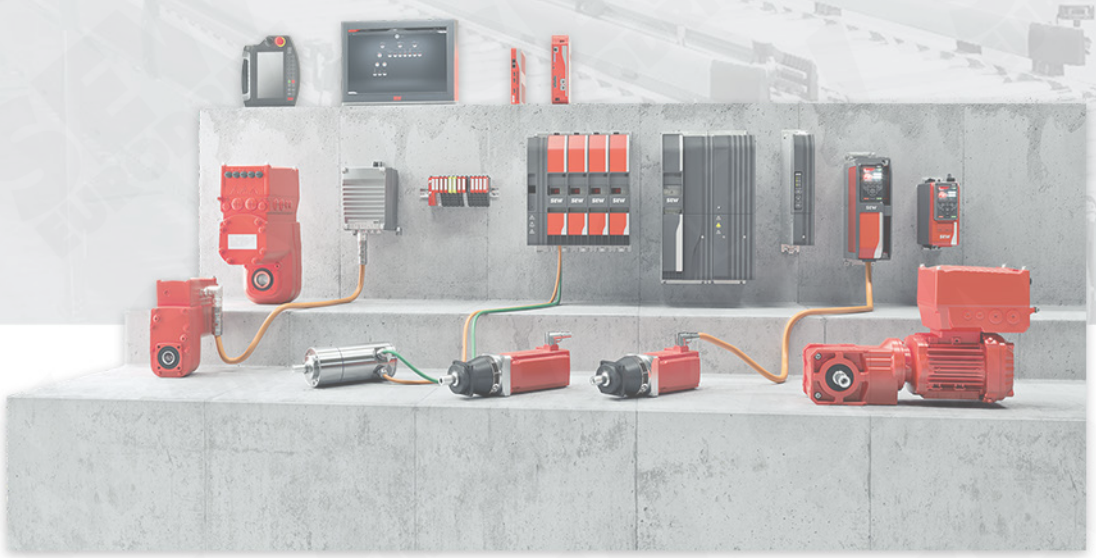
Product Training Workbook



MOVI-C® Automation System

MOVIKIT® FlyingSaw Software Module

Parameterization and Diagnostics

C141

DRIVE ACADEMY®

Exclusion of liability

These training documents supplement the existing documentation from SEW-EURODRIVE GmbH & Co KG. They were created as informational documents to accompany training according to the author's best knowledge.

Compliance with the information in the operating instructions for the devices mentioned in the training documents has priority and is a basic requirement for safe operation. The safety provisions therein apply.

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Ensure that the operating instructions are made available in legible condition to those responsible for the system and its operation, as well as to personnel working on the device independently.

Objectives of this training document

- In this workbook, you will learn to start up the flying saw application on a training model and control it via the process data interface.

Additional documents

- MOVIKIT FlyingSaw software module manual, PDF version
- MOVIKIT® FlyingSaw software module manual, HTML version
- MOVIKIT® FlyingSaw brief information

The product training team will be happy to assist you if you have any questions or suggestions.

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Meaning of the symbols:


Operating notes


Information


Safety-relevant information


Tip


Diagnostics and troubleshooting


Practical task


Additional documentation

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Workbook steps

1. Introduction
2. Project setup and basic startup in MOVISUITE®
3. Configuring the master axis (Axis1_Master_Feed)
4. Configuring the slave axis (Axis2_Slave_Saw)
5. Creating an IEC project and starting an IEC program
6. Control via the process data monitor

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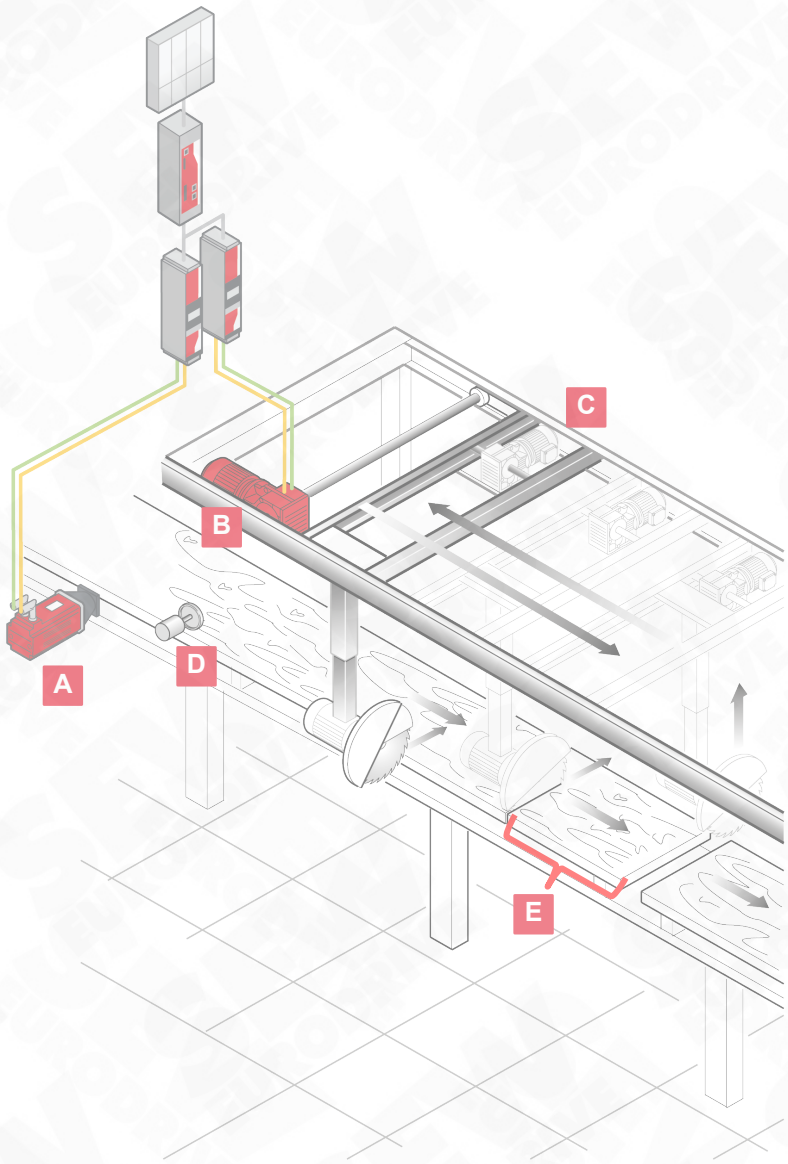
1 Introduction

Objectives:

- Being familiar with the flying saw application with cut length control
- Being familiar with the system configuration with the training model and software used

1.1 Flying saw application



Application: A common industrial application for the MOVIKIT® FlyingSaw is the woodworking industry. In the application example, long pressed particle boards are cut to length. The software module controls the drive for the feed of the saw carriage along the longitudinal axis.

A Material feed drive
The material feed drive is commonly not part of the SEW-EURODRIVE drive solution. In the standard case, the material speed is only recorded via an external encoder. This setup is too hardware-dependent for the workbook. For this reason, an SEW-EURODRIVE axis will be used instead of an external encoder for the simulation of the material feed here.

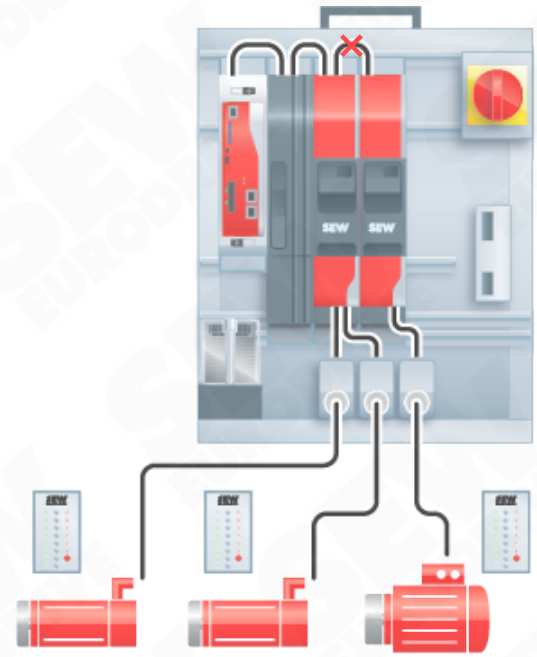
B Saw carriage feed drive

C Saw feed drive
This drive is not controlled by the MOVIKIT® FlyingSaw software module. For simplification, it is disregarded in the application example.

D External encoder: The external encoder provides the speed of the material.

E Cutting length

1.2 Training model



Axis 1 = **Axis1_Master_Feed** drive with motor encoder => MOVIKIT® Gearing
Axis 2 = **Axis2_Slave_Saw** drive with motor encoder => MOVIKIT® FlyingSaw
Axis 3 = not used

Software:
MOVISUITE® 2.40

- IEC Editor 3.5.18.2
- MOVIKIT® Gearing V8.0.41.200
- MOVIKIT® FlyingSaw V8.0.40.200

Hardware:
2 x MOVIDRIVE® modular or system or technology, double axis is also possible.
2 x synchronous or asynchronous motor with encoder. Mixes are also possible.
1 x MOVI-C® UHX CONTROLLER...All classes are possible

If the training model is not available, the exercises can also be done using any MOVI-C® CONTROLLER and MOVIDRIVE® modular/system with drive.
The hardware configuration must then be adapted according to the hardware being used. If no inverter/drive hardware is available, the axes must be operated in a simulation.

2 Project setup and basic startup in MOVISUITE®

Objectives:

- Being able to set up a project and perform basic startup of the axes

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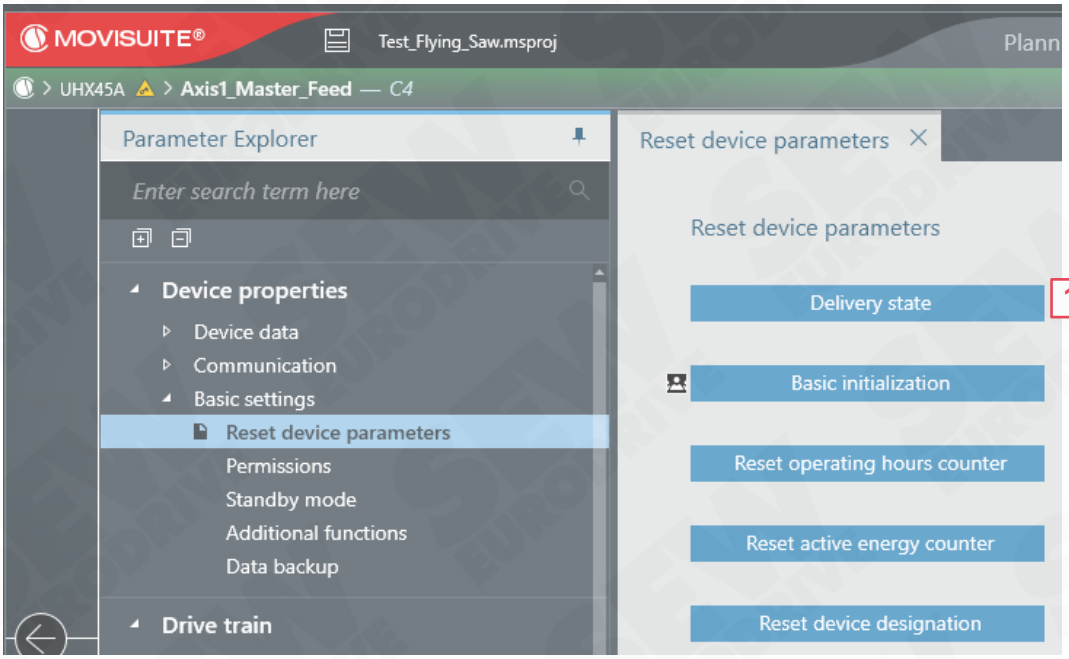
2.1 Project setup

1. Creating a new project

1 Create a new project from the network scan and save it under the name "**Test_FlyingSaw**."

2. Resetting axes to delivery state



1 Reset each axis to the **delivery state**.

2 Assign the names for the axes exactly as shown here in the workbook.

Important information:

- The names of the axes must not contain any empty spaces between the words. Empty spaces between words lead to errors in the IEC editor.

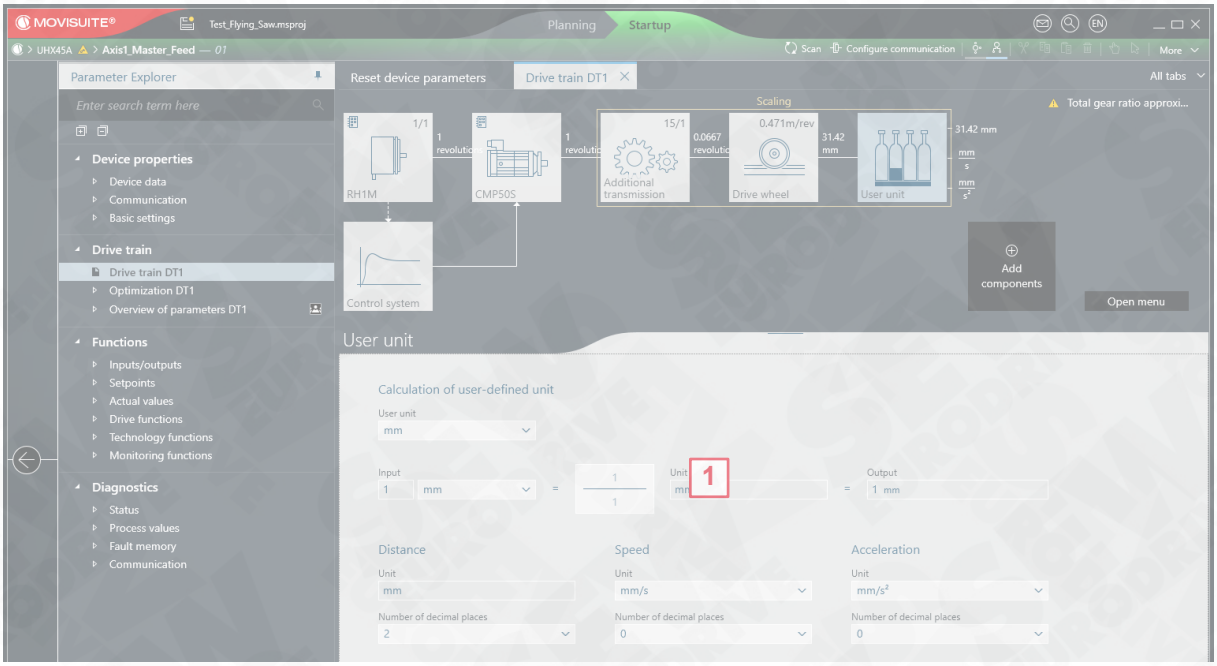
Axis 1	Axis1_Master_Feed
Axis 2	Axis2_Slave_Saw

- Your project should encompass the controller and 2 axes. If there are more than two axes, disconnect all other axes.
- The left one is the master axis with MOVIKIT® Gearing and the right one is the slave axis with MOVIKIT® FlyingSaw.
- Make sure that the master axis is in the first position (to the left of all slave axes).

2.2 Basic startup of master and slave axes

In this example application, the master and slave axes are started up using the same parameters. Perform the following 3 steps for the master axis and the slave axis.

1. Setup of the drive train



1 Enter the depicted components into the drive train and parameterize them as follows:

Component	
Additional transmission	i-total = 15
Drive wheel	Diameter = 150 mm
User unit	Distance, rotational speed, and acceleration must be in the same units: mm, mm/s, mm/s² Leave the decimal places unchanged. They will be automatically adjusted by MOVIKIT® Gearing

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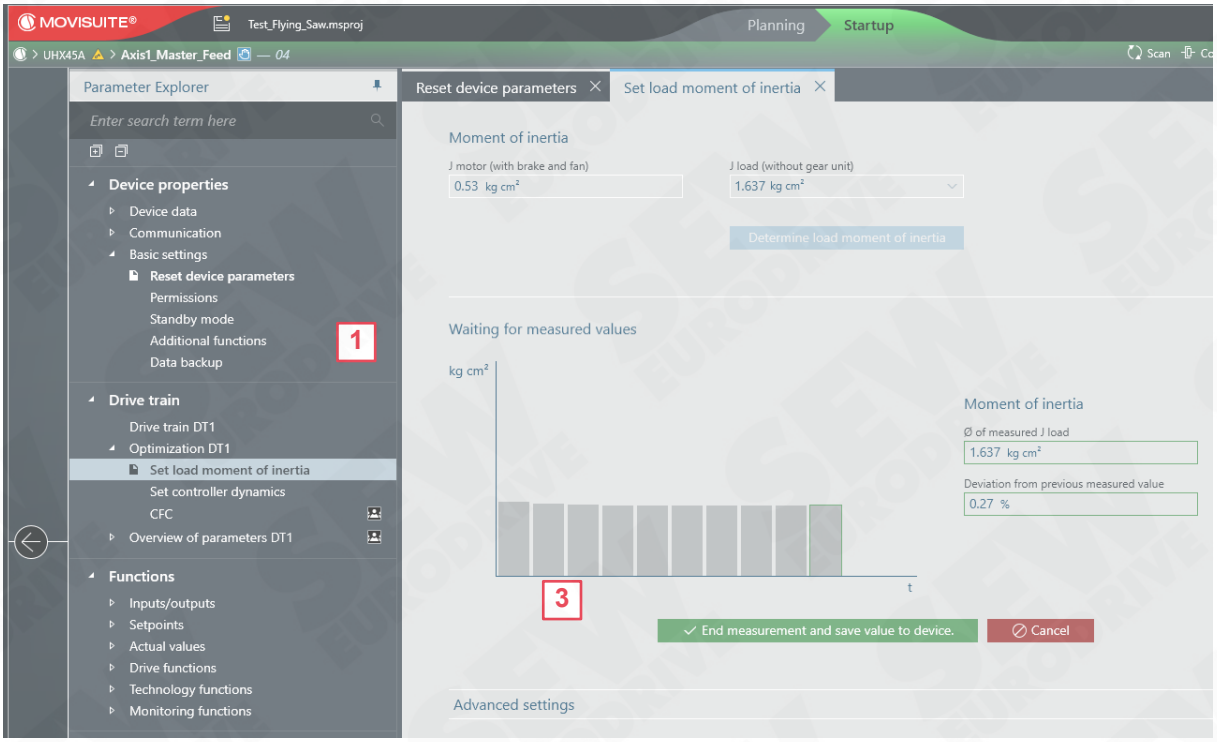
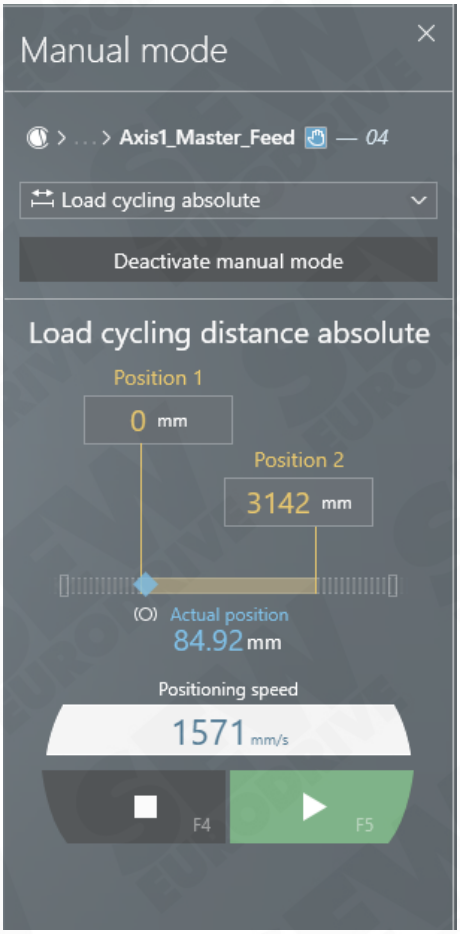
2. Optimization of the axis "Axis1_Master_Feed"

- Determining the load moment of inertia



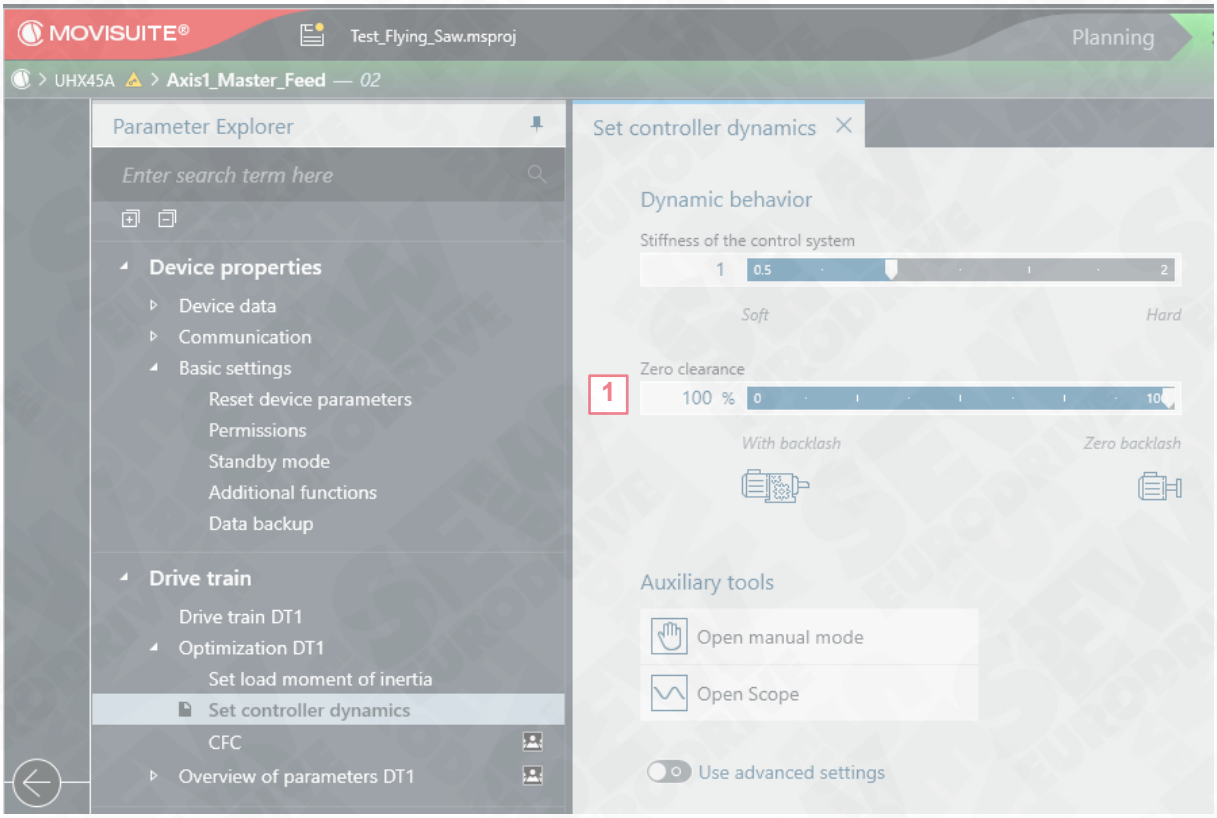
1 Determine the load moment of inertia through a measurement



2 To do so, move the axis to the absolute position in manual mode using load cycling

3 Adopt the determined load moment of inertia of the load (without gear unit)

- Setting the controller dynamics



2 Set the controller dynamics and check the configuration in manual mode.
The motor should be well optimized.

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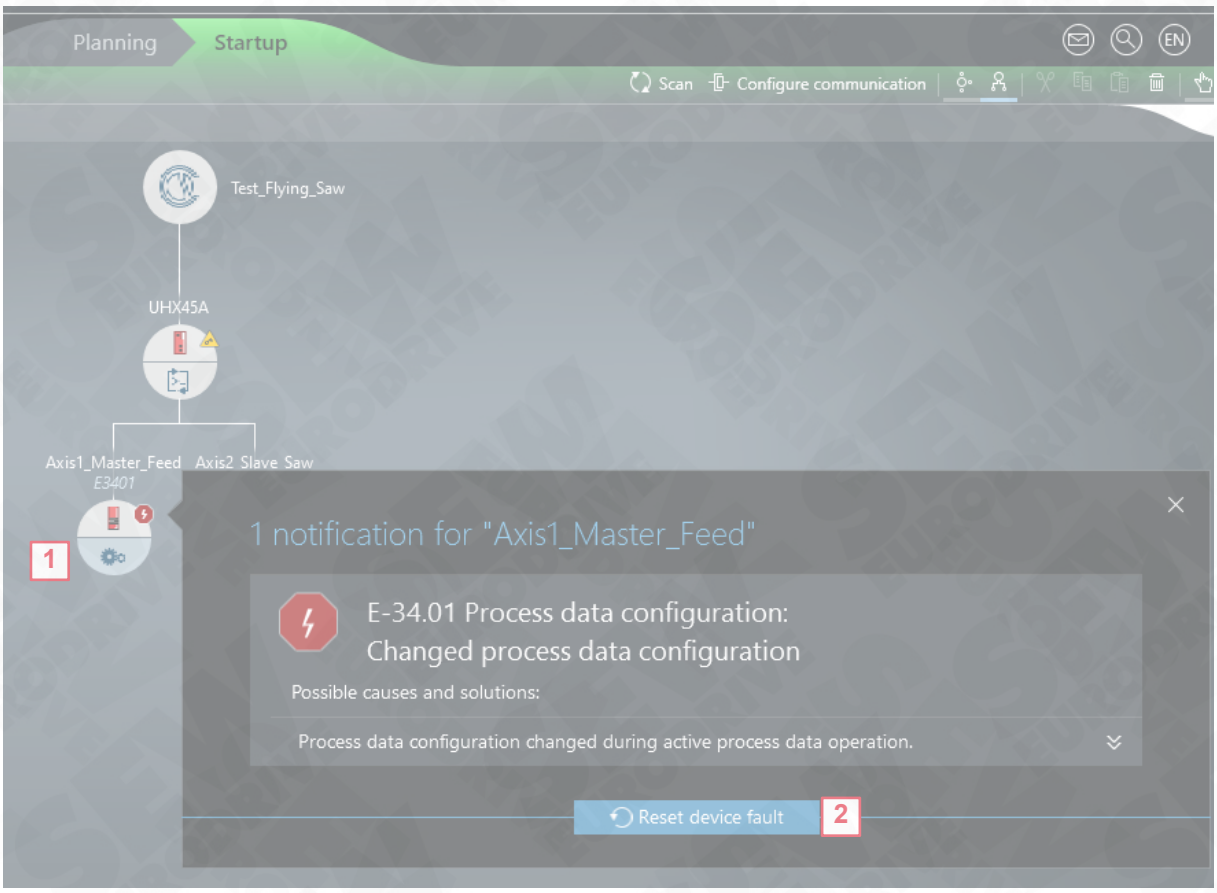
3 Configuring the master axis (Axis1_Master_Feed)

Objectives:

- Being able to assign the MOVIKIT® Gearing to the master axis
- Being able to parameterize the master axis

3.1 Assigning the MOVIKIT® Gearing software module



1 Assign the MOVIKIT® Gearing from the catalog to the master axis

2 Acknowledge the "Changed process data configuration" message

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3.2 Activating the fieldbus interface

1. Configuring the fieldbus interface

1 Activate the fieldbus interface by choosing **Yes**

2 Set the start address to **1**

4 Configuring the slave axis (Axis2_Slave_Saw)

Objectives:

- Being able to assign the MOVIKIT® FlyingSaw to the slave axis Axis2_Slave_Saw
- Being able to parameterize the slave axis

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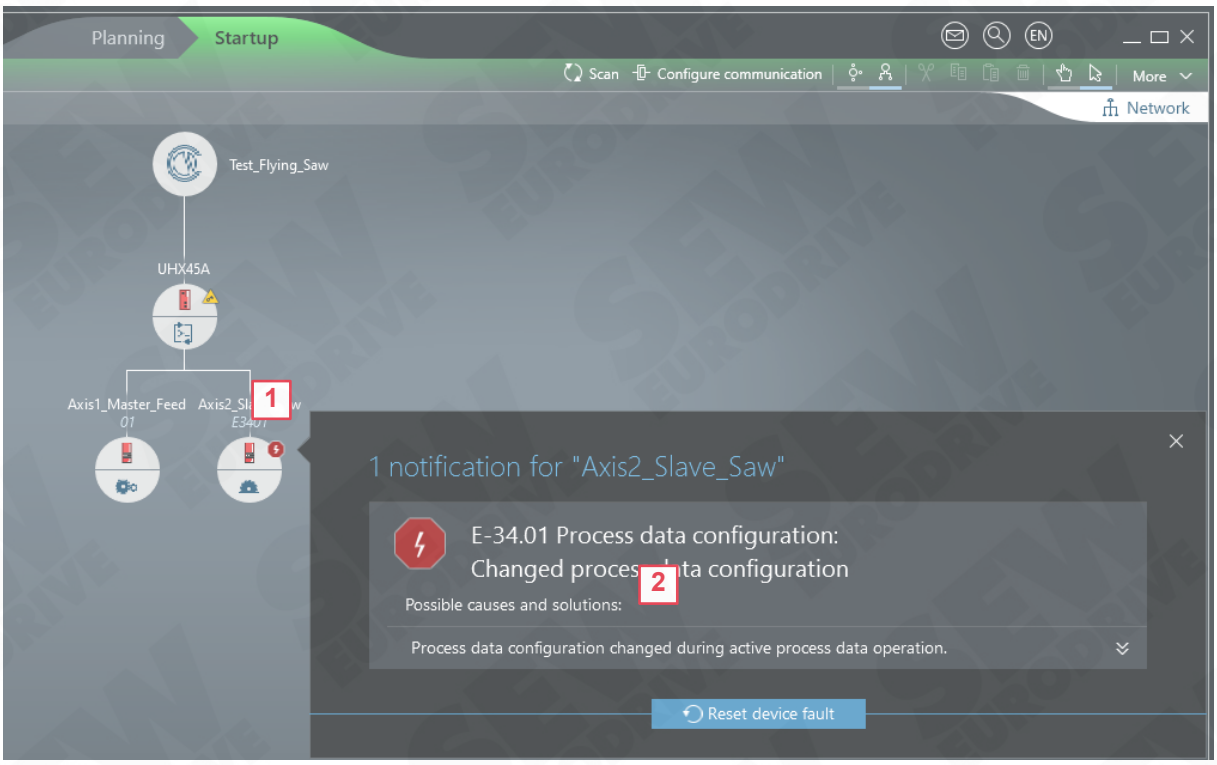
4.1 Assigning the MOVIKIT® FlyingSaw software module

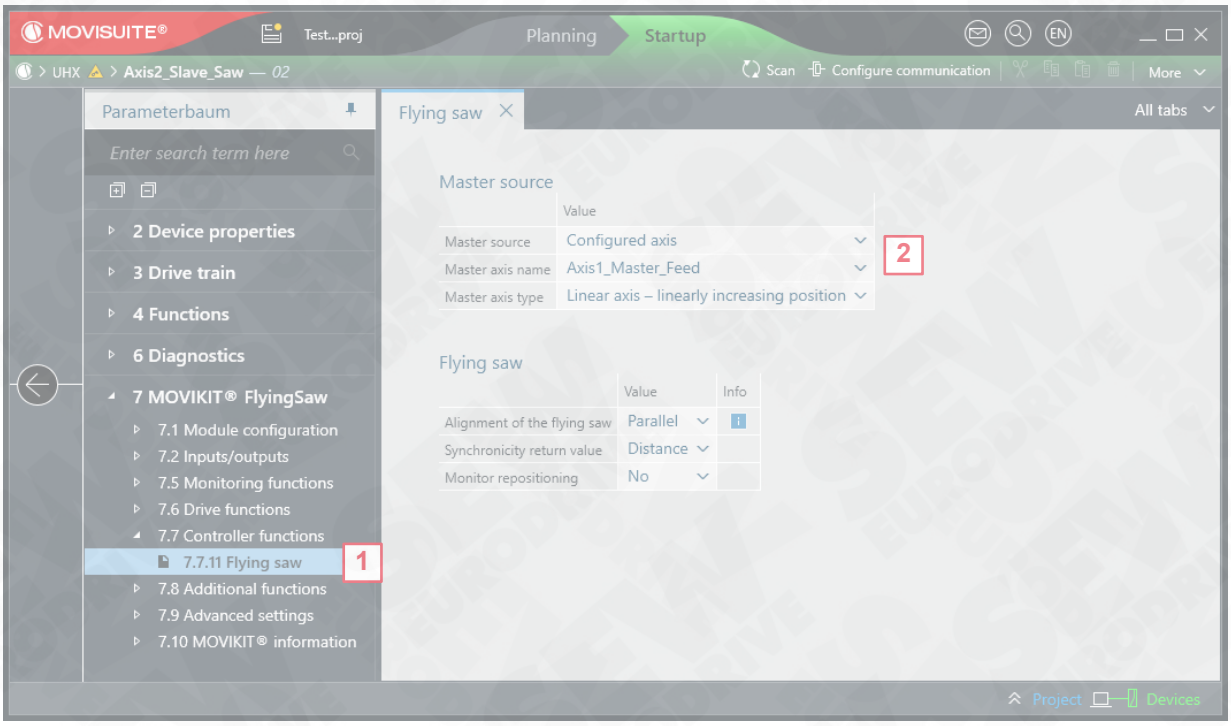


1 Assign the MOVIKIT® FlyingSaw from the catalog to the slave axis

2 Acknowledge the "Changed process data configuration" message

4.2 Configuring the master/slave connection

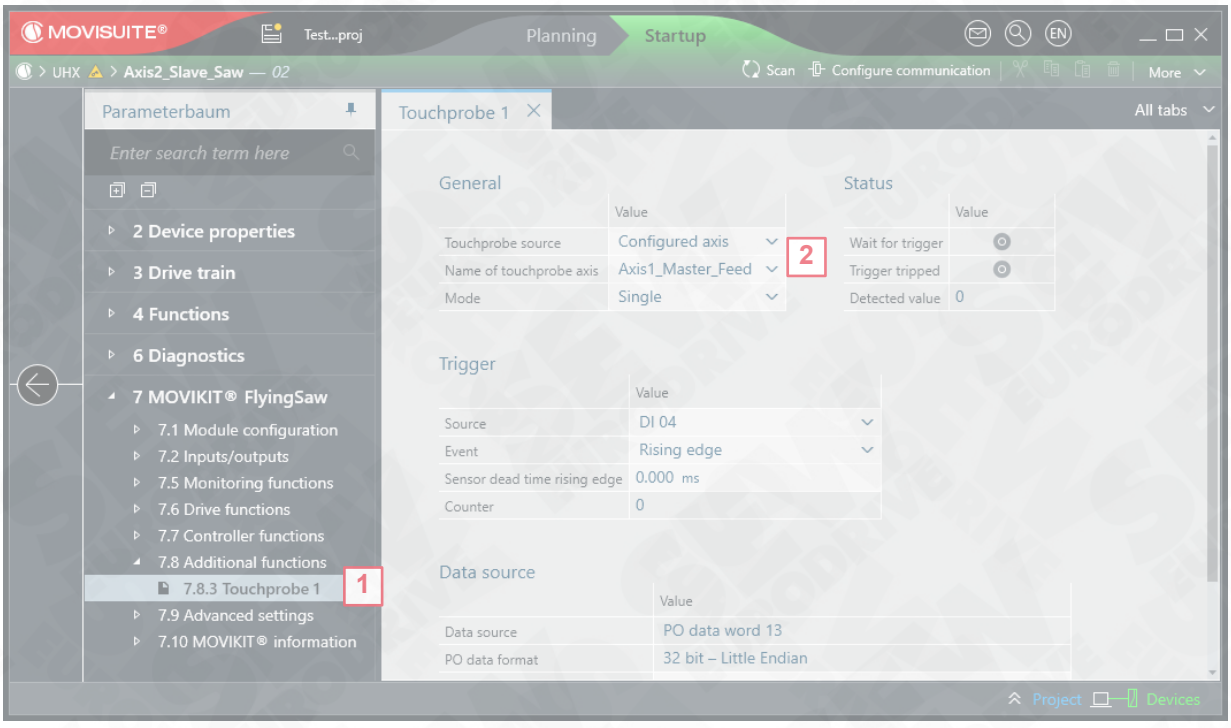
1. Configuring the master source



1 Go to **Controller functions** **Flying saw**

2 Set the parameters for the flying saw as shown here

2. Configuring the Touchprobe



1 Go to **Additional functions** **Touchprobe 1**

2 Enter the **Touchprobe source** and the **Name of touchprobe axis** as shown

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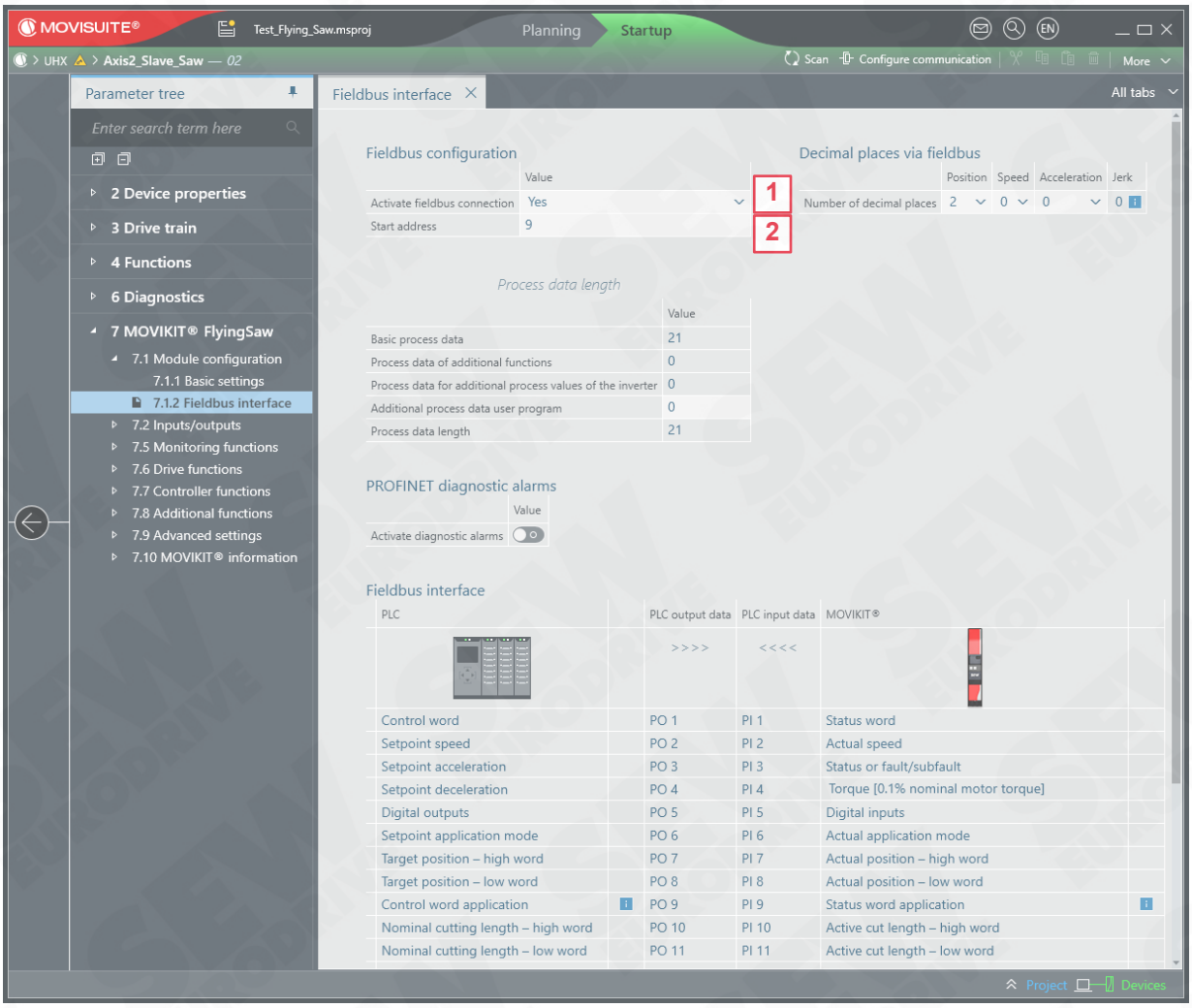
4.3 Activating the fieldbus interface

1. Configuring the fieldbus interface



1 Activate the fieldbus connection by choosing **Yes**

2 Set the start address to **9**
Start address = master axis 1 + 8PD = 9

5 Creating and starting the IEC project

Objectives:

- Being able to parameterize the fieldbus
- Being able to operate the license manager tool and select the appropriate licenses
- Being able to activate the trial licenses and load them onto the MOVI-C® CONTROLLER
- Be able to create an IEC project

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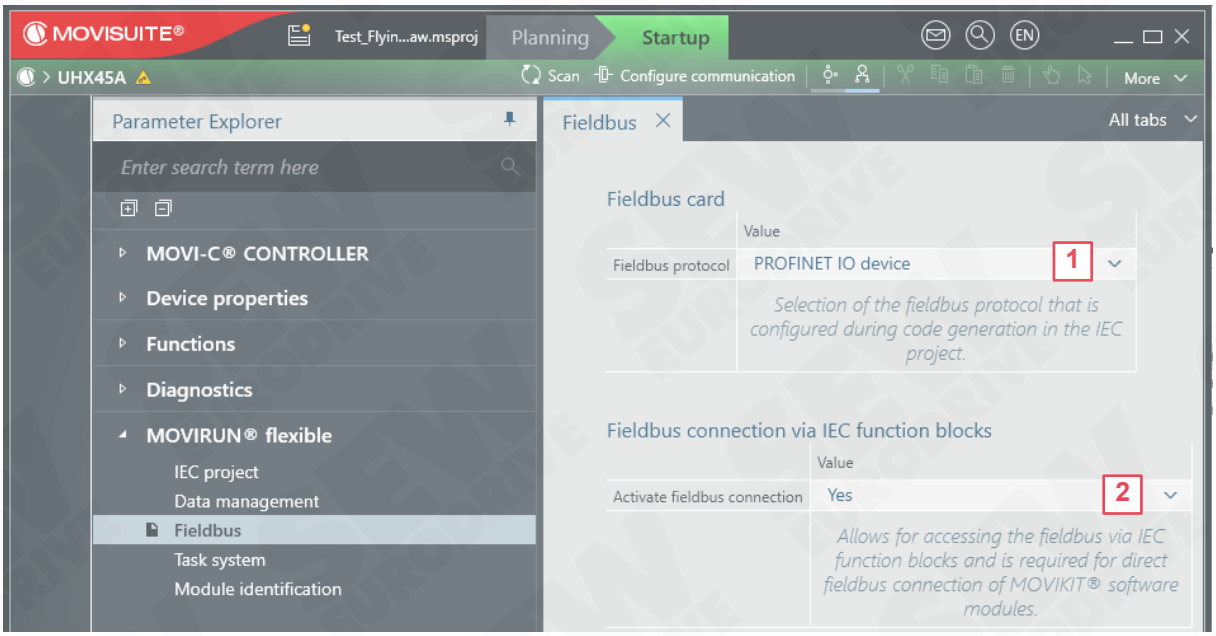
5.1 Configuring the fieldbus of the MOVI-C® CONTROLLER

1. Activating the fieldbus interface

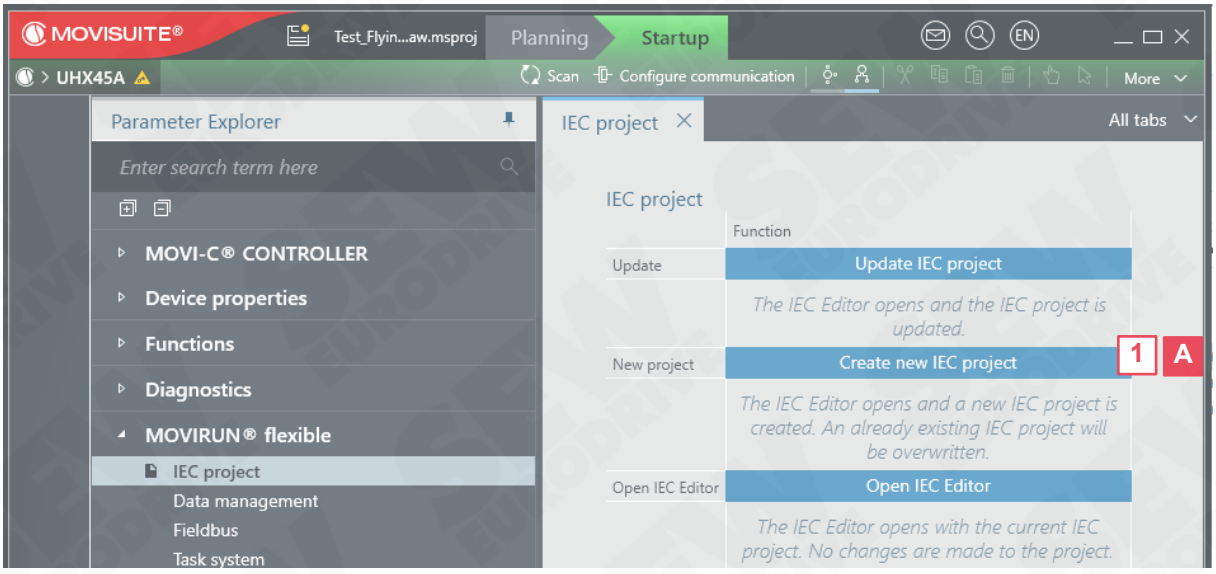


1 Select the **fieldbus protocol**

2 Activate **fieldbus connection via IEC function blocks: Yes**.

5.2 Creating the IEC project

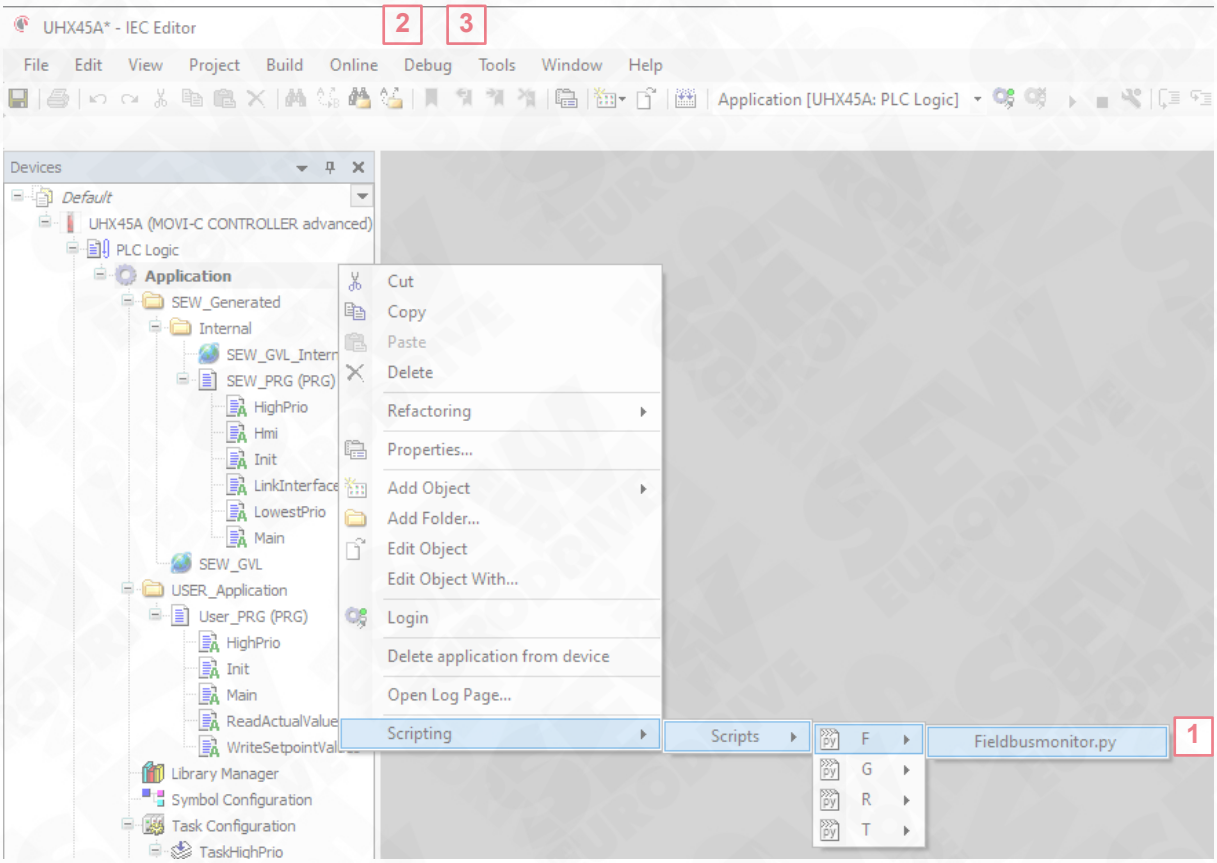
1. Creating a new IEC project



1 Click **Create new IEC project** to start the code creation process.

A When you create a new IEC project, the existing project is deleted. Even the self-programmed part is then overwritten/deleted.

2. Activating the process data monitor



1 Right-click **Application** and select **Scripting** **Scripts** **F** **Fieldbusmonitor** to insert the fieldbus monitor

3. Starting the IEC program

2 Compile the IEC program with **Online** **Log in**

3 Start the IEC program with **Debug** **Start**

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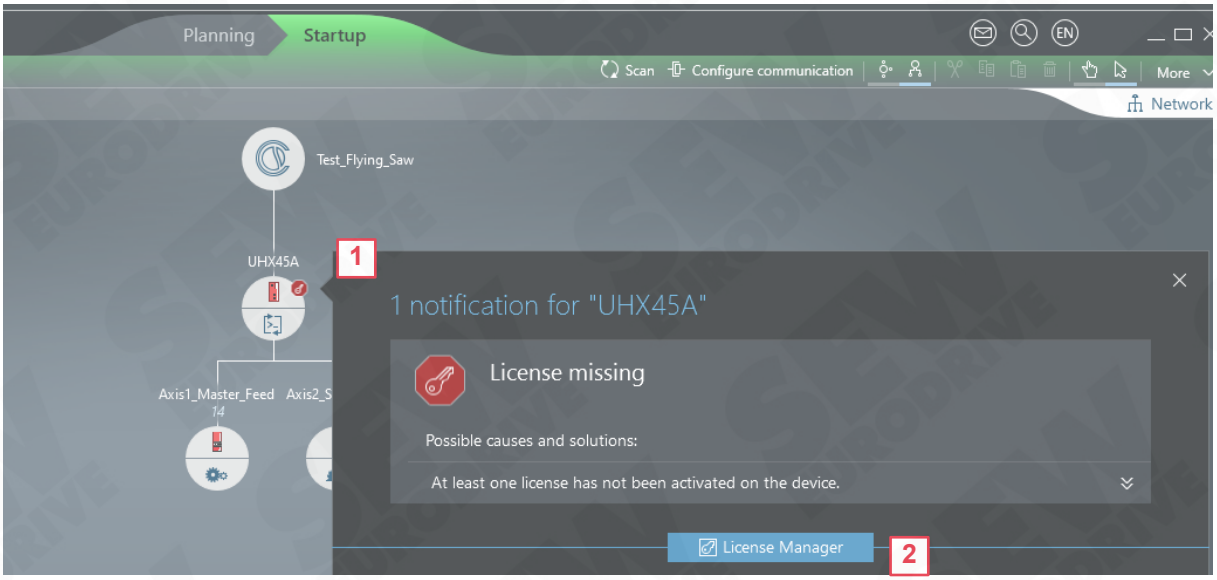
5.3 Licensing the MOVI-C® CONTROLLER

1. Starting the License Manager

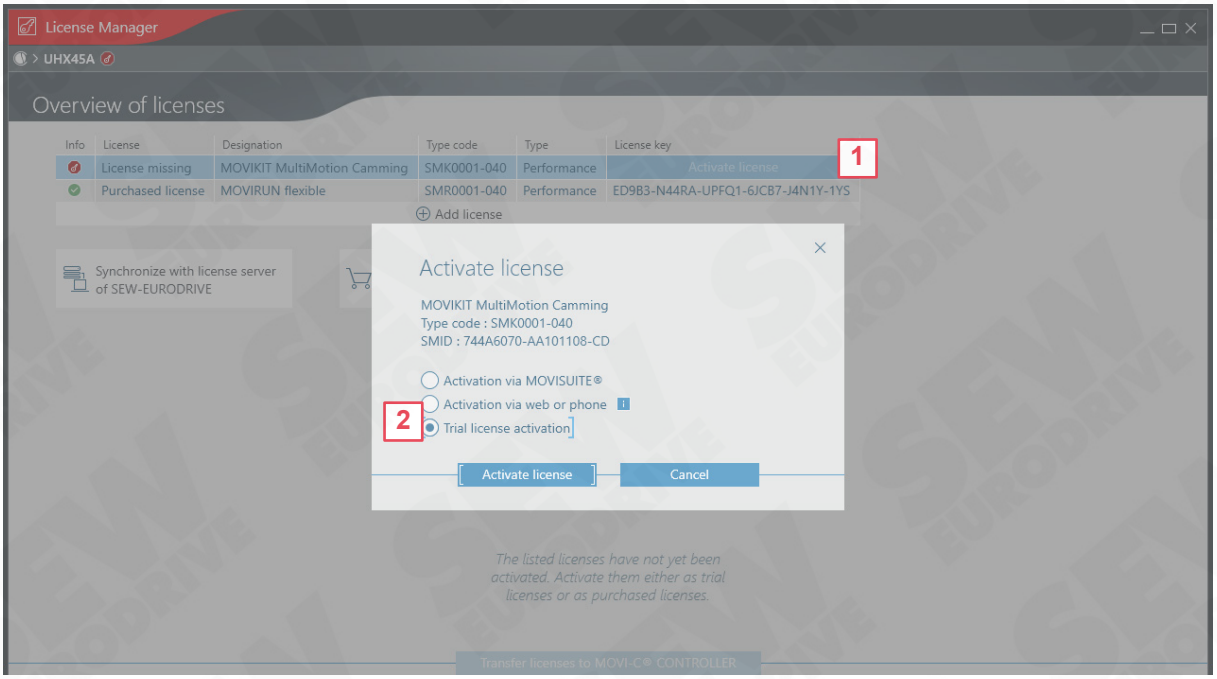
An Internet connection is required to activate the licenses.



1 Right-click the MOVI-C® CONTROLLER or select the symbol

2 Start the **License Manager** in **Tools**

2. Selecting the licenses



The missing license is automatically displayed in the License Manager

1 Click **Activate license** in the line of the missing license

2 Select **Trial license activation**

3 Click **Activate license**

A trial license allows for software functions to be tested before purchase. It is valid for 7 days and can be reactivated at any time. After the trial license expires, the program continues to run and is not shut down. A message regarding the expired trial license will be displayed on the MOVI-C® CONTROLLER.

3. Activating a license

A The activated license must still be transferred to the MOVI-C® CONTROLLER

1 Click **Transfer licenses to MOVI-C ® CONTROLLER**.

2 Click **Yes, I agree with the license terms**

After activating the licenses, the controller must be reset. The IEC program must then be restarted.

When **updating an IEC project**, the missing licenses are automatically displayed sequentially. Repeat the procedure for MOVIKIT® FlyingSaw.

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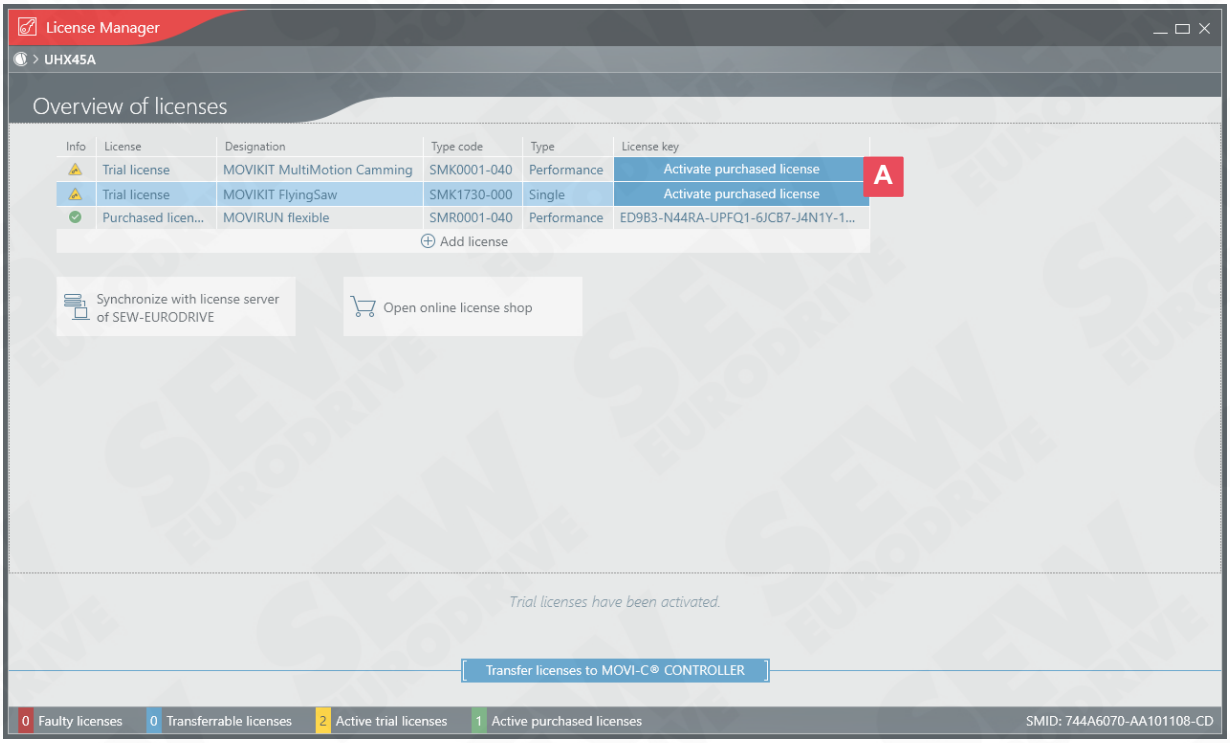


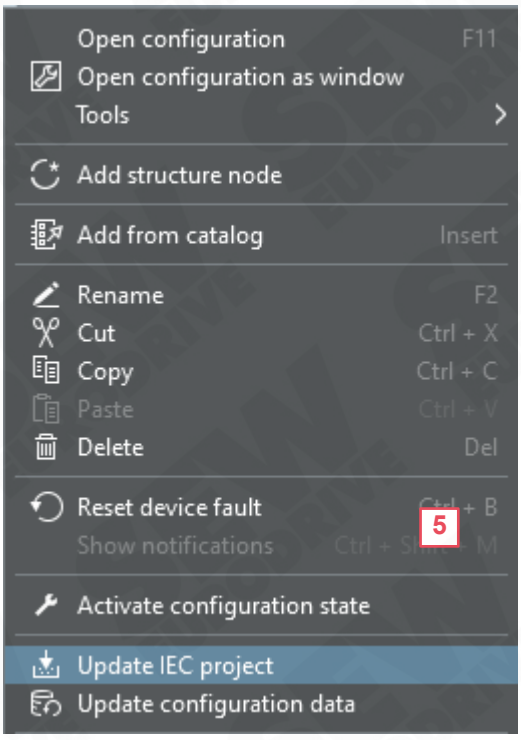
Load and activate the shown licenses for the flying saw application:

A **MOVIKIT® MultiMotion Camming**: The MOVIKIT® MultiMotion Camming license is required because the MOVIKIT® FlyingSaw also contains a curve-based solution for cyclically operating flying saws. The license for MOVIKIT® Gearing is included in the MOVIKIT® MultiMotion Camming license.

MOVIKIT® FlyingSaw: One license is required for each rotation axis.

MOVIRUN® flexible: The MOVIRUN® flexible license contains the license for the EncoderInterface software module.

4. Updating the IEC project



5 Then click **Update IEC project**

6 Control via process data monitor

Objectives:
- Opening and operating the process data monitor
- Controlling the flying saw application using the process data monitor

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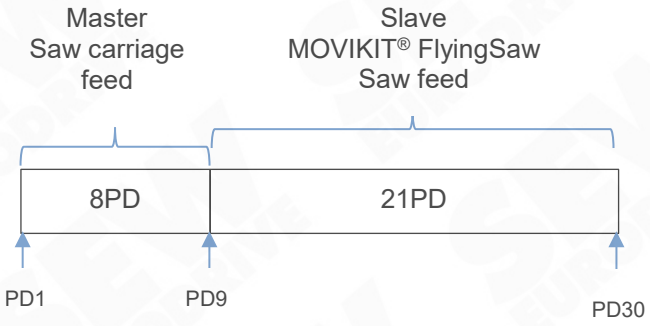
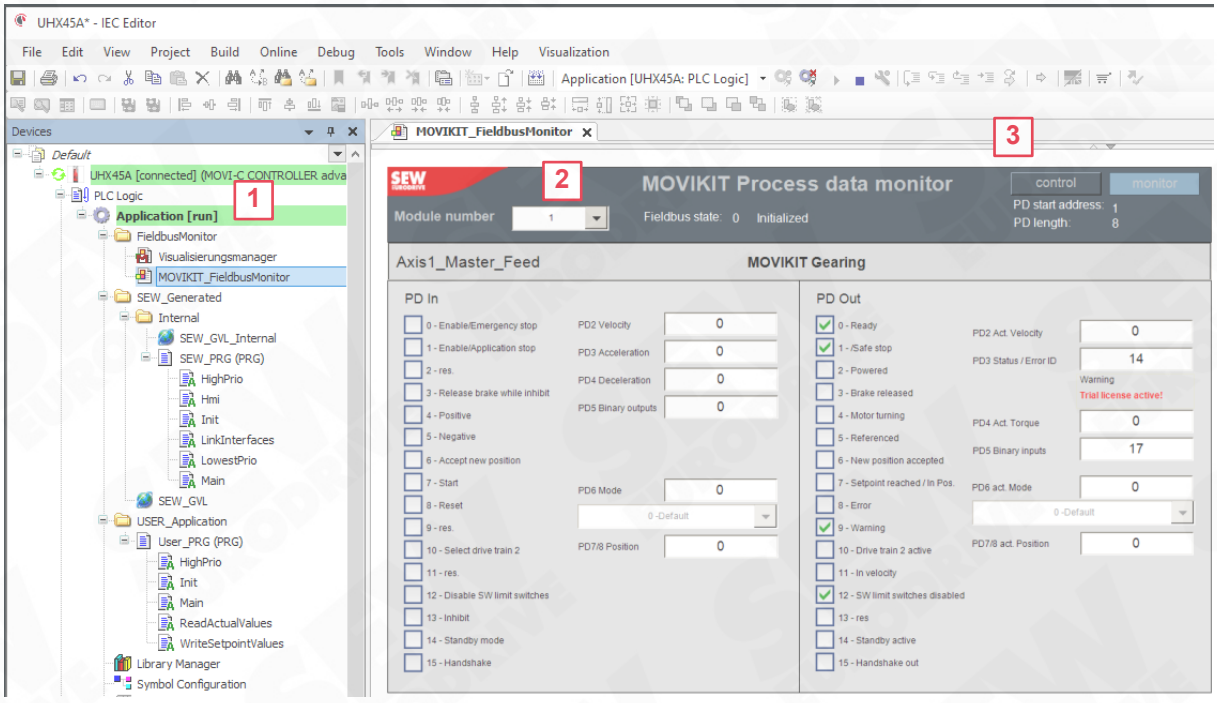
6.1 Opening and operating the process data monitor

The configuration results in the following process data assignment:



1. Opening the process data monitor



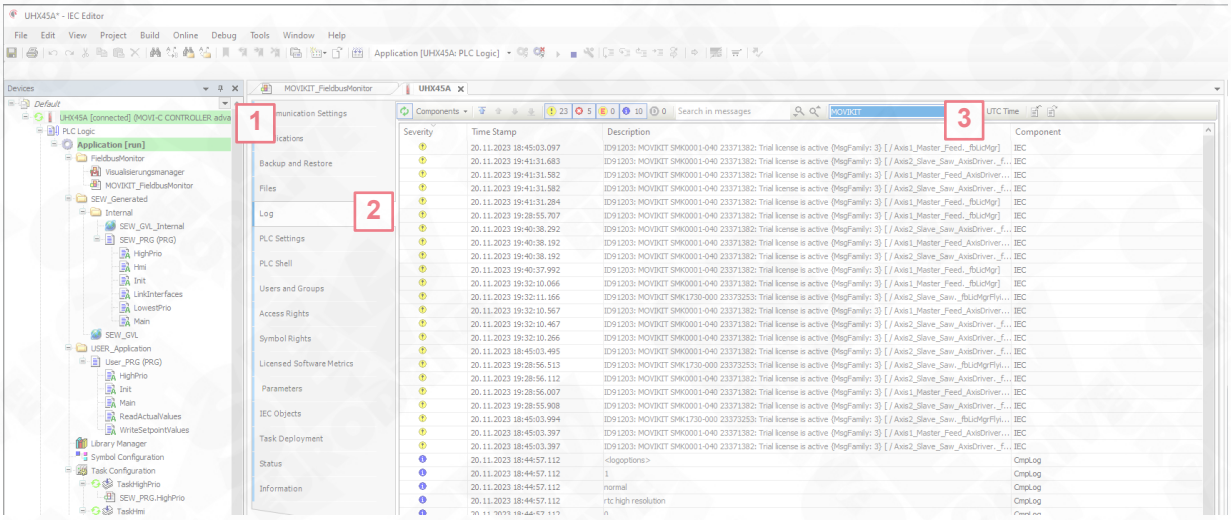
1 Double-click **MOVIKIT_FieldbusMonitor**.

2 Change the process data monitor by selecting the module number:

Saw carriage feed:	MOVIKIT® Gearing	Module number: **1**
Saw feed:	MOVIKIT® FlyingSaw	Module number: **2**

3 Click **control** to start the control mode

2. Opening the log file



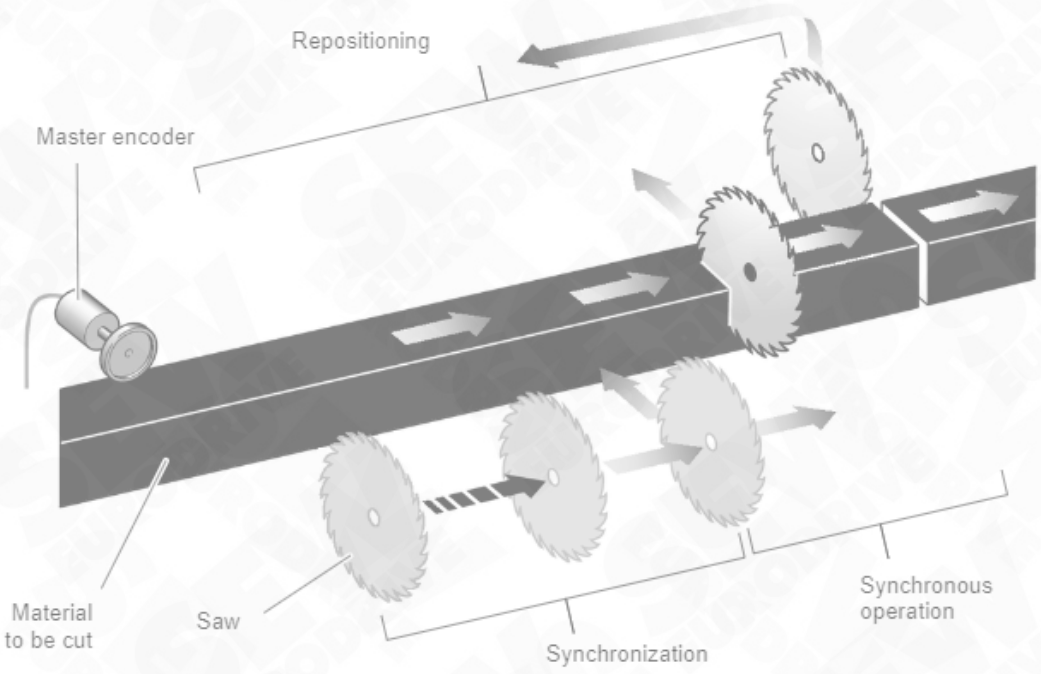
1 Double-click **UHX45A**

2 Click **Log**

3 Select **MOVIKIT** to display the error/status messages of the MOVIKIT® software module

6.2 Flying saw with cut length control

In cut length control, a master encoder measures the feed of the material to be cut. This information is processed by the inverter and is used for calculating the start position of the saw carriage. There need not be any cut marks on the material.



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6.2.1 Testing the function

Module no. 1: Material feed (Axis1_Master_Feed) is the master axis with MOVIKIT® Gearing
Module no. 2: Saw carriage feed (Axis2_Slave_Saw) is the slave axis with MOVIKIT® FlyingSaw

1. Referencing the saw carriage feed slave axis

1 Select the operating mode **PD6 Mode = 300**

2 Start the referencing with **PD7=1**

3 Check PD Out: **PD5 Referenced = 1** and **PD7/8 Position = 0**

5 Then reset the start bit to 0 **PD7=0**

2. Parameterizing the saw carriage feed slave axis

Cutting length:	Start with 1000.00°mm
Cutting angle:	0°
Synchronization distance:	100 mm

1 Set the cutting length: **PD10/11 = 100000**

2 Set the cutting angle: **PD12 = 0**

3 Set the synchronization distance: **PD18/19 = 10000**

3. Activating automatic mode for saw feed slave axis

The setpoints for speed, acceleration, and deceleration are used when the flying saw returns to the start position.

1 Select the operating mode **PD6 Mode = 1400**

2 Enter the dynamic values:
Speed: 1000 mm/s
Acceleration: 1000 mm/s^2
Deceleration: 1000 mm/s^2

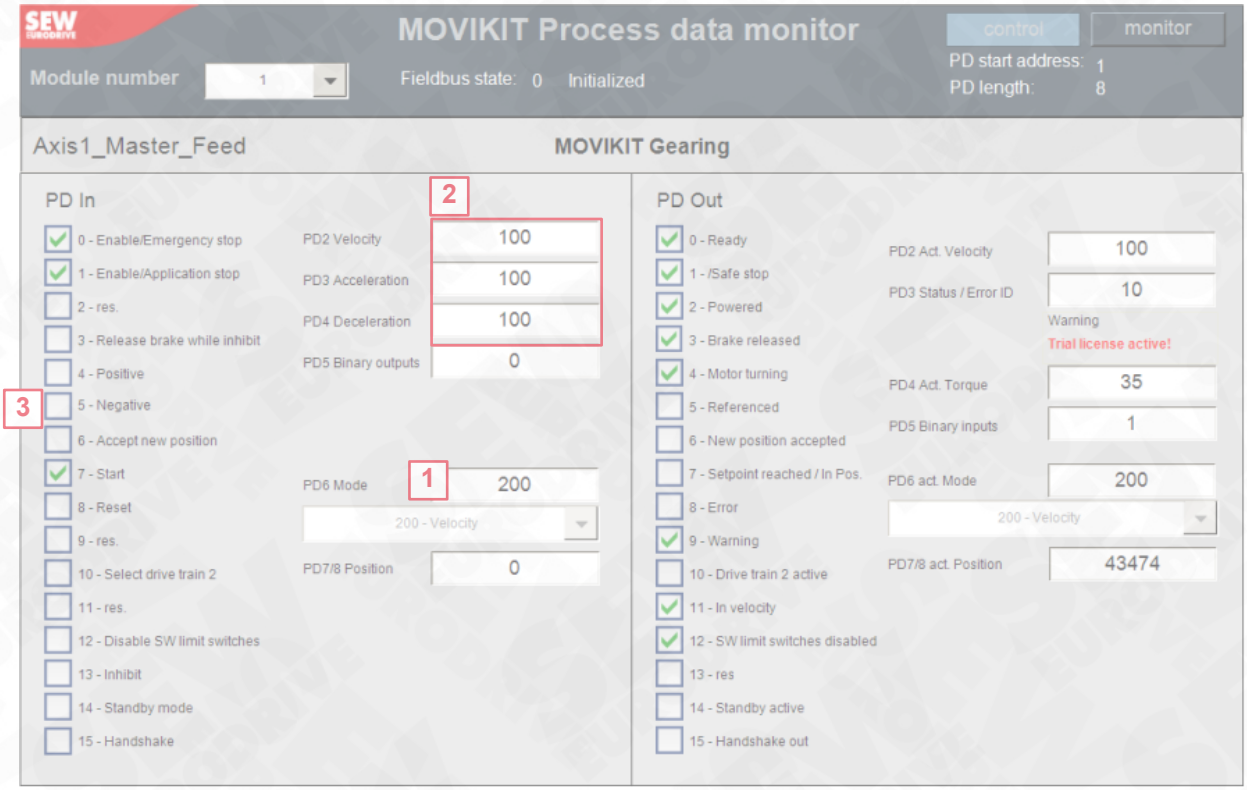
3 Enable the drive **PD0 and PD1 = 1**

4 Start automatic mode with **PD7 - Start = 1**

5 PD9 shows **WAITING_FOR_STARTPOSITION** -> The slave axis is waiting for a suitable master position.

4. Starting the material feed master axis

The master axis simulates a linear axis with endless material. The linear axis operates in speed mode. Set the speed to 100 mm/s for a gentle start.

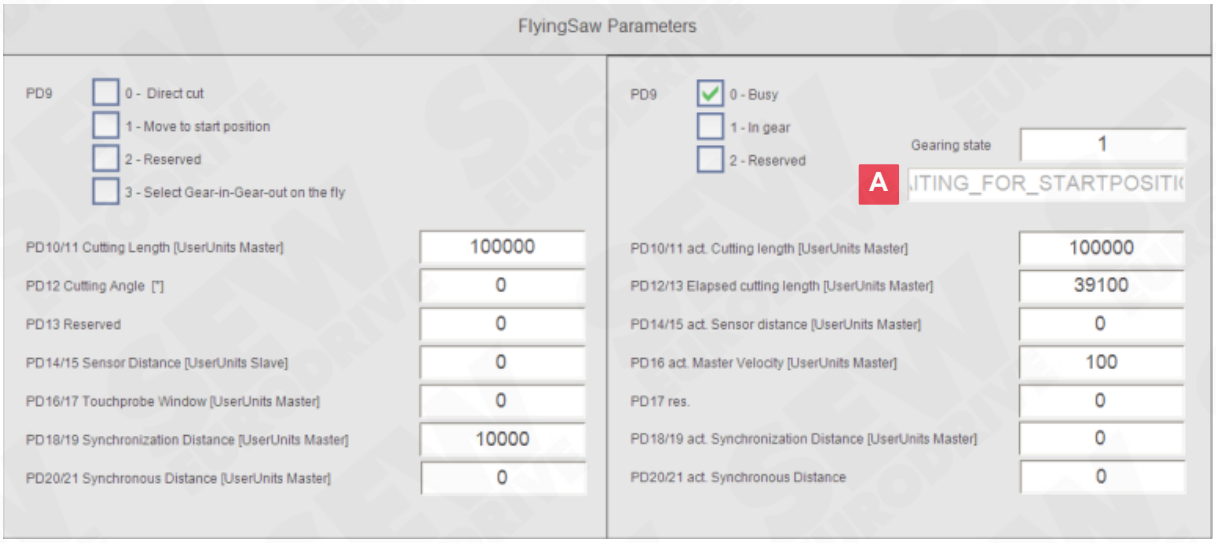


1 Select the operating mode **PD6 Mode = 200**

2 Enter the dynamic values:
Speed: 100 mm/s
Acceleration: 100 mm*s²
Deceleration: 100 mm*s²

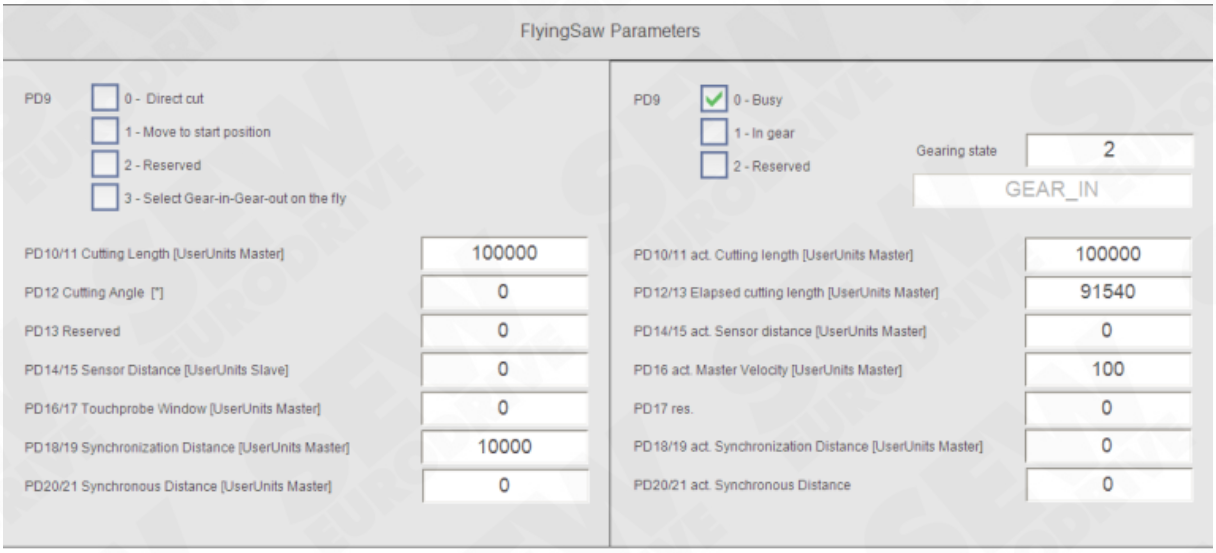
3 Enable the drive **PD0 and PD1 = 1** and start the operating mode with **PD7 - Start = 1**

5. Slave axis (saw carriage feed) waits until master axis (material feed) cutting length is reached



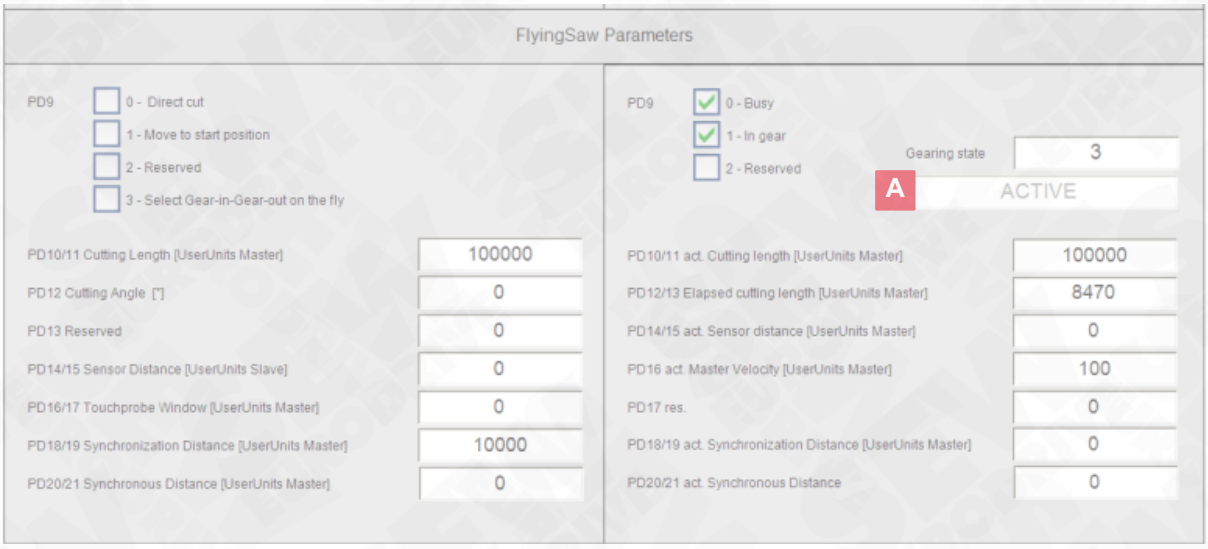
A The slave axis (saw carriage feed) waits until the master axis reaches the set cutting length. This is displayed by the state **Gearing state = 1** "WAITING_FOR_STARTPOSITION"

6. Slave axis (saw feed) synchronizes with the master axis (material feed)



A The slave axis (saw carriage feed) synchronizes with the master before the PD18/19 cut length setpoint = 100 mm. The cut begins as soon as the set length is reached.
Gearing state = 2 GEAR_IN -> Synchronization is active. To synchronize with the master, the slave axis follows a transition function.

7. Slave axis (saw carriage feed) is synchronized with master axis (material feed)



A As soon as the cut length setpoint is reached, the gearing state changes to **Gearing state = 3** ACTIVE -> The slave axis is synchronized with the master axis and the processing/cutting can begin. The flying saw itself does not know the duration of the processing/cutting. As soon as the processing is completed and the tool is no longer in contact with the material, the higher-level controller must send the "MoveToStartPosition" signal to the flying saw.

8. Moving the slave axis (saw carriage feed) back to the start position

1 Set **Bit 9 Move to start position = 1**

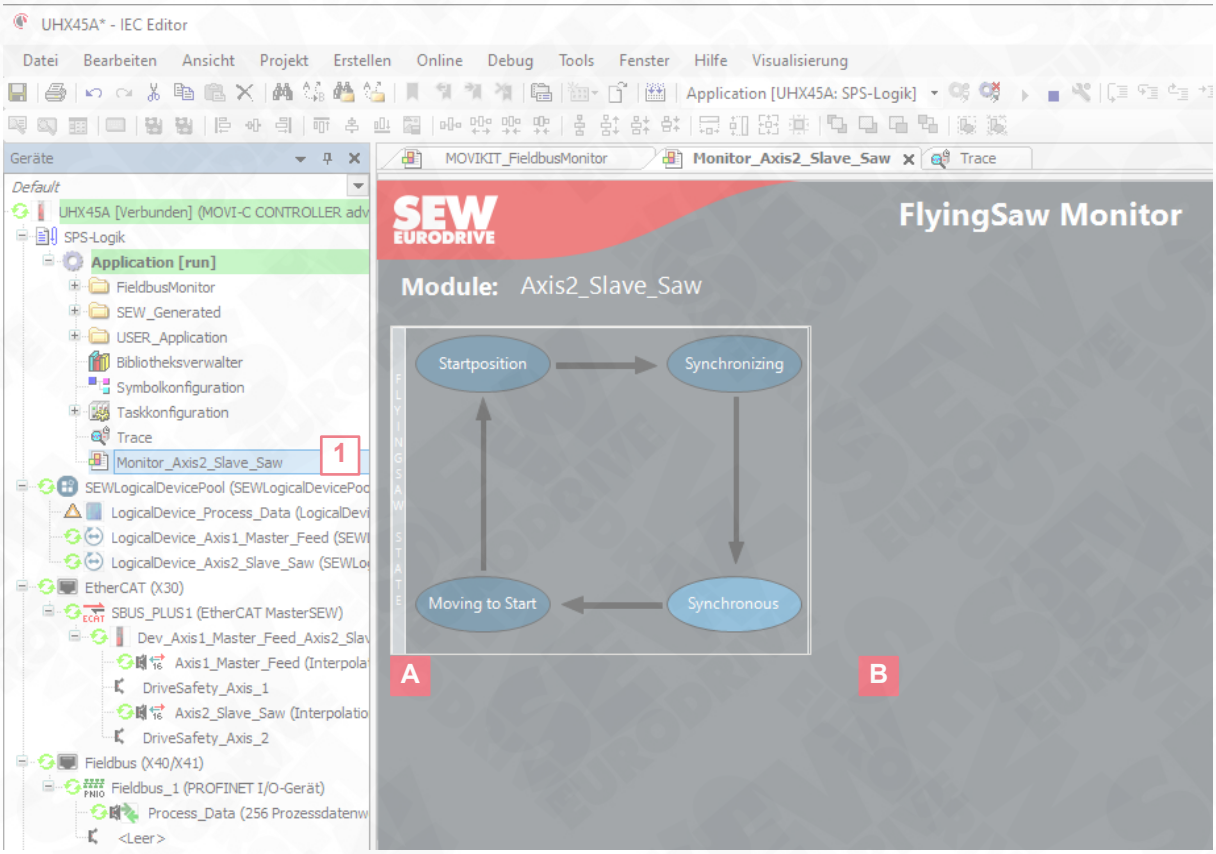
2 The signal **Bit 9 Move to start position = 0** must be reset again as soon as the saw carriage has reached the start position A **PD 1.7 Setpoint reached / in Pos = 1** so that the slave axis moves back to the start position.

The saw carriage must reach the start position early enough before the material feed reaches the calculated synchronization position of the next cut. Otherwise the saw reports an error or the current product becomes longer than the setpoint. You can parameterize this with the "Monitor back-positioning" parameter in MOVISUITE®.

A **Gearing state = 0** STOPPED -> The slave axis is desynchronized and does not follow the master axis

6.2.2 Activating and monitoring the FlyingSaw monitor

1. Opening the monitor in the IEC Editor



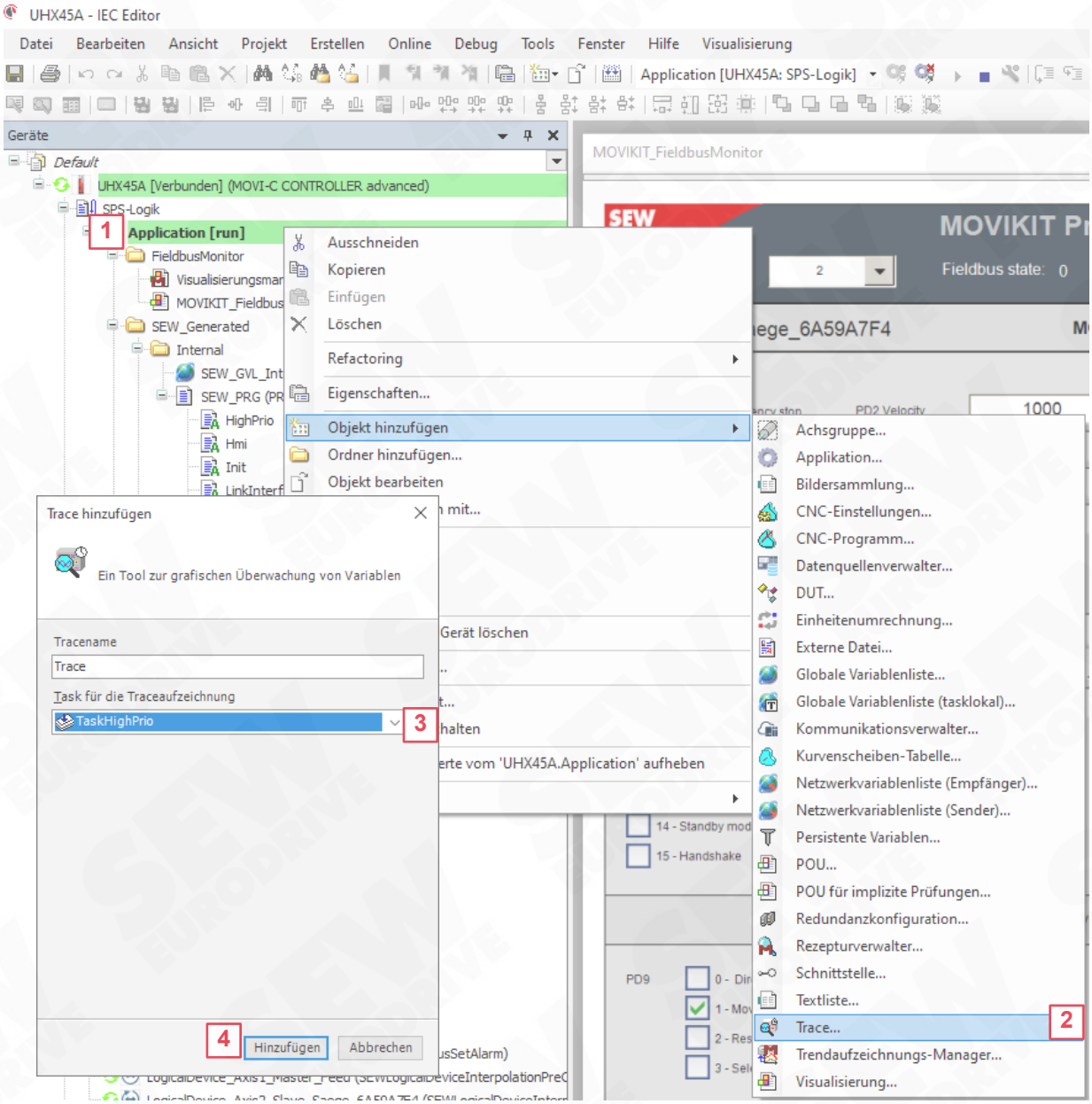
1 Double-click **Monitor_Axis2Slave_Saw**.

A The current state of the automatic operation of the flying saw is displayed here.
The register can be depicted offset and simultaneously next to the MOVIKIT® FielbusMonitor.

B When the master axis type is "modulo," the curve profile of the flying saw curve is shown next to it.

6.2.3 Performing a trace recording

1. Adding a trace

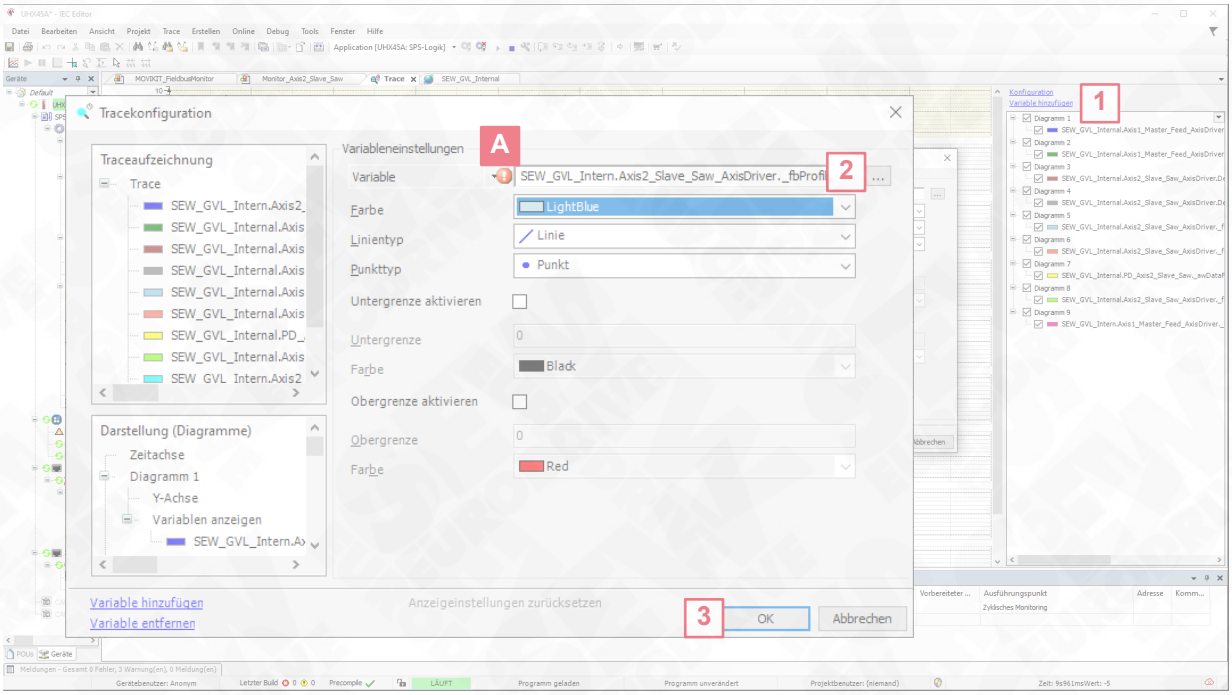


1. Right-click **Application**.
2. Select **Add object** **Trace**
3. Select **TaskHighPrio**
4. Click **Add**

2. Adding variables

There are multiple ways to add variables to the trace:

- **Copying and pasting the text strings into the input assistant**

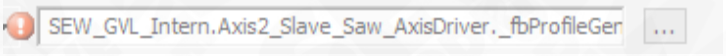


1 Click **Add variable**

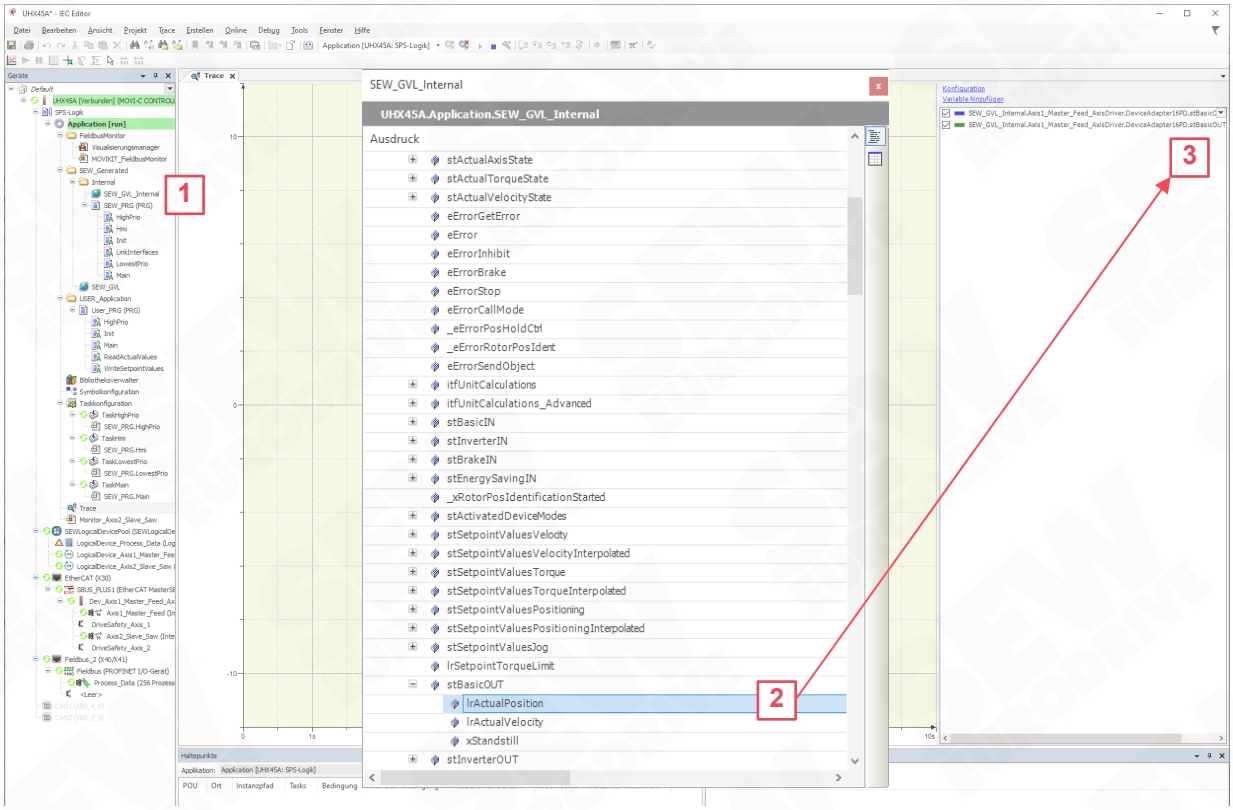
2 Copy the correct variable from the workbook and paste it into the Variable input field

3 Click **OK**

A The exclamation point symbol before the Variable input field is also displayed for traceable variables in Codesys Version V3.5.18.2 and is therefore irrelevant to the variables displayed below.



- **From the SEW_GVL_Internal variable structure using drag-and-drop**



1 Double-click **SEW_GVL_Internal**

2 Choose the correct variable

3 Drag the variable into the trace

Variables:

- **Virtual linear axis, actual position, and speed:**

SEW_GVL_Internal.Axis1_Master_Feed_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualPosition

SEW_GVL_Internal.Axis1_Master_Feed_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualVelocity

- **FlyingSaw, actual position, speed, and machine state:**

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualPosition

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualVelocity

- **FlyingSaw, setpoint position, and speed:**

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbProfileGenerationControl._stOUTInterpolation.StSetpointsUserUnits.lrPosition

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbProfileGenerationControl._stOUTInterpolation.StSetpointsUserUnits.lrVelocity

- **Synchronous operation state:**

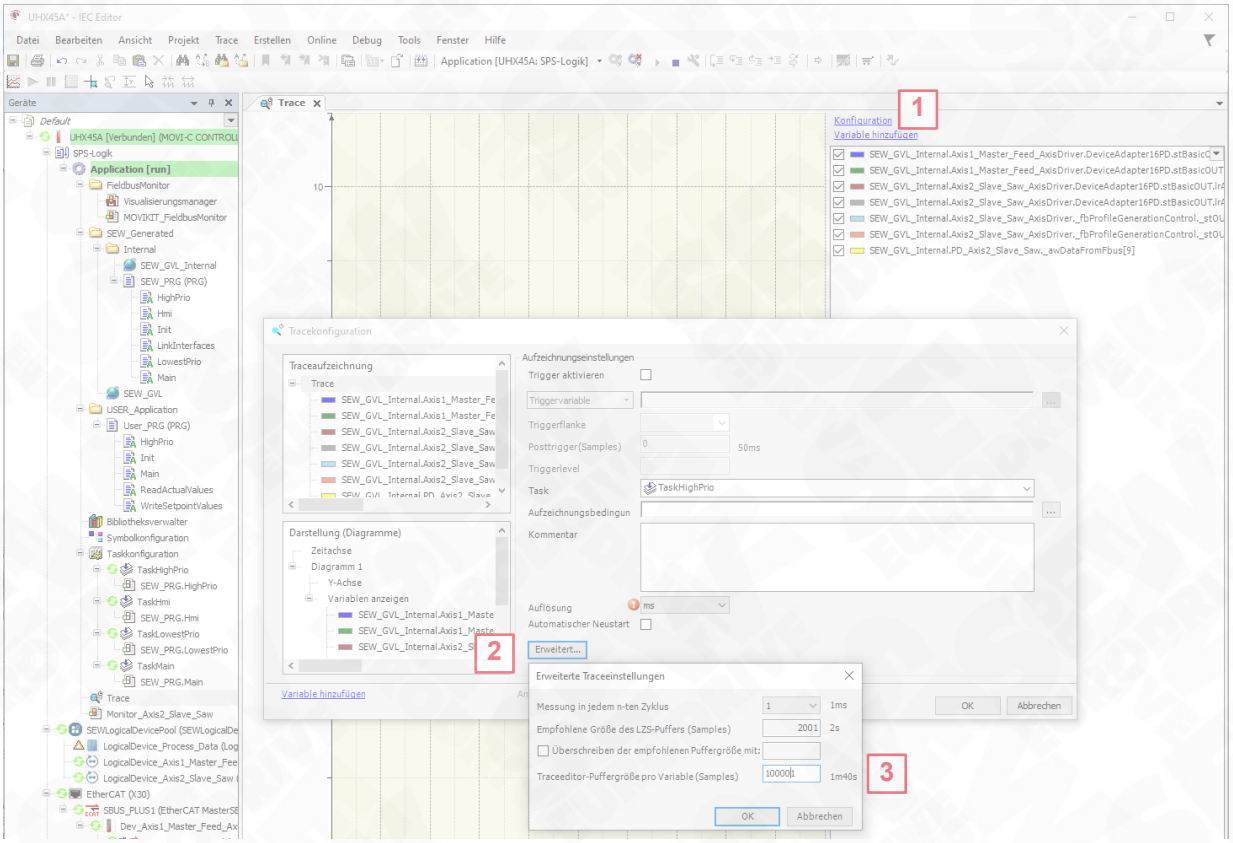
SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbGearingProfile._stOUTSignals.eGearingState

Info: This variable can only be entered by copying and pasting it into the input assistant

- **Moving to start position:**

SEW_GVL_Internal.PD_Axis2_Slave_SAW._awDataFromFBus[9]

3. Increasing the buffer size

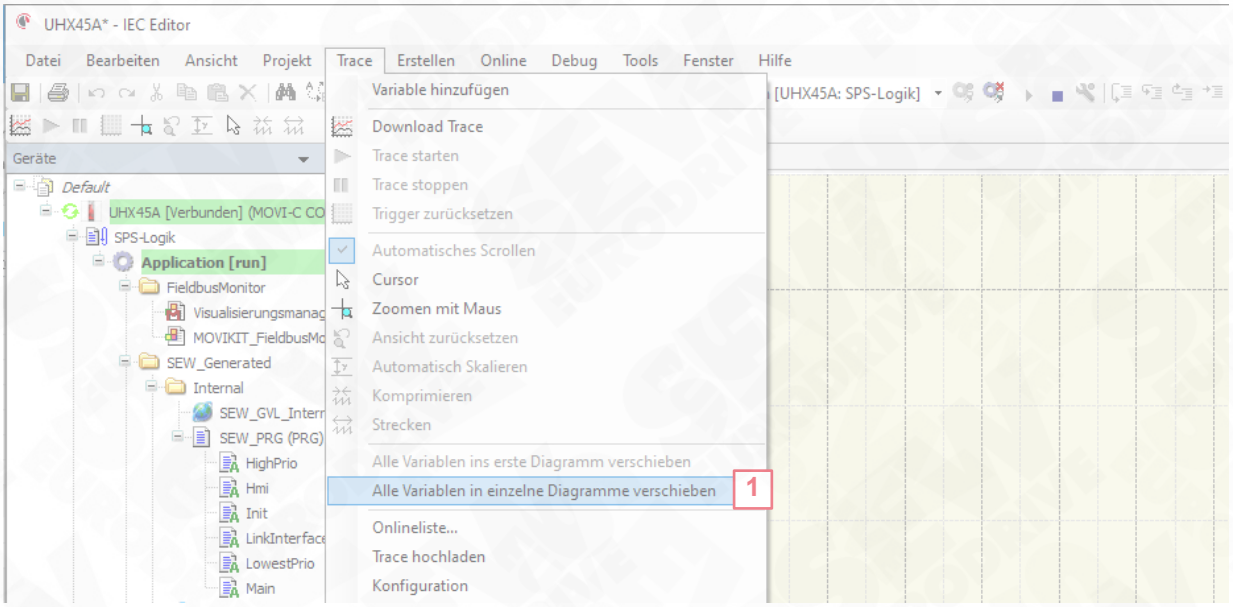


1 Click **Configuration**

2 Click **Advanced**

3 Change the buffer size to **Buffer size = 100001**

4. Optimizing the view



1 Click **Move all variables to individual diagrams**

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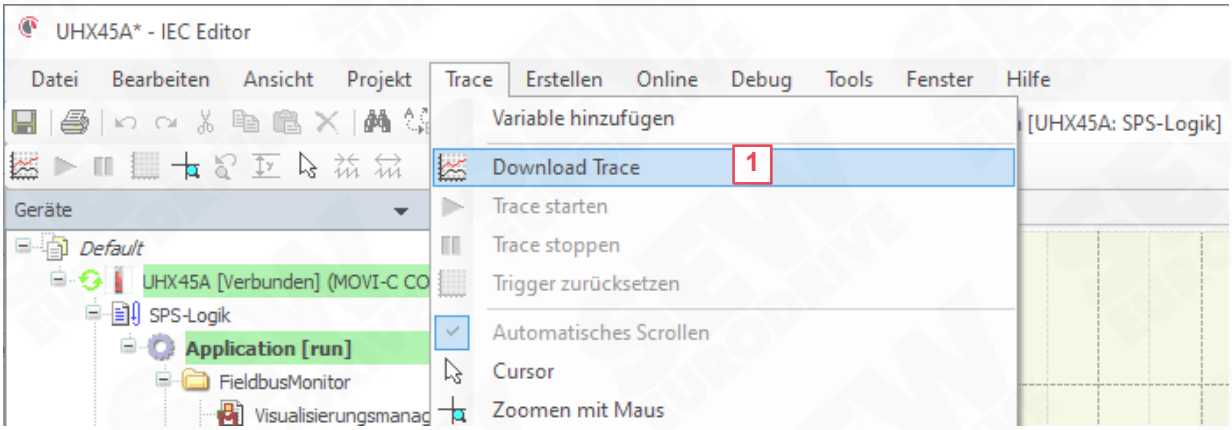
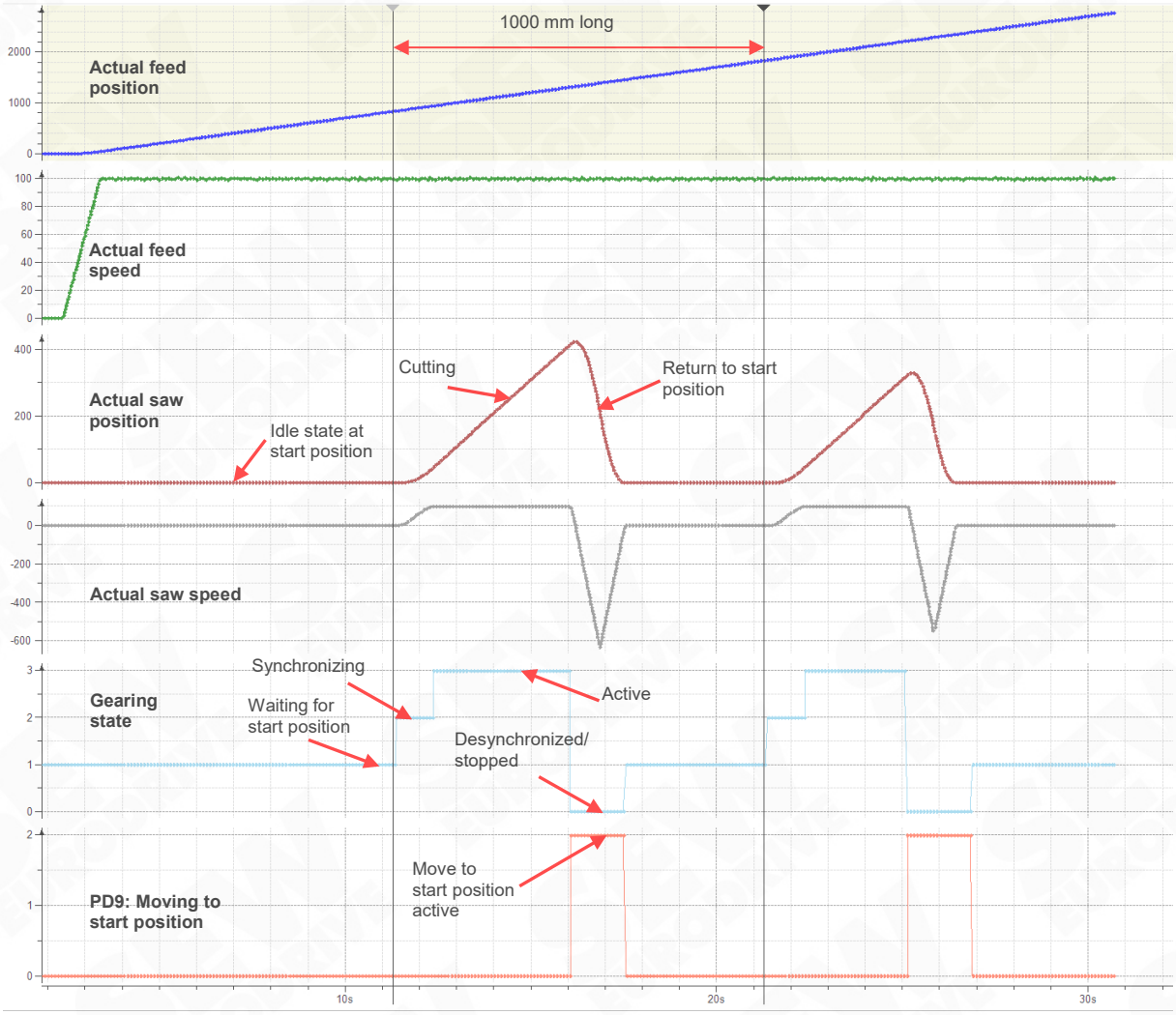
5. Starting the trace



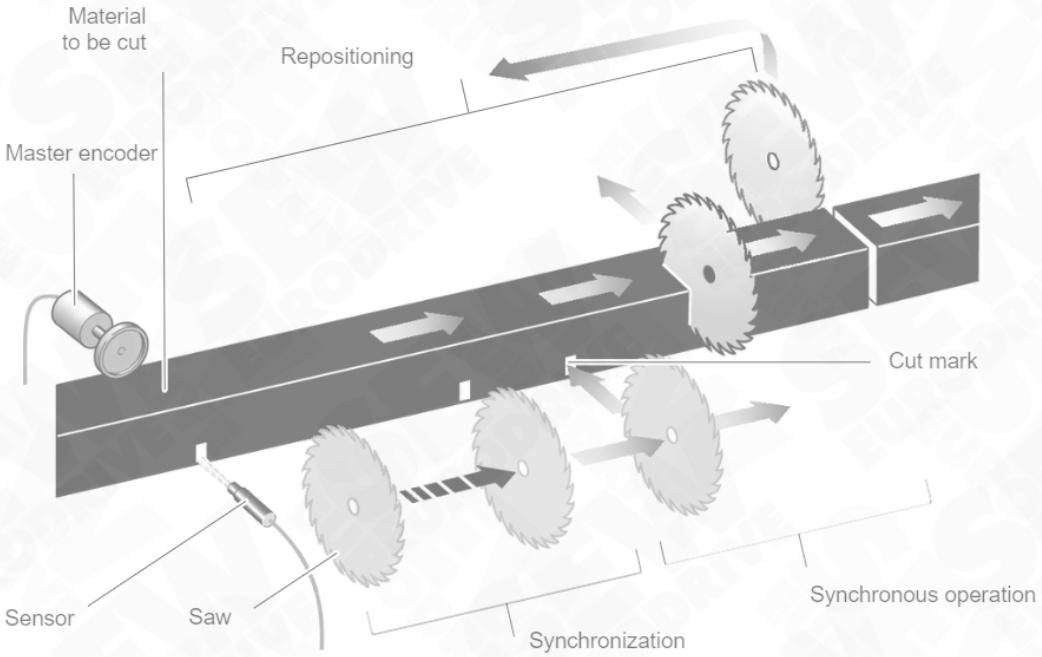
1 Click **Download trace**

6. Results of the trace measurement



6.3 Flying saw with cut mark control

In cut mark control, a sensor detects the cut marks on the material. This sensor signal is processed in the MOVI-C® CONTROLLER and is used for starting the saw carriage.



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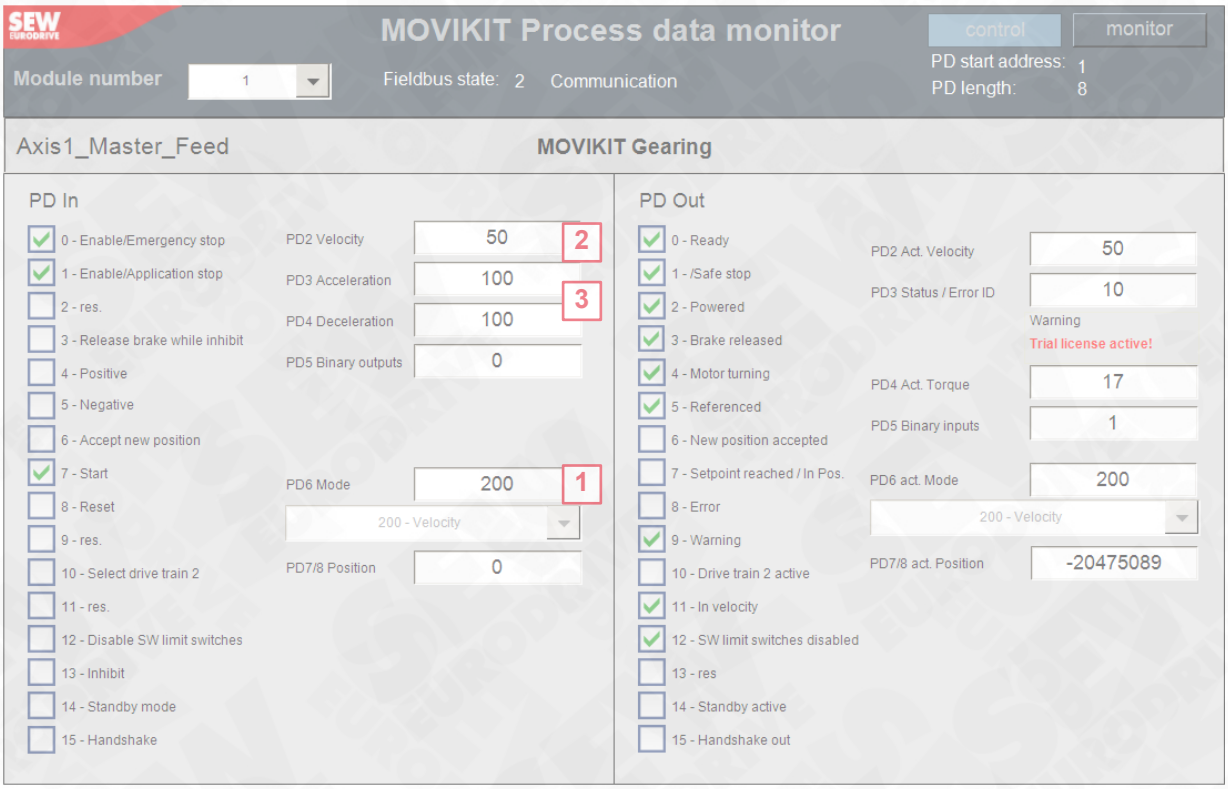
6.3.1 Testing the function

The Touchprobe input DI04 is wired to the flying saw. When the Touchprobe is activated (positive edge at DI04), the position of the master axis (Axis1_Master_Feed) is adopted. The following steps show how cut mark control mode is used.

1. Set the cut mark control with **PD6 Mode = 1402**
2. Set the speed setpoint **PD2 Velocity = 1000 mm/s**. This is the speed setpoint for returning to the start position.
3. Set the acceleration and deceleration to **PD3 Acceleration and PD4 Deceleration 1000 mm/s²**
4. Set **PD10/11 Cutting Length = 10000** and **PD 16/17 Touchprobe Window = 0** to receive all Touchprobe signals and simplify the exercise

A. If no Touchprobe is activated when starting the saw, the axis reports an error after one cut length.

5. Set the sensor distance to the cut mark to **PD14/15 Sensor Distance = 25000**
6. Set the synchronization distance by which the saw is synchronized with the master axis before the cut to **PD18/19 = 10000**



1 Set your master axis to **Mode 200**: Speed

3 Set the speed setpoint to **50 mm/s** to get a slow feed.

4 Set the acceleration and deceleration to **100 mm/s²**

It is very important that the master axis is not too slow. If the master rotational speed is too slow, the Touchprobe function will not function.

1 Start the saw and activate the Touchprobe. The state of the synchronous operation of the axis changes to 1 "Waiting for start position."

2 As soon as the material feed axis reaches the calculated synchronization position, the state of the synchronous operation changes to 2 "Gear in" and then to 3 "Active."

3 As soon as the saw is synchronous, activate PD9 = 1 "Move to start position" to reset the saw for the next step.

4 Activate the Touchprobe again to start a second cut.

6.3.2 Performing a trace recording

Perform the trace recording as described in the chapter above. Enter the following variables into the trace for this:

Variables:

- **Virtual linear axis, actual position, and speed:**

SEW_GVL_Internal.Axis1_Master_Feed_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualPosition

SEW_GVL_Internal.Axis1_Master_Feed_AxisDriver.DeviceAdapter16PD.StBasicOUT.lrActualVelocity

- **FlyingSaw, setpoint position, and speed:**

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbProfileGenerationControl._stOUTInterpolation.StSetpointsUserUnits.lrPosition

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbProfileGenerationControl._stOUTInterpolation.StSetpointsUserUnits.lrVelocity

- **Synchronous operation state:**

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbGearingProfile._stOUTSignals.eGearingState

Info: This variable can only be entered by copying and pasting it into the input assistant

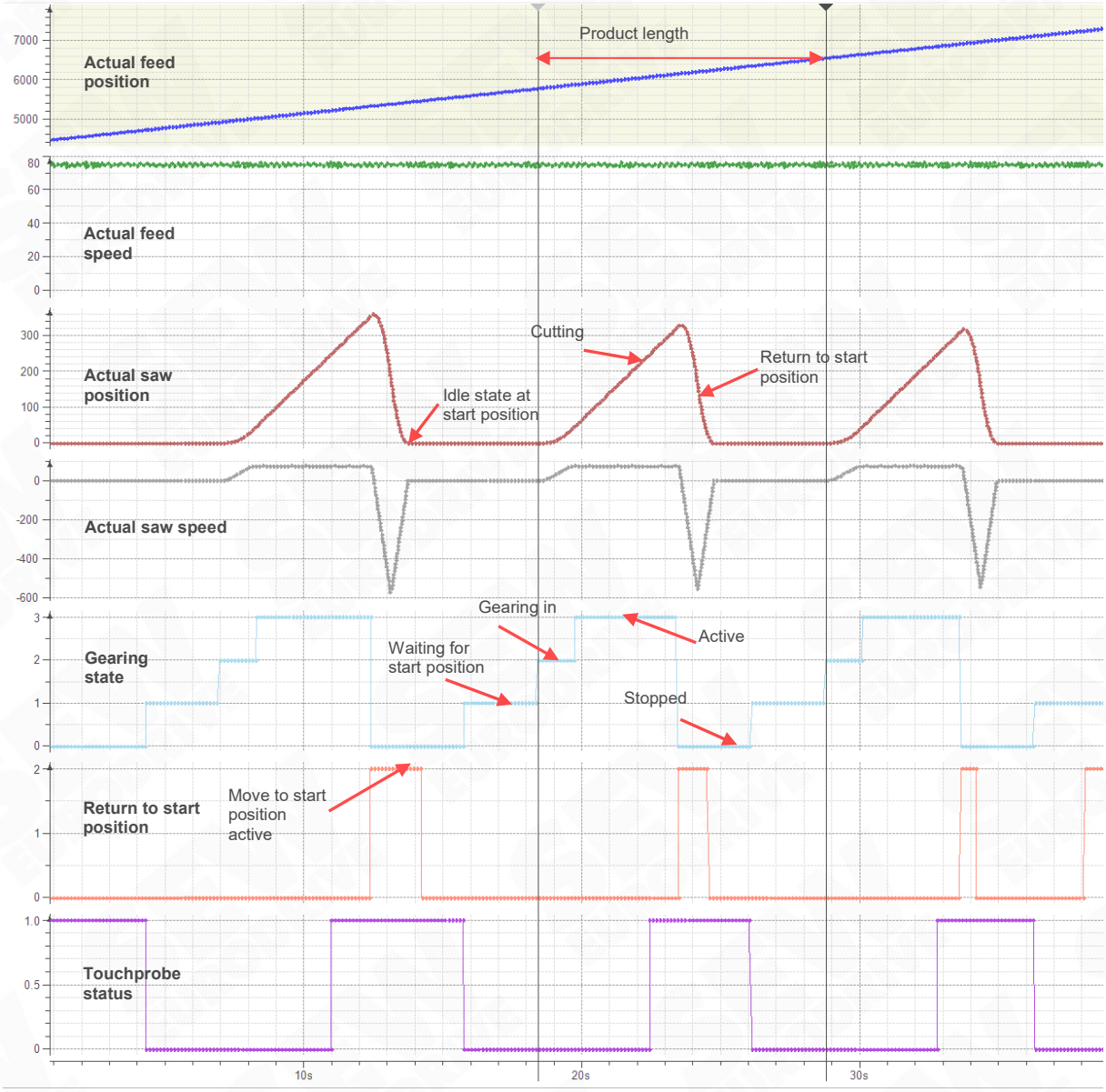
- **Moving to start position:**

SEW_GVL_Internal.PD_Axis2_Slave_SAW._awDataFromFBus[9]

- **Touchprobe signal:**

SEW_GVL_Internal.Axis2_Slave_Saw_AxisDriver._fbTouchprobe._stOUTSignals.xaktiv

Results of the trace recording:



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