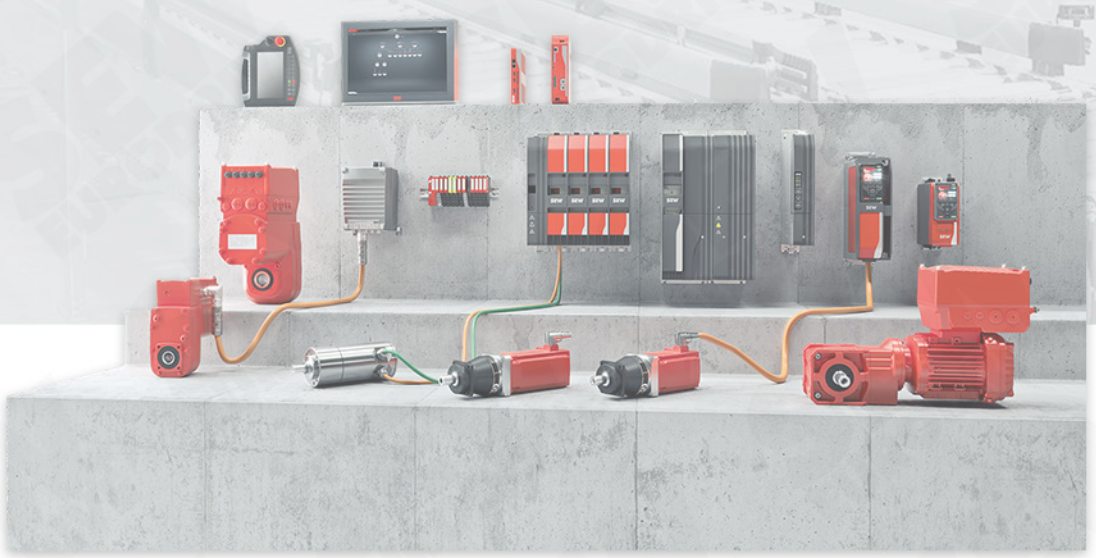
Product Training Workbook



MOVI-C® Automation System

MOVISUITE® – Practice on the Inverter

Startup, Parameterization and Diagnostics

C101

DRIVE ACADEMY®

Urheberrecht

Exclusion of liability

This training document supplements the existing documentation from SEW-EURODRIVE GmbH & Co KG. It was prepared as an informative document to accompany training – to the best of our knowledge and in good faith. SEW-EURODRIVE GmbH & Co KG assumes no liability for any mistakes.

You must observe the operating instructions of the units listed in the training document to ensure safe operation. The safety guidelines listed there apply.
SEW-EURODRIVE GmbH & Co KG assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of these operating instructions. In such cases, any liability for defects is excluded. Make sure that the operating instructions are available to persons responsible for the system and its operation as well as to persons who work independently on the unit. You must also ensure that the documentation is legible.

Objectives of this training document

- Start up and parameterize the MOVIDRIVE® modular, system and technology application inverters and perform drive optimizations.
- Become familiar with using fault diagnostics and the Scope function for the graphical recording of measured quantities.
- Perform data backup.

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

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Meaning of the symbols:


Operating instructions


Information


Safety-related information


Tip


Diagnostics and troubleshooting


Practical task


Additional documentation

Workbook steps

The workbook shows the practical procedure for startup, parameterization and diagnostics of the inverters of the MOVI-C® automation system. Due to the uniform operating principle, the workbook applies to all MOVI-C® inverters.

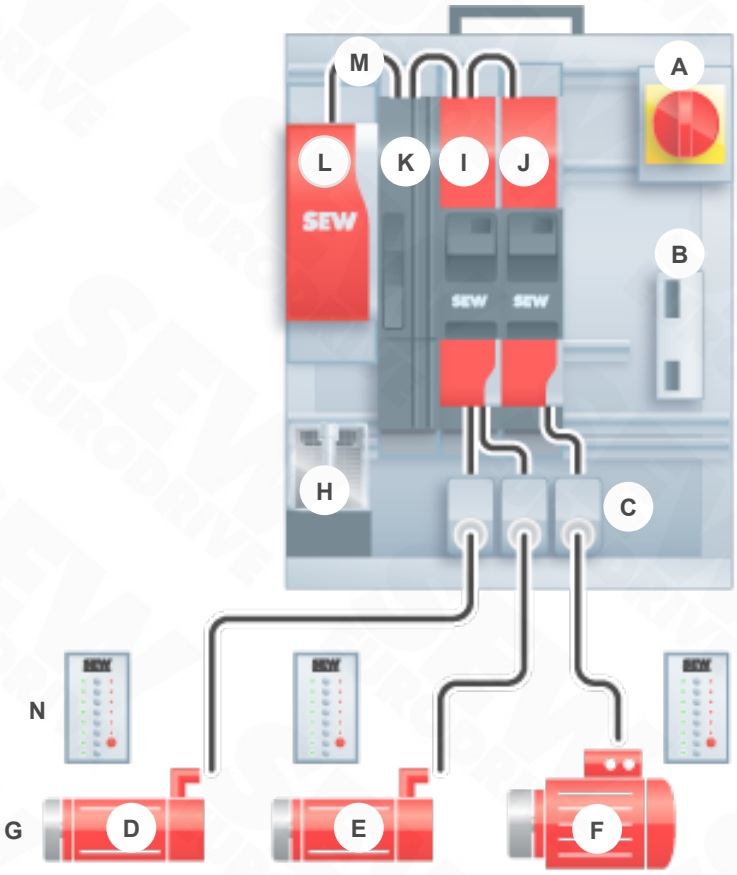
1. Presentation of the training models
2. Establishing communication between PC and inverter
3. Entry into the MOVISUITE® engineering software
4. Startup
5. Manual mode
6. Drive diagnostics
7. Drive optimization and diagnostics with Scope
8. Configuration of user units
9. Data management
10. Terminal control
11. Bus control
12. Control with CBG21A keypad

1 Presentation of the training models

Objectives:

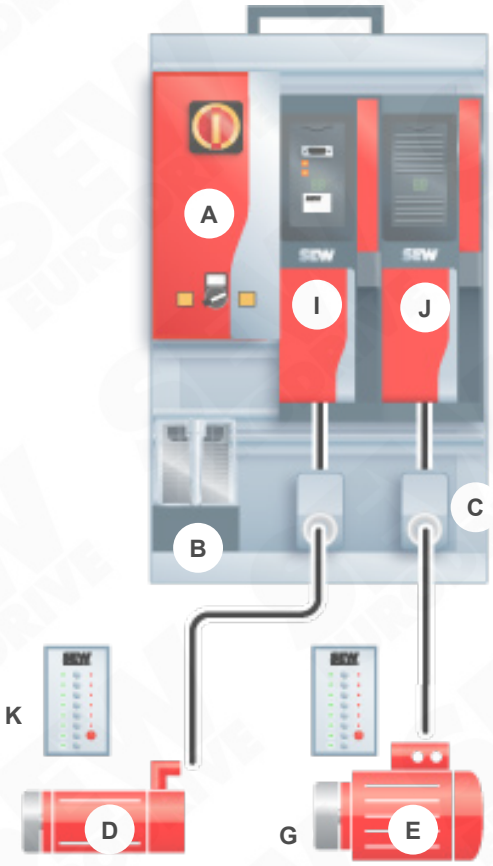
- You will be familiar with the different training models and the installed components

1.1 MOVIDRIVE® modular training model with MOVI-C® CONTROLLER



A	Main switch	Main switch with thermal and magnetic rapid tripping and undervoltage tripping, motor protection preset to 10 A.
B	24 V power supply	24 V switched-mode power supply for supplying the 24 V supply voltage
C	Motor connection	Motor cable with Harting plug connector systems.
D	Drive 1	CMP50S/BK/KY/RH1M/SB1 Note: For drives 1 and 2, the motor assignment can also be reversed.
E	Drive 2	CMP50S/BK/KY/AK0H/SB1
F	Drive 3	DRS71S4BE05HR/FI/IS/TF/AS7W Note: Drive 3 is wired in a Y connection.
G	Flywheels	Flywheels with protective cover
H	Brake control	BE.. brake control with BMK via brake output of the MOVIDRIVE® modular axis modules
I	MOVIDRIVE® modular double-axis module	MDD90A-0040-503-X-S00/X
J	MOVIDRIVE® modular single-axis module	MDA90A-0040-503-X-S00
K	MOVIDRIVE® modular power supply module	MDP90A-0100-503-4-000
L	MOVI-C® CONTROLLER	UHX85A-R / UHX45A
M	EtherCAT®/SBus^{PLUS}	The MOVI-C® CONTROLLER power communicates with the lower-level application inverters via the EtherCAT®/SBus^{PLUS} system bus
N	Universal control box S for each axis	Digital inputs DI00 – DI07 Digital outputs DO00 – DO07 and potentiometer
	Braking resistor	Mounted on the back of the model

1.2 MOVIDRIVE® technology training model



A	Terminal box	Terminal box with ▪ Main switch with thermal and magnetic rapid tripping and undervoltage tripping, motor protection preset to 10 A. ▪ Fuse ▪ Power socket ▪ Brake control Toggle switch: Permanently released, not controlled, controlled by inverters
B	24 V switched-mode power supply	24 V switched-mode power supply for supplying the 24 V supply voltage
C	Motor connection	Motor cable with Harting plug connector systems
D	Drive 1	CMP50S/BK/PK/AK0H/SB1
E	Drive 2	DRS71S4BE05HR/FI/IS/TF/AS7W Note: Drive 3 is wired in a Y connection.
G	Flywheels	Flywheels with protective cover
I	MOVIDRIVE® technology	MDX91A-0040-5E3-4-T00
J	MOVIDRIVE® technology	MDX91A-0040-5E3-4-T00
K	Universal control box S for each axis	Digital inputs DI00 – DI07 Digital outputs DO00 – DO07 and potentiometer
	Braking resistors	Each mounted under the MOVIDRIVE® technology inverter

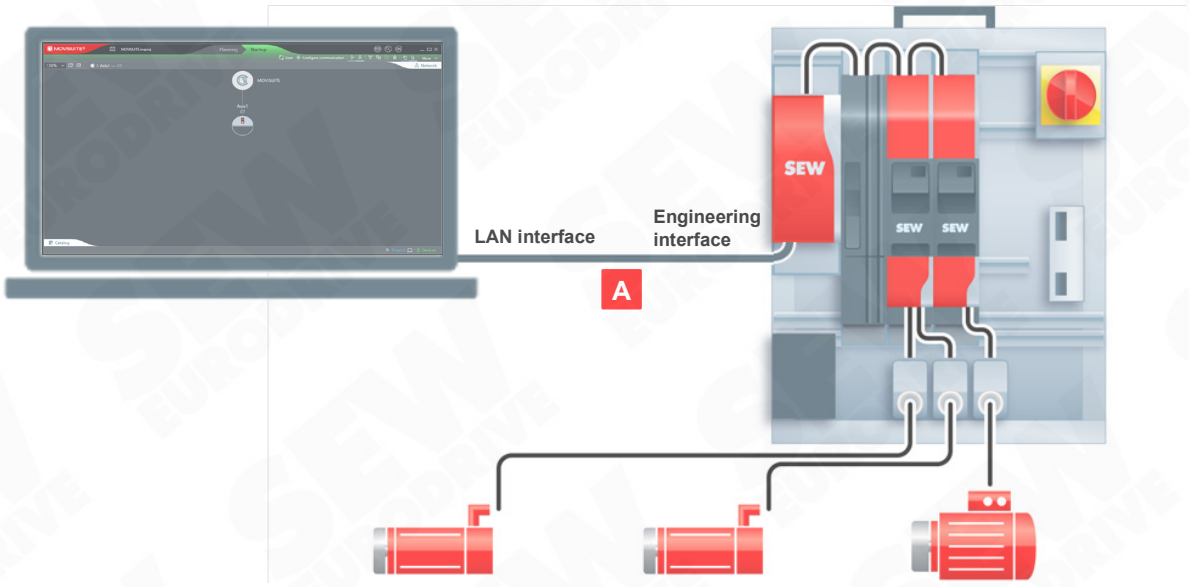
2 Communication between PC and inverter

Objectives: You can establish a connection from the engineering PC to the inverter via different network types to:

- MOVI-C® CONTROLLER
- MOVIDRIVE® modular/system
- MOVIDRIVE® technology

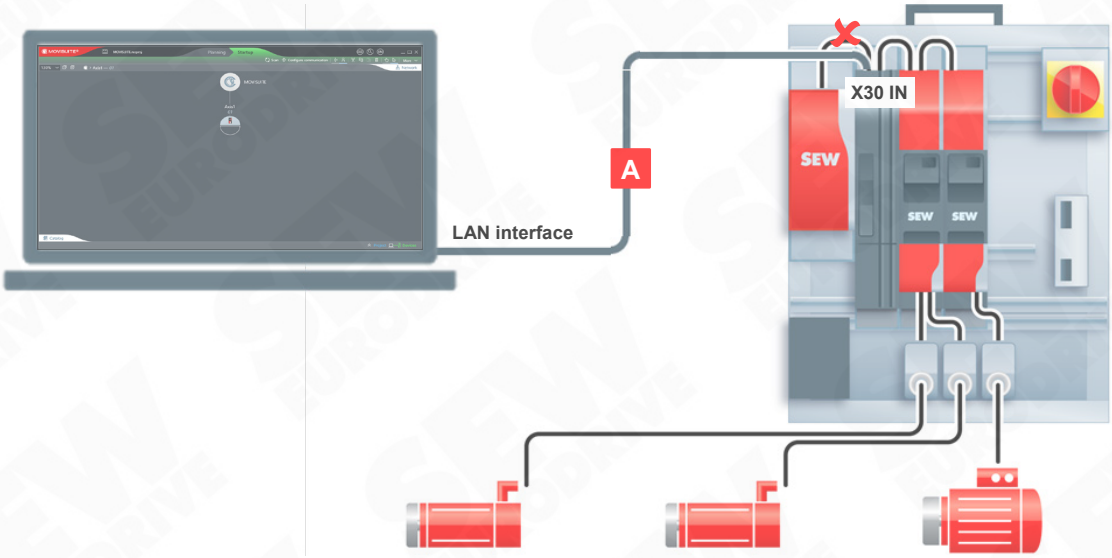
2.1 Connection of the PC and training model

2.1.1 Connection to MOVIDRIVE® modular with Ethernet via MOVI-C® CONTROLLER



A Ethernet communication: Connect the LAN interface on the engineering PC to the engineering interface on the MOVI-C® CONTROLLER power via a network cable.

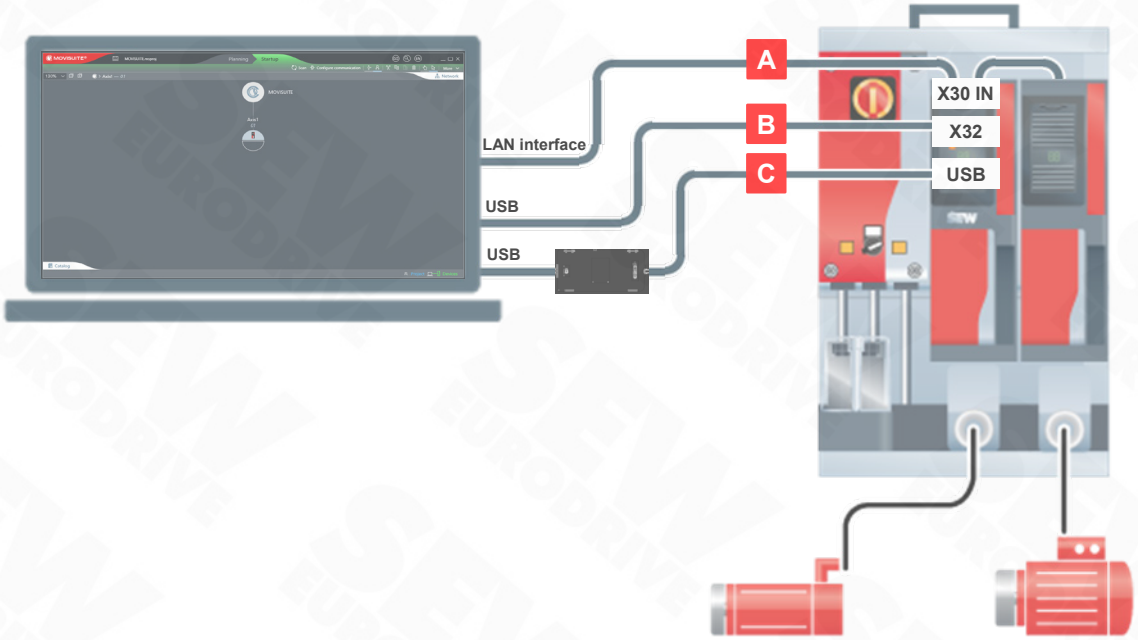
2.1.2 Connection to MOVIDRIVE® modular with EtherCAT®/SBus^{PLUS}



A EtherCAT®/SBus^{PLUS} communication: Connect the LAN interface on the engineering PC to the X30 IN interface on the power supply module via a network cable.

The connection to the MOVI-C® CONTROLLER must be disconnected!

2.1.3 Connection to MOVIDRIVE® technology



A EtherCAT®/SBus^{PLUS} communication: Connect the LAN interface on the engineering PC to the X30 IN interface on MOVIDRIVE® technology via a network cable.

B USB communication via keypad: Connect the USB interface on the engineering PC to the USB interface on the CBG21A or CBG11A keypad.

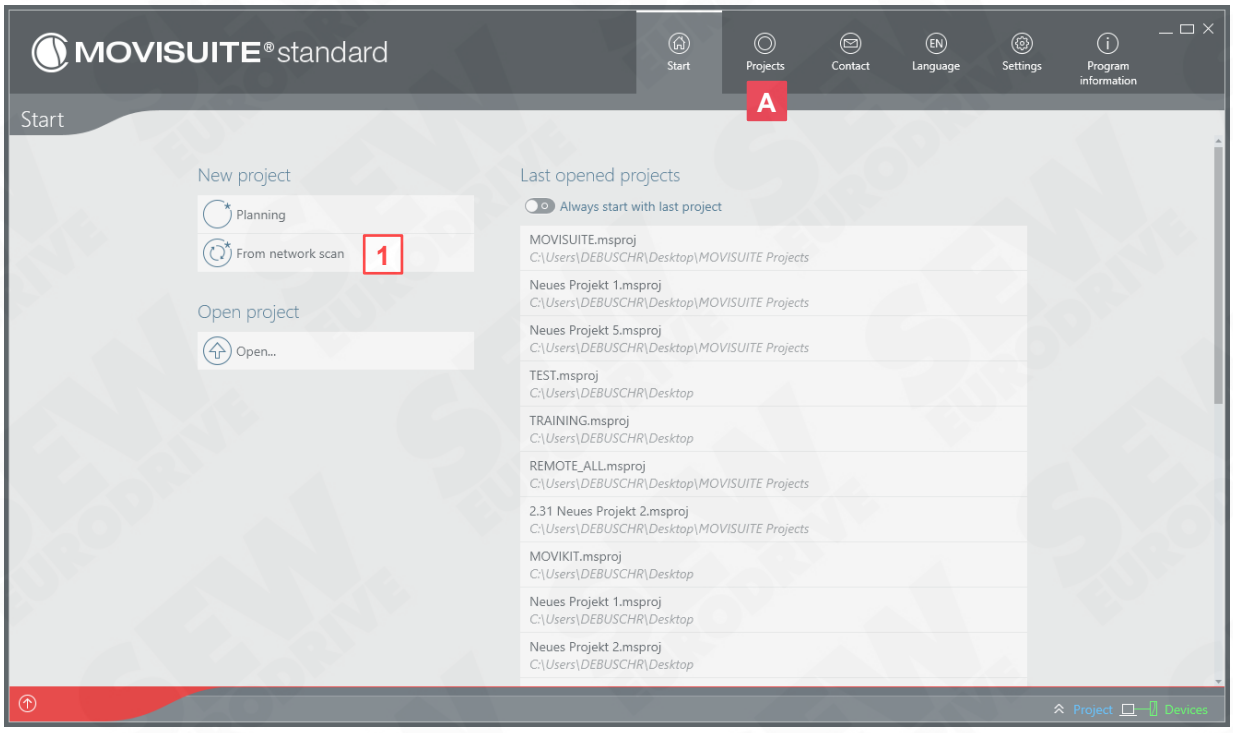
C USB communication via interface adapter: Connect the USB interface on the engineering PC to the X32 service interface on MOVIDRIVE® technology via the USM21A interface adapter.

2.2 Create a new project in MOVISUITE®

1. Start MOVISUITE®

1 Start MOVISUITE® from the Start menu under **SEW > MOVISUITE standard** or click the shortcut on your desktop.

2. Create a new project from the network scan



1 Select **Start > New project > From network scan**.

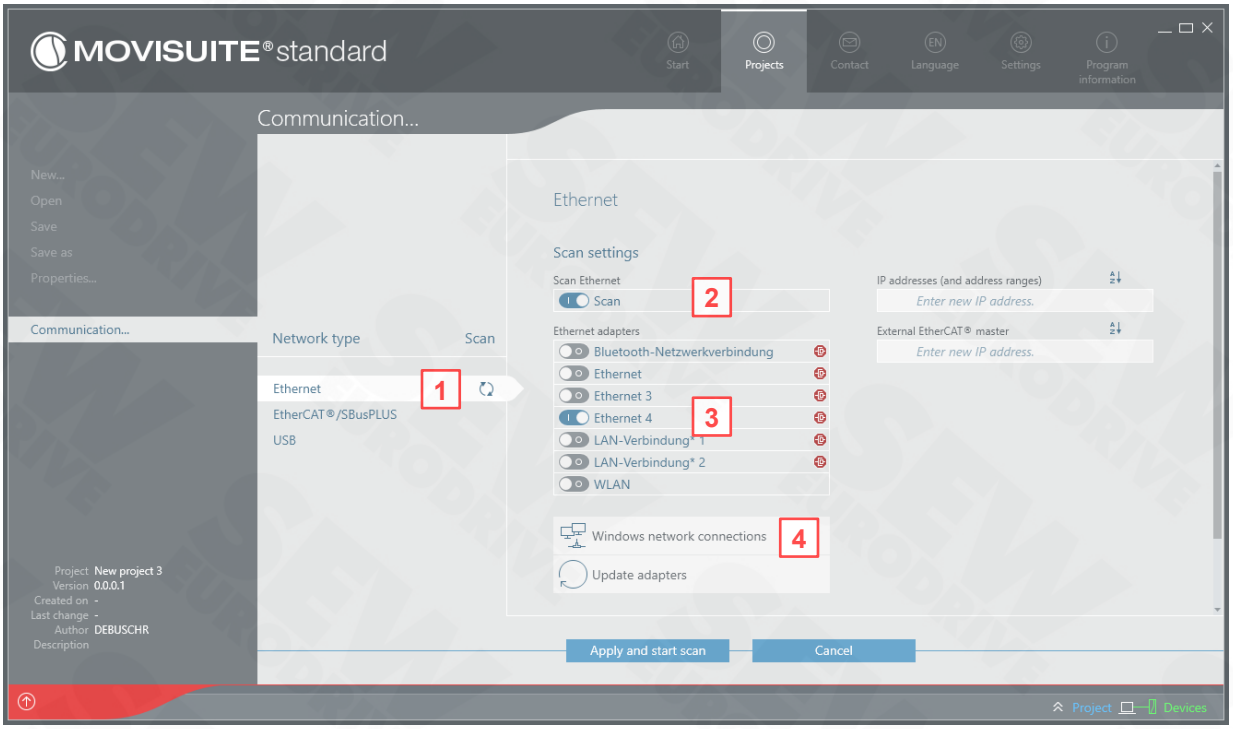
A Alternatively, you can open a new project under **Projects > New...**.

2.3 Set the network type

Select the appropriate communication depending on the hardware connection.

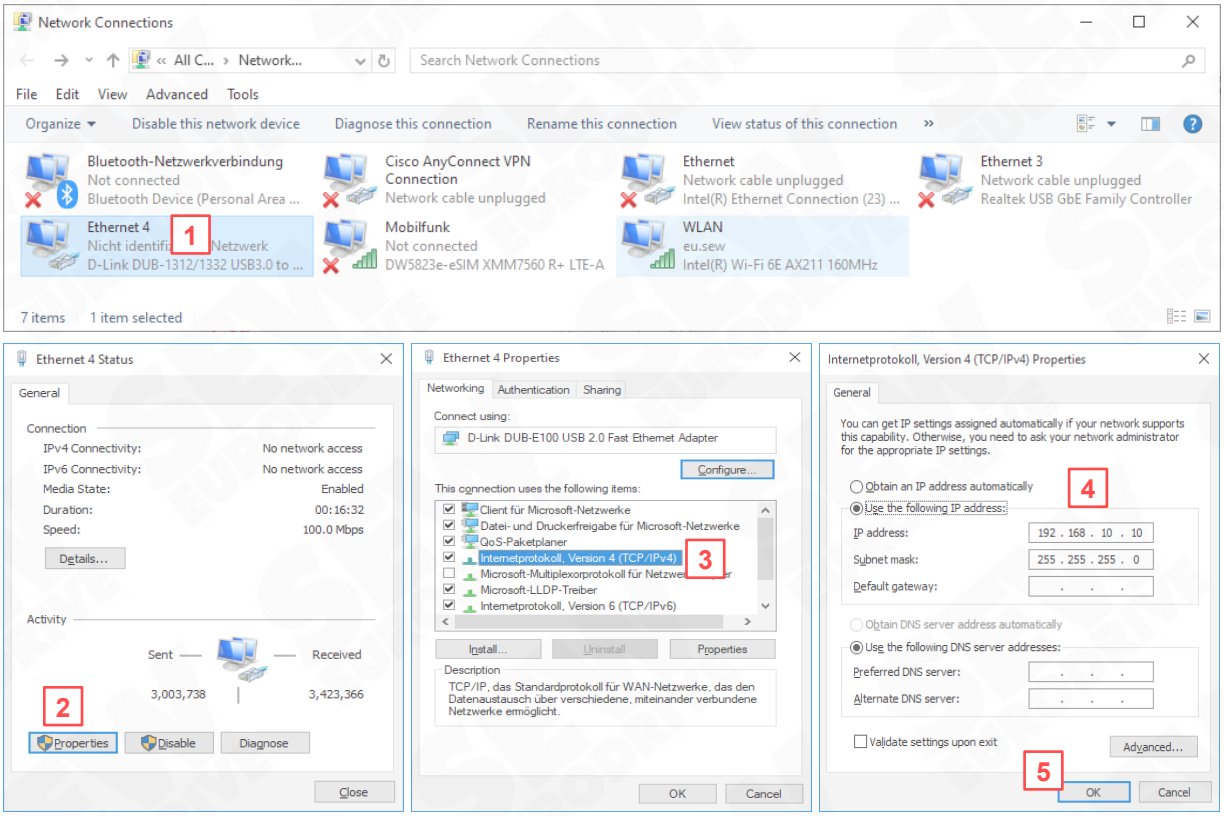
2.3.1 Set communication via Ethernet

1. Configure communication



1. Select the **Ethernet** network type.
2. Switch on **Scan**.
3. Select the appropriate Ethernet adapter for engineering (**Ethernet 4** in the example).
4. Open **Windows network connections**.

2. Configuring the engineering PC's Ethernet adapter



1 Double-click the corresponding network connection.

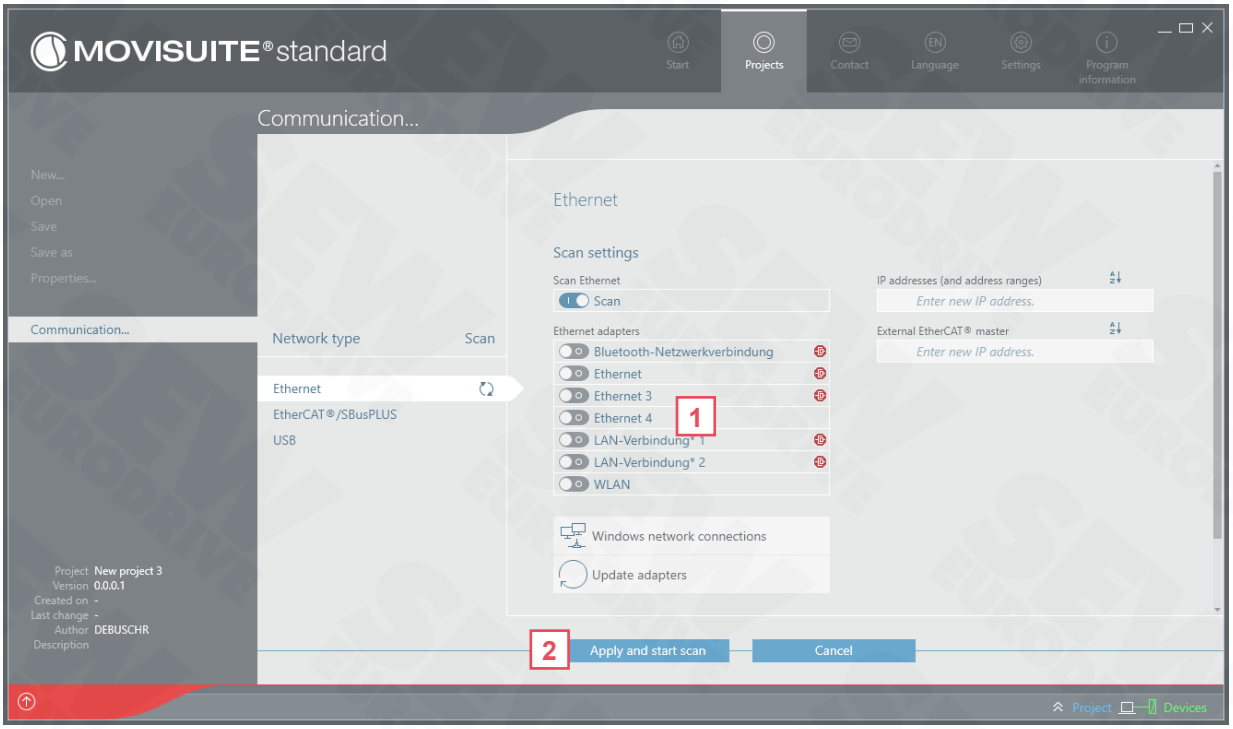
2 Click **Properties**.

3 Double-click **Internet Protocol Version 4 (TCP/IPv4)**.

4 Set the IP address to **192.168.10.10** as shown in the example. The default IP address of the MOVI-C® CONTROLLER is 192.168.10.4; the PC interface's last digit must be different and must not be 0 or 255. Click the subnet mask to automatically fill the fields.

5 Confirm the settings with **OK** and close the open windows.

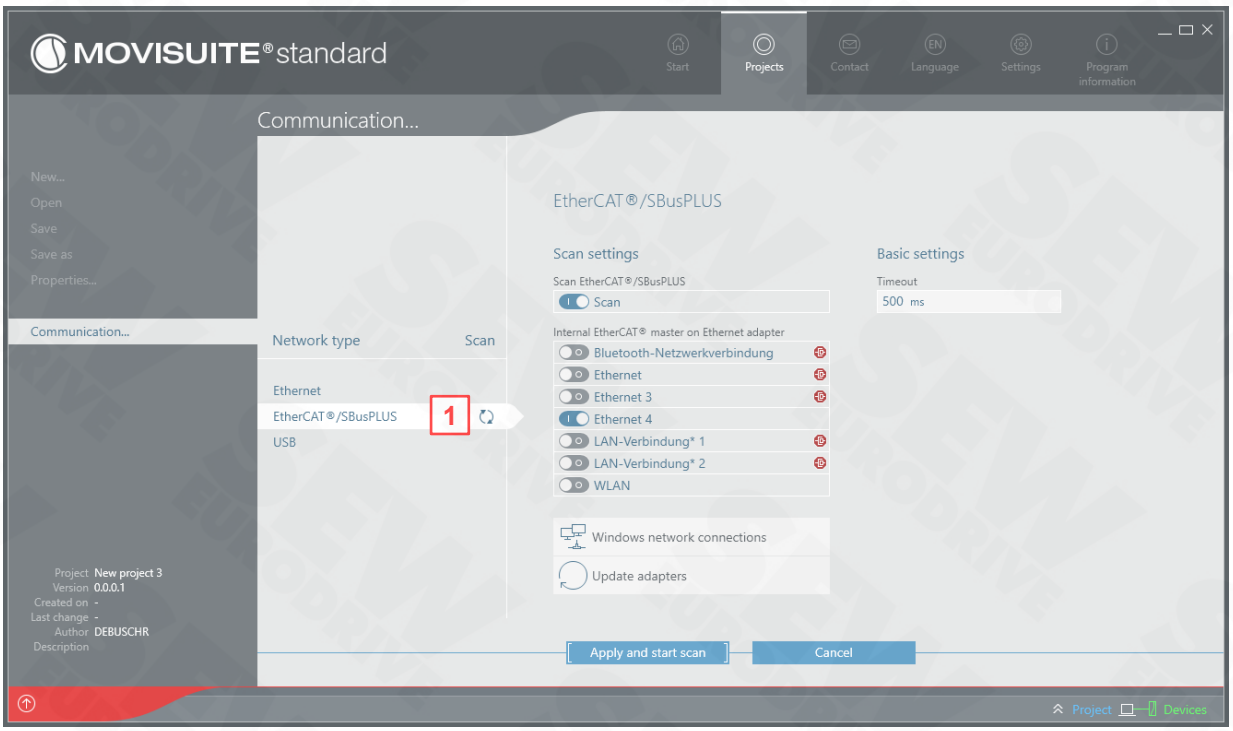
3. Apply the network configuration and network scan



1 The settings are applied with **Update adapters**.

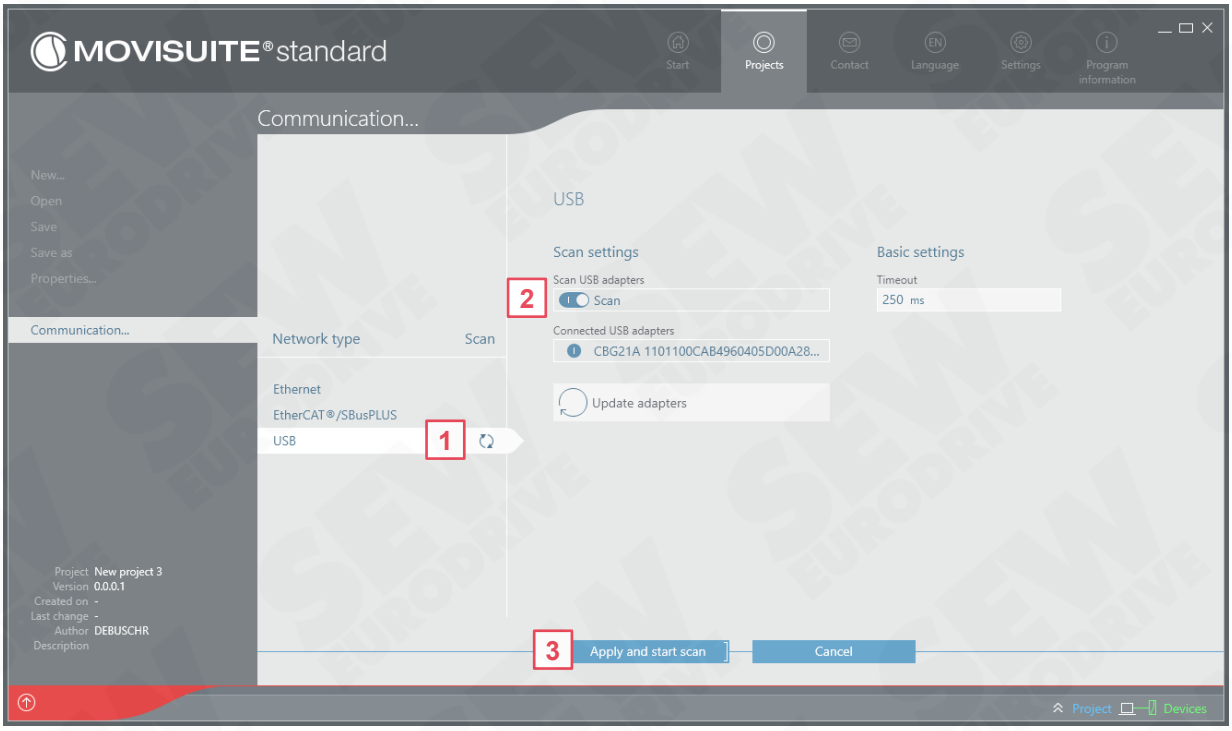
2 Start the network scan by clicking **Apply and start scan**.

2.3.2 Set communication via EtherCAT®/SBus^{PLUS}



1 Select **EtherCAT®/SBus^{PLUS}** as the network type and proceed as for the Ethernet network type.

2.3.3 Set communication via USB

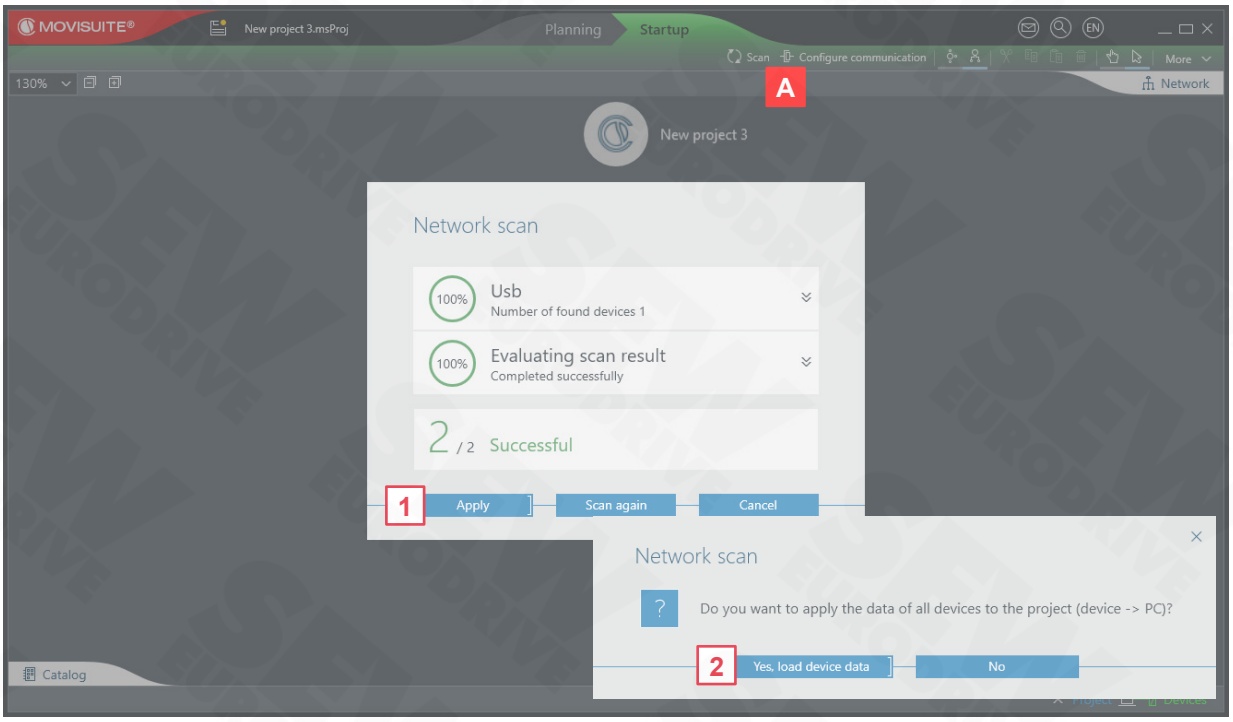


1. Select the **USB** network type.
2. Switch on **Scan**.
3. Select **Apply and start scan**; the network scan is then started.

2.4 Perform a network scan

The network scan is performed automatically after the communication settings have been applied and it displays the network with the devices found.

1. Apply network scan

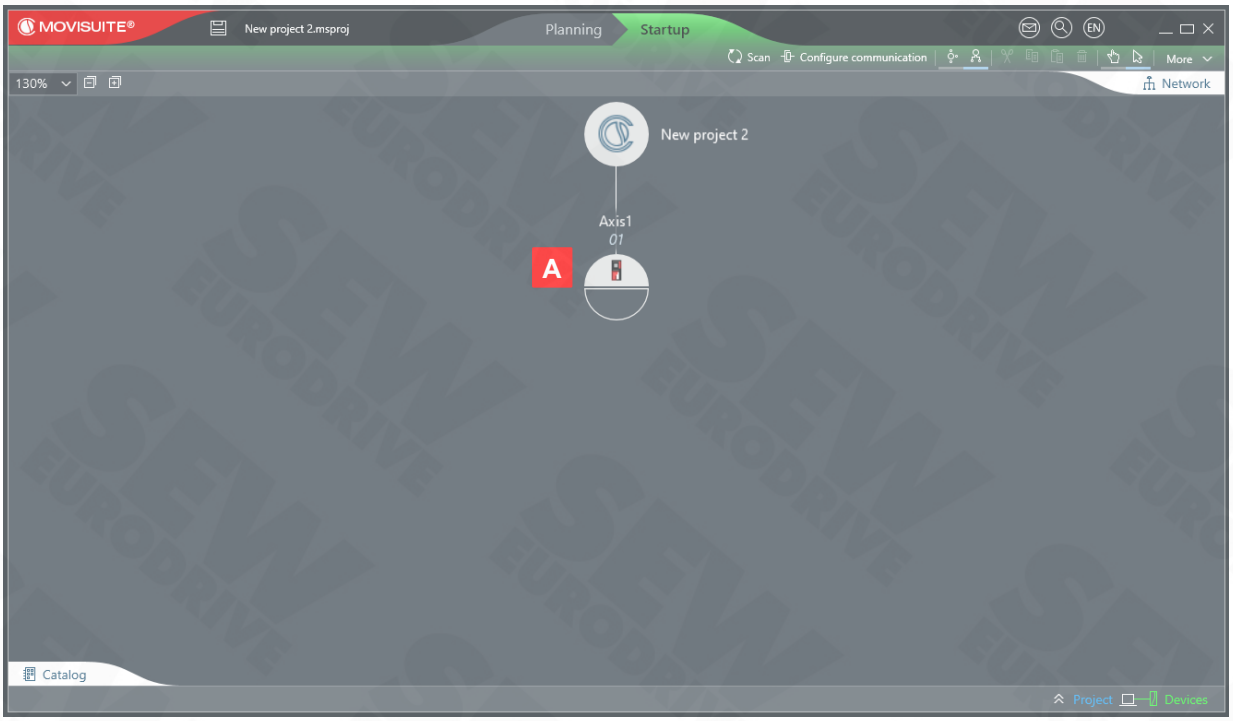


1 **Apply** the found device to the project.

2 Then load the device data.

A Use the menu bar of the main window to edit the communication settings and perform further network scans.

1. Scan result



A After the scan, the function view is displayed with the detected device.

3 Entry into the MOVISUITE® engineering software

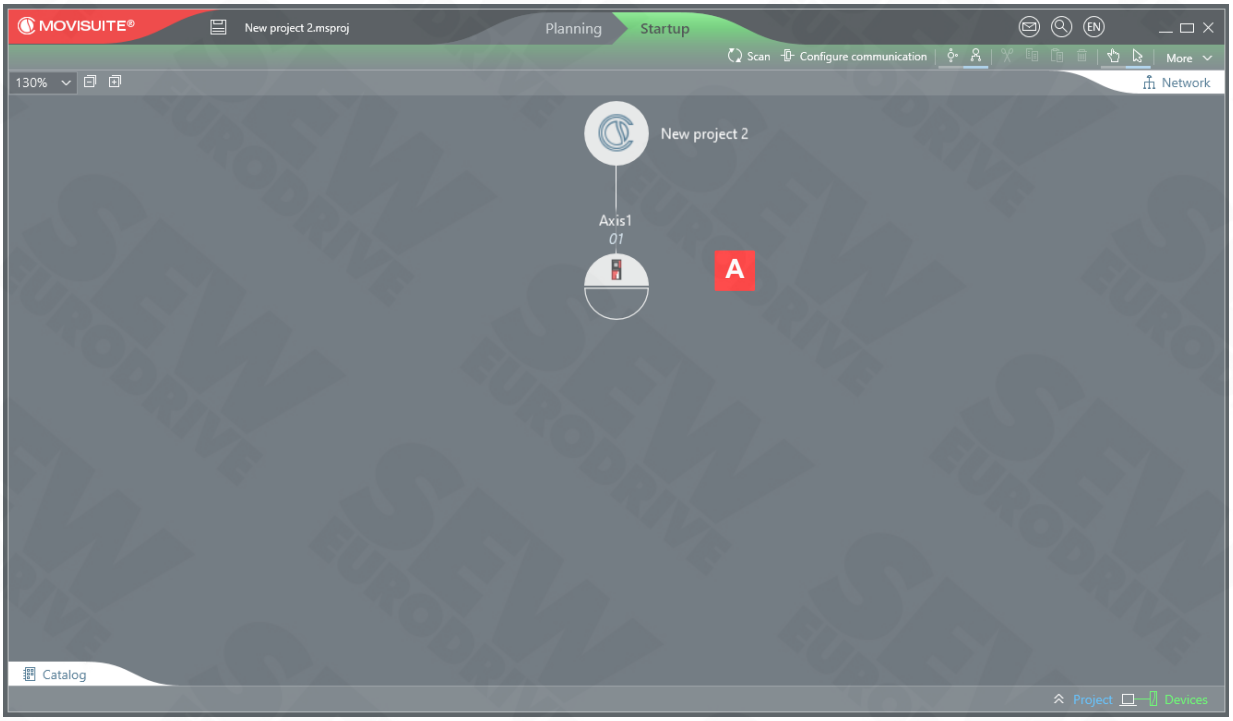
Objectives:

- You are familiar with the different views of MOVISUITE® and can select the parameters and device functions

3.1 Overview of MOVISUITE®

A MOVISUITE® project has two different levels, namely the **function view** and the **network view**.

1. Function view



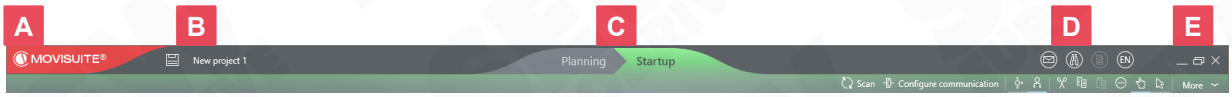
A The function view shows the entire project with the components used in the MOVI-C®.

2. Network view

A The network view shows all connected devices that are detected during a network scan. Open the network view by clicking **Network**.

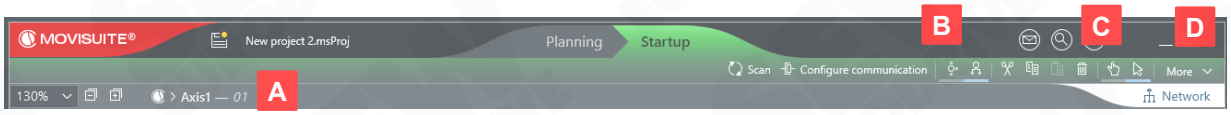
3.2 Title bar and toolbar

The **title bar** contains the following menus and buttons:



A	**Main menu**	The main menu offers the following functions: Start, project, contact, help, search, language, settings, program information
B	**Project name**	There is a **Save** button in front of the project name, which can be used to save changes.
C	**Work phases**	Work phases are used to distinguish between the following modes:
	Planning	In this mode, no communication is established with the physically connected devices. This means that data is saved only in the project database of MOVISUITE® and is read from there.
	Startup	In this mode, communication is established with the physically connected devices. This means that data is saved in the project database of MOVISUITE® as well as in the device.
D	**Global functions**	Direct calling of global functions
	Feedback	Opens the feedback window in the main menu
	Language setting	Opens the language setting in the main menu
E	**Window controls**	These include familiar functions such as close, minimize, maximize, and restore

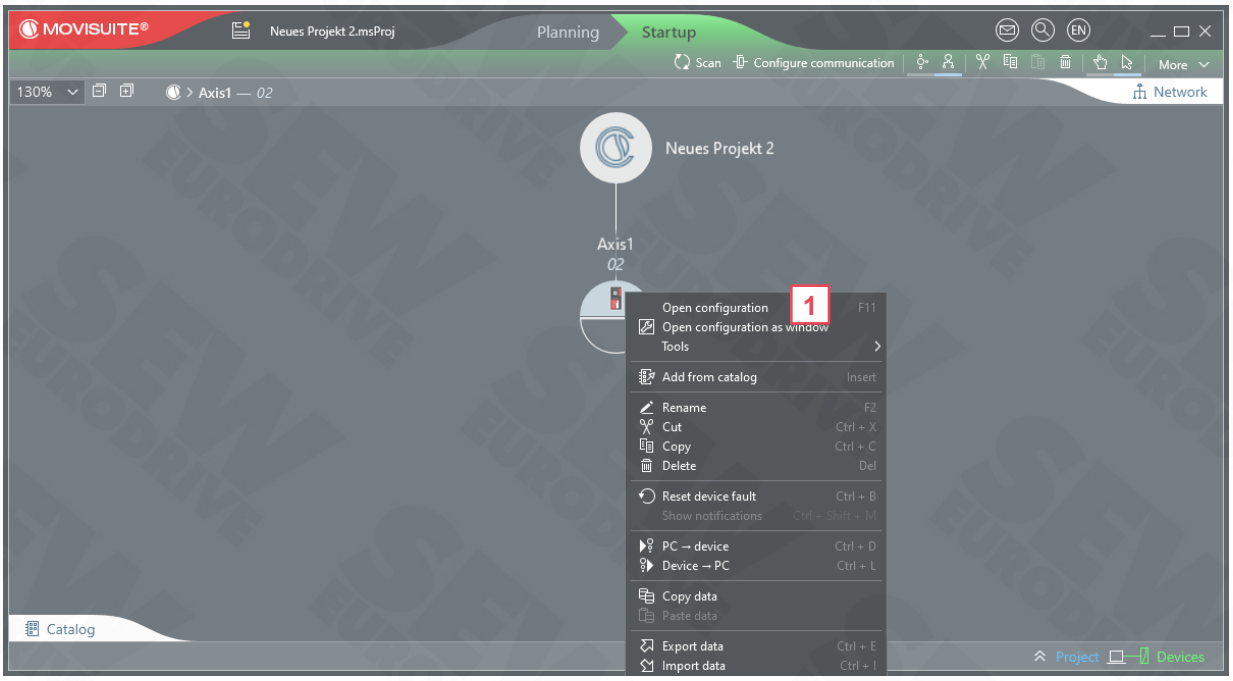
The **toolbar** is the second bar in MOVISUITE®. The following functions are provided here:



A	Breadcrumb with device name and path	The breadcrumb navigation displays the path of the selected device with the current device status.
B	Context-related toolbar functions	The context-related toolbar functions depend on the current selection: 1. New structure node 2. New segment 3. Scan 4. Configure communication 5. Collapse all segments 6. Expand all segments 7. Expand selection only
C	Edit toolbar functions	The Edit toolbar functions include the following: 1. Cut 2. Copy 3. Paste 4. Delete 5. Switch selection/navigation mode on/off
D	**More** menu	All toolbar functions are listed in the **More** menu. The toolbar functions are enabled or disabled depending on the current context.

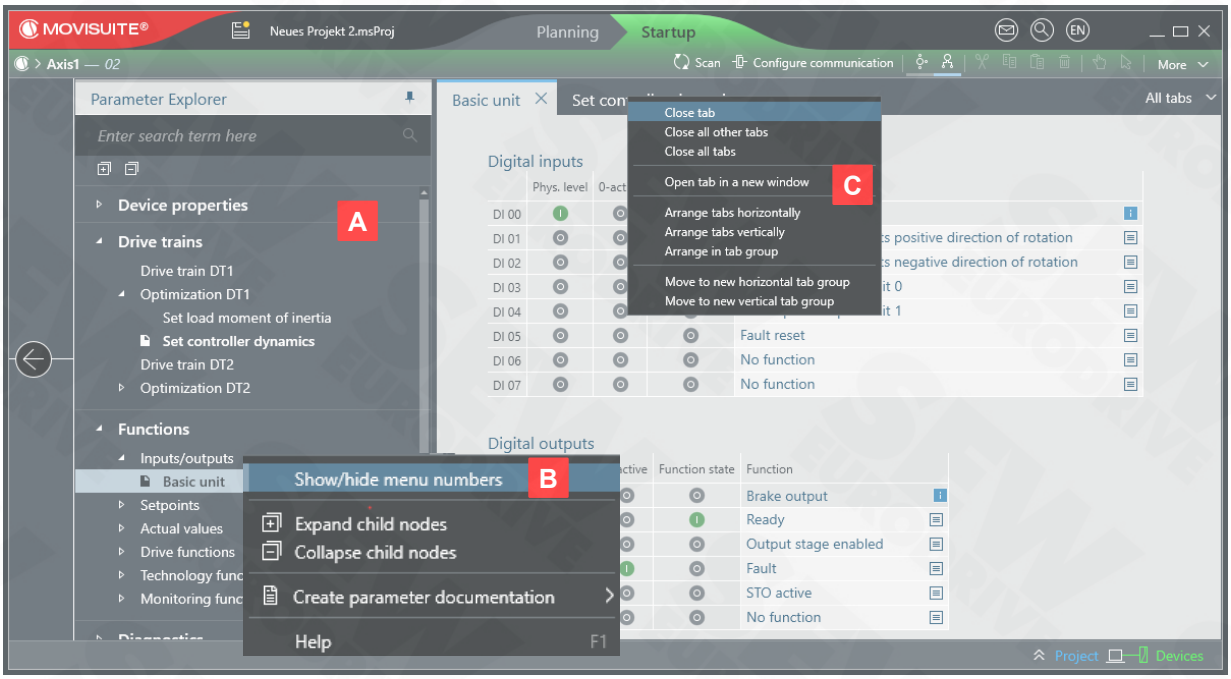
3.3 Parameter Explorer

1. Open the configuration



1 Open the inverter configuration by right-clicking the upper semicircle and select **Open configuration**, or alternatively double-click the upper semicircle.

2. Working with the Parameter Explorer



A In the Parameter Explorer, you can change the parameters of the inverter or observe display values. The parameters are mapped in a folder structure with the main groups, namely **Device properties, Drive trains, Functions and Diagnostics**, as well as the respective subgroups.

B Right-click to open the Parameter Explorer menu. You can display menu numbers for the parameter groups here.

C The parameters are opened as tabs. Right-click one of the tabs to access various window functions for the organization.

4 Startup and optimization of the drive train

Objectives:

- You can restore the delivery state of an inverter
- You can start up the drive train of the inverter
- You can optimize the drive train of the inverter
- You can save the inverter data in the project

The following startup procedure is performed as an example in the VFC^{PLUS} control mode with encoder. The procedure shown is generally applicable for all other control modes.

Overview of control modes:

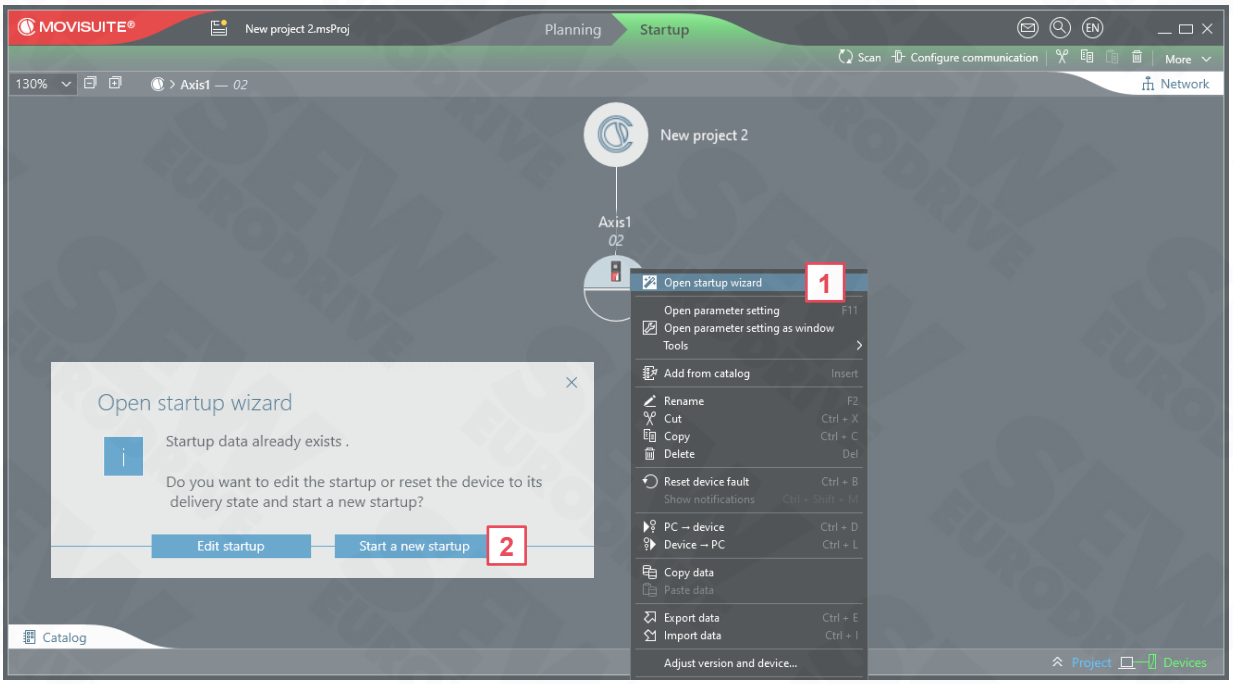
- **V/F**: Voltage/frequency characteristic curve for asynchronous motors without encoder. Areas of application: Simple applications in materials handling technology and group drives.
- **VFC^{PLUS}**: Voltage-controlled control mode for asynchronous motors with and without encoders. Areas of application: Without encoder for simple applications in materials handling technology. With encoder for demanding applications such as positioning hoists, corner transfer units, etc.
- **CFC**: Current-controlled control mode for synchronous motors and asynchronous motors with encoder. Areas of application: Demanding and highly dynamic applications such as positioning, cams, robotics, etc.
- **ELSM®**: Current-controlled control mode for synchronous motors without encoder. Areas of application: Simple speed-controlled applications with high energy efficiency.

The startup procedure shown is guided by the startup wizard. Experienced users can also start up the drive using the corresponding parameters:

- **Drive trains > Drive train DT1**
- **Drive trains > Optimization DT1**
- **Functions > Monitoring functions > Limit values**
- **Functions > Monitoring functions > Control functions > Speed monitoring**

4.1 Basic settings

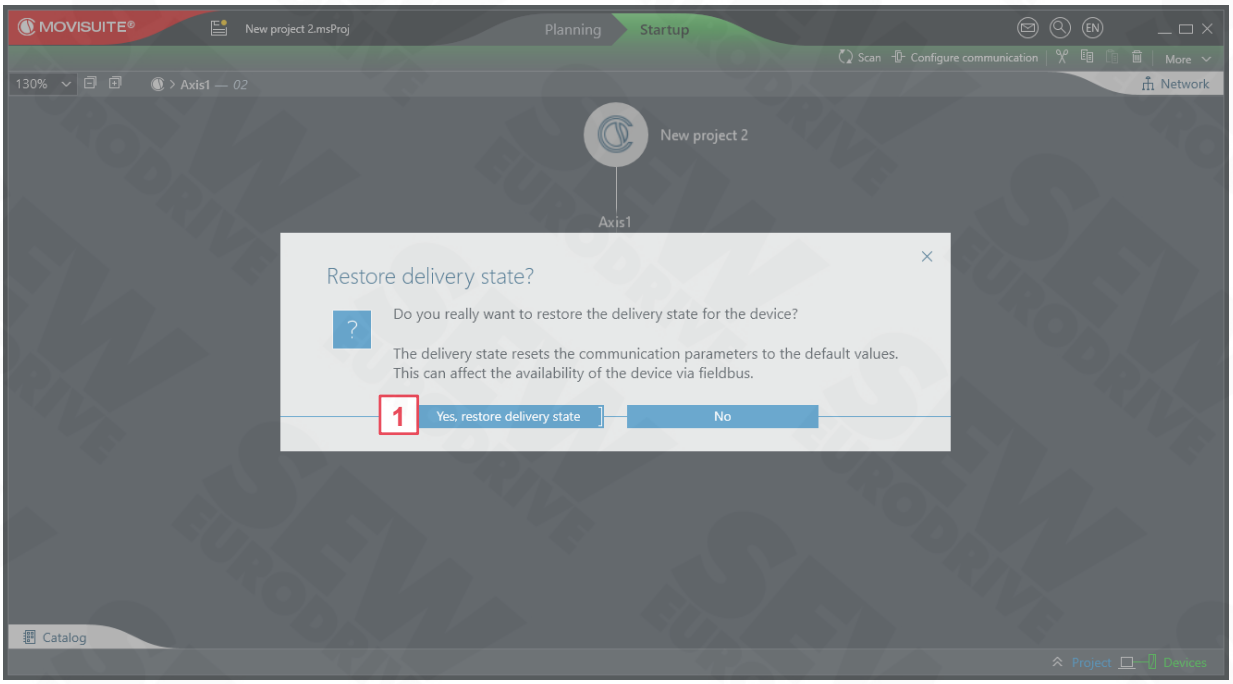
1. Open the startup wizard



1 Right-click the upper semicircle of the inverter and select **Open startup wizard**.

2 Then select **Start a new startup**. To change an existing startup, select **Edit startup**.

2. Reset device parameters

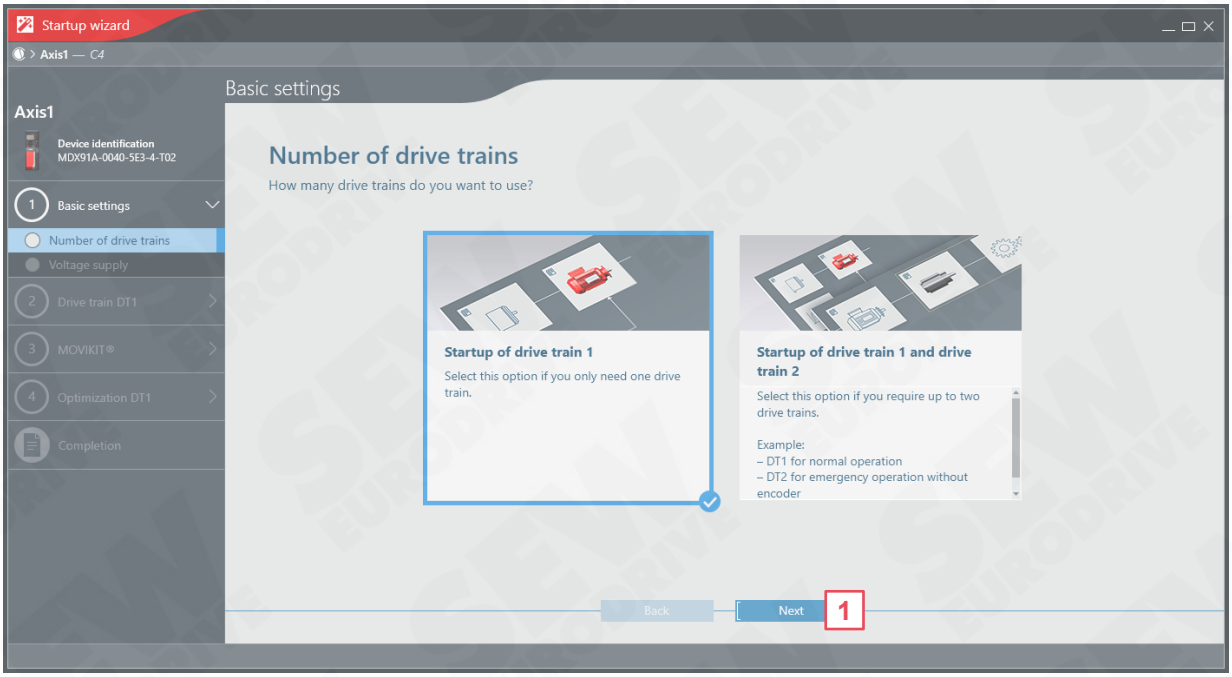


1 Select **Yes, restore delivery state**.

The delivery state is used to prepare the inverter for the exercises in this workbook. It is not always necessary to reset the device parameters before startup. Proceed with extreme caution on a system or machine in this regard!

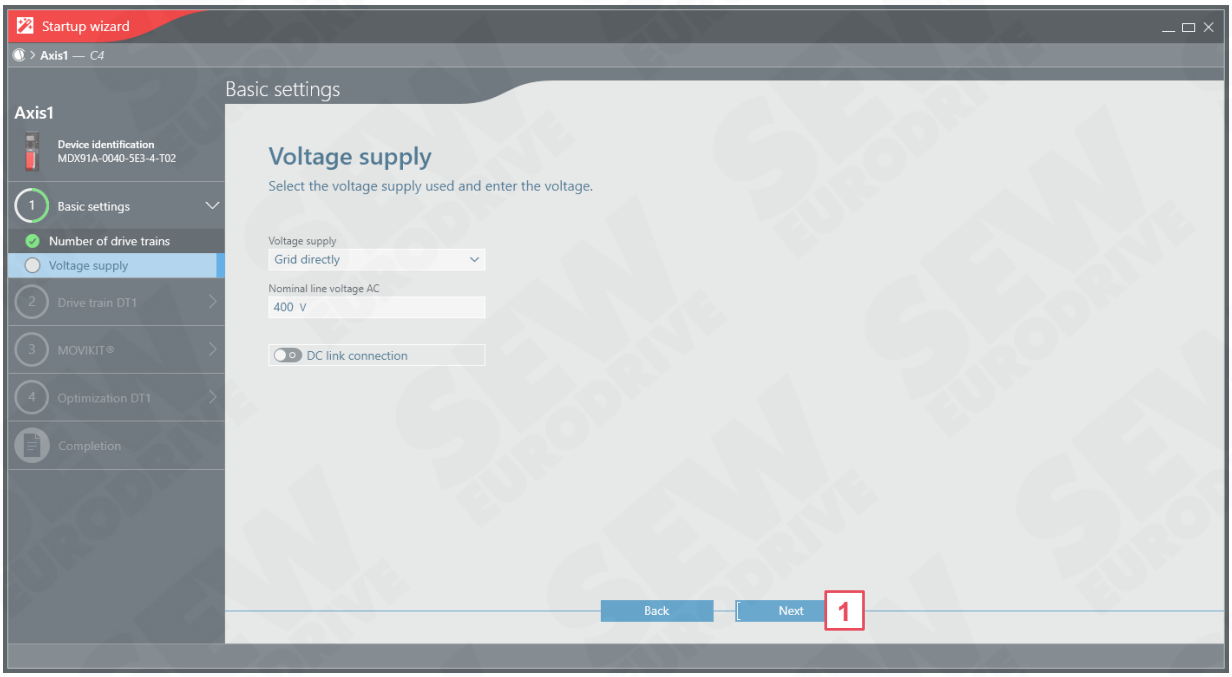
After resetting the device parameters, the startup wizard opens automatically as a plug-in. The previous two steps only appear if the inverter was not yet in delivery state. Otherwise, the startup wizard starts directly with the selection of the drive trains as shown in the following step.

3. Select the drive train



1 Select **Startup of drive train 1** and then click **Next**.

4. Select voltage supply



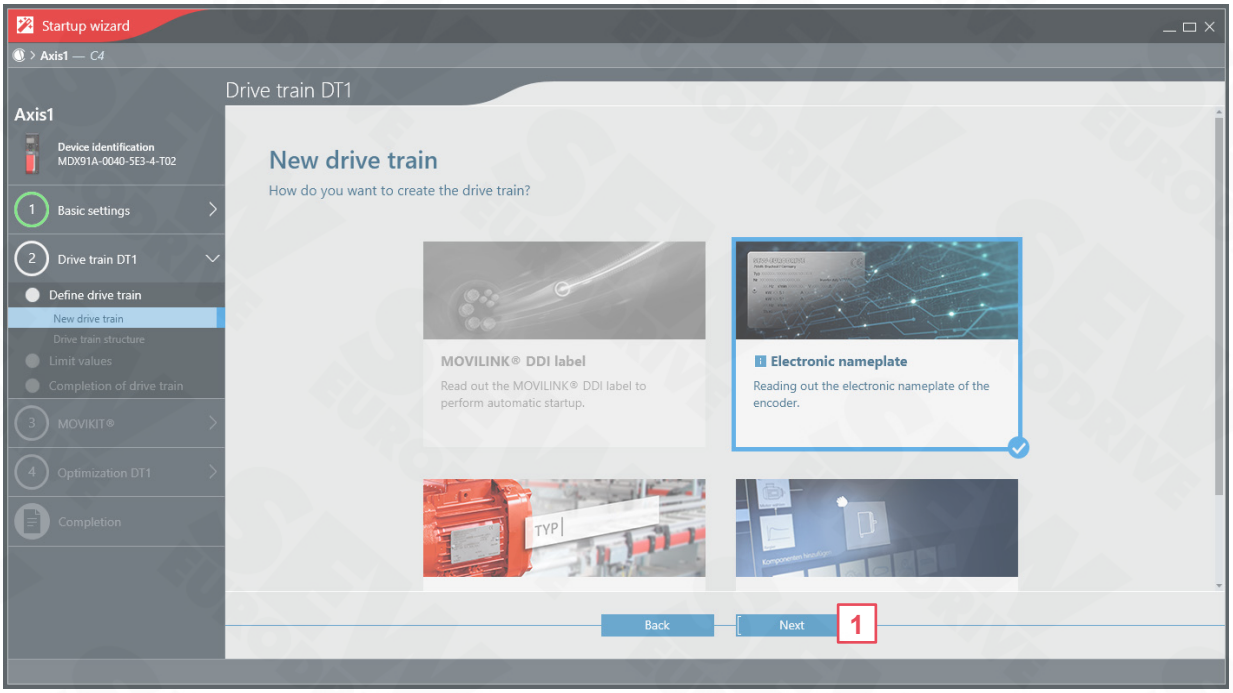
1 Select the appropriate settings and then click **Next**.

4.2 Startup of the drive train

Depending on the encoder type, you can choose from four variants for startup:

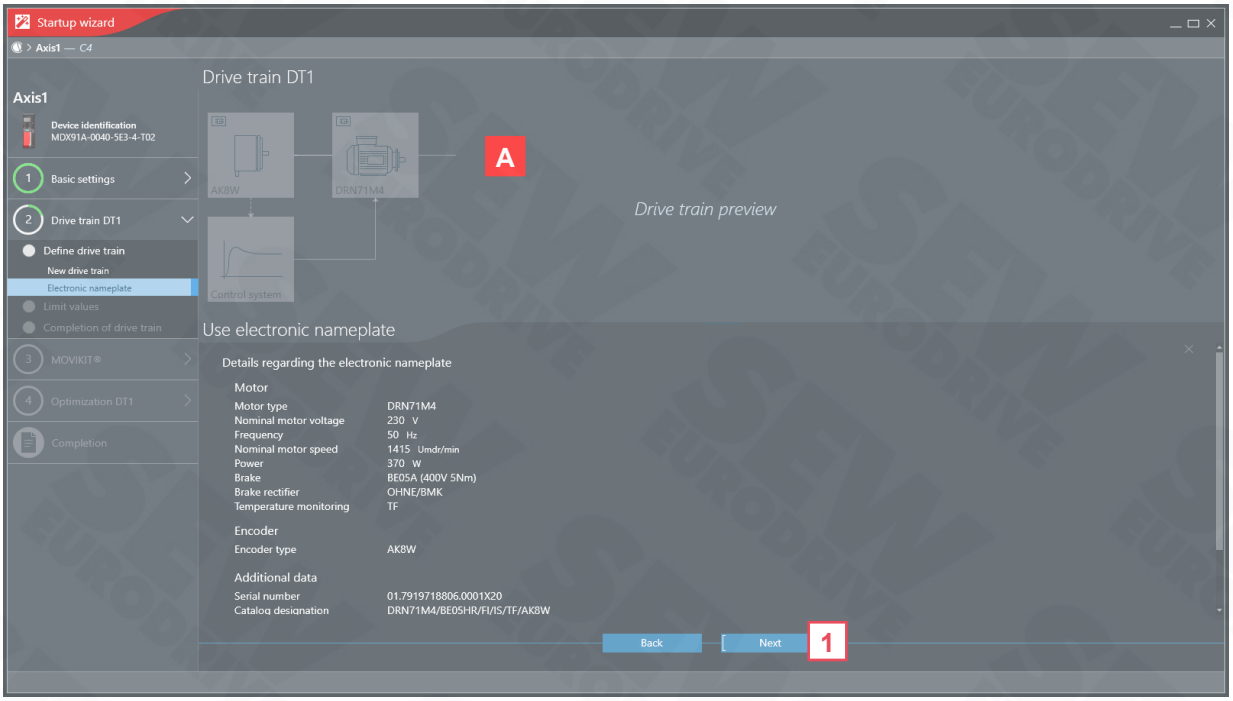
- MOVILINK® DDI label
- Electronic nameplate
- Nameplate/type designation
- Create the drive train manually

1. Perform startup with electronic nameplate



1 Select **Electronic nameplate** and then click **Next**.

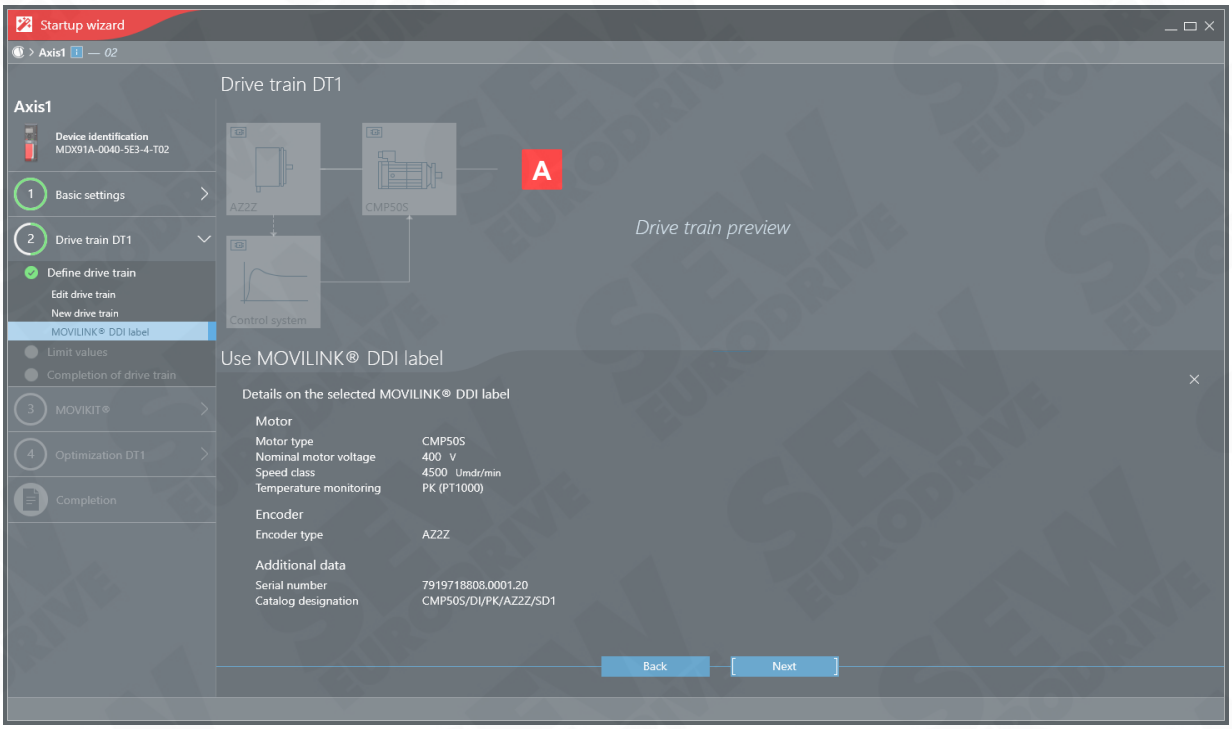
2. Apply preview of the drive train



1 Click **Next**.

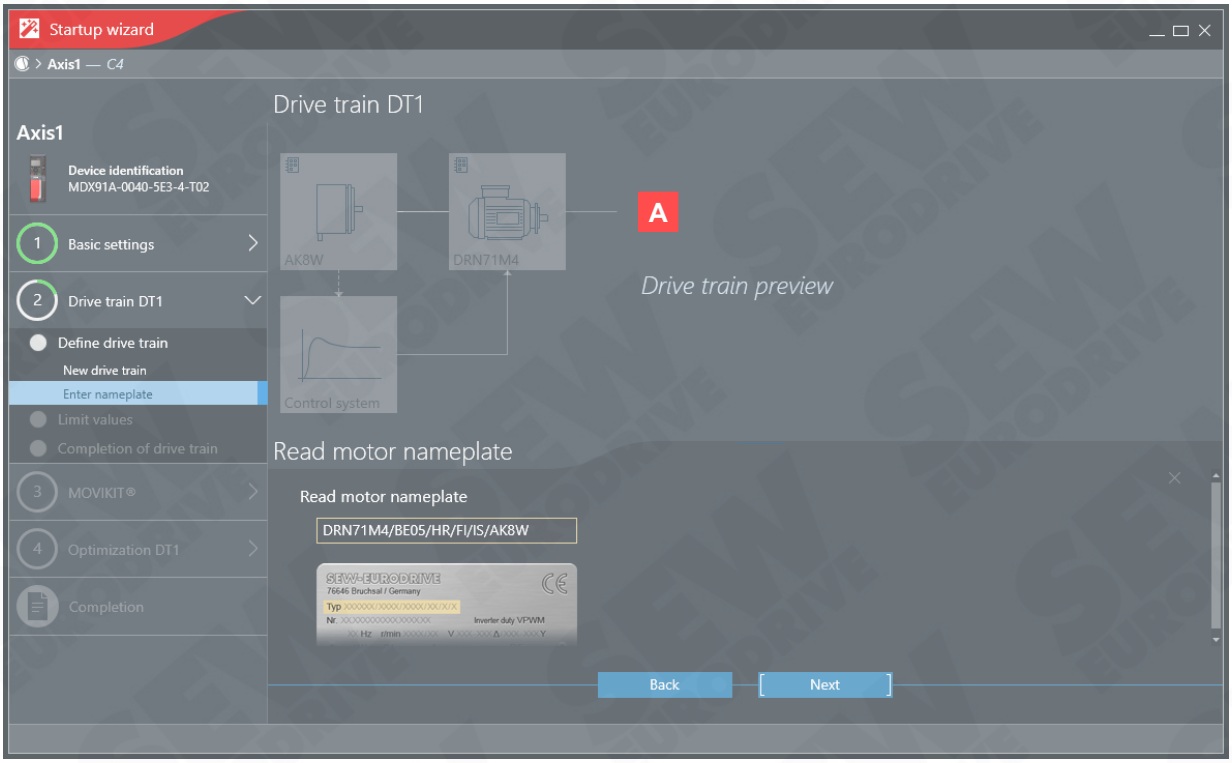
A The drive train is configured automatically using the electronic nameplate.

- Startup with MOVILINK® DDI label



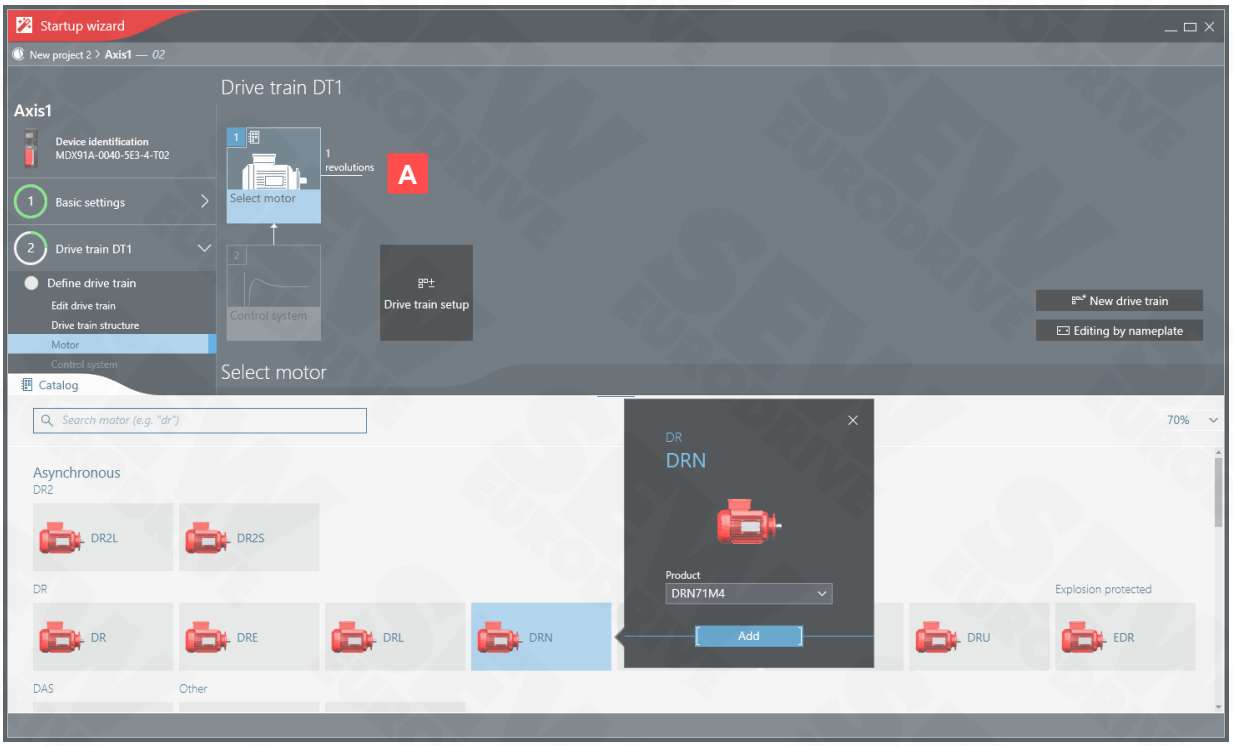
A For a motor with MOVILINK® DDI encoder, the drive train is automatically started up after delivery. For changes, always proceed as with a motor encoder with an electronic nameplate.

- Startup with nameplate/type designation



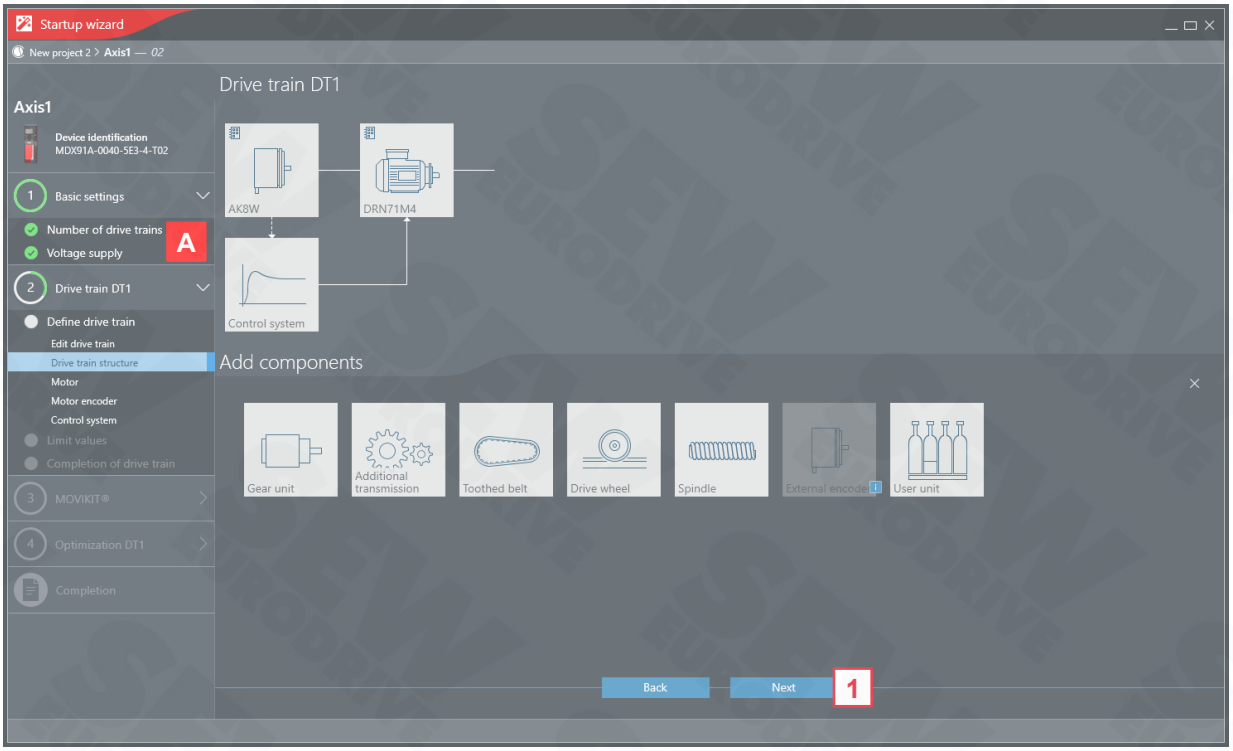
A For a motor encoder without an electronic nameplate, enter the motor data according to the nameplate and then take over the drive train. During the entry, the detected components are created automatically.

- Create the drive train manually



A As an additional option for a motor encoder without an electronic nameplate, you can create the drive train manually.

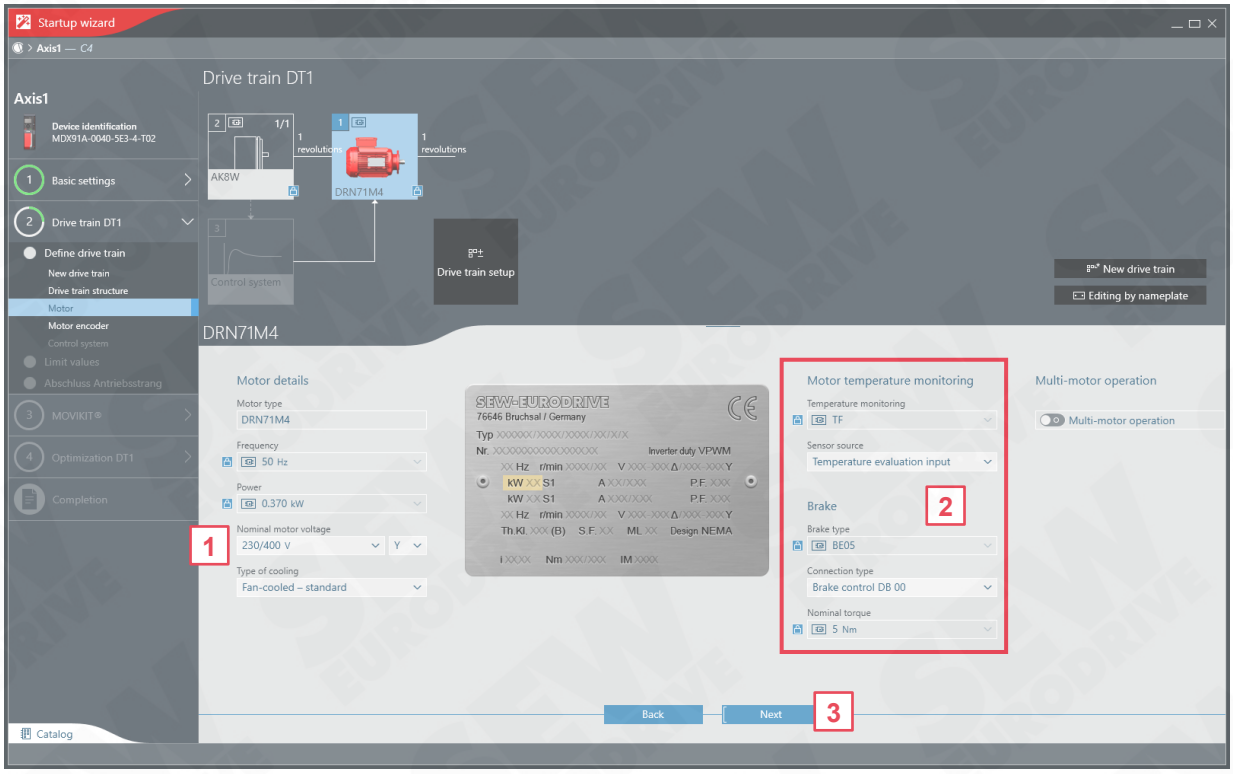
3. Perform the drive train assembly



1 Set up the drive train to suit your application and then click **Next**.
No changes to the training model are required at this point.

A You can select individual menu items directly in the process with a mouse click.

4. Configure the motor



1 Set the correct nominal motor voltage and connection.

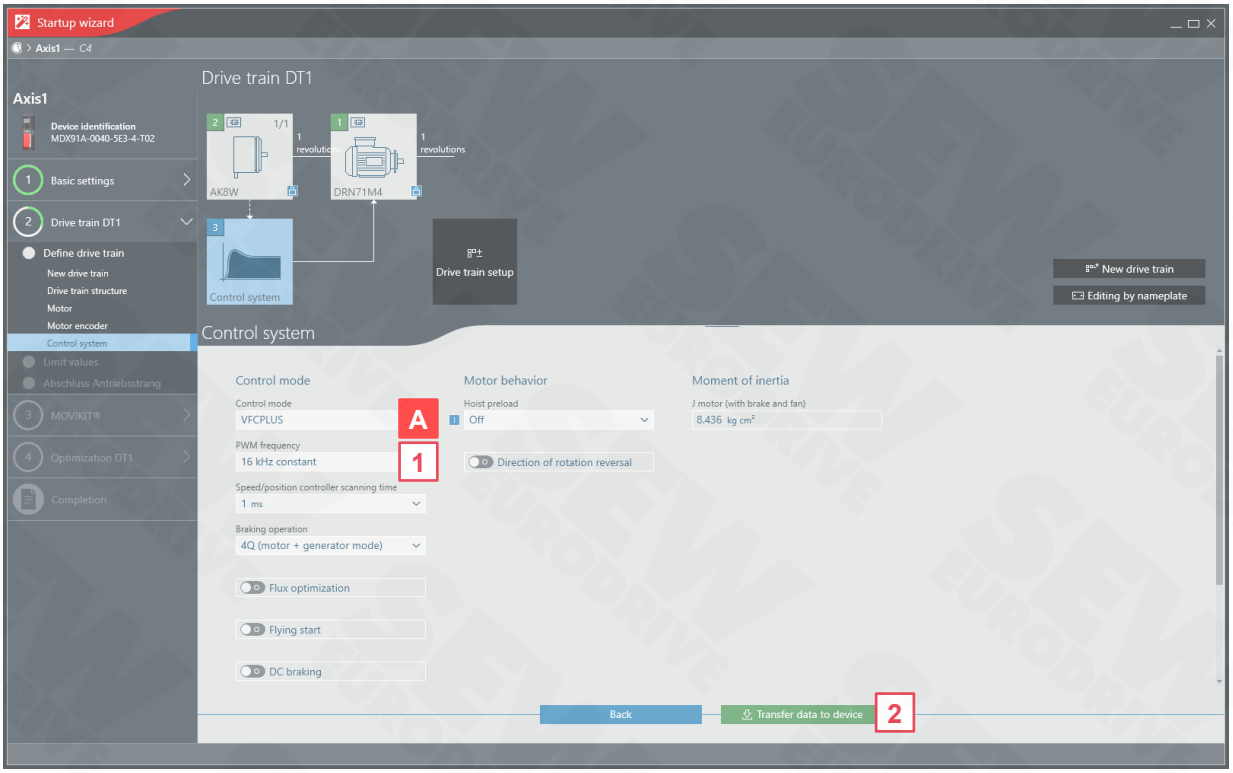
2 You can configure motor temperature monitoring and brake control here. For an encoder with electronic nameplate or MOVILINK® DDI label, these values are preset accordingly.

3 Click **Next**.

5. Configure the encoder

1 The initial values of the encoder data are retained; click **Next**.

6. Configure the control system

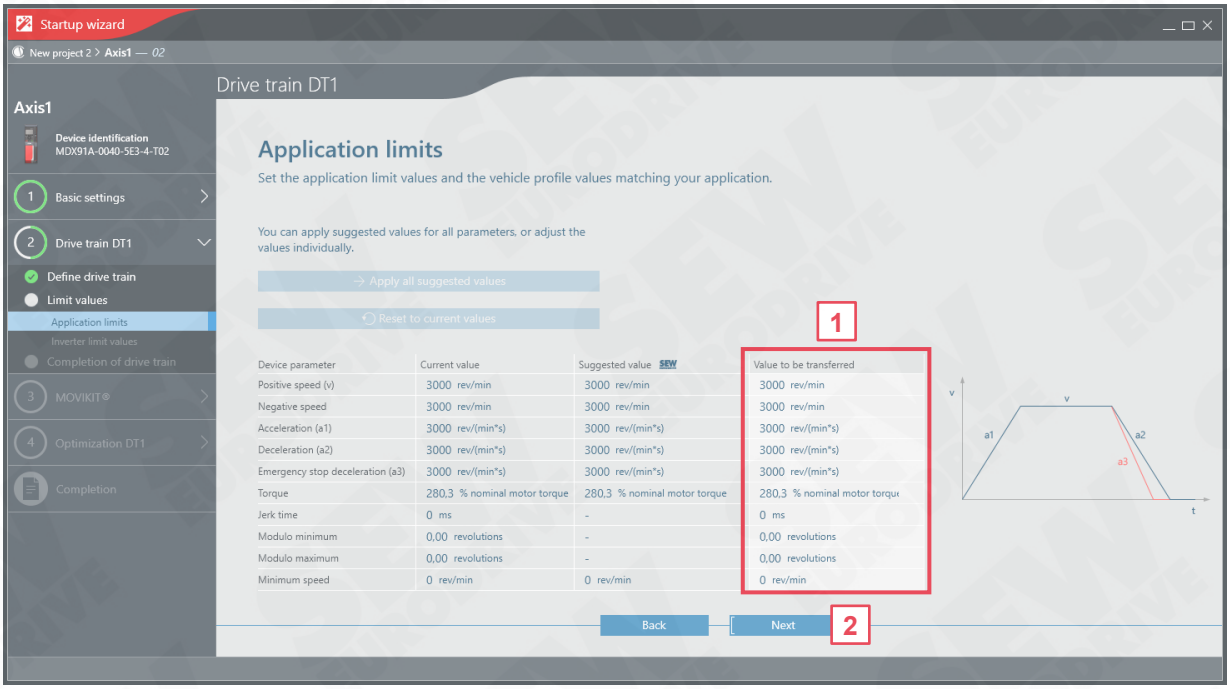


1 Change the PWM frequency **for training mode** to **16 kHz constant**. A higher PWM frequency leads to increased power loss, which may require a larger inverter. **For a real application noise-free operation must therefore be configured in advance!**

2 Apply the settings with **Transfer data to device**.

A You can select the desired control mode here. Different control modes are available depending on the motor type. VFC^{PLUS} is preset for an asynchronous motor.

7. Set application limits



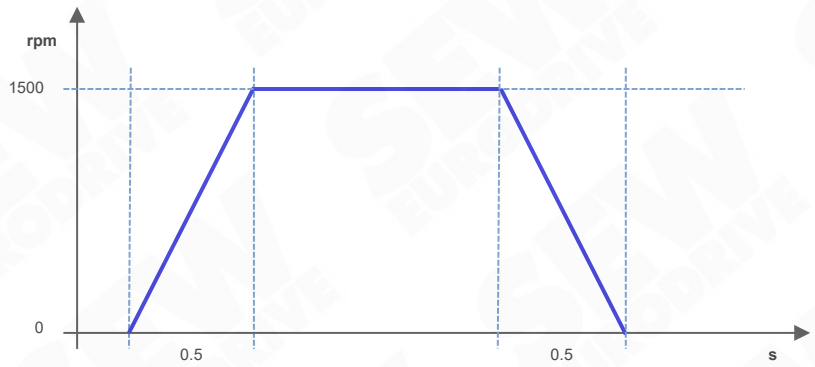
1 Configure the application limits to match your application. You can apply the proposed values completely or edit individual values manually. You can also make changes later in the **Functions > Monitoring functions > Limit values** parameter group.

2 Click **Next**.

The application limits must be adapted individually to the load states and the mechanics of the application.

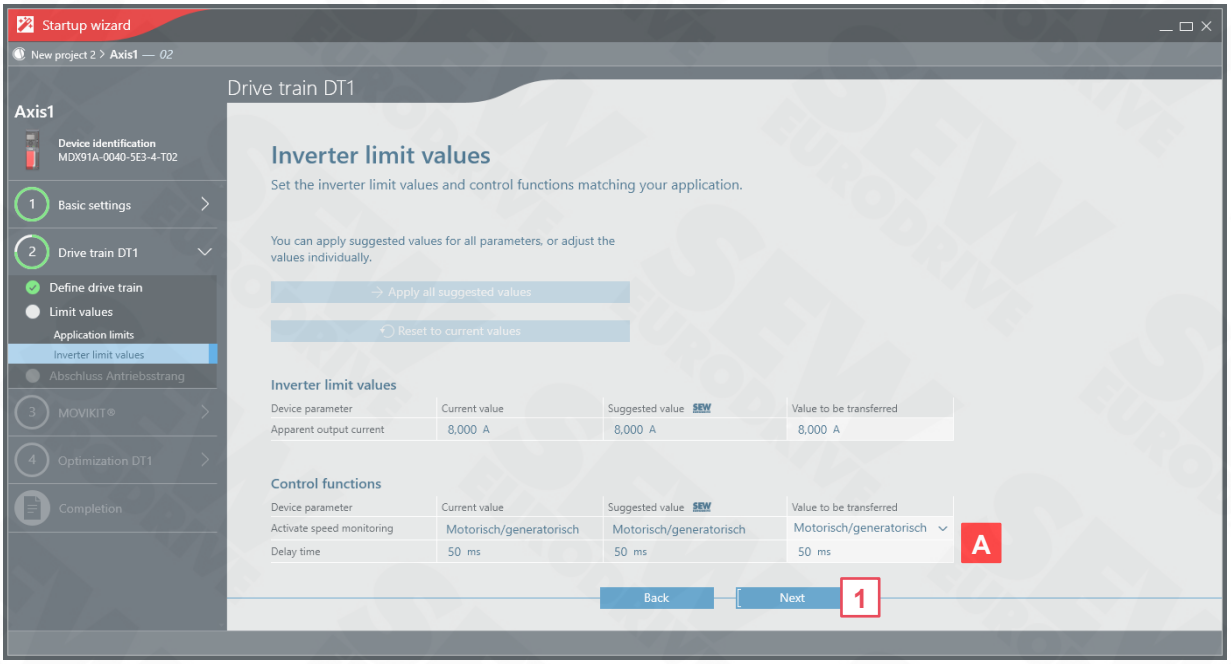
Example for setting acceleration and deceleration:

Positive speed	1500 rpm
Acceleration	3000 revolutions/min*s
Deceleration	3000 revolutions/min*s



The drive accelerates to 1500 rpm in 0.5 s.

8. Set inverter limit values

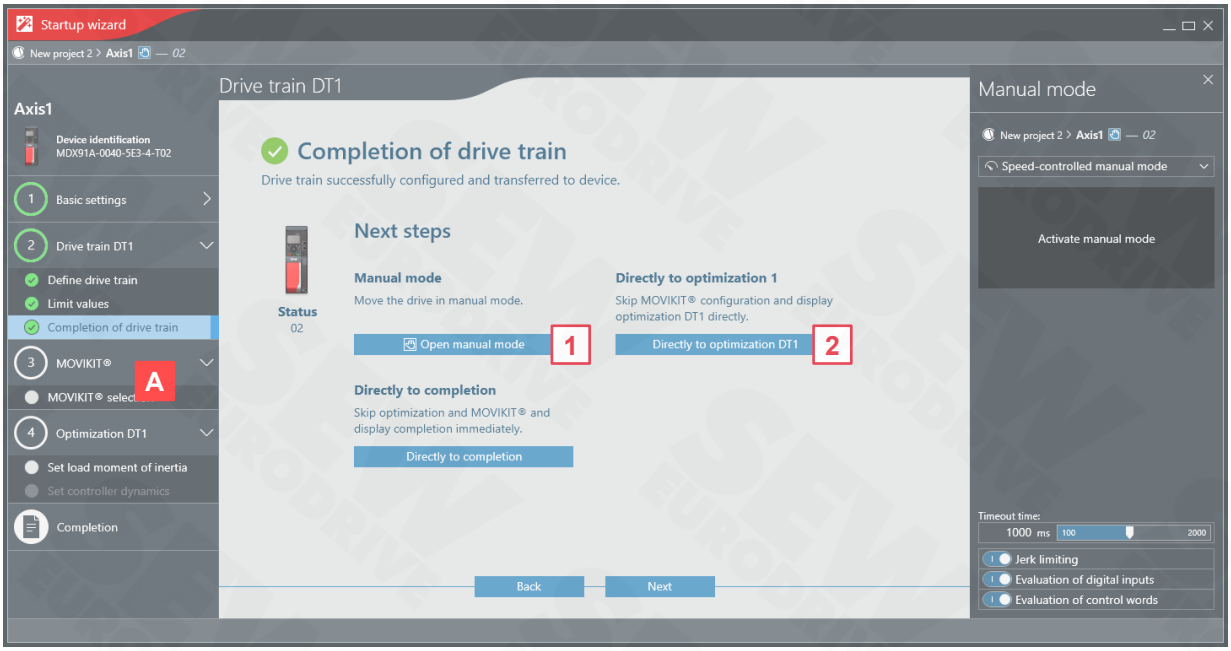


1 Apply the inverter limit values and click **Next**.

A By increasing the delay time, you can make speed monitoring less sensitive and thus prevent unwanted errors of the drive. Here, you can also switch off speed monitoring completely or selectively activate it for regenerative or motor operation. You can also make changes later in the **Monitoring functions > Control functions > Speed monitoring** parameter group.

To avoid damage, change the speed monitoring function with absolute care and adapt it to the requirements of the application.

9. Complete startup of the drive train



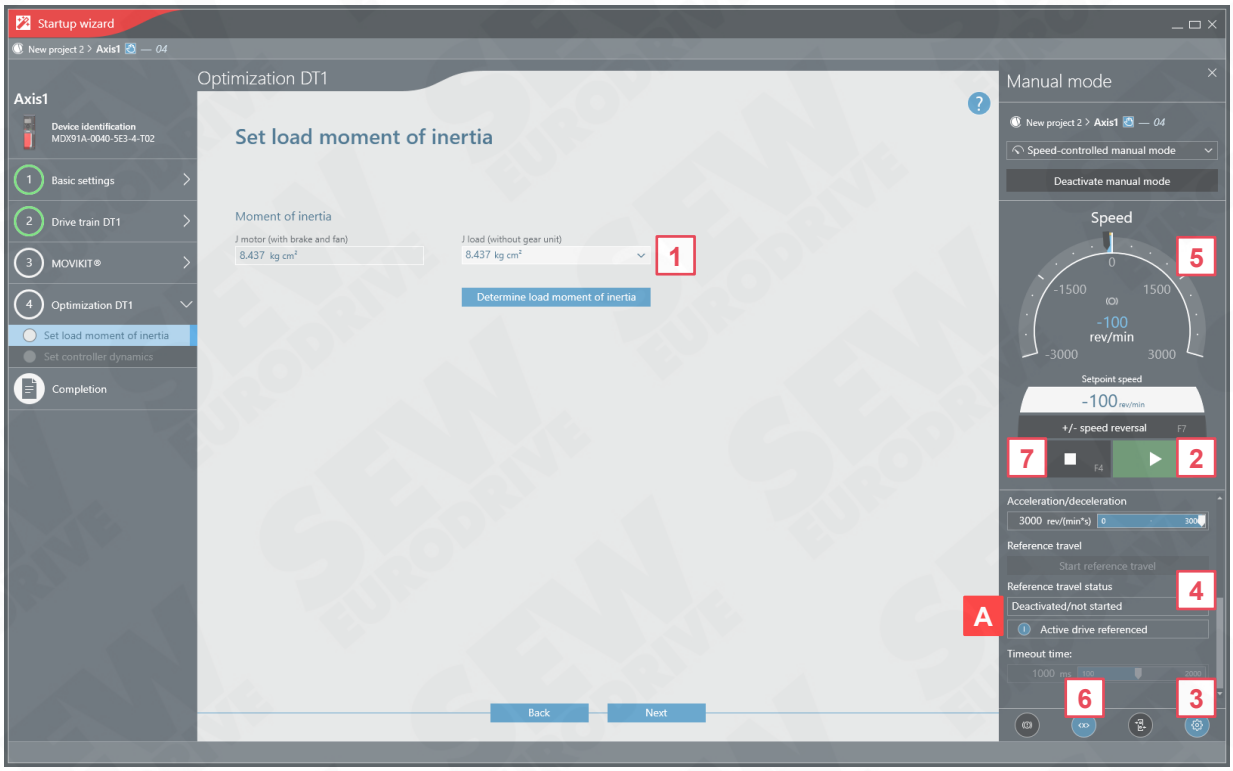
1 Open manual mode.

2 Select **Directly to optimization DT1.**

A The MOVIKIT® software modules will be started up later. For more information, refer to the Workbook C102 MOVIKIT® software modules category Drive.

4.3 Test the function of the drive

1. Preinitialize load moment of inertia and start test travel



Practical tip for the procedure on a system or machine:

1 Select a realistic value for pre-initialization of the drive from the list:
- Small load: J load = 1 x J-Motor
- Mean load: J load = 3 x J-Motor
- High load: J load = 10 x J-Motor

2 Perform a test drive:
- Switch on the digital input DI00 – output stage enable.
- Activate manual mode in **Speed-controlled manual mode**.
  Then travel at **slow speed** and test the correct function of the drive. Specify the **Setpoint speed** by typing the keyboard or dragging the tachometer with the mouse button pressed down. Change the direction of rotation via setpoint or **+/- speed reversal**.
- Then travel in negative direction to a safe position with sufficient distance to the left hardware limit switch or other travel limits.

3 Open the settings of manual mode.

4 Start the reference travel. The preset reference travel type references the drive at the current position.

5 Then move **slowly** in the opposite direction and test the available safe travel range here as well.

6 Open the display of the actual values and read the actual position.

7 Stop manual mode again and then optimize the drive train as described below.

A You can monitor the status of the reference travel here.

Make sure that moving in manual mode does not lead to a collision! Therefore, always move at low speed first and test the correct function of the drive. Also make sure that existing hardware limit switches have been started up correctly!
Do not move at full dynamics and speed until you have optimized the drive!

4.4 Optimization of the drive train

4.4.1 Determine the load moment of inertia

MOVISUITE® provides a convenient method of determining the load moment of inertia for the VFC^{PLUS}, CFC and ELSM® control modes. The measurement is performed during acceleration and deceleration of the drive. The travel profile during the measurement must therefore include changes in speed or direction of rotation.

1. Determine load moment of inertia

1 Switch manual mode to **Load cycling absolute**. As a result, the drive positions cyclically between the two specified positions.

2 Specify the two target positions within the previously determined travel range. Position 2 must always be greater than position 1.

3 Set **Positioning speed**.

4 Start the measurement.

5 Start the travel process and leave it active until valid measured values (recognizable by the green frame) are displayed.

6 Stop the travel process.

7 Click **End measurement and save value to device**.

8 Click **Next**.

A You can set the ramp for acceleration and deceleration here. The lower value of the application limits acceleration or deceleration is adopted as the maximum value.

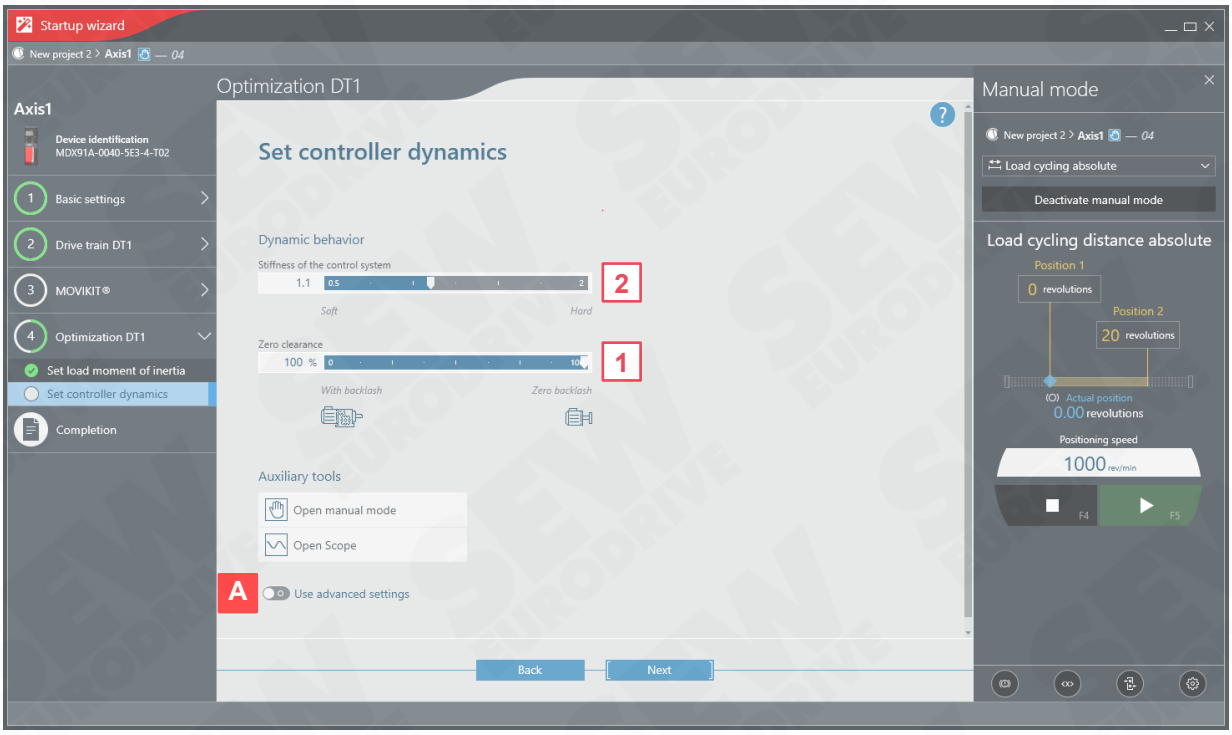
B You can specify the **Cycle idle time** of the Load cycling absolute mode here.

Load cycling absolute mode is only available for motors with encoder. For motors without encoder, perform the determination of the load moment of inertia in speed-controlled manual mode.

4.4.2 Set controller dynamics

Controller oscillation can damage the application. Therefore, proceed with extreme caution and care when setting the controller dynamics on a system or machine.

1. Optimize dynamic behavior



1 Set the zero clearance:
- 0%: Standard gear units
- 50%: E.g. toothed belt with low backlash planetary gear unit
- 100%: Direct drive, e.g. rotating knife

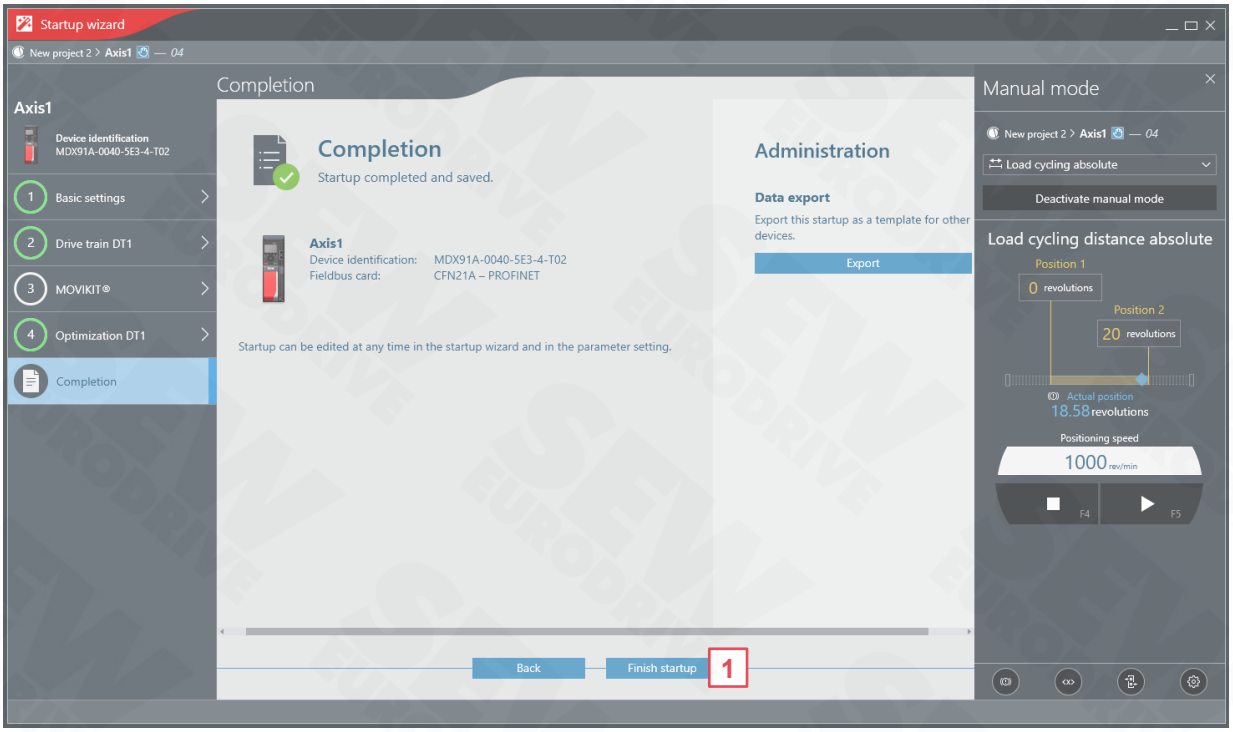
2 **Practical tip:** Carefully increase the stiffness with the default value starting at slow speed until the drive begins to oscillate audibly. The optimum controller setting for the stiffness is approx. 70% of this critical value.

A You can set the controller parameters individually here.

Stiffness is a function introduced by SEW-EURODRIVE for convenient setting of the various controllers with just one parameter. This allows the control behavior to be easily varied between very soft and slow (stiffness 0.5) to very hard and dynamic (stiffness 2.0). The default setting is 1.0.

- If the stiffness is increased, the controller responds more quickly to control deviations. From a critical value, the control loop oscillates, which results in noise from the motor.
- If the stiffness is reduced, the controller responds more slowly to control deviations. The speed deviations and the lag distance increase.

2. Complete startup



1 Complete startup with **Finish startup**. This automatically closes the startup wizard.

4.5 Save inverter data

3. Save the project to the PC

1 Changes in the project have not yet been saved in the project path on the hard disk.
To save the data, click the save icon .

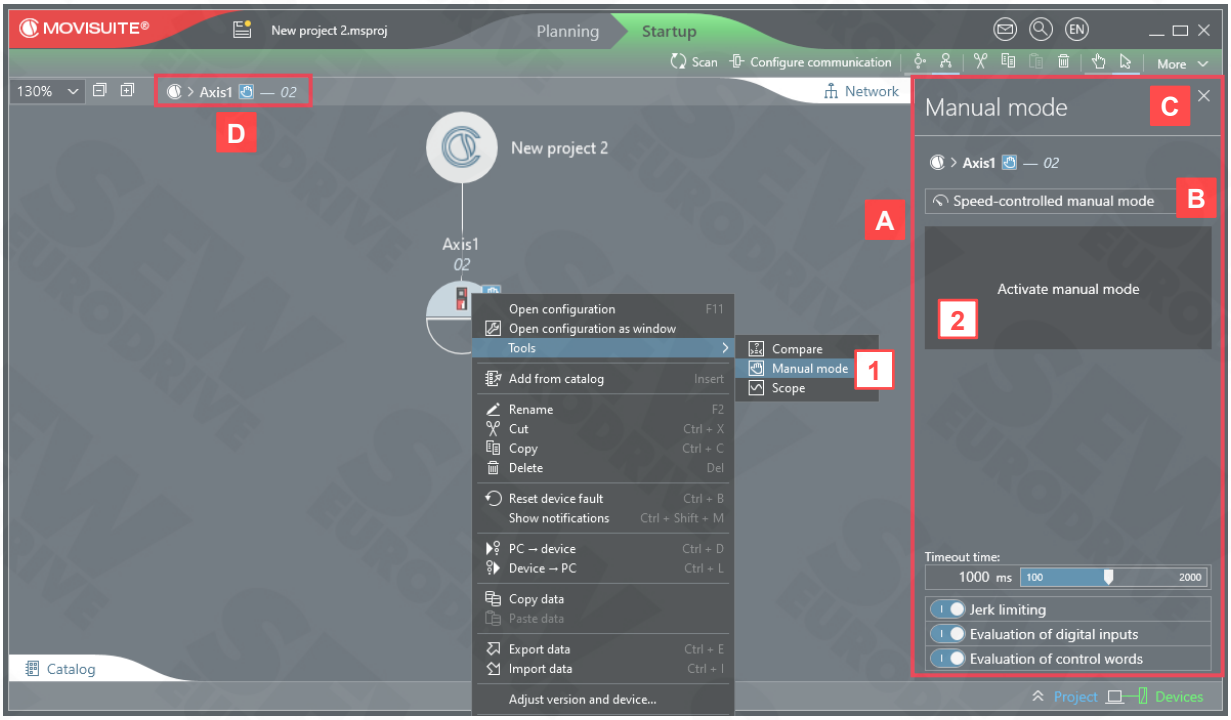
5 Manual mode

Objectives:
- You can start and end manual mode
- You can move the drive in different manual modes

Make sure that moving in manual mode does not lead to a collision! Therefore, always move at low speed first and test the correct function of the drive. Also make sure that existing hardware limit switches have been started up correctly!

The drive can be moved using MOVISUITE® in manual mode. The manual mode window can be started and displayed in parallel with the other applications. Manual mode can only be switched on with one drive at a time.

1. Switch on manual mode



1 Right-click to open the context menu and select **Tools > Manual mode**.

2 Click **Activate manual mode**.

A Manual mode is always displayed on the right as a narrow window.

B Manual mode has four operating modes; when used without a motor encoder, only speed-controlled manual mode is available.

Mode:

- Speed-controlled manual mode: Control via speed setpoints with or without motor encoder
- Positioning-controlled manual mode: Absolute positioning with a target position
- Load cycling absolute: Cyclic absolute positioning between two target positions
- Cycle mode: Cyclic relative positioning

C You can close manual mode again by clicking ×.

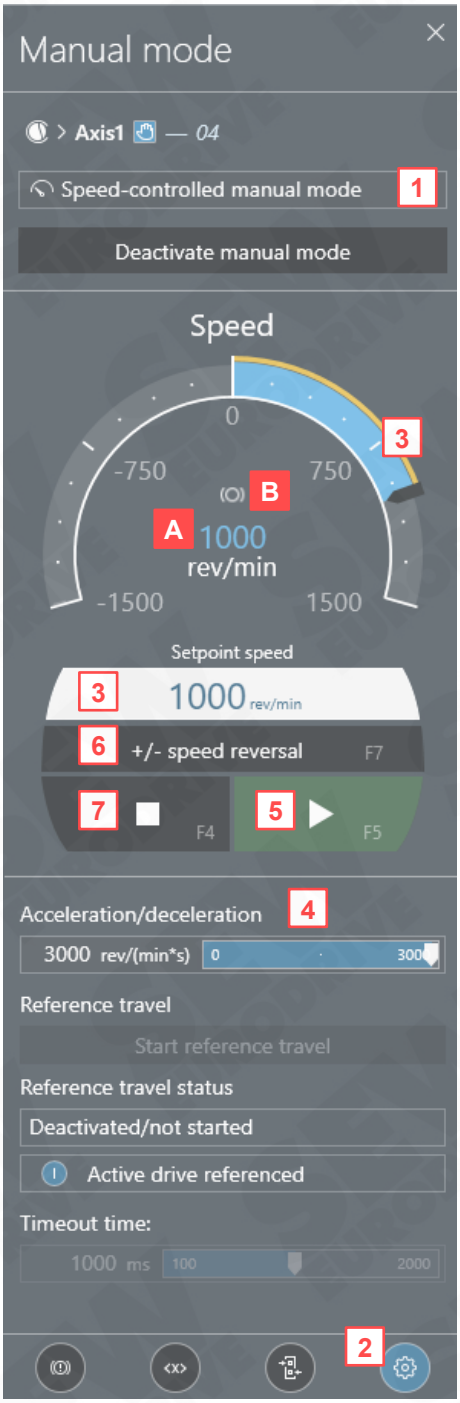
D The status display shows which drive is currently in manual mode.

In order for the drive to be moved in manual mode, the drive must be enabled via input DI00 = 1.

Displaying the 7-segment display in manual mode:

Display	Meaning	Status DI00 / Output stage enable	Manual mode
01	Output stage inhibit	DI00 = 0	deactivated
04	Manual mode	DI00 = 1	active

2. Move the drive in speed-controlled manual mode



1 Select **Speed-controlled manual mode.**

2 Display the setting values.

3 Set the setpoint speed in the tachometer with the mouse or enter it in the edit box.

4 Set **Acceleration/deceleration**.

5 Start the movement with  .

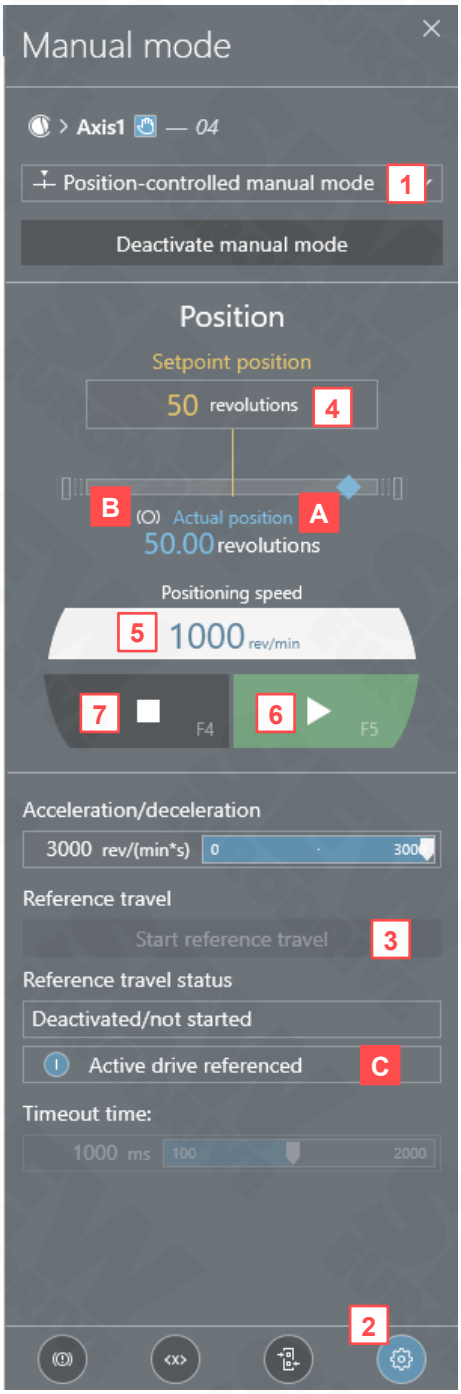
6 Click **+/- speed reversal** to change the direction.

7 Here you can stop the drive  .

A Actual speed

B Status of the brake

3. Move the drive in position-controlled manual mode



1 Select **Position-controlled manual mode**.

2 Display the setting values.

3 Start referencing.

4 Set the setpoint position.

5 Set the positioning speed.

6 Start the movement.

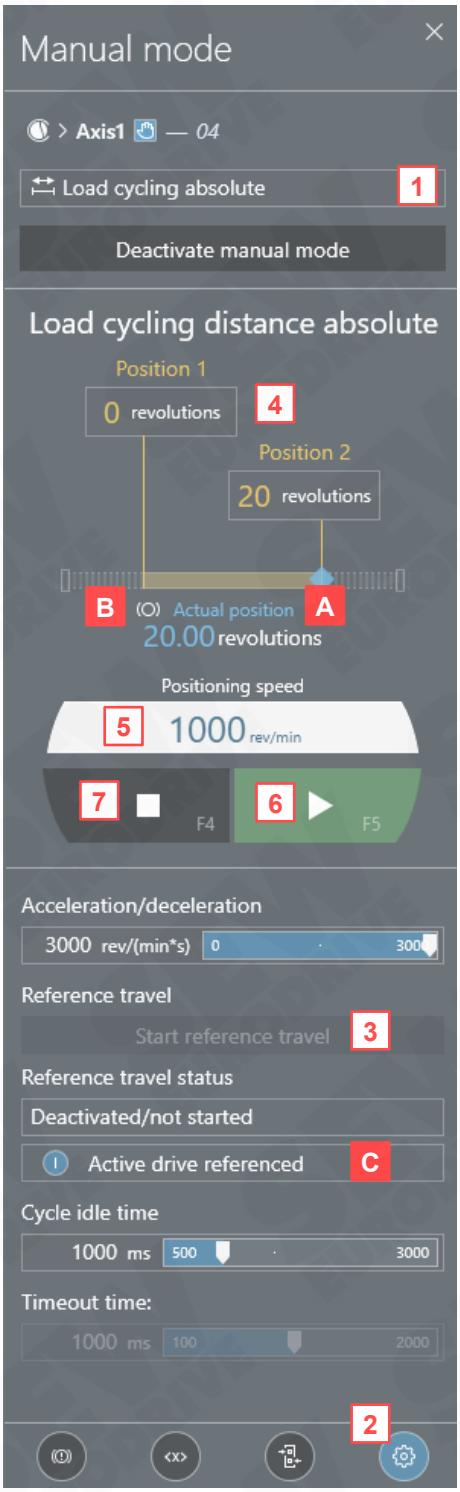
7 Here you can stop the drive.

A Actual position

B Condition of the brake

C Drive is referenced

4. Move the drive in absolute mode in alternating operation



1 Select **Load cycling absolute**.

2 Display the setting values

3 Start referencing

4 Set the two target positions.
Position 2 must always be greater than Position 1!

5 Set the positioning speed.

6 Start the movement.

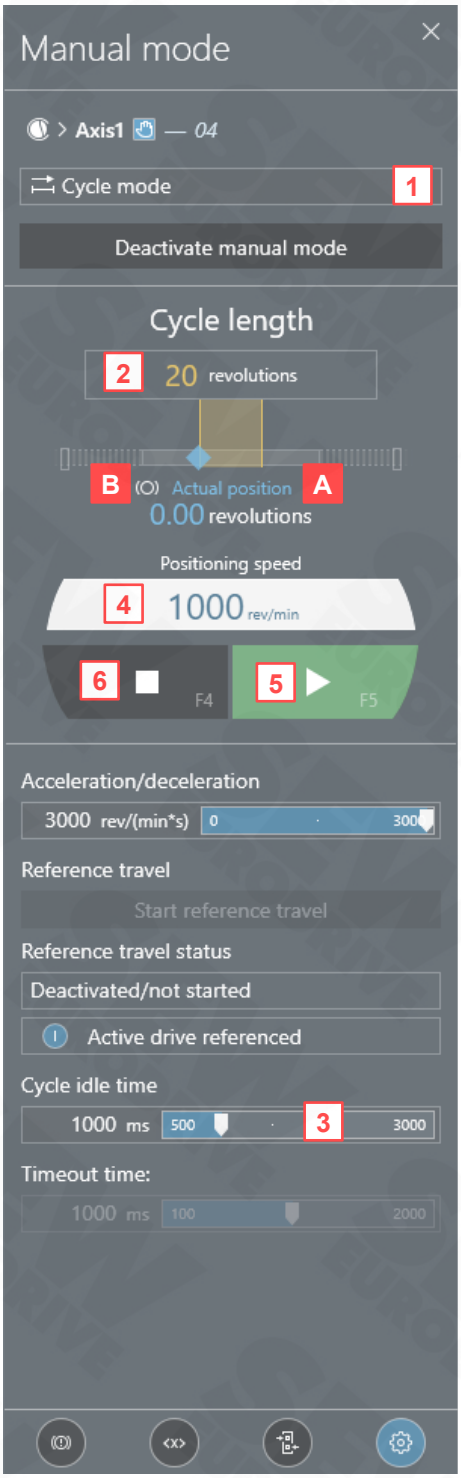
7 Here you can stop the drive.

A Actual position

B Condition of the brake

C Drive is referenced

5. Move the drive in cycle mode



1 Click **Cycle mode.**

2 Set the **Cycle length**.

3 Set the **Cycle idle time**.

4 Set the **Positioning speed**.

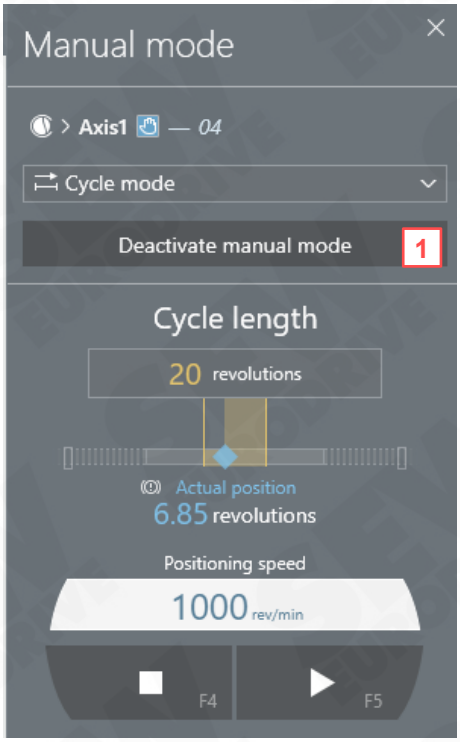
5 Start the movement.

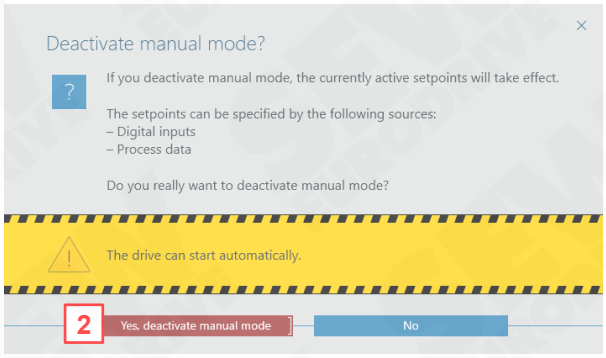
7 Here you can stop the drive.

A Actual position

B Condition of the brake

6. Deactivate manual mode





1 Click **Deactivate manual mode**.

2 Click **Yes, deactivate manual mode** to exit manual mode.

The currently present setpoints become active again and the drive can start automatically.

6 Drive diagnostics

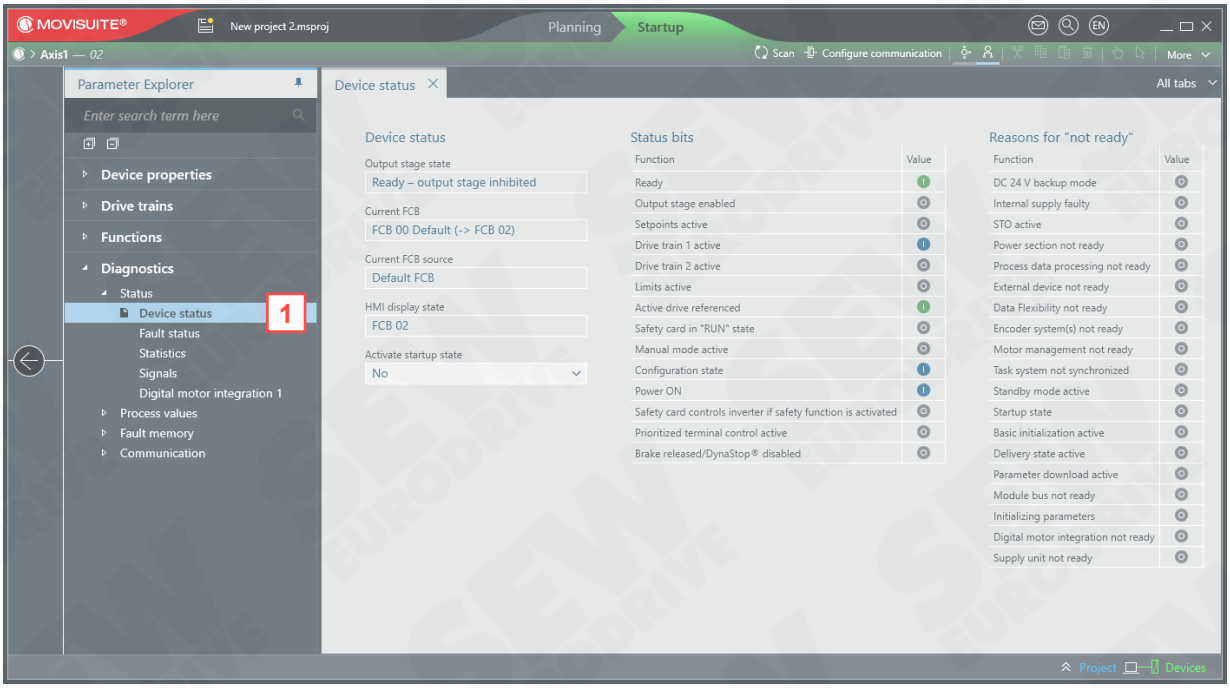
Objectives:

- You can generate an error on the active drive
- You can diagnose and correct the error
- You can acknowledge the error

6.1 Diagnostics parameter group

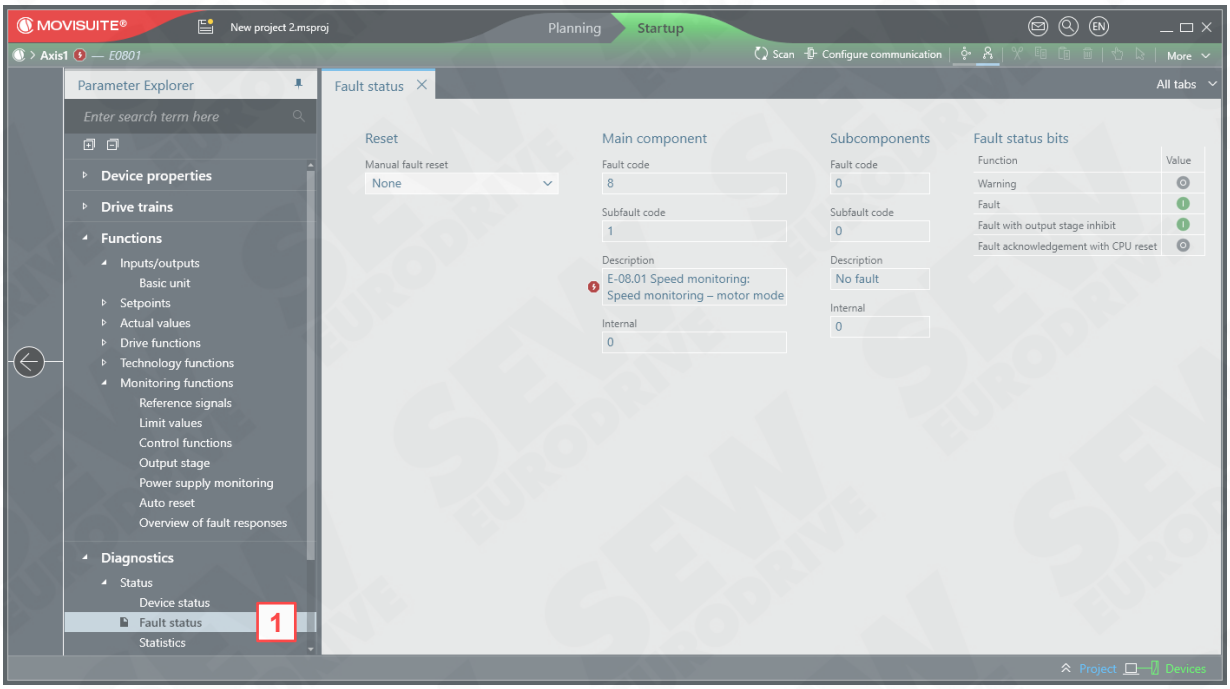
6.1.1 Device status and fault status

1. Device status



1 You can find the status information of the inverter under **Diagnostics > Status > Device status**.

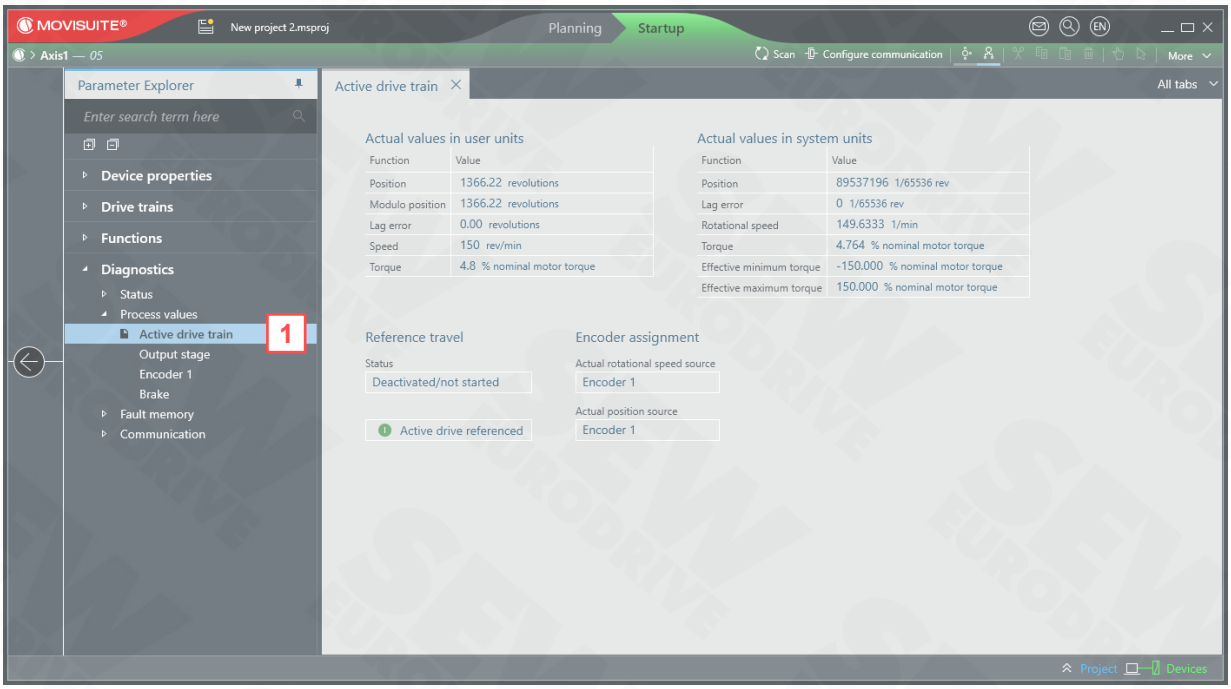
2. Fault status



1 You can find the fault information of the inverter under **Diagnostics > Status > Fault status**.

6.1.2 Process values

1. Open process values

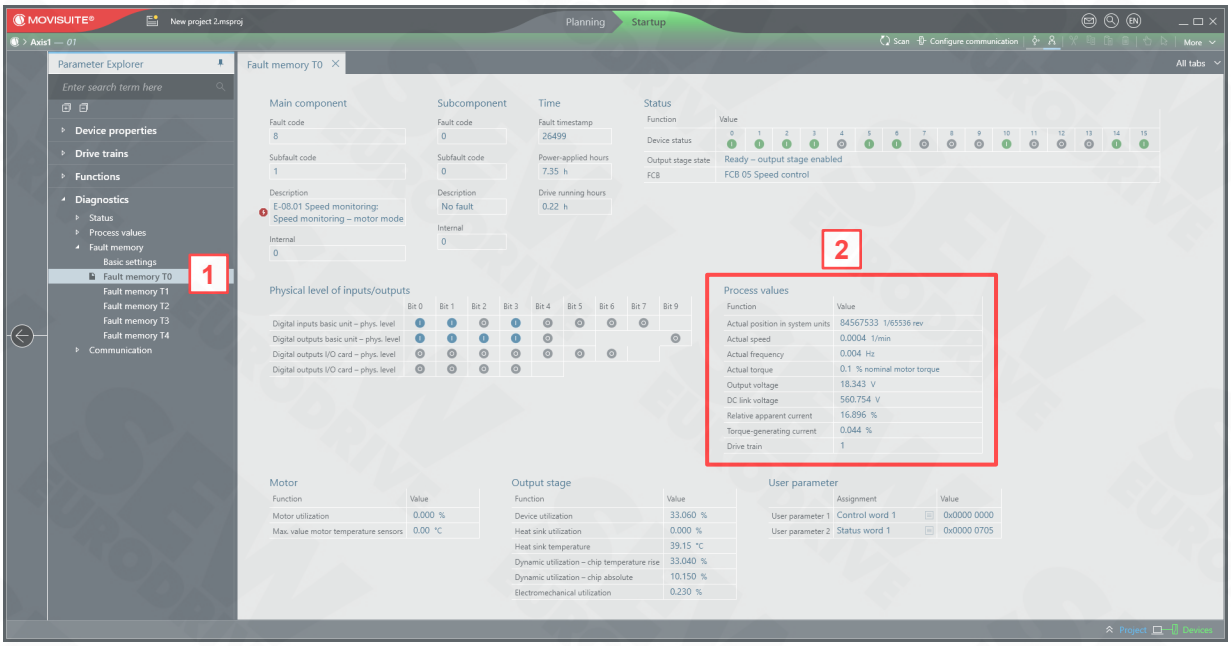


1 Select **Diagnostics > Process values > Active drive train** to display the most important process values of the inverter.

6.1.3 Fault memory

The fault memory consists of five storage locations T0 to T4 in which the most recent inverter faults with fault status and the most important drive values at the time of the fault are displayed. The fault memory is filled according to the stack principle, the last fault that occurred is displayed in T0.

1. Read out fault memory

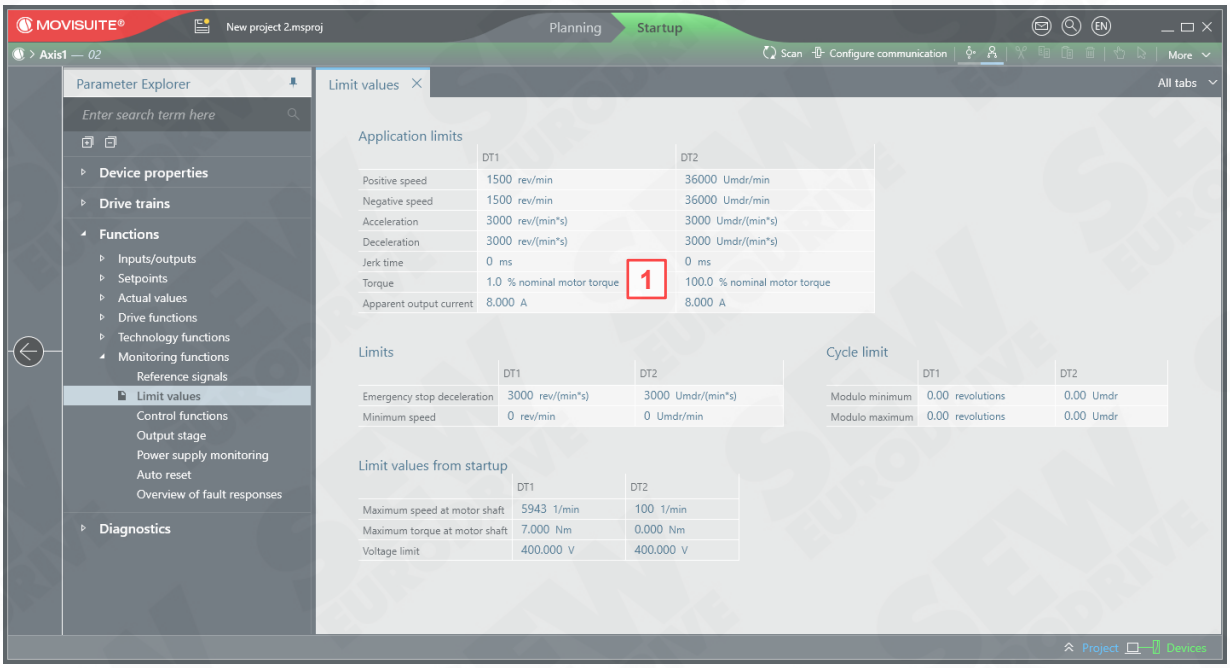


1 Select **Diagnostics > Fault memory > Fault memory T0.**

2 The process values provide information about the fault (actual position, speed, torque, etc.).

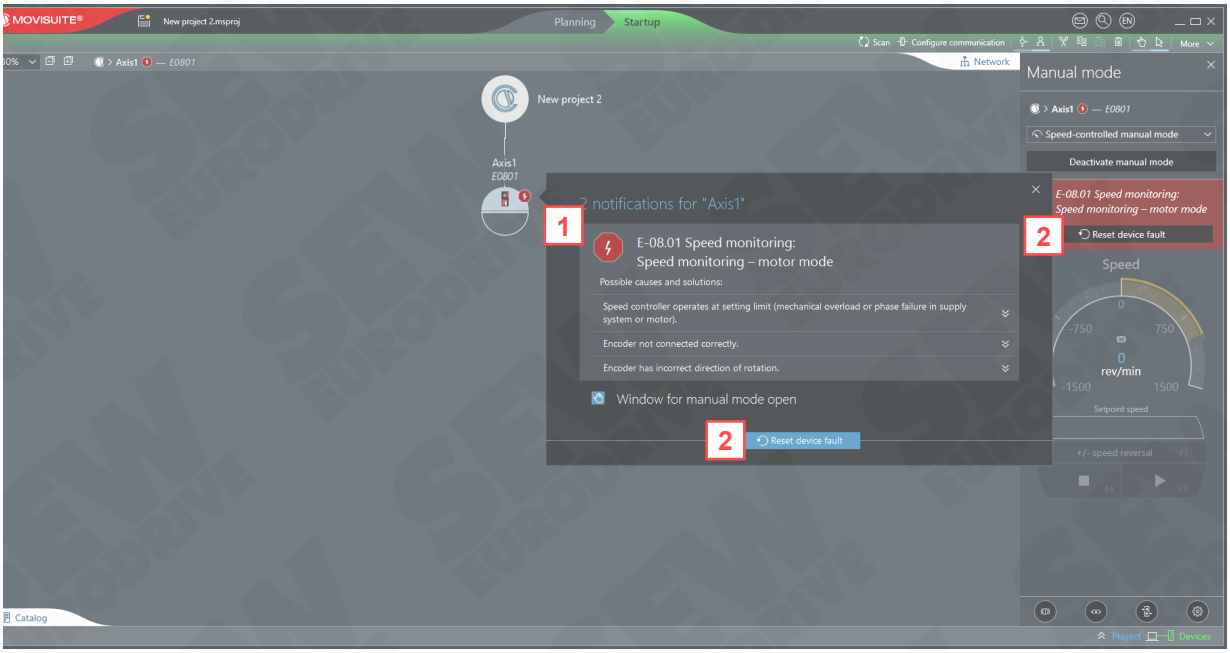
6.2 Fault diagnostics and acknowledgment

1. Generate error by reducing the torque



1 Reduce the torque by selecting **Monitoring functions > Limit values > Application limits > Torque > 1% nominal motor torque** and then move the drive in manual mode.

2. Diagnose and acknowledge the error on the active drive



1 Error E-08.01 appears on the inverter display. 08 is the main error number and 01 is the sub-error code. When the mouse is hovered over the error icon, a context menu with the cause of the error is displayed in short form. You can obtain detailed error information with possible causes and possible remedies by clicking the error icon.

2 Then reset the torque limit to its original value and acknowledge the error.

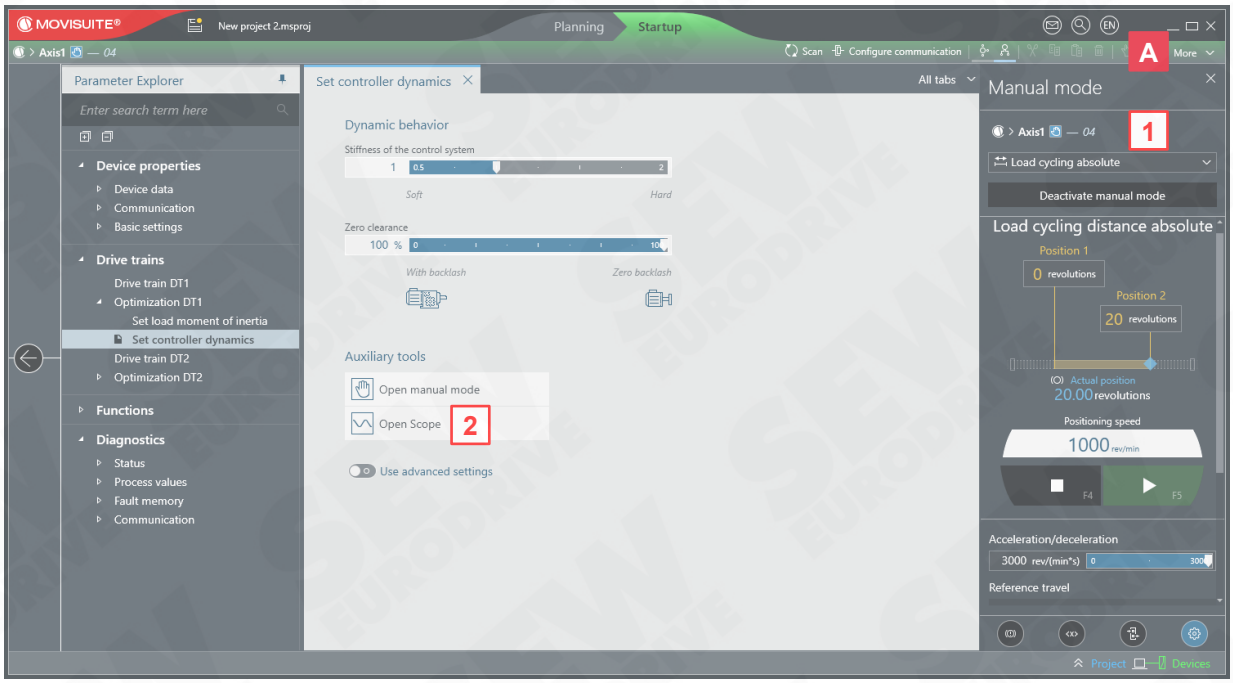
7 Drive optimization and diagnostics with Scope

Objectives:

- You can perform Scope recordings
- You can evaluate Scope recordings

7.1 Scope measurement in continuous trace mode

1. Open Scope



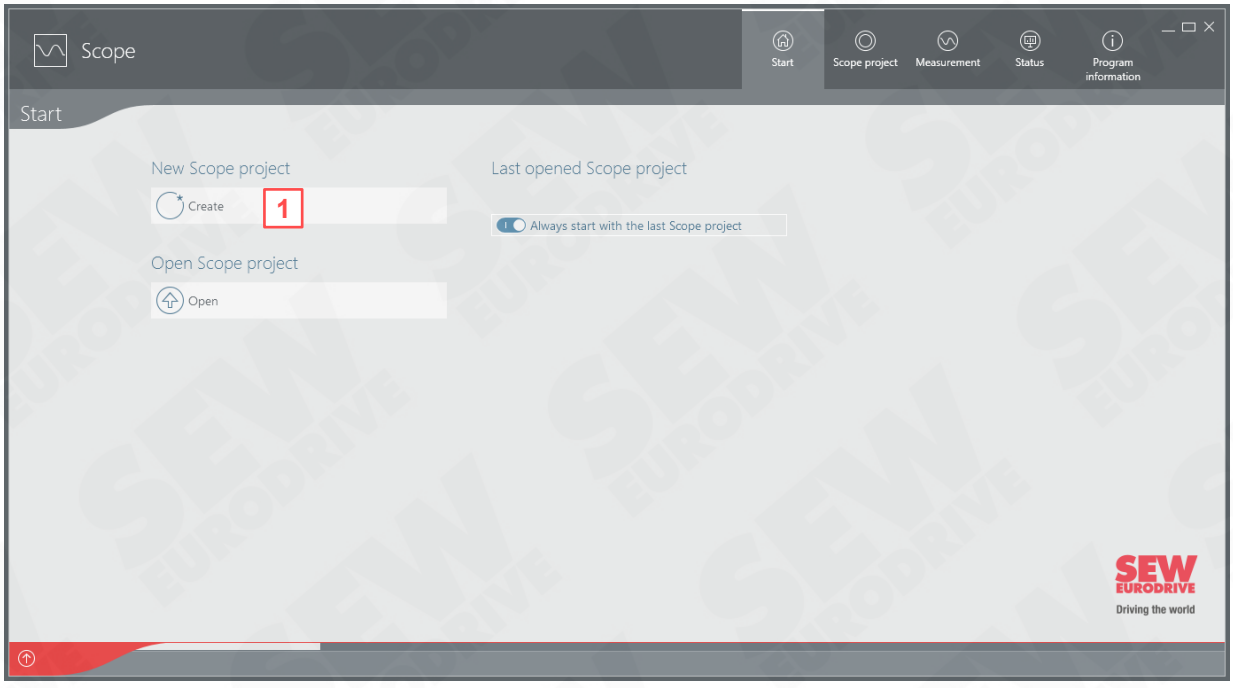
1 Start and configure manual mode as shown:

Mode	Load cycling absolute
Positioning speed	1000 rpm
Oscillation distance	0 – 20 rev.
Acceleration/deceleration	3000 revolutions/min*s

2 Open Scope.

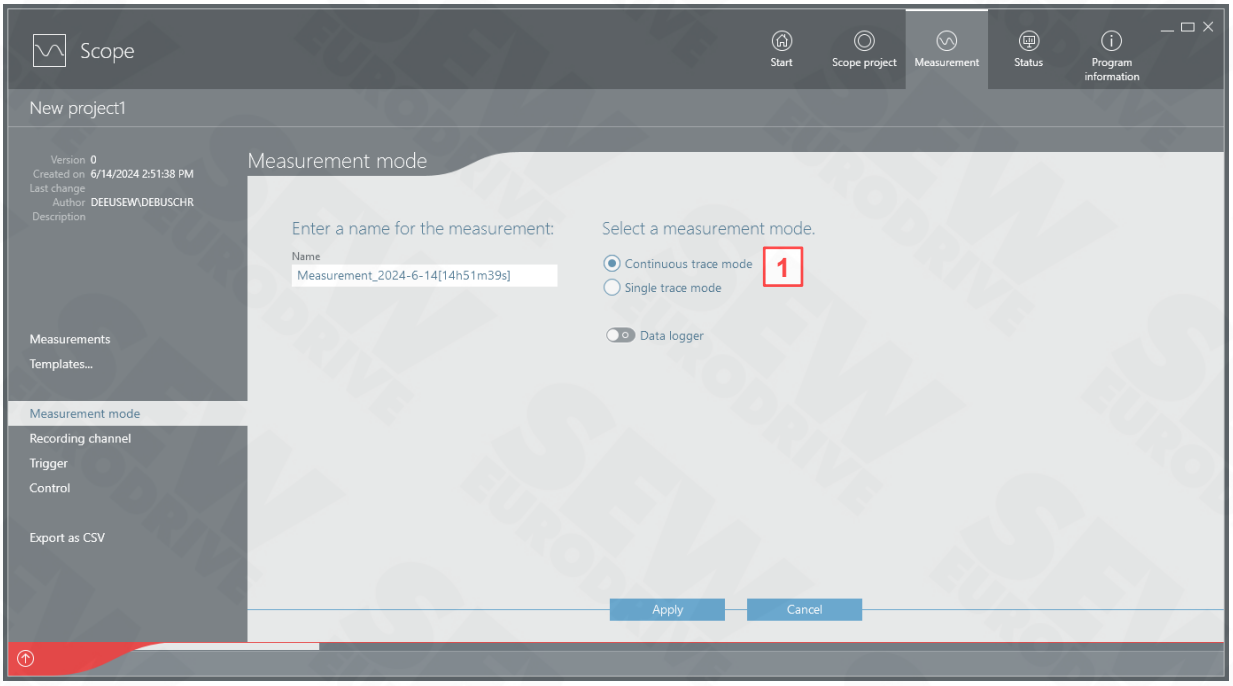
A Alternatively, you can also start Scope under **More > Tools > Scope**.

2. Create Scope project



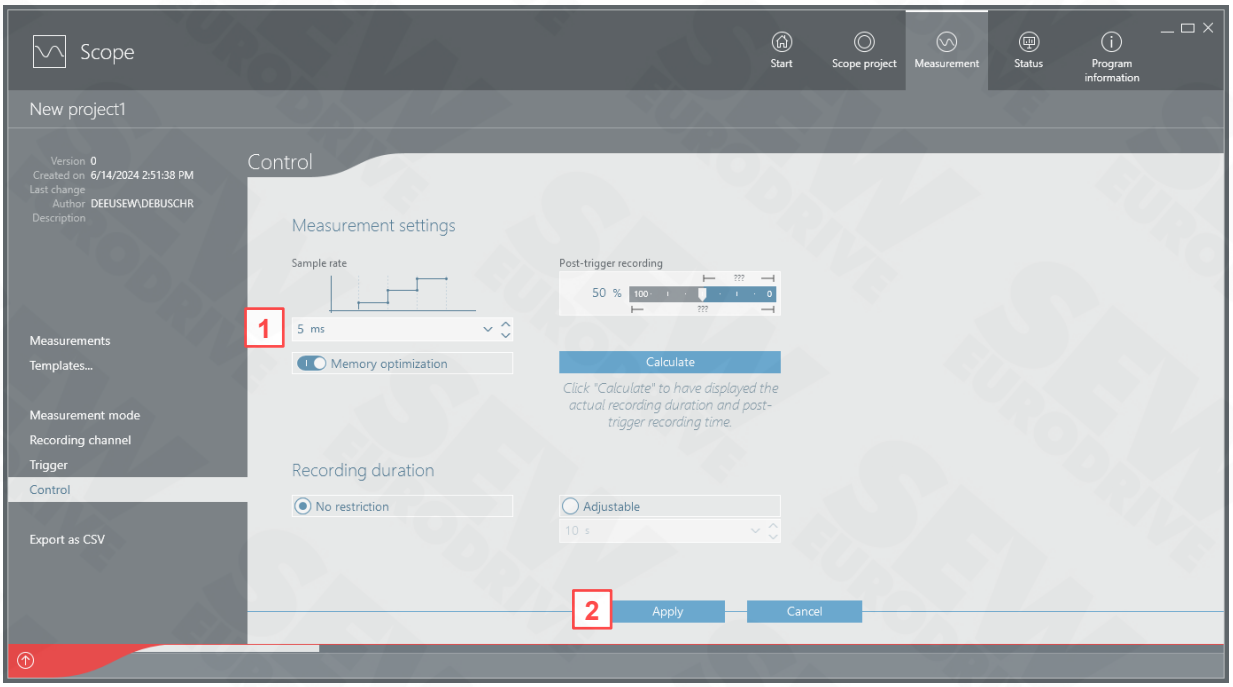
1 Create a new Scope project.

3. Select measurement mode



1 Select **Continuous trace mode**.

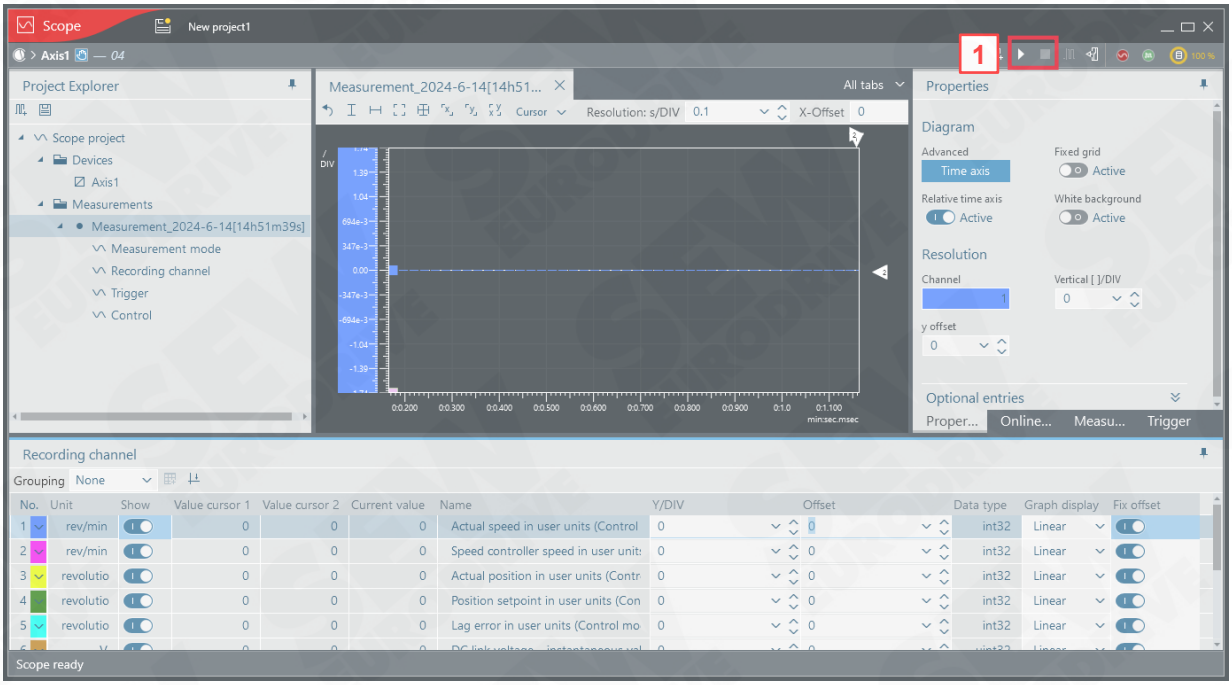
4. Configure the control system



1 Select **Control > Sample rate > 5 ms**.

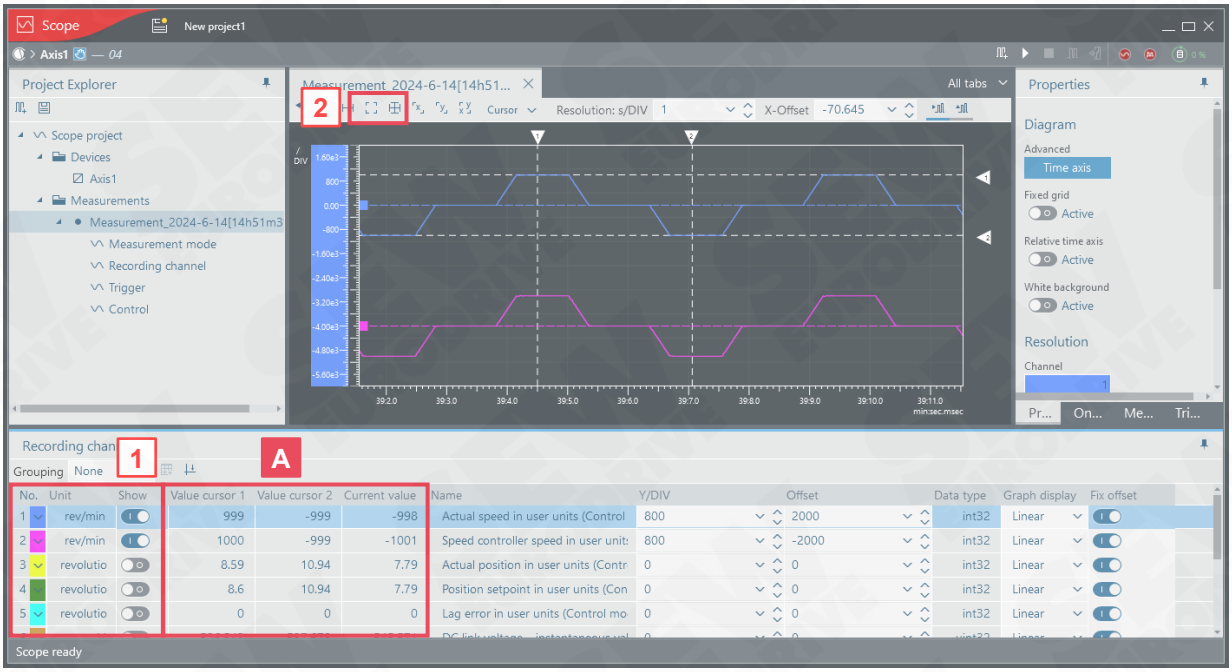
2 **Apply** the settings.

5. Start and stop the Scope measurement



1 Start ▶ the measurement and then move the drive in manual mode. Stop ■ the measurement again after a few travel cycles.

6. Measurement result



1 Here you can show, hide and group measurement channels as desired.

2 Align the measuring channels; Scope performs an auto scaling function.

- All measuring channels are displayed below each other
- All measuring channels are placed on top of each other

A Here you can see the measured values of the two horizontal measurement cursors and the current value of the mouse pointer when you move it over the measurement.

7.2 Evaluation of the Scope measurement

Meaning of the symbols in the measuring window:

Switch to the previous display/scaling setting

Optimization of scaling in Y direction

Optimization of scaling in X direction

Scaling setting so that all signals are displayed on the display.

All channels are aligned so that each channel uses the full height of the display. The signals are superimposed.

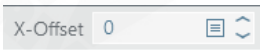
Activation of the zoom function with the mouse in the x-direction.

Activation of the zoom function with the mouse in the y-direction.

Activation of the zoom function with the mouse in the xy direction.

Visible: Display of the cursors

Resolution of the X axis (time axis)



Specification of the X offset so that the curve can be moved in the X direction.

Activation of continuous trace mode

Activation of single trace mode

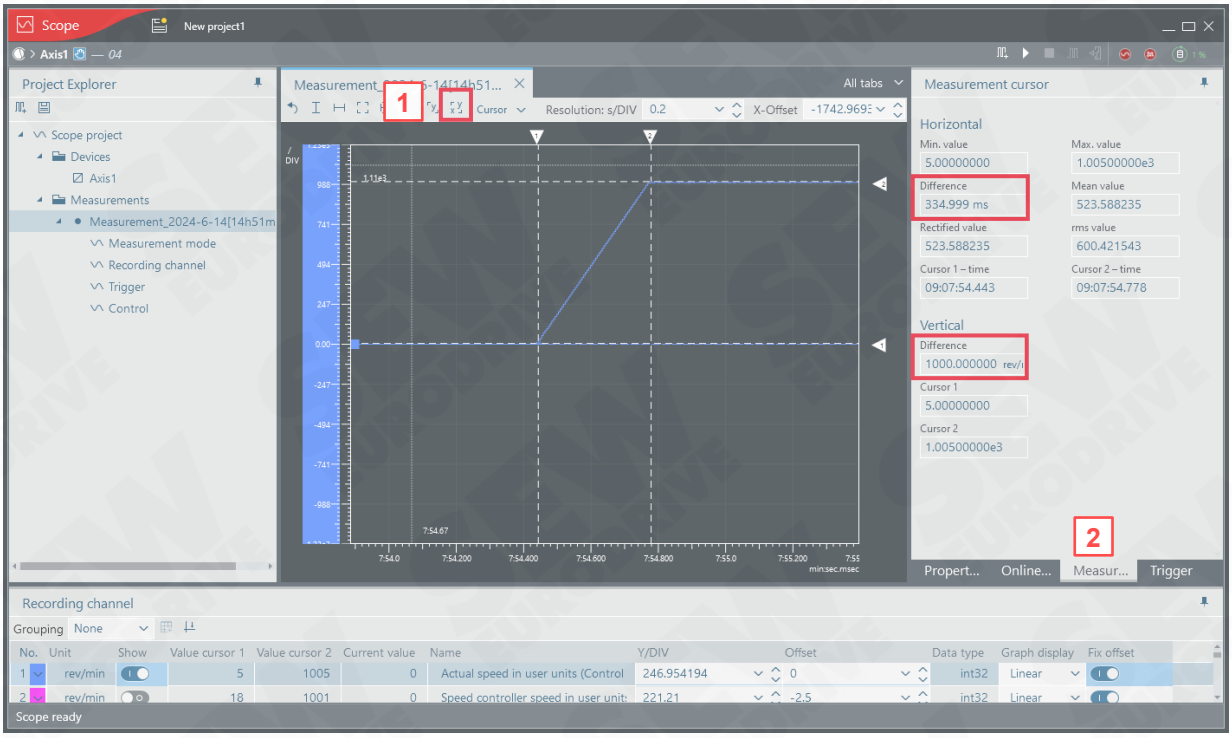
The following keyboard shortcuts are available for operating the scaling function:

Keyboard shortcuts	Description
Scroll wheel	Change the scaling of the selected channel
Panning	Clicking on the diagram and dragging with the mouse moves the view in all directions.
Shift + drag the mouse	Zoom in X and Y direction
Ctrl + drag the mouse	Zoom in X and Y direction
Pos	Perform the FIT function
F11	Create a screenshot of the current display and save it to the clipboard.
Ctrl + s	Save the current display as a screenshot in a file.

7.3 Cursor measurement

Scope has two horizontal and two vertical measurement cursors. You can use these to perform differential measurements of the time axis (horizontal cursors) and the measured value (vertical cursors), as well as linked differential measurements with all four cursors.

1. Perform cursor measurement of the acceleration



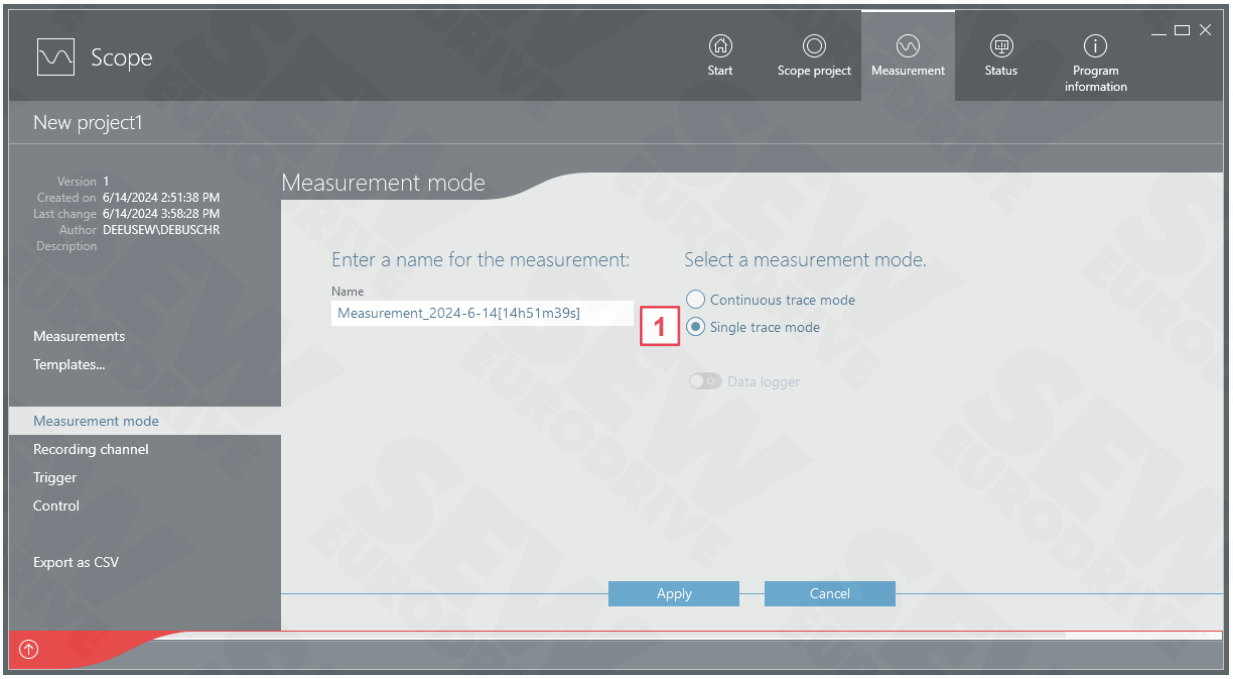
1 Zoom in at the actual speed of the drive as shown and place the measurement cursors.

2 In the **Measurement cursor** tab, you can evaluate the cursor measurement.

7.1 Scope measurement in single trace mode

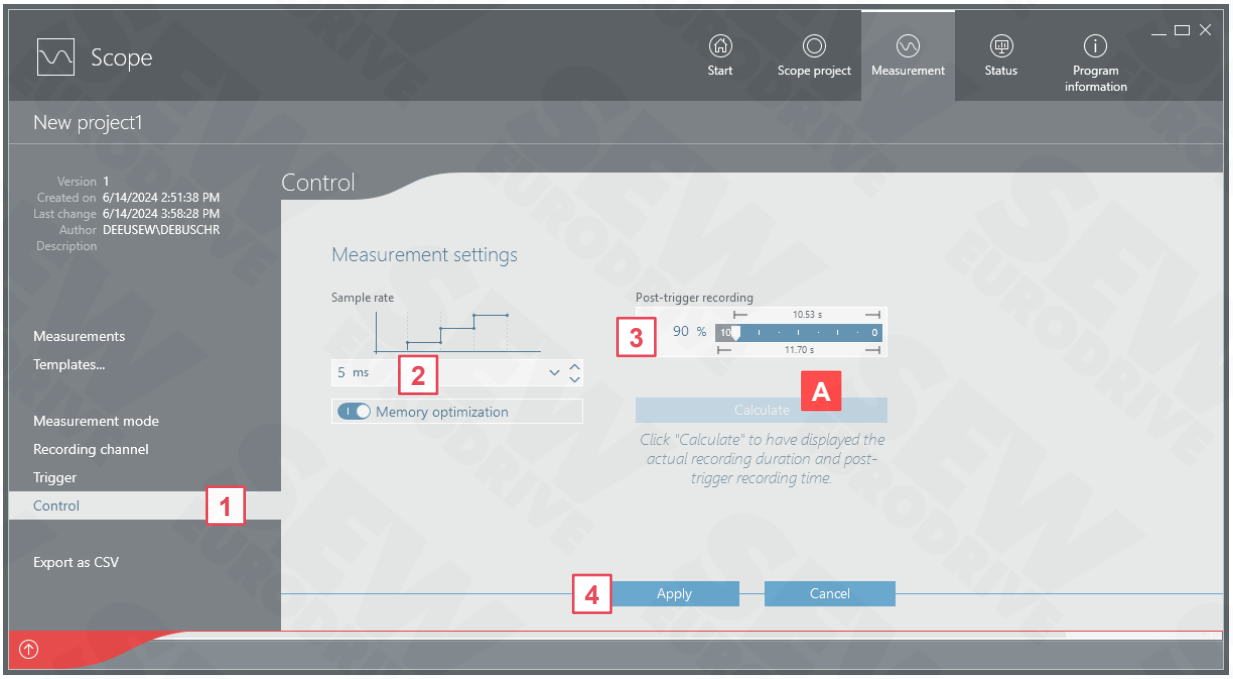
7.1.1 Measurement with manual trigger

1. Select measurement mode



1 Select **Single trace mode.**

2. Configure the Scope control



1 Select **Control**.

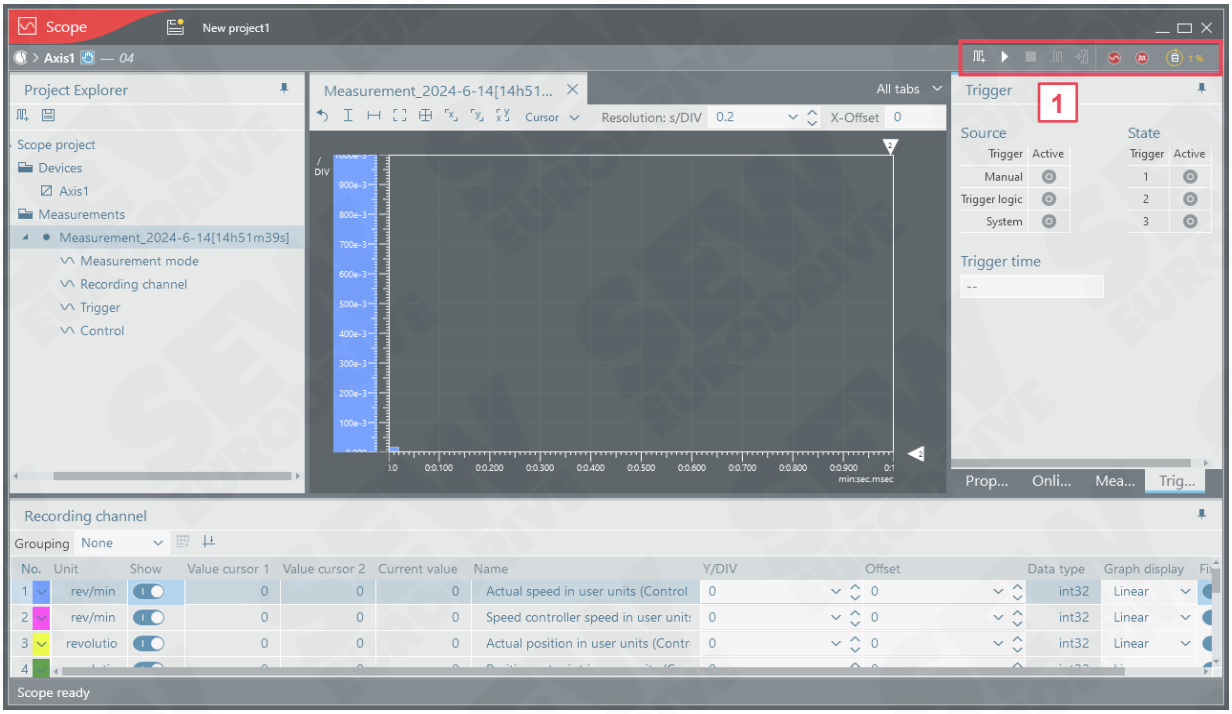
2 Set the sample rate to **5 ms**.

3 Set the Post-trigger recording to **90%**, which records the majority of the travel process **after** the trigger event.

4 **Apply** the settings.

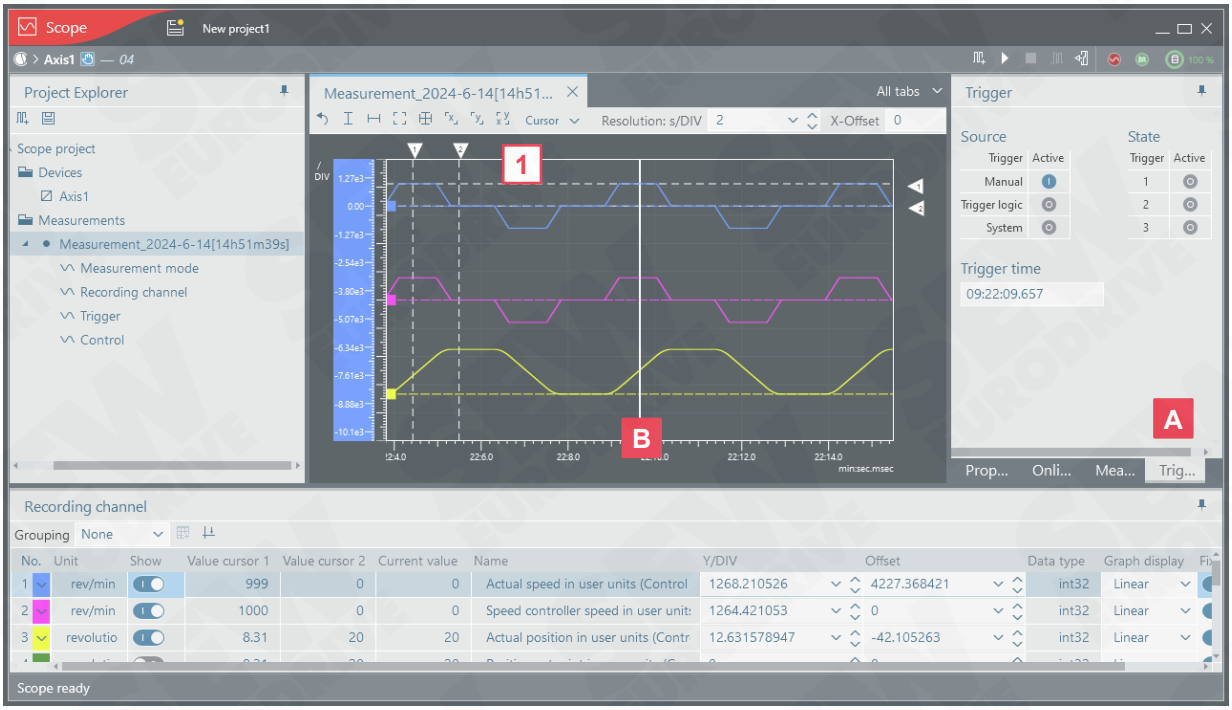
A The total runtime of the measurement and the runtime after the trigger are displayed here. You can adjust the total runtime to the travel process using the sample rate; you can update the displayed runtime with **Calculate**.

3. Start, trigger and load the measurement



1 Start the measurement by clicking ▶, wait until the Scope memory is 100% and then move the drive in manual mode with loading cycle absolute. Trigger the measurement and then open it.

4. Measurement result



1 Edit the measurement as shown.

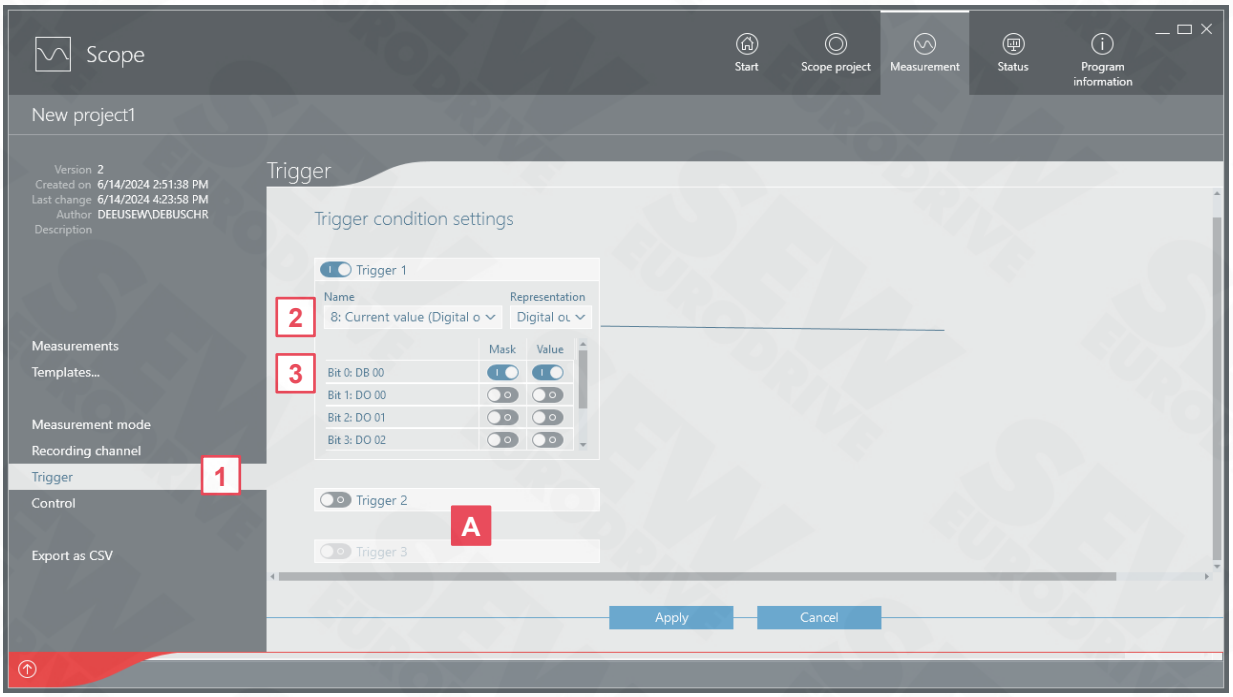
A In the Trigger tab, you can monitor the status of the various trigger signals.

B The trigger signal is indicated by the vertical white bar.

The manual trigger has priority and can be activated independently of other parameterized trigger signals. Therefore, no further trigger settings are required.

7.1.2 Measurement with trigger via digital output

1. Configure the trigger



1 Select **Trigger**.

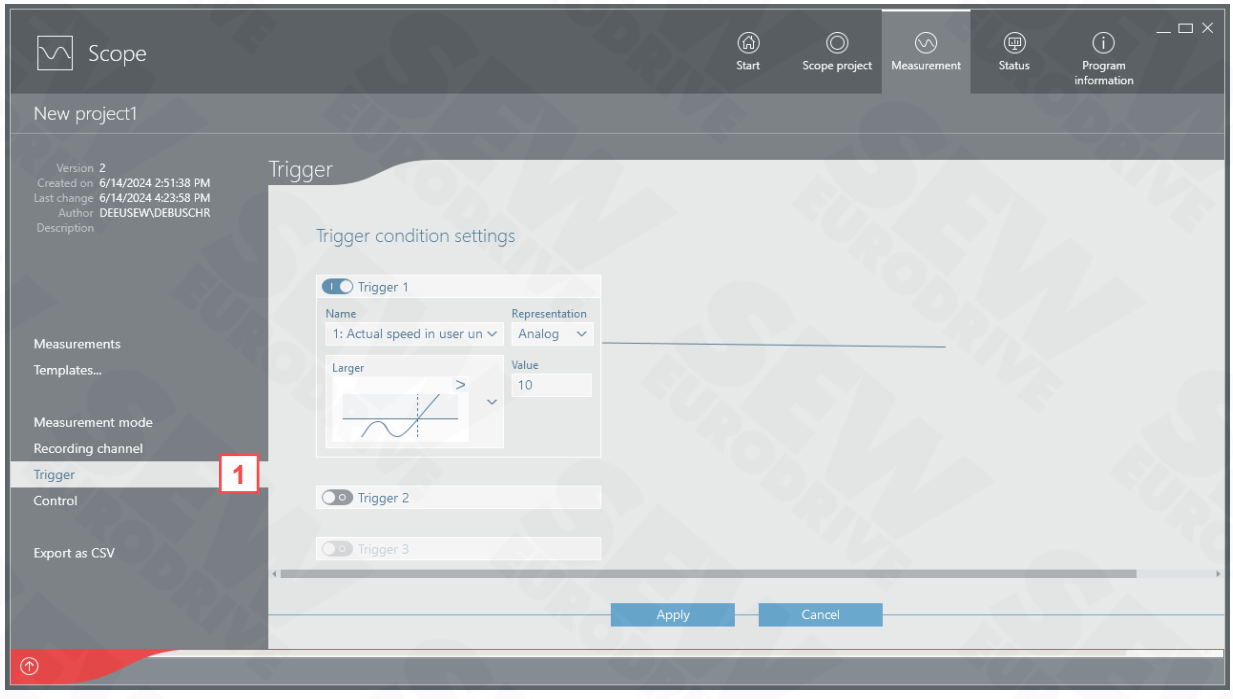
2 Select **Name > 8: Current value (Digital outputs basic unit)** and **Representation > Digital outputs** as the trigger condition for Trigger 1.

3 Switch on the mask and the value for brake output DB00. Then perform the measurement as shown in the previous chapter.

A Up to three different trigger sources can be configured and logically linked (AND/OR).

7.1.3 Measurement with trigger via analog value

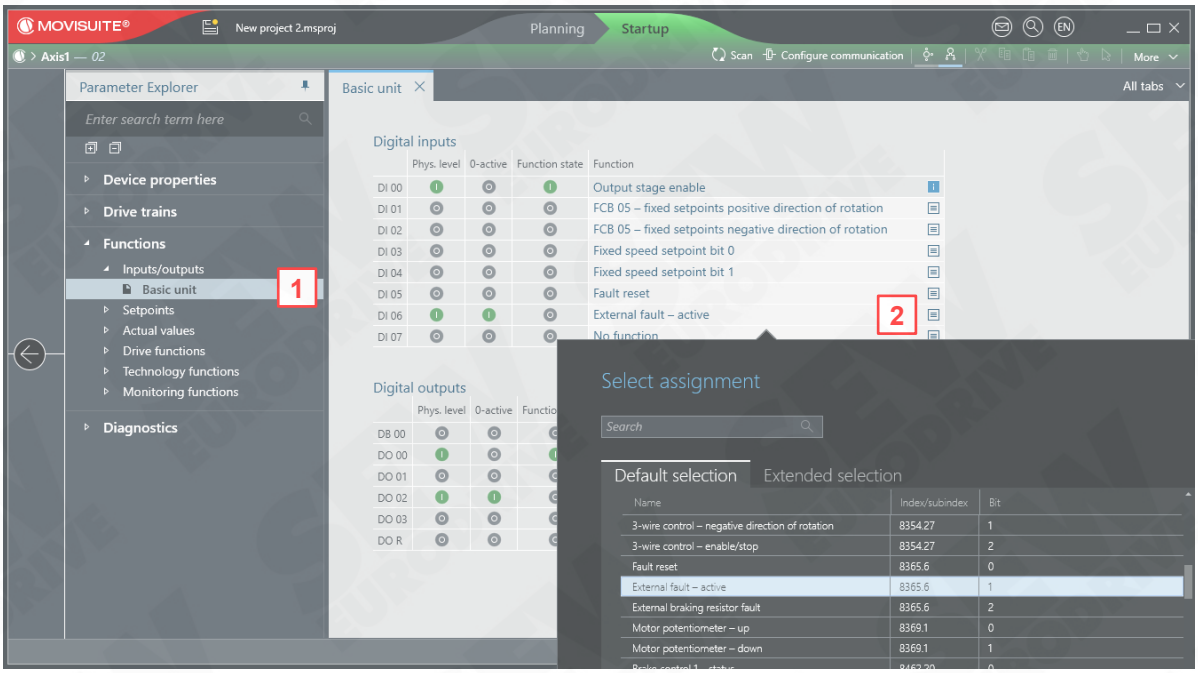
1. Configure the trigger



1 Configure the trigger conditions as shown and then perform the measurement in accordance with the previous chapters.

7.1.4 Measurement for inverter fault as trigger

1. Parameterize digital input

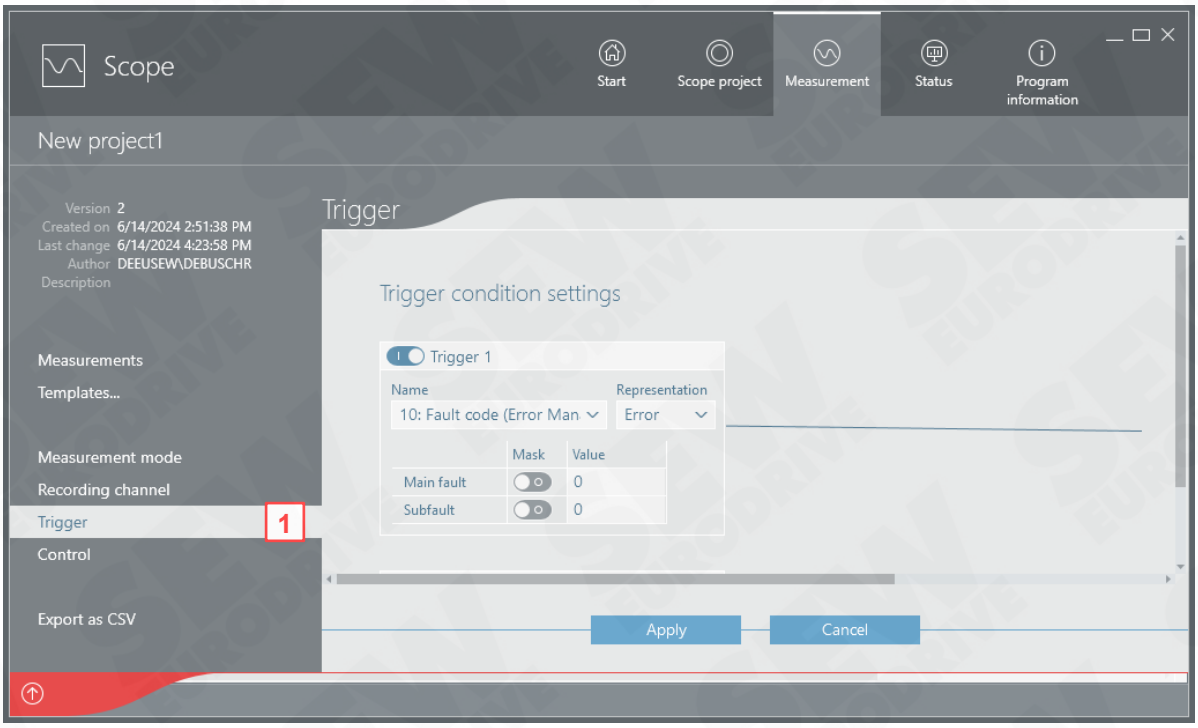


1 Select **Functions > Inputs/outputs > Basic unit.**

2 Set DI 06 to **External fault – active**.

Then switch the input to 1 signal, otherwise an external error would occur due to the NC contact logic.

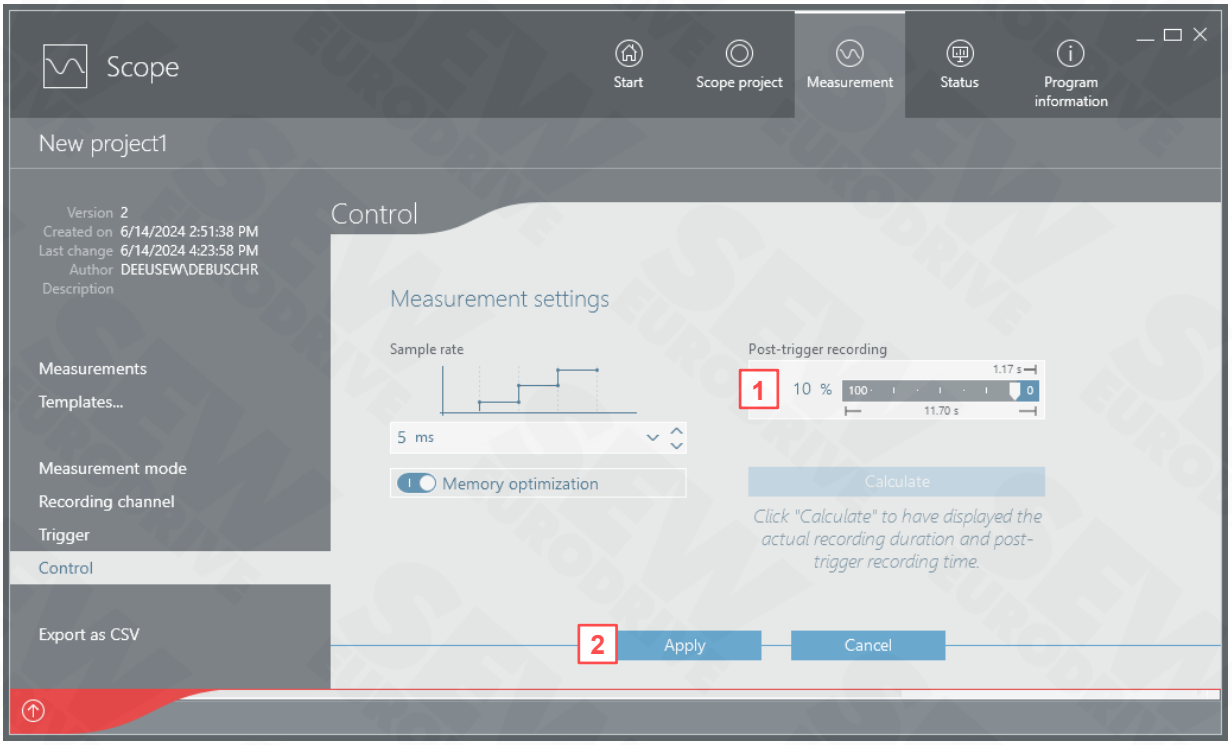
2. Configure trigger condition settings



1 Configure the trigger settings as shown.

In the fault code, you can trigger certain faults by activating the masks and entering the desired fault number as the value for the main fault and subfault. If masks are deactivated, all inverter faults will trigger the measurement.

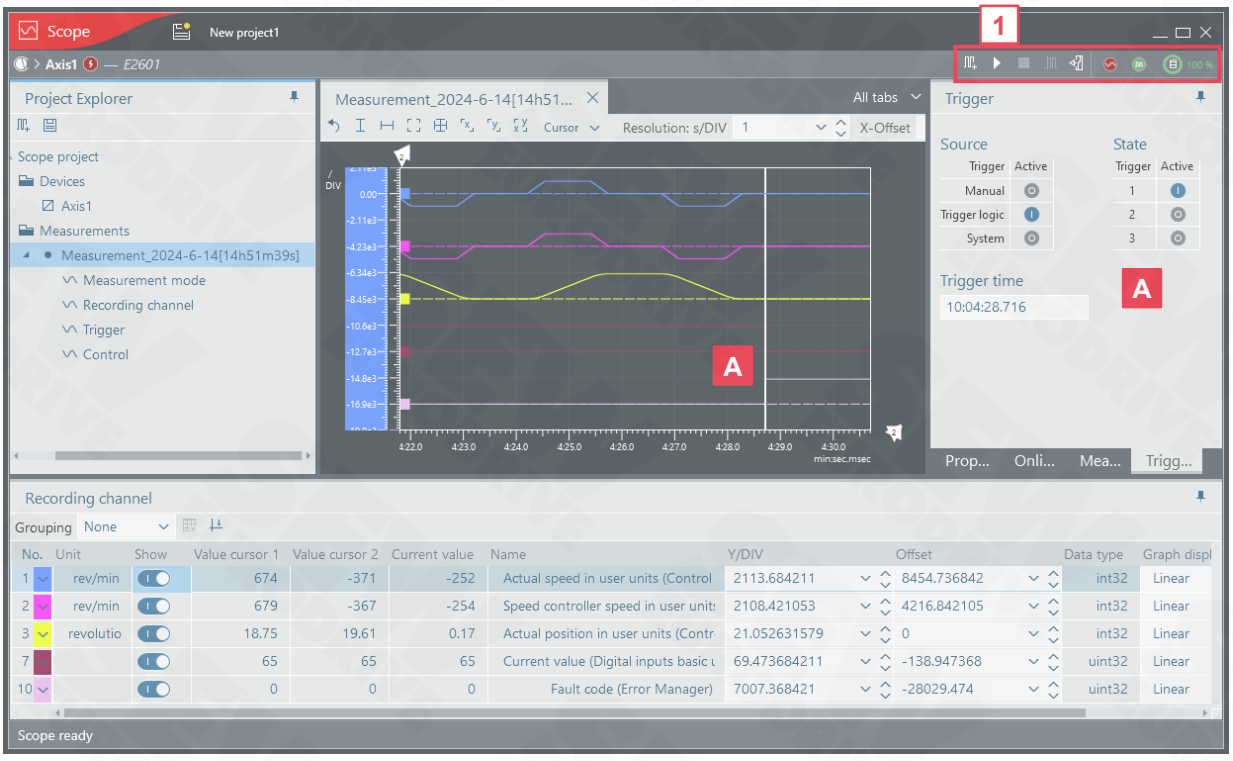
3. Configure Scope control



1 Change the trigger lag to 10%, which records the majority of the travel process **before** the trigger.

2 **Apply** the settings.

4. Start and load the Scope measurement



1 Start the measurement by clicking and wait until the memory is 100% . Then move the drive in manual mode (absolute shuttle mode) and switch off DI 06 while traveling. Then open the measurement .

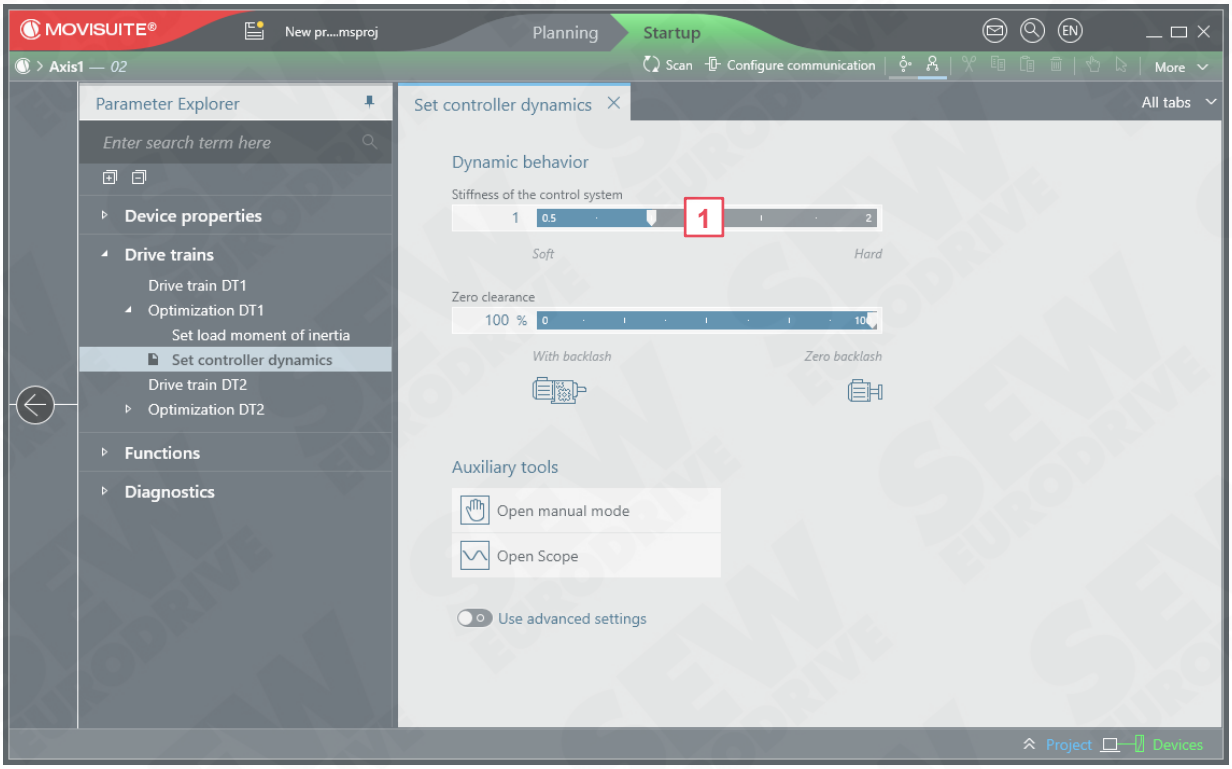
A The falling edge of DI 06 generates the external error and triggers the Scope measurement.

B Here you see the source and the status of the trigger signal.

7.2 Controller optimization with Scope

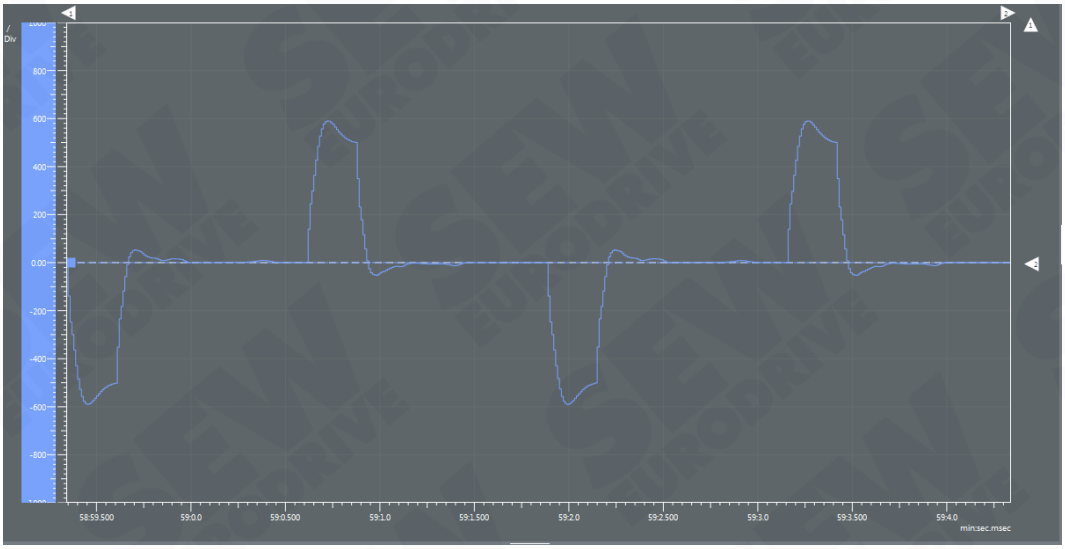
The following exercise can be performed both in continuous trace mode and in single trace mode. Configure your Scope measurement accordingly.

1. Change the stiffness of the control system

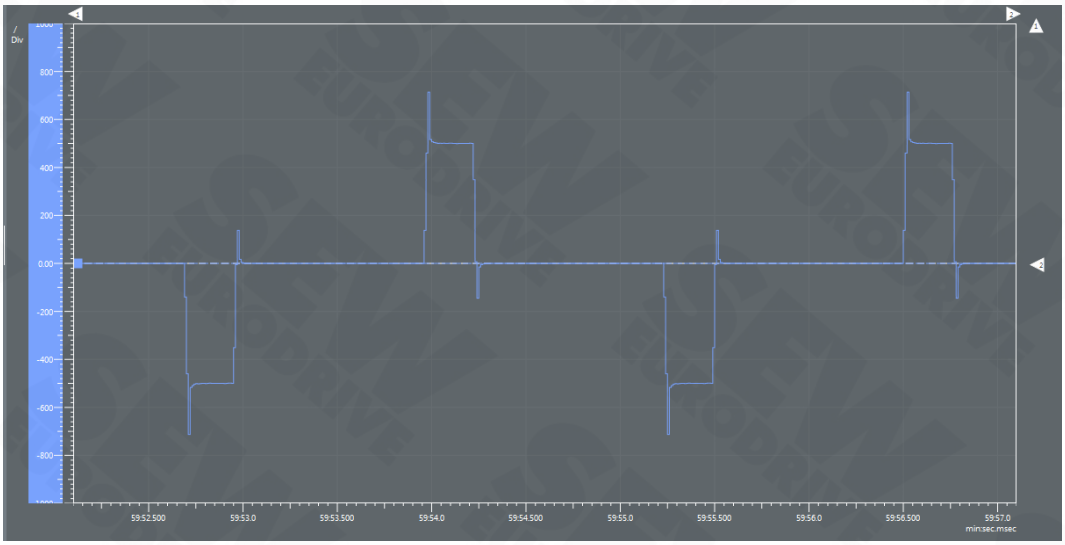


1 Start the Scope measurement again and set the stiffness 0.5, 1.0 and 1.5 one after the other. Observe the Scope recording in each case.

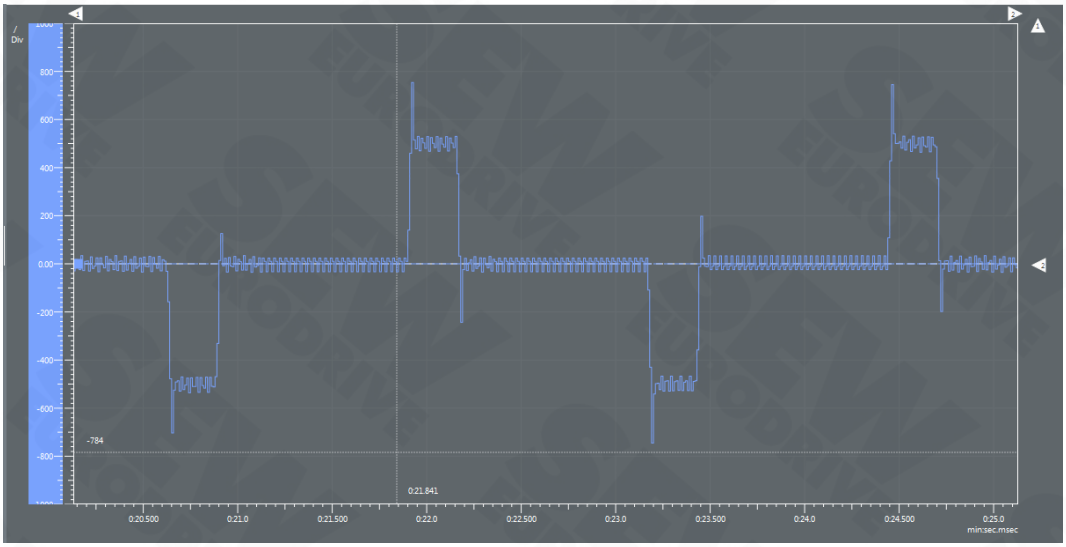
2. Evaluate the results



- Stiffness 0.5: Actual speed is compensated with a long overshoot.



- Stiffness 1.0: Actual speed is compensated with a short overshoot.



- Stiffness 1.5: Actual speed swings – the drive generates clearly audible noises.

The optimum stiffness value is between 1.0 and 1.5.

8 Configuration of user units

Objectives:
- You can define the user units of the inverter
- You can specify travel parameters and limits in user units

After the following exercise, reset the drive train to the default units.

8.1 Configure user units

The user units can be used to apply a scaling factor to the mechanical gear ratios.

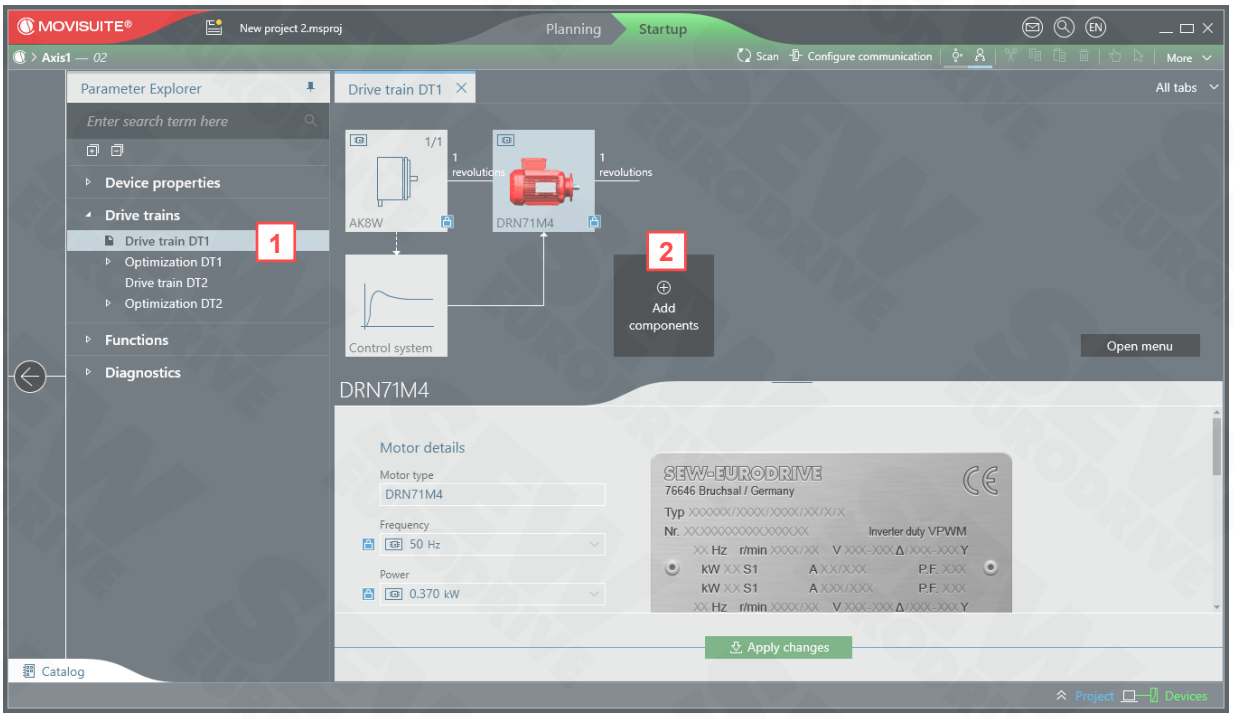
The following advantages and possibilities are associated with this:

- The user can define any user unit in which the setpoints are specified and the actual values are calculated. For example, in a bottle filling system, the unit can be scaled to bottles. The speed can then be specified with bottles/min or the acceleration in bottles/(min*s).
- The number range and the accuracy of the process values in the process data can be optimized for the application by scaling.

Procedure for entering the user units for the following application example:

User units for chassis application	
Gear unit ratio	3.21
Drive wheel diameter	100 mm
Desired user unit:	
Unit for distance	mm
Unit for speed	mm/s
Unit for acceleration	mm/s²

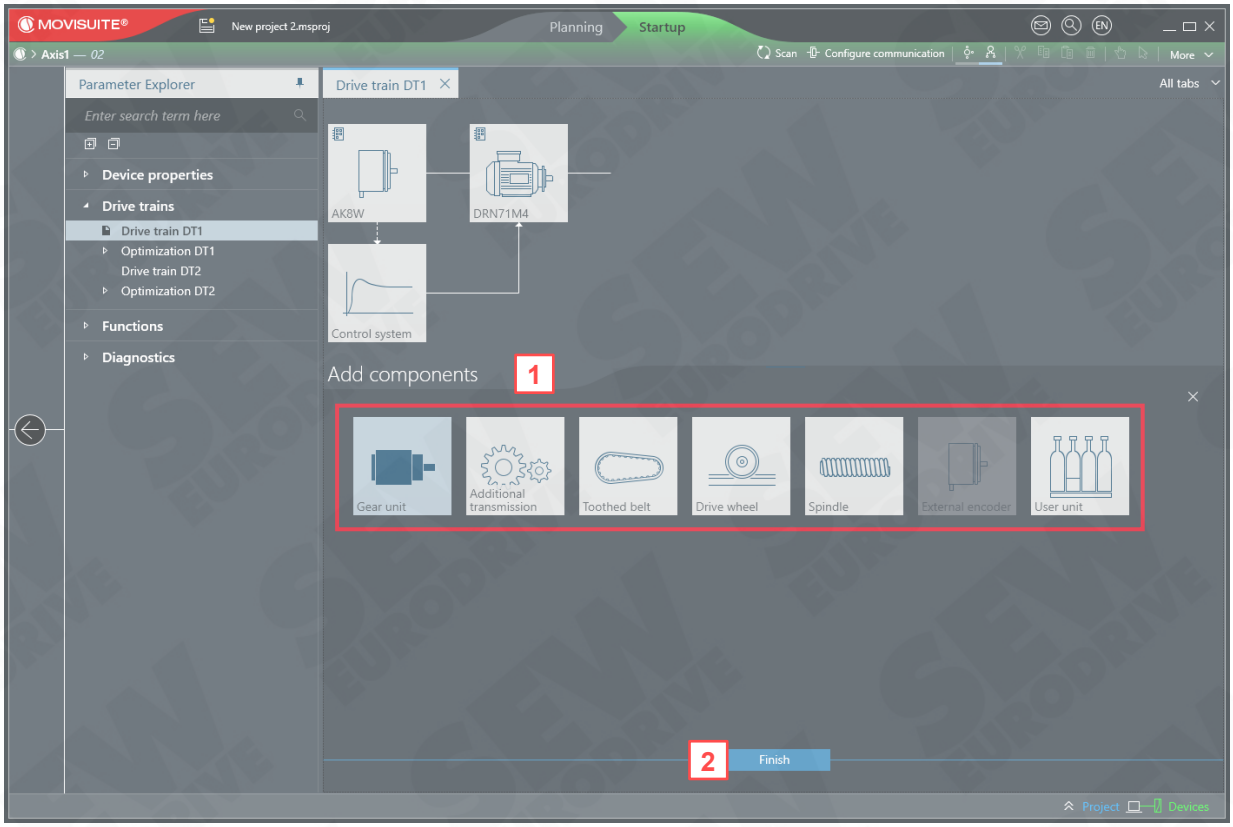
1. Open drive train DT1



1 Select **Drive train DT1**.

2 Click **Add components**.

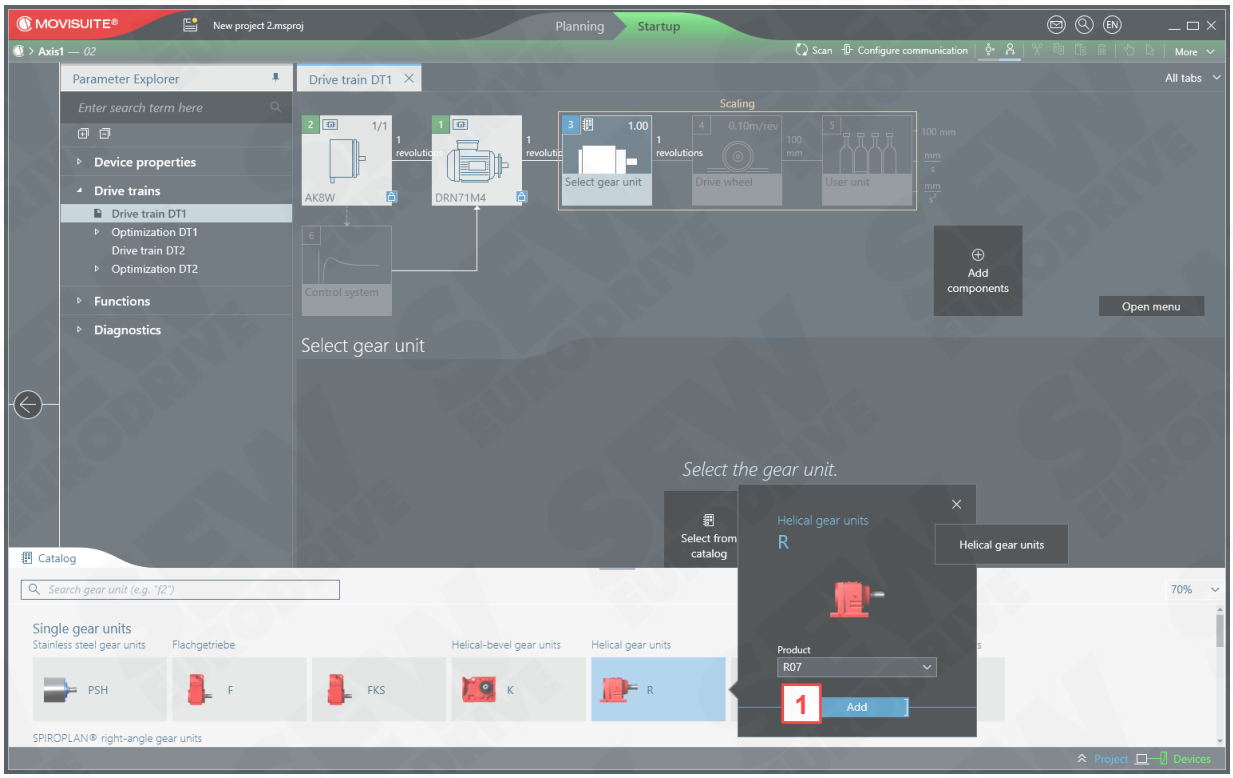
2. Edit the drive train



1 Click **Gear unit**, **Drive wheel** and **User unit** one after the other to add the components to the drive train.

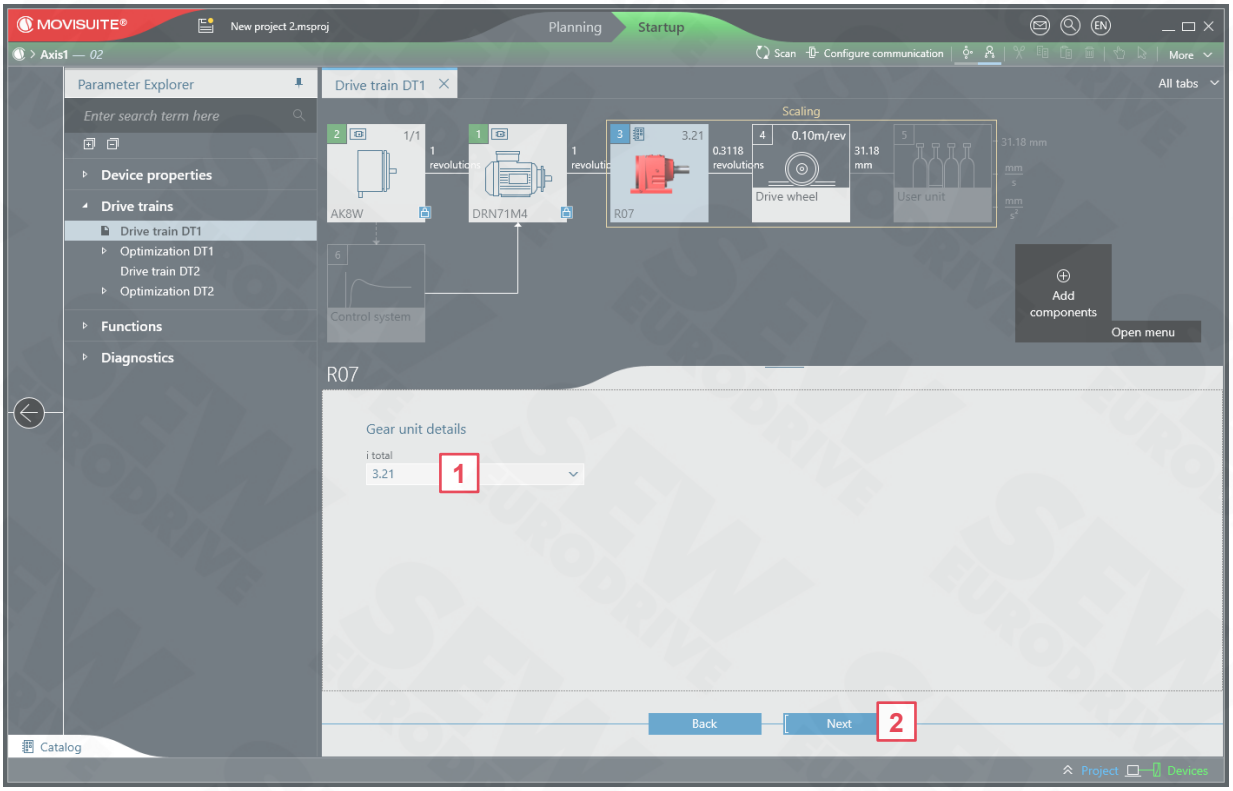
2 Apply the settings by clicking **Finish**.

3. Select the gear unit



1 Select the suitable gear unit from the catalog and confirm your selection.

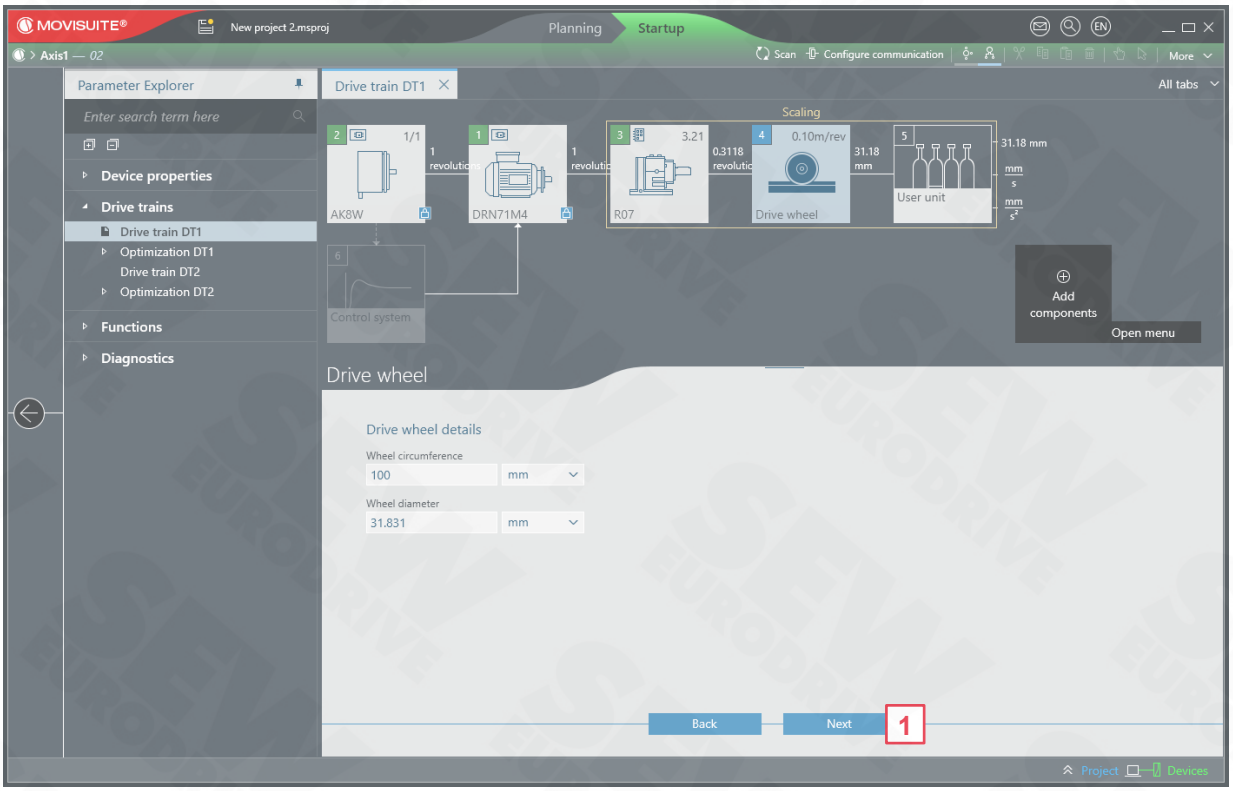
4. Enter gear unit details



1 Select the appropriate gear ratio.

2 Confirm with **Next**.

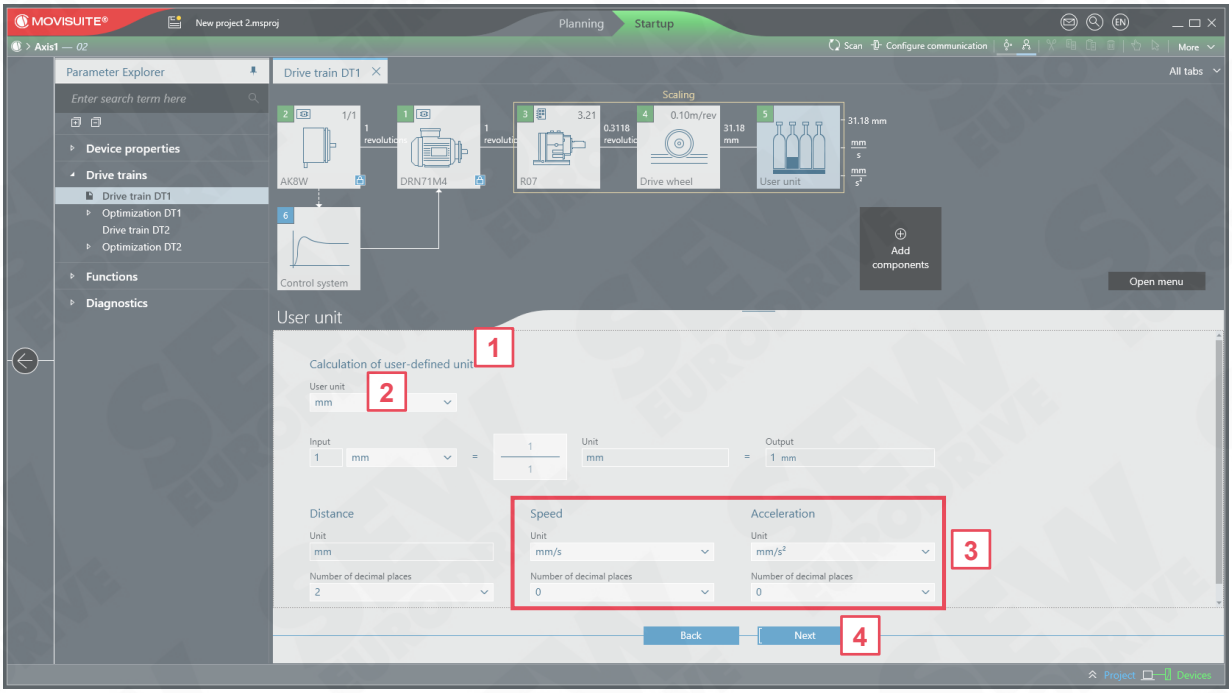
5. Parameterize the drive wheel



1 Enter the circumference or diameter of the drive wheel and confirm with **Next**.

Wheel circumference	100 mm
Wheel diameter	31,831 mm

6. Parameterize user-defined user unit



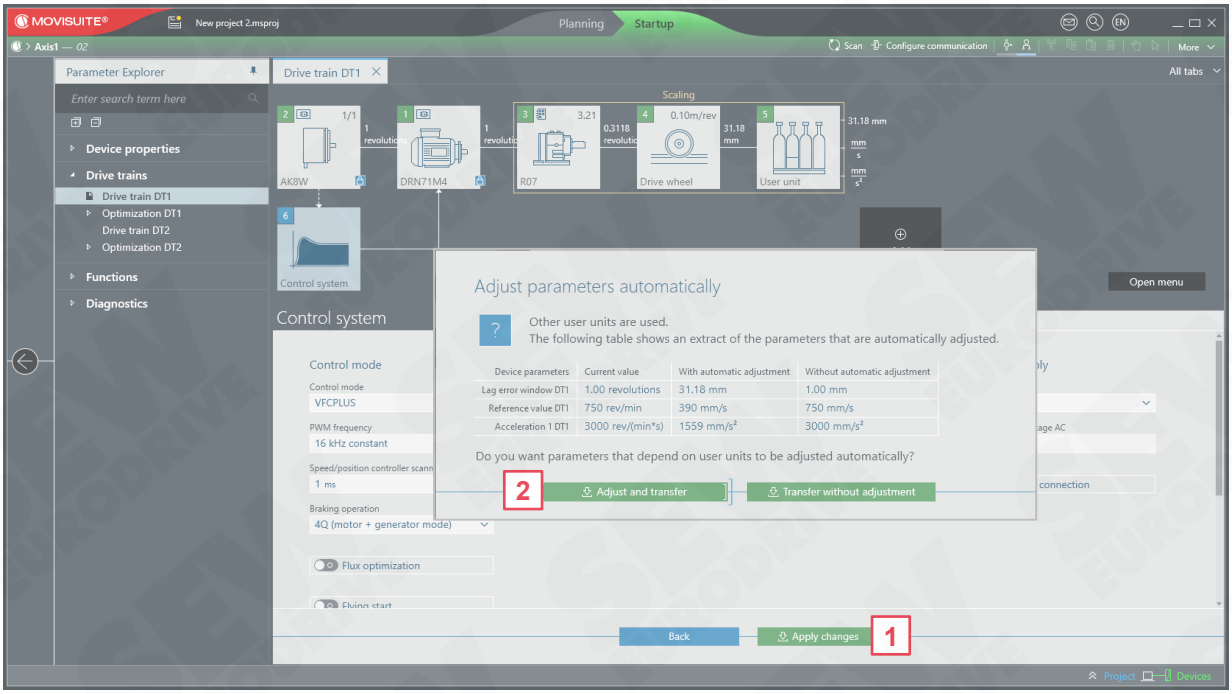
1 Enter the conversion factor as a fraction.

2 Enter the user unit for the position.

3 Enter the user units for speed and acceleration with the required decimal places.

4 Confirm with **Next**.

7. Transfer changes to the device



1 Confirm the settings by clicking **Apply changes.**

2 Then select **Adjust and transfer** to transfer the user units to the application.

Note that changing the user units means that the drive is no longer referenced!

9 Data management

Objectives:

- You know the difference between startup mode and planning mode
- You can save and load the inverter data
- You can compare the data from different sources
- You can perform a device replacement

9.1 Getting to know the startup and planning mode

The startup and planning modes are available in the MOVISUITE® project:

- In planning mode, the data is saved exclusively in the project.

- In startup mode, the data is saved in the inverter **and** in the project.

1 Click **Planning** to activate planning mode. You can configure and start up devices **offline** here.

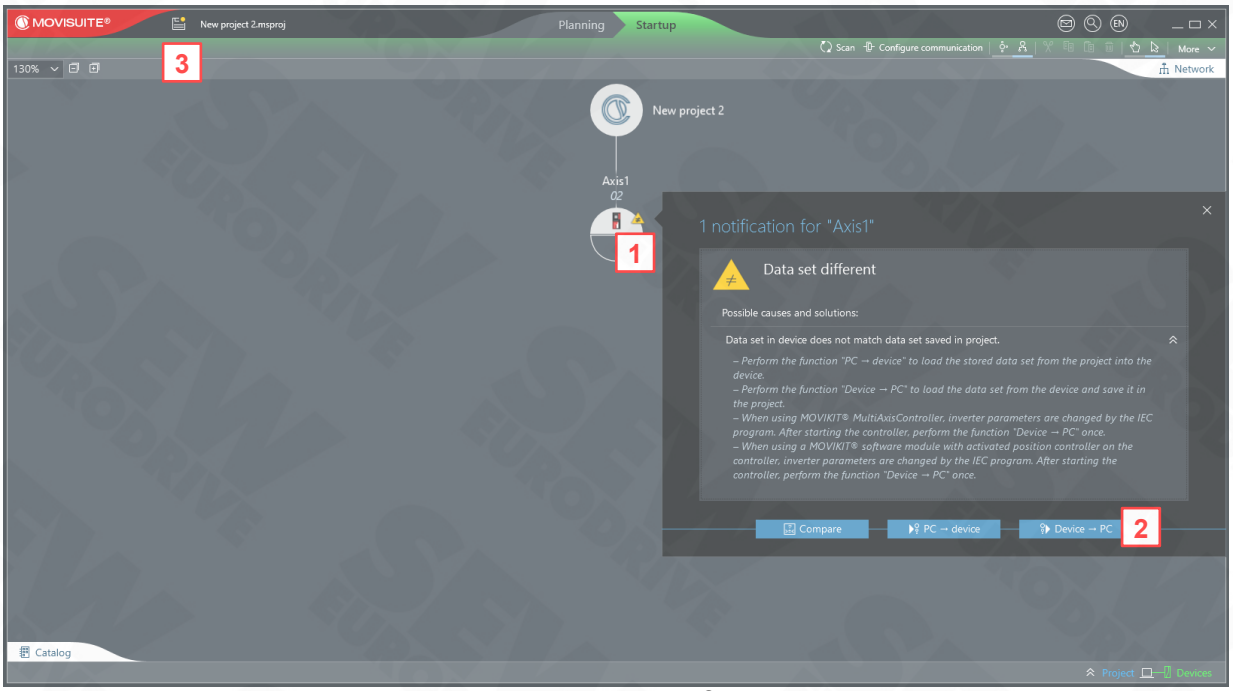
2 Click **Startup** to activate startup mode. You are connected to the inverter **online** here.

A Changes in the project have not yet been saved in the project path on the hard disk. Click the save icon to save the data.

Changes in the project are saved in the project path on the hard disk.

9.2 Compare the data set of the inverter with the project

1. Save inverter data in the project



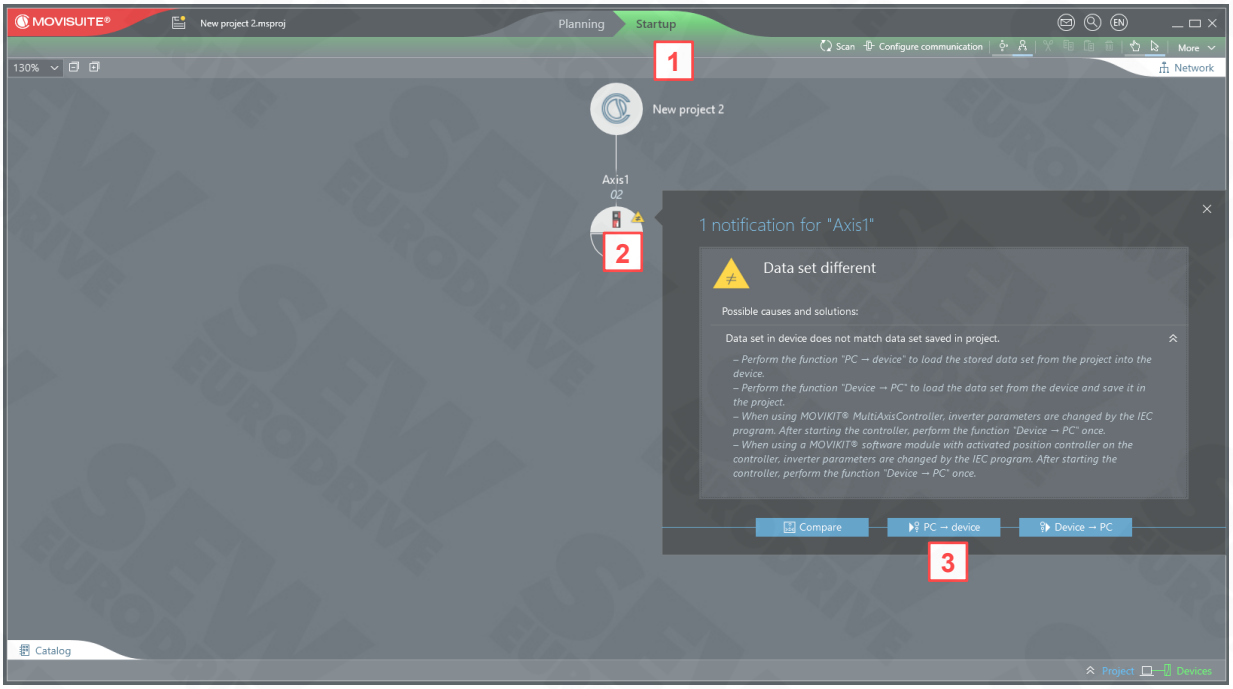
In startup mode, data differences between the MOVISUITE® project and the device are indicated by the ≠ icon. For the exercise, you can provoke this message by changing a parameter in planning mode and then switching to startup mode.

1 Click the ≠ icon.

2 Load the inverter data into the project by selecting **Device → PC**.

3 Save the inverter data in the project by clicking .

2. Load data from offline project to inverter



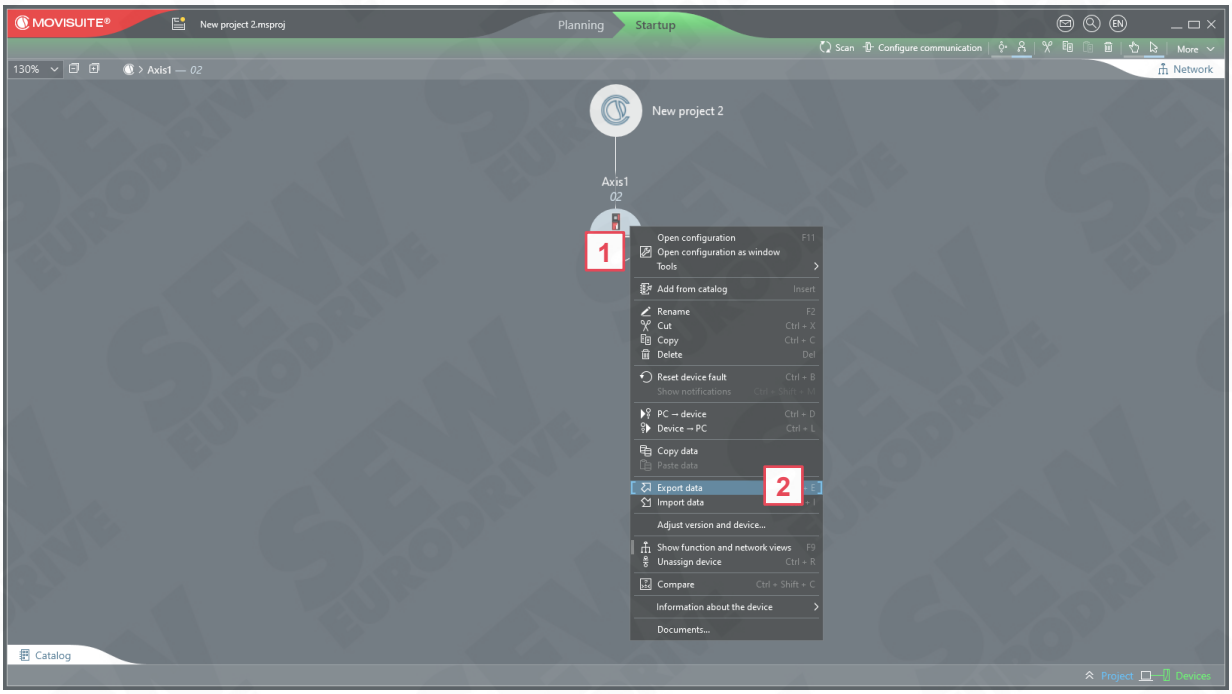
1 Switch from planning mode to startup mode.

2 Click the ≠ icon.

3 Load the data from the offline file to the inverter by selecting **PC → device**.

9.3 Export and import inverter data

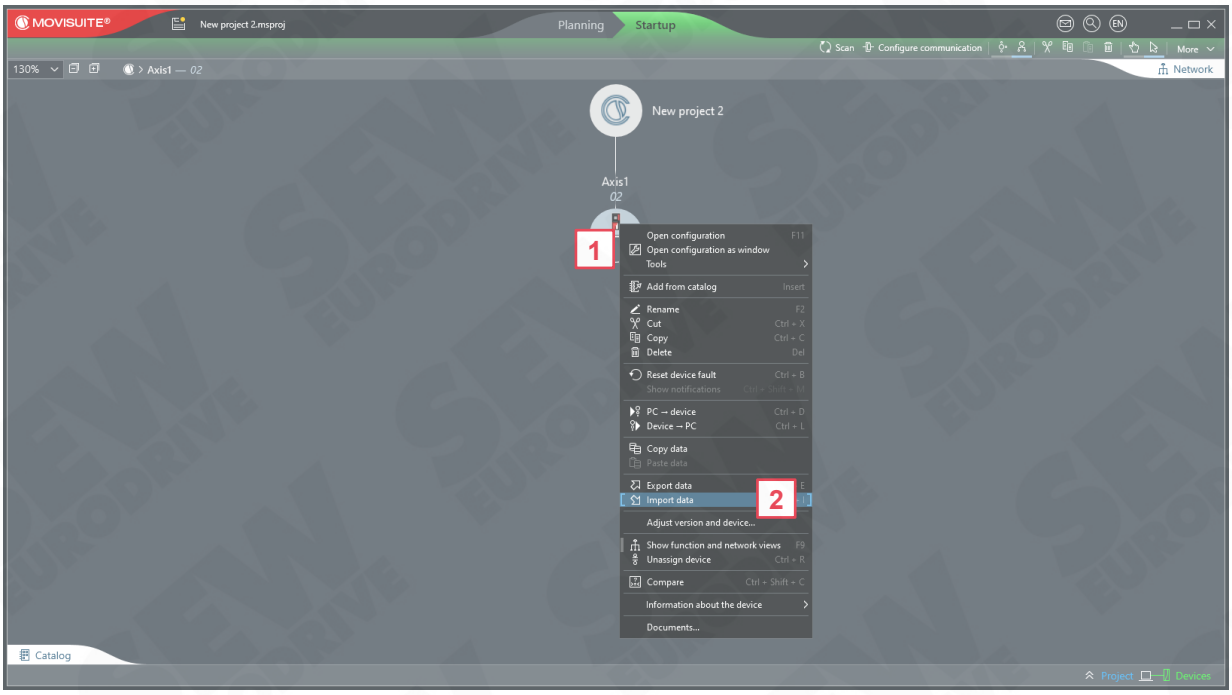
1. Export inverter data



1 Right-click to open the context menu of the inverter.

2 Select **Export data** and save the file under the required project path.
The export creates a parameter file (axis name.mcex).

2. Import inverter data

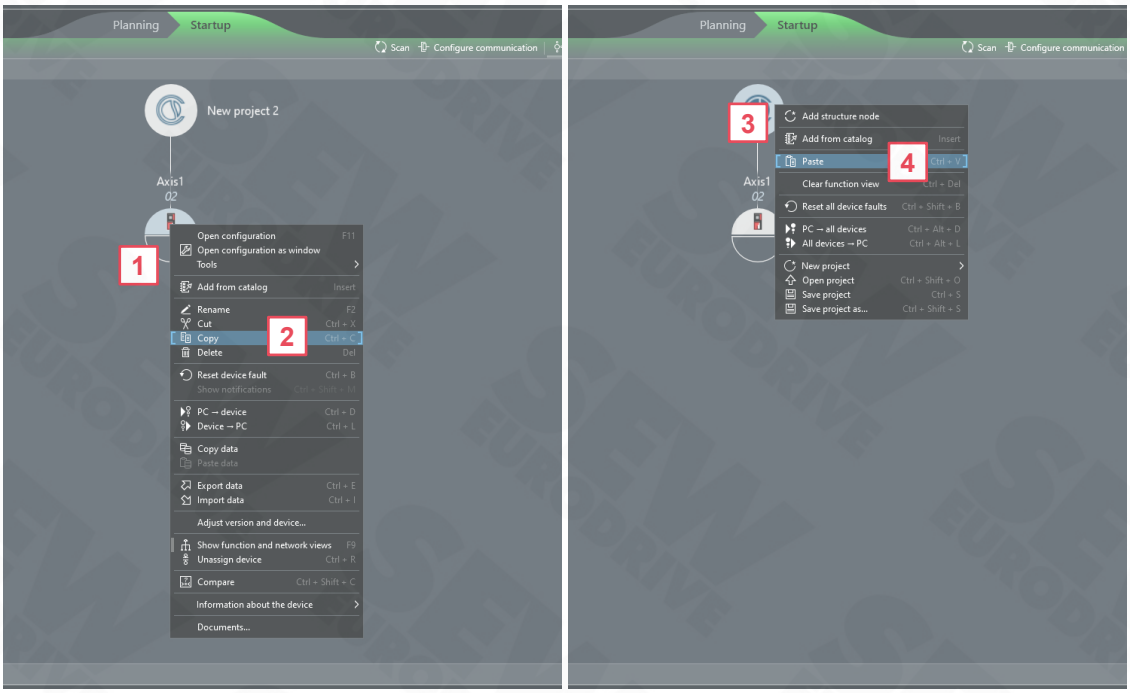


1 Right-click to open the context menu of the inverter.

2 Select **Import data** and select the appropriate parameter file.

9.4 Create an axis copy

1. Copy and paste the axis

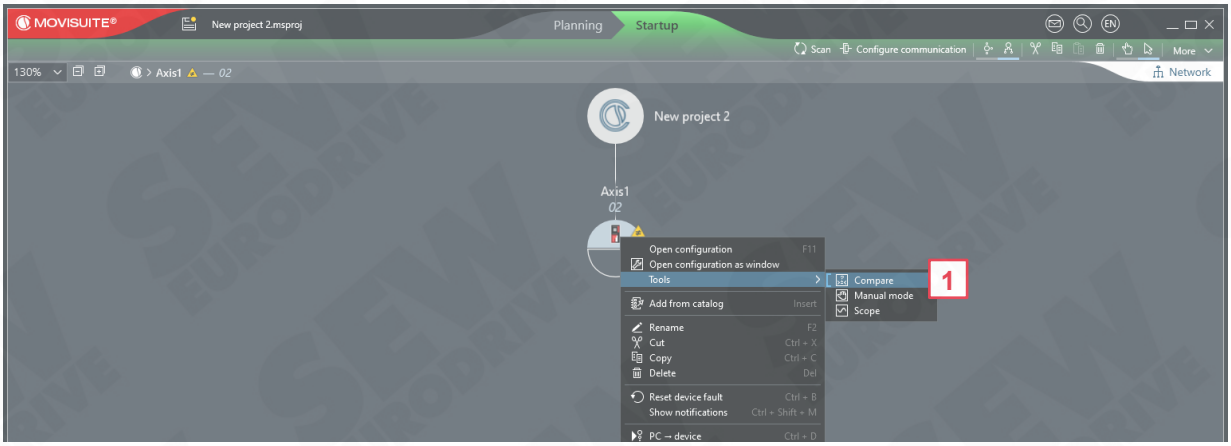


1. Right-click to open the context menu of the inverter.
2. Select **Copy.**
3. Right-click to open the context menu of the project.
4. **Paste** the copied axis into the project.

9.5 Compare inverter data

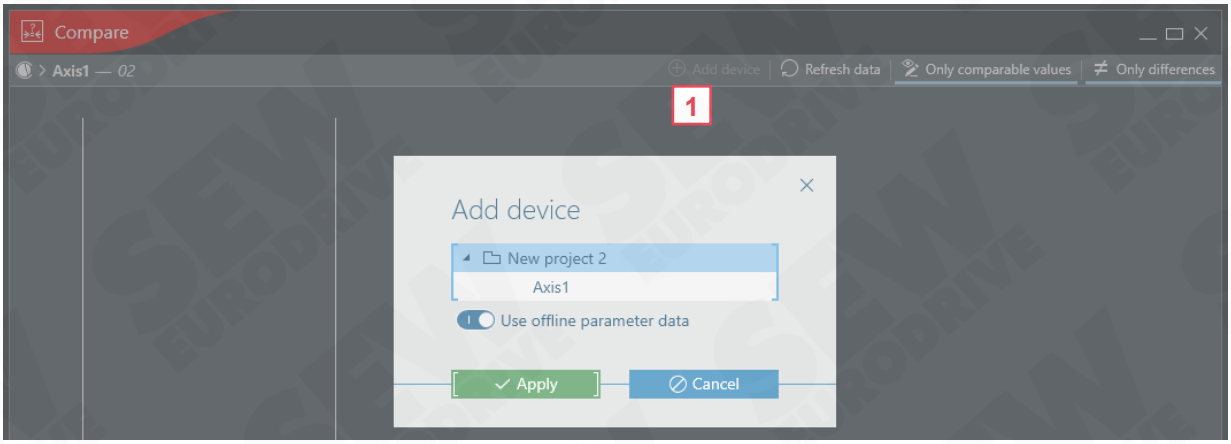
In the following exercise, the inverter data is to be compared with the offline parameter data in the project. Therefore, switch to planning mode and change any parameter. Then switch back to startup mode and start the comparison.

1. Open comparison



1 Open the context menu of the inverter and select **Tools > Compare**.

2. Add device



1 Click **Add device** and select the required device.
To compare the inverter data with the project, select **Use offline parameter data**.

3. Detect data differences

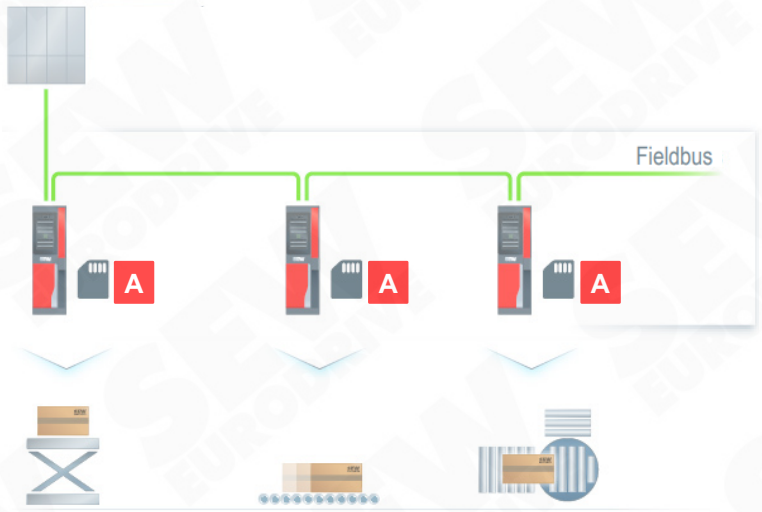
1 To display only the different parameters, select **Only differences**. Differences are indicated by red shading.

9.6 Device replacement

Objectives: You will be familiar with the options for replacing devices with different devices.

The replacement device must have the same configuration as the original device.

9.6.1 Example of MOVIDRIVE® technology



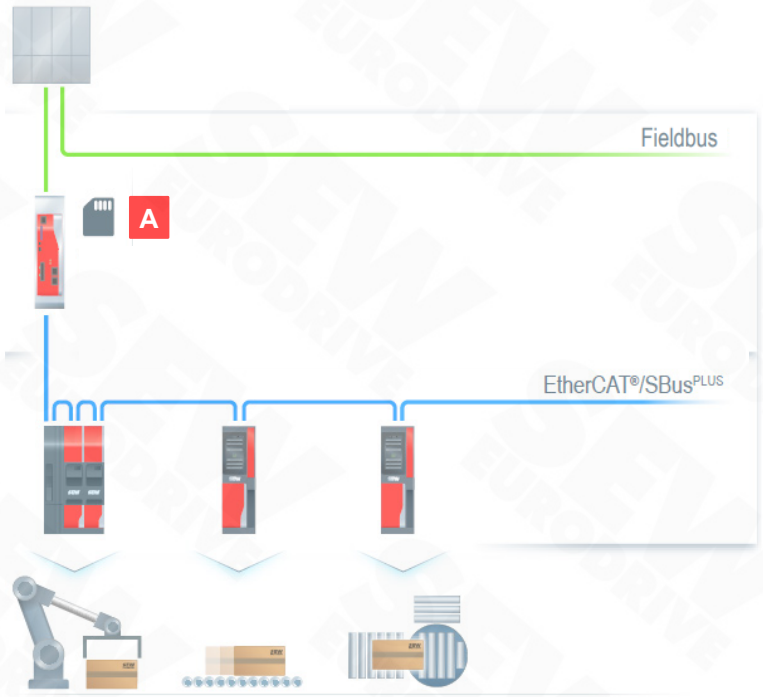
A Memory modules in MOVIDRIVE® technology devices

MOVIDRIVE® technology has a pluggable memory module. All device data is stored on this memory module and is always up-to-date. If a device needs to be replaced, simply replugging the memory module means that the system can be restarted in a very short time without any additional resources.

Procedure:

1. **Observe the safety notes!**
2. **Disconnect the device from the voltage!**
3. **Disconnect/unplug the connections**
4. **Remove the inverter**
5. **Install the memory module from the original device into the replacement device**
6. **Mount the replacement device and plug/screw on the connections.**
7. **Switch on the device with activated output stage inhibit**
8. **In MOVISUITE®, the device replacement is indicated via the ≠ message icon on the device.**
9. **If an absolute encoder is used as a motor encoder or distance encoder, you must reference the encoder again after replacing the device.**

9.6.2 Example of MOVIDRIVE® modular/system



A Memory card in the MOVI-C® CONTROLLER

Procedure:

1. **The device replacement function of the MOVI-C® CONTROLLER under Functions > Device replacement must be activated (default). This saves all parameter and configuration settings of the connected MOVIDRIVE® modular/system on the SD card and provides a checksum. Update changes to the inverter parameters in the configuration of the MOVI-C® CONTROLLER by selecting Functions > Device replacement > Update configuration data.**
2. **Observe the safety notes!**
3. **Disconnect the device from the voltage!**
4. **Disconnect/unplug the connections**
5. **Remove the inverter**
6. **Mount the replacement device and plug/screw on the connections**
7. **Switch on the device with activated output stage inhibit**
8. **The MOVI-C® CONTROLLER automatically detects the device replacement when it is restarted and loads the saved data set into the new inverter.**

10 Terminal control

Objectives:

- You can control the drive with the digital inputs via fixed setpoints
- You can configure the assignment of the digital inputs
- You can control the FCB with the digital inputs
- You can parameterize and diagnose the FCBs

10.1 Principle of terminal control

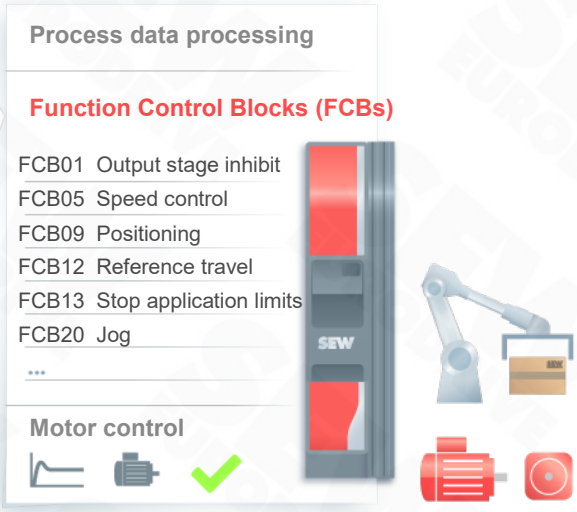
The inverters operate according to a uniform operating principle regardless of which higher-level controller and which motor is used in the application.
The firmware of the inverter is modular with FCBs (Function Control Blocks) and can therefore cover a wide range of applications. The operating modes and functions of the inverter such as speed control, position control, torque control and others are shown in the FCBs. The FCBs are activated by a higher-level controller via digital inputs. The selected FCB activates the motor control and generates the motor setpoint via the selected control mode.

FCB concept:

Individual inverter functions such as positioning, speed control, position control, jog, manual mode, reference travel, stop, etc. are implemented as FCBs.

Some FCBs, such as FCB26 **Stop** or **FCB05 Speed Control**, can be activated in all control modes, while others, such as **FCB09 Positioning**, can only be selected in VFC^{PLUS} control modes with encoder or CFC.

The FCBs normally receive their setpoints automatically from the controller via the process data.

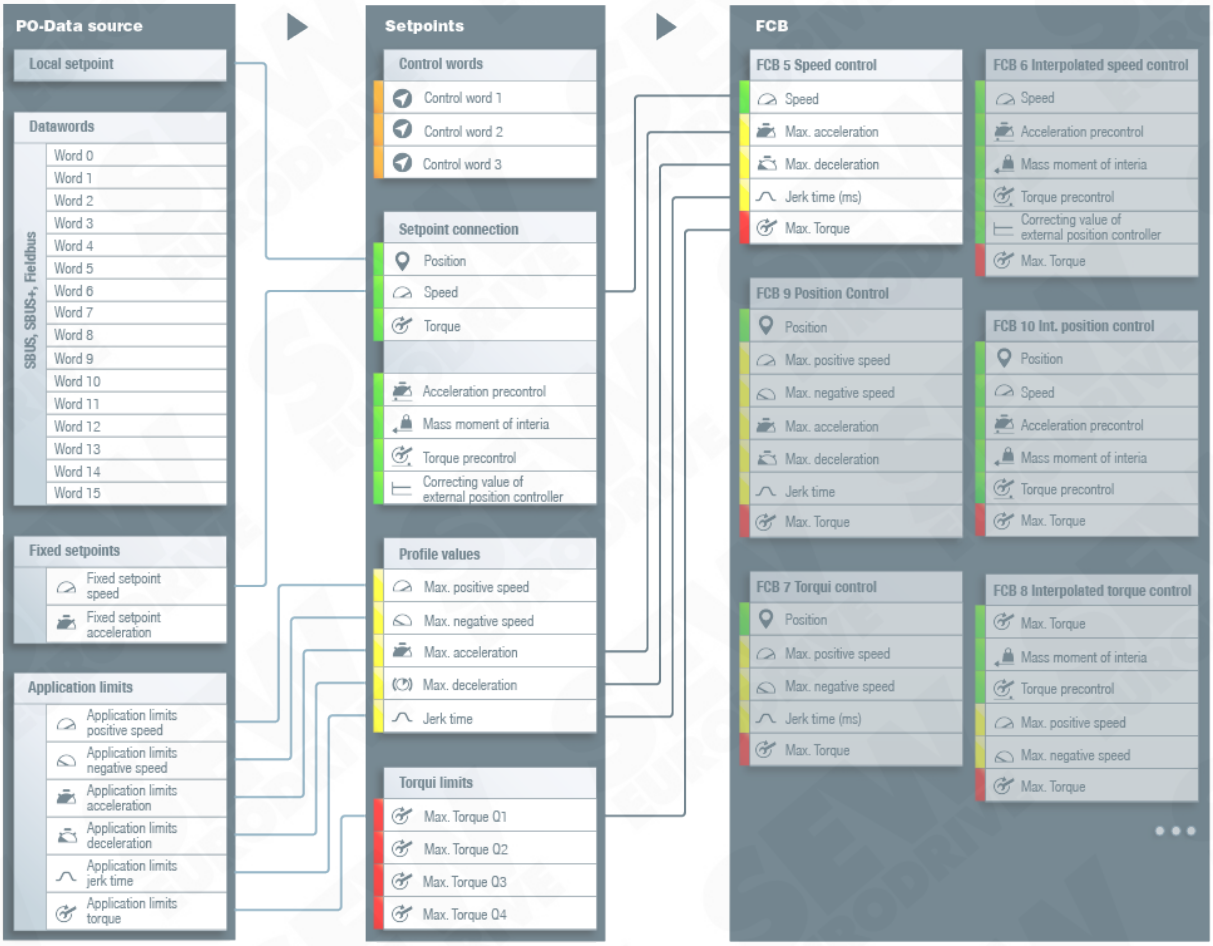


- For further information on the FCBs, refer to the appendix.
- You can find out more about the operating principle of MOVI-C® inverters in the MOVI-C® modular, system and technology operating principles e-learning course

10.2 Control with fixed speed setpoints

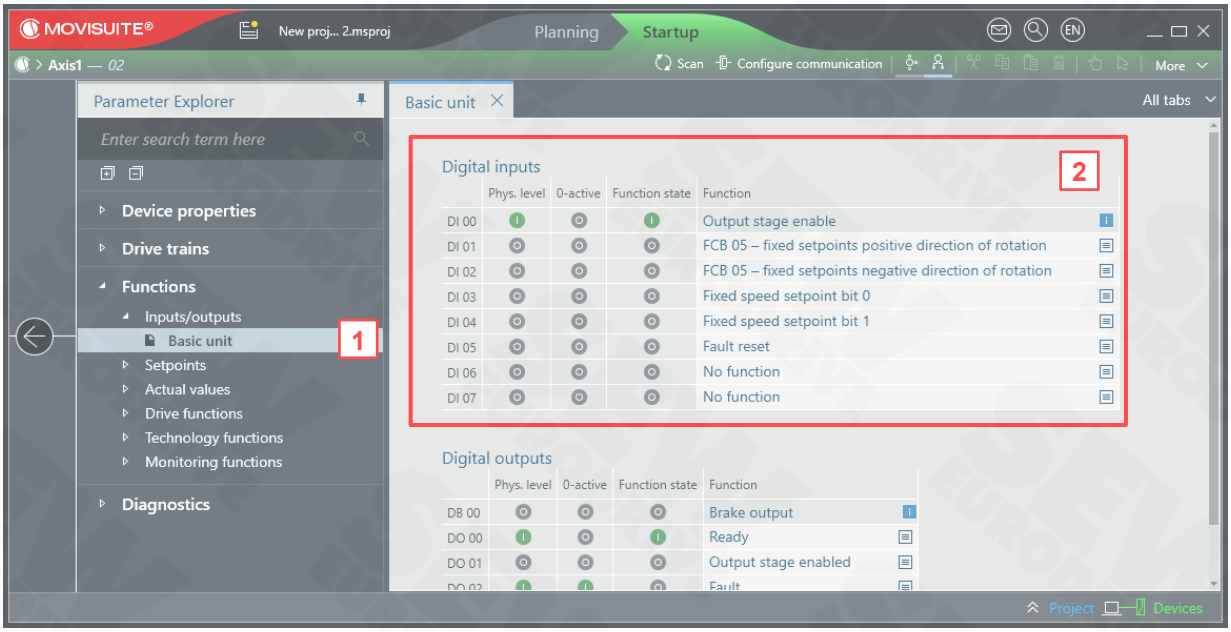
The inverter can be moved directly via the digital inputs with fixed setpoints after the delivery state. The control function is implemented with **FCB 05 Speed control**.

- Process data connection for FCB 05 speed control:



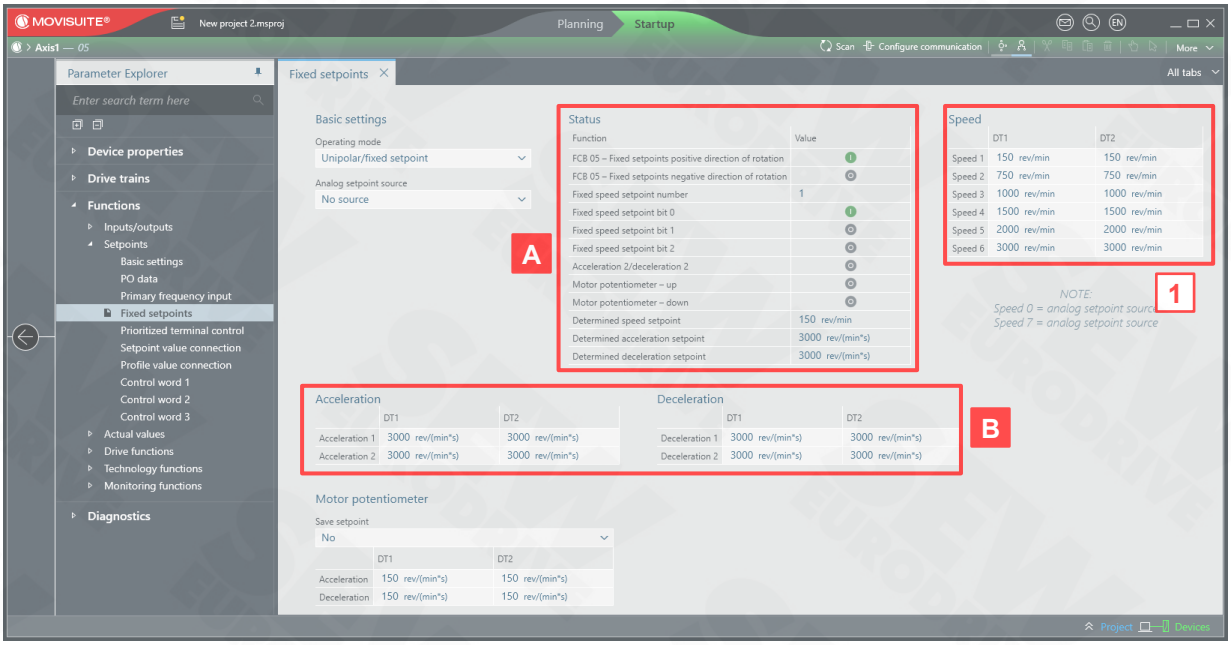
Procedure for controlling the axis via the digital inputs in both directions with three different speeds:

9. Open the inputs/outputs of the basic unit



1 Select **Functions > Inputs/outputs > Basic unit** and set the digital inputs as shown.

10. Activate the fixed setpoints



1 Switch the inputs on the I/O control box and observe the status and speed of the drive. Change the default **speed 1** value with the selected fixed setpoint from 150 rev/min to 500 rev/min and observe the speed.

A Status of the selected fixed setpoint with speeds and ramps.

B Acceleration and deceleration of fixed setpoints.
These only become active if the profile values **Maximum acceleration/deceleration** are configured as **Fixed setpoints – acceleration/deceleration**.

Task: Control the axis via the fixed setpoints.

1. Parameterize DI05 as shown

Digital inputs

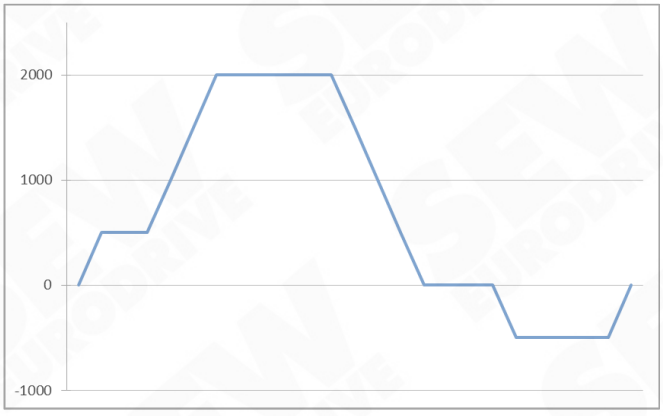
	Phys. level	0-active	Function state	Function
DI 00	I		I	Output stage enable
DI 01				FCB 05 – fixed setpoints positive direction of rotation
DI 02				FCB 05 – fixed setpoints negative direction of rotation
DI 03				Fixed speed setpoint bit 0
DI 04				Fixed speed setpoint bit 1
DI 05				Fixed speed setpoint bit 2
DI 06				No function
DI 07				No function

2. Parameterize the fixed setpoints according to the speeds in the following table. Move all fixed setpoints and enter the status of the required digital inputs in the table.

	Phys. level	0-active	Function	Status					
DI 00	I		Output stage enable	I					
DI 01			Fixed setpoints – positive rotation direction	I					
DI 02			Fixed setpoints – negative rotation direction	0					
DI 03			Fixed speed setpoint bit 0	I					
DI 04			Fixed speed setpoint bit 1	0					
DI 05			Fixed speed setpoint bit 2	0					
Speed fixed setpoint rev/min				**500**	**750**	**1000**	**1500**	**1800**	**2000**

3. Which parameters must be adjusted to travel all fixed setpoints?

4. Move the drive according to this travel profile with the fixed setpoints.

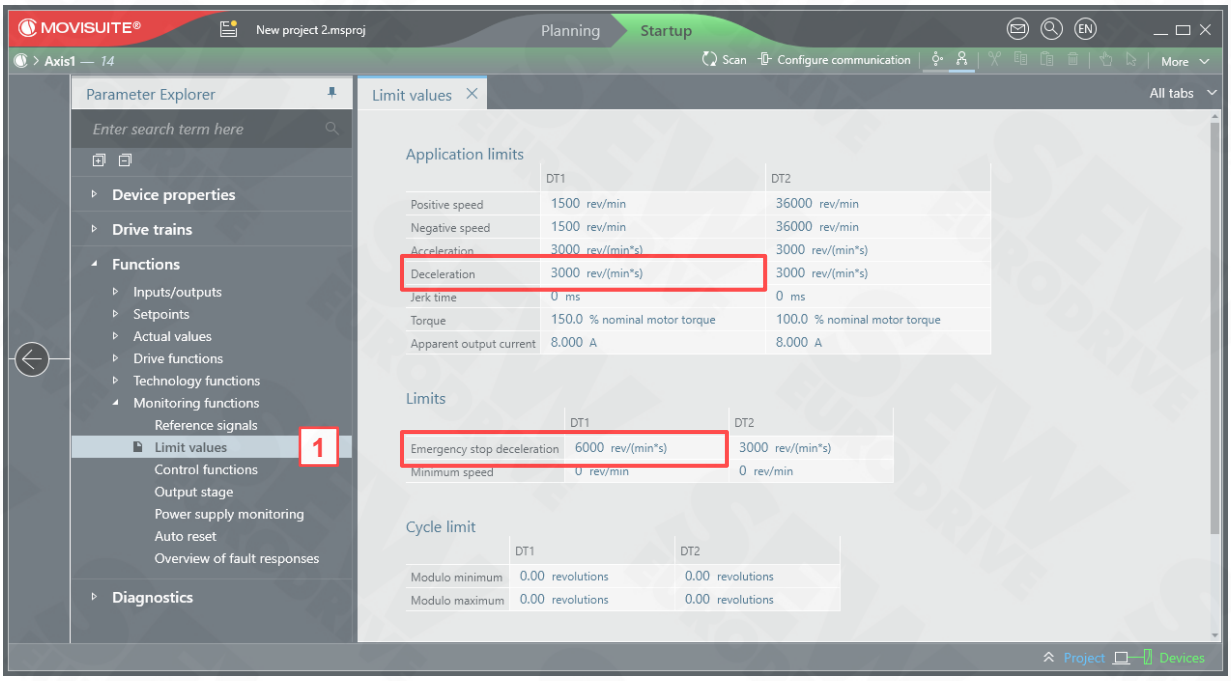


10.3 Stop with different FCBs

The following FCBs can be selected to stop a movement:

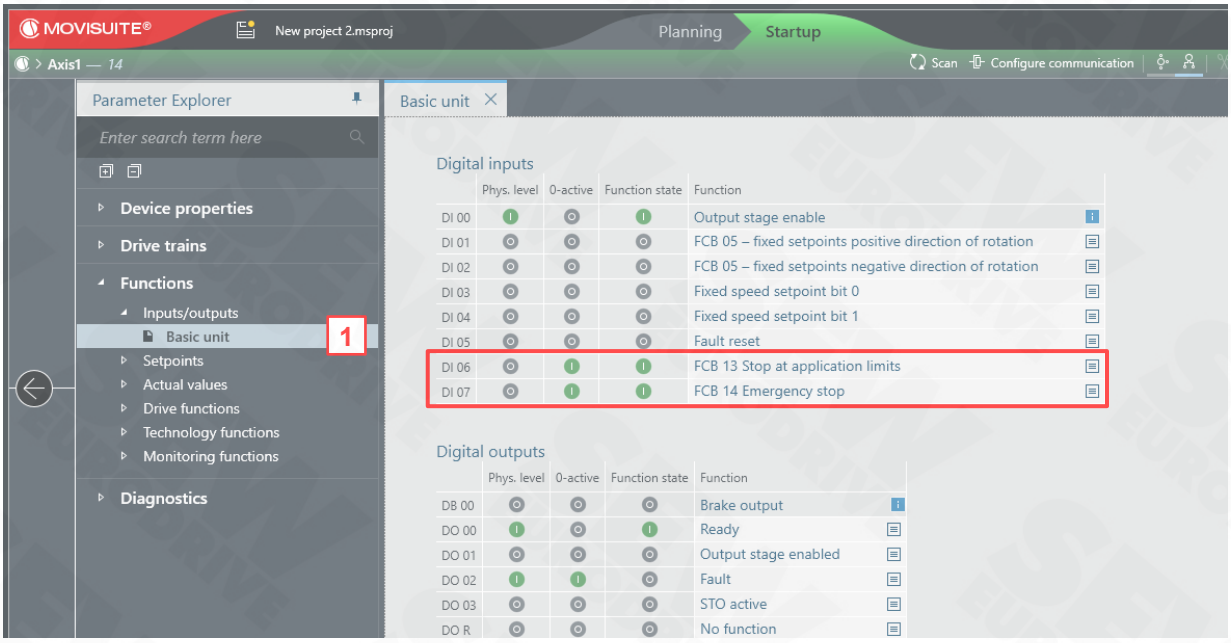
FCB	Name	Prio
FCB 01	Output stage inhibit	
FCB 14	Emergency stop	
FCB 13	Stop at application limit	
FCB 26	Stop at user limits	

1. Set deceleration ramps



1 Set the deceleration values for FCB 13 Stop at application limits and FCB 14 Emergency stop. The emergency stop delay can be steeper than the application limit.

2. Assign digital inputs

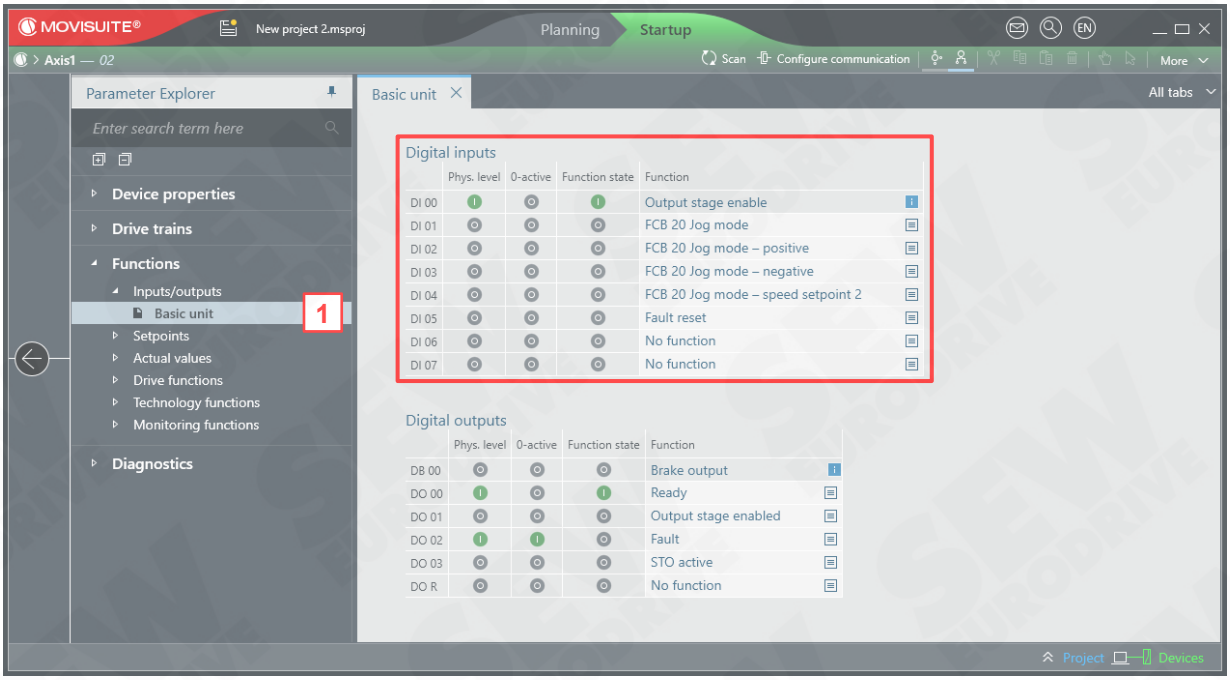


1 Parameterize FCB 13 and FCB 14 to terminals DI06 and DI07 and test the function. As a comparison, also test the output stage inhibit by switching off DI00.

10.4 Control of FCB 20 Jog via terminals

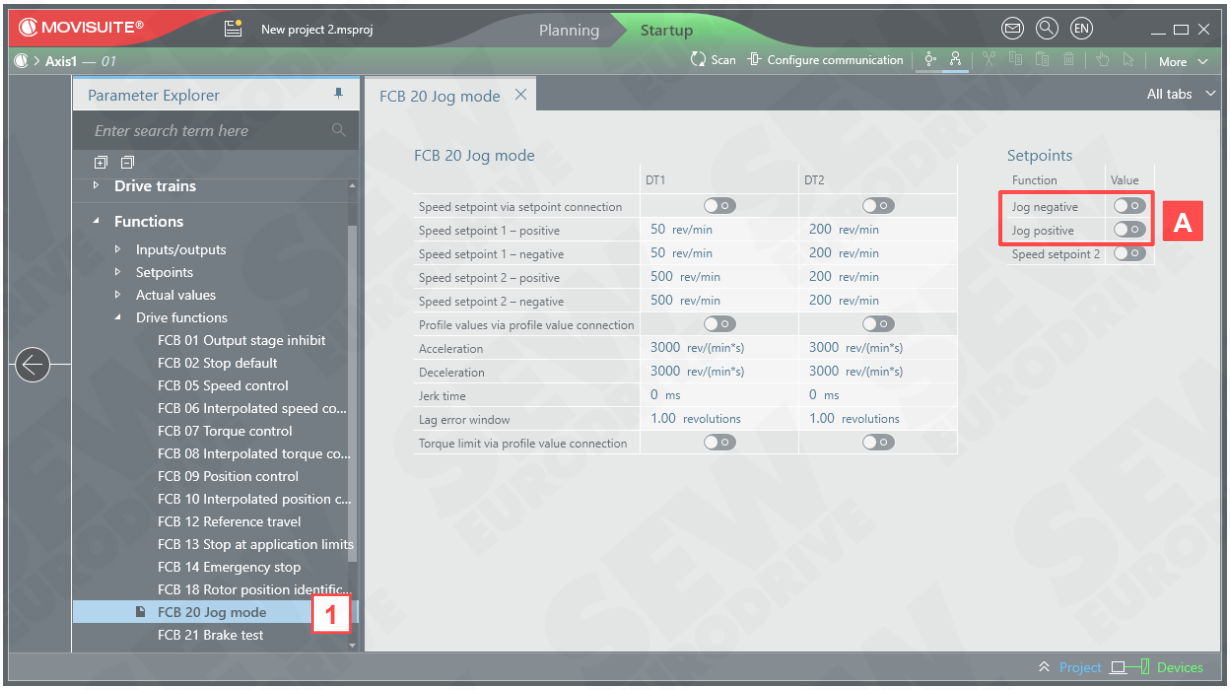
Procedure for controlling in jog mode via the digital inputs:

1. Configure the digital inputs



1 Select **Functions > Inputs/outputs > Basic unit** and configure the digital inputs as shown.

2. Parameterize FCB 20 Jog mode



1 Select **Functions > Drive functions > FCB 20 Jog mode**.

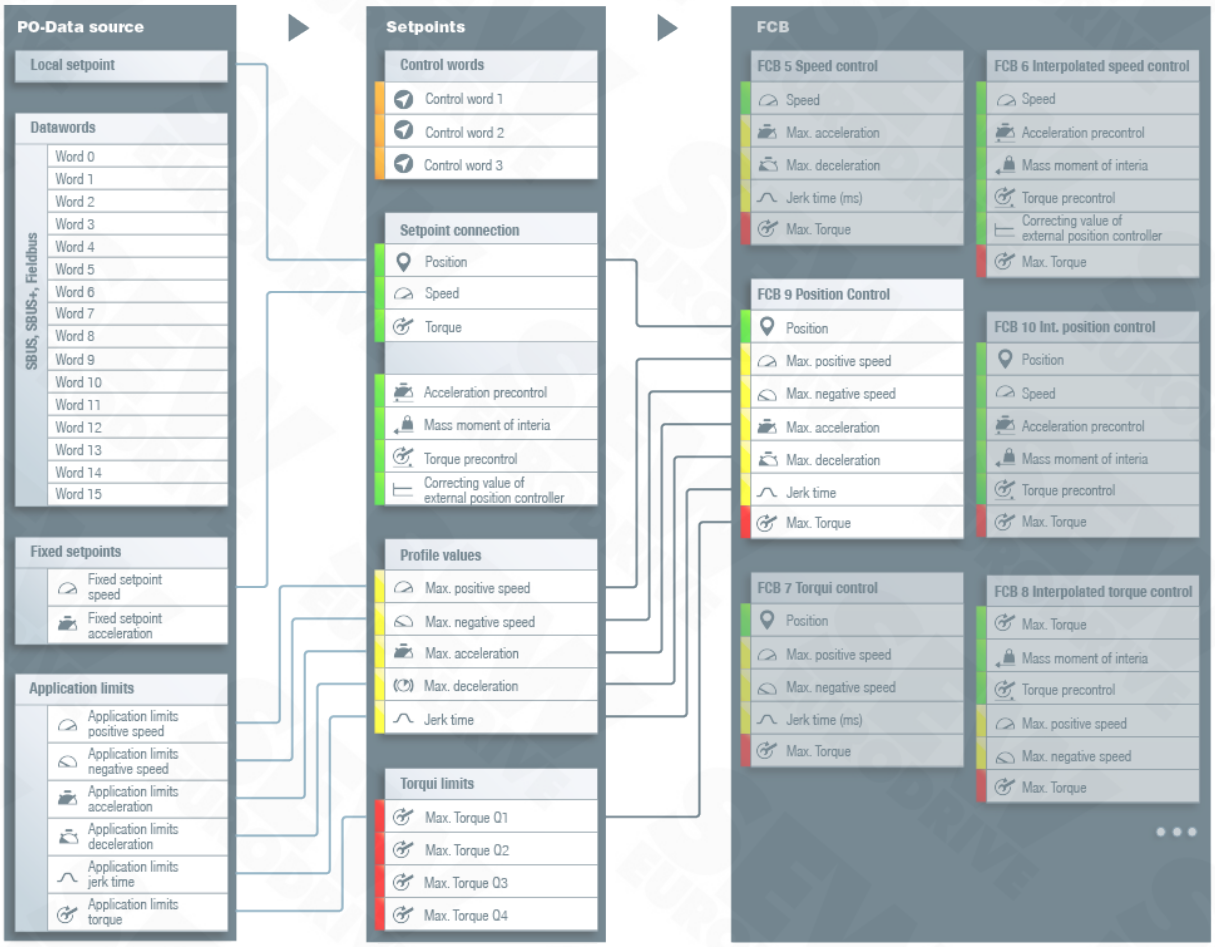
A The **Jog negative** and **Jog positive** switches can only be used if they are not parameterized as a terminal or in a control word (default control word 1).

3. Move the axis in jog mode

Move the drive in positive direction of rotation with DI01 and DI02 = 1 and in negative direction of rotation with DI01 and DI03 = 1. Switch the speed setpoints with DI04.

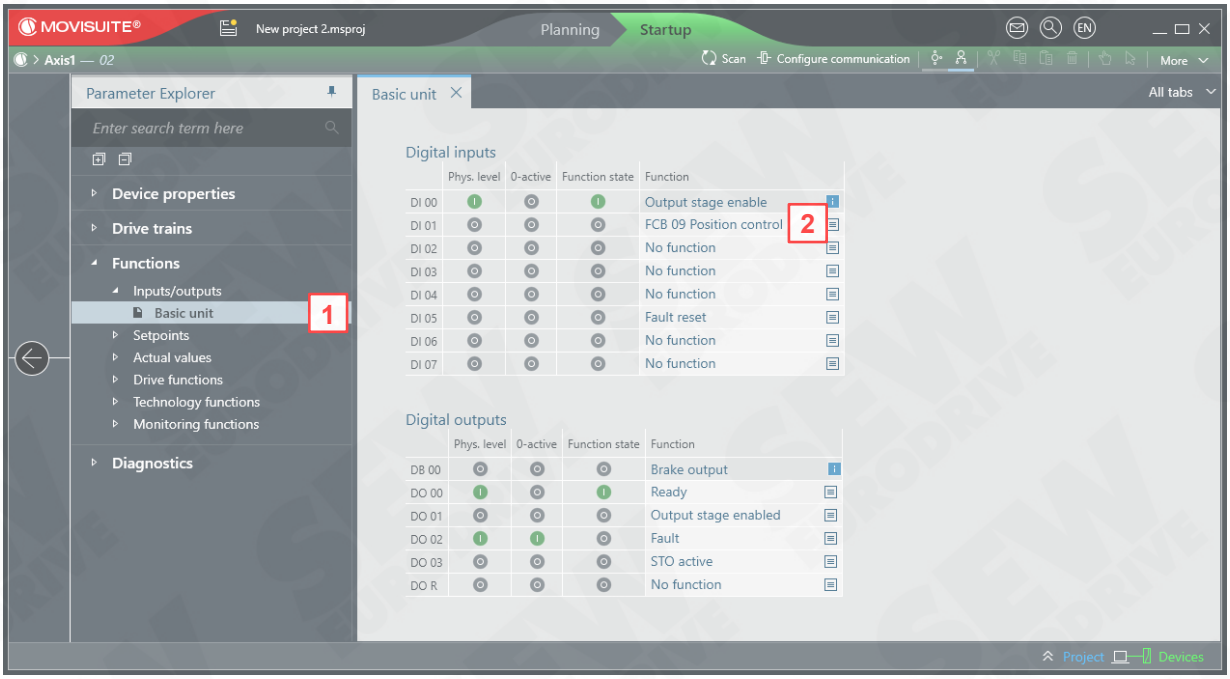
10.5 Control of FCB 09 Position control via terminals

- Process data connection for FCB 09 Position control:



Procedure for controlling the axis in positioning mode via the digital inputs:

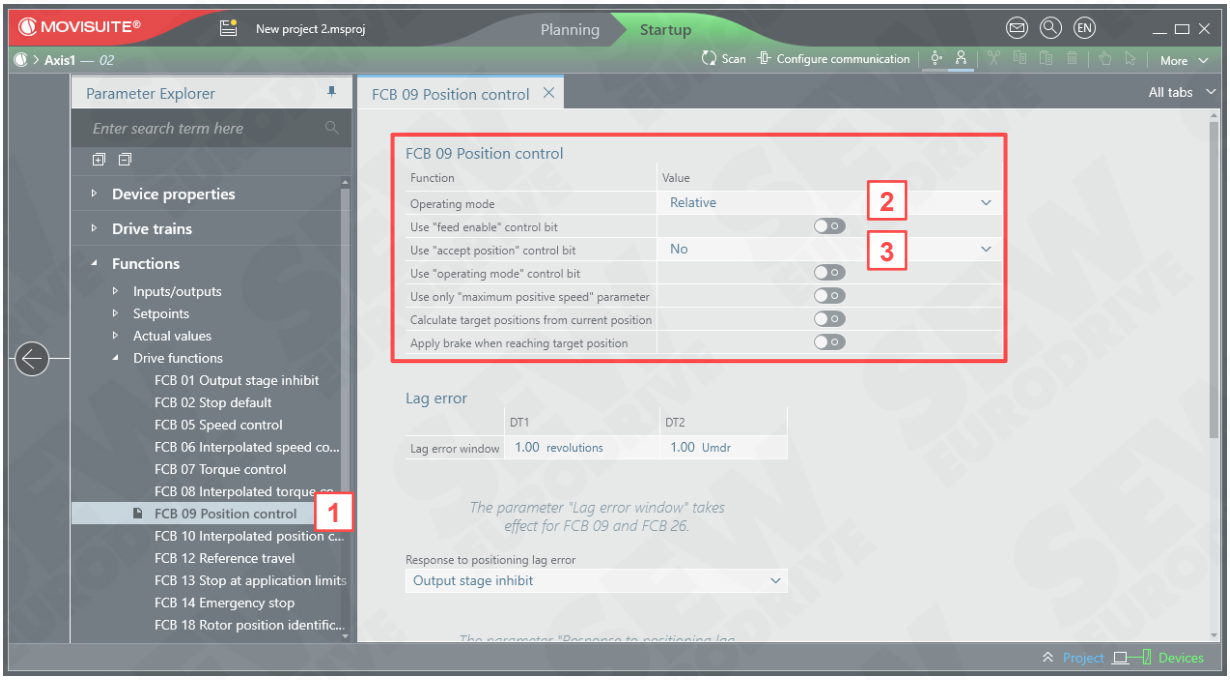
1. Inputs/outputs > Parameterize basic unit



1 Select **Functions > Inputs/outputs > Basic unit**.

2 Set **DI01 > FCB 09 Position control**.

2. Parameterize FCB 09 Position control

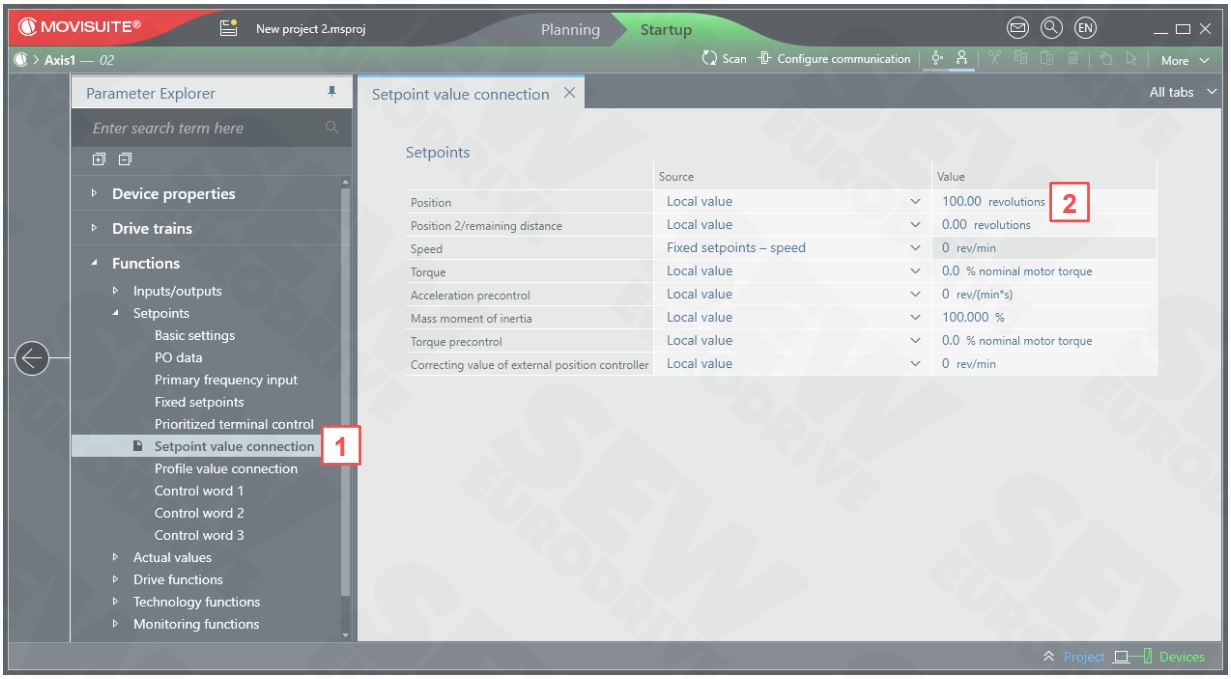


1 Select **Functions > Drive functions > FCB 09 Position control.**

2 Select **Operating mode > Relative.** The drive is repositioned from the current position by the position setpoint.

3 Set all control bits to 0. The feed enable control bit can be used to interrupt ongoing movements. The movement is continued when the feed enable is set again.

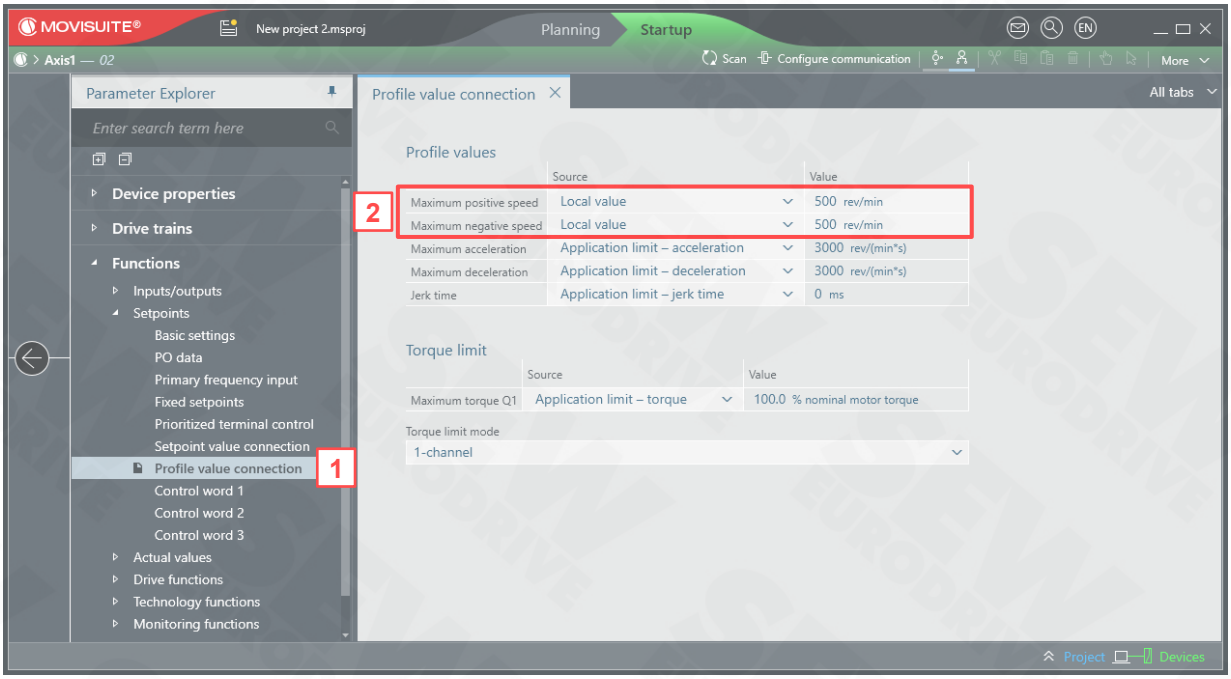
3. Specify the setpoint for the position



1 Select **Functions > Setpoints > Setpoint value connection.**

2 Enter **100.00 revolutions** as the setpoint for the position.

4. Specify profile values for speed



1 Select **Functions > Setpoints > Profile value connection.**

2 Set the maximum positive and negative speed to **Local value** and **500 rev/min**.

5. Move the axis in positioning mode

Start the relative positioning of the axis with DI01 = 1 and test the function with different positions and profile values. You can start further travel processes by toggling DI01.

11 Bus control

Objectives:

- You are familiar with the principle of bus control of the inverter
- You can configure the inverter for bus control
- You can control FCBs via the bus

11.1 Principle of bus control

For bus control, the setpoints are specified via process data of a higher-level controller. For this purpose, the bus system and the assignment of the process data must be configured in the inverter. You can either freely parameterize these settings or have a MOVIKIT® software module perform them automatically. The MOVIKIT® software modules are available in the MOVISUITE® catalog.

This workbook deals exclusively with bus control **without** MOVIKIT® software modules; information on control with MOVIKIT® software modules can be found in further workbooks and in the general documentation of SEW-EURODRIVE.

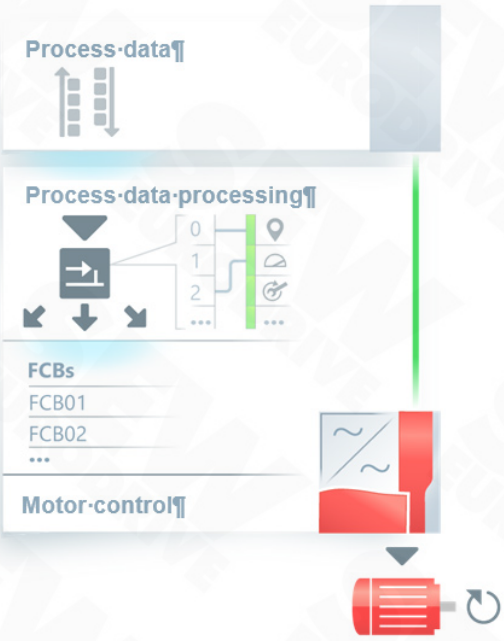
Bus control options:

1. Bus control via fieldbus without MOVIKIT® software modules

Process data processing is parameterized here directly in the inverter.

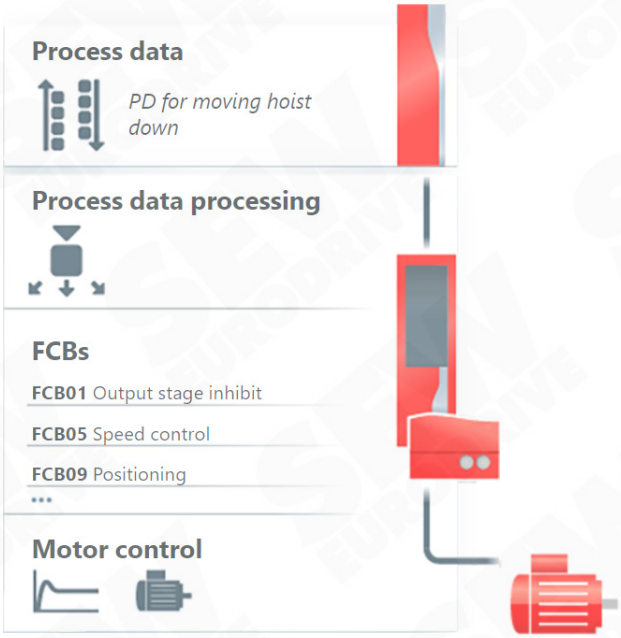
2. Bus control via fieldbus with MOVIKIT® software modules of the Drive category

The MOVIKIT® software module handles the interconnection of the process data.



3. Bus control with MOVI-C® CONTROLLER via EtherCAT®/SBus^{PLUS}

Here, a MOVIKIT® software module handles the parameterization of the process data. In addition, a program is loaded in the MOVI-C® CONTROLLER that can either be parameterized or programmed and can control several inverters simultaneously.



11.2 Basic settings

4. Set the source

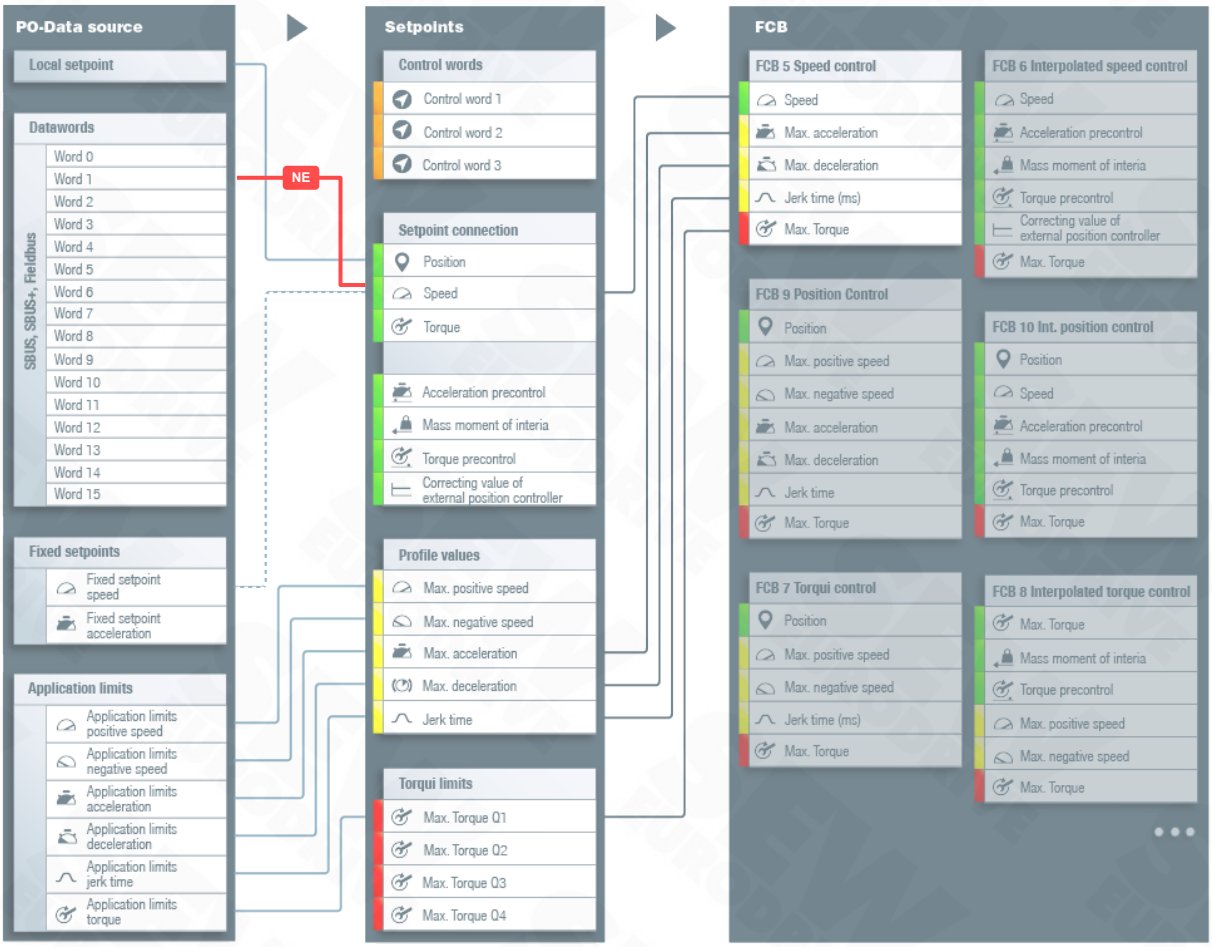
1 Select **Functions > Setpoints > Basic settings** and select the connection of the MOVI-C® inverter to the higher-level controller here:
- With MOVIDRIVE® technology = **Source > Fieldbus**
- With MOVIDRIVE® modular/system = **Source > EtherCAT®/SBus^{PLUS}**

2 Changing the process data configuration automatically generates error E-34.01; acknowledge this error message.

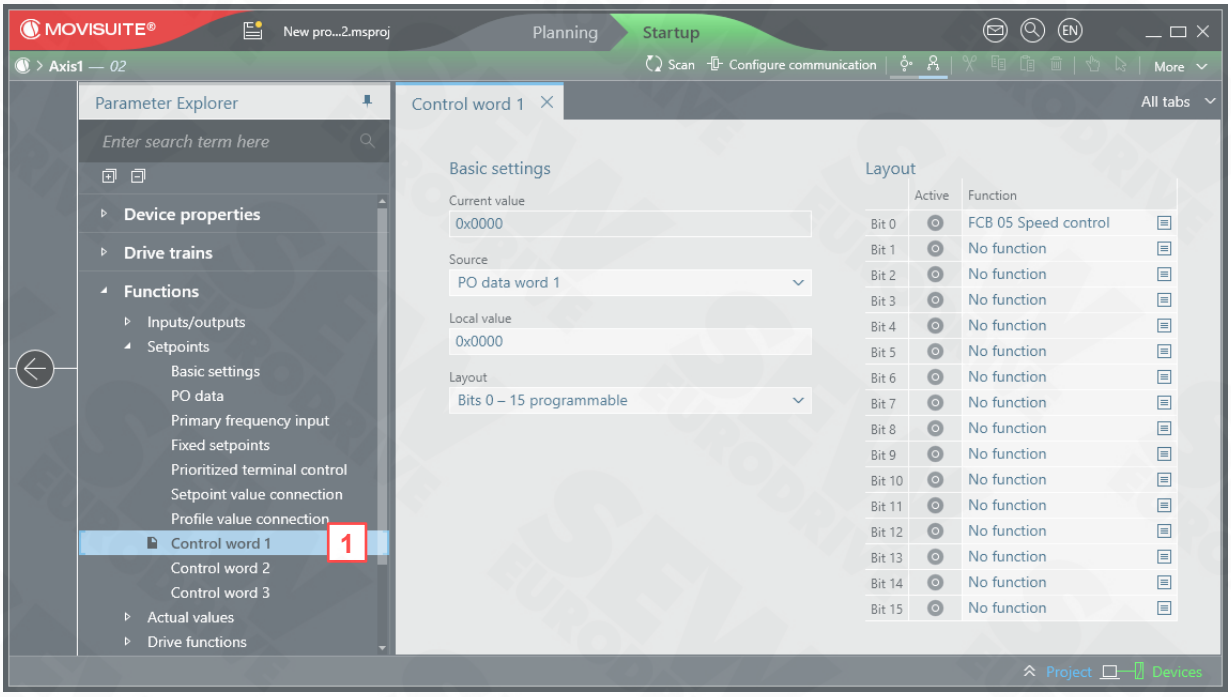
For the following exercises, leave the setting **No source**, as the inverter otherwise remains in status C3 (process data processing not ready) due to the lack of communication with the higher-level controller and therefore the drive cannot be moved.

11.3 Control of FCB 05 Speed control via bus

FCB 05 Speed control obtains its setpoints according to the delivery state from the sources shown below. To specify the speed via the bus, the process data configuration must be adjusted accordingly.

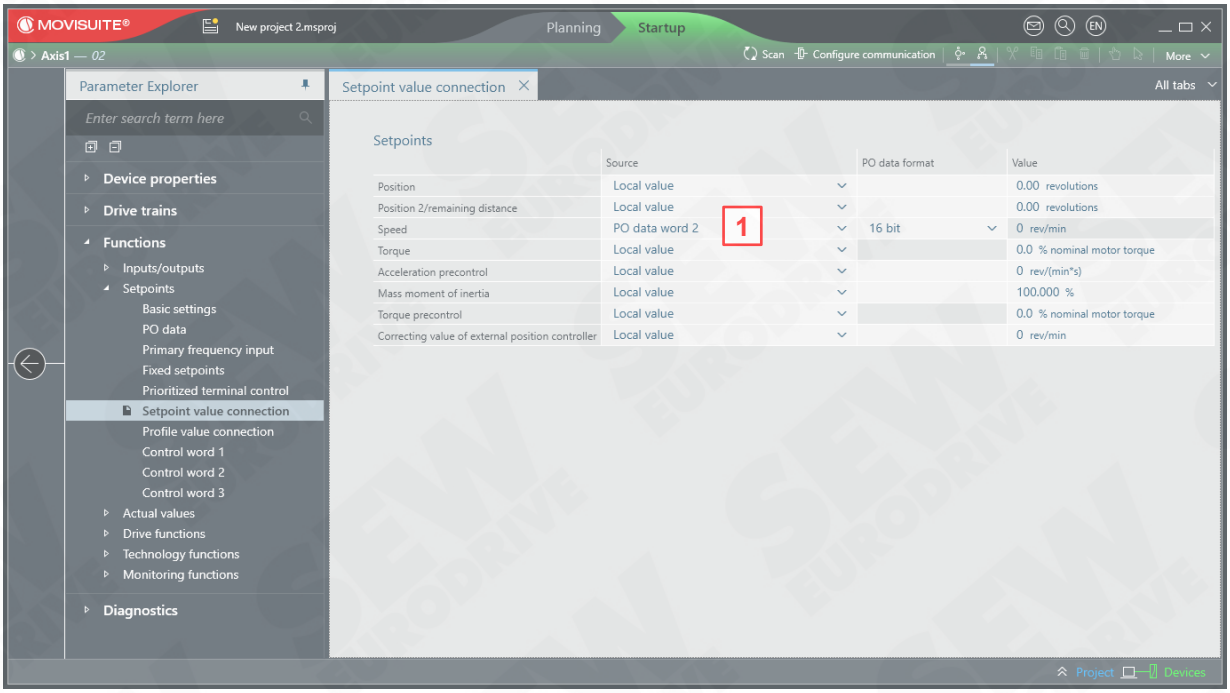


1. Configure control word 1



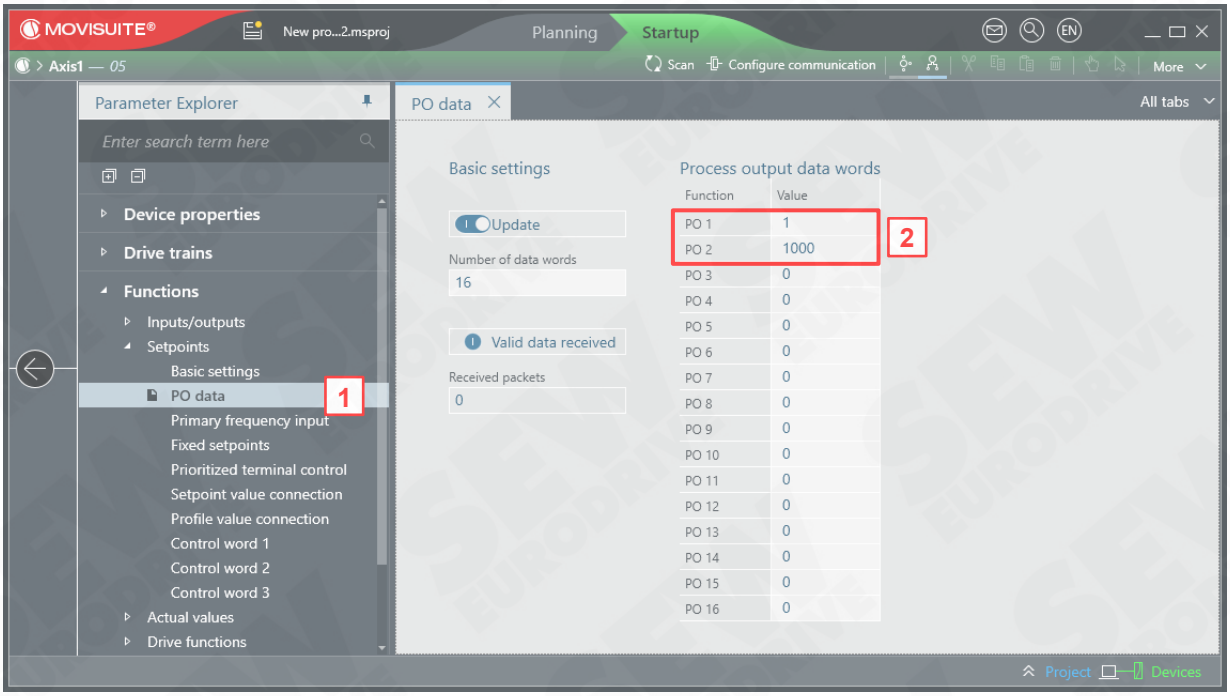
1 Configure **Functions > Setpoints > Control word 1** as shown.

2. Configure the data source for the speed



1 Select **Functions > Setpoints > Setpoint value connection** and select **PO data word 2** as the source for the speed.

3. Write PO data to control the drive



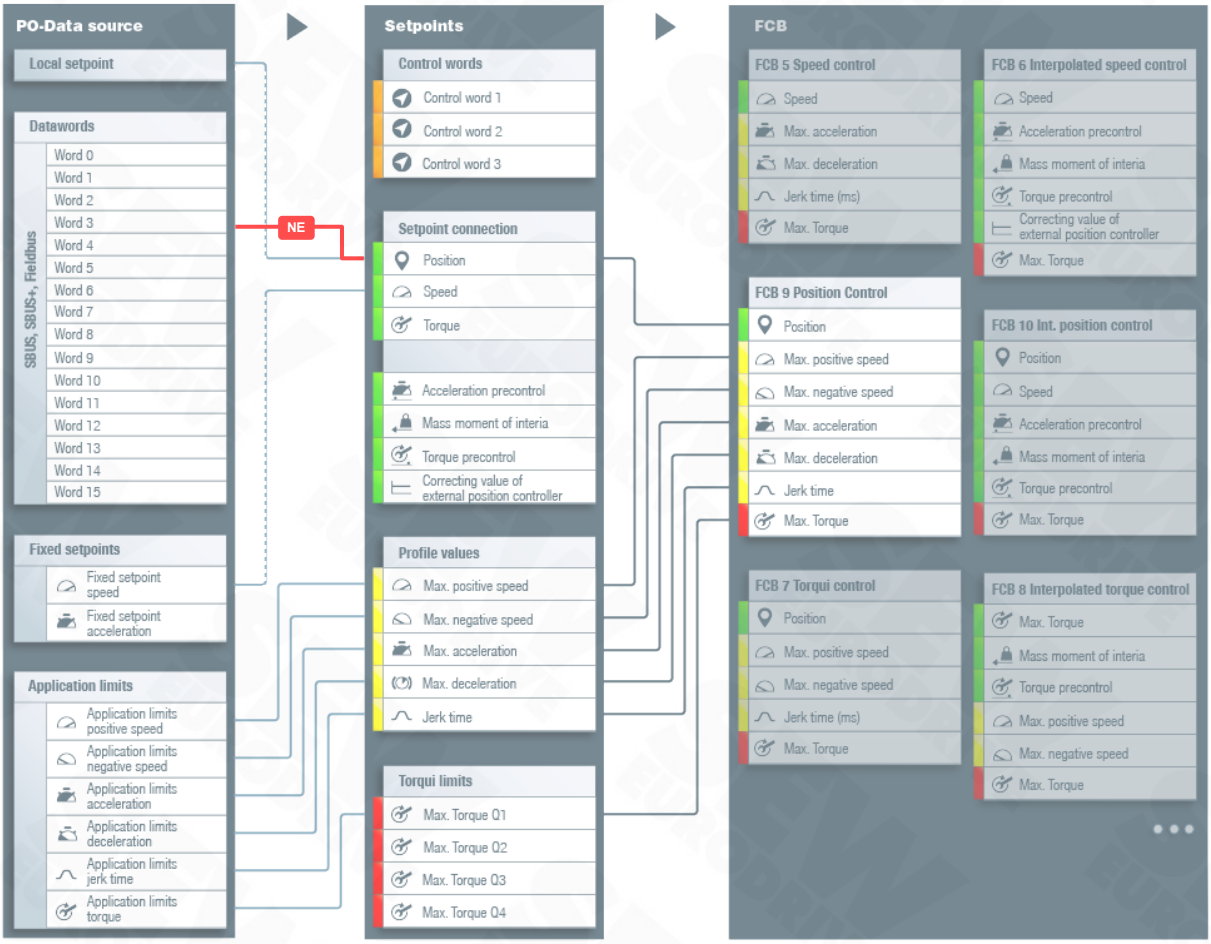
1 Select **Functions > Setpoints > PO data.**

2 Enter the value **1** in data word **PO1** to set bit 0 in control word 1 and enter the value **1000** as the speed setpoint in data word **PO2**. Result: FCB 05 is activated and the drive rotates at 1000 rpm. Then test different speeds and directions of rotation.

The manual input of the process output data is used for simulation for test purposes.
In a real application, the process output data is sent by the higher-level controller via the bus as long as the **Update** parameter is activated. Deactivating this parameter stops the process output data from being updated.

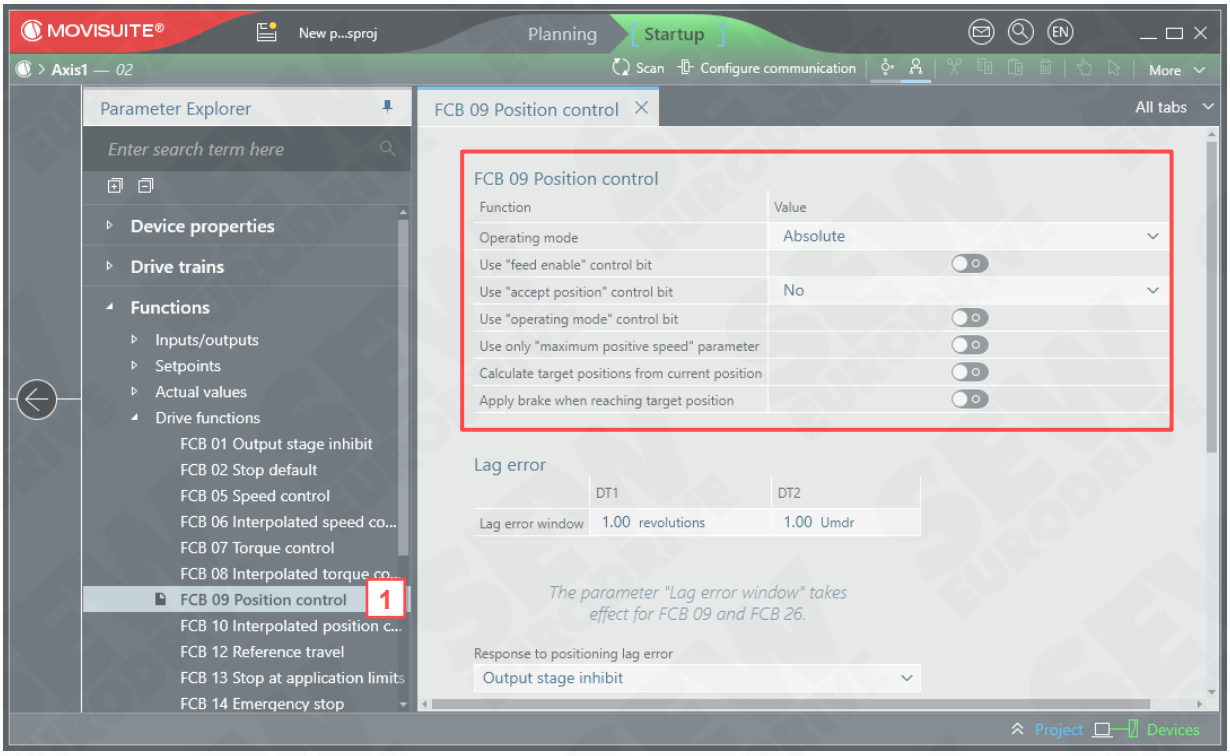
11.4 Control of FCB 09 Position control via bus

FCB 09 Position control obtains its setpoints according to the delivery state from the sources shown below. To specify the position via the bus, the data source must be adapted to the bus in the setpoint buffer.



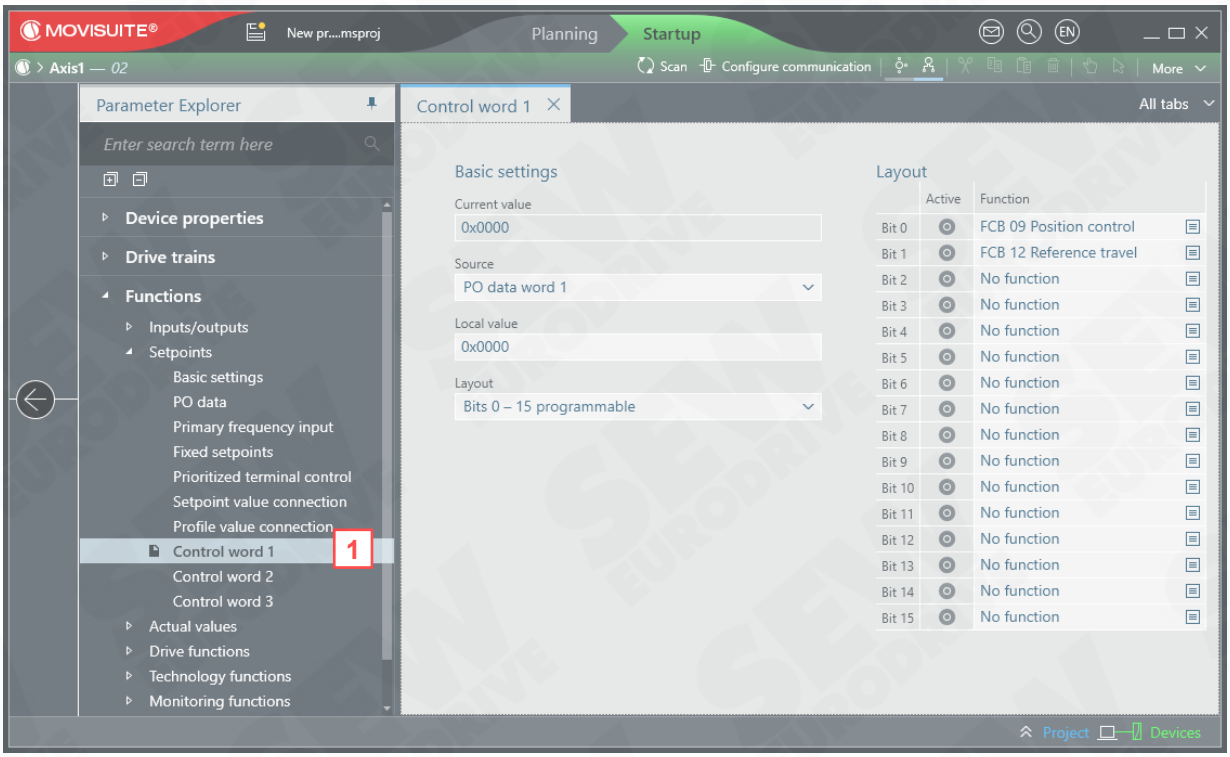
In this exercise, absolute positioning with FCB 09 is to be controlled via the bus.
The setpoints for speed, ramps and speed are also to be specified via process data.

1. Configure FCB 09



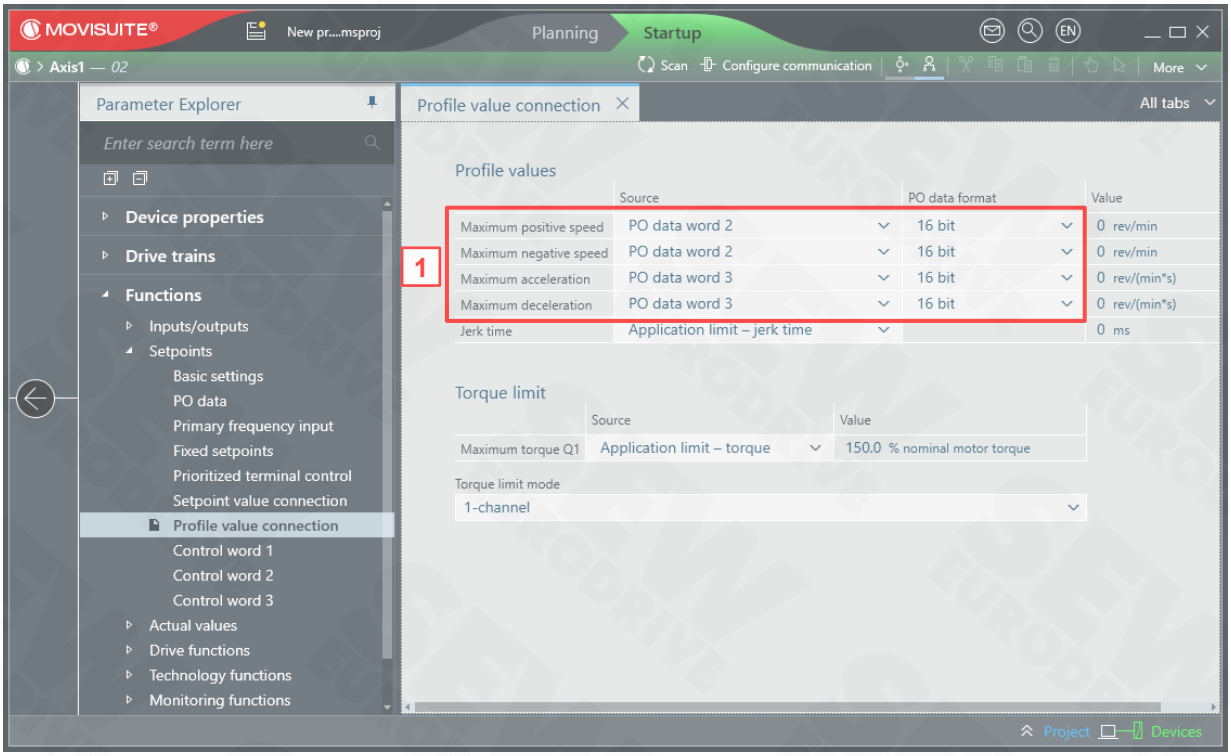
1 Select **Functions > Drive functions > FCB 09 Position control** and configure FCB 09 as shown.

2. Configure control word 1



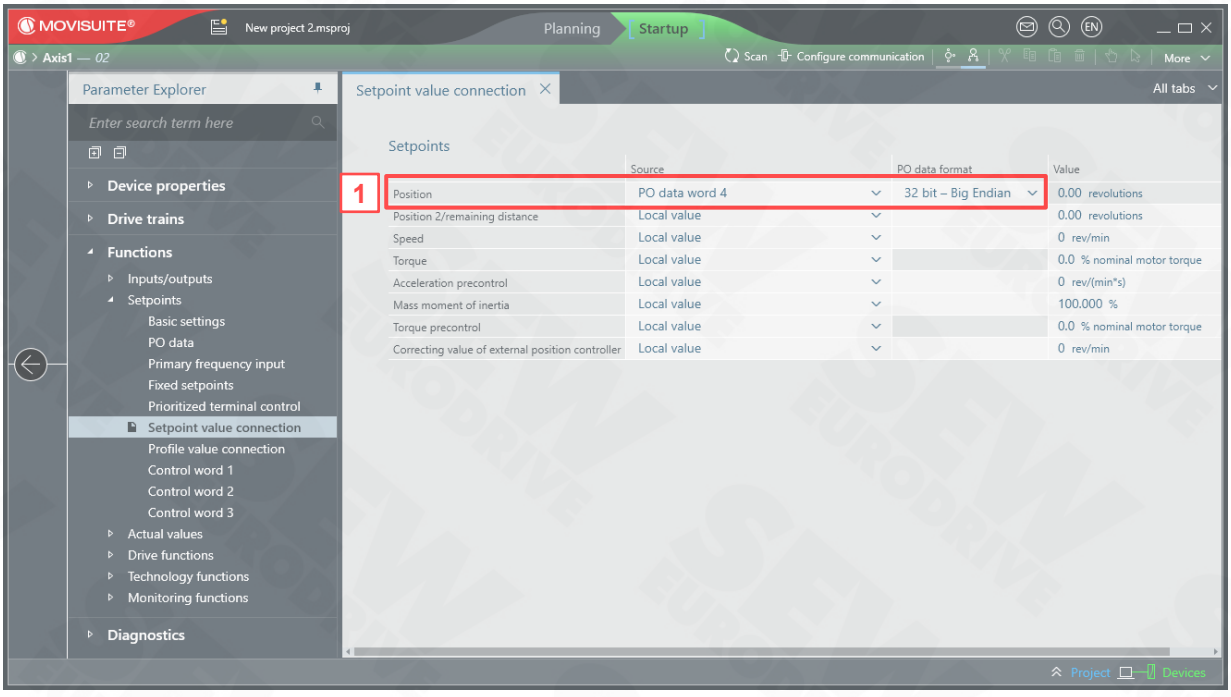
1 Configure **Functions > Setpoints > Control word 1** as shown.

3. Configure the data source for positioning speed and ramps



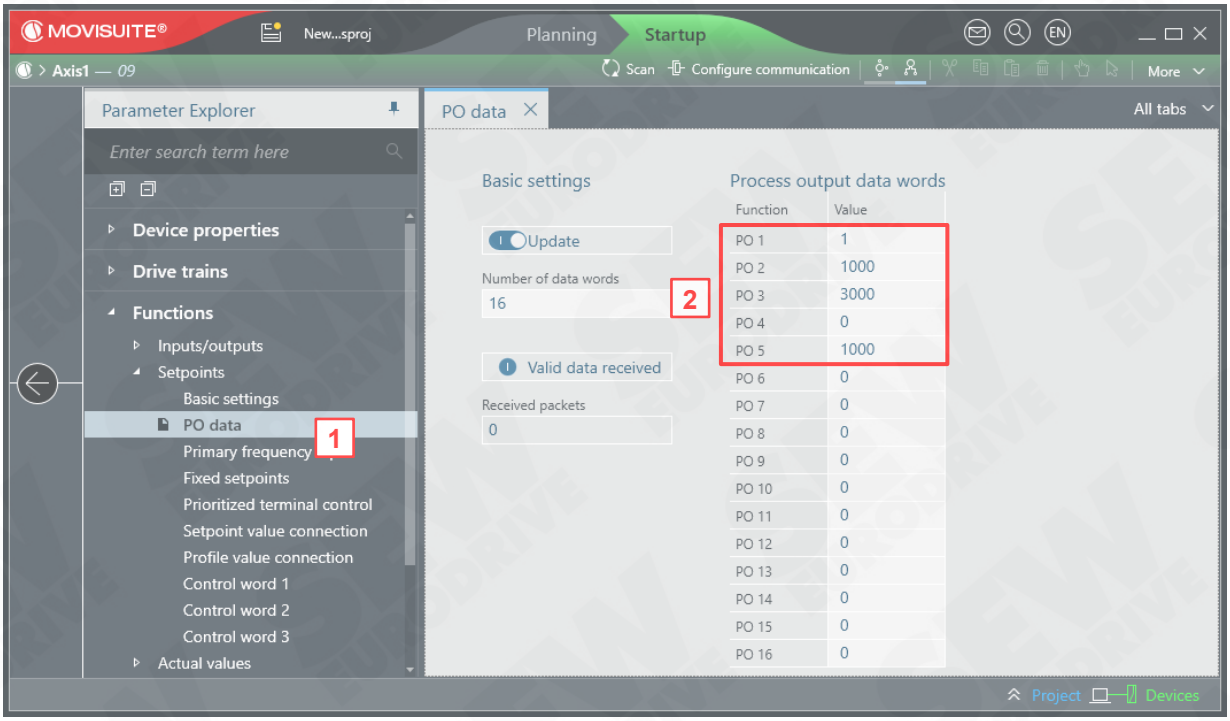
1 Select **Functions > Setpoints > Profile value connection** and assign the profile values as shown. This sends the positive and negative speed as well as acceleration and deceleration via one process data word each.

4. Configure the data source for the position



1 Select **Functions > Setpoints > Setpoint value connection** and parameterize the source and format for the position as shown to **PO data word 4 / 32 bit – Big Endian**. The position thus occupies PO data word 4 (high word) and PO data word 5 (low word).

5. Control the drive via PO data

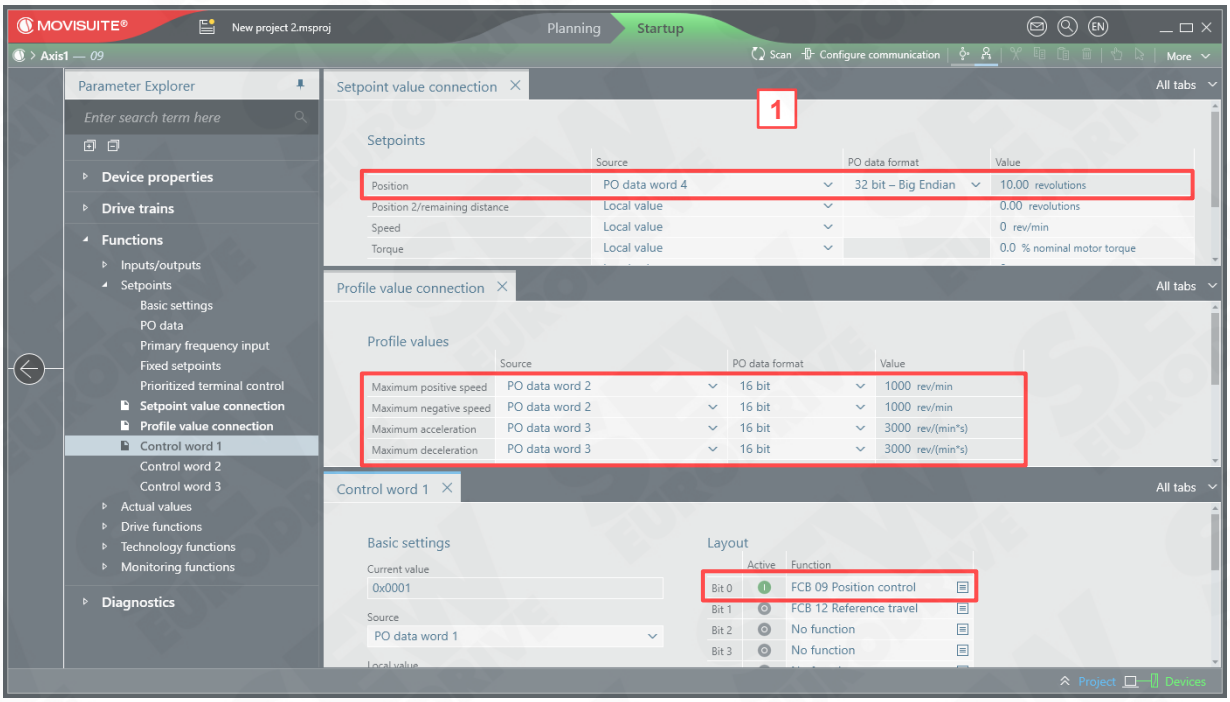


1 Select **Functions > Setpoints > PO data.**

2 Procedure:

- First perform a reference travel with FCB 12 with **PO 1 > Value: 2**.
- Then activate FCB 09 with **PO 1 > Value: 1**.
- Specify the positioning speed in PO2 and the ramps in PO3.
- Specify the position in PO5. The position is configured with two decimal places by default => the drive moves with the setpoint via bus from 1000 rev to the position 10 rev.
- Test the function with various positions and travel parameters.

6. Observe PO data



1 Select **Setpoint value connection / Profile value connection / Control word 1** and observe the specified process data.

12 Control with the CBG21A keypad

Objectives:

- You are familiar with the various keypads
- You are familiar with the CBG21A menu guidance
- You can move the drive in manual mode with the CBG21A
- You can control the brake/DynaStop with the CBG21A
- You can acknowledge inverter faults with the CBG21A
- You can perform a data backup with the CBG21A

12.1 Overview of keypads

The following keypads are available for simple, fast and direct on-site operation and monitoring of process sequences.

	CBG01A	CBG11A	CBG21A	CBG22A	CDM11A
					
Description	Keypad for motor startup, display of status and parameters, and saving and copying parameter sets			CBG22A keypad, with locked manual mode optimized for system operators.	Diagnostic module for displaying the inverter status and adaptation of CBG11A, CBG21A, CBG22A, USM21A.
Display	5 x 7-segment display	1.5 Monochrome display	2.4 Color display	2.4 Color display	2 x 7-segment display
Languages	None	EN	DE/EN/FR/ES/IT/ PT/ZH/RU/HU/KR	DE/EN/FR/ES/IT/ PT/ZH/RU/HU/KR	None
Parameter access	Yes	Yes	Yes	Only to selected diagnostic data	No
Engineering interface for MOVISUITE®	No	Yes, via USB mini interface	Yes, via USB mini interface	Yes, via USB mini interface	Yes, via 9-pin SUB-D connector and USM21A interface adapter or keypad
Actual value and status display	Yes	Yes	Yes	Yes	Yes (inverter status only)
Output of text	No	No	No	Yes	No
Save and copy the inverter parameter set	One parameter set	One parameter set	Several parameter sets can be edited and exchanged with a PC via USB mini interface	No	No
Startup	Asynchronous motors ▪ With/without brake ▪ Motor sensor ▪ Without optimization of the drive train	Asynchronous motors ▪ With/without brake ▪ Motor sensor ▪ Optimization of the drive train	Asynchronous and synchronous motors ▪ Integrated motor and encoder catalog ▪ With/without brakes ▪ Motor sensor ▪ With/without encoder ▪ Optimization of the drive train	No	No
Manual mode	Yes	Yes	Yes	Yes (in combination with key switch)	No
Emergency mode	No	No	Yes	Yes	No
Firmware of the keypad can be updated	No	Yes	Yes	Yes	No
Control cabinet inverter	MOVITRAC® advanced/ MOVITRAC® basic	MOVITRAC® advanced/ MOVITRAC® basic + CDM11A MOVIDRIVE® technology	MOVITRAC® advanced/ MOVITRAC® basic + CDM11A MOVIDRIVE® technology	MOVITRAC® advanced/ MOVITRAC® basic + CDM11A MOVIDRIVE® technology	MOVITRAC® advanced/ MOVITRAC® basic
Decentralized drive technology	No	Can be used on all designs, usually in remote operation or in conjunction with MOVIMOT® flexible MMF3 and front module for keypad. 		Can be used on all designs, usually in remote operation or in conjunction with MOVIMOT® flexible MMF3 and front module for on-site keypad incl. key switch.	No.

12.2 CBG21A main menu

1. Open the main menu

1 Pressing the ESC key takes you from the start menu to the main menu.

2 The main menu offers the following selection options:


Start menu


Manual mode


Movisafe CS..


Diagnostics


Parameters


Data management


Startup


Drive train optimization


Gateway


Keypad settings

12.3 Manual mode

Not all manual modes are always available. If, for example, no encoder system has been started up via the drive train, the position-controlled modes are not displayed!

2. Switch on manual mode

1 Use the arrow keypad to navigate through the main menu.

2 Select the main menu entry "Manual mode" and confirm with **OK**.

12.3.1 Speed-controlled manual mode

With speed-controlled manual mode, the drive can be moved using a speed specification.

1 Select **Speed-controlled manual mode** and confirm with **OK**.

2 Enter the **Setpoint speed**.

3 Enter the **Accel./decel. setpoint**.

4 Switch the **Direction of rotation** with **OK**.

5 Start the drive with the green **RUN** key.

6 Stop the drive with the red **STOP** key.

Activate the input window of a setpoint with **OK**. You can then edit the setpoint using the arrow keys. Press **OK** again to confirm the entry and close the input window.

12.3.2 Reference travel

To be able to use position-controlled manual mode, the drive must be referenced in advance.

1. Select **Reference travel** and confirm with **OK**.
2. Start the reference travel with **OK**.
3. **Active drive referenced** is displayed after successful referencing.

12.3.3 Position-controlled manual mode

Position-controlled manual mode enables absolute positioning in the configured user units (default unit: Revolutions)

1. Select **Pos. controlled manual mode** and confirm with **OK**.
2. Enter the desired **Setpoint position**.
3. Enter the **Setpoint speed**.
4. Enter the ramp for **Accel./decel setpoint**.
5. Start positioning with **RUN**.
6. You can stop the positioning again with **STOP**.

12.3.4 Load cycling

You can move cyclically between two absolute positions with Load cycling absolute mode. Make sure that the setpoint position 1 is set smaller than the setpoint position 2.

1. Select **Load cycling** and confirm with **OK**.
2. Enter **Setpoint position 1** and **position 2**.
3. Enter the **setpoint speed**.
4. Enter the ramp for **Accel./decel setpoint**.
5. Start positioning with **RUN**.
6. You can stop the positioning again with **STOP**.

12.3.5 Cycle mode

Cycle mode can be used to move cyclically by a specified distance (relative positioning).

1. Select **Cycle mode** and confirm with **OK**.
2. Enter the **Travel distance**.
3. Enter the **Setpoint speed**.
4. Enter the ramp for **Accel./decel setpoint**.
5. Start positioning with **RUN**.
6. You can stop the positioning again with **STOP**.

12.3.6 Brake/DynaStop control

Releasing the brake when the output stage is inhibited can cause the hoist to crash in hoist applications!

This function can be used to release the brake when the output stage is inhibited.

1. Select **Brake/DynaStop control** and confirm with **OK**.
2. Before the brake can be controlled, the output stage inhibit must be activated in the inverter. To do so, select **Inhibit output stage** and confirm with **OK**.
3. Select **Release brake** and confirm with **OK** to release the brake electrically.
4. Select **Apply brake** and confirm with **OK** to apply the brake electrically. The two green icons **Output stage inhibited** and **Brake released** indicate the active states.

12.4 Error acknowledgment

If an error occurs in the system, it is displayed directly on the display of the keypad.

1 The error code is displayed here in the display format **main error.suberror**.

2 Press the key to open the error menu. In addition to the error number the **error text** is displayed here.

3 The associated causes and their possible solutions are listed here.

4 Press **Reset** to reset the error.

5 The error-free state is indicated by error code **0.0** and a green display.

12.5 Data backup

The keypad can be used to load data sets from the inverter to the keypad or from the keypad to the inverter.

3. Select data backup

1 Select **Data management** and confirm with **OK**.

4. Data backup from inverter to keypad

1 Select **Inverter > keypad** and confirm with **OK**.

2 Press the key to add a data set and confirm with **OK**. The name consists of a consecutive number and the device signature.

3 Start loading the data set from the inverter to the keypad with **OK**.
The green check mark indicates the upload has been successful!

5. Data recovery from keypad to inverter

1 Select **Keypad > inverter** and confirm with **OK**.

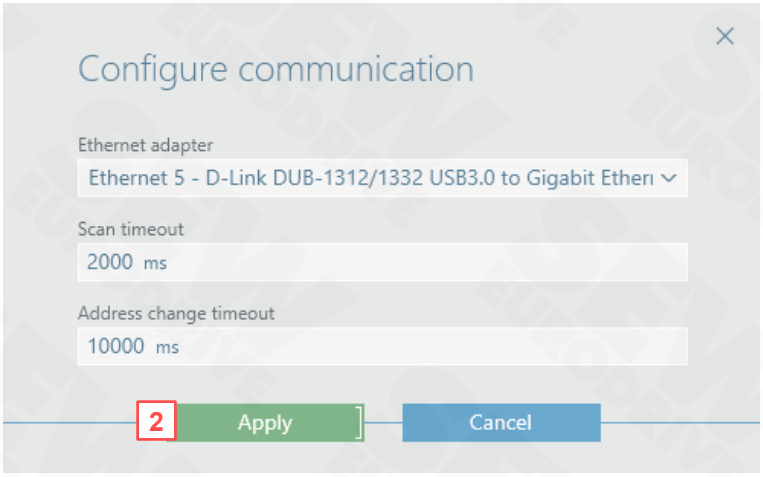
2 Select the required data set and confirm with **OK**.

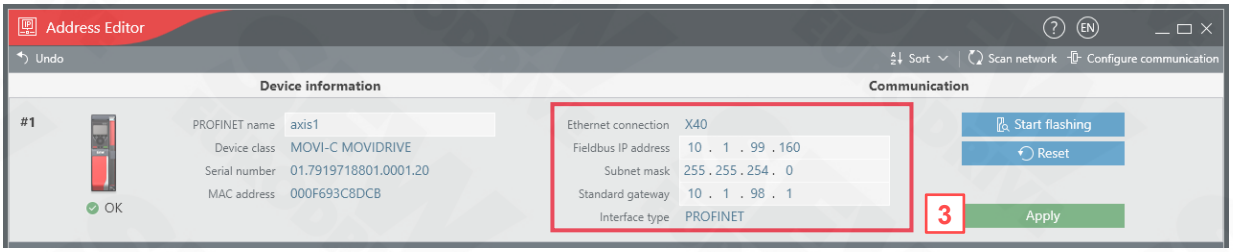
3 Start loading the data set from the keypad to the inverter with **OK**. The green check mark indicates the download has been successful!

13 Appendix

13.1 Set fieldbus communication via MOVI-C® Address Editor

The MOVI-C® Address Editor can be used to find and configure fieldbus stations for the PROFINET, EtherNet/IP or Modbus TCP bus systems.





1 Start the MOVI-C® Address Editor via **Start > SEW > MOVI-C® Address Editor**.

2 Select the appropriate Ethernet adapter and **Apply** the settings.

3 Configure the required address parameters and **Apply** the settings.

13.2 Operating displays on MOVIDRIVE®

Display	Description	Condition	Comment/action
Displays during boot process			
b0 b1 b3 br	The device goes through various states when loading the firmware (booting).	Status: Not ready, output stage is inhibited, communication is not possible	Wait until the boot process is finished. Device remains defective in this state
Displays for various device statuses			
•	Energy-saving mode		Energy-saving mode active
00	DC link voltage missing	Status: Not ready, output stage is inhibited, communication is possible	Check the supply system
C0 flashing	Module bus is not ready		Check the module bus connection
C2 flashing	STO active	Status: Not ready, output stage is inhibited, communication is possible	Safe Torque Off function is active
C3 flashing	Synchronization with the bus not OK Process data processing is not ready		Check the bus connection Check synchronization setting on device and controller, check process data settings on device and controller
C4 flashing	Encoder evaluation is not ready		Encoders are initialized Device remains in this state: No encoder selected Parameter source actual speed or actual position indicates a non-existent encoder
C5 flashing	Motor management not ready		
C6 flashing	Internal device supply incomplete		
Display	**Description**	**Condition**	**Comment/action**
C7 flashing	Power section not ready		
C8 flashing	External device not ready		
C9 flashing	Data flexibilization layer not ready		
CD flashing	Parameter download in progress		
Displays during initialization processes (parameters are reset to default values)			
d0 flashing	Basic initialization	Status: Not ready, output stage is inhibited, communication is possible	Wait until initialization is complete
d1 flashing	Initialization of delivery state		
Displays in normal operation			
01	Output stage inhibit	Output stage is inhibited	The drive is not controlled by the output stage. The brake is applied; without a brake, the motor coasts to a standstill. FCB 01 is permanently selected with terminal DI00. However, it can also be selected from other sources.
02	Default stop	For more information, refer to the description of the FCBs.	Drive function (FCB) Default stop active if no other FCB is selected and the system is ready.
04	Manual mode		Manual mode active
05	Speed control		Speed control with internal ramp generator
06	Interpolated speed control		Speed control with setpoints cyclically via bus, the ramp generator is arranged externally, e.g. in a higher-level controller.
07	Torque control		Torque control
08	Interpolated torque control		Torque control with setpoints cyclically via bus
09	Position control		Positioning mode with internal ramp generator

10	Interpolated position control	Positioning mode with setpoints cyclically via bus The ramp generator is arranged externally, e.g. in a higher-level controller
12	Reference travel	The drive performs a reference travel.
13	Stop at application limits	Deceleration at the application limit FCB 13 is also active if no other FCB is selected than the default FCB 02.
14	Emergency stop	Deceleration at the emergency stop limit.
18	Rotor position identification	Commutation of the encoder for synchronous motors
19	Position hold control	Position control to instantaneous position
20	Jog	Jog mode active
21	Brake test	Brake is tested by applying a torque when the brake is closed.
25	Motor parameter measurement	Motor parameter measurement active
26	Stop at user limits	Used to stop at user limits

13.3 FCB pool and distribution of priority

FCB no.	FCB	Prio
01	FCB output stage inhibit	
14	FCB emergency stop	
13	FCB stop at application limit	
22	FCB output stage test	
18	FCB rotor position identification	
25	FCB parameter estimation	
12	FCB reference travel	
04	FCB manual mode	
20	FCB jog	
19	FCB position hold control	
21	FCB brake test	
23	FCB brake test DriveSafety	
10	FCB interpolated position control	
09	FCB position control	
06	FCB Interpolated speed control	
05	FCB speed control	
08	FCB Interpolated torque control	
07	FCB torque control	
26	FCB Stop User	
02	FCB default stop	
00	FCB standard (default stop)	

13.4 Hardware combinations

Designation	V/f		VFC^{PLUS}		CFC/SERVO		ELSM®
Technical principle	Voltage controlled according to characteristic curve		Field orientation, voltage-controlled, flux controller, torque control		Field orientation, current controller		Field orientation, current controller
Motor	ASM	LSPM	ASM	ASM	ASM	SM	SM
Encoder	—	—	—	Yes	Yes	Yes	—
Dynamics	+	+	++	+++	+++	++++	++
Efficiency	+	+++	++	++	+	++++	+++

13.5 Applications and control

Control	V/f	VFC^{PLUS}	CFC/SERVO	ELSM®
Typical application	Group drives, multi-motor drives, third-party motors	Belt conveyors, travel and hoist drives, pumps/fans, winding machines	Packaging and handling technology, dynamic positioning	Horizontal belt conveyor
Speed control	✓	✓		✓
Torque control	—	✓		✓
Positioning	—			—
n = 0 min-1	—			—

13.6 Possible combinations of control modes and functions

Control	V/f	VFC^{PLUS}	CFC/SERVO	ELSM®
DC brake	✓	✓	—	—
2Q operation	✓	✓	—	—
Flying start	✓	✓	✓	✓
Energy-saving function	—	✓	—	—
Motor data identification	✓	✓	✓	✓
Jext measurement	—	✓	✓	✓

13.7 Possible combinations of control modes and FCB drive functions

Control	V/f	VFC^{PLUS}	CFC/SERVO	ELSM®
01 Output stage inhibit	✓	✓	✓	✓
05 N control	✓	✓	✓	✓
06 Interpolated n control	✓	✓	✓	✓
07 M control	—	✓	✓	✓
08 Interpolated M control	—	✓	✓	✓
09 P control	—	✓	✓	—
10 Interpolated p-control	—	✓	✓	—
12 Reference travel	✓	✓	✓	✓
18 Rotor position identification	✓	✓	✓	✓
20 Jog mode	—	✓	✓	—
21 Brake test	—	✓	✓	—
25 Motor parameter ID.	✓	✓	✓	✓
26 Stop at user limits	✓	✓	✓	✓

SEW EURODRIVE

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