
# SIMIT drive simulation of a SINAMICS S120 via Basic Positioner (EPos) with tel. 111 701 and 902

SIMIT SP V10.2

https://support.industry.siemens.com/cs/ww/en/view/109761007

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# 1 Introduction

This application example will demonstrate how a (real) SINAMICS S120 drive, linked as a PROFINET device to a SIMATIC S7-1500 functioning as PROFINET controller, can be configured and operated as a simulation in SIMIT.

For this purpose, this example uses the technology object "TO_BasicPos" (Basic Positioner) with the SIEMENS telegrams 111, 701 and 902.

## 1.1 Overview

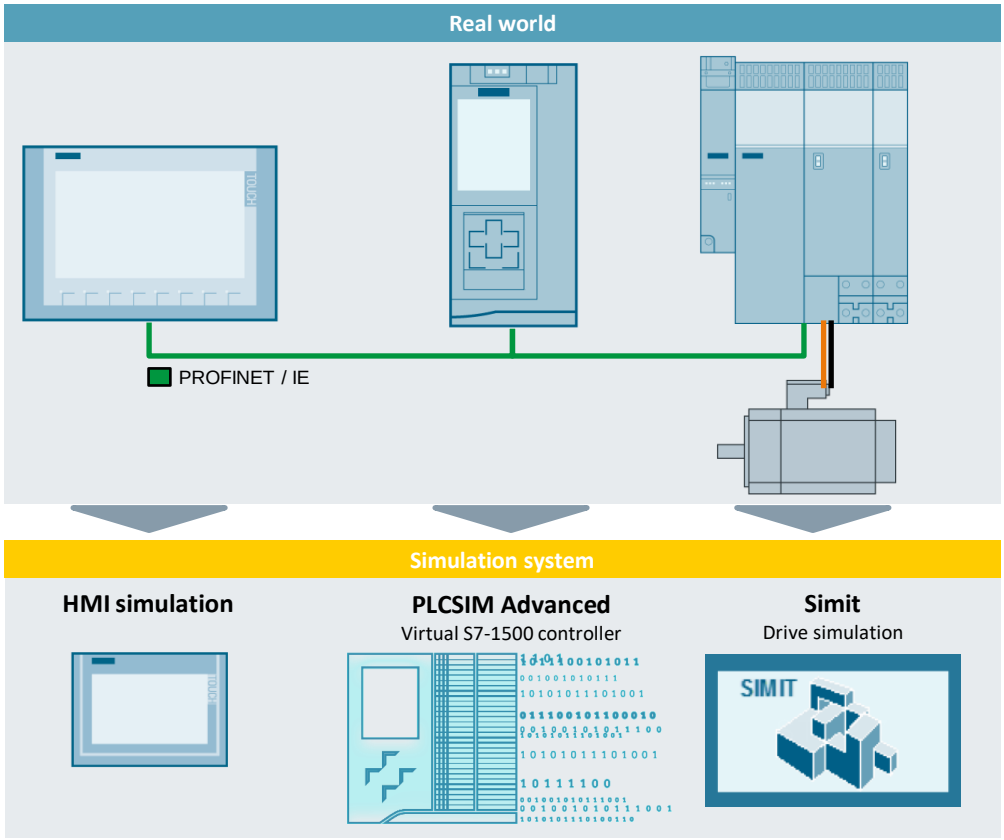
The SIMATIC S7-1500 CPU can be operated as a PROFINET controller. In this case, the PROFINET-capable SINAMICS S120 drive can be deployed as a PROFINET device and driven by the SIMATIC controller.

The following Figure gives an overview of the real hardware setup being simulated in this application example.

The following software applications will be used for the simulation of the HMI, PLC and drive:

- TIA Portal (for engineering and to simulate the HMI)
- PLCSIM Advanced (as a virtual controller)
- SIMIT SP (with tel. 111, 901 & 702 as behavior model)

Figure 1-1



## 1.2 Principle of operation

In this application example, a setpoint position is specified for a SINAMICS S120 drive. The drive then moves to the setpoint position with the Basic Positioner (Epos) function. The traversal movement of the drive is controlled with the standard technology block "TO_BasicPos". This block is called in the cyclic user program and is part of the technology objects.

**Assigning the communication parameters**

Both the SIMATIC controller and the SINAMICS inverter are configured and programmed in TIA Portal. The following data are automatically created in the hardware configuration:

- IP addresses
- PROFINET device names
- Peripheral address ranges for data to be exchanged between SIMATIC controller and SINAMICS drive

The data can be modified at any time. Which process data the SIMATIC controller and the SINAMICS drive exchange is determined by the telegram type (in the example: Siemens telegram 111, 370, 701 and 902). The corresponding telegram types are assigned parameters in the hardware configuration.

**Data exchange**

The data exchange between SINAMICS S120 and SIMATIC S7-1500F is carried out with the technology block "TO_BasicPos" in the process data range. The process data are transmitted cyclically, i.e. in each bus cycle.

**Positioning**

The SINAMICS drive axis is positioned exclusively with the technology block "TO_BasicPos". This block utilizes the functionality of the Basic Positioner (Epos), which is configured in the drive.

**Simulation**

**SIMIT SP**

This application example uses SIMIT SP as a simulation platform. Using the (drive) components telegram 111, 902 and 701 as a behavior model, it is possible to simulate the specific functions of the drive.

**PLCSIM Advanced**

PLCSIM Advanced is used as a virtual controllers. It runs the control program once the program is uploaded from TIA Portal; it replaces the real PLC.

Thanks to the corresponding coupling in the SIMIT project, it is possible to exchange data between the simulated PLC and the simulated drive components.

**HMI runtime simulation**

The runtime of the integrated simulation function in TIA Portal will be used as an HMI.

## 1.3 Components used

The following hardware and software components were used to create this application example:

Table 1-1

| Component | Quantity | Item number | Note |
|---|---|---|---|
| SIMATIC S7-1511F-1 PN | 1 | 6ES7 511-1FK01-0AB0 | Alternatively, another S7-1500F controller with version 2.5 may be used. |
| SINAMIC Control Unit CU320-2 PN | 1 | 6SL3040-1MA01-0AA0 | - |
| SINAMICS S120 Active line module | 1 | 6SL3130-7TE21-6Axx | - |
| SINAMICS S120 Single motor module | 1 | 6SL3120-1TE13-0AAx | - |
| Synchronous motor with absolute value encoder and DRIVE-CLIQ interface | 1 | 1FK7042-xAK7x-xCHx | - |
| SIMATIC HMI KTP900 Basic PN | 1 | 6AV2123-2JB03-0XA0 | - |
| STEP 7 Professional V16 | 1 | 6ES7822-1AA06-0YA5 | - |
| SINAMICS Startdrive V16 | 1 | 6SL3072-4GA02-0x.. | At least Update 5 |
| SIMIT V10.2 | 1 | 6DL8913-0AKxx | - |

This application example consists of the following components:

Table 1-2

| Component | File name | Note |
|---|---|---|
| Documentation | 109761007_SIMIT_Drives_Application_DOC_v10_en.pdf | - |
| TIA Portal example project | 109761007_SIMIT_Drives_Application_TIA_PROJ_v10.zip | - |
| SIMIT SP example project | 109761007_SIMIT_Drives_Application_SIMIT_PROJ_v10.zip | - |
| SIMIT SP library | 109761007_SIMIT_Drives_BehLib_PROJ_v30.zip | - |

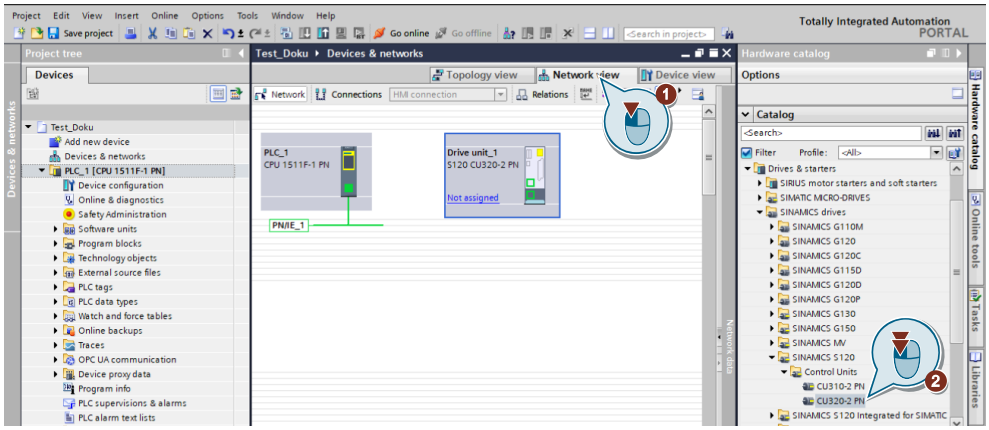
# 2 Engineering

## 2.1 Configuration

### 2.1.1 Configuring the SINAMICS S120 drive

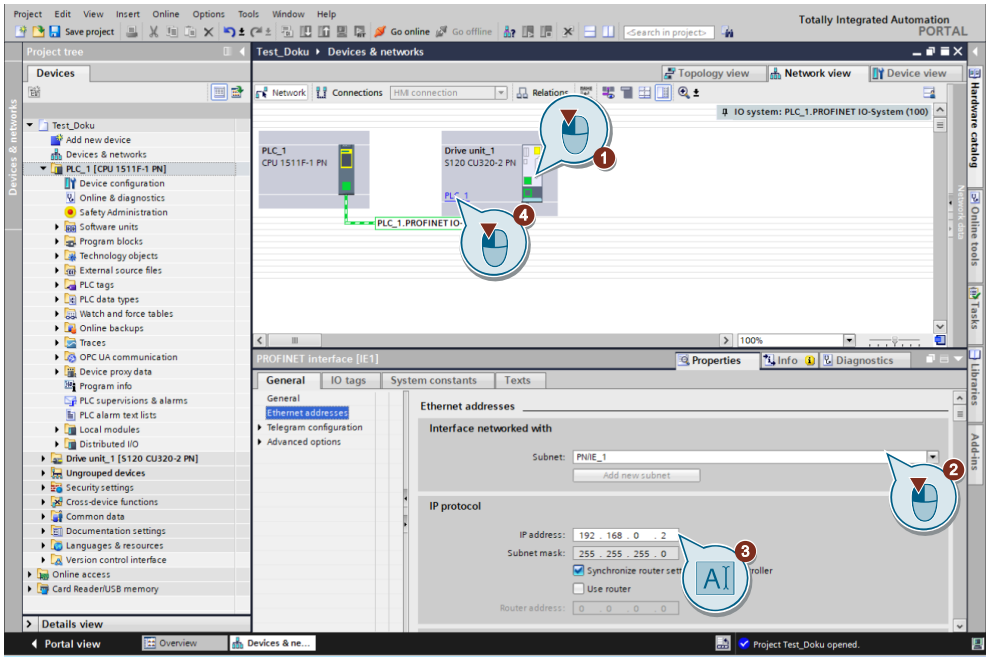
**Add the SINAMICS drive:**

1. Switch to the Network view.
2. Select the corresponding CU320-2 PN module and add it by dragging and dropping.



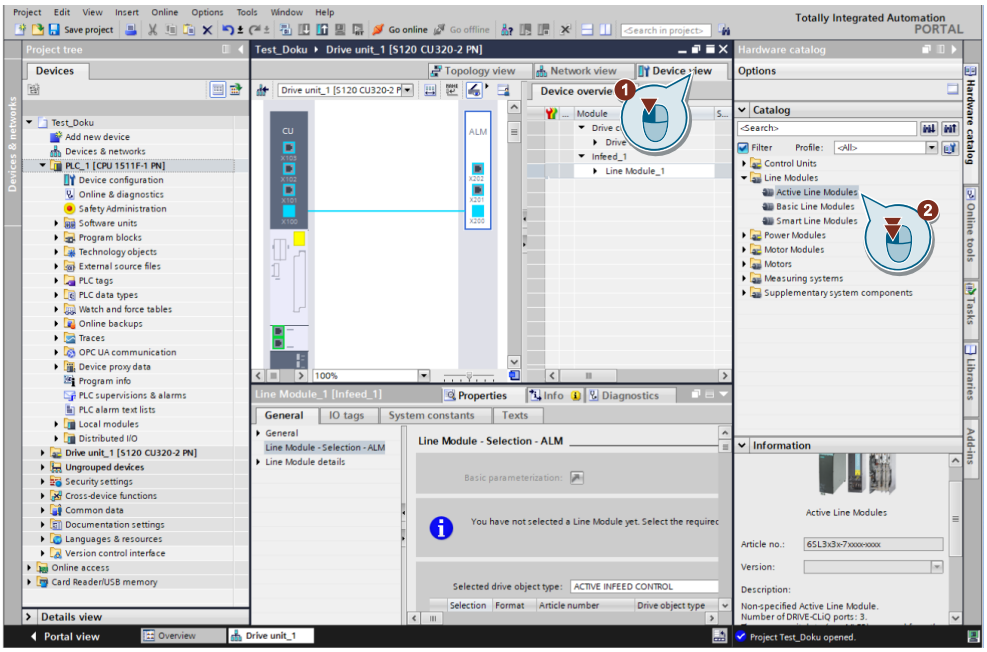

**Set the network**

1. Open the properties of the drive in the Inspector window.
2. Select the network under "Ethernet addresses".
3. Enter the IP address, for example 192.168.0.2.
4. Assign the drive to the controller.

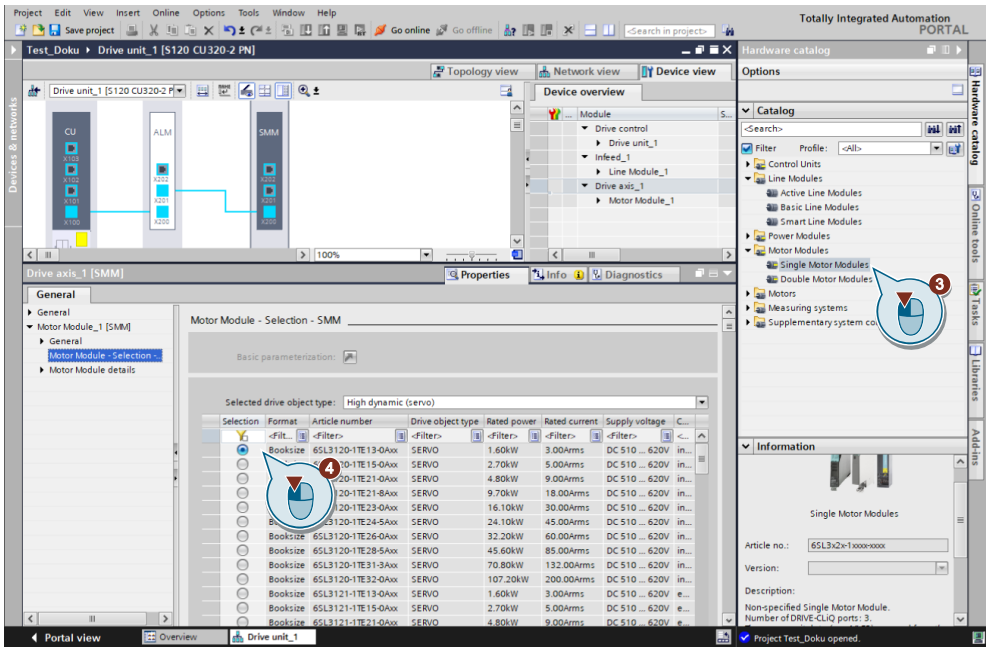


### Assign components

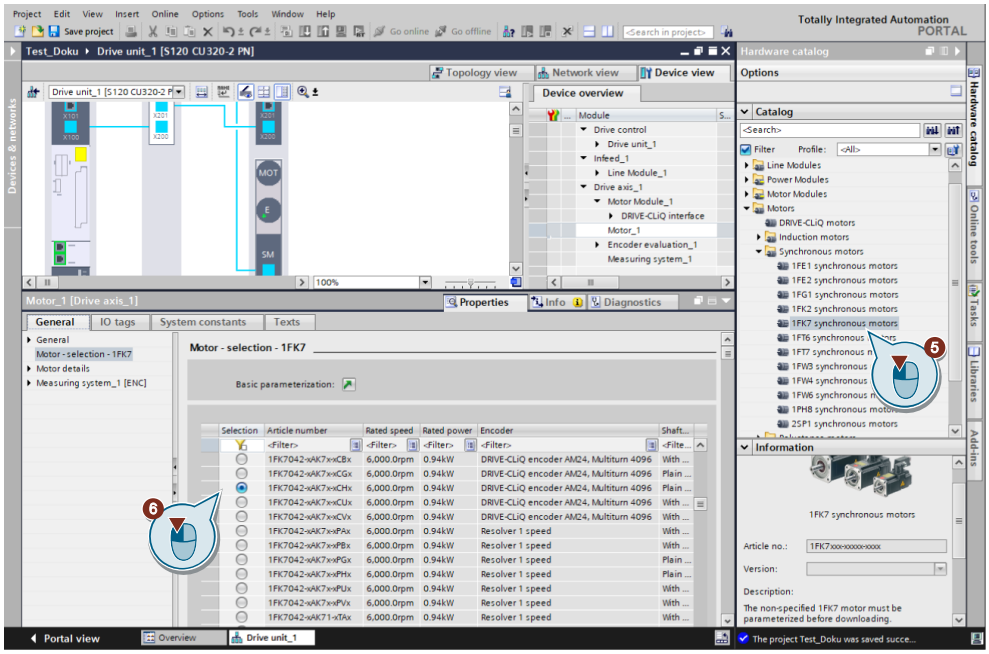
1. Switch to the Device view of the drive (Drive Unit).
2. Select the corresponding "Line Module" and then drag & drop it into the Device view.



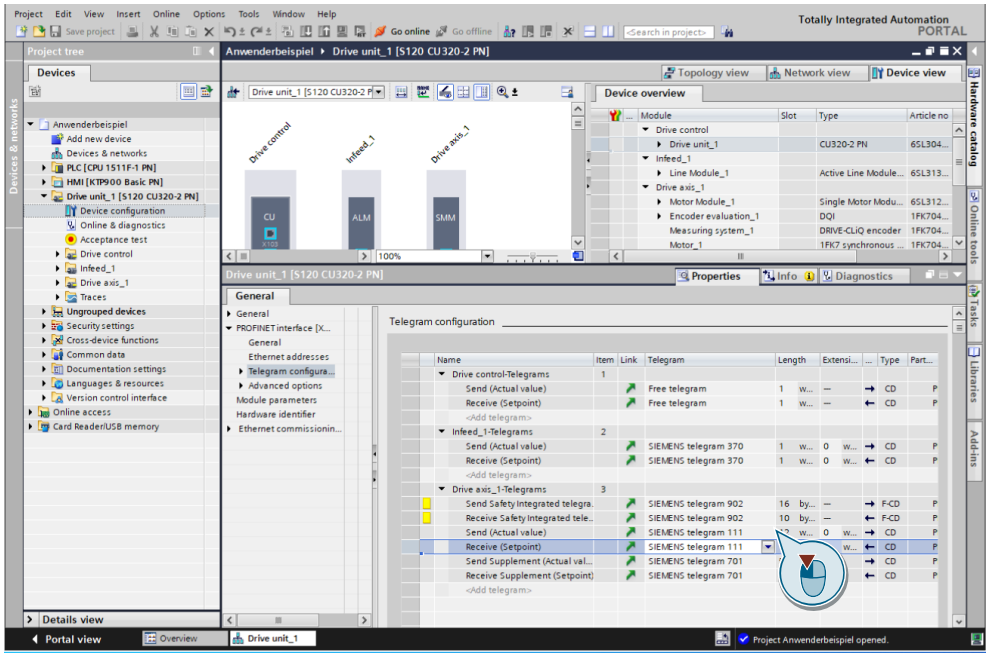
3. Select the motor module and drag & drop it into the Device view.
4. In the Inspector window, select the item number of the motor module.



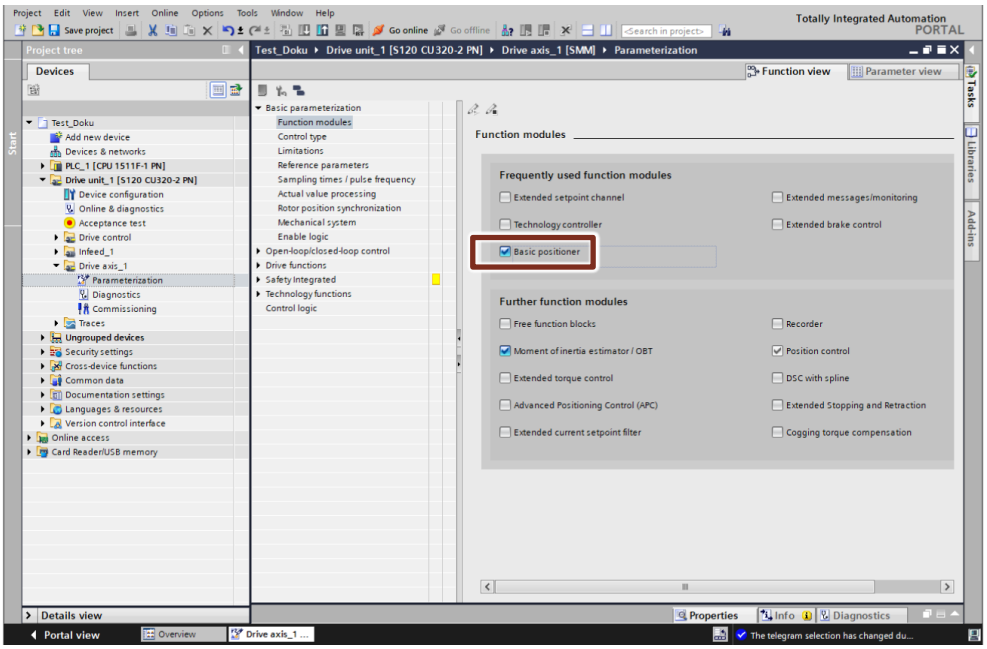
5. Select the motor in the hardware catalog.
6. In the Inspector window, select the item number of the motor. A selection is possible with the use of filters.



7. Under "PROFINET interface" > "Telegram configuration", assign telegram 111 and the safety telegrams 701 and 902 to the drive axis; add telegram 370 to the infeed.



8. In the project tree under "Drive unit" > "Drive axis", open "Parameterization". Under "Basic parameterization" > "Function modules", enable the option "Basic positioner".




9. Save and compile the complete hardware project.

The components of the SINAMICS S120 drive are also listed in the "Device overview".

Figure 2-1: Device overview

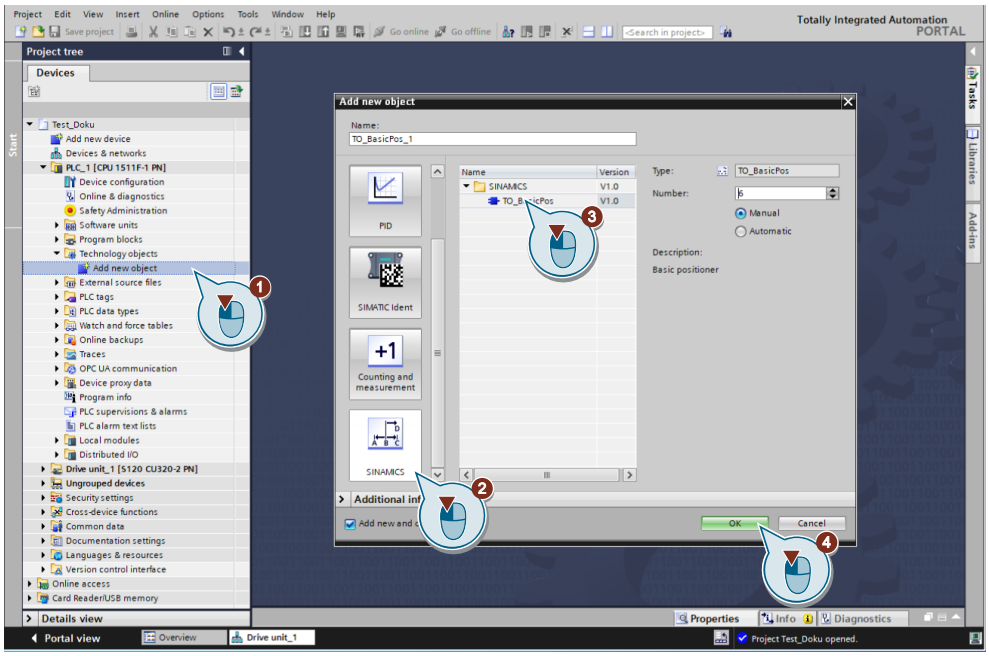
**Device overview**

| Module | Type | Article no | D... | Firmw.. |
|---|---|---|---|---|
| Drive control | | | 1 | |
| Drive unit_1 | CU320-2 PN | 6SL3040-1MA01-0Axx | 1 | V5.2.3 |
| Infeed_1 | | | 2 | |
| Line Module_1 | Active Line Module Booksize | 6SL3130-7TE21-6Axx | 2 | |
| Drive axis_1 | | | 3 | |
| Motor Module_1 | Single Motor Module Books... | 6SL3120-1TE13-0Axx | 3 | |
| Encoder evaluation_1 | DQI | 1FK7042-xAK7x-xCHx | 6 | |
| Measuring system_1 | DRIVE-CLiQ encoder | 1FK7042-xAK7x-xCHx | 5 | |
| Motor_1 | 1FK7 synchronous motor | 1FK7042-xAK7x-xCHx | 4 | |

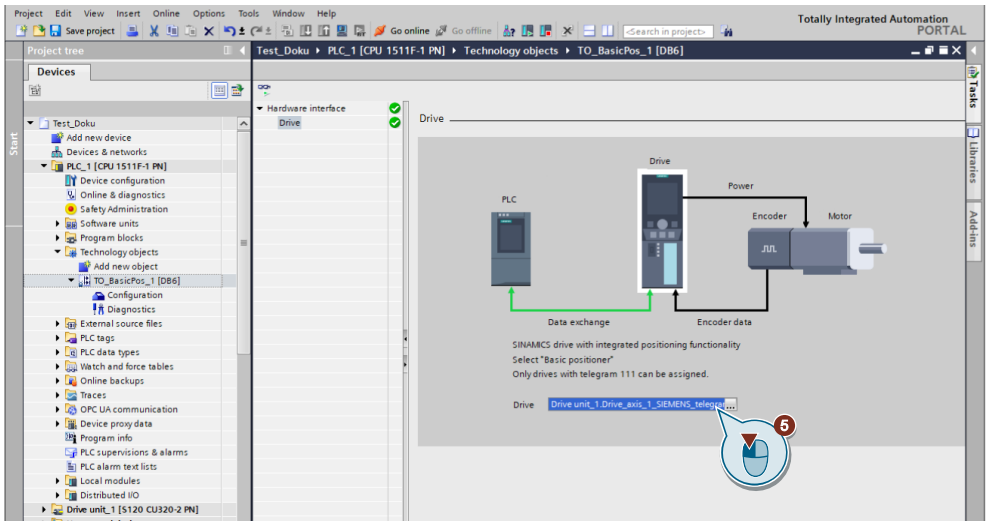
### 2.1.2 Configuring the technology object "TO_BasicPos"

Proceed as follows to insert a technology object "TO_BasicPos" to the project:

1. Double-click on "Add new object" in the "Technology objects" folder.
2. Select the "SINAMICS" group in the dialog.
3. Select the "TO_BasicPos" type.
4. Click "OK" to confirm the selection.




5. The configuration will open. Under "Hardware interface > Drive", select telegram 111.

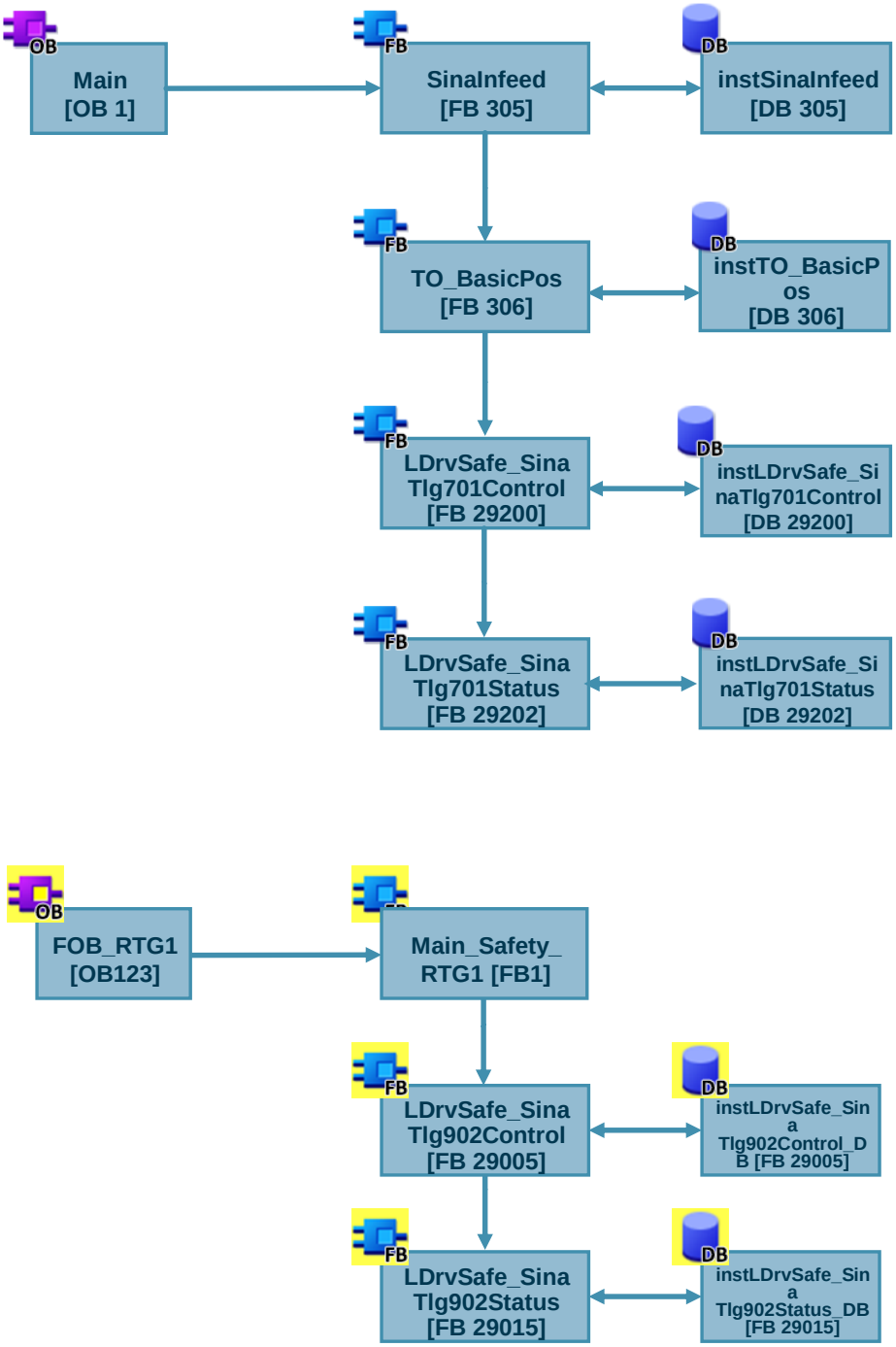



## 2.2 Integration into the user project

### 2.2.1 Structure of the control program

The following Figure shows the program structure of the control program.

Figure 2-2: Program overview




To integrate the application example into your user project, you will need the following blocks:

- "TO_BasicPos":Task Card Instructions > Technology > SINAMICS
- "SinaInfeed": Task Card Instructions > Options packages > SINAMICS)
- "LDrvSafe_SinaTlg701Control": Library "LDrvSafe"

- "LDrvSafe_SinaTlg701Status": Library "LDrvSafe"
- "LDrvSafe_SinaTlg902Control": Library "LDrvSafe"
- "LDrvSafe_SinaTlg902Status": Library "LDrvSafe"

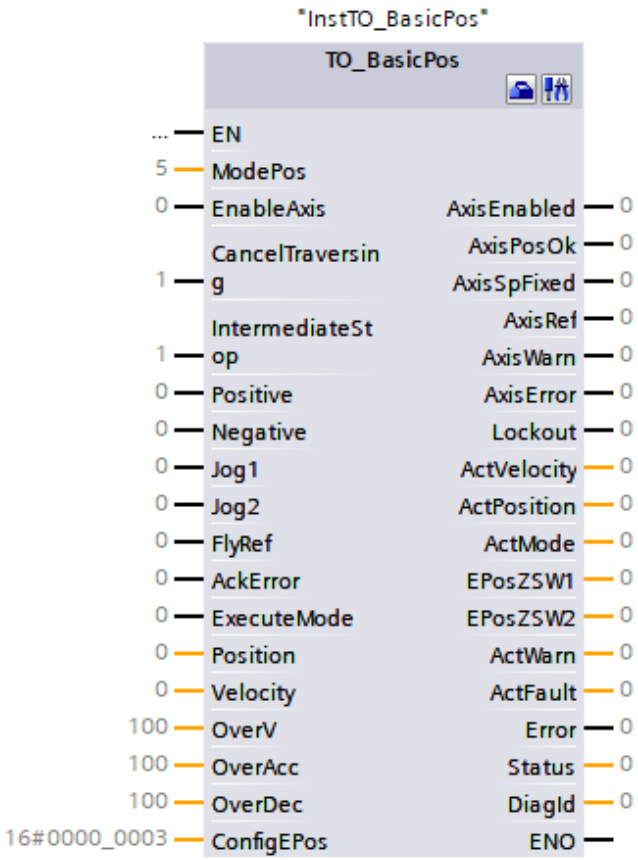
Note

The "LDrvSafe" library and the description of the blocks can be found in the SIEMENS Industry Online Support at the following link:

https://support.industry.siemens.com/cs/ww/en/view/109485794

### 2.2.1.1 Information on the block "TO_BasicPos"

Figure 2-3: FB306 TO_BasicPos




You can use the SINAMICS instruction "TO_BasicPos" if the Basic Positioner function model is used in the connected SINAMICS drive. "TO_BasicPos" is used for cyclic control of a SINAMICS drive with the technology for SINAMICS S/G/V Basic Positioner.

Note

Due to the various Epos operating modes, there is a special mode input, the "ModePos" input. The individual operating modes are selected with this input. Owing to the EPos structure, it is not possible to select multiple modes at the same time. However, it is possible to switch to other modes at any time while in a given mode. In this way, for example, you can switch from setup mode to absolute positioning.

Note

When configuring the SINAMICS drive, you must ensure that the standard telegram type 111 is selected for the communication.

**LU (Length Unit)**

The block "TO_BasicPos" works with the neutral length unit, LU. The length unit (LU) can correspond to a distance (e.g. 1 LU = 1 mm) or an angle on the axis (e.g. 1 LU = 1 millidegree). The definition is set in the drive configuration.

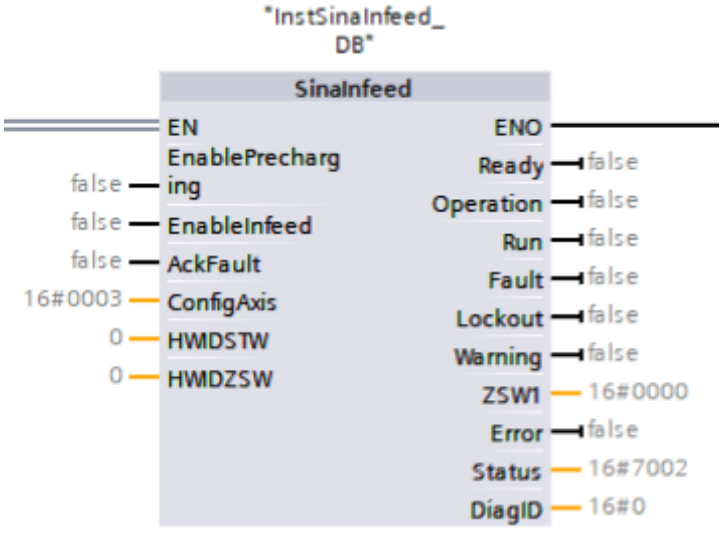
Note

For an example of the use of the LU length unit, refer to the chapter entitled "Position control" in the "SINAMICS S120 Function Manual Drive Functions" functional manual.

https://support.industry.siemens.com/cs/ww/en/view/109754299

### 2.2.1.2 Information on the "SinaInfeed" block (telegram 370)

Figure 2-4: FB305 SinaInfeed




This block serves to operate the infeed unit of a SINAMICS S120. The module only operates control word STW1 and evaluates status word ZSW1 from the infeed (standard telegram 370).

When the "SinaInfeed" block (FB305) is integrated, the corresponding instance DB is created automatically.

### Functional description

The hardware ID of the setpoint value slot is specified via the input "HWIDSTW"; the hardware ID of the actual value slot is specified via the "HWIDZSW" input.

By setting the input "EnablePrecharging" (STW1.0), the infeed can be pre-charged, and switched on with the input "EnableInfeed" (STW1.3) (by setting the corresponding control bits in STW1).

The functions are only executed when the infeed is in the necessary state for this (evaluation of the current ZSW1).

The individual infeed responses (relevant status bits) and the complete status word 1 are output via the block outputs.

In addition to the inputs "EnablePrecharging", "EnableInfeed" and "AckError", the user can also make other specifications in control word 1 via the parameter "ConfigAxis" (default: 3h). For immediate operation, certain bits in the telegram are pre-set with the help of this input.

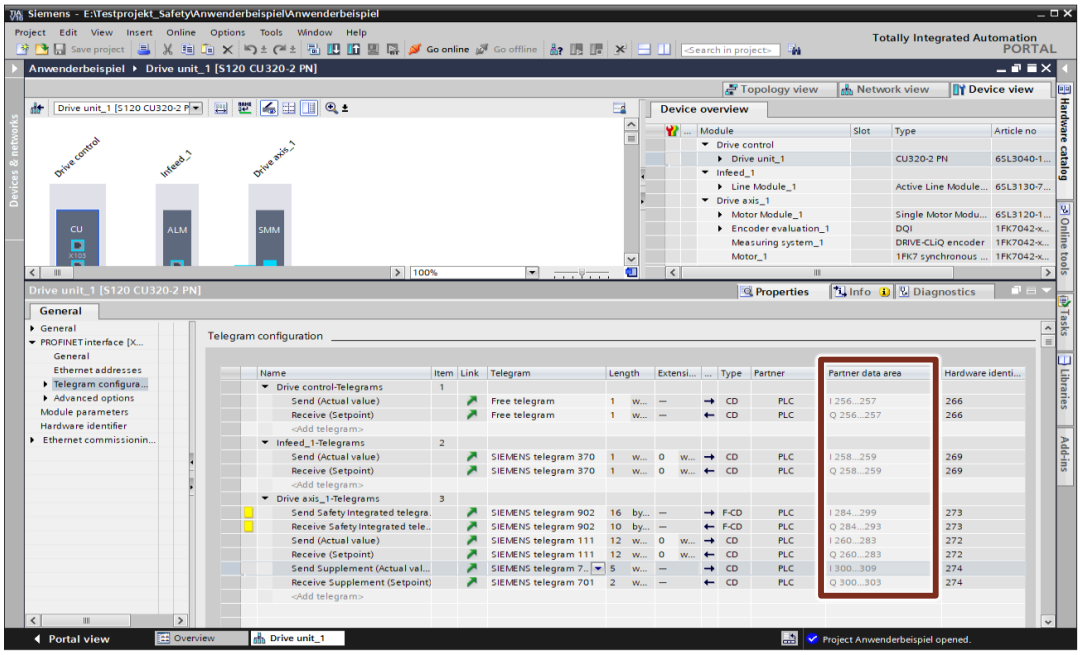
The "control requested" bit (STW1.10) is set cyclically within the block.

## 2.2.2 PLC tags for PROFIdrive telegrams

With the PLC data types for PROFIdrive telegrams, you can create PLC tags in the tag table and thereby access the input and output range in the user program in a structured and symbolic way.

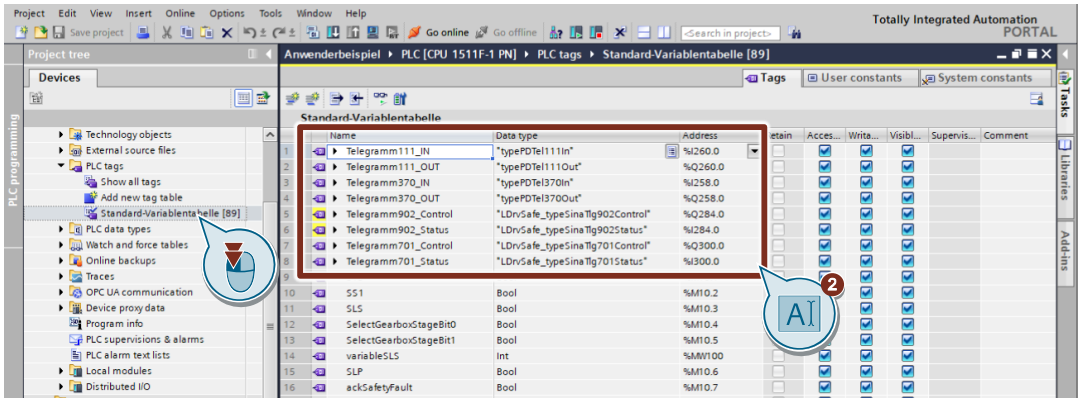
The address range of the telegrams can be found in the telegram configuration of the drive.

Figure 2-5: Telegram address ranges



All necessary PLC tags for the complete address range of the necessary telegrams have been created accordingly. Note the assignment of the data type Word or DWord.

Figure 2-6: PLC tags for PROFIdrive telegrams



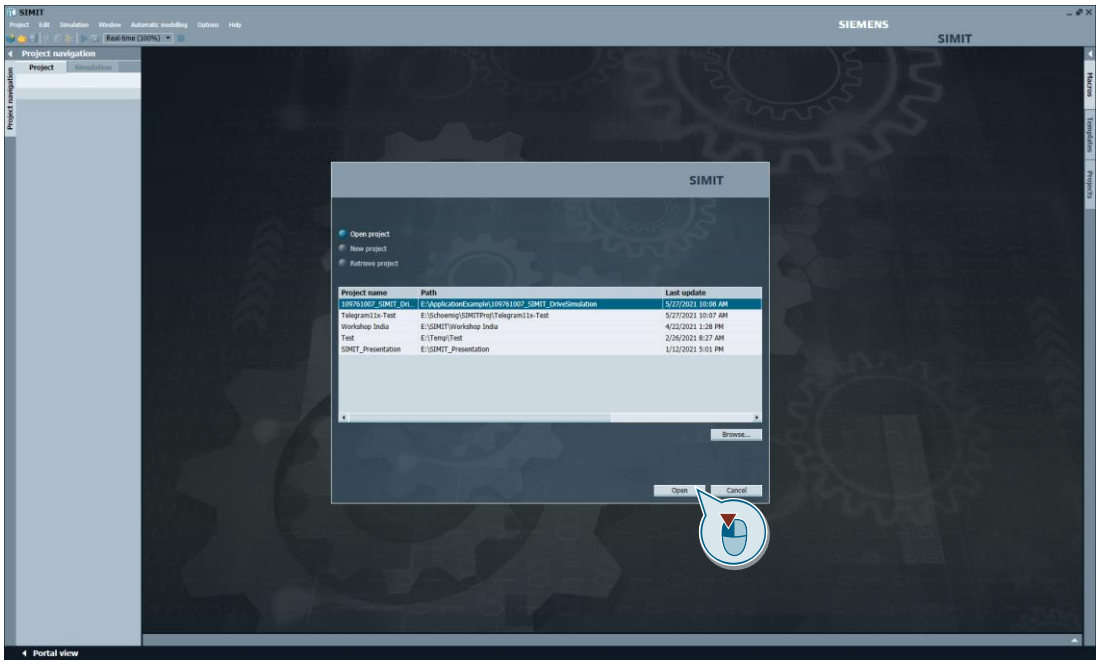
## 2.3 Operation

| | |
|---|---|
| WARNING | Make sure that the moving drive does not pose a danger to persons or parts of the plant. Take appropriate measures to prevent the drive from going beyond technically or mechanically specified limits. |

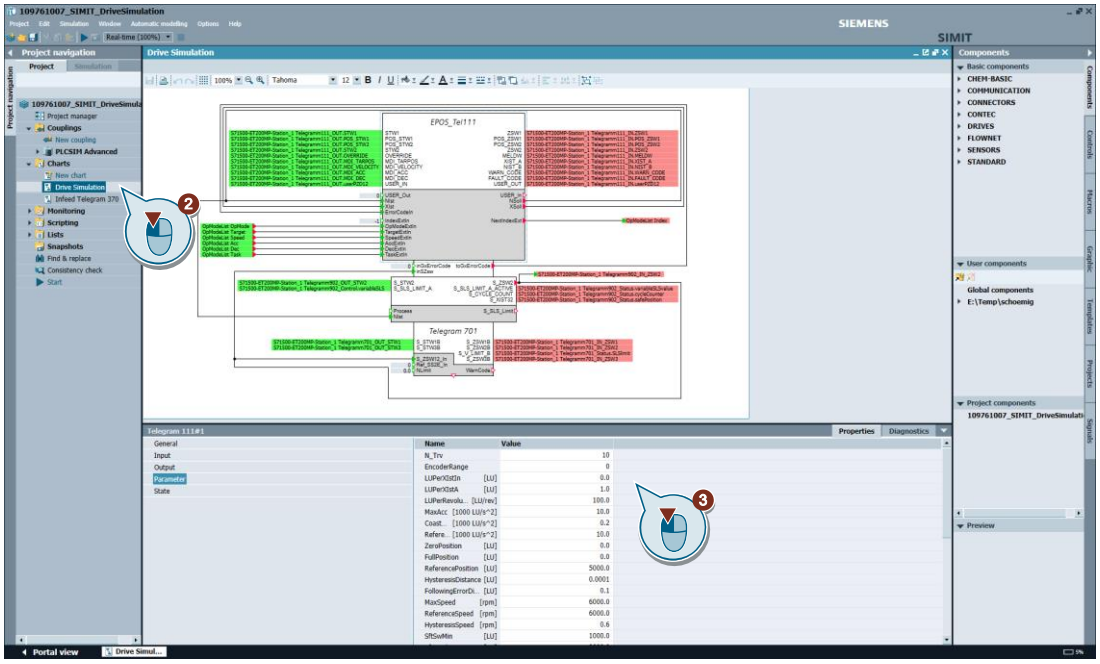
### 2.3.1 Starting the applications

#### 2.3.1.1 Start SIMIT

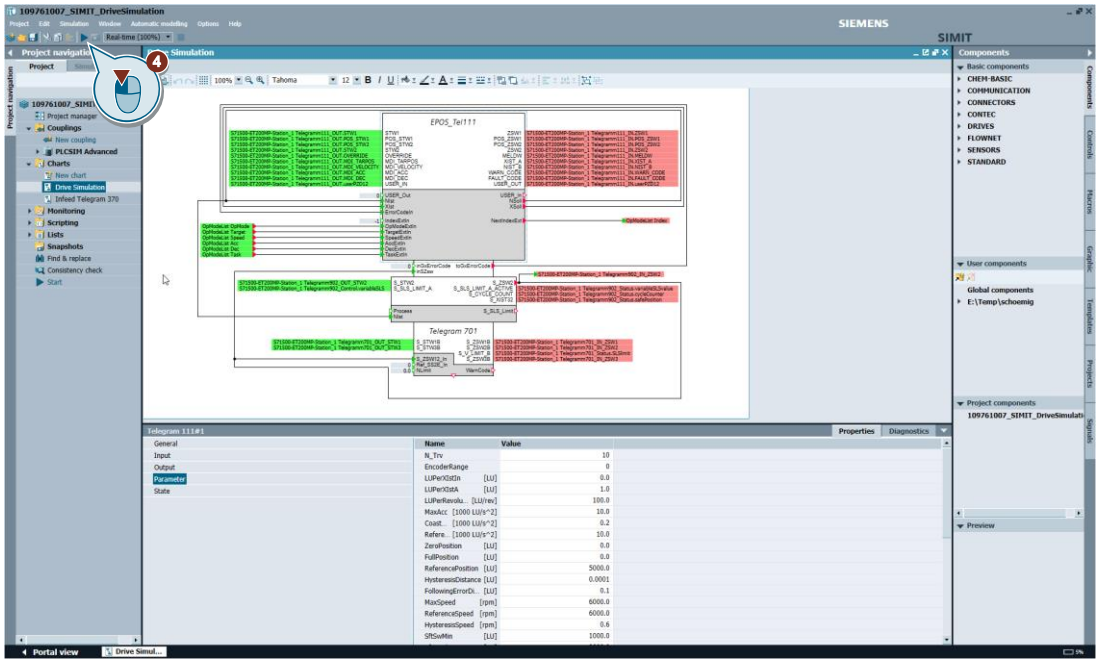
1. Start SIMIT and open the application example project.
   When launching for the first time, select the size of the software license.



2. Open the chart and select a component.
3. Check the parameters and modify them if necessary.




4. Start the simulation.

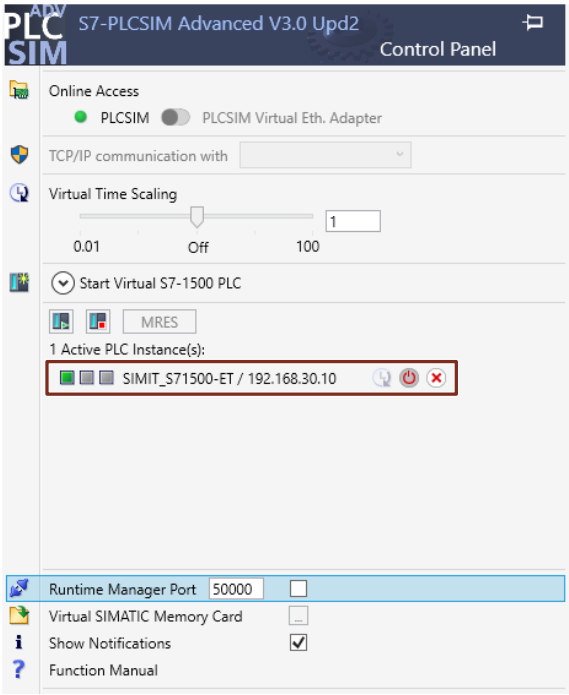



The simulation switches to Online mode.

### 2.3.1.2 Start PLCSIM Advanced

Starting the SIMIT simulation will have already created an instance of the SIMIT coupling and switched it to RUN. When you open PLCSIM Advanced, you can see it and check its status.

Figure 2-7: Start PLCSIM Advanced

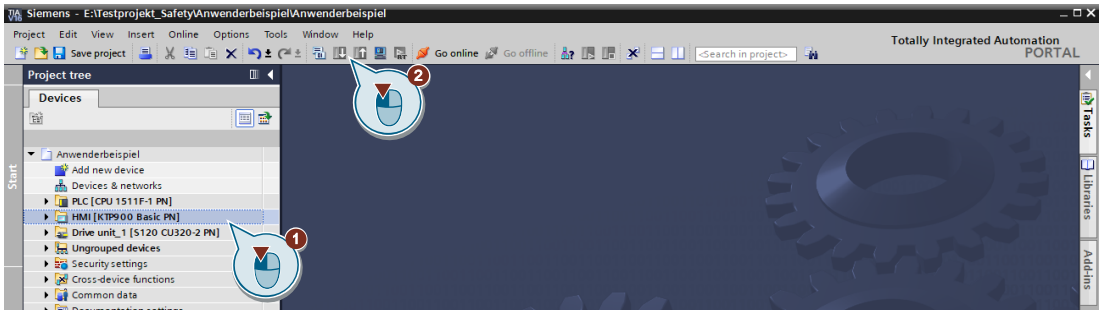



### 2.3.1.3 Start TIA Portal

1. Open the TIA Portal project from the application example. Select the controller (PLC).
2. Load the project to the virtual controller of PLCSIM Adv.

### 2.3.1.4 Start HMI simulation (in TIA Portal)

1. Select the HMI in the project tree of the TIA Portal project.
2. Start the HMI simulation with the "Start simulation" button.

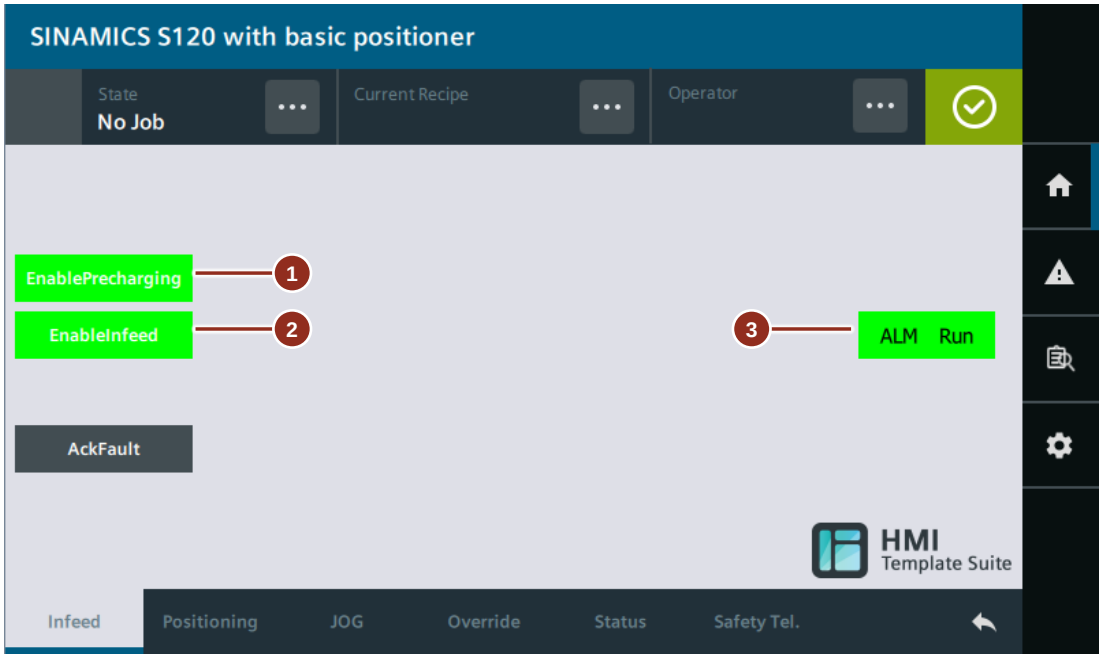



3. The HMI simulation will be launched with the start screen.
   Click on "Start Application".

### 2.3.2 Setting enable signals

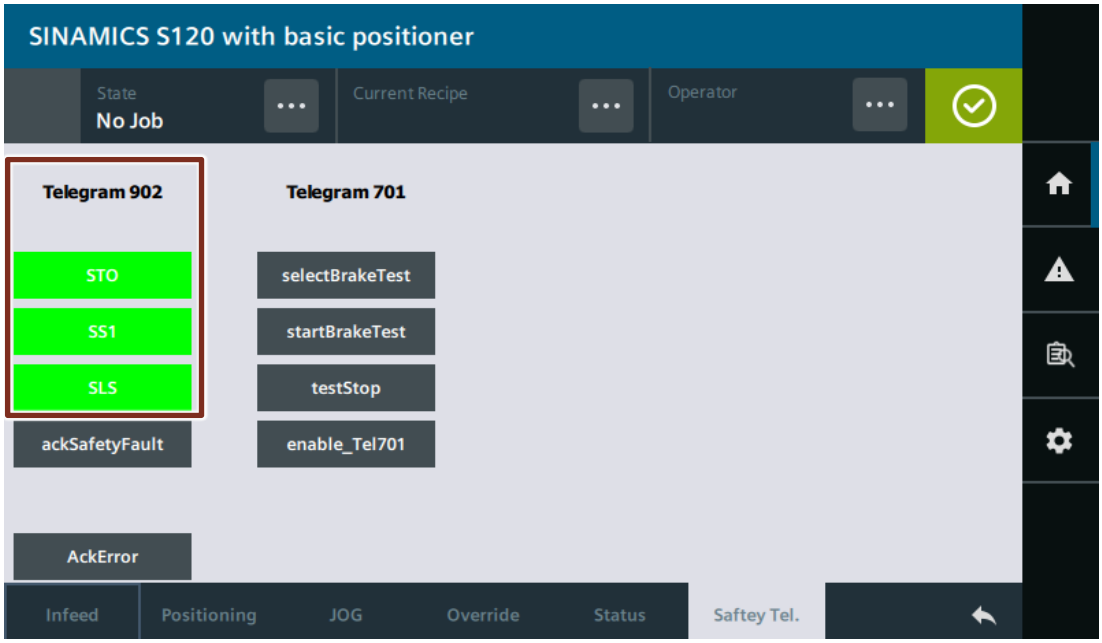
**Setting enables on the HMI**

1. Open "Infeed" HMI screen to set the enable signals:
   - Enable precharging (1);
   - Enable the infeed. (2)
   - "Run" will be set to "TRUE" as a response. (3)




2. Open the HMI screen "Safety Tel." for the telegrams 902 and 701.

   For the safety enable, the functions "STO", "SS1" and "SLS" must be set to "True"; they are pre-set with "1" when the controller starts.



**Setting enable signals in the watch table**

Using the configuration input "ConfigEPos", you can adjust various parameters for the block "TO_BasicPos", such as

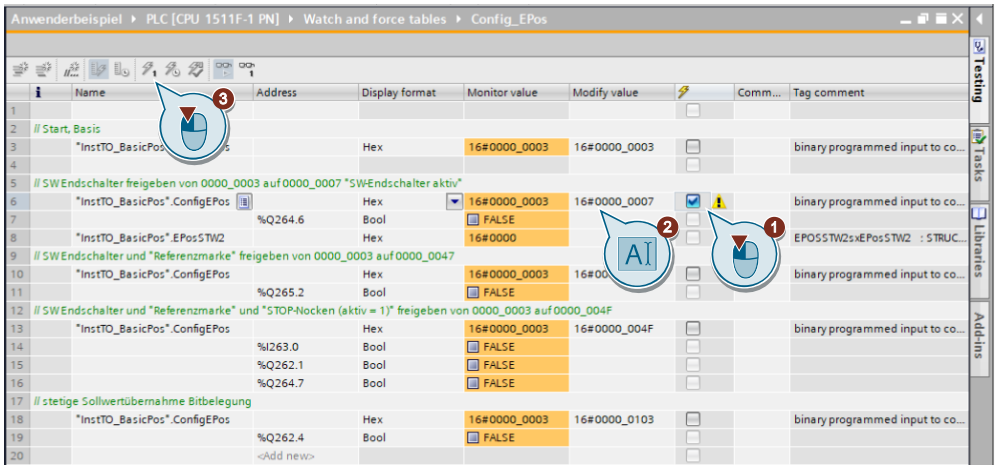
- Stop cams
- Software limit switch(es)
- Continuous setpoint transfer

Note

An exhaustive description of the configuration input "ConfigEPos" can be found in the TIA Portal Online Help.

Open the watch table "Config_EPos" to set the enable signals:

1. Select the configuration that needs to be controlled (e.g. software limit switch) by ticking the checkbox for control in the column next to the "Modify value" column.
2. Specify a value in the "Modify value" column.
3. Select the "Modify now" command to immediately modify the selected configuration once with the specified values.




## 2.3.3 Operation via the HMI panel

To operate the application example, user interfaces are stored in the HMI project. If no SIMATIC HMI is available, the operator screens can be used in simulation mode (see chapter 2.3.1.4). In this simulation mode, the runtime of the operator device is displayed in the TIA environment.

The "Positioning" tab summarizes all inputs and outputs necessary for positioning and homing the axis.

The left side of the user interface shows the input signals. An active input is highlighted in green here.

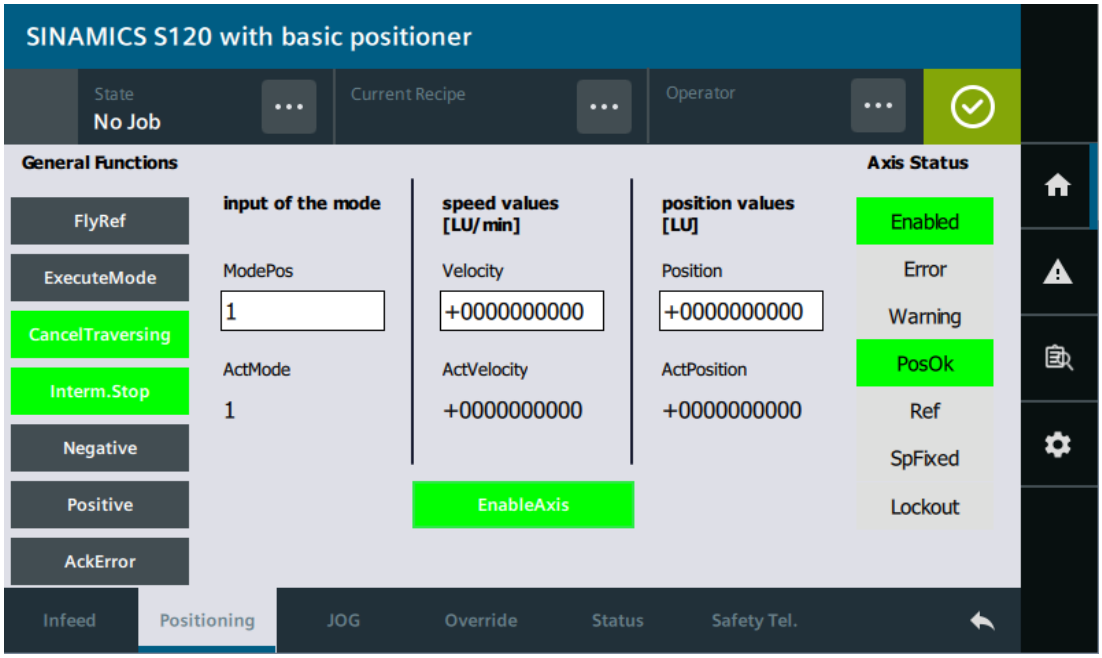
The right side of the user interface shows the output signals. An active output is highlighted in color:

- Display of states in green
- Display of errors in red
- Display of warnings in orange

The required analog values are listed in the middle of the user interface:

- Preselected and current operating mode (ActMode) of the block
- Setpoint and actual velocity of the axis (ActVelocity)
- Setpoint and actual position of the axis (ActPosition)

Figure 2-8: User interface "Positioning"






### 2.3.3.1 Relative positioning

The relative positioning mode is implemented with the "MDI Positioning Relative" drive function. It facilitates position-controlled traversal of traversal paths via the integrated position control of the SINAMICS drive.

**Requirements**

- The operating mode is selected with "ModePos" = 1.
- The device is switched on with "EnableAxis".
- The axis does not need to be homed, nor does the encoder need to be calibrated.
- The axis is at a standstill if a mode higher than 3 is selected. Switching between the MDI operating modes (1,2,3) is possible at any time.

**Sequence**

The specification of the traversal path and dynamics is accomplished with the inputs "Position", "Velocity", "OverV" (velocity override), "OverAcc" (acceleration override) and "OverDec" (deceleration override).

The velocity override here pertains to "Velocity".

The operating conditions "CancelTraversing" and "IntermediateStop" must be set to "1". "Jog1" and "Jog2" have no effect and should be set to "0" (false).

In relative positioning, the direction of movement always derives from the sign of the traversal path.

A positive edge at "ExecuteMode" starts the traversal movement. With "EPosZSW1 / EPosZSW2" it is possible to track the current status of the running command (see the Appendix for details on the value assignment of the status words).

The block acknowledges successfully reaching the end of the traversal path, "AxisPosOk". If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

The running command can be replaced on the fly with a new command via "ExecuteMode". This is only possible for the operating modes 1,2,3 of "ModePos".

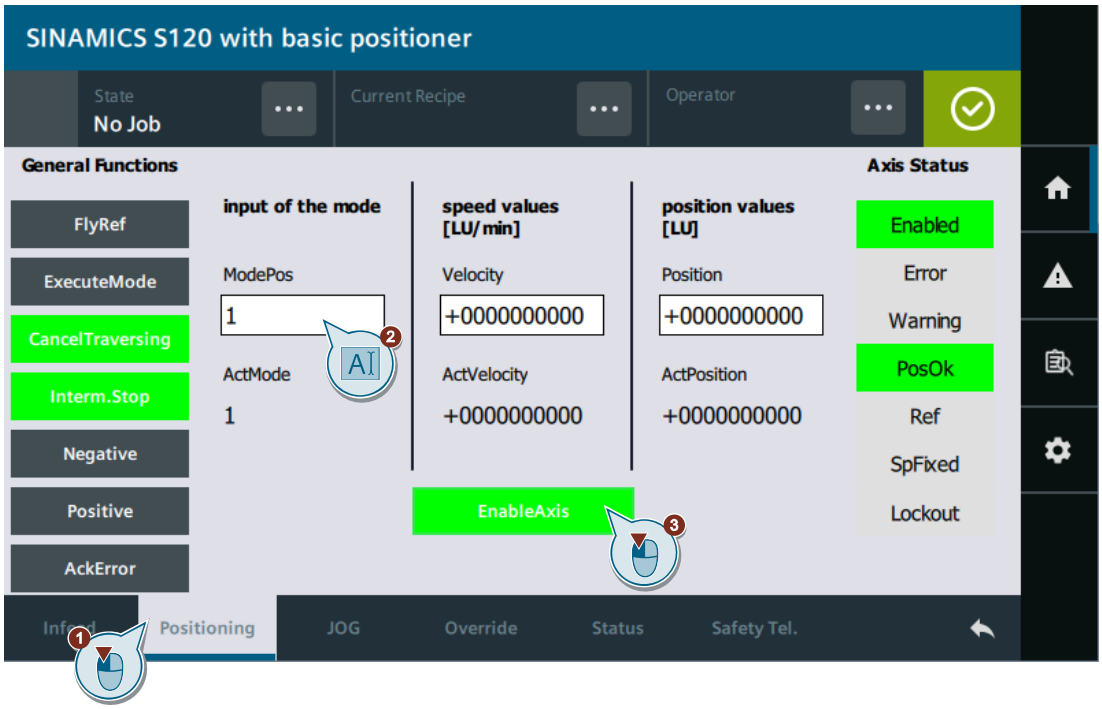
**SIMIT**

The operating mode "Relative positioning" enables position-controlled travel along traversal paths via the integrated position controller of the behavior model "EPOS_Tel111".

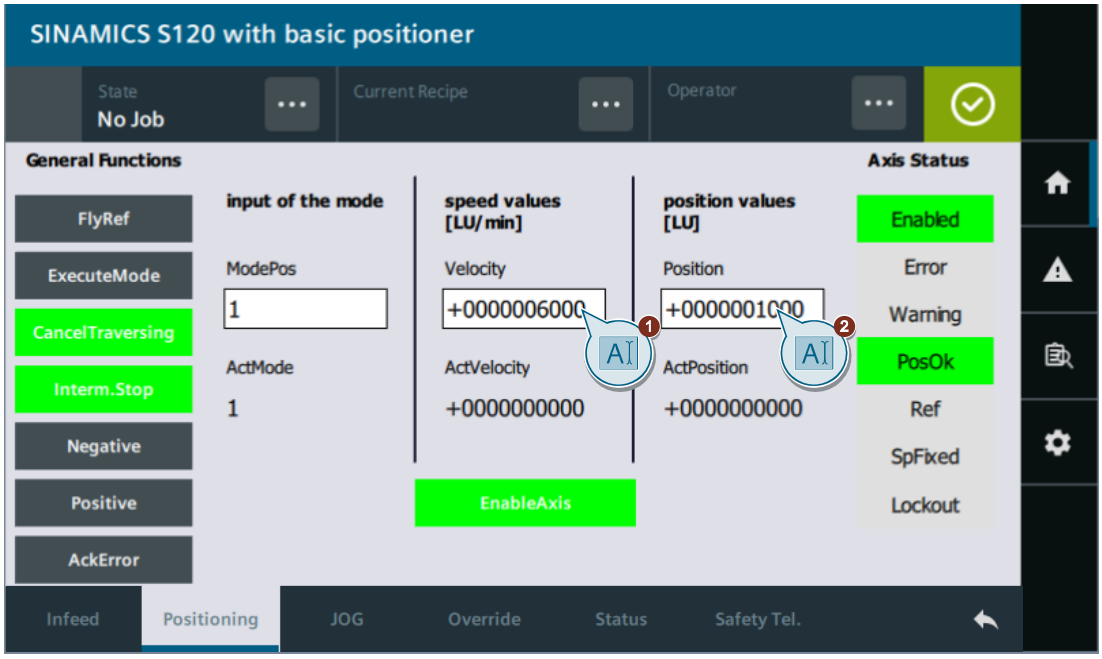
**Procedure**

Proceed as follows to set the function "Relative positioning":

1. Select the "Positioning" menu item (1).
2. Enter "1" for the "ModePos" field (2).
3. Switch on the device via "EnableAxis" (3).



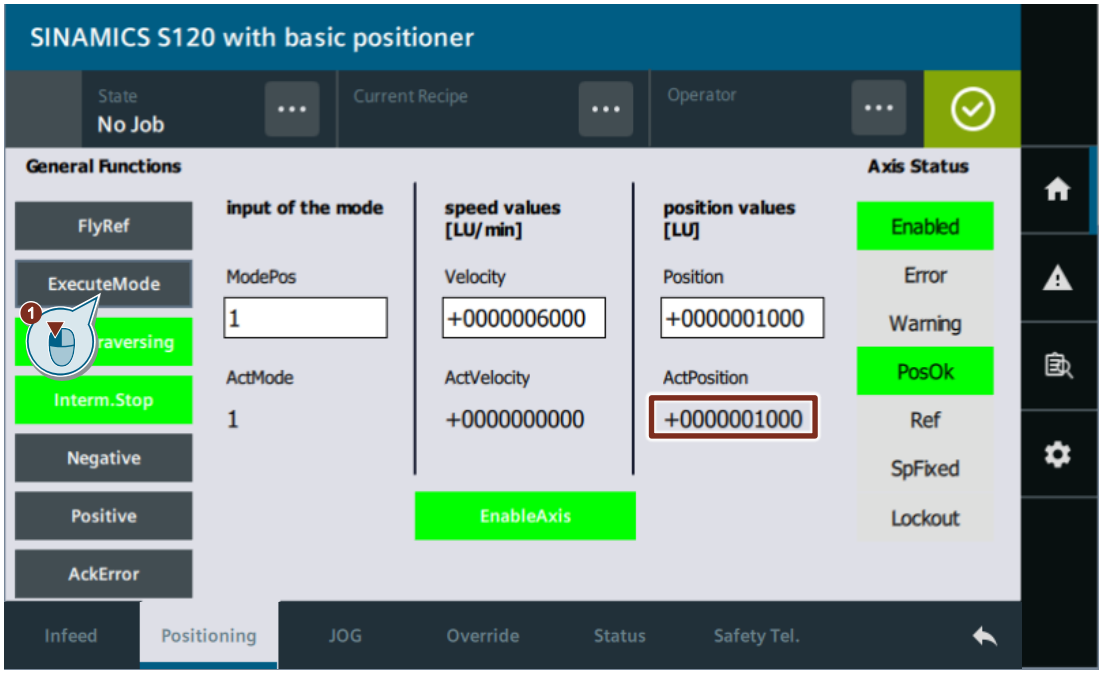
4. Enter the travel path using the following input fields:
   - Velocity = 6.000 LU/Min (1)
   - Position = 1.000 LU (2)



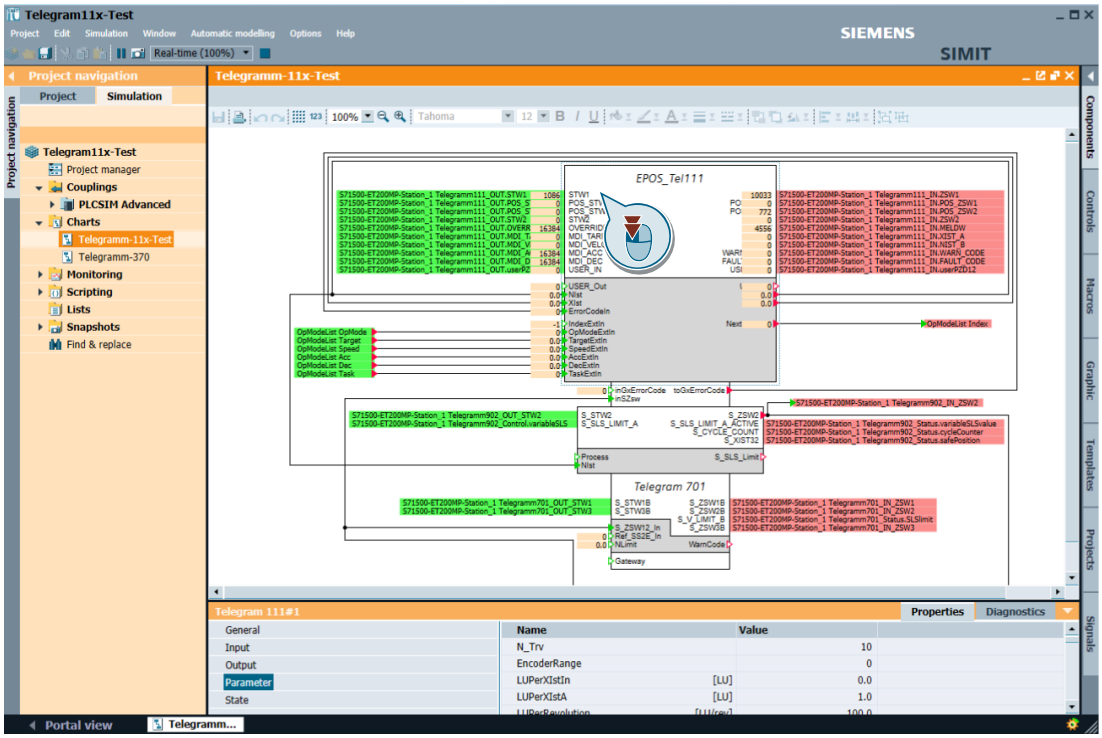

5. Select the menu item "Override" (1) to set the dynamics using the following input fields:
   - Speed override = 100% (2)
   - Acceleration override = 2% (3)
   - Delay override = 4% (4)

6. Click on "ExecuteMode" (1) to start running the relative movement you have programmed.

   "ActPosition" displays the current position. The "PosOk" display indicates that the final position has been reached and that the axis is stationary.

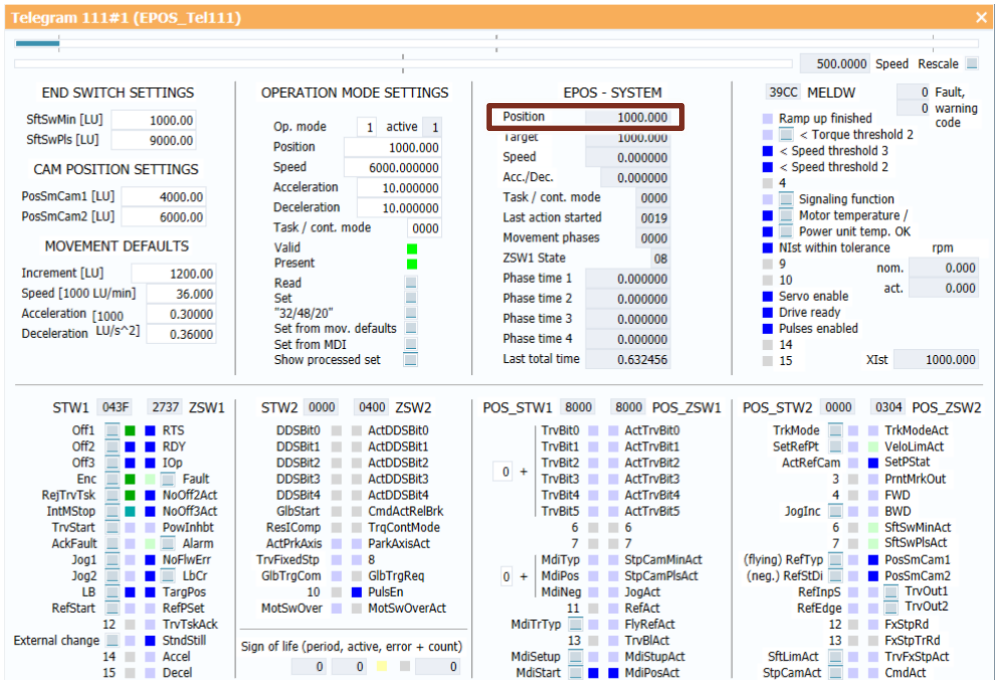



7. Open the operating window of the behavior model "EPOS_Tel111".



The behavior model "EPOS_Tel111" reaches internal position 1000.0 starting from position 0.0 and is displayed in the operating window.

Figure 2-9: Behavior model "EPOS_Tel111"



### 2.3.3.2 Absolute positioning

The absolute positioning operating mode is implemented with the drive function "MDI Positioning Absolute". It facilitates position-controlled approach of absolute positions via the integrated position control of the SINAMICS drive.

**Requirements**

- The operating mode is selected with "ModePos" = 2.
- The device is switched on with "EnableAxis".
- To execute an absolute movement, the axis must be homed (see chapter 2.5.3.6).
- The axis is at a standstill if a mode higher than 3 is selected. Switching between the MDI operating modes (1,2,3) is possible at any time.

**Sequence**

The specification of the traversal path and dynamics is accomplished with the inputs "Position", "Velocity", "OverV" (velocity override), "OverAcc" (acceleration override) and "OverDec" (deceleration override). The velocity override here pertains to "Velocity".

The operating conditions "CancelTraversing" and "IntermediateStop" must be set to "1". "Jog1" and "Jog2" have no effect and must be set to "0".

In absolute positioning, the direction of movement always depends on the shortest path to the target position. In this case, the inputs "Positive" and "Negative" are both "0".

Note: If a preferred direction for approaching the target position needs to be specified when using a modulo axis, this can be accomplished by selecting either "Positive" or "Negative". Selecting "Positive" and "Neg" at the same time will cause the axis to come to a standstill without any additional warnings or errors. With a linear axis, the selection has no effect and will be ignored.

A positive edge at "ExecuteMode" starts the traversal movement. With "EPosZSW1 / EPosZSW2" it is possible to track the current status of the running command (see the Appendix for details on the value assignment of the status words). The block acknowledges successfully reaching the end of the traversal path, "AxisPosOk". If an error occurs during the traversal movement, the output signal "Error" will be set.

Note: The running command can be replaced on the fly with a new command via "ExecuteMode". This is only possible for the operating modes 1,2,3 of "ModePos".

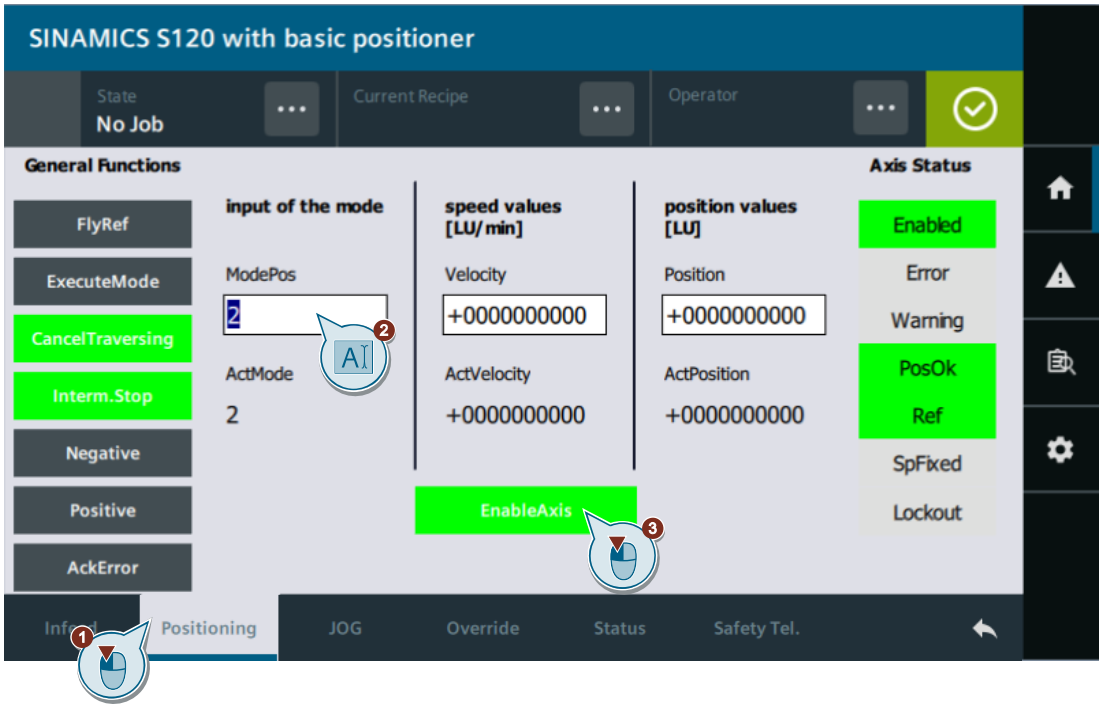
**SIMIT**

The operating mode "Absolute positioning" enables position-controlled approach of absolute positions via the integrated position controller of the behavior model "EPOS_Tel111".

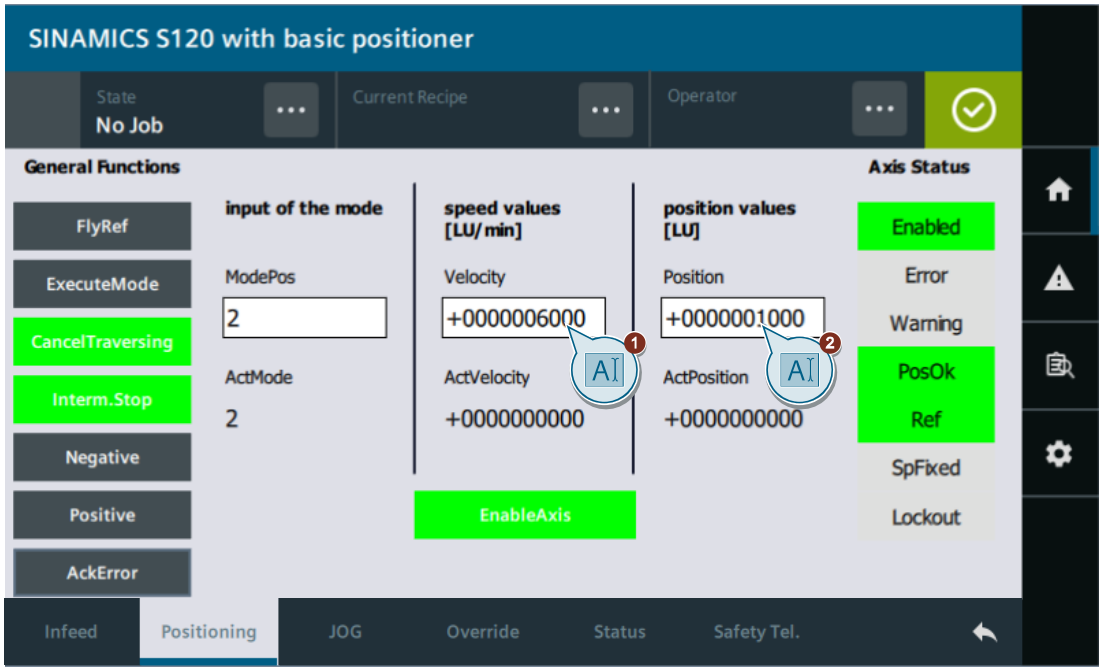
**Procedure**

To program the "Absolute positioning" function, proceed as follows:

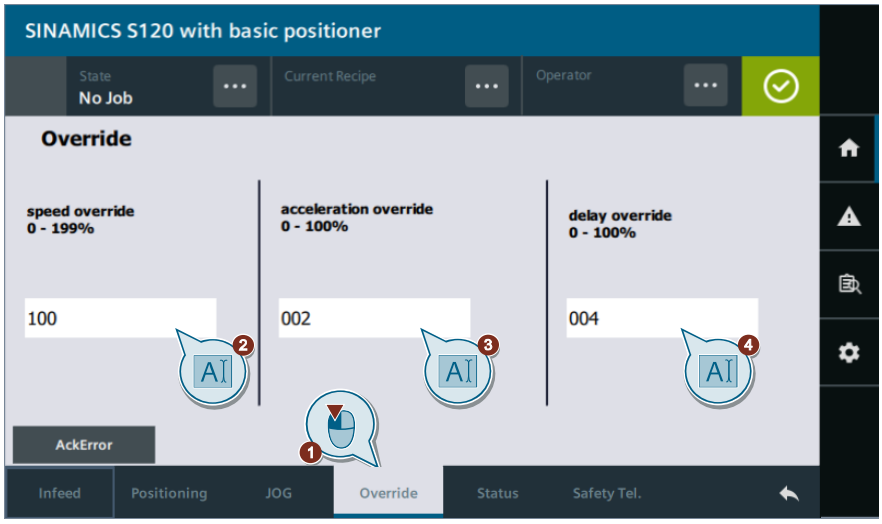
1. Select the "Positioning" menu item (1).
2. Enter the value "2" for the "ModePos" input field (2).
3. Switch on the device via "EnableAxis" (3).




4. Enter the travel path using the following input fields:
   - Velocity = 6.000 LU/Min (1)
   - Position = 1.000 LU (2)

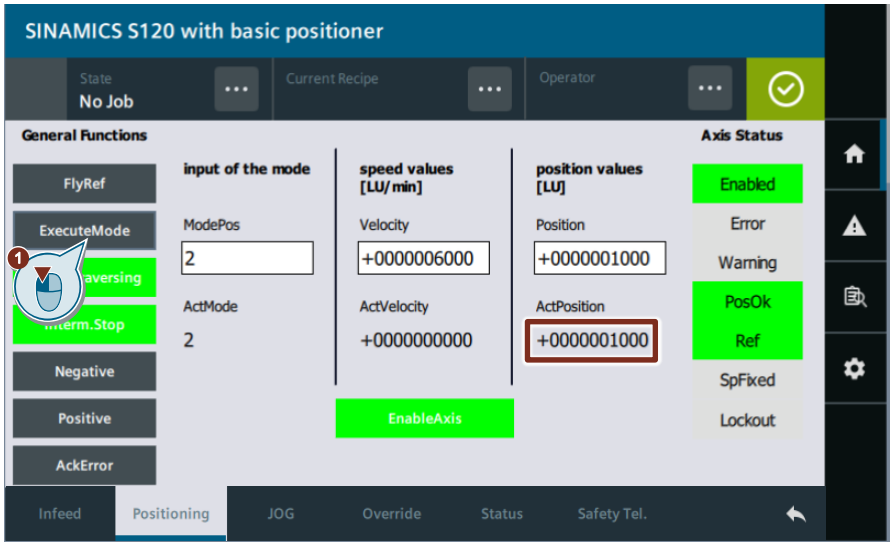


5. Select the menu item "Override" (1) to set the dynamics using the following input fields:
   - Speed override = 100% (2)
   - Acceleration override = 2% (3)
   - Delay override = 4% (4)

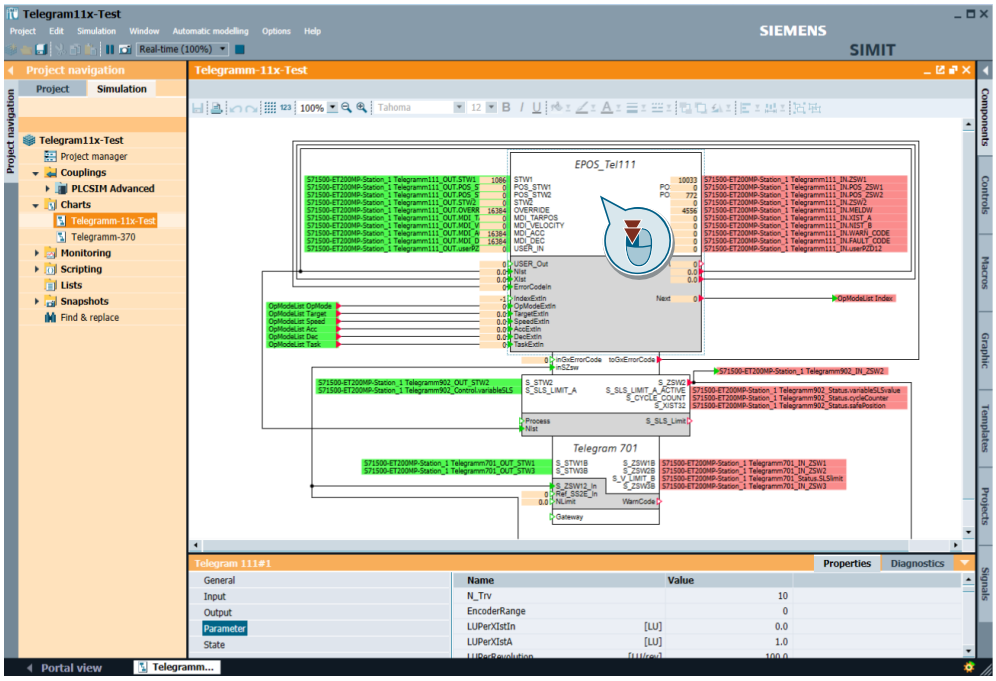



6. Click on "ExecuteMode" (1) to start running the relative movement you have programmed.

   "ActPosition" displays the current position. The "PosOk" display indicates that the final position has been reached and that the axis is stationary.

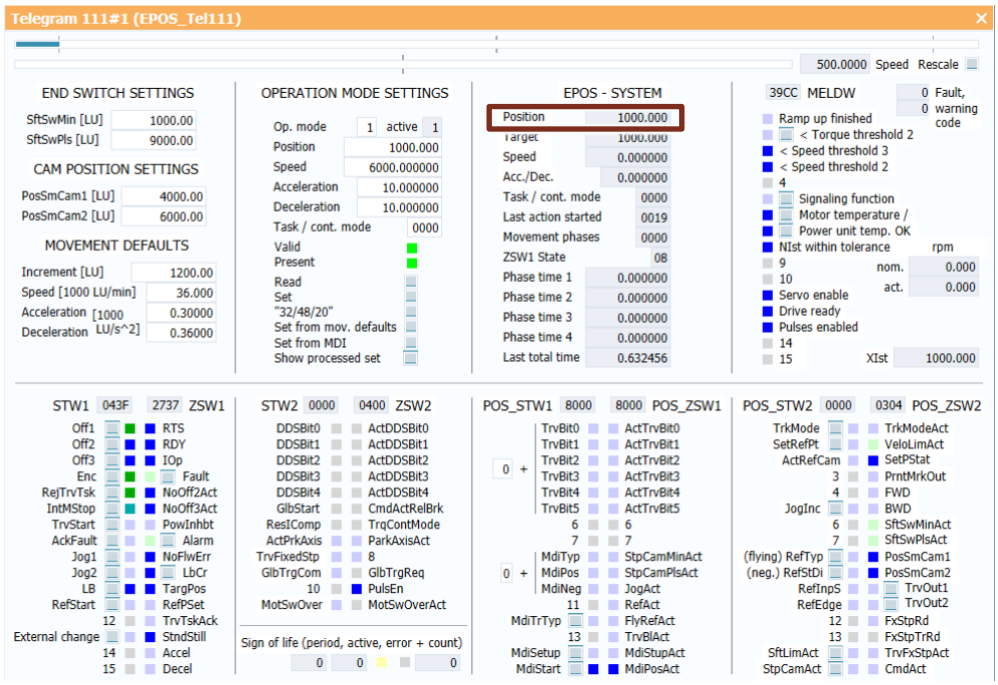


7. Open the operating window of the behavior model "EPOS_Tel111".




The behavior model "EPOS_Tel111" reaches internal position 1000.0 starting from position 0.0 and is displayed in the operating window.

Figure 2-10: Behavioral model "EPOS_Tel111"



### 2.3.3.3 Setup mode

The setup mode facilitates position-controlled traversal of the axis in a positive or negative direction of travel with constant velocity without specifying a target position via the drive function "MDI Setup".

**Requirements**

- The operating mode is selected with "ModePos" = 3.
- The device is switched on with "EnableAxis".
- The axis does not need to be homed, nor does the encoder need to be calibrated.
- The axis is at a standstill if a mode higher than 3 is selected. Switching between the MDI operating modes (1,2,3) is possible at any time.

**Sequence**

The specification of the traversal path and dynamics is accomplished with the inputs "Velocity", "OverV" (velocity override), "OverAcc" (acceleration override) and "OverDec" (deceleration override).

The operating conditions "CancelTraversing" and "IntermediateStop" must be set. "Jog1" and "Jog2" have no effect and must be set to "0".

The traversal direction is determined with "Positive" and "Negative". Selecting both at the same time puts the drive in standstill without any additional warnings or errors.

A positive edge at "ExecuteMode" starts the traversal movement. Using "EPosZSW1 / EPosZSW2", the current status of the running command can be tracked (for details on value assignment of the status words, refer to the documentation on telegram 111 on the article page \9\).

The output signal "AxisPosOk" is set when the setup mode is terminated due to a traversal command and the axis reaches a standstill. If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

The running command can be replaced on the fly with a new command via "ExecuteMode". This is only possible for the operating modes 1,2,3 of "ModePos".

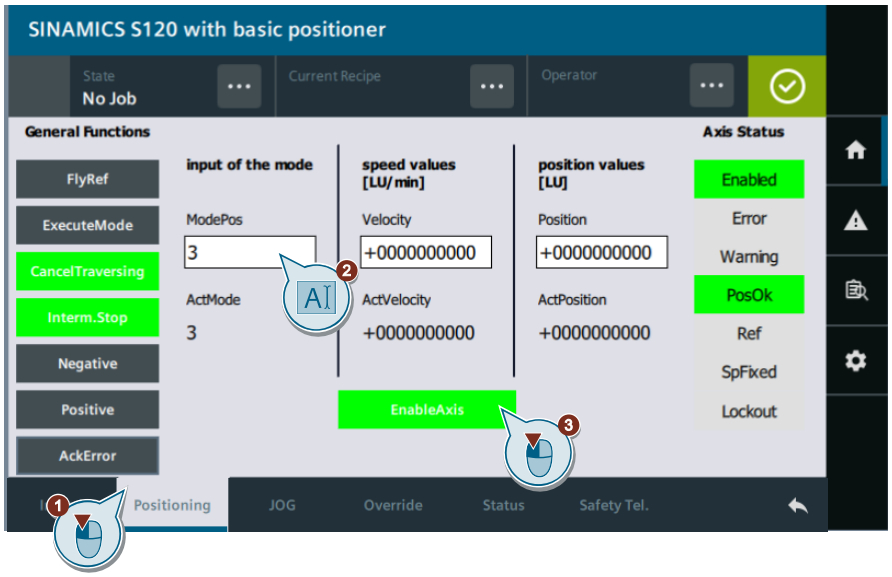
**SIMIT**

The operating mode "Setup mode" enables position-controlled movement of the axis in positive or negative direction at constant speed without specifying a target position.

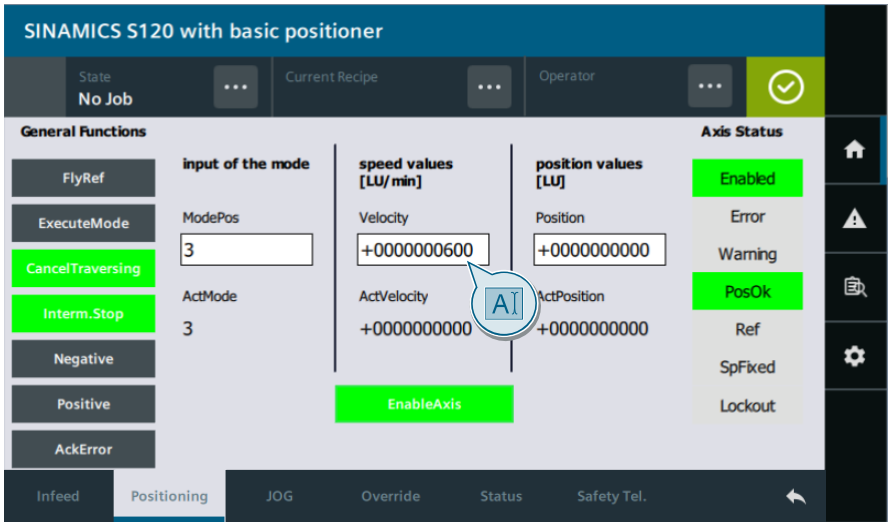
**Procedure**

Proceed as follows to program the "Setup mode" function:

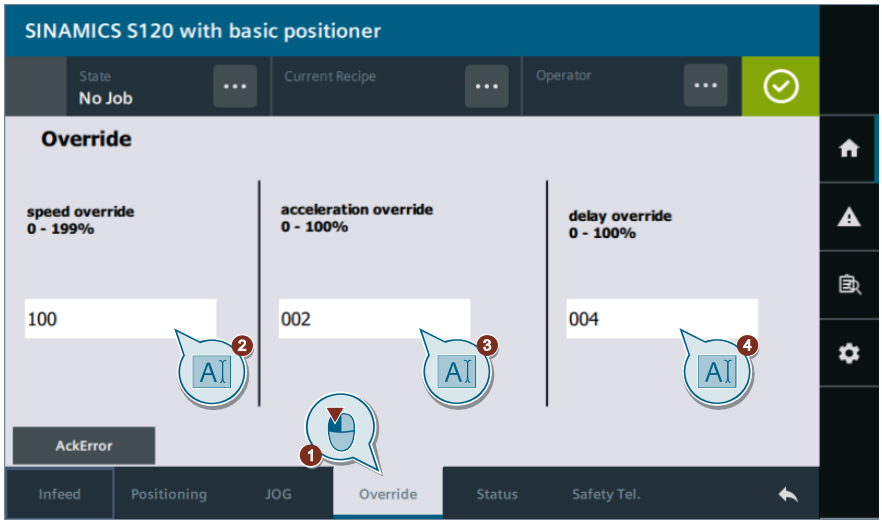
1. Select the "Positioning" menu item (1).
2. Enter the value "3" for the "ModePos" input field (2).
3. Switch on the device via "EnableAxis" (3).




4. Enter the speed with the following input:
   - Velocity = 600 LU/Min



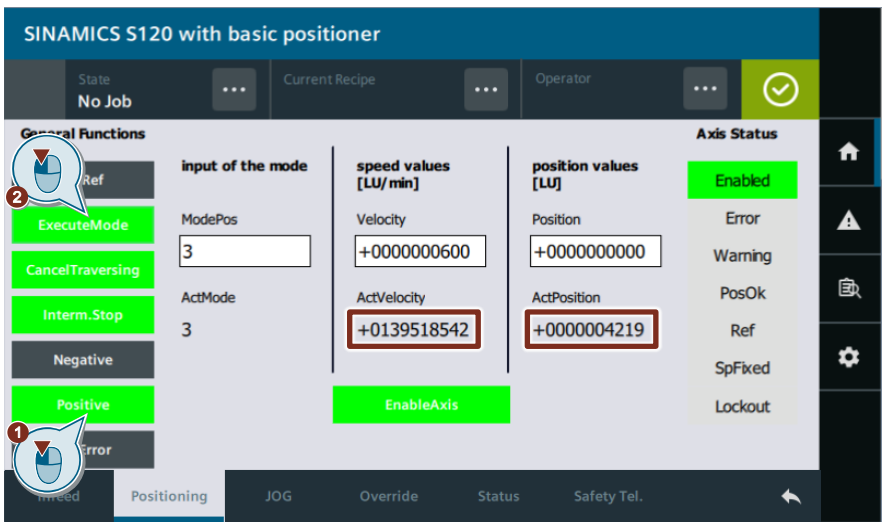
5. Select the menu item "Override" (1) to set the dynamics using the following input fields:
   - Speed override = 100% (2)
   - Acceleration override = 2% (3)
   - Delay override = 4% (4)




6. Click "Positive" (1) to select the positive direction.
7. Click on "ExecuteMode" (2) to start running the programmed movement in the positive direction.

   When "Positive" is deactivated and there is another edge at "ExecuteMode", the movement will be stopped with the programmed deceleration; the stop position will then be accepted as the target position.

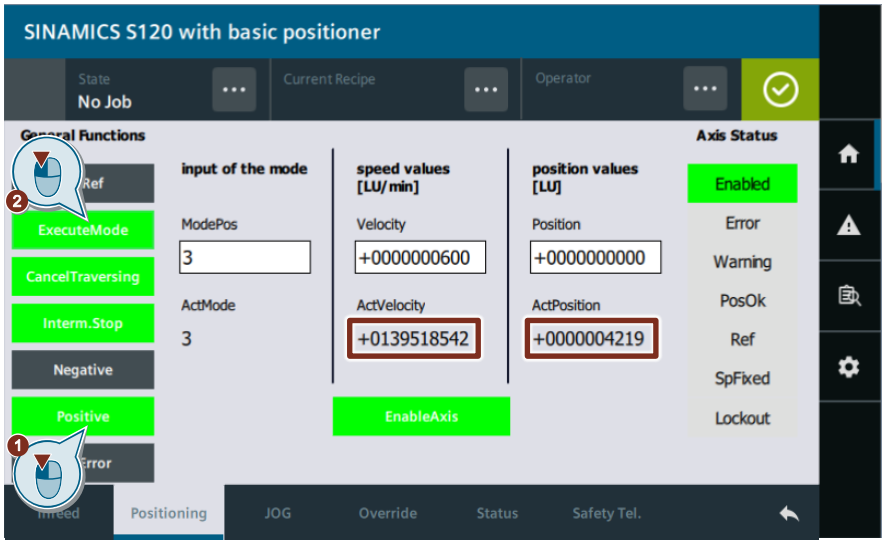
   The current position and velocity are displayed under "ActPosition" and "ActVelocity".



8. Click "Negative" (1) to select the negative direction.
9. Click on "ExecuteMode" (2) to start running the programmed movement in the positive direction.

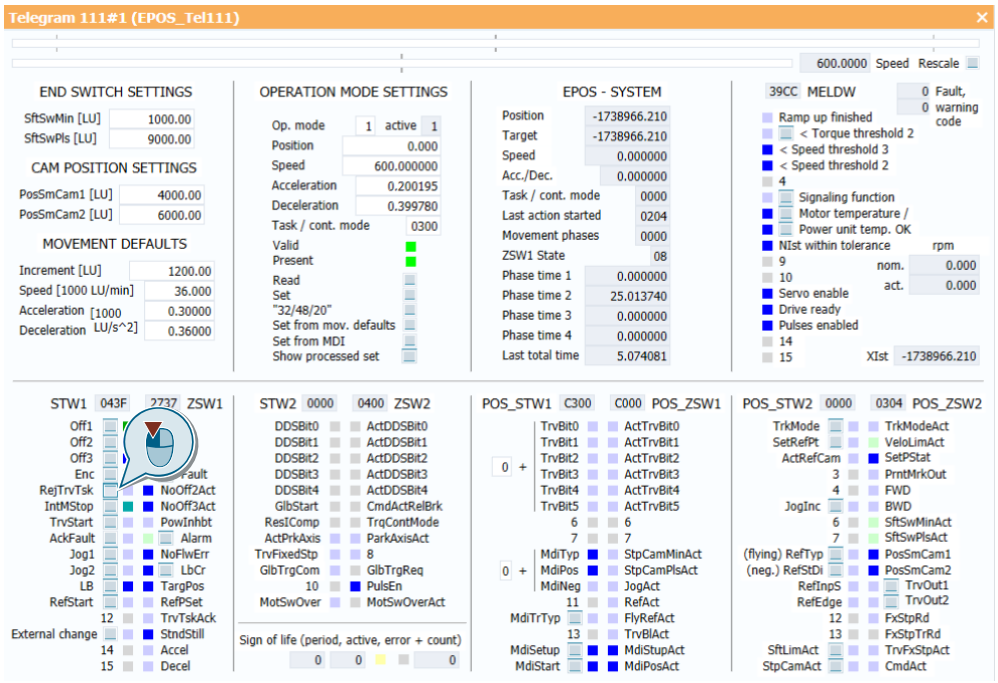
   When "Negative" is deactivated and there is another edge at "ExecuteMode", the movement will be stopped with the programmed deceleration; the stop position will then be accepted as the target position.

   The current position and velocity are displayed under "ActPosition" and "ActVelocity".




The setup mode can be canceled with the tag "RejTrvTsk". The axis will come to a standstill and the output signal "PosOk" will be set.

Figure 2-11: Behavioral model "EPOS_Tel111"



### 2.3.3.4 Homing - Homing movement

The homing/homing movement operating mode facilitates an axis homing movement in the positive or negative direction with a preconfigured velocity and homing mode; it is achieved via the "Active Homing" drive function.

**Requirements**

- The operating mode is selected with "ModePos" = 4.
- The device is switched on with "EnableAxis".
- The axis is at a standstill.

**Sequence**

The desired velocity is specified as a velocity profile and stored in the SINAMICS drive. Additionally, the preconfigured acceleration and deceleration values have an effect in the axis traversing profile. The velocity override "OverV" affects the preconfigured traversal velocity.

The operating conditions "CancelTraversing" and "IntermediateStop" must be set. "Jog1" and "Jog2" have no effect and must be set to "0".

The traversal direction is determined with "Positive" and "Negative". Selecting both at the same time is not permitted and will cause an error.

A positive edge at "ExecuteMode" will start the homing movement.

A positive edge at "ExecuteMode" starts the traversal movement. Using "EPosZSW1 / EPosZSW2", the current status of the running command can be tracked (for details on value assignment of the status words, refer to the documentation on telegram 111 on the article page \9\).

The output signal "AxisRef" is set when the referencing cam has been found and evaluated.

If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

For an exhaustive graphical depiction of the homing movement, refer to the Basic Positioner function manual \10\, or the current version of the SINAMICS S120 compact manual, \11\.

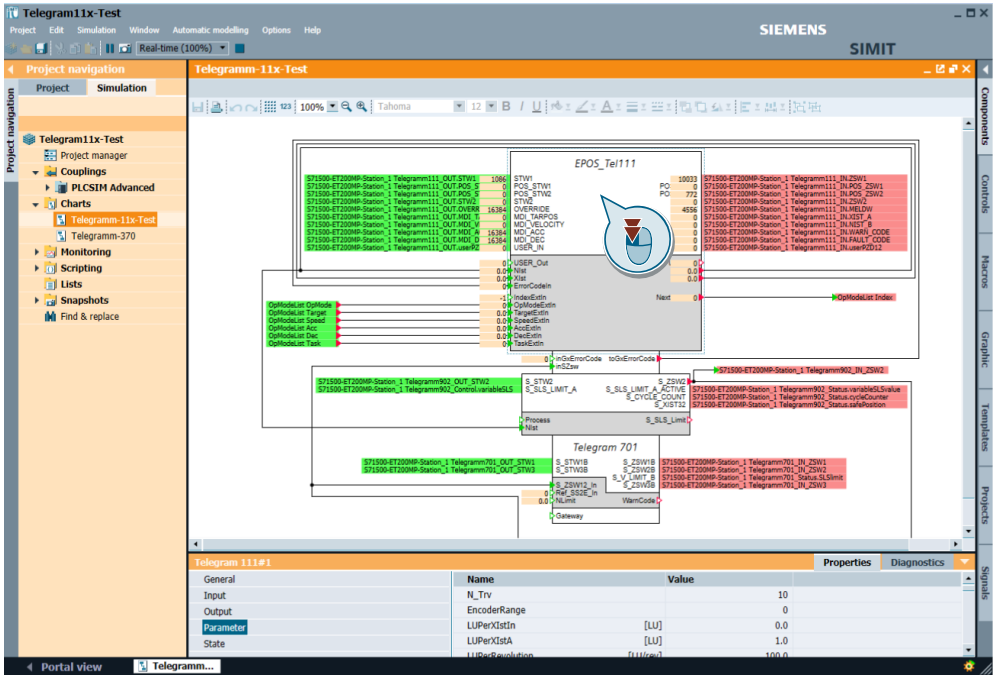
**SIMIT**

The operating mode "Homing - Homing movement" enables the axis to perform a homing movement in the positive or negative direction with a defined speed in homing mode.

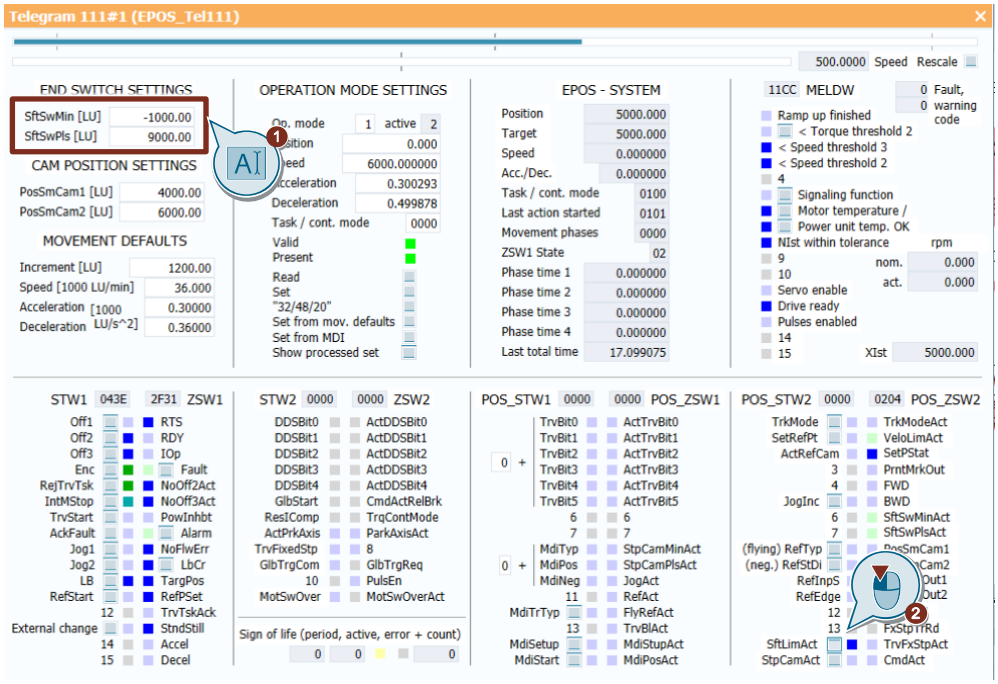
## Procedure

To execute the function "Homing - Homing movement", proceed as follows:

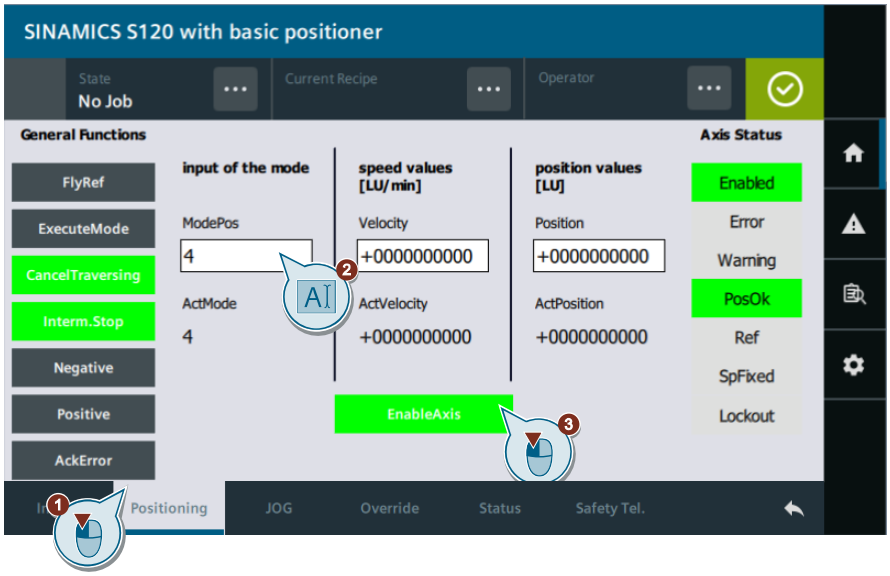
1. Open the operating window of the behavior model "EPOS_Tel111".



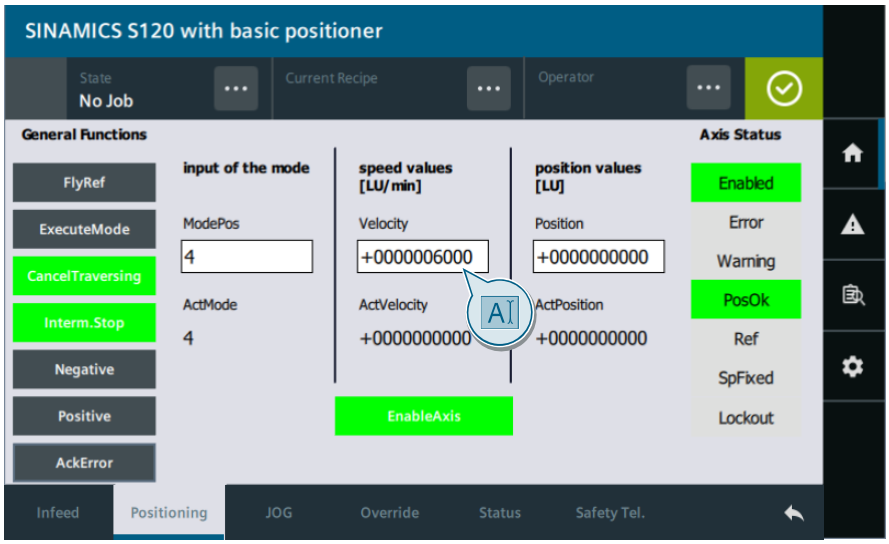

2. Enter the end switch positions in the "EPOS_Tel111":
   - "SftSwMin" = -1000.0 (1)
   - "SftSwPls" = 9000.0 (1)
3. Enter this with "SftLimAct" (2).



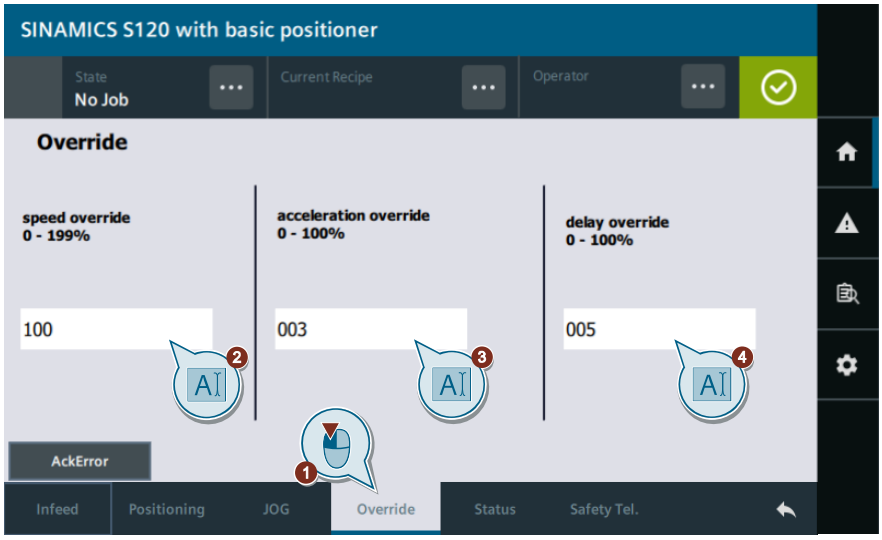
4. Select the "Positioning" menu item (1).
5. Enter "4" in the "ModePos" field (2).
6. Switch on the device via "EnableAxis" (3).




7. Enter the speed with the following input:
   - Velocity = 6.000 LU/Min.



8. Select the menu item "Override" (1) to set the dynamics using the following input fields:
   - Speed override = 100% (2)
   - Acceleration override = 3% (3)
   - Delay override = 5% (4)

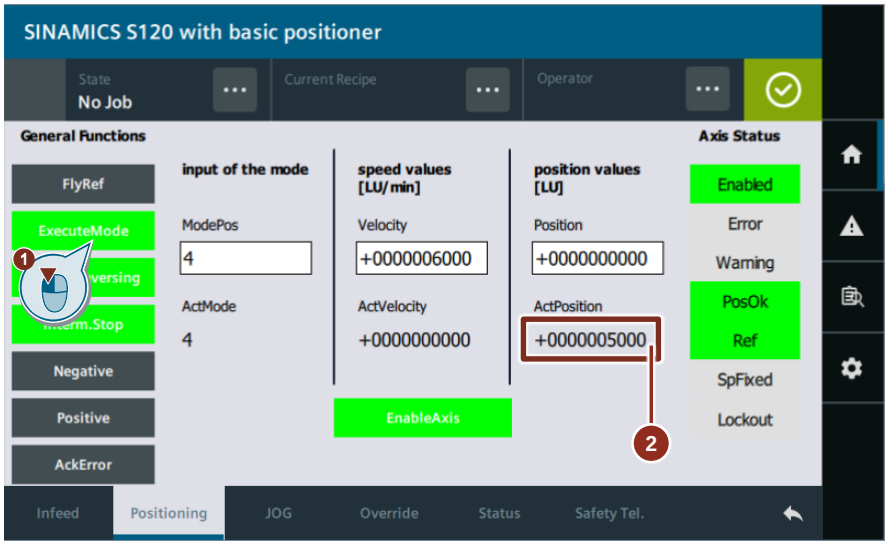



9. Click on "ExecuteMode" (1) to start running the homing movement.

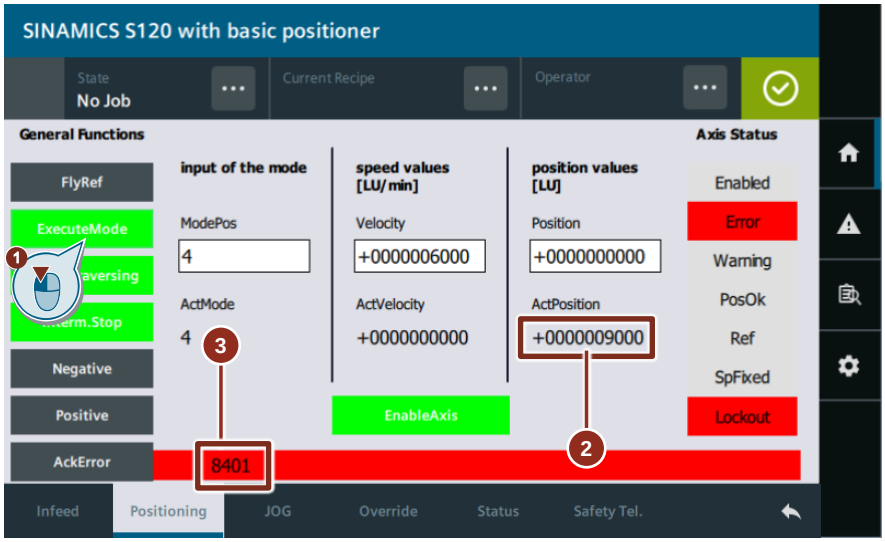
   "ActPosition" (2) displays the current position. The "PosOk" display indicates that the home position has been reached and that the axis is stationary. The "Ref" indicator shows that the axis has been homed (referenced).

   The home position can be set with the ReferencePosition parameter.

   In this example, the home position is 5.000.

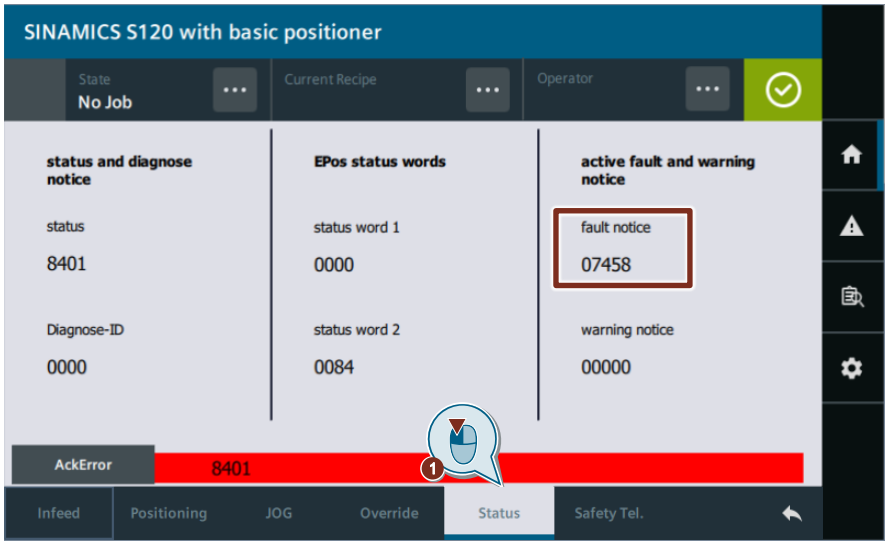


10. "ExecuteMode" (1) starts the execution of a second homing movement, which cancels the current homing movement.
11. The limit switch position of the upper limit switch "SftSWPls" (2) is adopted as the new target position.
12. When the target position of the upper limit switch "SftSWPls" has been reached, the error message "8401" (3) appears and the display shows "Error".



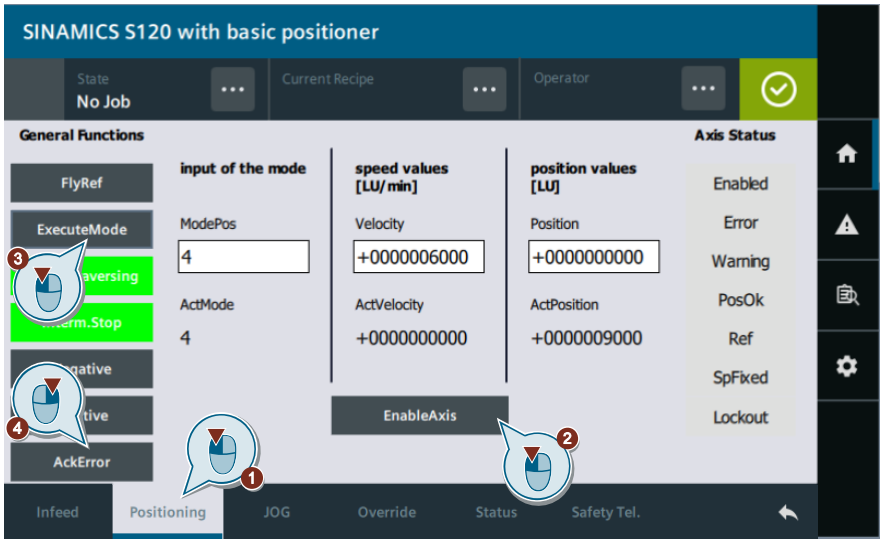

13. Select the "Status" menu (1).

    The error code "7458" is transmitted from the behavior model "EPOS_Tel111" and displayed when there is a "Fault notice".



To acknowledge the error, proceed as follows:

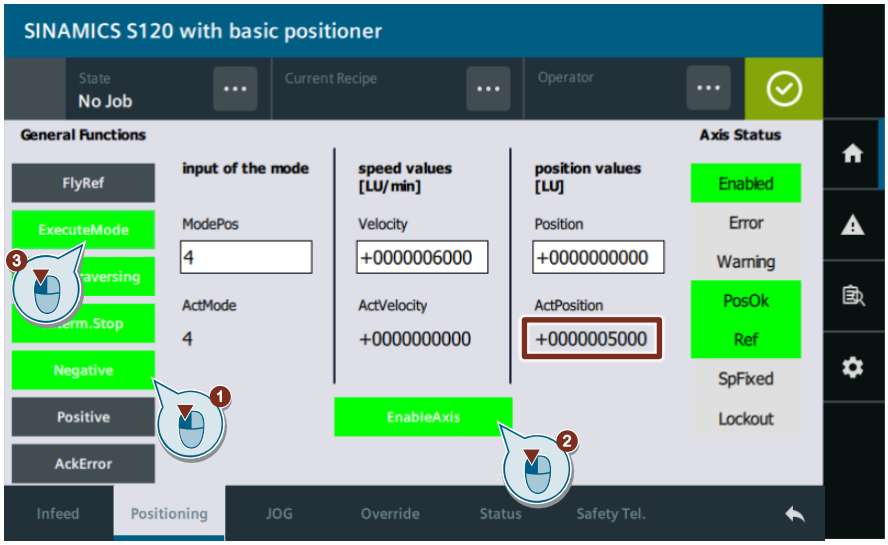
1. Select the "Positioning" menu item (1).
2. Disable the device via "EnableAxis" (2).
3. Disable "ExecuteMode" (3).
4. Acknowledge the fault via "AckError" (4).




Since the current position is above the home position, you must select "Negative" for another homing movement.

1. Use "Negative" (1) to select the negative travel direction.
2. Switch on the device via "EnableAxis" (2).
3. Start running a third homing movement with "ExecuteMode" (3).

   "ActPosition" displays the current position. The "PosOk" display indicates that the home position has been reached and that the axis is stationary. The "Ref" indicator shows that the axis has been homed (referenced).



### 2.3.3.5 Homing - Set home position

The operating mode "Homing - Set home position" facilitates homing of the axis to any position; it is carried out with the "Set home position" drive function.

**Requirements**

- The operating mode is selected with "ModePos" = 5.
- The axis can be in feedback control, however it must be at a standstill.

**Sequence**

Axis is at a standstill, while the home position is set with a positive edge at "ExecuteMode". If an error occurs while setting the home position, the "Error" output signal will be set.

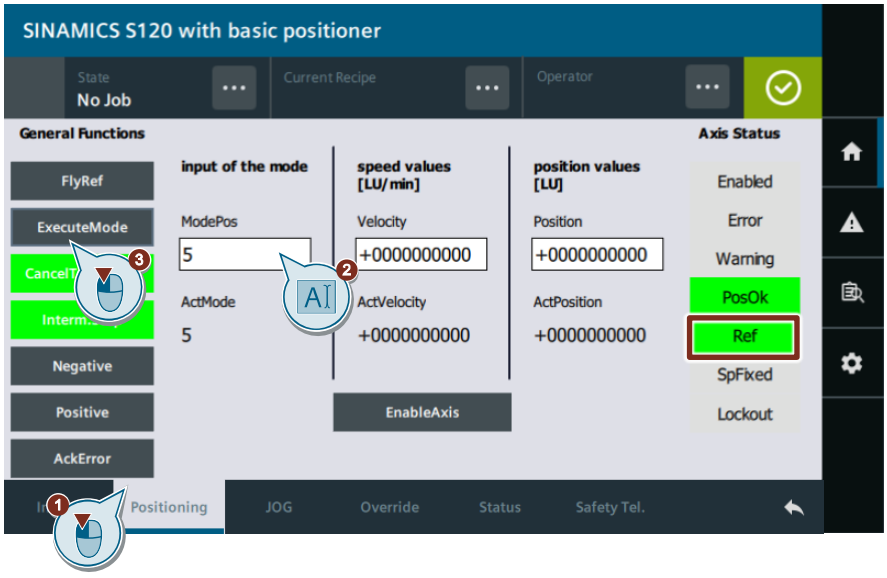
**SIMIT**

The operating mode "Homing - Set home position" allows the axis to be homed at any position.

**Procedure**

To run the "Homing - Set home position" function, proceed as follows:

1. Select the "Positioning" menu item (1).
2. Enter the value "5" in the "ModePos" field (2).
3. Home the axis to the current position, "ActPosition", with "ExecuteMode" (3).
   The "Ref" indicator shows that the axis has been homed (referenced).



### 2.3.3.6 Traversing blocks

The Traversing blocks operating mode is implemented with the "Traversing blocks" drive function. It facilitates the creation of automation programs, traversal to a fixed stop, as well as the setting and resetting of outputs.

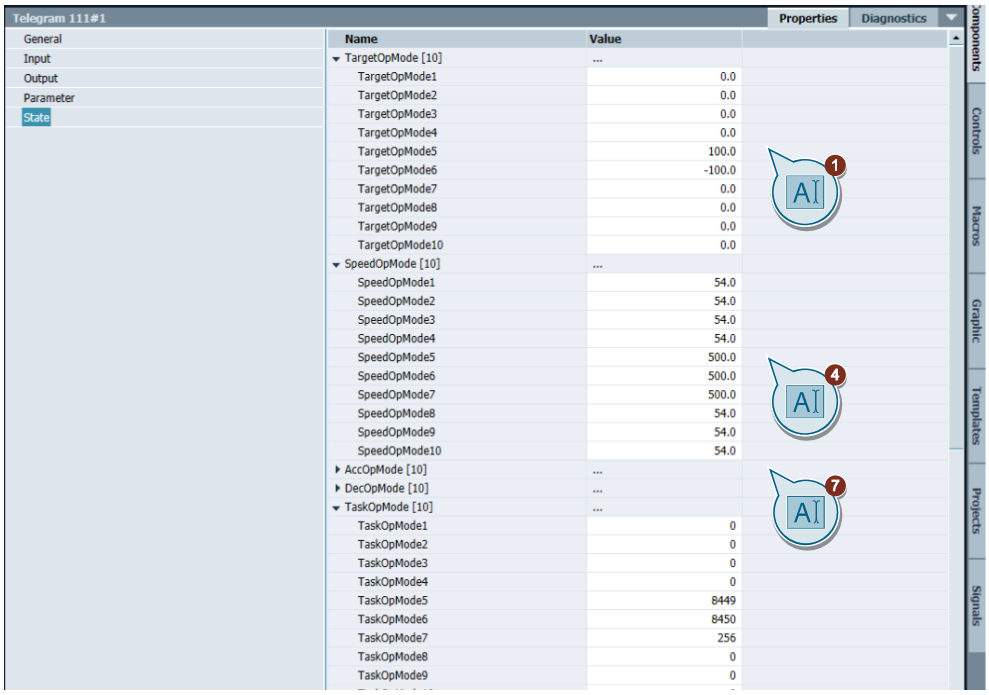
**Example parameter assignment of three traversing blocks in Simit**

This is one option for parameter assignment of traversing blocks (SIMIT is offline).

Assign parameters to the following values:

1. TargetOpMode5 = +100.0 (1)
2. TargetOpMode6 = -100.0
3. TargetOoMode7 = +00.0
4. SpeedOpMode5 = 500.0 (4)
5. SpeedOpMode6 = 500.0
6. SpeedOpMode7 = 500.0
7. AccOpMode5 = 1.0 (7)
8. AccOpMode6 = 1.0
9. AccOpMode7 = 1.0
10. DecOp Mode5 = 1.0
11. DecOp Mode6 = 1.0
12. DecOp Mode7 = 1.0
13. TaskOp Mode5 = 8449dez
14. TaskOp Mode6 = 8450dez
15. TaskOp Mode7 = 8449dez

Figure 2-12: Sample parameter assignment of traversing blocks in Simit



**Requirements**

- The operating mode is selected with "ModePos" = 6.
- The device is switched on with "EnableAxis".
- The axis is at a standstill.
- The axis must be homed and the encoder must be calibrated.

**Sequence**

The execution modes, target positions and dynamics are specified with the traversing block parameters in the SINAMICS drive. Here, the velocity override "OverV" pertains to the setpoint velocity stored in the traversing block. The operating conditions "CancelTraversing" and "IntermediateStop" must be set to "1". "Jog1" and "Jog2" have no effect and should be set to "0".

The direction of movement depends on the execution mode and the programmed position setpoint. The inputs "Positive" and "Negative" are not relevant in this case and should be set to "0".

Note

The selection of the traverse command is programmed via the "Position" input. The value must be a value between 0 and 63 (S120). If the value is not in this range, a warning will be output at the block.

Note

If a preferred direction for approaching the target position needs to be specified when using a modulo axis, this can be programmed by selecting "AbsPos" or "AbsNeg" as the execution mode.

A positive edge at "ExecuteMode" starts the traversal movement. Using "EPosZSW1 / EPosZSW2", the current status of the running command can be tracked (for details on value assignment of the status words, refer to the documentation on telegram 111 on the article page \9\).

The block shows the command is being processed with "AxisEnabled" and acknowledges successfully reaching the target position or the termination of the last execution step with "AxisPosOk".

If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

The running command can be replaced on the fly with a new command via "ExecuteMode". This is only possible for the operating modes 1,2,3 of "ModePos".

**SIMIT**

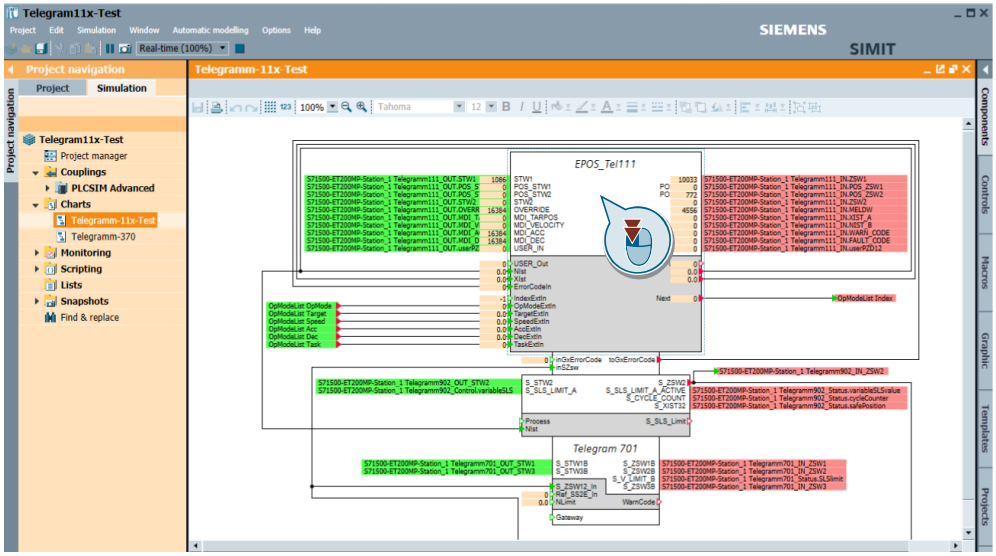
The operating mode "Traversing blocks" facilitates traversal according to saved settings.

**Procedure**

To execute the "Traversing blocks" function, proceed as follows:

1. Select the "Positioning" menu item (1).
2. Enter the value "6" in the "ModePos" field (2).
3. Switch on the device via "EnableAxis" (3).

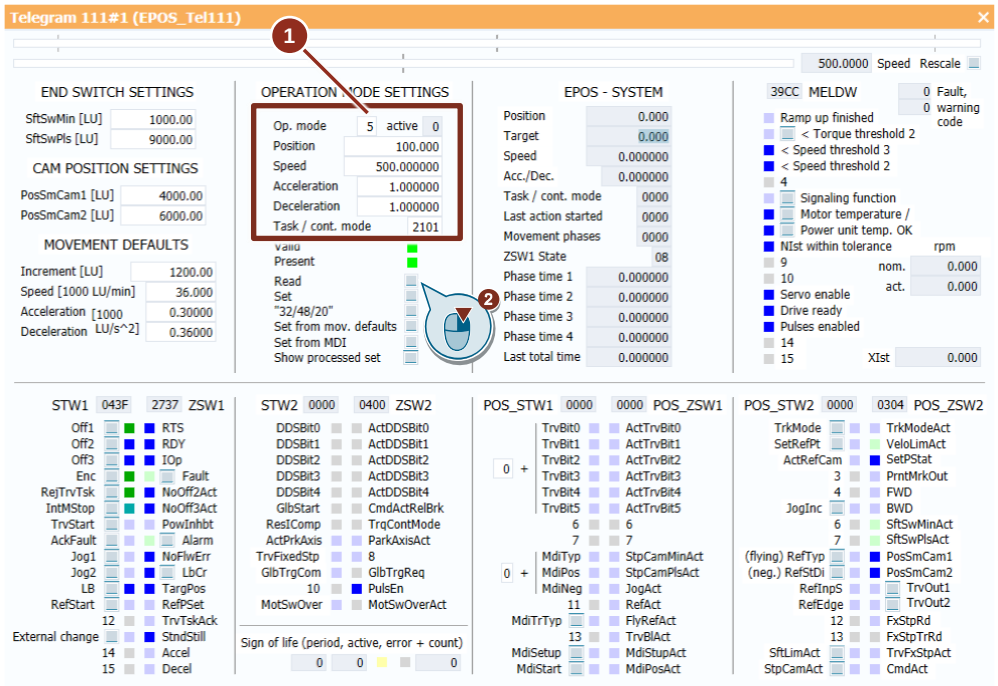

4. Open the operating window of the behavior model "EPOS_Tel111".



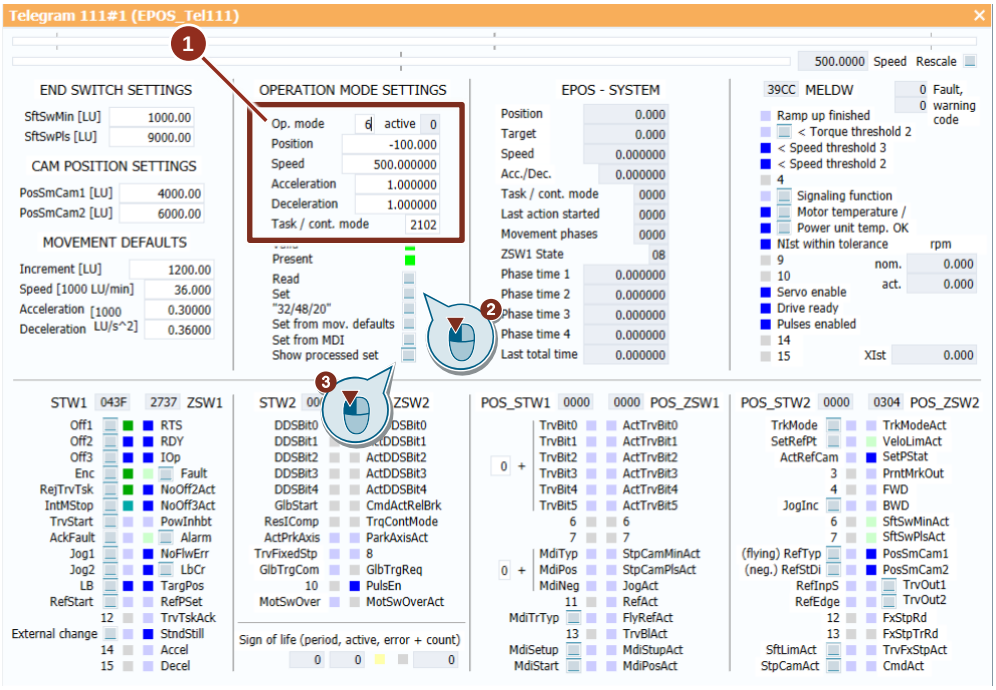
5. Set "Op. mode" (1) = 5.
6. Set the "Read" button (2) to read the traversing block "0".

   The first traversing block that was parameterized will be displayed in the operating window of the behavior model "EPOS_Tel111" with the following values:

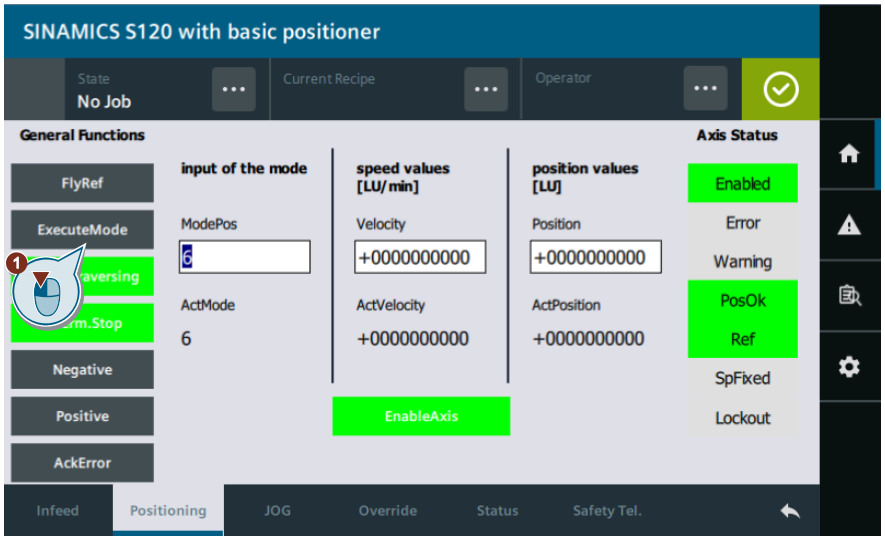
   - Op. mode = 5
   - Position = 100.0
   - Speed = 500.0
   - Acceleration = 1.0
   - Deceleration = 1.0
   - TaskOpMode = 2101



7. To create the second traversing block, parameterize the following values in the operating window of the behavior model "EPOS_Tel111" (1):
   - Op. mode = 6
   - Position = -100.0
   - Speed = 500.0
   - Acceleration = 1.0
   - Deceleration = 1.0
   - TaskOpMode = 2102
8. Set the button "Set" (2) to save the traversing block "1".
9. Set the button "Show processed set" (3) to display the traversing block "1".

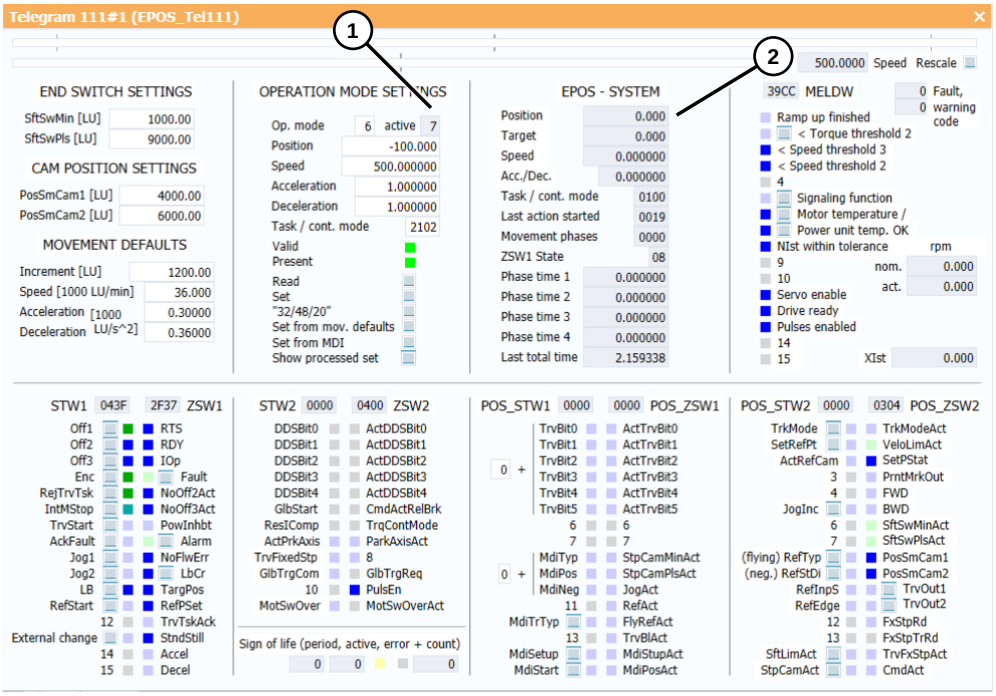



10. Click "ExecuteMode" (1) to start running the traversing blocks.



11. The traversing block "0" = 5 is active, the traversing block "1" = 6 is active, and the traversing block "2" = 7 will be traversed. (1)
12. The stored value of the "Position" parameter from traversing block "2" is displayed as the target position. (2)

    Due to the programmed TaskOpMode on traversing block 0, the system switches to traversing block 1 while in operation, and from there to traversing block 2 again while in operation, where this block is terminated with a stop at pos. 0.



### 2.3.3.7 Jog

The Jog operating mode is implemented with the "Jog" drive function. This operating mode facilitates position-controlled, velocity-dependent traversal of axes via the integrated position control of the SINAMICS drive.

**Requirements**

- The operating mode is selected with "ModePos" = 7.
- The device is switched on with "EnableAxis".
- The axis is at a standstill.
- The axis does not need to be homed, nor does the encoder need to be calibrated.

**Sequence**

The jog velocity is specified via the STARTER/Startdrive screen or the acyclic communication for configuring the mode in the SINAMICS drive. For the axis dynamics, the SINAMICS drive uses the acceleration and deceleration programmed in the SINAMICS drive.

The velocity override is also active in this operating mode and is set via "OverV".

The operating conditions "CancelTraversing" and "IntermediateStop" are not relevant for this operating mode and can be set to "1" by default.

Note

"Jog1" and "Jog2" are the signal sources for jog mode in the Epos. The direction of the traversal movement of each of the signal sources is configured in the SINAMICS drive and, by default, is set to Jog1 = negative and Jog2 = positive.

In jog mode, the direction of travel depends on the programmed velocity setpoint.

The inputs "Positive" and "Negative" are not relevant for this operating mode and can be set to "0" by default.

Using "EPosZSW1 / EPosZSW2", the current status of the running command can be tracked (for details on value assignment of the status words, refer to the documentation on telegram 111 on the article page \9\). The block shows the command running with "AxisEnabled" and acknowledges the termination of the jog function ("Jog1" or "Jog2" = 0) when the axis is at a standstill with "AxisPosOk". If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

The running command can be replaced on the fly by a new command via "Jog1" or "Jog2"
. This is only possible while remaining in one of the two jog operating modes.

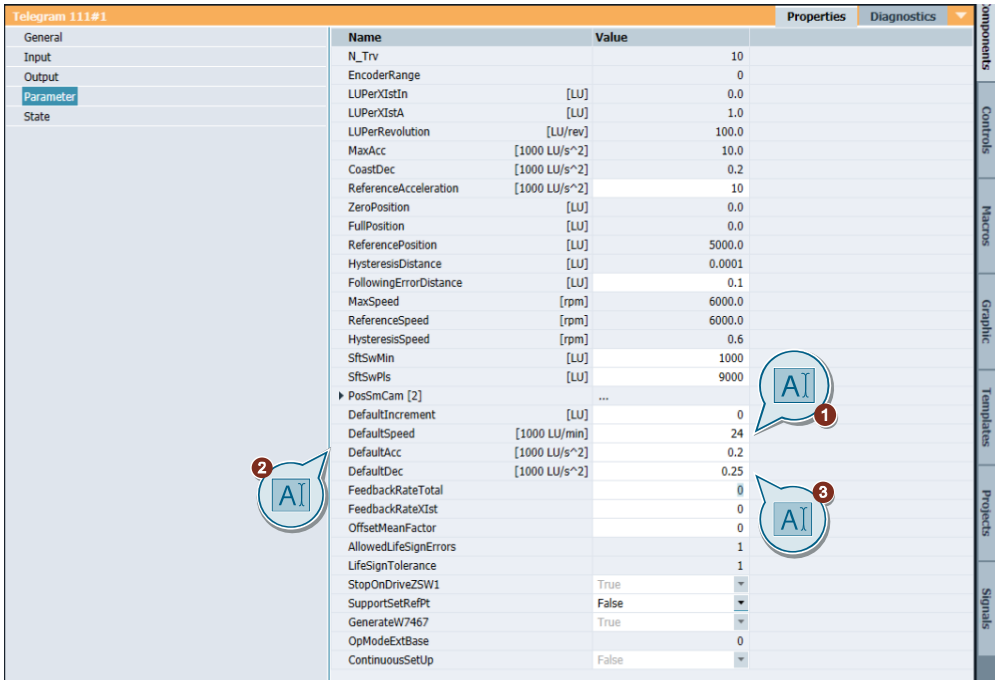
**SIMIT**

The "Jog" operating mode enables position-controlled, speed-dependent movement of axes via the integrated position controller of the "EPOS_Tel111" behavior model.

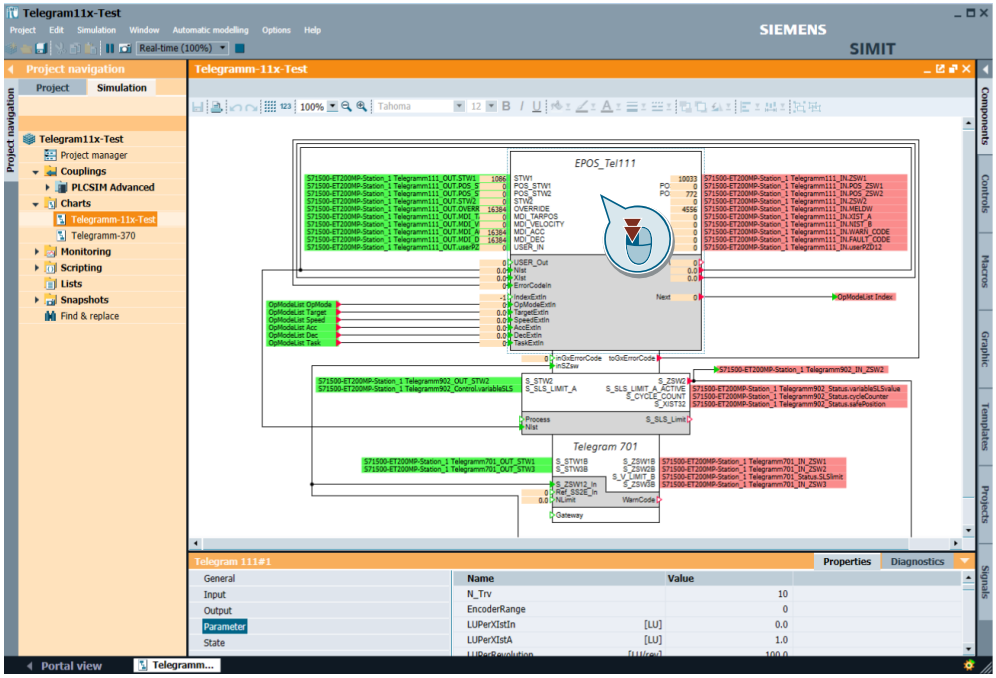
## Procedure

To execute the "Jog" function, proceed as follows:

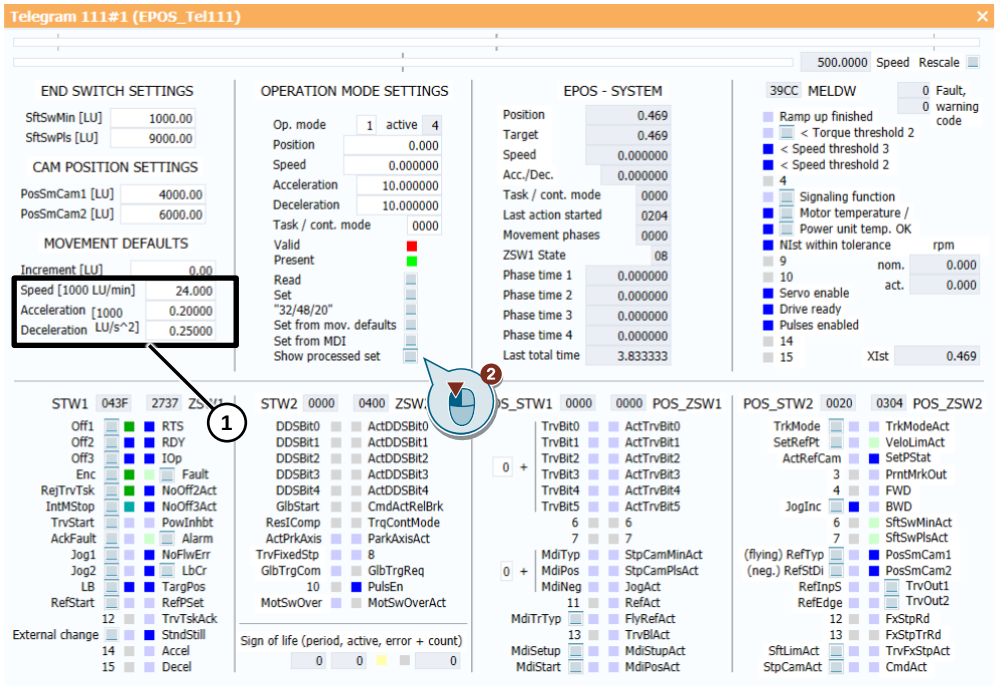
1. Assign parameters to the following values (SIMIT is offline):
   - DefaultSpeed = 24.0 (1)
   - DefaultAcc = 0.2 (2)
   - DefaultDec = 0.25 (3)
2. Restart the SIMIT simulation (see chapter 2.3.1).



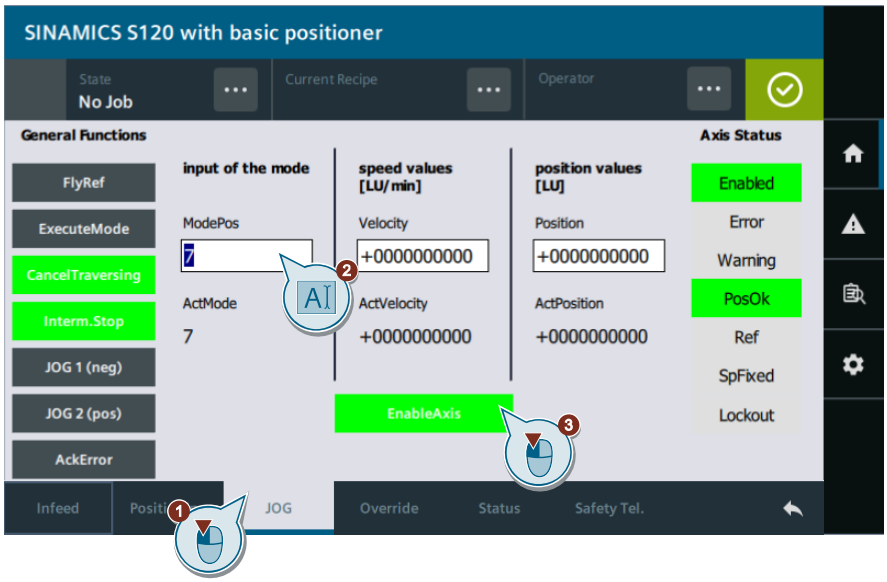

3. Open the operating window of the behavior model "EPOS_Tel111".



4. The parameterization on the behavior model "EPOS_Tel111" from Step 1 is displayed in the operating window (1).
5. Set the switch "Show processed set" (2) in the operating window.



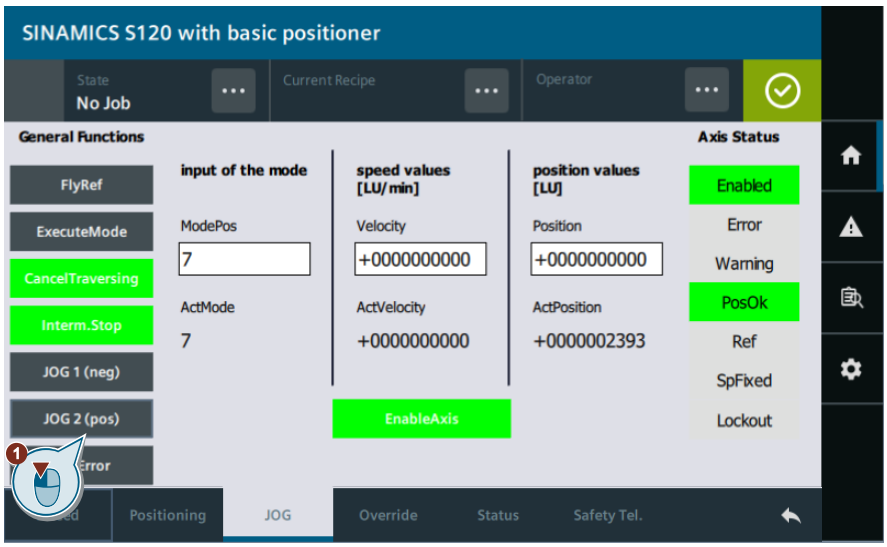

6. Select the "Jog" menu item (1).
7. Enter the value "7" in the "ModePos" field (2).
8. Switch on the device via "EnableAxis" (3).



9. "JOG 2" (1) starts the movement in the positive direction.

   The velocity value thus becomes positive.

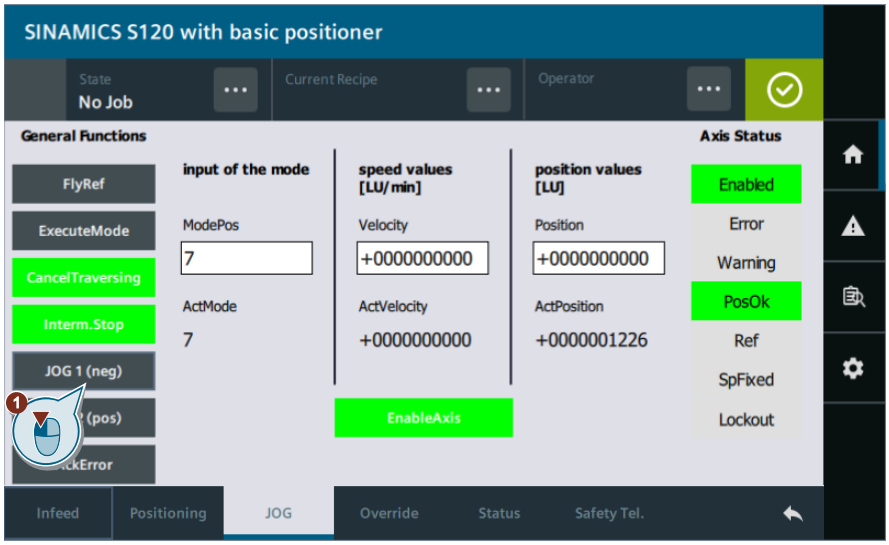
   When "JOG 2" is deactivated, the movement is stopped with the set deceleration and the stop position is adopted as the target position.



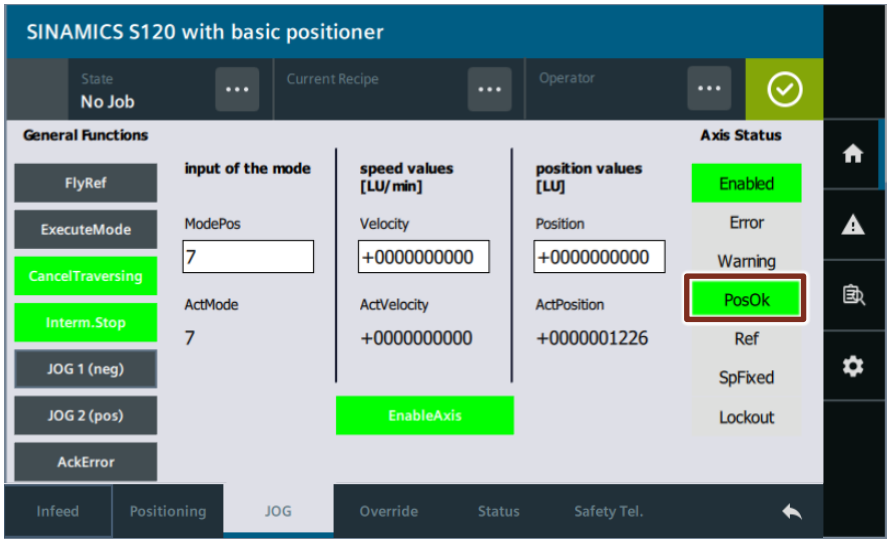

10. "JOG 1" (1) starts the movement in the negative direction.

    The velocity value thus becomes negative.

    When "JOG 1" is deactivated, the movement is stopped with the set deceleration and the stop position is adopted as the target position.



11. The "PosOk" display indicates that the axis is stationary and that the jog function has ended.




### 2.3.3.8 Jog incremental

The Jog incremental operating mode is implemented via the "Jog" drive function. It enables position-controlled, distance-dependent movement of axes via the integrated position control of the SINAMICS drive.

**Requirements**

- The operating mode has been selected with "ModePos" = 8.
- The device is switched on with "EnableAxis".
- The axis is at a standstill.
- The axis does not need to be homed, nor does the encoder need to be calibrated.

**Sequence**

The path and velocity are specified via the STARTER/Startdrive screen or acyclic communication for configuring the operating mode in the SINAMICS drive. For the axis dynamics, the SINAMICS drive uses the configuration for acceleration and deceleration in the SINAMICS drive.

The velocity override is also active in this operating mode and is set via "OverV". The operating conditions "CancelTraversing" and "IntermediateStop" are not relevant for this operating mode and can be set to "1" by default.

Note

"Jog1" and "Jog2" are the signal sources for jog mode in the Epos. The direction of the incremental traversal movement of each signal source is configured in the SINAMICS drive and, for incremental jogging, is set to 1000LU (length units) in each case.

In jog mode, the direction of movement depends on the programmed path setpoint.

The inputs "Positive" and "Negative" are not relevant for this operating mode and can be set to "0" by default.

With "EPosZSW1 / EPosZSW2" it is possible to track the current status of the running command (see the Appendix for details on the value assignment of the status words). The block shows the command running with "AxisEnabled" and acknowledges the termination of the jog function ("Jog1" or "Jog2" = 0) when the axis is stationary with the bit "AxisPosOk". If an error occurs during the traversal movement, the output signal "Error" will be set.

Note

The running command can be replaced on the fly by a new command via "Jog1" or "Jog2". This is only possible while remaining in one of the two jog operating modes.

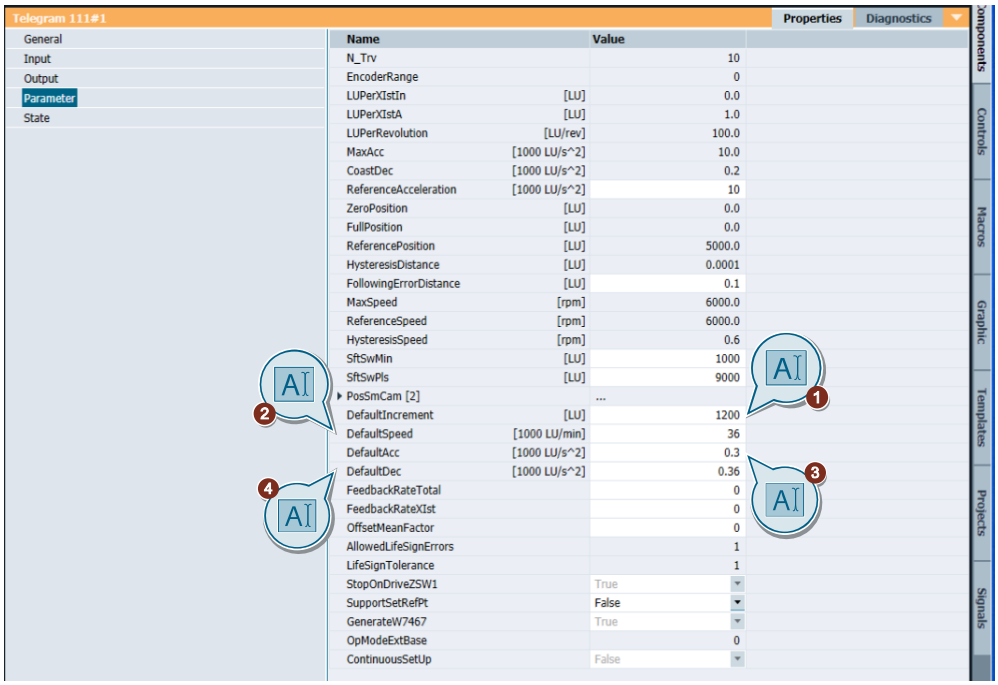
**SIMIT**

The operating mode "Jog incremental" enables position-controlled, distance-dependent movement of axes via the integrated position control of the behavior model "EPOS_Tel111".

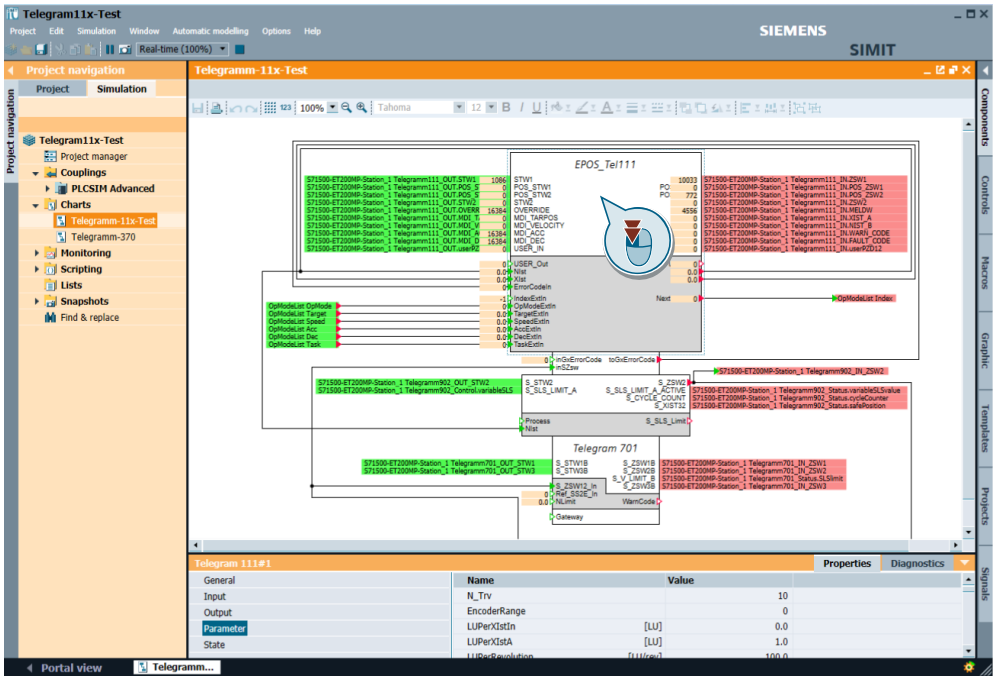
**Procedure**

Proceed as follows to execute the "Jog incremental" function:

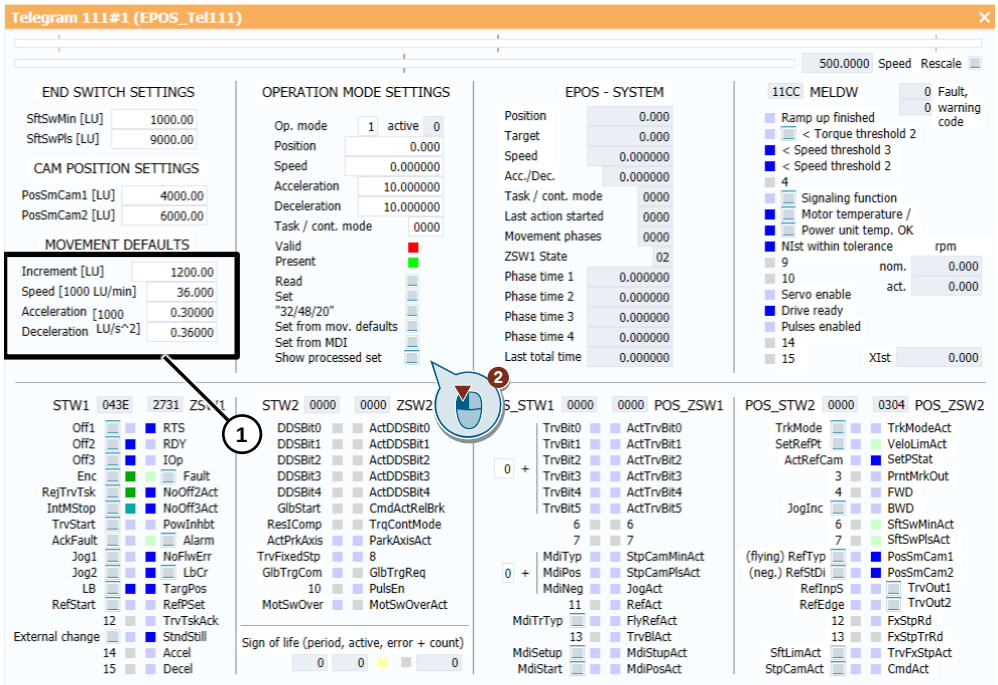
1. Assign parameters to the following values (SIMIT is offline):
   - DefaultIncrement = 1200.0 (1)
   - DefaultSpeed = 36.0 (2)
   - DefaultAcc = 0.3 (3)
   - DefaultDec = 0.36 (4)
2. Restart the SIMIT simulation (see chapter 2.3.1).



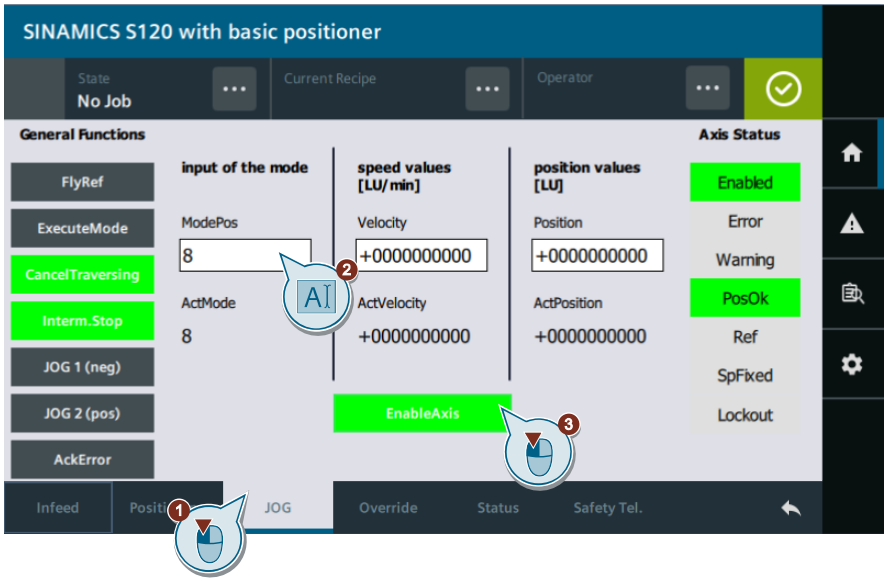
3. Open the operating window of the behavior model "EPOS_Tel111".




4. The parameterization on the behavior model "EPOS_Tel111" from Step 1 is displayed in the operating window (1).
5. Set the switch "Show processed set" (2) in the operating window.



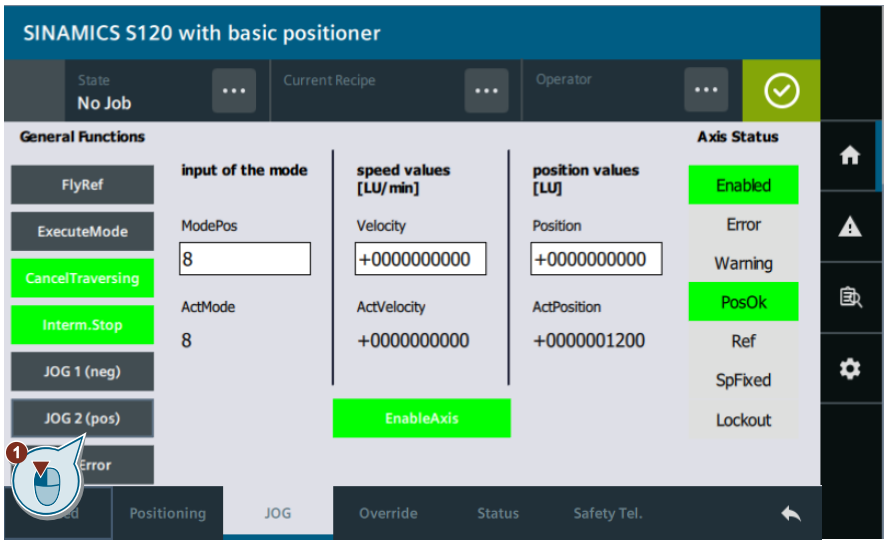
6. Select the "Jog" menu item (1).
7. Enter the value "8" in the "ModePos" field (2).
8. Switch on the device via "EnableAxis" (3).




9. "JOG 2" (1) starts the movement in the positive direction.

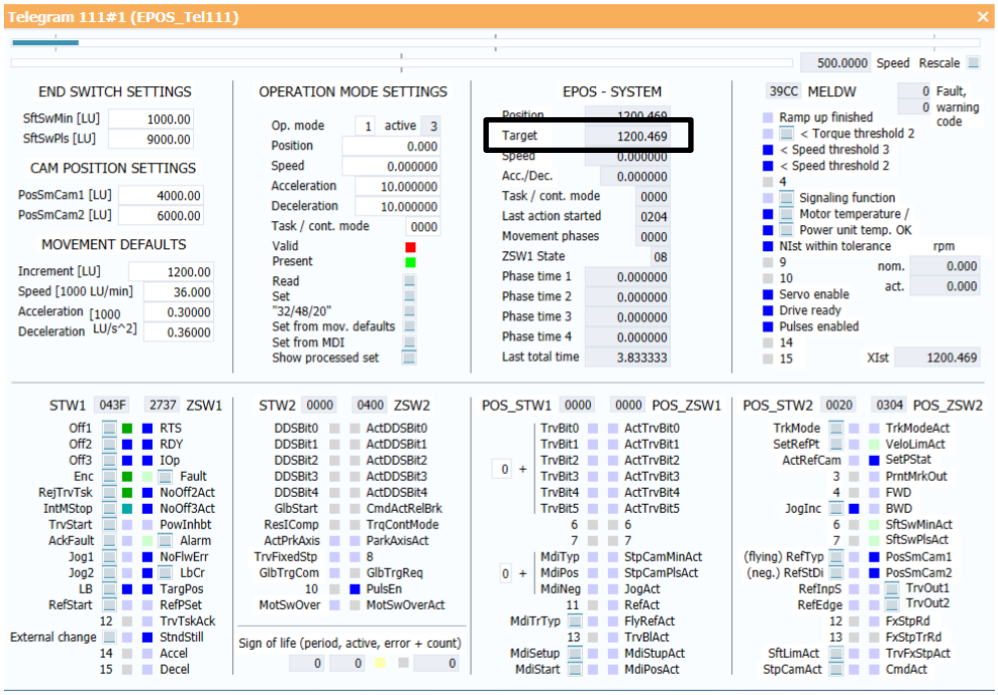
   The velocity value thus becomes positive.

   When "JOG 2" is deactivated, the movement is stopped with the set deceleration and the stop position is adopted as the target position.



10. After activating "JOG 2", the parameter "DefaultIncrement" is added to the current position to define the target position.

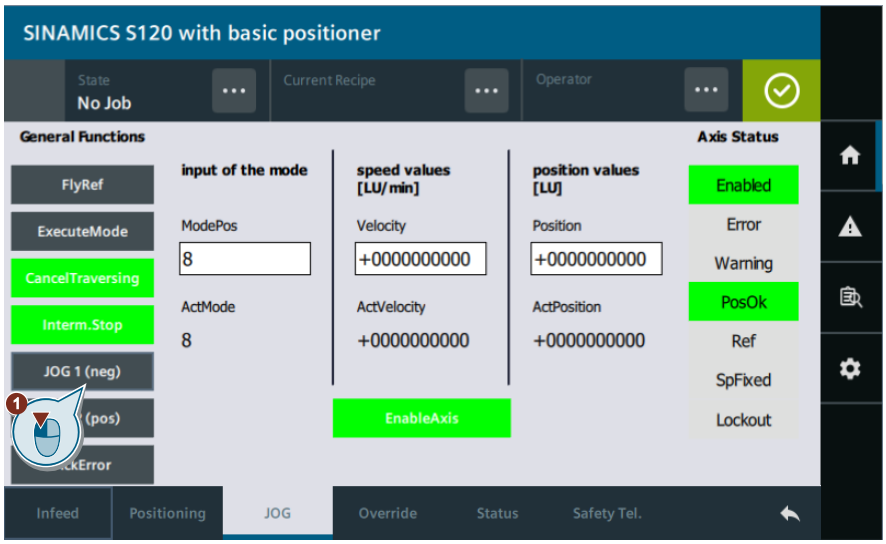
    Disabling "JOG 2" after the braking point no longer affects the target position because the deceleration remains active.




11. "JOG 1" (1) starts the movement in the negative direction.

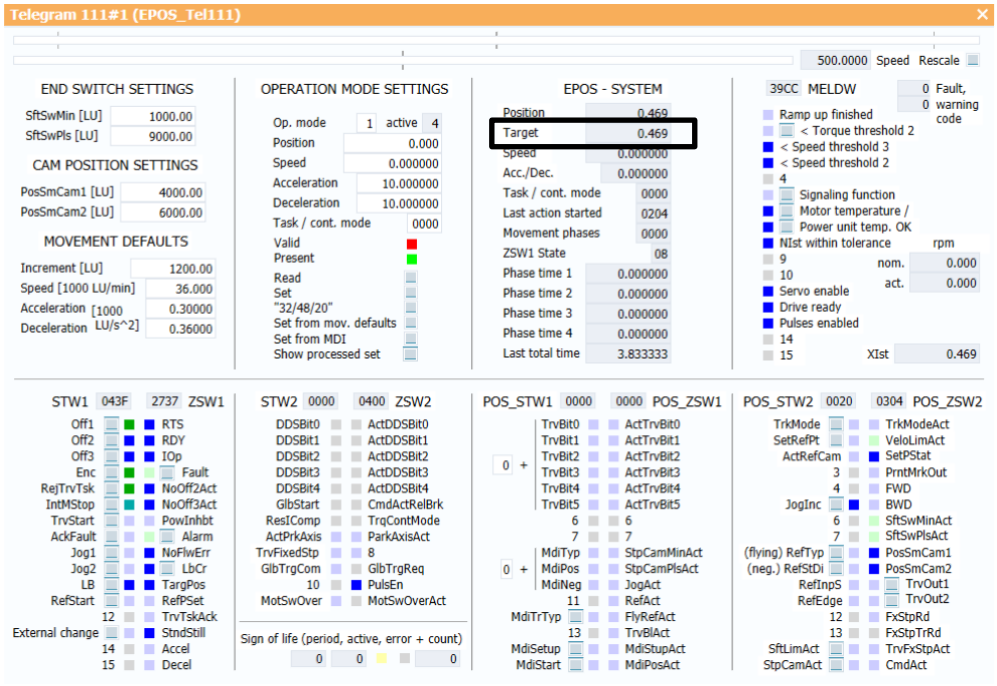
    The velocity value thus becomes negative.

    When "JOG 1" is deactivated, the movement is stopped with the set deceleration and the stop position is adopted as the target position.

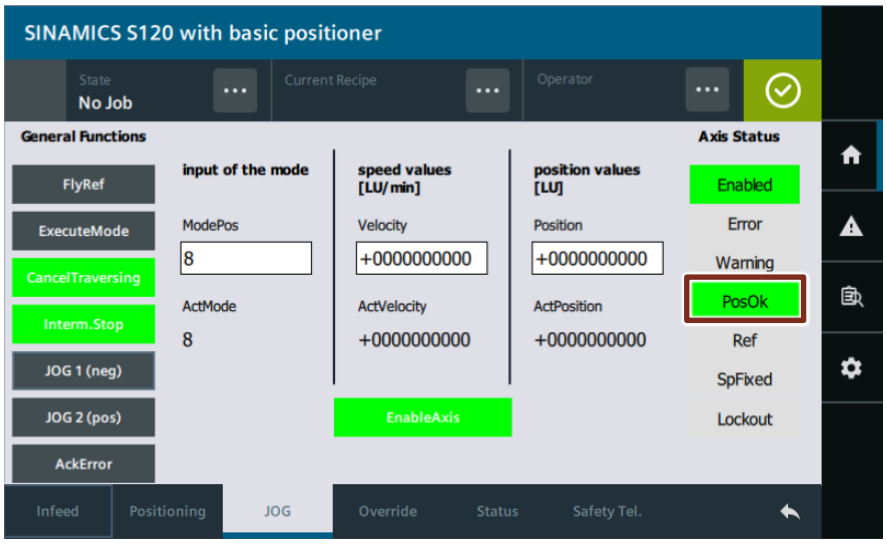


12. After activating "JOG 1", the parameter "DefaultIncrement" is subtracted from the current position to define the target position.

    Disabling "JOG 1" after the braking point no longer affects the target position as the deceleration remains active.




13. The "PosOk" display indicates that the axis is stationary and that the jog function has ended.



### 2.3.3.9 Homing on the fly

The "Homing on the fly" operating mode (passive homing) is implemented with the "Homing" drive function and is subordinate to most operating modes. It facilitates homing of the SINAMICS while in operation.

**Requirements**

- The "FlyRef" input is set to "1".
- Neither "ModePos" = 4 (homing movement) nor 5 (set home position) is selected.

**Sequence**

The settings/requirements of the active operating mode apply. Homing on the fly can be selected or deselected at any time. Upon reaching the programmed homing sensor, the setpoint and actual value are edited on the fly.

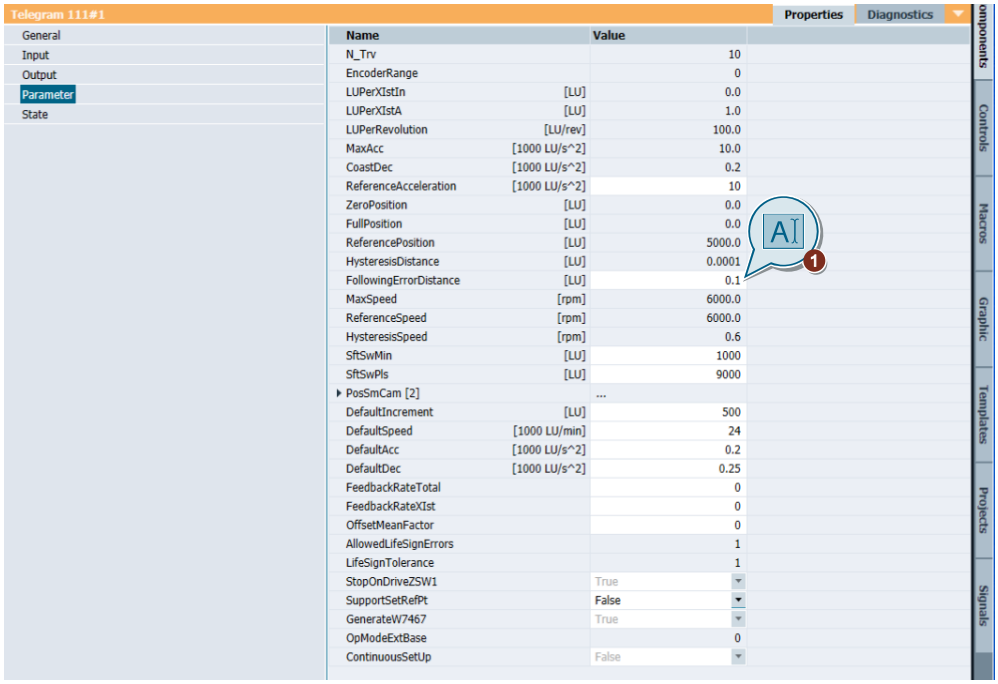
**SIMIT**

The "Homing on the fly" mode of operation allows the drive to be homed during operation.

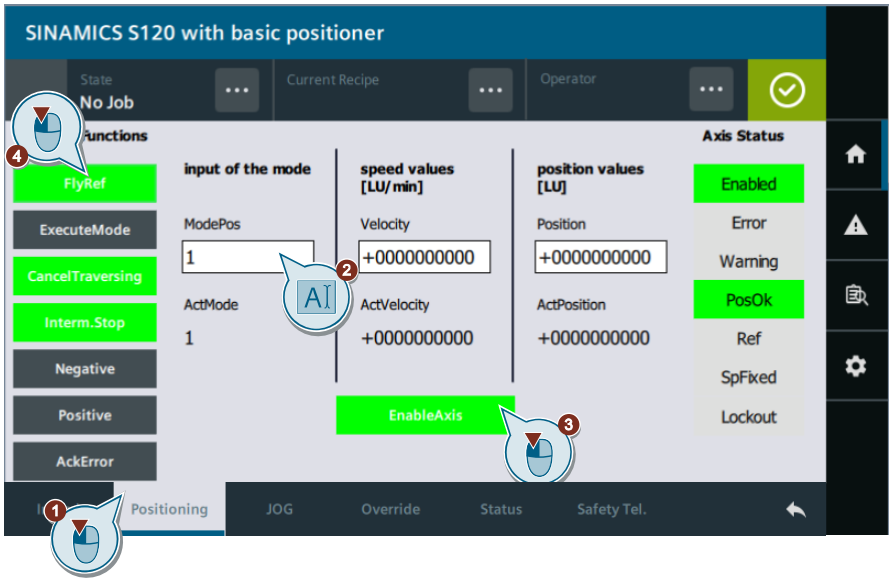
**Procedure**

Proceed as follows to execute the function "Homing on the fly":

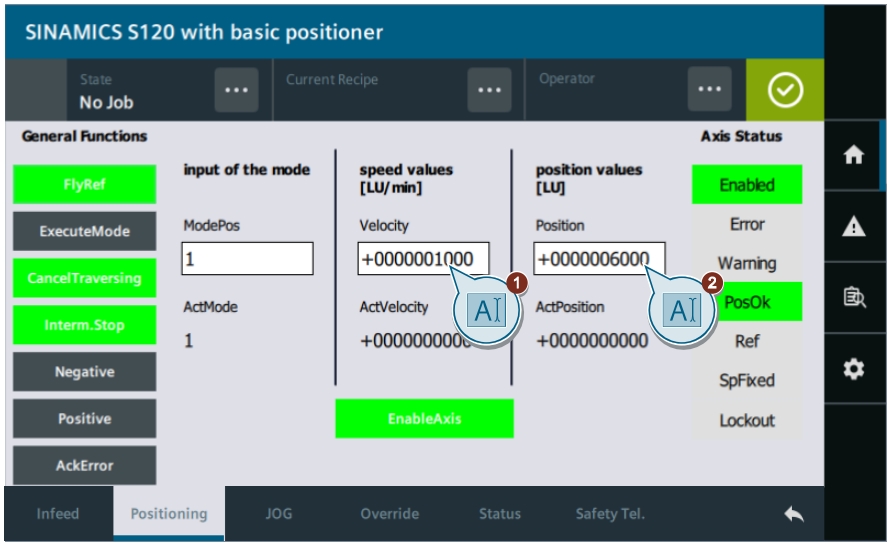
1. Assign parameters to the following values (SIMIT is offline):
   - FollowingErrorDistance = 0.1 (1)
2. Restart the SIMIT simulation (see chapter 2.3.1).



1. Select the "Positioning" menu item (1).
2. Enter "1" for the "ModePos" field (2).
3. Switch on the device via "EnableAxis" (3).
4. Enable the "Homing on the fly" function via "FlyRef" (4).

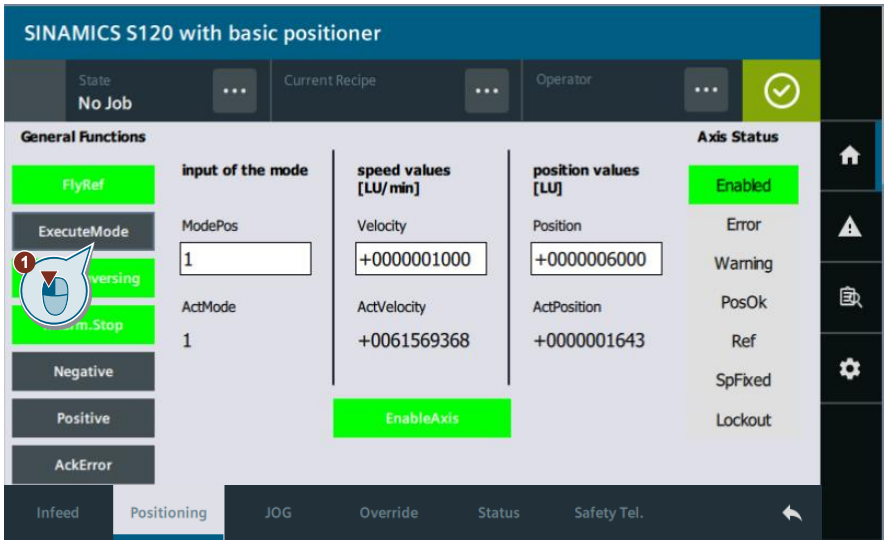



5. Enter the travel path using the following input fields:
   - Velocity = 1.000 LU/Min. (1)
   - Position = 6.000 LU (2)



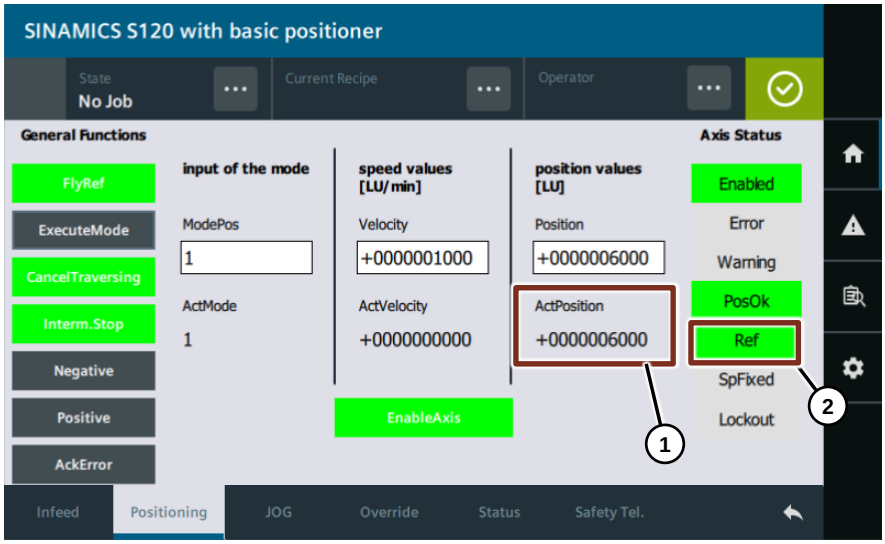
6. Select the menu item "Override" (1) to set the dynamics using the following input fields:
   - Speed override = 100% (2)
   - Acceleration override = 1% (3)
   - Delay override = 1% (4)


7. Click on "ExecuteMode" (1) to start running the relative movement you have programmed.



8. "ActPosition" (1) displays the current position. The "PosOk" display indicates that the home position has been reached and that the axis is stationary.
9. The "Ref" display (2) indicates that the axis has been homed (referenced).

   In this example, ReferencePosition has the value 5.000 and was crossed on the way to position 6.000.



## 2.3.4 Operation using the watch table

You can use the application example even without the HMI. For this purpose, the watch tables "Control_TO_BasicPos" and "Control_SinaInfeed" have already been created in the project. The tags that you can observe or modify are the same ones that are also displayed on the operator device.

To modify the tags via the watch table, proceed as follows:

1. Select the tag you wish to modify by ticking the control checkbox in the column next to the "Modify value" column.
2. Specify a value in the "Modify value" column.
3. Select the "Modify now" command to immediately modify the selected tag once with the specified values.

Figure 2-13: Watch table "Control_TO_BasicPos"

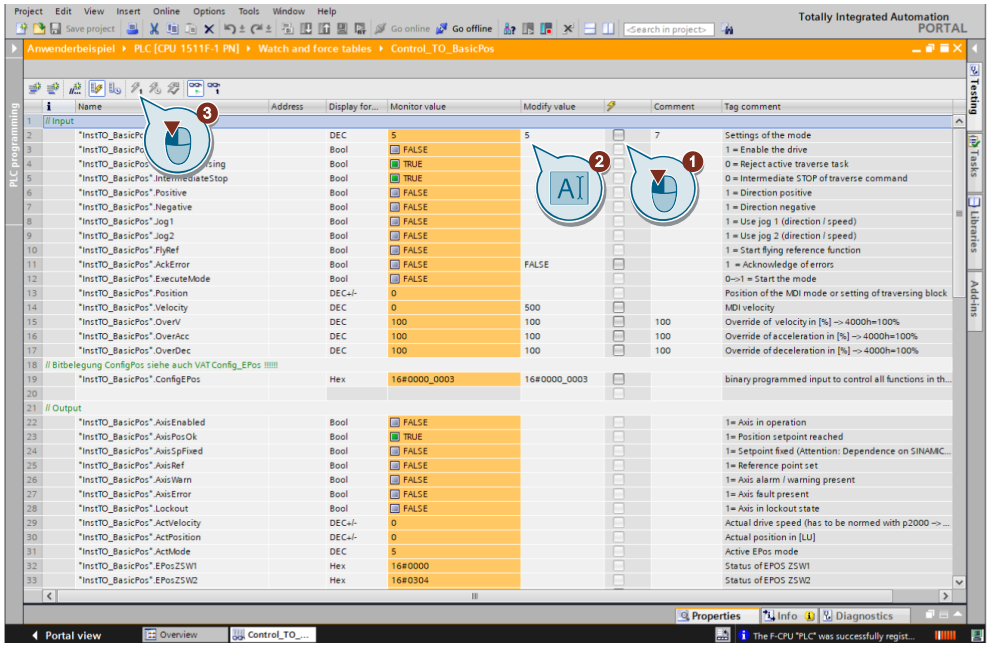
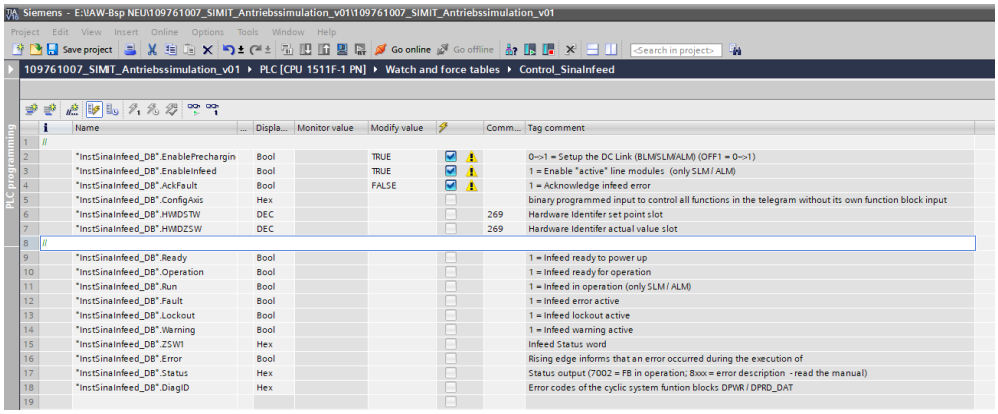



Figure 2-14: Watch table "Control_SinaInfeed"

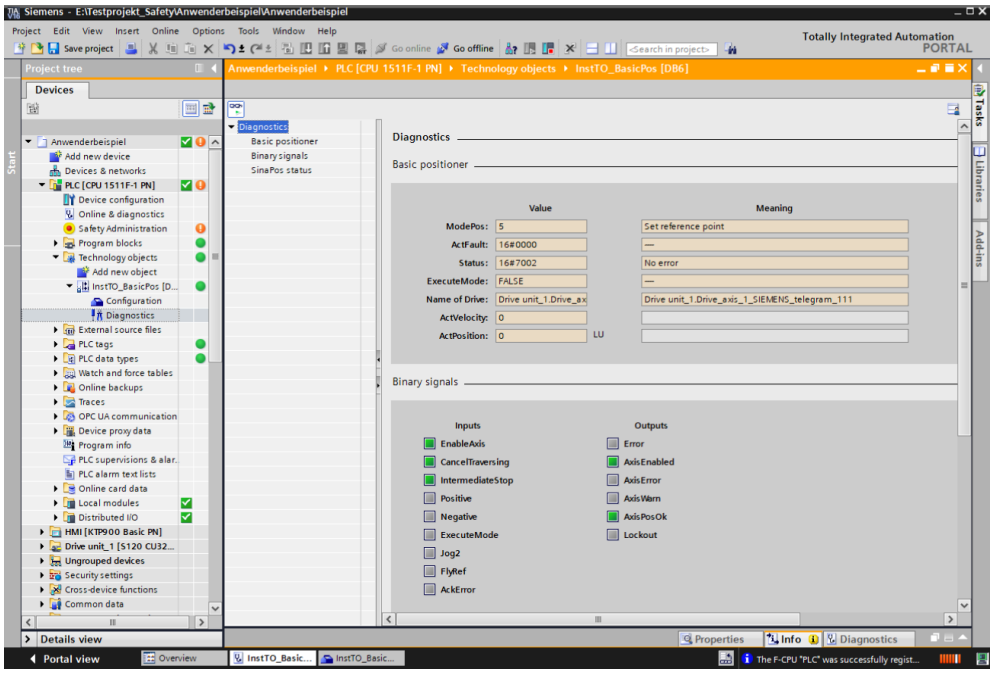


### 2.3.5 Diagnostics with technology module "TO_BasicPos"

Using the technology object diagnostics, it is possible to check the following signals and values during the runtime:

- Diagnostic data from the Basic Positioner
- Binary signals of the inputs and outputs
- Status SinaPos

Figure 2-15



# 3 Useful information

## 3.1 Telegram 701 (Control/Status block)

For telegram 701, the interface blocks "LDrvSafe_SinaTlg701Control" and "LDrvSafe_SinaTlg701Status" have been added to the control program from the "Failsafe library LDrvSafe for controlling Safety Integrated Functions of the SINAMICS drive family". Using these interface blocks, it is possible to access all control and status signals of telegram 701 and to interconnect them in your own program as needed. Further information can be found in the documentation for the LDrvSafe library at \6\.

## 3.2 Telegram 902 (Control/Status block)

For telegram 902, the interface blocks "LDrvSafe_SinaTlg902Control" and "LDrvSafe_SinaTlg902Status" have been added to the control program from the "Failsafe library LDrvSafe for controlling Safety Integrated Functions of the SINAMICS drive family". Using these interface blocks, it is possible to access all control and status signals of telegram 902 and to interconnect them in your own program as needed. Further information can be found in the documentation for the LDrvSafe library at \6\.

# 4 Appendix

## 4.1 Service and support

**Industry Online Support**

Do you have any questions or need assistance?

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support.industry.siemens.com/cs/my/src

**SITRAIN – Digital Industry Academy**

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

siemens.com/sitrain

**Service offer**

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

**Industry Online Support app**

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

## 4.2 Industry Mall


The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

## 4.3 Links and literature

Table 4-1

| No. | Subject |
|---|---|
| \1\ | Siemens Industry Online Support<br>https://support.industry.siemens.com |
| \2\ | Link to the article page of the application example<br>https://support.industry.siemens.com/cs/ww/en/view/109761007 |
| \3\ | SIMATIC SIMIT Simulation Platform - Overview<br>https://support.industry.siemens.com/cs/ww/en/view/109746429 |
| \4\ | SINAMICS S: EPos calculation with Startdrive and activation with SINA_POS<br>https://support.industry.siemens.com/cs/ww/en/view/98961635 |
| \5\ | SINAMICS communication blocks DriveLib for reading and writing drive data within TIA Portal Context<br>https://support.industry.siemens.com/cs/ww/en/view/109475044 |
| \6\ | SINAMICS LDrVSafe<br>https://support.industry.siemens.com/cs/ww/en/view/109485794 |
| \7\ | SINAMICS S120 Function Manual Drive Functions<br>https://support.industry.siemens.com/cs/ww/en/view/109754299 |
| \8\ | SINAMICS S120 Safety Integrated<br>https://support.industry.siemens.com/cs/ww/en/view/109760403 |
| \9\ | DRIVES Behavior Library for SIMIT<br>https://support.industry.siemens.com/cs/ww/en/view/109761007 |
| \10\ | Basic Positioner Function Manual<br>https://support.industry.siemens.com/cs/ww/en/view/109757593 |
| \11\ | SINAMICS S120/S150 compact manual<br>https://support.industry.siemens.com/cs/ww/en/view/109781807 |

## 4.4 Abbreviations

PZD Process data

PLC Programmable logic controller

TO Technology object

## 4.5 Change documentation

Table 4-2

| Version | Date | Change |
|---|---|---|
| V1.0 | 11/2021 | First edition |
| | | |