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Learn-/Training Document

Siemens Automation Cooperates with Education (SCE) | From Version V15.1

TIA Portal Module 020-120
SIMIT Process Simulation
Basics of simulation creation

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We wish to thank the TU Dresden, the Michael Dziallas Engineering Corporation and all other involved persons for their support during the preparation of this Learn-/Training Document.

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SIMIT Process Simulation – Basics of simulation creation

1 Goal

The following pages will show how a simple simulation for a sorting station with conveyor and extension cylinder can be created in the SIMIT process simulation software.

2 Requirement

This chapter builds on the chapter SIMIT Process Simulation – Coupling with S7-PLCSIM Advanced via TCP/IP. You can use the following project for this chapter, for example: "sce-020-110 simit-s7-1500 plcsimadv-ie-en.simarc".

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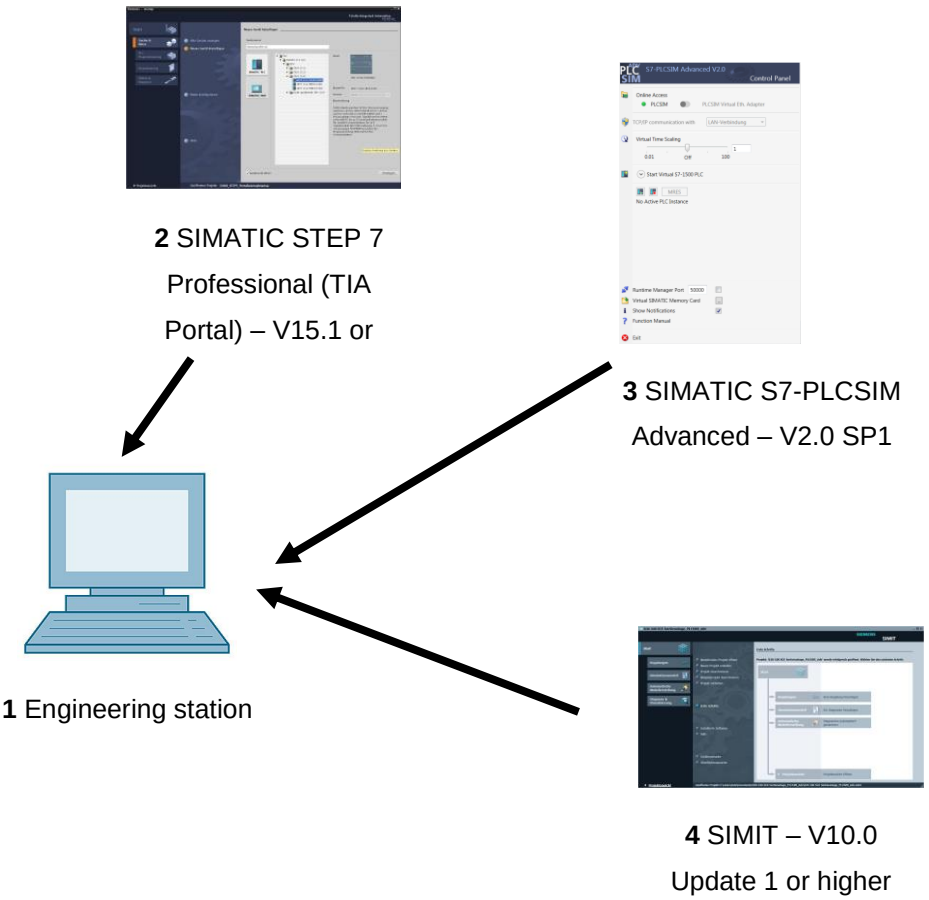
3 Required hardware and software

1. Engineering station: Requirements include hardware and Windows 10 operating system (for additional information, see Readme on the TIA Portal Installation DVDs)
2. SIMATIC STEP 7 Professional software in TIA Portal – V15.1 or higher
3. SIMATIC S7-PLCSIM Advanced software – V2.0 SP1 or higher
4. SIMIT software – V10.0 Update 1 or higher (with dongle or in demo mode)



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4 Theory

4.1 SIMIT V10

SIMIT is **process simulation software** that can be used for the following:

- Complete plant simulation
- Simulation of signals, devices and plant responses
- Input and output simulator of test signals for an automation controller
- Testing and commissioning of automation software

SIMIT provides the following components for creating a simulation:

- Chart

To build a simulation, components available in the libraries are put together in the chart editor and suitable parameters are entered.

- Visualization

Visualizations provide an overview of the signals of your plant. Signals are visualized with controls (input and display objects) and graphic objects.

- Coupling

The coupling is the interface to the automation system and is required for signal exchange. In addition to couplings with PLCSIM, PLCSIM Advanced, PRODAVE, etc., there is also a coupling with SIMIT as OPC UA client.

Demo mode

Demo mode provides you with an idea of the handling and performance of SIMIT without having a valid license.

However, SIMIT has only a limited range of functions in demo mode.

Existing models can be opened and simulated in demo mode. These models can also be modified, and new models can also be created. The models created or modified in demo mode can only be executed on the computer on which they were created.

SIMIT Simulation is limited to 45 minutes in demo mode. The simulation must then be restarted.

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Note:

– *Additional details and information can be found in the manuals, which can be downloaded from support.automation.siemens.com.*

5 Task

A simulation for a sorting station with conveyor and extension cylinder is to be created in a SIMIT project with existing coupling with PLCSIM Advanced via TCP/IP.

The symbols for the inputs and outputs are already created for the coupling.

5.1 Short description of the sorting station

The automated sorting station (see Figure 1) is used to separate plastic and metal parts. A part is fed to the conveyor via a chute. The conveyor starts as soon as the part has been detected. If a part made of metal is on the conveyor, it is detected, transported up to the height of the metal magazine and pushed by a cylinder into the metal magazine. If no metal is detected, the part is made of plastic. The plastic part is transported to the end of the belt, where it falls into the plastic magazine. As soon as a part is sorted, the next part can be fed.

5.2 Technology diagram

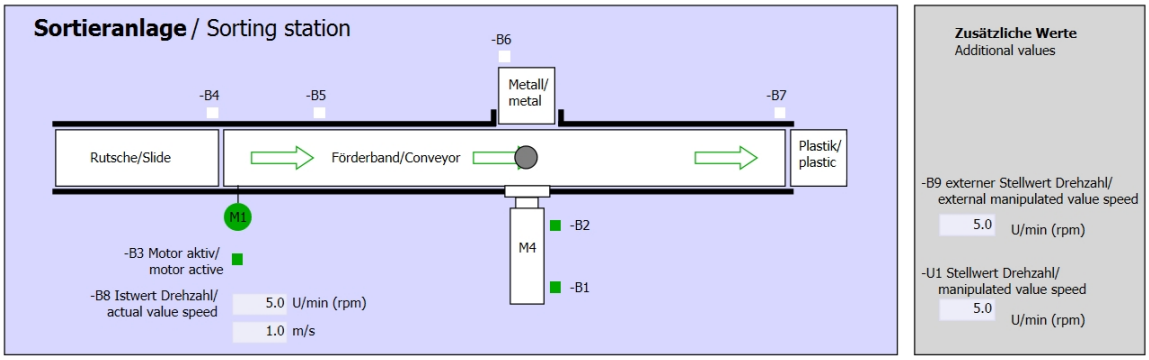

Figure 1: Technology diagram

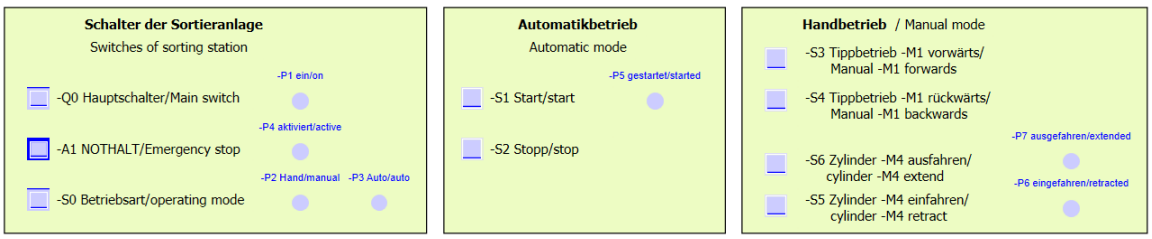

Figure 2: Control panel

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5.3 Reference list of the sorting station

DI	Type	Identifier	Function	NC/NO
I 0.0	BOOL	-A1	Return signal emergency stop OK	NC
I 0.1	BOOL	-K0	Main switch "ON"	NO
I 0.2	BOOL	-S0	Mode selector manual (0)/ automatic (1)	Manual = 0 Auto = 1
I 0.3	BOOL	-S1	Pushbutton automatic start	NO
I 0.4	BOOL	-S2	Pushbutton automatic stop	NC
I 0.5	BOOL	-B1	Sensor cylinder -M4 retracted	NO
I 0.6	BOOL	-B2	Sensor cylinder -M4 extended	NC
I 0.7	BOOL	-B3	Sensor motor -M1 active (pulse signal also suitable for positioning)	NO
I 1.0	BOOL	-B4	Sensor part at chute	NO
I 1.1	BOOL	-B5	Sensor metal part detection	NO
I 1.2	BOOL	-B6	Sensor part in front of cylinder -M4	NO
I 1.3	BOOL	-B7	Sensor part at end of conveyor	NO
I 1.4	BOOL	-S3	Pushbutton manual mode conveyor –M1 forwards	NO
I 1.5	BOOL	-S4	Pushbutton manual mode conveyor –M1 backwards	NO
I 1.6	BOOL	-S5	Pushbutton retract cylinder -M4, "manual mode"	NO
I 1.7	BOOL	-S6	Pushbutton extend cylinder -M4, "manual mode"	NO

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DO	Type	Identifier	Function	
Q 0.0	BOOL	-Q1	Conveyor motor -M1 forwards fixed speed	
Q 0.1	BOOL	-Q2	Conveyor motor -M1 backwards fixed speed	
Q 0.2	BOOL	-Q3	Conveyor motor -M1 variable speed	
Q 0.3	BOOL	-M2	Cylinder -M4 retract	
Q 0.4	BOOL	-M3	Cylinder -M4 extend	
Q 0.5	BOOL	-P1	Display "main switch on"	
Q 0.6	BOOL	-P2	Display "manual mode"	
Q 0.7	BOOL	-P3	Display "automatic mode"	
Q 1.0	BOOL	-P4	Display "emergency stop activated"	
Q 1.1	BOOL	-P5	Display "automatic mode started"	
Q 1.2	BOOL	-P6	Display cylinder -M4 "retracted"	
Q 1.3	BOOL	-P7	Display cylinder -M4 "extended"	
AI	**Type**	**Identifier**	**Function**	
IW 64	INT	-B8	Sensor actual value speed of motor +/-10V	
IW 66	INT	-B9	Setpoint specification via potentiometer +/-10V	

AO	Type	Identifier	Function	
QW 64	INT	-U1	Manipulated value speed of motor in 2 directions +/- 10V	

Legend for reference list

DI	Digital input	DO	Digital output
AI	Analog input	AO	Analog output
I	Input	Q	Output
NC	Normally Closed (contact)		
NO	Normally Open (contact)		

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6 Planning

First, the existing SIMIT project is retrieved from the archive in order to then create the simulation of the sorting station.

The simulation is subdivided into the following charts:

- Control display with conveyor
- Conveyor motor
- Part
- Light barrier
- Metal sensor (exercise)
- Cylinder (exercise)

For testing the simulation, the simulation will be started in the SIMIT project. PLCSIM Advanced is then also activated in the background, and the TIA Portal project can be loaded into PLCSIM Advanced for testing.

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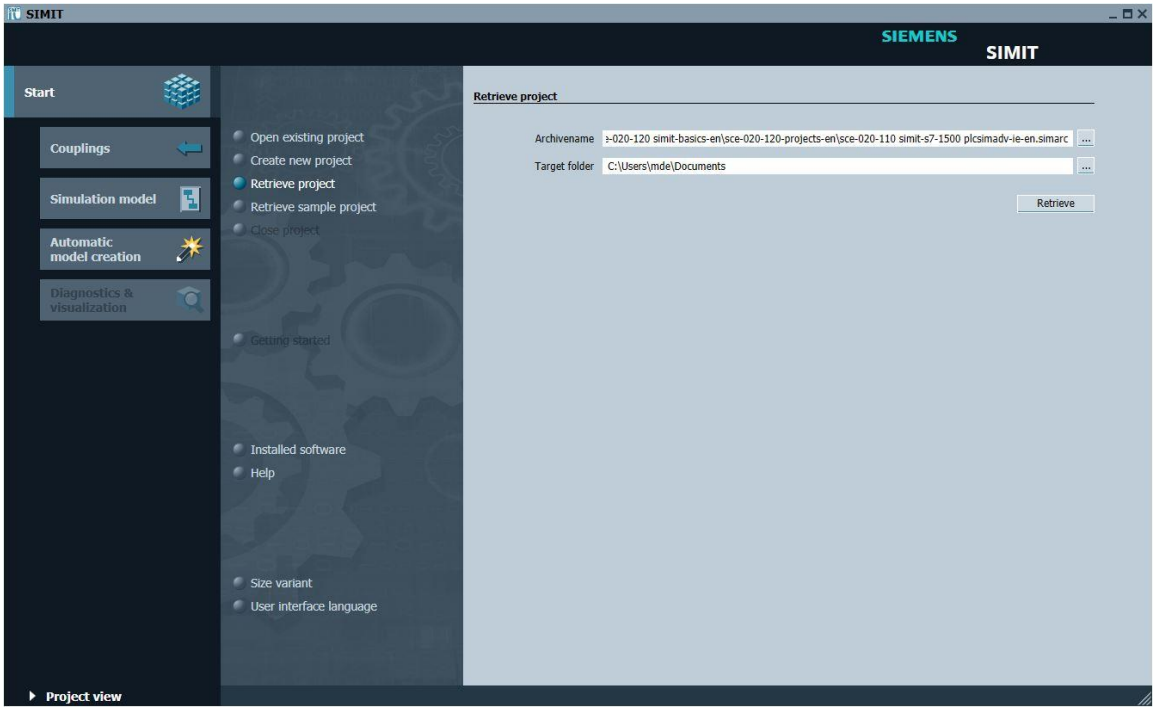
7 Structured step-by-step instructions

You can find instructions on how to carry out planning below. If you already have a good understanding of everything, it will be sufficient to focus on the numbered steps. Otherwise, follow the individual instructions in the steps below.

7.1 Retrieving an existing project in SIMIT

→ Start SIMIT from the desktop of your computer by double-clicking on the logo for the "SIMIT SP" application (for Demo mode, "SIMIT SP Demo"). (→ SIMIT SP)

→ Retrieve the project "sce-020-110 simit-s7-1500 plcsimadv-ie-en.simarc". (→ Retrieve project → sce-020-110 simit-s7-1500 plcsimadv-ie-en.simarc → Retrieve)



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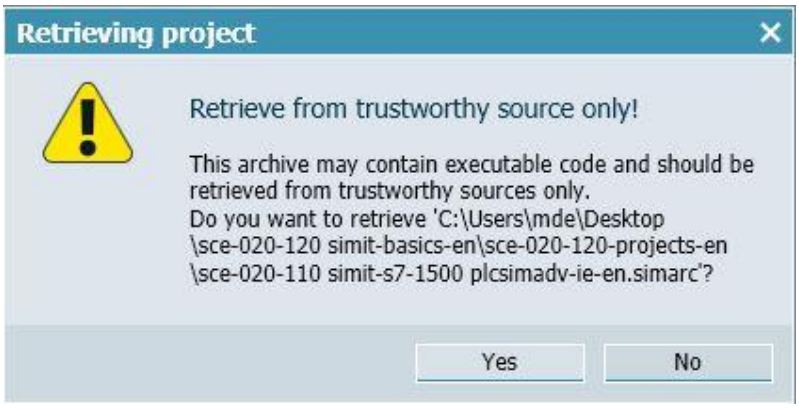
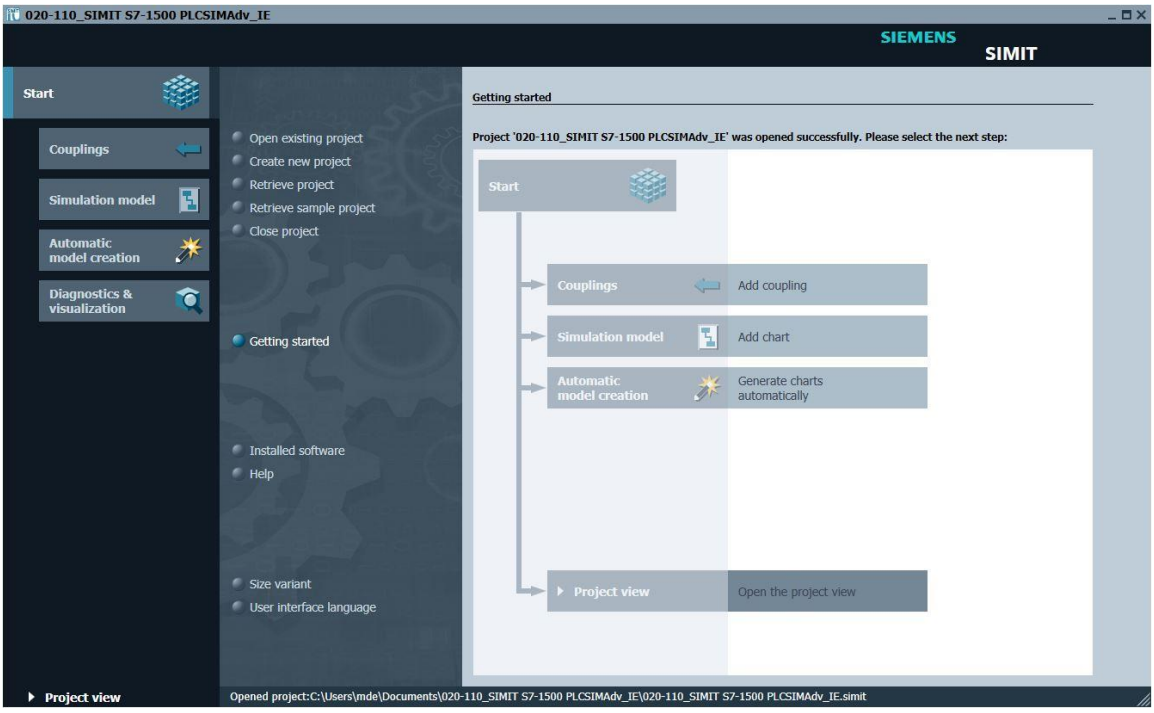
→ Confirm the security prompt with "Yes". (→ Yes)



→ Change to the "Project view". (→ Project view)



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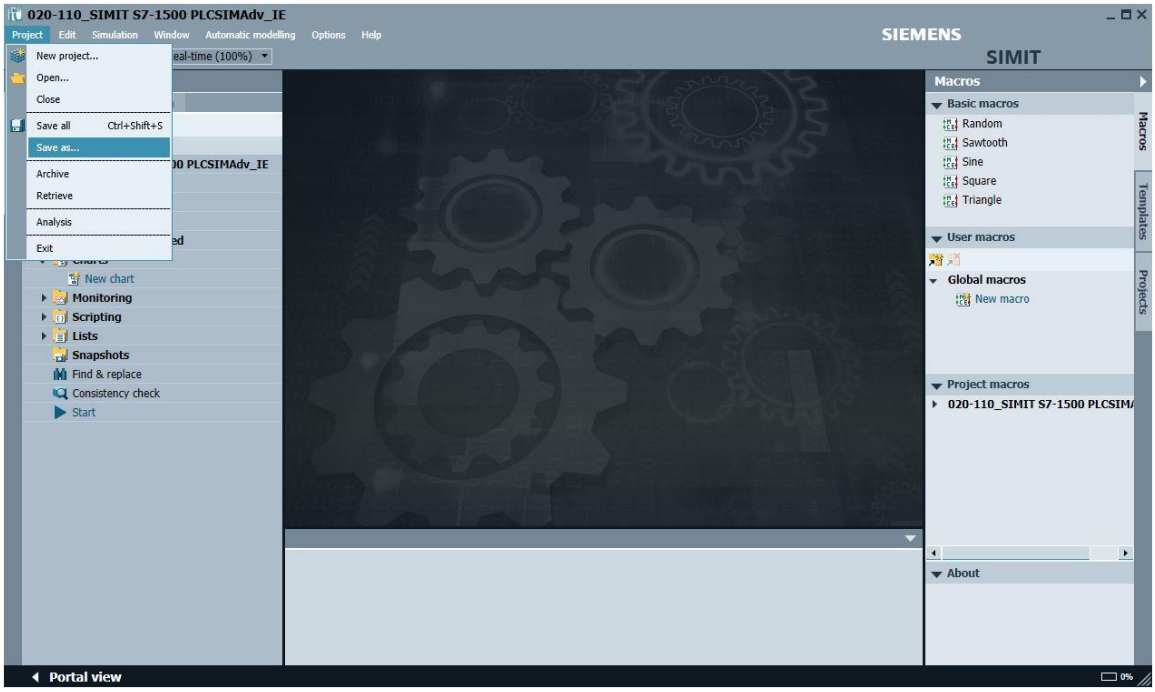
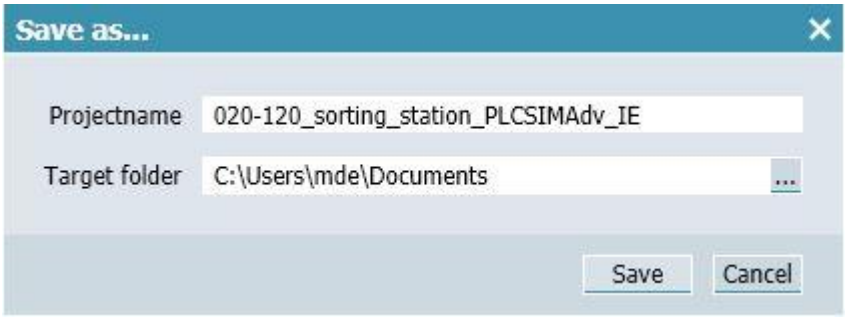
→ Save your project under the name "020-120_sorting_station_PLCSIMAdv_IE". (→ Project → Save as … → 020-120_sorting_station_PLCSIMAdv_IE → Save)





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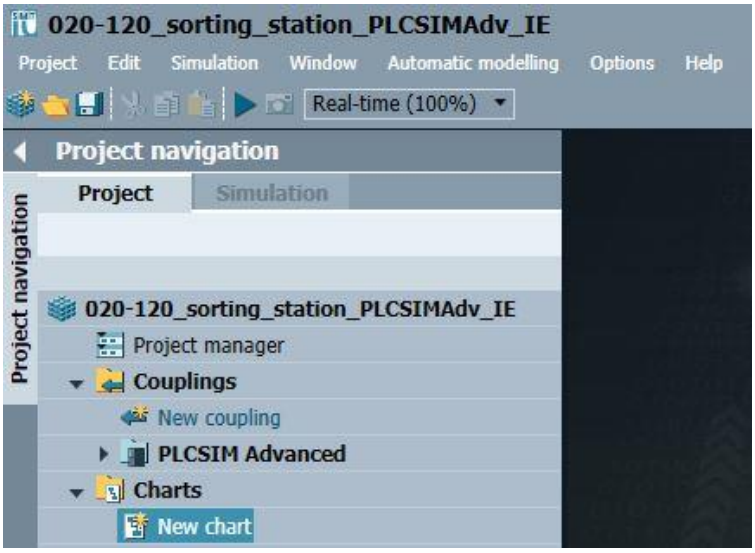
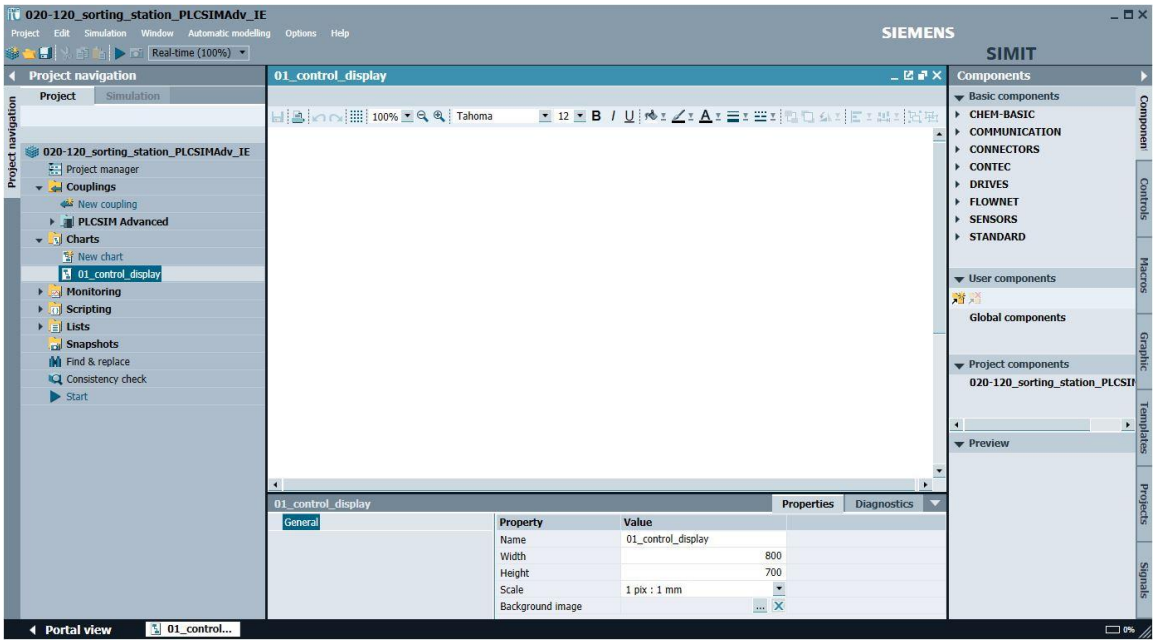
7.2 Creating the "01_control_display" chart and the display of the simulated sorting station

→ Now, create a "New chart" in your project "020-120_sorting_station_PLCSIMAdv_IE". (→ Project → 020-120_sorting_station_PLCSIMAdv_IE → Charts → New chart)



→ The new chart is opened. Change the "Name" to "01_control_display" in the "Properties" under "General". (→ Properties → General → Name: 01_control_display)



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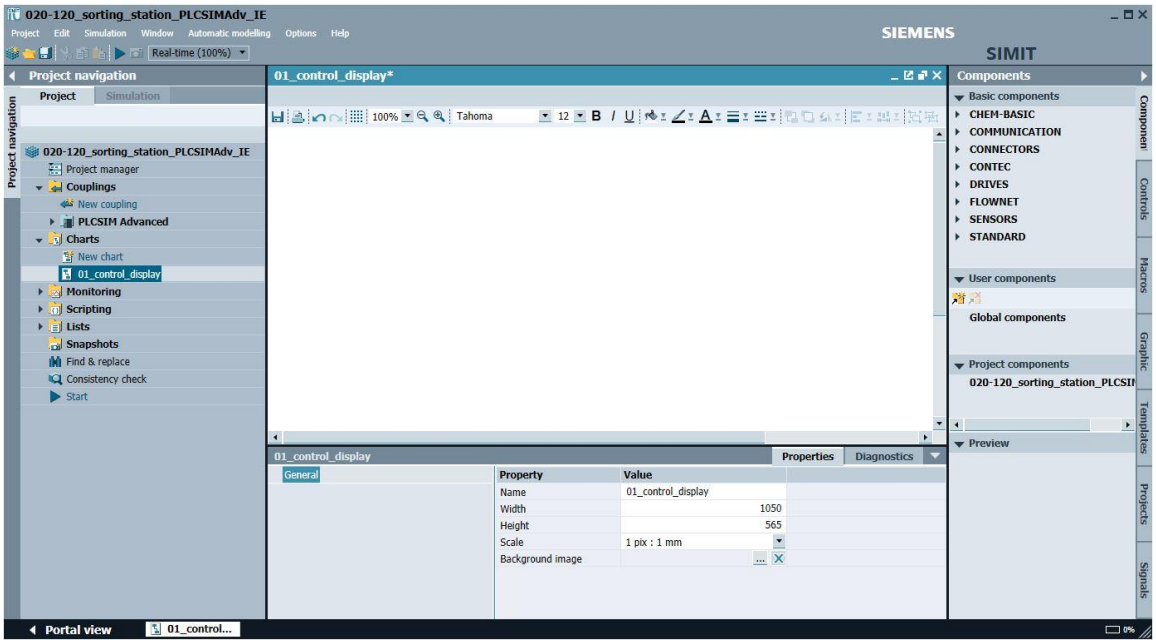
→ Next, change the format of "01_control_display" by entering the value 1050 for "Width" and the value 565 for "Height". Then, click "Background image ..." to open an input dialog for selecting the graphic. (→ Width: 1050 → Height: 565 → Background image ...)



Note:

– *The project should be saved and compiled at regular intervals by clicking "Save all". If the last changes in the open chart have not yet been saved and compiled, the symbol * is displayed behind the name of the chart.*

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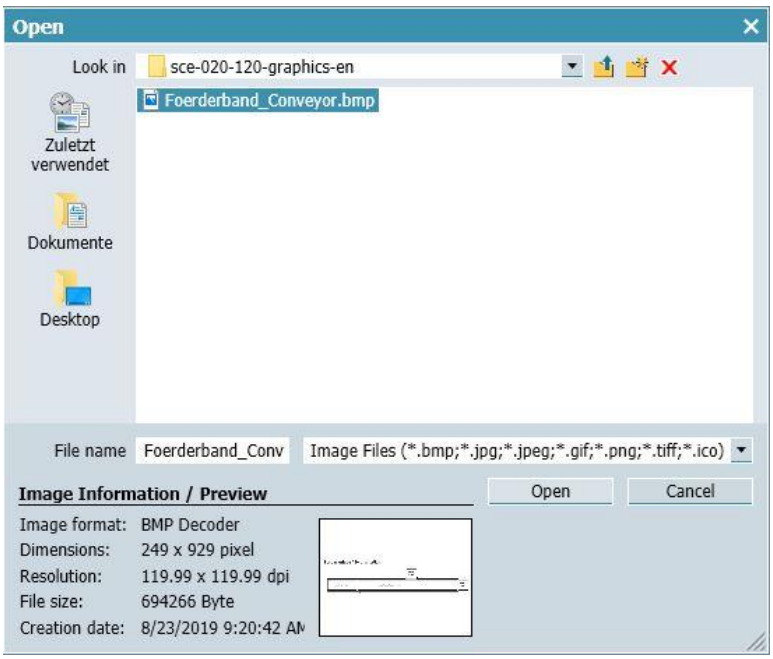
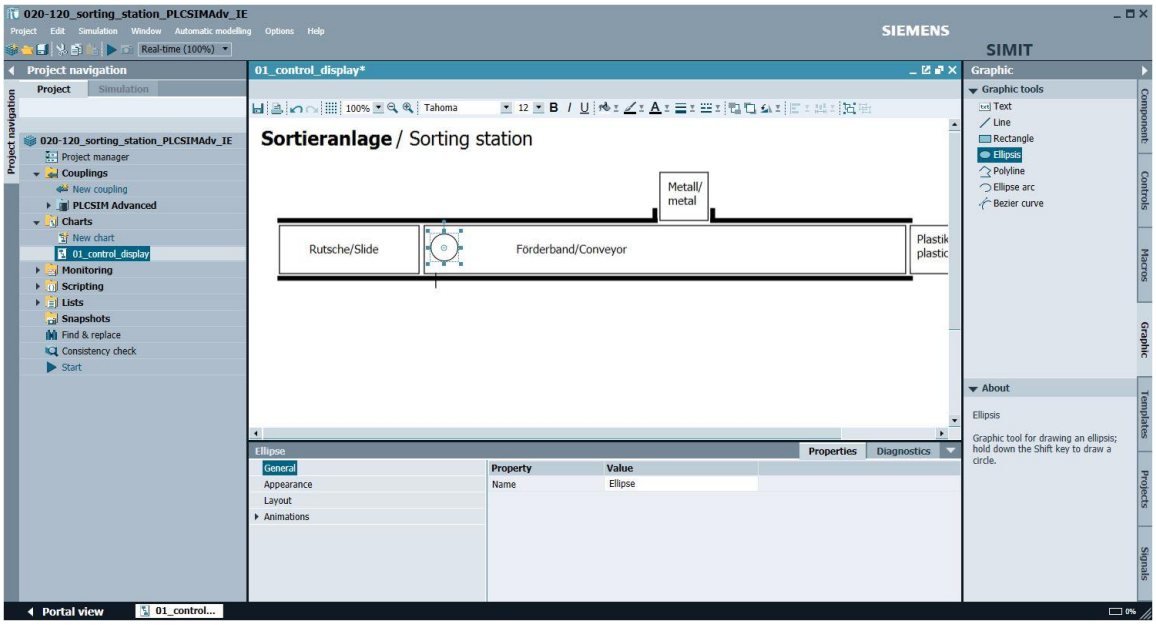
→ Now, select the "Foerderband_Conveyor.bmp" image from the "sce-020-120-graphics-en" folder and accept it as the background image by clicking "Open". (→ sce-020-120-graphics-en → Foerderband_Conveyor.bmp → Open)



→ You will find graphic elements for use in the charts in the "Graphic" task card on the right. First, you want to draw a circle for displaying the plastic parts. Press and hold down the "Ctrl" key and select an "Ellipsis" from "Graphic tools" and draw a circle on the left end of the conveyor, as shown here. (→ Graphic → Graphic tools → Ctrl → Ellipsis)



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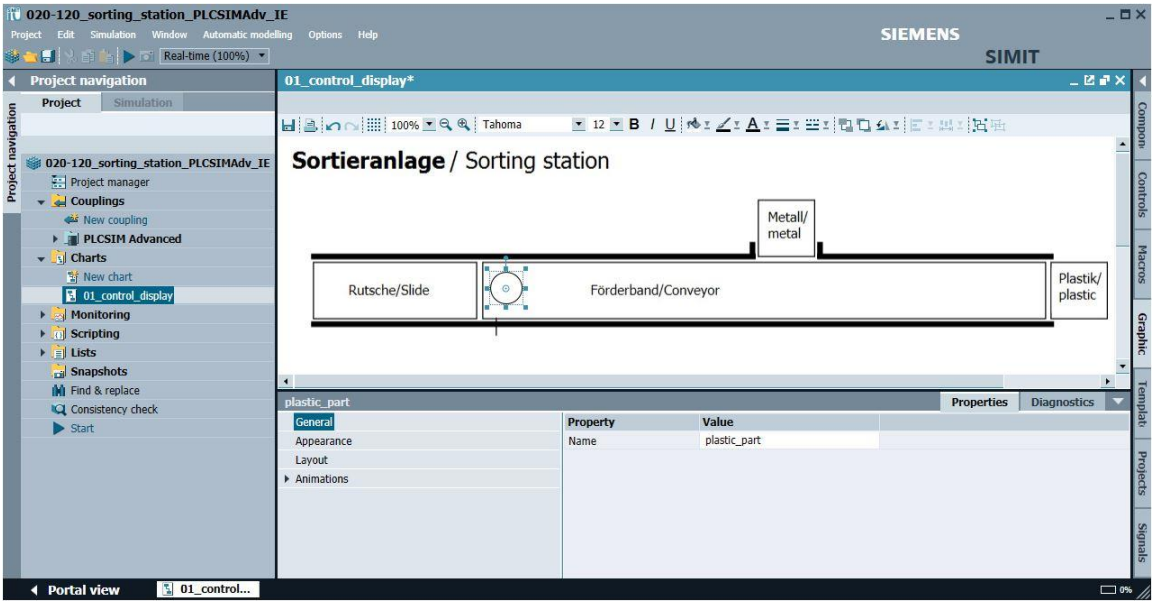
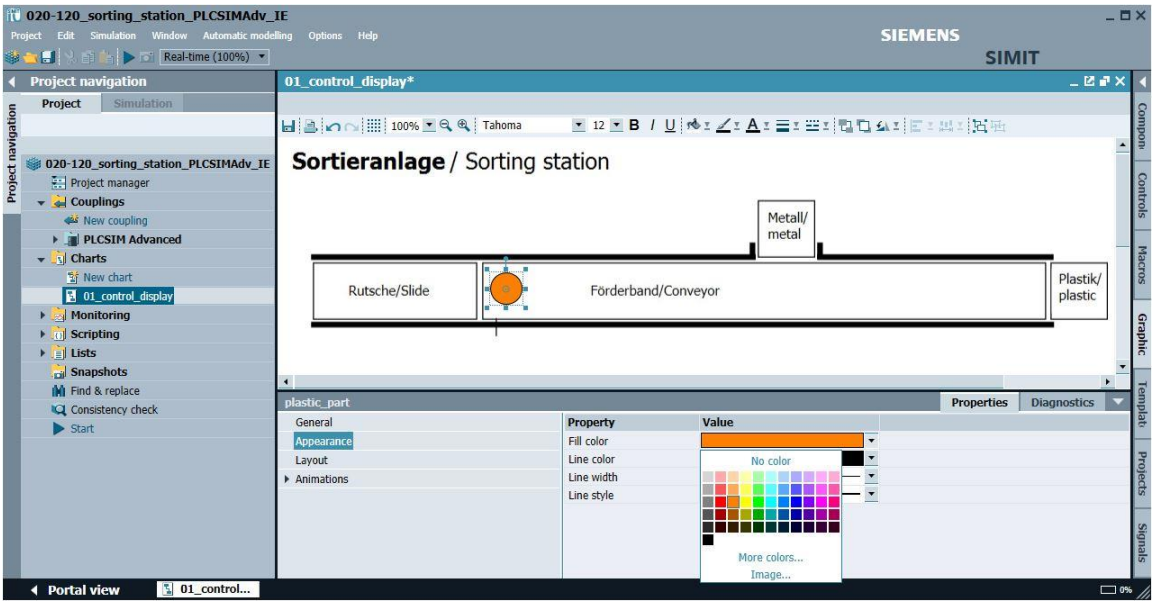
→ Change the "Name" to "plastic_part" in the "Properties" under "General". (→ Properties → General → Name: plastic_part)



→ Under "Appearance" in the "Properties", change the "Fill color" to orange. (→ Properties → Appearance → Fill color: orange)



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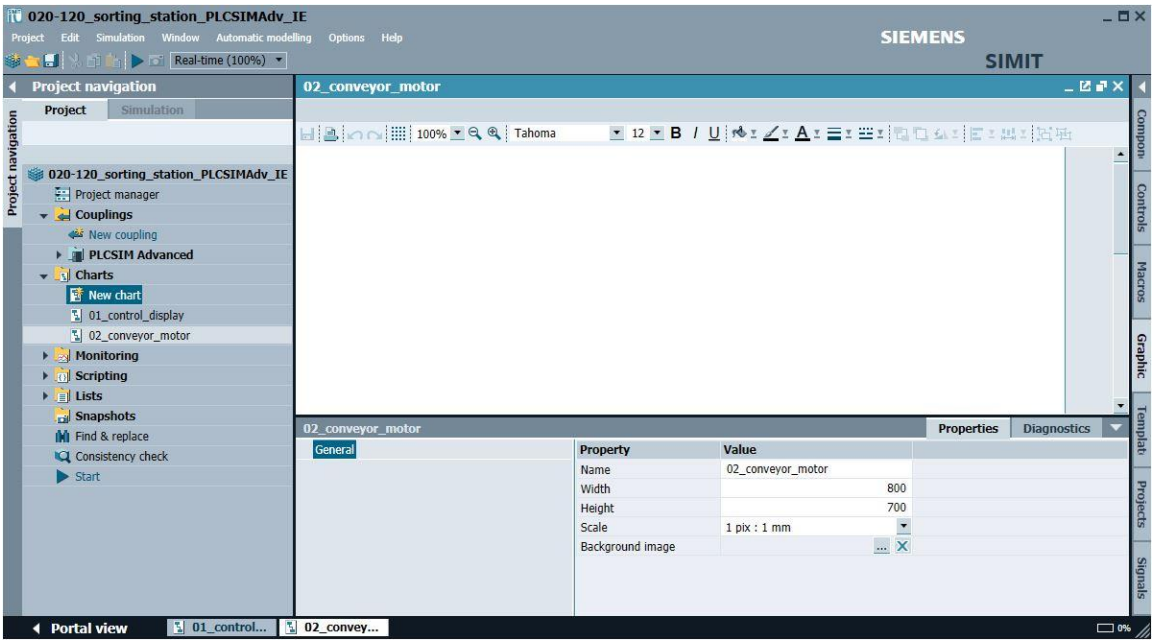
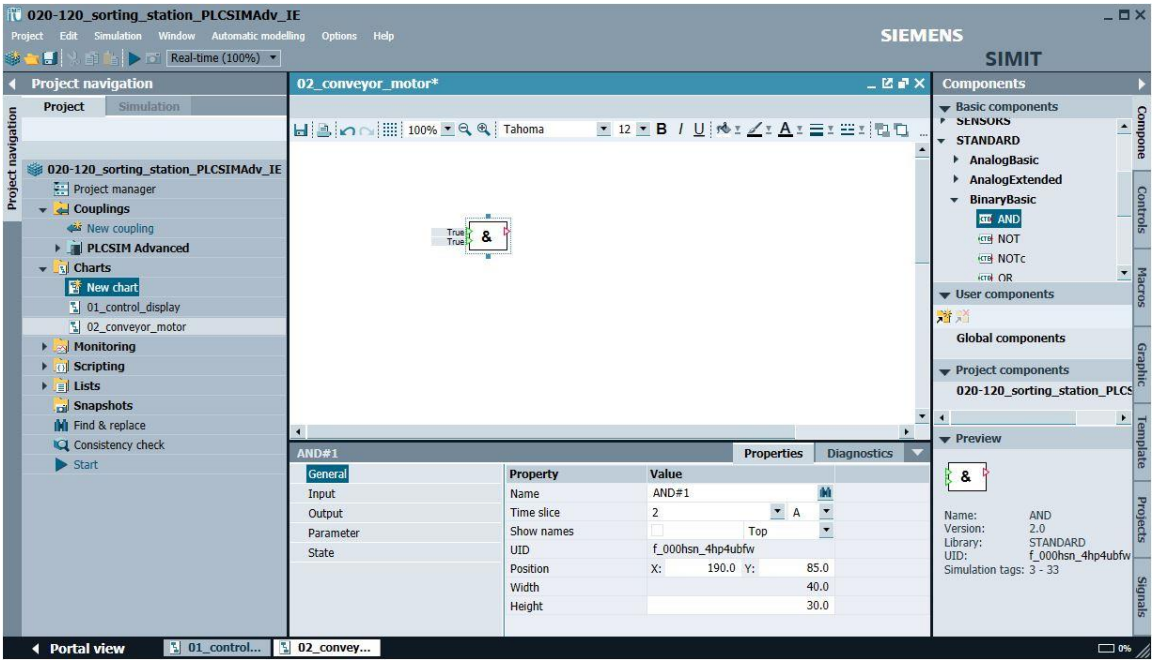
7.3 Creating the "02_conveyor_motor" chart with simulation logic

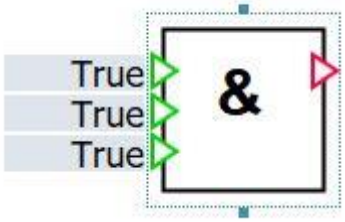
→ Create another chart named "02_conveyor_motor" with the format shown here. (→ New chart → Name: 02_conveyor_motor → Width: 800 → Height: 700)



→ You will find the component types of the basic library under "Basic components" on the right in the "Components" task card. For simple simulation of the conveyor motor, drag an → "AND", located under → "Standard" → "BinaryBasic", to the "02_conveyor_motor" chart. (→ Components → Basic components → Standard → BinaryBasic → AND)



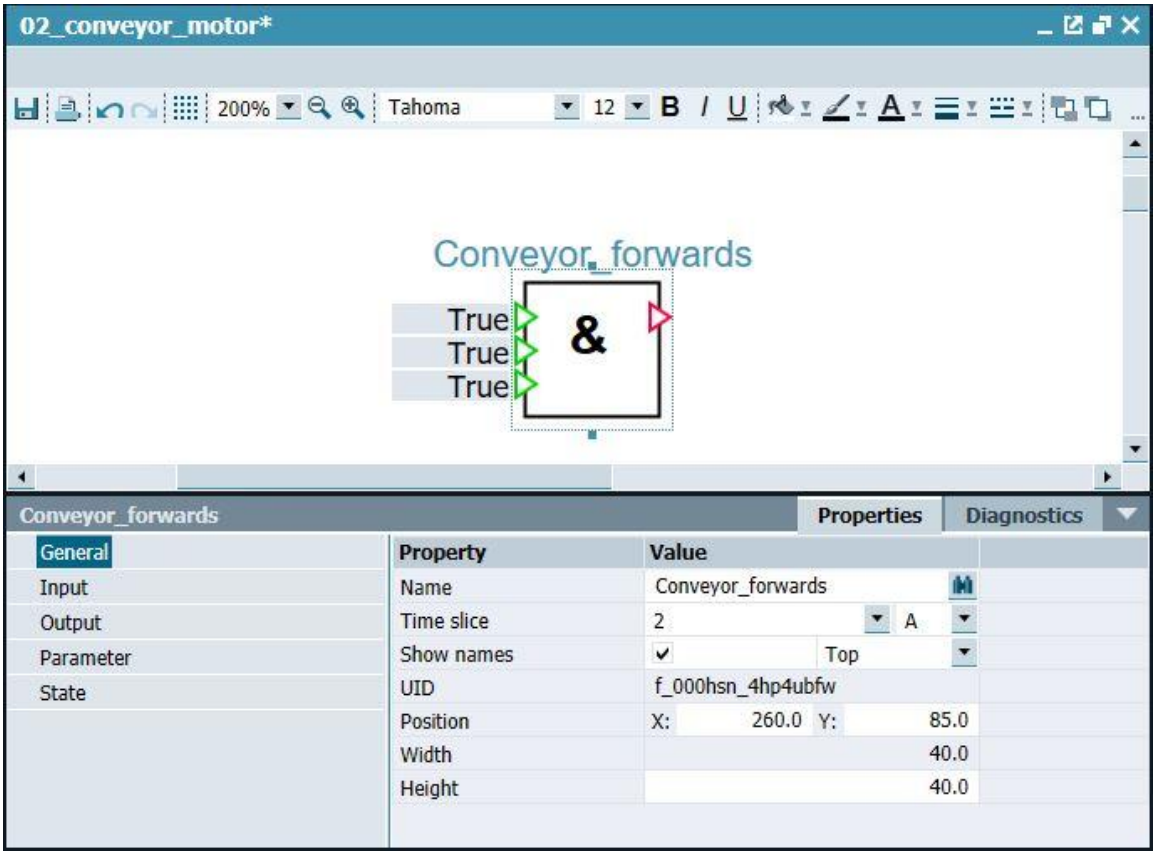
→ The "AND" has two inputs by default. Further inputs are available when you zoom in on the component.



Note:

– *The number of inputs can be set to a value between 2 and 32. All inputs are preset with 1.*

→ Change the "Name" to "Conveyor_forwards" in the "Properties" under "General" and select the "Show names" check box "☑". (→ Properties → General → Name: Conveyor_forwards → Show names ☑)



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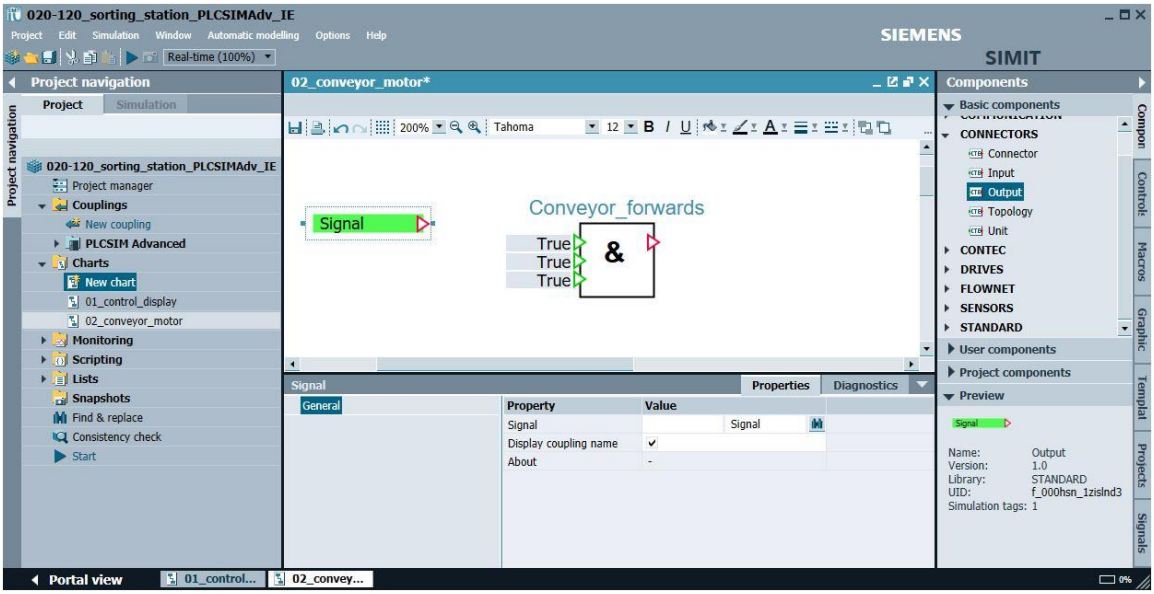
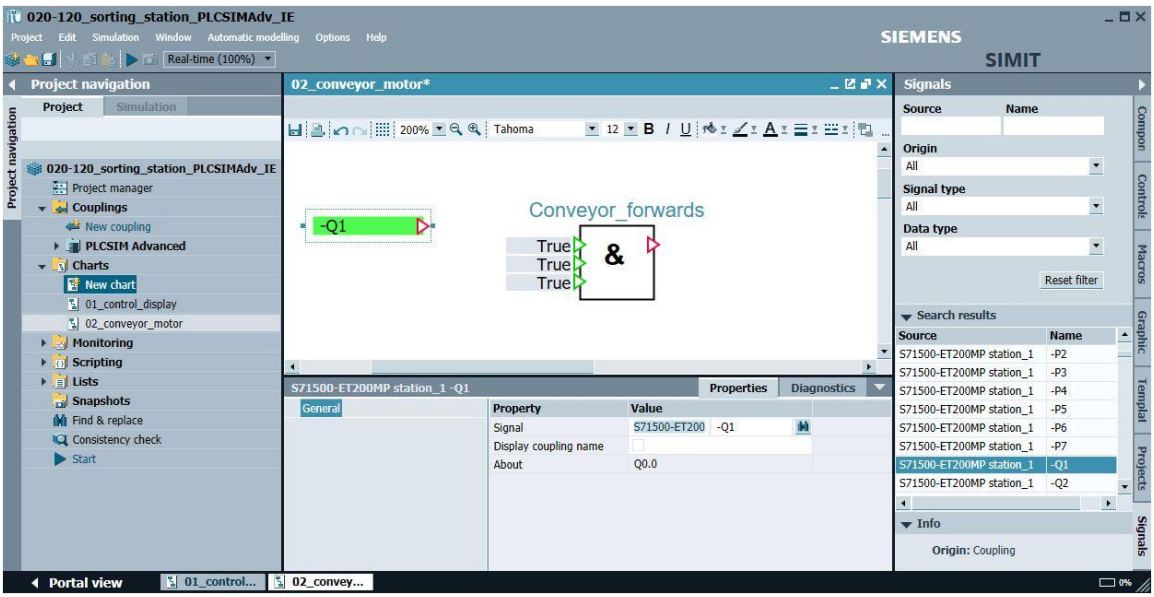
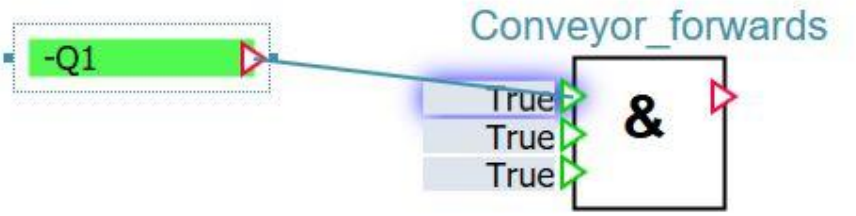
→ First, the input of the "Conveyor_forwards" component is to be connected to an output signal of the PLC. Drag the → "Output" component, located under → "CONNECTORS", to the "02_conveyor_motor" chart in front of the "AND". (→ Components → Basic components → CONNECTORS → Output)



→ In the "Signals" task card, you can search for the signals in the open project and have them displayed. Open → "Properties" → "General" of the "Output" component. Drag the → "-Q1" signal there to "Signal". (→ Properties → General → Signals → -Q1 → Signal)

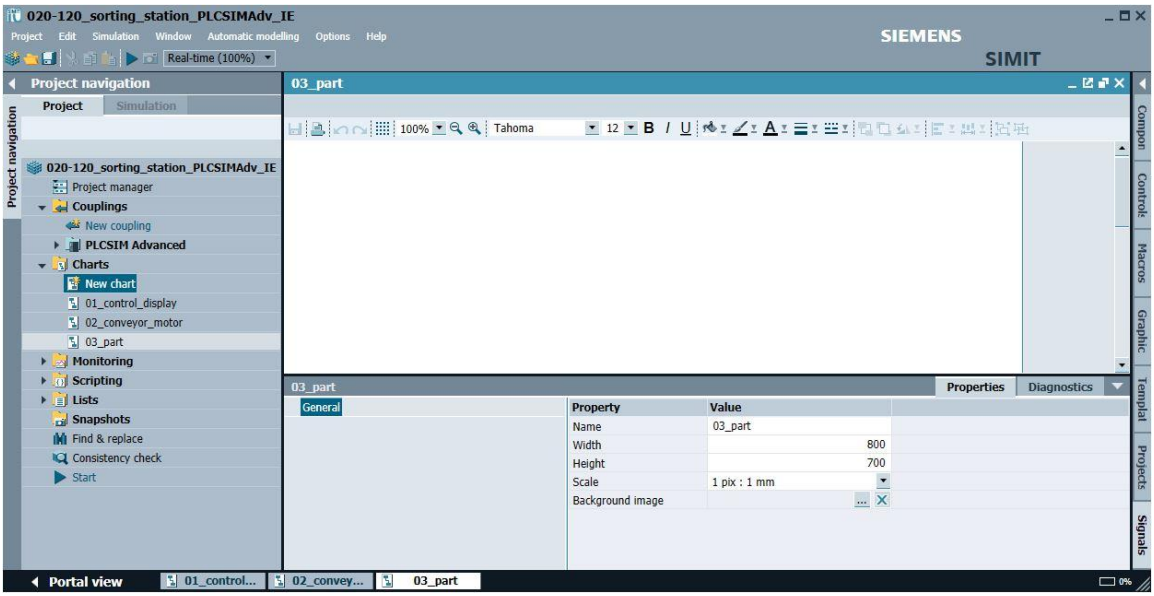


→ Now, establish the connection of the "Output" component with the "-Q1" signal from the PLC to the "AND" component ("Conveyor_forwards"). This happens by first clicking the input symbol at the top → ▷ of the "AND" component ("Conveyor_forwards") and then clicking the output symbol → ▷ of "Output" (-Q1). The connection is automatically closed. (→ ▷ Conveyor_forwards → -Q1 ▷)

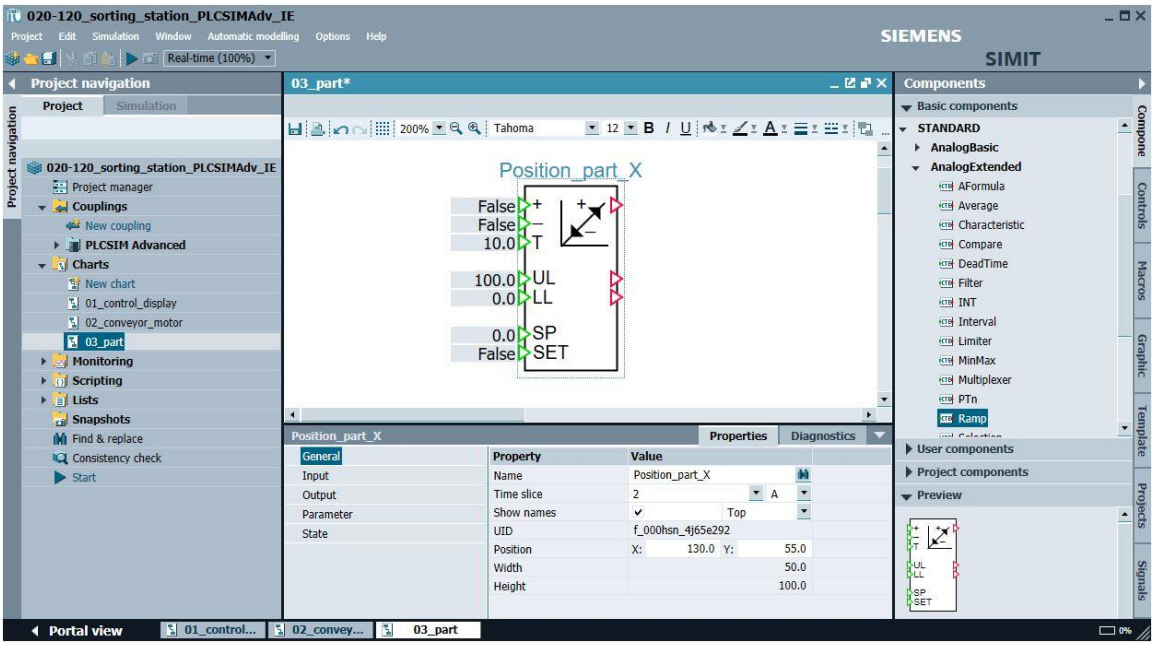


7.4 Creating the "03_part" chart with simulation logic

→ Create another chart named "03_part" with the format shown here. (→ New chart → Name: 03_part → Width: 800 → Height: 700)



→ The → "Ramp" component from the "Basic components" under → "STANDARD" → "AnalogExtended" is suitable for simulating the position of the part in the X-axis direction. Drag this component to the "03_part" chart. Change the "Name" to "Position_part_X" in the "Properties" under "General" and select the "Show names" check box "☑". (→ Components → Basic components → STANDARD → AnalogExtended → Ramp → Properties → General → Name: Position_part_X → Shown names ☑)



Note:

- *Additional information on the "Ramp" component is available in the online help and the manual.*

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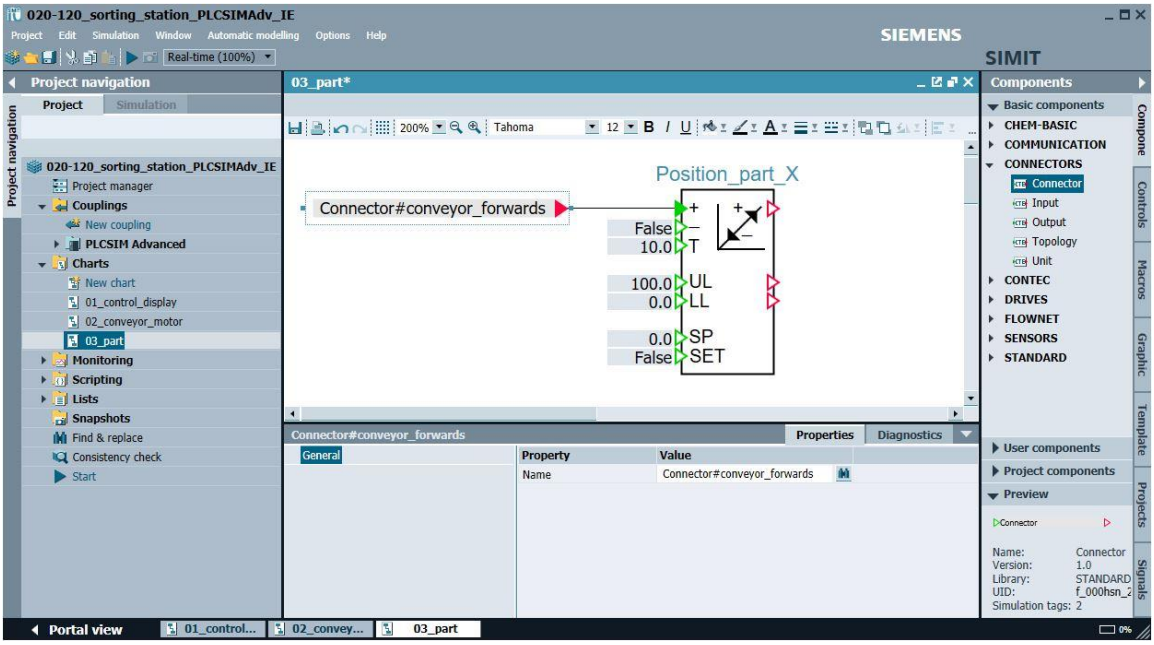
→ To configure a connection between two charts, the → "Connector" component from the "Basic components" under → "CONNECTORS" can be used. Drag a "Connector" to the "03_part" chart in front of the "Ramp" component ("Position_part_X") and change the "Name" to "Connector#conveyor_forwards" in the "Properties" under "General". Establish a connection of the "Ramp" component ("Position_part_X") to the "Connector#conveyor_forwards".

The connection to an input turns the connector into an input connector. (→ Components → Basic components → CONNECTORS → Connector → Properties → General → Name: Connector#conveyor_forwards → ▷ Position_part_X → Connector#conveyor_forwards ▷)



Note:

– *Additional information on the "Connector" component is available in the online help and the manual.*

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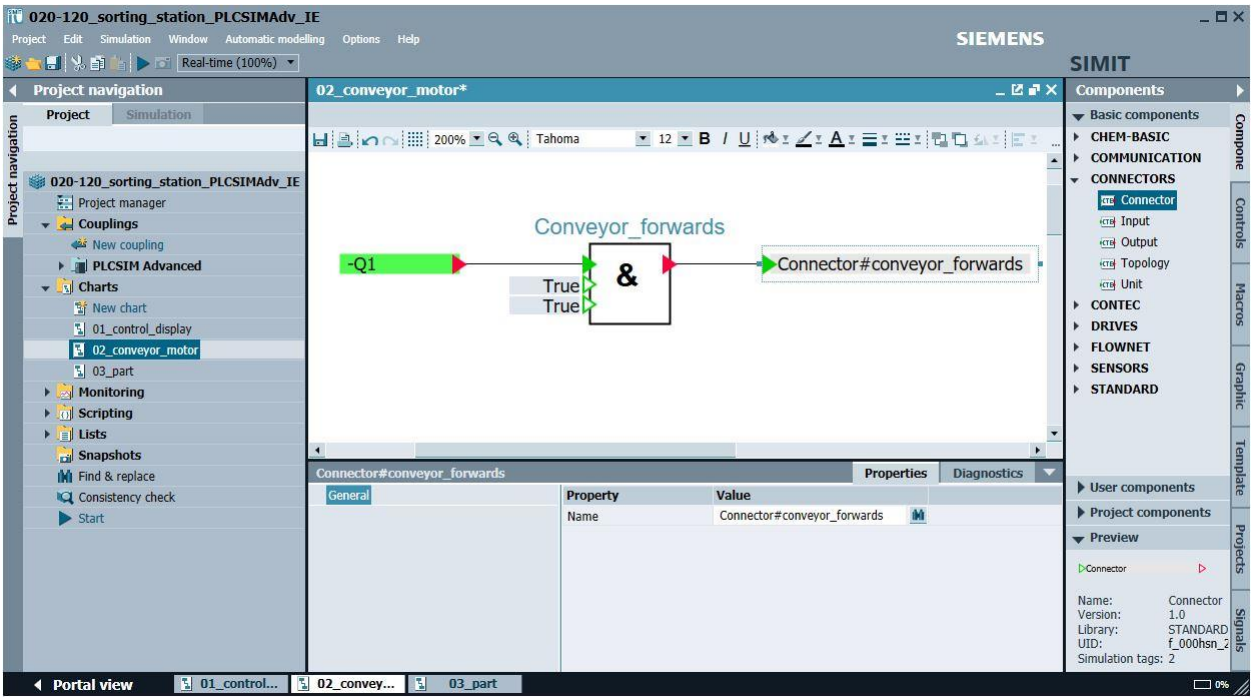
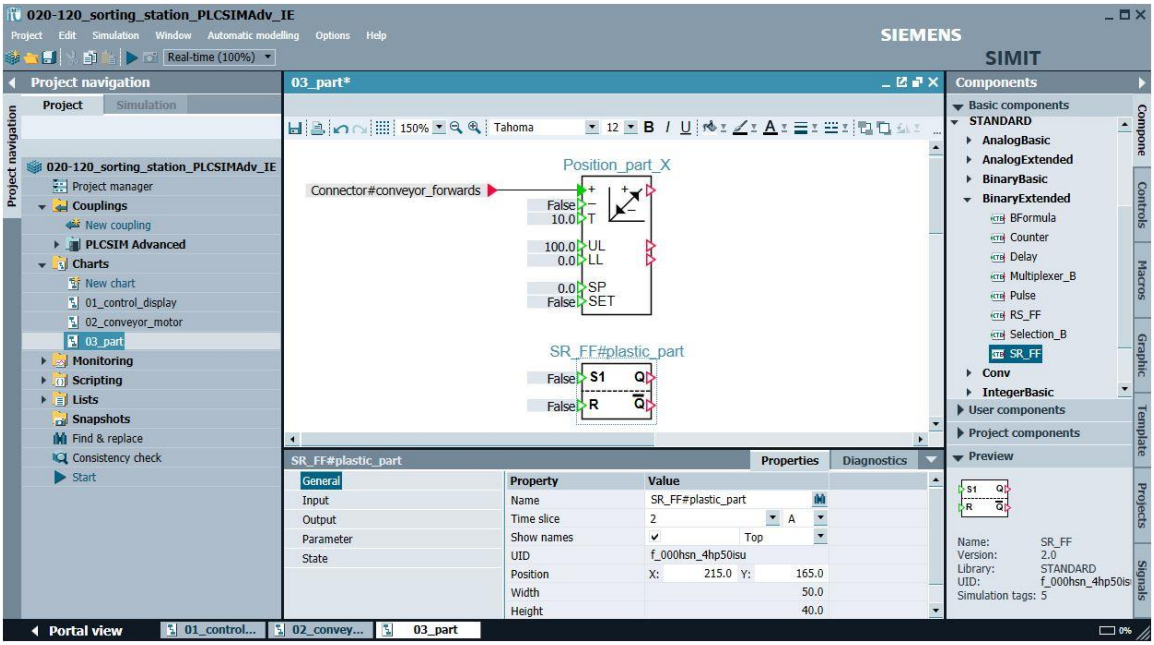
→ Also drag a "Connector" to the "02_conveyor_motor" chart behind the "AND" component ("Conveyor_forwards") and change the "Name" to "Connector#conveyor_forwards" in the "Properties" under "General". Establish a connection of the "AND" component ("Conveyor_forwards") to the "Connector#conveyor_forwards". The connection to an output turns the connector into an output connector. By assigning it the identical name, the connection to the previously created input connector in the "03_part" chart is made automatically. (→ Components → Basic components → CONNECTORS → Connector → Properties → General → Name: Connector#conveyor_forwards → ▷ Connector#conveyor_forwards → Conveyor_forwards ▷)



→ Now drag the → "SR_FF" component from the "Basic components" under → "STANDARD" → "BinaryExtended" to the "03_part" chart below the "Ramp" component ("Position_part_X"). The purpose of the SR_FF state display is to indicate whether a plastic part is present. Change the "Name" to "SR_FF#plastic_part" in the "Properties" under "General" and select the "Show names" check box "☑". Now, save the project by clicking "Save all". (→ Components → Basic components → STANDARD → BinaryExtended → SR_FF → Properties → General → Name: SR_FF#plastic_part → Show names ☑ →)



Note:

– *Additional information on the "SR_FF" component is available in the online help and the manual.*

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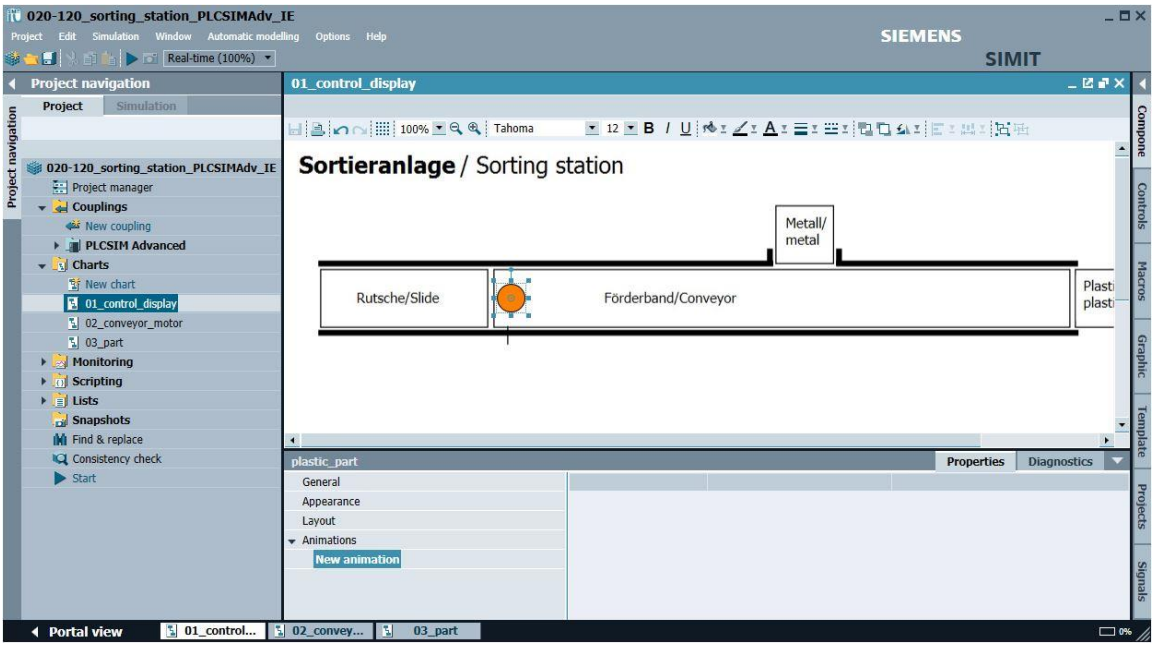
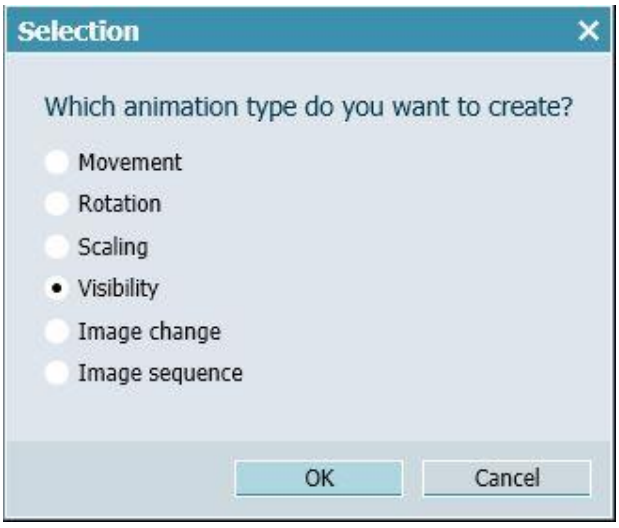
7.5 Creating animations in the "01_control_display" chart with reference to the simulation logic

→ In order to now animate the display of the plastic part, select it in the "01_control_display" chart. Select the "New animation" item in the "Properties" under "General". (→ plastic part → Properties → Animation → Neue animation)



→ Select the animation type "Visibility". (→ Visibility → OK)



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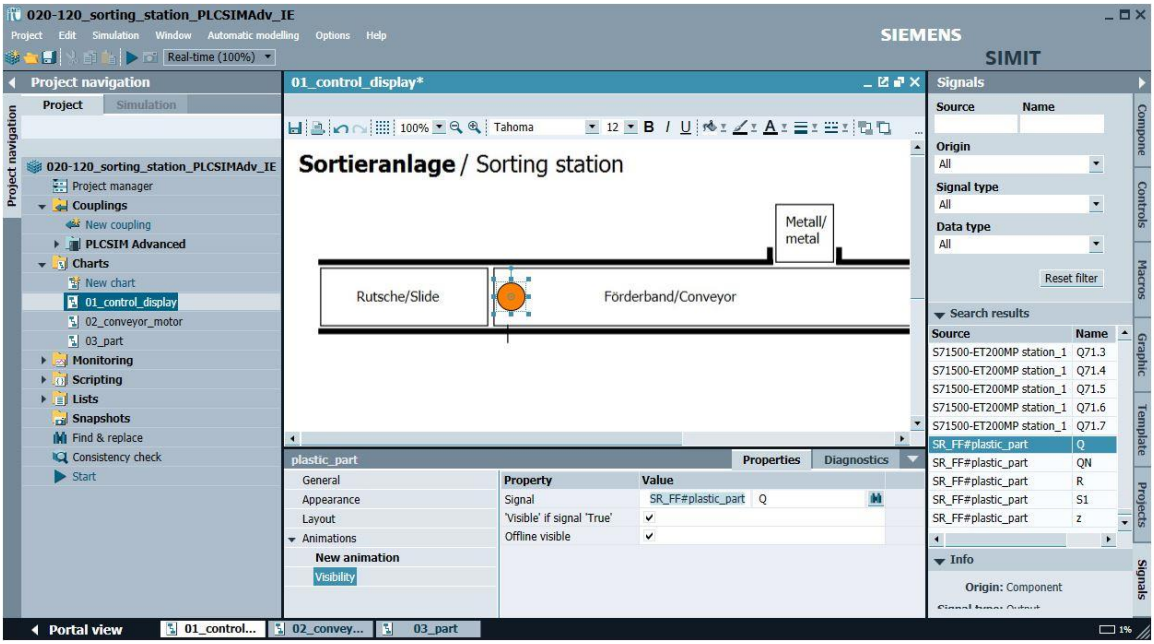
→ "Visibility" now appears as an additional item under Animation. Here, drag the → "Q" signal of the "SR_FF#plastic_part" source from the "Signals" task card to the "Signal" property. (→ Signals → SR_FF#plastic_part → Q → Signal)



Note:

– *The "SR_FF#plastic_part.Q" signal only becomes visible in the "01_control_display" chart when the "03_part" chart containing the "SR_FF#plastic_part" source has been saved.*

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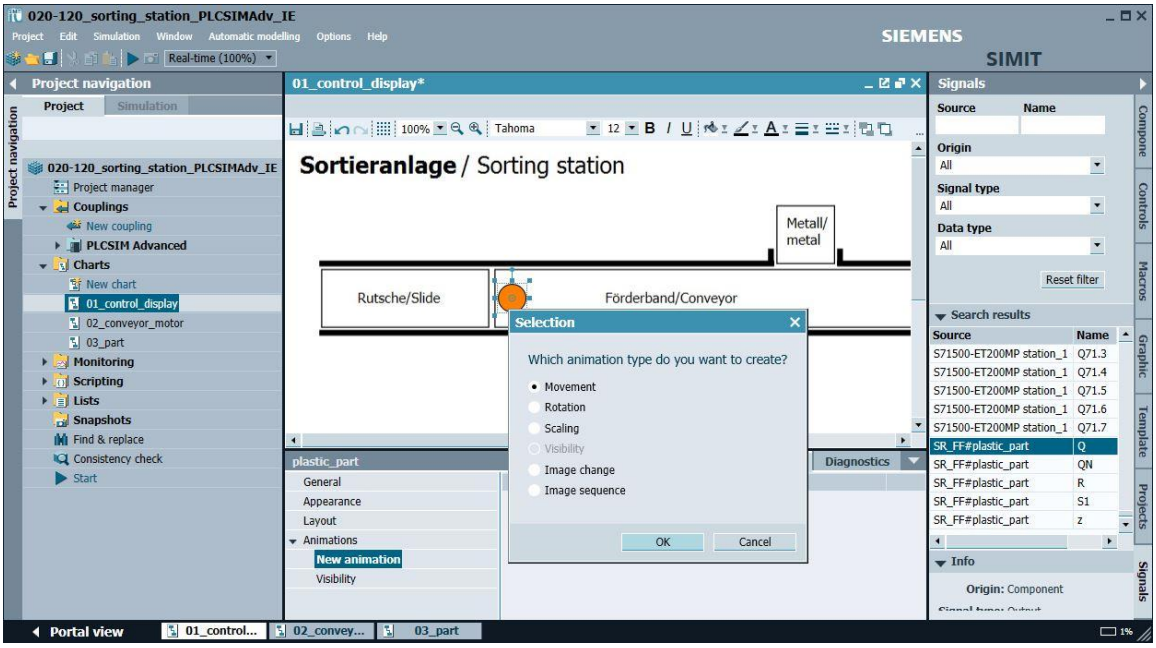
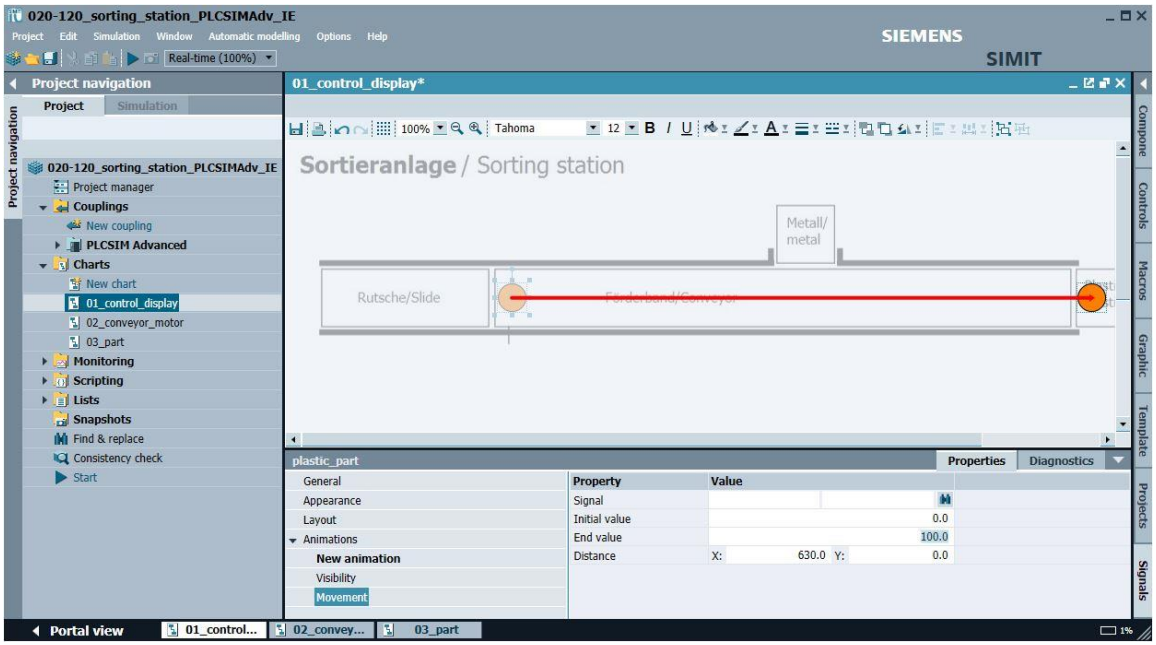
→ In order to now animate the movement of the plastic part, click on "New animation" again. Select the animation type "Movement". (→ plastic part → Properties → Animation → Neue animation → Movement → OK)



→ "Movement" now appears as an additional item under Animation. In the "01_control_display" chart, you can now specify the destination position with a mouse-click. This position should be directly after the end of the conveyor. Alternatively, the coordinates of the destination position can be entered. (→ X: 630.0 → Y: 0.0)



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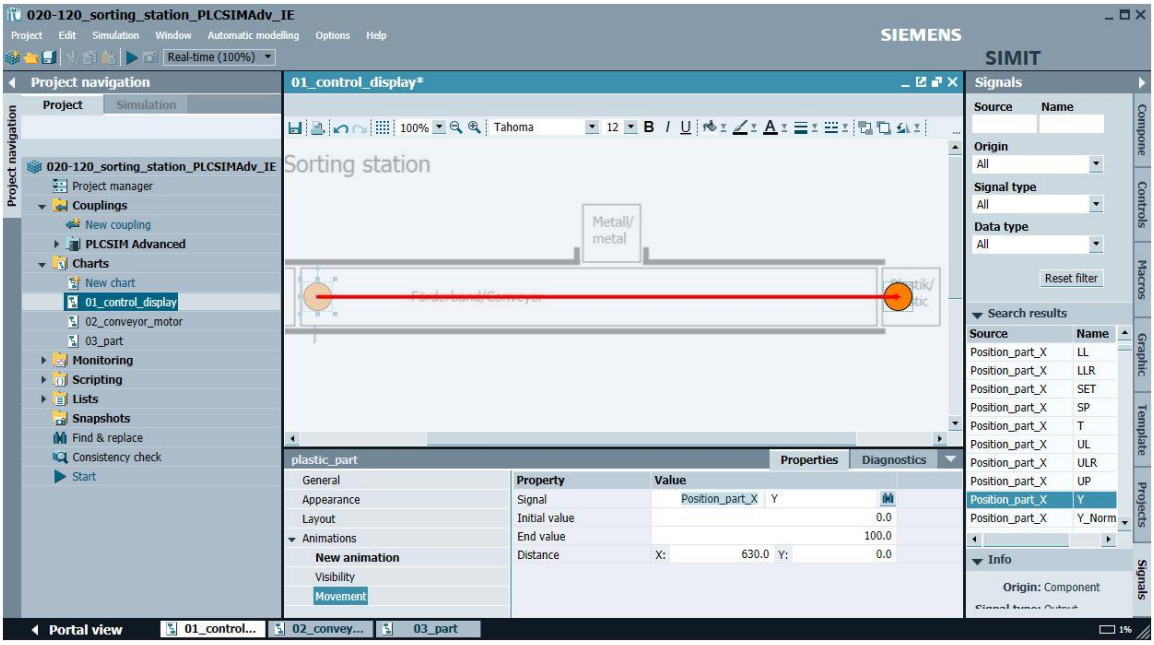
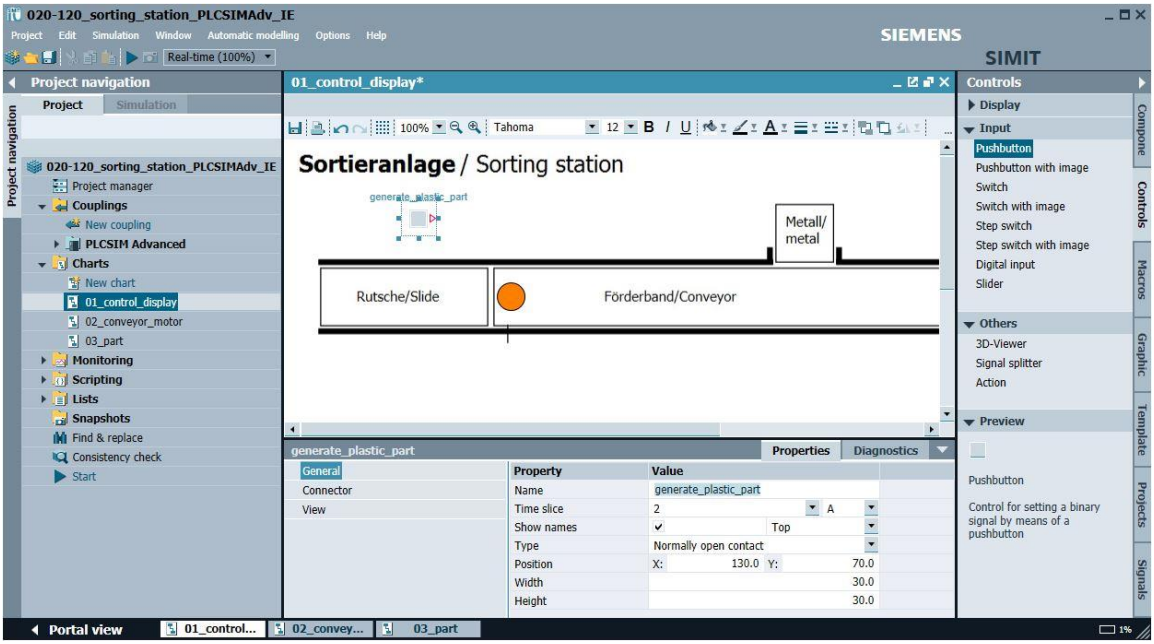
→ The movement must then still be linked with the output signal of the "Ramp" component ("Position_part_X"). Here, drag the → "Y" signal of the "Position_part_X" source from the "Signals" task card to the "Signal" property. (→ Signals → Position_part_X → Y → Signal)



→ For a part to be placed on the conveyor, drag a "Pushbutton" into the "01_control_display" chart, as shown here. You will find operator controls such as "Pushbutton" in the → "Controls" under → "Input". Change the "Name" to "generate_plastic_part" in the "Properties" under "General",and select the "Show names" check box "☑". (→ Controls → Input → Pushbutton → Properties → General → Name: generate_plastic_part → Show names ☑)



Note:

– *Additional information on the "Pushbutton" component is available in the online help and the manual.*

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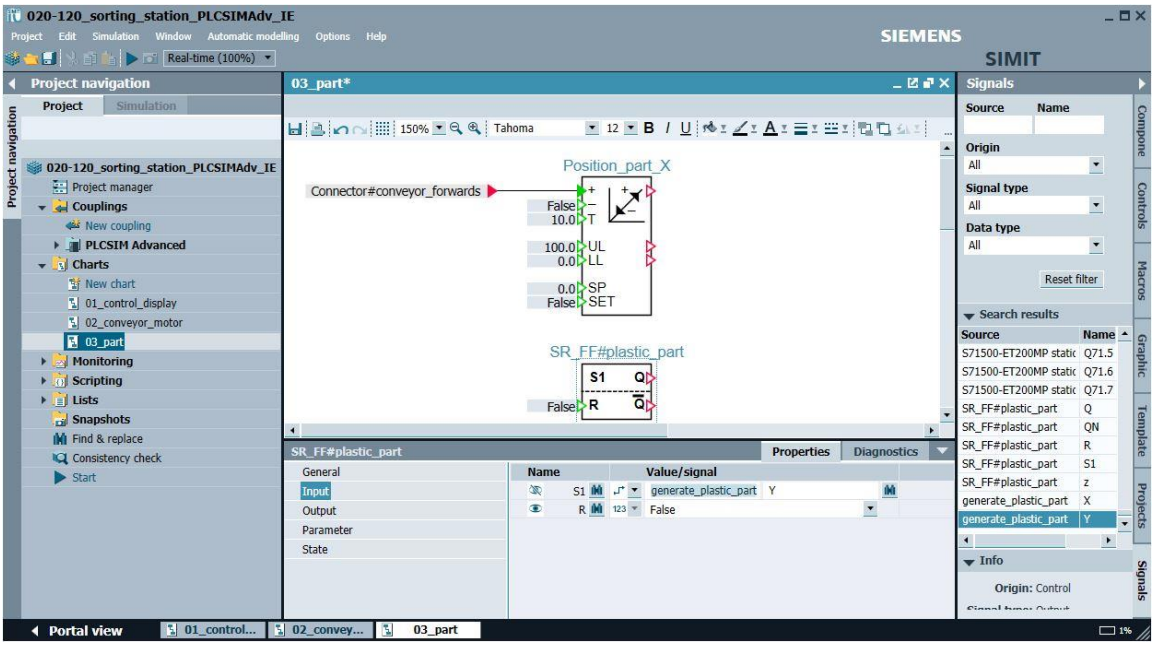
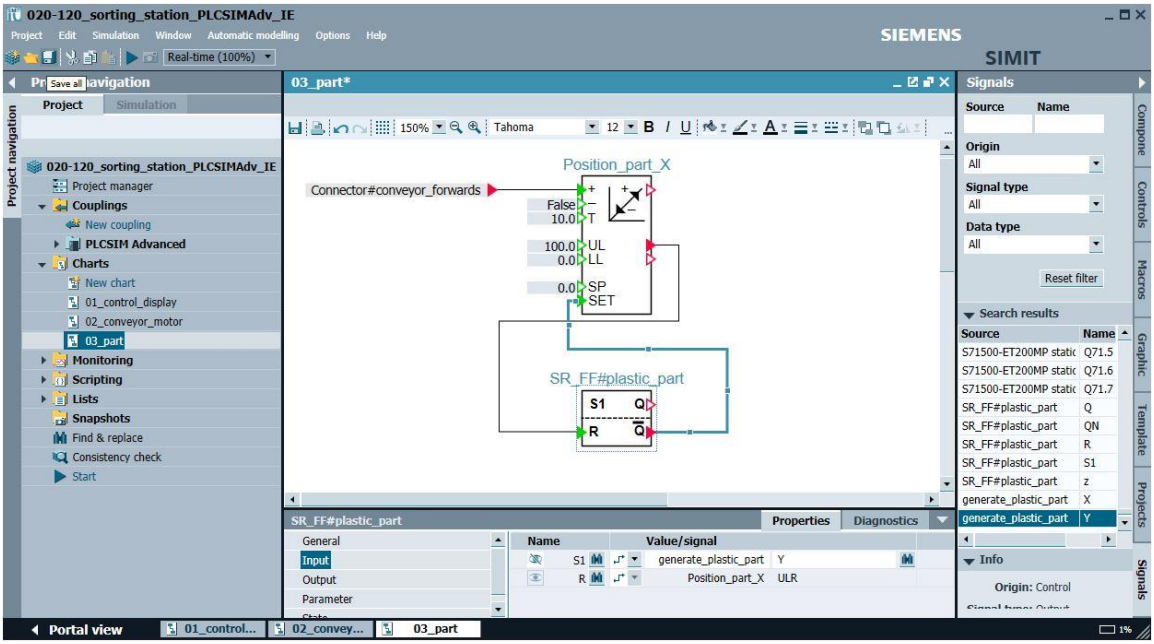
→ You link the "generate_plastic_part" pushbutton with the "SR_FF#plastic_part" component in the "03_part" chart. Select the "Input" "S1" in the "Properties" of "SR_FF#plastic_part" and make it invisible by clicking on "". Then, select the interconnection option "" for "Value/Signal" and drag the → "Y" signal of the "generate_plastic_part" source from the "Signals" task card to here. (→ 03_part → SR_FF#plastic_part → Properties → Input → S1 → → → Signals → generate_plastic_part → Y → Value/Signal)



Note:

– *A link to an input of a component can only be made after the input has been made invisible by clicking on "".*

→ Now make the local interconnections shown here in the "03_plastic_part" chart. Then click "Save all" . (→ "Save all")



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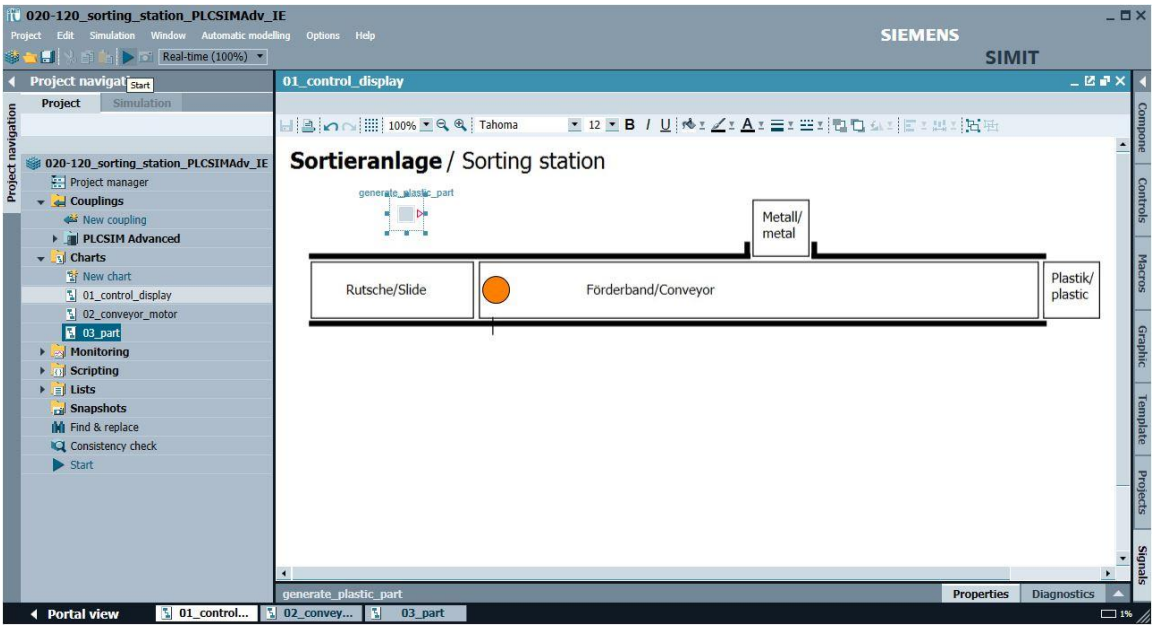
7.6 Testing the SIMIT application within SIMIT

→ Select "▶" to start the simulation. (→ ▶)



Note:

- *When the simulation is started, PLCSIM Advanced is also automatically activated in the background. This allows you to test the access to the inputs and outputs of the S7-1500 station in SIMIT. Clicking on "■" stops the simulation in SIMIT again. (→■)*

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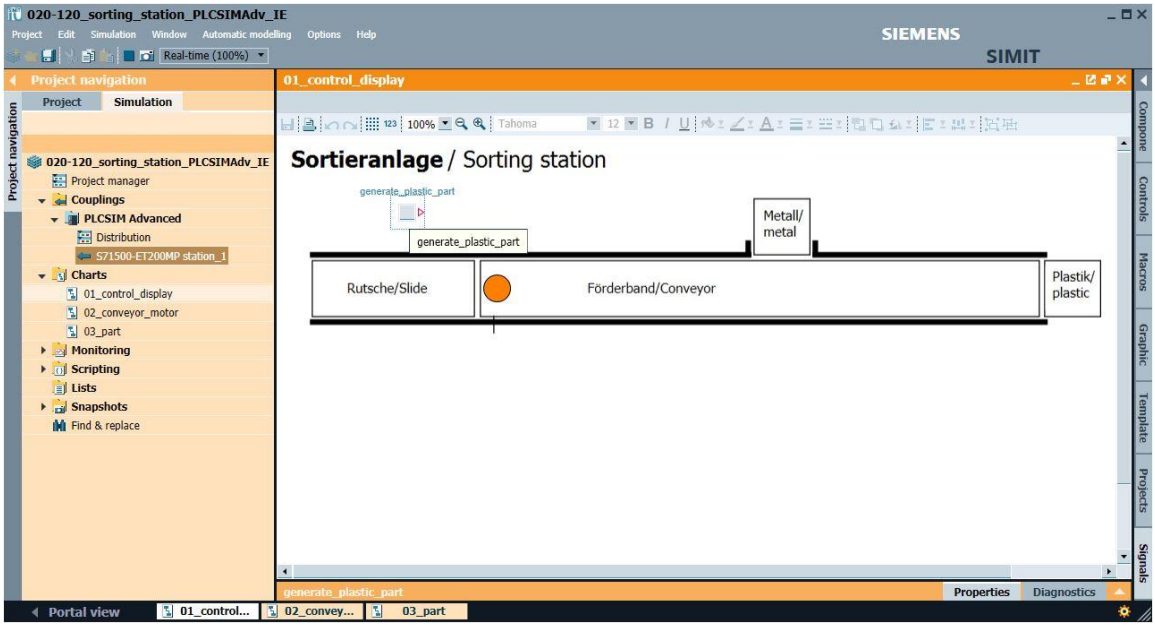
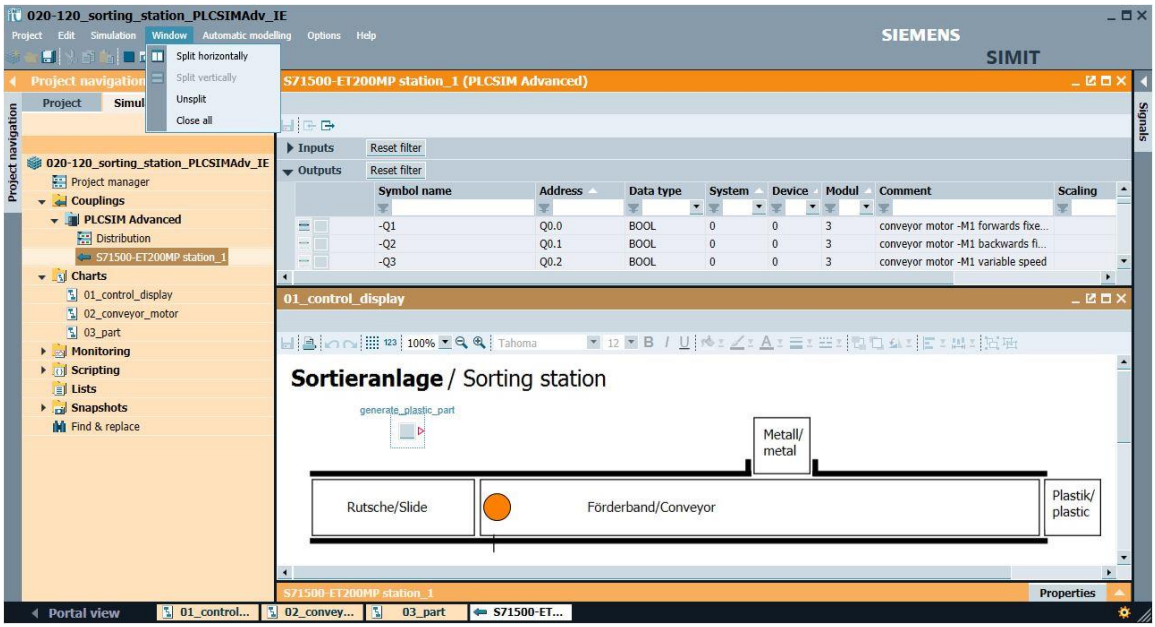
→ The simulation is now activated. The application turns orange to indicate this. To set the "-Q1" output within SIMIT, open the "PLCSIM Advanced" coupling by clicking the station contained in it. (→ Couplings → PLCSIM Advanced → S71500-ET200MP station_1)



→ Split the window vertically so that you can see the "01_control_display" chart and the coupling at the same time. Now, open the "Outputs" within the PLCSIM Advanced coupling. (→ Window → Split vertically → Outputs)



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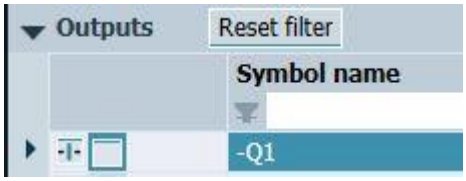
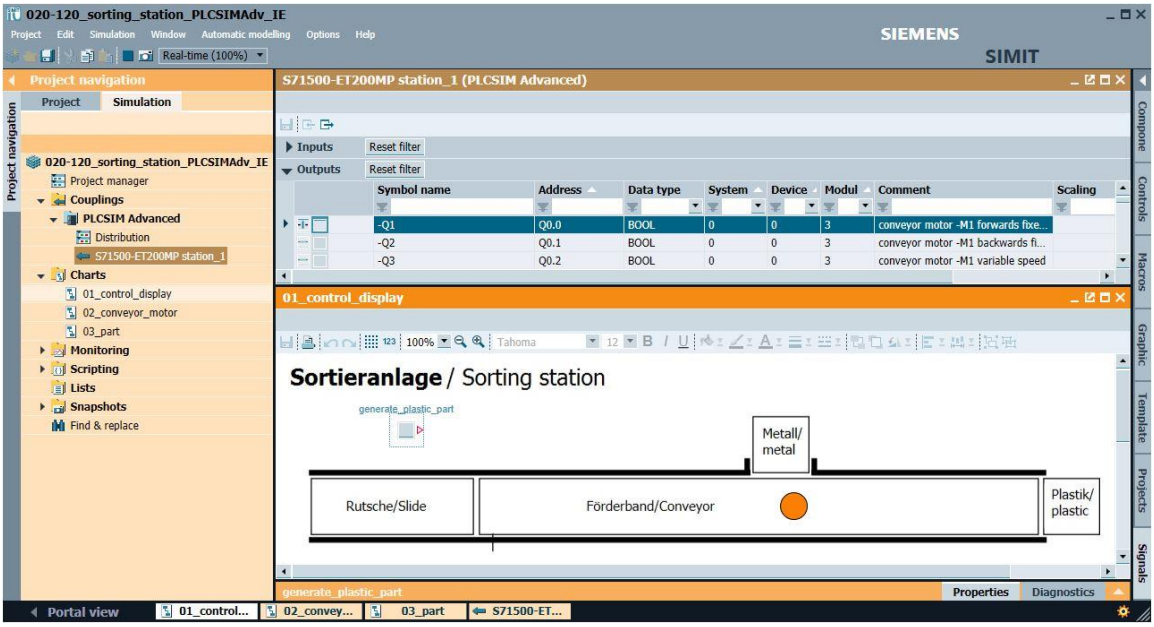
→ In order to directly control the "-Q1" output in SIMIT, you must enable the output for controlling by clicking on " ". You can then switch "-Q1" on and off with the " " button. (→ Outputs → -Q1 → →)



→ The application can now be tested. A part is placed on the starting end of the conveyor by clicking on "generate_plastic_part". If conveyor motor –M1 is switched on with "-Q1" (forwards), the part moves to the right at constant speed and disappears again after exiting the conveyor. By clicking on " ", the simulation in SIMIT can be stopped again. But, don't stop the simulation yet. Rather, leave it running for the next test with the PLC program.



Note:

– *When the simulation in SIMIT is stopped, the instance in PLCSIM Advance is also deleted. This means that it is no longer possible to work "online" from the TIA Portal.*

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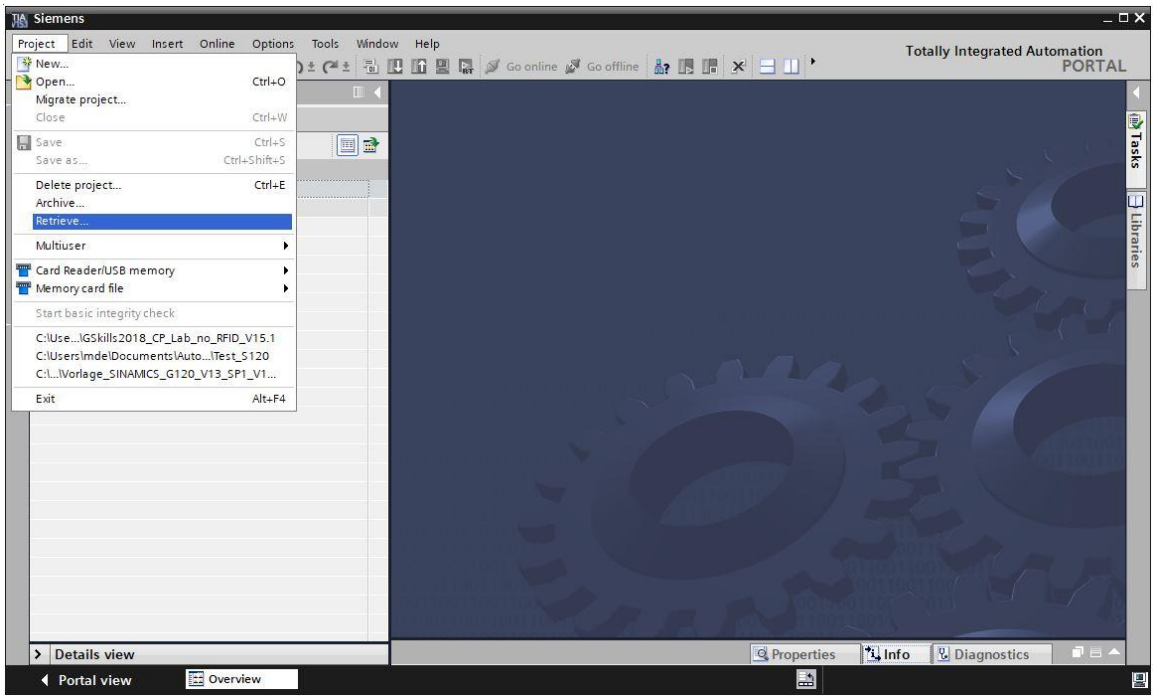
7.7 Testing the SIMIT application with PLC program

→ Now, start the "TIA Portal" from the desktop of your computer by double-clicking on the logo for the application. (→ TIA Portal)

→ Change to the Project view and retrieve the desired TIA Portal project there. The first test project for the sorting station project "S020-120-sorting_station_plcsimadv-ie-test01…" is retrieved and opened here. (→ Project view → Project → Retrieve → select a *.zap15_1 archive → 020-120_sorting_station_plcsimadv-ie-test01…zap15_1 → Open)



→ The next step is to select the destination folder where the retrieved project will be stored. Confirm your selection with "OK". (→ Target directory → OK)

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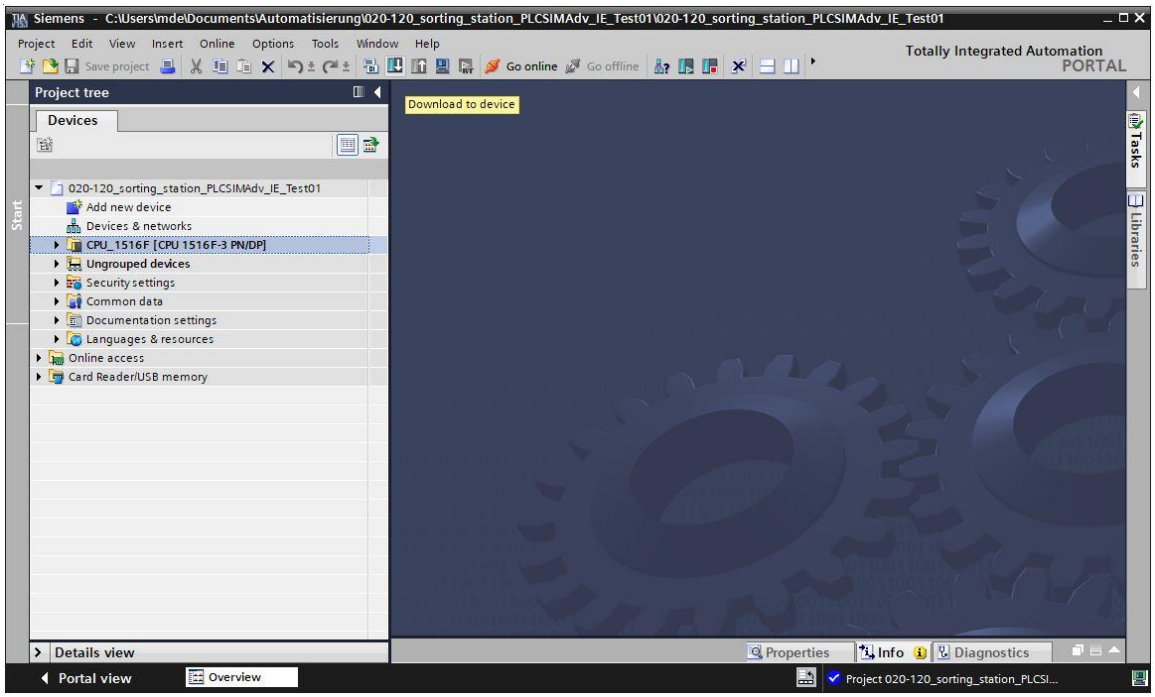
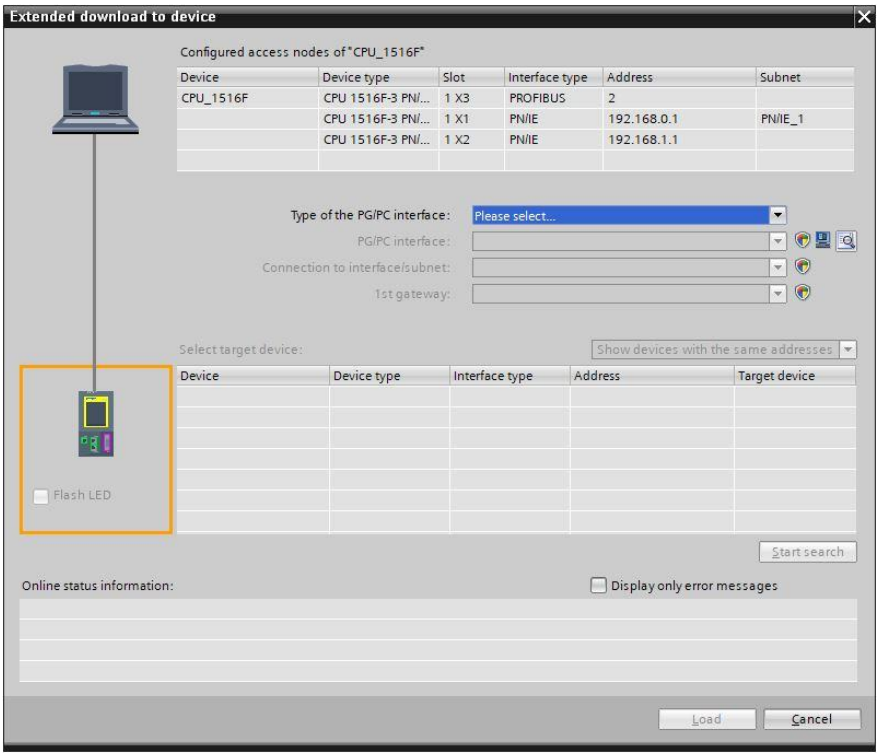
→ To download your entire CPU, select the → "CPU_1516F [CPU1516F-3 PN/DP]" folder and click the symbol → "Download to device" .



→ The manager for configuring the connection properties (extended download) opens shortly thereafter.



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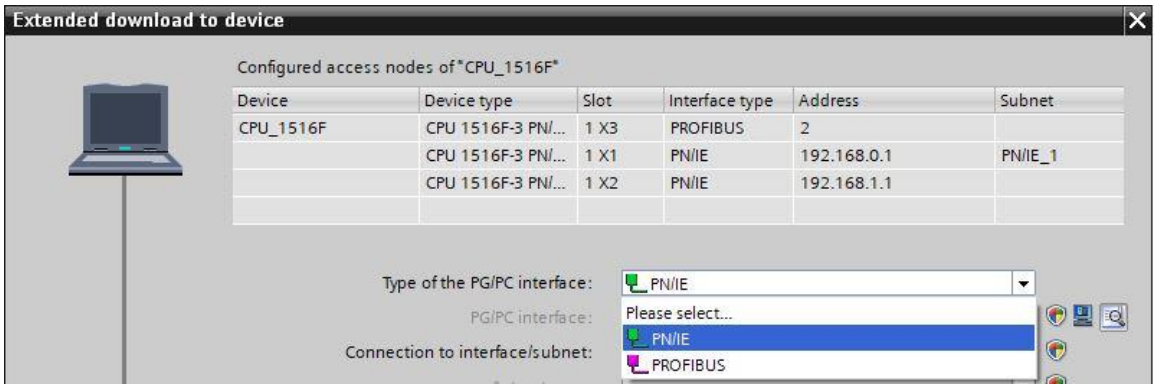
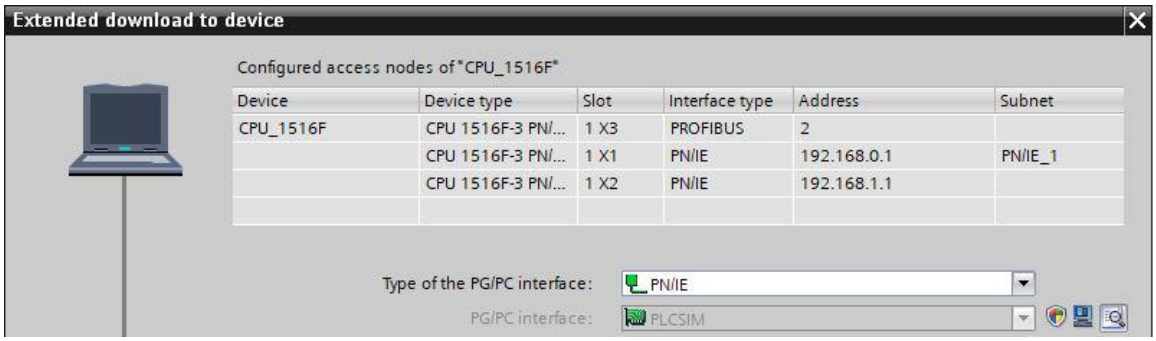
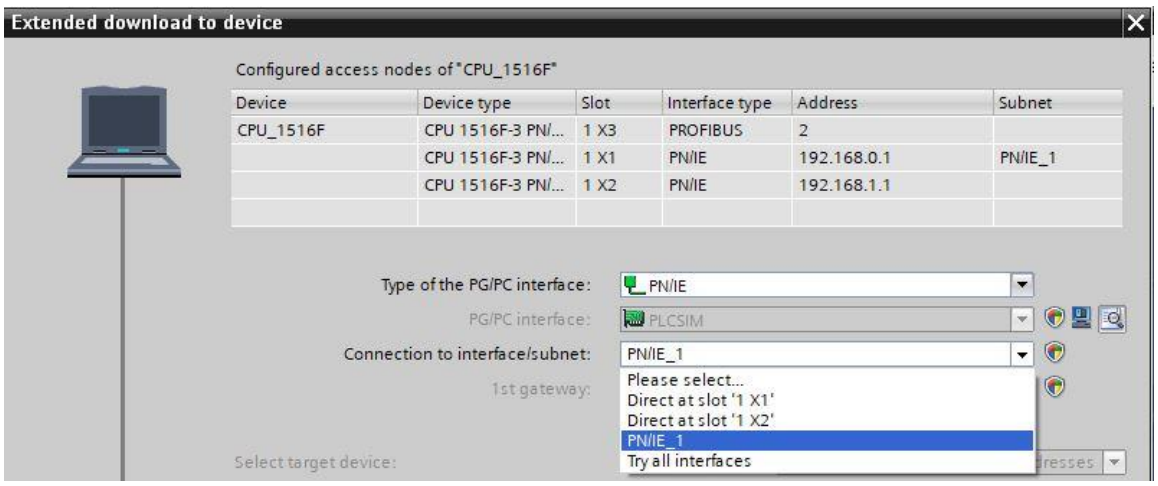
→ First, the interface must be correctly selected. This happens in three steps. → Type of the PG/PC interface → PN/IE



→ PG/PC interface → PLCSIM (if PLCSIM Advanced has already been started, this is preset.)



→ Connection to interface/subnet → "PN/IE_1"



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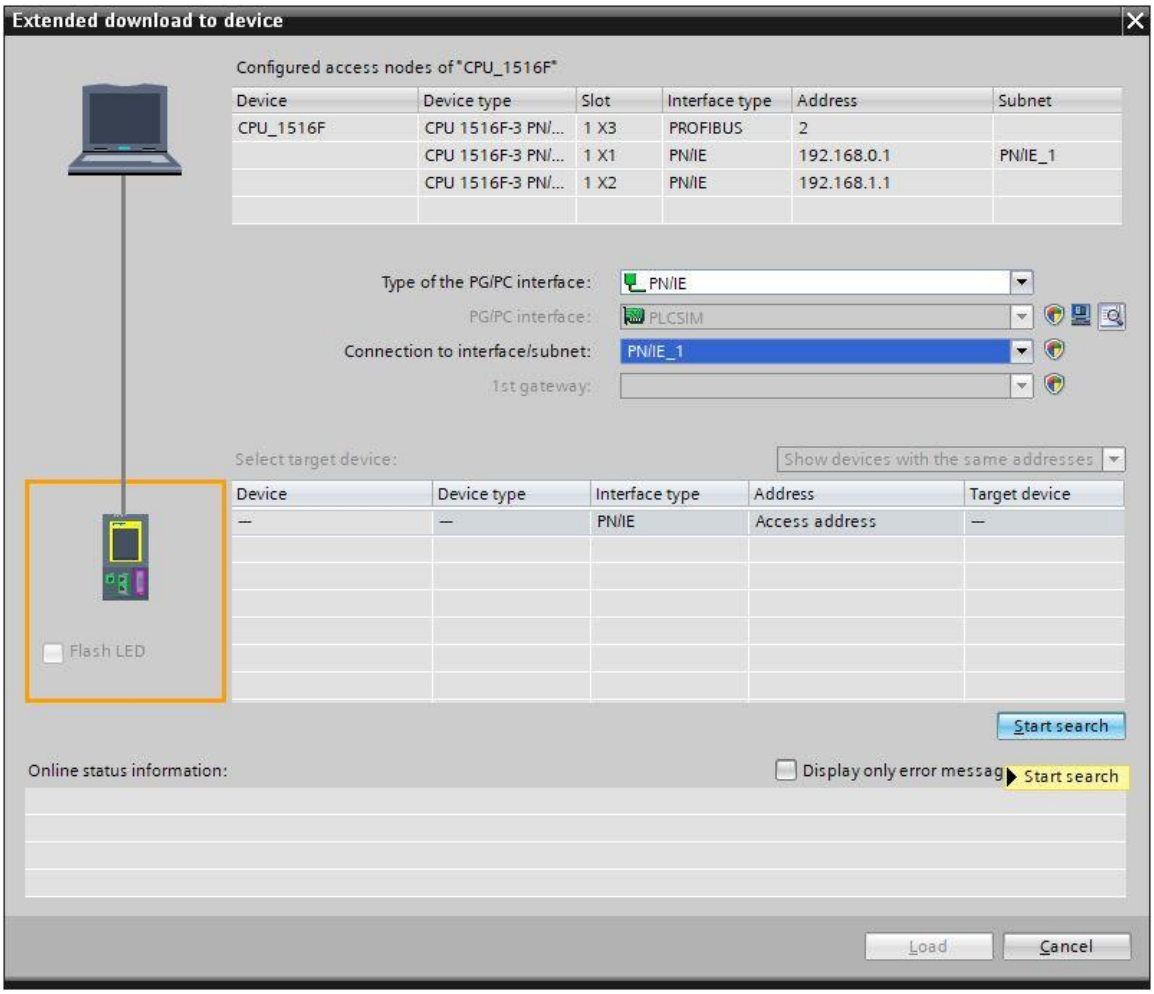
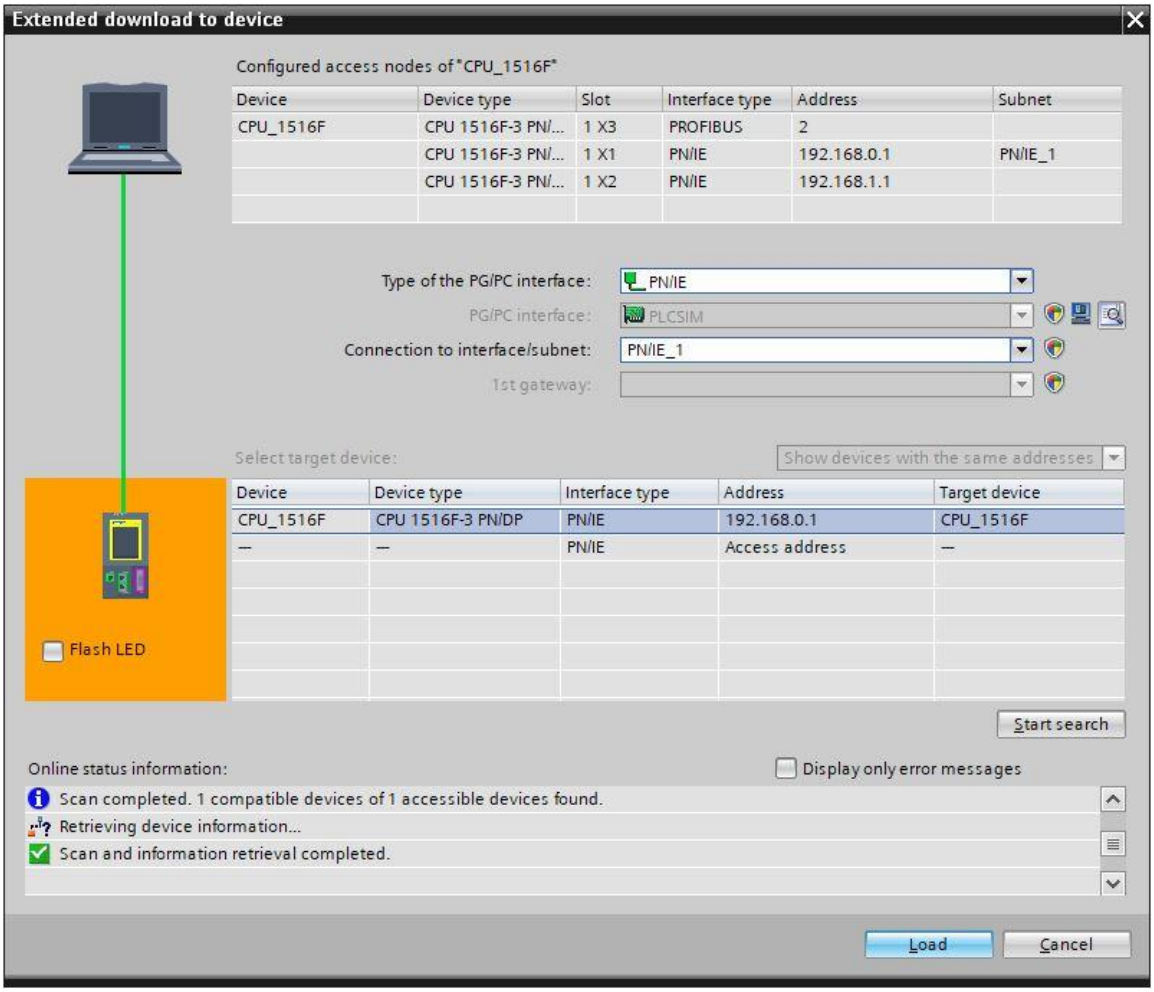
→ The search for target devices must then be started by clicking the → Start search button.



→ If the controller is shown in the list, it must be selected before the download can be started. (→ CPU1516F → Load)



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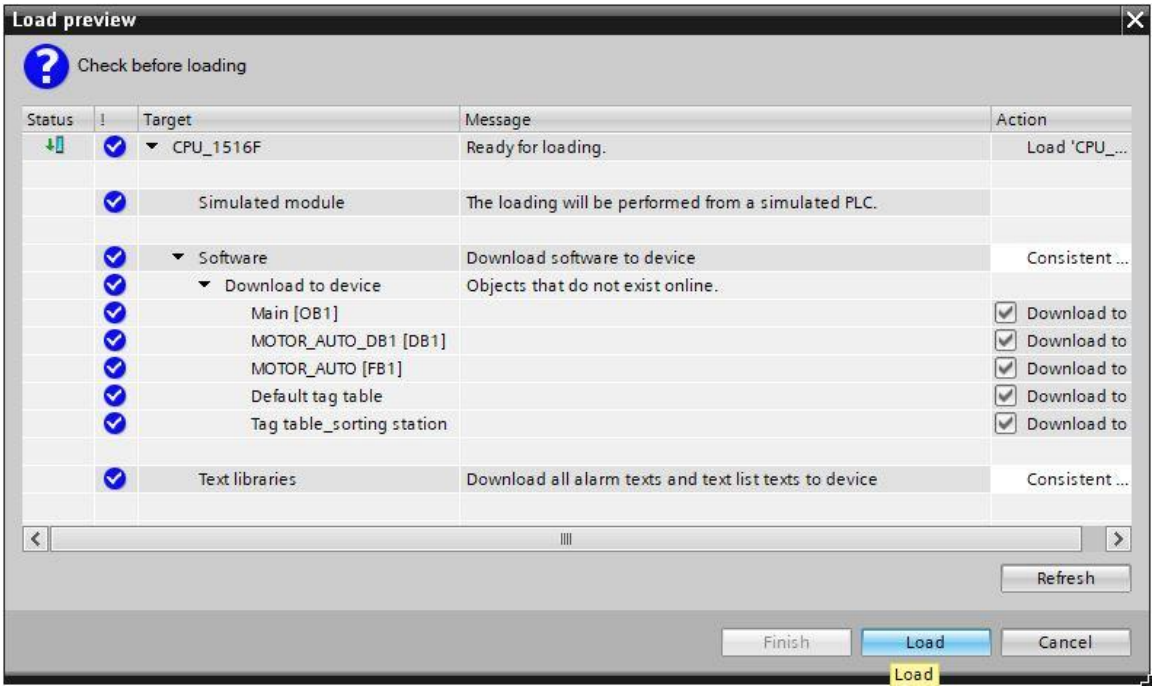
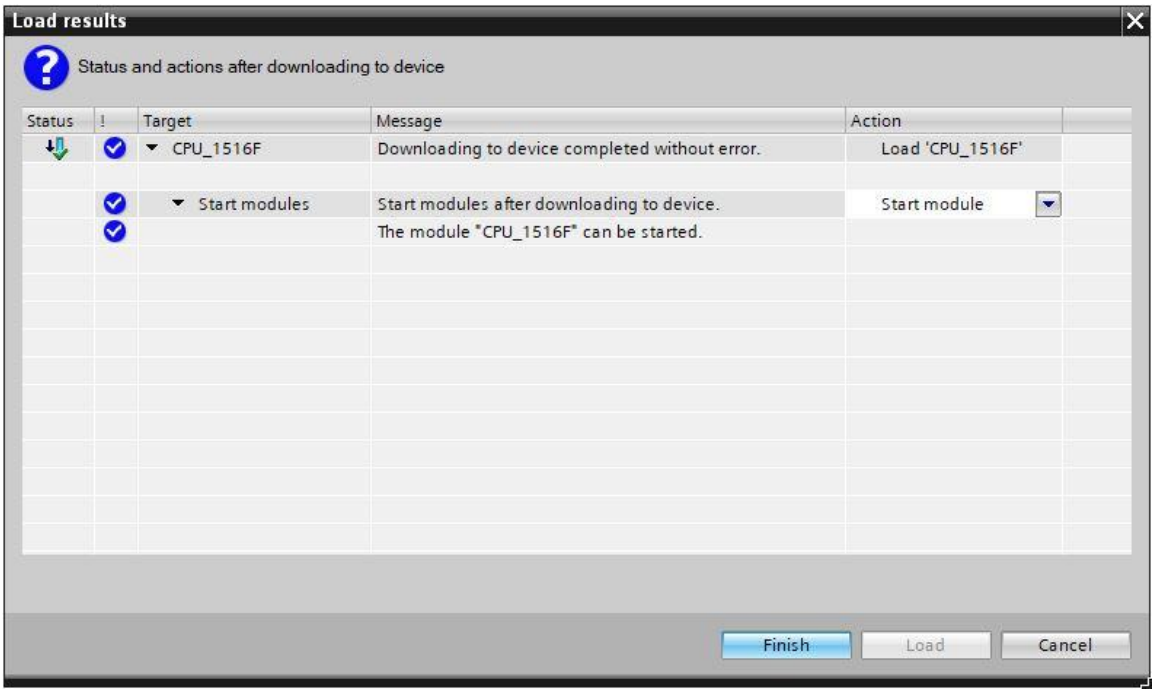
→ You first obtain a preview. Confirm the suggested actions and continue with → "Load".



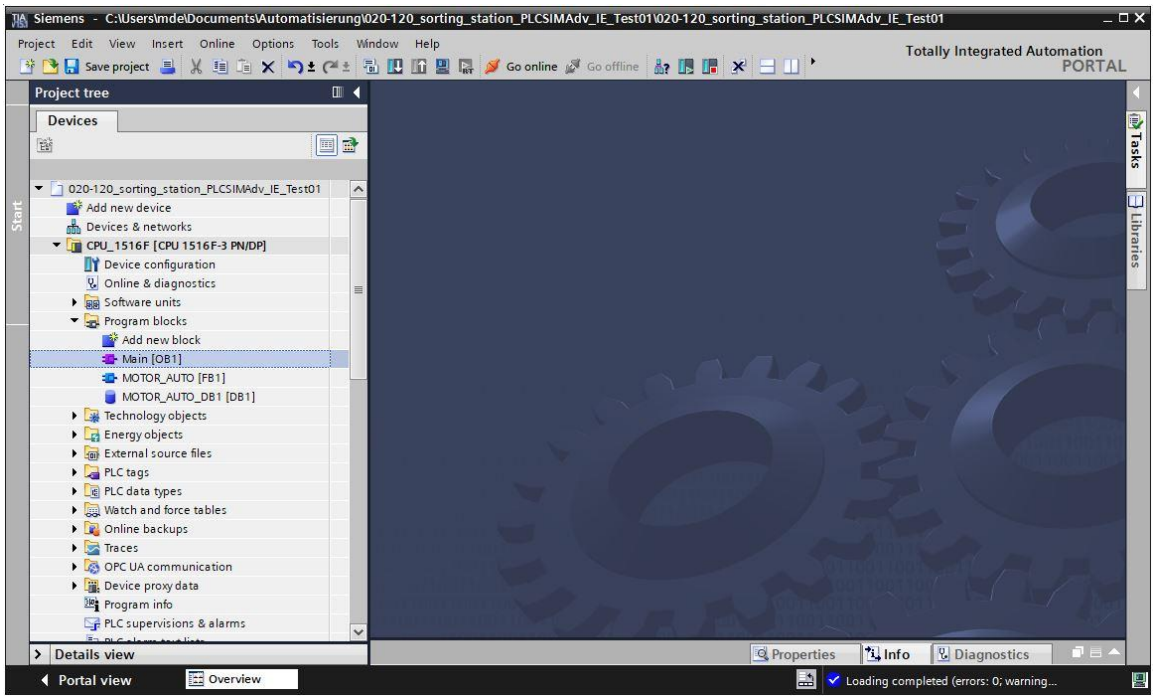
Note:

– *The symbol should be visible in every line of the "Load preview". You can find additional information in the "Message" column.*

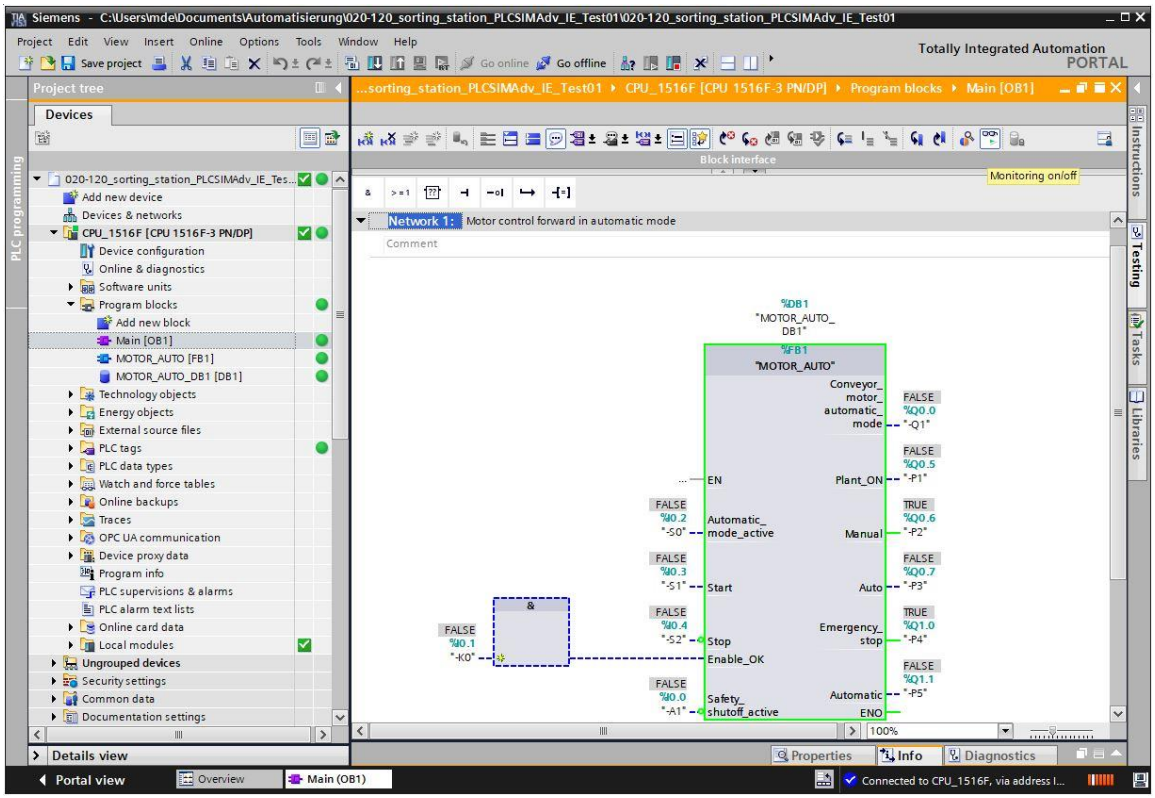
→ The → "Start module" option is now selected before the download operation can be completed with → "Finish".



→ In order to monitor the interfaces of the called blocks, first open the Main[OB1] block. (→ Main [OB1])



→ The signals interconnected here can now be monitored by clicking the "" button for Monitoring on/off. (→)



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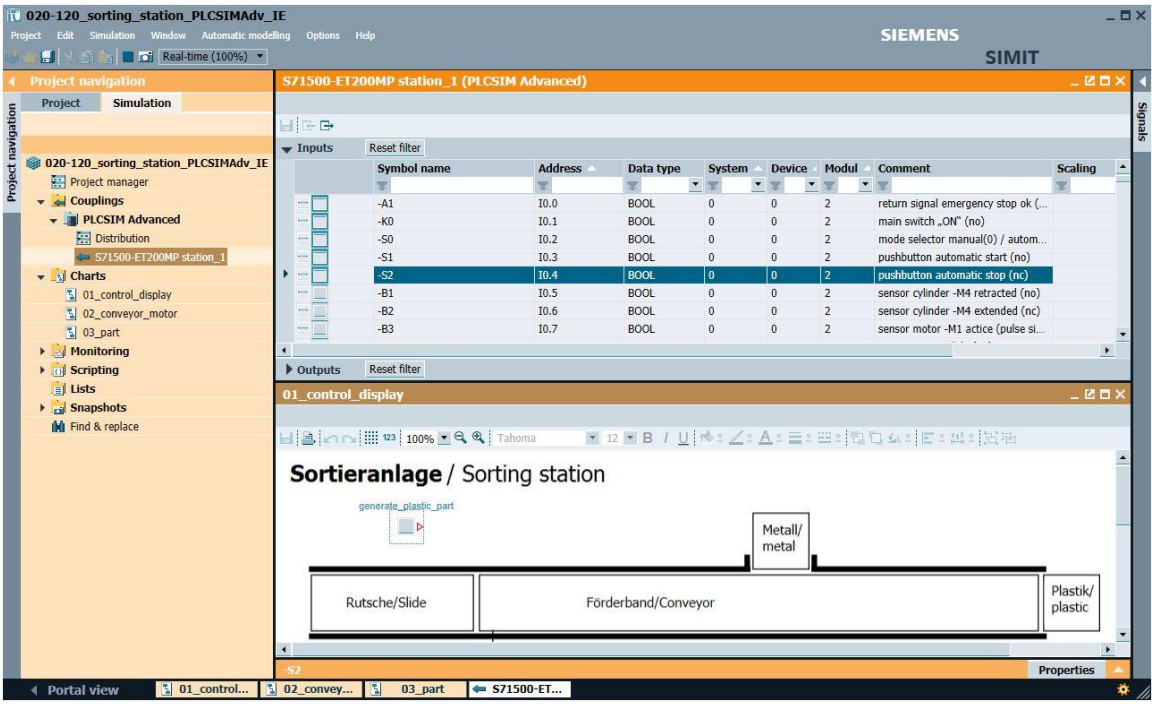
→ Now, change to the still activated SIMIT simulation. Here, the "Inputs" of the simulation can be displayed under "S71500-ET200MP station_1 (PLCSIM Advanced)" and switched on and off by clicking the " " buttons. To switch on the conveyor motor in our program example, the inputs should be switched on in the following order: → -A1 → -KO → -S0 → -S2 → -S1. (→ S71500-ET200MP station_1 (PLCSIM Advanced)→ Inputs → -A1 → -KO → -S0 → -S2 → -S1)



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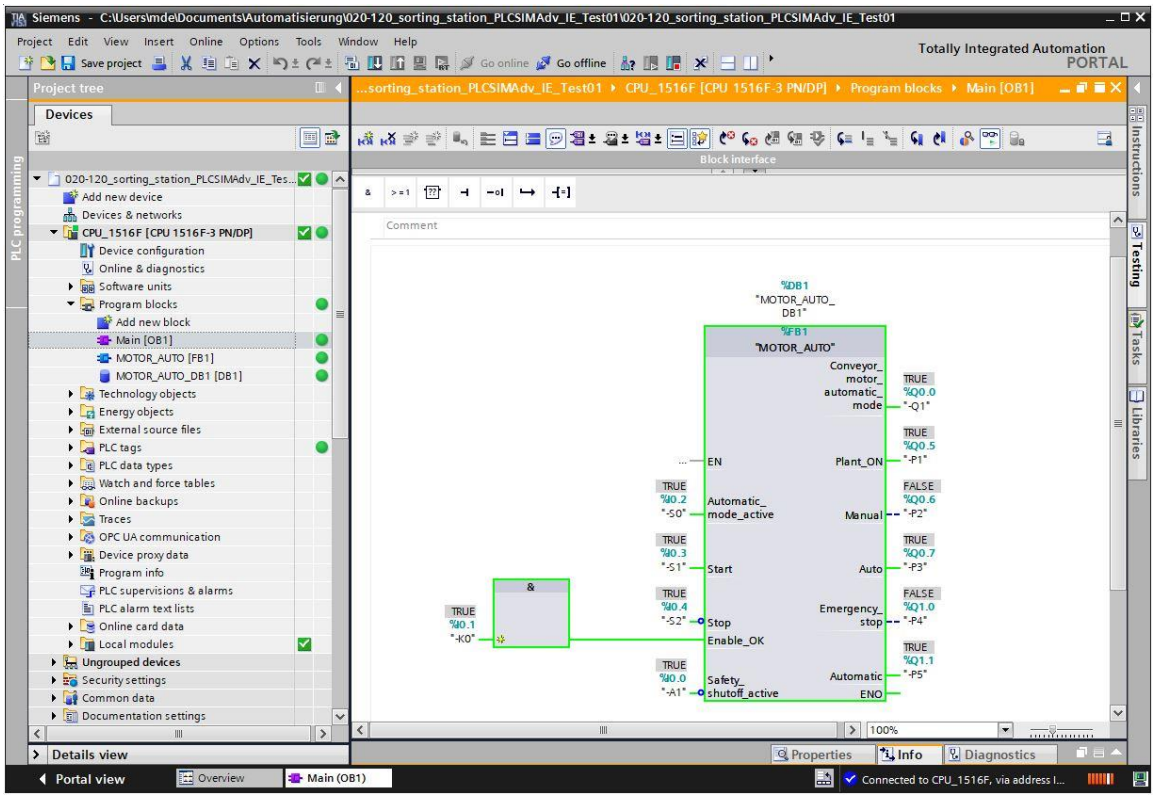
→ The changes of the signal states in the Main[OB1] block can be monitored in the TIA Portal.



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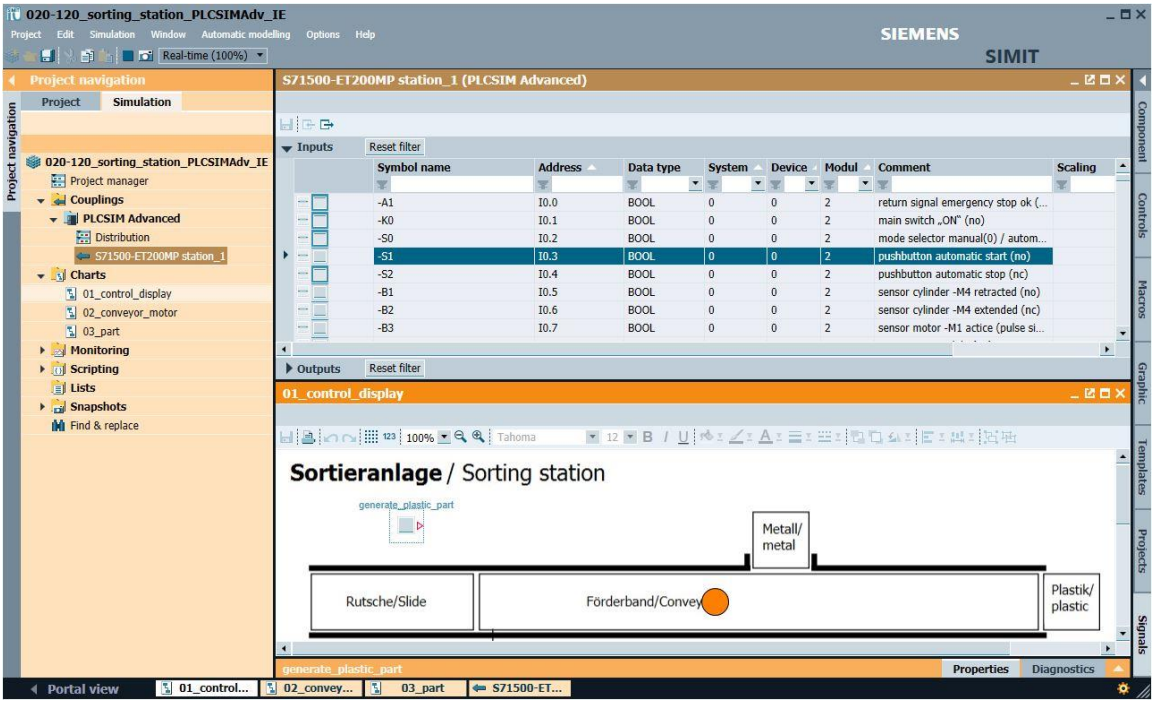
→ The application can now be tested in SIMIT. The conveyor motor –M1 is already switched on with "-Q1" (forwards). Clicking on "generate_plastic_part" places a part on the starting end of the conveyor, which then moves to the right at constant speed. The part disappears after exiting the conveyor. By clicking on " ", the simulation in SIMIT can be stopped again.



Note:

– *When the simulation in SIMIT is stopped, the instance in PLCSIM Advance is also deleted. This means that it is no longer possible to work "online" from the TIA Portal.*

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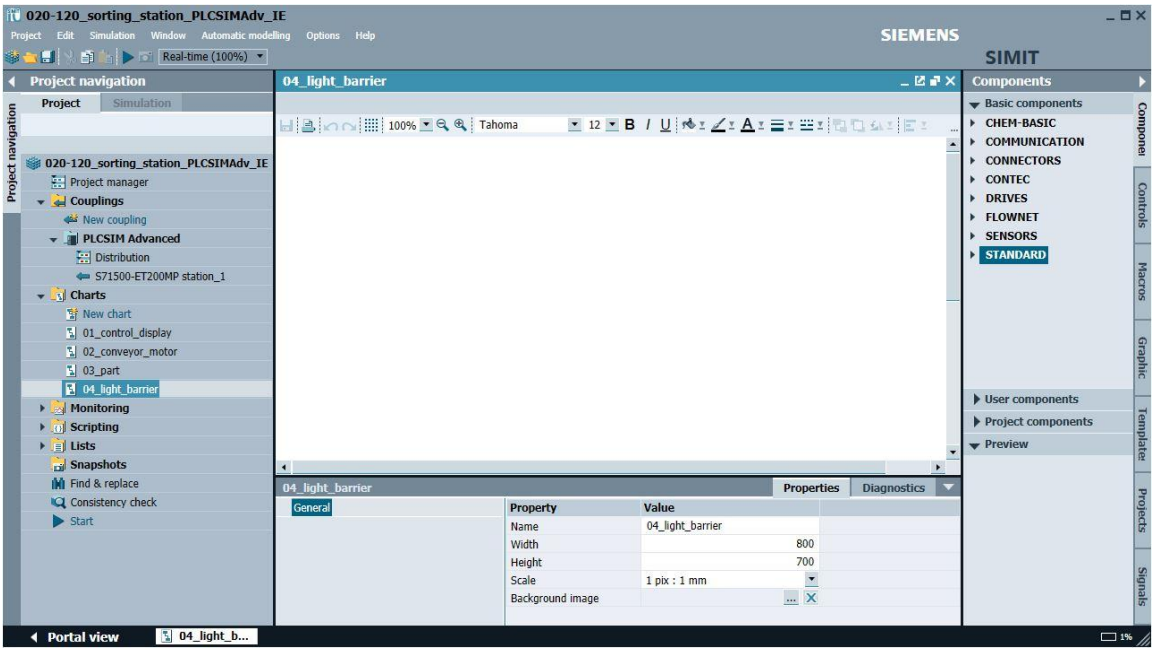
7.8 Creating the "04_light_barrier" chart with simulation logic

→ Create another chart named "04_light_barrier" with the format shown here. (→ New chart → Name: 04_light_barrier → Width: 800 → Height: 700)



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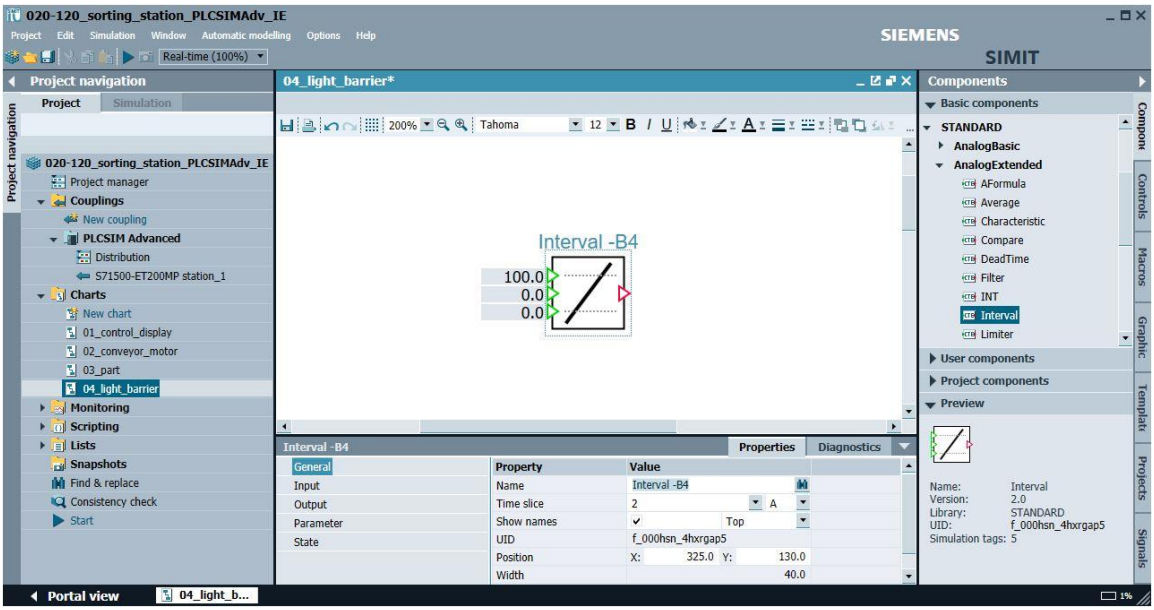
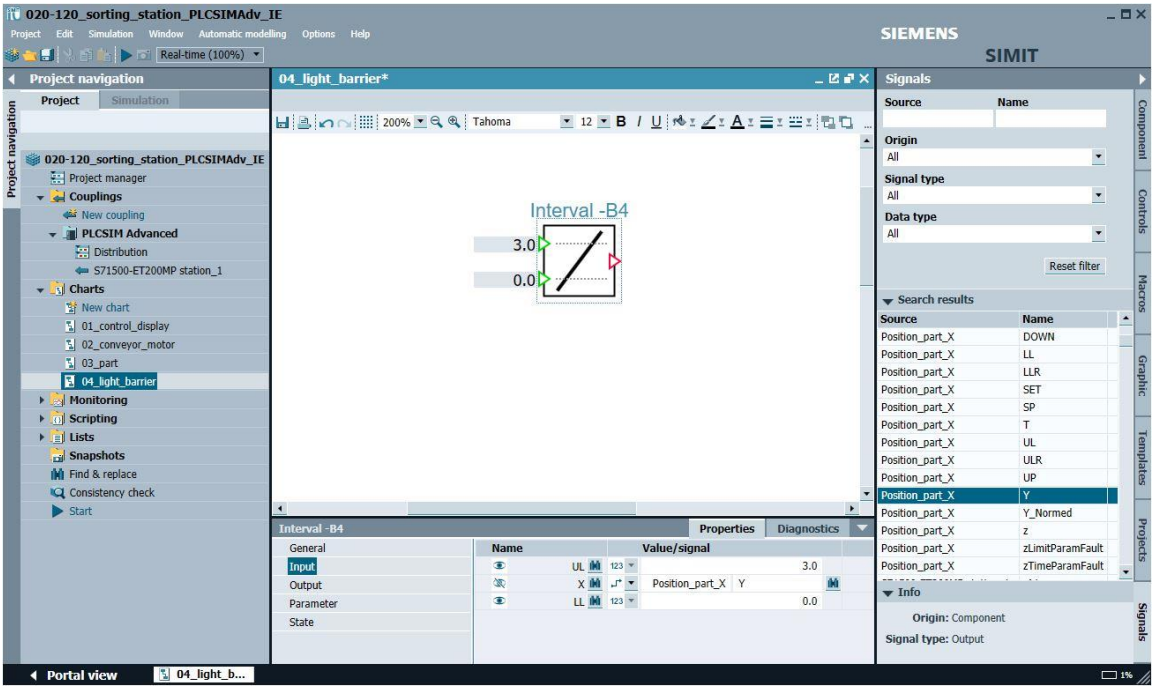
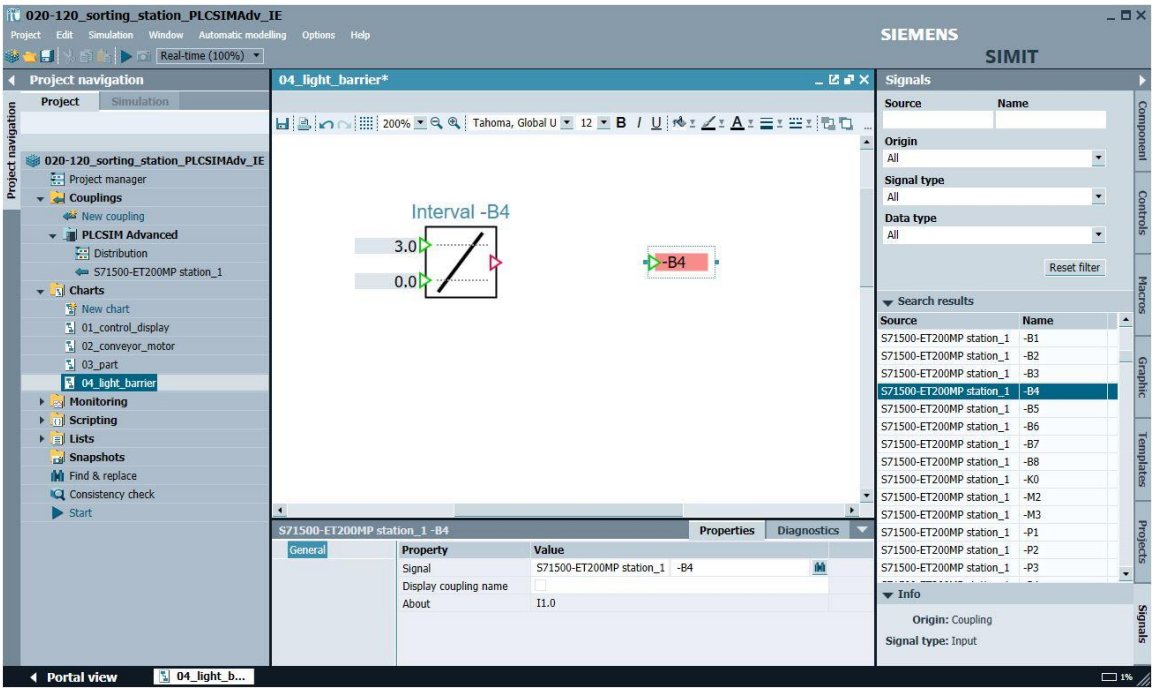
→ You will find the component types of the basic library under "Basic components" on the right in the "Components" task card. For simulation of a light barrier, drag an → "Interval", located under → "Standard" → "AnalogExtended", to the "04_light_barrier" chart. Change the "Name" to "Interval –B4" in the "Properties" under "General" and select the "Show names" check box "☑". (→ Components → Basic components → Standard → AnalogExtended → Interval → Properties → General → Name: Interval –B4 → Show names ☑)



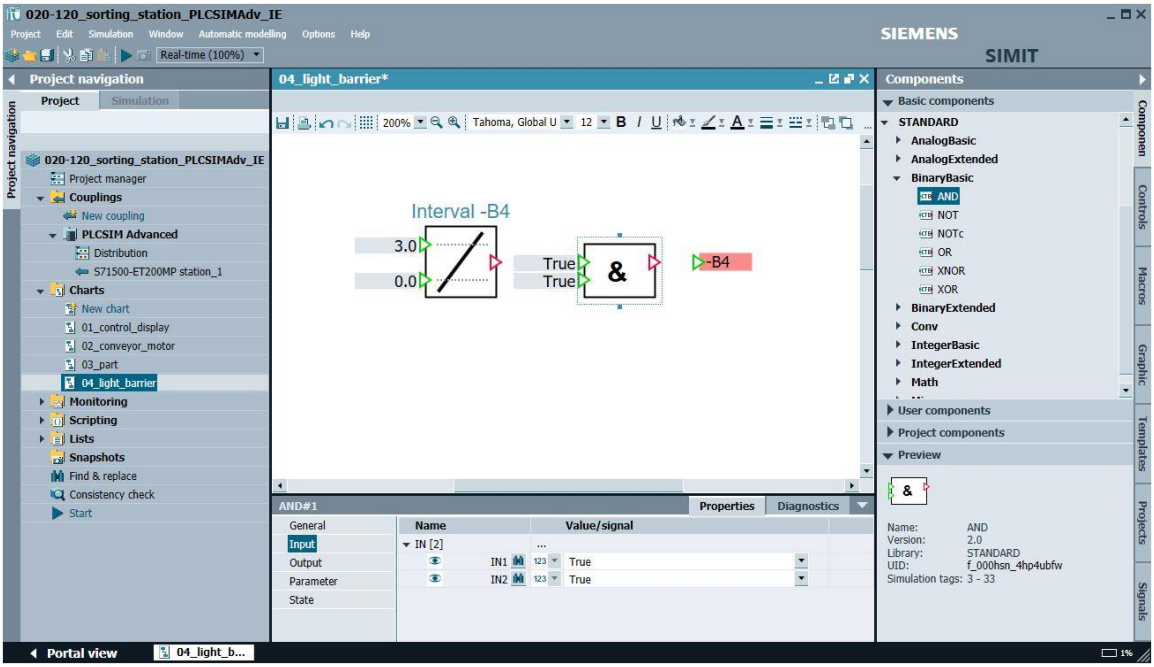
→ Select the "Input" "X" in the "Properties" of "Interval -B4" and make it invisible by clicking on " ". Then, select the interconnection option " " for "Value/Signal" and drag the → "Y" signal of the "position_part_X" source from the "Signals" task card to here. Then, enter the values "3.0" for the "UL" input (high limit) and "0.0" for "LL" (low limit). (→ Properties → Input → X → → → Signals → position_part_X → Y → Value/Signal → UL: 3.0 → LL: .0)



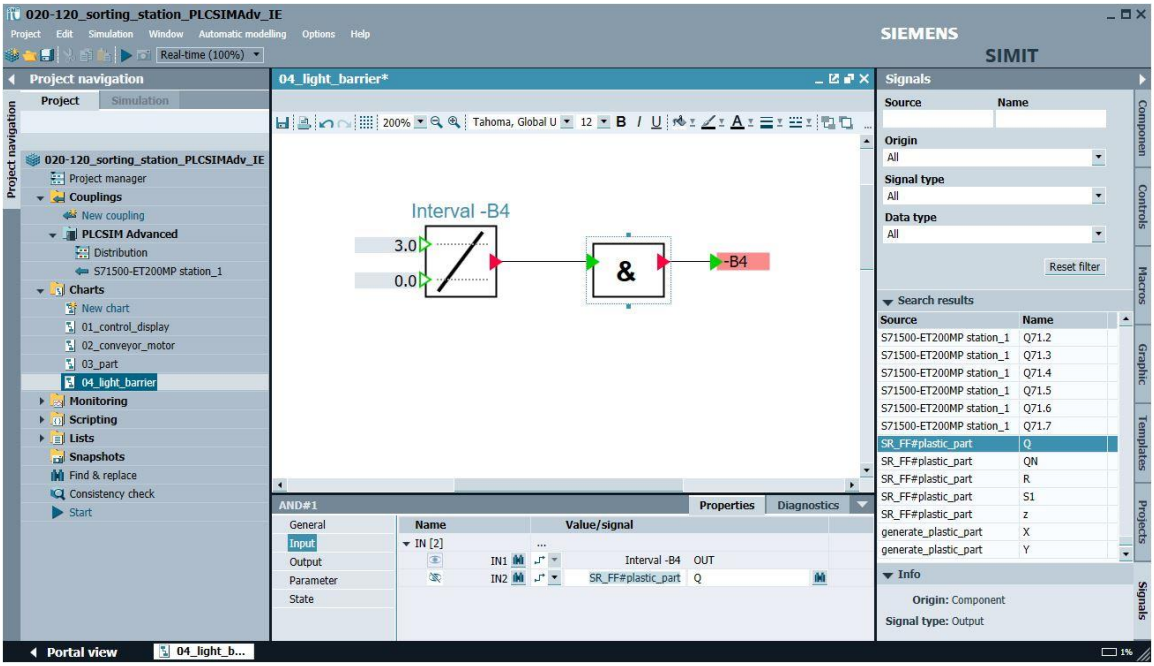
→ Now, press and hold down the "Shift" key and drag the → "-B4" signal from the "Signals" task card to the "04_light_barrier" chart. A "CONNECTOR" of type "Output" is automatically created with the "-B4" signal. Deselect the "Show coupling name" check box in the "Properties" area under "General". (→ Properties → General → Signals → Shift → -B4 → Properties → General → Show coupling name ☐)



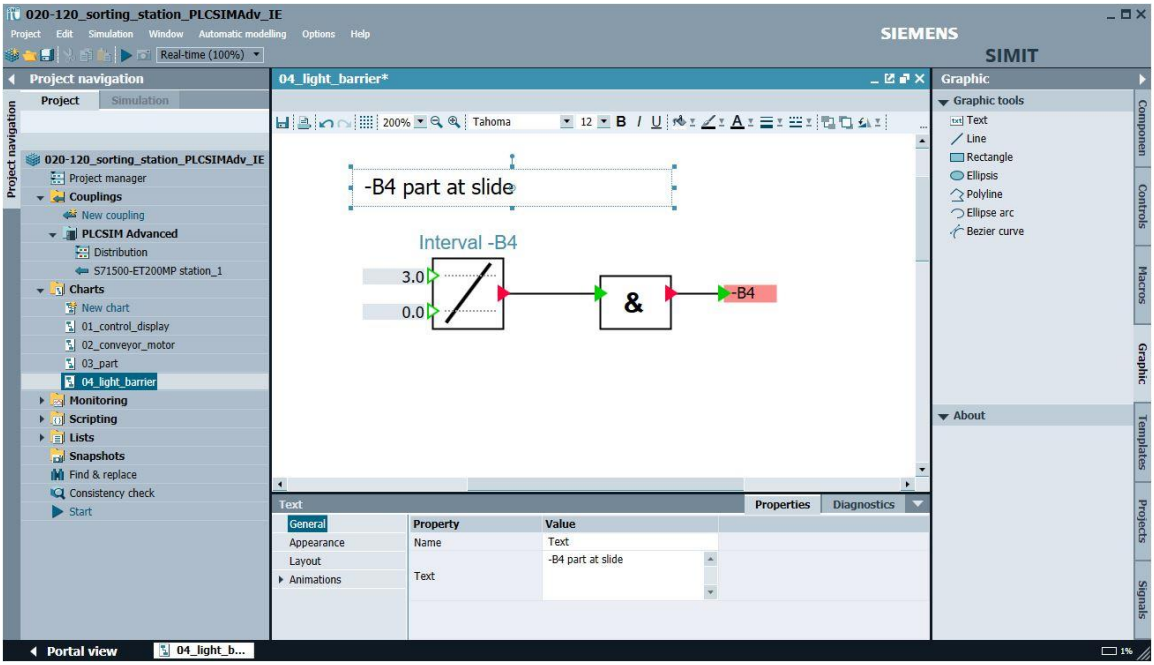
→ Then, drag an → "AND" between the "Interval -B4" and "-B4" components from the "Components" task card under → "Basic components" → "Standard" → "BinaryBasic". (→ Components → Basic components → Standard → BinaryBasic → AND)



→ Select the "Input" "IN2" in the "Properties" of the "AND" block and make it invisible by clicking on "". Then, select the interconnection option "" for "Value/Signal" and drag the → "Q" signal of the "SR_FF#plastic_part" source from the "Signals" task card to here. Interconnect the other connectors of the "AND" block, as shown here. (→ AND → Properties → Input → IN2 → → → Signals → SR_FF#plastic_part → Q → Value/Signal)



→ For labeling the light barrier, drag a text from → "Graphic" → "Graphic tools" to the "04_light_barrier" chart and enter "-B4 part at starting end of conveyor" as text. (→ Graphic → Graphic tools → Text: -B4 part at starting end of conveyor)



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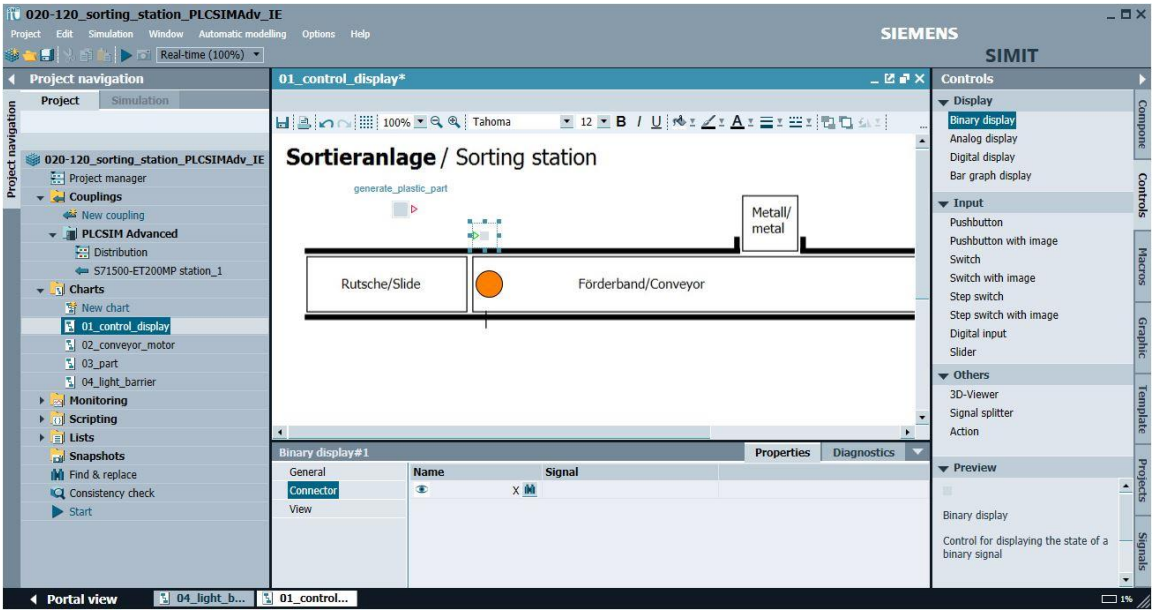
→ To display the signal state of the "-B4" sensor in the "01_control_display" chart, drag a "Binary display" to the starting end of the conveyor from → "Controls" under → "Display". (→ 01_control_display → Controls → Display → Binary display)



Note:

– *Additional information on the "Binary display" component is available in the online help and the manual.*

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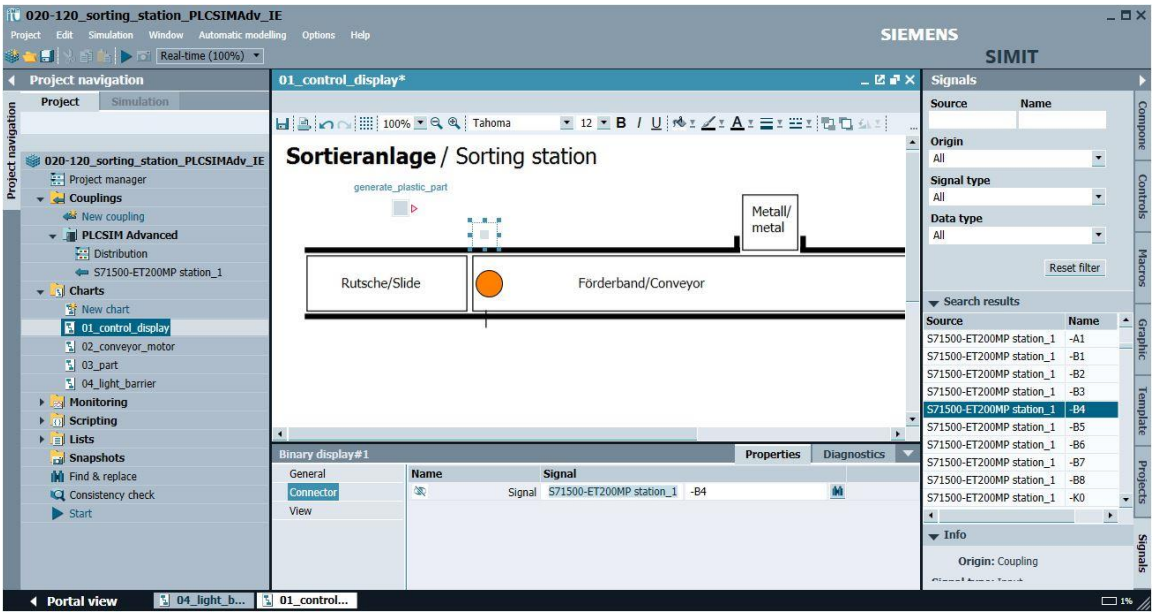
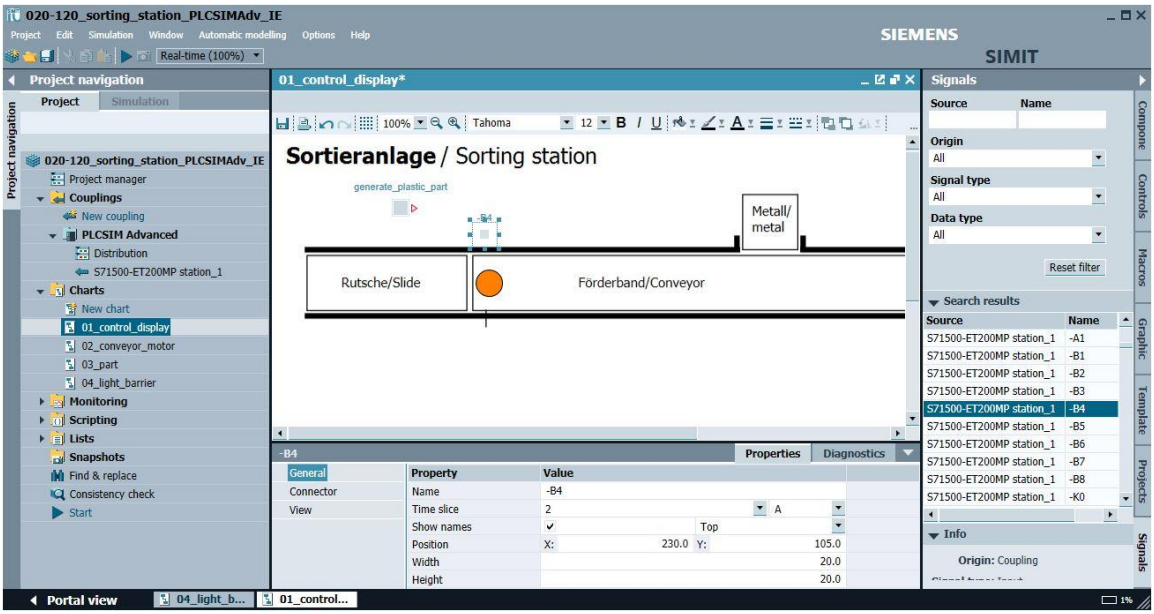
→ The "Binary display" must now be linked with the "-B4" input signal. Here, drag the → "-B4" signal of the "S71500-ET200MP station_1" source from the → "Signals" task card to the → "Connector" property. (→ Binary display#1 → Properties → Connector → Signals → S71500-ET200MP station_1 → -B4 → Signal)



→ Change the "Name" to "-B4" in the "Properties" under "General" and select the "Show names" check box "☑". (→ Property → General → Name: -B4 → Show names ☑)



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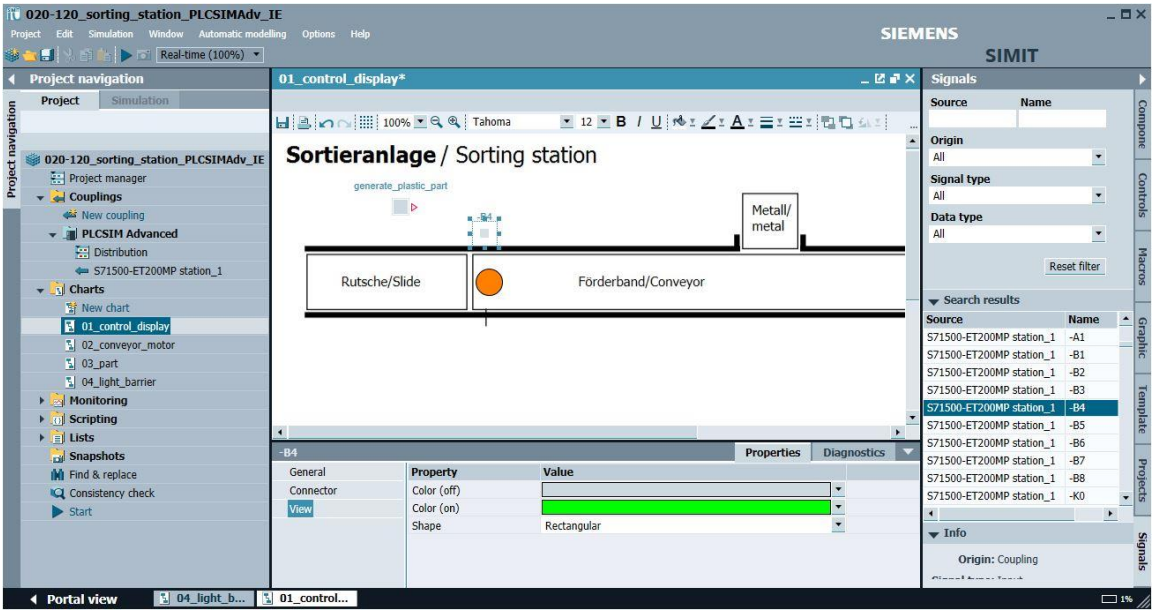
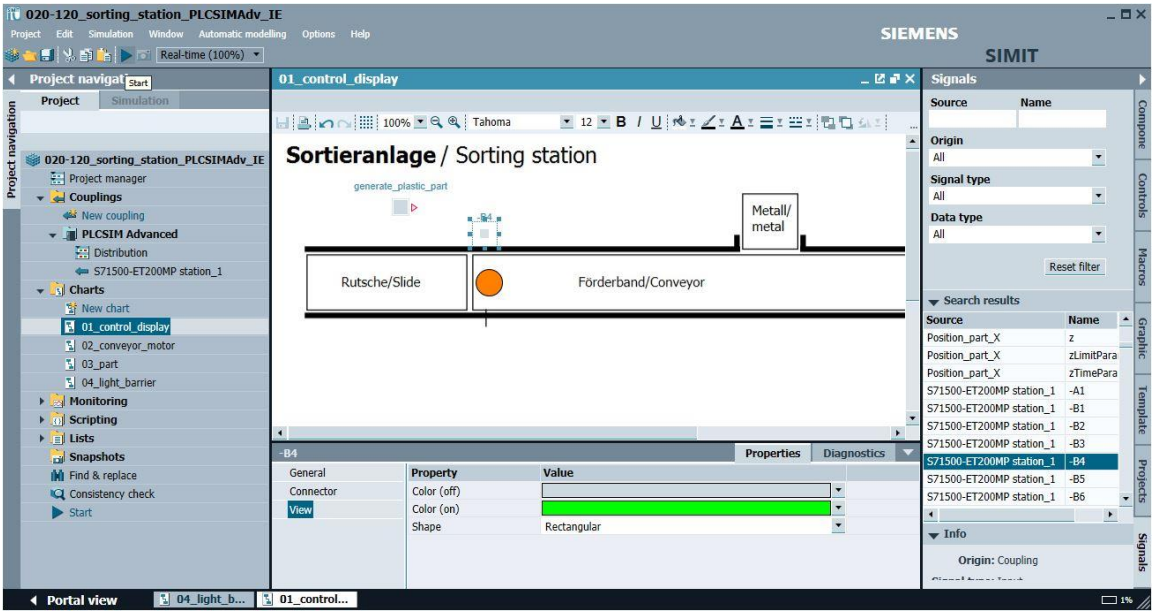
→ Change "Color (on)" to green in the "Properties" of the "-B4" component under "View". (→ -B4 → Properties → View → Color (on))



→ Now, first save and compile the project by clicking "Save all" and then start the simulation by clicking on "". (→ →)



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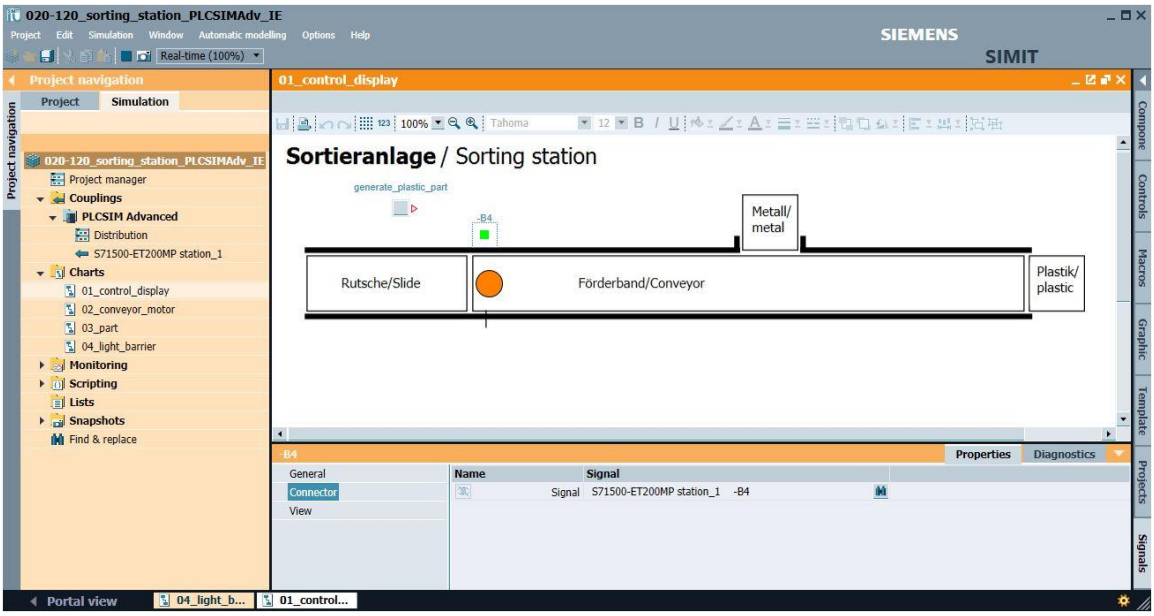
→ The application can now be tested in SIMIT by placing a part on the starting end of the conveyor by clicking on "generate_plastic_part". The color of the sensor changes to green. The color of the sensor changes back to gray when the part has been moved far enough to the right with the conveyor. By clicking on " ", the simulation in SIMIT can be stopped again.



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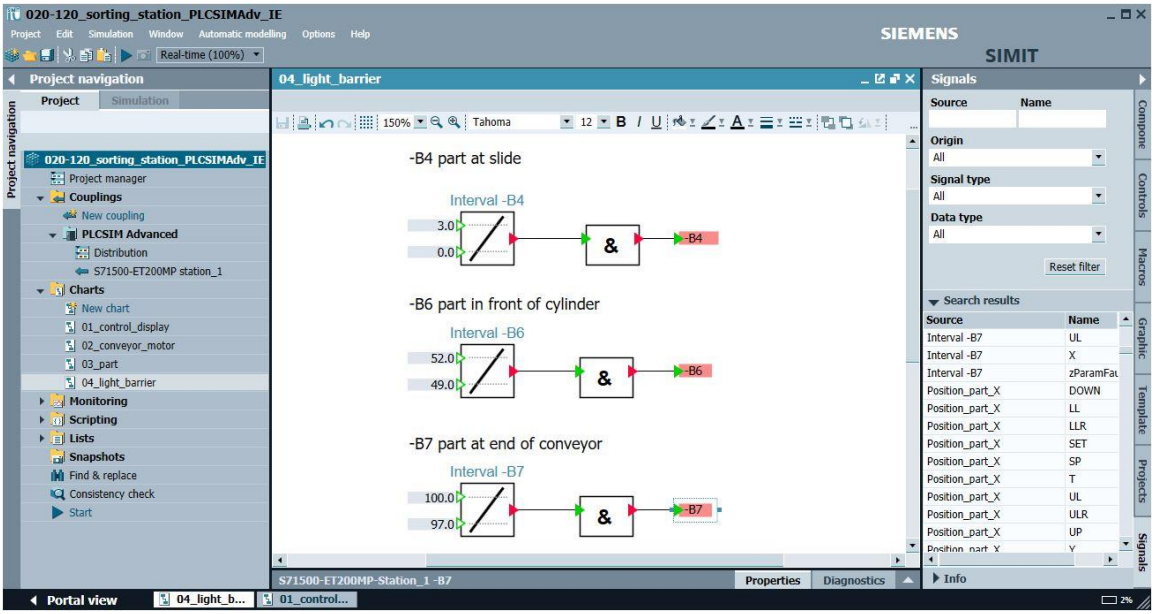
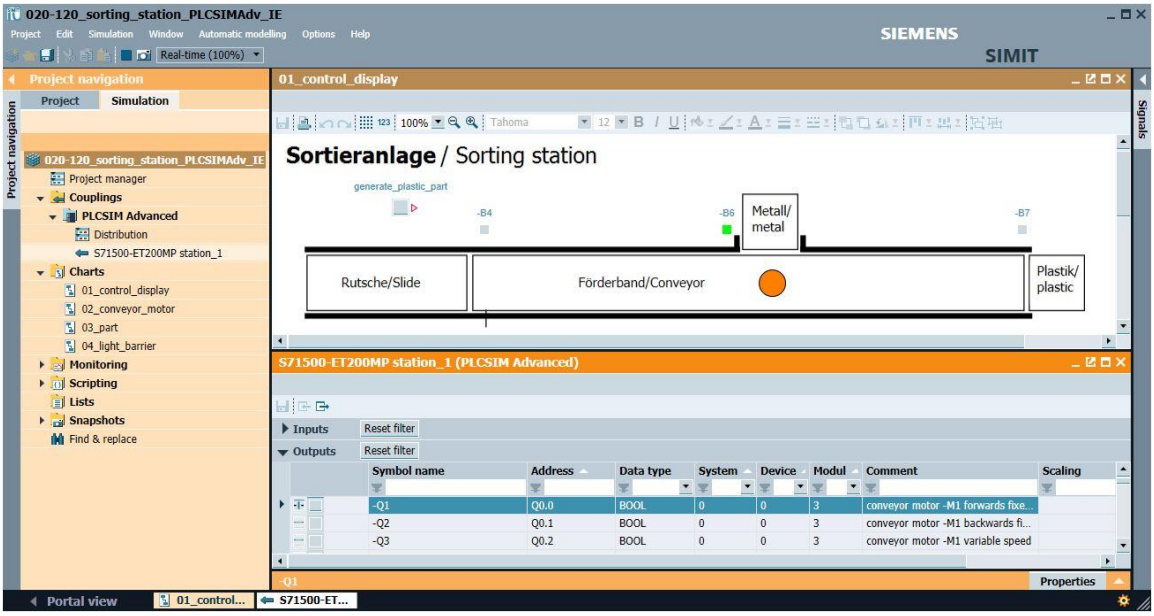
→ In the "04_light_barrier" chart, as shown previously, create the simulation logic for the sensors "-B6" (part in front of cylinder) and "-B7" (part at end of conveyor) with the high and low limits. Insert two additional "Binary displays" for these sensors in the "01_control_display" chart and test the simulation.





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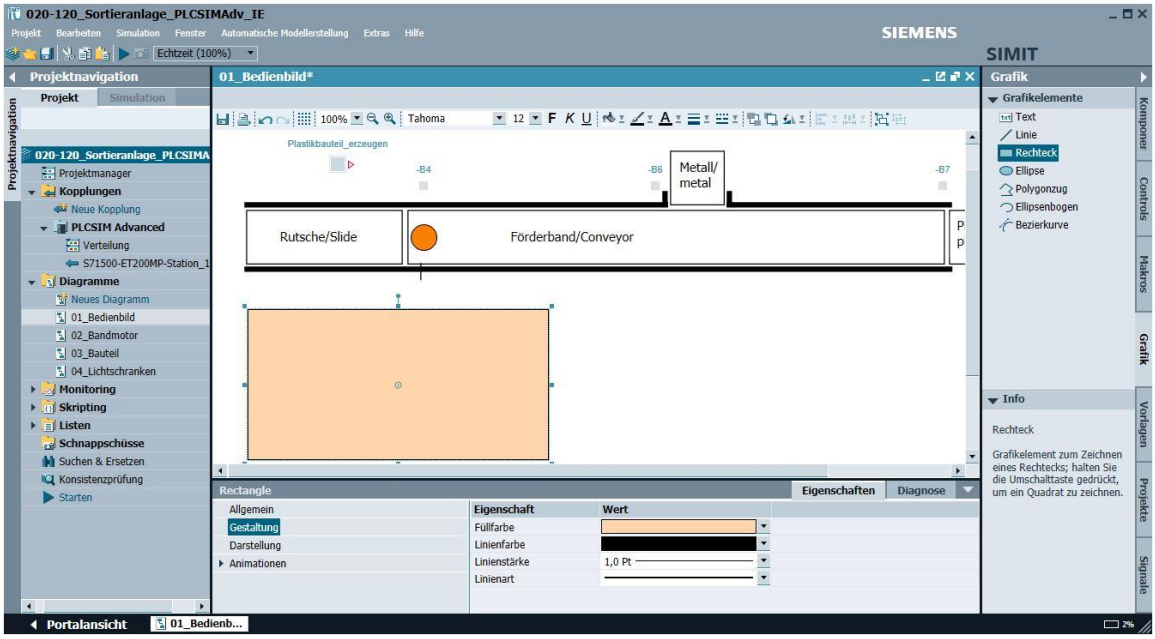
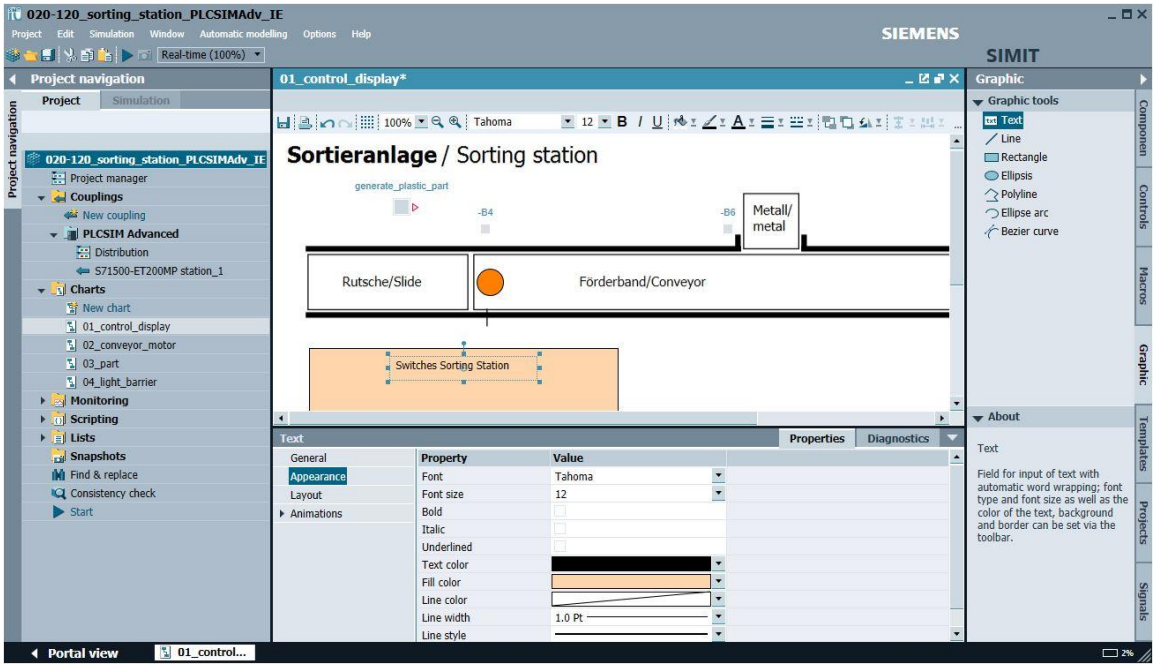
7.9 Creating simulation logic for switches and pushbuttons in the "01_control_display" chart

→ For the control panel, first drag a "Rectangle" from → "Graphic" → "Graphic tools" to the "01_control_display" chart and change the fill color to a light orange. (→ 01_control_display → Graphic → Graphic tools → Rectangle → Properties → Appearance → Fill color:)



→ For the label, drag a Text from → "Graphic" → "Graphic tools" onto the rectangle, enter "Switches Sorting Station" as text and select the same "Fill color" as the rectangle. (→ Graphic → Graphic tools → Text: Switches Sorting Station→ Properties → Appearance → Fill color:)



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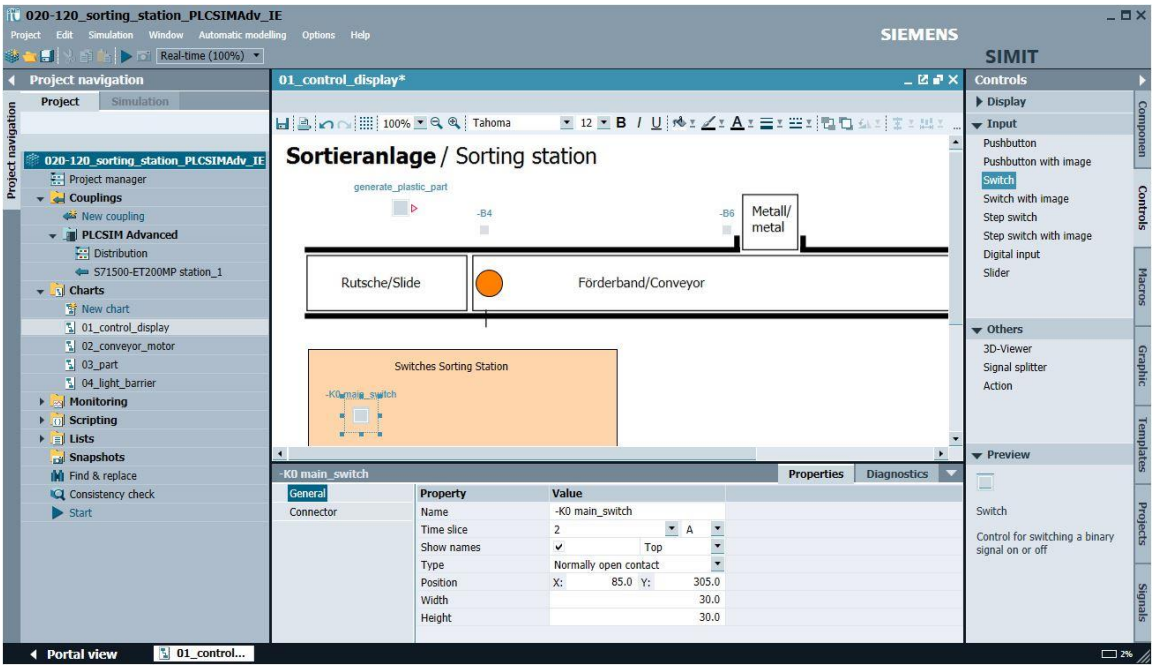
→ As the first control element, configure "-K0" (main switch) as "Switch". You will find the "Switch" and "Pushbutton" in the → "Controls" under → "Input". Change the "Name" to "-K0 main_switch" in the "Properties" under "General", select the "Show names" check box " ☑ " and leave the "Type" as "Normally open contact". (→ Controls → Input → Switch → Properties → General → Name: - K0 main_switch → Show names ☑ → Type: Normally open contact)



Note:

– *Additional information on the "Switch" and "Pushbutton" component is available in the online help and the manual.*

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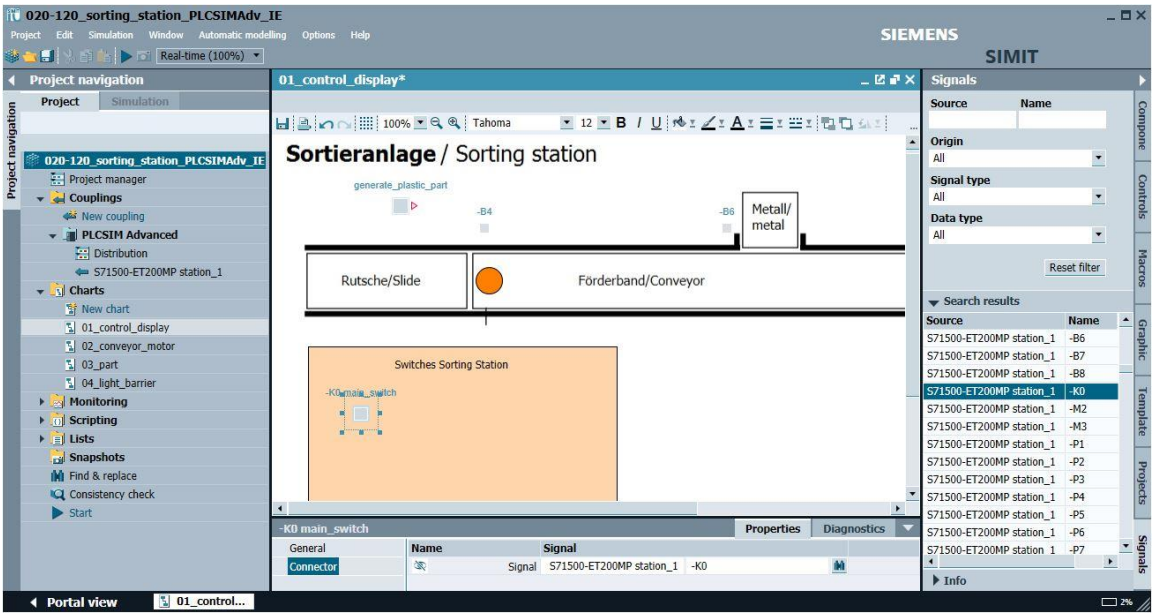
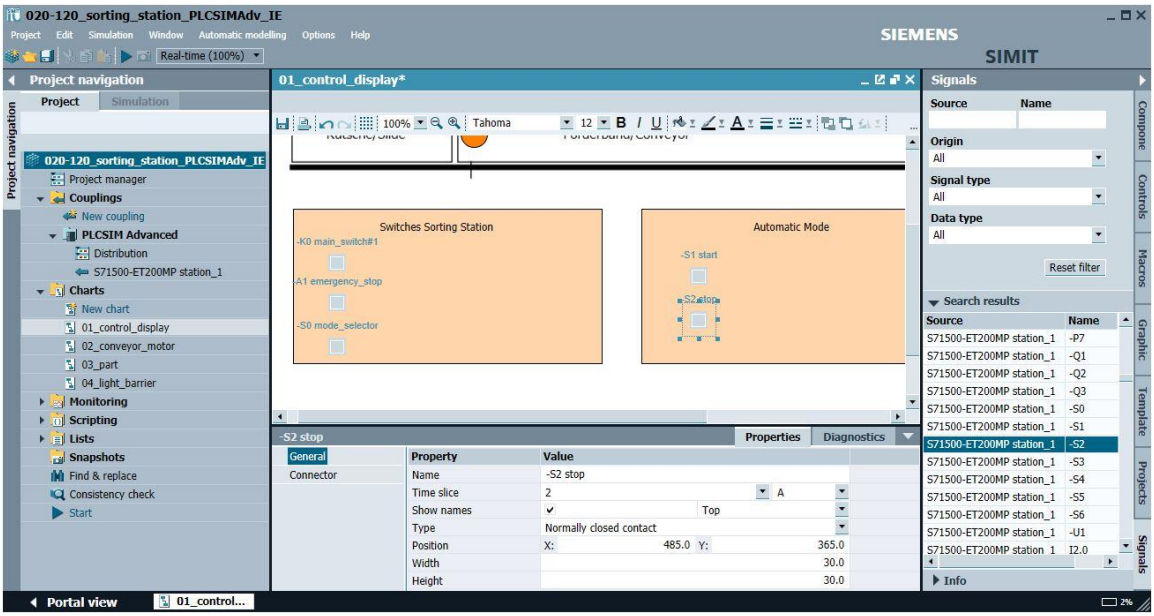
→ The "Switch" must now be linked with the "-K0" input signal. Here, drag the → "-K0" signal of the "S71500-ET200MP station_1" source from the "Signals" task card to the → "Connector" → "Signal" property. (→ -K0 main_switch → Properties → Connector → Signals → S71500-ET200MP station_1 → -K0 → Signal)



→ In the next step, as shown previously, insert an additional "Rectangle" with "Text", the switches "-A1" (emergency_stop) and "-S0" (mode_selector) and the pushbuttons "-S1" (start) and "-S2" (stop). For the switch "-A1" (emergency_stop) and pushbutton "-S2" (stop), change the "type" to "Normally closed contact". (→ -A1 emergency_stop →Properties → General → Type: Normally closed contact→ -S2 stop → Properties → General → Type: Normally closed contact)



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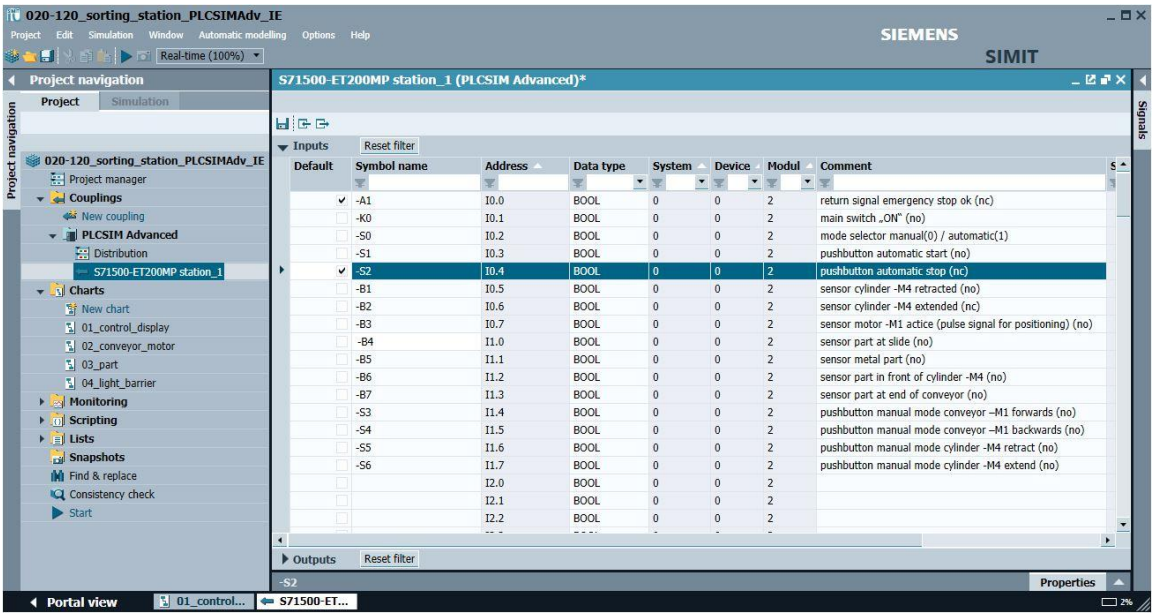
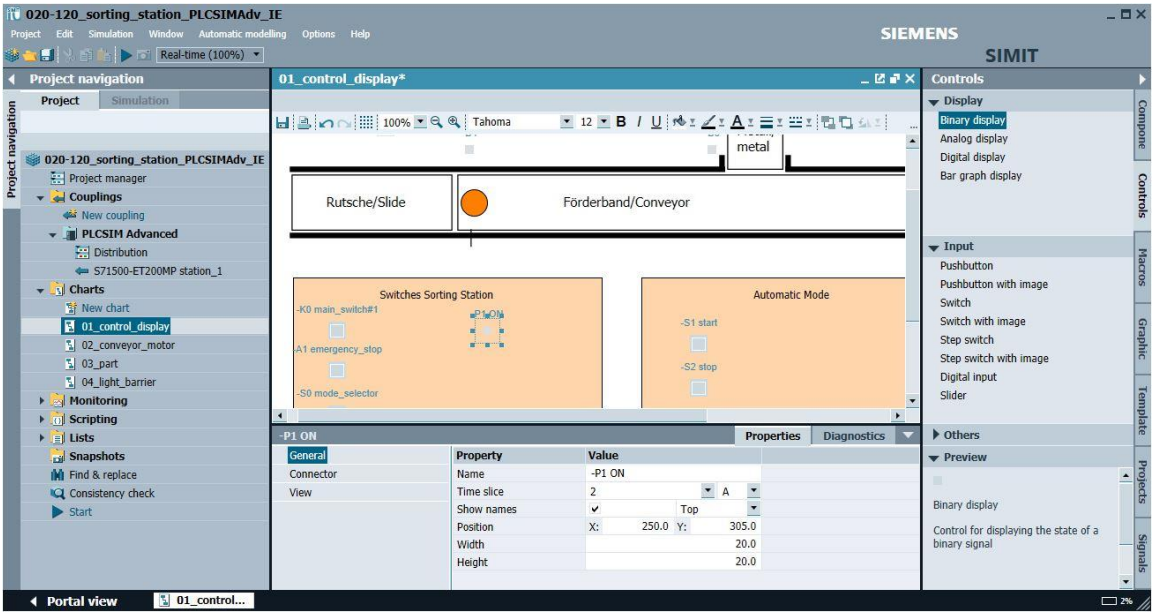
→ Change to the "S71500-ET200MP station_1" coupling and select the "Default" check box "☑" for the "-A1" and "-S2" inputs. As a result of this, the signal states of the normally closed contacts will already be set to 1 when the simulation is started. (→S71500-ET200MP station_1 → Inputs → -A1 → Default ☑ → -S2 → Default ☑)



→ Then, configure the "-P1 ON" display as a binary display. You will find the "Binary display" in the → "Controls" under → "Display". Change the "Name" to "-P1 ON" in the "Properties" under "General" and select the "Show names" check box "☑". (→ Controls → Display → Binary display → Properties → General → Name: -P1 ON → Show names ☑)



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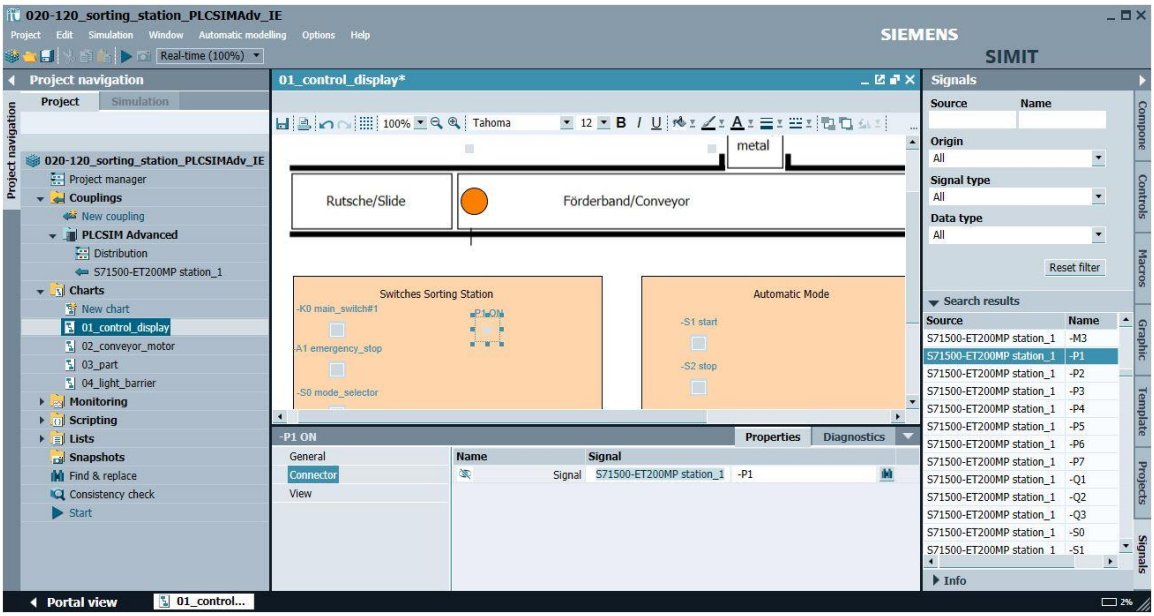
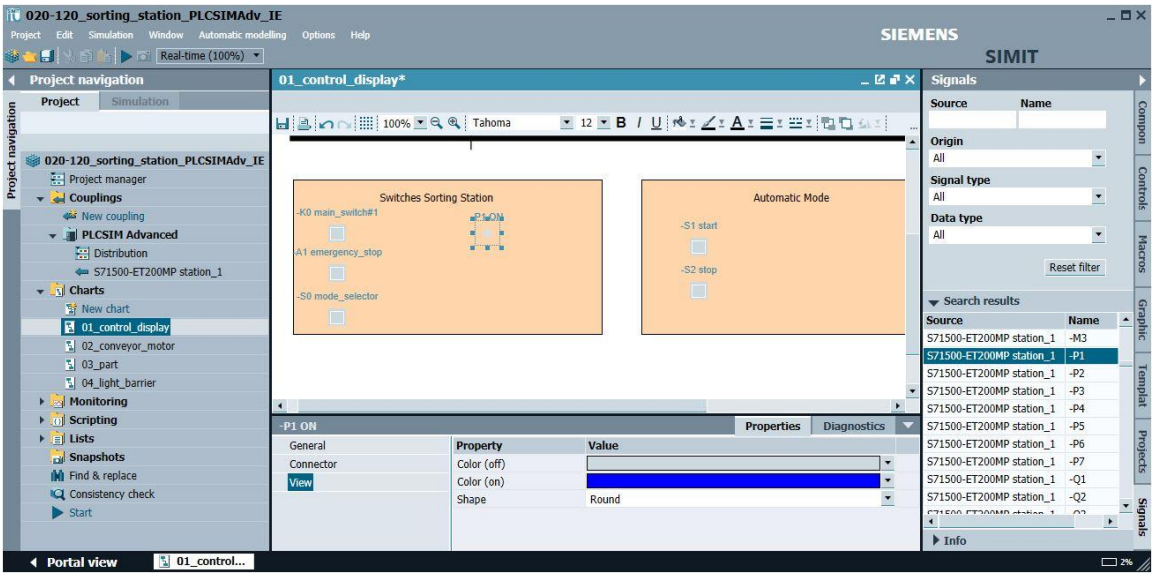
→ The "Binary display" must now be linked with the "-P1" output signal. Here, drag the → "-P1" signal of the "S71500-ET200MP station_1" source from the "Signals" task card to the → "Connector" → "Signal" property. (→ -P1 ON → Properties → Connector → Signals → S71500-ET200MP station_1 → -P1 → Signal)



→ In the properties of "P1 ON", change "Color (on)" to blue and "Shape" to "Round". (→ -P1 ON → Properties → View → Color (on) → Shape Round)



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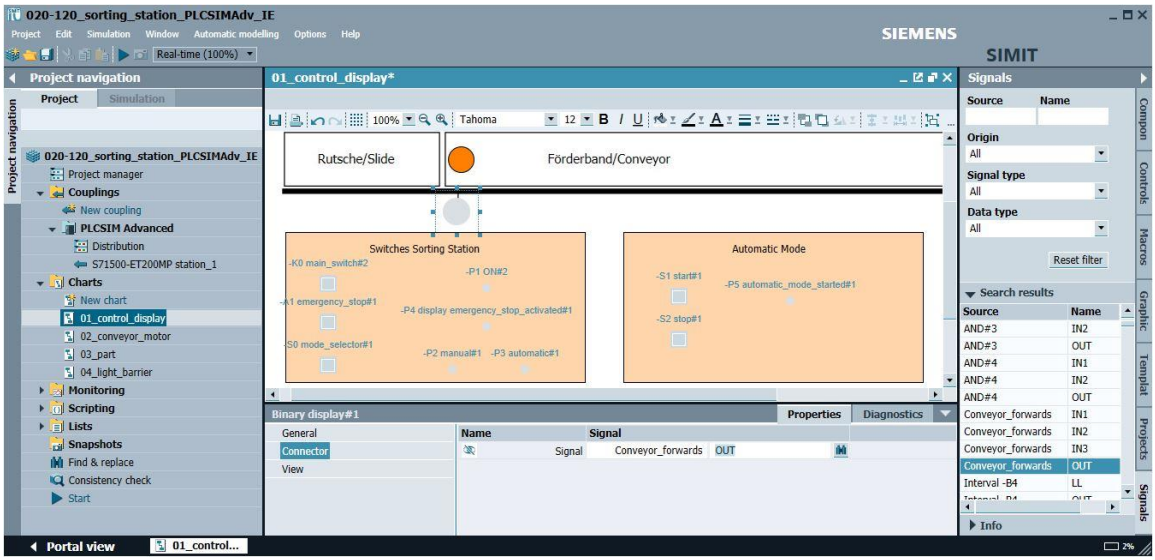
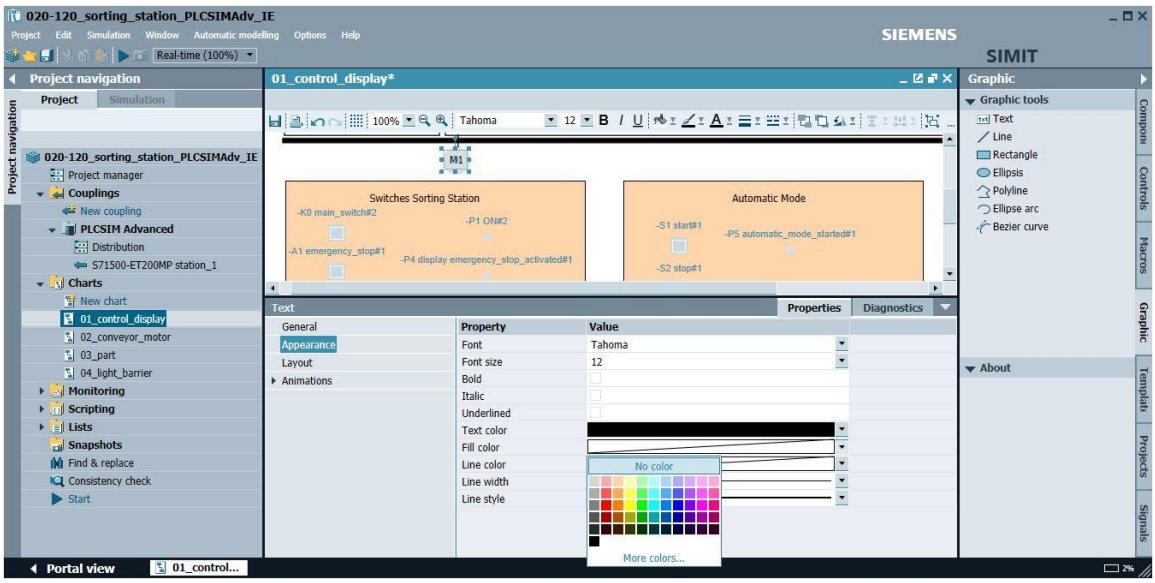
→ As shown previously, now create the "Binary displays" "-P4 display emergency_stop_activated", "P2 manual", "-P3 automatic" and "-P5 automatic_mode_started". An additional "Binary display" is also configured for the conveyor motor. Connect its "Connector" to the "Signal" "Conveyor_forwards" "OUT" and set "Color (on)" to green and "Shape" to "Round". (→ -P4 display emergency_stop_activated → -P2 manual → -P3 automatic → -P5 automatic_mode_started → Binary display#1 → Properties → Connector → Signals → Conveyor_forwards → OUT → Signal→ View → Color (on) → Shape Round)



→ For the label, drag a Text from → "Graphic" → "Graphic tools" onto the binary display, enter "M1" as text and select "No color" as the "Fill color". (→ Graphic → Graphic tools → Text: M1 → Properties → Appearance → Fill color: No color)



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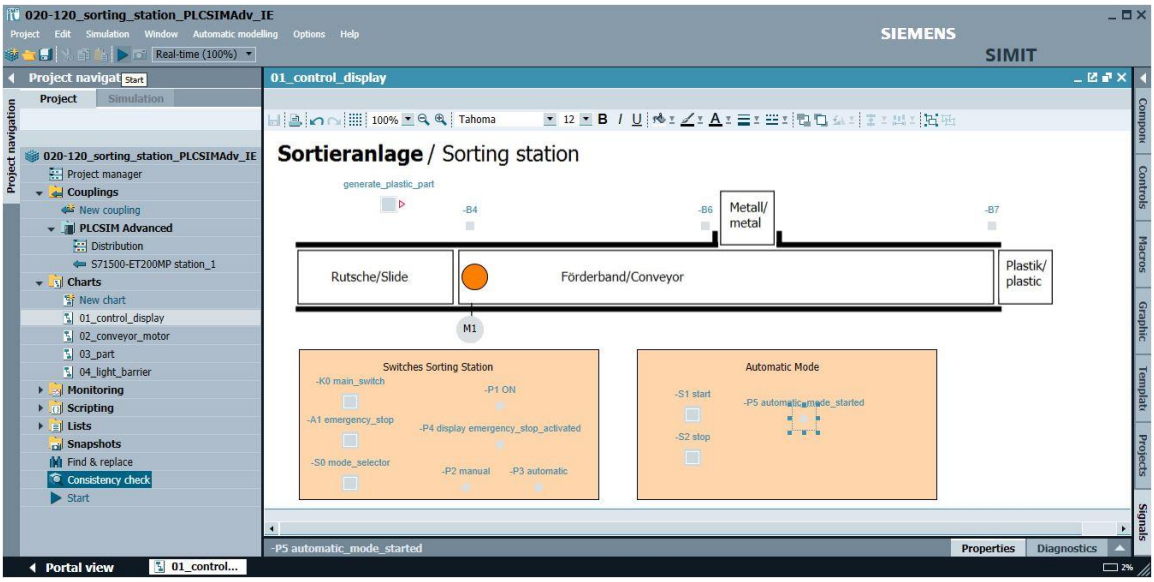
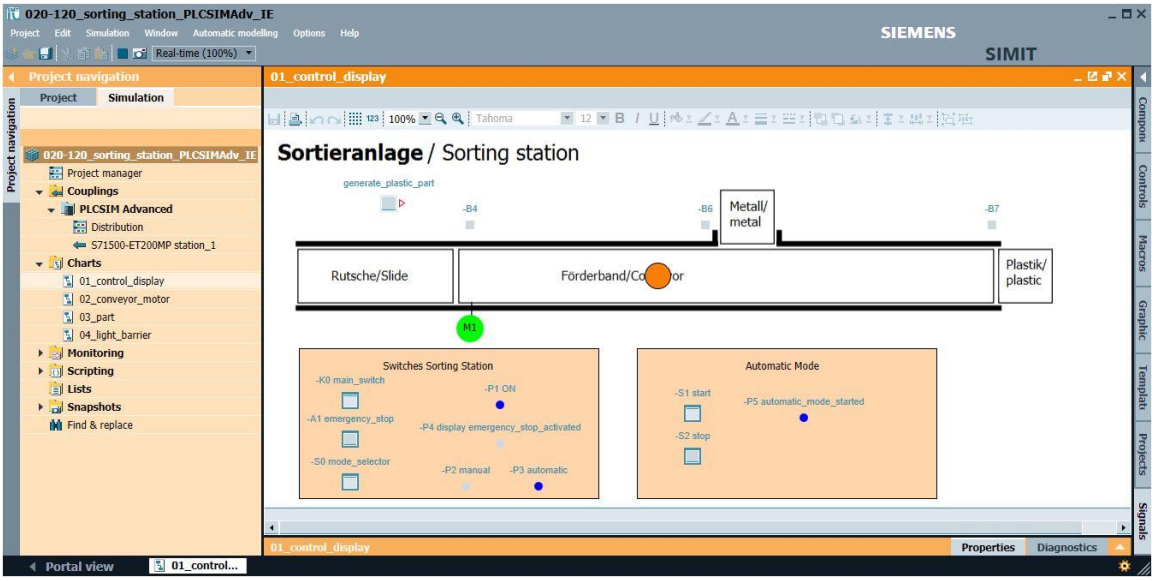
→ Now, save and compile the project by clicking "Save all" and then start the simulation by clicking on "". Test all functions of the simulation. Clicking on "" stops the simulation in SIMIT again. (→ → →)





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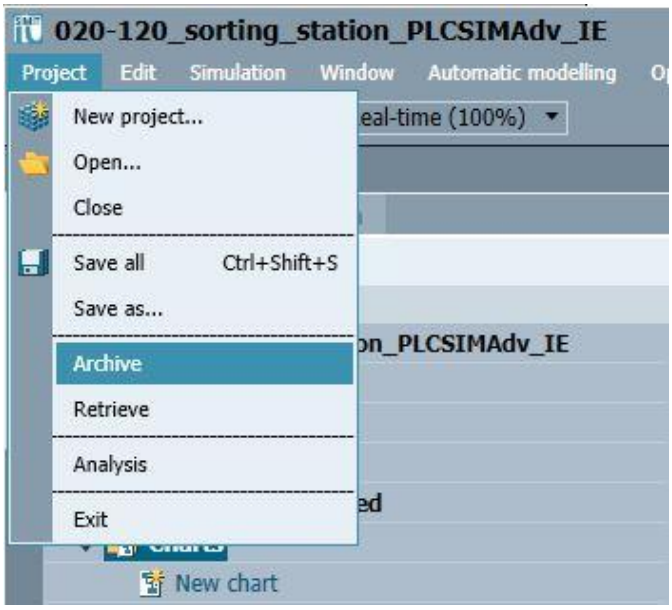
7.10 Archiving the project

→ As the final step, we want to archive the complete SIMIT project. Select the → "Archive …" command in the → "Project" menu. Select a folder where you want to archive your project and save it as file type "SIMIT project (*.simarc)". (→ Project → Archive → *.simarc)



7.11 Checklist – step-by-step instructions

The following checklist helps trainees/students to independently check whether all steps of the step-by-step instructions have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	"01_control_display" chart created in SIMIT according to the specification.	
2	"02_conveyor_motor" chart created in SIMIT according to the specification.	
3	Animations in the "01_control_display" chart created according to the specification.	
4	SIMIT project successfully compiled and started.	
5	Simulation successfully tested within SIMIT.	
6	Simulation successfully tested together with SIMIT Simulation.	
7	"04_light_barrier" chart created in SIMIT according to the specification.	
8	Display of sensors added in the "01_control_display" chart according to the specification.	
9	Control panel with simulation for switches, pushbuttons and displays added in the "01_control_display" chart according to the specification.	
10	SIMIT project successfully compiled and started.	
11	Simulation successfully tested within SIMIT.	
12	Simulation successfully tested together with SIMIT Simulation.	
13	SIMIT project successfully archived.	

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8 Exercises

8.1 Task – Exercise Metal part

Create the simulation logic for an additional part made of metal in the "03_part" chart.

Create a new "05_metal sensor" chart for "-B5" (Sensor metal part) and display the "-B5" sensor and the animated metal part in the "01_control_display" chart.

Add a "Pushbutton" in the "01_control_display" chart for placing a metal part on the conveyor.

Interlock the simulation logic in such a way that only one part at a time can be on the conveyor.

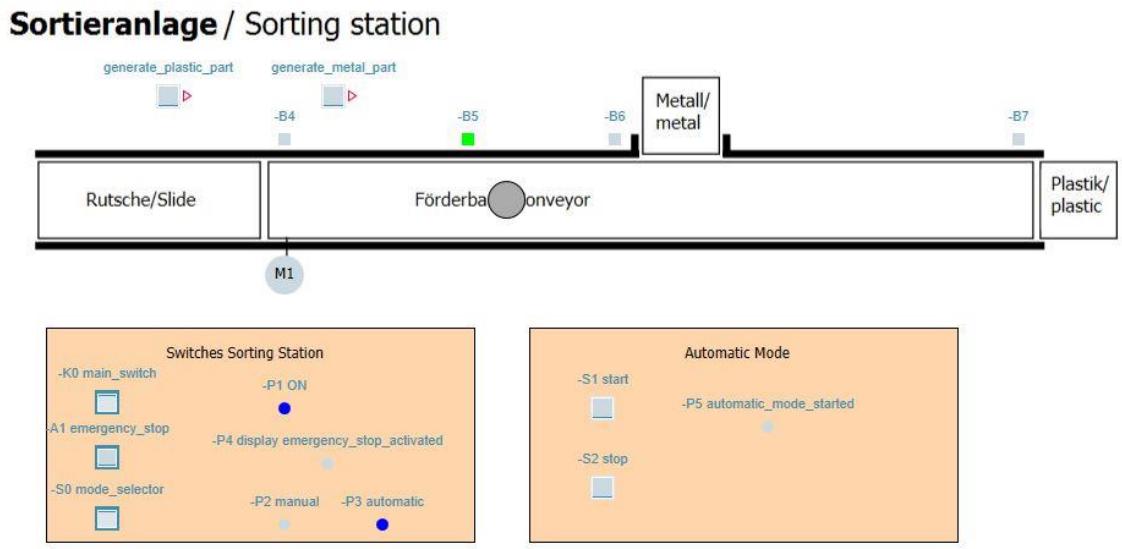

Figure 3: Control display with metal part

8.2 Planning

Plan the implementation of the task on your own.

For testing you can load the following TIA Portal project in S7-PLCSIM Advanced:

"020-120-sorting_station_plcsimadv_ie_test01-en".

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8.3 Checklist – Exercise

The following checklist helps trainees/students to independently check whether all steps of the exercise have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Simulation logic for a metal part added in the "03_part" chart.	
2	"05_metal_sensor" chart created in SIMIT according to the specification.	
3	Display for metal part, metal sensor and pushbutton for placing a metal part on the conveyor added in the "01_control_display" chart according to the specification.	
4	Simulation successfully tested within SIMIT.	
5	Simulation successfully tested together with SIMIT Simulation.	
6	SIMIT project successfully archived.	

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8.4 Task – Exercise Cylinder

Create a new "06_Cylinder" chart with the simulation logic for the "M4" cylinder and the two sensors "-B1" (Sensor cylinder -M4 retracted / NO) and "-B2" (Sensor cylinder -M4 extended / NC).

Draw a schematic drawing of the cylinder in the "01_control_display" chart and animate it.

Also take into account how the part movement is influenced by the cylinder position.

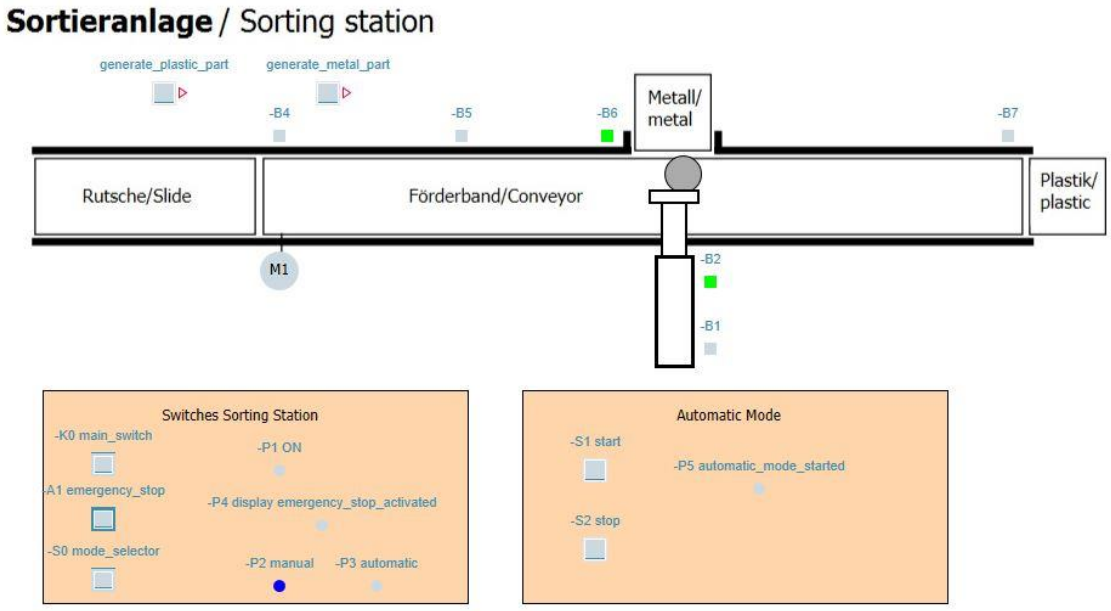

Figure 4: Control display with cylinder

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8.5 Planning

Plan the implementation of the task on your own.

For testing you can load the following TIA Portal project in S7-PLCSIM Advanced:

"020-120-sorting_station_plcsimadv_ie_test02-en"

Example of a display of the cylinder in retracted and extended state:

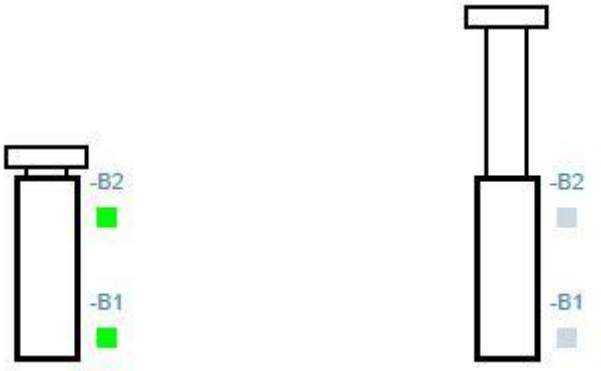

Figure 5: Control panel

8.6 Checklist – Exercise

The following checklist helps trainees/students to independently check whether all steps of the exercise have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	"06_cylinder" chart created in SIMIT according to the specification.	
2	Display for the cylinder added in the "01_control_display" chart analogous to the specification.	
3	Position of the cylinder taken into account in the simulation of the part movement.	
4	Simulation successfully tested within SIMIT.	
5	Simulation successfully tested together with SIMIT Simulation.	
6	SIMIT project successfully archived.	

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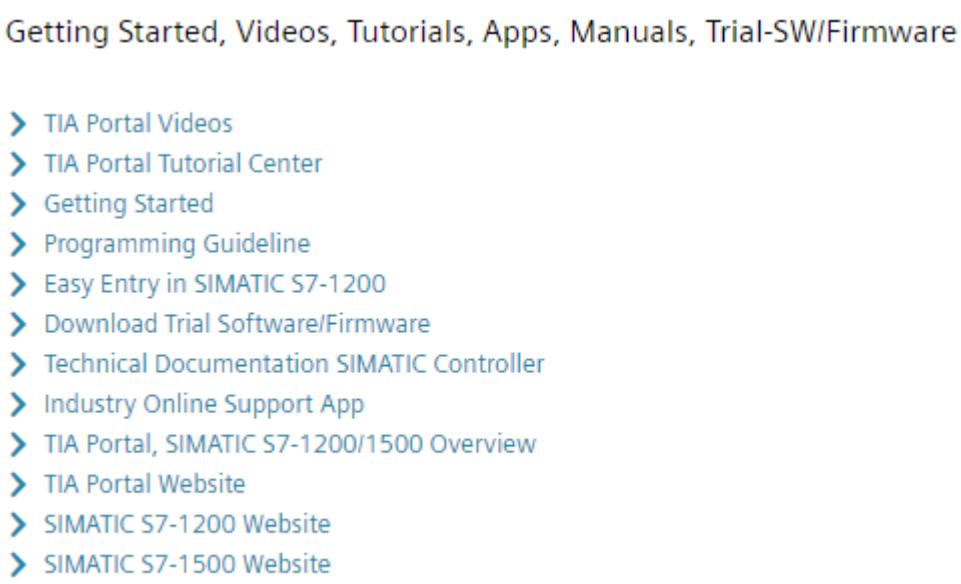
9 Additional information

More information for further practice and consolidation is available as orientation, for example: Getting Started, videos, tutorials, apps, manuals, programming guidelines and trial software / firmware, under the following link:

siemens.com/sce/s7-1200

Preview „Additional information“



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Further Information

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