axis	1

Process data length

	Value
Basic process data	24
Optional process data	0
Additional process data user program	0
Process data length	24

Decimal places via fieldbus

	Position	Speed	Acceleration	Jerk
Number of decimal places	0	0	0	0

1 Set **Activate fieldbus connection = Yes** and **Start address = 1**












2 Set decimal places for the fieldbus:

Number of decimal places	Value	Resolution
0	Position	1 mm = 1 mm
0	Speed	1 mm/s = 1 mm/s.
0	Acceleration	1 mm/s ² = 1 mm/s ²
0	Jerk	1 mm/s ³ = 1 mm/s ³

3.5.2 Process data assignment of the fieldbus interface



Process data assignment in MOVISUITE®

Fieldbus interface		PLC	PLC output data	PLC input data	MOVIKIT®
			>>>>	<<<<	
Axis group					
	Setpoint application mode		PO 1	PI 1	Actual application mode
	Control word		PO 2	PI 2	Status word
	Reserved (override)		PO 3	PI 3	Status or fault/subfault
	Reserved		PO 4	PI 4	Reserved
x-direction					
	Control word		PO 5	PI 5	Status word
	Setpoint speed		PO 6	PI 6	Actual speed
	Setpoint acceleration		PO 7	PI 7	Status or fault/subfault
	Setpoint deceleration		PO 8	PI 8	Torque
	Digital outputs		PO 9	PI 9	Digital inputs
	Control word MultiAxisController		PO 10	PI 10	Status word MultiAxisController
	Target position – high word		PO 11	PI 11	Actual position – high word
	Target position – low word		PO 12	PI 12	Actual position – low word
	Setpoint jerk		PO 13	PI 13	Actual jerk
	Reserved		PO 14	PI 14	Reserved
y-direction					
	Control word		PO 15	PI 15	Status word
	Setpoint speed		PO 16	PI 16	Actual speed
	Setpoint acceleration		PO 17	PI 17	Status or fault/subfault
	Setpoint deceleration		PO 18	PI 18	Torque
	Digital outputs		PO 19	PI 19	Digital inputs
	Control word MultiAxisController		PO 20	PI 20	Status word MultiAxisController
	Target position – high word		PO 21	PI 21	Actual position – high word
	Target position – low word		PO 22	PI 22	Actual position – low word
	Setpoint jerk		PO 23	PI 23	Actual jerk
	Reserved		PO 24	PI 24	Reserved



Target application mode

- 0 Default
- 100 Jog
- 300 Referencing configured offset
- 301 Referencing bus offset
- 400 Positioning absolute
- 1200 Energized-optimized XY positioning
- 1210 Mechanics-optimized positioning
- 1300 External braketest



Control word x-& y-direction

Bit 0	Enable emergency stop
Bit 1	Enable application stop
Bit 2	Reserved
Bit 3	Release brake
Bit 4	Jog positive
Bit 5	Jog negative
Bit 6	Reserved
Bit 7	Start/stop with fieldbus ramp
Bit 8	Reset fault
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Deactivate external encoders
Bit 12	Deactivate SW limit switches
Bit 13	Activate output stage inhibit
Bit 14	Activate standby mode
Bit 15	MOVIKIT® Handshake In

Status word x-& y-direction

Bit 0	Ready
Bit 1	STO inactive
Bit 2	Output stage enabled
Bit 3	Brake released
Bit 4	Motor turning
Bit 5	Referenced
Bit 6	Reserved
Bit 7	In position
Bit 8	Fault
Bit 9	Reserved
Bit 10	Reserved
Bit 11	External encoder disabled
Bit 12	SW limit switch inactive
Bit 13	Reserved
Bit 14	Standby mode active
Bit 15	MOVIKIT® Handshake Out



MultiAxisController control word

Bit 0	Deactivate member 1/11
Bit 1	Deactivate member 2/21
Bit 2	Deactivate member 12
Bit 3	Deactivate member 22
Bit 4	member 1/11 Release brake with inhibited output stage
Bit 5	member 2/21 Release brake with inhibited output stage
Bit 6	member 12 Release brake with inhibited output stage
Bit 7	member 22 Release brake with inhibited output stage
Bit 8	Deactivate balance controller
Bit 9	Reserved (deactivate position controller)
Bit 10	Deactivate skewing error
Bit 11	Allow skew compensation
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved

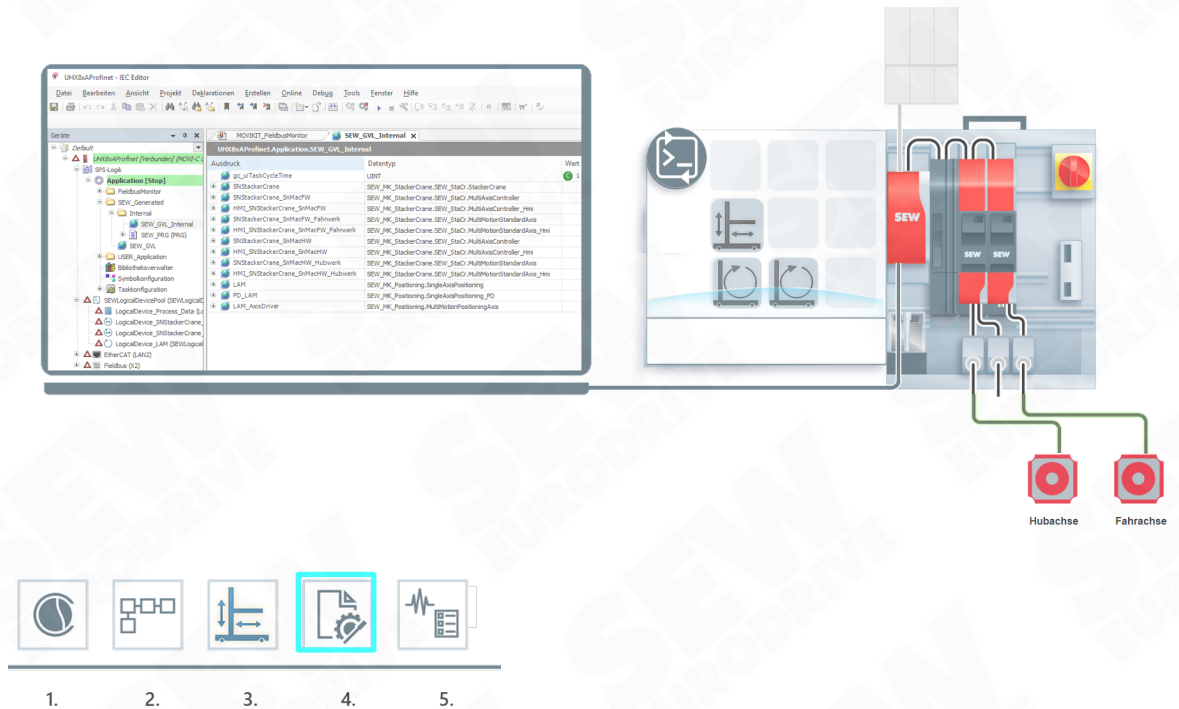
Status word x-& y-direction

Bit 0	Axis group member 1/11 deactivated
Bit 1	Axis group member 2/21 deactivated
Bit 2	Axis group member 12 deactivated
Bit 3	Axis group member 22 deactivated
Bit 4	Axis group member 1/11 brake released
Bit 5	Axis group member 2/21 brake released
Bit 6	Axis group member 12 brake released
Bit 7	Axis group member 22 brake released
Bit 8	Balance controller deactivated
Bit 9	Position controller deactivated
Bit 10	Skew in skew window
Bit 11	Overload guard active
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved

3.6 Step 4 – Generation of the software project

Objectives

- Parameterize fieldbus
- Be able to configure cycle times
- Be acquainted with the controller stages and be able to assign licenses
- Be able to create an IEC project
- Know how to debug the IEC program



3.6.1 Fieldbus parameterization



1. Parameterize fieldbus

The screenshot shows the 'Fieldbus' parameterization window. On the left is a 'Parameter tree' with a search bar and a list of categories: 2 Device properties, 4 Functions, 6 Diagnostics, 7 MOVIRUN® flexible (7.40 IEC project, 7.41 Data management, 7.42 Fieldbus, 7.43 Task system, 7.99 Module identification). The '7.42 Fieldbus' category is selected. The main area is divided into two sections: 'Fieldbus card' and 'Fieldbus connection via IEC function blocks'. In the 'Fieldbus card' section, the 'Fieldbus protocol' is set to 'PROFINET IO device' (marked with a red box 1). In the 'Fieldbus connection via IEC function blocks' section, the 'Activate fieldbus connection' is set to 'Yes' (marked with a red box 2).

1 Set the fieldbus protocol to **PROFINET IO device**

2 Activate the **fieldbus connection**.

3.6.2 Cycle time on the MOVI-C® CONTROLLER



General information:

The StackerCrane applications are always operated with a cycle time of **1 ms or 4 ms** depending on the controller. Select the controller from the following table depending on the scope of application (MultiMotion / MultiAxisController / Add-on AntiSway):

Controller

MOVIKIT® StackerCrane with ...	UHX25	UHX45 UHX65A-R01	UHX65A-R02 UHX65A-R04
MOVIKIT® StackerCrane MultiMotion	1 ms	1 ms	1 ms
... With MOVIKIT® PowerMode	4 ms	1 ms	1 ms
MOVIKIT® StackerCrane MultiAxisController	-	4 ms	1 ms
... With MOVIKIT® MOTION add-on AntiSway	-	4 ms	4 ms
... With MOVIKIT® MultiAxisController add-on Cascading	-	4 ms	4 ms
... With MOVIKIT® PowerMode	-	4 ms	4 ms



1. Parameterize the cycle time on the MOVI-C® CONTROLLER

Parameter tree

Enter search term here

- 2 Device properties
- 4 Functions
- 6 Diagnostics
- 7 MOVIRUN® flexible
 - 7.40 IEC project
 - 7.41 Data management
 - 7.42 Fieldbus
 - 7.43 Task system**
 - 7.99 Module identification

Fieldbus Task system X

Task system

Function	Value
HighPrio task cycle time	1 ms 1
EtherCAT® cycle time	1000 µs
Sync Offset EtherCAT®	-30 2 → -30 %

The parameter "Sync Offset EtherCAT®" defines the delay time of the sync interrupt of the EtherCAT® slave compared to the cycle time of the controller. With the preset value in %, the process data can be processed optimally. If the "Cycle time HighPrio Task" parameter is changed, SEW-EURODRIVE recommends adjusting the "Sync Offset EtherCAT®" parameter by clicking the arrow button [→].

- 1** Set the EtherCAT® cycle time to 1 ms (default).
- 2** Apply suggested **Sync Offset EtherCAT® value**

2. Change the cycle time in the parameter tree of the axes

Parameter tree

Enter search term here

- 2 Device properties
- 3 Drive train
- 4 Functions
 - 4.1 Inputs/outputs
 - 4.2 Setpoints
 - 4.2.1 Basic settings**
 - 4.2.2 PO data
 - 4.2.10 Fixed setpoints
 - 4.2.25 Prioritized terminal control
 - 4.2.11 Setpoint value connection
 - 4.2.12 Profile value connection
 - 4.2.21 Control word 1
 - 4.2.22 Control word 2
 - 4.2.23 Control word 3

Basic settings X

Basic settings

Function	Value
Source	EtherCAT®/SBusPLUS
1 Controller setpoint cycle	1.000 ms
Stop	<input type="checkbox"/>
Response to process data timeout	Application stop + output stage inhibit with self reset
Response to external fault	Application stop + output stage inhibit

Synchronization

Function	Value
Use synchronization signal	1
Basic cycle time	1 ms
Current cycle time	1 ms
Period duration of sync signal	1.000 ms
Response to external synchronization	Warning with self reset

- 1** Under **Setpoints** **Basic settings**, set **Controller setpoint cycle** to 1 ms (default).

3. Parameterize the mean value filter time in the parameter tree of the axes

The screenshot shows the 'Parameter tree' on the left and the 'FCB 10 Interpolated position control' settings on the right. In the parameter tree, the path is: 7 MOVIKIT® StackerCrane MultiMotion > 7.6 Drive functions > 7.6.10 FCB 10 Interpolated position con... (highlighted). In the settings panel, the 'Mean value filter time' is set to '5.0 ms' and is highlighted with a red box and the number 1.

Parameter	Value
Mean value filter time	5.0 ms

- 1 Under **Drive functions FCB10 Interpolated position control**, set the **Mean value filter time** to a multiple of the cycle time.



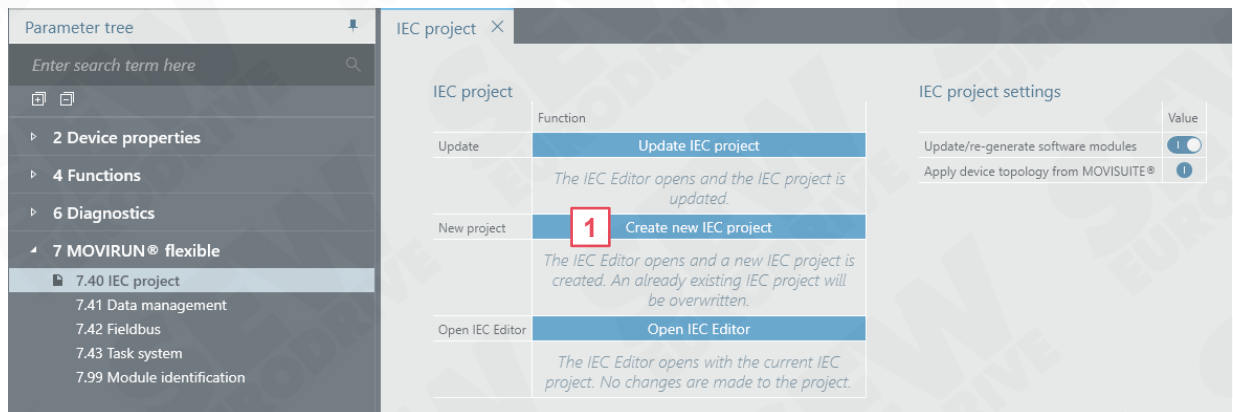
With a cycle time of 1 ms, the default value of the mean filter time (5 ms) can be used.
For a cycle time of 4 ms, we recommend a mean filter time of 8 ms.

3.6.3

Create IEC project

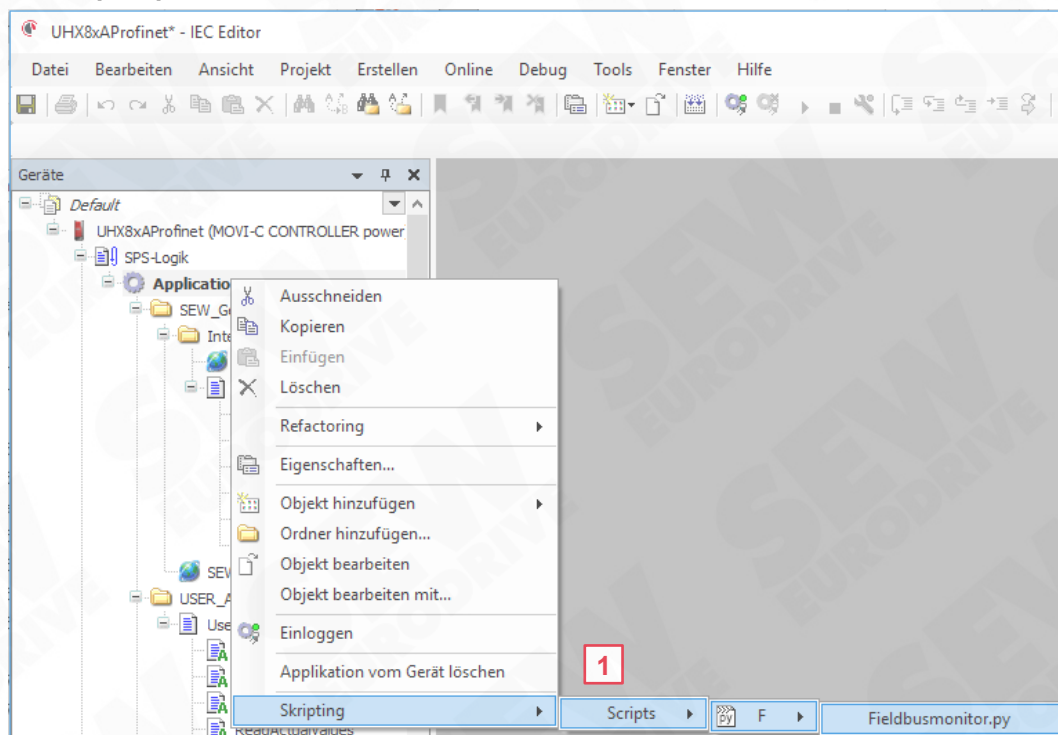


1. Create IEC project



1 Click **Create new IEC project** to start the automatic code generation process

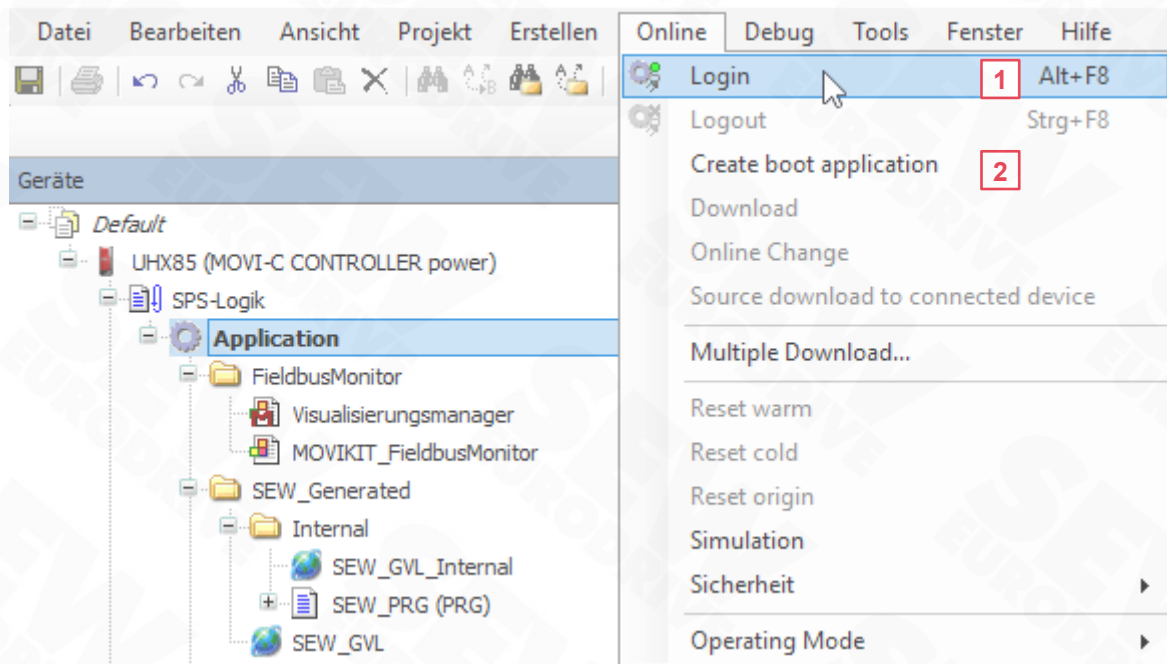
2. Import process data monitor



1 Activate the **fieldbus monitor**.

3. Start the project

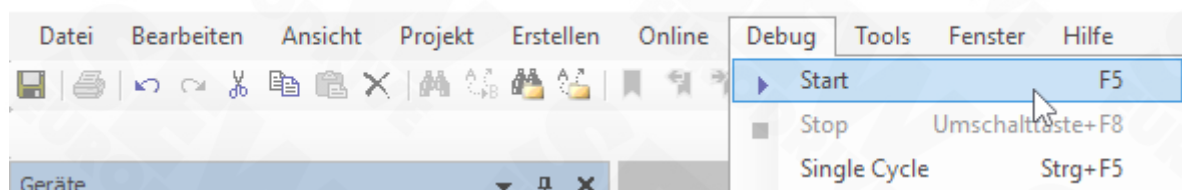
UHX85* - IEC Editor



1 Click **Login** to compile the IEC project.

2 Click Create **boot application** to start the program on the MOVI-C® CONTROLLER automatically after power off.

UHX85* - IEC Editor



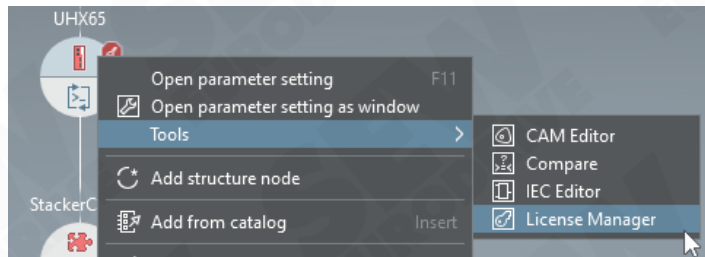
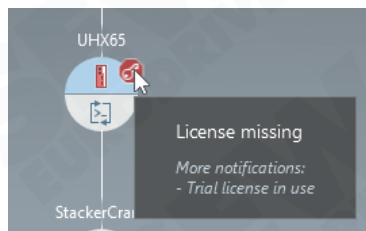
3 Start the program with **Debug Start**, ► Or **F5**.

3.6.4 License MOVI-C® CONTROLLER



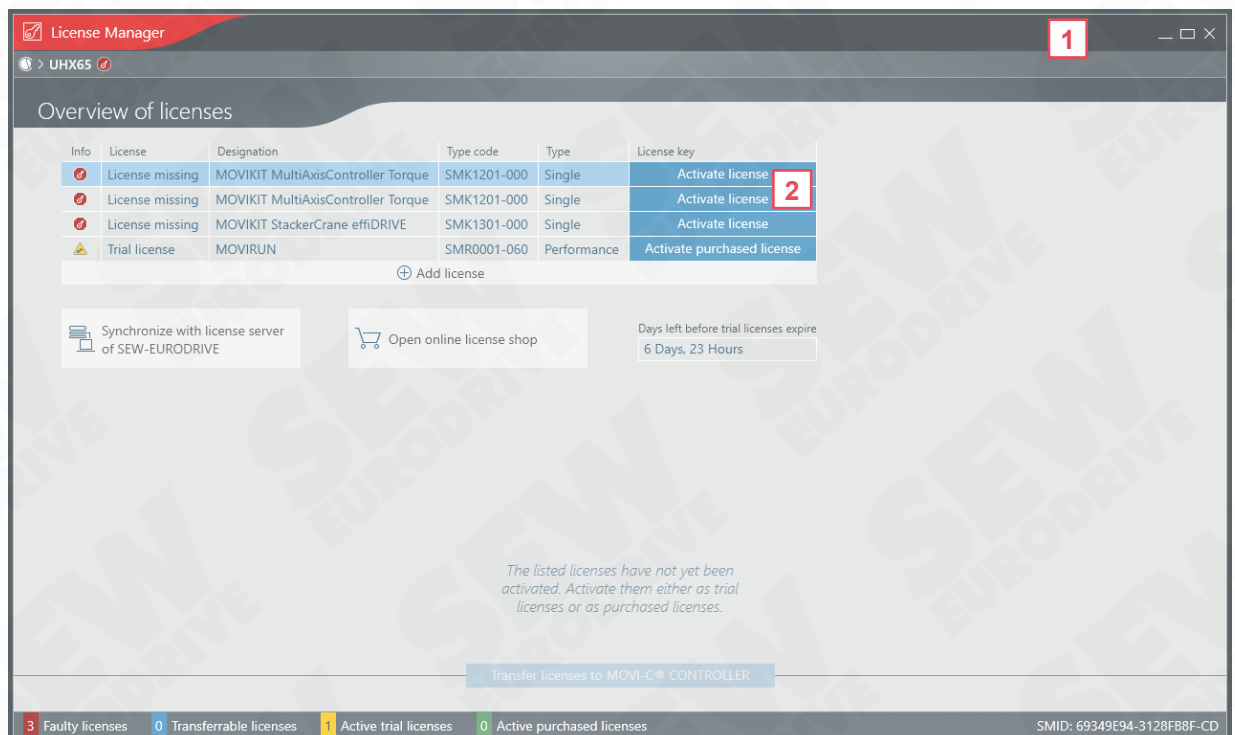
1. Start the license manager

An Internet connection is required to activate the licenses. A trial license can also be generated without an Internet connection.

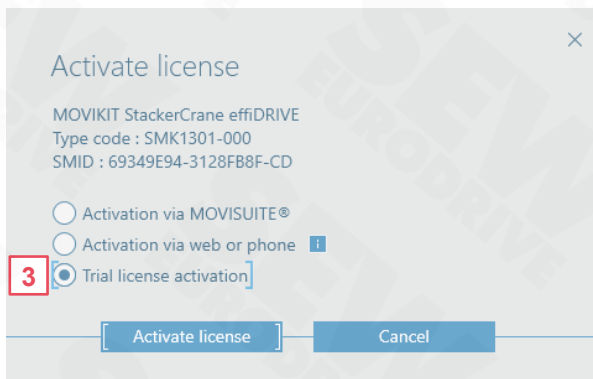


1 Start the **License Manager**

2. Activate license



2 Activate suggested licenses. Press **Activate license**



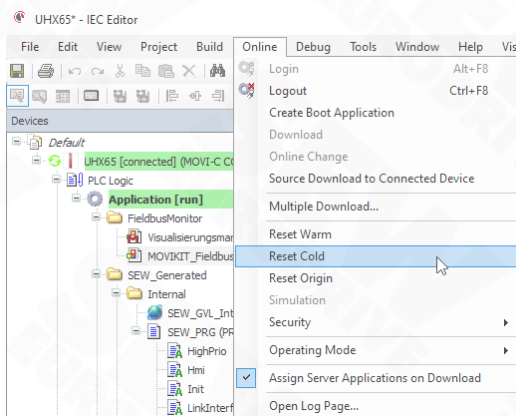
3 Activate trial license

3. Transfer licenses to MOVI-C® CONTROLLER



4 Transfer licenses to the MOVI-C® CONTROLLER

4. Cold reset



4 Perform cold reset.



Examples of required licenses

Application	Licenses
1x travel drive & 1x lifting drive	MOVIRUN® Flexible + StackerCrane
2x travel drive & 1x lifting drive	MOVIRUN® Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC torque (lifting)
1x travel drive & 2x lifting drive	MOVIRUN® Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC skewing (lifting)
2x travel drive & 2x lifting drive	MOVIRUN® Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC skewing (lifting)

3.6.5 Diagnose the IEC program



1. Call up the debug log

In the event of an error, FIRST look into the log!

The screenshot shows the MOVIKIT FieldbusMonitor software interface. The top-left pane displays the 'Devices' tree with 'UHX65 [connected] (MOVI-C CONTROLLER progressive)' highlighted, marked with a red box and the number 1. The bottom pane shows the 'Log' window, marked with a red box and the number 2. The log window has a 'Components' dropdown menu on the right, marked with a red box and the number 3, which is open and shows 'MOVIKIT' selected. The log table displays various system messages.

Severity	Time Stamp	Description
Info	02.08.2024 08:25:24.560	ECM (Instance 0): Started successfully.
Info	02.08.2024 08:25:21.564	ECM (Instance 0): EtherCAT prepared successfully and can be used now. (PreOp)
Info	02.08.2024 08:25:21.028	PLC-BootupReason: BootupReason_Normal
Warning	02.08.2024 08:25:21.004	Number of configured licensed cores for IEC-tasks: 3 from 4
Info	02.08.2024 08:25:20.896	ECM (Instance 0): Reset successful.
Info	02.08.2024 08:24:19.648	Post LicenseFileReloadEvent succeeded (with 0 releases of consumed license instances)
Info	02.08.2024 08:18:30.848	ECM (Instance 0): Started successfully.
Info	02.08.2024 08:18:28.134	Application [Application] loaded via [Download]
Info	02.08.2024 08:18:28.134	ECM (Instance 0): EtherCAT prepared successfully and can be used now. (PreOp)
Info	02.08.2024 08:18:27.431	PLC-BootupReason: BootupReason_Normal

- 1 Click the MOVIKIT® CONTROLLER
- 2 Click **Log**
- 3 Switch the logger to **MOVIKIT** in the drop-down list

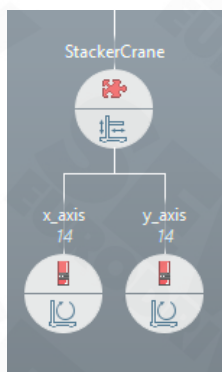


2. Call up and monitor debug variables
3. Open IEC Editor → Open SEW_GVL_Internal

Expression	Type	Value	Prepar...	Address	Comm...
StackerCrane	SEW_M...				
gc_uiError	BOOL	TRUE			Bit, if fu...
gc_uiWarning	BOOL	FALSE			Bit, if fu...
gc_uiMessageID	UDINT	8199			The mes...
gc_uiControlSource	E_CON...	PD			Aktive C...
gc_ConfigHandling	SEW_A...				
gc_InitDone	BOOL	FALSE			
gc_fbAxisGroup	AxisGroup				
gc_fbX	AxisX				
gc_fbY	AxisY				
gc_fbLidMgr	SEW_Ie...				
gc_astSoftwareDescription	ARRAY ...				
gc_fbLidMgr_Confirm	Confirm...				
gc_fbModeAdministrator	ModeAd...				
gc_fbModeXYOptimized	ModeXY...				
gc_xInitDone_ScalerCrane	BOOL	TRUE			Init
gc_axLinkModuleToIndexDone	ARRAY ...				
gc_sFileName	STRING ...	'Stacker...			
gc_xProcessDataDone	BOOL	TRUE			
gc_usPowerLimitation	USINT	0			
gc_xChangeVelocityOnTheFly	BOOL	FALSE			
gc_xReadConfigFromAGMemberDone	BOOL	TRUE			
gc_stConfigID	ST_Con...				
gc_xInitConfig	BOOL	TRUE			
gc_sAxisName	STRING	'Stacker...			
gc_tftConfigData	SEW_IA...	16#0 IF...			
gc_tftAxisConfig	SEW_IA...	16#0 IF...			
gc_tftConfigDataHandler	SEW_IA...	16#0 IF...			
gc_sNameOfInstance	STRING...	'Config/...			
StackerCrane_xMAC	SEW_M...				
StackerCrane_xMAC_ReferenceRetain	SEW_M...				
OptMonitor_ScalerCrane_xMAC	SEW_M...				
StackerCrane_xMAC_xaxis1	SEW_M...				
StackerCrane_xMAC_xaxis2	SEW_M...				
StackerCrane_yMAC	SEW_M...				
StackerCrane_yMAC_ReferenceRetain	SEW_M...				
OptMonitor_ScalerCrane_yMAC	SEW_M...				
StackerCrane_yMAC_xaxis	SEW_M...				



Global variables



Code generation

Ausdruck
gc_uiTaskCycleTime
StackerCrane
StackerCrane_x_axis
HMI_ScalerCrane_x_axis
StackerCrane_y_axis
HMI_ScalerCrane_y_axis



Overview of debug variables

Debug variables: Fieldbus process data

SEW_GVL_Internal.StackerCrane.fbModeAdministrator_eActualMode
 SEW_GVL_Internal.StackerCrane.fbModeAdministrator_eSetpointMode
 SEW_GVL_Internal.StackerCrane.fbX_In
 SEW_GVL_Internal.StackerCrane.fbX_Out
 SEW_GVL_Internal.StackerCrane.fbX_Config
 SEW_GVL_Internal.StackerCrane.fbY_In
 SEW_GVL_Internal.StackerCrane.fbY_Out
 SEW_GVL_Internal.StackerCrane.fbY_Config
 SEW_GVL_Internal.StackerCrane.fbAxisGroup_Out

Debug variables: Error level

SEW_GVL_Internal.StackerCrane.xError
SEW_GVL_Internal.StackerCrane_x_Axis.xError
SEW_GVL_Internal.StackerCrane_y_Axis.xError

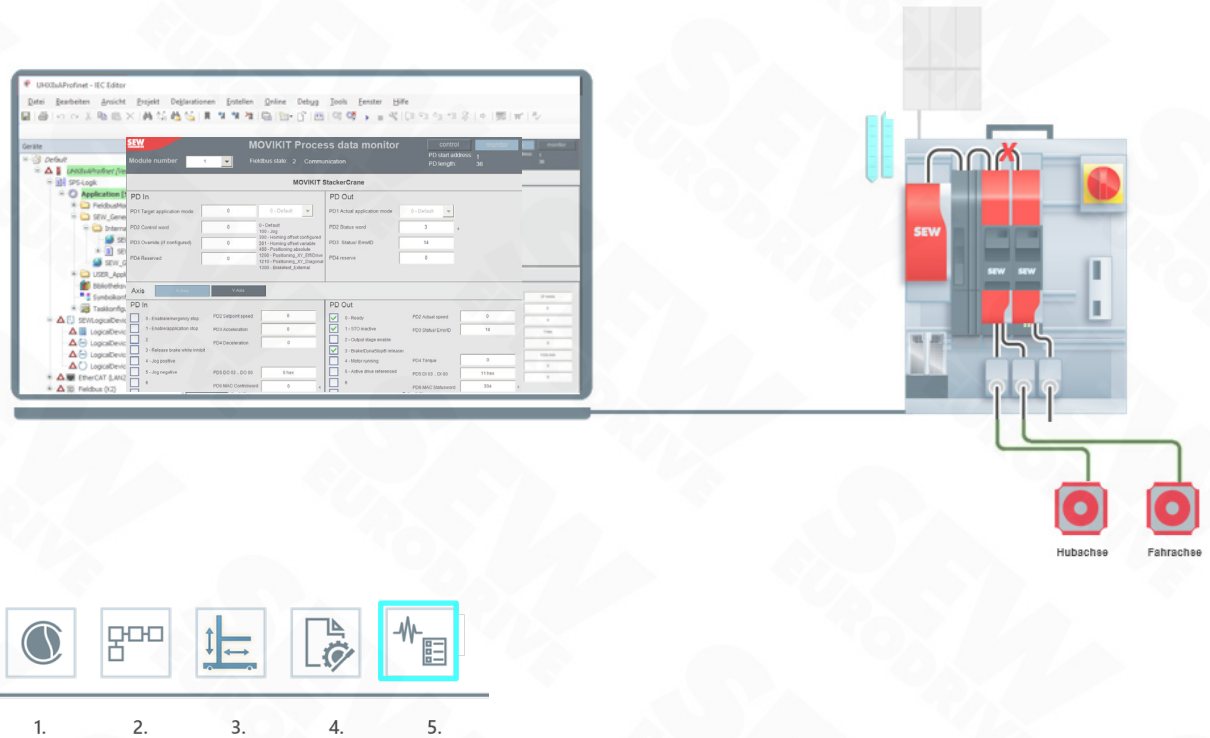
Debug variables: SC-MultiMotion

SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stBasicIN
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stBasicOUT
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stInverterIN
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stInverterOUT
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stBrakeIN
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stBrakeOUT
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stActivatedDeviceModes
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stSetpointValuesVelocityInterpolated.IrVelocity
SEW_GVL_Internal.StackerCrane_x_Axis.DeviceAdapter16PD.stSetpointValuesVelocityInterpolated.IrManValPosCtrlr

3.7 Step 5 - MOVIKIT® StackerCrane process data monitor

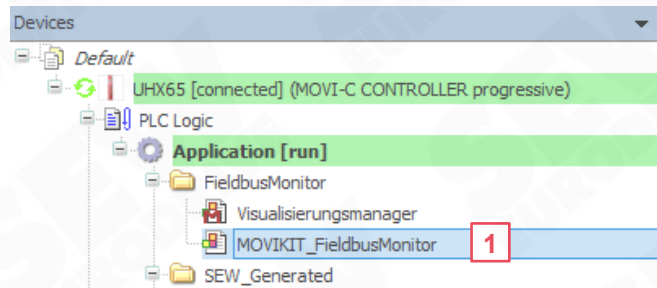
Goals

- Handling the process data monitor





1. Open the process data monitor



1 Click the **MOVIKIT_FieldbusMonitor**

2. Switch the process data monitor mode

SEW EURODRIVE **MOVIKIT Process data monitor** 2 control monitor

Module number: 1 1 Fieldbus state: 2 Communication PD start address: 1 PD length: 36

MOVIKIT StackerCrane

PD In		PD Out	
PD1 Target application mode	0 0 - Default	PD1 Actual application mode	0 - Default
PD2 Control word	0 0 - Default 100 - Jog 300 - Homing offset configured 301 - Homing offset variable 400 - Positioning absolute 1200 - Positioning_XY_EffIDrive 1210 - Positioning_XY_Diagonal 1300 - Braketest_External	PD2 Status word	3
PD3 Override (if configured)	0	PD3 Status/ ErrorID	14
PD4 Reserved	0	PD4 reserve	0

Axis X-Axis Y-Axis

PD In		PD Out	
<input type="checkbox"/> 0 - Enable/emergency stop	PD2 Setpoint speed 0	<input checked="" type="checkbox"/> 0 - Ready	PD2 Actual speed 0
<input type="checkbox"/> 1 - Enable/application stop	PD3 Acceleration 0	<input checked="" type="checkbox"/> 1 - STO inactive	PD3 Status/ ErrorID 14
<input type="checkbox"/> 2	PD4 Deceleration 0	<input type="checkbox"/> 2 - Output stage enable	
<input type="checkbox"/> 3 - Release brake while inhibit		<input checked="" type="checkbox"/> 3 - Brake/DynaStop® release	
<input type="checkbox"/> 4 - Jog positive		<input type="checkbox"/> 4 - Motor running	PD4 Torque 0
<input type="checkbox"/> 5 - Jog negative	PD5 DO 03 .. DO 00 0 hex	<input type="checkbox"/> 5 - Active drive referenced	PD5 DI 03 .. DI 00 11 hex
<input type="checkbox"/> 6	PD6 MAC Controlword 0	<input type="checkbox"/> 6	PD6 MAC Statusword 304
<input type="checkbox"/> 7 - Start/stop with fieldbus ramp	PD7/8 Target position 0	<input type="checkbox"/> 7 - "In position" signal active	PD7/8 Actual position 1009
<input type="checkbox"/> 8 - Fault reset	PD9 Jerk 0	<input type="checkbox"/> 8 - Fault	PD9 Actual jerk 0
<input type="checkbox"/> 9	PD10 Reserved 0	<input type="checkbox"/> 9 - Warning	PD10 Reserved 0
<input type="checkbox"/> 10		<input type="checkbox"/> 10	
<input type="checkbox"/> 11 - Disable external encoder		<input type="checkbox"/> 11 - External encoder disable	
<input type="checkbox"/> 12 - Disable SW limit switches		<input type="checkbox"/> 12 - SW limit switches inactive	
<input type="checkbox"/> 13 - Activate inhibit		<input type="checkbox"/> 13	
<input type="checkbox"/> 14 - Activate standby mode		<input type="checkbox"/> 14 - Standby mode active	
<input type="checkbox"/> 15 - Handshake in		<input type="checkbox"/> 15 - Handshake out	

1 Selection of the parameterized MOVIKIT®. Select module 1 **MOVIKIT StackerCrane**

2 Switch between **control** and **monitoring**.



Groups – process data monitor

PD In		PD Out	
PD1 Target application mode	0	0 - Default	A
PD2 Control word	0	0 - Default 100 - Jog 300 - Homing offset configured 301 - Homing offset variable 400 - Positioning absolute 1200 - Positioning_XY_EffDrive 1210 - Positioning_XY_Diagonal 1300 - Braketest_External	A
PD3 Override (if configured)	0		B
PD4 Reserved	0		C

A Mode numbering

0	Default
100	Jog
300	Referencing with configured offset
301	Referencing with bus offset
400	Position
700	Test of all brakes one after the other
701	Test of the 1st axis group member of the MultiAxisController (no function without MultiAxisController)
702	Test of the 2nd axis group member of the MultiAxisController (no function without MultiAxisController)
1200	Energy-optimized X-Y positioning
1210	Mechanically optimized positioning
1300	External brake test

B Status word axis group (X and Y)

Bit 0	Ready for operation
Bit 7	In position
Bit 8	Error

C Status of the inverters, The status of the lower-level stations is - Equal: The status is displayed. - Not equal: "-1" = FFFF = "undefined" is displayed. Or in the event of an error ErrorID:

High byte	Error code
Low byte	Subfault code



Axes - Process data monitor axes

Axis

X-Axis

Y-Axis

A

PD In

<input type="checkbox"/> 0 - Enable/emergency stop	PD2 Setpoint speed	0
<input type="checkbox"/> 1 - Enable/application stop	PD3 Acceleration	0
<input type="checkbox"/> 2	PD4 Deceleration	0
<input type="checkbox"/> 3 - Release brake while inhibit		
<input type="checkbox"/> 4 - Jog positive		
<input type="checkbox"/> 5 - Jog negative	PD5 DO 03 ... DO 00	0 hex
<input type="checkbox"/> 6	PD6 MAC Controlword	0
<input type="checkbox"/> 7 - Start/stop with fieldbus ramp	PD7/8 Target position	0
<input type="checkbox"/> 8 - Fault reset	PD9 Jerk	0
<input type="checkbox"/> 9	PD10 Reserved	0
<input type="checkbox"/> 11 - Disable external encoder		
<input type="checkbox"/> 12 - Disable SW limit switches		
<input type="checkbox"/> 13 - Activate inhibit		
<input type="checkbox"/> 14 - Activate standby mode		
<input type="checkbox"/> 15 - Handshake in		

PD Out

<input checked="" type="checkbox"/> 0 - Ready	PD2 Actual speed	0
<input checked="" type="checkbox"/> 1 - STO inactive	PD3 Status/ ErrorID	14
<input type="checkbox"/> 2 - Output stage enable		
<input checked="" type="checkbox"/> 3 - Brake/DynaStop® release		
<input type="checkbox"/> 4 - Motor running	PD4 Torque	0
<input type="checkbox"/> 5 - Active drive referenced	PD5 DI 03 ... DI 00	11 hex
<input type="checkbox"/> 6	PD6 MAC Statusword	304
<input type="checkbox"/> 7 - "In position" signal active	PD7/8 Actual position	1009
<input type="checkbox"/> 8 - Fault	PD9 Actual Jerk	0
<input type="checkbox"/> 9 - Warning	PD10 Reserved	0
<input type="checkbox"/> 10		
<input type="checkbox"/> 11 - External encoder disabled		
<input type="checkbox"/> 12 - SW limit switches inactive		
<input type="checkbox"/> 13		
<input type="checkbox"/> 14 - Standby mode active		
<input type="checkbox"/> 15 - Handshake out		

A Changeover between X and Y axes

B Status of the inverter
 For MAC: The status of the lower-level stations is
 - Equal: The status is displayed.
 - Not equal: "-1" = FFFF = "undefined" is displayed.
 Or in the event of an error ErrorID:

High byte	Error code
Low byte	Subfault code

C Digital inputs and outputs

Bits 0 – 3	Axis 1
Bits 4 – 7	Axis 2
Bits 8 – 11	Axis 3
Bits 12 – 15	Axis 4

D Control word for the MultiAxisController

Bits 0 – 3	Deactivate axis group members
Bits 5 – 7	Release brake without enable

E Jerk in user unit/s³

F Disable external encoder

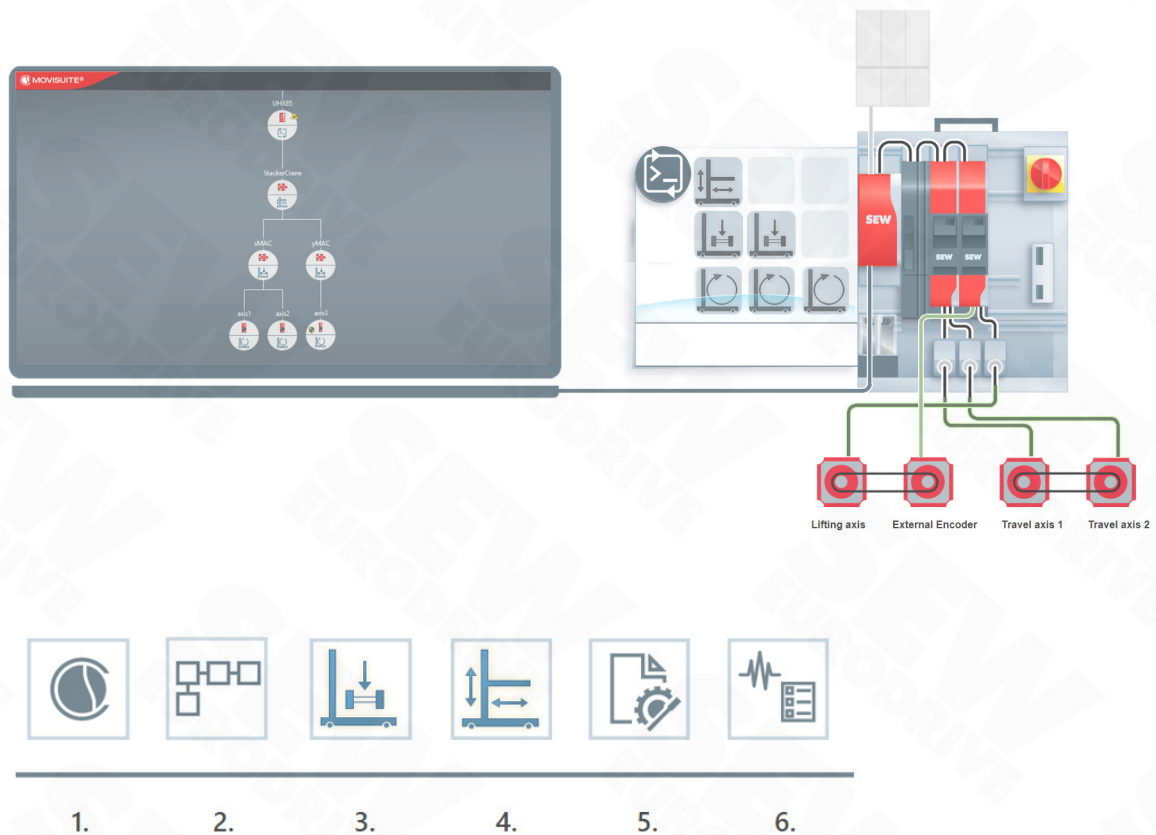
G Disable software limit switch

H Activate controller inhibit

4

Tutorial 2 – SRS with MOVIKIT® StackerCrane MultiMotion and StackerCrane MultiAxisController

Workbook steps – Tutorial 2



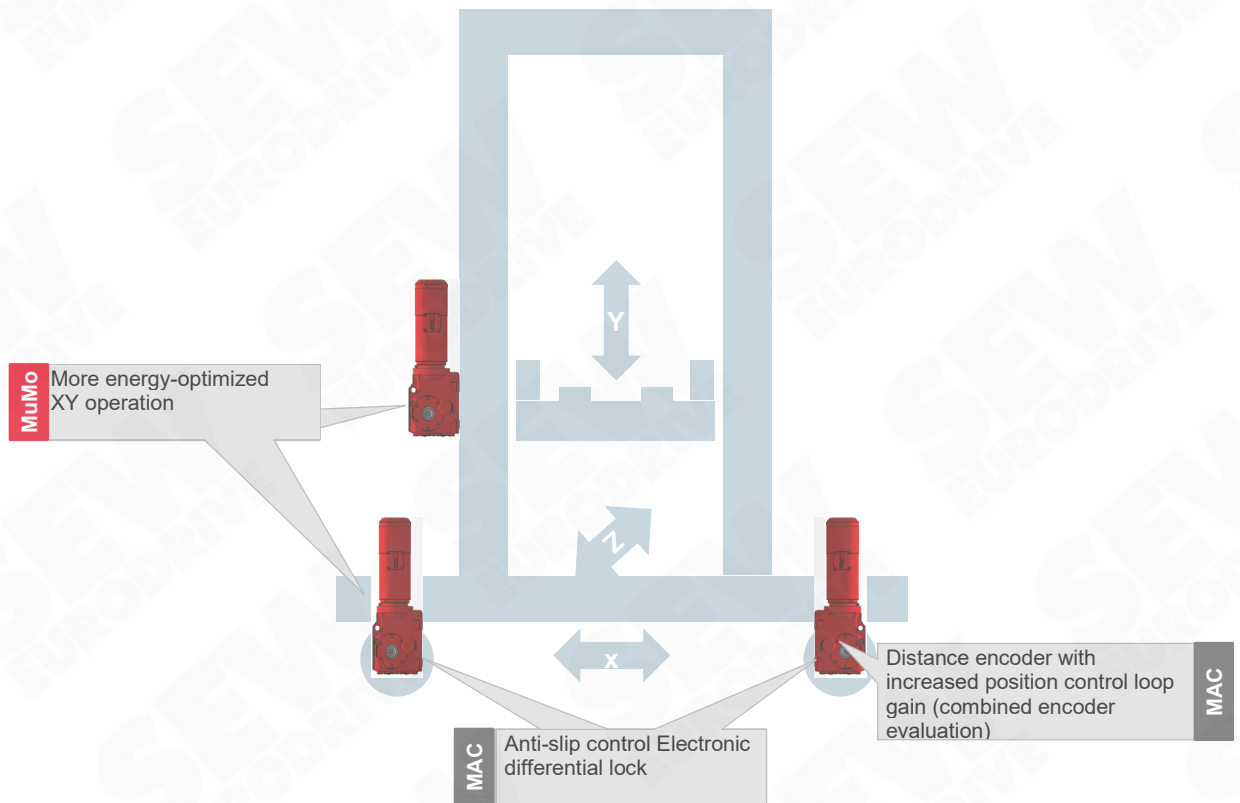
1. MOVISUITE® project structure
2. Startup of the travel and hoist
3. Parameterization of MOVIKIT® StackerCrane MultiAxisController (MAC)
4. Parameterization of MOVIKIT® StackerCrane
5. Generation of the software project
6. MOVIKIT® StackerCrane process data monitor

4.1 Scope of functions Tutorial 2



In this tutorial, an SRS with 2 axes in the chassis with motor encoder and an axis in the hoist with motor and external encoder is started up.

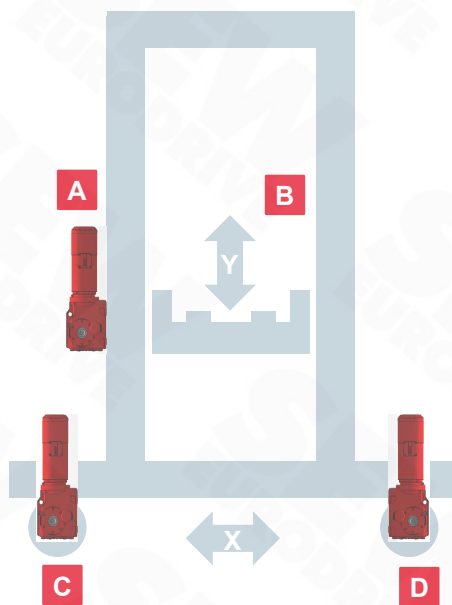
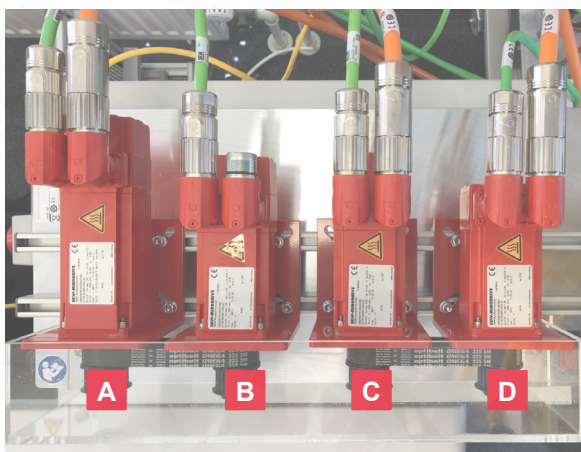
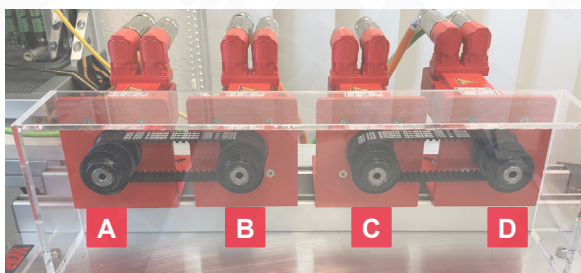
- X-axis 2 drives with motor encoder => MultiMotion + MAC
- Y-axis with motor encoder and external encoder => MultiMotion + MAC (combined encoder evaluation)



Scope of functions of MOVIKIT® StackerCrane effiDRIVE® in combination with MOVIKIT®...

MuMo	MultiMotion
MAC	MultiAxisController

4.2 Training model / training system storage/retrieval system



- A** Vertical drive
- B** Motor B serves only as an external encoder
- C** Horizontal drive 1
- D** Horizontal drive 2

CMP40S/BK/PK/EK0H/SB1

CMP40S/PK/AK0H/SM1

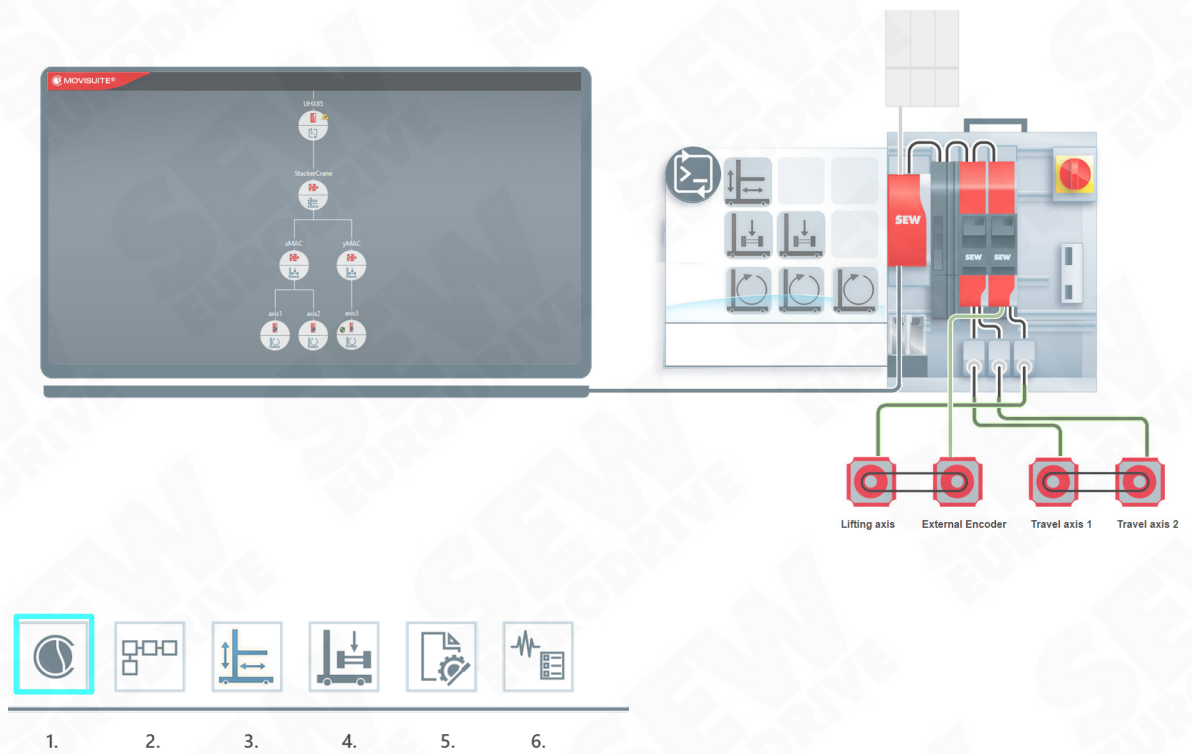
CMP40S/PK/AK0H/SM1

CMP40S/PK/RH1M/SM1

4.3 Step 1 – Project setup in MOVISUITE®

Goals

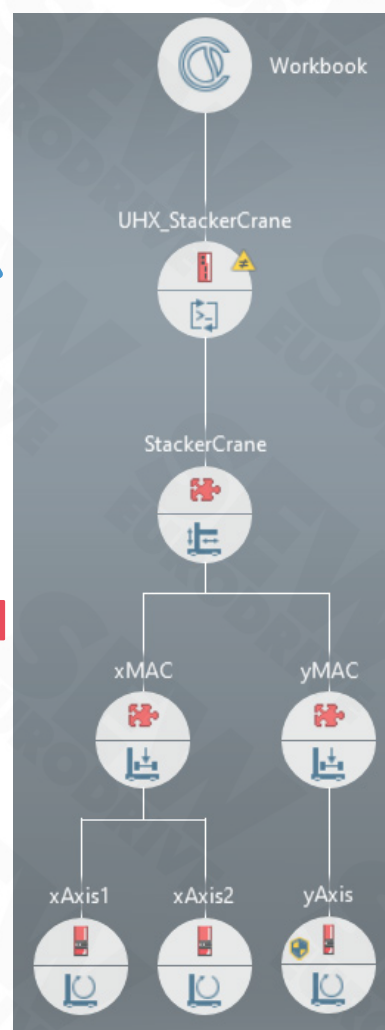
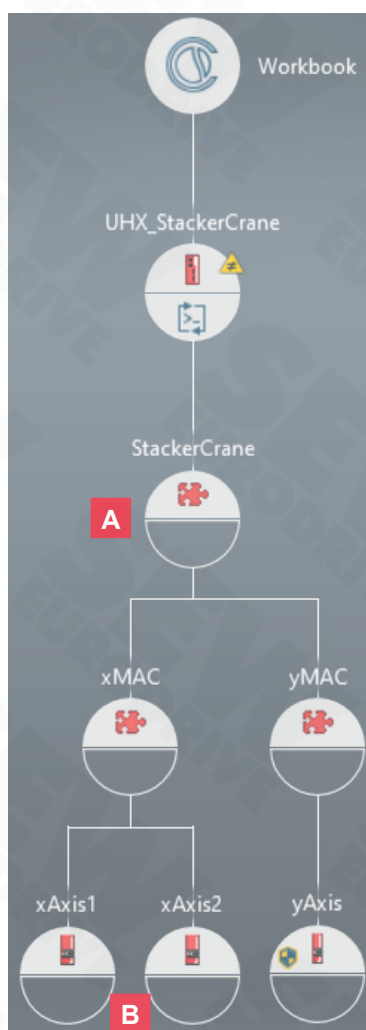
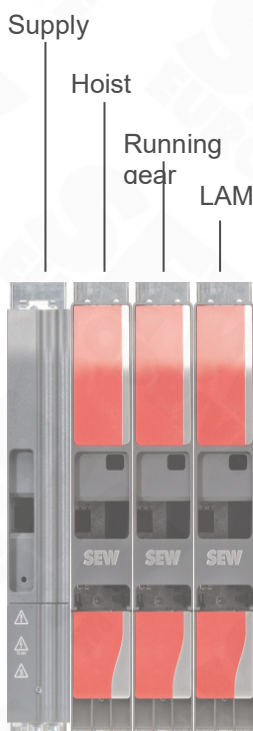
- Procedure for setting up the project offline and online
- Can set up a project



4.3.1 Useful information about the project structure



General information



1 Set up structure: **From the top to the bottom**

2 Configure and start up: **From the bottom to the top**

A Software nodes: A MOVIKIT® software module can be added to each software node for an axis group or higher-level functionality, such as:

- StackerCrane
- MultiAxisController (can also be used with only one subordinate axis)
- Robot
- ...

B **Horizontal drive** must be positioned **TO THE LEFT** under the StackerCrane, regardless of the hardware structure of the axis block

Note: The vertical drive usually needs more current than the horizontal drive. The vertical drive's axis module is therefore positioned on the left next to the horizontal drive in the hardware structure.

Observe and/or produce positioning in the MOVISUITE view during online startup



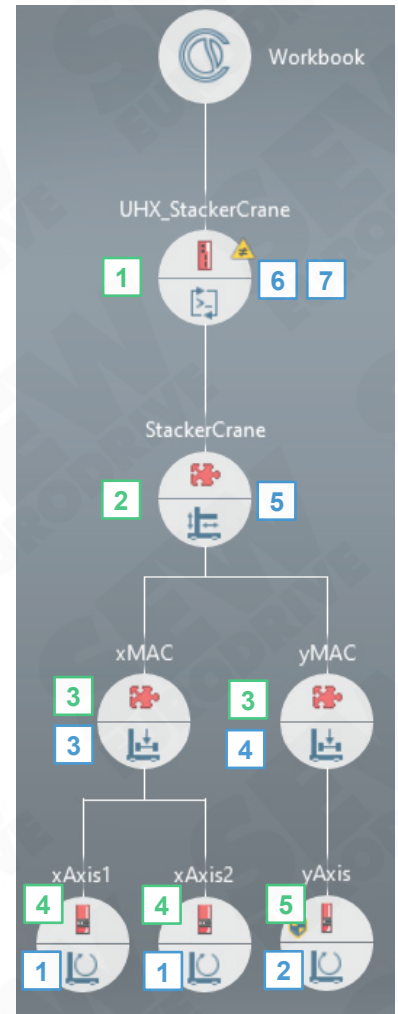
Project setup offline – MOVISUITE® planning phase

1. Build structure

- 1 Add MOVI-C® CONTROLLER
- 2 Add software node
- 3 Add 2 x SoftwareNode (later for MAC software module)
- 4 Add x-axis
- 5 Add y-axis

2. Configure modules

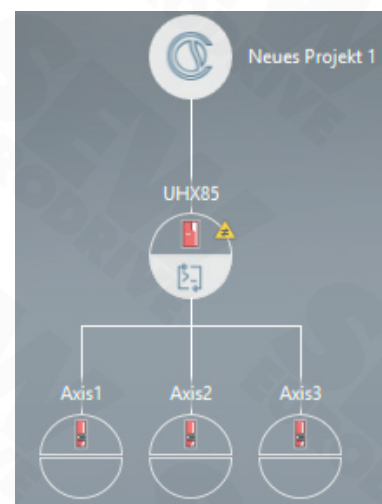
- 1 Parameterize the x-axes drive trains with the startup wizard
- 2 Parameterize the y-axis drive train with the startup wizard
- 3 Add and parameterize StackerCrane MultiAxisController
- 4 Add and parameterize StackerCrane MultiAxisController
- 5 Add and parameterize StackerCrane in the software code
- 6 Configure MOVI-C® CONTROLLER
- 7 Create IEC project





Online project setup – MOVISUITE® startup phase

1. New project from scan

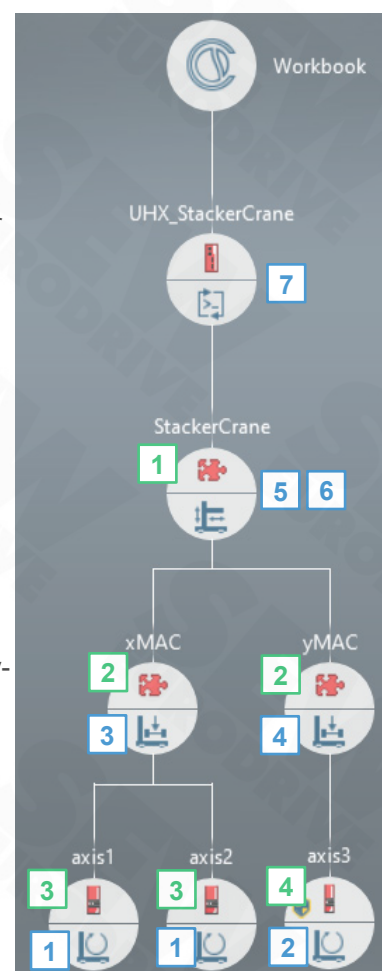


2. Build structure

- 1 Add SoftwareNode
- 2 Add 2 x SoftwareNode
- 3 Drag horizontal drive (x-axis 1 & x-axis 2) under SoftwareNode for horizontal drive MAC
- 4 Drag vertical drive (y-axis) under SoftwareNode for vertical drive MAC

3. Configure modules

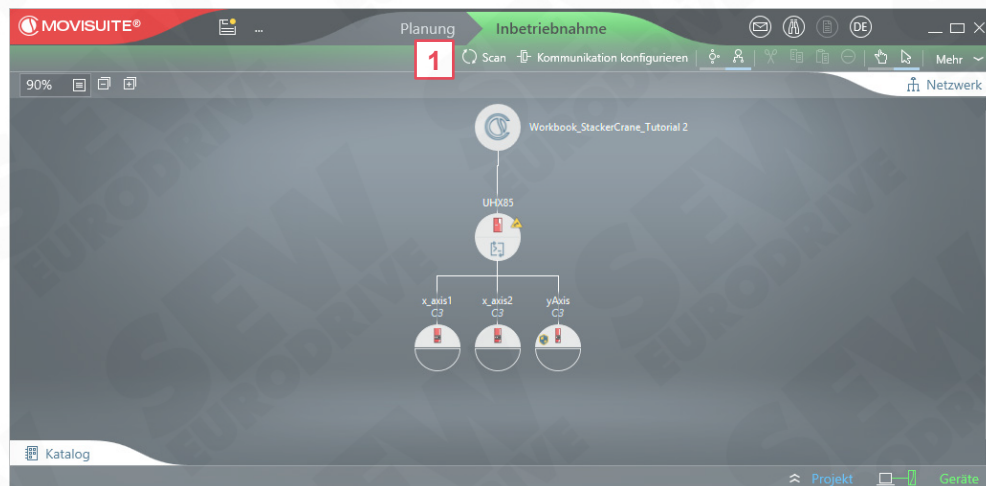
- 1 Parameterize the x-axes drive trains with the startup wizard
- 2 Parameterize the y-axis drive train with the startup wizard
- 3 Add and parameterize StackerCrane MultiAxisController in SoftwareNode x-axis
- 4 Add and parameterize StackerCrane MultiAxisController into the y-axis SoftwareNode
- 5 Add and parameterize StackerCrane in the software code
- 6 Configure MOVI-C® CONTROLLER
- 7 Create IEC project



4.3.2 Create project structure

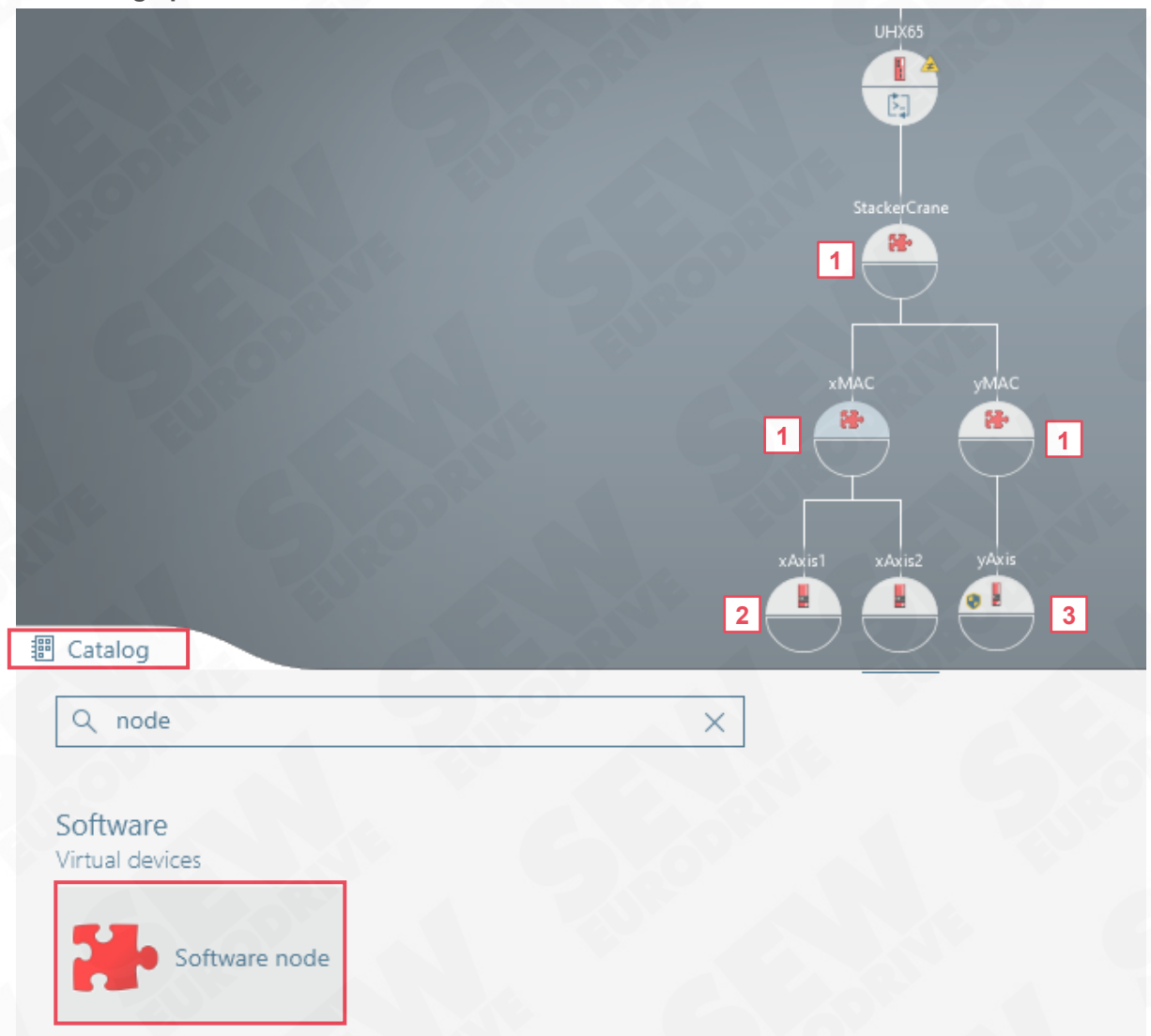


1. Scan axes



1 Click **Scan**

2. Setting up the structure



1 Insert the **MOVI-C® SoftwareNode** from the **catalog**

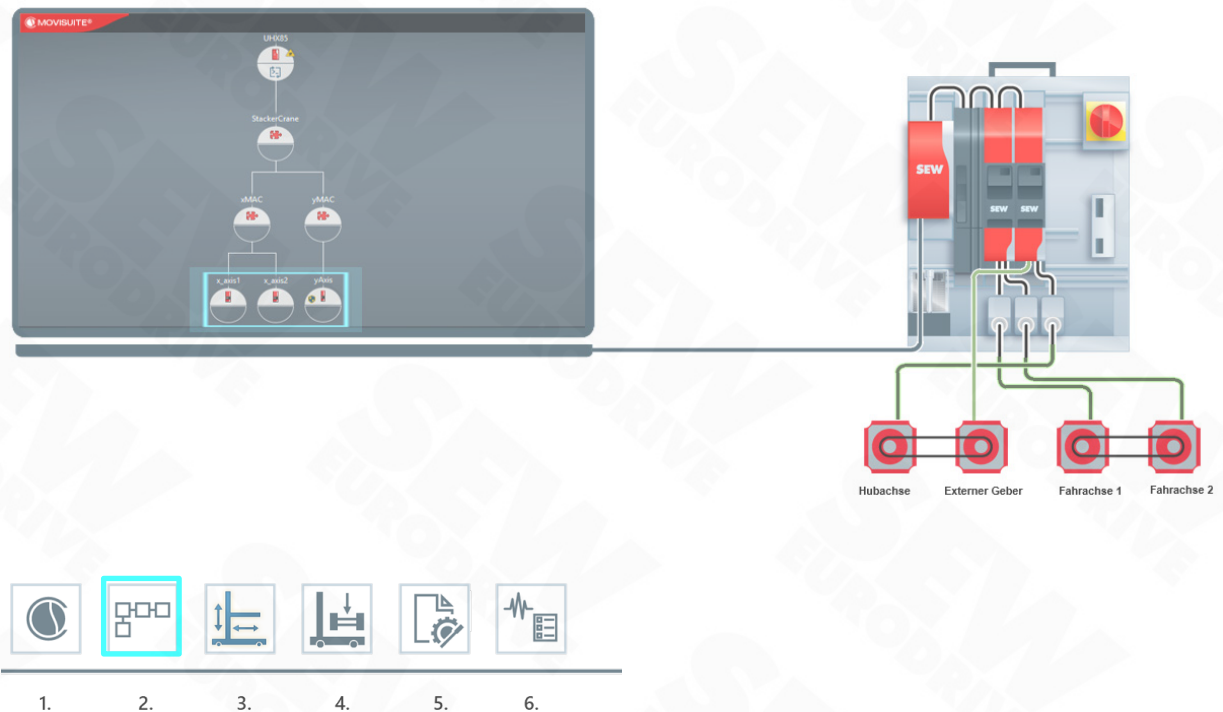
2 Move the x-axes below the SoftwareNode for the chassis

3 Move the y-axis below the software node for the hoist

4.4 Step 2 – Startup of the travel and hoist

Goals

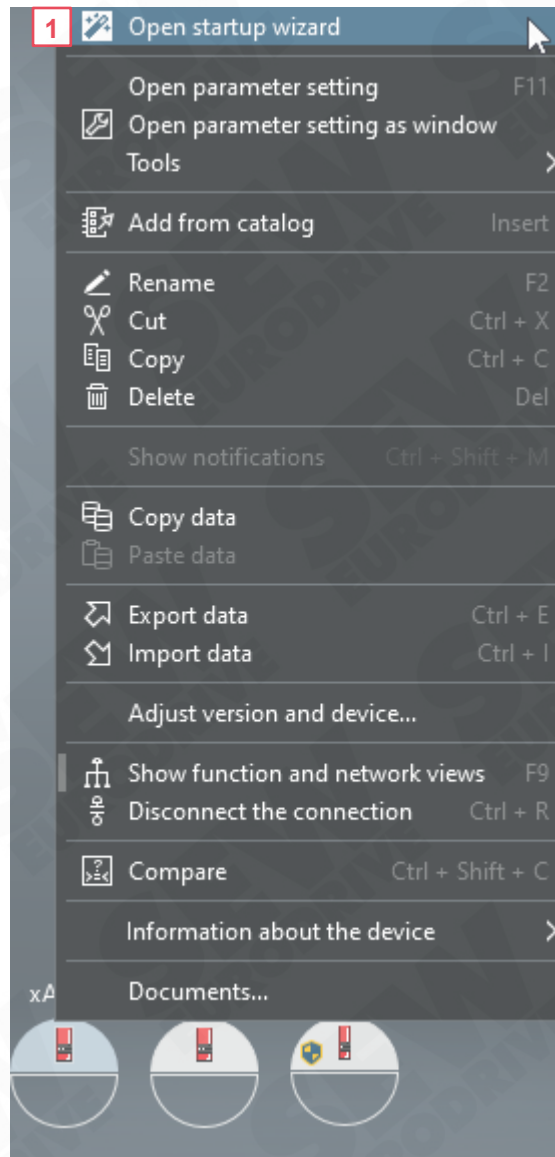
- Drive train can start up and parameterize x-axes and y-axis.
- Can assign and parameterize MOVIKIT® StackerCrane MultiMotion for the x-axes and the y-axis.



4.4.1 Start up the drive trains

4.4.1.1 Travel unit (x-axis)

1. Open startup assistant



1 Right-click to open the startup assistant.

2. Voltage supply

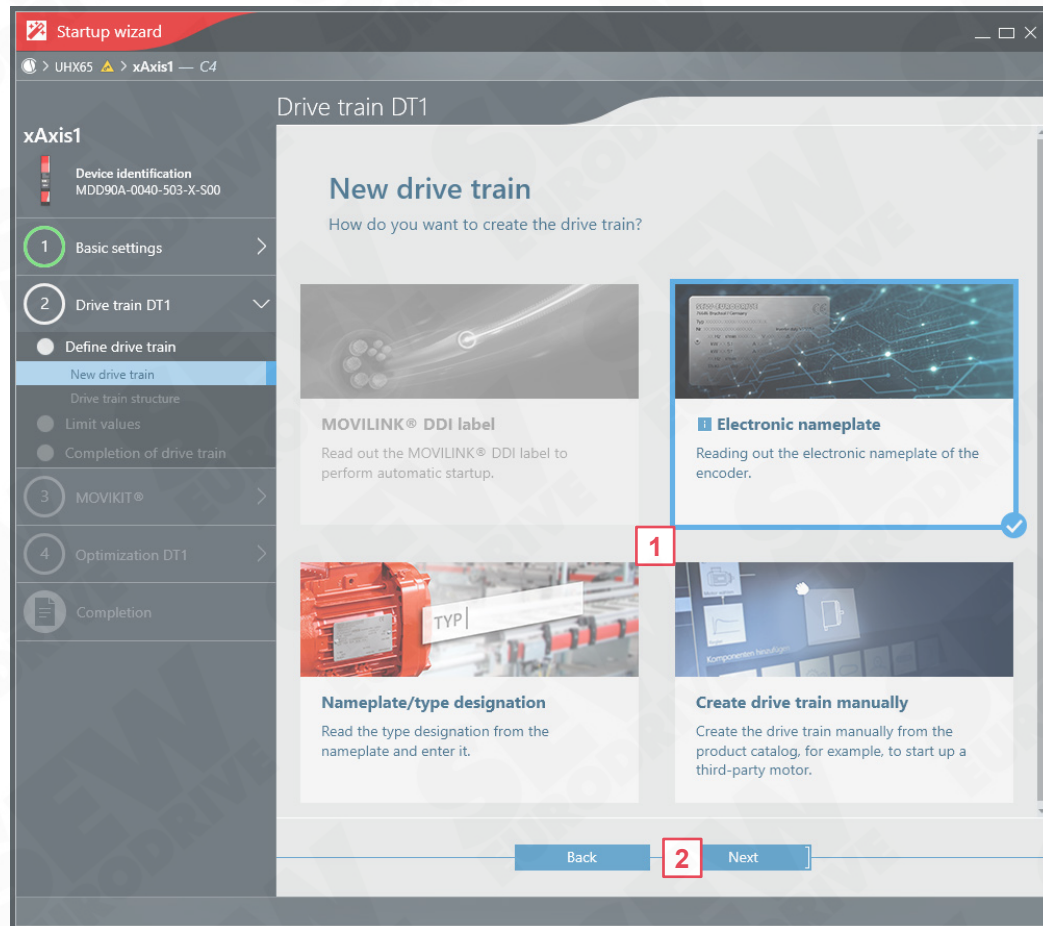
The screenshot shows the 'Startup wizard' interface for 'xAxis1'. The sidebar on the left lists the steps: 1 Basic settings, 2 Voltage supply (highlighted), 3 Drive train DT1, 4 MOVIKIT®, 5 Optimization DT1, and 6 Completion. The main area is titled 'Basic settings' and 'Voltage supply'. It contains the following fields and controls:

- Voltage supply:** A dropdown menu set to 'MDP90 power supply module'.
- Nominal line voltage AC:** A text input field containing '400', highlighted with a red box and labeled '1'.
- Remote axis system:** A toggle switch, currently turned off.
- Navigation:** 'Back' and 'Next' buttons at the bottom. The 'Next' button is highlighted with a red box and labeled '2'.

1 Select the power supply module and the line voltage.

2 Press **Next**.

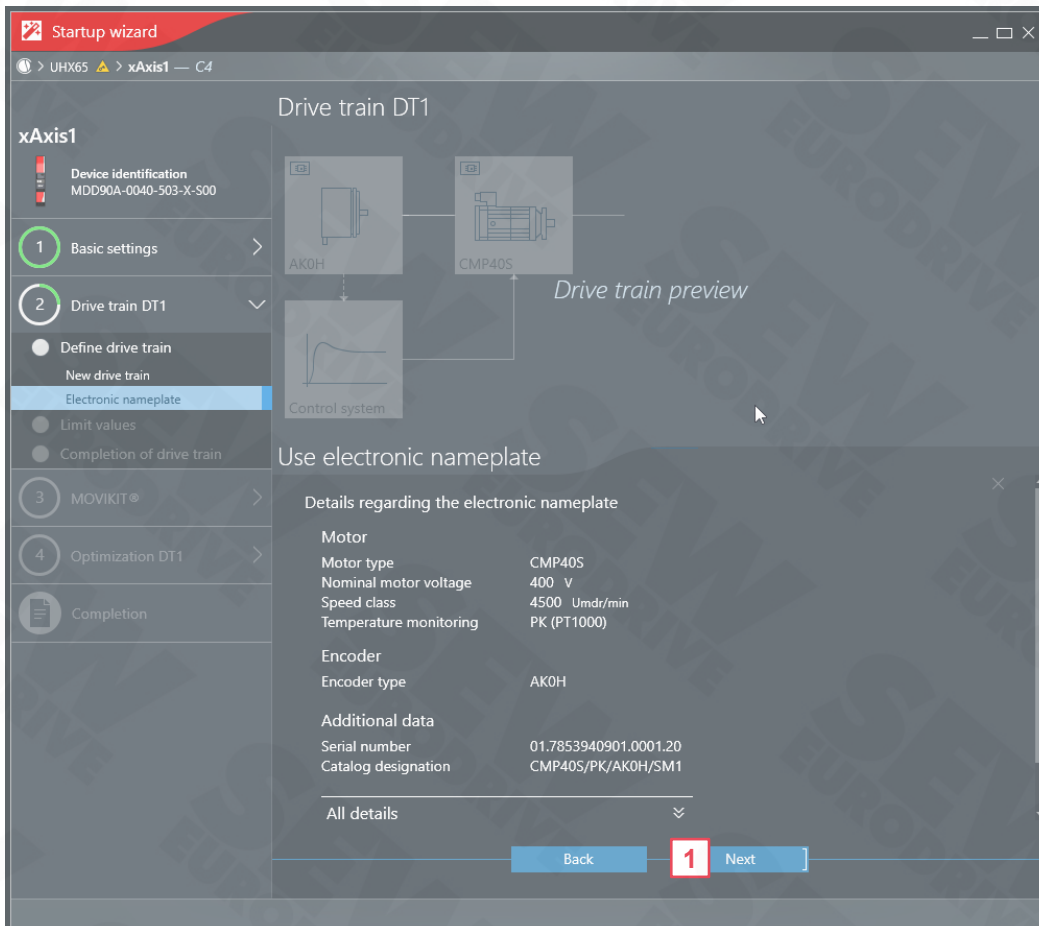
3. Edit the drive train



1 Select how you want to start up the drive train.

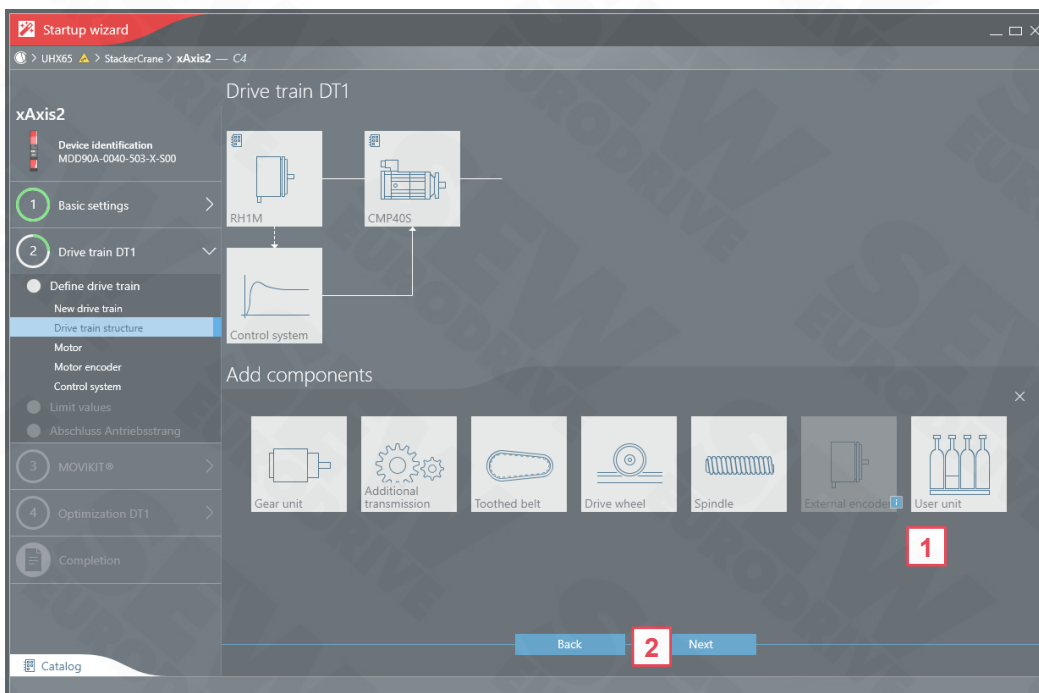
2 Press **Next**.

4. Electronic nameplate



1 Press **Next**.

5. User units



1 Add the user units.

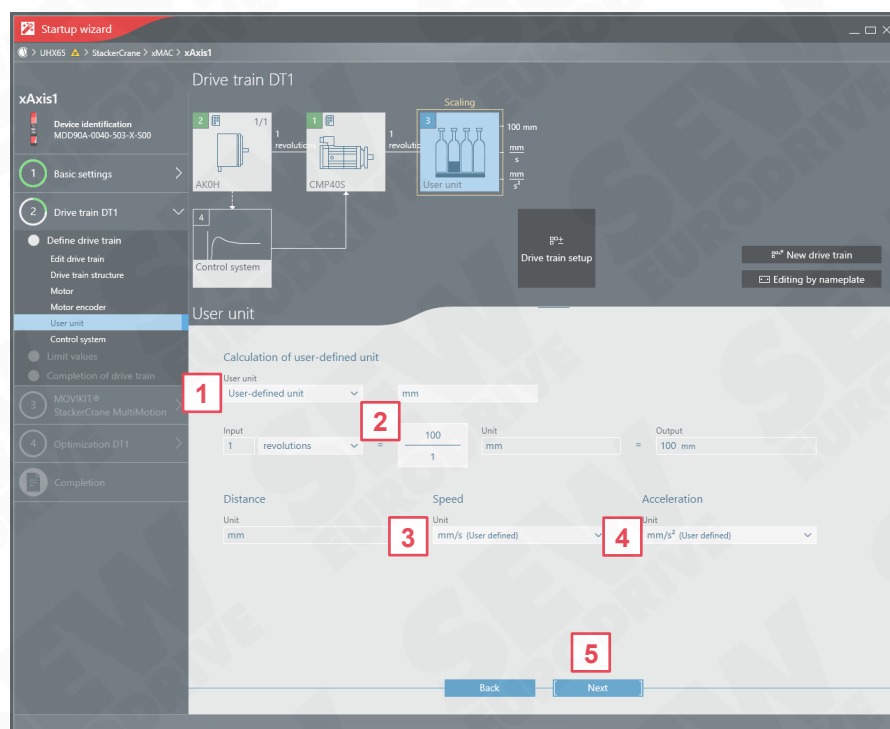
2 Press **Next**

6. Select position-given encoder



1 Press **Next**.

7. User units

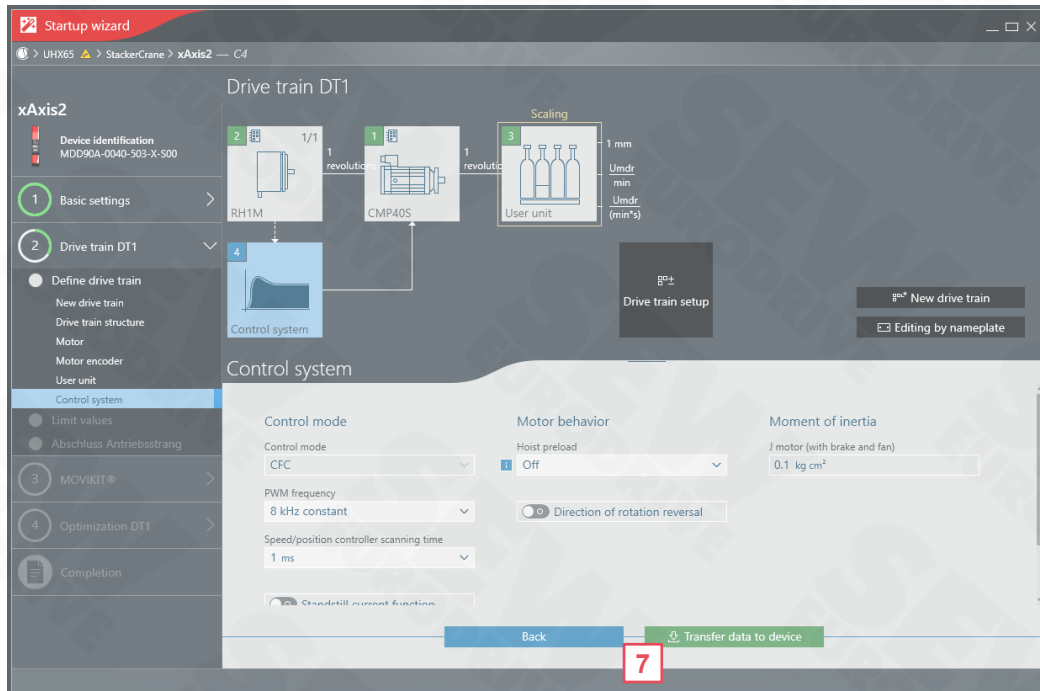


- 1** Define user unit. We recommend mm.
- 2** Set input revolutions to 100 mm.
- 3** Select user-defined speed unit. **User unit/s** must be used.
- 4** Select user-defined acceleration unit. **User unit/s²** must be used.
- 5** Press **Next**.



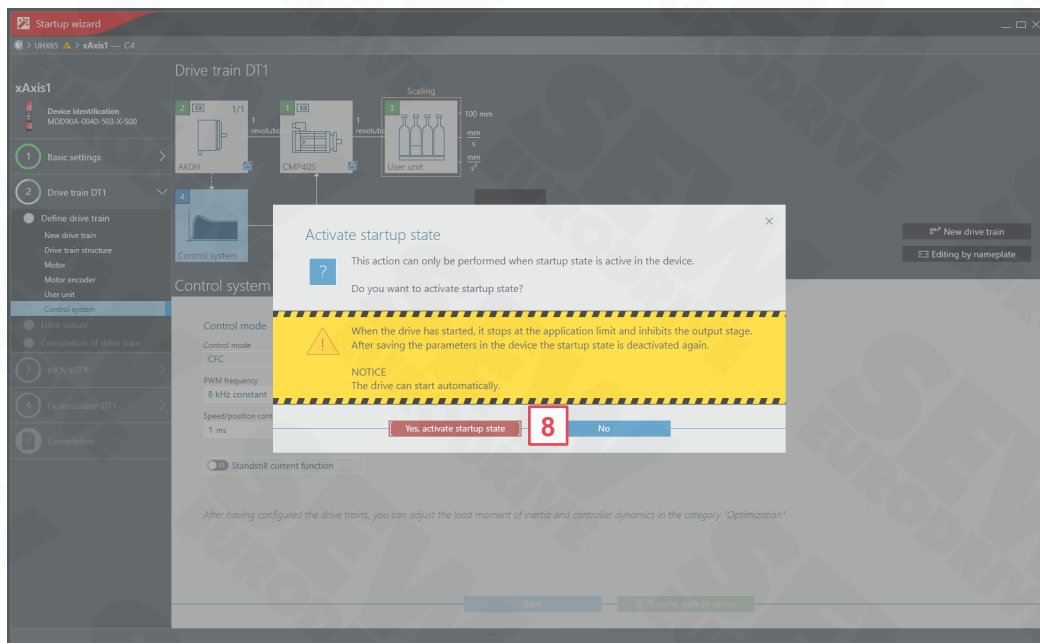
The jerk is transferred in the StackerCrane in user unit/s3.

8. Transfer data to device



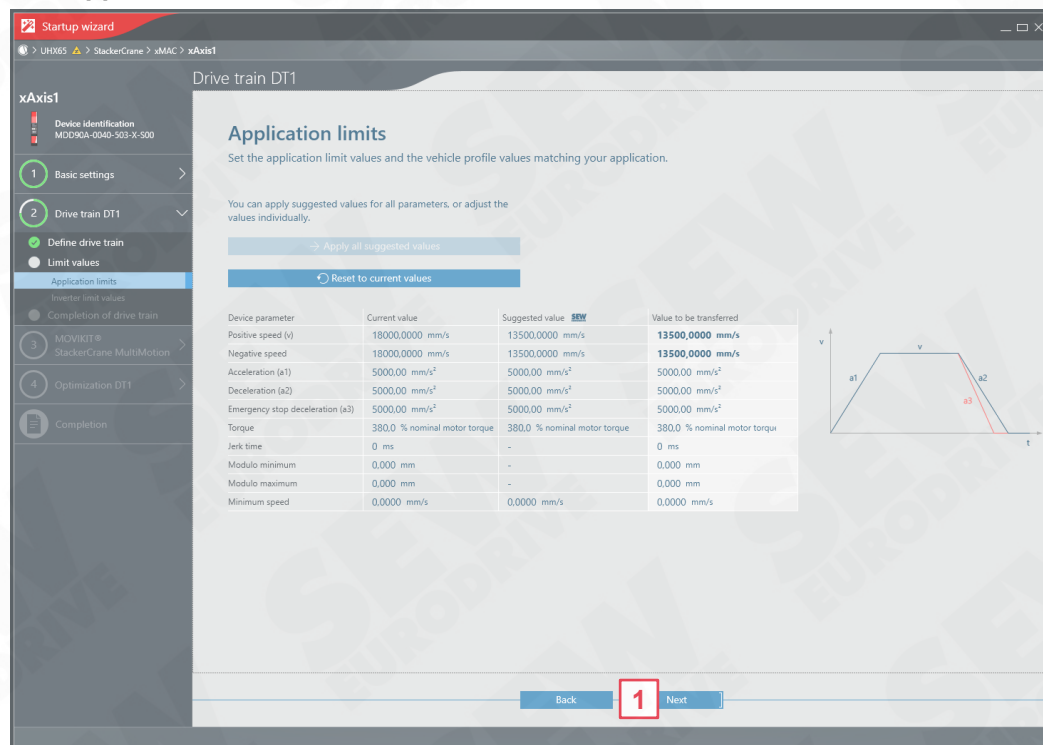
7 Press **Transfer data to device**.

9. Activate startup state



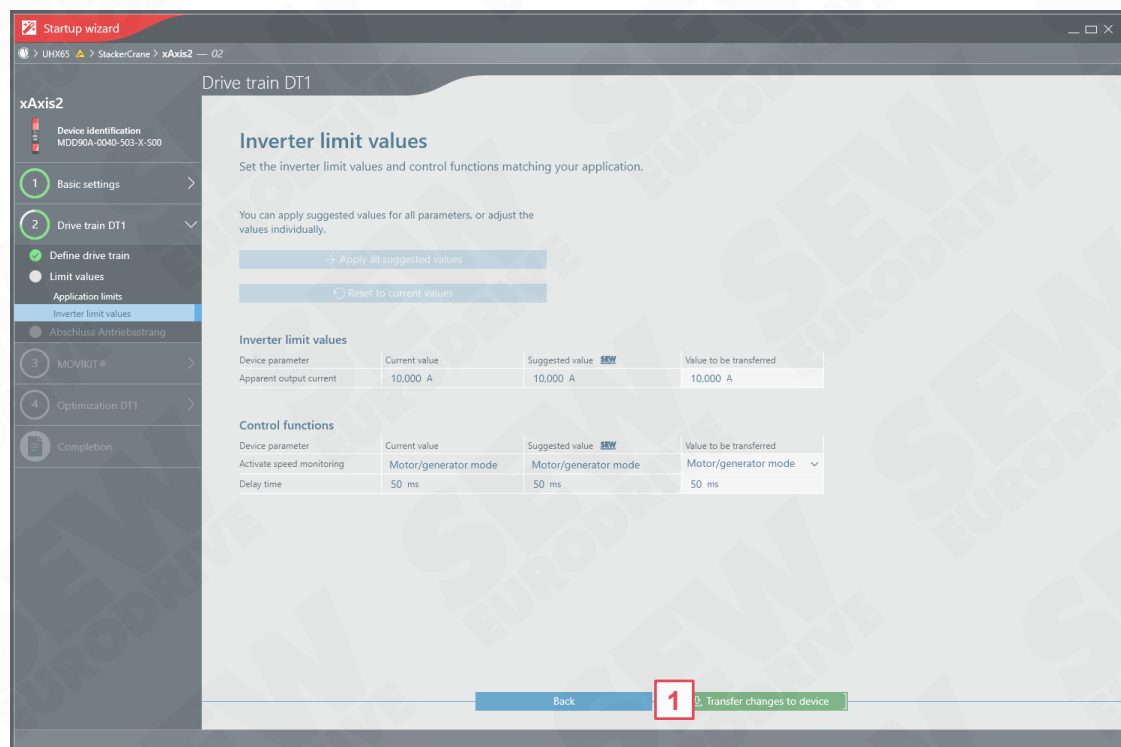
8 Press **Yes, activate startup state**.

10. Application limits



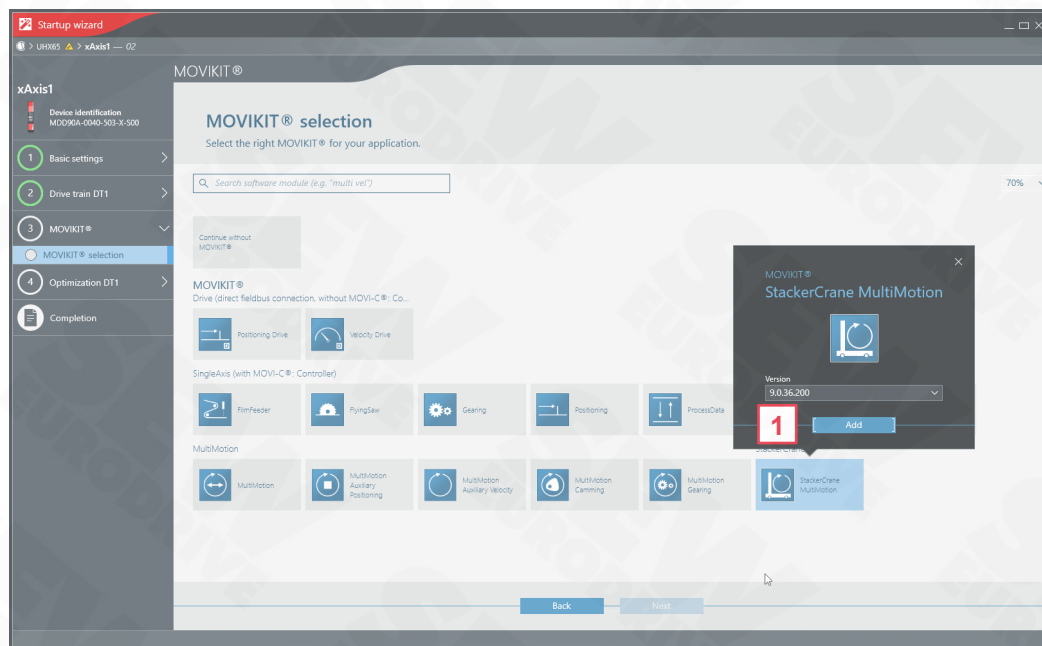
1 Press **Next**.

11. Inverter limits



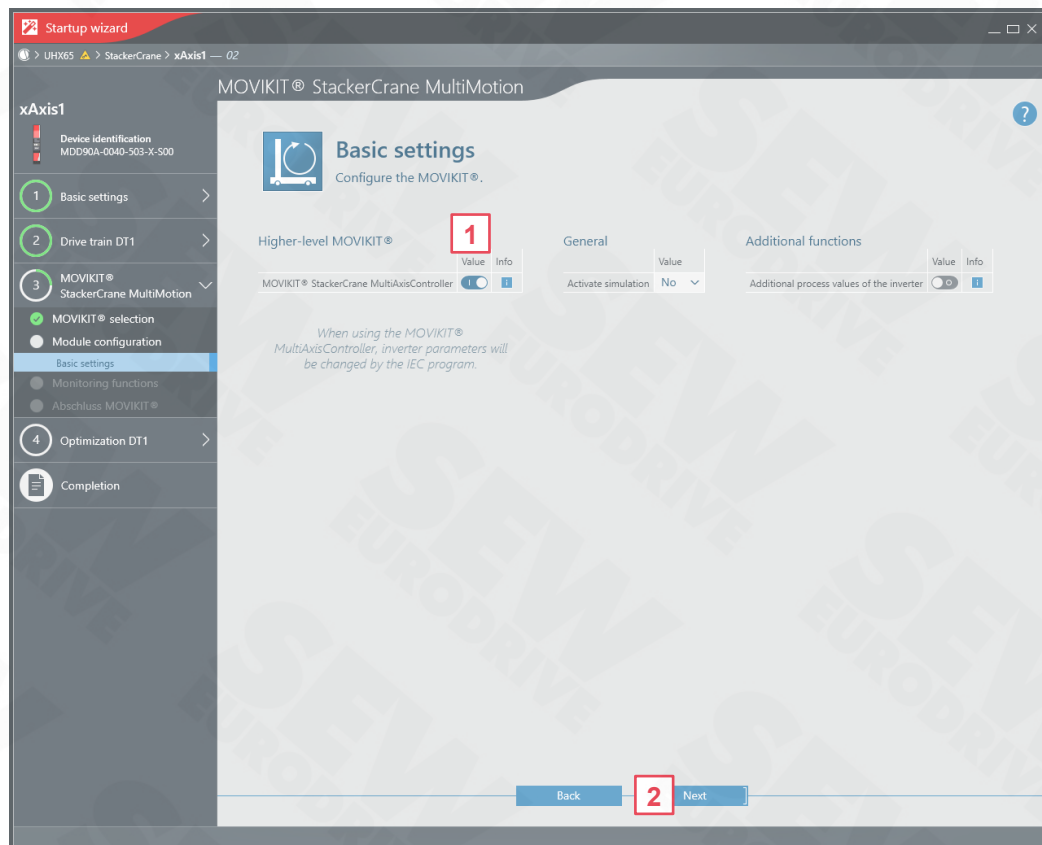
1 Press **Next**.

12. Add MOVIKIT®



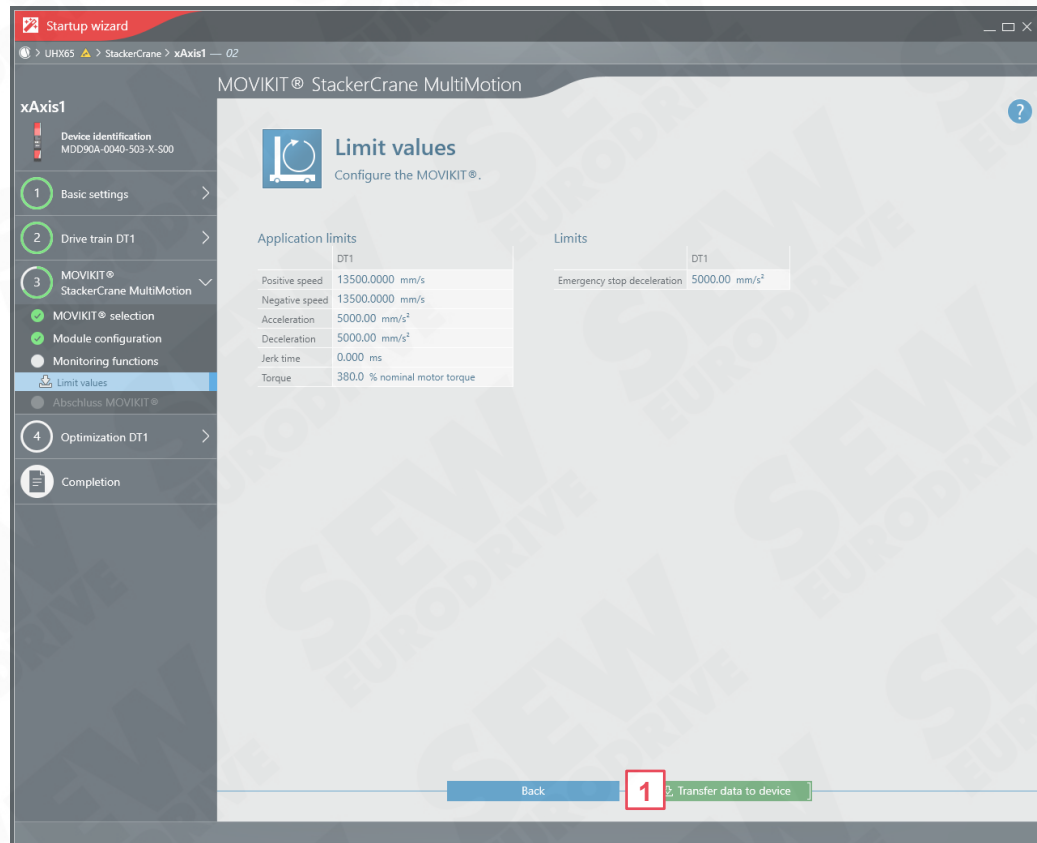
- 1 Add MOVIKIT® StackerCrane MultiMotion.

13. Basic settings



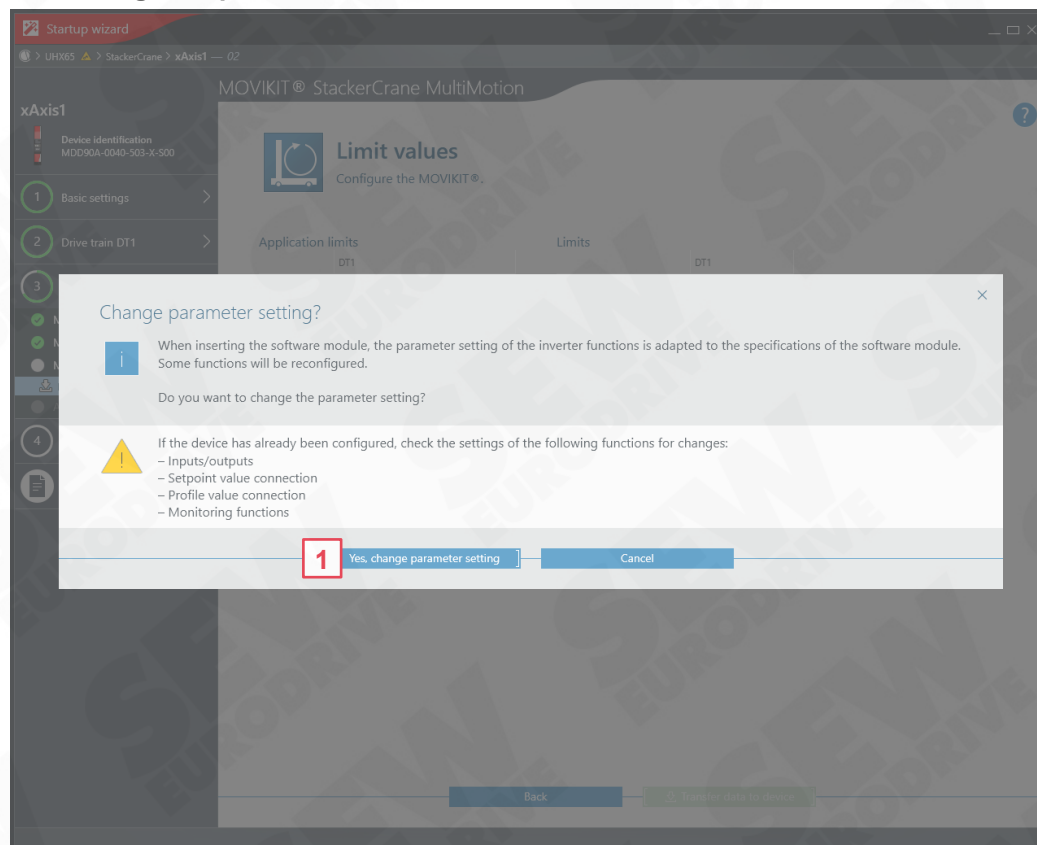
- 1 Activate the use of the higher-level MOVIKIT® StackerCrane MultiAxisController
- 2 Press **Next**.

14. Limit values



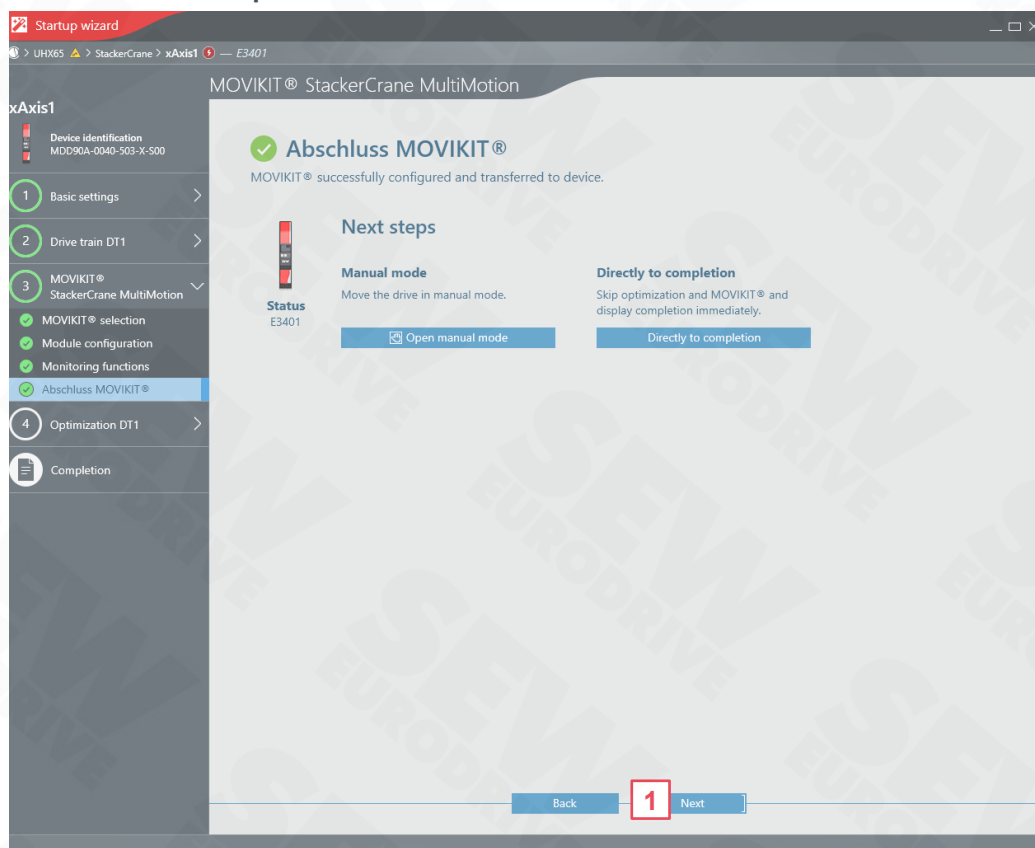
1 Press **Transfer data to device.**

15. Change the parameterization



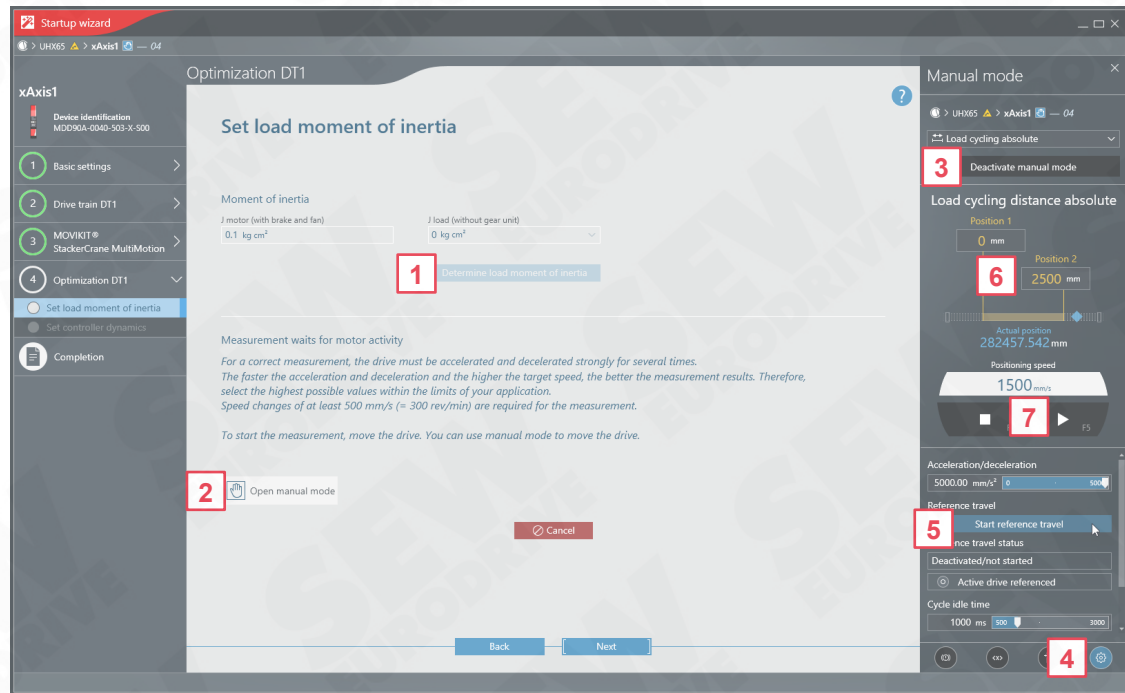
1 Press **Change parameter data.**

16. MOVIKIT® completion

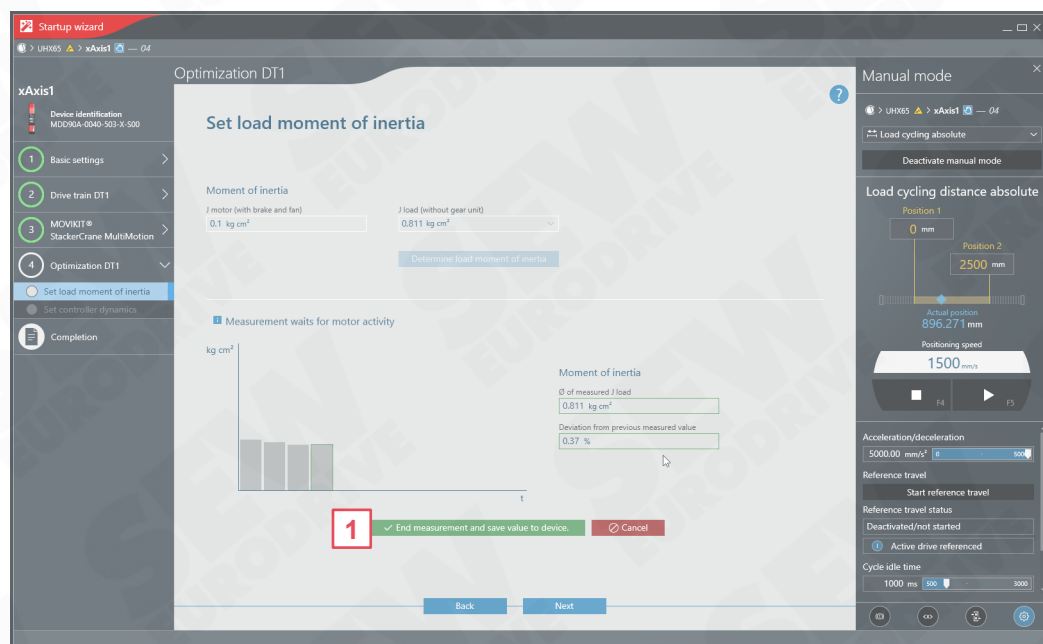


1 Press **Next**.

17. Optimization – set load moment of inertia



- 1 Activate the load moment of inertia determination
- 2 Activate manual mode
- 3 Switch on manual mode
- 4 Open the Reference travel tab using the "Gear wheel" button
- 5 Start reference travel
- 6 Defining positions 1 and 2 for the oscillation distance in absolute order
- 7 Start oscillation section ▶, F5

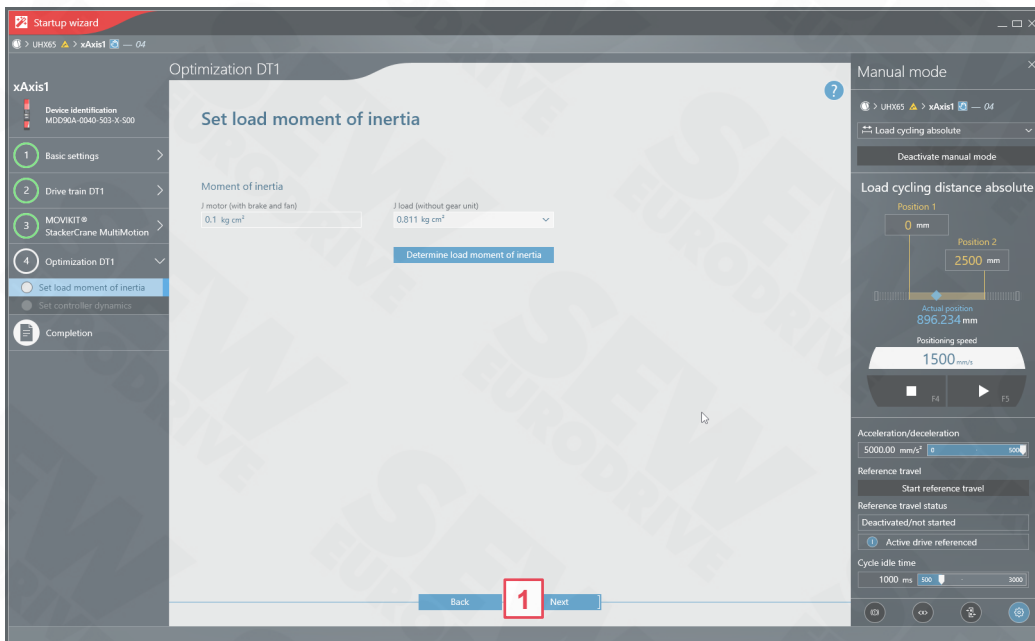


- 8 End measurement and save value in device

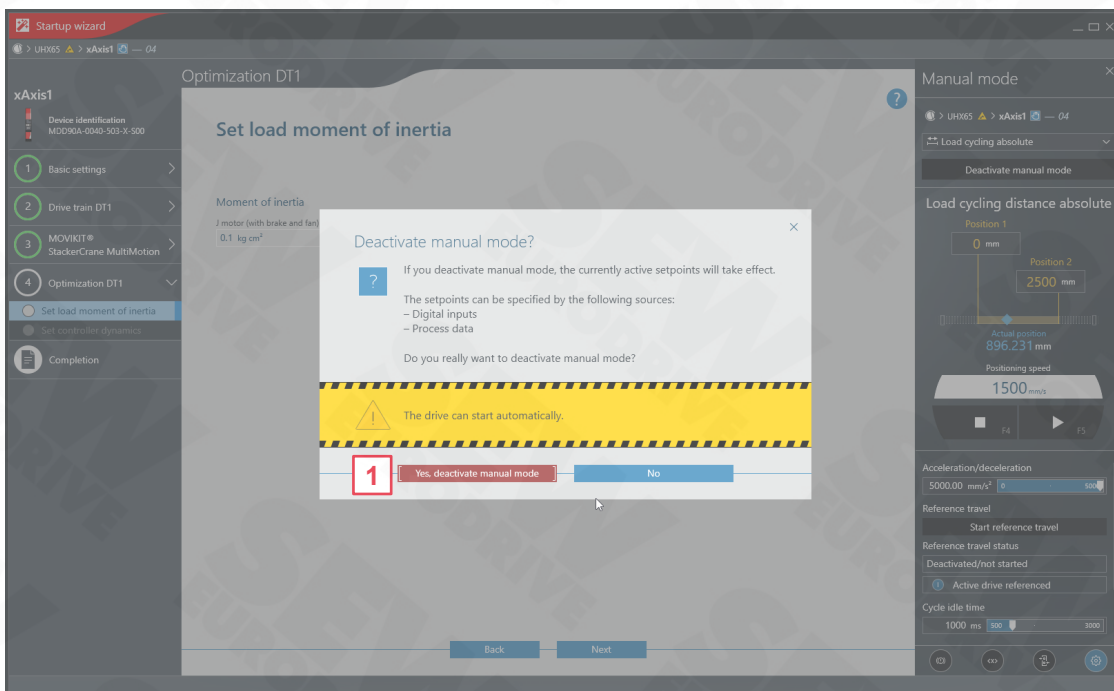


General information:

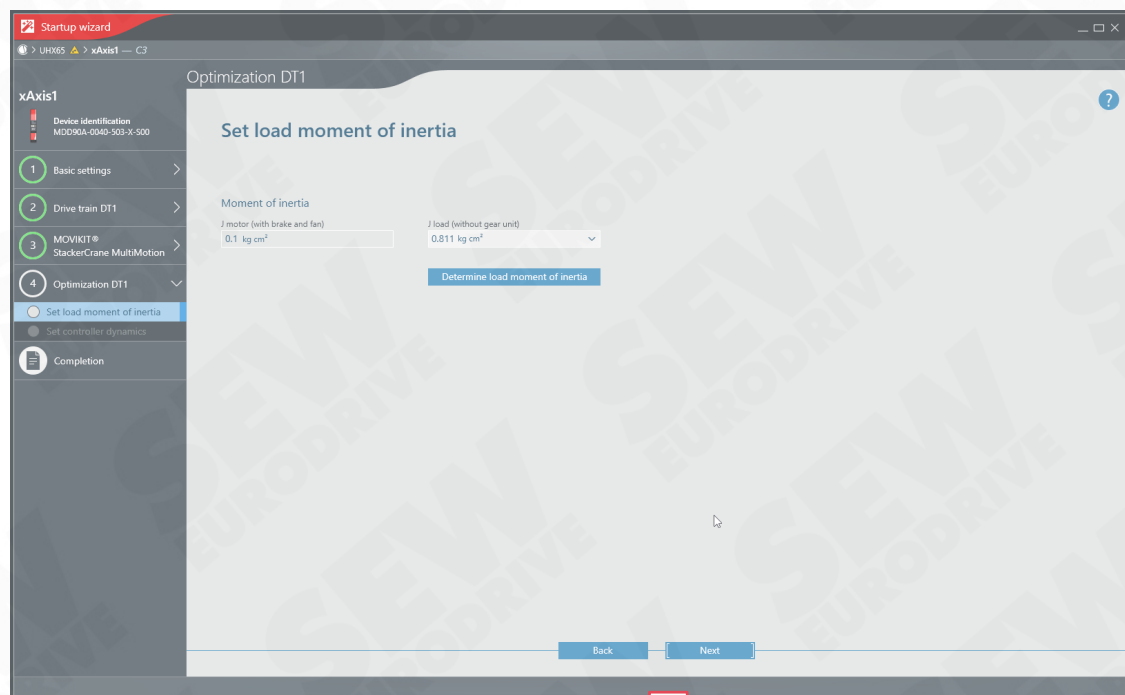
If no load moment of inertia can be determined, increase the acceleration and deceleration and start the process again. If no load moment of inertia can still be determined, increase the positioning speed additionally.



1 Press **Next**.

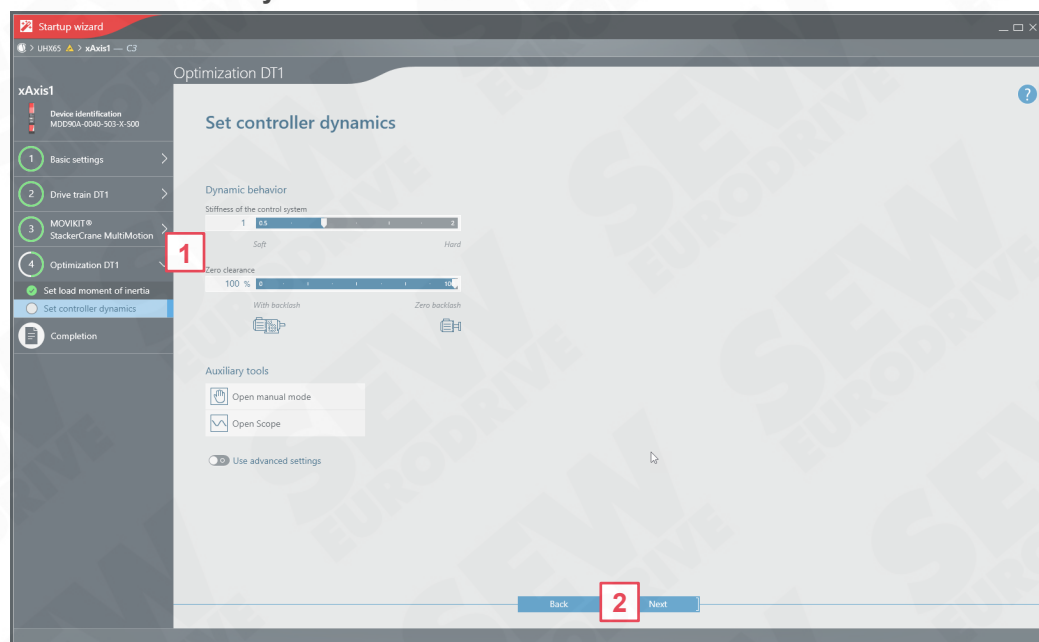


1 Press **Yes, activate startup state**



1 Press **Next**.

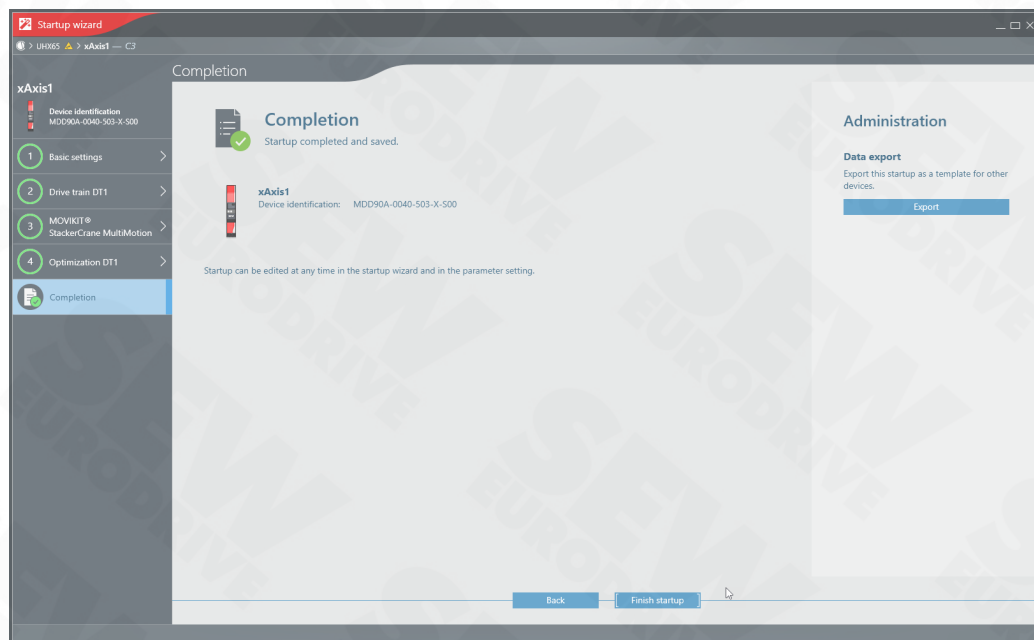
18. Set controller dynamics



1 Set stiffness and clearance. Press **Next**.

2 Press **Next**.

19. Conclusion



1 Press **End startup**.

4.4.1.2 Second axis of the landing gear (x-axis)



Repeat startup for the second x-axis with the startup wizard as in the previous chapter (travel axis x-axis)

4.4.1.3 Hoist (y-axis)

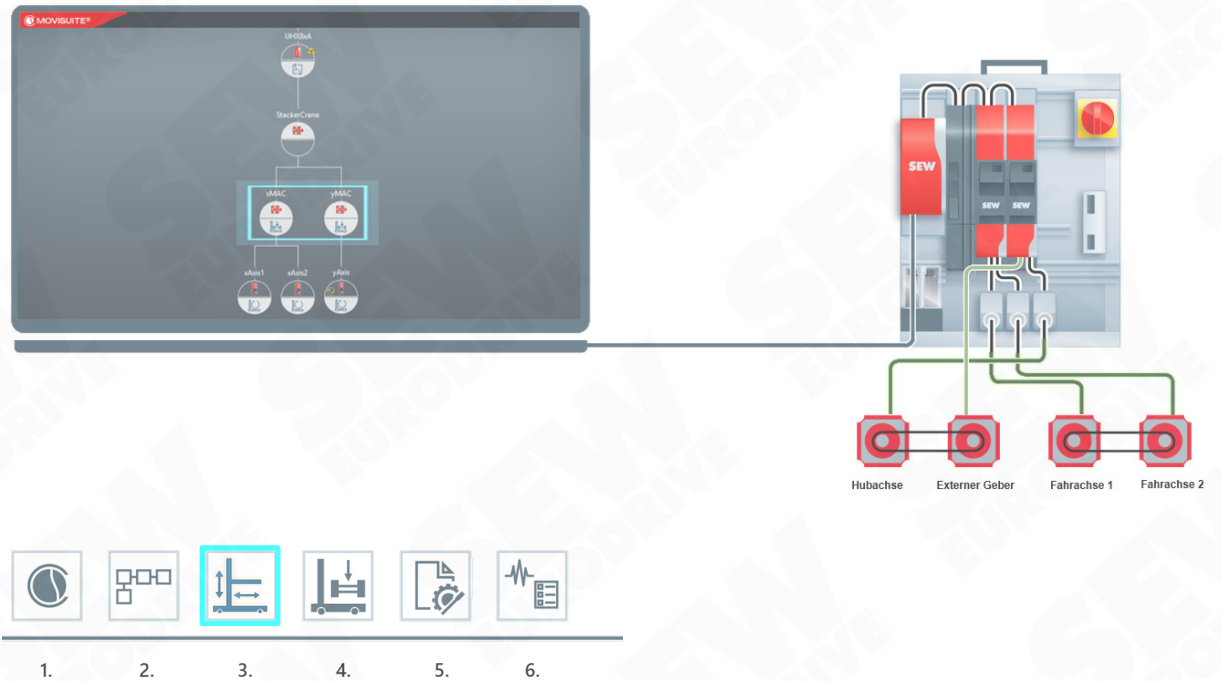


Repeat startup for the y-axis with the startup wizard as in the previous chapter (travel axis x-axis)

4.5 Step 3 – Startup of MOVIKIT® StackerCrane MultiAxisController MAC

Goals

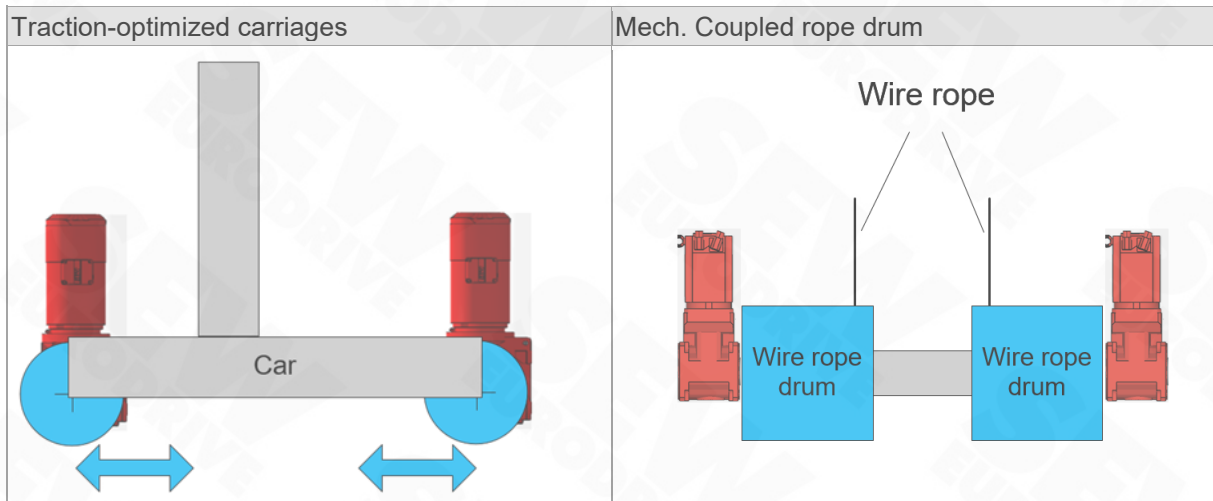
- Getting to know MOVIKIT® StackerCrane MultiAxisController Torque/Skewing
- Start up MOVIKIT® StackerCrane MultiAxisController in SoftwareNodes



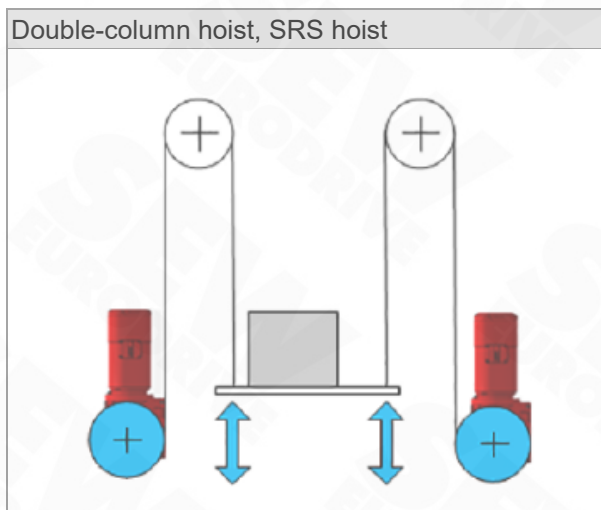
4.5.1 MOVIKIT® MultiAxisController Torque/Skewing



MOVIKIT® MultiAxisController Torque balances the torque between mechanically coupled drives ("Torque priority" operating mode).



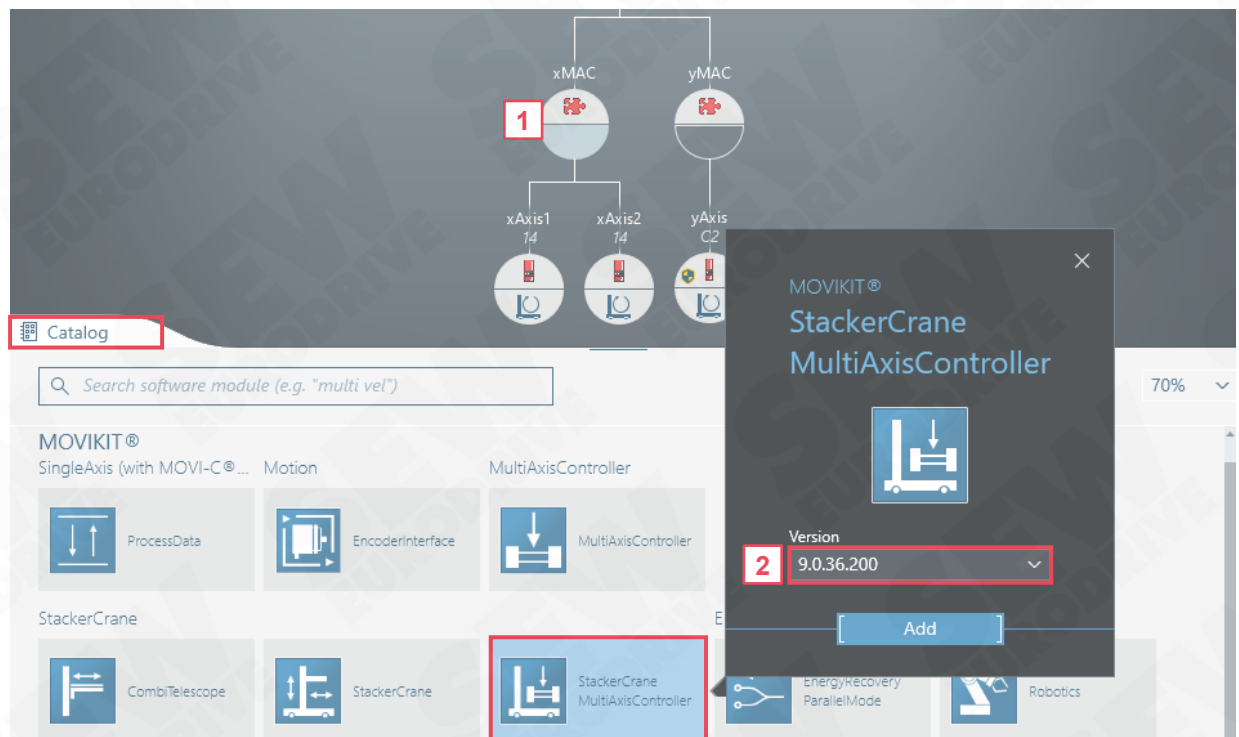
MOVIKIT® MultiAxisController Skewing corrects **skewing** between mechanically coupled drives ("skewing priority" operating mode).



4.5.2 Parameterizing MOVIKIT® StackerCrane MultiAxisController (x-axis)



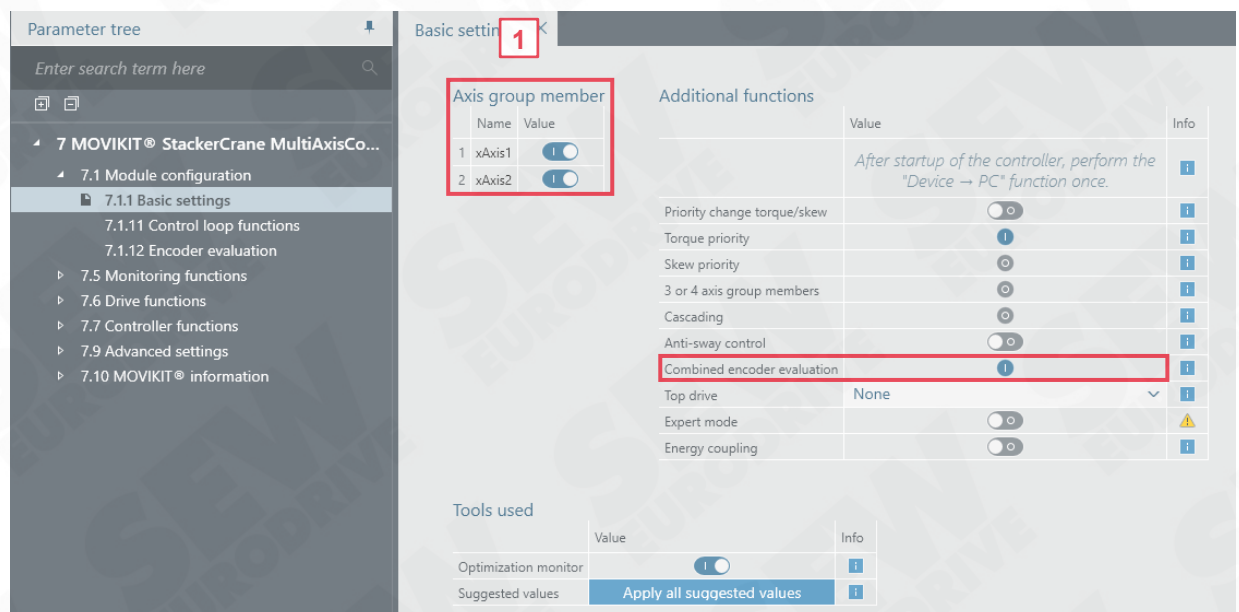
1. Assign MOVIKIT®



Assign the MOVIKIT® to the prepared software node for travel and hoist.

- 1 Activate the **lower semicircle of the chassis**
- 2 Select the latest version of **MOVIKIT® StackerCrane MultiAxisController** in the **catalog** and click **Add**.

2. Perform basic settings



- 1 Perform the highlighted settings in **Basic settings**.



General information:

"Combined encoder evaluation" is always active if "Motor encoder and external encoder" is selected in the encoder source, see step 5



General information:

When using monitoring and/or controller functions, these must always be performed in the MultiAxisController and not in MultiMotion.

3. Configure the control function

- 1** Set the **priority of the compensation** as follows:
- Torque: Default
 - Skewing: For hoists with TWO external encoders

4. Configure the position controller

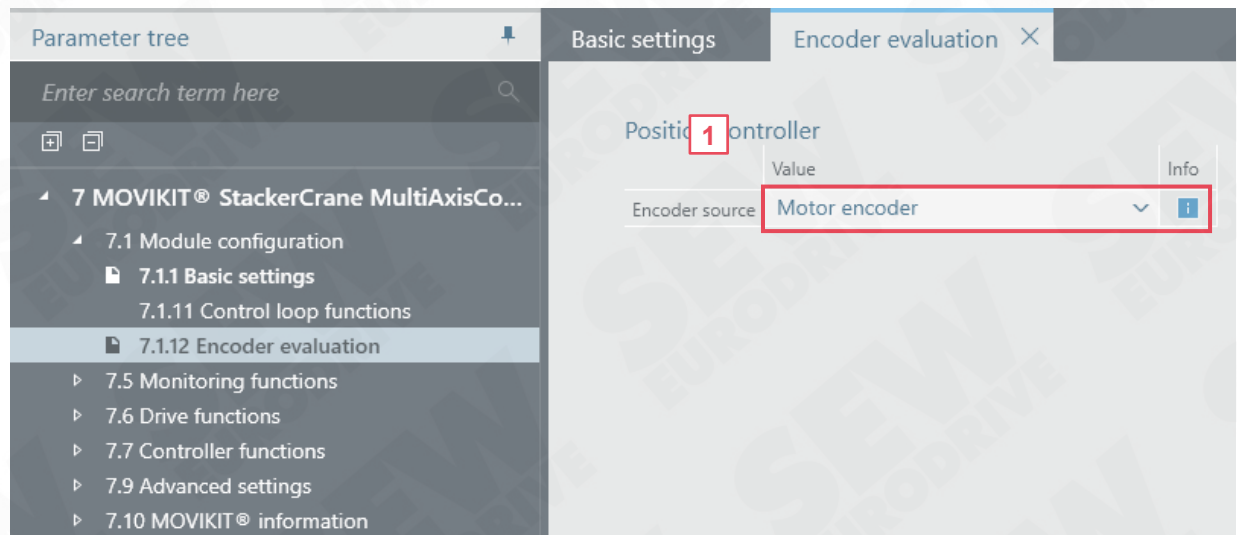
- 1** The P gain is reduced to 2%. Increase the p gain step-by-step from 2% to approx. 50%. Sometimes the position controller can be set even more strongly to up to 100%.



Note:

For detailed information on optimizing the MultiAxisController, refer to chapter 7.8.1.2

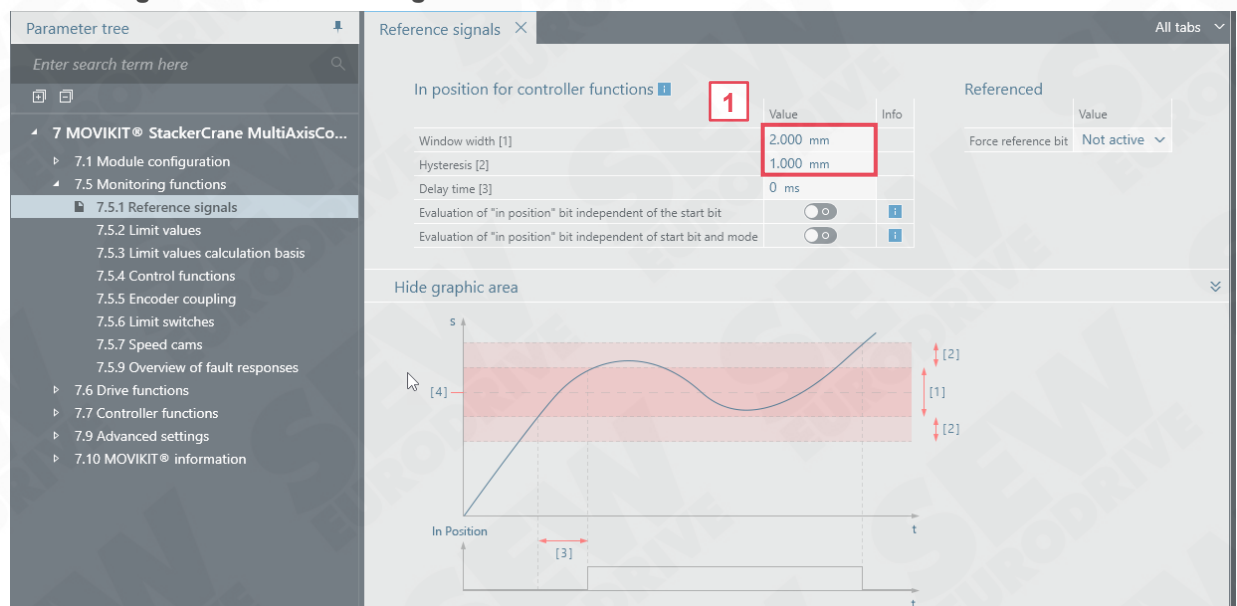
5. Configure encoder evaluation



1 Set the **encoder source** depending to your demo unit. In the shown demo unit **encoder source** is **Motor encoder**.

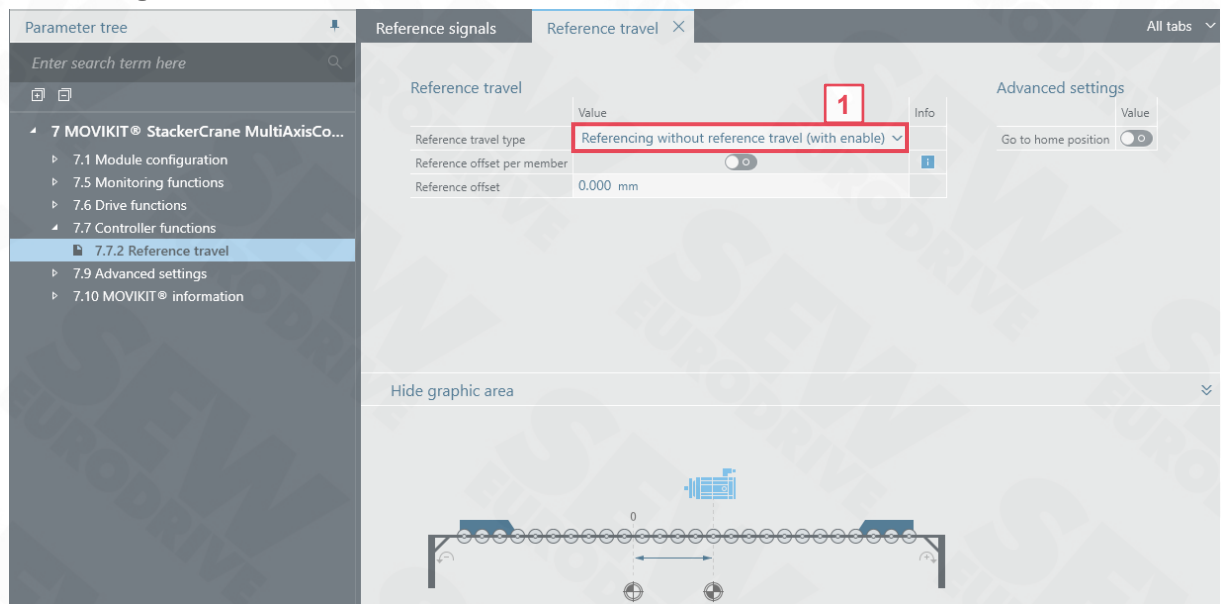
2 Set the **time constant**, if an external encoder is in use.

6. Configure reference message



1 Set the values as shown:
 Recommendation: **Window width** (2 mm)
Hysteresis (1 mm)

7. Configure reference travel



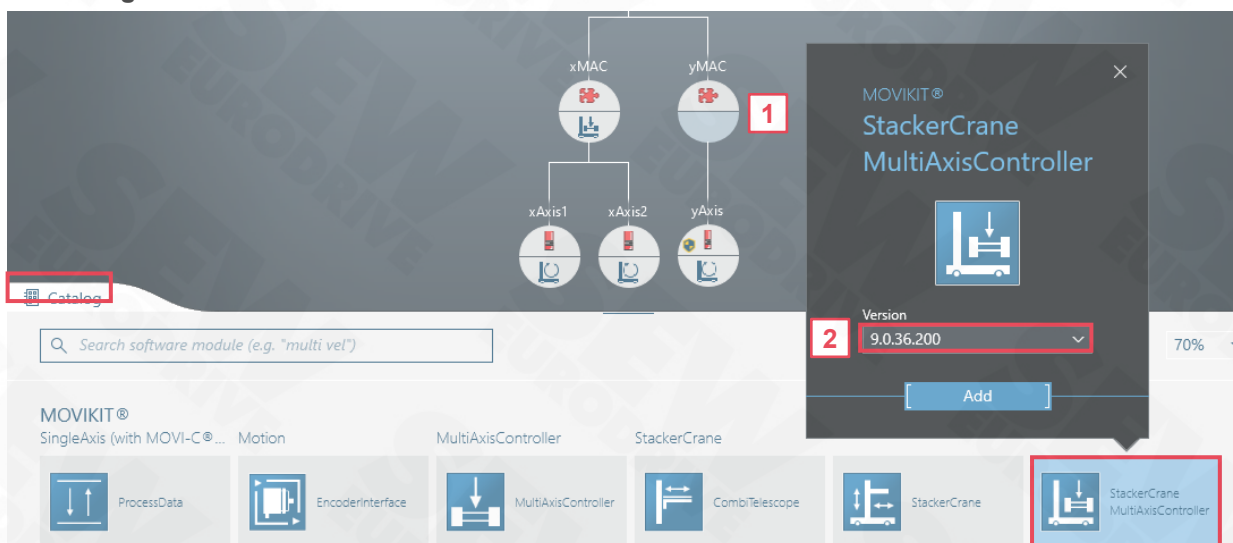
- 1 Set the **reference travel type** and the **reference offset**.

4.5.3



Parameterizing MOVIKIT® StackerCrane MultiAxisController (y-axis)

1. Assign MOVIKIT®



Assign the MOVIKIT® to the prepared software node for hoist.

- 1 Activate the **lower semicircle of the hoist**
- 2 In the **catalog**, select the **MOVIKIT® StackerCrane MultiAxisController** latest version
And click **Apply**.

2. Perform basic settings

Parameter tree

Enter search term here

- 7 MOVIKIT® StackerCrane MultiAxisCo...
 - 7.1 Module configuration
 - 7.1.1 Basic settings
 - 7.1.11 Control loop functions
 - 7.1.12 Encoder evaluation
 - 7.5 Monitoring functions
 - 7.6 Drive functions
 - 7.7 Controller functions
 - 7.9 Advanced settings
 - 7.10 MOVIKIT® information

Basic settings

Axis group member	Name	Value
1	yAxis	<input checked="" type="radio"/>
2	Axis group member 2	<input type="radio"/>

Additional functions

	Value	Info
	After startup of the controller, perform the "Device → PC" function once.	<input checked="" type="checkbox"/>
Priority change torque/skew	<input type="radio"/>	<input checked="" type="checkbox"/>
Torque priority	<input checked="" type="radio"/>	<input checked="" type="checkbox"/>
Skew priority	<input type="radio"/>	<input checked="" type="checkbox"/>
3 or 4 axis group members	<input type="radio"/>	<input checked="" type="checkbox"/>
Cascading	<input type="radio"/>	<input checked="" type="checkbox"/>
Anti-sway control	<input type="radio"/>	<input checked="" type="checkbox"/>
Combined encoder evaluation	<input checked="" type="radio"/>	<input checked="" type="checkbox"/>
Top drive	None	<input checked="" type="checkbox"/>
Expert mode	<input type="radio"/>	<input checked="" type="checkbox"/>
Energy coupling	<input type="radio"/>	<input checked="" type="checkbox"/>

Tools used

	Value	Info
Optimization monitor	<input checked="" type="radio"/>	<input checked="" type="checkbox"/>

Suggested values [Apply all suggested values](#)

1 Perform the highlighted settings in **Basic settings** according to your demi unit.

General information:

"**Combined encoder evaluation**" is always active if "Motor encoder and external encoder" is selected in the encoder source, see step 5.

General information:

When using monitoring and/or controller functions, these must always be performed in the MultiAxisController and not in MultiMotion.

3. Configure the control function

Parameter tree

Enter search term here

- 7 MOVIKIT® StackerCrane MultiAxisCo...
 - 7.1 Module configuration
 - 7.1.1 Basic settings
 - 7.1.11 Control loop functions
 - 7.1.12 Encoder evaluation
 - 7.5 Monitoring functions
 - 7.6 Drive functions
 - 7.7 Controller functions
 - 7.9 Advanced settings
 - 7.10 MOVIKIT® information

Basic settings

Control loop functions

Position controller

	Value	Info
Position controller	Active	<input checked="" type="checkbox"/>
P gain	2 1/s = 2 % <input type="text"/> 100 x 100	<input checked="" type="checkbox"/>

Balance controller

	Value	Info
Priority of compensation	Torque	<input checked="" type="checkbox"/>
P gain	100 % <input type="text"/> 0 <input type="text"/> 600	<input checked="" type="checkbox"/>
Slip limiter	Active	<input checked="" type="checkbox"/>
Curve mode	None	<input checked="" type="checkbox"/>
Maximum slip speed	675.0000 <input type="text"/> 675.0000 mm/s	<input checked="" type="checkbox"/>

Torque ratios

	Value
xAxis1	1
xAxis2	1

1 Set the **priority of the compensation** as follows:
 Torque: Default
 Skewing: For hoists with TWO external encoders

4. Configure the position controller

The screenshot shows the 'Basic settings' tab for the 'Position controller'. The 'P gain' is set to 2% (2 1/s). A red box highlights the 'P gain' field with a red '1' next to it. The 'Balance controller' section shows 'P gain' set to 100% and 'Slip limiter' set to 'Active'. The 'Torque ratios' section shows 'xAxis1' and 'xAxis2' both set to 1.

- 1 The P gain is reduced to 2%. Increase the p gain step-by-step from 2% to approx. 50%. Sometimes the position controller can be set even more strongly to up to 100%.



Note:

For detailed information on optimizing the MultiAxisController, refer to chapter 7.8.1.2

5. Configure encoder evaluation

The screenshot shows the 'Encoder evaluation' tab. The 'External encoders' section shows 'yAxis' with a toggle switch. A red box highlights the 'Encoder source' dropdown menu with a red '1' next to it. The 'Settings of external encoders' section shows 'Type' set to 'Encoder 2 connected to inverter' and 'Time constant' set to 0.1 s. A red box highlights the 'Time constant' field with a red '2' next to it.

- 1 Set the **encoder source**.

- 2 Set the **time constant**.



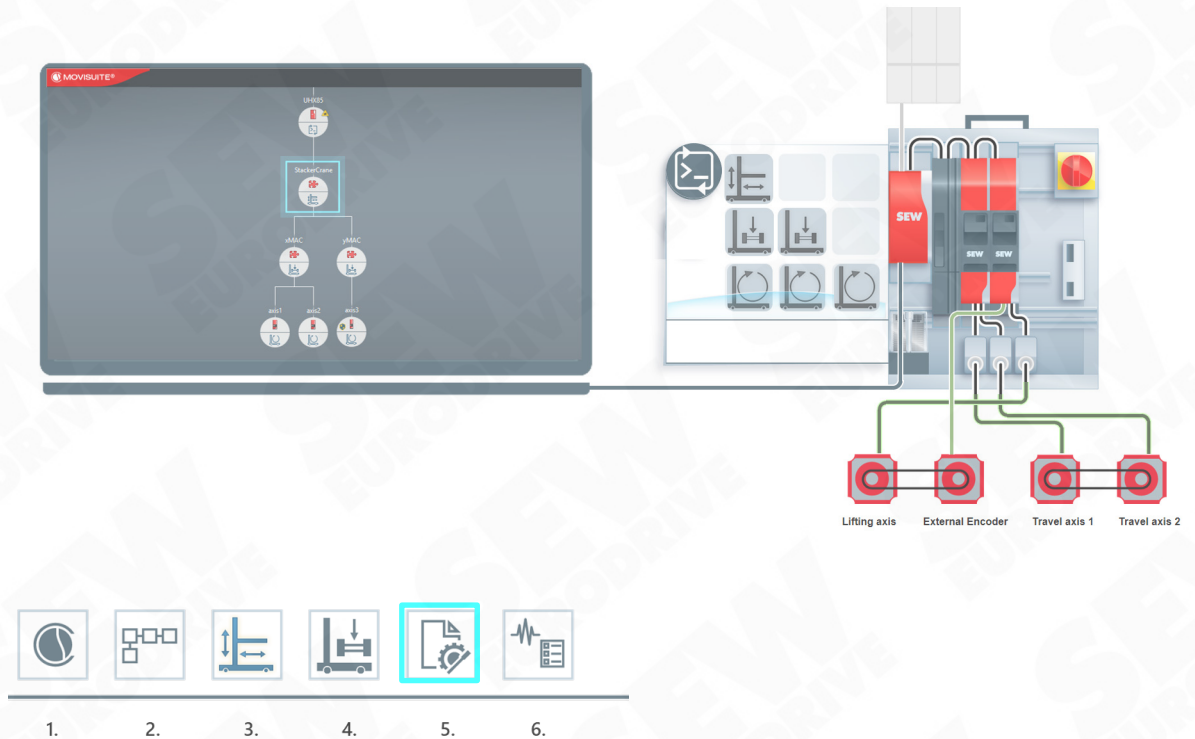
Determining the time constant

For detailed information on determining the time constant, refer to chapter 7.8.1.2

4.6 Step 4 – Startup of MOVIKIT® StackerCrane

Goals

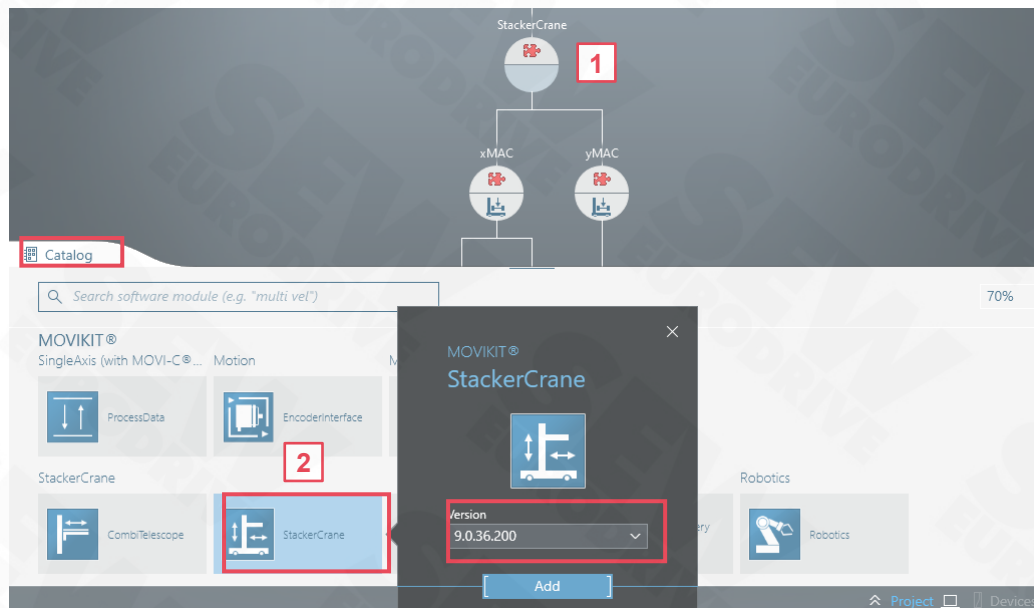
- Assigning and parameterizing MOVIKIT® StackerCrane
- Get to know the process data assignment of the fieldbus interface



4.6.1 Parameterize MOVIKIT® StackerCrane

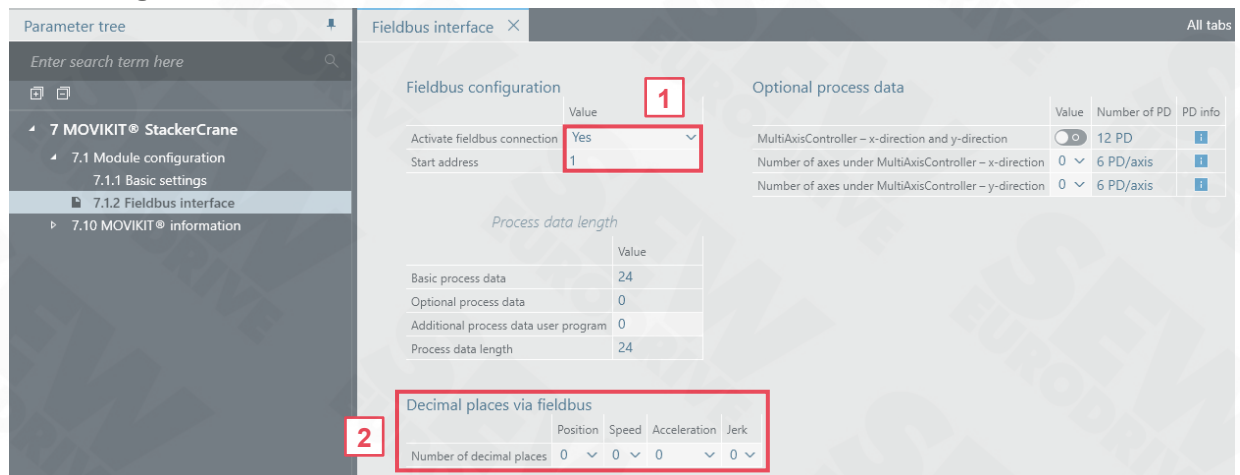


1. Assign MOVIKIT®



- 1 Activate the **lower semicircle of the software node**
- 2 Select the latest version of **MOVIKIT® StackerCrane** in the **catalog**
And click **Apply**.

2. Configure the fieldbus interface














- 1 Set **Activate fieldbus connection = Yes** and **start address = 1**
- 2 Set decimal places for the fieldbus:

Number of decimal places	Value	Resolution
0	Position	1 mm = 1 mm
0	Speed	1 mm/s = 1 mm/s
0	Acceleration	1 mm/s ² = 1 mm/s ²
0	Jerk	1 mm/s ³ = 1 mm/s ³

4.6.2 Process data assignment of the fieldbus interface



Process data assignment in MOVISUITE®

Fieldbus interface		PLC	PLC output data	PLC input data	MOVIKIT®
			>>>>	<<<<	
Axis group					
	Setpoint application mode		PO 1	PI 1	Actual application mode
	Control word		PO 2	PI 2	Status word
	Reserved (override)		PO 3	PI 3	Status or fault/subfault
	Reserved		PO 4	PI 4	Reserved
x-direction					
	Control word		PO 5	PI 5	Status word
	Setpoint speed		PO 6	PI 6	Actual speed
	Setpoint acceleration		PO 7	PI 7	Status or fault/subfault
	Setpoint deceleration		PO 8	PI 8	Torque
	Digital outputs		PO 9	PI 9	Digital inputs
	Control word MultiAxisController		PO 10	PI 10	Status word MultiAxisController
	Target position – high word		PO 11	PI 11	Actual position – high word
	Target position – low word		PO 12	PI 12	Actual position – low word
	Setpoint jerk		PO 13	PI 13	Actual jerk
	Reserved		PO 14	PI 14	Reserved
y-direction					
	Control word		PO 15	PI 15	Status word
	Setpoint speed		PO 16	PI 16	Actual speed
	Setpoint acceleration		PO 17	PI 17	Status or fault/subfault
	Setpoint deceleration		PO 18	PI 18	Torque
	Digital outputs		PO 19	PI 19	Digital inputs
	Control word MultiAxisController		PO 20	PI 20	Status word MultiAxisController
	Target position – high word		PO 21	PI 21	Actual position – high word
	Target position – low word		PO 22	PI 22	Actual position – low word
	Setpoint jerk		PO 23	PI 23	Actual jerk
	Reserved		PO 24	PI 24	Reserved



Target application mode

0	Default
100	Jog
300	Referencing configured offset
301	Referencing bus offset
400	Positioning absolute
1200	Energized-optimized XY positioning
1210	Mechanics-optimized positioning
1300	External braketest

Control word x-& y-direction

Bit 0	Enable emergency stop
Bit 1	Enable application stop
Bit 2	Reserved
Bit 3	Release brake
Bit 4	Jog positive
Bit 5	Jog negative
Bit 6	Reserved
Bit 7	Start/stop with fieldbus ramp
Bit 8	Reset fault
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Deactivate external encoders
Bit 12	Deactivate SW limit switches
Bit 13	Activate output stage inhibit
Bit 14	Activate standby mode
Bit 15	MOVIKIT® Handshake In

Status word x-& y-direction

Bit 0	Ready
Bit 1	STO inactive
Bit 2	Output stage enabled
Bit 3	Brake released
Bit 4	Motor turning
Bit 5	Referenced
Bit 6	Reserved
Bit 7	In position
Bit 8	Fault
Bit 9	Reserved
Bit 10	Reserved
Bit 11	External encoder disabled
Bit 12	SW limit switch inactive
Bit 13	Reserved
Bit 14	Standby mode active
Bit 15	MOVIKIT® Handshake Out

MultiAxisController control word

Bit 0	Deactivate member 1/11
Bit 1	Deactivate member 2/21
Bit 2	Deactivate member 12
Bit 3	Deactivate member 22
Bit 4	member 1/11 Release brake with inhibited output stage
Bit 5	member 2/21 Release brake with inhibited output stage
Bit 6	member 12 Release brake with inhibited output stage
Bit 7	member 22 Release brake with inhibited output stage
Bit 8	Deactivate balance controller
Bit 9	Reserved (deactivate position controller)
Bit 10	Deactivate skewing error
Bit 11	Allow skew compensation
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved

Status word x-& y-direction

Bit 0	Axis group member 1/11 deactivated
Bit 1	Axis group member 2/21 deactivated
Bit 2	Axis group member 12 deactivated
Bit 3	Axis group member 22 deactivated
Bit 4	Axis group member 1/11 brake released
Bit 5	Axis group member 2/21 brake released
Bit 6	Axis group member 12 brake released
Bit 7	Axis group member 22 brake released
Bit 8	Balance controller deactivated
Bit 9	Position controller deactivated
Bit 10	Skew in skew window
Bit 11	Overload guard active
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved



Optional process data

Optional process data can be added to use additional functions of the MAC if required (see broken down process data assignment). These can be used, for example, to specify the payload or torque distribution.

Optional process data	Value	Number of PD
MultiAxisController – x-direction and y-direction	<input checked="" type="checkbox"/>	12 PD
x-direction – payload	<input type="checkbox"/>	1 PD
x-direction – position controller P gain	<input type="checkbox"/>	1 PD
x-direction – enable anti-sway control	<input type="checkbox"/>	1 PD
y-direction – payload	<input type="checkbox"/>	1 PD
y-direction – position controller P gain	<input type="checkbox"/>	1 PD
Number of axes under MultiAxisController – x-direction	0 ▾	6 PD/axis
Number of axes under MultiAxisController – y-direction	0 ▾	6 PD/axis

Fieldbus interface: optional process data

MultiAxisController – x-direction and y-direction (12 PD)				
	PLC	PLC output data	PLC input data	MOVIKIT®
x-direction	Reserved	PO 25	PI 25	Top drive – scaled analog value
	Reserved	PO 26	PI 26	Top drive – speed correction
	Torque distribution A4 (high byte)/A3 (low byte)	PO 27	PI 27	Top drive – speed ratio
	Torque distribution A2 (high byte)/A1 (low byte)	PO 28	PI 28	Top drive – slip
	Reserved	PO 29	PI 29	Top drive – unscaled analog value
	Reserved	PO 30	PI 30	Reserved
	Reserved	PO 31	PI 31	Reserved
	Reserved	PO 32	PI 32	Reserved
y-direction	Reserved	PO 33	PI 33	Reserved
	Reserved	PO 34	PI 34	Reserved
	Reserved	PO 35	PI 35	Reserved
	Reserved	PO 36	PI 36	Reserved

4.7.1 Fieldbus parameterization



1. Parameterize fieldbus

The screenshot shows the MOVIKIT software interface for fieldbus parameterization. On the left, the 'Parameter tree' is visible with '7.42 Fieldbus' selected. The main area is divided into two sections: 'Fieldbus card' and 'Fieldbus connection via IEC function blocks'. In the 'Fieldbus card' section, the 'Fieldbus protocol' is set to 'PROFINET IO device', which is highlighted with a red box and the number '1'. In the 'Fieldbus connection via IEC function blocks' section, the 'Activate fieldbus connection' is set to 'Yes', which is highlighted with a red box and the number '2'.

1 Set the fieldbus protocol to **PROFINET IO device**

2 Activate the **fieldbus connection**.

4.7.2 Cycle time on the MOVI-C® CONTROLLER



General information:

The StackerCrane applications are always operated with a cycle time of **1 ms or 4 ms** depending on the controller. Select the controller from the following table depending on the scope of application (MultiMotion / MultiAxisController / Add-on AntiSway):

Controller

MOVIKIT® StackerCrane with ...	UHX25	UHX45 UHX65A-R01	UHX65A-R02 UHX65A-R04
MOVIKIT StackerCrane MultiMotion	1 ms	1 ms	1 ms
... With MOVIKIT® PowerMode	4 ms	1 ms	1 ms
MOVIKIT StackerCrane MultiAxisController	-	4 ms	1 ms
... With MOTION add-on AntiSway	-	4 ms	4 ms
... With MOVIKIT® MultiAxisController add-on Cascading	-	4 ms	4 ms
... With MOVIKIT® PowerMode	-	4 ms	4 ms



2. Parameterize the cycle time on the MOVI-C® CONTROLLER

Parameter tree

Enter search term here

- 2 Device properties
- 4 Functions
- 6 Diagnostics
- 7 MOVIRUN® flexible
 - 7.40 IEC project
 - 7.41 Data management
 - 7.42 Fieldbus
 - 7.43 Task system**
 - 7.99 Module identification

Fieldbus Task system X

Task system

	Value
HighPrio task cycle time	1 ms 1
EtherCAT® cycle time	1000 µs
Sync Offset EtherCAT®	-30 2 → -30 %

The parameter "Sync Offset EtherCAT®" defines the delay time of the sync interrupt of the EtherCAT® slave compared to the cycle time of the controller. With the preset value in %, the process data can be processed optimally. If the "Cycle time HighPrio Task" parameter is changed, SEW-EURODRIVE recommends adjusting the "Sync Offset EtherCAT®" parameter by clicking the arrow button [→].

1 Set the EtherCAT® cycle time to 1 ms (default).

2 **Apply the** suggested value **Sync Offset EtherCAT®**

3. Change the cycle time in the parameter tree of the axes

Parameter tree

Enter search term here

- 2 Device properties
- 3 Drive train
- 4 Functions
 - 4.1 Inputs/outputs
 - 4.2 Setpoints
 - 4.2.1 Basic settings**
 - 4.2.2 PO data
 - 4.2.10 Fixed setpoints
 - 4.2.25 Prioritized terminal control
 - 4.2.11 Setpoint value connection
 - 4.2.12 Profile value connection
 - 4.2.21 Control word 1
 - 4.2.22 Control word 2
 - 4.2.23 Control word 3

Basic settings X

Basic settings

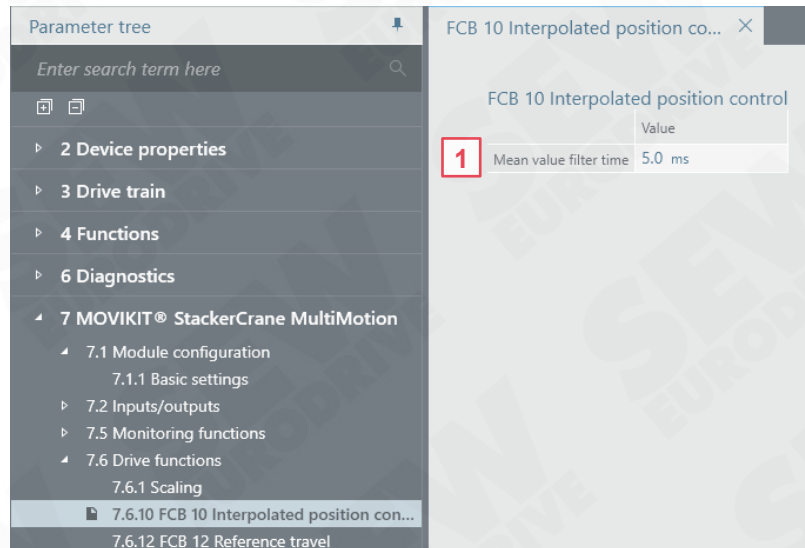
Function	Value
Source	EtherCAT®/SBusPLUS
1 Controller setpoint cycle	1.000 ms
Stop	<input type="checkbox"/>
Response to process data timeout	Application stop + output stage inhibit with self reset
Response to external fault	Application stop + output stage inhibit

Synchronization

Function	Value
Use synchronization signal	<input type="checkbox"/>
Basic cycle time	1 ms
Current cycle time	1 ms
Period duration of sync signal	1.000 ms
Response to external synchronization	Warning with self reset

1 Under **Setpoints Basic settings**, set **Controller setpoint cycle** to 1 ms (default).

4. Parameterize the mean value filter time in the parameter tree of the axes



- 1** Under **Drive functions** **FCB10 Interpolated position control**, set the **Mean value filter time** to a multiple of the cycle time.

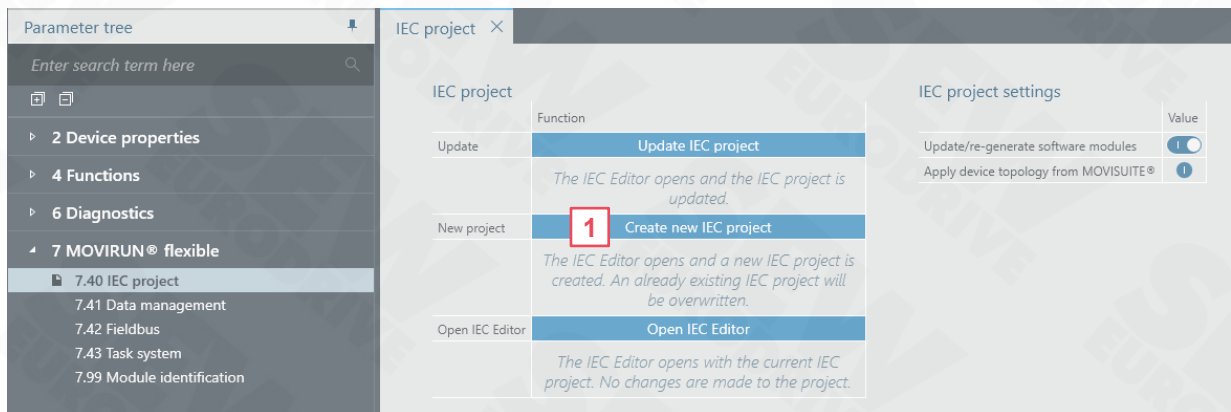


- With a cycle time of 1 ms, the default value of the mean filter time (5 ms) can be used.
- For a cycle time of 4 ms, we recommend a mean filter time of 8 ms.

4.7.3 Create IEC project

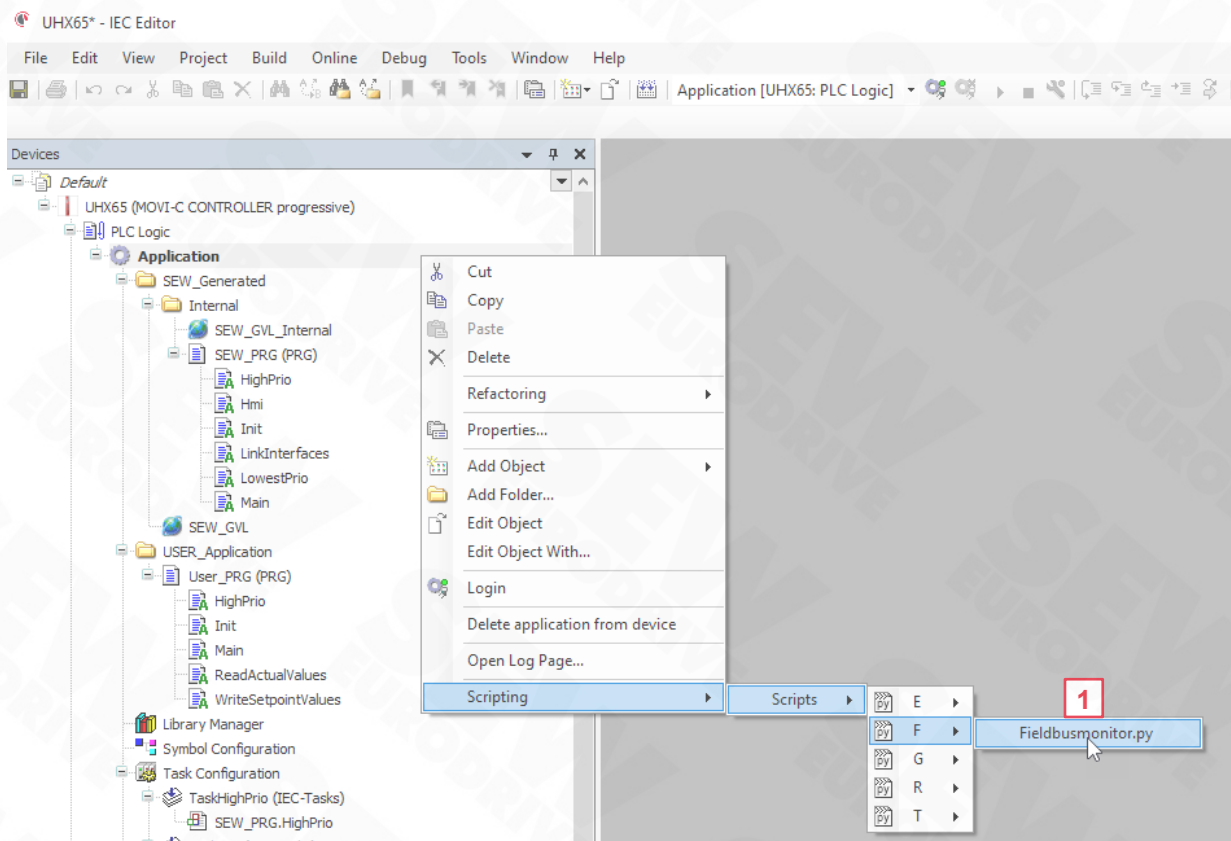


1. Create IEC project



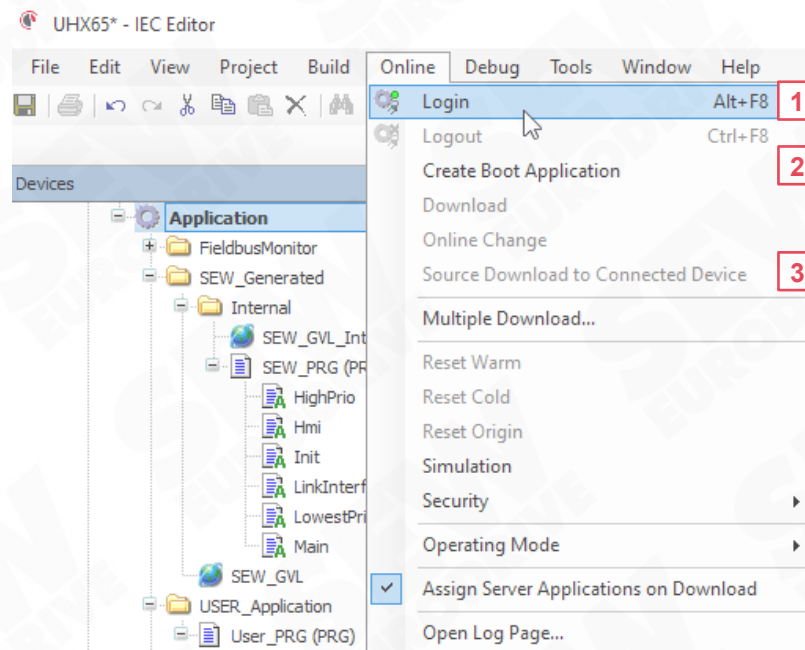
1 Click **Create new IEC project** to start the automatic code generation process

2. Import process data monitor

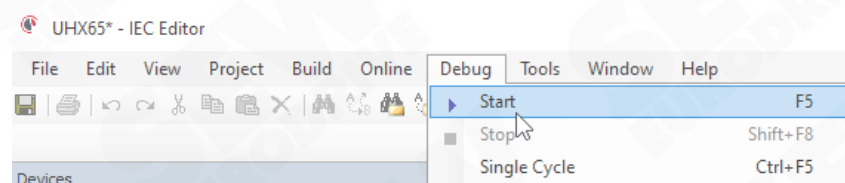


1 Activate the **fieldbus monitor** by pressing the right mouse button on the Application.

3. Start the project



- 1** Click **Login** to compile the IEC project.
- 2** Click **Create boot application** to start the program on the MOVI-C® CONTROLLER automatically after power off.
- 3** Click **Source download to the Connected device** to save the entire project.

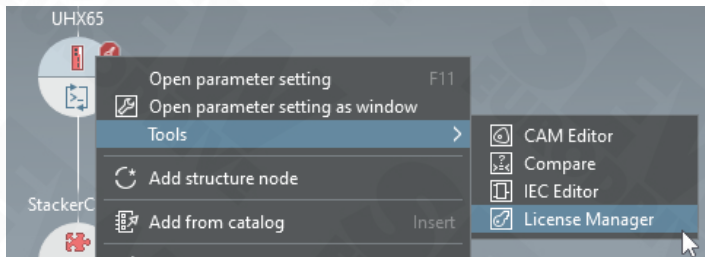
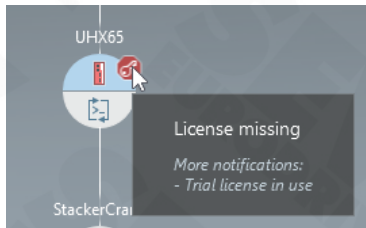


4.7.4 LICENSE MOVI-C® CONTROLLER



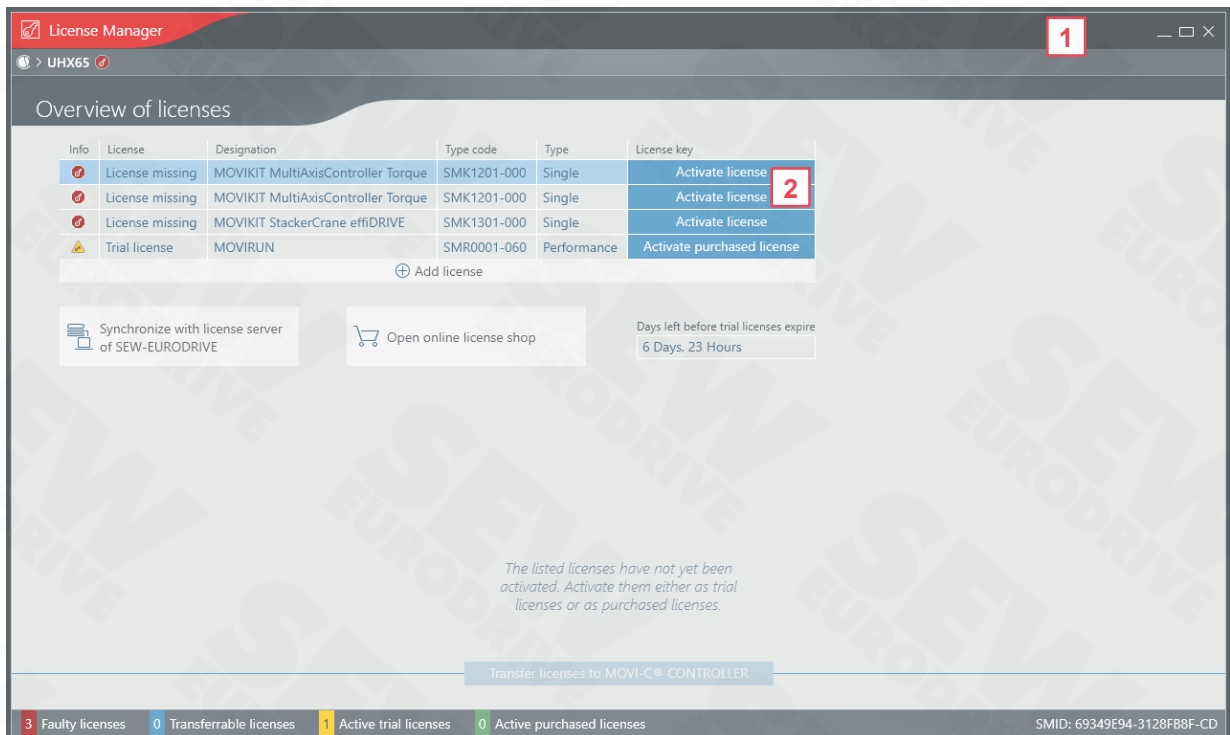
1. Start the license manager

An Internet connection is required to activate the licenses. A trial license can also be generated without an Internet connection.

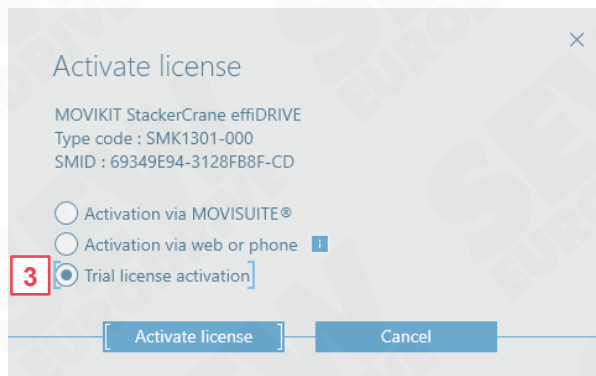


1 Start the **License Manager**

2. Activate license



2 Activate suggested licenses. Press **Activate license**



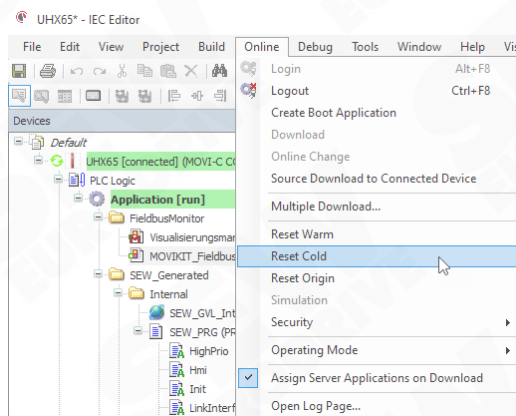
3 Activate trial license

3. Transfer licenses to MOVI-C® CONTROLLER



4 Transfer licenses to the MOVI-C® CONTROLLER

4. Cold reset



4 Perform cold reset.



Examples of required licenses

Application	Licenses
1x travel drive & 1x lifting drive	MOVIRUN Flexible + StackerCrane
2x travel drive & 1x lifting drive	MOVIRUN Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC torque (lifting)
1x travel drive & 2x lifting drive	MOVIRUN Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC skewing (lifting)
2x travel drive & 2x lifting drive	MOVIRUN Flexible + StackerCrane + 1x MAC Torque (travel) + 1x MAC skewing (lifting)

4.7.5 Diagnose the IEC program



1. Call up the debug log

In the event of an error, FIRST look into the log!

The screenshot shows the SIMATIC Manager interface. In the top left, the 'UHX65 [connected] (MOVI-C CONTROLLER progressive)' device is selected (1). In the left sidebar, the 'Log' tab is selected (2). The log window displays a list of messages. The 'MOVIKIT' logger is selected in the drop-down menu (3).

Severity	Time Stamp	Description
Info	02.08.2024 08:25:24.560	ECM (Instance 0): Started successfully.
Info	02.08.2024 08:25:21.564	ECM (Instance 0): EtherCAT prepared successfully and can be used now. (PreOp)
Info	02.08.2024 08:25:21.028	PLC-BootupReason: BootupReason_Normal
Info	02.08.2024 08:25:21.004	Number of configured licensed cores for IEC-tasks: 3 from 4
Info	02.08.2024 08:25:20.896	ECM (Instance 0): Reset successful.
Info	02.08.2024 08:24:19.648	Post LicenseFileReloadEvent succeeded (with 0 releases of consumed license instances)
Info	02.08.2024 08:18:30.848	ECM (Instance 0): Started successfully.
Info	02.08.2024 08:18:28.134	Application [Application] loaded via [Download]
Info	02.08.2024 08:18:28.134	ECM (Instance 0): EtherCAT prepared successfully and can be used now. (PreOp)

- 1 Click the MOVI-C® CONTROLLER
- 2 Click **Log**
- 3 Switch the logger to **MOVIKIT** in the drop-down list



2. Call up and monitor debug variables

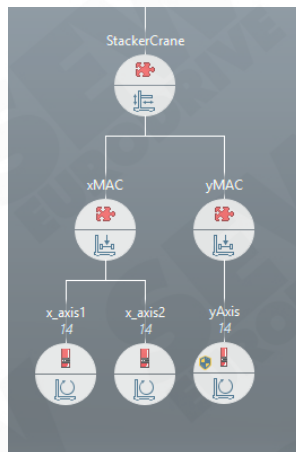
3. Open IEC Editor → Open SEW_GVL_Internal

The screenshot shows the IEC Editor with the 'SEW_GVL_Internal' program selected in the left sidebar. The main window displays the program code with various variables and comments.

Expression	Type	Value	Prepar...	Address	Comm...
SEW_M...	BOOL	TRUE			Bit, if fu...
xError	BOOL	FALSE			Bit, if fu...
xWarning	UDINT	8199			The mes...
udtMessageD	E_CON...	PD			Aktive C...
_eControlSource	SEW_A...				
_xInitDone	BOOL	FALSE			
_fbAxisGroup	AxisGroup				
_fbX	AxisX				
_fbY	AxisY				
_fbLidMgr	SEW_Je...				
_astSoftwareDescription	ARRAY ...				
_fbLidMgr_Confirm	Confirm...				
_fbModeAdministrator	ModeAd...				
_fbModeXVOptimized	ModeX...				
_xInitDone_StackerCrane	BOOL	TRUE			Init
_asLinkModuleToIndexDone	ARRAY ...				
_sFileName	STRING...	'Stacker...			
_xProcessDataDone	BOOL	TRUE			
_usiPowerLimitation	USINT	0			
_xChangeVelocityOnTheFly	BOOL	FALSE			
_xReadConfigFromMAGMemberDone	BOOL	TRUE			
_stConfigPD	ST_Con...				
_xInitConfig	BOOL	TRUE			
_sAxisName	STRING	'Stacker...			
_tftConfigData	SEW_JA...	16#0 IF...			
_tftAxisConfig	SEW_JA...	16#0 IF...			
_tftConfigDataHandler	SEW_JA...	16#0 IF...			
_sNameOfInstance	STRING...	'Config/...			
StackerCrane_xMAC	SEW_M...				
StackerCrane_xMAC_ReferenceRetain	SEW_M...				
OptMonitor_StackerCrane_xMAC	SEW_M...				
StackerCrane_xMAC_axis1	SEW_M...				
StackerCrane_xMAC_axis2	SEW_M...				
StackerCrane_xMAC	SEW_M...				
StackerCrane_yMAC_ReferenceRetain	SEW_M...				
OptMonitor_StackerCrane_yMAC	SEW_M...				
StackerCrane_yMAC_axis	SEW_M...				



Global variables



Code
generation

SEW_GVL_Internal x	
UHX85.Application.SEW_GVL_Internal	
Ausdruck	
	gc_uiTaskCycleTime
	StackerCrane
	StackerCrane_xMAC
	HMI_StackerCrane_xMAC
	StackerCrane_xMAC_x_axis1
	HMI_StackerCrane_xMAC_x_axis1
	StackerCrane_xMAC_x_axis2
	HMI_StackerCrane_xMAC_x_axis2
	StackerCrane_yMAC
	HMI_StackerCrane_yMAC
	StackerCrane_yMAC_yAxis
	HMI_StackerCrane_yMAC_yAxis



Overview of debug variables

Position controller P gain

SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbPositionController._stConfig.lfPGain

Encoder evaluation time constant

SEW_GVL_Internal.StackerCrane_xMac._fbController._fbEncoderEvaluation._stConfig.lfTimeConstant_MotEncT
OExtEnc_Diff

Encoder evaluation dead time

SEW_GVL_Internal.StackerCrane_xMac._fbController._fbEncoderEvaluation._stConfig.lfDeadtime_ExtEnc

Trace/lag error

SEW_GVL_Internal.StackerCrane_xMac._stBasicOut.lfActualVelocity
SEW_GVL_Internal.StackerCrane_xMac._fbController._stSetpointValues.stFromPG.lfVelocityPrecontrol
SEW_GVL_Internal.StackerCrane_xMac._fbController._fbPositionController._Stout.lfManVal
SEW_GVL_Internal.StackerCrane_xMac._fbController._fbMAC._Stout.stMACManVal.stVelocityCorrection
SEW_GVL_Internal.StackerCrane_xMac_fbController._fbPositionController._Stout.lfLagError

Debug variables: Fieldbus process data

SEW_GVL_Internal.StackerCrane.fbModeAdministrator._eActualMode
SEW_GVL_Internal.StackerCrane.fbModeAdministrator._eSetpointMode
SEW_GVL_Internal.StackerCrane.fbX._In
SEW_GVL_Internal.StackerCrane.fbX._Out
SEW_GVL_Internal.StackerCrane.fbX._Config
SEW_GVL_Internal.StackerCrane.fbY._In
SEW_GVL_Internal.StackerCrane.fbY._Out
SEW_GVL_Internal.StackerCrane.fbY._Config
SEW_GVL_Internal.StackerCrane.fbAxisGroup._Out

Debug variables: Error level

SEW_GVL_Internal.StackerCrane.xError
 SEW_GVL_Internal.StackerCrane._stLocalVar_ErrorBasic.rstAdditionalText.sAdditionalText
 SEW_GVL_Internal.StackerCrane_xMAC.xError
 SEW_GVL_Internal.StackerCrane_xMAC._stLocalVar_ErrorBasic.rstAdditionalText.sAdditionalText
 SEW_GVL_Internal.StackerCrane_xMAC_x_axis1.xError
 SEW_GVL_Internal.StackerCrane_xMAC_x_axis2.xError
 SEW_GVL_Internal.StackerCrane_xMAC_x_axis1._stLocalVar_ErrorBasic.rstAdditionalText.sAdditionalText
 SEW_GVL_Internal.StackerCrane_xMAC_x_axis1._stLocalVar_ErrorBasic.rstAdditionalText.sAdditionalText

Debug variables: SC-MAC**STARTUP**

Position controller P gain
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1._fbController._fbPositionController._stConfig.lrPGain
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis2._fbController._fbPositionController._stConfig.lrPGain

Encoder evaluation time constant

SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbEncoderEvaluation._stConfig.lrTimeConstant_
 MotEncToExtEnc_Diff

Encoder evaluation dead time

SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbEncoderEvaluation._stConfig.lrDeadtime_ExtEnc

Trace/lag error

SEW_GVL_Internal.StackerCrane_xMAC._stBasicOut.lrActualVelocity
 SEW_GVL_Internal.StackerCrane_xMAC._fbController._stSetpointValues.stFromPG.lrVelocityPrecontrol
 SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbPositionController._Stout.lrManVal
 SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbMAC._Stout.stMACManVal.stVelocityCorrection
 SEW_GVL_Internal.StackerCrane_xMAC._fbController._fbPositionController._Stout.lrLagError

Debug variables: SC-MultiMotion

SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stBasicIN
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stBasicOUT
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stInverterIN
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stInverterOUT
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stBrakeIN
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stBrakeOUT
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stActivatedDeviceModes
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stSetpointValuesVelocityInterpolated.lrVelocity
 SEW_GVL_Internal.StackerCrane_xMAC_xAxis1.DeviceAdapter16PD.stSetpointValuesVelocityInterpolated.lrManValPosCtrlr

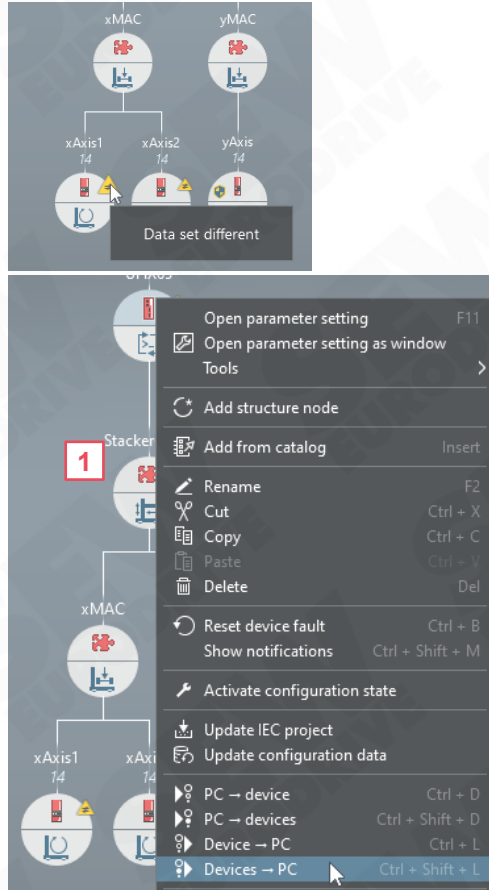
4.7.6 Update the MOVISUITE project and save



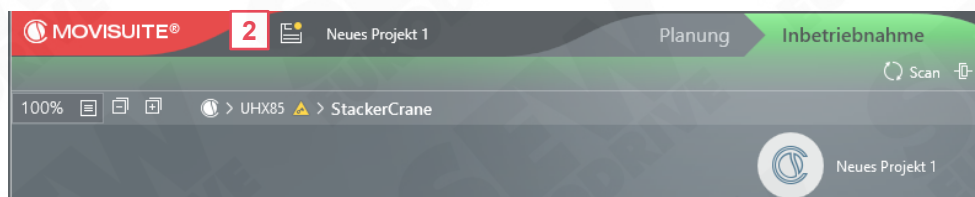
When the IEC project is created in the controller, the MOVIKIT® StackerCrane MultiAxisController automatically sets parameters in the inverters.

These are not parameterized in the MOVISUITE® project and must be transferred from the inverter to the MOVISUITE project.

1. Update the data set



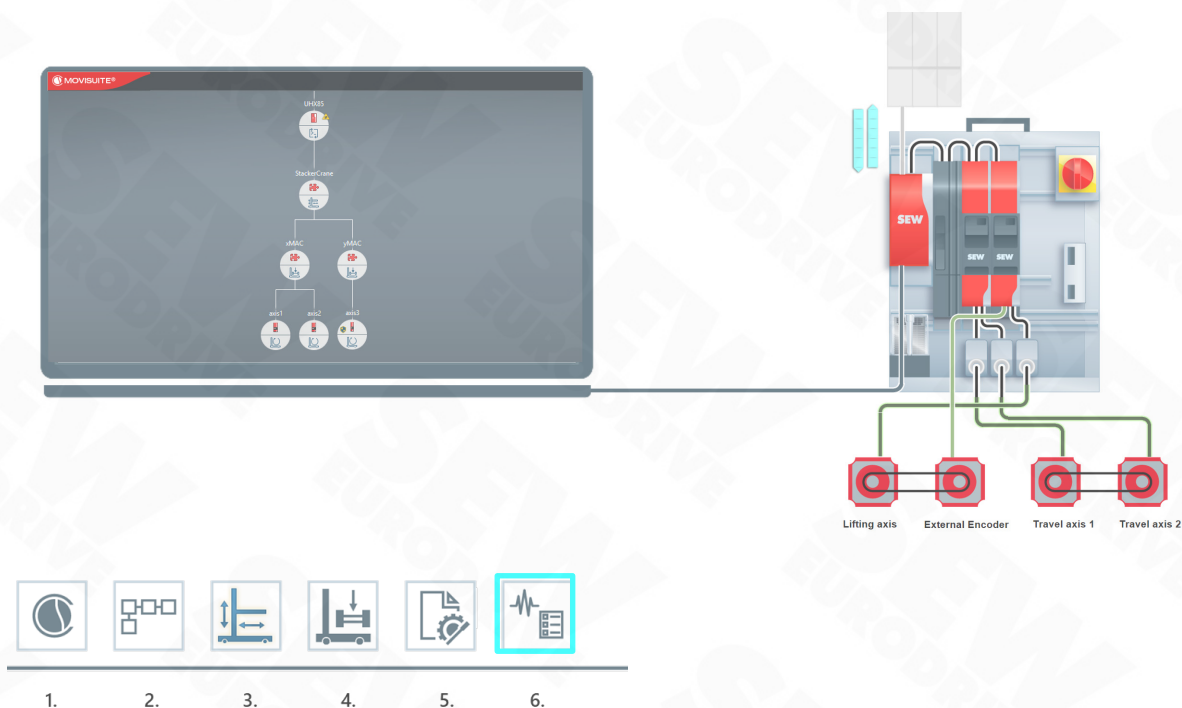
1 Right-click the StackerCrane Software node **Devices -> PC**



2 Save project

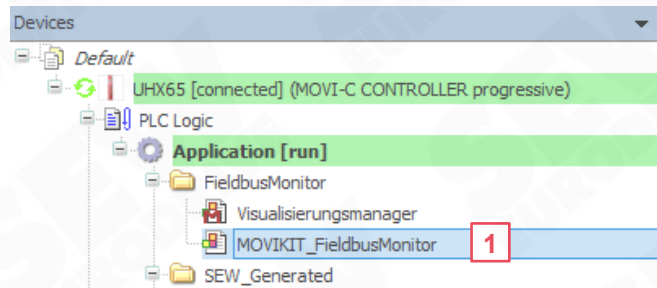
4.8 Step 6 - MOVIKIT® StackerCrane process data monitor

- Goals
- Handling the process data monitor





1. Open the process data monitor



1 Click the **MOVIKIT_FieldbusMonitor**

2. Switch the process data monitor mode

The screenshot shows the MOVIKIT Process data monitor interface. The 'monitor' tab is selected. The 'Module number' is set to 1. The 'Fieldbus state' is 'Communication'. The 'PD start address' is 1 and the 'PD length' is 36. The interface is divided into two main sections: 'PD In' and 'PD Out'.

PD In

PD1 Target application mode	0	0 - Default
PD2 Control word	0	0 - Default 100 - Jog 300 - Homing offset configured 301 - Homing offset variable 400 - Positioning absolute 1200 - Positioning_XY_EffDrive 1210 - Positioning_XY_Diagonal 1300 - Braketest_External
PD3 Override (if configured)	0	
PD4 Reserved	0	

PD Out

PD1 Actual application mode	0 - Default
PD2 Status word	3
PD3 Status/ ErrorID	14
PD4 reserve	0

Axis

X-Axis

PD In

<input type="checkbox"/> 0 - Enable/emergency stop	PD2 Setpoint speed	0
<input type="checkbox"/> 1 - Enable/application stop	PD3 Acceleration	0
<input type="checkbox"/> 2	PD4 Deceleration	0
<input type="checkbox"/> 3 - Release brake while inhibit	PD5 DO 03 .. DO 00	0 hex
<input type="checkbox"/> 4 - Jog positive	PD6 MAC Controlword	0
<input type="checkbox"/> 5 - Jog negative	PD7/8 Target position	0
<input type="checkbox"/> 6	PD9 Jerk	0
<input type="checkbox"/> 7 - Start/stop with fieldbus ramp	PD10 Reserved	0
<input type="checkbox"/> 8 - Fault reset		
<input type="checkbox"/> 9		
<input type="checkbox"/> 10		
<input type="checkbox"/> 11 - Disable external encoder		
<input type="checkbox"/> 12 - Disable SW limit switches		
<input type="checkbox"/> 13 - Activate inhibit		
<input type="checkbox"/> 14 - Activate standby mode		
<input type="checkbox"/> 15 - Handshake in		

PD Out

<input checked="" type="checkbox"/> 0 - Ready	PD2 Actual speed	0
<input checked="" type="checkbox"/> 1 - STO inactive	PD3 Status/ ErrorID	14
<input type="checkbox"/> 2 - Output stage enable	PD4 Torque	0
<input checked="" type="checkbox"/> 3 - Brake/DynaStop® release	PD5 DI 03 .. DI 00	11 hex
<input type="checkbox"/> 4 - Motor running	PD6 MAC Statusword	304
<input type="checkbox"/> 5 - Active drive referenced	PD7/8 Actual position	1009
<input type="checkbox"/> 6	PD9 Actual jerk	0
<input type="checkbox"/> 7 - "In position" signal active	PD10 Reserved	0
<input type="checkbox"/> 8 - Fault		
<input type="checkbox"/> 9 - Warning		
<input type="checkbox"/> 10		
<input type="checkbox"/> 11 - External encoder disable		
<input type="checkbox"/> 12 - SW limit switches inactive		
<input type="checkbox"/> 13		
<input type="checkbox"/> 14 - Standby mode active		
<input type="checkbox"/> 15 - Handshake out		

1 Select the module 1 **MOVIKIT® StackerCrane**

2 Switch between **control** and **monitor**.



Process data monitor group

PD In			PD Out	
PD1 Target application mode	<input type="text" value="0"/>	0 - Default	PD1 Actual application mode	<input type="text" value="0 - Default"/> A
PD2 Control word	<input type="text" value="0"/>	0 - Default 100 - Jog 300 - Homing offset configured 301 - Homing offset variable 400 - Positioning absolute 1200 - Positioning_XY_EffiDrive 1210 - Positioning_XY_Diagonal 1300 - Braketest_External	PD2 Status word	<input type="text" value="3"/> B
PD3 Override (if configured)	<input type="text" value="0"/>		PD3 Status/ ErrorID	<input type="text" value="14"/> C
PD4 Reserved	<input type="text" value="0"/>		PD4 reserve	<input type="text" value="0"/>

A Mode numbering

0	Default
100	Jog
300	Referencing with configured offset
301	Referencing with bus offset
400	Position
700	Test of all brakes one after the other
701	Test of the 1st axis group member of the MultiAxisController (no function without MultiAxisController)
702	Test of the 2nd axis group member of the MultiAxisController (no function without MultiAxisController)
1200	Energy-optimized X-Y positioning
1210	Mechanically optimized positioning
1300	External brake test

B Axis group status word (X and Y rounded)

Bit 0	Ready for operation
Bit 7	In position
Bit 8	Error

C Status of the inverters, The status of the lower-level stations is - Equal: The status is displayed. - Not equal: "-1" = FFFF = "undefined" is displayed. Or in the event of an error ErrorID:

High byte	Error code
Low byte	Subfault code



Process data monitor axes

Axis

X-Axis

Y-Axis

A

PD In

<input type="checkbox"/> 0 - Enable/emergency stop	PD2 Setpoint speed	0
<input type="checkbox"/> 1 - Enable/application stop	PD3 Acceleration	0
<input type="checkbox"/> 2	PD4 Deceleration	0
<input type="checkbox"/> 3 - Release brake while inhibit		
<input type="checkbox"/> 4 - Jog positive		
<input type="checkbox"/> 5 - Jog negative	PD5 DO 03 ... DO 00	0 hex C
<input type="checkbox"/> 6	PD6 MAC Controlword	0 D
<input type="checkbox"/> 7 - Start/stop with fieldbus ramp	PD7/8 Target position	0
<input type="checkbox"/> 8 - Fault reset	PD9 Jerk	0 E
<input type="checkbox"/> 9	PD10 Reserved	0
<input type="checkbox"/> 11 - Disable external encoder		
<input type="checkbox"/> 12 - Disable SW limit switches		
<input type="checkbox"/> 13 - Activate inhibit		
<input type="checkbox"/> 14 - Activate standby mode		
<input type="checkbox"/> 15 - Handshake in		

PD Out

<input checked="" type="checkbox"/> 0 - Ready	PD2 Actual speed	0
<input checked="" type="checkbox"/> 1 - STO inactive	PD3 Status/ ErrorID	14 B
<input type="checkbox"/> 2 - Output stage enable		
<input checked="" type="checkbox"/> 3 - Brake/DynaStop® release		
<input type="checkbox"/> 4 - Motor running	PD4 Torque	0 C
<input type="checkbox"/> 5 - Active drive referenced	PD5 DI 03 ... DI 00	11 hex D
<input type="checkbox"/> 6	PD6 MAC Statusword	304
<input type="checkbox"/> 7 - "In position" signal active	PD7/8 Actual position	1009
<input type="checkbox"/> 8 - Fault	PD9 Actual Jerk	0
<input type="checkbox"/> 9 - Warning	PD10 Reserved	0
<input type="checkbox"/> 10		
<input type="checkbox"/> 11 - External encoder disabled		
<input type="checkbox"/> 12 - SW limit switches inactive		
<input type="checkbox"/> 13		
<input type="checkbox"/> 14 - Standby mode active		
<input type="checkbox"/> 15 - Handshake out		

A Changeover between X and Y axes

B Status of the inverter
 For MAC: The status of the lower-level stations is
 - Equal: The status is displayed.
 - Not equal: "-1" = FFFF = "undefined" is displayed.
 Or in the event of an error ErrorID:

High byte	Error code
Low byte	Subfault code

C Digital inputs and outputs

Bits 0 – 3	Axis 1
Bits 4 – 7	Axis 2
Bits 8 – 11	Axis 3
Bits 12 – 15	Axis 4

D Control word for the MultiAxisController

Bits 0 – 3	Deactivate axis group members
Bits 5 – 7	Release brake without enable

E Jerk in user unit/s³

F Disable external encoder

G Disable software limit switch

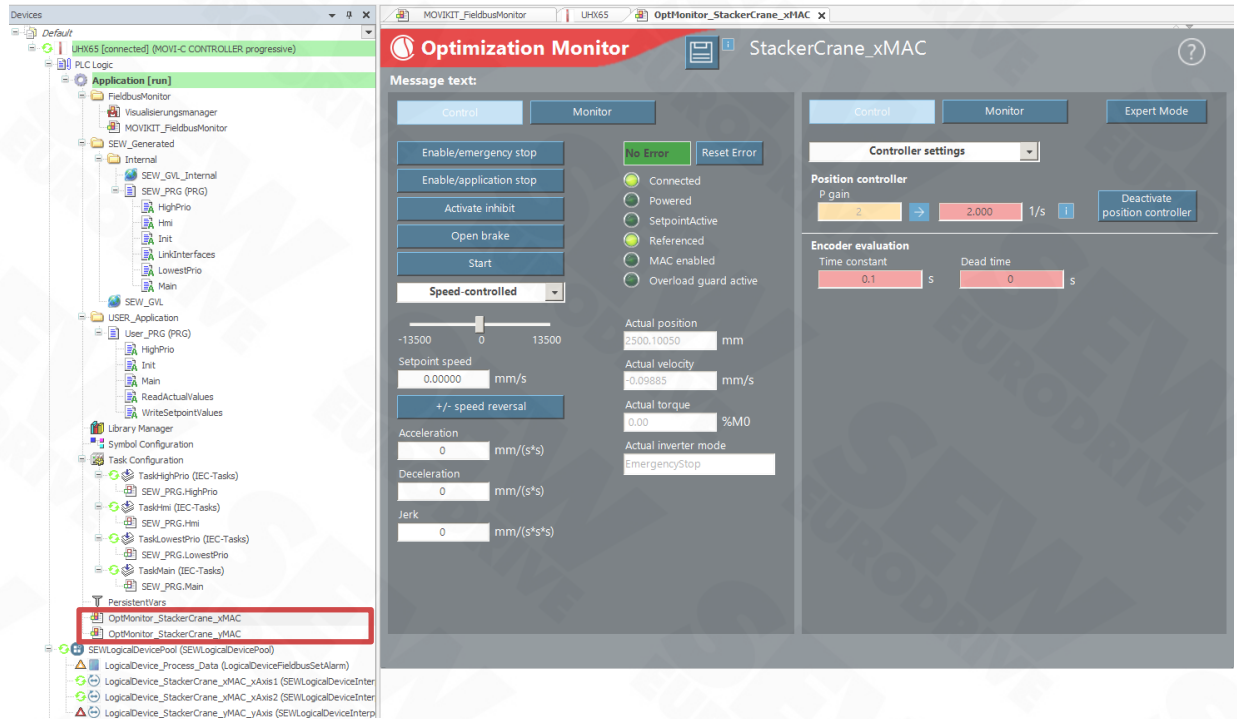
H Activate controller inhibit

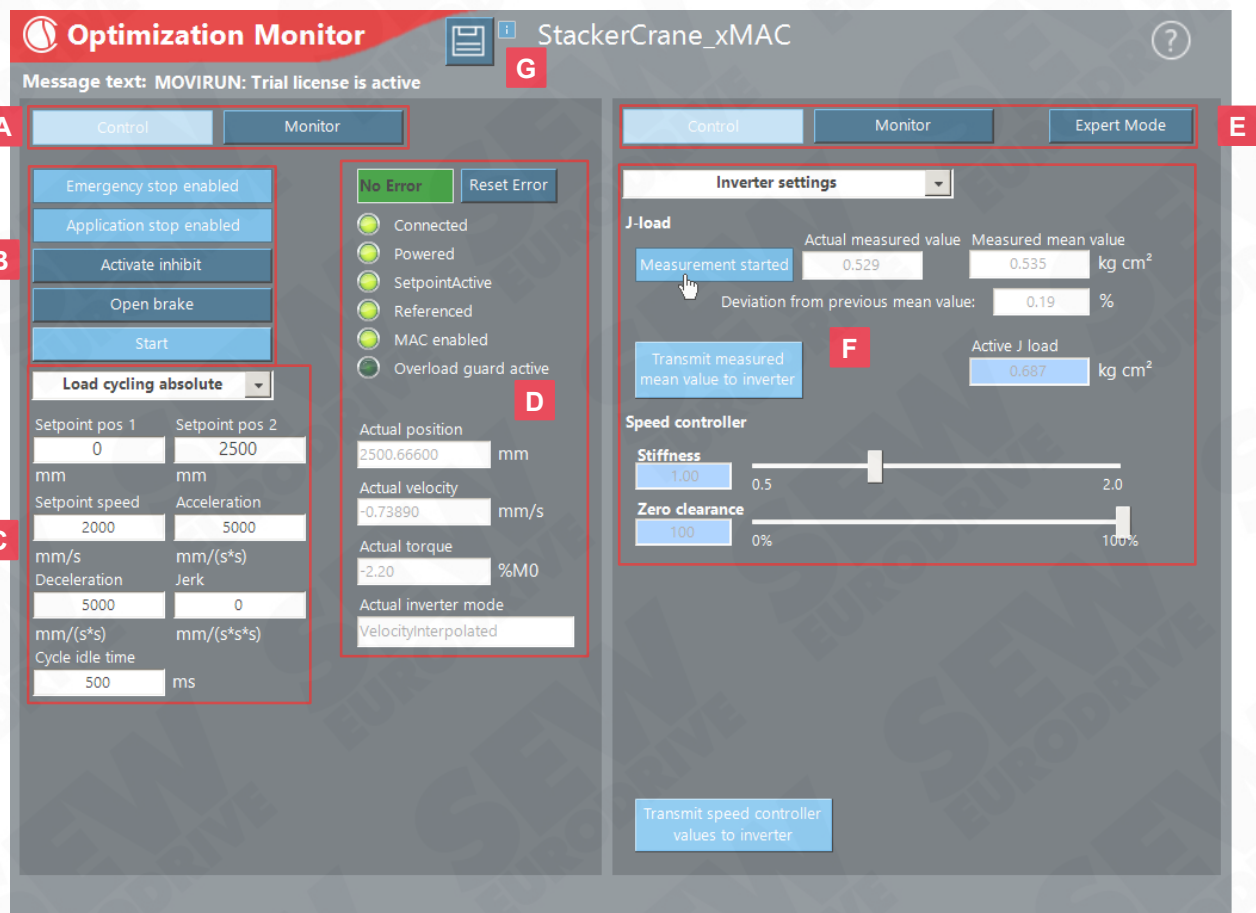
4.8.1 Optimization of MultiAxisController

4.8.1.1 Optimization monitor



The optimization monitor is used to operate the MOVIKIT® MultiAxisController via manual mode and for optimizing the control function. The optimization monitor is available in MOVISUITE® in the configuration menu "Module configuration" > "Basic settings" of the MOVIKIT® MultiAxisController under "Tools used" is activated by default. The optimization monitor is added to the IEC project via code generation.





A Select the operating mode for motion control:

- Control – operate the software module independently of the application program or the control of a higher-level controller.
- Monitor (monitor mode) – View current control/status information. There is no intervention in the application program or in the control of the higher-level controller.

B General control signals

C General status signals

D Route travel options

- Referencing
- Speed specification
- (Absolute) positioning
- Shuttle mode

E Operating mode and mode for the optimization functions

- Control – Change inverter settings and settings of the MultiAxisController without preventing the control of the software module by the higher-level controller or the application program.
- Monitor (monitor mode) – Current configuration of the inverter or the MultiAxisController system.
- Expert mode – Show settings.

F Optimization function

- Inverter settings
- MultiAxisController settings
- MultiAxisController actual values
- Actual values of the axis group members of the MultiAxisController
- Advanced settings



Save settings to the memory card of the MOVI-C® CONTROLLER



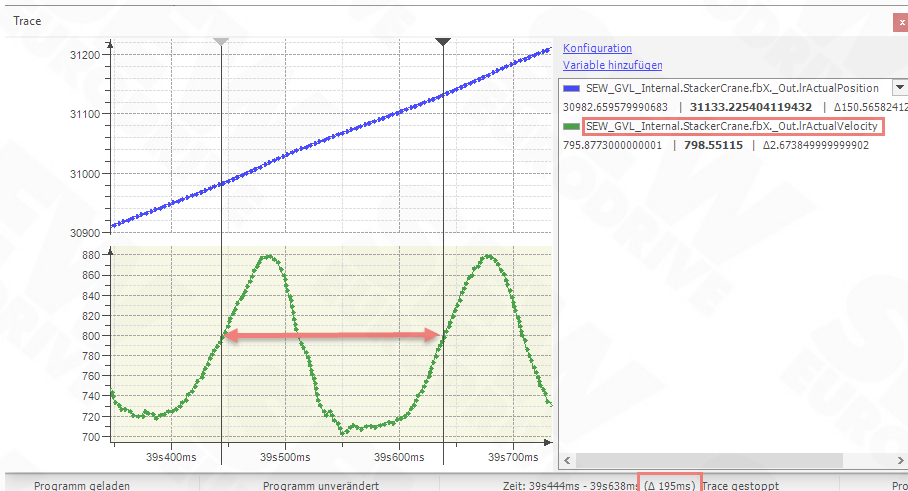
NOTE: The saved values can be uploaded to MOVISUITE® via the [All devices -> PC] function.

Inverter settings, actual values, MAC deactivation, "Allow skew" and "Ignore skew error" are not saved.

4.8.1.2 Determining the time constant



- Set the jerk to "0" in the parameter tree of the axes and via the fieldbus.
- Record a travel with maximum possible ramps and speed and trace the travel.
- In the trace, the period duration corresponds to the time constant to be set.



4.8.1.3 Optimization of P gain

- Increase in P gain
 - Increase in P gain by 2-5%
- Does the controller start to vibrate?



- No: Repeat the previous step
- Yes: Reset the P gain to the PREVIOUSLY determined values and proceed to the next step:
- Check the following dynamic sets. If a dynamic set of this results in vibrations, go back to the step "Increase of P gain". If you can move well with dynamics sets, you have optimized the controller of the MultiAxisController.
 - Slow acceleration and slow speed
 - Slow acceleration and fast speed
 - Fast acceleration and fast speed
 - Fast acceleration and slow speed

If the above measures are not sufficient, increase the time constant in steps of 10%.



Optimization of the MultiAxisController axis in the StackerCrane environment after completion of the initial startup

- Use of the **StackerCrane PD Editor** for controlling the X or Y axis
- Light tuning:** See above

Strong tuning: If the controller cannot be optimized via the slight tuning / the above process, the controller settings of the lower-level axis(s) must be checked. As soon as the controller settings of the lower-level axes are changed (e.g. doubling the speed gain), the MAC must be reinitialized.

The screenshot displays the StackerCrane PD Editor interface. On the left, a search bar and a tree view are visible. The tree view shows the following structure:

- 7 MOVIKIT® StackerCrane MultiAxisCo...
 - 7.1 Module configuration
 - 7.1.1 Basic settings (selected)
 - 7.1.11 Control loop functions
 - 7.1.12 Encoder evaluation
 - 7.5 Monitoring functions
 - 7.5.1 Reference signals
 - 7.5.2 Limit values
 - 7.5.3 Limit values calculation basis
 - 7.5.4 Control functions
 - 7.5.5 Encoder coupling
 - 7.5.6 Limit switches
 - 7.5.7 Speed cams
 - 7.5.9 Overview of fault responses
 - 7.6 Drive functions
 - 7.7 Controller functions
 - 7.7.2 Reference travel
 - 7.9 Advanced settings
 - 7.10 MOVIKIT® information

The main window shows the 'Basic settings' tab. It contains two tables:

Axis group member		Additional functions	
Name	Value	Value	Info
1. xaxis1	<input checked="" type="checkbox"/>	After startup of the controller, perform the "Device → PC" function once.	
2. xaxis2	<input checked="" type="checkbox"/>		
		Priority change torque/skew	<input checked="" type="checkbox"/>
		Torque priority	<input checked="" type="checkbox"/>
		Skew priority	<input checked="" type="checkbox"/>
		3 or 4 axis group members	<input checked="" type="checkbox"/>
		Cascading	<input checked="" type="checkbox"/>
		Anti-sway control	<input checked="" type="checkbox"/>
		Combined encoder evaluation	<input checked="" type="checkbox"/>
		Top drive	None
		Expert mode	<input checked="" type="checkbox"/>
		Energy coupling	<input checked="" type="checkbox"/>

On the right, the 'Tools used' section shows the 'Optimization monitor' with a 'Value' column and an 'Info' column. Below this, there are buttons for 'Suggested values' and 'Apply all suggested values'.

The parameters of the parameter group [Controller functions] > [Reference travel] > [Readjustment] are overwritten. The other settings of the controller functions remain unchanged.

Then continue with the slight tuning (see above).

5 MOVIKIT® StackerCrane effiDRIVE add-on AntiSway

5.1 MOTION add-on AntiSway overview



The MOVIKIT® StackerCrane add-on AntiSway extends the range of functions of the MOVIKIT® StackerCrane MultiMotion and the MOVIKIT® StackerCrane MultiAxisController by a function for suppressing vibrations in the drive train.

By using the function, vibrations that have a dominant resonance frequency can be suppressed. In certain operating modes of the MOVIKIT® StackerCrane add-on AntiSway, a changing resonance frequency can also be suppressed.

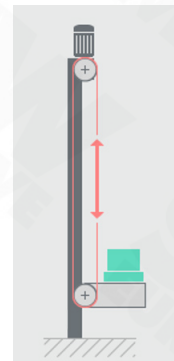
Avoidance of mast vibrations in the x direction

TowerSway - MOVIKIT® StackerCrane effiDRIVE add-on AntiSway



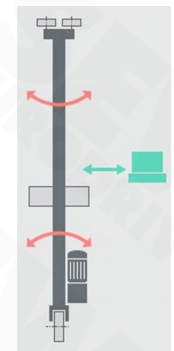
Rope length compensation in y-direction

Combined encoder evaluation - MOVIKIT® MultiMotion add-on
CombinedEncoderEvaluation



Avoidance of abdominal vibrations in the z direction

BellySway - MOVIKIT® StackerCrane effiDRIVE add-on AntiSway
(In preparation) - If interested, request MFA-PS-ASS.



5.2 TowerSway startup

Goals Using an application example, learn how to use the AntiSway MOTION add-on "mast swinging".

5.2.1 Activation of anti-sway control in MOVIKIT® StackerCrane MultiAxisController



1. Activate anti-sway control

The add-on must be activated in the "Basic settings" configuration menu of the software module in the "Functions used" area. If the add-on is activated, the associated configuration menus are displayed in MOVISUITE® under Advanced functions and the corresponding structures are created when generating an IEC project.

Axis group member		Additional functions		
Name	Value		Value	Info
1 xAxis1	I		After startup of the controller, perform the "Device → PC" function once.	i
2 xAxis2	I			
		Priority change torque/skew	<input type="checkbox"/>	i
		Torque priority	<input checked="" type="checkbox"/>	i
		Skew priority	<input type="checkbox"/>	i
		3 or 4 axis group members	<input type="checkbox"/>	i
		Cascading	<input type="checkbox"/>	i
		Anti-sway control	<input checked="" type="checkbox"/>	i
		Combined encoder evaluation	<input checked="" type="checkbox"/>	i
		Top drive	None	i
		Expert mode	<input type="checkbox"/>	w
		Energy coupling	<input type="checkbox"/>	i

- 1** Click **Basic settings** in MOVIKIT® StackerCrane MultiAxisController
- 2** Activate **Anti-sway control**.
- 3** **Anti-sway control** appears in the main menu under **Additional functions**

5.2.2 Parameterization of anti-sway control



1. Parameterize the anti-sway control

Parameterbaum

Enter search term here

- 7 MOVIKIT® StackerCrane MultiAxisCo...
 - 7.1 Module configuration
 - 7.5 Monitoring functions
 - 7.6 Drive functions
 - 7.7 Controller functions
 - 7.8 Additional functions
 - 7.8.7 Anti-sway control**
 - 7.8.8 Advanced settings
 - 7.10 MOVIKIT® information

Anti-sway control

Parameter	Value	Info
Application type	Tower sway	
User unit travel axis	User-defined unit	
Conversion factor for user unit in meters	0.001	
Source of distance between lifting and traveling	Configuration value	

Time window

Parameter	Value	Info
Cycle time of the HighPrio task for limit value calculation	1 ms	
Ramp time tension build-up	0.3 → 0.5 s	
Jerk time tension build-up	0.05 → 0.5 s	

Basic settings

Parameter	Value	Info
Height of tower [1]	15.755 m	
Distance between lifting and traveling vehicle [2]	7.8775 m	
Mass of lifting vehicle [4]	4800 kg	
Mass of payload [5]	0 kg	
Mass of tower [6]	5970 kg	
Support for parameter determination	Active	
Amplitude of oscillation [20]	1	
Amplitude of oscillation [21]	1	
Period of oscillation [22]	1 s	
Spring stiffness between tower and vehicle [1]	312598/4.837042 Nm/rad	
Damping rate between tower and vehicle [8]	0.000000	

General information for assessing the design

Parameter	Value
Resonant frequency	1 Hz
Maximum acceleration	1 m/s²
Deflection to lifting height	0.021949 m
Auxiliary tower mass	9090.352665 kg
Auxiliary tower height	9.333045 m
Auxiliary deflection	0.002786 rad

1 Click the new chapter Anti-sway control in the main menu.

2 Select the **Application type** **Tower sway**

3 Select the conversion factor for user units into m.

This step is necessary because the function operates in physical units. System Meter is already selected as the user unit, the conversion can be set Of the value "0".

The conversion factor for the user unit from the drive train to the SI unit meter depends on the setting of the "User unit travel axis" parameter.

Examples:

User unit	Conversion factor	SI unit
m	* 0	⚠ m
mm	* 0.001	⚠ m
User-defined unit	* input value	⚠ m

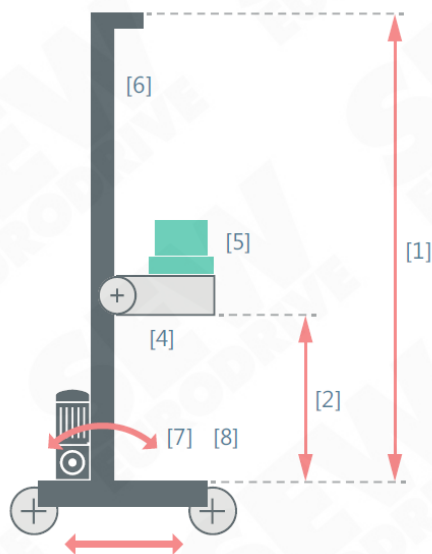
NOTE

For the setting "User-defined unit", both the input value 0 and 1 result in the SI unit meter. The conversion factor 0 is optimized with respect to computing time.

Example: User unit 1000 mm * 0.001 = 1 m.

Conversion factor 0.001

- 4 Enter the dimensions and masses of your application in the basic settings.



No.	Field in the configuration menu	IEC name
[1]	Height of the mast	RHeightTower
[2]	Distance between lifting and traveling trolley (Current position of the trolley at the time of signal recording)	RDistanceHoistToCar
[4]	Mass of the lifting trolley	LrMassHoist
[5]	Mass of the payload (Current payload on the load handling device at the time of signal acquisition)	LrMassPayload
[6]	Mass of the mast	LrMassTower
[7]	Spring stiffness between mast and trolley Note: To determine this parameter, see Chapter "Determining stiffness"	LrSpringTowerToCar
[8]	Degree of damping between mast and trolley	RDampTowerToCar



Configuring mast swings (TowerSway) involves defining the parameter "Spring stiffness between mast and trolley [7] & damping degree between mast and trolley [8]". If you do not know these values, they can be determined from the signal curve of the swinging-out Systems by using the damping measured values in the configuration menu

Support for parameter determination.

The values "damping ratio between mast and chassis" and "spring stiffness between mast and chassis" are calculated and applied directly for anti-sway control.

- 5 Activate **support for parameter determination.**

- 6 The **support for parameter determination** appears.

- 7 Recommendation: First use the default values in the time window. If the trolley strongly regulated (jerk) back and forth, you can set the **jerk time tension build-up** and increase **Ramp time tension build up**.

The original motion profile is delayed by the sum **Jerk time tension build-up** (lrJerkTime) and **ramp time tension build-up** (lrRampTime). During this time, the mechanical voltage that corresponds to the desired acceleration is built up.

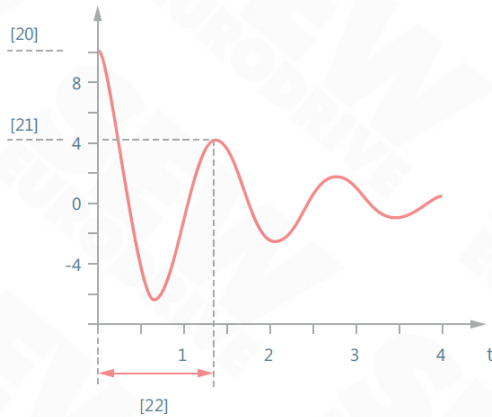
5.2.3 Support for parameter determination



To determine the parameters, parameter values are also used that are specified under [Anti-sway control]

> [Basic settings]. Make sure that the values for the payload and the lifting height are entered at the time of signal recording.

Damping parameters



No.	Field in the configuration menu
[20]	Amplitude of oscillation (1st peak)
[21]	Amplitude of oscillation (2nd peak)
[22]	Period of oscillation (time between 1st and 2nd vibration amplitude)

1. Determine stiffness



Variant 1 for determining the damping parameters using a scope of the actual torque

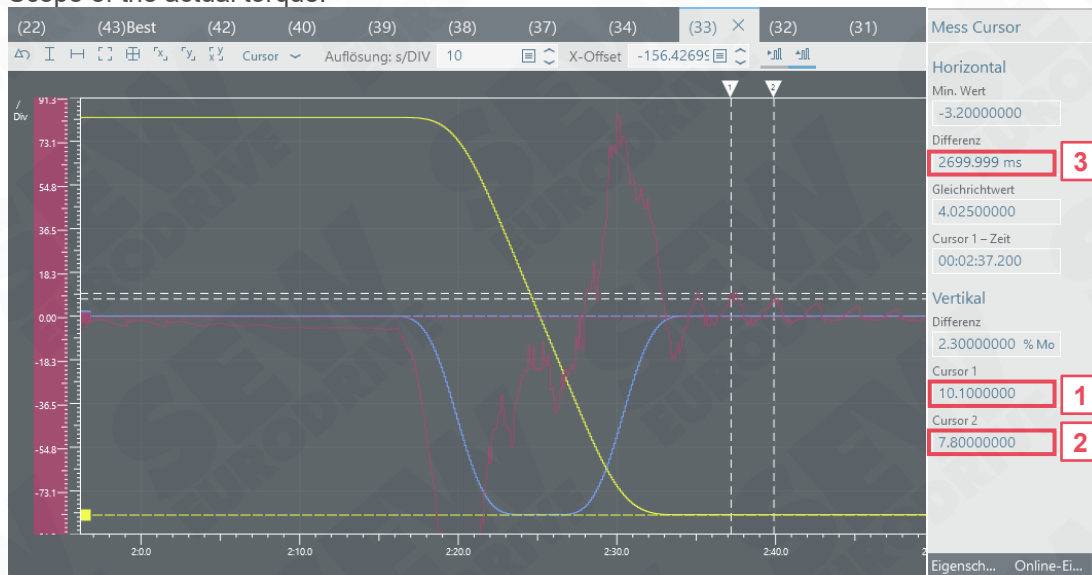
Load your application with the required payload and move the lifting axis to the position at which the greatest vibration of the mast occurs. At Application type "tower sway", for example, this is usually the highest point on the mast and the center of the mast for the "belly swing" application type. Update For the period during which stiffness is determined, enter the value for the "Distance" parameter between lifting and traveling trolley" to the lifting height at which the measurement is performed is carried out. If the application does not allow it without anti-sway control moving to the suggested lifting position can also cause the vibration with a lower lifting height or with a lower load. Update them accordingly the parameters.

Deactivate anti-sway control to measure the vibration in the select the setting "Anti-sway control OFF" as the "Application type" or via the fieldbus interface in the optional process data under anti-sway control switch anti-sway control off and on via the control word.

Move the application and take the amplitudes of the oscillating one systems, e.g. by means of a video recording at the point of the greatest vibration. If sufficient torque from the oscillating mass is applied to the motor, a scope recording of the torque can also be used.

Determine the 3 parameters illustrated below using the recordings. The peaks of the vibration amplitudes can also be independent of your amplitude as a ratio to each other (e.g. 1 : 0.8). The "Vibration period" can also be determined over several periods (e.g. measured time / number of oscillation periods)

Scope of the actual torque:



- 1 Value for **Amplitude of oscillation [20]**
- 2 Value for **Amplitude of oscillation [21]**
- 3 Value for **Period of oscillation [22]**

1. Enter damping parameters

Amplitude of oscillation [20]	1	10.1
Amplitude of oscillation [21]	2	7.8
Period of oscillation [22]	3	2.69999 s

- 1 Enter the **Amplitude of oscillation [20]**
- 2 Enter the **Amplitude of oscillation [21]**
- 3 Enter the **Period of oscillation [22]**

Activate anti-sway control again by selecting your application type.
Check the setting for "Name of axis for lifting position",
If you use the "mast swing" application type.

Enter the measured values determined (see figure) in the corresponding setting fields "Anti-sway control" in the configuration menu.

- The values "damping ratio between mast and chassis" and "spring stiffness between mast and chassis" are calculated and applied directly for anti-sway control.
- The natural frequency, the resonance frequency, and the "deflection at lifting height" are determined to check plausibility in relation to reality and the design calculations

General information for assessing the design

	Value
Resonant frequency	0.370058373002718 Hz
Maximum acceleration	1 m/s ²
Deflection to lifting height	0.185755 m
Auxiliary tower mass	9090.352665 kg
Auxiliary tower height	9.333045 m
Auxiliary deflection	0.023583 rad

- Perform a plausibility check using the value "deflection at lifting height" in the "General information for assessing the design" area in the "Anti-sway control" configuration menu.

Perform a plausibility check using the value "deflection at lifting height" in the "General information for assessing the design" area in the "Anti-sway control" configuration menu.

2. Transfer configuration

Generate an IEC project using automatic code generation and load it and the changed configuration data onto the MOVI-C® CONTROLLER.

3. Control anti-sway control

Since the *InPosition* bit is linked to *xBusy* (anti-sway control active) and thus the compensation movement of the anti-sway control is not yet complete, the *InPositions* Bit when using anti-sway control in certain cases only with deceleration.

To control anti-sway control the configuration parameters of MOVISUITE® and the following process data via the fieldbus interface can be used:

- PO 29 Enable anti-sway control: Switch the function on or off
- PO 25 X: Payload (optional)

6 Copy project/aisle



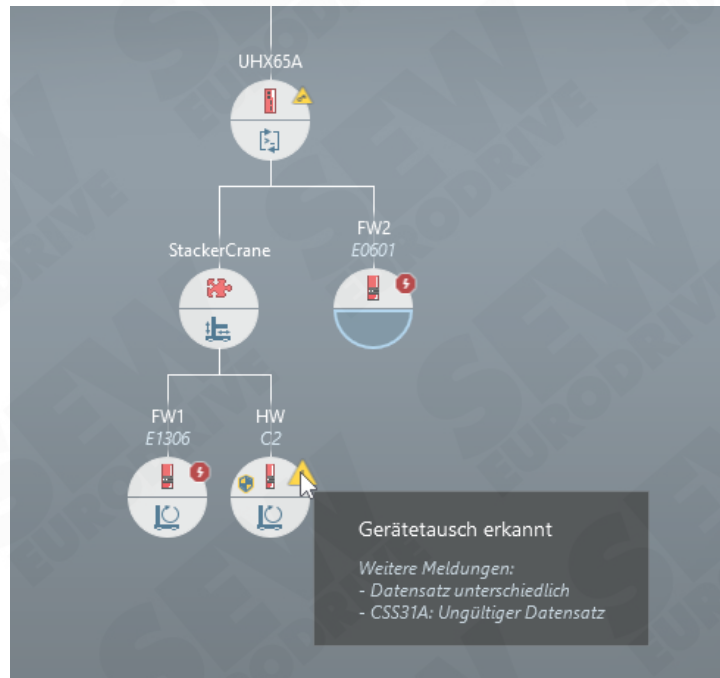
Prerequisite:

- MOVISUITE and IEC project including safety have been put into operation.
- MOVI-C CONTROLLER of the new project, e.g. aisle 2, has the same PROFINET address and firmware version.
- The same PC or laptop is used to copy the project.

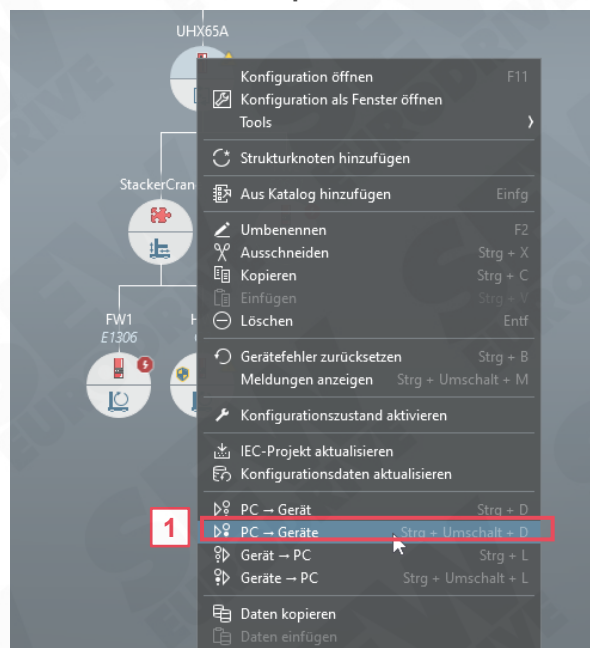
6.1 Perform device replacement



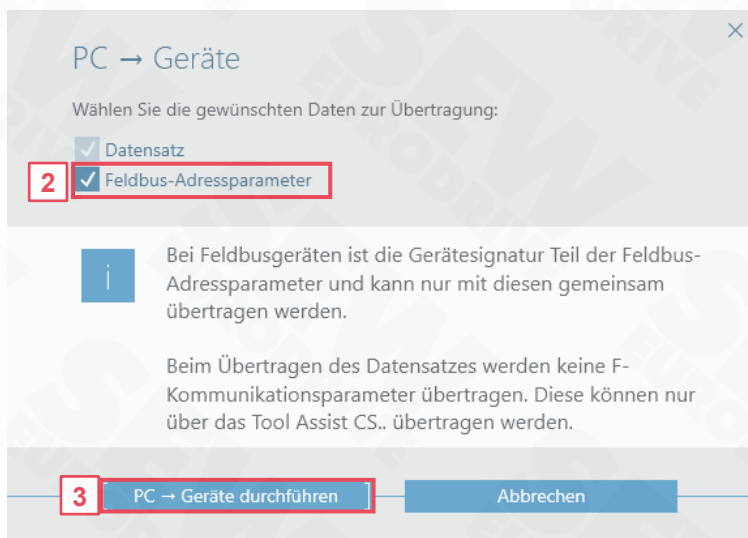
1. Connect the project to a new aisle
2. Device replacement detected



3. Perform device replacement

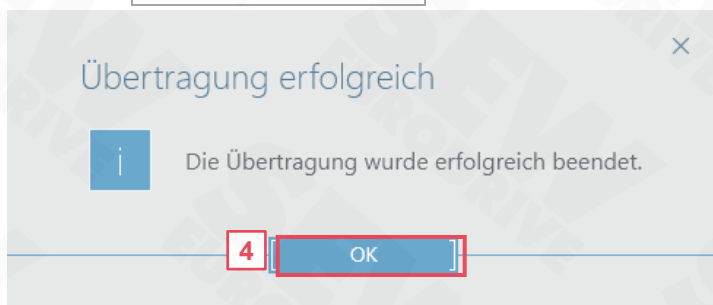


1. Select the controller and right-click and select **PC -> devices**.



2 Activate the **fieldbus address parameters for transmission.**

3 Click **PC -> Perform devices.**



4 Click **OK.**

6.2 Safety data set in CS.. copy

1. Axes with safety cards indicate a critical error.

The screenshot shows the MOVISAFE CS.. interface. At the top, a tree view displays the system hierarchy: UHX65A (top), StackerCrane (middle), and two sub-units: FW1 E1306 and HW E4652. A red error icon is visible on the HW E4652 unit. A tooltip for 'E-46.52 Sicherheitskarte: Systemfehler' is shown, with the message 'Weitere Meldungen: - CSS31A: Ungültiger Datensatz'. Below the tree view, a sidebar menu lists various functions, including 'Geräte-Eigenschaften', 'Antriebsstränge', 'Funktionen', 'Diagnose', and 'MOVISAFE® CS..'. The 'Geräte-Eigenschaften' menu is expanded, showing options like 'Geräteidentifikation', 'Grundeeinstellungen', 'Gerätestatus', 'Fehlerstatus', 'Fehlerpeicher', 'Prozesswerte', 'Status STO', 'Status Positionsfunktionen', 'Status Geschwindigkeitsfunktio...', 'Status Beschleunigungsfunktio...', 'Muting/Testmodus', 'Grenzwerte', 'Ein-/Ausgänge', 'F-Prozessdaten', and 'F-Kommunikation'. The main area displays '6.4.1 Gerätedaten' with fields for 'Geräteidentifikation' (Seriennummer: 1192935143) and 'Kundenspezifische Gerätedaten' (Gerätebezeichnung). A red box highlights the 'Tool Assist CS.. starten' button.

1 Click **Tool Assist CS.. start.**

The screenshot shows the 'Geräte-Login' screen. It features a vertical image of a device on the left. The main text reads: 'Geben Sie die Schlüsselspeicher-ID des Geräts ein, um dessen Identität zu verifizieren.' Below this, there is a text input field for 'Schlüsselspeicher-ID' containing the value '9e00 0028 feb2 ca2d hex'. A red box highlights the 'Schlüsselspeicher-ID auslesen' button. Below the ID field, the text reads: 'Bestätigen Sie mit Eingabe des Passworts Ihre Berechtigung, die Parametrierung vorzunehmen.' At the bottom, there is a text input field for 'Passwort' with the placeholder 'Passwort eingeben' and a small icon.

2 Click **Read key memory ID.**



- 3 Check whether the selected axis flashes and click **Yes, flashing pattern identical.**



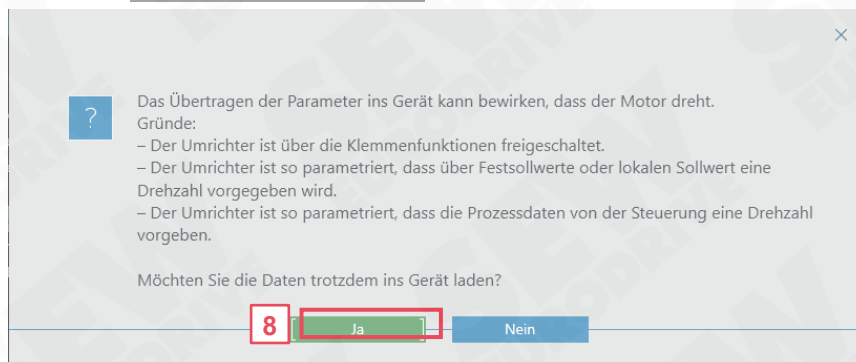
- 4 Enter the **password**.



5 Select **PROFIsafe** in F-communication.

6 Select the **F-address and the address type**.

7 Click **Transfer data to device**.



8 Click **Yes**.



9 Click **Continue to create report**.

1 Einloggen 2 Parametri... 3 Report ers... 4 Abnahme ...

Projekt

Firma: SEW Aufstellort: Aufstellort eintragen

Betriebsmittelkennzeichnung: Betriebsmittelkennzeichnung eintragen

☒ Passwort in Report einfügen

Anspruchspartner

	Firma/Name	Telefon	Fax
Firma			
Lieferant			
Errichter			

Abnahmeart

☒ Vollständige Abnahme ☐ Änderungsabnahme

Zurück zu "Parametrieren" 10 Report erstellen und weiter

10 Click **Continue to create report**.

Report erstellen

100% Report erstellen Report wird generiert.

Schließen 11 Weiter zur Abnahme

11 Click **Next to acceptance**.

1 Einloggen 2 Parametri... 3 Report ers... 4 Abnahme ...

Abnahme veröffentlichen

1. Sicherheitstechnische Überprüfung der Parametrierung mit Hilfe des Reports und Funktionstest durchführen.
2. Report ausdrucken und unterschreiben.
3. Report archivieren.

Abnahme bestätigen

Prüfsumme des Reports eingeben

12 cc5b 3b5c hex

Zurück zu "Parametrieren" 13 Abnahme bestätigen

12 Enter the checksum of the report.

13 Click **Confirm acceptance**.



14 Click **Tool Assist CS.. exit.**

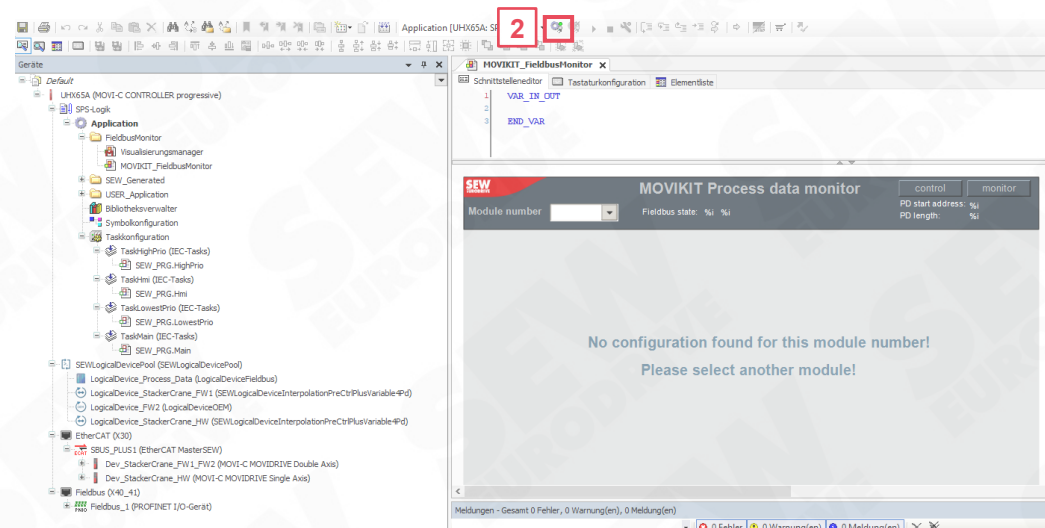
5. Safety reset by power off/power on

6.3

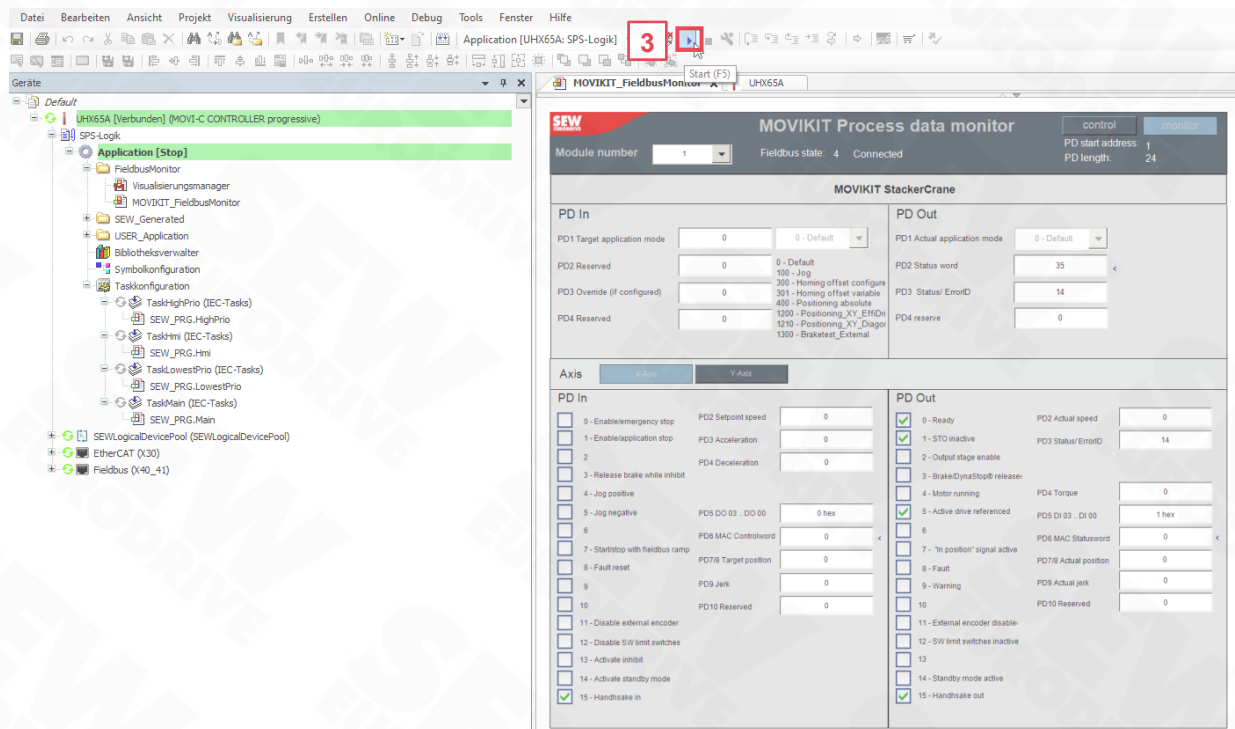
IEC project



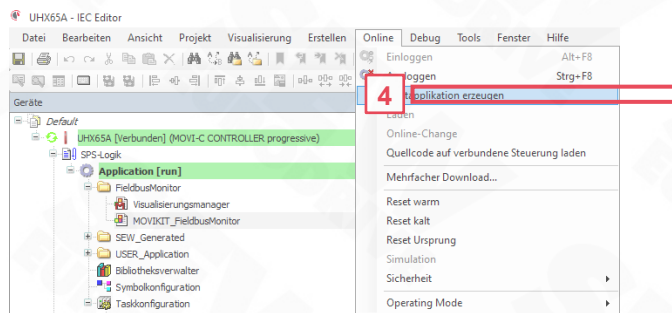
1 Click **Open IEC Editor**.



2 Log in to the controller.

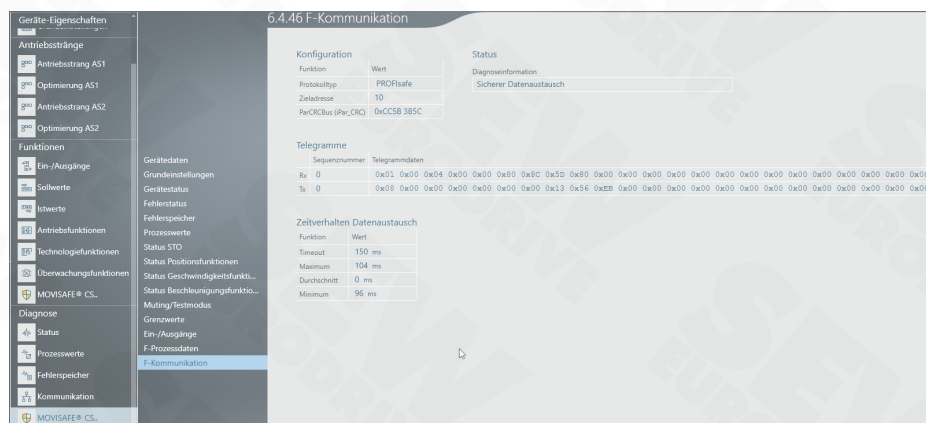


3 Click **Start** or **F5**



4 Create boot application

Check F-communication status



5 Check F-communication status **Safe data exchange**

Geräte-Eigenschaften

Antriebsstränge

- Antriebsstrang AS2
- Optimierung AS2

Funktionen

- Ein-/Ausgänge
- Sollwerte
- Istwerte
- Antriebsfunktionen
- Technologiefunktionen
- Überwachungsfunktionen
- MOVISAFE® CS..

Diagnose

- Status
- Prozesswerte
- Fehlerpeicher
- Kommunikation
- MOVISAFE® CS..

Gerätedaten

- Grundeinstellungen
- Gerätestatus
- Fehlerstatus
- Fehlerpeicher
- Prozesswerte
- Status STO
- Status Positionsfunktionen
- Status Geschwindigkeitsfunktio...
- Status Beschleunigungsfunktio...
- Muting/Testmodus
- Grenzwerte
- Ein-/Ausgänge
- F-Prozessdaten
- F-Kommunikation

6.4.42 F-Prozessdaten

Prozessausgangsdaten			Prozesseingangsdaten				
Byte	Bit	Bedeutung	Wert	Byte	Bit	Bedeutung	Wert
Byte 1	0	STO 1	1	Byte 1	0	STO 1	0
Byte 1	1	SLI Schrittfreigabe	0	Byte 1	1	Diagnose ASF	0
Byte 1	2	SBT clearance	0	Byte 1	2	SBT active	0
Byte 1	4	Muting	0	Byte 1	3	Eingangsdaten gültig	1
Byte 1	5	Testmodus	0	Byte 1	4	Muting	0
Byte 2	6	Entriegelung F-DI	0	Byte 1	5	Testmodus	0
Byte 2	7	Fehlerquittierung	0	Byte 1	6	Warnung	0
Byte 2	0	F-DO 00	0	Byte 1	7	Fehlerstatus	0
Byte 2	1	F-DO 01	0	Byte 2	0	F-DI 00	0
Byte 3	0	SOS 1	0	Byte 2	1	F-DI 01	0
Byte 3	2	SSx 1	1	Byte 2	2	F-DI 02	0
Byte 3	3	SSx 2	0	Byte 2	3	F-DI 03	0
Byte 3	4	SDI 1	0	Byte 3	0	SOS 1	0
Byte 3	5	SDI 2	0	Byte 3	2	SSx 1	0
Byte 3	6	SLI 1	0	Byte 3	3	SSx 2	0
Byte 3	7	SLI 2	0	Byte 3	4	SDI 1	0
Byte 4	0	SLS 1	0	Byte 3	5	SDI 2	0
Byte 4	1	SLS 2	0	Byte 3	6	SLI 1	0
Byte 4	2	SLS 3	0	Byte 3	7	SLI 2	0
Byte 4	3	SLS 4	0	Byte 4	0	SLS 1	0
Byte 4	4	SSR 1	0	Byte 4	1	SLS 2	0
Byte 4	5	SSR 2	0	Byte 4	2	SLS 3	0
Byte 5	0	SLA 1	0	Byte 4	3	SLS 4	0
Byte 5	1	SLA 2	0	Byte 4	4	SSR 1	0
				Byte 4	5	SSR 2	0
				Byte 5	0	SLA 1	0
				Byte 5	1	SLA 2	0
				Byte 5	2	SSM 1	0

6 Set F-process data in S7 and check in MOVISUITE.

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Version 3.2

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